



Upgrading to SQL Server 2017

Thomas LaRock
Head Geek
SolarWinds



Why Are You Here?



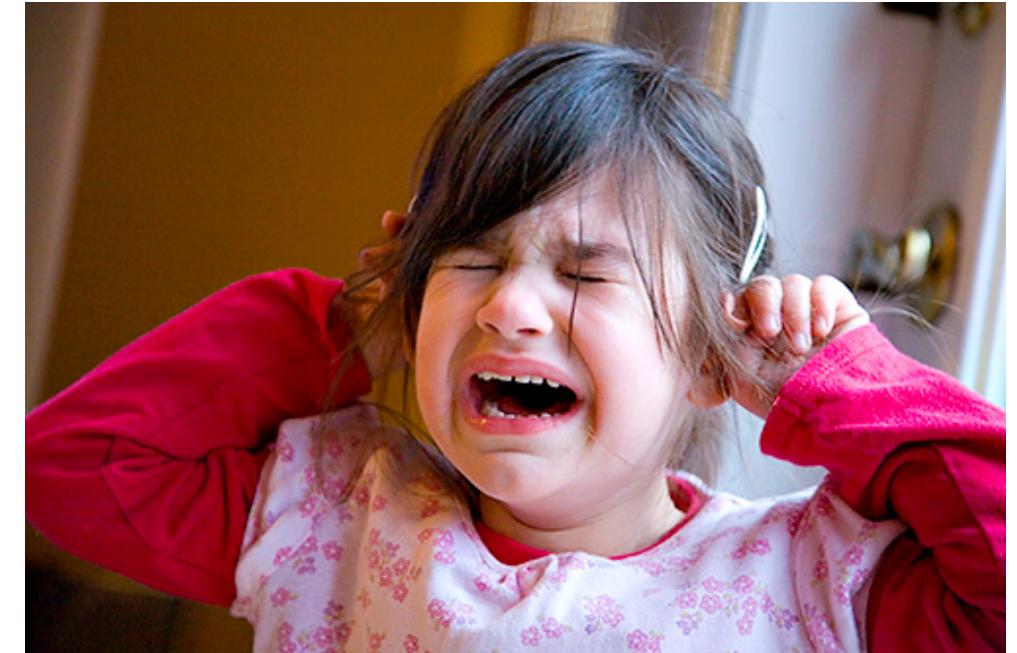
You want/need to upgrade



Why Are You Here?



You want/need to upgrade
You've had trouble with upgrades in
the past



Why Are You Here?



You want/need to upgrade
You've had trouble with upgrades in
the past
Users are scary when they're mad



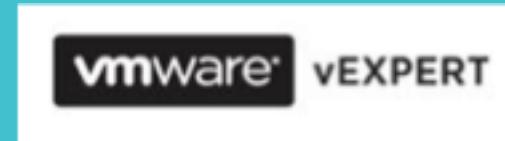
Thomas LaRock

Head Geek™, SolarWinds®



Over 20 years experience in roles including programmer, developer, analyst, and DBA.

Enjoys working with data, probably too much to be healthy, really.

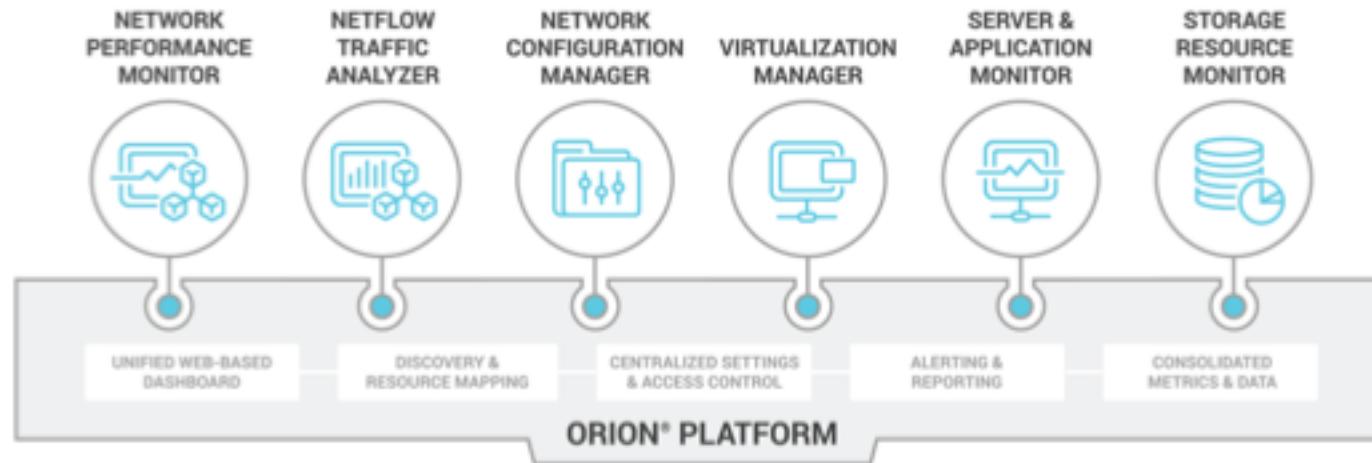


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A Little About SolarWinds



solarwinds.com/products





1 Why upgrade?

2 Pre-upgrade tasks

3 Upgrade tasks

4 Post-upgrade tasks

5 Questions



1 Why upgrade?

2 Pre-upgrade tasks

3 Upgrade tasks

4 Post-upgrade tasks

5 Questions



1 Why upgrade?

2 Pre-upgrade tasks

3 Upgrade tasks

4 Post-upgrade tasks

5 Questions

Agenda



1 Why upgrade?

2 Pre-upgrade tasks

3 Upgrade tasks

4 Post-upgrade tasks

5 Questions

Agenda



1 Why upgrade?

2 Pre-upgrade tasks

3 Upgrade tasks

4 Post-upgrade tasks

5 Questions

Why Upgrade?



If it ain't broke...

Upgrades seen as hard; things will break

Fear, uncertainty, and doubt (FUD) around upgrades

Data is the most critical asset your company owns

Cost, benefit, and risk

Why Upgrade?



New Features

Always Encrypted

Dynamic Data Masking

Row Level Security

Stretch Database

Temporal tables

Query Store

Why Upgrade?



New Features

Supportability

SQL Server 2005 ended support in April 2016

No additional fixes, SPs, or CUs released

You can purchase a VERY expensive yearly support plan

SQL Server 2008 ends extended support in July 2019*

Why Upgrade?



New Features

Supportability

Vendor Requirements

3rd party tools may require latest version of SQL Server (or earlier, possibly)

Check with vendor prior to any upgrade

Why Upgrade?



New Features

Supportability

Vendor Requirements

Company Standard

Possible rule: 'No
more than one major
version behind'

Company/industry
standards vary

Auditors

Pre-Upgrade Tasks



Know your path

SQL 2000 SP4

SQL 2005 SP4

SQL 2008 SP4

SQL 2008R2 SP3

SQL 2012 SP2

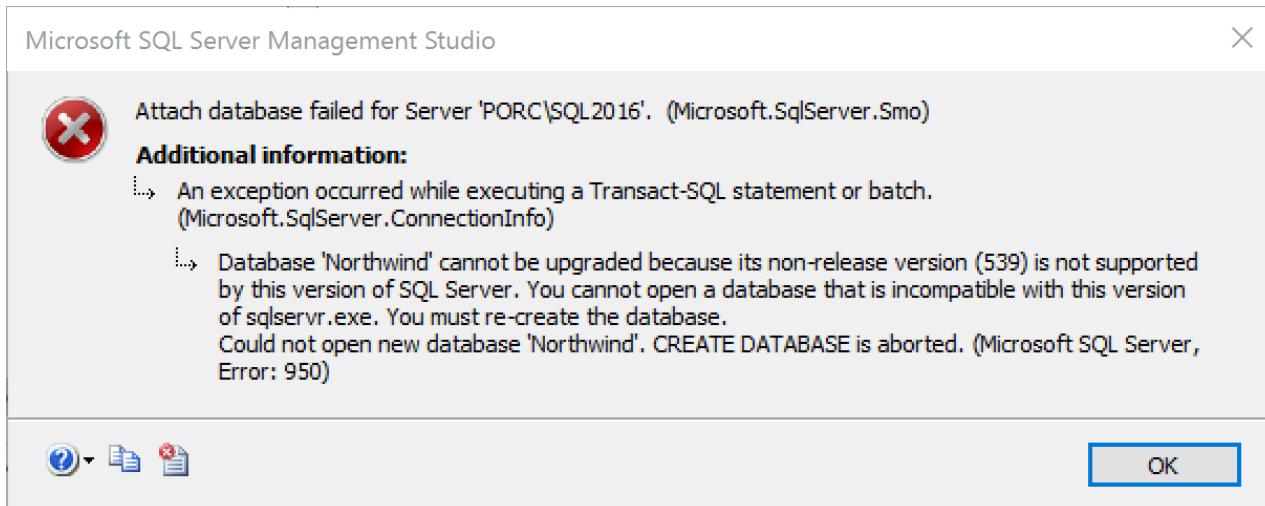
SQL 2014

SQL 2016

Pre-Upgrade Tasks



Know your path



Pre-Upgrade Tasks



Know your path
Licensing changes

Was per socket, now per core
(as of SQL 2012)

Per core may be more
expensive

In-place upgrades may not be
reasonable

SQL 2016 SP1 allows for additional
features available in Std edition

Pre-Upgrade Tasks



Know your path

Licensing changes

Know your options

**In
Place**

Upgrade current instance of SQL Server to be the next version of SQL Server

**Side-
By-Side**

Install SQL Server on new/existing hardware and eventually cut over databases when necessary

Pre-Upgrade Tasks



Know your path

Licensing changes

Know your options

Gather inventory details

Microsoft Assessment and Planning Toolkit,
SQL Power Doc (Codeplex)

Consider object counts (i.e., number of tables)

Inventory of applications using the server

Application-specific configurations

Pre-Upgrade Tasks



Know your path

Licensing changes

Know your options

Gather inventory details

Data Migration Assistant

Welcome to Data Migration Assistant

Data Migration Assistant

New

Project type

Assessment

Migration

Project name

MSIgnite

Source server type

SQL Server

Target server type

Azure SQL Database

Azure SQL Database

SQL Server

SQL Server on Azure Virtual Machines



Deprecated features

Discontinued features

Features Not Supported in the Next Version of SQL Server

The following SQL Server Database Engine features will not be supported in the next version of SQL Server. Do not use these features in new development work, and modify applications that currently use these features as soon as possible. The Feature name value in trace events as the ObjectName and in performance counters and sys.dm_os_performance_counters as the instance name. The Feature ID value appears in trace events as the ObjectId.

