Capacity Planning for Microsoft® SharePoint® Technologies

Capacity Planning

The process of evaluating a technology against the needs of an organization,

and making an educated decision

about the configuration and procurement of hardware to meet the demands specific to a system being installed.

Common Questions

- How much hardware do we need?
- Should we implement a server farm?
- Do we need SQL Server?
- How much data can we store?
- What benefits are there in using 64-bit HW?
- How many users can our environment support?
- How many sites can we run on our servers?
- How do we validate our design?

Module Objectives And Takeaways

- **Module Objective(s):**

  Discuss the Components and Factors to Consider when Planning for Performance and Capacity in MOSS

  Better understand the caching features and their usage

  Demonstrate the Steps for Stress/Load-Testing a MOSS 2007 Server Farm

  Provide Recommendations and Best Practices

- **After viewing leave with a Better Understanding of the Platform, Features, and Recommendations**
- **Describe the Configuration Options for Improving SharePoint Performance**
- **Describe the Process for Determining the Hardware and Topology Requirements**

Module Agenda

- Performance and Capacity Planning Components
  - Understanding the Platform and Recommendations
- Planning SharePoint Hardware and Storage
- Other Considerations
- SharePoint Capacity Planning Tool

Performance and Capacity Planning
Understanding the Platform & Recommendations

- **Components**
  - Software Boundaries
  - Throughput Targets
  - Data Capacity
  - Hardware
- **Planning Activities**
  - Plan for Software Boundaries
  - Estimate Performance and Capacity Requirements
  - Plan Hardware and Storage Requirements
  - Test Your Design

Performance and capacity planning: The process of mapping your solution design to a farm size and set of hardware that will support your business goals.

