Cisco IPv6 At-A-Glance

Cisco: Leading the Transition

For the last 10 years, Cisco, as the world's networking leader, has been promoting a forward-looking, thoughtful, and network-tested pursuit of the development and integration of IPv6, along with the coexistence of IPv4 and IPv6. Cisco has achieved this movement through its thought leadership in the Internet Engineering Task Force (IETF) while standardizing the IPv6 protocol specifications; the phased integration of IPv6 into its product set, best practices, and training; and network architecture planning and support—which make a thoughtful, secure, and business-driven integration to IPv6 a reality. Some sample Cisco® IPv6 contributions include:

- Cisco IOS® Software with IPv6 deployed in the 6Bone network in 1996
- Founding member of the IPv6 Forum in 1999
- Cisco engineers function as co-chairs in multiple IETF working groups

Many currently shipping Cisco routers and switches support IPv6, as Cisco focuses on enabling IPv6 in all its next-generation hardware platforms. To enable customers and partners to transition securely to IPv6, Cisco has received many product certifications (e.g., IPv6 Ready Logo, US DoD IPv6 certification, etc.) and has developed a phased IPv6 architecture integration plan that moves both our products and our customers' networks forward into the IPv6 future.

Cisco Operating Systems: Extensive, Proven IPv6 Support

In 2001, Cisco released the first commercial version of Cisco IOS Software with IPv6 support. Today, Cisco operating system software enables production deployment of IPv6 across the following Cisco devices:

Cisco Operating System	Device Deployment
Cisco IOS-XR	· Cisco CRS/1 · Cisco 12000 Series
Cisco IOS-XE	· Cisco ASR 1000 Series
Cisco IOS Release 12.4M	· General production
Cisco IOS Release 12.4T	· Technology development
Cisco IOS Release 12.28x	· Cisco Catalyst® switches · Cisco 7x00 and 10000 Series
Cisco NX-OS	· Nexus 7000
Cisco SAN-OS	· MDS9500

Cisco Hardware Platforms: Embedded IPv6 Support

As with IPv4, interface speeds and port density determine the need for IPv6 hardware acceleration within Cisco routing and switching systems. The following Cisco platforms benefit from IPv6 hardware forwarding:

System	IPv6 Hardware Forwarding	
Routers	· Cisco CRS/1 · Cisco 12000 · Cisco 10720 · Cisco ASR 1000	· Cisco ASR 1000 · Cisco 7600 w/Sup720 · Cisco 10000
Switches	· Catalyst 6500 w/Sup720 · Catalyst 4500 w/Sup6-E	· Catalyst 3750/3750-E · Catalyst 3560/3560-E · Nexus 7000 · MDS9500

The Driving Forces Behind IPv6 Adoption

Continuous growth of the Internet requires the overall architecture to evolve. New technologies that support growing numbers of users, applications, appliances, and services are transforming the way people interact and communicate. IPv6 is designed to meet these requirements to enable a global environment where network addressing is again transparent to the applications.

Cisco Security/Management: IPv6 Oversight and Optimization

As networking infrastructures evolve to accommodate IPv6, security and management services are two primary components for a successful integration and deployment. The following are sample security and management systems or services that can be deployed today in Cisco IPv6 networks:

Service Set	Sample IPv6 Services
Security	· Firewall (Cisco IOS firewall, ASA appliances, Catalyst 6500 Series FWSM) · Packet filtering (std, extended, reflexive) · IPSec (OSPFv3, site-to-site tunnels, etc.) · IPv6 IPSec HW Encryption devices on ISR and 7200 · IPv6 intrusion prevention with IPS 6.2 code
Management	· Instrumentation—Unified IP MIBs, NetFlow for IPv6 records, IPv6 SLA, etc. · Applications running over an IPv6 network layer—SNMP, Syslog, Telnet, HTTP, TCL, SOAP, SSH, etc. · Network Management applications for IPv6—Cisco LMS 2.5, CNR 6.2, NetFlow Collector 5.x, NAM, etc.

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What Does IPv6 Deliver to Tomorrow's Networks?

