Microsoft Exchange 2000 Server Back-End Mailbox Scalability

White Paper

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Microsoft Exchange 2000 Server Back-End Mailbox Scalability

White Paper

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Introduction

Microsoft® Exchange 2000 Server performs very similarly with all protocols including Post Office Protocol version 3 (POP3), Internet Message Access Protocol version 4 (IMAP4), Simple Mail Transfer Protocol (SMTP), Messaging Application Programming Interface (MAPI), and Microsoft Outlook® Web Access. This document demonstrates how servers processing POP3, IMAP4, and Outlook Web Access requests perform on Exchange 2000 Server as varying amounts of load are run against 4-processor and then 8-processor servers.

Scenario

On average, the tests that were run used 70 percent of the additional 4 processors on the 8-processor tests. A 100-Mbps network card is required to prevent network saturation, and approximately 1 spindle is needed for each log drive and database drive, per 1,000 users using POP3 and Outlook Web Access. Disk requirements increase significantly for IMAP4, and, for the 8,000-user run, you should have at least a 10-disk RAID 0 array.

Outlook Web Access

The goal of this test was to determine how well Outlook Web Access would scale in 4-processor and 8-processor tests. Low, medium, and high amounts of load were run against a 4-processor server, and then the tests were repeated with 8 processors installed. There are a few extra data points so that it could be graphically represented.

Hardware: For the Outlook Web Access tests, eight 550-MHz Xeon processors, with 2 GB of RAM and 20 disk spindles for database files (.edb and .stm files) were used. In addition, 4 spindles for logs (1 for each storage group) were used. There were 4 storage groups with 3 private mailbox stores in each. For the 4-processor tests, 4 processors were removed from the 8-processor server.

Scenario: Average size of the messages that the clients were sending was 20 KB. Each user’s Inbox had approximately 30 messages to begin with. Transport traffic occurs as each user sends several pieces of e-mail to the Internet. Each Outlook

Web Access user's connection duration was approximately 10 minutes and each user performed the actions in the following table.

Action	Times Performed
Log On	1
Check Mail	2
Send Messages	2
Recipients of Message Sent	1
Receive Messages	4
Read Messages	4
Move Messages	1
Delete Messages	1

To see the Outlook Web Access ESP script, see the Appendix. Outlook Web Access is a protocol that uses HTTP to access an Exchange server. With any web browser, you can access most of the feature that are available to a client using Outlook. An Exchange 2000 back-end server servicing only Outlook Web Access client requests exhibits the following characteristics.

Outlook Web Access Users	Processor %	Context Switches	ISAPI* Extension Reqs/Sec	Messages Delivered /Sec	Network in KB	Disk Transfers LOG/Sec	Disk Transfers EDB/Sec
8-processor server							
1,200	20.5	3,999	41.5	3.9	500	124	48
1,800	40.6	5,336	62.1	5.9	750	126	87
2,400	61.0	6,638	83.1	7.8	956	220	127
3,000	62.4	7,776	103.9	9.8	1,287	296	236
3,600	67.1	9,572	124.6	11.8	1,545	320	358
3,900	81.2	10,409	134.7	12.8	1,760	380	420
4,200	95.5	16,627	138.5	13.2	1,827	388	431
4-processor server							
1,200	34.5	3,667.5	41.7	3.9	569	120	60
1,500	49.2	4,043.5	51.8	4.8	724	148	66
1,800	56.4	4,591.2	62	6	835	180	95
2,100	69.9	4,863.4	72.5	6.8	992	208	128
2,400	85.9	5,145.5	82.9	7.8	1,086	232	151

Note In the above table, ISAPI* Extension Reqs/Sec is a performance monitor counter for Outlook Web Access transactions. Disk Transfers is a rate counter that counts all disk activity for physical disks, including disk reads and writes.

The Exchange log files and database files are on separate arrays and have listed counters indicating that. Network in KB is a rate counter for network traffic to and from the server's network card. Messages Delivered/Sec is a rate counter indicating the number of SMTP messages that are being delivered.

Processor Scalability

Outlook Web Access exhibits very good 8-processor scalability. (What this means is, if a 4-processor test uses 100 percent of the CPU and the same test uses 50 percent of the CPU on an 8-processor test, you would have 100-percent scalability.) In the test scenario, it can be scaled to about 71 percent with the additional 4 processors. In the above example, only 5,145 context switches are generated per second when the processor is at 86 percent with 4 processors, and only 16,627 context switches are generated per second when the processor is at 95 percent with 8 processors. The following 2 figures shows the relatively linear scalability of running an Outlook Web Access back-end server on both a 4-processor and 8-processor server.