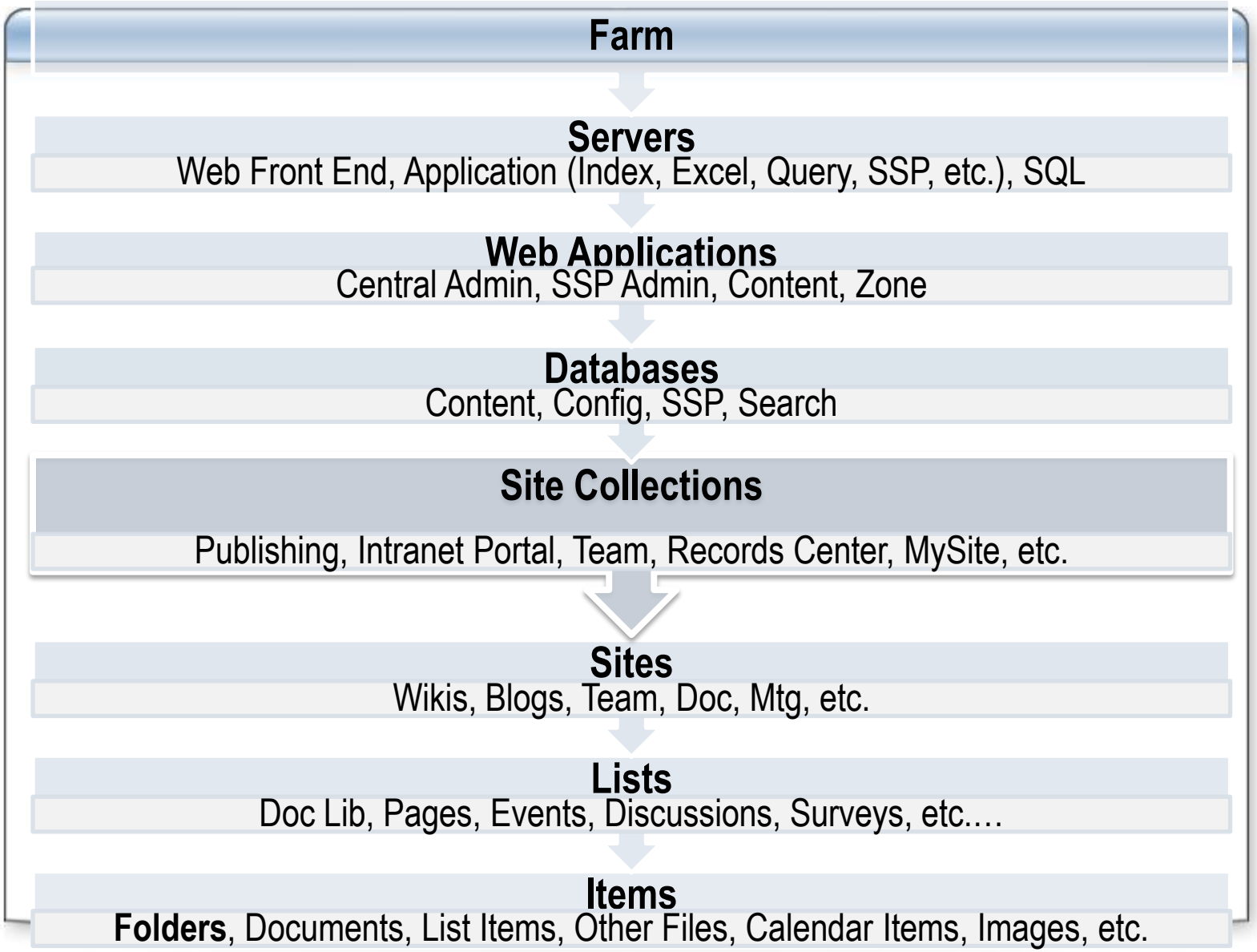
Plan for Software Boundaries

- **Object Categories**
- **Software Scalability vs. Hardware Scalability**
- **RTM Test Results, Findings, and Recommendations from the Product Group**
  - Test Environment
  - Test Results
  - Recommendations
- **Other Considerations**

Plan for Software Boundaries
Object Categories

- **Site Objects**
  Site Collections, Web sites, documents, document libraries, list items, document file size, etc.
- **People Objects**
  User profiles, security principals, etc.
- **Search Objects**
  Search indexes, Indexed documents
- **Logical Architecture Objects**
  Shared Services Providers, Site Collections, Content Databases, Zones, etc.
- **Physical Objects**
  Servers: Index, WFE, Database, Application, etc.

SharePoint Containment Hierarchy



Plan for Software Boundaries
Test Results and Findings

- **Things to Know About SharePoint Scalability:**
  - SQL Server used as the content store
  - Can scale up and out
  - When configured properly, can scale to millions of users and terabytes of data*
  - Can store millions of documents and Web sites
  - Provides a means to delegate administration

*The key is the configuration choices – we'll dive into this in more detail

Plan for Software Boundaries
Software Scalability vs. Hardware Scalability

- **Software scalability**

  Recommendations for acceptable performance based on software behavior and characteristics

- **Hardware scalability**

  Does not change/modify software behavior or characteristics…but can increase overall throughput of a server farm and might be necessary to achieve acceptable performance as the number of objects approach recommended limits

Plan for Software Boundaries
Product Group's Test Environment

- **Hardware Specifications:**

Computer Role	Specifications
Stand-alone computer	1 dual core Intel Xeon 2.0 GHz 64-bit processor, 2 GB RAM
Web Front-End computer	2 dual core Intel Xeon 2.8 GHz 64-bit processors, 4 GB RAM
Database (SQL Server) computer	4 dual core Intel Xeon 2.8 GHz 64-bit processors, 32 GB RAM
Client computers	Pentium III 1.2 GHz processor, 1 GB RAM

- **Network: Gigabit Ethernet (one billion bits/sec)**
- **Farm Configurations Tested:**

DB's	1 WFE	2 WFE	3 WFE	4 WFE	5 WFE	6 WFE	7 WFE	8 WFE
1	X	X	X	X	X	X	X	X

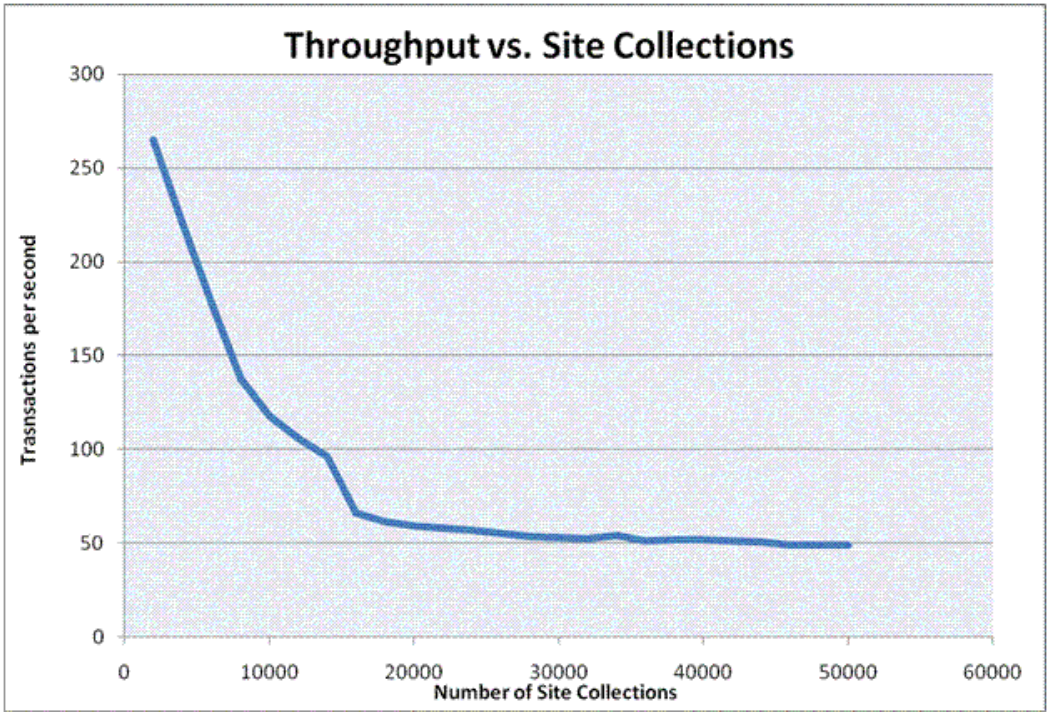
Plan for Software Boundaries
Recommendations & Guidelines (subset)

