

IPv6 Design (Session 9276)

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Agenda

- **IPv6 Network Connectivity Design:**
 - **Major Design Decisions**
 - **IPv6 Address Considerations**
 - IPv6 Addressing Sizing
 - IPv6 Address Design

Next SHARE – Atlanta – March 2011

- **IPv4/6 IPAM (IP Address Management)**
- **IPv6 DHCP**
- **IPv6 DNS**
- **IPv6 QOS**
- **IPv6 NMS Considerations**
- **IPv6 Security Considerations**

- **Q&A**
- **References**

Customer X Topology

- **High Level Planning Steps Completed:**
 - Project Management Team and Critical Stake Holders Identified and Positioned
 - Current IPv6 Business Requirements Identified
 - Planning and Architecture Requirements
 - Infrastructure Assessment
 - Network Device Upgrade or Replace Strategy Accomplished
 - Application Testing and or Certification for IPv6 compliance
- **IPv6 Architectural / Design Standards:**
 - /48 Network Address from ARIN
 - Global addressing everywhere.
 - /128 Bit for Loopbacks
 - /127 for P2P connections between devices
 - Address Space Blocks setup for Internal and External reachability.
 - Addressing Block Sizes designed for Upper Level Growth
 - More !!!!

Infrastructure Overview

IPv4 to IPv6 Network Infrastructure

Things to consider: Where do they live ???

HW/SW --- Swapout or Upgrade ???

Do we design around our limitations???

Hardware – Can it support IPv6 ???

Software -- Does it support IPv6 ???

Feature – Does it support what you have today and are looking to use in the future ???.

- Devices Currently IPv6 Capable
- Devices Requiring Only Software Upgrade
- Hardware IPv6 Capable, requires IOS and FLASH Upgrade
- Hardware IPv6 Capable, requires IOS and DRAM Upgrade
- Hardware IPv6 Capable, requires IOS, DRAM and FLASH Upgrade
- Not IPv6 Capable
- Devices Requiring Further Analysis

IPv6 High Level Planning Steps

Business Case Identified/Justified



Evaluate effect
on business
model

1

Establish IPv6
project
management
team

2

Assess
network
hardware and
software

3

IPv6 Training
strategy

4

Obtain IPv6
prefix(es) / 48
or Larger (/44)

