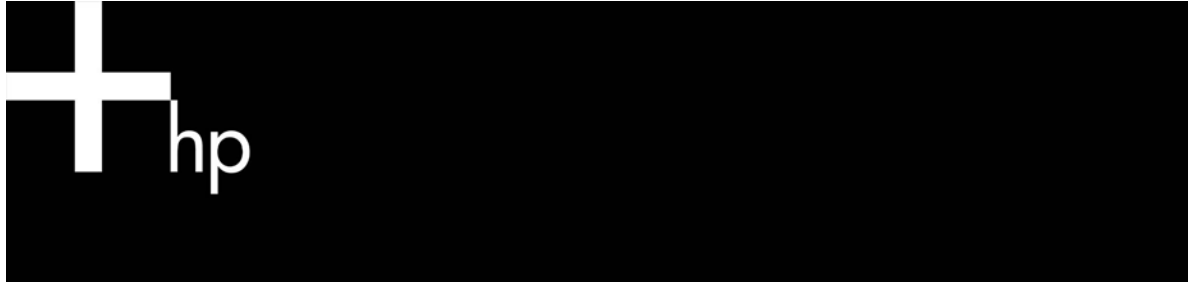


IPv6 FAQs – November 2003



Why do I need IPv6 when IPv4 is working fine for me?	2
What can I do with IPv6 that I can't do with IPv4? What are the features of IPv6?	2
Are there any alternatives to IPv6?	3
How do I change my application to make use of IPv6 features? How do I continue to use my applications and solutions once I deploy IPv6-enabled products?	4
What is the HP history with IPv6?	4
How much IPv6 expertise exists within HP?	5
What makes HP unique? What is the HP value proposition?	5
What IPv6-enabled services does HP offer?	5
What type of partnerships does HP have?	6
What do I need to consider when deploying an infrastructure that supports IPv6? What else do I need to do to be ready for the future?	6
What additional components are needed for IPv6 deployment?	7
Why will Mobile IPv6 be deployed?	7
For more information	8

Why do I need IPv6 when IPv4 is working fine for me?

If you're not having any problems with IPv4, that is great. However, you probably will soon. It's best to prepare in advance so you have time to properly plan.

You may wonder how, given that IPv4 can mathematically handle up to 2^{32} (that's over 4 billion) possible values, the community can possibly be running out of addresses. The problem, in fact, isn't that there aren't enough bits; it's in the way the bits are grouped under IPv4's simple network/host numbering scheme.

IPv4 has become inadequate because the Internet's explosive growth has rapidly depleted the available address space, forcing many organizations to resort to complex addressing schemes simply to connect to the Internet.

Network management is also increasingly more complex and the end-to-end model of the original Internet is broken due to temporary solutions to problems.

If mobility services are key to your future, you'll need Mobile IPv6 to efficiently support mobility.

While you do not have to do a forklift upgrade of your network, HP suggests that you start deploying IPv6-enabled infrastructure, solutions, and devices when possible so that you're prepared in the future when your business does require the features of IPv6.

What can I do with IPv6 that I can't do with IPv4?

What are the features of IPv6?

The Internet Protocol version 6 (IPv6) protocol family was designed to support a range of new functionality, examples of which are listed below. IPv6 takes into account critical areas of IP standards, such as address depletion, end-to-end authentication and security, packet handling efficiency, and improved scalability.

IPv6 provides true IP mobility by enabling secure access from any place, at any time, all the time. IPv6 is simpler and easier to configure and offers better network management capabilities than the current version, IPv4. It is the standard for global information technology for decades to come.

All the designs were optimized for use on 64-bit hardware and software.

- **Addressing:** The size of an IP address increases from 32 bits in IPv4 to 128 bits in IPv6. This provides enough IP addresses such that for the foreseeable future, all nodes can have their own global unique address, enabling true peer-to-peer communication. The IPv6 addressing scheme uses hierarchically assigned addresses. This structure provides a logical separation of "who you are" (interface ID) from "where you are connected to" (prefix) thus allowing more efficient routing.
- **Support for renumbering:** IPv6 brings link level support for renumbering (changing IP addresses across a network). IPv6 addresses have lifetimes associated with them. As the lifetime of the old address expires, a new address can be automatically configured. Renumbering IPv6 hosts is easy, just add a new prefix to the router and reduce the lifetime of the old prefix. As nodes depreciate the old prefix, the new prefix will start to be used for new connections. Renumbering is designed to happen! One benefit that may come from this is the end of ISP "lock in" and improved competition. Another benefit may be reduced costs when renumbering is necessitated by the joining of two networks, as in the case of a corporate mergers or acquisitions.
- **Management:** IPv6 makes getting on the network as simple as plugging a cable into your computer. IPv6 nodes automatically configure themselves using IPv6 stateless auto-configuration or a version of the Dynamic Host Configuration Protocol (DHCPv6), all without human intervention. These features make for true plug-and-play network access, putting the IT director in control and allowing network operation staff to focus on running the network.

