TECHNOLOGY BRIEF

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Microsoft Exchange 2000 Consolidation Using ProLiant Essentials Workload Management Pack

CONTENTS

ABSTRACT

Increasingly, today's enterprises need to reduce costs while increasing uptime and better leveraging hardware and software investments. One of the most effective means of cost reduction is consolidating applications spread across the IT infrastructure. A Microsoft Exchange 2000 environment, for example, often requires multiple servers and multiple supporting applications. By combining such applications onto a single or fewer servers and better managing resources used by these services, costs are greatly reduced and management of the environment becomes much easier.

The ProLiant Essentials Workload Management Pack from the new HP, featuring Resource Partitioning Manager (RPM), enables system administrators to set processor affinity and allocate memory usage on a per process basis to maximize system performance. This paper explains how to set up and configure RPM partitions for use with Microsoft Exchange 2000 and supporting applications and to ensure a consolidation scenario that can be easily deployed and managed in the enterprise.

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NOTICE

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INTRODUCTION

Today's corporate IT environments mandate the use of many supporting applications to ensure availability of mission critical applications. These supporting applications include antivirus software, management applications, and backup solutions that can cause a significant drain on system resources. The negative impact on system performance due to excessive CPU utilization or memory consumption by these supporting applications is evident when using primary applications such as Microsoft Exchange 2000. A virus scan, for example, consumes a considerable amount of CPU resources. Microsoft Windows 2000 does an excellent job of symmetrical multiprocessing: equally distributing load generated by application and system processes among all processors in a multiprocessor system. If two processes have the same priority, each is allocated equal CPU time. Thus, a supporting application shares CPU time equally with a primary application. This sharing of CPU time can result in a performance degradation of the primary application, in this case Exchange 2000.

Information Store: *The default message store provider for Microsoft Exchange Server. Built on the Microsoft Extensible Storage Engine, the Information Store consists of multiple files (properties and streaming databases), organized into storage groups with transactional log files. The information store organization of public folders, private folders, and messages is referred to as the organization hierarchy. Information Store services are contained in file store.exe.*

To facilitate consolidation and ensure reliable and consistent performance, the new HP provides the Resource Partitioning Manager (RPM). This software allows administrators to set processor affinity and allocate memory usage on a per process basis.

In an Exchange 2000 server environment, the most compute intensive process is the store.exe process. Using RPM, an Exchange 2000 administrator can allocate a specific number of processors to store.exe and a specific number of processors to supporting applications. The administrator can configure RPM partitions to ensure that the Information Store (store.exe) process has consistent access to system resources, while available resources are accessible to other applications and services consolidated onto the same platform.

This paper explains how to set up and configure RPM to isolate an Exchange 2000 server process from supporting applications and therefore allow managed co-existence on a single server. First, the partitions are set up and configured to run some typical applications. Then a potential conflict is resolved by modifying the registry. Next, the processors are divided to provide effective utilization. Finally, the testing was performed by the Messaging and Collaborative Applications Solutions Engineering team within the Industry Standard Server Group of the new HP. The tests were designed to confirm the hypothesis that use of RPM in an Exchange 2000 environment would provide performance, resource availability, and system utilization benefits.

For this paper, two partitions were created and tested on an 8-way ProLiant DL7606 server: one partition for the Exchange 2000 store process (the primary consumer of system resources in an Exchange 2000 environment) and one partition for the supporting applications (a popular Exchange anti-virus solution). This is just one possible configuration. Each environment's needs and requirements vary with the application mix. Using performance monitor's process object to record process and memory utilization (working set) is useful in determining which processes to assign to a partition. CPU and memory-intensive processes associated with supporting applications are prime candidates for RPM partitions. Restricting these applications to specific resource ensures the availability of resources for the primary application such as Microsoft Exchange 2000 Server.

EXCHANGE 2000 CONSOLIDATION

Today, the backbone of many corporate messaging infrastructures is Microsoft Exchange 5.5. Typical Microsoft Exchange 5.5 deployments are limited by the architecture of the messaging store, which is a relational database (the Extensible Storage Engine, or ESE) containing user email, attachments, calendar and PIM data. The Exchange 5.5 message store is a single file that can grow to sizes in excess of 100 GB and is governed by the 32-bit store.exe process, which also runs as a single instance. The number of users supported on a single server is a by-product of the maximum size of the information store that will allow the organization to meet their backup/restore

requirements in the event of database corruption or failure. Assuming an average mailbox size of 50 MB and a target database size of 35 to 50 GB, the average number of users on an Exchange 5.5 server would be between 700 and 1000.

Exchange 2000 addresses the single instance of ESE by allowing up to four instances of ESE per server (still governed by a single instance of store.exe), known as storage groups. Each storage group has its own transactional logs, thereby making it the unit of backup. Also, each storage group can contain as many as five databases, which become the unit of restore. Partitioning the information store into more manageable sizes (for backup and restore) provides the basis for consolidating larger numbers of users onto a single server.

