



IPv6 via IPv4 SP Networks - "6rd"



draft-townsley-ipv6-6rd-01.txt
(also RFC 5569 from Remi Despres)

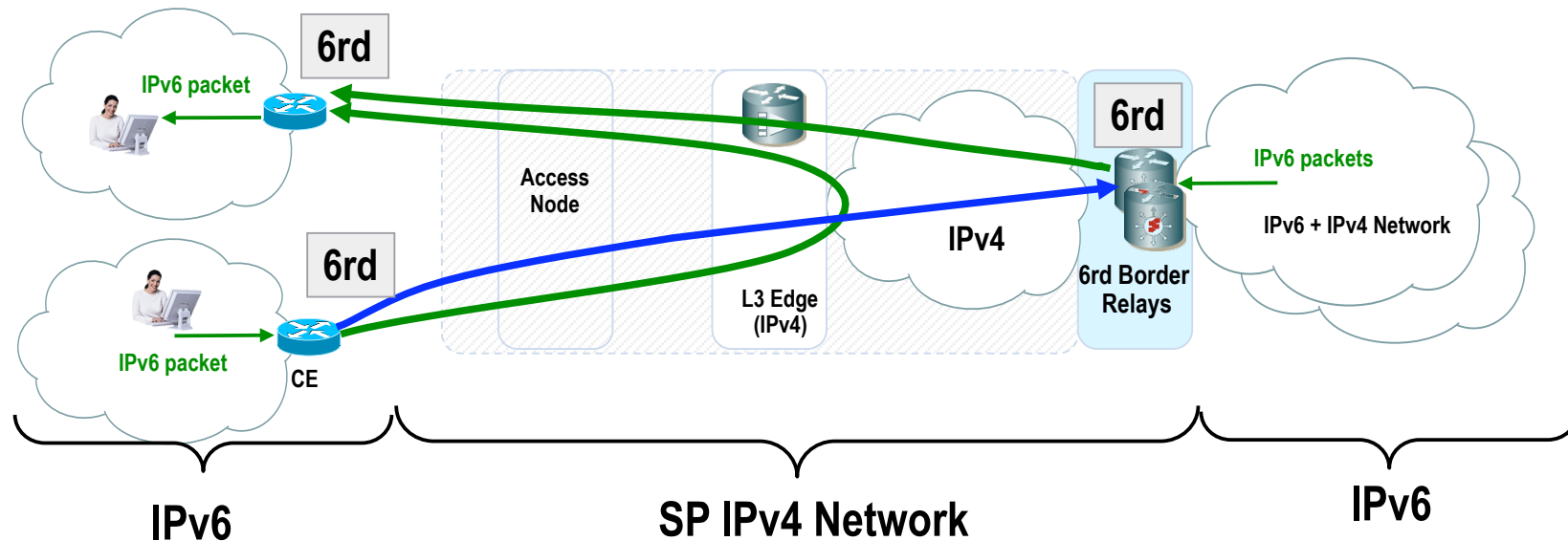
Agenda

1. Brief 6rd overview
 - softwires is for detailed protocol discussion
2. 6rd in Operation (Free Telecom)
3. Provisioning + other operational considerations

