IPV6 THE FUEL OF THE FUTURE

Or just another symptom of poor practices?

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- What does it take to deploy IPv6 well?
  - ➢Plan Ahead
  - ➢Design Holistically
  - ➢Test Rigorously
  - ➢Implement Cautiously
  - ➢Verify Results

Plan Ahead

- If you aim at nothing – you will hit it!
  - Define your requirements
  - Build your strategy/architecture/options/solutions
  - Outline a path to success (Plan your work)
  - Determine your method of measurement
  - Implement (Work your plan)
- If IPv6 is something that is just now being addressed – there are systemic issues.
  - If you are panicked about the ability to support IPv6, understand that IPv6 is a symptom to a larger planning problem in your organization
- Planning for 3 year scenarios is a minimum requirement
  - It takes a long time and a lot of resources to change out a network
  - IPv6 did not occur overnight
    - The signs were publicly available

▪ For several years ViaWest has had a requirement that all deployments must be IPv6 capable in hardware.

➢ Replaced the Cisco GSR GRP with PRP controllers and the Engine 2 with Engine 3 and 5 line cards.
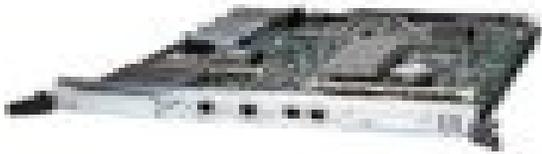
Plan Ahead

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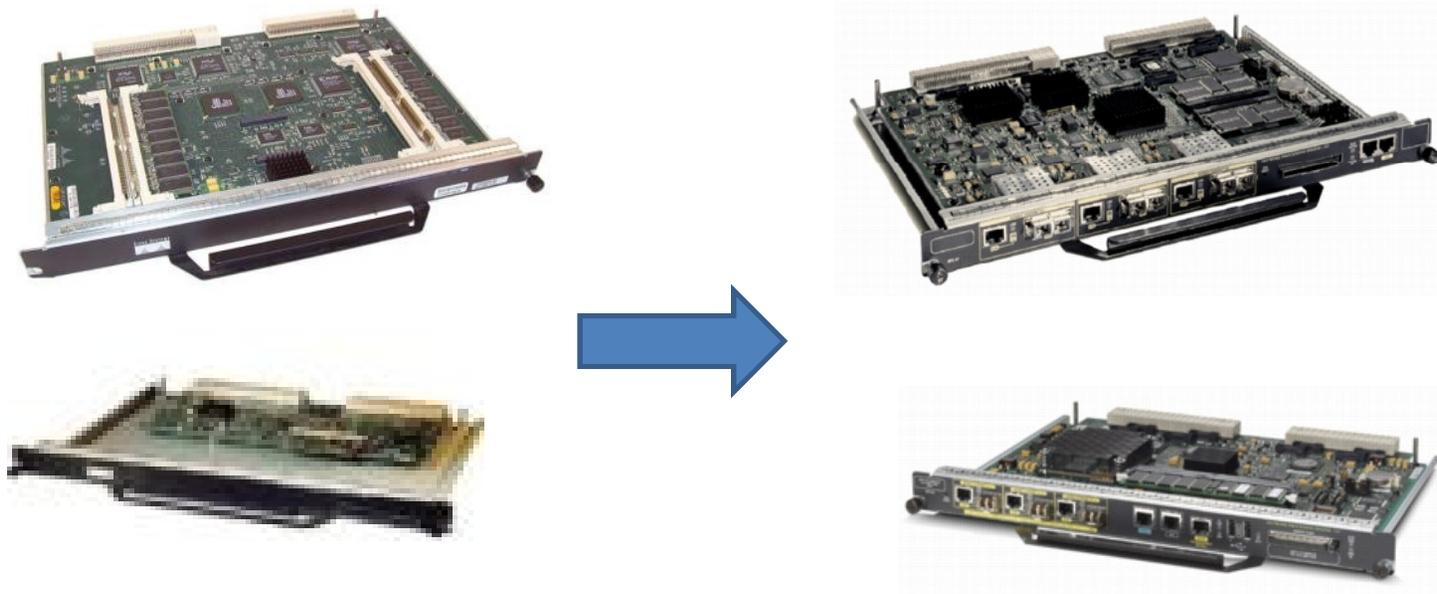 - Replaced key Cisco GSR chassis with 7600 and ASR1006 chassis.

