

# Guide to Branch Office Token Ring Networks



**Smart Networking™**



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## Introduction

Many organisations today are expanding their Token Ring networks from central sites to their branch offices in order to provide remote users with LAN-based applications. PCs are being attached to the Token Ring network, often to replace 3270 terminals and provide extra functions.

The needs of these remote LANs are fundamentally different from the central site due to the size of the networks, the number of branches, and the lack of local MIS support personnel. As a result, network administrators are faced with the problem of how to manage and maintain a fully operational network in these remote branches whilst minimizing installation and support costs.

An exciting new approach to this problem is to combine the functions of the router or SNA gateway, and branch office hub with the branch office server. This not only reduces costs but provides an easy-to-install, compact and fully manageable solution.

This guide is aimed at network administrators who are planning or installing branch office networks. Here the term branch office means a small network of between 2 and 30 nodes and covers a wide range of industries including:

- banking
- insurance
- retail
- transportation
- government

The guide discusses the issues facing LAN administrators as they implement Token Ring networks in the branch offices, and describes the benefits of the integrated server-based solution.

# 1 Branch Office Networks

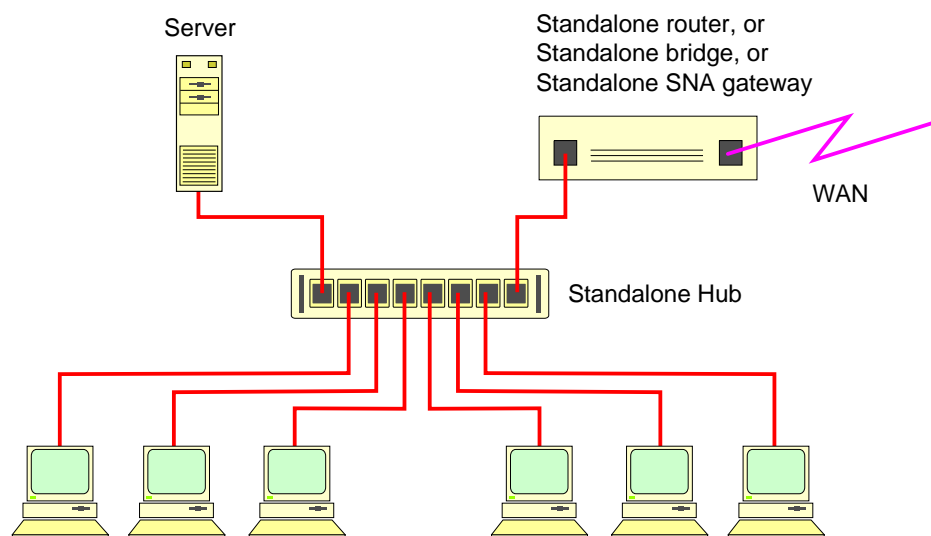
In considering how to roll out Token Ring LANs in branch offices, LAN administrators are faced with the problem of how to maintain continuous and secure network services in these remote locations - where there are no MIS or technical resources available - at the same time as minimizing costs. The solutions available are now discussed.

## Standalone Solutions

One solution to this problem is to use standalone devices for the different components on the network. For example, a typical branch office network would have a standalone server, a standalone router or SNA gateway, and a standalone hub.

However, this solution does have a number of disadvantages:

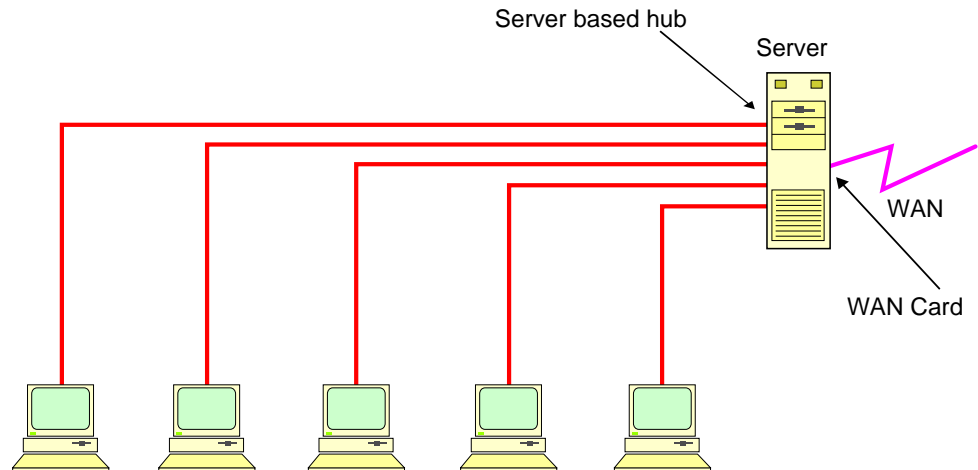
- the cost of this solution tends to be high due to the number of individual network components
- installation is complex due to the number of devices
- support and maintenance is more complex and costly because a variety of vendors' devices are involved in the system
- separate management solutions are required for each device, therefore increasing overall costs and the time required to resolve problems
- a large amount of space is occupied in the branch office



*Traditional branch office network*

## Integrated Branch Office Solution

A new approach to this problem is to combine the functions of the router or SNA gateway, and the Token Ring hub with the server. This reduces the number of separate components on the branch office network, and provides a more cost-effective and compact solution.



