



Dell manual server installation time

Executive summary

Dell Inc. (Dell) commissioned Principled Technologies (PT) to study the manual setup time of preparing a server and installing on it Microsoft Windows Server 2003 R2 Enterprise x64 Edition SP2 and a set of common server applications.

We timed the preparation of the server and the installation of Windows Server 2003 as well as the following applications:

- File and print services
- Microsoft Exchange Server 2007 SP1
- Microsoft Internet Information Server (IIS) 6
- Microsoft SQL Server 2008 x64

We used the Dell PowerEdge 2950 for both our active directory server (ADS) and our server under test (SUT). We provide more detailed configuration information in Appendix A.

We measured the total time cost from the moment we began downloading drivers and BIOS updates to load on the SUT to the moment it became an active server. We did not measure the time we spent unpacking or physically connecting the SUT to the ADS. We distinguish between two types of elapsed time: that of elapsed staff time and that of elapsed total time. Elapsed staff time measures how long PT staff spent actually inputting information, configuring settings, etc., while elapsed total time measures the total elapsed time, which includes staff, server, and application times. We make this distinction to illustrate how much dedicated time a user can expect to spend during this manual setup and how much “hands-off” time he or she will have while the server performs the setup tasks.

The base server installation (preparing the server and installing Windows Server 2003) consisted of the following stages: downloading the most recent BIOS, downloading drivers, installing the most recent BIOS, installing the drivers, installing Windows Server 2003 x64, and installing Windows updates through 3/16/09. The file and print services, Internet Information Server (IIS), SQL Server, and Microsoft Exchange application setups consisted of an installation stage and a Windows update stage. We provide more detailed application information in our Test applications section.

Manual server installation times on the Dell PowerEdge 2950		
	Elapsed total time hour:min:sec	Elapsed staff time hour:min:sec
Windows Server 2003 R2 Enterprise x64 Edition SP2	01:11:18	00:19:31
File and print services	01:36:24	00:20:59
Microsoft Exchange Server 2007 SP1	02:48:49	00:26:40
Microsoft Internet Information Server (IIS) 6	01:16:56	00:20:43
Microsoft SQL Server 2008 x64	01:45:00	00:25:52

Figure 1: Median total times for the manual setup of servers Microsoft Windows Server 2003 and common applications. The times in the last four rows include the installation of Microsoft Windows Server 2003 as well as the application.

KEY FINDINGS

- Preparing the server and installing Microsoft Windows Server 2003 R2 Enterprise x64 Edition SP2 took a skilled technician 1 hour and 11 minutes.
- Installing file and print services took the same technician an additional 25 minutes beyond the time for preparing the server and installing Windows Server 2003.
- Installing Exchange Server took an additional 1 hour and 37 minutes.
- Installing Internet Information Server took an additional 5 minutes.
- Installing SQL Server took an additional 33 minutes.

Figure 1 displays the median total times in hours, minutes, and seconds for each application in the three manual server installation tests we performed. Each application installation also includes the installation of Windows Server 2003. We provide times for the individual stages of each installation test in the Test results section.

The base server install took our PT staff 00:19:31, while the elapsed total time was 01:11:18. The file and print services install took our PT staff an additional 00:01:28, while the elapsed total time was an additional 00:25:06. The Microsoft Exchange 2007 install took our PT staff an additional 00:07:09, while the elapsed total time was an additional 01:37:31. The Microsoft Internet Information Server install took our PT staff an additional 00:01:12 while the elapsed total time was an additional 00:05:38. The Microsoft SQL Server install took our PT staff an additional 00:06:21, while the elapsed total time was an additional 00:33:42. We present detailed setup information for these applications in our Test methodology section.

Test applications

We tested the install time of four common server applications: file and print services, Microsoft Exchange Server 2007 SP1, Microsoft Internet Information Server (IIS) 6, and Microsoft SQL Server 2008 x64.

File and print services enable users to securely store and transfer information across servers, enabling the safe sharing of data throughout the network. File services help ensure data synchronization, data encryption, and data backups. They also provide disk management capabilities, increased CHKDSK performance and enhanced disk defragmentation, fast content indexing, automated system recovery, remote document sharing, and anti-virus support. Print services make printing more reliable, manageable, and available. They also offer support for a wide range of devices, such as USB 2.0 and high-end color printers.

Microsoft Exchange Server 2007 SP1 is the latest version of Microsoft's client/server enterprise mail solution, and provides server users with email, calendar, and messaging capabilities. Exchange Server 2007 offers several improvements over its predecessor, Exchange Server 2003, such as enhanced data storage, disaster recovery features, 64-bit support, more robust anti-virus and anti-spam protection, and increased storage groups and mail databases per server.

IIS, which Microsoft includes in Windows Server 2003 x64, is a Web platform that allows organizations to develop and host Web applications and services. IIS allows for more centralized management of Web content and servers, greater ASP.NET, PHP, and media support, increased reliability of data transfer and server stability, and improved server and Web site security.

Microsoft SQL Server 2008 x64 is a database platform that allows organizations to manage their data in many formats, both structured and unstructured. More robust search capabilities and media-type awareness allow SQL Server 2008 to efficiently store and search for multiple types of files: digital audio and video, email, XML, etc. Microsoft includes high-availability features such as database mirroring and clustering to improve uptime potential. Various features are included with SQL Server 2008, but we focus on the core database engine installation. There are several versions of SQL Server 2008, each aimed at different users. We used SQL Server Enterprise Edition.

Test results

Figures 2 through 6 display our elapsed total and elapsed staff times in hours, minutes, and seconds for the manual installation of each of the applications and their individual stages. Figure 2 displays the elapsed total and elapsed staff times for the Windows Server 2003 base server install.

