Novell
NetWare® 6

NETWARE LINK SERVICES
PROTOCOL MIGRATION

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Novell®

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About This Guide

Introduction

This documentation provides the information you need to implement NetWare® Link Services Protocol™ (NLSP™) software in a Novell® Internetwork Packet Exchange™ (IPX™) internetwork. Implementing NLSP in a RIP-based IPX internetwork, a process known as migration, involves adding NLSP link state routing functionality to NetWare servers and dedicated routers. In most cases, NLSP can eventually replace the Routing Information Protocol (RIP), the routing protocol that NetWare has traditionally used to carry out network-level operations.

This documentation is written for network managers, administrators, and consultants responsible for planning, installing, and managing an IPX internetwork.

Documentation Conventions

In this documentation, a greater-than symbol (>) is used to separate actions within a step and items in a cross-reference path.

Also, a trademark symbol ($^{®}$, ™, etc.) denotes a Novell trademark. An asterisk (*) denotes a third-party trademark.

1 Understanding

This section introduces NetWare® Link Services Protocol™ (NLSP™) software, Novell's *link state* routing protocol for Internetwork Packet Exchange™ (IPX™) internetworks.

NOTE: NetWare 4.1 and IPX Upgrade for NetWare Servers provide NLSP and RIP/SAP routing only for LAN-based NetWare servers. If you want to run NLSP or RIP/SAP over a WAN connection, you must use NetWare MultiProtocol Router™ 3.*x* software, Novell® Internet Access Server 4.*x* software, or a third-party product that supports NLSP.

Overview of NLSP

NetWare servers have traditionally used the Routing Information Protocol (RIP) to route IPX packets, and the Service Advertising Protocol (SAP) to exchange service information with other NetWare servers. In addition to providing the same functionality for network devices that rely on RIP and SAP (NetWare 2 servers, for example), NLSP provides link state routing for IPX internetworks.

NLSP is derived from IS-IS (Intermediate System-to-Intermediate System), the link state routing protocol developed by the International Standards Organization (ISO). Like IS-IS, NLSP exchanges routing information between routers and makes routing decisions based on that information. For workstation-to-router communication, NLSP routers continue to use RIP and SAP.

NLSP routers exchange information such as connectivity states, path costs, throughput, maximum packet size (MTU size), and networks learned through RIP (external network numbers). In networks with RIP/SAP devices, the routers keep track of services and external (RIP-based) routes. This information is carried in a *Link State Packet* (LSP). By exchanging this

information with its peer routers, each NLSP router builds and maintains a logical map of the entire internetwork.

Unlike RIP and SAP, which periodically broadcast routing and service information, NLSP transmits routing information only when a change occurs in a route or service, or every two hours—whichever occurs first.

Migrating an IPX internetwork to NLSP involves only the NetWare servers and routers; you do not need to install additional software on the NetWare workstations. NLSP is compatible with all NetWare workstations and RIP/ SAP routers, and with other network devices—such as print servers—that use SAP to advertise their services.

Although NLSP is a routing protocol specifically for IPX, it is not limited to pure IPX LANs. NLSP operates seamlessly within multiprotocol LAN and WAN environments, such as TCP/IP, AppleTalk*, frame relay, and X.25, to name a few.

The IPXRTR NLM

The IPXRTR NetWare Loadable Module™ (NLM™) file is the IPX protocol stack for the NetWare operating system. IPXRTR provides combined NLSP routing and full RIP/SAP functionality for network-level operations.

IPXRTR allows you to enable or disable RIP, SAP, and NLSP selectively on network interfaces within the same server or router. For example, you can use RIP and SAP exclusively on one interface and NLSP on another. Additionally, an interface can use NLSP as the active routing protocol but still accept and process RIP and SAP broadcasts from network devices that use RIP and SAP.

IPXRTR also allows you to bind IPX to two or more network interface boards connected to the same LAN. This enables NetWare workstations on that LAN to use either interface when accessing the server—a feature called *load balancing* or *load sharing*.

Novell Products That Provide NLSP Functionality

Which products you need to migrate your internetwork depends on the specifics of the network topology—that is, how many NetWare LANs it comprises, whether it uses WAN connections or third-party routers, and so on. Novell currently offers the following products with NLSP functionality:

◆ Novell Internet Access Server 4.*x* software

This product combines NetWare MultiProtocol Router 3.1 and NetWare 4.11 into a single product.

◆ NetWare MultiProtocol Router 3.1

This product provides routing for IPX, TCP/IP, and AppleTalk protocols over LANs and WANs. NetWare MultiProtocol Router 3.1 can be installed on two-user NetWare systems to operate as a dedicated router, or on multiuser NetWare 3.12 servers and NetWare 4™ servers to provide multiprotocol routing in addition to standard NetWare file and print services.

◆ Any product that contains NetWare 4.1 or NetWare 4.11

Any product that contains either release of the NetWare operating system provides NLSP routing for IPX.

◆ IPX Upgrade for NetWare Servers

This product provides NLSP routing for IPX on NetWare 3.12 servers by upgrading the IPX protocol stack. You retain all the functionality of the base NetWare operating system but gain the efficiency of NLSP routing.

IPX Upgrade for NetWare Servers 6.5a is available by searching for IPX65A.EXE at the following sources:

   ◆ WWW location http://support.novell.com

   ◆ WWW location http://ftp.novell.com

   ◆ CompuServe* (Enter GO NOVELL.)

   ◆ Novell Support Connection Library CD-ROM (Call 1-800-377-4136 to order in the U.S. and Canada. In all other locations, call 888-321-4272.)

Why You Should Migrate Your IPX Internetwork from RIP to NLSP

This topic explains how the NLSP routing protocol can benefit your IPX internetwork.

This topic includes the following sections:

    This section presents several reasons supporting the use of NLSP on an IPX internetwork.

    This section answers questions that NetWare® administrators often ask about NLSP.

How NLSP Can Benefit Your Internetwork

This section summarizes the principal benefits of running NLSP on your internetwork.

Less Routing and Service Traffic on the Internetwork

Each RIP router broadcasts its entire routing table and service database every 60 seconds, even if none of the information has changed since the previous broadcast. This generates a significant amount of traffic on the internetwork.

By contrast, NLSP transmits information only when a change occurs in a route or service, or every two hours—whichever occurs first. Although this information is broadcast by default, it can be *multicast* if the network interface driver supports multicast transmission.

Faster Convergence

When a router or a link comes up or goes down, or when a service becomes available or inaccessible, it takes time for that information to become known to all routers throughout the internetwork. *Convergence* is the process by which a routing protocol learns of a topology or service change and makes that change known to each of the active routers on the internetwork. A network is said to have converged when all routers once again share the same view of the network.

As a link state routing protocol, NLSP converges faster than RIP, the traditional distance vector routing protocol for IPX. Fast convergence is advantageous for the following reasons:

- ◆ It helps keep sessions active across the internetwork.

  While a network is converging, there is a brief period during which the routers are busy rebuilding their routing databases. In-transit packets are often lost during this process.

- ◆ It enables you to discover network problems more quickly.

- ◆ It reduces routing loops.

Larger IPX Internetworks Possible

With NLSP, you can build and operate larger IPX internetworks than are possible with RIP.

Although packets relayed by RIP routers can travel no more than 15 hops between their source and destination, packets relayed by NLSP can travel up to 127 hops.

Low Overhead over WAN Connections

Periodic SAP broadcasts consume substantial bandwidth and can even saturate low-speed WAN connections.

NLSP uses a highly efficient and reliable delivery mechanism for transmitting and updating service information across a WAN connection. Because no SAP (or RIP) traffic travels across the connection, NLSP improves performance significantly on WANs. Also, because NLSP ensures reliable delivery, it eliminates the need for retransmissions that waste bandwidth.

Load Balancing

NLSP makes efficient use of network resources by automatically distributing forwarded traffic across network interfaces. That is, given two or more equal-cost routes between two network nodes, NLSP distributes the traffic evenly among them. If you have NetWare 4.1 or Novell Internet Access Server 4.*x* software, you can use the Novell Internet Access Server Configuration utility (NIASCFG) to specify up to eight equal-cost routes or even configure a router to use a single route.

Faster Data Transfer

For added efficiency over WAN connections, NLSP compresses the IPX packet headers to reduce the size of data packets. NLSP also reduces the size of the service information it carries. Together, these features further reduce overhead traffic and make more network bandwidth available for actual data. The increase in data transfer speed is especially noticeable across WAN connections.

More Extensive Network Management

Any network management application that uses Simple Network Management Protocol (SNMP)—such as Novell's ManageWise® software—can monitor an NLSP router or a RIP router implemented to the Management Information Base (MIB) specification. You can then use these applications to derive a topology map of your entire IPX internetwork from a single NLSP router.

Such far-reaching management capability enables you to detect problems such as duplicate network numbers, inactive routers or links, and even failed interface boards anywhere on your internetwork.

Configurable Link-Cost Assignment

NLSP routers know the cost of every link and use this information to choose the most efficient route for each outgoing packet.

NIASCFG enables you to change the cost of a link. For example, you can increase the cost of a particular link so that NLSP routes traffic through a preferred, less-expensive link.

Compatibility with IPX RIP and SAP

Because NLSP is fully compatible with IPX RIP and SAP, you can use NLSP and RIP routers together in the same internetwork. NLSP routers also interoperate with devices and applications that use or depend on RIP and SAP. NLSP encapsulates and propagates the routing and service information it receives from RIP/SAP devices and networks.

