Product
Reference
Guide

River
STONE
NETWORKS ™

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Company Background

Riverstone Networks builds routers for Metropolitan Area Networks. Riverstone is the only Internet infrastructure vendor focusing exclusively on the needs of carriers in metropolitan area networks. Riverstone provides routing solutions for every segment of the metro network, from building access and metro aggregation to the data center and the Internet core edge. Riverstone's routers are optimized to help service providers deliver value-added services in the metro environment. The company's customer base includes some of the largest and most sophisticated carriers in the world, including Verizon, Qwest, and British Telecom, as well as emerging service providers such as Telseon and Intellispace.

Founded in 1996, Riverstone is based in Santa Clara, California, and currently has sales offices in North and South America, Europe, and Asia. The company employs more than 500 people, with about half of these employees devoted to engineering and product development. Riverstone is listed on the Nasdaq Stock Market and trades under the symbol RSTN.

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Overview of Competitive Positioning

Industry Background

Service providers today confront severe economic challenges. Bandwidth is becoming a commodity, while operational costs continue to rise. As a result, service providers are increasingly interested in infrastructure solutions that can help them develop new revenue streams and reduce the expense and complexity of their networks. This is where Riverstone Networks can help.

Market Focus

Because Riverstone is focused exclusively on service providers in metropolitan area networks, the company has a unique understanding of the challenges and requirements of this market. Every aspect of its products – from service features and hardware performance to the size and shape of the boxes themselves – has been designed to help service providers increase revenues and decrease costs in their metro networks.

Riverstone Products Deliver Unmatched Revenue Potential

Service providers understand that the key to improving their revenues is developing new value-added services. Riverstone specializes in building routers that convert raw bandwidth into profitable services for Metropolitan Area Networks. Supporting profitable services requires three key capabilities: enabling the services themselves, delivering those services over any network, and accurately billing and accounting for those services. Riverstone has significant competitive advantages in each of these areas, and is the only infrastructure vendor – bar none – capable of delivering all three of these requirements to customers.

Unparalleled Service-enabling Technology

Cutting-edge routing capabilities:
Carrier-grade routing is the foundation of any service creation platform. Riverstone's Robust, highly stable implementations of BGP-4, OSPF, and IS-IS have been certified by Tier 1 carriers worldwide and are fully interoperable with Cisco and Juniper core routers.

No performance degradation with features enabled: Rich service capabilities have no value if the network slows to a crawl when they are activated. This is precisely the problem with software-based service solutions. Because Riverstone implements all of its advanced service creation features in the ASICs, service providers never have to choose between features and performance. Lab tests consistently confirm that Riverstone outperforms the competition with service features enabled.

Unmatched range of service-enabling features: Value-added services require the right technological enablers. Competitors' products lack many of Riverstone's powerful service-enablers and often feature unreliable, unstable implementations of others. Additionally, many competitive products implement some or all of their technological enablers in software, producing the performance degradation problems described above. The following table summarizes some of Riverstone's distinctive service-enabling features.

Service Delivery over Any Network

Unsurpassed interface support:
The physical infrastructure of the metropolitan area network consists of a medley of different media types, and service providers must often make do with whatever type of media happens to be available. Riverstone offers the broadest range of interface options in the industry, enabling service providers to connect to whatever media type they encounter, including:

- **T1/E1** (clear-channel and channelized)
- **T3/E3** (clear-channel and channelized)
- **Packet over SONET/SDH** (OC-3 to OC-48)
- **ATM** (OC-3 to OC-12)
- **WDM** (CWDM & DWDM)
- **Fast Ethernet** (TX, FX, SX, LX-IR, & LX-LR)
- **Gigabit Ethernet** (FX, SX, LX-IR, & LX-LR)
- **10 Gigabit Ethernet**

Services	Riverstone Differentiators
Metro VPN services (virtual leased lines, transparent LAN services)	• **Hardware-based, field-programmable MPLS featuring circuit emulation (Martini)** • **Reliable support for the full 4,096 VLANs** • **Stackable VLAN technology, permitting creation of over 16 million VLANs**
Dynamic scalable bandwidth provisioning	• **Hardware-based, bit-level rate limiting per port for up to 2,048 customers per line card** • **Open APIs to manage provisioning**
Prioritized class of service (tiered services)	• **Hardware-based MPLS** • **DiffServ (ToS)** • **802.1p**
Content delivery services	• **Hardware-based multicast, content management, traffic policing, and web cache redirect**
Security services	• **Hardware-based support for up to 20,000 access control lists (ACLs) at wire speed** • **Layer 2-4 network address translation (NAT)** • **Port address translation (PAT)**

Market footprint and time-to-market advantage: Because service providers simply can't afford to wait for fiber pulls, the ability to connect to existing infrastructure translates into a substantially wider market footprint and often provides a first mover advantage.

Billing and Accounting for Services

Industry's only irrefutable accounting solution: Services accounting means more than simply gathering general statistics on average network usage; it requires accounting data that is sufficiently detailed and reliable to support an itemized customer bill. That means gathering data with irrefutable reliability. Because competitors' products gather accounting data through connectionless (UDP-based) solutions, critical accounting data that is dropped en route to the accounting server will never be re-sent. Riverstone offers the only connection-oriented (TCP-based) accounting solution on the market, ensuring irrefutable accounting and reliable services billing.

Unmatched granularity of accounting data: More granular accounting data enables a broader range of options for customer billing and generates detailed insights into customer behavior that can be used to develop additional services. Riverstone is the only vendor to support all RMON I and RMON II groups in hardware on every port, capturing a level of accounting information that competitors cannot match.

Accounting enabled: Because Riverstone's accounting solution is implemented in hardware, performance never suffers when the accounting features are activated.

Riverstone Products Can Also Slash Costs

Riverstone routers help service providers minimize both capital costs and network operating expenses. They do so by enabling the efficient use of legacy infrastructure, reducing the number of network elements, streamlining network management, and reducing the need for manual provisioning.
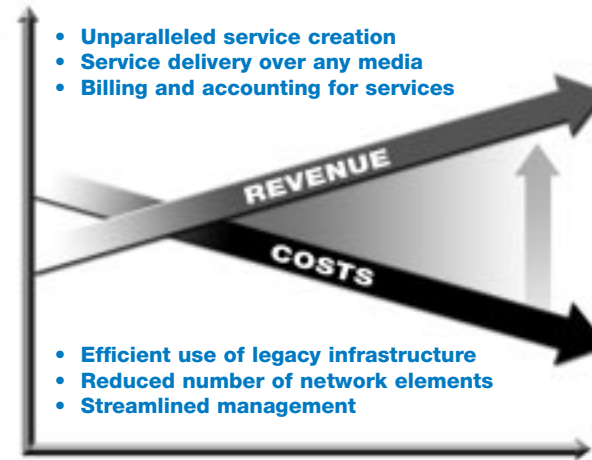
Efficient Use of Legacy Infrastructure

Broadest range of legacy and optical interfaces: Riverstone's unmatched interface options (see above) enable service providers to seamlessly migrate from existing legacy infrastructure to next generation optical networks. That means they can begin delivering value-added services today, without incurring the costs of speculative build-outs on next generation equipment.

Reduced Number of Network Elements

High port-density in a chassis-based platform: Riverstone's RS router family features some of the highest port densities available anywhere, including the RS 16000, which boasts over 70% greater gigabit density than its closest rival. And since the RS family is a modular, chassis-based platform, service providers can scale their networks without adding new boxes.

Integrated functionality: All Riverstone routers are built around the same core technology, including a common set of ASICs and the same RapidOS system software. That means that all Riverstone routers feature the full spectrum of service-enabling technologies, from the smallest access box to the largest aggregation router. As a result, Riverstone can often accomplish with one box what competitors do in two or three box solutions.

- **Unparalleled service creation**
- **Service delivery over any media**
- **Billing and accounting for services**

REVENUE

COSTS

- **Efficient use of legacy infrastructure**
- **Reduced number of network elements**
- **Streamlined management**

Streamlined Management

Common core technology: Because all Riverstone routers are built around the same core technology, there is no need to master a multitude of systems and feature sets. Partner and customer learning are streamlined because all products use the same RapidOS firmware platform and all features are common across the entire RS family.

Open APIs: Service providers need routers that can support any applications they choose to deploy. Whether the carrier uses proprietary software or best-of-breed third-party solutions, it must be confident that its infrastructure vendor can integrate with those applications quickly and painlessly. Riverstone supports open APIs for flexible and reliable integration with any service provider application, including accounting, provisioning, and network management software.

The figure above illustrates and highlights some of the key competitive differentiators discussed above.

Product Line Overview

Riverstone's flagship product line is the RS series of metro routers, designed from the ground up to enable profitable services and reduce costs for service providers in metro networks. The RS series combines a carrier-class Layer 2-4 multi-gigabit switching and routing architecture with the most advanced service creation features available, including dynamic bandwidth provisioning, tiered services, and MPLS-based VPNs. The RS family of routers brings this unique combination of IP intelligence and high performance to any legacy, broadband, or optical network – from broadband to Gigabit Ethernet, 10 GbE, WDM, ATM, and traditional TDM networks. And because profitable services require irrefutable billing, the RS series offers fine-grained, connection-oriented accounting at wire speed.

Product Positioning

Metro Access Routers

Service providers delivering access to end users must move quickly to bring buildings online and deliver on-demand business services if they hope to gain a competitive edge. And because space is normally at a premium in the building basement, wiring closet, or data center, access and services must be delivered as efficiently as possible.

Riverstone's RS 1000 and RS 3000 Optical Metro Access Routers meet these challenges head on. The company's unsurpassed range of connectivity options allows service providers to immediately connect to existing infrastructure without waiting for a fiber installation. Auto-provisioning features enable rapid deployment of services to the building. Compact form-factor chassis with high port density serve to optimize the capacity of space-constrained environments. And since Riverstone's core technology scales across the entire product line, these compact access routers carry the same rich set of service enablers as the largest Riverstone router.

Metro and Core Edge Aggregation Routers

While access is one side of the equation, aggregation is the other. Riverstone's family of aggregation routers – the RS 8000/8600, RS 16000, and RS 38000 – deliver cost-effective, service-rich aggregation solutions that scale across the metro network. From metro aggregation to the core edge, Riverstone offers routers that combine unmatched service-enabling technology with high-port density and throughput capacity. Versatile connectivity in a chassis-based system enables service providers to interface with legacy technologies throughout the metro. At the same time, Internet-caliber routing protocols and full interoperability with core routers ensure seamless uplinks to the core.

