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GroupWise 5.2 Performance Tuning and Capacity Planning

Abstract: *This solution guide provides suggestions for improving Novell GroupWise 5.2 performance and recommends appropriate server hardware for GroupWise 5.2 running on Novell intraNetWare. Compaq and Novell engineers conducted the performance testing and data analysis in order to make recommendations regarding the relationship between system resources and GroupWise performance. They provide GroupWise administrators with detailed recommendations on user load variances and stress testing--as well as server-specific results based on the monitoring and utilization of the system, processor, memory, and disk subsystems. They also offer performance tuning guidelines for running GroupWise 5.2 on Windows NT.*

Notice

Compaq's Preliminary Examination of Novell GroupWise 5.5 Performance and Scalability with NetWare 5.0 Solutions Guide prepared by Messaging and Collaborations Solutions Business Unit

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Introduction

This paper will assist the reading with better understanding of the relationship between system resources and GroupWise 5.2 performance. It will help to make informed server configuration decisions when upgrading or purchasing a new system. The following topics will be addressed:

- Description of testing methodology
- Guidelines for planning memory and the disk subsystem requirements
- Recommendations on user load variances and stress testing--as well as server-specific results such as the monitoring and utilization of the system, processor, memory, and disk subsystem
- Performance tuning guidelines
- Performance comparisons when running GroupWise 5.2 on Windows NT

Performance Management and Capacity Planning

The goal of capacity planning is to find the best server and equipment required to meet network workload demands and performance requirements, while doing so in a cost-effective manner. Capacity planning helps to balance the demand for present and anticipated workload with the supply of present and future computer resources. A basic objective should be consistent and acceptable user response times.

GroupWise performance depends on the number of users on the system, the operating environment of the server and workstations, and the bandwidth and speed that are available to the physical network. The type of server, network interface cards (NICs), and cabling systems also play an important role in how the network operates under heavy traffic conditions.

The amount of time, effort, and cost spent properly planning the GroupWise implementation will be worth the investment when the system adequately meets user response-time expectations and optimally utilizes system resources.

Components of a Basic GroupWise System

A basic GroupWise system consists of a single domain with one post office and one or more users. Each GroupWise user has a mailbox in the post office. Users run the GroupWise client to access their mailbox and to send mail or receive mail from other users. The GroupWise agents deliver messages between users' mailboxes in a post office, and route messages between post offices in a multiple post office system (see Figure 1).

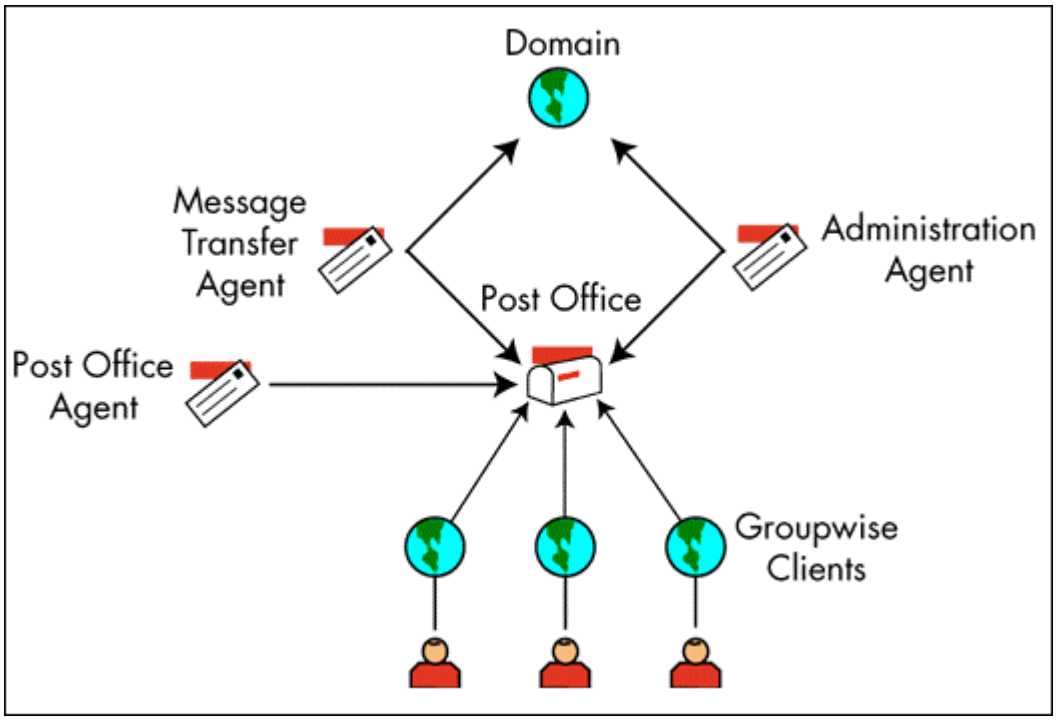

Figure 1: *Components of a basic GroupWise system.*

In a basic GroupWise system, the domain serves two purposes:

- In a multiple post office system, the domain organizes post offices into a logical grouping for addressing and routing purposes. Each user in the domain has an address that consists of the domain name, the user's post office name, and the user's GroupWise ID (domain.po.userID).
- The domain functions as the main administration unit for the GroupWise system. When GroupWise information is added (such as other domains, post offices, and users) through NetWare Administrator, it is stored in Novell Directory Services and the GroupWise domain database. From the database, GroupWise information is then distributed to each post office database.

The domain/post office architecture makes it possible to scale and configure the GroupWise system to meet both current and future needs.

Test Methodology

The tests were performed in Novell's Super Laboratory (SuperLab), a state-of-the-art testing facility available to developers and third-party testing groups. SuperLab consists of more than 1,700 computers, with the ability to configure complex topologies using various LAN and WAN technologies.

The benchmark tool used during the test was developed by Novell engineers and provides a means for customers to compare GroupWise running on different hardware and under various load conditions.

Test Environment

The table below illustrates the various Compaq server configurations tested.

System	Processor	Memory	Network Adapter	Hard Disk
Compaq Prosignia 200	Pentium II 233	128MB EDO	3x Compaq Netelligent100 TX	1x 2.1GB with a Wide- Ultra SCSI Controller
Compaq ProLiant 1600	Pentium II 266	128MB EDO	3x Compaq Netelligent100 TX	3x 2.1GB disks in a RAID 0 configuration with a SMART-2/P Controller
Compaq ProLiant 3000	Pentium II 300	128MB EDO	3x Compaq Netelligent100 TX	3x 2.1GB disks in a RAID 0 configuration with a SMART-2/P Controller
Compaq ProLiant 6500	Pentium Pro 200/512K	128MB EDO	3x Compaq Netelligent100 TX	3x 2.1GB disks in a RAID 0 configuration with a SMART-2/P Controller
Compaq ProLiant 7000	Pentium Pro 200/512K	128MB EDO	3x Compaq Netelligent100 TX	3x 2.1GB disks in a RAID 0 configuration with a SMART-2/P Controller

The test bed used consisted of a system under test and then a number of users generating a mail workload. The software used for the system under test was NetWare 4.11 and GroupWise 5.2. The clients were running Windows 95 and the GroupWise 5.2 Client for Windows 95.

Test Procedure

The test consisted of an automated test script: Each client generated 20 messages to three recipients randomly picked by the client. In the test, Compaq and Novell engineers analyzed network server/environment performance and collected baseline statistics. The NetWare MONITOR.NLM utility monitored system resources. Novell also provides a custom utility called STAT.NLM for logging statistics during the test process. The test results were collected through GroupWise log file.

Subsystem Performance Comparison

This section offers guidelines for achieving optimum performance/value from your Compaq server. They are based on analysis of data gathered during Novell's in-house benchmark testing. This following sections describe each subsystem, present the data collected during the tests, and then provide recommendations for the optimal configuration for Compaq servers.

