IPv6 Transition Work in the IETF

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IPv6 Transition Work in the IETF

Outline of Presentation

- Why transition to IPv6?
- Transition scenarios
- What's available now
  - Dual-stack
  - Softwire tunnel solutions
- Tunnel-based transition work
  - Dual-stack lite
  - 6-to-4
  - 6rd

The Goal…

- In general, the goal is “Continue the growth of the Internet and its businesses”:
- For some, that means “retain simplicity by extending addressing to more prefixes and more machines.”
- For others, that means “retain the infrastructure I am familiar with and have invested heavily in.”
- That implies:

  Deploy IPv6 for more addresses.

  IPv4/IPv6 coexistence is required for a turn-up period.

  At some point, IPv4 is no longer needed.

  At that point, turn IPv4 off.

Drivers for IPv6 transition

- IPv4 global address exhaustion
- Limits on use of IPv4 RFC 1918 addresses
- These constraints can limit growth:
  - Global addressing for subscribers
  - Internal network addressing
- IPv6 addressing architecture solves these problems
- Other techniques such as address sharing may also be available; won't discuss those here

When to Deploy IPv6?

RFC 5211: John Curran's Internet Transition Plan for ISPs

- **2009** Preparation Phase:

  ISPs deploy a parallel IPv4+IPv6 service.

  ISPs and end users enable IPv6 access to their various servers.

- **2010** Transition Phase

  As users turn up IPv6, raise price of IPv4-only and IPv4+IPv6; introduce lower-price IPv6-only service.

- **2012 or Later** Post-Transition Phase

  Turn down IPv4 when economics warrant.

Enterprise implication:
Presume your ISP is doing this and act accordingly.

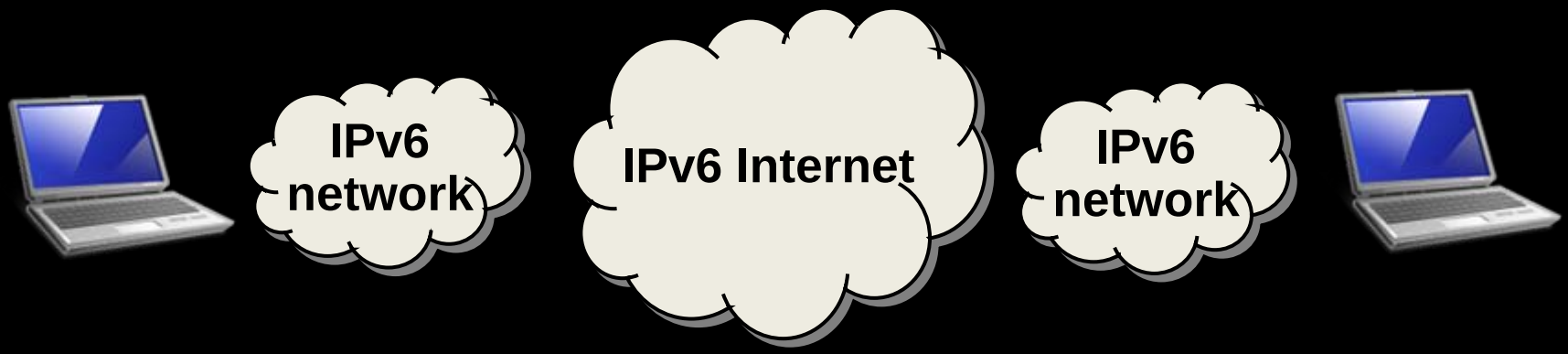
Status of IPv6 Development

Basic protocol work is done…

- Basics: the specifications for IPv6 – Done!
- Maintenance
  - Correcting bugs, operational guidance
  - Very similar to what we do with IPv4
- Addressing new deployment requirements:
  - Ongoing!
- New features
  - Often IP-version agnostic, sometimes related to feature parity

So, why hasn't IPv6 been deployed?