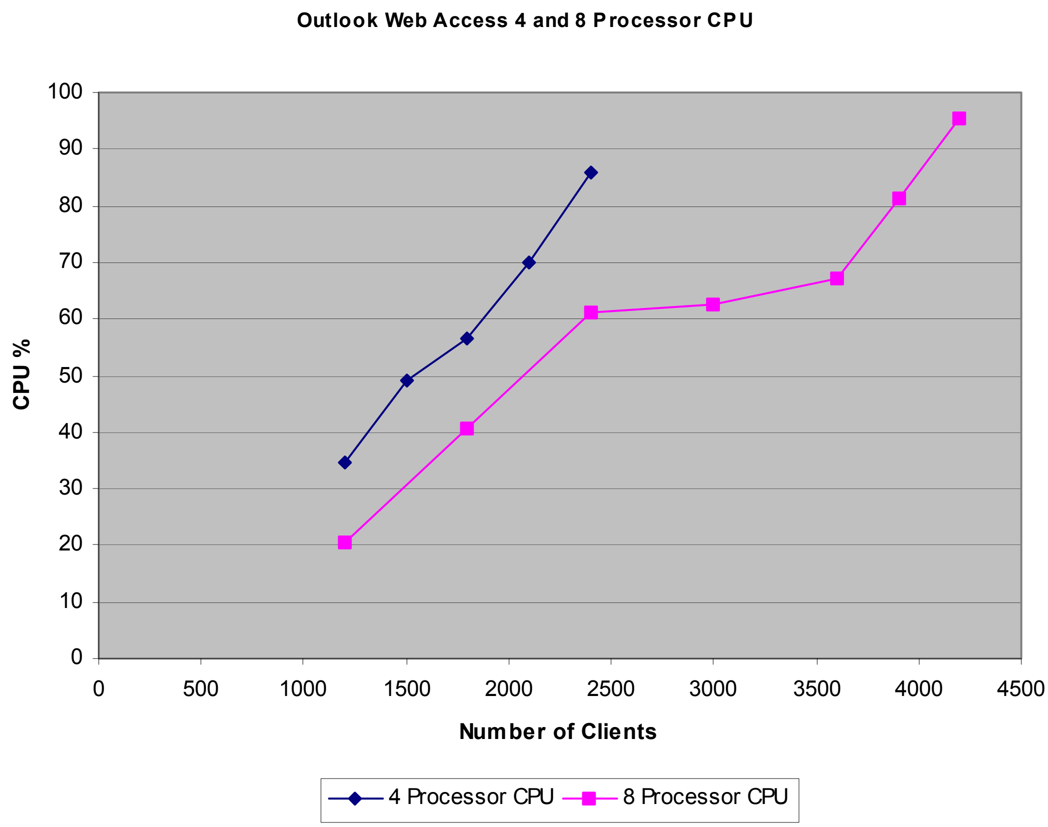

Figure 1.1 CPU Activity Generated on a 4-Processor Server and an 8-Processor Server

The information in Figure 1.1 was generated using an Outlook Web Access back-end server running with 4 550-MHz and 8 550-MHz processors (1-MB L2 cache). It shows how the server responds to an identical load on three of the tests. It also shows the high CPU usage on the 8-processor CPU when additional load is applied.

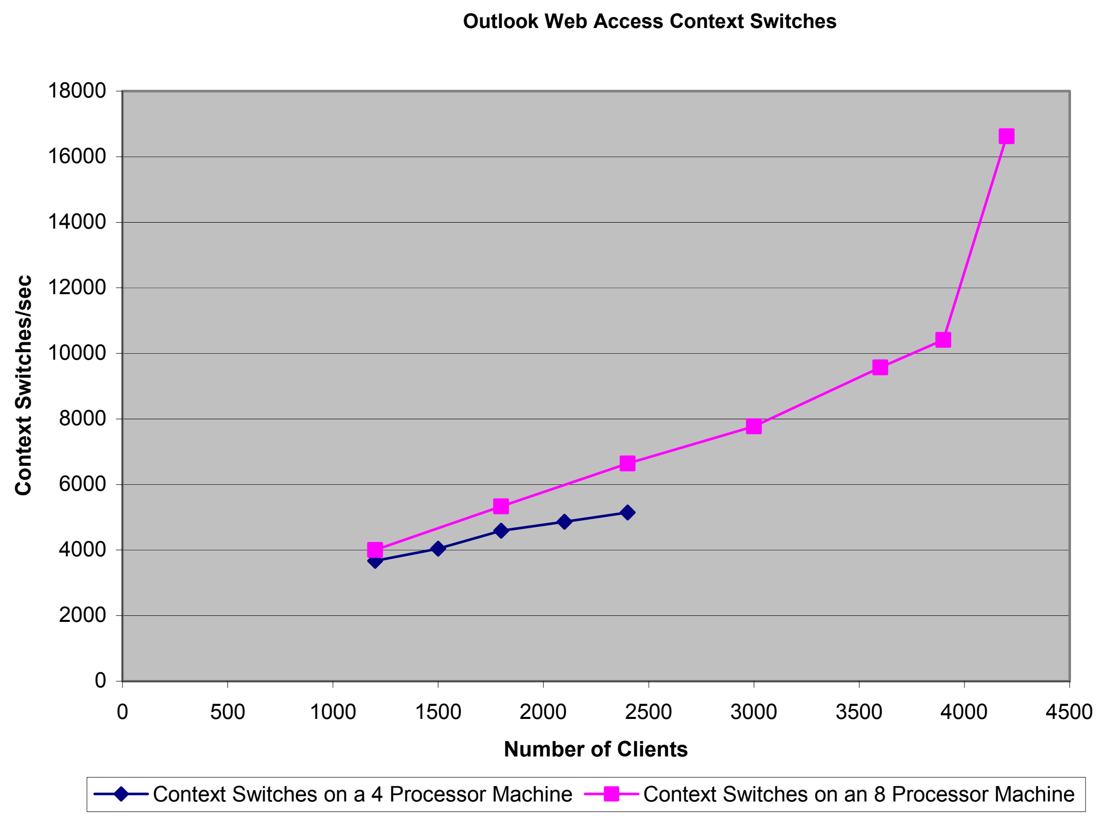

Figure 1.2 Relationship of Context Switches and Client Connections on 4-Processor and 8-Processor Servers

Figure 1.2 illustrates the relationship between the number of context switches that occur and the number of clients contacting the Outlook Web Access back-end server. It also illustrates that, even with 3,900 clients connected to a back-end server with 8 processors, only about 10,000 context switches occur per second. However, when 4,000 clients connect to the 8-processor server, context switching sharply increases as the CPU activity increases to 95.5-percent usage.

Memory

The 4-processor Outlook Web Access back-end servers require at least 500 MB of RAM. During most of the 4-processor scenarios described in this document, the Store.exe process consumed a total of 1 GB of RAM. However, the 8-processor scenarios increase the Store.exe memory consumption to slightly over 1 GB, increasing the required memory to a total of 1.5 GB. The maximum amount of memory that Exchange will use efficiently is 3 GB. This is because the more RAM the server has, the less often it will page to a disk, thus increasing the server's overall performance. The reverse is also true. The less RAM the server has, the more often it will page to a disk, thus decreasing performance. For more information on memory usage, see the Appendix.

Disk Usage

When using a back-end server dedicated to Outlook Web Access clients, you should run the server with RAID 0 or RAID 0+1 striping and use cache-backed RAID controllers. Disk usage for each 1,000 users required at least one database spindle and one log spindle. For more information on disk usage, see the Appendix.

Network Usage

A 100-Mbps, full duplex, network connection is generally sufficient for all Outlook Web Access mailbox server applications. The Outlook Web Access tests conducted to support this paper did not exceed 16-Mbps network utilization even under the most severe of test conditions. This is well below the network saturation point of 100-Mbps, full duplex, network connection.

