



Successfully Deploying IPv6

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IPv6 Planning Pitfalls

- Failing to build a cross-function IPv6 deployment team
 - Multidisciplinary, Collaborative, Cooperative
- Organizations need to treat IPv6 as a “Program” not just like a typical smaller IT “Project”.
 - IPv6 transition is made up of many projects that will span multiple years and cross the entire enterprise.
- Regular/Frequent meetings are key to maintaining pace.
- Just like anything, executive buy-in and support is essential.

Training for Success

- Assume your IT organization has not taken the initiative to immerse themselves in learning IPv6.
- People need to be trained early in the process, but not too early that they forget what they learned.
 - Train “just in time”, not years before an IPv6 address is actually configured on a production device.
- Train for different skillsets (appdev, sysadmin, net admin, sec admin, DevOps, helpdesk, PMs, ...).
- Much of your IPv4 experience is applicable to IPv6.
- Don't fear the larger addresses – Learn to “Think in Hex”.

IPv6 Addressing

- IPv4-Think is dangerous when planning IPv6 addressing
 - Crazy Talk: Using decimal #s, embedding VLAN #, IPv4 address converted to hex
- There is no scarcity of IPv6 addresses
 - If there is no scarcity, there can be no waste
 - Don't try to assign only the minimum-needed prefix length
 - Plan for the number of subnets, not the number of hosts
- Perform addressing for simplicity and ease of use and management
 - Don't be concerned about lots of reserved space

IPv6 Addressing

- Don't force levels of hierarchy that are not needed.
- Use standard prefix lengths: /48, /56, /64
- Use nibble-boundary – don't use /50, /57, /65, ...
- Consistency between sites can increase operational efficiency, however, not every site needs the same addressing plan.
 - Branches need a different plan than a data center “site”.
- Stick with Global Unicast Addresses (GUA) 2000::/3
 - Use these everywhere, you don't need NAT66 or NPT
- Avoid Unique Local Addresses (ULA) FC00::/7 (FD00::/8)

IPv6 Routing

- IP addressing and routing go hand-in-hand.
- All IP routing protocols have IPv6 capabilities.
- Separating control plane for two data planes can be desirable.
 - Establish BGP peer over IPv4 TCP 179 for sharing IPv4 routes
 - Establish BGP peer over IPv6 TCP 179 for sharing IPv6 routes
- Don't forget to use a 32-bit RID to the IPv6 routing process.
- Peering using global IPv6 addresses is preferred
- Consider using locally-administered link-local addresses.
 - fe80::cccc:0001, fe80::dddd:0002, ...
- Type carefully – don't fat-finger that address

Dual-Protocol Applications

- Assessing current code for IPv6-capability
 - Most applications do not create socket-level connections.
 - Most applications use higher-level APIs or rely on lower-level web services for connectivity.
- Create code that is Address-Family (AF) independent.
- Presentation-to-Numeric (p2n) & Numeric-to-Presentation (n2p)
 - Robustness principle: Be conservative in what you send, be liberal in what you accept.
- Be careful of data structures for storing 128-bit addresses.
- Create code that performs dual-protocol DNS resolution and incorporates Happy Eyeballs (RFC 6555).
- Write code that properly handles Path MTU Discovery (PMTUD).

