Workstation
Server
Enterprise

CHAPTER

25

Performance Optimization

About Chapter 25

This chapter is all about getting the fastest server and/or network response out of your hardware and software combination. The technical term for this is performance optimization.

Because bottlenecks slow down system performance, Chapter 25 begins by explaining how to identify a bottleneck. Specific Performance Monitor counters are recommended.

The remainder of this chapter focuses on practical things you can do to resolve bottlenecks and optimize system performance. Various techniques, including adding RAM, optimizing paging files, optimizing or upgrading disks, upgrading or adding a processor, optimizing the server, and optimizing network traffic are discussed.

This chapter includes two hands-on labs. In the first lab, you'll get practical experience in analyzing Performance Monitor statistics in order to identify a bottleneck. In the second, you'll make recommendations to optimize server and/or network performance for a given situation.

This chapter is a "must read" no matter which of the three Windows NT 4.0 Microsoft Certified Professional exams you're preparing for. This chapter maps to the "Identify and resolve a given performance problem" and "Optimize system performance" objectives for the Workstation exam, to the "Identify performance bottlenecks" objective for the Server and Enterprise exams, and to the "Optimize performance for various results" objective for the Enterprise exam.

What Is Performance Optimization?

Performance optimization is the process of modifying server and/or network hardware and software configurations with the intent of speeding up server and/or network response.

Performance optimization is performed for several reasons:

- To get the most performance out of existing hardware
- When planning for a new server or network
- In response to user or administrator observations of slow system performance

Performance optimization should be performed with a specific goal in mind. Your primary goal might be to provide the fastest possible file services to client computers. Or your goal might be to remedy slow system response by identifying the problem and implementing a solution. In short, your goal can be almost anything that focuses on improving efficiency and speed of system performance.

For most network administrators, performance optimization usually means resolving user reports of slow system performance. Determining the cause of the slow performance is referred to as *identifying a bottleneck*. This chapter focuses on identifying bottlenecks, as well as on ways to optimize system performance and to resolve bottlenecks.

Identifying Bottlenecks

A *bottleneck* is the component in the system that is slowing system performance. In a networking environment, the bottleneck is the part of the system that is performing at peak capacity while other components in the system are not. In other words, if it weren't for the limiting component, the rest of the system could go faster.

When you are attempting to identify the bottleneck in your system, use Performance Monitor to measure performance of the server's memory, processor, and disk. You can also use Performance Monitor and/or Network Monitor to gather statistics about your network that may help you identify network bottlenecks.

The following tables contain Performance Monitor counters that may help you in identifying bottlenecks. Table 25-1 shows the counters you can use to monitor the server's memory.

TABLE 25-1 PERFORMANCE MONITOR MEMORY COUNTERS

OBJECT	*COUNTER*	*DESCRIPTION AND HOW TO INTERPRET*
Memory	Pages/sec	Measures the amount of 4KB memory pages that are read from or written to the paging file during a one-second time period. This counter is used to obtain an overall view of how memory is utilized by Windows NT. If the server does not have enough memory, then excessive paging will occur. A consistently high number for this counter (greater than 2–3) indicates that the current amount of RAM may be insufficient for the computer.
Paging File	% Usage	This counter measures the percentage of paging file utilization. A consistently high percentage for this counter (approaching 100%) may indicate that you should add RAM to the system or enlarge the paging file. Enlarging the paging file won't speed up the system—only adding RAM will do that.

Table 25-2 shows the counters you can use to monitor the server's processor.

TABLE 25-2 PERFORMANCE MONITOR PROCESSOR COUNTERS

OBJECT	*COUNTER*	*DESCRIPTION AND HOW TO INTERPRET*
Processor	% Processor Time	Measures the percentage of time that the processor is actively being used by processes other than the Idle process. This counter only measures one processor—if your system has multiple processors, use the System % Total Processor Time counter instead. A consistently high number for this counter (approaching 100%) may indicate that a faster processor (or an additional processor) may be required for adequate system performance. Check the memory counters *before* upgrading your processor—if the memory counters are consistently high, you might just need more RAM.