The subsystems to be discussed include:

- System Processor
- Memory
- Disk

System Processor

Whereas in a NetWare resource-sharing environment, network adapters, hard drive subsystems, and the amount of system memory tend to be more significant performance factors than the speed or type of system processor running in the server. However, with GroupWise, the system processor plays the most important role in performance tuning.

Pentium Pro vs. Pentium II. In the test, the performance of the Intel Pentium Pro processors was compared to Pentium II processors. As the test results in Figure 2 illustrate, the high core frequencies of the Pentium II processor enhance the performance of the Compaq system when used in a CPU-intensive environment.

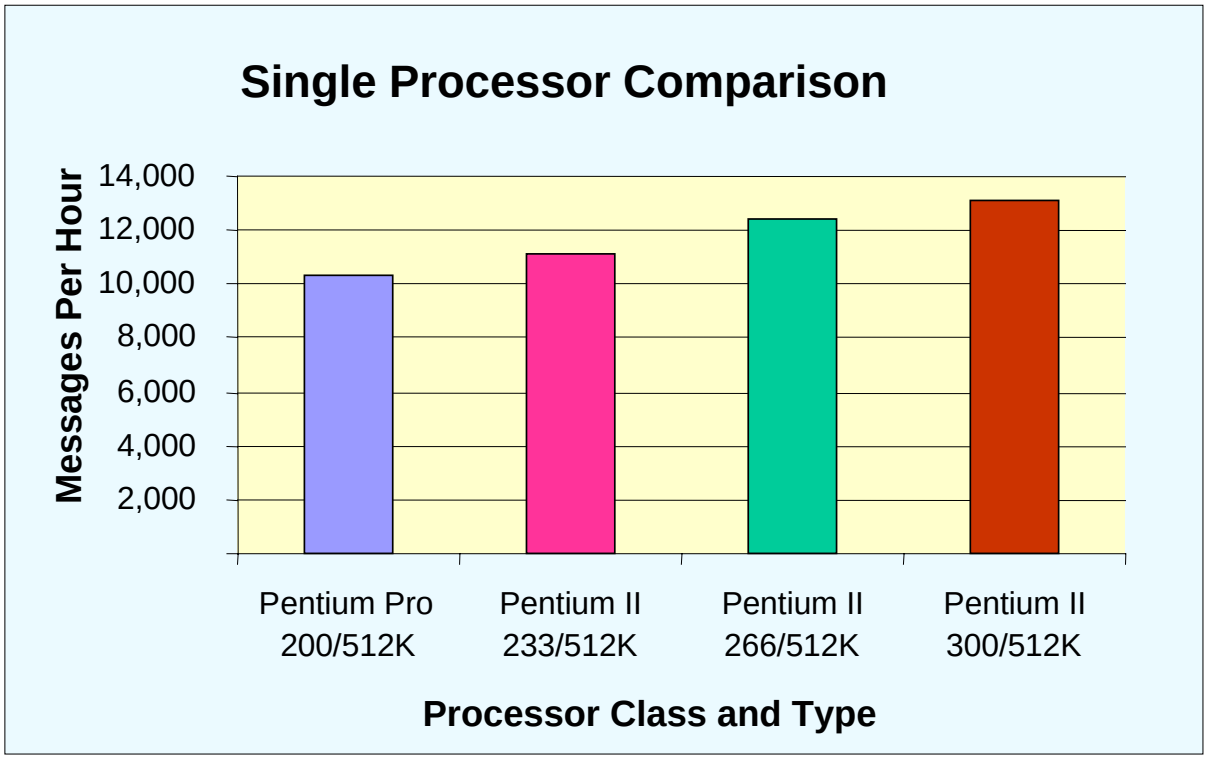

Figure 2: *Results of CPU performance tests.*

These results reveal that 30 percent more messages can be delivered using the Pentium II processor at 300 MHz than when using a Pentium Pro processor at 200 MHz. The high core frequencies of the Pentium II contribute to a significant performance increase within a CPU-bound environment.

Level 2 Cache. Level 2 cache memory is the high-speed Static RAM that resides between the CPU and the main system memory. Level 2 cache stores snapshots of the most recently used system memory regions in fast static RAM memory, so that it is available to the processor immediately. Since Level 2 cache memory returns information to the processor faster than system memory, the processor spends less time waiting for the main system memory to return data and

more time performing real processing work. In the Pentium Pro processor, the L2 cache connects to the processor via a 64-bit data bus operating at the processor core frequency.

During the Level 2 cache test, the number of active users was held to 70 per Compaq ProLiant 7000 system. The Level 2 cache configuration varied from 256KB through 1024KB (see Figure 3). The PL7000 was configured using a SMART-2/P disk array controller. A RAID 0 array of three striped drives was used as the NetWare volume.

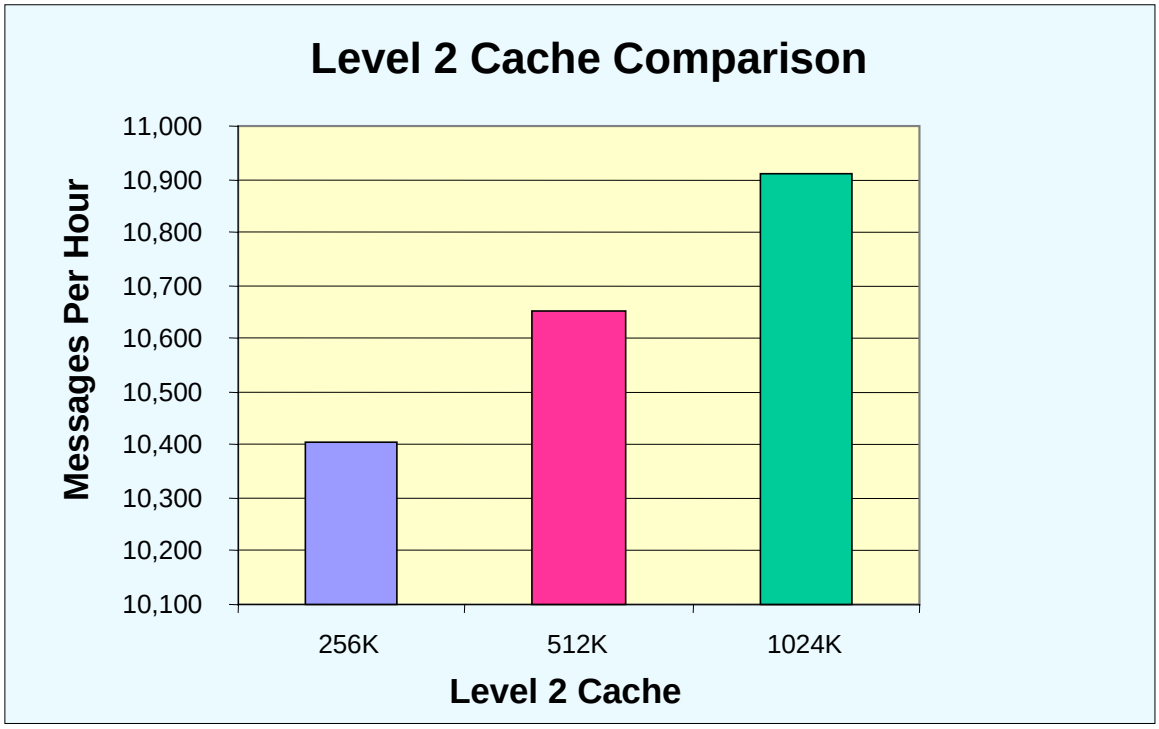

Figure 3: *Results of Level 2 cache performance tests.*

The data charted in Figure 3 indicates that upgrading a server Level 2 cache from 256KB to 1024KB increases the system level performance by 5%. When applications are executing, multiple system functions occur concurrently. With these functions occurring at the same time and each function able to benefit from Level 2 cache, the increased Level 2 cache provides each function with more cache. This additional cache then increases the cache 'hit ratio' and thereby increases overall performance and productivity. Cache performance can impact overall system performance, especially when using multiprocessor configuration and in systems running memory-intensive application such as large database applications.

