

VA IPv6 Addressing Plan

Options and Final Proposal

2/28/08

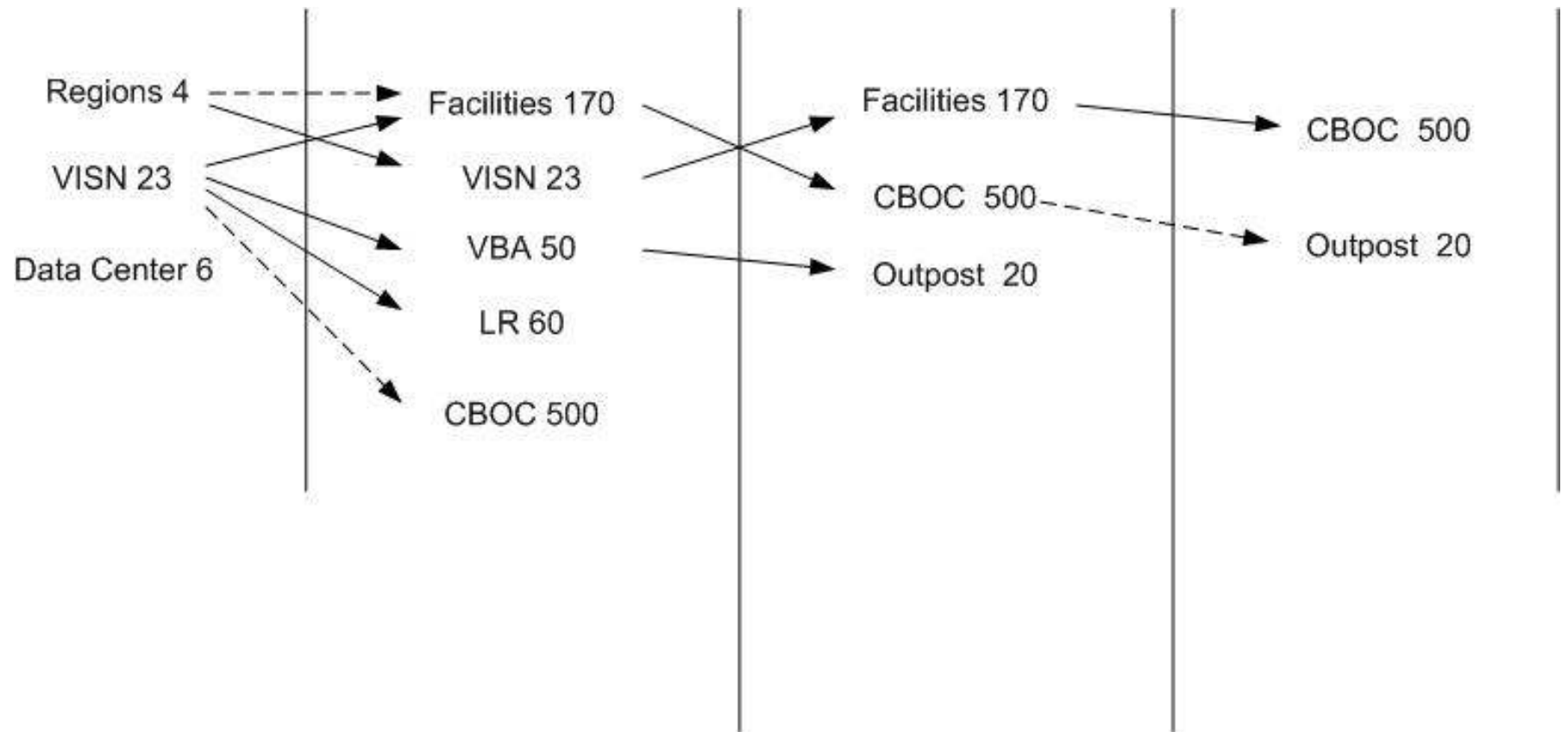
Design Considerations

- VA IPv6 address space from ARIN
 - 2610:00d8::/32
 - /32 is considered as an ISP address space
 - Since VA is an enterprise, it acts as a service provider to its entities
 - Tier 1 Internet service providers will not advertise any block longer than a /32 between themselves, thus breaking the multi-homing capability of VA
 - Stateful firewall checking is a requirement
 - Multi-homing and its future – Currently being discussed at IETF and multiple RFCs are being developed.
 - Keep bit boundaries as clean as possible – No overlapping at nibble boundary
 - IPv6 based service – still pending