IPv6 via IPv4 Service Provider Networks

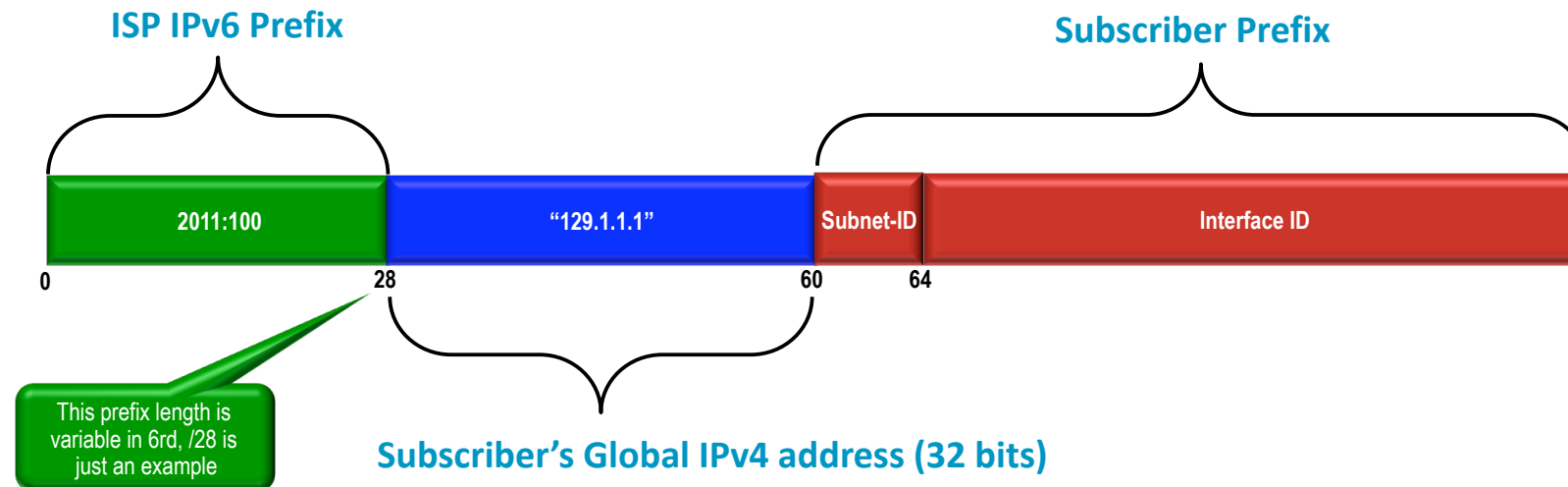
- 6to4 (RFC3056) was designed to offer IPv6 connectivity for sites who could not obtain IPv6 from their Service Provider
- 6rd adapts 6to4 for Service Providers to deliver IPv6 via their IPv4 Network

6rd in one slide



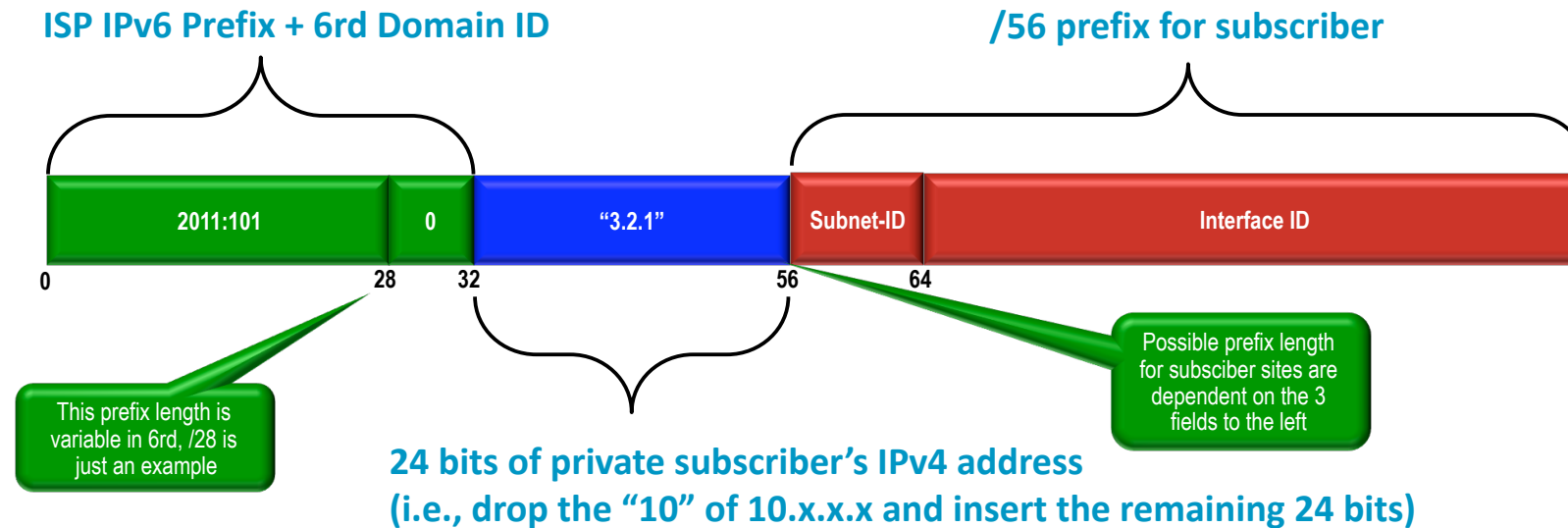
- IPv6 service in the home is essentially identical to native IPv6 service
- IPv6 Packets Follow IPv4 routing
- 6rd Border Relay traversed only when exiting or entering a 6rd Domain
- 6rd Border Relays are fully stateless, no limit on “number of subscribers” supported
- Border Relays may be placed in multiple locations, addressed via anycast.

