To go along with the Understanding how SQL Server executes a query.pdf document here is a good talk by kevin kline:<https://www.youtube.com/watch?v=34VqSliEfsc> .Title is ” SQL Server Internals and architecture”.Also, a simplified picture is shown below in this word doc.

Course hands on lab content <https://www.dropbox.com/s/x74iqdqevr2eknw/SQL_Admin_JumpStart.iso?dl=0>

Hands on content at <https://www.microsoft.com/en-au/learning/companion-moc.aspx>

Mva hands on lab content <https://www.dropbox.com/s/x74iqdqevr2eknw/SQL_Admin_JumpStart.iso?dl=0>

* 1GiB = 1024MiB = 1024x1024KiB = 1024x1024x1024B
* 1GB = 1000MB = 1000x1000KB = 1000x1000x1000B

Disk have co-centric tracks which in turn have 512 bytes sectors. These sectors are then grouped in what is called blocks. Earlier 1 sector mapped to 1 block but now multiple sectors map to a block(as the disk sizes have increased and thus the number of sectors and due to the inability to refer to such a large number of sectors). A block is also called the allocation unit for the hard drive. Data is written in terms of blocks/allocation units. If you create a txt file and add some content to it, then the ‘size of the file’ would be different from the ‘size of the file on the disk’ which is the block size/allocation unit. Nowadays the 4KiB is generally used as allocation unit or block size. The guideline for NTFS formatted disk for SQL Server data files is to have 64KiB allocation unit(I think 4KiB would also have been fine in this case but since we know that extents are always going to be 64 KiB, hence we use same block size so that the system does not have to maintain more metadata as each block has some metadata associated with it.)

CRYSTALDISKMARK(it uses DISKSPD underneath which is a replacement for SQLIO). SQLIO(benchamarking) and SQLIOSIM(generates SQL Server load). Generate some metrics using crystaldiskmarkinfo and then try to replicate the result using [sqlio](https://technet.microsoft.com/en-us/library/cc966412.aspx) or diskspd or iometer. The cmds in bold below generated different results but should have been same(the param.txt file had this line: e:\diskio\testfile.dat 8 0x0 50):

C:\Program Files (x86)\SQLIO>doskey /history

sqlio -kW -s10 -fsequential -t8 -o8 -b8 -LS -Fparam.txt timeout /T 10

sqlio -kW -s10 -fsequential -t1 -o32 -b8 -LS -Fparam.txt timeout /T 10

sqlio -kW -s10 -fsequential -t1 -o32 -b64 -LS -Fparam.txt timeout /T 10

sqlio -kW -s10 -fsequential -t1 -o32 -b4 -LS -Fparam.txt timeout /T 10

sqlio -kW -s10 -fsequential -t1 -o32 -b64 -LS -Fparam.txt timeout /T 10

sqlio -kW -s10 -fsequential -t1 -o32 -b128 -LS -Fparam.txt timeout /T 10

sqlio -kW -s10 -frandom -t1 -o32 -b128 -LS -Fparam.txt timeout /T 10

sqlio -kW -s10 -frandom -t1 -o32 -b4 -LS -Fparam.txt timeout /T 10

sqlio -kW -s10 -frandom -t1 -o1 -b4 -LS -Fparam.txt timeout /T 10

sqlio -kW -s10 -frandom -t8 -o8 -b4 -LS -Fparam.txt timeout /T 10

sqlio -kW -s10 -frandom -t8 -o8 -b4 -LS timeout /T 10 e:\diskio\testfile.dat

sqlio -kW -s12 -frandom -t8 -o8 -b4 -LS timeout /T 10 e:\diskio\testfile.dat

sqlio -kR -t8 -s120 -o8 -frandom -b8 -BH -LS E:\diskio\TestFile.dat

sqlio -kR -t8 -s120 -o8 -frandom -b8 -BN -LS E:\diskio\TestFile.dat

sqlio -kR -t8 -s120 -o8 -frandom -b4 -BN -LS E:\diskio\TestFile.dat

sqlio -kW -t8 -s120 -o8 -frandom -b4 -BN -LS E:\diskio\TestFile.dat

sqlio -kW -t8 -s120 -o8 -frandom -b4 -BH -LS E:\diskio\TestFile.dat

sqlio -kW -t8 -s120 -o8 -frandom -b4 -BY -LS E:\diskio\TestFile.dat

sqlio -kW -t8 -s120 -o8 -frandom -b4 -BS -LS E:\diskio\TestFile.dat

sqlio -kW -t8 -s120 -o8 -frandom -b64 -BS -LS E:\diskio\TestFile.dat

sqlio -kW -s60 -fsequential -o8 -b64 -LS -Fparam.txt timeout /T 60

**sqlio -kW -s20 -frandom -o8 -b4 -LS -Fparam.txt timeout /T 60**

**sqlio -kW -t8 -s120 -o8 -frandom -b4 -BN -LS E:\diskio\TestFile.dat**

sqlio -kW -t8 -s20 -o8 -frandom -b4 -BN -LS E:\diskio\TestFile.dat

sqlio -kW -t8 -s20 -o8 -frandom -b4 -LS E:\diskio\TestFile.dat

--find the open connections to the database

USE master

SELECT \* FROM sys.sysprocesses WHERE dbid = DB\_ID('TinyDB')

--this should also give some idea

exec sp\_who2

exec sp\_whoisactive

KILL <SPID>

--you could also try to set it to read-only in which case it will ask u if u want to close all connections

--u can also open Activity monitor in SSMS context menu for the server to find the processes

--get the current instance configs

USE master;

GO

SELECT \* FROM sys.configurations;

GO

-- Step 1: Open and execute the query 91 - Workload.sql from

-- Solution Explorer. WARNING: Make sure you have followed

-- the instructions at the top of that window before clicking

-- Execute.

-- Step 2: Query the currently executing requests.

-- Note that a large number of requests is returned but that

-- most are system requests.

SELECT \* FROM sys.dm\_exec\_requests;

GO

-- Step 3: The is\_user\_process column of the sys.dm\_exec\_sessions view can

-- be used to filter out system activity

SELECT \* FROM sys.dm\_exec\_sessions WHERE is\_user\_process = 1;

GO

-- Step 4: Use that column to filter the currently executing requests

-- by joining the two tables on session\_id.

SELECT s.original\_login\_name, s.program\_name, r.command,

r.wait\_type, r.wait\_time, r.blocking\_session\_id, r.sql\_handle

FROM sys.dm\_exec\_requests AS r

INNER JOIN sys.dm\_exec\_sessions AS s

ON r.session\_id = s.session\_id

WHERE s.is\_user\_process = 1;

GO

-- Step 5: Note that we can also retrieve details of the SQL Batch that

-- is being executed, instead of just the handle. We do that by

-- using the sys.dm\_exec\_sql\_text function.

SELECT s.original\_login\_name, s.program\_name, r.command, t.text,

r.wait\_type, r.wait\_time, r.blocking\_session\_id

FROM sys.dm\_exec\_requests AS r

INNER JOIN sys.dm\_exec\_sessions AS s

ON r.session\_id = s.session\_id

OUTER APPLY sys.dm\_exec\_sql\_text(r.sql\_handle) AS t

WHERE s.is\_user\_process = 1;

GO

-- Step 6: Do not be too concerned about the complexity of the subquery

-- below but note that it is possible to find the actual statement

-- that is being executed rather than the batch.

