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Overview of NetWare Client 32 for Windows 95

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The NetWare Client 32 product family represents the next step in the evolution of Novell's client software. The architecture of this new client has been completely redesigned to take full advantage of the 32-bit capabilities of the 80386 and higher microprocessors. Client 32 combines the best elements of Novell's previous client architectures (the NETX Shell and the NetWare DOS Requester, or "VLM" client) and adds some significant enhancements of its own.

NetWare Client 32 is a two-fold release. One version is NetWare Client 32 for Windows 95, which extends the Windows 95 desktop by fully integrating with NetWare 2.x, 3.x, and 4.x services, including Bindery and Novell Directory Services (NDS). The other version of the 32-bit client is NetWare Client 32 for DOS/Windows 3.x, designed for PCs running DOS, Windows 3.1, or Windows for Workgroups 3.11. While there are many similarities between these two client versions, there are also significant differences. This AppNote covers only NetWare Client 32 for Windows 95. (For more information about NetWare Client 32 for DOS/Windows 3.x, see the May 1996 issue of *Novell Application Notes*.)

This introductory AppNote provides a general overview of the Windows 95 networking architecture. It covers the following topics:

- The Windows 95 networking architecture
- How NetWare Client 32 for Windows 95 interfaces with and enhances that environment
- The various components that make up the Client 32 software

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Windows 95 Networking Architecture

Windows 3.x was not designed with networking in mind. It wasn't until the release of Windows for Workgroups that Microsoft began adding networking features to the Windows platform. With the release of Windows NT, Microsoft introduced a new architecture designed for networking. Windows 95 inherited much of this new networking architecture, giving Windows 95 a consistent network model that is comparable to that of Windows NT.

One of the biggest problems integrators faced in the past was getting two network redirectors from various vendors (Banyan, DEC, IBM, Microsoft and Novell) to coexist. To alleviate this problem, Microsoft designed

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the networking architecture of Windows 95 to support more than one "network provider" at a time. This architecture allows multiple protected-mode network clients to run at the same time, as long as they are specifically written to the Windows 95 networking interface.

To better understand the networking architecture of Windows 95, it helps to be familiar with the different network components and with the terminology involved. This section:

- Describes the components of the Windows 95 networking architecture.
- Identifies the network redirectors and servers that are natively supported in Windows 95.
- Compares the different protocol options available in Windows 95 and identifies the protocol interfaces that are supported.

Components of the Windows 95 Networking Architecture

Windows 3.1 and Windows for Workgroups 3.11 used an Application Program Interface (API) referred to as "WinNet 16" to interface with the network. For Windows NT, Microsoft developed a new 32-bit interface called the "Win32 WinNet" or "WinNet 32" API. In designing the networking architecture of Windows 95, Microsoft had three main design goals:

1. *To support the Win32 WinNet APIs that were defined in Windows NT and apply these APIs in Windows 95.*

   To meet this goal, Microsoft updated all "WNet" commands and function calls (such as WNetGetConnection) to support the same interface that Windows NT provides.

2. *To ensure that Windows 95 is backwards compatible with the networking architecture of Windows for Workgroups 3.11.*

   Besides providing compatibility with WinNet 16 calls, this meant supporting one WinNet 16 network driver. (For Novell, this is the NETWARE.DRV driver that comes with the NetWare DOS Requester.)

3. *To provide a generic API interface that allows seamless browsing of network resources.*

   Since multiple networks are supported, application requests to list non-specific resources (such as "all known servers") use the generic WinNet API to query the different providers and redirectors that are enabled to display those resources. This browsing capability appears in Windows 95 programs such as Network Neighborhood, My Computer, and the Explorer.

Figure 1 illustrates the resulting networking architecture of Windows 95.

Figure 1: The Windows 95 networking architecture is modularized and layered.

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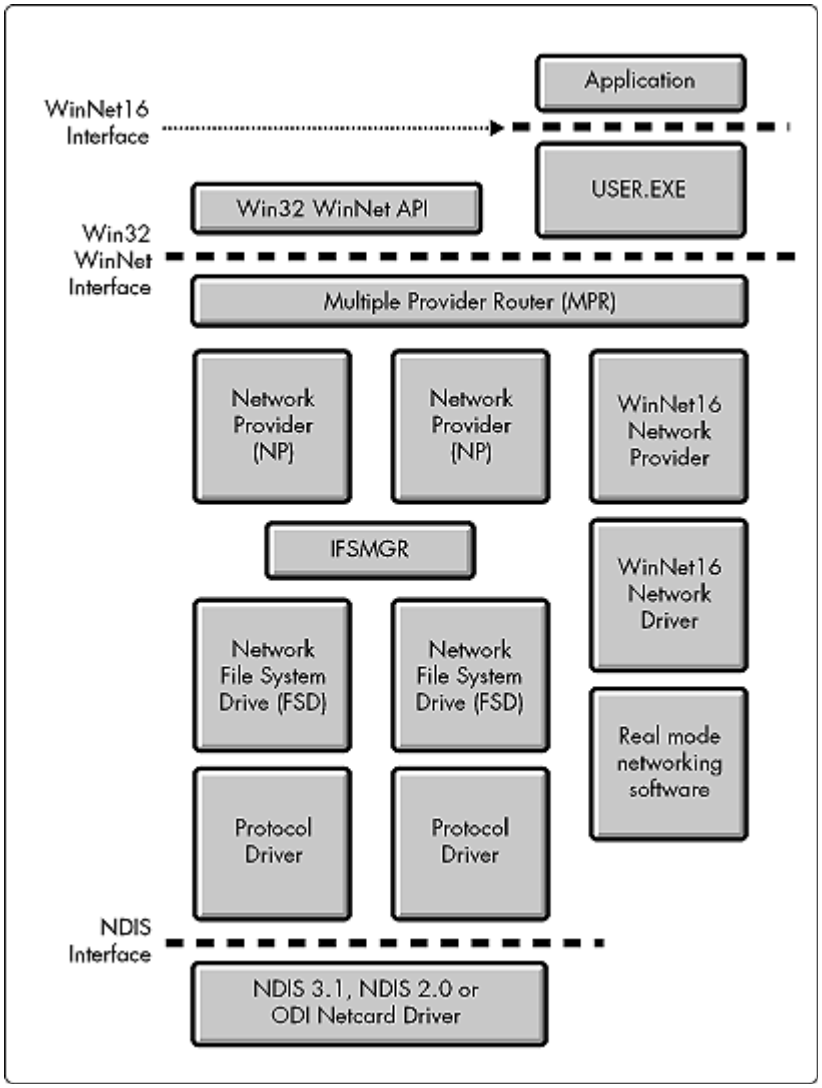

This diagram shows the different paths that network requests take from applications that make either WinNet 16 or WinNet 32 calls. All of these calls are passed through the Multiple Provider Router (MPR) to the proper network provider. In the case of a WinNet 16 API call, the request goes through USER.EXE and is routed to the WinNet 16 Network Provider, which passes it on to the WinNet 16 network driver to get it out onto the network. Win32 API calls are routed to the appropriate Network Provider, which passes them through the Installable File System Manager (IFSMGR) to the appropriate network File System Driver (FSD). From there, they go to the protocol driver, and onto the network through an NDIS (Network Device Interface Specification) or ODI (Open Data-link Interface) LAN driver.

What Microsoft has basically done is modularized the networking architecture so that requests are routed by several different "managers" through the various layers. The following paragraphs describe the purpose and function of each of these architectural components in more detail.

Multiple Provider Router. Microsoft's Multiple Provider Router, or MPR, is the component that manages the network API calls. It is implemen ted as a Dynamic Link Library (DLL) running in Windows 95. The MPR is a request manager that collects calls and determines which provider to route the call to.

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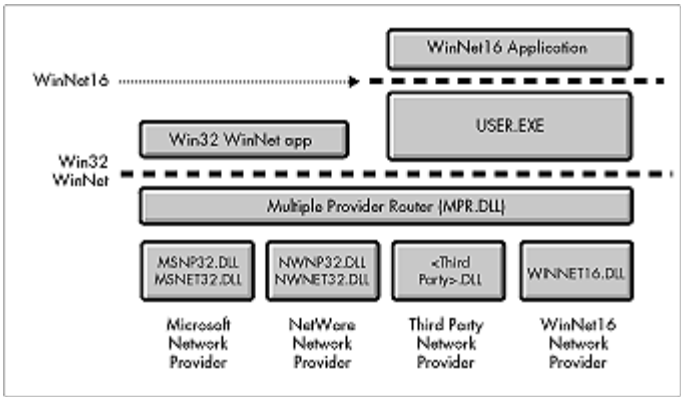
As a 32-bit example, suppose you are using a Windows 95 application such as the Explorer or Network Neighborhood, and you click on an option that makes a NetWare request. The program issues a call using the Win 32 WinNet API. The call goes to the MPR, which routes it to Novell's Network Provider (DLL).

As a 16-bit example, suppose you are running the NetWare User Tools (`NWUSER.EXE`) utility, a NetWare DOS Requester application that is supported in the Windows 95 client as well. NWUSER is hooked into Novell's `NETWARE.DRV` driver, which uses a WinNet 16 call to make network requests. The application calls `USER.EXE`, and is then passed by the Multiple Provider Router to the supported WinNet 16 Network Provider (`NETWARE.DRV` in this case).

Network Providers. The MPR interacts with the various Network Providers, such as Microsoft's Network Provider, Novell's NetWare Network Provider, or other third-party 32-bit network providers. For WinNet 16 applica tions, the MPR interacts with one WinNet 16 Network Provider (see Figure 2).

Figure 2: Windows 95 supports multiple Network Providers.



The Microsoft Network Provider is a 32-bit network-specific driver interface contained in the `MSNP32.DLL` and `MSNET32.DLL` files. If an application issues an SMB (Server Message Block) call to a Microsoft network, it uses the WinNet 32 API. The call is passed down through the MPR, which routes the call to the Microsoft Network Provider.

Microsoft has included a 32-bit NetWare-compatible network provider as a standard part of Windows 95. This component is officially called the "Network Provider File for Novell" and is contained in the `NWNP32.DLL` and `NWNET32.DLL` files. With this provider loaded, when an application issues a WinNet 32 call for NetWare services, the NetWare Network Provider translates the call into an NCP request. The MPR then routes the call to the appropriate network provider.

Note: Do not confuse the NetWare-compatible provider supplied by Microsoft with the NetWare Provider (NOVELLNP.DLL) that comes with Novell's Client 32 software. Novell's NetWare Provider allows you to perform network functions such as logging in, authenticating to NDS, and accessing NetWare resources. You perform these functions through the Windows 95 interface available in the Explorer or Network Neighborhood programs, which interact through the networking architecture of Windows 95. (The NetWare Provider is covered in more detail in the AppNote "Accessing Network Resources with the GUI Login Utility and the NetWare Provider" in this issue.)

Typically, the installed Network Providers are sorted by a value in the Windows 95 Registry database. Providers with lower values are called before those with higher values. One of the providers is designated

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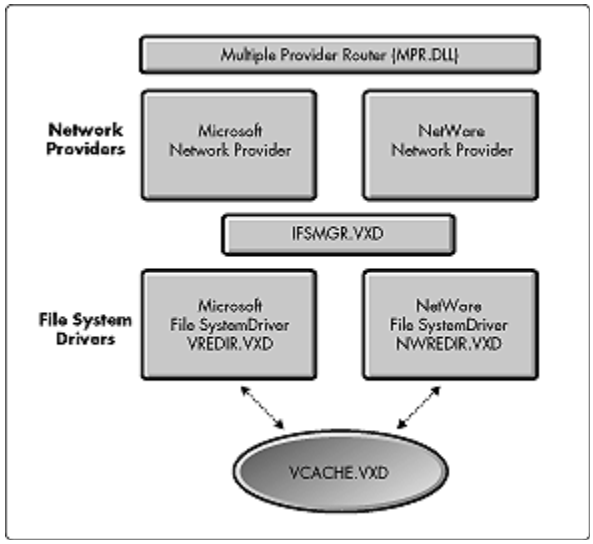
as the Primary provider. Other providers are available, such as the print provider, but they are outside the scope of this AppNote.

Network File System Drivers. Microsoft has written a number of File System Drivers (FSDs), or "redirectors." One example is Microsoft's SMB Redirector, called VREDIR.VXD. Another is the Microsoft-supplied NetWare Redirector, called NWREDIR.VXD. VxDs are "virtual device drivers," which is how Microsoft implements Ring 0 interaction with the Windows 95 operating system kernel and various interfaces for protected-mode clients (see Figure 3).

Figure 3: Network file system drivers (redirectors).



Microsoft also supplies other file system drivers, including the disk drive interface, which handles all disk I/O activity. There is also a CD-ROM file system driver that is implemented as a VxD and interfaces with the IFS Manager.

VCACHE.VXD is a common cache that File System Drivers use. All of the FSDs mentioned above use the memory that has been allocated through VCACHE.VXD.

Note: In NetWare Client 32, the device drivers are written as NetWare Loadable Modules (NLMs) instead of as VxDs. Because of the way NetWare Client 32 is designed, it does not use VCACHE.VXD. It uses its own, separate cache mechanism instead. We'll explain more about how Client 32 uses this cache later in this AppNote.

Network (Peer-to-Peer) Servers

Naturally, Windows 95 supports Server Message Block (SMB), which is the protocol Microsoft clients use to talk to their servers or to other SMB clients in a peer-to-peer fashion. SMB server support for SMB clients in Windows 95 is implemented through a virtual device driver called VSERVER.VXD.

NetWare uses a similar protocol for client-server interaction, called NetWare Core Protocol (NCP). Microsoft provides a "clone" NCP server called NWSERVER.VXD with Windows 95. This NCP server claims to be the equivalent of a NetWare 3.1x server, but it is actually more like a NetWare 2.x server because it doesn't understand the "Case 87" NCPs that Novell has used in NetWare since version 3.11. NetWare Client 32 for Windows 95 *does not support* Microsoft's clone NCP Server and *will not communicate* with that server.

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Note: The SMB server and the clone NCP server cannot both be installed at the same time. If you want to access both SMB and NCP services from a workstation, use VSERVER.VXD. The corresponding client must also be installed.

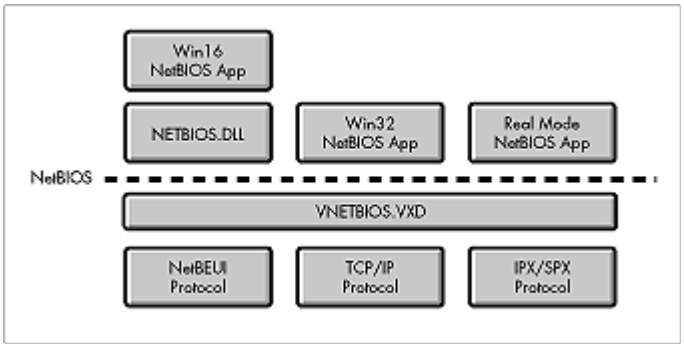
Protocol Interfaces

Microsoft has included a number of network protocol interfaces in Windows 95. These include:

- NetBIOS
- Windows Sockets (WinSock)
- ECB (Event Control Block)
- TDI (Transport Driver Interface)

NetBIOS Interface. All of Microsoft's offerings use the NetBIOS interface. NetBIOS provides a protocol-independent way of creating sessions, datagrams, and name resolution management over whatever transport protocol you want to use: NetBEUI, TCP/IP, or IPX/SPX (see Figure 4).

Figure 4: The NetBIOS interface in Windows 95.



The Microsoft implementation of SMB encapsulates requests within the NetBIOS interface. The NetBIOS information is ten wrapped by a transport protocol. This double-wrapping overhead has a performance effect on the client-server request.

The NetBIOS interface supports any kind of application (16-bit, 32-bit, or real- mode) as long as it is written to the standard NetBIOS calls. Microsoft provides a VxD called `VNETBIOS.VXD` to determine which protocol the NetBIOS application calls are routed to. For example, a Win16 NetBIOS application communicates through `NETBIOS.DLL`, a DLL provided for the NetBIOS interface.

Windows Sockets (WinSock) Interface. The Windows Sockets interface was originally designed to be a vendor-independent method of accessing datagram and session services over TCP/IP. Microsoft has now extended this interface to their 32-bit implementation of IPX/SPX.

With the Windows Sockets Interface, you can have a 32-bit WinSock application, such as the NetScape Web browser, and a 16-bit WinSock application, such as the Trumpet news reader, running at the same time. Each application interfaces into the appropriate DLL depending on the calls they make: `WINSOCK.DLL` for 16-bit application calls, and `WSOCK32.DLL` for 32-bit application calls.

Figure 5 shows how information flows through the different interface layers, with the DLLs interfacing with the VxDs that they support, and the VxDs interfacing with specific transport protocols (TCP/IP or IPX/SPX).

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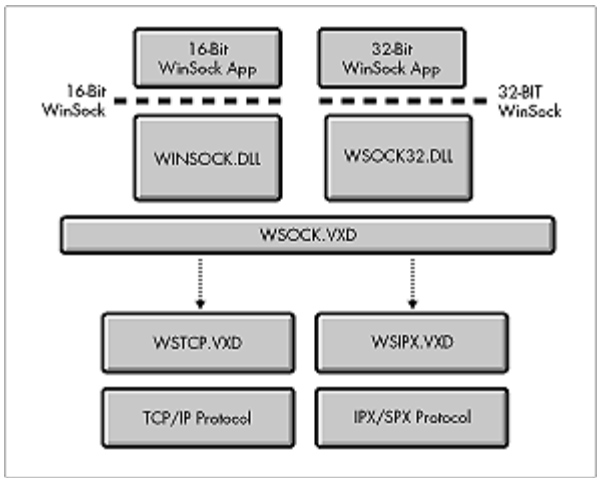
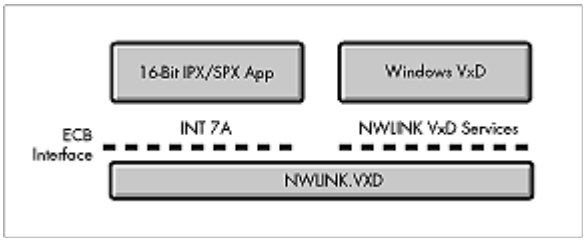
Figure 5: The Windows Sockets (WinSock) interface in Windows 95.



Event Control Block (ECB) Interface. The ECB interface in Windows 95 allows applications to send and receive data over the IPX/SPX protocol. However, this ECB interface is different than the IPX support Novell provides with Client 32. The Windows 95 ECB interface for IPX works through Int 7Ah for 16-bit applications and through a VxD called NWLINK for 32-bit applications. `NWLINK.VXD` handles Microsoft's implementation of IPX (see Figure 6).

Figure 6: The ECB (Event Control Block) IPX/SPX interface.



You could use this interface if you were using Microsoft's peer-to-peer networking capability through the SMB client and you wanted your information to go over IPX. In this scenerio, your information would be routed through NWLINK, which interfaces with the IPX interface that Microsoft provides.

TDI (Transport Driver Interface). The TDI interface is strictly for TCP/IP, allowing applications to send and receive data over the Microsoft TCP/IP stack. A number of other vendors are coming out with TCP/IP modules that are TDI-compliant. Thus TDI has become a "standard" interface for all TCP/IP stack providers. Developers can write to a single API and their networking components can work with different TCP/IP stacks (see Figure 7).

Figure 7: The TDI (Transport Driver Interface) interface in Windows 95.

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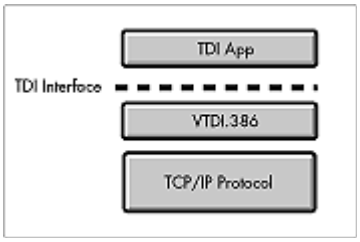


Novell uses TDI to provide support for NetWare/IP in Client 32. Instead of providing our own TCP/IP stack, we use Microsoft's TCP/IP stack so that Client 32 can run NetWare/IP client/server access through Microsoft's TDI interface. If you are using a TDI-compliant TCP/IP stack from another vendor, NetWare Client 32 can interface through that stack when accessing NetWare/IP servers.

Transport Protocols

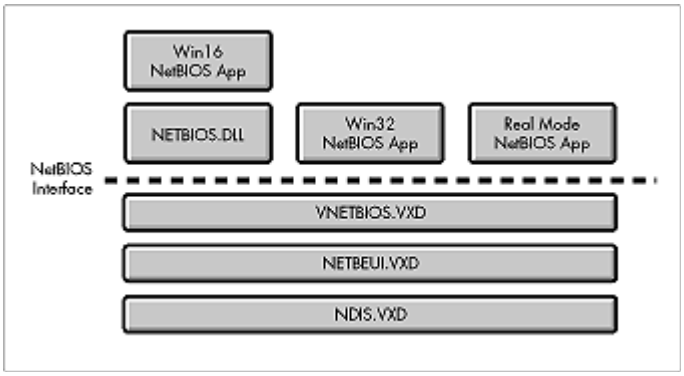
The transport ("network") protocols that Microsoft supports in Windows 95 include:

- NetBEUI
- IPX/SPX
- TCP/IP
- SDLC

In this discussion of Microsoft's Windows 95 architecture, the examples are NDIS-based. Later in this AppNote we'll look at how ODI drivers are supported in Novell's Client 32 networking architecture.

NetBEUI Protocol. NetBEUI (NetBIOS Extended User Interface) is an implementation and extension of the NetBIOS transport protocol. It is used by Microsoft to communicate with a network through the NDIS interface. In Windows 95, NetBIOS-based applications communicate through the NetBIOS interface. The `VNETBIOS.VXD` module routes the requests to a specific transport protocol driver`)NETBEUI.VXD` in this case`)`which then interfaces with `NDIS.VXD` (see Figure 8).

Figure 8: The NetBEUI protocol in Windows 95.



If you are using Novell's Client 32 with a 32-bit ODI driver, Novell provides an ODINSUP module that interfaces with `NETBEUI.VXD` and emulates the NDIS interface. The NetBIOS application interfaces with `NETBEUI.VXD` as usual, but the requests are translated by ODINSUP. From here, requests are passed to

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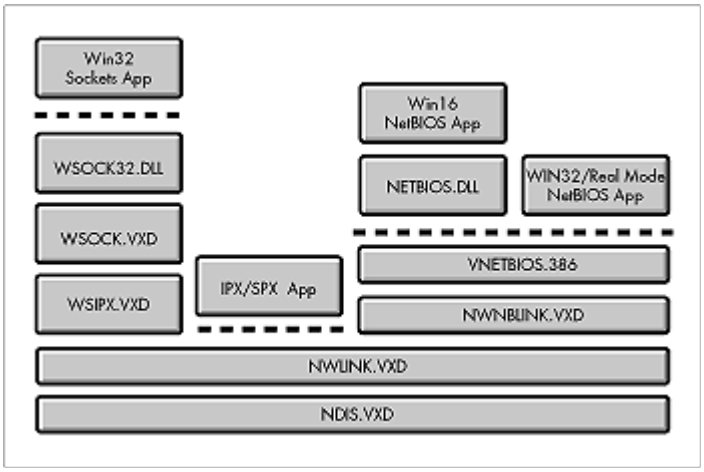
the ODI driver, rather than going through the NDIS interface, and are then transmitted onto the wire. Novell also provides a VMLID shim which allows ODI protocols and requesters to run over an NDIS driver. This is discussed in more detail later in this AppNote when we talk about NetWare Client 32.

IPX/SPX Compatible Protocol. Microsoft provides an IPX/SPX compatible protocols that not only IPX/SPX-based applications can use, but also Win32 sockets applications and NetBIOS applications (see Figure 9).

Figure 9: The Windows 95 IPX/SPX compatible protocol.



Requests from a Windows Sockets application, for example, flow down through the 32-bit WinSock DLL to WSOCK.VXD. Because we're using IPX, the communications flow goes to WSIPX.VXD, then to the NWLINK interface, and then to the NDIS interface and out onto the network.

TCP/IP Protocol. In Windows 95, TDI-based applications, Windows Sockets applications, and NetBIOS applications can all use TCP/IP as their transport protocol. A TDI application, for example, interfaces with VTDI.386 and then passes on to the VTCP.386 driver, down to the VIP.386 driver, and finally through NDIS.VXD (see Figure 10).

Figure 10: The TCP/IP protocol in Windows 95.

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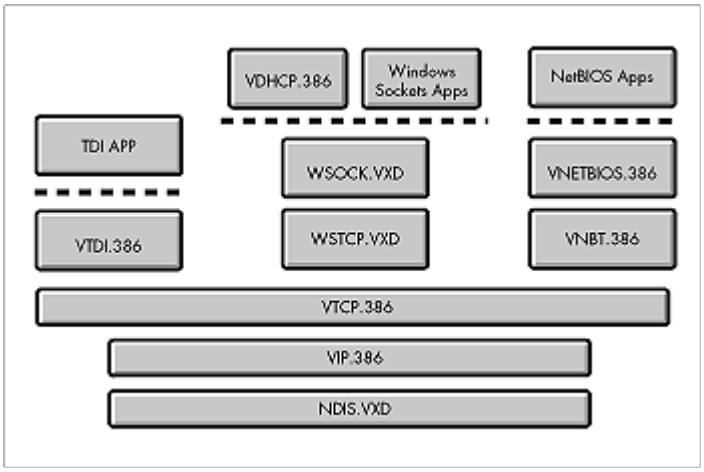

32-bit DLC (Data Link Control) Protocol. Since the initial release of Windows 95, Microsoft has added support for DLC (Data Link Control) drivers for accessing IBM mainframes. A service pack add-on to Windows 95 includes 32-bit DLC software which allows mainframe access to plug into Windows 95's existing networking models. In the past it was an intricate process to integrate LAN-based clients with the DLC protocol. But with 32-bit DLC support integrated into this new architecture, connecting LAN users and mainframes is significantly easier.

Note: The service pack update from Microsoft includes this as well as other patches that are required for using NetWare Client 32. You can download the service pack from the World Wide Web at http://www.microsoft.com.

Windows 95 Support for Netcard Drivers

The last part of the Windows 95 networking architecture we need to look at is the support for various types of network interface card drivers. Out of the box, Windows 95 supports four basic groups of drivers:

- NDIS 3.1 drivers
- NDIS 3.0 "mini-port" drivers
- NDIS 2.x drivers
- 16-bit ODI "MLID" drivers

Figure 11 summarizes the components that provide support for these drivers in Windows 95.

Figure 11: Windows 95 support for netcard drivers.

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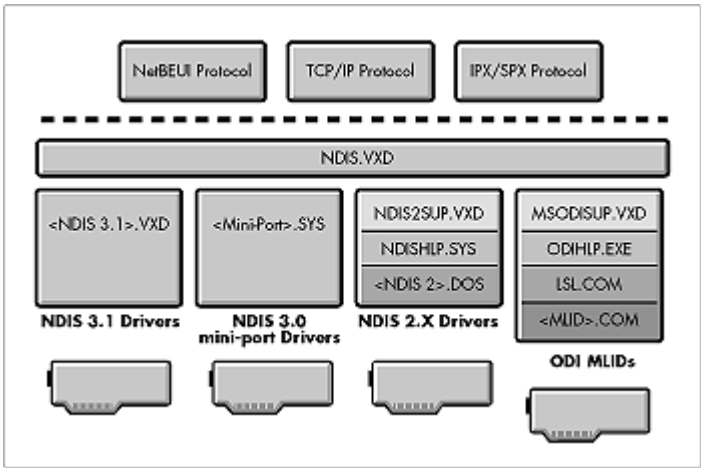

Note: Both NDIS 3.1 and 3.0 drivers interface directly with the network interface board. NDIS 2.x drivers must go through a real-mode interface, as do 16-bit ODI drivers.

NDIS 3.1 Drivers. The main differences between NDIS 3.1 and 3.0 drivers are that the 3.1 drivers are more modularized and they support Plug- and-Play in addition to the "mini-port" model (explained below). NDIS 3.1 drivers can also be used with NetWare Client 32, as we'll discuss later in this AppNote.

NDIS 3.0 Mini-Port Drivers. With NDIS 3.0, Microsoft introduced the "mini-port" model for NDIS drivers. This model splits out the functionality so that NDIS can support multiple LAN drivers, similar to what Novell's ODI technology provides. The `NDIS.VXD` is analagous to Novell's Link Support Layer, and functions as an interface that communicates down to hardware- specific modules: either a VXD netcard driver or a mini-port *.SYS file.

Windows for Workgroups shipped with NDIS 3.0 mini-port drivers, which are compatible with Windows 95. You can use these drivers if you don't have any NDIS 3.1 drivers for your network adapter.

NDIS 2.x Drivers. Windows 95 will work with NDIS 2.x drivers. However, NDIS 2.x drivers are 16-bit, real-mode drivers, so they are not as easy to set up and use. They require an NDIS2SUP.VXD module and an NDISHLP.SYS shim in addition to the *.DOS driver file itself. (From the Novell client perspective, Client 32 doesn't support NDIS 2.x real-mode drivers, only protected-mode drivers.)

Note: Up until recently, DLC was the only protocol that still required 16-bit, real-mode drivers in Windows 95. The 32-bit version of DLC, included in the Windows 95 Service Pack 1, eliminates the need to run NDIS 2.x drivers.

ODI Drivers (MLIDs). Windows 95 also works with 16-bit ODI drivers, sometimes referred to as MLIDs (Multiple Link Interface Drivers). This support is similar to what is offered in Windows for Workgroups in the form of an ODI Help shim. ODIHLP.EXE registers itself at the LSL level as a pre- scan module and as the default protocol stack. Microsoft's 32-bit protocol stacks communicate through NDIS.VXD. NDIS talks to a module called MSODISUP.VXD, which translates between NDIS and ODI. The ODIHLP shim knows how to talk to both MSODISUP and LSL.COM. From the LSL, requests go out onto the network through a 16-bit MLID ODI driver.

NetWare Client 32 Architectural Overview

Up until now we have been discussing the Windows 95 networking architecture from Microsoft's

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perspective. We now turn our attention to NetWare Client 32 and how it hooks into the model that Microsoft has provided. This section provides an overview of the NetWare Client 32 architecture and describes the various components included in the software.

Client 32 Design Goals

Novell programmers designed the underlying architecture of the 32-bit clients to be dynamic, modular, and portable. Their main goal was to create a consistent, cross-platform architecture that could be integrated as tighly as possible to the native DOS, Windows 3.1x, and Windows 95 environments. Even though each of these desktop operating environments is unique, Novell hoped to supply similar features for 32-bit access, as well as client utilities that have a consistent look-and-feel across platforms.

Another design goal was to ensure that Client 32 is backwards compatible with Novell's previous client software)the NetWare Shell (NETX) and the NetWare DOS Requester (VLMs). Client 32 emulates and supports the existing 16-bit client interfaces, so applications that worked with the VLMs or NETX will continue to work under Client 32.

The 32-bit client code is written entirely in ANSI C, and it makes no calls to a specific operating system or networking protocol. This portable design allows the underlying architecture to be independent of client operating system, name services, and authentication methods, as well as session and transport layer protocols.

Note: Client 32 is based on NCP (NetWare Core Protocol), not on Microsoft's SMB (Server Message Block) protocol. Therefore, Client 32 cannot talk to Windows NT servers or to peer-to-peer servers in Windows 95, unless you also load an SMB Redirector. (The procedure for doing this is given in the AppNote entitled "Installing NetWare Client 32 for Windows 95" later in this issue.)

Architectural Highlights

NetWare Client 32 for Windows 95 offers full 32-bit access to NetWare services, including Novell Directory Services (NDS). Build on the same code- base as NetWare Client 32 for DOS/ Windows, the NetWare Client 32 for Windows 95 software provides advanced features such as full automatic reconnection to all network files and resources, simultaneous access to multiple NDS trees, and local file caching routines. (See Appendix A of this issue for a full listing of NetWare Client 32 features.)

NetWare Client 32 for Windows 95 is designed for workstations running Microsoft Windows 95. It supports bindery connections to NetWare 2.2 and 3.1x servers, as well as NDS connections in NetWare 4.x networks. Although Client 32 is not exclusively for NetWare 4, it does take advantage of some of NetWare 4's extended capabilities, such as extended NCPs (NetWare Core Protocols).

Note: At this time, Client 32 does not support peer-to-peer connections via Personal NetWare.

Windows 95 users can maintain peer-to-peer connectivity with other Windows 95 machines on the network while running NetWare Client 32.

NetWare Client 32 is designed to take full advantage of the 32-bit capabilities of Intel's 386, 486, and Pentium microprocessors. Unlike the 286 microprocessor, which addresses memory in 16-bit chunks, these newer microprocessors address memory in 32-bit chunks and can therefore run 32- bit programs. Because 32-bit processors can move data in bigger chunks, a program that is optimized for 32-bit processors can be smaller and execute much faster than the same program written to run on 16-bit computers.

Based on NetWare Server Technology. If you are familiar with the NetWare 3 and 4 server architecture, you will recognize many of the same architectural elements implemented in Client 32 for Windows 95. These elements include protected-mode execution, a flat memory model, advanced memory management, and even client NetWare Loadable Modules (NLMs) and 32-bit ODI LAN drivers. We'll

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discuss these elements in more detail as we go along.

Protected-Mode Operation. Novell's previous clients)NETX and the VLMs)operate in 16-bit real mode, which requires conventional memory. By contrast, NetWare Client 32 for Windows 95 operates in protected mode. When the CPU is running in protected mode, memory is addressable as one continuous range of addresses. This flat memory model makes memory allocation and management much more efficient and flexible. By using protected-mode services, Client 32 loads exclusively in extended memory, with only a 3–4KB footprint in conventional memory for backwards compatibility.

NLM Components. Novell's NetWare Client 32 is different from its Microsoft counterparts because the device drivers are written as NetWare Loadable Modules (NLMs). NLMs are similar to VxDs in nature, and they work similarly as far as functionality in the calls and interfaces to the resources available to them. The exception is that VXDs must be written in Assembly language, while client NLMs are written in C code. The set of 32- bit NLMs that come with NetWare Client 32 are similar to (but not interchangeable with) those that are loaded on NetWare servers. These client-based NLMs can be loaded and unloaded in extended memory as needed. They no longer have to rely on terminate-and-stay-resident (TSR) programming with its inherent quirks.

"Shell" Design. Another difference between Microsoft's network components and Novell's Client 32 is that Client 32 is not a File System Device or Redirector. Instead, Novell implemented Client 32 as an Interrupt 21 "shell," similar to the technology we used with the NETX Shell client software. Client 32 hooks in *above* the IFS Manager, and therefore it receives all application calls before the IFS Manager does. Client 32 looks at the information and passes all NetWare requests to the Client 32 Requester NLM. Any request that is not destined for a NetWare network is passed on to the IFS Manager to interact with the other FSDs that are installed (see Figure 12).

Novell chose the shell technology for Client 32 to avoid some of the problems that the NetWare DOS Requester experienced initially when certain network requests were not sent through the Int 2Fh interface. As an Int 21h shell, Client 32 is able to catch all requests before they go to the Windows 95 IFS Manager. Client 32 can then process NetWare requests as needed, and pass the others to the IFS Manager to be routed to the appropriate FSDs.

In addition, an Int 21 shell is not limited to the rules of DOS like DOS Requesters are. Thus Client 32 does not require the `LASTDRIVE=Z` parameter in the CONFIG.SYS file, as is the case with the NetWare DOS Requester. Another problem solved by implementing Client 32 as a shell has to do with accessing the `SYS:LOGIN` directory to run the LOGIN.EXE program. Due to a quirk of DOS, workstations running the VLMs would see a mapping to the root directory (F:\) rather than to the `SYS:LOGIN` subdirectory (`F:\LOGIN`) after the client software loaded. This isn't as much of an issue now that Novell is providing a graphical login utility for Windows and Windows 95 workstations with Client 32. But on DOS workstations running Client 32, users will see the desired mapping to `F:\LOGIN` so they can run the LOGIN.EXE text utility if needed.

Figure 12: Client 32 is implemen ted as an Int 21 shell that hooks in above the Windows 95 IFS Manager.

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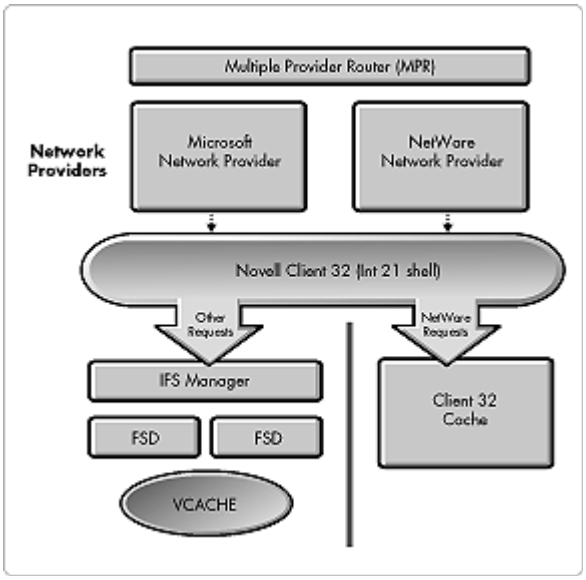

Client 32 Components

The Client 32 architecture is comprised of three main components that make up the 32-bit client environment:

- The NetWare I/O Subsystem (NIOS.NLM)
- LAN drivers and communications protocols (LSLC32.NLM, CMSM.NLM, CNE2000.LAN, IPX.NLM, TCPIP.NLM, SNMP.NLM, and so on)
- The NetWare Client 32 Requester (CLIENT32.NLM)

In addition, NetWare Client 32 for Windows 95 comes with a number of client utilities, including the GUI Login utility, the NetWare Provider, and the NetWare Application Manager. The following sections describe the Client 32 architectural components listed above. The client utilities are discussed in other AppNotes in this issue.

The NetWare I/O Subsystem (NIOS)

The NetWare I/O Subsystem (NIOS.NLM) is the main component around which all the others revolve. In fact, Client 32 is sometimes referred to as the "NIOS" client. NIOS serves as the interface layer between the client operating system and the 32-bit client services provided by NetWare (see Figure 13).

Figure 13: Architecture of the NetWare I/O Subsystem (NIOS).

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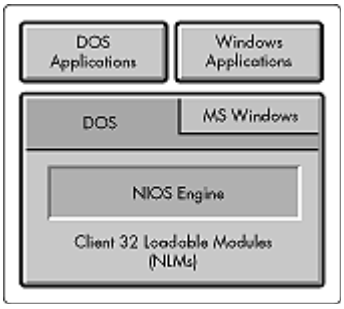

NIOS is the lowest layer in the NetWare client architecture. It is implemen ted as a VxD to provide Ring 0 protected-mode access to the computer's resources (Ring 0 is the "privileged" level of access on Intel processors). Since the Client 32 code is specific to Intel-based computers, NIOS requires a 386 processor or better. Of course, Windows 95 won't run on a 286-based machine, so this isn't much of an issue. But from an architectural standpoint, NIOS requires the services of an Intel 80386 or better processor.

Based on NetWare Server Technology

To better understand the role of NIOS, we can compare it to the SERVER.EXE module in Novell's server technology. SERVER.EXE is really two components in one: a DOS-based loader mechanism (LOADER.EXE) that auto-loads the NetWare operating system (SERVER.NLM), and a module handler which allows you to load and unload server-based NLMs. A list of NLMs to load is typically contained in the server's AUTOEXEC.NCF file.

With NIOS, Novell uses the same technology. Think of NIOS as a mini- operating system that is abstracted from the desktop environment. Different loader mechanisms are used, based on the desktop operating system that is running (either DOS/Windows or Windows 95). In Windows 95, NIOS is implemented as a virtual device driver (VxD). It provides the loader mechanism (LOADER.VXD) from which you load the NIOS.NLM engine. Once NIOS.NLM is loaded, you can load other client-based NLMs and drivers. Instead of using an AUTOEXEC.NCF file, Client 32 loads its modules through the Registry database in Windows 95.

Note: Architecturally, Client 32 has the capability to load and unload NLMs "on the fly." This feature will be exposed in a future release of Client 32 for Windows 95.

Because NIOS provides a flexible and dynamic environment, it can dynamically allocate and deallocate memory for various Client 32 settings. Thus many of the settings can be changed without having to reboot the machine for the changes to take effect.

Client-Based NLM Architecture

Client-based NLMs can be classified as portable modules or as OS-specific modules. Portable modules work across either Windows 95 or DOS/Windows. Modules that are OS- or platform-specific only work in the environment they are designed for. The Client 32 Requester Libraries sit on top of these modules. Applications interface with the client via the API calls provided by these new 32-bit NetWare libraries (see Figure 14).

Figure 14: Relationship between NIOS and client-based NLMs.

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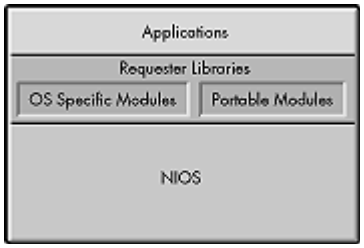

With the exception of the 32-bit ODI binary-compatible *.LAN drivers, you cannot load NetWare server NLMs on a NIOS-based client workstation. Although much of the code is similar, the two types of NLMs are compiled as different binaries. You cannot simply take an NLM for a NetWare server and load it on a NIOS-based client workstation. NIOS gives you an error message and won't allow it to happen. The same is true if you try to load client NLMs on the server.

How NIOS Allocates Memory

Another important function of NIOS is managing memory allocation for Client 32 modules. NIOS allocates memory through Microsoft's Virtual Memory Manager (VMM) in Windows 95. Because NIOS is loaded as a VxD, it has hooks to the VxD callback interface. This allows client NLMs and Windows 95 VxDs to interface with each other in extended memory. VXDs can call NLMs, and vice versa.

Working from the flat memory model, NIOS uses the Windows 95 VMM to allocate memory for each of the Client 32 modules as they load. It takes approximately 800KB to 1.3 MB of extended memory to load the base Client 32 software, which includes NIOS, the LSL, the 32-bit ODI driver, IPX, and the Client 32 Requester/NCP Redirector. File caching takes additional extended memory resources. By default, roughly 25 percent of the available extended memory is allocated to Client 32's file caching and other internal tasks upon initialization.

Note: This default allocation can be overwritten by changing the Max Cache Size parameter in the Client 32 Advanced Settings. This parameter allows you to decrease the amount of memory allocated to Client 32's cache. (See Appendix B for a complete listing of Client 32 Advanced Settings.)

Almost all of the Client 32 software loads in extended memory (above 1MB), rather than in conventional memory. Client 32 uses about 2KB to 4KB of Upper Memory Block (UMB) or conventional memory for a "workplace pointer." This pointer ensures backwards compatibility for applications that make calls to a real mode address to see if the Novell NCP Redirector is loaded. By default, the pointer loads in UMB memory. If NIOS can't find at least 4KB of UMBs available, the pointer is loaded in conventional memory (see Figure 15).

Figure 15: Memory usage in Client 32 for Windows 95.

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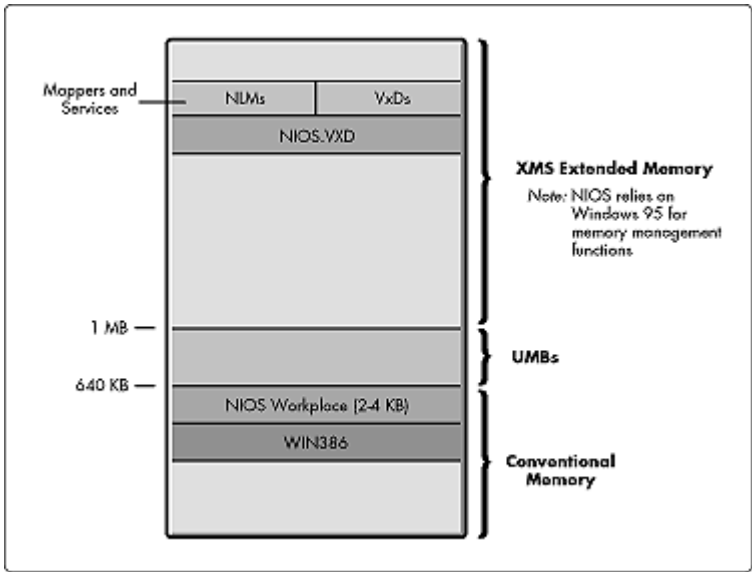

Because NIOS allocates memory through the VxD callback interface in Windows 95, if you go to a DOS Box and type `MEM <Enter>`, you'll see that WIN386, not Client 32, is actually taking that memory.

On workstations with a limited amount of memory installed, the amount of extended memory taken by Client 32 can become an issue. However, Novell chose this architecture because you can always add more extended memory to a machine by adding RAM. Client 32 requires at least 6MB of workstation memory to install properly on a Windows 95 machine; 8MB is the recommended minimum. This is not much of an issue since Windows 95 workstations typically require at least 16MB to run efficiently. The more memory you have, the better Windows 95 and NetWare Client 32 for Windows 95 will run together.

Note: If you have a Windows 95 workstation with very limited memory (4MB or less), you are probably better off using Novell's 16-bit VLM client rather than trying to run Client 32 without sufficient memory resources. For information on configuring the VLM client for Windows 95, see "Integrating the NetWare Client for DOS/MS Windows (VLMs) with Windows 95" in the October 1995 issue of *Novell Application Notes*.

LAN Drivers and Communications Protocols

The next category of Client 32 components includes the communications protocols and LAN drivers, along with their supporting modules. NetWare Client 32 uses the ODI (Open Data-link Interface) architecture to communicate to the network (see Figure 16). Client 32's Link Support Layer, IPX, and TCP/IP components are similar to their NetWare DOS Requester counterparts. However, the Client 32 components have been rewritten as NLMs rather than as DOS executables. This way, the NetWare Client 32 components can take advantage of the flat memory model that NIOS provides.

Figure 16: Client 32 is based on the 32-bit ODI LAN driver architecture used for the NetWare operating system.

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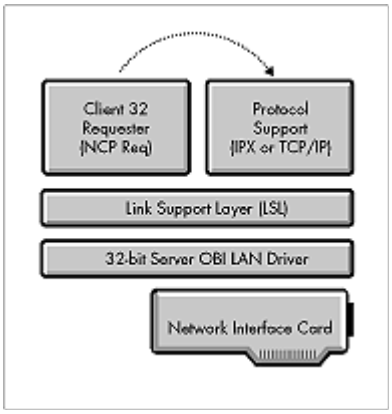

This architecture is similar to that shown in the previous section on Windows 95 networking architecture, but with ODI instead of NDIS. Novell's LSL is similar to the NDIS.VXD interface that Microsoft provides, while the ODI LAN drivers are similar to the NDIS 3.1 VxD drivers. Using ODI allows us to run the Client 32 Requester and Novell protocols (such as IPX/SPX) on top of the NDIS layers, if necessary.

Note: Since the Client 32 components are ODI-compliant requesters and ODI-compliant protocols, they need to talk to ODI interfaces.

LSLC32.NLM is the Client 32 version of the Link Support Layer (LSL). It is a ported version of the LSL for the NetWare OS LAN architecture that has been rewritten in ANSI C code. LSLC32.NLM is not platform specific, so it can be used on other platforms supported by NIOS. The LSL module is loaded first and interfaces with the 32-bit ODI LAN driver, which communicates with the network interface board.

CMSM.NLM is a C-based version of the Media Support Module in the ODI architecture. Client 32 also uses Topology Support Modules, or TSMs, which are components of the NetWare OS LAN driver architecture. TSMs provide an intermediate layer between the actual LAN driver and the LSL. TSMs are topology-dependent)if you have an Ethernet topology, you load the ETHERTSM.NLM; if you have Token-Ring, you load the TOKENTSM.NLM file; if you have an FDDI topology, you load the FDDITSM.NLM file. (There are no 32-bit support modules available for ARCnet.)

The TSMs are customized to each individual desktop operating system. Instead of using the traditional LSL buffer pool approach that the NetWare OS TSMs use, the Client 32 TSMs use NIOS's Receive Look-Ahead method. Receive Look-Ahead allows protocols to preview packet header information, and then allocate buffers directly to incoming packets.

LAN Drivers for Client 32

Unlike NetWare Client 32 for DOS/Windows 3.1, in which LAN drivers are loaded via the LOAD command in the STARTNET.BAT file, with NetWare Client 32 for Windows 95 drivers are loaded from the Registry database. Client 32 for Windows 95 supports 32-bit LAN drivers as well as the older 16- bit ODI LAN drivers. You can thus choose from four basic sets of available LAN drivers:

- 32-bit ODI LAN drivers included with NetWare Client 32
- Many of the 32-bit ODI Server LAN drivers included with NetWare 4.1 and above
- NDIS 3.1 drivers that come with Windows 95
- 16-bit ODI LAN drivers from previous NetWare client software

Note: For best results, you should use 32-bit LAN drivers whenever possible with NetWare Client 32.

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See the AppNote entitled "Installing NetWare Client 32 for Windows 95" for more information on selecting a LAN driver.

32-bit ODI LAN Drivers Included with Client 32. The 32-bit ODI LAN drivers provided with the NetWare Client 32 for Windows 95 software have been rewritten in C especially for Client 32. They are based on version 1.1 of Novell's 32-bit ODI driver specification. (Future versions of these drivers will contain additional functionality to provide the most benefit from using the NetWare Client 32 for Windows 95, especially if you have 32-bit network interface boards.)

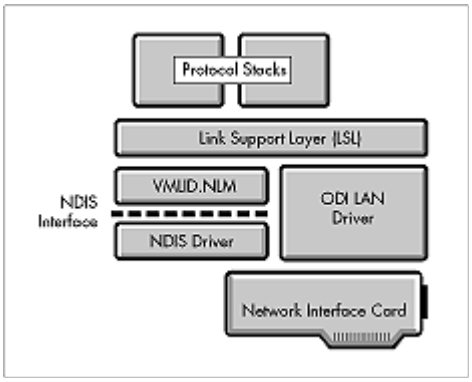
32-bit Server LAN Drivers Included with NetWare 4.1. You can also use many of the 32-bit *.LAN drivers included with the NetWare 4.1 operating system, provided they are binary-compatible with the 32-bit C- based drivers. (NetWare 3.x server drivers are not compatible with NIOS.) These LAN drivers are based on version 3.2 of Novell's assembly-based driver specification. NIOS will work with these drivers in a compatibility mode. However, to take advantage of future client enhancements, you should eventually move to the C-based ODI drivers as they become available from third-party vendors.

The binary *.LAN files developed for NetWare 4.11 ("Green River") are written to version 3.3 of Novell's assembly driver specification. They are designed to work with Client 32 as 32-bit LAN drivers. Over time, Novell plans to move away from assembly-based ODI drivers toward C-based ODI LAN drivers.

Note: NetWare Client 32 for DOS/Windows is also based on NIOS and thus supports 32- bit ODI LAN drivers. The currently-shipping NetWare Client for Windows NT is *not* based on the NIOS architecture (nor will it be in the future). However, the implementation allows the same 32-bit ODI drivers to be used.

NDIS 3.1 Drivers. With NetWare Client 32 for Windows 95, you can use an NDIS 3.1 driver with Client 32's protected-mode redirector, protocol stacks, and LSL. Instead of loading a 32-bit ODI LAN Driver, you load a Virtual MLID shim (VMLID.NLM) in its place. This VMLID interface or translator knows how to communicate with the ODI layers (LSLC32, IPX protocol stack, and Client 32 Requester). It also provides an NDIS interface to communicate with the network adapter. Figure 17 shows where the VMLID sits between the ODI and NDIS layers.

Figure 17: The VMLID interface translates between the ODI and NDIS layers.



Note that the use of VMLID involves an additional step for translating NDIS protocols, which in some cases can cause a performance degradation.

16-bit ODI LAN Drivers. Client 32 also includes a 32-bit ODI to 16-bit ODI shim, called PC32MLID.NLM, which allows protected-mode protocols and requesters to run over Novell's real-mode ODI layers. This module allows Client 32 to run with 16-bit ODI LAN drivers. To implement this configuration, you load

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PC32MLID.NLM in place of the 32-bit ODI LAN driver. LSLC32 still thinks it is talking to a 32-bit ODI driver, but PC32MLID handles the translation down into the real-mode ODI interface.

PC32MLID.NLM provides support that is similar to Microsoft's ODIHLP.EXE module. However, ODIHLP is a 16-bit real-mode TSR that loads at DOS and talks to the MSODISUP.VXD. This transition causes a performance degradation. By contrast, Novell's PC32MLID shim is a client NLM and can therefore talk to the 16-bit ODI driver as a protected-mode NLM. Consequently, the Client 32 implementation with PC32MLID is faster than using ODIHLP.

ODINSUP. If you are using a 32-bit ODI server driver and you need to install TCP/IP (Microsoft's TCP/IP or their 32-bit DLC driver) or some other NDIS-based protocol, an additional interface is required. Client 32's ODINSUP module provides this interface by registering itself with ODI and providing an NDIS interface to these additional protocols. Thus ODINSUP performs the translation from the NDIS protocols and requesters to the 32-bit ODI driver that actually places the packet onto the wire.

Communications Protocols

NetWare Client 32 for Windows 95 supports both IPX/SPX and TCP/IP protocols equally. The Novell IPX and NetWare/IP protocol stacks have been ported to NLM format (IPX.NLM and NWIP.NLM) for use with Client 32. Some optional modules, such as SNMP.NLM, are implemented as NLMs as well. Others, such as NetBIOS, 3270 emulation, and Btrieve support, remain in their current terminate-and-stay-resident (TSR) implementation for the initial release of Client 32.

Note: Novell does not ship a TCPIP.NLM protocol stack with Client 32 for Windows 95. Client 32 is compatible with and can be configured to use Microsoft's TCP/IP stack.

The Client 32 protocols contain built-in support for Packet Burst and Large Internet Packets (LIP) for optimized performance on both local and wide area networks. They also support binding to multiple network adapters and auto- binding to dynamically loaded LAN drivers.

The Client 32 Requester

In Novell's 32-bit client architecture, the NetWare Client 32 Requester (CLIENT32.NLM) takes the place of the NETX shell or the NetWare DOS Requester (VLMs). The Client 32 Requester provides the internal tables and services necessary to track network resources, file caching, and automatic reconnection levels.

As with the DOS Requester, the NetWare Client 32 Requester is a set of modules, or subcomponents. However, the modules are all contained within the CLIENT32.NLM file instead of as separate files. Thus with Client 32 there is no way to selectively choose which subcomponents you want to load, as was possible with the VLM client. Following is a list of the subcomponents contained within CLIENT32.NLM:

Module	Name	Description
CONNMAN	Connection Manager	Used by Client 32 to keep track of the connection tables, and to store other connection information.
TASKMAN	Task Manager	Keeps track of each task in the system, whether these are WINDOS, WIN16, or WIN32 applications or activities.
FILEDIR	File and Directory	Handles all file system functions.
PRINT	Printing	Set up network printing capabilities for Client 32.
SESSMUX	Session Multiplexor	Currently supports only NCP (NetWare Core Protocol) sessions attaching and accessing NetWare servers. However, future releases of Client 32 may include support

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		for Microsoft's SMB (Server Message Block) sessions.
NCP	NetWare Core Protocol	A child module that ties to the Session Multiplexor.
NSMUX	Name Services Multiplexor	Coordinates activities between the child modules, or processes, that you load.
NDS	Novell Directory Services	A child module to the Name Service Multiplexor module. Provides the name resolution and authentication processes for Directory Services connectivity.
BINDERY	Bindery Services	Also a child module to the Name Service Multiplexor. It provides the name resolution and authentication processes for Bindery connectivity.
MOCKNW	Mock NetWare	Catches raw NCPs sent from applications and redirects them to Client 32 functions in order to take advantage of Client 32's caching and automatic reconnection settings.
POLYPROC	Poly-procedure	Contains a set of generic miscellaneous routines that didn't specifically fit in any of the other CLIENT32.NLM modules.
NETX	DOS Interrupt 21h redirector	Used to redirect all Interrupt 21h (NETX) function calls to Client 32 functions.
VLMMAP	VLM Mapper	Used to redirect all DOS Requester (VLM) function calls to Client 32 functions. The VLMMAP module is used to support applications and utilities that are written to NETX and DOS Requester APIs.

The NetWare Client 32 Requester is fully backward-compatible with the NETX shell and the NetWare DOS Requester, so NetWare-aware applications taking advantage of the earlier client APIs should run with no modification under NetWare Client 32. This compatibility is accomplished through the NETX and VLMMAP modules that are a part of CLIENT32.NLM.

Documentation and Technical Support

The help files included with NetWare Client 32 for Windows 95 are the primary documentation for the product. These files contain information on understanding, installing, configuring, using, and troubleshooting Client 32. To view the Client 32 help, select Start | Help | NetWare Client 32 after NetWare Client 32 for Windows 95 is installed. This opens the `SETUPNW.HLP` file. All of the other Client 32 help files are accessible from the `SETUPNW.HLP` file.

Technical support for NetWare Client 32 for Windows 95 is provided by all the usual Novell channels.

You can submit enhancement requests for NetWare client software by sending an e-mail message to:

`enhclient@novell.com`

Evolution of NetWare Clients

Novell is no longer developing or maintaining the NetWare Shell (NETX) client software. The NetWare DOS Requester (VLMs) remains Novell's 16-bit client solution. If you are in a situation where you have 386-based workstations that don't have enough memory or other resources necessary to run Client 32, you should use the DOS Requester. Novell will continue to maintain the NetWare DOS Requester, and there

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will be future releases based on critical issues that are discovered.

With all of the advantages that NetWare Client 32 has to offer, Novell hopes to see most of its customers migrating toward 32-bit client solutions. In the next release of IntranetWare (scheduled for early 1997), the name of NetWare Client 32 for Windows 95 will change to IntranetWare Client for Windows 95.

NOVEMBER 1996

NOVELL® RESEARCH

Installing NetWare Client 32 for Windows 95

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NetWare Client 32 for Windows 95 features an improved installation process that allows easy initial installations as well as upgrades of previous NetWare client software. For example, the Windows 95-based SETUP.EXE program auto-detects previously loaded LAN drivers and configures the updated software to match the detected settings. Client 32 also supports a "hands-off" scripted installation of Windows 95 and NetWare Client 32 using Microsoft's MSBATCH process.

This AppNote covers the following aspects of installing NetWare Client 32 for Windows 95:

- How to obtain the NetWare Client 32 for Windows 95 software and prepare for installations using SETUP.EXE
- Examples of installing Client 32 for Windows 95 on a computer running the MS NetWare Client, and of upgrading from the NetWare DOS Requester (VLM) to NetWare Client 32
- Enabling support for Microsoft's peer-to-peer services in Windows 95
- How to install Windows 95 and the NetWare Client 32 software on a NetWare server to allow a "hands-off" installation of both products at the same time using Microsoft's MSBATCH process
- Installation-related issues such as selecting a LAN driver, using third-party LAN drivers, and uninstalling NetWare Client 32

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Obtaining NetWare Client 32 for Windows 95

You can install NetWare Client 32 for Windows 95 from diskettes, from CD-ROM, from a local hard disk, or from a NetWare server. The files needed to install NetWare Client 32 are provided as part of Novell's IntranetWare product (included on the NetWare 4.11 Operating System CD-ROM) and on various other CD-ROMs Novell has distributed. They are also generally available as downloadable files from the sources listed below.

Downloading Client 32 for Windows 95

The downloadable version of NetWare Client 32 for Windows 95 is contained in one of two self-extracting files: one for the diskette version, and one for the version that can be installed from a NetWare server or local hard drive. The latest version is available in English, French, Italian, German, Spanish, and Portuguese.

Note: You should also download any patches and updates that are available for Client 32. As of this writing, the latest version of NetWare Client 32 for Windows 95 is v2.11, dated 10-18-96. The is the same version of Client 32 that ships with IntranetWare and NetWare 4.11, with all previous patches incorporated into it. However, you should periodically check for new patches that become available.

From the Novell Support Connection Home Page. As of this writing, you can find NetWare Client 32 for Windows 95 on the World Wide Web by setting your Web browser to the following URL (as always, the location of files online is subject to change):

```
http://support.novell.com/
```

From here, click on Product Support, then on Client 32 for Windows 95, then on File Updates to see a list of available files. Click on the appropriate filename to download the file.

From the Novell FTP Server. The Client 32 for Windows 95 software can also be downloaded by anonymous ftp from Novell's FTP server on the Internet. The path is:

```
ftp.novell.com: /pub/updates/nwos/nwc32211
```

From NetWire on CompuServe. To access the NetWare Client 32 for Windows 95 software on CompuServe, type GO NWCLIENT at any CompuServe prompt. Select "Download NW Client 32 for Windows 95" to download the software, along with any patches and updates.

Extracting the Files

The files needed to install NetWare Client 32 for Windows 95 from a NetWare server or local hard disk are contained in the network installation version of the compressed file. After downloading this file, copy it to a directory named `\C32W95` (or another name of your choice) on a NetWare server or on a local hard drive. To extract the Client 32 files, go to the directory you copied the self-extracting file to and type the name of the file. As the file decompresses, it creates a full subdirectory structure that should resemble the following:

```
C32W95 (or whatever name you gave the parent directory)
      ENGLISH
      BATCH
      DIAGTOOL
      NMS
      POLICIES
```

Note: The default language of English is used in the examples throughout this AppNote. If you are installing another language version of Client 32, substitute the appropriate language

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subdirectory name in place of \ENGLISH or \IBM_ENU.

The NetWare Client 32 SETUP.EXE program does not support long file or directory names, nor does it support the use of spaces in directory names. The directory that contains the SETUP.EXE program, and all parent and child directories, must conform to the standard DOS 11 character (8.3) naming convention.

Note: This restriction to use the 8.3 naming convention applies only to the SETUP.EXE installation program, not to the NetWare Client 32 product itself. Client 32 for Windows 95 fully supports long file and directory names.