You can also migrate NetWare LANs from RIP to NLSP as needed; you do not need to migrate your entire internetwork at the same time.

Answers to Commonly Asked Questions

The following sections answer some commonly asked questions about NLSP.

Can NLSP Reduce SAP Traffic on My WAN Connections?

Yes. Like RIP, SAP propagates service information every 60 seconds. NLSP also carries service information, but broadcasts it only when a change occurs in a service or route, or every two hours—whichever occurs first. By these figures, NLSP reduces service advertising overhead to 1/120 of that generated by SAP. In a typical internetwork running NLSP, you can expect a 90 to 99 percent reduction in service advertising overhead.

However, the best long-term solution for reducing SAP overhead is to use NetWare 4 software and enable your applications to use Novell Directory Services™ (NDS™) software.

Do Link State Protocols Use More CPU Than Distance Vector Protocols?

Each large internetwork is different in its complexity and the network events it must process. Some events are processed more quickly by distance vector protocols; others are processed more quickly by link state protocols.

Link state protocols dispense with many of the time-consuming tasks associated with traditional distance vector protocols. Also, older implementations of distance vector protocols are often inefficient.

Novell has tested NLSP in very large networks, and has verified that the algorithms perform well and use a nominal amount of CPU.

Do Link State Protocols Use More Memory Than Distance Vector Protocols?

Typically they do, but not in every network. In addition to the 290 KB that IPXRTR requires, NLSP uses about 600 KB in a large internetwork of 3,000 network numbers and 1,600 services.

Can I Use NLSP on a Network with Routers That Do Not Support NLSP?

Yes. Because NLSP is fully RIP/SAP-compliant, it interoperates with third-party routers that support IPX RIP/SAP. NLSP cannot, however, reduce the amount of RIP/SAP traffic where those routers are located.

For third-party routers that support Internet Protocol (IP) routing, you can use the IPRELAY driver to tunnel through the third-party routers. IPRELAY is

available with the NetWare MultiProtocol Router™ 3.*x* software or the Novell Internet Access Server 4.*x* software. For more information, refer to

Many third-party router manufacturers plan to support NLSP. Contact your router manufacturer for details.

What if I Do Not Want to Use IP Tunneling with These Routers?

There are still advantages to running NLSP software on your internetwork, even if some third-party routers on the internetwork do not yet support NLSP:

- When your third-party routers *do* start running NLSP, the NetWare servers and dedicated routers already running NLSP start exchanging link state information automatically with these routers.

- You can bind two or more network interface boards to the same NetWare LAN. This *load balancing* increases the router's effective bandwidth in a switched environment and provides an immediate backup if an interface fails.

- You can use the IPX network management console (IPXCON) along with the NLSP, IPX RIP, and SAP MIB variables to troubleshoot and gather information about your IPX internetwork.

- You can use the IPXPING utility to check the connectivity of remote NetWare servers and dedicated routers.

- On networks that comprise NetWare 3.12 servers, NLSP significantly reduces the time required to process RIP and SAP broadcasts.

Can I Use NLSP to Migrate a NetWare 2 Network to NetWare 3?

Yes. NLSP automatically detects the presence of NetWare 2 software on an internetwork. However, wherever you have a mix of NetWare 2 and NetWare 3™ servers, you run NLSP, RIP, and SAP.

How Many NLSP Routers Can I Have on One LAN Segment?

NLSP allows for up to 230 systems—routers and servers combined—on a single Ethernet LAN segment. This number is higher for token ring and FDDI networks, depending on the maximum packet size you configure on each server on the LAN.

Can NLSP Run on the Same Network with OSPF and IS-IS?

Yes. NLSP can run on the same network—or even the same router—with Open Shortest Path First (OSPF) and IS-IS routing protocols. Because NLSP information is carried within IPX packets, it does not interfere with other routing protocols running on the same network.

Can I Use Third-Party Network Management Software with NLSP?

Yes. NLSP, IPX RIP, and SAP use MIB variables in SNMP format that are fully compatible with the following network management products:

- Novell ManageWise
- SunNet Manager*
- Hewlett-Packard* OpenView*
- IBM* NetView*
- Any other SNMP-based management console

Some of these products have already integrated the NLSP, IPX RIP, and SAP MIB variables. IPX Upgrade for NetWare Servers provides these MIB variables in ASN.1 format so that you can use your MIB compiler to convert them into a format that your network management software can use.

What Is the Difference Between Fast and Default Convergence?

The primary difference is the rate at which NLSP routers send keep-alive messages—in the form of Hello packets—to their peers. If a system is not forwarding packets (that is, not operating as a router), there is little need to send Hello packets frequently. On an NLSP router, however, you should consider increasing the Hello Interval frequency. This enables other NLSP routers on the internetwork to detect failed routers more quickly so that an alternate route can be chosen.

Where in My Internetwork Should I Start Migrating to NLSP?

Generally, wherever you want. However, if you have a WAN mesh internetwork, that is typically the best place to start.

If you have a large internetwork, first decide how you intend to partition it into routing areas, then migrate the routers at the area boundaries. You should also migrate one LAN at a time. Guidelines for partitioning your internetwork are presented in "Defining Routing Areas in an Internetwork" on page 33.

Even if your internetwork uses third-party routers that support RIP/SAP but not NLSP, you can still migrate your NetWare servers to NLSP. In this case, the servers and third-party routers can continue to exchange routing information using RIP/SAP. When you later migrate your dedicated routers and integrated server-routers to NLSP, your NetWare servers automatically use NLSP instead of RIP/SAP to exchange routing information with the NLSP routers.

As the percentage of NLSP routers on your internetwork increases, the bandwidth use and convergence time improves throughout your internetwork.

2 Planning

This section explains the process of planning for the implementation of NLSP™ in your internetwork.

NLSP Memory Requirements

IPXRTR and its internal stack processes occupy about 290 KB of system memory. The amount of memory required beyond this baseline depends on the size of the internetwork—specifically, how many network numbers, RIP routes, and SAP-based services are supported throughout the internetwork.

For example, on an IPX™ internetwork using only NLSP as the routing protocol and having 400 network numbers, NLSP uses about 240 KB in addition to the 290 KB that IPXRTR requires. On an IPX internetwork using both NLSP and RIP/SAP and having about 3,000 network numbers and 1,600 services, NLSP uses about 600 KB in addition to the 290 KB baseline requirement.

Trying Out NLSP on Your IPX Internetwork

This topic provides quick, easy-to-implement migration solutions for those who want to see immediate benefits of NLSP software on their IPX internetwork. This approach enables you to test drive NLSP before migrating your entire IPX internetwork. Each solution also provides ways to measure server and network performance before and after migration.

This topic includes the following sections:

-

  This section explains how to migrate the NetWare® servers on a small LAN in your internetwork.

This section explains how to migrate the NetWare systems linking a simple point-to-point WAN connection.

This section shows how you can take a closer look at the NetWare systems you migrate.

Trying Out NLSP on a Single NetWare LAN

This section explains how to see the benefits of NLSP on a small NetWare LAN.

Choosing the LAN
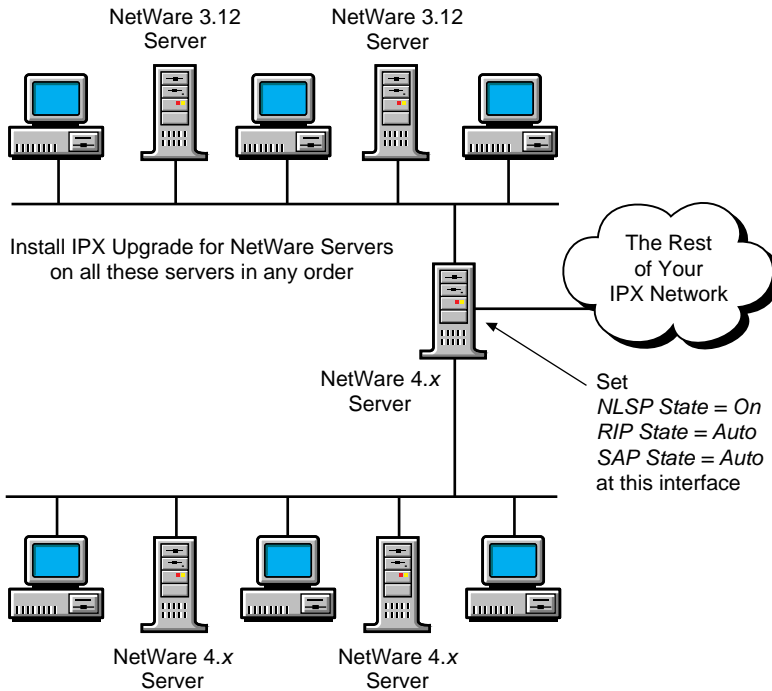
Choose a LAN with the following characteristics:

◆ Supports no more than 10 servers running NetWare 3.12

◆ Has no third-party routers connecting the LAN to other networks

NOTE: If your IPX internetwork uses third-party routers, refer to "Replacing Third-Party Routers with Novell Internet Access Server 4.1."

Figure 1 on page 21 shows two connected LANs that satisfy these criteria.

Figure 1   Example NetWare LANs

NetWare 3.12
Server

NetWare 3.12
Server

Install IPX Upgrade for NetWare Servers
on all these servers in any order

The Rest
of Your
IPX Network

NetWare 4.*x*
Server

Set
NLSP State = On
RIP State = Auto
SAP State = Auto
at this interface

NetWare 4.*x*
Server

NetWare 4.*x*
Server

Measuring LAN and Server Performance (Optional)

Before you migrate the servers, use any of the following NetWare software to
examine server and network performance:

- *TRACK ON—* Use the TRACK ON command to display incoming and
  outgoing RIP and SAP traffic on the server. Note the frequency.

