NLSP

NETWARE LINK SERVICES PROTOCOL

An Overview of IPX Routing Enhancements

February 1993

Novell, Inc.
Network Management and Internetworking Products Division
2180 Fortune Drive
San Jose, California 95131

NLSP
NetWare Link Services Protocol

An overview of IPX routing enhancements

In the past few years NetWare networks have experienced a tremendous growth rate. As a result of this growth, large LAN-WAN internets have appeared with NetWare resources distributed across a wide area. To address the needs of large LAN-WAN internets, Novell is developing NetWare Link Services Protocol. NLSP will provide better performance, reliability and management of NetWare traffic while maintaining compatibility with existing systems.

NLSP is a link-state routing protocol. "Link-state" is a term used to describe modern routing protocols used to address large scale internetworking. Link-state protocols differ significantly from traditional distance vector routing protocols. Before examining the features and benefits of NLSP it will be helpful to understand the fundamental differences between link-state and distance vector protocols.

Link-State versus Distance Vector Routing Protocols

Imagine driving from New York to Los Angeles without a road map. To get to LA without a map you would rely only on road signs. Each sign that pointed in the direction of LA, you would follow. Some signs would direct you over modern interstate highways with multiple lanes, gas stations, hotels, restaurants and scenic vistas. Other signs would direct you over old two lane highways with slow traffic, stop signs and limited services. Using only road signs for direction, the trip to LA could take a very long time, cost a lot more money and be very unpleasant.

Now imagine making that trip using a brand new road map that is completely accurate and contains a lot of information. That road map tells you which roads are fast interstate highways, which roads go over mountains, which roads are slow and should be avoided and which roads lead to better roads. Using this map the trip can be planned using the fastest and least expensive way to get to LA.

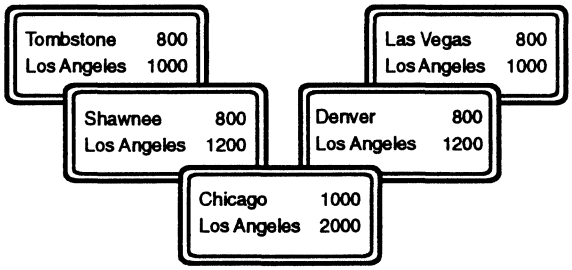
The first example, using only road signs, is how distance vector routing protocols work. Distance vector routing protocols maintain tables that contain information such as "LA 200 miles." The second example, using a new and accurate road map is how link-state routing protocols work. Link-state protocols know whether roads are fast or slow and which roads lead to better roads. Link-state routers build and maintain a map of the entire network. They make traveling efficient because they know the quality and capacity of every road.

The road sign versus road map analogy explains the fundamental difference between distance vector and link state routing protocols. There is another important difference as well.

Distance vector routing protocols periodically forward road sign information to each other. They periodically forward this information whether or not the information has changed. Imagine repainting all the road signs every day with the same information. That isn't necessary. Road signs and maps should change only when the road changes. That is how

the link-state routing protocol works. Road signs and maps are repainted only when a change occurs. Link-state protocols are also efficient in how they repaint maps—they only repaint the sections of the map that need repainting.

Thus link-state routing protocols are smarter, cause less network chatter and are more efficient than distance vector protocols. NLSP will contain these features and other features as well.



Distance vector routers use road signs

Link state routers use road maps

Spreading the News: RIP and SAP

Currently, NetWare uses two mechanisms to propagate information: IPX RIP (Routing Information Protocol), a distance vector protocol, for routing information and SAP (Service Advertising Protocol) to advertise services such as file and print. RIP and SAP work by sending information about routes and services once a minute. This means that routes and services are automatically discovered on a NetWare network. This feature makes resource discovery and access easy. Other protocols such as IP, XNS, and AppleTalk also use RIP to propagate information.

NLSP will also propagate SAP information and routing information. However, it will handle this propagation in a manner that is complete and efficient. With NLSP, RIP and

SAP information will no longer be broadcast periodically. Once the NLSP routers and servers have learned about all the routes and services available on the network, they will communicate with each other only when changes occur. When a server or link is added to a network, NLSP servers and routers communicate that change throughout the network. When a server or link disappears, that change is also communicated.