IMAP4

The goal of this test was to determine how well IMAP4 would scale in 4-processor and 8-processor tests. Low, medium, and high amounts of load were run against a 4-processor server, and then the tests were repeated with 8 processors installed. There are a few extra data points so that it could be graphically represented.

Hardware: For the IMAP4 tests, 8 550-MHz Xeon processors with 2 GB of RAM, 20 disk spindles for database files (.edb and .stm files), and 4 spindles for logs (1 for each storage group) were used. There are 4 storage groups with 3 private mailbox stores in each storage group. For the 4-processor scenario, 4 processors were removed from the server.

Scenario: An average message size of 20 KB was sent. Each user’s Inbox had approximately 5 messages before starting the test. Transport traffic occurs as each user sends a few pieces of mail during the session for local delivery. Each IMAP4 user’s connection duration was approximately 43.5 minutes. To see the IMAP4 ESP script, see the Appendix.

An Exchange 2000 back-end server servicing only IMAP4 requests exhibits the following characteristics.

IMAP4 Users	Processor %	Context Switches	Messages Del/Sec	SMTP Local Queue	IMAP4 UID/Sec	Disk Transfers LOG/Sec	Disk Transfers EDB/Sec	Network in KB
8-processor server								
24,000	57.1	11346	21.6	38.4	41.6	246	794	1002
16,000	30.1	9,281	18.8	11.9	99.8	276	467	810
8,000	23.2	7,200	10.8	0.8	94	288	221	797
4,000	12.6	4,537	5.6	0.3	46.2	196	128	469
2,000	6.6	2,856	2.8	0.18	35.2	60	50	236
4-processor server								
8,000	53.5	6,889	10.8	1	95.4	292	314	845
4,000	21.4	4,055	5.6	0.3	69.7	132	137	420
2,000	10.3	2,481	2.9	0.2	32.7	60	52	215

Note In the above table, UID/Sec is a rate counter for IMAP4 transactions. Disk Transfers is a rate counter for physical disks, which counts all disk activity including disk reads and writes. Network in KB is a rate counter for network traffic on the back-end server going to and from the server's network card.

Processor Scalability

IMAP4 scales well to both 4-processor and 8-processor back-end servers. When determining the appropriate hardware for your IMAP4 back-end server, you should keep in mind that the amount of disk input/output (I/O) increases as the average user's number of Inbox messages increases. The following figures show the relatively linear scalability of running an IMAP4 back-end server with 4 processors and 8 processors installed. Figure 1.3 shows CPU activity generated on a 4-processor and 8-processor server and how well the 8-processor server handles the same amount of load as the 4-processor server.

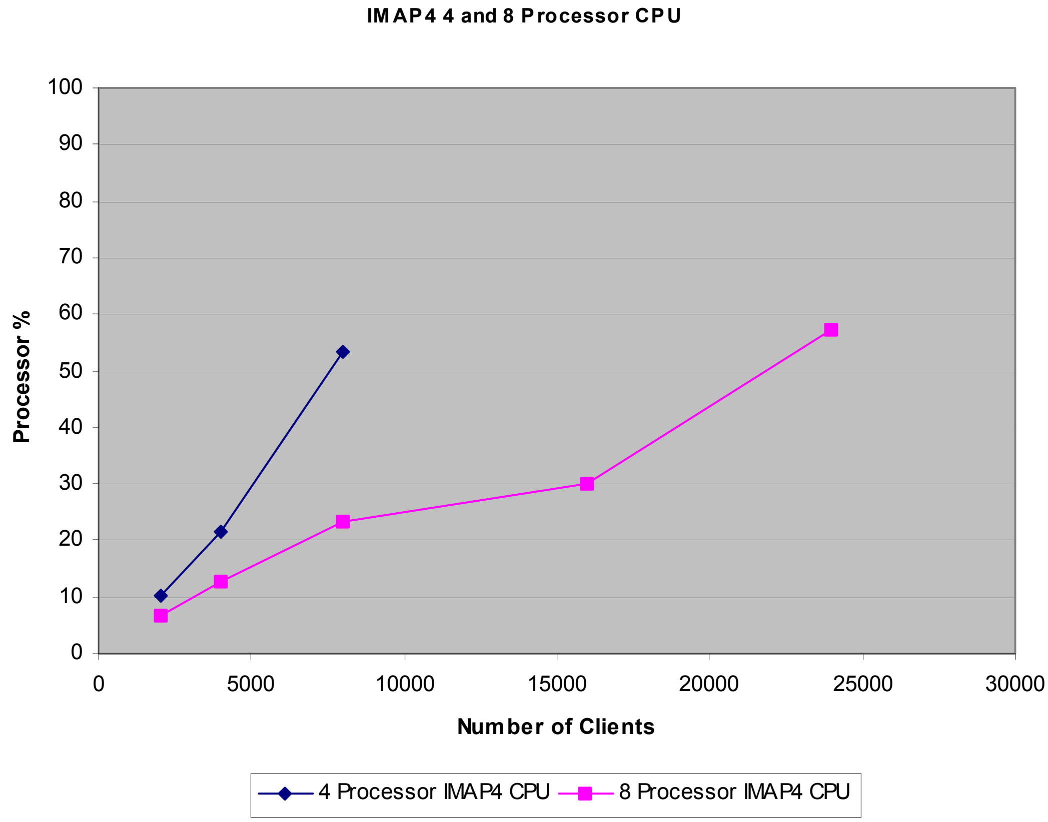

Figure 1.3 CPU Activity Generated on a 4-Processor Server and an 8-Processor Server

Figure 1.4 shows how well an 8-processor IMAP4 server handles the load with minimal context switching.