System Memory

The total amount of server memory will impact significantly the overall performance of the system. GroupWise 5.2 memory requirements vary depending on several factors. It is important to note, however, that providing more memory than is required can actually slow performance down. This is because the system and processor must manage a larger pool of memory resources.

During the memory test, the number of active users was held to 70 on a Compaq ProLiant 3000 using a Pentium II 300 processor with 512K cache. Memory configuration varied from 64MB through 512MB (see Figure 4). The PL3000 was configured using a SMART-2/P disk array controller. The NetWare volume was on a RAID 0 array of three striped drives.

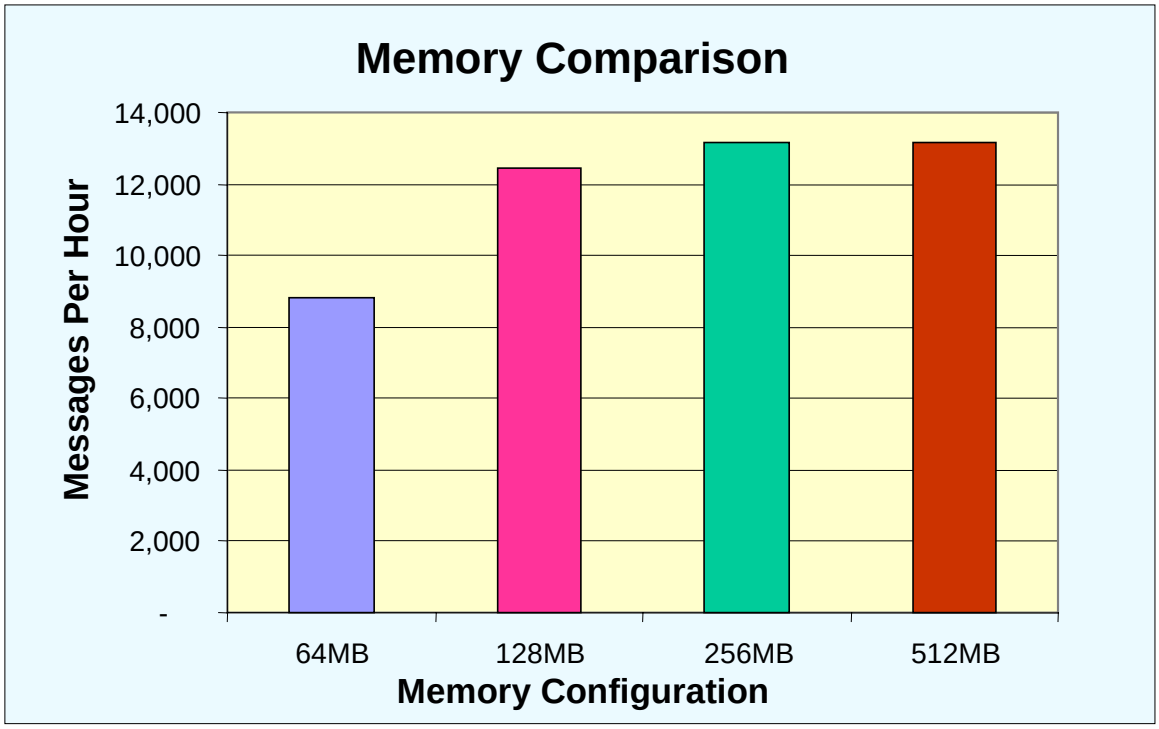

Figure 4: *Results of memory performance test*

The results in figure 4 show that performance improved 50 percent by doubling 64MB of memory to 128MB on the system. However, increasing memory beyond 128MB had minimal impact on performance. In short, more memory is not necessarily always better; a system without proper configured memory may result in performance degradation.

Memory Recommendations. Compaq and Novell engineers suggest the memory recommendation summarized in the table below. These guidelines can be used by the system administrator as a rule-of-thumb for determining initial GroupWise memory requirements. Once the system is in production, the administrator can use NetWare monitoring tools such as MONITOR.NLM to determine whether a memory upgrade is necessary. It is important to note that the memory configuration presented in the table below does not include memory required for the NetWare operating system.

Concurrent Users	Actual Server Memory Used During Peak Time	Recommended Memory Configuration
100 Active Users (100-250 Users)	42 MB	128 MB
250 Active Users (250-500 Users)	104 MB	192 MB
500 Active Users (500-1000 Users)	116 MB	256 MB
1000 Active Users (1000-2500 Users)	137 MB	512 MB

Disk Subsystem

Key disk subsystem components can play a major role in overall system performance. Novell GroupWise is a very I/O-reliant application, so the disk subsystem is an important contributor to overall system performance. Identifying potential bottlenecks within the disk subsystem is crucial.

Determining disk subsystem impact involves analyzing these options:

- Fault Tolerance (RAID 0, RAID 1, RAID 4, RAID 5)
- Accelerator Read/Write Ratio of the Array Controller
- Cache Memory
- Volume Block Size

Fault Tolerance. Redundant Array of Inexpensive Disks (RAID) levels are briefly defined below.

RAID 0 - No Fault Tolerance

RAID 0 is not true fault tolerance since it does not provide data redundancy, and thus provides no fault protection against data loss. If a logical drive fails, data on that drive will be lost. No logical drive capacity is used for redundant data. RAID 0 is known as "stripe sets" because data is simply striped across all of the drives in the array. This configuration provides high performance at a low cost. However, you incur a risk of possible data loss.

RAID 1 - Drive Mirroring

This is typically the highest performance method of fault tolerance. RAID 1 is the only possible option for fault tolerance if no more than two drives are selected. This configuration of mirrored sets of data uses 50 percent of drive storage capacity to provide greater data reliability by storing a duplicate of all user data on a separate disk drive. Therefore, half of the drives in the array are duplicated or "mirrored" by the other half. This RAID level does provide performance equal to or better than RAID 0, but drive costs double because this level requires twice as many disk drives to store the same amount of data.

RAID 4 - Data Guarding

RAID 4 is referred to as "data guarding" because it uses parity data to guard against the loss of data. While this is similar to RAID 5 ("*distributed* data guarding"), the difference is that RAID 4 writes all of the parity data to a dedicated single drive in the array. If a drive fails, the parity data and the remaining functioning drives with data use the parity information to reconstruct data from the failed drive. But if the drive(s) containing parity information fail, parity drive data cannot be reconstructed.

Space required for parity is on a single drive. For example, if you have a three-drive system, then 33 percent of the total drive space (one drive) would be used for fault tolerance. In this case, two drives would store data, and one drive would store parity data. A maximum of 14 drives can be supported. Of these 14 drives, 7 percent of the total space available or one drive would be used for parity data. Writing all the parity data to a single drive also introduces performance degradation, since parity data is not striped across all drives. Therefore, a disk configuration using RAID 4 for fault tolerance has historically proven to yield performance results at a level below RAID 5 configurations.

RAID 5 - Distributed Data Guarding

RAID 5 is commonly called "distributed data guarding" or "stripe sets with parity." This level of RAID divides data into blocks, calculates parity, then writes the data blocks in "stripes" to the disk drives, saving one stripe on each drive for the parity data. This method is cost-effective, with the added benefit of high performance because the parity information is distributed across all the drives. Total disk space used for redundancy is equivalent to the capacity of a single drive. Therefore, the overall cost for this method of fault tolerance is lower than for Disk Mirroring (RAID 1).

Fault Tolerance Test Results

The Compaq SMART-2 Array Controller provides high availability, high performance, and fault tolerance for data stored on hard disks. It also provides significant expansion capabilities for large-scale centralized computing, protecting mission-critical data where it has previously been cost prohibitive.

The tests compared the fault tolerance levels of RAID 0, RAID 1, RAID 4, and RAID 5 (see Figure 5) and were run on a Compaq ProLiant 6500 with a single Pentium Pro 200 processor and 512MB of RAM. The test had 70 active users. The RAID 0 and RAID 5 tests were performed using three 2.1GB drives in an array. The RAID 1 test was run using six total drives, with three drives mirroring the other three.

