

Carrier Grade Dynamic Routing with RIP and OSPF

Highlights

- Provides integral T1 CSU for standard T1 connectivity.
- Low-cost, reliable blade installs in NEBS-compliant rack-mount packaging or in a compact standalone box.
- Low power consuming appliance ideal for “green” enterprises or where power savings is a concern.
- Performs dynamic routing with standards-based RIP and OSPF protocols for interoperability.
- Offers secure route learning with MD5 authentication.
- Minimizes network downtime by dynamically routing around network faults.
- Command Line Interface (CLI) based on ‘de facto’ router standard.
- CLI management accessed via Telnet, secure shell (SSH) and console interface.
- Front Panel status LEDs for traffic, power and testing; Front Panel craft port connection.
- Scalable, Ethernet LAN via integral 10/100 Mbps Ethernet switch support.
- Supports ping, traceroute and T1 loopbacks for network troubleshooting.
- Provides interoperability for IP traffic delivery over the WAN utilizing standards-based PPP or Frame Relay.
- Supports firmware upgrade and configuration download/restoral via TFTP.
- Supports TACACS+ Authentication.

Introduction

The SpectraComm T1 Mini Router (MR1-T1) is the newest member of GDC’s carrier-class IP/Ethernet product family. The MR1 extends the carrier’s internal IP network to remote locations where separate IP networks are required. The device forwards IP data between WAN and Ethernet (LAN). The MR1 provides an integral T1 interface for provisioning over the carrier’s T1 facility.

The MR1 provides full dynamic routing capability with support for standard RIP and OSPF. Enhanced security is supported with secure shell (SSH), and MD5 authenticated dynamic routing. TACACS+ authentication is also supported. Network maintenance is streamlined with the MR1 automatically adapting to changing network topologies and rerouting traffic around faults.

Figure 1 shows a simplified example of the MR1 forwarding traffic in the network according to the lowest path cost, then automatically routing the traffic around a detected network fault.

