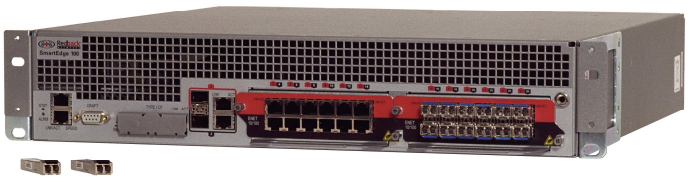
SmartEdge 100
Service Gateway

Highlights

- 12 Gbps throughput, 8 Mpps wire speed performance in a compact 2-RU form factor
- Support for 8,000 simultaneous users with up to 16,000 VLANs
- Simplifies triple play networks by combining edge routing, Ethernet aggregation, and subscriber management
- Reduces TCO for triple play networks by up to 22%
- Enables triple play for smaller network environments with fewer subscribers or requiring less ports
- Hardware based, high performance multicast replication for IPTV and video on demand
- IPv6 ready for advanced services without any hardware upgrades
- Granular service control with up to 8 queues per subscriber
- Advanced QoS to control bandwidth for each service per subscriber
- In service ASIC microcode updates for new features and investment protection
- Semi-modular design for interface flexibility

Compact form-factor, with advanced subscriber management enabling powerful and flexible IP service delivery, optimized to triple play enable smaller network environments with fewer subscribers or requiring less ports.

The SmartEdge® Service Gateway family leads the industry as the most advanced and comprehensive multi-service broadband aggregation platform enabling a wide-range of advanced broadband network deployments. The platform has been specifically architected and optimized to deliver carrier-class triple-play services encompassing video, voice, data and interactive content delivery. With an inherent ability to identify and deliver specific and unique services on a per-user, personalized basis the SmartEdge Service Gateway family delivers performance predictability with unprecedented bandwidth and session capacities, enabling seamless delivery of revenue generating subscriber services. As a result of this multi-functional design, the SmartEdge platform enables the construction of highly versatile and consolidated Smart Broadband Networks that are Personalized, Adaptive and Efficient. There is no wonder why SmartEdge Service Gateway has become the extensible network foundation for the world's most exciting, highest profile, and most demanding broadband deployments.



Product Overview

Based on proven SmartEdge 400/800 Service Gateway hardware and software technology, SmartEdge 100 unifies high-performance edge routing, Ethernet aggregation and advanced subscriber management capabilities into a compact and flexible multi-service broadband aggregation platform. Optimized to enable triple play in smaller network environments such as distributed points of presence (POPs), remote central offices (RCOs) and multi-tenant units (MTUs), SmartEdge 100 extends the reach of the industry's-leading SmartEdge Service Gateway technology that, until now, was only available in a higher-density, more costly chassis-based solution. SmartEdge 100 delivers a consistent operating environment with the SmartEdge 400/800 that is simple to deploy and easy to maintain, while bringing unsurpassed operational and financial efficiencies.

Precision-engineered for the bandwidth and service demands of advanced triple play networks, SmartEdge 100 delivers up to 12 Gbps of throughput with packet processing capacity of 8 Mpps with performance predictability and multi-dimensional scalability. The compact two rack unit (RU) form-factor offers two fixed gigabit Ethernet ports and two universal FlexSlots supporting several modular interface options with space-saving efficiency. Providing complete deployment flexibility, the two fixed Gigabit Ethernet ports are dual-wired and support any two Gigabit Ethernet connections in TX copper or Small Form-factor Pluggable (SFP) based interfaces simultaneously. The two modular FlexSlots support optional Media Interface Cards (MICs) that enable deployment of 100FX, 10/100/1000 TX Ethernet, or SFP-based fiber Gigabit Ethernet ports.

A removable compact flash module enables extended real-time operations, such as DHCP server operations and stores system configuration details to speed multi-unit deployments, simplify software upgrades and configuration backup. The device can be managed in-band or by using a separate out-of-band Ethernet management port that enables effective local or remote management of the device without consuming high-performance system bandwidth or ports.

Redback® NETWORKS

SmartEdge 100 delivers proven, high performance and well-developed third-generation subscriber management capabilities and can be licensed to support up to 8,000 subscribers, integrating support for all advanced Subscriber Management (BRAS) capabilities such as Point-to-Point Protocol (PPP) termination and tunneling, DHCP Server, RADIUS and AAA support. Advanced Edge Routing capabilities are supported in hardware with robust IP routing protocols, hierarchical quality of service (HQoS), efficient hardware-based multicast replication, multi-protocol label switching (MPLS), and virtual private LAN services (VPLS). With fully programmable ASICs, the SmartEdge 100 is also IPv6 ready. As a result of the device's highly scalable and flexible provisioning capabilities, SmartEdge 100 delivers a comprehensive network infrastructure solution for service providers delivering residential broadband services, real-time video and content delivery, Voice over IP (VoIP) or Business Ethernet with IP/MPLS Virtual Private Networks where chassis based systems are not economically feasible.