Features Not Supported in a Future Version of SQL Server

The following SQL Server Database Engine features are supported in the next version of SQL Server, but will be removed in a later version. The specific version of SQL Server has not been determined.

Discontinued Features in SQL Server 2016

- SQL Server 2016 is a 64-bit application. 32-bit installation is discontinued, though some elements run as 32-bit components.
- Compatibility level 90 is discontinued. For more information, see [ALTER DATABASE Compatibility Level \(Transact-SQL\)](#).
- ActiveX subsystem is discontinued. Use command line or PowerShell scripts instead.

Pre-Upgrade Tasks



Deprecated features

Discontinued features

Breaking changes

Behavioral changes

Breaking

Changes that **might** break based on earlier versions of SQL Server

Behavioral

Changes that affect how features work or interact compared to earlier versions of SQL Server

Pre-Upgrade Tasks



Deprecated features

Discontinued features

Breaking changes

Behavioral changes

Read the Release Notes

Welcome

> Overview

Recently Updated Articles for SQL Server

▽ Release Notes

SQL Server Release Notes

SQL Server 2016 Release Notes

SQL Server 2017 Release Notes

SQL Server 2014 Release Notes

SQL Server 2012 Release Notes

SQL Server 2012 SP1 Release Notes

SQL Server 2012 SP2 Release Notes

SQL Server 2012 SP3 Release Notes

SQL Server 2008 R2 SP2 Release Notes



New environment requirements

Hardware and Software Requirements for Installing SQL Server

This topic contains the following sections:

- [Hardware and Software Requirements](#)
- [Processor, Memory, and Operating System Requirements](#)
- [Cross-Language Support](#)
- [Hard Disk Space Requirements](#)
- [Storage Types for Data Files](#)
- [Installing SQL Server on a Domain Controller](#)

Pre-Upgrade Tasks



New environment requirements

Take baselines



Pre-Upgrade Tasks

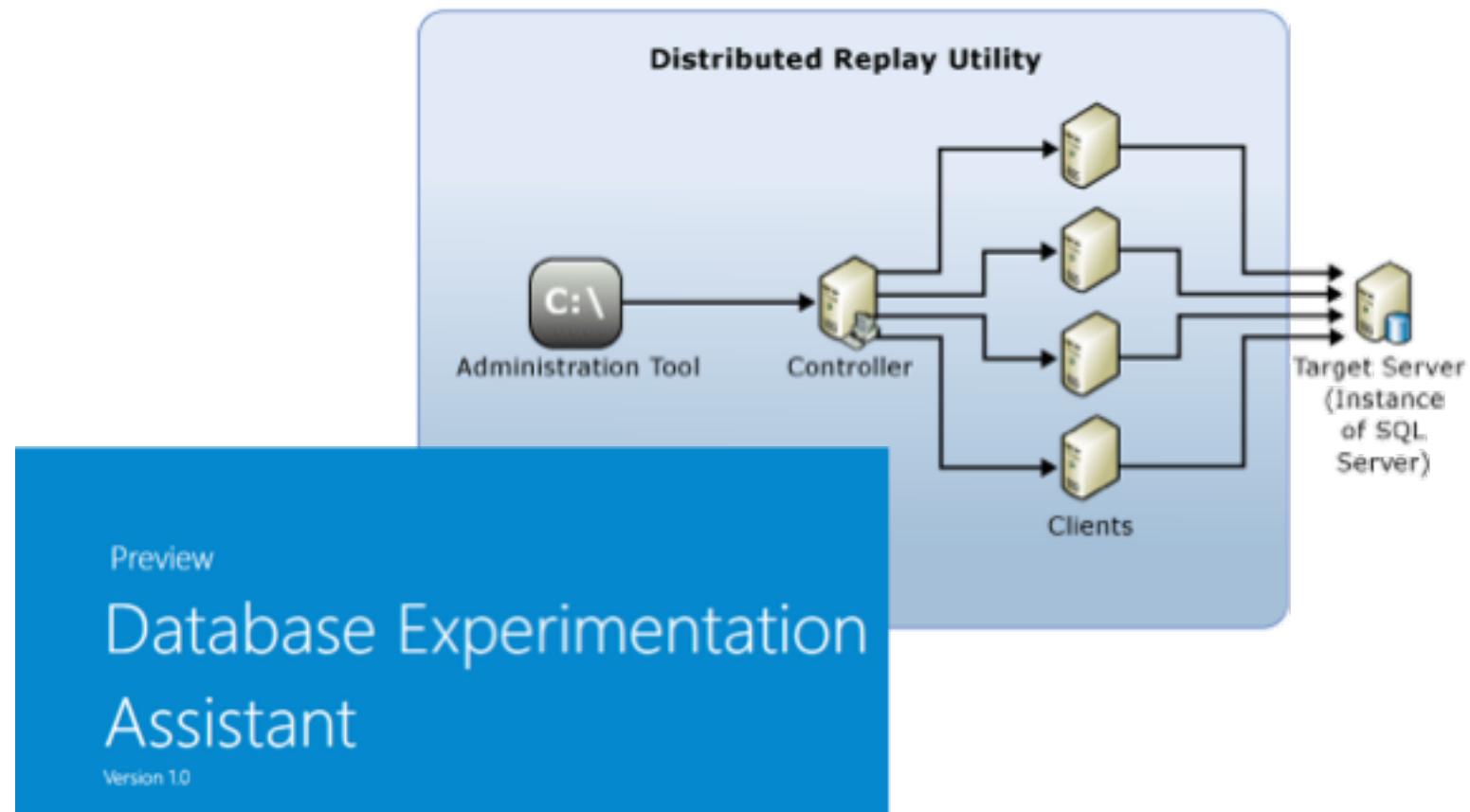


New environment requirements

Take baselines

Capture workloads

SQL Server Distributed Replay



Pre-Upgrade Tasks



New environment requirements

Take baselines

Capture workloads

Test server O/S

Total IO thread	bytes	I/Os	MB/s	I/O per s	AvgLat	LatStdDev	file
0	29843456	3643	14.23	1821.34	2.193	0.685	c:\diskspd\io.dat (1024MB)
1	29958144	3657	14.28	1828.34	2.185	0.656	c:\diskspd\io.dat (1024MB)
2	29655848	3628	14.14	1809.84	2.210	0.694	c:\diskspd\io.dat (1024MB)
3	30064640	3670	14.33	1834.84	2.178	0.627	c:\diskspd\io.dat (1024MB)
total:	119521280	14590	56.99	7294.35	2.192	0.666	
Read IO thread	bytes	I/Os	MB/s	I/O per s	AvgLat	LatStdDev	file
0	23814144	2907	11.35	1453.37	2.198	0.713	c:\diskspd\io.dat (1024MB)
1	23977984	2927	11.43	1463.37	2.197	0.672	c:\diskspd\io.dat (1024MB)
2	23885952	2906	11.35	1452.87	2.219	0.784	c:\diskspd\io.dat (1024MB)
3	24059904	2937	11.47	1468.37	2.184	0.651	c:\diskspd\io.dat (1024MB)
total:	95657984	11677	45.61	5837.98	2.199	0.685	
Write IO thread	bytes	I/Os	MB/s	I/O per s	AvgLat	LatStdDev	file
0	6029312	736	2.87	367.97	2.177	0.558	c:\diskspd\io.dat (1024MB)
1	5980160	730	2.85	364.97	2.138	0.589	c:\diskspd\io.dat (1024MB)
2	5849888	714	2.79	356.97	2.171	0.650	c:\diskspd\io.dat (1024MB)
3	6004736	733	2.86	366.47	2.158	0.519	c:\diskspd\io.dat (1024MB)
total:	23863296	2913	11.38	1456.37	2.161	0.580	

Pre-Upgrade Tasks



New environment requirements

Take baselines

Capture workloads

Test server O/S

Take backups



Upgrade Tasks



Types of upgrades

**In
Place**

Upgrade current instance of SQL Server to be the next version of SQL Server

**Side-
By-Side**

Install SQL Server on new/existing hardware and eventually cut over databases when necessary

Upgrade Tasks



Types of upgrades

**In
Place**

Upgrade current instance of SQL Server to be the next version of SQL Server

**Side-
By-Side**

Install SQL Server on new/existing hardware and eventually cut over databases when necessary

Data migration techniques

Backup/restore
(or detach/attach)

Database
mirroring

Pre-staging
(log shipping)

Availability
Groups

Upgrade Tasks – In-Place Upgrades



Verify backups exist

Both user and system databases

If database not in SIMPLE recovery mode, make certain a transaction log backup exists

