



Microsoft Dynamics AX 2012 Implementation Planning Guide

Includes information for Microsoft Dynamics AX 2012 R2

Microsoft Corporation

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Welcome

Welcome to the Microsoft Dynamics AX 2012 Implementation Planning Guide. The Implementation Planning Guide provides architectural overview information and prescriptive, technical guidance to system architects, consultants, and IT professionals involved with planning a Microsoft Dynamics AX 2012 implementation.

Latest version

The newest version of this guide is available from the [Microsoft Download Center](http://go.microsoft.com/fwlink/?LinkID=163797) (<http://go.microsoft.com/fwlink/?LinkID=163797>). You can see the [TechNet Library](http://go.microsoft.com/fwlink/?LinkID=182420) (<http://go.microsoft.com/fwlink/?LinkID=182420>) website for up-to-date information about administration of Microsoft Dynamics AX 2012.

Feedback

Please provide feedback on this documentation. Send e-mail to adocs@microsoft.com.

Getting Microsoft Dynamics AX assistance

This topic provides information about Microsoft Services Premier Support and additional online resources that are available from Microsoft.

Microsoft Services Premier Support

A Microsoft Services Premier Support agreement provides features and components that you can use to support your implementation of Microsoft Dynamics AX. For more information, contact your value-added reseller (VAR), or visit the [Microsoft Services Premier Support page](http://www.microsoft.com/premiersupport) (<http://www.microsoft.com/premiersupport>).

Additional online information

The following table lists Microsoft websites that provide additional online resources.

Resource	Location
Microsoft Dynamics AX Developer Center	http://go.microsoft.com/fwlink/?LinkId=182435&clcid=0x409
Microsoft Dynamics AX	http://go.microsoft.com/fwlink/?LinkId=182436
Microsoft Dynamics AX technical community on MSDN	http://go.microsoft.com/fwlink/?LinkId=182437

Resource	Location
CustomerSource	http://www.microsoft.com/dynamics/customersource.aspx
PartnerSource	http://www.microsoft.com/dynamics/partnersource.aspx

**Note:**

CustomerSource is a password-protected site for customers who use Microsoft Dynamics and related business products. PartnerSource is a password-protected site for partners who focus on Microsoft Dynamics and related products. Both sites require an account for logon.

Searching for Documentation with WebSearchAx

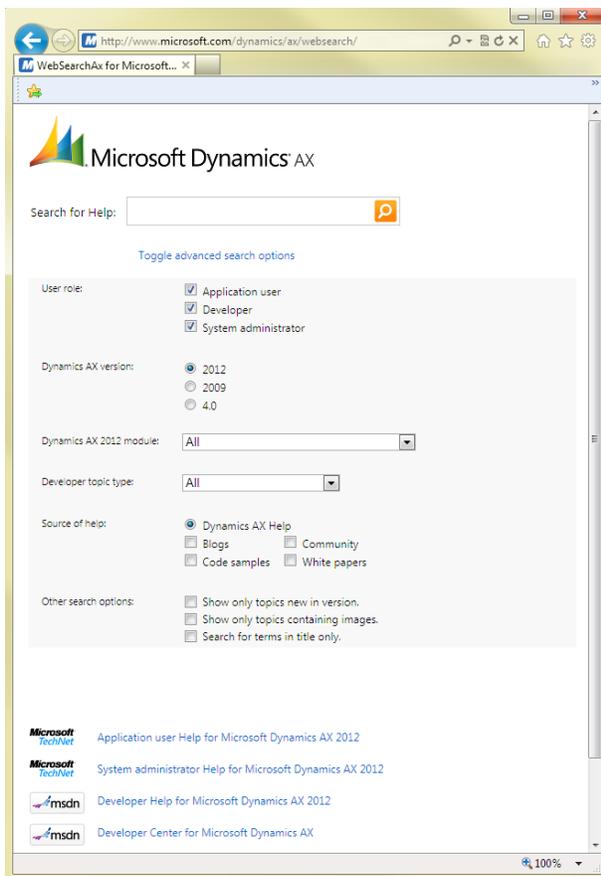
For Microsoft Dynamics AX 2012, all Help documentation topics are published to the web. Each topic is published to either Microsoft [TechNet](http://technet.microsoft.com/en-us/library/dd362025.aspx) (<http://technet.microsoft.com/en-us/library/dd362025.aspx>) or [MSDN](http://msdn.microsoft.com/en-us/library/aa155304.aspx) (<http://msdn.microsoft.com/en-us/library/aa155304.aspx>), depending on its target audience:

- For application users – TechNet
- For developers – MSDN
- For system administrators – TechNet

Only the English editions of Help topics are published to the web for Microsoft Dynamics AX 2012.

WebSearchAx Tool for Advanced Searches on the Web

The [WebSearchAx.htm](http://go.microsoft.com/fwlink/?LinkID=194311) (<http://go.microsoft.com/fwlink/?LinkID=194311>) page is available to provide advanced search capabilities for a variety of information about Microsoft Dynamics AX. **WebSearchAx** searches for Help topics on TechNet and MSDN. **WebSearchAx** can also search the web for white papers, code samples, and blog entries about Microsoft Dynamics AX.



The WebSearchAx.htm page

The labels on the **WebSearchAx** page are displayed in the language of the user. However, all Help topics found by **WebSearchAx** are in English.

Application User Help is Installed Locally

The Help server is part of a complete installation of Microsoft Dynamics AX 2012. The Help server hosts Help topics for the application user audience. Each Help topic is an `.htm` file that can be viewed with the Help viewer or any web browser. The Help server hosts the following types of topics:

- Help topics that are installed with the product.
The hosted topics target application users and the Application Workspace.
- Help topics for forms that are used by developers and system administrators.
These Help topics are not listed in the table of contents in the Help viewer. You can see this type of Help topic by pressing the F1 key while the form has focus.
- Custom help topics that are created by partners and customers.
For more information, see [Writing Documentation for the Help System](http://msdn.microsoft.com/library/f9fe4da3-140e-442d-8bf8-d04ac3dd5789(AX.60).aspx) ([http://msdn.microsoft.com/library/f9fe4da3-140e-442d-8bf8-d04ac3dd5789\(AX.60\).aspx](http://msdn.microsoft.com/library/f9fe4da3-140e-442d-8bf8-d04ac3dd5789(AX.60).aspx)).

The Help viewer is the client that you use to read topics from the Help server. You start the Help viewer when you press F1 from the Application Workspace. In addition, you can use links that are available in the Help menu of the Application Workspace. The Help viewer includes links to **WebSearchAx** at the bottom of every search results list.

For more information about the Help server and Help viewer, see [Help System Components](#).

See Also

[Getting Started with Microsoft Dynamics AX](http://msdn.microsoft.com/library/f156b8a9-16cc-4ce8-8d3a-56e041f8a9b7(AX.60).aspx) ([http://msdn.microsoft.com/library/f156b8a9-16cc-4ce8-8d3a-56e041f8a9b7\(AX.60\).aspx](http://msdn.microsoft.com/library/f156b8a9-16cc-4ce8-8d3a-56e041f8a9b7(AX.60).aspx))

Prerequisite skills and knowledge

Microsoft Dynamics AX is built on several other Microsoft products and technologies. To implement the Microsoft Dynamics AX program in a manner that takes full advantage of this technology platform, you must have advanced information technology skills and knowledge.

Prerequisites for system administrators

We recommend that system administrators who are preparing to deploy Microsoft Dynamics AX be familiar with general industry practices that pertain to the reliability, scalability, availability, performance optimization, security, and monitoring of a network infrastructure and applications. The base components of Microsoft Dynamics AX include Application Object Server (AOS), the database server, the model store, which was previously known as the application file server, and the Microsoft Dynamics AX client. To install the base components, you must understand the following Microsoft technologies:

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- The Windows Server operating system that is used to deploy the Microsoft Dynamics AX server components
- The Windows client operating system that is used to deploy the Microsoft Dynamics AX Windows client
- The Microsoft .NET Framework
- Windows Server Terminal Services, if this technology is required
- Advanced network management in an environment that uses Active Directory Domain Services.

The following table describes the skills and knowledge that are required to deploy specific components of a Microsoft Dynamics AX implementation.

Microsoft Dynamics AX component	Required skills and knowledge
Database server	<ul style="list-style-type: none"> • Microsoft SQL Server® administration • The planning of relational database infrastructures and sizing of the database infrastructure • Performance optimization and monitoring of a database server • Database backup and recovery
Reporting and analytics	<ul style="list-style-type: none"> • Microsoft SQL Server Analysis Services • Microsoft SQL Server Reporting Services • Internet Information Services (IIS), websites, virtual directories, application pools, and administration of web services • The Microsoft .NET Framework version 4 and ASP.NET
Enterprise Portal for Microsoft Dynamics AX	<ul style="list-style-type: none"> • IIS administration • Microsoft® SharePoint® Foundation 2010 administration or Microsoft® SharePoint® Server 2010 administration, depending on the production version that is used • The .NET Framework version 4 and ASP.NET • The creation and management of websites, web services, virtual directories, and application pools

Microsoft Dynamics AX component	Required skills and knowledge
Services and Application Integration Framework (AIF)	<ul style="list-style-type: none"> • IIS administration, if web services are deployed • Microsoft® BizTalk® Server, if you must integrate BizTalk Server with Microsoft Dynamics AX • The .NET Framework, especially Windows Communication Foundation (WCF) • Integration concepts, such as enterprise application integration (EAI), business-to-business (B2B), and synchronous and asynchronous transports • The creation and management of websites, web services, virtual directories, and application pools, if you deploy web services • The .NET Framework version 4 and ASP.NET • Message Queuing, which is also known as MSMQ, if this technology is used
Workflow	<ul style="list-style-type: none"> • The .NET Framework, especially Windows Workflow Foundation • IIS administration, which is required during an upgrade from the previous release
Microsoft Project Server integration functionality	<ul style="list-style-type: none"> • The deployment and management of Windows services • Message Queuing • Project Server administration

What's new for Microsoft Dynamics AX 2012

Microsoft Dynamics AX 2012 and Microsoft Dynamics AX 2012 R2 introduce many new features and technologies that were not available in previous versions. Additionally, changes introduced in these versions update a number of existing features and technologies significantly to help increase system security, user productivity, and reduce administrative overhead. If you have worked with a previous version of Microsoft Dynamics AX, you should read "New, Changed, and Deprecated Features for Microsoft Dynamics AX 2012" to learn about these changes. This document also includes deprecated feature notices for features that are planned to be removed in Microsoft Dynamics AX 2012 or future versions.

You can download the document from the [Microsoft Download Center](http://go.microsoft.com/fwlink/?LinkId=272622) (<http://go.microsoft.com/fwlink/?LinkId=272622>).

Architecture and planning

When you understand the architecture of Microsoft Dynamics AX, you can better plan, customize, and deploy the Microsoft Dynamics AX system. The topics in this section provide an overview of the Microsoft Dynamics AX system and its base components.

The following topics are included in this section:

[Microsoft Dynamics AX architecture](#)

[Plan an implementation](#)

Microsoft Dynamics AX architecture

If you understand the architecture of Microsoft Dynamics AX, you can more effectively plan, customize, and deploy the Microsoft Dynamics AX system. The topics in this section provide an overview of the Microsoft Dynamics AX system and associated components.

[System architecture](#)

[Security architecture](#)

[Data partitioning architecture](#)

[Component architecture](#)

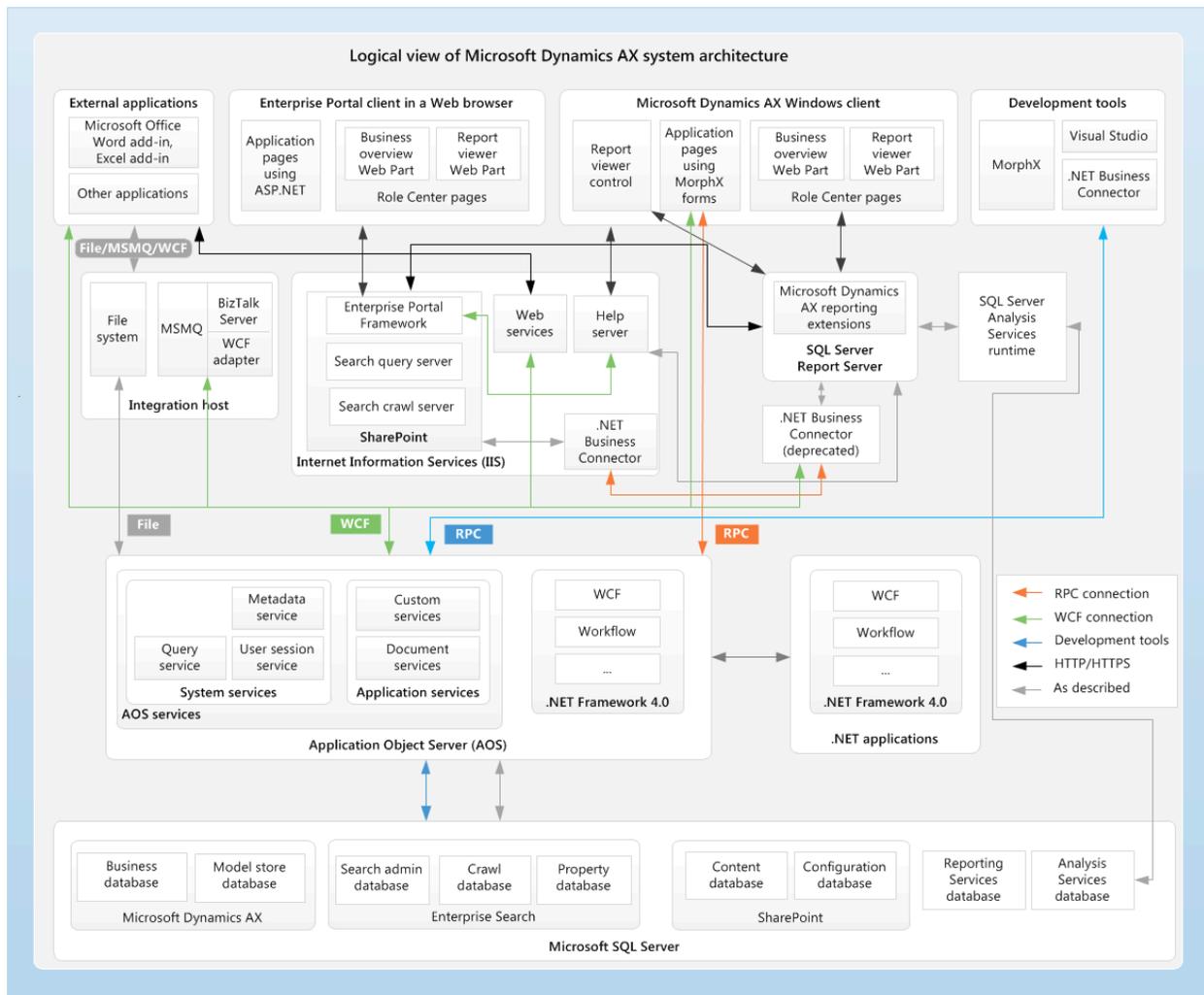
[Development environment](#)

System architecture

If you understand the internal architecture of Microsoft Dynamics AX, you can more effectively make decisions when you plan, customize, and deploy a system. This topic provides a high-level overview of the system architecture of Microsoft Dynamics AX.

Microsoft Dynamics AX system architecture

The following diagram provides a high-level overview of the system architecture of Microsoft Dynamics AX. This diagram does not depict the system topology or physical infrastructure that is required for the deployment. Your infrastructure can consist of many Microsoft Dynamics AX components, and these components can be installed on either a single physical server or multiple physical servers. For factors that you must consider when you plan a deployment infrastructure, see [Plan system topology](#). For detailed information about Microsoft Dynamics AX components, see [Component architecture](#). For the current hardware and software requirements for Microsoft Dynamics AX, see the [system requirements](http://go.microsoft.com/fwlink/?LinkId=165377) (http://go.microsoft.com/fwlink/?LinkId=165377) document that is available from the Microsoft Download Center.



Authentication and authorization

Microsoft Dynamics AX uses integrated Windows authentication to authenticate Active Directory Domain Services users. If you configure Microsoft Dynamics AX to use a different authentication provider, users are authenticated by that provider. Authorization for access to data, business functionality, and

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presentation elements, such as forms, menus, fields, and reports, is governed by Microsoft Dynamics AX security. Anonymous web users can access Enterprise Portal for Microsoft Dynamics AX. However, only limited functionality is available to these users.

For more information, see [Security architecture](#).

Presentation tier (clients and external applications)

A client provides an interface to Microsoft Dynamics AX data and functionality. An external application is integrated with Microsoft Dynamics AX to programmatically integrate functionality or exchange data.

- The Windows client for Microsoft Dynamics AX is a native 32-bit program that provides a rich user interface.
- Supported web browsers provide access to Microsoft Dynamics AX functionality and data through Enterprise Portal.
- External applications interact with Microsoft Dynamics AX via services and Application Integration Framework (AIF). Services and AIF provide an extensible framework for XML-based scenarios for enterprise application integration (EAI), business-to-business (B2B), and service-oriented architecture (SOA).

Note:

Use services and AIF to interact with the Microsoft Dynamics AX application. We recommend that you not use .NET Business Connector for integration with the Microsoft Dynamics AX application.

For more information about the architecture of the presentation tier, see the following topics:

- [Client architecture](#)
- [Enterprise Portal architecture](#)
- [Services and AIF architecture](#)

Application tier

The application tier consists of one or more of the following Microsoft Dynamics AX components or computer roles.

Active Directory domain controller

A domain controller for AD DS is a prerequisite for installing Microsoft Dynamics AX.

For more information, see [Security architecture](#).

Application Object Server

Application Object Server (AOS) controls communication among Microsoft Dynamics AX clients, databases, and applications. AOS also hosts Microsoft Dynamics AX services and the workflow system. You can deploy AOS on a single computer or create a load-balanced cluster of multiple AOS instances. AOS is a Windows service that requires a Windows Server operating system. For the current hardware and software requirements for Microsoft Dynamics AX, see the [system requirements](#) (<http://go.microsoft.com/fwlink/?LinkId=165377>) document that is available from the Microsoft Download Center.

AOS uses libraries from the Microsoft .NET Framework version 4, such as Windows Communication Foundation and Windows Workflow Foundation.

For more information, see [AOS architecture](#).

Enterprise Portal

Microsoft Dynamics AX provides a set of websites that give you access to data. On these sites, you can also participate in business processes by using web-based forms. These sites are collectively called Enterprise Portal.

For more information, see [Enterprise Portal architecture](#).

Reporting

Microsoft SQL Server Reporting Services is the primary reporting platform for Microsoft Dynamics AX.

For more information, see [Reporting architecture](#).

Analytics

Microsoft SQL Server Analysis Services is a server-based solution that provides functionality for online analytical processing (OLAP). OLAP reports help users analyze business data and identify trends that they might not discover if they view the data in traditional reports.

For more information, see [Analytics architecture](#).

Workflow

Workflow is a system that is installed together with Microsoft Dynamics AX, and that runs on AOS. The workflow system provides functionality that you can use to create individual workflows, or business processes.

For more information, see [Workflow system architecture](#).

Services and Application Integration Framework (AIF)

The capability to integrate Microsoft Dynamics AX with other systems inside and outside the enterprise is a common requirement. Services and AIF provide this capability by enabling the exchange of data through formatted XML.

For more information, see [Services and AIF architecture](#).

Help server

The Help system uses a client/server architecture. Help content is hosted on a dedicated server component, the Help server, which manages the storage and display of product documentation. The Help viewer, which is a component of the Microsoft Dynamics AX client, provides access to Help content from individual workstations.

For more information, see [Help system architecture](#).

Microsoft Project Server integration

The integration of Microsoft Dynamics AX with Microsoft Project Server requires two integration components, the synchronization service for Project Server and synchronization proxy for Project Server. To use the Project Server functionality, you must install both components.

For more information, see [Project Server integration architecture](#).

Microsoft Dynamics AX

Data tier

Microsoft Dynamics AX requires several database components.

The Microsoft Dynamics AX database

The *database* is a Microsoft SQL Server database that stores transaction and reference data. This database is functionally equivalent to the principal database in Microsoft Dynamics AX 4.0 and Microsoft Dynamics AX 2009.

For more information, see [Database components](#).

The model store

The *model store* is a SQL Server database that stores all application elements for Microsoft Dynamics AX. These elements include customizations. Information about layers and models is an integral part of the store. AOS has access to the model store, handles layer flattening, and provides model data to all the Microsoft Dynamics AX subsystems. These subsystems include the subsystems for form rendering, report rendering, and X++ code. The model store replaces the Microsoft Dynamics AX Object Data (AOD) files that were used in earlier versions of Microsoft Dynamics AX.

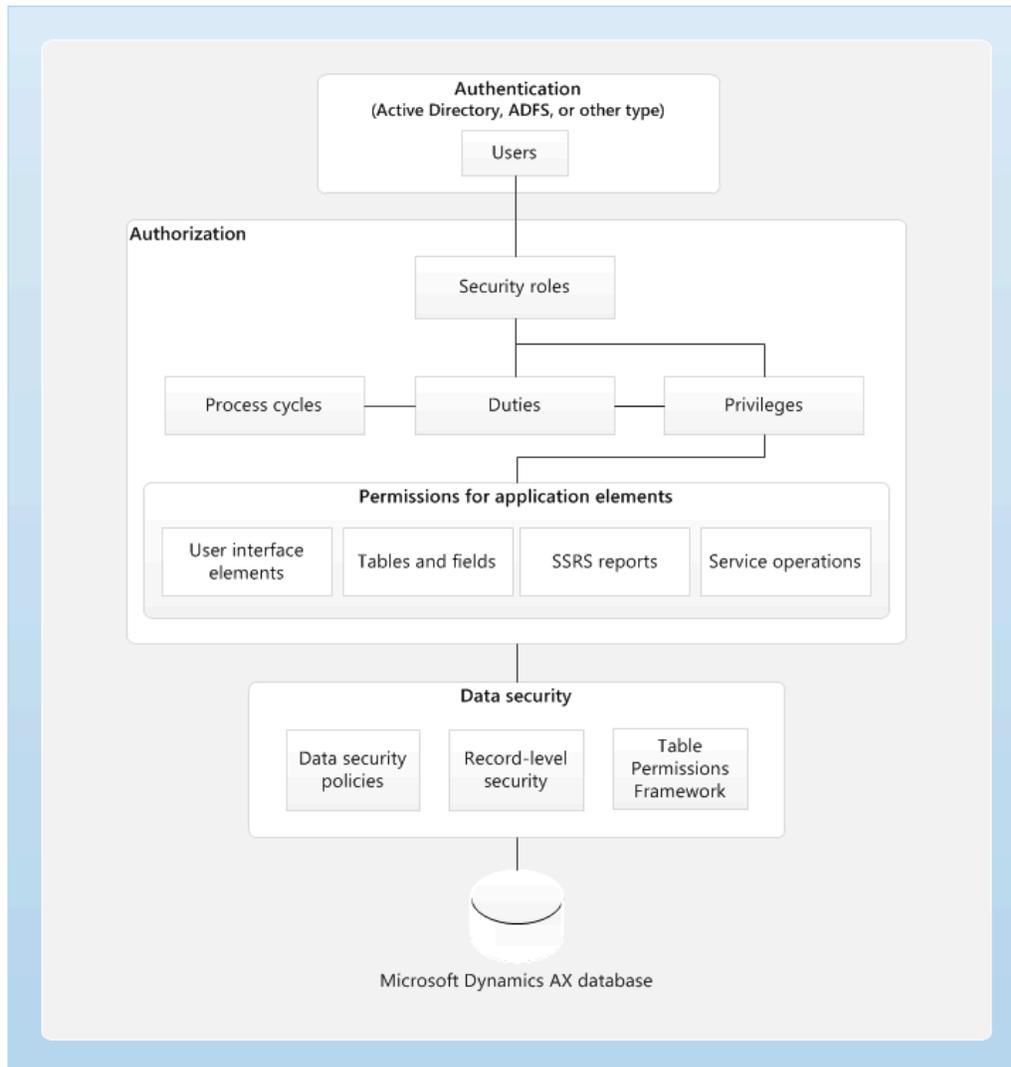
For more information, see [Model store architecture](#).

Other databases

Enterprise Portal requires content and configuration databases for SharePoint 2010 products. Reporting Services requires a Reporting Services database. Support for OLAP cubes requires an Analysis Services database.

Security architecture

When you understand the security architecture of Microsoft Dynamics AX, you can more easily customize security to fit the needs of your business. The following diagram provides a high-level overview of the security architecture of Microsoft Dynamics AX.



Authentication

By default, only authenticated users who have user rights in Microsoft Dynamics AX can establish a connection.

Microsoft Dynamics AX uses integrated Windows authentication to authenticate Active Directory users. If you configure Microsoft Dynamics AX to use a different authentication provider, users are authenticated by that provider.

After a user connects to Microsoft Dynamics AX, access is determined by the duties and privileges that are assigned to the security roles that the user belongs to.

Authorization

Authorization is the control of access to the Microsoft Dynamics AX application. Security permissions are used to control access to individual elements of the application: menus, menu items, action and command buttons, reports, service operations, web URL menu items, web controls, and fields in the Microsoft Dynamics AX client and Enterprise Portal for Microsoft Dynamics AX.

In Microsoft Dynamics AX, individual security permissions are combined into privileges, and privileges are combined into duties. The administrator grants security roles access to the application by assigning duties and privileges to the roles.

For more information about role-based security in Microsoft Dynamics AX, see [About role-based security](#).

Data security

Authorization is used to grant access to elements of the application. By contrast, data security is used to deny access to tables, fields, and rows in the database.

Use the extensible data security framework to control access to transactional data by assigning data security policies to security roles. Data security policies can restrict access to data, based on the effective date or based on user data, such as the sales territory or organization. For more information about how to use data security policies in Microsoft Dynamics AX, see [Overview of Security Policies for Table Records](http://msdn.microsoft.com/library/c726332f-48a4-4b00-a9ef-441e7e3b970e(AX.60).aspx) ([http://msdn.microsoft.com/library/c726332f-48a4-4b00-a9ef-441e7e3b970e\(AX.60\).aspx](http://msdn.microsoft.com/library/c726332f-48a4-4b00-a9ef-441e7e3b970e(AX.60).aspx)).

In addition to the extensible data security framework, record-level security can be used to limit access to data that is based on a query. However, because the record-level security feature is becoming obsolete in a future release of Microsoft Dynamics AX, we recommend that you use data security policies, instead.

Additionally, the Table Permissions Framework helps protect some data. Data security for specific tables is enforced by Application Object Server (AOS). For more information about the Table Permissions Framework, see [Manage data access by using the Table Permissions Framework](http://technet.microsoft.com/library/101d7291-6637-4519-9859-1b357398939d(AX.60).aspx) ([http://technet.microsoft.com/library/101d7291-6637-4519-9859-1b357398939d\(AX.60\).aspx](http://technet.microsoft.com/library/101d7291-6637-4519-9859-1b357398939d(AX.60).aspx)).

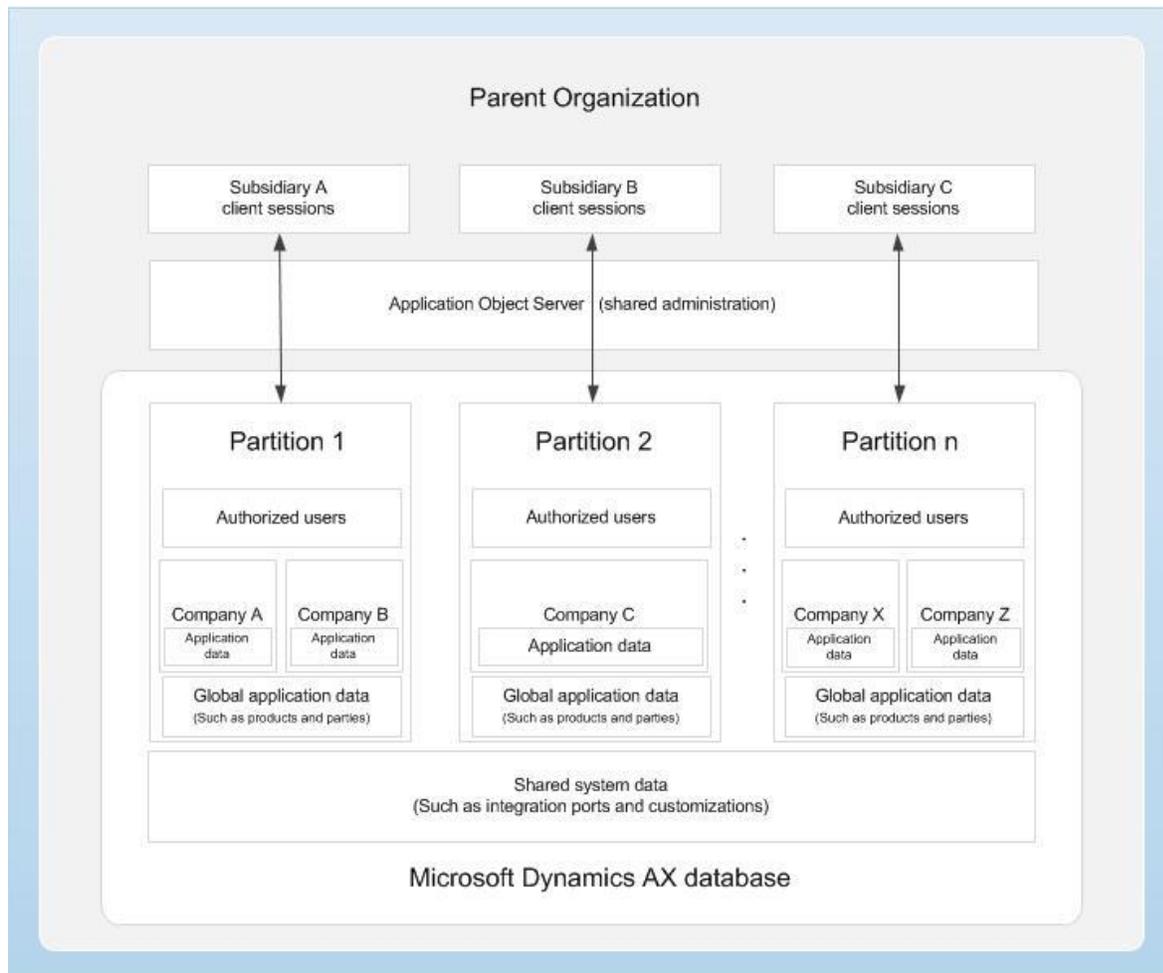
Data partitioning architecture

Microsoft Dynamics AX 2012 R2 enables data isolation by using data *partitions*. For example, an organization has several subsidiaries. If the management of the organization does not want employees of one subsidiary to have access to the data for other subsidiaries, data partitions can provide the boundaries that are required for data isolation.

Data partitions provide a logical separation of data in the Microsoft Dynamics AX database. To achieve this separation, Microsoft Dynamics AX adds a column to each table that contains data that must be isolated. This column contains a partition ID, which is the `RecId` of an entry in the **Partitions** table. In a partitioned table, rows that contain the same partition ID value belong to the same partition. The partition ID is also added to relevant indexes.

Partitions are defined in the **Partitions** form, where the system administrator creates the partition and provides a *partition key*. A partition key identifies a partition by using a unique string value that the system administrator specifies. Microsoft Dynamics AX displays the partition key in the title bar of the client application. Partitions can also be defined during installation and upgrade.

The following diagram illustrates the architecture for data partitioning.



Microsoft Dynamics AX data partitioning architecture

Scope of data isolation

It is important to understand that data partitions do not create separate installations of Microsoft Dynamics AX. Consider the following characteristics of partitioned systems:

- **Shared AOS** – A partitioned system is created in the context of a single instance of Microsoft Dynamics AX Application Object Server (AOS) or an AOS cluster. When Microsoft Dynamics AX is first set up, the system creates a default partition. The partition key for the default partition is "initial". Additional partitions can be created during installation or upgrade, or at any time after the system is deployed. After a partition has been created, it cannot be deleted.

Microsoft Dynamics AX

- **Shared database** – In a partitioned system, all data is stored in the same database or database cluster. Partitions provide only logical data separation. No physical isolation of data occurs. Many system tables are shared tables that do not contain a column for the partition ID.
- **Shared AOT** – A partitioned system has one Microsoft Dynamics AX Application Object Tree (AOT). Customizations are always shared across all partitions. The model store database is not partitioned. Metadata that describes objects in the AOT is shared. Custom code is shared across the system.

By default, code runs in the context of the partition for the current session. This behavior resembles the behavior of X++, which handles companies by using the `dataAreaId` field. Therefore, pre-existing code that uses the X++ query mechanism works without modification. Direct SQL calls must be modified to filter on the context of the current partition.

For more information about using data partitions in development projects, see [Partitions, Companies, and Data Isolation in Microsoft Dynamics AX](http://msdn.microsoft.com/library/1fdc4428-e235-4cd6-ae2f-f8f58f806db8(AX.60).aspx) ([http://msdn.microsoft.com/library/1fdc4428-e235-4cd6-ae2f-f8f58f806db8\(AX.60\).aspx](http://msdn.microsoft.com/library/1fdc4428-e235-4cd6-ae2f-f8f58f806db8(AX.60).aspx)).

The Microsoft Dynamics AX cross-reference system is shared. Role definitions are shared across the system. In Microsoft Dynamics AX 2012 R2 and later versions, multi-partition configurations have no new requirements to define or maintain reports.

- **Common administration** – Users who have the system administrator role can access data in all partitions. However, to view data in a particular partition, the administrator must log on to a client instance for that partition.

System administrators can create new partitions. Both system administrators and security administrators can manage users in the context of a partition.

License keys and configuration keys are shared across the system.

- **Common application integration** – In a partitioned system, Services and Application Integration Framework (AIF) is a shared subsystem. To guarantee that incoming requests are correctly isolated, you can restrict an inbound integration port to a particular partition. Additionally, you can specify a target partition for an incoming request by including the partition key in an XML element in the header of the document. Similarly, outbound responses indicate the source partition for the response data by including the partition key in the header.

Because AIF uses a single gateway queue, a system administrator can view all documents in the queue, AIF history, or exceptions list in any partition. The forms that display these lists now have a field that shows the partition key for each document.

- **Common batch framework** – Like AIF, the batch processing framework is a shared subsystem. One batch server is shared across partitions. However, each batch job is associated with a specific partition. The batch server executes batch jobs in the context of the correct partition. To view batch jobs or their history, you must log on to the partition that the batch jobs are associated with.
- **Separate application data** – Access to application data is controlled by a combination of the partition ID and the user's role and permissions. The Microsoft Dynamics AX client does not let users view unified data across partitions. Microsoft Dynamics AX does not provide a query mechanism to retrieve and combine data from multiple partitions.
- **Separate organizational hierarchies** – Each partition contains its own organizational hierarchy, which includes one or more legal entities. Like a new deployment of Microsoft Dynamics AX, each

partition that is created contains the DAT company as a default legal entity. System administrators can add legal entities to each partition. Legal entities are never shared between partitions, even if the legal entities have the same name.

- **Separate user configurations** – Each partition contains its own list of authorized users. The system administrator who created the partition is automatically created as a user who has the system administrator role in the new partition. After a system administrator logs on to a partition, he or she can add authorized users to the partition.

A user can be authorized to access data in more than one partition. However, the user must be created and managed separately in each partition. This user must use a separate client configuration to start a separate client session for each partition. Each user is associated with a default partition. This default partition can be changed by a system administrator. A user who logs on to Microsoft Dynamics AX by using a default client configuration is logged on to the user's default partition.

The Microsoft Dynamics AX client application displays the partition key for the current session in the title bar of the main window.

User roles are assigned for each partition.

Component architecture

This section lists Microsoft Dynamics AX components by functional category and describes the Microsoft Dynamics AX architecture of selected components.

The following topics are included in this section:

[Database components](#)

[Server components](#)

[Business intelligence components](#)

[Client architecture](#)

[Integration components](#)

Database components

Microsoft Dynamics AX relies on two Microsoft SQL Server databases, the business database and the model store database. During upgrade, an additional database, the baseline model store, is used. This topic provides an overview of the databases and the types of tables that each database stores.



Important:

In Microsoft Dynamics AX 2012 R2, the model store was moved into a database that is separate from the business database.

The Microsoft Dynamics AX business database contains two primary types of tables:

- Tables that can be accessed from the data dictionary in the Application Object Tree (AOT).
- Kernel tables that can be accessed from the **System Documentation** section of the AOT. Kernel tables are used by Microsoft Dynamics AX. These tables are not associated with table groups, and cannot be directly imported, exported, or changed.

The *model store* is the database where all application elements for Microsoft Dynamics AX are stored. Customizations are also stored in the model store. The model store replaces the Application Object Data (AOD) files that were used in earlier versions of Microsoft Dynamics AX.

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The name of the model store consists of the name of the business database plus **_model**. Both the business database and the model store database must be hosted on the same database server and the same instance of SQL Server. The model store database holds model store tables that can be accessed from the **System Documentation** section of the AOT. These tables cannot be directly imported, exported, or changed. For more information, see [Model store architecture](#).

The model store can be managed by using the AXUtil command-line utility or Windows PowerShell. In Microsoft Dynamics AX, the model store tables are visible in the AOT, in the **System Documentation > Tables > SysModel*** section.

The baseline model store holds model store tables for the earlier version of the metadata and is used only during upgrade. The baseline model store is like the **old** folder in earlier versions of Microsoft Dynamics AX.

Tables that can be accessed from the data dictionary

The tables that can be accessed from the data dictionary in the AOT include tables in the following table groups:

- **Framework** – Includes tables that are used by underlying Microsoft Dynamics AX frameworks, such as Application Integration Framework (AIF). These tables are created during installation and are not associated with configuration keys.
- **Group** – Includes tables that are used to categorize the tables in the **Main** table group.
- **Main** – Includes the principal or master tables that contain data for central business objects. These tables typically hold static, base information.
- **Miscellaneous** – Includes tables that have not been otherwise categorized. This table group is the default group for new tables.
- **Parameter** – Includes tables that contain parameters or setup information for tables in the **Main** table group.
- **Reference** – Includes tables that contain reference data.
- **Transaction, Transaction header, and Transaction line** – Include tables that contain transaction data. The tables in the **Transaction header** table group categorize the tables in the **Transaction line** table group. There is a one-to-many relationship between a **Transaction header** table and a **Transaction line** table.
- **Worksheet, Worksheet header, and Worksheet line** – Include tables that contain information that is validated and made into transactions. Unlike the data that is contained in tables in the **Transaction** table groups, data in the **Worksheet** table groups is temporary. After data from these tables has been made into transactions, and moved into transaction tables, the **Worksheet** tables become obsolete and can be deleted without affecting system stability.

For a list of all the tables that can be accessed from the data dictionary, see [Table group reference](http://technet.microsoft.com/library/0d41cc20-f60d-4b0e-8f5d-6dca9fb0d82a(AX.60).aspx) ([http://technet.microsoft.com/library/0d41cc20-f60d-4b0e-8f5d-6dca9fb0d82a\(AX.60\).aspx](http://technet.microsoft.com/library/0d41cc20-f60d-4b0e-8f5d-6dca9fb0d82a(AX.60).aspx)).

Model store architecture

The *model store* is the database where all application elements for Microsoft Dynamics AX are stored. Customizations are also stored in the model store. The model store replaces the Application Object Data (AOD) files that were used in earlier versions of Microsoft Dynamics AX.

 **Important:**

In Microsoft Dynamics AX 2012 R2, the model store was moved into a database that is separate from the business database. The name of the model store consists of the name of the business database plus **_model**.

Layer information and model information are integral parts of the model store. The Application Object Server (AOS) has access to the model store. The AOS manages layer flattening or overshadowing at runtime. That is, when you make an object modification in one layer, the modification overshadows the object on a lower layer at runtime. You could, for example, decide to change a caption on a standard form. The change is saved on your layer only, and the revised—or flattened—form replaces the standard form at runtime. The AOS also provides all the Microsoft Dynamics AX subsystems with model data, such as form rendering, report rendering, and X++ code.

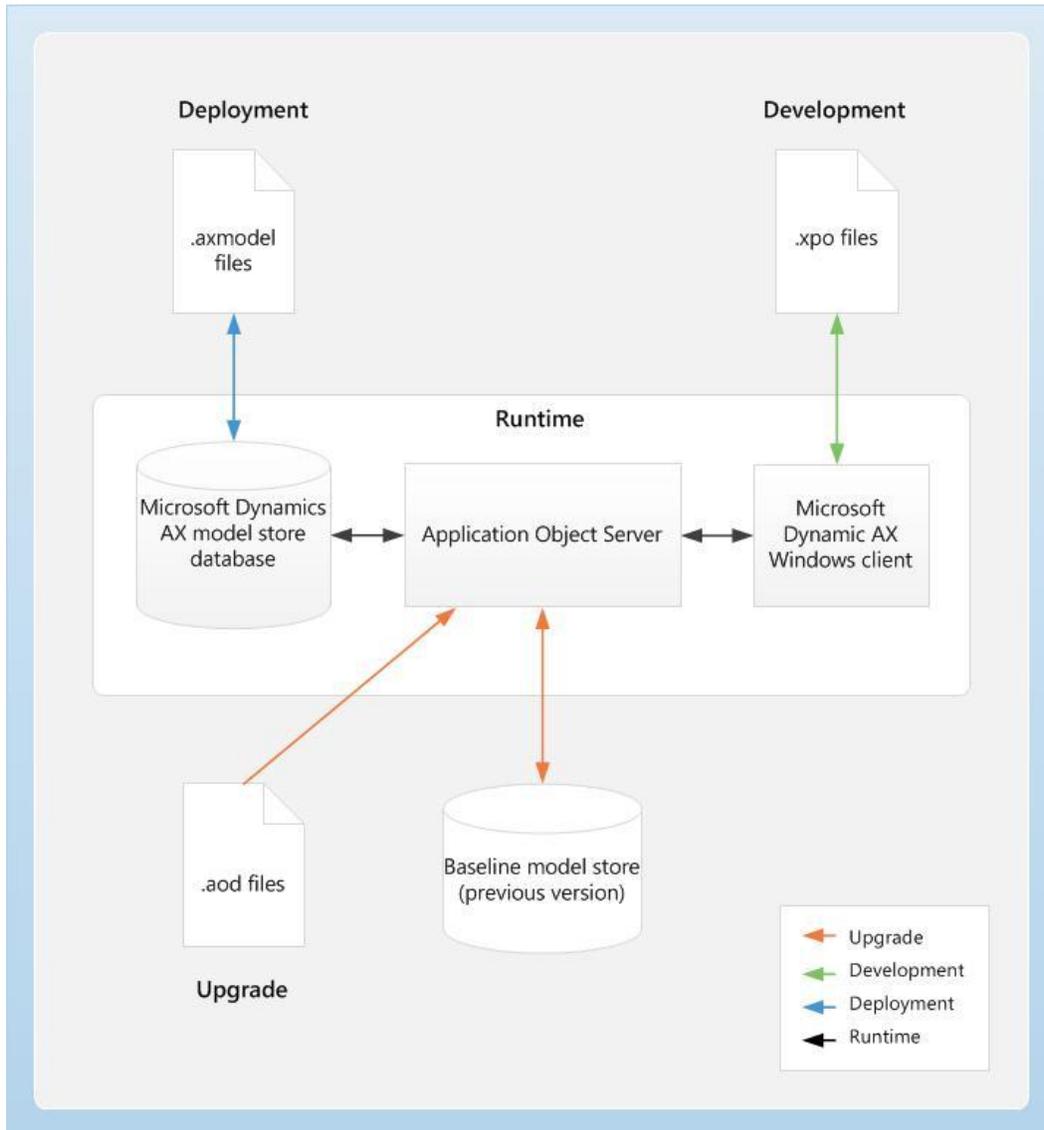
Microsoft Dynamics AX contains sixteen layers. Each layer consists of one or more logical parts called models. A model is generated for each layer. For example, **VAR Model** is the model that the system generates for the VAR layer. The system-generated models let you install and work with the base Microsoft Dynamics AX system. When you customize the Microsoft Dynamics AX program, you can take advantage of the capabilities of models.

The model store is used in the following ways in Microsoft Dynamics AX:

- **Installation** – During installation, the Setup program uses axutilib.dll to import the .axmodel files from the installation path into the model store.
- **Upgrade** – During an upgrade, the application files, or AOD files, from the earlier version are imported into the model store, which is the new model. The application files are also imported into the baseline model store, or the model store for the earlier version of the metadata. The baseline model store is similar to the **old** folder in earlier versions of Microsoft Dynamics AX.
- **Development environment** – In the development environment, developers can continue to use .xpo files to export and import code. Use .axmodel files to migrate application elements from one environment to another, such as from a development environment to a test environment. Export models from the source system to .axmodel files, and then import .axmodel files into the target system.
- **Run time** – At run time, an Application Object Server (AOS) instance retrieves the application elements, such as forms, reports, and classes, from the model store to respond to client requests.

Microsoft Dynamics AX

The following diagram provides an overview of the model store architecture.



Models, Layers, and the Model Store

Models were introduced in Microsoft Dynamics AX 2012 to help partners and customers more easily install and maintain multiple solutions side by side in the same layer. This topic introduces the concept of models, and describes how models relate to layers and label files. This topic also describes the model store, which is a database in which all application elements for Microsoft Dynamics AX are stored.

Models

A *model* is a set of elements in a given layer. Each layer consists of one or more models. Each layer contains one system-generated model that is specific to that layer. Every element in a layer belongs to only one model. In other words, no element can belong to two models in the same layer, and every element must belong to a model.

A model is permanently associated with the layer that the model was created in. If you need to move one of your models from one layer to another, you must create a project from the model in the Application Object Tree (AOT), export the project as an xpo file, create a target model in the desired layer, delete the original model to avoid having to resolve layer conflicts, and import the xpo file to the target model. If you are moving elements between models in the same layer, you can use the **Move to model** command in the AOT.

Models are stored in the *model store*. The model store is a database in which all application elements for Microsoft Dynamics AX are stored. Customizations are also stored in the model store. The model store replaces the Application Object Data (AOD) files that were used in earlier versions of Microsoft Dynamics AX. Models that have been installed in the model store are used at run time.

 **Important:**

In Microsoft Dynamics AX 2012 R2, the model store was moved into a database that is separate from the business database.

Models can be exported to files that have the .axmodel extension. These files are called model files. Model files are deployment artifacts. Model files can be signed with strong name signing and Microsoft Authenticode signing.

Models and label files

In Microsoft Dynamics AX 2012, label files, or ALD files, are part of models. A label file must be added to a model before the model can be installed. After a model has been installed, ALD files are pulled from the model store to the local of Application Object Server (AOS) instance when the AOS is started. When the AOS is shut down, the ALD files are pushed back to the model store.

ALD files from earlier versions of Microsoft Dynamics AX are not part of a model file. However, you can import these files into the model store from the **Label Files** section of the AOT. Use the **Create from file** shortcut command.

 **Important:**

The ALD file from an earlier version of Microsoft Dynamics AX must not be located in the application folder of AOS. Otherwise, you cannot import the file.

How models improve the installation and maintenance of side-by-side customizations

In earlier versions of Microsoft Dynamics AX, multiple partner solutions could not exist side by side in the same layer. However, models now enable side-by-side customizations. Additionally, the following improvements help you work with side-by-side customizations:

- The development environment for Microsoft Dynamics AX lets you create a project for each model that is installed. Therefore, you can quickly see all the installed customizations in a layer for a given model.
- When you import a model, elements in the model that you are importing may conflict with another model in the same layer. You can now create a *conflict model* in the patch layer that is associated with the layer that you are working in. You can then resolve the conflicts in the conflict model. In earlier versions, no warnings about conflicts were displayed. Instead, elements were just replaced.
- You can now leave the rest of the layer intact when you uninstall a model. In earlier versions, if you wanted to uninstall customizations, you had to either remove the customizations manually from the AOT or remove the layer.

Important:

Element IDs are now specific to each installation. In other words, the same method or class has a different element ID in different installations. To maintain installation-specific element IDs when you import and export models and model stores, you must strictly follow specific procedures. If you do not follow the correct procedure when you import or update models, IDs can become randomized, and data integrity can be affected. For more information, see [Maintaining Installation-Specific Element IDs and Element Handles](#)

([http://msdn.microsoft.com/library/e41443b8-1acf-4144-9b7f-2b7c216916ef\(AX.60\).aspx](http://msdn.microsoft.com/library/e41443b8-1acf-4144-9b7f-2b7c216916ef(AX.60).aspx)).

Working with label files across solutions

We recommend that you use one label file per solution to simplify installation.

If you find that you require multiple label files, we recommend that you create a single shared, cross-solution label file and package it as a model file. Then, when you install solutions, you must install two models: the solution itself and the label model.

If you want to ship additional languages, you can add the languages to the solution model, increment the model's version number, and then reimport the model.

Installing metadata

Metadata can be installed in various ways. The following table describes each installation method that is available.

	XPO files	Model files	Model store files
Installation tool	MorphX	AXUtil.exe or Windows PowerShell cmdlets	AXUtil.exe or Windows PowerShell cmdlets
The files can be uninstalled.	No	Yes	No
The files can be signed.	No	Yes	No
Microsoft Dynamics AX element IDs are preserved.	Yes, if the elements already exist in the target model store	Yes, if the elements already exist in the target model store	Yes, all element IDs of the source model store are preserved.
Compilation is required after installation.	Yes	Yes	No
CIL generation is required after installation.	Yes	Yes	No

Important:

To avoid ID conflicts, we recommend that you do not use xpo export/import to move customizations in environments in which you are primarily relying on importing and exporting models and model stores.

The following table describes the scenarios in which we recommend you use each installation method.

Scenario	Recommended installation method
Distributing a solution to customers	Model files
Deploying a solution in a development or test environment	Model files or XPO files
Deploying a solution to a production environment	Model store files

Server components

The topics in this section provide an overview of the server components for Microsoft Dynamics AX. The server components include Application Object Server (AOS) and the components that are hosted on either AOS or Internet Information Services (IIS).

The following topics are included in this section:

[AOS architecture](#)

[Help system architecture](#)

[Enterprise Portal architecture](#)

[Enterprise Search architecture](#)

[Workflow system architecture](#)

AOS architecture

Introduction to the Application Object Server architecture

An Application Object Server (AOS) is a core component of the Microsoft Dynamics AX installation and is installed by using Setup. An AOS enforces security, manages connections between clients and the database, and provides the foundation where business logic for Microsoft Dynamics AX is executed. An AOS is implemented as a Microsoft Windows service. By default, an AOS is listed in the **Services** pane as **Microsoft Dynamics AX Object Server 6.0\$ InstanceName**. As a Windows service, AOS works in the following ways:

- An AOS runs in the security context of either a specific domain account or the NT Authority/Network Service account, depending on the setup.
- The status of an AOS is reported to the Windows event logs. Therefore, administrators can view errors and warnings that can help them troubleshoot problems.

You can install an AOS on a single computer, together with the database, model store, and other Microsoft Dynamics AX components. Alternatively, you can install application object servers on multiple computers and group these computers in a load-balanced cluster. Because Microsoft Dynamics AX requires Windows-integrated authentication for all servers in the system, you must be running Active Directory.

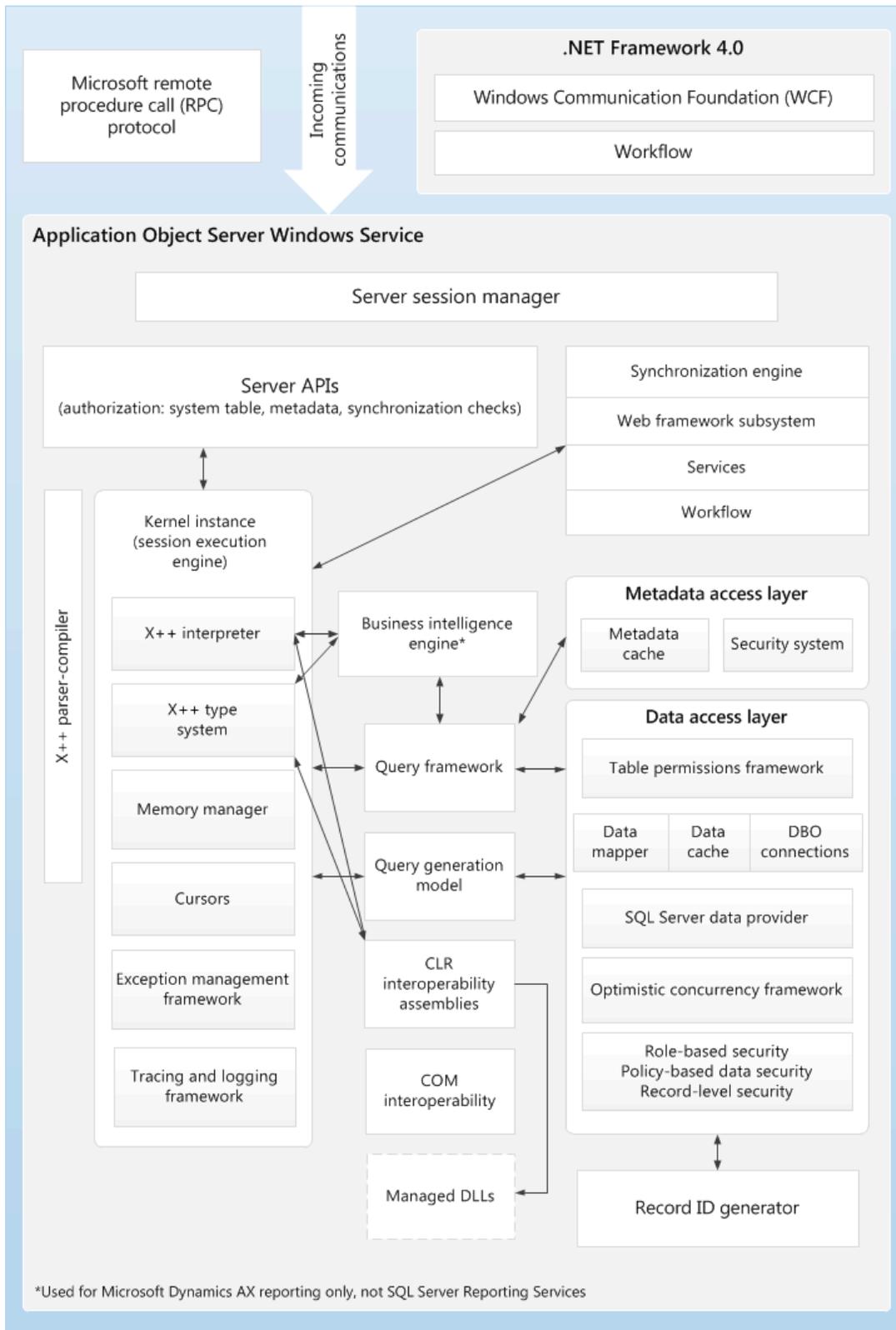
Client/AOS communications

Clients communicate with an AOS by using remote procedure calls (RPCs), Windows Communication Foundation (WCF), or AOS services. In previous releases, other components and third-party programs could communicate with an AOS by using either .NET Business Connector or Application Integration

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Framework (AIF). For this release, we recommend that third-party programs use AOS services to communicate with AOS.

The following diagram shows the AOS architecture.

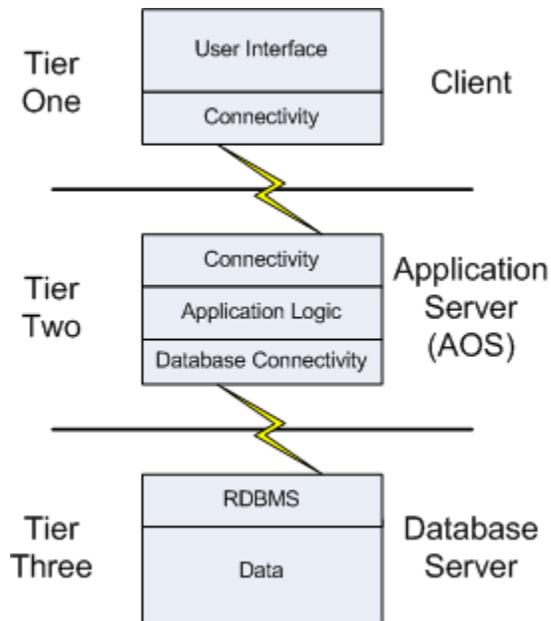


Microsoft Dynamics AX

AOS Overview

In Microsoft Dynamics AX, there is a three-tier infrastructure with a database server, an application object server (AOS), and a client. The database server contains the table data. The AOS is used to execute application objects, such as queries and classes. Application objects in the user interface, such as forms and reports, run on the client computer. This topic describes how to develop an application using the different tiers and how record buffers are related to the tiers.

The following illustration shows the three-tier architecture.



Separating Application Objects into Tiers

When you separate the application data from the application objects, it is easier to distribute upgrade versions of your application. This is because you can distribute forms, queries, classes, and reports that are based on the same set of underlying tables without affecting application data. In addition, separating data from other application objects can reduce network load.

You can use the AOS for sharing objects and information as an effective tool to increase performance. Microsoft Dynamics AX and SQL server databases can be used together to provide powerful programming languages to validate data and enforce business rules. For more information, see [Best Practices: Application Object Server \(AOS\)](http://msdn.microsoft.com/library/d3ad30d8-9692-4f58-98bc-817af4bfe411(AX.60).aspx) ([http://msdn.microsoft.com/library/d3ad30d8-9692-4f58-98bc-817af4bfe411\(AX.60\).aspx](http://msdn.microsoft.com/library/d3ad30d8-9692-4f58-98bc-817af4bfe411(AX.60).aspx)) and [How to: Optimize an Application for the AOS](http://msdn.microsoft.com/library/14877ac8-7512-4b37-9e3e-aa0ead1201eb(AX.60).aspx) ([http://msdn.microsoft.com/library/14877ac8-7512-4b37-9e3e-aa0ead1201eb\(AX.60\).aspx](http://msdn.microsoft.com/library/14877ac8-7512-4b37-9e3e-aa0ead1201eb(AX.60).aspx)).

Multiple AOS Computers

When you start the program `AX32.exe -development`, the MorphX development workspace window opens. A session is created to connect this client program to an AOS. This connection uses the standard Remote Procedure Call (RPC) protocol. This session is kept open and is used each time you open another Application Object Tree (AOT).

More sessions are needed as more client programs connect to the AOS tier. Every session adds to the workload on the AOS tier. The workload on the AOS tier can be shared among multiple instances of the

AOS. These AOS instances can be distributed among one or more computers. The system controls which AOS each new client session connects to. The system balances the workload among AOS instances to improve performance.

Session Pool for Services

Another session is needed when the client issues a service call. Services are stateless, which means the session is no longer needed after the service call returns to the caller. After the call returns, the system assigns the session back to a session pool. Future service calls that are received by the AOS can reuse a session from the pool. Different sessions might be assigned to several service calls made by one client. The reuse of sessions improves performance by avoiding the overhead of creating a new session for each service call.

For more information, see [Locating the WSDL for Services](http://technet.microsoft.com/library/0705736a-315b-4e5c-bb85-aabefc93af7b(AX.60).aspx) ([http://technet.microsoft.com/library/0705736a-315b-4e5c-bb85-aabefc93af7b\(AX.60\).aspx](http://technet.microsoft.com/library/0705736a-315b-4e5c-bb85-aabefc93af7b(AX.60).aspx)).

Record Buffers

Record buffers are automatically replicated between the application object server and the client as needed. As buffers are replicated, calls between the application object server and the client increase. For example, consider the following scenario.

1. A record is selected on the AOS.
2. A table instance method that has been set to `Client` is called.
3. The buffer is replicated and sent to the client.
4. The client reads and then modifies the buffer.
5. The buffer is replicated and sent to the server.