SELECT s.original\_login\_name, s.program\_name, r.command,

(SELECT TOP (1) SUBSTRING(t.text, r.statement\_start\_offset / 2 + 1,

((CASE WHEN r.statement\_end\_offset = -1

THEN (LEN(CONVERT(nvarchar(max), t.text)) \* 2)

ELSE r.statement\_end\_offset

END) - r.statement\_start\_offset) / 2 + 1)) AS SqlStatement,

r.wait\_type, r.wait\_time, r.blocking\_session\_id

FROM sys.dm\_exec\_requests AS r

INNER JOIN sys.dm\_exec\_sessions AS s

ON r.session\_id = s.session\_id

OUTER APPLY sys.dm\_exec\_sql\_text (r.sql\_handle) AS t

WHERE s.is\_user\_process = 1;

GO

-- Step 7: Stop the script execution in the 91 - Workload.sql window

-- (Change to that window and click the Cancel Executing

-- Query toolbar button then return to this window)

-- Step 8: Investigate how the procedure cache is distributed at this point

SELECT cacheobjtype,

objtype ,

COUNT(\*) as CountofPlans,

SUM(usecounts) as UsageCount,

SUM(usecounts)/CAST(count(\*)as float) as AvgUsed ,

SUM(size\_in\_bytes)/1024./1024. as SizeinMB

FROM sys.dm\_exec\_cached\_plans

GROUP BY cacheobjtype, objtype

ORDER BY CountOfPlans DESC;

GO

-- Step 9: Locate the top 10 queries based on Average Reads

SELECT TOP (10) total\_logical\_reads/execution\_count AS AvgReads,

SUBSTRING(st.text, (qs.statement\_start\_offset/2) + 1,

((CASE statement\_end\_offset

WHEN -1 THEN DATALENGTH(st.text)

ELSE qs.statement\_end\_offset END

- qs.statement\_start\_offset)/2) + 1) as StatementText

FROM sys.dm\_exec\_query\_stats AS qs

CROSS APPLY sys.dm\_exec\_sql\_text(qs.sql\_handle) AS st

ORDER BY total\_logical\_reads/execution\_count DESC;

GO

-- Step 10: View I/O statistics for the database files

SELECT DB\_NAME(fs.database\_id) AS DatabaseName,

mf.name AS FileName,

mf.type\_desc,

fs.\*

FROM sys.dm\_io\_virtual\_file\_stats(NULL,NULL) AS fs

INNER JOIN sys.master\_files AS mf

ON fs.database\_id = mf.database\_id

AND fs.file\_id = mf.file\_id

ORDER BY fs.database\_id, fs.file\_id DESC;

GO

-- Step 11: View general wait statistics

SELECT \* FROM sys.dm\_os\_wait\_stats;

GO

select \*

from msdb.dbo.suspect\_pages

--size of db

exec sp\_spaceused

--size of db

SELECT DB\_NAME(database\_id) AS DatabaseName,

Name AS Logical\_Name,

Physical\_Name,

(size \* 8) / 1024 SizeMB

FROM sys.master\_files

WHERE DB\_NAME(database\_id) = 'ManufacturingDB'

select \*

from sys.dm\_db\_file\_space\_usage

select \*

from sys.dm\_db\_log\_space\_usage

Use DB2BMoved;

GO

Select \* from sys.database\_files;

|  |  |
| --- | --- |
| **Drive Letter and Directory** | **Purpose** |
| C: | System drive, Page file |
| L:\SQLLogs  K:\SQLLogs | SQL Server Log drive(s) |
| M:\SQLBackups  N:\SQLBackups | SQL Server Backup drive(s) |
| P:\SQLData  Q:\SQLData  R:\SQLData  S:SQLData | SQL Server Data drive(s) |
| T:\TempDB | SQL Server TempDB |
| Z: | Optical drive |

Table 1: Naming Standards and Structure for Logical Drives

<https://www.red-gate.com/simple-talk/sql/database-administration/provisioning-a-new-sql-server-instance-part-two/>

**Physical RAM**                    **MaxServerMem Setting**   
8GB                                        6000   
12GB                                     9000   
16GB                                     12000   
24GB                                     20000  
32GB                                     27000   
48GB                                     43000   
64GB                                     58000  
72GB                                     66000  
96GB                                     90000  
128GB                                   120000  
192GB                                   184000  
256GB                                   248000

--Database Backups

SELECT

CONVERT(CHAR(100), SERVERPROPERTY('Servername')) AS Server,

msdb.dbo.backupset.database\_name,

msdb.dbo.backupset.backup\_start\_date,

msdb.dbo.backupset.backup\_finish\_date,

msdb.dbo.backupset.expiration\_date,

CASE msdb..backupset.type

WHEN 'D' THEN 'Full Database backup'

WHEN 'I' THEN 'Differential'

WHEN 'L' THEN 'Transaction Log'

END AS backup\_type,

msdb.dbo.backupset.backup\_size,

msdb.dbo.backupmediafamily.logical\_device\_name,

msdb.dbo.backupmediafamily.physical\_device\_name,

msdb.dbo.backupset.name AS backupset\_name,

msdb.dbo.backupset.description

FROM msdb.dbo.backupmediafamily

INNER JOIN msdb.dbo.backupset ON msdb.dbo.backupmediafamily.media\_set\_id = msdb.dbo.backupset.media\_set\_id

WHERE (CONVERT(datetime, msdb.dbo.backupset.backup\_start\_date, 102) >= GETDATE() - 7)

and msdb.dbo.backupset.database\_name like '%natsoil%'

ORDER BY

msdb.dbo.backupset.database\_name,

msdb.dbo.backupset.backup\_finish\_date

--Database Backups

SELECT

BS.server\_name AS [Server Name]

,BS.database\_name AS [Database Name]

,BS.recovery\_model AS [Recovery Model]

,BMF.physical\_device\_name [Location]

,(CAST(BS.backup\_size / 1000000 AS INT)) AS [Size of Backup (MB)]

,CASE BS.[type] WHEN 'D' THEN 'Full'

WHEN 'I' THEN 'Differential'

WHEN 'L' THEN 'Transaction Log'

END AS [Type of Backup]

,BS.backup\_start\_date AS [Backup Date]

,BS.first\_lsn AS [First LSN]

,BS.last\_lsn AS [Last LSN]

FROM msdb.dbo.backupset BS

INNER JOIN msdb.dbo.backupmediafamily BMF ON BS.media\_set\_id = BMF.media\_set\_id

WHERE BS.database\_name like '%natsoil%'

ORDER BY backup\_start\_date DESC

,backup\_finish\_date

If you don’t have clear RPO/RTO requirements from your business, you might start out with a job schedule like this for ola hallengren scripts:

| **Job Name** | **Run Schedule** |
| --- | --- |
| CommandLog Cleanup | Every Sunday at 12:00AM |
| DatabaseBackup – SYSTEM\_DATABASES – FULL | Every day at 11:55PM |
| DatabaseBackup – USER\_DATABASES – DIFF | Every day at 12:00PM |
| DatabaseBackup – USER\_DATABASES – FULL | Every day at 12:00AM |
| DatabaseBackup – USER\_DATABASES – LOG | Every 30 minutes |
| DatabaseIntegrityCheck – SYSTEM\_DATABASES | Every Saturday at 8:00AM |
| DatabaseIntegrityCheck – USER\_DATABASES | Every Saturday at 9:00AM |
| IndexOptimize – USER\_DATABASES | Every Monday at 3:00AM |
| Output File Cleanup | Every Sunday at 12:01AM |
| sp\_delete\_backuphistory | Every Sunday at 12:02AM |
| sp\_purge\_jobhistory | Every Sunday at 12:03AM |

If we have a Service Level Agreement (SLA) of 10 minutes, take log backup every 10 minutes.

Raid 01 vs raid 10:

**Example Scenario**

For example, with a 30-minute data-loss requirement and a 2 hour downtime requirement, you might design a restore strategy that is:

* Perform a tail-of-the-log backup
* Restore from the most recent full backup
* Restore all log backups since the most recent full backup

And then set the full backup frequency at every day at midnight and the log backup frequency at every half hour. The full backup takes 20 minutes to complete and each log backup takes 5 minutes to complete.

