Migrating your Windows Azure Applications between Data Centers

Considerations, approaches and risk management

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Summary

Windows Azure Data Centers (WADC) have been in general availability for over three years now. The ever growing customer demand and trust relationship from Cloud Service Consumers has meant that Windows Azure has now expanded its global footprint to new data center locations across the globe. With that in mind, this short paper covers migration considerations of application workloads **between** Windows Azure Data Centers (WADC). The topics covered in the migration include the planning, risk, technical considerations, financial considerations and also migration assistance advice along with technical resource links on how best to begin the migration.

Introduction

The choice of WADC location for your applications, servers and related data is one that is often decided on the basis of whether it's wholly on-premises, in the cloud or a combination of both (hybrid).

You may be an existing Windows Azure customer with applications already running in a data center, and your migration to a new data center is now more attractive to you. Some maybe in process or planning to make use of Windows Azure for other applications, in which case the choice of data center is important to you. For others you may use Windows Azure services sometime in the future and the choice of data center is more of an academic exercise.

Choices

Three different perspectives are worth considering in more detail for the deployment choices available for your application portfolio.

Windows Azure currently provides eight (8) state of the art data centers worldwide, each of which can be a target for your workloads and all provide Geographic Disaster Recovery (DR) for storage and selected Windows Azure services.

With the release of the **two new Australian sub regions** there are now more options!

As new data centers become available in different geographies you may be wondering what the significant benefits are and what your choices are for where your applications are currently deployed.

Benefits

The two most common benefits for a data center in your geography are lower network latency and perceived or real cloud compliance concerns. Lower network latency is a relative measure. The closer the data center is to your customers, the more likely it is that you will experience a lower time delay and time to first byte (TTFB). It's worth noting that Latency and throughput are quite different. A Windows Azure application that on each request requires multiple calls between data center and client may result in a reduced user experience. In this case, another benefit of using a local data center is opening new possibilities to using Windows Azure for these more "chatty" applications.

Unlike network latency, regulatory compliance of cloud based applications is much harder to isolate and objectively measure. Often, the viability of a cloud deployment depends on the system being able to be built, deployed and managed according to relevant regulatory compliance restrictions on your organisation. These normally focus on the data that the applications deals with either in transit or at rest. Guidance currently in use for your on premises applications can often be applied to data in transit or at rest in Windows Azure Storage.

Existing workloads in Windows Azure

If your application is already using Windows Azure you will have chosen one of the available data centers in a particular geography to host your services. Ideally keeping all the services in close proximity for performance, cost and management reasons. You probably based your choice of data center on its availability/proximity to where your business or data is located, performance (latency) in relation to you or your customer's expectations, and other deployment preferences.

With the new Windows Azure Data Center offerings you now have the choice of migrating these applications to the data center closer to your target geography. A number of factors could drive this decision such as cost, value and timing. Since the costs of Windows Azure are stanadardised and available in multiple currencies, costs considerations center on the migration effort. The value is likely to be in terms of user experience (both customer and developer/administrator), time to migrate and availability of the new data center.

Future workloads for Windows Azure

For new greenfield applications and workloads, there has never been a better time to leverage Windows Azure Services, from IaaS to SaaS, Windows Server to Linux, C# to Python, etc. There are only a few edge cases that would not benefit from the Windows Azure Cloud computing platform today. With Windows Azure, you can build new applications and continue to use your existing development tools, identity sources, operating systems, and management tools or data stores.

Planning workloads to move to Windows Azure

Over the past 3 years Microsoft has increased Windows Azure's capacity, availability and number of data centers worldwide, whilst lowering costs and increasing features for developers, administrators and IT professionals.

Whether you plan or wait for additional features, new services, or perhaps even data center availability in your location, there are plenty of good reasons to get started now:

1. **Plan, test and migrate**
   Windows Azure will help reduce the time for development and deployment of your applications but the same rigour is required as your on premises applications. Going through this migration exercise will allow you to develop procedures, management tools and practices so you are prepared when your target data center comes online.

2. **Get ahead of your competition**
   With Windows Azure as a foundation, Microsoft makes ideas into reality in a shorter period of time. Reduced time to market, cost savings and agility can be realised whilst still keeping the door open for a change in your choice of data center location at a later date. Migration is simplified because it involves the same repeatable steps as previous deployments.

3. **The same Windows Azure features are available in every data center**
   Whether it's a specific feature, or a security/risk issue (e.g. data sovereignty) the same requirements of your applications will apply regardless of your selected geography. All general release Windows Azure services are, available in every data center worldwide.