When deployed in combination with a SmartEdge 400 or 800 chassis solution, SmartEdge 100 extends the Smart Broadband Network for advanced triple play. As a result, service providers can build scalable networks that extend centralized subscriber management with distributed policy enforcement across the entire access network into smaller, lower port density segments.

Flexible Modular Interface Design

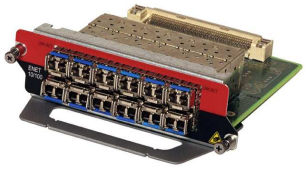
SmartEdge 100 blends the cost advantage of a lower cost, fixed-configuration platform with the flexibility of interface modularity through the use of Media Interface Cards (MICs). Bringing new dimensions of investment preservation to this class of product, SmartEdge 100 offers two FlexSlots per device which support a number of different interfaces. Helping to lower up-front investments, FlexSlots do not need to be populated for the device to operate, so a configuration could start with just a single MIC and then expanded as required. SmartEdge 100 Ethernet-based Media Interface Cards options include:

- 12-port 100 FX SFP-based MIC
- 12-port 10/100 TX MIC
- 2-port SFP-Based Gigabit Ethernet MIC (available Q3 2006)
- 2-port 1000Base-TX Gigabit Ethernet MIC (available Q3 2006)

Media Interface Cards (MICs) are hot-swappable, so SmartEdge 100 can be cost-effectively expanded and quickly reconfigured to support new interface options, with no platform downtime. Individual MICs can be replaced without reconfiguration, minimizing extensive re-configurations. Optical MICs, such as the 100FX and fiber Gigabit Ethernet MICs utilize Small Form-factor Pluggable (SFP) optics, further enhancing deployment flexibility. The total flexibility offered by MICs optimizes infrastructure investments and results in extended network equipment deployment cycles thereby reducing the total cost of ownership.

Wire-Speed, Predictable Performance

SmartEdge 100 delivers low latency, wire-speed performance for all device ports. This is enabled by two PPA2 Broadband IP Engine (PPA2) Application-Specific Integrated Circuits (ASICs) that perform hardware-based, per-subscriber packet inspection, transformation and forwarding at wire-speed. For true full-duplex operation, one PPA2 ASIC is dedicated for ingress (incoming traffic) and the other is dedicated to egress (outgoing traffic) packet processing activities. SmartEdge 100 has two additional CPUs, separating system management overhead functions from packet processing services. One CPU is dedicated to protocol and subscriber management functions, and the other is dedicated to time-critical system functions, such as fault and performance monitoring and alarms. As a result of this comprehensive separation of data, control and management functions, SmartEdge 100 delivers unprecedented scale and performance predictability for every port and every subscriber, regardless of the number of route entries, BGP Peers or Layer 3 and layer 4 services that are enabled.



Flexible Programmable ASIC Technology

The PPA2 Broadband IP Engine ASICs combines the performance predictability and scalability of hardware ASIC technology with the flexibility of micro-coded programmability. So in addition to scaling performance, this innovative approach allows new features and capabilities to be easily implemented through ASIC-level micro-code updates without replacing hardware. Many ASIC micro-code updates can be achieved without terminating active subscriber sessions or requiring system restarts. Consequently, this unsurpassed system flexibility reduces network downtime and the need for premature hardware replacements, which extends the deployable life of SmartEdge 100 well beyond that of a traditional fixed configuration device with hard-coded ASIC technology.

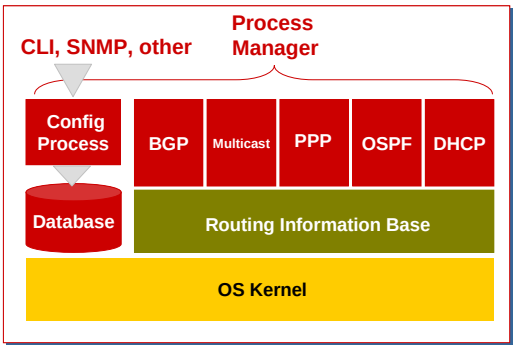
Modular SmartEdge Operating System Software

SmartEdge 100 leverages the same widely-deployed and production-proven SmartEdge Operating System (SEOS) software as the SmartEdge 400/800 chassis family to provide

a comprehensive feature offering while delivering operational consistency across the network. Purpose-built and engineered to exacting carrier-class standards, SEOS is highly optimized for demanding triple-play network deployments, enabling the reliable delivery of delay- and jitter-sensitive applications such as broadband-quality video services, on-line gaming and Voice over IP (VoIP). SEOS uses familiar Command Line Interface (CLI), with an extensive command set for system configuration, provisioning and troubleshooting. Real-time configuration is intuitive and uses secure access methods, such as secure shell, to control access and configuration of the SmartEdge 100 platform.