Windows Server 2003 base server install	Elapsed total time	Elapsed staff time
<i>Download BIOS</i>		
Locate drivers and BIOS, start first download	00:01:28	00:01:27
<i>Download drivers from www.Dell.com</i>		
Start network driver download	00:00:25	00:00:20
Start RAID driver download	00:00:30	00:00:29
Start Backplane driver download	00:00:17	00:00:16
Start video driver download	00:02:12	00:00:12
<i>Install BIOS and firmware</i>		
Extract the BIOS update package	00:00:45	00:00:18

Windows Server 2003 base server install	Elapsed total time	Elapsed staff time
Boot to floppy drive	00:04:18	00:01:58
Flash BIOS and restart	00:03:02	00:00:05
Configure RAID	00:02:05	00:01:58
<i>Install Windows Server 2003</i>		
Extract RAID driver and begin floppy format	00:01:02	00:00:54
Copy driver onto floppy drive	00:00:27	00:00:14
Specify driver in OS install	00:04:38	00:03:12
Format hard drive and begin install	00:09:30	00:00:15
Fill in OS information	00:11:12	00:00:51
Finalize R2 installation	00:01:09	00:00:37
<i>Install drivers and patches</i>		
Copy files and start NIC driver install	00:03:08	00:03:03
Continue NIC install	00:01:15	00:00:10
Locate and start Backplane install	00:00:45	00:00:45
Locate and start video driver install, then reboot	00:02:28	00:00:28
<i>Install Windows Update through 3/16/09</i>		
Go to windowsupdate.microsoft.com	00:00:34	00:00:28
Install Windows Update	00:00:39	00:00:08
Let Windows Update browse for updates (express option)	00:00:34	00:00:01
Download and start installing IE7 update and reboot	00:07:42	00:00:40
Go to windowsupdate.microsoft.com	00:00:44	00:00:40
Let windows update browse for updates	00:00:10	00:00:01
Start installing updates and reboot	00:10:19	00:00:01
Totals	01:11:18	00:19:31

Figure 2: Elapsed total and elapsed staff times for the server preparation and the Windows Server 2003 base server install.

Figure 3 displays the elapsed total and elapsed staff times for the IIS install.

IIS install	Elapsed total time	Elapsed staff time
Begin IIS Install	00:00:41	00:00:37
Insert Windows Server 2003 R2 SP2 x64 CD	00:00:59	00:00:12
Go to windowsupdate.microsoft.com	00:00:25	00:00:21
Let windows update browse for updates	00:00:12	00:00:01
Start installing updates and reboot	00:03:21	00:00:01
Totals	00:05:38	00:01:12

Figure 3: Elapsed total and elapsed staff times for the IIS install.

Figure 4 displays the elapsed total and elapsed staff times for the file and print install.

File and print install	Elapsed total time	Elapsed staff time
Install file server & restart server	00:09:08	00:00:39
Install print server	00:00:51	00:00:35
Go to windowsupdate.microsoft.com	00:00:13	00:00:12
Let Windows Update browse for updates	00:00:11	00:00:01
Start installing updates and reboot	00:14:43	00:00:01
Totals	00:25:06	00:01:28

Figure 4: Elapsed total and elapsed staff times for the file and print install.

Figure 5 displays the elapsed total and elapsed staff times for the SQL Server install.

SQL Server install	Elapsed total time	Elapsed staff time
Install .NET framework	00:05:42	00:00:57
Install hotfix, then reboot	00:02:55	00:00:24
Install SQL Server 2008	00:17:30	00:04:46
Go to windowsupdate.microsoft.com	00:00:15	00:00:12
Let Windows Update browse for updates	00:00:17	00:00:01
Start installing updates and reboot	00:07:03	00:00:01
Totals	00:33:42	00:06:21

Figure 5: Elapsed total and elapsed staff times for the SQL Server install.

Figure 6 displays the elapsed total and elapsed staff times for the Exchange install.

Exchange install	Elapsed total time	Elapsed staff time
Copy Exchange SP1, .NET 2.0 framework, and Windows PowerShell onto flash drive	00:02:12	00:00:25
Copy Exchange SP1, .NET 2.0 framework, and Windows PowerShell onto server	00:01:13	00:00:29
Extract Exchange SP1 files	00:00:44	00:00:13
Perform .Net 2.0 installation	00:05:31	00:00:09
Install Windows PowerShell	00:00:19	00:00:07
Set IP information, join domain, and restart	00:04:03	00:01:39
Install necessary IIS prerequisites	00:02:03	00:01:08
Go to windowsupdate.microsoft.com	00:00:32	00:00:24
Let Windows Update browse for updates	00:00:20	00:00:01
Start installing updates and reboot	00:16:03	00:00:01
Start Exchange installation	00:01:50	00:01:30
Complete Exchange install and reboot	00:38:30	00:00:01
Start Exchange SP1 Install	00:01:07	00:00:38
Complete Exchange SP1 Install	00:19:14	00:00:01
Go to windowsupdate.microsoft.com	00:00:23	00:00:21
Let Windows Update browse for updates	00:00:11	00:00:01
Start installing updates and reboot	00:03:16	00:00:01
Totals	01:37:31	00:07:09

Figure 6: Elapsed total and elapsed staff times for the Exchange install.

Test environment

Figure 7 displays our server test bed environment.

