Product Assessment

Cisco 7600 Series

Carrier Ethernet in Carrier Infrastructure

September 15, 2009

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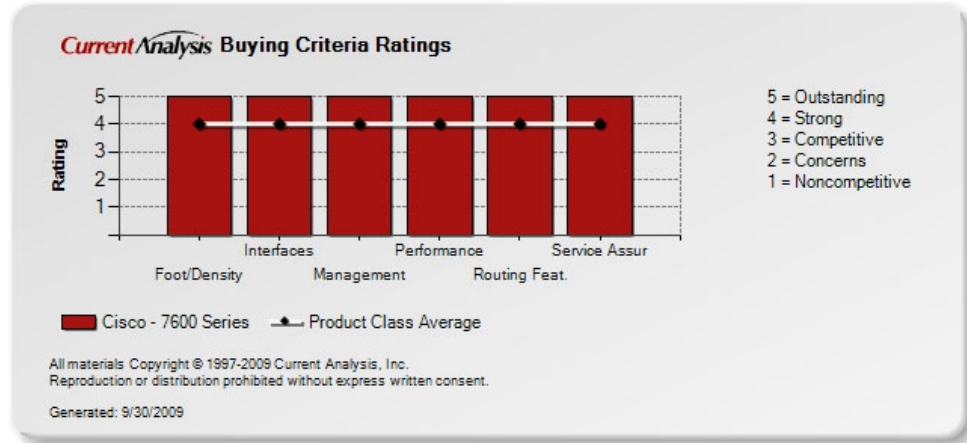
Cisco 7600 Series

Analyst:

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Date Updated:

Sep 15, 2009

Product Class:

Carrier Ethernet in Carrier Infrastructure

■ **Summary**

Buying Criteria

Current Analysis **Buying Criteria Ratings**

Rating

5 = Outstanding
4 = Strong
3 = Competitive
2 = Concerns
1 = Noncompetitive

Foot/Density   Interfaces   Management   Performance   Routing Feat.   Service Assur

■ Cisco - 7600 Series   ▬▲▬ Product Class Average

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Current Perspective: Very Threatening

The 7600 series is very threatening in the carrier Ethernet services edge (ESE) router market due to its broad range of features and market penetration. The 7600 provides support for carrier Ethernet services such as DSL, cable, FTTx, PON, fixed mobile convergence, and wireless service aggregation. The 7600 supports both Layer 2 and Layer 3 service models and includes features such as HVPLS, H-QoS, pseudowire redundancy, endpoint auto-discovery, and high-density GigE and 10 GigE interfaces. The 7600 provides full IP H-QoS and a suite of advanced Ethernet OAM features to reduce administration and operations costs, and it complies with the MEF-9 and MEF-14 certifications.

The 7600 leverages Cisco's Interface Flexibility (I-Flex) architecture, which combines compatible shared port adapters (SPAs) and SPA interface processors (SIPs) to offer consistent feature support and service delivery across Cisco's midrange and high-end routing platforms. This includes the Cisco ASR1000, Catalyst 6500, 7304, 7600, 10000, XR 12000, and 12000 series routers as well as the flagship CRS-1 core router. The I-Flex architecture allows customers to mix and match interface types, such as OC-3 to OC-192, Gigabit Ethernet, copper, and legacy ATM and frame relay interfaces, in the same slot to support services such as "triple play," IP VPNs, and IP security (IPSec). The 7600 operates under Cisco's IOS operating system and it has centralized and distributed feature processing and forwarding technology, which can carry feature-laden IP traffic.

The 7600 series not only addresses Ethernet switching, routing, and aggregation functions; it also provides support for converged voice, video, and data services as well as extensions to support IP mobility transparently. This capability is accomplished through integration with PDSN and GGSN networks, enabling providers to achieve additional cost reductions by using IP networks to backhaul wireline and mobile traffic; this reduces the need to continue investments in legacy TDM/ATM network infrastructures. The 7600 now supports

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applications such as subscriber-aware Ethernet services (Broadband Network Gateway – BNG) and mobile transport over packet (MToP). These features are now part of Cisco's mobile backhaul solution, which utilizes circuit emulation over packet (CEoPS) and PWE3. These new applications are extensions to Cisco's overall Ethernet strategy and support Ethernet convergence.

Recent 7600 series portfolio enhancements include multicast connection admission control (CAC) capability to deliver video services efficiently, an integrated video/IPTV quality-monitoring module to improve the delivery of high-quality video services, standards-based Ethernet OA&M capabilities to enable service assurance for Ethernet-based services, and new enhanced service 20G Ethernet interfaces. Others include integrated session border control for IP multimedia and non-IMS services, an intelligent services gateway for data service convergence, PDSN and GGSN integration, Service and Application Module for IP (SAMI), and an integrated mesh Wireless Service Module (WiSM) for metropolitan WiFi mesh network aggregation to expand service provider Ethernet services more efficiently.

