

A white line drawing of the Golden Ratio (Fibonacci spiral) is positioned in the top-left corner of the blue header. It consists of a series of squares of decreasing size, with a spiral line that starts from the center and winds outward, touching the outer corners of the squares.

Remote Router Porting with E1

A guide to getting more from your network for less

Use Patton's E1 EtherRocket and your existing hardware to provide the most economical network connectivity to your branch office, remote site, or Internet connection.

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Introduction

Connectivity isn't just a luxury, it is a necessity. Today, every office is filled with network-aware applications chewing-up bandwidth. With eCommerce becoming the trading method of choice, connectivity with trading partners is a must. Of course, Email/WWW traffic is now the preferred method for communication and information.

Traditional deployment strategies require capital equipment purchases, trained personnel for configurations, and a truck roll to the site for installation. Through outsourcing, many have looked towards several hot technologies that promised bandwidth and connectivity to the masses. Unfortunately, these technologies have somewhat missed the mark. The integration of an existing network with the outsourced network has proved to be expensive, complicated, or simply non-existent.

As businesses and ISP's strive to connect remote branches to the network, managers and engineers have to provide optimum network performance while balancing lean budgets and scarce technical resources. Using Patton's Remote Router Porting, enterprise users and service providers can use tried-and-true data services to keep-up with demand while maintaining low costs.

Traditional Network Connectivity

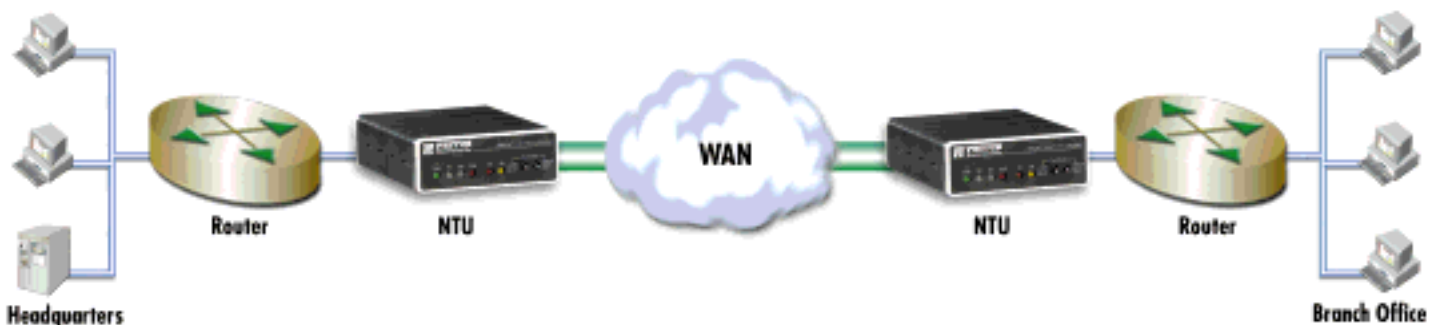
Remote network connectivity requires three fundamental pieces: equipment, configuration, and installation. A common theme with all of these three is expense, expense, and expense. Let's take a look at how a traditional remote office/network would be connected to the central site.

Equipment, Configuration, and Installation

First, E1 or Fractional-E1 service is ordered between the central site and the remote office. With competitive prices for E1 and Fractional-E1 services at an all time low, you can scale from 64 kbps all the way up to a blazing 2.048 megabits a second and provide the bandwidth and connectivity required without extra cost.

Next, a router, NTU, and cables are delivered to the remote site and the central site. A technician goes to the remote site to connect everything together and configures the router. After connecting the E1 link to the NTU, the user must connect the NTU to the serial port of the router (V.35, EIA-530, X.21, or RS-232).

Figure 1. Traditional LAN-to-LAN deployment.



Usually special cables are required as most router manufacturers use one type of connector to present a variety of interfaces (for example, Cisco typically uses an HD-60 connector). The serial port on the router is then configured internally upon detection of the cable's pinout. The physical connection and orientation of the NTU also has to be determined. For instance, many NTU manufacturers may present the physical V.35 interfaces on a DB-25, HD-26, or M/34 connector. The orientation of DTE or DCE gender must be determined. WAN Transmission devices are usually assumed to be DCE, but that is not always the case.