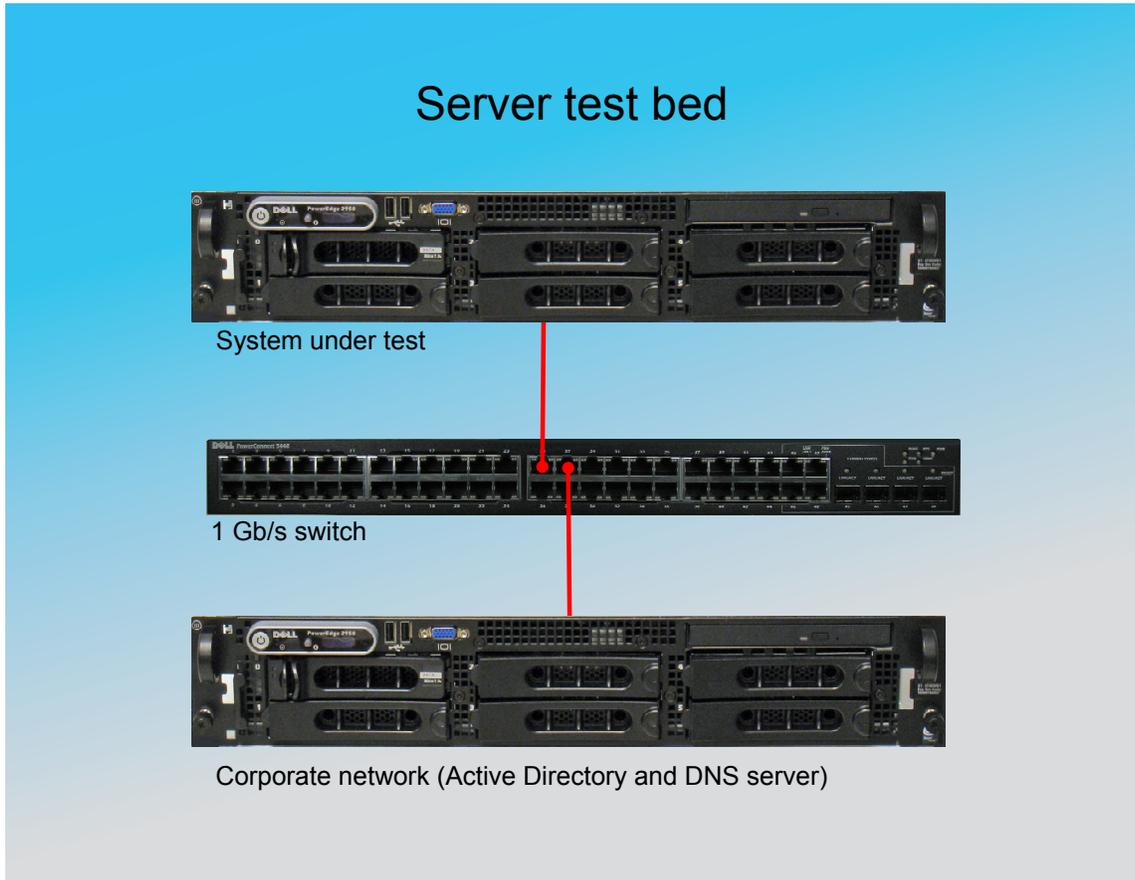


Figure 7: Server test bed configuration.

Each test bed included the following components:

- Two Dell PowerEdge 2950 servers. We attached each server to the switch via their respective on-board NICs and Cat5e cables
- One Dell PowerConnect 5448 switch

Test methodology

Our goal was to measure both elapsed total time and elapsed staff time when manually configuring a server for the test applications. We began by downloading BIOS updates, firmware, and drivers from www.dell.com. We then configured the server with Windows Server 2003 R2 Enterprise x64 Edition SP2, installed drivers, and installed high-priority updates. This process is what we refer to as our base server install.

Following the base server install, we tested four application areas separately: IIS, file and print services, Microsoft SQL Server 2008, and Microsoft Exchange 2007. We installed and configured each application on clean images of Windows Server 2003. Between tests, we reimaged the server back to its base level with Windows Server 2003 and updates installed.

Base server install

Downloading the BIOS update

1. Locate downloads and BIOS, begin BIOS download:

- a. Start timing elapsed staff and elapsed total time.
- b. Click Start→Internet Explorer.
- c. Type www.dell.com in the address bar, and press Enter.
- d. When the website finishes loading, scroll to the bottom, and click Drivers & Downloads.
- e. Click Select Model.
- f. Click Servers, Storage, Networking.
- g. Click PowerEdge Server.
- h. Click 2950.
- i. Click Confirm.
- j. Switch the Operating System to Windows Server 2003 x64 by selecting Windows Server 2003 x64 in the Operating System drop-down list.
- k. Expand the BIOS category by clicking the plus mark beside the label BIOS.
- l. Click Download Now.
- m. Click Save.
- n. At the Save As screen, click Save, and stop elapsed staff time. When the download completes, stop elapsed total time.

Downloading drivers from www.dell.com

1. Start the network driver download:
 - a. Start timing elapsed staff and elapsed total time.
 - b. On the Dell PowerEdge 2950 driver website, click the plus mark beside the label Network.
 - c. Locate the latest Broadcom NetXtreme II driver, and click Download Now for that driver.
 - d. Click Save.
 - e. At the Save As screen, click Save, and stop elapsed staff time.
 - f. When the download completes, stop elapsed total time.
2. Start the storage controller driver download:
 - a. After that download has finished, start elapsed staff time and elapsed total time, and click the plus mark beside the label SAS RAID Controller.
 - b. Locate the latest Dell SAS 6 driver, and click Download Now for that driver.
 - c. Click Save.
 - d. At the Save As screen, click Save, and stop elapsed staff time.
 - e. When the download completes, stop elapsed total time.
3. Start the Backplane driver download:
 - a. After that download has finished, start elapsed staff time and elapsed total time, and click the plus mark beside the label SCSI non-RAID Controllers.
 - b. Locate the latest Dell Backplane driver, and click Download Now for that driver.
 - c. Click Save.
 - d. At the Save As screen, click Save, and stop elapsed staff time.
 - e. When the download completes, stop elapsed total time.
4. Start the video driver download:
 - a. After that download has finished, start elapsed staff time and elapsed total time, and click the plus mark beside the label Video.
 - b. Locate the latest Dell video driver, and click Download Now for that driver.
 - c. Click Save.
 - d. At the Save As screen, click Save, and stop elapsed staff time.
 - e. When the download completes, stop elapsed total time.

