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Contents

intraNetWare Client for Windows NT Optimization

Abstract: This Integration Note describes the Advanced Settings Parameter Groups available in intraNetWare Client for Windows NT. Generally, the default values for the advanced settings provide the best client performance in most network environments. However, there are circumstances in which modifying these settings may improve client performance.

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intraNetWare Client for Windows NT Optimization
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Executive Summary

Servers play an increasingly key role in complex networking environments where the demand for quick and reliable network transmissions has never been greater than today. Even the slightest loss of productivity translates into a costly business venture.

intraNetWare Client for Windows NT provides the critical server connection between a workstation and the NetWare local area network (LAN). By tailoring server parameters and configuration settings to an enterprise's unique needs, overall client/server performance can increase.

This Compaq Integration Note summarizes the results of intraNetWare Client for Windows NT performance testing and evaluation conducted by Compaq software engineers in a closely controlled environment. System integrators and network administrators with knowledge of Compaq server products will benefit most from the information provided in this document.

Overview

Productivity depends on the smooth operation of the entire enterprise network. Client network access speed and reliability can be affected by the server configuration, network traffic, and/or client software. The intraNetWare Client for Windows NT Advanced Settings can be configured to optimize performance on the client and to meet the particular requirements of the network environment.

This Integration Note discusses the results from performance testing and evaluation of intraNetWare Client for Windows NT. Three major topics are discussed:

- Available network parameters and configuration settings
- Performance considerations
- Client management and troubleshooting

Client Configuration Settings

Optimal configuration settings can aid in optimizing client performance. The Advanced Settings property page of the intraNetWare Client for Windows NT allows you to easily modify parameter values to uniquely customize login script preferences, as well as optimize performance of the client software. Configuration settings are categorized by group: Environment, NETX Compatibility; Packet Management; and Wide Area Network (WAN). Some of the parameters are dynamic, which means that adjusting the intraNetWare Client for Windows NT setting takes effect immediately; whereas, other parameters require rebooting the client.

Environment, NETX Compatibility Parameters

The Environment, NETX Compatibility group consists of the parameters listed in Table 1. The values of these parameters do not affect performance, but can facilitate client management tasks such as customizing login and profile scripts.

Table 1. Environment, NETX Compatibility Parameters

Parameter	Description	Setting (*default)
Receive Broadcast Messages	Tells the client software which broadcast messages to receive.	All*, Server Only, None
DOS Name	The %OS variable in the login or profile script uses this variable when mapping a search drive to the network DOS directory. It reflects the name of the operating system used in the shell.	This value can be 1 to 5 characters. **Example:** WINNT*
Long Machine Type	The %MACHINE variable contains this value to set the machine's search path to the correct version of DOS.	This value can be 1 to 6 characters. **Example:** IBM_PC*
Short Machine Type	The %SMACHINE variable holds this setting.	This value can be up to 4 characters. **Example:** IBM*

Packet Management Parameters

Modifying the Packet Management group and WAN group settings can affect the performance of the client. The default settings are best suited for most network environments. However, certain conditions may necessitate adjusting the settings to meet the unique demands of your networking environment. Table 2 provides a description of the Packet Management parameters and the associated settings.

Table 2. Packet Management Parameters

Parameter	Description	Setting (*default)
Link Support Layer Max Buffer Size	Specifies the maximum packet size in bytes.	4736*, 100 to 24682 bytes
Burst Mode	Controls the use of the Packet Burst protocol for file input/output.	ON*, OFF
Max Read Burst Size+	Specifies the maximum read burst size that can be requested from the server.	36000*, 1 TO 65536 bytes
Max Write Burst Size+	Specifies the maximum write burst size the client can request from the server.	15000*, 1 TO 65536 bytes
Signature Level+	Denotes the level of enhanced security support.	1*, 0 to 3
+Dynamic parameter		

WAN Parameters

The WAN group of parameters, listed in Table 3, primarily affect the client software performance over wide area links. The effect that these parameters can have on client performance is contingent on the Maximum Physical Receive Packet Size setting on the server, as well as the protocols in use on the network.