*Integrated branch office solution*

Being based around off-the-shelf PC hardware platforms, the solution is easy to install and maintain. Standard configurations can be built at the central site and distributed to the remote branch offices. Also, if a system fails, the PC can be replaced with another PC therefore reducing costs and the number of spares that must be kept.

Since all the major network components are located in the same PC they can be managed from a single management station. This not only reduces support and training costs, but also the time taken to locate problems because only one management console has to be referred to.

Novell NetWare is a vital part of the solution. Running in the branch office server, NetWare provides both a network operating system, for file and print services, and a common base which allows the different network components - the intelligent hub, and remote router or SNA gateway - to co-reside in the same server PC.

In addition, Novell offers a wide range of routing, bridging and SNA gateway software for the server which gives you choice and flexibility in the implementation and evolution of your wide area network.

The Token Ring part of the solution is provided by Madge with a range of intelligent and high performance products designed for branch office networks.

The Token Ring hub function is provided by the Madge Smart 16/4 AT Hubcard, an intelligent wiring concentrator which integrates with the NetWare server and provides advanced features including remote SNMP management, automatic fault recovery, and network security.

Together with the Smart 16/4 Ringnodes, a range of high performance Token Ring adapters for both server and workstation environments, and the Smart 16/4 Bridgenodes, a range of performance leading Token Ring adapters designed specifically for the NetWare Multiprotocol Router version 2.1, Madge delivers the solution to your Token Ring needs.

## Components of the Integrated Branch Office Solution

The components which are installed in the branch office server are summarised below:

<u>Function</u>	<u>Product</u>	<u>Vendor</u>
Intelligent hub	Smart 16/4 AT Hubcard	Madge
Server adapter	Smart 16/4 Ringnodes or Smart 16/4 Bridgenodes	Madge
Server software	NetWare	Novell
WAN connection	WAN card	WAN vendor

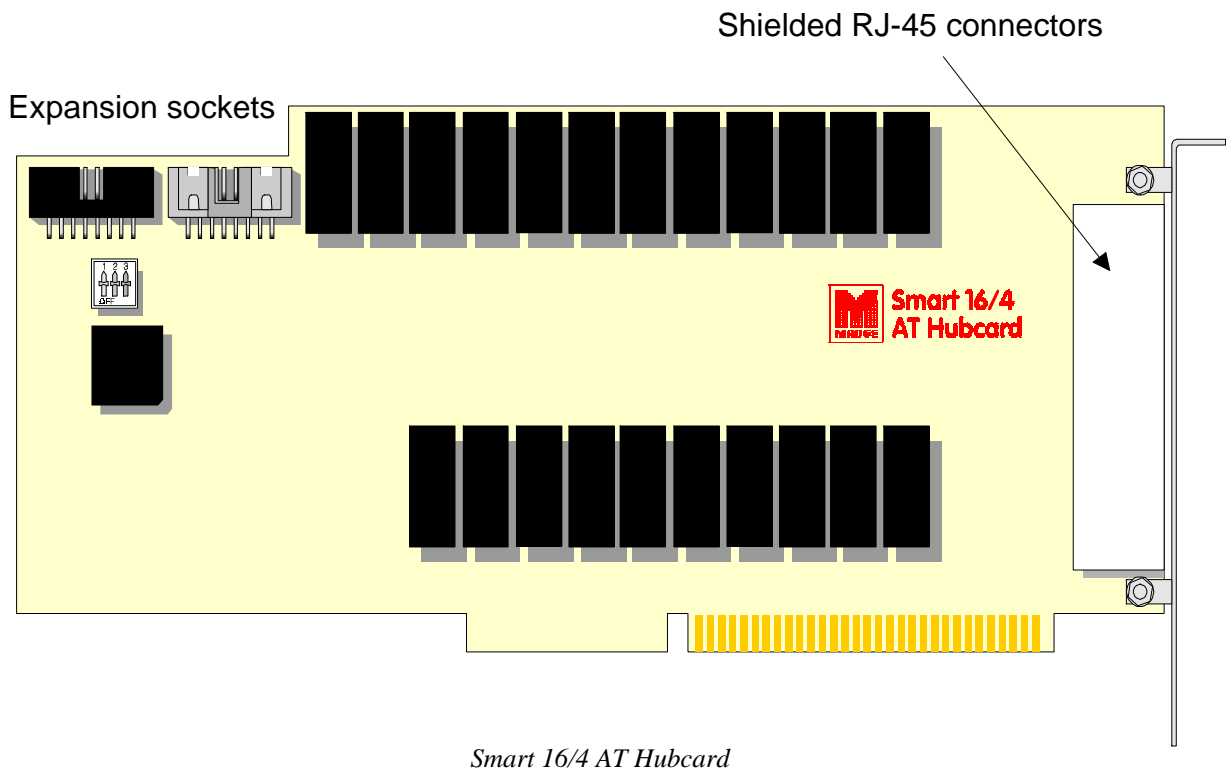
These individual components will now be discussed in more detail.