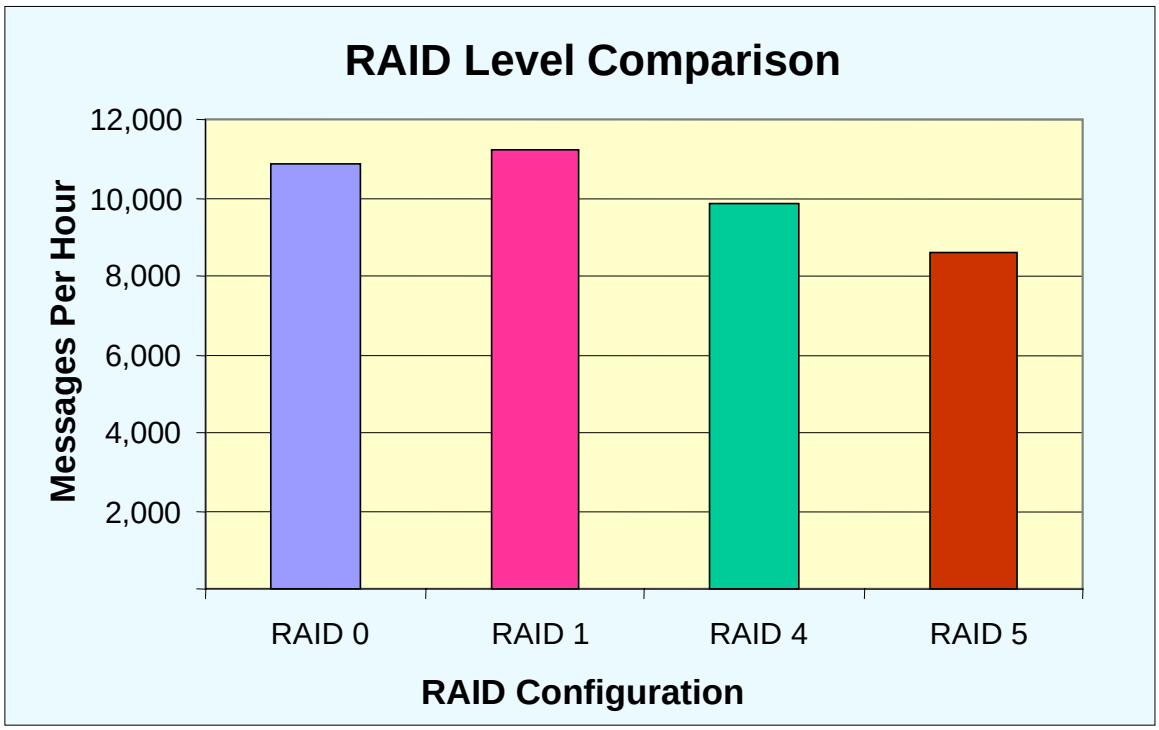

Figure 5: *Results of fault tolerance tests.*

These results show that RAID 1 performed best, outperforming RAID 0 by 5 percent and performing about 30 percent better than RAID 5. Keep in mind that although RAID 0 does utilize available disk space most efficiently, this level provides no protection against data loss. You risk data loss if you choose RAID 0. For systems with critical data, RAID 5 is frequently the best choice because it provides better disk space usage.

Based on these tests, the recommendation for a GroupWise system is RAID 1, because of the performance gains over RAID 5, combined with hardware fault tolerance.

Array Controller Accelerator Read/Write Ratio. The Compaq Array Controller Configuration Utility offers five options for Read/Write ratio:

- 0/100
- 25/75
- 50/50
- 75/25
- 100/0

During the Read/Write Ratio test, the number of active users was held to 70 on a Compaq ProLiant 3000 Pentium II 300 system with 512KB cache. The Read/Write Ratio was configured at 25/75, 50/50, and 75/25 (see Figure 6). The PL3000 was configured using a SMART-2/P disk array controller. A RAID 0 array of three striped drives was used as the NetWare volume.

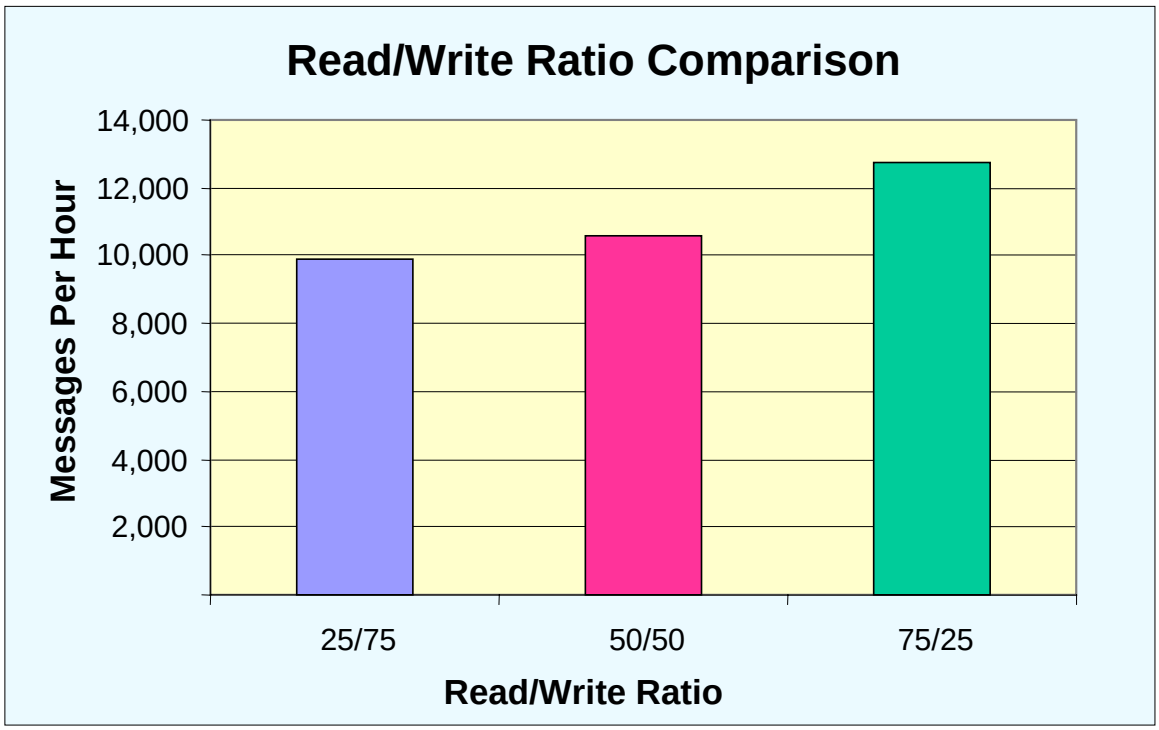

Figure 6: *Results of read/write ration comparison test.*

These test results show that a Read/Write Ratio of 75/25 achieved best performance, outperforming the other two configurations by 20 to 30 percent. This indicates an optimal Read/Write Ratio of 75/25 for GroupWise because of performance improvement.

Cache Memory. The enhanced Array Accelerator on the SMART-2 Controller has 4 MB of usable cache to offer good performance with optimal cost effectiveness. The enhanced Array Accelerator on the SMART-2/DH Controller has 16 MB of usable cache. With the streamlined architecture of the SMART-2 Controller, these cache sizes provide excellent performance enhancements for sequential, small read requests and small- to medium write requests (see Figure 7).