Plan Ahead

- For several years ViaWest has had a requirement that all deployments must be IPv6 capable in hardware.

  - Replaced older Cisco 6500 Supervisor Engines with the Sup720-3BXL and removed all bus cards from the chassis.
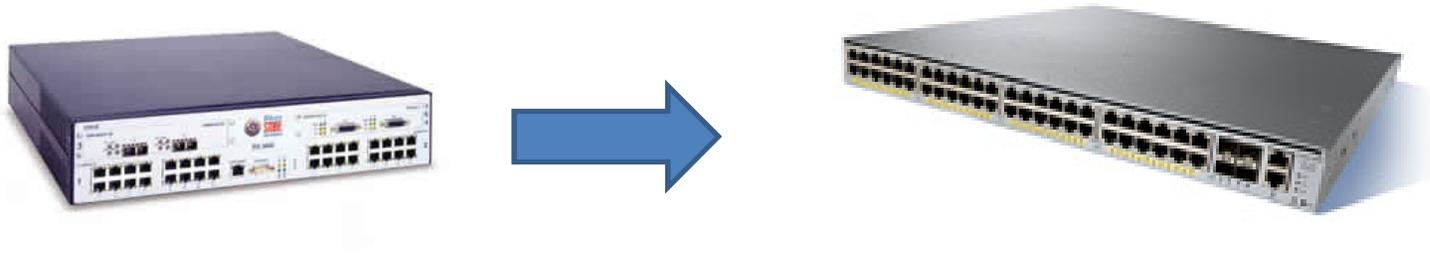
Plan Ahead

- For several years ViaWest has had a requirement that all deployments must be IPv6 capable in hardware.
  - Replaced the Cisco 7200 NPE-300/400 with NPE-G1/G2 controllers.

Plan Ahead

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➢ Upgraded Layer 2 distribution switches to allow for IPv6 manageability.

Plan Ahead

- For several years ViaWest has had a requirement that all deployments must be IPv6 capable in hardware.
  - Utilized firewalls that have NAT64 capability.

Plan Ahead

▪ For several years ViaWest has had a requirement that all deployments must be IPv6 capable in hardware.

➢ Switched critical products to devices that support IPv6.
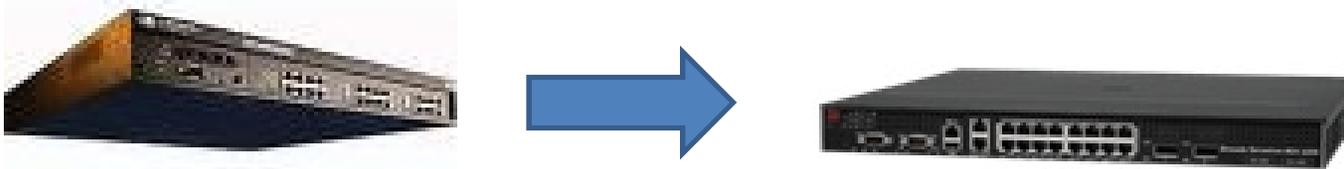
Plan Ahead

- Running the right code makes a difference.
  - On the Cisco 7600 we upgraded from 12.2(33)SRD1 to SRD4, anything SRD higher offers good IPv6 support, SRD does not support 32 bit AS peers. That is the reason we are looking at the 15.1(2)S code.
  - On the Cisco GSR we loaded the latest available in the 12.0 train and we are heavily testing the XR code. The 12.0 seems to handle all the functionality we need.
  - On the Cisco 6500 we upgraded from 12.2(33)SXH5 to SXI5, primary reason was HSRPv6 support.
  - On the 7200 we upgraded from 12.0 to 12.2(33)SRD4.
  - No specific code upgrades on the distribution layer were needed since it is layer 2 only.
  - Juniper firewalls are being upgraded to 6.2(7) to get all the IPv6 features that are needed.
  - Brocade ADX load-balancers are running ASM12201b

Plan Ahead

- DNS, Tools, and Monitoring are still maturing.
  - BIND is primarily used, a management web interface is being used that does not support AAAA records. Records are managed via command line.
  - Upgrading the existing IPAM is an active project. A feature matrix was created to help ensure that requirements are met.
    - You have determined your requirements haven't you?
  - Monitoring started by creating basic IPv6 ping checks.
    - Monitoring vendors are being pushed to release an IPv6 compliant version.