6rd Prefix Delegation (From a Global IPv4 address)



- Subscriber's IPv6 prefix is built based on subscriber's Global IPv4 address
- Treated by the CE exactly as if received from DHCPv6 PD
- Provisioning of 6rd Prefix, etc. to all CEs either manually, via DHCPv4, TR-69, etc.
- Subscriber's IPv4 prefix always able to be determined algorithmically from IPv6 prefix

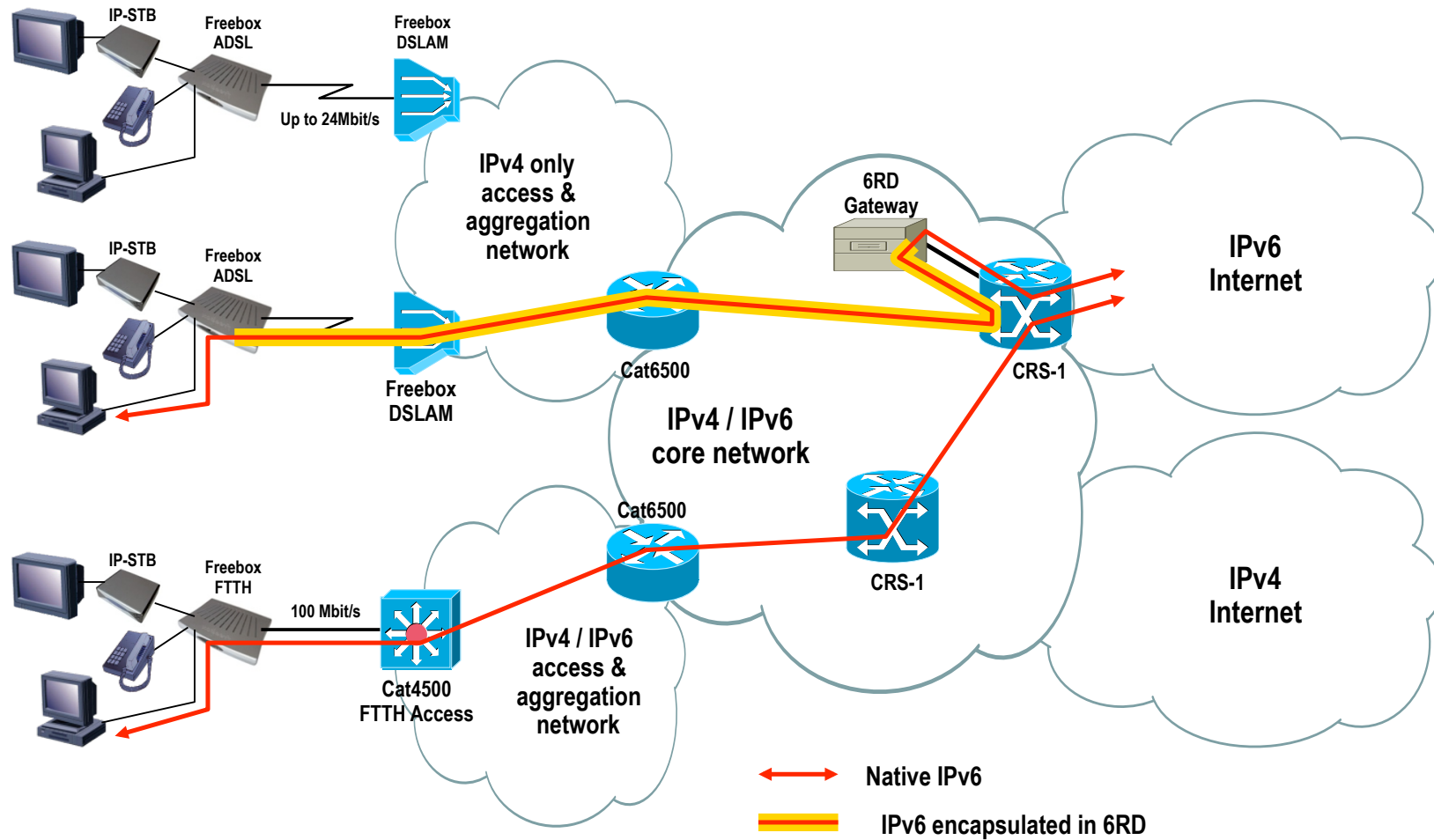
6rd Prefix Delegation (From a Private* IPv4 address)