Aggregation Routers:
RS 8000, RS 8600, RS 38000 and RS 16000
Access Routers:
RS 3000 and RS 1000 (From left to right)

Ports/Line Cards per Chassis

RS Product Family	RS 1000		RS 3000		RS 8000		RS 8600		RS 16000		RS 38000		RS Product Family
Base System													**Base System**
Fixed Configuration	–		32x10/100 TX		–		–		–		–		*Fixed Configuration*
No.of Open Slots[1]	2		2		7		15		7		15		*No.of Open Slots[1]*
Interface Modules	*Ports per Card*	*Max Ports per Chassis*	*Ports per Card*	*Max Ports per Chassis*	*Ports per Card*	*Max Ports per Chassis*	*Ports per Card*	*Max Ports per Chassis*	*Ports per Card*	*Max Ports per Chassis*	*Ports per Card*	*Max Ports per Chassis*	**Interface Modules**
10/100 TX	8 or 16	32	8 or 16	64[2]	8 or 16	112	8 or 16	240	–	12[5]	24 or 32	480	**10/100 TX**
100 FX	8	16	8	16	8	56	8	120	–		–	–	**100 FX**
1000 T	–	–	–	–	2	14	2	30	–		–	–	**1000 T**
1000 SX[3]	1-2	4	1-2	4	1-2	14	1-2	30	1-8	60[5]	4 or 8	120	**1000 SX[3]**
1000 LX[3]	1-2	4	1-2	4	1-2	14	1-2	30	1-8	60[5]	4 or 8	120	**1000 LX[3]**
1000 LH[3]	1-2	4	1-2	4	1-2	14	1-2	30	1-8	60[5]	4 or 8	120	**1000 LH[3]**
10 GbE[4]	–	–	–	–	–	–	–	–	1[6]	3[6]	1[6]	4[6]	**10 GbE[4]**
CWDM	–	–	–	–	–	–	–	–	2	14	1	15	**CWDM**
Serial	2 or 4	8	2 or 4	8	4	28	4	60	–	–	–	–	**Serial**
HSSI	2	4	2	4	2	14	2	30	–	–	–	–	**HSSI**
T1/E1 *(clear channel or channelized)*	2 or 4	8	2 or 4	8	2 or 4	28	2 or 4	60	–	–	–	–	**T1/E1** *(clear channel or channelized)*
T3/E3 *(clear channel)*	1-2	4	1-2	4	1-2	14	1-2	30	–	–	–	–	**T3/E3** *(clear channel)*
T3/E3 *(channelized)*	–	–	–	–	2	14	2	30	–	–	4	60	**T3/E3** *(channelized)*
ATM DS-3/T3/E3	–	–	1-2	4	1-2	14	1-2	30	–	–	–	–	**ATM DS-3/T3/E3**
ATM OC-3c	–	–	1-2	4	1-2	14	1-2	30	–	–	4	60	**ATM OC-3c**
ATM OC-12c	–	–	–	–	1	7	1	15	–	–	2[6]	30[6]	**ATM OC-12c**
POS OC-3c[4]	–	–	–	–	4	28	4	60	–	–	4[6]	60[6]	**POS OC-3c[4]**
POS OC-12c[4]	–	–	–	–	2	14	2	30	–	–	4[6]	60[6]	**POS OC-12c[4]**
POS-OC-48c[4]	–	–	–	–	–	–	–	–	–	–	1	15	**POS-OC-48c[4]**
RPR POS OC-48c	–	–	–	–	1	6	1	14	–	–	–	–	**RPR POS OC-48c**
DWDM	–	–	1	2	–	–	–	–	–	–	–	–	**DWDM**

1 Reflects number of slots available for interface cards assuming single control module.
2 Reflects capacity of 2 open slots plus fixed configuration ports
3 Available with or without MPLS
4 May be available with MPLS. Check with Riverstone for details.
5 The RS 16000 control module comes with either 12 10/100 TX ports or 4 GbE ports. Data on maximum ports per chassis for the
   RS 16000 reflects the availability of these control module ports in addition to the maximum number of ports available via line cards
6 Scheduled for future release

Riverstone RS Family Matrix

Features	RS 1000	RS 3000	RS 8000/8600	RS 16000	RS 38000
Switch Fabric	6 Gbps	8 Gbps	16 Gbps / 32 Gbps	170 Gbps	170 Gbps
Routing Performance	4.6 Mpps	9.5 Mpps	15 Mpps / 30 Mpps	90 Mpps	90 Mpps
Max # of L2 MACs	256,000	256,000	400,000 / 800,000	1,600,000	1,600,000
Max # of L3 Routes	250,000	250,000	250,000	250,000	250,000
Max # of L4 Flows	512,000	512,000	2,000,000 / 4,000,000	8,000,000	8,000,000
Max # of VLANs	4,096	4,096	4,096	4,096	4,096
RIP	Yes	Yes	Yes	Yes	Yes
OSPF	Yes	Yes	Yes	Yes	Yes
BGP-4	Yes	Yes	Yes	Yes	Yes
IGMP	Yes	Yes	Yes	Yes	Yes
DVMRP	Yes	Yes	Yes	Yes	Yes
VRRP	Yes	Yes	Yes	Yes	Yes
PIM	Future	Future	Future	Future	Future
802.1p Priority	Yes	Yes	Yes	Yes	Yes
802.1Q VLANs	Yes	Yes	Yes	Yes	Yes
MPLS	Yes	Yes	Yes	Yes	Yes
HRT	Yes	Yes	Yes	Yes	Yes
RMON1 Groups	9	9	9	9	9
RMON2 Groups	9	9	9	9	9
LFAP	Yes	Yes	Yes	Yes	Yes
Link Aggregation	Yes	Yes	Yes	Yes	Yes
Layer 4 Filtering	Yes	Yes	Yes	Yes	Yes
Layer 4 Bridging	Yes	Yes	Yes	Yes	Yes
Flow/Port/Aggregate Rate Limiting	Yes	Yes	Yes	Yes	Yes
ACLs	20,000	20,000	20,000	20,000	20,000
NAT/PAT	Yes	Yes	Yes	Yes	Yes
Number of Queues	4	4	4	4	4
Jumbo Frame Support	Yes	Yes	Yes	Yes	Yes
WFQ	Yes	Yes	Yes	Yes	Yes
WRED	Yes	Yes	Yes	Yes	Yes
Server Load Balancing	Hardware-based	Hardware-based	Hardware-based	Hardware-based	Hardware-based
SSH	Yes	Yes	Yes	Yes	Yes
SNMPv3	Yes	Yes	Yes	Yes	Yes
Radius	Yes	Yes	Yes	Yes	Yes
TACACS+	Yes	Yes	Yes	Yes	Yes
Secure ID	Yes	Yes	Yes	Yes	Yes
Redundant Processor			Yes	Yes	Yes
Redundant Fabric			Yes	Yes	Yes
Hot Swap Modules			Yes	Yes	Yes
Redundant PS	Yes	Yes	Yes	Yes	Yes
-48 DC	Yes	Yes	Yes	Yes	Yes
NEBS			Yes	Yes	Yes

RS 1000/3000
Optical Metro Access Routers

Product Overview

The RS 1000 and RS 3000 are Riverstone's optical metro access routers, among the most widely deployed access platforms in the metro. Featuring metro-optimized MPLS, full function routing and switching, dynamic bandwidth provisioning, and connection-oriented accounting, these products extend the delivery of intelligent IP services to the metro access edge. At the same time, the RS 1000 and RS 3000 combine a compact form factor with high port density to reduce operational costs and improve service provider margins.

A key factor in the popularity of these routers is their unique ability to deliver Layer 2 and Layer 3 services to the access edge over both legacy and optical networks. The RS 1000 and the RS 3000 both feature two flexible media slots that accommodate Fast Ethernet, Gigabit Ethernet, T1/E1, T3/E3, ATM, and DWDM lambda add/drops. The RS 3000 also features 32 fixed configuration 10/100 ports for high-density building access over fast Ethernet.

Applications and Positioning

The RS 1000 and RS 3000 are both access platforms that are typically used in the building basement to connect enterprise subscribers to metro and WAN networks. Service providers have deployed the RS 1000 and RS 3000 to extend metro Ethernet deployments to customers with last-mile TDM access, to offer VLAN-based or MPLS-based Transparent LAN services over a wide-area ATM network, or to simply provide fast Ethernet access with Gigabit uplinks.

Like all Riverstone routers, the RS 1000 and RS 3000 feature the same core technology, including a common set of ASICs and the same system software. Interface cards are interchangeable between these two products. The RS 1000 and RS 3000 also share the same 2-rack unit form factor and are suitable for many of the same applications. The key difference between these products is that the RS 3000 features 32 fixed configuration 10/100 ports that are absent on the RS 1000. Which product is appropriate for a given customer will depend on the specific access configuration required.

Key Benefits and Selling Points

IP service delivery to the access edge: The broad range of interfaces supported on the RS 1000 and RS 3000 means that service providers can extend their IP/Ethernet services to subscribers regardless of the last mile access technology in place. And the flexible, modular design of the RS 1000/3000 platform means service providers can migrate seamlessly from legacy to optical infrastructure. Interface options available for the RS 1000 and RS 3000 include T1/E1, T3/E3, 10/100 and Gigabit Ethernet, ATM, and DWDM.

Value-added services closer to the end-user: Because all Riverstone routers share the same core technology, the RS 1000 and RS 3000 feature all the robust service-creation technologies found on the largest core edge router. This means service providers can deploy value-added services right at the customers' premises for true end-to-end service delivery. And since all service-enabling features are implemented in hardware, performance never suffers when they are activated. Examples of key service-enabling technologies featured in the RS 1000/3000 include:
- Metro-optimized MPLS in hardware, enabling service providers to activate VPN and traffic prioritization services right at the access edge for end-to-end VPNs and QoS
- Hardware-based rate limiting on every port supports dynamic bandwidth provisioning at the subscriber level
- Reliable support for the full 4,096 VLANs specified in 802.1Q provides service providers and their customers with an easy method of rolling out VPNs and segmenting traffic
- Carrier-class routing, featuring Tier 1-certified implementations of OSPF and BGP-4

Services billing at the customer level: The RS 1000 and RS 3000 feature Riverstone's unique billing and accounting technology – the only irrefutable services accounting solution on the market. This enables service providers to capture services accounting data at the access edge. Key accounting features include:
- The industry's only connection-oriented (TCP-based) accounting solution, ensuring that critical accounting data will never be lost
- All accounting features in hardware for wire speed network performance with accounting enabled
- All RMON I and RMON II groups on every port for unmatched granularity of accounting data

Wire-speed security at the subscriber site: The RS 1000 and RS 3000 bring the full security capabilities of Riverstone's core ASIC set directly to the customer site, providing user, address, application, and port-level security. Key security features include:
- All security features in hardware so network performance never suffers when security is activated
- Up to 20,000 access control lists (ACLs) or Layer 2 filters
- Hardware-based network address translation (NAT)

High port density on the RS 3000: The RS 3000 features as many as 64 10/100 ports in a 2-rack unit form factor, offering service providers an efficient platform for conserving rack space.
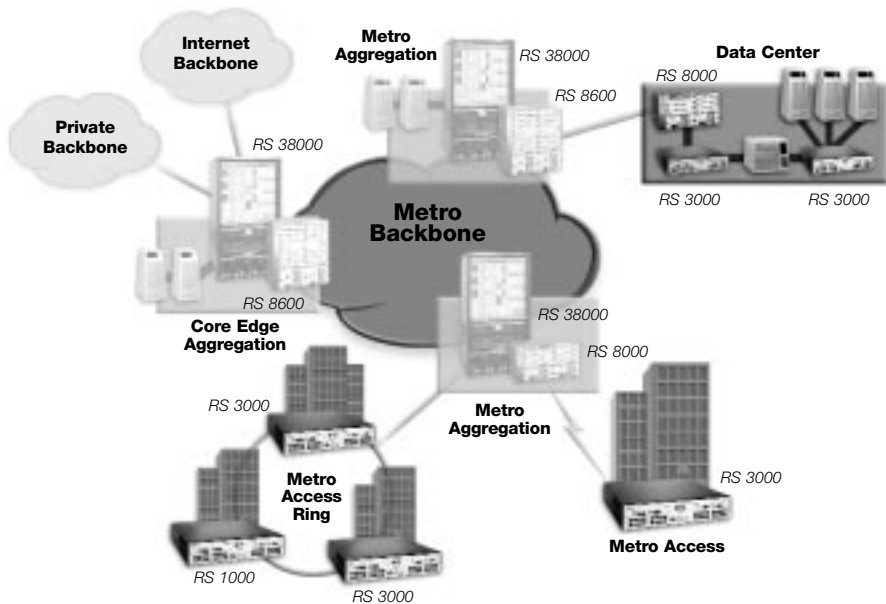
RS 1000

RS 3000

Ordering Information

RS 1000 Base Module

Part Number	Description
G10-B128	RS 1000 base unit with 128 MB. Includes RS router services and a single AC power supply. (Line cards are not included)
G10-B128-DC	RS 1000 base unit with 128 MB. Includes RS router services and a DC single power supply. (Line cards are not included.)