Design Holistically

- Flexibility
  - You don't know what the future holds
- Scalability
  - You don't want to build yourself into a corner
- Reliability
  - It has to be usable
  - Should include your High Availability (HA) plan
- Availability
  - How and when is it accessible
- Affordability
  - With unlimited funds you can do some great work – but few will pay for it!

Design Holistically

- IP addressing scheme
  - Address dissemination is structured so that it will be easy to manage.
    - By looking at an IPv6 address you can tell the deployed region, data center, device, and VLAN.
  - Make your addressing schema obvious
  - 2001:0DB8:1100:100A::/64
    - /36 is assigned to each regional backbone
    - /40 to each data center
    - /52 to aggregation layer
    - /64 to each VLAN with the VLAN encoded in the address
  - Customers are assigned a /48 routed prefix per data center

Design Holistically

- Routing Protocols
  - OSPFv3 was chosen because of staff familiarity with the OSPFv2 protocol.
    - For ease of management, OSPF costs were kept consistent between IPv4 and IPv6.
  - BGP4 is still utilized as the gateway protocol.
    - For ease of management, IPv6 configurations mimic IPv4.
    - Traffic management is consistent as well.
- Redundancy Protocols
  - HSRP for IPv6
    - Cisco 6500 only allows link local addresses for the standby IP.
      - FE80::1 was used for all configurations.

Design Holistically

- Transition mechanisms
  - IPv6 to IPv4 translation may be offered on our managed firewall service.
    - Many customer applications will not be IPv6 capable without external assistance.
    - The same method will be used for corporate applications for the short term.
    - Legacy systems will stay on IPv4 while utilizing NAT64 to provide IPv6 connectivity
      - Examples of such systems are:
        - Building management systems
        - Power distribution systems
   - Security systems

Test Rigorously

- Trust but verify vendor claims
  - When a vendor is under pressure, they will state just about anything.
    - Marketing material is written under the most optimistic circumstances.
    - However, in the end it is your business that is at stake – so TEST!
  - A lab is critical to your business' success
    - Don't subject your business/customers to untested solutions
    - Document your testing results
      - You'll refer to them years later to determine why a certain decision was made.
    - Stage before deployment
    - Deploy in stages
      - No lab can replicate the real thing – so have a controlled deployment plan.
        - Lab – test with real configurations
        - Pilot – test with real traffic
        - Full production – the real thing

