

# Dell™ PowerEdge™ R920 server and Microsoft® SQL Server® 2014

*Migration and benefits guide*



A Principled Technologies migration guide commissioned by Dell Inc.

# TABLE OF CONTENTS

<b>Table of contents</b> .....	<b>2</b>
<b>Introduction</b> .....	<b>3</b>
<b>Why migrate?</b> .....	<b>3</b>
<b>About the hardware components</b> .....	<b>4</b>
Dell PowerEdge R920.....	4
<b>About the software components</b> .....	<b>5</b>
Microsoft SQL Server 2014 .....	5
Microsoft Windows Server 2012 R2 .....	6
<b>We show you how</b> .....	<b>7</b>
Preparing for the migration .....	7
Installation considerations .....	7
Evaluating the source environment.....	8
Installing Windows Server, Hyper-V, and Microsoft SQL Server 2014 .....	11
Making the move .....	17
After the move.....	20
<b>Cost benefits</b> .....	<b>24</b>
How much can your business save? .....	24
<b>Summing it all up</b> .....	<b>28</b>
<b>Appendix A – System configuration</b> .....	<b>29</b>
<b>Appendix B – Installing and running Upgrade Advisor</b> .....	<b>31</b>
<b>Appendix C – Installing the SQL Server environment</b> .....	<b>32</b>
<b>Appendix D – Backing up and restoring the database</b> .....	<b>35</b>
Moving the SQL Server 2008 R2 database.....	35
<b>Appendix E – Post-installation tasks</b> .....	<b>36</b>
<b>Appendix F – Cost calculations</b> .....	<b>37</b>
<b>About Principled Technologies</b> .....	<b>38</b>

## INTRODUCTION

The latest Dell server technologies can provide highly scalable performance for large enterprises, in addition to other beneficial features. Breakthroughs in Microsoft database technologies offer enhanced in-memory online transaction processing (OLTP) and in-memory analytics and closer integration with hybrid cloud environments, and can provide attractive solutions to large enterprises when run on Dell server platforms.

Migrating legacy database applications to the latest database technologies on new Dell server platforms is an attractive proposition for dealing with data platform challenges. The usual question that arises for IT departments is how to upgrade the database software and move the organization's databases to the new server technologies while minimizing IT downtime and preserving the integrity of the business' information stores. This reference architecture answers this question and shows how the Dell PowerEdge R920 can provide a reliable platform for consolidating multiple legacy servers running older versions of Microsoft SQL Server.

In addition, upgrading the hardware and software stack of your organization can save money. Each environment differs, but recent studies have shown one Dell PowerEdge R920 can consolidate the workloads of multiple older servers. Consolidation can lower licensing, power, and management costs, due to simply having fewer servers. For this study, we calculated the savings attainable using multiple hypothetical consolidation ratios, and how long it would take to pay off the replacement server. We found that a consolidation ratio of 13 to 1 could yield \$531,725 in software savings, easily paying back the cost of the Dell PowerEdge R920 server many times over.

This guide shows how to successfully migrate a Microsoft SQL Server 2008 R2 database running on other servers onto a Dell PowerEdge R920, and then how to update databases to benefit from the latest features of Microsoft SQL Server 2014.

## WHY MIGRATE?

Large enterprises benefit from migrating to a more modern hardware/software stack in many ways. In the case of the Dell PowerEdge R920, this server is a four-socket, 4U server from Dell, and uses the Intel® Xeon® processor E7 v2 family, which is designed to support mission-critical, high-performance workloads. For the operating system, Windows Server 2012 R2 is designed to provide an open application and Web platform for the datacenter and the cloud. At the database application level, Microsoft SQL Server 2014 is designed to provide databases with enhanced data redundancy, protection, and availability features, while also adding new features such as In-memory OLTP. Migrating to this stack enables your organization to reap these benefits.

# ABOUT THE HARDWARE COMPONENTS

## Dell PowerEdge R920

The Dell PowerEdge R920 is the fastest four-socket 4U server from Dell. Designed to provide expanding scalable performance for large enterprises, it supports up to

- 96 DIMMs of memory
- 24 internal disks
- 8 NVMe Express Flash disks (with the optional PCIe backplane)
- 10 PCIe Gen3/Gen2 slots
- 12Gb/s SAS disks

It also offers a Dual PERC option, PERC9 (H730P), Dell Fluid Cache for SAN capability, and a number of built-in RAS features for high reliability, such as Fault Resilient Memory and Intel Run Sure technology.

According to Dell, the PowerEdge R920 can handle demanding, mission-critical workloads such as enterprise resource planning (ERP), e-commerce, large-scale virtualization, and large databases. It is particularly well suited to the following workloads and environments:

- accelerating large corporate-wide applications (ERP, CRM, Business Intelligence)
- implementing very large traditional databases or in-memory databases
- consolidating enterprise workloads with large-scale virtualization
- migrating from expensive and outdated RISC hardware to a future-ready data center

The PowerEdge R920 makes use of the Intel Xeon processor E7 v2 family, which Intel designed to support mission-critical, high-performance workloads by adding up to 50 percent more cores/threads and 25 percent more cache to provide significant jumps in performance from previous releases. The Intel Xeon processor E7 v2 family provides up to 6 TB of DDR3 memory, supports up to 24 DDR3 DIMMs per socket, and supports up to 1,600 MHz DDR3 speeds to improve performance and increase scalability.

The Intel Xeon processor E7 v2 family supports all the previous reliability, availability, and serviceability features of previous processor releases to support critical workloads. With Intel Run Sure technology, these processors add new RAS features, including eMCA Gen 1, MCA Recovery – Execution Path, MCA I/O, and PCIe Live Error Recovery.

For detailed hardware specifications for the Dell PowerEdge R920 we used, see [Appendix A](#). To learn more about the Dell PowerEdge R920 server, see [www.dell.com/us/business/p/poweredge-r920/pd](http://www.dell.com/us/business/p/poweredge-r920/pd).

# ABOUT THE SOFTWARE COMPONENTS

## Microsoft SQL Server 2014

The latest member of the Microsoft SQL Server family is a next-generation data platform that includes new features oriented to enterprise users seeking greatly improved transactional performance and speed, better time-to-insight and more powerful business analytics, high availability, and ease of integration of their data streams into cloud environments.

Microsoft SQL Server 2014 is a resilient platform for building, deploying, and managing enterprise solutions spanning on-premises and cloud that eases the transition to hybrid environments from on-premises solutions. Many hybrid solutions can be configured with the platform, e.g., databases can be deployed onto SQL Server running on a Microsoft Azure virtual machine (VM), or they can be deployed directly to Microsoft Azure Database, a PaaS database offering. Microsoft SQL Server 2014 can help performance of mission-critical OLTP and data warehousing applications using in-memory technologies, and can enable faster insights from databases. Its ease of integration with Microsoft Azure makes it a potential platform for the hybrid cloud, supporting scenarios such as cloud backup and cloud disaster recovery.

Microsoft SQL Server 2014 allows much better redundancy with AlwaysOn Availability Groups, allowing up to eight secondary replicas to be placed in different locations for better high availability, read-access efficiency, and backup and data recovery. Secondary replicas can also be created in Microsoft Azure, the Microsoft public cloud, for increased protection. SQL Server 2014 also allows managed backups to Microsoft Azure to improve disaster recovery, as data in the Microsoft cloud is automatically replicated to multiple data centers around the world. It also enables encryption for cloud and on-premises backups.

Microsoft SQL Server 2014 now features In-memory OLTP, a memory- and OLTP-optimized database engine integrated into the platform's data engine, and enhancements to the in-memory column store already present in Microsoft SQL Server 2012 to make it updatable, faster, and with better compression. The In-memory OLTP features can be activated by marking tables as memory optimized. These tables continue to be fully transactional, durable, and accessible through Transact-SQL in the same manner as disk-based tables. The significant price drops in memory have made it possible for some OLTP databases to fit in memory, increasing transaction throughput. According to Microsoft, transaction speeds may see increases between 10 times and 30 times over their past performance.

Other improvements in Microsoft SQL Server 2014 over previous releases of the data platform include the following:

- separating the database administrator role from the system administrator role with more defined capabilities
- resource pooling that now allows I/O to be pooled jointly with CPU and memory for better workload management and workload performance predictability
- integration of SSDs and other NVRAM extensions with the Database Engine buffer pool to significantly improve query performance and I/O throughput—benefits of using these buffer pool extensions can include increased random I/O throughput, reduced I/O latency, increased transaction throughput, and improved read performance with a larger buffer pool
- enhancements to in-memory column store indices supporting updateable operations such as inserts, updates, and deletes.<sup>1</sup>

For more information about Microsoft SQL Server 2014, visit

[www.microsoft.com/en-us/sqlserver/default.aspx](http://www.microsoft.com/en-us/sqlserver/default.aspx).

## Microsoft Windows Server 2012 R2

Windows Server® 2012 R2, the latest release of this server OS from Microsoft®, is at the core of the Microsoft Cloud OS vision. To handle the largest database applications, Windows Server 2012 R2 supports up to 2,048 logical processors per Hyper-V host. In a virtual environment, it supports up to 64 virtual CPUs, up to 1 terabyte (TB) of memory, and up to 64 TB of virtual disk capability per Hyper-V VM. With Windows Server 2012 R2, it is possible to have up to 64 nodes in a SQL Server cluster and up to 8,000 VMs within a Hyper-V cluster.

According to Microsoft, Windows Server 2012 R2 focuses on six core areas:

- **Better server virtualization.** Windows Server 2012 R2 provides a robust and dynamic virtualization platform through Hyper-V® that includes live migration for VM mobility and flexible options for delivering cloud services.
- **Better storage features and capabilities.** Windows Server 2012 R2 improves the provisioning, accessing and managing of storage. Windows Server 2012 R2 enhances Storage Spaces – a feature introduced in Windows Server 2012 – that enables the creation of storage pools built from aggregates of physical disk devices and introduces Storage Tiering functionality.