The worst case scenario is that a crash occurs at 23:59:59. This means the restore sequence is (with some estimated completion times):

* Perform the tail-of-the-log backup to backup the log generated since the log backup at 23:30. This takes 5 minutes.
* Restore the full backup from midnight. This takes 20 minutes.
* Restore the 48 log backups from today, starting with the one at 00:00 and ending with the one at 23:30. Each one takes 5 minutes, for total time of 240 minutes.
* Restore the tail-of-the-log backup. This takes 5 minutes.

In total, the restore sequence takes 270 minutes, or 4 hours 30 minutes. This is clearly longer than the downtime requirement.

The solution is to add differential backups during each day, say every 4 hours starting at midnight, with each one taking 10 minutes to complete.

The restore sequence then becomes:

* Perform the tail-of-the-log backup to backup the log generated since the log backup at 23:30. This takes 5 minutes.
* Restore the full backup from midnight. This takes 20 minutes.
* Restore the most recent differential backup from 20:00. This takes 10 minutes.
* Restore the 8 log backups from today, starting with the one at 20:00 and ending with the one at 23:30. Each one takes 5 minutes, for total time of 40 minutes.
* Restore the tail-of-the-log backup. This takes 5 minutes.

Now the total restore sequence takes 80 minutes, or 1 hour 20 minutes. This is within the downtime requirement.

USE Branch;

GO

SELECT file\_id,

name,

size as SizeInPages,

FILEPROPERTY(name, 'SpaceUsed') as SpaceUsedInPages,

size\*8/1024. as SizeInMB,

FILEPROPERTY(name, 'SpaceUsed')\*8/1024. as SpaceUsedInMB,

physical\_name

FROM sys.database\_files;

GO

EXEC sp\_spaceused 'dbo.Prospect', 'true'

use tools

exec SDU\_Tools.ListUserTableAndIndexSizes

N'branch'

--ESTIMATE SIZE OF A ROW IN A TABLE. VAR COLS NEED EXTRA HANNDLING NOT TAKEN CARE OF IN THIS QUERY

--https://docs.microsoft.com/en-us/sql/relational-databases/databases/estimate-the-size-of-a-heap

-- Row\_Size = Fixed\_Data\_Size + Variable\_Data\_Size + Null\_Bitmap + 4

;WITH CTE AS

(select OBJECT\_NAME(object\_id) as tablename, COUNT(1) as nr\_columns, sum(max\_length) as maxrowlength

from sys.columns as S

where object\_id = object\_id('FactInventory')

GROUP BY OBJECT\_NAME (object\_id)

)

SELECT \*, maxrowlength + 2 + ((nr\_columns + 7) / 8) + 4

FROM CTE

dbcc ind('natsoil','codes',1)—65 or 64 pages?

EXEC sp\_spaceused 'dbo.codes', 'true'--114 pages tot, 64 pages of data

set statistics io on

select \*

from codes--gives u 64 pages(logical reads)

USE Branch;

GO

SELECT i.data\_space\_id,

s.name as Filegroup

FROM sys.indexes AS i

INNER JOIN sys.data\_spaces AS s

ON i.data\_space\_id = s.data\_space\_id

WHERE i.object\_id = OBJECT\_ID(N'dbo.Contact');

GO

RESTORE HEADERONLY

FROM DISK = 'C:\mssqlDatabases\backups\AdventureWorks2012.bak';

GO

-- Step 6: Use RESTORE FILELISTONLY to get a list of files that are contained in the backup.

-- Mention that S means filestream backup and that filestream is an advanced

-- topic that is out of scope for this course.

RESTORE FILELISTONLY

FROM DISK = 'C:\mssqlDatabases\backups\AdventureWorks2012.bak';

GO

-- Step 7: Use RESTORE VERIFYONLY to check backup.

RESTORE VERIFYONLY

FROM DISK = 'C:\mssqlDatabases\backups\AdventureWorks2012.bak';

GO

EXEC sp\_configure 'show advanced options',1;

GO

RECONFIGURE;

GO

EXEC sp\_configure 'xp\_cmdshell',1;

GO

RECONFIGURE;

GO

select OBJECT\_NAME(t.object\_id), OBJECT\_NAME(t.stats\_id), \*

from sys.stats as t

where OBJECT\_NAME(t.object\_id) = N'Person'

dbcc show\_statistics([person.person], [IX\_Person\_LastName\_FirstName\_MiddleName])

select \*

from sys.dm\_exec\_connections

where session\_id = @@SPID

select SUSER\_SNAME(owner\_sid) as owner, \*

from sys.databases

exec sp\_helpdb

select \*

from sys.database\_files

select \*

from sys.objects

exec sp\_help

Primary file group is the default but does not have to be. Primary data file goes in PFG. For other files(secondary data files), if the file group is not specified, they go to default file group whichever that is.

Dbcc stands for database console command(during sysbase days it stood for database consistency checker)

dbcc checkdb

dbcc checkdb with estimateonly

dbcc checkdb with data\_purity

logs: windows event log, sql server error log. Recovery vs restore

select \*

from sys.server\_principals

select \*

from sys.database\_principals

select s.name as [Login Name], p.name as [User Name], default\_schema\_name

from sys.server\_principals as s

inner join sys.database\_principals as p

on s.sid = p.sid

EXEC sp\_dbcmptlevel

EXEC sp\_dbcmptlevel 'NatSoil'

select compatibility\_level

from sys.databases as s

where s.[name] = 'NatSoil'

--EXEC sp\_dbcmptlevel 'NatSoil', 120

--EXEC sp\_dbcmptlevel 'NatSoil', 110

--will work for stored procs, views, etc. but not tables. 'sys.databases' is a view

exec sp\_helptext 'sys.databases'

select OBJECT\_DEFINITION(OBJECT\_ID('sys.databases'))

exec sp\_help 'dbo.CODES'

--will not work..if you do not want to use sh\_help stored proc and want to use queries to

--get equivalent info, then write your own using sys.tables, sys.columns, etc.

select OBJECT\_DEFINITION(OBJECT\_ID('dbo.CODES'))

--better option than this is to query the sys.dm\_exec\_sessions dmv as shown below

dbcc useroptions

select \*

from sys.dm\_exec\_sessions

where session\_id = @@SPID

sysindexes

sysobjects

syscolumns

sysdatabases

sys.indexes

sys.objects

sys.columns

sys.databases

use tempdb

--create table t

--(

--id char(30),

--id1 char(30),

--id2 char(30),

--id3 char(30),

--)

select \*

from sys.indexes as i

where i.object\_id = object\_id('t')

select \*

from sys.partitions as p

where p.object\_id = object\_id('t')

--only contains 'in\_row\_data'

select a.\*

from sys.allocation\_units as a

inner join sys.partitions as p on a.container\_id = p.partition\_id

where p.object\_id = object\_id('t')

--alter table t

-- add id4 varchar(8000);

--rerun the 3 queries and see the sys.allocation\_units table contains 'in\_row\_data' and 'row\_overflow\_data'

--alter table t

-- add id5 varbinary(max);

--rerun the 3 queries and see the sys.allocation\_units table contains 'in\_row\_data', 'row\_overflow\_data' and 'lob\_data'

--create clustered index idx1 on t(id);

--rerun the 3 queries and see the type entry in indexes table changes to clustered

--create nonclustered index idx2 on t(id1);

--rerun the 3 queries and see that a new entry has been made in all three tables

dbcc traceon(3604)

dbcc ind(natsoil, samples, -1) –get the page number to feed into the command below

dbcc page(natsoil,1,22733,1)

--get index depth and index level. The index\_id param would be 0 for heap, 1 for CI and 2 or more for NCI. If null is passed, that means all indexes

SELECT

[index\_depth],

[index\_level],

[page\_count],

[record\_count]

FROM sys.dm\_db\_index\_physical\_stats (

DB\_ID (N'AdventureWorks2012'),

OBJECT\_ID (N'Test1'),

1,

0,

'DETAILED');

GO

C:\Users\sin17h>wmic partition get BlockSize, StartingOffset, Name, Index

Before cloning a template as noted down below, you should first run sysprep on the template as noted [here](http://www.sqlservercentral.com/articles/MCSA+70-462/103881/) as otherwise some internal identifier called ‘sid’ remains same for all clones and will cause issues.