Test Rigorously

- Things we found in our lab testing:
  - Cisco GSR Engine 3 card TCAM limitation, the default 4k TCAM limit was changed to 192k. ACL entries were limited to 10k.
  - Port bundles are not supported in hardware with regard to IPv6 on Cisco GSR Engine 3 line cards.
  - The Cisco GSR maximum path command does not work under BGP address family IPv6.
  - Cisco does not have IPSEC support for OSPFv3, specifically on the 6500 and 7600 platforms.
  - Cisco 6500 and 7600 platforms do not support uRPF in hardware for IPv6
  - No MIBs are available to monitor OSPFv3.
  - On the Cisco 6500 and 7600 the TCAM was changed from 512k v4/256k v6 to 640k v4/192k v6 to handle expected IPv4 routing table growth.
  - Ran into an interesting Cisco bug in the 6500 SXI code, the 0::/96 preventing the 6700 series DFC equipped line cards from booting.
    - The work around is to make sure you don't have a route covering that subnet, this is valid for both static and learned routes.
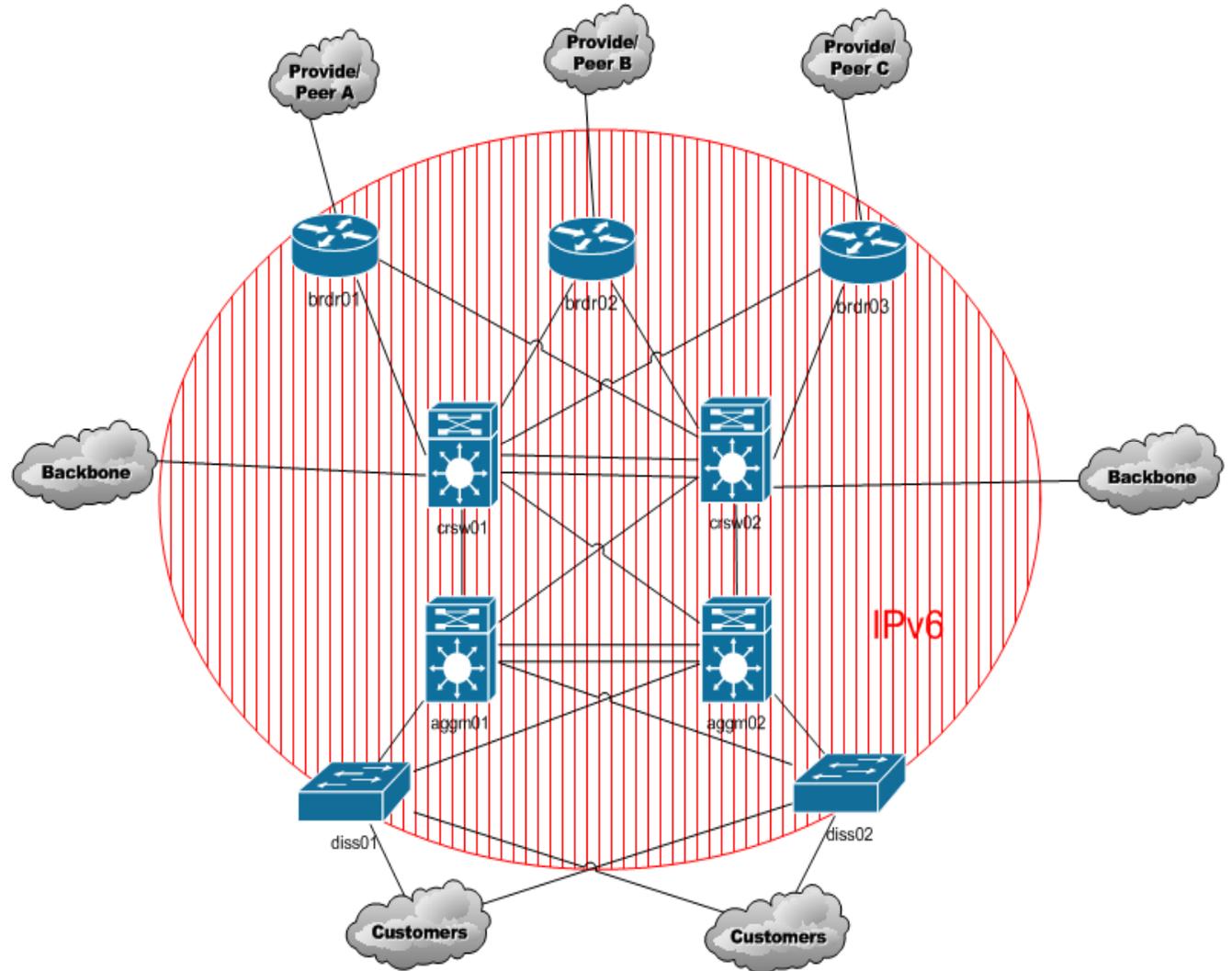 - Less than 1% increase in CPU/memory resource utilization with these changes.

