

RICi-16

Ethernet over Bonded PDH Network Termination Unit

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 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.



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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.

Specifications

E1 INTERFACE

Number of Ports

4, 8, or 16

Compliance

G.703

G.704

Data Rate

2.048 Mbps

Line Code

HDB3, AMI

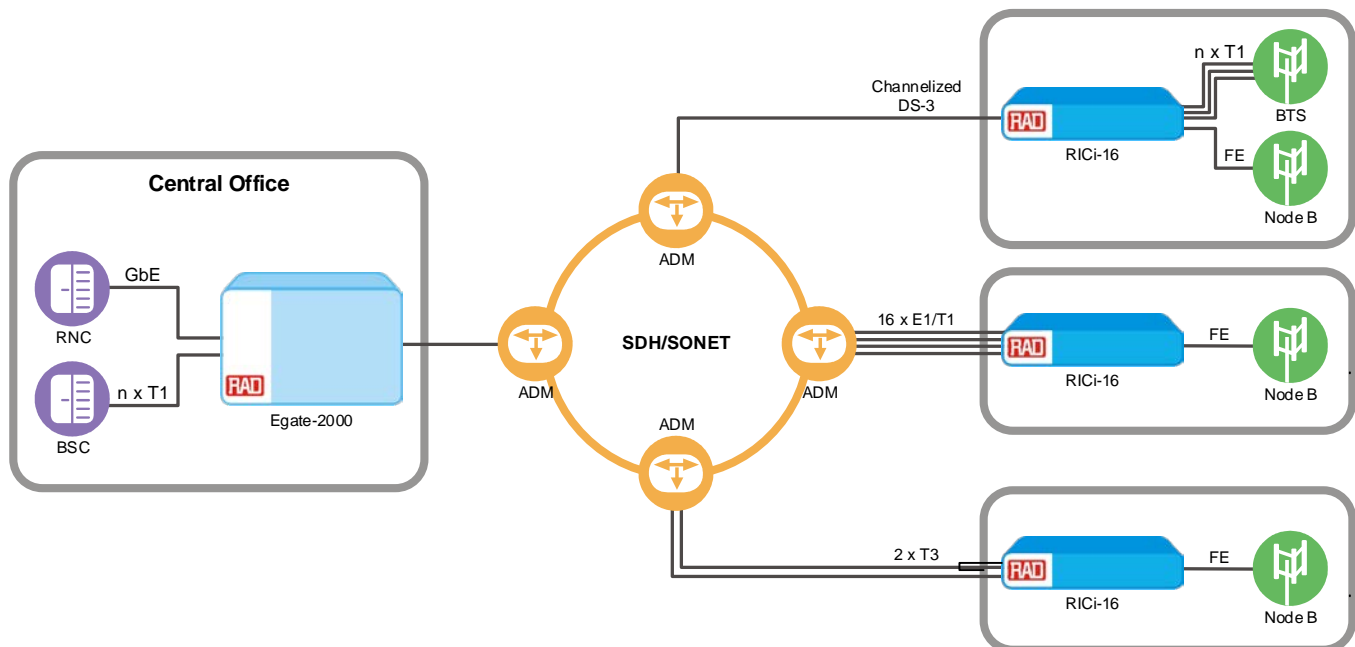


Figure 1. Ethernet Cellular Backhauling over PDH/Sonet/SDH

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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