Where we would like to be:



- Individual adoption is possible, but multiple stakeholders are needed for actual use:

  Application, host, local network, and Internet

- Each stakeholder has no motivation to make the transition before others

Refining the Deployment Strategy

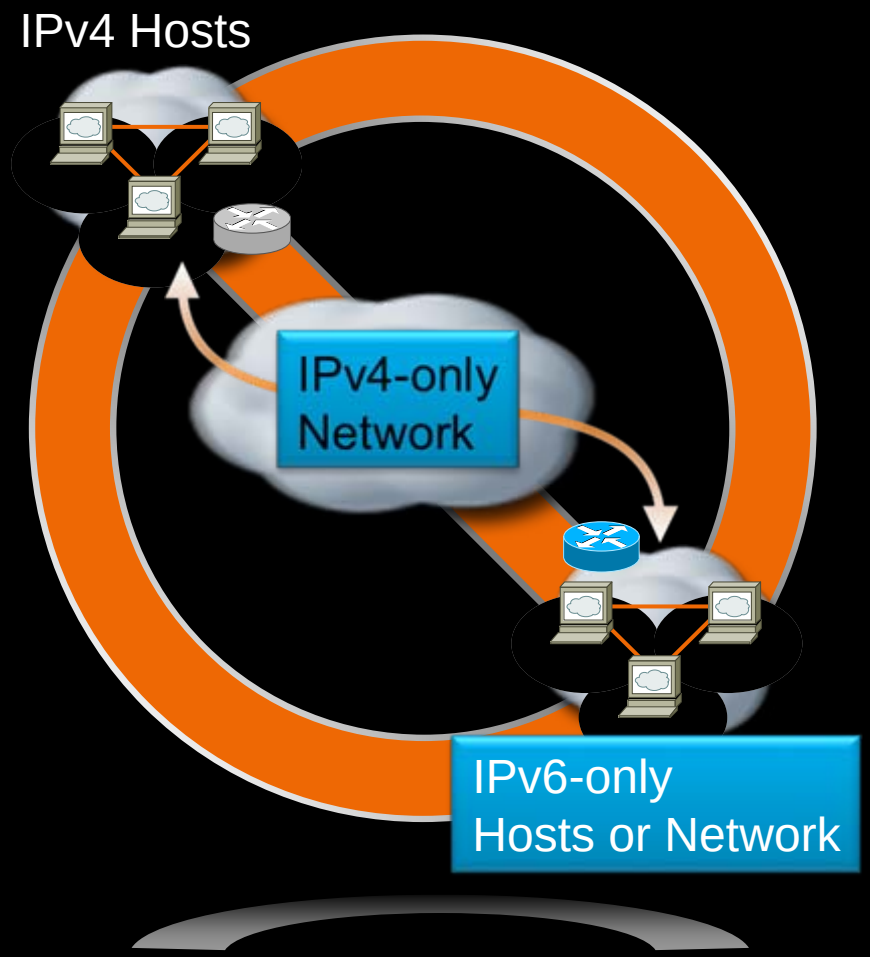
- Prior focus has largely been on the basics
- Emphasis is now on co-existence and specific deployment scenarios
  - Keeping IPv4 alive while moving forward with IPv6: Dual-stack lite
  - Providing IPv6 service to the edge of a network without deploying IPv6 throughout the organization core
- The tools are mostly in place…
- …what's left is hard work of deployment: vendors, network administrators, planning, implementation

Unworkable Approach to Transition:

Expect IPv4 and IPv6 to Directly Interwork?