Installing the BIOS update package

1. Extract the BIOS update package:

- a. Start elapsed staff and elapsed total time.
 - b. Insert a USB floppy drive into the workstation where the BIOS was downloaded.
 - c. Click Start->Computer
 - d. Browse to the location of the BIOS update file.
 - e. Double-click the BIOS exe file.
 - f. Click Run at the Security Warning.
 - g. Insert a floppy disk into the USB floppy drive.
 - h. Click Continue. Stop staff time.
 - i. When the extraction completes, click Finish and stop elapsed total time.
2. Boot to floppy drive:
 - a. Start staff time and elapsed total time.
 - b. Insert the USB floppy drive with the BIOS floppy disk into the server.
 - c. Power on the server. Press F11 to go to the boot menu.
 - d. Choose the USB floppy drive for the boot device. Stop staff time.
 - e. When the Flash BIOS update program finishes loading, stop elapsed total time.
 3. Boot to floppy drive:
 - a. When you reach the Flash BIOS update program screen, press any key to continue. Start elapsed staff time and elapsed total time.
 - b. Press Y to replace BIOS contents and if prompted, press C to confirm. In our case, we overwrote the BIOS with the same update. Stop staff time.
 - c. Press any key to restart. After restart completes, stop elapsed total time.

Configuring the RAID

1. Press the power button on the server, and start elapsed staff and elapsed total time.
2. Press Ctrl+C to enter the RAID BIOS.
3. When the RAID BIOS screen appears, press Enter.
4. Select Raid Properties, and press Enter.
5. Select Create IM Volume, and press Enter.
6. Move the selection box over to the RAID Disk column, and press Plus for both drives, then press C.
7. Select Save changes, exit this menu, and press Enter.
8. At the warning menu, press F3, and stop elapsed staff time.
9. When the RAID finishes building, stop elapsed total time.

Installing Windows Server 2003

1. Extract the storage controller driver and begin floppy format:
 - a. Start elapsed staff and elapsed total time.
 - b. Select Start→My Computer.
 - c. Change the directory to the location of the Dell RAID driver.
 - d. Double-click the RAID driver EXE.
 - e. At the Security Warning screen, click Run.
 - f. At the Install screen, click Continue.
 - g. Leave the default unzip folder, and click OK.
 - h. After the unzip finishes, click OK.
 - i. Connect a USB floppy drive to your computer.
 - j. Place a floppy in the floppy drive.
 - k. Select Start→My Computer.
 - l. Right-click the floppy drive, and select Format.
 - m. When the format menu appears, click the Quick Format check box, click OK, and stop elapsed staff time.

- n. When the quick format completes, stop elapsed total time.
2. Copy the driver onto the floppy drive:
 - a. When the format finishes, start elapsed staff time and elapsed total time, and close the format menu.
 - b. Select Start→My Computer.
 - c. Double-click the floppy drive.
 - d. Copy the RAID driver files from the default unzip location to the floppy drive, and stop elapsed staff time.
 - e. When the copy completes, stop elapsed total time.
3. Specify the driver in the OS Install:
 - a. When the files finish copying, start elapsed staff time and elapsed total time, and connect the USB floppy drive to the server.
 - b. Press the power button on the server.
 - c. Place the Windows Server 2003 R2 SP2 x64 CD in the CD drive.
 - d. When the server boots into the Windows Installation, press F6.
 - e. At the first Windows setup screen, press S to specify an additional storage driver.
 - f. At the SCSI Adapter Selection Screen, press Enter.
 - g. Press Enter to continue, and stop elapsed staff time.
 - h. When the file loading completes, stop elapsed total time.
4. Format the hard drive and begin installation:
 - a. At the Welcome to Setup screen, start elapsed staff time and elapsed total time, and press Enter.
 - b. At the Windows License Agreement screen, press F8.
 - c. At the Partitioning screen, press C to create a partition.
 - d. Press Enter to confirm partition creation.
 - e. At the Partitioning screen, press Enter to install.
 - f. Select Format the partition using the NTFS file system (Quick), press Enter, and stop elapsed staff time.
 - g. When the initial part of the installation completes, stop elapsed total time.
5. Fill in the OS information:
 - a. At the Regional and Language Options screen, start elapsed staff time and elapsed total time, and click Next.
 - b. At the Personalize Your Software screen, type `user` as the name and `PT` as the organization, and click Next.
 - c. At the Your Product Key screen, fill in your product key, and click Next.
 - d. At the Licensing Modes screen, click Next.
 - e. At the Computer Name and Administrator Password screen, type `server` as the computer name and `password` in the Administrator Password and Confirm password fields, and click Next.
 - f. When the installer prompts you about the safety of your password, click Yes.
 - g. At the Date and Time Settings screen, set the correct date and time, click Next, and stop elapsed staff time.
 - h. After the installation completes, when the server reboots and returns to the login screen, stop elapsed total time.
6. Finalize the R2 installation:
 - a. When the server reaches the login screen, start elapsed staff time and elapsed total time, and press Ctrl+Alt+Delete.
 - b. Enter the administrator name and password, and press Enter.

- c. Put the Windows Server 2003 R2 SP2 x64 disk 2 into the CD drive, and click OK at the Windows Setup screen.
- d. At the Welcome to the Windows Server 2003 R2 Setup Wizard screen, click Next.
- e. At the End Term License Agreement screen, select I accept the terms in this license agreement, and click Next.
- f. At the Setup Summary screen, click Next, and stop elapsed staff time.
- g. After completing the install, click Finish, and stop elapsed total time.