Table 3. WAN Parameters

Parameter	Description	Setting (*default)
Large Internet Packets (LIP)	Used to enable or disable LIP support.	ON*, OFF
Large Internet Packet Start Size+	Determines the starting value for negotiating the LIP size.	1 to 65535* bytes
Minimum Time To Net	Used for bridged WAN/satellite links.	0* to 65535 milliseconds
+ Dynamic parameter		

Other Configuration Options

Some DOS and 16-bit Windows applications require modification of the FILE HANDLES setting. Unlike previous versions of the client, to increase the FILE HANDLES available to applications, SETFILES = nnn in the CONFIG.NT file rather than the NET.CFG file, which is primarily used for NETX and DOS Requestor. The CONFIG.NT file is located in the WINN\SYSTEM32 directory.

Client Performance Considerations

Ziff-Davis' NetBench® version 5.01 benchmark program was used to see how the intraNetWare Client 4.0 for Windows NT Advanced Settings affect performance. The goal of the NetBench tests were not to stress the server, but to monitor the throughput of the clients after deviating from suggested parameter values. A test mix was created using the NetBench I/O Throughput Tests (Sequential Read, Sequential Write, Random Read, and Random Write) and the NIC Test for the analysis. Table 4 provides details of the test options.

Table 4. NetBench Test Options

Option	Description	Setting
Request Size	Number of bytes of data to read or write at one time.	1024*, 1 to 65534
File Size	Size of the initial test data file to create.	1024*, 1 KB to 100 MB
Data Pattern	Type of data to use to create the test file.	Text*, Binary, or User Defined
Length	Minimum time that the test runs.	660 seconds
Delay Time in Seconds	Maximum time for a client to wait before starting a test.	0 seconds
Think Time in Seconds	Length of time for a client to wait once it gets a response from the server before it issues another request to the server.	0 seconds
*Value used for testing		

The controlled testing environment consisted of the following hardware and software listed in Table 5. All products used in the test were the shipping versions available to the general public. No service pack was applied to the client OS. Since NetBench only supports Windows 95 or Windows for Workgroups OS on the controller, we chose Windows 95 for the controller OS.

Table 5. Network Hardware and Software Configurations

	Hardware	Operating System	Client Software
Server	Compaq ProLiant 2500 200-MHz Dual Pentium Pro Processor Board System ROM E24 (12/30/96) 256 MB RAM Compaq SMART-2/P Array Controller with 1 logical drive; cache size 4 MB; firmware revision 1.48 Compaq Integrated 10/100 TX UTP Controller Compaq Netelligent 10/100 TX PCI UTP Controller Compaq Wide-Ultra SCSI Controller	intraNetWare 4.11 Compaq Drivers: CPQDA386.DSK CPQNF3.LAN CPQS710.DSK CPQSDISK.DSK	N/A

	Hardware	Operating System	Client Software
Controller	Compaq ProSignia 500 90-MHz Pentium Processor Board System ROM E15 (8/30/95) 48 MB RAM Embedded PCI Ethernet Controller Compaq NetFlex-3/E Controller 100 Base-TX Compaq Integrated 32-Bit Fast-SCSI-2 Controller/P Compaq 1.05-GB Hard Drive	Windows 95 Compaq Drivers: CPQNF3.COM	intraNetWare Client 2.12 for Windows 95 4.00.95.0
Clients	Compaq ProSignia 300 90-MHz Pentium Processor Board System ROM E15 (12/6/95) 16 MB RAM Embedded PCI Ethernet Controller Compaq Integrated 32-Bit Fast-SCSI-2 Controller/P 1.05-GB Hard Drive	Windows NT 4.00.1381	intraNetWare Client 4.0 for Windows NT

The NetWare 4.11 environment consisted of two Fast Ethernet hubs, each with 16 UTP ports. The hubs were connected to provide ports for 21 clients on a single segment. The frame type used in this testing was the 802.3 protocol (IPX only).