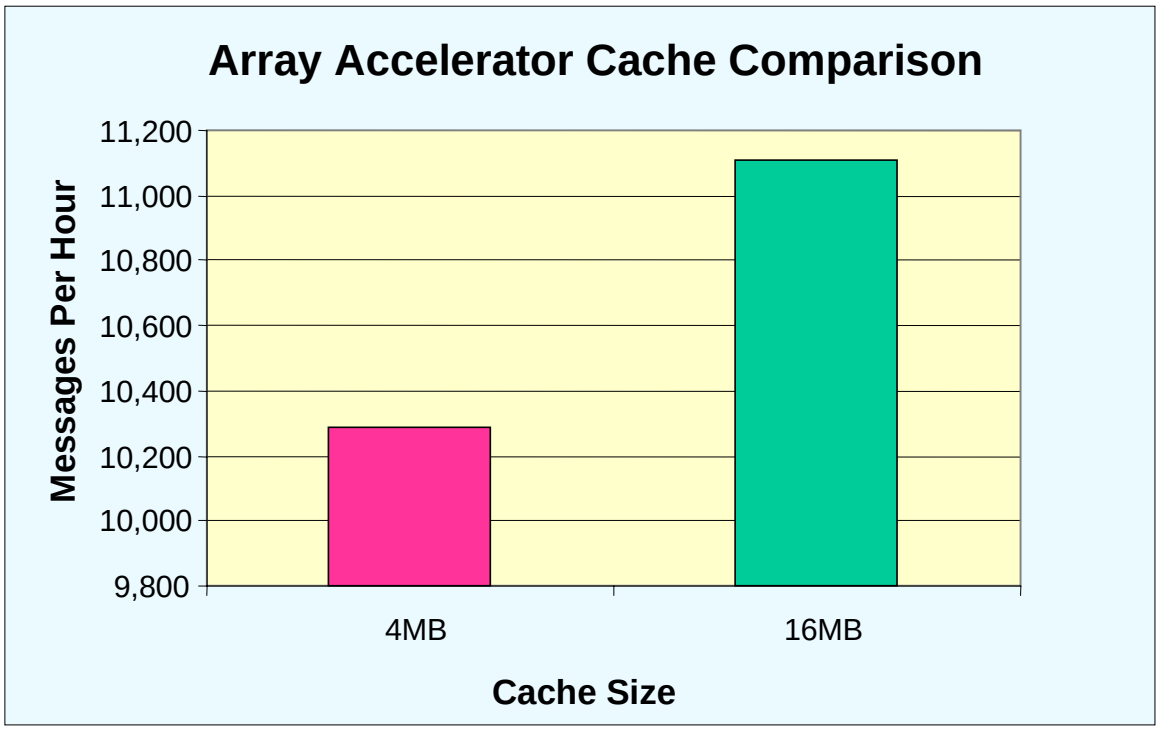

Figure 7: *Results of cache size comparison test.*

These results quantified a 7-10 percent performance gain for GroupWise mail activity when upgrading Array Accelerator cache memory from 4MB to 16MB. Therefore, optimizing cache size provides great performance enhancement.

To gain added performance for a GroupWise system, consider using the SMART-2/P Controller with the cache memory upgraded from 4 MB to 16 MB. Upgrading the cache requires replacing the cache board on the SMART-2/P controller with a 16-MB cache board, so customers can maintain their previous hardware investment.

Volume Block Size. One feature of the NetWare operating system is the ability to support large volume blocks. Using a large volume block size increases the performance of almost every associated subsystem, such as disk channel, file cache, directory cache, directory entry table, and file allocation table. This large volume block size does not waste disk capacity when storing lots of small files because of the way files are sub-allocated.

The results shown in Figure 8 display a noticeable improvement in message rates when the volume block size is set to 64KB.

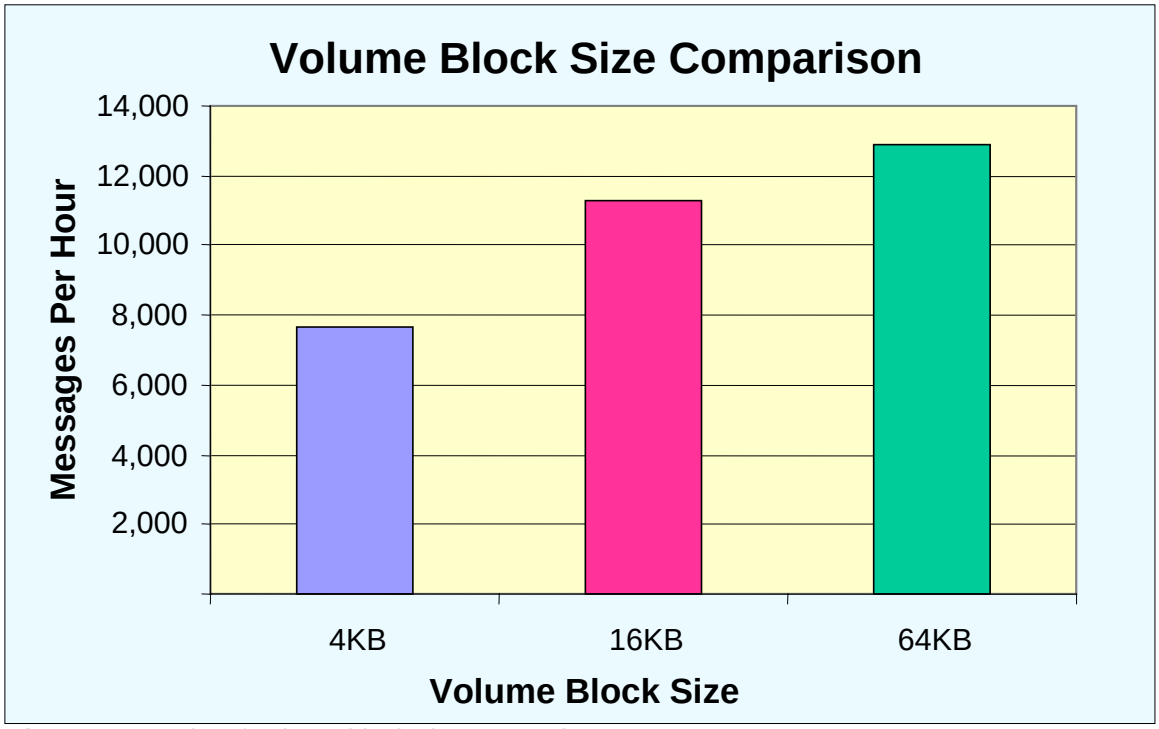

Figure 8: *Results of volume block size comparison test.*

Compaq and Novell engineers recommend that you always select a volume block size of 64KB. With a smaller block size, more system memory is employed to manage the blocks. With the sub-allocation feature provided with intraNetWare, a block size of 64KB will give you the best performance for file reads and writes, without wasting disk space.

Performance Tuning

This section provides performance tuning guidelines in the following areas:

- Hard disk controller (read-ahead caching, write-back caching, and balanced cache size)
- GroupWise POA
- NetWare operating system

Hard Disk Controller

The SMART-2 Controller offers exceptional performance characteristics because of its underlying intelligent I/O architecture that has been streamlined for high performance. The advanced architecture consists of optimized hardware and firmware components working together efficiently, with functions and embedded intelligence distributed across the design.

The enhanced Array Accelerator of the SMART-2 Controller provides significant performance improvement for I/O operations through its read-ahead and write-back caching capabilities.

Read-Ahead Caching. The SMART-2 Controller uses an intelligent read-ahead algorithm that can anticipate data needs and reduce wait time. This adaptive read-ahead scheme provides excellent performance for sequential small block read requests. It overcomes the problem with

some array controllers in the industry today: fixed read-ahead schemes that improve sequential read performance but degrade random read performance.

Write-Back Caching. The SMART-2 Controller also uses a write-back caching scheme that allows applications to continue without waiting for the completion of write operations. Without this type of caching, the controller would be forced to wait until write data is actually written to disk before returning completion status to the operating system. With write-back caching, the controller can "post" write data to high-speed cache memory and immediately return completion status to the operating system. The write operation is completed in microseconds rather than milliseconds.

Balanced Cache Size. The enhanced Array Accelerator has 4 MB or 16MB of usable cache to provide good performance with optimal cost effectiveness. With the streamlined architecture of the SMART-2 Controller, these cache sizes provide excellent performance enhancements for sequential, small-size read requests and small- to medium-size write requests.

The Array Accelerator read/write cache ratio can be customized to fit your GroupWise activity using the Compaq Array Controller Configuration Utility. The default setting is 50% Read/50% Write, but several other ratios are possible.