- Same as in global IPv4 case, except:
 - Less bits used in the IPv6 prefix
 - Domain ID to allow overlapping Private IPv4 space (if/when needed)
 - Different starting ISP IPv6 Prefix allows for differentiating between formats on the same SP network.

*Really only needs to be a summarizable prefix, which the private range typically is

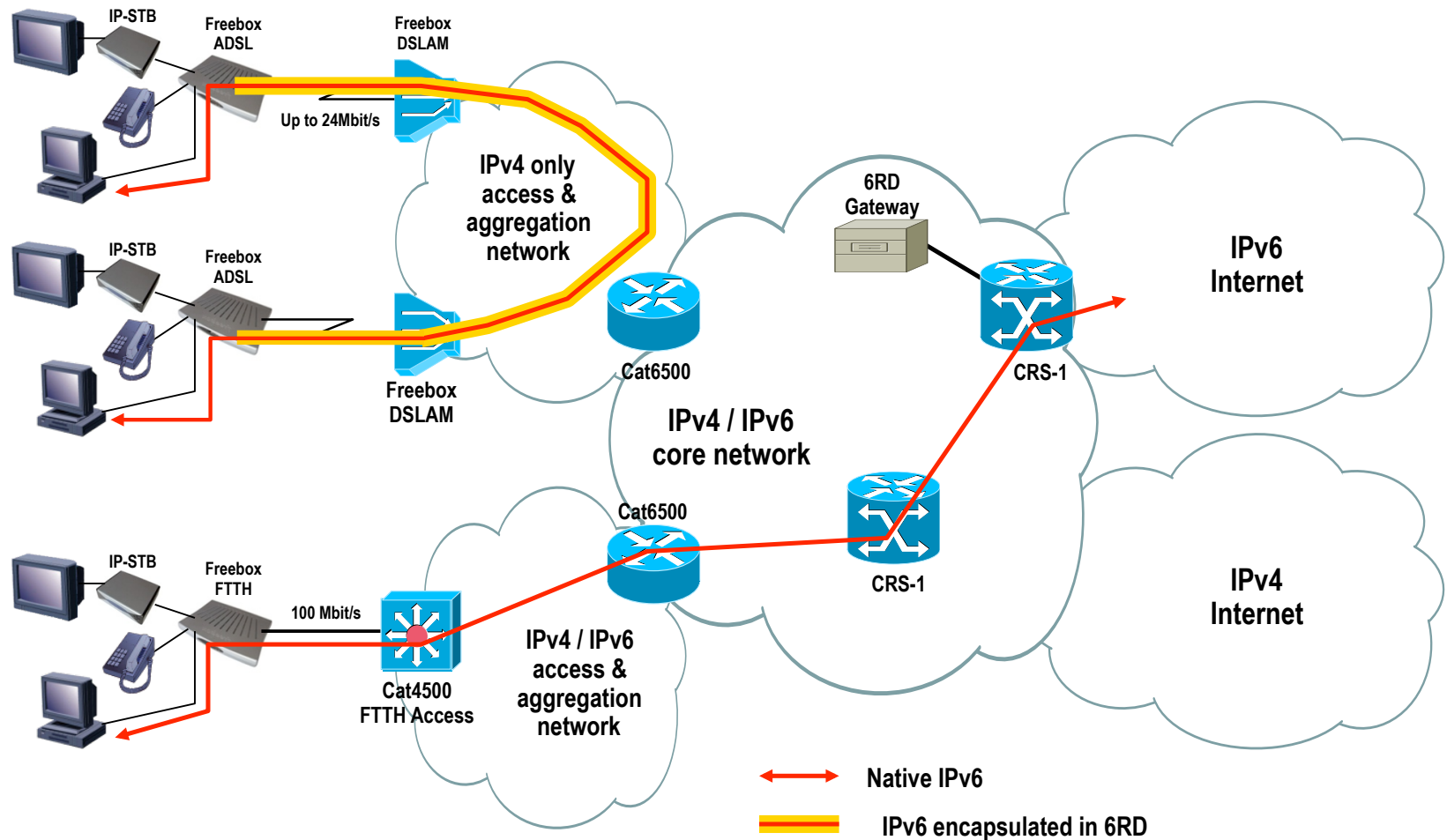
<http://www.ripe.net/ripe/meetings/ripe-58/agendas.php? wg=plenary3>



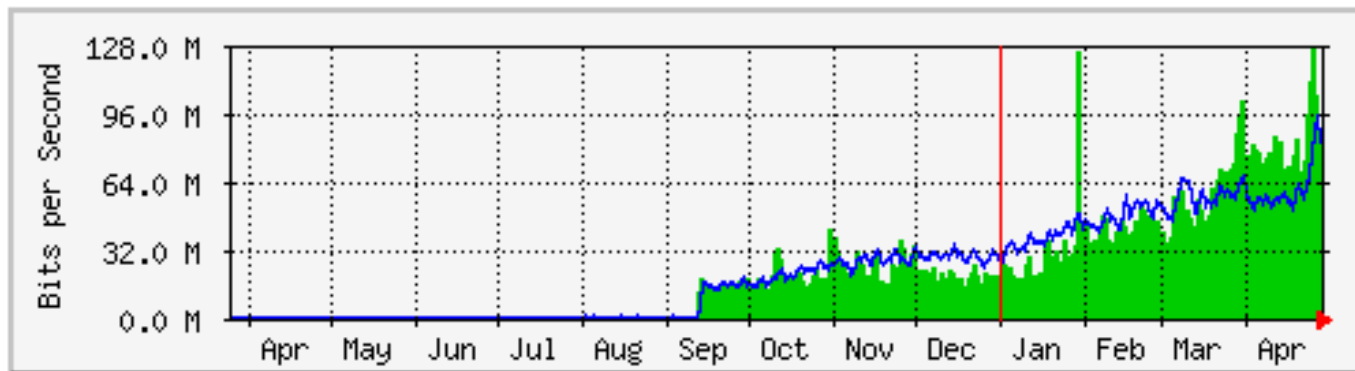
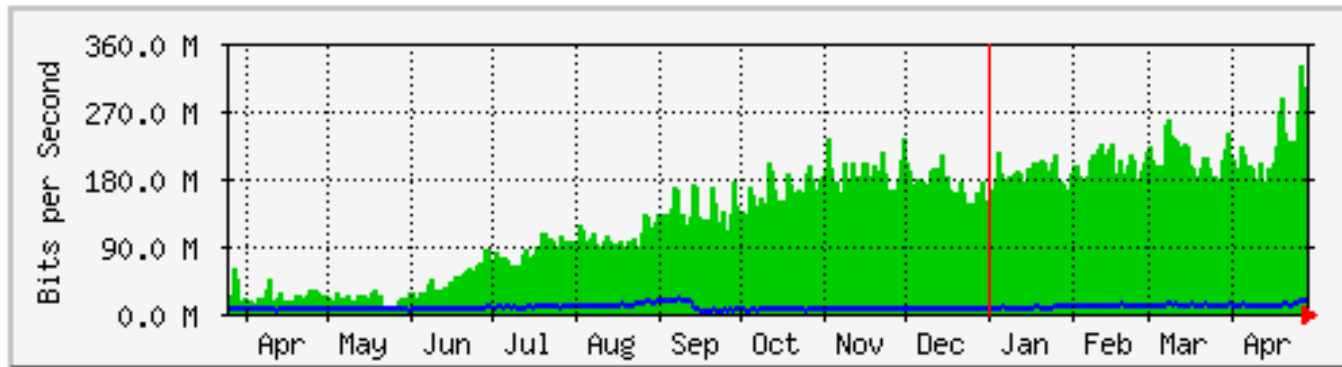
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IPv6 @ Free

