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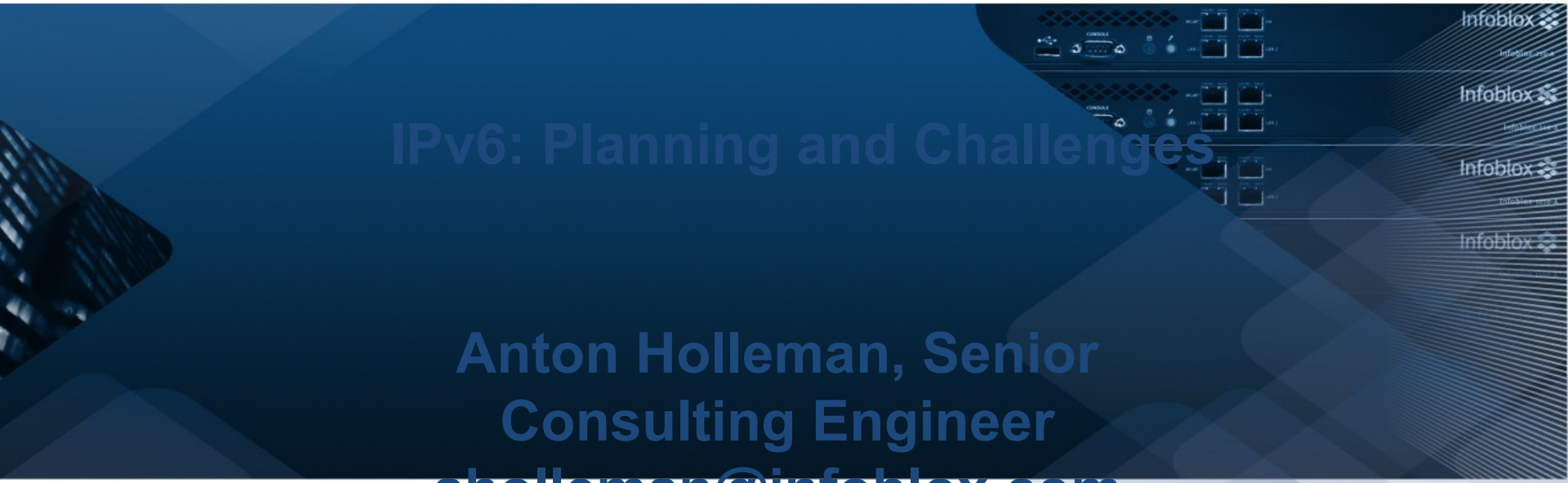

IPv6: Planning and Challenges

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What are the benefits?

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Drivers to IPv6

- You can't get enough IPv4 addresses
- Your business partners are using IPv6
- Clean up your current network architecture
- Performance and security enhancements

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Your supply of IPv4 space

- If you're short on it, you already know it.
- If you're not yet short on it, use the time you have well
- You don't have time to waste but you do have time to do it right.

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Network architecture planning

- You can get enough IPv6 space
  - Do the architecture you want, not the one you're stuck with
  - Use GUA space everywhere, make NAT a choice
  - Get enough to replace *all* public and private address space
  - No dealing with duplicate address usage with other companies

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Better Performance and Security

- Routing and flows much more efficient
- Better route aggregation
- IPSec built in

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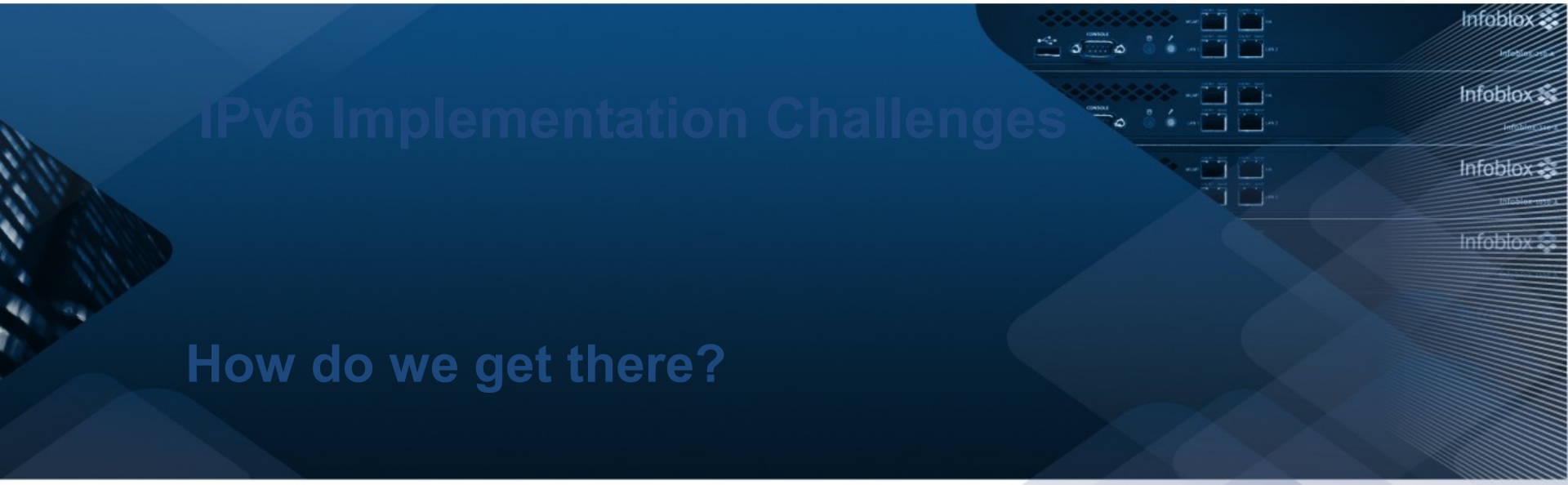
IPv6 Implementation Challenges



How do we get there?

