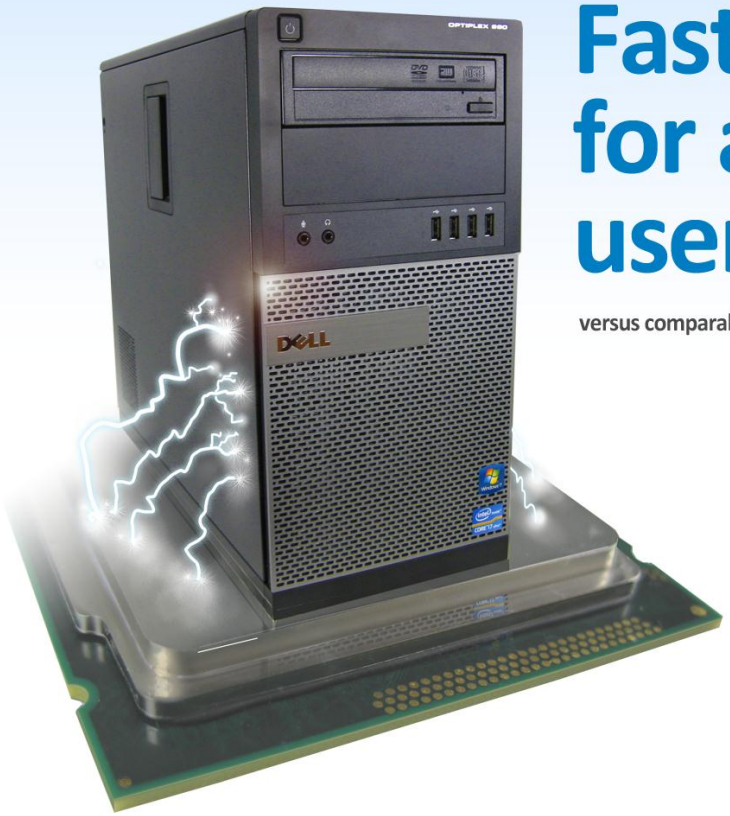
A USER-EXPERIENCE COMPARISON OF DELL AND HP WORKSTATION SYSTEMS

Dell™ workstations powered by the Intel® Xeon® processor family:



Faster response for a better user experience

versus comparable HP workstations with AMD workstation processors

Workers can be only as productive as their tools allow them to be. On a sluggish system, carrying out routine tasks such as opening and copying files, starting up and shutting down the system, and even entering and leaving hibernation and sleep modes becomes annoying for employees and causes their productivity to suffer. Systems that respond faster improve the user experience and increase office efficiency.

Principled Technologies conducted a series of custom hand-timed tests to measure system responsiveness on tasks that users perform throughout the day. We tested two Dell workstation systems powered by Intel Xeon processors, a mid-range Dell Precision™ T3500 and a high-end Dell Precision T7500, and two HP workstations powered by AMD processors, a mid-range HP Pavilion Elite HPE-500z and a high-end HP Pavilion Elite HPE-560z.

The Intel Xeon processor-based Dell Precision systems consistently performed tasks more quickly—as much as 43.7 percent faster—than the corresponding HP Pavilion systems, making Dell a great choice for an efficient workplace.

MAY 2011

A PRINCIPLED TECHNOLOGIES TEST REPORT

Commissioned by Dell Inc.

SPEEDING UP THE WORKDAY WITH DELL AND INTEL

Today's business world is moving faster than ever, and every second counts. Extra seconds and minutes spent doing everyday office tasks adds up quickly over time and over a large number of employees. That's why, when choosing workstation systems for the workplace, it makes sense to purchase systems with enough processing power to complete routine tasks quickly and efficiently.

In our tests, we found that the Intel Xeon processor-based Dell Precision T3500 and Dell Precision T7500 sped up everyday tasks considerably over comparable AMD processor-based HP systems – enough to decrease time doing these tasks by up to a total of 6.7 percent. Note: The Dell Precision T7500 ships with a RAID controller, providing all the RAID features you have come to count on. However, in order to make the configurations for the two high-end workstations comparable, we used the SATA controller in the Dell Precision T7500. (To learn more about the systems we tested, see Appendix A.)

Figure 1 shows the time that each system took to open three Microsoft Office® files—one Word, one Excel®, and one PowerPoint®. We timed each system opening each of the files two ways—from a local hard drive and from a network share using an Ethernet connection. Each bar represents the number of seconds the system needed to perform all six file-opening tasks. (See the System Responsiveness Results section for complete results.)

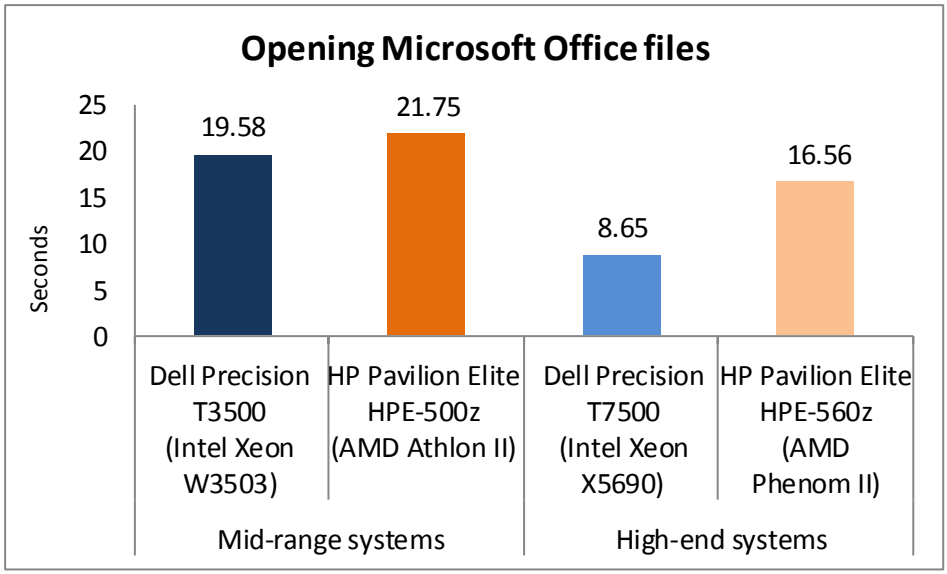


Figure 1: Combined times, in seconds, the four test systems took to perform six file-opening tasks. Lower numbers are better.

The Intel Xeon processor W3503-based Dell Precision T3500 workstation took 10.0 percent less time than the AMD Athlon II-based HP Pavilion Elite HPE-500z, a savings of 2.17 seconds. The Intel Xeon processor X5690-based Dell Precision T7500 workstation took 47.8 percent less time than the AMD Phenom II-based HP Pavilion Elite HPE-560z, a savings of 7.91 seconds.

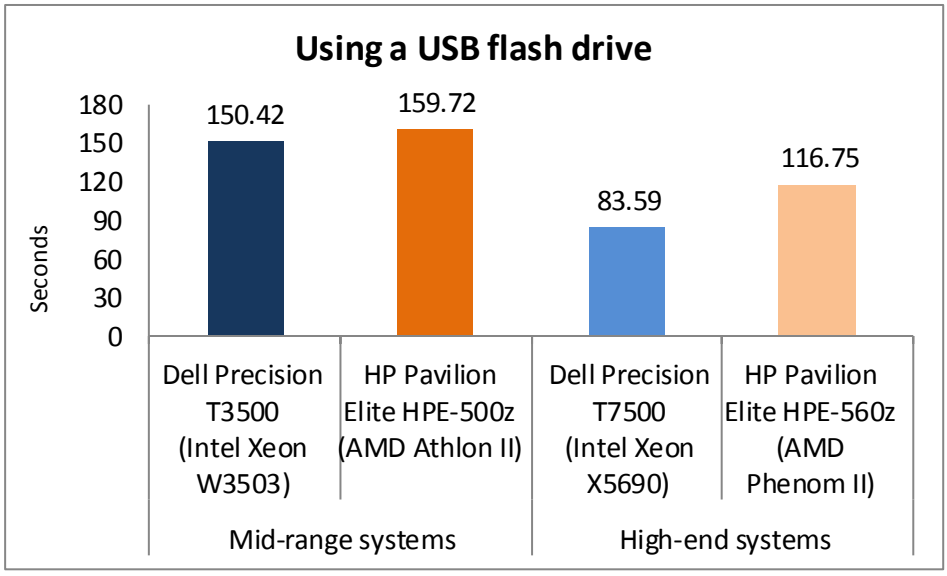


Figure 2: Combined times, in seconds, the two test systems took to perform six tasks involving USB flash drives. Lower numbers are better.

Figure 2 shows the time that each system took to perform three tasks involving USB flash drives—installing the flash drive, reinserting the flash drive, and copying files to the flash drive. We timed each system performing these tasks with two brands of USB flash drive—Kingston® and PNY®. Each bar represents the number of seconds the system needed to perform all six tasks.

The Intel Xeon processor W3503-based Dell Precision T3500 workstation took 5.8 percent less time than the AMD Athlon II-based HP Pavilion Elite HPE-500z, a savings of 9.30 seconds. The Intel Xeon processor X5690-based Dell Precision T7500 workstation took 28.4 percent less time than the AMD Phenom II-based HP Pavilion Elite HPE-560z, a savings of 33.16 seconds.

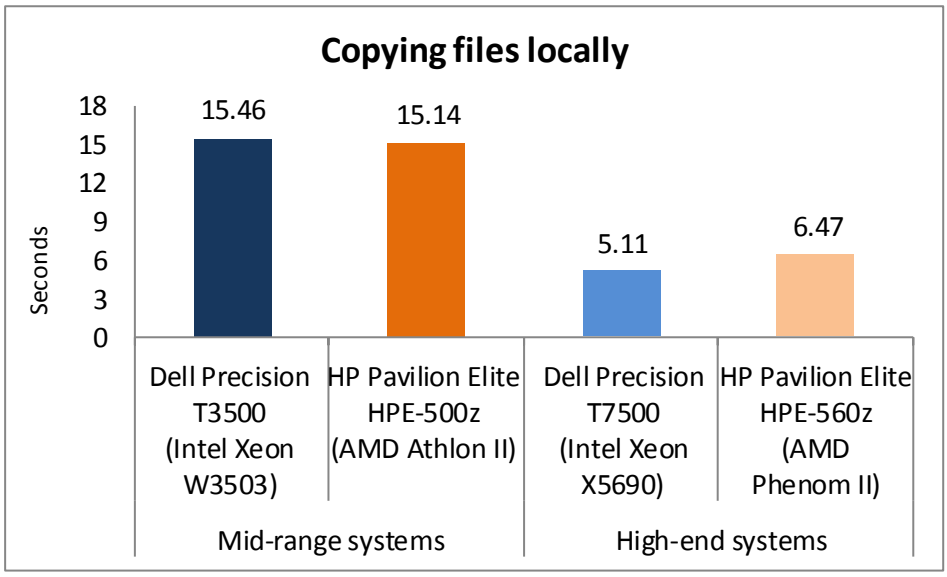


Figure 3: Time, in seconds, the four test systems took to perform one file-copying task. Lower numbers are better.

Figure 3 shows the time each test system took to copy files from one location to another on the local hard drive. The Intel Xeon processor W3503-based Dell Precision T3500 workstation took 2.1 percent more time than the AMD Athlon II-based HP Pavilion Elite HPE-500z, a difference of

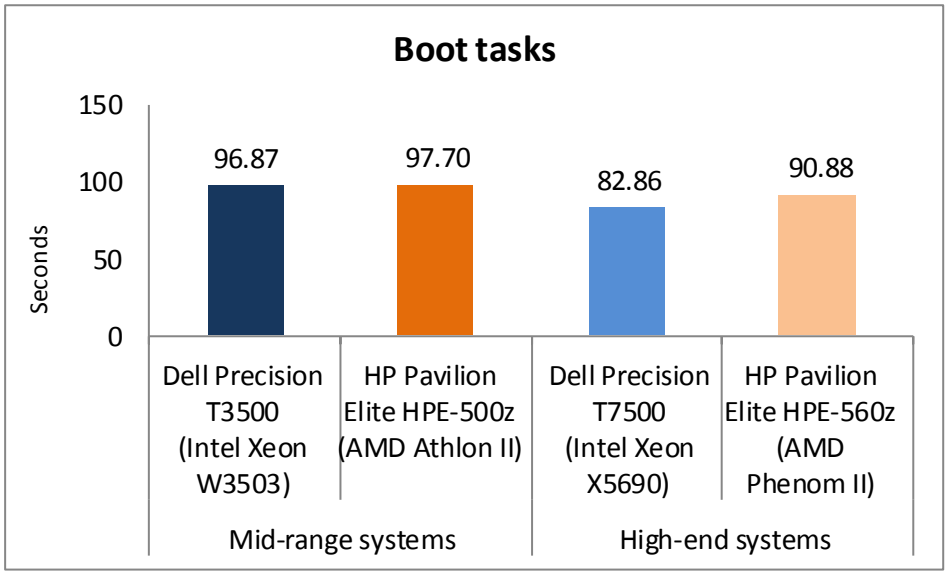


Figure 4: Combined times, in seconds, the four test systems took for three events to occur as the system booted. Lower numbers are better.

