

# RICi-16

## Ethernet over Bonded PDH Network Termination Unit



- Ethernet traffic over 16 bonded E1 or T1 ports or two clear channel T3 ports, using Ethernet over NG-PDH protocols
- MEF-9/MEF-14 certified, supporting EPL and EVPL services with flexible mapping of user traffic into Ethernet flows
- Enhanced QoS mechanism and flow-based provisioning (service multiplexing) with advanced traffic management
- Monitoring and diagnostic tools for quick fault isolation on TDM and Ethernet ports
- Complete Ethernet OAM solution based on IEEE 802.3-2005 (formerly 802.3ah), IEEE 802.1ag and ITU-T Y.1731

RICi-16 is a state-of-the-art Network Termination Unit (NTU) connecting Fast Ethernet LANs over up to 16 bonded E1/T1 lines or up to two clear-channel T3 circuits.

RICi-16 features Carrier Ethernet attributes that include Ethernet OAM for proactive SLA monitoring, quality of service (QoS) per Ethernet flow, and advanced traffic management capabilities, all starting at the service hand-off points.

### MARKET SEGMENTS AND APPLICATIONS

RICi-16 can transport Ethernet over bonded and TDM T1s using a single channelized T3 as uplink. This enables service providers to supply high-capacity Ethernet services to remote locations and transparently connect corporate LANs over existing PDH infrastructure.

Typical applications include:

- IP DSLAM, cellular IP, and WiMAX base station backhauling (see Figure 1)
- Interoffice or enterprise LAN connection.

### ETHERNET

#### Encapsulation and Bonding

RICi-16 employs Ethernet over NG-PDH technologies, such as Generic Framing Procedure (GFP G.8040), Virtual Concatenation (VCAT G.7043) and Link Capacity Adjustment Scheme (VCAT G.7042). NG-PDH solutions improve overall network availability, by reducing latency and optimizing line utilization and throughput.

The unit supports up to 16 GFP VCAT groups (VCG), for connecting up to 16 different customers per site.

#### Flexible Traffic Mapping

Traffic is mapped to the Ethernet flows (EVCs) using the following per-port criteria:

- Port-based (All-to-one bundling)
- CE-VLAN
- CE-VLAN priority
- DSCP
- IP precedence
- CE-VLAN + CE-VLAN priority
- CE-VLAN ID + IP precedence (user to network only)
- CE-VLAN + DSCP (user to network only)
- Non-IP
- CE-VLAN + non-IP
- Untagged.

#### Traffic Separation

VLAN stacking and stripping option at ingress and egress enables transporting user traffic transparently, keeping the user VLAN settings intact. In addition, the management traffic can be tagged with a different VLAN, fully separating user traffic from management data.

#### Quality of Service-QoS

Different service types require different levels of QoS to be provided end-to-end. QoS can be defined per subscriber as well as per service. QoS has two aspects: rate limitation and traffic prioritization.

Two policing mechanisms are applied per flow. The policing mechanisms operate according to the dual leaky bucket mechanism (CIR + CBS, EIR + EBS: two rates, three colors).

For prioritizing user traffic, RICi-16 employs up to four separate queues. The queues handle traffic with different service demands, such as real-time traffic, premium data, or best-effort data.

#### Ethernet OAM

Two types of Ethernet OAM are provided:

- Single segment (link) OAM according to IEEE 802.3-2005 (formally 802.3ah) for remote management and fault indication
- OAM Connectivity Fault Management (CFM) based on IEEE 802.1ag and

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ITU-T Y.1731 enabling Service Providers to monitor their Ethernet services proactively, measure end-to-end performance, and guarantee that customers receive the contracted SLA.

### L2CP Handling

RICi-16 can be configured to pass through Layer-2 control frames across the network, to peer-supported protocols (OAM.ah), or to discard the L2CP frames.

### TIMING AND SYNCHRONIZATION

RICi-16 uses Simple Network Time Protocol (SNTP) to synchronize to an accurate time from an NTP server at user-selectable intervals.

### RESILIENCY

The unit features a user-configurable bidirectional fault propagation mechanism that notifies local and remote equipment of faulty conditions. This enables routers and switches on both ends of the link to reroute traffic.

### MANAGEMENT AND SECURITY

The following management options are supported:

- Remote inband management via the network ports, using Telnet, Web browser or RADview, RAD's SNMP-based management system.
- Out-of-band management via one of the user data ports that can be configured as a management port
- Local management via an ASCII terminal connected to the RS-232.

To provide a high level of client-server communication security, the following security protocols are supported:

- SNMPv3
- RADIUS authentication
- SSL for Web-based management
- SSH for Secure Shell communication.