Truly Modular Software Architecture

SEOS is constructed using a highly sophisticated modular architecture that delivers the highest possible levels of real-time flexibility and network availability. Each SEOS functional element, such as each routing protocol, Routing Information Base (RIB), IP services, system configuration and management interfaces are implemented as separate processes, each in a separate protected memory space. As a result of this highly resilient approach, each process, including OSPF, BGP, DNS, DHCP, L2TP, SNMP and many others, are executed independently so a failure or restart of any single process has no impact on any other active processes. This unmatched process separation greatly enhances physical device availability along with operational stability delivering unprecedented fault-isolation and containment.



Real-Time Reconfiguration and Updatability

service providers can re-configure and update[2] most individual SEOS modules in real-time, and in many cases without effecting active subscriber sessions or impacting system forwarding. As a result, software certification and time-to-deployment is significantly improved as real-time updates and new features can be deployed without reloading the entire SEOS image. Additionally, the flexible modularity of SEOS significantly reduces problem resolution and software development cycles by enabling rapid new feature development, testing and implementation.

Flexible Software Options

SmartEdge 100 offers a flexible pay-as-you-grow software licensing model allowing customized software configurations to meet immediate network service requirements. Incremental support for new services can be added at any time as the subscriber base grows, or service delivery requirements change. As a result, service providers can minimize initial capital costs, while maximizing their return on investment (ROI) by only purchasing needed functionality. SmartEdge 100 Software Options include:

License Package	Description
Subscriber Management (BRAS) – Basic Access	Up to 60Kb/s per sub per direction (licensed per direction)
Subscriber Management (BRAS) – Enhanced Access	Up to 100Kb/s per sub per direction (licensed per direction)
Subscriber Management (BRAS) – Power Access	Up to 250Kb/s per sub per direction (licensed per direction)
Subscriber Management (BRAS) – Triple-Play Access	Up to 1Mb/s per sub per direction (licensed per direction)
Dynamic IP Services feature set	Dynamic re-auth, Dynamic profiles, HTTP Redirect and CLIPS
MPLS/VPN feature set	Includes VPLS, MPLS LS-VPN, LDP, RSVP, Multi-context.
L2TP Tunnel Networking feature set	Tunnel/Terminate L2TP Subscribers via LAC, LNS, and LTS.
Advanced Traffic Management feature set	Required for subscriber-based queuing, policing, and shaping
IPv6 Routing feature set	Adds support for all IPv6 supported routing capabilities
Lawful Intercept feature set	Adds support for US CALEA and ETSI lawful intercept capabilities

Integral Edge and Service Routing

SmartEdge 100 delivers comprehensive and proven IP routing foundation required for world-class triple-play broadband network deployments with predictable and sustained performance for both unicast and multicast services. SmartEdge 100 delivers robust support for a comprehensive range of interior and exterior gateway routing protocols with the latest feature extensions for edge routing, multicast, virtual private LAN services (VPLS) and multi-protocol label switching (MPLS) implementations.

Engineered for availability and optimized for scalability, SmartEdge 100 can support one million-plus routes, 1000 plus peers, 2000 plus MPLS/VPNs and 8,000 subscribers at wire-speed. As a result, the platform is equally suitable for deployment in peering, edge aggregation and services routing applications where high-performance IP routing is an absolute requirement. Routing protocol support includes:

- **Border Gateway Protocol** (BGP) – including: Route Aggregation, MD5 Authentication, Route Reflection, Route Flap Dampening, Confederations, Communities, Peer Groups and new extensions such as BGP Refresh, Outbound Route Filtering, and BGP Graceful Restart and support for high-performance BGP/MPLS VPNs (RFC 2547bis)

- **Open Shortest Path First (OSPF)** – Including: Designated Router (DR), Backup Designated Router (BDR), Area Border Router (ABR), Autonomous System Border Router (ASBR) with stub area support, Redback OSPF Fast Reroute (FRR) and Redback BFD Bi-Directional Forwarding Detection
- **Intermediate System-to-Intermediate System** (IS-IS) – including: multiple levels, multiple instances, re-distribution between instances, load balancing and authentication
- **High-performance Multicast Routing**, including: protocol independent multicasting (PIM), Internet group management protocol (IGMP) and RFC 2547bis multicast routing
- **RIP, Static Routes and Dynamic Verified Static Routes** (DVSR)
- **Virtual Router Redundancy Protocol** (VRRP) – enabling standards-based network resiliency between routing devices

Multi-Context Based Design for Virtual Routers

SmartEdge 100 supports thousands of routing contexts that allow service providers to partition a SmartEdge chassis into separate contexts or virtual routers. As an important service provisioning enabler, each context is simple to create and maintain and functions as an independent, full-featured router with the configuration, monitoring and accounting features expected from a dedicated routing device. By leveraging these highly scalable contexts service providers can quickly create thousands of secure administrative domains that are individually manageable and easy to troubleshoot. As a result, service providers gain new levels of flexibility and revenue creation opportunities from a single broadband network investment.