0.32 seconds. The Intel Xeon processor X5690-based Dell Precision T7500 workstation took 21.0 percent less time than the AMD Phenom II-based HP Pavilion Elite HPE-560z, a savings of 1.36 seconds.

Figure 4 shows the time that each system took for three events to occur as the system boots—the taskbar appearing, indicating the operating system has completely loaded, followed by opening a Word 2010 document, indicating the system is useable, and finally, making a connection to an Exchange Server with Outlook® 2010, indicating the network is functioning. Each bar represents the number of seconds the system needed to perform all three tasks in quick succession.

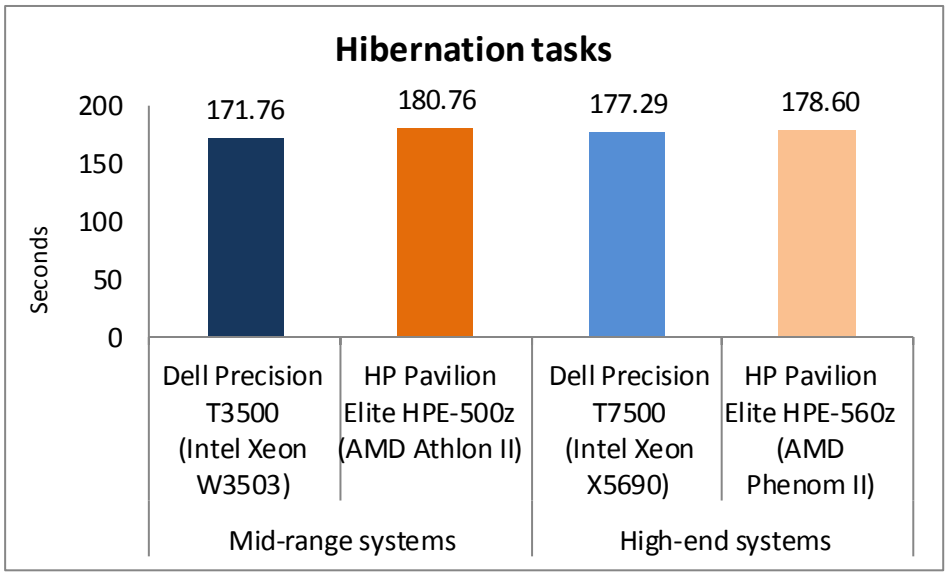


Figure 5: Combined times, in seconds, the four test systems took to complete eight tasks related to hibernation. Lower numbers are better.

The Intel Xeon processor W3503-based Dell Precision T3500 workstation took 0.8 percent less time than the AMD Athlon II-based HP Pavilion Elite HPE-500z, a savings of 0.83 seconds. The Intel Xeon processor X5690-based Dell Precision T7500 workstation took 8.8 percent less time than the AMD Phenom II-based HP Pavilion Elite HPE-560z, a savings of 8.02 seconds.

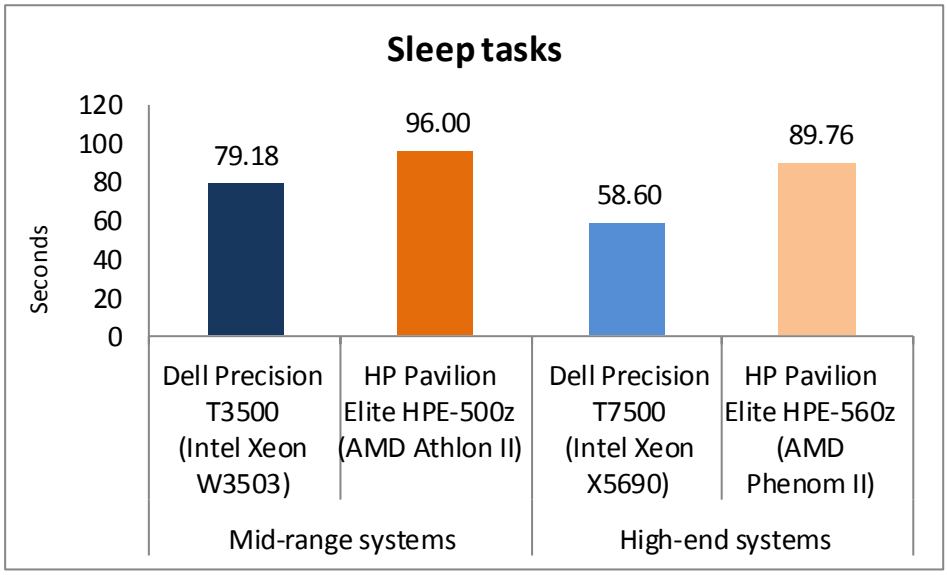


Figure 6: Combined times, in seconds, the four test systems took to complete eight tasks related to sleep mode. Lower numbers are better.

Figure 5 shows the time each system took to complete eight tasks related to hibernation. Each bar represents the number of seconds the system needed to perform all eight tasks. The Intel Xeon processor W3503-based Dell Precision T3500 workstation took 5.0 percent less time than the AMD Athlon II-based HP Pavilion Elite HPE-500z, a savings of 9 seconds. The Intel Xeon processor X5690-based Dell Precision T7500 workstation took 0.7 percent less time than the AMD Phenom II-based HP Pavilion Elite HPE-560z, a savings of 1.31 seconds.

Figure 6 shows the time each system took to complete eight tasks related to sleep mode. Each bar represents the number of seconds the system needed to perform all eight tasks. The Intel Xeon processor W3503-based Dell Precision T3500 workstation took 17.5 percent less time than the AMD Athlon II-based HP Pavilion Elite HPE-500z, a savings of 16.82 seconds. The Intel Xeon processor X5690-based Dell Precision T7500 workstation took 34.7 percent less time than the AMD Phenom II-based HP Pavilion Elite HPE-560z, a savings of 31.16 seconds.

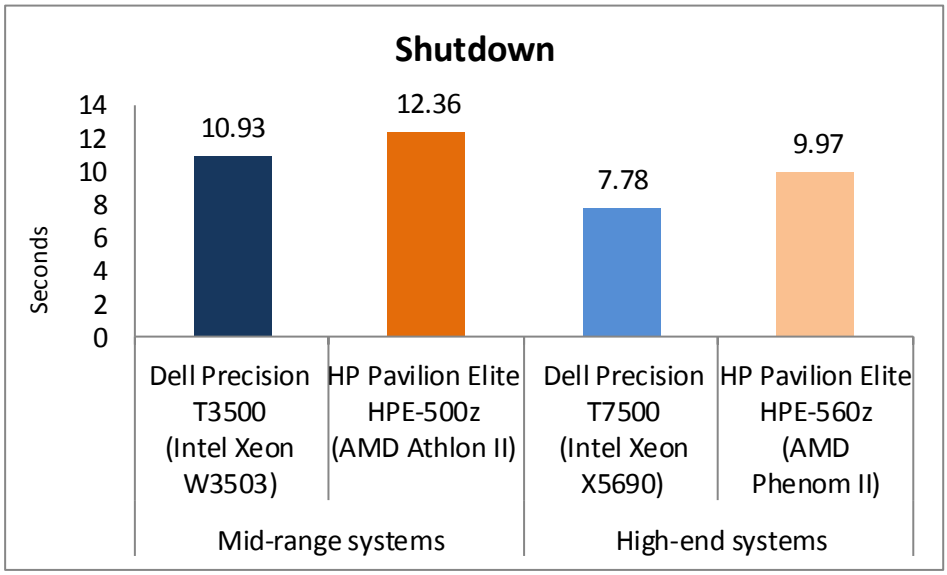


Figure 7: Time, in seconds, the four test systems took to shut down. Lower numbers are better.

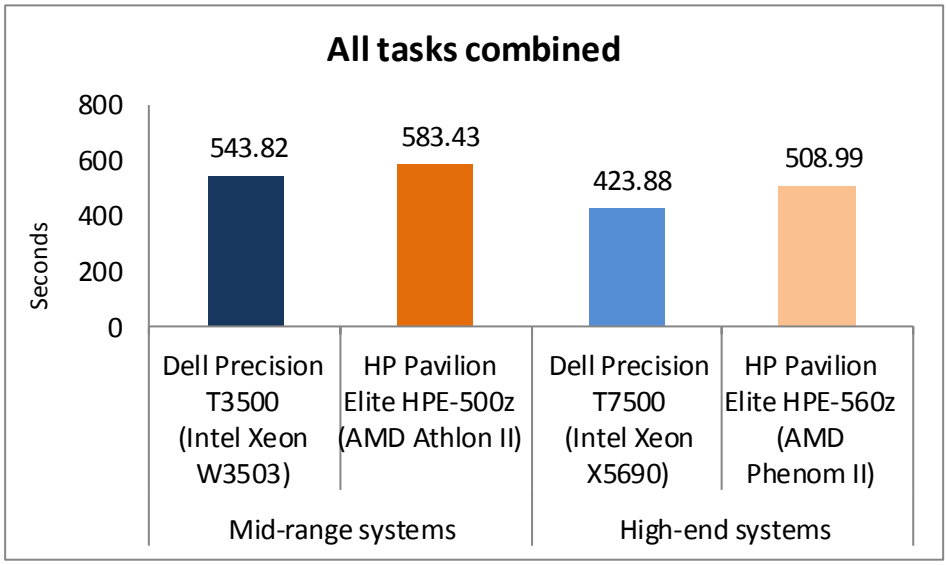


Figure 8: Time, in seconds, the four test systems took to complete all tasks. Lower numbers are better.

Figure 7 shows the time each system took to shut down. The Intel Xeon processor W3503-based Dell Precision T3500 workstation took 11.6 percent less time than the AMD Athlon II-based HP Pavilion Elite HPE-500z, a savings of 1.43 seconds. The Intel Xeon processor X5690-based Dell Precision T7500 workstation took 22.0 percent less time than the AMD Phenom II-based HP Pavilion Elite HPE-560z, a savings of 2.19 seconds.

Figure 8 shows the time in seconds each system took to complete all 33 tasks we tested. The Intel Xeon processor W3503-based Dell Precision T3500 workstation took 6.8 percent less time than the AMD Athlon II -based HP Pavilion Elite HPE-500, a savings of 39.61 seconds. If each worker performed this set of tasks daily, the annual savings for the company would work out to **55.01 hours for 100 employees** and **550.14 hours for 1,000 employees**. The Intel Xeon processor X5690-based Dell Precision T7500 workstation took 16.7 percent less time than the AMD Phenom II -based HP Pavilion Elite HPE-560z, a savings of 85.11 seconds. If each worker performed this set of tasks daily, the annual difference for the company would work out to **118.21 hours** for 100 employees and **1,182.09 hours for 1,000 employees**.

SYSTEM RESPONSIVENESS RESULTS

Figures 9 and 10 show a detailed breakdown of system responsiveness results, in seconds, for the four test systems. These results represent the median of three test runs. Appendix C presents the results from all three runs.

	Dell Precision T3500 (Intel Xeon W3503)	HP Pavilion Elite HPE-500 (AMD Athlon II)	Time saved with Dell Precision T3500 (Intel Xeon W3503)
Opening Microsoft Office files			
Opening local Word document	4.46	4.78	0.32
Opening local Excel spreadsheet	2.14	2.56	0.42
Opening local PowerPoint deck	1.34	2.66	1.32
Opening Word document - network connection	6.52	6.76	0.24
Opening Excel spreadsheet - network connection	2.85	2.81	(0.04)
Opening PowerPoint deck - network connection	2.27	2.18	(0.09)
USB flash drive tasks			
Installing PNY USB flash drive	4.02	5.75	1.73
Installing Kingston USB flash drive	3.03	2.55	(0.48)
Re-inserting PNY USB flash drive	2.77	2.53	(0.24)
Re-inserting Kingston USB flash drive	2.01	1.52	(0.49)
Copying files to a USB flash drive	108.53	115.21	6.68
Copying files from a USB flash drive	30.06	32.16	2.10
Copying files locally			
Copying files locally	15.46	15.14	(0.32)
Boot tasks			
Taskbar appears	36.06	36.57	0.51
Word document appears	52.10	52.90	0.80
Time to connect to Exchange Server after booting system	8.71	8.23	(0.48)
Hibernation tasks			
Cold hibernate experience			
Time to hibernate	13.62	19.92	6.30
Time to resume from hibernate	26.10	23.34	(2.76)
Warm hibernate experience			
Time to hibernate	12.53	16.93	4.40
Time to resume from hibernate	25.83	23.56	(2.27)
Cold hibernate experience with applications open			
Time to hibernate	16.84	23.34	6.50
Time to connect to Exchange Server after resume from hibernate	27.26	25.40	(1.86)

	Dell Precision T3500 (Intel Xeon W3503)	HP Pavilion Elite HPE-500 (AMD Athlon II)	Time saved with Dell Precision T3500 (Intel Xeon W3503)
Warm hibernate experience with applications open			
Time to hibernate	15.27	20.96	5.69
Time to connect to Exchange Server after resume from hibernate	33.93	27.31	(6.62)
Sleep tasks			
Cold sleep experience			
Time to sleep	13.18	22.20	9.02
Time to resume from sleep	6.79	4.56	(2.23)
Warm sleep experience			
Time to sleep	8.73	14.34	5.61
Time to resume from sleep	5.26	4.56	(0.70)
Cold sleep experience with applications open			
Time to sleep	15.65	23.40	7.75
Time to connect to Exchange Server after resume from sleep	5.25	5.92	0.67
Warm sleep experience with applications open			
Time to sleep	16.69	15.68	(1.01)
Time to connect to Exchange Server after resume from sleep	7.63	5.34	(2.29)
Shutdown			
Time to turn system off	10.93	12.36	01.43
Total seconds	**543.82**	**583.43**	**39.61**
Total minutes	**9.06**	**9.72**	**0.66**

Figure 9: Application and system responsiveness, in seconds, for the test systems. Lower numbers are better.