The following statements go into vboxmanage.bat file:

vboxmanage clonevm Template --name SQL-A --register

vboxmanage clonevm Template --name SQL-B --register

vboxmanage clonevm Template --name SQL-C --register

vboxmanage clonevm Template --name SQL-D –register

c:\Program Files\Oracle\VirtualBox>"c:\Users\sin17h\Documents\vboxmanage.bat"

for hyper-v, <http://www.sqlservercentral.com/articles/MCSA+70-462/103881/>

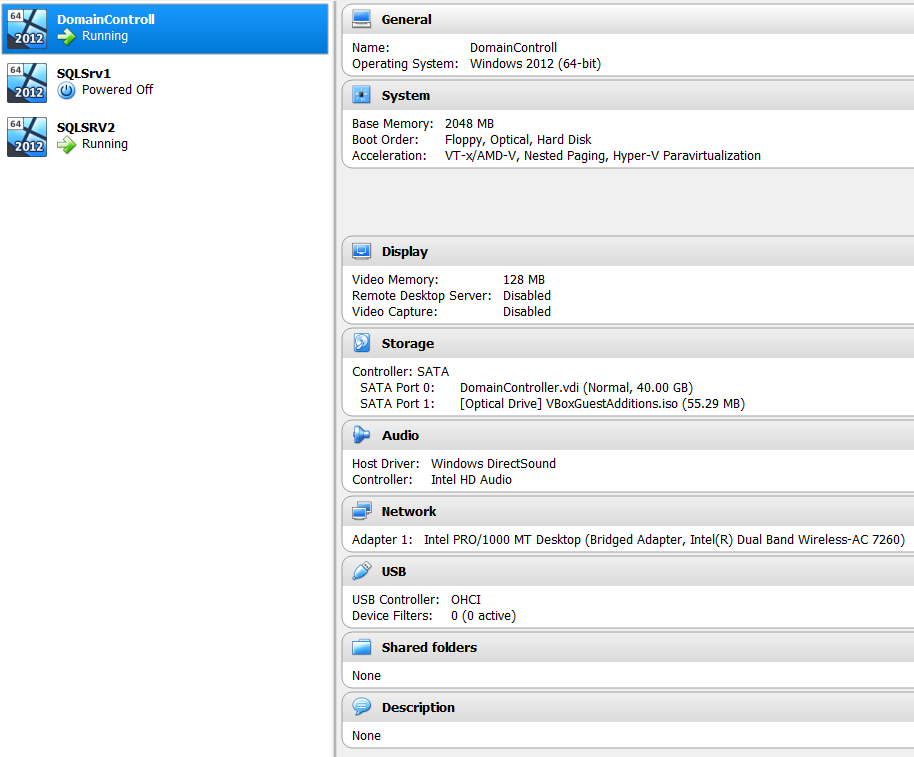
To disable hyper-v so that virtual box could be used

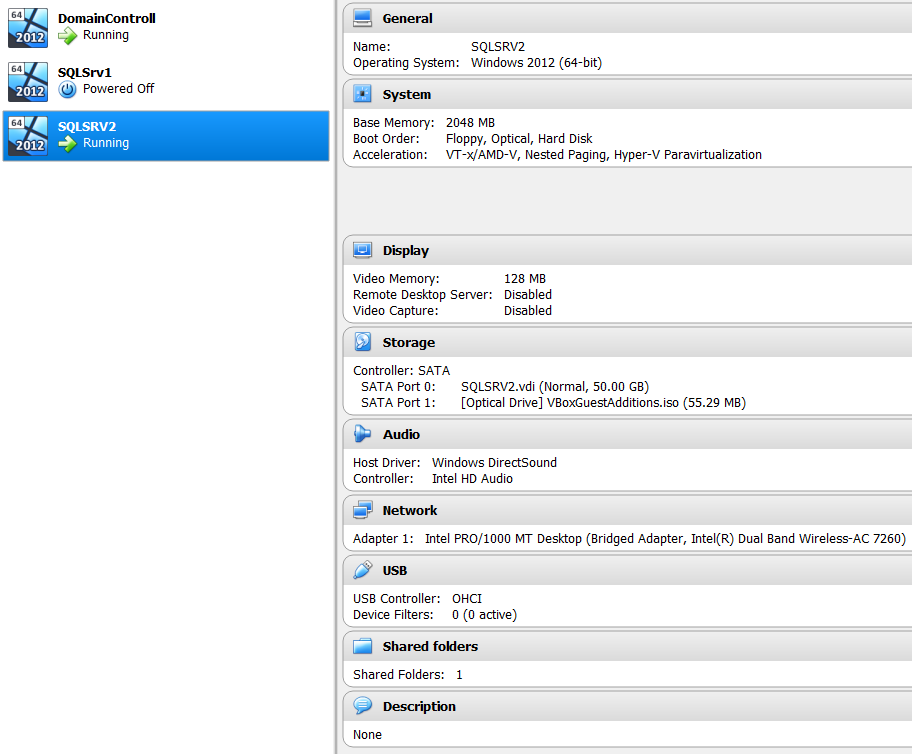
C:\>bcdedit /copy {current} /d "No Hyper-V"

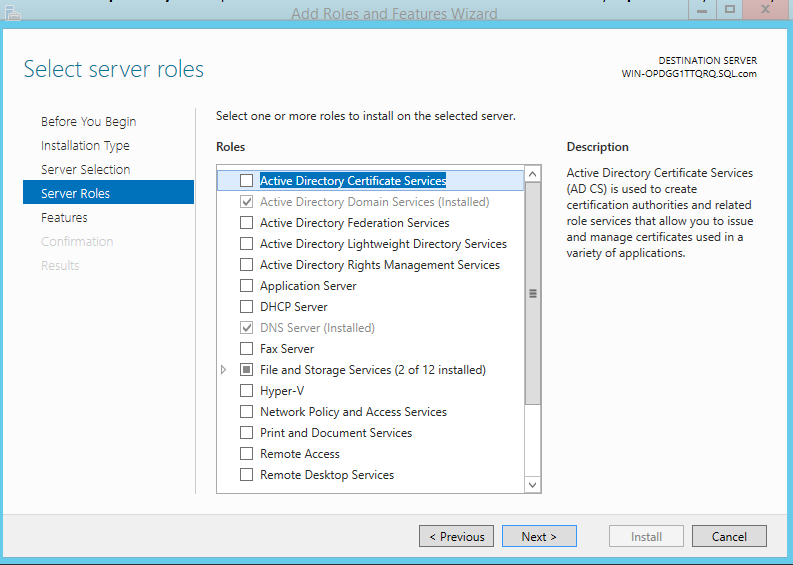
The entry was successfully copied to {ff-23-113-824e-5c5144ea}.