Object	Recommended Maximum	Scope	Object Category
Content Databases	100 per Web application	Web application	Logical architecture
Site Collections	50,000 per Content Database	Content Database	Logical architecture
Web Sites	250,000 per Site Collection	Site collection	Site object
Documents	5 million per library (2,000 per nested folder/view)	Library	Site object
Indexed Documents/Items	50 million per search index (1 index per index server, 1 index server per SSP)	SSP	Search object
Web Servers to Database Server Ratio	8 Web servers per database server	Farm	Physical object

For all recommendations, visit "Plan for software boundaries (Office SharePoint Server)" at
http://technet2.microsoft.com/Office/en-us/library/6a13cd9f-4b44-40d6-85aa-c70a8e5c34fe1033.mspx

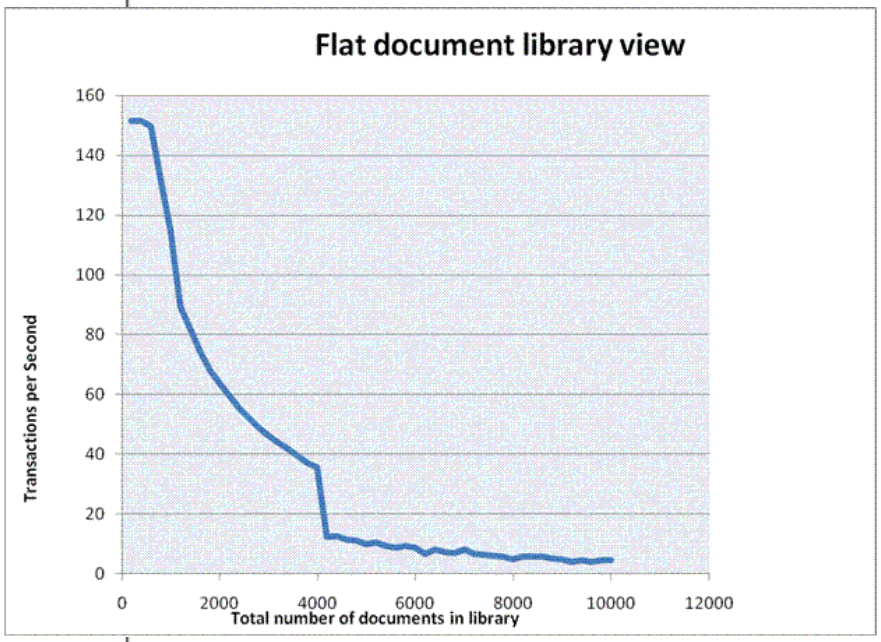
Plan for Software Boundaries
Test Results and Findings

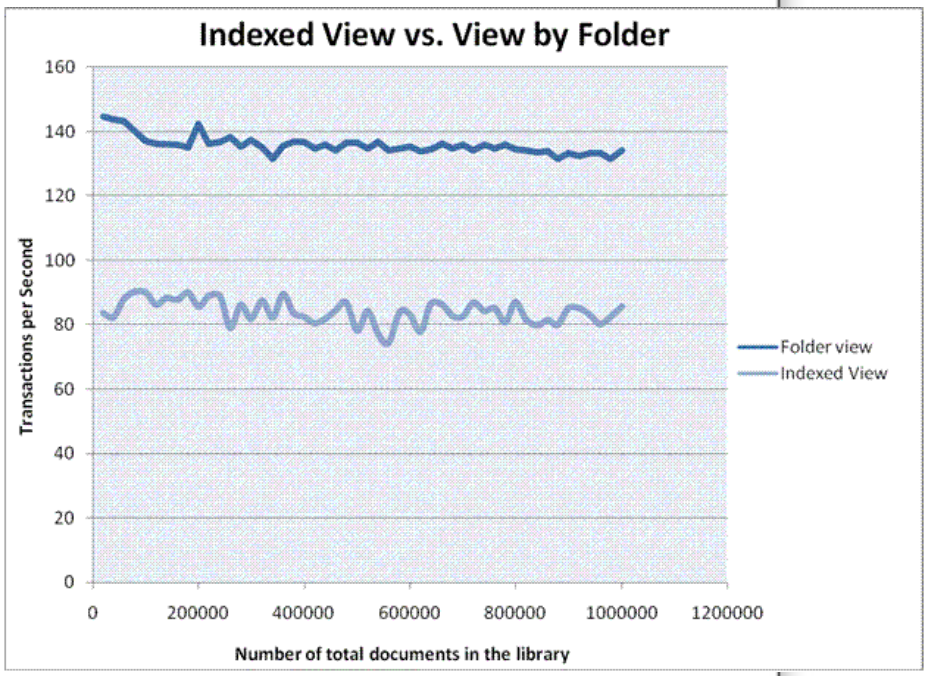
- **Throughput vs. Number of Site Collections in One Content Database**