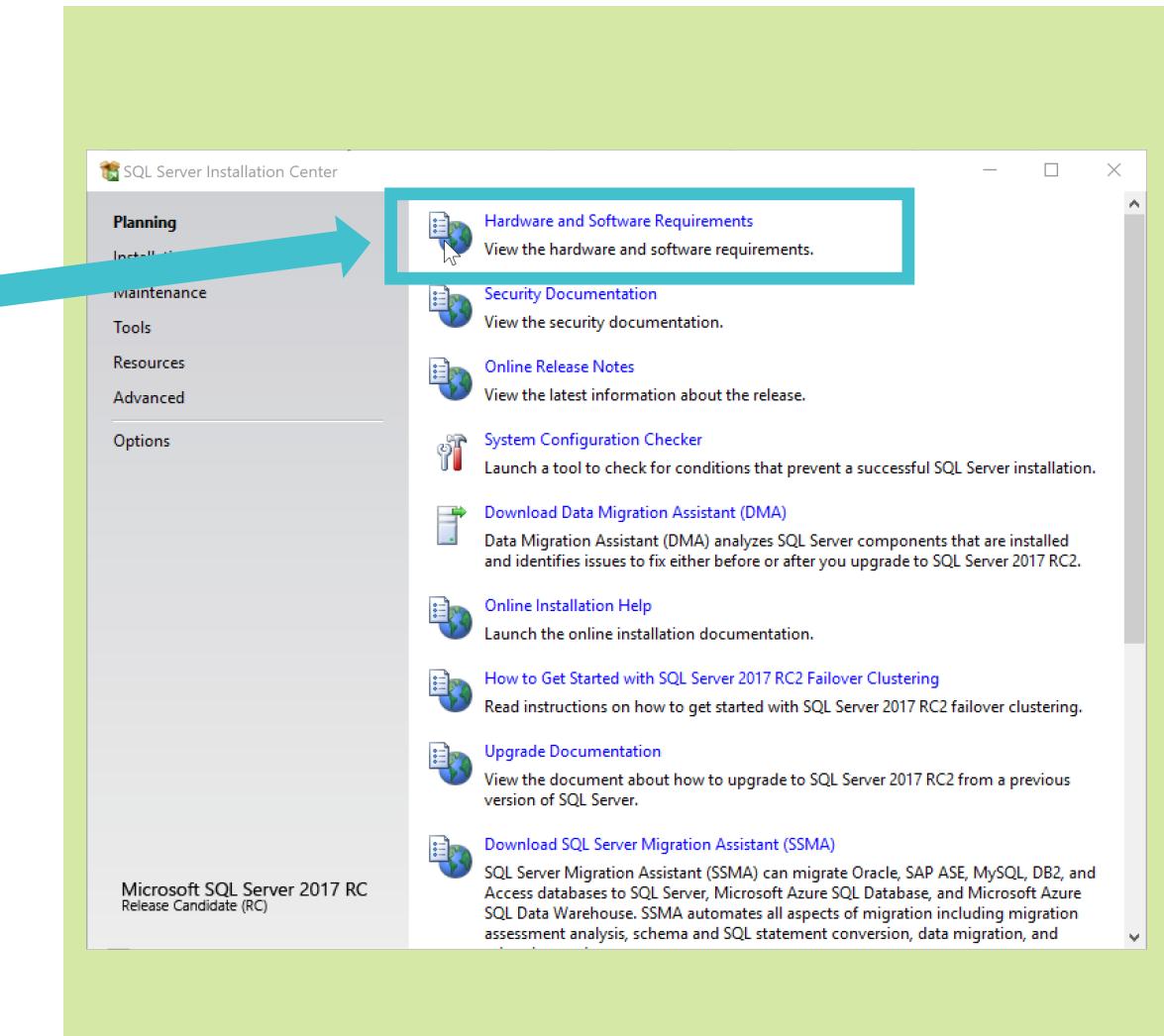
Verify that these backups can be restored

Upgrade Tasks – In-Place Upgrades



Verify backups exist

Review prerequisites



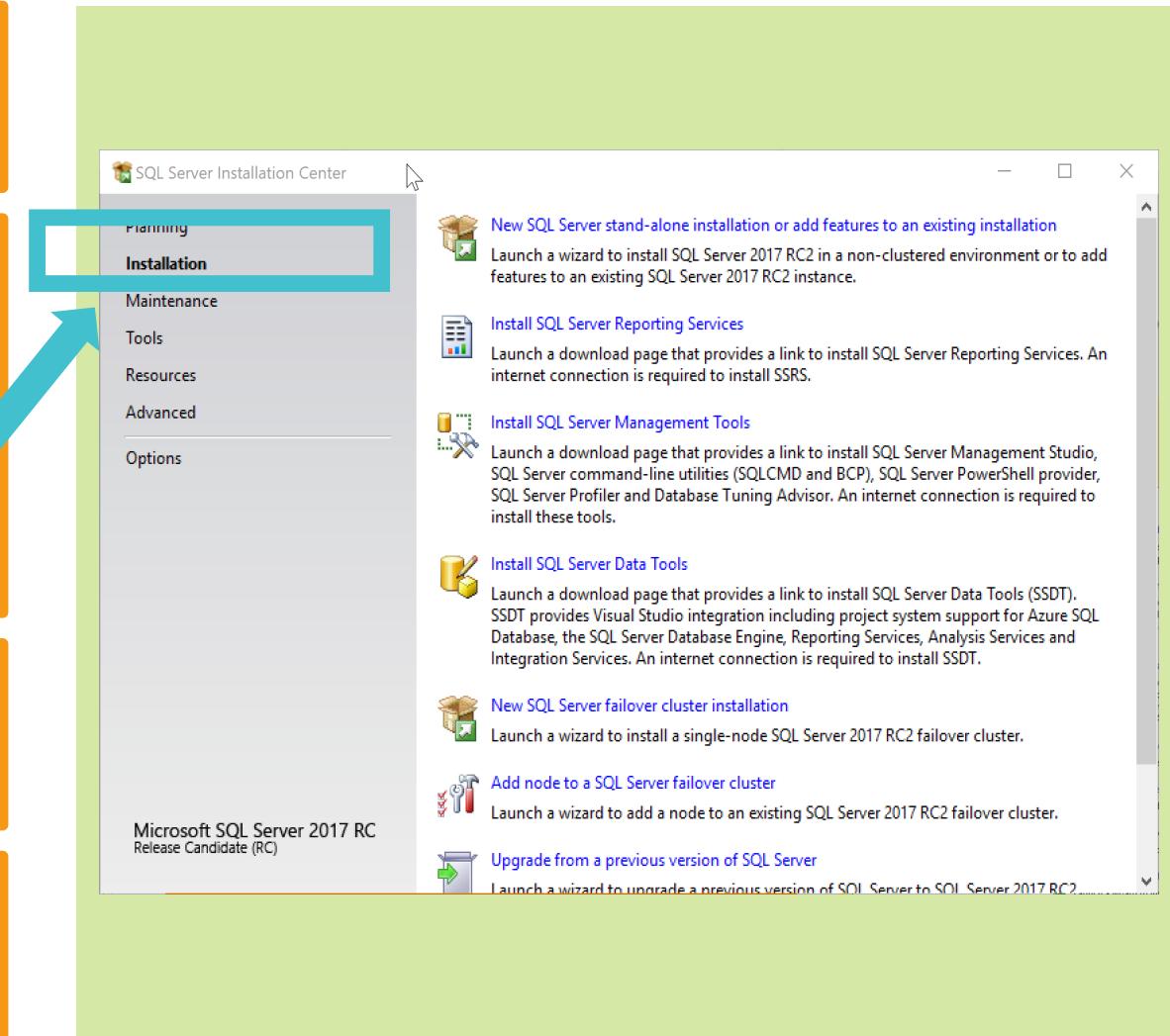
Upgrade Tasks – In-Place Upgrades



Verify backups exist

Review prerequisites

Run installation media



Upgrade Tasks – In-Place Upgrades



Verify backups exist

Review prerequisites

Run installation media

Do post-upgrade tasks

(will cover this
later)