4. **There are high value, low impact workloads you can run from any data center**
   Scenarios such as Development and Test, Load Simulation/Testing, Data Analysis (e.g. HDInsight[1]) and Storage (e.g. StorSimple) are all solutions that can be quickly and

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[1] HDInsight - http://blogs.msdn.com/b/windowsazure/archive/2013/03/22/developing-for-hdinsight.aspx
MSDN 2013

efficiently setup on Windows Azure removing common on premises issues such as high setup, running and maintenance costs. Delays due to infrastructure acquisition are eliminated entirely when deploying these workloads on Windows Azure.

5. **Get familiar with the Windows Azure platform**
   For the foreseeable future there will be continual updates and improvements to Windows Azure. The earlier you get started the easier it will be to take advantage of these new features and regions as they become available. Many features benefit from the global nature of Windows Azure, so starting now can help you with high availability and future global expansion.

Migration

Windows Azure provides portability options and consistency between on-premises and off-premises experiences as well as between data centers.

For guidance on migrating applications from on-premises to Windows Azure there are multiple resources to help you. We have included the most relevant ones in Appendix A of this document.

Should you choose to migrate your application **between Windows Azure Data Centers**, it can be as simple as redeploying cloud services wholesale in the new data center, or require more careful consideration such as virtual machines (VM) porting and data migrations.

Planning

Windows Azure provides service parity in each data center, so there will no loss of capability in your migration. However we recommend reviewing the following considerations before you begin your migration:

Risk considerations

Service availability – Do you want to keep the service running during the migration? It's likely there will be some downtime between services, though Windows Azure can assist service switch over by using the Windows Azure Traffic Manager[2] (running two sites and crossing over) or swapping your DNS CNAME entry or forwarding from your ISP. Naturally you should consider the migration at a time that has minimal impact to end users – regardless of cut over time.

Duplicated environments – Do you need to keep some of your users active during migration? Prior to full migration you may want to validate the new environment is working as expected, resulting in risk of duplicating data, repeat transactions and stale data. To help mitigate this, leverage synthetic transactions, have clean-up and start-up scripts to remove test date and isolate subscriptions so that that the impact of one environment is limited.

Volume – If you are using a considerable amount of Windows Azure Compute, Application or Data Services you may find that you will require assistance from Microsoft, and/or our partners to manage the migration. In this scenario we recommend contacting your Microsoft Account Manager as soon as possible to help you plan.

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[2] Windows Azure Traffic Manager, http://msdn.microsoft.com/en-us/library/windowsazure/hh744833.aspx, MSDN, 2012

Technical considerations

Choice of tools – Where possible you should create automation scripts and build tools to construct and deconstruct environments in your target Windows Azure Subscriptions. There are also tools such as Microsoft System Center App Controller that can help you move workloads.

Time to migrate - Even with the best tools there is a limit on your network bandwidth and how fast data can be transmitted, which is more notable when considering larger data sizes.

Financial considerations

Bandwidth charges – Data transfer out (egress) from Windows Azure is charged per GB. Transferring data outside of data centers should be done with as few iterations as possible to minimise charges.

Subscriptions – You may elect to align your Windows Azure subscriptions with a particular set of services running from a specific geography. You should make sure that the target subscription has the same quota allocations and is linked to any existing billing structure you have in place. If in doubt contact Windows Azure billing support.

Recommendations

It's possible to use the Windows Azure management portal[3] to manage and migrate your applications and environments. Often, however, the key to successful, repeatable and faster deployments is automation. Microsoft recommends that you keep configurable scripts and tools (see Appendix B) that will enable you to deploy, update and remove your services. Additionally you should consider investing in backup (see Appendix C on business continuity guidance) and build restoration processes.

Once you are ready to migrate you should prioritise migrating workloads that:

- Can be, or have been, automated
- Do not rely on large cloud data sets
- Have 1-2 Cloud Services
- Have service maintenance windows

