IPv6: How to Get Started

Internet Protocol Version 6, or IPv6, is enabling the new Internet, creating new opportunities for business growth. Organizations need to enable IPv6 on their networks to maintain critical connectivity with partners, customers, and employees. You can accomplish this using a phased approach that reduces disruption to your business and incorporates industry best practices and knowledge gained from successful customer deployments. This paper describes an IPv6 approach that helps you preserve what you have; prepare for this new economy; deploy new resources, applications, and devices; and compete effectively using next-generation Internet technologies.

Summary

Why Implement IPv6?

The Time Is Now

IPv6 is no longer an option. IPv4 addresses may be exhausted as early as spring 2011,[1] increasing the urgency for organizations to make this transition. Many nations have developed IPv6 strategies, including the United States, which has set a deadline of September 30, 2012[2] for U.S. agencies to switch their public-facing networks to IPv6. This need to develop an IPv6 strategy now extends to any enterprise or service provider competing in the new economy, and many have already begun the transition:[3]

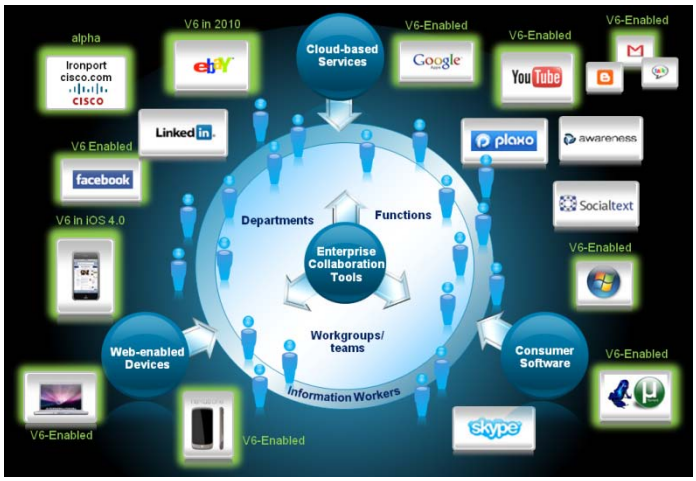
- Thirty-two percent of Internet service providers (ISPs) offer public IPv6 services today, and more than 60 percent are expect to offer these within a year.
- Eighty-four percent of companies have already obtained IPv6 addresses or will obtain them in the near future.
- OS providers, application developers, and network operators have IPv6 enabled their offerings.

It is time for your organization to adopt IPv6 if you are:

- Experiencing difficulty expanding into new global regions because public IPv4 Internet addresses are not available. This is compounded by IPv4 addressing redundancies as a result of mergers and acquisitions.
- Deploying innovative network environments, applications, and devices (as shown in Figure 1) – including sensors supporting smart connected communities – that quickly expend your assigned IPv4 addresses.
- Needing to maintain seamless connectivity across fixed and mobile users when using collaborative applications, and Network Address Translation is no longer an option.
- Implementing IPv6-based 4G mobile networks or connecting workers to these networks.
- Working in the public sector, or working with the government as a partner or supplier, where IPv6 is fast becoming the standard.
- Encountering IPv6 on your network already, through deployments of Microsoft Windows 7, Windows Vista, Windows Server 2008, Apple OS X 10.3, and virtualization.

1 IPv4 address report, “Real-time view of projected IPv4 exhaustion date,” www.potaroo.net/tools/ipv4/index.html.
2 “Transition to IPv6,” memorandum to chief information officers of executive departments and agencies, Executive Office of the President, Office of Management and Budget, September 28, 2010, www.cio.gov/documents/IPv6MemoFINAL.pdf.
3 “Organizations Urged to Stop Delaying IPv6 Deployment to Safeguard Future Growth of the Internet,” Number Resources Organization, September 15, 2010, www.nro.net/media/urgedtoStopDelayingIPv6.html.

Figure 1. "Three Mega Business Trends Will Reshape the Tech Sector," Forrester Research, November 2008



Reducing Business Risks

IPv6 is here, but as with any new technology, deployment is not without challenges. You must thoroughly understand how IPv6 integration will affect different groups within your organization and plan accordingly. You require a well-thought-out strategy spanning the total enterprise, extending to partners where appropriate, and balancing investment, usability, and security. The goal? Transparency to the end user – a seamless IPv6 integration experience that spans from the desktop to corporate data centers, providing access to content and applications, whether local or on the other side of the world.