Installing drivers

1. Copy the files and start the NIC driver install:
 - a. Start timing elapsed staff and elapsed total time.
 - b. Copy all of the drivers onto a flash drive.
 - c. Connect the flash drive to the server, and copy the drivers to the server's desktop.
 - d. Double-click Bcom_LAN_12.4_W2K3_8_64_A03.EXE.
 - e. At the Security Warning screen, click Run.
 - f. When the Windows Self-Extractor prompts you to do so, click Unzip.
 - g. At the successful extraction screen, click OK.
 - h. Click Close.
 - i. Select Start→My Computer.
 - j. In My Computer, type
C:\Broadcom\W2K3_W2k8_64\Driver_Management_Apps_Installer in the address bar, and press Enter.
 - k. Double-click setup.EXE, and stop elapsed staff time.
 - l. When the installation completes, stop elapsed total time.
2. Continue NIC install:
 - a. At the Welcome screen, start elapsed staff time and elapsed total time, and click Next.
 - b. At the License agreement screen, select I accept the terms in the license agreement, and click Next.
 - c. At the Custom Setup screen, click Next.
 - d. At the Ready to Install the Program screen, click Install.
 - e. At the first warning screen, click OK.
 - f. At the second warning screen, click OK, and stop elapsed staff time.
 - g. When complete, press Finish, and stop elapsed total time.
3. Locate and start Backplane driver install:
 - a. Start elapsed staff time and elapsed total time.
 - b. On the Desktop, double-click DellBPA04.EXE.
 - c. At the Security Warning screen, click Run.
 - d. When the Windows Self-Extractor prompts you to do, type C:\Dell\backplannedriver in the Unzip To Folder: field, and click Unzip.
 - e. At the successful extraction screen, click OK.
 - f. Click Close.
 - g. Select Start, and right-click My Computer.
 - h. Select Manage.
 - i. Click Device Manager.
 - j. Click the plus beside Other devices.
 - k. Right-click DP BACKPLANE SCSI Enclosure Device, and select Update Driver...
 - l. At the Welcome screen, select No, not this time, and click Next.
 - m. Select Install from a list or specific location (Advanced), and click Next.

- n. Check the Include this location in the search check box, and uncheck the Search removable media check box.
 - o. Type `C:\Dell\backplannedriver` in the text field beneath Include this location in the search, and click Next.
 - p. Stop elapsed staff time and click Finish.
 - q. When the installation completes, stop elapsed total time.
4. Locate and start the video driver install, then reboot:
- a. Start elapsed staff time and elapsed total time.
 - b. On the Desktop, double-click `ATI_ATI-RN50-Video-Controllor_A02_R144864.EXE`.
 - c. At the Security Warning screen, click Run.
 - d. At the install screen, click Continue.
 - e. Accept the default extracting location, and click OK.
 - f. When the installer prompts you about that location not existing, click Yes.
 - g. When the unzip finishes, click OK.
 - h. When the Video Driver screen appears, click Next.
 - i. At the Welcome screen, click Next.
 - j. At the License Agreement screen, click Yes.
 - k. When the installer prompts you to restart, click Finish, and stop elapsed staff time.
 - l. When the server returns to the login screen, stop elapsed total time.

Installing Windows updates through 3/16/09

1. Go to Windows Update.microsoft.com:
 - a. Start elapsed staff and elapsed total time.
 - b. Select Start→Program Files→Internet Explorer.
 - c. Type `Windows Update.microsoft.com` in the address bar, press Enter, and stop elapsed staff time.
 - d. When the page fully loads, stop elapsed total time.
2. Install Windows update:
 - a. When Windows Update prompts you to do so, start elapsed staff time and elapsed total time, and click Install.
 - b. Click Install Now, and stop staff time.
 - c. When the installation completes and the page reloads, stop elapsed total time.
3. Let windows update browse for updates (express option):
 - a. Start elapsed staff time and elapsed total time, click Express, and stop staff time.
 - b. When the updates appear after the page reloads, stop elapsed total time.
4. Download and start installing IE7 updates and reboot:
 - a. When the installer warns you about trusted sites, start elapsed staff time and elapsed total time, and click Yes.
 - b. Click Install Updates.
 - c. When installing the IE7 update, start staff time, and click Install.
 - d. At the license agreement screen, click I accept.
 - e. Leave defaults on the Malicious Software screen, and click Next.
 - f. Click Restart Now, and stop elapsed staff time.
 - g. Wait until Windows reaches the login screen, and stop elapsed total time.
5. Go to Windows Update.microsoft.com:
 - a. Start elapsed staff time and elapsed total time, press Ctrl+Alt+Delete, enter the Administrator name and password, and press Enter.
 - b. Click Start→Program Files→Internet Explorer.

- c. Type `Windows Update.microsoft.com` in the address bar, press Enter, and stop elapsed staff time.
 - d. When the page fully loads, stop elapsed total time.
6. Let Windows Update browse for updates:
 - a. Start elapsed staff time and elapsed total time, click Express, and stop elapsed staff time.
 - b. When the updates appear after the page reloads, stop elapsed total time.
7. Start installing updates, and reboot:
 - a. Start elapsed staff time and elapsed total time
 - b. Click Install Updates, and stop elapsed staff time.
 - c. When the updates finish downloading and installing, the installation prompts you to reboot. Reboot the machine.
 - d. When the machine returns to the Ctrl+Alt+Delete screen, stop elapsed total time.
8. Repeat steps 5-7 until there are no more high priority updates to install.

IIS install

Installing Internet Information Services 6.0

1. Begin IIS install:
 - a. Start elapsed total and elapsed staff times, select Start→Control Panel→Add or Remove Programs.
 - b. Click Add/Remove Windows Components.
 - c. Select Application Servers, and click Details.
 - d. Click the Internet Information Services (IIS) check box, and click Details.
 - e. Click NNTP Services and SMTP Services, make sure a check appears in both check boxes, and click OK.
 - f. Click OK to close the Application Server window.
 - g. At the Windows Components Wizard, click Next to begin the installation, and stop elapsed staff time.
2. Insert CD:
 - a. When the system prompts you to insert the OS CD, start elapsed staff time and elapsed total time, insert the OS CD, click OK, and stop elapsed staff time.
 - b. At the Completing the Windows Components Wizard window, click Finish.
 - c. Close the Add or Remove Programs window.
 - d. When the installation completes, stop elapsed total time.
3. Go to Windows Update.microsoft.com:
 - a. Start elapsed staff time, and click Start→Program Files→Internet Explorer.
 - b. Type `http://windowsupdate.microsoft.com` in the address bar, press Enter, and stop elapsed staff time.
 - c. When the page fully loads, stop elapsed total time.
4. Let Windows Update browse for updates:
 - a. Start elapsed staff time, click Express, and stop elapsed staff time.
 - b. When the updates appear after the page reloads, stop elapsed total time.
5. Start installing updates and reboot:
 - a. Start elapsed staff time.
 - b. Click Install Updates, and stop elapsed staff time.
 - c. When the updates finish downloading and installing, the installation prompts you to reboot. Reboot the machine.
 - d. When the machine returns to the Ctrl+Alt+Delete screen, stop elapsed total time.

