SharePoint 2010 Products: Virtualization Process

Using Hyper-V technology to virtualize servers

Hyper-V[™] hardware virtualization uses software to create a virtual machine that resembles the resources of a physical computer. The virtual machine has its own operating system environment that is logically isolated from the virtualization (host) server. By providing multiple virtual machines at once, this approach allows different versions of the operating system to run simultaneously on a single physical machine. It provides strong isolation between the (independent) running virtual machines.

Benefits

- Consolidates multiple, underutilized physical servers on a
- single host
- Reduces cabling and peripheral requirements Reduces space requirements and power consumption.
- Increases flexibility, speed, and ease of server deployment

Constraints

- Number of virtual machines cannot exceed the capacity of the
- virtualization server (host).
- Virtual processor limit of four processor per virtual machine. A clustered environment requires enough free resources on each host to
- enable live migration. In a SharePoint 2010 Products environment you have to monitor the
- virtualization host as well as the virtual farm servers. For capacity-planning purposes, only physical cores should be taken into

Operating system requirements

system performance.

Virtualization server (Hyper-V host) Before you can deploy Microsoft® SharePoint® Server 2010 or Microsoft® SharePoint®

Foundation 2010 on a Hyper-V™ virtual machine, you must meet the following requirements for the virtualization server (host):

Architecture examples

Farm B

Small farm

Farm installed on two servers

Hardware requirements

Requirements

Processor: x64 compatible processor with Intel VT or AMD-V technology enabled. Hardware Data Execution Prevention (DEP) available and enabled.

Adequate physical resources, particularly cores, RAM, and high performance disks with the capacity to support the virtual machines that are hosted. This includes an allowance for resource overhead on the host.

We recommend that you use Windows Server® 2008 R2 or Microsoft Hyper-V™ Server 2008 R2 for virtualization servers. These software versions provide significant improvements in virtual core support, power management, live migration, performance (virtual drives and networking), and general

SharePoint 2010 Products virtual machine

Before you can deploy SharePoint Server 2010 or SharePoint Foundation 2010, you must meet the following requirements:

Operating system requirement: Windows Server 2008 or Windows

SharePoint Server 2010 and SharePoint Foundation 2010 must be run on a 64-bit edition of Windows Server 2008 with Service Pack 2 (SP2) or Windows Server 2008 R2.

Database requirement: 64-bit SQL Server 2005 or 64-bit SQL Server 2008

For farm installations of SharePoint Server 2010 and SharePoint Foundation 2010, you must be running 64-bit versions of Microsoft SQL Server® 2005 or Microsoft SQL Server 2008 (each with the appropriate service packs and updates) on the database servers.

Resources

Server 2008 R2

Planning and architecture for SharePoint Server 2010 (http://go.microsoft.com/fwlink/?LinkID=89404) Virtualization planning for SharePoint Server 2010 (http://go.microsoft.com/fwlink/?LinkId=194755)

Analysis

Virtualization stages

Purpose

Before you can deploy, you must plan the virtualization solution that you want to deploy. It is critical that everyone clearly understands the goals and objectives for virtualization. Determine the type of farm that you want to deploy and its

purpose. For example, test and quality assurance, authoring, or

The Microsoft Assessment and Planning (MAP) Toolkit for Hyper-V (http://go.microsoft.com/fwlink/?LinkId=194756)

Expected duration and stability

Not a stable environment – no service-

usually a single-server deployment or a

Expected duration and stability

small farm that has the database on a

level agreement for users

Typically a throw-away solution

Determine business goals and objectives.

- Identify the type of farm and farm elements that you want to virtualize.
 - Determine virtualization server requirements.

Output

Steps

 Virtualization plan Topology and resource requirements

Create virtual machines.

the services.

disk space.

Decide to continue.

Output

Deploy a single server or a two-server

Evaluate the solution by configuring

Information that will enable you to:

for testing proof of concept.

SharePoint Server 2010 and enabling

Collect initial benchmark data on virtual

machines and virtualization host. For

Implement refinements that are required

example, CPU use, memory use, hard

account, not possible hardware threads.

