

## 8840 Smart Router

*High Performance, Carrier-Class Core and Provider Edge Router Supporting Fixed and Mobile Networks*

### HIGH PERFORMANCE IP/MPLS-BASED ROUTER

The Coriant® 8840 Smart Router is an IP/MPLS-based router designed to offer high performance, carrier-class transport services for network and service convergence. The 8840 Smart Router can be deployed as a core and Provider Edge (PE) router for LTE, 4G, 3G, and 2G mobile backhaul, converged fixed-mobile environments, legacy network migration, and provisioning Carrier Ethernet services. In addition, the 8840 Smart Router supports broadband aggregation, triple play services, and high speed Internet access.

### ANY-TO-ANY TRUE SERVICE INTERWORKING

The 8840 Smart Router offers any-to-any true service interworking at line rate, enabling any customer with any Layer 1 or Layer 2 access technologies such as ATM, FR, Ethernet/VLAN, metro Ethernet, TDM, PPP, and HDLC to communicate with each other, regardless of access media. Enabling full flexibility in network design, the 8840 Smart Router implements an any service, any channel, any port design approach. The 8840 Smart Router has highly scalable IP routing and L3 VPN capabilities.

With next-generation Ethernet support, the 8840 Smart Router provides Metro Ethernet Forum (MEF) certified E-Line and E-LAN services, Ethernet-over-MPLS, Ethernet-over-ATM, Ethernet-over-FR, and Ethernet-over-SONET (EoS) for both VPLS and Q-in-Q implementations.

The 8840 Smart Router also extends the lifetime of service provider legacy investments by scaling its capacity as customer demands grow, without forklift upgrades. The 8840 Smart Router provides a consolidated network infrastructure, collapsing multiple overlay networks to reduce the total number of network elements and optimize capital expenditure. The network element design supports operational task automation and compact inventory for minimized operational expenditure.

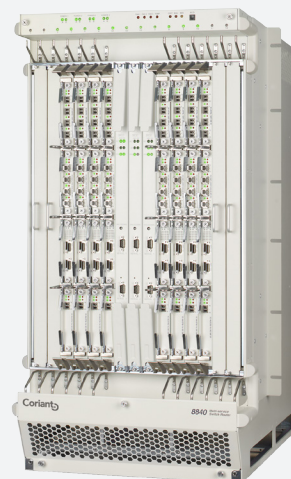
The Coriant ServiceAssured™ Upgrade (SAU) assures non-service affecting product upgrades, Layer 2 and Layer 3 redundancy, in-service network expansion, and distributed processing to maximize fault tolerance and performance.

### CARRIER-CLASS RELIABILITY AND SUPERIOR TRAFFIC MANAGEMENT

The 8840 Smart Router is a fully redundant platform offering immediate forwarding and hitless service preservation for all Layer 2 and Layer 3 services. It offers deterministic and granular per-flow and per-service bandwidth management. Per-port policies defining service contracts for each customer flow are honored and can be used to support Service Level Agreements (SLAs). The 8840 Smart Router offers sophisticated multi-protocol resilience solutions supported with advanced OAM protocols for troubleshooting and root cause analyses of potential issues.

### BENEFITS OF THE CORIANT® 8840 SMART ROUTER

- **Delivers** high performance, carrier-class transport services for network and service convergence
- **Offers** any-to-any true service interworking
- **Scales** as capacity demands grow
- **Minimizes** operational expenditure with intelligent network management and design
- **Provides** full redundancy and superior traffic management



## The Smart Router Series

The Smart Router series offers versatile and scalable solutions for mobile backhaul from small aggregation sites to controller and gateway sites. In addition, Smart Routers serve fixed and mobile convergence and cloud computing networking needs. These solutions are designed to meet the ever-growing requirements of data hungry mobile and enterprise users. All of the Smart Routers are LTE-ready and provide an extensive Ethernet and IP/MPLS feature set. Simultaneous support for multi-service applications in access and aggregation networks protects earlier network investments. The Smart Router product family is supported by the 8000 Intelligent Network Manager, which is an easy-to-use end-to-end network management solution. The 8000 INM minimizes operational and maintenance costs and scales up to tens of thousands of network elements.

## 8840 SMART ROUTER ARCHITECTURE

The 8840 Smart Router is a 288 Gbps full duplex, 15-slot, multiservice IP router that supports up to three Switch and Control Cards (SCCs), and up to 12 Universal Line Cards (ULCs) each containing up to 4 Physical Line Modules (PLMs), or up to 12 Line Card Adapters (LCAs) each containing up to two Ethernet Line Cards (ELCs). ULCs and LCAs can be intermixed on an 8840 Smart Router shelf to optimize the desired port configuration and density. The SCCs provide the data switching, control, and management functions for the 8840 Smart Router. Two SCCs are needed for switch and control redundancy, and a third SCC can be deployed to maximize switching capacity in a fully populated system. The SCC2 is required to support enhanced services and 24 Gbps per slot bandwidth available with ELCs.