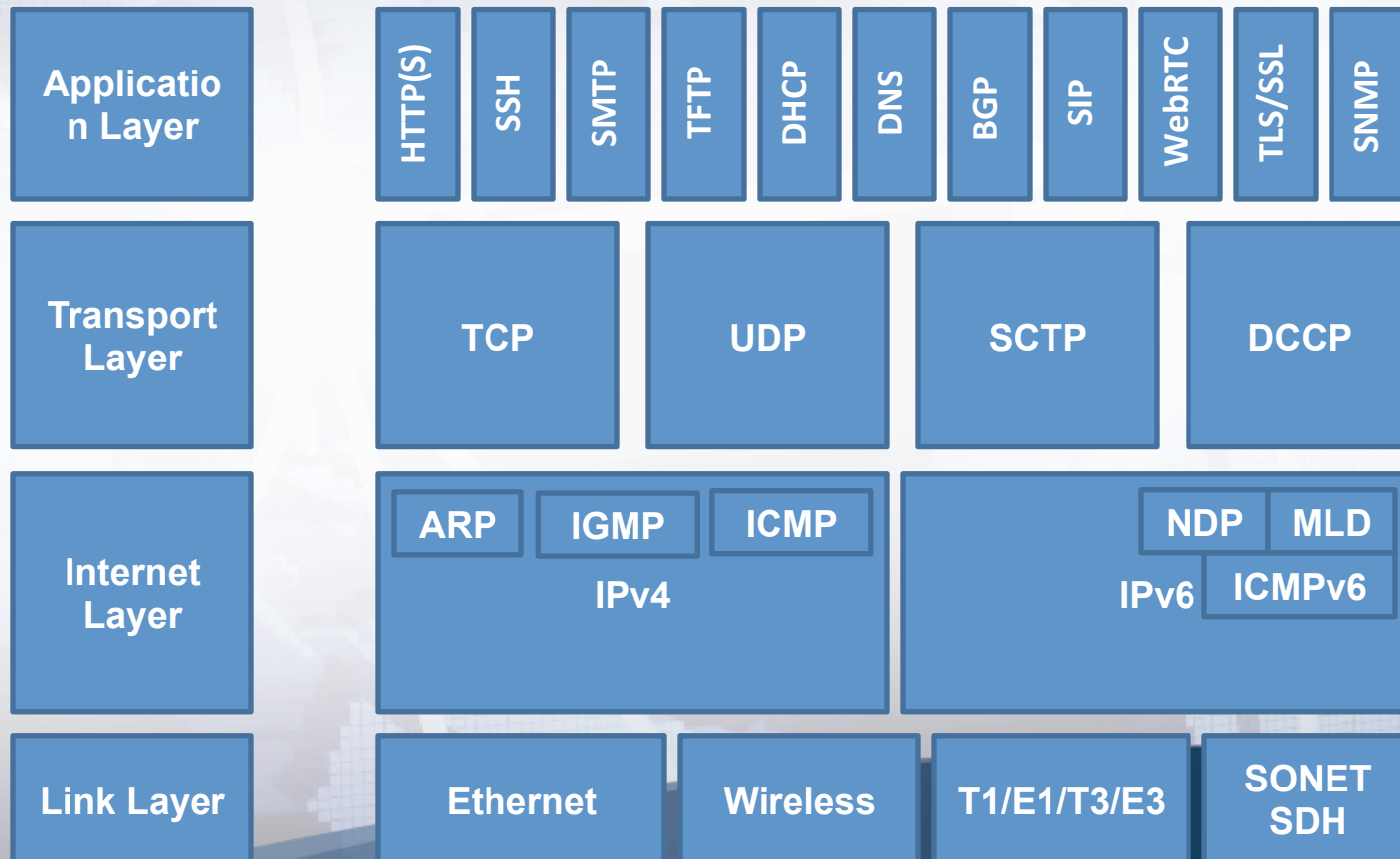
IPv6 Security Considerations

- Understand how IPv4 and IPv6 are different in terms of networking (NDP, extension headers, dynamic tunnels)
- Don't deploy IPv6 if you lack the products to secure the protocol properly.
- Don't be overly worried about IPv6 NDP security weaknesses.
 - You likely haven't secured ARP on your IPv4 LANs either.
 - <https://community.infoblox.com/blogs/2015/02/10/holding-ipv6-neighbor-discovery-higher-standard-security>

Troubleshooting Dual Protocol Networks

- Even if you do not deploy IPv6, there could still be IPv6-related issues that you must deal with.
- You now have IPv6-enabled nodes in your environment.
- Using a disciplined troubleshooting methodology will pay dividends when dealing with multi-part problems.
- Troubleshoot IPv6 in segments (LAN1, WAN, LAN2).
- Troubleshooting NDP requires a magnifying lens.
 - You may need to break out the protocol analyzer.
 - Looking for an IPv6 needle in a haystack of IPv4.

Troubleshooting Dual Protocol Networks



Troubleshooting Dual Protocol Networks

- Our network management and operations systems must be dual-protocol capable and give us visibility to IPv6
- View yourself from the Internet-perspective using IPv6-capable looking glasses
- In a dual-protocol environment there are many tasks that will need to be performed twice (once for each IP version).
 - IP addresses, DNS, DHCP, firewall policies, end-to-end testing
 - We want test systems to check both protocols in parallel

Troubleshooting Dual Protocol Networks

- Different applications and different OSs create dual-protocol connections in different methods
 - Happy Eyeballs, RFC 6555, Microsoft NCSI, Apple Mac OS X & iOS
- Some connections could use IPv4 and/or IPv6
 - Web pages could be delivered over a combination of protocols. How do you know which protocol was used?
 - IPv6 Browser add-ons, plug-ins can be helpful
 - SixOrNot, IPvFox (Firefox), IPvFoo (Chrome)



Thank You!

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