Design Considerations

- VA current infrastructure
 - Overall design is still in flux – current plan is to have One-VA Net that will connect all regions and sub-agencies
 - Design based on consistencies in the network
 - Internet routing gateways
 - Regions and/or maybe VISN
 - Data Center consolidation
 - Zones (Production/Research) – Still in evaluation
 - Many different ways to carve the space out as long as plan is easy to follow by the IP address administrators
 - Plan based on current known design with as many consistencies as possible

Overall Design view/goal - conceptual



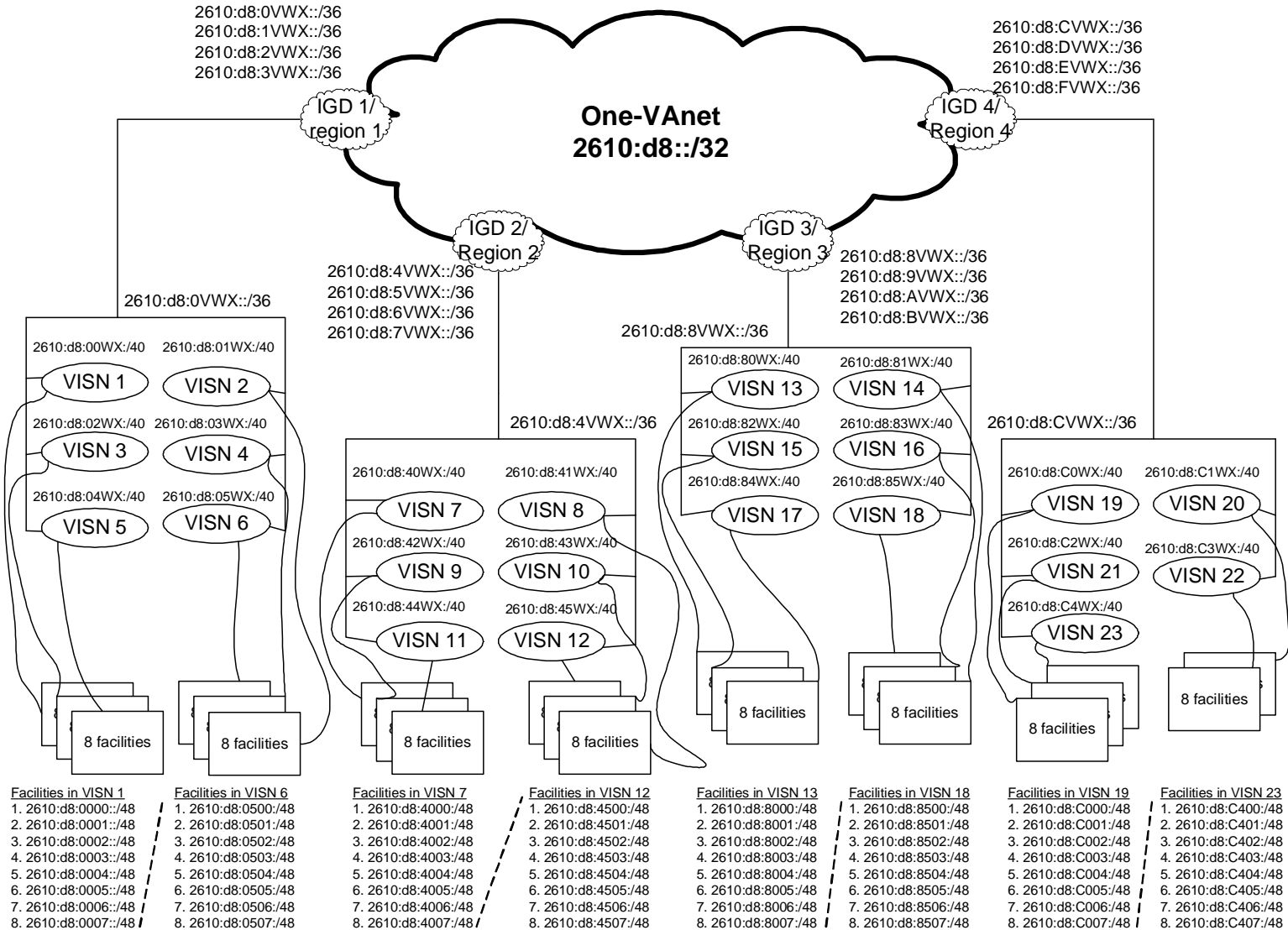
Design Option 1

- 1st design option – Break down at the Internet gateway domain (IGD)
 - ARIN assigned space - 2610:d8::/32
 - 2610:d8:0::/36 to 2610:d8:f000::/36 – Internet gateway domain (IGD)
 - IGD 1 – 2610:d8:0::/36 to 2610:d8:3000::/36
 - IGD 2 – 2610:d8:4000::/36 to 2610:d8:7000::/36
 - IGD 3 – 2610:d8:8000::/36 to 2610:d8:B000::/36
 - IGD 4 – 2610:d8:C000::/36 to 2610:d8:F000::/36
 - Zones (production/research) – 1 more bit to /37
 - This creates problems – boundaries are not clear as /37 only has 2 subnets and since there are 4 bits available in that particular nibble, which has potential of 14 more subnets to be clean in a /40 boundary. Reconsider zones or expand zones to /40 nibble, which might be wastage.
 - 2610:d8:01::/37 – Production for IGD 1
 - 2610:d8:02::/37 – Research for IGD 1
 - /38 - /54 reserved for subnets as listed in the overall design view
 - /55 - /64 reserved for lower stacks

Design Option 2

- Break down at the Internet gateway domain (IGD) – change zone concept
- Overall view of the 2nd design
 - ARIN assigned space - 2610:d8::/32
 - IGD boundaries 2610:d8:UVWX:/36 (This seems to be same as region, so not sure if region is needed below this)
 - U is from 0-F and each region has 2 production and 2 research zones
 - VISN boundaries 2610:d8:UVWX:/40 (There are total 23 VISNs, approx. about 6 VISNs in each IGD/region)
 - V is from 0-F for each IGD, provides max of 16 VISN in each IGD/region
 - Data centers can be accommodated under this level or can be moved one above (Need discussion???)
 - Next subnet boundary to accommodate facilities that belong to each VISN (170 total facilities or approx. 8 facilities per VISN)
 - Can be /48 – 2610:d8:UVWX::/48
 - WX is total of 8 bits, which gives about 256 sites per VISN, still provides plenty of growth
 - Each /48 can be further divided up to /64 and that is per facility and has a potential of 65,536 subnets.