Cisco has introduced new access and aggregation router solutions dubbed the Access Service Router 1000 Series and the ASR 9000 series. The new ASR 9000 addresses high-density Ethernet aggregation applications along with the rich services features that have evolved with the 7600 series. Initial versions of the ASR 9000 were generally available beginning in Q1 2009 and the new platform has been tested by the European Advanced National Test Center (EANTC) as part of Cisco's "Mega Test," where it performed the role as the Ethernet aggregation layer. The testing validated the 7600's ability to perform better than 50ms switchover as well as high-scale multicast and its 40Gbps/slot capabilities.

■ Strengths and Weaknesses

Strengths

• The 7600 is one of the primary router platforms that comprises Cisco's NGN suite to fulfill the role of IP routing and switching at the service provider edge. Its field-hardened IOS and complete IP/MPLS capabilities provide a flexible IP edge platform for the delivery of MEF-compliant Ethernet edge services (the 7600 was one of the first 39 products to receive MEF certification for its carrier Ethernet services), subscriber-aware Ethernet (BNG), IP aggregation, and low-speed line aggregation.

• The 7600 supports "any play" services with asymmetric next-generation video networking, asymmetric EtherChannel, and unidirectional link routing, along with GigE and 10GigE optical interfaces. Cisco's NGN platform, which also includes the SIP-based Session Border Controller, provides an end-to-end solution for delivering video over an Ethernet and IP infrastructure. Integrated video quality of experience (VQOE) has been added to eliminate the need for external appliances.

• The 7600 also supports functions such as IPSec, firewall (FWSM), intrusion detection (IDS), DDoS anomaly and guard, GGSN, persistent storage device (PSD), content services gateway (CSG), and Wireless Services Module (WiSM) and Network Analysis Module (NAM) support.

• The 7600 series portfolio includes standards-based Ethernet OA&M capability to enable service assurance for Ethernet-based services. An integrated mesh Wireless Service Module (WiSM) supports metropolitan WiFi mesh network aggregation to expand service provider

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Ethernet services more efficiently.

• The 7600 series delivers 40 Gbps of switching capacity per slot and provides native support for IPv4, IPv6, and MPLS protocols. With hardware-enabled forwarding for IPv4, IPv6, and MPLS, the system performance is capable of 400 Mpps for IPv4 and 200 Mpps for IPv6 traffic with all features enabled. New Ethernet interfaces provide 20G of performance (20 x 1 GigE or 2 x 10GigE at line rate). Also available are 4 x 10GigE and 8 x 10GigE over-subscribed interfaces.

• The 7600 provides high Ethernet interface density across a breadth of interface options to give service providers the best of both worlds by enabling both traditional IP/MPLS network edge aggregation and deployment of advanced Ethernet services using GigE and 10GigE optical interfaces. The system supports up to 820/1,640 line rate/oversubscribed GigE interfaces in a single telco rack. 10G IPoDWDM capabilities have been added to support tighter integration with the optical transport network.

Weaknesses

• Configuration rules for the 7600s can become complex, given the multiple generations of interfaces and processor modules that continue to be supported. Much of the complexity is a result of investment protection, which Cisco takes seriously, noting that customers want to carry legacy line cards forward so that they do not have to fork-lift upgrades or replace existing line cards every few years. Users should fully understand the capabilities and limitations of the older-generation interfaces.

• The 7600 runs under Cisco's IOS operating system, which Cisco has enhanced with multiple high-availability features such as in-service software upgrade (ISSU), MPLS-TE fast reroute, non-stop forwarding, and stateful switchover (SSO). However, IOS does not have all of the high-availability features and service isolation present in its IOS XR operating system, which runs on the CRS-1, XR 12000, and ASR 9000 series routers.

• The 7600 is one of multiple edge platforms that Cisco offers. Customers often desired to have multiple functions supported on a single box, which can lead to a level of confusion in the market as to which Cisco edge platform to use. However, the 7600 is targeted toward subscriber-aware Ethernet applications while the 10008 is the lead BRAS, the XR 12000 is now positioned as the lead multiservice provider edge platform, and the ASR 9000 is emerging as the high-scale Ethernet service edge platform.