Exchange 2000 also features improved SMP scalability over its predecessor to take better advantage of multi-processor servers. Vying for system resources on Exchange 2000 deployment servers, however, are additional applications and services, including:

- **Anti-Virus agents.** The primary entry point for viruses into organizations has migrated from floppy disks and internet downloads, to the outward-facing email environment. Many third parties offer Exchange-specific anti-virus solutions, which may integrate directly with ESE through the virus-scanning API 2.0 to scan email and attachments. These agents have a resource cost in real-time monitoring mode, and they may have an additional impact when performing a scan of the information store.
- **Management agents.** In addition to server management agents such as Insight Manager, third party vendors such as NetIQ and BMC provide enhanced management capabilities for applications such as Exchange. While designed to be unobtrusive to the environment, these agents may also require additional server resources, depending upon their level of activity.
- **Backup/Restore agents**. Most organizations will leverage a third-party backup vendor to take advantage of such Exchange-specific capabilities as storage group and individual database recovery, parallel backup of storage groups, and backup/recovery of key Exchange services, such as site replication services and the key management service. Like anti-virus agents, these agents have may have additional resource impact during the backup or restore.
- **Other Exchange services**. New to Exchange 2000, the full-text indexing service can place a CPU-intensive load during its crawl and rebuild operation. These types of services are often scheduled for after-hours operation, due to the load placed on the server and the potential impact to the core messaging services.
- **Other applications**. Exchange 2000 scales well through four processors, and initial testing indicates some potential benefits with as many as six processors. However, the resources of an 8-way server, such as the ProLiant DL760 server, may be better utilized through the partitioning of services, specifically by limiting the Exchange STORE process to four or six processors, and granting other agents or processes access to the remaining physical processors. These applications could include Active Directory, Collaborative Applications, and even file/print services. Our testing was designed to prove that the Exchange environment would function similarly when limited to six processors, thereby freeing up additional resources for other supporting or even unrelated applications.

Our testing focused on using RPM to better manage the supporting agents partitioning the workload on the Exchange 2000 server, while experiencing the same or better overall Exchange performance (measured through lower CPU consumption).

NOTE: It is important to mention that CPU utilization is only one resource consumed by Exchange. Before consolidating unrelated applications on the same box, consider the additional resource constraints of these applications and factor these requirements, such as storage I/O, memory, network, etc., into your configuration.

ProLiant DL760 Server

THE TEST PLATFORM: PROLIANT DL760

The ProLiant DL760 server was designed for mission-critical environments and offers an outstanding combination of high performance and high availability features, with 8 processors, 16 GB of SDRAM, 11 hot-pluggable 64-bit I/O slots (of which 8 are PCI-X slots), redundant hot plug power supplies and fans, and more. The ProLiant DL760 has been developed to meet the needs of customers requiring scalability and fault tolerance in a data center environment. With the latest performance, reliability, manageability, and serviceability features in a modular, dense 7U form factor design, this server provides an ideal solution for demanding enterprise applications. PCI-X is the next evolution of the PCI I/O standard and is backward compatible with PCI. Customers can install their existing PCI adapters in the ProLiant DL760 while investing in new PCI-X adapters. High speed PCI-X I/O technology was developed by Compaq and is being licensed to others in the industry.

Today's mission-critical applications demand ever-increasing scalability and availability from data center servers. The ProLiant DL760, with new Intel Pentium III Xeon 900-MHz processors and PCI-X I/O, delivers the performance and uptime required to meet the current and future demands of enterprise server consolidation, e-business, ERP, thin client, compute engine, mail and messaging, and data mining applications. Based on the Profusion architecture jointly developed by Compaq, Corollary and Intel, the ProLiant DL760 offers excellent scalability driven by its balanced system architecture.

Test Server Configuration		
Component	**Quantity**	**Description**
CPU:	8	900-MHz Intel Pentium III Xeon processors
CPU Cache:		2 MB
RAM:		4 GB
OS:		Windows 2000 Advanced Server - build 2195 with SP1
Storage:	2	4-GB disks for OS/Exchange DS/MTA and NTDS (Active Directory) files
	7	18.2-GB disks for log files (RAID 0)
	56	18.2-GB disks for information store files (RAID 0)
	7	18.2-GB disks for SMTP queue (RAID 0)
Controller:	1	SmartArray 5i embedded RAID controller
	3	SmartArray 5304 4-channel RAID controllers
NIC:	1	Compaq NC3163 (100BaseTX) network interface card

RESOURCE PARTITIONING MANAGER

Workload Management Pack, featuring Resource Partitioning Manager (RPM), is a resource management tool to enable workload consolidations on ProLiant servers running Microsoft Windows 2000 Server, Advanced Server, and DataCenter operating systems. Workload Management Pack increases the stability and availability of applications under Windows 2000, thereby allowing customers to confidently deploy multiple applications on a single server. RPM builds upon the embedded job object technology in Windows 2000 to provide a quick and easy way to manage processor and memory resources dynamically.[1]

PARTITION CONFIGURATION

On a server, RPM is used to create two resource partitions isolating Exchange 2000 Information Store processes from supporting application processes. The first partition contains the store.exe process. The second partition contains the processes associated with supporting applications: an Exchange 2000 antivirus scanner and a management application discovery agent. Other applications, such as management agents and backup/restore agents, are good candidates for an RPM partition. Processor-intensive services like MS_SEARCH (Microsoft's content indexing service) may also benefit from dedicated resources through RPM.