Design Option 2



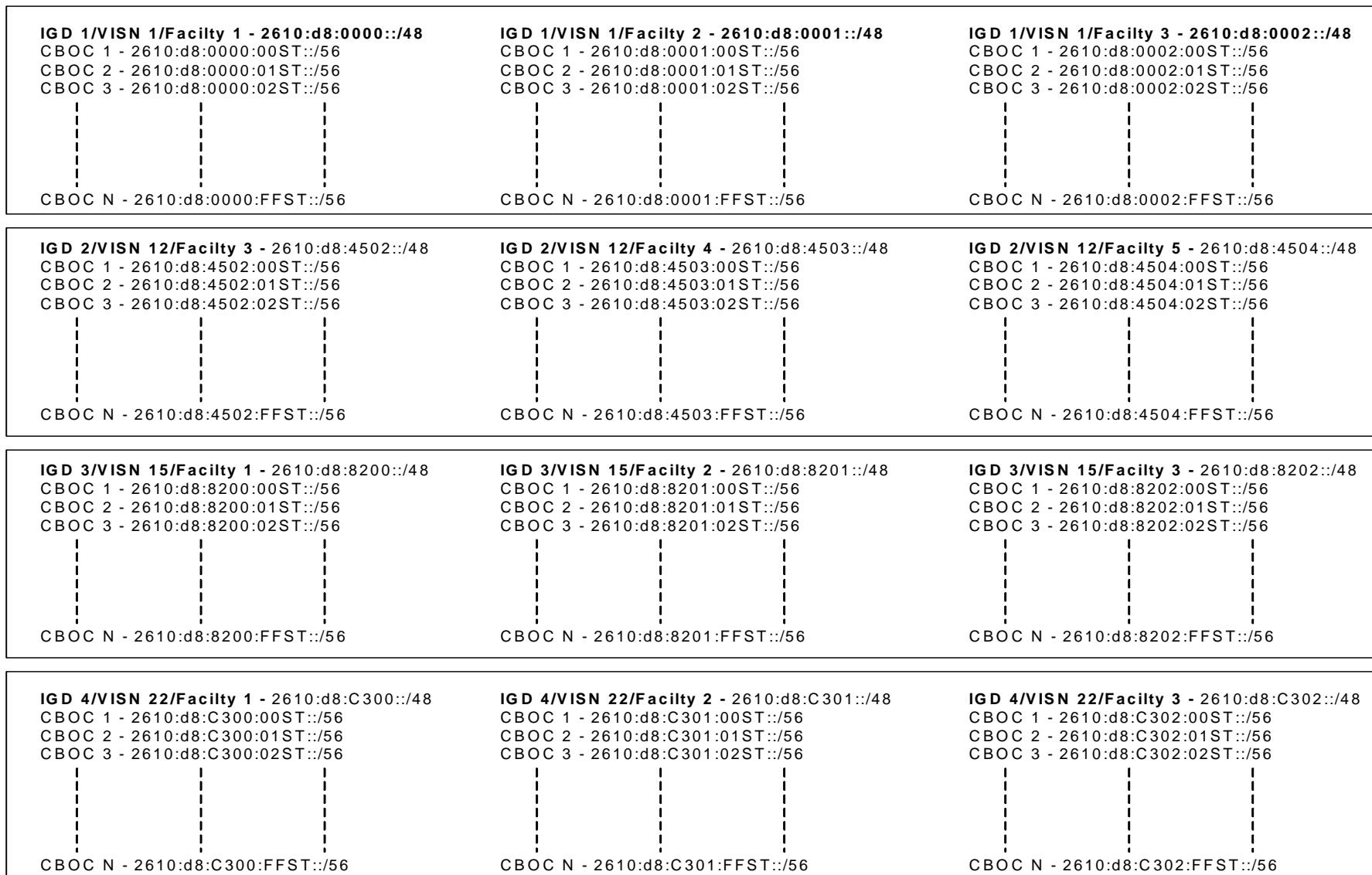
Design Option 2 – For Example

- For Example
 - ARIN assigned space - 2610:d8::/32
 - IGD boundaries 2610:d8:UVWX:/36 (same as regions as there are no 4 regions in each IGD) – U is from O-F
 - IGD 1 production – 2610:d8:0VWX::/36 to 2610:d8:1VWX::/36
 - IGD 1 research – 2610:d8:2VWX::/36 to 2610:d8:3VWX::/36
 - IGD 2 production – 2610:d8:4VWX::/36 to 2610:d8:5VWX::/36
 - IGD 2 research – 2610:d8:6VWX::/36 to 2610:d8:7VWX::/36
 - IGD 3 production – 2610:d8:8VWX::/36 to 2610:d8:9VWX::/36
 - IGD 3 research – 2610:d8:AVWX::/36 to 2610:d8:BVWX::/36
 - IGD 4 production – 2610:d8:CVWX::/36 to 2610:d8:DVWX::/36
 - IGD 4 research – 2610:d8:EVWX::/36 to 2610:d8:FVWX::/36
 - VISN boundaries 2610:d8:UVWX:/40 (6 VISNs in each IGD/region)
 - V is from 0-F
 - 2610:d8:U0WX:/40 - 2610:d8:UFWX:/40
 - » For IGD 1 and VISN 1 – 2610:d8:00WX:/40
 - » For IGD 1 and VISN 2 – 2610:d8:01WX:/40
 - » For IGD 2 and VISN 7 – 2610:d8:10WX::/40
 - Doesn't answer Data center (Are they global at One-VA Net)