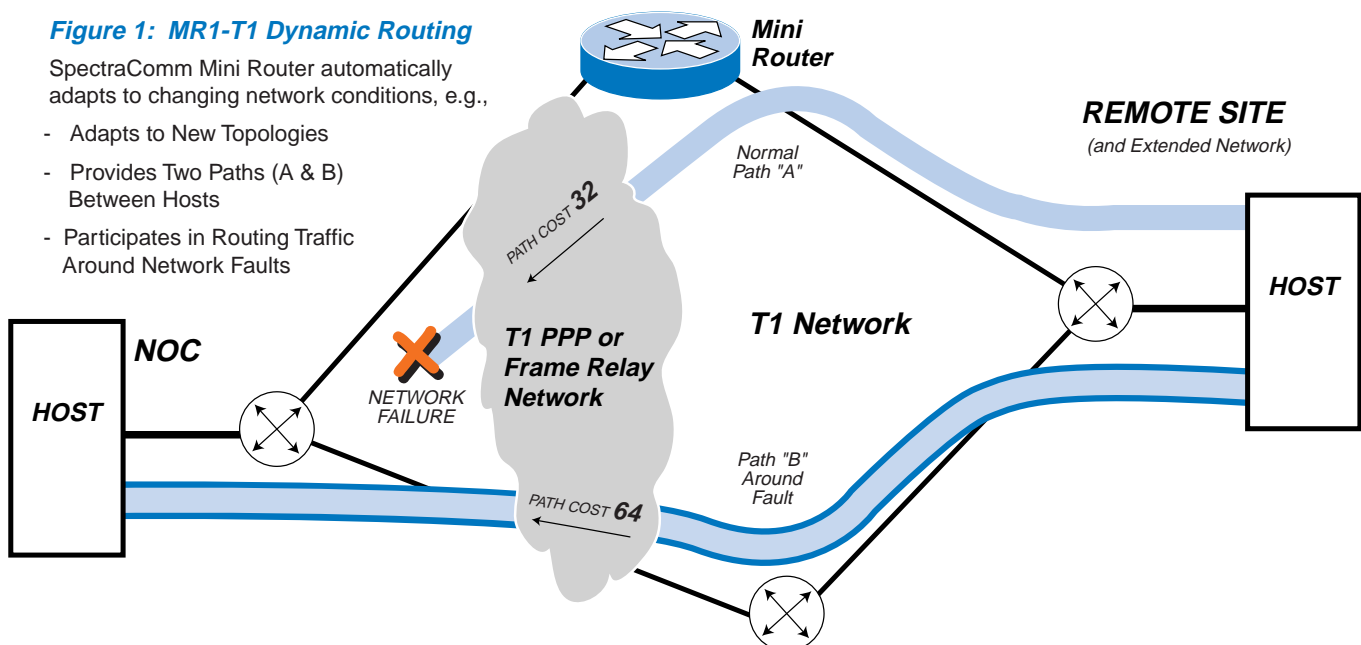
Additional Features

- Supports routing of standard 802.1q tagged VLAN packets.
- Supports VRRP-based router redundancy (RFC 3768).
- Provides loopback interface IP addressing features that aid in the security and stability of the routed networks.

Figure 1: MR1-T1 Dynamic Routing

SpectraComm Mini Router automatically adapts to changing network conditions, e.g.,

- Adapts to New Topologies
- Provides Two Paths (A & B) Between Hosts
- Participates in Routing Traffic Around Network Faults



Typical Deployment

The basic deployment of the MR1 is as a standards-based dynamic router, providing low-cost, NEBS-compliant IP connectivity to the carrier's internal network and between managed sites.

The MR1 can be located anywhere within a carrier's network: within the Central Office environment as part of the inside plant, in a remote office, or in CEV-Hut environments as part of the outside plant. Virtually all remote devices can be connected back to the NOC through remote device ethernet (LAN) ports.

The MR1 can be accessed over the carrier's T1 data network utilizing its integral T1 CSU/DSU. The MR1 may employ static routes, and/or dynamic routing to provide IP connectivity of remote sites. The MR1 supports enhanced security features with MD5 authenticated dynamic route learning, SSH for CLI access, and TACACS+ authentication.

Figure 2 shows a typical Point-to-Point or Frame Relay T1 network with the Network Operations Center (NOC) connecting to equipment at remote sites. The MR1 forwards the IP data between remote sites and the NOC.

Carrier-grade Packaging

The MR1 is a rack-mount card that installs in a SC 5000 shelf (16 slots) or in a SC 2000 shelf (2 slots) for NEBS-compliant applications. For non-NEBS applications, the MR1 card can be installed in the single-slot SpectraComm AC or DC standalone enclosures.

Management & Security

Remote MR1s can be managed from the Network Operations Center via IP network connectivity, using a variety of management protocols, described below.

The MR1 employs Smart CLI, an interactive command line interface (via terminal, Telnet or SSH) that will feel familiar to field personnel. Added features include auto-prompting for command arguments, recognition of abbreviated commands, online help and command line recall. The front panel craft port is used for local configuration and monitoring.