Whilst further investigation is required for applications that:
- Have >10GB cloud storage
- Have complex applications
- Use Windows Azure Virtual Networks (including S2S, P2S)
- Have high SLAs
- There is a high level of integration between workloads
- Related architectural goals to be achieved
- Are using preview services
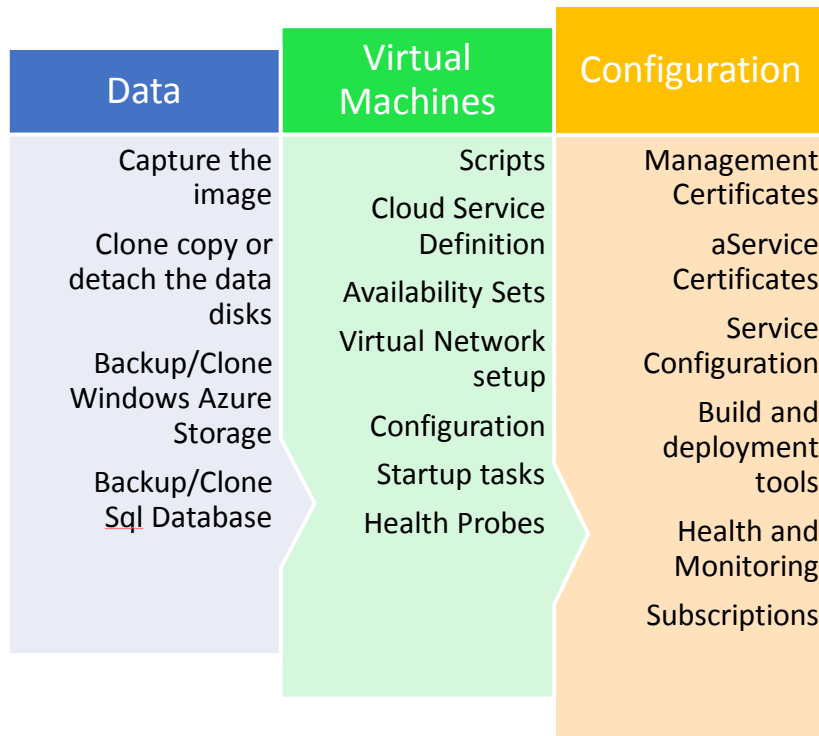
Implementing the Migration Plan

When considering what you need to do and in what order to do it you should develop a plan for your data, virtual machines and service dependencies. One approach is to create a migration review checklist and compare it against your current documented configuration process to make sure you have covered each service your application relies on.

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[3] Windows Azure Management Portal, https://manage.windowsazure.com/?whr=live.com

A 'big bang' approach to migration is less likely to be successful in the Cloud. Since Windows Azure applications are best designed to be logically independent. A divide and conquer approach is a more realistic migration plan. One approach is to split existing workloads into logical tiers, and build your migration from the network layer up.

Whether it's pure IaaS, PaaS or hybrid you may want to consider this quick guide which starts with your data, the machines that leverage this data and finally the configuration necessary to create the new deployment in the new Data Center.

Data	Virtual Machines	Configuration
Capture the image	Scripts	Management Certificates
Clone copy or detach the data disks	Cloud Service Definition	aService Certificates
Backup/Clone Windows Azure Storage	Availability Sets	Service Configuration
Backup/Clone Sql Database	Virtual Network setup	Build and deployment tools
	Configuration	Health and Monitoring
	Startup tasks	Subscriptions
	Health Probes	

Please see a more comprehensive [migration checklist](#) in the Appendix for a complete list of activities you can look at to execute on your plan. When considering your data migration and copying, an important execution step is to make sure you copy data directly between data centers to minimise time and effort.
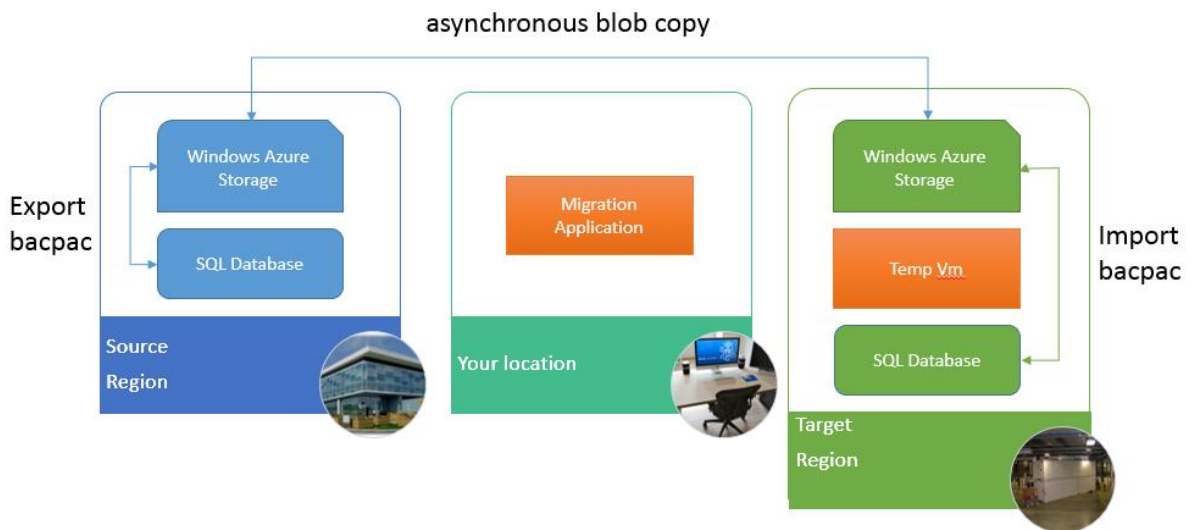
Although you could achieve a cross data center data copy through a download followed by an upload, this would be much slower than just doing an internal copy within or between data centers. With the use of third party tools or by leveraging the Windows Azure Management APIs you can copy blobs (asynchronous cross transfer blob copies) directly between data centers.