5

Decide IPv6
architectural
solution

6

Test
application
software and
services

7

Develop
security
policy

8

Develop
procurement
plan

9

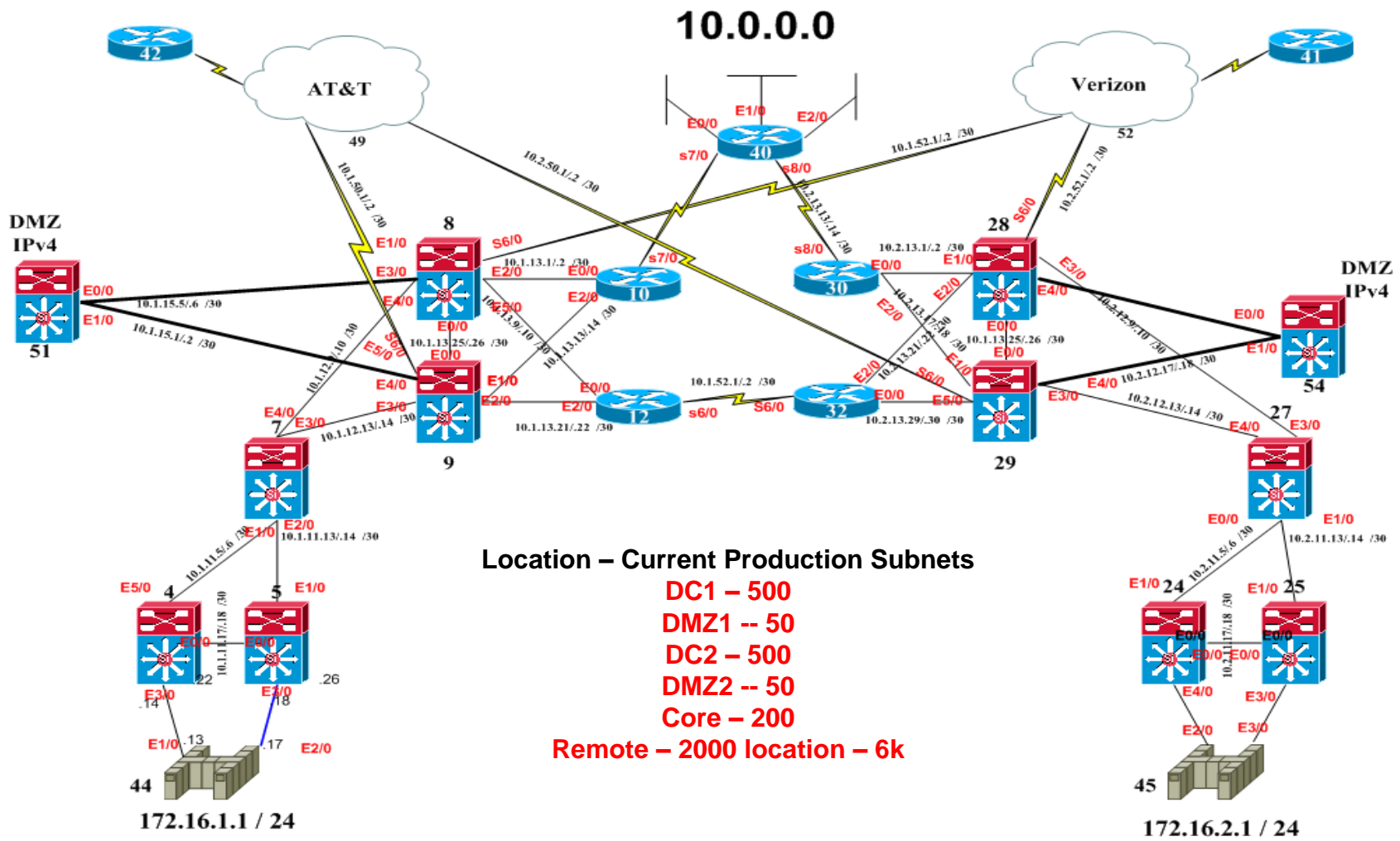
Develop IPv6
exception
strategy

10

Major Design Decisions

Addressing	Subnetting Scheme	Address Distribution	Co-existence Methodology	Migration Strategy	Tunneling methods
Provider Assigned (PA)	/64 subnet everywhere	Statically assigned	Dual Stack	Internet facing	ISATAP
Provider Independent (PI)	/64 with /127 infrastructure	Stateless Autoconfiguration (SLAC)	Tunneling	Core outwards	Toredo
/48 block (/44 if you can)	/64 with link local infrastructure	DHCP	Translation	Edge inward	6to4
Multiple /48 blocks (per region)			Separate Infrastructure	Forklift / Everywhere at once	
Unique-local addressing			Combinations/ permutations		