Upgrade Tasks – In-Place Upgrades



Verify backups exist

Review prerequisites

Run installation media

Do post-upgrade tasks

Test, test, test

And then test
some more, make
sure everything is
working as
expected

Upgrade Tasks – Side-by-Side Upgrades



For existing system

For new system

Upgrade Tasks – Side-by-Side Upgrades



For existing system

Verify backups

Script system objects

Script SSIS packages

Take database offline

For new system

Upgrade Tasks – Side-by-Side Upgrades



For existing system

Verify backups

Script system objects

Script SSIS packages

Take database offline

For new system

Review prerequisites

Install SQL Server

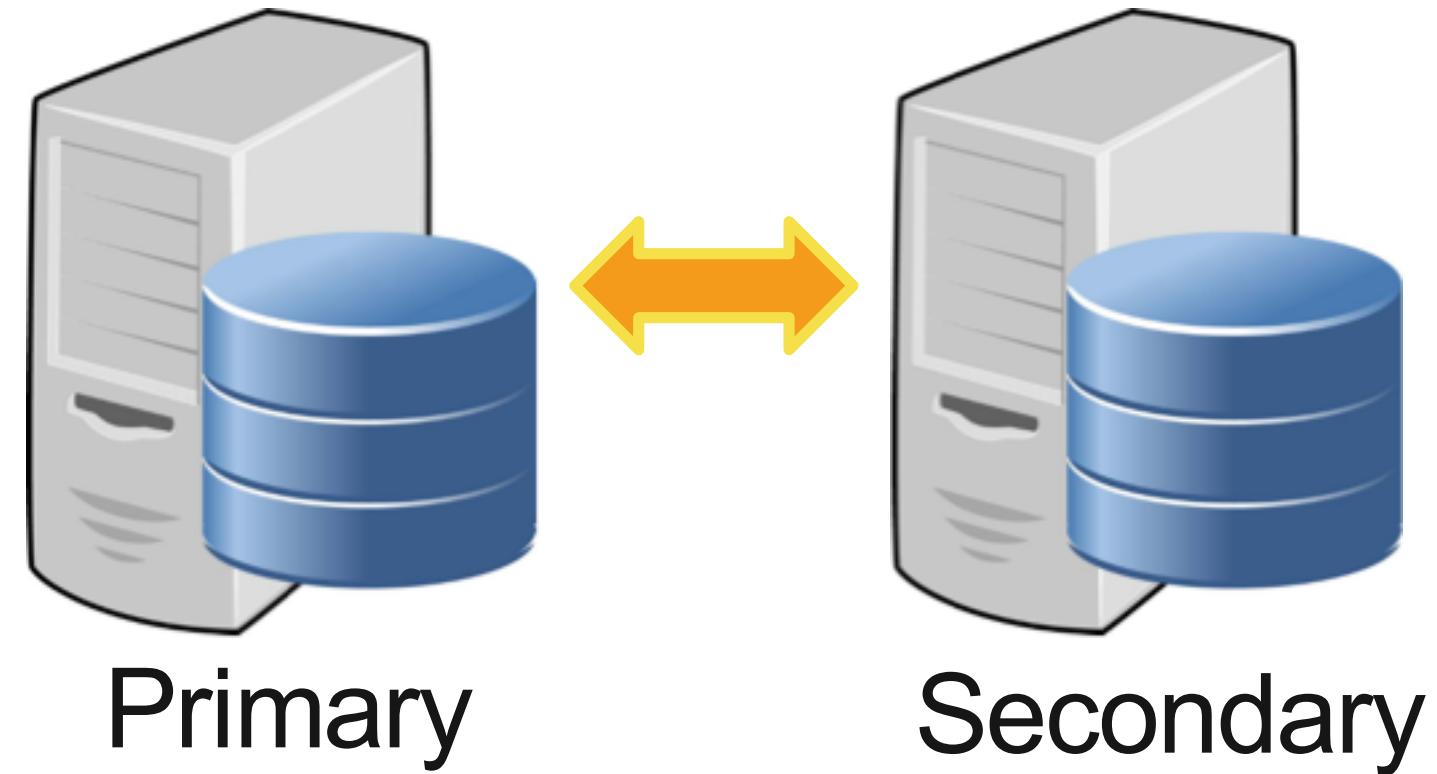
Run scripts

Data migration

Upgrade Tasks – Rolling Upgrades



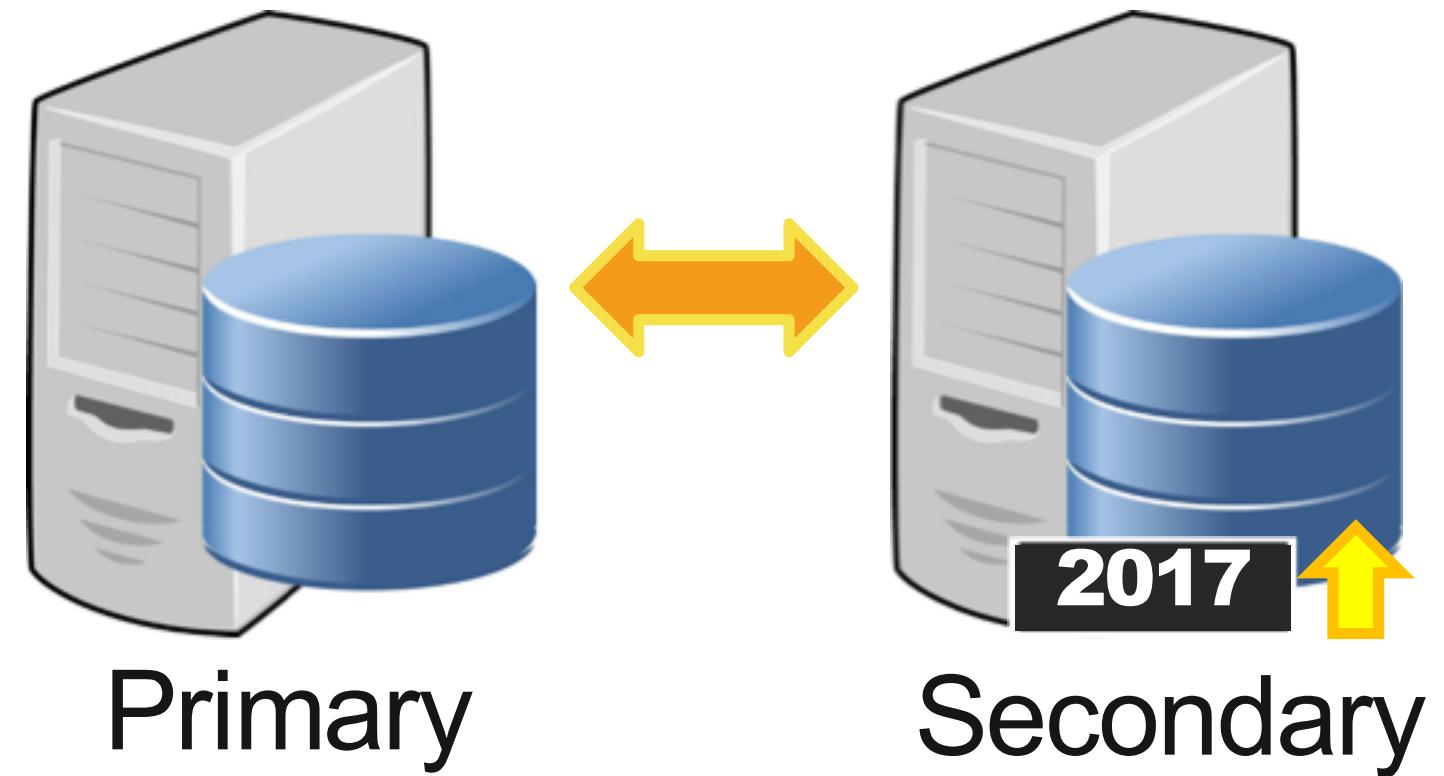
Choose your high-availability method (log-shipping, mirroring, Availability Groups)



Upgrade Tasks – Rolling Upgrades



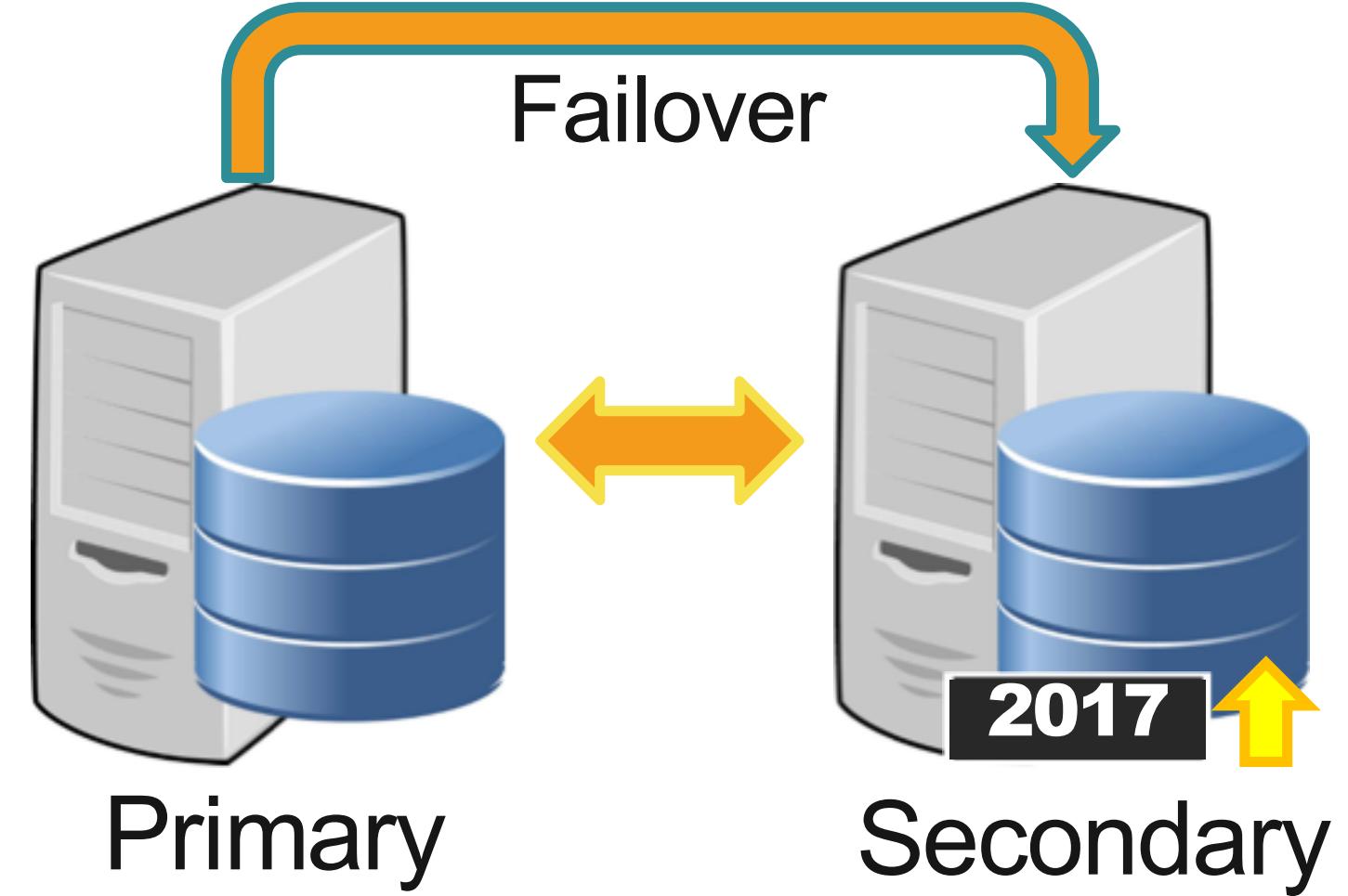
Upgrade one of
the secondary
nodes following
the in-place
upgrade steps