Subscriber Management and Control for Flexible, Personalized Service Delivery

SmartEdge 100 applies user configuration and management policies to individual subscriber data streams on a per subscriber, personalized basis – even when hundreds of subscribers are being transported over the same physical network port. Personalized subscriber management allows service providers to enhance subscriber retention and increase the average revenue per subscriber (ARPU) through the introduction of value added services such as tiered/on-demand bandwidth, IP-TV and on-demand video delivery, dynamic service selection, as well as volume and time based services.

SmartEdge 100 can be licensed to support up to 8,000 subscribers per device and all methods of subscriber encapsulation including Point-to-Point Protocol over Ethernet (PPPoE), Internet Protocol over Ethernet (IPoE) and Dynamic Host Configuration Protocol (DHCP) access clients. In addition, SmartEdge 100 supports Client-Less IP Subscribers (CLIPS) environments, without requiring PPPoE client software, thereby enabling identification of these subscriber types for dynamic service provisioning. Traditional Broadband Remote Access Server (BRAS) support includes Layer 2 Tunneling Protocol (L2TP), including full L2TP Access Concentrator (LAC), L2TP Network Server (LNS) and extensive LTS tunnel switching capabilities. As a result, service delivery can be easily scaled, highly personalized and granularly controlled.

Advanced Quality of Service with Advanced Traffic Management

SmartEdge 100 delivers comprehensive Quality of Service (QoS) with Advanced Traffic Management capabilities for all device ports, including the 10/100 ports. Extending beyond simple port-level QoS and services, SmartEdge 100 enables very granular control, on a per-subscriber basis, enabling the service provider to offer highly adaptable, differentiated and personalized service delivery.

QoS Parameters can be defined based upon user traffic, specific applications and network utilization including initiation and termination of specific services or applications. Traffic classification is flexible and dynamic with extensive classification, queuing, scheduling and filtering capabilities based on ingress port/subscriber, source/destination IP address and/or TCP port or protocol. SmartEdge 100 provides up to eight queues per-subscriber with the flexibility for dynamically configuring the number and use of each queue. Packets can be marked per the Diffserv specification, enabling the setting of Type of Service (ToS) bits.

Hierarchical Traffic Management

With the Advanced Traffic Management capabilities of SmartEdge 100, service providers can account for, and model, the entire access and edge network hierarchy from a common control point to minimize the chance of low priority traffic reaching critical congestion points. Consequently, SmartEdge 100 becomes the hierarchical network control point that can apply end-to-end edge and access network control from the consolidated edge/aggregation network layer – thereby reducing deployment complexities arising from multi-device configurations.

SmartEdge 100 supports up to four levels of network hierarchy which can be defined based upon specific applications and controlled and prioritized on a per-subscriber basis. The hierarchical queue scheduler offers both Strict Priority Queuing (SPQ) and Weighted Round Robin (WRR), as well the possibility for a hybrid of the two implementations. Hierarchical queue scheduling and rate shaping functions can be dynamically applied on a per-queue or per-group basis. System administrators can quickly implement real-time, per-subscriber, or system-wide changes, such as hierarchical level additions to address behavior changes on-demand,

without requiring a system reboot or impacting subscriber sessions.

Subscriber Traffic Policing and Access Control

Ingress policing and egress shaping can be implemented on a per-user basis, so incoming and outgoing traffic can be conditioned to meet a stringent traffic profile including a sustained bandwidth value plus a burst tolerance. Dynamic Rate Limiting (DRL) can also be defined on a per-subscriber basis in 64Kb increments, with both "minimum" and "maximum" rates, along with assignment of scheduling priorities, for exceptionally granular per-subscriber traffic control. In addition, extensive Access Control List (ACL) capabilities are supported in conjunction with QoS implementations to permit or deny packets based on the same filter criteria, enabling dynamic Network Admission Control (NAC) implementations.

Highly Efficient Multicast Services

SmartEdge 100 leads the industry with its breadth of Multicast and sustainable data streaming capabilities to support large-scale deployments of common application flows, such as audio and high-definition broadcast video, to enable the best possible use of network bandwidth. SmartEdge 100 performs per-port and per-user multicast replication in hardware to optimize network performance and preserve bandwidth for high subscriber count deployments. SmartEdge 100 allows up to 10,000 Internet Group Management Protocol (IGMP) groups, with support for Protocol Independent Multicast (PIM) routing protocol and PIM Sparse Mode (PIM-SM). A complete suite of multicast enabling protocols such as IGMP-Snooping, Multicast Source Discovery Protocol (MSDP), Multi-protocol Border Gateway Protocol (MBGP), Source Specific Multicast (SSM) and SSM Mapping are also supported. In addition, service providers can limit the number of members in a multicast group on a per-port basis to scale support for the delivery of high-capacity, multi-subscriber IP video services, such as HDTV. This protects link bandwidth and preserves the quality of multicast streams specifically for high user count broadband deployments.

