

Cisco uBR7246VXR Universal Broadband Router

The Cisco® uBR7246VXR Universal Broadband Router is a service-enabling, communications-grade cable modem termination system (CMTS) that offers high reliability, modular scalability, and significant investment protection. Because of the Cisco uBR7246VXR's (Figure 1) support for a broad range of features, cable operators can cost-effectively deploy solutions that address a wide range of density, performance, and service requirements, and feel confident the router also will support future networking needs.

The Cisco uBR7246VXR is qualified for DOCSIS® 1.1 and 1.0, as well as Euro-DOCSIS 2.0, 1.1 and 1.0. The product is also PacketCable™ 1.1-qualified. Beginning in Cisco IOS® Release 12.3(13)BC, the product supports PacketCable™ Multimedia (PCMM), enabling cable operators to deploy unique, next-generation multimedia services on their communications-grade CMTSs. Beginning in Cisco IOS® Release 12.3(33)SCD, the product is full DOCSIS3.0 and Euro-DOCSIS3.0 compliant.

The product further supports the CableLabs® OpenCable™ DOCSIS Set-Top Gateway (DSG) specification. DSG enables cable operators to transport upstream and downstream video traffic directly through the CMTS instead of through a proprietary, standalone video infrastructure. Incorporating out-of-band (OOB) messaging in DOCSIS digitally modulated carriers, cable operators can consolidate cable modem and set-top box (STB) data traffic on a shared DOCSIS channel.

As operators evolve their traditional infrastructures to an IP Next-Generation Network supporting 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 hybrid fiber-coaxial (HFC) networks. The product supports up to 10,000 subscribers.

Figure 1. Cisco uBR7246VXR Universal Broadband Router



Communications-Grade CMTS Delivers Profitable Tiered IP Data, Voice, and Video Services

As cable operators move toward converged services, the network edge becomes critical. The Cisco uBR7246VXR 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, Euro-DOCSIS, or PacketCable/PCMM infrastructures, supporting 1,000 to 10,000 subscribers. The product offers one of the widest ranges 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 VPN applications. Cable operators have the ability to offer VPN services using 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).

The Cisco uBR7246VXR chassis is fully RF hardened to help ensure virtually noise-free transmission. The Cisco uBR7246VXR supports 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 primary benefits of the Cisco uBR7246VXR is its modularity. The Cisco uBR7246VXR works with 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. Not required for chassis that contains the Cisco uBR7200 Series NPE-G2 or NPE-G1.
- Cisco uBR7200 Series NPE-G2 Network Processing Engine.
- 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 uBR7200 Series NPE-400 or Cisco uBR7200 Series NPE-225. For chassis that contain the Cisco uBR7200 Series NPE-G2 or 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 Systems® routers, the Cisco uBR7246VXR runs Cisco IOS Software - one of the industry's most feature-rich software platforms. The Cisco uBR7246VXR delivers high-performance routing capability at the edge, supporting Border Gateway Protocol version 4 (BGPv4), Internal Border Gateway Protocol (IBGP), IP 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 Detection (WRED), and Resource Reservation Protocol (RSVP). The product enables tiered service provisioning based on DOCSIS 1.1 QoS or PCMM Dynamic QoS (D-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 requires 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 solves this problem. NBAR is a classification engine that can recognize a wide variety of applications, including Web-based applications and client/server applications (for example, P2Ps such as Kazaa) that dynamically assign TCP or User Datagram Protocol (UDP) port numbers. After the application is recognized, the network can invoke specific services for that particular application. NBAR works with QoS features to help ensure network bandwidth is best used to fulfill cable

operator objectives. These features include the ability to assign appropriate 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 across devices.

The Cisco uBR7246VXR offers advanced subscriber traffic management capabilities. The CMTS monitors, analyzes, and responds in real time to traffic usage, supporting volume-based metering with rate-limiting capability. The Cisco uBR7246VXR identifies the primary users of bandwidth, 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.