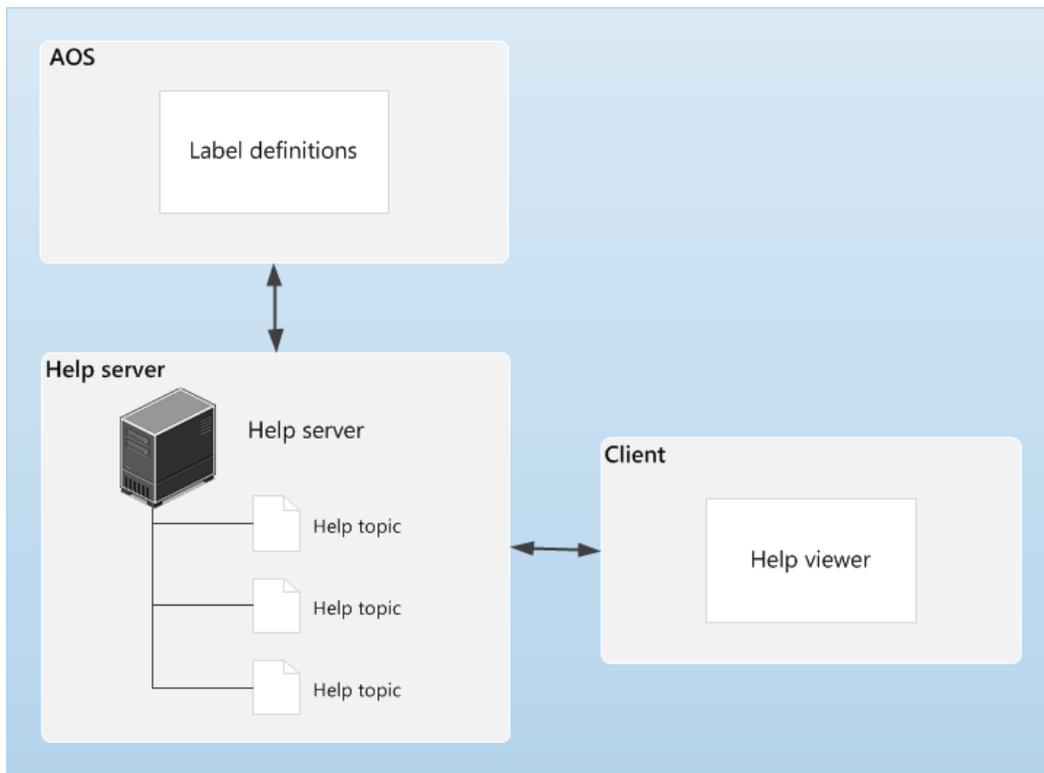
The buffer is replicated only if needed, as in the preceding example. If the value of the buffer was unchanged, the buffer would not be replicated on the AOS.

Avoid calling client based objects from the server as this will decrease application performance. This is because when a `<record> .datasource` method on a client object is called from the server, the method returns an object and must access the client even if the **T:FormDataSource** object does not exist on the client. For more information, see [Best Practices: Application Object Server \(AOS\)](http://msdn.microsoft.com/library/d3ad30d8-9692-4f58-98bc-817af4bfe411(AX.60).aspx) ([http://msdn.microsoft.com/library/d3ad30d8-9692-4f58-98bc-817af4bfe411\(AX.60\).aspx](http://msdn.microsoft.com/library/d3ad30d8-9692-4f58-98bc-817af4bfe411(AX.60).aspx)).

Microsoft Dynamics AX

Help system architecture

The following diagram illustrates the architecture of the Microsoft Dynamics AX Help system.



To better understand how the components in this diagram work together, consider the following example.

1. An employee clicks the **Help** menu or presses **F1** when viewing a form in Microsoft Dynamics AX.
2. The Microsoft Dynamics AX client determines which Help topic should be displayed. It requests that specific topic from the Help server.
3. The Help server locates the topic and determines if there are any labels to define for that topic. If so, the Help server requests the definitions of the labels from the Microsoft Dynamics AX Application Object Server (AOS).

For example, suppose a help topic contains the label `@SYS11904`. The help sever will request the definition of this label from the AOS. After the AOS returns the definition, *Customer group*, the Help server replaces all instances of `@SYS11904` with *Customer group*.

4. The Help server sends the topic to the client, where it is displayed in the Help viewer.

Help System Components

Microsoft Dynamics AX Help is a client and server based system that distributes and displays documentation.

- The client is the *Help viewer* application that requests and displays documentation. The Help viewer is installed with the Microsoft Dynamics AX client application.

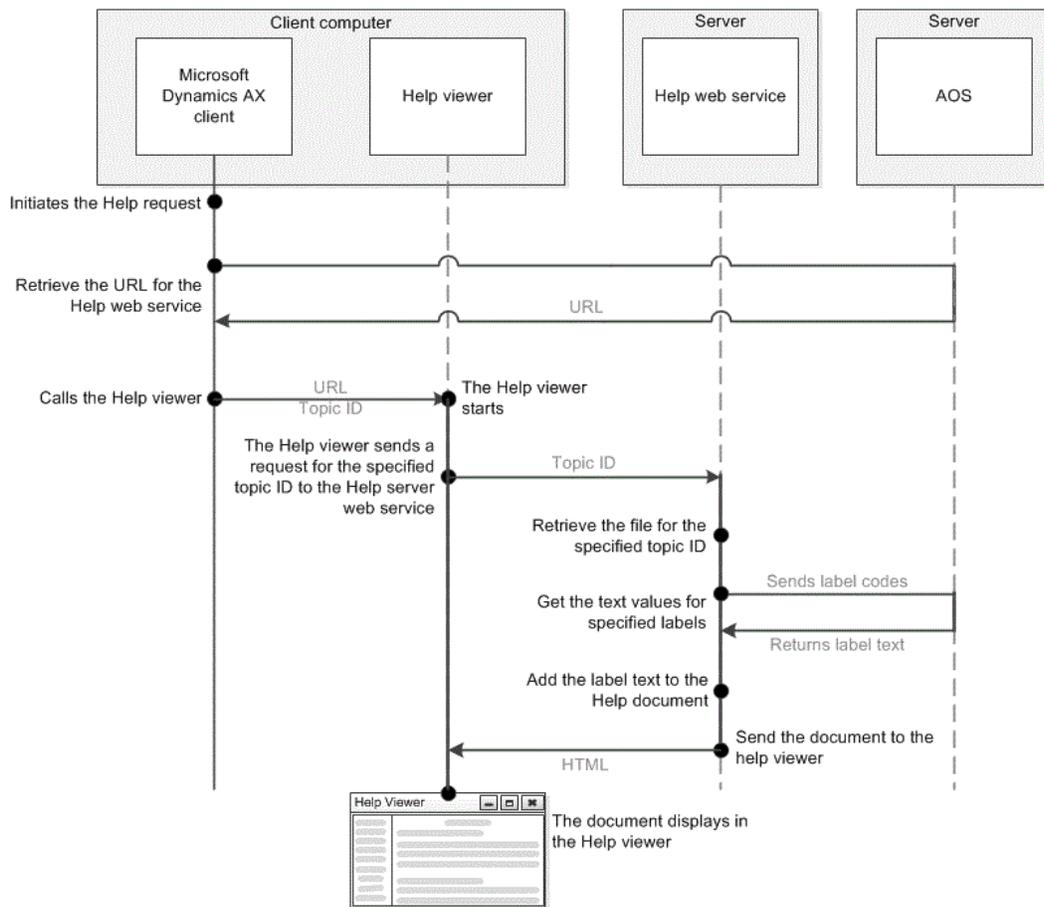
- The server is the *Help server* that responds to the Help viewer request for documentation. In addition, the Help server stores the files that contain the Help documentation.

Important:

The Help system does not supply Help documentation for Enterprise Portal.

The following illustration shows how the Help viewer and Help server interact with the client and the Application Object Server (AOS). In addition, the illustration identifies the sequence of events that occur between the request and display of a document.

Help system components and events



The following sections discuss how each component responds to a typical request for Help documentation.

Microsoft Dynamics AX client

The client application is the workspace you use to view and update information. Typically, you initiate a help request from either the client or developer workspace. For example, you press F1 or click a button or command to obtain Help while you are viewing a form. To get documentation for that form, the client performs the following actions:

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- The client identifies the Help topic to retrieve. For example, the client obtains the ID of the form that was open when you pressed F1. To identify the documentation for the form, the documentation has an ID property that has the same value as the ID of the form.
- The client retrieves the URL of the Help web service. The first time that you request help; the client contacts the AOS to retrieve the URL of the help web service. The client then caches the URL and uses the cached URL for additional help requests.
- The client calls the Help viewer. If the Help viewer is not running, the viewer is started. The call to the Help viewer includes the URL of the help server and the ID of the form.

Help Viewer

The Help viewer is an application that retrieves and displays documentation. To retrieve documentation, the Help viewer requires a URL, and a topic ID or search parameters. Typically, the client provides the URL and ID. However, you can use a link, button, or command in the Help viewer to request a topic or search for documentation. The Help viewer then contacts the Help server and requests the specified documentation. After the Help server responds, the Help viewer displays the documentation in the viewer window. The Help viewer displays the following types of information.

- The Help viewer displays the specified documentation.
- If the Help server finds more than one document for the specified topic ID, the Help viewer displays a list of the available documents. The list includes links to the individual documents for that topic. To see specific a document, click the link for that document.
- If you perform a search, the Help viewer lists the documents that match your search query. To open a specific document in the Help viewer, click the link for that document.
- The Help viewer displays the table of contents. The table of contents contains links to other topics.

Help Server

Help server is the name given to a group of related components that respond to a request for documentation from a Help viewer. When you install the Help server, you add the following components to the specified server.

Help Web Service

The Help web service is an IIS web service that responds to a Help viewer request for documentation. The Help web service receives the request, finds the documentation that matches the request, retrieves the text for specified labels from the AOS, adds the label text to the HTML of the document, and then sends the HTML documentation to the Help viewer.

Document Files

The installation adds a collection of HTML and XML files to folders on the web server. The HTML files are the documents that contain the information that appears in the Help viewer. The XML files contain the table of contents information that appears in the Help viewer.

Each HTML file includes a set of document properties. To respond to a request, the Help web service does a search for documents that have properties that match the criteria in the Help viewer request. A typical request includes criteria that match one or more of the following properties.

Property type	Description
Document ID	The ID that uniquely identifies a document. In the HTML file, the document ID is the Microsoft.Help.Id property.
Document set	The name of the document set associated with the client workspace. In the HTML file, the document set is the DocumentSets property.
Language	Specifies the language displayed by the Help viewer. In the HTML file, the language is the Language property.
Topic ID	The ID that specifies the documentation about a subject area. In the HTML file, the topic ID is the Microsoft.Help.F1 property.

Windows Search Service

The installation enables the Windows Search Service. The Windows Search Service indexes all the document files that are added to the web server. The index includes the document properties found in each HTML file. When the Help web service receives a request, it queries the search service to find the document files that match the criteria specified by the request.

The following table specifies the precedence that is used to rank the content elements that appear in the list of search results. For example, a content element that has a keyword that matches the search request appears at the top of the list of search results.

Document element	Description
Keywords	The search service matches the search request to a specified keyword for a content element.
Title	The search service matches the search request to part of the title of the content element.
Topic ID	The search service matches the search request to the topic ID of the content element.
Content	The search service matches the search request to one our more values found in the body of the content element.

Document Sets

A *document set* is a named collection of related help topics. All the document files on the Help server are a member of a document set. You use document sets to associate a collection of help documents to the client or developer workspace. The Help system includes the following documents sets:

Name	Description
DeveloperDocumentation	The document set that provides help information for users of the Microsoft Dynamics AX developer workspace. You cannot add new documents to the DeveloperDocumentation document set.
UserDocumentation	The document set that provides help information for users of the Microsoft Dynamics AX client workspace.

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Application Object Server

To support the Help system, the AOS performs the following actions.

- The AOS stores the URL of the Help server. Each Help viewer retrieves this URL before sending a request for documentation. This guarantees that changes to the URL of the Help server are available to all the clients of the AOS.
- The AOS returns the text associated with a label. A label is the localized text you see in the user interface of the Microsoft Dynamics AX client. The Help web service retrieves label text and adds that text to the HTML of the document file. This allows the text in the documentation to match the text and language found in the user interface of the Microsoft Dynamics AX client.

Enterprise Portal architecture

This topic introduces concepts that pertain to the architecture of Enterprise Portal for Microsoft Dynamics AX. The topic also describes the various components of the Enterprise Portal architecture.

About Enterprise Portal

Microsoft Dynamics AX provides a set of websites that give you access to data. On these sites, you can also participate in business processes by using web-based forms. These sites are collectively called Enterprise Portal. Enterprise Portal requires Internet Information Services (IIS), which is a feature of Windows Server, and either Microsoft SharePoint Foundation 2010 or Microsoft SharePoint Server 2010.

Role Centers

Enterprise Portal can be configured to display role-specific home pages that are called *Role Centers*. Role Centers provide an overview of information that pertains to a user's job function in the business or organization. This information includes transaction data, alerts, links, and common tasks that are associated with the user's role in the company. Role Centers also include reports that are generated by SQL Server Reporting Services or SQL Server Analysis Services. Microsoft Dynamics AX 2012 includes more than two dozen predefined Role Centers, which users can access from Enterprise Portal or the Microsoft Dynamics AX client.

Sites and pages

An Enterprise Portal site consists of a root SharePoint 2010 products site and collections of subsites. The subsites approximate the features and functionality of the modules in the Microsoft Dynamics AX client. For a detailed description of each Enterprise Portal module, and the common tasks, features, and reports that are available in each module, see [Overview of Enterprise Portal for Microsoft Dynamics AX](http://technet.microsoft.com/library/5c731ae4-5882-41cc-9748-6b0e65a1664d(AX.60).aspx) ([http://technet.microsoft.com/library/5c731ae4-5882-41cc-9748-6b0e65a1664d\(AX.60\).aspx](http://technet.microsoft.com/library/5c731ae4-5882-41cc-9748-6b0e65a1664d(AX.60).aspx)).

An Enterprise Portal page can include standard Microsoft Dynamics AX web parts, such as the toolbar, or User Control Web parts that display Microsoft Dynamics AX data. An Enterprise Portal page can also include standard SharePoint 2010 products web parts, such as lists, announcements, and discussions. Users can modify these Web parts as needed. If you set up and configure Enterprise Portal with Role Centers, Role Center pages can include the following elements:

- Cues that provide a visual representation of records based on the status of the records. For example, there can be cues for pending sales orders or items that are on backorder.
- Key performance indicators (KPIs) that provide information from predefined data cubes. You can use this information to monitor business performance against a defined goal.
- A Report web part that provides access to SQL Server Reporting Services reports.

- A Business Overview web part that displays historical performance, such as year-over-year performance or month-over-month performance.
- A work list that displays action items that are generated either by a workflow or by an alert, according to business needs.
- Community links that provide access to items that are published on community sites for Finance, Services, and Sales and Marketing.
- Links that provide access to important internal and external sites.

Customizing Enterprise Portal

Enterprise Portal is built on ASP.NET. All Enterprise Portal objects are located in the **Web** node of the Application Object Tree (AOT).

Microsoft Dynamics AX includes a standard web part that can host a User Control. Developers can write or modify User Controls in Microsoft Visual Studio. User Controls are used to present Microsoft Dynamics AX content on a page, and they are the primary way to add new functionality to Enterprise Portal.

Users and communication

In Microsoft Dynamics AX, Enterprise Portal users, or Web users, can be any of the following individuals:

- Employees who access Microsoft Dynamics AX through an intranet or an extranet
- Customer or vendors who access Microsoft Dynamics AX through an extranet
- Unsolicited vendors who want to sign up to be vendors, and who access Microsoft Dynamics AX through a public Internet site

All web users access Microsoft Dynamics AX through Enterprise Portal.

Note the following information about Enterprise Portal client connections and communications:

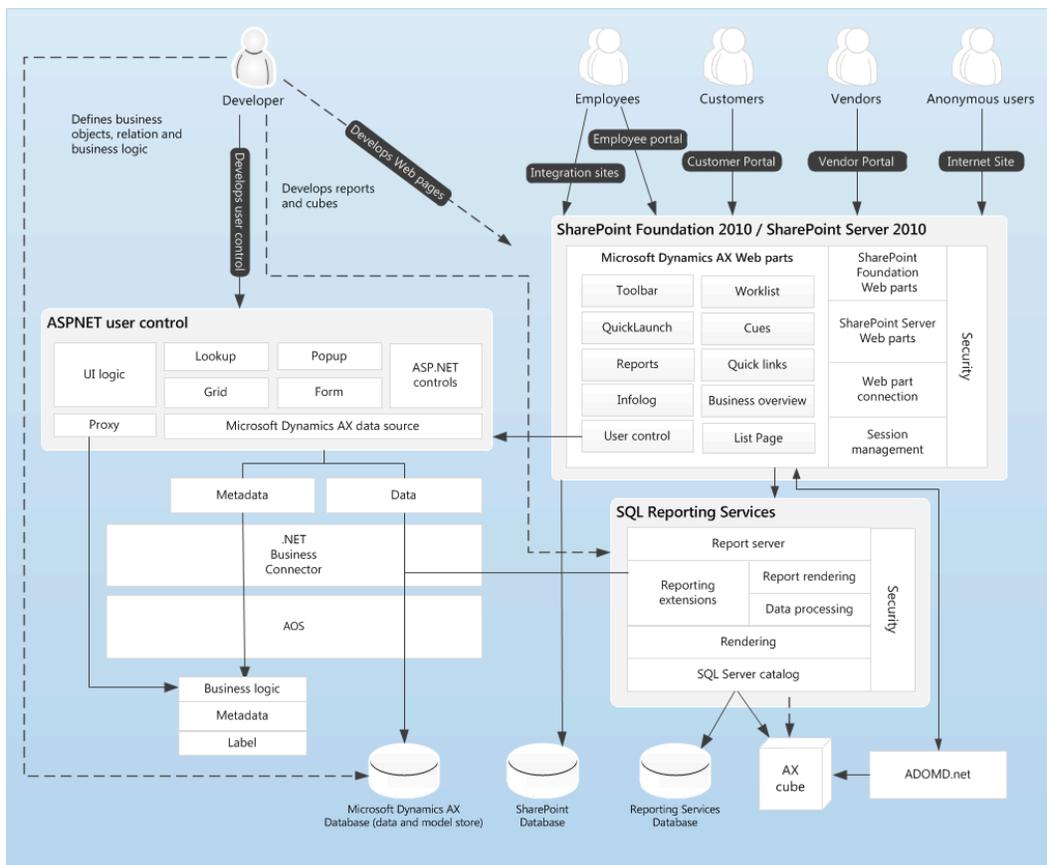
- All browser-based clients and Microsoft Dynamics AX clients access Role Centers through Enterprise Portal. Microsoft Dynamics AX clients use a browser control to display Role Centers.
- Enterprise Portal uses the Report Web part to display reports that exist on the SQL Server Reporting Services server.
- Enterprise Portal uses ASP.NET user controls and the Enterprise Portal framework to display Microsoft Dynamics AX data and reports.
- Enterprise Portal uses Windows Communication Framework (WCF) and .NET Business Connector to interact with an Application Object Server (AOS).

The language that is used in the user interface for Enterprise Portal is determined by the user interface language that is specified for each user in the Microsoft Dynamics AX client. The user interface language also determines how values are formatted.

Microsoft Dynamics AX

Enterprise Portal architecture

The following diagram provides a high-level overview of the Enterprise Portal architecture.



Enterprise Search architecture

This topic describes the various concepts and components of Microsoft Dynamics AX Enterprise Search.

The search experience

Enterprise Search in Microsoft Dynamics AX 2012 enables users to search through data, metadata, and documents that are attached to records by using either the Microsoft Dynamics AX client or Enterprise Portal. Users can search for common nouns such as 'customer' and 'cash flow report'. Users can also search for specific data, such as a customer name, a product ID, or a telephone number. The search box is prominently displayed, and users can view recent search terms in a drop-down list.

The search engine

All aspects of crawling, indexing, and retrieving Microsoft Dynamics AX data and metadata for search are performed by one of the following products.

- Microsoft SharePoint Server 2010
- Microsoft Search Server 2010
- Microsoft Search Server Express 2010 (a free download)
- Microsoft FAST Search Server 2010

One of these products must be available in the computing environment before you can install Enterprise Search. We recommend that you use SharePoint Server 2010 if your business or organization intends to deploy Enterprise Portal. Of all the products listed here, SharePoint Server 2010 is the only product that will host Enterprise Portal and Enterprise Search.

Installation and configuration overview

This section provides a high level overview of how an administrator installs and configures Microsoft Dynamics AX Enterprise Search.

Install Enterprise Search

Microsoft Dynamics AX Enterprise Search is installed by using Setup. Setup installs the Microsoft Dynamics AX Search Service, which enables Microsoft Dynamics AX clients and Enterprise Portal to communicate with the SharePoint Search service. Setup also configures the Business Connector proxy account and the Enterprise Search account. After Setup finishes installing Search, the system publishes the out-of-box searchable queries and starts the full data and metadata crawl. For more information about how to install search, see [Install Microsoft Dynamics AX Enterprise Search](http://technet.microsoft.com/library/36f61f99-a708-411e-8808-de637f669fc7(AX.60).aspx) ([http://technet.microsoft.com/library/36f61f99-a708-411e-8808-de637f669fc7\(AX.60\).aspx](http://technet.microsoft.com/library/36f61f99-a708-411e-8808-de637f669fc7(AX.60).aspx)).

Specify searchable data and metadata

After you install Enterprise Search, you specify which data and metadata should be indexed for search by configuring Microsoft Dynamics AX queries. Specifically, in the **Queries** node of the Application Object Tree (AOT), you set the **Searchable** property to True for those queries that should be indexed for search. After you specify a query as searchable, you must check the best practices on the query to ensure it can be published to the Microsoft SharePoint Business Data Connectivity Service (BCS). Administrators must work closely with business decision makers to identify queries that should be searchable.

Search Configuration wizard

After queries are identified as searchable, you publish those queries to the BCS by using the Search Configuration wizard. The Search Configuration wizard includes several screens that enable administrators to select which queries to publish, and which fields should be available in search results. For more information about how to use the Search Configuration wizard, see [Configure Enterprise Search by using the Search Configuration wizard](http://technet.microsoft.com/library/e52f66f3-7ed0-4ad7-8fe3-f8db8b75c779(AX.60).aspx) ([http://technet.microsoft.com/library/e52f66f3-7ed0-4ad7-8fe3-f8db8b75c779\(AX.60\).aspx](http://technet.microsoft.com/library/e52f66f3-7ed0-4ad7-8fe3-f8db8b75c779(AX.60).aspx)). For information about related administrative tasks for deploying and configuring Enterprise Search, see [Checklist: Deploy Microsoft Dynamics AX Enterprise Search](http://technet.microsoft.com/library/5e416444-e326-4097-b95b-9e378acbd1cc(AX.60).aspx) ([http://technet.microsoft.com/library/5e416444-e326-4097-b95b-9e378acbd1cc\(AX.60\).aspx](http://technet.microsoft.com/library/5e416444-e326-4097-b95b-9e378acbd1cc(AX.60).aspx)).

Crawling and indexing

After the queries have been published, the SharePoint Search service runs in the context of the Enterprise Search account to crawl the Microsoft Dynamics AX database. After the crawl is completed, users can view search results depending on their role assignments in Microsoft Dynamics AX. For information about the Enterprise Search account, see [Configure the Search Crawler account](http://technet.microsoft.com/library/ae8848a8-308d-4158-bb29-356ed00dd9e2(AX.60).aspx) ([http://technet.microsoft.com/library/ae8848a8-308d-4158-bb29-356ed00dd9e2\(AX.60\).aspx](http://technet.microsoft.com/library/ae8848a8-308d-4158-bb29-356ed00dd9e2(AX.60).aspx)).

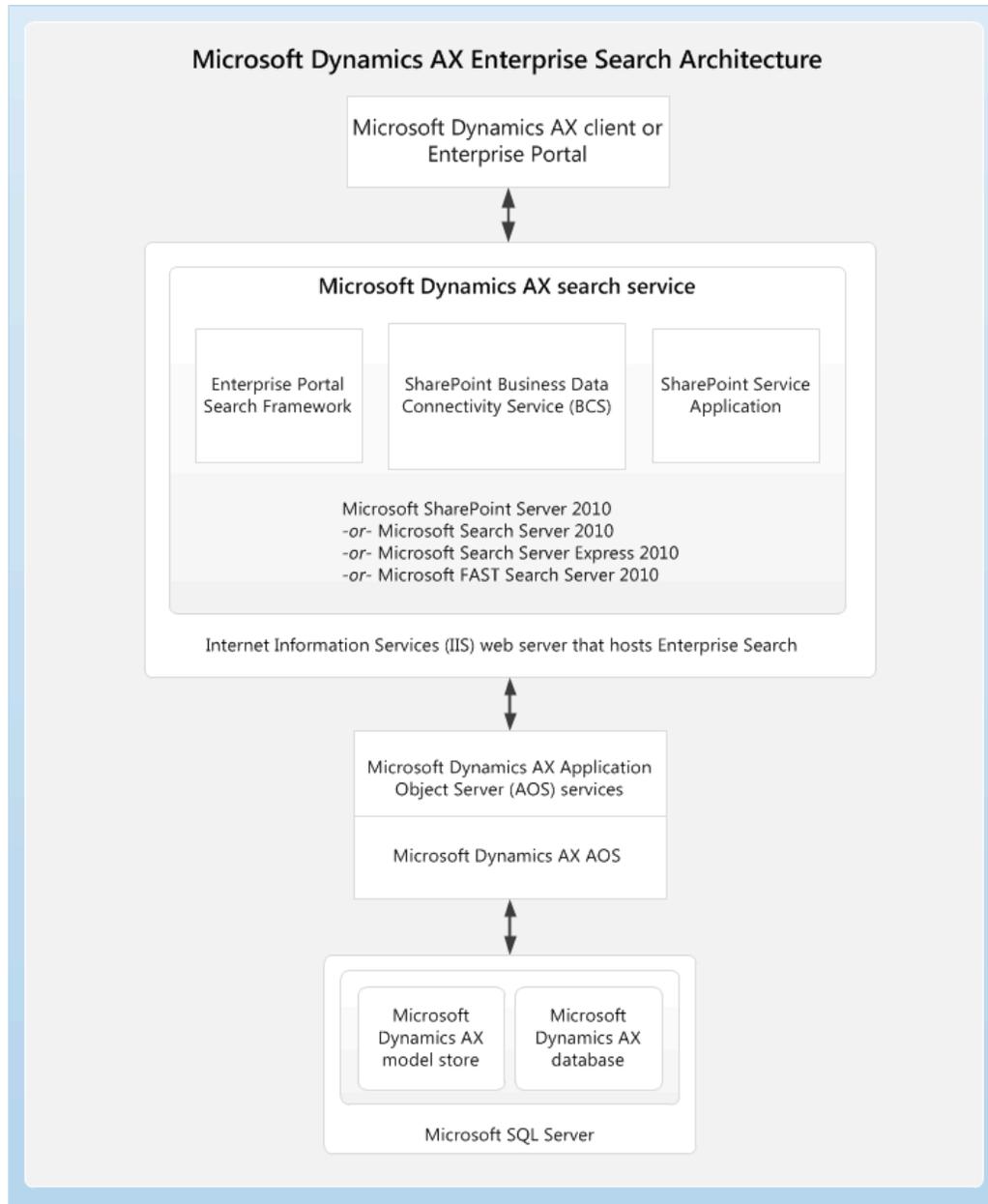
The Search Service

Setup installs the Microsoft Dynamics AX Enterprise Search service on the web server. The Microsoft Dynamics AX Enterprise Search service is a .NET DLL that enables Microsoft Dynamics AX clients and Enterprise Portal to communicate with SharePoint by using web services. The Microsoft Dynamics AX Enterprise Search service also enables communication between SharePoint and Application Object Server (AOS) services for crawling, indexing, and retrieving data from the Microsoft Dynamics AX database.

Microsoft Dynamics AX

Enterprise Search architecture

The following diagram provides a high-level overview of the Microsoft Dynamics AX Enterprise Search architecture.



Workflow system architecture

The workflow infrastructure consists of two components that are hosted on Application Object Server (AOS): the X++ workflow runtime and the managed workflow runtime.

The X++ workflow runtime consists of:

- Workflow runtime API
- A messaging batch job
- A message queue

The messaging batch job or the workflow runtime API can invoke the application code, if it is required.

The X++ workflow runtime is compiled into the Common Intermediate Language (CIL) of the .NET

Framework. For more information, see [X++ Compiled to .NET CIL](#)

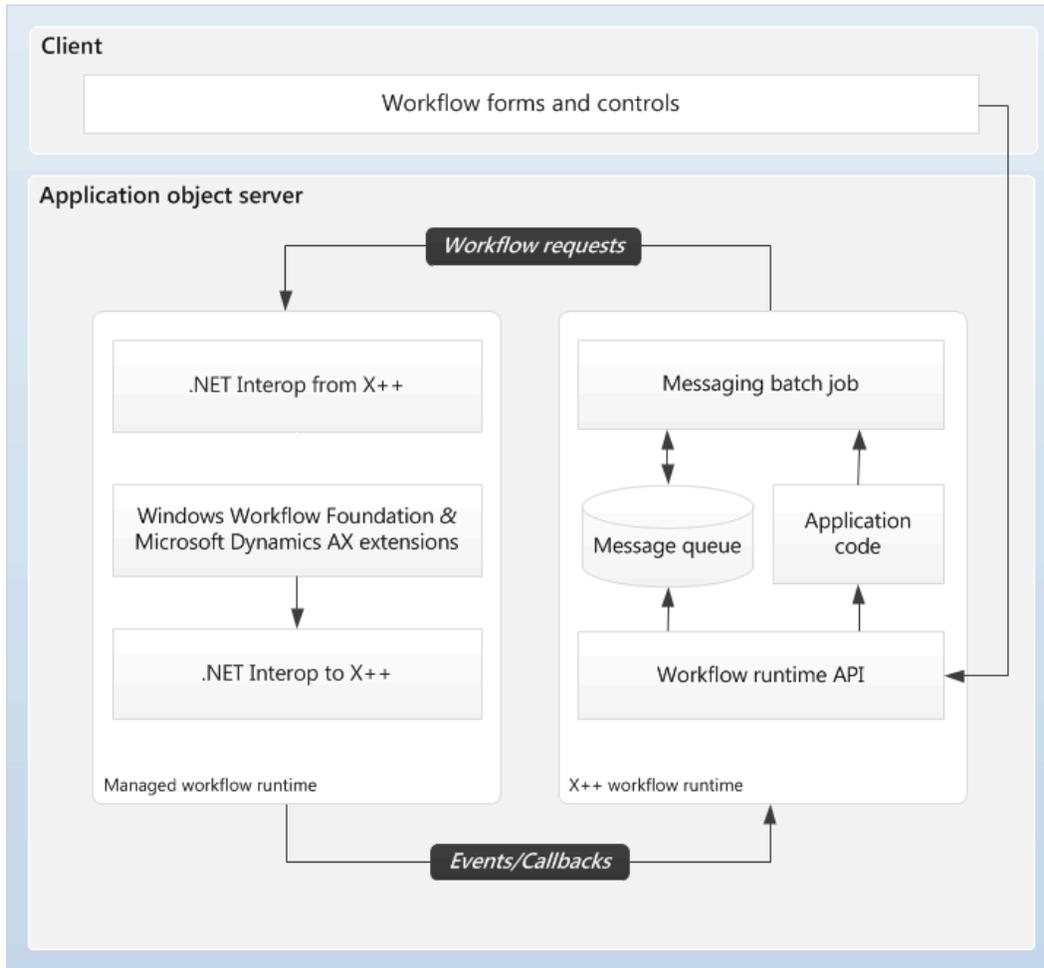
([http://msdn.microsoft.com/library/02098aad-2028-4f59-b53f-6b0bd002b25a\(AX.60\).aspx](http://msdn.microsoft.com/library/02098aad-2028-4f59-b53f-6b0bd002b25a(AX.60).aspx)).

The managed workflow runtime consists of the Windows Workflow Foundation and Microsoft Dynamics AX extensions.

Logically, the workflow infrastructure is an extension of Microsoft Dynamics AX and is transparent to users. Physically, both the X++ workflow and the managed workflow runtimes are hosted on AOS. The workflow infrastructure uses batch processing on the AOS and .NET Interop to integrate both subsystems and to pass messages from one subsystem to another. The X++ code that is executed in the batch processor is compiled to .NET CIL. The batch processing runs in the .NET common language runtime (CLR).

Microsoft Dynamics AX

The following figure illustrates the high-level architecture of the workflow infrastructure.



Users can use the workflow forms and controls in the Microsoft Dynamics AX client and in Enterprise Portal for Microsoft Dynamics AX to participate in business processes.

Developers can create workflows for objects that they have added to Microsoft Dynamics AX. For more information, see [Implementing Workflow for Microsoft Dynamics AX](http://msdn.microsoft.com/library/248c4cd6-325c-4815-b56f-cf8862559152(AX.60).aspx) ([http://msdn.microsoft.com/library/248c4cd6-325c-4815-b56f-cf8862559152\(AX.60\).aspx](http://msdn.microsoft.com/library/248c4cd6-325c-4815-b56f-cf8862559152(AX.60).aspx)).

The following table describes the workflow steps that occur when a user submits an expense report to the workflow system for approval.

Step	Runtime	Activity
1	X++ workflow runtime	<p>A user submits an expense report by clicking the Submit button on one of the workflow controls. This causes X++ code to activate a workflow instance by calling the workflow runtime API. The workflow runtime API posts a message to the message queue. The messaging batch job reads the message and sends a workflow activation request to the managed workflow runtime.</p> <p> Note: The messaging batch job processes the message queue at one-minute intervals.</p>
2	Managed workflow runtime	<p>.NET Interop from X++ receives the message and starts a new workflow instance via Windows Workflow Foundation. This workflow instance performs a callback to the X++ workflow runtime API via .NET Interop to X++ CIL and posts a message that the workflow has started.</p> <p>After posting the message, the managed workflow runtime saves the idle workflow instance to the Microsoft Dynamics AX database. Runtime then removes it from memory. When the managed workflow runtime receives another message from the X++ workflow runtime for this workflow instance, it restores the workflow instance to memory and resumes it.</p> <p>Each workflow instance is unique. If you have two users who submit their expense reports for approval, two workflow instances are started.</p>
3	X++ workflow runtime	<p>The messaging batch job reads the <i>workflow started</i> message from the message queue and invokes the application event handler to process a <i>workflow started</i> event. The batch job then posts an acknowledgment message that the event was processed.</p>
4	Both	<p>This same messaging pattern is repeated, as necessary, throughout the life cycle of the workflow instance.</p>

The workflow architecture helps to provide a reliable and durable messaging system and helps to ensure that the state of the workflow is always synchronized with the state of the application. In the event of an unexpected hardware or software failure, the workflow instance state is returned to its last known saved point and the message stays in the queue. Therefore, from an architecture perspective, the recovery model is to fix the problem and resume the workflow.

About Workflow Development

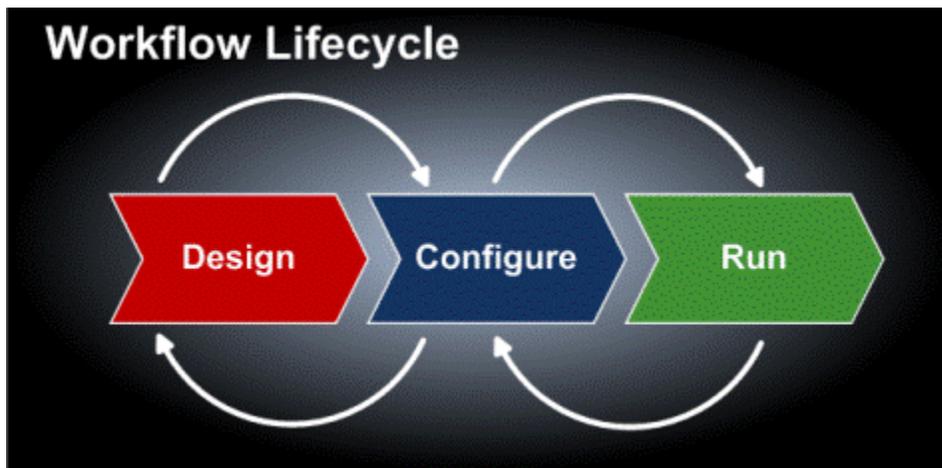
Workflow is defined as the movement of documents or tasks through a work process. In Microsoft Dynamics AX, the focus of workflow is on approval and task-oriented workflows. The developer role in Microsoft Dynamics AX is primarily to add workflow to existing business documents or create new documents that support workflow. This topic describes what the workflow life cycle is and the developer role for a workflow in Microsoft Dynamics AX.

Microsoft Dynamics AX

Workflow can be described as structured or unstructured. In Microsoft Dynamics AX, workflow is structured and based on user interaction and system automation of business data. For example, when a purchase requisition (business data) is created it, workflow can be used to verify and approve the data.

Workflow Lifecycle

All workflows follow a basic life cycle as shown in the following illustration.



You design the workflow based on customer requirements. The company administrator configures the workflow, and users run the workflow. This section describes some of the main development concepts used in the design section of the workflow life cycle in Microsoft Dynamics AX.

Workflow types

The workflow type is a building block that can be used to create customized workflows that enforce business policies. The workflow type is defined in the Application Object Tree (AOT) at design time. The metadata from the workflow type is used by the customer to create a workflow configuration. For more information, see [Creating a Workflow Type](http://msdn.microsoft.com/library/375fab94-9122-4ec9-8375-f1e69ce2cf8a(AX.60).aspx) ([http://msdn.microsoft.com/library/375fab94-9122-4ec9-8375-f1e69ce2cf8a\(AX.60\).aspx](http://msdn.microsoft.com/library/375fab94-9122-4ec9-8375-f1e69ce2cf8a(AX.60).aspx)).

Workflow configurations

Workflow configurations are created by application administrators that use the Microsoft Dynamics AX workflow editor. The administrator configures the workflow, workflow elements, and approval steps that control the flow of the business document through the workflow process. For example, the configuration data for a workflow task describes what type of business calendar to use to determine the due date of the task.

Workflow instances

A workflow instance is created by the workflow runtime when a workflow is activated.

Workflow elements

The elements of a workflow are created by you in the AOT and configured by application administrators. The workflow structure consists of sequences of workflow elements. An element can be a task, automated task, approval, or a sub-workflow. For more information, see [Creating Workflow Tasks, Automated Tasks, and Approvals](http://msdn.microsoft.com/library/778ad141-dc87-4700-b7d5-ba6d86361244(AX.60).aspx) ([http://msdn.microsoft.com/library/778ad141-dc87-4700-b7d5-ba6d86361244\(AX.60\).aspx](http://msdn.microsoft.com/library/778ad141-dc87-4700-b7d5-ba6d86361244(AX.60).aspx)).

Approvals are specialized workflow elements that allow for sequencing of multiple steps, which use a fixed set of outcomes. Tasks are generic workflow elements that represent a single unit of work which use custom outcomes defined by the developer. Automated tasks are workflow elements used to invoke X++ code within the application without requiring human intervention.

Work items

Work items are the units of work created by the workflow at runtime. They are the main interface between the end user who participates in a workflow and the workflow runtime. All work items for users who are logged on are surfaced in the **Unified Work List** and are used to inform a user about work assignments.

Developer Role

You must create the workflow artifacts, dependent workflow artifacts, and business logic to support the workflow. The following sections describe most of the developer artifacts used in a Microsoft Dynamics AX workflow.

Workflow Artifacts

- Workflow type
 - Define the workflow document. For more information, see [How to: Create a Workflow Document Class](http://msdn.microsoft.com/library/6ca32cdb-772f-412a-bd73-19be04882e29(AX.60).aspx) (http://msdn.microsoft.com/library/6ca32cdb-772f-412a-bd73-19be04882e29(AX.60).aspx).
 - Define event handlers for workflow **Started**, **Completed**, **ConfigDataChanged**, and **Canceled**. For more information, see [Handling Workflow Events](http://msdn.microsoft.com/library/8f885bae-3a1c-4984-bb6b-6782696e7c66(AX.60).aspx) (http://msdn.microsoft.com/library/8f885bae-3a1c-4984-bb6b-6782696e7c66(AX.60).aspx).
 - Define menu items used for the workflow type like **Submit**. For more information, see [Creating a Workflow Type](http://msdn.microsoft.com/library/375fab94-9122-4ec9-8375-f1e69ce2cf8a(AX.60).aspx) (http://msdn.microsoft.com/library/375fab94-9122-4ec9-8375-f1e69ce2cf8a(AX.60).aspx).
 - Define the workflow category.
 - Define required approvals, tasks, and automated tasks. For more information, see [How to: Add a Task, Automated Task, or Approval to a Workflow Type](http://msdn.microsoft.com/library/f4938343-ad9d-4fa2-bd1a-24888a471332(AX.60).aspx) (http://msdn.microsoft.com/library/f4938343-ad9d-4fa2-bd1a-24888a471332(AX.60).aspx).
 - Enable and disable activation conditions.
- Workflow category
 - Define the module that the workflow type is enabled in. For more information, see [How to: Create a Workflow Category](http://msdn.microsoft.com/library/5218479b-2909-4165-9cb2-96d2df26c2b2(AX.60).aspx) (http://msdn.microsoft.com/library/5218479b-2909-4165-9cb2-96d2df26c2b2(AX.60).aspx).
- Approval
 - Define the approval workflow document.
 - Define approval event handlers for **Started** and **Canceled**.
 - Define approval menu items such as **Document**, **Resubmit**, and **Delegate**.
 - Enable or disable fixed approval outcomes.
 - Define approval outcome menu items for **Action** and **ActionWeb**.
 - Define approval outcome event handler.
 - Define the **DocumentPreviewFieldGroup**.

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- Task
 - Define the task workflow document.
 - Define task event handlers for **Started** and **Canceled**.
 - Define task menu items for **Document**, **DocumentWeb**, **Resubmit**, **ResubmitWeb**, **Delegate**, and **DelegateWeb**.
 - Enable or disable task outcomes.
 - Define task outcome menu items for **Action** and **ActionWeb**.
 - Define task outcome event handler.
 - Define the **DocumentPreviewFieldGroup**.
- Automated Task
 - Define the automated task workflow document.
 - Define automated task event handlers for **Execution** and **Canceled**.

Dependent Workflow Artifacts

The following workflow artifacts are dependent upon the type of workflow defined in the AOT.

- Workflow `Document` class - identifies the document query and any calculated fields. For more information, see [How to: Create a Workflow Document Class](http://msdn.microsoft.com/library/6ca32cdb-772f-412a-bd73-19be04882e29(AX.60).aspx) ([http://msdn.microsoft.com/library/6ca32cdb-772f-412a-bd73-19be04882e29\(AX.60\).aspx](http://msdn.microsoft.com/library/6ca32cdb-772f-412a-bd73-19be04882e29(AX.60).aspx)).
 - Document query - defined in the AOT to expose data that is used for conditions in the configuration user interface.
- `SubmitToWorkflow` class - displays the **Submit to Workflow** dialog box in the user interface, receives user comments, activates the workflow, and can update workflow state. For more information, see [How to: Create a SubmitToWorkflow Class](http://msdn.microsoft.com/library/134385b2-6cdc-46f7-b641-c66668b7ad5a(AX.60).aspx) ([http://msdn.microsoft.com/library/134385b2-6cdc-46f7-b641-c66668b7ad5a\(AX.60\).aspx](http://msdn.microsoft.com/library/134385b2-6cdc-46f7-b641-c66668b7ad5a(AX.60).aspx)) and [Activating a Workflow](http://msdn.microsoft.com/library/37c319a1-4d0c-4afb-bfb9-c436ead1df4a(AX.60).aspx) ([http://msdn.microsoft.com/library/37c319a1-4d0c-4afb-bfb9-c436ead1df4a\(AX.60\).aspx](http://msdn.microsoft.com/library/37c319a1-4d0c-4afb-bfb9-c436ead1df4a(AX.60).aspx)).
- State model - tracks the state of the document in the workflow process, for example, `Submitted`, `ChangeRequested`, or `Approved`. For more information, see [How to: Enable a State Model for a Workflow Document](http://msdn.microsoft.com/library/6f02ef6a-5f0c-47db-af7e-a9c4da78c517(AX.60).aspx) ([http://msdn.microsoft.com/library/6f02ef6a-5f0c-47db-af7e-a9c4da78c517\(AX.60\).aspx](http://msdn.microsoft.com/library/6f02ef6a-5f0c-47db-af7e-a9c4da78c517(AX.60).aspx)).
- Event handlers for the workflow itself on the workflow type, approval, approval outcomes, automated task, task, and task outcomes.
- Action and display menu items as well as classes which determine the action taken when a menu item is selected in the user interface.
- Custom workflow providers. For more information, see [How to: Create a Custom Workflow Provider](http://msdn.microsoft.com/library/9fae733b-dfe5-4ca6-a3ef-38961a272096(AX.60).aspx) ([http://msdn.microsoft.com/library/9fae733b-dfe5-4ca6-a3ef-38961a272096\(AX.60\).aspx](http://msdn.microsoft.com/library/9fae733b-dfe5-4ca6-a3ef-38961a272096(AX.60).aspx)).
- `canSubmitToWorkflow` method - required on each table enabled for workflow. For more information, see [How to: Enable a Form or List for Workflow](http://msdn.microsoft.com/library/8859306a-f5e2-4027-a18b-f2eda00a97b8(AX.60).aspx) ([http://msdn.microsoft.com/library/8859306a-f5e2-4027-a18b-f2eda00a97b8\(AX.60\).aspx](http://msdn.microsoft.com/library/8859306a-f5e2-4027-a18b-f2eda00a97b8(AX.60).aspx)).

Business intelligence components

The topics in this section provide an overview of the architecture of the business intelligence components for Microsoft Dynamics AX.

[Reporting architecture](#)

[Analytics architecture](#)

Reporting architecture

This topic describes the architecture of the reporting functionality in Microsoft Dynamics AX.

Architecture for typical installations

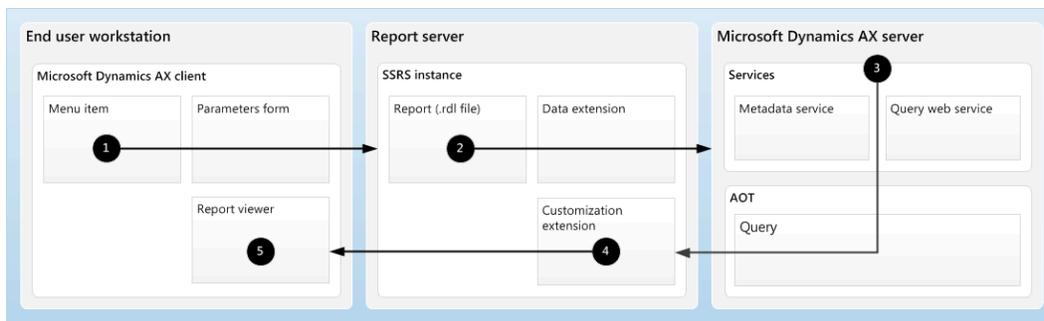
The following diagram illustrates how a report is rendered in Microsoft Dynamics AX. This diagram represents the reporting architecture when one of the following versions of Microsoft SQL Server Reporting Services is installed:

- Reporting Services 2008 in native mode
- Reporting Services 2008 in SharePoint integrated mode
- Reporting Services 2008 R2 in native mode
- Reporting Services 2008 R2 in SharePoint integrated mode
- Reporting Services 2012 in native mode



Note:

SharePoint integrated mode is supported if you are using Microsoft Dynamics AX 2012 R2.



To better understand how a report is rendered, review the following steps:

1. A user requests a report.

A menu item in the Microsoft Dynamics AX client may be bound to a report for Reporting Services. After a user clicks the menu item, a parameters form is displayed to the user. The user enters parameters to filter the data that is displayed on the report.

The Microsoft Dynamics AX client then requests the report from an instance of Reporting Services. The request includes the parameters that the user entered.

2. Reporting Services receives the request and requests the report data from the Microsoft Dynamics AX server.

Reporting Services receives the request and examines the report. The report is stored as an .rdl file. The .rdl file indicates the report's data source. The data source may be a Microsoft Dynamics AX

Microsoft Dynamics AX

query, a report data provider class, or an external data source that is accessed through report data methods.

If a Microsoft Dynamics AX data source is used for the report, Reporting Services uses the Microsoft Dynamics AX data extension to retrieve the data.

Reporting Services then requests metadata about the data source from Microsoft Dynamics AX. Then Reporting Services requests the data for the report.

3. The Microsoft Dynamics AX server receives the request and sends the report data back to Reporting Services.

The Microsoft Dynamics AX services examine the query in the Application Object Tree (AOT) to return the requested metadata. The services also run the query to generate the data for the report.

Microsoft Dynamics AX then returns the metadata and data to Reporting Services.

Note:

Microsoft Dynamics AX enforces security on all data that it returns. If the user who is running the report is not allowed to see a specific field, the data for that field is not returned.

4. Reporting Services renders the report and sends it to the Microsoft Dynamics AX client.

The Microsoft Dynamics AX customization extension formats the report. The customization extension uses metadata to provide automatic formatting of data and can affect the positioning and layout of elements on the report.

Reporting Services then renders the report into a visual representation and sends that representation to the Microsoft Dynamics AX client.

5. The report is displayed to the user.

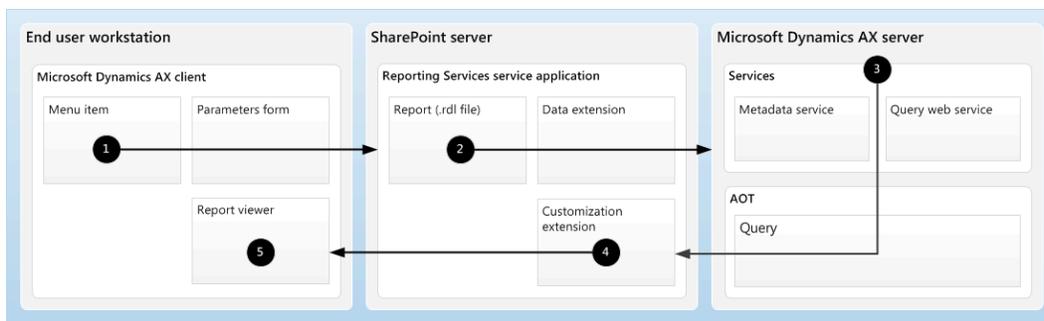
The Microsoft Dynamics AX client displays the report to the user in the report viewer control.

Architecture for Reporting Services 2012 installations in SharePoint integrated mode

The following diagram illustrates how a report is rendered in Microsoft Dynamics AX. This diagram represents the reporting architecture when Reporting Services 2012 is installed in SharePoint integrated mode.

Note:

SharePoint integrated mode is supported if you are using Microsoft Dynamics AX 2012 R2.



To better understand how a report is rendered, review the following steps:

1. **A user requests a report.**

A menu item in the Microsoft Dynamics AX client may be bound to a report for Reporting Services. After a user clicks the menu item, a parameters form is displayed to the user. The user enters parameters to filter the data that is displayed on the report.

The Microsoft Dynamics AX client then requests the report from the Reporting Services service application in SharePoint. The request includes the parameters that the user entered.

2. **The Reporting Services service application receives the request and requests the report data from the Microsoft Dynamics AX server.**

The Reporting Services service application receives the request and examines the report. The report is stored as an .rdl file. The .rdl file indicates the report's data source. The data source may be a Microsoft Dynamics AX query, a report data provider class, or an external data source that is accessed through report data methods.

If a Microsoft Dynamics AX data source is used for the report, the Reporting Services service application uses the Microsoft Dynamics AX data extension to retrieve the data.

The Reporting Services service application then requests metadata about the data source from Microsoft Dynamics AX. Then the Reporting Services service application requests the data for the report.

3. **The Microsoft Dynamics AX server receives the request and sends the report data back to the Reporting Services service application.**

The Microsoft Dynamics AX services examine the query in the Application Object Tree (AOT) to return the requested metadata. The services also run the query to generate the data for the report.

Microsoft Dynamics AX then returns the metadata and data to the Reporting Services service application.

 **Note:**

Microsoft Dynamics AX enforces security on all data that it returns. If the user who is running the report is not allowed to see a specific field, the data for that field is not returned.

4. **The Reporting Services service application renders the report and sends it to the Microsoft Dynamics AX client.**

The Microsoft Dynamics AX customization extension formats the report. The customization extension uses metadata to provide automatic formatting of data and can affect the positioning and layout of elements on the report.

The Reporting Services service application then renders the report into a visual representation and sends that representation to the Microsoft Dynamics AX client.

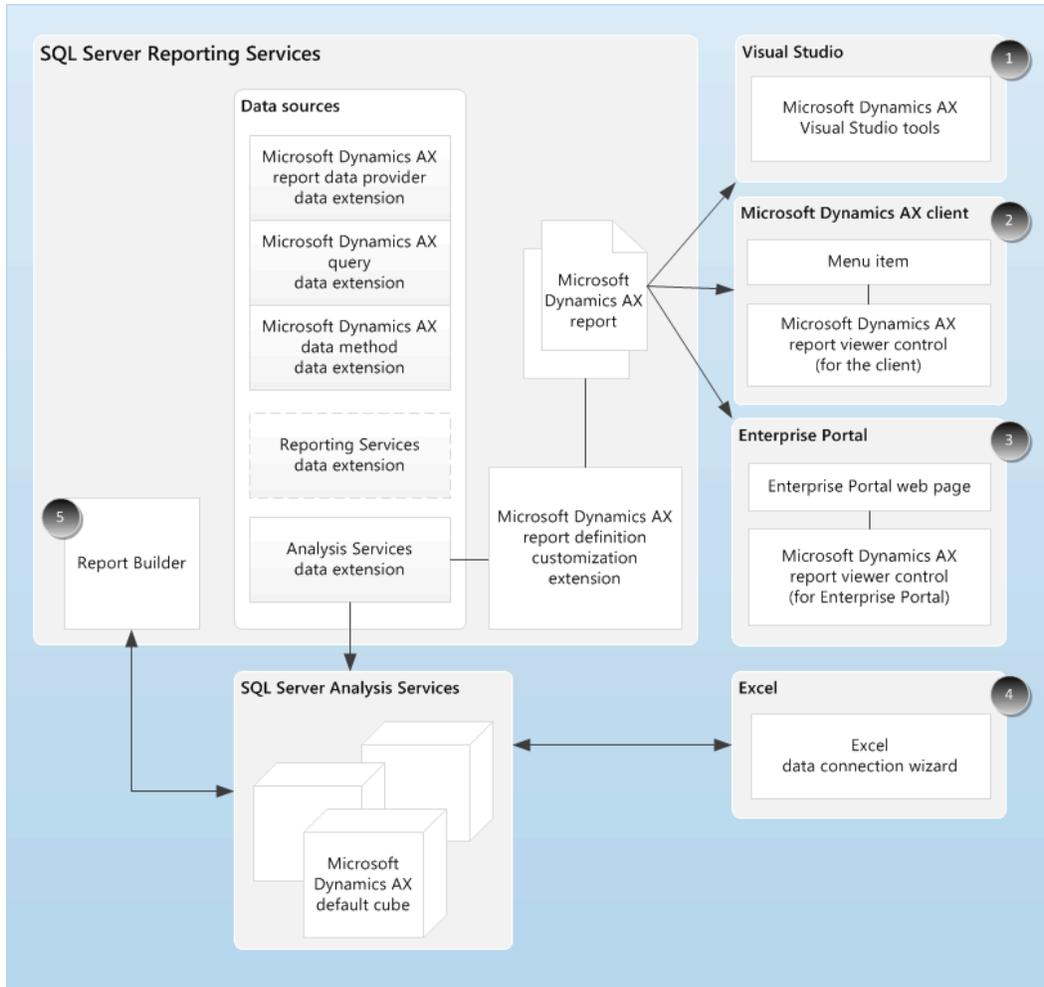
5. **The report is displayed to the user.**

The Microsoft Dynamics AX client displays the report to the user in the report viewer control.

Microsoft Dynamics AX

Analytics architecture

The following diagram shows the Microsoft SQL Server Analysis Services cubes that are included with Microsoft Dynamics AX, and the components that are used to access them.



The following components are used to access cubes or display cube data. The numbers in the following list correspond to the components in the diagram.

1. **Visual Studio** – Developers can use Microsoft Visual Studio tools to build Microsoft SQL Server Reporting Services reports that use cubes as a data source. In order for such a report to be displayed, the Analysis Services data extension retrieves data from a cube, and then the Microsoft Dynamics AX report definition customization extension formats the report. The report is then displayed in the Microsoft Dynamics AX client or in Enterprise Portal for Microsoft Dynamics AX. For information about how to create reports by using the Visual Studio tools, see [Walkthrough: Displaying Cube Data in a Report](http://technet.microsoft.com/library/3147f042-ae36-4c41-894d-1ac64e2ece77(AX.60).aspx) ([http://technet.microsoft.com/library/3147f042-ae36-4c41-894d-1ac64e2ece77\(AX.60\).aspx](http://technet.microsoft.com/library/3147f042-ae36-4c41-894d-1ac64e2ece77(AX.60).aspx)).
2. **Microsoft Dynamics AX client** – Users can access preconfigured analytical reports from the Microsoft Dynamics AX client. Analytical reports are typically displayed on Role Center pages. For more information about Role Centers, see [Using Role centers](http://technet.microsoft.com/library/ae4438d6-c276-48eb-a8e1-130e86bef6a6(AX.60).aspx) ([http://technet.microsoft.com/library/ae4438d6-c276-48eb-a8e1-130e86bef6a6\(AX.60\).aspx](http://technet.microsoft.com/library/ae4438d6-c276-48eb-a8e1-130e86bef6a6(AX.60).aspx)).

3. **Enterprise Portal** – Users can access preconfigured analytical reports from Enterprise Portal. Analytical reports are typically displayed on Role Center pages. For more information about Role Centers, see [Using Role centers](http://technet.microsoft.com/library/ae4438d6-c276-48eb-a8e1-130e86bef6a6(AX.60).aspx) (http://technet.microsoft.com/library/ae4438d6-c276-48eb-a8e1-130e86bef6a6(AX.60).aspx).
4. **Excel** – Microsoft Excel has a data connection wizard that users can run to access cubes and design PivotTable or PivotChart reports. For more information, see [Create a report by using the Excel data connection wizard to connect to a cube](http://technet.microsoft.com/library/ab93489c-4cd2-4b32-add5-9d7234b75ff3(AX.60).aspx) (http://technet.microsoft.com/library/ab93489c-4cd2-4b32-add5-9d7234b75ff3(AX.60).aspx).
5. **Report Builder** – Microsoft Report Builder is a component of Reporting Services that users can use to design and format reports and charts. For more information, see [Create a report by using SQL Server Report Builder to connect to a cube](http://technet.microsoft.com/library/0fe8ca70-c5af-4d3f-9019-27d769b80ba6(AX.60).aspx) (http://technet.microsoft.com/library/0fe8ca70-c5af-4d3f-9019-27d769b80ba6(AX.60).aspx).

Client architecture

This topic describes the high-level architecture of the Windows client for Microsoft Dynamics AX.

The client application is a 32-bit Windows application that provides a rich user interface for the Microsoft Dynamics AX application. The client is typically used by employees in the organization. External users, and users who do not require the rich user interface that the client application offers, can use Enterprise Portal for Microsoft Dynamics AX. Enterprise Portal provides access to the Microsoft Dynamics AX application from a web browser.

Note:

Because of the volume of communication that passes between the client and the server, you may experience diminished response time if your network does not meet the minimum requirements for latency and bandwidth. For more information, see the [System requirements](http://go.microsoft.com/fwlink/?LinkId=165377) (http://go.microsoft.com/fwlink/?LinkId=165377).

Client functionality

The client application provides the following functionality:

- **Rich user interface** – The client application that provides a rich user interface that consists of forms, menus, and controls. The client includes more than 3,000 forms that are built from a combination of metadata and X++ code. The Microsoft Dynamics AX forms use X++ to process events and business logic. Forms can host managed WinForms or Windows Presentation Foundation (WPF) controls, and X++ can interoperate with managed, or .NET, classes and assemblies.
- **The MorphX development environment** – The development environment is integrated into the client application. Authorized developers can use the MorphX development environment to enhance or customize the Microsoft Dynamics AX application.
- **Integration with Microsoft Office** – The Microsoft Dynamics AX application can be integrated with Microsoft Office. Data in lists can be exported to Microsoft Excel, where that data can be formatted, manipulated, updated, modified, and saved back into Microsoft Dynamics AX. You can integrate Outlook with CRM to synchronize schedules and tasks bi-directionally.
- **Unified communications** – The client provides integrated unified communications by using Microsoft Office Communicator. Important forms and controls use presence awareness for

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contacts and employees. These forms and controls also provide a visual indicator of the availability of contacts. Users can also use real-time messaging, such as instant messaging and outgoing voice communication.