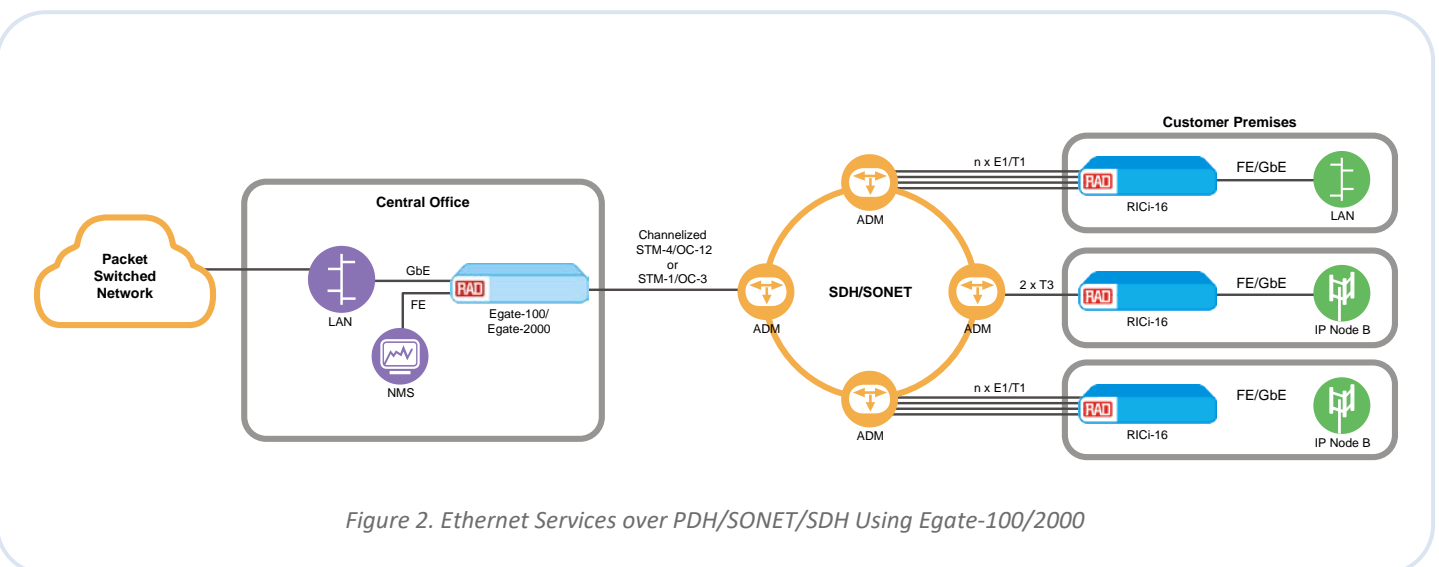
Clear-channel: both ports are operational

Compliance

T1.102, T1.107

Data Rate

44.736 Mbps



RICi-16

Ethernet over Bonded PDH Network Termination Unit

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

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.

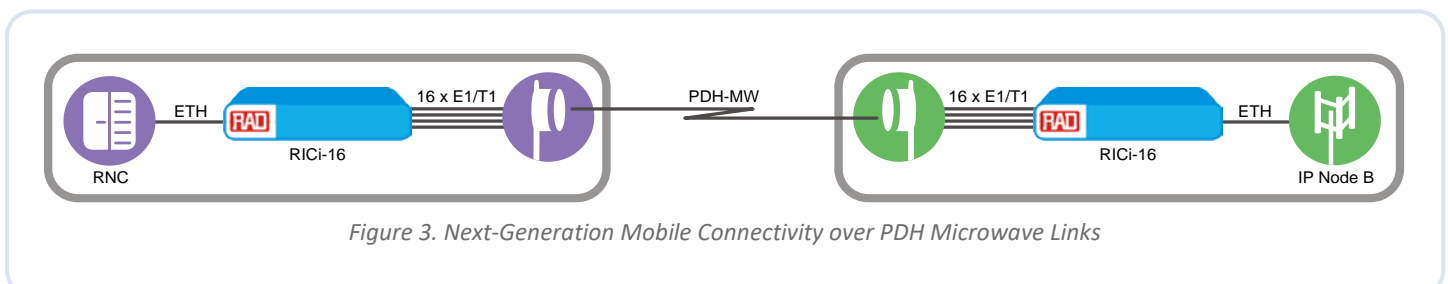


Figure 3. Next-Generation Mobile Connectivity over PDH Microwave Links

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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

