IPv6 Addressing

ISP Training Workshops

Where to get IPv6 addresses

- Your upstream ISP
- Africa
  - AfriNIC – http://www.afrinic.net
- Asia and the Pacific
  - APNIC – http://www.apnic.net
- North America
  - ARIN – http://www.arin.net
- Latin America and the Caribbean
  - LACNIC – http://www.lacnic.net
- Europe and Middle East
  - RIPE NCC – http://www.ripe.net/info/ncc

Internet Registry Regions

Getting IPv6 address space (1)

- From your Regional Internet Registry
  - Become a member of your Regional Internet Registry and get your own allocation
  - General allocation policies are outlined in RFC2050
    - RIR specific details for IPv6 allocations are listed on the individual RIR website
  - Open to all organisations who are operating a network
  - Receive a /32 (or larger if you will have more than 65k /48 assignments)

Getting IPv6 address space (2)

- From your upstream ISP
  - Receive a /48 from upstream ISP's IPv6 address block
  - Receive more than one /48 if you have more than 65k subnets
- If you need to multihome:
  - Apply for a /48 assignment from your RIR
  - Multihoming with provider's /48 will be operationally challenging
    - Provider policies, filters, etc

Using 6to4 for IPv6 address space

- Some entities use 6to4
  - Not recommended due to operational problems
  - Read http://datatracker.ietf.org/doc/draft-ietf-v6ops-6to4-to-historic
- FYI: 6to4 operation:
  - Take a single public IPv4 /32 address
  - 2002:<ipv4 /32 address>::/48 becomes your IPv6 address block, giving 65k subnets
  - Requires a 6to4 gateway
  - 6to4 is a means of connecting IPv6 islands across the IPv4 Internet

Addressing Plans – ISP Infrastructure

- ISPs should receive /32 from their RIR
- Address block for router loop-back interfaces
  - Generally number all loopbacks out of **one** /64
  - /128 per loopback
- Address block for infrastructure (backbone)
  - /48 allows 65k subnets
  - /48 per region (for the largest international networks)
  - /48 for whole backbone (for the majority of networks)
  - Summarise between sites if it makes sense

Addressing Plans – ISP Infrastructure

- What about LANs?
  - /64 per LAN
- What about Point-to-Point links?
  - Protocol design expectation is that /64 is used
  - /127 now recommended/standardised
    - http://www.rfc-editor.org/rfc/rfc6164.txt
    - (reserve /64 for the link, but address it as a /127)
  - Other options:
    - /126s are being used (mirrors IPv4 /30)
    - /112s are being used
      - Leaves final 16 bits free for node IDs
    - Some discussion about /80s, /96s and /120s too

Addressing Plans – Customer

- Customers get one /48
  - Unless they have more than 65k subnets in which case they get a second /48 (and so on)
- In typical deployments today:
  - Several ISPs give small customers a /56 or a /60 and single LAN end-sites a /64, e.g.:
  - /64 if end-site will only ever be a LAN
  - /60 for small end-sites (e.g. consumer/broadband)
  - /56 for medium end-sites (e.g. small business)
  - /48 for large end-sites
  - (This is another very active discussion area)

Addressing Plans – Customer

- Consumer Broadband Example:
  - DHCPv6 pool is a /48
    - DHCPv6 hands out /60 per customer
    - Which allows for 8192 customers per pool
- Business Broadband Example:
  - DHCPv6 pool is a /48
    - DHCPv6 hands out /56 per customer
    - Which allows for 256 customers per pool
- Business "leased line":
  - /56 per customer
  - Reserve the /48 – allows for growth of customer network

