Microsoft

Windows NT® Server

Server Operating System

Terminal Server Capacity Planning

White Paper

Abstract

This document provides guidelines to help customers and partners specify and purchase the correct server hardware resources needed for their Microsoft® Windows NT® Server, Terminal Server Edition installation. Although thorough testing in the actual environment is the best way to effectively measure how many users your Terminal Server environment can support, this paper provides results gathered from a prototypical test environment. Testing included three different user scenarios: light, medium and heavy. Results are given for users per processor, memory utilization, and network bandwidth utlization of the Remote Display Protocol (RDP).

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TERMINAL SERVER CAPACITY PLANNING

The aim of this document is to provide guidelines to help customers and partners specify and purchase the correct server hardware resources needed for their Terminal Server installation. It is important to understand that these are general guidelines only, developed using very specific applications scenarios and controlled testing processes. Results in your own environment will very likely vary, depending on three factors: 1) the type of hardware that is being used (server, clients, and network), 2) the type of application being run and 3) the activity level of the users in that environment. It is also critical to note that performance requirements are by nature subjective, so perceived latency may be different between organizations or individuals. If the goal is to approximate for the end user the experience of a distributed personal computer environment with local desktop application processing, that requirement must be noted. Thorough testing in the actual environment is the best way to effectively measure how many users your Terminal Server environment can support. These numbers are provided only as a reference. All testing was done on Data General Aviion Servers, at Data General Headquarters in Westborough, Mass.

Hardware

Client devices:

Intel Pentium personal computers running the Microsoft® Windows NT® Workstation version 4.0 operating system connected to the Terminal Server via local area network (LAN) at 10 megabits.
Three server platforms were tested:

- 2x Pentium II 300 (512 KB cache) with 512 MB of RAM (Data General AViiON AV 2650R)
- 2x Pentium Pro (512 KB cache) with 512 MB of RAM (Data General AViiON High Density Server)
- 4x Pentium Pro (512 KB cache) with 1 gigabit of RAM (Data General AViiON AV 3650)

Software

Microsoft Office 97: Microsoft Word, Microsoft Excel, Microsoft Outlook™ 97 (accessing Microsoft Exchange 5.5), Microsoft Internet Explorer 3.02 (accessing Internet Information Server 4.0).

A custom call-center application written in Microsoft Visual Basic® 5.0 development system accessing Microsoft SQL Server™ 6.5.

User Scenarios

- **Light (task-oriented) user** – simulates a single line-of-business application user, in this case a call-center application with database queries; reads, writes and prints.
- **Medium (administrative) user** – simulates an average user, using Microsoft Word to create small documents, simple data entry in Microsoft Excel, sending

and receiving e-mail using the Microsoft Outlook 97 messaging and collaboration client (seven e-mails per hour) and minimal browsing of an intranet site using Microsoft Internet Explorer 3.02. Average typing speed was 35 – 40 wpm.

- **Heavy (knowledge) user** – simulates a heavy productivity application user. During the test, this user created several full-page documents with Microsoft Word, performed much more extensive Microsoft Excel activity than the Medium User, including use of PivotTable® dynamic views and graphing/charting of data.

Configuration	Light	Medium	Heavy
Dual-processor Pentium II 512 MB of RAM	90	60	37
Dual-processor Pentium Pro 200 MHz 512 MB of RAM	75	50	30
Quad-processor Pentium Pro 200 MHz 1 gigabyte of RAM	150	100	50

User also browsed the intranet site extensively using Internet Explorer 3.02 and sent and read a significant amount of e-mail (approximately 20 e-mail messages per hour). Average typing speed was 45 – 50 wpm.

Conclusions

A: Users Per Processor/Per Scenario

Based off of the previous table's information, testing results showed that that in a light user scenario, a Pentium Pro processor 200 MHz can support approximately 37 users and a Pentium II 300 Processor can support approximately 45 users. For a medium user, these numbers are approximately 25 users for the Pentium Pro and 30 for the Pentium II 300. And finally, for a heavy user, Terminal Server on a Pentium Pro can support approximately 15 users per processor, and on a Pentium II 300, 18 users per processor.

B: Memory Utilization Per User/Per Scenario

Test results show that memory utilization on a Terminal is between 4 and 12 MB per user, depending on the user scenario. For light users, between 4-6 MB of RAM was used, for medium users, RAM usage varied between 6 – 10 MB, and for heavy users, up to 12 – 13 MB of RAM was needed to support the client activity. These memory requirements assume all users have similar display performance expectations.

C: Network Utilization Per User/Per Scenario

Network utilization per user varied slightly with processor type. The light user scenario resulted in average traffic per user of 2 Kbps, medium users resulted in approximately 2.5 Kbps per user, and the heavy user scenario resulted in an average of about 6 Kbps per-user traffic on the wire.

Summary

Using the information above, the following rules of thumb apply to capacity planning for Microsoft Windows NT Server, Terminal Server Edition, version 4.0:

- **Users per Pentium processor:** 15 – 45 users per processor, depending on processor type and usage scenario. Leave room for future growth (plan for more users than you currently have).
- **RAM usage per user:** 4 – 12 MB of RAM per user, depending on usage scenario. Again, plan for more users than are currently in place, to provide room for growth.
- **Network bandwidth utilization:** 2 – 6 Kbps per user, depending on user scenario.

For More Information

For more information and the latest articles on Terminal Server, check out the Terminal Server Web site at http:\\www.microsoft\com\ntserver\basics\terminalserver.

For the latest information on Microsoft Windows NT Server 4.0, check out our World Wide Web site at http://www.microsoft.com/ntserver.