Similarly SQL Databases can be transferred directly between data centers by first exporting to bacpac files which are stored in Windows Azure Storage and then importing the bacpac to the target SQL Database on the other side. One alternative is to use the simpler but likely slower Windows Azure SQL Data Sync [4]service for synchronising a number of moderate number of smaller sized Databases.

Direct transfers in addition to being faster also reduce the need to implement temporary Virtual Machines in the target data center to run your software to perform the important and export

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[4] Windows Azure SQL Data Sync (SDS) - http://msdn.microsoft.com/en-us/library/windowsazure/jj856263.aspx

Migration Assistance

Many organisations might opt to not migrate these application workloads themselves; the question for them is who can help you to migrate services between Data Centre?

1. Support
   Please review the Windows Azure support plans. Customers with professional support, and above, will be able to request assistance in migrating your storage and database migration. Please note that this will process will take longer than doing it yourself, or having expert assistance, and will involve *some* downtime and egress costs.
2. Partners –have existing process/approach to help you migrate
   - You may use your Software Assurance Planning Services to engage partners in assisting you to plan
   - You may benefit by working with a partner through the Windows Azure IaaS Accelerator process template – DEPIM (Discover, Education, Planning, Implement & Manage)
3. Services and Tools
   - Please see the Appendix for services and tools that can help
4. Microsoft Services/Premier
   - You may use your proactive hours as part of your Premier agreement to assist in the planning for migration
   - Customer with Premier support and Premier Mission Critical will receive a personalised service through their account manager.
   - Microsoft Consultancy services have Infrastructure Services specialists who can work alongside your organisation

Conclusion

A migration from one Windows Azure Data Center to another can be achieved by following some straight forward service planning steps. For existing customers familiar with Windows Azure this process is simply automating the same familiar steps taken when deploying the application. Windows Azure provides the options to manage this yourself, through public APIs or by using support, partner or third party tools to expedite your efforts.

Appendix A: Planning

Planning migration from on premises to Windows Azure

- [Migrating Data-Centric Applications to Windows Azure](#)
- [Cloud Migration Tips #3: Plan to Fail](#)
- [Active Directory Considerations in Azure Virtual Machines and Virtual Networks](#)
- Old: [Tips for Migrating Your Applications to the Cloud](#)
- Is your [application a Good Fit for Windows Azure?](#)
- [Migrating with Windows Azure Cloud Services](#)
- [Migrate an On-Premise Application to the Cloud in 60 Minutes](#)
- Windows Azure IaaS for Hybrid Cloud Fast-track (link unavailable at time of publishing)

Migration preparation resources

Sql Database
- [Business Continuity: Backup, Restore, and High Availability](#) **(Windows Azure SQL Database)**
- [How to: Migrate a Database by Using the Generate Scripts Wizard (Windows Azure SQL Database)](#)

Windows Azure Storage
- [HOW TO: Copy files between Windows Azure storage accounts](#)

Networking resources

- [Overview of Windows Azure Virtual Network](#)
- [Configuring a Virtual Network using the Windows Azure Portal](#)
- [Network Configuration schema documentation](#)
- [Notes on supported VPN devices](#)
- [Name resolution support](#)

Migration checklist

☐ **Analysis :** Review, your current application deployment in Windows Azure
Reason: Identity application logical tiers which will enable you to define your migration approach

☐ **Planning a Migration:**
- Plan for cost – ensure your application logical tiers are collocated to reduce any data center costs
- Identify key technical requirements in the migration
- Plan the timeline
- Make a plan for regression testing
- Identify the resources needed
- Plan the application management in the new Windows Azure Data Center

Reason: Migrating applications to a new data center will need consideration on the migration, deployment and regression testing of your application once it has been cutover.

☐ **Implementing the Migration Plan:**
- [Setting up for validation tests](#) - Confirm test and debug environments including tools
- [Synchronizing databases to minimize cut over time](#) - Consider minimizing the amount of data that must migrate at cut over time as it helps to minimize the downtime required
- [Backup and restore](#) - enable you to recover from data loss caused by administrative errors, application errors, or the total loss of a data center
- [Cut over to Windows Azure](#) Run in parallel or pause and cutover

Reason: It is strongly recommend that after you migrate your application to the new Data center that you run the functional and performance regression tests on your application just like you do for any newly deployed application. DB synchronizing (relational/non-relational), backup and restore points should be catered for and then application cutover should take place.