File and print services install

Installing the file server and restarting the server

1. Start timing elapsed total time and staff time:
 - a. Log into the server by pressing Ctrl+Alt+Delete.
 - b. Select Start→Administrative Tools→Configure Your Server Wizard.
 - c. At the Welcome to the Configure Your Server Wizard screen, click Next.
 - d. At the Preliminary Steps screen, click Next.

- e. At the Select Server Roles screen, select File Server, and click Next.
 - f. At Summary of Selections screen, click Next.
 - g. At the Welcome to the Add File Server Role Wizard screen, click Next.
 - h. At the File Server Environment screen, click Next.
 - i. When the installer prompts you to do so, insert CD 1.
 - j. When the installer asks if you would like to restart your computer now, click Yes, and stop staff time.
 - k. When the server returns to the login screen, stop elapsed total time.
2. Install the print server:
 - a. At the Windows login screen, start staff timing and elapsed total time, press Ctrl+Alt+Delete, enter the administrator name and password, and press Enter.
 - b. If the This Server Is Now a File Server screen appears, click Finish.
 - c. Select Start→Administrative Tools→Configure Your Server Wizard.
 - d. At the Welcome to the Configure Your Server Wizard screen, click Next.
 - e. At the Preliminary Steps screen, click Next.
 - f. At the Select Server Roles screen, select Print Server, and click Next.
 - g. At Summary of Selections screen, click Next.
 - h. At the This Server Is Now a Print Server screen, click Finish, and stop staff time and elapsed total time.
3. Go to <http://windowsupdate.microsoft.com/>:
 - a. Start elapsed staff time, and click Start→Program Files→Internet Explorer.
 - b. Type `http://windowsupdate.microsoft.com` in the address bar, press Enter, and stop elapsed staff time.
 - c. When the page fully loads, stop elapsed total time.
4. Let Windows Update browse for updates:
 - a. Start elapsed staff time, click Express, and stop elapsed staff time.
 - b. When the updates appear after the page reloads, stop elapsed total time.
5. Start installing updates and reboot:
 - a. Start elapsed staff time and elapsed total time.
 - b. Click Install Updates, and stop elapsed staff time.
 - c. When the updates finish downloading and installing, the installation prompts you to reboot. Reboot the machine.
 - d. When the machine returns to the Ctrl+Alt+Delete screen, stop elapsed total time.

SQL Server install

Installing SQL Server 2008

1. Install .NET framework:
 - a. Start elapsed total time and elapsed staff time. Press Ctrl+Alt+Delete, and log into Windows.
 - b. Insert the DVD into the DVD drive.
 - c. If the DVD does not auto play, then double-click the DVD drive in Windows Explorer.
 - d. When the application prompts you to install the .NET Framework, click OK.
 - e. Select the Accept radio button, click Install, and stop elapsed staff time.
 - f. When the installation finishes, click Exit, and stop elapsed total time.
2. Install the hotfix and reboot:
 - a. Start elapsed staff time and elapsed total time. When the application prompts you, click OK to install a hotfix for Windows (KB942288).
 - b. Click Restart now to restart the server, and stop elapsed staff time.
 - c. When the server returns to the login screen, stop elapsed total time.
3. Install SQL Server 2008:
 - a. When the Ctrl+Alt+Delete screen appears, start elapsed staff time and elapsed total time, and log into the server.
 - b. Click Start, Computer.
 - c. Double-click the CD/DVD drive.
 - d. Click Installation.
 - e. Click New SQL Server stand-alone installation.

- f. On the Setup support rules screen, click OK.
 - g. Specify the Enterprise Evaluation free edition. Click Next.
 - h. Click the checkbox to accept the license terms. Click Next.
 - i. Click Install to install the setup support files.
 - j. You may see a Windows Firewall warning. For now, ignore this, and click Next.
 - k. On the Feature Selection screen, select Database Engine Services, Full-Text Search, Client Tools Connectivity, Client Tools Backward Compatibility, Management Tools –Basic, and Management Tools – Complete. Click Next.
 - l. On the Instance configuration screen, click Next.
 - m. On the Disk space requirements screen, click Next.
 - n. On the Server configuration screen, choose NT AUTHORITY\SYSTEM for SQL Server Agent, and choose NT AUTHORITY\SYSTEM for SQL Server Database Engine. Click Next.
 - o. On the Database Engine Configuration screen, select Mixed Mode.
 - p. Enter a password for the system administrator account.
 - q. Click Add Current user. This may take several seconds.
 - r. Click Next.
 - s. On the Error and Usage reporting screen, click Next.
 - t. On the Installation Rules screen, click Next.
 - u. On the Ready to Install screen, click Install, and stop elapsed staff time. Click Next, then close, after the installation is complete.
4. Go to <http://windowsupdate.microsoft.com/>:
 - a. Start elapsed staff time and elapsed total time, and click Start→Program Files→Internet Explorer.
 - b. Type `http://windowsupdate.microsoft.com` in the address bar, press Enter, and stop elapsed staff time.
 - c. When the page fully loads, stop elapsed total time.
 5. Let Windows Update browse for updates:
 - a. Start elapsed staff time, click Express, and stop elapsed staff time.
 - b. When the updates appear after the page reloads, stop elapsed total time.
 6. Start installing updates and reboot:
 - a. Start elapsed total time and elapsed staff time.
 - b. Click Install Updates, and stop elapsed staff time.
 - c. When the updates finish downloading and installing, the installation prompts you to reboot. Reboot the machine.
 - d. When the machine returns to the Ctrl+Alt+Delete screen, stop elapsed total time.