## 2 Smart 16/4 AT Hubcard

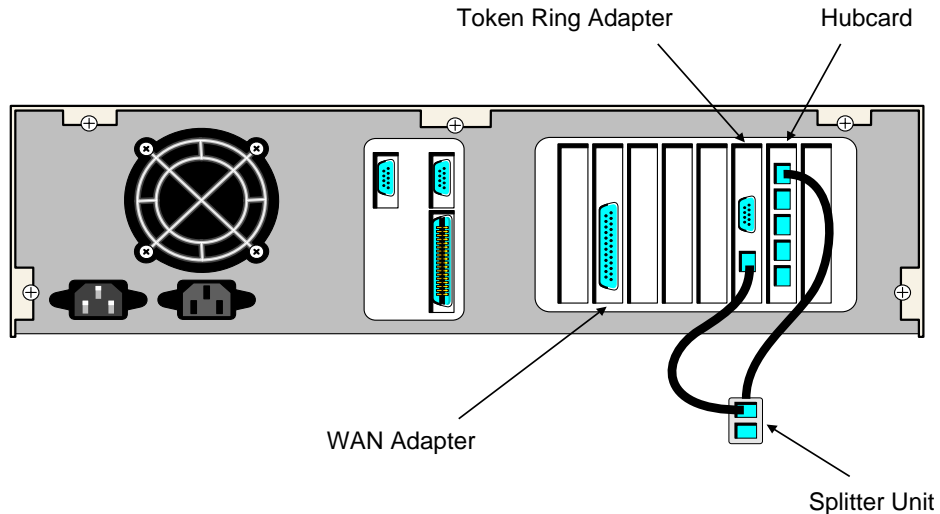
The Madge Smart 16/4 AT Hubcard is an essential part of the branch office solution. Supporting Novell's Hub Management Interface (HMI), the Hubcard can be integrated into ISA and EISA PCs running a wide range of Novell NetWare services, including:

- NetWare file server version 3.11, 4.0 or higher
- NetWare Multiprotocol Router (MPR) 2.0 and WAN Links
- MPR 2.1 and MPR 2.1 Plus
- NetWare for SAA and NetWare SNA Links



The Smart 16/4 AT Hubcard provides five shielded RJ-45 connectors for the attachment of stations over UTP or STP cable. Provided with the Hubcard are five splitter connectors which allow two stations to be attached to each port on the Hubcard.

This unique feature is particularly useful if stations are located somewhat from the Smart 16/4 AT Hubcard. Two stations can share the same lobe cable therefore reducing the amount of cabling in the branch office. In this case, the splitter device is located near the end-stations.



*Smart 16/4 AT Hubcard inside the server PC with splitter device*

In larger branch office networks, multiple Smart 16/4 AT Hubcards can be connected together inside the server PC using the expansion cable provided. A maximum of 15 Smart 16/4 AT Hubcards, supporting up to 150 nodes, can be connected together. Additional servers may be connected, if required, to ports on any Hubcard.

In addition, multiple Token Ring segments can be constructed in the branch office by installing multiple Smart 16/4 AT Hubcards in the server. The Smart 16/4 AT Hubcards, in this case, are not connected together and a Token Ring adapter for each segment is required.

The Smart 16/4 AT Hubcard offers flexibility in the choice of Token Ring adapter used in the server PC. Any of the following Token Ring adapters are supported:

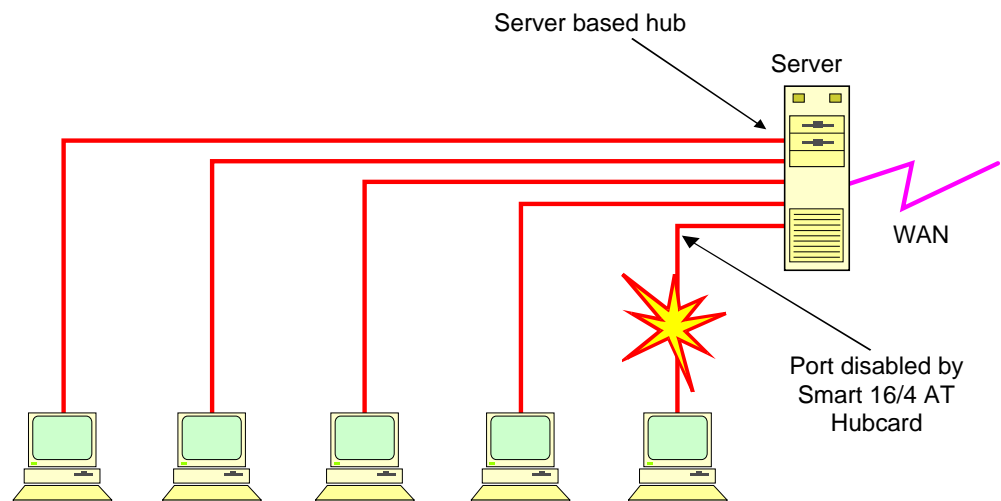
- Smart 16/4 AT Ringnode
- Smart 16/4 EISA Ringnode
- Smart 16/4 AT Bridgenode
- Smart 16/4 EISA Bridgenode