Plan for Software Boundaries
Test Results and Findings

- **Throughput differences between flat document library vs. document library with folders**





Plan for Software Boundaries
Other Considerations

- **Throughput vs. number of Web servers**
  - Test findings showed plateau at 5:1(YMMV)
  - Perform tests in your environment
- **Other Recommendations**
  - Carefully plan your site hierarchy and design
  - Minimize # Web applications and application pools
  - Limit # of Shared Service Providers
  - Plan for database growth
  - Follow data and feature best practices and suggested limits

Estimate Performance and Capacity
Usage Profiles

- **Determine Usage Profile**

  Usage profile == User community's behavior

  - Distribution of requests across content
  - Operation types and frequency

  Existing solution in place? Mine IIS logs

  Leverage usage profiles provided in configurations tested by Product Group as starting point:

Configurations tested by Product Group
Windows SharePoint Services Collaboration Environments
Portal Collaboration Environments
Search Environments
Determine Resource Requirements to Support Excel Services

Estimate Performance and Capacity
Sample Usage Profile (WSS Collaboration)

Operation	Percentage of throughput
Get home page	15.00
Get cached document	15.00
Get static document	15.00
Get list page (HTML)	10.00
Get list page (grid)	10.00
Get list form	7.00
404 errors	5.00
Insert list item	2.00
Edit list item	2.00
Delete list item	2.00
Insert document	2.00
Synchronize with Outlook	2.00
Delete document	2.00
RSS (Really Simple Syndication)	1.00
Start workflow	0.75
Workflow task completion	0.75

Estimate Performance and Capacity
Throughput Requirements

- **Estimating Throughput Targets**

  User response time, concurrency

Total Users	5%	10%	15%	25%
		0.5	0.75	1.25
1,000			1.5	2.5
5,000	2.5			12.5
10,000	5.0			25.0
20,000	10.0	20.0		
50,000	25.0	50.0	75.0	
100,000	50.0	100.0	150.0	250.0

Warning: Plan for Peak Concurrency

Throughput targets (in RPS) at various concurrency rates (recommended response time of 1 – 2 seconds)

Estimate Performance and Capacity
Other Factors

- **Other configuration factors that can influence throughput targets**
  - Indexing (schedule indexing window off-hours)
  - Caching enabled?
    - Output Caching and Cache Profiles
    - Object Caching
    - Disk-based Caching for Binary Large Objects
  - Page customizations
  - Custom Web parts

Custom Caching Overview (Office SharePoint Server 2007):

http://msdn2.microsoft.com/en-us/library/aa589700.aspx

Estimate Performance and Capacity
Other Factors, Latency

- **Latency components**
  - Server processing
  - SQL processing, # SQL round trips, AJAX processing, security trimming
  - Client processing
  - Javascript, CSS, AJAX requests, HTML load, Client machine specs
  - Wire transfer
  - Bandwidth, size of download
- **Recommendations**
  - Primary cause of latency problems: custom web parts
  - Watch for: SQL round trips, unnecessary data, excessive client side script
  - Re-use existing client code versus adding more
  - Design code for performance – (Use HTML and .Net best practices)
  - Profile your solutions

Plan Hardware and Storage
How SharePoint Scales

- **Designed to grow with organization needs**

  Server resources: x32, x64, CPU, RAM, HDD

  - Recommend 64-bit for back end services (SQL) which can leverage additional addressable memory
  - SQL: HDD configuration critical

  Server Farm

  - Topology restrictions removed
  - WFE, Query, Index, Excel Calc, Project, SQL

  Adopted WSS adage: content only limited by HW capability*

  - Sites: In WSS 3.0, Portals sites are "just another WSS site”