RS 3000 Base Module

G30-B128	RS 3000 base unit with 128 MB, 32-port 10/100 Base-TX RJ-45, and two expansion slots. Includes RS router services software, redundant power supply
G30-B256	RS 3000 base unit with 256 MB, 32-port 10/100 Base-TX RJ-45, and two expansion slots. Includes RS router services software, redundant power supplies
G30-B128-DC	RS 3000 base unit with 128 MB, 32-port 10/100 Base-TX RJ-45, and two expansion slots. Includes RS router services software, redundant DC power supplies

RS 1000 and 3000 Ethernet Modules

G2M-HFXA4-08	8-port 100 Base-FX expansion module for RS 1000/3000 with MT-RJ connectors
G2M-GLHA8-01	1-port 70 km 1000 Base-LX Gigabit Ethernet module (built to order)
G2M-HTXA2-08	8-port 10/100 Base-TX expansion module
G3M-GSXB1-02	2-port 1000 Base-SX module via SC connectors with 16 MB memory
G3M-GLXB9-02	2-port 1000 Base-LX module via SC connector with 16 MB memory
G3M-HTXB2-16	16-port 10/100 TX module via Cat 5 RJ-45 with 16 MB memory
G3M-GBCMM-02	2-port MPLS GbE base module; requires GBICs (maximum 2)
GIC-11	1-port GBIC 1000 Base-SX (MMF, SC)
GIC-19	1-port GBIC 1000 Base-LX-IR (SMF-IR), SC
GIC-18	1-port GBIC 1000 Base-LX-IR (SMF-LR), SC

RS 1000 and 3000 WAN Modules

G2M-HSIAC-02	2-port HSSI module
G2M-SERAC-02	2-port Serial module
G2M-SECAC-04	4-port Serial module with compression
G2M-SCEAC-04	4-port Serial module with compression and encryption
G2M-DE1BM-04	2-slot Multirate WAN module, requires WICs to support different interface rate (max of 2 per card)
WICT1-12	2-port T1 WAN Interface card for WAN base module
WICE1-12	2-port E1 WAN Interface card for WAN base module
WICT3-1B	1-port T3 Clear Channel WAN Interface card
WICE3-1B	1-port E3 Clear Channel WAN Interface card

RS 3000 WAN Module

G3M-A03BM-02	2-port ATM base module; requires physical modules for connectivity (max of 2 per base module)
AIC-67	1-port DS-3/T3 physical module (coax)
AIC-77	1-port E-3 physical module (coax)
AIC-21	1-port OC-3c MMF physical module; SC connector
AIC-29IR	1-port OC-3c SMF-IR physical module; SC connector

Other Components

G2M-HSIAC-02	2-port HSSI module
G2M-SERAC-02	2-port Serial module

RS 1000

RS 3000

Minimum Configuration

- **Chassis** (comes with firmware)

- **Line card** (optional for RS 3000)

Competitive Matrix

Features	Riverstone RS 1000/ RS 3000	Extreme Summit 48	Foundry FastIron 4802	Cisco 2948-L3
Service-Enabling Technologies				
Hardware-based MPLS on Ethernet and POS	*Yes*	*No*	*No*	*No*
Hardware-based rate limiting	*Yes*	*Yes*	*Yes*	*Yes*
Support for 4,096 VLANs	*Yes*	*No*	*Yes*	*No*
Server load balancing	*Yes*	*Yes*	*No*	*No*
20,000 ACLs at wire speed	*Yes*	*No*	*No*	*No*
Hardware-based NAT	*Yes*	*No*	*No*	*No*
Superior Connectivity	*Available media interfaces and port densities*			
10/100	*32-64*	*48*	*48*	*48*
GbE	*4*	*1-2*	*2*	*1-2*
Serial	*8*	*NA*	*NA*	*1-2*
HSSI	*4*	*NA*	*NA*	*1-2*
T1/E1	*8*	*NA*	*NA*	*1-2*
T3/E3	*4*	*NA*	*NA*	*1-2*
ATM	*4*	*NA*	*NA*	*1-2*
DWDM	*2*	*NA*	*NA*	*1-2*
Accounting Features				
Real time billing data (wire speed accounting features)	*Yes*	*No*	*No*	*No*
Full RMON I and II in hardware	*Yes*	*No*	*No*	*No*
Protection against lost accounting data (connection-oriented accounting)	*Yes*	*No*	*No*	*No*

Technical Specifications

(See tables on pages 9–12 for additional platform features)

Platform Features
Hardware-based MPLS
Hardware Rate Limiting
Local hardware routing table
VLANs based on port or protocol
IP routing, unicast, and multicast
Security (ACLs, L2 filters)
Layer 4 application-flow switching and QoS
Network Address Translation (NAT)
Server Load Balancing (LSNAT)
Hardware-based WAN compression and encryption

Highly Fault Tolerant
Redundant power supply
Standards-based VRRP

Extensive Management
Wire-speed full RMON/RMON2
SNMP manageable
Telnet client
RS-232 (out-of-band management)
Command Line Interface (CLI)

Interfaces
- 100 Base-FX
- 1000 Base-SX (with or without MPLS)
- 1000 Base-LX (with or without MPLS)
- 1000 Base-LH (70 km) (with or without MPLS)
- T1/E1, Channelized
- Serial T1/E1, T3/E3
- ATM-OC-3c

Specifications
Up to 4,096 VLANs
Up to 256,000 routes
Up to 20,000 security/access control filters
Up to 512,000 Layer 4 application flows
Up to 256,000 Layer 2 MAC addresses

Capacity and Performance
6/8 Gbps non-blocking switching fabric
4.6/9.5 million packets per second routing throughput
MTBF (predicted) > 200,000 hours

Physical
Dimensions:	2.8" H x 17" W x 18.5" D (7.1cm x 43.2cm x 47cm)
Weight:	20 lbs. (9.1kg)

RS 8000/8600
Flexible Multi-service Metro Routers

Product Overview

The RS 8000 and RS 8600 are high-performance, all-purpose metro routers capable of providing both access and aggregation services in any type of metro network. Among the most widely deployed routers in the metro, the RS 8000 and RS 8600 combine powerful service creation capabilities with a full range of optical and legacy interfaces in a compact, NEBS-compliant platform. The RS 8000 and RS 8600 provide an ideal service-provisioning platform for service providers in the metro, featuring powerful service creation tools such as Riverstone's metro-optimized MPLS, hardware-based rate limiting, and connection-oriented accounting architecture.

Versatile connectivity is a major factor in the success of the RS 8000/8600. These products are capable of delivering services over the full range of media types found in metro networks, including TDM, WDM, POS/SDH, ATM, cable (CMTS), and Fast and Gigabit Ethernet. Support for OC-48 packet ring (RPR) is scheduled for early 2002.

Applications and Positioning

The RS 8000 and RS 8600 act primarily as versatile aggregation routers. They are typically positioned in the metro POP or at the data center gateway, where they serve to aggregate traffic over a variety of media types and provide uplinks to the Internet core edge. These products are also suitable as high-density access routers for large MTUs and enterprise campus environments. Other, more specialized applications include broadband cable aggregation (CMTS) and aggregation/routing alongside a voice gateway as part of a class 4/5 switch replacement in the central office.

Like all Riverstone routers, the RS 8000 and RS 8600 share the same core technology, including a common set of ASICs and the same system software. The RS 8000 and RS 8600 also use the same interface cards. The principal distinction between the RS 8000 and the RS 8600 is size and capacity. The RS 8000 features a 5-rack unit chassis with 8 slots and a 16 Gbps backplane. The RS 8600 features an 11-rack unit chassis with 16 slots and a 32 Gbps backplane. Which product is appropriate for a given application will depend on the port density and throughput requirements of that application.

Key Benefits and Selling Points

Interoperability across legacy and emerging backbone media: Effective metro aggregation requires the flexibility to aggregate traffic of all media types and provide a range of uplink alternatives. The RS 8000 and RS 8600 are all-purpose metro aggregation routers, supporting an industry-leading set of WAN connectivity options. And the flexible, modular design of the RS 8000/8600 means service providers can migrate seamlessly from legacy to optical infrastructure. Available interfaces include ATM, POS/SDH, T1/E1, T3/E3, 10/100 and Gigabit Ethernet (see table on page 9 for available interfaces).

Robust services provisioning: The RS 8000 and RS 8600 support an unrivalled range of service-enabling technologies, allowing service providers to seamlessly extend value-added services across the metro to the core edge. Hardware implementations ensure wire speed performance with all features enabled. Key service-enabling technologies include:
- Carrier-class routing, featuring Tier 1-certified implementations of OSPF, BGP-4, and IS-IS
- Metro-optimized MPLS in hardware, enabling the RS 8000/8600 platform to act as an LER or LSR to extend VPN and traffic prioritization services across the metro, across the country, or around the world
- Reliable support for the full 4,096 VLANS specified in 802.1Q, and VLAN to LSP mapping
- Hardware-based rate limiting on every port, enabling dynamic bandwidth provisioning at both the wholesale level and the subscriber level
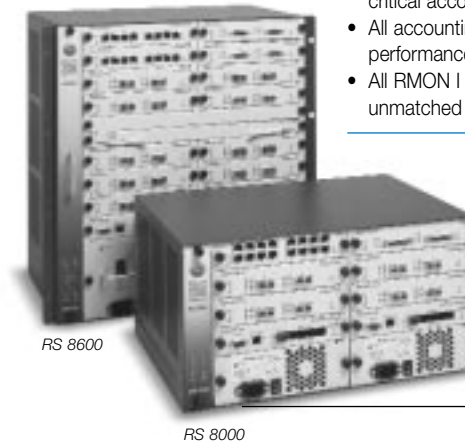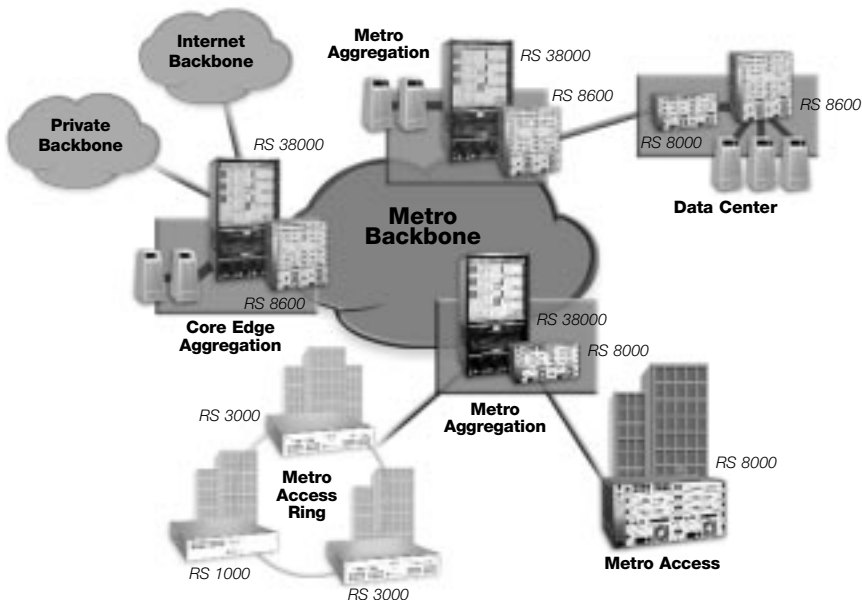
Carrier-class reliability: Network reliability is a paramount concern in the metro POP or data center. The RS 8000/8600 is a fully NEBS-compliant, carrier-class router with a range of battle-tested redundancy mechanisms. Key reliability features include:
- NEBS level 3 certification
- Redundant CPU, power supplies and switching fabric
- Hot-swappable media modules
- Standards-based virtual router redundancy protocol (VRRP)
- Highly stable, Tier 1-certified routing code
- Self-healing route paths (OSPF multipath, MLPPP, and Smart Trunking)

Services billing at the customer site or POP: Retail service providers need accurate wire speed accounting for each subscriber at the access edge, while wholesale service providers need reliable billing for their carrier customers in the metro POP. Whether the RS 8000/8600 is deployed as an access router or as an aggregation platform, it leverages Riverstone's unique billing and accounting technology – the only irrefutable services accounting solution on the market. Key accounting features include:
- The industry's only connection-oriented (TCP-based) accounting solution ensures that critical accounting data will never be lost
- All accounting features in hardware for wire speed network performance with accounting enabled
- All RMON I and RMON II groups on every port for unmatched granularity of accounting data

High port density: Compact, high-density routers enable service providers to save colocation costs in the metro POP or data center and reduce the number of elements in their networks. The RS 8000 and RS 8600 deliver high port density in a compact, modular, chassis-based platform capable of scaling with customer needs. (See page 9 for specific port densities).