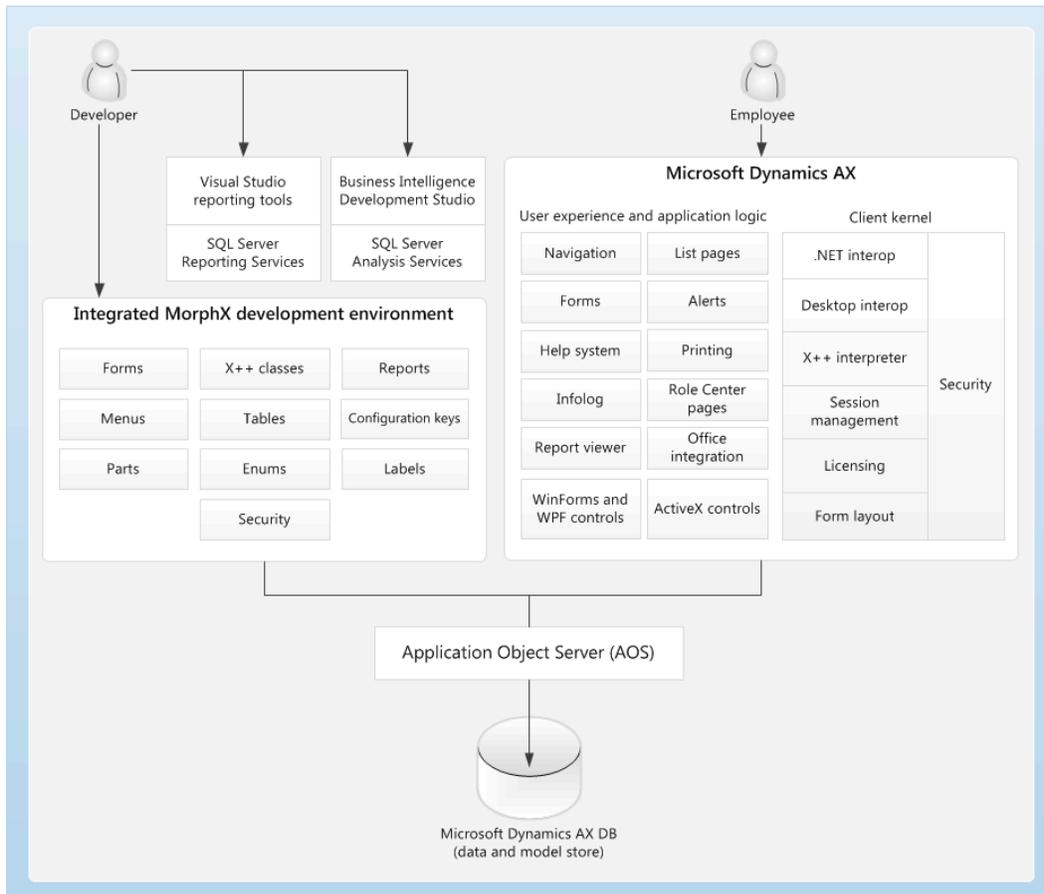
- **Integration with the Telephony Application Programming Interface (TAPI)** – The client supports TAPI, which is a standard Windows interface that is used to integrate telephone systems and Windows-based software. For example, your application displays information about the caller when you receive a call.
- **Reports** – The Microsoft Dynamics AX application provides reports that are based on Microsoft SQL Server Reporting Services (SSRS).

Client/server communication

The client communicates with various Microsoft Dynamics AX components in the following ways:

- The client uses the remote procedure call (RPC) protocol to communicate with Application Object Server (AOS). The client never accesses the database or metadata directly. AOS sends the application objects and data to the client.
- The data layer that the client uses is based on data sources that are specified in metadata for forms and queries. In addition, any X++ code that is required to retrieve data can use the built-in language support to query and adjust data.
- The client uses a report web part to interact with the report server. By calling the web services that are exposed by the report server, the report control in the web part displays information that is contained in Reporting Services reports. These reports can include either transactional data from the Microsoft Dynamics AX application or OLAP cubes from Microsoft SQL Server Analysis Services. Cubes provide business analytics and key performance indicators (KPIs).
- The client provides workflow forms, alerts, and controls so that users can participate in the business process by using the Workflow system. The Workflow system is a Microsoft Dynamics AX component that enables workflow processes by using Windows Communication Foundation classes.
- The client provides a Help viewer, which is an application that displays context-sensitive Help topics. The Help topics are retrieved from a Help server that is located on-premises.
- The client also provides Role Centers, or role-based home pages, for users. Role Centers provide role-specific tasks, activities, alerts, reports, and business intelligence that help users increase their productivity. To interact with the Role Centers that are provided by Enterprise Portal and hosted on Internet Information Services (IIS), the client uses a browser control.

The following figure illustrates the high-level client architecture.



Integration components

This section explains the high-level architecture of the integration components. Understanding integration components can help you plan your Microsoft Dynamics AX implementation and infrastructure.

The following topics are included in this section:

[Services and AIF architecture](#)

[.NET Business Connector architecture](#)

[Project Server integration architecture](#)

Services and AIF architecture

This topic describes the high-level architecture of services and Application Integration Framework (AIF). Microsoft Dynamics AX exposes its functionality through services that are based on Windows Communication Foundation (WCF) and hosted on Application Object Server (AOS). External applications and client applications on the local area network consume Microsoft Dynamics AX services by accessing them directly from AOS. These clients and applications include Microsoft Dynamics AX components such as the Microsoft Dynamics AX client, Office Add-ins for Microsoft Dynamics AX, and Enterprise Portal for Microsoft Dynamics AX. Internet-based external applications and clients access the Microsoft Dynamics

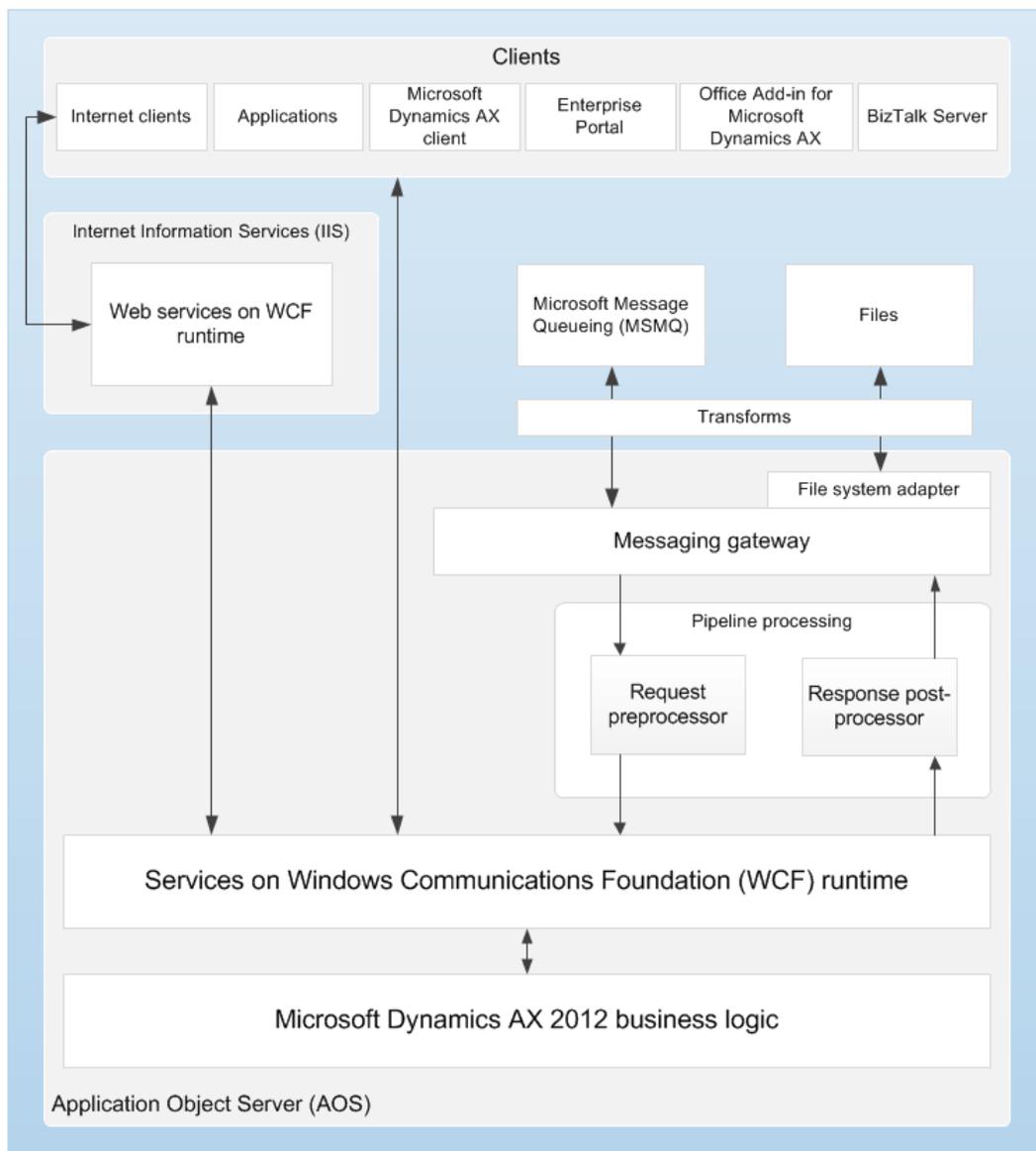
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AX services through Internet Information Services (IIS). IIS routes the incoming requests for Microsoft Dynamics AX services to AOS. All services requests, regardless of their origin, are handled by the WCF runtime that is hosted on AOS.

The AIF request preprocessor, if it is configured, can intercept the inbound request messages for custom preprocessing, such as message transforms or value substitutions. The Microsoft Dynamics AX service invokes the necessary business logic to process the inbound request message. Similarly, the AIF response postprocessor, if it is configured, can intercept the outbound response messages for custom post-processing, such as message transforms or value substitutions. The AIF response postprocessor then returns the response to the client.

Note that Microsoft Dynamics AX 2012 no longer includes a BizTalk adapter. For more information about how to use Microsoft BizTalk Server together with Microsoft Dynamics AX 2012, see [Exchanging documents between BizTalk Server and AIF](#).

The following diagram illustrates the services and AIF architecture.



Services and Application Integration Framework architecture

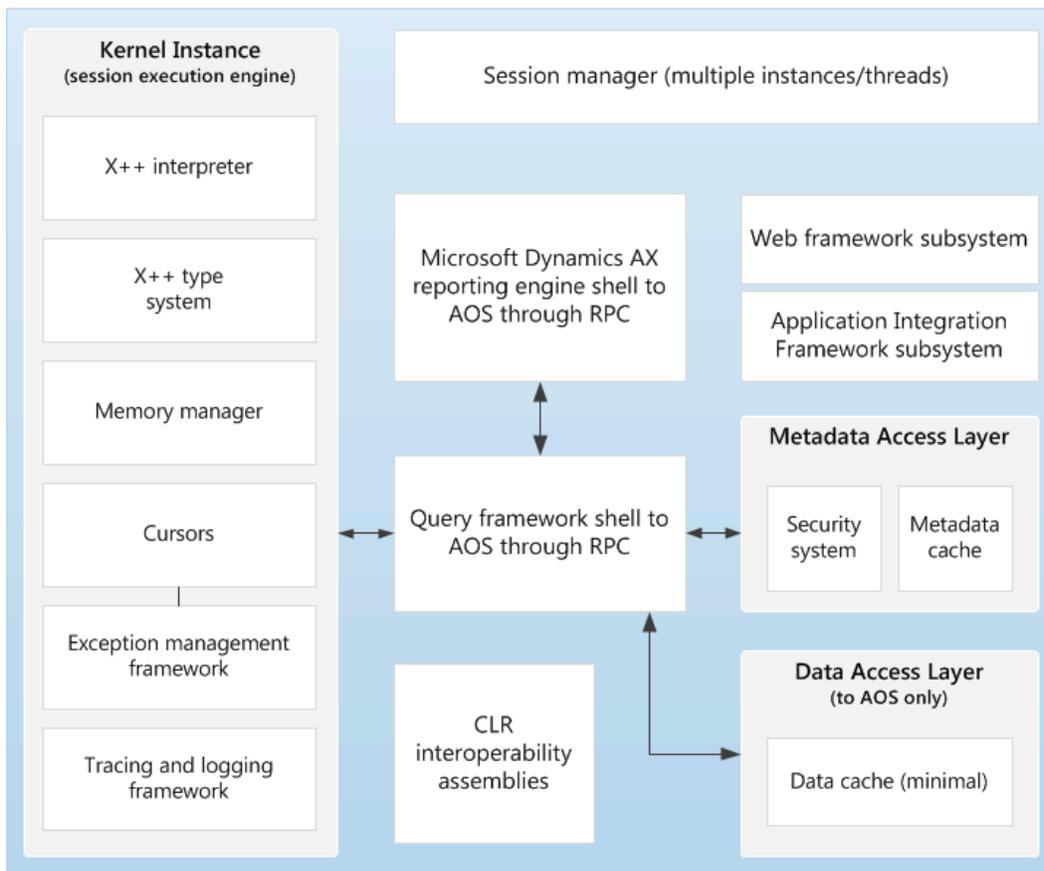
.NET Business Connector architecture

The .NET Business Connector is a component of the development environment for Microsoft Dynamics AX and is used to interpret and execute code. During execution, applications that are created by using the .NET Framework are managed by the common language runtime (CLR). These applications are called managed applications. The .NET Business Connector enables these managed applications to interact with instances of an Application Object Server (AOS) by providing a set of .NET managed classes. These .NET managed classes, in turn, enable access to X++ classes in Microsoft Dynamics AX. For more information about the .NET Business Connector, see [Developer documentation on MSDN](http://go.microsoft.com/fwlink/?LinkId=78282) (<http://go.microsoft.com/fwlink/?LinkId=78282>).

By default, the .NET Business Connector is installed together with the Application Integration Framework (AIF). However, the .NET Business Connector can also be installed as a stand-alone component and used to develop third-party applications that can be integrated with Microsoft Dynamics AX.

For more information about how to integrate other applications with Microsoft Dynamics AX, see [Application integration](http://technet.microsoft.com/library/9882a593-9cb8-45d9-aa40-0b4323deec71(AX.60).aspx) ([http://technet.microsoft.com/library/9882a593-9cb8-45d9-aa40-0b4323deec71\(AX.60\).aspx](http://technet.microsoft.com/library/9882a593-9cb8-45d9-aa40-0b4323deec71(AX.60).aspx)). For information about how to call .NET methods from X++ code, see [Developer documentation on MSDN](http://go.microsoft.com/fwlink/?LinkId=78282) (<http://go.microsoft.com/fwlink/?LinkId=78282>).

The following diagram shows the Business Connector architecture.



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Project Server integration architecture

By setting up integration between Microsoft Dynamics AX and Microsoft Project Server, project managers can create projects in either program, and then synchronize project data between the programs.

Therefore, you can take advantage of both the core capabilities that Project Server provides for project management and the capabilities that Microsoft Dynamics AX provides for financial management.

For more information about how to set up integration with Project Server, see the [Microsoft Project Server 2010 Integration](http://go.microsoft.com/fwlink/?LinkId=215155) (<http://go.microsoft.com/fwlink/?LinkId=215155>) white paper that is available from the Microsoft Download Center.

Development environment

Microsoft Dynamics AX offers a rich set of features for software developers. For more information about software development for Microsoft Dynamics AX, see the MSDN web site:

- [Microsoft Dynamics AX Developer Center](http://go.microsoft.com/fwlink/?LinkId=110356) (<http://go.microsoft.com/fwlink/?LinkId=110356>)
- [Microsoft Dynamics AX 2012 for Developers](http://go.microsoft.com/fwlink/?LinkId=224461) (<http://go.microsoft.com/fwlink/?LinkId=224461>)

AOT Overview

In Microsoft Dynamics AX, the Application Object Tree (AOT) contains all of the definitions of elements that are used to build Microsoft Dynamics AX, such as classes, tables, forms, and so on. This topic provides an overview of the AOT and defines the top-level nodes.

To create a new element in the AOT, right-click the relevant node, and then click **New**. In addition, drag-and-drop operations are available for many elements.

All elements under the top-level nodes have:

- A shortcut menu. To open the shortcut menu, right-click an element. For more information, see [Shortcut Menu Commands: AOT](http://msdn.microsoft.com/library/9b842089-d0d5-4d0a-a3a3-73d976f689e5(AX.60).aspx) ([http://msdn.microsoft.com/library/9b842089-d0d5-4d0a-a3a3-73d976f689e5\(AX.60\).aspx](http://msdn.microsoft.com/library/9b842089-d0d5-4d0a-a3a3-73d976f689e5(AX.60).aspx)).
- Properties. To see the properties and property values of an element, right-click the element and then click **Properties**. The **Properties** sheet is displayed. For more information, see [Application Object Properties](http://msdn.microsoft.com/library/3d623951-8d6d-48cb-ad05-40ad1fb13632(AX.60).aspx) ([http://msdn.microsoft.com/library/3d623951-8d6d-48cb-ad05-40ad1fb13632\(AX.60\).aspx](http://msdn.microsoft.com/library/3d623951-8d6d-48cb-ad05-40ad1fb13632(AX.60).aspx)).

The AOT contains the top-level nodes described in the following table.

Node	Description
Data Dictionary	<p>Contains the data types and tables that make up the database. Also contains objects to control access to the data. It contains the following subnodes:</p> <p>Tables: Tables that contain the Microsoft Dynamics AX data.</p> <p>Maps: Enables you to create associations between closely related (but non-identical) table fields and methods.</p> <p>Views: Enables you to join data from different tables, and then to select which fields you want to display.</p> <p>Extended Data Types: Data types that extend one of the primitive data types or another extended data type.</p> <p>Base Enums: Enumerable types that contain a list of literals.</p> <p>License Codes: Determines which components of Microsoft Dynamics AX functionality are available to a company.</p> <p>Configuration Keys: Allows administrators to enable or disable features in the application for all users.</p> <p>Security Keys: Security keys are obsolete in Microsoft Dynamics AX 2012 and only exist to use for reference during a code upgrade. There is a new security framework, which is called role-based security. For more information on the new security framework, see What's New: Security for Developers in Microsoft Dynamics AX 2012 (http://msdn.microsoft.com/library/061a4eea-876c-482b-91ea-bb1e76cc409b(AX.60).aspx) and Role-based Security in the AOT for Developers (http://msdn.microsoft.com/library/e3d0cfab-a7f0-43a9-9ff4-540a3d887e93(AX.60).aspx).</p> <p>Table Collections: Collections of tables that contain data that is often shared between companies.</p> <p>Perspectives: Collections of tables that were used to organize information for report models.</p>
Macros	<p>Contains the source code for the macros used by the standard application. In addition to viewing the existing code, you can add your own macros.</p>
Classes	<p>Contains the source code for the application (X++) classes.</p> <p>You can also use system classes (also known as kernel classes). They are listed in the System Documentation\Classes node.</p>
Forms	<p>Dialog boxes in the user interface that are used to access the database.</p>
Parts	<p>Contains controls you can use to retrieve and show a collection of data. For more information, see Parts (http://msdn.microsoft.com/library/347f61a0-c3f7-4c9d-a2c1-3b9f6e286395(AX.60).aspx).</p>

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Node	Description
Data Sets	Provides a generic data access layer that allows for external presentation layers to bind to Microsoft Dynamics AX tables and data types. For more information, see Data Sets for Enterprise Portal (http://msdn.microsoft.com/library/e304b14d-7c58-4567-8897-730ea492161e(AX.60).aspx).
SSRS Reports	Contains SQL Server Reporting Services reports that are included with Microsoft Dynamics AX.
Reports	Enables users to print or display summary information from the database.
Visual Studio Projects	Contains projects created in Visual Studio and added to Microsoft Dynamics AX by using Application Explorer. Project types that can be added to this node include Dynamics AX Model Projects, C Sharp Projects, Visual Basic Projects, Web Application Projects, and Analysis Services Projects. For more information, see Visual Studio Integration (http://msdn.microsoft.com/library/f7c6e32a-be2c-41ec-98ea-4a1e7ff9b342(AX.60).aspx) and How to: Add a Visual Studio Project to the AOT (http://msdn.microsoft.com/library/71a99dff-dbe2-43a3-a017-d28318759c46(AX.60).aspx).
Report Libraries	Used to store Microsoft Dynamics AX 2009 SQL Server Reporting Services report libraries that are being upgraded for the Microsoft Dynamics AX 2012 AOT environment.
Queries	Used as the source of records for forms and reports.
Jobs	Typically holds small X++ programs that are used to test new code.
Menus	Contains the menus you want the end user to see.
Menu Items	Contains a complete list of the items that can be presented in a menu. Menu items act as a higher layer of abstraction for forms, reports, and so on.
Web	Contains objects related to web development.
Services	Contains services that are exposed by Microsoft Dynamics AX.
Service Groups	Contains collections of services that are frequently consumed and managed together. All the services in a service group are published in a single WSDL file.
Workflow	Contains the workflow model elements used to create a workflow configuration. This node contains Categories , Tasks , Approvals , and Templates . For more information, see Implementing Workflow for Microsoft Dynamics AX (http://msdn.microsoft.com/library/248c4cd6-325c-4815-b56f-cf8862559152(AX.60).aspx).
Security	Contains the objects you use to implement application security, such as roles and permissions.
Resources	Contains references to image and animation files.

Node	Description
Label Files	Contains label files that store labels for all user interface elements. For more information, see Label Editor (http://msdn.microsoft.com/library/9d9d2443-5dd6-4913-aab3-53545ed084eb(AX.60).aspx).
References	Contains references to Microsoft .NET assemblies and to external web services. Both types of references can be used in X++ statements.
Help Documentation Sets	Specifies the documentation sets on the Help Server.
System Documentation	Contains items that represent system (kernel) classes, functions, tables, and so on.

Microsoft Dynamics AX IDE

The integrated development environment (IDE) in Microsoft Dynamics AX is called MorphX. It includes tools for designing, editing, compiling, and debugging code in Microsoft Dynamics AX. This topic describes the MorphX development environment, concepts, and development tools.

The programmable objects in Microsoft Dynamics AX—tables, forms, reports, classes, and so on—are organized in a tree structure called the Application Object Tree (AOT). Creating and editing objects is enhanced by drag-and-drop functionality, and by automatic settings for certain object properties. The source code for methods on classes, tables, forms, and other objects is available to help you extend and customize Microsoft Dynamics AX functionality.

Warning:

If your underlying database participates in Microsoft SQL Server replication, you must temporarily suspend replication before you use the AOT to make schema changes such as adding fields to tables.

The concept of inheritance is central to the system—what is defined at the lowest level can be inherited by higher levels in the system. For example, if you change the length of a database field from 10 characters to 20, this change is automatically reflected on all forms in the application that displays this field.

X++ is the programming language in Microsoft Dynamics AX. X++ uses object-oriented programming principles, such as encapsulation, inheritance, classes, objects, methods, and properties. The X++ syntax will be familiar to C# developers, and incorporates SQL data manipulation statements.

Microsoft Dynamics AX uses a layering system where layers are a hierarchy of levels in the application source code. This ensures that modifications and additions can be made without interfering with the application objects on other levels.

Visual Studio Development for Microsoft Dynamics AX

The Microsoft Dynamics AX development environment (MorphX) and the Visual Studio development environment are integrated through Visual Studio Tools for Microsoft Dynamics AX (Visual Studio Tools). Visual Studio Tools is a collection of tools and functionality that enable managed code development for Microsoft Dynamics AX.

Microsoft Dynamics AX

Visual Studio Tools gives developers a rapid application development (RAD) experience and supports managed code within MorphX and the Visual Studio integrated development environment (IDE). The tools and functionality can be categorized as follows:

- [Managed Code Integration Functionality](#)
- [Managed Code Tools](#)

Close integration between MorphX and Visual Studio means that developers can take advantage of the benefits of each development tool and work in the environment that best suits their development scenario. For more information, see [Selecting the Best Development Technology for Your Application Development Scenario](#) (<http://go.microsoft.com/fwlink/?LinkId=213138>).

Note:

Managed code is code that is executed by the common language runtime (CLR) environment instead of directly by the operating system. Managed code applications gain common language runtime services such as automatic garbage collection, runtime type checking and security support, and so on. In this context, it refers to .NET managed code.

Managed Code Integration Functionality

Managed code integration refers to a set of capabilities that enable integration between X++ objects and managed code. This integration is provided by the following developer features:

- Managed code business logic
- Proxies
- Event handlers

Managed Code Business Logic

You can write business logic in C# or Visual Basic and manage this code in Microsoft Dynamics AX just as you would with X++ classes.

- You can save C# or Visual Basic class library projects to the model store.
- You can customize these managed code projects using the various layers.
- Managed code projects are updated when you build in Visual Studio and automatically deployed if they are configured to do so. Any modifications to the managed project are live and persisted to the Microsoft Dynamics AX model store. For more information, see [Model store architecture](#).

Proxies

This feature lets you add an X++ object to your project in Visual Studio so that it can be accessed by managed code. You can add the following X++ object types to a project: classes, tables and enums.

When you add an X++ object to a project by using the Application Explorer, a proxy for that class is created internally by the system. After the proxy is created, that type is available as a strong type and features such as IntelliSense are available. For more information, see [Integration with X++ Objects from Visual Studio](#) ([http://msdn.microsoft.com/library/3ce3d09e-6f79-4737-b5cf-14247e493139\(AX.60\).aspx](http://msdn.microsoft.com/library/3ce3d09e-6f79-4737-b5cf-14247e493139(AX.60).aspx)) and [Walkthrough: Adding an X++ Object to a Visual Studio Project](#) ([http://msdn.microsoft.com/library/55663cc6-f865-4316-ab58-dfb3117f78b1\(AX.60\).aspx](http://msdn.microsoft.com/library/55663cc6-f865-4316-ab58-dfb3117f78b1(AX.60).aspx)). For more information about proxies, see [Proxy Classes for .NET Interop to X++](#) ([http://msdn.microsoft.com/library/a1f6adc2-6dd6-447f-b1fc-a5dee3116e6f\(AX.60\).aspx](http://msdn.microsoft.com/library/a1f6adc2-6dd6-447f-b1fc-a5dee3116e6f(AX.60).aspx))

If you change an X++ object after you add it to a project, the proxy is automatically updated.

Event Handlers

You can create an event handler in managed code or X++. The event handler subscribes to an event (method) in X++. Event handlers can handle events raised only by a class in the **Classes** node in the Application Object Tree (AOT). For more information about event handlers in the AOT, see [Event Handler Nodes in the AOT](http://msdn.microsoft.com/library/0088e394-cb54-44b8-89d8-b447ea8cfc96(AX.60).aspx) (http://msdn.microsoft.com/library/0088e394-cb54-44b8-89d8-b447ea8cfc96(AX.60).aspx). For more information about managed code event handlers, see [Integration with X++ Objects from Visual Studio](http://msdn.microsoft.com/library/3ce3d09e-6f79-4737-b5cf-14247e493139(AX.60).aspx) (http://msdn.microsoft.com/library/3ce3d09e-6f79-4737-b5cf-14247e493139(AX.60).aspx) and [Walkthrough: Creating an Event Handler in Visual Studio](http://msdn.microsoft.com/library/4aa960dc-c897-4deb-9d35-f5c29716db07(AX.60).aspx) (http://msdn.microsoft.com/library/4aa960dc-c897-4deb-9d35-f5c29716db07(AX.60).aspx).

Deployment from Visual Studio

The deployment functionality enables you to make assemblies (DLLs) that you create in Visual Studio available in Microsoft Dynamics AX. After you specify whether the assembly should be deployed to the client, server, or Enterprise Portal, the system deploys the assembly to the appropriate locations. For more information, see [Deploying Managed Code](http://msdn.microsoft.com/library/54955e3b-f484-4337-ba07-488a91fbb577(AX.60).aspx) (http://msdn.microsoft.com/library/54955e3b-f484-4337-ba07-488a91fbb577(AX.60).aspx).

Managed Code Tools

In addition to the managed code integration functionality, there are tools in both MorphX and Visual Studio that support managed code development. These tools include the following:

- Application Explorer in Visual Studio
- AOT support for Visual Studio projects
- Cross-reference tool support for managed code in MorphX
- Code upgrade tools support for managed code in MorphX

Application Explorer in Visual Studio

Application Explorer is a tool in Visual Studio that provides a view into the Microsoft Dynamics AX model store. You can use Application Explorer to:

- View the properties of elements in the AOT
- View code for elements in the AOT
- Add AOT elements to a Visual Studio Project
- Open a Visual Studio project for edit
- Remove a project from the model store

Visual Studio Projects in the AOT

When you create a project in Visual Studio, you can add it to the model store by using Application Explorer. After you add a project to the model store, the project appears in the AOT below the **Visual Studio Projects** node. As you add files to your project, those changes are reflected in the AOT. After you add a project to the model store, the managed code in that project can be accessed in Microsoft Dynamics AX.

Important:

You must add a managed code project to the model store before you can access it from Microsoft Dynamics AX. This is necessary if you want X++ elements and managed code elements to interact, for example, if you create a managed code event handler.

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Cross-Reference Tool

The [Cross-reference Tool](http://msdn.microsoft.com/library/411ffb69-e4c2-4313-9005-6bd8396091cc(AX.60).aspx) ([http://msdn.microsoft.com/library/411ffb69-e4c2-4313-9005-6bd8396091cc\(AX.60\).aspx](http://msdn.microsoft.com/library/411ffb69-e4c2-4313-9005-6bd8396091cc(AX.60).aspx)) in Microsoft Dynamics AX lets you see the relationships between objects. By using the Cross-reference tool, you can see which other objects the current object uses or which other objects use the current object. The Cross-reference tool fully supports Visual Studio projects in the AOT (under the Visual Studio Projects node). This means you can identify whether an AOT element such as an X++ class or a managed code class is used by a managed code project.

Code Upgrade

The code upgrade tools enable developers to detect and resolve conflicts between two versions of Microsoft Dynamics AX. The layered architecture of Microsoft Dynamics AX enables third-parties such as VARs to customize the code base and add functionality. When an updated version of Microsoft Dynamics AX such as a service pack is released, conflicts can occur when the service pack contains changes to elements that were also changed by the VAR. The code upgrade tools are used to find and resolve these conflicts. The code upgrade tools include the following:

- Detect code upgrade conflicts tool - Compares the elements in the current layer and the underlying layer. If any differing elements are found, the tool creates an upgrade project and moves the conflicting element in the current layer to that project. You then use the Compare tool to analyze the conflicts and decide which element should be included in the current layer.

The Detect code upgrade conflicts tool supports managed code that has been added to the model store by using Application Explorer. This means you use the same process to upgrade code, whether that code originates from MorphX or Visual Studio.

- Compare tool - Compares two elements in the AOT or two elements in an upgrade project created by the Detect code upgrade conflicts tool. The Compare tool supports managed code so that you can compare two managed code files in the AOT.

About the Development Workspace

The Development Workspace in Microsoft Dynamics AX 2012 provides tools to create and edit application elements, such as forms, tables, and X++ classes.

By default, Microsoft Dynamics AX opens in the Application Workspace, which displays user interface elements for end-users. To open a Development workspace, press CTRL + Shift + W. You can also open Microsoft Dynamics AX directly into a development workspace. For more information, see [How to: Open a Development Workspace](http://msdn.microsoft.com/library/7363e6c5-afa2-4a70-90de-e1dc5359c5cd(AX.60).aspx) ([http://msdn.microsoft.com/library/7363e6c5-afa2-4a70-90de-e1dc5359c5cd\(AX.60\).aspx](http://msdn.microsoft.com/library/7363e6c5-afa2-4a70-90de-e1dc5359c5cd(AX.60).aspx)).

By using two or more display monitors, you can open multiple workspaces on the same client where application elements are always synchronized. Up to eight workspaces per client can be opened at the same time, and you can drag-and-drop application elements between different Development workspaces. You can open forms and menu items from the AOT within the Development Workspace. To view forms in the context of the end-user interface, switch to the Application Workspace.

Customizing the Development Workspace

By default, the AOT and the **Properties** sheet are automatically opened when a Development Workspace is opened. The **Properties** sheet and the Compiler output window can be docked or moved as needed by

right-clicking the title bar for the window, and then selecting a new location. Window sizing and location preferences are saved automatically when you close the Development Workspace.

 **Note:**

If a **Startup project** is specified on the **Development** tab of the **Options** form, the startup project opens instead of the AOT. However, if the startup project is already open in another Development Workspace, the AOT opens by default in a new Development Workspace.

MorphX Development Tools

MorphX development tools are available in the **Tools** menu. Many are also available from the [Add-ins shortcut menu](#) in the Application Object Tree (AOT). When tools are activated from the **Add-Ins** menu, they take the current AOT node as the point of departure.

The [X++ code editor](#), the [X++ compiler](#), the [Reverse Engineering Tool](#) ([http://msdn.microsoft.com/library/032188e1-900d-4140-a46a-8e980b582a1d\(AX.60\).aspx](http://msdn.microsoft.com/library/032188e1-900d-4140-a46a-8e980b582a1d(AX.60).aspx)), and the [tracing tools](#) are not available from the **Development tools** menu or the AOT **Add-Ins** menu. The code editor opens when you double-click a method or create a new job. The compiler can be accessed from the Code editor window. To open the Reverse Engineering tool, right-click a project, and then select **Add-Ins > Reverse Engineer**. For information about enabling the tracing tools, see [Setting Up the Tracing Tools](#) ([http://msdn.microsoft.com/library/439f6fad-93be-4cc5-930c-400187dd22b8\(AX.60\).aspx](http://msdn.microsoft.com/library/439f6fad-93be-4cc5-930c-400187dd22b8(AX.60).aspx)).

The development tools available in the **Development tools** and **Add-Ins** menus are described in the following table.

 **Note:**

The Code Explorer, Benchmark, and Visual MorphXplorer tools are no longer available. The Reverse Engineering tool has replaced the Visual MorphXplorer tool.

Tool	Opened from	Description
Application objects	Tools > Application objects menu Add-Ins menu	Lists application objects, grouped by object type.
Axd Wizard	Tools > Wizards menu	Helps you to create a XML document (Axd) class

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Tool	Opened from	Description
Check Best Practices	Add-Ins menu	Checks whether your X++ code is in compliance with Microsoft Dynamics AX standards. Note This command does not check all best practices and does not guarantee that your X++ code complies with Microsoft Dynamics AX standards. For more information, see Best Practices for Microsoft Dynamics AX Development (http://msdn.microsoft.com/library/833e44ff-d89a-459a-84be-0cc5da57ee90(AX.60).aspx).
Class Wizard	Tools > Wizards menu	Helps you to create a new class.
Code profiler	Tools menu	Records the execution time of each line of code and enables you to analyze the data to find performance bottlenecks.
Code Upgrade	Tools menu	Helps you to compare and merge your X++ source code when upgrading to a new version of Microsoft Dynamics AX.
COM Class Wrapper Wizard	Tools > Wizards menu	Helps you to create a wrapper class for a COM object. Ensures type safety when using dynamic binding.
Compare	Add-Ins menu	Enables you to compare the current object with another object or another version of the same object.
Compare layers	Tools > Code upgrade menu	Enables you to compare any two application object layers. For example, the current SYS layer and the OLD SYS layer. Creates a project that contains objects that only exist in one layer and objects that are different in the two layers.
Create upgrade project	Tools > Version upgrade menu	Analyzes your system and creates a project that contains the application objects that must be upgraded manually.
Cross-reference	Tools menu Add-Ins menu	Enables you to see relationships between objects. You can see which objects use the current object and which other objects the current object uses.

Tool	Opened from	Description
Debugger	Tools menu	Enables you to debug your X++ code. For more information, see the Debugger Help. It is available from the Help menu in the debugger and from the Microsoft Dynamics AX Debugger node in the table of contents of the Help opened from the Help > Developer Help menu.
Financial Dimensions Wizard	Tools > Wizards menu	Helps you add a new financial dimension to the system.
Images	Tools > Web development menu	Enables you to manage the images available for use in web applications.
Label editor	Tools > Label menu	Enables you to create, edit, and delete labels.
Label log	Tools > Label menu	Displays the history of labels in the application.
Label file wizard	Tools > Label menu Tools > Wizards menu	Enables you to create a new label file.
Label intervals	Tools > Label menu	Enables you to specify which label IDs can be used with a particular label file.
Legacy Help Texts	Development tools menu	Obsolete. In previous versions of Microsoft Dynamics AX, this tool enabled you to view and edit the HTML source of Help topics available for application objects.
Legacy Help Validation	Development tools menu	Obsolete. In previous versions of Microsoft Dynamics AX, this tool enabled you to search for text and tags in documentation objects to find Help topics that do not conform to best practices for Microsoft Dynamics AX documentation.
Locked application objects	Development tools > Application objects menu	Displays a list of the application objects that are currently locked.

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Tool	Opened from	Description
Number of records	Tools menu	Counts the number of records in each table in the current company.
Old application objects	Tools > Application objects menu	Displays the system's old application objects and a detailed log of each object's history.
Refresh AOD	Development tools > Application objects menu	Flushes cached application object information.
Refresh runtime model data	Tools > Caches menu	Flushes cached model metadata information.
Refresh Data	Tools > Caches menu	Flushes cached database records.
Refresh Dictionary	Tools > Caches menu	Flushes cached application object dictionary information.
Reindex	Development tools > Application objects menu	Re-indexes the AOT.
Report Wizard (http://msdn.microsoft.com/library/f27c0fa6-5d1d-4512-947c-961193235973(AX.60).aspx)	Tools > Wizards menu	Helps you to create a new report.
Source Code Titlecase Update	Add-Ins menu	Applies the correct case to objects names used in your code. For example, classes begin with an uppercase letter (for example, AddressCheck) and methods begin with a lowercase letter (for example, classDeclaration).
Style sheets and Themes	Development tools menu	Enables you to create style sheets and themes. Themes are style sheets with a set of images that define the overall look of a website. For more information, see How to: Create New SharePoint Themes (http://msdn.microsoft.com/library/c9d72fc6-90db-49c8-944c-db788f0848b0(AX.60).aspx).
Table browser	Add-Ins menu	Enables you to view or update data in the current table.

Tool	Opened from	Description
Table definitions	Tools menu Add-Ins menu	Enables you to generate a report that presents an overview of selected tables. The overview includes fields, types, labels, configuration keys, and help texts.
Type Hierarchy Browser and Type Hierarchy Context (http://msdn.microsoft.com/library/bafd0028-6fa1-4156-bf2f-4be59abcbf2b(AX.60).aspx)	Tools > Type hierarchy browser Add-Ins > Type hierarchy browser Tools > Type hierarchy context	Enables you to view the hierarchy of a table, class, enum, or extended data type (EDT).
Unit Test	Tools menu	Enables you to use the Unit Test Framework.
Usage data	Development tools > Application objects menu	Enables you to view the settings that a user has selected while using Microsoft Dynamics AX. These preferences are saved to make it faster for the user to use the same functionality the next time.
Version control	Development tools menu	Provides version control for all AOT objects, projects, and label files.
Websites	Tools > Web development menu	Enables you to set up and administrate your websites.
Wizard wizard	Tools > Wizards menu	Helps you to create your own wizard.

Version Control System

MorphX, the Microsoft Dynamics AX Integrated Development Environment (IDE), can integrate various Version Control Systems (VCS). You can integrate:

- Microsoft Visual Studio Team Foundation Server (TFS)
- Microsoft Visual SourceSafe
- MorphX VCS
- Another third-party VCS



Note:

We recommend that you use TFS or MorphX VCS for version control.

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Version Control Considerations

If you use the VSS or TFS version control systems, you should consider the following before you develop code or write documentation:

- Version control is file-based.
- You must install Microsoft Visual Studio or Microsoft Visual Studio Team Explorer.
- Each developer must have an Application Object Server (AOS) and database server.

MorphX VCS allows for out-of-the-box version control system integration. MorphX VCS is intended for one to ten developers who use a shared AOS. Instead of checking out objects and storing them in a repository, MorphX VCS signals to other users that a specific element is being worked on by another user. It provides change description functionality, change history functionality, and quality bar enforcement.

Caution:

Because versioning history is stored in the business database when you use MorphX VCS, you should back up the business database before you perform tasks that could lead to restoring the business database. Otherwise, versioning history may be lost.

Microsoft Dynamics AX can integrate with VSS, TFS, and MorphX VCS, but you can extend the version control functionality to use other version control systems.

The following table compares the features available from the different version control options:

	MorphX	MorphX VCS	Visual SourceSafe	Team Foundation Server
Concurrent development	No	No	Yes	Yes
Isolated development	No	No	Yes	Yes
Change description	No	Yes	Yes	Yes
Change history	No	Yes	Yes	Yes
Quality bar enforcement	No	Yes	Yes	Yes
Branching	No	No	No	Yes
Work item integration	No	No	No	Yes
Labeling support	No	No	Yes	No

Plan an implementation

This section provides information about hardware and software requirements, security, and other components so that you can plan your implementation.

The following topics are included in this section:

[Implementation methodology](#)

[Getting started with associated technologies](#)

[Plan system topology](#)

[Plan hardware and software infrastructure](#)

[Plan for data](#)

[Plan security in an implementation](#)

[Plan business intelligence](#)

[Plan for product-wide features](#)

[Plan maintenance of Microsoft Dynamics AX](#)

Implementation methodology

Microsoft Dynamics Sure Step is the prescribed methodology for deploying Microsoft Dynamics AX. The Sure Step application provides product-specific and general project-based templates, workflows, process maps and tools to assist the implementation partners. Sure Step is currently available as an online tool or for download from [PartnerSource](http://go.microsoft.com/fwlink/?LinkID=215499) (<http://go.microsoft.com/fwlink/?LinkID=215499>).

The Sure Step methodology is divided into the following phases:

Phase	Tasks during phase
Diagnostic	<ul style="list-style-type: none"> Evaluate a customer's business processes and infrastructure Assist the customer with their due diligence cycle, including ascertaining requirements and their fit with the solution, and assessing the resource needs for the solution delivery Prepare the project plan, proposal, and the Statement of Work
Analysis	<ul style="list-style-type: none"> Analyze current business model and finalize the Functional Requirements document Finalize the fit-gap analysis Develop the Environment Specification documentation
Design	<ul style="list-style-type: none"> Develop the Functional Design, Technical Design, and Solution Design documents Finalize the data migration design Establish test criteria
Development	<ul style="list-style-type: none"> Finalize configurations and setup of the standard solution Develop and finalize the custom code that is required to support the solution Conduct functional and feature testing of the solution Create the user training documentation

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Phase	Tasks during phase
Deployment	<ul style="list-style-type: none">• Set up the production environment• Migrate data to the production environment• Conduct user acceptance test of the system• Train users and finalize the user documentation• Conduct go-live check and promote the system to production
Operation	<ul style="list-style-type: none">• Resolve pending issues• Finalize user documentation and knowledge transfer• Conduct a post-mortem of the project• Provide on-going support (activities that continue through any future involvement with the customer after the project is closed)

The Sure Step methodology also provides guidance for the following areas:

Activity area	Actions performed
Optimization	<ul style="list-style-type: none">• Leverage Review Offerings to determine proactively if the system is being designed and delivered optimally to meet the customer's requirements• Analyze the system to determine how it can be optimized for the best performance based on customer's needs
Upgrade	<ul style="list-style-type: none">• Assess the customer's current business processes and solution• Document the requirements for new functionality• Upgrade the system to new release—including the addition of new functionality, promotion of existing customizations that are required, and elimination of custom code no longer required

Getting started with associated technologies

To implement and administer the Microsoft Dynamics AX solution will require that you understand Microsoft infrastructure software such as Windows Server, Microsoft SQL Server, and Microsoft SharePoint 2010 products. An efficient and optimized information technology infrastructure is required for Microsoft Dynamics AX. This topic lists online resources that you can use to learn about best practices for IT infrastructure deployment and management.

For up-to-date hardware and software requirements for Microsoft Dynamics AX, download Microsoft Dynamics AX 2012 System Requirements from the [Microsoft Download Center](http://go.microsoft.com/fwlink/?LinkID=195222) (<http://go.microsoft.com/fwlink/?LinkID=195222>).

Infrastructure Planning and Design (IPD)

The IPD guide series provides architectural guidance for Microsoft infrastructure products. These guides help clarify and streamline design processes for Microsoft infrastructure technologies. Each guide addresses a unique infrastructure technology or scenario.

For more information, see [Introduction to the Infrastructure Planning and Design Series](http://go.microsoft.com/fwlink/?LinkId=190377) (http://go.microsoft.com/fwlink/?LinkId=190377).

Microsoft Solution Accelerators

Microsoft Solution Accelerators are tools and guidance that help you solve your deployment, planning, and operational IT problems. They are free and fully supported.

For more information, see [Solution Accelerators home page](http://go.microsoft.com/fwlink/?LinkId=190371) (http://go.microsoft.com/fwlink/?LinkId=190371).

Infrastructure Optimization Model

The Infrastructure Optimization Model provides a maturity framework for IT infrastructure that is useful for benchmarking technical capability and business value. The vision of infrastructure optimization is to build an efficient, secure, and optimized information technology (IT) infrastructure and services in a logical sequence.

To begin, understand the maturity levels and then determine your maturity level, when compared to model. When this level is established, the next step is to use the model to plan your progress toward the target level that is needed for maximum business benefit.

For more information, see [Resource Guide Overview](http://go.microsoft.com/fwlink/?LinkId=190373) (http://go.microsoft.com/fwlink/?LinkId=190373).

Microsoft Operations Framework (MOF)

Microsoft Operations Framework (MOF) delivers practical guidance for everyday IT practices and activities. MOF helps users establish and implement reliable, cost-effective IT services.

For more information, see [Microsoft Operations Framework](http://go.microsoft.com/fwlink/?LinkId=190379) (http://go.microsoft.com/fwlink/?LinkId=190379).

Associated technologies

You must be familiar with Microsoft infrastructure software to deploy Microsoft Dynamics AX components successfully. This section lists some of the prerequisite technical knowledge.

Operating systems

Microsoft Dynamics AX client requires a Windows client or server operating system. Microsoft Dynamics AX server components require a server operating system.

Prerequisite knowledge	Resources
Advanced administration of Windows-based networks using Windows Server. This includes Active Directory Domain Services, domain controllers, Domain Name System (DNS), and general network administration concepts.	Windows Server home page (http://go.microsoft.com/fwlink/?LinkId=232955) Windows Client TechCenter (http://go.microsoft.com/fwlink/?LinkId=232956)

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Internet Information Services (IIS)

Enterprise Portal for Microsoft Dynamics AX, web services on Internet Information Services (IIS), and the Microsoft Dynamics AX Help server require IIS.

Prerequisite knowledge	Resources
<ul style="list-style-type: none">IIS administrationMicrosoft .NET Framework 4, especially ASP.NET and Windows Communication Foundation	<p>Windows Server home page (http://go.microsoft.com/fwlink/?LinkId=232955)</p> <p>The Official Microsoft IIS Site (http://go.microsoft.com/fwlink/?LinkId=232984)</p>

Microsoft SharePoint 2010 technology

Enterprise Portal requires either Microsoft SharePoint Foundation 2010 or Microsoft SharePoint Server 2010.

Prerequisite knowledge	Resources
Installation and administration of SharePoint Foundation 2010 or SharePoint Server 2010	<p>Microsoft SharePoint Products page (http://go.microsoft.com/fwlink/?LinkId=189311)</p>

Microsoft .NET Framework

.NET Framework is required to install Microsoft Dynamics AX. The Microsoft Dynamics AX application uses many libraries from .NET Framework such as Windows Presentation Foundation, Windows Workflow Foundation, and Windows Communication Foundation.

Prerequisite knowledge	Resources
.NET Framework 4, especially Windows Communication foundation and Windows Workflow Foundation	<p>Windows Server home page (http://go.microsoft.com/fwlink/?LinkId=232955)</p> <p>Microsoft.NET site (http://go.microsoft.com/fwlink/?LinkId=232957)</p>

SQL Server administration

Prerequisite knowledge	Resources
<ul style="list-style-type: none">Database server infrastructure designDatabase backup and recoverySQL Server administration	<p>SQL Server TechCenter (http://go.microsoft.com/fwlink/?LinkId=232960)</p> <p>SQL Server 2008 R2 - Planning and Architecture (http://go.microsoft.com/fwlink/?LinkId=232963)</p> <p>SQL Server 2008 R2 – Technical Articles (http://go.microsoft.com/fwlink/?LinkId=232965)</p>

Reporting and analytics

Microsoft SQL Server Reporting Services is the primary reporting platform for Microsoft Dynamics AX. The default, predefined reports that are provided with Microsoft Dynamics AX run on the Reporting Services platform.

Microsoft SQL Server Analysis Services provides online analytical processing (OLAP) functionality for Microsoft Dynamics AX. You can use Analysis Services to design, create, and manage cubes that contain detailed and aggregated data from multiple data sources.

Prerequisite knowledge	Resources
<ul style="list-style-type: none"> Reporting Services administration Analysis Services administration 	SQL Server Reporting Services (SSRS) (http://go.microsoft.com/fwlink/?LinkId=232966) SQL Server Analysis Services (SSAS) (http://go.microsoft.com/fwlink/?LinkId=234114)

Highly available systems

You must consider the availability of your infrastructure and applications carefully. Apply the concepts of availability, disaster recovery planning, load-balancing, and failover clustering to deploy Microsoft Dynamics AX components.

Prerequisite knowledge	Resources
<ul style="list-style-type: none"> Load balancing Failover clustering Disaster recovery planning 	Windows Server 2008 documentation for Availability and Scalability (http://go.microsoft.com/fwlink/?LinkId=232968) High Availability with SQL Server 2008 (http://go.microsoft.com/fwlink/?LinkId=232966)

Performance tuning and optimization

Prerequisite knowledge	Resources
<ul style="list-style-type: none"> Windows performance management Database performance management Database and application tracing 	Performance and Reliability (http://go.microsoft.com/fwlink/?LinkId=234156) Performance (Database Engine) (http://go.microsoft.com/fwlink/?LinkId=234157) Microsoft Dynamics AX Performance Team's Blog (http://go.microsoft.com/fwlink/?LinkId=232970)

Security

Prerequisite knowledge	Resources
<ul style="list-style-type: none">Active Directory Domain ServicesNetwork administrationPerimeter networkIPsec	<p>Security TechCenter (http://go.microsoft.com/fwlink/?linkid=42203)</p> <p>Infrastructure Planning and Design Guides for Security (http://go.microsoft.com/fwlink/?LinkId=232971)</p> <p>IPsec site on TechNet (http://go.microsoft.com/fwlink/?LinkId=232972)</p>

Plan system topology

Plan your system topology carefully before deploying Microsoft Dynamics AX. Environments for development, testing, and production should be carefully optimized for throughput, response time, scalability, and availability. The following topics describe considerations in planning your system topology:

[AOS topology](#)

[SQL Server topology](#)

[Application Integration Framework topology](#)

[Project Server integration topology](#)

[Sample deployment scenarios](#)



Note:

This section describes network and system topologies, not how a Microsoft Dynamics AX system communicates internally. For information on internal Microsoft Dynamics AX architecture, see [System architecture](#).



Important:

You need to make sure that your planned topology is supported by Microsoft. For more information, contact your value added reseller (VAR). If you are enrolled in a support plan directly with Microsoft, you can log on to [CustomerSource](#) (http://go.microsoft.com/fwlink/?LinkId=92647) and submit a new support request.

AOS topology

An Application Object Server (AOS) instance is a core component of your Microsoft Dynamics AX installation and is installed by using Setup. An AOS instance enforces security, manages connections between clients and the database, and provides the foundation where Microsoft Dynamics AX business logic runs. The topics in this section describe the various roles in which AOS can function.

[AOS clusters without a dedicated load balancer](#)

[AOS clusters with a dedicated load balancer](#)

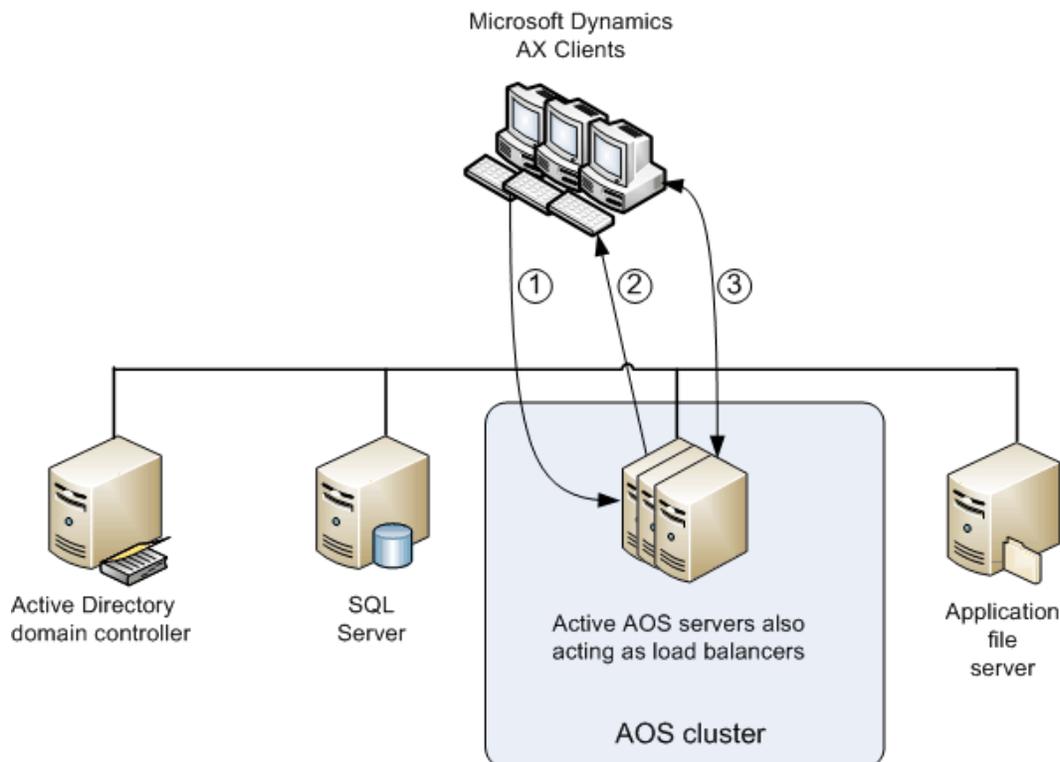
AOS clusters without a dedicated load balancer

You can configure Microsoft Dynamics AX Application Object Server (AOS) clusters that include a dedicated load balancer. You can also configure clusters that do not include a dedicated load balancer. This topic describes planning considerations for an AOS cluster that does not include a dedicated load balancer.

Overview

The following figure shows how a client establishes a connection with an AOS instance in a cluster when a dedicated load balancer is not present.

1. When a Microsoft Dynamics AX client starts, the client reads the list of AOS instances that is specified in the Microsoft Dynamics AX 2012 Configuration utility. The client initiates a handshake with the first AOS instance in the list. If the first AOS instance does not respond, the client initiates a handshake with the next AOS instance in the list. The client continues in this manner until the handshake occurs.
2. The AOS instance that received the client request queries the database and all active AOS instances in the cluster. The AOS instance returns to the client a list of all active AOS instances in the cluster, sorted by workload. The server that has the smallest workload is at the top of the list. The workload is based on the number of connected clients, divided by the maximum number of clients that are allowed on the server.
3. The client attempts to connect to each AOS instance in the sorted list until a successful connection is established. The client then uses the AOS instance that it connected to for the whole session.



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Considerations for using an AOS instance in a cluster that does not include a dedicated load balancer

- If a dedicated load balancer is not present, each AOS instance in the cluster functions as both an active AOS instance and a load balancer.
- An active AOS instance has higher hardware requirements than an AOS instance that functions as a dedicated load balancer.

For information about how to configure load balancing clusters, see [Create a load balancing cluster](http://technet.microsoft.com/library/b070501d-cf46-49fb-8168-785259178d27(AX.60).aspx) ([http://technet.microsoft.com/library/b070501d-cf46-49fb-8168-785259178d27\(AX.60\).aspx](http://technet.microsoft.com/library/b070501d-cf46-49fb-8168-785259178d27(AX.60).aspx)).

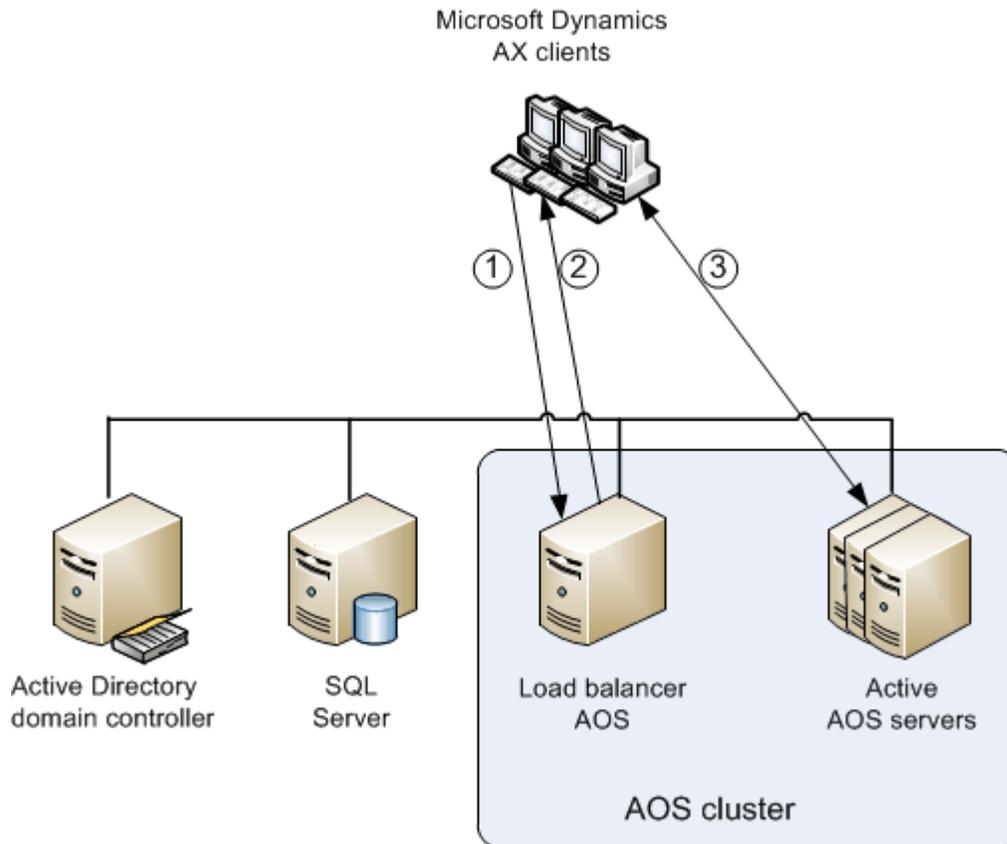
AOS clusters with a dedicated load balancer

You can configure Microsoft Dynamics AX Application Object Server (AOS) clusters that include a dedicated load balancer. You can also configure clusters that do not include a dedicated load balancer. This topic describes planning considerations for an AOS cluster that includes a dedicated load balancer.

Overview

The following figure shows how a client establishes a connection with an AOS instance in a cluster when a dedicated load balancer is present.

1. When a Microsoft Dynamics AX client starts, the client reads the list of active AOS instances that is specified in the Microsoft Dynamics AX 2012 Configuration utility. The client initiates a handshake with the first AOS instance in the list. In this scenario, the administrator has configured the first AOS instance as a dedicated load balancer.
2. The load balancing AOS instance that received the client request queries the database and all active AOS instances in the cluster. The AOS instance returns to the client a list of all active AOS instances in the cluster, sorted by workload. The server that has the smallest workload is at the top of the list. The workload is based on the number of connected clients, divided by the maximum number of clients that are allowed on the server.
3. The client attempts to connect to each AOS instance in the sorted list until a successful connection is established. The client then uses the AOS instance that it connected to for the whole session.



