

CISCO UBR7246VXR UNIVERSAL BROADBAND ROUTER

PRODUCT SUMMARY

The Cisco uBR7246VXR universal broadband router is a service-enabling, communications-grade cable modem termination system (CMTS) that offers carrier-class reliability, modular scalability, and unmatched investment protection. The Cisco uBR7246VXR offers unparalleled features and exceptional performance/price. Customers can deploy solutions that address a wide range of density, performance, and service requirements, while ensuring future network needs.

The Cisco uBR7246VXR is Data Over Cable Service Interface Specifications (DOCSIS®) 1.1 and 1.0-qualified, as well as EuroDOCSIS 1.1 and 1.0-qualified. The product is also PacketCable™ 1.0-qualified. The product further supports CableLabs® OpenCable™ DOCSIS Set-Top Gateway (DSG) specification. DSG enables cable operators to transport upstream and downstream video traffic directly through the CMTS versus through a proprietary, standalone server. Incorporating out-of-band (OOB) messaging in DOCSIS digitally modulated carriers, cable operators can consolidate cable modem and set-top box data traffic on a shared DOCSIS channel.

As operators move toward the vision of all digital networks and converge IP data, voice, and video traffic, the CMTS must support advanced routing protocols and offer advanced automated intelligence. The Cisco uBR7246VXR evolves the CMTS into an intelligent broadband edge platform that delivers highly competitive service bundles. The product enables cable operators to capture the full potential of their cable spectrum and DOCSIS HFC networks. The product supports up to 10,000 subscribers.

COMMUNICATIONS-GRADE CABLE MODEM TERMINATION SYSTEM THAT DELIVERS HIGHLY PROFITABLE, TIERED IP DATA, VOICE, AND VIDEO SERVICES

As cable operators move toward converged services, the network edge becomes critical. The Cisco uBR7246VXR universal broadband router gives cable operators a feature-rich and scalable interface between subscribers and the backbone network. The Cisco uBR7246VXR offers flexible, cost-effective expansion of DOCSIS, EuroDOCSIS, or PacketCable infrastructures, supporting 1,000 to 10,000 subscribers. The product offers the widest range of field-installed capacity upgrades, including processors, cable line cards, and network interfaces. The Cisco uBR7246VXR supports a broad set of residential and commercial multiservice offerings, including high-speed Internet access, IP telephony, and Virtual Private Network (VPN) applications. Cable operators have the ability to offer VPN services via a comprehensive set of Multiprotocol Label Switching (MPLS) capabilities. For cable plants not fully upgraded to support two-way transmission, the routers work in conjunction with dialup access products to support upstream traffic from DOCSIS-based cable interfaces connected to the public switched telephone network (PSTN).

Figure 1 Cisco uBR7246VXR Universal Broadband Router



The Cisco uBR7246VXR chassis is fully radio frequency (RF) hardened to ensure virtually noise-free transmission. The Cisco uBR7246VXR supports the complete portfolio of Cisco Universal Broadband Router (uBR) line cards and Cisco Broadband Processing Engines (BPEs) that offer varying upstream-to-downstream interface ratios, differing bandwidth, modulation schemes, and the ability to dynamically perform complex spectrum management. The router supports 6 MHz North American channel plans using ITU-T J.83 Annex B operation and 8 MHz Phase Alternate Line (PAL) or Sequential Colour Avec Memoire (SECAM) channel plans using ITU-T J.83 Annex A operation.

With its combination of modular performance and density, the Cisco uBR7246VXR allows network-layer capabilities to be extended to a wide range of network configurations and environments. One of the key benefits of the Cisco uBR7246VXR is its modularity. The Cisco uBR7246VXR offers a variety of line cards, network interfaces, processors, I/O controllers, and memory options to offer customers customized configurations to meet network needs.