- *LANalyzer network analyzer—* Use the LANalyzer® product to examine
  the percentage of network utilization consumed by broadcast traffic.
  Record this number.

- *MONITOR—* If your IPX internetwork has a large number of NetWare
  3.12 servers, load MONITOR on one of the servers on which you intend
  to install NLSP. Record the number displayed in the Utilization counter;
  this shows the percentage of time the CPU is busy.

  On a large internetwork of NetWare 3.12 servers, CPU utilization
  typically exceeds 95 percent during RIP and SAP broadcasts. You should
  see a marked reduction in CPU utilization after migration.

Migrating the Servers

To migrate the servers on the LAN, complete the following steps:

1. Install and configure IPX Upgrade for NetWare Servers 6.5a on each server *in any order* .

   For instructions, refer to the README file .

2. Reexamine server and network performance with the same software you used in "Measuring LAN and Server Performance (Optional)."

3. Compare these performance statistics with those you observed before migrating the servers.

Trying Out NLSP on a Point-to-Point WAN Connection

This section explains how to see the benefits of NLSP on a simple point-to-point WAN connection linked by two NetWare servers or dedicated routers running version 2.*x* of Novell® multiprotocol routing software.

Choosing the Connection

Choose a point-to-point WAN connection with the following characteristics:

- Is linked by two NetWare systems running one of the following Novell products:

  - NetWare WAN Links™ 2.0 software

  - NetWare MultiProtocol Router Plus™ 2.1 software

  - NetWare MultiProtocol Router Plus 2.11 software

- Runs at 56 KB or slower and has no packet compression enabled

- Has slow performance because of excessive RIP and SAP traffic traveling across the connection

- Uses no third-party routers

Figure 2 on page 23 shows a WAN connection that satisfies these criteria.

Figure 2   Example Point-to-Point WAN Connection

NetWare Servers or Dedicated Routers
Running NetWare WAN Links 2.0,
NetWare MultiProtocol Router Plus 2.1,
or NetWare MultiProtocol Router Plus 2.11

NetWare
LANs

Point-to-Point
WAN Connection

NetWare
LANs

Install NetWare MultiProtocol Router 3.*x*
or any product that contains
Novell Internet Access Server 4.*x*
on these servers/routers
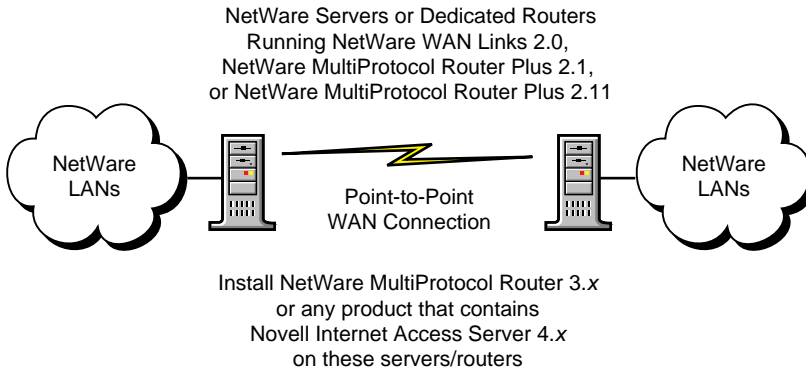
Measuring Connection Performance (Optional)

Before you migrate the systems, check the performance of the connection as follows:

1. Pick a large data file—at least 3 MB.

2. Copy the file to the system at the other end of the connection.

3. Determine how long it took to copy the file across the connection. Record this number.

Migrating the Systems at Each End of the Connection

Complete the following steps to migrate the systems:

1. Upgrade the systems at each end of the connection to Novell Internet Access Server 4.1.

   NLSP runs RIP and SAP automatically until you have upgraded both systems.

2. Enable NLSP routing on each system.

   For detailed configuration instructions, refer to Setting Up in the *IPX* documentation.

3. Copy the *same* file you used in "Measuring Connection Performance (Optional)." to measure performance across the connection.

4. Determine how long it took to copy the file.

5. Compare this transit time with the one you recorded before migrating the systems.

Examining the Operation of Your NLSP Systems

After you migrate a portion of your internetwork to NLSP, you can gain management access to the NLSP systems with the IPX network management console (IPXCON). IPXCON allows you to monitor the operation of local and remote systems for troubleshooting, checking configuration parameters, and observing general performance and load statistics.

You can also use the IPXPING utility to check the connectivity and *latency* — response time over the internetwork—of remote NLSP systems.

For information about how to use IPXCON and IPXPING, refer to Managing in the *IPX* documentation.

Where to Go from Here

If you want to migrate other portions of your IPX internetwork, proceed to "Developing a Migration Strategy." That topic helps you develop an organized and comprehensive strategy that suits the size and topology of your internetwork.

If you have migrated all the systems you want—or need—to migrate at this time, you are done.

Developing a Migration Strategy

This topic provides the information you need to develop a comprehensive migration strategy for your IPX internetwork.

HINT: Use this topic as a point of reference when planning and implementing the migration.

This topic includes the following sections:

- "Step 1: Determine the Size of Your Internetwork" on page 25

  This section explains how to determine how many internal and external network numbers are represented on the internetwork.

- "Step 2: Characterize Your Internetwork" on page 25

  This section outlines the steps you follow to develop the migration strategy that best suits your internetwork.

- "Step 3: Migrate Your Internetwork to NLSP" on page 27

  This section gives general guidelines for migrating your internetwork.

Step 1: Determine the Size of Your Internetwork

The migration strategy you adopt depends primarily on the number of networks and servers on your IPX internetwork. To determine this number, enter

DISPLAY NETWORKS

The screen displays the internal network number of each server and the external network number of each IPX network that can be reached from the server. The total number of network numbers is displayed at the end of the list.

If Your Internetwork Has Fewer Than 400 Network Numbers

A small internetwork—one having fewer than 400 network numbers—is easy to migrate, especially if it comprises only NetWare servers and includes no third-party routers that do not support NLSP software. In this case, you can install NLSP on the servers in any order.

If Your Internetwork Has 400 or More Network Numbers

A large internetwork—one having 400 or more network numbers—should be partitioned into *routing areas* .

HINT: You should also consider reserving a contiguous block of IPX network addresses through the Novell Network Registry service.

For information about partitioning your internetwork and participating in the Novell Network Registry℠, refer to "Partitioning an Internetwork into Routing Areas."

Step 2: Characterize Your Internetwork

How you migrate your internetwork depends on the following characteristics:

- ◆ Size
- ◆ NetWare versions
- ◆ Novell products other than NetWare on the internetwork
- ◆ WAN connections
- ◆ Third-party routers that do not support NLSP

This section provides a set of tasks that helps you determine what you need to do to migrate your internetwork. Each step directs you to complete a task and

refers you to a section in this guide for specific instructions. The number of sections to which you must refer depends largely on the topological complexity of your internetwork.

To plan your migration strategy, complete the following tasks:

- If your internetwork has 400 or more network numbers, define the routing areas.

  Routing areas provide a manageable hierarchy and preserve routing efficiency in large IPX networks. For further instructions, refer to "Partitioning an Internetwork into Routing Areas."

- Determine which versions of NetWare are running on the internetwork.

  In particular, NetWare 2 servers require special consideration because of their dependence on IPX RIP and SAP broadcasts. For further instructions, refer to "Migrating an Internetwork with Different NetWare Versions."

- Determine whether any of the following Novell products are running on the internetwork:

  - NetWare MultiProtocol Router™ 2.0, 2.1, or 2.11 software

  - UnixWare software

  - OS/2* Named Pipes

  - NetWare/IP™ software

  Like NetWare 2, these products depend on RIP, SAP, or both. For further instructions, refer to "Migrating an Internetwork with Products That Require RIP and SAP."

- Determine whether the internetwork uses any WAN connections.

  This includes WAN connections using either Novell multiprotocol routing software or third-party routers that do not currently support NLSP. For further instructions, refer to "Migrating an Internetwork with WAN Connections or Third-Party Routers."

- Determine whether the internetwork uses any third-party routers that do not support NLSP.

  Some third-party routers do not currently support NLSP. For NLSP to interoperate with these routers, you can use a combination of IPX header compression and IP encapsulation (tunneling), or continue to use IPX RIP and SAP to interconnect the routers. For further instructions, refer to "Migrating an Internetwork with WAN Connections or Third-Party Routers."

Step 3: Migrate Your Internetwork to NLSP

This section offers guidelines to help your migration progress smoothly.

IMPORTANT: To maintain connectivity between LANs during migration, do not disable RIP routing on any interface until you have installed NLSP on every system.

Because NLSP is fully compatible with RIP and SAP, you can migrate your NetWare LANs as needed; you do not need to migrate your entire internetwork at the same time.

If You Need to Define Routing Areas

Use the following guidelines if you need to partition your internetwork into routing areas:

- ◆ **Define the routing areas first.** For information, refer to "Guidelines to Follow When Defining Routing Areas."

- ◆ **Migrate the core routers first, then migrate one LAN at a time.** Core routers are typically those that form the network backbone or share a high-speed transit LAN. For information, refer to the examples in "Defining Routing Areas in an Internetwork."