Plan Hardware and Storage
Single Server Example

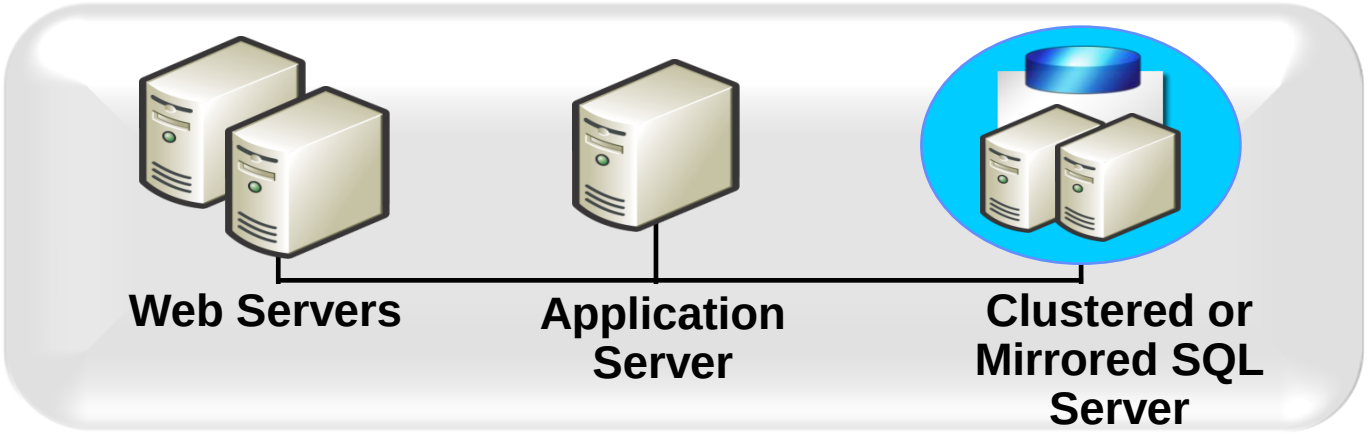
One Server Configured as:

- **Web Front-End Server Role**
- **Application Server Role**
- **Database Server Role**

Server Type	RAM	Disk	Processors
Stand-alone	2 GB	NTFS file system–formatted partition with 3 GB of free space plus adequate free space for your Web sites (Typically at least 100GB)	Dual processors that are each 3 GHz or faster

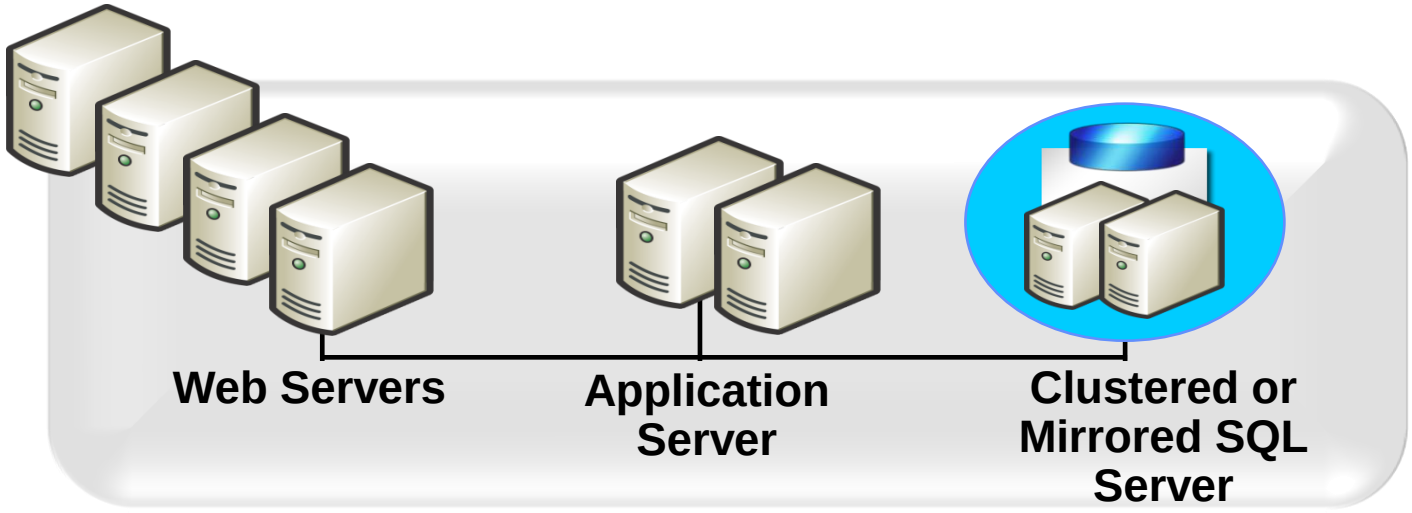
- **Appropriate for limited use-scenarios including the following:**
  - **Installing Office SharePoint Server 2007 for evaluation purposes.**
  - **Deploying only Microsoft Windows SharePoint Services 3.0.**
  - **Deploying a subset of the Office SharePoint Server 2007 features.**
  - **Deploying Office SharePoint Server 2007 for a limited purpose (such as for a single department) or for a limited number of users.**

Plan Hardware and Storage
Multi-Server Farm Example (Medium Size)



- **Optimizes performance of web servers**
- **Increases redundancy and reduces points of failure**
- **Redundancy at WFE and Database server roles**
- **Determine configuration based on your business needs and goals**
- **Determine config of other Application roles (Excel Services, Index, Forms, etc)**

Plan Hardware and Storage
Multi-Server Farm Example (Scaling Out)