OBJECT	COUNTER	DESCRIPTION AND HOW TO INTERPRET
System	% Total Processor Time	This counter measures the percentage of time that *all* processors in the computer are actively being used by processes other than the Idle process. A consistently high number for this counter (approaching 100%) may indicate that faster processors (or an additional processor) may be required for adequate system performance. Check the memory counters *before* upgrading your processor(s)—if the memory counters are consistently high, you might just need more RAM.

Table 25-3 shows the counters you can use to monitor the server's disk.

TABLE 25-3 PERFORMANCE MONITOR DISK COUNTERS

OBJECT	COUNTER	DESCRIPTION AND HOW TO INTERPRET
PhysicalDisk	Avg. Disk Queue Length	This counter measures the average number of disk reads and writes waiting to be performed. A consistently high number for this counter (greater than 2–3) may indicate that a faster hard disk and/or disk controller, or a different disk configuration (such as a stripe set or a stripe set with parity) may be required for adequate system performance. Check the memory counters *before* upgrading your disk(s)—if the memory counters are consistently high, you might just need more RAM.
PhysicalDisk	% Disk Time	This counter measures the percentage of time that the disk is actually busy performing reads and writes. A consistently high number for this counter (approaching 100%) may indicate that a faster hard disk and/or disk controller, or a different disk configuration (such as a stripe set or a stripe set with parity) may be required for adequate system performance. Check the memory counters *before* upgrading your disk(s)—if the memory counters are consistently high, you might just need more RAM.

continued

TABLE 25-3 *(continued)*

Object	*Counter*	*Description and How to Interpret*
LogicalDisk	% Free Space	This counter measures the percentage of unused disk space. A consistently high or gradually increasing number for this counter (approaching 100%) indicates that the server does *not* have sufficient disk space available. An additional disk or a replacement disk that has more capacity may be required.

Table 25-4 shows the counters you can use to monitor the network.

TABLE 25-4 Performance Monitor Network Counters

Object	*Counter*	*Description and How to Interpret*
Network Segment	% Network utilization	This counter measures the total network utilization on a given network segment as a percentage of the maximum amount of network traffic possible on that segment. A consistently high number for this counter (approaching 100%) may indicate that there are too many computers or too much network traffic on that network segment. An additional network adapter may need to be installed in the server, or a router may need to be installed on the network to further segment the network.

OBJECT	COUNTER	DESCRIPTION AND HOW TO INTERPRET
Server	Bytes Total/sec	This counter measures the total amount of network utilization of a Windows NT Server computer. Specifically, it measures the total number of bytes sent to and received from all network adapters in the Windows NT computer by the Server process. *This counter should only be used to measure network utilization when there is only one server on a network segment, and there is only one network adapter in that server.* A consistently high number for this counter (approaching the maximum number of bytes that can be sent on the network segment in one second) may indicate that there are too many computers or too much network traffic on that network segment. An additional network adapter may need to be installed in the server, or a router may need to be installed on the network to further segment the network.

Once you've interpreted the Performance Monitor and Network Monitor statistics and have identified the bottleneck in your system, you're ready to take steps to resolve that bottleneck. The next section covers ways to optimize performance and to resolve bottlenecks.

To refresh yourself on how to use Performance Monitor, see Chapter 22; for details on how to use Network Monitor, see Chapter 23.

Optimizing Performance and Resolving Bottlenecks

Performance optimization involves getting the most speed out of your existing hardware and software combination. It can also involve adding to or upgrading specific components to resolve bottlenecks.

You don't have to make a large number of configuration or Registry setting changes to optimize the performance of Windows NT. Windows NT is designed to automatically tune itself for providing the best performance it can with the hardware resources available in the computer. For example, Windows NT automatically adjusts the amount of memory assigned to cache, the amount of memory assigned to buffering network packets, and prioritizes processor allocation as needed.

However, the administrator can modify hardware and software configurations to optimize system performance and to resolve bottlenecks. You can add RAM, optimize paging files, optimize or upgrade disks, upgrade or add a processor, optimize the server, and optimize network traffic. Depending on your situation, implementing one or more of these options may improve your system's performance or resolve a bottleneck.