High-end systems	Dell Precision T7500 (Intel Xeon X5690)	HP Pavilion Elite HPE-560z (AMD Phenom II)	Time saved with Dell Precision T7500 (Intel Xeon X5690)
Opening Microsoft Office files			
Opening local Word document	2.19	2.14	(0.05)
Opening local Excel spreadsheet	1.04	1.73	0.69
Opening local PowerPoint deck	0.72	1.36	0.64
Opening Word document - network connection	2.43	6.59	4.16
Opening Excel spreadsheet - network connection	1.33	2.87	1.54
Opening PowerPoint deck - network connection	0.94	1.87	0.93
USB flash drive tasks			
Installing PNY USB flash drive	2.88	10.45	7.57
Installing Kingston USB flash drive	2.68	2.56	(0.12)
Re-inserting PNY USB flash drive	2.57	8.73	6.16
Re-inserting Kingston USB flash drive	1.85	1.54	(0.31)
Copying files to a USB flash drive	55.18	65.22	10.04
Copying files from a USB flash drive	18.43	28.25	9.82
Copying files locally			
Copying files locally	5.11	6.47	1.36
Boot tasks			
Taskbar appears	38.17	32.66	(5.51)
Word document appears	41.24	51.38	10.14
Time to connect to Exchange Server after booting system	3.45	6.84	3.39
Hibernation tasks			
Cold hibernate experience			
Time to hibernate	10.12	16.04	5.92
Time to resume from hibernate	33.35	23.94	(9.41)
Warm hibernate experience			
Time to hibernate	9.66	16.09	6.43
Time to resume from hibernate	31.67	25.29	(6.38)
Cold hibernate experience with applications open			
Time to hibernate	11.98	20.33	8.35
Time to connect to Exchange Server after resume from hibernate	35.37	27.38	(7.99)
Warm hibernate experience with applications open			
Time to hibernate	11.71	21.62	9.91
Time to connect to Exchange Server after resume from hibernate	33.43	27.91	(5.52)
Sleep tasks			
Cold sleep experience			
Time to sleep	5.15	15.62	10.47
Time to resume from sleep	7.11	4.78	(2.33)

High-end systems	Dell Precision T7500 (Intel Xeon X5690)	HP Pavilion Elite HPE-560z (AMD Phenom II)	Time saved with Dell Precision T7500 (Intel Xeon X5690)
Warm sleep experience			
Time to sleep	3.23	12.89	9.66
Time to resume from sleep	7.12	4.53	(2.59)
Cold sleep experience with applications open			
Time to sleep	10.87	21.40	10.53
Time to connect to Exchange Server after resume from sleep	7.03	5.92	(1.11)
Warm sleep experience with applications open			
Time to sleep	10.88	19.77	8.89
Time to connect to Exchange Server after resume from sleep	7.21	4.85	(2.36)
Shutdown			
Time to turn system off	7.78	9.97	2.19
Total seconds	**423.88**	**508.99**	**85.11**
Total minutes	**7.06**	**8.48**	**1.42**

Figure 10: Application and system responsiveness, in seconds, for the high-end systems. Lower numbers are better.

SUMMARY

A few seconds here, a few seconds there. Over the course a day, it may not seem like much, but it adds up to hours of lost time per employee each year. As our tests prove, Dell workstations powered by the Intel Xeon processor family help you avoid wasting time by running common applications responsively, increasing productivity in your workplace.

APPENDIX A – DETAILED SYSTEM CONFIGURATION INFORMATION

Figure 11 presents each test system and the details of its configuration.

System	Dell Precision T3500 (Intel Xeon W3503)	Dell Precision T7500 (Intel Xeon X5690)	HP Pavilion Elite HPE-500 (AMD Athlon II X4)	HP Pavilion Elite HPE-560z (AMD Phenom II)
General				
Number of processor packages	1	1	1	1
Number of cores per processor	2	6	4	6
Number of hardware threads per core	2	6	4	6
System power management policy	Dell	Dell	Balanced	Balanced
Processor power-saving option	Enhanced Intel SpeedStep® Technology	Enhanced Intel SpeedStep Technology	AMD PowerNow! Technology (Cool'n'Quiet Technology)	AMD PowerNow!™ Technology (Cool'n'Quiet™ Technology)
System dimensions (length x width x height)	17.5" x 6.5" x 17.5"	20.5" x 8.5" x 22.5"	16.5" x 7" x 15.75"	16.5" x 7" x 15.75"
System weight	39 lbs.	52 lbs.	12 lbs.	26 lbs.
CPU				
Vendor	Intel	Intel	AMD	AMD
Name	Xeon W3503	Xeon X5690	Athlon II X4	Phenom II X6
Model number	W3503	X5690	640	1090
Stepping	D0	B1	PH-EO	PH-EO
Socket type and number of pins	Socket 1366 LGA	Socket 1366 LGA	Socket AM3 (938)	Socket AM3 (938)
Core frequency (GHz)	2.40	3.46	3.00	3.20
Bus frequency	2,400 MHz	3,200 MHz	4,000 MHz HyperTransport Technology	4,000 MHz HyperTransport™ Technology
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)	64 KB + 64 KB (per core)
L2 cache	512 KB (256 KB per core)	1.5 MB (256 KB per core)	2 MB (512 KB per core)	3 MB (512 KB per core)
L3 cache	4 MB	12 MB	N/A	6 MB

System	Dell Precision T3500 (Intel Xeon W3503)	Dell Precision T7500 (Intel Xeon X5690)	HP Pavilion Elite HPE-500 (AMD Athlon II X4)	HP Pavilion Elite HPE-560z (AMD Phenom II)
Platform				
Vendor	Dell	Dell	FOXCONN	FOXCONN
Motherboard model number	09KPNV	06FW8P	2A92	2A92
Motherboard chipset	Intel X58	Intel 5520	AMD 785G	AMD 785G
BIOS name and version	Dell A10 (01/21/2011)	Dell A09 (01/21/2011)	American Megatrends Inc. 6.11 (03/21/2011)	American Megatrends Inc. 6.11 (03/21/2011)
Memory module(s)				
Vendor and model number	Hynix HMT125U6TFR8C-H9	Hynix HMT112R7BFR8C-H9	Hynix HMT125U6TFR8C-H9	Samsung M378B5773CH0-CH9
Type	PC3-10600E	PC3-10600R	PC3-10600U	PC3-10600U
Speed (MHz)	1,066	1,333	1,333	1,333
Speed running in the system (MHz)	1,066	1,333	1,333	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	7-7-7-20	9-9-9-24	9-9-9-24	9-9-9-24
Size (MB)	4,096	6,144	4,096	8,192
Number of memory module(s)	4 x 1,024 MB	6 x 1,024 MB	2 x 2,048 MB	4 x 2,048 MB
Chip organization (single-sided/double-sided)	Single	Double	Dual	Single
Channel (single/dual)	Triple	Triple	Dual	Dual
Hard disk				
Vendor and model number	Seagate® ST3500418AS	Samsung PM810	Hitachi HDS72107SCLA332	Seagate ST31000528AS
Number of disks in system	1	1	1	2
Size (GB)	500	256	750	1,000
Buffer size (MB)	16	128	32	32
RPM	7,200	N/A	7,200	7,200
Type	SATA 3.0 Gb/s	SATA II 3.0 Gb/s	SATA 3.0 Gb/s	SATA 3.0 Gb/s
Controller	Intel 82801JR (ICH10R)	Intel 82801JR (ICH10R)	AMD SB700	AMD AHCI Compatible RAID Controller

System	Dell Precision T3500 (Intel Xeon W3503)	Dell Precision T7500 (Intel Xeon X5690)	HP Pavilion Elite HPE-500 (AMD Athlon II X4)	HP Pavilion Elite HPE-560z (AMD Phenom II)
Driver	Intel 9.6.0.1014 (03/03/2010)	Intel 8.9.4.1004 (10/13/2009)	Advanced Micro Devices Inc. 3.2.1545.19 (08/27/2010)	Advanced Micro Devices Inc. 3.2.1545.19 (08/27/2010)
Operating system				
Name	Windows® 7 Ultimate	Windows 7 Ultimate	Windows 7 Ultimate	Windows 7 Ultimate
Build number	7600	7600	7600	7600
Service Pack	N/A	N/A	N/A	N/A
File system	NTFS	NTFS	NTFS	NTFS
Kernel	ACPI x64 – based PC	ACPI x64 – based PC	ACPI x64 – based PC	ACPI x64 – based PC
Language	English	English	English	English
Microsoft DirectX® version	DirectX 11	DirectX 11	DirectX 11	DirectX 11
Graphics				
Vendor and model number	NVIDIA Quadro® FX580	NVIDIA Quadro 4000	AMD Radeon™ HD 6450	NVIDIA Geforce® GT 440
Type	Discrete	Discrete	Discrete	Discrete
Chipset	Quadro FX 580	Quadro 4000	ATI Radeon HD 6450	GeForce GT 440
BIOS version	62.94.96.0.5	70.0.2f.0.12	113-AC88800-103-PE	70.6.1d.0.2
Total available graphics memory (MB)	2,302	4,862	2,299	4,095
Dedicated video memory (MB)	512	2,048	512	3,072
System video memory (MB)	0	0	0	0
Shared system memory (MB)	1,790	2,814	1,787	1,023
Resolution	1,280 x 1,024 x 32 bit	1,280 x 1,024 x 32 bit	1,280 x 1,024 x 32 bit	1,280 x 1,024 x 32 bit
Driver	NVIDIA 8.16.11.9175 (12/04/2009)	NVIDIA 8.17.11.9810 (06/14/2010)	ATI Technologies Inc. 8.784.1.0 (11/23/2010)	NVIDIA 8.17.12.5935 (08/08/2010)

System	Dell Precision T3500 (Intel Xeon W3503)	Dell Precision T7500 (Intel Xeon X5690)	HP Pavilion Elite HPE-500 (AMD Athlon II X4)	HP Pavilion Elite HPE-560z (AMD Phenom II)
Sound card/subsystem				
Vendor and model number	SoundMAX Integrated Digital High Definition Audio	SoundMAX Integrated Digital High Definition Audio	Realtek High Definition Audio	Creative Sound Blaster X-fi
Driver	Analog Devices 6.10.2.7250 (04/23/2009)	Analog Devices 6.10.2.7250 (04/23/2009)	Realtek Semiconductor Corp. 6.0.1.6196 (09/07/2010)	Creative 6.0.1.1325 (03/05/2010)
Ethernet				
Vendor and model number	Broadcom NetXtreme 57xx Gigabit	Broadcom NetXtreme 57xx Gigabit	Realtek PCIe GBE Family	Realtek PCIe GBE Family
Driver	Broadcom 14.0.0.7 (02/09/2010)	Broadcom 14.0.0.7 (02/09/2010)	Realtek 7.26.902.2010 (09/02/2010)	Realtek 7.26.902.2010 (09/02/2010)
Optical drive(s)				
Vendor and model number	Samsung TS-H653G/DEWHW	PLDS DH-16ABS	HP DH16ABLH	HP BDDVDRW CH20L
Type	CD/DVD-RW	CD/DVD-RW	CD/DVD-RW	BD-ROM
USB ports				
Number	8	8	8	8
Type	2.0	2.0	2.0	2.0
Other	eSATA	eSATA, 2 x 1394	Media Card Reader, 1394	Media Card Reader, 1394
Monitor				
LCD type	Optiquest® Q7	Optiquest Q7	Optiquest Q7	Optiquest Q7
Screen size (inches)	17	17	17	17
Refresh rate (Hz)	60	60	60	60

Figure 11: Configuration information for the four test systems.

APPENDIX B - TEST METHODOLOGY

Note: We ran each test three times, and report the results of the median run.

Setting up the test workload

We used a specific test workload for four of five test cases (see Appendix D). Before running the test on a system image, we copied the workload to both the system itself and to a target system. While the workload is the same for four test cases, we gave the workload folder a unique name for each test case. We describe the initial setup of the test workload below. When applicable, we include steps for renaming the test workload in the setup for the specific test case.

Setting up the test workload on the test system

1. Reset the system to the base image.
2. Copy the Corpus workload folder to the Documents folder (Windows 7, Windows Vista) or the My Documents folder (Windows XP). Note: For simplicity, we will refer to this folder only as the Documents folder throughout this report.

Setting up the test workload on the target system

1. Copy the Corpus folder to the target system.
2. Rename the Corpus folder to `openfiles2`

Opening Microsoft Office files (local HDD)

This test requires a stopwatch. We used the following test documents:

- TwoCities.docx 496 KB (507,904 bytes)
- Supply Requisition Form2.xlsx 820 KB (839,680 bytes)
- Welcome!.pptx 352 KB (360,448 bytes)

Setting up the test

1. Rename the Corpus folder to `openfiles1`
2. Reboot the system.
3. Allow the system to idle for 3 minutes before running the test.

