6rd
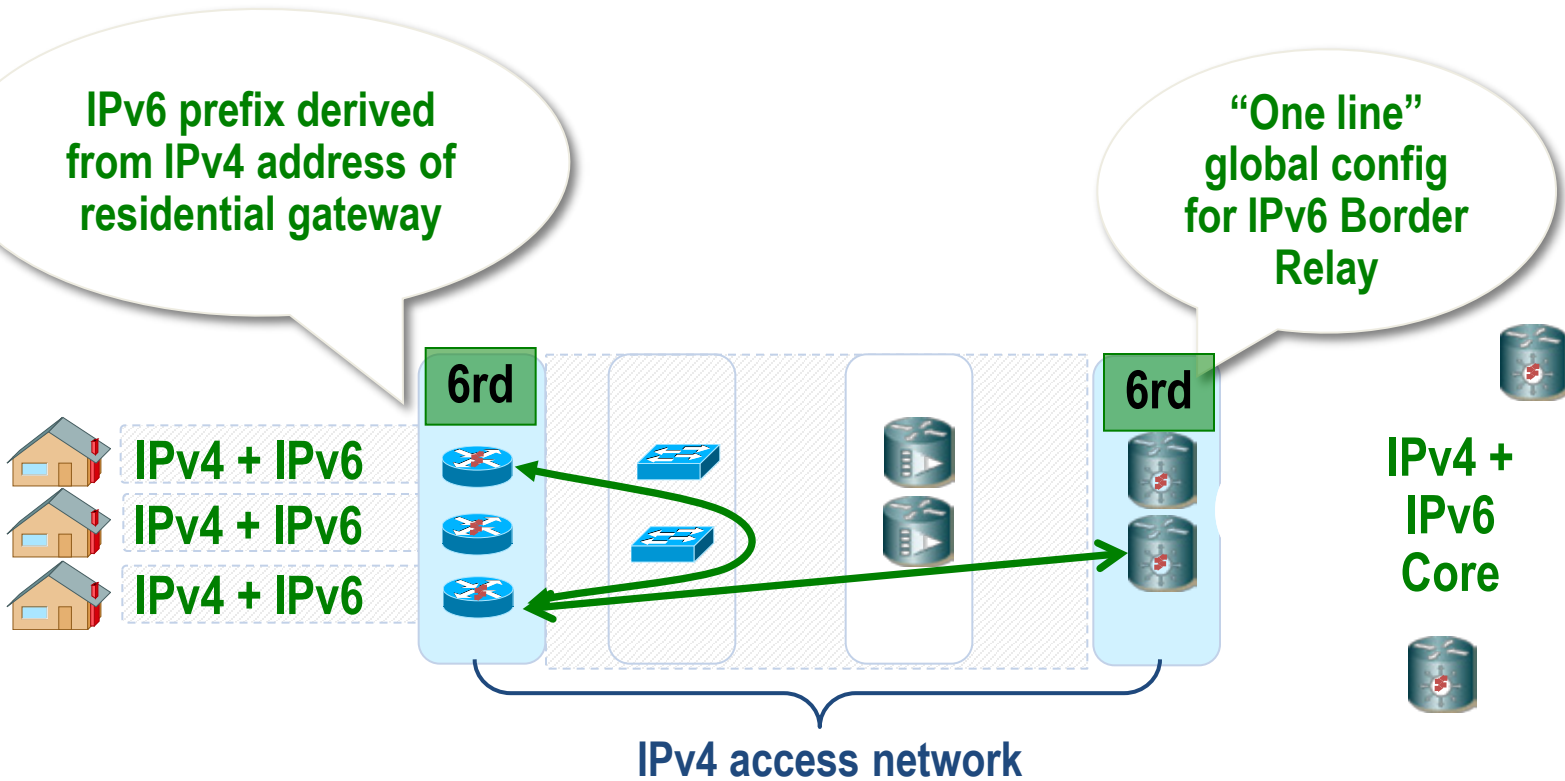
Alain Durand, Juniper

Marla Azinger, Frontier Communications

Mark Townsley, Cisco

6rd: IPv6 overlay on IPv4 Access

IPv6 prefix derived from IPv4 address of residential gateway

"One line" global config for IPv6 Border Relay

6rd

6rd

IPv4 + IPv6

IPv4 + IPv6

IPv4 + IPv6

IPv4 + IPv6 Core

IPv4 access network

- Offers dual-stack IPv6 to the subscriber premise

- Access network remains IPv4

- Simple, stateless, automatic IPv6-in-IPv4 encap and decap functions

- IPv6 traffic automatically follows IPv4 Routing to a border router (BR)

6rd-aware Residential Gateway

LAN-Side:
Production IPv6 Service +
Natted IPv4

WAN-Side:
IPv6 via IPv4
Global or Private IPv4

**IPv6 +
IPv4 Dual
Stack**

**IPv4 ISP
Network**

**6rd lives
here**

IPv6 Internet Access delivered to
home, allowing IPv6 enabled
applications and content to
remain unaffected by IPv4
exhaustion

IPv6 in ISP Network evolves at its
own pace, with its own balance of
costs and incentives

Standardization Status

- Was defined in draft-townsley-ipv6-6rd-01.txt
- Now, **draft-ietf-softwire-ipv6-6rd-08.txt** has finished IETF Working Group Last Call and is headed to the IESG for review and publication as a Standards Track IETF RFC
- The Idea has been circulating in the IETF since 2007 when Free Telecom first deployed it (RFC 5569 independent submission from Remi Despres describes this)