NLSP automatically detects the presence of routers and servers that require RIP and SAP broadcasts and will generate these periodic advertisements for compatibility. By doing so, NLSP allows an easy and comfortable migration path to NLSP technology.

NLSP Features

Overall NLSP will enhance the scalability, reliability and manageability of IPX networks. Specifically NLSP will offer the following features:

Eliminate RIP and SAP broadcasts

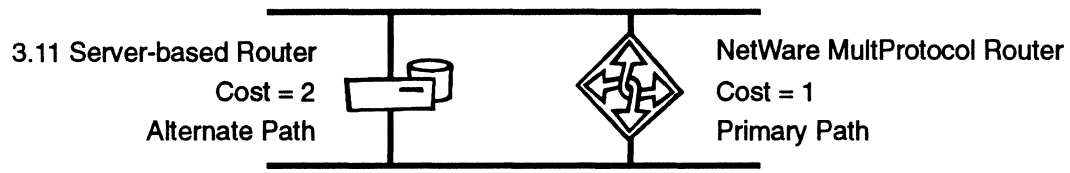
Since NLSP communicates only changes in routes and services, periodic broadcasts will not ordinarily occur. Periodic broadcasts will only occur when non-NLSP devices are present. This will improve the wide area networking capability of NetWare.

More intelligent routing decisions based on a complete network map

Since NLSP routers have a complete map of the network they will make more intelligent decisions on how to forward traffic. This can improve performance on complex LAN-WAN internets.

Automatic and manual link cost assignments

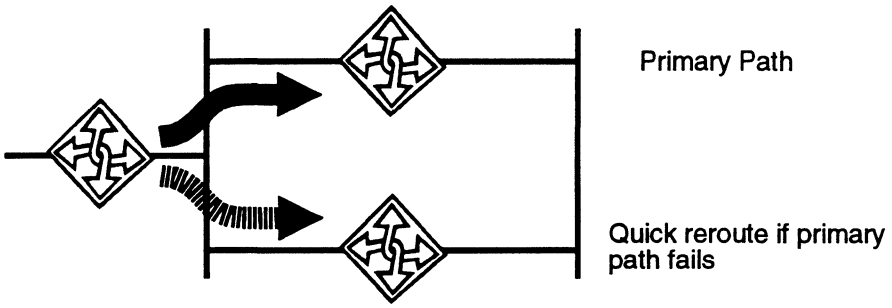
NLSP routers will know the cost of every link and by default choose the most efficient path. A manual override will allow network managers to designate routes as being more or less costly. A common application of this feature will be to use a dedicated router as a primary path and a server based router as the back up path. The manager can use the manual link cost assignment of NLSP to make the server based route more costly. By default traffic will be routed through the dedicated router. If the dedicated router fails or is brought down for maintenance, the server is used as the backup router.



Cost Assignments

Quick Re-routing over Redundant Links

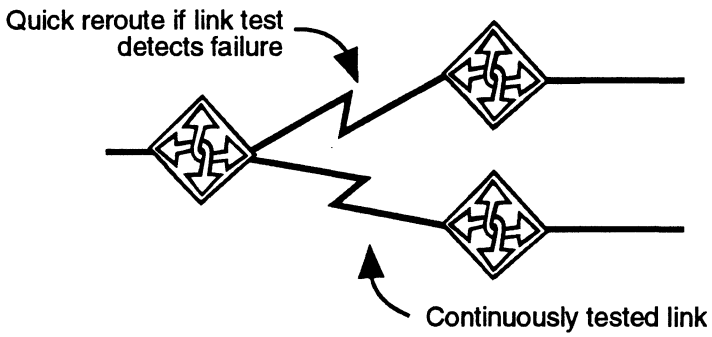
NLSP will switch to an alternate route if a primary route fails and it will do so quickly. Many networks used for mission critical applications are constructed with redundant links. NLSP will quickly switch to the alternate link if the primary link fails.