Problem:

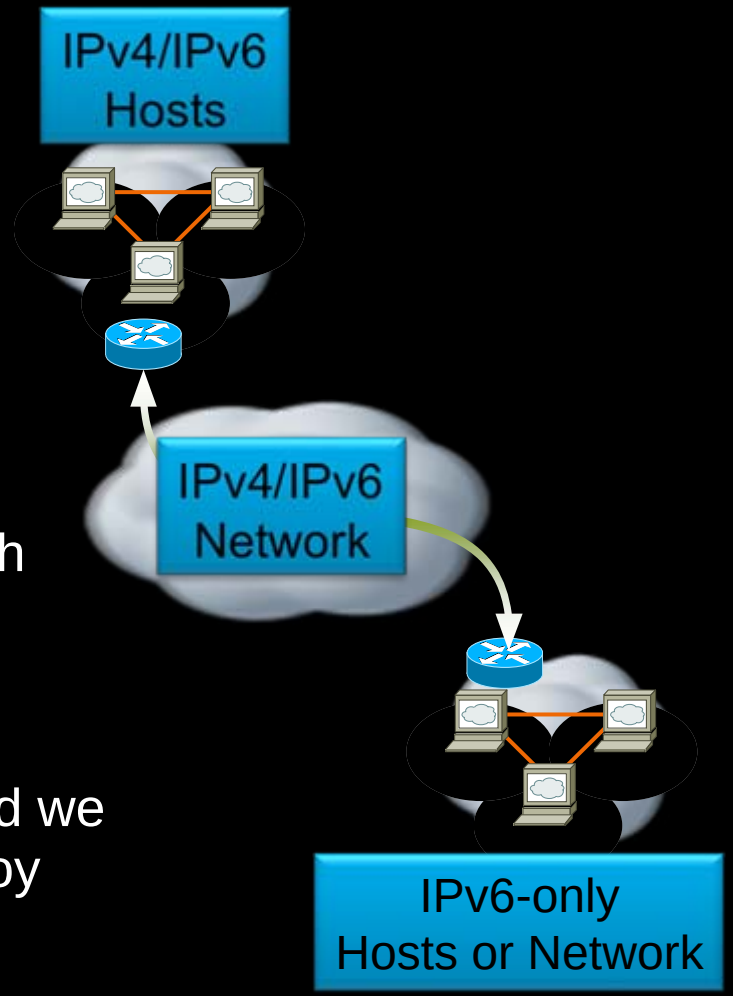
- We are running out of IPv4 addresses.
- IPv4 and IPv6 are noninteroperable.
- If we simply deploy IPv6 networks, they won't be able to talk with IPv4-only hosts.



Preferred Approach to Transition:

RFC 4213 Dual-Stack Deployment

- Solution:
  - Hosts today are IPv4+IPv6:
    - Windows Vista, Macintosh, Linux, BSD
    - (… not Windows XP!)
  - Make the network IPv4+IPv6.
  - When forced to deploy IPv6-only networks, they will be able to talk with other hosts.
- But…
  - That depends on contract cycles, and we do have not enough time left to deploy dual-stack the way we would like.



Should We Forget Dual-Stack?

- No! The new tools are for new scenarios; existing tools continue to be valid for other cases
- While you see a lot of new tools being built
- This is NOT an indication that the existing tools should no longer be used – Dual Stack works and is the most well-understood way to deploy IPv6 today
- Other existing tools also continue to be valid, e.g, SOFTWIRE mesh solutions

