Senior Design Project in Electrical & Computer Engineering

IPv6: The Next Generation of the Internet

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Sponsor: TISCOM

Project Background

Internet Protocol Version 6 (IPv6) increases the number of network address bits from 32 bits (in IPv4) to 128 bits, which provides more than enough unique IP addresses for every network device on the planet; this allows over 1500 addresses for every square meter on the surface of the Earth.
IPv4's system administration is labor intensive, complex, slow, and error prone. With IPv6, any device can obtain an address simply by plugging into the network. The device creates its own address and then checks the network for duplicate addresses, greatly simplifying administration. With IPv4, security is optional; there is no single standard. However, in IPv6, IPSec (IP security) is mandatory, providing end-to-end security, authentication (packet signing), and encryption (data confidentiality). IPv6 allows large amounts of classified traffic or FOUO (For Official Use Only) traffic to be sent over the CG network. Another issue with IPv4 is that there is no way of making sure a sent packet gets to its destination. Quality of Service (QoS) fixes this, which is built into IPv6. This service allows you to prioritize certain types of time-sensitive streams (like video), and multicasting which conserves bandwidth when streams are sent to multiple users at different locations.

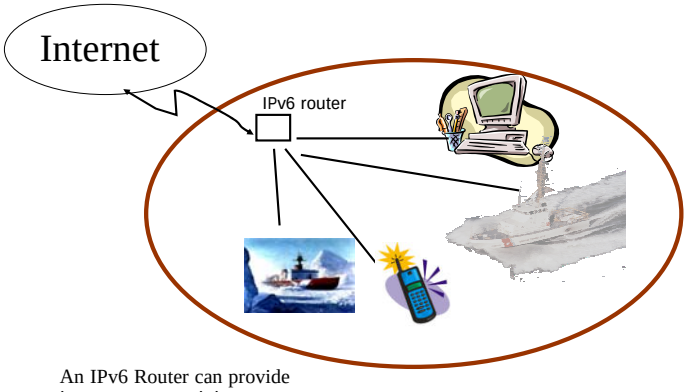
The secure connectivity of IPv6 will allow diverse CG platforms to easily communicate.

Project Plan

- Obtain information on Operating System upgrades in order to work with IPv6.
- Research required infrastructure upgrades.
- Explore the IPv6 upgrade impact on established CG policies, processes, and procedures.
- Determine transition planning and coordination required within the DHS.
- Determine transition and interoperability testing required.
- Research any increased support costs during the upgrade and maintenance.
- Research interoperability with allies, coalition partners, government agencies, contractors, research institutions, and potential adversaries.
- Research how to transition from IPv4 to IPv6 with minimal disruption in internet services.

Project Work

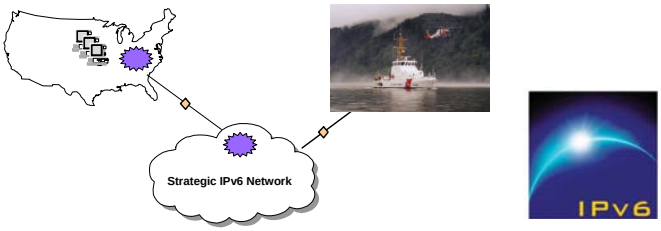
The principle goal is to examine IPv6's inherent security features to provide Coast Guard interoperability and secure Homeland Security operations.
A thorough test bed for CG Workstation III applications will be developed to test any adverse effects of the new protocol, while studying and analyzing the limitations, advantages, and associated risks of the IPv6 network.
A secondary goal is to collect data to determine the value of migrating to IPv6 vs. the cost.



An IPv6 Router can provide internet connectivity to a variety of hardware.

Project Deliverables

- A plan for operating a dual stack (IPv4 and IPv6 co-existing on the same network) environment
- A user's manual for system administrators
- An evaluation of the current technology available
- A description of the test results
- A thorough description of the testing process so that the test bed can be replicated
- A "lessons learned" analysis



Future IPv6 Network Securely Connecting a Coast Guard Cutter