Implement Cautiously

- Staged implementations help you build confidence in your solutions.
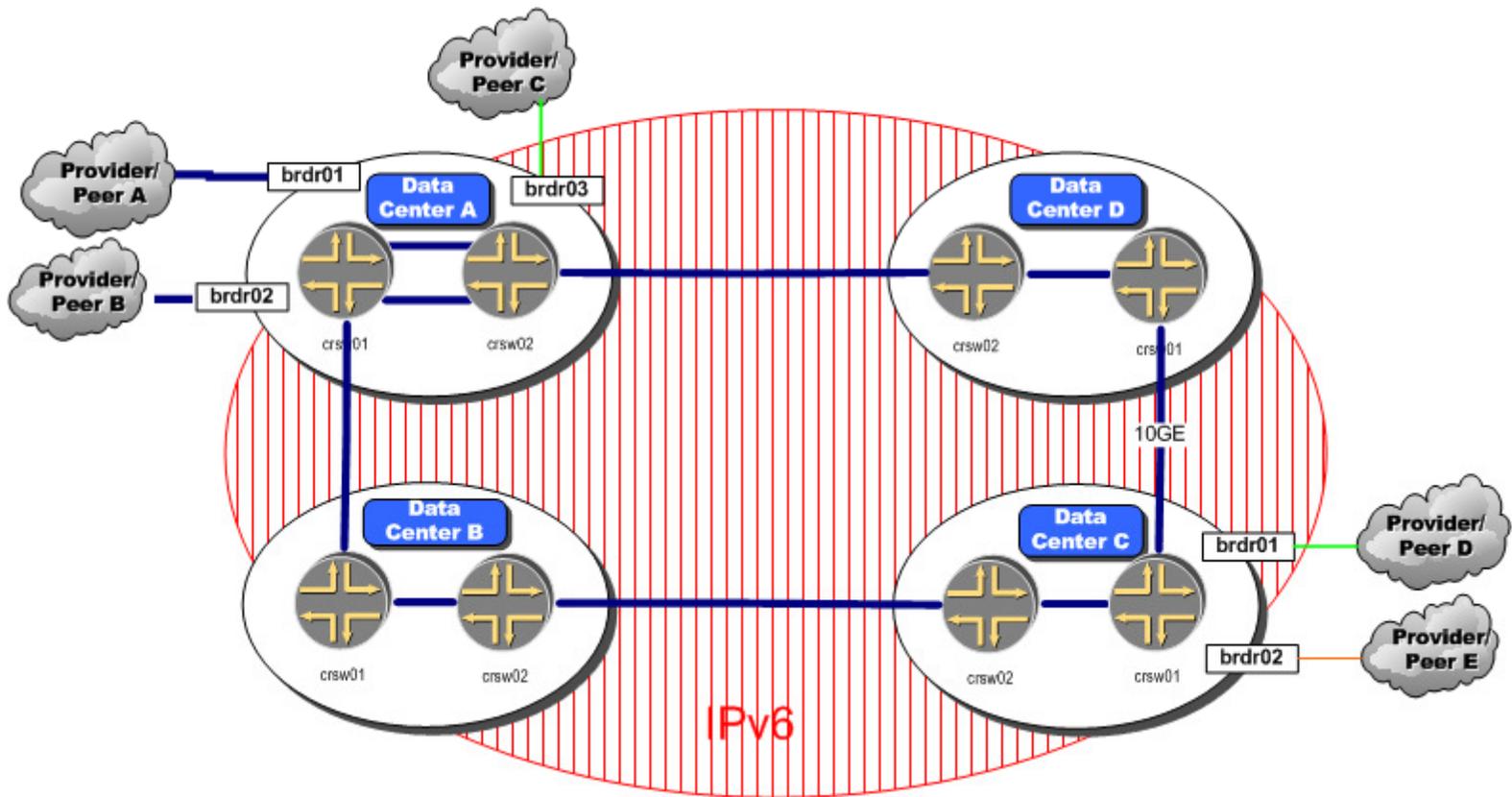