Point and Counterpoint

Point: The competition will point out that, given the rapid pace of technology development, many aspects of the 7600 series' Optical Service Modules cannot be upgraded using Cisco's PXF technology. This means that Cisco's cards will become as outmoded as those of most competitors within a similar timeframe, negating some of the value of the "evergreen" upgrade abilities of the PXF processors

Counterpoint: Cisco will explain that the 7600 is integral to its NGN edge router offerings. The 7600 shares interfaces with other members of the NGN such as the CRS-1, 12000, and 7304. It also offers investment protection for past platforms, such as the Enhanced FlexWAN modules, by providing a means to perform field upgrades of feature

functionality; this enables timely upgrades without the need for major interruptions to service.

Point: Competitors such as Alcatel-Lucent and Ericsson will point out that their platforms are purpose-built to address the needs of premium IP and Ethernet-based services. Meanwhile, the 7600 is being evolved to address the needs of services such as triple play and it lacks the resilient architecture and performance to meet the needs of service providers facing increased levels of performance per subscriber, as well as video on demand (VoD) services, in particular.

Counterpoint: Cisco will point out that its NGN solutions address the needs of service providers, as evidenced by recent enhancements such as video traffic management with a multicast call admission control (CAC) function, standards-based OAM functionality for Ethernet traffic, and a new integrated mesh Wireless Service Module (WiSM) for metropolitan WiFi mesh network aggregation. Also included are new service modules such as SBC, SAMI, and ISG, which enhance the service delivery capabilities of the 7600.

Point: Competitors will tend to spread "FUD" related to the demise of the 7600 now that the long-awaited Viking (ASR 9000) has arrived.

Counterpoint: Cisco will point out that the 7600 is laden with the features service providers need to deploy advanced service networks. The 7600 offers a 40G/slot (80Gps/slot half-duplex) performance that is on par with its competitors and actually complements the ASR 9000 for applications that need sub-100G/slot performance.

■ **Buying/Selecting Criteria**

Footprint and Density: OUTSTANDING

• The 7600 series is available in multiple chassis sizes to address the needs of service provider PoPs. The 7613 is 19 RUs, the 7609/7609S are 21 RUs, and the 7606/7606S are seven RUs. The 7604 is a five-RU modular chassis designed to enable service providers to deploy L2/L3 VPN and triple play services in small PoPs and Internet gateways requiring edge aggregation. The smallest member of the family is the 7603, which is four RUs.

• The power options for the 7600 series include: 6,000W AC/DC, 4,000W AC/DC, 3,000W AC, and 2,500W DC for the 7613/7609/7609-S; 1,900W AC/DC and 2,700W AC/DC for the 7606/7606-S; 2,700W AC/DC for the 7604; and 1,500W DC for the 7603-S. Cisco has achieved NEBS Level 3 certification and is designed for "five-nines" reliability. It is suitable for deployment in a service provider PoP location.

• The 7609/7609-S supports the following port densities: 34 10-GigE ports/chassis, 386/386 GigE ports/chassis line-rate/oversubscribed, 386 to 770 10/100 ports/chassis, and 386 to 770 100Base-FX ports/chassis. With the addition of the new ES+XT series two and four-port line cards, the system can connect to LAN, WAN, and OTN interfaces in support of Cisco's IPoDWDM integration. The new cards support up to 40 Gbps of bandwidth with four ports of 10G Ethernet interfaces, or 20 Gbps with two ports of 10 Gbps.

• The 7613 supports 192 T3/E3 ports with twelve slots which can be configured with a single SIP-200 plus four four-port T3/E3 SPAs, 192 OC-3c/STM-1 POS ports/chassis, 24 OC-12c/STM-4 POS ports/chassis, 24 OC-48c/STM-16 POS ports/chassis, and 24 ATM

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OC-12c/STM-4 ports/chassis. Up to 12 OC-192/STM-64 ports, along with DWDM optics and up to eight wavelengths and 32 wavelengths per optical ring per system are supported.

• For class comparisons based on a fully loaded rack with 44 RU of mounting space, excluding power considerations, the 7609/7609-S delivers a total 10 GigE density of up to eight non-blocking ports per rack, which is greater than the average for the class; up to 132 oversubscribed 10 GigE ports can be supported.

• The 7600 supports up to 820 non-blocking ports per rack; this is above the class average. Operators can obtain greater Ethernet port densities by using the 7606/7606-S chassis.

Interface Support: OUTSTANDING

• The 7600 supports Cisco's Interface Flexibility (I-Flex) design for shared port adapters (SPAs) and SPA interface processors (SIPs), and it provides broad interface options (copper, channelized, PoS, ATM, and Ethernet) for the Cisco carrier routing portfolio, which includes the Cisco ASR 1000, Catalyst 6500, 7304, 7600, 12000, and Cisco XR 12000 series routers, as well as the Cisco CRS-1. These new SPAs and SIPs reduce total cost of ownership by providing slot-economics and scalability for cross-platform sharing/sparing.