- **Mandated security:** IP-level security, an add-on in IPv4, is a mandatory part of IPv6. Authentication, security encryption, and data integrity safeguards are an integral part of the IPv6 protocol, accomplished by using the IP Security Protocol (IPSEC) architecture.
- **Efficient mobility-support:** Built-in mobility support. Every network is mobile ready. Very little pre-existing infrastructure is required. Each IPv6 node can act as a correspondent and redirect packets to the new care-of-address of the mobile node.
- **IPv6/IPv4 interoperability:** Given the millions of existing systems running IPv4 today, it is clear that successful adoption of the IPv6 technology suite will be largely based on its ability to integrate with the existing IPv4 infrastructure. To address this requirement, IPv6 was designed carefully to ensure that hosts or routers can be upgraded in an incremental manner and that IPv6 and IPv4 hosts and routers can interoperate in a variety of configurations.

The mobile IP protocol was designed to allow a mobile node to keep its home IP address while acquiring a care-of address when it moves from network to network. Whenever the mobile node moves to a foreign network, it acquires a care-of address and then it registers securely its new care-of address with its home agent. When packets addressed to the mobile node appear on the home network, the home agent redirects the packet to the mobile node care-of address.

Mobile IPv6 shares many features with Mobile IPv4, but the protocol is fully integrated into IP and provides many improvements. Mobile IPv4 has proven too costly and complex to deploy:

- **Acquiring a care-of address:** Mobile nodes make use of IPv6 features, such as IPv6 Neighbor Discovery and Address Auto-configuration, to operate in any location away from home without any special support required from its local router. No pre-existing infrastructure like foreign agents required.
- **Security:** Mobile IPv6 utilizes IP-level security (IPSEC) for all security requirements. Mobile IPv4 relies on its own security mechanisms, based on statically configured “mobility security associations.”
- **Redirection:** Most packets sent to a mobile node while away from home in Mobile IPv6 are sent using an IPv6 routing header rather than IP encapsulation. The use of a routing header requires less additional header bytes to be added to the packet, reducing the overhead of mobile IP packet delivery.
- **Route optimization:** The requirement to have traffic go through the home network and then be redirected to the foreign network is known as the “triangle routing” problem. Mobile IPv6 support for “route optimization” is built in. Security is done using a procedure defined as Return Routability (RR).

Are there any alternatives to IPv6?

The use of private addresses, coupled with Network Address Translation (NAT) and Application Layer Gateways (ALGs), has extended the life of IPv4 by reducing consumption of the public IPv4 address space.

However, these technologies carry with them hidden costs and a number of limitations including:

- **Performance issue:** Rather than simply being forwarded, each packet traversing a NAT must be parsed and modified, and session state updated. Packets traversing an ALG must go further up the stack and be processed by the application proxy.
- **Single point of failure:** Due to the state maintained in the NAT/ALG, traffic cannot simply be re-routed when the NAT/ALG fails.
- **Barrier to growth:** Applications that carry IP address information above the IP level (e.g. as application data) are susceptible to breakage by NATs. Examples include: FTP, mobile IP, DNS, VoIP, and streaming media. To accommodate these applications, NAT must incorporate

application-level knowledge. ALGs by definition require detailed application-level knowledge. This presents a barrier to deployment of new applications, which is in turn a barrier to growth.

- **Loss of end-to-end IP security:** IPSEC authentication and encryption depend on the original addresses in the IP header.
- **Access from other networks:** It is difficult to access nodes using private addresses (e.g. in a home network) from the public Internet or from other private addressing domains.
- **Management:** The NAT and/or ALG functions pose additional network management burdens.

How do I change my application to make use of IPv6 features? How do I continue to use my applications and solutions once I deploy IPv6 enabled products?

HP IPv6 infrastructure products were developed with a hybrid stack supporting a dual IP (v4/v6) layer, a common transport layer and dual API layer. This means that HP products will support both IPv4 and IPv6.

IPv4 applications will continue to run over the hybrid stack.

In order for your application to take advantage of IPv6 you have to port to IPv6. Your applications may or may not require enhancements to support IPv6. Some applications will be transparent to the networking protocol underneath them, while others will require some enhancements to support IPv6.

Once you port to an HP IPv6 platform, the same API can be used to support both IPv4 and IPv6 for the application.

HP offers a basic IPv6 porting tool to assist you with porting

As you deploy IPv6-enabled products, prioritize your applications into those that are business critical and those that are not. Each application will need to be tested.