Internet Backbone • Metro Aggregation • RS 38000 • RS 8600 • RS 8600 • RS 8000 • Private Backbone • RS 38000 • Data Center • Metro Backbone • RS 8600 • Core Edge Aggregation • RS 38000 • RS 8000 • RS 3000 • Metro Aggregation • RS 8000 • Metro Access Ring • RS 8000 • RS 1000 • RS 3000 • Metro Access

RS 8600

RS 8000

Ordering Information

RS 8000 and 8600 Base Modules

Part Number	Description
G86-CHS	RS 8600 16-slot base system including chassis, Switch Fabric Module, backplane, and modular fan
G80-CHS	RS 8000 8-slot base system including chassis, backplane, and modular fan
G86-PAC	AC power supply for the RS 8600
G86-PDC	DC power supply module for the RS 8600
G80-PAC	AC power supply module for the RS 8000
G80-PDC	DC power supply module for the RS 8000
G8M-CM2-128	RS 8x00 Control Module 2 with 128 MB memory
G8M-CM3-256	RS 8600 Control Module 3 with 256 MB memory
G86-SWF	RS 8600 Switch Fabric Module. One module ships with the base system Order only if second is required for redundancy
G86-FAN	RS 8600 fan tray module (field replacement unit)
G80-FAN	RS 8000 fan tray module (field replacement unit)

RS 8000 and 8600 Ethernet Modules

G8M-GLHB8-02	2-port 1000 Base-LLX (Long Haul) module via SC connector with 16 MB memory (70 km); build to order
G8M-GLXB9-02	2-port 1000 Base-LX module via SC connector with 16 MB memory
G8M-GSXB1-02	2-port 1000 Base-SX module via SC connectors with 16 MB memory
G8M-GTXB2-02	2-port 1000 Base-T module via Category 5 RJ-45 with 16 MB memory
G8M-HFXA1-08	8-port 100 Base-FX module, MMF SC ports, and 16 MB memory (supporting up to 2,000,000 flows per RS system)
G8M-HTXA2-08	8-port 10/100 Base-TX module, Cat 5 RJ-45 ports, and 16 MB memory (supporting up to 2,000,000 flows per RS system)
G8M-HTXB2-16	16-port 10/100 TX module via Cat 5 RJ-45 with 16 MB memory
G8M-GBCMM-02	RS 8x00 2-port MPLS GbE base module; requires GBIC modules (maximum 2)
G8M-GBCDM-02	RS 8x00 2-port GBIC based GbE base module; requires GBIC modules (maximum 2)
GIC-11	1-port GBIC 1000 Base-SX (MMF, SC)
GIC-19	1-port GBIC 1000 Base-LX-IR (SMF-IR), SC
GIC-18	1-port GBIC 1000 Base-LX-LR (SMF-LR), SC

RS 8000 and 8600 WAN Modules

G8M-HSIAC-02	2-port HSSI module
G8M-SECAC-04	4-port Serial module with compression
G8M-SCEAC-04	4-port Serial module with compression and encryption
G8M-DE1BM-04	2-slot Multirate WAN module for RS 8x00, requires WICs to support different interface rate (max of 2 per card). Support 4 DS1 with 2 WICT1-12
WICT1-12	2-port T1 WAN Interface card for WAN base module
WICE1-12	2-port E1 WAN Interface card for WAN base module
WICT3-1B	1-port T3 Clear Channel WAN Interface card
WICE3-1B	1-port E3 Clear Channel WAN Interface card
G8M-CT3BB-02	2-port channelized T3 line card for RS 8x00
G8M-A03BM-02	2-port ATM base module; requires physical modules for connectivity (2 per base module)
AIC-67	1-port DS-3/T3 physical module (coax)
AIC-77	1-port E-3 physical module (coax)
AIC-21	1-port OC-3c MMF physical module; SC connector
AIC-29IR	1-port OC-3c SMF-IR physical module; SC connector
G8M-P03B1-04	4-port OC-3c/STM-1 Packet over SONET/SDH MMF module; MT-RJ connectors
G8M-P03B9-04	4-port OC-3c/STM-1 Packet over SONET/SDH SMF-IR module; MT-RJ connectors
G8M-P12B1-02	2-port OC-12c/STM-4 Packet over SONET/SDH MMF module; SC connectors
G8M-P12B9-02	2-port OC-12c/STM-4 Packet over SONET/SDH SMF-IR module; SC connectors
G8M-A12B1-02	1 + 1 OC-12c/STM-4 ATM MMF module
G8M-A12B9-02	1 + 1 OC-12c/STM-4 ATM SMF-IR module

Other Components

SYS-OS-16	RS Router Services: Include IP routing (RIP v2, OSPF, BGP), QoS services. One required with every RS chassis, shipped on 16 MB PCMCIA card
SYS-PCM16	RS 8x00, 16000, and 38000 16 MB PCMCIA card, upgrade option (SYS-OS ships with 8 MB)
SYS-MEM128	128 MB control module memory upgrade kit for the RS 8x00
SYS-MEM256-D	256 MB control module memory upgrade kit for the RS 8x00 and 38000

Minimum Configuration

- Base chassis
- Power supply
- Control module
- System OS
- Line card

Competitive Matrix

Features	Riverstone RS 8000/ RS 8600	Extreme Alpine 380x	Foundry BigIron 4000/8000	Cisco Catalyst 6506
Service-Enabling Technologies				
Hardware-based MPLS on Ethernet and POS	Yes	No	No	Yes
Hardware-based rate limiting	Yes	Yes	No	Yes
Support for 4,096 VLANs	Yes	No	Yes	Partial*
20,000 ACLs at wire speed	Yes	No	No	No
Hardware-based NAT	Yes	No	No	No***
Superior Connectivity	*Available media interfaces and port densities*			
10/100	112-240	128-256	88-184	240
GbE	14-30	16-32	32-64	40**
Serial	28-60	NA	NA	NA
HSSI	14-30	NA	NA	NA
T1/E1	28-60	16-32	NA	NA
T3/E3	14-30	NA	NA	NA
ATM DS-3	14-30	NA	NA	NA
ATM OC-3	14-30	NA	12-28	NA
ATM OC-12	7-15	NA	NA	5
POS/SDH OC-3	28-60	NA	NA	80
POS/SDH OC-12	14-30	NA	6-14	20
RPR OC-48	6-14	NA	6-14	NA
Accounting Features				
Real time billing data (wire speed accounting features on all ports)	Yes	No	No	No***
Full RMON I and II in hardware	Yes	No	No	No
Protection against lost accounting data (connection-oriented accounting)	Yes	No	No	No
BGP accounting at wire speed	Yes	No	No	No

*   Certain configurations of the 6506 can support 4096 VLANs, but many do not.
**   Assumes 5 payload slots populated with 8-port cards. There is a 16-port GbE card available for this chassis, but the backplane capacity of the 6505 is only 32 gbps, which means that even with 8-port cards the box is oversubscribed.
***   This functionality is available through an additional specialized line card that increases expense and decreases port density.

Technical Specifications
(See tables on pages 9–12 for additional platform features)

Platform Features
Hardware-based MPLS
VLANs based on port or protocol
IP routing, unicast, and multicast
Security (ACLs, L2 filters)
Layer 4 application-flow switching and QoS
Network Address Translation (NAT)
Server Load Balancing (LSNAT)
Hardware-based WAN compression and encryption
Hardware-based Rate Limiting
Jumbo Frame Support

Highly Fault Tolerant
Redundant CPU, power supply, and switching fabric
Hot-swappable media modules
Standards-based VRRP

Extensive Management
Wire-speed full RMON/RMON2
SNMP manageable
Telnet client
RS-232 (out-of-band management)
Command Line Interface (CLI)

Specifications
Up to 4,096 VLANs
Up to 250,000 routes
Up to 20,000 security/access control filters
MTBF (predicted) > 200,000 hours

Interfaces
- 10/100 Base-TX
- 100 Base-FX
- 1000 Base-T
- 1000 Base-SX (with or without MPLS)
- 1000 Base-LX (with or without MPLS)
- 1000 Base-LH (with or without MPLS)
- T1/E1, Serial
- T3/E3, HSSI/clear channel
- Channelized T3/E3
- ATM (DS-3, OC-3c, OC-12c/STM-4)
- POS (OC-3c/STM-1, OC-12c/STM-4)

RS 8000 (8-slot chassis) Capacity & Performance
16 Gbps non-blocking switching fabric
15 million packets per second routing throughput
Up to 2,000,000 Layer 4 application flows
Up to 400,000 Layer 2 MAC addresses performance

Physical
Dimensions: 8.75" H x 17.25" W x 12.25" D (22.23cm x 43.82cm x 31.12cm)
Weight: 44.5 lbs (20.2kg)

RS 8600 (16-slot chassis) Capacity & Performance
32 Gbps non-blocking switching fabric
30 million packets per second routing throughput
Up to 4,000,000 Layer 4 application flows
Up to 800,000 Layer 2 MAC addresses performance

Physical
Dimensions: 19.25" H x 17.25" W x 12.25" D (48.9cm x 43.82cm x 31.12cm)
Weight: 61.75 lbs (28kg)

RS 16000 High Density Gigabit Ethernet Router

Product Overview

The RS 16000 is a new generation of aggregation router designed to aggregate Gigabit Ethernet at line rate while enabling 10 Gigabit metro networks. It provides full Metro service-creation capabilities through a hardware-based architecture in the industry's highest density chassis for Gigabit Ethernet aggregation. The RS 16000 delivers 60 wire-speed Gigabit Ethernet ports in a 5-rack unit chassis, saving rack space and decreasing operational complexity by reducing the number of deployed network elements. The modular chassis is designed to grow as customers are added — the RS 16000 can be deployed with as few as 4 Gigabit Ethernet ports, and is expandable up to 60 full wire-speed Gigabit Ethernet ports. In addition, the RS 16000's bandwidth capacity will scale as the network grows by supporting 8 Gigabit/CWDM and will support 10 Gigabit Ethernet as the standard is finalized.

Like all Riverstone RS routers, the RS 16000 features full-function routing capabilities — OSPF, BGP-4, and IS-IS — as well as an unmatched range of service-enabling features, including on-demand bandwidth provisioning

and hardware-based MPLS VPNs. By supporting Riverstone's Metro-optimized MPLS implementation, the RS 16000 serves as an ideal Label Edge Router (LER) or Label Switch Router (LSR) for deployment of an MPLS VPN, Transparent LAN, or Virtual Leased Line solution. Riverstone's Lightweight Flow Accounting Protocol (LFAP) enables reliable, real-time billing with wire-speed data collection to turn network services into profit generating revenue. Overall, the RS 16000 is designed for maximum capabilities at a minimum size for the most demanding points in a service provider's network.