With Cisco IOS Software Release 12.3(13)BC or greater, operators can optimize network utilization in real time for prioritized and aggregated resource demands from all PCMM applications and enhance the broadband subscriber experience by prioritizing or reserving bandwidth for latency-sensitive and feature-rich services. The CMTS fulfills service flow requests and now supports admission control - real-time decision making concerning a service-by-service request prior to committing CMTS or CMTS-controlled resources. Operators can establish policies for how resources are allocated among multiple services and can set thresholds for dealing with demand spikes. Features such as admission control and advanced traffic engineering, as well as advanced-mode DSG on their cable IP networks, help operators converge voice, video, and data traffic on their cable IP networks. In addition, Service-Independent Intercept (SII) support is added to assist operators in meeting the needs of law enforcement.

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 can take corrective action prior to any system shutdown. To enhance serviceability, each component of the Cisco uBR7246VXR is replaceable in the field.

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.

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;
- Highest reliability
- Demonstrated mean time between failure (MTBF) beyond PacketCable requirements
 - Field-proven reliability with more than 275,000 upstream ports deployed worldwide
- Proven investment protection

- Qualified to PacketCable 1.1 and 1.0, DOCSIS 1.1 and 1.0 qualified, as well as Euro-DOCSIS 2.0, 1.1, and 1.0. Full DOCSIS3.0 and Euro-DOCSIS3.0 compliant
- Most versatile standards support - IETF, ITU, Euro-DOCSIS, PacketCable, PCMM, MPLS, Dynamic Packet Transport/Resilient Packet Ring (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 a wide range of connectivity options, including:

- Fast Ethernet 100BASE-TX and 100BASE-FX
- Gigabit Ethernet with transceiver options
- Multichannel T1, E1, T3
- Packet over SONET (POS)

Software Features

Primary 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, PCMM D-QoS
- MPLS
 - MPLS VPN
 - MPLS QoS
 - MPLS traffic engineering
- Tunneling
 - Generic routing encapsulation (GRE)
 - Layer 2 Tunneling Protocol (L2TP)

- Universal Transport Interface (UTI)
- Security/other
 - Dynamic shared secret (DMIC), which allows the CMTS to help 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.
 - SII
 - Access control lists (ACLs)
 - Network Address Translation (NAT)
 - NetFlow
 - Firewall
 - Multicast
- DSG

DOCSIS Set-Top Gateway 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 Software Release 12.2(15)BC2. Advanced mode DSG is supported using Cisco IOS Software Release 12.3(13)BC or greater. Based on CableLabs OpenCable standards, DSG is a technology that bridges the traditional video environment with what can be considered “next-generation 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 the video headend and subscriber digital STBs.

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 an intelligent and more lasting network infrastructure that increases return on investment and reduces operating expenses. DSG adds the power of DOCSIS technology for new services, accelerating deployment 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.

Specifications

Table 1 lists the Cisco uBR7246VXR specifications.

Table 1. Cisco uBR7246VXR Universal Broadband Router Specifications

Description	Specification
Midplane	Two PCI buses with an aggregate bandwidth of 3.2 Gbps
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 (2730 Btu)
AC input power	800W maximum (with either a single or dual power supply configuration)
Maximum AC input voltage	100 to 240 VAC4 wide input with power factor correction

Description	Specification
AC input current rating	7A4 maximum at 110 VAC and 3.5A maximum at 240 VAC with the chassis fully configured
AC input cable	18 AWG5 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 VDC6 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) 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
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

1. Some derating applies because of (1) multiplexing address and data on a PCI bus, (2) mix of read (slow) and write (fast) operations, and (3c) burst transfer sizes.

2. AWG = American Wire Gauge.

DOCSIS Set-Top Gateway Specifications

DSG feature support in Cisco IOS Software Release 12.3(13)BC is based on CM-SP-DSG-I04-050408. Support includes:

- Up to four separate conditional access vendors per router; vendor names must be unique and are limited to a maximum of seven characters.
- A maximum of eight DSG tunnels (as identified by the well-known MAC address) per conditional access vendor, for a maximum possible total of 32 DSG tunnels per router.
- Multiple conditional access 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 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.
- Advanced mode capabilities such as downstream channel descriptor, regionalization, fragmentation, QoS, and enhanced security for Multicast delivery of OOB messages dynamically to STBs.