The sections that follow reflect throughput statistics resulting from manipulating the intraNetWare Client for Windows NT Advanced Settings.

Note: These tests were performed without independent verification by Ziff-Davis. Ziff-Davis makes no representations or warranties as to the results of the tests.

intraNetWare Client for Windows NT Features

intraNetWare Client for Windows NT was designed specifically for NetWare 4.1x and NetWare 5 environments and is completely compatible with Novell Directory Services (NDS). NDS provides users and administrators with a global view of all network resources; including stored files, printing, and applications.

NDS compatibility not only provides access to NetWare file and print resources on a specific server, but also allows users to login to multiple directory trees. intraNetWare Client for Windows NT also includes the Novell Application Launcher (NAL). NAL leverages information in NDS to provide a system for central management of networked applications. These features are not limited to intraNetWare Client for Windows NT, but are also available with other Novell clients[1].

In addition to these accommodating features, intraNetWare Client for Windows NT can improve network performance. Compaq testing found intraNetWare Client for Windows NT to be quite

[1] For more information, see intraNetWare Client for NT: Product Details at the Novell web site, http://www.novell.com.

robust in the NetBench I/O Throughput Tests and the NIC Test. The NetBench Random Read and Sequential Write tests in our labs revealed that intraNetWare Client for Windows NT achieved a 22% higher throughput rate than Microsoft Client Service for NetWare (CSNW)[2].

The sections that follow describe the effects of the intraNetWare Client for Windows NT Advanced Settings parameters on client performance. As each chart indicates, client performance is relative to the number of clients on the network. However, the effect of each parameter is generally consistent, regardless of the client load.

Link Support Layer Max Buffer Size

The NetWare link support layer allows the LAN driver for an adapter to service more than one protocol. If the server that the client accesses uses only one protocol (for example, IPX; or with NetWare 5, IP), it is not necessary to modify the Link Support Layer Max Buffer Size setting on the client. As shown in Figure 1, only a minimal performance gain was achieved as the Link Support Layer Max Buffer Size value increased. This setting, however, can be used to optimize performance for media in a token ring network.

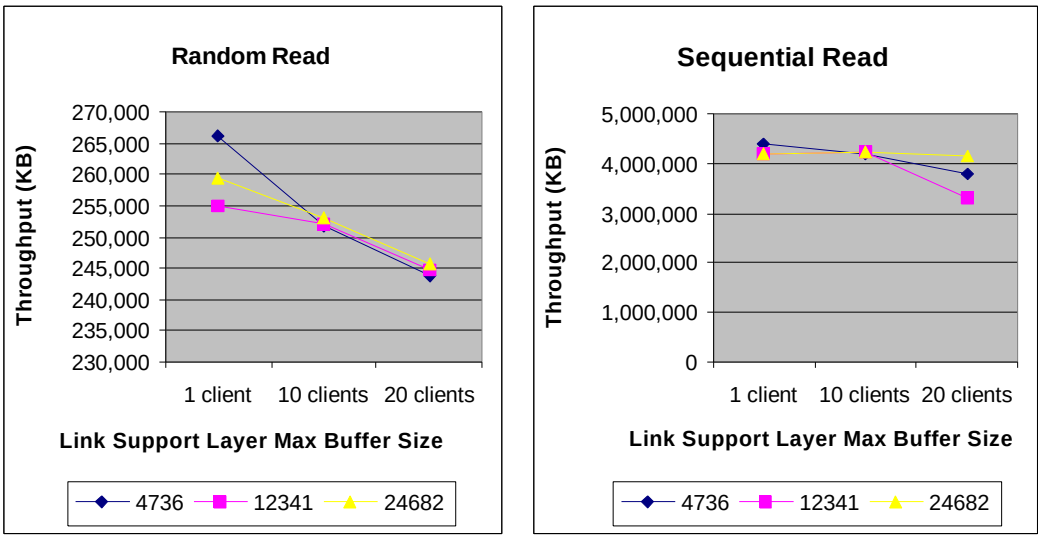

Figure 1. Link Support Layer Buffer Size

As an additional note, increasing the Link Support Layer Max Buffer Size setting on the client can result in greater memory utilization on systems with network boards that use bus-mastering. However, the adverse effects generally associated with memory utilization problems were not present with the Compaq NetFlex-3 adapter, which uses bus-mastering.