Enhanced System Security

To meet the security expectations and requirements of broadband networks, SmartEdge 100 integrates critical capabilities to protect the platform itself from attempted attacks as well as unauthorized device access or malicious re-configuration so that all aspects of service delivery network are safe and secure.

Subscriber Traffic Separation

SmartEdge 100 isolates each subscriber session, so that users' data flows remain separated and secure from other users on the same system. This helps to protect privacy and prevents the hijacking of services or individual subscriber service levels.

Denial of Service Prevention

SmartEdge 100 has a number of inherent, well defined IP services that enable the platform to prevent and address a wide-range of service-effecting Distributed Denial of Service (DDoS)-type attacks. Additionally, to prevent flooding attacks on the control plane and central processor, SmartEdge 100 can apply control plane queuing and rate limiting to packets being sent to the Control Processor, dropping malicious traffic preventing potential processor overload. Security capabilities include:

- **Secure ARP** helps to prevent subscriber IP address hijacking by preventing a subscriber from configuring their computer with the IP address of another subscriber. With secured ARP enabled, SmartEdge 100 will only forward traffic to the circuit on which an IP address is configured as identified in the local IP forwarding table.
- **Source Address Validation (SAV)** protects against flooding attacks by denying IP packets from address sources that are not reachable through the subscriber's associated circuit by comparing the IP address in the packets with the IP Address range configured for the subscriber.
- **Message Digest Algorithm 5 (MD5)** route authentication prevents routing information from being spoofed
- **Reverse Path Forwarding (RPF)** helps to protect against IP Address Spoofing and can be used in quickly locating or stopping the source of PING or other DDoS attacks.

Access Control Lists

SmartEdge Service Gateway provides robust Access Control List (ACL) support on a per-port, per-subscriber, and per-VLAN basis. ACLs are useful for a number of applications and can help to provide access security, service access control and policy-based routing. Additionally, SmartEdge 100 supports full ACL counters for monitoring filter hits and can monitor all traffic with ACL logging.

Device Access Security

SmartEdge 100 provides access control to physical device administration and configuration sub-systems with encrypted passwords and multilevel access control to prevent unauthorized users from accessing the system. SmartEdge makes use of industry-standard RADIUS, and Terminal Access Controller Access Control System Plus (TACACS+) for validation of users attempting to gain access, as well as tracking of access and configuration changes made.

Enhanced Device Manageability

In addition to the far-reaching capabilities provided by the NetOp family of management tools, SmartEdge 100 offers enhanced manageability capabilities within the device to allow easy device configuration and management. This includes many embedded tools and troubleshooting capabilities

including statistics, events and alarms. These capabilities include:

- **Simple Network Management Protocol (SNMP)** – SmartEdge platform has an embedded SNMP agent, with support for SNMP versions 1, 2c, and 3. The embedded SNMP agent can be used for management of the platform and to collect statistics.
- **Extensive Management MIB Support** – SmartEdge 100 provides an extensive range of MIBs including MIBs for RMON, RADIUS and Redback enterprise MIB implementations to simplify monitoring and ease troubleshooting.
- **Granular Traffic Mirroring** – Traffic mirroring is a powerful tool for troubleshooting and traffic analysis. Packets can be mirrored or sampled from any port in the system and can be granularly defined to mirror at the subscriber session, service session or VLAN level at ingress or egress. Packets are sent to any other port or defined session on the system which is connected to a monitoring device or system. Up to eight classes of packets can be specified, with each class being mirrored to a different output circuit.
- **Syslog** – Reports system events in real-time as they occur
- **Bulkstats** – Bulkstats provide a more efficient alternative to SNMP as a means of gathering network accounting statistics. SmartEdge 100 samples and stores system, network, and traffic statistics at specified sampling intervals. Data is then sent at specified intervals as a text file via FTP to a network management station to enable simplified network management.

Billing & Accounting

Leverage the existing provisioning, accounting, and management control systems that service providers may have in place, SmartEdge 100 supports over a hundred Vendor Specific Attributes (VSA's) for RADIUS administration. It also provides administrative flexibility and control through support of TACACS+, SNMP and Dynamic Refresh of attributes assigned to subscriber sessions and circuits. Combined with the powerful RADIUS accounting capabilities, multi-session capabilities give providers the tools to design, deliver and account for a variety of new service applications.