Considerations for using an AOS instance as a dedicated load balancer

- An AOS instance that is configured as a load balancer does not accept any client connections as either an application server or a batch server. This AOS instance functions only as a load balancer.
- A dedicated load balancer can be used only for remote procedure call (RPC) connections. To balance the load of connections for Application Integration Framework (AIF) and services, you must use Microsoft Network Load Balancing (NLB). For more information, see [Configuring network load balancing for services](#).
- An AOS instance that is configured as a load balancer does not require an AOS license, because the server does not provide any application services to the clients.
- If you configure an AOS instance as a dedicated load balancer, you do not have to update client configurations when AOS instances are added to or removed from the cluster.
- A dedicated load balancer has lower hardware requirements than an AOS instance that functions as an application server, because the load balancer does not process application requests or business logic.
- You can configure multiple AOS instances to function as dedicated load balancers. However, you must make sure that dedicated load balancers appear first in the list of active servers in the client configuration.

For information about how to configure load balancing clusters, see [Create a load balancing cluster](#) ([http://technet.microsoft.com/library/b070501d-cf46-49fb-8168-785259178d27\(AX.60\).aspx](http://technet.microsoft.com/library/b070501d-cf46-49fb-8168-785259178d27(AX.60).aspx)).

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SQL Server topology

The choice topology of the Microsoft SQL Server environment that supports Microsoft Dynamics AX is driven primarily by requirements for availability and performance.

General topology recommendations

We recommend the following guidelines as a baseline for your topology:

- Follow the documented best practices for SQL Server.
- Use a dedicated server that is running SQL Server 2012, SQL Server 2008 R2 or SQL Server 2008.
- Use a single instance of SQL Server that is dedicated to running the Microsoft Dynamics AX production database.
- Store your test and development databases on a separate server from the production database.

Availability recommendations

SQL Server provides several options that can help you achieve high availability: Windows Server Failover Clustering, SQL Server database mirroring, SQL Server log shipping, and SQL Server 2012 AlwaysOn Availability Groups. Of these options, failover clustering and availability groups provide the least amount of downtime. However, replication, database mirroring, log shipping, and availability groups can satisfy other requirements. For example, some of these options can be used to provide a reporting environment that can reduce the load on your production server. The high availability option that you select for your implementation of Microsoft Dynamics AX depends on your availability requirements, a cost/benefit analysis, and the risk tolerance of your organization.

Important:

Before you select a high availability option for SQL Server, we strongly recommend that you contact your value-added reseller (VAR) or Microsoft Support to make sure that the option that you want to use is supported.

Determine and document your availability needs carefully, and test the solution that you select to make sure that it provides the expected availability. The following table lists supported high availability configurations.

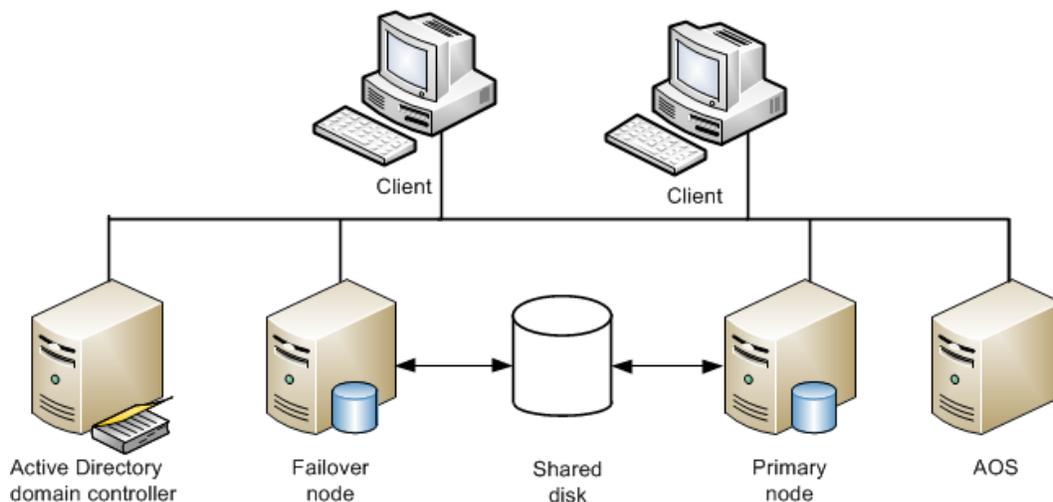
High availability configuration	Support status
Windows Server Failover Clustering (WSFC)	Supported
Log shipping	Supported
Transactional replication	Supported. Requires KB 2765281.
Snapshot replication	Supported
Database mirroring	Supported
Merge replication	Not supported, because complex resolution is required to guarantee data integrity
SQL Server 2012 AlwaysOn Availability groups	Supported. Both synchronous and asynchronous secondary configurations are supported.

If you are running SQL Server 2012, we recommend that you deploy AlwaysOn Availability Groups.

If you are running SQL Server 2008, we recommend that you deploy a Windows Server Failover Cluster with one active node and one inactive node.

Availability groups and failover clusters do not require a restart of the Application Object Server (AOS) service.

The following figure shows a SQL Server failover topology.



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When you use SQL Server failover clustering, note the following behavior:

- The failover is transparent to AOS, and the service typically does not require a restart.
- In-process transactions are rolled back, and the user may have to reenter data that was being entered at the time of failure.

Note:

We recommend that a failover cluster be configured so the active node will fail over to an inactive node. If the active node fails over to another active node in the cluster, you must make sure there is sufficient capacity to sustain the Microsoft Dynamics AX database workload, otherwise performance may be degraded significantly.

Caution:

Microsoft SQL Server Reporting Services cannot be installed on a failover cluster, because you cannot run the Reporting Services service as part of a failover cluster. However, you can install the report server database on a computer that has a failover cluster installed.

For more information about availability options, see:

- [Getting started with SQL Server 2008 R2 Failover Clustering](http://go.microsoft.com/fwlink/?LinkId=216763) (http://go.microsoft.com/fwlink/?LinkId=216763)
- [Windows Server Failover Clustering \(WSFC\) with SQL Server](http://technet.microsoft.com/en-us/library/hh270278.aspx) (http://technet.microsoft.com/en-us/library/hh270278.aspx)
- [Database mirroring](http://go.microsoft.com/fwlink/?LinkId=216767) (http://go.microsoft.com/fwlink/?LinkId=216767)
- [Log shipping](http://go.microsoft.com/fwlink/?LinkId=216765) (http://go.microsoft.com/fwlink/?LinkId=216765)
- [Transactional replication](http://go.microsoft.com/fwlink/?LinkId=216768) (http://go.microsoft.com/fwlink/?LinkId=216768)
- [Snapshot replication](http://go.microsoft.com/fwlink/?LinkId=216769) (http://go.microsoft.com/fwlink/?LinkId=216769)
- [Host a Report Server Database in a SQL Server Failover Cluster](http://technet.microsoft.com/en-us/library/bb630402.aspx) (http://technet.microsoft.com/en-us/library/bb630402.aspx)

Performance recommendations

The performance of the database can significantly affect overall Microsoft Dynamics AX performance.

To achieve the best performance, the SQL Server environment and storage subsystem must be correctly configured. For more information, see [Configure SQL Server and storage settings](#).

Application Integration Framework topology

This topic describes factors to consider when you plan the topology of services and Application Integration Framework (AIF).

Factors that affect the AIF topology

Application Object Server (AOS), which is the application server for the Microsoft Dynamics AX application, is the key component of the infrastructure. Which additional components and infrastructure are required depends on the types of adapters that you choose to use. The types of adapters that are required depend on your integration requirements.

- **HTTP adapter** – This adapter enables synchronous exchanges through web services on Internet Information Services (IIS), which can expose services on a network or the Internet. Web services

on IIS require IIS 7.0. You can deploy AIF web services on a dedicated IIS server or a dedicated IIS farm. Alternatively, you can share an IIS server or IIS farm with other Microsoft Dynamics AX components, such as Workflow, Enterprise Portal for Microsoft Dynamics AX, and report server. We recommend that you deploy AIF web services on a dedicated IIS server or a dedicated IIS farm. For current hardware and software requirements for Microsoft Dynamics AX, see the [system requirements web page](http://go.microsoft.com/fwlink/?LinkId=165377) (<http://go.microsoft.com/fwlink/?LinkId=165377>). For more information about web services, see [Install web services on IIS](http://technet.microsoft.com/library/83827f45-6e85-4ec4-b673-133d284b2763(AX.60).aspx) ([http://technet.microsoft.com/library/83827f45-6e85-4ec4-b673-133d284b2763\(AX.60\).aspx](http://technet.microsoft.com/library/83827f45-6e85-4ec4-b673-133d284b2763(AX.60).aspx)).

- **NetTCP adapter** – This adapter enables synchronous exchanges by using support for WS-* standards over the Transmission Control Protocol (TCP) transport. You can use this adapter to expose services on a network.
- **MSMQ adapter** – This adapter enables asynchronous exchanges through message queues. To use this adapter, you must install Message Queuing, which is also known as MSMQ, on a computer on the network. You must also create at least one public queue to configure the MSMQ Adapter for Microsoft Dynamics AX. For more information, see [Deploy Message Queuing for AIF](http://technet.microsoft.com/library/1e5a2329-3f18-40cc-ad10-3d2f1530f6c7(AX.60).aspx) ([http://technet.microsoft.com/library/1e5a2329-3f18-40cc-ad10-3d2f1530f6c7\(AX.60\).aspx](http://technet.microsoft.com/library/1e5a2329-3f18-40cc-ad10-3d2f1530f6c7(AX.60).aspx)).
- **File System adapter** – This adapter enables asynchronous exchanges through file system directories. You must enable and configure at least one file system directory, or *folder*, for messages. Inbound messages and outbound messages require separate folders. For more information, see [Walkthrough: Exchanging documents by using the file system adapter](http://technet.microsoft.com/library/c121bfd3-7833-4f55-9944-45506c10559a(AX.60).aspx) ([http://technet.microsoft.com/library/c121bfd3-7833-4f55-9944-45506c10559a\(AX.60\).aspx](http://technet.microsoft.com/library/c121bfd3-7833-4f55-9944-45506c10559a(AX.60).aspx)).

 **Note:**

Microsoft Dynamics AX 2012 no longer includes a BizTalk adapter. Earlier versions of Microsoft Dynamics AX required a BizTalk adapter for integration with Microsoft BizTalk Server. However, BizTalk Server can now connect to AIF through standards-based adapters. For more information, see [Exchanging documents between BizTalk Server and AIF](#).

Consider the following points when you calculate your expected workload for AIF:

- You must estimate the workload that services generate. You must consider the effect that service traffic has on your network, and plan for services when you plan your network capacity. You must consider the availability requirements of services that you deploy, and make sure that your network can provide the availability that the services require.
- Make sure that your calculations include the workload that is generated by external applications that use services and AIF.
- If you expect high data volume through asynchronous message processing, consider scaling out by using parallel processing of service requests on multiple AOS instances. Parallel processing lets you scale asynchronous message processing across AOS instances that are configured as batch servers. See [Sequential and parallel processing in services and AIF](#).

If you use parallel processing, carefully consider the load that incoming messages generate on the batch servers. Plan the clusters and the number of AOS instances in each cluster accordingly. For more information about batch servers, see [Batch server overview](#).

- For high availability of services, consider the options for load balancing service traffic. For information about load balancing for services, see [Configuring network load balancing for services](#).

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For more information about services and AIF, see [Services and Application Integration Framework \(AIF\)](http://technet.microsoft.com/library/5e350529-8fca-4faa-b820-4db3348233b0(AX.60).aspx) ([http://technet.microsoft.com/library/5e350529-8fca-4faa-b820-4db3348233b0\(AX.60\).aspx](http://technet.microsoft.com/library/5e350529-8fca-4faa-b820-4db3348233b0(AX.60).aspx)).

Configuring network load balancing for services

Clusters of instances of Application Object Server (AOS) for Microsoft Dynamics AX can be load balanced in two ways: the cluster can either include or lack a dedicated load-balancing AOS instance. However, load-balanced AOS clusters cannot load balance network traffic for services. When you use either of the two AOS load-balancing approaches, all traffic for services is routed to the first AOS instance in the list of servers that belong to the cluster. For more information about how to load balance AOS clusters, see [AOS clusters without a dedicated load balancer](#) and [AOS clusters with a dedicated load balancer](#). To enable load balancing for services, you must instead use Windows Server Network Load Balancing (NLB). For information about NLB, see the [Network Load Balancing Deployment Guide](#) (<http://go.microsoft.com/fwlink/?LinkId=225684>) on the TechNet website.

Network Load Balancing considerations for services

When you set up systems to load balance the traffic for Microsoft Dynamics AX services, keep the following points in mind:

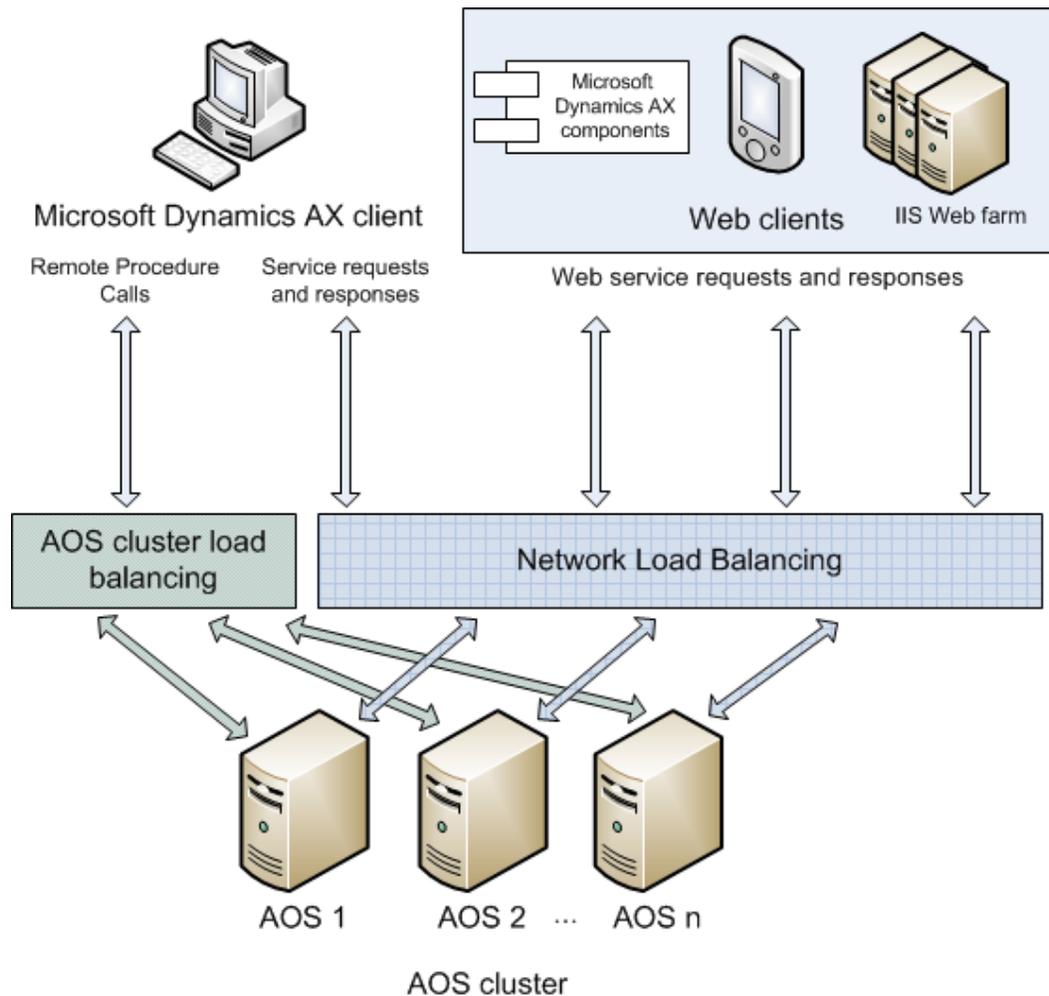
- If load balancing is configured without a load-balancing AOS instance, all AOS computers should also participate in the NLB cluster.
- If a dedicated load-balancing AOS instance is used, do not include the dedicated AOS instance in the NLB cluster. In this scenario, service calls are routed through NLB, but remote procedure calls (RPCs) continue to be routed to the dedicated load-balancing AOS instance.
- Any client that consumes Microsoft Dynamics AX services must use the virtual name or IP address of the NLB cluster to make service calls. These clients include the following clients:
 - The Microsoft Dynamics AX client program.
 - Custom client applications.
 - Clients that consume web services over the Internet. These clients include clients that consume web services through an Internet Information Services (IIS) Web farm. For more information, see [Considerations for services that are hosted by IIS](#). For more information about IIS Web farms, see [Managing Shared Configuration](#) (<http://go.microsoft.com/fwlink/?LinkId=225687>) on the IIS website. For more information about how to work with configuration files in IIS, see [Working with Configuration Files in IIS 7](#) (<http://go.microsoft.com/fwlink/?LinkId=225688>) on the TechNet website.
- The following Microsoft Dynamics AX features must use NLB as the load-balancing mechanism when high availability of service is required:
 - **Kanban schedule board** form
 - Microsoft SQL Server Reporting Services
 - Office Add-ins for Microsoft Dynamics AX
- NLB manages host instances, but it does not manage AOS instances. Therefore, when a host instance fails, NLB removes the failed host instance from the cluster. However, when an AOS instance fails, NLB does not remove the host instance from the cluster. Instead, NLB continues to try to route traffic to the failed AOS instance. Therefore, you must implement a monitoring solution to detect when an AOS instance fails, so that you can appropriately deal with the failure. For example, [Microsoft System Center Operations Manager](#)

(<http://go.microsoft.com/fwlink/?LinkId=226205>) (SCOM) provides this kind of system management facilities.

Warning:

Do not mix calls to RPC and web services in this environment.

The following diagram shows the topology for load balancing services by using NLB.



Configuring Network Load Balancing for services

To configure NLB for Microsoft Dynamics AX, follow these general steps:

1. On each computer that is participating in the load-balancing cluster, install an AOS instance.
2. On a client computer, install the Microsoft Dynamics AX client program. For information about how to install the Microsoft Dynamics AX client program, see [Install a client](http://technet.microsoft.com/library/8211f4bd-180f-4a0b-b3d0-88f6dbfceda4(AX.60).aspx) ([http://technet.microsoft.com/library/8211f4bd-180f-4a0b-b3d0-88f6dbfceda4\(AX.60\).aspx](http://technet.microsoft.com/library/8211f4bd-180f-4a0b-b3d0-88f6dbfceda4(AX.60).aspx)).
3. On each server computer in the cluster, configure NLB. For information about how to configure NLB, see the [Microsoft Support website](http://support.microsoft.com/kb/323437) (<http://support.microsoft.com/kb/323437>).

 **Important:**

Do not use the same virtual name for the AOS cluster and the NLB cluster.

4. On the client computer, create a new client configuration by using the Microsoft Dynamics AX Client Configuration Utility. For information about how to use this utility, see [Client operations](http://technet.microsoft.com/library/7c502824-aec8-4f9e-91db-cc9d46f33194(AX.60).aspx) ([http://technet.microsoft.com/library/7c502824-aec8-4f9e-91db-cc9d46f33194\(AX.60\).aspx](http://technet.microsoft.com/library/7c502824-aec8-4f9e-91db-cc9d46f33194(AX.60).aspx)).
5. Save the configuration, and close the utility.
6. On the client computer, use Regedit to add the two values that are listed in the following table to the registry subkeys at the path
\\Software\\Microsoft\\Dynamics\\6.0\\Configuration*new_configuration_name* for both
HKEY_CURRENT_USER and HKEY_LOCAL_MACHINE.

Name	Description
wcflbservername	A string value that contains the virtual name of the NLB cluster.
wcflbwSDLport	A string value that contains the port number that is used to retrieve Web Services Description Language (WSDL) documents.

 **Note:**

This subkey enables Microsoft Dynamics AX components to work with NLB settings. If you develop a client application that consumes Microsoft Dynamics AX services, and you want to use NLB, you can read these values, and then use them to route your calls appropriately.

7. On the client computer, reopen the Microsoft Dynamics AX Client Configuration Utility.
8. Click **Configure Services** to open the Microsoft Service Configuration Editor. This step updates the Windows Communication Foundation (WCF) configuration so that it uses endpoint addresses that point to the virtual name or IP address of the NLB cluster.
9. Save the WCF configuration file, and close the editor.
10. In the Microsoft Dynamics AX Client Configuration Utility, click **Manage**, and then save the configuration information as an .axc file. You can use this file as the standard file for configuring any client that connects to the NLB cluster to consume services.
11. Install any remaining components.
12. For each new client instance that you install, use the .axc file that you saved to specify the configuration. During setup, you can specify the path of the configuration file on the **Specify a location for configuration settings** page.

Integration port considerations

When you create a new port, you must restart all AOS instances in the NLB cluster. If you do not restart the AOS instances, the new port will only be available on the AOS on which it was created.

To view the WSDL document for a service through NLB, replace the AOS name in the address that is provided by the port with the NLB name or its IP address.

Considerations for services that are hosted by IIS

When you activate an integration port that exposes a web service by using the HTTP adapter, Application Integration Framework (AIF) creates a folder that has a name that matches the name of the integration port. You can find this folder under the root folder of the site on the computer that runs IIS. You specified the name of this computer either during the installation of web services on IIS or in the **Web sites** form.

The subfolder that AIF creates contains several files that are related to the deployment of the integration port. These files include a file that is named web.config. For IIS servers that connect to NLB clusters that load balance Microsoft Dynamics AX services, you must modify the web.config file for the website of each HTTP integration port. For Web farms, you must copy the configuration file and the associated service assemblies to each IIS server in the cluster. If you do not modify this file, the service URL on the WSDL page does not point to the NLB virtual name. Instead, the service URL contains the name of an individual AOS instance. To modify the web.config files, add or modify the section that is shown in the following example XML code. You must replace the text "IIS_Port_Number" with your IIS port number.

```
<behaviors>
  <serviceBehaviors>
    <behavior name="routingData">
      <useRequestHeadersForMetadataAddress>
        <defaultPorts>
          <add scheme="http" port="IIS_Port_Number" />
        </defaultPorts>
      </useRequestHeadersForMetadataAddress>
    </behavior>
  </serviceBehaviors>
  ...
</behaviors>
```

For more information about the `<useRequestHeadersForMetadataAddress>` element, see [the MSDN website](http://go.microsoft.com/fwlink/?LinkId=226206) (http://go.microsoft.com/fwlink/?LinkId=226206).

Sequential and parallel processing in services and AIF

When you use asynchronous adapters, performance can be affected by the rate at which messages move through the gateway queue for Application Integration Framework (AIF). In asynchronous scenarios, messages are periodically retrieved from file folders or Message Queuing queues. These messages include batched messages. The frequency at which messages are retrieved and then processed is determined by the recurrence setting of a batch job.

Sequential processing

Typically, messages that are processed by asynchronous adapters are processed in alphabetical order by file name during each occurrence of a batch job. This type of processing is called *sequential processing*. You can control the order in which messages are processed by using sequential file names. For example,

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you can prefix each file name with a numerical value, such as 001_, 002_, and so on. Provided that you send all the files at the same time, the files are guaranteed to be processed in the order that you specify. However, the order in which files are sequentially processed applies only during a single occurrence of a batch job.

Parallel processing

To improve the performance of message processing when you use asynchronous adapters, AIF supports *parallel processing*. Parallel processing distributes the processing of messages across one or more instances of Application Object Server (AOS). For a single AOS instance, parallel processing uses multiple threads to process messages. If the computer that is running a single AOS has multiple processors, you can expect better performance by using parallel processing. You can further improve the performance of message processing by using parallel processing with multiple AOS instances. For more information about how to load balance the processing of messages, see [Configuring network load balancing for services](#).

To enable parallel processing of inbound messages, select the **Process requests in parallel** check box on the **Processing options** FastTab of the **Inbound ports** form. Clear the check box to use sequential processing. This check box affects both single and batched message types.

By default, when you enable parallel processing, the number of messages that AOS can process in parallel is set to 1000. The `MaximumInboundParallelMessages` macro defines the number of inbound messages that are processed in parallel. You can change this setting by changing the corresponding AIF macro in the Application Object Tree (AOT). You must have a developer license to access the AOT. The following macro is defined in the `Aif` subnode.

```
#define.MaximumInboundParallelMessages (1000)
```

To enable parallel processing of outbound messages, you must modify the code that calls the AIF Send API. For more information, see [Walkthrough: Deploying the Document Service in an Outbound Exchange](#) ([http://technet.microsoft.com/library/5f807796-8b0e-4903-a803-91c46eb3295c\(AX.60\).aspx](http://technet.microsoft.com/library/5f807796-8b0e-4903-a803-91c46eb3295c(AX.60).aspx)).

Conversations

Sometimes, the order in which messages are processed is important. For example, new customer accounts must be created before sales orders for the customers can be processed. You can specify that certain messages must be processed sequentially by an integration port, even when parallel processing is enabled for that port. In each document that must be processed in parallel, include a special XML element that is named `ConversationId`. All messages that have the same conversation ID are processed sequentially by any port for which parallel processing is enabled. The `ConversationId` element has no effect when messages are processed by ports for which parallel processing is not enabled. For more information about the `ConversationId` element, see [Message Header](#) ([http://technet.microsoft.com/library/d290df0a-0902-49c3-a732-b2b85eb92fb3\(AX.60\).aspx](http://technet.microsoft.com/library/d290df0a-0902-49c3-a732-b2b85eb92fb3(AX.60).aspx)).

Summary

The following table summarizes processing behavior.

Message type	Parallel processing is enabled	Parallel processing is disabled
Single message	Message processing is distributed across one or more AOS instances. The order of processing is not deterministic.	Messages are processed by a single AOS instance, in alphabetical order by file name, during each occurrence of the batch job.
Batched messages	Batched messages are separated into single messages. Message processing is then distributed across one or more AOS instances. The order of processing is not deterministic.	Batched messages are separated into single messages. Messages are then processed by a single AOS instance, in alphabetical order by file name, during each occurrence of the batch job.
Conversations	Single messages that have the same conversation ID are processed by the same AOS instance, in alphabetical order by file name, during each occurrence of the batch job.	The ConversationId element is ignored.

Configuring batch jobs and tasks for AIF

Application Integration Framework (AIF) uses its gateway queue to handle asynchronous message routing in an orderly way. To move message into and out of the gateway queue, AIF requires a Microsoft Dynamics AX batch job that runs a particular set of services. For detailed information about how batch jobs work on Application Object Servers (AOS), see [Process batch jobs and tasks](http://technet.microsoft.com/library/5002a400-7a5c-4193-a4dd-f894d5eb9d92(AX.60).aspx) ([http://technet.microsoft.com/library/5002a400-7a5c-4193-a4dd-f894d5eb9d92\(AX.60\).aspx](http://technet.microsoft.com/library/5002a400-7a5c-4193-a4dd-f894d5eb9d92(AX.60).aspx)).

AIF batch services

The four services that move documents through the gateway queue are:

1. **AIFGatewayReceiveService** – This service communicates with the adapters, receives messages from their external source locations, and puts them into the gateway queue to wait for processing.
2. **AIFInboundProcessingService** – This service takes incoming messages from the gateway queue and then processes the documents according to the rules that are specified by the inbound port.
3. **AIFOutboundProcessingService** – This service processes an outbound document according to the rules that are specified by the integration port and then adds the envelope XML code to create a fully-formed AIF message. The service then places the message into the gateway queue to send.
4. **AIFGatewaySendService** – This service sends the messages to the correct external destinations.

These services must run in a specific order because they depend on each other. For example, the gateway receive service must run before the inbound processing service. Otherwise, the inbound processing service will have no data to process. The order in which these services must run is the order in the previous list.

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Running batch jobs

Typically, these services run as four tasks in one batch job. You can create other batch job configurations, depending on your business requirements. For example, to schedule the AIF services to run at different time intervals, you can divide the services among multiple batch jobs. When you create the batch job, you can specify the order in which the services run by specifying conditions for the tasks. For information about how to create a batch job, including how to set conditions, see [Create a batch job](http://technet.microsoft.com/library/81a1c46c-d305-4b78-81f1-fb8029d575f7(AX.60).aspx) ([http://technet.microsoft.com/library/81a1c46c-d305-4b78-81f1-fb8029d575f7\(AX.60\).aspx](http://technet.microsoft.com/library/81a1c46c-d305-4b78-81f1-fb8029d575f7(AX.60).aspx)).

In order for the AIF services to run, you must set the batch job status to **Waiting**. For information about how to change the status of batch jobs, see [View or change batch job status](http://technet.microsoft.com/library/3c1c6a3e-64c7-4802-9dc4-7f1ffafc9b5c(AX.60).aspx) ([http://technet.microsoft.com/library/3c1c6a3e-64c7-4802-9dc4-7f1ffafc9b5c\(AX.60\).aspx](http://technet.microsoft.com/library/3c1c6a3e-64c7-4802-9dc4-7f1ffafc9b5c(AX.60).aspx)).

Project Server integration topology

For information about setting up integration with Project Server, see the [Microsoft Project Server 2010 Integration](http://go.microsoft.com/fwlink/?LinkId=215155) (<http://go.microsoft.com/fwlink/?LinkId=215155>) white paper that is available from the Microsoft Download Center.

Sample deployment scenarios

This section describes sample deployment scenarios that range from a single-server deployment to a large-scale, distributed deployment. The scenarios are provided to help you understand requirements for the infrastructure and servers. These scenarios do not provide any guidelines for infrastructure sizing.

The following topics are included in this section:

[Single-server deployment](#)

[Small-scale deployment](#)

[Large-scale deployment](#)

Single-server deployment

A single-server deployment occurs when you deploy all the Microsoft Dynamics AX components on a single computer. We recommend that you consider a single-server deployment only for development or demonstration environments.

You must make sure that the single-server deployment fits in with your overall strategy for IT infrastructure and development. Carefully consider the hardware and software that are required for the single-server deployment to guarantee appropriate response times for your developers. For the current hardware and software requirements for Microsoft Dynamics AX, download Microsoft Dynamics AX 2012 System Requirements from the [Microsoft Download Center](http://go.microsoft.com/fwlink/?LinkID=195222) (<http://go.microsoft.com/fwlink/?LinkID=195222>).

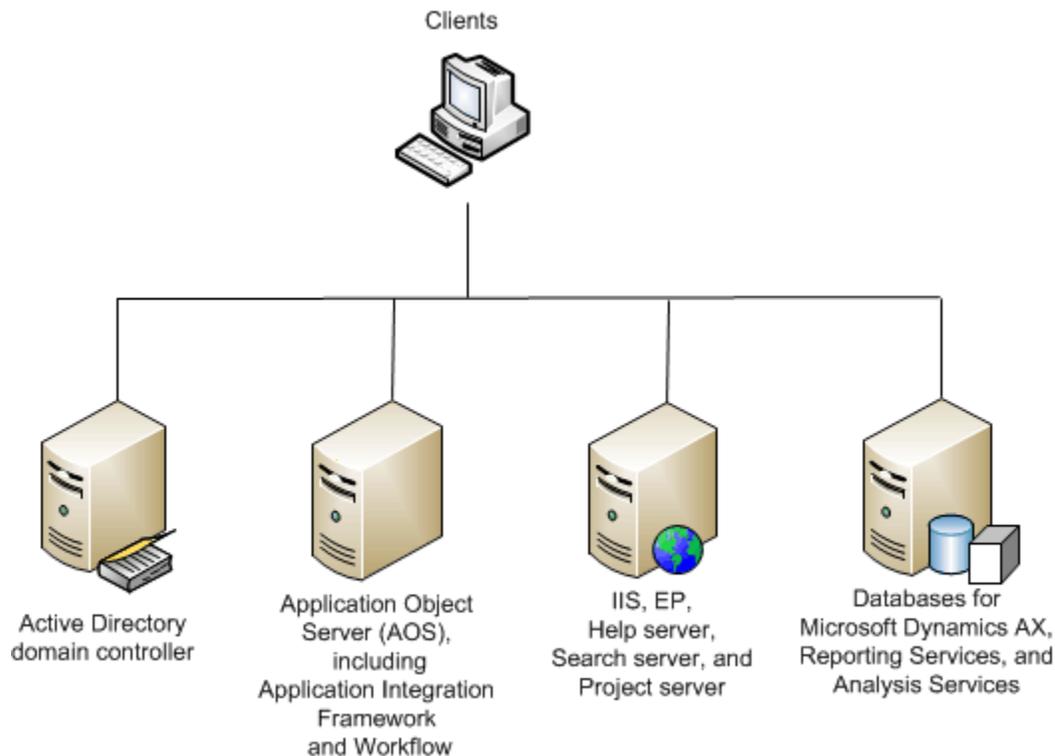
Small-scale deployment

This topic provides a sample topology for a small-scale deployment. The topology for a small-scale deployment expands on the topology for a single-server deployment that is described in the [Single-server deployment](#) topic.

This topology does not offer scalability or high availability. Scalability and high availability are introduced in the large-scale topology that is described in the [Large-scale deployment](#) topic. This topology is suitable as a test environment and for training purposes.

The following diagram shows a sample topology for a small-scale deployment.

Small-scale deployment topology



The following list describes how the computers in this sample topology are used:

- An Active Directory domain controller is required to deploy Microsoft Dynamics AX components.
- Windows clients for Microsoft Dynamics AX that connect over a wide area network (WAN) are configured to use Terminal Services to communicate with Application Object Server (AOS). Windows clients on the local area network (LAN) are configured to communicate with AOS directly.
- AOS is deployed on a single-server computer. AOS can host the following components:
 - Workflow
 - Services and Application Integration Framework (AIF)
- External applications use services and AIF to exchange data with Microsoft Dynamics AX.
- A web server can host the following components:
 - Search server
 - Enterprise Portal for Microsoft Dynamics AX
 - Web services on IIS
 - Microsoft Project Server
- The server that runs Microsoft SQL Server can host the following components:
 - Microsoft Dynamics AX online transaction processing (OLTP) database
 - Model files in the OLTP database

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- Microsoft SQL Server Analysis Services (SSAS)
- Microsoft SQL Server Reporting Services (SSRS)

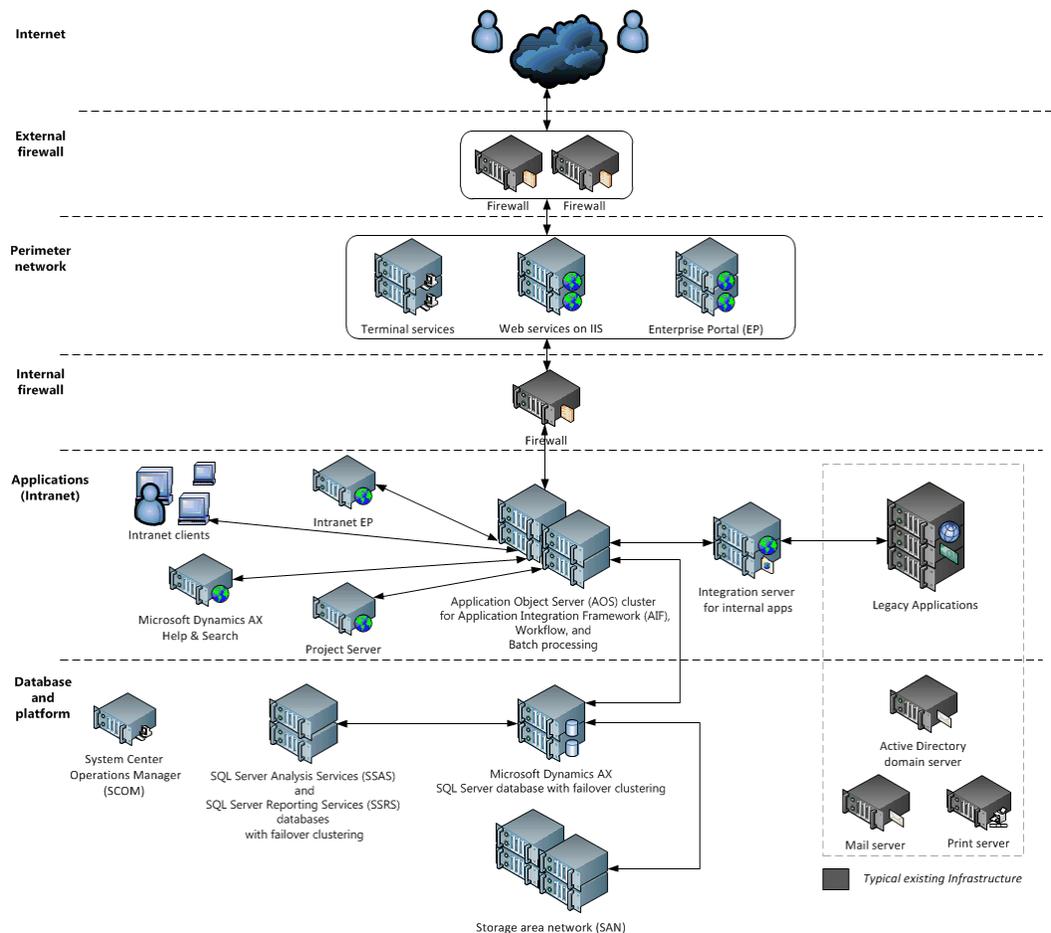
Large-scale deployment

This topic provides a sample topology for a large-scale deployment. This topology focuses on high availability that is based on load-balancing server clusters for the application servers and failover server clusters for the database server.

Topology diagram

The following diagram shows the sample topology for a large-scale deployment.

Large-scale deployment



This diagram shows a layered topology that helps provide security through the strategic placement of firewalls and the use of a *perimeter network*. A perimeter network, which is also known as a *demilitarized zone (DMZ)* or a *screened subnet*, prevents external users from directly accessing the corporate intranet.

Inside the corporate intranet, servers are divided among the following layers:

- An *applications layer*, which contains servers that specialize in serving information to clients.

- A *database and platform layer*, which contains servers that specialize in storing information that can be retrieved by servers in the applications layer. This layer also contains servers that provide company-wide administrative and security functions, such as directory servers and mail servers.

Microsoft Dynamics AX Windows clients that connect over a wide area network (WAN) are configured to use Terminal Services to communicate with Application Object Server (AOS). Microsoft Dynamics AX Windows clients on the local area network (LAN) are configured to communicate with AOS directly.

Perimeter network

The perimeter network provides external users access to Microsoft Dynamics AX functionality through the following types of server clusters:

- A Terminal Services cluster provides virtual private network (VPN) access to authorized users.
- An Internet Information Services (IIS) cluster provides access to services through the web services on IIS feature for Microsoft Dynamics AX.
- An IIS cluster is dedicated to Enterprise Portal for Microsoft Dynamics AX (EP).

Applications layer

The applications layer contains servers that provide information both to internal clients and to external clients that access Microsoft Dynamics AX through the perimeter network. This layer contains the following servers:

1. A single AOS cluster supports clients and application components. You can configure one or more AOS instances in the cluster to act as batch servers. The AOS cluster natively provides functionality for services and Application Integration Framework (AIF), Workflow, and batch processing tasks. This cluster typically uses Network Load Balancing (NLB) to distribute the workload among the AOS instances.
2. A cluster of integration servers connects to pre-existing systems.
3. Dedicated servers provide internal clients access to Enterprise Portal, Microsoft Dynamics AX Help Server, Search Server, and Microsoft Project Server.

Database and platform layer

The database and platform layer contains the following servers:

- A Microsoft SQL Server failover cluster contains the Microsoft Dynamics AX database. This cluster may support additional database requirements. For example, the cluster may host the database that is required for Microsoft SharePoint 2010 products.

Note:

You must determine whether additional database clusters are required, based on the expected workload.

- A second SQL Server failover cluster is dedicated to Microsoft SQL Server Analysis Services and Microsoft SQL Server Reporting Services.
- All data is backed up through a storage area network (SAN).
- System Center Operations Manager (SCOM) enables monitoring for the whole system.
- An Active Directory domain controller is required to deploy Microsoft Dynamics AX components.

Plan hardware and software infrastructure

When you deploy Microsoft Dynamics AX, you must have a clear understanding of your organization's or customers' requirements. In this manner, you can make good decisions as you recommend hardware and software, install the system, and customize the system.

We recommend that you carefully consider the performance requirements for your deployment during the planning stage, to guarantee that the deployment is successful.

Different roles in your information technology department raise different performance considerations:

- An infrastructure architect has to balance performance and scalability with other quality of service (QoS) attributes, such as manageability, interoperability, security, and maintainability.
- A developer has to make sure that your modifications produce the results that users expect.
- A tester has to validate application functionality, optimization, and expected workloads.
- A system administrator has to monitor the infrastructure and applications, to make sure that they meet the service level agreements.

The following topics are included in this section:

[Hardware and software requirements](#)

[Planning hardware infrastructure](#)

[View benchmark reports](#)

[Configure SQL Server and storage settings](#)

[Considerations for global deployment](#)

[Plan for batch processing](#)

[Planning considerations for the Help system](#)

[Plan for integration](#)

[Virtual company accounts in Microsoft Dynamics AX](#)

[Global address books and address reference data](#)

Hardware and software requirements

For up-to-date hardware and software requirements for Microsoft Dynamics AX, download the [systems requirements document](#) (<http://go.microsoft.com/fwlink/?LinkId=165377>).

Planning hardware infrastructure

This topic describes key factors that you must consider when you plan the hardware infrastructure for Microsoft Dynamics AX.

Planning hardware

Decisions about appropriate hardware depend upon several factors. The following list describes some key factors:

1. Evaluate and document the existing infrastructure. Your documentation must include the following information:
 - Network bandwidth
 - The storage system that is used

- The operating system that is used
 - Databases that are used
 - Servers that are used
 - Current processes for disaster recovery, availability, and scalability
 - Existing applications that must be integrated with Microsoft Dynamics AX
2. Define and document the following information:
- Uses of the system: The components and modules of Microsoft Dynamics AX that you plan to deploy
 - The number of transactions over a period of time, and the total number of transactions during peak business hours
 - The number of active or concurrent users over a period of time, and the total number of active or concurrent users during peak business hours
 - The external user access that is required
 - The web access that is required
 - The required availability
 - The projected growth rate
 - The number of sites and the number of users who connect through a wide area network (WAN)
 - Integration requirements: Do any applications have to be integrated with Microsoft Dynamics AX, and what is the workload that is generated by these applications? Are these real-time transactions, or can they be batched?
3. When you have the information from steps 1 and 2, you can start to determine how to structure the system. The following key decisions must be made:
- Can any server components for Microsoft Dynamics AX be combined on a single computer? If server components can be combined, which components do you want to combine?
 - What is your deployment plan for high availability and scalability for Microsoft Dynamics AX components?
 - What is your backup and recovery strategy?

Transactional volume

The total average number of transactions that are processed per work hour is a key indicator of the hardware and software requirements. Use the transactional volume to plan your hardware and software components, such as the following components:

- The database server infrastructure, such as the type and number of drives
- The number of Application Object Server (AOS) clusters
- The number of AOS instances in a cluster
- The number of batch servers
- Network capacity

In Microsoft Dynamics AX, a transaction is defined as the processing of a single line item. For example, a sales order that has 100 line items is considered 100 transactions.

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Estimate the number of transactions that are required for each module that you plan to use, and the number of any corresponding transactions that may be triggered by these changes. Determine whether there are any integration points to internal or external applications. For example, a large volume of transactions may come from Microsoft BizTalk Server. This volume of transactions must be factored into your infrastructure and topology planning.

Determine whether these are real-time transactions, or whether they can be batched and processed during off-peak hours. Microsoft Dynamics AX is an integrated enterprise resource planning (ERP) product that provides real-time updates throughout all modules as information is changed. However, Microsoft Dynamics AX also provides a batch system for scheduled processing.

The number of concurrent users

The total number of concurrent users is another indicator of the size of the Application Object Server (AOS) system that is required for appropriate response times and throughput. Although other criteria are also used to plan the capacity of AOS instances or server clusters, the number of concurrent users is an important factor.

Concurrent users are defined as Microsoft Dynamics AX rich clients, web clients, mobile clients, or third-party applications that require that some processing occur in the Microsoft Dynamics AX system. The number of concurrent users also affects network bandwidth and latency.

Network requirements

Determine the number of users who access Microsoft Dynamics AX by using the rich client, web client, or mobile client. Users who access Microsoft Dynamics AX by using the rich client must meet minimum network requirements. If those requirements are not met, consider deploying Windows Server Terminal Services.

Planning hardware for additional components

The core components of a Microsoft Dynamics AX implementation are a Windows client, AOS, and a database server. Additional components include Enterprise Portal for Microsoft Dynamics AX, workflow, reporting, analytics, Help server, and web services that are based on Internet Information Services (IIS). Determine the workload that is generated for each component, and the resource requirements for an appropriate deployment that has acceptable response times and throughput.

For example, if users access Microsoft Dynamics AX over a WAN by using the Windows client, you must deploy Terminal Services. Similarly, users who access role-based home pages create workload for Enterprise Portal. Users who access reports create workload for the report server for Microsoft SQL Server Reporting Services, the report server database, and the Microsoft Dynamics AX database.

View benchmark reports

The benchmark reports for Microsoft Dynamics AX 2012 measure the performance and scalability of Microsoft Dynamics AX in simulated scenarios. The benchmark reports are listed in the [Benchmark white papers](http://technet.microsoft.com/library/3f25f10b-7684-43d6-9eb0-092da7d0d1f5(AX.60).aspx) (http://technet.microsoft.com/library/3f25f10b-7684-43d6-9eb0-092da7d0d1f5(AX.60).aspx) section of TechNet. The benchmark papers are hosted on [CustomerSource](http://go.microsoft.com/fwlink/?LinkID=210925) (http://go.microsoft.com/fwlink/?LinkID=210925) and [PartnerSource](http://go.microsoft.com/fwlink/?LinkID=210926) (http://go.microsoft.com/fwlink/?LinkID=210926). You must sign in to download the reports.

**Caution:**

These benchmark reports are based on sample configurations. Do not use the reports as models to size your own infrastructure.

Configure SQL Server and storage settings

This topic provides information about how to configure Microsoft SQL Server to support the business and model store databases for Microsoft Dynamics AX. To achieve optimal Microsoft Dynamics AX performance, you must correctly configure the database infrastructure.

This topic does not describe how to configure the infrastructure for reporting and analytics databases. For information about those features, see [Reporting in Microsoft Dynamics AX](http://technet.microsoft.com/library/6728b08f-6618-4719-a333-ec7f5bec25c2(AX.60).aspx) ([http://technet.microsoft.com/library/6728b08f-6618-4719-a333-ec7f5bec25c2\(AX.60\).aspx](http://technet.microsoft.com/library/6728b08f-6618-4719-a333-ec7f5bec25c2(AX.60).aspx)) and [Analytics in Microsoft Dynamics AX](http://technet.microsoft.com/library/8f284ccb-628f-4e84-b82c-3e0c032ad80f(AX.60).aspx) ([http://technet.microsoft.com/library/8f284ccb-628f-4e84-b82c-3e0c032ad80f\(AX.60\).aspx](http://technet.microsoft.com/library/8f284ccb-628f-4e84-b82c-3e0c032ad80f(AX.60).aspx)).

This information is designed for Microsoft Dynamics AX administrators and Microsoft SQL Server database administrators who are responsible for administration of the Microsoft Dynamics AX application.

To benefit from this topic, you must have knowledge in the following areas:

- Windows Server administration.
- SQL Server administration. Specific areas of knowledge include advanced configuration options, memory management, performance management, and troubleshooting.
- Microsoft Dynamics AX system administration.

Minimal SQL Server infrastructure

The configuration of Windows Server and SQL Server greatly affects the performance of the Microsoft Dynamics AX business database. This section provides detailed recommendations for the configuration of Windows Server and SQL Server.

The configuration recommendations are based on the following assumptions:

- You are following the documented best practices for Windows Server and SQL Server.
- You are using a dedicated server that runs SQL Server 2008 R2.
- You are using a single instance of SQL Server that is dedicated to running the Microsoft Dynamics AX production databases.

We recommend that you store your test and development databases on a separate server from the production databases.

Configuring Windows Server

Verify that SQL Server is configured to run as a background service in Windows.

1. In Windows Server 2008 R2, in Control Panel, click **System and Security**, and then click **System**.
In Windows Server 2008, in Control Panel, double-click **System**.
2. Click **Advanced system settings**.
3. On the **Advanced** tab, under **Performance**, click **Settings**.
4. On the **Advanced** tab, under **Processor scheduling**, select **Background services**, and then click **OK**.

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Configuring the server that runs SQL Server

In addition to the documented best practices for SQL Server, we recommend the following configuration settings for the SQL Server service.

- Run the SQL Server service under an Active Directory domain account that has the minimum necessary privileges. For more information, see [SQL Server 2008 Security Overview for Database Administrators](http://go.microsoft.com/fwlink/?LinkId=213202) (http://go.microsoft.com/fwlink/?LinkId=213202).
- Confirm that the account for the SQL Server service has been granted the **Lock pages in memory** privilege. We recommend this setting, because it significantly affects whether other processes affect SQL Server. For instructions, see [How to: Enable the Lock Pages in Memory Option \(Windows\)](http://go.microsoft.com/fwlink/?LinkId=213203) (http://go.microsoft.com/fwlink/?LinkId=213203). For more information, see the following web pages:
 - The [Microsoft Customer Service and Support \(CSS\) SQL Server Engineers blog](http://go.microsoft.com/fwlink/?LinkId=213204) (http://go.microsoft.com/fwlink/?LinkId=213204)
 - Knowledge base article 981483, [How to reduce paging of buffer pool memory in the 64-bit version of SQL Server](http://go.microsoft.com/fwlink/?LinkId=213205) (http://go.microsoft.com/fwlink/?LinkId=213205)
 - [Slava Oks's WebLog](http://go.microsoft.com/fwlink/?LinkId=213207) (http://go.microsoft.com/fwlink/?LinkId=213207)
- Configure the account for the SQL Server service for instant file initialization. Instant file initialization is only available if the account for the SQL Server service, MSSQLSERVER, has been granted the SE_MANAGE_VOLUME_NAME right. Members of the Windows Administrator group have this right and can grant it to other users by adding them to the **Perform Volume Maintenance Tasks** security policy. For more information, see [Database file initialization](http://go.microsoft.com/fwlink/?LinkId=213208) (http://go.microsoft.com/fwlink/?LinkId=213208).
- Enable the TCP/IP network protocol. Depending on the edition of SQL Server that you use, this protocol may be automatically installed during installation. For instructions, see [How to: Enable or Disable a Server Network Protocol \(SQL Server Configuration Manager\)](http://go.microsoft.com/fwlink/?LinkId=213210) (http://go.microsoft.com/fwlink/?LinkId=213210).
- Disable hyperthreading. This step must be performed in the BIOS settings of the server. For instructions, see the hardware documentation for your server.

Configuring the instance of SQL Server

In addition to the documented best practices for SQL Server, we recommend the following storage settings for the instance of SQL Server.

Configuring max degree of parallelism

The **max degree of parallelism** option is a setting that affects the entire instance of SQL Server. Microsoft Dynamics AX workloads generally perform better when intra-query parallelism is disabled. However, the upgrade process benefits from parallelism, as do activities that are used exclusively for batch jobs or maintenance. Use the following settings when the system performs maintenance activities or an upgrade:

- Before an upgrade to a new release of Microsoft Dynamics AX, or before a large number of maintenance or batch activities, set **max degree of parallelism** to the smallest of the following values:
 - 8
 - The number of physical processor cores

- The number of physical processor cores per non-uniform memory access (NUMA) node
- When the Microsoft Dynamics AX database is used in a production environment, set **max degree of parallelism** to 1.

Use the following statements to set the value of **max degree of parallelism**.

Examine the output from the second `sp_configure 'max degree of parallelism'` statement, and confirm that the value has been changed. In the following query, the first `sp_configure 'max degree of parallelism'` statement sets the value of **max degree of parallelism** to 1. The second `sp_configure 'max degree of parallelism'` statement returns a value of 1.

```
EXEC sp_configure 'show advanced options', 1;

RECONFIGURE;

GO

EXEC sp_configure 'max degree of parallelism', 1;

RECONFIGURE;

GO

EXEC sp_configure;
```

For more information, see [max degree of parallelism Option](http://go.microsoft.com/fwlink/?LinkId=213211) (<http://go.microsoft.com/fwlink/?LinkId=213211>). For general guidelines, see Knowledge base article 329204, [General guidelines to use to configure the MAXDOP option](http://go.microsoft.com/fwlink/?LinkId=213212) (<http://go.microsoft.com/fwlink/?LinkId=213212>). For tips from the SQL Server team, visit the SQL Server Relational Engine team's blog, [SQL Server Engine Tips](http://go.microsoft.com/fwlink/?LinkId=213213) (<http://go.microsoft.com/fwlink/?LinkId=213213>).

Configuring max server memory

SQL Server dynamically acquires and frees memory as required. Typically, an administrator does not have to specify how much memory is allocated to SQL Server. However, the **max server memory** option can be useful in some environments. Make sure that sufficient memory is available for the operation of Windows Server. For more information, see [Monitoring available memory](#), later in this topic.

If you find that the dynamic allocation of memory adversely affects the operation of Windows Server, adjust the value of **max server memory** based on the available random access memory (RAM). For more information, see [Effects of min and max server memory](http://go.microsoft.com/fwlink/?LinkId=213214) (<http://go.microsoft.com/fwlink/?LinkId=213214>).

Monitoring available memory

Make sure that sufficient memory is available for the operation of Windows Server. For example, make sure that you run a dedicated instance of SQL Server on a server that has at least 4 gigabytes (GB) of memory. If the available memory for the server drops below 500 megabytes (MB) for extended periods, the performance of the server may degrade.

Use the **Memory: Available Mbytes** performance counter for the Windows Server operating system to determine whether the available memory drops below 500 MB for extended periods. If the available memory drops below 500 MB frequently or for extended periods, we recommend that you reduce the **max server memory** setting for SQL Server or increase the physical memory of the server.

Detailed guidance about memory management is beyond the scope of this topic. For more information about how to monitor memory and troubleshoot performance issues, see the Windows Server and SQL Server documentation.

Allocating storage for tempdb

We recommend that you determine the total size of the data files and transaction log files that are required for the tempdb database, and that you set a specific value. Do not use automatic growth, or autogrow, setting for space management. Instead, use autogrow as a safety mechanism, so that tempdb can grow if tempdb files use the space that was originally allocated to them. Follow this process to determine the number and placement of data files.

- Determine the number of processors that are available to SQL Server. Unless you are using an affinity mask, this number is same as the total number of processors that you see on the **Performance** tab of Windows Task Manager. When hyperthreading is not enabled, each processor corresponds to a processor core. Affinity masks and processor cores are beyond the scope of this topic. For more information, see the Windows Server and SQL Server documentation.
- Based on performance testing of the OLTP workload for Microsoft Dynamics AX, we recommend that you maintain one tempdb data file per processor. For more information, see the performance benchmark reports on [PartnerSource](http://go.microsoft.com/fwlink/?LinkId=143994) (<http://go.microsoft.com/fwlink/?LinkId=143994>) or [CustomerSource](http://go.microsoft.com/fwlink/?LinkId=213216) (<http://go.microsoft.com/fwlink/?LinkId=213216>).
- Isolate tempdb on dedicated storage, if you can. We recommend that you move the primary data file and log file for tempdb to high-speed storage, if high-speed storage is available. The Microsoft Dynamics AX database runs in read committed snapshot isolation (RCSI) mode. In RCSI mode, row versions are stored in tempdb. By creating multiple files for tempdb data, even if these files reside on the same storage device, you can improve the performance of tempdb operations.
- Determine the size of the tempdb data files and log files. You must create one primary data file and one log file. Determine how many additional, secondary data files you require for the tempdb data. For best results, create data files of equal size. The total number of data files must equal the total number of processor cores. The aggregate size of the primary data file and all other data files must equal the total data size that you determined for the tempdb database.

For more information, see [Optimizing tempdb performance](http://go.microsoft.com/fwlink/?LinkId=213217) (<http://go.microsoft.com/fwlink/?LinkId=213217>).

- Resize the primary data file and log file for tempdb. Move the primary data file and log file to dedicated storage, if dedicated storage is available. The primary tempdb data file cannot be moved while the instance of SQL Server is running. To complete the move, you must use an ALTER DATABASE statement and restart the instance of SQL Server. For more information, see [ALTER DATABASE](http://go.microsoft.com/fwlink/?LinkId=213218) (<http://go.microsoft.com/fwlink/?LinkId=213218>).



Note:

The data files and transaction log files for tempdb can reside on the same storage device.

- If space is available on the drive where tempdb files are allocated, do not configure the autogrow property for data files and log files as a percentage. Instead, configure the autogrow property as a specific number of megabytes. If you can, configure the data files and log files to grow by 100 to 500 MB, depending on the available space. Monitor the data files, and when they grow, adjust the original allocation to prevent automatic growth later. If the autogrow property is configured in megabytes instead of as a percentage, the allocation of space is more predictable, and the chance of extremely small or large growth increments is reduced.

- Monitor the tempdb data files and log files to make sure that they are all sized correctly, and that all data files are of equal size. Use SQL Server Management Studio or a transact-SQL query to view the database properties. Verify that all the data files are of equal size, and that they have the same size as the value that you originally provided. If one or more files have grown, adjust the initial size of all files.

Configuring the Microsoft Dynamics AX business database

We recommend the following settings for the Microsoft Dynamics AX business database. You can use SQL Server Management Studio or the appropriate ALTER DATABASE statement to configure these settings. For more information, see [ALTER DATABASE](http://go.microsoft.com/fwlink/?LinkId=213218) (http://go.microsoft.com/fwlink/?LinkId=213218).

- Set COMPATIBILITY_LEVEL to 100.
- Set READ_COMMITTED_SNAPSHOT to **on**. Performance testing has shown that Microsoft Dynamics AX performs better when the READ_COMMITTED_SNAPSHOT isolation option is set to **on**. You must use an ALTER DATABASE statement to set this option. This option cannot be set by using SQL Server Management Studio.

Run the following query, where <database name> is the name of the Microsoft Dynamics AX database. There can be no other active connections in the database when you run this query.

```
ALTER DATABASE <database name>
    SET READ_COMMITTED_SNAPSHOT ON;
```

Query the sys.databases catalog view, and verify that the Microsoft Dynamics AX database contains a value of 1 in the is_read_committed_snapshot_on column. For more information, see the following web pages:

- [sys.databases](http://go.microsoft.com/fwlink/?LinkId=213219) (http://go.microsoft.com/fwlink/?LinkId=213219)
- [Choosing Row Versioning-based Isolation Levels](http://go.microsoft.com/fwlink/?LinkId=213220) (http://go.microsoft.com/fwlink/?LinkId=213220)
- Set AUTO_CREATE_STATISTICS and AUTO_UPDATE_STATISTICS to **on**. Set AUTO_UPDATE_STATISTICS_ASYNC to **off**. Performance testing has shown that Microsoft Dynamics AX performs better when the options have these settings.
- Make sure that the AUTO_SHRINK option is set to **off**. When database files are automatically shrunk, performance of the database degrades. We recommend that the database administrator manually shrink the database files on a predefined schedule. For more information, see [Turn AUTO_SHRINK OFF!](http://go.microsoft.com/fwlink/?LinkId=213221) (http://go.microsoft.com/fwlink/?LinkId=213221) on the SQL Server Storage Engine Team's blog.

Important:

All Microsoft Dynamics AX databases must use the same SQL collation. These databases include the business database, model store database, Microsoft SQL Server Reporting Services database, and Microsoft SQL Server Analysis Services database.

Plan database storage

Designing a data storage solution involves multiple interrelated aspects. We recommend that you follow this process when you must complete this task.

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1. Characterize the input/output (I/O) load of the application. The I/O characteristics depend on your business requirements, and on the Microsoft Dynamics AX modules and components that you deploy. To determine your I/O characteristics, answer the following questions:
 - What is the read ratio versus write ratio of the application?
 - What is the typical I/O volume, or I/O per second (IOPs)?
 - How much of the I/O is sequential, and how much is random?
2. Determine the availability and performance requirements for the database system.
3. Determine the hardware that is required to support the analysis that you performed made in steps 1 and 2.
4. Configure SQL Server to take advantage of the hardware that you determined in step 3.
5. Track the performance as the workload changes.