Applications and Positioning

The RS 16000 is designed for high-density aggregation of Gigabit Ethernet traffic in the metro POP or data center. Whereas the RS 8000 and RS 8600 are positioned as versatile aggregation and access routers capable of processing traffic over any media type, the RS 16000 is targeted specifically at Gigabit aggregation opportunities. With 10 Gigabit Ethernet and CWDM uplinks, the RS 16000 is also suitable for building out a metro core and providing high-speed uplinks to the Internet core edge. The RS 16000 features the same core technology as the rest of the RS family, including a common set of ASICs and the same system software, enabling it to support the full range of service applications available with other Riverstone products.

Key Benefits and Selling Points

Highest Gigabit Ethernet port density on the market: Higher port density means reduced colocation costs and greater revenue potential per rack. Dense routers also enable service providers to reduce the number of network elements, leading to simpler networks and lower operating costs. The RS 16000 is the densest Gigabit aggregation platform on the market by far.
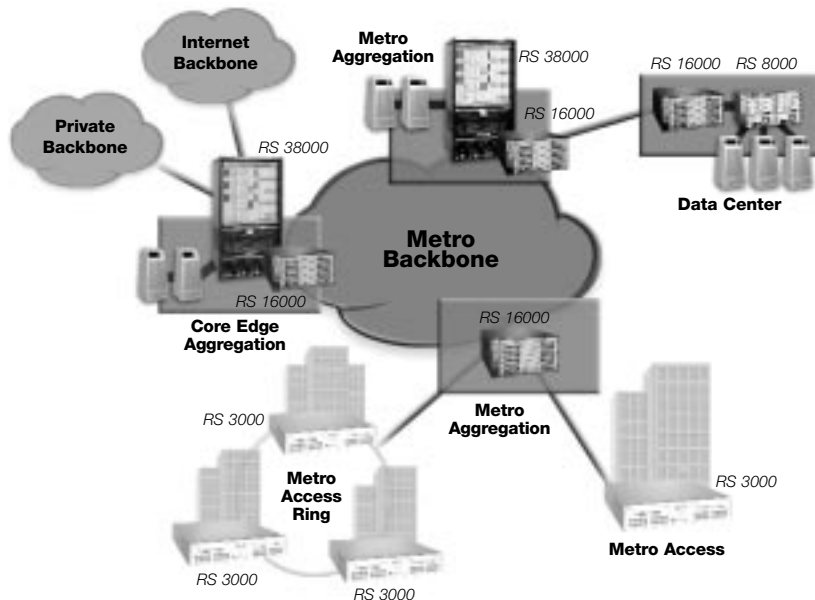- 60 wire-speed GbE ports in a 5-rack unit form factor (8.75 inches) – over 70% more ports per rack-inch than the nearest competitor
- Up to 540 GbE ports in a standard 7-foot rack – almost 90% greater capacity than the nearest competitor

Massive scalability and uplink capacity: Service providers need substantial uplink capacity to backhaul their metro POP and data center traffic, and to build out regional transport networks. The RS 16000 meets this need with a choice of high-capacity uplink options.
- Wire-speed 10 Gigabit Ethernet, scheduled for release in the near future
- CWDM links delivering 4 Gbps of bi-directional data over a single pair of fiber and transport over distances up to 70 km
- Modular, chassis-based platform that allows scaling from 4 to 60 wire-speed GbE ports
- 170 Gbps switch fabric capacity, ensuring wire-speed performance even when router is fully populated

Cutting-edge service capabilities: The RS 16000 supports an unrivalled range of service-enabling technologies, allowing service providers to seamlessly extend value-added services across the metro to the core edge. Hardware implementations ensure wire-speed performance with all features enabled. Key service-enabling technologies include:
- Carrier-class routing, featuring Tier 1-certified implementations of OSPF, BGP-4, and IS-IS
- Metro-optimized MPLS in hardware, enabling the RS 16000 platform to act as an LER or LSR to extend VPN and traffic prioritization services across the metro, across the country, or around the world
- Reliable support for the full 4,096 VLANs specified in 802.1q, and VLAN to LSP mapping
- Hardware-based rate limiting on every port, enabling dynamic bandwidth provisioning at the wholesale level
- Irrefutable services accounting at wire-speed, featuring the industry's only connection-oriented accounting solution with full RMON I and II on every port in hardware

Internet Backbone
Metro Aggregation
RS 38000
RS 16000
RS 16000   RS 8000
Private Backbone
RS 38000
RS 16000
Data Center
Metro Backbone
RS 16000
Core Edge Aggregation
Metro Aggregation
RS 3000
Metro Access Ring
RS 3000
RS 3000   RS 3000
Metro Access

RS 16000

Ordering Information

RS 16000 Base Module

Part Number	Description
R16-CHS	Chassis, which includes backplane, switching fabric, clock
R16-CM4EG-04	Control module with 256 MB (upgradeable to 512 MB), 1 RJ-45 10/100 port, and 4 non-MPLS Gigabit Ethernet ports
R16-CM4EF-12	Control module with 256 MB (upgradeable to 512 MB), 1 RJ-45 10/100 port, and 12 10/100 ports through a telco adapter
R16-PDC	DC power supply
R16-PAC	AC power supply

RS 16000 Ethernet Modules

R16-GSFEM-08	8-port SFP GbE Card (requires SFP GBICs)
R16-GSFNM-08	8-port GbE SFP Card MPLS (requires SFP GBICs)
SFP-SX*	1-port MMF SFP SX (Quantity 4)
SFP-LX*	1-port SMF SFP LX (Quantity 2)
SFP-LH*	1-port SMF SFP LH
R16-WDME8B-02	CWDM bi-directional
R16-WDME8U-02	CWDM uni-directional

Other Components

SYS-OS-16	RS Router Services: Include IP routing (RIP v2, OSPF, BGP), QoS services. One required with every RS chassis, shipped on 16 MB PCMCIA card
SYS-PCM16	RS 8x00, 16000, and 38000 16 MB PCMCIA card – (ships with SYS-OS-16, second required for redundant CM configuration)

*SFP small form factor plugable or mini GBIC

Minimum Configuration

• Base chassis
• Power supply
• Control module
• System OS
• Line card and SFPs

RS 16000

Competitive Matrix

Features	Riverstone RS 16000	Foundry BigIron 4000	Foundry BigIron 8000	Extreme Alpine 380x	Extreme Black Diamond 6808	Cisco Catalyst 6509
Service-Enabling Technologies						
Hardware-based MPLS	**Yes**	Yes	Yes	No	No	Yes
Hardware-based rate limiting	**Yes**	No	No	Yes	Yes	Yes
Support for 4,096 VLANs	**Yes**	Yes	Yes	No	No	Partial*
20,000 ACLs at wire speed	**Yes**	No	No	No	No	No
Hardware-based NAT	**Yes**	No	No	No	No	No***
Superior Connectivity	*Available media interfaces and port densities*					
GbE ports per rack	**540**	288	256	128	128	128**
10 GbE support	**Yes**	No	No	No	No	No
CWDM support	**Yes**	No	No	No	No	No
Accounting Features						
Real time billing data	Yes	No	No	No	No	No***
(wire speed accounting features on all ports)						
Full RMON I and II in hardware	**Yes**	No	No	No	No	No
Protection against lost accounting data (connection-oriented accounting)	**Yes**	No	No	No	No	No
BGP accounting at wire speed	**Yes**	No	No	No	No	No

* Certain configurations of the 6509 can support 4096 VLANs, but many do not.
** Based on vertical slot model with 256 Gbps backplane. Increasing port count would require use of non-NEBS-compliant horizontal slot model or smaller (30 Gbps) switch fabric, which is insufficient to handle high port counts.
*** This functionality is available through an additional specialized line card that increases expense and decreases port density.

Technical Specifications
(See tables on pages 9–12 for additional platform features)

Platform Features
Hardware-based MPLS
IP routing, unicast, and multicast
Routing in hardware on each line card
LSR and LER MPLS support in hardware
RSVP-TE and LDP-CR traffic engineering support
Security (ACLs, L2 filters)
Layer 4 application-flow switching and QoS
Network Address Translation (NAT)
Hardware-based Rate Limiting
Jumbo Frame support
VLANs based on port or protocol
Managed Services Server Load Balancing (LSNAT)

Highly Fault Tolerant
Redundant CPU, power supplies
Hot-swappable media modules
Standards-based VRRP
Layer 2 and 3 redundant protocol support

Extensive Management
Wire-speed full RMON/RMON2
SNMP manageable
SSH and Telnet client secured by:
RADIUS
TACACS+
RS-232 (out-of-band management)
Command Line Interface (CLI)

Interfaces
• 10/100 Base-TX (on control module)
• 1000 Base-SX (with or without MPLS)
• 1000 Base-LX (with or without MPLS)
• 1000 Base-LH (with or without MPLS)
• 4 GbE Lambda on bi-directional CWDM (intermediate range)
• 4 GbE Lambda on uni-directional CWDM (long range)
• 10 GbE (scheduled for release)

Specifications
Up to 4,096 VLANs
Up to 250,000 routes
Up to 20,000 security/access control filters
Up to 1,600,000 Layer 2 MAC addresses
Up to 8,000,000 Layer 4 application flows
Up to 170 Gbps non-blocking switching fabric
Up to 90 million packets-per-second routing throughput
MTBF (predicted) > 200,000 hours

Capacity and Performance
Up to 170 Gbps non-blocking switching fabric
Up to 90 million packets-per-second routing throughput
MTBF (predicted) > 200,000 hours

Physical
Dimension: 8.75" H x 17" W x 22" D (22.2 cm x 43.2 cm x 55.9 cm)
Weight: approx. 50 lbs (20 kg)

RS 38000 Service Creation Platform for Core Edge

Product Overview

The RS 38000 is Riverstone's highest capacity metro aggregation router. As the largest member of the RS family, this product sets the standard for service-rich, high-capacity metro aggregation. The RS 38000 is a NEBS-compliant, carrier-class router featuring fully redundant processors, switch fabrics, and power supplies, along with a standards-based implementation of the Virtual Router Redundancy Protocol (VRRP).

Combining powerful service creation capabilities with hardware-based, connection-oriented services accounting, the RS 38000 is also uniquely positioned to extend the delivery of value-added services across backbone networks. At the same time, a broad range of interface options enables the RS 38000 to aggregate traffic and deliver services over any type of optical or legacy network. Overall, the RS 38000 makes the perfect fit for service creation in the most demanding and highest density environments found in today's Metro networks.