Novell's NetWare Hub Services, including the HUBCON utility, are supplied with the Smart 16/4 AT Hubcard. HUBCON allows the Hubcard to be configured and managed both locally in the branch office or remotely using RCONSOLE.

## Automatic Fault Recovery

In most cases, there are no staff skilled in LAN administration and maintenance in branch offices. In the event of a network fault, much time can be lost while Head Office LAN administrators attempt to diagnose the fault remotely and correct the problem with the aid of unskilled local personnel. Network downtime in branch offices can lead directly to lost revenue, missed business opportunities and extra costs.

The Smart 16/4 AT Hubcard is designed to minimize the impact of network fault conditions. It automatically detects, locates and isolates faults on the network within a few seconds, therefore ensuring that network users can continue to work, even in the face of multiple fault conditions.



*Fault recovery on the Smart 16/4 AT Hubcard*

The fault detection, location and isolation mechanisms are fully automatic and require absolutely no intervention from the network administrator. From the management console at Head Office, the network administrator can view the status of the remote LAN and identify the location of the fault on the network.

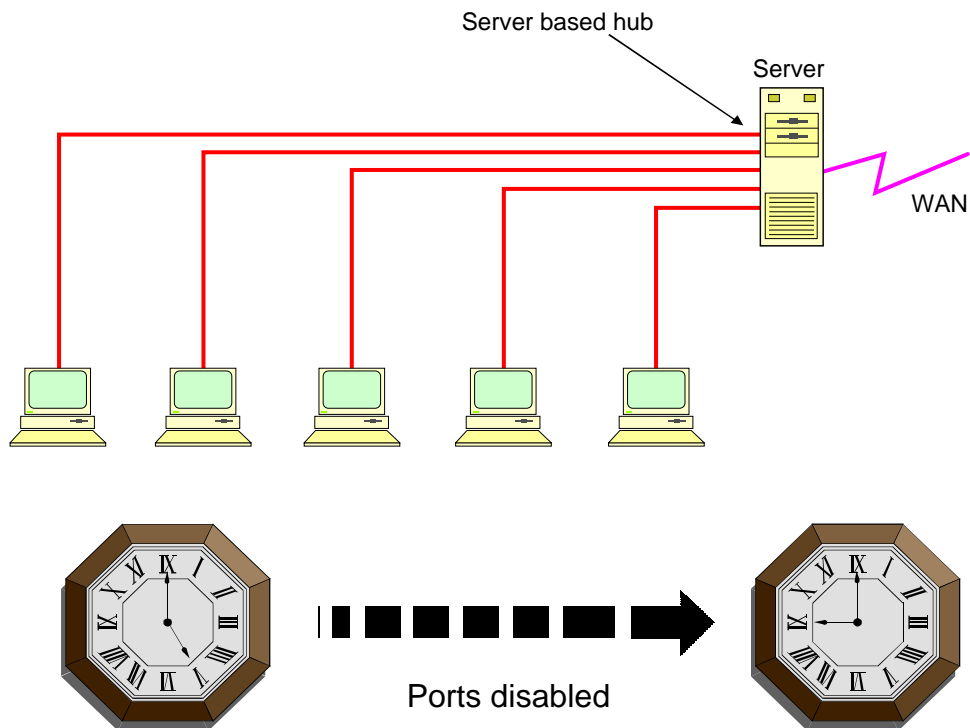
## Network Security

Network security may be critical in branch office locations where sensitive data travels on the network or confidential information is stored on the server. Since there are no local MIS personnel to ensure a secure environment, the branch office hub needs to maintain network security.

The Smart 16/4 AT Hubcard provides a range of advanced, but easy-to-use, security functions to maintain the integrity of the branch office.

The Smart 16/4 AT Hubcard can maintain a list of stations which are allowed to attach to the branch office network. If an unknown station, which is not in the list, inserts into the ring the Smart 16/4 AT Hubcard can automatically disable the port the station is connected to in order to prevent it from monitoring the data on the ring.

In addition, the Smart 16/4 AT Hubcard can automatically disable ports at certain times of day. For example, ports can be disabled between 5:00pm in the evening and 9:00am the following day, to prevent stations from accessing the network outside normal office hours.