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<sup>1</sup> For more information on the features in this section and other features of Microsoft SQL Server 2014 please refer to the *Microsoft SQL Server 2014 Technical Overview* e-Book downloadable from [www.microsoft.com/en-us/server-cloud/products/sql-server/default.aspx?WT.srch=1&WT.mc\\_ID=SEM\\_GOOGLE\\_USEvergreenSearch\\_SQLServer2014&CR\\_CC=200072479#fbid=NaC8RZmBpWz](http://www.microsoft.com/en-us/server-cloud/products/sql-server/default.aspx?WT.srch=1&WT.mc_ID=SEM_GOOGLE_USEvergreenSearch_SQLServer2014&CR_CC=200072479#fbid=NaC8RZmBpWz)

- **Better and simplified networking.** Windows Server 2012 R2 strives to make management of your networking as straightforward as that of a single server, and to provide reliability and scalability at a lower cost.
- **Better server management and automation.** Microsoft Windows Server 2012 R2 empowers users and IT staff with remote access to data, applications, and simpler management tools while strengthening security and compliance.
- **Better Web and application platform.** According to Microsoft, Windows Server 2012 R2 is a highly scalable and flexible Web and application platform helping build and deploy applications whether on-premises, in the cloud, or both at once.
- **Better information security and access protection.** Windows Server 2012 R2 helps accommodate the new approaches to identity management and security needed in today's global cloud computing environment.

## WE SHOW YOU HOW

### Preparing for the migration

#### Prerequisites for this guide

This guide assumes an existing installation of Microsoft SQL Server 2008 R2, complete with the necessary infrastructure and support, and understanding of the installation and surrounding infrastructure. This document shows how to build the Microsoft SQL Server 2014 environment, create a database backup, transfer the database to the Dell PowerEdge R920, upgrade it to SQL Server 2014, and then how to transfer logins and agent jobs. While multiple migration methods are possible, we use the method of using native SQL Server backup files for transporting the user database files to the new server. For considerations not covered in this guide, see [msdn.microsoft.com/en-us/library/bb677622.aspx](http://msdn.microsoft.com/en-us/library/bb677622.aspx).

The steps in this guide require time for the database to be in a read-only state so that modifications to the database during migration are not lost. The length of required read-only time will depend on the required time to create a database backup, copy the database backup to the new Microsoft SQL Server 2014 instance, and to restore the database.

### Installation considerations

#### Hardware and software requirements

The following is a brief summary of the hardware and software requirements for installing Microsoft SQL Server 2014. For a complete list of hardware and software

requirements, and a list of supported operating systems for each SQL Server edition, see [msdn.microsoft.com/en-us/library/ms143506.aspx](http://msdn.microsoft.com/en-us/library/ms143506.aspx).

#### **Basic requirements that apply to all SQL Server installations**

- .NET™ Framework 3.5 SP1 and 4.0
- Windows PowerShell 2.0
- Network Software (Shared memory, Named Pipes, TCP/IP or VIA)
  - Shared memory and VIA are not supported on failover clusters, and VIA will be diminished in future versions of SQL Server.
- 6GB of hard disk space

#### **Processor, memory, and OS requirements**

- Minimum 1 GB (512 MB for Express Editions), recommended 4 GB or more depending on database size (1 GB for Express Editions)
- Minimum 1.0 GHz for x86 processors or 1.4 GHz for x64 processors, recommended 2.0 GHz or faster

#### **Server core considerations**

Microsoft SQL Server 2014 can be installed on most Microsoft Windows Server Core versions of Windows Server 2008 R2 SP1 and Windows Server 2012. Some features cannot be installed on Microsoft Windows Server Core versions and must be installed on a different machine. For a list of which features are supported, see [msdn.microsoft.com/en-us/library/hh231669.aspx](http://msdn.microsoft.com/en-us/library/hh231669.aspx).

#### **Working in a multi-version environment**

It is possible to install distinct versions of SQL Server (e.g., SQL Server 2012, SQL Server 2014) on the same machine, but certain considerations apply. For a detailed list of these considerations, see [msdn.microsoft.com/en-us/library/ms143694.aspx](http://msdn.microsoft.com/en-us/library/ms143694.aspx).

## **Evaluating the source environment**

As with any migration or consolidation, planning is key. This is especially true when moving to a virtualized environment. There are specific details related to each server targeted for migration or upgrade, including the maintenance window for migrating the databases to their new environment, metadata, affected users, and configuration tasks necessary to assimilate the databases into the consolidated environment. Information to gather before consolidation includes the following:

- Windows Server version and patch level
- SQL Server version and patch level
- number of logins on this SQL Server instance, and what type of logins these are (Windows or SQL)

- current backup strategy and schedule for the databases on this server
- replication details for this SQL instance, if any
- detailed information regarding permissions and roles
- SQL Server Agent jobs on this SQL Server

In addition, after moving the databases to their new SQL Server instance, make sure that any system or application using the database has updated connection information. This includes logins, permissions, applications, SQL Server Agent jobs, third-party backup products, and so on.

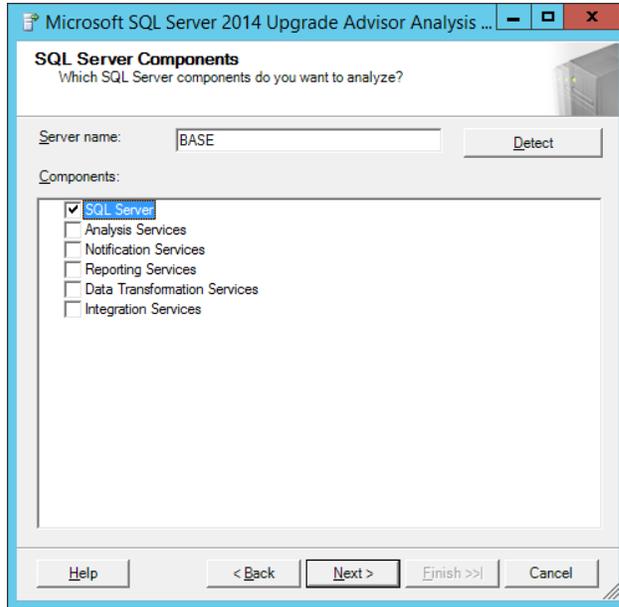
### Utilizing Upgrade Advisor

The SQL Server 2014 Upgrade Advisor can be a major aid in migration research. This utility, which the SQL Server 2014 setup wizard includes, scans prior versions of SQL Server databases and SQL Server components for compatibility issues, features, and T-SQL syntax the newer version may not support. The Upgrade Advisor interface allows for viewing or saving reports that list warnings and errors.

The Upgrade Advisor works on machines running Windows Vista® SP1, Windows 7, Windows Server 2008 (SP2), or Windows Server 2008 R2. The Microsoft .NET framework is also a requirement. For more detailed information about SQL Server 2014 Upgrade Advisor, see [msdn.microsoft.com/en-us/library/ee210467\(v=sql.120\).aspx](http://msdn.microsoft.com/en-us/library/ee210467(v=sql.120).aspx).

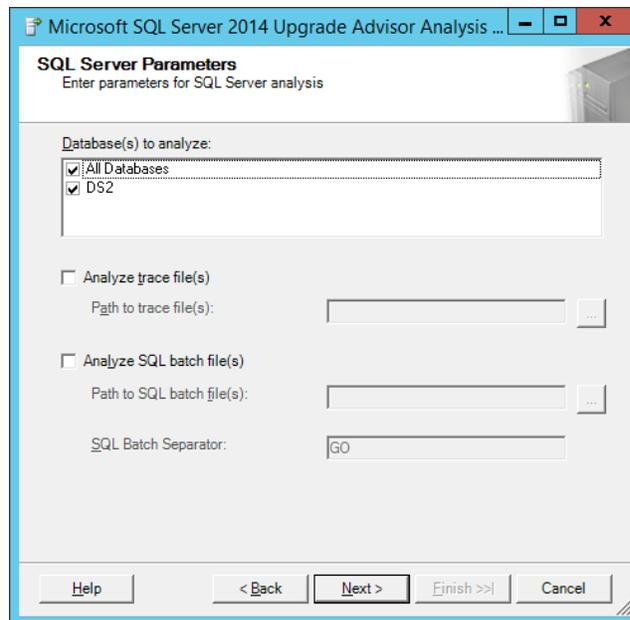
For more detailed steps, see [Appendix B](#). To install the Microsoft SQL Server 2014 Upgrade Advisor from the Planning menu on the installation media, perform the following steps:

1. Select Start→All Programs→Microsoft SQL Server 2014→SQL Server 2014 Upgrade Advisor.
2. Click the Launch Upgrade Advisor Analysis Wizard link, and click Next to begin.
3. Enter the older SQL Server computer name, and select the features you want the Upgrade Advisor to analyze. Alternately, click Detect to have the Upgrade Advisor remotely scan the older SQL Server machine and detect the components running on the server (Figure 1).



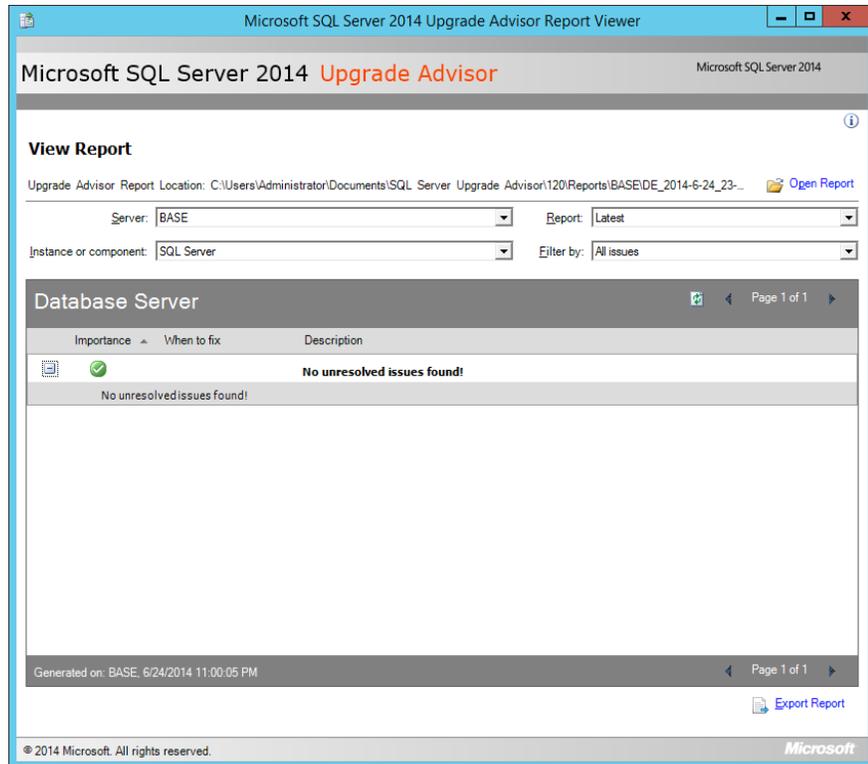
**Figure 1: Upgrade Advisor component selection.**

4. Choose the instance, provide proper authentication to the older SQL Server, and select the database you want to analyze. Alternatively, if you have captured SQL trace files using SQL Profiler or have a particular T-SQL batch to check, input SQL script files and trace files at this time (Figure 2).