• The 7600 supports 10 GigE port requirements with multiple modules, including: the Ethernet Services 20G, which supports two ports of 10G Ethernet interface; a one-port 10 GigE module, and a four-port 10 GigE module. For over-subscribed applications, there is an eight-port 10G module. The one-port 10 Shared Port Adapter (SPA), Version 2, is also available, which is IEEE 802.3ae standards-based for compatibility and interoperability.

• The 7600 supports GigE port requirements with multiple modules, including: the Ethernet Services 20G (7600-ES20), which supports 20 ports of Gigabit (SFP and DFC3C/3CXL) at full line rate with services enabled; and two-, five-, and ten-port Gigabit Ethernet shared port adapters (Version 2).

• POS support is provided by new SPA interfaces and includes the following interfaces: 16 OC-3 POS per slot (four x four-port SPAs), four OC-12 POS per slot (four x one-port SPAs), up to four OC-48 POS per slot (4 x one-port SPA), and one OC-192 POS per slot.

• ATM is supported on the 7600 with the OC-12/STM-4 SPA and OC-48/STM-16, in addition to the OC-3c/STM-1, T3/D3, T1/E1 SPA for the SIP-200/400, and the port adapter for the Enhanced FlexWAN (two SPAs or PAs per carrier card).

• For T1 - DS3 support, the 7600 provides channelized T1/E1, T3, OC-3, and one-port CHOC-12/CHSTM-4 to DS0. The 7600 also offers a number of clear channel and channelized shared port adapters and SIPs.

Routing and Service Features: OUTSTANDING

• The 7600 supports Layer 2 and Layer 3 MPLS VPNs, including RFC 2547 bis, VPLS, Ethernet over MPLS, frame relay over MPLS, PPP over MPLS, HDLC over MPLS, ATM AAL5 over MPLS, cell relay over MPLS, MPLS CoS, RSVP, and LDP. For Ethernet aggregation, the 7600 supports Q-in-Q to assist in VLAN scaling.

• The 7600 offers advanced service delivery options. Recent enhancements include the addition of integrated session border control (SBC) for IP multimedia and non-IMS services as well as an intelligent services gateway IISG) for data service convergence, Service

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and Application Module for IP (SAMI), and PDSN and GGSN integration to enable service providers to leverage the 7600 to reduce mobile backhaul constraints and reduce costs.

• The 7600 supports IGMP (snooping), CGMP, GMRP, hardware IP multicast replication and forwarding, PIM-SM, and PIM-DM; with the ES20, VLAN trunking enables multiple enterprise customers to share a single GigE access switch fiber but use separate VLANs to access the PoP.

• The ES20 supports up to 20 Gbps of bandwidth optimized for Ethernet aggregation and it has the ability to combine native Layer 2 bridging and Layer 3 routing, which is particularly useful in metro Ethernet applications.

• Services are centralized in the supervisor engine; they run at 30 Mpps, including ACL, classification, and marking based on differentiated services code point (DSCP), type of service (ToS) and interface (physical or logical), and policy-based routing (PBR).

• The 7600's route scalability includes one million simultaneous IPv4 FIB entries or 512,000 simultaneous IPv6 FIB entries, and it supports IGRP, EIGRP, RIP, RIPII, BGP4, IS-IS, RTMP, and DECnet Phase IV routing protocols.

Service Assurance: OUTSTANDING

• The 7600 provides hardware-based QoS, classification on IP CoS, IP precedence, ToS, DSCP, MPLS EXP, policing, RSVP priority mapping, and CiscoAssure L2, L3, and L4 policy management. Software enhancements include hierarchical quality of service (H-QoS), enhanced capabilities for prioritizing IP traffic, and dynamic multipoint virtual private network (VPN) security capabilities.

• The 7600 features a redundant CPU, switch fabric modules, load sharing power supplies (AC & DC), fans, and 1:1 SONET APS per port, per line card, or per chassis.

• The 7600 supports load balancing of traffic over 16 equal-cost paths (load balancing per packet) and aggregation/load balancing across eight Fast Ethernet or GigE ports from the same I/O module or diverse I/O modules. Also supported is load balancing across up to eight 10 GigE ports.

• The 7600 supports non-stop forwarding (NSF) and stateful switchover (SSO) to eliminate or reduce the impact on system failures.