Installing and configuring a branch office router and associated hardware requires time and highly trained personnel. A laptop is a standard requirement for configuring, testing, and troubleshooting a router. In addition to configuring the router's port at the central site, the installer at the branch office has to deal with the local router's dizzying number of configuration options, software features, protocols, routing tables, security features...most of which are not needed. This array of options, coupled with the cryptic command line interface used in most routers, make configuration a daunting task.

Of course, the same technician has to go back to the central site and connect and configure the other end of the link. A doubling of work. Finally the moment of truth...does it work? Installation delays, increase in cost-per-installation, angry customers and subsequent loss of business are often the result of simple interconnection problems.

What would you pay for all of this?

It is clear that the use of a router, a WAN interface device, special cables, a laptop, and specialized personnel for configuration and management, can make branch office interconnection expensive and time consuming. These costs are amplified as more remote networks come on-line. Routers and NTUs, with all their complexities and limitations, do not present a simple, economical, and repeatable solution to remote networking.

For example, a typical remote site supporting 1–150 users would cost approximately \$7,100 in equipment, configuration, and installation expenses.

Item	Qty	Total Cost	Note
Cisco 2600 Series Router	2	\$4,500	Routers required for both ends of the link
WAN serial cables	2	\$220	Cables to connect the router to the NTU
E1 NTU	2	\$1,790	E1 or Fractional-E1 NTU
Accessories	1	\$150	E1 cables and miscellaneous
Technician's time	8 hrs	\$440	Based on \$55/hour and 1 hour each way to remote office

Wouldn't it be nice if there were an easier, lower cost way to connect up to the world? Yes!

Service Delivery with Remote Router Porting—New Solutions to Old Problems

Remote Router Porting (RRP) combines equipment and configuration to interconnect remote networks & branch offices to the central site, while offering all the services, security, and scalability of a routed connection. Remote Router

Porting creates a virtual Ethernet port at the central site router while giving the remote site a standard Ethernet network connection. Plus, RRP leaves the configuration and routing smarts at the head office instead of the remote site. Incorporating an E1/FE1 NTU, the Point-to-Point Protocol (PPP), and Ethernet bridging technologies, RRP offers network managers and integrators a simple and economical way to deploy LAN-to-LAN connectivity.

Here's how it works. At the remote office, RRP replaces the traditional router and configuration, E1 NTU, and cables with a single Patton E1-EtherRocket'. The E1-EtherRocket connects to the E1 WAN on one port and to the local LAN with its Ethernet Port.

On the other end of the E1 link, at the central site, any standard E1 NTU, such as the Patton Model 2701/C, is connected to an available router port. The central site router is then configured to act as a PPP Half-Bridge. Half-Bridging is just like standard Ethernet bridging except that the router (at the central

Bridging in a Nutshell
Bridges became available in the early 1980s and were used to connect multiple physical networks together so they could function as one logical network.

Bridges are not complicated devices and operate at the lowest logical level within the network. Here's what they do: A bridge has two ports—the local side and the remote side. During operation, a bridge analyzes all network messages on the local side, builds a table of local hosts and simply forwards non-local messages to the remote port.

The Point-to-Point Protocol (PPP) is a standard method of transporting Ethernet packets over the wide area. Now wide-area-networks can use bridging to deliver economical LAN connectivity with plug-and-play ease.

site) takes the bridged Ethernet packet from the remote LAN and converts it into a routed packet. Now, the router can be configured to process this packet with security, special access rules, or privileges. In other words, all of the traditional remote site configuration you would have done can be eliminated!