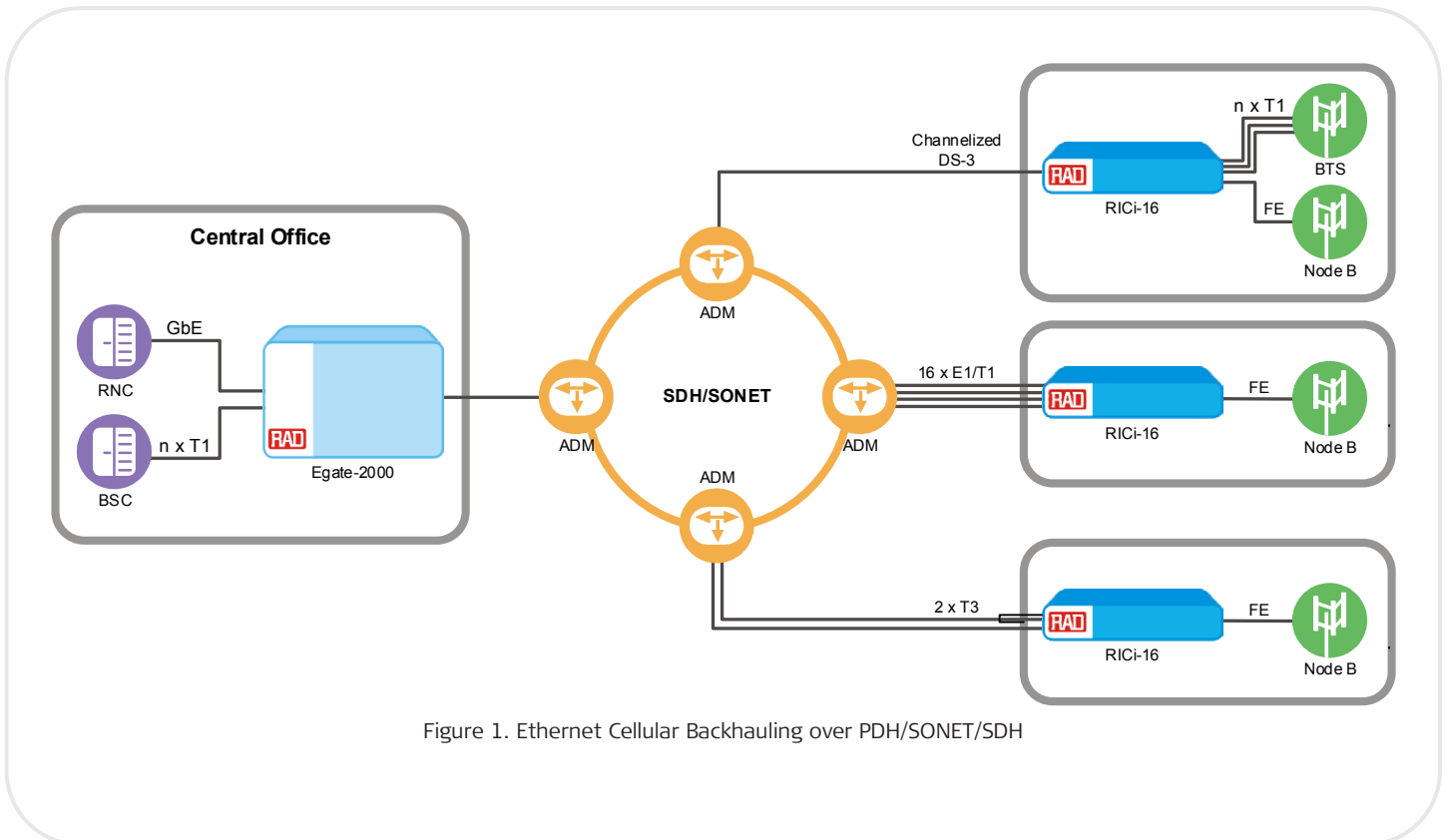


Figure 1. Ethernet Cellular Backhauling over PDH/SONET/SDH

## Specifications

### E1 INTERFACE

**Number of Ports**

4, 8, or 16

**Compliance**

G.703  
G.704

**Data Rate**

2.048 Mbps

**Line Code**

HDB3, AMI

**Framing**

Framed (G732N with CRC)

**Line Impedance**

120Ω, balanced  
75Ω, unbalanced (via adapter cable)

**Connector**

RJ-45, balanced

**System Clock**

Internal or loopback timing

### T1 INTERFACE

**Number of Ports**

4, 8, or 16

**Compliance**

T1.403

**Data Rate**

1.544 Mbps

**Line Code**

B8ZS, AMI

**Framing**

ESF

**Line Impedance**

100Ω, balanced

**System Clock**

Internal or loopback timing

**Connector**

RJ-45

### T3 INTERFACE

**Number of Ports**

2

**Port Operation Mode**

Channelized: 1 port is operational  
Clear-channel: both ports are operational

**Compliance**

T1.102, T1.107

**Data Rate**

44.736 Mbps

**Line Code**

B3ZS

**Framing**

M23 or C-bit parity

**Line Impedance**

75Ω, unbalanced

**System Clock**

Internal or loopback timing

**Connector**

BNC

### WAN PROTOCOL

**Encapsulation**

GFP (G.7041)  
GFPoPDH (G.8040)