 A benchmark for evaluating outcome against goals and objectives

Server 2010, are shown for the purposes of illustration and discussion only. For the purpose of this model, domain controller and firewall servers are physical servers.

virtualization server and its virtual Showing the distribution of farm servers

across virtualization servers.

CA

DB

Farm A

Small farm

Search

Farm installed on a single server

8 GB

The following physical and virtual Illustration key: architectures, which feature SharePoint Virtual machine layer Physical machine and virtual machine Physical machine layer resources are provided for the purpose of: Showing the relationship between a

Search

8 GB

Virtualization server

WFE: Web server APP: Application server DB: Database server CA: Central Administration Query: Query component Crawl: Crawl component **HOST:** Virtualization server DC: Domain controller FS: Firewall server LP: Logical processor

WFE CA

Search

2xVP

4 GB

8 GB

VP: Virtual processor

2 GB

n GB = Amount of RAM in GB

Do

- Plan for the worst case scenario on the host server. Monitor host and virtual machine health and
- performance data on an ongoing basis. Plan for redundancy and growth on each host.

especially processor architectures

Virtual machine

Dual processor virtual machine.

Use 40 GB dynamic virtual hard disks.

Farm A or Farm B:

Analysis

• Use the same operating system version and patch level on the hosts and the virtual machines. Be aware of differences in server hardware -

Use 4 GB of RAM for each virtual machine that hosts the

system for redeploying SharePoint Server 2010.

Use the snapshot feature to keep a clean image of the operating

Assuming that there is 8 GB of RAM on the physical computer:

Do not

- Take a snapshot of a running virtual machine in a production environment.
- Install anything on the host root partition except the operating system and Hyper-V.
- Overcommit host CPU resources. Assume that all server applications have the same

capacity characteristics. Use snapshots as a backup strategy.

Virtualization server

preferred, but not required.

Virtualization server

The CPU for the Farm A host is slightly

system reserve or Hyper-V overhead.

oversubscribed (4 LP : 6 VP), but the CPU for Farm B

which will degrade performance. The virtual machines

in Farm B require 24 GB of RAM without an operating

is oversubscribed (4 LP: 10 VP) at a higher rate,

For this phase, the physical computer can be a laptop

or workstation that has enough memory to support a

server deployment. A quad core physical machine is

single virtual machine or two virtual machines in a two-

2 - Evaluation

Purpose

publishing portal.

Used to deploy SharePoint 2010 Products in a virtual environment to see if virtualization is feasible

Characteristics Topology For evaluation purposes, the topology is Initial deployment of the solution is

solution. ——— 3 - Proof of concept (POC) Purpose

followed by testing and refining the

Used to determine whether a partial

or full SharePoint 2010 Products

virtualization solution will meet business needs and to determine an

appropriate infrastructure plan. Characteristics Environments for the POC phase can be created by deploying new POC is to demonstrate that the planning solution is feasible and

farms or by scaling the farm used for evaluation. In either case, the goal of should be pursued. There can be continuous development and tailoring during this phase to refine the proof of concept.

separate server.

agreement for users

usage flow for the POC phase, a typical topology is three-tier small or medium farm. cycle.

Set up, reviewed, and then discarded Not a stable environment – no service-level

In order to better illustrate functionality and

Use this topology and scale to refine the vision for the production farm as well as gather farm server and virtualization performance data. This is a good phase to start establishing a benchmark that can be refined later in the

Expected duration and stability

Production service-level agreement for

Limited service-level agreement for solution

Limited time frame

readiness testing

production testing

Steps

- Scale up virtualization server or add virtualization server.
- Create virtual machines with adequate capacity for running a farm with more servers and more features.
- Deploy farm. • Expand scope of benchmark data to include
- farm servers and virtualization servers. Expand user base. Determine how you will manage the farm and
- supporting infrastructure. Evaluate proof of concept. Refine goals and infrastructure requirements

Output

- Updated virtualization plan Updated topology and resource
- requirements Updated virtualization server resource requirements

Preliminary operations plan

Query

2xVP

4 GB CA Crawl 2xVP Farm A 4 GB Small farm Farm servers distributed across DB three tiers 2xVP 6 GB

Query

2xVP

Query Query 2xVP 2xVP 4 GB 4 GB App-1 CA Crawl 2xVP Farm B 4 GB Medium farm Farm servers distributed across DB three tiers 2xVP 8 GB HOST 2

Allow a 2-GB reserve for the operating system and Hyper-V This leaves less than 6 GB for the virtual machines.