Although networking vendors have focused on IPv6-enabling their router and switch offerings for some time, the challenge encompasses more than hardware alone. Organizations must develop a comprehensive technical, business, and operational solution that addresses concerns such as:

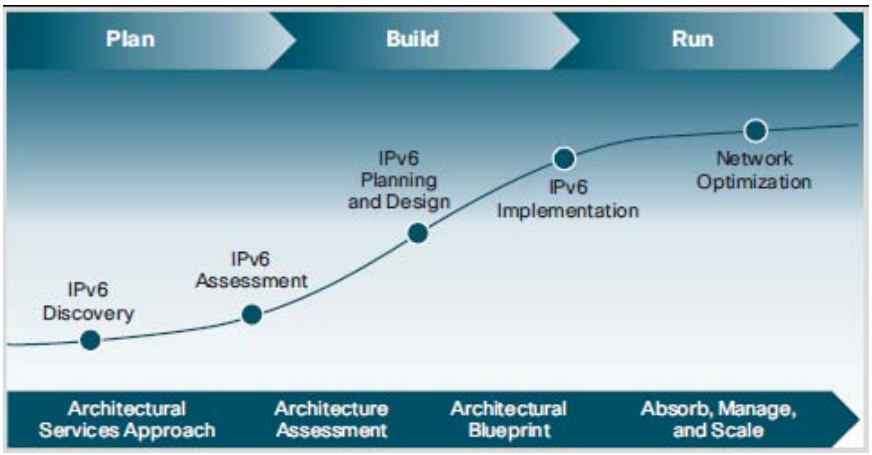
- Do you have the in-house expertise to properly migrate the network and services infrastructure, including internal and external access to corporate resources and applications?
- Do you understand the cost implications of hardware and software support?
- Do you have the expertise to address the security implications of IPv6 integration, even more critical in a phased deployment?

IPv6 Implementation: Where to Begin for Deployment Success?

The challenges are not insurmountable. It is critical to adhere to best practices, while working with a trusted vendor throughout the process. The vendor you select should have the experience to help you develop in-house expertise, apply best practices to avoid common pitfalls, and provide support as you begin the deployment process. Assess the success of your deployment by how well IPv6 integrates within your network and preserves existing investments, and how the smooth and incremental transition through IPv4 and IPv6 interoperability ultimately sets the stage for a more productive and global enterprise. But what exactly does this mean, and just how do you begin the process?

Best practices call for a prioritized, iterative approach to adoption, and one that is aligned to your business strategy. IPv6 deployment requires a structured approach that includes network discovery, deployment assessment, planning and design, IPv6 implementation, and continual optimization, as shown in Figure 2. The framework described in this paper assumes that the organization has already made the decision to begin IPv6 migration.

Figure 2. A Phased Approach to Successful IPv6 Adoption Aligns to Your Business Strategy



Business and Network Discovery

The first step toward deployment is business and network discovery, where an organization identifies high-level business requirements for the migration, including timing, as well as external considerations such as regional address availability and government compliance. These requirements and considerations align to assets within the enterprise that must be IPv6 enabled such as the corporate WAN, the security infrastructure, network services, and critical applications.

Deployment Assessment

In the assessment phase, an organization lays out its technical requirements and determines how to best deploy the technology with goals of minimizing disruption, facilitating troubleshooting, and containing implementation costs. As part of the assessment, various deployment options, such as dual-stack or hybrid models, are jointly discussed, along with desktop and data center support. The result is a high-level implementation plan that covers all IT assets.

Planning and Design

The design phase is where the proverbial rubber hits the road. Because you cannot map a route without knowing the destination, you should decide on the deployment model before beginning any design. There are three deployment models to consider.[4]

Dual-Stack Model

In the dual-stack model, desktops, the campus, hosts within the data center, and any connectivity to the outside world are both IPv4 and IPv6 enabled in most cases. This model works quite well if some parts of the enterprise are IPv6 only, because they will have access to all resources. Where a user is capable of only IPv4, the IPv6 infrastructure will be invisible. The dual-stack model also facilitates longer term IPv4 phase-out by providing for incremental IPv6 deployment. Planning includes migration of routers and switches to IPv6-capable Cisco IOS® Software releases and in some cases IPv6-capable hardware. The same applies for servers and applications within the data center, as well as any virtualization infrastructure.