*Advanced security features on the Smart 16/4 AT Hubcard*

## **3 Token Ring Adapters**

With the Smart 16/4 Ringnodes, Madge delivers a wide range of high performance Token Ring adapter cards designed to give you maximum choice and flexibility in the implementation of your branch office network.

From the Smart 16/4 ISA Client Ringnode, an optimized adapter for DOS/Windows workstations running a single protocol, to the Smart 16/4 EISA Ringnode, a very high performance adapter for server applications, Madge offers an unbeaten combination of easy installation, high performance, memory savings and configuration flexibility.

All Smart 16/4 Ringnodes offer switchable 4 and 16 Mbps operation, on-board media filter and RJ-45 socket for direct connection to UTP cabling, and an optional EEPROM module for remote boot support.

### **Driver Software**

The Smart LAN Support Software, supplied with every Smart 16/4 Ringnode, includes an exceptionally wide choice of driver modules to enable you to configure your networked PCs for your precise needs.

For workstation applications requiring more than one LAN protocol, drivers based on Madge's Smart Software Architecture provide LAN protocol processing on the adapter card itself, greatly reducing PC memory usage while boosting throughput.

For server applications or environments where only one protocol is required, driver modules based on Madge's Fastmac Plus technology can be used. Fastmac Plus is optimized for very high performance applications, and achieves outstanding packet processing speed and data throughput. In addition, Madge's NetWare server driver supports Novell's Remote LANalyzer agent, used for remote Token Ring monitoring and traffic measurement.

## **Server adapters**

The Smart 16/4 EISA Ringnode is a very high performance adapter card for use in server PCs with the EISA bus. Offering a 32-bit data and address interface, and support for EISA burst mode, the Smart 16/4 EISA Ringnode operates as a bus master to transfer data to and from the server memory at speeds of up to 33 Mbyte/second. This high speed PC bus interface enables the Smart 16/4 EISA Ringnode to drive a network at full 16 Mbps wire speed with minimal usage of the PC bus and CPU resources - ideal for server applications.

For ISA server machines, the Smart 16/4 AT Ringnode is the ideal choice. Supporting bus master operation, the Smart 16/4 AT Ringnode delivers outstanding performance in Novell NetWare server machines. For example, with a typical NetWare application, the Smart 16/4 AT Ringnode can drive the network at up to 1800 kbyte/second, equivalent to 90% of 16 Mbps wire speed.

Servers running Novell's NetWare Multiprotocol Router (MPR) version 2.1 with source route bridging enabled require special Token Ring adapter cards which support source route bridging. In this case the Madge Smart 16/4 AT Bridgenode or the Smart 16/4 EISA Bridgenode should be installed in the server. These cards have additional hardware which support the high speed bridging function of MPR 2.1.

## **Workstation adapters**

The Madge Smart 16/4 ISA Client Ringnode is the first Token Ring adapter card optimized for desktop PC systems running DOS or Windows applications. Compatible with ISA bus PCs, the Smart 16/4 ISA Client Ringnode provides 16-bit Programmed I/O operation and 128 KBytes of on-board RAM for high performance in single protocol environments whilst minimizing costs.

The Smart 16/4 ISA Client Ringnode is ideal for the vast majority of branch office networks running Novell NetWare where a single IPX interface is required.

## **4 Wide Area Connectivity**

Connectivity between the central site and the branch offices is vital to support transaction processing, and the sharing of data. Additionally, the network administrator at Head Office needs the ability to monitor and manage the remote networks, as well as update applications and data remotely without having to travel.

There are several options available for connecting branch offices to the central site across a WAN:

- using an SNA WAN
- using remote routers
- using remote source routing bridges

The choice will depend on your existing WAN infrastructure, what applications are communicating across the WAN, what protocols are being run, and whether communication with the central site mainframe is required.

The various alternatives are now discussed in more detail.

### **Connectivity across SNA**

SNA is the most predominantly used technology for connecting remote offices to the central site, with 70% of the Fortune 1,000 using SNA WANs today (source: Forrester Research). Due to the large financial and human investment in SNA, it is expected that as the 3270 terminals in the branch offices are replaced with PCs attached to Token Ring LANs a large proportion of corporates will keep their existing SNA infrastructure.