Exchange install

Installing Microsoft Exchange

1. Copy the relevant files to flash drive:
 - a. Start timing elapsed total and elapsed staff times.
 - b. On a separate machine, copy Microsoft Exchange 2007 SP1, .NET 2.0 framework, and Windows PowerShell onto a flash drive, and stop elapsed staff time (we downloaded each of these separately before testing).
 - c. When the copy completes, stop elapsed total time.
2. Copy relevant files to server:
 - a. Start elapsed staff time and elapsed total time, and log into the server by pressing Ctrl+Alt+Delete.
 - b. Put the flash drive in the server, copy both files onto the desktop, and stop elapsed staff time.
 - c. When the copy completes, stop elapsed total time.
3. Extract Exchange SP1files:
 - a. Start elapsed staff time and elapsed total time, and double-click the Exchange SP1 file.
 - b. After the server finishes reading the file, type `c:\ExchangeSP1` into the extraction text field, click OK, and stop staff time.
 - c. When the extraction is complete, click OK, and stop elapsed total time.
4. Perform .NET 2.0 installation:

- a. Start elapsed staff time and elapsed total time, and double-click the .NET EXE to begin the .NET installation.
 - b. Click Next.
 - c. Accept the license agreement, and click Install. Stop elapsed staff time.
 - d. Click Exit at the end of the installation, and stop elapsed total time.
5. Install Windows PowerShell:
- a. Start elapsed staff time and elapsed total time, and double-click the PowerShell EXE.
 - b. At the Welcome screen, click Next.
 - c. Select I agree, click Next, and stop elapsed staff time.
 - d. Click Finish when installation is complete, and stop elapsed total time.
6. Set IP information, join domain, and restart:
- a. Start elapsed staff time and elapsed total time. Click Start→Control Panel→Network Connections→Local Area Connection.
 - b. Click Properties.
 - c. Click Internet Protocol(TCP/IP).
 - d. Click Properties.
 - e. Click Use the following IP address, and set your IP address, subnet mask, and gateway.
 - f. Click Use the following DNS server addresses, and set the DNS server to your Active Directory server.
 - g. Close all property boxes.
 - h. Click Start-→Control Panel→System.
 - i. Click the Computer Name tab.
 - j. Click Change.
 - k. Click the Domain radio button.
 - l. Type the domain name.
 - m. When the installer prompts you for a user with credentials to join the domain, enter the user information.
 - n. After joining the domain, close the property boxes, and stop elapsed staff time. Reboot the server.
 - o. When the server returns to the login screen, stop elapsed total time.
7. Install needed prerequisites from IIS:
- a. Start elapsed staff time and elapsed total time. Log into the server by pressing Ctrl+Alt+Delete and entering credentials.
 - b. Click Start→Control Panel→Add or Remove Programs.
 - c. Click Add/Remove Windows Components.
 - d. In the Components list, select the Application Server check box.
 - e. Click Details.
 - f. Select Internet Information Services. Click Details.
 - g. Click the Internet Information Services Manager check box and the World Wide Web Service checkbox.
 - h. Click OK to return to the Windows Component Wizard screen.
 - i. Click Next to complete the Windows Component Wizard.
 - j. When the installer prompts you to do so, insert the CD. Stop elapsed staff time.
 - k. At the completion of the install, click Finish, and stop elapsed total time.
8. Go to <http://windowsupdate.microsoft.com/>:
- a. Start elapsed staff and elapsed total time, and click Start→Program Files→Internet Explorer.
 - b. Type `http://windowsupdate.microsoft.com` in the address bar, and press Enter.
 - c. Click Add to add this address to the trusted zone, and stop elapsed staff time.
 - d. When the page fully loads, stop elapsed total time.
9. Let Windows Update browse for updates:
- a. Start elapsed staff time and elapsed total time, click Express, and stop elapsed staff time.
 - b. When the updates appear after the page reloads, stop elapsed total time.
10. Start installing updates and reboot:
- a. Start elapsed staff time and elapsed total time.
 - b. Click Install Updates. Stop elapsed staff time.

- c. When the updates finish downloading and installing, the installation prompts you to reboot. Reboot the machine.
 - d. When the machine returns to the Ctrl+Alt+Delete screen, stop elapsed total time.
11. Start Exchange installation:
- a. Start elapsed staff time and elapsed total time, and log into the domain on the server by pressing Ctrl+Alt+Delete. Ensure that you have selected the domain, instead of the local machine.
 - b. Insert the Exchange 2007 DVD into the DVD drive.
 - c. When the splash screen appears, click Install Microsoft Exchange.
 - d. On the Introduction screen, click Next.
 - e. On the License agreement screen, click Next.
 - f. On the Error Reporting screen, leave the No radio button checked, and click Next.
 - g. On the Installation Type screen, leave the default of Typical selected, and click Next.
 - h. On the Exchange Organization screen, enter your organization, and click Next.
 - i. On the Client Settings screen, leave the default of No, and click Next.
 - j. On the Readiness Check screen, stop elapsed staff time. Wait for readiness check to complete.
 - k. Click Next after readiness check is complete, and stop elapsed total time.
12. Complete Exchange installation:
- a. Start elapsed staff time and elapsed total time.
 - b. Click Install, and stop elapsed staff time.
 - c. When the installation completes, click Finish. Reboot the machine to prepare for SP1.
 - d. When the server returns to the login screen, stop elapsed total time.
13. Start the installation of Microsoft Exchange 2007 SP1:
- a. Start elapsed staff time and elapsed total time, and log into the domain on the server by pressing Ctrl+Alt+Delete. Ensure that you have selected the domain, instead of the local machine.
 - b. Browse to C:\ExchangeSP1 folder.
 - c. Double-click Setup.EXE.
 - d. Click Install Microsoft Exchange Service Pack 1.
 - e. On the Introduction screen, click Next.
 - f. Choose to accept the license agreement, and click Next. Stop staff time, and wait for the readiness check to complete.
 - g. When the readiness check completes, stop elapsed total time.
14. Complete Microsoft Exchange SP1 installation:
- a. Start elapsed staff time and elapsed total time. Click Upgrade.
 - b. Stop elapsed staff time. When the upgrade completes, click Finish, then click Close.
 - c. Reboot the server.
 - d. When the server returns to the login screen, stop elapsed total time.
15. Go to <http://windowsupdate.microsoft.com/>:
- a. Start elapsed staff time and elapsed total time, and click Start→Program Files→Internet Explorer.
 - b. Type `http://windowsupdate.microsoft.com` in the address bar, press Enter, and stop elapsed staff time.
 - c. When the page fully loads, stop elapsed total time.
16. Let Windows Update browse for updates:
- a. Start elapsed staff time and elapsed total time, click Express, and stop elapsed staff time.
 - b. When the updates appear after the page reloads, stop elapsed total time.
17. Start installing updates and reboot:
- a. Start elapsed staff time and elapsed total time. Click Install Updates, and stop elapsed staff time.
 - b. When the updates finish downloading and installing, click Close.
 - c. Reboot the server a final time.
 - d. When the server returns to the login screen, stop elapsed total time.