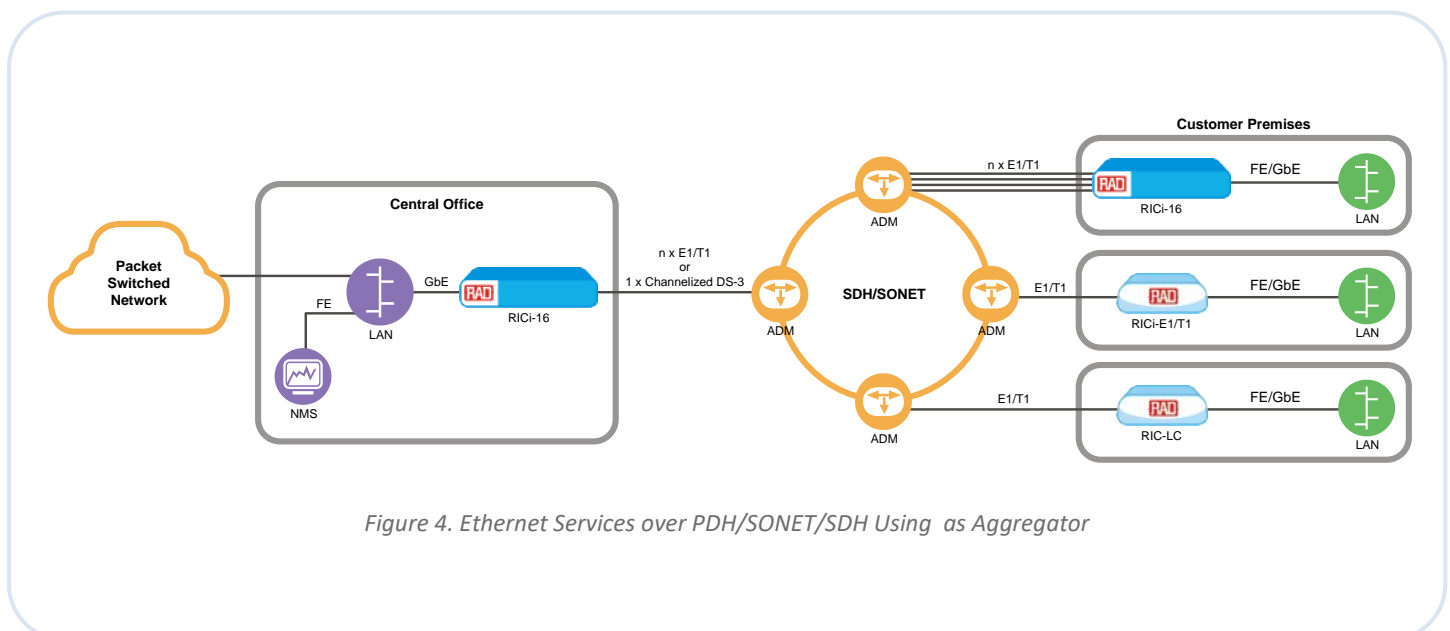


Figure 4. Ethernet Services over PDH/SONET/SDH Using as Aggregator

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Ethernet over Bonded PDH Network Termination Unit

Ordering

Legend

RICi-16	Ethernet over bonded PDH Network Termination Unit
RICi-16/B/@/*/#!/ /\$/?	
B	E1/T1 balanced ports (Default=16 ports)
16E1	16 E1 ports
16T1	16 T1 ports
8E1	8 E1 ports
8T1	8 T1 ports
4E1	4 E1 ports
4T1	4 T1 ports
2T3	2 T3 ports
@	T3 ports (Default=no T3 ports):
2T3	2 T3 ports
*	License pack for PDH link activation
Pack 1	8 E1/T1 links
Pack 2	12 E1/T1 links
Pack 3	16 E1/T1 links
#	Operation mode (Default=bridge)
EVPL	Enable Ethernet Virtual Private Line services using Ethernet flows
	Power supplies (Default=one power supply)
R	Two power supplies
\$	E1 interface (Default=balanced)
U	Unbalanced E1 interface via RJ-45 to BNC adapter cable
?	Temperature range (Default=normal temperature range, NEBS non-compliant)
H	Temperature-hardened, compliant with NEBS level 3, s 2, 3, and 4/

RECOMMENDED CONFIGURATIONS

RICi-16 can be ordered either without or with the following license packages:

- EVPL – enables Ethernet Virtual Private Line services using Ethernet flows
- Pack 1, Pack 2, Pack 3 – License packs enabling PDH link activation (see details above)