Add the Active Process

The first step in creating a partition for the store.exe process is to start the Exchange 2000 server. Next, use the RPM application to create a new partition (*EXstore*) and assign the store.exe process to this partition. The Add Active Process GUI, shown in Figure 1, is used to assign processes to partitions. At this time, assign the store.exe process to the *EXstore* partition. For the purposes of this test, a second partition (manageapp) is created for the supporting applications (antivirus, in this particular example). Separate resource partitions could be created for other applications sharing resources on the same hardware.

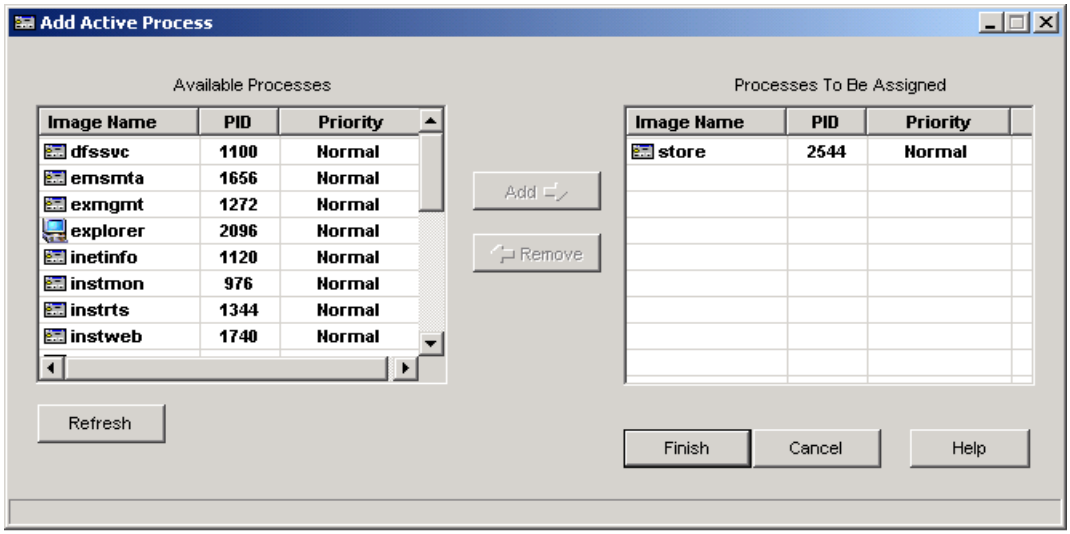

Figure 1. Add Active Process GUI

[1] *For more information, see the technology brief titled "Compaq Resource Partitioning Manager: A Server Consolidation Solution for Windows 2000," document number TC020102TB.*

Add the Active Process to Resource Partition

The Resource Partition Processes screen displays processes assigned to the resource partition. Figure 2 shows the store.exe process assigned to the *EXstore* partition. The process will remain in a pending state until the partition is activated by the RPM service. Partitions are either Available (not started) or Active. When a partition is Available, the processes assigned to the partition may be running; but those processes are not managed by RPM until the partition is Active. Not all partitions are activated at this time due to a potential conflict. After this is resolved, as described in the next section, the partition is then activated.