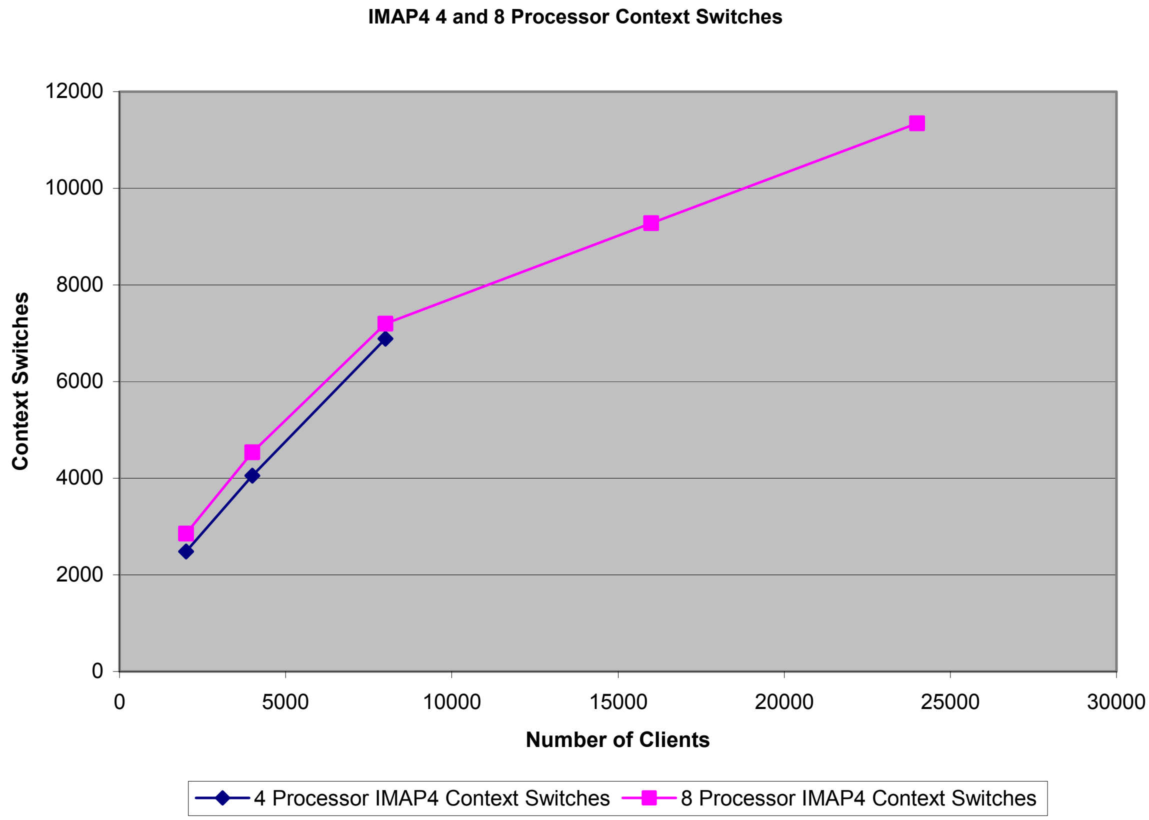

Figure 1.4 Relationship of Context Switches and Client Connections on 4-Processor and 8-Processor Servers

Memory

The 4-processor IMAP4 back-end servers require at least 500 MB of RAM. However, if you are using an 8-processor server with 20,000 clients, these memory requirements increased to over 1.7 GB in the Store.exe and InetInfo processes. The maximum amount of memory that Exchange will use efficiently is 3 GB. The more RAM the server has, the less often it will page to disk, which increases performance. The reverse is also true. The less RAM the server has, the more often it will page to a disk, thus decreasing performance. For more information on memory usage, see the Appendix.

Disk Usage

It is recommended that you have at least 3 spindles for the log drive and at least 10 spindles for the database files to support about 8,000 users. It is a good idea to add a spindle for each additional 100 disk I/Os expected. The more users you add to your server, the less likely any particular user will be cached and the less likely disk usage will increase. Because your disk subsystem will be your first bottleneck on an IMAP4 back-end mailbox server, make sure that the Current Disk Queue Length performance monitor counter stays below 10 (or *n*, where *n* equals the number of spindles in the array). For more information on disk usage, see the Appendix.

Network Usage

A single 100-Mbps, full duplex, network connection is sufficient for nearly all IMAP4 back-end applications.

POP3

The goal of this test was to determine how well POP3 would scale in 4-processor and 8-processor tests. Low, medium, and high amounts of load were run against a 4-processor server, and then the tests were repeated with 8 processors installed. There are a few extra data points so that it could be graphically represented.

Hardware: For the POP3 tests, 8 550-MHz Xeon processor with 2 GB of RAM, 20 disk spindles (or physical hard disks) for .edb and .stm files, and 4 spindles for logs were used. For the 4-processor scenario, 4 processors were removed from the server.

Scenario: An average message size of 20 KB was sent. Transport traffic occurs when the POP3 back-end server receives incoming e-mail from the Internet during the session targeted to one recipient. Activity on the POP3 back-end server includes users logging on to the server, retrieving all mail, and then deleting all mail from the server. To see the POP3 ESP script, see the Appendix.

An Exchange 2000 back-end server servicing POP3 and inbound SMTP requests exhibits the following characteristics with the given profile.

POP3 and SMTP Users	Processor %	Context Switches	Messages Del/Sec	SMTP Local Queue	POP3 Stat / Sec	POP3 Dele/ Sec	Disk Transfers EDB	Disk Transfers LOG	Network in KB
8-processor server									
POP3-200 SMTP-30	56.4	14,204	30	39	90.3	20.6	426	332	1,504
POP3-180 SMTP-27	49.7	13,164	29.2	23.9	82.7	19.9	164	324	1,393
POP3-160 SMTP-24	43.4	12,029	27	18.8	73.5	18.5	151	308	1,342
POP3-120 SMTP-18	32.3	9,793	21.7	11.3	55.8	15.4	116	260	1,117
POP3-80 SMTP-12	23.2	7,725	15.8	2	37.3	12.2	88	200	857
4-processor server									
POP3-200 SMTP-30	78.4	11,257	30.9	53.2	92.1	21.9	163	340	1,521
POP3-180 SMTP-27	73.1	10,508	29.5	37.6	83.3	21.6	141	332	1,486
POP3-160 SMTP-24	65	9,697	27.5	23.3	74.3	20.1	119	300	1,330
POP3-120 SMTP-18	46	8,175	21.4	10.7	56	16.1	95	260	1,125
POP3-80 SMTP-12	34.4	6,493	15.8	1.3	37.3	13.8	81	220	908

Note In the above table, Dele/Sec and Stat/Sec are key POP3 performance counters, which can be used to gauge the number of POP3 transactions occurring each second on the back-end server.