  1. Specific layers in a single data center
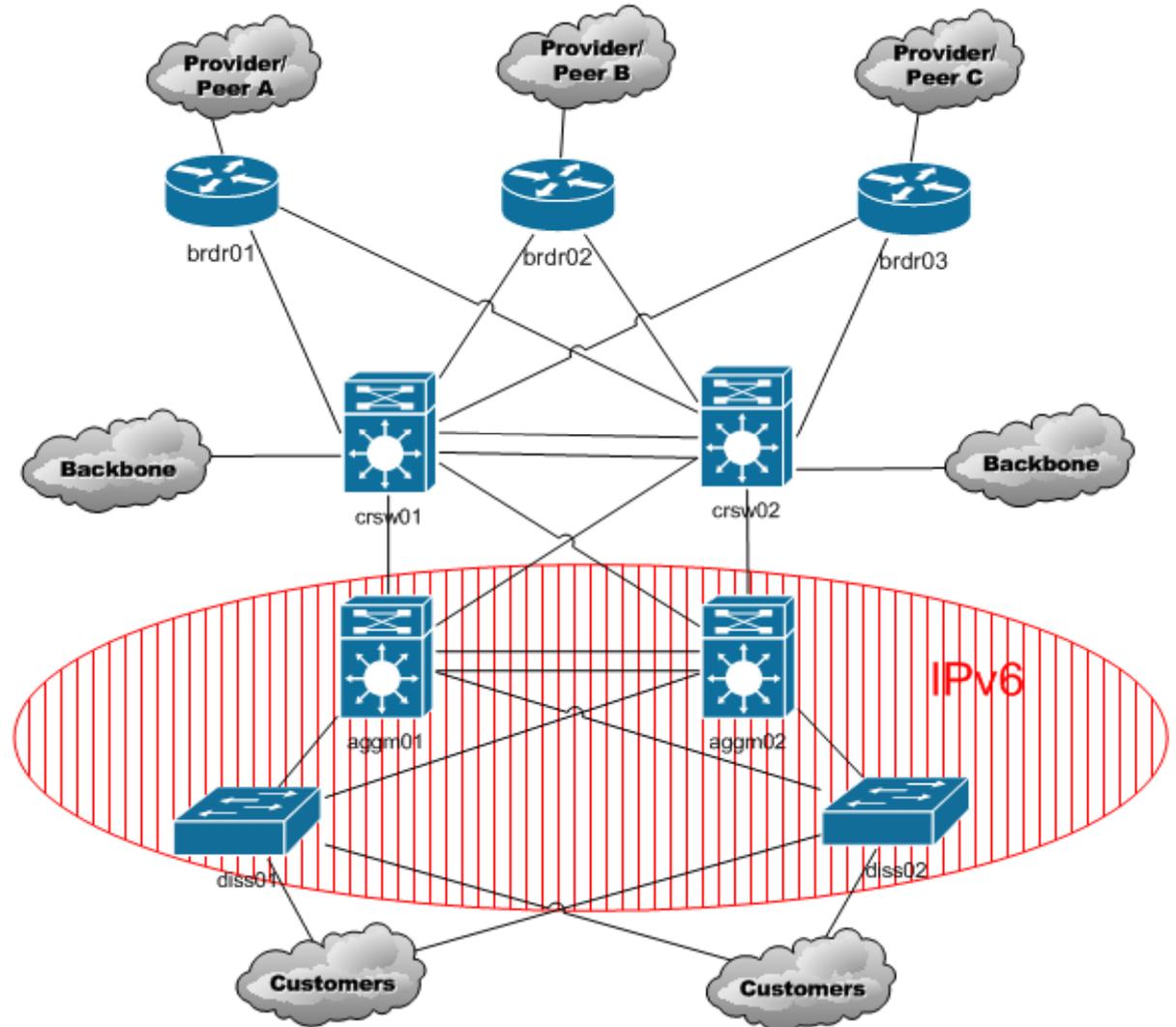
Implement Cautiously