Running the test

1. Open the openfiles1 folder.
2. Click once on the TwoCities.docx file to highlight the file.
3. Simultaneously press Enter to open the test document and start the timer.
4. Stop the timer when the document appears.
5. Close Word.
6. Wait 30 seconds.
7. Click the Supply Requisition Form2.xlsx file once to highlight the file.
8. Simultaneously press Enter to open the test spreadsheet and start the timer.
9. Stop the timer when the workbook appears.
10. Close Excel.

11. Wait 30 seconds.
12. Click the Welcome!.pptx file once to highlight the file.
13. Simultaneously press Enter to open the test slide deck and start the timer.
14. Stop the timer when the first slide appears.
15. Close PowerPoint.
16. Repeat steps 2 through 15 two times, and report the median.
17. Close the openfiles1 folder.

Opening Microsoft Office files (over a network using a wired connection)

This test requires a target system on the network and a stopwatch. We used the following test documents:

- TwoCities.docx 496 KB (507,904 bytes)
- Supply Requisition Form2.xlsx 820 KB (839,680 bytes)
- Welcome!.pptx 352 KB (360,448 bytes)

Note: We installed Windows 7 Ultimate (32-bit) on the target system.

Setting up the test

1. Disable the wireless network connection on the test system.
2. Verify that the wired network connection works properly.
    a. Open the openfiles2 folder on the test system.
    b. Close the folder.
3. Reboot the system.
4. Allow the system to idle for 3 minutes before running the test.

Running the test

1. Browse to the target system on the network using the test system's wired network connection, and open the openfiles2 folder.
2. Click the TwoCities.docx file once to highlight the file.
3. Simultaneously press Enter to open the test document and start the timer.
4. Stop the timer when the document appears.
5. Close Word.
6. Wait 30 seconds.
7. Click the Supply Requisition Form2.xlsx file once to highlight the file.
8. Simultaneously press Enter to open the test spreadsheet and start the timer.
9. Stop the timer when the workbook appears.
10. Close Excel.
11. Wait 30 seconds.
12. Click the Welcome!.pptx file once to highlight the file.
13. Simultaneously press Enter to open the test slide deck and start the timer.
14. Stop the timer when the first slide appears.
15. Close PowerPoint.
16. Repeat steps 2 through 15 two times, and report the median.

17. Close the openfiles2 folder.

Installing/re-inserting a USB drive

This test requires a stopwatch, a 1GB PNY USB flash drive, and a 1GB Kingston Traveler USB flash drive.

Setting up the test

1. Copy the test.mp3 file from the Corpus folder to the PNY USB flash drive.
2. Copy the test.mp3 file from the Corpus folder to the Kingston USB flash drive.
3. Copy the 32-bit decay.exe device driver removal tool to the hard drive (e.g., C:\decay.exe).
4. Run the decay.exe tool.
    a. Open an administrative command prompt.
        i. In Windows 7 and Windows Vista, click the Start button, type `cmd` in Start Search, and press Ctrl+Shift+Enter.
        ii. In Windows XP, click the Start button, click Run, type `cmd` and press Enter.
    b. Type `cd C:\` and press Enter.
    c. Type `decay.exe -l` and press Enter to view drivers installed by the two USB flash drives.
    d. Type `decay.exe` and press Enter to run the tool and remove these device drivers.
    e. Type `decay.exe -l` and press Enter to confirm that the tool removed the USB device drivers.
5. Reboot the system.
6. Allow the system to idle for 3 minutes before running the test.

Running the test

1. Simultaneously insert the PNY USB flash drive into USB port #1 and start the timer.
2. Stop the timer when the AutoPlay menu for the USB flash drive appears on the workstation.
3. After the USB device driver software installs successfully, remove the USB flash drive using the Safely Remove Hardware tool.
4. Wait 30 seconds.
5. Simultaneously insert the PNY USB flash drive into USB port #2 and start the timer.
6. Stop the timer when the AutoPlay menu for the USB flash drive appears on the workstation.
7. Remove the USB flash drive using the Safely Remove Hardware tool.
8. Wait 30 seconds.
9. Simultaneously insert the Kingston USB flash drive into USB port #1 and start the timer.
10. Stop the timer when the AutoPlay menu for the USB flash drive appears on the workstation.
11. After the USB device driver software installs successfully, remove the USB flash drive using the Safely Remove Hardware tool.
12. Wait 30 seconds.
13. Simultaneously insert the Kingston USB flash drive into USB port #2 and start the timer.
14. Stop the timer when the AutoPlay menu for the USB flash drive appears on the workstation.
15. Remove the USB flash drive using the Safely Remove Hardware tool.
16. Run the decay.exe tool.
    a. Open an administrative command prompt.
        i. In Windows 7 and Windows Vista, click the Start button, type `cmd` in Start Search, and press Ctrl+Shift+Enter.

ii. In Windows XP, click the Start button, click Run, type `cmd` and press Enter.

b. Type `cd C:\` and press Enter.

c. Type `decay.exe -l` and press Enter to view drivers installed by the two USB flash drives.

d. Type `decay.exe` and press Enter to run the tool and remove these device drivers.

e. Type `decay.exe -l` and press Enter to confirm that the tool removed the USB device drivers.

17. Repeat steps 1 through 16 two times, and report the median.

Copying files

This test requires a stopwatch, a 1GB Kingston Traveler USB flash drive, and the following workload:

- Corpus: 426 MB (446,697,472 bytes)

Setting up the test

1. Rename the openfiles1 folder to `copyfileslocal1`
2. Right-click the copyfileslocal1 folder, and select Copy.
3. Right-click the Document folder, and select Paste.
4. Rename the new folder to `copyfilesusb1`
5. Create two new output folders in the in Documents folder (e.g., `testouta1` and `testoutb1`).
6. Insert the USB flash drive, and create one output folder on the USB drive (e.g., E:\`testusbout1`).
7. Remove the USB flash drive using the Safely Remove Hardware tool.
8. Reboot the system.
9. Allow the system to idle for 3 minutes before running the test.

Running the test

1. Open the copyfileslocal1 workload folder in the Documents folder.
2. Press Ctrl+A to select all files, right-click the files, and select Copy.
3. Open the testouta1 folder.
4. Right-click the testouta1 folder.
5. Simultaneously select Paste and start the timer.
6. Stop the timer when the copy operation is complete, as indicated by the disappearance of the copy status bar.
7. Delete the testouta1 folder from the Documents folder and empty the Recycle Bin.
8. Insert the USB flash drive into a USB port.
9. Open the copyfilesusb1 workload folder in the Documents folder.
10. Press Ctrl+A to select all files, right-click the files, and select Copy.
11. Open the testusbout1 folder on the USB flash drive.
12. Right-click the testusbout1 folder.
13. Simultaneously select Paste and start the timer.
14. Stop the timer when the copy operation is complete, as indicated by the disappearance of the copy status bar.
15. Rename the testusbout1 folder to `testusbin1` and remove the USB flash drive using the Safely Remove Hardware tool.
16. Re-insert the USB flash drive into the same USB port.
17. Open the testusbin1 folder.

18. Press Ctrl+A to select all files, right-click the files, and select Copy.
19. Open the testoutb1 folder in the Documents folder.
20. Right-click the testoutb1 folder.
21. Simultaneously select Paste and start the timer.
22. Stop the timer when the copy operation is complete, as indicated by the disappearance of the copy status bar.
23. Repeat steps 1 through 22 two more times, using the following steps to set up the test for each subsequent run.
    a. Delete the testusbin1 folder from the USB flash drive.
    b. Create a new output folder with a different unique name on the USB drive (e.g., E:\`testusbout2`).
    c. Remove the USB flash drive using the Safely Remove Hardware tool.
    d. Delete the testoutb1 folder from the Documents folder and empty the Recycle Bin.
    e. Create two new output folders with unique names in the Documents folder (e.g., `testouta2` and `testoutb2`).
    f. Rename both the copyfileslocal1 and copyfilesusb2 workloads to unique names (e.g., `copyfileslocal2` and `copyfilesusb2`).

Boot experience tests

Cold boot experience

This test requires a stopwatch with multiple timers.

Setting up the test

1. Reset the system to the base test image.

Running the test

1. Boot the system.
2. Shut down the system, and wait 3 minutes.
3. Simultaneously start the timer and boot the system.
4. Stop timer 1 when the taskbar appears.
5. Immediately after the taskbar appears, click once on the test Word document on the workstation and then press Enter to open the document.
6. Stop timer 2 when the word count for the document appears in the bottom left of the task pane.
7. Stop timer 3 when the disk LED stops flashing.
8. Wait 3 minutes before shutting the system down.
9. Repeat steps 3 through 8 two more times.

Trained boot experience

This test requires a stopwatch with multiple timers. This test requires no setup.

Running the test

1. Simultaneously start the timer and boot the system.
2. Stop timer 1 when the taskbar appears.

3. Immediately after the taskbar appears, click once on the test Word document on the workstation and then press Enter to open the document.
4. Stop timer 2 when the word count for the document appears in the bottom left of the task pane.
5. Stop timer 3 when the disk LED stops flashing.
6. Wait 3 minutes before shutting the system down.
7. Repeat steps 1 through 6 two more times.

Boot experience with Outlook 2007

This test requires a stopwatch. This test requires no setup.

Running the test

1. Boot the system.
2. Launch Outlook.
3. Shut down the system, and wait 3 minutes.
4. Boot the system.
5. Simultaneously launch Outlook and start the timer.
6. Stop the timer when the system is online with Microsoft Exchange, as indicated by the status bar in Outlook 2007.
7. Wait 3 minutes before shutting the system down.
8. Repeat steps 4 through 7 two more times, but do not shut down the system after the third timed run.

Trained boot experience with Outlook 2007

This test requires a stopwatch. This test requires no setup.

Running the test

1. Boot the system.
2. Simultaneously launch Outlook and start the timer.
3. Stop the timer when the system is online with Microsoft Exchange, as indicated by the status bar in Outlook 2007.
4. Wait 3 minutes before shutting the system down. Repeat steps 1 through 4 two more times.

Shutdown experience tests

Shutdown experience

This test requires a stopwatch. This test requires no setup.

Running the test

1. Boot the system.
2. Wait 2 minutes.
3. Shut down the system: Start→Turn Off Computer→Shut Down (Windows XP), Start→Shut Down (Windows Vista, Windows 7).
4. Simultaneously start the timer and select Shut Down.
5. Stop the timer when the hard drive LED turns off.
6. Repeat steps 1 through 5 two more times.

Shutdown experience with non-responsive applications

This test requires a stopwatch. Microsoft provided the script to simulate non-responsive applications on shutdown.

Setting up the test

1. Place the script file folder on the workstation of the machine under test.
2. Double-click the script folder.
3. Create a shortcut on the workstation to the UserShutdownWithApps batch file by right-clicking the UserShutdownWithApps batch file and selecting Send to→Workstation (Create Shortcut).
4. Shut down the system.

Running the test

1. Boot the system.
2. Wait 2 minutes.
3. Launch the test script that simulates non-responsive applications.
4. Shut down the system: Start→Turn Off Computer→Shut Down (Windows XP), Start→Shut Down (Windows Vista, Windows 7).
5. Simultaneously start the timer and select Shut Down.
6. When Windows displays a shutdown dialog (in XP: End Now, Vista: Shutdown Now, Windows 7: Force Shutdown), press Enter.
7. Stop the timer when the hard drive LED turns off.
8. Repeat steps 1 through 7 two more times.

Hibernate experience tests

Cold hibernate experience

This test requires a stopwatch. This test requires no setup.

Running the test

1. Boot the system.
2. Put the system into hibernate mode: Start→Hibernate.
3. Select Hibernate.
4. Press the power button to resume from hibernate mode.
5. Shut down the system.
6. Boot the system.
7. Wait 5 minutes.
8. Put the system in hibernate mode: Start→Hibernate.
9. Simultaneously start the timer and select Hibernate.
10. Stop the timer when the hard drive LED turns off.
11. Reset the timer.
12. Simultaneously start the timer and press the power button to resume from hibernate mode.
13. Stop the timer when the system displays the workstation.
14. Shut down the system.

15. Repeat steps 6 through 14 two more times, but do not shut down the system after the third timed run.

Warm hibernate experience

This test requires a stopwatch. This test requires no setup.

Running the test

1. Wait 1 minute.
2. Put the system in hibernate mode: Start→Hibernate.
3. Simultaneously start the timer and select Hibernate.
4. Stop the timer when the hard drive LED turns off.
5. Reset the timer.
6. Simultaneously start the timer and press the power button to resume from hibernate mode.
7. Stop the timer when the system displays the workstation.
8. Repeat steps 1 through 7 two more times.

Cold hibernate experience with applications open with Outlook

Microsoft provided the files we used in this test. This test requires a stopwatch. This test requires no setup.