Design Option 2 – For Example

- For Example - continued
 - Facilities boundaries 2610:d8:UVWX::/48
 - WX – 8 bits provide 256 subnets
 - IGD 1/VISN 1/Facilty 1 - 2610:d8:0000::/48
 - IGD 1/VISN 1/Facilty 2 - 2610:d8:0001::/48
 - IGD 1/VISN 2/Facilty 1 - 2610:d8:0100::/48
 - IGD 1/VISN 2/Facilty 2 - 2610:d8:0101::/48
 - IGD 2/VISN 7/Facilty 1 - 2610:d8:1600::/48
 - IGD 2/VISN 8/Facilty 1 - 2610:d8:1700::/48, etc.....
 - Next subnet boundary to accommodate sites that belong to each Facility, such as CBOCs and outposts – Approx. 3 to 4 CBOCs for each facility
 - 2610:d8:UVWX:YZST::/56 – This is another 256 subnets under each facility, where YZ is for the CBOCs under each facility
 - Each /56 can be further divided into another /64 that is another 8 bits, which gives another 256 subnets as lower stacks
 - 2610:d8:UVWX:YZST::/64 – This is another 256 subnets under each CBOC, where ST is for the location under each CBOC

Design Option 2 – Overall view



Design Option 3

Breakdown at the Internet Gateway Domain (IGD)

- ARIN assigned space – 2610:d8::/32
- /36 – IGDs
- /37 – Production/Development
- /38.../40 – Reserved Nibble
- /40.../47 - VISNs
- /48.../55 – Facility
- /56.../64 – Sub-Facility

Design Option 4

- Breakdown at the Internet Gateway Domain (IGD)
 - ARIN assigned space – 2610:d8::/32
 - /37 – gateway
 - /36 – Each pair of gateways (4 pairs)
 - /54 – Location/Facility level (except clinics)
 - /55.../64 – Sub-facility/subnet level

Note: Backbone ULA (Unique Local Address)

Note: /38.../40 – Production/Development

Final Allocation

All VA IPv6 Space	/32	/33	/33		# 48's	# 64's		
		Reserved 2610:D8	Active 2610:D88		16384	N/A	2 IP Spaces to move between	
Active IPv6 Space	/33	/36	/36	/36			
		IDP1 2610:D8C::37	Gateway2/IDP2 2610:D8C:8::37 <i>ex Santa Clara GW</i>		2048	N/A	Up to 8 Gateway IDPs	
Major Region	/36	/40	/40	/40			
		AS 2610:D8C:8::40 <i>ex. AS22</i>	AS 2610:D8C:8D::40		256	N/A	Up to 16 AS/Major Region	
AS	/40	/48	/48		/48			
		Reserved 2610:D8C:8::48	Reserved 2610:D8C:8xxx:xxxx	Facility 2610:D8D:8::48	Facility 2610:D8C:8::48 <i>San Diego VAMC</i>	1	65536	256 Facilities
Facility-Network & Sub-Facility	/56	/56	/56	/56			
		2610:D8Cx::56 <i>CBOC Chula Vista</i>	2610:D8Dx::56 <i>San Diego Bldg 32</i>		N/A	256	256 Sub-Facilities	
Subnets	/64	/64	/64	/64			
		<i>CBOC Chula Vista Subnet1</i>			<i>CBOC Chula Vista Subnet 256</i>	N/A	1	

Address Allocation

- The VA was allocated IPv6 address block 2610:d8::/32 by the American Registry for Internet Numbers (ARIN) for allocation within the enterprise.
- Figure above depicts the proposed partitioning of the total VA addressing space. Of 2 possible /33 blocks, 1 /33 block will be active and used for Production and Development.
- The remaining /33 block will be reserved for future use. This will support network growth, enabling applications that are not yet defined, and future renumbering requirements.
- The /36 block will be used to carve eight possible gateway or IDP, four will be utilized.
- Eight /40 blocks, each representing an autonomous system AS/Major Region.
- The /48 will be allocated to each facility.
- The /56 will be allocated to sub-facility
- The /64 will be allocated to subnets. In cases of lower level to the subnet, contiguous allocation of /64 will be assigned as to maintain bit boundary.