Processor Scalability

POP3 scales well to both 4-processor and 8-processor servers. However, when using an 8-processor server, only 68 percent of the additional 4 processors are used. In the POP3 scenario outlined above, only 11,257 context switches occur each second when the processor is at 78 percent with 4 processors, and only 14,204 context switches occur each second when the processor is at 56.4 percent with 8 processors. Figure 1.5 shows the relatively linear scalability of running a POP3 back-end server on both a 4-processor and an 8-processor server. It also shows that, in the 8-processor tests, the server became more efficient as the load was increased.

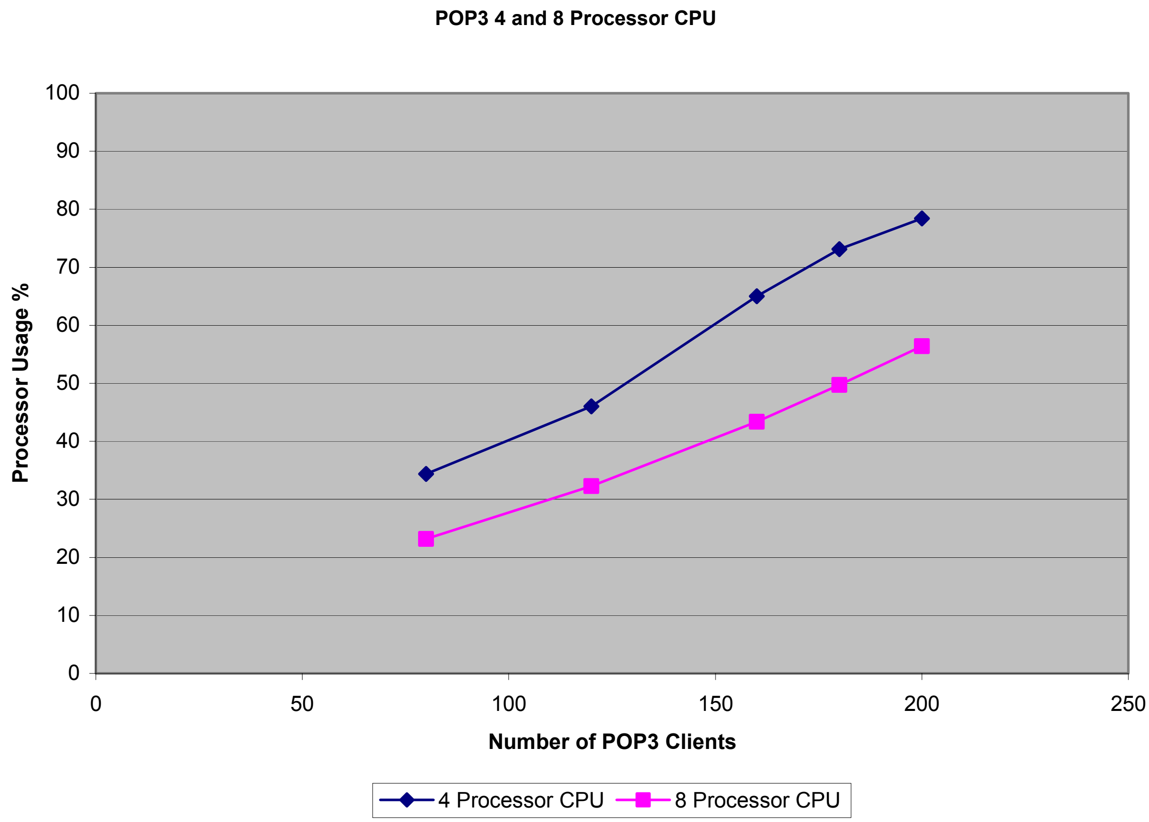

Figure 1.5 POP3 4-Processor and 8-Processor CPU Usage

Figure 1.6 shows the context switches that were used during the tests. This figure demonstrates how the context switches grow linearly when more load is applied. It also shows that the same amount of load on an 8-processor server uses more context switches because there are more processors to switch between.