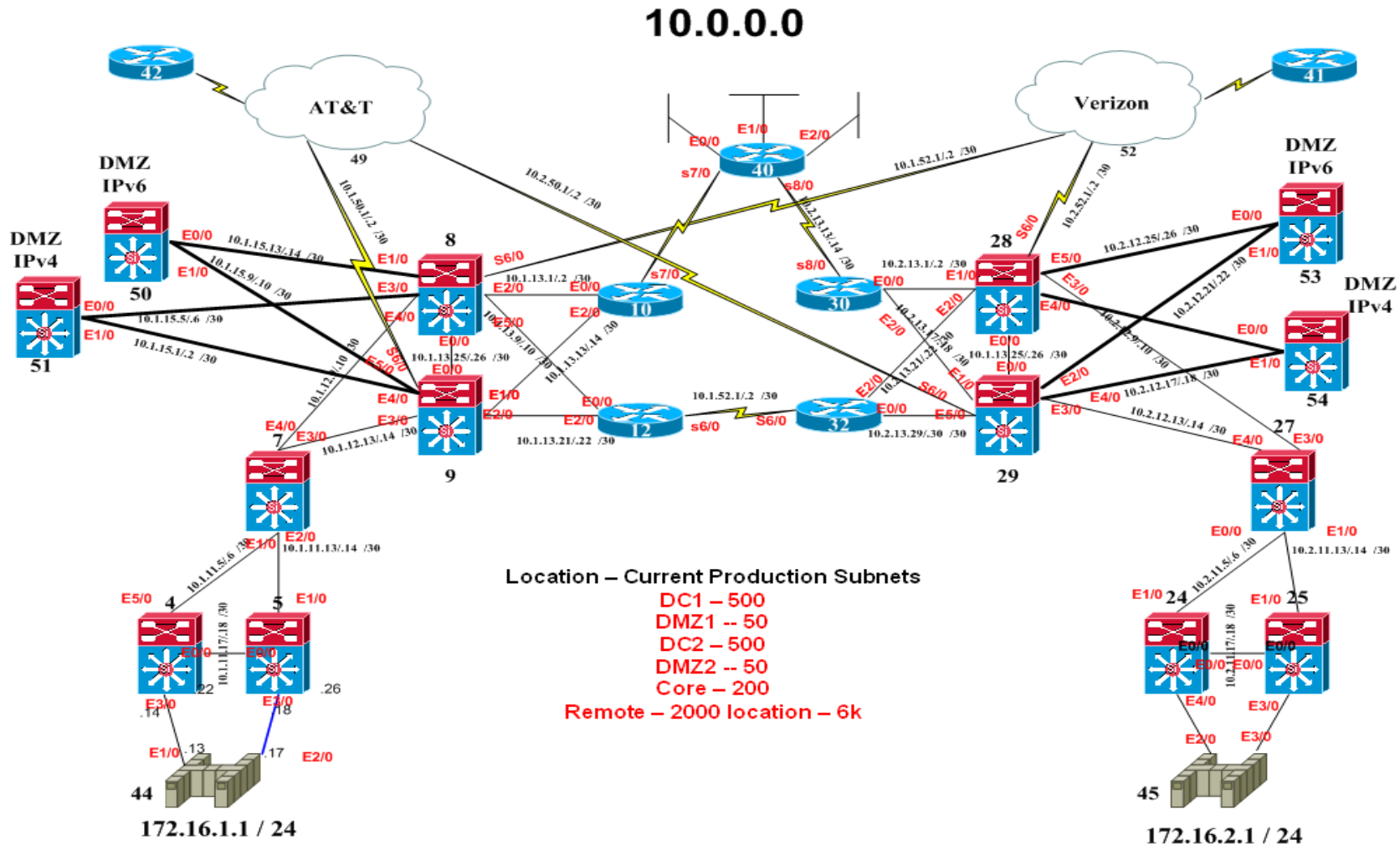
Current IPv4 Network



Data Center 1

Data Center 2

IPv6 Network Presence ??? Topology



IPv6 Address Considerations

ARIN Guidelines for Address Allocation



<https://www.arin.net/policy/nrpm.html#six>

6.5.8.2. Initial assignment size:

The initial assignment size will be determined by the number of sites justified below.

An organization qualifies for an assignment on the next larger nibble boundary when their sites exceed 75% of the /48s available in a prefix. For example:

More than 1 but less than or equal to 12 sites justified, receives a /44 assignment;

More than 12 but less than or equal to 192 sites justified, receives a /40 assignment;

More than 192 but less than or equal to 3,072 sites justified, receives a /36 assignment;