• The CNS Notification Engine software application assists in management of the network. CNS converts Syslog messages to user-selected SNMP trap notifications or XML events, and it eliminates duplicates and correlates events at the device layer before presenting to the network management layer. It also provides remote management capabilities such as service ping, mirroring, and trace route to aid in diagnostics and troubleshooting activities.

System and Service Management: OUTSTANDING

• The 7600 is supported by the Cisco Element Manager Framework GUI or through higher-level applications accessing the EMS using its northbound CORBA interface. Cisco Domain Managers provide provisioning, service-level monitoring, and service-level accounting. The Domain Managers support service domains such as MPLS VPN, IPSec VPN, any transport over MPLS (AToM), Internet access, managed security, metro Ethernet, voice over IP, cable, access voice, and wireless.

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• The 7600 is supported by the "Cisco Internet Solution Center" (ISC) provisioning application.

• Fault management is addressed by the CNS Notification Engine software application, which converts Syslog messages to user-selected SNMP trap notifications or XML events. The CNS de-duplicates and correlates events at the device layer before presenting to the network management layer. Recent enhancements include standards-based Ethernet OAM capabilities for end-to-end management support.

• Configuration management supports the configuration of IP, VLANs, EtherChannel, BGP, EIGRP, and OSPF, and it provides inventory details for chassis and modules. Recent enhancements include a multicast call admission control (CAC) to assure the quality of video traffic.

• Accounting management is supported and includes records by total bytes/flow, total packets/flow, ToS of packets/flow, first and last packet time stamps/flow, and source and destination ports. BGP policy accounting services use the BGP policy accounting traffic index to perform services such as destination-sensitive billing/accounting based on the destination of a packet.

System Performance and Architecture: OUTSTANDING

• The 7600 series is available in multiple chassis sizes to provide operators with the ability to scale performance and port density to match specific site and application requirements. Models 7609, 7609-S, and 7613 offer a total Layer 2/3 switching capacity of 720 Gbps. The 7606 and 7606-S models support up to 480 Gbps. The 7604 and 7603/7603-S models deliver 320 Gbps and 240 Gbps, respectively.

• The 7600-S enhanced chassis delivers improved services; the 7609-S delivers numerous design improvements including improved hardware failover mechanisms, up to 750W per slot, redundant multispeed fans, and a front-to-back airflow design as well as improved thermal flow measurement and management. The 7603-S enables mobile operators to pre-aggregate TDM and ATM circuits over a common pseudowire layer, to reduce OpEx. The 7606-S delivers on multiple networking solutions at the enterprise edge.

• The Cisco 7600 provides performance and reliability with options for redundant route processors and power supplies. The inclusion of two Gigabit Ethernet ports on the Supervisor Engine 720 with the Multilayer Switch Feature Card 3 (MSFC-3), or the Route Switch Processor 720 (RSP 720) with the MSFC-4, eliminates the need for a line card slot for uplink ports, resulting in efficient use of available line card slots and increased deployment flexibility.

• The 7600 provides scalable routing performance, with the 7613, 7609, and 7609-S models each providing up to 400 Mpps of packet forwarding, the 7606-S providing 270 Mbps, and the 7604 and 7603-S providing 170 Mbps and 120 Mbps, respectively, using the distributed forwarding characteristics of the DFC3/4 running in distributed mode.

• For class comparisons based on a fully loaded rack with 44 RU of mounting space, excluding power considerations, the 7606/7606-S (based on six chassis per rack) can provide a total switching capacity equivalent to 2.8 Tbps per rack. This is above the average for the class (2.178 Tbps). In addition, it delivers routing performance equivalent to approximately 1,600 Mbps per rack, which is above the average (1,247 Mbps per rack).