GroupWise POA Optimization

You can adjust how the GroupWise Post Office Agent (POA) functions to optimize its performance. Before attempting optimization, you should run the POA long enough to observe its efficiency and its impact on other network applications running on the same server or workstation. Also, keep in mind that optimizing your network hardware and operating system can have an effect on POA performance.

Number of POA Threads and Connections. Threads are operating system processes. If the POA is configured with client/server processing enabled, it starts TCP handler threads to handle current client/server requests, up to the number of threads specified by the TCP Handler Threads option.

If the POA is not keeping up with the client/server requests from GroupWise client users, you can increase the maximum number of TCP handler threads, so the POA can create additional threads. The default is 6 TCP handler threads (valid values range from 1 to 50). Anticipate about 1 TCP handler thread per 20-30 client/server users. Or just increase the number of TCP handler threads in increments of three to five threads until you achieve acceptable throughput. The optimum number of threads for a POA is affected by many factors, including available system resources.

If GroupWise client users cannot connect to the POA or if response is sluggish, you can increase the maximum number of connections. Connections are the number of "sockets" through which client/server requests are communicated from the GroupWise client to the POA. Application connections are the TCP/IP connections between the POA and the GroupWise clients run by GroupWise users. Each GroupWise user creates one application connection when he or she starts GroupWise. The default is 2048.

Physical connections are created as users perform specific activities in the GroupWise client. If a physical connection is idle for 5 seconds, it terminates—but another one is established on demand. Each GroupWise client user could have zero or multiple physical connections, depending on what activities he or she is doing. The default is 512.

Number of POA Threads for Message File Processing. If the POA is configured for message file processing, it starts the number of threads specified by the Message Handler

Threads option. Each thread can perform any POA function. Though the threads are started from the same program, each thread operates independently of the others. For example, one thread may be processing a message, while another thread may be polling the input queue directories in the post office, and another thread may be idle. The default number of message handler threads is 8; valid values range from 3 to 30.

The more message threads the POA uses, the faster it can process GroupWise messages. However, the more threads the POA uses, the fewer resources are available to other processes running on the server or workstation. The optimum number of threads for a POA is affected by many factors, including available system resources. You might consider increasing the number of threads in increments of three to five threads until acceptable throughput is reached.

CPU Utilization for NLM POA. To ensure that it does not dominate the server CPU, the NLM POA has a CPU utilization threshold. The default CPU utilization threshold for the NLM POA is 85 percent. You can change this threshold using the CPU Utilization option. If CPU utilization exceeds the threshold by 5 percent, any idle NLM POA threads remain idle for the number of milliseconds set by the Delay Time option. This cycle continues until CPU utilization drops below the CPU utilization threshold.

To determine the optimum utilization setting for your network, you must consider the amount of available memory, the demands of other network applications, and the type of throughput you want the NLM POA to provide. As you raise the utilization threshold, NLM POA efficiency increases; however, other network applications have fewer available network resources. As you decrease utilization threshold, NLM POA efficiency is reduced; however, the NLM POA cooperates better with other network applications.

The following table provides general guidelines for setting the CPU Utilization and Delay Time settings, based on the amount of memory available on the server where the NLM POA runs. The values in this table are just guidelines. The best way to determine these settings for your network is to experiment.

Memory	Setting
4MB	CPU Utilization: 25 Delay Time: 500
8MB	CPU Utilization: 50 Delay Time: 300
16+MB	CPU Utilization: 85 Delay Time:100

NetWare Operating System Tuning

You should always analyze network server/environment performance and obtain baseline statistics before making any changes to the server.

Packet Receive Buffers. Normally, NetWare dynamically allocates packet receive buffers based on its needs. However, the operating system allows you to set a maximum and minimum number of buffers. Compaq and Novell engineers preset the Packet Receive buffers to an optimum setting for 10-15 percent performance gain. It is important to monitor the value of the current packet receive buffers to see if the value is close to maximum. If this is the case, you should increase the maximum to account for increased server workload.

However, keep in mind that increasing the minimum Packet Receive Buffers takes system memory from the NetWare memory pool. Also, take care to ensure that increasing this value does not leave the server with too little memory.

Read-Ahead Cache. The read-ahead feature in NetWare provides the requesting workstation with a faster response time when reading files from the server. The operating system anticipates read requests from the workstation and caches the next volume or disk block of a file. Therefore, Compaq and Novell engineers recommend that you enable read-ahead cache to enhance read performance (see Figure 9).

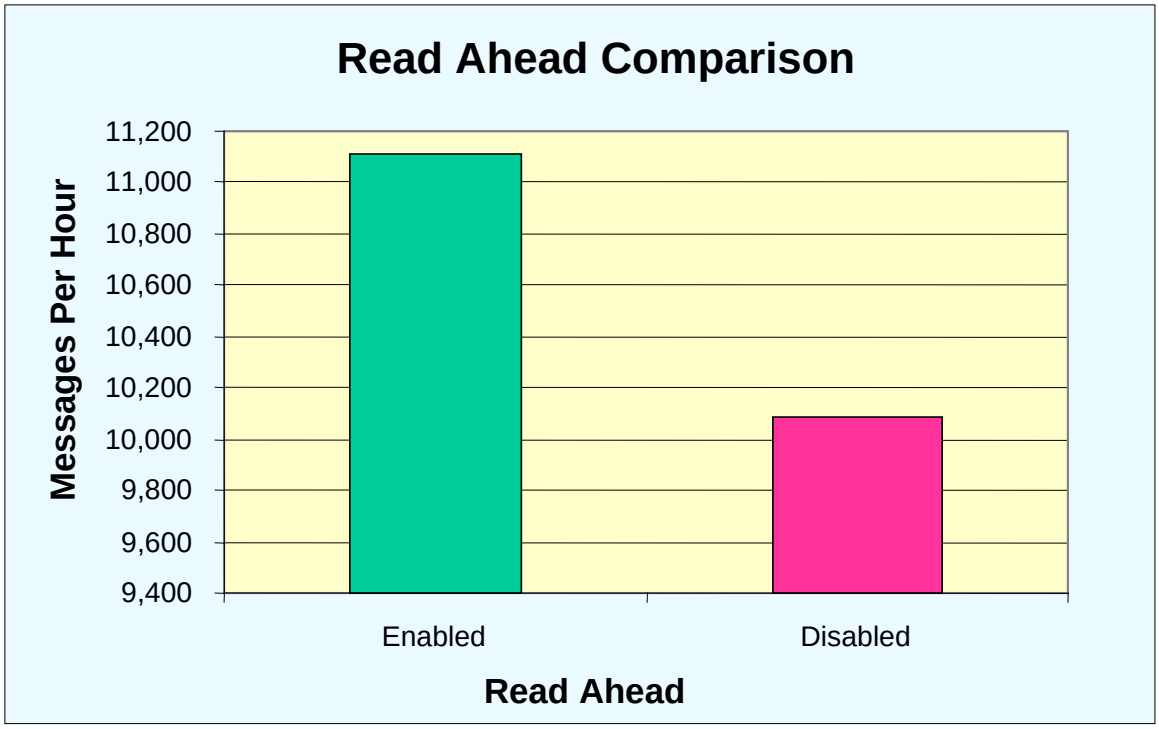

Figure 9: *Enhancement of enabling read-ahead cache.*

Concurrent Disk Requests. The Concurrent Disk Request values display the number of queued disk requests for the server to process. To enable more efficient read and write requests for your system, you can adjust the maximum number of concurrent disk cache writes. The data charted in Figure 10 illustrates that adjusting the setting of Concurrent Disk Cache will enhance system performance.