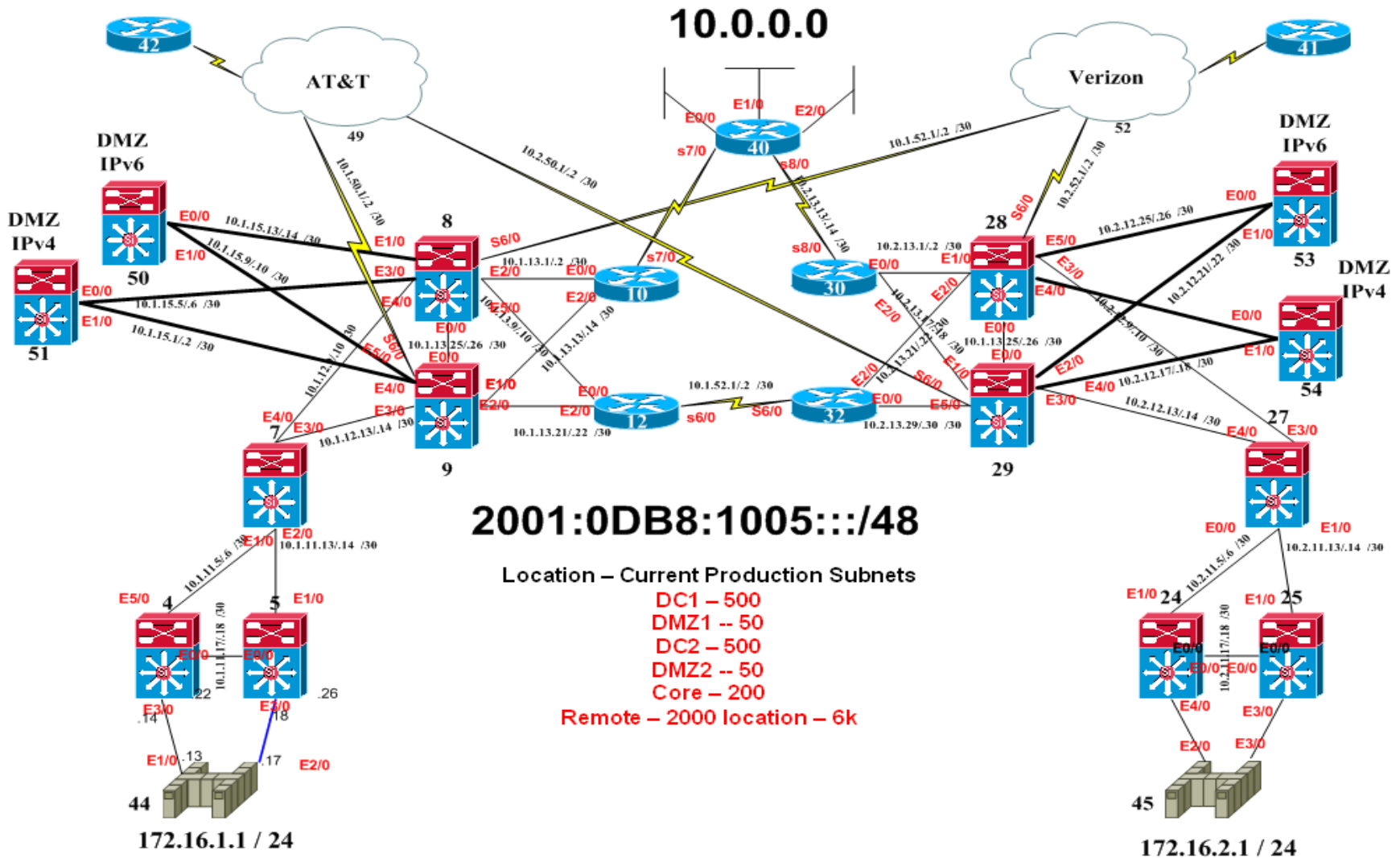
More than 3,072 but less than or equal to 49,152 sites justified, receives a /32 assignment;
etc...



IPv6 Prefixes

- **Prefix** **IPv6 Addresses**
- /32 $2^{(128-32)} = (4,294,967,296 /64 \text{ Subnets})$
- /40 $2^{(128-40)} = (33,554,430 /64 \text{ subnets})$
- /44 $2^{(128-44)} = (2,097,151 /64 \text{ subnets})$
- /48 $2^{(128-48)} = (65,536 /64 \text{ subnets})$**
1,208,925,819,614,629,174,706,176 (2^{80}) (septillion)
- /56 $2^{(128-48)} = (256 /64 \text{ subnets})$
- /64 18,446,744,073,709,551,616 IPv6 addresses