**Figure 2: Upgrade Advisor instance selection.**

5. Following the analysis of the older SQL Server instance, view the Upgrade Advisor report. Each warning or error will have associated information to solve any issues (Figure 3).



**Figure 3: Sample Upgrade Advisor output report.**

### Gathering baseline performance data

During the research and planning phase for this migration, use Windows Performance Monitor, SQL Server Profiler, SQL Server Distributed Replay, and other tools to gather data on the typical query load and performance statistics of the databases potentially moving to the new environment. This serves two purposes: first, it provides an opportunity to identify potential problems before moving to a consolidated solution; second, the information can help to analyze resource allocation needs, which can then be used to configure the new VMs, either by using different memory allocations, or by allocating differing numbers of virtual CPUs on the VMs. For more information on SQL Server Profiler and SQL Server Distributed Replay, see [msdn.microsoft.com/en-us/library/ff878183.aspx](http://msdn.microsoft.com/en-us/library/ff878183.aspx).

### Installing Windows Server, Hyper-V, and Microsoft SQL Server 2014

After the prerequisite infrastructure is in place and the migration is planned, it is time to set up the Microsoft SQL Server 2014 environment on the Dell PowerEdge R920. For more detailed steps, see [Appendix C](#).

#### Configuring the Dell PowerEdge R920 internal storage

In our test bed, we used only internal storage on the Dell PowerEdge R920, as this provided the requirements for our scenario. In your environment, you may need further planning in order to integrate with the necessary external storage providers.

1. To enter the PERC H730P Configuration Utility during POST, press Ctrl+R at the prompt.
2. Select the controller, and press F2. Select Create VD.
3. Specify the RAID level, select the desired physical disks, choose the cache settings required, and press Apply.
4. Exit the configuration utility, and reboot the server.

### Installing Microsoft Windows Server 2012 R2

After configuring the internal storage on the Dell PowerEdge R920, install the operating system. We installed Windows Server 2012 R2 with default options. The Server Manager feature allows for adding Roles and Features to the installation after the initial configuration. The following required steps install the operating system:

1. Boot the Dell PowerEdge R920 into the Microsoft Windows Server 2012 R2 installation.
2. Select the appropriate language, time and currency format, and keyboard layout. Enter the product key, and choose Windows Server 2012 R2 Datacenter (Server with a GUI).
3. Accept the license terms, and install the OS to the appropriate disk.
4. After the installation has finished, configure Microsoft Windows Server 2012 R2 as your specific environment requires with any security policies, Active Directory requirements, and so on.

### Installing Hyper-V and creating VMs

The next process is to install the Hyper-V role on the server, enabling the hypervisor feature of Windows Server 2012 R2. Then finally, create the VM that will host the SQL Server 2014 instance. If your organization is using failover clustering and shared storage to create a highly available VM, use Failover Cluster Manager and follow the instructions at [technet.microsoft.com/en-us/library/hh831579.aspx](http://technet.microsoft.com/en-us/library/hh831579.aspx). The following instructions outline how to install a non-clustered VM on the Dell PowerEdge R920:

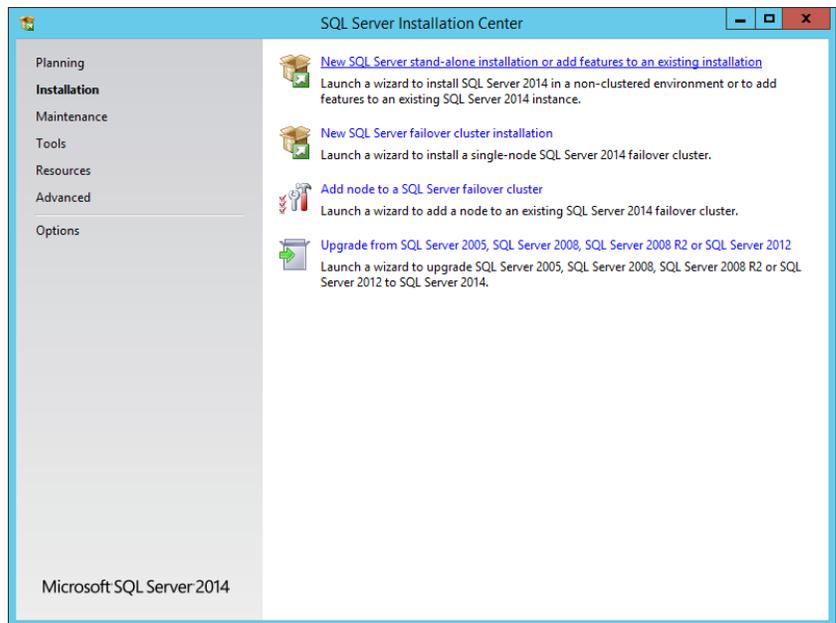
1. Use Server Manager to add the Hyper-V role to the server, and reboot when prompted.
2. Create the necessary virtual switches for the environment.
3. Create a VM and allocate appropriate memory and virtual CPUs, then create the necessary virtual hard drive and virtual network connections.
4. Connect the Microsoft Windows Server 2012 R2 installation media to the VM and install the OS.
5. Configure the guest OS with the settings, roles, and features necessary to the environment.

### Installing Microsoft SQL Server 2014

After creating the VM, install SQL Server 2014. Although not required, for best practices, deploy SQL Server 2014 on machines that are part of an Active Directory® domain. If deploying SQL Server in a domain, do not make the SQL Server service

domain accounts members of the Domain Administrators group. In fact, grant only the necessary rights on the local server to the SQL Server service account as part of the pre-installation planning. The SQL Server installation software creates the local groups it needs for security purposes. For more information on SQL Server service accounts, see more details at [msdn.microsoft.com/en-us/library/cc281953.aspx](https://msdn.microsoft.com/en-us/library/cc281953.aspx).

1. Using Server Manager, add the .NET Framework 3.5 feature, and if necessary, reboot.
2. Attach the Microsoft SQL Server 2014 installation media to the VM, and start the SQL Server 2014 setup.
3. Select Installation, and click New SQL Server stand-alone installation or add features to an existing installation (Figure 4).



**Figure 4: SQL Server 2014 Installation Center.**

4. Follow the installation wizard, providing licensing details and allowing all rule checks to complete without error.
5. At the Feature Selection screen (Figure 5), select the features required by your organization. For this guide, we selected Database Engine Services, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, Client Tool Backwards Compatibility, Management Tools – Basic, and Management Tools – Complete. Specify a directory, and click Next.

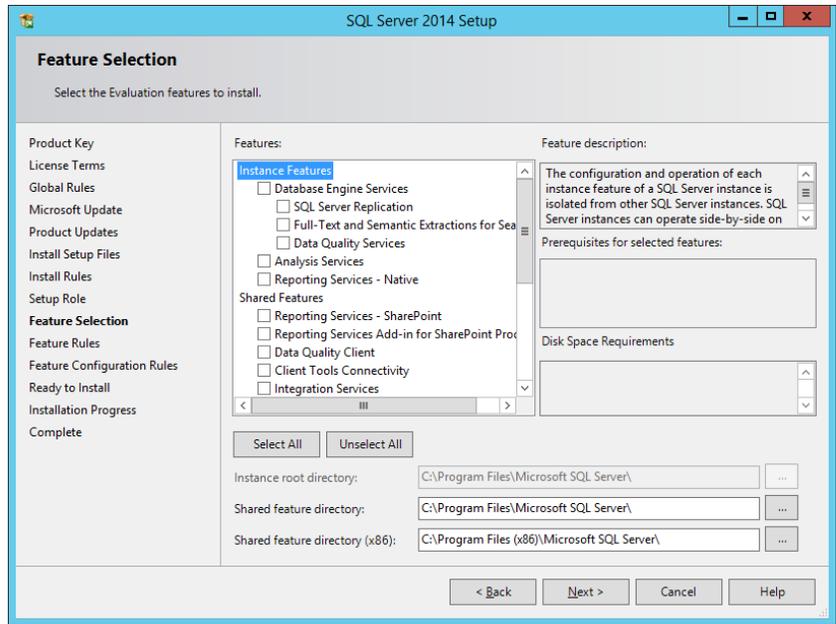


Figure 5: SQL Server 2014 Feature Selection screen.

6. Choose Default instance or Named instance, depending on the needs of your organization. Click Next.
7. On the Server Configuration screen (Figure 6), choose the accounts to be used for each SQL Server component. For this guide, we left the default accounts. If you have specific domain accounts to be used for SQL Server service accounts, adjust them on this screen. Click Next.

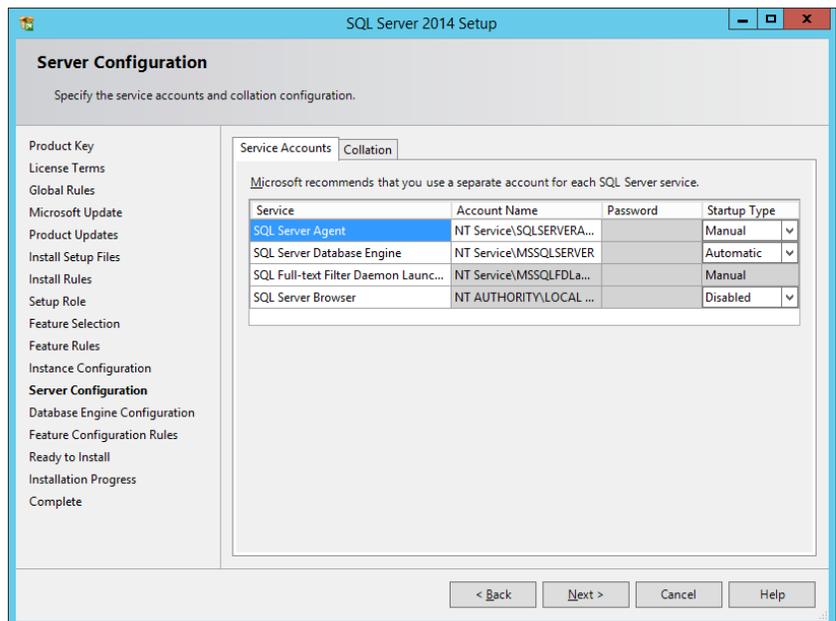


Figure 6: SQL Server 2014 Server Configuration screen.