Step-by-step guidance about database architecture and storage is beyond the scope of this topic. For more detailed recommendations from the SQL Server team, see [Microsoft SQL Server Storage Top 10 Best Practices](http://go.microsoft.com/fwlink/?LinkId=213199) (<http://go.microsoft.com/fwlink/?LinkId=213199>) and [Physical Database Storage Design](http://go.microsoft.com/fwlink/?LinkId=213201) (<http://go.microsoft.com/fwlink/?LinkId=213201>).

Configuring physical storage

This section provides general recommendations for physical storage. Determine the applicability of these recommendations to your environment. Some storage area network (SAN) vendors may have alternative recommendations that take precedence. Recommendations are listed in order of priority.

- Many factors contribute to optimal I/O performance for a disk. By default, Windows Server 2008 aligns partitions. When you upgrade to Windows Server 2008, preexisting partitions are not automatically aligned and must be manually rebuilt to guarantee optimal performance. Therefore, until you rebuild the migrated partitions, alignment of disk partitions remains a relevant technology.

Check existing disks on the server, and be aware of the differences in the analysis of basic partitions and dynamic volumes. Rebuild the partitions, if you can, and appropriate and create all new partitions based on guidance from the SAN vendor. If the vendor does not provide recommendations, follow the best practices for SQL Server. See [Disk Partition Alignment Best Practices for SQL Server](http://go.microsoft.com/fwlink/?LinkId=213222) (<http://go.microsoft.com/fwlink/?LinkId=213222>).

The partition offset value must be a multiple of the stripe size. In other words, the expression, , must resolve to an integer value.

- Create the tempdb database files, data files for the Microsoft Dynamics AX database, and Microsoft Dynamics AX log files on disk arrays of type RAID 1, RAID 0 + 1, or RAID 10. We recommend RAID 10 for these files. Do not use RAID 5.
- Store the data files for the Microsoft Dynamics AX database on separate physical stores from the transaction log files.
- Store the tempdb data files on a separate physical store from the data files and log files for the Microsoft Dynamics AX database.
- Store other database files on separate physical stores from the data files and log files for tempdb and the Microsoft Dynamics AX database.

Summary

To help achieve optimal Microsoft Dynamics AX performance, you must correctly plan and configure and the settings for SQL Server and storage. Additionally, you may have to adjust the database configuration periodically.

Considerations for global deployment

This topic provides an overview of considerations for global deployment of Microsoft Dynamics AX.

Considerations for Microsoft Dynamics AX 2012

Earlier versions of Microsoft Dynamics AX included country-specific or region-specific functionality in the GLS layer. Microsoft Dynamics AX 2012 contains this type of functionality only in the SYS layer.

Country-specific or region-specific functionality included in the SYS layer

For Microsoft Dynamics AX 2012, the SYS layer includes country-specific or region-specific functionality for Australia/New Zealand, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Italy, Malaysia, Mexico, the Netherlands, Norway, Saudi Arabia, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, the United Kingdom/Ireland, and the United States.

For Microsoft Dynamics AX 2012 R2, the SYS layer also includes country-specific or region-specific functionality for the countries/regions that were in the GLS layer in earlier versions of Microsoft Dynamics AX.

Released languages

Microsoft Dynamics AX 2012 was released in US English in all countries/regions, and in the following languages that are specific to a country/region.

Country/region	Language	ID
Australia	English	en-AU
Austria	German	de-AT
Belgium	Dutch	nl-BE
Belgium	French	fr-BE
Canada	English	en-CA
Canada	French	fr-CA
Denmark	Danish	da-DK
Finland	Finnish	fi-FI
France	French	fr-FR
Germany	German	de-DE
Iceland	Icelandic	is-IS
Ireland	English	en-IE

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Italy	Italian	it-IT
Malaysia	English	en-MY
Mexico	Spanish	es-MX
Netherlands	Dutch	nl-NL
New Zealand	English	en-NZ
Norway	Norwegian Bokmål	nb-NO
Saudi Arabia	Arabic	ar-SA
Singapore	English	en-SG
South Africa	English	en-ZA
Spain	Spanish	es-ES
Sweden	Swedish	sv-SE
Switzerland	French	fr-CH
Switzerland	German	de-CH
Switzerland	Italian	it-CH
Thailand	Thai	th-TH
United Kingdom	English	en-GB
United States	English	en-US

Microsoft Dynamics AX 2012 R2 adds the following languages.

Country/region	Language	ID
Brazil	Portuguese - Brazil	pt-BR
China (PRC)	Chinese	zh-CN
Czech Republic	Czech	cs-CZ
Estonia	Estonian	et-EE
Finland	Finnish	fi-FI
Hungary	Hungarian	hu-HU
India	English	en-IN
Japan	Japanese	ja-JP
Latvia	Latvian	lv-LV
Lithuania	Lithuanian	lt-LT
Poland	Polish	pl-PL

Russia	Russian	ru-RU
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Plan for batch processing

You can use *batch processing* to enable you to run specific tasks as *batch jobs*, which can be scheduled and run on a different computer. The topics in this section can help you plan for batch processing.

The following topics are included in this section:

[Batch server overview](#)

[Batch processing overview](#)

Batch server overview

This topic describes batch processing and batch servers, and how to plan for their use.

The batch framework provides an asynchronous, server-based batch processing environment that can process tasks across multiple Application Object Server (AOS) instances. There is no need for an interactive client for server-side batches. Client-side batch jobs are supported, but are required only for end-user-defined batch tasks. A job can contain both client-side and server-side batch tasks. A job that has client-side tasks requires a Microsoft Dynamics AX client to be open in order to process the client-side tasks.

You should become familiar with the following aspects of the batch framework:

- A *batch job* is a process that is used to achieve a specific goal. A batch job consists of one or more batch tasks.
- A *batch task* is an activity that is run by a batch job. You can add batch tasks that have multiple types of dependencies to a batch job. You can also configure AOS servers to run multiple threads, with each thread executing a task. All batch tasks that are waiting for execution can be executed by any available AOS server that is configured as a batch server. You can choose to define a batch job as many tasks, and then use a batch server to execute the tasks against all available AOS instances to improve throughput and reduce overall execution time.
- A *batch group* is an attribute of a batch task that allows the administrator to determine which AOS runs the task. When you create a new task, it is put in the default batch group. All batch servers are configured to process the default batch group and to process waiting tasks from any job. You can create a named batch group and set an affinity between the batch group and specific AOS servers. When you have created this affinity, only the configured AOS servers will process tasks from the named batch group only. You can also add the default batch group to the configured servers, if it is required.

Batch server topology planning

You can configure any active AOS server as a batch server. To create a dedicated batch server that does not act as an active AOS server, you must put the batch server in a cluster separate from the active AOS server. You must also make sure that users are not connecting to this dedicated batch server.

Note:

A dedicated load balancer cannot be configured as a batch server.

The capacity of a batch server is determined based on the maximum number of threads that can run on the AOS server concurrently. Each thread executes one batch task. You can add complex dependencies

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between or among tasks. You can run these tasks in a serial steps or parallel steps, depending on the business logic and requirements. All tasks that do not have any dependencies are considered parallel tasks. AOS servers that are configured as batch servers periodically check for tasks that are waiting for processing. The batch server assigns each parallel task to a thread and starts to process the thread.

You can run multiple threads across multiple AOS servers. Each AOS automatically runs multiple threads, depending on capacity that is defined in the configuration settings. Therefore, parallel tasks from a job can execute on multiple threads across multiple AOS servers.

A batch server checks for available threads once a minute. Therefore, you might have to wait for a minute before you can see a waiting task being picked up for processing by an available thread.

Batch server management planning

All batch servers can be managed from a single location.

One common use of batch servers is to load balance jobs across multiple time zones and servers. You can define the time period during which an AOS acts as a batch server. You can also set the number of threads that the batch server will process during the time period. The applicable time is based on the user's time zone and not on the time zone of the location of the AOS server. The time period is configured based on a schedule of start time and end time.

Because batch servers are also active AOS servers that service requests from Microsoft Dynamics AX clients and other Microsoft Dynamics AX components, determine carefully when an AOS is available to process batches.

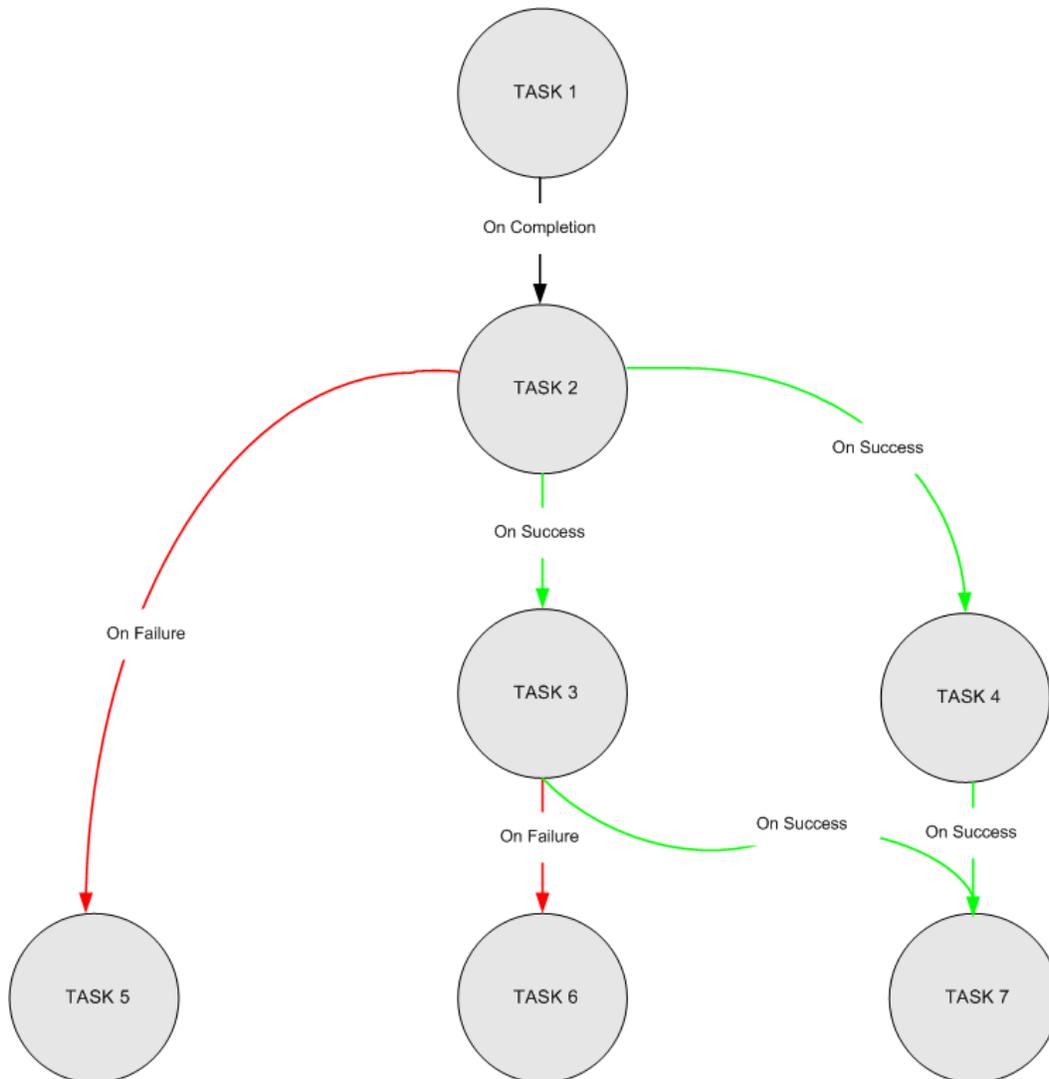
For example, a batch server might be set to process only two batch threads from 8:00 to 6 pm in the time zone that it is located in. But from 6 pm to 7:30 am, it could be set to process 20 threads.

Walkthroughs

The following walkthroughs describe how tasks are processed, and how batch groups can be used to associate batch jobs with batch servers.

Batch processing of dependent tasks

Consider that you have created a job that is called JOB 1. As shown in the following diagram, the job has seven tasks: TASK 1, TASK 2, TASK 3, TASK 4, TASK 5, TASK 6, and TASK 7.



The dependencies of your tasks are as follows:

- TASK 1 is the first task.
- TASK 2 runs on completion of TASK 1 (regardless of the success or failure of TASK 1).
- TASK 3 runs on success of TASK 2.
- TASK 4 runs on success of TASK 2.
- TASK 5 runs on failure of TASK 2.
- TASK 6 runs on failure of TASK 3.
- TASK 7 runs on success of both TASK 3 and TASK 4.

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Let us assume that two batch servers, Batch1 and Batch2, are configured with a capacity of one thread each. Batch1 checks for waiting tasks, assigns TASK 1 to its thread, and starts execution. Although Batch2 is also available with one thread, TASK 2 will keep waiting until TASK 1 is completed successfully.

As soon as TASK 1 is completed successfully, TASK 2 is ready for execution. Let us assume this time that Batch2 checks for waiting tasks, assigns TASK 2 to its thread, and starts execution of TASK 2. If TASK 2 is successful, TASK 3 and TASK 4 are awaiting execution. Let us assume that Batch2 checks for waiting tasks, assigns TASK 3 to its thread, and starts execution. Batch1 also checks for waiting tasks, assigns TASK 4 to its thread, and starts execution. If TASK 3 and TASK 4 are completed successfully, one of the batch servers will execute TASK 7.

If TASK 2 fails, one of the batch servers will execute TASK 5. If TASK 3 fails, one of the available batch servers will execute TASK 6.

Note:

Note that we are using Batch1 and Batch2 to explain the concept. Any batch server that has available threads will start executing a waiting task. You must create a batch group to determine or specify which batch job runs on which server.

Batch processing with batch groups

The following describes how batch jobs can be processed on specific batch servers:

1. You have configured three batch servers: AOS1, AOS2, and AOS3.
By default, all of the batch servers process tasks from all batch jobs, depending on the number of available threads.
2. You now create a named batch group, BG1, and configure it to run on AOS2 and AOS3. Tasks from jobs in BG1 will run only on AOS2 and AOS3, depending on the number available threads. AOS1 will not process tasks from jobs in BG1. Likewise, AOS2 and AOS3 will process tasks from only BG1.
You can configure AOS2 and AOS3 to process tasks from other batch groups. This includes the default batch group.

Batch processing overview

This topic describes how you can use batch processing to enable you to run specific tasks as batch jobs, which can be scheduled and run on a different computer (a batch server). Many tasks in Microsoft Dynamics AX can be run as part of batch jobs. For example, batch jobs can include tasks for printing reports, performing maintenance, or sending electronic documents. By using batch jobs, you can avoid slowing down your computer or the server during typical working hours.

Most batch tasks can be run on a batch server, but some must be run on the client. Tasks that run on the server can run automatically as part of batch jobs, regardless of whether a client is open. However, tasks that run on the client must be run manually by using the **Set up batch processing** form. If a client task is marked **Private**, only the user who created that task can run it.

The tasks in a batch job can run sequentially or at the same time. In addition, you can create dependencies between tasks. This means that you can set up a different sequence of tasks depending on whether an earlier task succeeds or fails.

You can set up recurrence patterns for batch jobs. For example, you can set up a job to process invoices automatically at the end of every month.

To monitor batch jobs, you can set up alerts. Alerts can be sent when the batch job succeeds, fails, or finishes.

After a batch job has been processed, you can view history. This includes any messages encountered when the job is running.

Use batch groups to categorize batch tasks and run them on specific servers. The servers in your environment may have different software installed or may be available at different times of day. Batch groups are used to direct batch tasks to the most appropriate server. Tasks in the same batch job can belong to different batch groups.

For example, you might have Server A set up to print reports and Server B set up to send electronic documents. You can use batch groups to make sure that reporting tasks are run on Server A and electronic documents are processed by Server B.

Batch jobs run on a per-partition basis. A system administrator can create, change, and view the history for the batch jobs in each partition. The batch job administration forms show only the information about the batch jobs for the partition to which you are currently logged on.

Planning considerations for the Help system

Before installing Microsoft Dynamics AX and implementing the Help system, you should prepare a plan covering each of the following areas.

Topology

Before selecting a topology, consider the following questions.

What computer will host the Help server?

The Microsoft Dynamics AX Help server manages the storage and display of Microsoft Dynamics AX product documentation. You must install the Help server on a computer that is running Internet Information Services (IIS). Keep in mind that you can install other web applications on this same computer, such as Enterprise Portal.

What computer will host the AOS?

When installing the Help server, you will need to specify the name of the computer that is running the Microsoft Dynamics AX Application Object Server (AOS). The Help server must have access to the AOS in order to retrieve label definitions. For more information, see [Help system architecture](#).

Security

To help plan for security, consider the following question.

Have you defined an account for the .NET Business Connector proxy?

The .NET Business Connector enables the Help server to communicate with an AOS instance. The Help server must have access to the AOS in order to retrieve label definitions.

The .NET Business Connector must be configured to connect to Microsoft Dynamics AX with a proxy account. The use of a proxy enables the .NET Business Connector to connect on behalf of Microsoft Dynamics AX users when authenticating with an AOS instance. We recommend that the proxy account be set up using the guidelines listed in [Specify the .NET Business Connector proxy account](#) ([http://technet.microsoft.com/library/3e46dc0a-2ff4-4a06-ae61-041e52dcc774\(AX.60\).aspx](http://technet.microsoft.com/library/3e46dc0a-2ff4-4a06-ae61-041e52dcc774(AX.60).aspx)).

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Performance

To ensure good performance of the Help system, consider the following questions.

Are other applications installed on the same computer?

The Help topics that are installed with the Help server must be indexed by the Windows Search Service. If other applications are installed on the same computer, those applications may affect the performance of the Windows Search Service.

What computer will host the AOS?

As noted above, the Help server must have access to the AOS in order to retrieve label definitions. If the AOS is installed on a computer in a different geographic location from the computer running the Help server, performance may suffer.

For more information about how the Help server and the AOS work together, see [Help system architecture](#).

Customization

If you plan to customize your Help system, consider the following question.

How will you publish your custom Help topics?

You can create custom Help topics and add them to the Help system. If you are going to create custom topics, consider how you are going to install them. For example, you may need to create a file share for the topics on the computer hosting the Help server. For more information about installing custom Help topics, see [Developing on the Help server](http://technet.microsoft.com/library/4a6d905d-ed67-4464-af11-2a3438d593cb(AX.60).aspx) ([http://technet.microsoft.com/library/4a6d905d-ed67-4464-af11-2a3438d593cb\(AX.60\).aspx](http://technet.microsoft.com/library/4a6d905d-ed67-4464-af11-2a3438d593cb(AX.60).aspx)).

Customizing the Help System

Microsoft Dynamics AX Help enables you to add new documentation, update existing documentation, and add entries to the table of contents. To customize documentation, you add one or more files to the Help server. While you can customize documentation, you cannot customize or change the operation of the Help server or the Help viewer. The following sections provide an overview of the types of customizations that you can perform and how you add or update Help documentation.

Documentation

The Help documentation that you see is from a collection of document files on the Help server. To customize documentation, you add files to that collection. Before you attempt to customize documentation, you should be familiar with how the Help system framework organizes the documentation that you see. The following list contains several important concepts that affect how you customize documentation.

- A *content element* is a single HTML file that contains the documentation for a specified topic. When you view documentation, the Help viewer displays a content element. To add or update Help documentation, you have to create a content element.
- A *topic* is the documentation for a specified subject area. A topic must include at least one content element but can include two or more. In addition, a topic can include content elements from more than one publisher. To identify the content elements for a topic, each content element includes a document property that specifies a topic ID.

- A *publisher* is an individual or organization that has documentation on the Help server. Each content element includes a document property that specifies the ID of a publisher. You also use the publisher ID to replace documentation for an existing topic.
- A *summary page* is a list that the Help viewer displays when the requested topic includes more than one content element. To view a specific document, you click the link for that document.
- A *table of contents* is a hierarchical list of topics that displays in the Help viewer. Each entry in the table of contents is a link to the documentation for that topic.

Topics

All Help documentation is organized by topic. When you plan to customize the Help documentation, evaluate how your documentation fits into the existing topic structure. The following table describes the types of topic changes you can make.

Event	Description
Add a topic	To add a topic, you create documentation for a new process, form, class, or other component. A new topic requires that you define an ID for that topic. To create a context-sensitive topic, the topic ID has to match the ID of the form, class, or other component that you are documenting. In addition, a new topic might require that you add an entry to the table of contents.
Update a topic	To update a topic, you create documentation that supplements or replaces an existing content element. An update documents a change, customization, or enhancement to an existing process, form, class, or other component. An update requires your content to include the same topic ID as the existing content element. To replace an existing content element, you have to know the ID of the publisher of that content element.

Content Elements

Whether you create or update a topic, you have to create a content element. The content element contains the documentation that you see in the Help viewer. The typical content element is an HTML document but you can use other types of documents. Each content element includes a collection of document properties that the Help server uses to match your documentation to a Help request.



Caution:

Do not edit or delete any files that were created by Microsoft or any other publisher. If you change an existing file, your changes might be lost during an update or reinstall of the documentation from that publisher.

To create a content element, you use XHTML. XHTML is a World Wide Web Consortium (W3C) standard that defines HTML as an XML document. The tag names in XHTML document must be lowercase. In addition, you must use closing tags for all the elements in the document. If you publish a content element that has an incorrect or missing tag, you will not be able to view that content element in the Help viewer.

Table of Contents

You can add entries to the table of contents that appears in the Help viewer. You add an entry to the table of contents when you want your topic to be more easily discovered and viewed from the Help viewer. If you have several related topics, you can use the table of contents to display these topics as a hierarchical group.

Note:

Adding entries to the table of contents is optional. You do not have to add an entry to the table of contents for each topic that you add or update. For example, an update to an existing topic does not need a new entry in the table of contents.

To add a topic to the table of contents, you use XML to create an entry in a file that is named **TableofContents.xml**. If you have to remove your entry from the table of contents, delete that entry from the **TableofContents.xml** file. For more information about how to create an entry in the table of contents, see [How to: Create Table of Contents Entries](http://msdn.microsoft.com/library/c184e978-77f3-43b6-a490-933beb1d9d7f(AX.60).aspx) ([http://msdn.microsoft.com/library/c184e978-77f3-43b6-a490-933beb1d9d7f\(AX.60\).aspx](http://msdn.microsoft.com/library/c184e978-77f3-43b6-a490-933beb1d9d7f(AX.60).aspx)).

The table of contents that appear in the Help viewer can include entries from more than one publisher. The table of contents entries that appear in the Help viewer are grouped by publisher. As a result, you cannot use your **TableofContents.xml** file to add, update, or modify the table of contents entries supplied by another publisher. To specify where the table of contents entries for each publisher appears in the Help viewer, use the list of publishers in the **web.config** file of the Help server. For more information about how to update the **web.config** file, see [How to: Add a Publisher to the Web.Config File](http://msdn.microsoft.com/library/b13355dc-9fe7-48d5-a01b-6775bf158b4a(AX.60).aspx) ([http://msdn.microsoft.com/library/b13355dc-9fe7-48d5-a01b-6775bf158b4a\(AX.60\).aspx](http://msdn.microsoft.com/library/b13355dc-9fe7-48d5-a01b-6775bf158b4a(AX.60).aspx)).

Producing Custom Documentation

After you identify the type of documentation that you need, you should consider how you will add this documentation to the Help server. Adding documentation to the Help server enables you to use the Help viewer and the existing context-sensitive help process. To help plan your customization, the following sections provide an overview of the processes that you use.

Authoring

Authoring describes how you create new documentation for the Help system. Before you add or update a topic, use the following guidelines to plan your custom documentation.

- Determine whether you want to create a new topic or update an existing topic. Identify the ID for your topic. If you update an existing topic, get the ID of that topic. If you are adding a new topic, determine whether to add an entry to the table of contents.
- Define the content you need for your topic. Determine whether your documentation requires one or more content elements.
- You should plan to create an HTML file for each content element that you identified. The Help server and Help viewer support the use of HTML.

You can use file types other than HTML to produce documentation but you have to also include an HTML file that contains the required document properties. In addition, each client system that opens your document must have an application that can open and view that type of file.

- You have to gather the information for the required document properties. The Help server uses these properties to identify the content elements that satisfy a Help request. Your content element must contain the required document properties or it will not appear in the Help viewer.
- You have to determine whether you want your documentation to match the look of the existing Help documentation. To use the existing document styles, the HTML in your content element has to include several cascading style sheet, script, and image files. In addition, your HTML must use the styles defined in the cascading style sheet files.

- If you plan to add an entry to the table of contents, you should plan to create a table of contents XML file. For more information about how to create a table of contents entry, see [How to: Create Table of Contents Entries](http://msdn.microsoft.com/library/c184e978-77f3-43b6-a490-933beb1d9d7f(AX.60).aspx) ([http://msdn.microsoft.com/library/c184e978-77f3-43b6-a490-933beb1d9d7f\(AX.60\).aspx](http://msdn.microsoft.com/library/c184e978-77f3-43b6-a490-933beb1d9d7f(AX.60).aspx)).

To simplify how you create documentation, the Help system includes a set of templates. The templates enable you to produce HTML or Microsoft Word documents that you can add to the Help server. For more information about how to create documents and modifying the table of contents, see [Authoring Help Documents](http://msdn.microsoft.com/library/0bd20f64-f93d-4172-9e1e-bd63836eb4ed(AX.60).aspx) ([http://msdn.microsoft.com/library/0bd20f64-f93d-4172-9e1e-bd63836eb4ed\(AX.60\).aspx](http://msdn.microsoft.com/library/0bd20f64-f93d-4172-9e1e-bd63836eb4ed(AX.60).aspx)).

Publishing

Publishing describes how you add a content element or table of contents file to the Help server. After you create a content element or table of contents file, you have to add that file to the file system of the Help server. Before you publish a file, use the following guidelines to determine whether you are ready to add files to the server.

- Identify the folder on the Help server where you put files. Each publisher should maintain a separate set of folders. If you do not have an existing folder, you might have to create a new folder for your documentation.
- Determine whether your logon identity has security permissions to add files to your target folder. If you first have to add a folder, make sure that you are permitted to create folders on the Help server. For more information about how to add folders, see [How to: Add Folders to the Help Server](http://msdn.microsoft.com/library/1761454d-0ae5-4172-a233-99690e3ee791(AX.60).aspx) ([http://msdn.microsoft.com/library/1761454d-0ae5-4172-a233-99690e3ee791\(AX.60\).aspx](http://msdn.microsoft.com/library/1761454d-0ae5-4172-a233-99690e3ee791(AX.60).aspx)).
- Determine whether to add your publisher ID to the web.config file of the Help server. The list of publishers helps determine where your documentation appears in a list of search results and the table of contents. For more information about how to add a publisher to the web.config file, see [How to: Add a Publisher to the Web.Config File](http://msdn.microsoft.com/library/b13355dc-9fe7-48d5-a01b-6775bf158b4a(AX.60).aspx) ([http://msdn.microsoft.com/library/b13355dc-9fe7-48d5-a01b-6775bf158b4a\(AX.60\).aspx](http://msdn.microsoft.com/library/b13355dc-9fe7-48d5-a01b-6775bf158b4a(AX.60).aspx)).
- If you plan to create non-HTML content element, you have to include the HTML file that contains the document properties in the same folder as the document file.

After you publish the file, your documentation will be available to the Help viewer of any client system that can access that Help server. For more information about publishing, see [Publishing Overview](http://msdn.microsoft.com/library/9b030c0d-f5c9-45af-b0ef-abcd27ab55ce(AX.60).aspx) ([http://msdn.microsoft.com/library/9b030c0d-f5c9-45af-b0ef-abcd27ab55ce\(AX.60\).aspx](http://msdn.microsoft.com/library/9b030c0d-f5c9-45af-b0ef-abcd27ab55ce(AX.60).aspx)).

Plan for integration

Note:

This topic provides guidelines that you may have to consider when you plan your data integration. Every deployment of Microsoft Dynamics AX represents a unique situation. Your specific requirements may vary.

Planning is an important part of any data integration effort. When you integrate Microsoft Dynamics AX with other systems, one of the first steps is the planning phase. In this phase, the implementation team must define high-level requirements and make decisions about the design of the integration. After these requirements are defined, the partner, IT staff, and development staff can work together to define the best way to implement the exchange in Application Integration Framework (AIF).

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The decisions that must be made about the design of the integration fit into two primary categories: decisions about the data and decisions about the environment.

- **Data** – At the core of data integration is the data itself. While you plan your data integration, many decisions must be made about the data that is being exchanged and the associated business rules. This phase often involves the expertise and knowledge of business users, because these users understand the meaning of the data and can define the requirements for integration.
- **Environment** – Configuration requirements define the environment that is used for the data exchange. Factors that affect these requirements include the network configuration, the hardware and software configuration of the external system, and the level of trust between Microsoft Dynamics AX and the external system.

Before document exchanges are configured, we recommend that the implementation team consider the questions that are described in the following table.

Question	Effect on the design	Related topics
Which business entities are involved, if any are involved?	This information helps you determine whether you can take advantage of an existing document service. If you cannot, you might have to create a new document service or a new custom service, or you might have to use one of the system services.	Standard Document Services Using Custom Services AIF System Services
Is the data sent from Microsoft Dynamics AX to an external system, or is the data received by Microsoft Dynamics AX from an external system?	This information helps you determine whether you must use an inbound or outbound integration port.	Application integration Integration ports
Is the integration based on the "pull" model or the "push" model? In the "pull" model, the external system requests data from Microsoft Dynamics AX. In the "push" model, an event in the application causes data to be sent to the external system.	This information helps you determine how to configure a document exchange.	Application integration

Question	Effect on the design	Related topics
<p>What business rules are associated with the data? For example, if data is created or updated, which data elements are required? If data is deleted, what are the conditions under which a record can be deleted?</p>	<p>This information helps you determine whether any customizations must be made to existing AIF documents.</p>	<p>Customize service contracts (http://technet.microsoft.com/library/f03eab90-9af3-4284-a039-19cdd9903789(AX.60).aspx)</p>
<p>Does the data have to be transformed? Do the transformations have to be performed before data is sent or when data is received? What is the extent of the data transformations? Are the transformations performed by Microsoft Dynamics AX or an external system, such as BizTalk?</p>	<p>This information helps you determine whether AIF value mapping, .NET transformations, or XSLT transformations must be used.</p>	<p>Messages and transforms in AIF (http://technet.microsoft.com/library/94d668e0-db8c-4fe4-b7e3-b144e57f4026(AX.60).aspx) Exchanging documents between BizTalk Server and AIF</p>
<p>Does the external system have any restrictions about how data is exchanged?</p>	<p>This information helps you determine the type of transport adapter that is required for the exchange.</p>	<p>Adapters (http://technet.microsoft.com/library/0bfad6cb-37b8-42c8-994e-f7433a9d656c(AX.60).aspx) Application integration (http://technet.microsoft.com/library/9882a593-9cb8-45d9-aa40-0b4323deec71(AX.60).aspx)</p>
<p>Is the external system an in-house system or an external trading partner?</p>	<p>This information helps you determine how users and security must be configured.</p>	<p>Services and AIF security and protection (http://msdn.microsoft.com/library/7c260e28-29d4-40e4-840d-883be22fc02b(AX.60).aspx)</p>
<p>What is the availability of the systems that are being integrated? What are the requirements for real-time data exchanges?</p>	<p>This information helps you determine whether you must use synchronous or asynchronous adapters.</p>	<p>Adapters (http://technet.microsoft.com/library/0bfad6cb-37b8-42c8-994e-f7433a9d656c(AX.60).aspx)</p>
<p>What is the volume of transactions?</p>	<p>This information helps you determine which adapters you must use. The information also helps you determine the scale of the deployment, such as the number of computers that run Application Object Server (AOS).</p>	<p>Configuring network load balancing for services Application Integration Framework topology</p>

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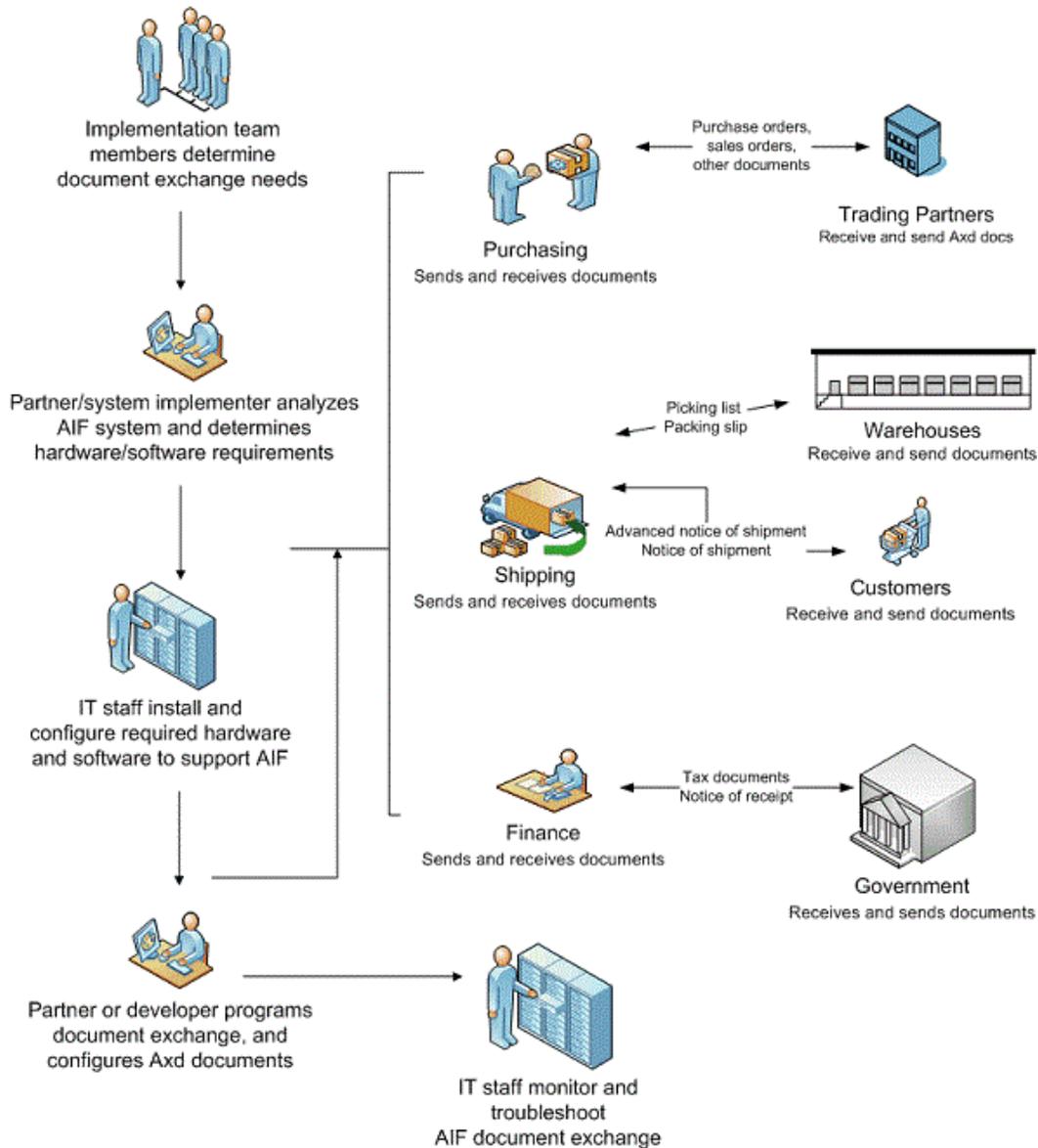
Integration planning process

A typical integration scenario uses document-based exchanges. Whether you require integration with internal legacy systems or external trading partners, planning for the integration involves common key steps.

Integration planning steps

1. In a typical integration scenario, users who have business expertise first determine the requirements for document exchanges. These requirements are requirements from a business perspective. The business users work with the implementation team to determine the following requirements:
 - The data that must be exchanged
 - Any business logic that is related to that data
 - The external systems with which data must be exchanged
 - The conditions under which data is sent from or received by Microsoft Dynamics AX
2. The system implementer works with the IT staff to determine the hardware and software requirements for Application Integration Framework (AIF). The system implementer analyzes the existing environment, and recommends any new hardware or software that must be installed.
3. The IT staff installs and configures any hardware and software that are required to support AIF.
4. A developer programs the document exchange. The developer may either customize the AIF documents or create new documents to meet the requirements of the business users. The configuration of AIF partly depends on the network environment. Therefore, the developer may work with the IT staff to implement an integration scenario.
5. The IT staff monitors the document exchanges and troubleshoots any errors that are generated.

The following figure provides a high-level view of the process that is used to integrate Microsoft Dynamics AX with other systems.



Overview of the process of integrating Microsoft Dynamics AX with other systems

Exchanging documents between BizTalk Server and AIF

Microsoft Dynamics AX 2009 included a specialized adapter that provided the ability to integrate with Microsoft BizTalk Server through Application Integration Framework (AIF). Microsoft Dynamics AX 2012 no longer includes this adapter. Instead, you can connect AIF with BizTalk by using the Windows Communication Framework (WCF)-based adapters that are included with AIF.

To read complete walkthroughs of scenarios that connect BizTalk with AIF, see [Using Microsoft BizTalk Server 2010 to exchange documents with Microsoft Dynamics AX](http://go.microsoft.com/fwlink/?LinkId=221937) (http://go.microsoft.com/fwlink/?LinkId=221937).

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Microsoft Dynamics AX 2012 introduces a new design for services and AIF. As a result, the BizTalk adapter was removed. In Microsoft Dynamics AX 2012, you must use various adapters to exchange documents between BizTalk and AIF.

In Microsoft Dynamics AX 2012, AIF exposes virtual integration ports to simplify administration of inbound and outbound connections for document exchanges. These virtual ports replace the channels and endpoints used by previous versions of Microsoft Dynamics AX. For more information about AIF configuration, see [Services and AIF operations](http://technet.microsoft.com/library/72e9566c-ce49-4321-a80f-5a9455ad9108(AX.60).aspx) ([http://technet.microsoft.com/library/72e9566c-ce49-4321-a80f-5a9455ad9108\(AX.60\).aspx](http://technet.microsoft.com/library/72e9566c-ce49-4321-a80f-5a9455ad9108(AX.60).aspx)).

AIF service documents are always constructed from XML that conforms to a service schema definition and is contained in a special wrapper, called an *envelope*. For exchanges that use SOAP, such as exchanges over TCP/IP or HTTP, the envelope is the standard SOAP envelope. For other exchanges, such as through Message Queuing or the file system, AIF provides an envelope schema. The namespace for the AIF envelope schema is:

```
http://schemas.microsoft.com/dynamics/2011/01/documents/Message
```

For message sets, AIF uses the message-set schema. The namespace of the message-set schema is:

```
http://schemas.microsoft.com/Microsoft Dynamics/2009/06/documents/Batch
```

AIF uses entity key schemas to contain name-value pairs, such as those used to query for a particular item during a read operation or when sending a response to a create operation. The namespaces for entity keys and entity key lists are:

```
http://schemas.microsoft.com/dynamics/2006/02/documents/EntityKey
```

```
http://schemas.microsoft.com/dynamics/2006/02/documents/EntityKeyList
```

AIF aggregates common property types in the shared-types schema. The namespace for the shared-types schema is:

```
http://schemas.microsoft.com/dynamics/2008/01/sharedtypes
```

AIF uses the fault schema to contain response messages about error conditions. The namespace for the fault schema is:

```
http://schemas.microsoft.com/dynamics/2008/01/documents/Fault
```

You can retrieve common schema files from the following directory where you installed Microsoft Dynamics AX:

```
Program files\Microsoft Dynamics AX\60\Server\Microsoft Dynamics
```

```
AX\bin\Application\Share\Include
```

You can save a full or customized version of a service schema by creating a custom data policy during configuration of an AIF integration port. The **Data policies** button (in the **Inbound ports** and **Outbound ports** forms) opens the **Document data policies** form. You can use this form to set rules for the fields that can be used in documents processed by an integration port for a given service operation. However, you cannot disable fields that are required by the service schema. The **View schema** button opens the XML viewer, where you can view and save the schema (and its imported schemas, such as the shared-types schema) to an XSD file.

You can generate schemas from the published WSDL document of an exposed network-protocol-based service, such as from a port that uses the NetTcp adapter. The WCF Consuming Services Wizard can generate the schema documents (and binding information) for you.

For information about how to consume a web service, download the white paper titled Consuming Microsoft Dynamics AX 2012 Web Services (<http://go.microsoft.com/fwlink/?LinkID=213142>).

Virtual company accounts in Microsoft Dynamics AX

When you create a virtual company account, you specify a collection of tables that is shared among a group of companies. When users save information in one of those tables, the data is available to the other company accounts in the group.

Note:

A company is a type of legal entity. A company is the only kind of legal entity that you can create, and every legal entity is associated with a company ID.

We recommend that you set up virtual companies when you first implement Microsoft Dynamics AX. If data has already been entered in the tables, data integrity can be affected when you combine records into a shared table later.

We do not recommend that you use virtual company accounts to share anything other than reference data and master data. You must not use virtual company accounts to share transactional data.

This topic includes the following information about virtual company accounts:

- [Company-specific data and shared data](#)
- [Create a table collection](#)
- [Before you create a virtual company account](#)
- [Create a virtual company account](#)
- [Allow non-administrators to create virtual company accounts](#)
- [Delete a virtual company account](#)

Company-specific data and shared data

Many of the tables in Microsoft Dynamics AX contain data that is company-specific. Company-specific data must be entered separately for each company. By default, users can access data only for the company that they are currently logged on to. To share this data among company accounts but maintain it only one time, you must create virtual company accounts.

Some tables are not company-specific. Therefore, by default, the data is available to all organizations. We recommend that you not include these tables in virtual companies.

Even when tables are shared, number sequences are always maintained for each company account. If you plan to use number sequences to automatically number records that are shared, we recommend that you create the data for the shared table in the company account where the number sequence was set up. Alternatively, make sure that there is no overlap between allocated numbers across the company accounts. Otherwise, numbers that are already used might be assigned again.

Some tables contain fields that are available only when you are logged on to a company account that operates in a particular country/region. When you maintain shared data, remember that the available fields may change, depending on the company that you are logged on to.

Create a table collection

Before you set up a virtual company account, you must create table collections that include the tables that will be shared in the virtual company account.

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A table collection defines a set of tables that have no foreign key relationships with tables outside the table collection. Each table occurs only one time in any one table collection, but tables can be added to more than one table collection. No data is stored in a table collection. Only companies and virtual companies store data.

Consider the following information when you are deciding which tables to include in a table collection:

- If a table has a foreign key relationship with another table, we recommend that you include the referenced table in the table collection. If you do not include the referenced table in the table collection, you must make sure that data is not entered in the foreign key field. Referential integrity can be affected if business logic that accesses the shared table does not have access to records in the referenced table.
- If two tables have a composite relationship, both tables must be part of the table collection. If the table that contains the foreign key relationship is not included in the table collection, maintenance of the data differs, depending on the company that you are logged on to. Referential integrity may also be affected, because business logic that accesses the shared table will not have access to records in the table that has been omitted.
- Adding a table that is not company-specific to a table collection has no effect, because the records in the table are already available to all organizations.

The following procedure describes how to create table collections by using drag-and-drop operations in the Application Object Tree (AOT).

1. In the Microsoft Dynamics AX client, press CTRL+SHIFT+W to open a development workspace.
2. Open two instances of the AOT, and display them side by side.
3. In one instance of the AOT, expand **AOT > Data Dictionary > Tables**.
4. In the other instance of the AOT, expand **AOT > Data Dictionary > Table Collections**.
5. Right-click **Table Collections**, and then click **New Table Collection**.
6. Right-click the table collection that you just created, and then click **Rename**. Name the new table collection appropriately.
7. Drag tables into the new table collection.

For information about the table collections that are required to support specific scenarios for virtual companies in Microsoft Dynamics AX, see the following topics:

- [Virtual company scenarios: Financials](http://technet.microsoft.com/library/349e484d-710a-486a-b51d-da8d50d553ab(AX.60).aspx) (http://technet.microsoft.com/library/349e484d-710a-486a-b51d-da8d50d553ab(AX.60).aspx)
- [Virtual company scenarios: CRM](http://technet.microsoft.com/library/20281b2c-1def-44f6-bfc7-5e73e8452961(AX.60).aspx) (http://technet.microsoft.com/library/20281b2c-1def-44f6-bfc7-5e73e8452961(AX.60).aspx)
- [Virtual company scenarios: Supply chain management \(SCM\)](http://technet.microsoft.com/library/2b597c20-5c14-4be4-a737-47e78e27757c(AX.60).aspx) (http://technet.microsoft.com/library/2b597c20-5c14-4be4-a737-47e78e27757c(AX.60).aspx)
- [Virtual company scenarios: Travel and expense](http://technet.microsoft.com/library/f68d496e-1ba1-4b58-b973-176e56f538f3(AX.60).aspx) (http://technet.microsoft.com/library/f68d496e-1ba1-4b58-b973-176e56f538f3(AX.60).aspx)
- [Virtual company scenarios: Project management and accounting](http://technet.microsoft.com/library/18066ccc-9266-4b1a-b980-93e413690648(AX.60).aspx) (http://technet.microsoft.com/library/18066ccc-9266-4b1a-b980-93e413690648(AX.60).aspx)
- [Virtual company scenarios: Retail](#)

Before you create a virtual company account

Your system must meet the following requirements before you can create or modify a virtual company:

- The instance of Application Object Server (AOS) that the administrator is connected to must be the only instance that is running. All other AOS instances must be shut down.
- Only the administrator who is creating the virtual company account can be connected. Only one active client connection is allowed.
- If a company account already contains data in company-specific tables, we do not recommend that you associate it with a virtual company. The existing data is not moved to the virtual company. Therefore, data can be corrupted, and you may have to manually update records in the database.
- If you used virtual companies in a previous release, you can continue to use them. However, before you create new virtual companies to share data, we recommend that you verify whether the data that you want to share is already stored in a shared table. For more information, see [About organizations and organizational hierarchies](#).

Create a virtual company account

1. Click **System administration > Setup > Virtual company accounts**.
2. Click **New** to create a new virtual company account.
3. In the **Company accounts** field, enter a company ID.
4. In the **Name of company accounts** field, enter a name for the virtual company.
5. Click the **Company accounts** tab, and then select the company accounts to include in the virtual company.
 - To add a company account, select the company name in the **Remaining company accounts** list, and then click the left arrow button (<) to move the company account to the **Selected company accounts** list.
 - To remove a company account, select the company name in the **Selected company accounts** list, and then click the right arrow button (>) to move the company account to the **Remaining company accounts** list.
6. Click the **Table collections** tab, and then select the tables to share in the virtual company.
7. After you create or modify a virtual company account, you must restart the Microsoft Dynamics AX client to update the client with information about the new virtual company account.

Allow non-administrators to create virtual company accounts

The system administrator can grant permission to create virtual company accounts to users who are not administrators.

1. Assign the user to a role that has the **Maintain virtual company accounts** privilege. By default, the **Information technology manager** role has this privilege. For more information, see [Assign users to security roles](http://technet.microsoft.com/library/214ee45b-5b99-4ea8-9454-f4297f68e38c(AX.60).aspx) ([http://technet.microsoft.com/library/214ee45b-5b99-4ea8-9454-f4297f68e38c\(AX.60\).aspx](http://technet.microsoft.com/library/214ee45b-5b99-4ea8-9454-f4297f68e38c(AX.60).aspx)).
2. If you assign the user to a role other than **Information technology manager**, use the **Override permissions** form to make sure that the role has **Full control** permissions to the TableCollectionList table and the VirtualDataAreaList table. For more information, see [Create or modify a security role](http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c(AX.60).aspx) ([http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c\(AX.60\).aspx](http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c(AX.60).aspx)).

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3. Disconnect all other client connections to the AOS instance, and shut down all AOS instances except the instance that is being used to create virtual company accounts. For more information, see [Monitor users](http://technet.microsoft.com/library/2d98ea0a-d3bd-42cc-a96e-6a174c3c8d1e(AX.60).aspx) ([http://technet.microsoft.com/library/2d98ea0a-d3bd-42cc-a96e-6a174c3c8d1e\(AX.60\).aspx](http://technet.microsoft.com/library/2d98ea0a-d3bd-42cc-a96e-6a174c3c8d1e(AX.60).aspx)).

Delete a virtual company account

When you delete a virtual company, the shared data that is associated with the virtual company is not deleted automatically. This data remains available in cross-company queries. To delete a virtual company, you must remove the associated data from the tables that were shared via the virtual company.

Global address books and address reference data

Microsoft Dynamics AX 2012 includes a global address book that is shared among all companies in your environment. You do not have to create virtual companies for the global address book, as in past releases of Microsoft Dynamics AX. The global address book stores party record information for each organization or person that your organization has contact with, such as customers, vendors, competitors, and workers. A party is a person or organization that is either internal or external to your organization. Each party has its own record.

Before you begin to work with address books, you can set the defaults, enable the parameters, and, if you choose, grant security privileges so that workers can access your organization's address books or party records. You can also enable the parameters for each party record individually in the global address book. For more information about the parameters for the global address book, see [Set up global address book parameters](http://technet.microsoft.com/library/d2e0ed31-fb63-4407-9ce3-9ffa52ff55e8(AX.60).aspx) ([http://technet.microsoft.com/library/d2e0ed31-fb63-4407-9ce3-9ffa52ff55e8\(AX.60\).aspx](http://technet.microsoft.com/library/d2e0ed31-fb63-4407-9ce3-9ffa52ff55e8(AX.60).aspx)). For more information about global address book security and granting privileges, see [About security in the global address book](http://technet.microsoft.com/library/8a7ce7ac-e482-48d9-892e-b16c08d50660(AX.60).aspx) ([http://technet.microsoft.com/library/8a7ce7ac-e482-48d9-892e-b16c08d50660\(AX.60\).aspx](http://technet.microsoft.com/library/8a7ce7ac-e482-48d9-892e-b16c08d50660(AX.60).aspx)).

Plan address books

You can create additional address books as needed, such as for each company in your organization or each line of business. This section contains an example of how a company might organize its address books.

Fabrikam is an international organization that has multiple companies and multiple lines of business. Fabrikam plans to create an address book for each line of business. For lines of business that occur in more than one location, such as its pneumatic tools business, Fabrikam will create an address book for each location. Chris, the IT manager for Fabrikam, has created the following list of address books that must be created, which also describes the party records to include in each address book:

- Public Sector Contracts (PubSC) – Party records for all parties that are involved in the public sector contracts that are held by Fabrikam.
- Private Sector Contracts (PriSC) – Party records for all parties that are involved in the private sector contracts that are held by Fabrikam.
- Electronic Tools (ET) – Party records for all parties that are involved in the purchase or sale of electronic tools, or that otherwise interact with the electronic tools that are provided by or purchased for Fabrikam in the Fabrikam-Japan company.
- Pneumatic Tools (PTJPN) – Party records for all parties that are involved in the purchase or sale of pneumatic tools, or that otherwise interact with the pneumatic tools that are provided by or purchased for Fabrikam in the Fabrikam-Japan company.

- Pneumatic Tools (PTUSA) – Party records for all parties that are involved in the purchase or sale of pneumatic tools, or that otherwise interact with the pneumatic tools that are provided by or purchased for Fabrikam in the Fabrikam-US company.

For more information about how to create address books, see [Create address books](http://technet.microsoft.com/library/98082cf8-7e21-42a4-bd8b-ee37ba108df2(AX.60).aspx) (http://technet.microsoft.com/library/98082cf8-7e21-42a4-bd8b-ee37ba108df2(AX.60).aspx).

Work with address reference data and party record information

In addition to creating address books, you can work with address reference data, such as countries/regions, states, and ZIP/postal codes, and more detailed elements of party records, such as address and contact information purposes.

An address and contact information purpose describes the reason or use of a particular address or telephone number. For example, if a customer record contains an address for each of the customer's four locations; you can assign an address purpose to each address. This can help you track where deliveries should be sent, where services are needed, or where mail is sent by using the postal service. For more information about how to create address purposes, see [Set up address and contact information purposes](http://technet.microsoft.com/library/d2cc4e3f-cb49-45e9-9135-2b06c0590067(AX.60).aspx) (http://technet.microsoft.com/library/d2cc4e3f-cb49-45e9-9135-2b06c0590067(AX.60).aspx).

Because numerous distinct address formats are used world-wide, your organization might need to adjust an address format when displaying a postal address. You can use the **Address setup** form to set up information about postal addresses for your organization. For more information about how to set up address formats, see [Key tasks: Set up address formats](http://technet.microsoft.com/library/4dd2cde8-11a8-4607-9054-c9683f00d730(AX.60).aspx) (http://technet.microsoft.com/library/4dd2cde8-11a8-4607-9054-c9683f00d730(AX.60).aspx).

You can set up translations of country/region information. You can view the country/region information in your user language, but the printed country/region information appears in the translated language that you select. For example, if your user language is Danish, and you have a customer in Japan, in Microsoft Dynamics AX, you can view the customer record in Danish, but when the address is printed for a sales order, the country/region information appears in Japanese. For more information about translations, see [Set up global address book translations](http://technet.microsoft.com/library/d6dbb900-16ac-4db6-a352-ab3c3e23be93(AX.60).aspx) (http://technet.microsoft.com/library/d6dbb900-16ac-4db6-a352-ab3c3e23be93(AX.60).aspx).

Plan for data

The topics in this section can help you plan for how to manage data in Microsoft Dynamics AX.

[Plan for data partitioning](#)

[Plan data import, export, and migration](#)

Plan for data partitioning

This topic provides information that you should consider before you implement the data partitioning feature of Microsoft Dynamics AX 2012 R2. You must have the system administrator role to configure partitions.

Decision points

Occasionally, you must make decisions about data partitions or create a new partition. Before you plan your implementation, it is important that you understand when and how you can work with partitions. The following list describes some of these decision points:

- **Installation** – When Microsoft Dynamics AX is installed, the setup creates a default partition. This partition is identified by the partition key that is named **initial**. During installation, you are prompted to create additional partitions as a step in the **Initialization checklist**. However, you do not have to create additional partitions at this point. You can create a new partition any time after installation.

You must initialize the initial partition and any partitions that you create by using the **Partition initialization checklist**.

- **Upgrade** – During an upgrade, you can create new partitions. You can then map companies, which are equivalent to legal entities in Microsoft Dynamics AX 2012 R2, from the source environment to partitions in the target environment. These steps occur as part of the **Preprocessing upgrade checklist**. You can map all companies to the initial partition, map each company to its own partition, or create any combination of companies and partitions that you require.
- **After deployment** – You can create a new partition any time after deployment by using the **Partitions** form. However, you can never delete a partition.
- **Implementation of financial functionality** – Business data cannot be shared across partitions. Financial functionality that depends on the sharing of data is not available between legal entities when the legal entities are in different partitions.

For example, information for the following financial functionality cannot be shared across partitions and is available only between legal entities that are in the same partition. This list is not exhaustive.

- Intercompany transactions for customer invoices, purchase orders, sales orders, and vendor invoices
- Consolidation transactions
- Elimination transactions
- Centralized payments for customers and vendors
- Allocation transactions

Number of partitions

To help decide the number of partitions that you require, consider the following questions.

Is partitioning necessary?

If you do not have to isolate data between legal entities, you do not have to create additional partitions. The initial partition is sufficient for your requirements. However, lots of data is shared between legal entities in Microsoft Dynamics AX 2012 R2. For example, products and parties are global for all companies in a partition. If you do not want this kind of data to be shared, you must create additional partitions. In any case, metadata such as role definitions is shared across all partitions.

How many legal entities require that their data be isolated?

You must identify each set of one or more legal entities that have sensitive data that other legal entities must not access. Each set requires one partition.

For example, your parent organization has three subsidiaries, and each subsidiary must be isolated from the others. This scenario requires three partitions. Therefore, you create two new partitions, so that the system has a total of three partitions.

Which legal entities will be in each partition?

Each partition can contain one or more legal entities. Users are configured separately for each partition. Users in a partition might be able to access data from all legal entities in the partition. Therefore, it sometimes is useful to model each partition so that it contains only one legal entity. Role-based security in Microsoft Dynamics AX lets you restrict the data that users in a partition can access, based on the company. This data includes share data. If a role enables access to shared data, users who have the role can see shared data across legal entities in the partition.

In upgrade scenarios, it is especially important that you understand, before you begin the upgrade, how companies map to partitions. During one step of the upgrade, you must explicitly map companies from the source system to partitions in the target system. You must plan carefully for this mapping.

Do existing legal entities share data?

When you upgrade from an earlier version of Microsoft Dynamics AX, determine whether the existing installation, or *source system*, contains companies that share business data. If companies in the source system share business data, do not plan to map these companies to different partitions. Mapping companies that share data into different partitions breaks the existing data references.

Security

To help decide the security configuration of each partition, consider the following questions.

Who should have access to each partition?

Although the set of roles, duties, and privileges is defined one time for the system, each partition has its own list of authorized users. You must plan which users will be authorized to access each partition. You must also plan which roles, duties, and privileges each user will have in each partition.

After you create a partition, you must create the users for the partition. To create users for a partition, you must log on to the partition by using a Microsoft Dynamics AX client configuration that specifies the partition key. For more information about how to create users, see [Create new users](http://technet.microsoft.com/library/4b742341-9d6e-4629-bbe5-620086b7fee8(AX.60).aspx) ([http://technet.microsoft.com/library/4b742341-9d6e-4629-bbe5-620086b7fee8\(AX.60\).aspx](http://technet.microsoft.com/library/4b742341-9d6e-4629-bbe5-620086b7fee8(AX.60).aspx)).

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Which users have access to multiple partitions?

When a user has access to more than one partition, you can specify one of the partitions as the default partition for the user. The default partition for a user is the partition that the user can log on to by using a default configuration of the Microsoft Dynamics AX client. For each user who can access multiple partitions, you should determine which partition is the default partition. You can specify the default partition for a user by logging on to the partition and then selecting the **Current partition is default partition** check box in the **User** form.

Which users must have access to all partitions?

System administrators have access to all partitions in the system. If a user requires access to all partitions, consider whether the user should have the system administrator role. Remember that the system administrator role grants many privileges that may not be appropriate for every user. Instead of making the user an administrator, a better approach might be to add the user to every partition as a separate user who has non-administrative roles.

Plan data import, export, and migration

This topic describes the tools and strategies to use when planning to import or export Microsoft Dynamics AX data. It describes how to plan to migrate data from one enterprise resource planning (ERP) system to another. Finally, it describes performance and security considerations for data import and export.

Select a tool

Data import and export are performed for many different business reasons throughout the life cycle of an implementation.

Data is imported into and exported from Microsoft Dynamics AX using a variety of tools and techniques. Before you select a tool, you should understand the business needs, the available data, and the desired outcomes.

The following table describes import and export tools and recommended techniques for customers and partners to use.

Tools and techniques	Usage scenarios
Data Migration Framework for Microsoft Dynamics AX	<p>The Data Migration Framework for Microsoft Dynamics AX 2012 is an extension that helps you migrate data into Microsoft Dynamics AX 2012.</p> <p>You can migrate predefined entities, or create custom entities to migrate.</p> <p>The Data Migration Framework is available from the InformationSource services download page (http://go.microsoft.com/fwlink/?LinkId=255246). The documentation for the Data Migration Framework is in the Data Migration Framework User Guide (http://technet.microsoft.com/library/618b2aed-b379-4c8f-b8e6-68232db72cfc(AX.60).aspx). It includes a list of the entities that can be migrated and supported file types.</p>
Microsoft Excel Add-in	<ul style="list-style-type: none"> • Excel import is a tool that can be used for data in an Excel format, or in a comma-separated list. You can use built-in or custom templates to help users import data. • Use this tool in the following situations: • Minimal data cleansing by end users is required. • You are handling low to medium data volumes (<10,000 records). • You are working with simple data structures that can easily be flattened. • No business logic is required outside an existing document service.