Devices without License Packages

RICI-16-PS

RICI-16/16E1

RICI-16/16E1/H

RICI-16/16E1/NULL

RICI-16/16E1/NULL/R

RICI-16/16E1/R

RICI-16/16E1/R/U

RICI-16/16E1/R/U/H

RICI-16/16E1/U

RICI-16/16T1

RICI-16/16T1/2T3/R

RICI-16/16T1/R

RICI-16/16T1/R/H

RICI-16/4E1

RICI-16/4E1/NULL

RICI-16/4E1/NULL/R

RICI-16/4E1/NULL/U

RICI-16/4E1/R

RICI-16/4E1/R/U

RICI-16/4E1/U

RICI-16/4T1

RICI-16/4T1/NULL

RICI-16/4T1/NULL/R

RICI-16/4T1/NULL/R/H

RICI-16/4T1/R

RICI-16/4T1/R/H

RICI-16/8E1

RICI-16/8E1/NULL

RICI-16/8E1/NULL/R

RICI-16/8E1/NULL/U

RICI-16/8E1/R

RICI-16/8E1/R/U

RICI-16/8E1/SFP-2/U

RICI-16/8E1/U

RICI-16/8T1

RICI-16/8T1/R

Devices with License Packages

RICI-16-EVPL

RICI-16/4E1/EVPL

RICI-16/4E1/EVPL/R

RICI-16/4T1/EVPL

RICI-16/8E1/EVPL

RICI-16/8E1/EVPL/R

RICI-16/8T1/EVPL

RICI-16/16E1/EVPL

RICI-16/16E1/EVPL/U

RICI-16/16T1/2T3/EVPL

RICI-16/16T1/2T3/EVPL/H

RICI-16/16T1/2T3/EVPL/R/H

RICI-16-PACK1

RICI-16-PACK2

RICi-16

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RICI-16-PACK3
RICI-16/16E1/PACK1
RICI-16/16E1/PACK1/EVPL
RICI-16/16E1/PACK1/R
RICI-16/16E1/PACK1/R/H
RICI-16/16E1/PACK1/R/U
RICI-16/16E1/PACK1/SFP
RICI-16/16E1/PACK1/SFP-2/U
RICI-16/16E1/PACK1/SFP/R
RICI-16/16E1/PACK1/U
RICI-16/16E1/PACK2
RICI-16/16E1/PACK2/R/U
RICI-16/16E1/PACK2/SFP-2/R/U
RICI-16/16E1/PACK2/U
RICI-16/16E1/PACK3
RICI-16/16E1/PACK3/EVPL
RICI-16/16E1/PACK3/EVPL/NULL/R
RICI-16/16E1/PACK3/EVPL/R
RICI-16/16E1/PACK3/EVPL/R/H
RICI-16/16E1/PACK3/EVPL/R/U
RICI-16/16E1/PACK3/EVPL/R/U/H
RICI-16/16E1/PACK3/EVPL/U
RICI-16/16E1/PACK3/NULL/R
RICI-16/16E1/PACK3/NULL/U
RICI-16/16E1/PACK3/R
RICI-16/16E1/PACK3/R/H
RICI-16/16E1/PACK3/R/U
RICI-16/16E1/PACK3/R/U/H
RICI-16/16E1/PACK3/SFP-1/R/U/H
RICI-16/16E1/PACK3/SFP-2
RICI-16/16E1/PACK3/U
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RICI-16/16T1/PACK1
RICI-16/16T1/PACK1/NULL/R
RICI-16/16T1/PACK1/R
RICI-16/16T1/PACK2/R
RICI-16/16T1/PACK3
RICI-16/16T1/PACK3/EVPL
RICI-16/16T1/PACK3/EVPL/R/H
RICI-16/16T1/PACK3/R
RICI-16/16T1/PACK3/R/H
RICI-16/16T1/PACK3/SFP-1/R

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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)

RM-34

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

OPTIONAL ACCESSORIES

CBL-DB9F-DB9M-STR

Control port cable

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)

LICENSE PACKAGES (OPTIONAL)

RICi-16-EVPL

Ethernet Virtual Private Line services using Ethernet flows
Note: When RICi-16 is ordered with 16 E1/T1 links (and without license pack), only four E1 or T1 ports are activated. To have more ports activated, order one of the following RICi-16-Pack licenses.

RICi-16-Pack 1

License pack for activating 8 E1/T1 links

RICi-16-Pack 2

License pack for activating 12 E1/T1 links

RICi-16-Pack 3

License pack for activating 16 E1/T1 links

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