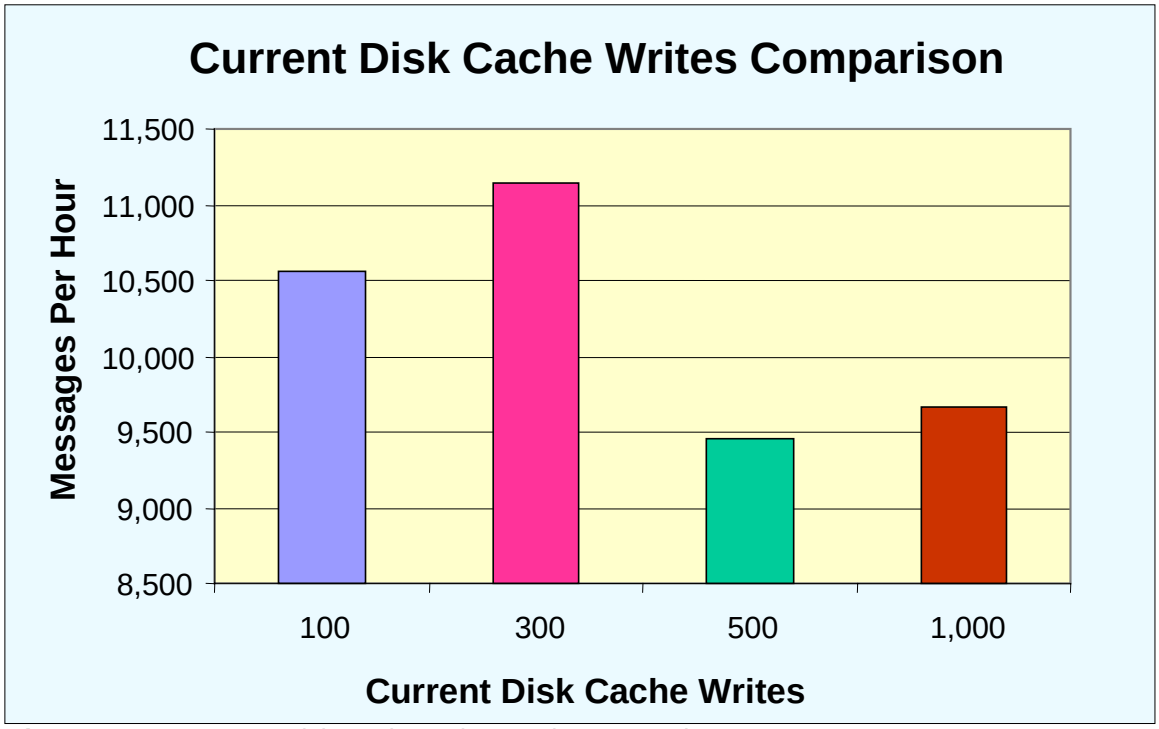

Figure 10: *Concurrent Disk Cache Writes setting comparison.*

Based solely on these test results, we concluded that optimum setting of Concurrent Disk Cache Writes for GroupWise is 300. Currently Compaq and Novell engineers identify three read operations to one write operation as a typical resource-sharing environment. However, you must be aware of your network read-write ratio when you change this parameter.

Running GroupWise 5.2 on Windows NT

GroupWise 5.2 runs not only on NetWare but also on Windows NT. However, to use GroupWise, customers must install at least one NDS server. Since the NDS server doesn't currently run on NT, customers must install a NetWare server even if they want to run GroupWise on NT. (Keep in mind that deploying GroupWise doesn't require as much of a commitment to NDS and NetWare as deploying Exchange does to NT and NT domain.)

Note: Novell is planning to make GroupWise independent of NetWare by using cross-platform NDS. At that time, GroupWise should be able to use NDS without a NetWare server.

The following are the GroupWise 5.2 configurations deployed during our tests:

- GroupWise Post Offices on a NetWare Server running NetWare NLM, MTA loaded on the same server
- GroupWise Post Offices on a NetWare Server with the MTA running on Microsoft Windows NT 4.0 application server
- GroupWise Post Offices on a Microsoft Windows 4.0 NT application server with the MTA running on the same server. Microsoft's high performance NT File System (NTFS) was used instead of ordinary DOS FAT file system.

The results are shown in Figure 11.

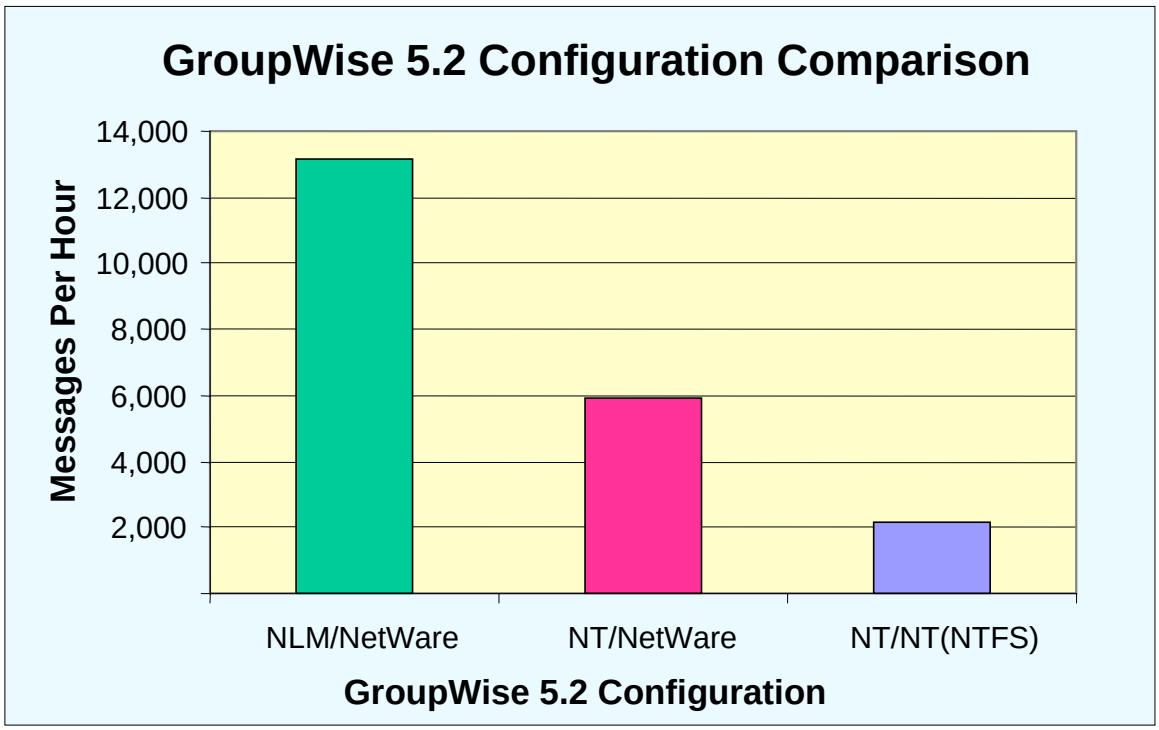

Figure 11: *Results of NT vs. NetWare NLM comparison test.*

These results demonstrate that GroupWise 5.2 on NetWare performed much better than GroupWise 5.2 on Windows NT. Although the results for NT and NTFS were slower than expected, it is adequate to handle any real-world messaging traffic.

Benchmark Conclusions

The following table summarizes the requirements for a single domain containing one post office in terms of POA, processor, memory, and disk subsystem.

Item	Requirement
NetWare 4.1	- GroupWise is administered through NetWare Administrator and NDS. You must have at least one NetWare 4.1 server installed. - NWADMN95.EXE or NWADMNNT.EXE (installed by GroupWise if necessary)
NetWare Administrator and GroupWise Administrator	- Windows 95 workstation with NetWare Client 32 for Windows 95 or Windows NT 4.0 workstation with NetWare Client 32 for Windows NT 80486 processor - 16 MB RAM
Domain Disk Space	- 1MB
Post Office Disk Space	- 2 MB per user (minimum) - 10 MB per user (recommended)
Software Distribution	- 275 MB maximum on network directory. This will be less if you choose not to install some GroupWise clients or agents.