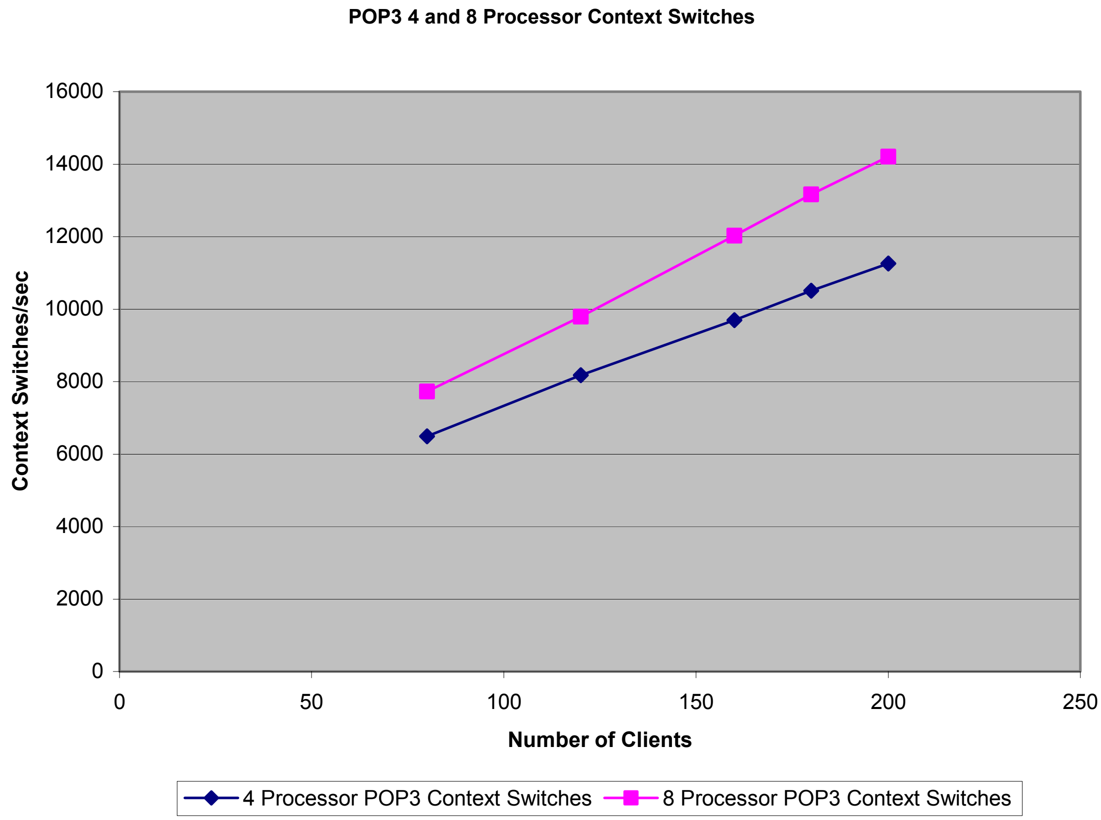

Figure 1.6 POP3 4-Processor and 8-Processor Context Switches

Memory

POP3 clients do not usually remain logged on to the server for extended periods of time. The typical behavior is to log on, retrieve all e-mail, delete all e-mail, and then log off the server. The 4-processor POP3 back-end servers require at least 500 MB of RAM; otherwise, you will have huge latencies and your queues will increase greatly. The InetInfo and Store.exe processes consumed a combined total of 1 GB of memory during the tests. The maximum amount of memory that Exchange will use efficiently is 3 GB. The more RAM the server has, the less often it will page to disk, which increases performance. The reverse is also true. The less RAM the server has, the more often it will page to a disk, thus decreasing performance.

Disk Usage

It is recommended that you have at least 2 spindles for the log drive and at least 2 spindles for the database files. It is a good idea to add a spindle for each additional 100 disk I/Os expected. For more information on disk usage, see Appendix.

Network Usage

A single 100-Mbps, full duplex, network connection is sufficient for nearly all POP3 back-end applications.

Appendix

This appendix includes computer recommendations, additional terminology, sample ESP scripts that you can use to test your equipment, and a list of Microsoft Knowledge Base articles that contain important information not available in the product.

Computer Recommendations at 60-Percent Usage

During tests, it was noted that different amounts of load and different protocols consumed differing amounts of system resources; recommended requirements for each protocol are listed below. It is recommended that you use RAID 0+1 for the database drives. This is especially beneficial for disk reads. It is fault tolerant, compared with no fault tolerance with RAID 0, and much faster than RAID 5. You will have a higher cost with RAID 0+1 as your total available space is $Nx/2$ where N is the drive size and x is the number of drives. With RAID 5, you can use the space on all drives in the array minus one for parity checking.

Outlook Web Access

- 4-processor server: 4 500-MHz processors, 1 GB of RAM, 3 log disks, 6 database disks, 100-Mbps network interface card (NIC)
- 8-processor server: 8 500-MHz processors, 1.5 GB of RAM, 4 log disks, 8 database disks, 100-Mbps NIC

IMAP4

- 4-processor server: 4 500-MHz processors, 1.5 GB of RAM, 3 log disks, 8 to 10 database disks, 100-Mbps NIC
- 8-processor server: 8 500-MHz processors, 2 GB of RAM, 4 log disks, 10 to 20 database disks, 100-Mbps NIC

POP3

- 4-processor server: 4 500-MHz processors, 500 GB of RAM, 3 log disks, 3 database disks, 100-Mbps NIC
- 8-processor server: 8 500-MHz processors, 1 GB of RAM, 4 log disks, 6 database disks, 100-Mbps NIC

Context Switching

A context switch occurs when the kernel switches the processor from one thread to another—for example, when a thread with a higher priority than the running thread becomes ready. Context-switching activity is important for several reasons. A program that monopolizes the processor lowers the rate of context switches because it does not allow much processor time for the other processes' threads. A high rate of context switching means that the processor is being shared repeatedly—for example, by many threads of equal priority. A high context-switch rate often indicates that there are too many threads competing for the processors on the system. The rate of context switches can also affect performance of multiprocessor computers.

For information about how to monitor and tune context-switch activity on multiprocessor systems, see "Measuring Multiprocessor System Activity" in the *Microsoft Windows® 2000 Server Resource Kit*. You can view context-switch data by monitoring the System/Context Switches/sec counter in System Monitor.

Working Set

Working Set is the current number of bytes in the Working Set of a process. The Working Set is the set of memory pages touched recently by the threads in the process. If free memory in the computer is above a threshold, pages are left in the Working Set of a process even if they are not in use. When free memory falls below a threshold, pages are trimmed from Working Sets. If they are needed, they will be soft-faulted back into the Working Set before they leave main memory.

Disk I/O

On a production 4-processor Exchange 2000 back-end server, it is recommended that you have a minimum of 10 hard disks for proper performance. You will need 1 disk for the operating system, 1 disk for the paging file, 2 disks striped for the log files, 2 disks striped for the SMTP queue, and at least 4 disks striped for the Exchange database files. Each spindle can accommodate approximately 100 disk I/Os per second, and you should add more spindles as the disks become saturated.

Sample ESP Scripts

POP3 ESP Script

This is the ESP script used to simulate POP3 load against a server. ESP can be found on the Exchange compact disc.

```
connect
mailbox RANDLIST(login-ng.txt)
SLEEP RANDNUMBER(100,100)
retr all
dele all
SLEEP 2000
```

```
Quit
```