IPv6 Network Presence ??? Topology



IPv6 Addressing Requirements: 2001:0DB8:1005:::/48

Location – Current Production Subnets

DC1 – 500

DMZ1 -- 50

DC2 – 500

DMZ2 -- 50

Core – 200

Remote – 2000 location – 6k

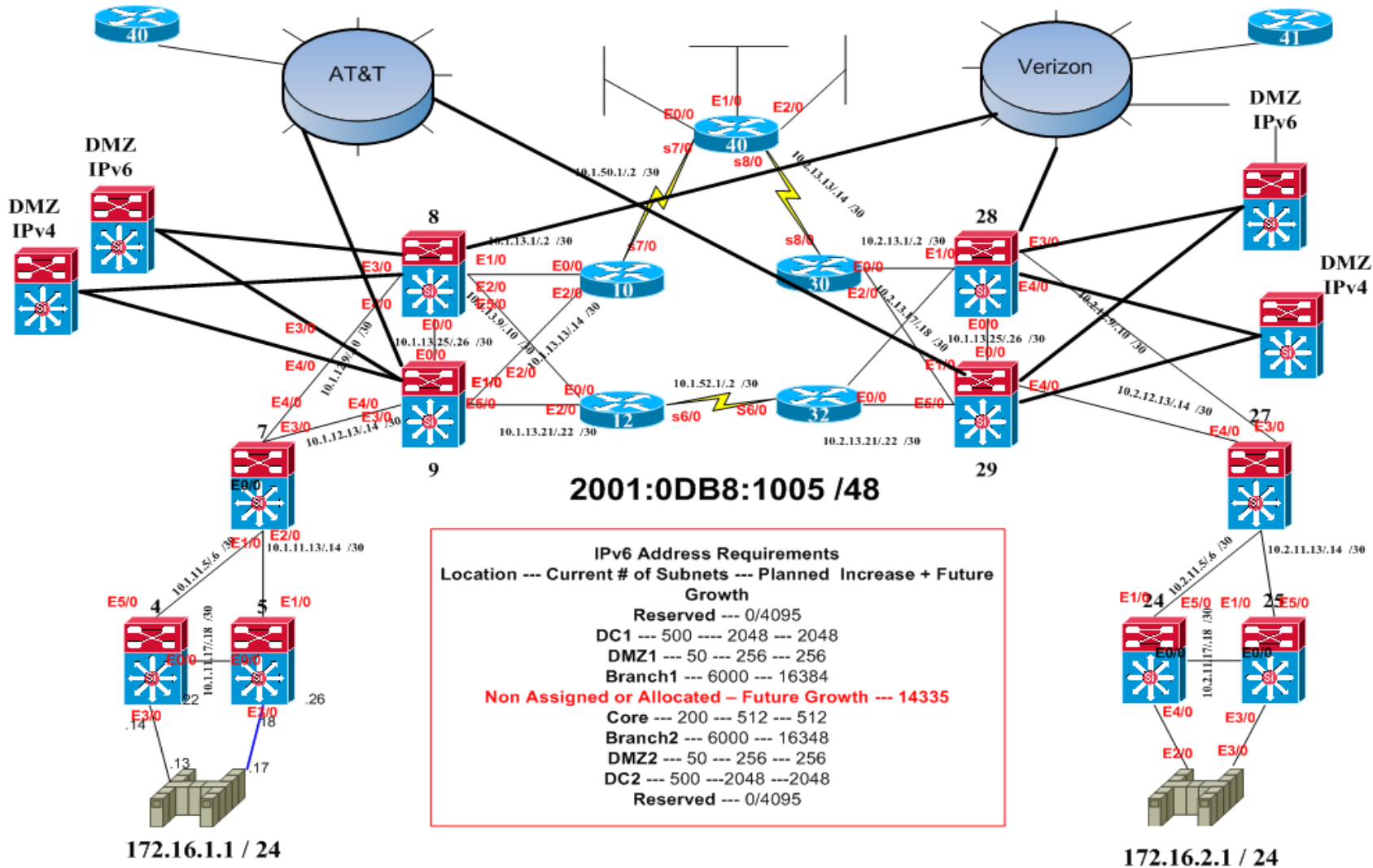
We must plan our IPv6 Address scheme to support current growth and future growth ???

IPv6 Addressing Requirements: 2001:0DB8:1005:::/48

Current / Future Growth Requirements:

Location	Current # of Subnet'	Planned Increase + Future Growth
Reserved	none	????????????????????
DC 1	500	????????????????????
DMZ1	50	????????????????????
Branch 1	3000	????????????????????
Future Growth	???	????????????????????
Core	250	????????????????????
Branch2	3000	????????????????????
DMZ2	50	????????????????????
DC2	500	????????????????????
Reserved	none	????????????????????

IPv6 Network Presence ??? Topology



/48 Address Breakdown

Switch to Excel Spreadsheet for Review of Breakdown:

I cannot upload the excel spreadsheet.

Please contact me via email and I will send.

IPv6 Network Topology