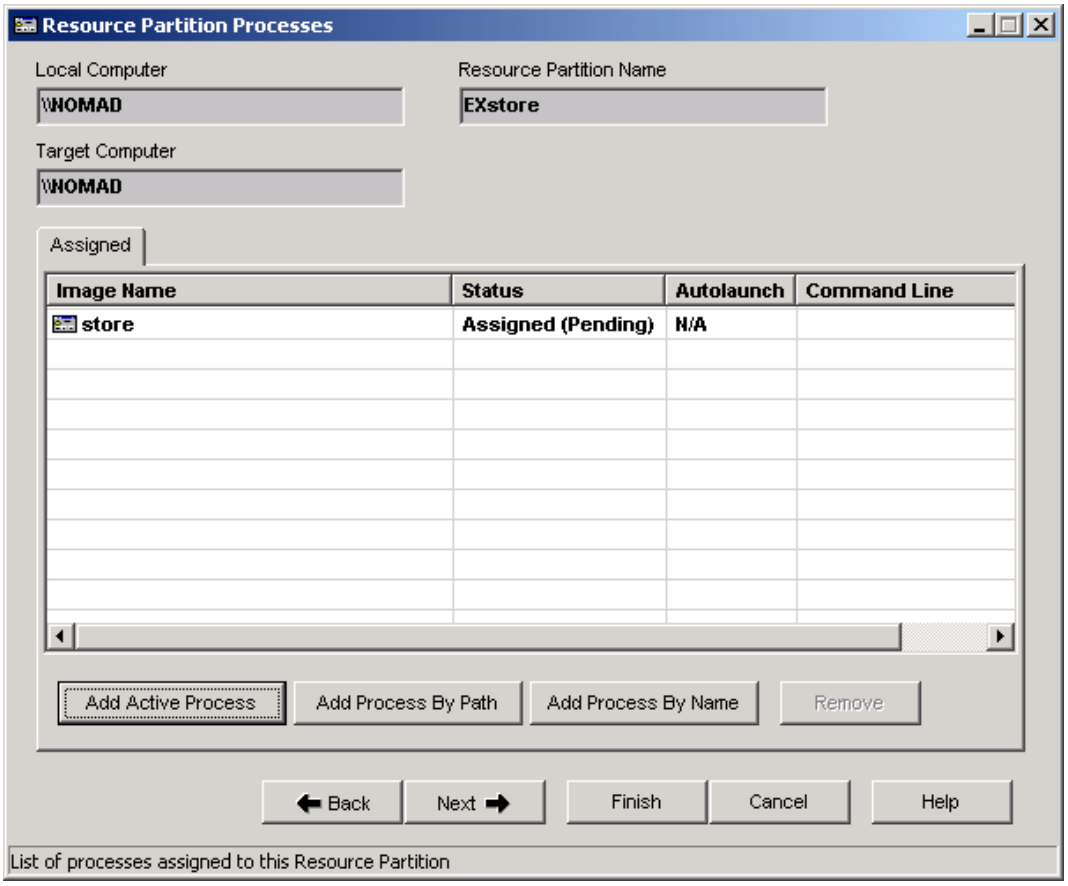

Figure 2. Adding a Process to a Resource Partition

Registry Setting for Exchange 2000

The Windows 2000 service manager automatically starts the RPM service. A system administrator can configure individual partitions to allow Resource Partitioning Manager to start one or more partitions automatically.

When RPM launches the partition containing store.exe (configured to start automatically), the store.exe process starts. This creates a problem when the Exchange 2000 Information Store Service also attempts to start the store.exe process. If the Exchange 2000 Information Store detects that the store.exe process is already running, Information Store Service and other Exchange 2000 services that are dependent upon the Information Store Service will fail.

To avoid this problem, an administrator can manually create a DependOnService service entry in the RPM service registry key, as shown in Figure 3. The DependOnService entry specifies the MSExchIS service. This ensures that the Exchange Information Store Service (store.exe) is started before the RPM service is launched. When the RPM service is started, the partition that contains the store.exe process activates and acquires the store.exe process. There are no special requirements or dependencies for starting the supporting maintenance applications.

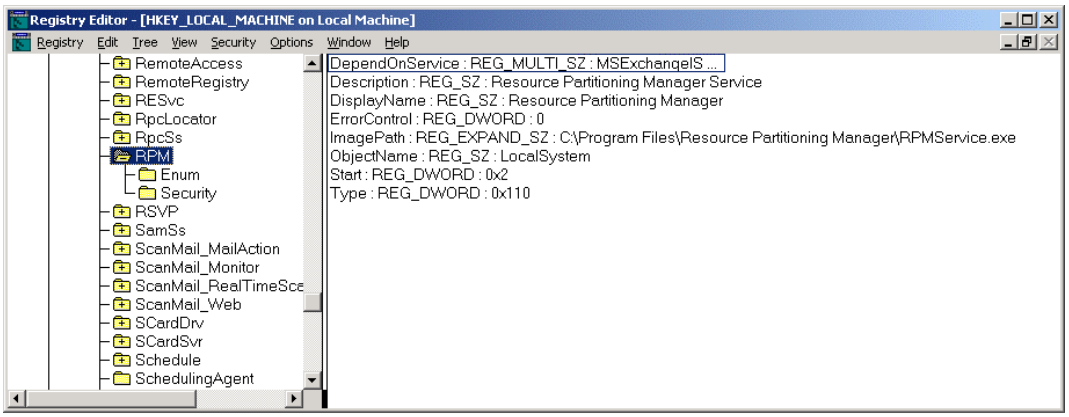

Figure 3. Registry Settings for Exchange 2000 and RPM

Processor Utilization

The Resource Partitioning Manager screen shown Figure 4 is the interface used to create and manage partitions. Figure 4 indicates that for this 8-processor ProLiant DL760 server, two partitions have been created: *Exstore,* which is available but not active, and *manageapp,* which is active. As discussed earlier, the *EXstore* partition is used to isolate the store.exe process from the management applications. The *manageapp* partition contains the processes associated with the supporting applications. The store.exe process is running but not currently managed by RPM, while the processes assigned to the *manageapp* partition are running on the processors configured to service that partition.