You should also extract any patch files you downloaded and follow the instructions provided with the patch to copy new or updated files into the appropriate subdirectories. If you have NetWare 3.11 and 4.1 servers on your network, be sure to load the server patches that are included with Client 32.

To support long filenames, NetWare 4.11 servers need to have LONG.NAM loaded. In addition, each volume needs to have LONG.NAM added to it. The NetWare 4.11 installation procedure places the LONG.NAM file in the `SYS:SYSTEM` directory and automatically loads this name space.

For previous versions of NetWare, use the OS/2 name space (OS2.NAM) instead of LONG.NAM. Instructions for loading this name space and the required server patches for NetWare 4.1 and NetWare 3.11 can be found in the Client 32 README.TXT file.

Be aware that each name space added to a volume requires additional server memory. If you add name space support to a volume and the server does not have enough memory, that volume cannot be mounted. For information about how to calculate the memory required for name space support, see *Supervising the Network* (for NetWare 4.x) or *System Administration* (for NetWare 3.x). Each name space also uses up to 252KB of disk space.

Client 32 Requirements

Before you install NetWare Client 32 for Windows 95, ensure that your workstations meet the following hardware and software requirements:

- A 386 processor or higher
- MS Windows 95
- A hard disk with 6MB of available storage space
- A network board installed and connected to the network
- A VGA or better graphics board and monitor
- A minimum of 6MB of memory (you should plan on *at least* 16MB to run Windows 95 efficiently)

Making Floppy Diskettes

If you downloaded the diskette version of Client 32, upon extraction the compressed file will create the files you need to make your own NetWare Client 32 for Windows 95 installation diskettes. You will need seven blank, formatted diskettes. To create the diskettes, go to the directory where you extracted the Client 32 files, such as `C:\CLIENTS\C32W95`, and type `MAKEDISK <Enter>`. Follow the onscreen prompts to insert and label the diskettes. (The compressed files require at least 512KB of available memory in a DOS box to extract properly.)

The IntranetWare INSTALL.BAT program on the NetWare 4.11 Operating System CD-ROM provides a menu-driven facility for creating these diskettes. Insert the CD-ROM and run INSTALL.BAT. After selecting

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the language and reading the license agreement, choose "Diskette Creation" and then choose "NetWare Client 32 for Windows 95." Follow the prompts to create a set of installation diskettes.

Starting the SETUP Program

The procedure for starting the SETUP.EXE installation program varies depending on whether you are running it from diskettes, from a local disk or network drive, or from a CD-ROM.

From Floppy Diskettes. To run the Client 32 installation program from the floppy diskettes, place the diskette labeled "Disk 1 – Setup" into drive A. From within Windows 95, choose Start | Run, and enter `A:\SETUP.EXE`. You can then follow the steps given in the first example below for a network server-based installation. The main difference is that you will be prompted throughout the procedure to insert the required diskettes.

From a Local Disk or Network Drive. The Client 32 SETUP.EXE program is located in the `\ENGLISH` subdirectory under the directory in which you extracted the Client 32 for Windows 95 files. For example, if you extracted the files in `SYS:PUBLIC\CLIENTS\C32W95`, change to the `\ENGLISH` subdirectory and type `SETUP <Enter>` to run the Client 32 installation program. Then follow the steps given in the first example below to complete the installation procedure.

From the NetWare 4.11 CD-ROM. You can run the Client 32 SETUP.EXE program from the IntranetWare INSTALL.BAT program on the NetWare 4.11 Operating System CD-ROM. On a Windows 95 workstation, insert the CD-ROM and run INSTALL.BAT. After selecting the language and reading the license agreement, choose "Client Installation" and then select "NetWare Client 32 for Windows 95" to launch the Client 32 SETUP.EXE program. (If you prefer to run SETUP.EXE directly, you will find the program in the `\PRODUCTS\WIN95\IBM_ENU` subdirectory on the CD-ROM.) Follow the steps given in the example below to complete the installation procedure.

Installing Client 32 Over the MS NetWare Client

This section gives an example of how to install NetWare Client 32 for Windows 95 on a machine that already has Windows 95 installed with the Microsoft Client for NetWare Networks option enabled. These steps assume you have already obtained the NetWare Client for Windows 95 software and followed the preparatory procedures described above, including applying any patches that are available. They also assume you will be running SETUP.EXE from a NetWare server. (Once you start the SETUP program, the procedure is very similar whether you are running it from a server, from a local hard disk, or from a CD-ROM. If you run the program from diskettes, you will be prompted to insert the required diskettes throughout the procedure.)

> The Microsoft Client for NetWare that came on the initial release of the Windows 95 CD-ROM does not support NDS connections to a NetWare 4 Directory tree. You must apply Service Pack 1 from Microsoft in order to enable NDS connections. To gain full benefit from a NetWare connection, Novell recommends the use of Client 32. See Appendix A for a feature comparison of the MS Client for NetWare and NetWare Client 32 for Windows 95.

1. Start Windows 95 on the PC you want to install NetWare Client 32 on. Verify that Microsoft's NetWare client is loaded by right-clicking on Network Neighborhood and then selecting Properties. "Client for NetWare Networks" should be listed as an installed network component, as shown in the sample screen below.

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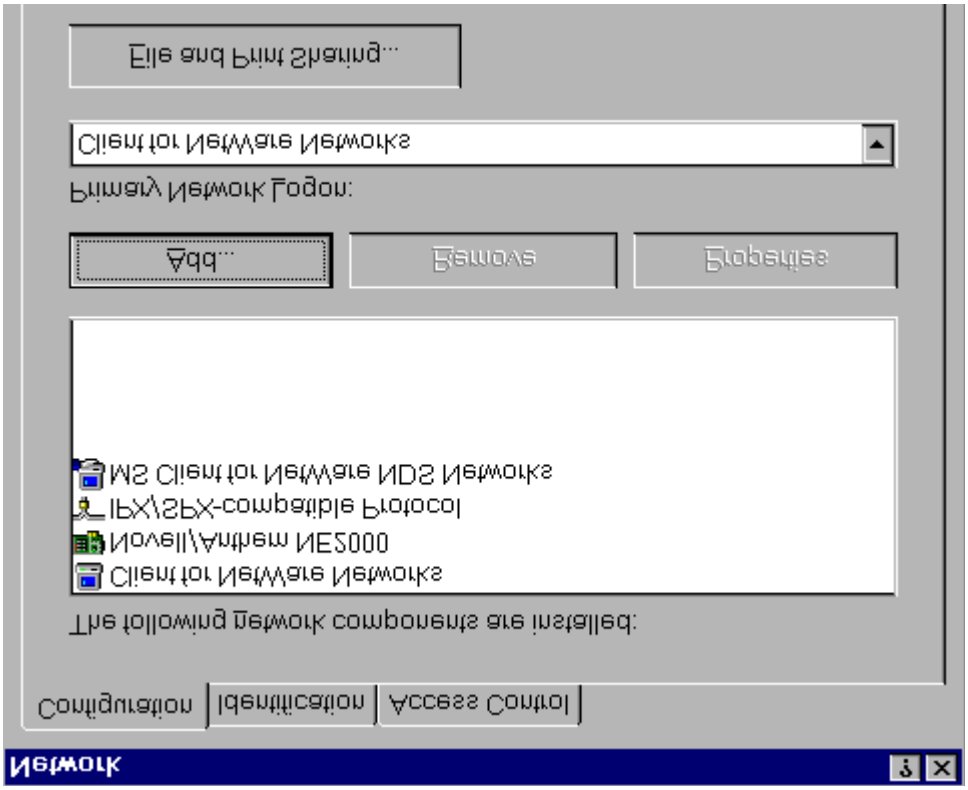

Note: By default, the MS Client for NetWare Networks uses an NDIS 3.1 LAN driver. The Client 32 SETUP program will detect the existing Microsoft client configuration and apply those settings to the Novell Client 32 configuration. If you want to change from the installed NDIS driver to an ODI driver, you will have to complete some additional steps after Client 32 is installed. (See the section on "Selecting a LAN Driver" in this AppNote for more information on what type of driver to choose.)

The Client 32 SETUP program will completely remove the MS Client for NetWare Networks. Once you have verified that the Microsoft Client for NetWare is installed, click on **OK**.

2. Start the NetWare Client 32 for Windows 95 SETUP.EXE program. Follow the instructions given under "Starting the SETUP Program" above for the type of installation you are running.

   This example assumes you are running SETUP from a NetWare server the workstation is connected to through the MS Client for NetWare. Drive H is mapped to the SYS:PUBLIC directory on that server.

   To start SETUP in this example, click on the Windows 95 **Start** button and select Run. Type in the full directory path to where the Client 32 installation files were copied. The SETUP.EXE file is in the `\ENGLISH` subdirectory:

   ```
   H:/PUBLIC/CLIENT/C32W95/ENGLISH/SETUP.EXE
   ```

   Press <Enter> or click on **OK** to continue.

3. After you consent to the license agreement, the NetWare Client 32 Installation welcome dialog is displayed, as shown below.

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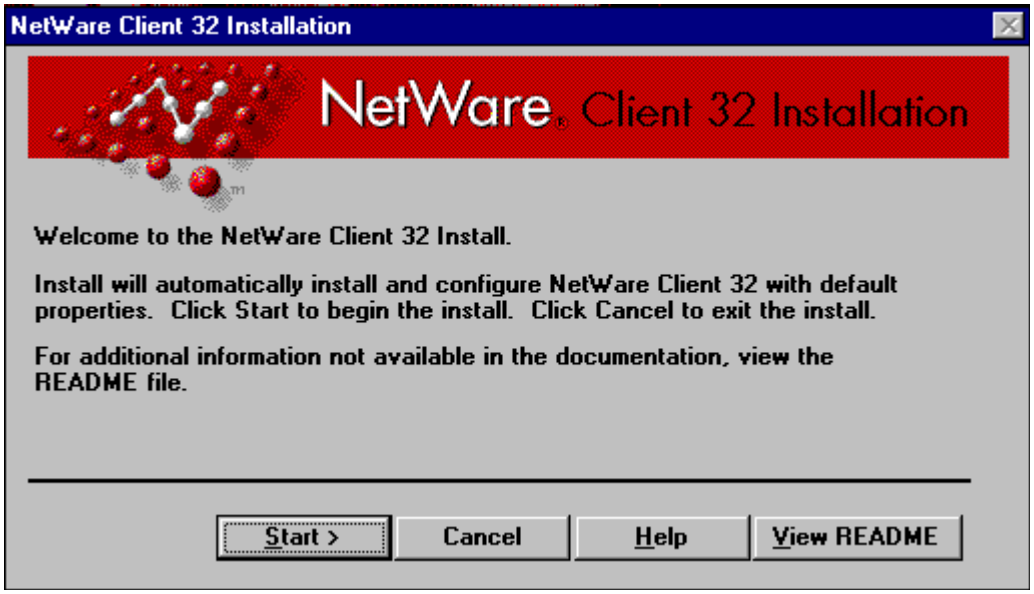
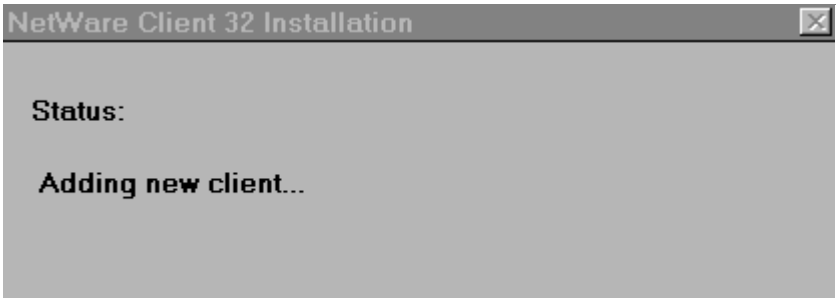


Note: You only need to run SETUP once to initially install the NetWare Client 32 for Windows 95 files, to replace the NWSETUP.INF file that ships with Windows 95 with the NWSETUP.INF from Novell that contains the Client 32 option. After that, you can change or update the Novell client through the Control Panel | Network interface, or through the Automatic Client Update method, without having to re-run SETUP.

Click on the **Start >** button to begin the installation process. While SETUP removes the existing client information from the Registry database and adds the new NetWare Client 32 keys to the Registry, several screens similar to the one shown below are displayed:



Next, the necessary Client 32 files are copied to the `C:\NOVELL\ CLIENT32` directory and subdirectories. A window similar to the one shown below displays the progress:

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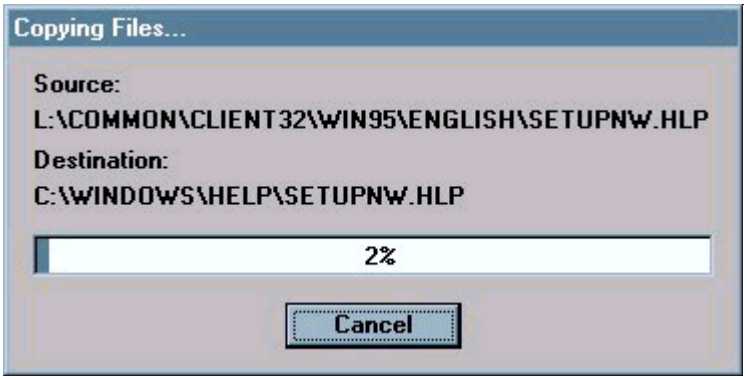


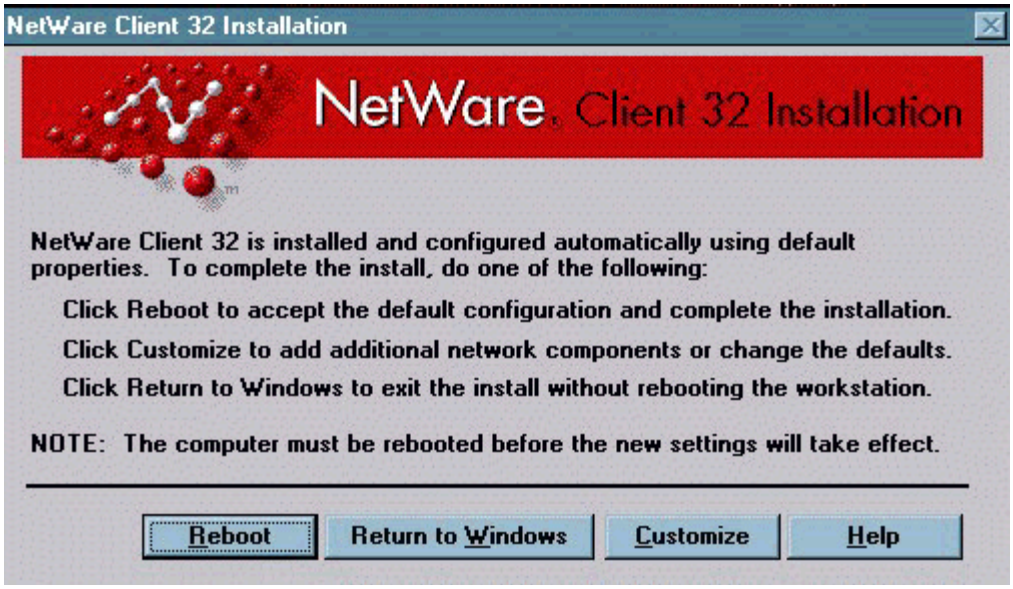
The SETUP program will also copy new *.INF and NWSETUP.DLL files for Client 32. You will see a dialog generated by Windows 95 that says:

```
Please wait while Windows builds the driver information database.
```

This process is necessary for Windows 95 to rebuild the index to include the Novell INF files that SETUP just copied to the workstation.

SETUP also copies some Windows 95 support files to the `C:\WINDOWS` and `C:\WINDOWS\SYSTEM` directories. If the needed Windows 95 Cabinet (*.CAB) files are not already found on the local drive or in a local directory, SETUP will prompt you for the location of these files. Type the directory path to where the .CAB files are located and click **OK**.

4. Once the Registry keys have been updated and all files have been copied over correctly, you will see the following dialog:



At this point, you can choose to accept the Client 32 defaults, make changes to the default settings, or exit the SETUP program without rebooting the workstation. In most cases, you will want to set a preferred NDS tree/context or NetWare server for the workstation. To do this, click on **Customize**.

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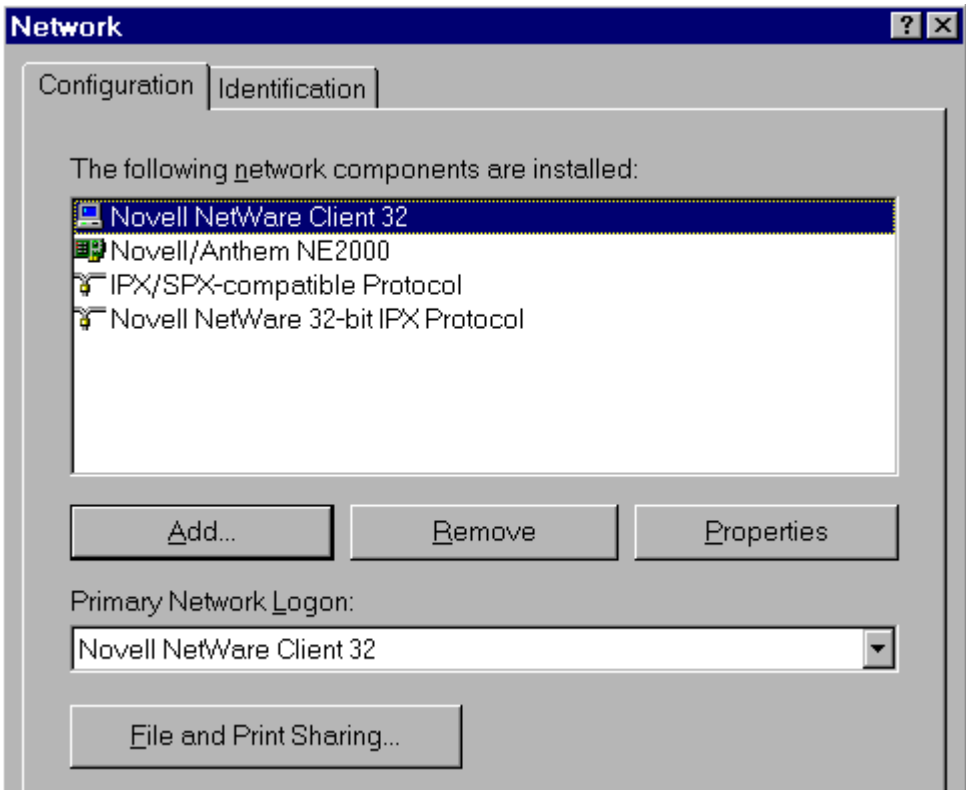
SETUP automatically launches the Control Panel | Network window with the "Configuration" tab active, as shown below:



If the Client 32 installation was successful, "Novell NetWare Client 32" and "Novell NetWare 32-bit IPX Protocol" should be listed as installed components. "Novell NetWare Client 32" should also be displayed as the active component in the Primary Network Logon box.

Note that the Microsoft "IPX/SPX-compatible Protocol" remains configured. Do not remove this protocol; it is required when using NetWare Client 32 with either NDIS or ODI drivers.

5. To make basic Client 32 settings, highlight "Novell NetWare Client 32" in the list of network components and click on the **Properties** button. You will see a dialog box similar to the following:

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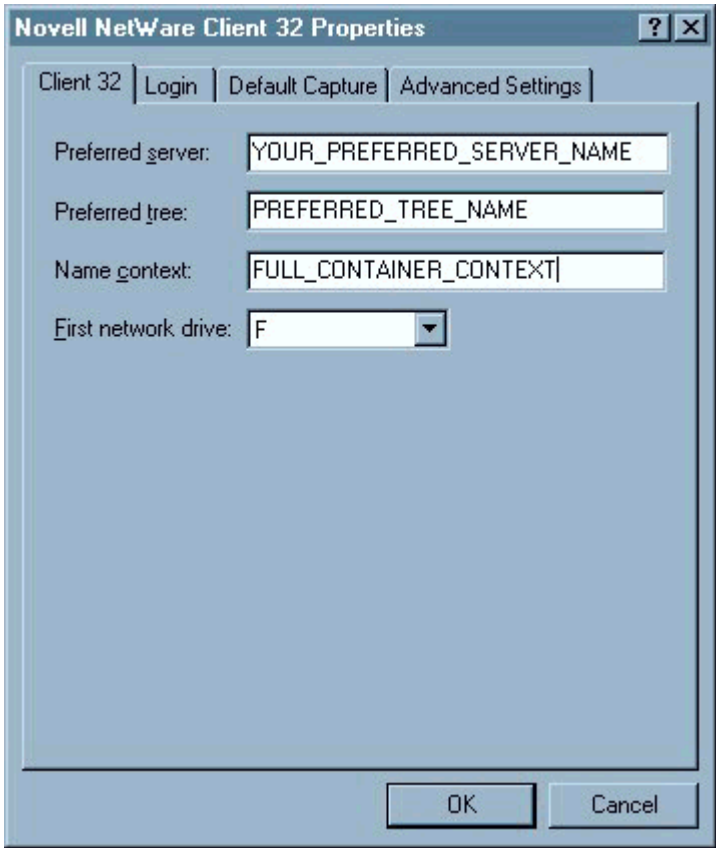

6. Type in the appropriate settings for each entry on the Client 32 property sheet, according to the following guidelines:

   - Preferred server is optional for NetWare 4. You can either leave it blank or type the name of the server this workstation uses most frequently.
   - Preferred tree and name context are usually required for NetWare 4 networks. Enter the appropriate names for this workstation.
   - You might want to change the first network drive setting if the workstation has a hardware configuration with extra DOS partitions or CD-ROM drives that take up drive letters past the network default of F.
   - Settings found in the Login, Default Capture, and Advanced Settings propery sheets are described elsewhere in this issue.

   When you are finished, click on **OK** to return to the main configuration screen.

7. At the main network configuration screen, click on **OK** to complete the installation process. Once the driver information database is rebuilt, you will see the following prompt:

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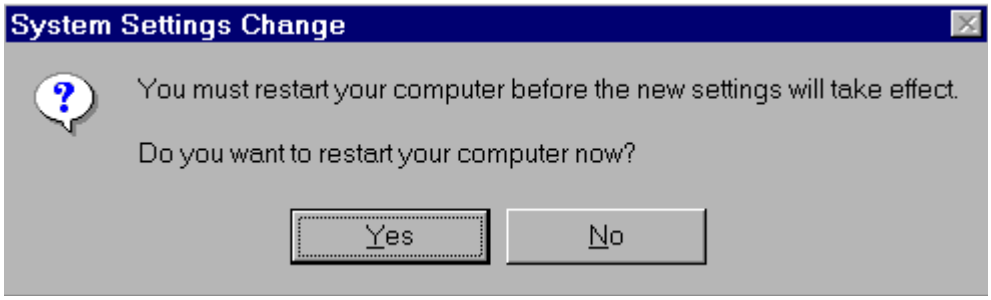

Click on **Yes** to restart the machine with the Novell Client 32 software installed.

Once the restart completes, you should see the Novell Client 32 logo flash on the screen as the NetWare Provider loads. After the Provider and other Client 32 modules load and the workstation connects to the specified NDS tree or NetWare server, the GUI Login window is displayed so you can log in. See the AppNote "Accessing the Network with the GUI Login Utility and the NetWare Provider" in this issue for additional information on logging in.

Upgrading from VLMs to NetWare Client 32

This next installation example describes the process of upgrading a workstation running the NetWare DOS Requester (VLM) software to NetWare Client 32 for Windows 95. It also shows how to switch from a 16-bit ODI LAN driver to a 32-bit ODI Server (.LAN) driver.

These instructions assume you have the VLMs successfully installed on the Windows 95 workstation through the Novell-recommended procedure. (See "Integrating the NetWare Client for DOS/MS Windows (VLMs) with Windows 95" in the October 1995 *Novell Application Notes*.)

The network adapter in this example is a Novell/Anthem NE2000 Ethernet board. The exact procedure may vary, depending on what type of adapter you have installed and how it is configured.

1. At the workstation running Windows 95 and the VLM client, log in (via the LOGIN.EXE text utility) to a NetWare server that has a copy of the Client 32 installation files.

2. Start Windows 95. Right click on Network Neighborhood and select Properties from the resulting menu. Verify that "Novell NetWare (Workstation Shell 4.0 and above [VLM])" and "Existing ODI Driver" (the 16-bit LAN driver) are both listed as installed network components:

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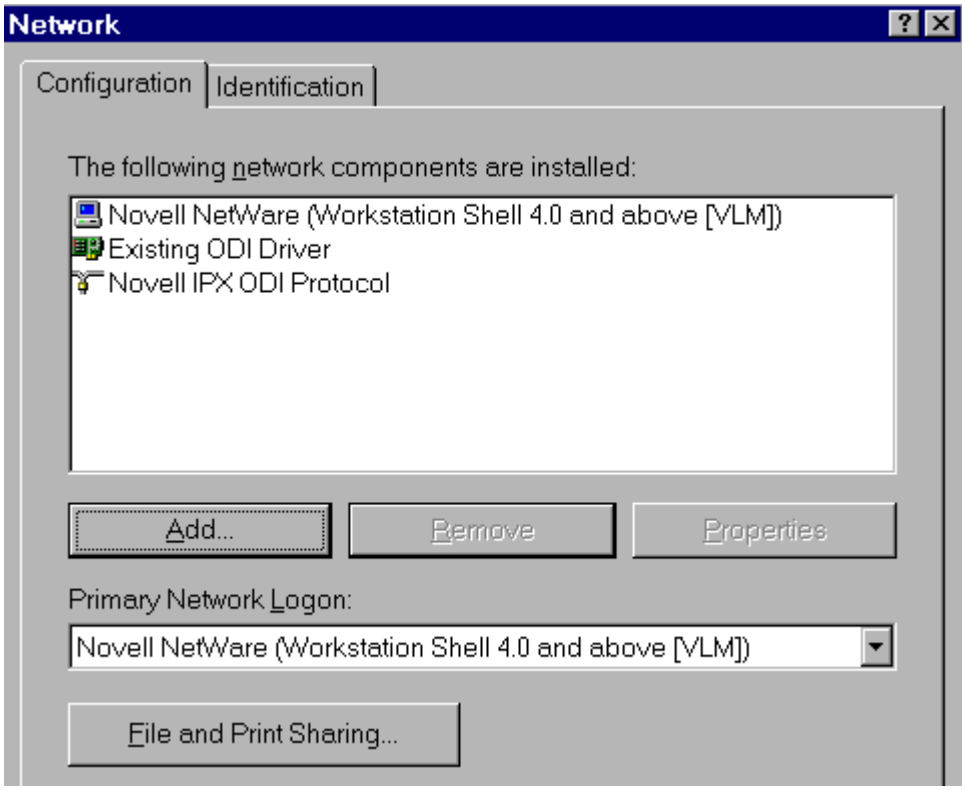

Note: Under this VLM configuration, Microsoft's INF setup has installed the MS NetWare Provider for Network Neighborhood and other Windows 95 modules.

3. Click on the Windows 95 **Start** button and select Run. Type the directory path to where the Client 32 installation files were copied. The SETUP.EXE file is in the `\ENGLISH` subdirectory. For example, if you have installed a network version of Client 32 for Windows 95 in the `SYS:\PUBLIC\CLIENTS\C32W95` directory, type:

   ```
   SYS:\PUBLIC\CLIENTS\C32W95\ENGLISH\SETUP.EXE
   ```

   Another method is to click on the **Browse...** button and select each directory level one at a time until you see the SETUP icon. Double-click on that icon to return to the Run dialog box.

   When the correct path and filename appear in the entry box, press <Enter> or click **OK** to continue.

4. After consenting to the NetWare Client 32 license agreement, click on the **Start >** button in the Client 32 Installation welcome dialog box to begin the installation process. A Status window will indicate the program's progress as it removes the existing client (the VLMs) and adds the new one (Client 32).

   Note: Depending on which network adapter is installed, you may see a Select Device screen and be asked to select the appropriate adpater and driver. Follow the screen prompts to complete this process. You may also be asked to indicate where the Windows 95 cabinet (.CAB) files are located. Type in the proper path to the files in the `\WIN95` directory or insert the requested Windows 95 diskette as prompted.

5. Once the Client 32 files are all copied, a window is displayed indicating that "NetWare Client 32 is installed and configured automatically using default properties." At the bottom are three choices:

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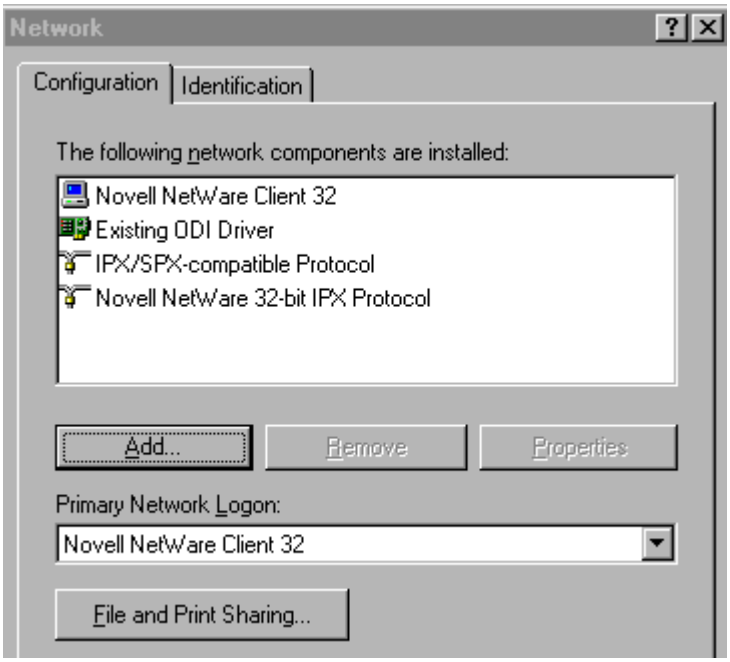
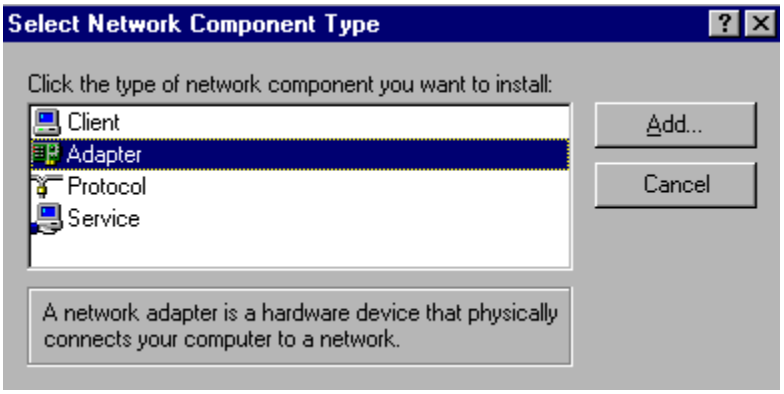
Reboot, Return to Windows, or Customize. Click on **Customize**.

6. At this point the Novell 32-bit client is still configured to run with the existing 16-bit ODI LAN driver. This is displayed as "Existing ODI driver" in the list of network components, as shown below:



To keep from losing the network connection, you need to add the 32-bit driver before removing the existing 16-bit driver. Click on **Add**.

7. Highlight Adapter and click on **Add**, as shown below:



8. In the Select Network Adapters dialog box, choose the appropriate driver for you network board. For this example, the manufacturer is "Novell/ Anthem" and the network adapter is "Novell/Anthem NE2000 (Novell)".

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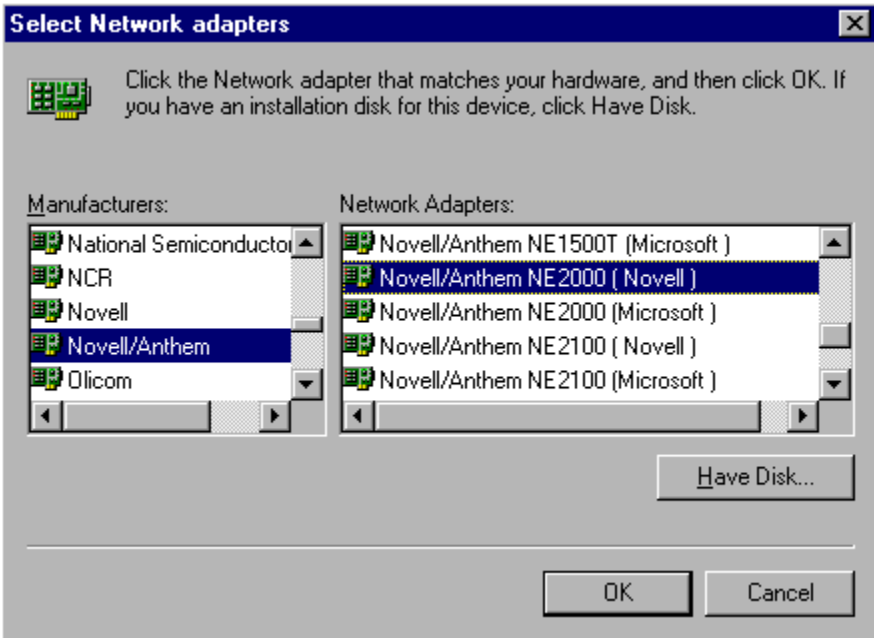
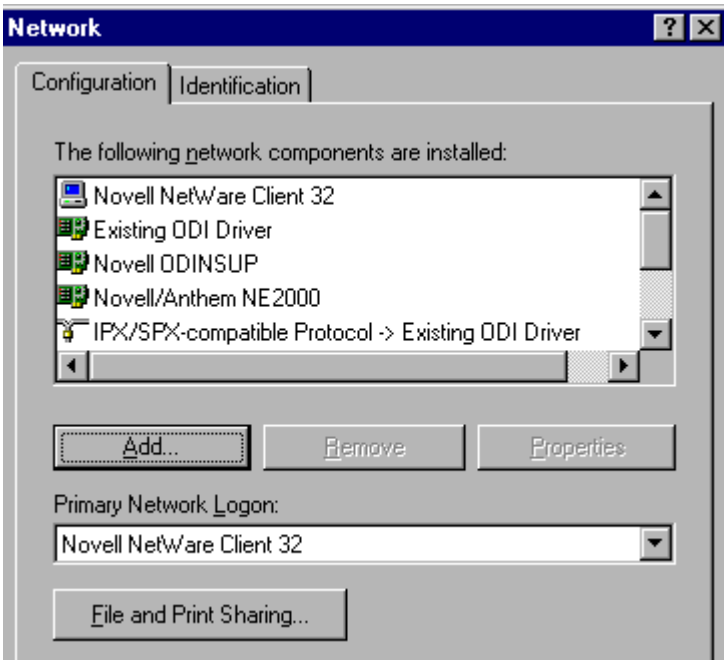


Note: The label "(Novell)" to the right of the network adapter name indicates an ODI driver, as opposed to "(Microsoft)" which means NDIS. Novell's 32-bit ODI drivers should be your first choice. Use an NDIS driver only if a 32-bit ODI driver is not available.

9. Click on **OK**. This will return you to the main network configuration window, which will look like the example below:



10. You can now remove the old 16-bit driver by highlighting "Existing ODI Driver" and clicking on **Remove**.

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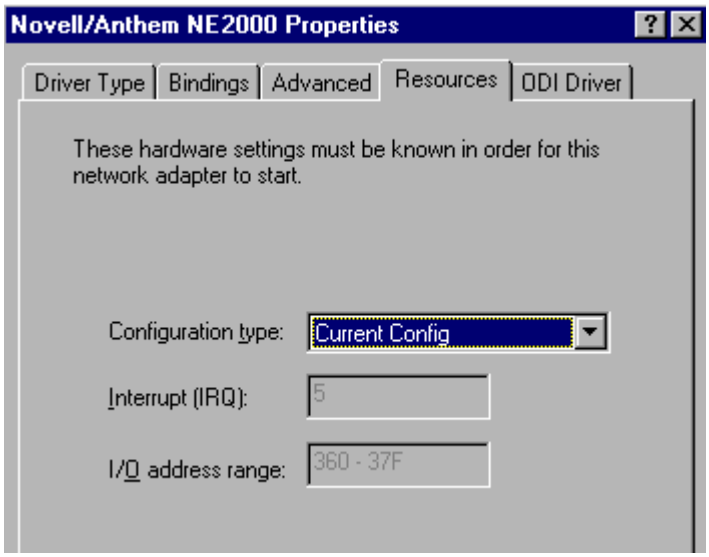
Then click on **OK**.

11. Check to ensure that SETUP has correctly matched the hardware settings on the network adapter (interrupt, I/O address, and so on). To do this, highlight the added driver and click on **Properties**. The Resources page for the 32-bit ODI driver will be shown, as in the example below:



Make any necessary changes so that the settings displayed match those on the network adapter, then click on **OK**.

12. At this time you are instructed to restart the computer for the client and driver changes to take effect. In the System Settings Change dialog box, click on **Yes** for a restart.

The workstation is now configured to run NetWare Client 32 using the 32-bit Novell/Anthem NE2000 ODI driver.

Supporting Microsoft's Peer-to-Peer Services

Since Windows 95 provides built-in peer-to-peer services, you might want to access files on other Windows 95 workstations on the network. This section explains how to add support for Microsoft peer-to-peer services to a Client 32 configuration using the Novell ODINSUP shim.

1. If you have not already done so, log in via the Novell GUI login window that comes up when you start the computer.

2. Right click on Network Neighborhood and select Properties. From the Network Configuration page, click on **Add**.

3. Highlight "Client" and click on **Add**. In the "Select Network Client" dialog, select "Microsoft" for Manufacturer and "Client for Microsoft Networks" for Network Client, as shown in the sample dialog below:

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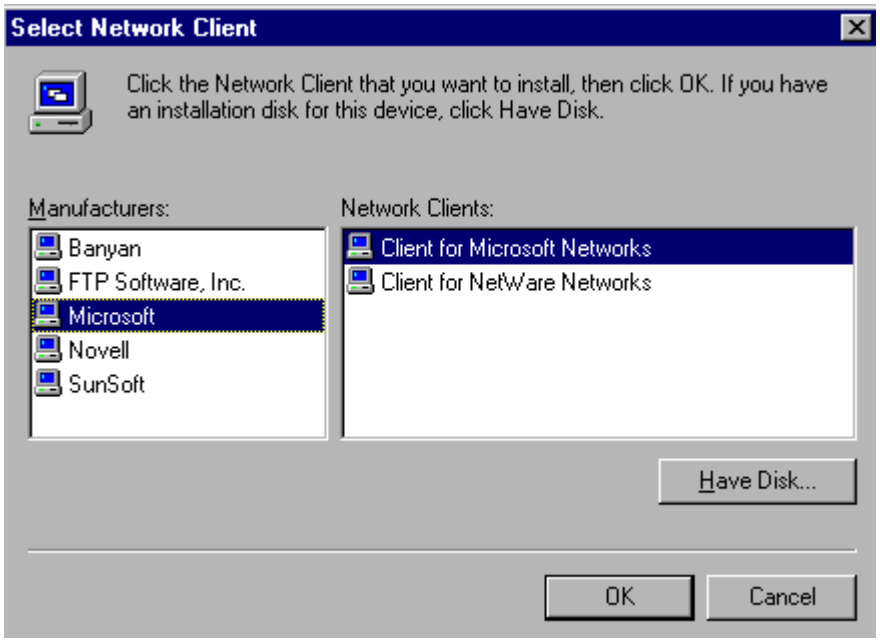

Click on the **OK** button to continue.

Note: If this is the first time you have done this procedure, Microsoft's SETUP program will copy the SMB Redirector files from the Windows 95 CD- ROM or from the .CAB files that were copied to a network drive. Make sure you know the path to these files.

4. Click **OK** to leave the Network Configuration page. You will be prompted in the System Settings Change dialog to restart the machine. Click **Yes**.

5. After the computer reboots, you will be prompted to log in to NetWare as usual. You will then need to enter Microsoft networking information, including username, password, and domain.

6. Confirm that your changes were made correctly by right-clicking on Network Neighborhood and selecting Properties. The Network Configuration page should look like the sample below:

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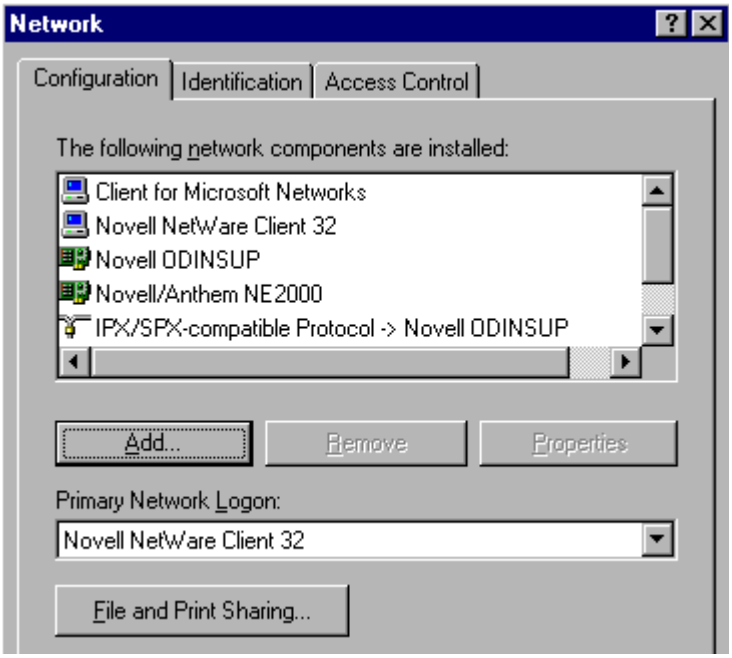

Now, when you click on Network Neighborhood, you will be able to see both Novell (NCP) servers and Microsoft (SMB) servers, if you have configured your Microsoft network resources correctly. You can tell that the workstation is using a 32-bit ODI driver because the Novell ODINSUP shim is loaded. ODINSUP provides the interface between the ODI and NDIS layers when communicating with Microsoft servers.

Note: Do not remove Novell ODINSUP unless you know which network adapter it is bound to. If there is only one network adapter in use, removing Novell ODINSUP also removes NetWare Client 32 for Windows 95.

Installing Windows 95 and NetWare Client 32 Using MSBATCH

Microsoft provides a batch installation procedure for Windows 95 that runs according to a script contained in a file called `MSBATCH.INF`. Network administrators can use a customized version of this file to automate the installation and configuration of both Windows 95 and Client 32 on a workstation from a NetWare server. Setting up MSBATCH requires some preparation, but once that is done you can perform a "hands-off" installation on each workstation.

For NetWare Client 32, the MSBATCH installation process has two limitations that you should be aware of:

- This procedure is designed for first-time installations of Windows 95 and Client 32. It will not work properly on a machine running NetWare Client 32 for DOS/Windows that you now want to upgrade to Windows 95.
- MSBATCH supports *NDIS drivers only*)it does not support Novell's ODI drivers. It will install and configure Client 32 to use an NDIS driver. In fact, the MSBATCH process will fail if you have a 32-bit ODI driver installed on the workstation. Make sure you have a 16-bit (real-mode) LAN driver installed before you run MSBATCH.

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The Microsoft utilities you will need to prepare the Windows 95 and Client 32 files on a file server (NETSETUP.EXE and INFINST.EXE) are provided only on the Windows 95 CD-ROM, not on the diskettes. As of this writing, you can download these utilities from Microsoft's World Wide Web site (http://www.microsoft.com).

To make it easier to follow the MSBATCH setup process, the overall procedure is divided into several sections, each containing a sequence of steps to be performed. We recommend that you read through each section completely as you progess through the setup procedure.

Preparing for an MSBATCH Setup

These instructions assume that you have two NetWare file servers installed:

- The *source server* is the server on which you set up the custom network installation of Windows 95. For this example, the source server is named SRC1. It contains a copy of the Windows 95 cabinet (.CAB) files and the network tools found in the ADMIN directory and its subdirectories on the Windows 95 CD-ROM.
- The *destination server* is the one on which you want to install the files necessary for the custom network installation of Windows 95. In our example, the server is named DEST1.

If you have NetWare Client 32 for Windows 95 on a CD-ROM, you can use that as the source for copying the Client 32 installation files. If not, you should copy the NetWare Client 32 files to a directory on the source server as directed below. The steps assume you have a CD-ROM in drive D.

Before you begin the setup procedure, copy the files and set up drive mappings as follows (substitute your own server names and drive letters):

```
MAP N:=SRC1\SYS:\CLIENT32\INSTALL
```

(copy the NetWare Client 32 installation files here, or use CD-ROM)

```
MAP W:=SRC1\SYS:\WIN95
```

(copy the Windows 95 installation files here)

```
MAP K:=DEST1\SYS:\
```

(parent directory for the Windows 95 network setup files)

Configure Windows 95 Setup with NETSETUP.EXE

1. Start Windows 95. Run the NETSETUP program by choosing Start | Run and typing the directory path to NETSETUP.EXE in the entry box. In this example, the path is:

   ```
   W:\WIN95\ADMIN\NETTOOLS\NETSETUP\NETSETUP.EXE
   ```

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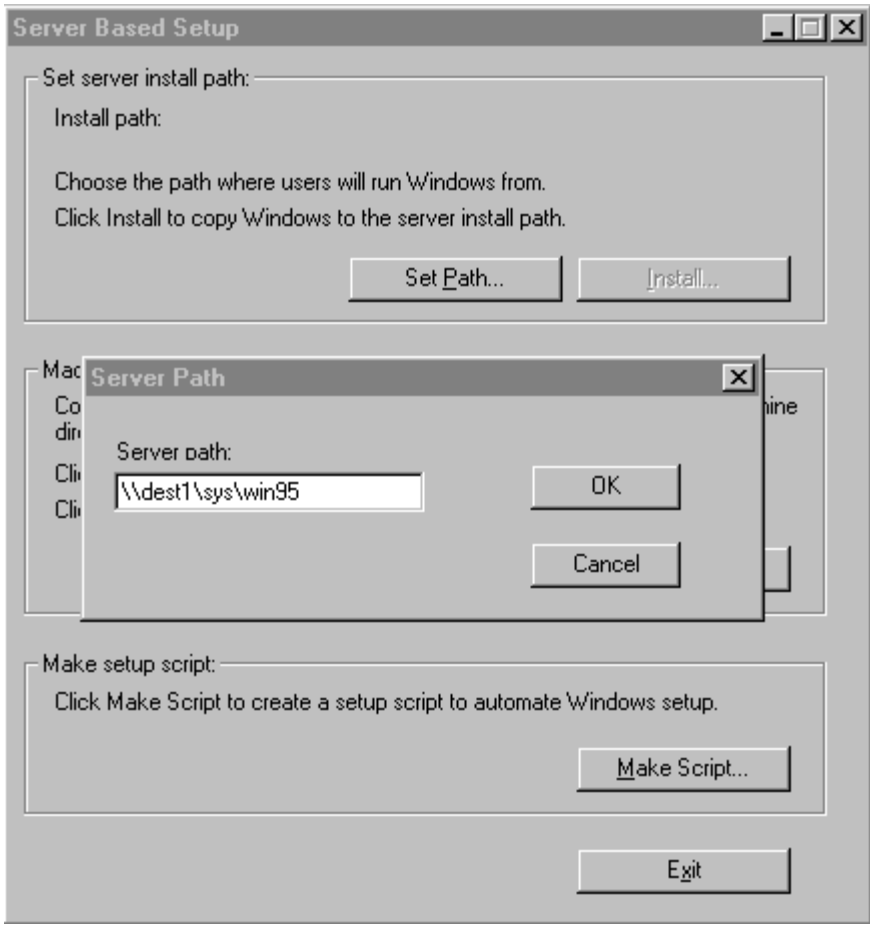
Click on **OK** to run the program.

2. In NETSETUP's Server Based Setup dialog box, select the destination for the network setup files by clicking on the **Set Path...** button. The path can be specified as a currently mapped network drive (K: in this example) or by using UNC naming as shown in the sample screen below:



Once you have entered the path, click **OK**. (If this is the first time you are performing this procedure, click on **OK** when you are prompted to create the `\WIN95` subdirectory.)

This process doesn't require any modifications in the Machine directory setup or Make setup script sections of the dialog box. Click on the **Install...** button to proceed.

3. In the Source Path window, the "Install policy" section allows you to select where you want the shared files to be installed. For this example, select "Local hard drive" as shown below:

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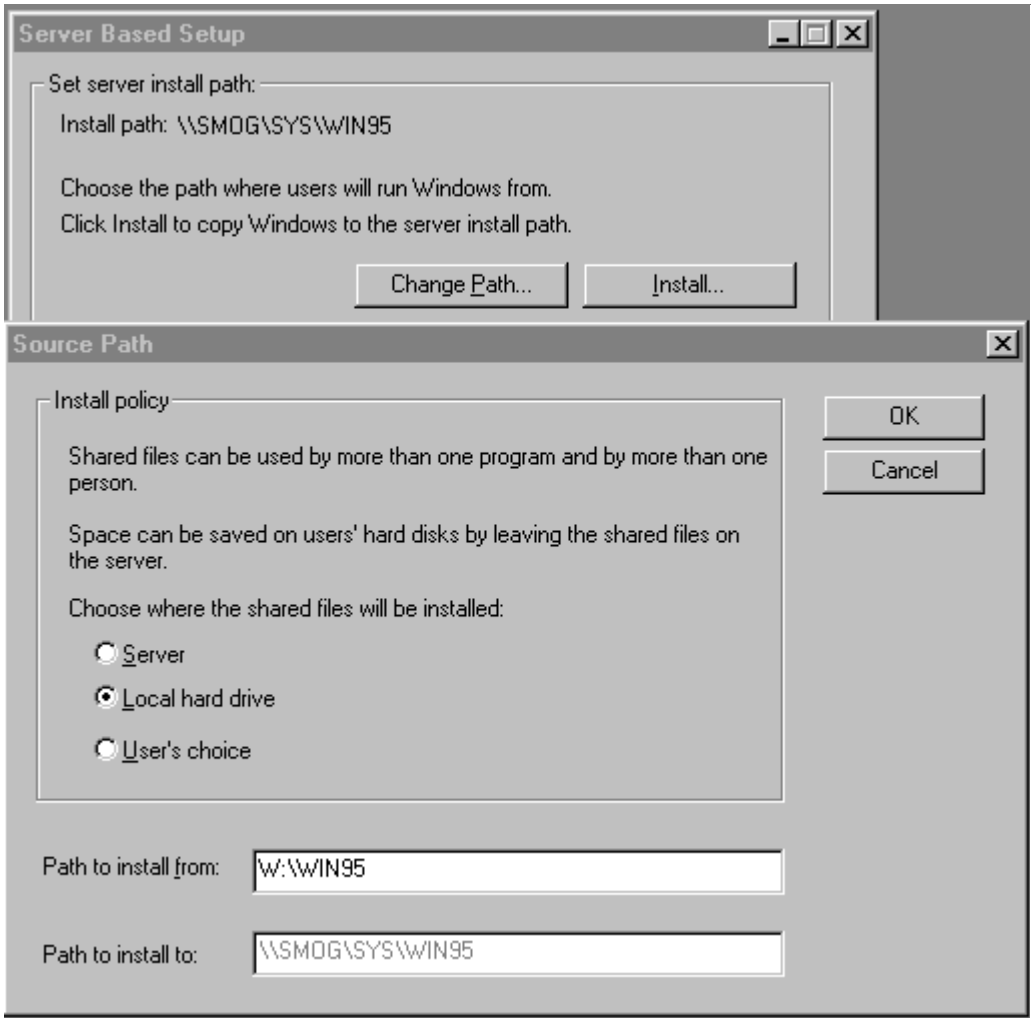

For "Path to install from" specify the location of the Windows 95 cabinet (.CAB) files. For this example it is `W:\WIN95`. Verify that the "Path to install too" is correct, and then click on **OK**.

4. In the Create Default Scripts dialog box, click "Don't Create Default."
5. In the Product Identification dialog box, click **OK** to bypass the product ID number.
6. A Copying Files windows shows the progress as the Windows 95 files are copied to DEST1. When the process has completed, click **OK** in the Server Based Setup dialog box.
7. Click on **Exit** to leave the NETSETUP program.
8. From a command prompt, go to the `K:\WIN95` subdirectory on the destination server. Change the following INF files to Read/Write:

   ```
   MSBATCH.INF
   INF\NETDEF.INF
   ```

   You can do this using the NetWare FLAG command as follows:

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```
FLAG filename +RW -RI -DI <Enter>
```

The MSBATCH.INF file will be replaced, and NETDEF.INF will need to be modified later.

Copy the Client 32 Files to the Destination Server

1. Create a directory (such as K:\C32) on server DEST1 and copy the NetWare Client 32 for Windows 95 files from the CD-ROM (or from the directory on the source server) to this directory. Do not copy the *.INF files from the \PRODUCTS\ADM32\IBM_ENU\BATCH95\NLS\ENGLISH directory on the CD-ROM (or the \ADMIN directory on the server) at this time.

   Note: If you use the NetWare INSTALL.BAT program on the NetWare 4.11 CD-ROM to install the NetWare Client 32 for Windows 95 files on a server, it does not create the \ADMIN directory on the server. You can use the Diskette Creation option and select "NetWare Administration Utility for Client 32" to copy the Client 32 administration utilities to two floppy diskettes.

2. Rename or delete all of the Client 32 *.INF files in the K:\C32 subdirectory.

3. Copy the following files from the \PRODUCTS\ADM32\<language>\ \BATCH95\NLS\<language> directory on the CD-ROM to the K:\C32 directory on the destination server:

   ```
   NWCLIENT.INF
   NWTRANS.INF
   NWLAYOUT.INF
   NWIP.INF   (if you want NetWare/IP support)
   NWSERV.INF   (if you want SNMP support)
   ```

4. If you have NetWare Client 32 for Windows 95 v2.11 or earlier, you will need to copy the following updated files to K:\C32:

   ```
   NWCLIENT.INF   9-20-96
   NWLAYOUT.INF    7-8-96 (8-21-96 for standalone setup)
   NWTRANS.INF     1-4-96
   LOCWIN16.DLL   8-29-96
   NWSETUP.DLL    8-29-96
   ```

   These updates are included in a file named W95UT1.EXE, which can be downloaded from the following locations:

   - NetWire on CompuServe: GO NWCLIENTS
   - World Wide Web: http://support.novell.com/search
   - FTP: ftp.novell.com /pub/updates/nwos/nwc32211

Create the Custom MSBATCH.INF File with BATCH.EXE

1. In Windows 95, choose Start | Run and type the following in the entry box:

   ```
   W:\WIN95\ADMIN\NETTOOLS\NETSETUP\BATCH.EXE
   ```

2. In the "Untitled - Windows 95 batch setup" window, fill in the Setup Information as shown below. If you want this to be an unattended install, enter general information in all of the fields.

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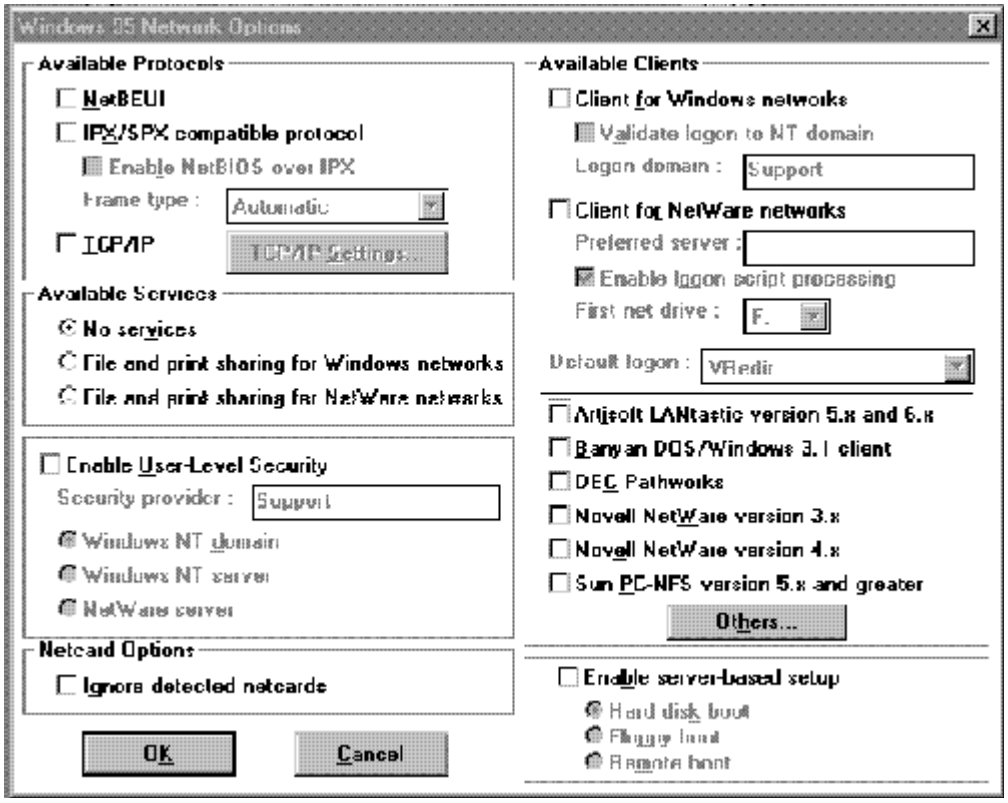

3. Click on the **Network Options...** button. Remove all options, as shown in the sample screen below:

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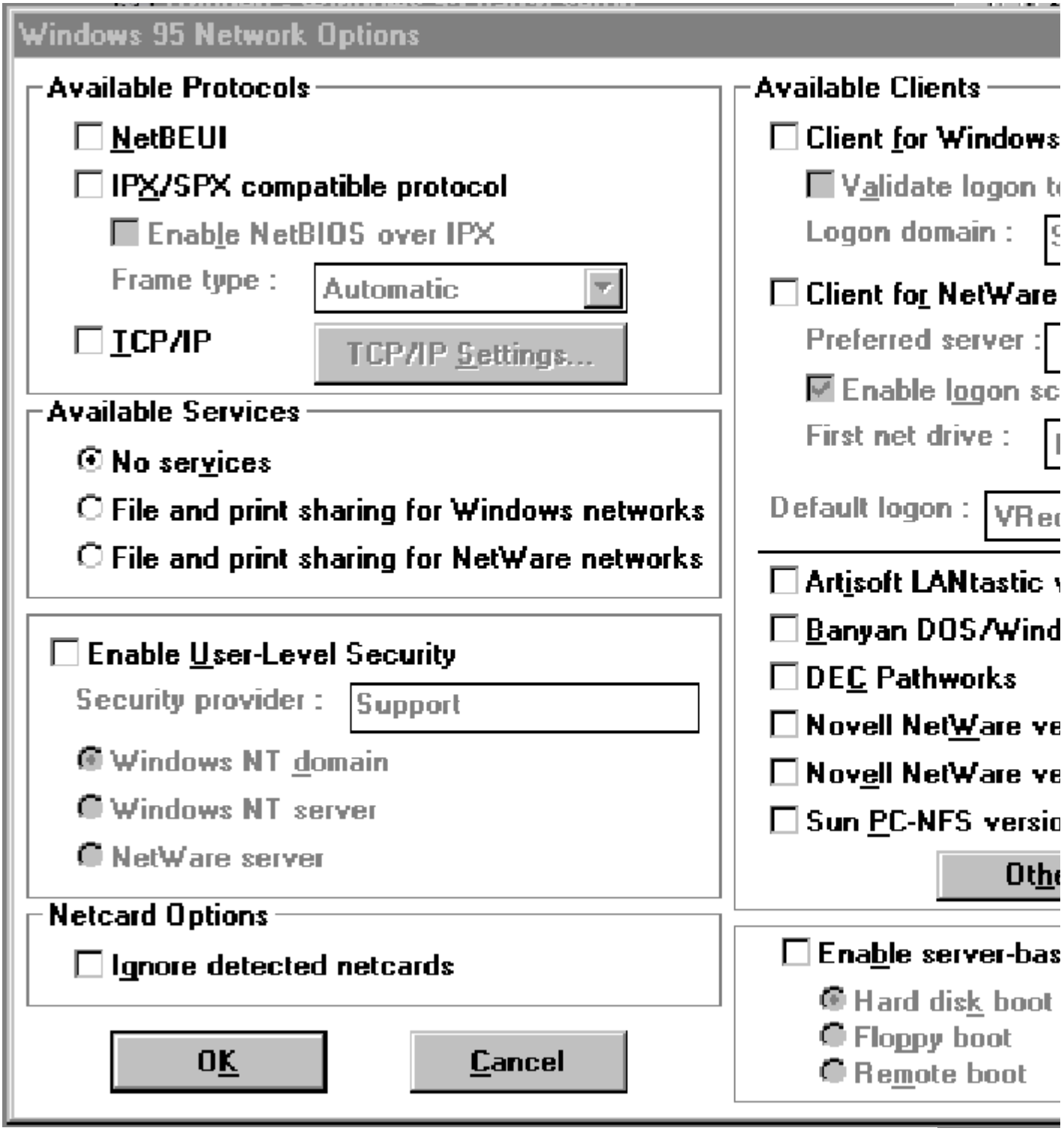

If you want to set up TCP/IP, check the TCP/IP entry in the Available Protocols section. Click on **TCP/IP Settings...** to configure TCP/IP and then click **OK**.

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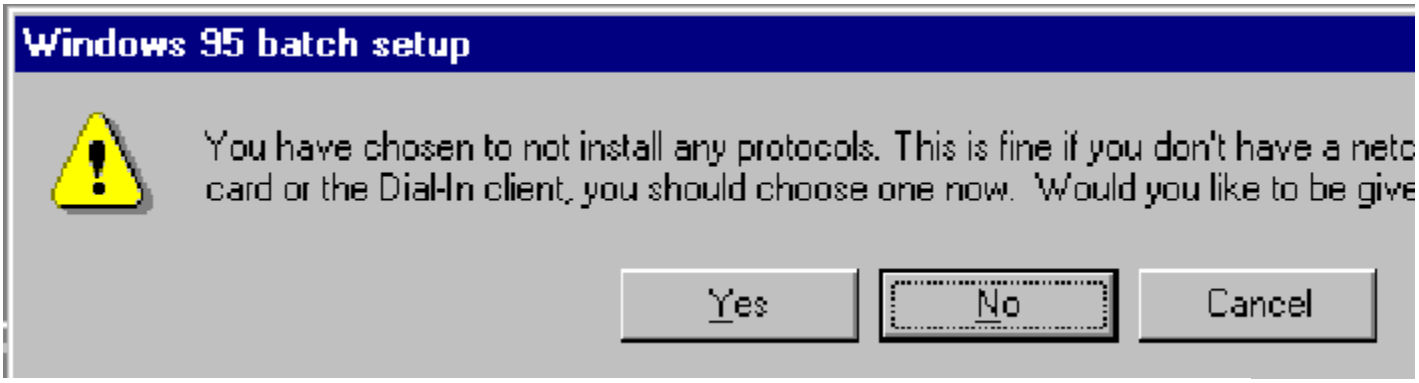
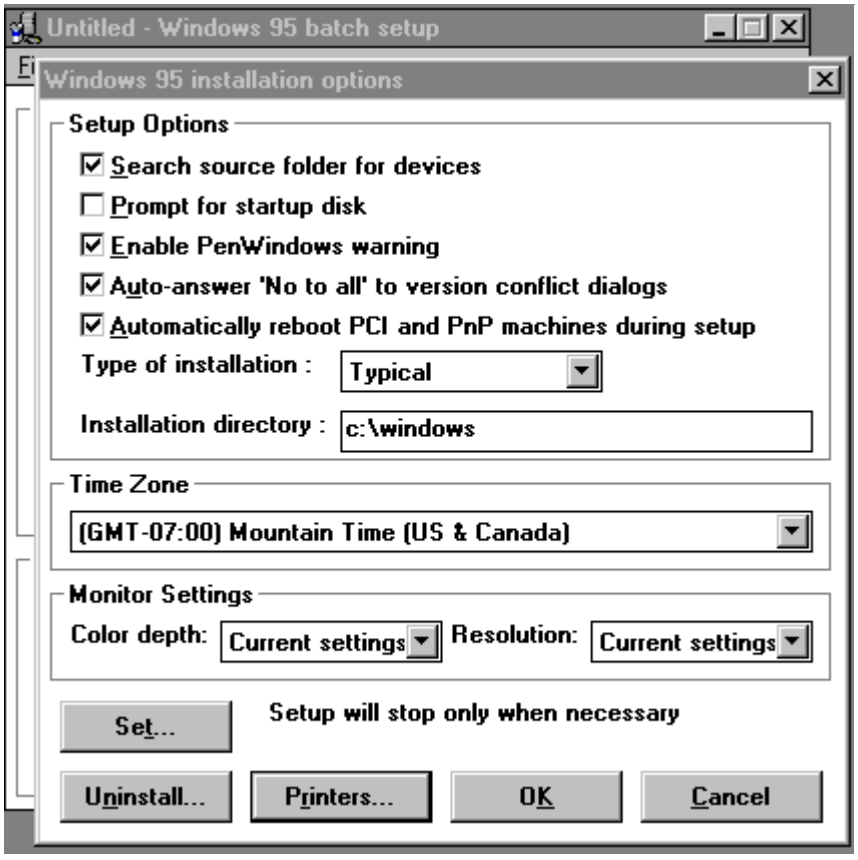
4. A prompt similar to the following appears:



   Answer "No" to this prompt.

5. In the "Untitled - Windows 95 batch setup" window, click on the **Installation Options...** button. The following dialog box appears:



   Modify the Setup Options as follows to keep users from having to provide input during the installation process:

   - Check all the options except "Prompt for startup disk".

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- Set the "Type of installation" to Typical.
- Specify `c:\windows` as the "Installation directory".
- Select your time zone.
- Click on the **Printers...** button at the bottom of the window and choose "Don't prompt to install printers during setup". Then click on **OK**.

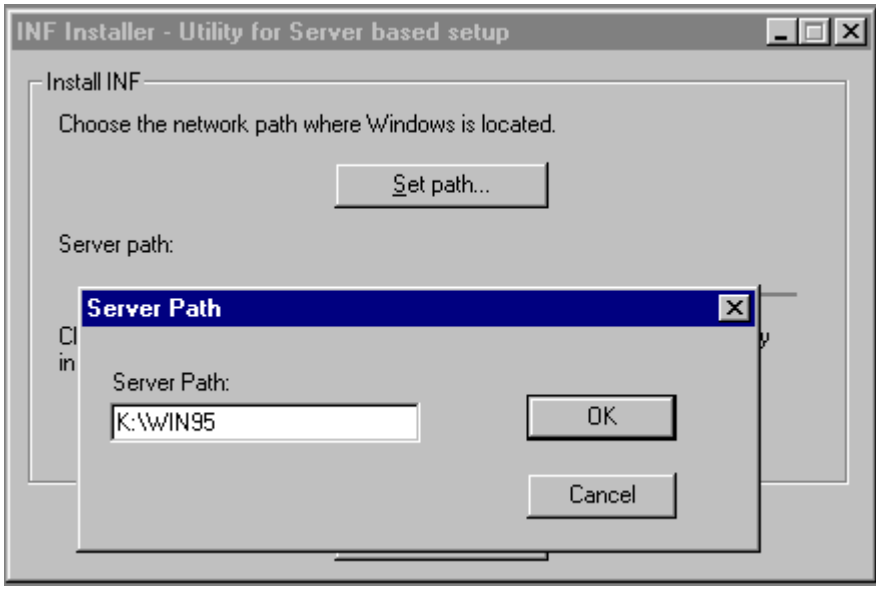
When all these selections have been made, click **OK** to exit the Windows 95 installation options window.

6. In the Windows 95 batch setup window, click on **Done**. You will be prompted to save the batch settings. Save the file as `MSBATCH.INF` in the `K:\WIN95` directory on the destination server. Answer "Yes" to overwrite the `MSTBATCH.INF` file that already exists in that directory.

Add Client 32 to Windows 95 with INFINST.EXE

1. In Windows 95, start the INF Installer (INFINST.EXE) utility. This is found in the `W:\WIN95\ADMIN\NETTOOLS\NETSETUP` directory on the source server (as well as on the Windows 95 CD-ROM).

2. In the INF Installer dialog box, click on the **Set path...** button. In the Server Path entry box, type the directory where Windows 95 is located. In this example, it is `K:\WIN95` (on server DEST1).



Click **OK** to continue.

3. Click on the **Install INF...** button. Choose the `NWCLIENT.INF` file that you copied to the `K:\C32` directory on the destination server, as shown below. *You must use the INF file that is in the directory containing the Client 32 files to be installed.*

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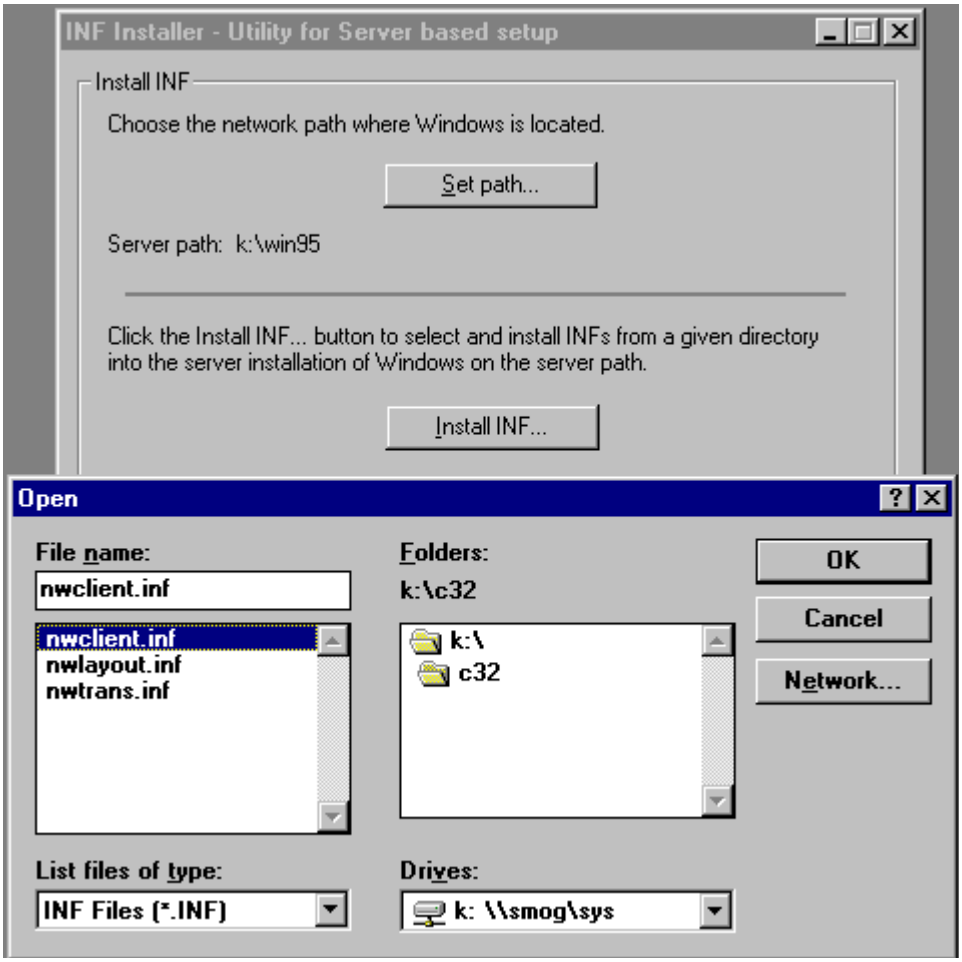

Once you select the file and click **OK**, INFINST will proceed to integrate Client 32 into the `MSBATCH.INF` file. During this process, a number of file copies will take place, which may take a few minutes. Here are some things to be aware of:

- When you are prompted for the location of a file, provide either the `\C32` or `\WIN95` directory on the destination server, whichever is appropriate. This will happen a number of times.
- *Do not* keep the existing `NETWARE.DRV` file, even if it is newer than the `NETWARE.DRV` file that is shipped with Client 32. Answer "No" in response to the "Version Conflict" message (this message will appear several times).
- If the computer appears to be "hung," be patient. It is normal to have periods of time in which it seems nothing is happening. The process will most likely finish normally.

4. When the process is finished, you will see the message "MSBATCH.INF file updated to integrate INF." Click **OK** to return to the Install INF window. Then click **Exit** to leave the program.

Review Client 32 Settings in the MSBATCH.INF File

With the Windows 95 Notepad utility, open the `MSBATCH.INF` file in the `\WIN95` directory on the destination server to review the settings it contains. Following is a partial listing of the `MSBATCH.INF` file included with v2.11 of NetWare Client 32 for Windows 95. It contains sample settings for Client 32 and

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NetWare/IP. You can modify these for your own situation.

Sample MSBATCH.INF

```
; Contains parameters for the Novell NetWare Client 32
[NOVELL32]
PreferredServer=sample
PreferredTree=sample_tree
NameContext=sample.context
FirstNetworkDrive=F             ; Letter type
DisplayConnectionPage=off       ; ON or OFF
                        ; Display Connection Page on Graphical Login if set to on
DisplayScriptPage=off           ; ON or OFF
                        ; Display Script Page on Graphical Login if set to on
DisplayVariablePage=off         ; ON or OFF
                        ; Display Variable Page on Graphical Login if set to on
CacheWrites=off                 ; ON or OFF
CloseBehindTicks=2              ; Valid range(0 - 65535)
DelayWrites=on                  ; ON or OFF
FileCacheLevel=2                ; Valid range(0 - 4)
MaxCacheSize=2                  ; Valid range(0 - 4294967295 KB)
OpportunisticLocking=off        ; ON or OFF
TrueCommit=on                   ; ON or OFF

; Contains parameters for Novell NetWare/IP
[NWIP]
NwipDomainName=novell.com
NearestNwipServers=sample1,sample2,sample3   ; Up to 5 servers seperated by commas,
                        Nearest NetWare/IP Servers
PreferredDomainServers=sample10,sample11     ; Up to 5 servers seperated by commas,
                        Preferred Domain SAP/RIP servers
RetriesToDSS=1                  ; Valid Range(0-10)
                        Retries to DSS during startup
TimeBetweenRetries=10           ; Valid Range(5-60)
                        Number of Seconds between retries
NSQBroadcast=on                 ; ON or OFF
                       ; Broadcast SAP nearest server queries to network
```

Modify the NETDEF.INF File

Depending on which version of Client 32 you have, you may need to make changes to the `NETDEF.INF` file. This file is found in both the `K:\WIN95` and `K:\WIN95\SUWIN` directories. If the following lines exist in the file, comment them out by placing a semicolon (;) in front of them:

```
;;;;;; NOVELL Directory Services VLM 4.x ;;;;;;;;
; [VLM]
; detection0=custom_dll
; detection_dll=NETOS.DLL
; detection_call=NW_IsNDSinUse
; full_install0=prevent
```

Installing Windows 95 and NetWare Client 32

You are now ready to install Windows 95 and the NetWare Client 32 for Windows 95 from the server. To do

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this, run SETUP.EXE from the \WIN95 subdirectory, using the following syntax:

```
SETUP /IW K:\WIN95\MSBATCH.INF
```

The /IW option (in capital letters) to the SETUP.EXE command line is added to avoid having Windows 95 query for acceptance of the license agreement.

Again, keep in mind that the MSBATCH process installs 32-bit NDIS drivers, not ODI drivers. To add ODI drivers later, you can run the Client 32 SETUP program, use the Automated Client Upgrade method, or add the driver manually through the Network | Control Panel interface.

Installation Issues

This section discusses some of the more common questions and issues you may encounter when installing NetWare Client 32 for Windows 95.

Selecting a LAN Driver

With all of the LAN driver choices available for Client 32, it can be confusing to decide which type of driver to use. Novell's general recommendation is:

1. *Use a 32-bit ODI driver whenever possible.*

   The best choice is to use one of the C-based 32-bit LAN drivers written specifically for Client 32. All of the changes and added functionality that Novell plans to integrate into Client 32 will be implemented in the C-based LAN drivers.

   Until more C-based LAN drivers become available, you can use many of the assembly-based *.LAN drivers that are already available for use in NetWare servers. But remember, not all of these will work with NIOS.

   Even if you have a 16-bit board in your workstation, you can still take advantage of a 32-bit LAN driver. Internally, all 386-based machines can execute the two-word code of 32-bit drivers, and it runs faster than one- word code. Thus even 16-bit network boards can see a performance increase running 32-bit drivers. (Of course, as the processed data is prepared to be sent out over the wire, it is encapsulated into data packets whose physical size is determined by the network protocol.)

2. *Use an NDIS 3.1 driver if it is available.*

   The number of 32-bit ODI drivers is increasing, but there are still many network adapters for which no such drivers are available. A common example is PCMCIA adapters. In this situation you should use one of the NDIS drivers provided with Windows 95. You'll also need the VMLID shim.

3. *Use an existing 16-bit ODI driver.*

   If no 32-bit ODI or NDIS drivers are available for your network adapter, your last option is to use one of the existing 16-bit ODI drivers from previous NetWare client software. You'll also need the PC32MLID shim.

Here is a list of network boards supported by Client 32, as of the latest released version. (This list may change slightly from one release to the next.) Note that, for LAN drivers written by Novell, the 32-bit C-based versions of the LAN drivers usually have a filename beginning with "C"—for example, CNE2000.LAN is the C-based version of the NE2000.LAN server driver.

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16-bit LAN Driver	Board(s)
NE2.COM	Novell/Eagle NE/2
NE2_32.COM	Novell/Eagle NE/2-32
NE1000.COM	Novell/Eagle NE1000
NE1500T.COM	Novell Ethernet NE1500T
NE2000.COM	Novell/Eagle/Microdyne NE2000, National Semiconductor NE2000 InfoMover
NE2100.COM	Novell Ethernet NE2100
NE3200.COM	Novell/Eagle/Microdyne NE3200, Intel EtherExpress32
PCIMLID.COM	Accton EN1203 PCI Ethernet, Accton EN1207(-TX) PCI Fast Ethernet
MPX2PNP.COM	Accton EN166X MPX-Series Ethernet
PCMMLID.COM	Accton EN2218 Ethernet+Modem/Fax Adapter
E22ODI.COM	Cabletron Systems Ethernet E22
F70ODI.COM	Cabletron Systems FDDI F70
DE22X.COM	D-Link DE-220 Family
DLKPCI.COM	D-Link PCI Ethernet
HPFEODIM.COM	Hewlett-Packard 10/100VG Bus Master LAN Adapter
E100BODI.COM	Intel EtherExpress PRO/100 LAN Adapter
NTR2000.COM	Novell/Microdyne NTR2000 Token-Ring Adapter, IBM Token-Ring Network
LANSUP.COM	ODI Module for the IBM LAN Support Program
MADGEODI.COM	Madge Smart 16/4 Ringnode Adapter
OCE2XODI.COM	Olicom OC-2231 Ethernet PCMCIA Card
OCTOK16.COM	Olicom Token-Ring PCI 16/4 Adapter
ILANPCI.COM	Racal InterLan PCI Ethernet MLID
NI6510.COM	Racal InterLan XLerator/EB/NI6510 Ethernet MLID
SMC8000.COM	SMC Ethernet LAN Adapter
SMC8100.COM	SMC TokenCard Elite Family Adapter
SMC9232.COM	SMC Ether100 Ethernet and Fast Ethernet EISA Adapter
SMCPWR.COM	SMC 8432/8434/9332 PCI Adapter
TCTOKSH.COM	Thomas-Conrad TC4035/TC4045/TC4046 Adapters
TC4048SH.COM	Thomas-Conrad TC4048 Adapter
TCVG45.COM	Thomas-Conrad VG45 ISA Adapter
TCVG47.COM	Thomas-Conrad VG47 EISA Adapter
XPSODI.COM	Xircom Performance Series
TRXNET.COM	Novell RX-Net/RX-Net II, RX-Net/2

32-bit LAN Driver	Board(s)

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CNE2.LAN	Novell/Eagle NE/2
CNE2_32.LAN	Novell/Eagle NE/2-32
NE1000.LAN	Novell/Eagle NE1000
CNE1500T.LAN	Novell Ethernet NE1500T
CNE2000.LAN	Novell/Eagle/Microdyne NE2000, National Semiconductor NE2000 InfoMover, IBM Ethernet Credit Card Adapter II
CNE2100.LAN	Novell Ethernet NE2100
CNE3200.LAN	Novell/Eagle/Microdyne NE3200, Intel EtherExpress32
CNTR2000.LAN	Novell/Microdyne NTR2000 Token-Ring Adapter
PCI40.LAN	Accton EN1203, EN1207 PCI Series Ethernet (960111)
ACC41.LAN	Accton EN166X PnP Adapter
NE100SP.LAN	Microdyne NE10/100SP Ethernet Adapter
OCTOK162.LAN	Olicom 16 bit Token-Ring Adapters (ISA adapter in EISA bus) Olicom 16 bit Token-Ring and Token-Ring PCI Adapters

Using Third-Party LAN Drivers

If you have a LAN driver for your network adapter that is newer than the one included in the current release of Client 32, you can install the driver during Client 32 setup. You can also update the driver after Client 32 is installed. To be able to select a third-party ODI LAN driver (from a vendor other than Novell) during the Client 32 SETUP program, do the following:

1. Before you run the Client 32 SETUP program, copy the driver and its accompanying .LDI or .INS file to the `\ENGLISH` subdirectory (or the installation subdirectory you created).
2. Open the cour file in a text editor.
3. Search for the .INF file that corresponds to the LAN driver you want to use. The .INF files for third-party LAN drivers are named ODI*xxxx*.INF, where "*xxxx*" is the manufacturer of the network adapter; for example, `ODI3COM.INF`.
4. Delete the semicolon at the front of the line.
5. Save your changes and exit the text editor.
6. Run the Client 32 SETUP program.

To update a LAN driver after Client 32 has been installed:

1. Do either of the following:
   - For 32-bit (*.LAN) drivers, copy the new driver and its .LDI file to the `NOVELL\CLIENT32` directory on the workstation.
   - For a 16-bit (*.COM) driver, copy the new driver and its .INS file to the `NOVELL\NWCLIENT` directory on the workstation.
2. Complete Steps 2 through 6 above.

Uninstalling NetWare Client 32

The Uninstall Client 32 (UNC32.EXE) utility is the preferred method for removing Client 32 from a Windows 95 workstation. This utility is available in the W95UT1.EXE update file. When this file is self-extracted, the

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files necessary to run Uninstall are placed in an \UNINSTAL subdirectory. *You must copy these files to a local directory on the Windows 95 workstation.* Uninstall will not run properly from a NetWare server.

Once you have copied the Uninstall files to a local drive, start Windows 95. Choose Start | Run, and then type the path to the UNC32.EXE file. For example:

> For more information about the Client 32 uninstall utility, see TID 2910349, "Client 32 for Win 95 Uninstall Summary". TIDs are available on Novell's Web site (www.novell.com), on the ftp server (ftp.novell.com), on the NetWire section of CompuServe, and on the Novell Support Connection (formerly NSEPro) CD-ROM.

```
C:\NOVELL\CLIENT32\UNINSTAL\UNC32.EXE
```

The utility's opening screen gives you the option to remove the Novell 32-bit ODI driver as part of the uninstall process. If you want to do this, check the box next to "Remove Novell 32-bit ODI Adapter". Then click **Continue**.

The status window displays the program's progress as the existing client (Client 32) is removed. Windows 95 will have to rebuild the driver information database several times during the course of this procedure.

When the uninstall completes successfully, you will see the message "NetWare Client 32 is now uninstalled from your system." You will need to reboot the computer for the changes to take effect.

Note: If you re-install Windows 95 on a machine that contains NetWare Client 32 for Windows 95, Client 32 will no longer work. When you restart the computer, the Novell splash screen will appear but no login window displays. The Network Control Panel will indicate that the Novell Client is still installed. This situation can be remedied by removing all components in the Network Control Panel, saving the changes, and then re-installing NetWare Client 32.

Additional Client 32 Installation Help

There are a number of other issues that might arise when you are installing NetWare Client 32 for Windows 95. We recommend that you read the README.TXT file that comes with Client 32 and the Frequently Asked Questions (FAQ) list for NetWare Client 32 for Windows 95. This, along with several other pertinent FAQs, can be found on the World Wide Web at the following URL:

```
http://support.novell.com/
```

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NOVELL® RESEARCH

Upgrading Windows 95 Workstations with Automatic Client Update (ACU)

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Product Manager

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Distributed Networks Business Unit

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In the past, when Novell released updates to the NetWare client software, network administrators had to go to each workstation and manually upgrade the client software. To reduce this administrative burden and make it easier to distribute and install NetWare client software, Novell has developed Automatic Client Update (ACU) to automate the process of updating NetWare client software for users.

The components necessary to run ACU are included as part of NetWare Client 32 for Windows 95, as well as in later releases of Client 32 for DOS and Windows 3.x. For Windows 95, ACU can be used to upgrade workstations running the Microsoft Client for NetWare Networks and any version of NetWare Client 32 for Windows 95.

The Client 32 for Windows 95 ACU does not upgrade workstations running the NETX Shell or the NetWare DOS Requester (VLMs). However, the ACU that comes with NetWare Client 32 for DOS and Windows 3.x can perform this type of upgrade. For information on running ACU on DOS and Windows 3.x workstations, see the AppNote entitled "Upgrading Network Client Software with Automatic Client Update (ACU)" in the May 1996 *Novell Application Notes*.

This AppNote covers the following aspects of ACU for Windows 95:

- An overview of the ACU process
- Steps for setting up ACU
- An example of using ACU to update Windows 95 workstations to the latest release of NetWare Client 32 for Windows 95
- Other uses for ACU

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Overview of the ACU Process

Novell's Automatic Client Update provides a way for network administrators to upgrade NetWare client software automatically. In a typical scenario, the administrator places instructions in a login script to run the Client 32 SETUP.EXE program if certain update conditions are met. Once the login script is set up properly and a special ACU installation directory is created on the server, ACU automatically upgrades the client software when users log in, without requiring any intervention from the user or the administrator.

Automatic Client Update is initiated by calling the SETUP.EXE utility for Client 32 for Windows 95 with the `/acu` option added. The usual method for setting up ACU is to include the `SETUP /ACU` command in a login script. When a user logs in, SETUP checks the version of the client software currently running on that user's workstation. If the version is determined to be older than the currently available update, the SETUP program installs the new client software on the workstation.

To determine whether the client software is current or old, the SETUP program compares the version contained in the `NWSETUP.INI` configuration file to the version stored in the Windows 95 Registry.

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SETUP.EXE reads the NWSETUP.INI file each time it runs to get instructions such as where to copy the drivers during the installation. NWSETUP.INI is located in the same directory as SETUP.EXE (the \ENGLISH subdirectory). Within this file is a section containing the current version of the client software, which for Client 32 v2.11 looks similar to the following:

```
[ClientVersion]
Version=1.1.0.0
```

From left to right, the four fields which refer to the version of the client software are Major Version, Minor Version, Revision, and Level. Details on setting these fields are given later in this AppNote. With each new version of Client 32, Novell supplies an updated NWSETUP.INI file containing different values for the Major Version, Minor Version, and Revision fields. Taken together, these values identify the particular version of the client software. For example, in v1.0 of Client 32 for Windows 95, the values were 0.1.0. For the latest release (v2.11), the values were changed to 1.1.0.

The Level field in NWSETUP.INI is intended to be a customer-defined field. It is initially set to 0 by Novell, but you can set it to any number you want, from 0 to 65000. You can use this field to cause updates when the Client 32 software itself hasn't changed, but you have made some other change that needs to be implemented on all user workstations. (See the heading "Updating Individual Files with ACU" for an example of such a usage.)

The other half of the comparison is found in the Registry database on each Windows 95 workstation. When NetWare Client 32 for Windows 95 is initially installed on a workstation, a Client Version key is added to the Registry with four fields that correspond to the ones specified in the NWSETUP.INI file. By default, the values are set to match those found in NWSETUP.INI.

A client upgrade will take place under two conditions:

1. If the "version number" formed by the four fields in NWSETUP.INI is greater than what is stored in the Client Version key in the Registry.

   For example, if the fields in NWSETUP.INI are 1.1.0.0 and the Registry fields are 0.1.0.0, the automatic update process will be initiated because 1.1.0 is considered a higher version than 0.1.0. The major/minor version and revision fields take precedence over the level in comparing the values. Thus, if NWSETUP.INI has 1.1.1.9999 and the Registry has 1.1.2.0, the update process will not run even though the Level of 9999 is greater than the Level of 0.

2. If no Client Version key is found in the Registry.

   This would be the case for a workstation running the Microsoft Client for NetWare Networks.

Before the ACU process finishes, it changes the settings in the Registry to match those in the NWSETUP.INI file so that the Automatic Client Update will not be activated again until the settings in either the Registry or the NWSETUP.INI file are changed.

Preparing for ACU

The basic process by which the NetWare client software is automatically updated with ACU is simple. Before you perform the actual ACU process, you need to complete the preliminary tasks described below.

Note: These instructions assume you have already installed the Client 32 for Windows 95 files onto a NetWare server, as explained in the AppNote "Installing NetWare Client 32 for Windows 95" in this issue. If you downloaded the Client 32 software from an online source, make sure you have also downloaded and followed the instructions for applying the latest updates (if any).

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Copying the Client 32 Setup Software to a Server

The first preparatory step is to copy the files needed to run the Client 32 SETUP.EXE program to a directory on a NetWare server(s). This should be done on each server that users to be upgraded will attach to upon logging in.

1. Log in to the server as Admin or a user with Admin equivalence.

   You will need to have sufficient rights to modify login scripts and to copy files to a directory all users can access.

2. On the NetWare server, create an ACU install directory (folder) that can be accessed by all users to be upgraded.

   For example, create a directory called C32WIN95 in the SYS:PUBLIC\CLIENT directory. Users will need at least Read and File Scan rights to run SETUP.EXE, and placing the files in a subdirectory of SYS:PUBLIC ensures users will have those rights by inheritance.

3. Copy all NetWare Client 32 for Windows 95 installation files into the ACU install directory you created in Step 2.

   If you have installed the Client 32 software onto a server (for example, by running the network install version of the Client 32 download file), the files are found in the \ENGLISH directory.

4. Copy all Windows 95 cabinet (*.CAB) files into the ACU install directory.

   These cabinet files are found in the `\WIN95` directory of the Windows 95 CD-ROM.

5. Make sure that all clients scheduled for automatic upgrade have Read and File Scan rights to the ACU install directory.

   If you have created the ACU install directory somewhere other than under SYS:PUBLIC, you will have to manually assign these rights using the NetWare Administration utility.

Running REGEDIT

Next, you need to find out what version identifiers exist in the Registry of the workstations you want to update. From a representative Windows 95 workstation, run the REGEDIT.EXE utility to view and, if necessary, modify the Registry database. If you have already installed Client 32 for Windows 95, you will see keys corresponding to the Major Version, Minor Version, Revision, and Level specified in the `NWSETUP.INI` file. These keys are found in the path HKEY_LOCAL_MACHINE | Network | Novell | System Config | Install | Client Version, as shown in the sample screen in Figure 1.

Notice that REGEDIT lists the same four version fields as are found in the NWSETUP.INI file, only here they are in alphabetical order and the values are specified in both hexadecimal and decimal notation. SETUP.EXE compares the values in the Registry and in NWSETUP.INI to determine whether the ACU process should run.

Figure 1: The Client Version is stored in the Registry database.

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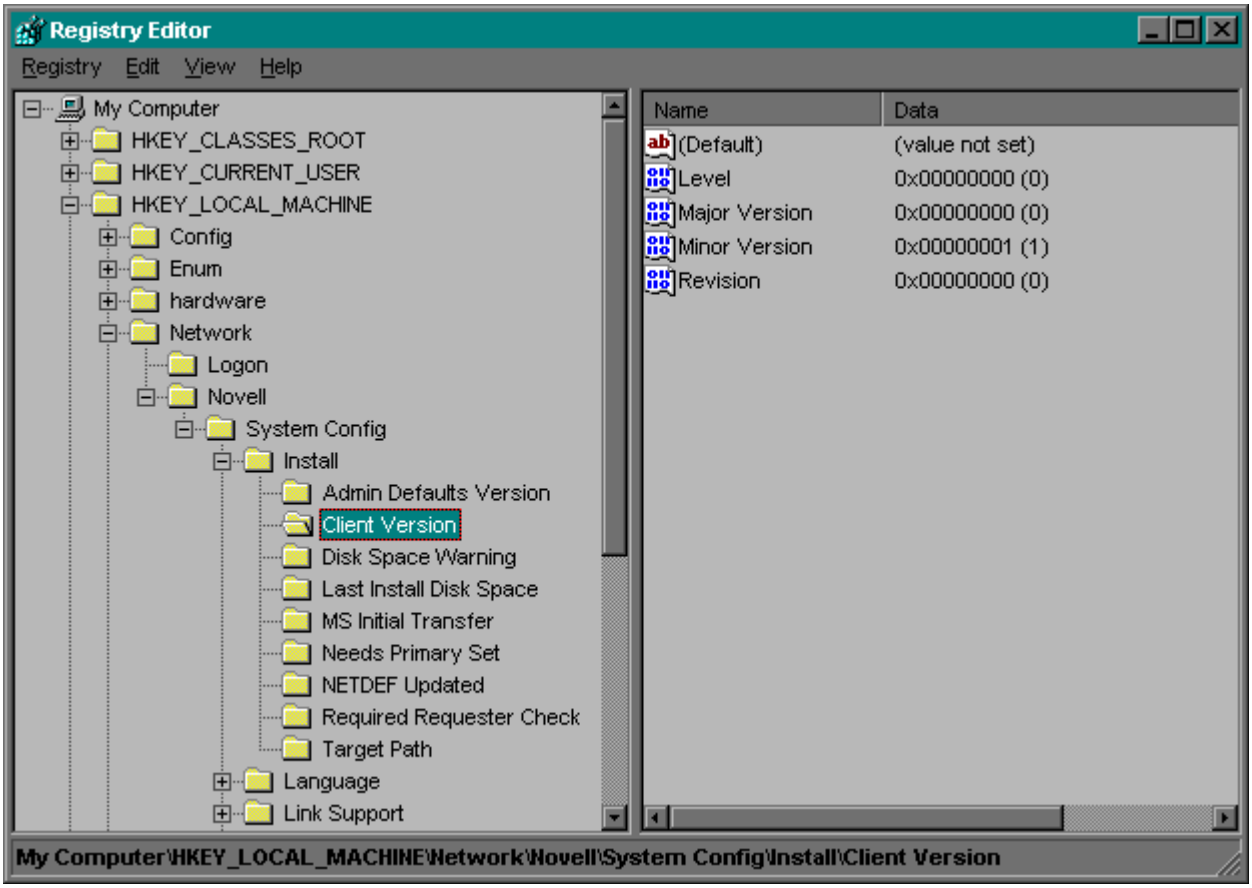

The ACU process runs only when SETUP.EXE determines that these fields in these Registry fields either (1) do not exist, or (2) contain values which are less than those in the `NWSETUP.INI` file.

Checking the NWSETUP.INI File

The next step is to check several settings in the `NWSETUP.INI` file to ensure that the client updates will occur as intended. `NWSETUP.INI` is a text file located in the same directory as `SETUP.EXE`. You can open it in Notepad or another text editor.

Setting the Client Version. Scroll down until you see the version section of the file. Look for the [ClientVersion] heading, as shown in Figure 2.

Figure 2: Client Version fields are also found in the NWSETUP.INI file.

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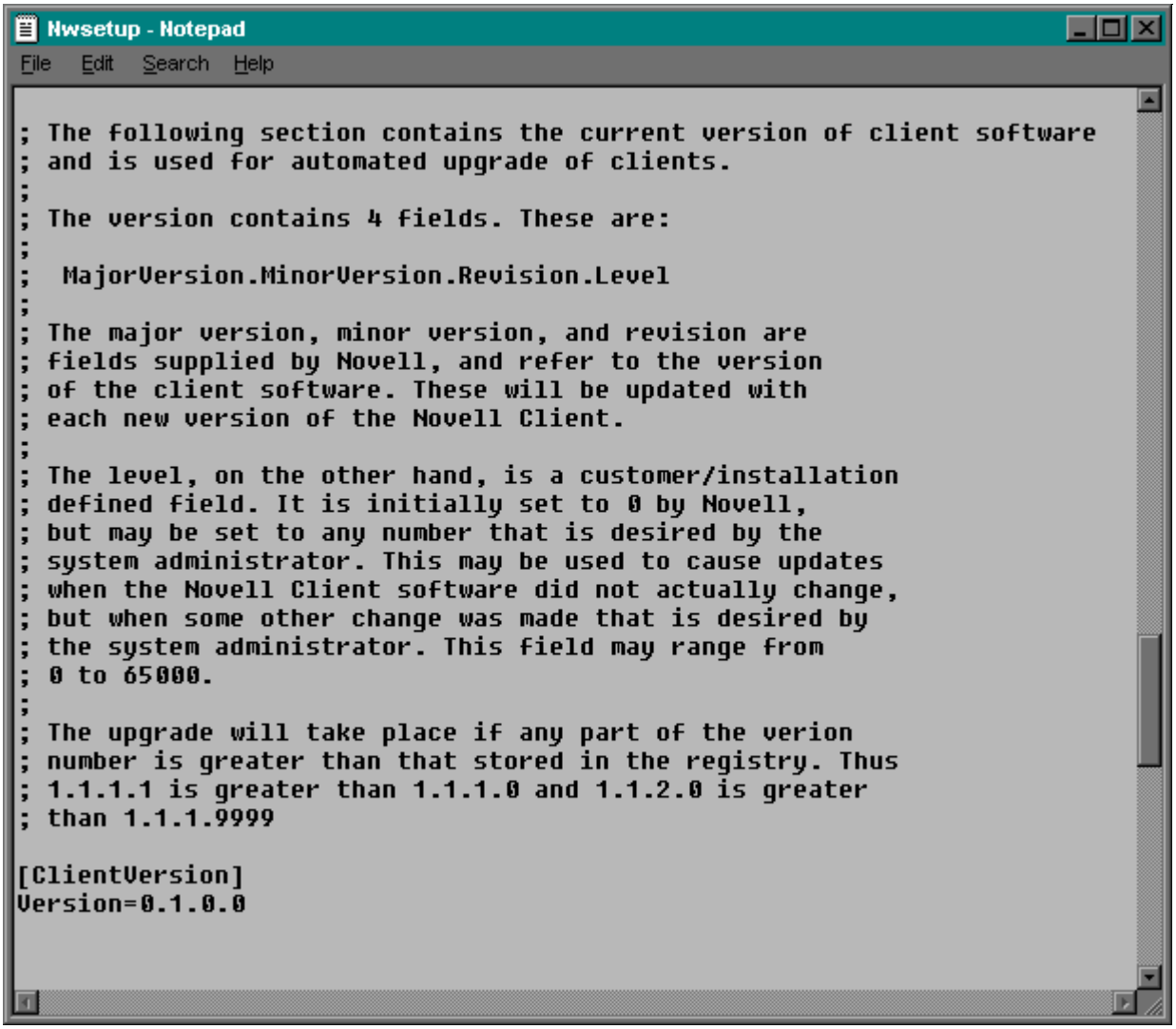

In most cases you won't need to change the version parameters. With each release of the Client 32 for Windows 95 software, Novell provides a new NWSETUP.INI file with updated values. The new values are designed to be higher than in previous versions, so you can usually just leave them at the default setting.

You may want to change the version parameter settings (the Level field in particular) in cases where the Client 32 software itself hasn't changed, but you have a new driver that needs to be installed or a configuration setting that needs to be made on all workstations. For example, you could modify the version parameters to identify what type of LAN driver is running on the workstation (NDIS or ODI) and the revision of the driver.

Note: If you do modify fields other than Level, you will need to make corresponding changes in the NWSETUP.INI files shipped with future releases of Client 32 for Windows 95 to maintain the ACU functionality.

If the values were set as shown in Figures 1 and 2, the ACU process would not run because the Registry contains the same values in the Client Version fields as are specified in `NWSETUP.INI` (0.1.0.0 in both places). If you have newer files that need to be installed on this workstation, you need to change either the

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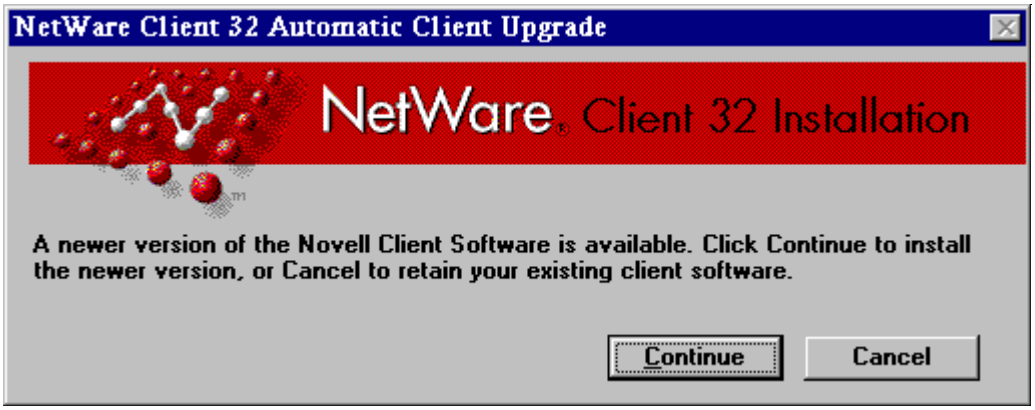
values in the Registry or those in the NWSETUP.INI file so that the version in NWSETUP.INI is greater than the corresponding version in the Registry. For example, 1.1.1.1 is greater than 1.1.1.0.

Setting the ACU Options (User Intervention). In Client 32 for Windows 95 v1.0, the Automatic Client Update required user intervention in two places during the upgrade. In the C3295B.EXE update and later releases of Client 32 for Windows 95, two ACU options were added to the NWSETUP.INI file to allow the administrator to decide whether user intervention will be required during the automated upgrade of clients. These options appear as follows with their default settings:

```
[AcuOptions]
DisplayFirstScreen=NO
DisplayLastScreen=NO
```

If you want no user intervention during the automated upgrade, leave both of these options set to NO.

Setting the "DisplayFirstScreen" option to YES will cause the following prompt to be displayed at the beginning of the ACU process:



If the user chooses Continue, the upgrade starts automatically. If the user chooses Cancel, the workstation will continue to function with the existing client software. However, each time the user logs in with the older client, the versions are compared and the option to upgrade is again presented.

Setting the "DisplayLastScreen" option to YES causes the following prompt to be displayed when the new client installation is complete:

To reboot and load the new client software, users should click on Yes. If they click on No, the workstation will continue through the remainder of the login and finish initializing with the older client software.

Modifying the Login Script

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Next, you need to modify the login script(s) that the users who are scheduled for automatic client upgrade will use. Depending on which type of login script you modify, you can allow different clients to be upgraded. For example, if you modify a user login script, only that user will run the ACU process. If you modify a container login script, all users in that container will run the ACU process.

The command you need to call at the beginning of the login script is `SETUP /ACU`. Both the Login Processor from Microsoft and Novell's GUI Login utility allow Windows programs to be run using the @ command. There are two ways to call this command from a login script:

- Using UNC Syntax. You can use the Universal Naming Convention syntax to specify the server name, volume, and path to the ACU install directory. For this syntax, place two backslashes (\\) before the server name and then separate the volume name and all subsequent directory names with a single backslash (\).

  For example, if you copied the ACU files to the `\C32WIN95` directory under `SYS:PUBLIC\CLIENT` on server SRV1, the line in the login script would appear as follows:

  ```
  @\\srv1\sys\public\client\c32win95\setup.exe /acu
  ```

  Note: Be sure to use the @ command and not the # command in the login script. The @ command allows other processes to run besides the login script and avoids problems with the workstation hanging when you run `SETUP /ACU` from a login script.

- Mapping a Drive. You can map a drive to the ACU install directory and call SETUP.EXE from that drive.

  For example, if you map drive G to `SYS:PUBLIC\CLIENT\C32WIN95` on server SRV1, the line in the login script would appear as follows:

  ```
  G:SETUP.EXE /ACU
  ```

Whichever format you use for this command, make sure you put it in the correct login script:

- For workstations running Bindery-based client software (such as the Microsoft Client for NetWare Networks that ships with Windows 95), or bindery emulation on a NetWare 4.x server, you'll use the *system* login script (NET$LOG.DAT in the PUBLIC directory). Or you can use individual user login scripts, which are contained in the LOGIN files in each user's mail directory. These scripts are accessed from the SYSCON utility.

- For workstations running Directory Services-based client software (such as previous versions of NetWare Client 32 for Windows 95) on a NetWare 4.x network, you can use either a *container* or a *profile* login script. These scripts are accessed using either NetWare Administrator (NWAdmin) or the NETADMIN utility.

Once you have modified the appropriate login script(s), you have completed the administrative steps necessary to upgrade all the workstation running Windows 95 to the latest version of Client 32 for Windows 95.

Running the Automatic Client Update

The Automatic Client Update process is initiated when users log in and run the login script into which you have inserted the `SETUP /ACU` command. To give you better idea of how ACU works, let's look at an example. Suppose you have ten Windows 95 workstations on your single-server network. These workstations are all running the initial release of Client 32 for Windows 95. You have just downloaded the

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latest Client 32 software update (v2.11 as of this writing) and you want to upgrade all ten workstations to this new version of Client 32 for Windows 95. The workstations are all located in an Organization (O) container named "Novell" in your NetWare 4 NDS tree.

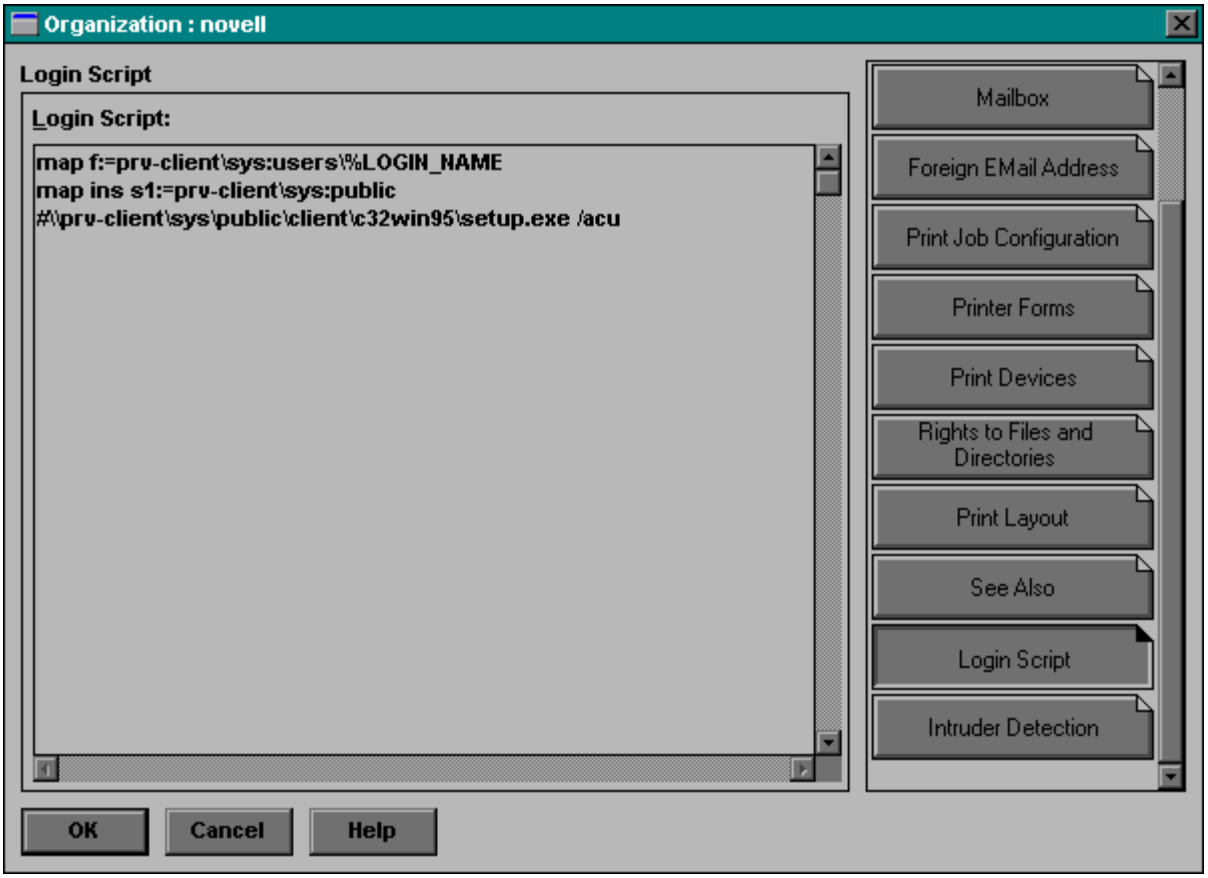
1. Follow the instructions that come with the Client 32 update to copy all new or updated files to your ACU installation directory. When you are finished, this directory should contain all the files necessary to run the Client 32 SETUP program, including the updated `SETUP.EXE` and `NWSETUP.INI` files. For this example, the ACU directory is `SYS:PUBLIC\CLIENT\C32WIN95`.

2. Using a text editor, open the `NWSETUP.INI` file and scroll down until you find the [ClientVersion] heading. Note that the line under this heading reads "Version=1.1.1.0". Since this is a higher version than "0.1.0.0" which was stored in the Registry on the Windows 95 workstations when you first installed Client 32 for Windows 95, you don't need to change anything.

   Leave both settings under the [ACUoptions] heading set to the default of NO.

3. Place the `SETUP /ACU` command in the appropriate login script. In this example, the `SETUP /ACU` command is inserted into the container login script for the Organization named "novell" (see Figure 4).

Figure 4: Example of the SETUP /ACU command inserted into a container login script.



The next time a Windows 95 workstation user logs in, the login script will be processed as usual. When the `SETUP /ACU` command is run, it compares the settings in `NWSETUP.INI` with those listed in the workstation's Registry. In this case, ACU detects a higher version in `NWSETUP.INI` than in the Registry, so

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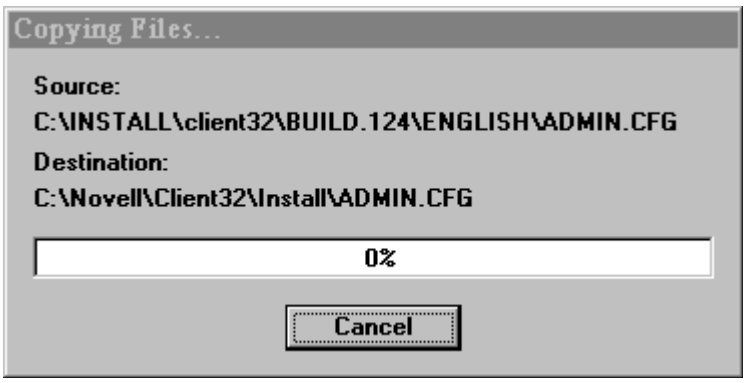
the ACU process is activated.

A progress indicator is displayed as the newer files are copied:



Before ACU finishes, it changes the settings in the Registry to match those in the NWSETUP.INI file. After the workstation is rebooted, the login script is processed again. This time, the Automatic Client Update will not be activated because SETUP.EXE detects that the Registry now contains the same settings as NWSETUP.INI.

Other Uses for ACU

Updating Individual Files with ACU

In some cases, you may want to update one or more individual files without upgrading the entire client software. For example, suppose Novell releases a new version of LOGINW95.EXE and you decide that all your Windows 95 users need the additional functionality provided in this update. Because this isn't a new version of Client 32 for Windows 95, no new NWSETUP.INI file is provided with different client version numbers. However, you can force the ACU process to run by changing the Level setting.

To do this, open the current NWSETUP.INI file in a text editor and change the Level number so that it is higher than it was when you first opened the file. For example, if the Level number is 0, make it a 1. Make sure you copy the new LOGINW95.EXE file (or any other files, such as LAN drivers, that you want to update) into your ACU installation directory. The next time your users log in, ACU will detect a higher Level setting and rerun SETUP.EXE to copy the newer Client 32 files to the workstation.

Upgrading to 32-bit ODI LAN Drivers

You can use ACU to automate an upgrade from a 16-bit LAN driver configuration to a 32-bit ODI driver. Here are the steps:

1. With a text editor, open the NWSETUP.INI file (located in the same directory as the Client 32 for Windows 95 SETUP.EXE program).

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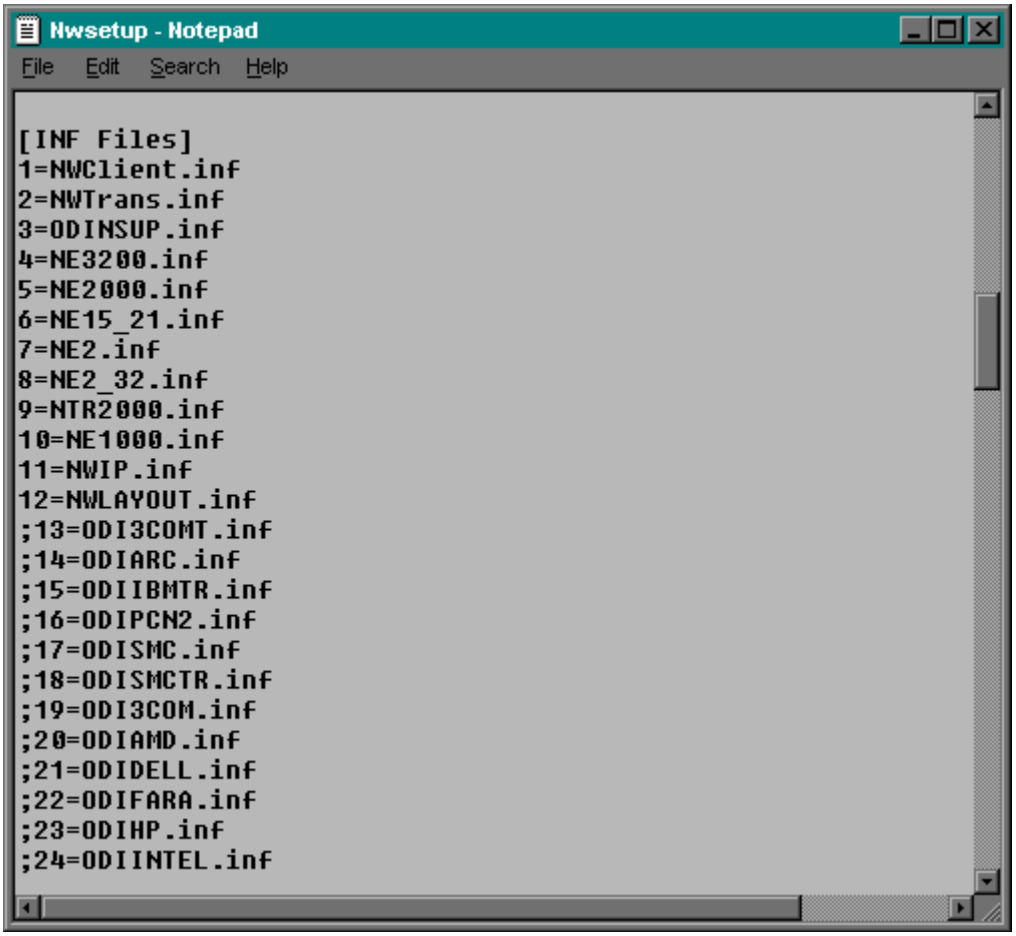

2. Find the line under the [INF Files] heading that corresponds to your network adapter. For example, if you have a 3Com EtherLink III adapter, the line is:

   ```
   ;19=ODI3COM.inf
   ```

   Remove the semicolon (;) from the line. This causes SETUP.EXE to copy that INF file to the `C:\WINDOWS\INF` directory, where it can be used to install and configure the 32-bit ODI driver.

3. Copy the 32-bit driver *.LAN file (such as 3C5X9.LAN) to the ACU install directory (`SYS:PUBLIC\CLIENT\C32WIN95`).

4. Add the "/o" command line parameter to the login script command that calls SETUP, as in the following example:

   ```
   @\\prv-client\sys\public\client\c32win95\setup.exe /acu /o
   ```

   The "/o" parameter instructs SETUP to override the NDIS default and install Client 32 with a 32-bit ODI driver.

   Note: Don't use the "/o" parameter unless you know that no workstations that will run ACU need NDIS. Otherwise, the workstations may lose their access to the network.

Running ACU via NAL

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Although ACU is normally run from a login script, it doesn't have to be. If the workstation can be manually rebooted after the installation of the new client software has completed successfully, you can use the Novell Application Launcher (NAL) utility to run ACU. You'll need to set up an application object within NDS that executes `SETUP /ACU` and assign users to the application object. If you want ACU to run automatically, assign the application to users as "launched automatically" rather than a "launched by user" application. (For more information on NAM, refer to "Using the Novell Application Launcher (NAL) Utility with Client 32 for Windows 95" in this issue.)

Summary

When the costs of owning a network are analyzed, the price of the network operating system is only a small part. The biggest percentage of the total cost of owning a network is administration costs. Novell is committed to reducing these costs by providing tools and technologies to ease the administrative burden of setting up and maintaining the network. Automatic Client Update is just one example of this commitment. It can significantly reduce the time and effort required to upgrade workstations when new versions of client software are released.

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NOVELL® RESEARCH

Configuring NetWare Client 32 for Windows 95

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Numerous options and parameters are available for configuring NetWare Client 32 for Windows 95, both during an installation or upgrade and afterwards. This AppNote describes some of the more common configurations for Client 32.

With the growing number of networks that are being connected to TCP/IP to access resources on the Internet, configuring NetWare Client 32 for TCP/IP and NetWare/IP is a common requirement. In addition, many network administrators have questions about how to integrate Client 32 with a Dynamic Host Configuration Protocol (DHCP) or Boot Protocol (BootP) server to automate the assignment of dynamic IP addresses. These issues are discussed in the first section of this AppNote.

NetWare Client 32 for Windows 95 supports the Dial-Up Networking capabilities in Windows 95. This allows remote users to access the network through a modem connection to remote access servers such as Novell's NetWare Connect or the Remote Access Server (RAS) in Windows 95. The second section of this AppNote describes how to configure Client 32 for Windows 95 for remote user access.

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In certain environments, administrators need control over the users' desktop configurations. Windows 95 includes an administrative feature called System Policies to establish set configurations that can be applied to individual users, groups of users, or specific computers. The third section of this AppNote tells how to manage and control the configuration of NetWare Client 32 for Windows 95 workstations through System Policies.

The AppNote concludes with a discussion of how to configure one of Client 32's most innovative features: workstation file caching.

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TCP/IP and NetWare/IP Configuration

NetWare Client 32 for Windows 95 does not come with a TCP/IP stack, but it is fully compatible with any TDI-compliant protocol stack. If you need TCP/IP support, you'll need to install the Microsoft TCP/IP protocol stack (`TCPIP.VXD`) or another TDI-compliant TCP/IP stack. (A NetWare TCP/IP stack is planned for a future Client 32 release.)

Client 32 does come with the NetWare/IP protocol, which requires that the Microsoft TCP/IP stack be installed. NetWare/IP replaces the IPX protocol (which provides the transport in the native NetWare environment) with the TCP/IP protocol. This is done by "wrapping" IPX packets inside of IP packets. You cannot simultaneously access NetWare servers over IP and IPX. However, a NetWare/IP server can be set up as an IP-to-IPX gateway so that all IPX SAPs are propagated to the DSS server. This makes it possible for NetWare/IP clients to access IPX servers.

In NetWare Client 32 for Windows 95, NetWare/IP can be configured with either DHCP or BootP. However, configuration via DHCP or BootP is dependent on the TCP/IP stack used. Currently, Client 32 uses the Microsoft TCP/IP stack that ships with Windows 95. This version of TCP/IP uses DHCP for configuration setup.

Novell provides a DHCP server with NetWare/IP v2.2 in the form of DHCPSRVR.NLM (current version is v2.0B). This NLM can be loaded on any NetWare 4.x server, including servers that provide DNS and DSS information. It can answer both DHCP and BootP requests.

Since some of the NetWare/IP parameters are Novell-specific, the DHCP server must be capable of providing this information. Novell's DHCP server provides a DHCPCFG.NLM utility for writing the configuration information to the DHCP server database. (Future versions may include a Snap-In DLL for the NetWare Administrator utility.) In addition to providing the standard IP information (leasing of an IP address, subnet mask, IP gateway, DNS domain name and up to three server names), Novell's DHCP server can also distribute information specific to NetWare/IP, such as NetWare/IP domain, NSQ broadcast, up to five nearest NetWare/IP servers, and up to five preferred DSSes. Lastly, Novell's DHCP can provide NetBIOS Name Server Information (also known as WINS) and NetBIOS node types b, p, h, and m.

Both DHCP and BootP clients can use Novell's DHCP server. BootP clients (such as those running Novell's 16-bit TCP/IP stack) can even obtain an IP address lease from the DHCP server and receive NetWare/IP information. Windows 95 clients can also receive all information, including both WINS and NetWare/IP-specific information, from a NetWare/IP DHCP server.

The following sections give a brief overview on how to configure and troubleshoot NetWare/IP on systems running Microsoft Windows 95 and NetWare Client 32 for Windows 95.

Note: This discussion is only concerned with installing and configuring NetWare/IP client software on a Windows 95 workstation. Information on configuring NetWare/IP on a NetWare server is beyond the scope of this document. For more information on server configuration, consult the electronic manuals integrated within the product.

Setting Up TCP/IP on a Windows 95 Workstation

For NetWare/IP access, you will need to make sure the following parameters are set correctly via either a manual or automatic configuration:

- IP address
- Subnet mask
- Gateway (default router)
- DNS domain
- DNS server

1. If the Microsoft TCP/IP stack is not already installed on your system (if you don't see it listed in Control Panel's Network Configuration window), install it now by selecting the following under Control Panel | Networks:

   ```
   Add  -> Protocol  -> Microsoft  -> TCP/IP
   ```

2. Once TCP/IP is installed, highlight it in Control Panel | Networks and click on **Properties**. You have two choices: to manually assign all IP configuration information yourself (specify an IP address) or to get this information automatically from a DHCP server (obtain an IP address automatically). If you choose to get this information automatically, skip the rest of this section and go to "Setting Up NetWare/IP."

3. Enter the IP address for your gateway (default router) in the Gateway page of the TCP/IP Properties dialog box.

4. Add your DNS Domain Name and the DNS Server IP address (to the DNS Server Search Order) via the DNS configuration page of the TCP/IP Properties dialog.

Setting Up NetWare/IP

1. If "Novell NetWare/IP Protocol" is not already installed (if you don't see it listed in Control Panel's Network Configuration window), install it by selecting the following under Control Panel | Networks:

   ```
   Add -> Protocol -> Novell -> Novell NetWare/IP Protocol
   ```

2. Once "Novell NetWare/IP Protocol" is installed, highlight it and click on **Properties**. As with the TCP/IP configuration, you have the option of manually configuring the NetWare/IP parameters (Custom configura tion) or getting these parameters automatically from a preconfigured DHCP server (Auto detect configuration). If you choose manual, enter your NetWare/IP domain name via the Parameters page of the NetWare/IP Protocol Properties dialog box.

Post-Installation Checks

After completing the previous two procedures (TCP/IP and Novell NetWare/IP Protocol setup), you should see the following items listed in Control Panel | Network | Configuration:

- Novell NetWare Client 32
- LAN Adapter/Driver (for example, NE2000)

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- IPX 32-bit Protocol for Novell NetWare Client 32
- IPX/SPX-compatible Protocol
- Novell NetWare/IP Protocol
- TCP/IP

Also verify that the "Bindings" option in TCP/IP Properties (*not* the bindings option of NetWare/IP) has "Novell NetWare/IP Protocol" enabled.

Basic Troubleshooting

Following are some basic troubleshooting steps you can take if you encounter problems with your TCP/IP and NetWare/IP configuration.

1. Verify that you can ping all hosts on your network.
    - If you cannot ping *any* IP addresses, verify the TCP/IP parameters with the WINIPCFG utility, which can be found in the Windows 95 directory.
    - If you can ping the IP hosts on your local segment but no IP hosts on a remote segment, check the state of your IP routing table with the NETSTAT command. You should have a default route entry of 0.0.0.0 in the table, with the next hop being the IP address of an IP router connected to your segment.
    - If you can ping local hosts and the IP address of the remote interface in your TCP/IP router, check the routing table of the remote host that you are pinging to see if it includes a route to your local segment.
2. Verify that the DNS name resolution is working.
    - Assuming that you can ping all hosts on the network with their IP address, make sure that you can also ping these addresses using host names. If you cannot, make sure that your DNS client resolver points to the correct DNS server and that the DNS domain is correctly specified (see Step 4 under "Setting Up TCP/IP", above).
3. Verify that the NetWare/IP client driver is loading successfully.
    - When configuring the NetWare/IP network driver, enable the "VERBOSE" option. This option writes information to the NIOS.LOG file located in the `\NOVELL\CLIENT32` directory. By default the NIOS.LOG file is *not* created. To enable it, add the following line to the `\WINDOWS\SYSTEM.INI` file under the [386Enh] heading:

      ```
      NWEnableLogging=TRUE
      ```

    - If the driver fails to load, it is most likely because a DSS server cannot be contacted and the DSS parameters cannot be obtained. Check the following:
        a. The DNS server is set up with a separate NetWare/IP domain containing all registered DSS servers for that domain.
        b. The PREFERRED DSS parameter is configured with the IP address or hostname of a DSS server in your NetWare/IP domain.
        c. With NetWare/IP 2.2, it is possible to get access to the DSS parameters without contacting the DSS server directly, assuming that the NetWare/IP server has contacted a DSS server at least once before. In this case, specify a NEAREST NWIP SERVER and disable the

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NSQ_BROADCAST parameter in your Windows 95 NetWare/IP configuration options.

4. Verify that you can contact the NetWare/IP server.

   - If the NetWare/IP driver loads successfully but you cannot contact a NetWare/IP server, check the following:

     a. The correct frame type is running on the NetWare/IP server (ETHERNET_II or ETHERNET_SNAP).

     b. NLSP is *not* activated on your NetWare/IP server.

     c. The DSS and NWIP databases contain an entry for the NetWare/IP server that you are trying to connect to. This can be done by loading the following two modules on the NetWare server and checking the output files generated:

     ```
     load DSSDBDMP
     load NWIPDUMP
     ```

     d. With the DISPLAY SERVERS command, check whether all the other servers in the network are receiving SAP updates from the "problem" server. If the problem server fails to appear in any of the SAP tables of the other servers, try the following:

        - Look at the SAP information of this server (via IPXCON in NetWare 4.1x, the DISPLAY SERVERS command on the server console, or by using the NetWare/IP DSSDBDMP module). If it is blank, the SAP database is not being updated.
        - Try resetting the SAP database with the RESET ROUTER console command
        - Try stopping and starting all NetWare/IP services by rebooting the servers.
        - Reset the DSS database by loading the module with the /RESETDB option (`LOAD DSS /RESETDB`)
        - The problem could possibly be related to a corrupt Btrieve database. The Btrieve database files (`NWIPRIP.BTR` and `NWIPSAP.BTR`) are located in the `SYS:ETC` directory. Try reinstalling these files from the original source.

Client 32 Dial-Up Installation

Dial-Up Networking allows mobile users to attach to a network and work as if they were directly connected. Through Dial-Up Networking, remote connec tions can be made to remote access servers such as Novell's NetWare Connect and the Remote Access Server (RAS) in Windows 95 and Windows NT.

This section shows the basic installation steps to configure a Windows 95 Client Dial-Up adapter. It also provides basic information on setting up a NetWare Connect 2.0 server to work with Client 32 and Dial-Up Networking.

Before proceeding with a Client 32 dial-up installation, you should be familiar with the following terms:

PPP	Point-to-Point Protocol
SLIP	Serial Line Internet Protocol
RAS	Remote Access Server
NRN	NetWare Remote Node
RNS	Remote Node Service

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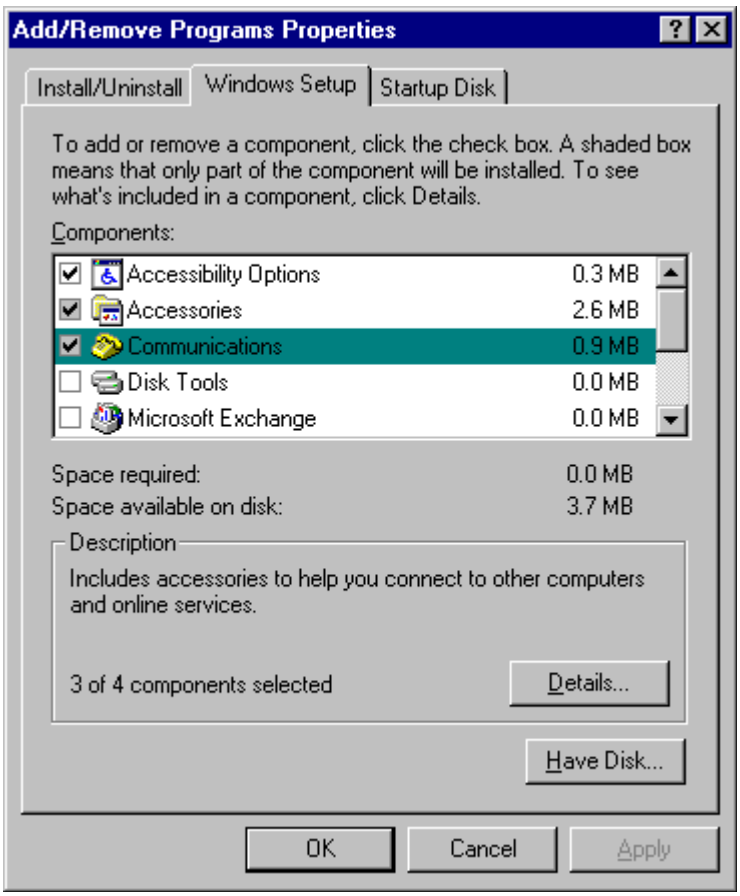
If you need more information, refer to the Windows 95 and NetWare Connect documentation.

Installing a Dial-Up Adapter

To install a dial-up adater in the Client 32 workstation, follow these steps.

1. In Windows 95, select My Computer | Control Panel | Add/Remove Programs. Click on the Windows Setup tab.
2. Double-click on "Communications" in the list of components.



3. Check Dial-Up Networking, as shown below:

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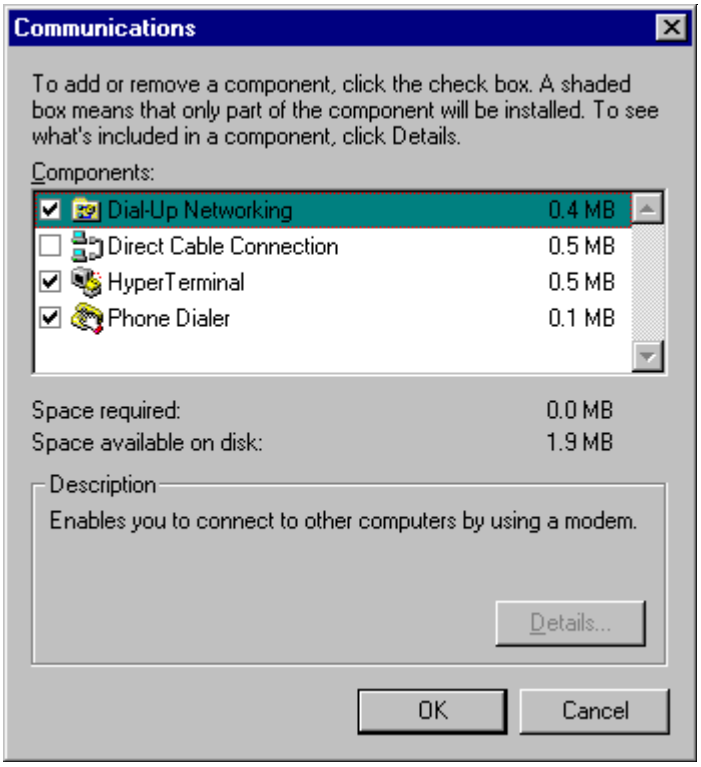

Click on **OK** to close the Communications dialog box, then click on **OK** again to proceed with copying the necessary files. Be sure you have the proper Windows 95 diskettes/CD-ROM/network drive mapping in place so you can provide the path to the Windows 95 *.CAB files. The Dial-Up Adapter will be added to the Network Properties list.

4. Refresh My Computer by closing and reopening the icon. You will see a Dial-Up Networking folder as one of the objects in the My Computer window. Double-click on this folder to open it. You will see a Make New Connection icon, as shown below:

5. Double-click on the Make New Connection icon to install a modem. The following screen will appear:

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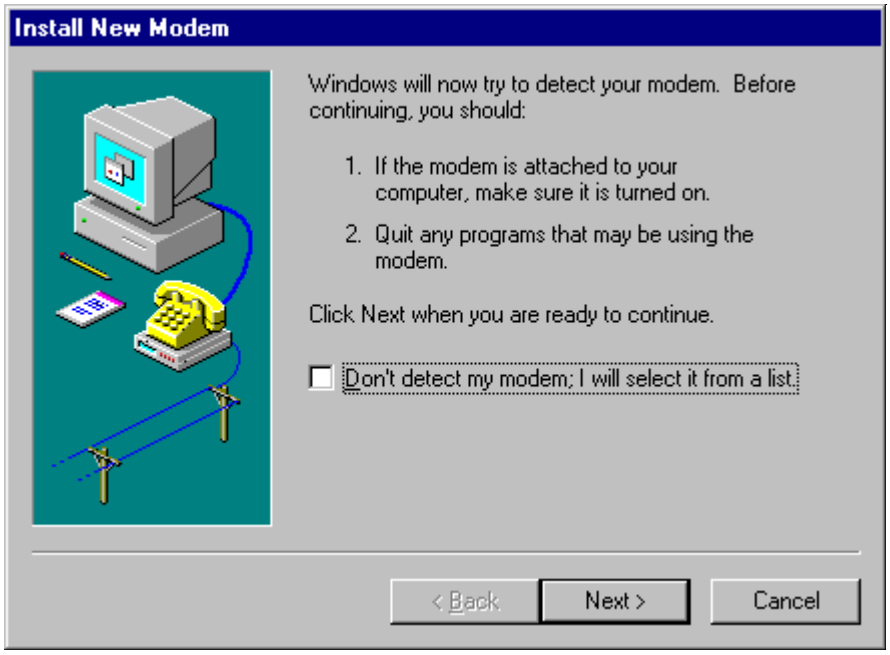
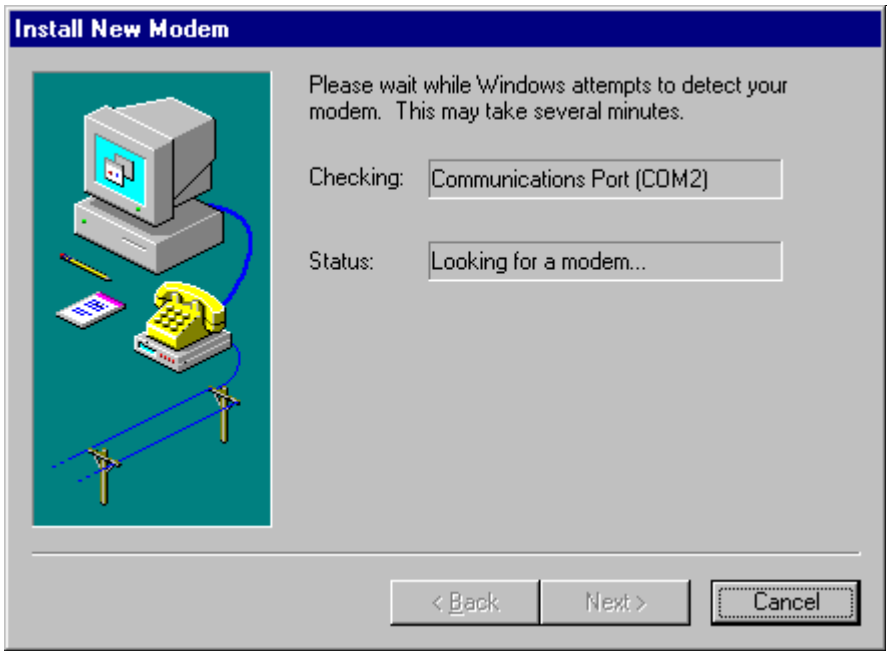


6. If this is a first-time installation, click on **Next>** to have Windows 95 detect your modem. (If you already have a modem installed, check the box to select your modem from a list and then click **Next>**. These steps assume a first-time installation.)

   A window similar to the following is displayed while Windows 95 looks for a modem:



7. The modem that was automatically detected will be displayed as shown in the sample dialog box below. If necessary, make changes to the Manufacturer and Model to match the modem you have

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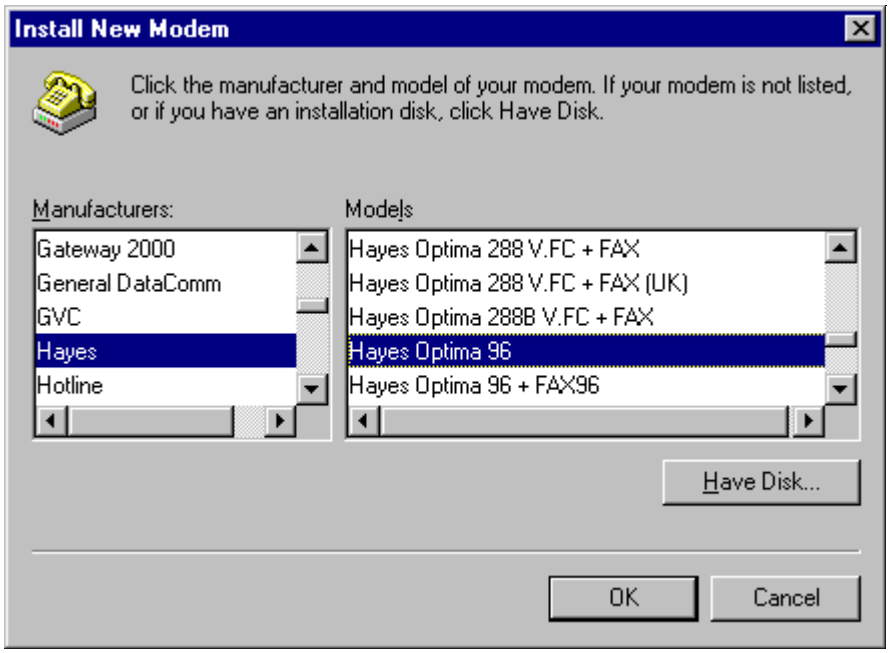
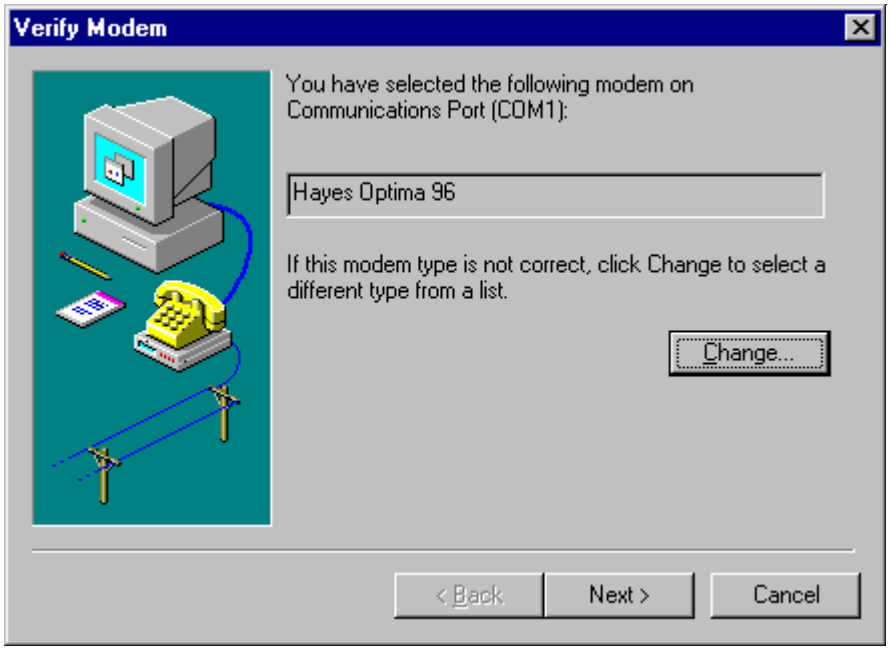
installed.



Click on **OK** to continue.

8. Verify the modem you have selected and click on **Next >**.



9. When the modem installation is completed, the following screen is displayed:

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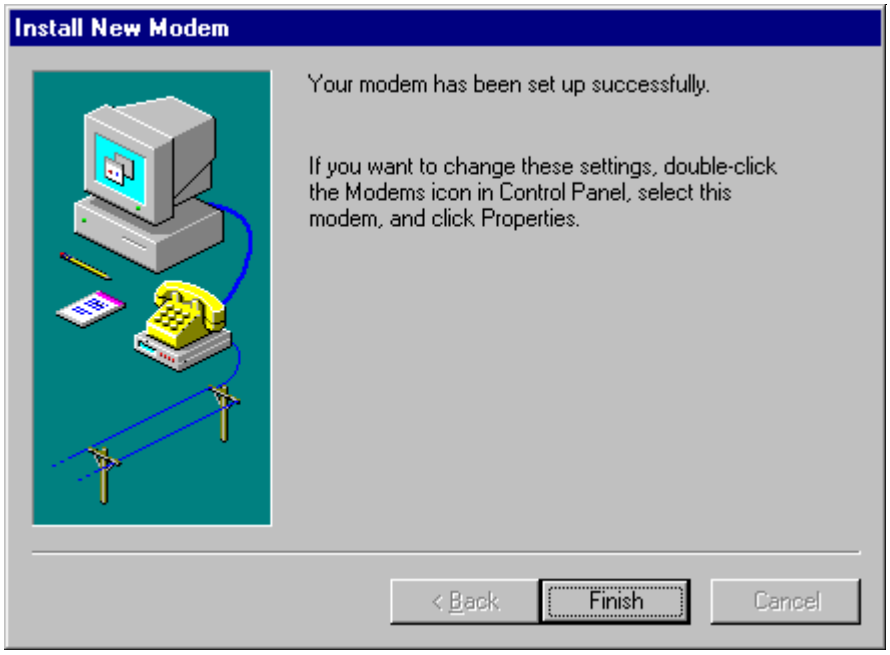
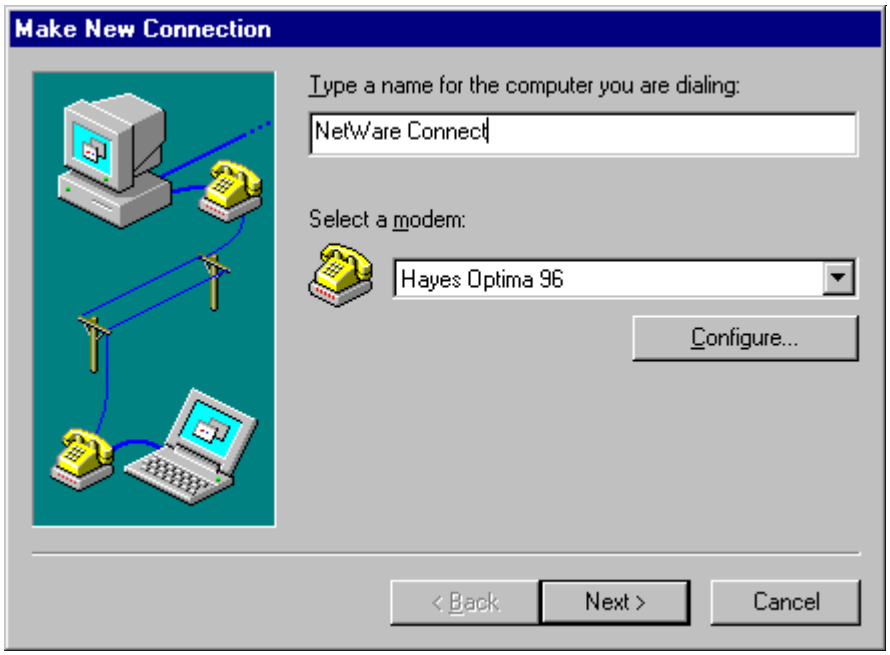


Click on **Finish**.

10. Enter a descriptive name for the type of computer connection you are dialing up. The default name is "My Connection". In the example below, we have entered "NetWare Connect".



Click on **Next >**.

11. Enter the Telephone Number and Country Code for the computer you want to call:

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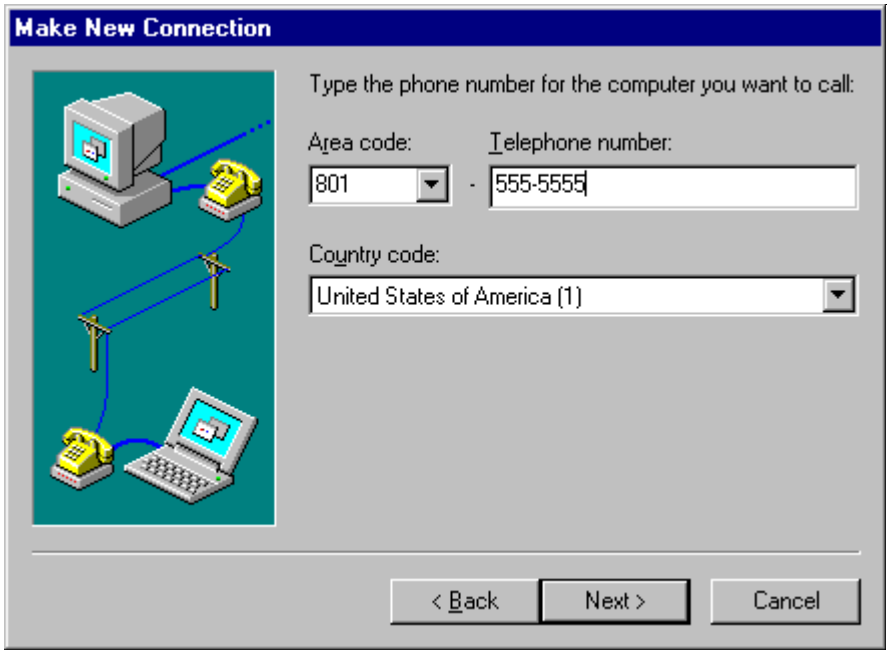


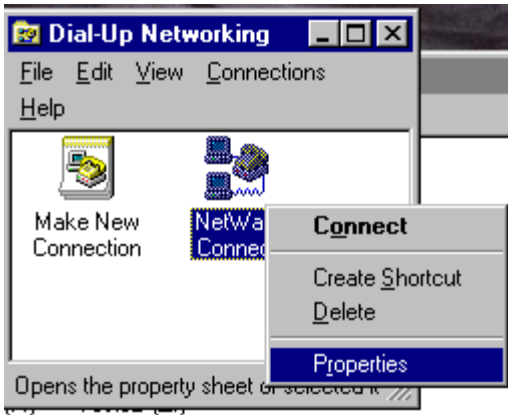
Click on **Next >**.

A new icon is created in the Dial-Up Networking folder for the connection you just defined. The name of this icon is the descriptive name you entered in Step 10.

Configuring the Dial-Up Connection

To configure the newly-created dial-up connection, proceed as follows.

1. Right-click on the newly-created icon and select Properties.



2. From the "General" page, click on **Server Type** to configure the Dial-Up server.

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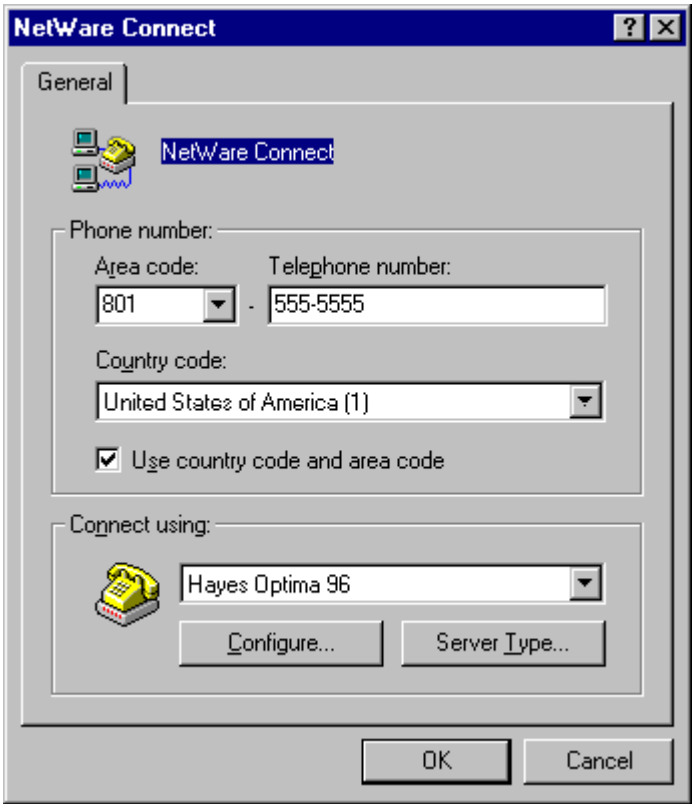

3. Click on the down-arrow next to "Type of Dial-Up Server" to see a list of choices similar to the following:

   NRN: NetWare Connect
   PPP: Windows 95, Windows NT 3.5, Internet
   Windows for Workgroups and NT 3.1

   Select the type of dial-up server you will use for this connection.

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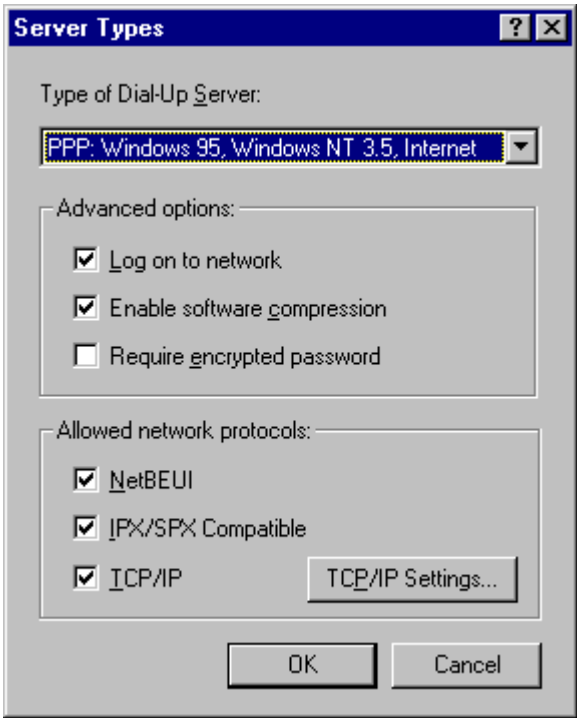

Set the other options as follows:

- Check "Log on to network " if you want to execute the network login utility upon establishing the dial-up connection.
- Under "Allowed Network Protocols", check the protocols you want to use. These must be supported and configured on the Dial-Up server.
- If needed, click on **TCP/IP Settings** to configure TCP/IP. These settings will depend on how the Dial-Up server is configured. You can use either a server-assigned IP address or specify an IP adddress. If you choose to specify an IP address, fill in the address. If you choose a name server-assigned address, you'll need to provide the appropriate information for Primary/Secondary DNS and Primary/Secondary WINS.

You can also specify IP Header Compression (default is On), as well as a default gateway on the remote network.

Using the Dial-Up Connection

To use the dial-up connection that has been created and configured, go back to the Dial-Up Networking folder and double-click on the icon you created. A screen similar to the following is displayed:

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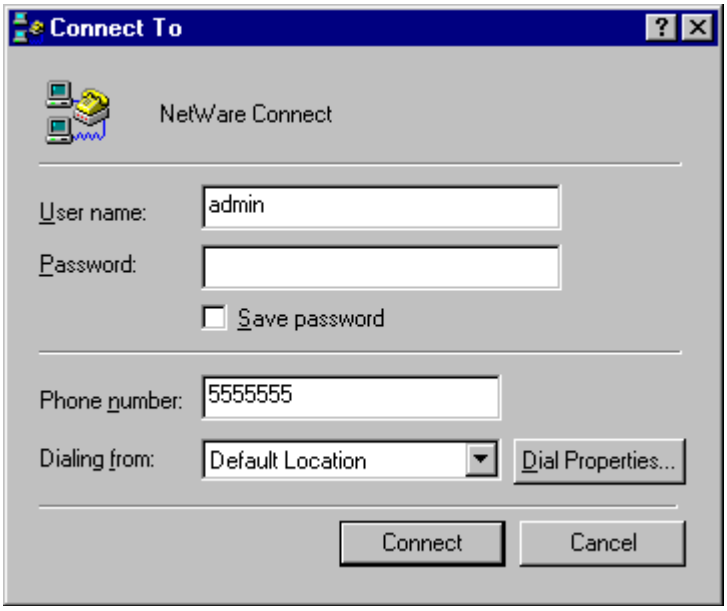

Enter the user name and password if needed to connect to the Dial-Up server.

Note: If you are connected to NetWare servers via a local network connection, you will be forced to log out before establishing the dial-up connection. Windows 95 displays the following message:

```
You are currently using NetWare servers which will be inaccessible if you
establish this connection. Click OK to continue dialing. Click Cancel if you
do not want to dial at this time.
```

If you do not log out of the network before you run the dial-up connect, you stand a good chance of corrupting the Registry entries for your network connection. When this happens, you must remove all of your network connection information and add it again. In extreme cases, you have to reinstall Client 32 before you can once again establish a network connection.

If the "Login to network" option has been enabled, the network login screen will appear and prompt for the network username and password.

Once the connection to the Dial-Up server has been established, you can use the Details button on the connection to see the server connection type and the protocols the connection has provided.

Preparing a NetWare Connect Server

This section gives information on how to enable a remote Windows 95 workstation to connect to a NetWare Connect server using the "NRN: NetWare Connect" option that comes with Windows 95 Dial-Up Networking.

Note: For additional information, obtain the file NWCINF. EXE (last updated 02/27/96). This file contains several readme text files that explain issues and patches needed to set up NetWare Connect to work with Windows 95. NWCINF.EXE is available from NetWire on CompuServe in NWGENFIL Library 3. It is also available on the World Wide Web at http://support.novell.com. More detailed information is also given in Novell FaxBack Document #200996 (call

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801-861-7642).

Server Tasks

The dial-up server must be a dedicated remote server running NetWare Connect version 2.0.25 or later (no other products installed). To upgrade to this version from version 2.0.18, install the patches NWC201.EXE and NWC202.EXE. Instructions for installing these patches can be found in the NWC201.TXT file provided in NWC201.EXE and in the NWCINF.EXE file.

If you have NetWare Connect 1.0 and RNS on your server and you upgrade to NetWare Connect 2.0, you have the option to retain RNS as a service on NetWare Connect 2.0. However, if you delete and reinstall NetWare Connect 2.0, RNS is no longer listed as an install option. To manually add RNS services to NetWare Connect 2.0, follow these steps:

1. Copy the following files from your NetWare Connect 2.0 disks to SYS:SYSTEM (if they are not already present):

Filename	Source
RNS.LAN	Disk 8
RNSNCF.NLM	Disk 8
RNSNCF.HLP	Disk 8 \nls\4
RNSNCF.MSG	Disk8 \nls\4
RNS.DEF	Disk 8 \connect (copy to SYS:SYSTEM\CONNECT)
SVCS.DEF	Disk 8 \connect
SVCDEF.MSG	Disk 9 \nls\4
SVCDEF.NLM	Disk 9 \nw3x (for NetWare 3.x servers)
SVCDEF.NLM	Disk 9 \nw4x (for NetWare 4.x servers)

2. After copying these files, run the following command:

```
LOAD SVCDEF SYS:\SYSTEM\CONNECT\RNS.DEF
```

Now when you load NWCCON, you will see RNS listed as a loadable/ configurable service.

If you want to establish an IP connection with the client, the PPPRNS service must be running on the server. In addition to starting the service, you need to execute the command `SET PPPTSM CALLBACK = OFF`. With this setting, all dial-back numbers must be set at the server. Roaming users will be able to use the dial-up connection only from one of these preconfigured numbers.

For security, enable the Password Authentication Protocol (PAP) or CHAP and make sure remote client passwords are set. PAP is enabled through the NWCCON utility (select these menu options: Configure NetWare Connect, Services, PPPRNS, Configure Security). PAP uses the remote client password, which is set through NWCCON or SETREMPW.

If you want to establish an IPX connection, the RNS service must be installed and running on the server. The file `RNS.TXT` (found in `NWCINF.EXE`) lists the steps for installing this service. Once RNS is installed, you need to activate it using a frame type of Ethernet 802.3 and a unique IPX address. (Using Ethernet 802.2 frames may work under certain circumstances, but it didn't perform consistently when tested at Novell under lab conditions.)

Finally, add the following lines to the server's `AUTOEXEC.NCF` file:

```
LOAD IPXNLP
LOAD DHCPD
```

Client Tasks

To configure a workstation running NetWare Client 32 for Windows 95, follow the general procedure given

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earlier in this AppNote for adding dial-up networking support. When you create the new Dial-Up Networking connection, uncheck NetBEUI and check either IPX or TCP/IP or both, depending on need. For TCP/IP, enter the appropriate DNS information. If dynamic IP addressing will be used, let the server set the address.

Check the "Logon to network" box if you want the logon window to appear so users can log in upon establishing the dial-up connection.

Managing Client 32 Settings through System Policies

System Policies significantly increase the level of control and manageability that administrators can have over the network. Using system policies, administrators can restrict user access to the Control Panel, customize desktop configurations, determine software settings, restrict users from unauthorized applications, and so on. System policies can be divided into three categories:

- User system policies
- Group system policies
- Computer system policies

Note: Client 32 for Windows 95 v1.0 supported only User and Computer system policies. Support for Group system policies has been added in later releases.

This section demonstrates how to use System Policies to manage Windows 95 workstations running NetWare Client 32 for Windows 95. (For more general information on using System Policies, refer to the Windows 95 Resource Kit on the Windows 95 CD-ROM.)

Overview of System Policies

System Policies are used to mandate Registry settings for Windows 95 workstations. These settings are defined with a System Policy Editor (`POLEDIT.EXE`) and stored in a policy file (`CONFIG.POL`). When a Windows 95 workstation logs into a NetWare file server, it automatically checks the `SYS:PUBLIC` directory for system policy (*.POL) files. If any such files are found, the workstation copies the settings from the policy file to the `USER.DAT` and `SYSTEM.DAT` files in its Registry, thus overwriting any settings that may already be defined.

The `SYSTEM.DAT` file contains settings defined for a specific computer or for the default computer. The `USER.DAT` file contains policy settings defined for a specific user or for the default user. In a bindery-only environment, the `USER.DAT` file is stored in the `SYS:MAIL` directory of the preferred server for each user. In an NDS environment, however, the MAIL directory only exists if bindery emulation is running. Administrators of NDS environments must specify the path for the `USER.DAT` file in the Home Directory attribute of the NDS user profile. This can be done through NWAdmin by choosing a user, clicking on the Environment tab, and entering a Home Directory for the user.

Policy files are created from a policy template with an .ADM extension. Microsoft provides a template called `ADMIN.ADM` which contains policies for administering the Windows 95 desktop and configuration. The customized policy template that comes with NetWare Client 32 for Windows 95 is called `CLIENT32.ADM`. You can combine settings from both templates, if desired.

Policies can be implemented for either automatic or manual download. This is set through the Computer-specific settings when using the `ADMIN.ADM` template in the POLEDIT utility. For manual download, the location of the policy file is defined in the local computer's Registry. When the user logs in to the network, the computer will go to this specified location and download the defined policies. For automatic

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download, the policy file must be named CONFIG.POL and placed in the SYS:PUBLIC directory on the preferred server where all users will have access to it. If no preferred server is specified, the policy file in the SYS:PUBLIC directory of the server with the first connection is used.

When a policy file is created, it is possible to designate within the file policy settings that pertain to particular users, groups, or computers. Thus only the designated users or computers will implement the defined policies. If you plan to have user or group policies, you must enable User Profiles on each workstation. This can be done through the Control Panel | Passwords | User Profiles tab. Click on "Users can customize their preferences and desktop settings."

For Group Policies to work with Client 32, you must either install the Client 32 software that ships with NetWare 4.11 or apply patch C3295D.EXE or later (which includes a NWGROUP.DLL file from Novell). Also, group policies need to be installed on each workstation. To do this, follow these steps:

1. In Windows 95, open Control Panel and select Add/Remove Programs. Click on the Windows Setup tab, and then click Have Disk.

2. In the Install From Disk dialog box, click **Browse** and specify the ADMIN\APPTOOLS\POLEDIT directory on the Windows 95 CD-ROM. Click **OK** and **OK** again.

3. In the Have Disk dialog box, make sure Group Policies is checked, and then click the **Install** button.

This places the GROUPPOL.DLL file in the Windows SYSTEM directory and makes required Registry settings. To verify that this has been done, you can run Regedit and seach for GROUPPOL.DLL.

Creating System Policies Using the CLIENT32.ADM File

Here are the general steps to create your own system policy settings using the CLIENT32.ADM template file. These instructions assume you have drive W mapped to the SYS:WIN95\ADMIN\NETTOOLS\NETSETUP directory and drive Z mapped to the SYS:PUBLIC directory.

1. From within Windows 95, start the Policy Editor program by selecting Start | Run and entering the following path:

   W:\WIN95\ADMIN\NETTOOLS\NETSETUP\POLEDIT.EXE

2. Select the Client 32 administration template CLIENT32.ADM. This file is found in the W:\ADMIN\POLICY95\NLS\ENGLISH directory.

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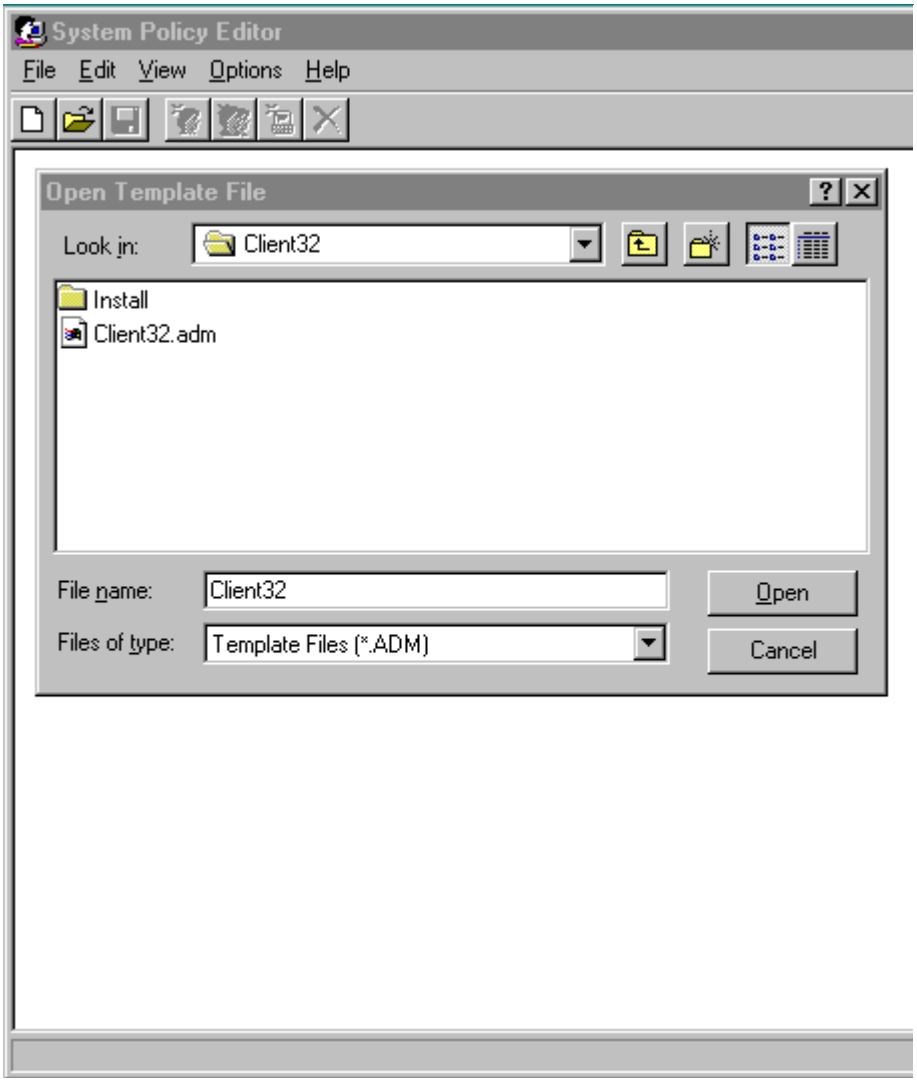

Click **Open** and wait for the template to be loaded.

3. Start a new policy file by selecting File | New File. This will automatically create the Default User and Default Computer icons, as shown below:

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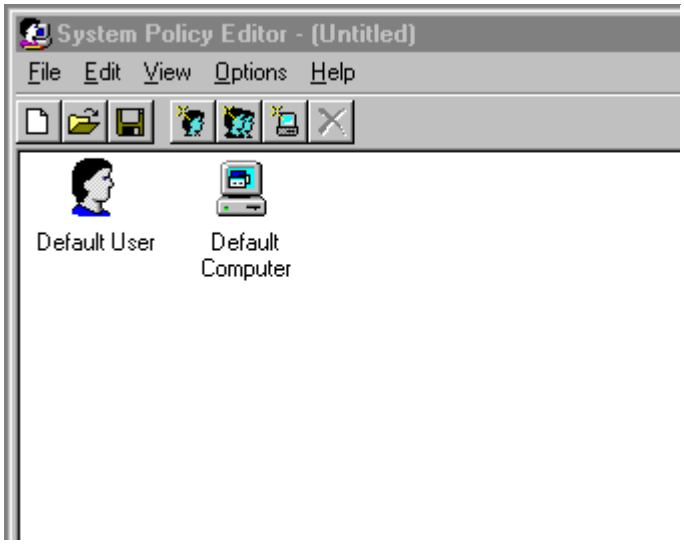
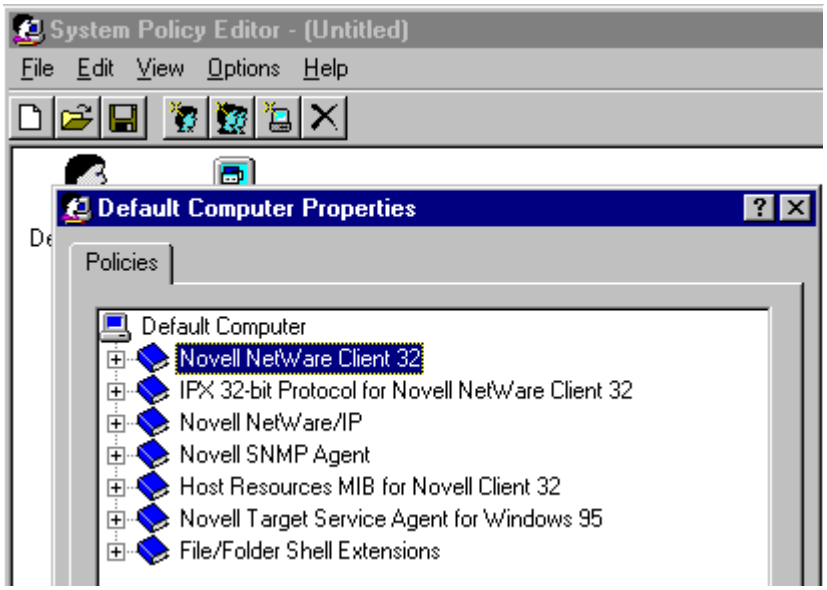


Settings defined for the default user and default computer will be applied to all users or workstations that log in to the preferred server.

4. Double-click on the Default Computer icon to open the policy template and view the Policies page. An example is shown below:



This window shows all Registry settings that can be defined on a computer-specific basis, based on the current template. These settings will be placed in the `SYSTEM.DAT` file.

To change the default policy settings, you double-click on the book icon for the appropriate category of settings. You have three options when defining a setting in the resulting dialog box:

Grayed - Initially, all Client 32 settings have a gray box in front of them. This indicates that no modifications have been made and the setting will not be changed when the user logs in.

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☑ Checked - A check indicates that the setting will be changed to "On" or to the value you specify when the user logs in. If the option was previously checked the last time the user logged on, no changes will be made.

☐ Cleared - A clear box indicates that the setting will be changed to "Off" for On/Off settings. For others, it indicates that the setting will be cleared from the Registry. If the setting was implemented previously, the previously specified settings will be cleared from the Registry.

As an example of how to make the settings, suppose you wanted to do the following:

- Change the preferred server
- Prevent users from specifying a preferred tree

To do this, you would double-click on the "Novell NetWare Client 32" book icon, and then open the Client 32 options. In the resulting list of options, check the "Preferred server" box and type the name of the new preferred server in the entry box at the bottom of the window. Clear the "Preferred Tree" box to disable this setting.

After you have done this, the settings would appear as in the following example screen:

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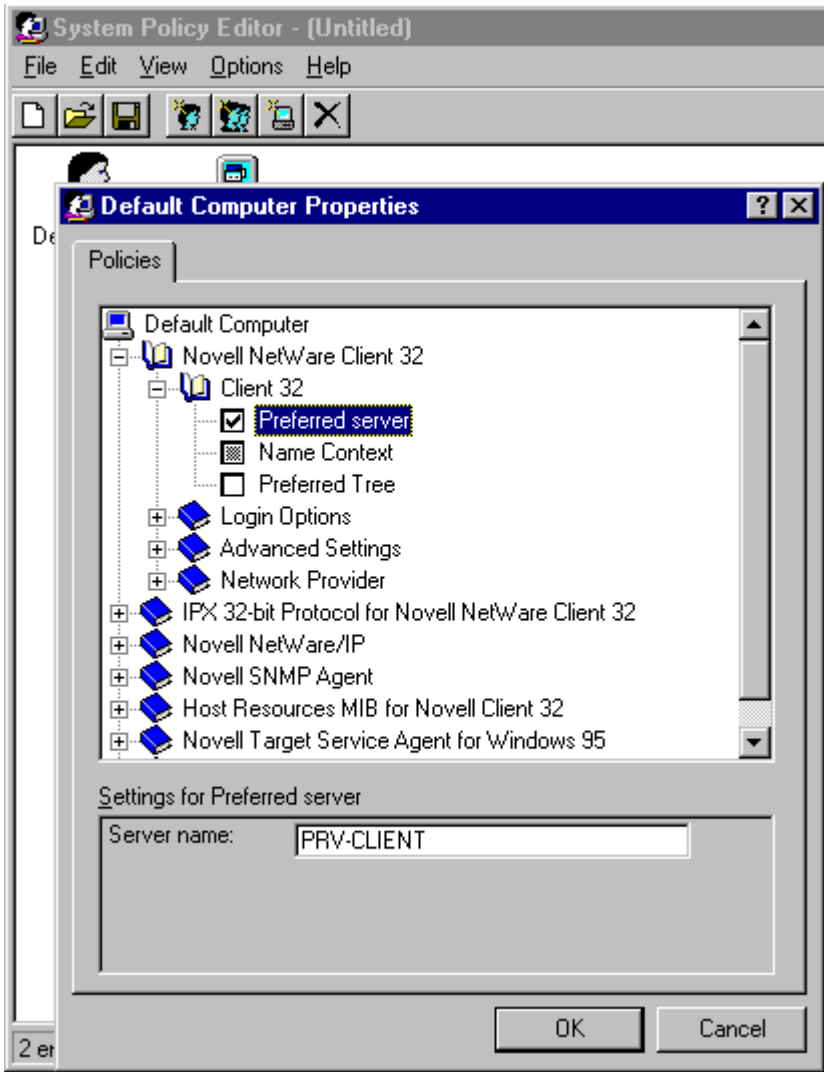

You can make your own changes to the settings in a similar manner, according to your particular situation. Click on **OK** when you are finished making changes.

5. Double-click on the Default User icon to see the Registry settings that are available to be defined on a user basis. These settings will be placed in the `USER.DAT` file. (The `CLIENT32.ADM` template does not include any user settings. If you want to make your own user settings, you will need to include the `ADMIN.ADM` template that comes with Windows 95.)

6. To create policies for specific users, click the User button on the menu bar. Type the login name of the user the policies are being created for and click **OK**. This will create a new user icon which you can open and select the settings desired.

7. To create policies for specific NetWare groups, click the Group button on the menu bar. Type the full NDS group name (for example, `group1. client.novell`) if you are using NDS, or the bindery group name if logging in as a bindery user. This will create a group icon which you can open and select the settings desired.

8. To create policies for specific computers, click the Computer button on the menu bar. Enter the

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machine name of the workstation for which the policies are being created, or click **Browse** to select a name from a list. (To find the name of the workstation, open the Network option in Control Panel and select the Identification tab.) This will create a computer icon which you can open and select the settings desired.

9. Save your changes by selecting File | Save. Name the file CONFIG.POL and save it in the SYS:PUBLIC subdirectory on your preferred server.

10. Exit the POLEDIT.EXE program.

The new system policy settings will take effect the next time the workstation is started.

Administrator Defaults and Smart Defaults

You can simplify the installation of Client 32 by specifying default values for configuration settings in a file named ADMIN.CFG. This configuration method is good for administrators who want to install and configure Client 32 at the same time, who are familiar with the NET.CFG file syntax, and who need to configure settings that can't be configured using the System Policy Editor.

The ADMIN.CFG file must beplaced in the same folder as the SETUP.EXE file that you run to install Client 32. It is a text file with the words "Admin Defaults" as its first line. The valid parameters for this option are Overwrite and Version, as in the following example:

```
Admin Defaults
      Overwrite = false
      Version = 0
```

The Overwrite parameter setting can be True or False. True means that all configuration settings in the ADMIN.CFG file are always written to the Registry. False means that the configuration settings in the ADMIN.CFG file are written to the Registry only if they aren't already there.

The Version parameter can be set o any number from 0 to 4,294,967,295. If this number is greater than the ADMIN.CFG version stored in the Registry, the configuration settings in the ADMIN.CFG file are written to the Registry and this number is stored as the new version number. Otherwise, they aren't. Since no version number exists in the Registry the first time Client 32 is installed, the Administrator Defaults, including the version number, are written to the Registry.

For information about the configuration settings you can specify in the ADMIN.CFG file, see "Administrator Defaults Parameters" in the SETUPNW.HLP online file.

Smart Defaults

Any time the Client 32 installation program (SETUP.EXE) runs, the Smart Defaults function also runs. Therefore, Smart Defaults apply whether you are installing NetWare Client 32 via SETUP.EXE on a workstation with Windows 95 already installed, via MSBATCH, or via Automatic Client Update (ACU).

During the installation of Client 32, the following settings are checked and used if applicable:

- If the Microsoft Client for NetWare Networks is installed, any values that have been specified for settings that are applicable to Client 32 are preserved.
- If there is a NET.CFG file, all applicable NET.CFG entries are preserved by moving them to the Registry. Some parameters are not used or needed for Client 32; these are not moved to the Registry.
- Since NetWare Client 32 for Windows 95 does not include its own TCP/IP protocol stack, any existing

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TCP/IP parameters are not moved from the NET.CFG file to the Registry.

- If there is an ADMIN.CFG file, the parameters specified therein are moved to the Registry.

The following NET.CFG options are moved to the Registry. (Other NET.CFG options are ignored. Obsolete NET.CFG parameters are also ignored.)