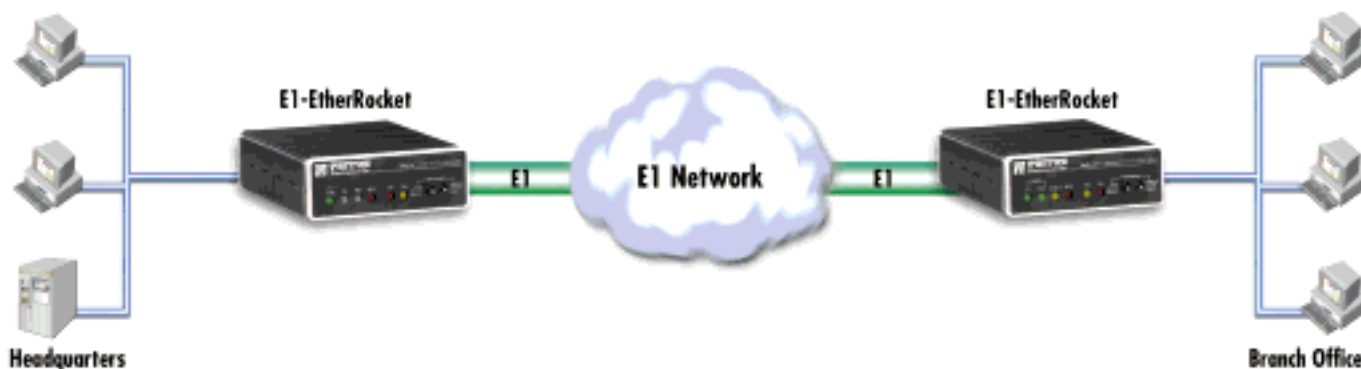
Basic Bridging: LAN over the WAN

In the most common installation of WAN Ethernet Bridging, two LAN segments are connected with a common WAN interface such as E1. Each bridge connects to the local Ethernet LAN and builds a table of local hosts on that network. If an Ethernet message is not for a

local host, the bridge forwards it over the WAN to the remote bridge.

Two Patton E1-EtherRockets can be used to link two Ethernet LANs over an E1/FE1 link (see figure 2).

Figure 2. Basic bridging with Patton's E1-EtherRocket.



PPP makes the World go 'Round

The Point-to-Point Protocol (PPP) is the industry standard protocol for encapsulating data for transport over a point-to-point link. PPP provides a method of establishing, configuring, maintaining, and terminating a point-to-point data connection. Operating on all media that are full duplex in nature, PPP is a symmetric peer-to-peer protocol, which can be broken into three main components:

- A standard for encapsulating datagrams over serial links.
- A Link Control Protocol (LCP) for establishing, configuring, and testing the data-link connection.
- A family of Network Control Protocols (NCPs) for establishing and configuring different network-layer protocols. The NCP is the actual data from the network.

When an E1 link is first established, PPP automatically negotiates line parameters with the far end. After the physical link is up, PPP will request to configure a network control protocol for the link. In the case of bridging, PPP will configure the Bridging Control Protocol (BCP) as the link's network control protocol. BCP allows LAN-to-LAN bridging using PPP as the link protocol. In operation, BCP passes the complete Ethernet frame

from the local network to the remote network. At the far end, the Ethernet frame is extracted from the PPP frame and passed on to the network.

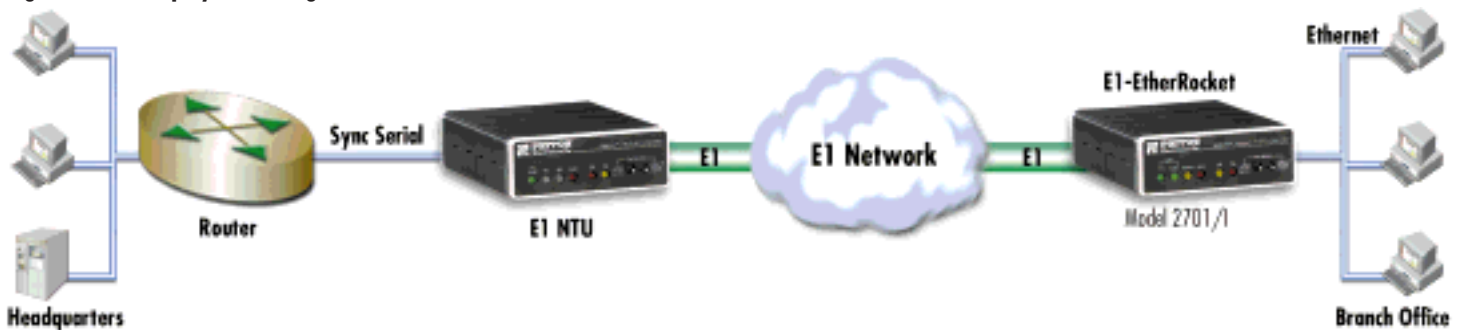
Deploying RRP: Combining Bridging, PPP, and a little Magic

RRP uses the technology of bridging, with PPP for standards-based transport, with a router configuration to offer a routed network connection with only one router. Deploying RRP requires three main elements: Central-Site E1 NTU, Central-Site Router, and a Patton E1-EtherRocket at the branch office (see figure 3).