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    2. An entire data center

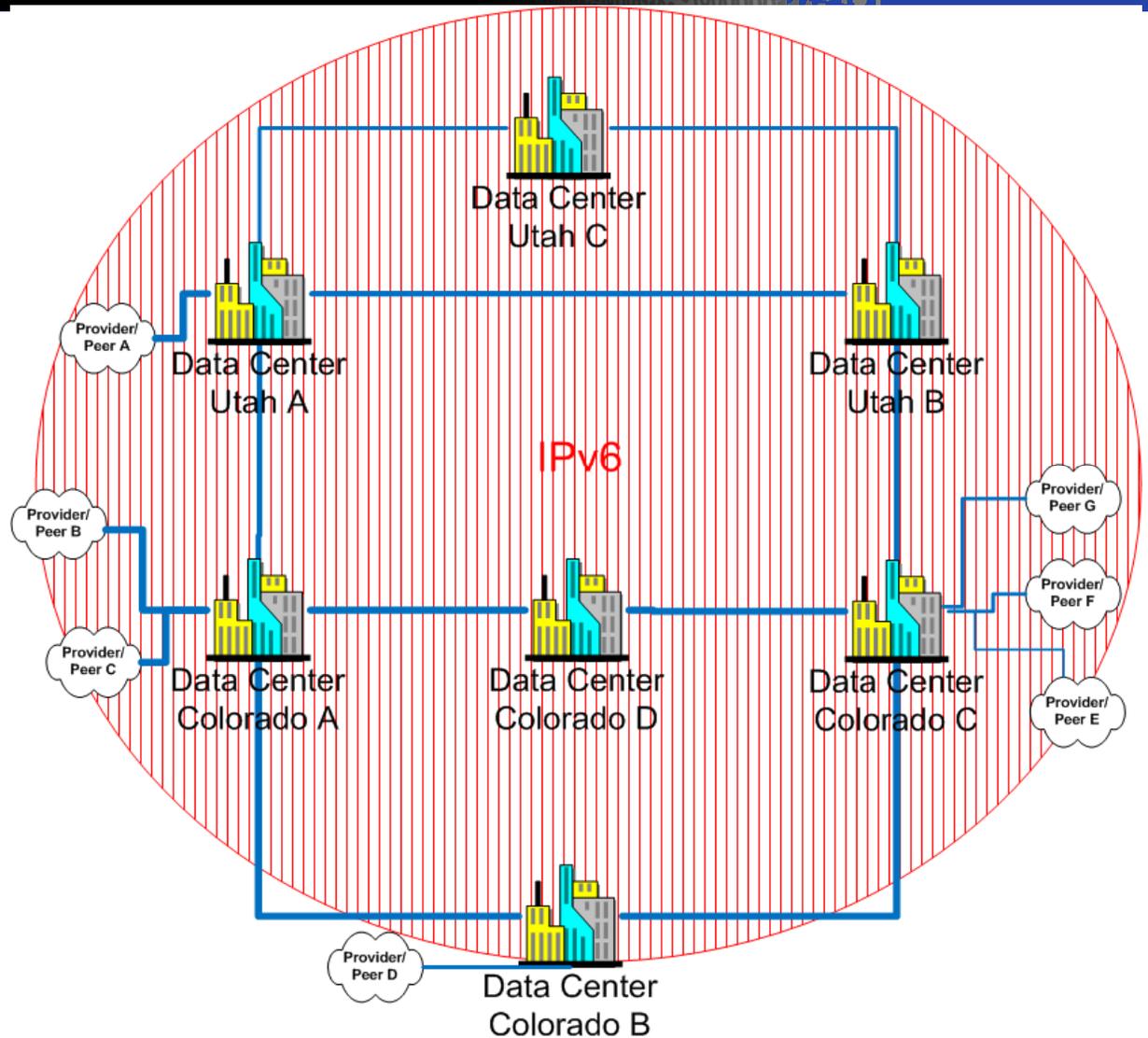# Implement Cautiously

- Staged implementations help you build confidence in your solutions.
    - 3. On particular layers in a single regional backbone
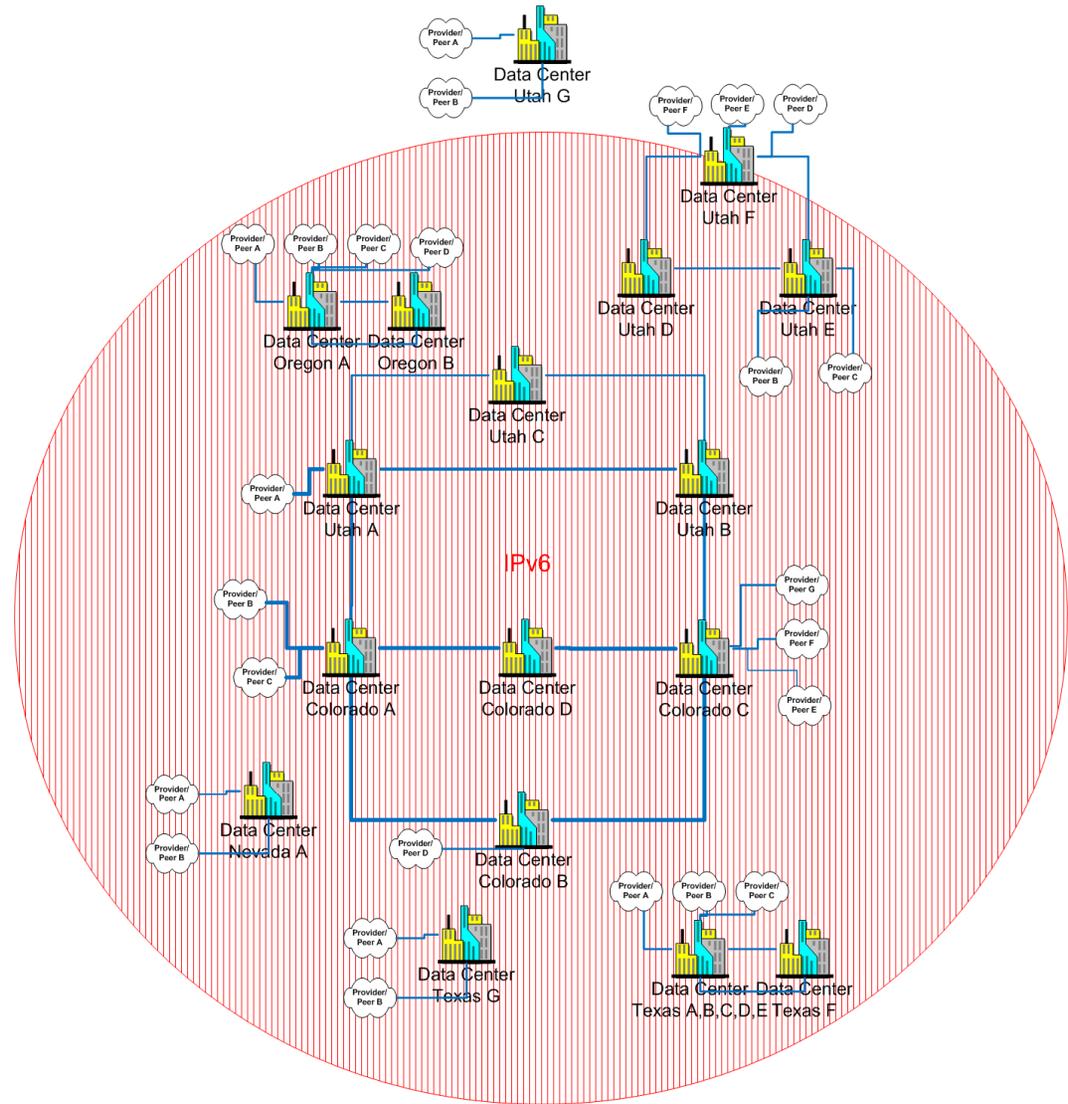
Implement Cautiously

- Staged implementations help you build confidence in your solutions.
    4. Connected two regional backbone

Implement Cautiously

- Staged implementations help you build confidence in your solutions.

   5. Implementations throughout the network

Implement Cautiously

- How to be a solid rock implementer – don't change on the fly.
- Deployment Methodology
  - Follow project management methodology
    - Initiation Phase
    - Planning Phase
    - Execution Phase
    - Control Phase
    - Close-out Phase
  - Follow change control methodology
    - Test
    - Design
    - QA
    - Approval
    - Execution
      - Pre-flight
      - In-flight
      - Post-flight
    - Follow Up

Verify Results

- Some peers are not able to offer an IPv6 BGP session at this time
  - Are they behind?
- Others have a significant gap in their IPv6 routing table due to lack of complete IPv6 peering.

- To deploy IPv6 well;
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  - Verify Results

THANK YOU

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