Directory Disk Space	- No disk space is required if you mount the GroupWise CD as a server volume.
NLM Agents	- NetWare 3.12 or 4.x server - MTA and ADA: 6 MB free disk space, 6.5 MB free RAM - POA: 6 MB free disk space, 5 MB free RAM (1.5 MB if running on same server as MTA or ADA)
NT Agents	- Windows NT 3.51 server or workstation - MTA and ADA: 4.5 MB free disk space, 6 MB free RAM - POA: 4.5 MB free disk space, 5 MB free RAM (1.5 MB if running on same machine as MTA or ADA)
Windows 95 GroupWise Client	- Windows 95 workstation or Windows NT 4.0 workstation - 80486 processor (minimum) - 24 MB free disk space to run from local drive - 5 MB free disk space to run from network drive - 8 MB RAM
Windows 3.1 GroupWise Client	- Windows 3.1 workstation or Windows 95 workstation - 80386/33 processor - 20 MB free disk space to run from local drive - 1 MB free disk space to run from network drive - 8 MB RAM

System Processor Summary

The tests clearly show that the system processor is the most important server subsystem affecting overall system performance of the GroupWise 5.2 system. The faster the system processor is, the better the system performance gain will be. Therefore Compaq and Novell engineers recommend the fastest processor that can be purchased within the budgetary limitations of your project.

Compaq provides servers featuring Pentium II technology. The higher core frequencies of the Pentium II processor bring enhanced performance to Compaq's system used in CPU-intensive application. However, keep in mind that the Pentium II processor is not targeted for use in all application environments. The Pentium Pro processor remains the primary processor for Compaq servers used in memory-intensive applications and systems employing more than two microprocessors.

Concurrent Users	Recommended Compaq System
50 Active Users 0-100 Users	**ProSignia 200** The ProSignia 200 family features the 233 Mhz Pentium II Processor. This server is designed for small and medium-sized businesses.
100 Active Users 100-250 Users	**ProLiant 1600** The ProLiant 1600 supports to two 266 MHz Pentium II processors.
250 Active Users 250-500 Users	**ProLiant 3000** The ProLiant 3000 features a 300 MHz Pentium II processor (upgradeable to dual processors).
500 Active Users 500-1000	**ProLiant 7000 or ProLiant 6500** The ProLiant 6500 and ProLiant 7000 features

	Pentium Pro processor(up to four 200MHz processors with 512KB or 1024KB level 2 cache per processor)with the power and breakthrough availability to support the most demanding 7x24 environment.
1000 Active Users 2500+ Users	**ProLiant 7000 or ProLiant 6500** The ProLiant 6500 and ProLiant 7000 features Pentium Pro processor (up to four 200MHz processors with 512KB or 1024KB level 2 cache per processor) with the power and breakthrough availability to support the most demanding 7x24 environment.

Memory Configuration Summary

The memory requirements are upper limits for a high usage messaging system. The memory required on a server for GroupWise 5.2 varies depending on many factors and the mathematical calculation techniques presented below may not be used as an absolute tool for calculating memory requirements. A GroupWise system will run with less than the maximum amount of memory, but it will perform better with adequate memory. Memory amounts stated are for GroupWise 5.2 and not total system memory.

Factors to consider in performance calculations follow:

- Number of post offices and domains
- Number of TCP Handlers and MF worker threads
- Number of client/server connections being supported
- Message traffic between post offices and domain
- Separate processors for POA, MTA and ADA
- IP or direct connections between MTAs
- High volumes of admin related traffic
- High volumes of large messages (large attachments, remote updates, and so on)

Here are the memory calculations for running GroupWise 5.2:

Base memory	GWENN1	- 3,500,000 bytes
	GWPOA	- 248,000 bytes
	GWADA	- 102,000 bytes
	GWMTA	- 190,000 bytes
	GWMTAIP	- 67,000 bytes
	GWTMTAALM	- 77,000 bytes

Stack POA	Base	- 207,872 bytes
	MF workers	- *n** 30,000 bytes
	TCP Handlers	- *n** 32,768 bytes
	QuickFinder	- 30,000 bytes
	Notify	- 30,000 bytes
	C/S connections	- *n** 32,000 bytes
Stack ADA	Base	- 56,536 bytes
	PO Worker	- *n** 16,384 bytes
	Domain worker	- 16,384 bytes
	NDS Sync	- 32,768 bytes
Stacks MTA	Base	- 6* 9,216 bytes
	Queues	- n* 36,864 bytes
	Controls	- n* 13,312 bytes
POA Processing		
	QuickFinder	- 4,000,000 bytes
	TCP Handlers	- n* 2,000,000 bytes
	MF Workers	- n* 2,000,000 bytes
ADA Processing		
	Base	- 128,000 bytes
	Workers	- *n** 128,000 bytes
MTA Processing		
	Base	- 250,000 bytes
	Post office	- *n** 50,000 bytes (*n*=# of POs)
	Transport	- 230,000 bytes
	Each dest. (*n*=# of dest.)	- 10,000 bytes +(*n**10,0000 bytes)

Note: No memory allocation is shown for Convert since it runs dedicated on a post office.

Sample Configuration Memory Requirements

As an example, here is how you would calculate the memory requirements for the following configuration: 50 connections, 6 TCP Handlers, 8 MF Workers, on a single processor with 1 POA, MTA and ADA.

Base memory	3,500,000	for GWENN1
	248,000	for GWPOA
	102,000	for GWADA
	190,000	for GWMTA
Connections	2,150,000	(50 * 43,000)
Stacks	825,000	
QuickFinder	4,000,000	
POA processing	28,000,000	
MTA processing	1,000,000	
ADA processing	300,000	
Total	40,275,000 bytes	

"Connections" is the memory to support 50 concurrent connections. Additional memory to process messages is in the processing number.

Memory Rule of Thumb. The GroupWise POA demands the most memory--the MTA and the ADA have smaller requirements. For the POA, three main groupings determine the memory requirements rule of thumb:

Base memory for code, data, and quickfinder:	8,000,000 bytes
Number of TCP handlers & MF workers:	*n**2,000,000 bytes
For C/S, number of concurrent connections:	*n**50,000 bytes

Disk Subsystem Configuration Summary

Compaq engineers and Novell engineers recommend disk striping for the gain in I/O performance. The recommendation is to use numerous smaller drives in an array rather than a few larger drives to achieve the best overall system performance providing comparable capacity.

Hardware striping is achieved by using Compaq's Smart-2 Array Controller with built-in data protection. The SMART-2 Controller offers exceptional performance characteristics because of its underlying intelligent I/O architecture that has been streamlined for high performance. The advanced architecture consists of optimized hardware and firmware components working together efficiently, with functions and embedded intelligence distributed across appropriate points in the design.

Fault Tolerance is strongly recommended by Compaq engineers and Novell engineers. RAID 1is the preferred level of fault tolerance for systems that have mission critical data, while RAID 5 is recommended for systems storing non-critical data. RAID 1 is the preference due to a combination of a high level of performance and protection of data. RAID 1 uses disk mirroring and provides performance equal to or better than RAID 0, but your drive costs double because this level requires twice as many disk drives to store the same amount of data and might not be cost-effective for your environment. RAID 5 uses distributed data guarding, stripping data, and parity data across all drives in the array. The more drives in the array, the lower the portion of each drive reserved for fault tolerance support.

When determining the disk subsystem configuration of a GroupWise system, use Wide-Ultra drives connected to controllers that support the Wide-Ultra transfer rates when possible. Disk access is often a major bottleneck in GroupWise performance. Using the fastest available SCSI drives combined with disk controllers that support Wide-Ultra transfer rates, the system will be configured to keep this impact minimized as much as possible.

Conclusion

This AppNote has provided configuration and performance guidelines for Novell GroupWise 5.2, based on Compaq and Novell integration and performance testing. This information will help you understand performance characteristics of GroupWise 5.2 and how different configuration options can affect the performance of your Compaq server.

Bear in mind that these are only guidelines; GroupWise 5.2 server system requirements vary depending on many factors, and this information should not be used as absolute tool for determining system requirements. The best way to determine the optimum configuration of your GroupWise 5.2 system is to experiment in your actual environment.