Depending upon your deployment scenario, you will most likely need transition mechanisms, or gateways, to reside between your IPv6 network(s) and the legacy IPv4 networks to ensure interoperability. You will need to select the transition mechanism that best supports your rate of adoption of IPv6. That adoption can be as slow or as fast as you choose, but you should assume you will have to interoperate with IPv4 for a long time.

HP platforms support transition mechanisms and gateways to interoperate with IPv4, as determined by your business needs.

What is the HP history with IPv6?

HP has been a key designer and implementer of IPv6 since 1995, and was a member of the IETF Internet Protocol Next Generation Directorate that selected IPv6 as the next-generation Internet protocol to transition from the current IPv4.

HP is one of the original founders and catalysts to create the industry IPv6 Forum. HP chairs the IPv6 Forum Technical Directorate and the North American IPv6 Task Force.

HP believes IPv6 will provide an Internet evolution to support the connectivity of devices and people, at a scale that is beyond the dreams of the Internet when it was created, or as it exists now, where devices are pervasive and ubiquitous and people are mobile. See www.hp.com/network/ipv6.

HP has already delivered IPv6 products across its business-critical server platforms (HP-UX, Tru64 UNIX®, OpenVMS, NSK, Linux and Microsoft®) and HP OpenView network management platform. HP

plans to deliver additional functionality for IPv6 across its product line from access devices to printers to managed services.

To enable the adoption of dual IPv4 and IPv6 solutions, HP has implemented the core IPv6 IETF standards specifications and a set of transition mechanisms. HP has successfully participated in North America's largest IPv6 network pilot deployed called Moonv6.

How much IPv6 expertise exists within HP?

HP has an outstanding team of IPv6 and Mobile IPv6 experts.

The chair of the IPv6 Forum Technical Directorate is an HP Staff Fellow. HP has several key engineers who have been involved in IPv6 since its inception within the IETF and are regular participants and speakers at IPv6 industry events. HP has four members on the IPv6 Forum Technical Directorate. HP chairs the North American IPv6 Task Force. HP has an IPv6 Core Team led by the Office of Strategy and Technology.

HP uses its technical expertise to develop products and demonstrate them to the industry. For example, HP was the first to exhibit a public demo of IPv6 at the TCP/IP Expo in 1995. HP was the first to exhibit a live, end-to-end Mobile IPv6 demo in 2001. HP was the first to exhibit DHCPv6 in 2002. And HP participated with its Business Critical Servers portfolio in the Moonv6 interoperability testing event in October 2003.

As the markets for IPv6 matures, customers will see the technology deployed in communications solutions across many industries such as healthcare, government, automotive industry, consumer industry and finance, in addition to telecom.

What makes HP unique? What is the HP value proposition?

The HP value proposition is its:

- IPv6 engineering and technical expertise
- Leadership in IPv6
- Leadership in the communications industry
- Solutions breadth and depth

HP has a complete end-to-end portfolio of life cycle services to offer worldwide design and consulting services, education services, installation, integration, management and support services, in addition to servers, solutions, access devices, and printers and imaging devices. HP offers the broadest range of business-critical server platforms options in the industry: from low-end to mid-range to high-end to fault-tolerant systems. HP offers full network management platform. In addition, at some point in the future, all HP product lines across all business units will support IPv6.

HP is committed to supporting the development of IPv6 and Mobile IPv6. Its product portfolio will continue to expand, covering today and tomorrow's needs, from development of consumer devices and networking infrastructure to support of back-end billing and customer care. HP is partnering with leading edge solutions providers to create an exciting new world of communications, helping to integrate infrastructure solutions with end-user devices, and providing packaged solutions to the market.

What IPv6-enabled services does HP offer?

IPv6 is a core technology that is embedded into HP operating systems. HP will not charge for this technology.

Services will be key to the success of IPv6. Customers need help understanding the technology, developing network architecture for deployment, developing integration plan for co-existence with legacy IPv4 networks and businesses, and with deployment, management, and support of IPv6 networks.

HP Services is evaluating the services portfolio plans for 2004 and beyond. Initial plans are to focus on customer training, pilot testing and interoperability support, application audits, porting and migration strategies, and IPv6 transition and migration consulting services.

Plans for 2005 are to expand the HP portfolio to offer application development, porting and migration, network architecture and design, network integration, configuration and deployment, network management and network support, and expanded customer training.

Another key requirement for success will be end-to-end solutions. Customers need consulting and planning services on the front end, but they also need core infrastructure equipment, access network equipment, access devices, applications and middleware, installation, integration, and support.

IPv6 transition and migration consulting is targeted to help customers understand and analyze the requirements of IPv6, to assess how IPv6 will impact customer's current environment and services offered, and to provide recommendations for the transition to IPv6 and co-existence of IPv4/IPv6.