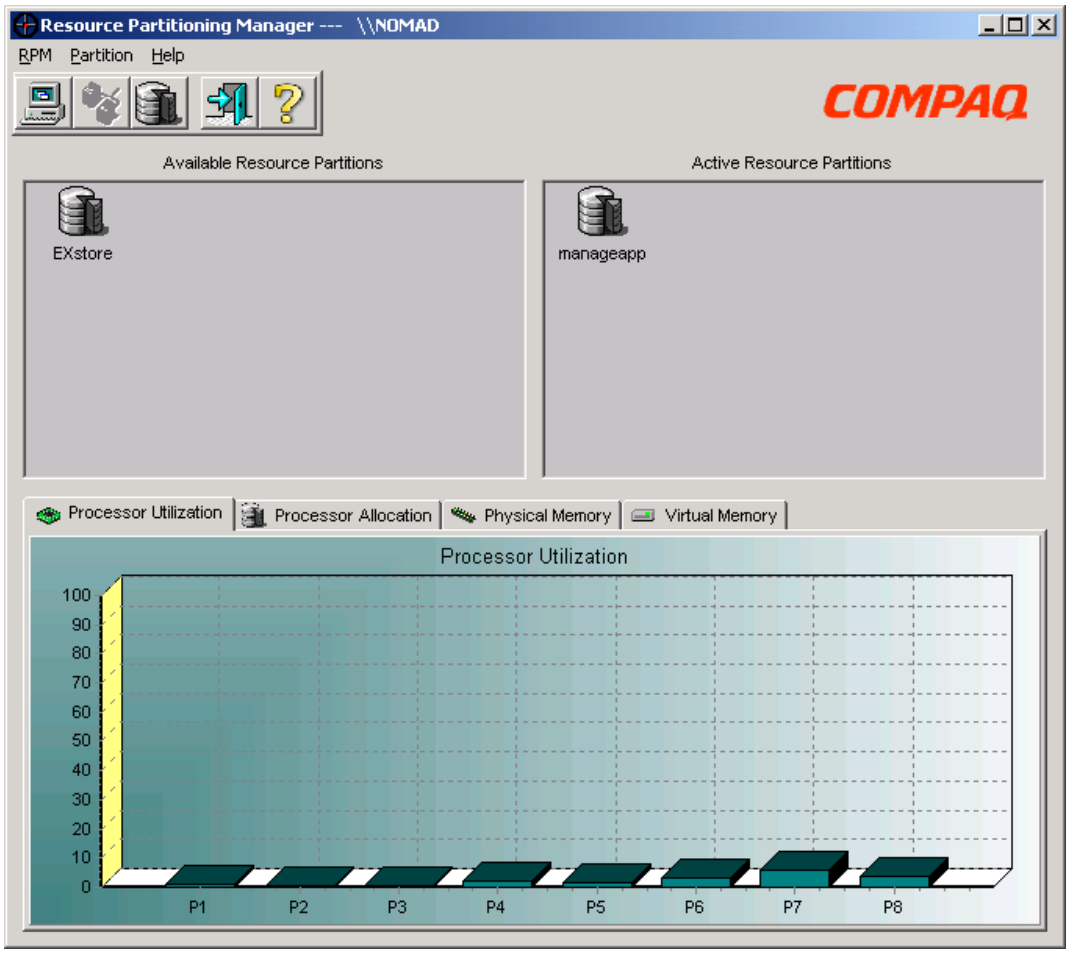

Figure 4. RPM Main Screen

Resource Partition Properties

The Resource Partition Properties screen in Figure 5 shows the *EXStore* partition assigned to processors 1 through 6 for use by the store.exe process. This partition is configured to start automatically when the RPM service starts.