- Virtual machine
- Small or medium farm with farm servers deployed across three tiers: Dual processor virtual machines. 4 GB of RAM for each front-end Web server and each application server, 8 GB of RAM for database server.
- Use three 30 GB dynamic virtual hard disk drives for all servers to deploy SharePoint Server on the drive topology that is typically used for farm servers. Use Hyper-V snapshots to capture the state of the virtual

machine before you deploy SharePoint Server. For Farm B, dedicate one application server for the crawl

Analysis

- Performance is not the focus for POC; however, perceived poor performance can affect the desired results. The options, in order of priority are: Host the virtual machines on two virtualization servers to accommodate CPU and RAM issues.
- Use a virtualization server that has 8 cores and at least 32 GB of RAM. Use multiple physical hard disk drives to host the virtual machine hard disk drives.
- We recommend two virtualization hosts for user acceptance testing and production environments. If you have the capability for POC,
- we recommend that you implement this architecture before going on to the next phase. Unless the virtualization hosts are only going to be used for POC, you should implement a virtual architecture that will carry through to subsequent stages. Evaluate the number of host cores and RAM to ensure that you have room to scale up or scale out during the pilot.

— 4 - Pilot

Purpose Used to test a solution on a small

Pilots are used to test solution readiness, typically without using real data because the focus is on functional testing. However, a pilot can also be used to

test for production characteristics by

using real data and having the pilot

environment. We recommend this

users do actual work in the

Purpose

Characteristics A limited set of users has access to the environment to test the

solution and infrastructure

functionality and performance of the

A preproduction environment used

for testing solutions against a subset

or complete copy of production data.

Also used for validating the backups

Topology should be as similar to

Testers ensure that all solution

match the conditions of the

production environment.

elements function as expected in

production environment as possible.

network and security conditions that

or operational procedures.

Characteristics

——— 5 - User acceptance test (UAT)

Topology Topologies will vary according to the planned solution, the number of pilot users, and the scope of functional and capacity management

Pilot environments are typically a scaleddown, but representative version of the planned production environment.

Expected duration and stability

Long-term availability – this is a stable

Limited service-level agreement for users.

Topologies vary, and have been determined

in the pilot phase. For acceptance testing, we

recommend that the farm servers be near the

same scale as the production environment.

machine configurations should be identical to

The final production topology and farm server

virtualization hosts should be the same as

If load testing is the goal, then the virtual

the production environment and the

configurations are tuned, refined, and

implemented by using the benchmarks

Expected duration and stability

Long-term availability – this should be a

the ones planned for production.

obtained in preproduction testing.

preproduction environment.

Topology

Steps

- Determine the number of virtualization servers
- Create virtual machines to support farm requirements that are identified in POC.

that are required to support the pilot farm.

- Deploy the pilot farm. Refine benchmark data for collection for farm servers and virtualization server. Evaluate pilot.
- Determine operations plan for supporting virtualization server and farm servers. Identify tools and processes for monitoring at both

Refine goals and infrastructure requirements.

virtual machines between virtualization servers.

Steps

Deploy farm.

Output

Steps

Deploy production farm.

Deploy production solution.

Deploy services farm.

- - Updated virtualization plan Updated topology and resource requirements for virtualization server and farm servers. Verify whether or not a fully virtualized

capacity management requirements

Refine virtual machine distribution over

Scale up virtualization servers, scale out

farm servers, deploy farm servers on

Implement operations plan along with in-

house or commercial monitoring product.

physical machines as appropriate.

Evaluate solution and operations plan.

Test for capacity and performance.

Revised virtual architecture.

Updated operations plan.

Implementation plan.

virtualization servers.