Burst Mode

NetWare 3.12 and later support a feature called Packet Burst, which increases LAN performance and reduces overall network traffic. Before the Packet Burst protocol was available, the server would send a packet to its receiver (generally the client) and wait for an acknowledgement (ack) of the receipt. This process wastes bandwidth and time. With Packet Burst, the server sends a series, or "burst," of packets and waits for an ack of the burst. This feature can be controlled

[2] The Microsoft Client Service for NetWare is a client service provided by Microsoft NT Workstation which allows you to access NetWare file and print resources.

(enabled or disabled) on the client with the Burst Mode parameter. In NetWare 4.1x, the Packet Burst protocol is automatically enabled and cannot be disabled on the server. In the 3.x environment, Packet Burst can be added to the server.

The Burst Mode parameter of the intraNetWare Client for Windows NT is an ON/OFF switch that can control the delay time between packet bursts. Since a fast server could possibly overwhelm a client with packets, this setting allows the client enough time to process the last burst.

Compaq testing indicates that enabling the Burst Mode setting does improve performance (refer to Figure 2), regardless of the number of clients on the network. However, there are circumstances, in which the Burst Mode parameter would hinder client performance. If packets have to cross a router or bridge that does not know how to handle burst traffic, disabling the Burst Mode setting might prevent a client from hanging or keep an application running properly.

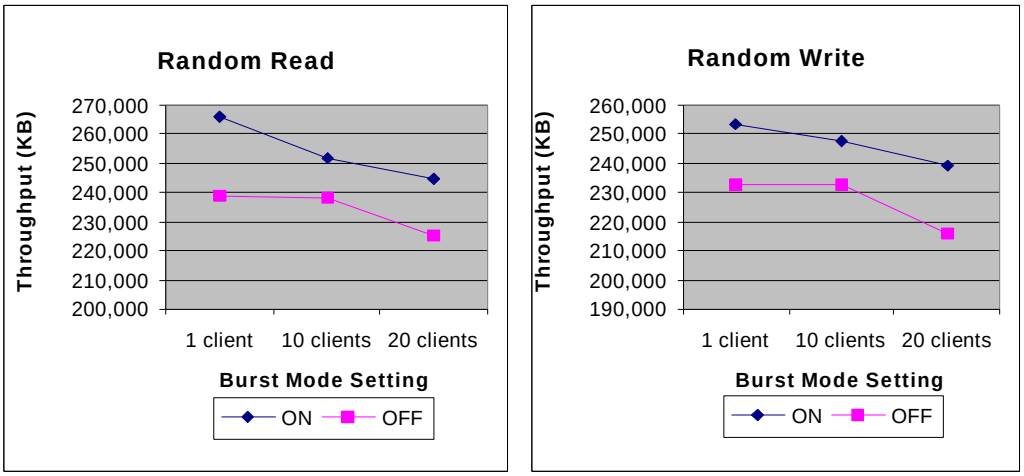

Figure 2. Burst Mode Setting

Max Read Burst Size/ Max Write Burst Size

By default, NetWare 4.x or later can burst up to 64K of data in a single request. Despite the maximum value of 65536 bytes supported by the Max Read/Write Burst Size parameters, the server dictates the window size (burst size).

Traffic on the network dictates the limitations of the burst size to prevent read and write requests from dominating the bandwidth. Figure 3 shows that as the number of clients increases, there is no significant difference in performance—regardless of the parameter setting. However, setting either parameter to a value lower than the maximum packet size supported by the server will, in effect, disable Packet Burst on the client.