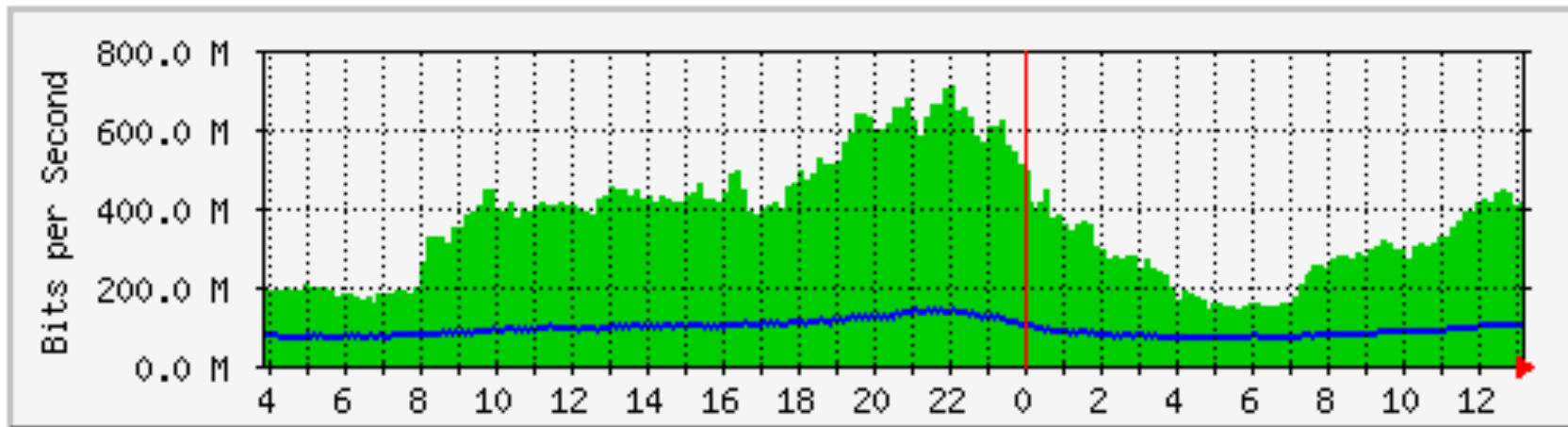
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- 6rd-gw1 Yearly Traffic (1Day AVG) :