Rolling Out the Remote Site

All that is needed at the remote network location is one Patton E1-EtherRocket™ (Model 2701/1). The E1-EtherRocket is equipped with an E1/FE1 interface and connects directly to the E1 Demarcation point via an RJ-48C twisted pair patch cable. The Ethernet interface uses a standard RJ-45 connector and connects directly to a LAN switch. Because the E1-EtherRocket integrates both hardware and software, the installer has only two interfaces to connect. For most installations there is little or no configuration required.

Figure 3. RRP deployment using E1-EtherRocket at the branch office.



If configuration is required, it will consist of setting up the E1 line. DIP switches on the underside of the EtherRocket allow the selection of the number of channels, or E1 bandwidth, that will carry data. The switches are pre-configured for Clear Channel (2.048 Mbps), network clock, and HDB3 line coding. Most applications will use these settings unchanged.

The 10Base-T Ethernet port of the E1-EtherRocket does not use a MAC or IP address and is completely plug-and-play. As soon as the unit is powered up, the built-in bridge enters "promiscuous" mode and listens to all Ethernet traffic on the LAN. The bridge then floods all Ethernet packets to the central LAN until it learns the addresses of all local hosts attached to the branch office LAN. As the bridge learns it creates a host table, and thereafter forwards packets destined for the central LAN. Addresses are automatically deleted from the bridge's memory after eight minutes of inactivity.

The WAN-side E1-EtherRocket negotiates a PPP link with the central router. After the link is established, the Bridge Control Protocol is established. Ethernet packets can now be passed end-to-end over the E1 transparently.

Central Site Setup

The central site is where all the intelligence is...and all the magic. The router located at headquarters requires an available WAN serial connection (e.g V.35, EIA-530, X.21, and so on) or built in E1/FE1 WAN Interface Card. If using a WAN serial port, an external E1 NTU (Use Patton Model 2701/C) will be needed to connect the router's serial port to the E1 network. Typically, the router 10/100Base-T port is connected directly to the local LAN switch.

The E1 NTU connects directly to the E1 network demarcation. Configure the NTU for bandwidth (number of channels), clock mode (normally Network clock), framing, and line coding. Next connect the NTU to the router's serial port using the appropriate cable.

In order for the central routed network to connect to a remote branch Ethernet network, the serial or WAN interface of the central router needs to be configured as a PPP IP half-bridge. In this configuration the E1-EtherRocket sends bridge packets to the router's serial interface. The router will then take the Ethernet Packet and route these packets based on its IP address. At the same time the router's port will convert routed packets destined for the remote LAN and forward them to the E1-EtherRocket.

The example below shows the simple router configuration on a Cisco router using a serial interface configured as a PPP Half-Bridge. Using a Patton E1-EtherRocket, the Cisco's serial interface will now function as node on the remote Ethernet network. As such, the serial interface on the Cisco router will have an IP address on the same Ethernet subnet as the E1-EtherRocket. The hosts on the remote network will then use this IP address as their default gateway.

For example:

- 1) We assign the Branch Office the logical IP network IP of 192.168.1.0/24 (netmask=255.255.255.0).
- 2) The Cisco serial interface (s0) is assigned the address of 192.168.1.1 (netmask=255.255.255.0). This ".1 " address is also the default gateway for the remote network. This removes any routing/forwarding intelligence from the remote network and places it at the central site where it belongs. In essence, you

are remotely porting the router's serial interface to the remote network.

The associated Cisco configuration is quite simple and will set the serial interface s0 to accommodate PPP half-bridging for the above example.

```

;
interface s0
  ppp bridge ip
  ip address 192.168.1.1 255.255.255.0

```

Going Beyond: Advanced RRP for the Wide-Area

Some networking systems do not define network numbers in packets sent out over a network. If a packet does not have a specific destination network number, a router will assume that the packet is destined for the local segment and will not forward it to any other sub-network. However, in cases where two devices need to communicate over the wide-area, bridging can be used to transport non-routable protocols.