```
DESKTOP SNMP
LINK SUPPORT
NETWARE DOS REQUESTER
NIOS
NWIP
PROTOCOL IPX
RESOURCES
```

The following syntax rules must be obeyed:

1. The NET.CFG options must be spelled as shown above.
2. The NET.CFG options are not case sensitive.
3. A line cannot be more than 512 characters long.
4. Spaces, tabs, or equal signs can be used to separate parameters and values.
5. Valid values must be specified for the parameters.

If a current NetWare Client is running, its NET.CFG file is used. If not, the first NET.CFG file found in the following locations is used:

```
C:\NOVELL\CLIENT32
C:\NWCLIENT
C:\NET\BIN
```

Otherwise, the first NET.CFG file found in the search path is used.

Workstation File Caching with NetWare Client 32

The file caching feature in NetWare Client 32 represents a major step forward for client caching. Because data is held in workstation memory, client-side caching eases network and server congestion, allowing more users access to network resources and improving performance of already existing applications. The Client 32 cache has several patents pending and more to come. The cache has been extensively tested at Novell and various third- party sites to help ensure data integrity.

Cache Size

As a general rule, the larger the cache, the better the network file I/O performance. Under Windows 95, the cache size that is allocated is 25 percent of free memory after Windows 95 is loaded.

Note: In the current version of Client 32, the memory used for its cache is statically allocated and is not shared with the system. A future version will share memory with the system such that as Windows 95 needs memory, cache memory will be given back, and vice versa.

Overriding the Default Cache Size. The default cache size may be configured by the user. To do this on a Windows 95 workstation, use the menu sequence Start | Settings | Control Panel | Network. Highlight the

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Novell NetWare Client 32 component and select Properties. From there, look for the keyword "Max Cache Size" and set that value to the desired cache size (specified in kilobytes). To turn the cache off altogether, look for the keyword "File Cache Level" and set it to zero.

Ensuring Data Integrity

File data that is being written to a network server is held in the client's workstation memory for a period of time after the application has reported that the file was saved. Therefore, it is important not to turn the power off on the workstation until the data has actually been written. The file data will be written immediately to the network if the application closes the file or if the application is exited. This reduces the chance of a user turning the machine off while data has not yet been committed to a network file.

The preferred way to ensure the file data has been written is to completely exit all applications that have written data and then exit Windows. If the user is willing to do this, there are a couple of options that can be turned on that will also increase network performance. With the same general directions for setting the cache size, use the following options:

```
Close Behind Ticks = 36
Delay Writes = ON
```

The "Close Behind Ticks" setting specifies how long the client will hold files open after they are closed, to optimize the case where applications frequently close and reopen the same file. The time is measured in ticks (36 in the above example is 2 seconds). This option takes effect regardless of the "File Cache Level" setting.

The "Delay Writes" option allows the write data to lag behind the application's Close File request. This allows the application to continue without having to wait for the data to be actually written to the network server, thereby improving apparent performance. When this option is on, the data is written in a "lazy" fashion (meaning 8KB of data are written every 1/18th of a second), so as to not bottleneck the server and disk channel. This option only takes effect if write operations are being cached.

Data Integrity of Cached Files After an Auto-reconnect. Consider the case where an application writes data to a network file, the file is cached at the client, is then written to the server, but is sitting in the server's cache memory when the server experiences a network fault. Normally, this data would be lost because the client received a successful acknowledgment from the write request and freed the cache block because it was no longer "dirty" or in use.

With Client 32, write data is held for a period of time after the acknowledged write so that if this condition occurs, the file will be auto-reconnected after the server comes back up and this data will be rewritten to the server's cache. While this method is not 100% reliable, there is a way to get 100% reliability for this case at the cost of file write I/O performance. This is accomplished by setting the "Auto Reconnect Level" to 4 (the default is 3). See Appendix B for a listing of what the various automatic reconnection levels mean.

Other Client 32 Configuration Tips

This AppNote has discussed only a few of the many tips and tricks for configuring NetWare Client 32. There are numerous other issues and configuration parameters you may need to be aware of. We recommend that you read the `README.TXT` file and the Frequently Asked Questions (FAQ) lists that come with NetWare Client 32 for Windows 95. Another good source of information are the Technical Information Documents (TIDs) available from Novell Technical Services.

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NOVELL® RESEARCH

Accessing Network Resources with the GUI Login Utility and the NetWare Provider

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NetWare Client 32 for Windows 95 comes with numerous tools and utilities to help both users and administrators. This AppNote examines the Client 32 GUI Login utility and the NetWare Provider. The NetWare GUI Login utility allows users to log in and run scripts while they are in the Windows 95 environment. The NetWare Provider extends the functionality of Microsoft's My Computer, Network Neighborhood, and Explorer utilities to include features specific to NetWare and Novell Directory Services (NDS).

This AppNote looks at these tools and describes how they can be used to access network resources with NetWare Client 32 for Windows 95. This information can be used to help network administrators, trainers, and users understand the capabilities available with Client 32.

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The GUI Login Utility

Included as a part of Client 32 for Windows 95, the NetWare GUI Login utility (LOGINW95.EXE) allows users to run login scripts, map search drives, and update environment variables—all from within Windows, which has never been possible before. Formerly, Novell provided only a command line utility, LOGIN.EXE, to enable users to log in to the network. The GUI Login for Windows 95 is based on Novell's new graphical login user interface and Login API library, which are portable to other client platforms. (NetWare Client 32 for DOS/Windows includes a similar GUI Login utility.)

The GUI Login utility supports both Bindery and NDS connections, with their respective login scripts (`NET$LOG.DAT` in the `SYS:PUBLIC` directory for NetWare 3.x, container and profile login scripts in Directory Services for NetWare 4.x). It supports all NetWare 3.x and 4.x login parameters. However, it does not allow the loading of 16-bit DOS TSRs from the login script.

GUI Login handles tasks such as authenticating the user to the NDS tree or to a bindery server, establishing connections to services, redirecting drives, redirecting ports for printing, controling password synchronization, detecting grace logins, setting up host machine environment variables, executing scripts, and executing programs and batch files.

Note: LOGINW95.EXE can only be run from the workstation's local hard drive. It cannot be executed from a copy placed on a server.

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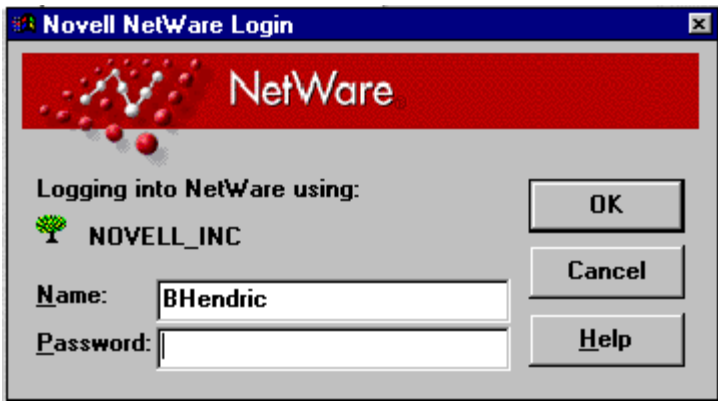
Once Client 32 is successfully installed, the Novell GUI Login automatically runs when the user starts Windows 95. Here's how the process works. Upon startup, Windows 95 checks to see if a network client is loaded. In the case of Client 32, the workstation will have an initial attachment to a NetWare server at this point. Windows 95 then calls the corresponding network provider (NetWare's) to perform its login function, which in our case is supplied by the GUI Login utility.

After you log in to NetWare, Windows 95 requires you to log in to the workstation itself. NetWare Client 32 caches the login information so that, if the user's Windows 95 name and password are the same as those for the network, the Windows 95 login will not be invoked. (If no network client is detected during the Windows 95 startup, only the Windows 95 login is displayed to log the user in to the workstation.)

Logging In with the Simple Login Option

With Client 32 loaded on a Windows 95 workstation, the user will see the NetWare GUI Login window after the Windows 95 workstation is started up. The sample window shown below illustrates the GUI Login's simple (default) login option, where the user is asked for only a name and password:



Enabling Additional Login Tabs

To enable the other available login tabs, go into Windows 95, select Control Panel | Network, highlight Novell NetWare Client 32 and click on **Properties**. Click on the Login tab to see the page shown below:

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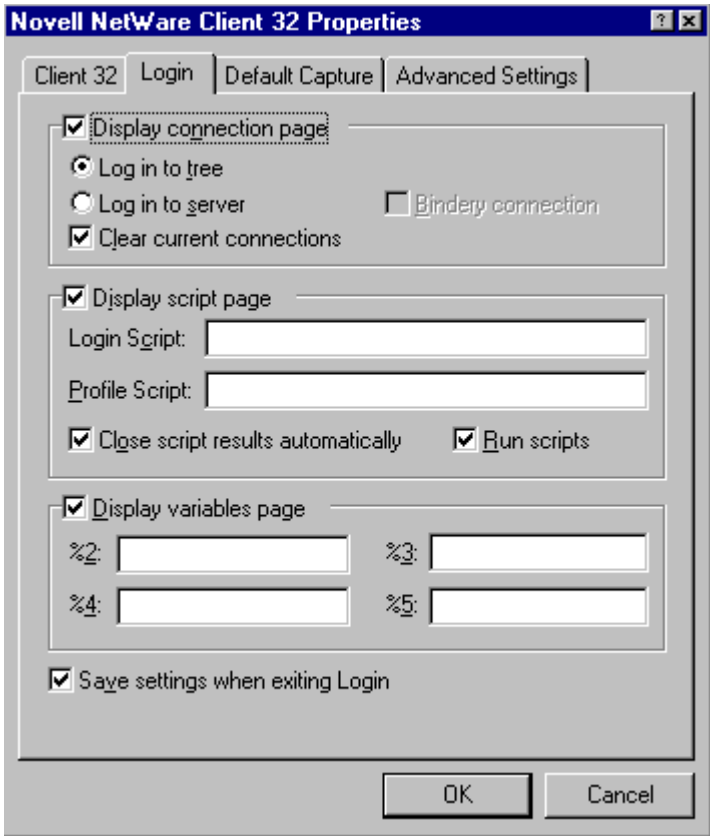

Check the box next to the page(s) you want to add to the default GUI Login screen: Connection, Script, and Variables.

Note: The login options you can configure here correspond to keys in the Registry database. The path is HKEY_LOCAL_ MACHINE | Network | Novell | System Config | Network Provider | Graphical Login. Below are the key names with their default values (0=OFF, 1=ON):

Name	**Value**
Connection Tab	0
Script Tab	0
Variables tab	0

With all of the additional login pages enabled, the next time the user logs in to Windows 95, he or she will see an expanded login window similar to the one shown below:

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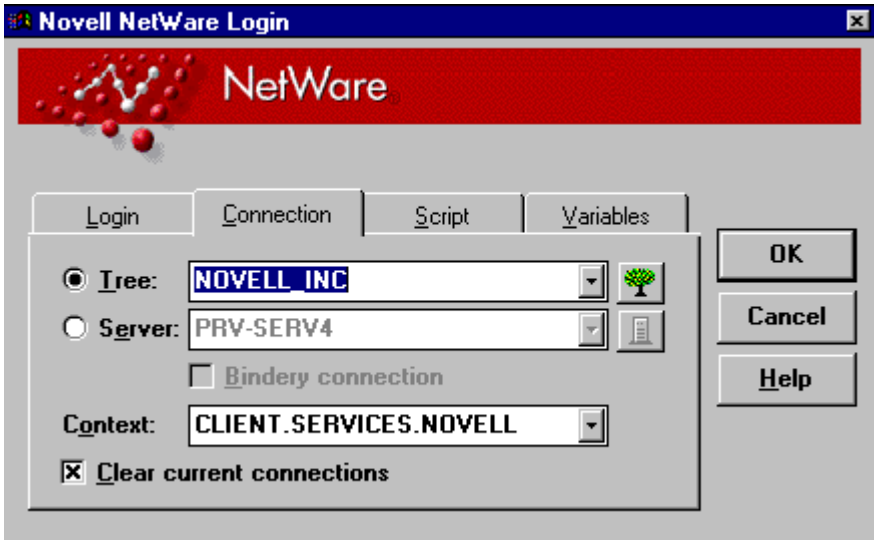
The sections below briefly describe the four categories of settings that can be configured when logging in: Login, Connection, Script, and Variables.

The Login Tab

The Login tab presents the same options as the default login screen (shown above under "Logging In with the Simple Login Option"). In this window, the user can enter a username and password. If Client 32 has successfully connected to the network, the utility displays the NDS tree or NetWare server being used under the "Logging into NetWare using" label.

The Connection Tab

The Connection tab allows you to specify an NDS tree or NetWare server to connect to. You can click on the buttons to the right of the tree or server names to browse for other NDS trees and NetWare servers that are available on the network (see the sample screen below):



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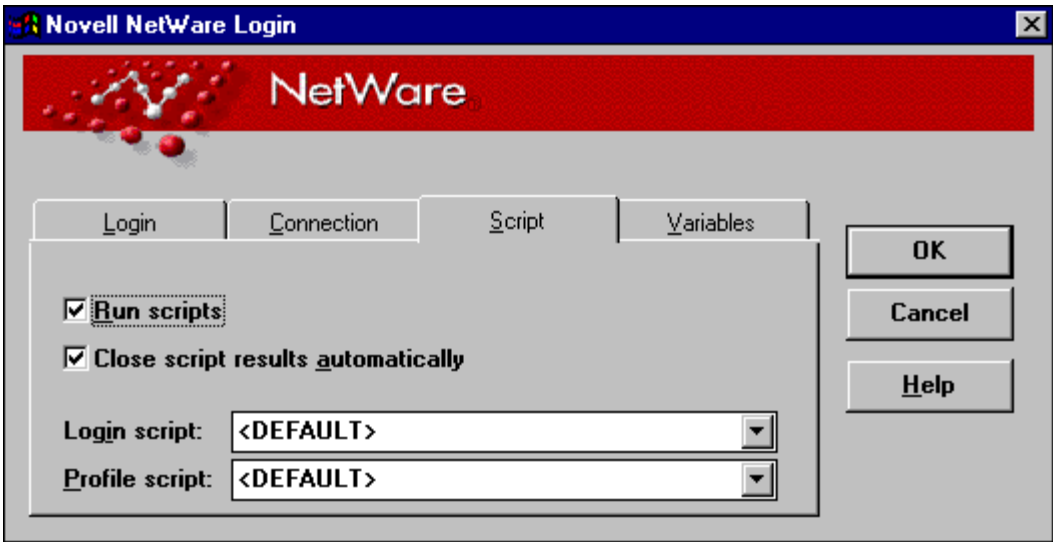
If you have selected a Server connection, you can click on "Bindery connection" to specify that you want a Bindery-based connection instead of the default NDS connection. You can also click on "Clear current connections" to specify that you want your current connections cleared when you run the GUI Login utility.

The Script Tab

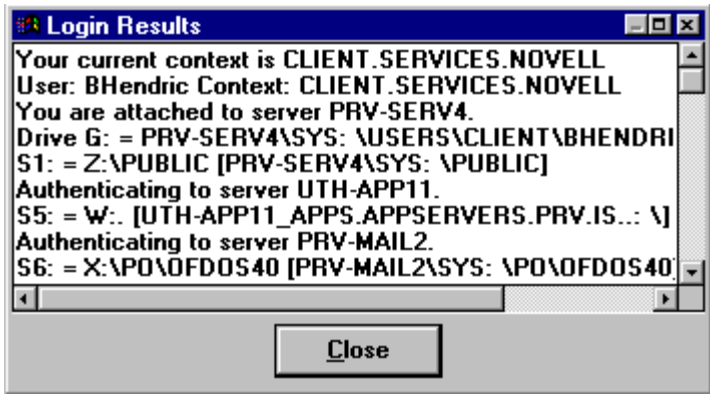
If you have an alternate login script or a profile script that you prefer to run, it can be specified in the Script tab:



For example, if you had an alternate login script stored locally as `C:\SCRIPT\USER.TXT`, you would enter that path and filename in the Login Script entry box.

The Script option remembers the last five scripts and paths for both user and profile scripts and stores them in the Registry database. These can be accessed by clicking on the pull-down arrow buttons.

After the login script executes, you can request to see the results of running the script. The Login Results window displays user authentications and drive mappings, as shown below:



By default, the results screen should close by itself. However, if any errors are encountered, the window will stay open so you can view them. If you want the results window to close automatically, check the "Close script results automatically" box under the Script tab.

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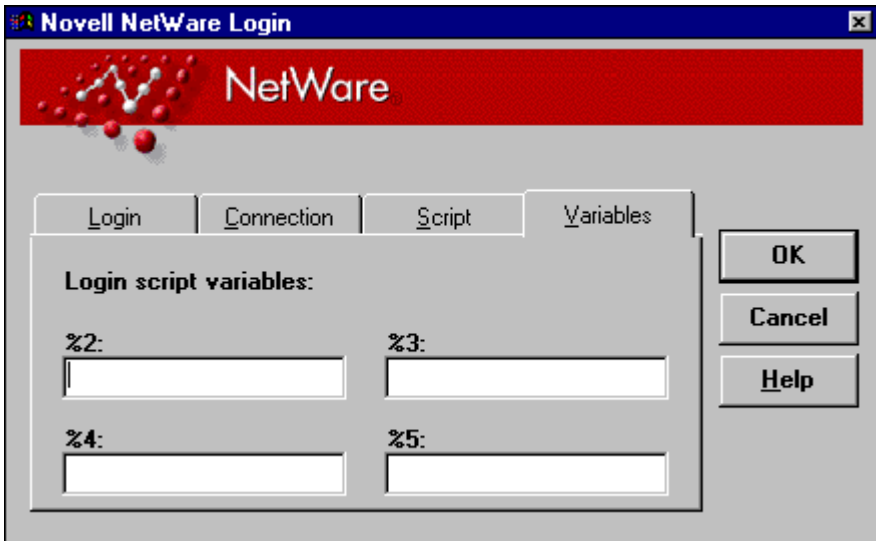
The Variables Tab

The Variables tab allows you to specify up to four variables that are passed to the login scripts that are executed when logging in using the graphical login utility. These can be used to pass additional parameters to your login script:



Simply specify the substitution values you want for login script variables %2, %3, %4, and %5 (%1 is your login name). These are equivalent to the corresponding parameters you can pass in the LOGIN command from DOS. These variables can also be used to launch conditional portions of the login script. For example, if you wanted to login and set up a test environment using an SVGA monitor, you could enter "SVGA" as the %2 variable.

GUI Login Tips and Tricks

This section provides some tips and tricks to be aware of when using the GUI Login utility with NetWare Client 32 for Windows 95. (For additional troubleshooting information, see "Troubleshooting and Optimizing NetWare Client 32 for Windows 95" in this issue.)

Executing External Commands (@). External commands can be executed from within a login script by using the # command or the @ command. LOGINW95.EXE uses @ to spawn a process for the command to run and then will continue with the login script. The # command waits for the process to complete before going on.

Note: The GUI Login for NetWare Client 32 for DOS/Windows 3.1 also has the capability to process the @ command. However, the LOGIN.EXE command line utility ignores the @ command in the login script.

Logging In to Multiple Trees. To log in to multiple NDS trees when using the GUI Login utility, use the following syntax in your login script:

```
TREE <treename>/<.full.NDS.name>
```

Avoid Multitasking while Logging In. Although Windows 95 allows you to perform other tasks while Client 32 processes a login script, you should avoid doing so as it can cause errors. For example, opening Network Neighborhood while Client 32 is processing a login script causes the Multiple Provider Router to page fault.

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Playing .WAV Sound Files. Longtime NetWare users may be familiar with the FIRE PHASERS login script command that generates a sound during the processing of the login script. NetWare Client 32 ships with a PHASERS.WAV sound file that is played by default when the FIRE PHASERS command is issued in login script.

If you want a different sound to be heard, you can specify another .WAV file by specifying the filename in the login script as follows:

```
FIRE FILENAME.WAV
or
FIRE PHASERS FILENAME.WAV
```

You could also rename your .WAV file to PHASERS.WAV if you want that .WAV file to play every time.

The NetWare Provider

Windows 95 allows users to access any number of different networks simultaneously. Each of these networks must have a *provider*)a piece of software that provides network services through the Windows 95 interface. The provider is not a standalone application with its own interface; rather, it is integrated into the Windows 95 desktop environment. When users access a Windows 95 utility such as My Computer, Explorer, or Network Neighborhood, requests for network services are routed through the Multiple Provider Router to the appropriate network provider. (See the AppNote entitled "Overview of NetWare Client 32 for Windows 95" in this issue for more information about the Windows 95 networking architecture.)

The NetWare Provider for Windows 95 is the network provider Novell has developed for use with Client 32 for Windows 95. The NetWare Provider takes full advantage of the Windows 95 user interface and is fully integrated with Microsoft's My Computer, Explorer, and Network Neighborhood utilities. Novell's NetWare Provider extendes the functionality of these utilities to include features specific to NetWare and NDS. With the NetWare Provider, Client 32 users can browse and access network resources)even resources on multiple NDS trees.

The NetWare Provider contains many of the same features as `NETWARE.DRV` provides for Windows 3.1 clients. The Provider can perform the following tasks:

- List resources
- Map drives
- Capture printers
- Log in and log out of servers and trees
- Authenticate users to Directory Services

The NetWare Provider establishes connections to NetWare servers, volumes, directories, and files, as well as print queues, either through UNC paths or through map and capture functions.

Note: Only certain NetWare-related objects are displayed when you browse resources in any of the Windows 95 utilities. This is because Microsoft didn't supply any APIs for displaying other types of objects (such as User objects) in Windows 95 browsers. As always, Novell supplies other utilities (such as NWAdmin and command line utilities) to perform operations on NDS leaf objects.

This section begins with an overview of how to browse network resources using the three Windows 95

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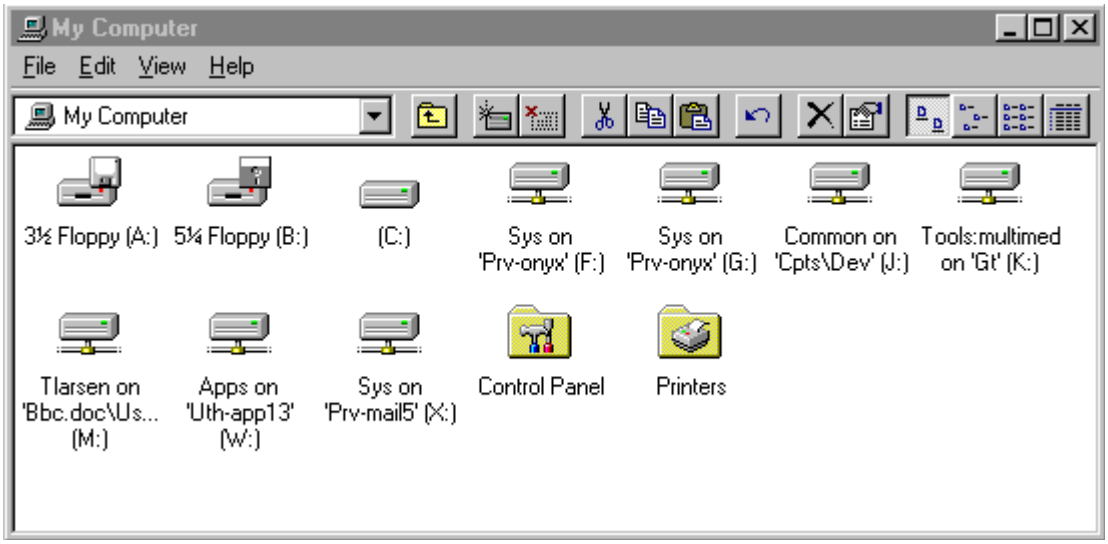
utilities and the services of the NetWare Provider. It then focuses on the various NetWare tasks you can perform through Explorer and Network Neighborhood.

Browsing Network Resources

In Windows 95, you can browse the resources available to your computer through three different utilities:

- *My Computer*)browses through your computer
- *Explorer*)browses through folders in a hierarchal fashion
- *Network Neighborhooa*)browses through the entire network

Browsing Using My Computer. When you start up My Computer, it dizsplays all of the physical devices available on your computer (floppy drives, local hard drives, network drives, and so on). It also displays the Control Panel folder and a folder for printers installed on your computer, as shown:



To view lower levels within a drive, simply double-click on its icon. For example, double-clicking on the C: icon shows the contents of the drive, as shown below:

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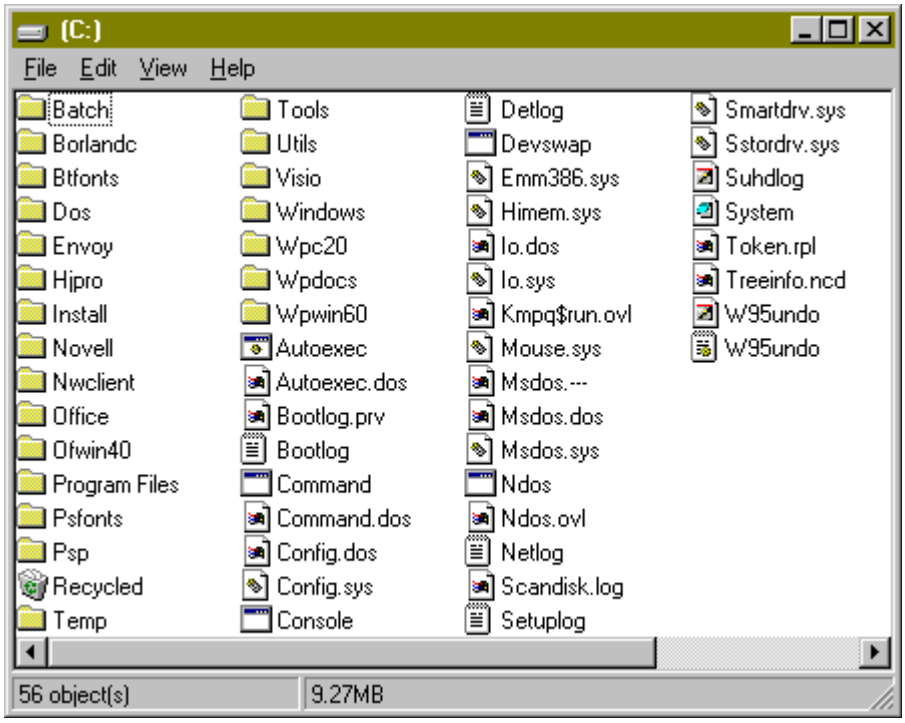

Double-clicking on a folder shows its contents. Double-clicking on a data file opens it. Double-clicking on an application runs it.

Double-clicking on a print queue icon shows the print queue if that printer has been previously installed on the workstation. Otherwise, Windows 95 asks if you would like to set up the selected print queue. (This is explained in the AppNote entitled "Setting Up Network Printing with Client 32 for Windows 95" in this issue.)

Browsing Using Explorer. When you launch Explorer by selecting Start | Programs | Windows Explorer, you will see a window displaying all folders on the local and network drives. The list on the right displays the contents of the folder currently selected at the left, as shown below:

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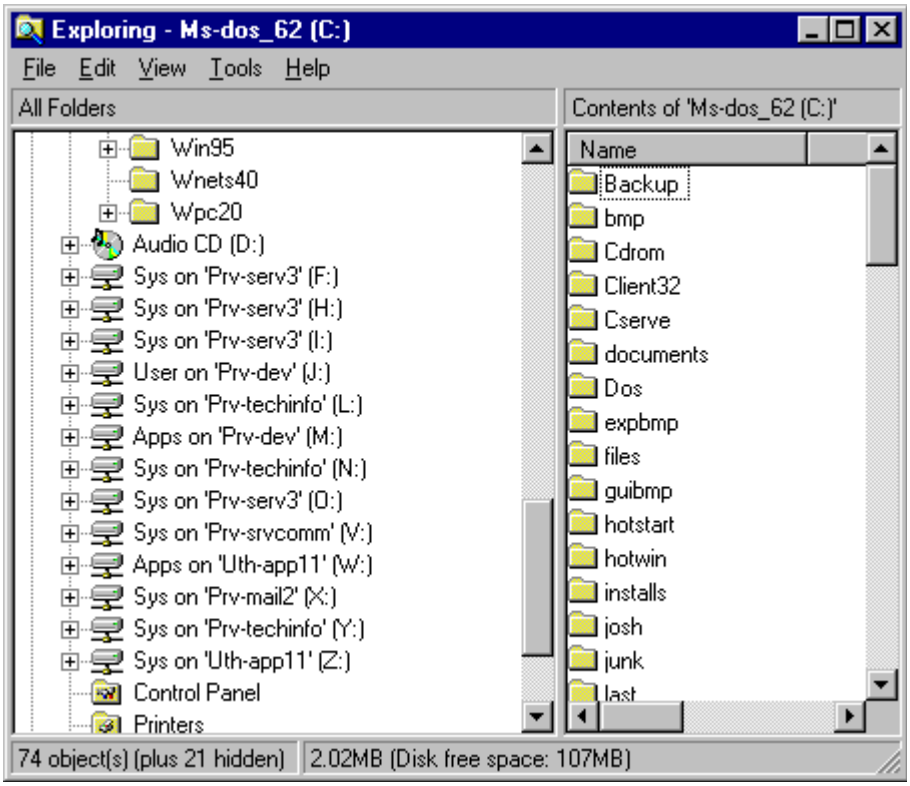

Explorer operates much as File Manager did in Windows 3.x. To browse through the directory hierarchy, double-click on a folder or drive icon. Browsing by exploring simplifies copying and moving files.

Another way to access the Explorer is to right-click on any folder or object and select the "Explore" option from the resulting menu. The sample screen below shows the result of right-clicking on a NetWare volume icon and selecting Explore:

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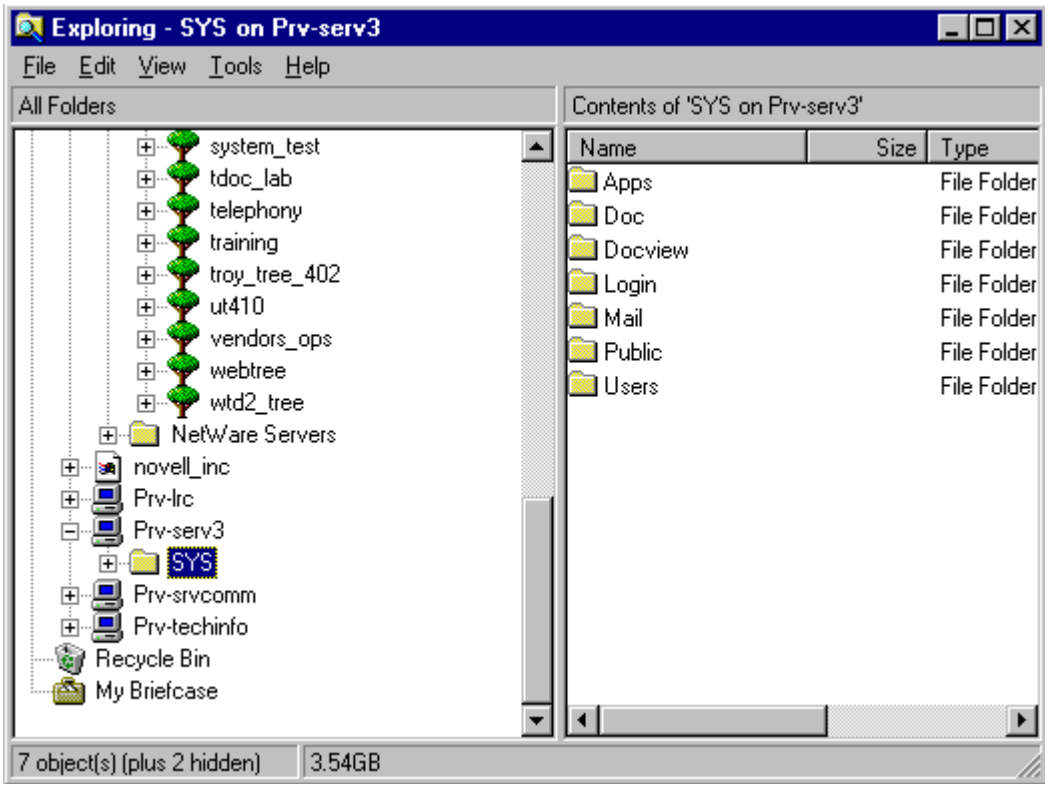

Browsing Using Network Neighborhood. Network Neighborhood allows you to browse not only through your own computer, but through other computers in your workgroup and through your entire network. When you start up Network Neighborhood, it shows icons for:

- The entire network
- Your current NDS tree
- Your default context in that tree
- Servers to which you are authenticated and licensed through NDS
- Servers to which you are Bindery authenticated

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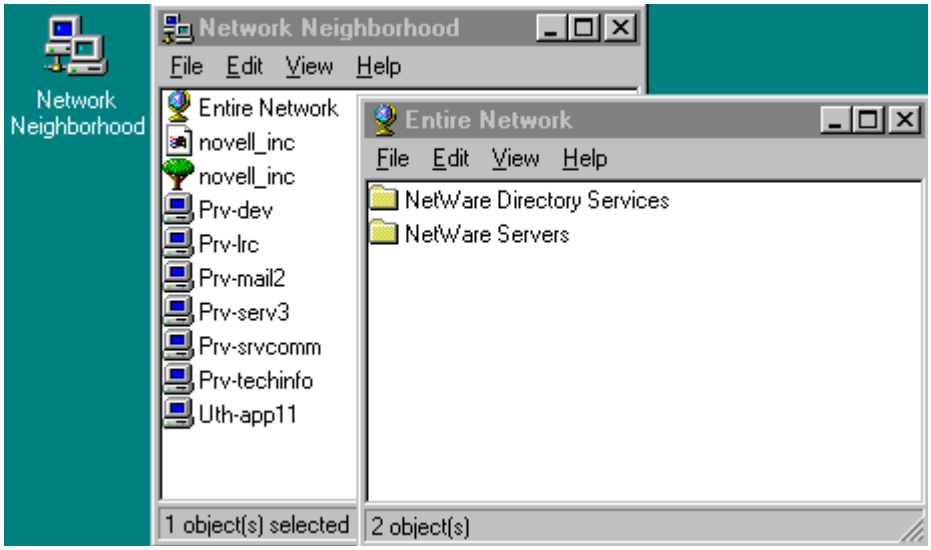
In this sample screen, "novell_inc" is the current NDS tree, "tdoc" is the default container (context), and "Cpt_401" is a server to which the user is authenticated and licensed through NDS. (This screen shows the use of Large Icons to represent network components, whereas previous screens used Small Icons. This is selectable from the Windows 95 View menu. Other view options are List and Details.)

To browse all network resources, click on the Entire Network icon. The network resources are categorized under NetWare Directory Services and NetWare Servers folders, as shown below:



The NetWare Directory Services folder is designed for users on a NetWare 4 network, whereas the NetWare Servers folder is designed for Bindery-based versions of NetWare (3.x and earlier). NetWare 4 users can choose either folder, depending on how they prefer to view network resources.

When you double-click on the NetWare Directory Services folder, you see a list of NDS trees that exist on your network. To log in to a tree, either double- click on the tree, or right-click on the tree and select the "Login to NDS Tree" option. You will be prompted for a username and password. Once you are authenticated, you can "walk" the tree by selecting containers one level at a time. The Provider displays the NDS Volume and Print Queue objects that exist in the current container, as shown in the example below:

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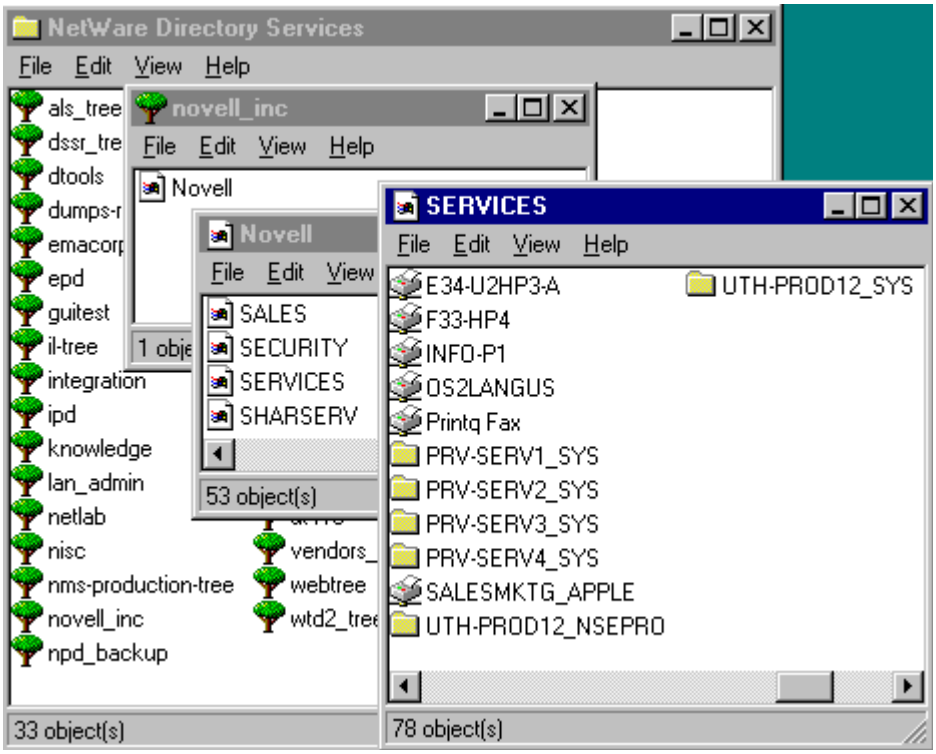

Going the other route from Entire Network and choosing the NetWare Servers folder allows you to browse through servers, volumes, directories, files, and print queues. When you double-click on the NetWare Servers folder, you see a list of servers available on the network, as shown below:

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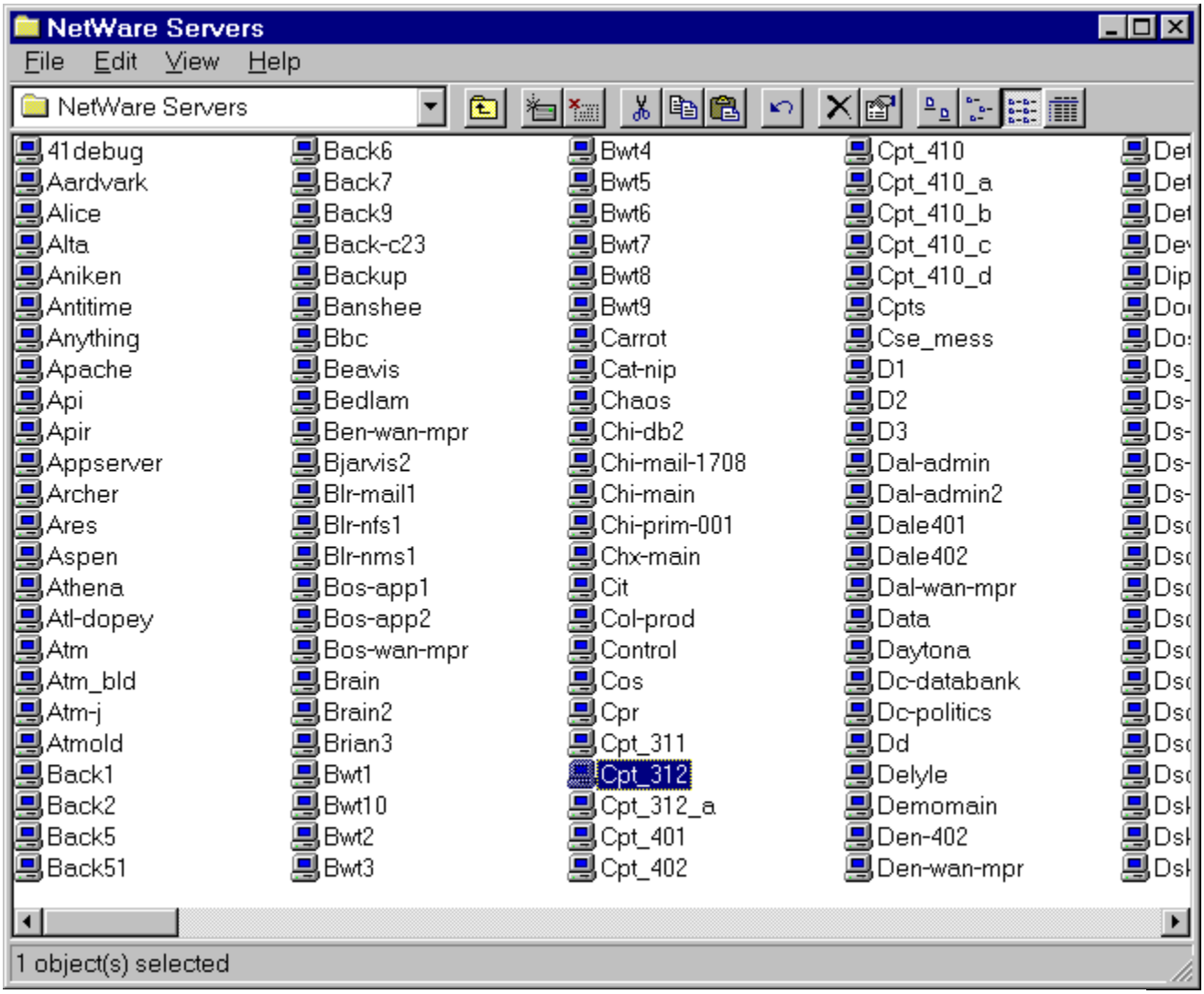

Performing NetWare Tasks in Explorer

You can perform a limited number of NetWare tasks from within Explorer. To access this functionality, highlight a network drive and select the Tools option from the menu bar at the top of the window:

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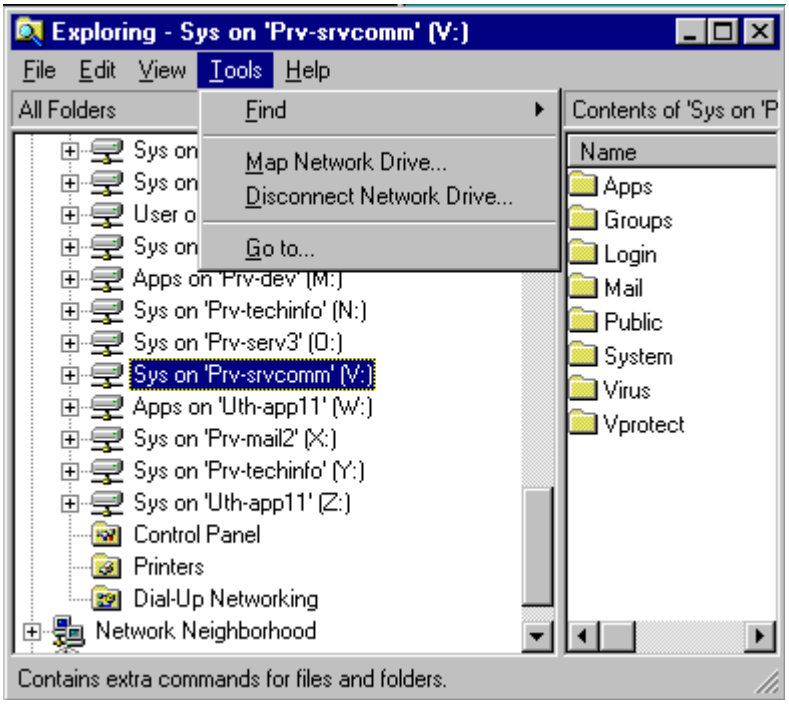
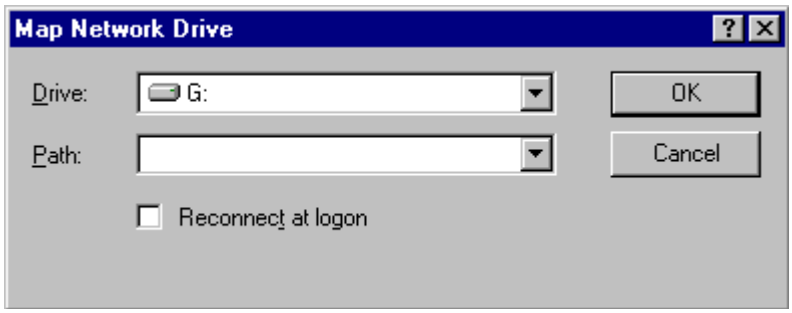


The resulting menu gives you the following options:

Option	Function
Find	Search for a file
Map Network Drive	Map a network directory to a drive letter
Disconnect Network Drive	Unmap a previously mapped drive
Go to...	Access a directory directly without having to traverse the hierarchy

Users can also view volume information and change NetWare passwords from within Explorer. These tasks are explained below, starting with mapping and unmapping drives.

Mapping a Network Drive. To map a drive, select the Map Network Drive option from the Tools menu. The next available drive letter is displayed in the Drive entry box, as in the sample below. You can select another by clicking on the pull-down arrow button to the right if the Drive entry box.



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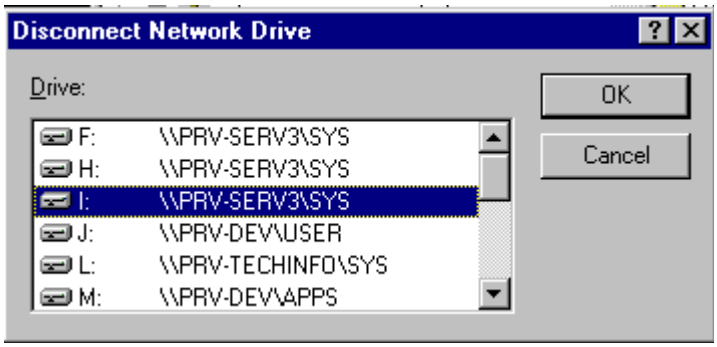
In the Path entry box, enter the directory path, using UNC syntax (for example, `\\srv1\sys\apps\misc`). If you want to have this drive mapping automatically re-established when you start Windows 95 and log in to NetWare, check the "Reconnect at logon" box. Click **OK** to complete the mapping.

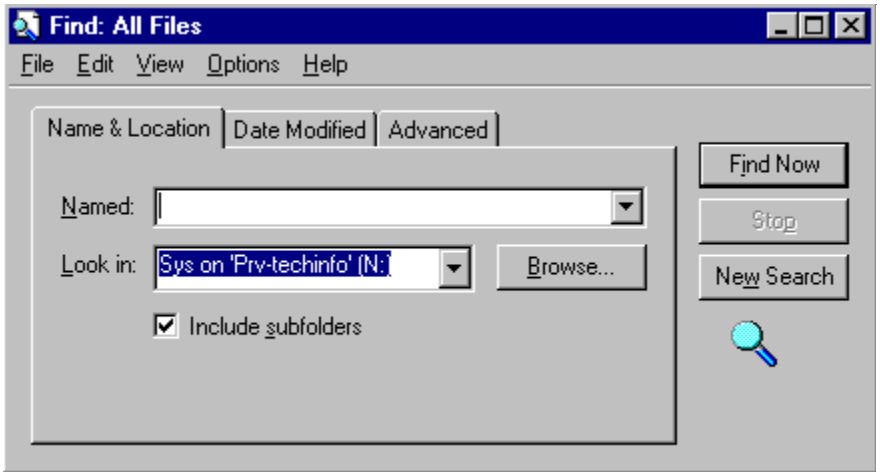
Because of the way Windows 95 operates, a drive mapped in this fashion will be "map rooted" when you access the directory from within Windows 95 Explorer or any other GUI utility. In other words, if you map drive G to `SYS:APPS\MISC`, when you access drive G you will see the contents of the `\MISC` directory. You can browse down from that level to any subdirectories, but you cannot browse up from the `\MISC` level.

Unmapping a Network Drive. To undo an existing drive mapping, select the Disconnect Network Drive option from the Tools menu. A window will appear listing the currently mapped drives:



Highlight the drive you want to unmap and click on **OK**.

Finding a File. To search for a file (or group of files) on the network, select the Find option from the Tools menu, and then select Files or Folders. The following dialog box is displayed:



Type the name of the file you want to locate in the Named entry box; you can use wildcard characters (* and ?) in the name. Click on the pull-down arrow button to select from a list of name options. Specify the path you want to search in the "Look in" box. Clicking on the pull-down arrow button displays a list of volumes you can choose from. The **Browse...** button lets you specify the directory level to begin the search. Check the "Include subfolders" box if you want to search in all subdirectories of this directory.

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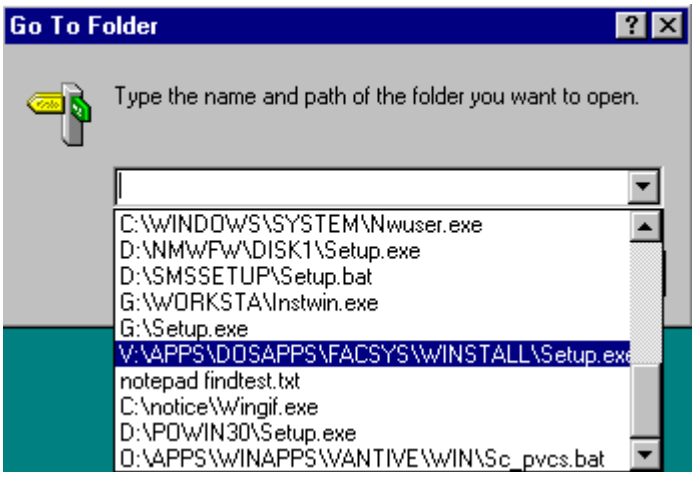
Under the Date Modified tab, you can specify date ranges for the search. For example, look only at files that were modified between September 1 and October 31, 1996. You can also specify a search for files that haven't been modified for a certain period of time. The Advanced tab lets you refine the search parameters even further, specifying that you want to search for files that contain a specific text string, or files of a certain size.

Accessing a Directory. To access a directory directly, without having to traverse the hierarchy, select the "Go to..." option from the Tools menu. Type the name and path of the folder you want to open. Or, you can click on the pull-down arrow button to select a previously accessed folder from the list, as shown below:



Viewing NetWare Volume Information. To see information about a particular NetWare volume, right-click on the drive icon for the volume and select Properties from the resulting menu. You will see a window of information similar to the one shown below:

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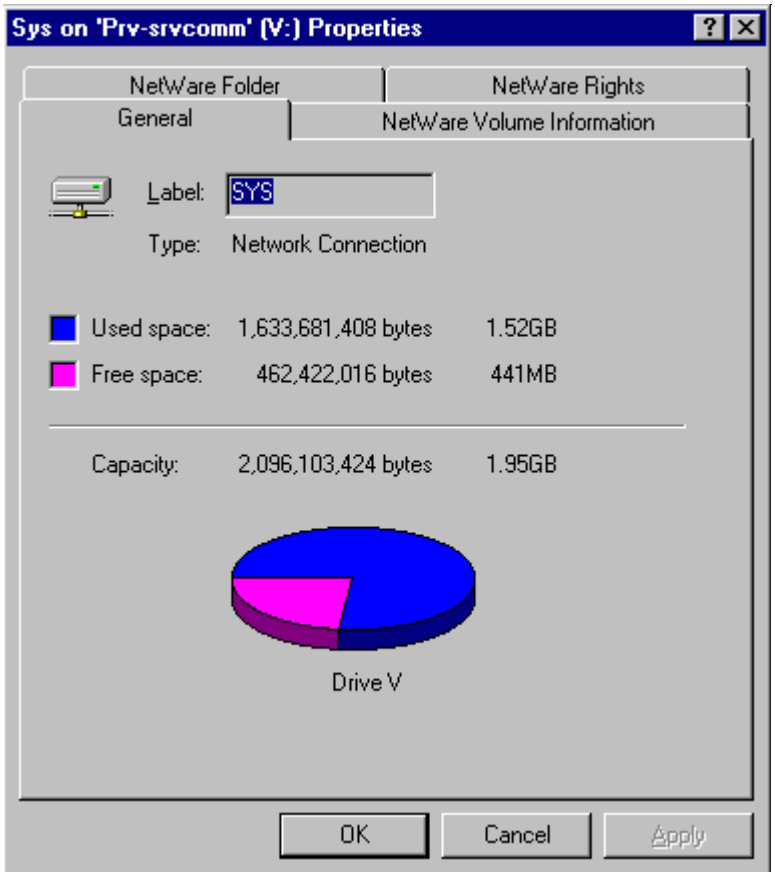

The NetWare Volume Information tab displays the volume number, the total and available space in KB, and the total and available number of directory entries. The NetWare Folder and NetWare Rights tabs can be used to assign NetWare attributes or trustee assignments. (An example of this is given at the end of this AppNote.)

Changing NetWare Passwords. To change a user's NetWare password from within Explorer, double-click on the Control Panel folder and select the Passwords option. The following screen is displayed:

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Click on the **Change Other Passwords...** button. In the Select Password dialog box, highlight Novell NetWare and click on the **Change...** button. You can now change the password for your current NetWare server or tree by entering the old password first and then typing the new password twice. If you are attached to more than one NetWare server, this option allows you to synchronize your passwords across all the servers.

Performing NetWare Tasks in Network Neighborhood

You can perform numerous NetWare tasks from within Network Neighbor hood. For example, you can view connection information, log in and out of servers, view properties of servers and trees, send messages, map network drives, and view information about volumes, directories, and files. You can also manage file system trustee rights and attributes using a more intuitive graphical interface than the command-line utilities previously used (RIGHTS, GRANT, REVOKE, and so on). This section shows just some of the many tasks you can do in Network Neighborhood with the services of the NetWare Provider.

Changing Default NetWare Connections. The NetWare Provider allows you to change your default NDS tree and server at any time during your current session. To do this, right-click on Network Neighborhood and select NetWare Connections. You will see a screen similar to the following:

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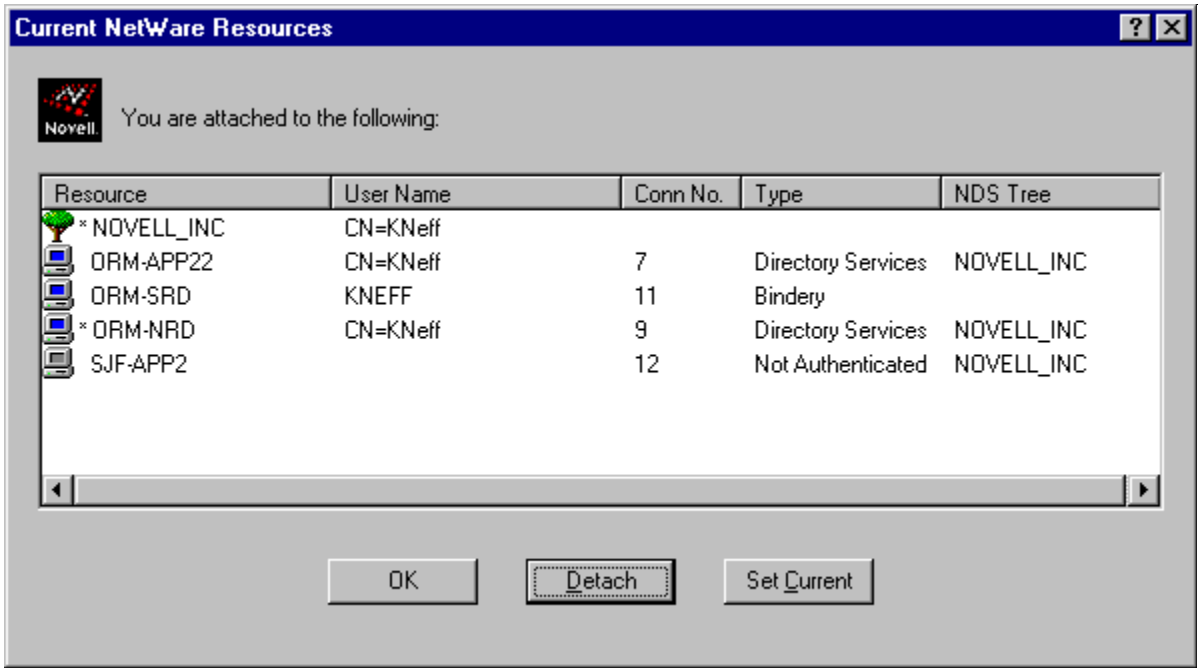

Your default NDS tree and server are indicated by an asterisk (*). To change the current default, highlight the one you want and click on **Set Current**. Note that changing the default tree or server affects Network Neighbor hood's entire view of the NetWare servers. For example, when you change to a different default NDS tree, Network Neighborhood will display only objects that exist in that tree.

Sending Messages. Newer versions of the NetWare Provider allow you to send broadcast messages to users on the network. To do this, click on Network Neighborhood, right-click on the server that the uers are connected to, and then choose the Send Message option. Type the message you want to send under "Send message to the selected user(s):". Select the users or groups to receive the message and click on **Send**.

You can only send messages to users who are currently connected to the server. The groups shown are those that are listed in the server's bindery. The maximum length of your message is 250 characters, including the "`From: <Username>(##)`" string placed at the beginning of the message. `<Username>` is your NetWare user account name and `##` is your connection number.

NDS Tree-Related Tasks. This set of tasks is accessed from the list of NDS trees you see after you start Network Neighborhood and choose Entire Network and the NetWare Directory Services folder. If you highlight an NDS tree and right-click on the mouse, a menu of options is displayed:

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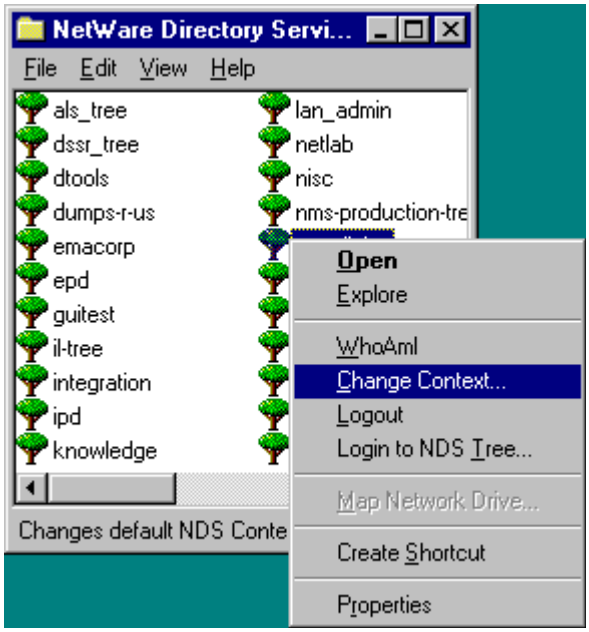

These options allow you to do the following:

Option	Function
Open	View the contents of the tree. This option work only when you have logged in to that particular tree.
Explore	Opens the Explorer to view the contents of the tree. Again, this option works only when you have logged in to that particular tree.
WhoAmI	Shows NetWare connection information. This option is available only for trees to which you have logged in.
Change Context	Allows you to change your default NDS context.
Logout	Log out of a tree to whcih you are logged in.
Login to NDS Tree	Log out of your current NDS tree and log in to the selected tree.
Create Shortcut	Create a shortcut link to the tree.
Properties	Show NDS tree properties

Following are some examples of using these options.

Changing NDS Context. To change your NDS context in Network Neighborhood, right-click on an NDS tree and select the "Change Context" option from the resulting menu. The resulting window shows your current context and allows you to change to a different default context:

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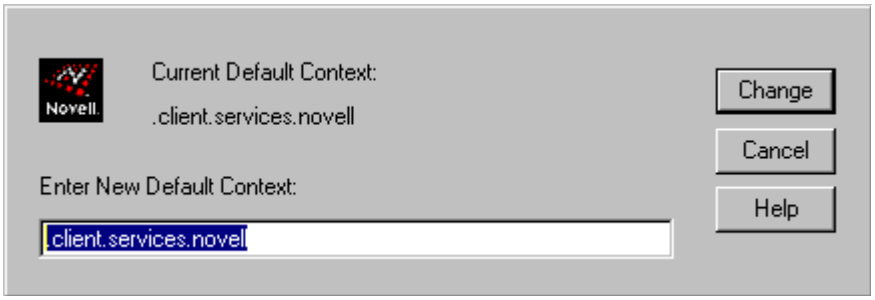
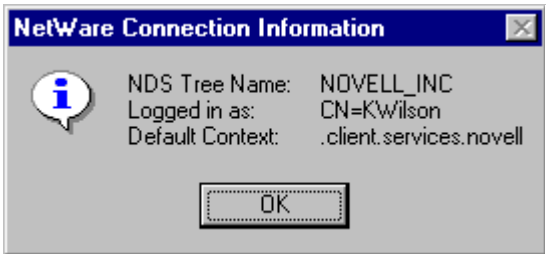


Type the new context in the entry box and click on the **Change** button.

Viewing Connection Information. Selecting the WhoAmI option after right-clicking on an NDS tree will display information concerning your context and connection, as shown below:



Viewing NDS Object Properties. Select the Properties option to display information about the highlighted object. For example, if you highlight an NDS Organization container, right-click, and select Properties, you will see information similar to the following:

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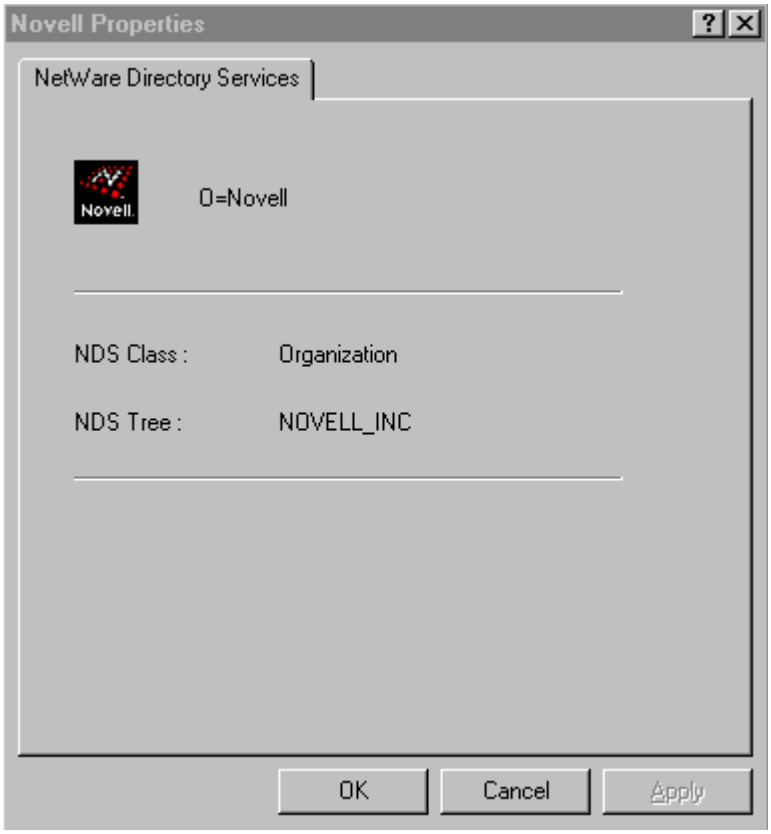
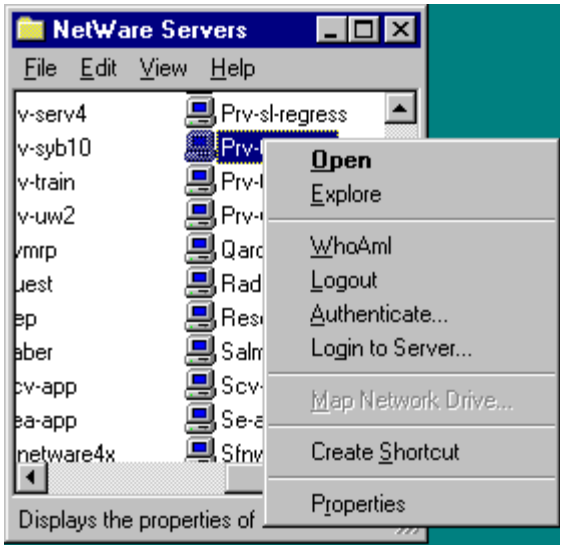


NetWare Server-Related Tasks. The next set of tasks can be accessed from the list of NetWare servers you see after you start Network Neighbor hood and choose Entire Network and the NetWare Servers folder. When you highlight a server and right-click on the mouse, a slightly different menu of options is displayed than for an NDS tree. An example is shown below:



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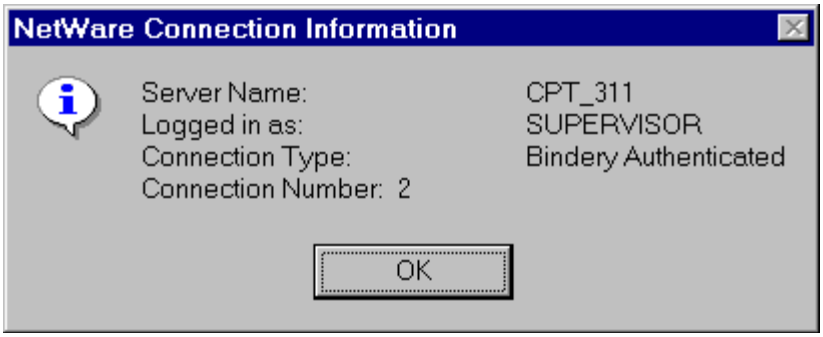
These options allow you to do the following:

Option	Function
Open	Log in to a server and view its contents
Explore	Log in to a server and view its contents using the Explorer
WhoAmI	Shows server connection information. This option is available only for servers to which you have logged in.
Logout	Log out of a server to which you are logged in
Authenticate	Log in to a server (NDS login)
Login to Server...	Log in to a server (Bindery login)
Create Shortcut	Create a shortcut link to the server
Properties	Show server properties

Following are some examples of using these options.

Viewing Connection Information. The following screen shows Bindery server connection information:



Logging Out of a Server. Highlight a server that you are logged into and right-click the mouse. Select Logout from the resulting menu:

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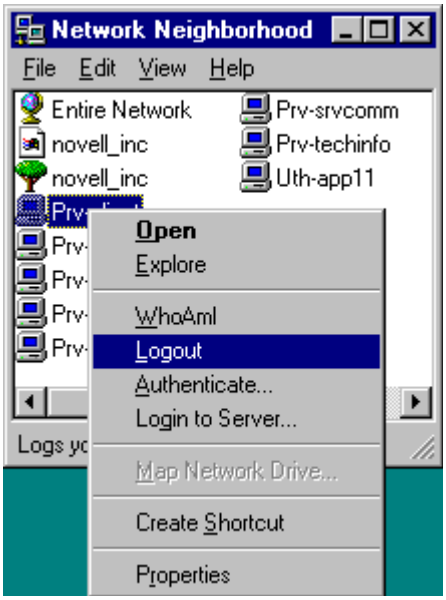

Press <F5> to refresh the screen. The server you logged out of should be removed from the list of resources in Network Neighborhood.

Logging In to a Server. To log in to a server in Network Neighborhood, double-click on the server icon, or highlight the server and right-click with the mouse. Select the "Authenticate..." option for an NDS login, or the "Login to Server..." option for a Bindery-based login. The GUI login utility will be launched, asking you to enter your username and password.

Viewing Server Properties. To see the properties of a server, right-click on the server icon and choose Properties from the pull-down menu. You will see information similar to that shown below:

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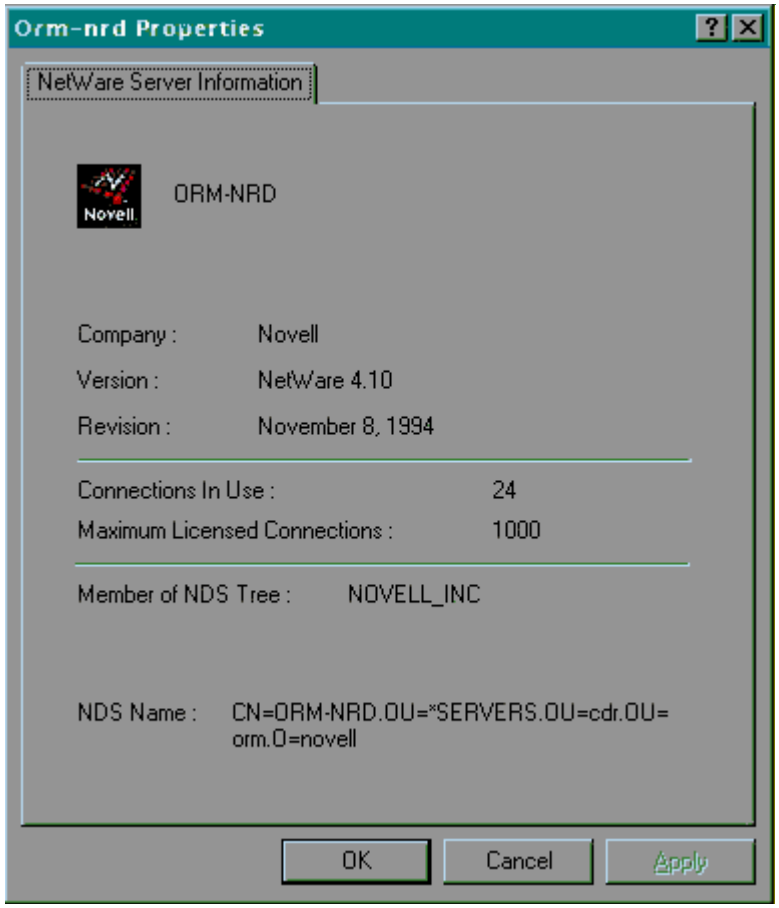

Viewing Volume Information. To view a server's resources (volumes and print queues), simply double-click on the server's icon.

Note: If the server is a Bindery-based server and you are not already attached, the Provider will first try your Windows 95 username and password to log in. If that fails, you will be prompted for your NetWare username and password.

As with servers and other objects, right-clicking on a volume displays a menu of options. The options for a volume are shown below:

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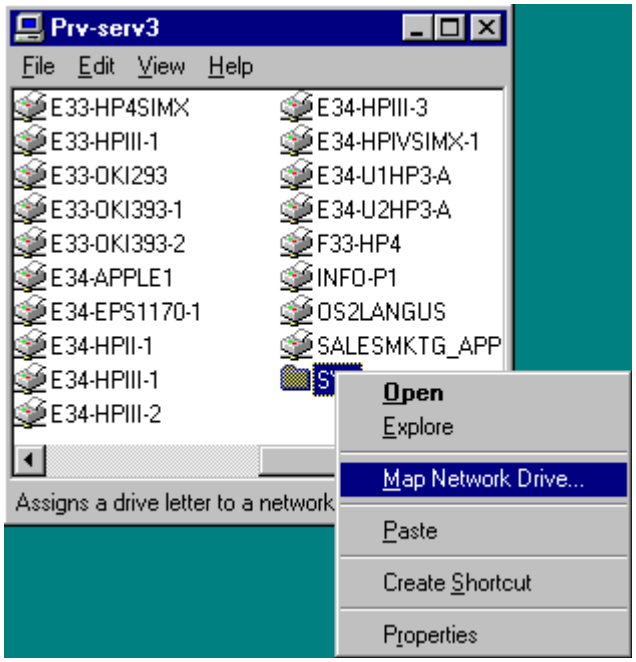
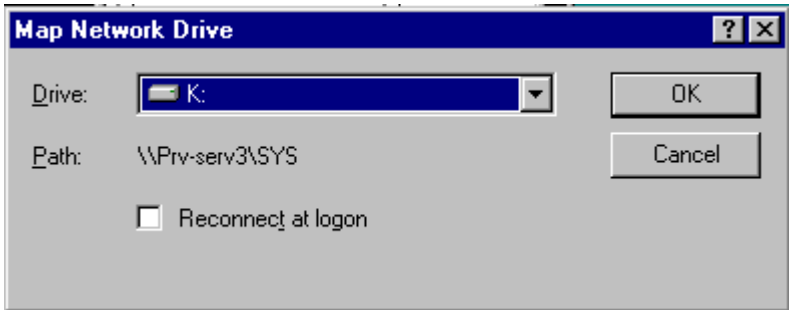


Mapping a Network Drive to a Volume. To map a drive to this volume, select Map Network Drive. This time the Path is filled in for you, so you simply specify the drive you want to map it to. (All mappings created this way are map rooted at the volume level.)



To have this mapping be automatically re-established when you start Windows 95 and log in to NetWare, check the "Reconnect at logon" box. Click **OK** when finished.

Viewing Volume Properties. Choosing the Properties option on a volume displays usage information about the volume, as shown in the example below:

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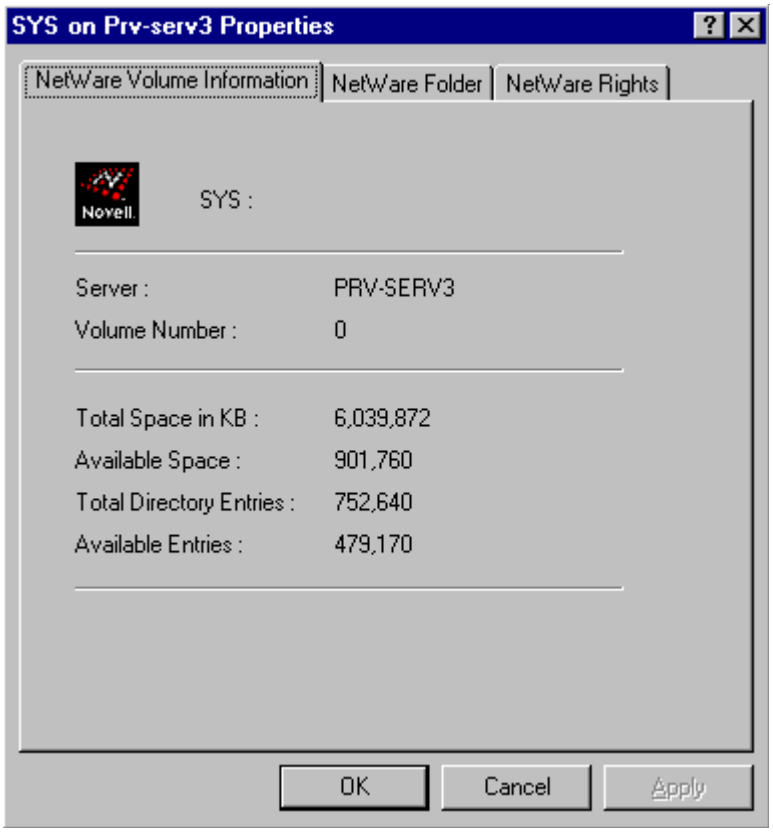
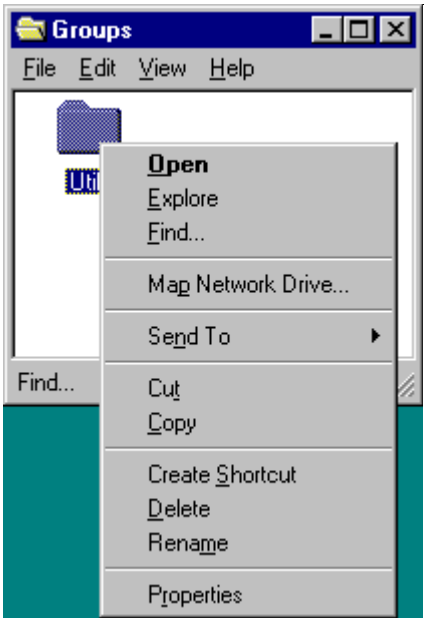


Working with Directories on a Volume. To work with directories on a volume, double-click on the volume. Highlight a directory and right-click on it:



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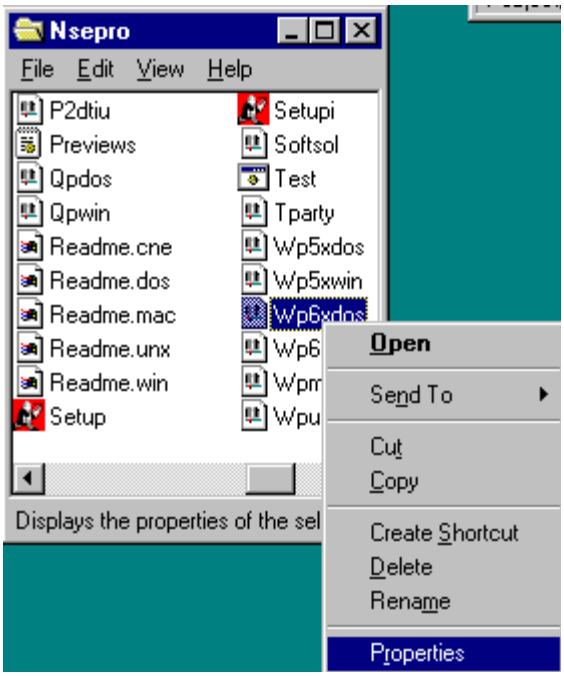
This list of options is similar to the other Properties menus we have seen. However, it includes additional Send To, Cut, and Copy options, as well as options for renaming and deleting the directory.

Working with Files on a Volume. To work with files within the directories, double-click on the directory and then highlight a file and right- click on it. Again you see the familiar list of options, as shown below:



Managing File System Rights and Attributes

From within the object Properties dialog, you can set a file system object's attributes and assign trustees without having to run the NWADMIN utility. This is done using the services of the NetWare Provider from within the Network Neighborhood or Explorer.

When you select a network directory or file, right-click, and choose Properties, you see a dialog box with three tabs:

- General
- NetWare File
- NetWare Rights

Note: If you don't have rights to change the properties of a directory or file, all of the options will be grayed out. If only some options are grayed out, the grayed options are not supported by your version of NetWare.

The General Tab. General is a Windows 95 tab that contains information about the object itself. (This is the only tab you'll see if you have selected a local object.) The example below shows the General information about a .BMP file on the network:

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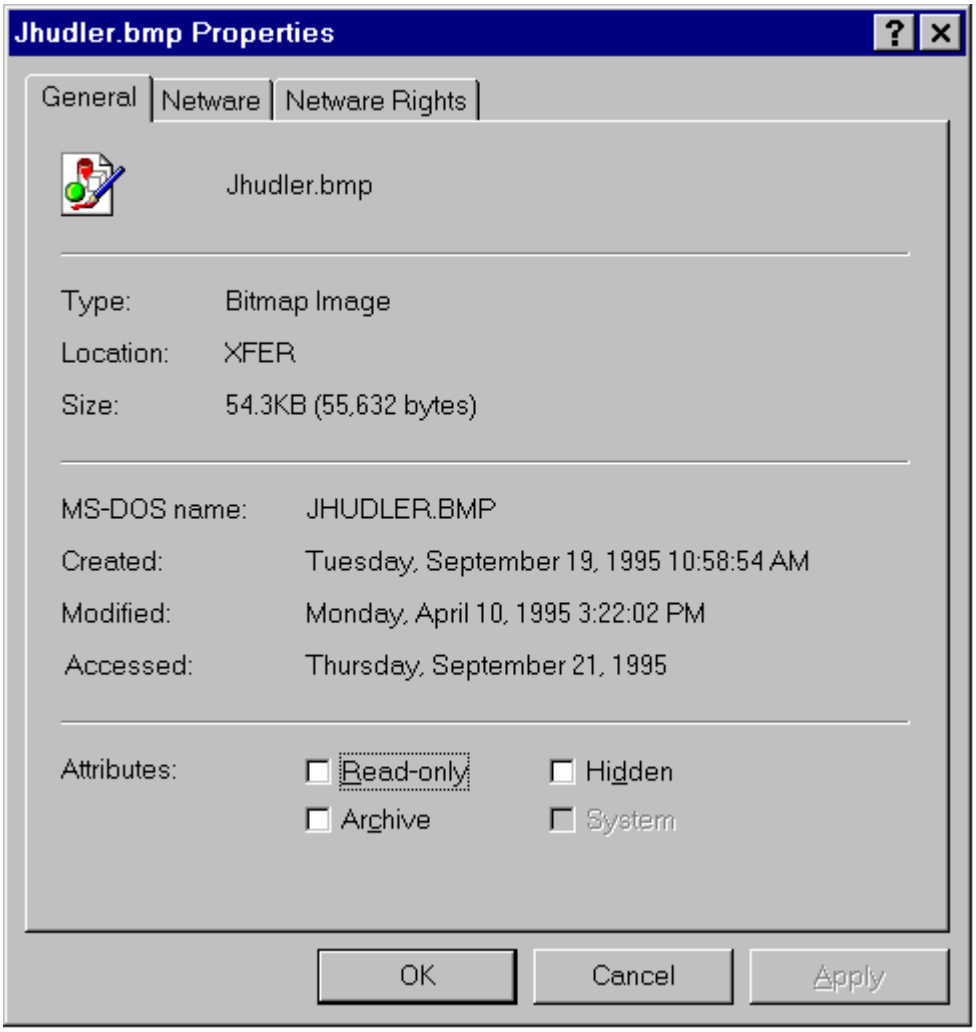

In the Attributes section you can set only the DOS attributes for the file or directory.

The NetWare Tab. The NetWare tab lists information that NetWare knows about the directory or file. The example below shows the NetWare information about the same .BMP file (note that the name of the tab changes to reflect whether you have selected a file or directory):

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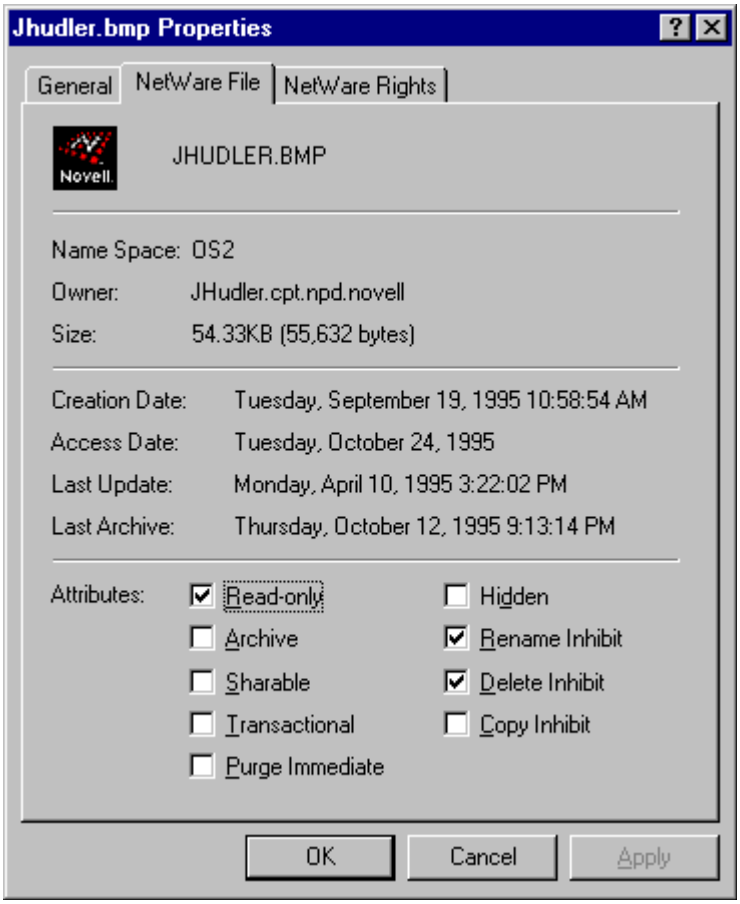

In the Attributes section is a list of NetWare attributes for the file or directory. These attributes are defined as follows:

Attribute	Definition
Read-only	Allows the file to be read, but not deleted or modified. This is a DOS attribute that NetWare uses too. Selecting *Read-only* causes *Rename Inhibit* and *Delete Inhibit* to be selected as well.
Archive	Used to mark a file that has changed since it was last backed up.
Sharable	Allows multiple users simultaneous access to files and directories. This attribute is usually used with the DOS Read-Only attribute.
Transactional	Indicates that the file or directory is protected by NetWare's Transaction Tracking System (TTS). TTS prevents data corruption by ensuring that either all changes are made or no changes are made when a group of files or directories are modified.
Purge Immediate	Notifies NetWare to immediately purge the object when it is deleted. Purged files cannot be salvaged.

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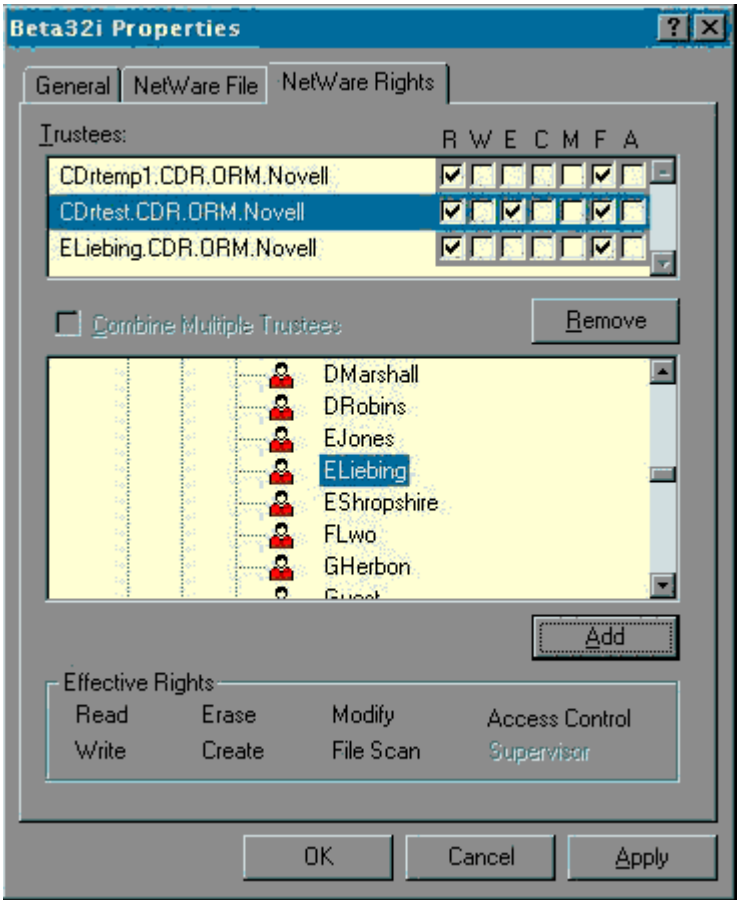
Hidden	"Hides" a file so that it does not show up in a DIR listing.
Rename Inhibit	Prevents any changing of the file or directory's name.
Delete Inhibit	Protects the file or directory from deletion.
Copy Inhibit	Disallows any copying of the file. This option works only with Macintosh workstations, but is available here because some Macintosh files use DOS naming conventions.

The NetWare Rights Tab. The NetWare Rights tab shows a list of trustees and the rights they have to the selected directory or file, as in the example below. Checkmarks indicate the rights granted to each trustee. The effective rights (those the user can actually exercise) are displayed at the bottom of the page.



Note: For security reasons, Supervisor rights are not listed or modified here. You must use NWADMIN to view or modify Supervisor rights.

Adding, Modifying, and Removing Trustee Rights. Follow the procedures below to add, modify, or remove trustee rights assignments:

- To add a trustee, search through the list of user objects in the tree and click on users to select them. This portion of the NetWare Rights page works similarly to Explorer. You can browse through contexts to find users and groups to add. Clicking on the **Add** button adds the selected users to the list of trustees. The new trustees are given Read and File Scan rights by default.

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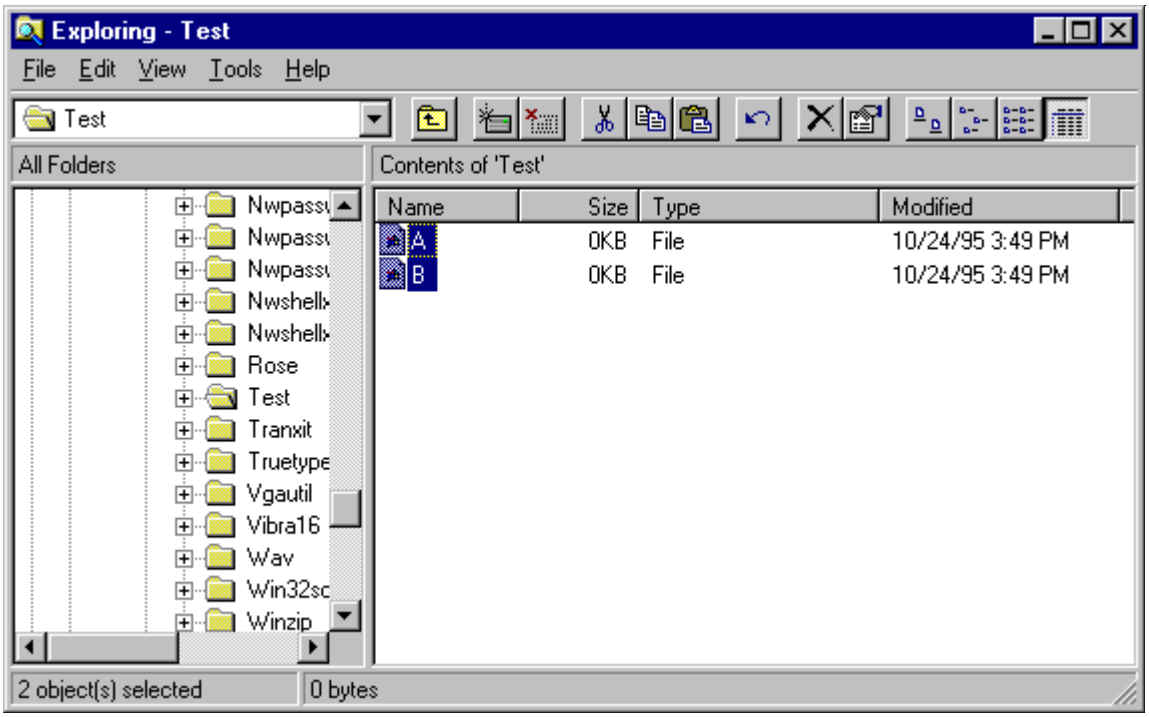
- To modify the rights of a listed trustee, click on the boxes. Clicking on an empty box adds a checkmark, while clicking on a marked box removes a checkmark.
- To remove a trustee, click on the trustee and then click on the Remove button.

Combining Multiple Trustees. You can also select two or more objects and combine their attributes and trustee lists. To do this, proceed as follows.

1. In Network Neighborhood or Explorer, select the two objects whose trustee assignments you want to combine (files A and B in this example):



2. Right-click the mouse and select Properties from the pull-down menu.
3. Select the NetWare File tab to view the attributes for both of these files together, as shown in the sample screen below:

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The black checkmark by the Archive attribute indicates that both File A and File B have that attribute set. The greyed out checkmark by the Sharable attribute indicates that only one of the files (File B) has this attribute set.

- Clicking on the Sharable attribute will clear the Sharable flag from both files.
- A second click on the Sharable attribute will set it for both files.
- A third click will return the attribute to its greyed state, meaning that the Sharable attribute will not be altered for either file.

Note: The Attributes only exhibit this three-state behavior when multiple files are selected and the flags differ between the files.

To view the list of trustees for the selected objects, click on the NetWare Rights tab. The Trustees list at the top shows all of the trustees who have rights assigned for the selected files, as in the example screen below:

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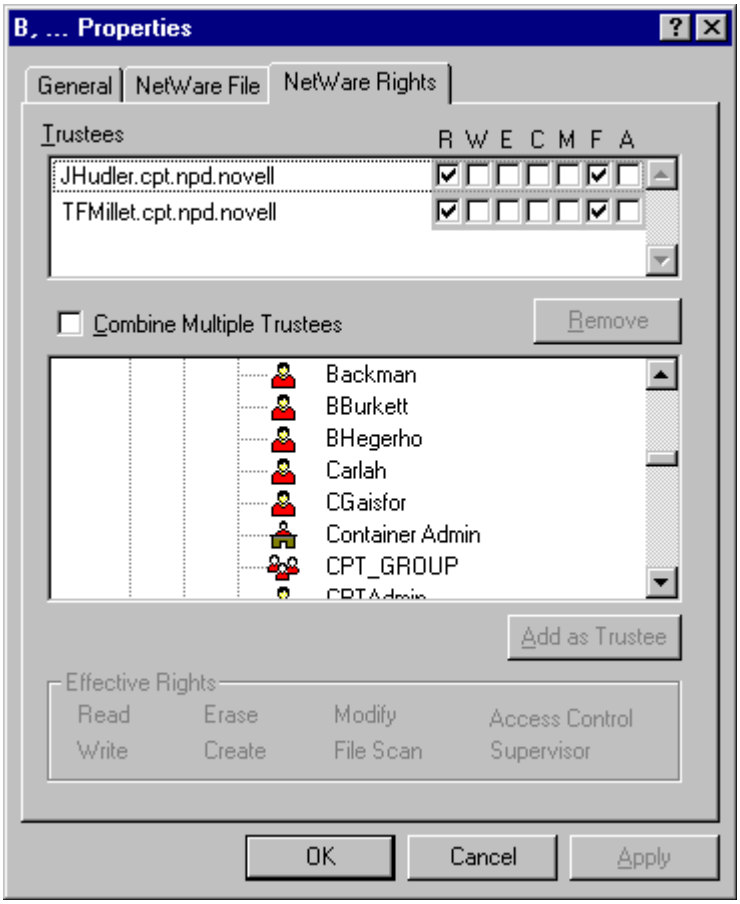

Although it is not readily apparent from the heading displayed at the top of the window ("B, ... Properties"), you are looking at a list of users who have rights assigned to either File A or File B, or both. In this example, File A has the trustee JHudler with the Read and File Scan rights set. File B has TFMillet as a trustee, also with the Read and File Scan rights set.

To add a new trustee to both files, click on a user icon in the middle portion of the NetWare Rights page and click on **Add**. The selected user (Carlah, for example) will be added to the Trustees list, as shown below:

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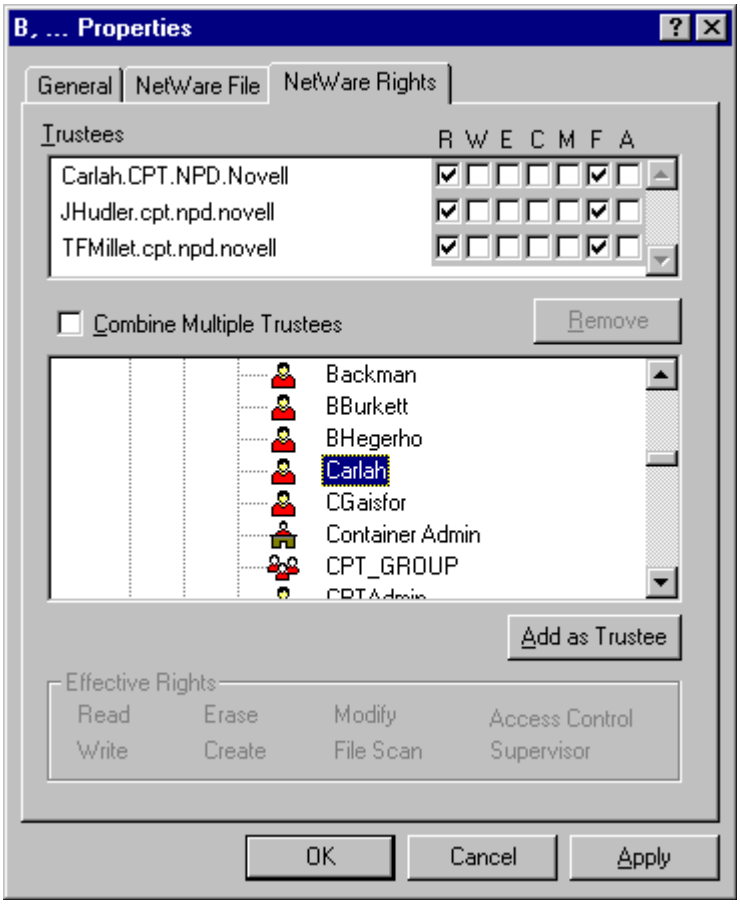

Each file now has its original trustees plus the added trustee. To combine the two lists of trustees, check the "Combine Multiple Trustees" box.

If one user has more rights to a file than other users when you combine multiple trustees, every user gains the same rights as the user with the most rights assigned.

Conclusion

There are many other features and capabilities offered by the NetWare Provider. We suggest that you take time to explore some of the other options on your own, using the online help where necessary to understand what the options do.

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Using the Novell Application Launcher (NAL) Utility with Client 32 for Windows 95

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One of Novell's ongoing goals is to make networking easier, both for administrators and for users. A fundamental technology for accomplishing this goal is Novell Directory Services (NDS). NDS simplifies network use by providing a single, global, logical view of all network resources. With NDS, users can access network resources with a single login, regardless of where the users and resources are located. In addition, NDS offers a single point of control for administrators with the graphical NetWare Administrator (NWADMIN) utility.

NetWare Client 32 is another key technology for reducing the level of complexity associated with the network. As part of Client 32, Novell has developed the Novell Application Launcher (NAL), formerly known as the NetWare Application Manager (NAM). NAL works with NDS to simplify management of network applications by allowing administrators to centrally control users' Windows desktops. NAL lets administrators use their own workstations to install new network applications or upgrade existing applications, and to have these applications dynamically appear on users' Windows desktops.

This AppNote:

- Discusses the benefits of using the Novell Application Launcher
- Provides an overview of installing workstation-based software with NAL
- Describes some of the options NAL provides to customize the application delivery

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Novell Application Launcher Overview

Generally, to make a new application available to users on a network, administrators have two choices: install it as a standalone application on each user's local hard drive, or install it as a shared application on the network. The first option is the most time intensive, as it requires the administrator to install, upgrade and support the application at each user's computer. The second option, though it saves time, still presents a number of problems:

- The administrator is required to visit each user's workstation to create the necessary Windows icon. Any upgrades or other changes to the application may require additional visits.
- If a user is not logged in to the network when the applications Windows icon is double-clicked, an error

message is received stating that the path is invalid. This may confuse the user and require support from the administrator.

- The user may delete the icon, then need the administrators help to restore it.

The Novell Application Launcher solves these problems, thus eliminating time-consuming effort and significantly reducing installation costs of new network applications.

Benefits of Using NAL

The following sections describe the benefits of using NAL to deliver network- based applications for users.

Simplifies Application Administration. Using NWADMIN, NAL gives administrators the ability to create NDS objects that represent applications. These objects contain information about where the applications are physically located and which users are authorized to use those applications. Administrators no longer have to visit each user's workstation to create a Windows icon for each application on the network. They simply use NAL and NDS to centrally administer and deploy network applications from the convenience of their own workstation. Access to files and directories is handled through NDS file system security, ensuring that network security is maintained.

Allows Dynamic Updates. NAL allows administrators to assign network applications by user, group, container, or any combination of the three. Network applications are delivered to users' Windows desktops dynamically, and any changes made are refreshed automatically.

Eliminates the Need for Login Scripts. Because the NDS application objects store pointers to the actual location of network applications, users no longer need to have drive mappings established through login scripts. Each NDS application object can also store subroutines (similar to login scripts) that can map additional drives and capture printers as users launch applications. Then as a user exits an application, drive mappings and printer ports are returned to their original configuration.

Frees Up Licensed Server Connections. Users often need access to an application installed on a server other than their default server. Without NAL, the administrator is required to map drives in login scripts for the users to easily access that application. Each user that has a drive mapped to the server that contains the application uses a licensed connection whether he or she is using the application or not. The Novell Application Launcher solves this problem by mapping the drives only when needed and then releasing the mapping (and hence, the connection) when the user exits the application. This reduces the number of user licences required on that server to only those that *concurrently* access the application.

Reduces Login Time. NAL also reduces the amount of time it takes to log in to the network. When a user logs in, much of the time required to complete the login is generated by drive mappings and printer port captures in the system and user login scripts. This information is now stored in each NDS application object and is executed when the application is launched, instead of at login time.

Simplifies User Access to Applications. To access applications, users run a component of NAL called the NetWare Application Launcher (NAL) which is normally stored in a common directory on the network, such as `SYS:PUBLIC`. NAL can be run from a login script if the NetWare GUI login utility is being used, or it can be placed in the Windows Startup or other program group.

NAL presents users with an NDS-delivered set of network applications that the administrator has assigned to them. When users are not logged in to the network, no network applications are displayed. In addition, users cannot delete the application icons or change any of the path information.

To launch an application, a user simply double-clicks on the appropriate icon in the group. The NetWare Application Launcher does the rest, taking care of drive mappings and paths automatically. The administrator can also specify that some network applications are to be launched automatically when the user runs the NetWare Application Launcher or when the user logs in.

When using the NetWare Application Launcher, standard Windows program items that represent network

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applications are no longer required and can be deleted from Windows desktops.

Provides Location Independence for Applications. Because the NDS-delivered network applications are associated with a user's network login ID, they "follow" the user around the network. Regardless of the login location, the user always sees the same set of network applications. This ensures that people who work from multiple locations or physical workstations always see a consistent set of network applications.

Enables Configurable Support Information. For each NDS delivered network application, the administrator can include a support number and E-mail address to use if help is required. This information is displayed in the properties of each application icon on the users' desktop. The help information can be tailored so each user is directed to the support group for his or her location.

In addition, if an application in unavailable for some reason, the administrator can easily modify the NDS object that represents the application so when the user selects it, they are informed that the application is not available.

Installing Workstation-based Software with NAL

Not only does the Novell Application Launcher simplify the administration of network applications, it can also help the administrator distribute software to workstations across the network. NAL can be used to:

- Install standalone workstation applications from the network
- Install the workstation portion of network applications
- Upgrade existing workstation based applications
- Upgrade NetWare Client software
- Upgrade Windows 3.x to Windows 95

This can all be accomplished from a central location without requiring the administrator to visit each individual workstation.

Third-Party Application Support

The Novell Application Launcher includes a software develop-ment library called NWAPP. When developing NetWare 4-aware applications, independent software vendors (ISVs) can use this library to create application objects in NDS that represent their application. Creating NDS application objects automatically at the time an application is installed on a NetWare 4 network eliminates the need for the installer to create the NDS application object manually.

The Novell Application Launcher also gives ISVs the opportunity to build their own application launcher that leverages NDS application objects. Some ISVs may even opt to include application launching capabilities into their own desktop metaphor products, such as the Novell PerfectOffice DAD Bar, Sidekick, TabWorks, Norton Desktop, and so on.

By leveraging the auto-launching feature of the Novell Application Launcher, critical service providers such as desktop virus scanners can allow administrators to strictly enforce usage policies.

NDS Directory Assistance

Through the DeveloperNet program, Novell assists third-party software developers in their goal to support NDS and NDS services such as NAL. This program provides training and support for independent software vendors (ISVs) to assist them in developing applica-tions that leverage the capabilities of NDS. Call 1-

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800-RED-WORD (733- 9673) or 801-429-5281 for information.

Using the Novell Application Launcher

Though the exact procedures for using NAL to install workstation-based software will vary from application to application, the general procedure is as follows:

1. Install the Novell Application Launcher on the network.

   If you have followed the installation procedure described in the AppNote entitled "Installing NetWare Client 32 for Windows 95" in this issue, you will find the Novell Application Launcher files in the `\ADMIN\NAM` subdirectory. You may want to copy the contents of this directory and its subdirectories into `SYS:PUBLIC` for easier access. These files can also be found in the `\NAM` directory on the "Admin - 2" diskette.

2. Copy the application program files or create an image of the application's installation disks on a network file server.

   Applications can be stored on NetWare 3.x servers, but you need at least one NetWare 4 server to have access to NDS and the NWADMIN utility, which are required to use the Novell Application Launcher.

3. Create an NDS application object pointing to the application or its image. (This is done through the NWADMIN utility.)

4. Associate the application object with a user, group, or container.

5. Ensure that the user, group, or container has the necessary file system rights to access the installation files.

Users will then be presented with the new application icon in their NetWare Application Launcher (NAL) program group. When a user double-clicks on the icon, the installation or setup routine is automatically launched.

The help files included with the Novell Application Launcher provide complete, detailed instructions for using it to install many applications, including PerfectOffice, Microsoft Office, Lotus Notes, Novell's Client 32 and Windows 95, and others.

Note: When working with NWADMIN and NAL to create NDS application objects, especially on a large network, allow sufficient time for NDS to complete the updates. Changes may take time to appear after you make them, depending on the number of replicas that must be updated.

NAL Example

This section provides step-by-step instructions for an example exercise that will familiarize you with the capability and options NAL provides. For this example, we will set up the NetWare Diagnostics (NWD) utility to be delivered by NAL.

By completing this exercise, you will learn how to do the following:

- Create application objects in NDS.
- Assign users to the applications.

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- See how NAL creates the icons on the user's desktop when loaded.
- Test the different options NAL provides.

1. At Windows startup, log in to NetWare as Admin or a user with Admin equivalence. You need to have the Write right at the root of the tree.
2. If you have not already done so, copy the Novell Application Launcher files from the C32W95\ADMIN\NAM subdirectory into the SYS:PUBLIC directory. One way to do this is from the MS-DOS prompt in Windows 95. After changing to the NAM subdirectory, type the following command:

   ```
   XCOPY *.* Z: /S <Enter>
   ```

   In this example, drive Z is mapped to SYS:PUBLIC. The /S parameter is needed to copy all of the .MSG, .DLL, and .HLP files from the NAM\NLS\ENGLISH subdirectory into the SYS:PUBLIC\NLS\ENGLISH directory.
3. Using a text editor such as the Windows 95 Notepad, edit the NWADMIN.INI file in your workstation's C:\WINDOWS directory. (If the NWADMIN.INI file does not exist, launch Windows and then launch NWAdmin. The NWADMIN.INI file will be created if one does not exist.)

   Add the following line under the indicated heading:

   ```
   [Snapin Object DLLs]
   Snapin1=z:\public\appsnap.dll
   ```

   or

   ```
   Snapin1=\\nrd\sys\public\appsnap.dll
   ```

   The second version uses the UNC (Universal Naming Convention) to designate the server\volume\directory\file path.

   The next time NWADMIN is run from this workstation, the NDS schema will be updated to include the new application objects associated with NAL. (You will need to add the above lines to the NWADMIN.INI file of all workstations on which you will work with the NAL objects in NWADMIN.)

   Note: A common problem here is that users inadvertently put the `appsnap.dll` line under the `[Snapin View DLLs]` heading. If you do this, the following error message will be returned:

   ```
   APPSNAP.DLL, version: 4.00.1, does not correspond with the version
   the NetWare Administrator requires (version: 4.10.2). Install the
   correct version before restarting the NetWare Administrator.
   ```
4. From the Windows 95 desktop, launch NWADMIN. You will be prompted as follows to update the NDS schema for the Application object snap-in: "The NDS Schema does not have the latest changes for the application classes. Do you want to update it?" Answer Yes.
5. In NWADMIN, create a test Organizational Unit (OU) under the Organization object in your NDS tree. Give this OU a name that will differentiate it from other OUs (such as your name). In this example, "TestOU" will represent your container object.
6. In NWADMIN, create a test user in your OU. Name the user Update. Make the user Admin equivalent (for convenience purposes). The following screen shows the TestOU and the user Update created under the Organization "novell" in our test NDS tree.

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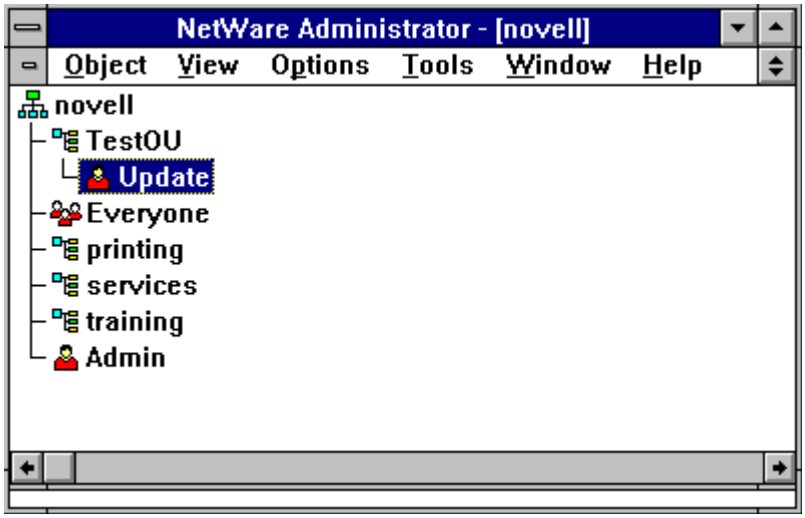
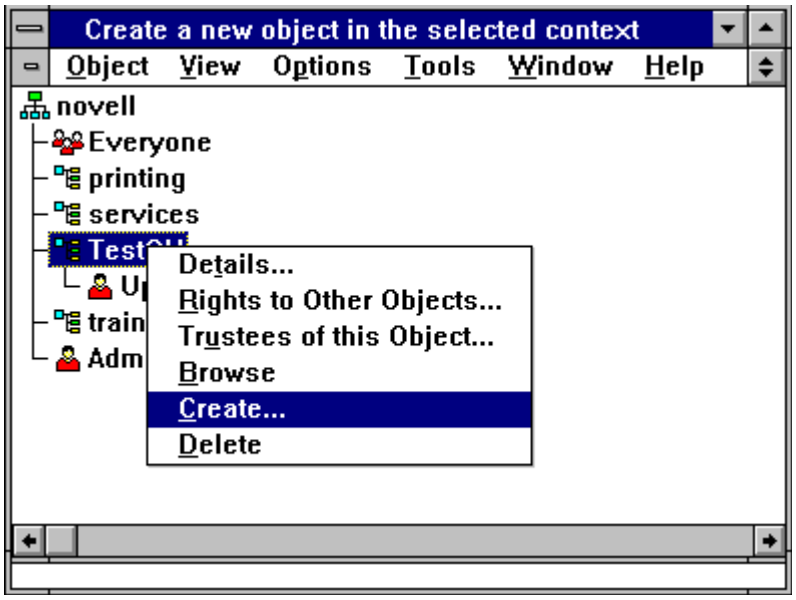


7. You are now ready to create the Application object in your test OU. In NWADMIN, right-click on TestOU to bring up the menu of actions you can perform. The following window will be displayed:



8. Select "Create" to create a new object, and then select the type of Application object you want to create. There are separate Application objects for DOS, Windows 3.x, Windows 95, and Windows NT applications.

   For this example, choose a Windows 95 application:

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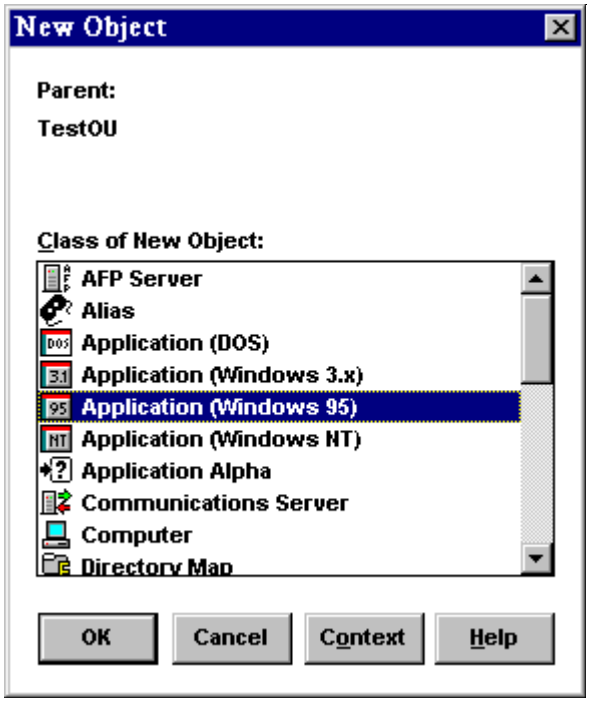

Click on **OK** to continue.

Application Object Types

Once you create Application objects in NAL, only those types of applications that can run on a given workstation platform will be displayed. For example, user who log in on Windows 95 workstations will see DOS, Windows 3.x, and Windows 95 applications. User who log in on Windows 3.1 workstations will see only DOS and Windows 3.x applications. They will not see Windows 95 or Windows NT applications because those do not run under Windows 3.x.

9. For this example, we are using NWD2.EXE, the NetWare Windows 95 Diagnostic tool that ships with Client 32. NWD2.EXE and its related files are located in the C32W95\ADMIN\ DIAGTOOL directory. If you have not already done so, copy these files to the SYS:PUBLIC directory using the command:

   ```
   XCOPY *.* Z: /s <Enter>
   ```

   where drive Z is mapped to the SYS:PUBLIC directory. The /S parameter is needed to copy the .HLP file from the DIAGTOOL\NLS\ENGLISH directory to the SYS:PUBLIC\ NLS\ENGLISH directory.

   Enter the application name and path as displayed in the "Create Application" window:

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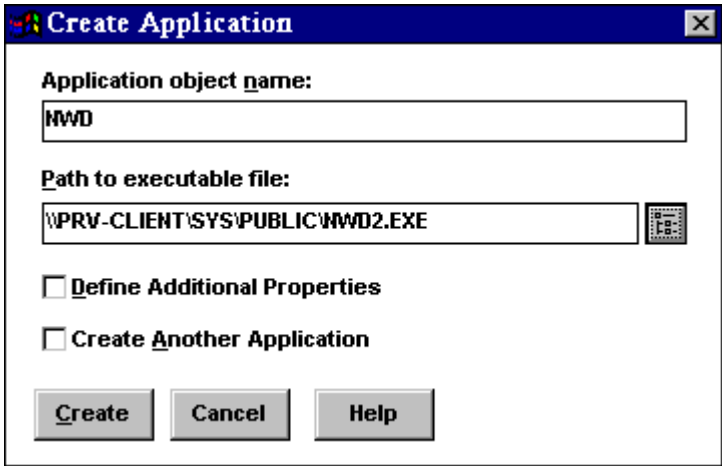
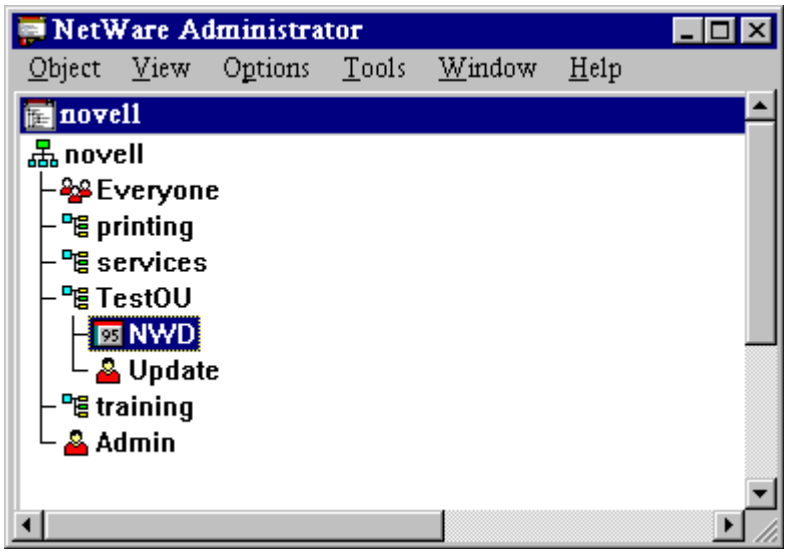


You can use the browse button to find the executable file of your choice. The path to the application will be entered using Universal Naming Convention.

10. Click on the Create button to create the Application object. The NWD object will now appear in the NWAdmin list as shown:



11. The next step is to assign users to the application. In NWADMIN, highlight the Update user and right-click to bring up the actions menu. Select the Details option to see the Details window. In the bottom right- hand corner of the window, you will see two new selections: Applications and Launcher Configuration. Click on Applications. Then click on the Add button under *Launched by user*. Find the application you created (NWD) and double-click on it. The Applications page will then look like this:

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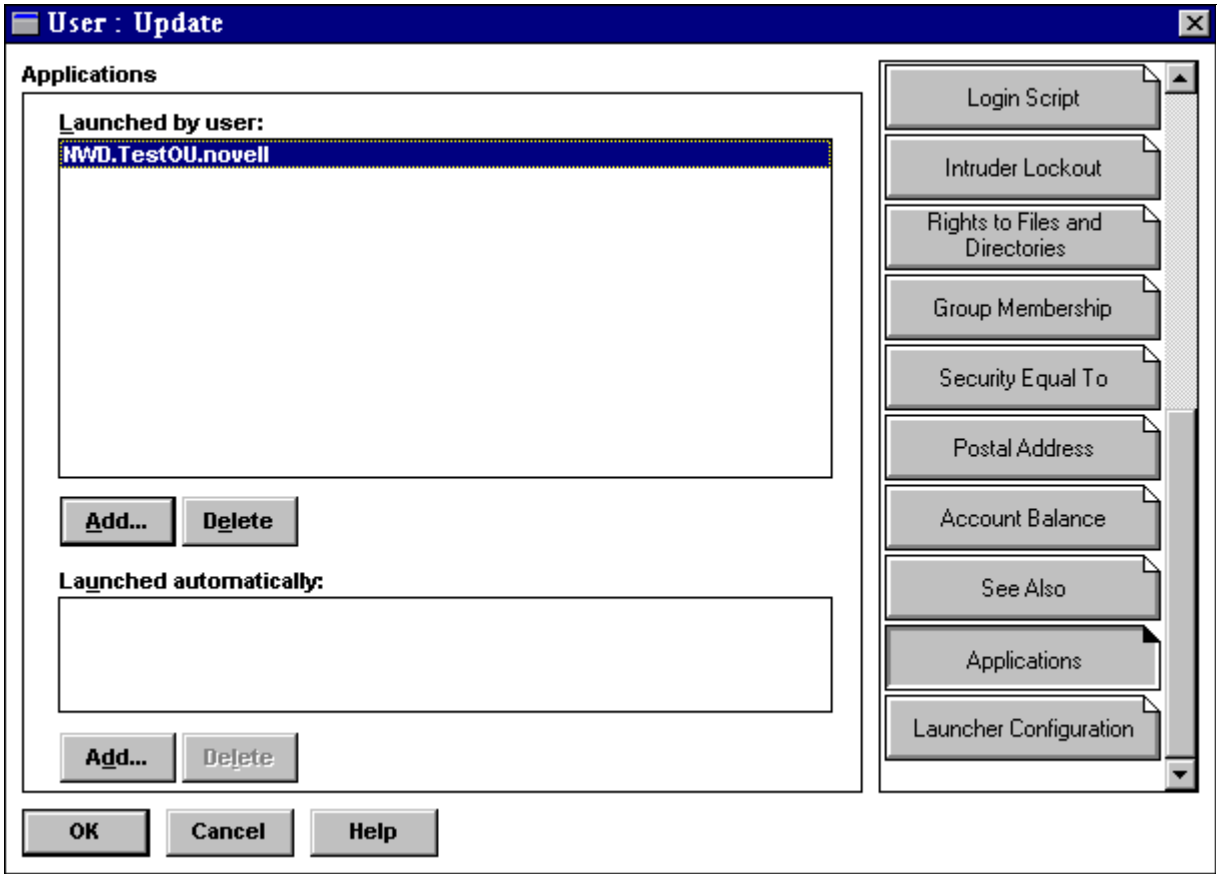

12. Place NAL.EXE in the startup folder. In this example, NAL.EXE (and its related files) should have already been copied to the SYS:PUBLIC directory. Using the Windows 95 Explorer or file cabinet, add an entry in the Startup folder as shown:

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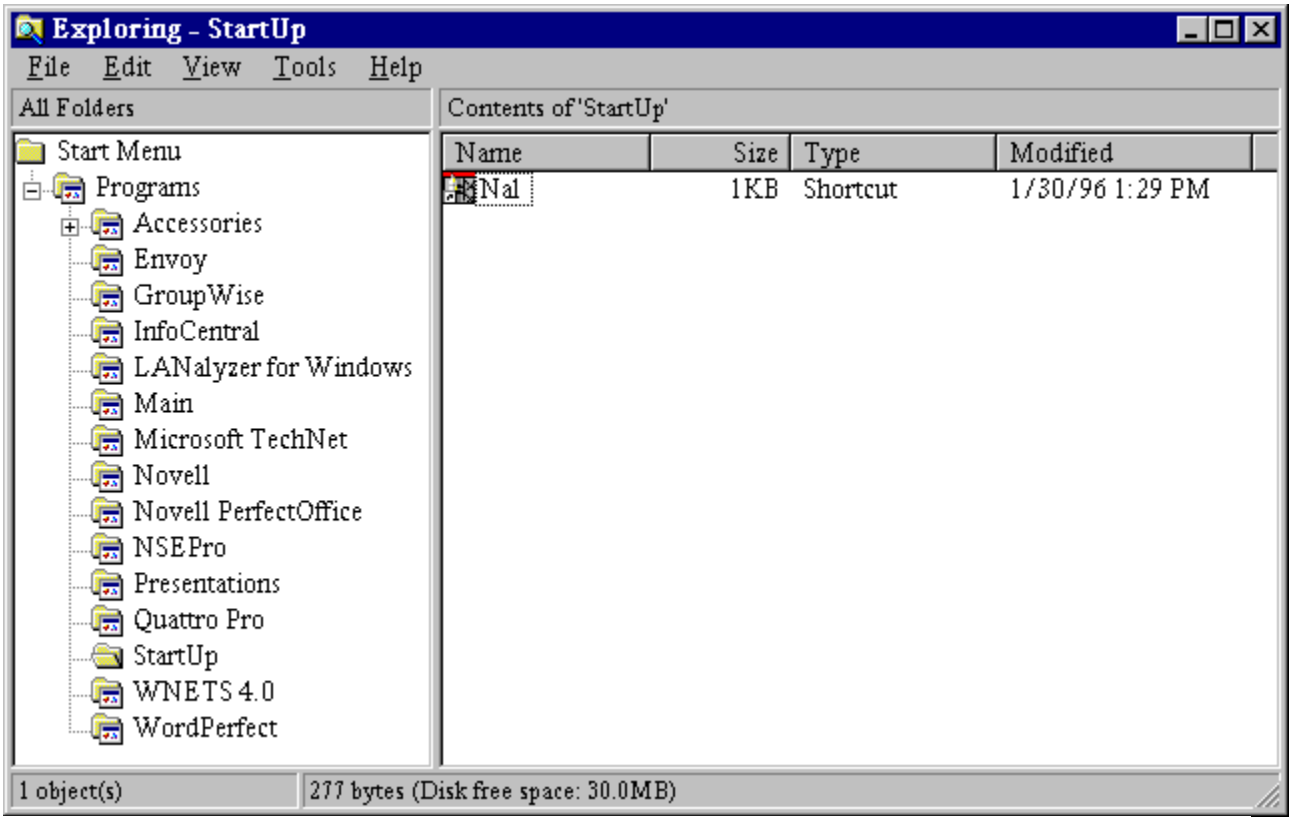
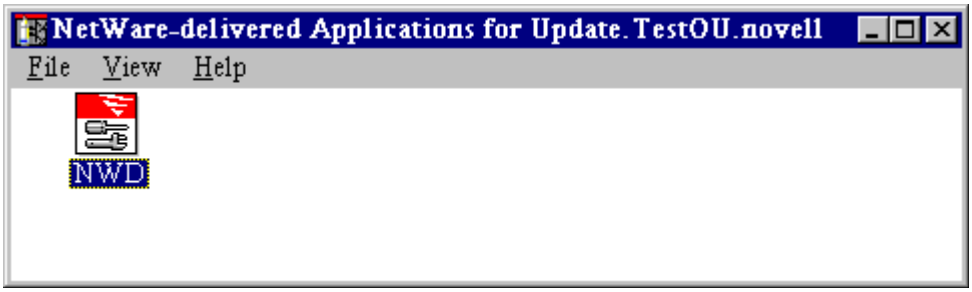


13. Restart Windows 95. Now use the GUI Login utility to log in as the Update user you created. (Be sure you are in the proper NDS context and have given proper rights and a drive mapping to SYS:PUBLIC to user Update.)

14. You will see NAL display a bitmap image as it queries NDS and creates the icons. After Windows 95 has initialized, you will see the following:



You can now launch the NetWare Diagnostic utility by double-clicking on the icon.

Exploring the NAL Options

Now let's look at some of the options NAL provides.

Drives/Ports. The following steps illustrate how to assign drive mappings and printer port captures for a particular application with NAL. By default, NAL cleans up all resources it configures when the application is

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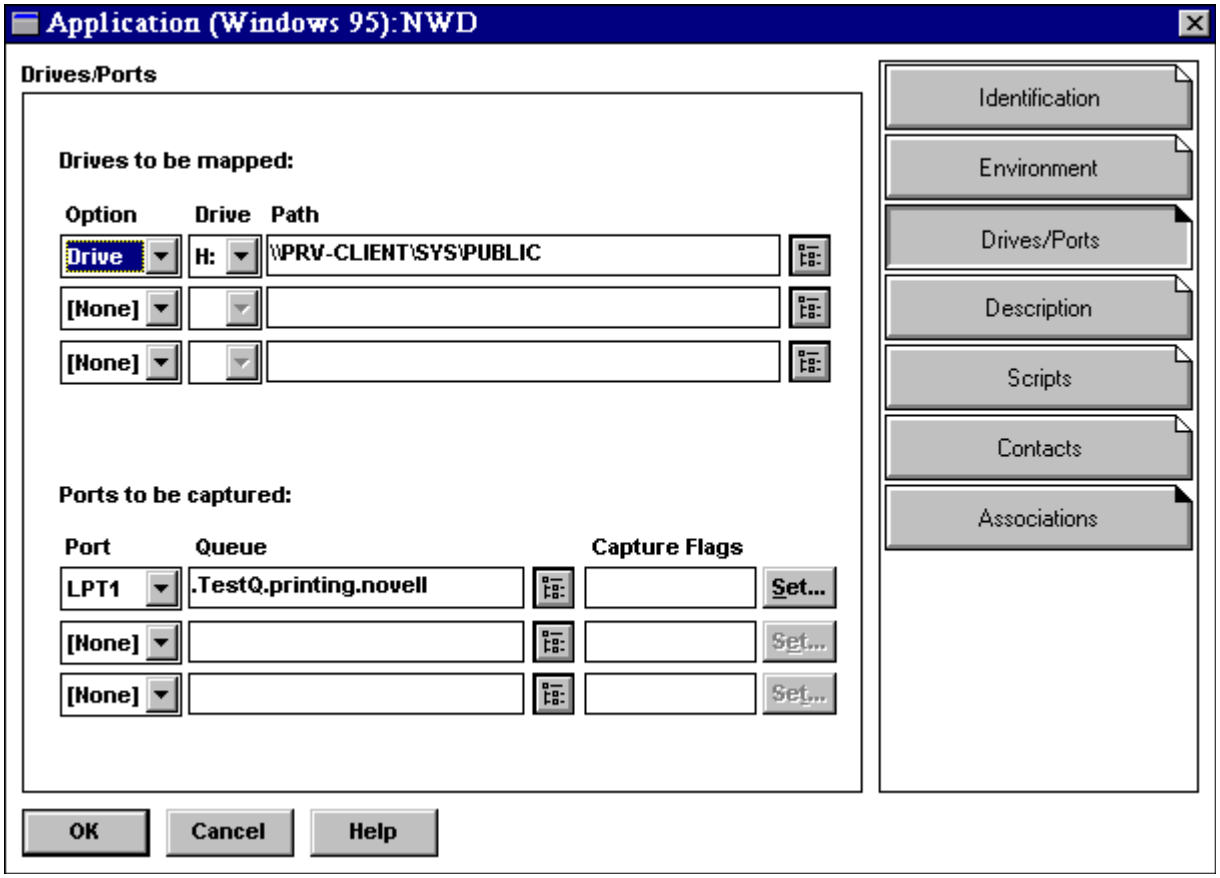
shut down.

1. In NWADMIN, double-click on the NAL Application object you just created. On the *Drives/Ports* page, insert a drive mapping and capture a printer port, as shown below (substitute a print queue that exists in your network). You can enter the information manually or by using the browse buttons.



2. Click OK to save the settings, then minimize NWADMIN.

3. In the Windows 95 desktop, double-click on the NetWare Diagnostics icon. NWD2.EXE will initialize.

4. Go to a DOS prompt and execute the MAP command to verify that drive H has been mapped. Then execute `CAPTURE /SH` to verify that the port has been captured.

5. Close the NWD2 application from the Windows 95 desktop. Then from a DOS prompt, execute MAP and `CAPTURE /SH` again. The mapping and capture will have been deleted.

Environment. On the Environment page, you can set command line parameters and a working directory for the application. You can also have the application run minimized and clean up network resources when it closes, as described above.

The Environment page for the NWD Application is shown below:

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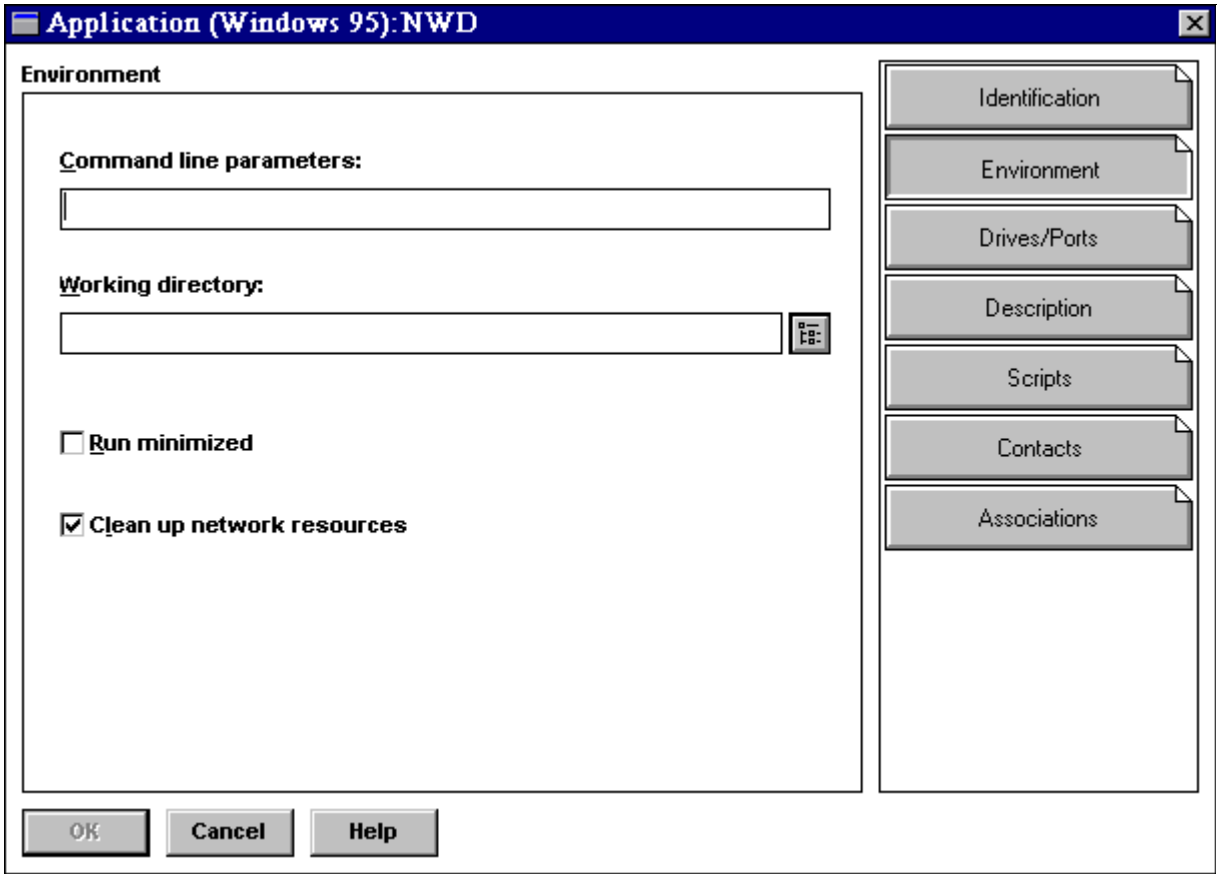

Description. On the Description page, you can type in a short description of the application, as shown in the sample screen below. You will see later where users can see this description.

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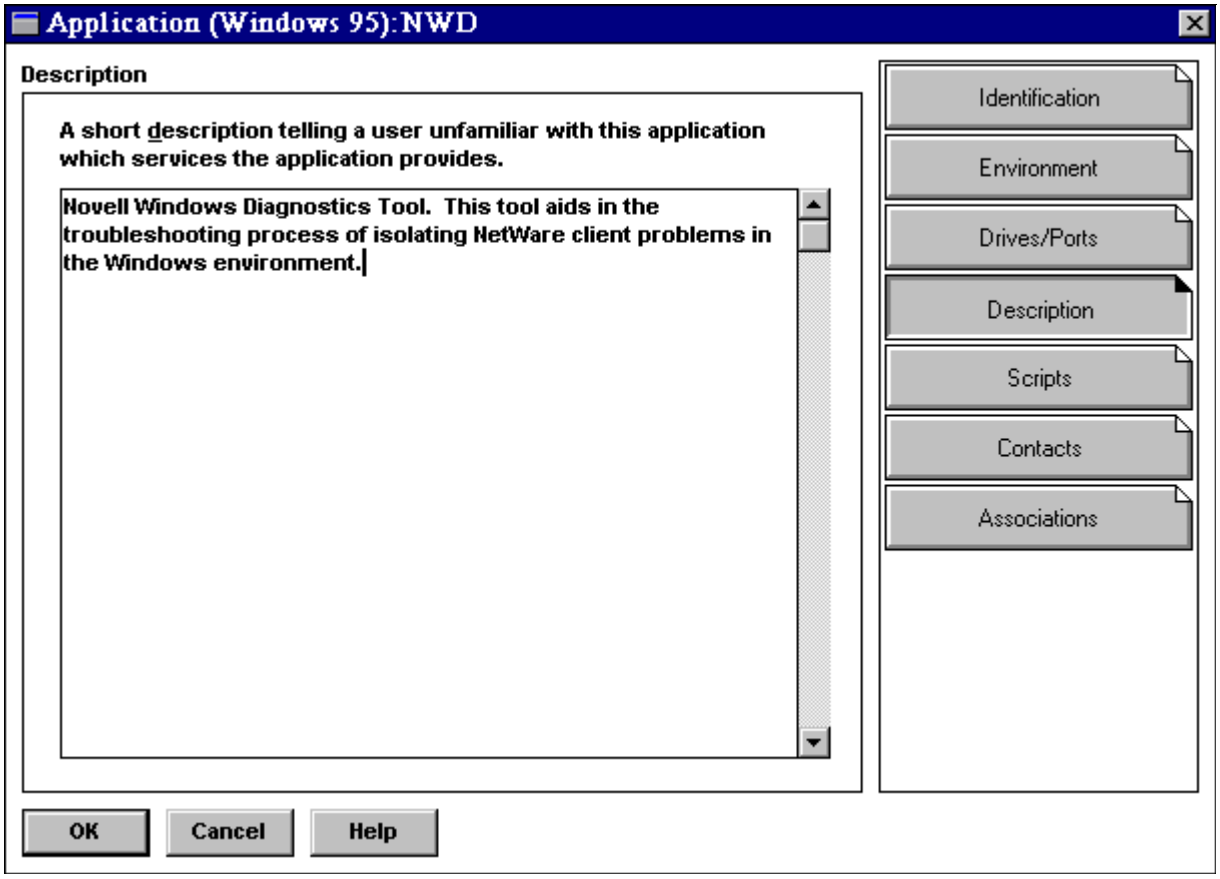

Scripts. On the Scripts page, you can create scripts (using the same syntax as login scripts) that are run before the application is launched and after the application is shut down. An example of this page is shown below:

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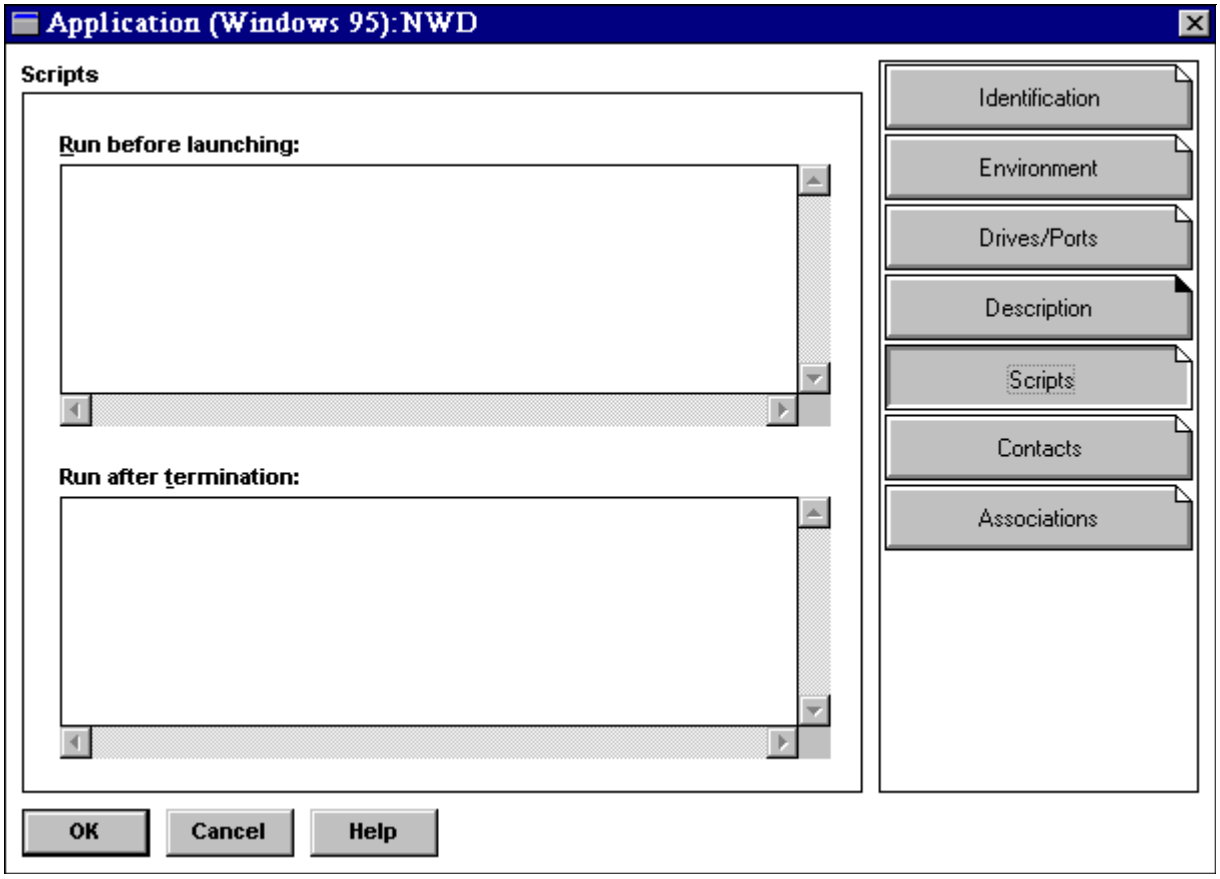

Contacts. Users can send E-mail to the contacts listed here if they have questions or problems with this application. You will see later where users can see the contact list.

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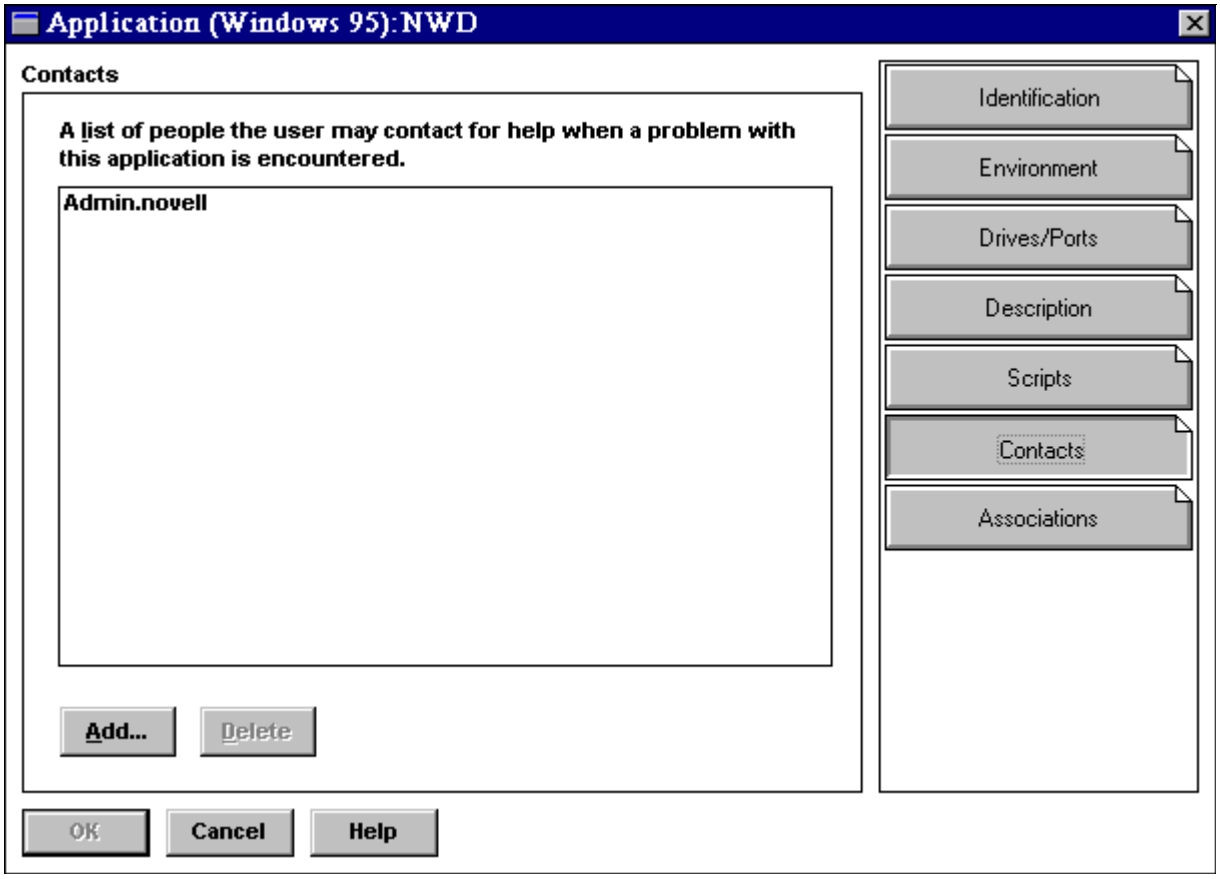

To see how a user would send E-mail to the contacts, complete this exercise:

1. Right-click on the NetWare Diagnostics icon in the group NAL created on your Windows 95 desktop. Select the "Properties" option from the resulting menu. Notice that the short description you entered in NWAdmin is displayed under the Description tab:

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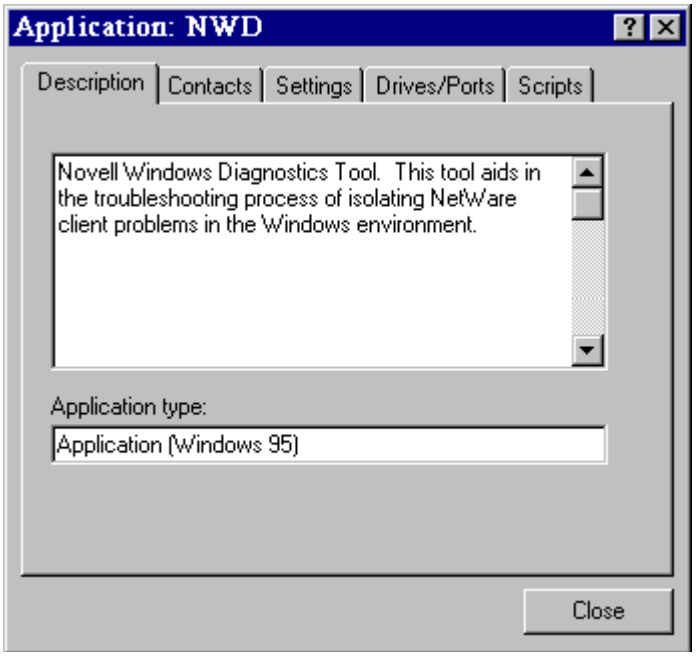

2. Click on Contacts. A list of users that have been defined as contacts for the application is displayed:

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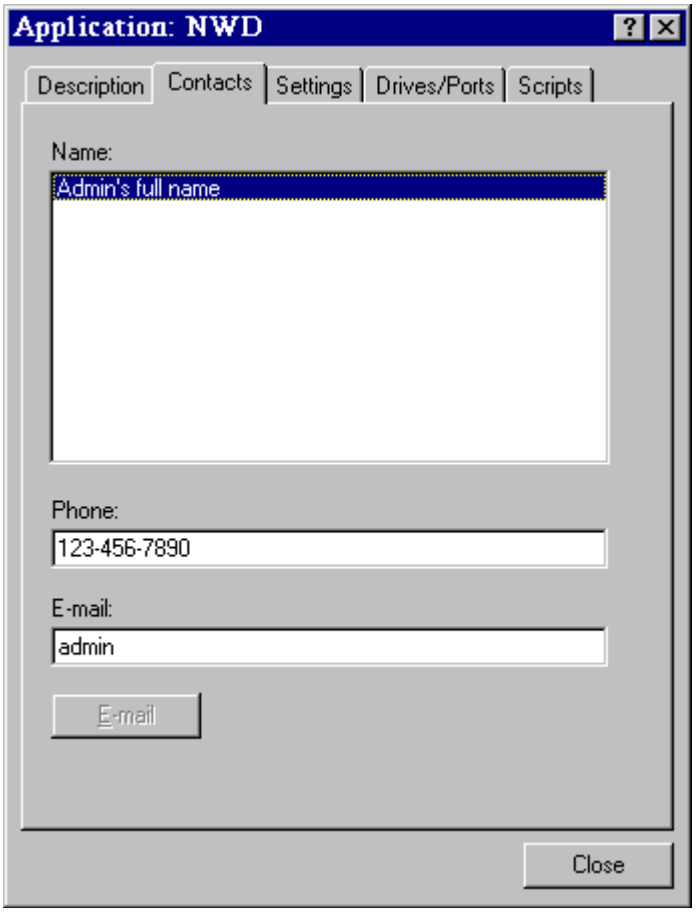

3. In Windows 95, if you have installed an application that is 32-bit MAPI enabled, the E-mail button will be active. Once an E-mail address is typed in the entry box, the user can click on the E-mail button to pop-up a dialog box in which he or she can type in a description of the problem or question. This message is then automatically sent to the user highlighted in the Contacts list.

4. Click on **Close** to exit this window.

5. Click on the Settings tab. The details of the application are displayed (these fields can be viewed but not edited):

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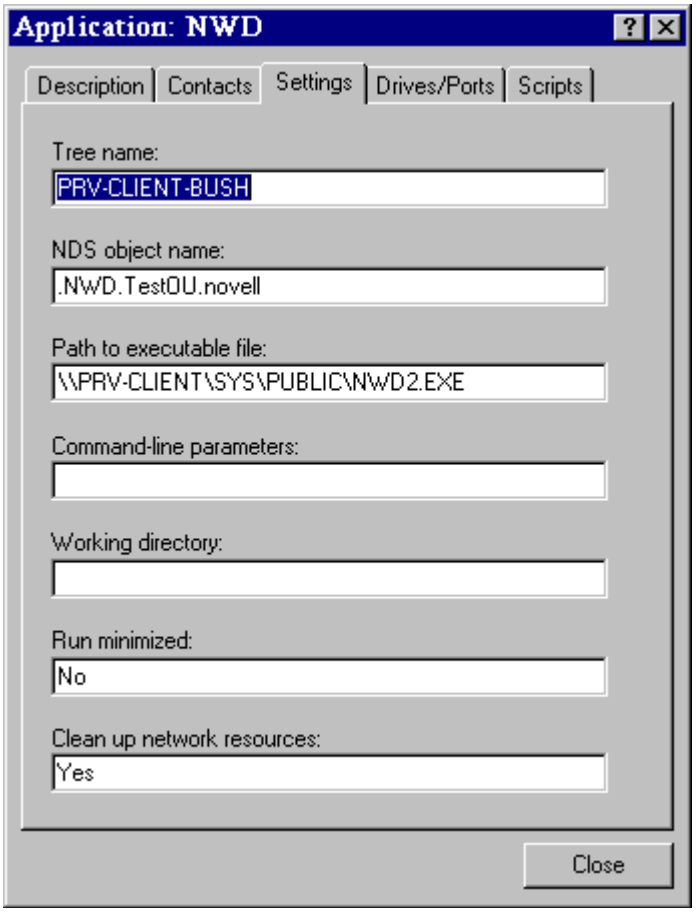

Click on **Close** to exit this window.

6. Click on the Drives/Ports tab. You will see the drives and LPT captures you defined to be configured when the application is executed, as shown in the following example:

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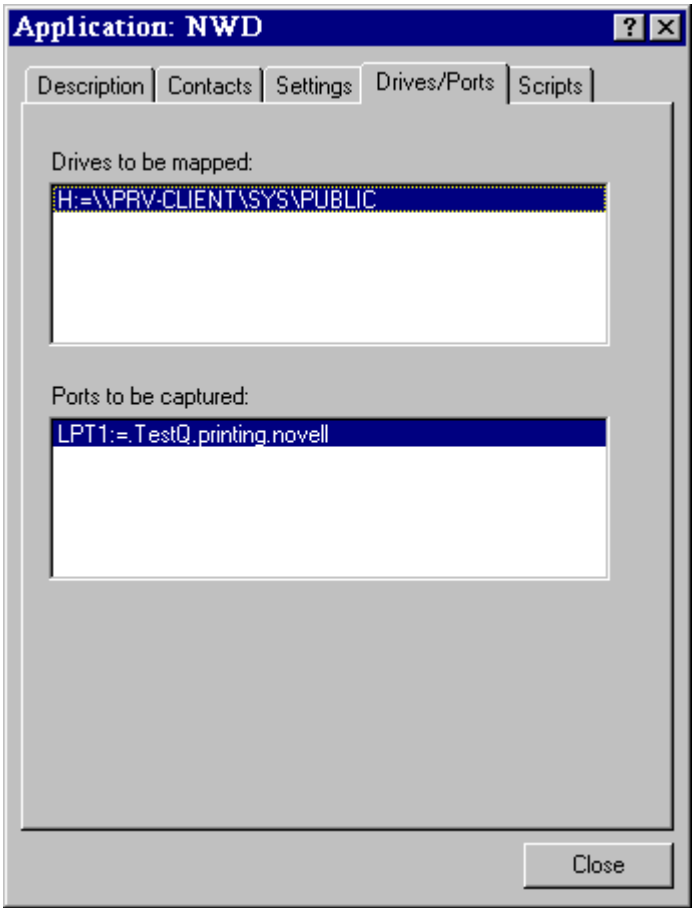

Click on **Close** to exit this window.

7. Close the Application properties sheet and return to NWADMIN.

Associations. The final button under the NWD Application object is Associations. Click on it to view all NDS objects that are associated with the application.

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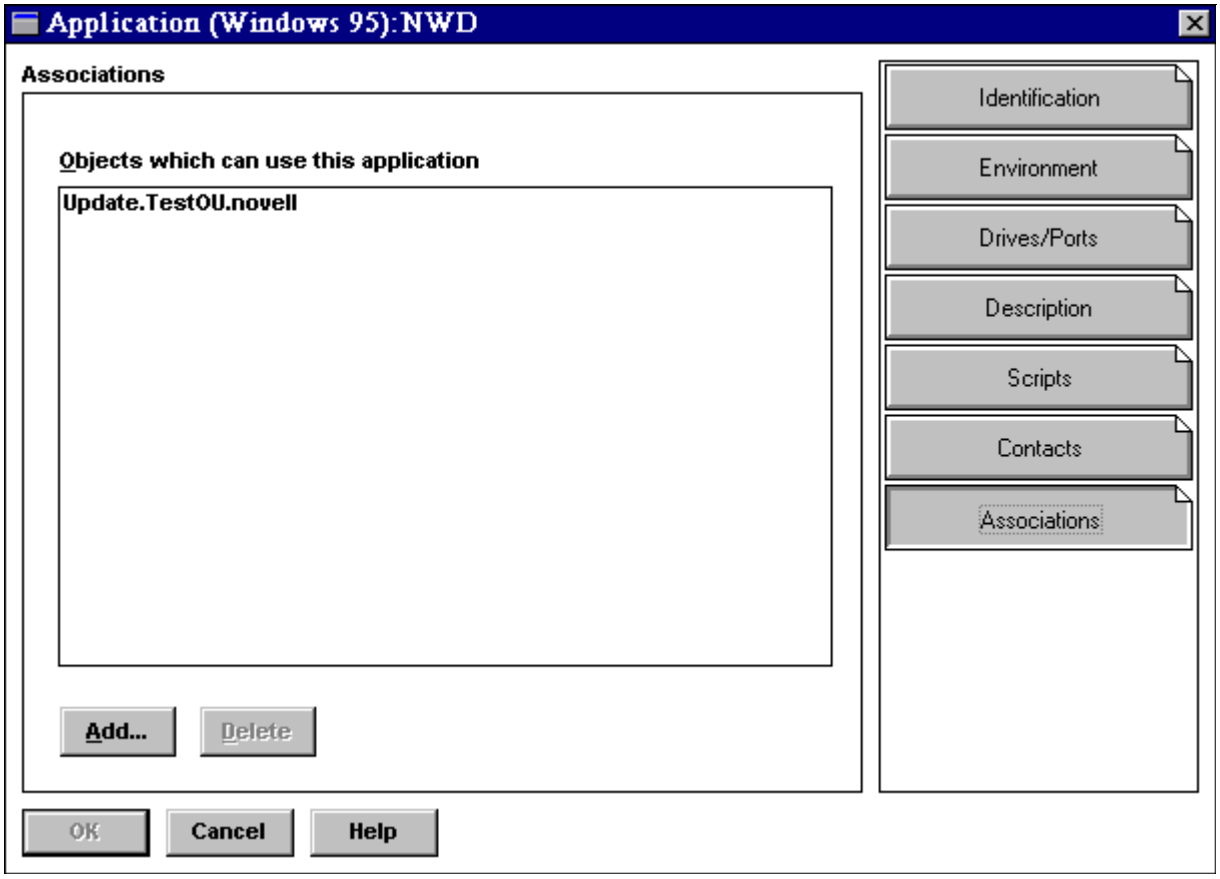

Click **Cancel** to exit this window.

Launcher Configuration Options. This exercise illustrates the use of various launcher options that you can set on a per-user basis.

1. In NWADMIN, right-click on the Update user you created and select Details from the menu. Click on the Launcher Configuration button to view the Launcher Configuration settings page. You can modify the default settings according to your needs.

2. To see how some of these settings work, change the defaults as follows:

   - By default the user will use the parent container's settings. Click on "Use current settings" to have the user use your modified settings instead of the parent container's settings.
   - Uncheck the "Exit the launcher" box if it is checked. With this setting, the user will not be able to close the group created by NAL.
   - The "Enable timed refresh" setting determines how often the workstation will send a packet to the server to query NDS for new application objects. For purposes of experimentation, set the refresh time to 15 seconds as shown. (It is not recommended that you set this value as low as 15 on a production network.)

   For more information about the other settings, click **Help**.

   When you are finished, the Launcher Configuration screen should look like the example shown below:

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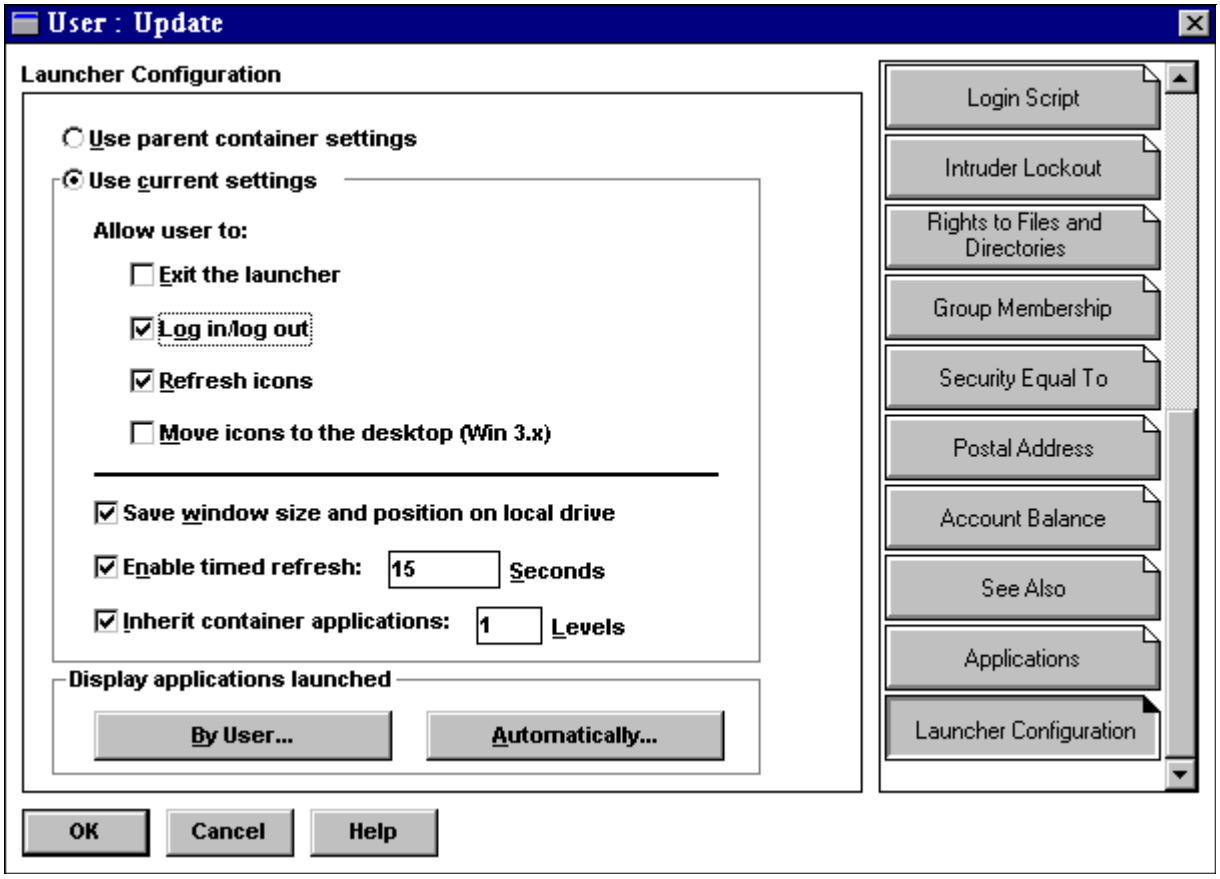

Click **OK** to save the changes.

3. In Windows 95, close the group NAL.EXE created. (You have to close NAL and start it again for the changes you just made in NWADMIN to take effect because they are read when NAL.EXE initializes).

4. Restart NAL by entering Start | Run | Z:\PUBLIC\NAL.EXE. Try to close the NetWare-delivered Applications group)the group should not close because you unchecked the "Exit the launcher" box above.

5. In NWADMIN, create another Application object in the TestOU container you created. For this exercise, this object can be for the NWADMIN utility:

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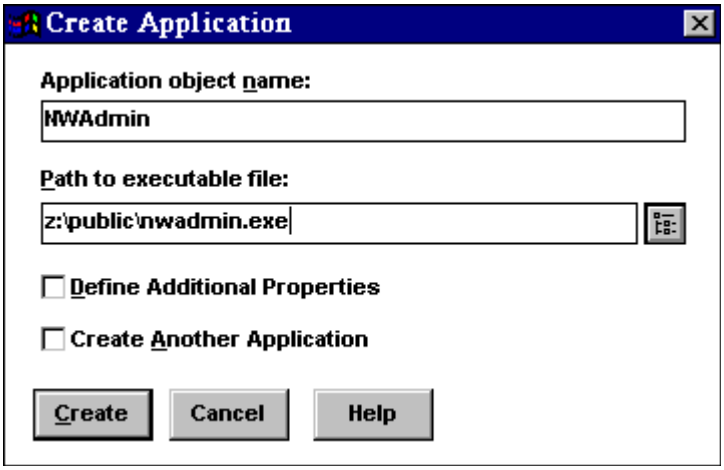
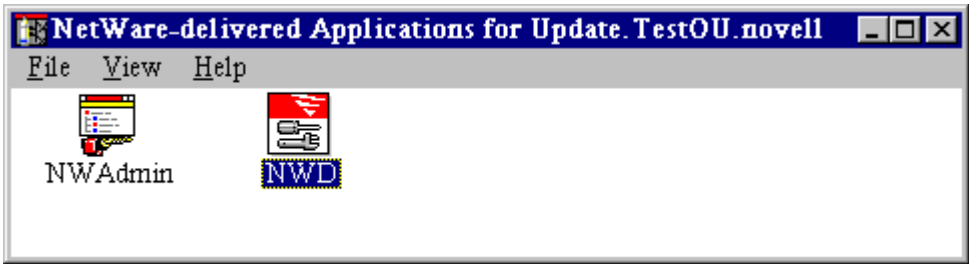


6. Make the Update user you created a user of the new application (NWADMIN.EXE). You can set this up in NWADMIN under the Applications tab for the user, or under the Associations tab for the Application object.

7. In Windows 95, make the NetWare-delivered Applications program group the active group. The new icon for NWADMIN should appear in the program group within the time specified in the "Enable timed refresh" setting (15 seconds with our experimental value). The exact time the icon takes to show up will vary according to the size of the NDS tree you are in and how long it takes for updates to be synchronized across all replicas of your partition. In small NDS trees, this can be a short time; in larger trees, it can take longer.

   If the icon does *not* appear after a reasonable amount of time, click on View | Refresh. The NetWare-delivered Applications group should appear as follows:



Launching Applications Automatically. The final exercise shows how to set up an application to be launched automatically when users start Windows 95. (This is synonymous with placing the application in the Windows Startup folder.)

1. In NWADMIN, right-click on the Update user and select Details. Click on the Applications button. Remove the NWD application from the *Launched by user* section and add it under *Launched automatically*, as shown below:

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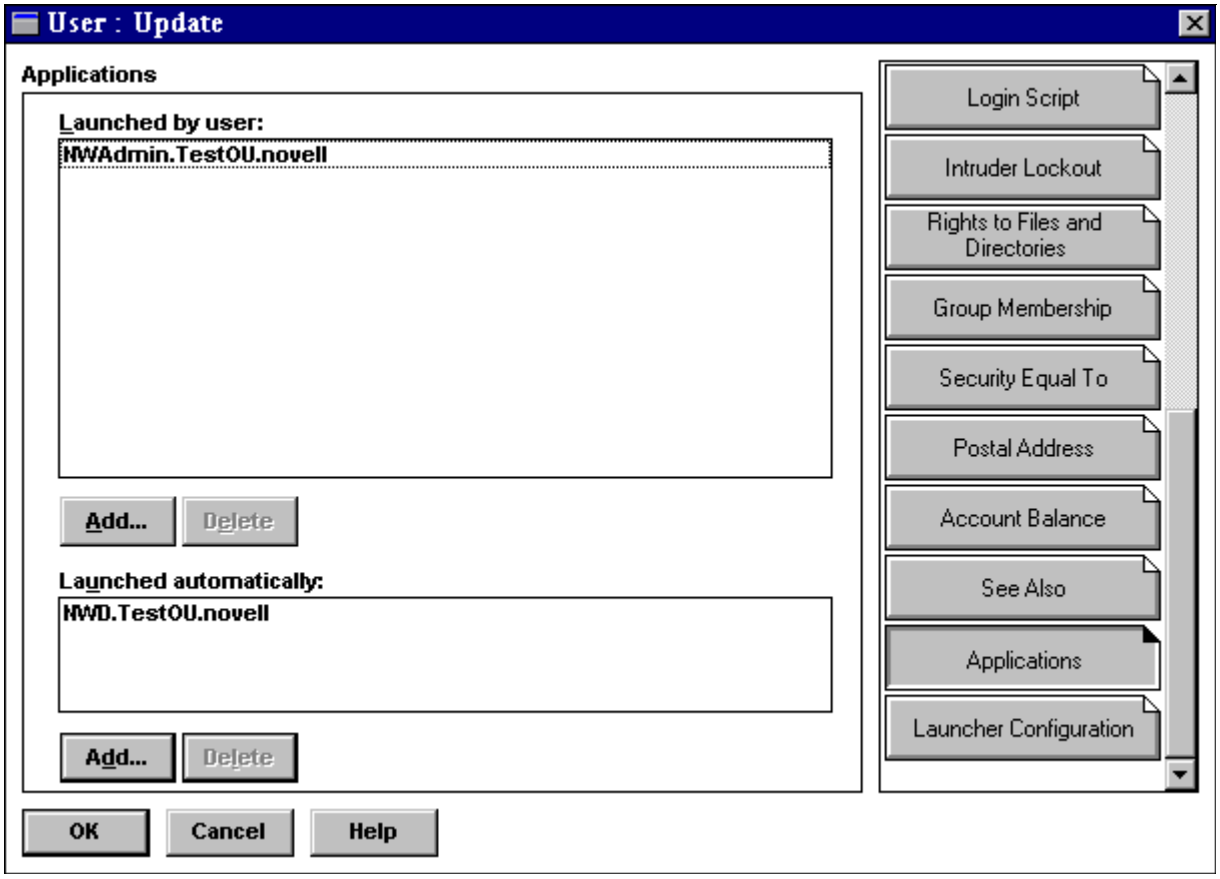
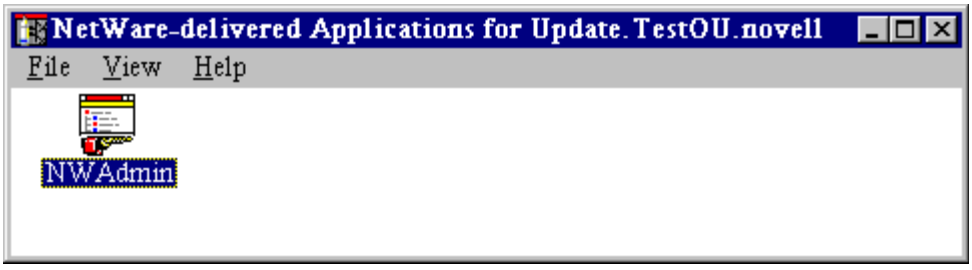


2. Shut down Windows 95 and start it back up again. This time when NAL executes, NWD2 should automatically be launched. Only the icon for NWADMIN will appear in the NetWare-delivered Applications group, as shown below:



Future Enhancements

Novell views the Novell Application Launcher as a crucial NetWare service. It is included with Novell's NetWare Client 32 for Windows 95 and for DOS and Windows 3.x. It will be included in all future releases of NetWare. Future releases of NAL will include features such as software metering, application fault tolerance, and application load balancing. These enhancements promise to make it even easier to manage networks and network applications.

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NOVEMBER 1996

NOVELL® RESEARCH

Setting Up Network Printing with Client 32 for Windows 95

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NetWare Client 32 for Windows 95 supports "deviceless" printing. In other words, it is no longer necessary to associate an LPT port with a specific printer and use a print capture to redirect the output to a network printer. Instead, GUI applications send print data directly to a Windows 95 printer device (such as a NetWare print queue), which points to a network printer. Windows 95 writes the printer configuration information to the Registry.

To support printing from MS-DOS or Windows 3.x applications, you can still set up an LPT port capture and redirect output to the network printer specified in the capture. Captures are global—if you do a capture at an MS-DOS prompt, the capture exists under the GUI; if you do a capture in the GUI world, it exists for MS-DOS boxes. However, any flags you set up under a DOS capture cannot be translated into the GUI world. There's no way to associate a Windows 95 printer device with an LPT port.

Client 32 for Windows 95 also supports "point-and-print" to simplify printer setup for users. Point-and-print allows you to store the print driver files for a network printer in a publicly-accessible network directory. When users want to use the printer, they can install it quickly without having to know the printer manufacturer/model and the location of the print driver.

In addition, a 32-bit NPRINTER Manager for Windows 95 is available to provide the same functionality previously supplied by the NPRINTER or RPRINTER program. By loading this on a Windows 95 workstation, you can share a locally-attached printer with other users on the network.

This AppNote covers the following aspects of setting up network printing:

- Printing to a network printer
- Configuring an installed network printer
- Setting up point-and-print for network printers
- Using the NPRINTER Manager for Windows 95

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Installing a Printer with the Add Printer Wizard

Windows 95 provides the Add Printer wizard to simplify the process of installing printers. The Printers folder acts as a central place for running the wizard and for managing printing processes.

Note: In the initial release of Windows 95, you must use Network Neighborhood or Explorer to install printers for Novell Directory Services (NDS) print queues. The Add Printer option in My Computer can only see Bindery print queues, due to a problem with Microsoft's SHELL32.DLL which limits this functionality for the provider. There is an update available in Microsoft's Service Pack 1 that will allow you to use My Computer to see NDS print queues. The Service Pack can be found at http://www.microsoft.com.

Below are the steps for installing a network printer using the Add Printer Wizard in Windows 95. These instructions assume a NetWare print queue (Bindery or NDS) has already been created for the printer.

1. In Windows 95, open the Printers folder. You can do this in one of the following ways:

   - From the Start menu, point to Settings, and then click on Printers.
   - In My Computer, double-click on the Printers folder.
   - In Control Panel, double-click on the Printers folder.

   The Printers folder contains icons for any printers that are already installed, plus an Add Printer icon, as shown below:

2. Double-click on the Add Printer icon to launch the Add Printer Wizard.

   Note: You can also launch the Add Printer Wizard by double-clicking on a print queue in Network Neighborhood or Explorer. This only works for print queues that haven't yet been set up on your workstation.)

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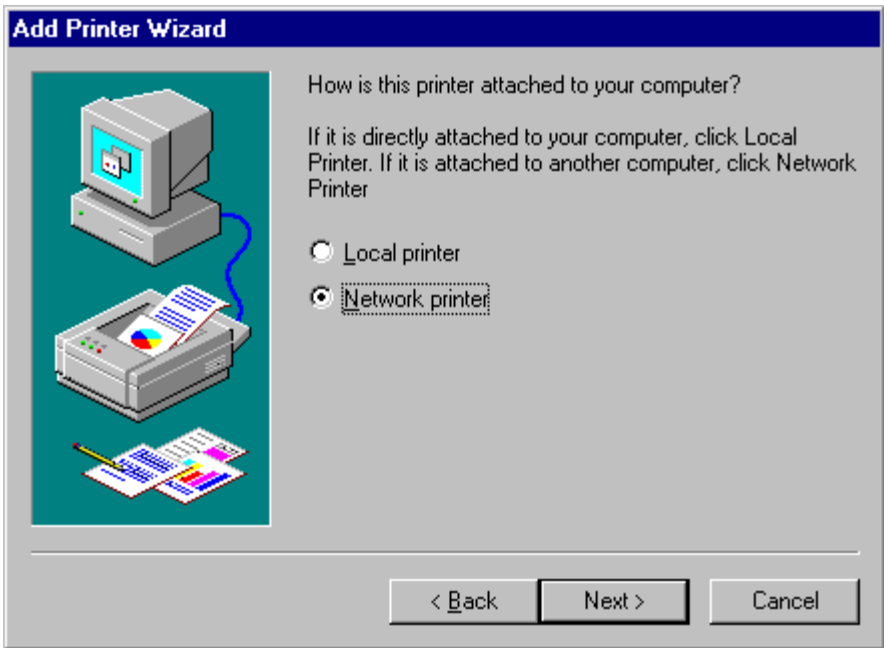
Click on **Next >** to begin installing your printer.

3. The next screen asks whether the printer is directly attached to your computer (a local printer) or if it is attached to another computer (a network or "remote" printer). The only difference between installing a remote printer and a local printer with the Add Printer Wizard is that you must specify the path to the remote printer.



For this example, assume you are installing a network printer. Select "Network printer" and click on

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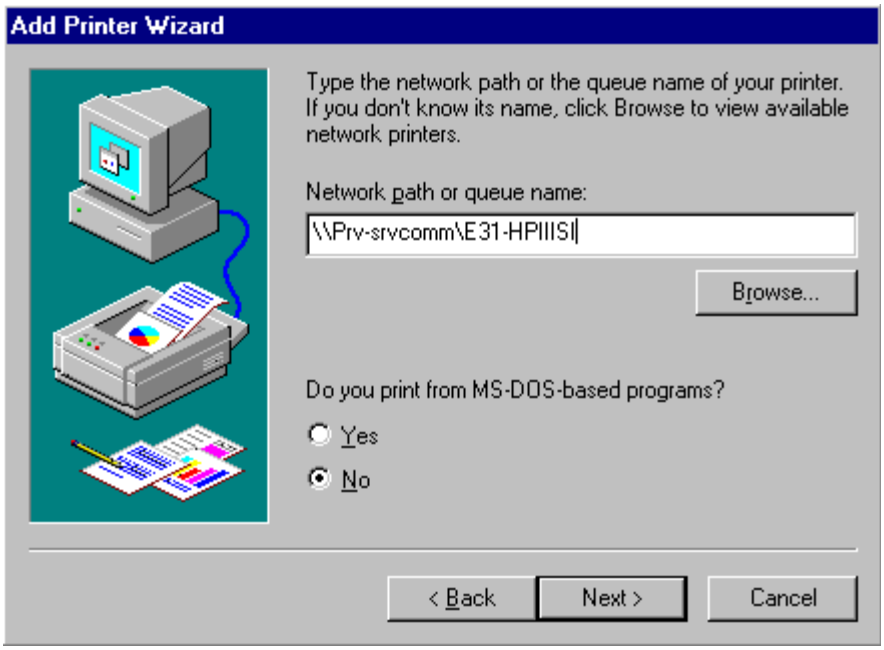
Next >.

4. Since you have selected a network printer, you need to specify the path to the print queue that has been set up for the printer. You can either type the UNC path or click on the **Browse...** button to browse the network resources and select the print queue. In this example, the UNC path is `\\Prv-srvcomm\E31-HPIIISI`.



With Windows 95, printers are not normally linked to an LPT port, but to a port "path" through the network. However, capturing printer ports is still available for backward compatibility with DOS programs. If you will need to print from DOS-based programs, answer Yes to the question at the bottom of the screen and then click on **Next >**. (Otherwise leave the answer as No, click on **Next>**, and skip to Step 6.)

5. In the next screen, click on the **Capture Printer Port...** button to associate the printer with an LPT port.

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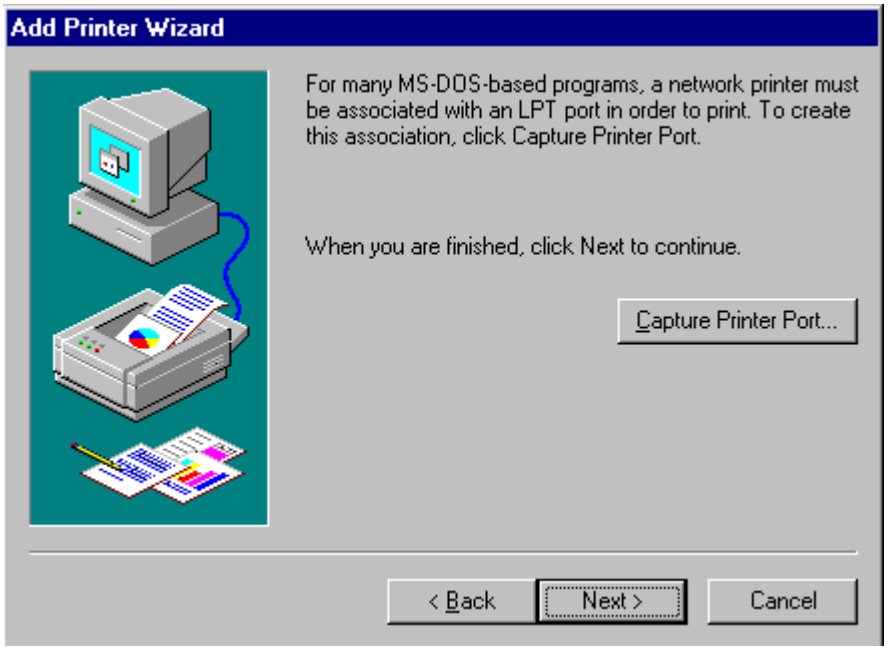
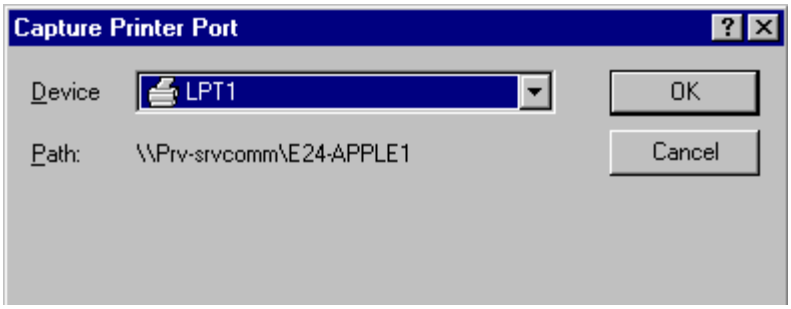


In the Capture Printer Port dialog box, select the LPT port you want to associate with this printer in the Device entry box (LPT1 in the example below):



Click on **OK**, and then click the **Next>** button.

6. Choose the manufacturer and type of printer you are installing. The example below shows the selection of an HP LaserJet III Si non- PostScript printer from Hewlett-Packard. (If your printer is not listed but you have Windows 95 drivers for it, click on the **Have Disk...** button and follow the on-screen instructions.)

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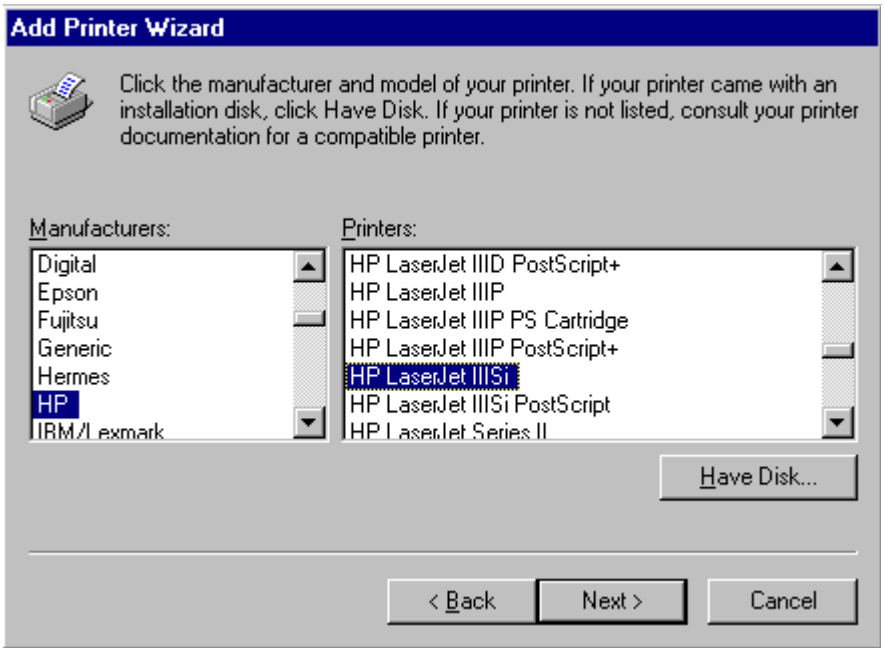
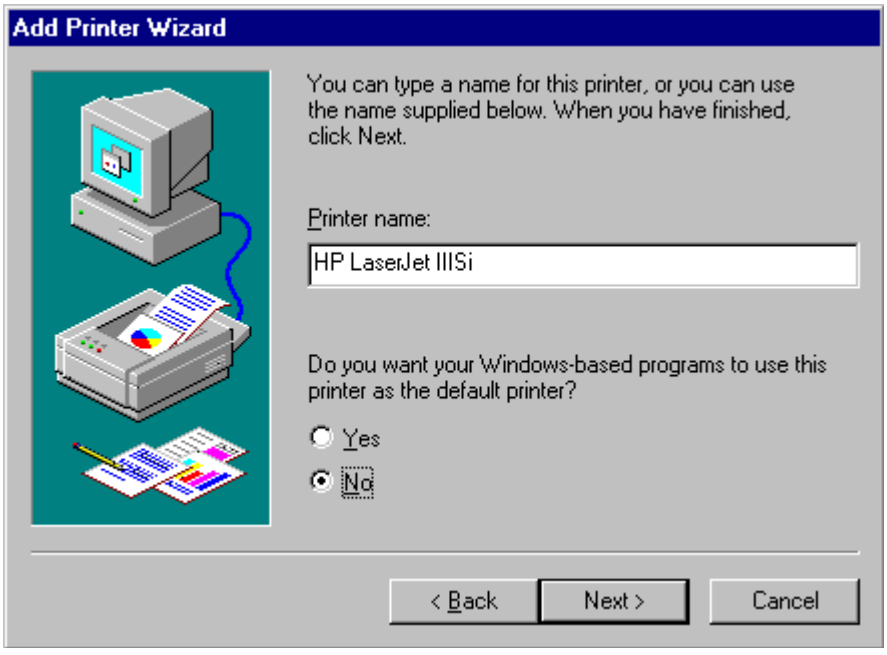


Click on **Next >**.

7. The next screen prompts you to name the printer:



You can either accept the default name supplied or type another name for the printer. If you want this to be the default printer for Windows-based programs, answer Yes to the question at the bottom of the screen. Click **Next >**.

8. The final question asks if you want Windows to print a test page to confirm that the printer is set up

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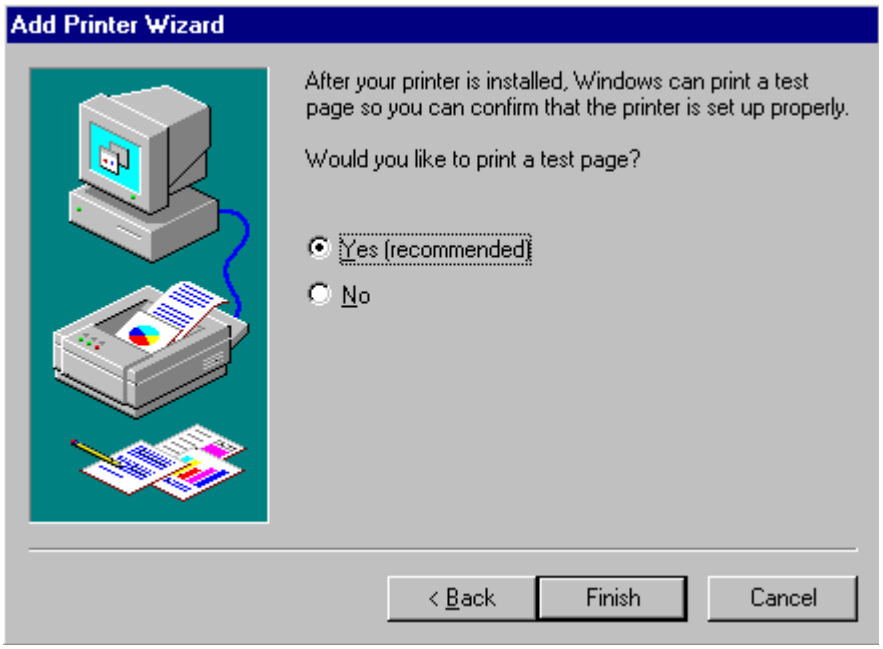
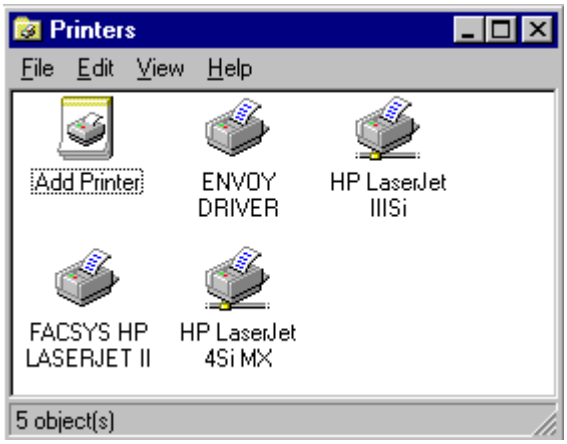
properly. Answer Yes or No and click on **Finish**.



An icon for the newly-installed printer should now appear in the Printers folder, as shown below:



If you chose to print a test page, you will see a prompt asking if the test page printed correctly. If it did not, answer No and go through the on-screen troubleshooting steps to find the problem. If the test page printed, answer Yes. The user can now print to the printer, as explained under the next heading.

Printing to a Network Printer

You can print two different ways: from within an application, or using a printer shortcut.

Printing from Within an Application

You can print from within an application in Windows 95 in the same manner as with Windows 3.x. The only

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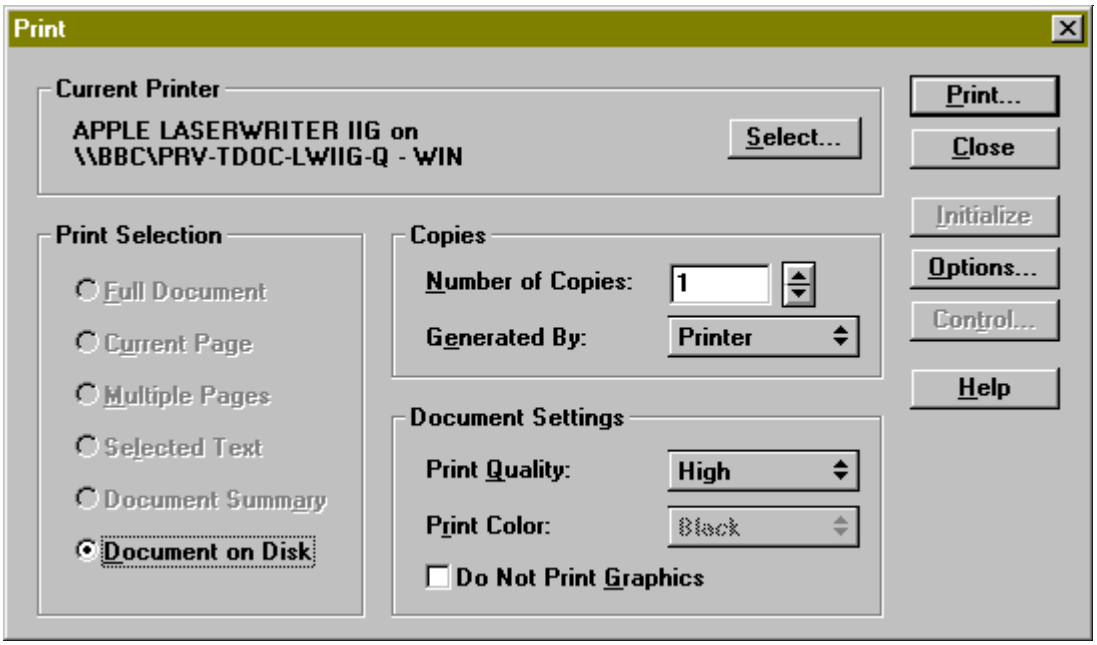
noticeable difference in the print dialog is the absence of an LPT port in the "Current Printer" designation, as you can see in the following example:



Printing Using a Shortcut

In Windows 95, "shortcuts" allow you to copy an icon that relates to any program, document, or printer and move the icon to the desktop or to another folder for quick access to frequently used resources. For example, you can create a printer shortcut icon and place it on the desktop for easier access.

Once a printer shortcut is set up, you can simply drag and drop a file onto the printer shortcut icon. The shortcut will automatically open the associated application and execute the print command.

Configuring an Installed Printer

To configure the printer after it is installed, right-click on the printer's icon in the Printers folder. The resulting menu lists several options for the printer, as shown in the example screen below:

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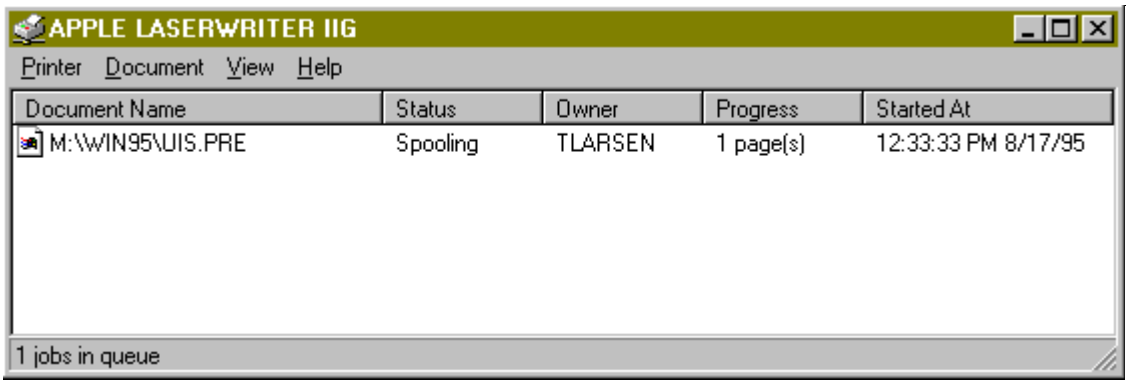
These pull-down menu options are defined as follows:

Option	Description
Open	Opens the printer's print queue and displays current print jobs
Work Offline	Stores print jobs until the printer is turned online by clikcing the Work Offline option again. This option is available only for portable computers or for computers using a network printer. For local printers, use the Pause Printing option.
Set As Default	Makes the selected printer the default printer
Create Shortcut	Creates a shortcut icon for the printer
Delete	Deletes the printer definition
Rename	Allows you to rename the printer
Properties	Sets printer properties and allows you to capture a printer

Below are some examples of what you can do with these options. The examples assume you are working from the Printers folder. Many of these same tasks can also be performed by right-clicking on printers and print queues that are viewed in Explorer.

Displaying Jobs in a Print Queue

To see jobs in a print queue, select "Open" from the pull-down menu. This opens the print queue and displays the current print jobs, as shown below:



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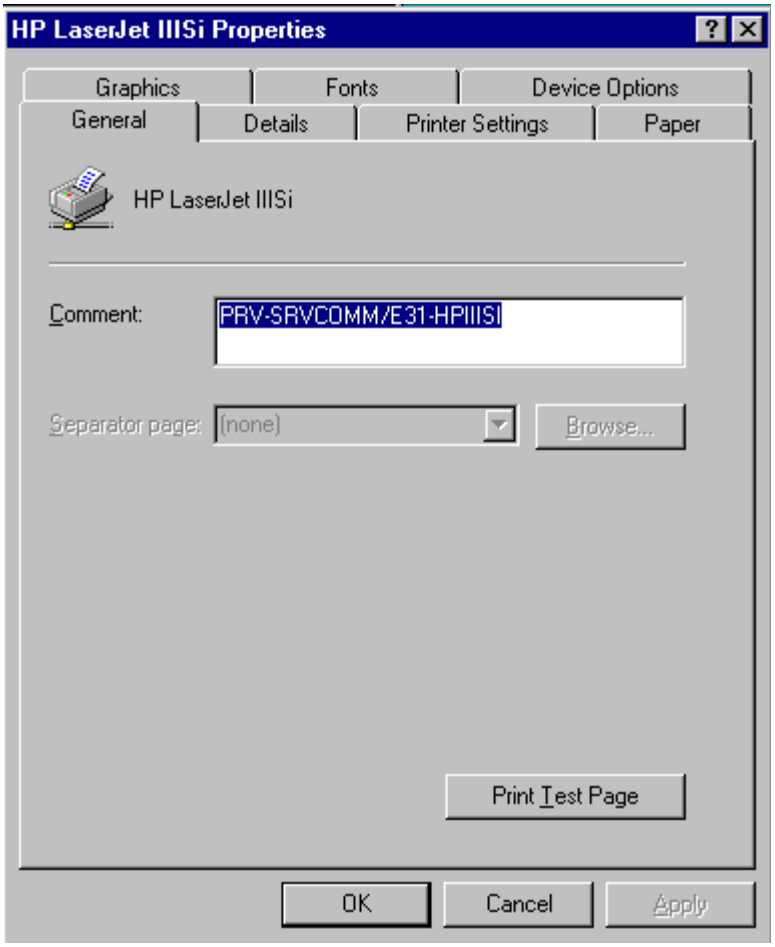
Note: You can access this same queue window by double-clicking on the printer icon in the Printers folder, or on the print queue in Explorer or Network Neighborhood.

Modifying Printer Properties

To change the properties associated with the printer, select Properties from the menu. From here you can configure general printer settings, details on the printer, printer settings, paper, graphics, fonts, and device options.

The General Tab. The sample screen below shows the options under the General tab:



By default, the Comment field contains the server/print queue name. You can change this to add a customized comment about the printer, such as when it is available or what it is used for. The Separator Page option is not available for network printers. You can click on **Print Test Page** to send a test page to the printer for troubleshooting purposes.

Details Tab. The Details tab lets you add or delete LPT ports, specify a new printer driver, capture and end capture, and configure the timeout settings. An example of this page is shown below:

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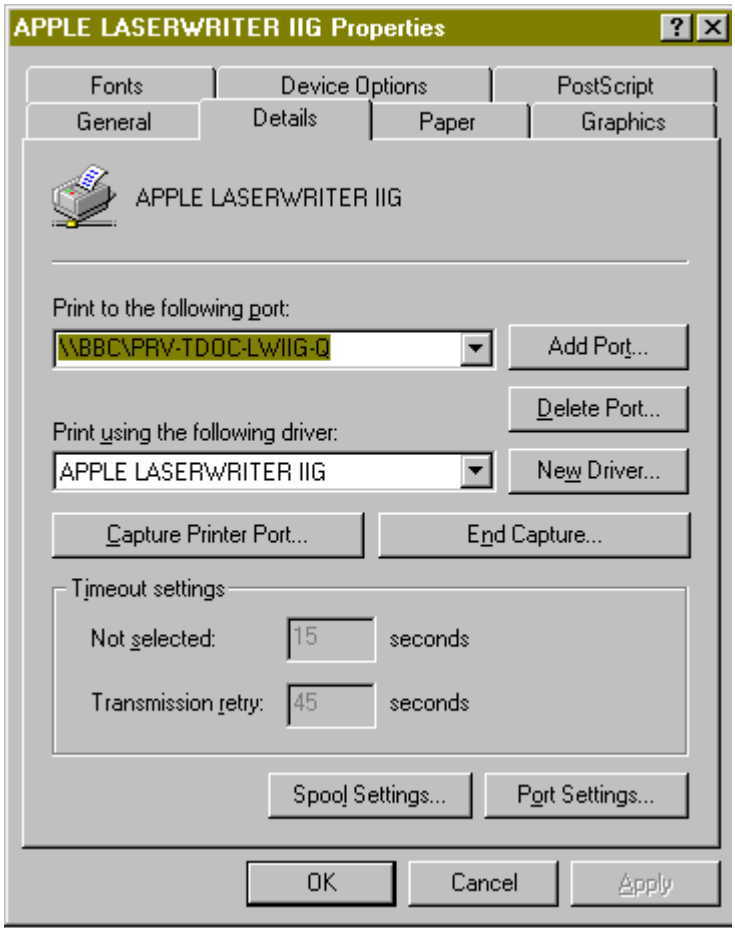

The port (destination) that was used when setting up the printer is displayed under "Print to the following port:".

To add a new port to this list, click on on the **Add Port**... button. (You can also click on the down-arrow button to the right to select from a list of possible destinations for the print output.) An Add Port dialog box similar to the following will appear:

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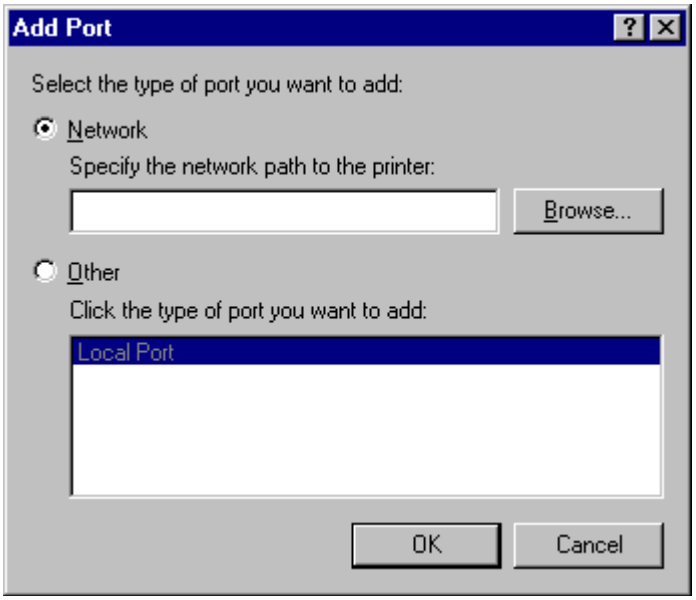
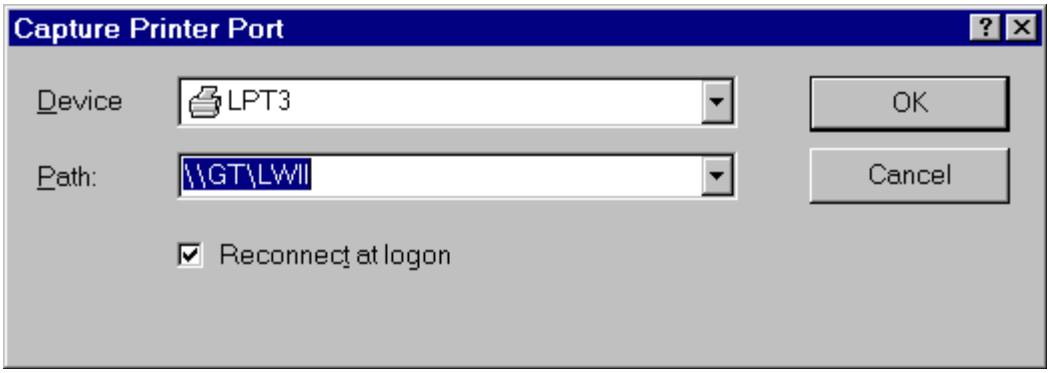


To add a network port (print queue), type in the network path to the printer. Or click on **Browse...** to select the queue from a list of defined print queues. Click **OK** when finished.

If you want to print to a file, click Other and then enter a filename for the port name. The filename will be added to the list of available ports, so that print jobs will go to a file with the specified name.

Capturing an LPT Port. To capture an LPT port, click on the **Capture Printer Port** button on the Details page. In the Capture Printer Port dialog box, choose the LPT port you want to connect and enter the path of the printer to connect with. In most cases, you should enter the path in the format: `\\servername\queuename`.



Click on **OK** to complete the printer port capture.

Many longtime NetWare users are familiar with the banner page, form feed, and other parameters that could be set for captured LPT ports. Windows 95 does not require LPT port captures for printing, but you can still set these parameters for your network printers. One way is through the Printer Settings tab, described next.

The Printer Settings Tab. Clicking on the Printer Settings tab brings up the page shown below (the layout of this page may vary slightly depending on which version of NetWare Client 32 you have):

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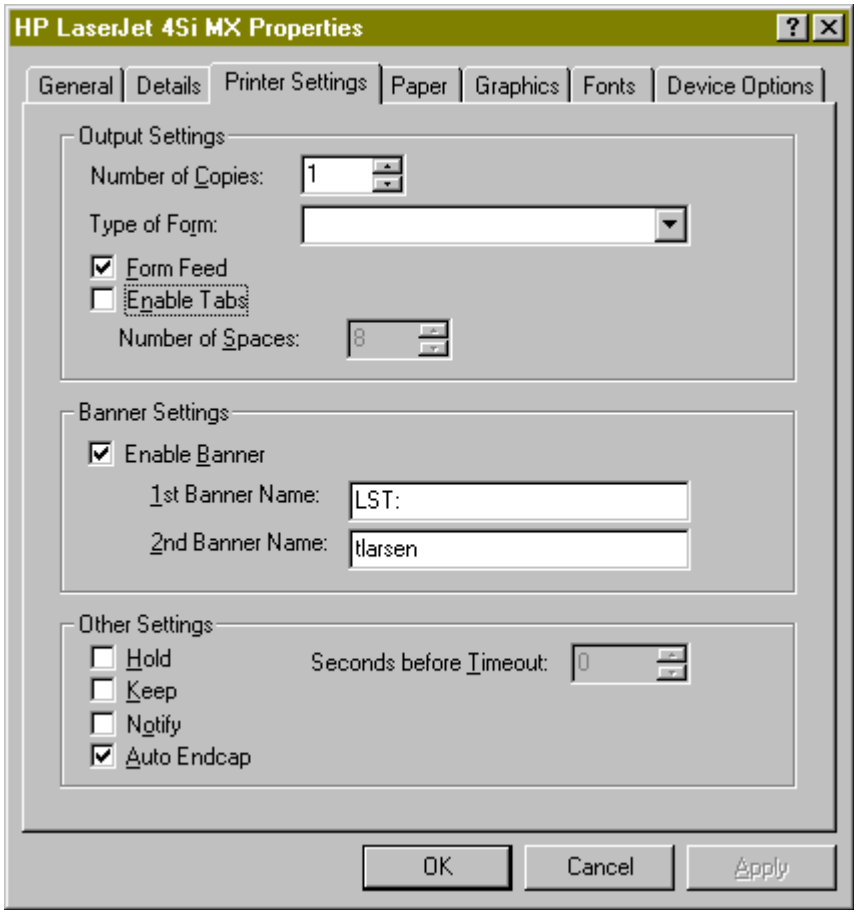

From here you can access the full set of capture parameters, such as banner page and form feed options. (If the computer was *not* set up to print from DOS or Windows 3.x applications, this tab is ignored.)

If the printer was set up to print applications from DOS or Windows 3.x, you can also make capture settings in the same way as for previous NetWare clients (in the login script or from the command line). To check the current settings, go to a DOS box and issue the `CAPTURE SH` command.

Note: If you have more than one printer set up to service the same queue, Windows 95 will only use the settings for the first printer that it finds. To avoid unexpected results, be sure to make the capture settings the same on all defined printers servicing the same queue.

If you want to set default printer settings for all future print captures, select Control Panel | Novell NetWare Client32 | Properties. Click on the Default Capture tab. These settings will affect existing captures after you restart your computer. They do not affect captures made from a login script or from the command line.

Using Point-and-Print for Network Printers

Point-and-print simplifies the process of installing a network printer for Windows 95 users. With NetWare Client 32 for Windows 95, the network administrator can configure a printer so that a user can simply "point" to the printer or queue and Windows 95 will retrieve printer-specific information from the network,

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including:

- The printer manufacturer and model
- The printer driver
- The name of the server on which the printer driver files are stored

From this information, it can be determined which driver to retrieve from a public directory on the server and copy to the Windows 95 workstation.

Note: If you are running the Microsoft Client for NetWare Networks with File and Print Sharing enabled, you can set up point-and-print to retrieve printer drivers from the Windows directory on the computer the printer is attached to. Client 32 users can use point-and-print even if it was set up using the Microsoft NetWare Client. In the case where point-and-print is set up twice for the same printer (once using NetWare Client 32 and once using the Microsoft Client for NetWare), Client 32 users will use the point-and-print configuration that was done using Client 32. This discussion focuses on setting up point-and- print for a network printer.

You can use point-and-print for either Bindery or NDS printers and print queues. The printer driver files are stored in the NetWare bindery or in the NetWare Directory via extending the NDS schema.

Setting Up a Network Printer for Point-and-Print

To set up point-and-print for a network printer and store the printer information on a NetWare 3.x or 4.x server, complete these steps:

1. Start Windows 95 and log in to an NDS tree or NetWare server as Admin/ Supervisor or equivalent user. (This should be the tree or server where you want the path to the printer driver files to be located.)
2. In Network Neighborhood, browse the network until you find the NetWare printer or print queue you want to set up. Right-click on the queue and select Properties from the resulting menu.
3. Click on the "Setup Point and Print" tab. (This tab only appears if you have logged in as Admin/Supervisor or equivalent.) A dialog box similar to the following is displayed:

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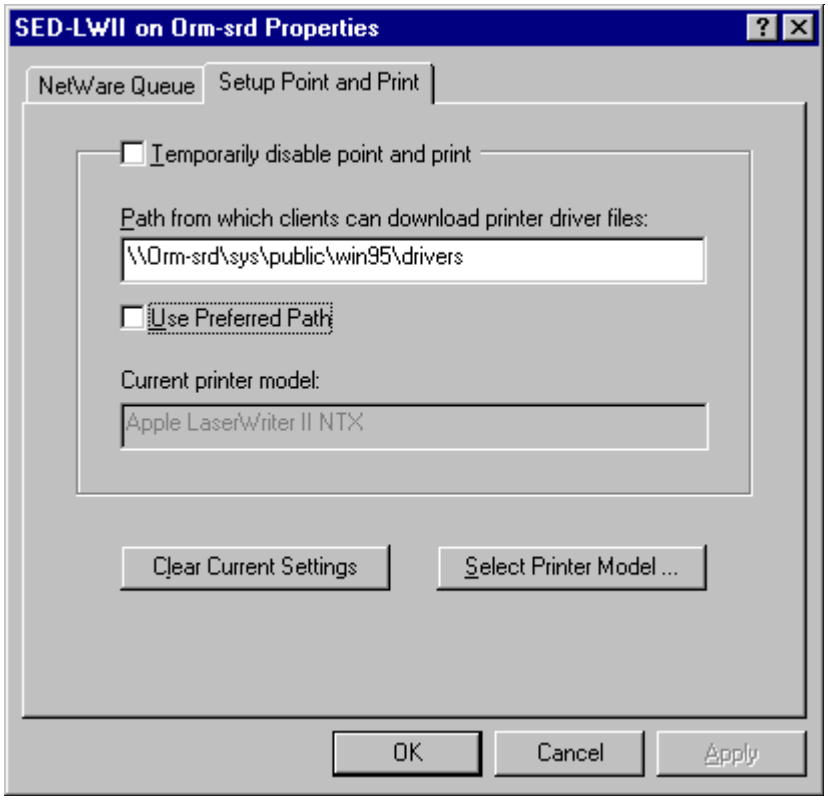

4. Specify the path for the printer driver files. (You must be logged in to the tree or server where the path is located and have sufficient rights to copy files to the specified directory.)

   It is recommended that you choose the preferred (default) path by checking the Use Preferred Path box. The default path is `SYS:PUBLIC \WIN95\DRIVERS`. If you don't want to use this path, uncheck the box and type another UNC path in the entry box (for example: `\\ORM-SRD\SYS\DRIVERS`).

   Note: If you need to later on, you can check the "Temporarily disable point and print" box to disable point-and-print for this printer. Client 32 saves the path and printer model information so you can easily re-enable point-and-print without having to respecify information or recopy the printer drivers.

5. Click on **Select Printer Model** and select your printer maufacturer and model from the lists provided in the Select Device dialog box, as shown below:

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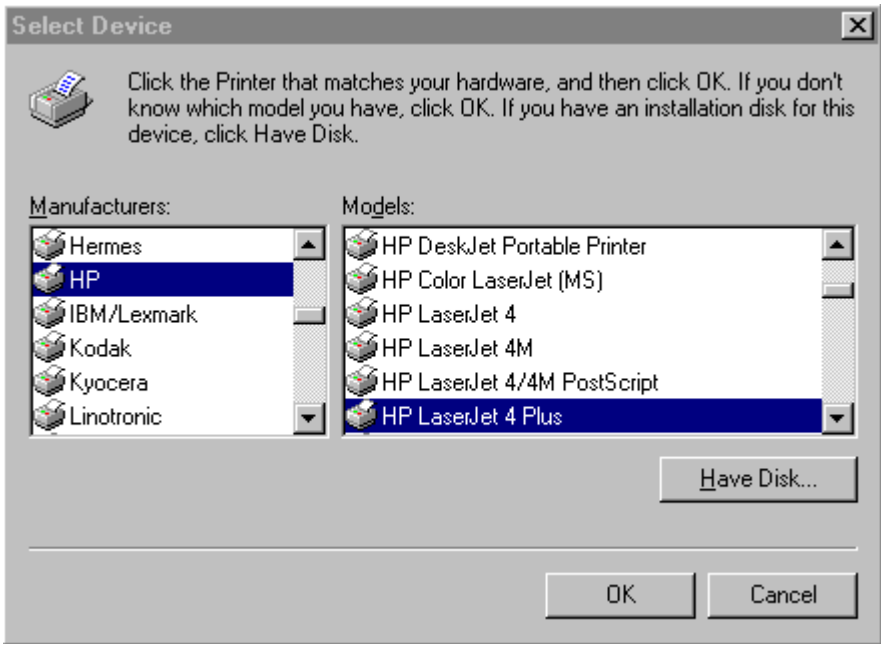

6. Click on **OK**. The appropriate printer driver files will be copied to the directory specified in Step 4. (The exact files that get copied are specified for each printer manufacturer and model in the `MSPRINT.INF` file.)

7. After the driver files are copied, click **OK** to close the point-and-print setup window.

Users will need at least Read and File Scan rights to the path specified in Step 4. Since all users have these rights in the `SYS:PUBLIC` directory, you do not need to grant any additional rights if you use the preferred path or any subdirectory of `SYS:PUBLIC`. If you specify a different directory for the Windows 95 print driver files, you will need to grant the rights explicitly.

If you later change the path for the printer driver files, you must reselect the printer model. Printer-specific settings such as paper size are not retrievable for a NetWare print queue. You'll have to adjust these printer settings manually after the printer is installed on the Windows 95 workstation.

Installing a Printer with Point-and-Print

To use point-and-print to install a NetWare printer, users should follow these steps:

1. Choose one of the methods below to "point" to the printer you want to install and launch the Add Printer Wizard:

   - In Network Neighborhood, double-click on the NetWare server icon for the server containing the desired print queue. Drag and drop the print queue into the Printers folder.
   - In Network Neighborhood, double-click on the desired print queue.
   - In Network Neighborhood, highlight the desired print queue and select File | Open from the pull-down menus.
   - From the Printers folder, start the Add Printer Wizard by double- clicking on the Add Printer icon.

2. Follow the instructions in the Add Printer Wizard as it prompts you to set up the printer. The steps are

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basically the same as described earlier in this AppNote, except that you don't need to select the printer manufacturer and model. Windows 95 will automatically copy the files for the printer driver (including .DRV, .DLL, .HLP, and other files, as needed) to the WINDOWS\SYSTEM directory.

Using the NetWare NPRINTER Manager for Windows 95

NetWare's print services allow print queues to be serviced from printers that are attached to file servers or to workstations. In NetWare 3 and 4, the NetWare Print Server software can be installed on a file server by loading PSERVER.NLM. (In NetWare 3, you have the option of running PSERVER.EXE on a DOS workstation to create a dedicated print server.) To use printers attached to DOS workstations as network printers, Novell provides a terminate-and-stay-resident (TSR) program to be loaded on those workstations. This program is called NPRINTER.EXE in NetWare 4 and RPRINTER.EXE in NetWare 3.

The NetWare NPRINTER Manager for Windows 95 (NPTWIN95.EXE) provides the same functionality for a printer attached to a Windows 95 workstation. The workstation must be running NetWare Client 32 for Windows 95; NPRINTER Manager is not compatible with the Microsoft Client for NetWare Networks.

The NetWare NPRINTER Manager requires the following hardware and software on the workstation:

- An Intel (or compatible) 386, 486, or Pentium CPU
- Windows 95 with NetWare Client 32 for Windows 95 loaded
- A printer directly attached via a parallel or serial interface cable

The functionality of the NPRINTER Manager is similar to that of the DOS- based version (NPRINTER.EXE). Because of this, you need to set up NetWare's print services in the traditional manner, including the association of a print server, printer and print queue. PSERVER.NLM should be loaded on the NetWare server.

When you load PSERVER.NLM on a NetWare server, the PSERVER software initializes itself based on configuration information stored in its Print Server ID directory (NetWare 3) or in the defined attributes of its Print Server object (NetWare 4). After logically attaching to the appropriate file servers, PSERVER builds a list of the printers it will service and associates the print queues with their designated printers.

To have PSERVER service a remote printer via NPTWIN95, you need to add a network printer to the NPRINTER Manager. This is where you specify the type of connection (parallel, serial, or other/unknown), whether NPTWIN95 will use interrupts or polled mode to communicate with the printer, the size of the "pass-along" buffers, and the serial communication parameters (if applicable). The exact configuration process is explained below.

NPTWIN95 is configured with the profile access through the NPRINTER.INI file, and accesses the Windows 95 Registry to find out port information as it loads. Once this is done, NPTWIN95 establishes an SPX client connection with the print server and is ready for PSERVER to start sending print jobs. The overall process by which NPTWIN95 processes print jobs is illustrated in Figure 1.

Figure 1: PSERVER passes print job data to NPTWIN95, which sends it to the remote printer.

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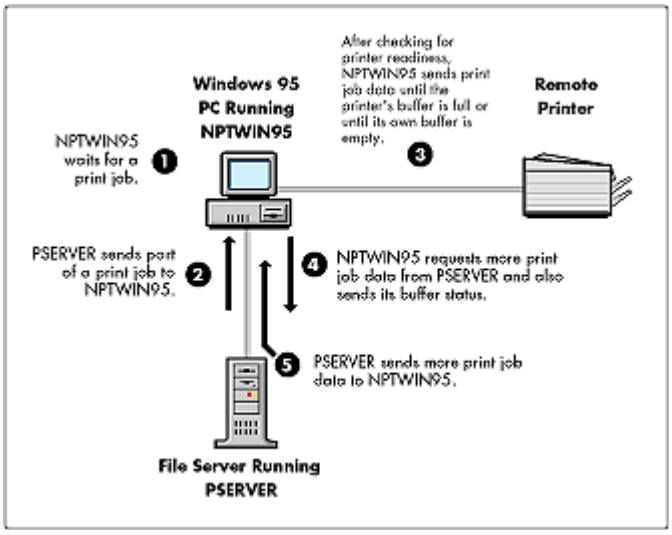

Configuring NPRINTER Manager on a Workstation

Two main functions need to be performed to automate the NetWare NPRINTER Manager on a Windows 95 workstation:

- Add the network printer to the NPRINTER manager.
- . Add the NPRINTER Manager to the Windows 95 startup folder.

This section also provides instructions on how to install the NPRINTER Manager on a local drive so it will work without anyone being logged in at the workstation.

Add a Network Printer. The Windows 95 workstation must be individually configured to have a locally connected printer available as a network device. After completing these steps, network users can capture the printer or queue as they would any other NDS printing object in Windows 95.

1. Start the NPTWIN95 program (usually located in the SYS:PUBLIC folder on your server).
2. The first time NPTWIN95 is executed, the "Add Network Printer" window is displayed, as shown below. (If you have previously run NPTWIN95 and added a printer, choose the Printers menu, and then choose "Add.") This is where you specify which printer object on the network will print to the printer connected to the workstation. You can specify either an NDS printer object (available only if you are authenticated to a server) or a Bindery-based print server and printer.

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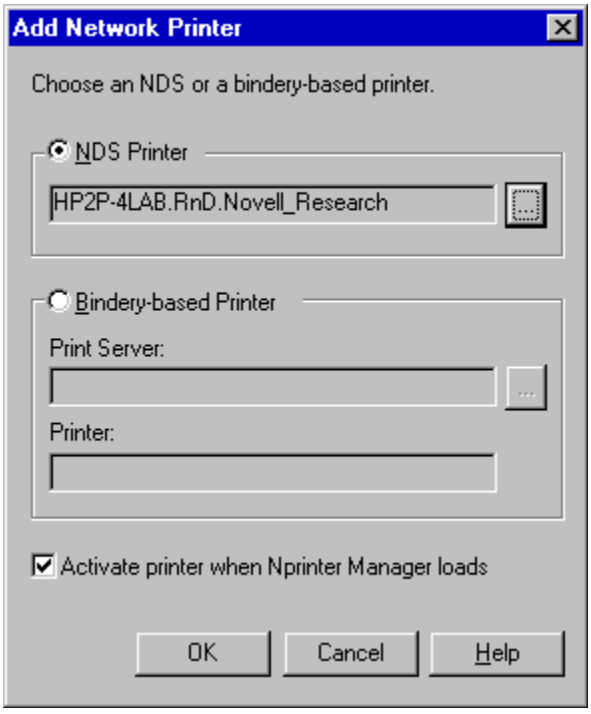
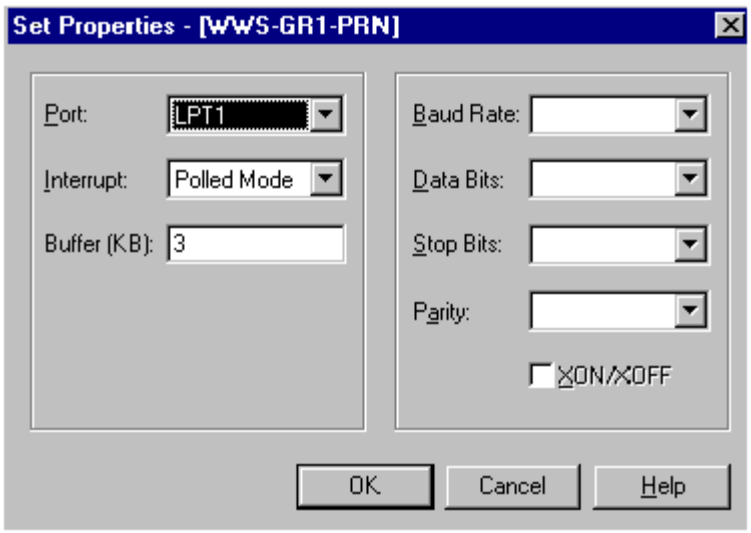


If the exact syntax is not known for an NDS printer, click the button labeled "**...**" to browse for the desired object. The NDS printing objects displayed may or may not be available if they are configured differently than the workstation's hardware or if the configured print server is not currently running.

The Bindery-based Printer option also has a button labeled "**...**" to browse for a print server and attached printers. The print servers displayed are those which are advertising to the server. When the desired print server is selected, only the printers available for that print server will be displayed.

3. If a "Set Properties" dialog box displays, set the printing properties in the box. Click on **OK** when finished. (This dialog box will only display if the selected printer was previously defined as "Other/Unknown.")



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4. If you want NPRINTER Manager to load this printer the next time it runs, check the "Activate printer when Nprinter Manager loads" box. If you uncheck this box, the remote printer will be loaded only for this NPRINTER Manager session.

5. Click **OK**. If NPRINTER Manager is successfully set up, a screen displays with printer-specific information. (If the information is not correct, choose "Clear" from the Printers menu and add the printer again.)

6. From the Printers menu, choose Exit. (This exits NPRINTER Manager, but leaves the NLMs required for printing loaded.)

Add NPRINTER Manager to the Startup Folder

To automatically load NPTWIN95 when you run your workstation, add NPTWIN95 to the workstation's Startup folder.

1. In Windows 95, choose Start, and then Settings.

2. Choose Taskbar, and then click on the Start Menu Programs tab.

3. Choose Add, and then Browse.

4. Navigate to the NPTWIN95 file and double-click on it.

5. Choose Next, and then double-click on StartUp.

6. Type the name that you want to see on the Startup menu (for example, NPRINTER), and then choose Finish. (If Windows prompts you to choose an icon, choose one, and then choose Finish.)

Running NPRINTER Manager without Logging In

To avoid having to have a user logged in to the network just to run NPRINTER Manager, you can run the program from a local drive. To ensure the proper execution of the program, you must copy not only the executable file but all associated files to the same directory on your local drive. To do this, follow these steps:

1. Open My Computer, choose a local drive, and create a folder called "NPRINTER."

2. Open Network Neighborhood and navigate to the SYS:PUBLIC folder on the server.

3. Copy the following files from the SYS:PUBLIC folder to the NPRINTER folder in My Computer:

   NPTWIN95.EXE (this usually displays without the .EXE extension)
   NPTWIN95.DLL
   NPTWIN95.HLP
   NRDDLL95.DLL
   NWADLG95.DLL
   NWADMR95.DLL
   NWCOMN95.DLL
   BIDS45F.DLL
   CW3215.DLL
   OWL252F.DLL

Conclusion

Once you have printing set up properly for NetWare Client 32 for Windows 95 workstations, users should

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be able to print to network printers as easily as to locally-attached printers. For more information about NetWare Client 32 and printing, refer to the `SETUPNW.HLP` online help file.

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Troubleshooting and Optimizing NetWare Client 32 for Windows 95

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Once you have NetWare Client 32 for Windows 95 installed and configured properly, it should perform reliably in a variety of network environments. As with all software, there will invariably be issues that arise with certain components, or situations in which performance could be improved.

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Thanks to Ben Hendrick at Novell for his help with this article.This AppNote outlines steps you should you take to troubleshoot problems with Client 32. It also gives some tips for tweaking the client for optimal performance.

Troubleshooting the Client

Since NetWare Client 32 for Windows 95 offers so many configuration options, it's not surprising that there are occasional conflicts with hardware or software. The trick is to pinpoint the problem as quickly as possible. Troubleshooting a system problem is like solving a mystery: You look for clues, eliminate suspects, and eventually discover the culprit.

Because anticipating every networking problem is difficult, this AppNote explains where to look for troubleshooting clues and outlines some common problems users encounter. You can start your investigation by asking logical questions such as the following:

- Did the previous NetWare client work before you upgraded? If it did work, what changes did you make to the workstation? For example, did you install any new hardware such as a new network interface board?
- After you upgraded the NetWare client, were you ever able to log in to the network successfully?
- Is the problem occurring on other workstations?
- Do you receive an error message when you load the NetWare Client 32 for Windows 95?

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The answers to these questions will determine your next course of action. For example, if the previous NetWare client worked properly and you have not changed your hardware configuration, the problem may be software-based, rather than hardware-based. If you were not able to log in after you upgraded the NetWare client, you may suspect a configuration problem. For example, your Name Context setting may be incorrect.

The NetWare Client 32 Log File

When you are troubleshooting a problem, one of the best ways to find clues is to enable the NetWare Client 32's log file. This file keeps a record of the NetWare loadable modules (NLMs) that are loaded on the workstation, the properties that are used, and any diagnostic messages from the NLMs. To enable the log file, you must edit your SYSTEM.INI file. (You can use the SYSEDIT utility to quickly edit SYSTEM.INI.) Under the [386Enh] section, the NWEnableLogging field should be set to True, as the following shows:

```
[386Enh]
NWEnableLogging=True
```

After you enable this option, the NetWare client will create a log file called NIOS.LOG, which is stored by default in the NetWare Client 32 home directory (C:\NOVELL\CLIENT32). You can change the filename by modifying the Log File option, and you can change the size of the log file by editing the Log File Size option. (To change these options, access Control Panel | Network, highlight the Novell NetWare Client 32 and click on Properties. Then select Advanced Settings.)

If you encounter a problem such as an error message appearing during the login process or the workstation hanging, you can check the log file to find the cause of the error. The log file will record problems such as an NLM did not load, IPX failed to bind successfully to a network interface board, or all of the NLMs loaded properly, but the NetWare Client 32 could not find a file server.

If your workstation hangs during the boot process, you can reboot and push the F8 key after you see the "Starting Windows 95 . . ." message. You will then see a menu of boot options. Have the workstation boot to DOS. Then at the DOS prompt, you can access the DOS EDIT program and read the NIOS.LOG file.

As an alternative, you can run Windows 95 in Safe Mode and view the NIOS.LOG file from Notepad. To do this, reboot your workstation and press the F8 key when you see the "Starting Windows 95 . . ." message. This time, choose Safe Mode from the menu of boot options. Safe Mode runs Windows 95 in real mode with the normal 32-bit optimizations disabled. If system conflicts prevent you from booting Windows 95, you can use Safe Mode to boot Windows 95. Then you can go to Control Panel | Network and change the settings for the NetWare Client 32 or for Windows 95 itself.

Enabling the log file will slow the boot process because the NetWare Client 32 must write information to the NIOS.LOG file. As a result, you may want to enable this option only when you are troubleshooting a problem.

The MODULES Command

If you are experiencing an intermittent problem, you may find the NetWare MODULES command useful. If you type `MODULES` in a DOS window, you will see a list of the currently installed NLMs. You can use this list to double-check which client NLMs you are using. You can also make sure that you are using the most current version of these NLMs. Installing the latest version of the client NLMs may solve your problem.

You can compare this information to another workstation's setup or report it to a technical support engineer. If you want to redirect this information to an ASCII text file, you can enter the following command:

```
MODULES > CLIENT32.TXT
```

Hardware Setup

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If you suspect a hardware problem, you should make sure you are using at least a 386 computer; a 486 computer or better is recommended. The workstation should also have at least 8MB of RAM.

In addition, remember that the NetWare Client 32 for Windows 95 does not support Remote Program Load (RPL), so you cannot run it on a diskless workstation. If you need to support diskless workstations, you should use Microsoft's client for NetWare or Novell's NetWare DOS Requester (virtual loadable module, or VLM, client). Novell plans to support RPL in a later release of the NetWare Client 32 for Windows 95.

You should also check the link status light on all network interface boards, hubs, or other equipment to which your workstation is connected. If the light is not on, you should make sure the network interface board or PCMCIA adapter is inserted properly. If other workstations are unable to log in to the network, you may also want to check the physical route between the workstations and the file server. Make sure the routers (or repeaters or bridges) are working properly. Also, inspect your cabling and ensure that the server's network interface board is plugged in. (If you can log in successfully with Novell's 16-bit client, the path to your file server is probably not the problem.)

The I/O addresses of video boards and network interface boards may also be an area of conflict. Because the NetWare Client 32 for Windows 95 will use all of the I/O address space on the boards, new conflicts may arise. Choosing the wrong driver can cause what will appear to be a hardware problem. For example, NE2000 clone boards typically have problems with a driver written specifically for the hardware, such as the CNE2000.LAN, a 32-bit server Open Data-link Interface (ODI) driver.

To factor out driver-related issues (as opposed to hardware issues), you should switch from Network Driver Interface Specification (NDIS) drivers to ODI drivers. For example, if you are using the Intel Pro 100 board, you will not be able to run NetWare Client 32 with the NDIS driver provided with Windows 95. You should contact Intel and get the latest version of E100.SYS, which works with NetWare Client 32 for Windows 95.

The Process of Elimination

If you determine that your problem is software-based, you may want to check the following:

- If terminate-and-stay-resident (TSR) programs, drivers, or system files are not being loaded, make sure the PATH statement is less than 128 bytes. Anything in your path beyond 128 bytes will be ignored. In addition, you should not load your PATH statement with network drives: The client's GUI login utility will delete network drives from the path if they are invalid when the client is initialized.

- If you cannot log in to NetWare 4, you should make sure your Name Context is set properly. (To check the Name Context, go to the Windows Control Panel | Network. Highlight Novell NetWare Client 32 and click on Properties.) If you are logging in to a NetWare 2 or 3 server in bindery emulation, make sure your Preferred Server is set properly.

- If you are having problems logging in to NetWare servers or using RCONSOLE to connect to remote NetWare servers, make sure IPX is bound to only one frame type. As mentioned earlier, you can verify if this is the problem by enabling the NetWare Client 32 log file. If IPX is bound to more than one frame type, you can open Control Panel | Network and select Novell NetWare 32-bit IPX Protocol. Then click on Properties and select Advanced IPX. Select the correct frame type in the menu that appears.

- If you receive an error message such as "An attempt to load CLIENT32.NLM failed because the module references an undefined external," you may still be loading the 16-bit client in your AUTOEXEC.BAT file. Check both the AUTOEXEC.BAT file and the CONFIG.SYS file to make sure you are not trying to load the 16-bit NetWare client.

Finally, if you cannot access a Windows 95 machine that is using Microsoft's File and Print Services for NetWare Networks (NWSERVER.VXD), you should be aware of the following: Although the Microsoft NWSERVER announces itself as a NetWare 3.12 server, it actually behaves as a NetWare 2 server, using older NetWare Core Protocols (NCPs). When NetWare Client 32 queries the Windows 95 server for its network operating system version, it responds that it is a NetWare 3.12 server. NetWare Client 32 then tries

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to communicate with the Windows 95 server using Novell's Case 87 NCP set, which all NetWare 3.1x and 4.x servers understand. Because Microsoft's NWSERVER software doesn't support these NCPs, the communication fails.

If Microsoft continues to claim NetWare 3.x compatibility, this problem should be fixed: NWSERVER.VXD should support Novell's Case 87 NCP set. Or it must be updated to report its actual network operating system version (NetWare 2.2 clone). This issue also occurs when you try to use Microsoft's Windows NT File and Print Services for NetWare with the NetWare Client 32 for Windows 95. (For more help on this issue, you should contact Microsoft Product Support Service.)

If you try the suggestions outlined in this AppNote and still cannot solve the problem, you may want to resolve it through your normal support channels.

- You can post a question to the NetWire system operators (sysops) on CompuServe. Type GO NETWIRE and follow the prompts for the Novell Client Forum, or type GO NOVCLI.
- On the Internet, you can post a message to one of the comp.os.netware.* newsgroups.
- You will find helpful information on Novell's World Wide Web site at http://support.novell.com. Check the frequently asked questions (FAQs) for NetWare Client 32 for Windows 95. The FAQs cover issues such as installation, NIOS, the Client 32 Requester, LAN drivers, the GUI Login utility, the NetWare Application Manager (NAM) utility, printing, and TCP/IP connectivity. You can download all the FAQs from http://support.novell.com/home/client/ client32/faq.htm.
- You can also find white papers, feature lists, and product overviews on Novell's WWW site or CompuServe (type GO NWCL32).

Tuning NetWare Client 32

Once the NetWare Client 32 for Windows 95 is working properly, you will probably want to optimize its performance. We will first examine ways you can get the most speed from your configuration, and then we will examine ways to make your system more functional.

The Need for Speed

To realize the best performance from the NetWare Client 32 for Windows 95, you should focus on the following areas:

- Protocol overhead
- Delayed writes
- File cache level
- Performance cache

Protocol Overhead. Each communications protocol you use (such as IPX/SPX or TCP/IP) consumes system resources and can potentially slow down the system. For maximum performance, you should bind protocols (such as IPX) only to the boards that use them. For example, if you are using IPX on only one Ethernet board, don't bind IPX to the other boards in your workstation. To change this setting, access Control Panel | Network. You will see a list of network components, including network interface boards and protocols. If you are not using one of the protocols listed, select the protocol and then click on the Remove button.

Delayed Writes. You can also increase the speed of the NetWare Client 32 for Windows 95 by allowing file writes to be delayed beyond the close of an application. The Delay Writes option allows actual network

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writes to lag behind an application's request to close a file, allowing the application to continue working without waiting for data to be written to the server.

To delay file writes, you can modify the Close Behind Ticks option. However, you should be aware that changing this setting can risk data integrity.

File Cache Level. The File Cache Level option can also increase performance. You can choose whether to disable file caching (which saves extended memory but decreases speed), to enable warehouse caching (which essentially caches everything), or to use one of the caching levels in between.

Performance Cache. One final suggestion to improve the speed of the NetWare Client 32 involves using the Performance, Cache option.

You can configure all of these options by accessing Control Panel | Network. Select Novell NetWare Client 32 and click on Properties. Then select Advanced Settings. You can right-click on any of these options to get more information, or you can use the online documentation for a more detailed explanation.

As you optimize the NetWare Client 32 for Windows 95, you will often have to choose between speed and complete data integrity. Before you decide how to balance speed and data integrity, you should understand the options that affect both.

Options such as True Commit, Cache Writes, Close Behind Ticks, and Delay Writes can be set for optimal data integrity. For example, True Commit ensures that a write operation will not be completed until the data is safely written to the server's hard disk. When the user is working with mission-critical data such as a database or an accounting system, turning on True Commit can provide additional insurance that each transaction has been successfully written to the NetWare server's hard disk.

Doing More with Less

You can also tune the NetWare Client 32 for Windows 95 so that it uses less disk space and less memory. To reduce the amount of disk space used by the NetWare Client 32, you will first want to remove unnecessary files. The NetWare Client 32 help files (such as `SETUPNW.HLP`) list all of the client files and explain how each file is used. You can use this list to determine the files you will not use and can, therefore, discard. Some decisions will be simple. For example, if you are not using an FDDI network adapter, you won't need the `FDDITSM.NLM`, so you can delete this driver from the `C:\CLIENT32` directory. (You may want to back up any files you delete to a temporary directory.)

You can further reduce the NetWare Client 32's memory footprint by reducing caching. To change file caching, you must modify the Maximum Cache Size option. (See Appendix B for a description of Client 32 parameters.)

There is a tradeoff between speed and available memory. A large client cache will provide a faster network client but will leave less memory available for other Windows applications. On the other hand, reducing the memory footprint consumed by the cache will give more memory back to the system for other applications, but the NetWare Client 32 will not be able to cache as much data from the NetWare server.

APPENDIX A

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NetWare Client 32 for Windows 95 Features

NetWare Client 32 for Windows 95 includes all the features users are familiar with in the NetWare clients they are using today. Client 32 builds on these features to deliver a number of advanced capabilities. This appendix provides a summary of the key features included in NetWare Client 32 for Windows 95 v2.11. It also provides a feature comparison between NetWare Client 32 and Microsoft's Client for NetWare Networks.

Full NetWare Connectivity. With Client 32, users can access NetWare 2.x, 3.x, and 4.x resources throughout the network, with full connectivity and backwards compatibility with all services and information. The Client 32 Requester support simultaneous multiple frame types, protocols, and name services (NDS and Bindery). At this time, Client 32 does not support peer-to-peer connections via Personal NetWare. However, Windows 95 users can maintain peer-to-peer connectivity with other Windows 95 machines on the network.

Improved Installation and Setup Procedures. Client 32 for Windows 95 comes with a Windows 95-based SETUP.EXE program. This setup program allows easy upgrade of previous NetWare clients, including NETX and VLMs. It auto-detects previously loaded LAN drivers and configures the updated client software to match the detected settings. It also configures TCP/IP and NetWare/IP protocol information.

The client software is installable via floppy disk, local hard drive, network drive, or CD-ROM drive. Upgrades can be centrally administered via Automated Client Update (ACU).

There is also an Uninstall program available for Client 32 for Windows 95 to remove the client from the workstation.

Smaller Memory Footprint. Client 32 operates with a smaller footprint in conventional memory or Upper Memory Block (UMB) footprint. In most environments using 32-bit LAN drivers, the memory footprint is 4KB. This frees up additional memory to run applications.

Support for UNC. Client 32 supports the use of UNC (Universal Naming Convention) for specifying volumes and directories on network servers. Directory Services names can be included in the UNC path; for example, note the NDS Volume object name in this UNC path:

```
\\novell_inc\.nrd_sys.nr.appnotes.novell\path
```

Expanded LAN and WAN Connectivity. For connectivity between the workstation and the server, users can select from a large number of 32-bit certified server *.LAN drivers. NetWare Client 32 for Windows 95 also provides a shim to support NDIS 3.1 drivers, such as drivers for PCMCIA cards, that are available for use with Windows 95. A shim is also provided to allow workstations to run a 16-bit ODI LAN driver, in the event an equivalent NLM-style drivers is not available.

Client 32 for Windows 95 supports the Dial-Up networking feature that Microsoft provides with Windows 95 for remote connections via modem.

LIP and Packet Burst Support. With Client 32, support for Large Internet Packets (LIP) and Packet Burst comes enabled by default to provide improved LAN and WAN performance.

Multiple NDS Tree Support. Users can authenticate to and simultaneously browse resources on multiple NDS trees, graphically within Windows 95. (At this time, multiple tree support *does not* include Linked Tree or Federated Tree support.)

Improvements over 16-bit VLM Client. Client 32 provides full 32-bit protected-mode operation via NIOS. There is no program swapping from extended memory to UMB or conventional memory, which results in better performance. Client 32 uses the advanced "Case 87" NCPs found in NetWare 4.x. Client 32 also features better handling of critical errors, including Int 24 and Windows 95 Critical Error conditions.

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Advanced Caching Mechanisms. Client 32 includes new NetWare caching algorithms for superior performance. Whereas previous client software only allowed cache buffers to be allocated in single bytes, Client 32 can cache file reads and writes in megabytes (provided the workstation has enough memory available).

Users can also benefit from dynamic client-side (local) caching for faster performance of repetitive desktop functions. Clients can now cache data files, executables, and directory entries locally. Since the data is available locally in memory, the client doesn't have to go out to the server as often, thus reducing traffic and increasing performance. Depending on the number of cache hits, the performance boost can be a high as 200 to 300 percent. The greatest performance increase is seen on workstations that access the same files over and over from the NetWare server, such as overlay files, DLLs, and other types of shared code.

Automatic Reconnection. Client 32 enables a complete restoration of the user environment after a network failure. The automatic reconnect capabilities include not only reauthentication of the user connection (as was possible in the VLM client software), but also re-establishment of open files, mappings, file locks, and printer captures. This increased level of auto-reconnect means that applications can have a complete environment restoration, which provides better data integrity for the application and its data files. The auto-reconnect APIs are built in to the NetWare Client 32 code, so it doesn't require a NetWare 4.x version of LOGIN.EXE (as was the case with the NetWare DOS Requester).

Dynamic Reconfiguration of Client Settings. With NetWare Client 32 for Windows 95, the client software no longer requires a NET.CFG file for making configuration settings. Novell has integrated the client software with the Microsoft Registry database so that changes made to the client properties are reflected as updates to the Registry. Client 32 for Windows 95 uses dynamic, self-configurable parameters, where possible, to minimize the need for individual administration of workstations.

User, Group, and System Policy Support. NetWare Client 32 for Windows 95 allows you to use System Policies to manage the configuration of Windows 95 workstations. These policies can be applied to particular users, groups, or computers on the network.

GUI Login Utility. Client 32 comes with a GUI login utility that allows users, from within Windows 95, to log in to NetWare servers, update environment variables, and establish drive mappings.

NetWare Provider. The NetWare Provider utility extends the functionality of the Windows 95 Network Neighborhood and Explorer to provide capabilities such as supporting Bindery-based connections and NDS connections to more than one Directory tree. The NetWare Provider also allows graphical management of NetWare files, directories, and trustee access.

Network Management Tools. NetWare Client 32 for Windows 95 provides tools to enable network administrators to dynamically set up and refresh client software across the network with Automatic Client Update (ACU), and to centrally administer applications access by users through NDS with Novell Application Launcher (NAL). NAL allows users to access network applications without having to install or maintain the applications. You can centralize application installation and administration, and users can access only the applications assigned to them.

NetWare Client 32 support the 16-bit version of the NetWare Administrator (NWAdmin) utility, as well as the 32-bit version for Windows 95 that is available with NetWare 4.11. NWAdmin provides full NDS administration, GroupWise and MHS service administration, control of all access rights, management of files, directories and volumes, and navigation of the network and searching of objects.

In addition, the new NetWare 4.11 NDS Manager utility for administering Novell Directory Services was designed to be run on workstations running NetWare Client 32.

Client 32 also features easier network node management through remote control and configuration management, SNMP reporting via IPX or TCP/IP, and Plug-and-Play support.

32-bit NetWare Client API Libraries. For developers who are writing applications using Novell's

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DeveloperNet 2000 components, they require the 32-bit Client API libraries that are supported in NetWare Client 32.

Comparative Matrix of Windows 95 Clients for NetWare Networks

Feature	NetWare Client 32	Microsoft Client for NetWare (with NDS Update)
Installation Method	• Via Network Control Panel or Setup Wizard • Migrates VLM configuration to to Windows 95 client. • Automatic Client Update from server if newer version is available • Client installed at same time as Windows 95	• Via Network Control Panel only • No configuration migration • No automatic update • Single installation process not supported
Login		
GUI Login utility	Customizable by user or admin, four tabbed option sheets to mix and match	One version for all users
Log in to multiple NDS trees at once	Yes	No
Search and specify a NetWare Server	Yes	Yes
Search and specify a NDS Tree	Yes	Yes
Specify context	Yes	Yes
Specify login script at login	Yes	No
Drop-down lists for use at login	Last user names, Servers, NDS Trees and Context	Servers, Trees and Context
Specify login script variables at login	Yes	No
Option to clear other connections at login	Yes	No
Ability to change expired passwords at login	Yes	No - requires use of SETPASS.EXE text utility in a DOS box after login
Ability to synchronize Windows Login username and password with Novell Login	Yes	No
Provider		
Displays NDS Tree in Explorer	Yes	No
Supports Novell Application Launcher (NAL)	Yes	No
Leverages NLM technology at the client	Yes	No
GUI management of network files, directories and trustee rights	Yes	No

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Driver support	Novell 32-bit ODI and NDIS	Novell 16-bit ODI and NDIS
System and Group Policy support	Yes	Yes
User Profile support	Yes	Yes
User Profile support in NDS environment	Yes	No
Ability to send messages graphically	Yes	No - requires use of SEND.EXE text utility
Configuration		
Advanced Parameter Configuration (GUI tab)	43 definable parameters	1 definable parameter
On-line configuration help	Yes	No
Does not require a reboot to force parameter change to take effect	Has 21 dynamic parameters that can be changed "on the fly" via a GUI interface	No
NDS Support		
Login to multiple NDS trees	Yes	No
Supports extended NDS Schema: view objects added to the NDS tree	Yes	No
Manage/assign file access rights from the Windows 95 Explorer	Yes	No
Supports Application object extensions (via NAL)	Yes	No
Auto Reconnect		
Reconnect to servers	Yes	Yes
Reconnect to NDS tree	Yes	No
Reconnect drive mappings	Yes	Yes
Restore open files	Yes	No
Restore file locks	Yes	No
Protocols		
Named Pipes	Yes	Yes
NETBIOS	Yes	Yes
SMB	Yes	Yes
NetWare/IP	Yes	No
NETBEUI	Yes	Yes
WINSOCK v1.1 IPX/SPX	Yes	Yes
WINSOCK v1.1 TCP/IP	Yes	Yes
Packet Burst	Yes	No
General		
Client-side caching	Yes	Yes
Bidirectional NCP support	Yes	No
Remote Access Server (RAS)	Yes	Yes

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support			
Bind IPX to multiple frame types	Yes	No	
IntranetWare IP/IPX Gateway support		Yes	No
SMS TSA backup support	Yes	No	
SNMP support	Yes	No	
Host Resource MIBs for ManageWise	Yes	No	
16-bit NetWare Client API libraries	Yes	No	
32-bit NetWare Client API libraries*	Yes	Yes	

* As Novell continues to enhance its NDS tools and client services (such as NWAdmin for Windows 95, NDS Manager, Novell Application Launcher, DeveloperNet 2000 OCX application support, and so on), the 32-bit library must become the foundation for your desktop environment. By making the decision to use Novell Client 32 now, you are laying the groundwork for current and future Novell enhancements that can be leveraged by applications that require this library support.

NOVEMBER 1996

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APPENDIX B
Advanced Options for NetWare Client 32 for Windows 95

NetWare Client 32 for Windows 95 offers a variety of options that can be configured in the Advanced Settings under the Novell NetWare Client 32 Properties. (You can right-click on each option to get an online description of that option.)

The table below lists these settings in alphabetical order for ease of reference. Default values are indicated in bold. For options listed as dynamic, you do not have to reboot the workstation to make them effective.

Setting	Group	Dynamic	Description
Alert Beep Values: **On**, Off	Troubleshooting	No	Specifies whether Client 32 should sound an audible beep when it pop-up alert messages. This parameter applies only to messages displayed in character mode.
Auto Reconnect Level Values: 0 - 5, **3**	Connection	Yes	Determines what services and data are restored after a workstation a critical network error and loses its connection to the server. Each includes the previous level, plus the additional features listed. 0 No auto reconnect. 1 Devices (connections, drive mappings, and printers only) are r This is the lowest level of auto-reconnection, providing the sar capabilities as were possible with the NetWare DOS Requeste client. 2 Devices and read-only files are restored. Adds read-only files items to be restored.

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			3 Devices, all files, and file locks are restored. When a client wr to the server, the server sends back an acknowledgment befo is actually written to the server's hard drive. This is fast, but ris because the server could possibly go down before that data h fully written to disk and the client would not be sure how much actually saved. To help ensure data integrity, NetWare Client rewrite any previously written data still in the cache upon auto- reconnection. 4 Devices, all files, and file locks are restored, plus file-write dat is guaranteed. This option is called "true commit." It means th server waits until data is fully written to the server's hard disk b sends an acknowledgment to the client. This option is slower, should be used when data reliability is very important. 5 In addition to everything restored in level 4, NetWare Client 32 switch to a local drive and resynchronize files later. (This level supported in future releases of NetWare.)
Cache NetWare Password Values: **On**, Off	Environment, NETX Compatibility	No	Specifies whether the NetWare password from the first login is stor memory and used to authenticate to additional NetWare resources
Cache Writes Values: **On**, Off	Performance, Cache	Yes	Specifies if the workstation caches network writes by saving files to workstation memory before saving them to the network. Enabling C Writes improves performance but may risk data integrity.
Checksum Values: 0 - 3, **1**	Packet Management	Yes	Provides a higher level of data integrity by validating NCP packets. an IPX checksum, which may be in addition to other error checking network board or driver may be doing. 0 Checksum disabled 1 Prefer not to checksum, but will if required 2 Prefer to checksum, but won't if not supported 3 Require checksum or don't communicate
Close Behind Ticks Values: **0** - 65535	Performance, Cache	Yes	Specifies how long (in ticks) the workstation will wait after a file is c before flushing the file from cache and writing it to the disk. The de value of 0 provides data integrity. Increasing this value improves performance but places data at risk should a failure occur before t fully written to disk.
Delay Writes Values: On, **Off**	Performance, Cache	Yes	Specifies whether writes can be delayed beyond the close of an ap After the application closes the file, the file is kept in cache for the a time specified by Close Behind Ticks. Use this option if applications repeatedly close and reopen files, such as overlay files. For examp WordPerfect and GroupWise will take advantage of Delay Writes f features such as spell check, thesaurus, and macros. Delay Writes up these types of external programs and their access to shared co
DOS Name Default: **MSDOS**	Environment, NETX Compatibility	No	The desktop operating system name used by the %OS parameter scripts.
Environment Pad Values: 0 - 32768, **64**	Environment, NETX Compatibility	No	Specifies the number of bytes to add to the DOS environment for D applications.
File Cache Level Values: 0 - 4, **3**	Performance, Cache	Yes	Defines how NetWare Client 32 for Windows 95 should cache file 0 Disabled. File caching is off; no extended memory is used. 1 Partial file caching (read-ahead and write-behind only). Read- caching mode were, on a read request, an entire block of data 4KB) is read from the network rather than just the portion of th that was requested. The assumption is that other nearby data 4KB block) is likely to be accessed next, thus reducing the nu network accesses necessary to read the file. Read-ahead mo

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			efficient when the file is being accessed sequentially. During r accesses to large files, read-ahead causes performance to de so read-ahead caching is turned off when random access is d NetWare Client 32 also performs write-behind caching where written into a cached data block until the entire block is filled, t entire block is written to disk at once (as opposed to writing da to disk in smaller chunks). 2 Full caching (open files only). With this setting, files are fully c when they are opened, meaning as many 4KB blocks as nece read until the entire file is stored in memory. The data remains in memory until the file is closed; if you reopen the file, it will h read again from the server (this is known as "short-lived cachi 3 Full caching (open and closed files). With this setting, both op closed files are kept in cache as long as memory is available known as "long-lived caching"). Closed files are retrieved from cache, but only if no changes have been made to the file on th since the last time it was in cache memory. 4 Warehouse caching (includes long-lived caching and local-dis caching). With this setting, instead of writing all cache into me NetWare Client 32 writes cache data to the local disk when it than accessing the network. Use this setting when local disk a faster than network access. The larger the value, the better the performance. Keep in mind tha local caching is more risky because data could be lost if the local h fails.
Force First Network Drive Values: On, **Off**	Environment, NETX Compatibility	No	Specifies the network drive letter the SYS:LOGIN directory is mapp logging out. ON returns you to the First Network Drive. OFF leaves the current drive.
Handle Net Errors Values: **On**, Off	Troubleshooting	Yes	Determines whether NetWare Client 32 or the applications handle network-critical errors. (A network error is generated when the clien workstation does not receive a response from the NetWare server. the option to On, NetWare Client 32 handles network-critical errors set it to Off, NetWare Client 32 generates an interrupt 24, allowing applications to handle network-critical errors.
Hold Files Values: On, **Off**	Environment, NETX Compatibility	No	Specifies whether files opened by a program using FCB_IO are he until the program exits. ON means they are. OFF means they can b by the program before it exits.
Large Internet Packets Values: **On**, Off	Packet Management	Yes	Allows your workstation to use packets larger than NetWare's defa 576 bytes. If you enable Large Internet Packets (LIP), NetWare Cli Windows 95 will negotiate the maximum packet size with the NetW server.
Large Internet Packet Start Size Values: 1 - **65535**	WAN	Yes	Specifies the starting value (in bytes) for negotiating the LIP size. U option to reduce the amount of traffic caused by the negotiation pro 1514 for Ethernet, 4096 for Token Ring). Setting this value can sho initial negotiation time for packet size over slow links.
Link Support Layer Max Buffer Size Values: 100 - 24682, **4736**	Packet Management	No	Specifies the maximum supported packet size, in bytes. Use this pa to optimize performance for media (primarily Token Ring) that can packets that are larger than the default size.
Lock Delay Values: **1** - 65535	File System	Yes	Determines the delay after a SHARE failure, prior to retrying the op of a file. Increase this value if you receive SHARE errors.
Lock Retries	File System	Yes	Determines the number of retries to open or lock a file, after receiv

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Values: 1 - 65535, **5**			SHARE failure. Increase this value if you receive SHARE errors.
Log File	Troubleshooting	No	Specifies the location of the log file used for client diagnostics (for C:\NOVELL\CLIENT32\LOG.TXT).
Log File Size Values: 1 - 1048576, **65535**	Troubleshooting	No	Determines the maximum size of the log file used for client diagno
Long Machine Type Default: **IBM_PC**	Environment, NETX Compatibility	No	The workstation type used by the %MACHINE login script paramet
Max Cache Size Values: **0** - 429,496,795	Performance, Cache	No	Determines the largest possible amount of memory (in KB) that Ne Client 32 can use for caching. If this option is 0 (the default), the ca is set to 25 percent of the memory that is free when NetWare Clien loads.
Max Cur Dir Length Values: **64** - 255	Environment, NETX Compatibility	No	Sets the character length of the DOS prompt. (Some applications function correctly if this value is set greater than 64.)
Message Timeout Values: **0** - 10,000	Troubleshooting	No	Defines the time (in ticks) before broadcast messages are cleared screen without user intervention.
Minimum Time To Net Values: **0** - 65535	WAN	Yes	Sets the minimum time-to-net in milliseconds. On bridged WAN/sa with low time-to-net values, workstations may fail to make a conne server is not running Packet Burst or the transfer rate is 2400 baud 2400 baud lines, set this value to 10000.
NCP Max Timeout Values: 0 - 65535, **30**	WAN	No	Specifies the number of seconds the server has to establish a netw connection. If the network connection cannot be established in the amount of time, an error message is displayed.
NetWare Protocol Default: **NDS BIND**	Connection	No	Allows you to specify the order NetWare Client 32 will use to acces supported NetWare name services (Novell Directory Services and Services) to resolve names during authentication to the network.
Net Status Busy Timeout Values: 1 - **600**	Troubleshooting	Yes	Specifies the number of seconds NetWare Client 32 waits for a no response before displaying a message saying that the file server is When the Handle Net Errors option is Off, the error message is ret the application that made the network request.
Net Status Timeout Values: 1 - 600, **30**	Troubleshooting	Yes	Specifies the number of seconds NetWare Client 32 for Windows 9 for a network response before concluding that a network error has (NetWare Client 32 may actually wait longer than the time specifie detects errors or retries on a slow WAN link.)
Network Printers Values: 0 - 9, **3**	Printing	No	Sets the number of logical LPT ports (LPT1 through LPT9) that Ne Client 32 can capture.
NW Language Default: **ENGLISH**	Environment, NETX Compatibility	No	Specifies the language that NetWare utilities will default to on this workstation.
Opportunistic Locking	)	)	Not supported in NetWare Client 32 for Windows 95 v2.11
Packet Burst Values: **On**, Off	Packet Management	No	ON enables Packet Burst, which speeds up network access and re allowing multiple packets to be sent before an acknowledgment is Packet Burst increases performance and reduces overall network between the client and the server by eliminating the need for a rep generated for every packet sent or received.
Packet Burst Read Window Size Values: 3 - 255, **24**	Packet Management	No	Sets the maximum number of packets that can be read from the s the workstation must send a reply. The read window size changes dynamically depending on network conditions.
Packet Burst Write	Packet	No	Sets the maximum number of packets that can be written to the se

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Window Size Values: 3 - 255, **10**	Management		the server must send a reply. The write window size changes dyna depending on network conditions.
Print Header Values: 0 - 1024, **64**	Printing	No	Specifies the size of the buffer (in bytes) that holds the information initialize a printer for each print job. If you send print jobs with num instructions in the header (such as initializing a printer for emulated changing defaults, font selections, or orientation) and the printer do deliver all the requested attributes, increase the Print Header size.
Print Tail Values: 0 - 1024, **16**	Printing	No	Specifies the size of the buffer (in bytes) that holds the information reset the printer after each print job. If your printer is not clearing ou buffer completely or resetting after each print job, increase the Prin
Read Only Compatibility Values: On, **Off**	File System	Yes	Determines whether a file marked Read Only can be opened with Read/Write access call. Some applications require this parameter ON. For example, some old FCB-based applications assume they files as read-write even if they only intend to read the file. The file n located where the user has only Read rights, such as SYS:PUBLIC
Search Dirs First Values: On, **Off**	Environment, NETX Compatibility	No	If set OFF, a DIR listing will display files first, then directories. If ON listing will display directories first, then files.
Search Mode Values: **1** - 7	Environment, NETX Compatibility	No	Alters the method for finding a file if it is not in the current directory
Set Station Time Values: **On**, Off	Environment, NETX Compatibility	No	If set ON, the workstation's time and date are synchronized with the NetWare server that the workstation attaches to initially.
Short Machine Type Default: **IBM**	Environment, NETX Compatibility	No	Determines what overlay file is used when the workstation accesse NetWare utilities.
Show Dots Values: On, **Off**	Environment, NETX Compatibility	No	NetWare doesn't have directory entries for '.' and '..' as DOS does. these in directory listings, turn this option ON.
Signature Level Values: 0 - 3, **1**	Packet Management	Yes	Determines the level of enhanced security support provided by pac signing on the first 64 bytes of a packet, which ensures some degr integrity. Increasing this value increases security, but decreases pe so it should be done only when data integrity is an issue. 0 Signing disabled 1 Prefer not to sign, but will if required 2 Prefer to sign, but won't if not supported 3 Require signing or don't communicate
True Commit Values: On, **Off**	Performance, Cache	Yes	Specifies if file writes should be written immediately to the server's the On setting when processing critical data to guarantee data inte However, performance will suffer because data is not cached at th workstation or the file server.
Use Video BIOS Values: On, **Off**	Environment, NETX Compatibility	No	Specifies whether the client uses BIOS or Direct Video Memory cal pop-up message is displayed. The BIOS method is slower than Dir Memory calls.

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