8. On the Database Engine Configuration screen, address the following three tabs:
  - a. The Server Configuration tab – select Windows Authentication Mode or Mixed Mode. Add any necessary users, and enter a password for the sa account if using Mixed Mode. For this guide, we selected Mixed Mode and added the current user (Windows Local Administrator).

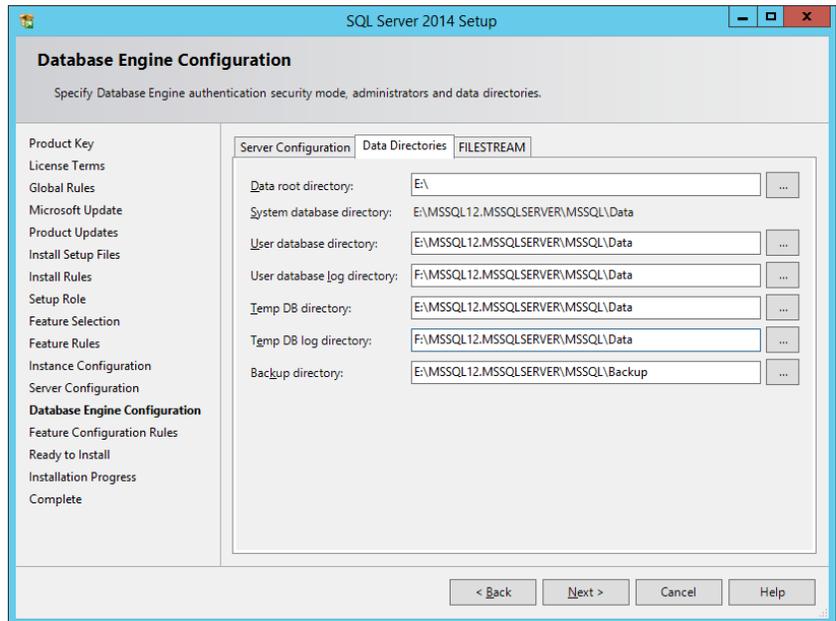
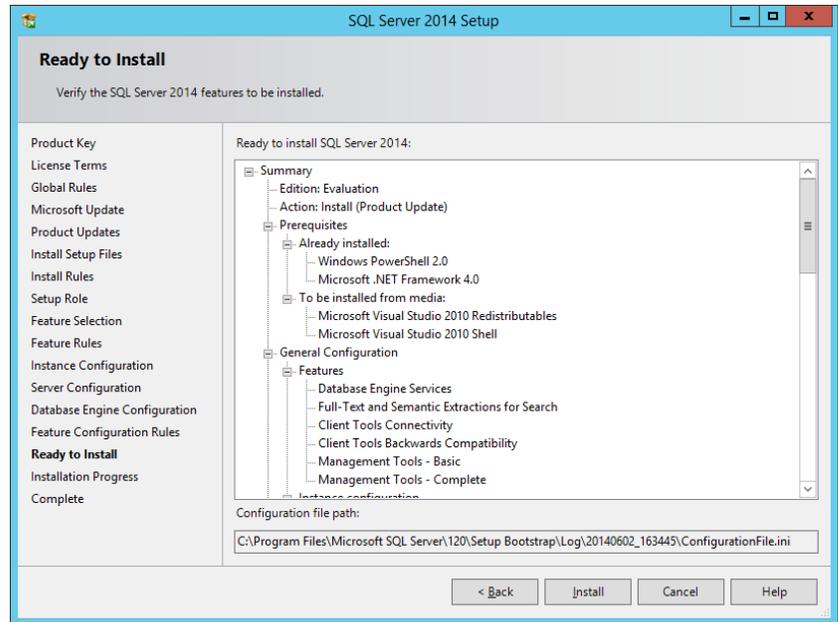


Figure 7: SQL Server 2014 Server Database Engine Data Directories tab.

- b. The Data Directories tab (Figure 7) – enter the default directories where the SQL Server installation will attempt to place its user database and log files upon creation.
    - c. The FILESTREAM tab – enable FILESTREAM if appropriate for your organization. For this guide, we left FILESTREAM disabled.
9. Click Next.
10. At the Ready to Install screen (Figure 8), review the summary info, and click Install.



**Figure 8: SQL Server Ready to Install screen.**

- 11.** After the installation completes, click Close.

After completing the Microsoft SQL Server 2014 installation, complete any additional steps required to match the SQL 2008 R2 environment. Transfer of SQL Server logins and agent jobs will be covered in the [After the move](#) section.

### Validating the installation

After completing the migration, the SQL Server features discovery report creates a list of all SQL Server 2014 products and features that are on the server. In this section we outline how to create a basic report. For more detailed information, see [msdn.microsoft.com/en-us/library/bb510455.aspx](http://msdn.microsoft.com/en-us/library/bb510455.aspx).

- 1.** From the installation media, launch the SQL Server Installation Center.
- 2.** Click Tools→Installed SQL Server features discovery report.
- 3.** View the report in a Web browser, and verify that it matches the setup (Figure 9).

Product	Instance	Instance ID	Feature	Language	Edition	Version	Clustered	Configured
Microsoft SQL Server 2014	MSSQLSERVER	MSSQL12.MSSQLSERVER	Database Engine Services	1033	Enterprise Evaluation Edition	12.0.2000.8	No	Yes
Microsoft SQL Server 2014	MSSQLSERVER	MSSQL12.MSSQLSERVER	Full-Text and Semantic Extractions for Search	1033	Enterprise Evaluation Edition	12.0.2000.8	No	Yes
Microsoft SQL Server 2014			Management Tools - Basic	1033	Enterprise Evaluation Edition	12.0.2000.8	No	Yes
Microsoft SQL Server 2014			Management Tools - Complete	1033	Enterprise Evaluation Edition	12.0.2000.8	No	Yes
Microsoft SQL Server 2014			Client Tools Connectivity	1033	Enterprise Evaluation Edition	12.0.2000.8	No	Yes
Microsoft SQL Server 2014			Client Tools Backwards Compatibility	1033	Enterprise Evaluation Edition	12.0.2000.8	No	Yes

Figure 9: SQL Server 2014 Setup Discovery Report.

## Making the move

In this section, we provide an overview of the processes involved in migrating a database from SQL Server 2008 R2 to a virtualized SQL Server 2014 environment on the Dell PowerEdge R920. We performed all administration for the SQL Server 2008 R2 and SQL Server 2014 installations using SQL Server Management Studio, the main administration interface for those versions. For detailed steps on backing up and restoring the database, see [Appendix D](#).

Various methods exist for migrating databases between instances and versions of SQL Server, including detach/attach, backup/restore, and the copy database wizard. We chose the backup/restore method because most businesses will have a backup routine in place and administrators will be familiar with the process.

### Performing the backup of the SQL Server 2008 R2 database

Using the SQL Server 2008 R2 server, take the following steps to back up the database. Backup times will vary. To minimize downtime, do any special planning in advance.

1. To keep users from issuing updates during the migration process, set the database to read-only mode or set the access property to SINGLE\_USER (Figure 10). Both choices immediately sever all user connections.

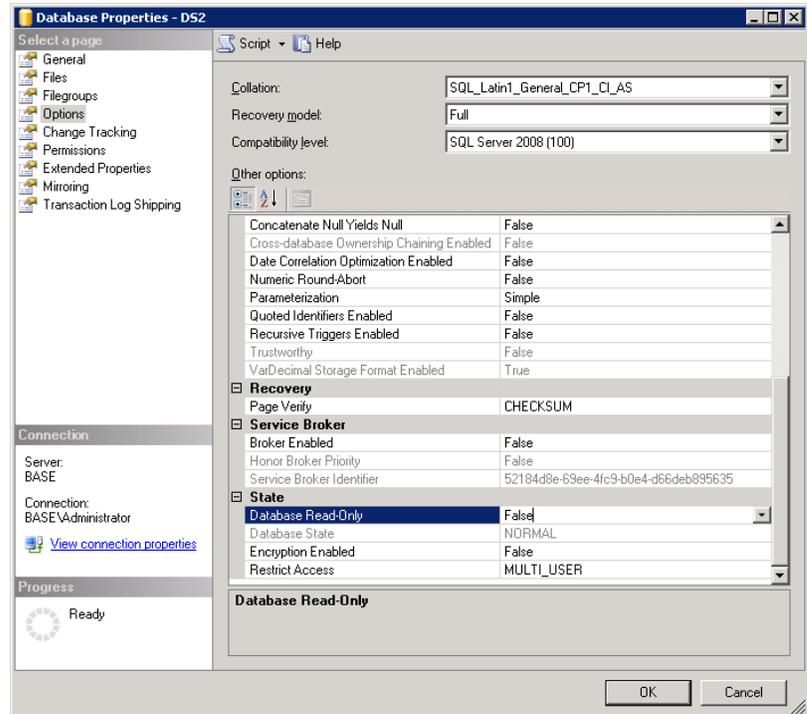


Figure 10: The legacy database options screen.