If You Do Not Need to Define Routing Areas

If you do not need to partition your internetwork into routing areas, refer to the remaining topics in this section, as necessary, to migrate your internetwork.

If your internetwork has fewer than 400 network numbers and uses no WAN connections or routers that do not support NLSP, install NLSP on the NetWare servers or dedicated routers *in any order*.

3 Setting Up

This section describes how to partition your internetwork into routing areas and how to implement NLSP™ under various conditions.

Partitioning an Internetwork into Routing Areas

This topic explains how to partition a large IPX™ internetwork into routing areas. Because large internetworks are typically linked by one or more WAN connections, the guidelines and examples provided in this topic are oriented primarily toward WAN connections, which require other Novell® products or third-party products in addition to NetWare® 4.1*x* software or IPX Upgrade for NetWare Servers. However, the information in this topic can still help you partition a purely LAN-based internetwork.

You should read this topic if

- ◆ Your IPX internetwork has 400 or more network numbers

  If you do not know how many network numbers your internetwork has, refer to .

- ◆ You want to use route or service filtering as a means of establishing security or limiting broadcast traffic on your internetwork

  NOTE: IPX Upgrade for NetWare Servers does not provide filtering capability. Filtering utilities are available with any product that contains NetWare 4.1*x* .

This topic includes the following sections:

- ◆

  This section explains what routing areas are.

- ◆

  This section introduces the Novell Network Registry℠ service and explains how to use the services it provides.

This section presents guidelines to help you determine how you should partition your internetwork.

Routing Areas

Routing areas establish hierarchy within an IPX internetwork. For growing networks, routing areas allow for better scaling—more LANs, servers, and routers than otherwise possible. Routing areas also separate an internetwork into manageable components, which is desirable for administrative simplicity.

Area Addresses and Masks

Two 32-bit numbers—a network number and a *mask*—identify a routing area. Together, these numbers constitute the *area address*. Here is an example:

08068500 (network number)

FFFFFF00 (mask)

The default values for the network number and mask are as follows:

◆ Address=00000000

◆ Mask=00000000

The address and mask are both set to zero to ensure compatibility with future versions of NLSP software. Zero values mean that all NLSP routers operate in a single routing area.

IMPORTANT: Although any product that contains NetWare 4.1*x* allows you to configure the area address and mask, accept the default values and use RIP to partition your areas as described in the next topic.

Using RIP to Partition Routing Areas

You *can* create routing areas by running RIP on the network interfaces that link the areas. Figure 3 on page 31 shows two routing areas partitioned by RIP.

Figure 3   Creating Routing Areas Partitioned by RIP
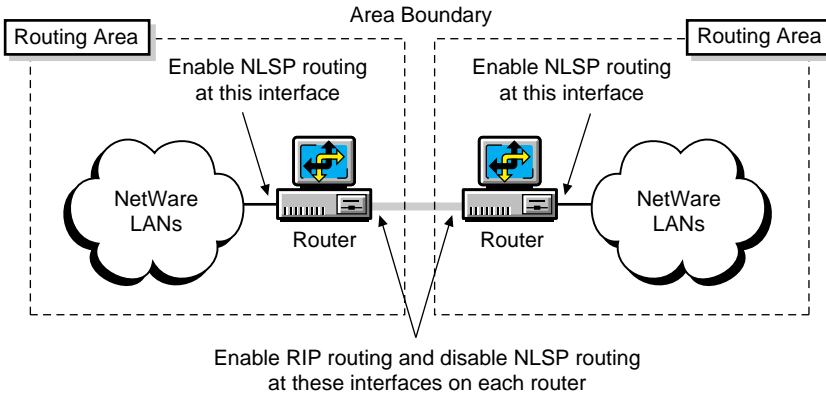
The following steps summarize how to configure the interfaces:

1 Enable NLSP routing on each router.

If you are using any product that contains Novell Internet Access Server 4.1, complete the following steps:

1a Load NIASCFG, then select the following parameter path:

Select Configure NIAS > Protocols and Routing > Protocols > IPX

1b Set the Routing Protocol parameter to NLSP with RIP/SAP Compatibility .

1c Save your changes.

If you are using IPX Upgrade for NetWare Servers 6.5a, load IPXRTR as follows:

```
LOAD IPXRTR ROUTING=NLSP
```

2 On the network interface that *links* the areas, turn off NLSP and turn on RIP and SAP.

If you are using any product that contains Novell Internet Access Server 4.1, complete the following steps:

2a Load NIASCFG, then select the following parameter path:

Select Configure NIAS > Protocols and Routing > Bindings

2b Select the interface.

2c Select Expert Bind Options , then select RIP Bind Options ; set the RIP State parameter to On .

2d Return to the Expert Bind Options menu, then select SAP Bind Options ; set the SAP State parameter to On .

2e Return to the Expert Bind Options menu, then select NLSP Bind Options ; set the NLSP State parameter to Off .

2f Save your changes.

If you are using IPX Upgrade for NetWare Servers, bind IPX to the interface as follows:

```
BIND IPX boardname NET=network_number RIP=YES SAP=YES
    NLSP=NO
```

Although NLSP is disabled on the interface at the area boundary, each router still imports the routes and services from the connected network into its own routing area.

Filtering Routes and Services Between Routing Areas

You can use routing areas to prevent RIP and SAP traffic on one network from flowing to another. For example, suppose you want to prevent some users from gaining access to the accounting services on a particular network. You can use service filters to restrict access to those services.

IMPORTANT: You cannot filter routes or services *within* a routing area, but you can filter routes and services *between* areas at the area boundaries. If you want to restrict Network-layer access within a routing area, you can filter IPX packets.

If you use route and service filters, you must configure the same inbound and outbound filters on *all* NLSP routers connected to the same LAN within the same area. With NLSP, all routers in the same area share the same link state information; however, a single system called the *Designated Router* imports routes and services for the entire network. Therefore, if you configure an inbound route or service filter on one—but not all—NLSP routers, and that router is not the Designated Router, the filter might have no effect.

NOTE: IPX Upgrade for NetWare Servers does not provide filtering capability. To configure filters, you must use a product that contains NetWare 4.1*x* .

Using the Novell Network Registry

Business organizations, each with its own enterprise network, sometimes merge or agree to share information. Or, these same organizations might want to connect their networks to a larger public internetwork to use the services it provides. This means that all network numbers throughout the connected organizations must be unique.

For this purpose, Novell offers the *Novell Network Registry* . The Novell Network Registry service assigns and tracks IPX network addresses and organization names. The Novell Network Registry enables participating organizations to share data between interconnected NetWare networks without name and address conflicts.

The Novell Network Registry assigns a contiguous block of IPX network addresses that are unique to your organization. The size of your address block depends on the number of NetWare LANs and servers in your IPX internetwork, including any additional LANs or servers you anticipate installing over the next two years.

To learn more about the Novell Network Registry, or to reserve a block of IPX network addresses, call 1-408-577-7506 or send Internet e-mail to registry@novell.com. You can also send e-mail by way of the Novell NHUB system to registry@novell. Ask for the publication The Novell Network Registry.

Defining Routing Areas in an Internetwork

This topic uses examples to show how to define routing areas in an IPX internetwork.

NOTE: There are many ways to partition an internetwork into areas. This topic provides only a few examples of how this can be done.

Guidelines to Follow When Defining Routing Areas

Apply the following guidelines when defining routing areas in your internetwork:

 * **Make a sketch of the internetwork.** A graphic representation can help you identify area boundaries and key routers more easily.

 * **Identify the routers that make up the core network infrastructure.** These routers typically form the corporate *backbone network*.

   A core area that uses backbone routers is shown in .

◆ **Identify the routers that feed one or more LANs.** These *feeder routers* service LANs that typically represent functional groups, such as remote sales offices, an engineering department, and so on.

An example of feeder routers is shown in "Partitioning an Internetwork That Uses a Transit LAN" on page 37.

◆ **Do not enable NLSP on the interfaces at area boundaries.** Two routers running NLSP at an area boundary automatically become *neighbors* and join their respective areas into a single area. Run only RIP at an area boundary, as shown in Figure 3 on page 31.

However, a router in one area can run NLSP on a *transit LAN* while routers to other areas run RIP. An example of this is shown in "Partitioning an Internetwork That Uses a Transit LAN" on page 37.

◆ **Avoid partitioning routing areas across WAN connections.** Doing so forces RIP to run over the WAN connection, which, along with SAP, consumes network bandwidth. Wherever it is possible, run only NLSP over the WAN connections in your internetwork.

"Partitioning an Internetwork That Uses a WAN Backbone" on page 35 and "Partitioning an Internetwork That Uses a Transit LAN" on page 37 show how an internetwork can be partitioned to keep WAN connections within a single area.

◆ **Avoid having more than one RIP connection between a backbone router and a single routing area.** Otherwise, the routers import the same routing and service information through *each* connection from the backbone into the routing area. This can double the routing traffic flowing into the area.

Figure 4 on page 35 shows the type of area configuration you should avoid.