Running the test

1. Reboot the system.
2. Launch Outlook, and connect to Exchange Server. A Connected to Microsoft Exchange message appears in the lower right corner of Outlook.
3. Launch PowerPoint, and open the test slide deck.
4. Launch Excel, and open the test spreadsheet.
5. Launch Word, and open the test document.
6. With the documents open, put the system in hibernate mode: Start→Hibernate.
7. Select Hibernate.
8. Press the power button to resume from hibernate mode.
9. Shut down the system.
10. Boot the system.
11. Launch Outlook, and connect to Exchange Server.
12. Launch PowerPoint, and open the test slide deck.
13. Launch Excel, and open the test spreadsheet.
14. Launch Word, and open the test document.
15. Select Outlook from the taskbar to bring it to the forefront.
16. Wait 5 minutes.
17. With the documents open, put the system in hibernate mode: Start→Hibernate.
18. Simultaneously start the timer and select Hibernate.
19. Stop the timer when the hard drive LED turns off.
20. Reset the timer.
21. Simultaneously start the timer and press the power button to resume from hibernate mode.

22. Stop the timer when the system successfully reconnects to Microsoft Exchange Server, as indicated by the connection status bar in Outlook 2007.
23. Shut down the system.
24. Repeat steps 10 through 23 two more times, but do not shut down the system after the third timed run.

Warm hibernate experience with applications open with Outlook

Microsoft provided the files we used in this test. This test requires a stopwatch. This test requires no setup.

Running the test

1. Wait 1 minute.
2. With the documents still open, put the system in hibernate mode: Start→Hibernate.
3. Simultaneously start the timer and select Hibernate.
4. Stop the timer when the hard drive LED turns off.
5. Reset the timer.
6. Simultaneously start the timer and press the power button to resume from hibernate mode.
7. Stop the timer when the system successfully reconnects to Microsoft Exchange Server, as indicated by the connection status bar in Outlook 2007.
8. Repeat steps 1 through 7 two more times.

Sleep experience tests

Cold sleep experience

This test requires a stopwatch. This test requires no setup.

Running the test

1. Reboot the system.
2. Put the system in sleep mode (Start→Sleep).
3. Press the power button to resume from sleep mode.
4. Shut down the system.
5. Boot the system.
6. Wait 5 minutes.
7. Put the system in sleep mode (Start→Sleep).
8. Simultaneously start the timer and select Sleep.
9. Stop the timer when the hard drive LED turns off.
10. Reset the timer.
11. Simultaneously start the timer and press the power button to resume from sleep mode.
12. Stop the timer when the system displays the workstation.
13. Shut down the system.
14. Repeat steps 5 through 13 two more times, but do not shut down the system after the third timed run.

Warm sleep experience

This test requires a stopwatch. This test requires no setup.

Running the test

1. Wait 1 minute.
2. Put the system in sleep mode (Start→Sleep).
3. Simultaneously start the timer and select Sleep.
4. Stop the timer when the hard drive LED turns off.
5. Reset the timer.
6. Simultaneously start the timer and press the power button to resume from sleep mode.
7. Stop the timer when the system displays the workstation.
8. Repeat steps 1 through 7 two more times.

Cold sleep experience with applications open with Outlook

Microsoft provided the files we used in this test. This test requires a stopwatch. This test requires no setup.

Running the test

1. Reboot the system.
2. Launch Outlook, and connect to Exchange Server. A Connected to Microsoft Exchange message appears in the lower right corner of Outlook.
3. Launch PowerPoint, and open the test slide deck.
4. Launch Excel, and open the test spreadsheet.
5. Launch Word, and open the test document.
6. Select Outlook from the taskbar to bring it to the forefront.
7. With the documents still open, put the system in sleep mode (Start→Sleep).
8. Select Sleep.
9. Press the power button to resume from sleep mode.
10. Shut down the system.
11. Boot the system.
12. Launch Outlook, and connect to Exchange Server.
13. Launch PowerPoint, and open the test slide deck.
14. Launch Excel, and open the test spreadsheet.
15. Launch Word, and open the test document.
16. Wait 5 minutes.
17. With the documents open, put the system in sleep mode (Start→Sleep).
18. Simultaneously start the timer and select Sleep.
19. Stop the timer when the hard drive LED turns off.
20. Reset the timer.
21. Simultaneously start the timer and press the power button to resume from sleep mode.
22. Stop the timer when the system successfully reconnects to Microsoft Exchange Server, as indicated by the connection status bar in Outlook 2007.
23. Shut down the system.
24. Repeat steps 11 through 23 two more times, but do not shut down after the third timed run.

Warm sleep experience with applications open with Outlook

Microsoft provided the files we used in this test. This test requires a stopwatch. This test requires no setup.

Running the test

1. Wait 1 minute.
2. With the documents still open, put the system in sleep mode (Start→Sleep).
3. Simultaneously start the timer and select Sleep.
4. Stop the timer when the hard drive LED turns off.
5. Reset the timer.
6. Simultaneously start the timer and press the power button to resume from sleep mode.
7. Stop the timer when the system successfully reconnects to Microsoft Exchange Server, as indicated by the connection status bar in Outlook 2007.
8. Repeat steps 1 through 7 two more times.
9. Shut down the system.

Warm sleep experience with applications open with Outlook

Microsoft provided the files we used in this test. This test requires a stopwatch. This test requires no setup.

Running the test

1. Wait 1 minute.
2. With the documents still open, put the system in sleep mode (Start→Sleep).
3. Simultaneously start the timer and select Sleep.
4. Stop the timer when the hard drive LED turns off.
5. Reset the timer.
6. Simultaneously start the timer and press the power button to resume from sleep mode.
7. Stop the timer when the system successfully reconnects to Windows Live Mail, as indicated by the connection status bar in Windows Live Mail.
8. Repeat steps 1 through 7 two more times.
9. Shut down the system.

APPENDIX C – DETAILED RESULTS

Figures 12 and 13 present the detailed test results for the systems.

Mid-range systems	Dell Precision T3500 (Intel Xeon W3503)			HP Pavilion Elite HPE-500 (AMD Athlon II)		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
Opening Microsoft Office files						
Opening local Word document	00:04.79	00:04.46	00:04.42	00:04.78	00:04.79	00:04.56
Opening local Excel spreadsheet	00:02.09	00:02.16	00:02.14	00:02.56	00:02.36	00:02.59
Opening local PowerPoint deck	00:01.36	00:01.34	00:01.25	00:02.65	00:02.76	00:02.66
Opening Word document - network	00:06.44	00:06.56	00:06.52	00:06.76	00:06.88	00:06.72
Opening Excel spreadsheet - network	00:02.72	00:02.87	00:02.85	00:02.79	00:02.83	00:02.81
Opening PowerPoint deck - network	00:02.26	00:02.27	00:02.33	00:02.18	00:02.21	00:02.17
USB flash drive tasks						
Installing PNY USB flash drive	00:05.56	00:04.02	00:03.53	00:05.07	00:06.12	00:05.75
Installing Kingston USB flash drive	00:03.03	00:03.03	00:02.94	00:02.55	00:02.60	00:02.49
Re-inserting PNY USB flash drive	00:02.77	00:02.67	00:02.84	00:02.53	00:02.44	00:02.56
Re-inserting Kingston USB flash drive	00:01.94	00:02.01	00:02.21	00:01.79	00:01.52	00:01.40
Copying files locally						
Copying files locally	00:15.25	00:15.46	00:15.65	00:14.34	00:15.14	00:15.24
Copying files to a USB flash drive	01:46.43	01:48.53	01:48.96	01:52.77	01:55.21	01:58.73
Copying files from a USB flash drive	00:29.91	00:30.06	00:30.11	00:32.15	00:32.16	00:32.52
Boot tasks						
Taskbar appears	00:36.06	00:35.65	00:36.56	00:36.57	00:36.64	00:35.43
Word document appears	00:51.57	00:52.64	00.53.48	00:54.16	00:52.90	00:52.65
Time to connect to Exchange Server after booting system	00:08.71	00:08.61	00:08.91	00:08.11	00:08.23	00:08.40
Hibernation tasks						
Cold hibernate experience						
Time to hibernate	00:13.08	00:13.62	00:13.78	00:19.92	00:19.95	00:19.79
Time to resume from hibernate	00:26.02	00:26.10	00:27.05	00:23.34	00:23.36	00:22.95
Warm hibernate experience						
Time to hibernate	00:12.53	00:12.67	00:12.40	00:16.93	00:17.32	00:16.82
Time to resume from hibernate	00:25.83	00:26.06	00:25.10	00:23.28	00:23.78	00:23.56
Cold hibernate experience with applications open						
Time to hibernate	00:16.95	00:16.84	00:16.57	00:23.08	00:23.84	00:23.34
Time to connect to Exchange Server after resume from hibernate	00:27.87	00:27.09	00:27.26	00:25.40	00:25.42	00:25.15
Warm hibernate experience with applications open						
Time to hibernate	00:15.27	00:15.00	00:15.81	00:21.30	00:20.96	00:20.92
Time to connect to Exchange Server after resume from hibernate	00:33.93	00:33.40	00:33.93	00:27.79	00:27.10	00:27.31

Mid-range systems	Dell Precision T3500 (Intel Xeon W3503)			HP Pavilion Elite HPE-500 (AMD Athlon II)		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
Sleep tasks						
Cold sleep experience						
Time to sleep	00:13.03	00:13.53	00:13.18	00:22.36	00:22.20	00:21.82
Time to resume from sleep	00:06.71	00:06.81	00:06.79	00:04.77	00:04.46	00:04.56
Warm sleep experience						
Time to sleep	00:08.90	00:08.56	00:.08.73	00:14.81	00:14.34	00:14.24
Time to resume from sleep	00:05.29	00:05.10	00:05.26	00:04.82	00:04.51	00:04.56
Cold sleep experience with applications open						
Time to sleep	00:15.37	00:15.78	00:15.65	00:23.40	00:24.09	00:23.17
Time to connect to Exchange Server after resume from sleep	00:05.07	00:05.25	00:05.32	00:05.83	00:05.98	00:05.92
Warm sleep experience with applications open						
Time to sleep	00:16.69	00:16.65	00:16.96	00:15.68	00:15.89	00:15.55
Time to connect to Exchange Server after resume from sleep	00:07.59	00:07.89	00:07.63	00:05.59	00:05.14	00:05.34
Shutdown						
Time to turn system off	00:10.90	00:10.93	00:10.98	00:12.36	00:12.63	00:12.01

Figure 12: System responsiveness results, in seconds, for the two mid-range workstation systems. Lower numbers are better.

High-end systems	Dell Precision T7500 (Intel Xeon X5690)			HP Pavilion Elite HPE-560z (AMD Phenom II)		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
Opening Microsoft Office files						
Opening local Word document	00:02.20	00:02.19	00:02.06	00:02.15	00:02.11	00:02.14
Opening local Excel spreadsheet	00:01.19	00:01.04	00:00.96	00:01.73	00:01.80	00:01.62
Opening local PowerPoint deck	00:00.76	00:00.72	00:00.70	00:01.28	00:01.37	00:01.36
Opening Word document - network	00:02.54	00:02.42	00:02.43	00:06.36	00:06.76	00:06.59
Opening Excel spreadsheet - network	00:01.30	00:01.33	00:01.35	00:02.88	00:02.73	00:02.87
Opening PowerPoint deck - network	00:00.94	00:00.94	00:00.90	00:01.79	00:01.98	00:01.87
USB flash drive tasks						
Installing PNY USB flash drive	00:02.97	00:02.87	00:02.88	00:11.06	00:10.34	00:10.45
Installing Kingston USB flash drive	00:02.70	00:02.56	00:02.68	00:02.54	00:02.61	00:02.56
Re-inserting PNY USB flash drive	00:02.40	00:02.57	00:02.62	00:08.80	00:08.73	00:08.71
Re-inserting Kingston USB flash drive	00:01.87	00:01.85	00:01.85	00:01.54	00:01.44	00:01.62
Copying files locally						
Copying files locally	00:05.11	00:04.55	00:05.11	00:06.20	00:06.47	00:06.59
Copying files to a USB flash drive	00:55.18	00:55.92	00:55.15	01:04.09	01:05.22	01:06.30
Copying files from a USB flash drive	00:18.21	00:18.56	00:18.43	00:27.23	00:28.36	00:28.25
Boot tasks						
Taskbar appears	00:37.96	00:38.90	00:38.17	00:33.70	00:31.39	00:32.66
Word document appears	00:41.24	00:41.06	00:41.94	00:52.18	00:51.38	00:49.41
Time to connect to Exchange Server after booting system	00:03.68	00:03.42	00:03.45	00:07.31	00:06.05	00:06.84
Hibernation tasks						
Cold hibernate experience						
Time to hibernate	00:10.27	00:09.99	00:10.12	00:15.67	00:16.04	00:16.23
Time to resume from hibernate	00:33.35	00:33.63	00:32.99	00:23.46	00:23.94	00:24.27
Warm hibernate experience						
Time to hibernate	00:09.66	00:09.56	00:09.72	00:14.40	00:18.52	00:16.09
Time to resume from hibernate	00:31.32	00:31.67	00:32.34	00:26.60	00:24.99	00:25.29
Cold hibernate experience with applications open						
Time to hibernate	00:12.45	00:11.98	00:11.96	00:20.80	00:20.33	00:19.81
Time to connect to Exchange Server after resume from hibernate	00:35.37	00:34.51	00:36.01	00:28.47	00:27.38	00:27.35
Warm hibernate experience with applications open						
Time to hibernate	00:11.71	00:11.76	00:11.62	00:18.44	00:21.62	00:22.41
Time to connect to Exchange Server after resume from hibernate	00:32.98	00:33.63	00:33.43	00:27.22	00:27.91	00:28.65
Sleep tasks						
Cold sleep experience						
Time to sleep	00:04.99	00:05.15	00:05.36	00:15.09	00:15.62	00:15.65
Time to resume from sleep	00:07.10	00:07.11	00:07.44	00:04.73	00:04.78	00:04.80

High-end systems	Dell Precision T7500 (Intel Xeon X5690)			HP Pavilion Elite HPE-560z (AMD Phenom II)		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
Warm sleep experience						
Time to sleep	00:03.29	00:03.23	00:03.06	00:12.10	00:12.89	00:13.03
Time to resume from sleep	00:07.12	00:07.03	00:07.30	00:04.75	00:04.53	00:04.42
Cold sleep experience with applications open						
Time to sleep	00:10.82	00:11.02	00:10.87	00:21.40	00:21.36	00:21.61
Time to connect to Exchange Server after resume from sleep	00:07.19	00:06.97	00:07.03	00:06.63	00:05.92	00:05.61
Warm sleep experience with applications open						
Time to sleep	00:10.88	00:10.61	00:10.93	00:19.77	00:20.07	00:19.72
Time to connect to Exchange Server after resume from sleep	00:07.21	00:07.40	00:07.13	00:04.85	00:04.50	00:05.02
Shutdown						
Time to turn system off	00:08.00	00:07.65	00:07.78	00:10.53	00:09.87	00:09.97

Figure 13: System responsiveness results, in seconds, for the two high-end workstation systems. Lower numbers are better.