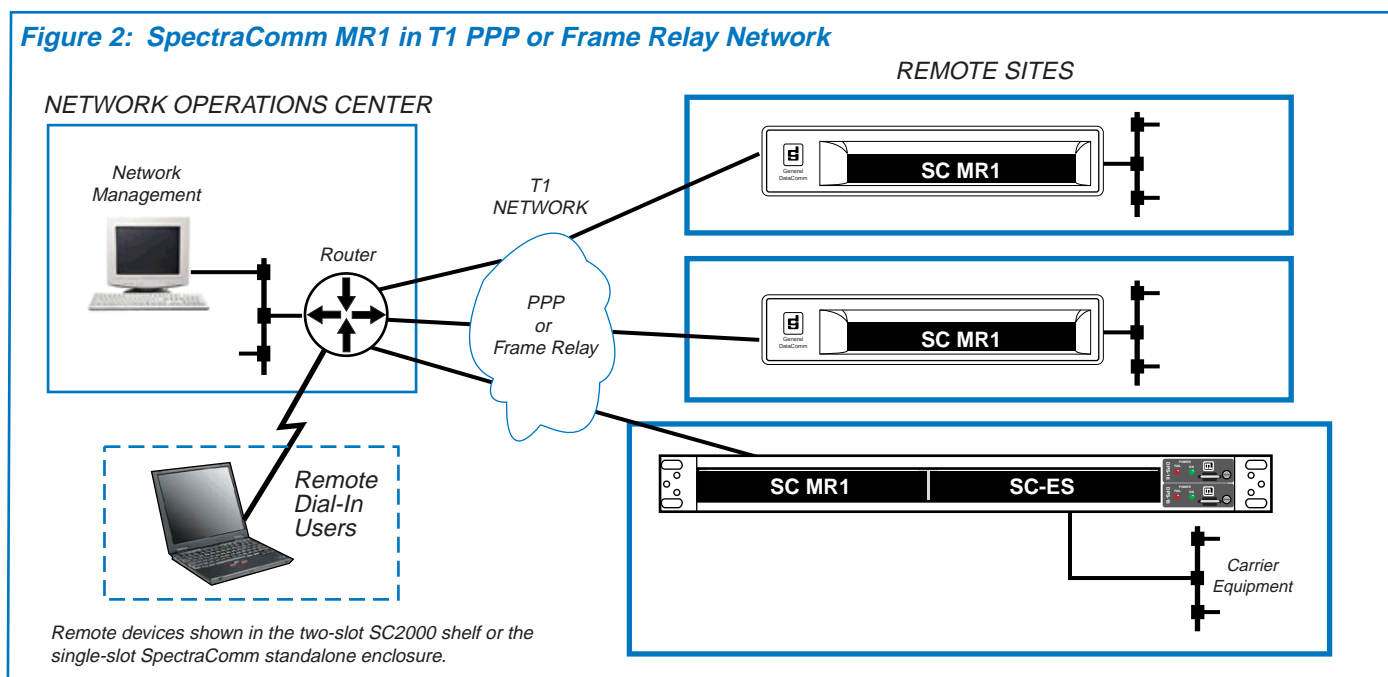
The MR1 supports the Trivial File Transfer Protocol (TFTP) for downloading firmware upgrades and for configuration download/restoration. TFTP service is password protected.

Multi-level Password protection authorizes every access attempt. TACACS+ authentication, MD5 authentication and secure shell (SSH) features provide enhanced security.

A loopback interface aids in the security and stability of routed networks. The MR1 provides a loopback interface that can be assigned a standard IP address as the router ID for OSPF protocol packets, or as the source address for IP packets coming from the the router to the central site.

The MR1 supports router redundancy based on the Virtual Router Redundancy Protocol (VRRP) standard. In the event of a power, WAN or Ethernet failure affecting a router, another router designated as backup can take over as the default gateway.

Figure 2: SpectraComm MR1 in T1 PPP or Frame Relay Network



SpectraComm MR1-T1

SC MR1 APPLICATIONS

Basic Dynamic Routing

Figure 3A shows SpectraComm MR1s performing basic dynamic routing using OSPF protocol.

- Changes in the network topology are automatically learned.
- NOC is able to maintain the IP connectivity to remote locations in changing network conditions.
- Configuration and maintenance to MR1 devices is performed using CLI via Telnet or SSH.
- MD5 authentication can be enabled when the network requires enhanced security.