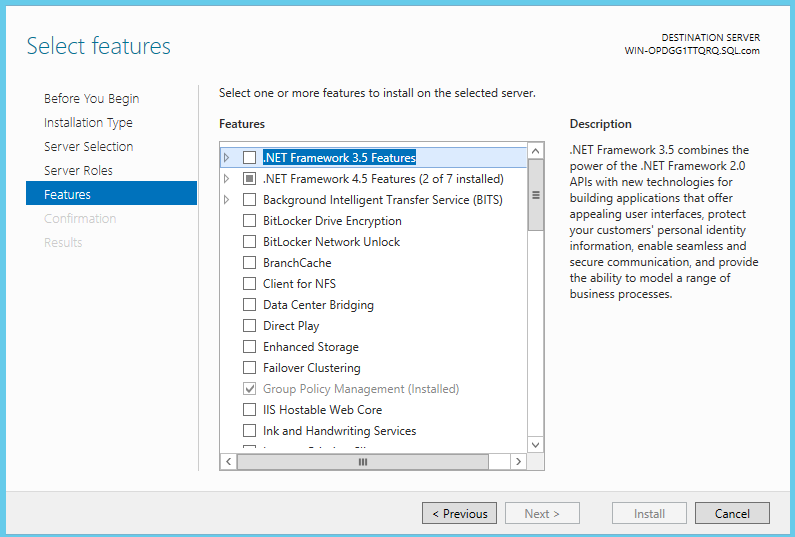
C:\>bcdedit /set {ff-23-113-824e-5c5144ea} hypervisorlaunchtype off

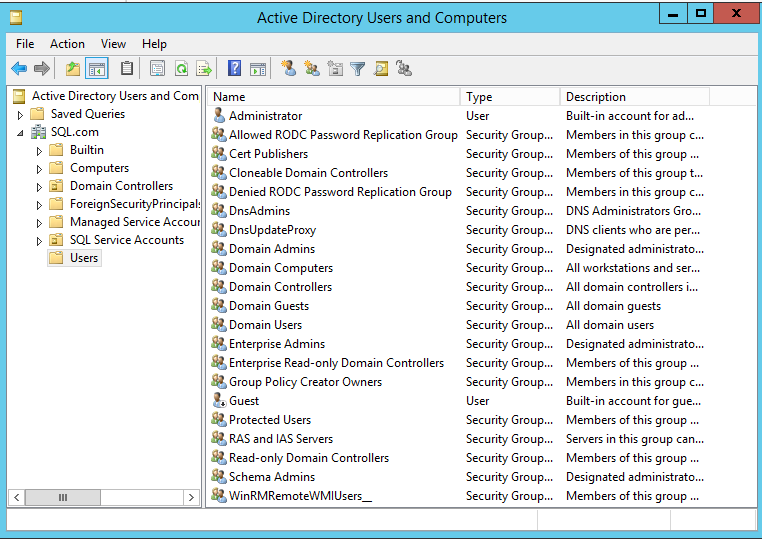
The operation completed successfully.