Active Directory install

Setting up the separate Active Directory Server

1. Setup a separate base server install as we describe in the Base Server Install section.
2. Click Start→Administrative Tools→Configure Your Server Wizard.
3. Click Next.
4. Click Next.
5. If you receive a warning about network connectivity, ensure that you have at least one active network connection.
6. Click Custom Configuration, then click Next.
7. Click Domain Controller (Active Directory), then click Next.
8. Click Next.
9. On the Welcome screen, click Next.
10. On the Operating System Compatibility screen, click Next.
11. Leave the default of Domain controller for a new domain checked, and click Next.
12. On the Create a New Domain screen, leave the Domain in a new forest radio button checked, and click Next.
13. Enter the fully qualified domain name, such as organization.local. Click Next.
14. Accept the NetBIOS Domain Name, and click Next.
15. Accept the default database and log folders, and click Next.
16. Accept the default folder location for the SYSVOL folder, and click Next.
17. Select Install and configure the DNS server on this computer, and click Next.
18. Select Permission compatible only with Windows 2000 and Windows Server 2003 operating systems radio button, and click Next.
19. Enter a password for the Restore Mode Administrator. Click Next.
20. On the Summary screen, click Next.
21. After the installation completes, click Finish.
22. When the installer prompts you to restart, reboot the machine.
23. After rebooting the machine, log into the domain controller by pressing Ctrl+Alt+Delete.
24. Click Start, Administrative Tools, Active Directory Domains, and Trusts.
25. Right-click your domain, and choose Raise Domain Functional Level.
26. Choose Windows Server 2003, and click Close.

Appendix A – System configuration information

This appendix provides detailed configuration information for the Dell PowerEdge 2950 Server.

Server	Dell PowerEdge 2950
General	
Number of processor packages	2
Number of cores per processor package	4
Number of hardware threads per core	1
System Power Management Policy	Always On
CPU	
Vendor	Intel
Name	Xeon E5405
Stepping	6
Socket type	Socket 771-LGA
Core frequency (GHz)	2.0
Front-side bus frequency (MHz)	1,333
L1 cache	32 KB + 32 KB (per core)
L2 cache	12 MB (2 x 6 MB shared)
Platform	
Vendor	Dell Inc.
Motherboard model number	0M332H
Motherboard chipset	Intel 5000X
Motherboard revision number	12
Motherboard serial number	JD6HWG1
BIOS name and version	Dell 2.3.1 (4/29/2008)
BIOS settings	Default
Chipset INF driver	Intel 7.3.0.1010
Memory module(s)	
Vendor and model number	Samsung M395T5750EZ4-CE66
Type	FB-DDR2 PC5300
Speed (MHz)	667
Speed in the system currently running @ (MHz)	667
Timing/Latency (tCL-tRCD-iRP-tRASmin)	5-5-5-15
Size	16,384 MB
Number of RAM modules	8 x 2,048 MB
Chip organization	Double-sided
Channel	Dual
Hard disk	
Vendor and model number	Western Digital WD800AAJS-18
Number of disks in system	2
Size	80 GB
Buffer size	8 MB

Server	Dell PowerEdge 2950
RPM	7,200 RPM
Type	SATA 3.0 Gb
Controller	Intel 6321ESB
Controller driver	Intel 7.3.0.1010 (11/18/2005)
Operating system	
Name	Windows Server 2003 R2 Enterprise x64 Edition SP2
Build number	3790
Service Pack	SP2
Microsoft Windows update date	8/26/2008
File system	NTFS
Language	English
Microsoft DirectX version	9.0c
Graphics	
Vendor and model number	ATI ES1000
Chipset	ATI ES1000
BIOS version	BK-ATI VER008.005.028.000
Type	Integrated
Memory size	16 MB
Resolution	1,024 x 768 x 32-bit
Driver	ATI 8.24.3.0 (4/5/2006)
Network card/subsystem	
Vendor and model number	Intel PRO/1000 PT Server Adapter
Type	Discrete
Driver	9.7.34.0 (2/1/2007)
Optical drive	
Vendor and model number	TEAC CD-224E-N
Type	CD
Interface	IDE
Vendor and model number	Sony DRX-820U (external)
Type	DVD/CD RW
Interface	USB
Dual/single layer	Dual
USB ports	
Number of ports	4
Type of ports (USB 1.1, USB 2.0)	2.0

Figure 8: Detailed server configuration information for the Dell PowerEdge 2950 Server.

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