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Product Metrics

Product: Cisco 7600 Series

Architecture	
Switch Fabric	Switch fabric: 720 Gbps crossbar fabric (Supervisor 720-3BXL/RSP720-3CXL); option to install second fully-redundant Sup720-3BXL/RSP720-3CXL with onboard 720G switch fabric. Fully compatible with line cards with dual or single fabric as well as non-fabric enabled line cards such as EFlexWAN and SIPs.
Distribution of Intelligence	Redundant engines with switch fabric/control plane functions. Services may be applied centrally or distributed (with DFCs).
Queuing, Buffering	64,000 queues (32,000 ingress and 32,000 egress) per SIP-400 with 256MB buffer
Performance	
Switching Capacity	7613 - 720Gbps; |7609-S - 720Gbps; |7606-S - 480Gbps; |7604 - 320Gbps; |7603-S - 240Gbps
Full Duplex Switching Capacity	7613 - 360Gbps; |7609-S - 360Gbps; |7606-S - 240Gbps; |7604 - 160Gbps; |7603-S - 120Gbps
Routing/Switching Performance	7613 - 400Mpps; |7609-S - 400Mpps; |7606-S - 270Mpps; |7604 - 170Mpps; |7603-S - 120Mpps, |(with distributed line cards)
Full Duplex Service Performance	Up to 48Gbps per slot
Rack Density	7613 - 2 per rack; |7609-S - 2 per rack; |7606-S - 6 per rack; |7604 - 9 per rack; |7603-S - 11 per rack
Service Assurance	
Hardware Redundancy	Redundant CPU, switch fabric modules, load sharing power supplies (AC & DC), fans; 1:1 SONET APS & MSP & ATM APS are supported
Redundant Power, Fans, Feeds	Yes,fully redundany power AC or DC power supplies and redundant fans
Redundant Switch Fabric/Forwarding Engines	Yes
Interface Redundancy 1:1	Yes
Interface Redundancy, 1:N	Yes
Redundant Hot Swappable Components	Yes
SONET APS	SONET APS and SDH MSP supported
RPR, Standard/Propietary	Resilient Ethernet
Resilience/Availability	Link redundancy is support with SONET APS, 802.3ad LACP as well as control/data plane features like NSF/SSO, Fast IP/MPLS convergence
Control, Data, and Management Plane Separation	Yes, Separate data and control plane
Graceful Restart	Yes
50 ms Link Failover	Yes
MPLS Fast Reroute	Yes
Non-Stop Switcing/Hitless Layer 2 Failover	Yes
Non-Stop Routing/Hitless Layer 3 Failover	Yes
Non-Stop Services/Hitless Layer 4 Failover	Yes
Hitless Software Upgrade	No

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Current Analysis

■ **Product Metrics** *(Continued)*

Product: Cisco 7600 Series *(Continued)*

Capacity	
10 Gbps Ports/Chassis (non-blocking)	7613 - 29; |7609-S - 34; |7606-S - 22;|7604 - 14; |7603-S - 10
10 Gbps Ports/Chassis (over-subscribed)	7613 - 49; |7609-S - 66; |7606-S - 42; |7604 - 26; |7603-S - 18
1 Gbps Ports/Chassis (non-blocking)	7613 - 410; |7609-S - 386; |7606-S - 242; |7604 - 146; |7603-S - 98
1 Gbps Ports/Chassis (over-subscribed)	|7613 - 410; |7609-S - 386; |7606-S - 242; | 7604 - 146; |7603-S - 98
10/100 Mbps Ports/Chassis	7613 - 820; |7609-S - 772; |7606-S - 1148; |7604 - 1314; |7603-S - 1078
100 Mbps Ports/Chassis	7613 - 650; |7609-S - 770; |7606-S - 482; |7604 - 290; |7603-S - 194
T3/E3 Ports/Chassis	7613 - 192; |7609-S - 128; |7606-S - 80; |7604 - 48; |7603-S - 32
ATM Ports/Chassis (OC-3)	7613 - 96; |7609-S - 64; |7606-S - 40; |7604 - 24; |7603-S - 16
ATM Ports/Chassis (OC-12)	7613 - 24; |7609-S - 16; |7606-S - 10; |7604 - 6; |7603-S - 4
ATM Ports/Chassis (OC-48)	7613 - 24; |7609-S - 16; |7606-S - 10; |7604 - 6; |7603-S - 4
ATM Ports/Chassis (OC-192)	Not Supported
POS Ports/Chassis (OC-3/STM-1)	Cisco 7613 - 192; Cisco 7609-S - 128; Cisco7606-S - 80; Cisco 7604 - 48; 7603-S - 32
POS Ports/Chassis (OC-12/STM-4)	7613 - 48; |7609-S - 32; |7606-S - 20; |7604 - 12; |7603-S - 8
POS Ports/Chassis (OC-48/STM-16)	7613 - 48; |7609-S - 32; |7606-S - 20; |7604 - 12; |7603-S - 8
POS Ports/Chassis (OC-192/STM-48)	7613 - 12;|7609-S - 8; |7606-S - 5; |7604 - 3; |7603-S - 2
WDM Lambdas/Chassis	32 DWDM lambdas and 8 CWDM lambdas are supported using SFPs, GBIC, XENPAKs, and XFPs; ES+XP 10Gig IPoDWDM capabilities on 2 or 4 ports per line card
Interfaces	
10/100 Mbps Ethernet	10/100Base-TX (48-port module, RJ-45, RJ21 interfaces), 10Base-FL (24-port module, MT-RJ connectors for MMF)
100 Mbps Ethernet	100Base-FX (24-port, MultiMode MT-RJ, MMF, SMF)
100/1000 Mbps Ethernet	16-, 48-, and 96-port 10/100/1000
1 Gbps Ethernet	Ethernet Services+ 40G LC (40 ports); Ethernet Services+ 20G LC (20 ports); 67xx LC (24 or 48 ports); SPA (2-, 5-, and 10-port)
10 Gbps Ethernet	Ethernet Services+ 40G LC (4 ports); Ethernet Services+ 20G LC (2 ports); 67xx LC (4 or 8 ports); SPA (1-port)
DS-1/DS-3/HSSI	1-port CHOC-12/CHSTM-4 to DS0; 1-port CHOC-12/CHSTM-4 to T3/E3; no CHOC-48 available
ATM	4-port OC3, 1-port OC-12, 1-port OC48 ATM per slot
POS	16-port OC-3, 2-port OC-12, 1-port OC-48, 1-port OC-192 POS interface per slot
Features	
CoS/QoS	Classification on IP COS, IP Precedence, TOS, DSCP, MPLS EXP; Policing, RSVP priority mapping, CiscoAssure L2, L3, L4 policy management
Hardware-based QoS	Yes
Forwarding Classes/Port	SIP and ES20 line cards support up to 8 per logical or physical port
Service-based QoS	Yes
Interface-based QoS	Yes
Subscriber-based QoS	Yes