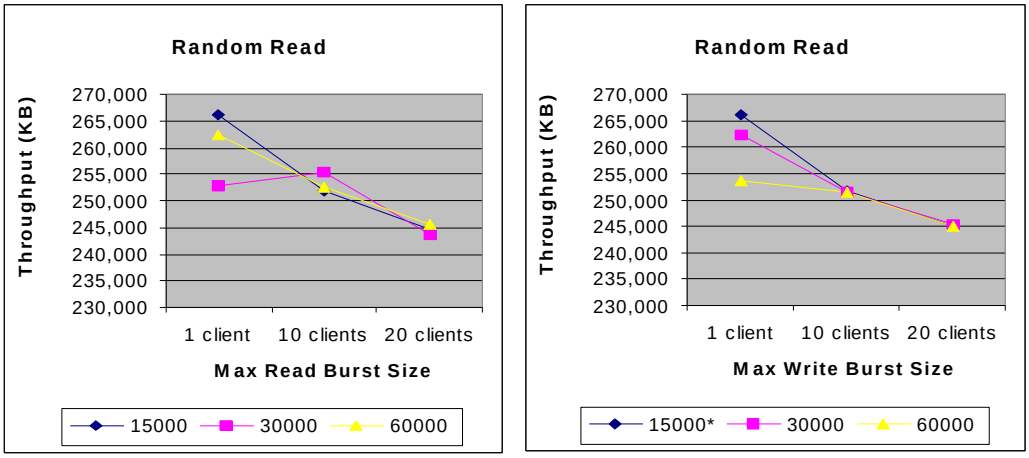

Figure 3. Max Read Burst Size/ Max Write Burst Size

Signature Level

The Signature Level parameter coincides with the NCP Packet Signature Option on NetWare 4.1x and NetWare 5 servers. The NCP Packet Signature Option controls the packet signing on the server. Packet signing adds another level of security to the NetWare environment that aids in preventing forged packets. NCP packet signing requires a unique signature on all messages. The signature is a combination of the workstation signature and a random number. When a packet is received, the correct signature is validated. Packets that do not have the correct signature are discarded.

The natural inclination would be to require the highest level of security on the network, especially for servers that have remote users. However, there is a tradeoff of added security for performance, both at the server and the workstation. The settings for the Signature Level parameter are:

0 = Disabled
1 = Enabled, but not preferred (default)
2 = Preferred
3 = Required

As shown in Figure 4, performance decreases as the amount of security increases (Signature Level = 2 or 3). The NCP Packet Signature Option on the server was set to 1, which means that the server signs packets only if the client requests it.