Rerouting

Increased reliability through periodic link integrity checks

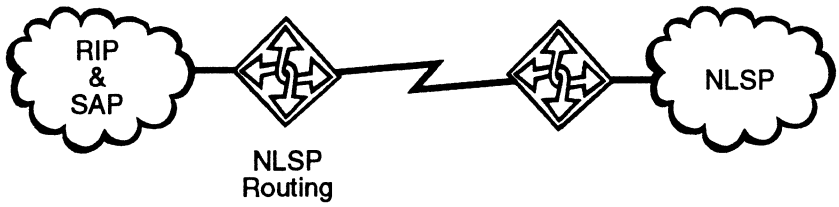
NLSP will periodically test a link for integrity and connectivity. If a link fails the test, NLSP will automatically switch to an alternate route if available. The combination of link test and fast switching makes IPX internets more reliable.



Link Integrity Checking

Compatibility with existing RIP and SAP advertisements

NLSP will work with existing routers and servers. It will be beneficial to migrate to a pure NLSP network. Because of the RIP and SAP compatibility, this migration can be done gradually.



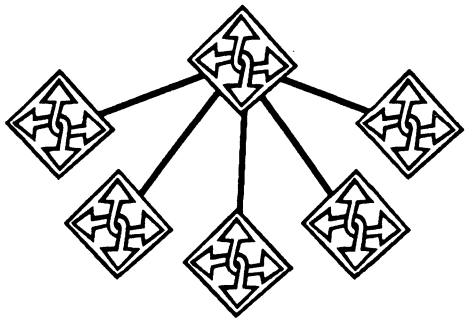
RIP and SAP compatibility migration

Eliminate the 16 router hop count limitation of IPX networks

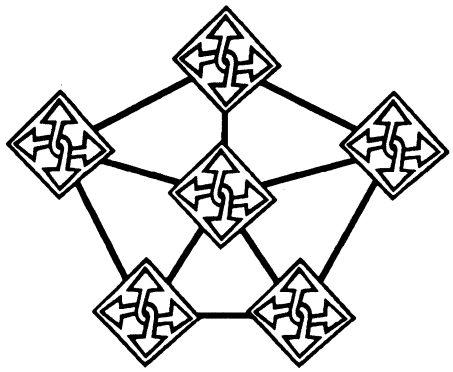
Currently IPX networks are limited to 16 router hops for connectivity and visibility. Devices that are more than 16 routers apart cannot see or communicate with each other. NLSP will allow networks with more than 16 hops apart to communicate with each other, enabling NetWare networks to become large and sophisticated.

Designing NLSP Networks

To take advantage of NLSP reliability, network designers should provide alternate routes. With alternate routes and NLSP, the likelihood that end user service will be disrupted is greatly reduced. The design of the network should look more like a mesh network, rather than a collapsed backbone. Collapsed backbones (see diagram below) are single points of failure and are vulnerable to faults. Mesh networks contain alternate routes to various locations and are much more immune to catastrophic events.



Collapsed backbone network



Fault tolerant mesh network

NetWare Routers and Third Party Routers

NLSP will be available as an NLM for use with NetWare 3.11 or 4.0 platforms. NLSP will also come with the NetWare MultiProtocol Router. Novell will also make NLSP specifications available to router developers. NLSP will be supported by a third party development program including specifications, technical support, interoperability testing and certification. Novell is committed to open systems with multi-vendor support and interoperability.

NLSP Fundamentals: IS-IS

NLSP is a derivative of the OSI Routing Protocol IS-IS (Intermediate System-to-Intermediate System). The IS-IS routing protocol is a link-state routing protocol developed by the ISO standards organization to route OSI traffic. IS-IS is a proven routing technology with acceptance worldwide. Novell is adapting aspects of IS-IS to build NLSP, achieving the advantages of link-state routing and providing other features as well.

The fact that NLSP was developed using IS-IS as the basis will be transparent to network managers and end users. The primary benefit of this approach will be in terms of third party support for NLSP. Since most router vendors support OSI, they have an IS-IS routing protocol stack available. Following Novell's specifications, they can adapt their IS-

IS implementations to produce NLSP in a timely manner.

Implementing NLSP

In most cases implementing NLSP will be easy. To prepare for NLSP simply convert 2.X routers to 3.X routers (using the NetWare MultiProtocol router or 3.11 server based routing). Future NetWare MultiProtocol Routers will come with NLSP and NLSP will be available as an NLM for use on file servers. As mentioned previously, Novell will make NLSP available to third party router vendors making these routers NLSP compatible. The RIP-SAP compatibility function of NLSP will interoperate with existing NetWare platforms and third party routers.