The Cisco uBR7246VXR features:

- Four cable line cards to connect to the cable plant
- Two port adapters (one slot for dual-width port adapter) to connect to the IP backbone and external networks; a range of network interfaces is available, including Cisco Dynamic Packet Transport (DPT) port adapters, which provide direct, high-speed optical connectivity combined with add-drop multiplexer capability
- One Cisco Network Processing Engine (NPE) that includes the choice of the Cisco uBR7200-NPE-G1, NPE-400, or NPE-225
- One I/O controller that includes the choice of a standard I/O controller, controller with one Fast Ethernet port, or controller with two Fast Ethernet or Ethernet ports for a chassis with a Cisco NPE-400 or NPE-225. For chassis that contain the Cisco uBR7200-NPE-G1, customers have the option of operating with or without an I/O controller.
- One cable clock card to lock onto and propagate a T1 clock signal throughout the router midplane

Like all other Cisco routers, the Cisco uBR7246VXR runs Cisco IOS® Software—the industry's most feature-rich software platform. The Cisco uBR7246VXR delivers high-performance routing capability at the edge, supporting Border Gateway Protocol (BGP4), Internal Border Gateway Protocol (IBGP), Multicast, Open Shortest Path First (OSPF), and many other routing and switching protocols. The Cisco uBR7246VXR supports NetFlow switching and quality of service (QoS) features including Weighted Fair Queuing (WFQ), Weighted Random Early

Discard (WRED), and Resource Reservation Protocol (RSVP). The product enables tiered service provisioning based on DOCSIS 1.1 QoS for true traffic shaping and management. The product enables differentiated billing by providing detailed traffic statistics by IP address, protocol, QoS, and application. Advanced plant troubleshooting and diagnostics enable proactive network management. Advanced spectrum management capabilities maintain reliable service to end users even in the presence of cable plant upstream noise.

Cable operators are increasingly concerned about inefficient use of network bandwidth. Traffic patterns are shifting, creating capacity challenges. The popularity of peer-to-peer (P2P) applications require advanced subscriber traffic management. Cable operators must know what traffic exists on the network and identify problem areas and applications. The CMTS must differentiate services and/or service levels based on traffic usage and patterns.

Network-based application recognition (NBAR) support on the Cisco uBR7246VXR provides intelligent network classification. NBAR is a classification engine that can recognize a wide variety of applications, including Web-based applications and client/server applications (P2P like Kazaa) that dynamically assign TCP or UDP port numbers. Once the application is recognized, the network can invoke specific services for that particular application. NBAR works with QoS features to ensure network bandwidth is best used to fulfill cable operator objectives. These features include the ability to guarantee bandwidth to critical applications, limit bandwidth to other applications, drop selective packets to avoid congestion, and mark packets appropriately so that the network can provide QoS from end-to-end.

The Cisco uBR7246VXR offers advanced subscriber traffic management capabilities using Cisco IOS Release 12.2(15)BC1 or later. The CMTS monitors, analyzes, and responds in real time to traffic usage, supporting volume-based metering with rate limiting capability. The Cisco uBR7246VXR identifies bandwidth top users, collecting usage per subscriber (downstream/upstream) and compares these to configured thresholds. Cable operators can rate limit subscribers with the option to either apply enforced QoS profile change for a specified period or change the DOCSIS ToS Override for policing and rate limiting in the network.

The Cisco uBR7246VXR supports load balancing—the ability to assign a cable modem when it comes online to a specific channel to use downstream and upstream bandwidth more efficiently. The Cisco uBR7246VXR assigns or reassigns cable modems based on operator-configurable criteria defined for a load-balancing group. Each load-balancing group contains one or more upstream interfaces and one or

more downstream interfaces. To balance each load balancing group, the Cisco uBR7246VXR monitors the load of each group to dynamically enable or disable the load balancing process.

High Availability, Serviceability, and Manageability

The Cisco uBR7246VXR offers exceptional availability, serviceability, and manageability. The Cisco uBR7246VXR supports dual current-sharing power supplies (AC or DC) and online insertion and removal (OIR) so that interfaces can be added, removed, or replaced without service interruption. A PC Flash memory card enhances reliability by storing backup software images and configuration files. Environmental monitors have levels of escalation so operators may take corrective action prior to any system shutdown. To enhance serviceability, each component of the Cisco uBR7246VXR is replaceable in the field.

For maximum uptime, the Cisco uBR7246VXR offers N+1 redundancy solutions with 99.999 percent high availability. The router works with the Cisco uBR 3x10 RF Switch to support fast failover of connected cable modems from an active CMTS to a standby CMTS. This ensures no single point of failure in the CMTS and offers fast switchover in the event of a system or link failure. The solution exceeds PacketCable high-availability requirements and optimizes switchover to:

- Prioritize voice flows over best-effort data flows
- Maintain advanced spectrum management states
- Support switchover of a single domain, line card, bundle, or chassis
- Offer quick command line interface (CLI)-based switchover for plant maintenance

Each Cisco uBR7246VXR supports up to four Cisco cable line cards, each featuring one or two downstream and six or eight upstream cable interfaces, for a total of up to eight downstream and 32 upstream interfaces in a chassis. Two Cisco RF Switches can be connected to four Working and one Protect Cisco uBR7246VXR, allowing operators to deploy an N+1 Redundancy scheme in which one protecting cable line card in the Working uBR7246VXR supports one Working cable line card in each of the four Working chassis.