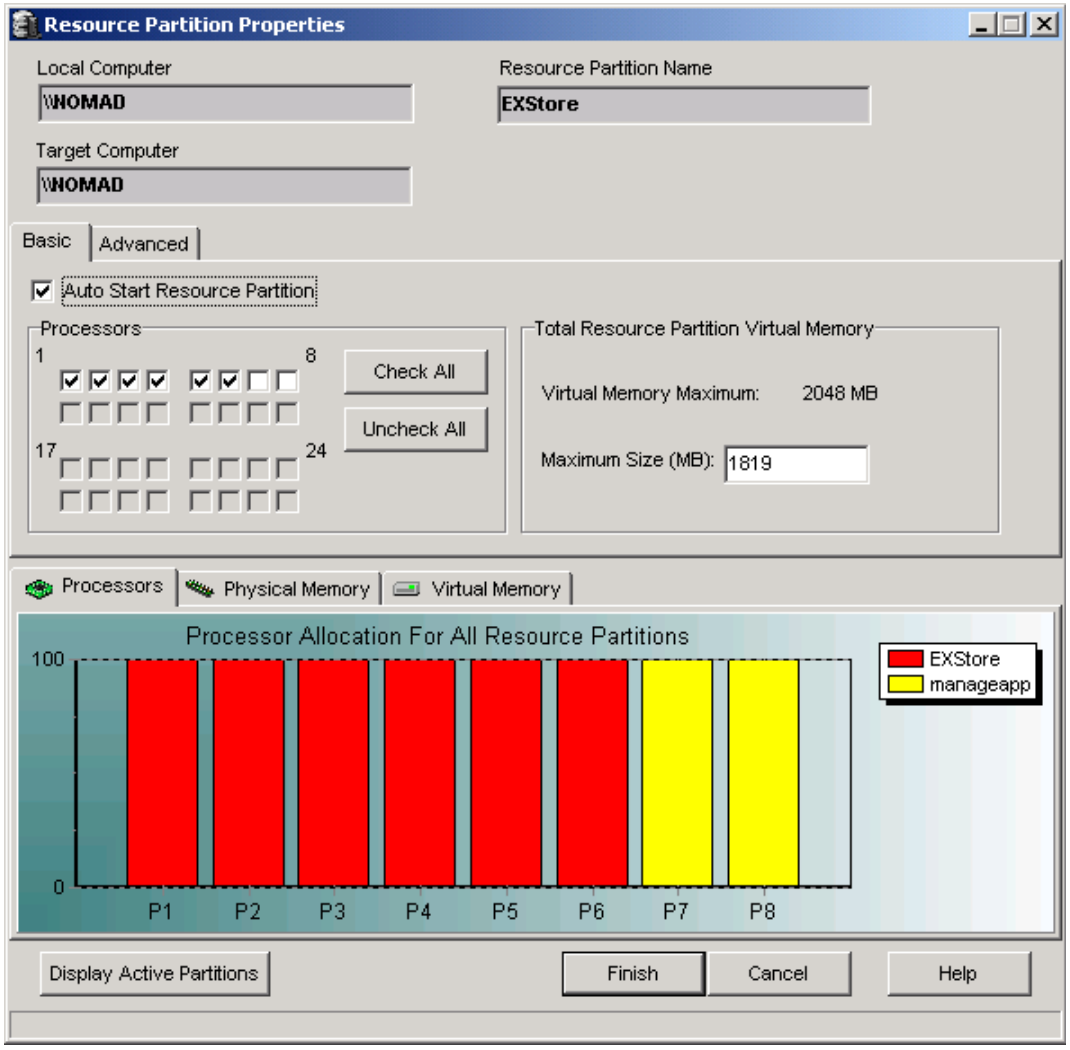

Figure 5. EXStore Partition Properties

The Resource Partition Properties screen in Figure 6 shows that the *manageapp* partition is assigned to processors 7 and 8 for use by the supporting applications. The *manageapp* partition is also configured to start automatically when the RPM service is launched. Since the *manageapp* partition is limited to two CPUs, any supporting applications assigned to this partition will be limited to sharing the two assigned processors. With this configuration, the supporting applications cannot run on any of the six processors assigned to the *EXStore* partition. The applications are isolated on the assigned processors unless additional rules are written (as explained in the next section).

