

IPv6 Capable A Guide for Federal Agencies

Understanding IPv6 Requirements and Technology
to Enable the Next Generation Internet

Executive Summary

The Internet has developed into the primary enabler of interoperable communications across the world and is quickly becoming the common foundation for the convergence of multiple technologies critical to our economy and government. Internet Protocol version 6 (IPv6) is being deployed to replace the Internet's current protocol, IPv4, and will continue the evolution towards a ubiquitous Next Generation Internet infrastructure for all forms and users of communications. Federal agencies must develop a core understanding of the requirements and technologies built into the Next Generation Internet and establish their definition of IPv6 Capable. This report, developed specifically for federal agencies transitioning to IPv6, provides valuable insights from industry experts on:

- the history of the Internet and why IPv6 is a necessary evolution in developing the Next Generation Internet
- the benefits of the Next Generation Internet and the fundamental technology differences between IPv4 and IPv6
- how to define IPv6 Capable to meet your specific agency's requirements and remain interoperable, and
- steps to take an active role in shaping the future of IPv6 and the Next Generation Internet to meet your federal agency's requirements.

The Internet, from the conception of packetized networks to today, is 45 years old; the Internet Protocol (IP), invented about 30 years ago has been in use for over 24 years.

Fortunately, Transmission Control Protocol/Internet Protocol (TCP/IP), the foundations of the Internet, were built with flexibility that permitted the technology to expand into a global community network. But, as we evolve to the Next Generation Internet, it is clear that the current version of IP (IPv4) is not flexible enough to permit the continued growth necessary to support the growing need for ubiquitous networking. Internet history is replete with examples of protocol enhancements and technology work-arounds to keep the Internet functioning. It is also full of examples of security concerns and upgrades to prevent denial of service and loss of critical data. The Internet has provided a glimpse of what the future of communications will be, but to achieve the vision of convergence and ubiquitous communications, federal agencies will need to embrace IPv6 to realize the promises of the Next Generation Internet.

Some federal government agencies contemplating the transition to IPv6 may view it as a huge endeavor with significant costs and no real value added; similarly, some believe that IPv6

does not provide an advantage over IPv4 other than additional address space. Nothing could be farther from the truth. Lessons from technological evolutions throughout history demonstrate that new capabilities often emerge that may never have been intended. When the Internet was born, no one envisioned JAVA, extensible markup languages, or preprocessors or their impact. Twenty years ago, who would have ever imagined an Internet community with all the

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capabilities it provides? Of course, the full potential of the Internet has not yet been realized; in fact, many believe it is still in its infancy and that evolutionary change is demanded to achieve the next threshold of capability.

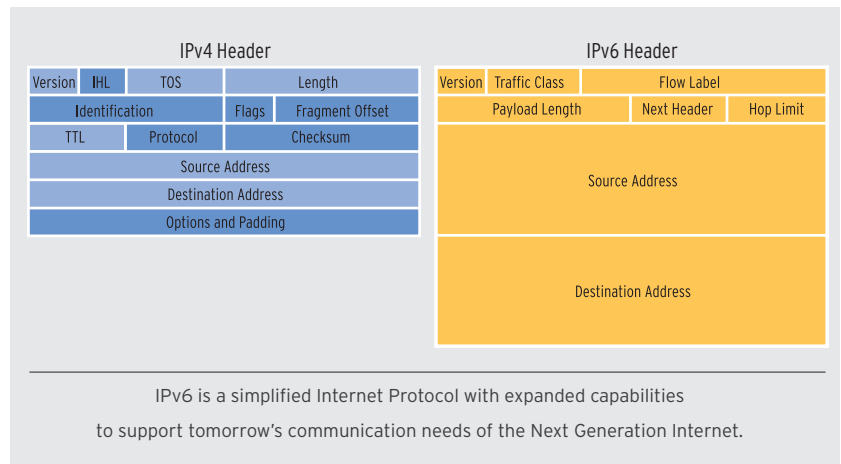
IPv6, the key to reaching the next evolutionary stage of the Internet, is vastly different than IPv4 and other technical solutions that have attempted to unseat the protocol over the past 20 years. Cynics of IPv6 say it is just another Government Open Systems Interconnection Profile (GOSIP), mandated by the government and destined for failure. Three specific things make IPv6 different than GOSIP; 1) IPv6 was developed by the international community, 2) IPv6 appeared in commercial products long before the government decided to mandate a transition, and 3) IPv6 provides new features and capabilities critical to achieve the vision of the Next Generation Internet.