- **Optimizes performance of web servers**
- **Increases redundancy and reduces points of failure**
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Plan Hardware and Storage
64-bit vs. 32-bit Hardware

- **WSS 3.0 and MOSS 2007 can work on both**
- **64-bit Hardware Recommended**

  32-bit can directly address only a 2GB Memory Address Space

  64-bit supports up to 1,024 GB Memory (Physical and/or Addressable)
- **Larger # of Processors**
- **Enhanced Bus Architecture**
- **WSS 3.0 and MOSS 2007 are last 32-bit version**
- **64-bit HW Prioritization**

  SQL Server → Index → Excel → Search → WFE

***64-bit hardware can be mixed within a farm, but not within server role level (i.e. WFEs, etc)**

Plan Hardware and Storage
Storage Considerations

- **Primary Metric: Document Storage**
  - Plan for 1.2 – 1.5 x file system size for SQL Server

    Note: metric is closely tied to RAID level used on SQL disks
- **Secondary Metric: Index Size**
- **Index Server: 30% - 50% of total size of all content indexed for a single server**
- **Query Server: 1 x index size**

Plan Hardware and Storage
Storage Considerations – SQL Planning

- Install SQL Server on a dedicated server that is not running any other farm roles
- Highly recommended that SQL Server be installed on 64-bit HW and OS
- Host SharePoint Products and Technologies on SQL Server 2005 with the latest Service Pack SP2+
- Ensure the SQL Server I/O channels to the disks are not shared by other applications, such as the swap file and IIS logs.
- Consider Scaling Out Server as well as Up

Plan Hardware and Storage
Monitoring Physical Servers

- **Processor: % Processor Time: _Total.**

  On the computer running SQL Server, this counter should be kept between 50%-75%. In case of constant overloading, investigate whether there is abnormal process activity or if the server needs additional CPU.

- **System: Processor Queue Length: (N/A).**

  Monitor this counter to ensure that it remains below two times the number of Core CPUs.

- **Memory: Available Mbytes: (N/A).**

  Monitor this counter to ensure that you maintain a level of at least 20% of the total physical RAM free.

- **Memory: Pages/sec: (N/A).**

  Monitor this counter to ensure that it remains below 100.

Plan Hardware and Storage
Storage Considerations

- Download “Performance Recommendations for Storage Planning and Monitoring “ whitepaper (http://go.microsoft.com/fwlink/?LinkID=105623&clcid=0x409)

  Information architecture recommendations
  Physical topology guidance
  Network topology recommendations
  MONITORING, MAINTAINING, AND TROUBLESHOOTING
  Physical Servers
  Disk counters to monitor
  Disk recommended practices
  SQL Server recommended practices
  Troubleshooting

Capacity Planning Tools & Resources

- **Plan for Performance and Capacity (Office SharePoint Server)**
  http://technet2.microsoft.com/Office/en-us/library/8dd52916-f77d-4444-b593-1f7d6f330e5f1033.mspx?mfr=true
- **Design the Logical Architecture**
- http://technet2.microsoft.com/Office/en-us/library/1a8e707a-a9b9-4cc1-9daa-08d450692d2d1033.mspx
- **Determine Hardware and Software Requirements (Office SharePoint Server)**
- http://technet2.microsoft.com/Office/en-us/library/4d88c402-24f2-449b-86a6-6e7afcfec0cd1033.mspx
- **Tools for Performance and Capacity Planning (Office SharePoint Server)**
- http://technet2.microsoft.com/Office/en-us/library/301ed832-95da-4251-b266-7be6288f7ea01033.mspx
- **Visual Studio 2005 Team Test Edition: Testing Demos**
  http://www.microsoft.com/downloads/details.aspx?FamilyId=88F7CB8B-473B-4ED5-BA47-ABBC06D0048E&displaylang=en

SharePoint Capacity Planning Tool

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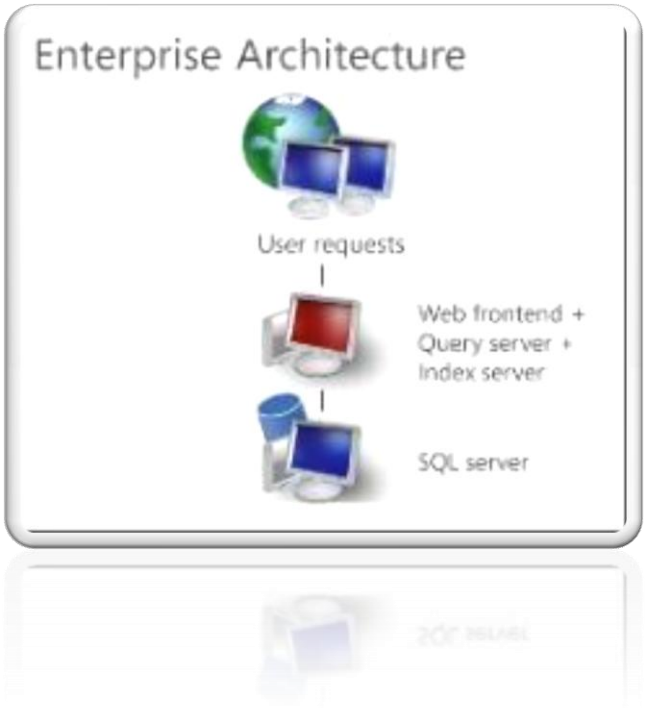
SharePoint Capacity Planning Tool

IT Pro Issues

- What is the minimum hardware to deploy?
- What is the correct topology to meet availability and performance requirements?
- How do I grow my existing installation if/when my capacity needs change?