APPENDIX D – CORPUS CONTENTS

The 426MB (446,697,762 bytes) test workload included the following files:

11/6/2005	7:14 PM	1,161,163	19th Century Asylum.JPG
9/3/2007	6:10 PM	14,239	2008 calendar10 (2).xlsx
9/3/2007	6:10 PM	14,239	2008 calendar10.xlsx
9/3/2007	11:35 PM	617,349	3boat-Jerome10 (2).docx
9/12/2007	12:57 AM	675,901	3boat-Jerome10 (2).pdf
9/12/2007	12:57 AM	1,071,399	3boat-Jerome10 (2).xps
9/3/2007	11:35 PM	617,349	3boat-Jerome10.docx
9/12/2007	12:57 AM	675,901	3boat-Jerome10.pdf
9/12/2007	12:57 AM	1,071,399	3boat-Jerome10.xps
9/9/2007	1:32 AM	11,947	Adjustable Meeting Agenda template1 (2).xlsx
9/9/2007	1:32 AM	11,947	Adjustable Meeting Agenda template1.xlsx
9/9/2007	2:01 AM	197,621	Adventure Works (2).pptx
9/9/2007	2:01 AM	197,621	Adventure Works.pptx
9/9/2007	1:18 AM	11,953	Agenda1 (2).xlsx
9/9/2007	1:18 AM	11,953	Agenda1.xlsx
9/3/2007	6:14 PM	11,968	Agenda10 (2).xlsx
9/3/2007	6:14 PM	11,968	Agenda10.xlsx
9/3/2007	5:58 PM	774,350	alice-carroll10 (2).docx
9/12/2007	12:56 AM	518,539	alice-carroll10 (2).pdf
9/12/2007	12:56 AM	629,597	alice-carroll10 (2).xps
9/3/2007	5:58 PM	774,350	alice-carroll10.docx
9/12/2007	12:56 AM	518,539	alice-carroll10.pdf
9/12/2007	12:56 AM	629,597	alice-carroll10.xps
7/28/2003	7:56 AM	70,144	Analysis (2).xls
7/28/2003	7:56 AM	70,144	Analysis.xls
9/16/2005	8:39 PM	1,074,183	Ancient christian stone marking Patrick's well.JPG
8/26/2005	5:12 PM	1,041,140	Art Gallery.JPG
9/10/2007	1:16 AM	26,694	Automation (2).rar
9/10/2007	1:16 AM	26,694	Automation.rar
12/19/2003	11:42 PM	16,896	bank24 (2).xls
12/19/2003	11:42 PM	16,896	bank24.xls
12/19/2003	11:42 PM	16,384	bank24temp (2).xls
12/19/2003	11:42 PM	16,384	bank24temp.xls
9/9/2007	1:13 AM	19,547	Bidder comparison worksheet and process1 (2).xlsx
9/9/2007	1:13 AM	19,547	Bidder comparison worksheet and process1.xlsx
9/3/2007	6:15 PM	24,480	Breakeven analysis10 (2).xlsx
9/3/2007	6:15 PM	24,480	Breakeven analysis10.xlsx
9/9/2005	4:22 PM	1,236,485	Bust of Collins.JPG
12/19/2003	11:42 PM	27,136	capbudget (2).xls
12/19/2003	11:42 PM	27,136	capbudget.xls
12/19/2003	11:42 PM	26,624	capbudgettemp (2).xls
12/19/2003	11:42 PM	26,624	capbudgettemp.xls

9/16/2005	8:38 PM	1,135,462	Christ Church 1038 AD.JPG
9/9/2007	12:16 AM	118,051	ChristmasCarol (2).docx
9/12/2007	12:56 AM	287,538	ChristmasCarol (2).pdf
9/12/2007	12:55 AM	507,684	ChristmasCarol (2).xps
9/9/2007	12:16 AM	118,051	ChristmasCarol.docx
9/12/2007	12:56 AM	287,538	ChristmasCarol.pdf
9/12/2007	12:55 AM	507,684	ChristmasCarol.xps
9/9/2005	4:21 PM	1,160,640	Church Altar-All Mosaic! (2).JPG
9/9/2005	4:21 PM	1,160,640	Church Altar-All Mosaic!.JPG
12/19/2003	11:42 PM	24,064	ciscoexpo (2).xls
12/19/2003	11:42 PM	24,064	ciscoexpo.xls
12/19/2003	11:43 PM	15,872	ciscoexpotemp (2).xls
12/19/2003	11:43 PM	15,872	ciscoexpotemp.xls
9/9/2005	4:21 PM	1,049,553	Clonakilty (2).JPG
9/9/2005	4:21 PM	1,049,553	Clonakilty.JPG
9/9/2007	2:03 AM	107,778	Communicating Bad News (2).pptx
9/9/2007	2:03 AM	107,778	Communicating Bad News.pptx
9/9/2007	2:23 AM	142,036	Company Handbook (2).pptx
9/9/2007	2:23 AM	142,036	Company Handbook.pptx
9/9/2007	2:24 AM	137,524	Company Meeting Title (2).pptx
9/9/2007	2:24 AM	137,524	Company Meeting Title.pptx
9/9/2007	2:09 AM	126,324	Company Meeting3 (2).pptx
9/9/2007	2:09 AM	126,324	Company Meeting3.pptx
9/9/2007	1:58 AM	252,618	Company Name (2).pptx
9/9/2007	1:58 AM	252,618	Company Name.pptx
9/9/2007	2:05 AM	340,381	Company Name2 (2).pptx
9/9/2007	2:05 AM	340,381	Company Name2.pptx
9/9/2007	2:18 AM	165,587	Company Name4 (2).pptx
9/9/2007	2:17 AM	165,587	Company Name4.pptx
9/9/2007	9:46 PM	1,467,429	conference (2).pptx
9/9/2007	9:46 PM	1,467,429	conference.pptx
9/11/2007	12:31 AM	1,468,617	conferenceA (2).pptx
9/11/2007	12:31 AM	1,468,617	conferenceA.pptx
9/11/2007	12:31 AM	1,468,621	conferenceC (2).pptx
9/11/2007	12:31 AM	1,468,621	conferenceC.pptx
9/11/2007	12:32 AM	1,468,505	conferenceD (2).pptx
9/11/2007	12:32 AM	1,468,505	conferenceD.pptx
9/11/2007	12:33 AM	1,468,329	conferenceE (2).pptx
9/11/2007	12:32 AM	1,468,329	conferenceE.pptx
9/9/2007	12:10 AM	448,701	ConnecticutYankee (2).docx
9/12/2007	12:53 AM	1,020,765	ConnecticutYankee (2).pdf
9/12/2007	12:53 AM	1,826,512	ConnecticutYankee (2).xps
9/9/2007	12:10 AM	448,701	ConnecticutYankee.docx
9/12/2007	12:53 AM	1,020,765	ConnecticutYankee.pdf
9/12/2007	12:53 AM	1,826,512	ConnecticutYankee.xps
9/3/2007	6:34 PM	1,342,932	copperfield10 (2).docx

9/3/2007	6:34 PM	1,342,932	copperfield10.docx
8/26/2005	5:12 PM	1,673,202	Crossing to UCC (2).JPG
8/26/2005	5:12 PM	1,673,202	Crossing to UCC.JPG
9/8/2007	8:41 PM	1,260,859	DavidCopperfield (2).docx
9/12/2007	12:58 AM	3,485,857	DavidCopperfield (2).pdf
9/8/2007	8:41 PM	1,260,859	DavidCopperfield.docx
9/12/2007	12:58 AM	3,485,857	DavidCopperfield.pdf
9/12/2007	12:59 AM	5,214,877	DavidCopperfield.xps
9/11/2007	1:30 AM	1,398,507	DavidCopperfieldA.docx
9/11/2007	1:31 AM	1,383,386	DavidCopperfieldB.docx
9/11/2007	1:32 AM	1,424,127	DavidCopperfieldC.docx
9/11/2007	1:33 AM	1,446,638	DavidCopperfieldD.docx
9/11/2007	1:34 AM	1,482,655	DavidCopperfieldE.docx
12/19/2003	11:42 PM	59,392	discretesim.xls
12/19/2003	11:43 PM	27,136	discretesimtemp.xls
9/8/2007	9:52 PM	1,343,812	DombeyandSon.docx
9/12/2007	12:41 AM	3,703,813	DombeyandSon.pdf
9/12/2007	12:55 AM	5,402,560	DombeyandSon.xps
9/11/2007	1:40 AM	1,596,493	DombeyandSonA.docx
9/11/2007	1:40 AM	1,594,242	DombeyandSonB.docx
9/11/2007	1:41 AM	1,566,559	DombeyandSonC.docx
9/11/2007	1:41 AM	1,581,002	DombeyandSonD.docx
9/11/2007	1:42 AM	1,495,818	DombeyandSonE.docx
9/16/2005	8:40 PM	1,334,598	Doorways of Cashel.JPG
9/9/2007	1:10 AM	26,103	Due diligence assessment model1.xlsx
8/26/2005	5:12 PM	1,235,942	Entering Campus.JPG
9/3/2007	6:39 PM	65,287	Excelfiles10.rar
9/3/2007	6:13 PM	15,249	Expense budget10.xlsx
12/19/2003	11:42 PM	13,824	exponentialdata.xls
12/19/2003	11:42 PM	51,200	fantasy2.xls
9/9/2007	1:57 AM	196,974	FINANCIAL PERFORMANCE.pptx
9/9/2007	2:22 AM	169,394	Financial Performance2.pptx
12/19/2003	11:42 PM	27,648	finmathsolver.xls
12/19/2003	11:42 PM	21,504	finmathsolvetemp.xls
9/5/2007	11:41 AM	48,776,192	Followup.pst
9/3/2007	6:12 PM	20,173	Forecasting report10.xlsx
10/1/2005	8:19 PM	1,277,141	Forest stream.JPG
12/19/2003	11:42 PM	13,824	fv.xls
12/19/2003	11:42 PM	13,824	fvtemp.xls
9/9/2007	10:55 AM	263,477	General Presentation.pptx
9/8/2007	10:24 PM	567,592	gildedage.docx
9/9/2007	1:51 PM	33,996	GoingIntoSociety.docx
9/12/2007	2:52 AM	78,803	GoingIntoSociety.pdf
9/12/2007	2:52 AM	126,330	GoingIntoSociety.xps
9/3/2007	11:32 PM	704,846	Grimm10.docx
9/12/2007	12:52 AM	1,436,779	Grimm10.pdf