☐ **Operations and Management**
- Monitor application performance in the new data center
- Manage new data recovery plan.

Reason: As with your old Data center application workload deployment it is important to monitor your application performance in the new data center and also implement your backup and recovery procedures that were in-place before.

Example Processes

Move from on premises to Windows Azure

1. Where ESX/other hosted VMs:
    a. Take server offline. Use VMM, MVMC, MAT or 3rd party to convert VMDK to VHD, remove
    b. Once converted, upload VHD to WA Storage (CSupload, AppController, Orchestrator IP 'Put', other 3rd party).
2. Where Hyper-V hosted VMs.
    a. Take Server offline. Upload VHD to WA Storage (CSupload, AppController, Orchestrator IP Put, other 3rd party).
3. Where Physical OS
    a. Use VMM or 3rd party to P2V convert OS to VHD image.
    b. Upload VHD to WA Storage (CSupload, AppController, Orchestrator IP Put, other 3rd party).

Move one subscription to another region

- First and most important. Existing virtual machines cannot be "moved". New services must be created and storage migrated. I.e. Source VM turned off. Configuration of Source VM mirrored at destination. Source VMs VHD copied to destination. Destination VM now turned on. Source VM deleted.
- This flow can easily be implemented via tools such as System Center Orchestrator and applied to multiple VMs.
    i. Secondly and equally important. Any dependencies of these services must be reconfigured to support them. This is items such as: S2S VPN to new Azure location. Any DNS records (e.g. public) must point to new IP addresses etc.
    ii. On the basis that the above consideration are taken in to account:
    iii. Moving Data: The Key here is to minimise data transfers as data egress has a cost per byte transferred outbound from the Azure Storage Account.
    iv. Option 0:
        1. Use Async Copy Blob API
    v. Option 1:
        1. Implement staging VM on Azure IaaS, either in destination or
        2. Use Windows Azure portal, App Controller, CSUpload or other 3rd party tool to download file to be moved (e.g. VHD) to local storage.
        3. Upload file to new storage account in new region using same download method.
    vi. Option 2:
        1. Download data to on premise. Upload data to new Azure location.
    vii. Option 3:
        1. Migrate Application Data to new VM sets at destination. Retire source VMs once service/application migration successful.

Appendix B: Tools

Management Tools

- [Windows Azure Portal](#)
- [App Controller & Virtual Machine Manager](#)
- [MVMC](#) / [MAT](#) / [Video](#)
- [Windows Azure Integration Pack for Orchestrator in System Center 2012 SP1](#) + [Video](#)
- Third party tools:

[MetricsHub](#)	[ManageEngine](#)
[Cerebrata](#)	Quest [Foglight for Windows](#)
[Management Studio](#)	[Azure Applications](#)
[Apica AzureCheck](#)	Paraleap [AzureWatch](#)
Avanade [Opstera](#)	[New Relic](#)

Migration Tools

- [VMware to Azure - Double-Take Move®](#)
- [Azure Copy](#) – (including Amazon S3 data to Windows Azure Storage)
- [CloudCopy Command Line Tool](#)
- [Aspera](#) ([Windows Azure Marketplace](#))
- [Build your own tool - example](#)

Virtual Machines Tools

- [5nine V2V Easy Converter](#)
- [MVMC Microsoft Virtual Machine Converter Solution Accelerator](#) (including VMware to VHD)
- [Migrate a Virtual Machine to Windows Azure with PowerShell](#)

Assessment Tools

- Checking your throughput to a data Center - [Azure Throughput Analyzer](#) (Microsoft Research)
- [Windows Azure Cost Assessment](#)

Guidance
Sql Database

- [Choosing Tools to Migrate a Database to Windows Azure SQL Database](#)
- [How to: Use a SQL Server Migration Assistant with Windows Azure SQL Database](#)

Books

- [The Windows Azure Handbook, Volume 1: Planning & Strategy: Windows Azure for Business and Technical Decision Makers](#)
- [Moving Applications to the Cloud, 3rd Edition](#)

Partner resources

If you are a Microsoft partner wishing to help customers make this move, please refer to your partner manager and these following technical resources

- [Migrating and Managing Workloads in Windows Azure Virtual Machine](#)
- [Tips for Migrating Your Applications to the Cloud](#)
- [Windows Azure Circle](#)