2. Perform a full backup of the SQL Server 2008 R2 database (Figure 11).

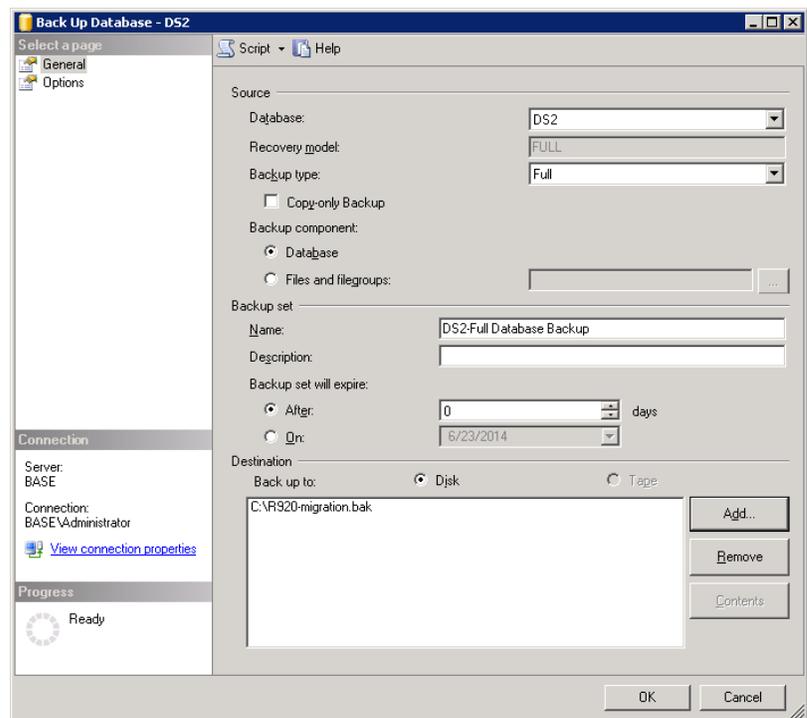


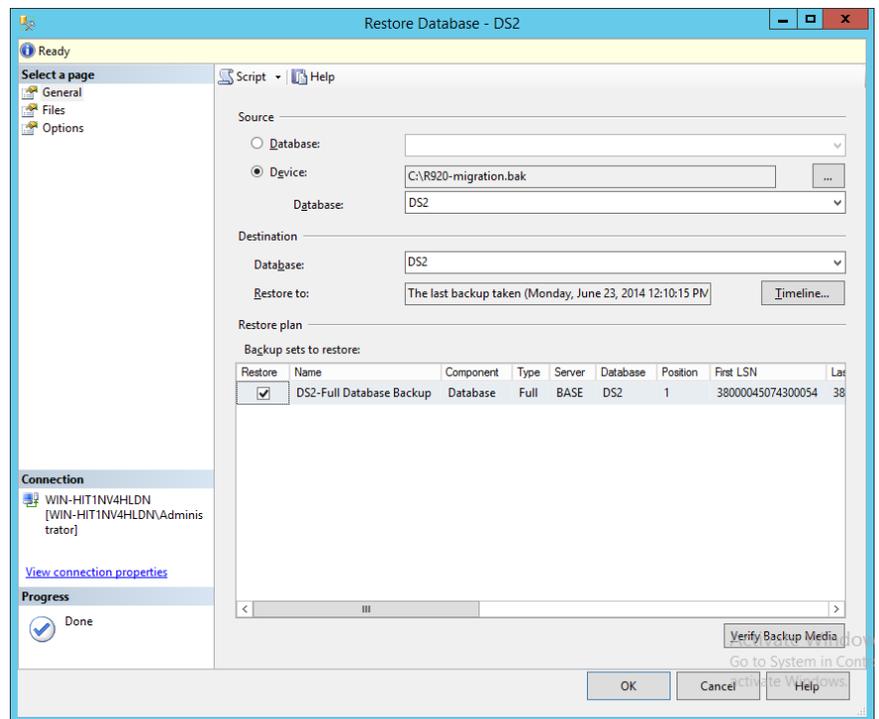
Figure 11: Backing up the SQL Server 2008 R2 database.

If the time to complete a full backup is too long, take the full backup at a previously scheduled time, and at this point of the migration, take only a differential or transaction log backup. If the transaction log size is small relative to the data file size, this approach can decrease migration time significantly. If choosing this option, be mindful to keep the backup chain intact.

## Restoring the database to the SQL Server 2014 VM

On the SQL Server 2014 VM, take the following steps:

1. Open the VM console, and log into the SQL Server 2014 VM.
2. Open SQL Server Management Studio, connect to the SQL Server 2014 instance, and restore the database (Figure 12).



**Figure 12: Restoring the SQL Server 2008 R2 database to the SQL Server 2014 environment on the Dell PowerEdge R920.**

At this step, give the new database the same name as the SQL Server 2008 R2 database. Changing the name could cause applications that refer to the database by name to crash or not connect.

3. In SQL Server Management Studio, reset the database access property to multi-user, and set the compatibility level to SQL 2014 (level 120). See Figure 13.

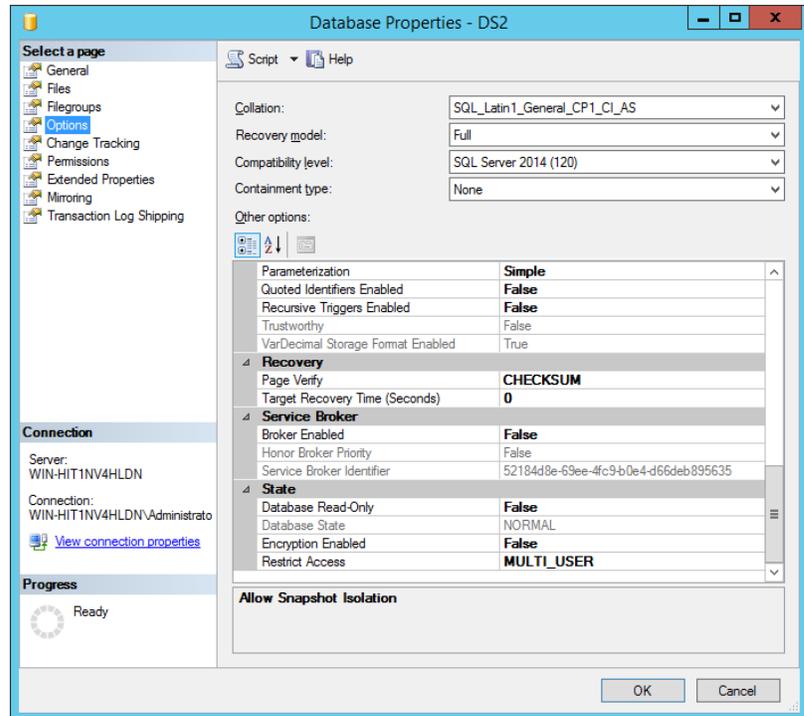


Figure 13: Setting the updated database back to read-write or MULTI\_USER.

4. Modify application connection strings, or change Domain Name System (DNS) pointers that reference the migrated database.

## After the move

### Post-migration considerations

Some post-migration tasks remain after completing the side-by-side migration. The specific list of tasks will depend on the pre-migration research and planning. In this section, we briefly discuss moving Windows and SQL Server logins and transferring SQL Server Agent jobs. See [Appendix E](#) for detailed steps.

### Windows and SQL Server logins

Similar to previous versions of SQL Server, there are two methods of authenticating to SQL Server 2014: Windows logins and SQL Server logins. Windows logins are created and administered at either the operating system level or the Active Directory domain level, while SQL Server logins are created and managed from within SQL Server. The processes for extracting login information and creating the transferred login entities on the migration server is similar for both Windows-authenticated and SQL Server-authenticated logins. Take some extra steps, however, to ensure a smooth migration for SQL Server logins.

The following steps detail how to script both Windows-authenticated logins and SQL Server-authenticated logins to a query window, and recreate them on the new SQL Server 2014 VM.

To transfer logins, take the following steps on the SQL Server 2014 VM. Note that steps 1 through 6 apply to both Windows logins and SQL Server logins, but Step 7 refers to only SQL Server logins.

1. Log into the VM.
2. In SQL Server Management Studio and in the Object Explorer pane, connect to both the SQL Server 2008 R2 server and the SQL Server 2014 virtual machine. Be sure to have the Object Explorer Details tab open (View→Object Explorer Details).
3. Expand the tree view of the SQL Server 2008 R2 server, browse to the Security tab, and click the Logins node (Figure 14). The Object Explorer Details will show a list of all logins on the SQL Server 2008 R2 server.

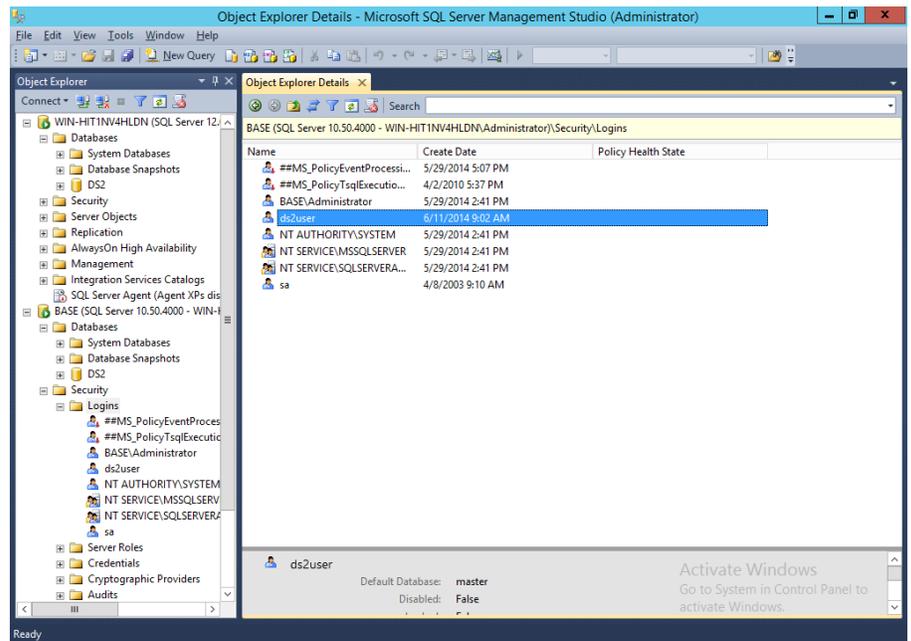


Figure 14: SQL Server 2008 R2 logins.