Upgrade Tasks – Rolling Upgrades



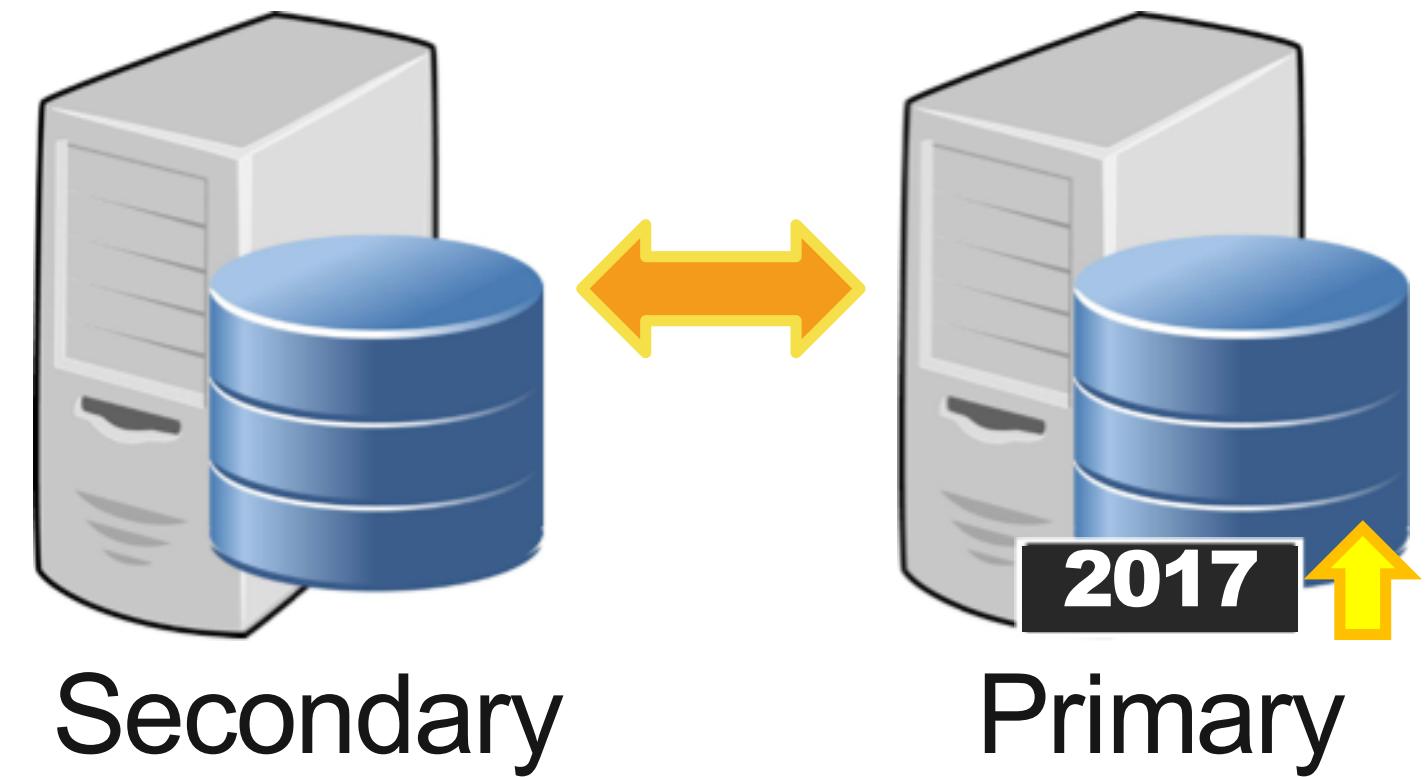
Failover to that secondary node



Upgrade Tasks – Rolling Upgrades



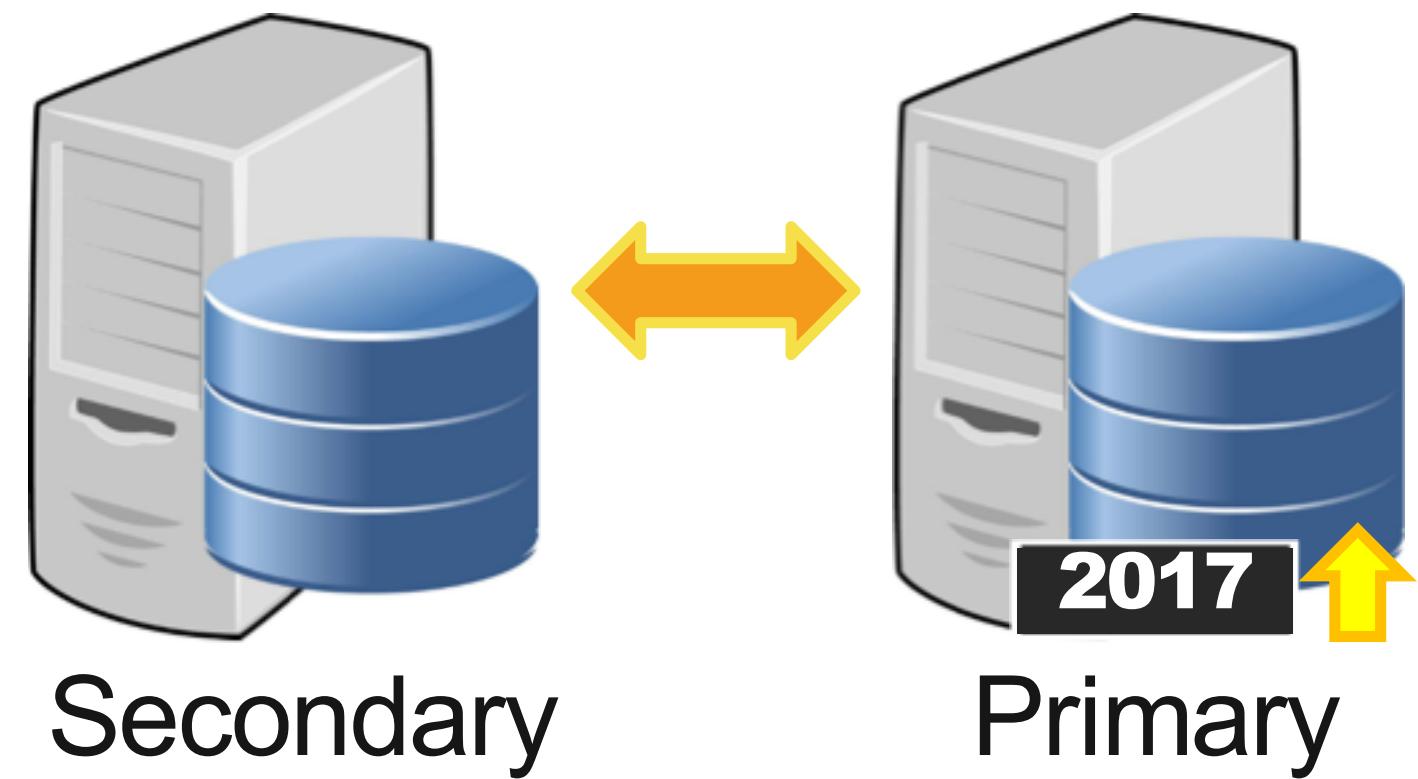
Perform any
post-upgrade
tasks



Upgrade Tasks – Rolling Upgrades



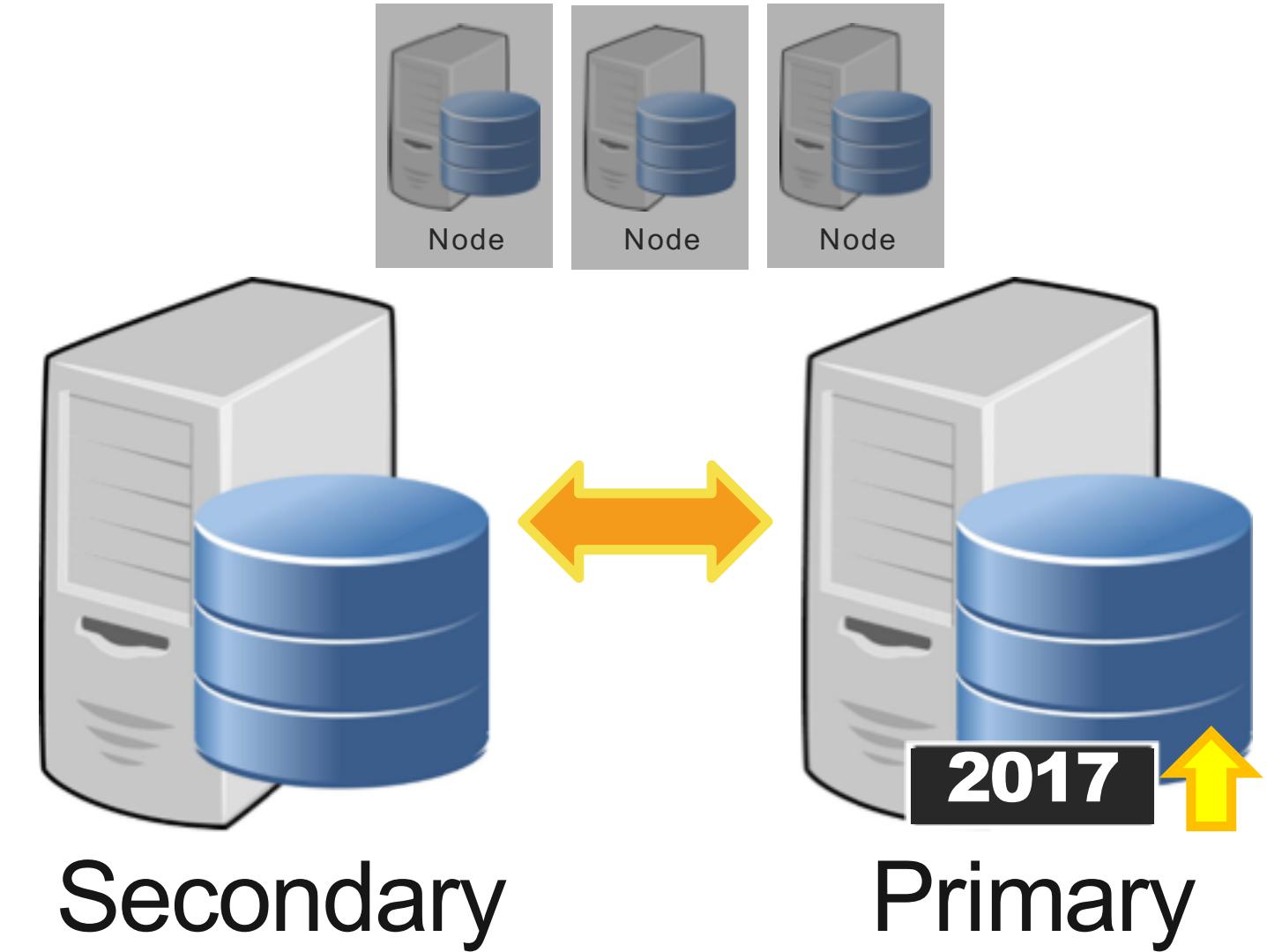
Test, test, and
test that
everything is
working as
expected