Figure 4   Why You Should Have Only One RIP Connection between a Backbone Network and a Routing Area
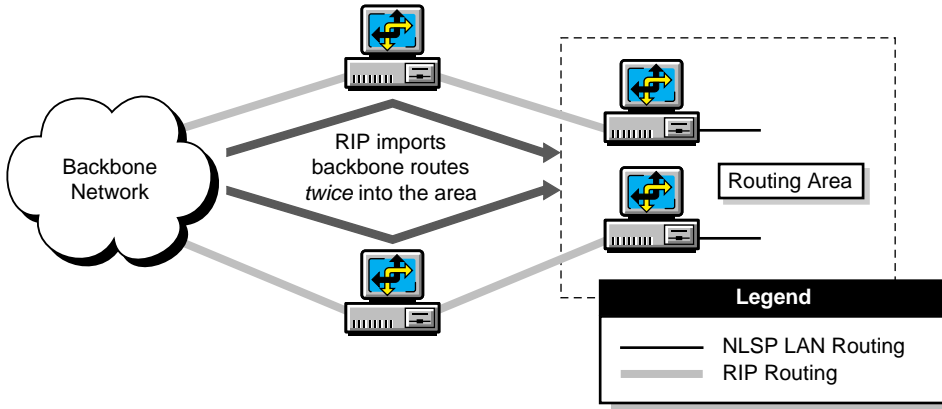
Partitioning an Internetwork That Uses a WAN Backbone

This topic explains how to define areas on an internetwork that uses a central backbone of WAN routers. shows a large IPX internetwork linked by five WAN routers that form the network backbone. Each WAN router is connected to a LAN router that services a small group of NetWare LANs. Without the benefit of NLSP or routing areas, RIP and SAP traffic from all the NetWare LANs traverses the backbone and consumes a large percentage of the available bandwidth.

Figure 5   Routing Areas in an Internetwork Connected by a WAN Backbone
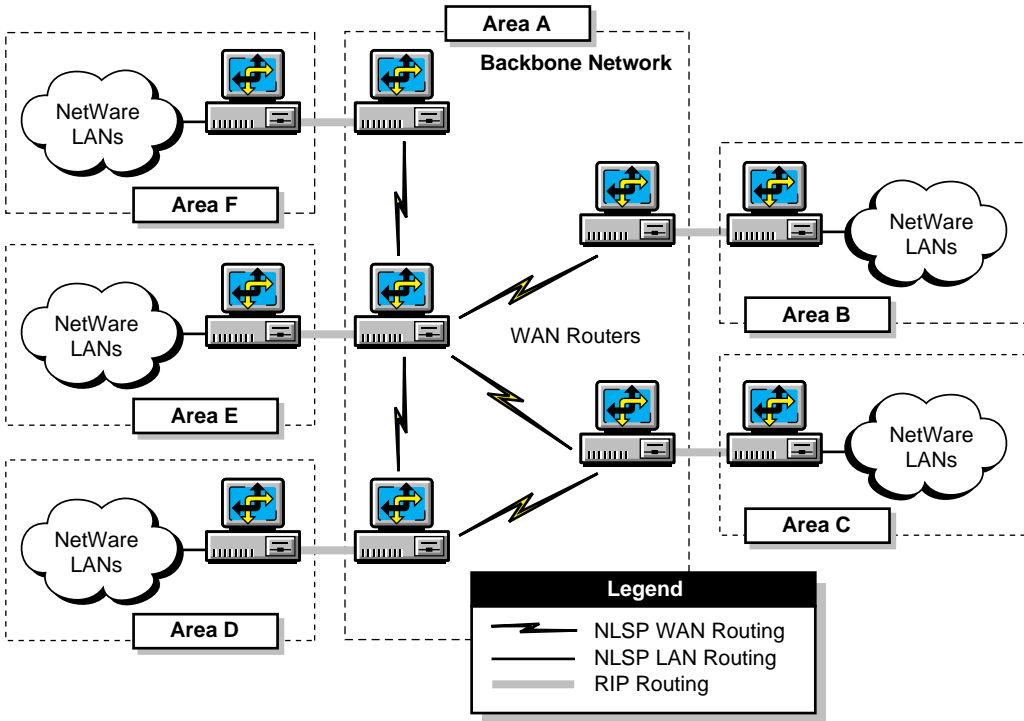
This internetwork is partitioned as follows:

- ◆ **Area A—** The backbone network of WAN routers forms one area.

  - ◆ NLSP routing is enabled on the WAN interface between each WAN router.

  - ◆ RIP routing is enabled on the interface between each WAN router and the corresponding LAN router that services its respective group of NetWare LANs.

- ◆ **Areas B through F—** Each group of NetWare LANs forms its own area.

  NLSP routing is enabled on the interface between each LAN router and its respective group of NetWare LANs.

Partitioning an Internetwork That Uses a Transit LAN

This topic explains how to define areas on an internetwork that uses a *transit LAN* . A transit LAN is typically a high-speed LAN—such as a high-speed token ring or Fiber Distributed Data Interface (FDDI) ring—that serves as a crossroads for all traffic on the internetwork. A transit LAN can link several routing areas.

The internetwork in has six routers connected to an FDDI transit LAN:

- A *backbone router* links the transit LAN to a corporate backbone network like the one shown in .

- Two LAN routers each connect a large group of NetWare LANs to the transit LAN.

- Three feeder routers are each linked through a WAN connection to several *branch office routers*. Each branch office router services a group of LANs at a branch office.

Figure 6   Routing Areas in an Internetwork Connected by an FDDI Transit LAN
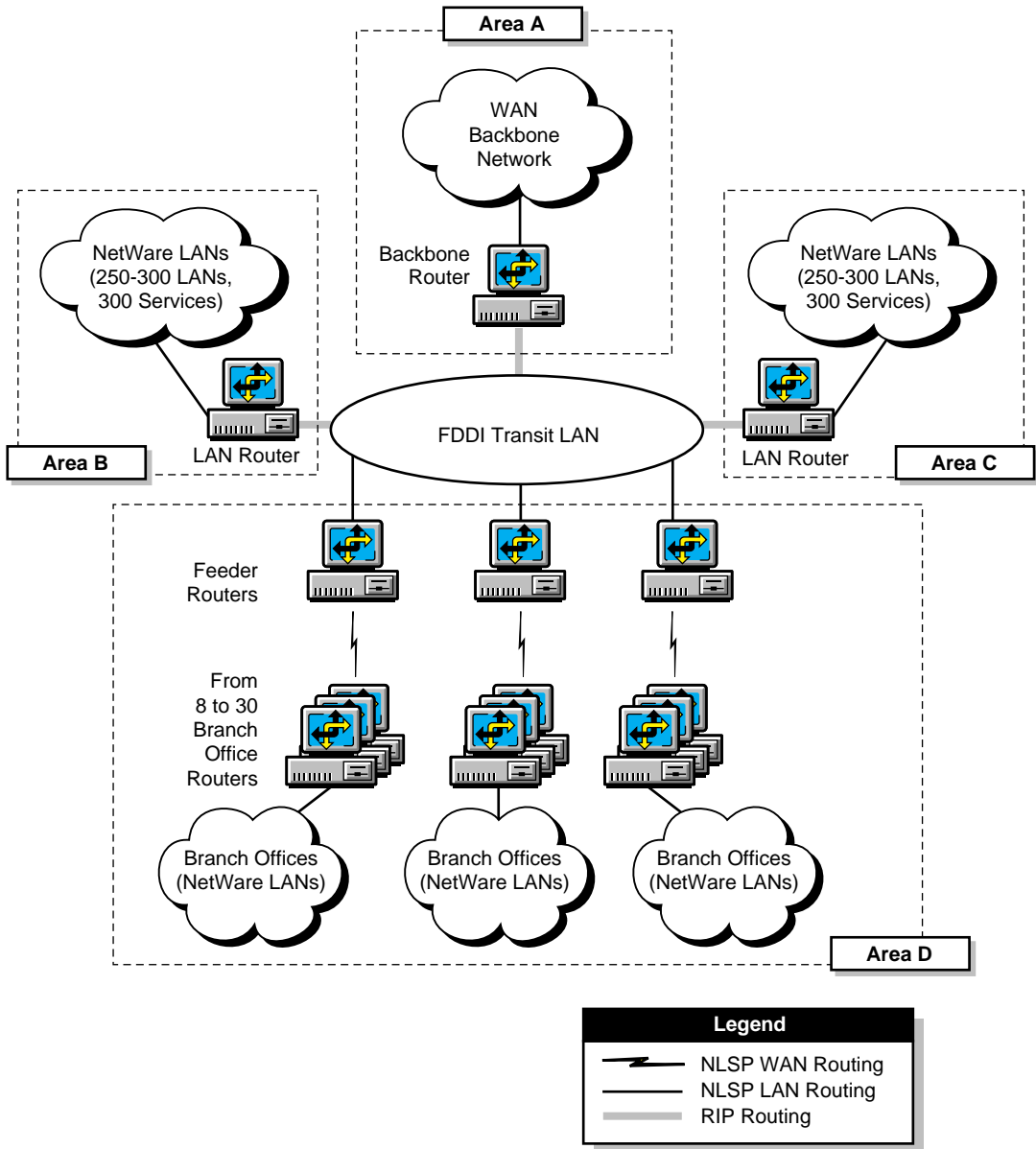
This internetwork is partitioned as follows:

◆ **Area A—** The backbone router and the backbone network form one area.

  ◆ RIP routing is enabled on the network interface between the backbone router and the FDDI transit LAN.

  ◆ NLSP routing is enabled on the network interface between the backbone router and the backbone network.

  Because the backbone router is running NLSP on the interface to the backbone network, it incorporates the route and service information it receives from the LAN routers into its Link State Packets (LSPs). The backbone router passes these LSPs to the backbone network.

◆ **Areas B and C—** Each LAN router and its group of NetWare LANs form a separate area.

  ◆ RIP routing is enabled on the network interface between each LAN router and the FDDI transit LAN.