Adding RAM

Perhaps the single most inexpensive and effective upgrade you can make to your server is to add additional RAM. I've never heard an administrator whine that he or she "just had too much RAM in his or her server." You can *never* have too much RAM.

Operating systems and applications are constantly being updated and revised. Each new version seems to need more RAM and a faster processor just to perform basic tasks.

Adding RAM can reduce how often the server reads or writes virtual memory pages to or from the paging file on the hard disk. This is called *reducing paging*. Because paging uses both processor time and disk time, when paging is reduced, the performance of the processor and the disk can also be improved.

When RAM is added to the server, Windows NT automatically increases the allocation of RAM made available to the disk cache. The disk cache temporarily stores user requested files from the hard disk. Because the disk doesn't need to be accessed when a file is retrieved from the cache, files in the cache are more quickly available to users than files on the disk. Thus, increasing the size of the cache can improve disk performance because the number of disk accesses is reduced.

Optimizing Paging Files

The best method for optimizing a paging file is adding more RAM. The more RAM in the computer, the less paging activity will occur.

That said, there are a few additional things you can do to optimize paging file performance. If the Performance Monitor Paging File % Usage and Paging File % Usage Peak counters indicate that the paging file is being used a consistently high percentage of the time, you might consider trying one of the following:

- Place the paging file on the physical disk in your system that has the least amount of activity.

- Place the paging file on a stripe set.
- Place multiple, smaller paging files on multiple physical disks in your system.
- Place the paging file on any other partition than the boot partition.

caution 

If you have configured Windows NT to create a memory dump file (`memory.dmp`) when a stop error occurs, you *must* have a paging file on the boot partition that is at least as large as the amount of RAM in the computer. If the paging file isn't large enough or has been moved from the boot partition, a memory dump file won't be created.

The next section explains how to move and configure paging files.

TO MOVE AND/OR CONFIGURE THE PAGING FILE(S) ON YOUR WINDOWS NT COMPUTER, FOLLOW THESE STEPS:

1. Select Start ➪ Settings ➪ Control Panel.
2. In the Control Panel dialog box, double-click the System icon.
3. In the System Properties dialog box, click the Performance tab.
4. On the Performance tab, click the Change command button in the Virtual Memory section.
5. The Virtual Memory dialog box appears, as shown in Figure 25-1. Notice that *all* logical drives are listed in the Drive list box, regardless of whether a paging file exists on each drive.
   - **To move a paging file to another disk,** create a new paging file on the disk to which you want to move the paging file (see instructions on how to create a paging file in the next step), and then reconfigure the original paging file with an initial size and maximum size of 0.
   - **To configure or create an additional paging file**, highlight the logical drive you want to configure or create the paging file on in the Drive list box.

     Next, configure the Initial Size and Maximum Size of the paging file in the Paging File Size for Selected Drive section of the dialog box. Click the Set command button.

   When you're finished configuring paging files, click OK.
6. The System Properties dialog box reappears. Click the Close command button.
7. A System Settings Change dialog box appears, indicating that you must restart your computer before the new settings will take effect. Click the Yes command button to restart your computer.

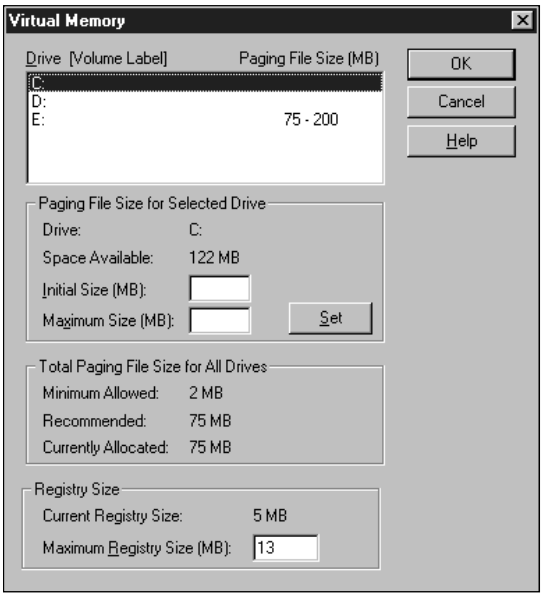


FIGURE 25-1 Configuring a paging file

tip **When deciding how large to make your paging files, check out the Total Paging File Size for All Drives section of the Virtual Memory dialog box. This section shows the minimum required paging file size, as well as the recommended and currently allocated sizes. Be aware that the numbers shown in this section are totals for all paging files on your system, not recommended settings for each individual paging file.**