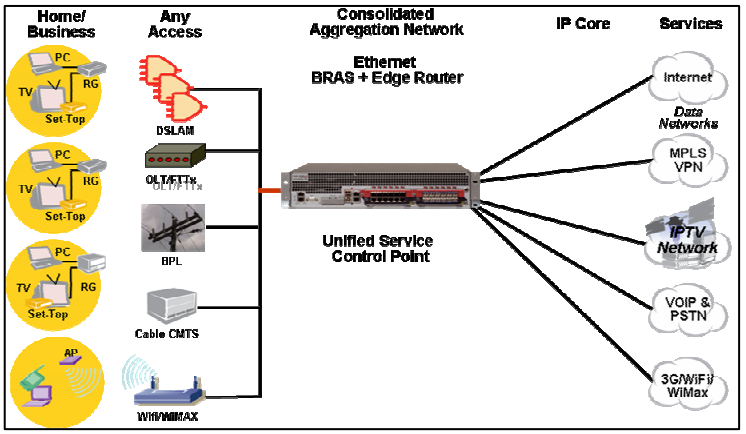
Device Management with NetOp Element Manager

The NetOp Element Management System (EMS) enables highly scalable, distributed management of broadband circuits and subscribers for the SmartEdge 100 device. Providing a full suite of advanced management capabilities through an easy-to-use graphical interface, NetOp EMS simplifies critical element management tasks related to fault management, node configuration and backup, performance and security. Together with the SmartEdge 100, NetOp EMS delivers an operations support infrastructure that simplifies service configuration and deployment for service providers, enabling them to increase customer satisfaction while minimizing costs.

NetOp Policy Manager

NetOp Policy Manager provides a dynamic policy management point for implementing and managing subscriber services on SmartEdge 100. NetOp Policy Manager facilitates initial subscriber configuration, simplifies network provisioning and enables assignment of services. After establishing the subscriber, NetOp Policy Manager greatly simplifies change management by allowing subscribers to adapt service levels on-demand, such as requesting increased bandwidth, or add new services, through an interactive web portal. This highly personalized self-service approach greatly increases customer satisfaction and retention while significantly streamlining ongoing subscriber management by reducing demand and strain on customer support organizations.

A single NetOp Policy Manager system can support hundreds of physical SmartEdge devices enabling the implementation of unified policy management with a single-point-of-control for highly-distributed triple-play service delivery with seamless mobility and roaming capabilities. As a result, NetOp Policy Manager identifies known subscribers and applies subscribed service levels regardless of which SmartEdge platform a user logs on from.



Device Specifications

Device Specifications

System CPU: Two 600 MHz Power PCs

Route/Switch Engine: two PPA2 Broadband IP Engine programmable ASICs, each with 32 RISC core processor providing all routing and IP services in hardware.

1 GB Onboard RAM

1 GB removable compact system flash card

12 Gbps maximum device throughput

7 Mpps forwarding/service performance

8,000 Subscribers

16,000 VLANs

10,000 IGMP groups and Multicast Routes

160,000 MAC Addresses

Physical Specifications

Dimensions (H x W x D): 3.47 x 17.5 x 18.625 inches (8.81 x 44.45 x 47.31 cm)

Weight

25 LBS (11.34 KG)

Power Requirements

AC Power Version
Single Autosensing AC Power supply – 90-132 VAC or 170-264 VAC, Frequency range: 47-63 Hz at 4.5 amps

DC Power Version
Two Redundant DC power entry points –
-39 VDC to –58 VDC at 8.5 amps

Power Consumption

200 Watts power consumption for typical configuration to 300 Watts max power consumption

682 British Thermal Units (BTUs) at average power draw of 200W

Environmental Specifications

Operating temperature, nominal:
41°to 104℉ (5°to 40℃)

Operating temperature, short term (96 hours or less):
23°to 131℉ (-5°to 55℃)

Storage temperature:
-38°to 150℉ (-40°to 70℃)

Operating relative humidity: 10% to 90% RH

Storage relative humidity: 5% to 95% RH

Operating altitude: 60 to 4000 meters

Shock and vibration

Maximum shock and vibration, as specified by the GR-63-CORE.