IPv6 quadruples the number of network address bits from 32 bits (in IPv4) to 128 bits or approximately 3.4x1038 addressable nodes. This not only allows for ready network expansion, but also meets the requirements of emerging networked applications, including:

- Internet-enabled wireless devices
- Home and industrial appliances
- Internet-connected transportations
- Integrated telephony services
- Sensor networks such as RFID and IEEE 802.15.4 (6LoWPAN)
- Distributed computing or gaming

The use of globally unique IPv6 addresses simplifies the mechanisms used for reachability and end-to-end security for network devices. The functionality is crucial to the applications and services that are driving the demand for the addresses.

The lifetime of IPv4 has been extended using techniques such as address re-use with translation and temporary-use allocations. Although these techniques appear to increase the address space and satisfy the traditional client/server setup, they fail to meet the requirements of on-rushing, innovative applications, and environments.

Did You Know...?

- The Organisation for Economic Co-Operation and Development report recommends all state members to adopt IPv6.
- At the end of 2007, according to Internet World Statistics, there were 1.25 billion Internet users and 1 billion connections to the Internet. In 2012, forecasts call for 2.5 billion Internet users and over 5 billion connections.
- The 128-bit address space of IPv6 allows the assignment of approximately 665,570,793,348,866,943,898,599 addresses to every square meter on the surface of the planet Earth!
- In 2007, all regional Internet registries (RIRs) warned that the IPv4 resource pool had been reduced to a point where it now advises the "migration to IPv6 is necessary."

The Move to IPv6: Selecting the Right Route to Success

The industry is in the early stages of large-scale IPv6 production deployment. A critical part of the IPv6 design is its capability to integrate and coexist with current IPv4 networks. The development of transition strategies, tools, and mechanisms has been part of the basic IPv6 design from the start.

Cisco recommends that customers and partners take a proactive, well-informed, and deliberate approach to IPv6 integration. Cisco is actively publishing recommended IPv6 network and security integration architectures and adoption best practices, which it will continue to refine as IPv6 solutions and networks evolve.

Three principal IPv6 deployment strategies are available:

- Tunneling—A simple, inexpensive way to start using IPv6, but not a long-term strategy:
  - Encapsulates IPv6 traffic within IPv4 packets, so they can be sent over an IPv4 backbone—allowing packets of IPv6 end systems and routers to communicate without the need to upgrade the IPv4 infrastructure that exists between them
- Dual-Stack—Best strategy for successful integration over the next 5 to 10 years. It allows for the greatest flexibility when supporting applications that run over IPv4 and/or IPv6:
  - Enables both IPv4 and IPv6 packets across the network, which requires all network infrastructure devices to operate both IPv4 and IPv6 protocol stacks and use each stack's specific routing protocols
- Translation—Applied as a simple tool when front-ending a web server or as a complex option when driving large-scale, carrier-class translation between IPv6-only devices (e.g., mobile handsets) and IPv4-only Internet resources:
  - Provides IPv6 communication end-to-end
  - Intercommunication between IPv4 and IPv6 requires some level of translation between the two protocols; this happens on the host or router with an application-level view as to which protocol to use

Selection of a deployment strategy or strategies depends upon the current network environment, forecasted amount of IPv6 traffic, and the availability of IPv6 applications on end systems/appliances.

Cisco Professional Services: Advanced IPv6 Support

Cisco's long-term involvement in large-scale IPv6 deployments uniquely qualifies Cisco's Professional Services as a highly experienced IPv6 consultancy. Cisco's IPv6 Assessment and Migration Services form a comprehensive support structure. This structure ranges from up-front network evaluations and design to deployment, to post-transition IPv6 optimization and planning.

Regardless of the support services provided or deployment strategy selected, Cisco adheres to the following objectives in any IPv6 transition:

- Transition is scheduled when and where needed.
- New or updated applications must be protocol-independent.
- Deployment is incremental, minimizing impact in the existing network.
- Operating costs and support requirements are minimized.

Cisco strongly believes that IPv6 will enable continued growth in global communications. We are committed to driving IPv6 standards, incorporating IPv6 into our products, and sharing best practices to help ensure IPv6 success.

For More Information

Refer to the following links for more information and guidance about supporting your organization's transition to IPv6:

Cisco: The IPv6 Transition

The IPv6 Forum: Driving IPv6 Development

go6: The IPv6 Portal