IMAP4 ESP Script

This is the ESP script used to simulate IMAP4 load against a server. ESP can be found on the Exchange compact disc.

```
CONNECT
CAPABILITY
AUTHENTICATE RANDLIST(login-ng.txt)
LIST "" "*"
SELECT "INBOX"
FETCHUID
UIDFETCH 1:* (FLAGS)
UIDFETCH UIDALL (UID RFC822.SIZE RFC822.HEADER)
NOOP
UIDFETCH LAST 1 (UID RFC822.SIZE RFC822)
CHECK
SLEEP RANDNUMBER(360000,840000)
NOOP
FETCH LAST 1 (UID)
UIDFETCH LAST 2 (FLAGS)
NOOP
FETCHUID
UIDFETCH 1:* (FLAGS)
UIDFETCH LAST 1 (UID RFC822.SIZE RFC822.HEADER)
UIDFETCH LAST 1 (UID RFC822.SIZE RFC822)
CHECK
SLEEP RANDNUMBER(248000,712000)
%80 SKIP 6
FETCHUID
UIDCOPY LAST 1 RANDLIST(IMAP_UPS_FolderList.txt)
UIDSTORE LAST 1 +FLAGS (\DELETED)
UIDCOPY RANDOM RANDLIST(IMAP_UPS_FolderList.txt)
UIDSTORE SAME +FLAGS (\DELETED)
NOOP
FETCHUID
UIDCOPY LAST 1 "Trash"
UIDSTORE LAST 1 +FLAGS (\Deleted)
UIDCOPY RANDOM "Trash"
UIDSTORE SAME +FLAGS (\Deleted)
SLEEP RANDNUMBER(60000,180000)
NOOP
FETCH LAST 1 (UID)
UIDFETCH LAST 2 (FLAGS)
NOOP
CHECK
%80 SKIP 4
FETCHUID
UIDCOPY RANDOM RANDLIST(IMAP_UPS_FolderList.txt)
UIDSTORE SAME +FLAGS (\DELETED)
NOOP
FETCHUID
UIDFETCH RANDOM (UID RFC822.SIZE RFC822)
UIDCOPY SAME "Trash"
UIDSTORE SAME +FLAGS (\DELETED)
SLEEP RANDNUMBER(240000,420000)
FETCHUID
UIDFETCH RANDOM (UID RFC822.SIZE RFC822)
CHECK
%80 SKIP 4
FETCHUID
UIDCOPY RANDOM RANDLIST(IMAP_UPS_FolderList.txt)
UIDSTORE SAME +FLAGS (\DELETED)
NOOP
UIDFETCH RANDOM (UID RFC822.SIZE RFC822)
```

```
UIDCOPY SAME "Trash"
UIDSTORE SAME +FLAGS (\DELETED)
SLEEP RANDNUMBER(240000,420000)
CHECK
SLEEP RANDNUMBER(30000,90000)
CLOSE
SELECT "Trash"
STORE ALL +FLAGS (\Deleted)
EXPUNGE
LIST "Trash" "*"
SLEEP RANDNUMBER(15000,45000)
CLOSE
SELECT RANDLIST(IMAP_UPS_FolderList.txt)
FETCHUID
UIDFETCH 1:* (FLAGS)
CHECK
%80 SKIP 4
FETCHUID
UIDCOPY SAME RANDLIST(IMAP_UPS_FolderList.txt)
UIDSTORE SAME +FLAGS (\DELETED)
NOOP
FETCHUID
UIDFETCH RANDOM (UID RFC822.SIZE RFC822)
UIDCOPY SAME "Trash"
UIDSTORE SAME +FLAGS (\DELETED)
SLEEP RANDNUMBER(240000,420000)
CHECK
%80 SKIP 4
FETCHUID
UIDCOPY RANDOM RANDLIST(IMAP_UPS_FolderList.txt)
UIDSTORE SAME +FLAGS (\DELETED)
NOOP
FETCHUID
UIDFETCH RANDOM (UID RFC822.SIZE RFC822)
UIDCOPY SAME "Trash"
UIDSTORE SAME +FLAGS (\DELETED)
SLEEP RANDNUMBER(240000,420000)
CLOSE
SKIP 4
```