For additional flexibility, the Cisco uBR7246VXR also supports 1+1 inter chassis redundancy which does not require an external Cisco RF Switch.

Key Features

- Modular scalability:
 - Highest density per seven-foot rack with forward-compatible cable line cards and a wide variety of network interfaces
 - Only platform with family of field-installable processor upgrades; additional subscribers with a 2x performance upgrade to the Cisco uBR7200-NPE-G1
- Highest reliability
 - Demonstrated mean time between failure (MTBF) beyond PacketCable requirements
 - 99.999 percent availability with N+1 Redundancy—cable industry's first inter-chassis, fully redundant N+1 system configuration
 - Field-proven reliability with more than 275,000 upstream ports deployed worldwide
- Proven investment protection
 - PacketCable 1.0, DOCSIS 1.1 and 1.0 qualified
 - Most versatile standards support-IETF, ITU, EuroDOCSIS, PacketCable, MPLS, DPT/RPR
 - DSG support, enabling cable operators to migrate from proprietary to open set-top technology and benefit from technical advantages and continued innovation of DOCSIS

Key Benefits

- Additional revenues with advanced IP services
- Increased customer satisfaction with field-proven high availability
- Reduced operational expenses with DPT backhaul resiliency
- Enhanced revenues with Layer 3 features designed specifically to support voice and commercial services
- Reduced operational expenses with industry-leading network management tools

NETWORK INTERFACES

The Cisco uBR7246VXR offers scalable density with the widest range of connectivity options including:

- Ethernet 10BASE-TX and 10BASE-FX
- Fast Ethernet 100BASE-TX and 100BASE-FX
- Gigabit Ethernet with transceiver options
- Serial; multiport T1, E1, T3, E3

- HSSI
- Multichannel T1, E1, T3, E3
- Packet Over SONET (POS)
- Dynamic Packet Transport (DPT)
- ATM

- ACLs
- NAT
- NetFlow
- Firewall
- Multicast

- DSG

SOFTWARE FEATURES

Key features the Cisco uBR7246VXR supports include:

- QoS
 - Subscriber Traffic Management (STM)
 - Low-Latency Queuing (LLQ)
 - Class-Based Weighted Fair Queuing (CBWFQ)
 - Class-Based Weighted Random Early Detection (CBWRED)
 - Policing
 - Marking
 - Shaping
 - Committed Access Rate (CAR)
 - Generic Traffic Shaping (GTS)
 - DOCSIS 1.1 and PacketCable QoS
- MPLS
 - MPLS VPN
 - MPLS QoS
 - MPLS traffic engineering
- Tunneling
 - GRE
 - L2TP
 - UTI
- Security/Other
 - Dynamic shared secret (DMIC) which allows the CMTS to ensure that every online cable modem uses the DOCSIS configuration file assigned to it; this protects against theft of service attempts from subscribers and safeguards operators against stolen or fraudulently downloaded configuration files. Configuration files are signed with a shared secret that is verified when a cable modem connects to the CMTS.

DSG Support

Traditionally, physical transport of OOB messaging is carried over dedicated channels as defined by the Society of Cable Telecommunication Engineers Digital Video Subcommittee (SCTE DVS) 167 and SCTE DVS 178. DSG allows the Cisco uBR7246VXR to deliver OOB messages with just a software upgrade using Cisco IOS Release 12.2(15)BC2 or higher. Based on CableLabs OpenCable standards, DSG is a technology that bridges the old video world with what can be considered "next generation out-of-band (OOB)." DSG moves away from traditional OOB transport, incorporating it into DOCSIS digitally modulated carriers now used for cable modem service. The CMTS transports digital video OOB messaging/signaling between video headend and subscriber digital set-top boxes. Consolidating cable modem and STB traffic over a common DOCSIS network enables cable operators to support new features and technology with minimal hardware change and offers a smarter and lasting network infrastructure that increases return-on-investment and reduces operating expenses. DSG adds the power of DOCSIS technology for new services, accelerating rollout of bandwidth-intensive, interactive video services such as online gaming, T-commerce, and targeted advertising. Migration of OOB messaging traffic to an operationally superior and higher bandwidth DOCSIS channel is critical to adoption of interactive services. For these services, the traditional OOB mechanism (DVS 167 and DVS 178) is inefficient and provides insufficient bandwidth at a higher cost point.