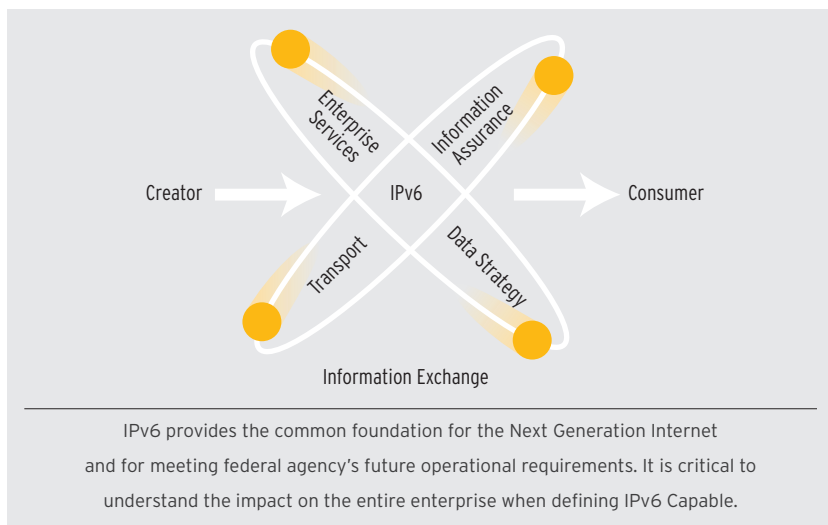
IPv6 is important for many reasons. The protocol solves many technical problems, only one of which is the limited address space of IPv4. IPv6 is simpler than IPv4 and has more flexibility for future enhancements. It incorporates much needed security features and auto-configuration capabilities required for mobile and ad-hoc networks. If implemented correctly, IPv6 will provide a communications platform with unbounded utility.

Federal agencies can achieve the benefits of the Next Generation Internet by becoming educated on IPv6 and understanding how its capabilities can help them transform the way they do business. To do so, it is critical to understand the structure of the Internet community and the Internet Engineering Task Force (IETF). The IETF is the principle body responsible for recommending the standards of the Internet, known as Requests for Comment (RFC). Involvement in these efforts will allow federal agencies to express their needs and opinions for future Internet capabilities and help the vendor and provider communities better understand what is needed by government users of IPv6. Influencing the future of Internet standards goes beyond just participating in the IETF process; it also includes influencing the governing bodies in the Internet Standards process such as the Internet Engineering Steering Group (IESG), the Internet Architecture Board (IAB) and the Internet Society (ISCO). It is critical for any agency that wants to impact the future of the Internet to understand the relationship between these organizations and how to participate.

The term IPv6 Capable is widely used to describe the IPv6 functionality required by the federal government. The Office of Management and Budget (OMB) and the Office of the Secretary of Defense (OSD) have developed high-level definitions of what IPv6 Capable means; however, it is not clear how these definitions translate into specific requirements or capabilities that government officials can include in their contracting language. In turn, little consensus on the specific definition(s) of IPv6 Capable has been achieved. Therefore, some of the most important questions regarding the definition of IPv6 Capable include:

- Does one size fit all - for example, should a backbone router and a sensor have the same IPv6 requirements?
- Will there be one definition of IPv6 Capable, and will it work for my agency's operational environment?
- Who will define IPv6 Capable, and will it meet the requirements of my agency?
- How will the definition of IPv6 Capable evolve to meet the changing needs of my agency?





IPv6 is not the first major technology transition the Internet has encountered, but it is the most significant. Leveraging the experiences and understanding from the inception of the Internet can help agencies understand what to expect as they move to IPv6. *IPv6 Capable: A Guide for Federal Agencies* provides a history of the Internet and explains the timelines necessary to participate in the evolution to the Next Generation Internet. It also explains the technology behind IPv6 and shows why it will provide new capabilities for enterprises

and federal agencies that IPv4 cannot offer. The federal government is the largest buyer of IT related products and services in the world, but has limited direct influence in the organizations creating standards and managing the resources for the Internet. This guide provides an essential understanding of the Internet organizations that create Internet related policies, define the standards for the current and Next Generation Internet, and manage the resources of the Internet (IP addresses and domain names). Federal agencies will also learn how they can influence the future development and management of the Next Generation Internet to ensure their requirements will be met.

Federal agencies are using a technology refreshment approach to lower the overall costs for implementing IPv6 and the Next Generation Internet; however, it is critical for each agency to determine what definition(s) of IPv6 Capable will successfully support their future acquisition and development process. This report describes several of the definitions used for IPv6 Capable and explains why there is no single universal definition of IPv6 Capable. The report also discusses a process for defining IPv6 Capable that can be used by federal agencies to define their requirements for the Next Generation Internet while maintaining interoperability.

To learn more:

This executive summary provides an overview of *IPv6 Capable – A Guide for Federal Agencies: Understanding IPv6 Requirements and Technology to Enable the Next Generation Internet*. This is the second volume in the *IPv6 Best Practices World Report* series. To request the complete version, please go to www.juniper.net/federal/IPv6.

Request your copy of Volume 1 titled *A Guide for Federal Agencies Transitioning to IPv6* released in January 2006 at www.juniper.net/federal/IPv6 or call 1.866.298.6428 for more information. The third volume in the *IPv6 Best Practices World Report* series will be released in Summer 2006.

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