Optimizing and/or Upgrading Disks

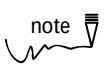
Optimizing disks is the process of speeding up hard disk response. Upgrading disks involves either adding to or replacing the existing disk(s) in a computer.

Consider optimizing disks when planning for a new Windows NT Server computer that will perform a specific task, such as file services.

Consider optimizing and/or upgrading disks when you determine, through performance monitoring, that the Windows NT computer's disk is a bottleneck to system performance. Before you upgrade a disk(s), ensure that memory (RAM) is *not* the bottleneck in your system.

You can increase disk performance by doing the following:

- Defragmenting the hard disk(s) in your computer
- Upgrading to a faster disk controller and/or a faster hard disk(s)
- Configuring a stripe set with parity across three or more disks
- Configuring a stripe set across two or more disks



Configuring disk mirroring does not necessarily improve disk performance. However, it does significantly improve fault tolerance.

Upgrading and/or Adding a Processor

When you determine, through performance monitoring, that the Windows NT computer's processor is a bottleneck to system performance, you should consider upgrading and/or adding a processor to the computer.

Before you upgrade and/or add a processor, ensure that memory (RAM) is *not* the bottleneck in your system.

The following are ways to improve processor performance, all of which involve replacing and/or adding hardware:

- Replacing the existing processor with a faster processor
- Replacing the existing motherboard and processor with a faster motherboard and processor
- Upgrading from a single processor system to a multiprocessor system
- Adding a processor to a multiprocessor system

Optimizing the Server

Optimizing your server enables you to get the most out of what you've got.

There are four primary ways to optimize a server. You can optimize a server by doing the following:

- Configuring load balancing across multiple servers
- Disabling unused services, protocols, and drivers
- Scheduling large, server-intensive tasks for nonpeak hours
- Optimizing the Server service

The following sections explain each of these server optimization methods in detail.

Configuring load balancing across multiple servers

Configuring load balancing across multiple servers involves spreading server tasks among more than one server so that no one server is overburdened.

Say you have two servers that are primarily used for file and print services. One of these servers is functioning near peak capacity, while the other server is hardly being used. To improve overall server performance, consider moving a portion of the busy server's files to the other server. This will reduce some of the load on the busy server, and "balance the load" with the second server.

Disabling unused services, protocols, and drivers

Another way to improve server performance is to disable unused services, protocols, and drivers. Each installed service, protocol, and driver uses processor time and memory space. Also, some services and protocols generate additional network traffic. If an installed service, protocol, or driver is no longer being used, consider removing the service, protocol, or driver; or, consider configuring the service, protocol, or driver to start manually (instead of automatically) when Windows NT starts.

Scheduling server-intensive tasks for nonpeak hours

Another way to improve server performance is to schedule large, server-intensive tasks to be performed during nonpeak hours.

For example, if you must update a large database or generate a large report on a daily basis, and it is *not* critical that this task be done during business hours, consider scheduling the task to run after business hours (and before the tape backup is run for the night). If the task *must* be done during business hours, consider scheduling it to run during a period of lower activity, such as during a lunch hour.

Optimizing the Server service

Finally, you can optimize the Server service for the type of tasks the server normally performs, and for the number of client computers that normally access the server.

You *can't* configure the Server service on a Windows NT Workstation computer.