- Customers : 310K
- Global Daily traffic (5min AVG) :

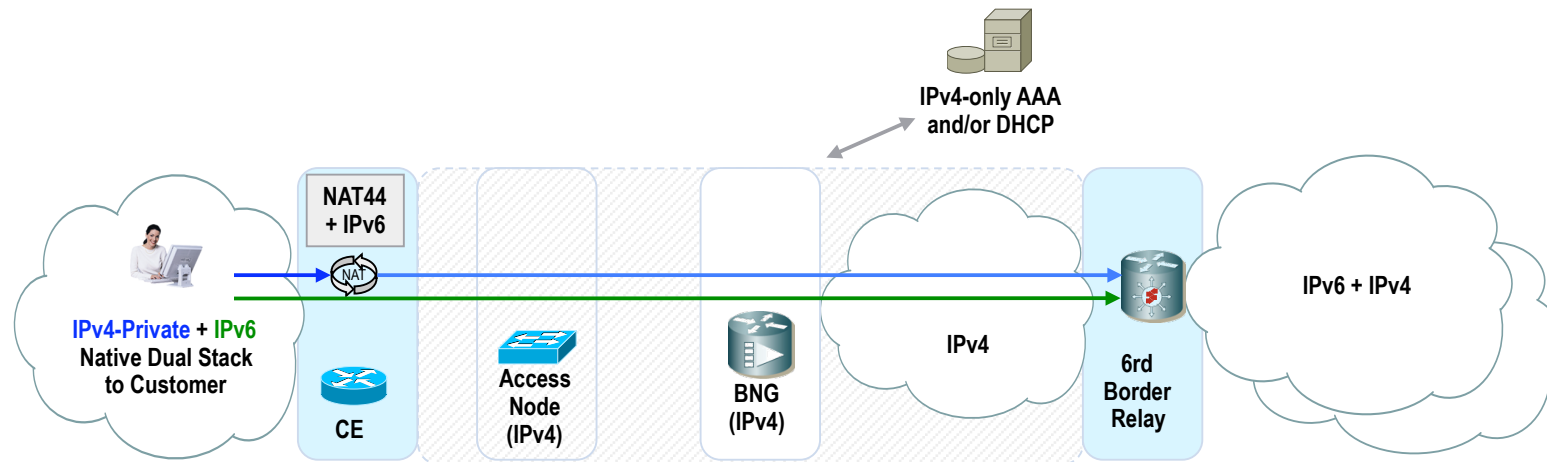


	Max	Average	Current
In	706.3 Mb/s (3.7%)	335.9 Mb/s (1.8%)	414.4 Mb/s (2.2%)
Out	138.9 Mb/s (0.7%)	89.9 Mb/s (0.5%)	101.6 Mb/s (0.5%)