  ◆ NLSP routing is enabled on the network interface between each LAN router and its corresponding group of NetWare LANs.

◆ **Area D—** The feeder routers, branch office routers, and branch office LANs form one area.

  ◆ NLSP routing is enabled on the network interface between each feeder router and the FDDI transit LAN.

  ◆ NLSP routing is enabled on the WAN interface between each feeder router and branch office router.

  ◆ NLSP routing is enabled on the network interface between each branch office router and its corresponding group of NetWare LANs.

  To exchange routing information, the feeder routers use NLSP among themselves and RIP with the three other routers on the transit LAN.

When you configure the network interfaces, start with the routers on the transit LAN—the backbone router in area A, the LAN routers in areas B and C, and the feeder routers in area D—then work out toward the branch office LANs.

You can use the IPX network management console (IPXCON) to make sure you have configured the routers correctly. Using the internetwork shown in Figure 6 on page 38 as an example, you would load IPXCON on one of the routers and view the neighboring routers on the transit LAN. The three feeder routers running NLSP on the transit LAN should show each other as neighbors. They should not, however, show the backbone router or the two

LAN routers as neighbors. The backbone router and the LAN routers should have no neighbors on the transit LAN.

For information about how to use IPXCON, refer to Managing in the *IPX* documentation .

Migrating an Internetwork with Different NetWare Versions

This topic presents upgrade options for servers running different versions of the NetWare operating system.

This topic includes the following sections:

-

    This section outlines the options available for migrating an internetwork that has NetWare 2 servers.

-

    This section outlines the options available for migrating an internetwork that has NetWare 3.12 servers.

Because NLSP software can receive and broadcast IPX RIP and SAP packets, it can interoperate with any NetWare server. However, although the NetWare 3.12 operating system can run NLSP, the NetWare 2 system cannot and must either continue using RIP and SAP or be upgraded to a NetWare version that provides NLSP.

If Your Internetwork Has NetWare 2 Servers

NetWare 2 servers depend on periodic RIP and SAP broadcasts. On an IPX internetwork, NLSP detects NetWare 2 servers automatically and updates them with RIP and SAP broadcasts. However, unless you confine the NetWare 2 servers to a single LAN, you must run both IPX routing protocols—RIP and NLSP—as well as SAP.

The following options are available for migrating or interoperating with NetWare 2 servers on an IPX internetwork:

- Upgrade the NetWare 2 servers to NetWare 3.12, then perform either of the following upgrades:

  - Install IPX Upgrade for NetWare Servers 6.5a on each NetWare 3.12 server.

    To install this product, refer to the README file. This product is available by searching for the IPX65A.EXE file at the following sources:

    WWW location http://support.novell.com

    WWW location http://ftp.novell.com

    CompuServe (Enter GO NOVELL.)

    Novell® Support Connection Library CD-ROM (Call 1-800-377-4136 to order in the U.S. and Canada. In all other locations, call 888-321-4272.)

  - Upgrade the NetWare 3.12 servers to NetWare 4.1*x* .

    In addition to providing NLSP routing for IPX, this option offers all the features of NetWare 4.1, including TCP/IP and AppleTalk routing.

- Put all NetWare 2 servers on the same LAN.

  This conserves network bandwidth by limiting the RIP/SAP traffic generated by the NetWare 2 servers to a single LAN. Any NetWare server running NLSP on an interface connected to the NetWare 2 LAN can then import and forward the routes and services from that LAN.

If Your Internetwork Has NetWare 3.12 Servers

To enable NetWare 3.12 servers to run NLSP, you can perform either of the following upgrades:

- Install IPX Upgrade for NetWare Servers 6.5a on each NetWare 3.12 server.

  To install this product, refer to the README file. This product is available by searching for the IPX65A.EXE file at the following sources:

  - WWW location http://support.novell.com

  - WWW location http://ftp.novell.com

- CompuServe (Enter GO NOVELL.)
  - Novell Support Connection Library CD-ROM (Call 1-800-377-4136 to order in the U.S. and Canada. In all other locations, call 888-321-4272.)
- Upgrade the NetWare 3.12 servers to NetWare 4.1*x* .

  In addition to providing NLSP routing for IPX, this option offers all the features of NetWare 4.1*x*, including TCP/IP and AppleTalk routing.

Migrating an Internetwork with Products That Require RIP and SAP

This topic explains how to migrate or interoperate with systems running Novell products other than the standard NetWare operating system. Like NetWare 2 software, the products named in this topic rely on RIP and SAP to advertise their services. These products can be running anywhere on the IPX™ internetwork, from a local server to systems on connected NetWare LANs.

IMPORTANT: This topic identifies products known to require special configurations to interoperate with NetWare servers or dedicated routers running NLSP software. Other Novell products, as well as third-party network interface boards and routing software, might also require special configurations.

Note also that some network printers use SAP to advertise their print services on the internetwork.

This topic includes the following sections:

NOTE: The procedures in this topic use examples where the system software has been upgraded to Novell Internet Access Server 4.1.

- "Interoperating with NetWare MultiProtocol Router 2.x" on page 43

  This section explains how to migrate or interoperate with NetWare servers or dedicated routers running NetWare MultiProtocol Router™ 2.0, 2.1, or 2.11 software, NetWare WAN Links™ 2.0 software, or NetWare MultiProtocol Router Plus™ 2.1 or 2.11 software.

- "Interoperating with UnixWare" on page 43

  This section explains how to configure an NLSP router to interoperate with systems running UnixWare™ software.

- "Interoperating with OS/2 Named Pipes" on page 45

  This section explains how to configure an NLSP router to interoperate with systems running OS/2 Named Pipes. Read this section only if you are using OS/2 Named Pipes from version 2.01 or earlier of NetWare Client™ for OS/2 software.

- "Interoperating with NetWare/IP" on page 46

  This section explains how to configure a NetWare server running both NLSP and NetWare/IP™ software.

Interoperating with NetWare MultiProtocol Router 2.*x*

The 2.*x* versions of NetWare MultiProtocol Router—2.0, 2.1, and 2.11—as well as NetWare WAN Links 2.0 and NetWare MultiProtocol Router Plus 2.1*x*, support RIP-based IPX routing. Two options are available for migrating or interoperating with these versions:

- Upgrade the 2.*x* versions to Novell Internet Access Server 4.1.

  This upgrade provides full NLSP routing functionality.

- Continue using the 2.*x* versions.

  In this case, the servers or dedicated routers running the 2.*x* versions continue to run RIP and SAP. NLSP interoperates with these systems.

If you want to migrate a WAN connection that uses NetWare WAN Links 2.0, NetWare MultiProtocol Router Plus 2.1, or NetWare MultiProtocol Router Plus 2.11, refer to "Migrating an Internetwork with WAN Connections or Third-Party Routers" on page 48.

Interoperating with UnixWare

If one or more UnixWare servers or clients are on a LAN connected to one of the network interfaces and the users are running the internal UNIX* NetWare client instead of the DOS NetWare client, you must enable RIP and SAP explicitly on the interface connected to the LAN.

Figure 7 on page 44 shows how you configure this interface.

Figure 7   Configuring an Interface for UnixWare

If the connected system is running Novell Internet Access Server 4.1, complete the following steps:

1 Load NIASCFG, then select the following parameter path:

Select Configure NIAS > Protocols and Routing

2 Complete the following tasks:

2a Make sure you have configured all necessary IPX protocol parameters.

This includes setting the Routing Protocol parameter to NLSP with RIP/SAP Compatibility .

2b Select Bindings.

2c Select the interface.

2d Select Expert Bind Options, then select RIP Bind Options; set the RIP State parameter to On .

2e Return to the Expert Bind Options menu, then select SAP Bind Options; set the SAP State parameter to On .

3 Press Esc , then select Yes to save your changes.

4 Press Esc to return to the Internetworking Configuration menu.

5 If you want these changes to take effect immediately, select Reinitialize System and select Yes to activate your changes.

If the connected system is running IPX Upgrade for NetWare Servers, add the following BIND command to the server AUTOEXEC.NCF file:
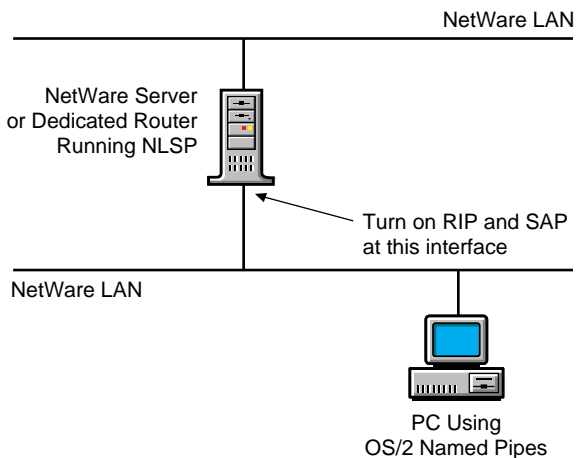
```
BIND IPX boardname  NET=network_number  RIP=YES SAP=YES
```

Interoperating with OS/2 Named Pipes

If you are using OS/2 Named Pipes from version 2.01 or earlier of NetWare Client for OS/2 on a LAN connected to one of the network interfaces, you must enable RIP and SAP explicitly on the interface. The OS/2 Named Pipes that is part of NetWare Client for OS/2 version 2.10 or later and Novell Client™ for OS/2 does not have this requirement.

Figure 8 shows how you configure this interface.