4. If necessary, use the sorting and filtering options in the Object Explorer Details tab, and take note of the logins to migrate. Click to select them.
5. Right-click the selected logins, and choose Script Login As→Create To→New Query Window. To change the connection of this new query window to the new SQL Server 2014 virtual server, right-click and select Change Connection (Figure 15).

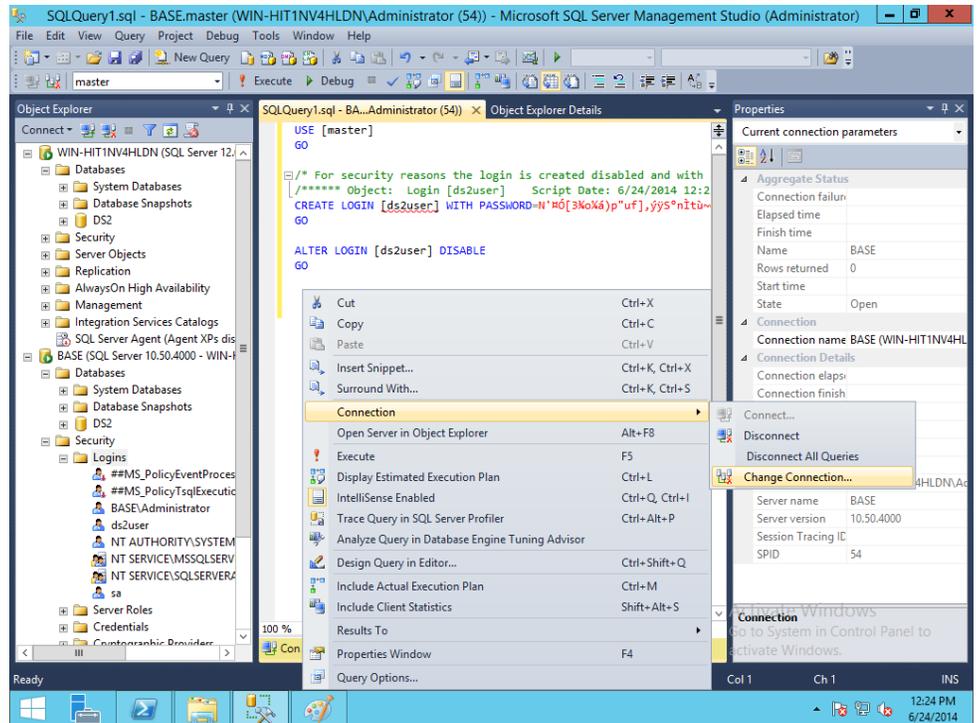


Figure 15: Changing the query editor connection to SQL Server 2014.

6. Execute the script on the SQL Server 2014 virtual server to create the logins. If transferring Windows-based logins, the process is complete. If transferring SQL Server logins, continue to Step 7.
7. The script executed in Step 6 created the login, marked it as disabled, and assigned it a random password. The script, however, did not map the login to the database user. To avoid having a database user that is “orphaned” from a login, use the `sp_change_users_login` stored procedure, to view orphaned users and to map a user to a login.

## SQL Server Agent jobs

Most organizations schedule SQL Server Agent jobs that run against their databases, such as backups, index rebuilds, and other maintenance items. These jobs must be migrated to the new SQL Server 2014 VM. Log into the VM, open SQL Server Management Studio, and connect to the older SQL Server 2008 R2 server. Locate the jobs to migrate in SQL Server Management Studio (on the SQL Server 2008 R2 server) under the SQL Server Agent, right-click them, and choose Script Job As → Create To → New Query Window (Figure 16). Connect to the SQL Server 2014 virtual server, and run the resulting script in a query window. Verify the job was created successfully in SQL Server Management Studio.

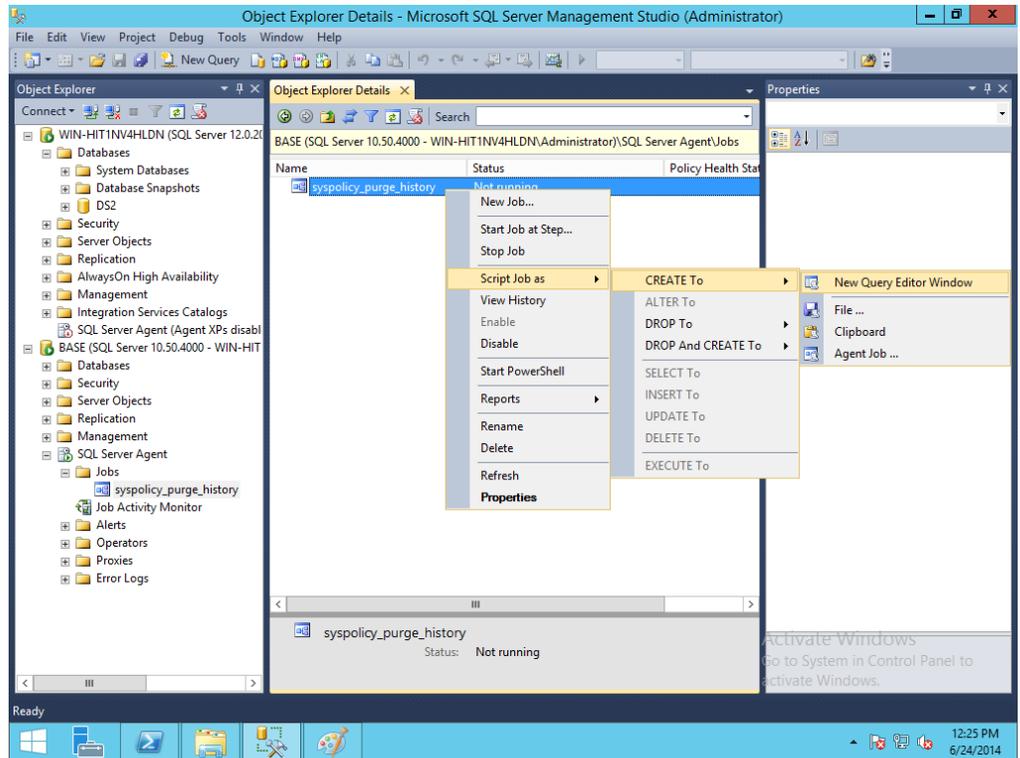


Figure 16: Scripting SQL Agent jobs in SQL Server Management Studio.

### Other external dependencies

The pre-migration research may have yielded a list of items to implement, including references to local or remote file shares, database mail or SQL Mail configurations, stored procedures in system databases, and linked servers. Addressing these external dependencies will ensure a smooth finish to the migration.

## COST BENEFITS

The Dell PowerEdge R920 can consolidate multiple older server systems, potentially saving the business licensing, power and management costs. This section looks at the potential licensing savings from the migration various consolidation scenarios can offer, starting with legacy servers running SQL Server 2008 R2 on either bare metal or Windows Server 2008 R2 VMs. For a detailed explanation on how we arrived at our figures, see [Appendix F](#).

With the release of SQL Server 2014, mainstream support for SQL Server 2008 R2 ending in July 2014, and also for Windows Server 2008 R2 in January of 2015, the time to upgrade the database of your business is shortening.

### How much can your business save?

Savings depends on software editions, the number of servers to be consolidated, and on the processor and core counts of the servers. We estimated costs for an organization that has four-year-old legacy dual-socket servers with 16 cores per server, and purchased licenses and two-year Microsoft Software Assurance coverage. We assumed they chose the Datacenter edition of Windows Server and the Enterprise Edition of SQL Server.

The licenses would automatically upgrade to the latest software version with each software release because they were covered with Software Assurance. For example, if a new version of a server product is available during the term of coverage, licenses are automatically upgraded to the new version. The original versions can continue to be used through downgrade rights, which are rights to use prior versions that are granted as part of Microsoft Volume Licensing agreements.

We assumed a change from the processor-based licensing of the SQL Server 2008 R2 Enterprise Edition to the core-based licensing of the newer Microsoft SQL Server 2012 edition upon renewal of the Software Assurance for another two years in June 2012.

Two years later, the Software Assurance is due to renew again. Microsoft support will soon end for the older 2008 R2 versions that these servers are running under downgrade rights, so it is an appropriate time to consolidate. Figure 17 summarizes the versions.

Date	Microsoft Windows version	SQL Server software version
June, 2010	Microsoft Windows Server 2008 R2 Datacenter Edition	Microsoft SQL Server 2008 R2 Enterprise Edition
June, 2014	Microsoft Windows Server 2012 R2 Datacenter Edition	Microsoft SQL Server 2014 Enterprise Edition

**Figure 17: Microsoft Windows Server and Microsoft SQL Server Software versions for our hypothetical pricing analysis.**

At the same time, they plan to replace the older servers and save money by consolidating multiple older servers onto a newer server, the Dell PowerEdge R920, with fewer processors and cores, and therefore fewer software licenses and lower software cost, than the servers it would replace. The Dell PowerEdge R920 would run Windows Server 2012 R2 Datacenter Edition and have VMs running SQL Server 2014 Enterprise Edition. Its VM count would be the total of the workloads of the servers it replaces.

### Calculating software costs for the Dell PowerEdge R920 server

In our pricing analysis, we assume the Dell PowerEdge R920 server has up to four processors, each with up to 15 cores and used that configuration and assumption for these calculations. The Software Assurance cost for a new Dell R920 PowerEdge server with four 15-core processors would be \$208,144 for both Windows Server and Windows SQL Server. Figure 18 shows those costs.

	Unit price	No. of license packs	Total
Microsoft Windows Server 2012 R2 Datacenter Edition (2 years software assurance, 2 processor pack)	\$3,017	2	\$6,034
Microsoft SQL Server 2014 Enterprise Core ( 2 year software assurance only, 2 core pack)	\$6,737	30	\$202,110
<b>Total</b>			<b>\$208,144</b>

**Figure 18: Two-year Software Assurance estimate for a 4-processor Dell PowerEdge R920 server with a total of 60 cores.**

We assume licenses would transfer from the older servers to the Dell PowerEdge server that would replace them so we did not include a license-purchase cost for the Dell PowerEdge R920 server. Because it has more cores and processors than one of the older servers, the Dell PowerEdge R920 server would need the licenses of multiple of the older servers. The four-processor Dell PowerEdge R920 would need Windows Server processor licenses from two of the two-processor older servers. The 60-core Dell PowerEdge R920 server would need the SQL Server core-based licenses from almost four of the older 16-core servers.