9/9/2007	2:01 PM	79,114	Hadleyburg.docx
9/12/2007	2:53 AM	224,473	Hadleyburg.pdf
9/12/2007	2:53 AM	329,705	Hadleyburg.xps
9/9/2007	1:35 PM	398,837	HardTimes.docx
9/12/2007	2:51 AM	1,076,448	HardTimes.pdf
9/12/2007	2:51 AM	1,610,487	HardTimes.xps
9/3/2007	11:28 PM	517,037	Holmes10.docx
9/12/2007	12:52 AM	1,402,971	Holmes10.pdf
7/28/2003	7:56 AM	23,040	Home Price Estimator.xls
9/3/2007	11:27 PM	832,842	Homer10.docx
9/12/2007	12:51 AM	1,856,367	Homer10.pdf
10/1/2005	8:18 PM	1,386,326	House grounds.JPG
9/9/2007	1:23 PM	381,257	HuckFinn.docx
9/12/2007	2:50 AM	843,079	HuckFinn.pdf
9/12/2007	2:48 AM	1,464,587	HuckFinn.xps
9/9/2007	1:04 PM	735,024	InnocentsAbroad.docx
9/9/2007	9:49 PM	1,812,449	Introducing PowerPoint 2007.pptx
9/11/2007	12:34 AM	1,812,476	Introducing PowerPoint 2007A.pptx
9/11/2007	12:34 AM	1,812,480	Introducing PowerPoint 2007B.pptx
9/11/2007	12:35 AM	1,812,479	Introducing PowerPoint 2007C.pptx
9/11/2007	12:35 AM	1,812,488	Introducing PowerPoint 2007D.pptx
9/11/2007	12:35 AM	1,812,481	Introducing PowerPoint 2007E.pptx
9/3/2007	6:11 PM	19,198	Inventory-analysis10.xlsx
9/3/2007	5:35 PM	1,346,405	Ireland descriptions10.pptx
9/11/2007	12:37 AM	1,346,414	Ireland descriptions10A.pptx
9/11/2007	12:37 AM	1,337,272	Ireland descriptions10B.pptx
9/11/2007	12:37 AM	1,534,168	Ireland descriptions10C.pptx
9/11/2007	12:37 AM	1,067,473	Ireland descriptions10D.pptx
9/11/2007	12:38 AM	1,097,490	Ireland descriptions10E.pptx
9/3/2007	5:32 PM	12,967,947	Ireland presentation10.pptx
9/11/2007	12:40 AM	13,000,486	Ireland presentation10a.pptx
9/11/2007	1:37 PM	6,781,038	Ireland6.zip
9/11/2007	1:38 PM	8,821,083	Ireland7.zip
9/16/2005	8:39 PM	1,503,203	Irish country lane.JPG
11/6/2005	7:15 PM	1,479,824	Killarney waterfall.JPG
9/11/2007	1:56 AM	7,096,706	leonardo.zip
9/11/2007	1:46 AM	1,155,760	Leonardo10.docx
9/12/2007	12:50 AM	3,245,463	Leonardo10.pdf
9/11/2007	1:47 AM	1,152,103	Leonardo10A.docx
9/11/2007	1:48 AM	1,170,931	Leonardo10B.docx
9/11/2007	1:48 AM	1,156,831	Leonardo10C.docx
9/11/2007	1:49 AM	1,333,853	Leonardo10D.docx
9/11/2007	1:50 AM	1,153,155	Leonardo10E.docx
9/9/2007	12:40 PM	544,715	LifeonMississippi.docx
9/12/2007	12:49 AM	1,343,595	LifeonMississippi.pdf
9/9/2007	2:00 PM	1,278,447	LittleDorrit.docx

9/12/2007	12:48 AM	3,339,544	LittleDorrit.pdf
9/11/2007	1:51 AM	1,024,556	LittleDorritA.docx
9/11/2007	1:51 AM	1,008,950	LittleDorritB.docx
9/11/2007	1:51 AM	1,009,241	LittleDorritC.docx
9/11/2007	1:52 AM	1,019,386	LittleDorritD.docx
9/11/2007	1:52 AM	1,018,168	LittleDorritE.docx
11/6/2005	7:13 PM	1,109,309	Looking East.JPG
11/4/2002	12:48 PM	20,480	LookupFunctions.xls
10/1/2005	8:19 PM	1,345,552	Lovely foliage.JPG
9/16/2005	8:36 PM	1,263,229	Main Gate Trinity.JPG
9/9/2007	2:08 AM	92,724	Marketing Plan.pptx
9/9/2007	2:44 AM	1,280,593	MartinChuzzlewit.docx
9/12/2007	12:47 AM	3,304,603	MartinChuzzlewit.pdf
9/9/2007	4:07 PM	1,280,678	MartinChuzzlewit.rar
9/11/2007	1:53 AM	1,018,128	MartinChuzzlewitA.docx
9/11/2007	1:53 AM	1,020,651	MartinChuzzlewitB.docx
9/11/2007	1:54 AM	1,017,247	MartinChuzzlewitC.docx
9/11/2007	1:54 AM	1,023,558	MartinChuzzlewitD.docx
9/11/2007	1:55 AM	1,020,227	MartinChuzzlewitE.docx
9/3/2007	11:47 PM	614,882	Math - Dudeney10.docx
9/11/2007	12:42 AM	800,966	Microsoft© Office A.pptx
9/11/2007	12:43 AM	800,998	Microsoft© Office B.pptx
9/11/2007	12:43 AM	800,994	Microsoft© Office C.pptx
9/11/2007	12:44 AM	800,974	Microsoft© Office D.pptx
9/11/2007	12:44 AM	801,013	Microsoft© Office E.pptx
9/9/2007	10:59 AM	1,025,163	Microsoft© Office.pptx
9/9/2007	12:52 PM	948,893	Microsoft© Office10.pptx
9/9/2007	1:06 PM	416,471	Microsoft© Office11.pptx
9/9/2007	12:53 PM	818,133	Microsoft© Office12.pptx
9/9/2007	12:54 PM	969,801	Microsoft© Office13.pptx
9/9/2007	12:56 PM	969,806	Microsoft© Office14.pptx
9/9/2007	12:56 PM	956,565	Microsoft© Office15.pptx
9/9/2007	1:01 PM	839,836	Microsoft© Office16.pptx
9/9/2007	12:57 PM	1,561,643	Microsoft© Office17.pptx
9/11/2007	12:53 AM	1,561,260	Microsoft© Office17A.pptx
9/11/2007	12:54 AM	1,561,582	Microsoft© Office17B.pptx
9/11/2007	12:54 AM	1,561,564	Microsoft© Office17C.pptx
9/11/2007	12:55 AM	1,561,657	Microsoft© Office17D.pptx
9/11/2007	12:55 AM	1,561,617	Microsoft© Office17E.pptx
9/9/2007	12:58 PM	562,491	Microsoft© Office18.pptx
9/9/2007	2:07 PM	327,489	Microsoft© Office19.pptx
9/9/2007	1:21 PM	712,466	Microsoft© Office2.pptx
9/9/2007	12:59 PM	1,244,906	Microsoft© Office20.pptx
9/11/2007	12:56 AM	1,186,711	Microsoft© Office20A.pptx
9/11/2007	12:57 AM	1,186,722	Microsoft© Office20B.pptx
9/11/2007	12:57 AM	1,186,727	Microsoft© Office20C.pptx

9/11/2007	12:58 AM	1,186,726	Microsoft© Office20D.pptx
9/11/2007	12:58 AM	1,186,726	Microsoft© Office20E.pptx
9/9/2007	1:00 PM	949,022	Microsoft© Office21.pptx
9/9/2007	1:02 PM	981,825	Microsoft© Office22.pptx
9/11/2007	1:23 AM	1,200,628	Microsoft© Office23.pptx
9/11/2007	1:23 AM	1,200,641	Microsoft© Office23A.pptx
9/11/2007	1:24 AM	1,200,610	Microsoft© Office23B.pptx
9/11/2007	1:24 AM	1,200,622	Microsoft© Office23C.pptx
9/11/2007	1:25 AM	1,200,706	Microsoft© Office23D.pptx
9/11/2007	1:25 AM	1,200,671	Microsoft© Office23E.pptx
9/9/2007	1:03 PM	1,013,396	Microsoft© Office24.pptx
9/9/2007	1:06 PM	962,131	Microsoft© Office25.pptm
9/9/2007	11:00 AM	650,568	Microsoft© Office25.pptx
9/11/2007	12:28 AM	958,094	Microsoft© Office25A.pptx
9/11/2007	12:28 AM	958,084	Microsoft© Office25B.pptx
9/11/2007	12:28 AM	958,053	Microsoft© Office25C.pptx
9/11/2007	12:29 AM	958,053	Microsoft© Office25D.pptx
9/11/2007	12:29 AM	958,086	Microsoft© Office25E.pptx
9/9/2007	1:08 PM	1,145,214	Microsoft© Office26.pptm
9/9/2007	2:26 PM	428,891	Microsoft© Office26.pptx
9/11/2007	12:22 AM	1,141,348	Microsoft© Office26A.pptx
9/11/2007	12:23 AM	1,141,351	Microsoft© Office26B.pptx
9/11/2007	12:23 AM	1,141,370	Microsoft© Office26C.pptx
9/11/2007	12:23 AM	1,141,363	Microsoft© Office26D.pptx
9/11/2007	12:24 AM	1,141,355	Microsoft© Office26E.pptx
9/9/2007	1:09 PM	603,421	Microsoft© Office27.pptx
9/9/2007	1:09 PM	478,895	Microsoft© Office28.pptx
9/9/2007	1:10 PM	941,158	Microsoft© Office29.pptx
9/9/2007	12:50 PM	1,571,647	Microsoft© Office3.pptx
9/9/2007	1:11 PM	739,109	Microsoft© Office30.pptm
9/9/2007	2:25 PM	461,492	Microsoft© Office30.pptx
9/9/2007	1:12 PM	1,221,010	Microsoft© Office31.pptx
9/11/2007	1:26 AM	1,220,255	Microsoft© Office31A.pptx
9/11/2007	1:26 AM	1,220,277	Microsoft© Office31B.pptx
9/11/2007	1:26 AM	1,220,268	Microsoft© Office31C.pptx
9/11/2007	1:27 AM	1,220,272	Microsoft© Office31D.pptx
9/11/2007	1:27 AM	1,220,296	Microsoft© Office31E.pptx
9/11/2007	1:27 AM	1,220,319	Microsoft© Office31F.pptx
9/9/2007	1:13 PM	583,427	Microsoft© Office32.pptx
9/9/2007	1:16 PM	391,371	Microsoft© Office33.pptx
9/9/2007	1:21 PM	449,972	Microsoft© Office34.pptx
9/9/2007	1:22 PM	322,092	Microsoft© Office35.pptx
9/9/2007	1:28 PM	479,077	Microsoft© Office36.pptx
9/9/2007	1:28 PM	472,584	Microsoft© Office37.pptx
9/9/2007	1:29 PM	230,500	Microsoft© Office38.pptx
9/9/2007	1:30 PM	481,285	Microsoft© Office39.pptx

9/11/2007	12:45 AM	1,571,526	Microsoft© Office3A.pptx
9/11/2007	12:45 AM	1,571,508	Microsoft© Office3B.pptx
9/11/2007	12:46 AM	1,571,475	Microsoft© Office3C.pptx
9/11/2007	12:46 AM	1,571,476	Microsoft© Office3D.pptx
9/11/2007	12:47 AM	1,571,505	Microsoft© Office3E.pptx
9/9/2007	12:44 PM	969,628	Microsoft© Office4.pptx
9/9/2007	1:31 PM	698,766	Microsoft© Office40.pptx
9/9/2007	1:32 PM	515,699	Microsoft© Office41.pptx
9/9/2007	1:33 PM	393,466	Microsoft© Office42.pptx
9/9/2007	1:34 PM	355,726	Microsoft© Office43.pptx
9/9/2007	2:07 PM	389,387	Microsoft© Office44.pptx
9/9/2007	2:08 PM	390,223	Microsoft© Office45.pptx
9/9/2007	2:09 PM	740,630	Microsoft© Office46.pptx
9/9/2007	2:13 PM	341,546	Microsoft© Office47.pptx
9/9/2007	2:15 PM	635,972	Microsoft© Office48.pptx
9/9/2007	2:23 PM	556,818	Microsoft© Office49.pptx
9/9/2007	11:03 AM	498,391	Microsoft© Office5.pptx
9/9/2007	2:24 PM	695,362	Microsoft© Office50.pptx
9/9/2007	11:02 AM	1,015,401	Microsoft© Office51.pptx
9/9/2007	4:12 PM	428,908	Microsoft© Office52.pptx
9/9/2007	4:12 PM	350,753	Microsoft© Office53.pptx
9/9/2007	4:13 PM	976,384	Microsoft© Office54.ppt
9/9/2007	4:14 PM	314,015	Microsoft© Office54.pptx
9/11/2007	12:25 AM	554,598	Microsoft© Office54A.pptx
9/11/2007	12:25 AM	554,610	Microsoft© Office54B.pptx
9/11/2007	12:26 AM	554,612	Microsoft© Office54C.pptx
9/11/2007	12:26 AM	554,611	Microsoft© Office54D.pptx
9/11/2007	12:26 AM	554,610	Microsoft© Office54E.pptx
9/9/2007	5:48 PM	437,892	Microsoft© Office55.pptx
9/9/2007	5:49 PM	573,438	Microsoft© Office56.pptx
9/9/2007	8:49 PM	573,428	Microsoft© Office57.pptx
9/9/2007	8:50 PM	525,453	Microsoft© Office58.pptx
9/9/2007	9:21 PM	297,037	Microsoft© Office59.pptx
9/9/2007	11:16 AM	498,382	Microsoft© Office6.pptx
9/9/2007	9:22 PM	569,541	Microsoft© Office60.pptx
9/9/2007	9:25 PM	365,319	Microsoft© Office61.pptx
9/9/2007	9:26 PM	383,562	Microsoft© Office62.pptx
9/9/2007	9:26 PM	356,419	Microsoft© Office63.pptx
9/9/2007	9:27 PM	656,644	Microsoft© Office64.pptx
9/9/2007	9:28 PM	580,065	Microsoft© Office65.pptx
9/9/2007	9:31 PM	453,163	Microsoft© Office66.pptx
9/9/2007	9:31 PM	388,797	Microsoft© Office67.pptx
9/9/2007	9:32 PM	409,618	Microsoft© Office68.pptx
9/9/2007	9:34 PM	618,184	Microsoft© Office69.pptx
9/9/2007	12:43 PM	1,696,999	Microsoft© Office7.pptx
9/9/2007	9:35 PM	304,286	Microsoft© Office70.pptx