**Bonding**

VCAT (G.7043) – Up to 16 VCAT groups  
LCAS (G.7042)

**Delay Compensation**

Up to 250 ms (E1/T1 ports)  
Up to 217 ms (clear channel T3 ports)

### ETHERNET INTERFACE

**Compliance**

IEEE 802.3 and 802.3u, relevant sections

**Number of Ports**

3 or 4

**Type**

10/100 Mbps, autonegotiation, full/half duplex, flow control

**Port Combinations**

4 built-in electrical  
2 built-in electrical + 1 fiber optic SFP (for transceivers, see *Ordering*)

**Max Frame Size**

1700 bytes

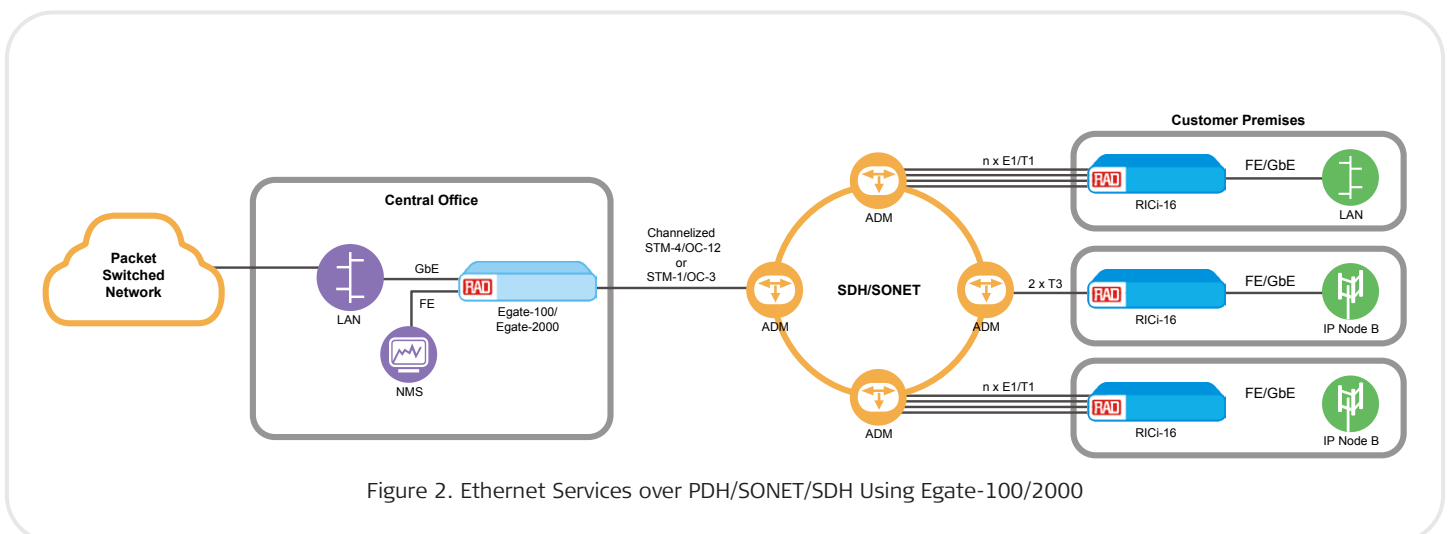


Figure 2. Ethernet Services over PDH/SONET/SDH Using Egate-100/2000

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## Ethernet over Bonded PDH Network Termination Unit

### SFP Transceivers

For full details, see the SFP Transceivers data sheet at <http://www.rad.com>

**Note:** It is strongly recommended to order this device with **original** RAD SFPs installed. This will ensure that prior to shipping, RAD has performed comprehensive functionality quality tests on the entire assembled unit, including the SFP devices. RAD cannot guarantee full compliance to product specifications for units using non-RAD SFPs. For detailed specifications of the SFP transceivers, see the SFP transceivers, see the SFP Transceivers data sheet.

