**IBM**

# Capacity Planning for IBM Netfinity Servers Running Microsoft Windows NT Server 4.0, Terminal Server Edition

*Implementing Terminal Server Edition on Netfinity Servers*

## Executive Summary

Microsoft® Windows NT® Server 4.0, Terminal Server Edition enables a variety of desktops to access 32-bit Windows® applications through terminal emulation. Terminal Server Edition allows companies to combine the benefits of low-cost terminals with the ease of use and familiarity of the Windows operating system.

The IBM Netfinity® family of servers enables small, medium and large companies to manage their networked business systems – from file and print capabilities to advanced applications – virtually anytime, anywhere.

This paper provides guidelines for the number of concurrent Terminal Server Edition users who can be supported on IBM Netfinity Servers.

## Overview of Windows NT Server 4.0, Terminal Server Edition

Terminal Server Edition uses a thin-client architecture to bring 16- or 32-bit Windows applications to almost any client desktop, including:

- Desktops running Windows NT, Windows 95, Windows 3.11 (Windows for Workgroups)
- Windows-based terminals (Windows CE)
- Apple Macintosh
- MS-DOS
- UNIX®

Terminal Server Edition consists of the Terminal Server application that runs on the server, the client application that runs on the desktop, the protocol used to communicate between the server and desktop, and administrative tools that can be used to manage client sessions.

For more information about Microsoft Windows NT Server 4.0, Terminal Server Edition, visit the Microsoft Web site at **www.microsoft.com/ntserver/terminalserver/default.asp**.

## Overview of IBM Netfinity Servers

As the world's leading server manufacturer, IBM has the goal of providing the greatest capability possible in an industry-standard server at a price appropriate for your business. If you are using industry-standard technologies, IBM Netfinity products provide you with a reliable foundation for your networked businesses by delivering outstanding power, scalability, control and service.

The Netfinity product family consists of servers specifically designed to meet the challenging demands of your business. For more information about IBM's Netfinity Servers, visit the IBM Netfinity Web site at **www.ibm.com/netfinity**.

## Test Network Configuration

The test network consisted of a total of:

- 80 - IBM PC clients connected to two 10/100-Mbps Ethernet LAN segments. The clients were Pentium® 133-MHz machines running Windows NT Workstation 4.0.

- 1 - Netfinity 3500 (Dual Pentium II, 333 MHz, 512 MB RAM) running Microsoft Internet Information Server

- 1 - Netfinity 7000 (Quad Pentium Pro, 200 MHz, 2 GB RAM) running Microsoft Exchange

The tests were conducted with Terminal Server Edition running on these servers:

- Netfinity 5500

    - Single Intel® 450-MHz Pentium II processor with 512 KB of Level 2 cache and 1 GB of RAM

    - Dual Intel 450-MHz Pentium II processors with 512 KB of Level 2 cache and 1 GB of RAM

- Netfinity 5510 M10

    - Single Intel 450-MHz Pentium II Xeon™ processor with 1 MB of Level 2 cache and 2 GB of RAM

    - Dual Intel 450-MHz Pentium II Xeon processors with 1 MB of Level 2 cache and 2 GB of RAM

## Testing Procedures Used

The test procedures were performed using Microsoft Office 97 (Microsoft Word, Microsoft Excel, Microsoft Outlook, and Microsoft Internet Explorer 4.0). Microsoft Exchange 5.5 and Microsoft Internet Information Server were also used.

The tests were designed to reflect typical users of these products in an actual production environment.

- **Light User**. The light user scenario was primarily task-oriented, simulating a user of Microsoft Outlook. The light user scenario involved reading, replying to, and composing e-mail. The goal was to simulate a medium Exchange Mail user running a single published application.