### Software costs for each of the older servers

We assume the older servers each have two eight-core processors for a total of 16 cores on each server. We estimated the cost to renew Microsoft Windows and SQL Server Software Assurance for another two years for each of these servers at \$56,913

using the Microsoft Open License licensing program and the Level C pricing level. We used the Microsoft License Advisor<sup>2</sup> to get the prices. Figure 19 shows those costs.

	Unit price	No. of license packs	Total
Microsoft Windows Server 2012 R2 Datacenter Edition (2-processor pack) <sup>3</sup>	\$3,017	1	\$3,017
Microsoft SQL Server 2014 Enterprise Core (2-core pack) <sup>4</sup>	\$6,737	8	\$53,896
<b>Total</b>			<b>\$56,913</b>

**Figure 19: Two-year Software Assurance estimate for a 2-processor server with a total of 16 cores.**

### A range of consolidations

Savings would start with consolidation ratios as low as four to one. Figure 20 shows savings for a range of consolidations. The Microsoft Windows Server 2012 DataCenter Edition and Microsoft SQL Server 2014 Enterprise Edition support unlimited virtualization. As a result, cost for the Dell PowerEdge R920 would be the same \$208,144 for all of these consolidations where each creates one VM on the Dell PowerEdge R920 for each of workloads on the older servers. The Dell PowerEdge server saves \$56,913 in these costs for each additional older server the new Dell PowerEdge R920 server can replace.

Consolidation factor	Software cost for multiple older servers	Software savings for the Dell PowerEdge R920 server
4	\$227,652	\$19,508
5	\$284,565	\$76,421
6	\$341,478	\$133,334
7	\$398,391	\$190,247
8	\$455,304	\$247,160
9	\$512,217	\$304,073
10	\$569,130	\$360,986
11	\$626,043	\$417,899
12	\$682,956	\$474,812
13	\$739,869	\$531,725

**Figure 20: Windows Server and SQL Server savings when consolidating between 4 and 13 older two-processor, 16-core servers to new four-processor, 60-core Dell PowerEdge R920 servers.**

<sup>2</sup>[mla.microsoft.com/default.aspx](http://mla.microsoft.com/default.aspx)

<sup>3</sup>Microsoft® Windows® Server Datacenter Sngl Software Assurance OPEN 1 License Level C 2 PROC

<sup>4</sup>Microsoft® SQL Svr Enterprise Core Sngl Software Assurance OPEN 2 Licenses Level C Core License

## Do the software savings pay back the price of the server?

The price of the Dell PowerEdge R920 server will depend on the configuration. We configured pricing in the Dell Online Store for a server configured with the four 15-core processors and other components that might help handle a data processing workload:

- four Intel® Xeon® E7-4870 v2 15-core processors,
- 64 16GB DIMMs,
- 22 300GB 15K RPM SAS drives and 2 900GB 10K RPM SAS drives
- one Intel Ethernet I350 QP 1Gb NIC
- four 1100W power supplies
- three-year Dell ProSupport Plus support plan

Its price before discounts was \$71,052. All the software savings we show in Figure 20 for consolidations of 5:1 or more are greater than this hardware cost. For most consolidations, therefore, software savings alone would pay back the cost of this new server.

### A consolidation example

A recent study by Dell showed that a single Dell PowerEdge R920 server could run 10 to 12 large Microsoft SQL Server database guests.<sup>5</sup> If each of those guests ran on bare metal on a separate legacy server, then that study demonstrates that consolidating and virtualizing the workloads from 10 to 12 legacy servers onto one Dell PowerEdge R920 server is possible. With that consolidation, your organization could see big savings in licensing.

As we showed in Figure 20, consolidating the workloads of 10 older, two-processor servers onto a four-processor, 60-core Dell PowerEdge R920 server could save up to \$360,986 in software costs. Those savings are over five times the \$71,052 cost before discounts of the configuration we priced.

A 12-to-1 consolidation could yield \$474,812 in software savings. Those savings are over 6.6 times the cost of that same server.

Savings are in Software Assurance costs for Microsoft Windows Server 2012 Datacenter Edition and Microsoft SQL Server 2014 Enterprise Edition.

**Save between  
\$360,986 and  
\$474,8120 with  
a 10- or 12-to-1  
consolidation.**

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<sup>5</sup> "Dell PowerEdge R920 System Powers High Performing SQL Server Databases and Consolidates Databases," [en.community.dell.com/techcenter/enterprise-solutions/m/sql\\_db\\_gallery/20438756.aspx](http://en.community.dell.com/techcenter/enterprise-solutions/m/sql_db_gallery/20438756.aspx)

### Additional ways to save

Software will not be the only area of savings. Data center space costs and server management costs with a lower server count can contribute to savings. The costs of the hardware maintenance agreements for the multiple older servers. The single Dell PowerEdge R920 will have lower energy costs for power and cooling than the servers it replaces. For each of these items, the savings will grow the more servers you consolidate.

## SUMMING IT ALL UP

The latest Dell PowerEdge R920 server is designed to provide highly scalable performance for large enterprises, with greater memory capacity, improved and expanded attached storage options, and processor architectures designed for high availability. Microsoft SQL Server 2014 is the perfect companion software to take advantage of the Dell PowerEdge R920's impressive specifications. Upgrading has never looked more attractive, and with hardware/software upgrades must come data migration.

Migrating legacy database applications to the latest database technologies on newer Dell server platforms is a common task for businesses upgrading their hardware/software stack. As this guide shows, the process is straightforward and the cost benefits can be enormous. We calculated the savings attainable from multiple consolidation ratios, as well as how long it would take to pay off the replacement server. We found that a consolidation ratio of 13 to 1 could yield \$531,725 in software savings, many times the cost of the replacement hardware itself. So not only will the business benefit from the massively-scalable current-generation Dell server technology paired with Microsoft Windows Server 2012 R2 running SQL Server 2014, but you can save money in the process.

## APPENDIX A – SYSTEM CONFIGURATION

Figure 21 shows detailed configuration information for the server.

System	Dell PowerEdge R920
<b>Power supplies</b>	
Total number	4
Vendor and model number	Dell 0GDPF3
Wattage of each (W)	1,100
<b>Cooling fans</b>	
Total number	6
Vendor and model number	Nidec® UltraFlow V12C12BS1M3 J87TW-A00
Dimensions (h × w) of each	5" × 5"
Volts	12
Amps	2.31
<b>General</b>	
Number of processor packages	4
Number of cores per processor	15
Number of hardware threads per core	2
System power management policy	Default
<b>CPU</b>	
Vendor	Intel
Name	Xeon
Model number	E7-4870 v2
Socket type	LGA 2011
Core frequency (GHz)	2.30
Bus frequency	8.0 GT/s
L1 cache	32 + 32 KB (per core)
L2 cache	256 KB (per core)
L3 cache	30 MB
<b>Platform</b>	
Vendor and model number	Dell PowerEdge R920
Motherboard model number	0Y4CNC
BIOS name and version	1.0.6
BIOS settings	Defaults
<b>Memory module(s)</b>	
Total RAM in system (GB)	1,024
Vendor and model number	Hynix® HMT42GR7MFR4C
Type	PC3L-12800R
Speed (MHz)	1,600
Speed running in the system (MHz)	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	13-13-13-36
Size (GB)	16
Number of RAM module(s)	64
Chip organization	Double-sided
Rank	2Rx4

<b>System</b>	<b>Dell PowerEdge R920</b>
<b>Operating system</b>	
Name	Microsoft Windows Server 2012 R2
Build number	9600
File system	NTFS
Kernel	6.1.7601.18409
Language	English
<b>RAID controller</b>	
Vendor and model number	Dell PERC H730P
Firmware version	25.2.0.0013
Cache size	2 GB
<b>Hard drives</b>	
Vendor and model number	Dell ST9300653SS / Dell ST9900653SS
Number of drives	22 / 2
Size (GB)	300 / 900
RPM	15K / 10K
Type	SAS / SAS
<b>Ethernet adapters</b>	
Vendor and model number	Intel I350 Quad-port 1Gb
Type	Integrated
<b>USB ports</b>	
Number	4
Type	USB 2.0

Figure 21: Detailed configuration information for the server.

## APPENDIX B – INSTALLING AND RUNNING UPGRADE ADVISOR

1. Insert the SQL Server 2014 DVD. Click the Planning link, and click Install SQL Server Upgrade Advisor.
2. Click Next to begin the installation wizard, accept the licensing terms, and click Next.
3. Click Next to accept the default Registration information, click Next to accept the default installation path, and click Next to begin the installation.
4. Select Start→All Programs→Microsoft SQL Server 2014→SQL Server 2014 Upgrade Advisor.
5. Click the Launch Upgrade Advisor Analysis Wizard link, and click Next to begin.
6. Enter the older SQL Server computer name, and select the features you want the Upgrade Advisor to analyze. Alternatively, click Detect to have the Upgrade Advisor remotely scan the older SQL Server machine and detect which components are running on the server. Click Next.
7. Choose your instance, provide proper authentication to the older SQL Server, and select the database you want to analyze. If necessary, you can also input SQL script files and trace files here. Click Next.
8. Click Run.

## APPENDIX C – INSTALLING THE SQL SERVER ENVIRONMENT

### Configuring the Dell PowerEdge R920 internal storage

1. During POST, press Ctrl-R at the prompt to enter the PERC Configuration Utility.
2. Select the controller and press F2. Select Create VD.
3. Specify the RAID level, select the desired physical disks, choose the cache settings required and press Apply.
4. Exit the configuration utility and reboot the server.

### Installing Microsoft Windows Server 2012 R2

1. Insert the Microsoft Windows Server 2012 R2 installation DVD into the optical drive.
2. Power on the server and boot into the Windows installer.
3. Once the installation files have been copied into memory, select the appropriate language, time and currency format, and keyboard layout, and click Next.
4. Click Install Now.
5. Enter the product key, and click Next.
6. Choose Windows Server 2012 R2 Datacenter (Server with a GUI), and click Next.
7. Check the I accept the license terms box, and click Next.
8. Choose Custom: Install Windows only (advanced).
9. Select the OS hard drive from the list, and click Next. This will begin the installation.