The Server service has the following four possible optimization options:

- **Minimize Memory Used:** Select this option when less than ten users will be accessing the Windows NT Server computer at the same time, and a user will sit at the server and use the server as his or her desktop computer.
- **Balance:** Select this option when less than sixty-four users will be accessing the Windows NT Server computer at the same time. This option is also a good choice when the server is used for file and print services as well as by a distributed application that performs its own memory caching, such as Microsoft SQL Server.
- **Maximize Throughput for File Sharing:** Select this option when more than sixty-four users will be accessing the Windows NT Server computer at the same time, and when the server is primarily used as a file and print server. *This is the default option for Windows NT Server*, and is a good selection whenever the server functions primarily as a file and print server, even if there are fewer than sixty-four users.
- **Maximize Throughput for Network Applications:** Select this option when more than sixty-four users will be accessing the Windows NT Server computer at the same time, and when the server is primarily used for a distributed application that performs its own memory caching, such as SQL Server. This is a good selection whenever the server functions primarily as an application server, even if there are fewer than sixty-four users.

If a Windows NT Server computer is primarily used as a WINS server, a DHCP server, or is the PDC for a large network, configuring the Server service to Maximize Throughput For Network Applications should yield the best server performance.

TO OPTIMIZE THE SERVER SERVICE ON A WINDOWS NT SERVER COMPUTER, FOLLOW THESE STEPS:

1. Select Start ➪ Settings ➪ Control Panel.
2. In the Control Panel dialog box, double-click the Network icon.
3. In the Network dialog box, click the Services tab.
4. On the Services tab, highlight Server in the Network Services list box. Click the Properties command button.

5. The Server dialog box appears, as shown in Figure 25-2. Notice the four options available for optimizing the Server service. Select the radio button next to the option that will provide the best performance for your server. Click OK.

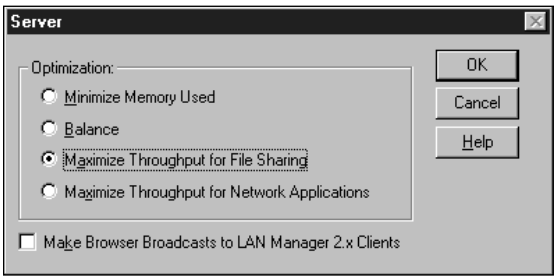


FIGURE 25-2 **Optimizing the Server service**

6. In the Network dialog box, click the Close command button.
7. A Network Settings Change dialog box appears, indicating that you must restart your computer before the new settings will take effect. Click the Yes command button to restart your computer.

Optimizing Network Traffic

There are two common situations when optimizing network traffic may be beneficial: when there is too much traffic on a network segment, and when a server is on the wrong side of a WAN link from the client computers it services.

When Performance Monitor and/or Network Monitor indicates a high percentage of network utilization on a network segment, you might consider further segmenting that network segment. You can accomplish this by adding an additional network adapter to the server, or by installing a router on the network.

When users of client computers report slow response time from a server that is physically located on the other side of a WAN link, consider one of the following options:

- *Move* the server to the other side of the WAN link so client computers can access the server directly, without having to send network traffic across the WAN link.

- *Add* an additional server of the appropriate type (BDC, DHCP, or WINS) on the other side of the WAN link to service the client computers on that side of the link and to minimize WAN traffic.

For example, when users access a server for logon authentication, IP address assignment, or NetBIOS name resolution across a WAN link (such as a BDC, a DHCP server, or a WINS server), and slow server response time is reported, consider placing an additional server of the appropriate type on the same side of the WAN link as the client computers that need to access that type of server. Placing the server physically close to the client computers will improve server response time and reduce WAN link traffic.

For more information on optimizing Directory Services traffic across a WAN link, including logon authentication and Directory Services synchronization, see Chapter 11.

Key Point Summary

Chapter 25 described *performance optimization*—the process of modifying server and/or network hardware and software configurations with the intent of speeding up server and/or network response. This chapter provided information on how to best optimize performance, including identifying and resolving bottlenecks.

- For most network administrators, performance optimization most often means resolving user reports of slow system performance. Determining the cause of the slow performance is referred to as identifying a bottleneck. A *bottleneck* is the component in the system that is slowing system performance. In a networking environment, the bottleneck is the part of the system that is performing at peak capacity while other components in the system are *not* working at peak capacity. In other words, if it weren't for the limiting component, the rest of the system could go faster.
- To identify the bottleneck in your system, use Performance Monitor to measure performance of the server's memory, processor, and disk. You can also use Performance Monitor and/or Network Monitor to gather statistics

about your network that may help you identify network bottlenecks. Once you've interpreted the statistics and have identified the bottleneck in your system, you're ready to take steps to resolve that bottleneck.