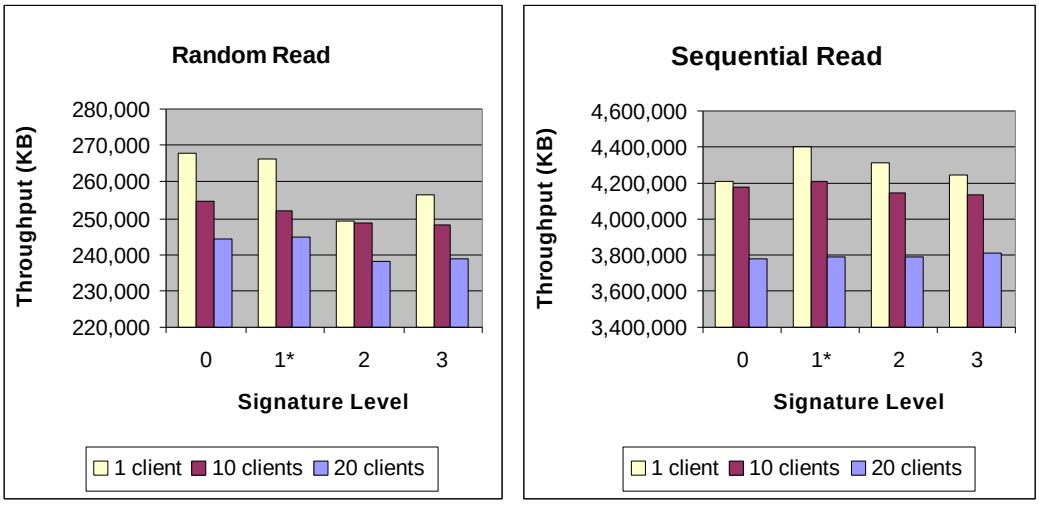

Figure 4. Signature Level Results

The decrease in performance occurs because of the increased overhead involved in the client performing additional processing of each packet transmitted. Since the server must also verify each packet, the decision to activate packet signing is contingent on the security required in the network environment. Networks that have both remote users and Internet access require more data security and would benefit most from packet signing. On the other hand, servers that do not transmit sensitive data do not necessitate an additional level of data verification.

This Signature Level setting is dynamic and can be changed on the workstation to take effect immediately to improve performance without rebooting. However, the NCP Packet Signature Option on the server must be 1 or 0; otherwise, client logins will fail.

Large Internet Packets

This setting primarily affects client performance on NetWare 3.x networks and networks in which packets must cross bridges or routers. When Large Internet Packets is enabled, intraNetWare Client for Windows NT will negotiate the maximum packet size with the NetWare server. By default, NetWare 3.x servers that act as routers limit the packet size to 576 bytes. However, this default setting can result in a waste of resources on most networks. For example, a mixed Ethernet/FDDI LAN could use 1514 bytes as the maximum packet size. This is because the largest packet size that can be transmitted on an Ethernet LAN is 1514, while FDDI can support a packet size of 4202.

As shown in Figure 5, Compaq testing revealed that enabling the Large Internet Packets setting on an isolated network still increases client performance. The setting allows the client and server to negotiate the largest packet size that can be transmitted on the network.

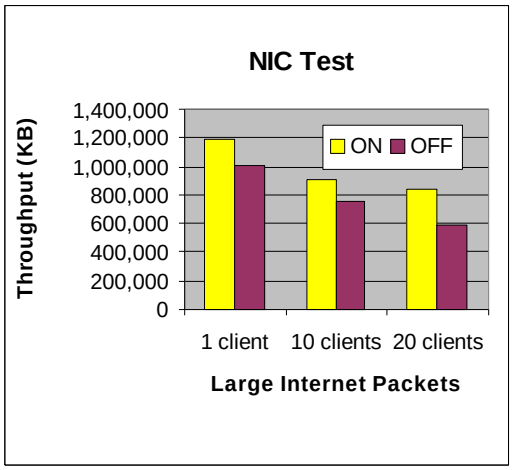

Figure 5. Large Internet Packets Results

Large Internet Packet Start Size

The Large Internet Packet Start Size setting can be used to fine-tune the start size of packets to reduce negotiation requests that must be exchanged over slow WAN links. NetWare 4.1x and NetWare 5 default to a Maximum Physical Receive Packet Size of 4202. On networks in which packets do not have to cross bridges or routers, changing this value will not have an effect on client performance.

Minimum Time to Net

This setting controls the amount of time before intraNetWare Client for Windows NT concludes that an attempt to connect to a server has failed. Increase this setting to 10000 milliseconds for 2400-baud lines, or as needed, if the server is not running Packet Burst.

Client Management and Troubleshooting

The messages listed in Table 6 will appear if an error occurs during login or during an attempted network transmission. The detailed instructions will aid in quickly correcting the error and avoiding unnecessary downtime.