Upgrade Tasks – Rolling Upgrades



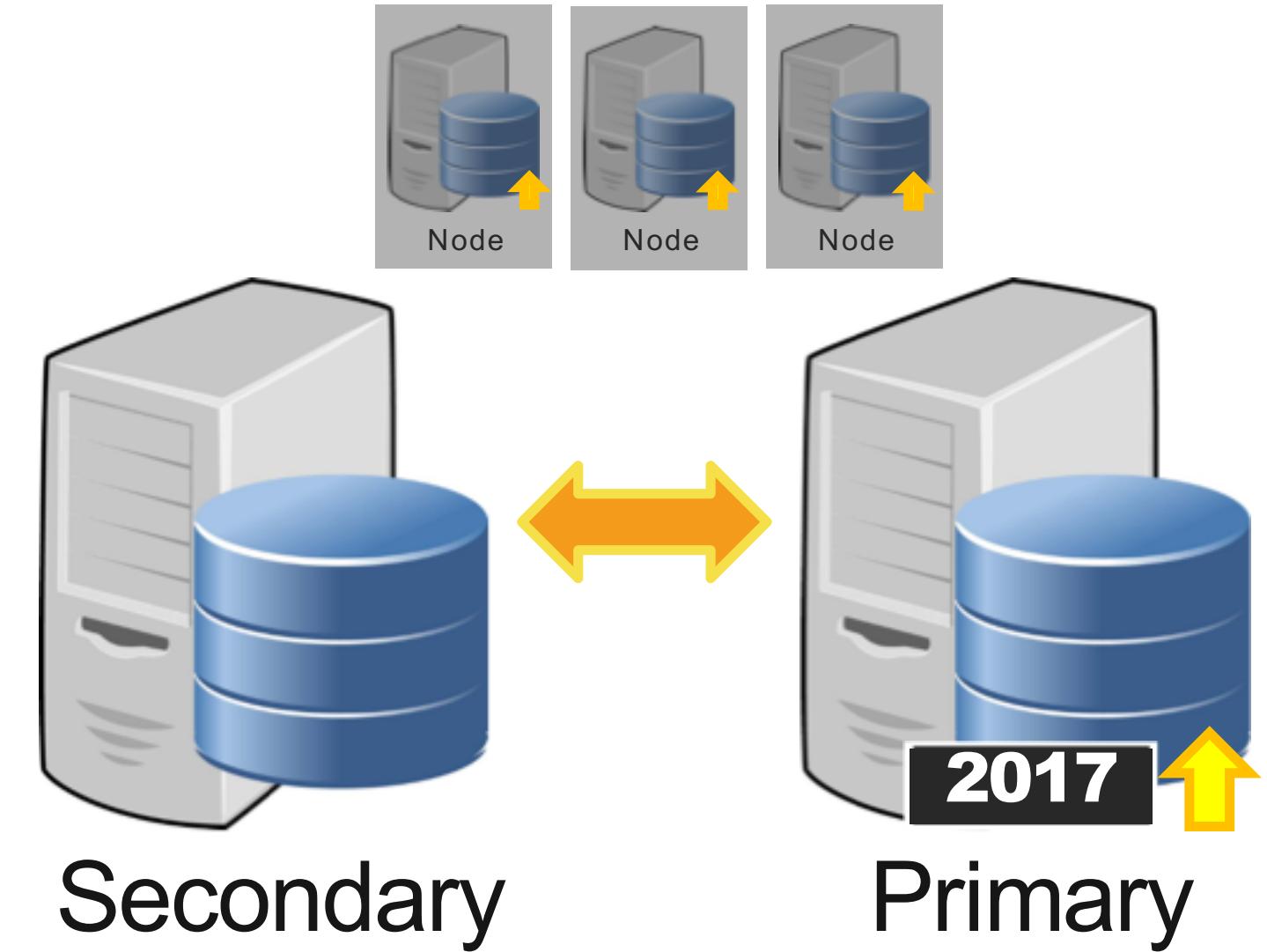
Repeat for any
remaining
secondary nodes



Upgrade Tasks – Rolling Upgrades



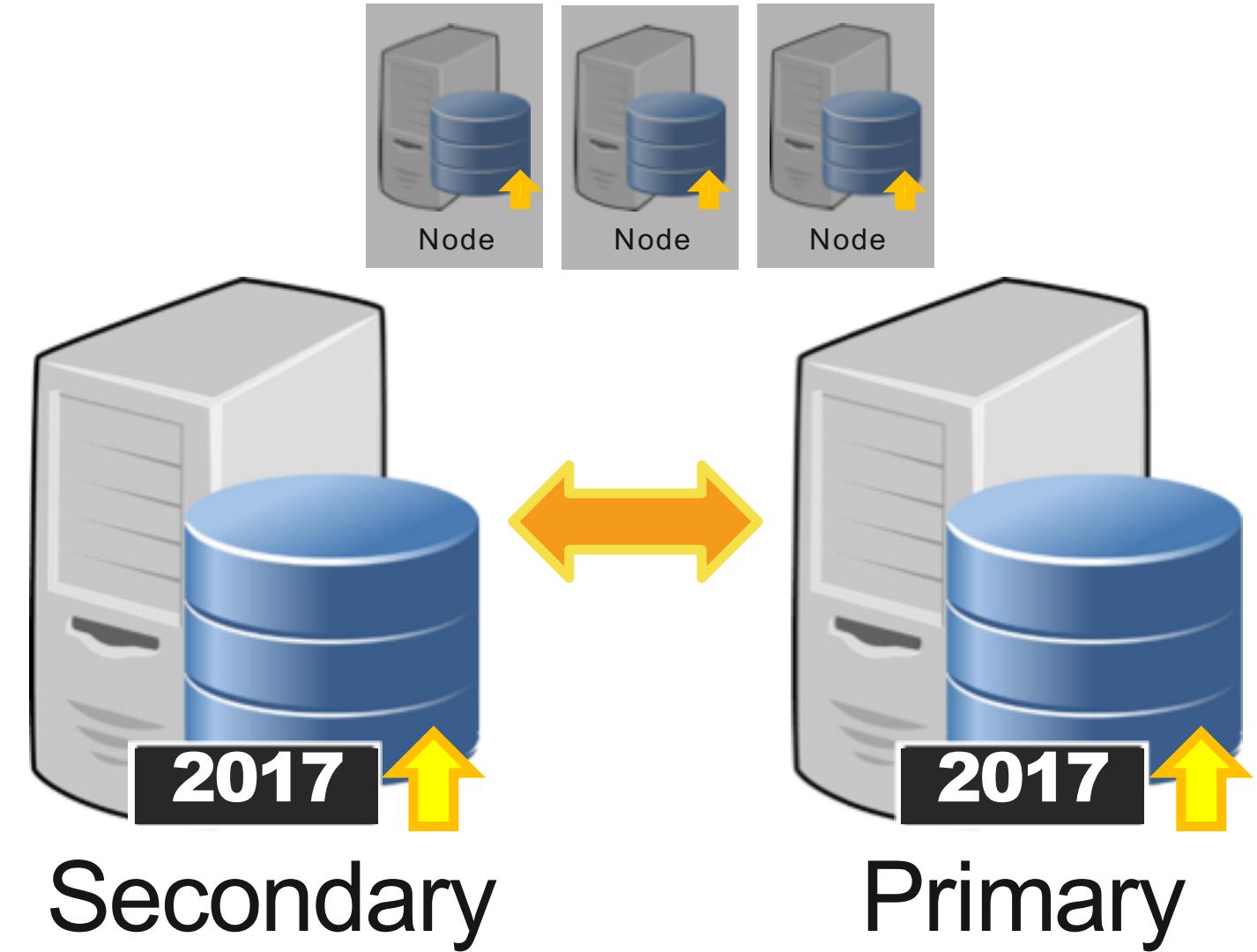
Repeat for any
remaining
secondary nodes