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<p>Microsoft Dynamics AX import/export (.DAT)</p>	<p>Microsoft Dynamics AX import/export is a mechanism for transferring data between different Microsoft Dynamics AX instances. Use this tool in the following situations:</p> <ul style="list-style-type: none"> • The source and target are Microsoft Dynamics AX instances. • No end-user cleansing of data is required. • You are moving data from one company to another. <p> Notes:</p> <p>Data can be exported from a company that is in one partition and imported into another company that is in another partition.</p> <p>Data cannot be imported into and exported from multiple companies at the same time.</p> <p>We recommend that you import all logically related records in a single export/import operation.</p> <p>For more information about Microsoft Dynamics AX export and import, see Use Microsoft Dynamics AX to transfer (export and import) data (http://technet.microsoft.com/library/60607cb9-ab51-4e97-8935-48c4e5f15c41(AX.60).aspx).</p>
<p>Manual data entry</p>	<p>Use Microsoft Dynamics AX forms to enter data with some copy and paste for low-volume data entry. This approach makes sure that all necessary business logic is performed.</p>
<p>AIF web services that use managed code</p>	<p>Write managed code that uses AIF Web services to access Microsoft Dynamics AX business logic.</p> <p>Use this approach when the structure of the data is not easily represented as tables, or if the web service that you want to use is not supported by the Excel Office Add-ins.</p> <p>This approach requires a professional developer.</p>
<p>AIF web services together with files that use inbound port and pipeline</p>	<p>This approach lets you author transformations in either XSLT or managed code to take data in an existing file format, such as an XML export from another system, and process it to match the schema expected by existing or customized AIF document services. Document services will require customization if the underlying tables and entities have been customized.</p> <p>Use this approach when you are importing many similar records.</p> <p>This approach requires a professional developer.</p>

Planning to migrate data

If you are moving from another ERP system to Microsoft Dynamics AX, you must migrate master and reference data.

Note:

We recommend that you do not migrate transactional data or historical data to Microsoft Dynamics AX. Instead, close all open transactions before migrating, if it is possible. Maintain the database that contained your previous transactional data for reporting and compliance purposes.

Data migration is a complex process that usually requires many iterations. General steps in the migration process include the following:

1. Identify the data in your existing system that must be migrated.
2. Consider cleaning up the data in your existing system. For example, determine whether old records can be deleted or archived, whether the current database contains duplicate records, and whether you want to change numbering schemes.
3. Become familiar with the relevant data structures in Microsoft Dynamics AX that the data from your existing system must be moved to.

Note:

Data from one table in another system may have to be moved into multiple tables in Microsoft Dynamics AX.

4. Determine the appropriate tools and techniques to use for the data that you must migrate.
5. Prepare a test Microsoft Dynamics AX environment. Required configuration for master records must be completed before you import data.
6. Create a backup of your existing system and of your Microsoft Dynamics AX environment before importing any data.
7. Perform a trial import of all types of data that are required.

Note:

Expect to encounter errors the first time that you perform an import. Review the errors that you encounter, make any fixes that are required, and perform the import again.

Reliability and performance

Data export and import are resource-intensive activities that can affect data integrity.

Warning:

Data import operations cannot be rolled back

Consider the following recommendations before you begin import or export:

- Plan to first perform a backup of both the source and target data.
- Data import should be the only process that is running that affects data.

Warning:

We strongly recommend that you shut down Enterprise Portal and SharePoint Products during data import. Otherwise, data corruption may result.

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- Perform all exports and imports outside core working hours, preferably not in a production environment.

Security

When you export or import Microsoft Dynamics AX tables, store them in a folder that has appropriately restrictive permissions. Many tables in Microsoft Dynamics AX contain sensitive information, such as the global address book tables, and the UserInfo tables. If you allow table data to be edited and then imported into the system, you risk providing increased access to the Microsoft Dynamics AX system.

Plan security in an implementation

The following topics describe considerations in planning security in Microsoft Dynamics AX:

[About role-based security](#)

[Security role reference](#)

[Security upgrade best practices](#)

[Manage client security](#)

[Application Object Server security and protection](#)

[Enterprise Search security and protection](#)

About role-based security

In role-based security, access is not granted to individual users, only to security roles. Users are assigned to roles. A user who is assigned to a security role has access to the set of privileges that is associated with that role. A user who is not assigned to any role has no privileges.

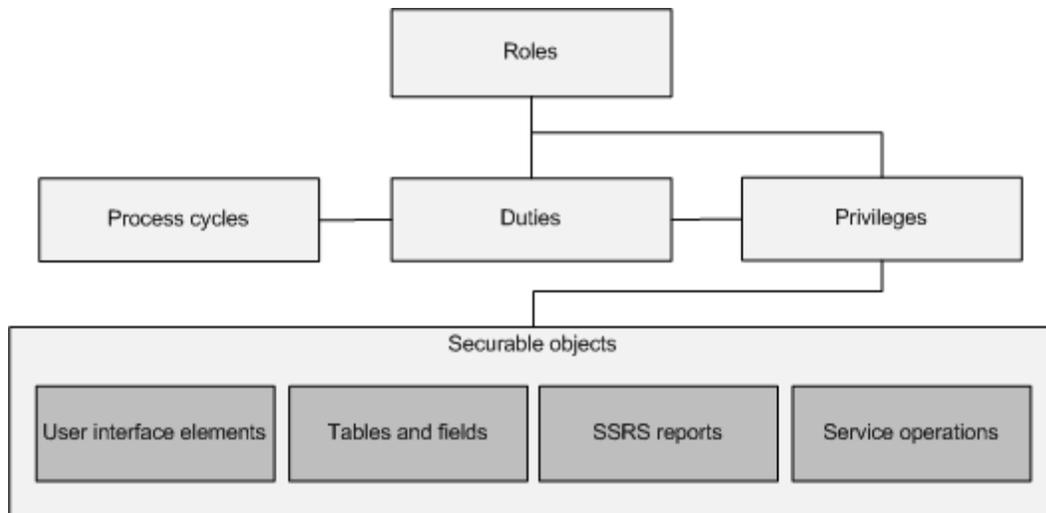
In Microsoft Dynamics AX, role-based security is aligned with the structure of the business. Users are assigned to security roles based on their responsibilities in the organization and their participation in business processes. The administrator grants access to the duties that users in a role perform, not to the program elements that users must use.

Because rules can be set up for automatic role assignment, the administrator does not have to be involved every time that a user's responsibilities change. After security roles and rules have been set up, business managers can control day-to-day user access based on business data.

Role-based security concepts

This section provides an overview of the elements of role-based security in Microsoft Dynamics AX. The security model is hierarchical, and each element in the hierarchy represents a different level of detail. Permissions represent access to individual securable objects, such as menu items and tables. Privileges are composed of permissions and represent access to tasks, such as canceling payments and processing deposits. Duties are composed of privileges and represent parts of a business process, such as maintaining bank transactions. Both duties and privileges can be assigned to roles to grant access to Microsoft Dynamics AX.

The following illustration shows the elements of role-based security and their relationships.



The following sections explain the elements of the security model in more detail.

Security roles

All users must be assigned to at least one security role in order to have access to Microsoft Dynamics AX. The security roles that are assigned to a user determine the duties that the user can perform and the parts of the user interface that the user can view.

Administrators can apply data security policies to limit the data that the users in a role have access to. For example, a user in a role may have access to data only from a single organization. The administrator can also specify the level of access that the users in a role have to current, past, and future records. For example, users in a role can be assigned privileges that allow them to view records for all periods, but that allow them to modify records only for the current period.

By managing access through security roles, administrators save time because they do not have to manage access separately for each user. Security roles are defined one time for all organizations. In addition, users can be automatically assigned to roles based on business data. For example, the administrator can set up a rule that associates a Human resources position with a security role. Any time that users are assigned to that position, those users are automatically added to the appropriate security roles. Users can also be automatically added to or removed from roles based on the Active Directory groups that they belong to. Security roles can be organized into a hierarchy. The role hierarchy allows the administrator to define a role based on another role. For example, the sales manager role could be defined as a parent role of the manager role and the salesperson role. A parent role automatically inherits the duties, privileges, and conditions that are assigned to its child roles. Therefore, a user who is assigned to the parent role can perform all of the tasks that users in the child roles can perform. A role can have one or more child roles or one or more parent roles.

By default, sample security roles are provided. All functionality in Microsoft Dynamics AX is associated with at least one of the sample security roles. The administrator can assign users to the sample security roles, modify the sample security roles to fit the needs of the business, or create new security roles. By default, the sample roles are not arranged in a hierarchy.

Note:

The sample security roles do not correspond to Role Centers.

For more information about how to work with security roles, see the following topics:

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- [Create or modify a security role](http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c(AX.60).aspx) (http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c(AX.60).aspx)
- [Assign users to security roles](http://technet.microsoft.com/library/214ee45b-5b99-4ea8-9454-f4297f68e38c(AX.60).aspx) (http://technet.microsoft.com/library/214ee45b-5b99-4ea8-9454-f4297f68e38c(AX.60).aspx)
- [Set up data security](http://technet.microsoft.com/library/1308d31a-552f-4808-b0bb-8d0c91e8b363(AX.60).aspx) (http://technet.microsoft.com/library/1308d31a-552f-4808-b0bb-8d0c91e8b363(AX.60).aspx)

Process cycles

A business process is a coordinated set of activities in which one or more participants consume, produce, and use economic resources to achieve organizational goals.

To help the administrator locate the duties that must be assigned to roles, duties are organized by the business processes that they are part of. In the context of the security model, business processes are referred to as process cycles. For example, in the accounting process cycle, you may find the **Maintain ledgers** and **Maintain bank transactions** duties.

Process cycles are used for organization only. The process cycles themselves cannot be assigned to roles.

Duties

Duties correspond to parts of a business process. The administrator assigns duties to security roles. A duty can be assigned to more than one role.

In the security model for Microsoft Dynamics AX, duties contain privileges. For example, the **Maintain bank transactions** duty contains the **Generate deposit slips** and **Cancel payments** privileges. Although both duties and privileges can be assigned to security roles, we recommend that you use duties to grant access to Microsoft Dynamics AX.

You can assign related duties to separate roles. These duties are said to be segregated. By segregating duties, you can better comply with regulatory requirements, such as those from Sarbanes-Oxley (SOX), International Financial Reporting Standards (IFRS), and the United States Food and Drug Administration (FDA). In addition, segregation of duties helps reduce the risk of fraud, and helps you detect errors or irregularities.

Default duties are provided. The administrator can modify the privileges that are associated with a duty, or create new duties.

Privileges

In the security model for Microsoft Dynamics AX, a privilege specifies the level of access that is required to perform a job, solve a problem, or complete an assignment. Privileges can be assigned directly to roles. However, for easier maintenance, we recommend that you assign only duties to roles.

A privilege contains permissions to individual application objects, such as user interface elements and tables. For example, the **Cancel payments** privilege contains permissions to the menu items, fields, and tables that are required to cancel payments.

By default, privileges are provided for all features in Microsoft Dynamics AX. The administrator can modify the permissions that are associated with a privilege, or create new privileges.

Permissions

Each function in Microsoft Dynamics AX, such as a form or a service, is accessed through an entry point. Menu items, web content items, and service operations are referred to collectively as entry points.

In the security model for Microsoft Dynamics AX, permissions group the securable objects and access levels that are required to run a function. This includes any tables, fields, forms or server side methods that are accessed through the entry point.

Only developers can create or modify permissions. For more information about how to work with permissions, see the Microsoft Dynamics AX developer documentation. Be aware that modifying permissions may affect your licensing requirements. For more information about how licensing relates to security, see the [Security roles and licensing white paper](http://go.microsoft.com/fwlink/?LinkID=228370) (http://go.microsoft.com/fwlink/?LinkID=228370) for Microsoft Dynamics AX 2012.

**Important:**

In the licensing model for Microsoft Dynamics AX, entry points are referred to as *menu items*.

Security role reference

The **Security role reference** contains topics that describe the security roles that are available by default in Microsoft Dynamics AX 2012.

All users must be assigned to at least one security role to access Microsoft Dynamics AX. The security roles that are assigned to a user determine the duties, or actions, that the user can perform and the parts of the user interface that the user can view. For more information about the security model in Microsoft Dynamics AX 2012, see [About role-based security](#) and [Security architecture](#). For information about how to create a custom security role, see [Create or modify a security role](#) (http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c(AX.60).aspx).

Security roles help determine your licensing requirements for Microsoft Dynamics AX 2012. In addition, be aware that modifying security roles may change your licensing requirements. For more information about how licensing relates to security, see the [Security roles and licensing white paper](http://go.microsoft.com/fwlink/?LinkID=228370) (http://go.microsoft.com/fwlink/?LinkID=228370) for Microsoft Dynamics AX 2012.

Security upgrade best practices

This topic provides an overview of some best practices that you should consider when you upgrade security. This topic does not describe how to upgrade security settings to Microsoft Dynamics AX 2012. For information about how to upgrade security settings, see the [Security Upgrade Advisor Tool User Guide](#) (http://technet.microsoft.com/library/ac9baada-7e30-47e3-9c64-35023d00abe4(AX.60).aspx).

User groups and roles

When you convert user groups to roles, we recommend that you use the default roles as much as you can. The default roles that are included with Microsoft Dynamics AX 2012 may contain additional permissions that were not available in earlier versions of Microsoft Dynamics AX.

If a user group has more permissions than the related default role, you can create a custom role based on the user group. We recommend that you nest the default role under the custom role, so that the custom role includes the permissions from the default role. The following table provides an example.

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User group in Microsoft Dynamics AX 4.0 or Microsoft Dynamics AX 2009	Default role in Microsoft Dynamics AX 2012	Recommendation for upgrade
<ul style="list-style-type: none"> • CustomBudgetClerk • AssetBudgetMaintain • AssetFixedAssetBudgetsMaintain • BudgetBudgetCheckResultsInquire • CustomPrivilege1 • CustomPrivilege2 	<ul style="list-style-type: none"> • BudgetBudgetClerk • AssetBudgetMaintain • AssetFixedAssetBudgetsMaintain • BudgetBudgetCheckResultsInquire 	<ul style="list-style-type: none"> • CustomBudgetClerk • CustomPrivilege1 • CustomPrivilege2 • BudgetBudgetClerk (nested role)

Use an abbreviation of the company name or function as a prefix in the name of a custom role, such as MS_CustomRole.

Whenever you can, customize security settings in a custom model. By using a model, you can more easily export security settings from, and import security settings to, a specific layer.

Security keys

The concept of security keys no longer applies in Microsoft Dynamics AX 2012. Instead, privileges and permissions are used to implement role-based security. By default, thousands of privileges are included in Microsoft Dynamics AX 2012, and each entry point is associated with one or more privileges. If you have created custom entry points, we recommend that you create new privileges that have the View and Full Control access levels. These privileges can then be included in duties or assigned to roles.

Manage client security

This topic describes important considerations and best practices for the security of Microsoft Dynamics AX 2012 client computers. One of the most important security considerations is how you deploy the client. Attention must be given to security when the Microsoft Dynamics AX client is deployed. Otherwise, malicious users may gain access to Microsoft Dynamics AX data, or users in your business or organization may unintentionally gain access to sensitive data. Regardless of whether your business or organization runs only a few Microsoft Dynamics AX clients or dozens of clients, we recommend that you deploy the client in the way that is described in this topic. By following these recommendations, you can help protect your data and reduce the overall attack surface of your computing environment. This topic includes the following information:

- Terminal Services deployment (more secure)
- Individual deployments (less secure)
- Encrypt communications between the client and Application Object Server (AOS)
- Best practices for secure client deployments

Terminal Services deployment (more secure)

Terminal Services, which is a feature of the Windows Server 2008 operating system, uses the Remote Desktop Protocol (RDP) to communicate between clients and servers. After you deploy an application on a Terminal Services server, clients can connect over a remote access connection, a local area network (LAN), a wide area network (WAN), or the Internet.

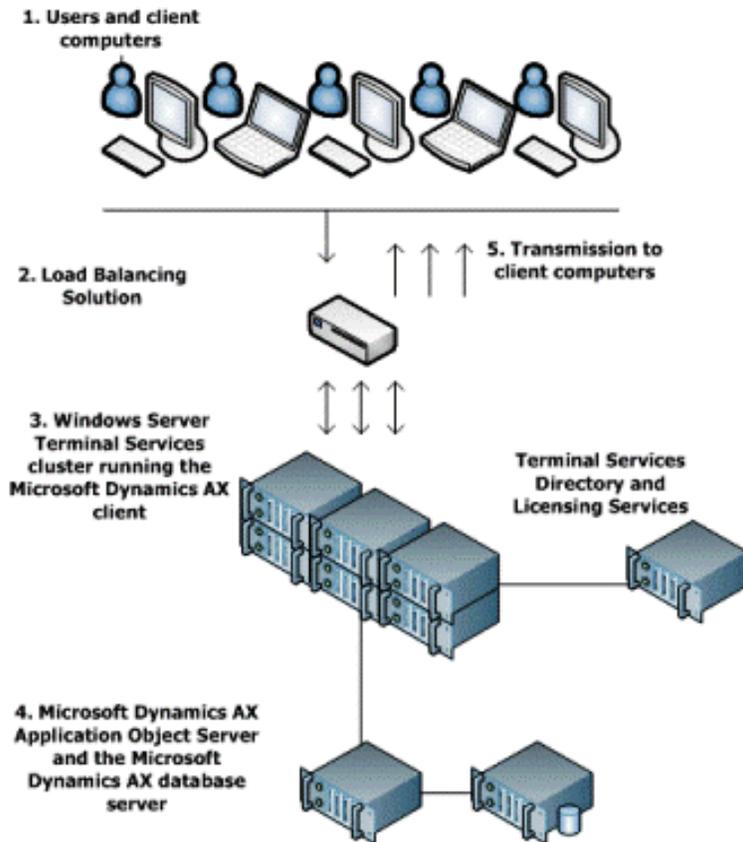
When a user accesses an application such as Microsoft Dynamics AX on a Terminal Services server, the application runs on the server. Only information from the keyboard, mouse, and display is transmitted over the network. Users can view only their own sessions. Each session is managed transparently by the server's operating system, and each session is independent of every other client session.

From a security perspective, there are several benefits to running the Microsoft Dynamics AX client on a Terminal Services cluster:

- Only keyboard strokes, mouse actions, and images of the information that is displayed on the Terminal Services server are transmitted over the network. Because Microsoft Dynamics AX data is not transmitted over the network to client computers, the threat that a malicious user may acquire data that is stored on a user's local client computer is reduced.
- No data is processed, cached, or stored on a user's local computer. All data processing, caching, and storage occur on the Windows Server computer that is running the Microsoft Dynamics AX client. Therefore, if a user's local client computer is stolen or lost, a malicious user cannot access Microsoft Dynamics AX data on that computer.
- If a security update is issued for Microsoft Dynamics AX, that update must be applied only to the computers in the Terminal Services cluster. Therefore, the overall attack surface of Microsoft Dynamics AX is minimized.

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The following figure shows an example of an architecture in which Microsoft Dynamics AX runs on a Terminal Services cluster.



1. Users log on to their client computers. The users then open either a remote desktop connection or, if they connect by using the HTTP service, a remote desktop web connection. Alternatively, users can double-click the Microsoft Dynamics AX client icon on their computers and run the application as a Terminal Services session. This capability is a feature of Windows Server 2008 that is named RemoteApp.
2. The load balancing solution routes traffic to the Terminal Services cluster based on server availability and load.
3. Terminal Services receives the session request. Terminal Services then communicates with the Terminal Services Directory and Licensing Services to manage sessions, and to verify that a license is available. If a license is available, Terminal Services starts a unique session for each user. Depending on the configuration of Terminal Services, users may see a Windows desktop. These users can then access the Microsoft Dynamics AX client from the **All Programs** menu. Alternatively, if users are using Terminal Services RemoteApp, the Microsoft Dynamics AX client opens and appears to the users as an application that runs on their client computer.
4. The Microsoft Dynamics AX clients that run on the Terminal Services cluster communicate with the Microsoft Dynamics AX AOS and database server through ordinary channels.

- The Terminal Services cluster transmits images of the information that is displayed on the Terminal Services server over the network to client computers. No data is transmitted over the network. Therefore, no Microsoft Dynamics AX data resides on any user's client computer.

Deployment considerations

- By default, Terminal Services enables only two client sessions at the same time. Before you can deploy a Terminal Services cluster, business decision makers in your business or organization must assess the cost of purchasing additional Terminal Services licenses. We highly recommend the investment, because a Terminal Services cluster reduces administrative overhead. Additionally, a Terminal Services cluster reduces the attack surface for security threats against Microsoft Dynamics AX and any other line-of-business applications that run on the cluster.
- Every user who connects to the Microsoft Dynamics AX client on the Terminal Services cluster must be a member of the Remote Desktop Users group in **Microsoft Windows Users and Groups**.
- To enhance the security of your computing environment, deploy Group Policy and Encrypting File System on all computers. If your business or organization uses Windows Server 2008, Windows 7, or Windows Vista, deploy Windows BitLocker Drive Encryption. Group Policy and Encrypting File System are described in more detail in the next section.

For more information about Terminal Services, see the [Windows Server 2008 Terminal Services Technical Library](http://go.microsoft.com/fwlink/?LinkId=118304) (<http://go.microsoft.com/fwlink/?LinkId=118304>).

Individual deployments (less secure)

The Microsoft Dynamics AX client can be deployed on users' local computers. However, for the following reasons, this kind of deployment is less secure than a deployment of the Microsoft Dynamics AX client on a Terminal Services server.

- Because more data is transmitted over the network, there is more risk that a malicious user may intercept Microsoft Dynamics AX data that is sent between the client and AOS.
- If users do not diligently help secure their computers, or if a computer is lost or stolen, there is more risk that a malicious user may access data that is stored on individual computers.
- If users have access to the Internet, there is more risk of virus attacks or problems with malicious software.
- If your business or organization does not enforce a policy that requires that users download and install security updates as soon as they are available, your computing environment is at more risk.

You can reduce some of these security risks by deploying the Windows security features that are described in the following sections.

Deployment considerations

If you deploy the Microsoft Dynamics AX client on individual computers, we recommend that you use the deployment practices that are described in this section. By following these recommendations, you can improve security and reduce some of the risks that were described earlier in this topic.

Deploy Group Policy

If you intend to deploy the Microsoft Dynamics AX client on individual computers in your business or organization, we recommend that you first implement Group Policy, and then deploy Microsoft Dynamics AX. Group Policy is a feature of Windows Server 2008. Group Policy provides an infrastructure for

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delivering and applying configurations or policy settings to users and computers in an Active Directory environment. By using Group Policy you can perform the following tasks:

- Manage user settings and computers from a central location.
- Implement security settings across an enterprise.
- Implement standard computing environments for groups of users.
- Centrally manage software installations, updates, repairs, and upgrades, and software removal.
- Centrally deploy, recover, restore, and replace users' data, software, and personal settings.
- Centrally configure and customize users' computers to provide a consistent computing environment and consistent system settings.
- Centrally manage and control power settings for computers.
- Control device installation and access to devices such as USB drives, CD-RW drives, DVD-RW drives, and other removable media.
- Manage Group policy settings for your firewall and Internet Protocol security (IPsec) at the same time. This feature provides more security when you must help secure server-to-server communications over the Internet, limit access to domain resources based on trust relationships or the health of a computer, and protect data communication to a specific server to meet regulatory requirements for data privacy and security.
- Open and edit Group Policy settings for Internet Explorer. This feature reduces the risk that you may unintentionally change the state of the policy settings based on the configuration of the administrative computer.
- Assign printers based on either a location in the business or organization or a geographic location. You can also enable Group Policy settings that allow users to install printer drivers.

For more information, see [Group Policy in Windows Server 2008](http://go.microsoft.com/fwlink/?LinkId=118676)

(<http://go.microsoft.com/fwlink/?LinkId=118676>).

Deploy Encrypting File System

Encrypting File System (EFS) is a component of the NTFS file system on Windows operating systems. EFS is used to encrypt files and folders on client computers and remote servers. When EFS is used, users can help protect their data from unauthorized access by other users or malicious users. Any individual or application that does not have the appropriate cryptographic key cannot read the encrypted data.

By deploying EFS on the computers where you install the Microsoft Dynamics AX client, you add another level of security for any data or files that users may store locally.

For more information, see [EFS in Windows Server 2008](http://go.microsoft.com/fwlink/?LinkId=118685) (<http://go.microsoft.com/fwlink/?LinkId=118685>).

Deploy Windows BitLocker Drive Encryption

Windows BitLocker Drive Encryption, or BitLocker, is a feature that is available in the Windows Server 2008, Windows 7, and Windows Vista operating systems. This feature can help protect data that is stored on client computers, especially mobile client computers.

BitLocker performs two functions:

- BitLocker encrypts all data that is stored on the Windows operating system volume and any data volumes that are configured. This data includes the Windows operating system, hibernation and paging files, applications, and data that is used by applications.

- BitLocker is configured to use a Trusted Platform Module (TPM) to help guarantee the integrity of components that are used in the early stages of the startup process. Any volumes that are protected by BitLocker are "locked." Therefore, these volumes remain protected, even if the computer is tampered with when the operating system is not running.

If a volume is protected by BitLocker, all data that is written to the volume is encrypted. This includes the operating system itself, and all applications and data. In this way, BitLocker helps protect data from unauthorized access. Although the physical security of servers remains important, BitLocker can help also protect data if a computer is stolen or shipped from one location to another, or if the computer is otherwise out of a user's physical control.

By encrypting the disk, BitLocker helps prevent offline attacks. For example, a malicious user may try to bypass Windows security provisions, such as permissions that are enforced by access control lists (ACLs) in NTFS, by removing a disk drive from one computer and installing it in another computer.

For more information, see [Windows BitLocker Drive Encryption](http://go.microsoft.com/fwlink/?LinkId=118687) (<http://go.microsoft.com/fwlink/?LinkId=118687>).

Special considerations for client computers that are used in development environments

Client computers that are used for Microsoft Dynamics AX development must be isolated from the clients, AOS instances, and database computers that are used in the production environment. Otherwise, if the environments are not correctly isolated, the process of testing or developing customizations may unintentionally affect the production environment.

To help maintain the security of the production environment, we recommend that you not grant developers access to the Microsoft Dynamics AX production database. Instead, make sure that client computers that are used for development have their own AOS instance and database, and that the development environment has its own data set. To help maintain security and privacy, do not use production data in a development environment.

Encrypt communications between the client and AOS

Microsoft Dynamics AX AOS performs business logic and data processing for all incoming and outgoing requests from client computers. If a malicious user intercepts requests between a client computer and AOS, that user may gain access to data or information. By using encryption, you can reduce the risk that a malicious user may intercept requests between client computers and AOS.

Remote procedure call encryption

By default, Microsoft Dynamics AX is configured to encrypt all credentials and data that are transmitted over the network between clients and AOS, and between AOS and the database. Microsoft Dynamics AX uses the remote procedure call (RPC) to perform the encryption.

We recommend that you not disable the RPC security feature. You can verify that RPC encryption is enabled by using the Microsoft Dynamics AX 2012 Configuration utility. The configuration utility is automatically installed when you install the Microsoft Dynamics AX client. If you suspect that users or administrators have disabled RPC encryption, verify the encryption setting on each Microsoft Dynamics AX client computer in your business or organization.

1. Click **Start > Control Panel > Administrative Tools > Microsoft Dynamics AX 2012 Configuration**.
2. Click the **Connection** tab.

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3. Verify that **Encrypt client to server communications** is selected. If this option is not selected, select it, and then click **OK**.

Role Center encryption

Role Centers provide overview information for Microsoft Dynamics AX users. This information includes work lists, activities, common links, and key information about business intelligence. Role Centers use the framework for Enterprise Portal for Microsoft Dynamics AX to display information either on an Enterprise Portal website or on a Role Center home page in the Microsoft Dynamics AX client.

If your business or organization uses Role Centers, and if the administrator installed Enterprise Portal without Secure Sockets Layer (SSL) encryption, all communications between Role Centers in the Microsoft Dynamics AX client and AOS are sent in clear text. As a result, if a malicious user intercepts communications between a client computer that is using Role Centers and AOS, that user can see data from those communications.

If your business or organization uses Role Centers, you must make sure that Enterprise Portal is configured to use SSL encryption. SSL encryption is a feature of Internet Information Services (IIS), which is the web server software that hosts the Enterprise Portal framework. For more information about how to configure SSL encryption, see [Secure Sockets Layer encryption in IIS 7.0](http://go.microsoft.com/fwlink/?LinkId=118362) (<http://go.microsoft.com/fwlink/?LinkId=118362>).

Best practices for secure client deployments

The following table describes the best practices that apply to all deployments of the Microsoft Dynamics AX client.

Recommendation	Description
<p>Always assign the least permissions when you set up and configure the user security features in Microsoft Dynamics AX.</p>	<p>Before you set up and configure the least permissions in Microsoft Dynamics AX, consider the following recommendations:</p> <ul style="list-style-type: none"> • By default, and by design, only Microsoft Dynamics AX system administrators have access to the Application Object Tree (AOT). Do not grant users access to the AOT, unless the users are members of a development role who must access the AOT as part of their job requirements. If you grant regular users access to the AOT, the users may intentionally or unintentionally compile the application, synchronize the application, change license files, or change module configurations. All of these actions can cause problems in your business or organization. • Do not make users members of the System administrators role, or grant these users access to System administration in Microsoft Dynamics AX, unless the users are responsible for setting up and configuring Microsoft Dynamics AX in your business or organization. If you grant regular users access to this group and module, the users may intentionally or unintentionally cause problems in the Microsoft Dynamics AX application. • Do not assign users to the Windows Administrators group or Power Users group on their local computers, unless the users are explicitly required to perform the job functions of an administrator or power user. Members of these groups can add applications to their local computers and remove applications from their local computers, and these actions can introduce security risks. Instead, assign users to the Windows User group. Click Start > Administrative Tools > Server Manager > Local Users and Groups.

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Recommendation	Description
Educate users about how to use strong passwords, and define password policies.	Strong passwords and password policies in your domain help maintain a secure computing environment. We highly recommend that you implement password best practices in your business or organization. For more information, see Password Best Practices (http://go.microsoft.com/fwlink/?LinkId=118273).
Enable Windows Firewall or another firewall device on each computer.	A firewall drops incoming traffic that has not been sent in response to a request of the computer. Traffic that is sent in response to a request is named solicited traffic. The firewall also drops unsolicited traffic that has not been specified as allowed. Traffic that is unsolicited but allowed is named excepted traffic. A firewall adds a level of protection against malicious users and applications that rely on unsolicited incoming traffic to attack computers. We recommend that you enable Windows Firewall or another firewall device on every computer in your business or organization. Windows Firewall is a Control Panel feature that is used to set restrictions on the traffic that can enter your network from the Internet. For more information, see Windows Firewall (http://go.microsoft.com/fwlink/?LinkId=118283).
Enable a virus scanner on each computer.	The threat of virus attacks is ongoing and always changes. We recommend that you deploy a virus scanner on every computer in your business or organization, and that you configure the scanners to scan computers and update virus signatures regularly.
Deploy smart cards in your business or organization.	We recommend that you deploy smart cards in your business or organization. A smart card contains a small computer chip that is used to store security keys or other types of personal information. Smart cards use cryptographic technology to store the information. Some businesses or organizations deploy smart card readers on every laptop and desktop computer, and require that employees insert their smart card into the reader to connect to the corporate network. By deploying smart cards in this manner, the business or organization adds another physical layer of security to its computing environment, because every user who connects to the corporate network must have a valid password and a smart card. For more information, see the Smart Card Reference (http://go.microsoft.com/fwlink/?LinkId=118292).

Application Object Server security and protection

Application Object Server (AOS) processes client requests for data and performs Microsoft Dynamics AX business logic. If a malicious user gains access to AOS, that user may gain access to sensitive data, such as financial information and trade secrets. Therefore, we recommend that you follow the guidelines in this topic when you deploy AOS. By following these guidelines, you can help protect the data in your business or organization, and reduce the overall attack surface of this core component of Microsoft Dynamics AX.

Configure AOS to use a domain account

When you install AOS by using Setup, you can configure the service to use either a domain account, a managed service account, or the Network Service account. By default, a domain account is used. The Network Service account is less secure than a domain account, provided that you set up and configure the domain account correctly. The Network Service account is less secure, because it is available to other applications that are installed on the same server. Additionally, the Network Service account is translated into a computer account if the service must communicate with a different server. For example, you deploy four AOS instances that use the Network Service account, and these servers communicate with a separate instance of Microsoft SQL Server. As a result, four different computer accounts are created in SQL Server. Therefore, in this scenario, you have four accounts that a malicious user may be able to use to gain access to AOS or the database. By using a domain account, there is only one account that you must help secure. Therefore, the attack surface of your computing environment is reduced.

Work with your domain administrator to create a new managed service account or domain account in Active Directory. Managed service accounts are managed domain accounts that provide automatic password management and simplified service principal name (SPN) management. SPN management includes delegation of management to other administrators. For information about managed service accounts, see [Service Accounts Step-by-Step Guide](#) (<http://go.microsoft.com/fwlink/?LinkID=218113&clcid=0x409>).

If you use a standard domain account, the account must not be used for any other services or back office operations. The account must be a dedicated account. You must make sure that the permissions for the new account are as low, or restrictive, as possible, to help reduce the risk of processes that can harm the server. Verify with the domain administrator that the account has the following configuration:

- The password for the domain user account is a strong password.
- The domain user account does not have interactive logon rights.
- The domain user account can log on as a service.
- The domain user account is not listed as a member of any Active Directory groups that are added to Microsoft Dynamics AX. Otherwise, the account automatically becomes a Microsoft Dynamics AX user.
- The domain user account is not listed as a user or member of any groups in **Windows Users and Groups** on AOS.

For more information about Microsoft Dynamics AX service accounts, see [Create service accounts](#) ([http://technet.microsoft.com/library/bab0792d-6a4f-4035-b8b4-422f3d0dc2c8\(AX.60\).aspx](http://technet.microsoft.com/library/bab0792d-6a4f-4035-b8b4-422f3d0dc2c8(AX.60).aspx)).

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Change the default port that is used by AOS

By default, when you install Microsoft Dynamics AX, AOS is configured to listen on port 2712 for TCP/IP communications, port 8101 for WSDL communications, and port 8201 for NET-TCP communications. If you install other AOS services on the same computer, the port numbers are incremented by 1 for each service.

If a malicious user who knows the default port numbers learns about a vulnerability in Microsoft Dynamics AX, that user may attempt to gain access to data by using a port number. You can reduce the attack surface by changing the default port numbers. For more information, see [Change AOS ports](http://technet.microsoft.com/library/2ba82a8b-bde4-4813-b231-5f025ff89927(AX.60).aspx) ([http://technet.microsoft.com/library/2ba82a8b-bde4-4813-b231-5f025ff89927\(AX.60\).aspx](http://technet.microsoft.com/library/2ba82a8b-bde4-4813-b231-5f025ff89927(AX.60).aspx)).

Use Windows features to reduce the attack surface

Microsoft Windows operating systems include security features that can help you reduce the attack surface of your computing environment. We recommend that you implement and use the following features on AOS.

Internet Protocol Security (IPsec)

IPsec is a feature of Microsoft Windows Server 2008 that helps protect networks from active and passive attacks by using packet filtering, cryptographic security services, and trusted communications.

IPsec helps provide in-depth defense against the following kinds of attacks:

- Network-based attacks from unknown computers
- Denial-of-service attacks
- Data corruption
- Data theft
- User credential theft

For more information, see [IPsec](http://go.microsoft.com/fwlink/?LinkId=119801) (<http://go.microsoft.com/fwlink/?LinkId=119801>).

Windows Firewall

Windows Firewall is a Control Panel feature that is used to set restrictions on the traffic that can enter the network from the Internet. Windows Firewall is included in Windows Server 2008.

For more information, see [Windows Firewall](http://go.microsoft.com/fwlink/?LinkId=118283) (<http://go.microsoft.com/fwlink/?LinkId=118283>).

The Microsoft Security Configuration Wizard

The Microsoft Security Configuration Wizard reduces the attack surface of the Microsoft Windows Server 2008 operating system. The wizard determines the minimum set of features that is required for a server's role or roles, and then disables all features that are not required.

The Security Configuration Wizard performs the following tasks:

- Disable nonessential services
- Block unused ports
- Enable additional address or security restrictions for ports that are left open
- Prohibit unnecessary web extensions for Internet Information Services (IIS)
- Reduce protocol exposure to server message block (SMB), LanMan, and Lightweight Directory Access Protocol (LDAP)
- Define a high signal-to-noise audit policy

To open the Security Configuration Wizard, click **Start > Administrative Tools > Security Configuration Wizard**. We recommend that you read the Help for the wizard before you change the system. For more information about services, ports, and protocols on the Windows Server 2008 operating system, see [Service overview and network port requirements for the Windows Server system](http://go.microsoft.com/fwlink/?LinkId=119804) (http://go.microsoft.com/fwlink/?LinkId=119804).

Microsoft Security Baseline Analyzer

The Microsoft Baseline Security Analyzer scans your computer to detect non-secure configurations and identify any security updates that are missing. The analyzer then recommends changes and updates that can help improve the security of the computer.

For more information, see [Microsoft Security Baseline Analyzer](http://go.microsoft.com/fwlink/?LinkId=119802) (http://go.microsoft.com/fwlink/?LinkId=119802).

Enterprise Search security and protection

This topic describes how Microsoft Dynamics AX restricts access to data, metadata, and documents in Enterprise Search results. If Search is installed by using Setup, users can search in the Microsoft Dynamics AX client or Enterprise Portal. After you install Search, the search box is available in the Microsoft Dynamics AX client. The data that is returned by Search is determined by queries that are listed in the Application Object Tree (AOT) and design features that trim data in Search results.

Note:

In this topic, Search results that include data, metadata, and documents are referred to as *data*.

Application Object Tree queries

Data can only be crawled and indexed for Search if the database table is included in an AOT query in Microsoft Dynamics AX. After the table is specified in a query, the query must be configured for Search. You configure a query for Search by setting the **Searchable** property to **True** in the AOT. By default, only the following queries are configured for Search. These queries are automatically published and indexed after you install Enterprise Search:

- BdcDocuRef
- CustTableListPage
- EcoResProductPerCompanySearch
- HcmWorkerListPage
- SecurityRoleAllTasks
- smmBusinessRelations_NoFilter
- VendorEnterpriseSearch

If you configure queries for Search, you must publish the queries to the SharePoint Business Data Connectivity Service, so that the tables can be crawled and indexed for Microsoft Dynamics AX Enterprise Search. For information about how to publish Microsoft Dynamics AX queries for Search, see [Configure Enterprise Search by using the Search Configuration wizard](http://technet.microsoft.com/library/e52f66f3-7ed0-4ad7-8fe3-f8db8b75c779(AX.60).aspx) (http://technet.microsoft.com/library/e52f66f3-7ed0-4ad7-8fe3-f8db8b75c779(AX.60).aspx).

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Design features that trim data in Search results

The following design features of Microsoft Dynamics AX Enterprise Search help trim data in Search results.

Role-based security

Microsoft Dynamics AX restricts the data that is returned in Search results, based on each user's role in Microsoft Dynamics AX. Role-based security trims data at the level of database tables, records, and fields.

- **Tables** – When a user performs a search, Microsoft Dynamics AX verifies that members of the user's role can view the tables that are listed in the AOT query. If the role does not have permission to view data from a table, Search trims the results. For example, an AOT query includes Table 1 and Table 2, but a user's role only has permission to view data from Table 1. In this case, Search returns data from Table 1 but trims all data from Table 2.
- **Records** – When a user performs a search, Microsoft Dynamics AX verifies that members of the user's role can view the records that are contained in the tables in the AOT query. If the role does not have permission to view one or more records in a table, Search trims the results. For example, an AOT query includes Table 1, a user's role has permission to view data from Table 1, but Table 1 has a record that the user's role is not permitted to view. In this case, Search returns data from Table 1 but trims the data for the restricted record.
- **Variable field access** – Microsoft Dynamics AX excludes a field from Search results if the field has different access permissions for different roles. For example, a record includes a field that is named **Employee Performance Score**. Role 1 can view the field, but Role 2 cannot view the field. In this case, the data in the field is excluded from all Search results. Therefore, **Employee Performance Score** is not displayed in the Search results, regardless of the user who performed the search, because the field is not indexed by Search. Fields that have variable access are not indexed and are therefore not discoverable in Search.

Form references

Tables in the AOT include a **FormRef** property. This property specifies the form that is used in the Microsoft Dynamics AX client to enter data for a specific table. Tables also include a **SearchLinkRefName** property. This property specifies the form that is used in Enterprise Portal to enter data for a specific table. If either of these properties is empty, Search excludes results for form metadata for the corresponding client, the Microsoft Dynamics AX client or Enterprise Portal. For example, an AOT query includes Table 1, and the **FormRef** property is empty for Table 1. In this case, Search results do not include metadata links to the form.

Plan business intelligence

The following topics describe considerations in planning business intelligence in Microsoft Dynamics AX:

[Planning considerations for reporting](#)

[Planning considerations for analytics](#)

[Tools used for analytics](#)

Planning considerations for reporting

Consider the following information before you implement the reporting features of Microsoft Dynamics AX.

Reporting Services modes

To integrate Microsoft SQL Server Reporting Services for use with Microsoft Dynamics AX, consider the following information.

Is native mode supported?

Microsoft Dynamics AX can be integrated with Reporting Services servers that are running in native mode. For instructions about how to configure Reporting Services in native mode, see [Before you install the Reporting Services extensions](http://technet.microsoft.com/library/11952a63-2f66-44fa-ae1a-fa0510a94dfe(AX.60).aspx) ([http://technet.microsoft.com/library/11952a63-2f66-44fa-ae1a-fa0510a94dfe\(AX.60\).aspx](http://technet.microsoft.com/library/11952a63-2f66-44fa-ae1a-fa0510a94dfe(AX.60).aspx)).

Is SharePoint integrated mode supported?

Reporting Services servers that are running in SharePoint integrated mode are supported only if you are using Microsoft Dynamics AX 2012 R2. For instructions about how to configure Reporting Services in SharePoint integrated mode, see [Before you install the Reporting Services extensions](http://technet.microsoft.com/library/11952a63-2f66-44fa-ae1a-fa0510a94dfe(AX.60).aspx) ([http://technet.microsoft.com/library/11952a63-2f66-44fa-ae1a-fa0510a94dfe\(AX.60\).aspx](http://technet.microsoft.com/library/11952a63-2f66-44fa-ae1a-fa0510a94dfe(AX.60).aspx)).

Topology

To help plan your Microsoft Dynamics AX implementation, consider the following information.

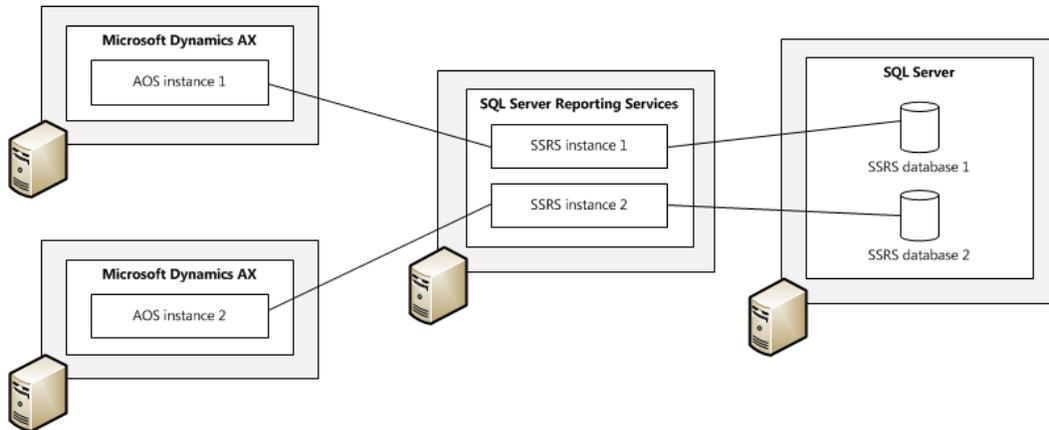
Can multiple instances of Reporting Services be installed on the same computer?

You can install multiple instances of Reporting Services on the same computer. In this kind of deployment environment, each instance of Reporting Services is connected to an independent Microsoft Dynamics AX installation. You may want to install multiple instances of Reporting Services on the same computer for the following reasons:

- To support development and production installations of Microsoft Dynamics AX
For example, in the following sample diagram, assume that *AOS instance 1* is a development installation of Microsoft Dynamics AX, and *AOS instance 2* is the production installation of Microsoft Dynamics AX.
- To support multiple production installations of Microsoft Dynamics AX

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For example, if you are a Microsoft Dynamics AX solution provider, you may have to support multiple production installations of Microsoft Dynamics AX. For this scenario, assume that *AOS instance 1* (in the sample diagram) is a production installation of Microsoft Dynamics AX for one client, Northwind Traders. Assume that *AOS instance 2* is a production installation of Microsoft Dynamics AX for another client, Contoso Pharmaceuticals.

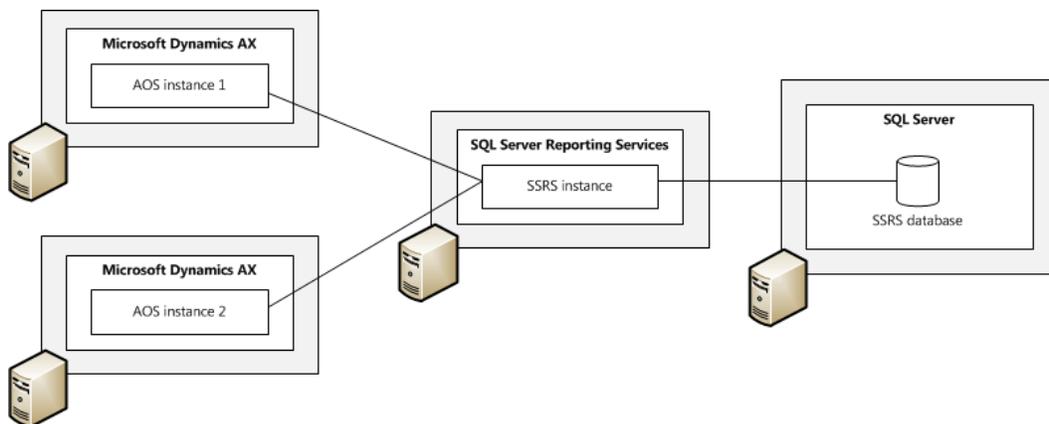


For more information, see [Install multiple instances of Reporting Services on the same computer \(for use with Microsoft Dynamics AX\)](http://technet.microsoft.com/library/0aca4bf4-aac9-4acd-9323-7547a8583c9f(AX.60).aspx) ([http://technet.microsoft.com/library/0aca4bf4-aac9-4acd-9323-7547a8583c9f\(AX.60\).aspx](http://technet.microsoft.com/library/0aca4bf4-aac9-4acd-9323-7547a8583c9f(AX.60).aspx)).

Is an AOS scale-out deployment supported with Reporting Services?

You can distribute the user load in Microsoft Dynamics AX across multiple instances of the Application Object Server (AOS) by creating a load balancing cluster. The cluster may or may not include a dedicated load balancer.

In an environment that contains an AOS load balancing cluster, you must point each AOS instance to the same Reporting Services instance. For example, your environment may resemble the following illustration.



To integrate an AOS load balancing cluster with Reporting Services, complete the following tasks.

1. Install the Reporting Services extensions on the server running Reporting Services. For more information, see [Install the Reporting Services extensions](http://technet.microsoft.com/library/d876745a-a2e7-4ce8-b608-beca6f8548dd(AX.60).aspx) ([http://technet.microsoft.com/library/d876745a-a2e7-4ce8-b608-beca6f8548dd\(AX.60\).aspx](http://technet.microsoft.com/library/d876745a-a2e7-4ce8-b608-beca6f8548dd(AX.60).aspx)).

When you install the Reporting Services extensions, the Setup wizard requires you to connect to an AOS instance. Connect to an AOS instance in the cluster. However, if the cluster includes a dedicated load balancer, **do not** connect to the AOS instance that serves as the dedicated load balancer.

When the installation is complete, the AOS instance that you selected is connected to the Reporting Services instance. You can view the properties of this connection in the **Report servers** form in Microsoft Dynamics AX.

2. Connect the other AOS instances in the cluster to the Reporting Services instance. To connect an AOS instance to the Reporting Services instance, complete these steps:
 - a. Open the Microsoft Dynamics AX client.
 - b. Click **System administration > Setup > Business intelligence > Reporting Services > Report servers**.
 - c. Connect the AOS instance to the Reporting Services instance by creating a new record in the **Report servers** form. For more information about how to use this form, see [Report servers \(form\)](http://technet.microsoft.com/library/00ef9cbb-6b3d-4f8d-bb05-c0cfa0e4e044(AX.60).aspx) ([http://technet.microsoft.com/library/00ef9cbb-6b3d-4f8d-bb05-c0cfa0e4e044\(AX.60\).aspx](http://technet.microsoft.com/library/00ef9cbb-6b3d-4f8d-bb05-c0cfa0e4e044(AX.60).aspx)).

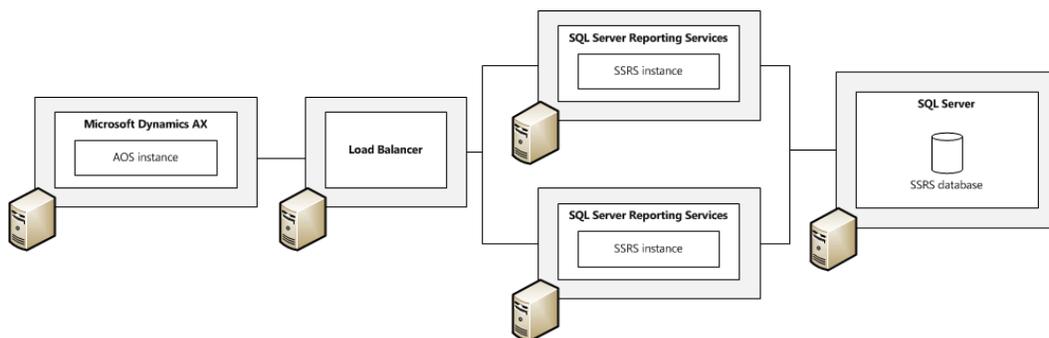
Is a Reporting Services scale-out deployment supported?

A report server scale-out deployment includes two or more report server instances that share a single report server database. By using a Reporting Services scale-out deployment, you can increase the number of users who can access reports at the same time. You can also improve the availability of the report server.

Microsoft Dynamics AX supports scale-out deployments of Reporting Services in an environment that has the following configuration:

- The Reporting Services instances are installed on separate computers.
- The Reporting Services instances share a single database.
- A Network Load Balancing (NLB) cluster is used.
- The Reporting Services extensions that are provided by Microsoft Dynamics AX are installed on each computer where Reporting Services is installed.

An environment of this kind may resemble the following illustration.



For more information about how to configure a scale-out deployment, see the [Configuring a SQL Server Reporting Services scale-out deployment to run on a Network Load Balancing cluster](http://go.microsoft.com/fwlink/?LinkID=248235) (<http://go.microsoft.com/fwlink/?LinkID=248235>) white paper. For more information about Reporting Services scale-out deployments, see [Planning for scale-out deployment](http://msdn.microsoft.com/en-us/library/bb630407.aspx) (<http://msdn.microsoft.com/en-us/library/bb630407.aspx>) in the SQL Server documentation.

Microsoft Dynamics AX

Is failover clustering supported?

Reporting Services cannot be installed on a failover cluster because you cannot run the Reporting Services service as part of a failover cluster. However, you can install the report server database on a computer that has a failover cluster installed. For more information, see [Host a Report Server Database in a SQL Server Failover Cluster](http://msdn.microsoft.com/en-us/library/bb630402.aspx) (http://msdn.microsoft.com/en-us/library/bb630402.aspx).

Is AlwaysOn supported?

SQL Server AlwaysOn is the new high availability and disaster recovery solution in SQL Server 2012. AlwaysOn is not supported for the report server database. This is because report data is accessed through the Microsoft Dynamics AX AOS server, which does not support read-only databases.

Security

To grant users access to reports, you must complete the following tasks:

- Configure security settings in Microsoft Dynamics AX.
- If you are running Reporting Services in native mode, assign users to the **DynamicsAXBROWSER** role on the Report Manager website.
- If you are running Reporting Services in SharePoint integrated mode, grant users **Read** permission to the document library that stores the reports.
- Assign users to roles in Microsoft SQL Server Analysis Services.

For more information about how to complete these tasks, see [Security settings for reports](http://technet.microsoft.com/library/fd45fcf5-f9c7-4f28-98c9-be021a6cbfe2(AX.60).aspx) (http://technet.microsoft.com/library/fd45fcf5-f9c7-4f28-98c9-be021a6cbfe2(AX.60).aspx).

Customizations

To help plan any customizations that you must implement, consider the following information.

How can I create new, custom reports?

If you or anyone in your organization has to create a new, custom report, several tools are available. For example, you can use the auto-report wizard in Microsoft Dynamics AX to create a report that lists the customers who receive a 5 percent discount. Alternatively, you can use the data connection wizard in Microsoft Excel to create a PivotChart report that displays the total sales, by product, for each salesperson in all regions over all recorded years.

For more information about the tools that you can use to create a customized report, see [Types of reports](http://technet.microsoft.com/library/6561330b-a38f-4870-a0f0-a5a9bb50e383(AX.60).aspx) (http://technet.microsoft.com/library/6561330b-a38f-4870-a0f0-a5a9bb50e383(AX.60).aspx).

How can I generate reports on a recurring basis?

You can configure Microsoft Dynamics AX to automatically print reports on a recurring basis. For example, Microsoft Dynamics AX can automatically send a specific report to you and your team members by email every Monday morning. For more information, see [Print a report on a recurring basis](http://technet.microsoft.com/library/e2d50663-83bf-4d3c-9f96-db3fdf60e2c0(AX.60).aspx) (http://technet.microsoft.com/library/e2d50663-83bf-4d3c-9f96-db3fdf60e2c0(AX.60).aspx).

Note:

Microsoft Dynamics AX reports do not support the subscription functionality that is available on the Report Manager site of Reporting Services.

Planning considerations for analytics

Consider the following information before you implement the analytical features of Microsoft Dynamics AX.

Topology

Before you deploy the analysis cubes for Microsoft Dynamics AX, consider the following information.

On which server should I install the Analysis Services database?

To make sure that the online transaction processing (OLTP) database for Microsoft Dynamics AX performs well, we recommend that you install the Microsoft SQL Server Analysis Services database on a separate server.

Can I use Analysis Services in a highly available environment?

High availability is the ability to provide a service with a minimum of interruptions. You can implement Analysis Services in a highly available environment by using network load balancing (NLB) technologies, failover clustering technologies, or both.

- **Network load balancing** – You can use network load balancing to improve the response time for queries as the number of end users increases. Network load balancing, which is also referred to as *scale out*, distributes the load among several small servers. For more information, see [Scaling out an Analysis Services Solution](http://msdn.microsoft.com/en-us/library/cc280669.aspx) (<http://msdn.microsoft.com/en-us/library/cc280669.aspx>).
- **Failover clustering** – A failover cluster is a combination of one or more nodes, or servers, with two or more shared disks. A SQL Server failover cluster instance appears on the network as a single computer. However, this instance has functionality that provides failover from one node to another if the current node becomes unavailable. For more information, see [Failover Clustering in Analysis Services](http://msdn.microsoft.com/en-us/library/dd207001.aspx) (<http://msdn.microsoft.com/en-us/library/dd207001.aspx>).

Is AlwaysOn supported?

SQL Server AlwaysOn is the new high availability and disaster recovery solution in SQL Server 2012. You can implement the Analysis Services database in an AlwaysOn environment to:

- Reduce the load on the primary Microsoft Dynamics AX online transaction processing database (OLTP).
- Reduce data latency in cubes and cube-based reports and key performance indicators (KPIs).

To implement the Analysis Services database in an AlwaysOn environment, complete the following tasks:

1. Create a read-only copy of the Microsoft Dynamics AX OLTP database.
2. Modify the data source for the Analysis Services database to point to the replicated database (that was created in step 1). To do so, follow these steps:
 - a. In SQL Server Management Studio, connect to your Analysis Services instance.
 - b. In the tree view, expand the **Databases > [Database Name] > Data Sources** node.
 - c. Right-click the **Dynamics Database** data source and choose **Properties**.
 - d. In the **Connection String** row, locate the text **Initial Catalog=[DatabaseName]**.
 - e. Change **[DatabaseName]** to the name of the replicated database that was created in step 1.

For more information about AlwaysOn, see [AlwaysOn Architecture Guide](http://msdn.microsoft.com/en-us/library/jj191711) (<http://msdn.microsoft.com/en-us/library/jj191711>) in the SQL Server documentation.

Microsoft Dynamics AX

Security

To help plan for security, consider the following information.

Who should have access to each cube?

Security for cubes is set up independently from security for Microsoft Dynamics AX. To grant users access to cubes, you must assign the users to database roles in Analysis Services. For more information about security for cubes, see [Grant users access to cubes](http://technet.microsoft.com/library/dd6bba5a-22d8-4bf0-9355-bee63b45818b(AX.60).aspx) (http://technet.microsoft.com/library/dd6bba5a-22d8-4bf0-9355-bee63b45818b(AX.60).aspx).

Do you plan to modify the Microsoft Dynamics AX security roles?

The default roles that are available in Analysis Services are not synchronized with the security roles in Microsoft Dynamics AX. For example, if you modify the permissions of the **Sales manager** role in Microsoft Dynamics AX, it does not affect the **Sales manager** role in Analysis Services.

For more information about the default roles that are available in Analysis Services, see [Default Analysis Services roles](http://technet.microsoft.com/library/7a5d0d7d-d3fd-4379-a40f-0f89887aacd1(AX.60).aspx) (http://technet.microsoft.com/library/7a5d0d7d-d3fd-4379-a40f-0f89887aacd1(AX.60).aspx).

Performance

To maintain the performance of the system, consider the following information.

How often should the cubes be processed?

A cube contains historical, or cached, data. To refresh the data in a cube, you must *process* the cube. Determine how often each cube should be processed. Consider that, when a cube is processed, it accesses the data in the Microsoft Dynamics AX OLTP database. Therefore, processing may affect the performance of that database. For more information about how to process cubes, see [Automate the processing of cubes](http://technet.microsoft.com/library/4b5e2423-febd-490f-8561-a09eecedcc78(AX.60).aspx) (http://technet.microsoft.com/library/4b5e2423-febd-490f-8561-a09eecedcc78(AX.60).aspx).

Customizations

To help plan any customizations that you must implement, consider the following information.

Do you plan to create custom cubes?

Microsoft Dynamics AX provides cubes that you can use and modify.

The following cubes are included with the initial release of Microsoft Dynamics AX 2012 and Microsoft Dynamics AX 2012 Feature Pack:

- Accounts payable cube
- Accounts receivable cube
- Customer relationship management cube
- Environmental sustainability cube
- Expense management cube
- General ledger cube
- Production cube
- Project accounting cube
- Purchase cube
- Sales cube

- Workflow cube

The following cubes are included with Microsoft Dynamics AX 2012 R2:

- Accounts payable cube
- Accounts receivable cube
- Budget control cube
- Budget plan cube
- Environmental sustainability cube
- Expense management cube
- General ledger cube
- Inventory value cube
- Production cube
- Profit tax totals cube
- Project accounting cube
- Purchase cube
- Retail cube
- Sales and marketing cube
- Sales cube
- Workflow cube

Determine whether these cubes meet your requirements. For more information about these cubes, see the [Cube and KPI reference for Microsoft Dynamics AX](http://technet.microsoft.com/library/965aac51-ae29-43f5-ba80-ec68608aab51(AX.60).aspx) (http://technet.microsoft.com/library/965aac51-ae29-43f5-ba80-ec68608aab51(AX.60).aspx). If you must create a custom cube, see [Walkthrough: Creating a Cube](http://technet.microsoft.com/library/dfe52292-1b9b-4374-a78c-27f89f49707c(AX.60).aspx) (http://technet.microsoft.com/library/dfe52292-1b9b-4374-a78c-27f89f49707c(AX.60).aspx).

Which configuration keys do you use?

The default cubes that are included with Microsoft Dynamics AX require that you enable specific configuration keys. If you disable a configuration key that is required for a cube, you must complete the following tasks:

1. Run the Analysis Services Project Wizard to remove the measures, dimensions, and key performance indicators (KPIs) that are no longer available (because the configuration key was disabled). For more information, see [How to: Configure an Existing SQL Server Analysis Services Project](http://technet.microsoft.com/library/ee0aa94f-28f9-4427-82c6-51a18e0939be(AX.60).aspx) (http://technet.microsoft.com/library/ee0aa94f-28f9-4427-82c6-51a18e0939be(AX.60).aspx).
2. Modify or remove the reports that require the configuration key.