Outlook Web Access ESP Script

This is the ESP script used to simulate Outlook Web Access load against a server. ESP can be found on the Exchange compact disc.

```
SET $xml$ = new XMLList
SET $host$ nightingale
SET $filepath$ \\thulsadoom\nt5\robq\web\4312\night\
SET $authorization$ RANDLIST(\\thulsadoom\nt5\robq\web\4312\night\
 login-ng.txt)
SET $folders$
 RANDLIST(\\thulsadoom\nt5\robq\web\4312\night\folders_night.txt)
SET $mailbox$ exchange
SET $cookie$ RESPHEADER(Set-Cookie)
REM
REM       <LOGON\AUTHENTICATE\INBOXVIEW>
REM
ADDHEADER Accept: image/gif, image/x-xbitmap, image/jpeg,
 image/pjpeg, */*
ADDHEADER Accept-Language: en-us
ADDHEADER Accept-Encoding: gzip, deflate
ADDHEADER User-Agent: Mozilla/4.0 (compatible; MSIE 5.01;
 Windows NT 5.0)
ADDHEADER Host: $host$
GET /$mailbox$/$USER$/
REM
```

```
ADDHEADER Accept: */*
ADDHEADER Referer: http://$host$/$mailbox$/$USER$/
ADDHEADER Cookie: $cookie$
GET /$mailbox$/$USER$/Inbox/?Cmd=contents
GET /$mailbox$/$USER$/?Cmd=navbar
DELHEADER Accept-Language:
DELHEADER Accept:
DELHEADER Accept-Encoding:
REM
REM SEARCH Inbox
REM
ADDHEADER Content-type: text/xml
ADDHEADER Brief: t
ADDHEADER range: rows=0-24
ADDHEADER Referer: http://$host$/$mailbox$/$USER$/Inbox/?Cmd=contents
SEARCH /$mailbox$/$USER$/Inbox/ $filepath$4312-IE5-SearchInboxData.1
 PARSEXML DAV:!href
DELHEADER Content-type:
DELHEADER Brief:
DELHEADER range:
DELHEADER Referer:
DELHEADER User-Agent:
SET $href1$ $xml$.NEXT
SET $href2$ $xml$.NEXT
SET $href3$ $xml$.NEXT
SET $href4$ $xml$.NEXT
REM
REM
REM
SLEEP RANDNUMBER(120000,180000)
REM
REM       <READ 4>
REM
ADDHEADER Accept: */*
ADDHEADER Accept-Language: en-us
ADDHEADER Accept-Encoding: gzip, deflate
ADDHEADER User-Agent: Mozilla/4.0 (compatible; MSIE 5.0; Windows NT 5.0)
ADDHEADER Referer: http://$host$/$mailbox$/$USER$/Inbox/?Cmd=contents
ADDHEADER Host: $host$
ADDHEADER Cookie: $cookie$
GET $href1$?Cmd=open
GET $href2$?Cmd=open
GET $href3$?Cmd=open
GET $href4$?Cmd=open
DELHEADER Accept:
DELHEADER Referer:
DELHEADER Accept-Language:
DELHEADER Accept-Encoding:
DELHEADER User-Agent:
REM
REM
REM
SLEEP RANDNUMBER(120000,180000)
REM
REM       <SEND 2>
REM
LOOP 2
ADDHEADER Accept: */*
ADDHEADER Accept-Language: en-us
ADDHEADER Accept-Encoding: gzip, deflate
ADDHEADER User-Agent: Mozilla/4.0 (compatible; MSIE 5.01;
 Windows NT 5.0)
ADDHEADER Host: $host$
ADDHEADER Cookie: $cookie$
ADDHEADER Referer: $href1$?Cmd=open
GET /$mailbox$/$USER$/Drafts/?Cmd=new
DELHEADER Accept:
```

```
DELHEADER Accept-Encoding:
REM
SET $senduser1$ RANDLIST(\\thulsadoom\nt5\robq\web\4312\
 night\smtp-ng.txt)
ADDHEADER Referer: http://$host$/$mailbox$/$USER$/Drafts/?Cmd=new
ADDHEADER Content-type: application/x-www-UTF8-encoded
POST /$mailbox$/$USER$/
 Drafts $filepath$4312-IE5-SendMsgTo4Data.1 replacevars
DELHEADER Accept-Language:
DELHEADER Content-type:
DELHEADER Referer:
DELHEADER User-Agent:
ENDLOOP
REM
REM
REM
SLEEP RANDNUMBER(120000,180000)
REM
REM Search again (include displayname)
REM
ADDHEADER content-type: text/xml
ADDHEADER Brief: t
ADDHEADER range: rows=0-24
SEARCH /$mailbox$/$USER$/Inbox/ $filepath$4312-IE5-SearchInboxData-var.1
 PARSEXML DAV:!displayname
DELHEADER content-type:
DELHEADER Brief:
DELHEADER range:
SET $name1$ $xml$.NEXT
URIESCAPE $name1$
SET $name2$ $xml$.NEXT
URIESCAPE $name2$
SET $name3$ $xml$.NEXT
URIESCAPE $name3$
SET $name4$ $xml$.NEXT
URIESCAPE $name4$
REM
REM       <MOVE 1 (plus refresh)>
REM
ADDHEADER Accept: */*
ADDHEADER Accept-Language: en-us
ADDHEADER Accept-Encoding: gzip, deflate
ADDHEADER User-Agent: Mozilla/4.0 (compatible; MSIE 5.01;
 Windows NT 5.0)
ADDHEADER Host: $host$
ADDHEADER Cookie: $cookie$
GET /$mailbox$/$USER$/?Cmd=dialog&template=dlg_movecopy
DELHEADER Accept:
DELHEADER Accept-Language:
DELHEADER Accept-Encoding:
REM
ADDHEADER Depth: 0
ADDHEADER Brief: t
ADDHEADER Content-type: text/xml
ADDHEADER Referer:
 http://$host$/$mailbox$/$USER$/?Cmd=dialog&template=dlg_movecopy
PROPFIND /$mailbox$/$USER$/ $filepath$4312-IE5-MoveMsgDialogData.1
DELHEADER Depth:
DELHEADER Brief:
DELHEADER Content-type:
REM
ADDHEADER Content-type: text/xml
ADDHEADER Brief: t
ADDHEADER Translate: f
SEARCH /$mailbox$/$USER$/ $filepath$4312-IE5-MoveMsgDialogData.2
DELHEADER Content-type:
DELHEADER Brief:
```

```
DELHEADER Translate:
REM
ADDHEADER Destination: http://$host$/$mailbox$/$USER$/$folders$/$name2$
ADDHEADER Content-type: text/xml
ADDHEADER Overwrite: F
ADDHEADER Translate: F
ADDHEADER Allow-rename: t
MOVE /$mailbox$/$USER$/Inbox/$name2$
DELHEADER Destination:
DELHEADER Overwrite:
DELHEADER Translate:
DELHEADER Allow-rename:
REM
ADDHEADER Accept-Language: en-us
ADDHEADER Brief: t
ADDHEADER range: rows=0-24
ADDHEADER Referer: http://$host$/$mailbox$/$USER$/Inbox/?Cmd=contents
SEARCH /$mailbox$/$USER$/Inbox/ $filepath$4312-IE5-SearchInboxData.1
DELHEADER Brief:
DELHEADER range:
DELHEADER Content-type:
DELHEADER Referer:
DELHEADER Accept-Language:
DELHEADER User-Agent:
REM
REM       <DELETE 1 (plus refresh)>
REM
ADDHEADER Content-type: text/xml
ADDHEADER Translate: f
ADDHEADER Allow-rename: t
ADDHEADER Overwrite: f
ADDHEADER Destination: http://$host$/$mailbox$/$USER$/Deleted%20Items
ADDHEADER Referer: http://$host$/$mailbox$/$USER$/Inbox/?Cmd=contents
ADDHEADER User-Agent: Mozilla/4.0 (compatible; MSIE 5.01;
 Windows NT 5.0)
ADDHEADER Host: $host$
BMOVE /$mailbox$/$USER$/Inbox/ $filepath$4312-IE5-DelMsgXData.2
 replacevars
DELHEADER Translate:
DELHEADER Allow-rename:
DELHEADER Overwrite:
DELHEADER Destination:
REM
ADDHEADER Accept-Language: en-us
ADDHEADER Brief: t
ADDHEADER range: rows=0-24
SEARCH /$mailbox$/$USER$/Inbox/ $filepath$4312-IE5-SearchInboxData.1
DELHEADER Content-type:
DELHEADER Brief:
DELHEADER range:
DELHEADER Referer:
DELHEADER Accept-Language:
DELHEADER User-Agent:
REM
REM
REM
SLEEP RANDNUMBER(120000,180000)
REM
REM All done
REM
SKIP 1
```

Microsoft Knowledge Base Articles

The following Microsoft Knowledge Base articles contain information that every Exchange administrator will need to know to successfully deploy the product. These articles can be found on the TechNet CD or at the Microsoft Support Online Web site (http://support.microsoft.com/).

- Q271084 - Exchange 2000 Server SMTP Optimized with Max Handle Threshold Registry Key
- Q267551 - Modifying Exchange 2000 Server File Handle Cache Parameters
- Q266096 - Exchange 2000 Requires /3GB Switch with More than 1 Gigabyte of Physical RAM

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