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Product Metrics *(Continued)*

Product: Cisco 7600 Series *(Continued)*

Rate Shaping/Limiting/Marking	Yes
Line Rate Forwarding	Yes
Layer 2, IEE 802.1p Traffic Prioritization	Yes
Policy-based Traffic Mangement	Yes
Hierarchial QoS	3 levels
Load Balancing	Supports CEF load-balancing over 16 paths (per flow)
Link Aggregation	Aggregation and load balancing across 8 Fast Ethernet, or Gigabit Ethernet, or 10 Gigabit Ethernet ports from same I/O module or diverse I/O modules
MPLS	Supports Layer 2 and Layer 3 MPLS VPNs, Ethernet over MPLS, frame relay over MPLS, ATM AAL5 and cell relay over MPLS, MPLS CoS, RSVP, LDP, and Inter-AS and CsC L3VPNs, VPLS, H-VPLS
Network Mgt.	Integrated Net. Analysis Module, RMON1 (stats, hist, alarms, events), RMON2, SPAN, CiscoWorks for Switched Internetworks, Cisco Resource Manager
Provisioning	Not available
Routed Protocols	IGRP, EIGRP, RIP, RIPII, BGP4, IS-IS, RTMP, OSPF
Routing Protocols	IGRP, EIGRP, RIP, RIPII, BGP4, IS-IS, RTMP, DECnet Phase IV
Route Scalability	1M Simultaneous IPv4 FIB Entries or 512K Simultaneous IPv6 FIB Entries
VLANs/Multicast	IGMP (snooping), SSM, BirDir PIM, M-BGP, MSDP, CGMP, GMRP, hardware IP multicast replication and forwarding, PIM-SM, PIM-DM; VLAN trunking enables multiple enterprise customers to share a single GigE access switch fiber but use separate VLANs to access the POP
Advanced Service Modules/ Capabilities	
Network Management	
EMS	EMS software applies to both the Catalyst 6500 and Cisco 7600 series. EMS can be used via the Cisco Element Manager Framework GUI or through higher-level applications accessing the EMS using its Northbound CORBA interface. | IP Solution Center (ISC) for provisioning and Active Network Abstraction (ANA) for manageablity.
Fault Management	CNS Notification Engine software application converts Syslog messages to user-selected SNMP trap nofifications or XML events. De-duplicates and correlates events at the device layer before presenting to the network management layer. Ethernet OAM capabilities.
Configuration Management	Enables configuration of IP, VLANs, EtherChannel, BGP, EIGRP, OSPF, and provides inventory details for chassis and modules.
Accounting	Records by total bytes/flow, total packets/flow, TOS of packets/flow, first and last packet time stamps/flow, source, and destination ports. BGP policy accounting services uses the Border Gateway Protocol (BGP) policy accounting traffic index as the classification criterion to perform services such as destination-sensitive billing/accounting based on the ultimate destination of a packet.
Performance Management	Service Assurance Agent (SAA) embedded in Cisco IOS enables service level monitoring without external probes. Collects response time, one-way latency, jitter, packet loss. Per-class traffic monitoring.
Security	ASIC-based Control Plane Rate Limiting for IP Unicast & Multicast (DoS Protection), ASIC-based ACLs, IPSec VPN, Firewall, IDS