New: Unilateral Deployment

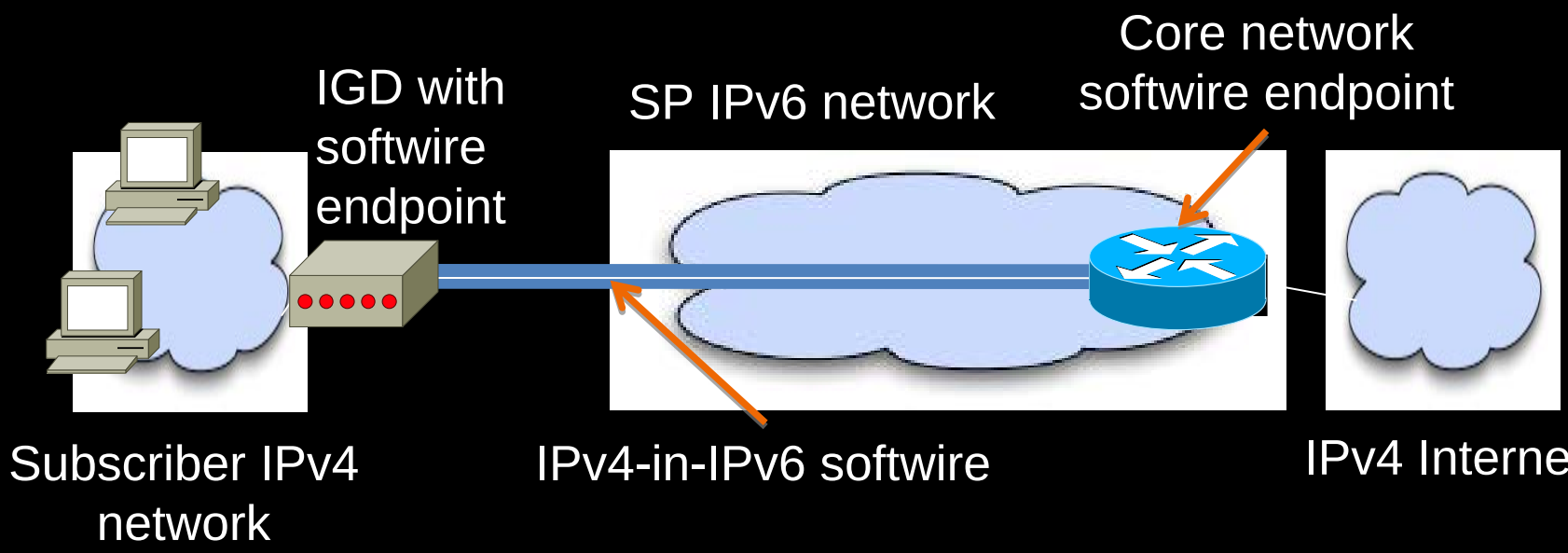
- Identify specific deployment scenarios
  - Entirely in organization domain
  - Provides specific benefit
  - Examples:
    - IPv6-only corporate network; IPv4 legacy service
    - IPv6 service over IPv4-only corporate network
- Deploy IPv6 to co-exist with IPv4

IPv4 Service over IPv6-only Network

- Scenario: Service provider goes to IPv6-only core network
  - Conserve global IPv4 addresses for subscribers
  - Conserve private IPv4 addresses in large networks
  - Simplify management and operation relative to dual-stack
- Tunnel IPv4 datagrams over IPv6-only network
  - IPv6 connectivity is native
  - No IPv4 address on subscriber tunnel endpoint
- Subscriber endpoint can be either IGD or host