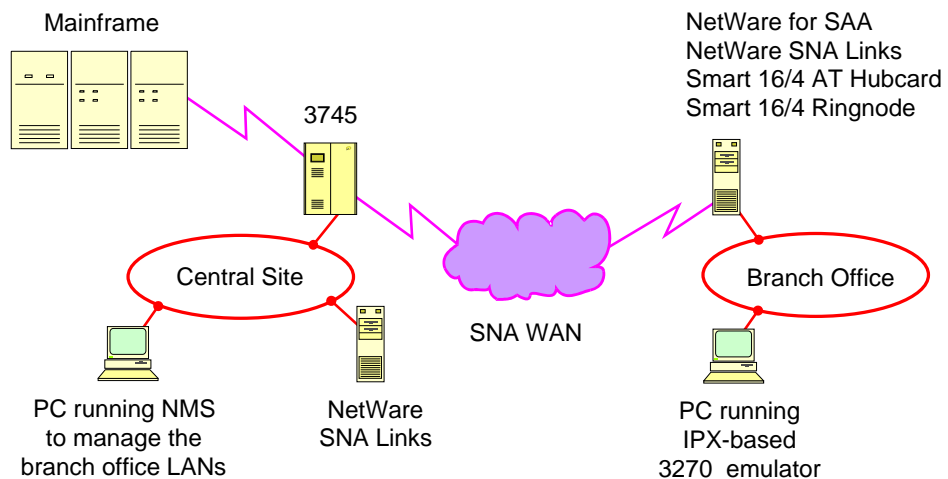
This poses a number of problems for the network administrator. First of these is how to attach the Token Ring LAN to SNA WAN. Although Token Ring interfaces can be installed in the 3174, the cost makes this solution expensive and not practicable for large numbers of branch offices.

The second problem is how to manage the branch office network across the SNA WAN. Native SNA does not allow LAN-based protocols to traverse the WAN. A management application located at the central site cannot communicate with the devices in the branch offices and, as a result, the network administrator cannot monitor or control the branch office LAN.

The integrated branch office solution offers a unique solution to these problems. Connection to the SNA network is achieved by installing a WAN card in the branch office server. This not only limits the cost but also reduces the number of components on the network and the level of support required.

Connection to the central site mainframe is provided by Novell's NetWare for SAA running on the branch office server. NetWare for SAA allows an IPX-based 3270 emulator, running on the branch office PCs, to connect to the central site mainframe via the NetWare SNA gateway running on the server. This solution has the major advantage that only one protocol, IPX, needs to be run on the branch office PCs.

Management and control of the branch office network across the SNA WAN is provided by Novell's NetWare SNA Links running on the server. SNA Links allows IPX packets to be routed across the SNA WAN therefore allowing the network administrator, located at the central site, to manage the branch office network.



*Mainframe connectivity across the SNA WAN*



## **Remote Routers**

If more than just connectivity to the central site mainframe is required, then other forms of wide area network need to be considered. This may be necessary because the data stored on a central site server needs to be accessed from the branch offices, or application stored on the branch office servers need to be updated remotely from the central site.

One of the solutions to this problem is to replace the SNA WAN with a router-based WAN. Routers have the advantage that LAN protocols, such as IP and IPX, can traverse the WAN directly without having to be encapsulated in another protocol. This results in a more logical connection between remote LANs.

With the increase in inter-LAN traffic, higher bandwidth lines need to be installed between the branch offices and the central site. Typically, with a routed WAN a minimum of 56 or 64Kbps lines are required.

The integrated branch office solution supports remote routing across the WAN. A WAN card needs to be installed in the branch office server together with either of the following Novell applications:

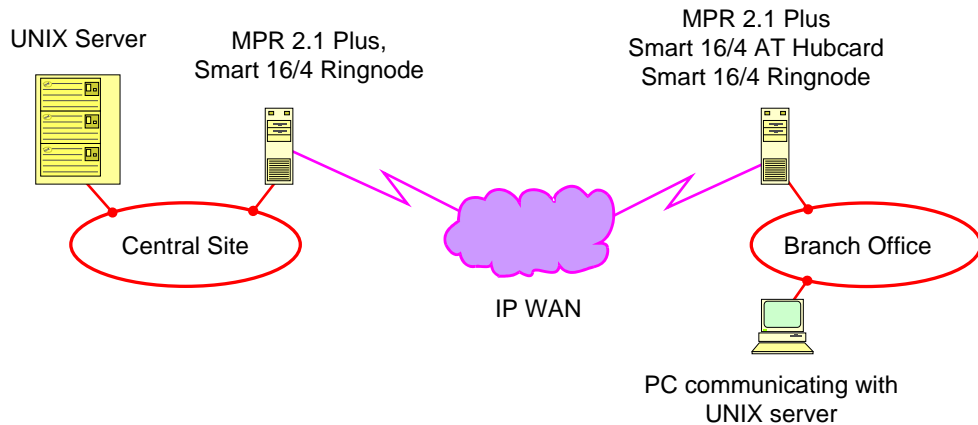
- NetWare Multiprotocol Router (MPR) 2.0 and NetWare WAN Links
- MPR 2.1 Plus

MPR allows multiple protocols, including IP and IPX, to be routed across the WAN.

At the central site, the network administrator can use a dedicated MPR PC to communicate with the branch offices. Since MPR can support up to 14 WAN cards, several branch offices can be serviced by a single MPR machine at the central site, therefore reducing costs.