9/9/2007	9:36 PM	451,891	Microsoft© Office71.pptx
9/9/2007	9:37 PM	258,210	Microsoft© Office72.pptx
9/9/2007	9:37 PM	473,998	Microsoft© Office73.pptx
9/9/2007	9:38 PM	547,570	Microsoft© Office74.pptx
9/9/2007	9:39 PM	587,596	Microsoft© Office75.pptx
9/9/2007	9:40 PM	247,814	Microsoft© Office76.pptx
9/9/2007	9:40 PM	386,262	Microsoft© Office77.pptx
9/9/2007	9:41 PM	435,885	Microsoft© Office78.pptx
9/9/2007	9:42 PM	260,788	Microsoft© Office79.pptx
9/11/2007	12:48 AM	1,672,311	Microsoft© Office7A.pptx
9/11/2007	12:48 AM	1,672,332	Microsoft© Office7B.pptx
9/11/2007	12:49 AM	1,672,329	Microsoft© Office7C.pptx
9/11/2007	12:49 AM	1,672,323	Microsoft© Office7D.pptx
9/11/2007	12:50 AM	1,672,355	Microsoft© Office7E.pptx
9/9/2007	12:51 PM	1,464,915	Microsoft© Office8.pptx
9/9/2007	9:44 PM	349,939	Microsoft© Office80.pptx
9/9/2007	9:44 PM	298,069	Microsoft© Office81.pptx
9/9/2007	9:57 PM	635,975	Microsoft© Office82.pptx
9/9/2007	10:00 PM	451,882	Microsoft© Office83.pptx
9/12/2007	12:00 AM	1,465,093	Microsoft© Office8A.pptx
9/12/2007	12:38 AM	1,465,103	Microsoft© Office8B.pptx
9/12/2007	12:38 AM	1,465,058	Microsoft© Office8C.pptx
9/12/2007	12:39 AM	1,465,089	Microsoft© Office8D.pptx
9/12/2007	12:39 AM	1,465,168	Microsoft© Office8E.pptx
9/9/2007	12:51 PM	803,809	Microsoft© Office9.pptx
9/9/2007	4:07 PM	702,034	Microsoft© Office9.rar
9/9/2007	1:21 AM	69,239	MONDAY.docx
10/1/2005	8:20 PM	1,292,403	Mountain stream.JPG
10/1/2005	8:18 PM	1,263,306	Muckross House.JPG
9/9/2007	2:33 AM	161,083	MysteriousStranger.docx
12/19/2003	11:42 PM	92,160	NBA01_02.xls
12/19/2003	11:42 PM	136,704	nba02_03.xls
12/19/2003	11:42 PM	29,184	nfl01.xls
12/19/2003	11:42 PM	68,096	NFL2002ratings.xls
12/19/2003	11:42 PM	216,576	nfl2002temp.xls
9/9/2007	3:55 PM	1,250,320	NicholasNickleby.docx
12/19/2003	11:42 PM	59,392	normalsim.xls
12/19/2003	11:43 PM	27,136	normalsimtemp.xls
9/9/2007	2:30 AM	828,326	OldCuriosityShop.docx
9/9/2007	4:07 PM	827,783	OldCuriosityShop.rar
9/9/2007	2:15 AM	625,145	OliverTwist.docx
9/3/2007	11:23 PM	417,426	Organization Chart10.pptx
9/9/2007	1:40 AM	1,230,430	OurMutualFriend.docx
9/16/2005	8:39 PM	1,045,606	Out to the valley of Cashel.JPG
7/28/2003	7:56 AM	26,624	Pacific Guitar Sales.xls
9/3/2007	6:36 PM	201,756	Pan10.docx

9/9/2007	12:42 AM	1,195,872	PickWickPapers.docx
9/9/2007	1:59 AM	177,375	Pitchbook.pptx
9/3/2007	6:18 PM	357,410	Plant10.pptx
12/19/2003	11:42 PM	15,872	pmt.xls
12/19/2003	11:42 PM	13,824	pmttemp.xls
9/3/2007	5:48 PM	14,454,815	PPTfiles10.rar
9/9/2007	10:57 AM	42,444	Presentation1.pptx
9/3/2007	6:19 PM	136,034	Presentation10.pptx
9/9/2007	9:50 PM	317,684	presentation2.pptx
9/9/2007	9:51 PM	74,504	presentation3.pptx
9/9/2007	9:51 PM	134,559	Presentation4.pptx
9/9/2007	9:52 PM	53,903	Presentation5.pptx
12/19/2003	11:42 PM	16,384	pressdata.xls
9/9/2007	12:32 AM	277,232	PrinceandPauper.docx
9/3/2007	5:33 PM	144,246	Process diagram10.pptx
12/19/2003	11:42 PM	28,160	prodmix.xls
12/19/2003	11:42 PM	26,112	prodmixtemp.xls
9/9/2007	2:11 AM	87,243	Product Name.pptx
9/9/2007	2:21 AM	300,846	Product Name5.pptx
9/9/2007	2:00 AM	283,493	Product Name].pptx
9/3/2007	6:10 PM	18,598	Project compare10.xlsx
9/9/2007	2:07 AM	206,208	Project Overview.pptx
9/9/2007	1:53 AM	11,852	Purchase order with sales tax1.xlsx
9/9/2007	1:49 AM	16,460	Purchase order(2)1.xlsx
9/9/2007	1:50 AM	15,854	Purchase order(3)1.xlsx
9/9/2007	1:51 AM	15,734	Purchase order(4)1.xlsx
9/9/2007	1:48 AM	21,972	PURCHASE ORDER.docx
9/3/2007	6:16 PM	15,819	Purchase order10.xlsx
12/19/2003	11:42 PM	13,824	PV.xls
12/19/2003	11:42 PM	13,824	PVtemp.xls
9/9/2007	2:13 AM	75,931	Quarterly Results and.pptx
12/19/2003	11:42 PM	41,984	randdemo.xls
12/19/2003	11:43 PM	27,136	randdemotemp.xls
9/9/2007	2:18 AM	76,882	Recommending a Strategy.pptx
12/19/2003	11:42 PM	17,920	ReorderPoint_Backorder.xls
12/19/2003	11:42 PM	17,920	ReorderPoint_Lostsales.xls
9/9/2007	2:23 AM	122,701	Reporting Progress or Status.pptx
9/9/2007	2:06 AM	161,158	Return on Investment.pptx
10/1/2005	8:19 PM	1,288,715	Ring of Kerry.JPG
11/5/2005	6:39 PM	1,070,887	River Lee rising.JPG
11/6/2005	7:13 PM	1,109,309	River Rising.JPG
9/9/2007	2:27 PM	632,401	RoughingIt.docx
9/11/2007	12:03 AM	45,764	s1-s10.rar
12/19/2003	11:42 PM	13,824	s10_1.xls
12/19/2003	11:42 PM	13,824	s10_10.xls
12/19/2003	11:42 PM	13,824	s10_2.xls

12/19/2003	11:42 PM	15,872	s10_3.xls
12/19/2003	11:42 PM	13,824	s10_4.xls
12/19/2003	11:42 PM	13,824	s10_5.xls
12/19/2003	11:42 PM	14,336	s10_6.xls
12/19/2003	11:42 PM	97,280	S10_7.xls
12/19/2003	11:42 PM	97,280	s10_8.xls
12/19/2003	11:42 PM	13,824	s10_9.xls
9/11/2007	12:04 AM	10,898	s24.rar
12/19/2003	11:42 PM	13,824	s24_1.xls
12/19/2003	11:42 PM	13,824	s24_2.xls
12/19/2003	11:42 PM	13,824	s24_3.xls
12/19/2003	11:42 PM	13,824	s24_4.xls
12/19/2003	11:42 PM	13,824	s24_5.xls
12/19/2003	11:42 PM	13,824	s24_6.xls
12/19/2003	11:42 PM	13,824	s24_7.xls
9/11/2007	12:04 AM	11,542	s25.zip
12/19/2003	11:42 PM	14,848	s25_1.xls
12/19/2003	11:42 PM	15,360	s25_2.xls
12/19/2003	11:42 PM	14,848	s25_3.xls
12/19/2003	11:42 PM	14,848	s25_4.xls
12/19/2003	11:42 PM	15,360	s25_5.xls
9/11/2007	12:05 AM	12,276	s26.zip
12/19/2003	11:42 PM	16,384	s26_1.xls
12/19/2003	11:42 PM	16,896	s26_2.xls
12/19/2003	11:42 PM	19,968	s26_3.xls
12/19/2003	11:42 PM	15,360	s26_4.xls
12/19/2003	11:42 PM	16,896	s27_1.xls
12/19/2003	11:42 PM	17,920	s27_2.xls
12/19/2003	11:42 PM	16,896	s27_3.xls
12/19/2003	11:42 PM	15,360	s27_4.xls
12/19/2003	11:42 PM	29,696	s28_1.xls
12/19/2003	11:42 PM	17,408	s28_2.xls
12/19/2003	11:42 PM	23,552	s29_1.xls
12/19/2003	11:42 PM	23,552	s29_2.xls
12/19/2003	11:42 PM	16,384	s29_3.xls
12/19/2003	11:42 PM	26,112	s29_4.xls
12/19/2003	11:42 PM	15,872	s29_5.xls
12/19/2003	11:42 PM	264,192	S30_1.xls
12/19/2003	11:42 PM	259,584	s30_2.xls
12/19/2003	11:42 PM	56,832	s30_3.xls
12/19/2003	11:42 PM	13,824	s30_4.xls
12/19/2003	11:42 PM	13,824	s30_5.xls
12/19/2003	11:42 PM	22,016	S42problems1thru4.xls
12/19/2003	11:42 PM	21,504	S42problems1thru5.xls
9/11/2007	12:06 AM	149,171	s58.zip
12/19/2003	11:42 PM	404,480	s58_1.xls

12/19/2003	11:42 PM	207,360	s58_2.xls
12/19/2003	11:42 PM	17,408	s66_1.xls
12/19/2003	11:42 PM	16,896	s66_2.xls
12/19/2003	11:42 PM	13,824	s66_3.xls
9/3/2007	6:20 PM	30,418	Sales effectiveness.xlsx
9/9/2007	1:52 AM	15,474	Sales order1.xlsx
9/9/2007	2:20 AM	164,904	Sales proposal.pptx
9/9/2007	2:17 AM	54,168	Sales Training.pptx
9/9/2007	9:58 PM	54,185	Sales Training2.pptx
9/9/2007	10:02 PM	48,145	Sales Training3.pptx
1/24/2008	10:26 AM	109	Search
1/24/2008	12:21 PM	0	SearchCorpus.txt
9/9/2007	2:12 AM	68,502	Selling a Product or Service.pptx
12/19/2003	11:42 PM	18,944	ServiceLevelReorder.xls
9/9/2007	1:46 AM	12,139	Software Inventory1.xlsx
9/9/2007	9:55 PM	68,590	Staff Training.pptx
7/28/2003	7:56 AM	150,016	Staff.xls
7/28/2003	7:56 AM	142,336	Staff2.xls
9/3/2007	5:31 PM	139,054	Status charts10.pptx
11/6/2005	7:15 PM	1,744,412	Stone path.JPG
9/11/2007	12:15 AM	1,741,369	Stone path.zip
11/6/2005	7:15 PM	1,752,998	Stone staircase.JPG
9/11/2007	12:18 AM	837,626	Supply Requisition Form2.xlsx
9/11/2007	12:18 AM	838,128	Supply Requisition Form3.xlsx
9/11/2007	12:19 AM	837,886	Supply Requisition Form4.xlsx
9/11/2007	12:20 AM	837,884	Supply Requisition Form5.xlsx
1/24/2008	10:20 AM	1,463,296	Test methodology.doc
1/16/2000	5:48 PM	3,941,355	test.mp3
9/9/2007	9:56 PM	90,037	Title of Training Presentation.pptx
9/9/2007	10:01 PM	58,226	Title of Training Presentation2.pptx
9/9/2007	12:29 AM	281,104	TomSawyer.docx
9/9/2007	12:27 AM	124,045	TomSawyerAbroad.docx
9/9/2007	10:03 PM	172,469	Training Presentation.pptx
12/19/2003	11:42 PM	18,944	transport.xls
12/19/2003	11:42 PM	16,384	transporttemp.xls
9/9/2007	1:14 AM	25,007	Treasury analysis worksheet1.xlsx
7/28/2003	7:56 AM	27,136	TreeOrders.xls
9/9/2007	12:24 AM	504,476	TwoCities.docx
12/19/2003	11:42 PM	177,664	valentine.xls
12/19/2003	11:43 PM	13,824	valentinetemp.xls
9/9/2007	1:58 AM	357,867	Welcome!.pptx
9/9/2007	2:21 AM	121,946	Welcome!2.pptx
9/9/2007	10:56 AM	174,213	Widescreen Presentation.pptx
9/3/2007	6:13 PM	38,404	worker hours10.xlsx

ABOUT PRINCIPLED TECHNOLOGIES

Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
www.principledtechnologies.com

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.