Routing with Gateway Redundancy

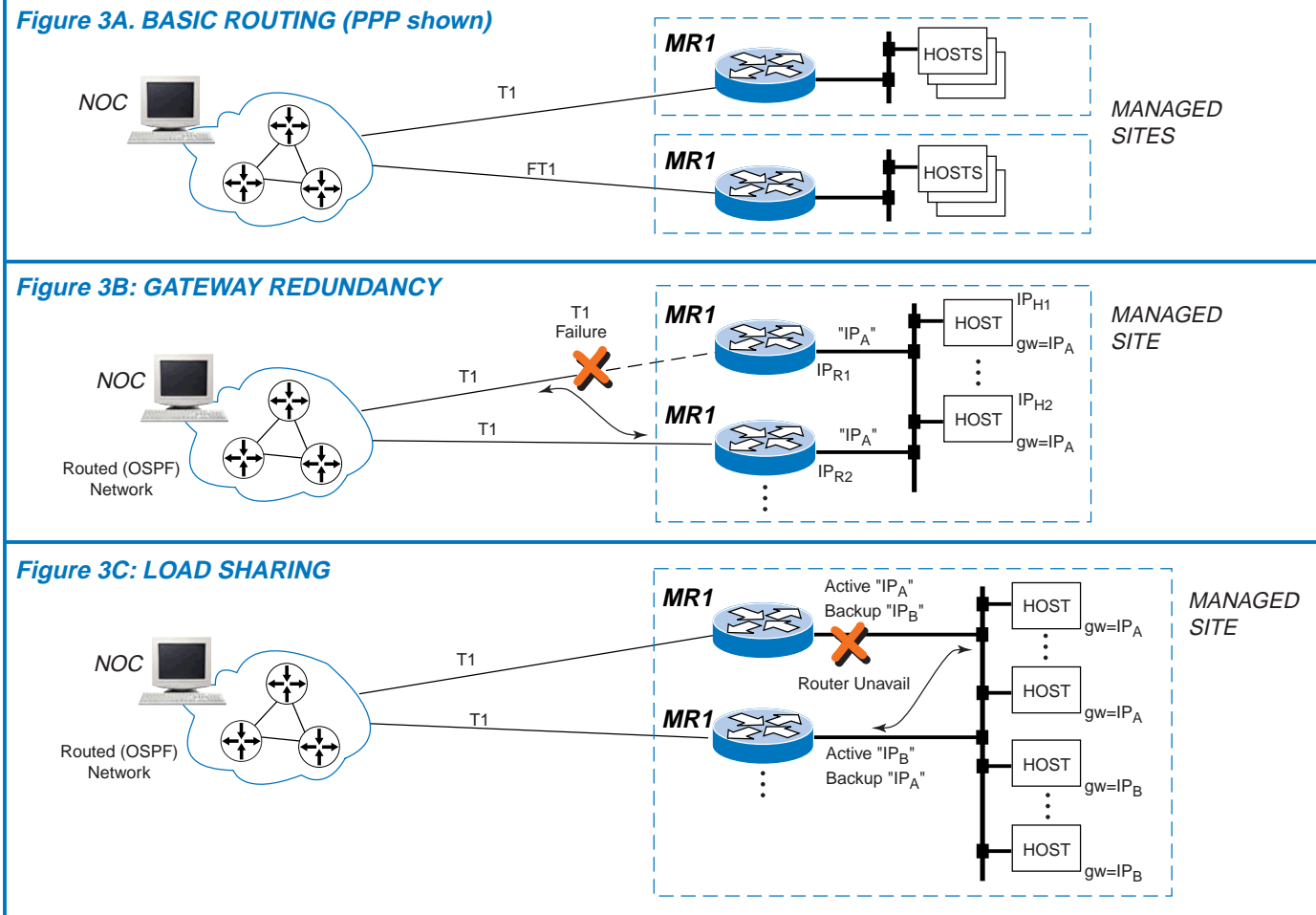
Figure 3B shows SpectraComm MR1s performing dynamic routing with gateway redundancy at remote sites.

- Two or more MR1s are used at each remote site with VRRP enabled.
- All local site hosts are typically given the default gateway router's IP address ("IP-A").
- VRRP allows all local MR1s to share the "IP-A" gateway address. If one MR1 fails, a remaining MR1 will take over as the gateway.
- No changes of hosts are required.
- All hosts will maintain connectivity to the NOC when the active gateway fails or during router upgrade.