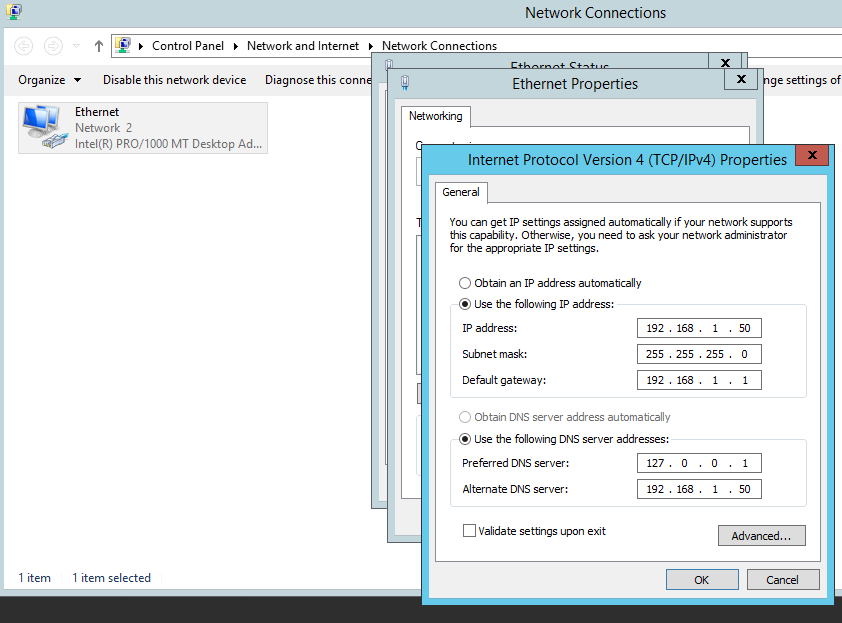


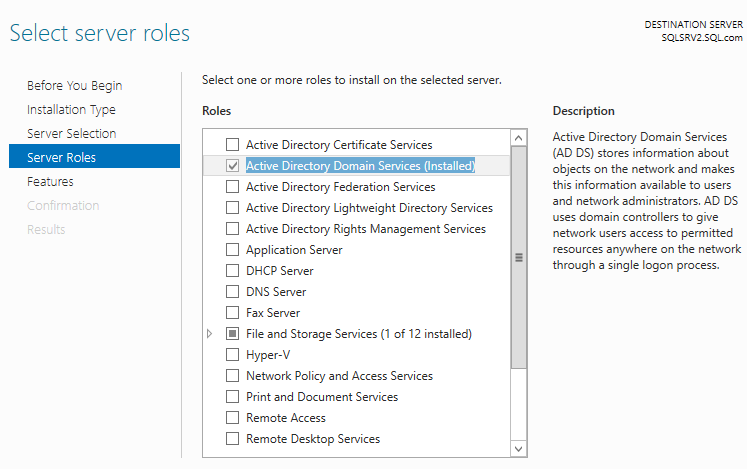


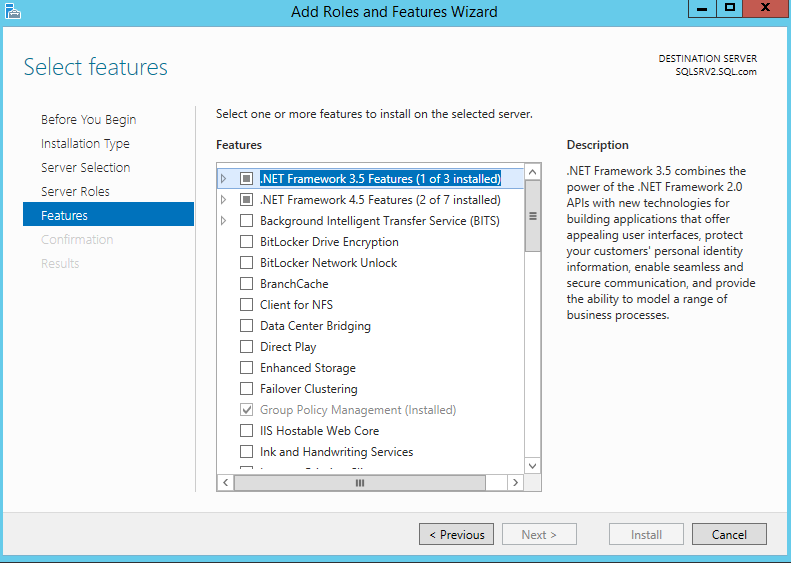


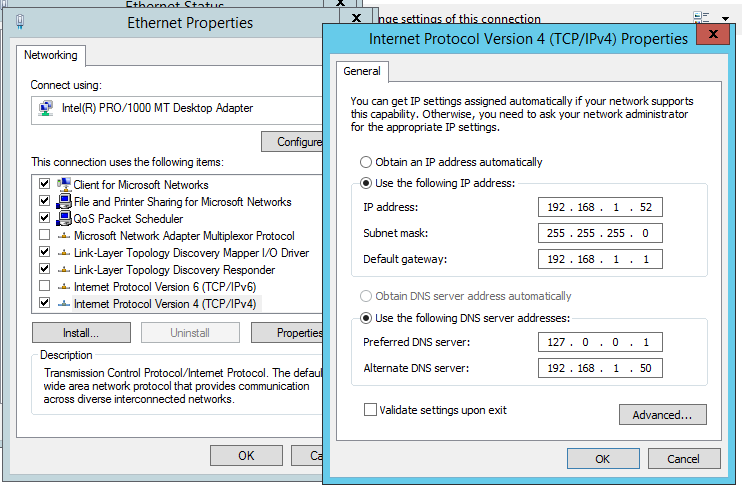




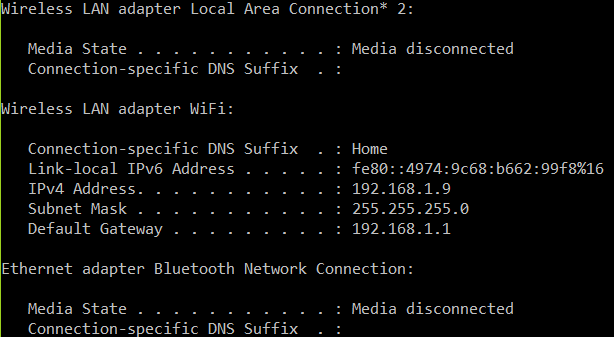


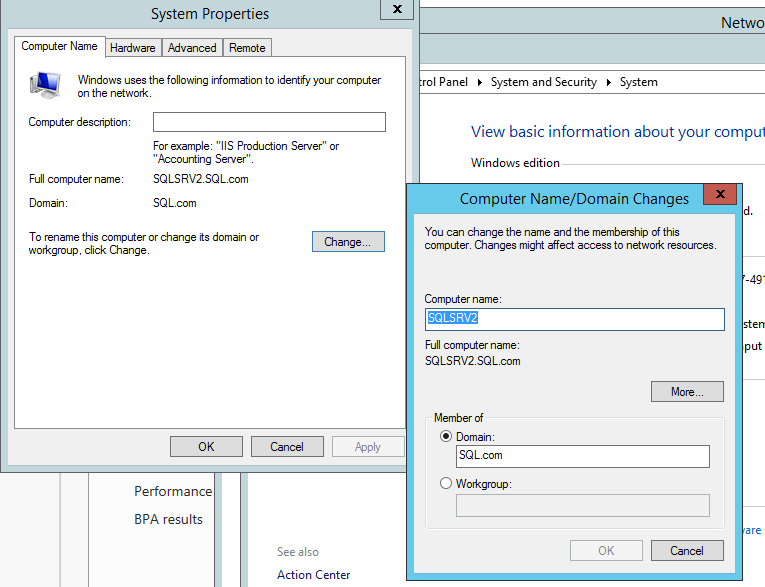


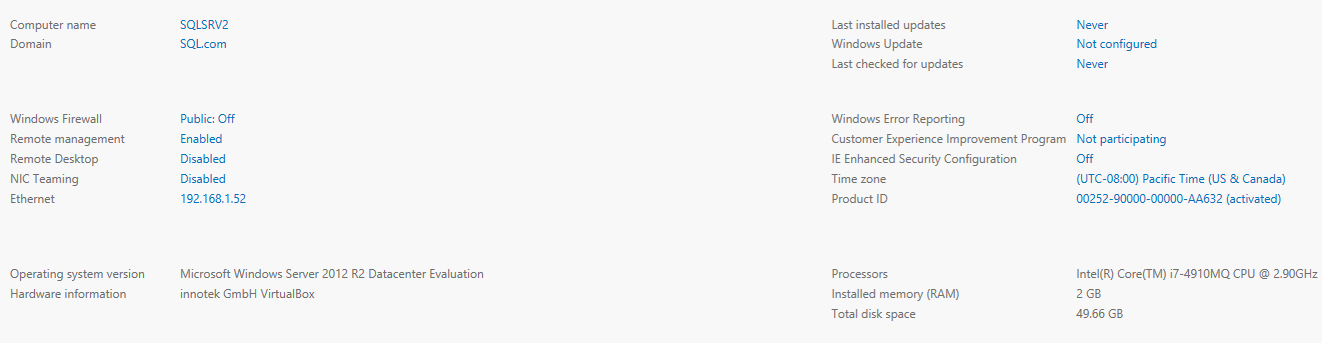




Default gateway from host machine







SET TRANSACTION ISOLATION LEVEL READ UNCOMMITTED ;

WITH XMLNAMESPACES

(DEFAULT 'http://schemas.microsoft.com/sqlserver/2004/07/showplan')

SELECT query\_plan AS CompleteQueryPlan ,

n.value('(@StatementText)[1]', 'VARCHAR(4000)') AS StatementText ,

n.value('(@StatementOptmLevel)[1]', 'VARCHAR(25)')

AS StatementOptimizationLevel ,

n.value('(@StatementSubTreeCost)[1]', 'VARCHAR(128)')

AS StatementSubTreeCost ,

n.query('.') AS ParallelSubTreeXML ,

ecp.usecounts ,

ecp.size\_in\_bytes

FROM sys.dm\_exec\_cached\_plans AS ecp

CROSS APPLY sys.dm\_exec\_query\_plan(plan\_handle) AS eqp

CROSS APPLY query\_plan.nodes

('/ShowPlanXML/BatchSequence/Batch/Statements/StmtSimple')

AS qn ( n )

WHERE n.query('.').exist('//RelOp[@PhysicalOp="Parallelism"]') = 1

Which solution do you use for SQL Server monitoring?

:one: Nothing (Ad-hoc queries) `4`

:two: No, really, nothing. `2`

:three: Redgate `6`

:four: SentryOne `6`

:five: Solarwinds `5`

:six: In-house solution `4`

And/Or Grafana/Telegraf, Grafana/InfluxDB used by MS Tiger Team, SO's Opserver. Configured Zabbix or Nagios aren't anywhere near "in-house" or "nothing" either :wink: (edited)

Which solution do you use for SQL Server Monitoring? (continued)

:one: dbareports

:two: Database Health Monitor `1`

:three: SQL Power Tools

:four: Idera `3`

:five: Heroix

:six: Zabbix `1`

--it invalidates the plan in the cache so that when the proc is called the next time, it will be recompiled. There could be multiple plans in cache for same proc for different session options

Exec Sp\_recompile GetCustInfo

--this also gives u the session options

select \*

from sys.dm\_exec\_sessions

where is\_user\_process = 1

The estimated number of rows can be different from actual number of rows in a plan due to 2 reasons:

1. The statistics are not up-to-date.
2. The plan that is being used was not compiled for that parameter value(due to parameter sniffing)

Run glenn berry’s [dmv queries](https://www.sqlskills.com/blogs/glenn/category/dmv-queries/) to collect stats:

PS C:\Windows\system32> $output = Invoke-DbaDiagnosticQuery -SqlInstance mssql-asris1.it.csiro.au –InstanceOnly

PS C:\Windows\system32> Export-DbaDiagnosticQuery -InputObject $output -ConvertTo Excel

PS C:\Windows\system32> $output = Invoke-DbaDiagnosticQuery -SqlInstance mssql-asris1.it.csiro.au

PS C:\Windows\system32> Export-DbaDiagnosticQuery -InputObject $output -ConvertTo Excel

<https://www.youtube.com/watch?v=BY2ZQTMGRDA>

--view cached plans

select distinct cp.bucketid, cp.cacheobjtype, cp.usecounts, co.sqlbytes, cp.size\_in\_bytes, co.[sql]

from sys.syscacheobjects as co

inner join sys.dm\_exec\_cached\_plans as cp on co.bucketid = cp.bucketid

select t.text, p.size\_in\_bytes, p.usecounts

from sys.dm\_exec\_cached\_plans as p

cross apply sys.dm\_exec\_sql\_text(p.plan\_handle) as t

fSELECT st.text, qs.execution\_count, qs.total\_elapsed\_time,

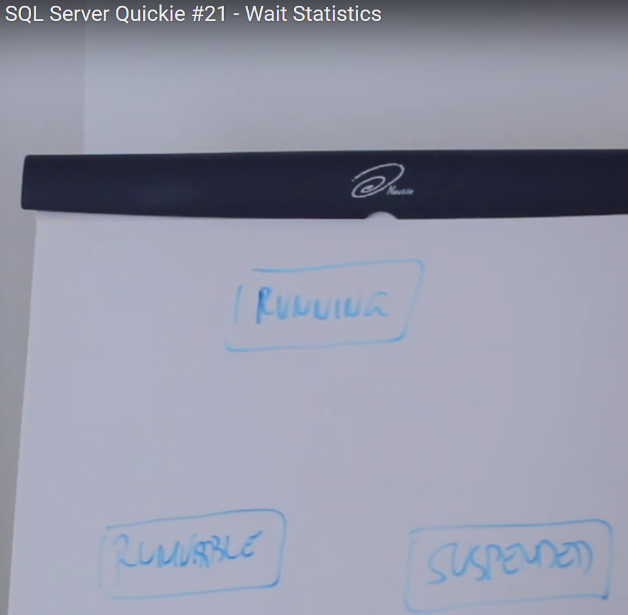
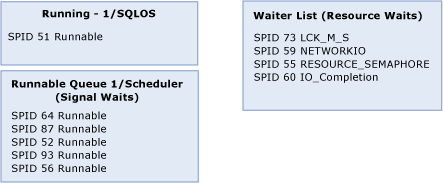
convert(decimal(11,2), qs.total\_elapsed\_time \* 1.0/qs.execution\_count) as avg\_time