Table 1 Cisco uBR7246VXR Universal Broadband Router Specifications

Description	Specification
Midplane	Two PCI buses with an aggregate bandwidth of 3.2 Gbps ^a
Dimensions (H x W x D)	10.5 x 17.00 x 21.25 in. (26.67 x 43.18 x 53.98 cm)
Weight	Chassis fully configured with a network processing engine, I/O controller, 2 port adapters, 4 cable line cards, a clock card, 2 power supplies, and a fan tray: ~ 100 lb (45.4 kg)
Heat Dissipation	800W ^b (2730 Btu ^c)
AC-Input Power	800W maximum (with either a single or dual power supply configuration)
Maximum AC-Input Voltage	100 to 240 VAC ^d wide input with power factor correction
AC-Input Current Rating	7A ^d maximum at 110 VAC and 3.5A maximum at 240 VAC with the chassis fully configured
AC-Input Cable	18 AWG ^e three-wire cable, with a three-lead IEC-320 receptacle on the power supply end, and a country-dependent plug on the power source end
DC-Input Voltage Rating	-48 VDC ^f nominal in North America -60 VDC nominal in the European Community
DC-Input Current Rating	Not to exceed 13A maximum at -48 VDC (370W/-48 VDC = 7.7A typical draw) Not to exceed 8A maximum at -60 VDC (370W/-60 VDC = 6.2A typical draw)
DC-Input Cable	14 AWG (2.08 mm ^g) recommended minimum, with at least three conductors rated for at least 140° F (60° C)
DC-Output Power	550W maximum (with either a single or dual power supply configuration)
DC Voltages Supplied	+3.5V, +5.2V, +12.2V, -12.2V, +16V, -16V
Operating Frequency	50/60 Hz
Airflow	~120 cfm ^h
Temperature	32 to 104° F (0 to 70° C) -4 to 149° F (-20 to 65° C)
Humidity	10 to 90% noncondensing
Agency Approval	Safety: UL 1950, CSA 22.2 No. 950, EN60950 EMI: FCC Class A, CSA Class A, EN60555-2, EN55022 Class B, VCCI Class 2, AS/NRZ 3548 Class A Immunity: IEC-1000-4-2, IEC-1000-4-3, IEC-1000-4-4, IEC-1000-4-5, IEC-1000-4-6, IEC-1000-4-11, IEC 1000-3-2

a. Some de-rating applies due to a) multiplexing address and data on a PCI bus; b) mix of read (slow) versus write (fast) operations; c) burst transfer sizes

b. W = watts

c. Btu = British thermal units

d. VAC = volts alternating current

e. A = ampere

f. AWG = American Wire Gauge

g. VDC = volts direct current

h. cfm = cubic feet per minute

DSG Specifications

The DOCSIS Set-Top Gateway feature is based on SP-DSG-I01-020228, <http://www.cablelabs.com>.

This specification is in draft form and is expected to change.

Cisco IOS Release 12.2(15)BC2—the first release that supports DSG—supports the following:

- Up to four separate conditional access (CA) vendors per router; vendor names must be unique and limited to a maximum of 7 characters
- A maximum of eight DSG tunnels (as identified by the well-known MAC address) per CA vendor, for a maximum possible total of 32 DSG tunnels per router
- Multiple CA vendors cannot use the same DSG tunnel (that is, two vendors cannot use a tunnel with the same IP multicast address).
- Each vendor must use a unique set of IP multicast addresses, and after an IP multicast address is assigned to a DSG tunnel, that same address cannot be used for any other purpose. However, all other multicast addresses and groups can still be used on the interface for other multicast applications.
- DSG-related IP unicast traffic is supported only by configuring Network Address Translation (NAT) on the cable and WAN interfaces, as described in the “DOCSIS Set-Top Gateway for the Cisco CMTS” feature module.
- DSG traffic should be less than 2.048 Mbps per vendor, so as to conform to the DSG specifications.
- If using bundled interfaces, operators must configure DSG configurations on the master interface only. When DSG is configured properly on the master interface, DSG traffic can flow across both master and slave interfaces.



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