Tools used for analytics

Microsoft SQL Server Analysis Services provides online analytical processing (OLAP) functionality for Microsoft Dynamics AX. Analysis Services lets you analyze large quantities of data. You can use it to design, create, and manage cubes that contain detailed and aggregated data from multiple data sources.

To use the Analysis Services cubes that are included with Microsoft Dynamics AX, or to create custom cubes, you must be familiar with Analysis Services and the following tools.

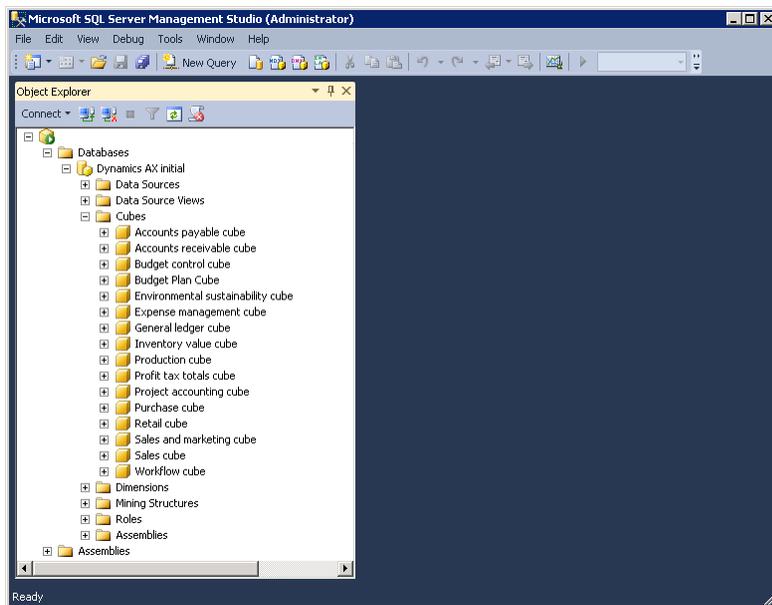
Microsoft Dynamics AX

Microsoft SQL Server Management Studio

Microsoft SQL Server Management Studio is an administrative environment that can be used to work with and manage the cubes in an Analysis Services database. You can use Management Studio to connect to an Analysis Services database and complete the following tasks:

- Process Analysis Services objects, such as cubes and dimensions.
- Browse Analysis Services objects.
- Help secure Analysis Services objects.
- Write scripts that create, modify, or delete Analysis Services objects.
- Manage Analysis Services databases.

The following picture shows the cubes that are included with Microsoft Dynamics AX 2012 R2 in the SQL Server 2012 Management Studio.

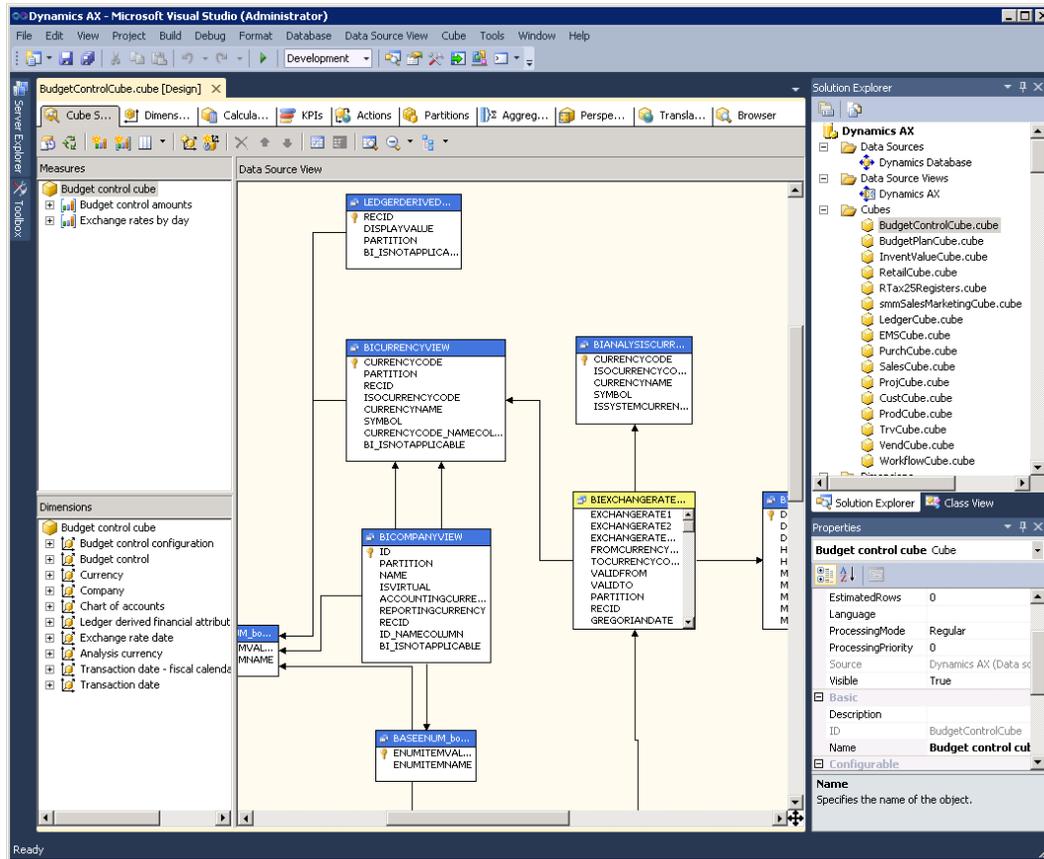


For more information about how to work with Analysis Services objects in Management Studio, see the SQL Server documentation on TechNet or MSDN.

Microsoft Visual Studio

The Microsoft Visual Studio environment can be used to modify the cubes in an Analysis Services database. If you are using SQL Server 2008, the Microsoft Visual Studio environment that you can use is called *SQL Server Business Intelligence Development Studio*. If you are using SQL Server 2012, the Visual Studio environment that you can use is called *SQL Server Data Tools*.

The following picture shows the Budget control cube that is included with Microsoft Dynamics AX 2012 R2 in SQL Server Data Tools.



For more information about how to use the Visual Studio environment to modify cubes, see the SQL Server documentation on TechNet or MSDN.

Microsoft Dynamics AX Analysis Services Project Wizard

The Analysis Services Project Wizard in Microsoft Dynamics AX is a tool that you can use to complete the following tasks:

- Deploy the default cubes that are included with Microsoft Dynamics AX.
- Configure an Analysis Services project after you disable a Microsoft Dynamics AX configuration key.
- Update an existing Analysis Services project.
- Create a new, custom Analysis Services project.

For more information, see [Working with Analysis Services Projects](#)

([http://technet.microsoft.com/library/e76fff2d-ec98-4e2c-819c-0b16ad1924f3\(AX.60\).aspx](http://technet.microsoft.com/library/e76fff2d-ec98-4e2c-819c-0b16ad1924f3(AX.60).aspx)).

Microsoft Dynamics AX

Microsoft Excel

Microsoft Excel is a spreadsheet application that you can use to create ad hoc analytical reports. To create a report, open Excel, select the cube data that you want to display on the report, and then format the data as a PivotTable or PivotChart report.

The following picture shows an ad hoc report in Excel.

The screenshot displays a PivotTable in Microsoft Excel. The PivotTable is titled 'Accounts receivable total - accounting currency' and is located in the range A1:B15. The data is summarized by customer, with the following values:

Customer	Value
A. Datum Corporation (DK)	6373.75
Adventure Works	0
Adventure Works (IT)	1457.44
Contoso Retail Dallas	493200
Fourth Coffee	9052.98
Kiwi Conference Center	10495.97
Pear Conference Center	153935
Pelican Wholesales	265118.63
Pine Company	19970
River Hotel	2759770
Sunset Wholesales	980437.08
Tennis Stadium	595792.03
Valley Hotel	278565.6
Grand Total	5574168.48

The PivotTable Field List on the right shows the following settings:

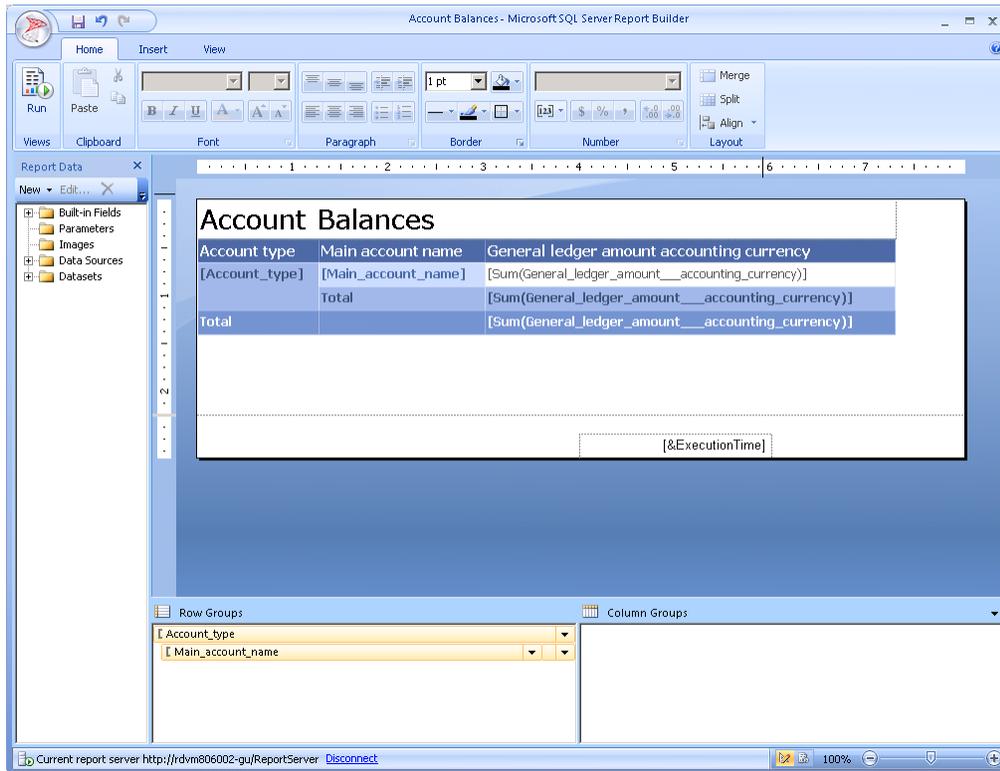
- Row Labels: Customers - ...
- Values: Accounts rec...

For step-by-step instructions about how to create an ad hoc report in Excel, see [Create a report by using the Excel data connection wizard to connect to a cube](http://technet.microsoft.com/library/ab93489c-4cd2-4b32-add5-9d7234b75ff3(AX.60).aspx) ([http://technet.microsoft.com/library/ab93489c-4cd2-4b32-add5-9d7234b75ff3\(AX.60\).aspx](http://technet.microsoft.com/library/ab93489c-4cd2-4b32-add5-9d7234b75ff3(AX.60).aspx)).

Microsoft Report Builder

Microsoft Report Builder is a component of Microsoft SQL Server Reporting Services that you can use to create ad hoc analytical reports. To create a report, open Report Builder, select the cube data that you want to display on the report, and then select the fields that you want to display on the report.

The following picture shows an ad hoc report in Report Builder.



For step-by-step instructions about how to create an ad hoc report in Report Builder, see [Create a report by using SQL Server Report Builder to connect to a cube](http://technet.microsoft.com/library/0fe8ca70-c5af-4d3f-9019-27d769b80ba6(AX.60).aspx) ([http://technet.microsoft.com/library/0fe8ca70-c5af-4d3f-9019-27d769b80ba6\(AX.60\).aspx](http://technet.microsoft.com/library/0fe8ca70-c5af-4d3f-9019-27d769b80ba6(AX.60).aspx)).

Plan for product-wide features

Product-wide feature are features that are available in more than one module.

[Number sequence overview](#)

[About organizations and organizational hierarchies](#)

[Global address books and address reference data](#)

[About date/time data and time zones](#)

[Electronic signature overview](#)

[About Intrastat](#)

[Case management](#)

Number sequence overview

Number sequences in Microsoft Dynamics AX are used to generate readable, unique identifiers for master data records and transaction records that require identifiers. A master data record or transaction record that requires an identifier is referred to as a *reference*.

Microsoft Dynamics AX

Before you can create new records for a reference in Microsoft Dynamics AX, you must set up a number sequence and associate it with the reference. We recommend that you use the forms in **Organization administration** to set up number sequences. If module-specific settings are required, you can use the parameters form in a module to specify number sequences for the references in that module. For example, in **Accounts receivable** and **Accounts payable**, you can set up number sequence groups to allocate specific number sequences to specific customers or vendors.

When you set up a number sequence, you must specify a *scope*, which defines which organization uses the number sequence. The scope can be **Shared**, **Company**, **Legal entity**, or **Operating unit**. Legal entity and company scopes can be combined with **Fiscal calendar period** to create even more specific number sequences.

Note:

If you are using Microsoft Dynamics AX 2012 R2, the **Company** scope also includes virtual companies. You cannot use module-specific forms to set up number sequences for virtual companies. You must use the forms in **Organization administration** instead.

Number sequence formats consist of segments. Number sequences with a scope other than **Shared** can contain segments that correspond to the scope. For example, a number sequence with a scope of **Legal entity** can contain a legal entity segment. By including a scope segment in the number sequence format, you can identify the scope of a particular record by looking at its number.

Important:

The available scopes depend on the reference that you are setting up a number sequence for. The **Shared** scope is available only for some references. To determine whether a reference can use a shared scope, select the area and reference in the **Segment configuration** form. (Click **Organization administration** > **Common** > **Number sequences** > **Segment configuration**.) If a scope segment is listed under **Segments**, the selected reference cannot use the shared scope.

A customization is required to change the scope for a reference. For more information about how to customize number sequences, see [Using the Enhanced Number Sequence Framework \(White paper\)](http://technet.microsoft.com/library/d7f8e81d-fcff-4fd9-8f87-4be94484b549(AX.60).aspx) ([http://technet.microsoft.com/library/d7f8e81d-fcff-4fd9-8f87-4be94484b549\(AX.60\).aspx](http://technet.microsoft.com/library/d7f8e81d-fcff-4fd9-8f87-4be94484b549(AX.60).aspx)).

In addition to segments that correspond to scopes, number sequence formats can contain **Constant** and **Alphanumeric** segments. A **Constant** segment contains a set of letters, numbers, or symbols that does not change. An **Alphanumeric** segment contains a set of letters or numbers that increment every time that a number is used.

Note:

Use a number sign (#) to represent incrementing numbers and an ampersand (&) to represent incrementing letters. For example, the format #####_2014 creates the sequence 00001_2014, 00002_2014, and so on.

Number sequence examples

The following examples show how to use segments to create number sequence formats. In particular, the examples demonstrate the effects of using scope segments.

Expense report numbers

In the following example, expense report numbers are set up for the legal entity that is titled **CS**.

Area: Travel and expense

Reference: Expense report number

Scope: Legal entity

Legal entity: CS

Segments	Segment type	Value
Segment 1	Legal entity	CS
Segment 2	Constant	-EXPENSE-
Segment 3	Alphanumeric	####

Example of formatted number: CS-EXPENSE-0039

You can set up a similar number sequence format for other legal entities. For example, for a legal entity that is named **RW**, if you change only the value of the legal entity segment, the formatted number is RW-EXPENSE-0039. You can also change the whole number sequence format for other legal entities. For example, you can omit the legal entity scope segment to create a formatted number such as Exp-0001.

Sales order numbers

In the following example, sales order numbers are set up for the company ID **CEU**.

Area: Sales

Reference: Sales order

Scope: Company

Company: CEU

Segments	Segment type	Value
Segment 1	Constant	SO-
Segment 2	Alphanumeric	####

Example of formatted number: SO-0029

Even though a scope segment is not included in the format, numbering restarts for each company ID. If you use the same format for all company IDs, the same numbers are used in each company. For example, sales order number SO-0029 is used in each company. You can also change the whole number sequence format for other company IDs.

Purchase requisition numbers

In the following example, purchase requisition numbers are organization-wide.

Microsoft Dynamics AX

Area: Purchase

Reference: Purchase requisition

Scope: Shared

Segments	Segment type	Value
Segment 1	Constant	Req
Segment 2	Alphanumeric	####

Example of formatted number: Req0052

Because the scope is **Shared**, the number sequence format is used across the organization. You cannot set up different number sequence formats for different parts of the organization.

Performance considerations for number sequences

Consider the following information about how the configuration of number sequences can affect system performance before you set up number sequences.

Continuous and non-continuous number sequences

Number sequences can be continuous or non-continuous. A continuous number sequence does not skip any numbers, but numbers may not be used sequentially. Numbers from a non-continuous number sequence are used sequentially, but the number sequence may skip numbers. For example, if a user cancels a transaction, a number is generated, but not used. In a continuous number sequence, that number is recycled later. In a non-continuous number sequence, the number is not used.

Continuous number sequences are typically required for external documents, such as purchase orders, sales orders, and invoices. However, continuous number sequences can adversely affect system response times because the system must request a number from the database every time that a new document or record is created.

If you use a non-continuous number sequence, you can enable **Preallocation** on the **Performance** FastTab of the **Number sequences** form. When you specify a quantity of numbers to preallocate, the system selects those numbers and stores them in memory. New numbers are requested from the database only after the preallocated quantity has been used.

Unless there is a regulatory requirement that you use continuous number sequences, we recommend that you use non-continuous number sequences for better performance.

Automatic cleanup of number sequences

In case of a power failure, an application error, or other unexpected failure, the system cannot recycle numbers automatically for continuous number sequences. You can run the cleanup process manually or automatically to recover the lost numbers.

Carefully consider server usage when you plan the cleanup process. We recommend that you perform the cleanup as a batch job during non-peak hours.

About organizations and organizational hierarchies

An organization is a group of people who are working together to carry out a business process or achieve a goal. Organizational hierarchies represent the relationships between the organizations that make up your business.

Organizations

In Microsoft Dynamics AX, you can define the following types of internal organizations: legal entities, operating units, and teams.

Legal entities

A legal entity is an organization that has a registered or legislated legal structure. Legal entities can enter into legal contracts and are required to prepare statements that report on their performance.

A company is a type of legal entity. In this release of Microsoft Dynamics AX, companies are the only kind of legal entity that you can create, and every legal entity is associated with a company ID. This association exists because some functional areas in the program use a company ID, or DataAreaId, in their data models. In these functional areas, companies are used as a boundary for data security. Users can access data only for the company that they are currently logged on to.

Operating units

An operating unit is an organization that is used to divide the control of economic resources and operational processes in a business. People in an operating unit have a duty to maximize the use of scarce resources, improve processes, and account for their performance.

In Microsoft Dynamics AX, the types of operating units include cost centers, business units, value streams, departments, and retail channels. The following table provides more information about each type of operating unit.

Operating unit type	Description	Purpose
Cost center	An operating unit in which managers are accountable for budgeted and actual expenditures.	Used for the management and operational control of business processes that span legal entities.
Business unit	A semi-autonomous operating unit that is created to meet strategic business objectives.	Used for financial reporting that is based on industries or product lines that the organization serves independently of legal entities.
Value stream	An operating unit that controls one or more production flows.	Commonly used in lean manufacturing to control the activities and flows that are required to supply a product or service to consumers.
Department	An operating unit that represents a category or functional part of an organization that performs a specific task, such as sales or accounting.	Used to report on functional areas. A department may have profit and loss responsibility, and may consist of a group of cost centers.

Microsoft Dynamics AX

Operating unit type	Description	Purpose
Retail channel	An operating unit that represents a brick and mortar store, an online store or an online marketplace.	Used for the management and operational control of one or more stores within or across legal entities.

Teams

A team is an organization in which the members share a common responsibility, interest, or objective. For more information about teams, see [Manage teams](http://technet.microsoft.com/library/00c979f0-6966-47cd-8395-ac8d267e8ef0(AX.60).aspx) (http://technet.microsoft.com/library/00c979f0-6966-47cd-8395-ac8d267e8ef0(AX.60).aspx). Teams cannot be used in organizational hierarchies.

Organizational hierarchies

Set up organizational hierarchies to view and report on your business from different perspectives. For example, you can set up a hierarchy of legal entities for tax, legal, or statutory reporting. Set up a hierarchy that is based on operating units to report financial information that is not legally required, but that is used for internal reporting. For example, you can create a purchasing hierarchy to control purchasing policies, rules, and business processes.

Organizations in a hierarchy can share parameters, policies, and transactions. An organization can inherit or override the parameters of its parent organization. However, shared master data, such as products and address books, applies to the whole organization and cannot be overridden for individual organizations.

Plan the organizational hierarchy

The organization model has a significant effect on the implementation of Microsoft Dynamics AX and on business processes. We recommend that you define organization structures based on feedback from executives and senior managers from functional areas, such as finance and accounting, human resources, operations, and sales and marketing. Your Microsoft Dynamics AX Partner has gained experience in various industries and across the customer base. Therefore, you can also work with your Microsoft Dynamics AX Partner for additional guidance.

Consider integration with application frameworks

The organization model framework is integrated with other application frameworks. Consider the following integrations when you plan organizations and hierarchies:

- Legal entities, operating units, and teams are all internal organizations, and all internal organizations are types of the **Party** entity. Therefore, these organizations use the capabilities of the address book to store address and contact information. A party, which can be either a person or an organization, can belong to one or more address books.
- Product definitions are shared, and they must be made available to individual legal entities before they can be included in transactions.
- Legal entities and operating units can be used to define financial dimensions, and those financial dimensions can be used in account structures. The relationships between organizations that are described through hierarchies can also be used as constraints if two organizations are used as separate financial dimensions in the account structure.
- Main accounts, dimensions, account structures, charts of accounts, and account rules can be used by multiple legal entities. A ledger that provides a chart of accounts, accounting currency, reporting currency, and fiscal calendar is required for each legal entity.

Consider application scenarios for hierarchies

When you plan your organization hierarchies, consider how the hierarchies are used by the following application features and scenarios.

Centralized customer and vendor payments

Organizations that include multiple legal entities can create and manage payments by using a legal entity that handles all payments. A legal entity that is used for centralized payments saves time. The same transaction does not have to be entered in multiple legal entities, and the following processes for cross-company payments are streamlined: payment proposals, settlements, modification of open transactions, and modification of closed transactions.

To use a hierarchy in this scenario, you must assign the **Centralized payments** purpose to it. For more information, see:

- [About centralized vendor payments](http://technet.microsoft.com/library/1c171d11-5b5e-45dd-92d1-87d4a7391a2b(AX.60).aspx) (http://technet.microsoft.com/library/1c171d11-5b5e-45dd-92d1-87d4a7391a2b(AX.60).aspx)
- [Set up centralized vendor payments](http://technet.microsoft.com/library/22f95748-f55d-40b7-afda-f4cc29ea4b38(AX.60).aspx) (http://technet.microsoft.com/library/22f95748-f55d-40b7-afda-f4cc29ea4b38(AX.60).aspx)
- [About centralized customer payments](http://technet.microsoft.com/library/870990b7-23a1-464a-8d11-a86ef544c3dd(AX.60).aspx) (http://technet.microsoft.com/library/870990b7-23a1-464a-8d11-a86ef544c3dd(AX.60).aspx)
- [Set up centralized customer payments](http://technet.microsoft.com/library/fe5e2c78-814b-4ffe-8256-c7d4b7895b5b(AX.60).aspx) (http://technet.microsoft.com/library/fe5e2c78-814b-4ffe-8256-c7d4b7895b5b(AX.60).aspx)

Policies

A policy is a collection of rules that controls a process for an organization. Policies enable internal management of organizations and help improve cost control, fraud detection, operating efficiency, and performance. You can set up policies for the following processes in Microsoft Dynamics AX: purchase requisitions, vendor invoice payments, audit control of documents, expense reports, and signing limits. To use a hierarchy to set up policies, you must assign an appropriate purpose to the hierarchy. For more information about how to set up policies, see [Set up policy parameters](http://technet.microsoft.com/library/c70691a0-73db-4410-b832-558e99f56676(AX.60).aspx) (http://technet.microsoft.com/library/c70691a0-73db-4410-b832-558e99f56676(AX.60).aspx).

The following table describes how policies correspond to hierarchy purposes.

Policy type	Description	Hierarchy purpose	More information
Purchasing policy	Controls the requisition process for a group of requisitioners. Purchasing policies help create a policy structure that is aligned with the organization's needs for strategic purchasing.	Procurement internal control	About purchasing policies (http://technet.microsoft.com/library/a1a6647e-dabd-4c96-a0e2-2dd5a4e0b54c(AX.60).aspx) Key tasks: Create purchasing policies (http://technet.microsoft.com/library/dade94d0-0e46-4d9d-a78f-6c3a14d4bf49(AX.60).aspx)

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Policy type	Description	Hierarchy purpose	More information
Vendor invoice policy	Enables you to evaluate vendor invoices for compliance with policy rules that you create.	Vendor payment internal control	Key tasks: Vendor invoice policies (http://technet.microsoft.com/library/cece6b77-79c6-43d1-9970-413da5f82465(AX.60).aspx)
Audit policy	Helps you implement the compliance strategy for your organization.	Audit internal control	Key tasks: Audit policies (http://technet.microsoft.com/library/6f34aced-dcd8-43ab-9d0f-763f8c5e2b7a(AX.60).aspx)
Expense policy	Controls the process for expense reports.	Expenditure internal control	About travel and expense policies (http://technet.microsoft.com/library/7112699b-aacf-41c0-9d17-8b8c61c95a86(AX.60).aspx) Create policies (http://technet.microsoft.com/library/408f928e-aab0-4ad7-bf3f-1f5c1fc0a590(AX.60).aspx)
Signing limit policy	Controls the level of financial commitment that a worker is authorized to make on behalf of his or her employer. As a result of the worker's approval activity, the employer may enter into a contractual relationship with a third party, such as a purchase order with a vendor.	Signature authority internal control	About signing limit setup (http://technet.microsoft.com/library/4bb412bd-a922-4ac6-bb08-cdbca8044182(AX.60).aspx) Key tasks: Manage signing-limit policies (http://technet.microsoft.com/library/b21300ed-94aa-4894-967b-8344e6ec1f50(AX.60).aspx)

Organization chart

An organization chart defines the relationships between departments, jobs, and positions. To use a hierarchy in this scenario, you must assign the **Organization chart** purpose to it. For more information, see [Key tasks: New worker positions](http://technet.microsoft.com/library/cf6ffc13-11af-4402-b6dd-8781408db244(AX.60).aspx) (http://technet.microsoft.com/library/cf6ffc13-11af-4402-b6dd-8781408db244(AX.60).aspx).

Data access

A user's access to data in Microsoft Dynamics AX can be granted based on the user's relationship to an organization. When you associate a user who is in a particular role with a hierarchy, the user's access to

data changes automatically when the hierarchy changes. To use a hierarchy in this scenario, you must assign the **Security** purpose to it. For more information, see [Organizations for the automatic role assignment rule \(form\) or Organizations for the user \(form\)](#) ([http://technet.microsoft.com/library/6cad9713-300d-4e30-a210-bb468730184f\(AX.60\).aspx](http://technet.microsoft.com/library/6cad9713-300d-4e30-a210-bb468730184f(AX.60).aspx)).

Best practices for modeling organizations and hierarchies

Consider the following best practices when you implement an organization hierarchy:

- Create a department to model the intersection between a legal entity and a business unit. You can then roll up data from a department to a legal entity for statutory reporting, and from a department to a business unit for internal reporting.

Departments can serve as profit centers. If you use departments, you do not have to use both legal entities and business units as dimensions in the account structure. You can use just departments as a dimension. However, you must use both cost centers and departments as dimensions in the account structure if cost centers are used only as cost accumulators, and departments are used for revenue recognition.

- Allocate the costs of shared service departments, such as Human Resources and Information Technology, so that the costs are accounted for in the profit and loss statements of profit centers, such as departments and business units.
- Model multiple hierarchies for operating units if you have complex requirements for reporting profit and loss.
- Do not model multiple hierarchies for one hierarchy purpose.
- Do not create a hierarchy for every purpose. Usually, you can use one hierarchy for multiple purposes. For example, one hierarchy of operating units can be assigned to all policy-related purposes.
- Create balanced hierarchies. In a hierarchy, all nodes that are the same distance from the root node are defined as a level. In a balanced hierarchy, only one type of operating unit can occur at each level, and the distance from the root node to each level is consistent. If there are intermediate levels between a department and a legal entity or a business unit, placeholder organizations may be required to create a balanced hierarchy.
- Do not model a separate hierarchy of operating units if the structure for legal entities is also your operating structure. A mixed hierarchy of legal entities and operating units may serve both purposes.
- Before you model major restructuring scenarios, use the hierarchy's effective dates to perform an impact analysis and a validation test.
- Use draft mode to change a hierarchy before you publish a new version in a production environment.
- Limit the number of people who have permissions to add or remove organizations from a hierarchy in a production environment. A smaller number reduces the chance that costly mistakes can occur and corrections must be made.

Example organizational hierarchies

This topic provides examples of organizational hierarchies for small, midsized, and large organizations.

These examples include suggestions and guidance about how to model organizational hierarchies.

However, business requirements should be the primary factor that determines your approach. The size

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and complexity of the business are important considerations. Microsoft Dynamics AX is primarily used by small and midsized businesses, which compose the segment of the market that is known as the midmarket segment. Therefore, the examples in this topic also focus on that market segment.

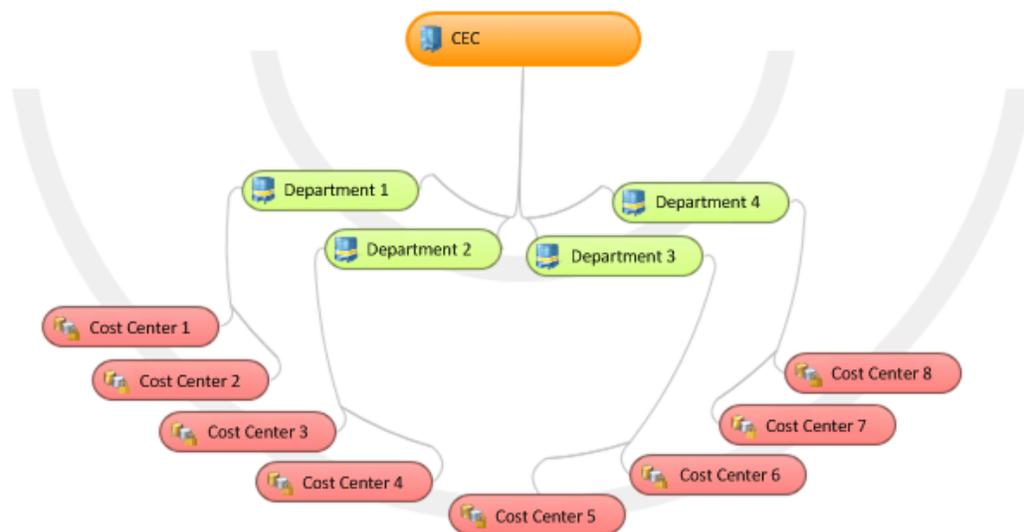
For more information about what to consider when you create an organizational hierarchy, see [Plan the organizational hierarchy](#).

Organization modeling for a small organization

Small organizations typically have just one or very few legal entities. The legal structure is often also used as the operating structure, because the business includes a very limited number of product lines or groups. A small organization can use the legal structure to measure performance and control operations for product lines.

An organizational hierarchy is not required for a small organization, if the business does not require complex internal control policies and data security access that are based on hierarchies. Simple policies and data security can be based on a list of legal entities that is not organized in a hierarchy. However, we recommend that you always create a single mixed hierarchy to support the organization as it grows. If more complex scenarios for internal control, such as audit control and invoice control, become necessary, a small organization must define additional hierarchies that consist of legal entities only.

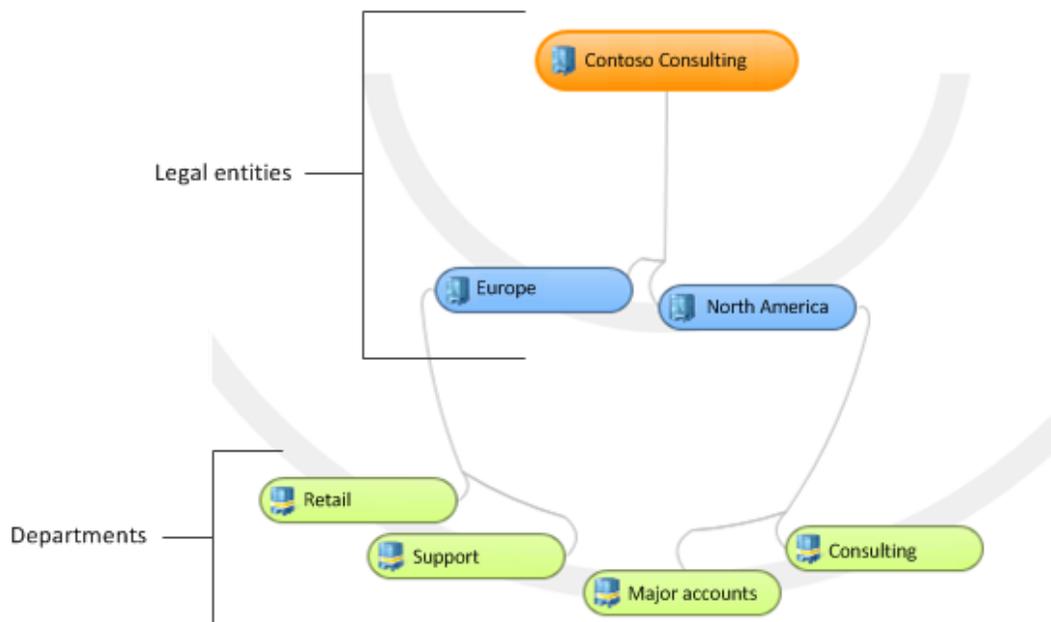
A typical small organization has a single mixed hierarchy that has a legal entity at the top. Departments and cost centers roll up to the legal entity.



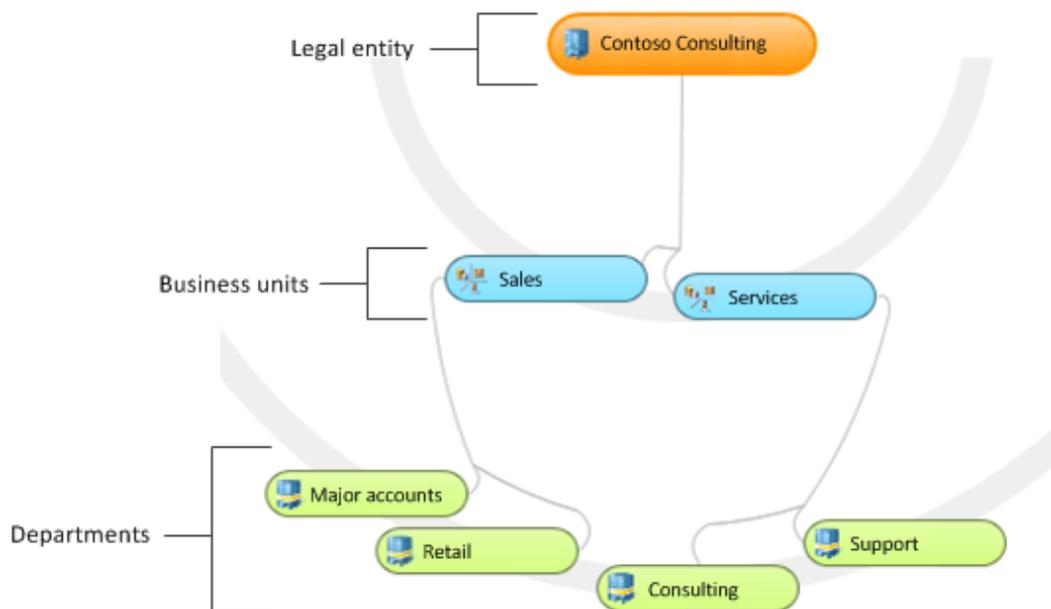
Organization modeling for a midsized organization

Midsized organizations may require complex internal control policies, and therefore may require separate hierarchies for legal entities and operating units.

The structure of the legal entities might be based on industries, consumers, or product lines. In the following illustration, the legal entity structure is based on geographic regions.



The hierarchy of operating units might have a legal entity at the top and business units under the legal entity. Each business unit might contain departments, and each department might consist of cost centers. Departments that are under a single legal entity in the legal entity hierarchy can roll up to different business units in the operating hierarchy, as in the following illustration.



Organization modeling for a large organization

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Large organizations grow through mergers and acquisitions. Leaders of these organizations typically want to analyze the business based on operating structures such as industries, consumers, or product lines. Additionally, leaders typically restructure their businesses to meet the requirements of the marketplace in an agile manner. A large organization requires an organizational structure that supports internal controls, effective performance measurement, and efficient delivery of goods and services. Large organizations must model multiple hierarchies to measure the effectiveness of restructuring, and to compare old and new organizational structures.

Larger organizations may require some hierarchies that are based on business units and other hierarchies that are based on shared services, such as human resources and IT. However, when you design hierarchies, make sure that cost centers are created in shared service departments, and that the cost centers are positioned under business units, so that the costs of shared services are appropriately allocated.

Virtual company accounts in Microsoft Dynamics AX

When you create a virtual company account, you specify a collection of tables that is shared among a group of companies. When users save information in one of those tables, the data is available to the other company accounts in the group.

Note:

A company is a type of legal entity. A company is the only kind of legal entity that you can create, and every legal entity is associated with a company ID.

We recommend that you set up virtual companies when you first implement Microsoft Dynamics AX. If data has already been entered in the tables, data integrity can be affected when you combine records into a shared table later.

We do not recommend that you use virtual company accounts to share anything other than reference data and master data. You must not use virtual company accounts to share transactional data.

This topic includes the following information about virtual company accounts:

- [Company-specific data and shared data](#)
- [Create a table collection](#)
- [Before you create a virtual company account](#)
- [Create a virtual company account](#)
- [Allow non-administrators to create virtual company accounts](#)
- [Delete a virtual company account](#)

Company-specific data and shared data

Many of the tables in Microsoft Dynamics AX contain data that is company-specific. Company-specific data must be entered separately for each company. By default, users can access data only for the company that they are currently logged on to. To share this data among company accounts but maintain it only one time, you must create virtual company accounts.

Some tables are not company-specific. Therefore, by default, the data is available to all organizations. We recommend that you not include these tables in virtual companies.

Even when tables are shared, number sequences are always maintained for each company account. If you plan to use number sequences to automatically number records that are shared, we recommend that you

create the data for the shared table in the company account where the number sequence was set up. Alternatively, make sure that there is no overlap between allocated numbers across the company accounts. Otherwise, numbers that are already used might be assigned again.

Some tables contain fields that are available only when you are logged on to a company account that operates in a particular country/region. When you maintain shared data, remember that the available fields may change, depending on the company that you are logged on to.

Create a table collection

Before you set up a virtual company account, you must create table collections that include the tables that will be shared in the virtual company account.

A table collection defines a set of tables that have no foreign key relationships with tables outside the table collection. Each table occurs only one time in any one table collection, but tables can be added to more than one table collection. No data is stored in a table collection. Only companies and virtual companies store data.

Consider the following information when you are deciding which tables to include in a table collection:

- If a table has a foreign key relationship with another table, we recommend that you include the referenced table in the table collection. If you do not include the referenced table in the table collection, you must make sure that data is not entered in the foreign key field. Referential integrity can be affected if business logic that accesses the shared table does not have access to records in the referenced table.
- If two tables have a composite relationship, both tables must be part of the table collection. If the table that contains the foreign key relationship is not included in the table collection, maintenance of the data differs, depending on the company that you are logged on to. Referential integrity may also be affected, because business logic that accesses the shared table will not have access to records in the table that has been omitted.
- Adding a table that is not company-specific to a table collection has no effect, because the records in the table are already available to all organizations.

The following procedure describes how to create table collections by using drag-and-drop operations in the Application Object Tree (AOT).

1. In the Microsoft Dynamics AX client, press CTRL+SHIFT+W to open a development workspace.
2. Open two instances of the AOT, and display them side by side.
3. In one instance of the AOT, expand **AOT > Data Dictionary > Tables**.
4. In the other instance of the AOT, expand **AOT > Data Dictionary > Table Collections**.
5. Right-click **Table Collections**, and then click **New Table Collection**.
6. Right-click the table collection that you just created, and then click **Rename**. Name the new table collection appropriately.
7. Drag tables into the new table collection.

For information about the table collections that are required to support specific scenarios for virtual companies in Microsoft Dynamics AX, see the following topics:

- [Virtual company scenarios: Financials](http://technet.microsoft.com/library/349e484d-710a-486a-b51d-da8d50d553ab(AX.60).aspx) (http://technet.microsoft.com/library/349e484d-710a-486a-b51d-da8d50d553ab(AX.60).aspx)

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- [Virtual company scenarios: CRM](http://technet.microsoft.com/library/20281b2c-1def-44f6-bfc7-5e73e8452961(AX.60).aspx) (http://technet.microsoft.com/library/20281b2c-1def-44f6-bfc7-5e73e8452961(AX.60).aspx)
- [Virtual company scenarios: Supply chain management \(SCM\)](http://technet.microsoft.com/library/2b597c20-5c14-4be4-a737-47e78e27757c(AX.60).aspx) (http://technet.microsoft.com/library/2b597c20-5c14-4be4-a737-47e78e27757c(AX.60).aspx)
- [Virtual company scenarios: Travel and expense](http://technet.microsoft.com/library/f68d496e-1ba1-4b58-b973-176e56f538f3(AX.60).aspx) (http://technet.microsoft.com/library/f68d496e-1ba1-4b58-b973-176e56f538f3(AX.60).aspx)
- [Virtual company scenarios: Project management and accounting](http://technet.microsoft.com/library/18066ccc-9266-4b1a-b980-93e413690648(AX.60).aspx) (http://technet.microsoft.com/library/18066ccc-9266-4b1a-b980-93e413690648(AX.60).aspx)
- [Virtual company scenarios: Retail](#)

Before you create a virtual company account

Your system must meet the following requirements before you can create or modify a virtual company:

- The instance of Application Object Server (AOS) that the administrator is connected to must be the only instance that is running. All other AOS instances must be shut down.
- Only the administrator who is creating the virtual company account can be connected. Only one active client connection is allowed.
- If a company account already contains data in company-specific tables, we do not recommend that you associate it with a virtual company. The existing data is not moved to the virtual company. Therefore, data can be corrupted, and you may have to manually update records in the database.
- If you used virtual companies in a previous release, you can continue to use them. However, before you create new virtual companies to share data, we recommend that you verify whether the data that you want to share is already stored in a shared table. For more information, see [About organizations and organizational hierarchies](#).

Create a virtual company account

1. Click **System administration > Setup > Virtual company accounts**.
2. Click **New** to create a new virtual company account.
3. In the **Company accounts** field, enter a company ID.
4. In the **Name of company accounts** field, enter a name for the virtual company.
5. Click the **Company accounts** tab, and then select the company accounts to include in the virtual company.
 - To add a company account, select the company name in the **Remaining company accounts** list, and then click the left arrow button (<) to move the company account to the **Selected company accounts** list.
 - To remove a company account, select the company name in the **Selected company accounts** list, and then click the right arrow button (>) to move the company account to the **Remaining company accounts** list.
6. Click the **Table collections** tab, and then select the tables to share in the virtual company.
7. After you create or modify a virtual company account, you must restart the Microsoft Dynamics AX client to update the client with information about the new virtual company account.

Allow non-administrators to create virtual company accounts

The system administrator can grant permission to create virtual company accounts to users who are not administrators.

1. Assign the user to a role that has the **Maintain virtual company accounts** privilege. By default, the **Information technology manager** role has this privilege. For more information, see [Assign users to security roles](http://technet.microsoft.com/library/214ee45b-5b99-4ea8-9454-f4297f68e38c(AX.60).aspx) ([http://technet.microsoft.com/library/214ee45b-5b99-4ea8-9454-f4297f68e38c\(AX.60\).aspx](http://technet.microsoft.com/library/214ee45b-5b99-4ea8-9454-f4297f68e38c(AX.60).aspx)).
2. If you assign the user to a role other than **Information technology manager**, use the **Override permissions** form to make sure that the role has **Full control** permissions to the TableCollectionList table and the VirtualDataAreaList table. For more information, see [Create or modify a security role](http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c(AX.60).aspx) ([http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c\(AX.60\).aspx](http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c(AX.60).aspx)).
3. Disconnect all other client connections to the AOS instance, and shut down all AOS instances except the instance that is being used to create virtual company accounts. For more information, see [Monitor users](http://technet.microsoft.com/library/2d98ea0a-d3bd-42cc-a96e-6a174c3c8d1e(AX.60).aspx) ([http://technet.microsoft.com/library/2d98ea0a-d3bd-42cc-a96e-6a174c3c8d1e\(AX.60\).aspx](http://technet.microsoft.com/library/2d98ea0a-d3bd-42cc-a96e-6a174c3c8d1e(AX.60).aspx)).

Delete a virtual company account

When you delete a virtual company, the shared data that is associated with the virtual company is not deleted automatically. This data remains available in cross-company queries. To delete a virtual company, you must remove the associated data from the tables that were shared via the virtual company.

Global address books and address reference data

Microsoft Dynamics AX 2012 includes a global address book that is shared among all companies in your environment. You do not have to create virtual companies for the global address book, as in past releases of Microsoft Dynamics AX. The global address book stores party record information for each organization or person that your organization has contact with, such as customers, vendors, competitors, and workers. A party is a person or organization that is either internal or external to your organization. Each party has its own record.

Before you begin to work with address books, you can set the defaults, enable the parameters, and, if you choose, grant security privileges so that workers can access your organization's address books or party records. You can also enable the parameters for each party record individually in the global address book. For more information about the parameters for the global address book, see [Set up global address book parameters](http://technet.microsoft.com/library/d2e0ed31-fb63-4407-9ce3-9ffa52ff55e8(AX.60).aspx) ([http://technet.microsoft.com/library/d2e0ed31-fb63-4407-9ce3-9ffa52ff55e8\(AX.60\).aspx](http://technet.microsoft.com/library/d2e0ed31-fb63-4407-9ce3-9ffa52ff55e8(AX.60).aspx)). For more information about global address book security and granting privileges, see [About security in the global address book](http://technet.microsoft.com/library/8a7ce7ac-e482-48d9-892e-b16c08d50660(AX.60).aspx) ([http://technet.microsoft.com/library/8a7ce7ac-e482-48d9-892e-b16c08d50660\(AX.60\).aspx](http://technet.microsoft.com/library/8a7ce7ac-e482-48d9-892e-b16c08d50660(AX.60).aspx)).

Plan address books

You can create additional address books as needed, such as for each company in your organization or each line of business. This section contains an example of how a company might organize its address books.

Fabrikam is an international organization that has multiple companies and multiple lines of business. Fabrikam plans to create an address book for each line of business. For lines of business that occur in more than one location, such as its pneumatic tools business, Fabrikam will create an address book for

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each location. Chris, the IT manager for Fabrikam, has created the following list of address books that must be created, which also describes the party records to include in each address book:

- Public Sector Contracts (PubSC) – Party records for all parties that are involved in the public sector contracts that are held by Fabrikam.
- Private Sector Contracts (PriSC) – Party records for all parties that are involved in the private sector contracts that are held by Fabrikam.
- Electronic Tools (ET) – Party records for all parties that are involved in the purchase or sale of electronic tools, or that otherwise interact with the electronic tools that are provided by or purchased for Fabrikam in the Fabrikam-Japan company.
- Pneumatic Tools (PTJPN) – Party records for all parties that are involved in the purchase or sale of pneumatic tools, or that otherwise interact with the pneumatic tools that are provided by or purchased for Fabrikam in the Fabrikam-Japan company.
- Pneumatic Tools (PTUSA) – Party records for all parties that are involved in the purchase or sale of pneumatic tools, or that otherwise interact with the pneumatic tools that are provided by or purchased for Fabrikam in the Fabrikam-US company.

For more information about how to create address books, see [Create address books](http://technet.microsoft.com/library/98082cf8-7e21-42a4-bd8b-ee37ba108df2(AX.60).aspx) (http://technet.microsoft.com/library/98082cf8-7e21-42a4-bd8b-ee37ba108df2(AX.60).aspx).

Work with address reference data and party record information

In addition to creating address books, you can work with address reference data, such as countries/regions, states, and ZIP/postal codes, and more detailed elements of party records, such as address and contact information purposes.

An address and contact information purpose describes the reason or use of a particular address or telephone number. For example, if a customer record contains an address for each of the customer's four locations; you can assign an address purpose to each address. This can help you track where deliveries should be sent, where services are needed, or where mail is sent by using the postal service. For more information about how to create address purposes, see [Set up address and contact information purposes](http://technet.microsoft.com/library/d2cc4e3f-cb49-45e9-9135-2b06c0590067(AX.60).aspx) (http://technet.microsoft.com/library/d2cc4e3f-cb49-45e9-9135-2b06c0590067(AX.60).aspx).

Because numerous distinct address formats are used world-wide, your organization might need to adjust an address format when displaying a postal address. You can use the **Address setup** form to set up information about postal addresses for your organization. For more information about how to set up address formats, see [Key tasks: Set up address formats](http://technet.microsoft.com/library/4dd2cde8-11a8-4607-9054-c9683f00d730(AX.60).aspx) (http://technet.microsoft.com/library/4dd2cde8-11a8-4607-9054-c9683f00d730(AX.60).aspx).

You can set up translations of country/region information. You can view the country/region information in your user language, but the printed country/region information appears in the translated language that you select. For example, if your user language is Danish, and you have a customer in Japan, in Microsoft Dynamics AX, you can view the customer record in Danish, but when the address is printed for a sales order, the country/region information appears in Japanese. For more information about translations, see [Set up global address book translations](http://technet.microsoft.com/library/d6dbb900-16ac-4db6-a352-ab3c3e23be93(AX.60).aspx) (http://technet.microsoft.com/library/d6dbb900-16ac-4db6-a352-ab3c3e23be93(AX.60).aspx).

About date/time data and time zones

There are three types of date and time fields in Microsoft Dynamics AX. They correspond to different data types in the database:

- Combined date/time fields – The preferred method of entering date and time data in Microsoft Dynamics AX. The **datetime** data type stores time and date data in a single field in Coordinated Universal Time (UTC). UTC is the standard time zone that is common to every location in the world, and it is coordinated by the International Bureau of Weights and Measures. It is also known as Greenwich Mean Time. The **datetime** data type is associated with a time zone.
- Date fields – Used to enter dates only. The **date** data type stores a day, month, and year. However, these values are not stored in UTC and cannot be associated with a time zone.
- Time fields – Used to display the number of seconds that have elapsed since midnight for the current date. The **timeOfDay** data type stores an integer value. Time values are not stored in UTC.

Time zones

To express UTC times in the local time, you must set a time zone. The time zone controls the offset from UTC that is the equivalent of the local time. For example, the offset for Moscow is UTC+3.

Your preferred time zone is first set according to the Windows locale of your computer, although it might have been changed by an administrator. Your preferred time zone is used only when displaying combined dates and times.

For more information, see [Set a preferred time zone](http://technet.microsoft.com/library/f12c3cd8-192f-40a6-9177-bd7774c8beec(AX.60).aspx) ([http://technet.microsoft.com/library/f12c3cd8-192f-40a6-9177-bd7774c8beec\(AX.60\).aspx](http://technet.microsoft.com/library/f12c3cd8-192f-40a6-9177-bd7774c8beec(AX.60).aspx)).

Arabic calendar

For Arabic-language installations, you can also set which calendar to use in calculating dates: Gregorian, Hijri, or Um al-Qura.

Electronic signature overview

This topic provides an overview of electronic signatures and describes how they can be used in Microsoft Dynamics AX.

What is an electronic signature?

An electronic signature confirms the identity of a person who is about to start or approve a computing process. In some industries, an electronic signature is as legally binding as a handwritten one.

Electronic signatures are a regulations compliance requirement for several regulated industries, such as pharmaceuticals, food and beverage, and aerospace and defense. They are also necessary for compliance with regulations in 21 CFR Part 11 issued by the Food and Drug Administration (FDA) in the United States.

Note:

An electronic signature by itself is not the same as a digital signature. An electronic signature is simply a substitute for a handwritten signature, while a digital signature provides additional security measures. A digital signature can help identify whether another user or process has tampered with the data. A digital signature can also be verified, and this verification cannot be refuted by the owner of the certificate that was used to sign the data. As described below, electronic signatures in Microsoft Dynamics AX have built-in digital signature functionality.

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Electronic signatures in Microsoft Dynamics AX

In Microsoft Dynamics AX, you can use electronic signatures for critical business processes. Some processes have built-in electronic signature capabilities. You can also create custom signature requirements for any database table and field. For more information, see [Choose processes that require electronic signatures](#).

Electronic signatures in Microsoft Dynamics AX have built-in digital signature functionality. Each user who signs documents must obtain a valid cryptographic certificate. When a document is signed, the private key associated with that certificate is validated. (For more information, see [Certificates for electronic signatures](#) ([http://technet.microsoft.com/library/dcad68bf-4019-4c6e-ad22-380651c55f2f\(AX.60\).aspx](http://technet.microsoft.com/library/dcad68bf-4019-4c6e-ad22-380651c55f2f(AX.60).aspx)).

Microsoft Dynamics AX records electronic signature information in a log to provide an audit trail.

Set up users to sign documents electronically

To sign documents electronically, a user must meet the following criteria:

- A user must belong to a role that is assigned the appropriate privileges.
- A user must have a valid certificate and password. For information about certificates, see [Certificates for electronic signatures](#) ([http://technet.microsoft.com/library/dcad68bf-4019-4c6e-ad22-380651c55f2f\(AX.60\).aspx](http://technet.microsoft.com/library/dcad68bf-4019-4c6e-ad22-380651c55f2f(AX.60).aspx)).

Three kinds of users typically require security access to electronic signatures: electronic signature administrators, signers, and electronic signature auditors.

Electronic signature administrator

The electronic signature administrator sets up signature requirements, general parameters, and approvers, and receives alerts when signatures cannot be verified. By default, a user who belongs to the **Information technology manager** security role has permission to administer electronic signatures.

Signer

A signer provides electronic signatures for documents and processes that require signatures. By default, a user who belongs to the **System user** security role has permission to sign documents electronically.

Note:

The signer may require additional permissions to access data that is related to the document or process that is being signed. A user who changes data, and then must sign for those changes, must have permission to change the data. A user who signs on behalf of another user may not require access to the data. An example of this kind of user is a supervisor who signs for an employee's changes.

Electronic signature auditor

The electronic signature auditor reviews the database log and the signature review log that is available from the database log. By default, a user who belongs to the **Information technology manager** security role has permission to audit electronic signatures.

If you use a role other than **Information technology manager**, make sure that the role is assigned the following privileges:

- **View electronic signature failures**
- **View database log**

For more information, see [Create or modify a security role](#) ([http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c\(AX.60\).aspx](http://technet.microsoft.com/library/69f36fc7-9792-410f-9f75-5a3cb74ab97c(AX.60).aspx)).

Choose processes that require electronic signatures

When you require electronic signatures for a process, the process cannot continue until the signature is provided. By default, the electronic signature functionality is available for the following manufacturing processes:

- Approve route
- Approve route version
- Activate route version
- Approve bill of materials (BOM)
- Approve BOM version
- Activate BOM version
- Release production order
- Report production order as finished

You can also set up a custom electronic signature requirement for a table or field in Microsoft Dynamics AX.



Caution:

Custom requirements for electronic signatures can cause application errors. Make sure that you test the effects of a custom requirement for electronic signatures before you implement the requirement in a production environment.

Follow these recommendations when you set up custom requirements for electronic signatures:

- We recommend that you do not set up signature requirements for the following actions on the following tables.

Table	Action
LedgerJournalTable	<ul style="list-style-type: none"> • Insert • Update • Delete
VendTable	<ul style="list-style-type: none"> • Insert
CustTable	<ul style="list-style-type: none"> • Insert • Delete
SalesTable	<ul style="list-style-type: none"> • Insert • Delete

If one of the tables in the previous list has a signature requirement and a user makes changes in the corresponding form, the message "Transaction does not contain a required signature" is displayed, and changes are not saved.

- We recommend that you do not set up signature requirements on the tables in an inheritance hierarchy. If some tables in the hierarchy have a signature requirement but others do not, and a user tries to insert a record, the record is not inserted. For example, the DirPerson and DirOrganizationBase tables inherit from the DirPartyTable table. If the DirPartyTable table has a

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signature requirement, but the DirPerson table does not, a new record cannot be created in the DirPerson table.

- We recommend that you do not set up a custom requirement for an electronic signature on a table that contains date-effective records.
- Custom signature requirements are not supported on tables or fields that are updated through Enterprise Portal for Microsoft Dynamics AX or Application Integration Framework (AIF). Requirements for electronic signatures on these tables and fields cause errors.

Require electronic signatures for an existing process

Use this procedure to require electronic signatures for built-in processes or processes that you previously created.

1. Click **Organization administration > Setup > Electronic signature > Electronic signature requirements**.
2. Select the check box next to each process that requires electronic signatures.
3. For signature requirements that you created, you can click the **Properties** button to modify the signature requirement. You can change the table, field, or action that requires a signature.



Note:

You cannot change the properties for built-in processes.

4. Close the form.

Set up a custom requirement for electronic signatures

Electronic signatures help guarantee compliance and accountability, and may be either mandated by law or required by company policy for critical business processes. The following examples show potential uses for electronic signatures:

- In financials, accountability is important. Electronic signatures can be required when purchase orders are approved or tax documents are submitted to government entities.
- In human resources, electronic signatures can be used for offer letters, compliance forms, handbook and policy acknowledgements, position approvals, new hires, transfers, or promotions.
- In the public sector, signatures can be required when purchase orders, budgets, budget revisions, or journals are approved.

Use this procedure to create a requirement for electronic signatures for a process.

1. Click **Organization administration > Setup > Electronic signature > Electronic signature requirements**.
2. Press CTRL+N or click **New** to create a new record.
3. Enter a name for the signature requirement.
4. Click **Properties** to open the **Signature requirement details** form.
5. Select the table where the data that must be signed is stored.
6. Select the field in the table that you want to monitor.
7. Specify when a signature is required. Select **Always** if a signature is required whenever the data in the field changes. Select **Only** if a signature is required only under certain conditions. If you select **Only**, you must also select one of the following options:
 - **When a record is inserted** – A signature is required only when a new record is created.

- **When a record is updated** – A signature is required only when a record is changed.
- **When a record is deleted** – A signature is required only when a record is removed from the table.

**Note:**

To require a signature any time that a record is inserted into or deleted from a table, we recommend that you select only that table. To require a signature any time that a record is changed, you must select both a table and a field.

8. Click **OK** in the **Signature requirement details** form to save your changes and close the form.
9. Close the **Electronic signature requirements** form.
10. Restart any Microsoft Dynamics AX clients that were open when the new requirement was set up. If a client has not been restarted, and the user attempts to change a field that now requires a signature, the user will get an error.

About Intrastat

Intrastat reporting is the system that is used to record information and generate statistics on the compulsory declaration of movements of goods to or from other Member States of the European Union (EU). Intrastat reporting is required whenever a transaction crosses the border of another EU country/region.

General steps in the Intrastat process

The following steps illustrate the overall flow of information that is used for Intrastat reporting.

1. Enter a transaction that crosses the border of another EU country/region. When you create a sales order, free text invoice, purchase order, or project invoice, the line transactions will be transferred to the **Intrastat** form. Information is transferred only if the **Country/region type** field in the **Vendors** or **Customers** form for the sender or receiver of the goods is **EU**. The **Transaction code** field in the **Intrastat** form is set to the default value that was specified in the **Foreign trade parameters** form. You can change the default value, and complete other Intrastat-related fields manually, before you post the invoice or receipt. When a document line is created, default entries for Intrastat-related fields are taken from the document header. You can change the information on the lines before you post the document and transfer transactions to the **Intrastat** form.
2. Generate Intrastat transactions by using the **Intrastat** form. The information for the **Intrastat** form is found in and transferred from customer packing slip journals, vendor product receipt journals, and invoice journals in Accounts receivable, Procurement and sourcing, and Project management and accounting.