Routing with Load Sharing

Figure 3C shows SpectraComm MR1 redundancy with load sharing. Using the VRRP protocol, the local traffic is split among the MR1s, with each MR1 able to backup the other's traffic during link or router failure. After the gateway is restored, normal traffic patterns resume.

SC Mini Router Applications



SC MR1 APPLICATIONS *(Continued)*

Inter-VLAN Routing

Figure 4 shows SpectraComm MR1 in an Inter-VLAN routing application, where MR1 routes between VLANs, reducing “broadcast domain” and enhancing network efficiency.

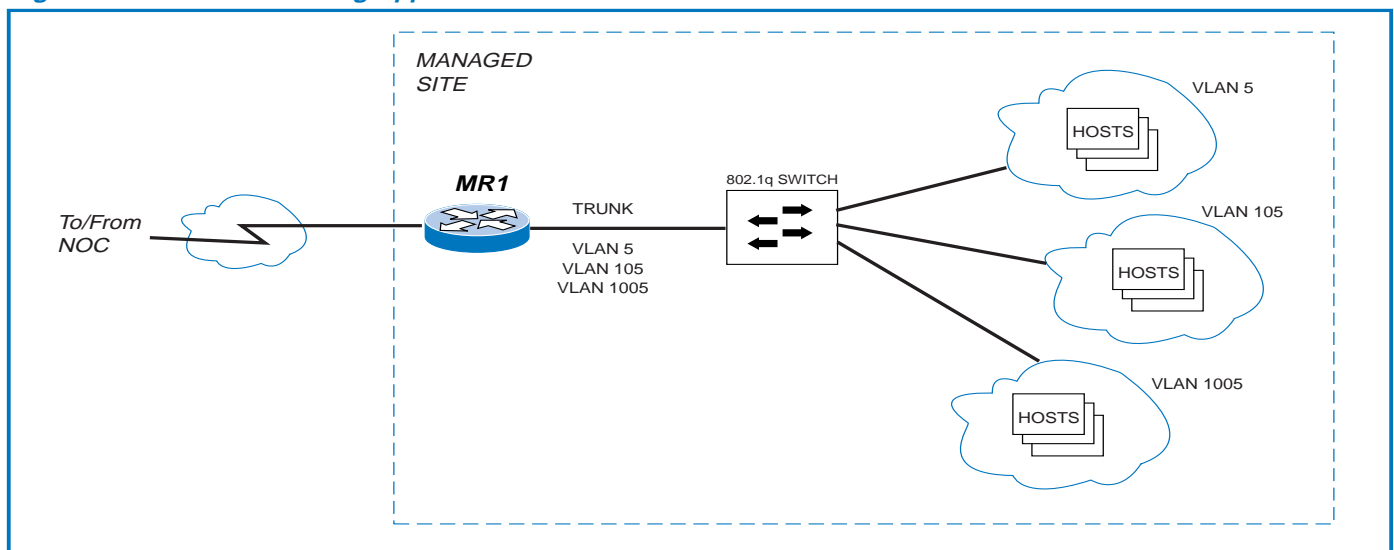
- External VLAN tagging (802.1q) ethernetswitch provides tags which are “trunked” to the MR1 and routed as IP subnets.
- Optionally, with VRRP enabled, VLAN redundancy integrates with WAN and gateway redundancy (**Figure 4A**).
- This application can also accommodate load sharing, with each MR1 backing up the other’s traffic during link or router failure.

Switched Ethernet Application

The SpectraComm Ethernet Switch (SC-ES), a companion to the MR1, can connect several 10/100B-T Ethernet devices on the same network segment for maximum speed and improved LAN performance (**Figure 2**).