Hybrid Model

Where all network assets cannot be IPv6 enabled, the hybrid model may be more appropriate. In this model, access to IPv6 resources from an IPv6 desktop relies on tunnels across an IPv4 campus or enterprise backbone (either private or provider based). This model supports options where either the access and distribution switches or the core is not yet IPv6 enabled.

[4] "Deploying IPv6 in Campus Networks," Cisco, February 9, 2009, www.cisco.com/en/US/docs/solutions/Enterprise/Campus/CampIPv6.html.

Service Block Model

A third model, the service block model, facilitates quick support of IPv6 where the campus network is not yet IPv6 enabled. It is an interim solution that can facilitate migration to the dual-stack model and, like the hybrid model, also takes advantage of tunneling.

In most cases, given increasing desktop support for IPv6, best practices call for the dual-stack model across the entire network infrastructure: WAN, campus, data center.

Developing a Detailed Design

The detailed design includes the IPv6 addressing plan; physical connectivity considerations, including WAN links and wireless LANs; creating and managing VLANs and their associated protocols; and the routing infrastructure to include provider connectivity, high availability, multicast (if required), quality of service, manageability, scalability, and performance.

Security

Security is a crucial consideration in IPv6 migration. IPv6 is not an update of IPv4 but an entirely new suite of protocols, raising new security challenges. Because of these unknown risks, organizations should adequately resource for such areas as firewall and intrusion prevention device readiness and IT expertise to properly identify and remedy threats. They should verify the readiness of third-party security suppliers (such as virus signature authorities), recognize complexities and tradeoffs in the various address assignment methods, and ensure the quality of OS and application implementations.[5] Sure, IPv6 offers the promise of end-to-end encryption, but the initial homework must be done. IPv6 implementation will result in a transition period that offers organizations the time they need to learn and develop security best practices.

Virtualization

With the growing emphasis on virtualization and the mobile enterprise, which are often interrelated, IPv6 support is critical but is also an area where organizations have less expertise. You should work closely with your data center virtualization provider to understand the potential effects of IPv6 migration on remote access to corporate assets using smartphones or tablets.

Implementation

The final stage of the planning process is to develop a plan for implementation and testing.

Given proper planning, the actual IPv6 implementation should be the low-risk part of the process. You initially deploy IPv6 within the lab or on a limited pilot network, covering the complete set of network devices, applications, and desktops targeted as the initial candidates for integration in the planning process. The test should exercise each element of the design and, if the deployment spans geographies, validate the design for each geography.

The pilot is an opportunity to solicit user feedback and eliminate problems that will likely be discovered as part of the larger deployment. It is critical to keep affected users informed of the deployment and to establish an effective feedback process.

Extending the pilot to a regional or line-of-business deployment is the next step.

Optimization

Once you have deployed IPv6, your work has just begun. The adoption process is a closed loop that offers opportunities for continual feedback and optimization. Your vendor should work closely with you to analyze operational metrics, any unexpected behavior, and, most importantly, the user experience. You will end up with a list of improvements that add additional capabilities and business value.

[5] "Defcon Speaker Calls IPv6 a 'Security Nightmare,'" *The Register*, August 6, 2010, www.theregister.co.uk/2010/08/06/ipv6_security_nightmare.

Why Cisco?

Cisco takes a phased approach to IPv6 adoption that is based on more than 10 years' IPv6 industry leadership and includes proven methodologies, architectures, and best-practice guidelines that help to reduce perceived challenges associated with your IPv6 implementation. We offer deep networking and business expertise, along with understanding of enterprises, service providers, and government organizations, to assist the IT manager at each step of the IPv6 adoption process.

Conclusion

Cisco offers a phased approach to IPv6 deployment that helps reduce risk and enhance return. It future-proofs the borderless enterprise experience, delivering seamless, reliable, and secure access to enterprise assets by anyone, at any time, from any location, and across any device. The Cisco® solution overcomes deployment challenges by combining technical, business, and services expertise.

For More Information

For more information about Cisco IPv6 Services and solutions, visit www.cisco.com/go/ipv6.

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV Amsterdam,
The Netherlands

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at **www.cisco.com/go/offices.**

Printed in USA C11-632532-00 11/10