Microsoft Windows 2000
Datacenter Server
and Dell’s Program

By Dwayne Rodi

The Windows 2000 Datacenter Server provides new enhancements and hardware controls that can provide large enterprise data centers with the high availability and redundancy expected of their systems. This article describes those new features and the Windows 2000 Datacenter Server program offered by Dell to help ensure the successful implementation of both hardware and software in the customer’s data center environment.

The Microsoft® Windows® 2000 kernel now has additional hardware controls in the operating system. Windows 2000 Datacenter Server supports 32 processors and 64 GB RAM compared to Windows 2000 Advanced Server, which supports eight processors and 8 GB RAM. Other advantages of Windows 2000 Datacenter Server include:

- 14/7 day certification for all stand-alone Datacenter Server configurations that consist of all Windows 2000 signed hardware and software drivers
- Physical Address Extension (PAE)/4GT (enhanced memory architecture)
- Winsock Direct, a component to build a Microsoft System Area Network (SAN)
- Four-node cluster
- Process Control
- Microsoft Gold Queue, which consists of OEM hardware vendor support and a Microsoft support person in a joint queue at the OEM to support all Microsoft products running on the OEM server, along with the OS

Certification program for Datacenter Server
Each hardware OEM for Windows 2000 Datacenter Server must create a Windows 2000 Datacenter Server program. Consumers and OEMs can install Datacenter Server only on an 8-way processor or more capable server. The Windows 2000 Datacenter Server is not available from any store or vendor authorized reseller (VAR), but only from OEMs, such as Dell.

Microsoft requires OEMs like Dell to pass a Microsoft 7- or 14-day hardware certification. The certification applies to the hardware platform, operating system, peripherals, drivers, and any applications with kernel-level drivers (for example, Dell® PowerSuites, VERITAS® Backup Exec® or NetBackup®). See Figure 1 for Datacenter Server certification requirements.

Dell performs a “Superset Theory of Certification” that certifies the maximum configuration of components available for the Dell PowerEdge® 8450 server. This enables Dell to ship any subset of that configuration. For example, Dell certifies the Dell PowerEdge 8450 with eight processors and 32 GB of RAM, so customers can order up to eight processors and a range of 4 GB (Dell minimum) to 32 GB of RAM.

1 See the following article for a complete discussion of the four-node cluster: Tibbs, Mark and Nguyen, Nam. “High Availability in a Four-Node Microsoft Cluster Environment.” Dell Power Solutions, Special Issue, 2001.
Enhanced Memory Architecture allows applications to scale

The Enhanced Memory Architecture in Datacenter Server enables applications to scale by using the memory above 4 GB of RAM. With the Intel® PAE (/PAE switch in the boot.ini), applications such as Microsoft SQL Server 2000, Oracle® database, and scientific and statistical analysis applications can address this memory up to 64 GB. PAE X86 is used on computers with 4 GB to 64 GB of memory.

PAE works in two ways:

- PAE X86 physical memory allows 4 GB blocks of memory per application, but the memory cannot be shared among processes or used as data buffers for graphics or video calls. It also is limited to 16 GB of RAM. This larger physical memory capacity reduces paging, thereby increasing application performance. For example, this scenario works if customers run multiple applications that require no more than 4 GB of memory.

- PAE X86 can also work when a single application uses the entire memory above 4 GB of RAM. Applications that use the Microsoft Address Windowing Extensions (AWE) application programming interface (API) can access the memory above 4 GB (for example, Microsoft SQL 2000 and Oracle).

Figure 2 illustrates the two approaches for using PAE memory in the data center.

The 4GT switch (/3GB switch in the boot.ini) is another memory switch. The OS loads 1 GB of memory and allows applications to use the other 3 GB of RAM for applications. Applications and services such as Terminal Services (service in Datacenter Server) and Microsoft Exchange® 2000 use the 4GT memory architecture.