Setup

The following steps illustrate the setup process for Intrastat.

1. Select base data for Intrastat. This can be found in the **Address setup**, **Commodity codes**, **Transaction codes**, **Transport method**, **Port**, and **Statistics procedure** forms. In addition to this information, you can also include information about weight, origin, additional units, and charges on net amount.
2. Set up default values for Intrastat transactions in the **Foreign trade parameters** form.

Prerequisites for transferring transactions to the Intrastat form

The following table shows requirements that must be completed before Intrastat transactions can be generated.

Form	Prerequisite
<p>Foreign trade parameters (Click Organization administration > Setup > Foreign trade > Foreign trade parameters.)</p>	<ol style="list-style-type: none"> 1. Click Country/region properties. 2. In the Country/region type field, verify that the selected country/region has a value of EU. 3. Click Intrastat. On the General FastTab, in the Transaction code field, select the transaction code for sales and purchase orders. 4. Click Compress, and then select the criteria that must be identical for the compression of Intrastat order lines. 5. Click the Transfer and Check setup FastTabs, and then select other specific criteria for transferring transactions to Intrastat. 6. Click Number sequences, and then specify number sequences for foreign trade documents. <p> Note: The country/region that you are sending goods to or receiving goods from must be in the EU.</p>
<p>Address setup (Click Organization administration > Setup > Addresses > Address setup.)</p>	<ol style="list-style-type: none"> 1. Click Country/region. 2. Specify the Country/region and ISO field values for the relevant countries/regions.
<p>Legal entities (Click Organization administration > Setup > Organization > Legal entities.)</p>	<ol style="list-style-type: none"> 1. Click the Foreign trade and logistics FastTab. 2. In the VAT exempt number export field, select the tax exempt number for export (dispatches). 3. In the Branch number extension export field, specify the branch number that is used in association with the value in the VAT exempt number export field. 4. In the VAT exempt number import field, select the tax exempt number for import (arrivals). 5. In the Branch number extension import field, specify the branch number that is used in association with the value in the VAT exempt number import field. 6. In the Intrastat code field, enter the Intrastat code for the relevant countries/regions.

Form	Prerequisite
Released product details (Click Product information management > Common > Released products . Select a record. On the Action Pane , click Edit .)	<ol style="list-style-type: none"> 1. Click the Foreign trade FastTab. 2. Select Commodity. Specify any other relevant field values. 3. Click the Manage inventory FastTab. 4. Enter a value in the Net weight field.
Customers (Click Accounts receivable > Common > Customers > All customers . Select a customer account. On the Action Pane , click Edit .)	<ol style="list-style-type: none"> 1. Click the Addresses FastTab. Click Edit. 2. Select a Country/region.
Vendors (Click Accounts payable > Common > Vendors > All vendors . Select a vendor account. On the Action Pane , click Edit .)	<ol style="list-style-type: none"> 1. Click the Addresses FastTab. Click Edit. 2. Select a Country/region.

Generate Intrastat transactions

The following steps illustrate the process for generating Intrastat information for reporting.

1. Click **Organization administration > Periodic > Foreign trade > Intrastat**.
2. Click the **Transfer XX** button, where **XX** is the International Organization for Standardization (ISO) code for the country/region, as specified in the **Address setup** form.
3. Verify the types of transactions that will be included, and then click **OK**.

Case management

You can use case management in Microsoft Dynamics AX and in Enterprise Portal for Microsoft Dynamics AX to record, update, track, follow up on, and close issues that are raised by your customers, vendors, or employees, or that are created through your audit processes. By planning, tracking, and analyzing cases, you can develop efficient resolutions that can be used for similar issues.

For example, when customer service representatives or human resources generalists create cases, they can find information in knowledge articles about how to work with or resolve a case more efficiently. For more information about knowledge articles, see [Store a knowledge article](http://technet.microsoft.com/library/1e4803d8-6278-47f2-8518-2caa7d15df49(AX.60).aspx) ([http://technet.microsoft.com/library/1e4803d8-6278-47f2-8518-2caa7d15df49\(AX.60\).aspx](http://technet.microsoft.com/library/1e4803d8-6278-47f2-8518-2caa7d15df49(AX.60).aspx)).

Because you can use case management for customer, vendor, or employee issues, the **Cases** form is located in **Home** in Microsoft Dynamics AX. Audit cases are always managed in **Compliance and internal controls**, even when they relate to documents that are created in other modules.

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Setup

Vince, the operations manager for Fabrikam, wants customer service representatives and human resources generalists to be able to create cases for customers, vendors, and employees. Before any one of these cases can be created, Vince must set up case categories and case processes.

Cassie, an internal auditor at Fabrikam, wants audit cases to be generated automatically when the audit policy is run against expense reports. Each audit case contains a group of audit policy violations.

Cassie also wants to have the option to create audit cases manually. For these cases, she can use the categories that are created when an audit policy is run, or she can create special categories to use for cases that are manually created.

For more information about how to create case processes and categories, see [Create case processes and categories](http://technet.microsoft.com/library/f2b47520-5705-49db-9e5d-9ebf4997842b(AX.60).aspx) ([http://technet.microsoft.com/library/f2b47520-5705-49db-9e5d-9ebf4997842b\(AX.60\).aspx](http://technet.microsoft.com/library/f2b47520-5705-49db-9e5d-9ebf4997842b(AX.60).aspx)).

Case grouping and categories

The first step for Cassie is to determine how audit violations should be grouped into cases. By default, each audit case contains all of the audit violations that were created for a particular document type and audit policy rule. Cassie can specify other case grouping criteria if she chooses. For more information about audit case grouping, see [Key tasks: Audit policies](http://technet.microsoft.com/library/6f34aced-dcd8-43ab-9d0f-763f8c5e2b7a(AX.60).aspx) ([http://technet.microsoft.com/library/6f34aced-dcd8-43ab-9d0f-763f8c5e2b7a\(AX.60\).aspx](http://technet.microsoft.com/library/6f34aced-dcd8-43ab-9d0f-763f8c5e2b7a(AX.60).aspx)).

The first thing Vince must do is create categories for cases. Case categories group similar case types together. For example, Vince might create categories for sales, employee benefits, or deliveries. He might also create child categories that group the cases at a more detailed level. For example, under a sales category, Vince could add child categories for pre-sale issues and post-sale issues.

Cassie can decide to create categories for cases that are created manually. She does not have to create categories for audit cases that are created automatically.

Every case must be assigned to a case category.

Grouping cases by category can help Fabrikam employees identify known solutions, such as knowledge articles, if similar issues occur over time.

Processes

After they create case groupings and categories, Vince and Cassie can create the processes that every case must follow from beginning to resolution. For example, a process might require that a case issue be assigned to a Fabrikam employee within 24 hours of when the case is created.

Working with cases

After setup is complete, Fabrikam employees with the appropriate permissions can create cases as issues are raised. Cases can be created in Microsoft Dynamics AX and in Enterprise Portal.

The following table describes tasks that Fabrikam employees can perform when they work with case management.

Task	Description
Create a case (http://technet.microsoft.com/library/63fd16e1-fbe4-4c62-abfe-5f73dd196485(AX.60).aspx)	Create a new case record for a customer, vendor, or employee, or for the results of an audit of business documents.

Task	Description
Add details to a case (http://technet.microsoft.com/library/ed8a7326-8378-4270-bccc-35d38b1b9355(AX.60).aspx)	Add detailed information such as activities to a case.
Close a case (http://technet.microsoft.com/library/98582959-b072-447e-857c-6844d76306ed(AX.60).aspx)	Change the status of an open case to Closed to indicate that the issue has been resolved.
Store a knowledge article (http://technet.microsoft.com/library/1e4803d8-6278-47f2-8518-2caa7d15df49(AX.60).aspx)	Create and store a knowledge article that includes tips, solutions, and other important information about an issue.
Rank a knowledge article (http://technet.microsoft.com/library/5fa1dcb2-b627-4ea9-b514-7a1914d534b2(AX.60).aspx)	Rate a knowledge article to indicate if it was successful in helping to close a case.

Example: How Fabrikam uses case management for customers in the private sector

Lisa, a customer service representative at Fabrikam, receives a telephone call from Lionel, a Fabrikam customer. Lionel is having trouble setting the correct volume level on the new sound system that Fabrikam just installed in Lionel's music store. Lisa creates a case for Lionel and assigns the category Volume to the case. Because Lisa knows that it is important for Lionel to have music in his store, she elevates the priority and assigns a one-day service level agreement (SLA) to the case. She also enters the case details in the case log. Lisa notices that there are several knowledge articles that are associated with the Volume category and that three of them are marked as helpful in resolving cases.

Lisa opens each article and discusses the resolution steps with Lionel, but none of the solutions solve the problem that Lionel is encountering with his new sound system. Lisa tells Lionel that within 24 hours an audio technician will call him and will work with him to attempt to solve the problem. Lisa activates the case and a set of activities is created. She assigns the activities to Terrence, a member of the audio engineering team.

Terrence sees that new activities have been assigned to him. He opens the case and reads the case log to learn more about the case. Terrence encountered the same issue the day before, and he developed a solution. Terrence contacts Lionel and offers a solution for the issue. Terrence also enters the solution in the case details. His solution is successful, and he decides to document the solution for others to use if they encounter the same problem. Terrence adds the document to the **Knowledge article** form, assigns the document to the Volume category, and manually elevates the ranking so that other Fabrikam employees will know that this is a successful solution.

Now Terrence elevates the case to the next level. Elevating the case creates a new activity for Marie, who is a quality assurance representative in the customer service department. Marie sees that a new activity is assigned to her, and she opens the case that is associated with the activity. Marie reviews the case and the case details to make sure that the process was followed correctly for the case. She verifies that the actual case time did not exceed the timeframe that was estimated in the SLA. She notes that Terrence contacted the customer and that the issue was resolved. Marie is satisfied with the treatment of the customer and the results of the case. She resolves the case as closed. When Marie closes the case, the open activity that is assigned to her is also closed.

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Example: How City Power and Light uses case management for customers in the public sector

Annie, a customer service representative with City Power and Light, receives a telephone call from a resident of the city that is served by City Power and Light. Annie records the call as an activity and takes notes of the conversation.

The resident tells Annie that his house has no power. Annie informs the resident that City Power and Light will investigate, locate, and resolve the problem as quickly as possible. She then creates a case, associates the telephone call with the case, and creates a service order.

Annie knows that it is likely that other residents will call to report a power outage. To avoid overwhelming the customer service center, and to save time, Annie sends a group instant message to inform the other representatives about the issue and to tell them that a case and service order have been created. She includes the case number and service order number in her instant message. If City Power and Light receives more telephone calls about the power outage, the customer service representatives can create an activity for each telephone call and assign them to the existing case.

Examples: How Fabrikam uses case management for employees

The following scenarios show how Fabrikam Human Resources generalists in different locations can use case management when they address issues for employees.

In the United States

Luke, the Human Resources generalist for the United States division of Fabrikam, receives an e-mail message from Shannon, a Fabrikam employee. Shannon is a machine operator who was injured on the job six months ago. She has been working with Humongous Insurance since the accident to have her medical expenses paid.

Shannon contacted Luke regarding this issue four weeks ago. Therefore, a case has already been created. Shannon's e-mail message explains that Humongous Insurance is still not returning her telephone calls. Luke opens the existing case, adds Shannon's e-mail message as a document, and reviews the case log.

When Luke created this case, he assigned it to the case category Insurance. He sees that there is a new knowledge article that is associated with the Insurance category. Luke reads the knowledge article and learns that Humongous Insurance's telephone system is being updated and that all phones are down. The article states that an e-mail message was sent to all insurance customers but that several customers did not receive the message because of a problem with the insurance company's e-mail system. All customers who have active insurance claims are being asked to send their inquiries by e-mail or by paper mail to Humongous Insurance.

Luke sends Shannon an e-mail message that explains what she must do to have her insurance claim settled. He also ranks the knowledge article that he read as a helpful piece of information.

Luke creates another activity for himself to follow up with both Shannon and Humongous Insurance in four weeks to make sure that the claim has been resolved. After four weeks have passed, Luke checks in with Shannon and learns that Humongous Insurance has paid her claims and that she is happy with the resolution. Luke changes the status of the case to Closed.

In the United Kingdom

Cristine, the Human Resources generalist for the United Kingdom division of Fabrikam, receives a telephone call from Claus, a Fabrikam employee. Claus informs Cristine that nine weeks ago, immediately after the birth of his son, he changed the number of dependents on his tax withholdings. Claus wants to know why the changes have not become effective.

Cristine creates a case for Claus. She reviews Claus's tax information and learns that although Claus did enter new dependent information, he did not select a start date for the new tax withholdings. Cristine sends an e-mail message to inform Claus that he must select a start date and resubmit his changes. Claus replies to Cristine's message and tells her that he has now selected a start date and resubmitted his changes. Cristine attaches the e-mail message from Claus to the case record, verifies that the correct changes were made and submitted, and closes the case.

Plan maintenance of Microsoft Dynamics AX

The Microsoft Dynamics AX system, like any other software system, requires ongoing monitoring and maintenance. Routine maintenance includes the following tasks:

- Backing up databases
- Monitoring alerts that are generated by infrastructure components, Microsoft Dynamics AX components, or the database
- Monitoring your infrastructure and applications to make sure that service level agreements are met
- Installing applicable hotfixes or updates

Before you implement a Microsoft Dynamics AX system in production, determine a maintenance strategy that meets the needs of your company. You must have a maintenance strategy for each environment that you run. This includes development, test, production, and training environments.

The topics in this section provide information about how to maintain Microsoft Dynamics AX and its components.

[Plan backup and recovery](#)

[Use alerts to monitor Microsoft Dynamics AX](#)

[Plan for updates and hotfixes](#)

Plan backup and recovery

By carefully planning and implementing a backup and restore strategy, you can help protect your environment against data loss. In addition to the transaction data that is stored in the business databases, all models and customizations are now stored in the model store databases. Therefore, we recommend that you protect both the business databases and the model store databases in your Microsoft Dynamics AX environment. Develop a strategy, and regularly test your backup and recovery procedures to make sure that you are prepared to effectively respond to a failure or disaster.

Important:

Microsoft Dynamics AX does not include any built-in backup and recovery tools. We assume that you rely on Microsoft SQL Server or other tools that support backup and recovery. For example, Microsoft System Center Data Protection Manager can be used to protect Microsoft Dynamics AX. For more information, see [How to Protect Microsoft Dynamics AX 2009 with System Center Data Protection Manager 2007 sp1](http://go.microsoft.com/fwlink/?LinkId=230427) (http://go.microsoft.com/fwlink/?LinkId=230427) and the [Data Protection Manager documentation](http://go.microsoft.com/fwlink/?LinkId=230428) (http://go.microsoft.com/fwlink/?LinkId=230428).

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The importance of backups

A backup is a copy of a database that is used to restore and recover data after a system failure. By using appropriate backups, you can recover from many failures, such as the following kinds:

- Media failures
- User errors, such as a table that is dropped by mistake
- Hardware failures, such as a damaged disk drive or permanent loss of a server
- Natural disasters

Database backups are also useful for routine purposes. For example, you can use a database backup to copy the database from one server to another, set up database mirroring, or archive the database for governmental purposes. For information about how to select and implement a backup and recovery strategy, see your database documentation.

Databases that must be backed up

Include all the databases in your Microsoft Dynamics AX system in your backup and restore strategy:

- The SQL Server Microsoft Dynamics AX business database.
- The Microsoft Dynamics AX model store database. The name of this database consists of the name of the business database plus **_model**.
- The Microsoft SharePoint Server 2010 databases that support Enterprise Portal for Microsoft Dynamics AX.
- The SharePoint 2010 products databases that support Enterprise Search.
- The Microsoft SQL Server Reporting Services database that supports ad hoc reporting.
- The Microsoft SQL Server Analysis Services database that supports OLAP reporting.
- The Microsoft BizTalk Server database, if BizTalk Server is deployed.
- Databases that are used by any applications that are integrated with Microsoft Dynamics AX.

Backup and recovery strategies

A well-designed backup and recovery strategy maximizes data availability and minimizes data loss. The actual amount of data that is available and the amount of data that is lost depend on your business requirements, environment, and resources. A backup and recovery strategy is based on service level agreements for recovery point objective (RPO) and recovery time objective (RTO).

- A recovery point objective specifies the acceptable interval between backups, or how much data loss is acceptable.
- A recovery time objective specifies the service level agreement for the time that a recovery takes.

A backup strategy defines the type and frequency of backups, the nature and speed of the hardware that is required for backups, and backup security. A backup strategy also defines how backups are tested, where backup media is stored, and how it is stored.

A recovery strategy defines how to restore databases to meet your goals for availability of the database and for minimizing data loss. A recovery strategy also defines who recovers the data.

We recommend that you document your backup and recovery procedures and that you keep a copy of the documentation in your operations manual.

Designing an effective backup and recovery strategy requires careful planning, implementation, and testing. Consider the following factors:

- RPO and RTO
- Availability requirements
- Constraints on resources, such as hardware, personnel, space for storing backup media, and the physical security of the stored media
- The use of each of your databases:
 - How often does the data in each database change?
 - Are some tables modified more often than others?
 - What are your critical time periods? What are the usage patterns during these periods?
 - When does the database experience heavy use that causes frequent inserts and updates? You may want to schedule differential or log backups during periods of heaviest use, and full backups during off-peak hours.
 - Does the database require additional protection, or can the information that it stores be re-created from other sources and still comply with your service level agreements?

Planning for disaster recovery

To guarantee that all your systems and data can be quickly restored to regular operation if a disaster occurs through natural or human causes, you must implement a comprehensive disaster recovery plan. As you create this plan, consider the various kinds of disasters that might affect your organization. These disasters might include natural disasters, such as a fire, and technical disasters, such as a multi-disk failure in a RAID. When you create a disaster recovery plan, identify the steps that are required to respond to each kind of disaster. You must test the recovery steps for each scenario. We recommend that you verify the robustness of your disaster recovery plan by simulating a catastrophic event.

When you plan for disaster recovery, consider your specific environmental and business needs. For example, if a fire occurs and wipes out your 24-hour data center, are you sure that you can recover? If you can recover, how long does it take you to recover and make your system available? How much data loss can your users tolerate?

We recommend that your disaster recovery plan specify how long recovery should take and the final database state that users can expect. For example, you may determine that recovery can be completed in 48 hours after replacement hardware is acquired, and that data can be guaranteed only until the end of the previous week.

A disaster recovery plan can be structured in various ways and can contain many kinds of information. A comprehensive recovery plan contains the following elements:

- A plan to acquire hardware, or to create and share virtual servers in another location.
- A communication plan.
- A list of people who must be contacted if a disaster occurs.
- Instructions for contacting the people who are involved in the response to the disaster.
- Information about who will administer the plan.
- A checklist of the tasks that are required for each recovery scenario. To help you review the disaster recovery later, initial each task on the checklist as it is completed, and indicate the time that the task was completed.

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To guarantee that you are ready for disaster, we recommend that you periodically perform the following actions:

- Perform regular backups of databases, transaction logs, and file systems to minimize the amount of data that is lost. We recommend that you back up both system databases and user databases.
- Test your backup and recovery procedures thoroughly. You must perform appropriate testing to make sure that you have the backups that are required to recover from various failures, and that the backups function correctly. Testing also helps you make sure that your procedures are clearly defined and documented, and that they can be executed smoothly and quickly by any qualified operator.
- Maintain system logs in a secure manner. Keep records of all service packs that have been installed for Microsoft Windows, your database, and Microsoft Dynamics AX.
- On another server or set of servers, test the steps that are required to recover from a disaster. If necessary, modify the steps so that they are appropriate to the server environment, and then test the modified steps.
- Make sure that you understand and document the database rights that are required to recover the database.
- Plan for the loss of your whole infrastructure and each Microsoft Dynamics AX server component. Additionally, consider the effect if the domain controller for your Microsoft Dynamics AX implementation is lost.
- Make sure that you identify all employees who perform recovery tasks. Additionally, make sure that you document all tasks that are required, so that the tasks can be performed even if those specific employees are unavailable.

Next steps

For more information about how to implement a backup and recovery strategy for your environment, see the following documentation:

- [Back up and recover databases](http://technet.microsoft.com/library/f63959d7-376c-4e69-afe9-0ed03ba13a1f(AX.60).aspx) (http://technet.microsoft.com/library/f63959d7-376c-4e69-afe9-0ed03ba13a1f(AX.60).aspx)
- [Backing Up and Restoring Databases in SQL Server](http://go.microsoft.com/fwlink/?LinkId=215815) (http://go.microsoft.com/fwlink/?LinkId=215815)
- [High Availability and Disaster Recovery for SharePoint Server 2010](http://go.microsoft.com/fwlink/?LinkId=215820) (http://go.microsoft.com/fwlink/?LinkId=215820)
- [Backup and Restore Operations for a Reporting Services Installation](http://go.microsoft.com/fwlink/?LinkId=215818) (http://go.microsoft.com/fwlink/?LinkId=215818)
- [Managing Backing Up and Restoring \(Analysis Services\)](http://go.microsoft.com/fwlink/?LinkId=215819) (http://go.microsoft.com/fwlink/?LinkId=215819)

Use alerts to monitor Microsoft Dynamics AX

Several alert systems are available to help you monitor Microsoft Dynamics AX and associated software components. The following table lists the alert systems that are available, and where you can learn more about them.

Alert system	More information
The alert system in Microsoft Dynamics AX	System and Application Setup Help, which is available from the Help menu in Microsoft Dynamics AX
The alert system that is provided for your database	Your database documentation
The Windows performance monitor	The Windows documentation
The Windows event log	The Windows documentation

Plan for updates and hotfixes

The information in this section can help you plan for service releases that Microsoft offers for Microsoft Dynamics AX.

[Overview of updates and hotfixes](#)

[Obtaining updates and hotfixes](#)

[Process for installing updates](#)

See Also

[Apply updates and hotfixes](http://technet.microsoft.com/library/7ff68f32-bb5e-4572-a205-9fb759ebd0ba(AX.60).aspx) (http://technet.microsoft.com/library/7ff68f32-bb5e-4572-a205-9fb759ebd0ba(AX.60).aspx)

Overview of updates and hotfixes

This topic describes the types of updates that are available for Microsoft Dynamics AX 2012 and the deployment process for updates. The topic also describes the naming convention that is used for updates and the structure of update packages.

Types of updates

This section describes the types of updates that are available for Microsoft Dynamics AX.

Hotfixes

A hotfix is code that resolves selected bugs that affect key features or a significant number of Microsoft Dynamics AX installations. A hotfix can address either a single issue or a cumulative set of issues.

Microsoft publishes a corresponding Knowledge Base (KB) article for every hotfix that is released for every Microsoft product. These products include Microsoft Dynamics AX. These KB articles describe the changes that the hotfix makes to objects, database tables, or files, or other code. Each hotfix is released to address a specific issue or scenario to restore the normal operation of the software. You must review the corresponding KB article to evaluate whether you have to apply the hotfix in your Microsoft Dynamics AX implementation.

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Microsoft Dynamics AX has the following standard types of hotfix:

- Binary hotfixes – Objects and components that are installed by using standard Windows installer (MSI) files are patched with Windows Installer Patch (MSP) files and are applied by using AXUpdate.exe. These updates are cumulative: each binary hotfix contains changes from all previously released hotfixes.
- Application hotfixes – Application hotfixes are those that are provided by using application model (.axmodel) files to any of the Microsoft application patch layers (SYP, GLP, FPP, SLP). Unlike binary hotfixes, application hotfixes target a specific fix and are not cumulative in nature.



Important:

All application hotfix model files must be installed by using AXUpdate.exe; importing these application models manually is explicitly unsupported and may result in errors.

- Pre-processing hotfixes – Pre-processing hotfixes are applied to data upgrade scripts (for example, DatabaseUpgrade) that are run on Microsoft Dynamics AX 4.0 and Microsoft Dynamics AX 2009 systems before upgrading to Microsoft Dynamics AX 2012.

Cumulative updates

A cumulative update (CU) is an update that contains all previous hotfixes to date. Additionally, a CU contains fixes for issues that meet the criteria for hotfix acceptance. These criteria may include the availability of a workaround, the effect on the customer, the reproducibility of the problem, and the complexity of the code that must be changed.

Service packs

A service pack is a tested, cumulative set of all hotfixes and updates. Service packs may also contain additional fixes for problems that have been found internally since the release of the product, and a limited number of design changes or features that were requested by customers.

Deployment process for updates

For any update that affects code or the database schema, we recommend that you first back up your database, then deploy updates, make all required changes to customizations, and compile your code in a test environment. After your system has been compiled in the test environment, we recommend that you use the Windows PowerShell Import-AXModelStore cmdlets to deploy changes to the production environment. This approach requires the least downtime for your production system. For more information, see [Deploying Customizations Across Microsoft Dynamics AX 2012 Environments \(White paper\)](#).

Naming convention for update packages

The following naming convention is used for packages that service Microsoft Dynamics AX:

`<ProductName>-KB<KBNumber>-v<PackageVersionNumber>-<ServicePackLevel>.exe`.

For example, a package might be named DynamicsAX2012-KB123456-v2-SP2.exe. The following table explains the name segments that are used in package names.

Name segment	Description
<ProductName>	This segment indicates the name of the product that is being serviced. For packages that service Microsoft Dynamics AX 2012, this segment is DynamicsAX2012.

Name segment	Description
<KBNumber>	This segment indicates the KB article that corresponds to the package, such as KB123456.
<PackageVersionNumber>	This segment is not used for the first release of a package. If the package is recalled or otherwise re-released, this segment indicates the revision of the package, such as v2, v3, or v4.
<ServicePackLevel>	This segment indicates the service pack level that the package services. This segment is used only for packages that must be applied to a product for which Service Pack 1 or a later version is installed. This segment is not used for packages that service the original release version of a product, for which no service packs are installed.

Update package structure

This section describes the structure of update packages.

When you run the self-extracting executable package, you unpack a folder. The following table describes the files and folders that this folder contains.

Name	Type of update that the file or folder is used for	Description
AXImpactAnalysis.exe	Application updates	The version of the Update wizard that you can run to analyze the effect of the update on customizations in your environment. Although AXImpactAnalysis.exe may be included in binary update packages, running it provides no additional information if you run it.
AXUpdate.exe	Binary and application updates	The Update wizard that you can run to install MSP and model files that are required for the update.
DatabaseUpgrade	Updates to pre-processing files that are shipped in cumulative updates	A folder that contains updated pre-processing files that are used to upgrade from Microsoft Dynamics AX 4.0 or Microsoft Dynamics AX 2009 to Microsoft Dynamics AX 2012.
LicenseTerms	Binary and application updates	A folder that contains the license terms that you must agree to before you can install an update. This folder is used by AXUpdate.exe.
Models	Application updates	A folder that contains the models that are being updated. This folder is used by AXUpdate.exe.

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Name	Type of update that the file or folder is used for	Description
MSI	Binary updates	A folder that contains subfolders for the components of Microsoft Dynamics AX that are being updated. Each subfolder contains one or more MSP files. This folder is used by AXUpdate.exe.
Support	Binary and application updates	A folder that contains support files and subfolders that are called by AXUpdate.exe. The files and subfolders include language-specific files for AXUpdate.exe. This folder is used by AXUpdate.exe.

Obtaining updates and hotfixes

This topic describes how to find hotfixes or updates.

For Microsoft Dynamics AX 2012, we provide general landing pages for hotfixes and cumulative updates on [CustomerSource](http://go.microsoft.com/fwlink/?LinkId=232954) (http://go.microsoft.com/fwlink/?LinkId=232954) and [PartnerSource](http://go.microsoft.com/fwlink/?LinkId=232950) (http://go.microsoft.com/fwlink/?LinkId=232950).

You can also search [CustomerSource](http://go.microsoft.com/fwlink/?LinkId=210925) (http://go.microsoft.com/fwlink/?LinkId=210925) or [PartnerSource](http://go.microsoft.com/fwlink/?LinkId=210926) (http://go.microsoft.com/fwlink/?LinkId=210926) for Knowledge Base (KB) articles, and for information about hotfixes and updates that have been released. Search for the term *hotfix* or *cumulative update*. If you do not find information about the specific issue that you are experiencing, you can try one of the following options:

- Open a support request by contacting your partner or value-added reseller (VAR).
- If you are enrolled in a support plan directly with Microsoft, log on to [CustomerSource](https://mbs.microsoft.com/support/newstart.aspx) (https://mbs.microsoft.com/support/newstart.aspx), and submit a new support request.

Process for installing updates

This topic describes an overall process that you can use to install updates and hotfixes.

It is important that day-to-day operation of your business be disrupted as little as possible when you install hotfixes. We recommend that you become familiar with the Microsoft Service Management Functions [Operations Framework Guide](http://www.microsoft.com/technet/solutionaccelerators/cits/mo/smf/default.msp) (http://www.microsoft.com/technet/solutionaccelerators/cits/mo/smf/default.msp). This guide contains information about how to define processes, establish best practices, and manage IT solutions.

Evaluate the hotfix

Each hotfix is created to address a specific issue, problem, or customer scenario. Hotfixes are distributed only to those customers, partners, and organizations that Microsoft technical support personnel determine can benefit from the changes that are made to the code. Each hotfix includes documentation that indicates what files, tables, code, or functions are changed by the hotfix.

Before you install a hotfix, review the knowledge base (KB) article that is released together with the hotfix. The KB article helps you determine whether the hotfix applies to your environment, and how the hotfix affects your environment.

 **Note:**

If you customized your environment before you received a hotfix, thoroughly review the KB article that describes the hotfix. Investigate any objects that are affected by the hotfix to determine whether the changes that are implemented by the hotfix should be merged with customizations in a higher layer, such as BUS, VAR, USR, or CUS.

Back up your database

If the hotfix affects the database, create a full database backup before you apply the hotfix. For more information, see [Back up and recover databases](http://technet.microsoft.com/library/f63959d7-376c-4e69-afe9-0ed03ba13a1f(AX.60).aspx) ([http://technet.microsoft.com/library/f63959d7-376c-4e69-afe9-0ed03ba13a1f\(AX.60\).aspx](http://technet.microsoft.com/library/f63959d7-376c-4e69-afe9-0ed03ba13a1f(AX.60).aspx)).

Test the hotfix in a test environment

After you have decided to install a hotfix, we recommend that you install the hotfix in a test or backup environment. Then validate the hotfix against the implementation, customizations, data, and processes that are currently used in your organization.

Because of the unique architecture of Microsoft Dynamics AX implementations, many issues can be encountered when you install a small code fix or change. We recommend that you test all business scenarios and customizations to verify that the hotfix is behaving as expected, that the hotfix is not affecting other areas, and that the resulting data is correct.

After the hotfix has been tested, you can roll the code changes forward to the production environment. Use the methodology that is described in [Deploying Customizations Across Microsoft Dynamics AX 2012 Environments \(White paper\)](#) and [How to: Export and Import a Model Store](#) ([http://msdn.microsoft.com/library/754c52af-4025-4495-979c-f99d8c5b7d89\(AX.60\).aspx](http://msdn.microsoft.com/library/754c52af-4025-4495-979c-f99d8c5b7d89(AX.60).aspx)). By exporting and importing the model store, you can avoid having to compile code in the production environment.

Install the hotfix

To install a hotfix, follow the instructions in the associated KB article, and in the articles in the [Installing updates and hotfixes](#) ([http://technet.microsoft.com/library/5cb03e74-f02f-4697-ba83-e4460e897d1e\(AX.60\).aspx](http://technet.microsoft.com/library/5cb03e74-f02f-4697-ba83-e4460e897d1e(AX.60).aspx)) section of TechNet. Additionally, make sure that business processes or operations can be restored to their original state if problems occur during or after installation.

- Back up the database that is being updated. By backing up the database, you can roll back to a known, reliable version if you have to. In this manner, you can reduce downtime if an unexpected error occurs.
- Schedule a time when the fewest system users, or no users, are affected. As a best practice, announce the time of the update in advance, to make sure that users are aware of the pending update and the expected downtime. By notifying all users of the time of the update, you can minimize data loss, data corruption, and loss of productivity.
- Make sure that the system runs in single-user mode while the hotfix is installed, and that only the administrator is designated to perform the update. Because changes to the code can affect Application Object Server (AOS), the changes can affect users who are currently on the system.

**Caution:**

Changes to the application may require a compilation or synchronization of the application. These operations increase downtime.

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Validate the hotfix in test and production environments

After the hotfix has been successfully installed, check the install log to make sure that there are no error messages and warnings that can affect the operation of the system. Test the system for the following conditions:

- The change that was implemented by the hotfix is working as expected.
- The change has not affected other areas of the system.
- The Microsoft Dynamics AX application as a whole is working as expected.

Troubleshooting

If errors or issues occur during or after installation of a hotfix, the hotfix must be uninstalled, and the system must be rolled back. Follow these steps to restore your system to the last known, reliable version:

1. If the hotfix installed any binary files, uninstall the hotfix by using the **Add or Remove Programs** item in Control Panel.
2. Restore the application directory and database backups.
3. Synchronize the application with the database, if synchronization is required, to return the implementation to pre-update conditions.
4. Optional: If you require help troubleshooting the installation errors or issues, open a support request by contacting your partner or value added reseller (VAR). Alternatively, if you are enrolled in a support plan directly with Microsoft, you can log on to CustomerSource and submit a new support request.

Install Microsoft Dynamics AX

The Microsoft Dynamics AX [Installation Guide](http://go.microsoft.com/fwlink/?LinkID=163796) (http://go.microsoft.com/fwlink/?LinkID=163796) provides step-by-step installation instructions for deployment of Microsoft Dynamics AX components.

Overview of the installation

This section provides an overview of the installation process and describes the servers that are used in the Microsoft Dynamics AX environment. The following topics are included:

Microsoft Dynamics AX components

This topic describes the components of Microsoft Dynamics AX that you can install by using the Setup wizard.

A minimum installation of Microsoft Dynamics AX consists of a business database, a model store, an instance of Application Object Server (AOS), and at least one client. These components can be installed on computers that are arranged in various topologies, but the system does not run unless all elements are installed.

Databases

Databases include the Microsoft Dynamics AX database, the model store, and the baseline database. The AOS connects to the Microsoft Dynamics AX database to process transactions. The AOS connects to the model store to display application elements such as forms and reports. The baseline database contains a model store that is used to upgrade X++ code to Microsoft Dynamics AX 2012. The baseline database is used to analyze application updates before they are applied.

Note:

Beginning with Microsoft Dynamics AX 2012 R2, the model store and the business data are stored in separate databases. In other versions of Microsoft Dynamics AX 2012, the model store and business data are stored in a single database.

For information about how to install the databases, see [Install the Microsoft Dynamics AX databases](http://technet.microsoft.com/library/bccedbf4-d5fe-4f2b-9767-31bb82c4f037(AX.60).aspx) ([http://technet.microsoft.com/library/bccedbf4-d5fe-4f2b-9767-31bb82c4f037\(AX.60\).aspx](http://technet.microsoft.com/library/bccedbf4-d5fe-4f2b-9767-31bb82c4f037(AX.60).aspx)).

Other Microsoft Dynamics AX components, such as Enterprise Portal and Reporting Services extensions, also include databases. The additional databases are created when you install those components and their prerequisites. They are not installed as part of the Microsoft Dynamics AX databases component.

Server components

Server components include AOS and the Microsoft Dynamics AX components that run on Internet Information Services (IIS). For information about how to install one of the server components, click the corresponding link in the following table.

Component	More information
Application Object Server (AOS)	Install an Application Object Server (AOS) instance (http://technet.microsoft.com/library/8f75137a-fb46-4f22-849a-8153feb7ed8e(AX.60).aspx)
Enterprise Portal for Microsoft Dynamics AX (web server)	Install Enterprise Portal (http://technet.microsoft.com/library/5c2b4f3d-407e-4944-b797-6adab3edfacd(AX.60).aspx)
Enterprise Search (web server)	Install Search (http://technet.microsoft.com/library/5d19f528-02c4-439b-a0b2-7b046137d231(AX.60).aspx)
Help Server (web server)	Install help server (http://technet.microsoft.com/library/705de82a-9883-4ff3-831a-1386457e0824(AX.60).aspx)

Business intelligence components

Business intelligence components provide reporting and analytical functionality that you can use to view and interpret business data. Integration with Microsoft SQL Server Reporting Services lets you create reports by using Reporting Services. Integration with Microsoft SQL Server Analysis Services lets you use

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cubes for business intelligence and analytical reporting in Microsoft Dynamics AX. For information about how to install one of the business intelligence components, click the corresponding link in the following table.

Component	More information
Reporting Services extensions	Install Reporting Services extensions for Microsoft Dynamics AX (http://technet.microsoft.com/library/00a2c290-14b7-4084-bf48-2b22368b7c8a(AX.60).aspx)
Analysis Services configuration	Configure Analysis Services by running Setup (http://technet.microsoft.com/library/300442b3-886e-450f-8f79-6285a26fb459(AX.60).aspx)

Client components

Client components give users access to Microsoft Dynamics AX data and functionality. For information about how to install one of the client components, click the corresponding link in the following table.

Component	More information
Microsoft Dynamics AX Windows client	Install the Microsoft Dynamics AX client (http://technet.microsoft.com/library/ea887acb-7579-4680-b990-5b8a2dff4617(AX.60).aspx)
Microsoft Office Add-ins	Install Office Add-ins (http://technet.microsoft.com/library/7e6aaf42-8ba7-4a4d-af53-06395c0d8730(AX.60).aspx)
Remote Desktop Services integration	Install Remote Desktop Services integration (http://technet.microsoft.com/library/59891698-40b9-4d94-b75a-14e0c1e2231b(AX.60).aspx)

Developer tools

Developer tools are used to customize Microsoft Dynamics AX. For example, you can create customizations or extensions to Enterprise Portal, or you can create advanced production reports for Microsoft Dynamics AX by using Reporting Services. For information about how to install one of the developer tools, click the corresponding link in the following table.

Component	More information
Debugger	Install the debugger (http://technet.microsoft.com/library/8a34aa8c-9d94-4d5a-89c5-988c573e50dd(AX.60).aspx)
Visual Studio Tools	Install Visual Studio Tools (http://technet.microsoft.com/library/03fbd4fd-0e0e-48d6-bf02-a0e600883a37(AX.60).aspx)

Component	More information
Trace Parser	Install the Trace Parser (http://technet.microsoft.com/library/c80a7da2-2914-485b-a797-4c8e5b9b1179(AX.60).aspx)

Integration components

Integration components enable integration between Microsoft Dynamics AX and external applications. For information about how to install one of the integration components, click the corresponding link in the following table.

Component	More information
Web services on IIS	Install web services on IIS (http://technet.microsoft.com/library/83827f45-6e85-4ec4-b673-133d284b2763(AX.60).aspx)
.NET Business Connector	Install the .NET Business Connector (http://technet.microsoft.com/library/c67944e8-73c5-4434-94d6-84484c810333(AX.60).aspx)  Note: .NET Business Connector is installed automatically when Microsoft Dynamics AX components that require it are installed.
Synchronization proxy for Microsoft Project Server	Install the synchronization proxy for Microsoft Project Server (http://technet.microsoft.com/library/1b3a19a1-cfbf-4bfe-85cb-b66ae4c615e7(AX.60).aspx)
Synchronization service for Microsoft Project Server	Install the synchronization service for Microsoft Project Server (http://technet.microsoft.com/library/b665dd6c-1d1f-4002-b69d-03e2006ea52d(AX.60).aspx)

Management utilities

Management utilities let you configure and manage Microsoft Dynamics AX components and artifacts, such as reports and web controls, from the metadata store.

For information about how to install management utilities, see [Install management utilities](http://technet.microsoft.com/library/09d85a6e-911b-4067-a512-9176b3aee44d(AX.60).aspx) (http://technet.microsoft.com/library/09d85a6e-911b-4067-a512-9176b3aee44d(AX.60).aspx).

Retail components

Microsoft Dynamics AX for Retail provides mid-market and large retailers a complete head office and point of sale (POS) solution. It can help retailers increase financial returns, improve service, manage

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growth, and streamline efficiencies. Microsoft Dynamics AX for Retail consists of several components that are typically distributed across multiple computers and locations.

For more information about how to install retail components, see [Install retail components](http://technet.microsoft.com/library/92192174-9c68-4cb7-9bc7-3b9fad20851d(AX.60).aspx) ([http://technet.microsoft.com/library/92192174-9c68-4cb7-9bc7-3b9fad20851d\(AX.60\).aspx](http://technet.microsoft.com/library/92192174-9c68-4cb7-9bc7-3b9fad20851d(AX.60).aspx)).

Installation types

Two types of installation are available from the Setup wizard: **Custom installation** and **Single-computer installation**.

Custom installation

Select **Custom installation** to install specific Microsoft Dynamics AX components on multiple computers. Use this type of installation in a production environment.

Single-computer installation

Select **Single-computer installation** to install a complete Microsoft Dynamics AX system on one computer. Setup uses default settings to configure all components, and new Microsoft Dynamics AX databases are created. User names and passwords are the only input that is required.

If you want to connect to an existing database or specify other custom settings, you must perform a custom installation.



Important:

Do not perform a single-computer installation in a production environment. Use this type of installation only for development and testing.

A single-computer installation includes the following components:

- Databases
- Application Object Server (AOS)
- Enterprise Portal
- Help server
- Reporting Services extensions
- Analysis Services configuration
- Client
- Office add-ins
- Remote Desktop Services integration
- Debugger
- Visual Studio Tools
- Trace Parser
- .NET Business Connector
- Management utilities

Upgrade

The [Upgrade Guide](http://go.microsoft.com/fwlink/?LinkID=163798) (http://go.microsoft.com/fwlink/?LinkID=163798) provides the information to upgrade from the previous releases of Microsoft Dynamics AX.

What's New: Upgrade

This topic has been updated to address upgrade to Microsoft Dynamics AX 2012 Feature Pack and Microsoft Dynamics AX 2012 R2.

The Microsoft Dynamics AX 2012 upgrade process is designed to keep downtime to a minimum. Shorter downtime means less impact on operations and lower total cost of upgrade.

The source-to-target model for full upgrades

Upgrades from Microsoft Dynamics AX 4.0 or Microsoft Dynamics AX 2009 to Microsoft Dynamics AX 2012 require two computer systems that operate in parallel:

- The *source* system, which remains in production for most of the upgrade process
- The *target* system with the latest Microsoft Dynamics AX version

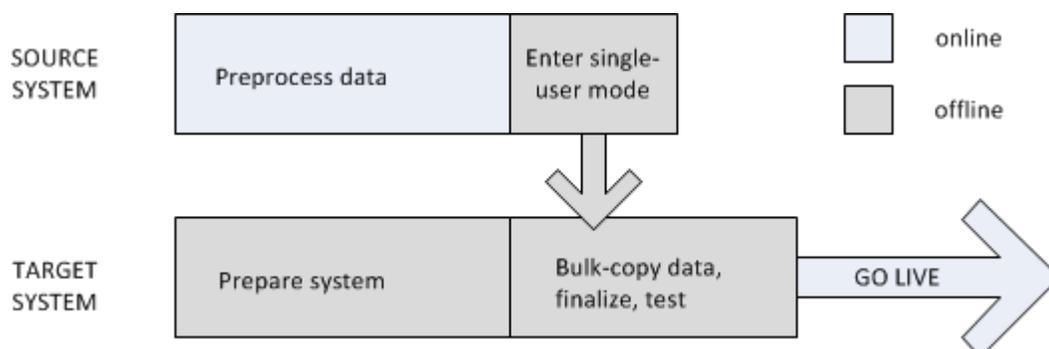
In previous versions of Microsoft Dynamics AX, all upgrade tasks were performed on a single production system, requiring the system to be offline through the entire process. Difficulties that arose had to be resolved under time pressure before business operations could resume. Now, under the source-to-target model, issues involving the upgrade of business data are mostly resolved on the source system with no interruption of operations. Similarly, procedures for upgrading customized application code are carried out on the offline target system.

When data preprocessing on the source system is complete, and the target system is ready, the source system is taken offline, the prepared business data is copied to the target system, and upgrade scripts are run. After testing, the target system can go live.

Important:

Source-to-target upgrade requires that the source system and target system be installed on separate server computers. Although side-by-side installation on a single computer is possible, we recommend that you use this approach only for testing purposes. For more information, see [Hardware and software requirements](#).

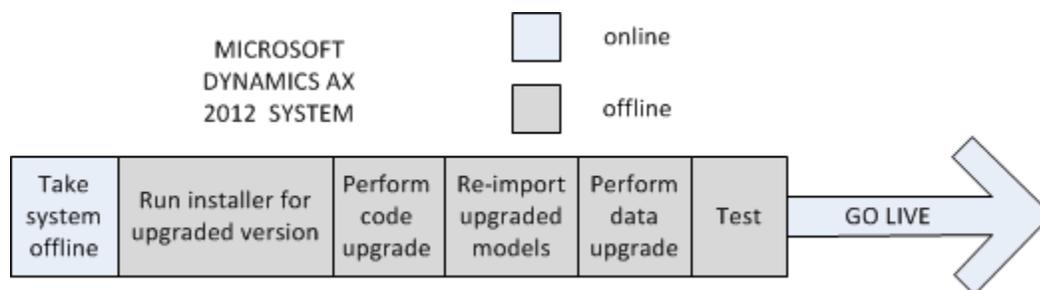
The following diagram shows the phases of an upgrade that follows the source-to-target model.



In-place upgrades

The upgrade framework for Microsoft Dynamics AX 2012 also provides a procedure for upgrading between versions within a major release. *In-place* upgrades do not follow the source-to-target model. Instead, all of the upgrade tasks are performed on the production system while it is offline.

The following diagram shows the phases of an in-place upgrade.



Tip:

For information about in-place upgrades between Microsoft Dynamics AX 2012, Microsoft Dynamics AX 2012 Feature Pack, and Microsoft Dynamics AX 2012 R2, see [Perform in-place upgrade](http://technet.microsoft.com/library/809f888a-3318-4d9e-bf9b-529c416dac9d(AX.60).aspx) ([http://technet.microsoft.com/library/809f888a-3318-4d9e-bf9b-529c416dac9d\(AX.60\).aspx](http://technet.microsoft.com/library/809f888a-3318-4d9e-bf9b-529c416dac9d(AX.60).aspx)).

Checklists for each stage and type of upgrade

Previous releases of Microsoft Dynamics AX implemented upgrades on a single computer system, and a single upgrade checklist contained all the core upgrade tasks. Under the source-to-target upgrade model, there are now several checklists and related forms to help you organize upgrade tasks on the source and target systems. Additional checklists have been added for in-place upgrades that are performed between versions within a major releases.

Checklist	Description
Preprocessing upgrade checklist	Tasks that prepare data on the source system for export into the database schema of a Microsoft Dynamics AX 2012 or later system
AOD code upgrade checklist	Tasks that are involved in migrating any customized code in legacy AOD files to the model architecture of a Microsoft Dynamics AX 2012 or later system
Model code upgrade checklist	Tasks that are involved in migrating any customized code in legacy models to the most recent Microsoft Dynamics AX release
Data upgrade checklist	Tasks that are involved in upgrading imported data on a Microsoft Dynamics AX 2012 or later target system

Checklist	Description
Software update checklist	Used for in-place upgrade from Microsoft Dynamics AX 2012 to Microsoft Dynamics AX 2012 Feature Pack. In Microsoft Dynamics AX 2012 R2, the upgrade framework replaces this checklist with the Code upgrade checklist for in-place upgrade and the Data upgrade checklist for in-place upgrade .  Note: The Software update checklist is still used for hotfixes and updates in Microsoft Dynamics AX 2012 R2.
Retail POS redeployment checklist	Tasks that are involved in redeploying point-of-sale (POS) terminals after the head-office system has been upgraded to Microsoft Dynamics AX 2012 R2 and up-to-date POS software has been installed in the stores
Code upgrade checklist for in-place upgrade	Code upgrade tasks for in-place upgrades to Microsoft Dynamics AX 2012 R2 from Microsoft Dynamics AX 2012 or Microsoft Dynamics AX 2012 Feature Pack
Data upgrade checklist for in-place upgrade	Data upgrade tasks for in-place upgrades to Microsoft Dynamics AX 2012 R2 from Microsoft Dynamics AX 2012 or Microsoft Dynamics AX 2012 Feature Pack

The upgrade state transfer tool

In a source-to-target upgrade, the most labor-intensive phase is data preprocessing. If you follow best practices, you will perform your upgrade first on a non-production system. Therefore, you will spend considerable time completing data preprocessing on a test source system. The upgrade state transfer tool lets you take full advantage of the results of that effort by transferring the preprocessed data from the test system to your production system. For more information, see [Using the preprocessing upgrade state transfer tool](http://technet.microsoft.com/library/414e3d48-f088-4e59-815e-0f8ad50da298(AX.60).aspx) ([http://technet.microsoft.com/library/414e3d48-f088-4e59-815e-0f8ad50da298\(AX.60\).aspx](http://technet.microsoft.com/library/414e3d48-f088-4e59-815e-0f8ad50da298(AX.60).aspx)).

Validating row counts after an upgrade

The **Compare data upgrade row counts** task in the **Data upgrade checklist** checks the data integrity on the Microsoft Dynamics AX 2012 target system after an upgrade. Row counts that are correctly correlated among the source, shadow, and target tables suggest, but do not confirm, that the bulk copying and data upgrade were completed successfully. For more information, see [Compare data upgrade row counts](http://technet.microsoft.com/library/cc3a5b18-388e-45c0-8681-c057e18cae55(AX.60).aspx) ([http://technet.microsoft.com/library/cc3a5b18-388e-45c0-8681-c057e18cae55\(AX.60\).aspx](http://technet.microsoft.com/library/cc3a5b18-388e-45c0-8681-c057e18cae55(AX.60).aspx)).

Enhanced code upgrade toolset

This feature is provided by Microsoft Dynamics AX 2012 R2 only.

The code upgrade toolset for detecting and resolving conflicts between standard and customized code now provides code analysis based on code conflict rules. The rules describe code conflicts involving

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changes in X++ classes and methods, and provide suggested resolutions. You can add your own rules to the ones provided by Microsoft. You have the option of allowing rule violations to be resolved automatically, or you can open a development project that is created and resolve the conflicts manually. For more information, see [Using the preprocessing upgrade state transfer tool](http://technet.microsoft.com/library/414e3d48-f088-4e59-815e-0f8ad50da298(AX.60).aspx) ([http://technet.microsoft.com/library/414e3d48-f088-4e59-815e-0f8ad50da298\(AX.60\).aspx](http://technet.microsoft.com/library/414e3d48-f088-4e59-815e-0f8ad50da298(AX.60).aspx)).

Support for data partitioning

This feature is provided by Microsoft Dynamics AX 2012 R2 only.

Microsoft Dynamics AX 2012 R2 enables data isolation by using data partitions. For example, an organization that is a holding company has several subsidiaries. If the management of the organization does not want employees of one subsidiary to have access to the data for other subsidiaries, data partitions can provide the boundaries that are required for data isolation but enable the metadata that supports business processes to be shared.

When upgrading from Microsoft Dynamics AX 4.0 or Microsoft Dynamics AX 2009, it is important that you first evaluate whether you require data isolation between companies. For example, the source system may have used companies as a means of data isolation. However, there is much data that is shared between companies in Microsoft Dynamics AX 2012 R2. For example, products and parties are global for all companies in a partition. If you do not want such data to be shared, you must create additional partitions. In any case, metadata such as role definitions will be shared across all partitions.

During the upgrade process, you will be given the option to create new partitions. If you choose to create new partitions, you will then map companies from the source environment to partitions in the target environment. If you do not have to isolate data between companies, you do not have to create additional partitions. The default partition that is created during installation is sufficient for your requirements.

For more information, see the product documentation.

Split of database into data and metadata

This feature is provided by Microsoft Dynamics AX 2012 R2 only.

During minor-version upgrade to Microsoft Dynamics AX 2012 R2 from AX 2012 or AX 2012 Feature Pack, the single Microsoft Dynamics AX database will be split into two databases, one for business data and one for application metadata. This change enables easier maintenance and backup of the databases.

Enhanced international support

This feature is provided by Microsoft Dynamics AX 2012 R2 only.

Upgrade is supported for internationalized versions of Microsoft Dynamics AX, such as versions for the following countries/regions:

- China
- Brazil
- Eastern Europe/Russia

Multi-version support for retail POS redeployment

This feature is provided by Microsoft Dynamics AX 2012 R2 only.

Upgrade of retail functionality requires redeployment (replacement and reconfiguration) of the legacy POS software on each terminal in each store. You must perform this redeployment during a tightly constrained time window to avoid disrupting retail activities. Although previous releases required that all stores be upgraded at the same time, Microsoft Dynamics AX 2012 R2 supports operations using two versions of Microsoft Dynamics AX POS software at the same time. Multi-version support lets upgrade administrators upgrade one store at a time while maintaining normal operations in stores that are still awaiting upgrade.

Supported upgrade paths

This topic has been updated to address Microsoft Dynamics AX 2012 Feature Pack and Microsoft Dynamics AX 2012 R2.

This topic describes upgrades to three target Microsoft Dynamics AX versions: Microsoft Dynamics AX 2012, Microsoft Dynamics AX 2012 Feature Pack, and Microsoft Dynamics AX 2012 R2.

Important:

We strongly recommend that you install the most recent available version of Microsoft Dynamics AX 2012. If there is functionality that you do not plan to take advantage of, you can remove the appropriate License code. For example, in the case of the Feature Pack, if you do not want to use the Public Sector functionality, remove the [Public sector license code \(PublicSector\)](http://technet.microsoft.com/library/b24518c1-2354-440f-a7f8-6e64ea31369b(AX.60).aspx) ([http://technet.microsoft.com/library/b24518c1-2354-440f-a7f8-6e64ea31369b\(AX.60\).aspx](http://technet.microsoft.com/library/b24518c1-2354-440f-a7f8-6e64ea31369b(AX.60).aspx)).

Do not uninstall Microsoft-released models to remove unwanted functionality. This action will place your system in an unsupported state. If you have uninstalled a Microsoft-released model after installing an instance of Microsoft Dynamics AX, you must reinstall the model using the instructions found in [How to: Export and Import a Model](http://msdn.microsoft.com/library/c2449a03-7574-4b9d-8518-9005b560209f(AX.60).aspx) ([http://msdn.microsoft.com/library/c2449a03-7574-4b9d-8518-9005b560209f\(AX.60\).aspx](http://msdn.microsoft.com/library/c2449a03-7574-4b9d-8518-9005b560209f(AX.60).aspx)).

Supported upgrade sources and targets

The following tables describe the supported methods for an upgrade to each target system.

Note:

We recommend that you install the newest service pack available for your source system before beginning an upgrade. For Microsoft Dynamics AX 4.0, this would be SP2. For Microsoft Dynamics AX 2009, this would be SP1.

Upgrading to Microsoft Dynamics AX 2012

Source version	Comment
Microsoft Dynamics AX 4.0	Direct upgrade using the source-to-target model.
Microsoft Dynamics AX 2009	Direct upgrade using the source-to-target model.

Upgrading to Microsoft Dynamics AX 2012 Feature Pack

Source version	Comment
Microsoft Dynamics AX 4.0	Direct upgrade using the source-to-target model.
Microsoft Dynamics AX 2009 (without Retail components)	Direct upgrade using the source-to-target model.
Microsoft Dynamics AX 2009 for Retail R1	Indirect upgrade. You must first upgrade to Microsoft Dynamics AX 2009 for Retail R2 Refresh. For more information, see the Deployment and installation Guide: Microsoft Dynamics AX for Retail (https://mbs.microsoft.com/customersource/downloads/servicepacks/microsoftdynamicsaxforretailcs.htm?printpage=false&sid=sv1zlv0gdopipwyrz22i0zez&stext=AX%20for%20Retail).
Microsoft Dynamics AX 2009 for Retail R2	Indirect upgrade. You must first upgrade to Microsoft Dynamics AX 2009 for Retail R2 Refresh. For more information, see the Deployment and installation Guide: Microsoft Dynamics AX for Retail (https://mbs.microsoft.com/customersource/downloads/servicepacks/microsoftdynamicsaxforretailcs.htm?printpage=false&sid=sv1zlv0gdopipwyrz22i0zez&stext=AX%20for%20Retail).
Microsoft Dynamics AX 2009 for Retail R2 Refresh	Direct upgrade using the source-to-target model.
Microsoft Dynamics AX 2012 (without Retail components)	In-place upgrade on a single system. No source-to-target workflow is used.

Upgrading to Microsoft Dynamics AX 2012 R2

Source version	Comment
Microsoft Dynamics AX 4.0	Direct upgrade using the source-to-target model.
Microsoft Dynamics AX 2009 (without Retail components)	Direct upgrade using the source-to-target model.
Microsoft Dynamics AX 2009 for Retail R1	Indirect upgrade. You must first upgrade to Microsoft Dynamics AX 2009 for Retail R2 Refresh. For more information, see the Deployment and installation Guide: Microsoft Dynamics AX for Retail (https://mbs.microsoft.com/customersource/downloads/servicepacks/microsoftdynamicsaxforretailcs.htm?printpage=false&sid=sv1zlv0gdopipwyrz22i0zez&stext=AX%20for%20Retail).

Source version	Comment
Microsoft Dynamics AX 2009 for Retail R2	Indirect upgrade. You must first upgrade to Microsoft Dynamics AX 2009 for Retail R2 Refresh. For more information, see the Deployment and installation Guide: Microsoft Dynamics AX for Retail (https://mbs.microsoft.com/customersource/downloads/servicepacks/microsoftdynamicsaxforretailcs.htm?printpage=false&sid=sv1zlv0gdopipwyrz22i0zez&stext=AX%20for%20Retail).
Microsoft Dynamics AX 2009 for Retail R2 Refresh	Direct upgrade using the source-to-target model.
Microsoft Dynamics AX 2012 (without Retail components)	In-place upgrade on a single system. No source-to-target workflow is used.
Microsoft Dynamics AX 2012 Feature Pack	In-place upgrade on a single system. No source-to-target workflow is used.

Upgrading to Microsoft Dynamics AX 2012 R2 (international builds)

Country	Source		Target
	AX 4.0	AX 2009	
Brazil	AX 4.0 SP2 + Brazil FP + 362 DIS + latest DIP	AX 2009 SP1 + GLS_Cons + RUx	AX 2012 R2
China	AX 4.0 SP2 + CN GLS	AX 2009 SP1 + GLS_Cons + RUx AX 2009 SP1 + GLS_Cons + RU7 or latest + China TR-1	
India	AX 4.0 SP2 + IN GLS	AX 2009 SP1 + GLS_Cons + RUx	
Japan	AX 4.0 SP2 + JP GLS	AX 2009 SP1 + GLS_Cons + RUx	
Russia/Eastern Europe	AX 4.0 SP2 FP1 EE + REGFs	AX 2009 SP1 + GLS_EE + RUx	
Russia (Payroll)	AX 4.0 SP2 FP1 EE + latest LOS layer	AX 2009 SP1 + RUx + latest SL layer	

Upgrading from a Microsoft Dynamics AX source system that uses an Oracle database

You cannot use an Oracle database together with Microsoft Dynamics AX 2012. If you are upgrading from an installation of Microsoft Dynamics AX that uses an Oracle database, you must first migrate your data to a Microsoft SQL Server database, and then upgrade to Microsoft Dynamics AX 2012.

To migrate your data to a SQL Server database, use the Oracle to Microsoft SQL Server Data Migration Assistant for Microsoft Dynamics AX tool. You can download this tool and the *Oracle to Microsoft SQL Server Data Migration Assistant for Microsoft Dynamics AX Installation Guide* from [CustomerSource](#) (https://mbs.microsoft.com/customersource/downloads/servicepacks/ax2009_OracleToSQL.htm).

Deploying Customizations Across Microsoft Dynamics AX 2012 Environments (White paper)

A separate document, "Deploying Customizations Across Microsoft Dynamics AS 2012 Environments," describes a standard process and best practices for developers and IT Pros who are seeking to deploy Microsoft Dynamics AX 2012 customizations between environments.

The paper has been updated to be organized around Application Lifecycle Management scenarios, and now includes a section that describes how to apply XPO files to a production environment.

[Download the paper](http://go.microsoft.com/fwlink/?LinkId=221067) (http://go.microsoft.com/fwlink/?LinkId=221067).