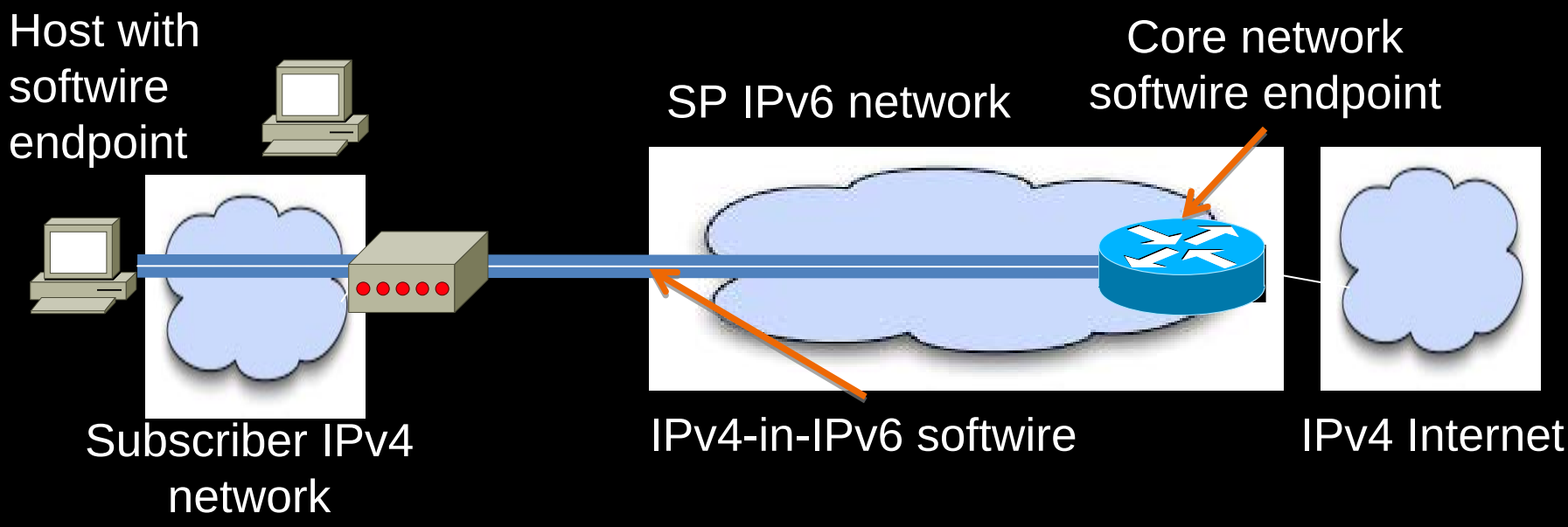
IPv4 Service to Subscriber Network

Dual-stack lite – IGD-based



IPv4 Service over IPv6-only Network

Dual-stack lite – Host-based



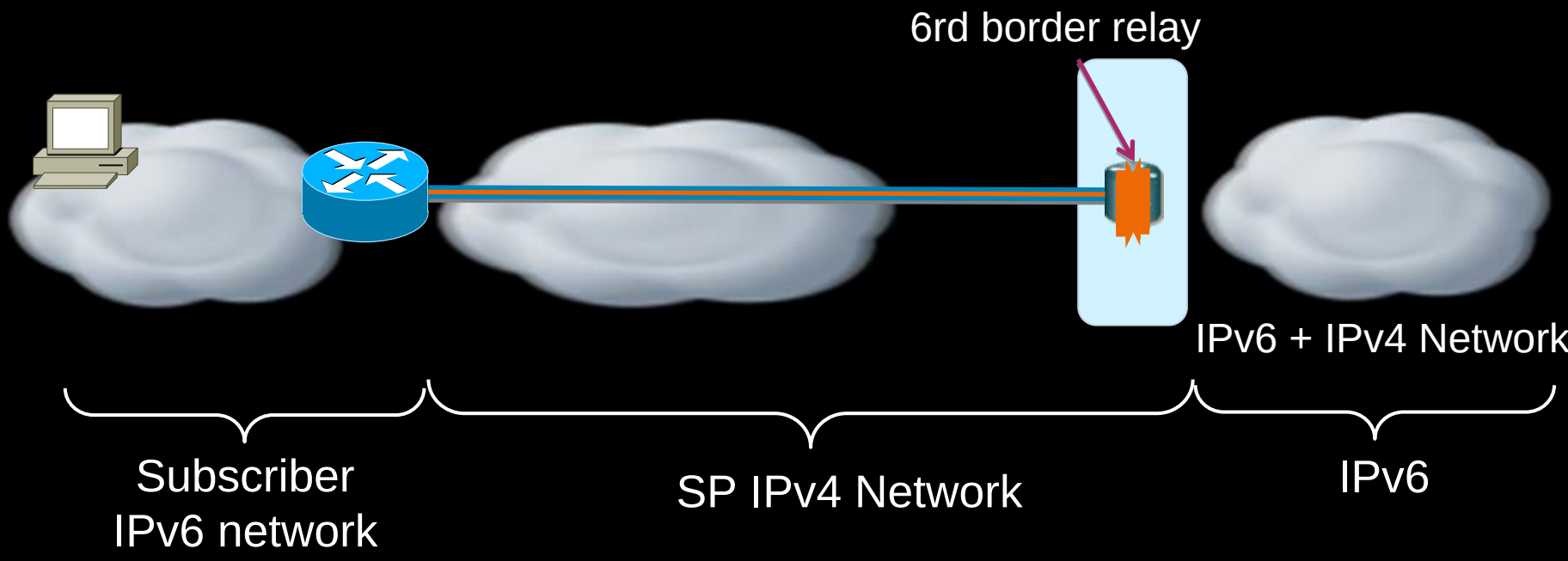
IPv6 Service over IPv4-only Network

- Scenario: Service provider wants to provide IPv6 service without deploying IPv6 in core network
  - Provide new service over IPv6
  - Give early adopters IPv6 service to Internet; e.g., IPv6 Google