Winsock Direct increases network performance

Another special enhancement with Datacenter Server is Windows Sockets Direct (WSD). With Winsock Direct,2 customers can create SANs, which are system area networks, not storage area networks. These SANs allow applications to increase network performance by 30 percent without incurring processor performance hits.

This technology has a modified TCP/IP stack to take advantage of the Microsoft SAN. Although Winsock Direct requires special device drivers, it does not require applications to be rewritten to use proprietary hardware technologies or APIs. (Note: Few network interface cards have drivers that can perform this feature. One example is cLAN™ from Emulex, but Dell does not support WSD on this card.) Also, because Winsock Direct handles the transport path, applications get the best of both worlds: they use the SAN communications when it makes sense and the standard TCP/IP for other operations. The WSD model increases application performance and allows highly reliable data transfer where Microsoft’s SAN exists. Figure 3 shows the WSD stack.

### Table: Component Changes

<table>
<thead>
<tr>
<th>Component name</th>
<th>Description</th>
<th>Refresh required (14-day test plus core HCT testing)</th>
<th>Configuration update (7-day test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows 2000 Datacenter</td>
<td>New versions</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Processor</td>
<td>Speed change</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Processor</td>
<td>Type change</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Processor</td>
<td>Increase number</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>BIOS</td>
<td>Version change</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Memory</td>
<td>Maximum size increase</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>NIC adapter</td>
<td>Type change</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>PCI bus</td>
<td>Type change</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>I/O slots</td>
<td>Number or type change</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Storage adapter</td>
<td>Type change</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Ports</td>
<td>Add or change type</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Video adapter</td>
<td>Type change</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>Type change</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Floppy</td>
<td>Type change</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Windows service pack</td>
<td>Installation</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Kernel drivers</td>
<td>Change</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Figure 1. Certification required for Datacenter Server

Figure 2. Two approaches to PAE memory in the data center

---

2Service Pack 2 (SP2) provides this feature in Windows 2000 Advanced Server.
Since the Microsoft SAN is an unsecured network, it should be located in a highly secure room (a room with limited employee access and little or no public network connectivity). This network within a network delivers extremely high-bandwidth data transfers (more than 1 Gbps) in a reliable, low-overhead (not using the TCP/IP stack) solution. For more information on WSD and SANs, see the Microsoft article “Description of System Area Networks” at http://support.microsoft.com/support/kb/articles/q260/1/76.asp.

Process Control enables tighter control of system resources

Another feature built into Datacenter Server is Process Control, a powerful tool created for administrators who need tighter control over system resources. Process Control assigns CPU affinity and job object control. It is especially valuable for server consolidation scenarios, in which multiple services and applications are deployed on a single server that has eight to 32 processors.

Process Control allows administrators to closely control multiple applications in terms of CPU and memory utilization on large systems under time-varying loads and needs. Although an application can limit itself to a smaller set of processors, a particular dispatching priority, or other self-imposed constraints, this is not typical. Even if applications support setting their own limits, this form of self-restriction or self-control does not easily offer an enterprise level of control.

Process Control, available as both a command line and a graphical user interface (GUI) utility, can interface with scripting tools and allow administrators to control resource allocation per application and service. This approach can reduce contention and thrashing, and boost overall system throughput for managed applications. Process Control complements Task Manager and System Monitor, and provides persistent data between boots. Using Process Control, administrators can perform these functions:

- Partition computer resources
- Group processes into process groups
- Assign processor affinity to processes and process groups
- Assign scheduling priority to processes and process groups
- Assign working set limits to processes and process groups
- Enforce user CPU time limits for process groups
- Enforce virtual memory limits for process groups
- Limit the number of active processes in a process group
- Display accumulated process group statistics
- Define the rules that Process Control applies
- Install Process Control on Windows 2000 Professional clients to remotely administer processes and process groups on Windows 2000 Datacenter Servers

Process Control conforms to all Windows 2000 service guidelines and uses named pipes to communicate with users. The service owns its own database and is the only software that updates it. The service attempts to minimize resource consumption by having a tunable process-space sampling interval, using the lowest overhead process discovery technique available, minimizing registry access, and using efficient scan and look-up algorithms.