## TECHNICAL SPECIFICATIONS

### Physical Dimensions

- 439 mm (W) x 889 mm (H) x 737 mm (D) / 17.3 in (W) x 35 in (H) x 29 in (D); width includes the metal mounting bracket ears
- Standard 19-inch rack mounting
- Weight (fully configured) 176 kg / 390 lbs

### Power and Cooling

- Four power inputs, each has A&B power inputs
- Maximum current per power input: 50 Amps at -40V DC
- Input voltage range: -40V DC to -56V DC
- Power consumption: maximum 5700 W (typical value dependent on the element configuration)
- 3 small fan trays with 4 fans each
- Top to bottom air flow

### Architecture

- Hardware-based forwarding
- Distributed switching architecture

### Forwarding Plane

- IPv4/IPv6 routing
- MPLS switching (LSR and LER)
- Ethernet MAC switching

### Functionality

- ATM: UNI 3.0 and 3.1, PNNI 1.0 and 1.1, ILMI 4.0, IISP 1.0, AINI 1.2, ITU T1.617, IMA 1.0 and 1.1
- Frame Relay: FRF 1.1 UNI, FRF 2.1 NNI, FRF.5 Network Interworking, and FRF.8 Service Interworking, ITU Q.933 FR LMI

- Ethernet/VLAN, link aggregation, E-Line and E-LAN, VPLS, H-VPLS, Q-in-Q STP, RSTP, MSTP
- EoS (X.86) and GFP
- TDM: SAToP
- HDLC
- PPP (POS)
- ML-PPP
- Pseudowires based on Martini Draft for ATM, Frame Relay, Ethernet/VLAN, PPP, HDLC, and TDM traffic encapsulation
- MFA: The Use of Virtual Trunks for ATM/MPLS Control Plane Interworking

### Forwarding Capacity

- 288 Gbps bi-directional with three SCC2 cards and 24 ELC cards
- 480 Gbps bi-directional with three SCC2 cards and 12 ELC-2 cards

### Chassis Configuration

- 3 slots for SCCs; 2 SCCs for redundancy, 3 SCCs to maximize switching capacity
- 12 slots for ULCs (ULC-1, ULC-2, ULC-3) or LCAs
- 4 PLMs per ULC (or one full height PLM)
- 2 ELCs per LCA (1x10G ELC, 12x1G ELC, or 6x10GbE ELC-2)
- 4 DC power blocks

### Physical Line Modules (PLMs)

- DS3/E3
  - 6-port DS3/E3 Channelized PLM
  - 6-port DS3/E3 ATM Concatenated PLM
  - 6-port DS3/E3 Concatenated PLM

- Fast Ethernet
  - 24-port Fast Ethernet PLM
  - 24-port Fast Ethernet Enhanced PLM
- Gigabit Ethernet
  - 4-port Gigabit Ethernet PLM (with optics)
  - 4-port Gigabit Ethernet PLM (without optics)
  - 1-port 10 Gigabit Ethernet PLM (full height)
  - 1-port 10 Gigabit Ethernet XFP PLM (full height)
  - 1-port 10 Gigabit Ethernet Tunable Laser PLM (full slot height)
- OC-n/STM-n
  - 2-port OC-3/STM-1 PLM
  - 2-port OC-3/STM-1 ATM IMA PLM
  - 2-port OC-3/STM-1 CES PLM
  - 2-port OC-3/STM-1 MS PLM
  - 4-port OC-3/STM-1 PLM
  - 4-port OC-3c/STM-1c PLM
  - 4-port OC-12/STM-4 PLM
  - 4-port OC-12c/STM-4c PLM
  - 1-port OC-48/STM-16 PLM
  - 1-port OC-48c/STM-16c PLM
  - 1-port OC-48/STM-16 GFP PLM
  - 1-port OC-192c/STM-64c PLM (full slot height)
  - 1-port OC-192c/STM-64c XFP PLM (full slot height)

## TECHNICAL SPECIFICATIONS

### Ethernet Line Cards

- LCA converts a full height line card slot into two half height ELC slots
- Up to 24 ELCs per 8840 Smart Router
- Up to 12 ELC-2s per 8840 Smart Router
- ELC configurations:
  - 1-port 10 Gigabit
  - 12-port 1 Gigabit
  - 6-port 10 Gigabit

### Resiliency

- Four redundant power inputs, each has A&B power inputs
- ServiceAssured™ Upgrade (SAU)
- Hot-swappable switch fabric and line cards
- N:1 redundancy on forwarding plane and common system elements
- 1+1 control plane redundancy and nonstop forwarding during control plane switchover
- APS/MPS for SONET/SDH
- MPLS over LAG interfaces (incremental bw mode)
- Routing resiliency: OSPF and RSVP-TE stateful redundancy, OSPF, ISIS, BGP, and LDP graceful restart
- Database redundancy: RIB and FIB routing and forwarding table, OSPF-TE and ISIS-TE traffic engineering database, CAC, statistics, VPLS MAC address, circuit states
- PPP states, ARP Cache, SVC states are maintained during control plane switchover
- Data path protection: Supports redundant LSPs and LSP fast reroute in sub-10 ms, ECMP, link aggregation and SONET/SDH APS/MSP protection, ATM IMA, MLPPP, VRRP, STP, RSTP, MSTP, H-VPLS, backup pseudowires and VRRP, loop detection blocking
- Pseudowire redundancy: dual-homing for H-VPLS
- BFD support for OSPF, IS-IS, BGP, LDP, LAG (micro BFD), and RSVP LSP
- Distributed PNNI signaling