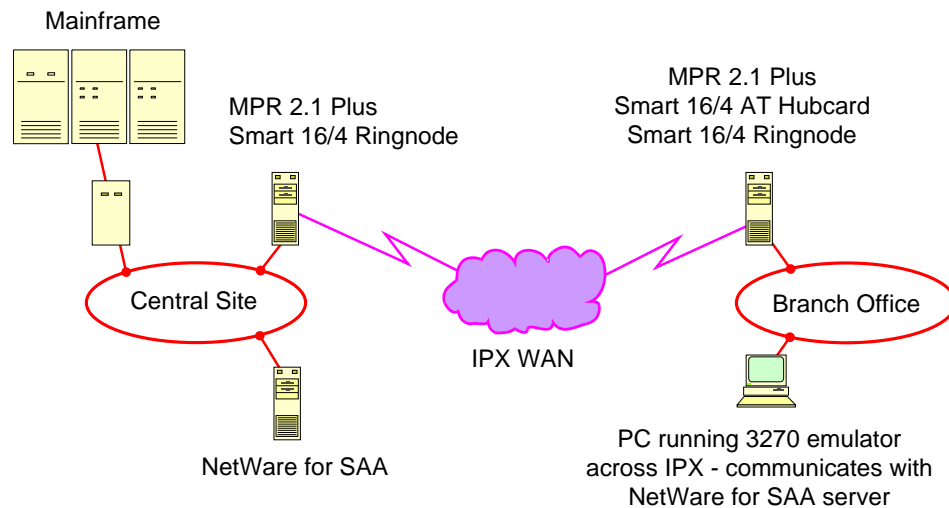
In addition, Wellfleet routers and MPR will interoperate across the WAN, therefore allowing MPR to be run in the branches connecting to a Wellfleet router at the central site.

There are numerous situations where a routed WAN can be used to connect branch offices to the central site. For example, consider a UNIX server located at the central site containing data which needs to be accessed by the branch offices. An IP-based routed WAN, running MPR in the branch offices, allows the branch offices to access this data while minimizing costs.



*Communication with a UNIX server located at the central site*

If mainframe connectivity is required across the routed WAN, NetWare for SAA can be used. NetWare for SAA acts as a gateway between an IPX routed network and the mainframe. In this case the PCs running the IPX-based 3270 emulators communicate with the NetWare for SAA server located at central site across the IPX WAN. Since NetWare for SAA can support up to 254 sessions, several branch offices can be serviced by one NetWare for SAA gateway, again reducing costs.



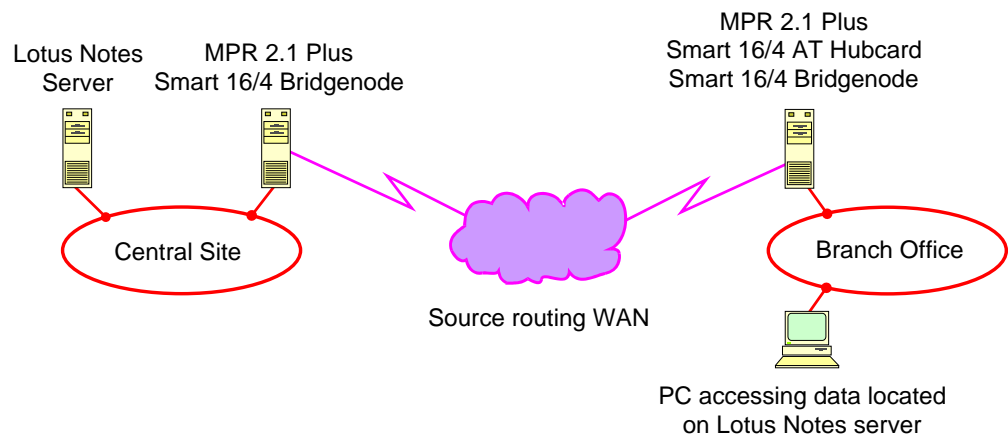
*Mainframe connectivity across a routed WAN*

## Remote Source Routing Bridges

Only certain protocols, called *routable protocols*, can be forwarded by routers. IBM protocols, such as NetBIOS and LLC, cannot be forwarded by routers. In environments where these protocols are run remote source routing bridges are required.

Novell's MPR 2.1 Plus supports remote source bridging and can be used to pass non-routable protocols between sites. For example, if a connection is required to carry NetBIOS traffic to a Lotus Notes server located at Head Office, MPR 2.1 Plus should be run in the branch office server and at the central site.

It should be noted that servers running MPR 2.1 to support source route bridging must be equipped with Smart 16/4 Bridgenodes for Token Ring connection, instead of Smart 16/4 Ringnodes.



*Communication with a Lotus Notes server located at the central site*

## WAN cards

A wide range of WAN cards are available for both SNA/SDLC and internetworked wide area connectivity across different physical media including:

- X.25
- Point-to-point communication lines
- ISDN
- Frame Relay

Vendors who supply suitable WAN cards include Novell, Eagle Technologies, and ADC.

## 5 Branch Office Management

Due to the lack of skilled LAN administrators in the branch offices, remote management and control for Head Office is vital in order to minimize support costs and ensure the branch office network is up-and-running at all times.