Upgrade Tasks – Rolling Upgrades



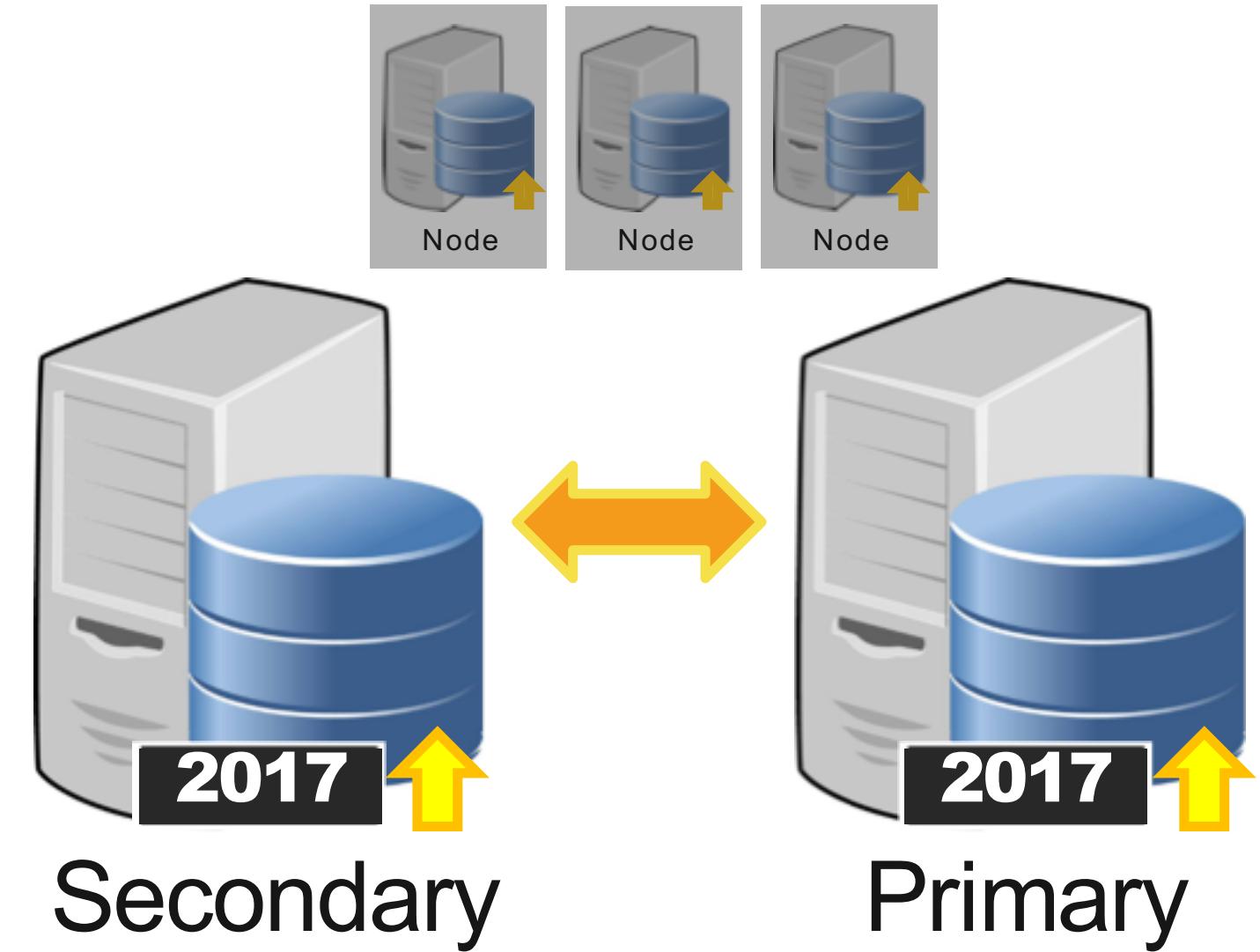
Repeat for
original primary
node



Upgrade Tasks – Rolling Upgrades



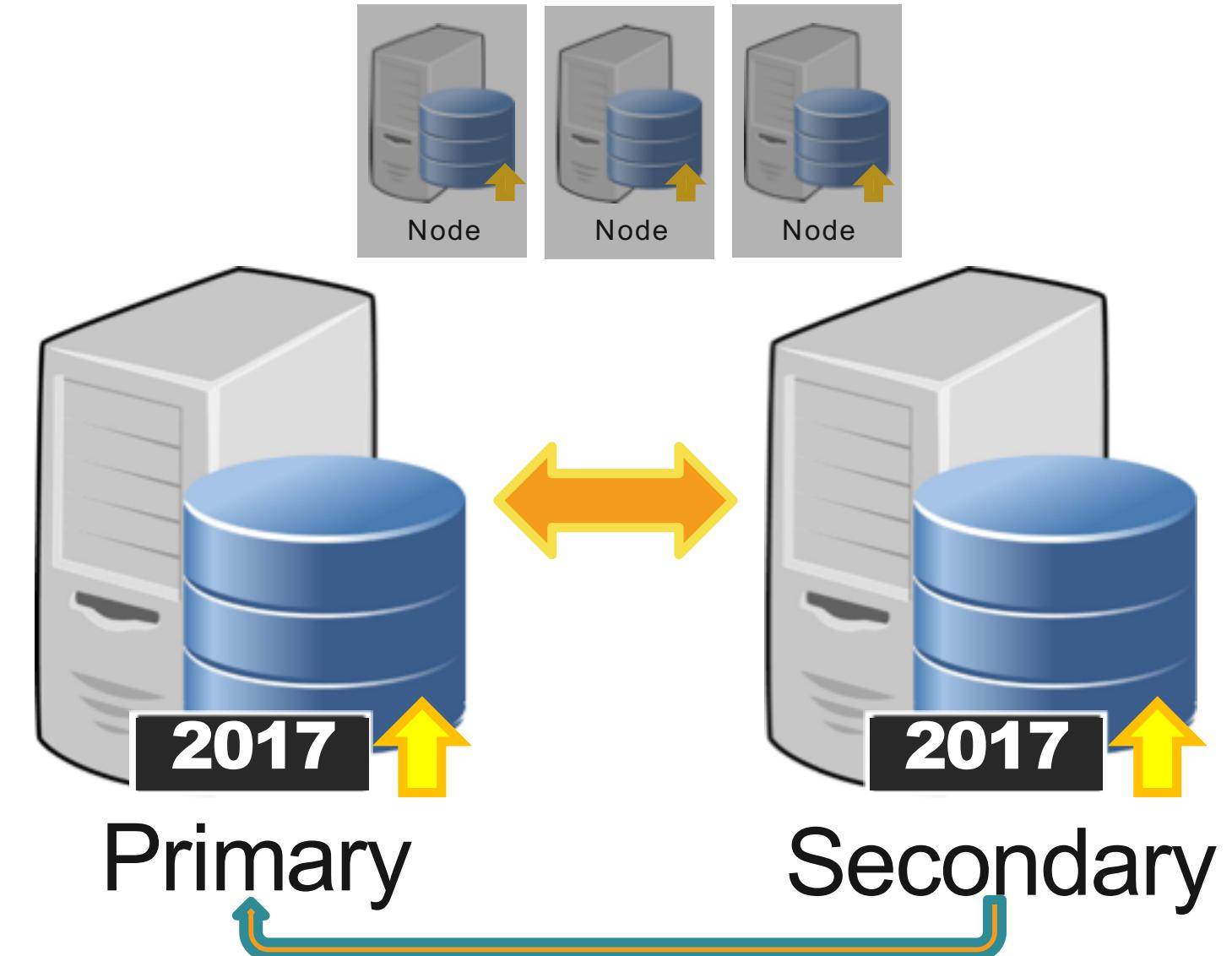
Perform any
post-upgrade
tasks



Upgrade Tasks – Rolling Upgrades



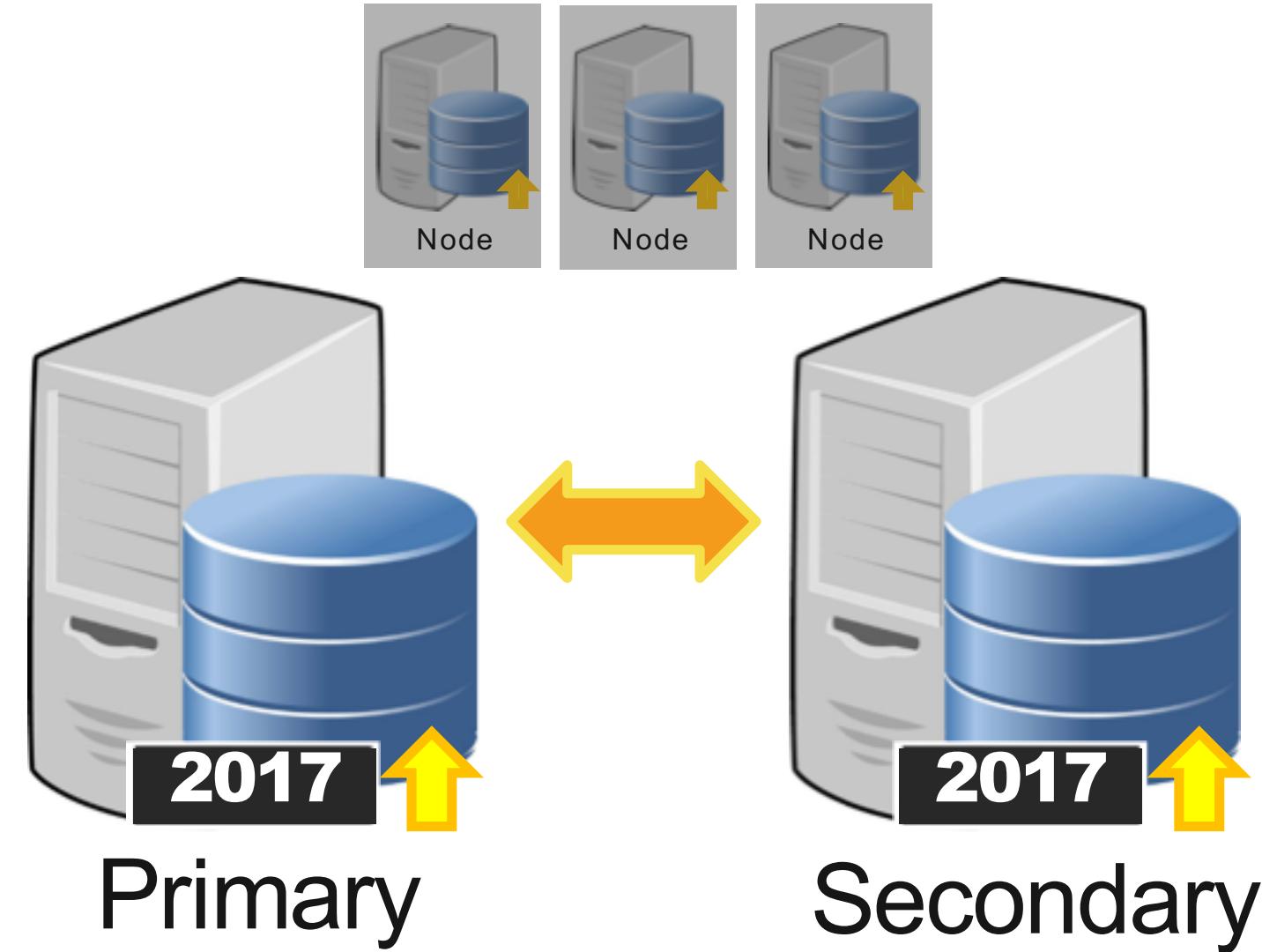
Fail back to
original primary
node



Upgrade Tasks – Rolling Upgrades



Test, test, and
test that
everything is
working as
expected



Post-Upgrade Tasks



Take backups



Post-Upgrade Tasks



Take backups

DBCC commands

The screenshot shows a SQL query window titled "SQLQuery1.sql - WI...Importers (sa (52))". The query contains three DBCC commands:

```
DBCC CHECKDB;
DBCC CHECKDB WITH DATA_PURITY;
DBCC UPDATEUSAGE (0);
```

The third command, "DBCC UPDATEUSAGE (0);", is highlighted with a blue selection bar. Below the query window, the "Messages" pane displays the results of the execution:

```
DBCC UPDATEUSAGE: Usage counts updated for table 'CustomerTransactions'
    USED pages (In-row Data): changed from (290) to (266) pages.
    RSVD pages (In-row Data): changed from (609) to (585) pages.
DBCC UPDATEUSAGE: Usage counts updated for table 'StockItemTransactions'
    USED pages (In-row Data): changed from (696) to (672) pages.
    RSVD pages (In-row Data): changed from (1073) to (1049) pages.
DBCC UPDATEUSAGE: Usage counts updated for table 'StockItemTransactions'
```

Post-Upgrade Tasks



Take backups

DBCC commands

Updating statistics

The screenshot shows a SQL Server Management Studio (SSMS) window titled "SQLQuery1.sql - WI...Importers (sa (52))". The query pane contains the following T-SQL code:

```
EXEC sp_MSforeachtable  
    @command1='UPDATE STATISTICS ? WITH FULLSCAN';
```

The status bar at the bottom of the window displays "Command(s) completed successfully.".

Post-Upgrade Tasks



Take backups

DBCC commands

Updating statistics

Refresh view definitions

```
SQLQuery2.sql - WI...Importers (sa (54))*
SELECT DISTINCT 'EXEC sp_refreshview ''' + name + '''
FROM sys.objects AS so
INNER JOIN sys.sql_expression_dependencies AS sed
    ON so.object_id = sed.referencing_id
WHERE so.type = 'V' AND sed.referenced_id = OBJECT_ID('Sales.Customers');
```

(No column name)
1 EXEC sp_refreshview 'Customers'

Post-Upgrade Tasks



Take backups

DBCC commands

Updating statistics

Refresh view definitions

Check compatibility levels

```
SQLQuery2.sql - WI...Importers (sa (54))*
SELECT name, compatibility_level
FROM sys.databases;
```

	name	compatibility_level
1	master	130
2	tempdb	130
3	model	130
4	msdb	130
5	AdventureWorks2016CTP3	130
6	AdventureworksDW2016CTP3	130
7	WideWorldImporters	130
8	乚(՞)乚	130

Post-Upgrade Tasks



Take backups

DBCC commands

Updating statistics

Refresh view definitions

Check compatibility levels

Verify counts (data from
inventory gathering)

SQLQuery2.sql - WI...Importers (sa (54))*

```
SELECT type, type_desc, count(*)
FROM sys.objects
GROUP BY type, type_desc
ORDER BY type_desc
```

150 %

	type	type_desc	(No column name)
1	C	CHECK_CONSTRAINT	9
2	D	DEFAULT_CONSTRAINT	47
3	F	FOREIGN_KEY_CONSTRAINT	98
4	IT	INTERNAL_TABLE	17
5	PK	PRIMARY_KEY_CONSTRAINT	36
6	SP	SECURITY_POLICY	1
7	SO	SEQUENCE_OBJECT	26
8	SQ	SERVICE_QUEUE	3
9	IF	SQL_INLINE_TABLE_VALUED_FUNCTION	1
10	FN	SQL_SCALAR_FUNCTION	1
11	P	SQL_STORED_PROCEDURE	42
12	S	SYSTEM_TABLE	72
13	TT	TYPE_TABLE	4
14	UQ	UNIQUE_CONSTRAINT	17
15	U	USER_TABLE	49
16	V	VIEW	3

Post-Upgrade Tasks



Take backups

DBCC commands

Updating statistics

Refresh view definitions

Check compatibility levels

Verify counts (data from inventory gathering)

Check configurations