Applications and Positioning

The RS 38000 is an aggregation router designed primarily for the Internet core edge, metro core ring, or high density data center. As Riverstone's highest capacity router, it is the appropriate choice wherever service providers require very high capacity aggregation over a variety of media types along with high-speed uplinks. The RS 38000 is ideally suited to serve as an MPLS Label Edge Router (LER) or Label Switch Router (LSR), and sits at the critical juncture for extending metro VPN services over a nationwide ATM or MPLS backbone. It is also suitable for cost-effective CWDM/Ethernet metro backhaul or regional transport networks between access rings, POPs, and data centers. And because it features the same core technology as the rest of the RS family, including a common set of ASICs and the same system software, the RS 38000 is capable of supporting the same rich array of service applications as all other Riverstone routers.
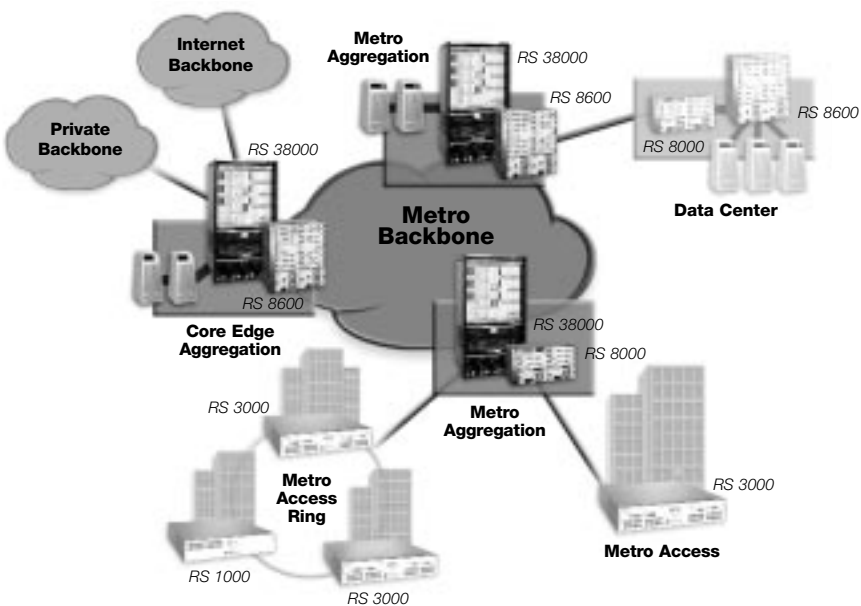
Key Benefits and Selling Points

Carrier-class reliability: When equipment fails at the Internet core edge, the entire network is jeopardized. That's why rock-solid reliability is the paramount concern of service providers operating in this part of the network. The RS 38000 is a fully NEBS-compliant router that delivers a host of redundancy features to ensure carrier-class reliability. Key reliability features include:

- Tier 1-certified routing code, featuring the industry's most stable implementations of OSPF, BGP-4, and IS IS
- NEBS level 3 certification
- Redundant CPU, power supplies, and switching fabric
- Hot-swappable media modules
- Standards-based virtual router redundancy protocol (VRRP)
- Self-healing route paths through OSPF multipath, MLPPP, and Smart Trunking

Streamlined networks through versatile, high-capacity aggregation: Nowhere in the network is the ability to aggregate high traffic volumes over a variety of interfaces more important than at the Internet core edge. Service providers need the ability to gather high-capacity data flows from the full spectrum of metro access and aggregation media, and then uplink that traffic over a range of backhaul technologies – all in a single router. The RS 38000 has the port density and media versatility to accomplish in one box what competitors often do in 2 or 3 box solutions. Key features include:

- High port capacity, with support for up to 480 Fast Ethernet ports and 120 Gigabit Ethernet ports. (See the table on pages 9-10 for full details on port densities)
- Broad range of connectivity options, including Fast Ethernet, GbE, CWDM, POS/SDH, ATM, and T3/E3, with scheduled support for 10 GbE and Packet Ring (RPR). (See the table on page 9 for available interfaces)

Services extension across the backbone: As service providers roll out value-added services to their subscribers, they need to be sure they can deliver those services on an end-to-end basis. The RS 38000 supports an industry-leading set of service-enabling technologies, allowing service providers to extend their service offerings to the Internet core and beyond. Hardware implementations ensure wire-speed performance with all features enabled. Key features include:

- Metro-optimized MPLS in hardware, enabling the RS 38000 to act as an LER or LSR for end-to-end VPN and traffic prioritization services
- Reliable support for the full 4,096 VLANS specified in 802.1q, along with VLAN to LSP mapping
- Hardware-based rate limiting on every port enabling dynamic bandwidth provisioning at the wholesale level
- Irrefutable services billing at wire-speed, featuring the industry's only connection-oriented accounting solution with full RMON I and II and BGP accounting

RS 38000

Ordering Information

RS 38000 Base Module

Part Number	Description
R38-CHS	RS 38000 base chassis with one Switch Fabric Module
R38-PAC	RS 38000 AC power supply (minimum 2 required, 3 or 4 required for redundancy)
R38-PDC	RS 38000 DC power supply (minimum 1 required, 2 required for redundancy)
R38-FAN	RS 38000 fan tray assembly (spare)
R38-SWF	RS 38000 Switching Fabric Module
R38-CM4-256	RS 38000 control module with 256 MB memory

RS 38000 Ethernet Modules

R38-GBCDM-04	RS 38000 4-port 1000 Base; supports max of 4 GBIC module
R38-GBCDM-08	RS 38000 8-port 1000 Base; supports max of 8 GBIC module
R38-HTXD2-24	RS 38000 24-port 10/100 Base-TX module
R38-HTXD3-32	RS 38000 32-port 100 Base-TX module
R38-WDMD9-01	RS 38000 4 lambda over one fiber GbE WDM
R38-GBCMM-04	RS 38000 4-port MPLS GbE Base module; requires GBIC modules (maximum 4)

RS 38000 GBIC Modules

GIC-11	RS GBIC module 1000 Base-SX (MMF, SC)
GIC-19	RS GBIC module 1000 Base-LX-IR (SMF-IR), SC
GIC-18	RS GBIC module 1000 Base-LX-LR (SMF-LR), SC

RS 38000 WAN Modules

R38-CT3DB-04	RS 38000 4-port channelized T3 line card

Other Components

SYS-OS-16	RS Router Services: Includes IP routing (RIP v2, OSPF, BGP), and QoS services. One required with every RS chassis, shipped on 16 MB PCMCIA card
SYS-PCM16	RS 8x00, 16000, and 38000 16 MB PCMCIA card – (ships with SYS-OS-16, second required for redundant CM configuration)
SYS-MEM128	128 MB control module memory upgrade kit for the RS 8x00 and 38000
SYS-MEM256-D	256 MB control module memory upgrade kit for the RS 8x00 and 38000

Minimum Configuration
- Base chassis
- Power supply
- Control module
- System OS
- Line card

RS 38000

Competitive Matrix

Features	Riverstone RS 38000	Extreme Black Diamond	Foundry NetIron	Cisco Catalyst 7600
Service-Enabling Technologies				
Hardware-based MPLS on Ethernet and POS	Yes	No	No	Yes
Hardware-based rate limiting	Yes	Yes	No	Yes
Support for 4,096 VLANs	Yes	No	Yes	Partial*
20,000 ACLs at wire speed	Yes	No	No	No
Hardware-based NAT	Yes	No	No	No***
Superior Connectivity	*Available media interfaces and port densities*			
10/100	480	256	88-184	335
GbE	120	114	32-64	114**
10 GbE	4	NA	NA	NA
CWDM	15	NA	NA	NA
T3/E3	60	NA	NA	NA
ATM OC-3	60	NA	12-28	NA
ATM OC-12	30	NA	NA	7
POS/SDH OC-3	60	NA	6-14	112
POS/SDH OC-12	60	NA	6-14	28
POS/SDH OC-48	15	NA	6-14	7
Accounting Features				
Real time billing data (wire speed accounting features on all ports)	Yes	No	No	No***
Full RMON I and II in hardware	Yes	No	No	No
Protection against lost accounting data (connection-oriented accounting)	Yes	No	No	No
BGP accounting at wire speed	Yes	No	No	No

* Certain configurations of the 7600 can support 4096 VLANs, but many do not.
** Based on vertical slot model with 256 Gbps backplane. Increasing port count would require use of non-NEBS-compliant horizontal slot model or smaller (30 Gbps) switch fabric, which is insufficient to handle high port counts.
*** This functionality is available through an additional specialized line card that increases expense and decreases port density.

Technical Specifications
(See tables on pages 9–12 for additional platform features)

Platform Features
Hardware-based MPLS
VLANs based on port or protocol
IP routing, unicast, and multicast
MPLS and policy-based routing
Security (ACLs, L2 filters)
Layer 4 application-flow switching and QoS
Network Address Translation (NAT)
Server Load Balancing (LSNAT)
Hardware-based WAN compression and encryption
Hardware-based Rate Limiting
Jumbo Frame support

Highly Fault Tolerant
Redundant CPU, power supplies, and switching fabric
Hot-swappable media modules
Standards-based VRRP

Extensive Management
Wire-speed full RMON/RMON2
SNMP manageable
Telnet client secured by:
RADIUS
TACACS+
RS-232 (out-of-band management)
Command Line Interface (CLI)

Interfaces
- 10/100 Base-TX
- 1000 Base-SX (with or without MPLS)
- 1000 Base-LX (with or without MPLS)
- 1000 Base-LH (with or without MPLS)
- Channelized T3
- ATM OC-3c, OC-12c (scheduled for release)
- POS OC-48c, 192c (scheduled for release)
- DWDM (scheduled for release)
- 10 GbE (scheduled for release)

Specifications
Up to 4,096 VLANs
Up to 250,000 routes
Up to 20,000 security/access control filters
Up to 1,600,000 Layer 2 MAC addresses
Up to 8,000,000 Layer 4 application flows

Capacity and Performance
Up to 128 Gbps non-blocking switching fabric
Up to 90 million packets per second routing throughput
MTBF (predicted) > 200,000 hours

Physical
Dimension: 35" H x 17.25" W x 19" D (88.9cm x 43.82cm x 48.26cm)
Weight: 125 lbs. (56.68kg)

Glossary
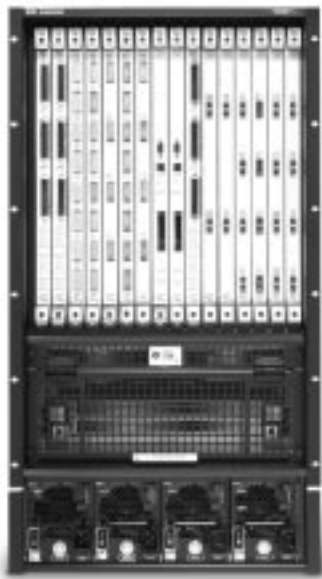
Add/Drop Multiplexer (ADM): A multiplexer capable of extracting or inserting lower-bit-rate signal from a higher-bit-rate multiplexed signal without completely demultiplexing the signal.

Address Resolution Protocol (ARP): Protocol for mapping IP addresses to MAC addresses.

Aggregation: The coalescing of groups of routes that have common addresses into a single entry in the routing table.

Area: In IS-IS and OSPF, a set of contiguous networks and hosts within an AS that have been administratively grouped together.

Automatic Protection Switching (APS): A technology used by SONET ADMs to protect against circuit faults between the ADM and a router, and to protect against failing routers.

Autonomous System (AS): Set of routers under a single technical administration. Each AS normally uses a single interior gateway protocol (IGP) and metrics to propagate routing information within the set of routers.

Backbone Area: In OSPF, an area that consists of all networks in area ID 0.0.0.0, their attached routers, and all area border routers.

Bandwidth: The carrying capacity or size of a communications channel; usually expressed in hertz (cycles per second) for analog circuits (the original meaning of the term), and in bits per second (bps) for digital circuits (newer meaning).

Bit Error Rate Test (BERT): Test that can be run on a T3 interface to determine whether it is operating properly.

Border Gateway Protocol (BGP): Exterior gateway protocol used to exchange routing information among routers in different AS's.

Broadband: Typically refers to copper, it denotes transmission facilities capable of handling a wide range of frequencies simulta-neously, thus permitting multiple channels in data systems rather than direct modulation.

Broadcast: The operation of sending network traffic from one network node to all other network nodes.

Carrier class: Carrier class refers to products designed specifically to meet the capacity, performance scalability, availability and network management requirements of network service providers.

Channel: A generic term for a communica-tions path on a given medium; multiplexing techniques allow providers to put multiple channels over a single medium.

Circuit Switching: A switching system that establishes a dedicated physical com-munication connection between end points, through the network, for the duration of the communication session; this is most often contrasted with packet switching in data communications transmissions.

Classless Interdomain Routing (CIDR): A method of specifying IP addresses in which you explicitly specify the bits of the address that represent the network address instead of determining this information from the first octet of the address.