The Dell Datacenter Server support program

Support is an important feature of the Datacenter Server program. The Microsoft Gold Certified Partner for Support Services program helps Windows 2000 Datacenter Server partners provide an integrated hardware and software service offering that is delivered jointly with Microsoft. The Microsoft Gold Certified Partner for Windows Datacenter Support Services is an extension of the base program. An OEM must first meet the base requirements and then the Microsoft Gold Certified Partner for Windows Datacenter Support Services to sell Windows 2000 Datacenter Server.

The Microsoft Gold Certified Partner for Windows Datacenter Support Services provides partners with access to the Microsoft resources they need to help customers achieve high levels of availability. The Datacenter program provides a comprehensive suite of services for high-end environments using Windows 2000 Datacenter Server. Organizations designated as a Microsoft Gold Certified Partner for Windows Datacenter Support Services have met a series of qualifications as a service provider including:

- **Quality.** Consistent achievement of target customer satisfaction levels for support services provided to end customers and ongoing quality analysis and improvement methodologies.
- **Staffing and certification.** Requirements for the number of full-time professionals that support Microsoft products and Microsoft certifications.
- **Escalation.** Maximum rates for escalation of non-bug incidents to Microsoft and the ability to share support cases across partner and Microsoft tracking systems.
- **Problem replication environments.** Lab and replication environments that can reproduce all Datacenter Server HCL systems for troubleshooting customer problems and testing software patches.
- **Independent hardware vendor/independent software vendor (IHV/ISV) escalation path.** 24×7 access to an escalation path to debug resources and symbols files for all products certified as a part of the Datacenter Server system.
- **The OEM service offerings.** The capability to provide service components including:
  - A minimum uptime guarantee of 99.9 percent availability
  - Installation and configuration services
  - Availability assessments
  - 24×7 hardware and software support
  - Response service for on-site hardware and software support
  - Change management service

As part of the overall program, Dell offers end-to-end services designed specifically for Dell enterprise customers to help ensure successful implementation of Microsoft Windows 2000 Datacenter Server. In addition to specialized consulting and deployment services, Dell’s Windows 2000 Datacenter Server services include a Microsoft Gold Certified Partner Support Center, which provides integrated hardware and software support with escalation to a joint Dell and Microsoft support team. This offering provides Dell Datacenter customers with direct access to both Dell and Microsoft resources in Dell’s expert center (third-level support team) for Datacenter Server. Dell support services also include the Premier Enterprise Support Service Tiers that provide hardware and software support across a wide range of complex computing environments. The Datacenter Platinum and Gold Tiers are tailored to satisfy the unique support needs of Dell Datacenter customers.

**Datacenter support services offer cost-effective solutions**

Windows 2000 Datacenter Server offers the high availability required by large enterprises today. Supporting the Datacenter Server is Dell’s Datacenter services, currently available with the PowerEdge 8450 server. This program offers hardware, software, services, and support for customers that require cost-effective, industry-standard solutions for their powerful large memory and stand-alone and clustered configurations.

---

**Dwayne Rodi** (dwayne_rodi@dell.com) is a member of the Operating System Engineering Group at Dell. He is the team leader for the Microsoft Operating System Development team, Windows .NET, and Datacenter Server projects. Dwayne has a B.S. in Computer Science from Southeastern Louisiana University and is a Microsoft Certified Systems Engineer (MCSE).

---

**FOR MORE INFORMATION**

- Dell Windows 2000 Datacenter Server program: www.dell.com/datacenter
- Microsoft Datacenter Server: www.microsoft.com/windows2000/datacenter
- Microsoft article “The Datacenter Program and Windows 2000 Datacenter Server Product”: support.microsoft.com/support/kb/articles/q265/1/73.asp