- Performance optimization involves getting the most speed out of your existing hardware and software combination. It can also involve adding to or upgrading specific components to resolve bottlenecks.
- Adding RAM is often the single most inexpensive and effective upgrade you can make to your server. A beneficial by-product of adding RAM is that processor and disk performance may be improved, as well, because paging is reduced and the disk cache size is increased when RAM is added.
- The best method for optimizing a paging file is adding more RAM. Additionally, you can place the paging file on the disk that has the least amount of activity, on a stripe set on a partition other than the boot partition, or place multiple, smaller paging files on multiple disks in the system. To move the paging file to a different disk or partition, or to configure and/or add additional paging files, use the System application in Control Panel.
- Consider optimizing disks when planning for a new Windows NT Server computer that will perform a specific task, such as file services. Consider optimizing and/or upgrading disks when you determine that the disk is a bottleneck to system performance. Before you upgrade a disk(s), ensure that RAM is *not* the bottleneck in your system.
- You can increase disk performance by defragmenting the hard disk(s) in your computer, upgrading to a faster disk controller and/or a faster hard disk(s), configuring a stripe set with parity across three or more disks, or configuring a stripe set across two or more disks.
- When you determine that the processor is a bottleneck to system performance, you should consider upgrading and/or adding a processor to the computer. Before you upgrade and/or add a processor, ensure that RAM is *not* the bottleneck in your system.
  - To improve processor performance, consider replacing the existing processor with a faster processor, replacing the existing motherboard and processor with a faster motherboard and processor, upgrading from a single processor system to a multiprocessor system, or adding a processor to a multiprocessor system.

- There are four primary ways to optimize a server. You can optimize a server by: configuring load balancing across multiple servers; disabling unused services, protocols, and drivers; scheduling large, server-intensive tasks during nonpeak hours; and by optimizing the Server service. The Server service is optimized by using the Network application in Control Panel.
- There are two common situations when optimizing network traffic may be beneficial: when there is too much traffic on a network segment, and when a server is on the wrong side of a WAN link from the client computers that it services.
  - When Performance Monitor and/or Network Monitor indicates a high percentage of network utilization on a network segment, consider further segmenting that network segment.
  - When users of client computers report slow response time from a server that is physically located on the other side of a WAN link, consider either moving the server to the other side of the WAN link, or adding an additional server of the appropriate type (BDC, DHCP, or WINS) on the other side of the WAN link.

Applying What You've Learned

Now it's time to regroup, review, and apply what you've learned in this chapter.

The Instant Assessment questions bring to mind key facts and concepts.

The hands-on lab exercises will really reinforce what you've learned, and give you an opportunity to practice some of the tasks tested by the Microsoft Certified Professional exams.

Instant Assessment

1. What is performance optimization?
2. In a networking environment, what is a bottleneck?
3. Which two Windows NT tools can you use to help identify a bottleneck in your Windows NT system?

4. Which four components should you monitor when attempting to identify a bottleneck in your Windows NT system?
5. What is perhaps the single most inexpensive and effective upgrade that you can make to your Windows NT Server computer?
6. Name one beneficial by-product of adding RAM to a Windows NT Server computer.
7. You decide you want to move the paging file on your Windows NT computer to a different disk. Which Control Panel application should you use to move/configure the paging file?
8. You determine that the disk is the bottleneck in your Windows NT Server computer. List three ways to increase disk performance.
9. You determine that the processor is the bottleneck in your Windows NT Server computer. List three ways to improve processor performance.
10. List four ways to optimize a Windows NT Server computer.
11. Users of client computers report slow server response time for logon authentication from a BDC that is located on the other side of a WAN link. What should you do to improve server response time?

For answers to the Instant Assessment questions see Appendix D.

Hands-on Lab Exercises

The following hands-on lab exercises provide you with practical opportunities to apply the knowledge you've gained in this chapter about performance optimization.