In a SpectraComm shelf at a remote site, the NEBS-Compliant SC-ES 9-port or 18-port card connects to one of the two ethernet ports on the MR1. This configuration extends carrier or enterprise management networks to reach remote devices attached to a scalable ethernet LAN.

Figure 4: Inter-VLAN Routing Application



SC MR1-T1 Physical Specifications

Single-slot Blade

Width: 178 mm (7.0 in.)
Height: 21 mm (0.81 in.)
Depth: 241 mm (9.5 in.)
Weight: 0.28 kg (10 oz.); Shipping weight: 0.74 kg (1 lb 10 oz)

Environmental Specifications

Non-Operating

Temperature: -40 to 70 degrees C (-40 to 158 degrees F)
Relative Humidity: 5% to 95%
Altitude: up to 12,191 m (40,000 ft)

Operating

Temperature: 0 to 50 degrees C (32 to 122 degrees F)
Relative Humidity: 5% - 90% non-condensing
Altitude: -60 to 4,000 m (-197 to 13,123 ft)

Electrical Specifications

Power Dissipation: 6 Watts, maximum
Power (AC or DC), voltage, frequency, and fusing determined by your SpectraComm shelf/enclosure.

Compliance and Compatibility (Pending)

SC MR1-T1 Blade in any SC Shelf or Enclosure

Safety: UL/CUL compliant
NEBS Level III compliant
Telco: FCC Part 68 compliant
EMI: FCC Part 15 Class A compliant
Bell Pub. 62310 and ANSI T1.410 standards compliant

SC MR1-T1 Blade in SC2000 Shelf Only

Meets certain requirements of the NEBS GR-2834-CORE document:

- Severe Climate Conditions (R5-3)
- Temperature Cycling Normal Conditions (R5-3)

Quality Assurance

ISO 9001: 2000 certified

Protocols

Point-to-Point: RFC 1661 (1994)
Frame Relay DTE interface (UNI-U)
Ethernet: ANSI/IEEE 802.3; Rates 10 Mbps, 100 Mbps
RIP Version 1, Version 2 (RFCs 1058, 2453)
OSPF Version 2 (RFC 2328)
Virtual Router Redundancy Protocol (RFC 3768)
VLAN Routing: ANSI/IEEE 802.1q tagged VLAN packets

Security and Authentication

Username and Password verification
MD5 Authentication Protocol Option for RIPv2(2082), OSPF (2328)
TACACS+ Authentication Protocol Ver. 1.78 (Cisco)
SSH v1, v2 Management Access
Multi-level permissions:

- User mode (Read-only)
- Enable mode (Read-Write and special functions)

Operational Specifications

Physical Interfaces

Front Panel Craft Port: TIA/EIA-232
LAN: Front Panel Ethernet Ports (2):
ANSI/IEEE 802.3; ANSI/IEEE 802.1d;
Full duplex 10/100 Mbps Etherswitch
WAN: T1 Interface: DS1 and DSX-1

Integral CSU/DSU Operation

T1 Data Rate:
N x 56/64 Kbps, where N = 1 - 24 DS0s
Data Encoding:
AMI (56 X N Kbps) or B8ZS (56/64 x N Kbps)
Frame Format/Mode:
D4, AT&T 54016 ESF, ANSI T1.403 ESF

Diagnostics and Alarms

T1 Network Line Loopback Test,
T1 Payload Loopback Test
Loopback IP addressing
Traceroute
Ping
Out Of Frame (OOF) Alarm
Loss of Signal (LOS) Alarm
Alarm Indication Signal (AIS)
Bipolar Violation (BPV) Alarm
Cyclic Redundancy Check (CRC) Error Alarm
Received Yellow (RYEL) Alarm Event
Low Average Density (LAD) Alarm

Management Interfaces

VT-100 compatible terminal
Telnet interface
Trivial File Transfer Protocol (TFTP)
Secure shell (SSH)
SNMP agent for MIB-2 traps and statistics
DHCP Relay (IP helper)

Future Interfaces

Modem Interface
AUX Interface