FROM sys.dm\_exec\_query\_stats AS qs

CROSS APPLY sys.dm\_exec\_sql\_text(qs.sql\_handle) AS st

ORDER BY total\_logical\_reads/execution\_count DESC;

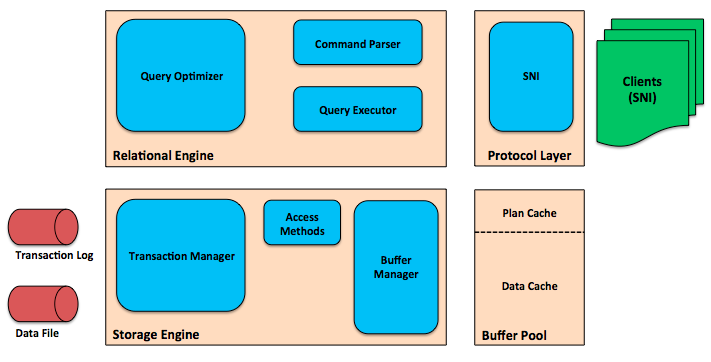
GO

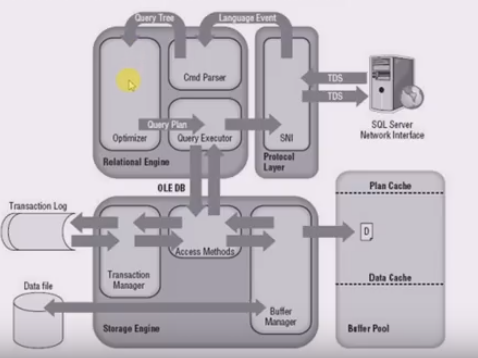


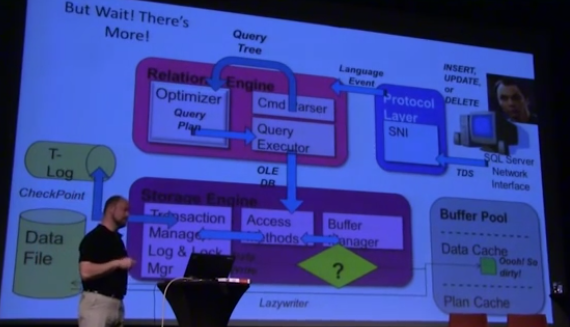
The current wait list can be seen in sys.dm\_os\_waiting\_tasks. The current runnable queue is found in sys.dm\_exec\_requests where the status is “runnable”. The total time that is spent waiting in sys.dm\_os\_waiting\_tasks is found in the column wait\_time\_ms and the time that is spent waiting for CPU in the runnable queue is called signal\_wait \_time\_ms. Not only is the info about runnable queue exposed by sys.dm\_exec\_requests using wait\_type ‘runnable’ but info about threads waiting for resources is also exposed through sys.dm\_exec\_requests with wait\_type set to the particular resource wait. The one kind of resource waits not exposed through sys.dm\_exec\_requests is the ‘threadpool’ wait\_type as that request has not been assigned a thread and has not started executing. For that, we need to used dmv sys.dm\_os\_waiting\_tasks as it will expose both started and not-started tasks.

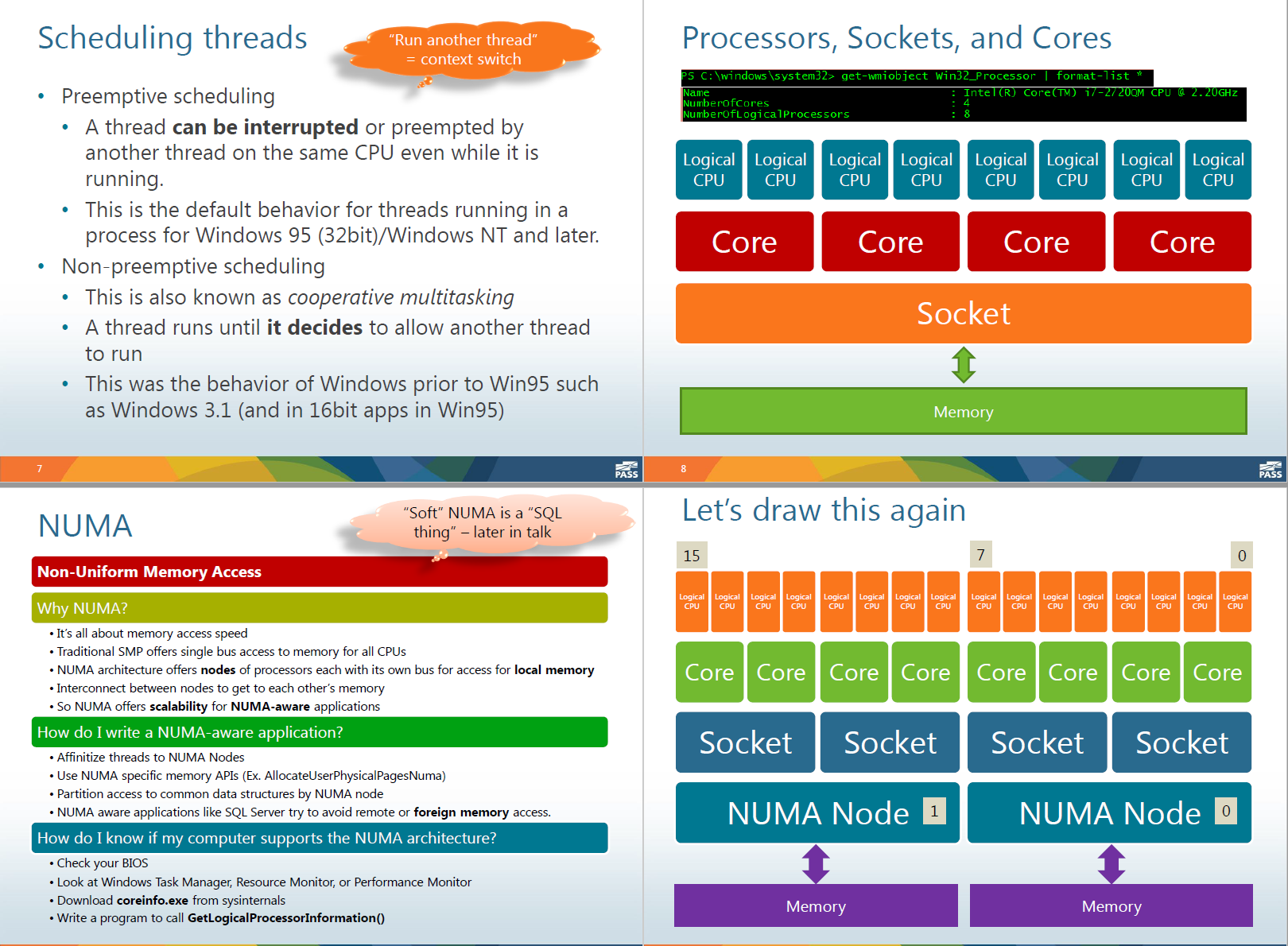
Useful DMVs for performance tuning purposes include sys.dm\_exec\_requests, sys.dm\_os\_waiting\_tasks, and sys.dm\_os\_wait\_stats. [sys.dm\_os\_wait\_stats (for the cumulative ones), sys.dm\_os\_waiting\_tasks for the current waits]

<https://www.youtube.com/watch?v=34VqSliEfsc>









The idea behind preemption (or **preemptive scheduling**) is that by default each active thread (i.e., a thread that actually has some work to do) gets an equal amount of time on the CPU. The amount of CPU time is split equally, and the CPU switches back and forth between the various tasks vying for its attention. Each equal CPU time slice is called a **quantum**. In reality, some threads are more important than others, and these are said to have a higher **priority**. In a preemptive environment, the higher priority threads are able to force the lower priority threads to yield, in order that the higher priority threads can get more of the CPU time and finish their work more quickly.