HP has an experimental, international IPv6 test network. HP is looking at infrastructure issues, product support issues, scalability, management, router failover, QoS support, management tools, network prioritization and reservation, and end-to-end encryption at the network layer. See www.hwp6.net.

What type of partnerships does HP have?

HP has partnerships with all major infrastructure vendors.

Customers must have the flexibility to take the entire solution, or bits and pieces (building blocks), so interoperability and partnerships with the top two to three key players in the industry is critical, as is the ability to incubate new, innovative application developers and help turn their ideas into deployable solutions.

HP is working closely with Cisco and Microsoft with respect to collaboration on IPv6 technologies, solutions and business opportunities to address early adopter opportunities.

HP and Cisco have been working together providing an IPv6 and Mobile IPv6 802.11 WLAN over an Internet connection as a joint technology demo with Cisco routers. The HP server, gateway, and handheld platforms used to date are HP-UX, Tru64 UNIX, and iPAQ Pocket PC (Linux).

What do I need to consider when deploying an infrastructure that supports IPv6? What else do I need to do to be ready for the future?

Some considerations are:

- **Hardware changes may be needed.** You can expect most systems to be software upgradeable. Beware of IPv4 implementations in hardware.
- **New and modified software.** Functionality such as IP stack, DNS, DHCP, routing protocols, and applications.
- **IPv6 should be transparent for end-users.** Network administrators will recognize many parts of IPv6, as it looks very similar to IPv4; however, they will still have a lot to learn. Administrators need to determine their network topology. They may choose to keep the IPv6 topology logically separate

from the IPv4 networks or they may decide to align the two topologies by using the same domain boundaries, areas, and subnet organization.

- **IPv6 infrastructure deployment.** To deploy your infrastructure, you'll need to make plans for obtaining IPv6 addresses, routing, DNS servers, network management, and lastly your hosts. DNS servers should be the first component of your network to be upgraded; you'll need to ensure that you can infer an IPv6 address from a name and infer a name from an IPv6 address. Your routers and hosts can be upgraded independently.

If you want to use IPv6 to gain competitive advantage, you need to develop and/or deploy innovative services leveraging the benefits of IPv6.

Deploy IPv6 in small, regional pockets to gain experience with IPv6. You'll find that many parts of it look just like or very similar to IPv4. Slowly upgrade other portions of your network as you gain experience with IPv6 and as necessary to support your business needs. For instance, whenever you must make a capital investment for your network, insist that IPv6 be supported from your vendor.

Apply the same IPv4 security policy to IPv6.

What additional components are needed for IPv6 deployment?

The core IPv6 standards are stable and well tested. It is shipping as a standard feature on almost all major platforms. It is widely deployed in national and international test beds and research and education networks.

Commercial deployment has only begun. A lot of work is still to be done in terms of moving applications and middleware to IPv6.

Many of the advanced features of IPv6 still need specification, implementation, and/or deployment work.

HP encourages ISVs to at least test their applications for IPv4/IPv6 transparency. If not transparent, ISVs need to upgrade to support IPv6.

HP also needs ISVs to develop new, innovative IPv6 applications.

Why will Mobile IPv6 be deployed?

Users are increasingly demanding seamless access to data from disparate access networks – Bluetooth, Wi-Fi, WLAN, CDMA, GSM, GPRS, W-CMDA, CDMA2000, etc. As networks are moving from circuit-switched to packet-oriented, a “macro-mobility” mechanism is needed to handle interworking between any types of wireless access network to provide seamless mobile services. Mobile IPv6 provides the mobility management functionality in the IP layer, specifically the IPv6 layer. As the IP layer is the only common protocol layer for all the applications used in IP networks, specifically the Internet, handling mobility in the IP layer is beneficial – transparent to applications and protocols above IP layer and mobility between networks with different link layer mechanisms can be achieved without specifying interworking mechanisms between these networks for handling the micro-mobility within the different access networks.

Mobile IPv6 permits users to remain connected across wireline (e.g. Ethernet, xDSL) and wireless (e.g. 802.11, cellular, satellite) networks, while roaming from one network to the next network.

These advantages permit the user to stay connected en route to the airport from home, rather than shutting down their PDA/laptop at home, and reconnecting at the Wi-Fi location at the airport. There is no doubt that mobility has become a way of life.

For more information

www.hp.com/network/ipv6

© 2003 Hewlett-Packard Development Company, L.P. The information contained herein is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

Microsoft is a U.S. registered trademark of Microsoft Corporation. UNIX is a registered U.S. trademark of Oracle Corporation, Redwood City, California.

XXXX-XXXXEN, 11/2003