Client Peer: In a BGP route reflection, a member of a cluster that is not the route reflector. See also nonclient peer.

Cluster: In BGP, a set of routers that have been grouped together. A cluster consists of one system that acts as a route reflector, along with any number of client peers. The client peers receive their route information only from the route reflector system. Routers in a cluster do not need to be fully meshed.

Command-Line Interface (CLI): Interface provided for configuring and monitoring the routing protocol software.

Community: In BGP, a group of destinations that share a common property. Community information is included as one of the path attributes in BGP update messages.

Confederation: A group of BGP systems that appears to external AS's as a single AS.

Complete Sequence Number PDU (CSNP): Packet that contains a complete list of all the LSPs in the IS-IS database.

Connection-Oriented: A term applied to network architectures and services which require the establishment of an end-to-end, predefined circuit prior to the start of a com-munications session. Frame relay circuits are examples of connection-oriented sessions.

Constrained Shortest Path First (CSPF): An algorithm used by MPLS that has been modified to take into account specific restrictions when calculating the shortest path across the network.

Daemon: Background process that performs operations on behalf of the system software and hardware. Daemons normally start when the system software is booted, and they run as long as the software is running.

Damping: A method of reducing the number of update messages sent between BGP peers, thereby reducing the load on these peers, without adversely affecting the route convergence time for stable routes.

Data-Link Connection Identifier (DCLI): Identifier for a Frame Relay virtual connection (also called a logical interface).

Dark Fiber: Fiber-optic cables that have been laid, but have no illuminating signals in them.

Default Address: Router address that is used as the source address on unnumbered interfaces.

Dense Wave Division Multiplexing (DWDM): An optical (analog) multiplexing technique used to increase the carrying capacity of a fiber network beyond what can currently be accomplished by time division multiplexing (TDM) techniques.

Designated Router: In OSPF, a router selected by other routers that is responsible for sending link-state advertisements that describe the network, which reduces the amount of network traffic and the size of the routers' topological databases.

Destination Prefix Length: Number of bits of the network address used for host portion of an IP address. Previously called the subnet mask.

Digital: A data format that uses two physical levels to transmit information corresponding to 0s and 1s. A discrete or discontinuous signal.

Dynamic Host Configuration Protocol (DHCP): Allocates IP addresses dynamically so that they can be reused when they are no longer needed.

Edge Router: A router located at the beginning or end of a label-switching tunnel. (See also MPLS.)

End System: Network entity that send and receives packets.

Exterior Gateway protocol (EGP): Such as BGP.

Egress Router: Last router in a label-switched path (LSP). See ingress router.

External BGP (EBGP): BGP configuration in which sessions are established between routers in different AS's.

Extrinsic: External; outside the fiber.

Fiber: The structure that guides light in a fiber optic system.

Gigahertz (GHz): A unit of frequency that is equal to one billion cycles per second, 109 Hertz.

Group: A collection of related BGP peers.

Hard-optics: The hardware technologies that create and transport light, such as DWDM, FEC, Raman amplification, tunable dispersion compensators, Variable Optical Attenuators (VOAs), dynamic spectral gain compensators, Micro-Electro-Mechanical Systems (MEMS), and Optical Spectrum Analyzers (OSAs).

Hold Time: In BGP, the maximum number of seconds allowed to elapse between when a BGP system receives successive keepalive or update messages from a peer.

Institute of Electrical and Electronics Engineers (IEEE): One of the functions of which is to define standards for data communications.

Import: To install routes from the routing protocols into a routing table.

Ingress Router: First router in a label-switched path (LSP). See also egress router.

Intelligent Optical Network: A dynamic flexible network of virtual lightpaths, which is light from end-to-end and delivers an abundance of cost-effective, usable band-width. The foundation of the next generation telecommunications infrastructure.

Intelligent Optical Networking: Bringing network intelligence to the optical domain – creation, configuration and management of virtual lightpaths within the optical domain. A new class of products for the development of an intelligent optical network.

Inter-AS Routing: Routing of packets among different AS's. See also EBGP.

Intercluster Reflection: In a BGP route reflection, the redistribution of routing information by a route reflector system to all nonclient peers (BGP peers not in the cluster).

Interior Gateway Protocol (IGP): Such as IS-IS, OSPF, and RIP.

Intermediate System: Network entity that send and receives packets and that can also route packets.

Intermediate System to Intermediate System (IS-IS): A link-state IGP for IP networks that also uses the shortest-path-first (SPF) algorithm to determine routes.

Internal BGP (IBGP): BGP configuration in which sessions are established between routers in the same AS's.

International Standards Organization (ISO):

Internet Assigned Numbers Authority (IANA): Regulatory group that maintains all assigned and registered Internet numbers, such as IP and multicast addresses. See also NIC.

Internet Control Message Protocol (ICMP):

Internet Engineering Task Force (IETF):

Internet Group Membership Protocol (IGMP): Used with multicast protocols to determine whether group members are present.

Internet Protocol (IP)

Label-Switched Path (LSP): Sequence of routers that cooperatively perform MPLS operations for a packet stream. An LSP is a point-to-point, half duplex connection from the ingress to the egress router. The first router in an LSP is called the ingress router, and the last router in the path is called the egress router (the ingress and egress routers cannot be the same router).

Lambda (λ): An optical wavelength

Lightpath: Analogous to virtual circuits in the ATM world, a lightpath is a virtual circuit in the optical domain that could consist of multiple spans each using a different physical wavelength for transmission of information across an optical network.

Local Area Network (LAN): Geographically limited communications network intended for the local transport of voice, data, and video. Often referred to as a customer premises network.

Local Preference: Optional BGP path attribute carried in internal BGP update packets that indicates the degree of preference for an external route.

Management Information Base (MIB): Definition of an object that can be managed by SNMP.

Maximum Transmission Unit (MTU): Maximum packet size, in bytes, that an interface can handle.

Megahertz (MHz): A unit of frequency that is equal to one million cycles per second.

Multicast: The operation of sending network traffic from one network node to multiple network nodes.

Multiprotocol BGP (MBGP): An extension to BGP that allows you to connect multicast topologies within and between BGP AS's.

Multiprotocol Label Switching (MPLS): Mechanism for engineering network traffic patterns that functions by assigning short labels to network packets that describe how to forward them through the network. Also called label switching or traffic engineering.

N-selector: Last byte of an NSAP address.

Neighbor: An immediately adjacent router. Also called a peer.

Network Entity Title (NET): ISO NSAP in which the n-selector is 00.

Network Information Center (NIC): Internet authority responsible for assigning Internet-related numbers, such as IP addresses and AS numbers. See also IANA.

Network Layer Reachability Information (NLRI): Information that is carried in BGP packets and is used by MBGP.

Network Monitoring and Analysis (NMA) is a fault management system used by RBOCs to perform network monitoring and surveillance.

Network Service Access Point (NSAP): A connection to a network that is identified by a network address.

Nonclient Peer: In a BGP route reflection, a BGP peer is not a member of a cluster. See also client peer.

Operations System/Intelligent Network Elements (OPS/INE): A provisioning system used to provide configuration management of remote equipment.

Optical Add/Drop Multiplexer (OADM): Also called a Wavelength Add/Drop Multiplexer, or WADM. An optical network element that lets specific channels of a multi-channel optical transmission system be dropped and/or added without affecting the through signals (the signals that are to be transported through the network node).

Optical Amplifier: A device that increases the optical signal strength without an optical to electrical to optical conversion process.

Optical Carrier (OC): A designation used as a prefix denoting the optical carrier level of SONET data standards. OC-1/STS-1, OC-3/STS-3, OC-12, OC-48 and OC-192 denote transmission standards for fiber-optic data transmission in SONET frames at data rates of 51.84 Mbps, 155.52 Mbps, 622.08 Mbps, 2.48832 Gbps, and 9.95 Gbps, respectively.

Optical Carrier (OC-x): This is a base unit found in the SONET hierarchy; the "x" represents increments of 51.84 Mbps. See also SONET.

Optical Fiber: A thin (~125 micrometer) silica glass cable with an outer cladding material and a ~ 9 micrometer diameter inner core with a slightly higher index of refraction than the cladding. (A typical index of refraction is 1.443 so that light travels in a fiber at roughly 2/3 the speed of light in a vacuum.)

Optical Network: The optical network will provide all basic network requirements in the optical layer; namely capacity, scalability, reliability, survivability, and manageability.

Optical Networking: The natural evolution of optical transport from a DWDM-based point-to-point transport technology to a more dynamic, intelligent networking technology.

Package: A collection of files that make up a software component.

Packet Forwarding Engine: The architectural portion of the router that packets by forwarding them between input and output interfaces.

Path Attribute: Information about a BGP route, such as the route origin, AS path, and next-hop router.

Product Data Unit (PDU): IS-IS packets.

Peer: An immediately adjacent router with which a protocol relationship has been established. Also called a neighbor.

Point-to-Point: A connection established between two specific locations as between two buildings.

Protocol Independent Multicast (PIM): A protocol-independent multicast routing protocol. PIM Sparse Mode routes to multicast groups that might span wide-area and interdomain Internets. PIM Dense Mode is a flood-and-prune protocol.

Preferred Address: On an interface, the default local address used for packets sourced by the local router to destinations on the subnet.

Primary Address: On an interface, the address used by default as the local address for broadcast and multicast packets sourced locally and sent out the interface.

Primary Interface: Router interface that packets go out when no interface name is specified and when the destination address does not imply a particular outgoing interface.

Remote Authentication Dial-In User Service (RADIUS): An authentication method for validating users who attempt to access the router using Telnet.

Resource Reservation Protocol (RSVP): Resource reservation setup protocol that is designed to interact with integrated services on the Internet.

Route Identifier: IP address of the router from which a BGP or an OSPF packet originated.

Route Flapping: The situation in which BGP systems send an excessive number of updated messages to advertise network reachability information.

Route Reflection: In BGP, configuring a group of routers into a cluster and having one system act as a route reflector, redistributing routes from outside the cluster to all routers in the cluster.

Routing Engine: Architectural portion of the router that handles all the routing protocol processes, as well as other software processes that control the router's interfaces, a few of the chassis components, system management, and user access to the router.

Reverse Path Multicasting (RPM): Routing algorithm used by DVMRP to forward multicast traffic.

Session Announcement Protocol (SAP): Used with multicast protocols to handle session conference announcements.

Shortest-Path-First Algorithm (SPF): Algorithm used by IS-IS and OSPF to make routing decisions based on the state of network links.

Simple Network Management Protocol (SNMP): Allows you to manage objects on a network.

Simplex Interface: Interface that assumes that packets it receives from itself are the result of a software loopback process. The interface does not consider these packets when determining whether the interface is functional.

Splitter: A device that creates multiple optical signals from a single optical signal.

Stub Area: In OSPF, an area through which or into which, AS external advertisements are not flooded.

Subnet Mask: See destination prefix length.

Synchronous Digital Hierarchy (SDH): The international standard for transmitting digital information over optical networks. Term used by ITU to refer to SONET.

Synchronous Optical Network (SONET): Standards for transmitting digital information over optical networks.

Tbps, **Terabit per second**: (1 trillion bits per second), an information carrying capacity measure used for high-speed optical data systems.

Terminal Access Controller Access Control System Plus (TACACS+): An authentication method for validating users who attempt to access the router using Telnet.

Time Division Multiplexing (TDM): An electrical (digital) multiplexing technique used to allow multiple streams of information to share the same transmission media.

Transmission: The process of sending information from one point to another

Transmission Control Protocol (TCP)

Type of Service (ToS)

Transit Router: Any intermediate router in MPLS in the LSP between the ingress and the egress router.

Unicast: The operation of sending network traffic from one network node to another individual network node.

Virtual Path Identifier (VPI): Identifier for an ATM virtual connection (also called a logical interface).