Provisioning

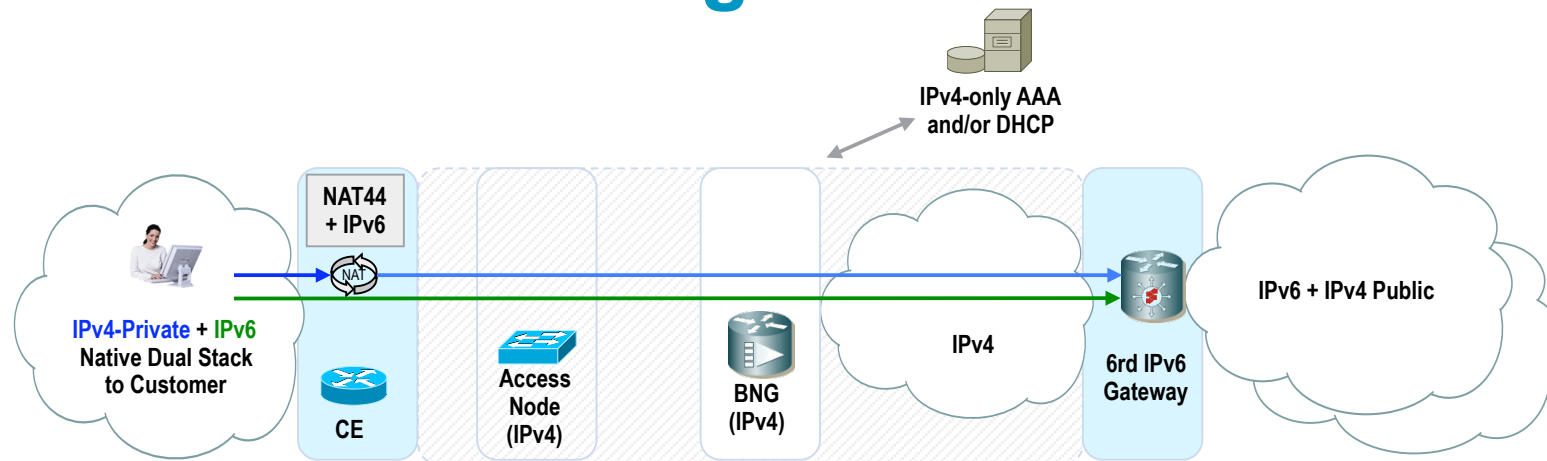
1. 6rd Border Relay (BR)
2. 6rd Customer Edge (CE)

6rd BR Provisioning



1. IPv6 reachability to the Internet by some means (Native, 6PE, etc).
2. An access-network-facing IPv4 address (may be anycast)
3. Global 6rd ISP Prefix and Length
4. Common IPv4 bits and length, if any

6rd CE Provisioning



- CE configured with following static items (via DHCPv4, TR-69 mgmt interface)
 1. ISP 6rd IPv6 Prefix
 2. 6rd Relay IPv4 address (may be anycast)
 3. Common Ipv4 bits and length, if any
- “Home side” of CE configured exactly as would be for “native” IPv6, e.g., same as for a DHCPv6 delegated prefix

6rd Domains

- An SP may subdivide a 6rd deployment into separate “6rd Domains” in order to:
 - Provide more than one 6->4 mapping on a given network (e.g., separate Global and Private IPv4 mappings)
 - Function in presence of overlapping Private IPv4 space in a single SP
 - Regional separation or other administrative purposes
- CEs are only aware of the Domains they are in
- BRs are only aware of the Domains they serve

IPv6 Prefixes & Address Space Usage

- All IPv6 Subscriber prefixes are automatically generated from IPv4
 - No DHCPv6, ND, etc. to deploy or operate
 - When the IPv4 address changes, so does the IPv6 prefix
- Must carefully select which 6rd IPv6 Prefix you are going to use, number of 6rd Domains, etc.
- If 6rd was deployed by all AS holders in the world today, using the most “inefficient” encoding described in the document, 6rd would consume a /9.
 - This is a “worst-case” scenario (see Section 10 for more details)

Some Other Operational Topics

- Location of the 6rd gateway(s)
 - At IPv6 peering point
 - Edge of IPv6-enabled core network
 - At L3 Edge Router
- Load-balancing, resiliency
 - VRRP and Anycast for upstream, off-net, traffic
- MTU
 - IPv6, IPv4 encap takes an extra 20 bytes
 - RA advertised by RG will take this into account

Security

When decapsulating, 6rd checks the IPv6 source address against the IPv4 source address in each packet

As long as IPv4 packets are not being spoofed, IPv6 packets will not either

6rd Operational Summary

- 6rd adapts 6to4 for Service Providers to deliver IPv6 via their IPv4 Network
- Decouples IPv6 evolution in the home network from the SP network
- Stateless operation - no tunnels to setup and maintain, IPv6 traffic automatically follows IPv4 traffic
- No per-subscriber provisioning
- Production-level IPv6 service to subscribers with minimal impact to IPv4 infrastructure and operations