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What do you have now?

- **Make sure you know what you have:**
  - **Current/accurate network inventory and map**
  - **Inventory of all firewalls, NATs, load balancers, anything with ACLs**
  - **Current/accurate desktop and server inventory**
  - **Inventory of all software/apps and services you use**

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Opportunity to change

- Keep your current network architecture and subnet scheme?
- New subnet scheme?
- New peering and connectivity?
- Redesign back ends to services/web

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Hardware/Software/Services

- Do you need to:
  - Replace
  - Upgrade
  - Buy new/additional hardware
  - Reconfigure existing hardware

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Constraining factors

- Shortage of IPv4 address space
- Level of control on platforms
- Legacy gear
- Partners' issues

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Security Considerations

- Human error due to lack of familiarity
- Firewall and IDS support for IPv6
- Maintaining IPv4 and IPv6 ACLs
- Tunnels

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Security Considerations

- Router and routing protocol issues
- Fragmentation
- NDP and ICMP
- IPv6 stack bugs
- IPSec

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IPv6 Deployment Methodologies

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Have a plan *FIRST!*

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Phased rollout

Get Address Space

Serv

- Simulate web environment in lab
- Test web/external with IPv6 subdomain (ipv6.example.com)
- Implement full IPv6 on external sites

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Phased rollout

1. **Make your plan, then get your new address space**

2. **Get your external presence IPv6 enabled**

3. **Get your internal sites IPv6 enabled**

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Address space

- Determine how much space you need
- Determine if you need PI (provider independent) space
- Apply to your ISP or RIR for address space

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External site rollout

- **Ensure your firewall/IDS is IPv6 ready**
- **Simulate your full site in a lab:**
  - Test in IPv4 to validate it reproduces your production site
  - Convert the test site to IPv6 only, put NAT64/DNS64 in front of the test site and see if it all still works
  - Remove the NAT64/DNS64, go IPv6 only and see what was using IPv4 that you thought was using IPv6
- **Work with your vendors on any bugs or lack of features**
- **Repeat until it all works**

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External site rollout, cont.

- Bring up a subdomain of your site (ipv6.example.com) and test
- Once all issues are ironed out, add the AAAA record to www.example.com
- You now have an IPv6 public site, a test lab and good staff experience with IPv6

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Internal site rollout

- Get firewalls, IDS and ACLs configured for IPv6
- Get an IPv6 link to your site (tunnel if necessary)
- Put all your core routers and switches on IPv6 but don’t enable any user or server subnets
- Get all your network monitoring and logging working with IPv6

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Internal site rollout, cont.

- Test all internal services & software as with external (IPv4, IPv6 w/NAT64/DNS64, IPv6 only)
- Work with your vendors until it all works in the lab
- Add subnets one at a time (start with eng?)
- Full internal IPv6

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IPv6 Transition Technologies

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How do we get there?

- There are technologies to help
- None of them are supposed to be permanent!
- They all have advantages and drawbacks.

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Dual stack

- Dual stack is the recommended transition method
- This does assume that you have enough IPv4 space

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Tunneling

Manual Tunnels: AYIYA, GRE

ted T

- Teredo
- 6to4
- ISATAP

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NAT64/DNS64

NAT (C
AFTR/B4

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Tools and technologies for IPv6 implementation and management

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A Records

- **Keeping an A record for www.example.com and a PTR for 1.1.168.192.in-addr.arpa in sync isn't bad.**

- **How would you like to type these in by hand?**

  - 1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.1.0.0.0.8.b.d.0.1.0.0.2.ip6.arpa. IN PTR www.example.com

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Address Tracking

- **Keeping a few /24s in IPv4 in a spreadsheet**
  - Maybe OK
- **An IPv6 /48, which can have 64k subnets of /64s, each with 4.3b x 4.3b hosts**
  - Not OK

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It’s Time to Automate

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Automation is no longer a luxury.

It’s a requirement

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What can we Automate?

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AUTOMATE

- Network configuration and change management
- IP Address Assignments and Reclamation
  - Replace spreadsheets-based IP space management
- Subnet calculation and allocation
  - Automated calculation and documentation
- DNS configuration
  - AAAA/PTR records are hard to manage manually

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Questions?

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Get your own tunnel

- **Hurricane Electric – http://ipv6.he.net**
- **SIXXS - http://www.sixxs.net/main**
- **HE Certification:**
  - On the Hurricane Electric IPv6 site is a certification program. Completing the program is an excellent introduction to IPv6 in a working environment.

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Books to look at

- IPv6 Essentials - Silvia Hagen
- Running IPv6 - Iljitsch van Beijnum
- IPv6 Security – Scott Hogg and Eric Vyncke

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Handy Web Resources

- **NIST Guidlines for the Secure Deployment of IPv6**
  - http://csrc.nist.gov/publications/nistpubs/800-119/sp800-119.pdf
- **ARIN IPv6 Wiki**
  - http://www.getipv6.info
- **IPv6 Forum**
  - http://ipv6forum.com

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