### Installing Hyper-V and creating VMs

1. Use Server Manager to add the Hyper-V role to the server and reboot when prompted.
2. Open Hyper-V Manager.
3. To create a virtual switch, click New → Virtual Switch Manager.
  - a. Select External, Internal, or Private, and click Create Virtual Switch. For our management network, we selected External.
  - b. Provide a name for the virtual switch. Choose a host network adapter from the drop-down list. Check the Allow management operating system to share this network adapter checkbox and enable SR-IOV if appropriate.
  - c. Provide a VLAN ID if appropriate, and click Apply.
4. To create a new VM, open Hyper-V Manager, and click New → Virtual Machine.
  - a. At the Before You Begin screen, click Next.
  - b. Provide a name for the VM, and click Next. You may also choose a location to store the VM configuration data.
  - c. Choose Generation 1 or Generation 2. Generation 2 is recommended for guest operating systems of Microsoft Windows Server 2012 or 64-bit Windows 8 or later. We chose Generation 2 for this guide. Click Next.

- d. Enter an amount of memory for the VM, and click Next.
      - e. Provide a virtual switch connection (or add one later), and click Next.
      - f. Choose to create a virtual hard disk or attach an existing disk, and click Next. For this guide, we created a new virtual hard disk and placed it on the Dell PowerEdge R920 local disk drives.
      - g. Select a method for installing the operating system, and click Next. For this guide, we chose to install an operating system later.
      - h. Review the summary information, and click Finish.
5. Right-click the newly created VM, and click Settings.
6. Provide the necessary virtual switch connections and hard disks. To add a virtual switch connection:
  - a. Click Add Hardware.
  - b. Select Network Adapter, and click Add.
  - c. Choose a virtual switch from the drop-down menu and provide any VLAN or bandwidth management settings. Click Apply.
7. To add a hard disk:
  - a. Click Add Hardware.
  - b. Select SCSI Controller, and click Add.
  - c. Select Hard Drive, and click Add.
  - d. Enter the hard disk details. For this guide, we created three VHDs: 50GB for the guest OS, 30GB for SQL data directories, and 30GB for SQL log directories.
8. Select DVD Drive and provide a path to the installation media. Click OK.
9. Power on the VM.
10. Follow the steps in the Installing Windows Server 2012 R2 section above to install the guest OS onto the VM. Configure the guest OS with the settings, roles and features necessary to your environment. Settings, roles and features required for Microsoft SQL Server 2014 will be discussed in the following section.

### Installing Microsoft SQL Server 2014

1. Using Server Manager, add the .NET Framework 3.5 feature and reboot if necessary.
2. Attach the Microsoft SQL Server 2014 installation media to the VM.
3. In the guest operating system, run SETUP.EXE.
4. Select Installation, and click New SQL Server stand-alone installation or add features to an existing installation.
5. Enter your product key, and click Next.
6. Check the I accept the license terms checkbox, optionally check the Customer Experience Improvement Program and Error Reporting checkbox, and click Next.
7. Allow the Global Rules check to complete. If there are no errors, check the Use Microsoft Update to check for updates (recommended) checkbox, and click Next.

8. After the Product Updates, Install Setup Files and Install Rules processes complete, select the SQL Server Feature Installation radio button, and click Next.
9. At the Feature Selection screen, select the features required by your organization. For this guide, we selected Database Engine Services, Full-Text and Semantic Extractions for Search, Client Tools Connectivity, Client Tool Backwards Compatibility, Management Tools – Basic, and Management Tools – Complete. Specify a directory (we kept the defaults), and click Next.
10. Choose Default instance or Named instance depending on the needs of your organization. For this guide, we chose Default instance. Click Next.
11. On the Server Configuration screen, choose the accounts to be used for each SQL Server component. For this guide, we left the default accounts. Click Next.
12. On the Database Engine Configuration screen, there are three tabs that must be addressed:
  - a. On the Server Configuration tab, select Windows Authentication mode or Mixed Mode. Add any necessary users and provide a password for the sa account if using Mixed Mode. For this guide, we selected Mixed Mode and added the current user (Windows Local Administrator).
  - b. On the Data Directories tab, enter the directories for SQL data and Logs. For this guide, we used the 30GB data and log VHDs (E and F).
  - c. On the FILESTREAM tab, enable FILESTREAM if appropriate for your organization. For this guide, we left FILESTREAM disabled.
13. Click Next.
14. At the Ready to Install screen, review the summary info, and click Install.
15. After the installation completes, click Close.

## APPENDIX D – BACKING UP AND RESTORING THE DATABASE

### Moving the SQL Server 2008 R2 database

#### Performing the backup

1. Using SQL Server Management Studio, connect to your SQL Server 2008 R2 instance.
2. Right-click the database, and click Properties.
3. In the left pane, select Options.
4. Either set the database to read-only mode or set the access property to SINGLE\_USER. Both choices immediately sever all user connections.
5. Click OK.
6. Right-click the database, and click Tasks→Backup.
7. Provide the necessary options for the backup. For this guide, we chose a Full backup type and backed up the database to a file on local storage. We left the default Media and Backup Options.

#### Restoring the database to the SQL Server 2014 VM

1. Open the VM console, and log into the VM.
2. Using SQL Server Management Studio, connect to your SQL Server 2014 instance.
3. Right-click Databases, and click Restore Database.
4. If restoring from a file, select the radio button for Device and browse to the backup file. Change the new file locations if necessary and provide any further options. Click OK to begin the restore process.
5. Right-click the newly-restored database, and click Properties.
6. In the left pane, select Options.
7. Set the database name to be the same as the legacy database (by default it will have the same name). Change the SQL Server compatibility level to 2014 (level 120). Change the database to read-write and/or set the access level to MULTI\_USER.
8. Click OK.
9. Modify application connection strings or change Domain Name System (DNS) pointers that reference the migrated database.

## APPENDIX E – POST-INSTALLATION TASKS

1. Log into the VM.
2. In SQL Server Management Studio, in the Object Explorer pane, connect to both your SQL Server 2008 R2 server and your SQL Server 2014 virtual server. Be sure to have the Object Explorer Details tab open (View→Object Explorer Details).
3. Expand the tree view of the SQL Server 2008 R2 server, browse to the Security tab,, and click the Logins node.
4. Select the logins you wish to migrate.
5. Right-click the logins you selected, and choose Script Login As→Create To→New Query Window.
6. Right-click the query window, and click Connection→Change Connection.
7. Choose to connect to your SQL Server 2014 instance.
8. Execute the script on your SQL Server 2014 virtual server to create the logins. If you are transferring Windows-based logins, the process is complete. If you are transferring SQL Server logins, continue with Step 7.
9. For SQL Server logins, the script you executed in Step 6 creates the login, marks it as disabled, and assigns it a random password, but the script does not map the login to the database user. To avoid having a database user that is “orphaned” from a login, use the `sp_change_users_login` stored procedure, to view orphaned users and to map a user to a login.
10. In the left pane, expand SQL Server Agent.
11. Locate the jobs you need to migrate in SQL Server Management Studio (on your SQL Server 2008 R2 server) and choose Script Job As→Create To→New Query Window
12. Connect to the SQL Server 2014 virtual server, and run the resulting script in a query window. Verify the job was created successfully in SQL Server Management Studio.

## APPENDIX F – COST CALCULATIONS

Figure 22 presents the costs we estimate for the Dell PowerEdge R920 regardless of VM count. Costs are for 2-year Software Assurance only. Each Windows server license covers two processors, so we need two licenses for the four processors on the server. Each SQL Server license covers two cores so we need 30 licenses for the 60 cores on the server.

	Unit costs	Number units	Total
Microsoft Windows Server 2012 Datacenter Edition (Software Assurance, 2 processor pack)	\$3,078	2	\$6,156
Microsoft SQL Server 2014 Enterprise (Software Assurance, 2 core pack)	\$6,737	30	\$202,110
Total			\$208,266

**Figure 22: Software costs for Dell PowerEdge R920.**

Licenses are Microsoft Open licenses with no pricing level for corporate customers. Source for the prices is [mla.microsoft.com/default.aspx](http://mla.microsoft.com/default.aspx)

For information on SQL Server 2014 licensing see: [download.microsoft.com/download/6/6/F/66FF3259-1466-4BBA-A505-2E3DA5B2B1FA/SQL\\_Server\\_2014\\_Licensing\\_Datasheet.pdf](http://download.microsoft.com/download/6/6/F/66FF3259-1466-4BBA-A505-2E3DA5B2B1FA/SQL_Server_2014_Licensing_Datasheet.pdf)

With the release of Microsoft SQL Server 2012, Microsoft shifted from processor-based licensing to core-based licensing. As a result we calculate software costs on a processor basis for the SQL Server 2008 R2 servers and on a core basis for the Dell PowerEdge R920 with Microsoft SQL Server 2014.

With Microsoft SQL Server 2014, Microsoft reduced the number of editions, cutting out the Datacenter edition that was available for Microsoft SQL Server 2008. As a result, we migrate both the Enterprise and Datacenter Editions of SQL Server 2008 R2 to the SQL Server 2014 Enterprise Edition.

Technically the migration would be from SQL Server 2012 because the 2008 user would have updated software assurance since the release of the 2012 version and would now be licensed for it and be running the 2008 software through downgrade rights.

[https://www.directionsonmicrosoft.com/sites/default/files/PDFs/Licensing\\_Changes\\_for\\_SQL\\_Server\\_2014.pdf](https://www.directionsonmicrosoft.com/sites/default/files/PDFs/Licensing_Changes_for_SQL_Server_2014.pdf)

We assume the same exchange rate that Microsoft offered for SQL Server 2012 still holds; that was SQL Server 2012 Enterprise Edition licenses for four cores in exchange for one SQL Server 2008 R2 Enterprise Edition license for one processor and for eight cores in exchange for one SQL Server 2008 R2 Datacenter Edition. That works out to the 60-core Dell PowerEdge R920 server needing to transfer SQL Server 2008 R2 Enterprise Edition licenses from 8 two-processor legacy servers with licenses for each legacy server covering 8 cores on the Dell PowerEdge R920. We therefore start our savings calculations at an 8:1 server consolidation ratio.

## ABOUT PRINCIPLED TECHNOLOGIES



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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.

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