- Tunnel IPv6 datagrams over IPv4-only network
  - IPv4 connectivity continue to be native
  - IPv4 tunnel endpoint embedded in IPv6 address
- Subscriber endpoint is in IGD or service provider edge router

IPv6 via IPv4 Service Provider Networks

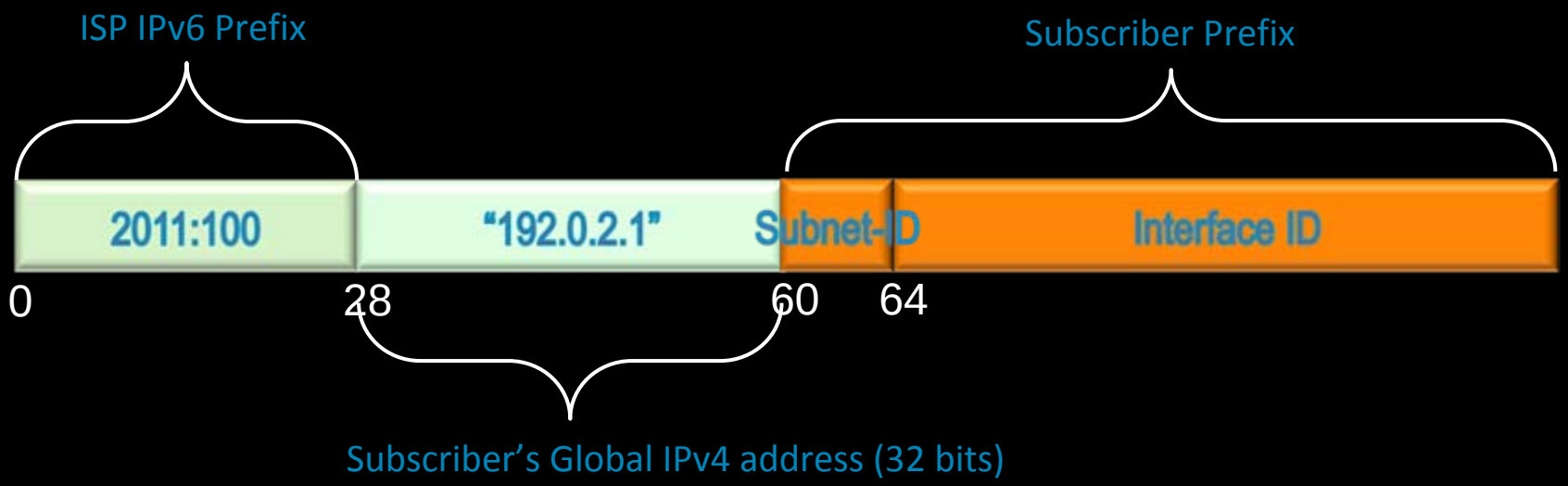
- 6to4 (RFC3056) was designed to offer IPv6 connectivity for sites who could not obtain IPv6 from their Service Provider
- 6rd adapts 6to4 for Service Providers to deliver IPv6 via their IPv4 Network