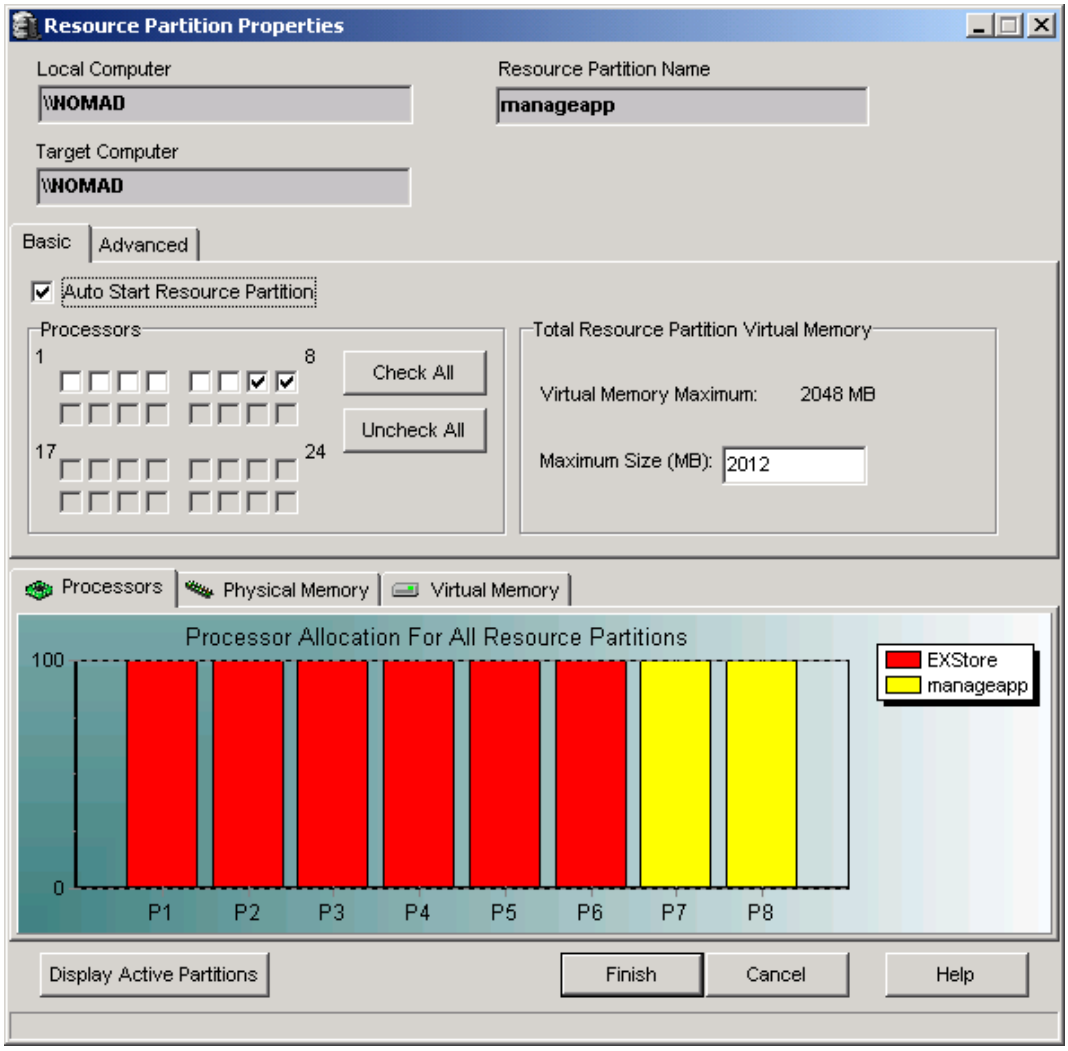

Figure 6. manageapp Partition Properties

PARTITION PERFORMANCE

After applications and processors are set up, monitoring utilization of the server might reveal existing resource conflicts. Through the use of additional features in RPM, real-time analysis yields information to improve overall server utilization. Administrators can set up rules to avoid current or future bottlenecks.

Partition Processor Utilization

Figure 7 shows the Resource Partitioning Manager screen for another 8-processor, ProLiant DL760 system running Exchange 2000 and an antivirus application for Exchange 2000. This configuration includes two partitions named *stor* and *AVPart*. The *stor* partition contains the store.exe process, and the *AVPart* partition contains the processes associated with the antivirus application. The *stor* partition is using approximately 60 percent of six processors to manage the Exchange server's information store. The *AVPart* partition is using approximately 80 percent of two CPUs to support the antivirus processes.