SQL Server runs on top of the Windows operating system, and so it must work within the confines of the operating system’s preemption model. However, internally SQL Server uses its own scheduler, which is one of the components of the SQL Server Operating System (**SQLOS** for short). Unlike Windows, the SQLOS scheduler uses a **cooperative** (also called **non-preemptive**) scheduling model. In this model each thread (abstracted within SQL Server by an entity called a **worker**) can spend as much time as it needs on the CPU until its task is finished. The idea is that preemption should not be necessary because threads will eventually have to stop and acquire non-CPU resources (e.g. data from the disk system) and will enter **wait states**, thereby liberating the CPU for other tasks. SQL Server’s cooperative model is somewhat limited in its flexibility since again, as a Windows application, it must also abide by the operating system’s preemptive model. This means that SQL Server’s threads will still be subject to time slicing if there are competing processes running on the server. But in optimally-configured environments where that’s not the case, SQL Server’s cooperative scheduler will effectively be in control of the full lifetime of its threads, keeping them active until they are either finished or need to enter a wait state.

1) create a base 2012 vm:

install ad, install .net 3.5 as well as sql server requires it, enable remote login, change password expiration policy, install firefox, install crystal disk mark, downloading bginfo won't help as it wont be replicated, sysprep

2) create sql 2012 base vm : differencing disk on base win 2012, add drives for data(allocation size should be 64 kb), logs, sys and backups(these drives would any would have to be added again(using differencing) but the thing is the properties you set for drives would be replicated. example. data drive allocation unit size would be replicated) , add acounts for agents, databse engine, etc.. install sql server through imaging option in advanded pane. On differenced disks u would need to complete the sql server install but only complete the install after u have joined the domain and logged-in with constoso\admin account. Also you could turn the firewall off as otherwise u need to do complex setup to be able to connect to sql instance from another vm

--u do not need to add data,log,etc. drives to DC

new-vm -Name "DC" -MemoryStartupBytes 2048MB -Path "E:\Virtual Images\Hyper-V" -SwitchName "Hyper V External Switch"

new-vhd -ParentPath "E:\Virtual Images\Hyper-V\Virtual Hard Disks\BaseSQLSrv2012Template.vhdx" -Path "E:\Virtual Images\Hyper-V\Virtual Hard Disks\DC.vhdx" -Differencing

Add-VMHardDiskDrive -VMName DC -Path “E:\Virtual Images\Hyper-V\Virtual Hard Disks\DC.vhdx”

new-vhd -ParentPath "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Data.vhdx" -Path "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Data\_DC.vhdx" -Differencing

Add-VMHardDiskDrive -VMName DC -Path “E:\Virtual Images\Hyper-V\Virtual Hard Disks\Data\_DC.vhdx” -ControllerType SCSI

new-vhd -ParentPath "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Logs.vhdx" -Path "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Logs\_DC.vhdx" -Differencing

Add-VMHardDiskDrive -VMName DC -Path “E:\Virtual Images\Hyper-V\Virtual Hard Disks\Logs\_DC.vhdx” -ControllerType SCSI

new-vhd -ParentPath "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Sys.vhdx" -Path "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Sys\_DC.vhdx" -Differencing

Add-VMHardDiskDrive -VMName DC -Path “E:\Virtual Images\Hyper-V\Virtual Hard Disks\Sys\_DC.vhdx” -ControllerType SCSI

new-vhd -ParentPath "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Backups.vhdx" -Path "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Backups\_DC.vhdx" -Differencing

Add-VMHardDiskDrive -VMName DC -Path “E:\Virtual Images\Hyper-V\Virtual Hard Disks\Backups\_DC.vhdx” -ControllerType SCSI

new-vm -Name "SQL-A" -MemoryStartupBytes 2048MB -Path "E:\Virtual Images\Hyper-V" -SwitchName "Hyper V External Switch"

new-vhd -ParentPath "E:\Virtual Images\Hyper-V\Virtual Hard Disks\BaseSQLSrv2012Template.vhdx" -Path "E:\Virtual Images\Hyper-V\Virtual Hard Disks\SQL-A.vhdx" -Differencing

Add-VMHardDiskDrive -VMName SQL-A -Path “E:\Virtual Images\Hyper-V\Virtual Hard Disks\SQL-A.vhdx”

new-vhd -ParentPath "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Data.vhdx" -Path "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Data\_SQL-A.vhdx" -Differencing

Add-VMHardDiskDrive -VMName SQL-A -Path “E:\Virtual Images\Hyper-V\Virtual Hard Disks\Data\_SQL-A.vhdx” -ControllerType SCSI

new-vhd -ParentPath "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Logs.vhdx" -Path "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Logs\_SQL-A.vhdx" -Differencing

Add-VMHardDiskDrive -VMName SQL-A -Path “E:\Virtual Images\Hyper-V\Virtual Hard Disks\Logs\_SQL-A.vhdx” -ControllerType SCSI

new-vhd -ParentPath "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Sys.vhdx" -Path "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Sys\_SQL-A.vhdx" -Differencing

Add-VMHardDiskDrive -VMName SQL-A -Path “E:\Virtual Images\Hyper-V\Virtual Hard Disks\Sys\_SQL-A.vhdx” -ControllerType SCSI

new-vhd -ParentPath "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Backups.vhdx" -Path "E:\Virtual Images\Hyper-V\Virtual Hard Disks\Backups\_SQL-A.vhdx" -Differencing

Add-VMHardDiskDrive -VMName SQL-A -Path “E:\Virtual Images\Hyper-V\Virtual Hard Disks\Backups\_SQL-A.vhdx” -ControllerType SCSI

Windows core installation join to domain:

1. netsh interface show interface

2. netsh interface ip show config

4. netsh interface ipv4 set address "Ethernet" static 192.168.1.55 255.255.0.0 192.168.1.1

5. netsh interface ipv4 add dnsserver "Ethernet" address=127.0.0.1 index=1

netsh interface ipv4 add dnsserver "Ethernet" address=192.168.1.50 index=2

6. netdom renamecomputer %computername% /newname:SQL-CORE

7. netdom join SQL-CORE /domain:contoso.com /UserD:contoso\administrator /PasswordD:Pass1234!@

8. Restart and login with contoso\admin account to run sql setup

10. add .net 3.5 for core: PS C:\Users\administrator.CONTOSO> Add-WindowsFeature NET-Framework-Core

check if it has been installed: PS C:\Users\administrator.CONTOSO> Get-WindowsFeature

11. Setup.exe /qs /Action=install /Features=SQLEngine,Replication,IS,Conn /InstanceName=MSSQLServer /SQLSYSADMINACCOUNTS="Contoso\administrator" /IAcceptSQLServerLicenseTerms

12. turn the firewall off: netsh advfirewall set allprofiles state off