### Security

- Operating security using protected memory and modular processes
- Management plane security using multi-level security matrix for secure EMS/NMS access, SNMPv3 security support, SFTP,

RADIUS, TACACS+, forensics capability for security audit or threat diagnostics, network database backup for disaster recovery

- Control plane security against DDoS and TCP SYN attacks and MD5 authentication for IP, ATM/FR, and MPLS
- Data plane security for flexible class-based traffic protection, E911 regulation for public safety, inspection, flexible access control list, lawful interception, resource protection, spoofing prevention

### Synchronization

- SCC generates Stratum-3 system clocking and synchronizes the timing to either a selected trunk or an external clock input

### IPv4 Routing and MPLS Label

#### Distribution Protocols

- Routing: BGP4, IS-IS, OSPF, PIM-SM, Constrained Shortest Path First (CSPF) in multiple areas
- Advanced routing features: BGP confederation and BGP graceful restart
- IS-IS: Graceful restart, jumbo frames, domain-wide prefix distribution, mesh groups, IGP shortcuts
- OSPF: Stateful redundancy, NSSA, IGP shortcuts, multiple instances, graceful restart
- MPLS: LDP, RSVP-TE
- Advanced MPLS features: MPLS traffic engineering, RSVP-TE, IS-IS-TE, OSPF-TE, Constrained Shortest Path First (CSPF)
- RSVP-TE: Stateful redundancy, fast reroute (FRR) with sub 10 ms failover, DiffServ encoding, backup LSPs, open-bandwidth LSPs, and auto-bandwidth LSPs
- LDP: LDP QoS, graceful restart, fault tolerant, LDP over RSVP tunnels
- IP VPN: RFC2547bis/4364 MP-BGP, OSPF multi-instance, overlapping VPNs, full mesh and hub/spoke VPN topologies
- IP Multicast: IGMPv2, PIM-SMv2, IGMP Snooping, IGMP Proxy
- Policies: Access lists, prefix lists, route maps, AS-path lists, extended community lists
- DHCP relay

### Traffic Management

- MPLS traffic engineering using OSPF-TE, ISIS-TE, RSVP-TE, LDP over RSVP tunnel
- CSPF routing
- E-LSP (EXP inferred)
- L-LSP (Label inferred)
- 2-Stage CAC at Layer 2, Layer 3, and LSP level
- Strict Priority Queuing: CBR, VBR-rt, VBR-nrt, UBR, UBR+, and UBR+ max
- Weighted Fair Queuing (WFQ) based on Deficit Round Robin (DRR) scheme
- Policing at the ingress (dual leaking bucket algorithm with 3 color marking + explicit drop)
- Shaping at the egress and ingress
- Weighted Random Early Detection (WRED) and/or Weighted Tail Drop (WTD)
- Hierarchical queuing
- 32,000 per-flow queues (unidirectional) per ULC or 384,000 per 8840 Smart Router chassis
- 4,000 per-group queues per ULC or 48,000 per 8840 Smart Router chassis
- Virtual output queues
- SLAs are applied (both policing and shaping) on per-flow queues via state-of-the-art ASICs
- Multi-class pseudowires
- Weighted QoS

### Management

- CLI with SSH2, FTP with SSH2
- SNMPv1 and SNMPv2 monitoring
- CORBA OSS northbound interface
- 8000 Intelligent Network Manager (INM)

### Standards

- Safety
  - UL 60950-1
  - EN 60950-1:2001
  - CSA C22.2 No. 60950-1
  - AS/NZS 60950.1:2003
  - EN 60825-1:1994, A11, A2
- EMC/Immunity
  - FCC Part 15 Class A
  - ICES-003 Class A (Canada)
  - EN 55022 (1998) Class A (Europe)
  - VCCI (April 2000) Class A (Japan)
- NEBS
  - GR-63-CORE: Issue 2 (APR 2002) NEBS Physical Protection
  - GR-1089-CORE: Issue 3 (2002) EMC and Electrical Safety

## TECHNICAL SPECIFICATIONS

- ETS 300 019-2-1
- ETS 300 019-2-2
- ETS 300 019-2-3
- ETS 300 019-2-4
- ETS 300 753
- AT&T NEDS (MLID#4069, V4.01, 1/16/2004)
- SBC-TP-96200 Issue 5A, Feb 2004
- Storage and transit humidity: 95% RH at 40°C
- Altitude: Up to 4,000 meters (13,123 feet)
- Seismic/Earthquake: NEBS - Zone 4 compliant

### Environmental Conditions

- Operating Temperature: 0°C (32°F) to 40°C (104°F)
- Operating humidity: 5% to 90% relative humidity (RH) non-condensing
- Storage and transit temperature: -40°C (-40°F) to +70°C (+158°F)

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