Figure 8   Configuring an Interface for OS/2 Named Pipes

If the connected system is running Novell Internet Access Server 4.1, complete the following steps:

1 Load NIASCFG, then select the following parameter path:

Select Configure NIAS > Protocols and Routing

2 Complete the following tasks:

2a Make sure you have configured all necessary IPX protocol parameters.

This includes setting the Routing Protocol parameter to NLSP with RIP/SAP Compatibility.

2b Select Bindings.

2c Select the interface.

2d Select Expert Bind Options , then select RIP Bind Options; set the RIP State parameter to On .

2e Return to the Expert Bind Options menu, then select SAP Bind Options; set the SAP State parameter to On.

3 Press Esc , then select Yes to save your changes.

4 Press Esc to return to the Internetworking Configuration menu.

5 If you want these changes to take effect immediately, select Reinitialize System and select Yes to activate your changes.

If the connected system is running IPX Upgrade for NetWare Servers with the ROUTING=NLSP option enabled from the LOAD IPXRTR command line, add the following BIND command to the server AUTOEXEC.NCF file:

BIND IPX *boardname* NET=*network_number* RIP=YES SAP=YES

The OS/2 Named Pipes that is part of NetWare Client for OS/2 version 2.10 or later and Novell Client™ for OS/2 does not require RIP and SAP to be active; in this case, just type the BIND command for the interface as follows:
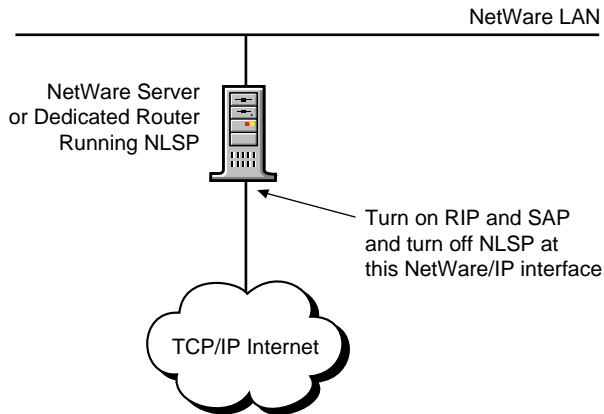
BIND IPX *boardname* NET=*network_number*

Interoperating with NetWare/IP

If you install NLSP software on a server that is running NetWare/IP, you must enable RIP and SAP and disable NLSP on the interface to which IPX is bound.

shows how you configure this interface.

Figure 9   Configuring an Interface for NetWare/IP

If the connected system is running Novell Internet Access Server 4.1, complete the following steps:

1 Load NIASCFG, then select the following parameter path:

Select Configure NIAS > Protocols and Routing

2 Complete the following tasks:

2a Make sure you have configured all necessary IPX protocol parameters.

This includes setting the Routing Protocol parameter to NLSP with RIP/SAP Compatibility .

2b Select Bindings .

2c Select an interface to which IPX is already bound or create a new binding.

2d Select Expert Bind Options , then select RIP Bind Options ; set the RIP State parameter to On .

2e Return to the Expert Bind Options menu, then select SAP Bind Options ; set the SAP State parameter to On .

2f Return to the Expert Bind Options menu, then select NLSP Bind Options ; set the NLSP State parameter to Off .

3 Press Esc , then select Yes to save your changes.

4 Press Esc to return to the Internetworking Configuration menu.

5 If you want these changes to take effect immediately, select Reinitialize System and select Yes to activate your changes.

If the connected system is running IPX Upgrade for NetWare Servers, add the following BIND command to the server AUTOEXEC.NCF file:

```
BIND IPX boardname  NET=network_number  RIP=YES SAP=YES
   NLSP=NO
```

Migrating an Internetwork with WAN Connections or Third-Party Routers

This topic explains how to migrate WAN connections or third-party routers on your internetwork to run—or interoperate with—NLSP software.

This topic includes the following sections:

◆ "Migrating WAN Connections That Use Novell Multiprotocol Routing Software" on page 49

This section explains how to migrate WAN connections that use any of the following Novell products:

  ◆ NetWare WAN Links™ 2.0 software

  ◆ NetWare MultiProtocol Router Plus™ 2.1 software

  ◆ NetWare MultiProtocol Router Plus 2.11 software

You can either continue using these products or upgrade them to Novell Internet Access Server 4.1.

NOTE: You can upgrade routers on each end of a WAN connection one at a time. Simultaneous upgrades are unnecessary; NLSP runs RIP and SAP automatically until you have upgraded both routers.

◆ "Migrating Connections That Use Third-Party Routers" on page 54

This section explains how to migrate LAN or WAN connections that use third-party routers that do not support NLSP but *do* support Internet Protocol (IP) routing or IPX RIP/SAP routing.

Migrating WAN Connections That Use Novell Multiprotocol Routing Software

This section explains the choices you have when migrating a WAN connection that uses any of the following Novell products:

- NetWare WAN Links 2.0
- NetWare MultiProtocol Router Plus 2.1
- NetWare MultiProtocol Router Plus 2.11

How you migrate the connection depends on how you want it to operate:

- If you want the connection to stay up but carry a negligible amount of routing traffic, refer to "Running NLSP over the Connection" on page 49.

- If you want the connection to come up only when data—not route or service updates—needs to cross it, you must convert the connection to an *on-demand call* .

    To configure an on-demand call, you use the on-demand call configuration utility (STATICON). Refer to Setting Up in the *IPX* documentation for instructions.

- If you want to continue using the earlier version of the NetWare multiprotocol routing software but want it to interoperate with NLSP, refer to "Enabling RIP/SAP Periodic Updates over the Connection" on page 50.

- If you want to continue running RIP and SAP over the connection but reduce the routing and service traffic they generate, refer to "Increasing the RIP and SAP Periodic Update Intervals" on page 52.

Running NLSP over the Connection

When NLSP operates over a WAN connection, it sends a Hello packet periodically to check whether the connection is still active. The traffic generated by NLSP is negligible compared to that generated by RIP and SAP.

To run NLSP over a WAN connection, you install and configure Novell Internet Access Server 4.1 on the routers at each end of the connection. The following steps summarize how to do this:

1 Install Novell Internet Access Server 4.1 on the routers at each end of the connection.

2 Start NetWare.

3 Load NIASCFG, then select the following parameter path:

Select Configure NIAS > Protocols and Routing

4 Complete the following tasks:

IMPORTANT: These tasks are outlined in greater detail under "Setting Up" for IPX and each WAN protocol. Refer to this documentation for complete instructions if you are unfamiliar with the Novell Internet Access Server Configuration utility (NIASCFG).

4a Assign a WAN driver to the interface you want to use.

4b Configure the interface parameters specific to the WAN medium (X.25, for example).

4c Create a WAN call destination to the router at the other end of the connection.

4d Select NLSP as the routing protocol.

4e Configure the IPX protocol parameters.

4f Bind IPX to the WAN interface; configure the bind parameters for the interface.

5 Press Esc , then enter

```
REINITIALIZE SYSTEM
```

Enabling RIP/SAP Periodic Updates over the Connection

This topic explains how to migrate a router running NetWare WAN Links 2.0, NetWare MultiProtocol Router Plus 2.1, or NetWare MultiProtocol Router Plus 2.11 to interoperate with Novell Internet Access Server 4.1.

These earlier versions of Novell multiprotocol routing software provide a configurable parameter that determines how the router transmits RIP and SAP packets over a WAN connection. This parameter, Send RIP/SAP Updates , has two options:

⬧ Periodically instructs the router to send a RIP packet every 60 seconds and a SAP packet every 60 seconds regardless of whether there has been a change in a route or service on either end of the connection.

⬧ Only on Change instructs the router to send a RIP packet or a SAP packet only when there has been a change in a route or service on either end of the connection.

IMPORTANT: The RIP/SAP functionality NLSP provides does not interoperate with Only on Change.

For a router running NetWare WAN Links 2.0, NetWare MultiProtocol Router Plus 2.1, or NetWare MultiProtocol Router Plus 2.11 to interoperate with Novell Internet Access Server 4.1, you must enable the router to transmit RIP and SAP updates periodically over the WAN connection.

If you want, you can migrate the local router—and the router at the other end of the connection—in stages. Figure 10 summarizes the three-stage process for migrating RIP/SAP routers to NLSP.

Figure 10   Migrating RIP/SAP Routers to NLSP

Router A

Start

Router B

Send RIP/SAP Updates = Only on Change

NetWare WAN Links 2.0 or NetWare MultiProtocol Router Plus 2.*x*

NetWare WAN Links 2.0 or NetWare MultiProtocol Router Plus 2.*x*

1

Send RIP/SAP Updates = Periodically

NetWare WAN Links 2.0 or NetWare MultiProtocol Router Plus 2.*x*

NetWare WAN Links 2.0 or NetWare MultiProtocol Router Plus 2.*x*

2

Send RIP/SAP Updates = Periodically

NLSP State = On

NetWare WAN Links 2.0 or NetWare MultiProtocol Router Plus 2.*x*

NetWare MultiProtocol Router 3.1 or any product that contains Internet Access Server 4.*x*

3

NLSP State = On

NetWare MultiProtocol Router 3.1 or any product that contains Internet Access Server 4.*x*

NetWare MultiProtocol Router 3.1 or any product that contains Internet Access Server 4.*x*

The following paragraphs explain each stage of migration.

- **Start** shows both routers running an earlier version of Novell multiprotocol routing software, such as NetWare WAN Links 2.0. The Send RIP/SAP Updates parameter is set to Only on Change .