Lab 25.37 *Finding and resolving bottlenecks*

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The purpose of this lab exercise is to give you experience in analyzing Performance Monitor statistics in order to identify the bottleneck in a system, and also to give you experience in making recommendations to resolve a bottleneck.

Each problem below presents a situation and a set of statistics. In the space provided, supply the requested response to the problem.

Problem 1 Users of your network report slow response times when accessing files from a Windows NT Server computer. The server has a 486/66MHz processor with 20MB of RAM and a 2GB IDE hard disk. You run Performance Monitor on that server and obtain the statistics shown in the following table:

Object	Counter	Statistic
Processor	% Processor Time	55%
Memory	Pages/sec	125
PhysicalDisk	% Disk Time	85%
Network Segment	% Network utilization	15%

There is enough money left in your annual equipment budget to enable you to do any *one* of the following:

- Upgrade the processor to a Pentium 166MHz processor
- Upgrade memory to 64MB of RAM
- Upgrade to a faster hard disk and a faster hard disk controller
- Install a second network adapter in the server and segment the network

Which upgrade would you perform, and why?

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Problem 2 Users of your network report slow response times when accessing files from a Windows NT Server computer. The server has a Pentium 100MHz processor with 64MB of RAM and a 4GB SCSI hard disk. You run Performance Monitor on that server and obtain the following statistics:

Object	Counter	Statistic
Processor	% Processor Time	15%
Memory	Pages/sec	4
PhysicalDisk	% Disk Time	90%
Network Segment	% Network utilization	15%

There is enough money left in your annual equipment budget to enable you to do any *one* of the following:

- Upgrade to a multiprocessor system with 2 Pentium PRO 200MHz processors

- Upgrade memory to 128MB of RAM
- Upgrade to a hardware-based RAID 5 (disk striping with parity) disk subsystem
- Install a second network adapter in the server to segment the network

Which upgrade would you perform, and why?

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concept link 

For answers to the hands-on lab exercise see Appendix D.

Lab 25.38 *Optimizing Windows NT performance*

Enterprise

The purpose of this lab exercise is to give you experience in analyzing a Windows NT Server network, and to make recommendations to optimize server and/or network performance for a given situation.

Assume that you are an outside consultant, hired to optimize server/network performance for a company. Each problem below presents a situation and what your customer wants to accomplish. In the space provided, supply the requested response to each problem.

Problem 1 Your client has three networks, each located in a different city. The three networks are connected by WAN links, as shown in Figure 25-3.

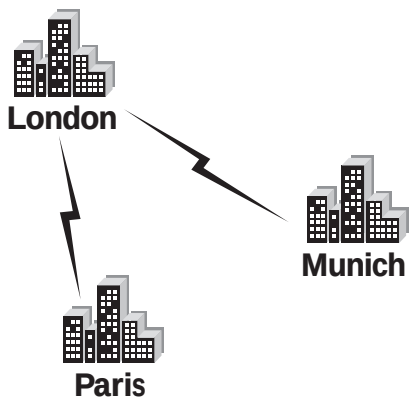

FIGURE 25-3 **WAN configuration for Problem 1**

The company uses a master domain model for its Windows NT network. The master domain is located in London, and resource domains are located in Paris and Munich.

Servers are currently installed as follows:

London PDC for LONDON domain
7 BDCs for LONDON domain
1 BDC for PARIS domain
1 BDC for MUNICH domain
4 WINS servers

Paris PDC for PARIS domain
3 BDCs for PARIS domain

Munich PDC for MUNICH domain
2 BDCs for MUNICH domain

The company wants you to make recommendations for minimizing the amount of logon authentication and NetBIOS name resolution traffic sent across their WAN links. What recommendations would you make to accomplish these two tasks?

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Problem 2 Your client wants you to optimize the Server service on a Windows NT Server computer. The computer functions as the PDC for a large network. The PDC is used primarily to manage the Directory Services database, and also functions as a DHCP server for clients on its local network segment.

How would you optimize the Server service on this Windows NT Server computer?

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For answers to the hands-on lab excercise see Appendix D.