Virtual router Redundancy Protocol (VRRP): On Gigabit Ethernet interfaces, allows you to configure virtual default routers.

Wide Area Network (WAN): A data communications facility involving two or more computers with the computers situated at different sites. (See also LAN.)

Wavelength Division Multiplexer (WDM): A passive device that combines light signals with different wavelengths on different fibers onto a single fiber. The wavelength division demultiplexer performs the reverse function.

Riverstone Parts List

Part Number   Description

RS 1000 and 3000 Base Modules

G10-B128	RS 1000 base unit with 128 MB. Includes RS router services and a single AC power supply. (Line cards are not included)
G10-B128-DC	RS 1000 base unit with 128 MB. Includes RS router services and a DC single power supply. (Line cards are not included.)
G30-B128	RS 3000 base unit with 128 MB, 32-port 10/100 Base-TX RJ-45, and two expansion slots. Includes RS router services software, redundant power supply
G30-B256	RS 3000 base unit with 256 MB, 32-port 10/100 Base-TX RJ-45, and two expansion slots. Includes RS router services software, redundant power supplies
G30-B128-DC	RS 3000 base unit with 128 MB, 32-port 10/100 Base-TX RJ-45, and two expansion slots. Includes RS router services software, redundant DC power supplies

RS 1000 and 3000 Ethernet Modules

G2M-HFXA4-08	8-port 100 Base-FX expansion module for RS 1000/3000 with MT-RJ connectors
G2M-GLHA8-01	1-port 70 km 1000 Base-LX Gigabit Ethernet module (built to order)
G2M-HTXA2-08	8-port 10/100 Base-TX expansion module
G3M-GSXB1-02	2-port 1000 Base-SX module via SC connectors with 16 MB memory
G3M-GLXB9-02	2-port 1000 Base-LX module via SC connector with 16 MB memory
G3M-HTXB2-16	16-port 10/100 TX module via Cat 5 RJ-45 with 16 MB memory
G3M-GBCMM-02	2-port MPLS GbE base module; requires GBICs (maximum 2)
GIC-11	1-port GBIC 1000 Base-SX (MMF, SC)
GIC-19	1-port GBIC 1000 Base-LX-IR (SMF-IR), SC
GIC-18	1-port GBIC 1000 Base-LX-IR (SMF-LR), SC

RS 1000 and 3000 WAN Modules

G2M-HSIAC-02	2-port HSSI module
G2M-SERAC-02	2-port Serial module
G2M-SECAC-04	4-port Serial module with compression
G2M-SCEAC-04	4-port Serial module with compression and encryption
G2M-DE1BM-04	2-slot Multirate WAN module, requires WICs to support different interface rate (max of 2 per card)
WICT1-12	2-port T1 WAN Interface card for WAN base module
WICE1-12	2-port E1 WAN Interface card for WAN base module
WICT3-1B	1-port T3 Clear Channel WAN Interface card
WICE3-1B	1-port E3 Clear Channel WAN Interface card

RS 3000 WAN Module

G3M-A03BM-02	2-port ATM base module; requires physical modules for connectivity (max of 2 per base module)
AIC-67	1-port DS-3/T3 physical module (coax)
AIC-77	1-port E-3 physical module (coax)
AIC-21	1-port OC-3c MMF physical module; SC connector
AIC-29IR	1-port OC-3c SMF-IR physical module; SC connector

Other Components

G2M-HSIAC-02	2-port HSSI module
G2M-SERAC-02	2-port Serial module

RS 8000 and 8600 Base Modules

G86-CHS	RS 8600 16-slot base system including chassis, Switch Fabric Module, backplane, & modular fan
G80-CHS	RS 8000 8-slot base system including chassis, backplane, & modular fan
G86-PAC	AC power supply for the RS 8600
G86-PDC	DC power supply module for the RS 8600
G80-PAC	AC power supply module for the RS 8000
G80-PDC	DC power supply module for the RS 8000
G8M-CM2-128	RS 8x00 Control Module 2 with 128 MB memory
G8M-CM3-256	RS 8600 Control Module 3 with 256 MB memory
G86-SWF	RS 8600 Switch Fabric Module. One module ships with the base system (RS-16). Order only if second is required for redundancy
G86-FAN	RS 8600 fan tray module (field replacement unit)
G80-FAN	RS 8000 fan tray module (field replacement unit)

RS 8000 and 8600 Ethernet Modules

G8M-GLHB8-02	2-port 1000 Base-LLX (Long Haul) module via SC connector with16 MB memory (70 km); build to order
G8M-GLXB9-02	2-port 1000 Base-LX module via SC connector with 16 MB memory
G8M-GSXB1-02	2-port 1000 Base-SX module via SC connectors with 16 MB memory
G8M-GTXB2-02	2-port 1000 Base-T module via Category 5 RJ-45 with 16 MB memory
G8M-HFXA1-08	8-port 100 Base-FX module, MMF SC ports, and 16 MB memory (supporting up to 2,000,000 flows per RS system)
G8M-HTXA2-08	8-port 10/100 Base-TX module, Cat 5 RJ-45 ports, and 16 MB memory (supporting up to 2,000,000 flows per RS system)
G8M-HTXB2-16	16-port 10/100 TX module via Cat 5 RJ-45 with 16 MB memory
G8M-GBCMM-02	RS 8x00 2-port MPLS GbE base module; requires GBIC modules (maximum 2)
G8M-GBCDM-02	RS 8x00 2-port GBIC based GbE base module; requires GBIC modules (maximum 2)
GIC-11	1-port GBIC 1000 Base-SX (MMF, SC)
GIC-19	1-port GBIC 1000 Base-LX-IR (SMF-IR), SC
GIC-18	1-port GBIC 1000 Base-LX-LR (SMF-LR), SC

RS 8000 and 8600 WAN Modules

G8M-HSIAC-02	2-port HSSI module
G8M-SECAC-04	4-port Serial module with compression
G8M-SCEAC-04	4-port Serial module with compression and encryption
G8M-DE1BM-04	2-slot Multirate WAN module for RS 8x00, requires WICs to support different interface rate (max of 2 per card). Support 4 DS1 with 2 WICT1-12
WICT1-12	2-port T1 WAN Interface card for WAN base module
WICE1-12	2-port E1 WAN Interface card for WAN base module
WICT3-1B	1-port T3 Clear Channel WAN Interface card
WICE3-1B	1-port E3 Clear Channel WAN Interface card
G8M-CT3BB-02	2-port channelized T3 line card for RS 8x00
G8M-A03BM-02	2-port ATM base module; requires physical modules for connectivity (2 per base module)
AIC-67	1-port DS-3/T3 physical module (coax)
AIC-77	1-port E-3 physical module (coax)
AIC-21	1-port OC-3c MMF physical module; SC connector
AIC-29IR	1-port OC-3c SMF-IR physical module; SC connector
G8M-P03B1-04	4-port OC-3c/STM-1 Packet over SONET/SDH MMF module; MT-RJ connectors
G8M-P03B9-04	4-port OC-3c/STM-1 Packet over SONET/SDH SMF-IR module; MT-RJ connectors
G8M-P12B1-02	2-port OC-12c/STM-4 Packet over SONET/SDH MMF module; SC connectors
G8M-P12B9-02	2-port OC-12c/STM-4 Packet over SONET/SDH SMF-IR module; SC connectors
G8M-A12B1-02	1 + 1 OC-12c/STM-4 ATM MMF module
G8M-A12B9-02	1 + 1 OC-12c/STM-4 ATM SMF-IR module

Other Components

SYS-OS-16	RS Router Services: Include IP routing (RIP v2, OSPF, BGP), QoS services. One required with every RS chassis, shipped on 16 MB PCMCIA card
SYS-PCM16	RS 8x00, 16000, and 38000 16 MB PCMCIA card, upgrade option (SYS-OS ships with 8 MB)
SYS-MEM128	128 MB control module memory upgrade kit for the RS 8x00 and 38000
SYS-MEM256-D	256 MB control module memory upgrade kit for the RS 8x00 and 38000

RS 16000 Base Module

R16-CHS	Chassis, which includes backplane, switching fabric, clock
R16-CM4EG-04	Control module with 256 MB (upgradeable to 512 MB), 1 RJ-45 10/100 port, and 4 non-MPLS Gigabit Ethernet ports
R16-CM4EF-12	Control module with 256 MB (upgradeable to 512 MB), 1 RJ-45 10/100 port, and 12 10/100 ports through a telco adapter
R16-PDC	DC power supply
R16-PAC	AC power supply

RS 16000 Ethernet Modules

R16-GSFEM-08	8-port SFP GbE Card (requires SFP GBICs)
R16-GSFNM-08	8-port GbE SFP Card MPLS (requires SFP GBICs)
SFP-SX*	1-port MMF SFP SX (Quantity 4)
SFP-LX*	1-port SMF SFP LX (Quantity 2)
SFP-LH*	1-port SMF SFP LH
R16-WDME8B-02	CWDM bi-directional
R16-WDME8U-02	CWDM uni-directional

RS 38000 Base Module

R38-CHS	RS 38000 base chassis with one Switch Fabric Module
R38-PAC	RS 38000 AC power supply (minimum 2 required, 3 or 4 required for redundancy)
R38-PDC	RS 38000 DC power supply (minimum 1 required, 2 required for redundancy)
R38-FAN	RS 38000 fan tray assembly (spare)
R38-SWF	RS 38000 Switching Fabric Module
R38-CM4-256	RS 38000 control module with 256 MB memory

RS 38000 Ethernet Modules

R38-GBCDM-04	RS 38000 4-port 1000 Base; supports max of 4 GBIC module
R38-GBCDM-08	RS 38000 8-port 1000 Base; supports max of 8 GBIC module
R38-HTXD2-24	RS 38000 24-port 10/100 Base-TX module
R38-HTXD3-32	RS 38000 32-port 100 Base-TX module
R38-WDMD9-01	RS 38000 4 lambda over one fiber GbE WDM
R38-GBCMM-04	RS 38000 4-port MPLS GbE Base module; requires GBIC modules (maximum 4)

RS 38000 GBIC Modules

GIC-11	RS GBIC module 1000 Base-SX (MMF, SC)
GIC-19	RS GBIC module 1000 Base-LX-IR (SMF-IR), SC
GIC-18	RS GBIC module 1000 Base-LX-LR (SMF-LR), SC

RS 38000 WAN Modules

R38-CT3DB-04	RS 38000 4-port channelized T3 line card

Common Components

SYS-OS-16	RS Router Services: Include IP routing (RIP v2, OSPF, BGP), QoS services. One required with every RS chassis, shipped on 16 MB PCMCIA card
SYS-PCM16	RS 8x00, 16000, & 38000 16 MB PCMCIA card, upgrade option (SYS-OS ships with 8 MB)
SYS-MEM128	128 MB control module memory upgrade kit for the RS 8x00 and 38000
SYS-MEM256-D	256 MB control module memory upgrade kit for the RS 8x00 and 38000
SYS-MEM256-S	256 MB memory upgrade kit for RS 3000 only

RS WAN Module Cables – Serial Cables

SYS-S449-DTE	3 meter 2 lead cable and 2 male RS449 DTE (male) connectors
SYS-SV35-DTE	3 meter 2 lead cable and 2 male V35 DTE (male) connectors
SYS-SX21-DTE	3 meter 2 lead cable and 2 male X21 DTE (male) connectors
SYS-S530-DTE	3 meter 2 lead cable and 2 male 530 DTE (male) connectors

HSSI Cables

SYS-HSSI-CAB	3 meter HSSI cable, male to male connector

RS Rackmount Kit

SYS-RMKT23-05	Mounting Kit to install in the RS 8x00, 32000 and 38000 chassis in a 23" rack (RS 8000 requires 1 set; 8600 -2 sets; 32000/38000 - 4 sets).

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