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Product Metrics *(Continued)*

Product: Cisco 7600 Series *(Continued)*

Physical Specifications	
Slots/Chassis	7613 - 13 slots, |7609-S - 9 slots, |7606-S - 6 slots, |7604 - 4 slots, |7603-S - 3 slots
I/O Slots	7613 - 12 slots, |7609-S - 8 slots, |7606 - 5 slots, |7604 - 3 slots, |7603 - 2 slots;	1 fixed line card per slot. Up to 4 I/O slots per SIP-200 and SIP-400
Dimensions	7613 - (H x W x D): 33.3 in. x 17.2 in x 18.1 in (82.3 x 42.5 x 44.7 cm); |7609/7609-S - (H x W x D): 36.75 x 17.2 x 20.7 in. (93.3 x 43.1 x 53.3 cm); |7606/7606-S - (H x W x D): 12.25 x 17.37 x 21.75 in. (31.11 x 44.12 x 55.25 cm);|7604 - (H x W x D): 8.75 x 17.5 x 21.75 in. (22.225 x 44.45 x 55.245 cm); |7603-S (H x W x D): 7 in. x 17.37 in. x 20.3 in.
MTBF	MTBF figures depend on specific system configurations. Information can be provided upon request.
NEBS Compliance	NEBS 3 Certified on all chassis
Power Requirements	2500W AC/DC, and 4000W AC/DC and 6000W AC/DC supply for 7609-S, 7609, 7613;	2700W AC/DC and 1900W AC/DC 7606-S, 7606; |1500W DC for 7603-S. |DC power supplies may operate lower depending on number of feeds are utilized giving customers more flexiblity and investment protection.
Power Draw & Thermal Load	For Specifics, contact vendor
Chassis Options	13-slot, 9-slot, 6-slot, 4-slot, and 3-slot
System Applications	MPLS PE, SP Edge (IPv4/IPv6), Metro Ethernet, Ethernet BRAS, Video, Cell Backhaul (Mobile), High-end Enterprise, Lease Line
RU	7613 - 18RU; |7609-S - 21RU; |7606-S - 7RU;	7604 - 5RU; |7603-S - 4RU
Chassis/Rack	7613 - 2 per rack; |7609-S - 2 per rack; |7606-S - 6 per rack; |7604 - 9 per rack; |7603-S - 11 per rack
Terms & Conditions	
Price (List)	
Availability	Requires Cisco IOS 12.2SR
Additional Information	
Customers	Over 3,000 customers including tier-1 providers as well as challengers across all geographic theaters. To name a few AT&T, Comcast, Cox, Sprint, Colt Telecom, U's Communications, Time Warner, Saudi Telecom, Qwest
Partners	Netflow partners include Concord Communications (performance and availability management), Narus (Internet Business Infrastructure Solutions), XACCT (IP billing record creation and account provisioning), Portal Software
Special Notes	1. Supports the full Catalyst 6500 Series Ethernet, Fast Ethernet, GigE, and 10 GigE Ethernet LAN modules. 2. Supports FlexWAN modules, enabling aggregation of low-speed DS-0 to OC-3 services.
Special Notes	3. The SIP-600 supports VLAN trunking so that multiple customers can share a Gigabit Ethernet access switch fiber but use VLANs to access the service provider's POP. 4. Several services are centralized in the supervisor; they run at 30 Mpps, including ACL, classification, and marking based on differentiated services code point (DSCP), type of service (ToS) and interface (physical or logical), and policy-based routing (PBR).
Special Notes	5. Supports L2 or L 3 point2point or multipoint2multipoint services. The ES20's Ethernet Virtual Service (EVC) capability furthermore allows for VLAN tag manipulation of various kind. the ES20 linecard supports hardware based forwarding up to 30Mpps per slot. |Intrusion detection system (IDS) and content switching modules (CWMs) make the Cisco 7600 a complete single-box solution for space-constrained data centers.

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■ Product Metrics *(Continued)*

Product: Cisco 7600 Series *(Continued)*

Special Notes	6.Network Processor-based traffic shaping can be used to offer sub-rate Gigabit Ethernet connections when customers do not have enough current traffic to justify a full Gigabit Ethernet. 7. Having 2 Gigabit Ethernet ports on the Cisco Supervisor 2 Multilayer Switch Feature Card 2 (MSFC2) route processor eliminates the need to use a line-card slot for uplink ports. The result of this design is more efficient use of available line-card slots and increased deployment flexibility. 8. Advanced Services Cards include ISG, SCE, IDS, IPSec, SBC, ISG, and VQE.

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