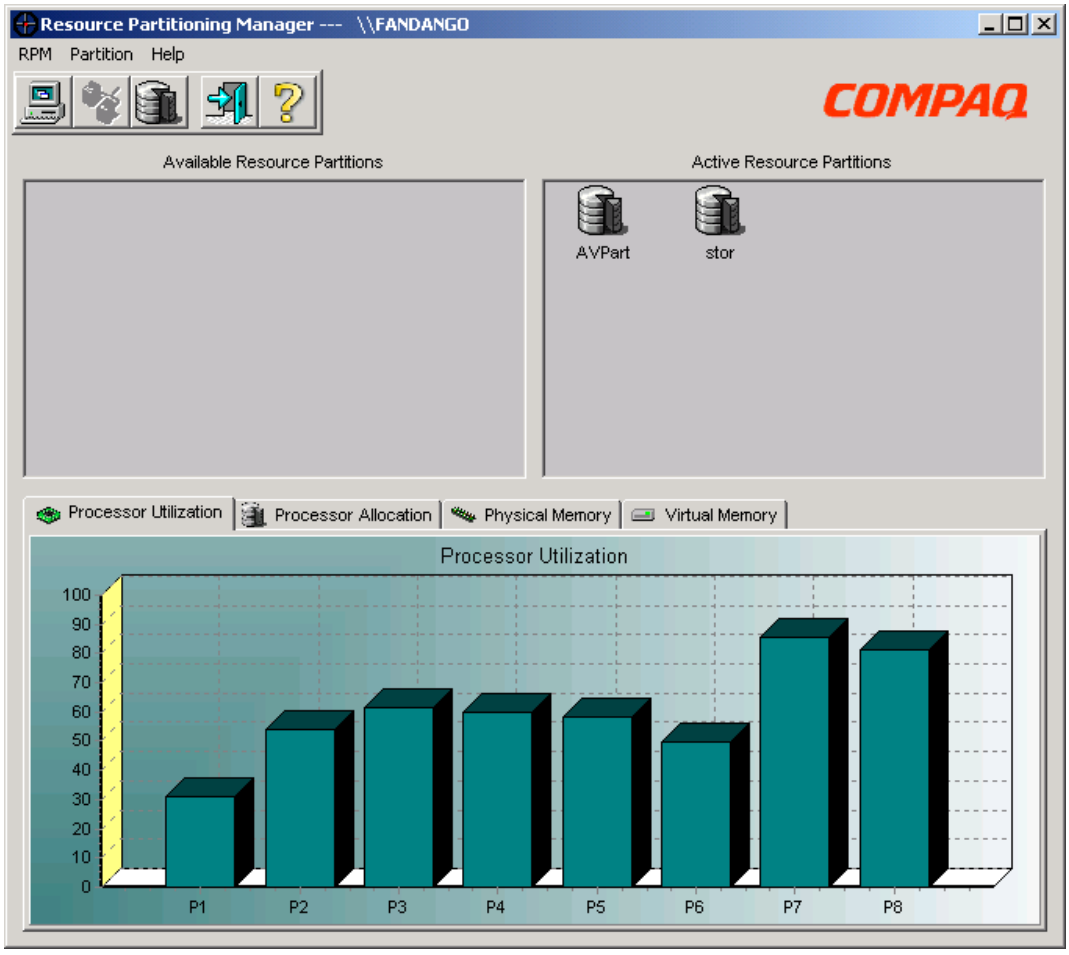

Figure 7. Resource Partition Processor Utilization

Partition Rules

Resource Partition Rules are used to allocate system resources to partitions dynamically to reduce the potential for resource bottlenecks. In Figure 8, a rule has been configured to add processors to the *EXStore* partition if CPU utilization exceeds 70 percent. The configuration shown adds up to two processors if utilization on the original six processors exceeds 70 percent for more than 30 seconds. A rule could also be enabled to remove processors from the partition when utilization drops below a certain threshold. Monitoring processor utilization and adjusting these rules could provide an optimized solution for each unique environment of applications and hardware.

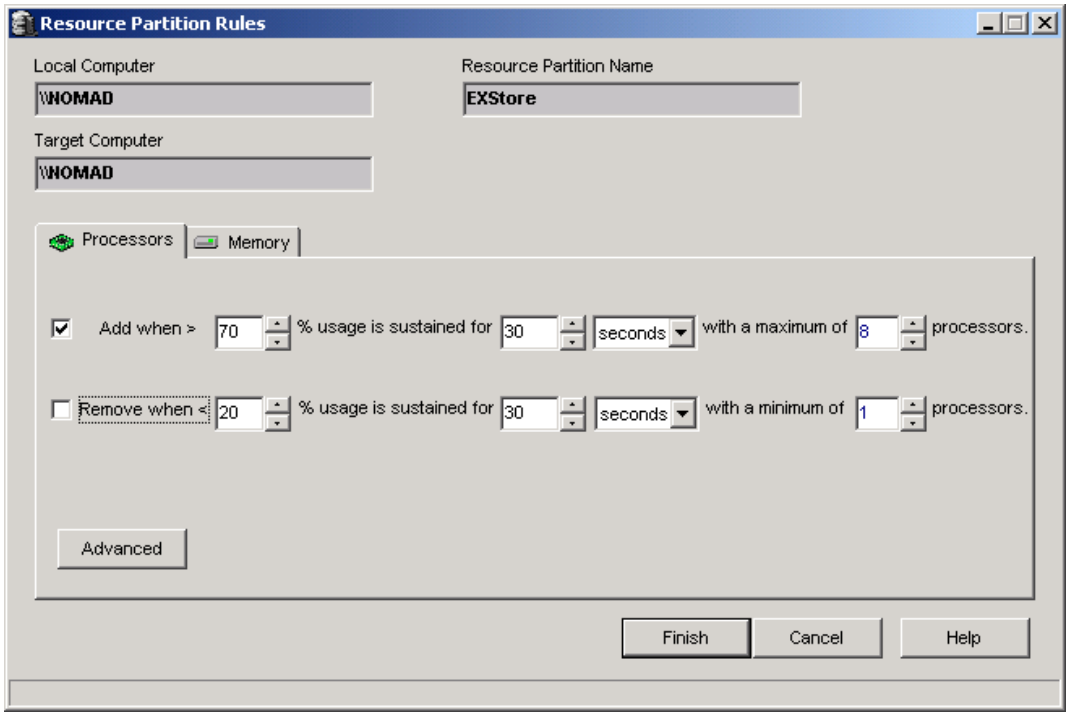

Figure 8. Partitioning Rules

TEST RESULTS

On a test system, a manual virus scan was run on an Exchange 2000 server with 280 GB of data in the information store. The manual scan lasted 8 hours and 54 minutes; overall CPU utilization was 66.9 percent for all eight processors as recorded by the Windows 2000 performance monitor (PerfMon). During the scan, processors 1 through 6, which were assigned to the *stor* partition, averaged 65 percent CPU utilization. Processors 7 and 8, which were assigned to the *AVPart* partition, averaged 85 percent CPU utilization. The same test was performed with both partitions disabled and yielded similar results: The scan lasted 8 hours and 50 minutes with overall CPU utilization for all eight CPUs at 64 percent. While the performance results are similar, it is important to note that if the processes assigned to the *AVPart* partition had consumed all the available CPU resources of processors 7 and 8, there would still have been ample processing capabilities available from processors 1 through 6 for the *stor* partition and the store.exe process.

CONCLUSION

An effective server consolidation scenario for Exchange 2000 is key to reducing costs and enabling better management of the environment. This paper illustrates how to use Resource Partitioning Manager to isolate Exchange 2000 server processes from supporting applications and thereby facilitate consolidation of resources. With a more granular level of resource management, it is possible to increase the availability of mission critical applications and ensure that processes have sufficient resources to operate.