Addressing Plans – Routing Considerations

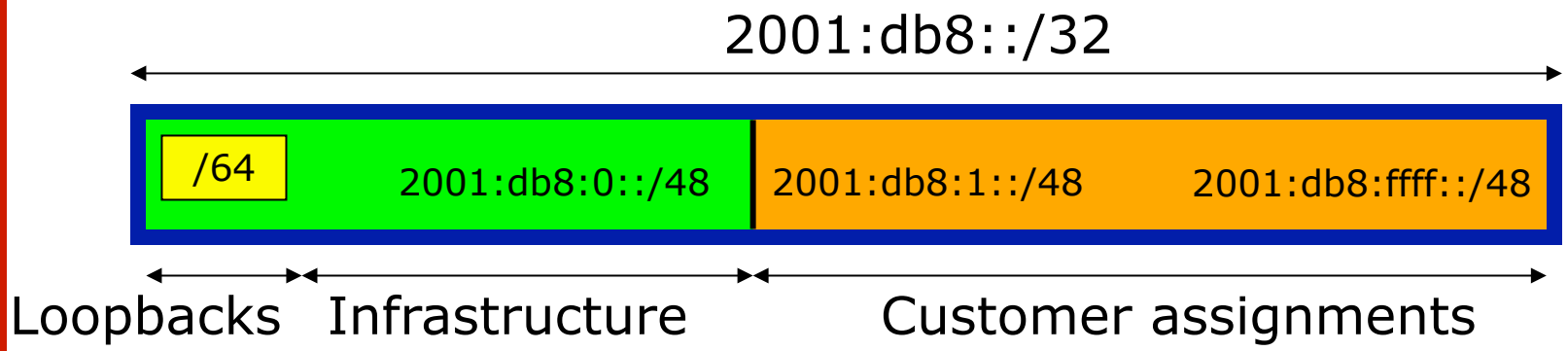
- Carry Broadband pools in iBGP across the backbone
  - Not in OSPF/ISIS
- Multiple Broadband pools on one BRAS should be aggregated if possible
  - Reduce load on iBGP
- Aggregating customer address blocks per router or per PoP is undesirable:
  - Interferes with ISP's traffic engineering needs
  - Interferes with ISP's service quality and service guarantees

Addressing Plans – Advice

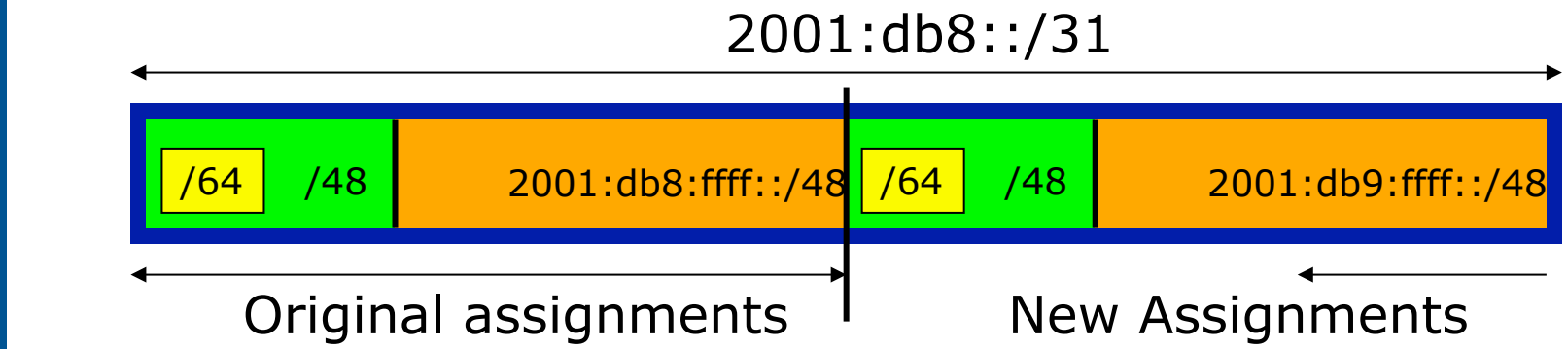
- Customer address assignments should not be reserved or assigned on a per PoP basis
  - Same principle as for IPv4
  - ISP iBGP carries customer nets
  - Aggregation within the iBGP not required and usually not desirable
  - Aggregation in eBGP is very necessary
- Backbone infrastructure assignments:
  - Number out of a single /48
    - Operational simplicity and security
  - Aggregate to minimise size of the IGP

Addressing Plans – ISP Infrastructure

- Phase One



- Phase Two – Second /32



Addressing Plans Planning

- Registries will usually allocate the next block to be contiguous with the first allocation
  - Minimum allocation is /32
  - Very likely that subsequent allocation will make this up to a /31
  - So plan accordingly

Addressing Plans (contd)

- Document infrastructure allocation
  - Eases operation, debugging and management
- Document customer allocation
  - Customers get /48 each
  - Prefix contained in iBGP
  - Eases operation, debugging and management
  - Submit network object to RIR Database

Addressing Tools

- Examples of IP address tools (which support IPv6 too):
  - NetDot — netdot.uoregon.edu
  - HaCi — sourceforge.net/projects/haci
  - IPAT — nethead.de/index.php/ipat
  - ipv6gen — techie.devnull.cz/ipv6/ipv6gen/
  - sipcalc — www.routemeister.net/projects/sipcalc/
  - freeipdb — home.globalcrossing.net/~freeipdb/

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