A refined operations plan that you can test

environment can met SharePoint business and

during the pilot. This plan includes backup and

recovery, adding, removing, and moving virtual

Farm servers distributed across three tiers 4xVP 8 GB Implement processes and tools for migrating

Query

12 GB

Query

12 GB

HOST-2

8xLP

Crawl

4xVP

8 GB

DB-2

4xVP

32 GB

Query

4xVP

8 GB

Query

8 GB

CA

4xVP

16 GB

Medium to large farm

Planned production

Farm B

HOST-1

8xLP

environment

8 GB

8xLP 32 GB

Database:

Clustered or mirrored

Crawl

4xVP

Query

12 GB

Farm A

environment

HOST-1

8xLP

72 GB

App-1 CA

Planned production

4xVP

8 GB

DB-1

4xVP

32 GB

Crawl 2xVP 4 GB

Query Query 2xVP 2xVP 2xVP 4 GB 4 GB 4 GB App-1 Crawl 2xVP Farm B 4 GB 4 GB Farm servers distributed across DB-1 three tiers 4xVP 4xVP 8 GB 8 GB HOST-1 HOST-2 24 GB

Query

8 GB

CA

4xVP

HOST-2

16 GB

App-3 Crawl

4xVP

16 GB

Virtual machine

For a pilot, the number of users taking part in the project is typical higher than POC participants. As a result, user activity is higher, which is reflected in a higher number of page hits, increased document storage, more search queries, and increased time to crawl the database. A small or medium farm with farm servers deployed across three tiers still provides a

- reasonable environment for pilots. Farm A is a small farm that has: Two processors for all the servers except the database server, which has four processors. 4 GB of RAM for each front-end Web server and each
- application server, 8 GB of RAM for the database server Continue to use three 40-GB hard disk configurations, but mix dynamic, fixed size, and pass through to gather IOPS data. Farm B is a medium farm running on two virtualization hosts.
- The virtual machines are configured as follows: • Two processors for all the servers except the database servers, which each have four processors All the servers have 4 GB of RAM, except the database servers, which have 8 GB of RAM each.

4 GB RAM for each front-end Web server and each application server, 8 GB RAM for the database server. Determine storage requirements and implement them for the pilot so they can be tested and you can use the benchmarks for user acceptance testing.

Virtualization server

For the Farm A environment, the memory requirements, without any memory committed to the operating system or Hyper-V, is 20 GB of RAM. You need a single host with at least 32 GB of RAM. In addition, continuing with a single quad core physical server results in a logical to virtual processor ratio of 8:10, which exceeds the recommended 1:1 ratio. A higher ratio increases CPU overcommitment and will likely affect performance. If you plan to use this farm for user acceptance testing, you need to add more

RAM to the virtualization server. For the Farm B environment, Host-1: Available memory, without any committed memory, is 8 GB of RAM, which leaves room to scale up a farm server.

• The logical to virtual processor ration is 1:1, which is good for performance, but adding another virtual machine would oversubscribe the host CPU. For the Farm B environment, Host-2: Available memory, without any committed

scale up a farm server.

memory, is 4 GB of RAM, which leaves no room to

• The logical to virtual processor ratio is 8:10, which

will reduce performance and leaves no capacity to add another virtual machine. Analysis • Before you start the pilot, determine if the databases need to be mirrored for high availability. If so, deploy them on two hosts. Review your benchmark data for database server performance to decide whether to continue with virtual database servers. If so, you must determine which of the following storage solutions you want to implement and test: fixed size virtual hard disks or pass

through to shared storage. If you are going to switch to physical database servers, do it before starting UAT. • The logical to virtual processor ratio is higher than the recommended 1:1. You can proceed with oversubscribed CPUs on the virtualization hosts, recognizing that you must implement changes during UAT. We recommend that you make host adjustments before you start acceptance testing.

- Load a substantive subset of actual content before you start UAT. Determine whether or not to continue on to the next phase using the same physical servers as well as the same physical and
- Virtual machine During user acceptance testing there typically is a service-level agreement. Ensure that:
- The farm servers are adequately sized and you can scale up You have a reasonable degree of high availability
- implemented. You have a backup and recovery strategy The virtual machines in Farm A and Farm B all have four
- servers, each with 32 GB of RAM. • Farm B: five front-end Web servers with 8 GB each, four application servers with 16 GB each.