Thermal exhaust

SmartEdge 100 offers front to back air-flow and exhausts air to the rear of the device

Network Equipment Building Systems

Network Equipment Building Systems
NEBS Level III
(Pending Certification at time of printing)

GR-1089-Core: Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment

SR-3580: Network Equipment Building Systems (NEBS): Criteria Levels (Level 3-compliant) –

GR-63-Core: Network Equipment Building System (NEBS) Requirements: Physical Protection –

Regulatory Compliance

UL 60950-1: 2001 - Safety of information technology equipment

EN 60950-1: 2001 + IEC 60950-1: 2001 - Safety of information technology equipment

21CRF1040, EN60825-1, EN60825-2 - Laser emissions safety

Emissions Certification

EN55022: Class A

EN 61000-3-2/3, (AC only)

FCC CFR 47 Part 15 Subpart B Class A, CISPR 22, ICES-003, AS/NZS 3548 Class A, , CNS-13438 Class A - BSMI in Taiwan, European Telecommunication Standards Institute, ETSI EN 300 386, Electromagnetic compatibility and radio spectrum Matters (ERM), Telecommunication network equipment, electromagnetic Compatibility (EMC) requirements

Immunity

EN61000-4-2 ESD immunity

EN61000-4-3 Radiated RF field immunity

EN61000-4-4 Immunity to electrical fast transients

EN61000-4-5 Surge immunity

EN61000-4-6 RF conducted immunity

European Telecommunication Standards Institute

ETSI EN 300 386: Electromagnetic compatibility and radio spectrum Matters (ERM); Telecommunication network equipment; electromagnetic Compatibility (EMC) requirements

Feature Specifications

Ethernet

Ethernet IEEE 802.3, 10BASE-T, Fast Ethernet IEEE 802.3u, 100BASE-TX, IEEE 802.3, 100BASE-FX, Gigabit Ethernet IEEE 802.3z, IEEE 802.3x, IEEE 802.3ab, IEEE 802.1Q, VLAN Trunking/Tagging, IEEE 802.3ad link aggregation

Encapsulations

PPP/HDLC, cHDLC, Ethernet, IEEE 802.1QinQ, MPLS, MFLR, PPP over Ethernet (RFC 2516), IPoE, DHCP

IP Address Management

DHCP: DHCP Proxy, DHCP Relay

Integrated DHCP Server

PPP: IPCP parameter negotiation, L2TP

Dynamic IP assignment: IP pools, RADIUS assigned addressing

Fixed IP address assignment: localized subscriber profile, RADIUS assigned addressing

Multicast Protocols

PIM-SM (RFC 2362 + IETF Draft), PIM-DM (IEFT Draft), IGMPv1, v2, v3 (RFC 3376), SSM (RFC 3569), MBGP (RFC 2858), MSDP (RFC 3618), IGMP snooping, IGMP filtering

Quality of Service

Up to 8 queues per subscriber and/or service up to 64,000 system queues

Ingress and egress policing, egress traffic shaping

Subscriber-level (user) rate limiting in 64 kbps increments

Dynamic QoS – Supports policy updates without disconnecting live subscriber sessions

QoS - 802.1p Class of Service (CoS), Differentiated Services Code Point (DSCP) ToS, IP Precedence, and MPLS EXP bits

Packet classification (RFC 2474, 2475, 2597, 2598); DiffServ packet marking by ACL, ingress policing, or BGP attribute-based QoS; class-based ingress policing and egress shaping; priority queuing and EDRR; RED and WRED; MPLS E-LSPs (RFC 3270)

Hierarchical QoS and Traffic Management

4 Hierarchical levels

64,000 Queues – 8 queues per subscriber

16,340 leaf nodes

8,000 aggregate nodes

26 port nodes

Routing Protocols

IPV4 and IPv6 ready routing capability supported in hardware with up to 1.5 million route entries and 1000 BGP Peers

BGP-4 (RFC 1771), IS-IS (RFC 1195 & ISO/IEC10589), OSPFv2 (RFC 2328), RIP v2 (RFC 2453), VRRP (RFC 2338), LDP, RSVP

Security

Reverse Path Forwarding (RPF), Secure ARP, MD5 support for routing protocols, key rollover, RADIUS, TACACS+; Administrative ACLs, packet mirroring and sampling, Secure Shell (SSH) Protocol, Kerberos, SNMPv3, IGMP filtering, SSHv2, VLAN ACLs, IP security router ACLs, subscriber-based ACLs

VPN Support

16,000 VLANs with 16,000 VLAN IDs

2,000 VPN contexts per system

2,000 L2TP tunnels per system

2,000 MPLS labels

1,000 H-VPLS instances with 802.1Q access and EoMPLS access

L2TP (RFC 2661) LAC, LTS, LNS

802.1Q Virtual LAN (VLAN) support with 802.1QinQ - with CoS mutation, 802.1Q tunneling with VLAN mapping

MPLS VPNs (RFC 2547bis), Carrier of carriers and Inter-AS, MPLS VPN over soft GRE) Multicast over MPLS VPN, GRE, Hard GRE, EoMPLS, VPN, Layer 2 VPNs (draft-martini), Transport Independent VPN, Traffic Engineering, RSVP (RFC 3209), LDP (RFC 3036, 3478), Layer 3 VPN (RFC 2547bis), Layer 2 VPN(draft-martini), Transport Independent, multicast, carrier of carriers, VLAN translation

CCOD

24,000 implicitly configured circuits with 16,000 active circuits

System Configuration and Management

Industry familiar Command Line Interface (CLI) and support via telnet or Secure Shell (SSH)

User authentication via RADIUS, TACACS+, local file

Transaction based configuration against a configuration database including commits, aborts and ability to roll back unintended changes

NetOp EMS support for event logs, SNMP traps, interface statistics for troubleshooting and performance monitoring, port views and chassis views.