- **Stage 1** shows the Send RIP/SAP Updates parameter set to Periodically on each router. This ensures that the routers interoperate with other systems running NLSP.

- **Stage 2** shows Router B upgraded to Novell Internet Access Server 4.1 and running NLSP at its WAN interface. At this stage, NLSP acknowledges periodic RIP and SAP broadcasts from Router A.

- **Stage 3** shows both routers upgraded to Novell Internet Access Server 4.1 and running NLSP over the connection.

To change the RIP/SAP update mode, or to verify that the active configuration is compatible with NLSP, complete the following steps on the router running the earlier version:

1 Load INETCFG.

2 The first selection, LAN and WAN Board Parameters , is already highlighted; just press Enter .

   A new screen displays the configured boards and interfaces.

3 Scroll to a WAN interface, then press Enter .

   A new menu displays the configuration parameters for the interface.

4 Find the Send RIP/SAP Updates parameter.

5 If the Send RIP/SAP Updates parameter is set to Only on Change , select the field and change it to Periodically .

6 Press Esc , then select Yes to save the change.

7 Press Esc again to return to the Internetworking Configuration menu.

Increasing the RIP and SAP Periodic Update Intervals

Another way to reduce RIP and SAP traffic over a WAN connection is to increase the RIP and SAP periodic update intervals on the routers at each end of the connection. This solution, however, is the least preferable for the following reasons:

- It increases the time it takes to propagate route or service changes throughout the internetwork.

- It can cause network timing problems that are difficult to troubleshoot.

- It might not work over slow dial-up lines.

    NOTE: NetWare 2 and NetWare 3™ software does not allow you to change the RIP and SAP periodic update intervals.

These intervals are measured in 30-second increments. You can set them to any value between 1 (30 seconds) and 10,000 (5,000 minutes, or slightly longer than 83 hours).

IMPORTANT: All routers with the same network number must use the same periodic update interval.

To increase the RIP and SAP periodic update intervals, install Novell Internet Access Server 4.1 on the routers at each end of the connection and then complete the following steps:

1 Load NIASCFG, then select the following parameter path:

Select Configure NIAS > Protocols and Routing

2 Select Bindings , then press Enter .

A new screen displays the interfaces currently bound to IPX.

3 Scroll to a WAN interface, then press Enter .

The Binding IPX to a WAN Interface menu appears.

4 Select Expert Bind Options , then press Enter .

The Expert WAN Bind Options menu appears.

5 To increase the RIP periodic update interval:

5a Select RIP Bind Options , then press Enter .

The RIP Bind Options menu appears.

5b Highlight the Periodic Update Interval parameter.

5c Enter any value up to 10,000, then press Enter .

5d Press Esc .

6 To increase the SAP periodic update interval:

6a Select SAP Bind Options , then press Enter .

The SAP Bind Options menu appears.

6b Highlight the Periodic Update Interval parameter.

6c Enter any value up to 10,000, then press Enter .

6d Press Esc.

7 Press Esc until you return to the Internetworking Configuration menu; when you are prompted, select Yes to save your changes.

8 Press Esc, then enter

```
REINITIALIZE SYSTEM
```

Migrating Connections That Use Third-Party Routers

If you are migrating any connections that use third-party routers that do not support NLSP but *do* support IP routing or IPX RIP/SAP routing, you have three choices:

- Replace each third-party router with a PC running Novell Internet Access Server 4.1.

  For more information, refer to "Replacing Third-Party Routers with Novell Internet Access Server 4.1" on page 54.

- Continue using the third-party routers as IP routers but *encapsulate* all IPX/NLSP traffic flowing between them in UDP/IP datagrams. This method of encapsulation is often called *IP tunneling*.

  For more information, refer to "Tunneling Through Third-Party IP Routers" on page 54.

- Continue using the third-party routers as IPX RIP/SAP routers.

  In this case, you allow the routers to operate as they are.

Replacing Third-Party Routers with Novell Internet Access Server 4.1

Although this solution offers many features in addition to NLSP routing, it is not always practical or possible because of throughput demands and budget restrictions.

Tunneling Through Third-Party IP Routers

This topic explains how to interoperate with third-party IP routers by setting up an *IP tunnel* between NetWare systems. Novell provides the following data-link drivers for this purpose:

- **IPRELAY,** a WAN driver that models the tunnel between NetWare systems as a point-to-point WAN connection between peer IP routers

  NOTE: IPRELAY is available only with NetWare MultiProtocol Router™ 3.*x* software or Novell Internet Access Server 4.1.

- *IPTUNNEL,* a LAN driver that models the tunnel between NetWare systems as a fully connected LAN mesh of peer IP routers

Using the IPRELAY Driver

NLSP works with third-party IP routers by means of IPRELAY. IPRELAY encapsulates IPX packets in UDP/IP datagrams that can be forwarded by any IP router.

IPRELAY operates more efficiently than the IPTUNNEL driver provided with NetWare 3.12 and NetWare MultiProtocol Router version 2.*x* or earlier. To further conserve network bandwidth and reduce the cost of IP encapsulation, Novell Internet Access Server 4.1 uses *IPX header compression* over the IPRELAY tunnel. Header compression reduces the size of the IPX header to a few bytes.

Figure 11 shows a typical example of a WAN connection that uses third-party IP routers to link two NetWare LANs.

Figure 11   Tunneling Through Third-Party IP Routers with IPRELAY
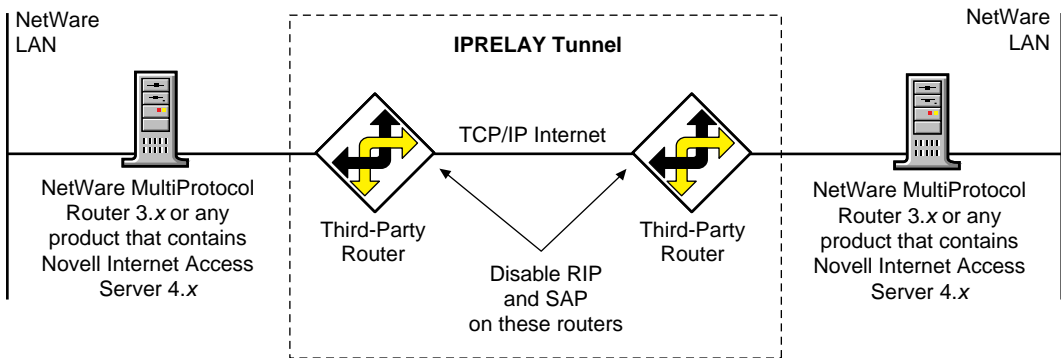
To configure the IPRELAY tunnel on each NetWare system, complete the following steps:

1 Install Novell Internet Access Server 4.1 on one of the NetWare systems.

2 Start NetWare.

3 Load NIASCFG, then select the following parameter path:

Select Configure NIAS > Protocols and Routing

4 Complete the following tasks:

IMPORTANT: These tasks are outlined in greater detail in Setting Up in the *IP Tunnels for IPX and AppleTalk* documentation. Refer to this documentation for complete instructions if you are unfamiliar with NIASCFG.

4a Enable the TCP/IP protocol and bind IP to the WAN interface you want to use.

The IPX protocol is enabled by default.

4b Enable the Tunnel IPX Through IP parameter.

NIASCFG assigns the IPRELAY driver automatically to the WAN interface.

4c Configure the IPRELAY tunnel parameters (Remote Peers , UDP Checksum , and so on).

NIASCFG binds IPX to the WAN interface automatically and creates a WAN call destination to the peer Novell router at the other end of the tunnel.

IPX header compression is enabled automatically on any WAN interface that uses IPRELAY.

5 Press Esc , then enter

```
REINITIALIZE SYSTEM
```

6 Repeat Steps 1 through 5 on the NetWare system connected to the third-party router at the other end of the tunnel.

7 After you have configured the tunnel on the NetWare systems, disable RIP and SAP routing on the third-party routers.

Using the IPTUNNEL Driver

You can also tunnel through third-party IP routers with IPTUNNEL, a data-link LAN driver provided with the following Novell products:

- NetWare 3.12
- NetWare WAN Links 2.0
- NetWare MultiProtocol Router 2.*x*
- NetWare MultiProtocol Router Plus 2.*x*

  NOTE: For compatibility with the IPTUNNEL driver provided with the products in the preceding list, Novell Internet Access Server 4.1 provides IPTUNNEL as well as IPRELAY.

Like IPRELAY, IPTUNNEL encapsulates IPX packets in UDP/IP datagrams that can be forwarded by any IP router. Although IPTUNNEL is less efficient than the newer IPRELAY for large networks, it can still provide a significant reduction in routing traffic over WAN connections.

If you want to use NLSP with IPTUNNEL, each NetWare system at the end points of the tunnel must be running NLSP software, such as IPX Upgrade for NetWare Servers 6.5a, NetWare MultiProtocol Router 3.*x,* or Novell Internet Access Server 4.*x*. For example, to exchange IPX/NLSP packets through an IP tunnel between two or more NetWare 3.12 servers, you must complete the following tasks:

1 Install IPX Upgrade for NetWare Servers 6.5a on each NetWare 3.12 server.

For instructions, refer to the README file .

2 Configure the IPTUNNEL parameters on each server.

For instructions, refer to your Novell product documentation.

3 When you bind IPX to the IPTUNNEL driver, set RIP=NO and SAP=NO at each tunnel interface.

The BIND command line should look like this:

```
BIND IPX IPTUNNEL NET=network_number  RIP=NO SAP=NO
```