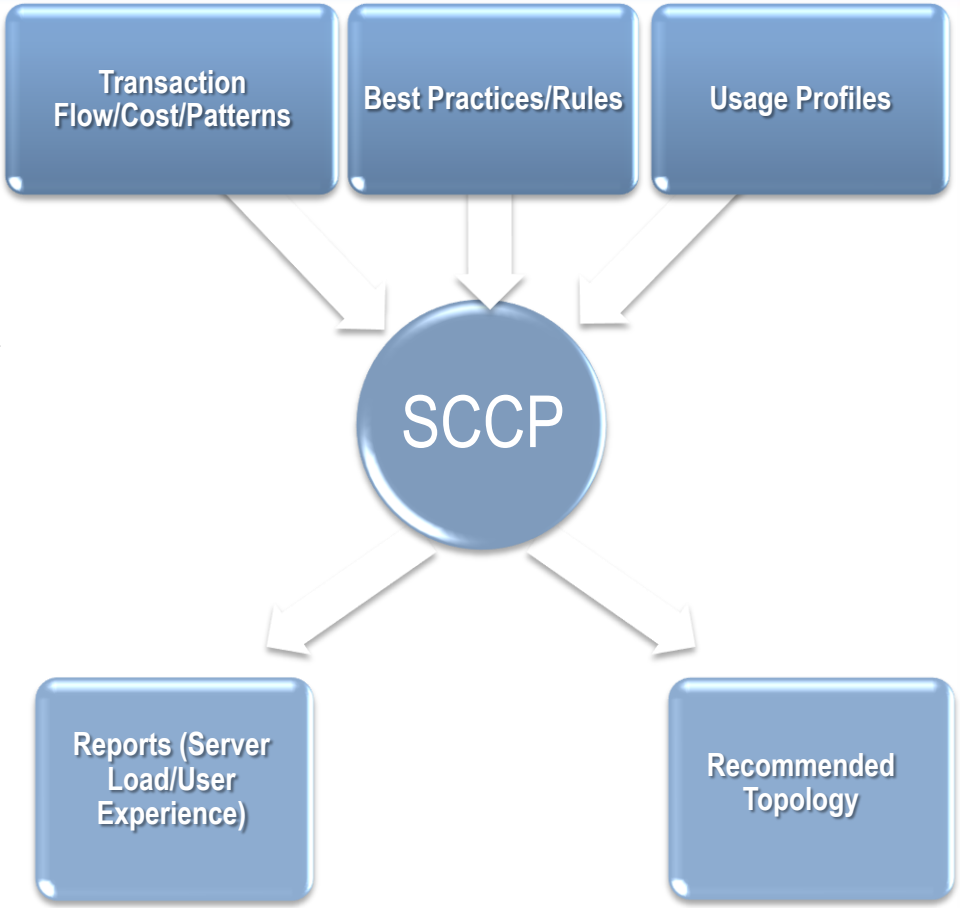
What is the tool?

- A capacity planner with basic models for WSS 3.0 and MOSS 2007 which gather data to get you started with your physical planning.
- A pre-sales/pre-deployment, and planning tool.
- An opinion to be considered for planning phys. topologies

SharePoint Capacity Planning Tool

Solution Overview

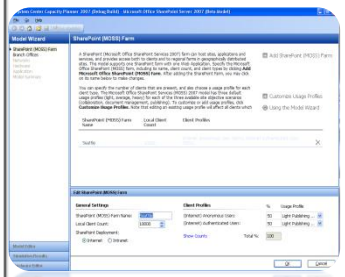
- Built-in Best Practices
- Visual Model Editor
- Ability to perform “What-if” Analysis
- Efficient deployment planning