- **Medium User**.  The medium user scenario represented an average user with an average typing speed of 35 to 40 words per minute.  The medium user scenario used:

    - Microsoft Word for creating small documents

    - Microsoft Excel for simple data entry

    - Microsoft Outlook for sending and receiving e-mail (seven e-mail messages per hour)

    - Microsoft Internet Explorer for browsing an intranet site

- **Heavy User**.  The heavy user scenario represented a heavy productivity application user with an average typing speed of 45 to 50 words per minute.  The heavy user scenario used:

    - Microsoft Word for creating several full-page documents

    - Microsoft Excel for extensive data manipulation, such as the use of PivotTable dynamic views and creating graphs/charts

    - Microsoft Outlook for reading and sending significant amounts of e-mail (20 e-mail messages per hour)

    - Microsoft Internet Explorer for extensive browsing of an intranet site

## Results

Microsoft provided the scripts used for the testing and the criteria used to determine when client performance had reached an unacceptable level.  Performance at the client was considered to be unacceptable when the processor queue length at the server exceeded 12.  At this level, there was a noticeable delay in client response between the keys being pressed at the keyboard and the display of the character on the screen.

The following tables show the maximum number of active users and the percentage of total processor utilization for each server configuration when the processor queue length reached 12.

### *Single Pentium II 450-MHz Processor with 512 KB of L2 Cache and 1 GB of RAM*

| User Scenario | Number of Users | Percent of Total Processor Utilization |
|---|---|---|
| Light | 50 | 84 |
| Medium | 40 | 70 |
| Heavy | 20 | 80 |

### *Dual Pentium II 450-MHz Processor with 512 KB of L2 Cache and 1 GB of RAM*

| User Scenario | Number of Users | Percent of Total Processor Utilization |
|---|---|---|
| Light | 90 | 70.5 |
| Medium | 72 | 64 |
| Heavy | 30 | 75 |

### Single Pentium II Xeon 450-MHz Processor with 1 MB of L2 Cache and 2 GB of RAM

| User Scenario | Number of Users | Percent of Total Processor Utilization |
|---|---|---|
| Light | 57 | 70 |
| Medium | 45 | 64 |
| Heavy | 22 | 75 |

### Dual Pentium II Xeon 450-MHz Processor with 1 MB of L2 Cache and 2 GB of RAM

| User Scenario | Number of Users | Percent of Total Processor Utilization |
|---|---|---|
| Light | 102 | 64 |
| Medium | 80 | 64 |
| Heavy | 36 | 73 |

## Conclusion

Although processor utilization did decrease, the number of users supported per processor is almost linear as a second processor is added.

Given such a small increase in the number of users supported between Pentium II and Pentium II Xeon processors, the indication is that larger and faster Level 2 Cache has little effect on Terminal Server Edition performance. This is due to the fact that thread scheduling on Terminal Server is tuned to run more like Windows NT Workstation rather than Windows NT Server. Therefore, fewer requests are fulfilled from Level 2 Cache.

There are dramatic differences in the number of heavy users supported compared with the number of medium users. This shows that in addition to the applications being used,  one of the biggest factors affecting Terminal Server Edition utilization is the type and amount of work actually being performed by the user.

In planning the number of Terminal Server sessions, use the data shown in the tables as a general guideline for a processor's capabilities. The maximum number of supported users shown for each configuration and user scenario is based on an average utilization during the test for that configuration and user scenario. In a real environment, you should plan for no more than four-fifths of the users shown in the tables to allow for utilization peaks without adversely affecting performance.

Of course, your actual results may vary and will be highly dependent on your specific operating environment.

### *Additional Information*

Visit these Web sites for more information about the topics discussed in this document.

- For more information about Microsoft Terminal Server Edition, visit Microsoft's Web site at:
  **www.microsoft.com/ntserver/terminalserver**

- For information about capacity planning for other types of processors (Pentium II and Pentium Pro), visit Microsoft's Web site at:
  **msdn.microsoft.com/library/backgrnd/html/tscapac.htm**

- For more information about Netfinity servers, visit IBM's Web site at:
  **www.ibm.com/netfinity**

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