 Farm A: three front-end Web servers with 12 GB each, two application servers with 8 GB each, and two database

virtual processors. The memory configurations are as follows:

For the Farm A environment, HOST-1

GB of RAM.

GB of RAM.

Virtualization server

- Available memory, without committed memory, is 8 The logical to virtual processor ratio is 8:16. For the Farm A environment, HOST-2 Available memory, without committed memory, is 20
- The logical to virtual processor ratio is 8:12. For the Farm B environment, HOST-1
- Available memory, without committed memory, is 16 GB of RAM.

The logical to virtual processor ratio is 8:20. For the Farm B environment, HOST-2

Available memory, without committed memory, is 24

The logical to virtual processor ratio is 8:16.

Virtualization server

The virtualization hosts for Farm A and Farm B

illustrate two approaches to increasing host capacity.

Farm A uses four 8 core hosts, each with 64 GB of

RAM. Host-3 only has one virtual machine, a crawl

processor virtual machine without oversubscribing

the CPU. In all cases, there is adequate memory to

server; and there is capacity to add another four-

scale up the virtual machines. The advantage of

using four hosts is that you have the flexibility to

move virtual machines around on the hosts. The

Analysis

The logical to virtual processor ratio is higher than the recommended 1:1. Both farms are seriously oversubscribed. We recommend that you address this issue before you start UAT. You can:

 Scale back the virtual processor configuration on the front-end Web servers or application servers. Add additional hosts, shown in Farm A of the following production illustration. Use hosts with more cores, shown in Farm B of the following production illustration.

- 6 - Production -

Purpose This is the live environment

that your users interact with.

Characteristics

It is business critical, and

appropriate service-level

agreements are in place.

Full service-level agreement for users, appropriate to the solution and business requirements.

Topology the pilot phase. For acceptance testing, we

recommend that the farm servers be near the same scale as the production environment.

stable environment.

Topologies vary, and have been determined in

If load testing is the goal, then the virtual machine configurations should be identical to the production environment.

The final production topology and farm server

configurations are tuned, refined, and

obtained in preproduction testing.

implemented by using the benchmarks

Output Final operations plan Implementation plan

Implement operations plan. App-1 CA Crawl 4xVP 4xVP 16 GB 32 GB DB-1 4xVP 32 GB Planned production environment HOST-2 HOST-3

WFE-3 Query Query Query Query 4xVP 4xVP 4xVP 4xVP CA Crawl Crawl **HOST-4** 4xVP 4xVP 16 GB 16 GB 16 GB 4xVP Farm B 32 GB Large farm Planned production environment HOST-1 HOST-2 Clustered or mirrored

Virtual machine

Analysis

The production environment typically matches that of the user

Farm A has the following virtual machine configurations: • Three front-end Web servers, each with four processors and Two application servers, each with four processors. Central Administration (CA) is installed on App-1, which has 16 GB of RAM. The Search Crawl component is installed on App-2,

acceptance testing environment. In some cases it may reflect

required changes that are a result of user acceptance testing.

also installed on App-2. • The database servers are mirrored; each has four processors and 32 GB of RAM. Farm B has the following virtual machine configurations: Four front-end Web servers, each with four processors and 8 GB of RAM (scale out rather than scale up).

which has 32 GB of RAM. Note that Central Administration is

 Four application servers, each with four processors and 16 GB of RAM. Two servers are dedicated to crawl and the other two The database servers are installed on physical machines.

disadvantage is that you have twice as many physical servers to manage. Farm B uses two 16-core hosts, each with 64 GB of RAM. The ratio of logical to virtual processors is 1:1 for both hosts. Adding an additional virtual machine would oversubscribe either of the hosts, as would moving a virtual machine from one host to the other.

capacity before putting the farm into production. There are several ways to ensure that you have extra capacity on the hosts, such as: Deploy hosts with 16 or more processor cores. Add one or more 8-core hosts to the environment • Consider deploying a dedicated services farm to offload services that have high resource requirements, such as

Oversubscribing a virtualization host in response to a performance issue or a failed virtual machine is acceptable as a short-term solution. The recommended approach is to ensure that you mitigate this scenario by having adequate host

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