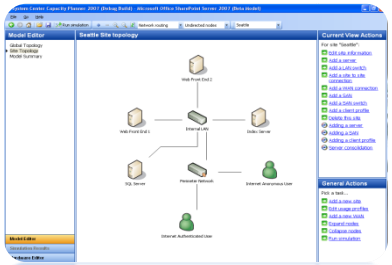


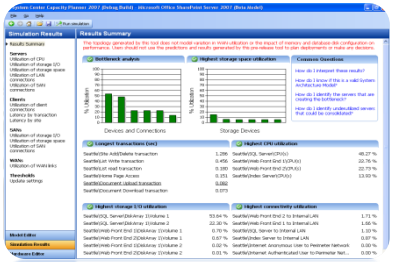
*SCCP – System Center Capacity Planner

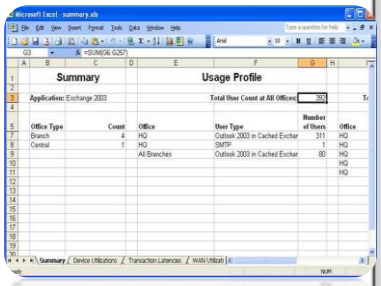
SharePoint Capacity Planning Tool

Solution Concept









Assess Determine organization-specific data, enter into tool

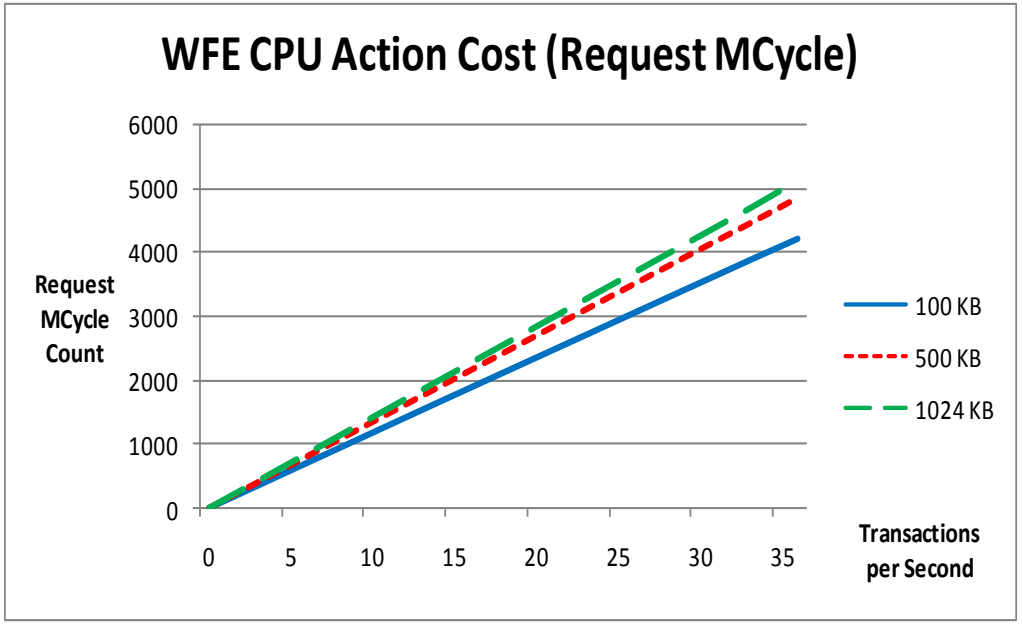
Recommend Inputs analyzed, best-fit topology Recommended

Simulate Run Simulations-"What If" analysis

Report Report is Generated in Excel/Visio format (summary or detail)

SharePoint Capacity Planning Tool

WSS/MOSS Transaction Cost Approach



- **Transaction mix ran at a specific load and measurements taken for various perfmon counters (like CPU time)**
- **Sample, find an average point for that specific load size.**
- **Find avg. points for load sizes, draw a best fit line-This is the line that gets modeled into SCCP capacity model.**

DEMO

SharePoint Capacity Planning Tool

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SharePoint Capacity Planning Tool

Demo Scenario: Contoso

- Centralized Deployment Architecture for Intranet scenario
- 1 Central Farm and 1 Branch Office
- Add additional Branch Office

City	# of Users	Usage Profile
New York	10,000	Heavy Collaboration (R/W – project team site)
Boston	1,000	Light Publishing (more read, less write – SharePoint marketing site)

SharePoint Capacity Planning Tool

Demo Scenario: Contoso Airways

- Mix of Anonymous and Authenticated Users
- SQL High Availability

City	# of Users	Usage Profile
Dallas	70,000	Light/Heavy Publishing

SharePoint Capacity Planning Tool

Demo Scenario: Contoso Airways

- **Customized Usage Profile**
- **Export Report**

City	# of Users	Usage Profile
Dallas	70,000	Customized Usage Profile

SharePoint Capacity Planning Tool

Out of Scope

- No upgrade scenarios for WSS or MOSS
- No self-discovery of existing MOSS/WSS installations
- No migration from competing products to MOSS/WSS

Capacity Planning Tool Resources

SCCP RC Download:
http://connect.microsoft.com/systemcenter
SCCP Home Page:
http://www.microsoft.com/systemcenter/sccp/default.mspx
SharePoint Capacity Planning Tool (TechNet):
http://technet.microsoft.com/en-us/library/bb961988.aspx
SharePoint Capacity Planning Tool (Beta):
https://connect.microsoft.com/programdetails.aspx?ProgramDetailsID=1602