Novell's NetWare Management System (NMS) provides powerful Windows-based graphical management for all of the services in the branch office server, including:

- file and print server
- remote router, remote source routing bridge, or SNA gateway
- Smart 16/4 AT Hubcard

For example, from Head Office the network administrator can disable individual ports on the Smart 16/4 AT Hubcard by just clicking on the picture displayed on the management console.

**1st Floor - Token Ring Hub Port Statistics Table**

Port name	User name	Port ID	Status	Type
H1-C1-P1			Inserted	Daisy
H1-C1-P2			Not Inserted	Normal
H1-C1-P3			Not Inserted	Normal
H1-C1-P4			Not Inserted	Normal
H1-C1-P5			Not Inserted	Normal
H1-C1-P6			Not Inserted	Normal
H1-C1-P7			Not Inserted	Normal
H1-C1-P8			Not Inserted	Normal
H1-C1-P9			Not Inserted	Normal
H1-C1-P10			Not Inserted	Normal
H1-C2-P1			Inserted	Local

**1st Floor : Hub 1, Card 1, Port 2 - Token Ring Hub Port Detail**

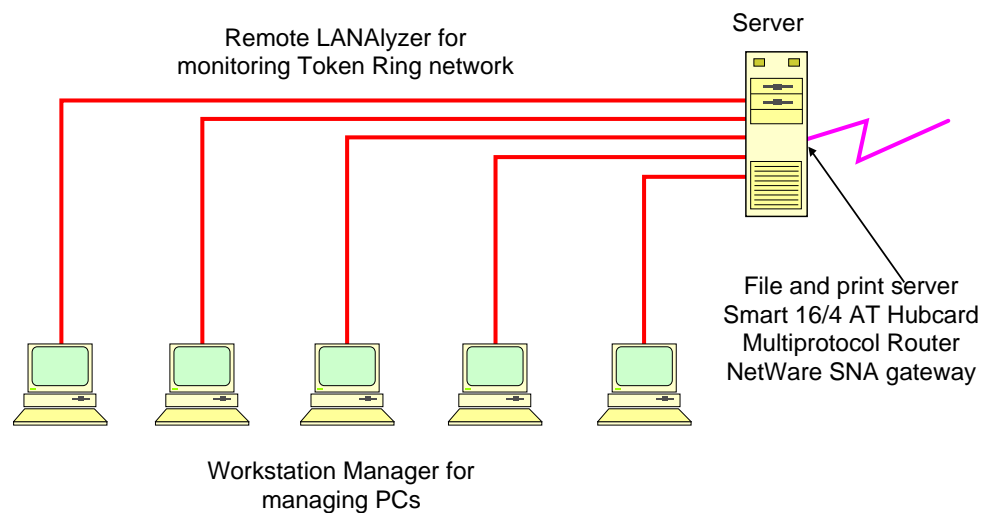
Port identification: Hub 1, Card 1, Port 2  
 Logged-in user name: <None>  
 Port status: Enabled Inserted Normal  
 Last MAC address: 000DF6003712  
 MAC address changes: 0  
 Neighbor: 000DF6003901  
 Neighbor changes: 0  
 Functional address: Not Enabled

Line errors: 0 Duplicate addresses: 0  
 Bust errors: 0 Receive congestions: 0  
 AC errors: 0 Beacon (rst recovery): 0  
 Abort transmissions: 0 Beacon (signal loss): 0  
 Internal errors: 0 Beacon (streaming): 0

Port uptime: 35 minutes 3 seconds

Communication between the branch office server and the Head Office management console is based on SNMP over IP or IPX. This means that the branch office server can also be managed by other SNMP management systems including HP OpenView for UNIX, IBM NetView/6000 and SunNet Manager.

This level of management is further enhanced by Novell's Remote LANalyzer software, which allows the network administrator at Head Office to monitor the status of the Token Ring network in the branch office, including errors on the network and the amount of network traffic.



*Complete management and control of the remote branch offices from the central site*

In addition, Madge's Workstation Manager software provides detailed information about the DOS PCs attached to the branch office network. The information available includes the hardware configuration of the PC, details of any memory managers loaded, network adapter card configuration and status, programs currently running in the PC, and user specific information such as name and telephone number.

From Head Office, the network administrator has complete management and control of all the branch office networks.

## **6 Conclusion**

Branch offices, due to their size, number of locations and lack of dedicated LAN support personnel, have very different network requirements from the central office.

The new approach to branch office networks is to combine the functions of the router or SNA gateway, and the branch office hub with the branch office NetWare file server. This not only reduces costs, but also provides an easy-to-install, compact and fully manageable solution.

Madge provides a complete range of Token Ring products to support the installation of NetWare server-based branch office LANs. These products include an intelligent card-based Token Ring hub, Token Ring adapter cards with hardware support for source route bridging, and driver support for remote LAN protocol analysis.

The combination of Madge's Token Ring products and Novell NetWare provides the basis for a radical new approach to branch office LANs, with improved manageability and affordability as the key benefits.





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