



Hands on...

A banner image showing a close-up of hands typing on a keyboard. The text 'Hands on...' is overlaid in a blue, sans-serif font.

## SQL Server & Virtualisation

To virtualise or not to virtualise? That is the question!

Virtualisation can offer the following benefits:

- \* Consolidate Servers
- \* Reduce costs
- \* Maximise Resource Usage
- \* Scalable Solutions
- \* Reduced Downtime
- \* Improved Application Availability
- \* Central management

Many SQL Server instances are now hosted in a virtualization environment, where one physical server hosts many virtual servers, each sharing the physical resources.

Virtualisation Host Servers have physical resources (CPU, memory, power, storage, and network resources), but present virtual resources to Virtual Machines.

Resources can be managed at the host level (individual VM host server) or at the cluster level (a group of hosts).

The resources available for Virtual Machines are the total physical resources minus the resources required for the hosts and clusters.

A Virtual deployment can work very well in getting optimum usage out of all available resources. With a “bare metal” approach, with dedicated servers for each application, there can be a lot of unused resource such as storage, memory & CPU as each individual server must be specified to cater for the maximum load at a point in time.

You can read more about virtualizing SQL Server in this PDF document from Microsoft:

[http://download.microsoft.com/download/6/1/D/61DDE9B6-AB46-48CA-8380-D7714C9CB1AB/Best\\_Practices\\_for\\_Virtualizing\\_and\\_Managing\\_SQL\\_Server\\_2012.pdf](http://download.microsoft.com/download/6/1/D/61DDE9B6-AB46-48CA-8380-D7714C9CB1AB/Best_Practices_for_Virtualizing_and_Managing_SQL_Server_2012.pdf)

## Server Consolidation

If we were to total the maximum CPU requirements for 5 Servers we might find that all five of them require 8 CPUs at some point in time:

- 5 Servers – Each with 8 CPUs = 40 CPUs in total

However, when investigating further we might find that all 5 servers require a minimum of 4 CPUs at all times, but none of them require 8 CPUs at the same point in time (some may run overnight, some may run in the morning, some might be month end, etc.). If this is the case:

- 5 Servers – Each with 4 CPUs, plus 4 additional CPUs that can be used by any server = 24 CPUs

This can be achieved in virtualization as the Virtual Host Server presents Virtual CPUs to the Virtual machines.

- One Physical Host with 32 CPUs
- 5 Virtual Machines, each with 8 Virtual CPUs
- Spare CPU capacity for the host and future requirements

If all 5 servers required 8 CPUs at the same time that would equate to 40 virtual CPUs. This exceeds the 32 physical CPUs and would result in a bottleneck and poor performance.

*It is very important that the total virtual resource does not exceed the total physical resource at any one time, but they can be “virtually” over resourced.*

## Virtualisation Benefits

There are a number of factors which make the virtualized approach more attractive:

- Lack of knowledge of anticipated load for new applications and associated databases.
- Scalability required for future growth and adjusting the needs of new and unknown applications.
  - Add and remove vCPUs and RAM between virtual machines as required
- Fewer physical Servers required
  - Pools of vCPU and RAM resources
- Ability to balance the resource requirements of servers which are busy at different times in the day
  - Moving virtual machines to different hosts to accommodate busy overnight periods or lighter daytime usage
- Ability to failover virtual machines to the Disaster Recovery Site.
- Relative ease of maintenance
- Additional physical servers can easily be added if future load requires it.
- Fewer physical servers will be required
- Required SQL Server licenses will likely be the same regardless of bare metal or virtualized approach
  - Added benefit that vCPU assignments can be changed as required for SQL Server servers and as long as the total number of vCPUs does not change no additional licenses will be required.
  - Should more vCPUs be required additional licenses can be purchases a required.

## SQL Server Virtualisation Licensing

SQL Server licensing is complex and there are different options available for virtualised environments.

SQL Server offers two licensing models:

- Per core (one for each vCPU or vThread) – minimum of 4 core licenses per VM
- Server + CAL (one server license per VM) – each connecting device/user requires a license

**Note** that Enterprise and Standard editions support both license models, but the Business Intelligence edition only support Server+CAL.

**Note also** that if hyperthreading is enabled a license is required per thread in the Per Core model.

Microsoft also offer a Maximum Virtualisation option where, if all physical cores on the server are licensed with Enterprise Edition and Software Assurance has been purchased, any number of VMs may be deployed on the server.

- Without Software Assurance a number of VMs equal to the number of core licenses may be deployed.

The following link is to a Microsoft PDF document on SQL Server 2012 Licensing for Virtualisation:

[http://download.microsoft.com/download/C/3/7/C37F243B-0246-493E-ABFC-41A7FFD6DE38/SQL\\_Server\\_2012\\_Virtualization\\_Licensing\\_Guide.pdf](http://download.microsoft.com/download/C/3/7/C37F243B-0246-493E-ABFC-41A7FFD6DE38/SQL_Server_2012_Virtualization_Licensing_Guide.pdf)

The following link is to a Microsoft PDF document on all aspects of SQL Server 2014 Licensing:

<http://go.microsoft.com/fwlink/?LinkId=230678>

## Performance Monitoring a Virtualised SQL Server Instance

The techniques used to monitor a virtualised SQL Server instance are the same as those for a bare metal solution.

We must still pay careful attention to:

- \* CPU Usage & CPU Queue Length
- \* Memory Usage
- \* Disk Usage & Disk Queue Length

We can monitor these resources and the server load with the following tools:

- \* Performance Monitor (perfmon)
- \* SQL Server Profiler (now deprecated in SQL Server 2014!)
- \* Extended Events (the new Profiler!)
- \* Dynamic Management Views
- \* DBCC
- \* SQL Server Reports

The challenge we have in a virtualised environment is understanding what physical configuration lies beneath the virtual environment.

- \* How much real contention is there for physical resources?
- \* Does the total virtual resource ever exceed the physical resource?
- \* Is the disk storage solution capable of supporting the maximum IOPS (IO per second) for all servers sharing it?
- \* And many more .....

IO often presents the biggest performance problems in a virtualised deployment. It is imperative that great thought and planning goes into the proposed storage solution that will support a virtualised environment.

The following document from EMC provides some best practise tips for SQL Server virtualisation:

<http://www.emc.com/collateral/white-papers/wp-the-essential-guide-to-sql-server-virtualization.pdf>

SQL Server Virtualisation and Performance & Tuning are complex topics involving many levels of architecture from hardware to operating system to application.

**[Learn more about this when you attend our updated SQL Server Performance & Tuning Course.](#)**