INTERNET PROTOCOL VERSION 6

Federal Agencies Need to Plan for Transition and Manage Security Risks

Why GAO Did This Study

The Internet protocol (IP) provides the addressing mechanism that defines how and where information such as text, voice, and video move across interconnected networks. Internet protocol version 4 (IPv4), which is widely used today, may not be able to accommodate the increasing number of global users and devices that are connecting to the Internet. As a result, IP version 6 (IPv6) was developed to increase the amount of available IP address space. It is gaining momentum globally from regions with limited address space.

GAO was asked to (1) describe the key characteristics of IPv6; (2) identify the key planning considerations for federal agencies in transitioning to IPv6; and (3) determine the progress made by the Department of Defense (DOD) and other major agencies to transition to IPv6.

What GAO Recommends

GAO recommends, among other things, that the Director of the Office of Management and Budget (OMB) instruct agencies to begin to address key planning considerations for the IPv6 transition, and that agencies act to mitigate near-term IPv6 security risks.

Officials from OMB, DOD, and Commerce generally agreed with the contents of this report and provided technical corrections, which were incorporated as appropriate.

www.gao.gov/cgi-bin/getrpt?GAO-05-471.

To view the full product, including the scope and methodology, click on the link above. For more information, contact David Powner at (202) 512-9286 or Keith Rhodes at (202) 512-6412.
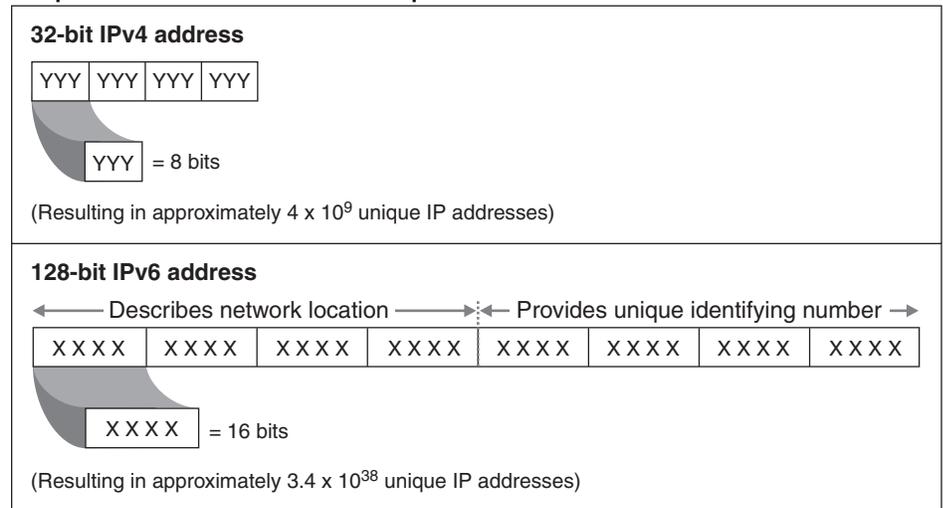
What GAO Found

The key characteristics of IPv6 are designed to increase address space, promote flexibility and functionality, and enhance security. For example, by using 128-bit addresses rather than 32-bit addresses, IPv6 dramatically increases the available Internet address space from approximately 4.3 billion addresses in IPv4 to approximately 3.4×10^{38} in IPv6 (see figure).

Comparison of IPv4 and IPv6 Address Spaces

32-bit IPv4 address

| YYY | YYY | YYY | YYY |

YYY = 8 bits

(Resulting in approximately 4×10^{9} unique IP addresses)

128-bit IPv6 address

← Describes network location → ← Provides unique identifying number →

| XXXX | XXXX | XXXX | XXXX | XXXX | XXXX | XXXX | XXXX |

XXXX = 16 bits

(Resulting in approximately 3.4×10^{38} unique IP addresses)

Source: GAO.

Key planning considerations for federal agencies include recognizing that the transition is already under way, because IPv6-capable software and equipment already exists in agency networks. Other important agency planning considerations include developing inventories and assessing risks; creating business cases that identify organizational needs and goals; establishing policies and enforcement mechanisms; determining costs; and identifying timelines and methods for transition. In addition, managing the security aspects of an IPv6 transition is another consideration since IPv6 can introduce additional security risks to agency information. For example, attackers of federal networks could abuse IPv6 features to allow unauthorized traffic or make agency computers directly accessible from the Internet.

DOD has made progress in developing a business case, policies, timelines, and processes for transitioning to IPv6. Despite these efforts, challenges remain, including finalizing plans, enforcing policy, and monitoring for unauthorized IPv6 traffic. Unlike DOD, the majority of other major federal agencies reported not yet having initiated key planning efforts for IPv6. For example, 22 agencies lack business cases; 21 lack transition plans; 19 have not inventoried IPv6 software and equipment; and none had developed cost estimates.

United States Government Accountability Office