6rd overview



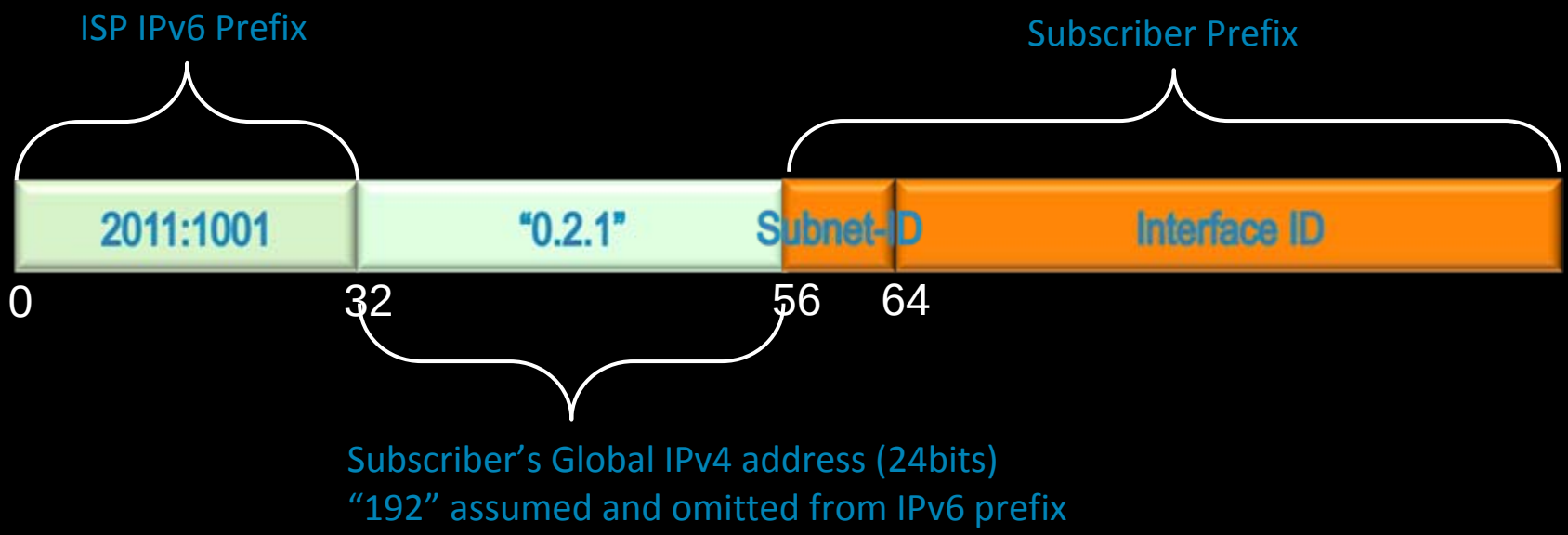
- IPv6 service in the home is essentially identical to native IPv6 service
- IPv6 traffic tunneled in IPv4 through subscriber IGD
- 6rd Border Relay traversed only when exiting or entering a 6rd Domain
- 6rd Border Relays are fully stateless, no limit on “number of subscribers” supported
- Border Relays 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 IGD exactly as if received from DHCPv6 PD
- Provisioning of 6rd Prefix, etc. to all IGDs either manual, via DHCPv4, TR-69, etc.
- Subscriber's IPv4 prefix always able to be determined algorithmically from IPv6 prefix

6rd Prefix Delegation (From a fixed IPv4 address range)



- Fewer bits from IPv4 address used in the IPv6 prefix
- Other variants available if subscriber addresses come from multiple IPv4 address blocks
- Variant IPv6 prefixes from ISP IPv6 address blocks can differentiate between IPv6 address formats in ISP network

Questions?