Domain Name System (DNS), Trivial File Transfer Protocol (TFTP), Network Timing Protocol (NTP)

SNMPv1, SNMPv2c, SNMPv3

MIBs supported include: SNMPv2-MIB, IF-MIB, IP-MIB, TCP-MIB, UDP-MIB, IP-FORWARD-, EtherLike-, RBN-CONFIG-FILE-MIB, RBN-BULKSTATS-MIB, RMON-MIB event/alarm, RBN-ENVMON-MIB, RBN-CPU-METER-MIB, ENTITY-MIB, RBN-PVC-MIB, RBN-MEMORY-MIB, RBN-SYS-RESOURCES-MIB, RBN-QOS-MIB, RBN-IP-BIND-MIB, RBN-SUBSCRIBER-ACTIVE-MIB, RBN-BGP-ACCOUNTING-MIB, RBN-BIND-MIB, BGP4-MIB, RBN-IPPOOL-MIB, RADIUS-AUTH-CLIENT-MIB, RADIUS-ACC-CLIENT-MIB, RBN-RADIUS-MIB, RBN-L2TP-MIB, RBN-TACACS-MIB, RBN-L2VPN-MIB, RBN-DHCP-MIB, SNMP-TARGET-MIB, SNMP-USER-BASED-SM-MIB, SNMP-VIEW-BASED-ACM-MIB, SNMP-NOTIFICATION-MIB, SNMP-FRAMEWORK-MIB, SNMP-MPD-MIB

Optical Power Budget

Fiber Interface	Power Budget	Output Power		Input Sensitivity	Wavelength	
	Total	Min	Max	Min	Min	Max
100BaseFX (100FX) SFP for MM Fiber	13.5dB	-19 dBm	-14 dBm	-32.5 dBm	1270 nm	1380 nm
100BaseFX (100FX) SFP for SM Fiber	13dB	-15 dBm	-8 dBm	-28 dBm	1260 nm	1360 nm
1000BaseSX SFP - Multi-mode fiber	7.5 dB	-9.5 dBm	-0 dBm	-17.0 dBm	770 nm	860 nm
1000BaseLX SFP - Single-mode fiber	10.5 dB	-9.5 dBm	-3.0 dBm	-20.0 dBm	1270 nm	1360 nm

Ordering Information

Module	Part Number	Minimum Software Required
SmartEdge 100 base system with 2 fixed GbE ports, 2 FlexSlots, redundant DC power entry points, integrated circuit breakers and Base SEOS software	SYS-SE100-DC	SEOS Version 5.0.5
SmartEdge 100 base system with 2 fixed GbE ports, 2 FlexSlots, single integrated AC power supply, integrated circuit breakers and Base SEOS software	SYS-SE100-AC	SEOS Version 5.0.5
Removable Compact Removable Flash Card - 1GB	CF2-SE8-1G	SEOS Version 5.0.5
12-port 100 FX Fiber Media Interface Card (MIC) for insertion to FlexSlot. Requires SFP Fiber Optic Connectors for MM or SM interfaces	MIC-SE100-12FE-FX	SEOS Version 5.0.5
12-port 10/100 TX Media Interface Card (MIC) for insertion to FlexSlot	MIC-SE100-12FE-TX	SEOS Version 5.0.5
2-port SFP-based Gigabit Ethernet Media Interface Card (MIC) for insertion to FlexSlot. Requires SFP Fiber Optic Connectors	MIC-SE100-2GE-FX	Q3 2006
2-port 10/100/100 TX Gigabit Ethernet Media Interface Card (MIC) for insertion to FlexSlot.	MIC-SE100-2GE-TX	Q3 2006
100BaseFX (100FX)SFP for MM Fiber up to 2 KM	SFP-FE-FX	SEOS Vrsion 5.0.5
100BaseFX (100FX) SFP for SM Fiber up to 10 KM	SFP-FE-FX-LX10	SEOS Version 5.0.5
Short-Reach Gigabit Ethernet SFP Optical Connector – Multi-Mode fiber LC connection	SFP-GE-SX	SEOS Version 5.0.5
Long-Reach Gigabit Ethernet SFP Optical Connector – Single-Mode fiber LC connection	SFP-GE-LX	SEOS Version 5.0.5
1000Base-T Copper Gigabit Ethernet SFP with Standard RJ-45 Interface	SFP-GE-TX	SEOS Version 5.0.5