The screenshot shows a SQL Server Management Studio (SSMS) window. The title bar reads "SQLQuery2.sql - WI_Importers (sa) [54]". The main pane displays a script titled "File: SQL_Server_vendor_install_check.sql". The script author is Thomas LaRock, with links to his contact information and a blog post. A summary of the script's purpose is provided, followed by a bulleted list of items it checks:

- * Check status of @@SERVERNAME
- * Creation/Alteration of linked servers
- * Creation/Alteration of new jobs in SQL Agent
- * Creation of databases, and check for non-default drives
- * Creation/Alteration of server logins
- * Altering server configurations - sp_configure

Below the script, there are two result panes. The top pane is titled "Results" and shows a single row for the server name "WIN-ASG3B4KTSE\SQL2016". The bottom pane is titled "Messages" and shows a table of database configuration settings.

name	dbid	sid	mode	status	status2	create	reserved	category	cmplevel	filename
tempdb	2	0x01	0	65544	1090520064	2017-01-20 08:41:14.827	1900-01-01 00:00:00.000	0	130	C:\Program Files\Microsoft SQL Server\M... data
	1	1	5120	-1	8	2	0	32767		C:\Program Files\Microsoft SQL Server\M... log
	2	0	160	268435456	8	66	0	32767		C:\Program Files\Microsoft SQL Server\M... AdventureWorksLT2012_Data
	3	1	1232	-1	2048	2	0	10		C:\Program Files\Microsoft SQL Server\M... AdventureWorksLT2012_Log
	4	2	0	256	268435456	2048	66	0	10	C:\Program Files\Microsoft SQL Server\M... =
	5	1	1024	-1	8192	2	0	9		C:\Program Files\Microsoft SQL Server\M... AdventureWorkLT2012_Log
	6	2	0	1024	268435456	8192	66	0	9	C:\Program Files\Microsoft SQL Server\M... =
	7	1	1024	-1	8192	2	0	8		C:\Program Files\Microsoft SQL Server\M... AdventureWorkLT2012_Log
	8	2	0	1024	268435456	8192	66	0	8	C:\Program Files\Microsoft SQL Server\M... =



Rolling Upgrades

But you only go 1-way:
upwards

Great for large systems

Or systems that need
minimal downtime



Rolling Upgrades

Newer is Better

Backup/restore and
detach/attach are easy

Great for small-mid size
databases

Or systems that allow
for downtime



Rolling Upgrades

Newer is Better

Learn to Count

Simple counts of objects

Compare datatypes and
collations worth effort

Compare configurations



Script all the things

Scripting saves time

Maintains consistency

Inventory collection



Script all the things

Azure option for POC

Azure is easy to use

Azure makes it easy to test

Just make sure you clean up when done



Script all the things

Azure option for POC

Baseline performance

Identify mission-critical queries

Build checklist of queries for testing

Test with minimal changes



Query Store

Help maintain performance

Freeze/unfreeze plans

Mitigate risk



Query Store

DMA isn't perfect

DMA may not catch everything

But it does catch a lot

Assists with migrating data



Query Store

DMA isn't perfect

Data Migration Guide

Create migration
playbook

Discover, migrate, test,
optimize

Build business case

Agenda



1 Why upgrade?

2 Pre-upgrade tasks

3 Upgrade tasks

4 Post-upgrade tasks

5 Questions

FOR MORE INFORMATION



<http://slrwnds.com/msdn-always-encrypted>

<http://slrwnds.com/msdn-dynamic-data-masking>

<http://slrwnds.com/msdn-row-level-security>

<http://slrwnds.com/msdn-stretch-db>

<http://slrwnds.com/msdn-temporal-tables>

<http://slrwnds.com/msdn-query-store>

<http://slrwnds.com/install-config-check>

<http://slrwnds.com/data-migration-guide>

<http://slrwnds.com/upgrade-sql-server>

<http://slrwnds.com/upgrade-sql-server-2016>





Q & A





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