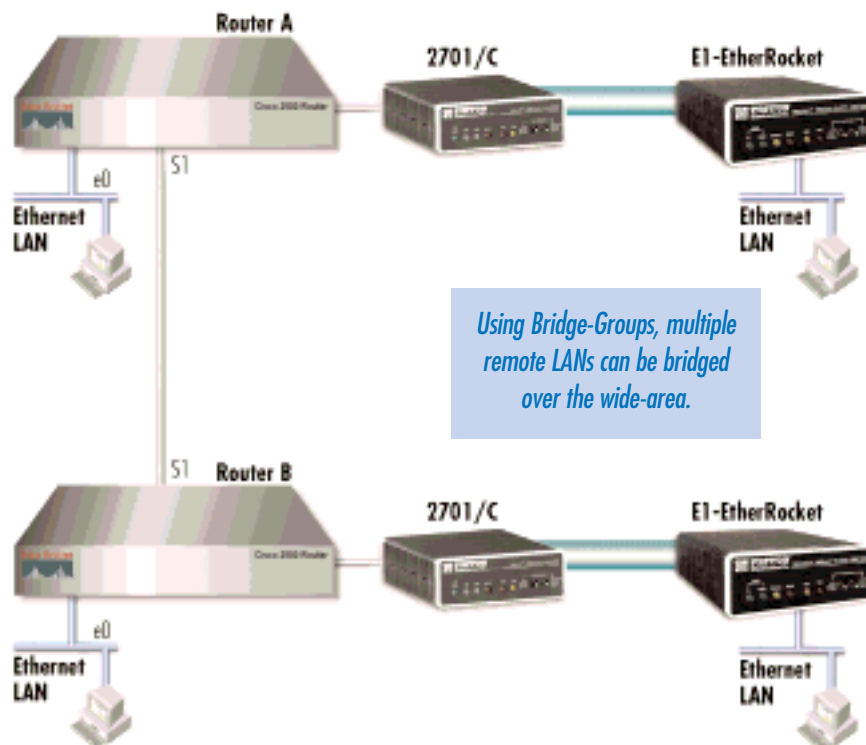
The following configuration illustrates transparent bridging between Cisco routers and Patton's bridging devices over an example serial link. Bridging will occur between both LANs connected on Router A and Router B.

Figure 4. Bridging groups

```

! Router A
no ip routing
!
interface Ethernet0
ip address 1.1.1.1
255.255.255.0
bridge-group 1
!
interface Serial1
ip address 2.2.2.2
255.255.255.0
encapsulation PPP
bridge-group 1

```



```

! Router B
no ip routing
!
interface Ethernet0
ip address 1.1.1.1
255.255.255.0
bridge-group 1
!
interface Serial1
ip address 2.2.2.2
255.255.255.0
encapsulation PPP
bridge-group 1

```


RRP is Changing the World!

Remote Router Porting offers simplicity of installation, configuration, and management. This directly translates into savings and advantages:

- **Savings per Installation.** Fewer pieces of equipment needed per branch connection translate immediately into lower cost per branch site installation.
- **Fewer Points of Failure.** By using a single piece of equipment and only two cables per installation, RRP achieves greater network reliability and additional savings in personnel time, and equipment repairs or replacements.
- **Better Tech. Resources Allocation.** Since the E1-EtherRocket eliminates the branch router, there is no longer a need to send a router specialist to configure branch office equipment; this frees key personnel to tend to more difficult configuration or installation issues in other parts of the network.
- **WAN Service Flexibility.** The E1-EtherRocket offers E1 rates from nx64kbps to 2.048 Mbps data rates, as the branch office grows and the need for more bandwidth arises, the user simply leases more channels from the carrier, and configures the E1-EtherRocket accordingly.

How Does This Sum Up?

Save \$3,500 or more by deploying Patton's EtherRocket solution with all new equipment. If you have a spare router port, you can save over \$5,000!

Wouldn't it be nice if there were an easier, lower cost way to connect up to the world? Now there is. Use Patton's E1-EtherRocket™ with Remote Router Porting.

Item	Qty	Total Cost	Note
Patton E1-EtherRocket	1	\$895	Call for great pricing!
Cisco 1700 Series Router	1	\$1,500	Router for central site if no spare port is available.
E1 NTU	1	\$895	E1 or Fractional-E1 NTU
Accessories	1	\$75	E1 cables and miscellaneous
Technician's time	3 hrs	\$165	Based on \$55/hour and 1 hour each way to remote office

Additional Resources

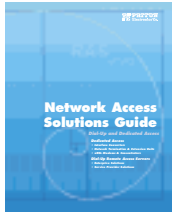
For additional information or questions, contact:

Jose Ventura

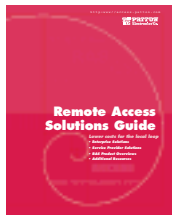
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Ever heard of RRP? Well read this Remote Router Porting with T1 Position Paper and learn how RRP can help you get much more from your network connectivity budget for far less.

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