### TERMINAL CONTROL PORT

#### Type

RS-232/V.24 (DCE asynchronous)

#### Data Rate

9.6, 19.2, 115.2 kbps

#### Connector

9-pin, D-type, female

### INTERNAL BRIDGE

#### LAN Table

Up to 2018 MAC addresses (learned) and 30 static addresses

#### Operation Mode

VLAN-aware, VLAN-unaware

#### Filtering and Forwarding

Transparent or filtered

### MANAGEMENT AND SECURITY

SNMPv3 with AES-128 key encryption

RADIUS authentication

SSL for Web-based management

SSH for Secure Shell communication

### DIAGNOSTICS

Remote loopbacks on E1, T1, T3 interfaces

### GENERAL

#### Indicators

PWR (green, per power supply) – Power status

TST (yellow) – Self test status

ALM (red) – Alarm status

#### Power

Wide-range AC/DC:

100–240 VAC, 50/60 Hz or

48/60 VDC nominal (40–72 VDC)

#### Power Consumption

13W max

#### Physical

Height: 43.7 mm (1.7 in) 1U

Width: 440.0 mm (17.3 in)

Depth: 240.0 mm (9.4 in)

Weight: 3.0 kg (6.6 lb)

#### Environment

Temperature:

Standard enclosure:

0 to 50°C (32 to 122°F)

Temperature-hardened enclosure:

-22° to 65°C (-7.6° to 149°F)

Humidity: Up to 90%, non-condensing



Figure 3. Next-Generation Mobile Connectivity over PDH Microwave Links

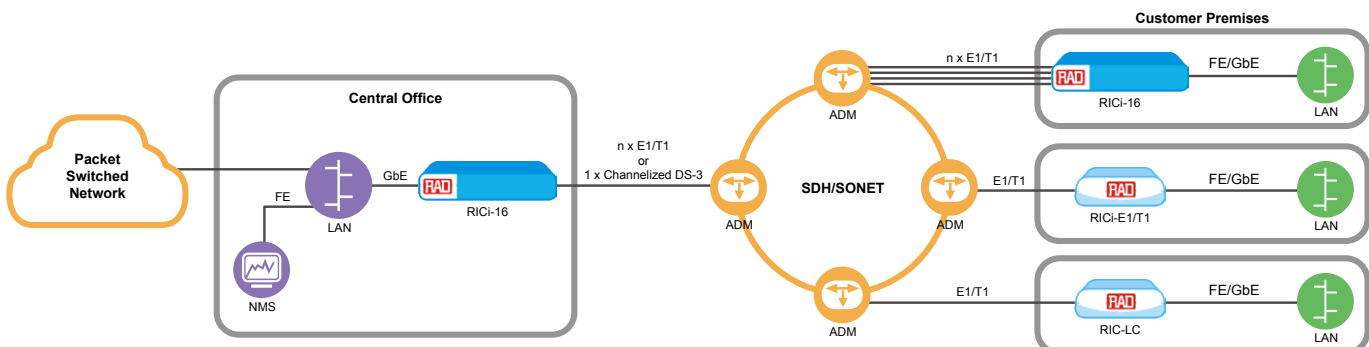


Figure 4. Ethernet Services over PDH/SONET/SDH Using RICi-16 as Aggregator

## RICi-16

### Ethernet over Bonded PDH Network Termination Unit

## Ordering

### RECOMMENDED CONFIGURATIONS

#### RICi-16/16E1

Ethernet over bonded PDH Network Termination Unit, 16 E1 ports

#### RICi-16/16T1

Ethernet over bonded PDH Network Termination Unit, 16 T1 ports

#### RICi-16/16T1/R

Ethernet over bonded PDH Network Termination Unit, 16 T1 ports, redundant power supply

#### RICi-16/4E1/R

Ethernet over bonded PDH Network Termination Unit, 4 E1 ports, redundant power supply

#### RICi-16/4T1

Ethernet over bonded PDH Network Termination Unit, 4 T1 ports

#### RICi-16/8E1

Ethernet over bonded PDH Network Termination Unit, 8 E1 ports

#### RICi-16/8T1

Ethernet over bonded PDH Network Termination Unit, 8 T1 ports

### SPECIAL CONFIGURATIONS

Please contact your local RAD partner for additional configuration options.

### SUPPLIED ACCESSORIES

AC power cord

DC power connection kit

#### CBL-RJ45/2BNC/E1

RJ-45 to BNC adapter cable (if unbalanced E1 interface is ordered)

### OPTIONAL ACCESSORIES

#### CBL-DB9F-DB9M-STR

Control port cable

#### RM-34

Hardware kit for mounting one RICi-16 unit in a 19-inch rack

#### WM-34

Hardware kit for mounting one RICi-16 unit on a wall

#### RICi-16-PS

Spare wide-range power supply module (100-240 VAC/-48 VDC)

Pulse Supply  
909 Ridgebrook Road., Sparks, Maryland  
21152, USA TEL : +1-410-583-1701  
FAX : +1-410-583-1704  
E-mail: sales@pulsesupply.com  
<https://www.pulsesupply.com/rad>  
[www.pulsesupply.com/rad](http://www.pulsesupply.com/rad)