Table 6. Error Messages and Problems

Error Message or Problem	Resolution
"You must enter a valid credential set in order to login."	This error means that a server or tree was not specified on the Connection tab of the Login screen. You must enter the server name or tree to which you want to login.
"Failed to connect to a NetWare service." "Please check your cabling or the event log for a problem."	The status at the bottom of the Novell Graphical Identification and Authentication (GINA) login box changes from *Services Starting* to *Disconnected,* but does not change to *Ready*. This is basically an indication that a file server was not found. If you still cannot login after verifying that the server, username, tree, and context are correct, you can bypass the NetWare login by clicking the Windows NT tab and selecting the *Windows NT Login Only* checkbox. Therefore, if no NetWare server is

Error Message or Problem	Resolution
	available, you can still login to the workstation.
The workstation displays a blue screen that prevents login.	It is possible to remove GINA and run the Microsoft GINA to get around the problem. If the NT workstation system partition is FAT, it is possible to reboot the workstation using a DOS floppy and then rename the GINAs. These files are located in the WINNT\SYSTEM32 directory. Backup the NWGINA.DLL and rename the MSGINA.DLL file to NWGINA.DLL. This causes the MSGINA to display for login when the machine reboots. At that point you can log into the NT workstation to continue troubleshooting. If the NT system partition is NTFS, use the Emergency Repair diskette to restore the registry to the state it was before the client was installed.
The client receives a bad RIP response.	After client startup, the NWLINK IPX/SPX stack will do a RIP request to determine the local network segment address. It will then use the network address of the first response it gets in all packets it sends out. So if a device; such as a router, workstation, or any other device that might respond to a RIP request, is the first to respond and it has a bad address, you will not be able to connect to a server. The best way to determine this is to use a protocol analyzer and take a trace while the client is booting.
"Can't find any DS services."	An internal network address is set. NT workstation allows you to set an internal network address for the NWLINK IPX/SPX protocol. This is not supported by intraNetWare Client for Windows NT.
"The tree or server cannot be found."	The correct frame type is not listed first. NT workstation allows you to specify a frame type or auto detect. Auto-detect may not find the correct frame type in use by the network, so specify the proper frame type.
"The NetWare redirector cannot find a network transport."	This error means that an adapter or protocol did not load properly. Check the NT Workstation Event Viewer to see what did not load. Since NetWare/IP is treated as an adapter by the client, you will get this error if the NetWare/IP configuration is faulty or an NetWare/IP server is not available.
The NT Machine Name changes after the Novell NetWare Client for NT version 4.0 was installed.	In all known cases of this error there was either a SET MACHINE = or SET MACHINE NAME = statement in the NetWare Login Script (Container, User, Profile, or Default). Removing this line from the Login Script prevents the NT Machine Name from changing.

Conclusion

No two enterprises are exactly alike; neither are their networking requirements. Compaq testing and analysis demonstrated that the default values of the intraNetWare Client for Windows NT Advanced Settings can provide optimal performance in most Novell NetWare 4.x and NetWare 5 environments. However, there are situations that will dictate adjusting some settings' values to meet the requirements of certain enterprise networks. The key to optimization: first analyze all of the factors that may affect client/server performance; then, if necessary, adjust settings accordingly.

Quick Reference Sheet

#	Parameter	Default	Server Parameter/Console Command	See Also
1	Burst Mode	ON	Packet Burst (NetWare 3.x only)	5, 7, 8, 12
2	DOS Name	WINNT	N/A	6, 10, 11
3	Large Internet Packet Start Size	65535	Maximum Physical Receive Packet Size*	4, 9
4	Large Internet Packets (LIP)	ON	Allow LIP	3, 9
5	Link Support Layer Max Buffer Size	4736	BIND protocol [TO] lan driver | board name	1, 7, 8, 12
6	Long Machine Type	IBM_PC	N/A	2, 10, 11
7	Max Read Burst Size	36000	Packet Burst (NetWare 3.x only)	1, 5, 8, 12
8	Max Write Burst Size	15000	Packet Burst (NetWare 3.x only)	1, 5, 7, 12
9	Minimum Time To Net	0	N/A	3, 4
10	Receive Broadcast Messages	All	SEND “message” [[TO] username | connection number]	2, 6, 11
11	Short Machine Type	IBM	N/A	2, 6, 10
12	Signature Level	1	NCP Packet Signature Option	1, 5, 7, 8

*Standard protocol values

- ARCnet 576
- Ethernet 1514
- FDDI 4202
- Token Ring 4202

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