IPv6 transition timeline

Phase I   Phase II   Phase III

6RD
Initial rapid
deployment
of an IPv6
overlay over
IPv4

Native Dual-Stack
Gradual
deployment
of IPv6 access
network

6RD may subsist in
zones where
native support is
lagging or
uneconomical

Dual-Stack Lite
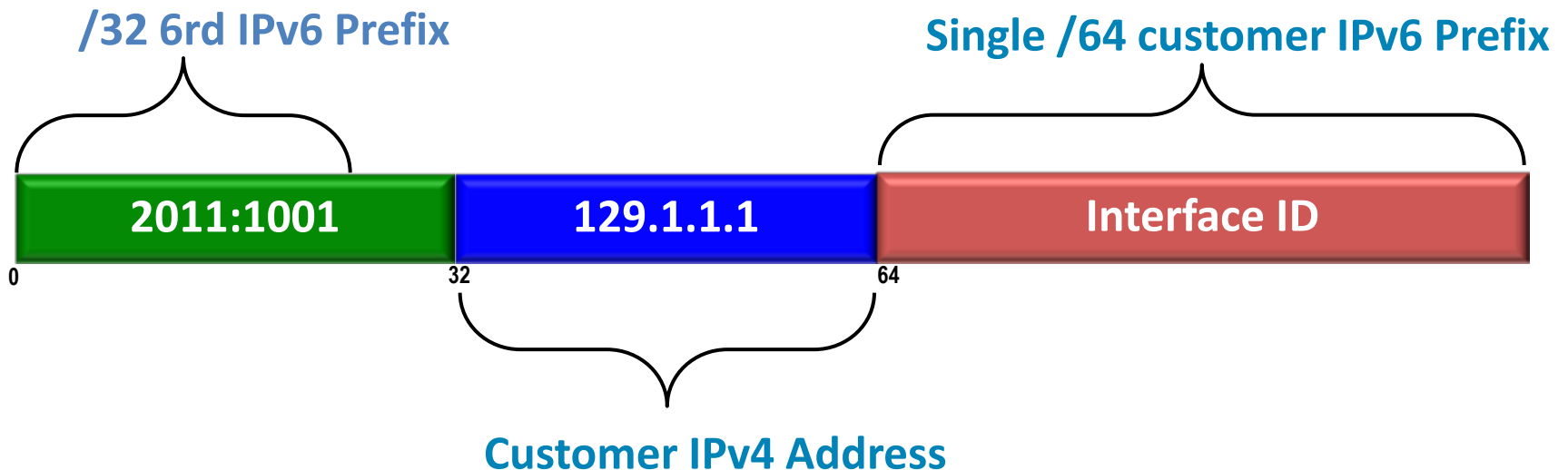IPv4 overlay over IPv6
or:
NAT444
Home gateway NAT +
ISP NAT

When IPv4 addresses are
no longer available, IPv4
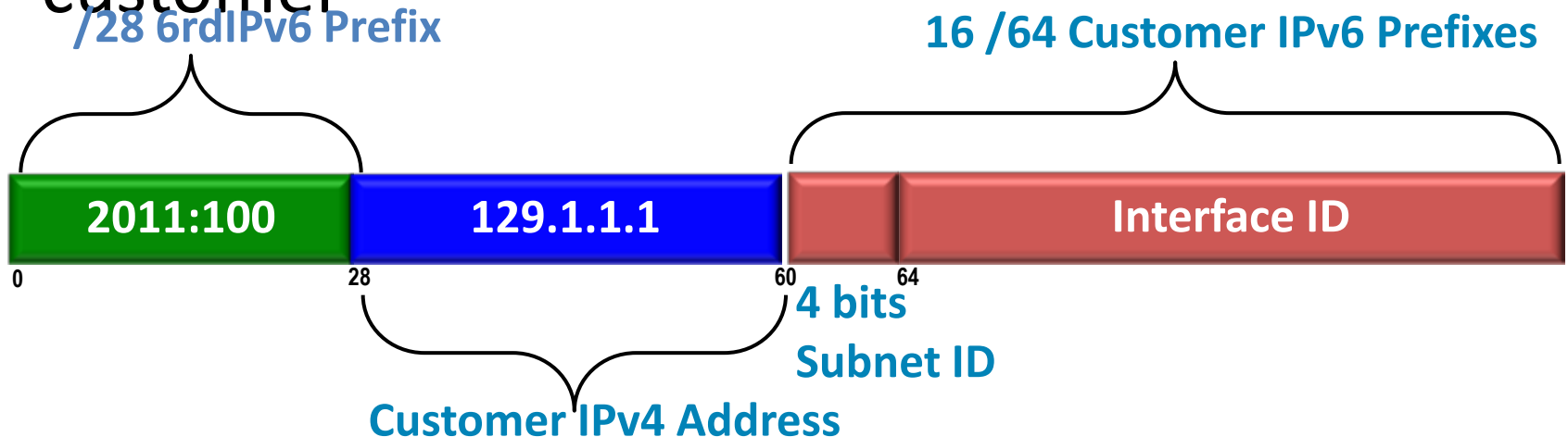addresses
have to be shared among
customers
one way or another

What is the minimum space needed?

- Assuming ISP IPv4 space is not contiguous…

- If ISP offers "only" one /64 subnet per home, there is a need for a /32 IPv6 prefix

- This space must be independent from the /32 IPv6 allocation the ISP may already have.

/32 6rd IPv6 Prefix

Single /64 customer IPv6 Prefix

2011:1001	129.1.1.1	Interface ID

0　　　　　　　　　　　　32　　　　　　　　　　　64

Customer IPv4 Address

What is a reasonable space?

- Assuming ISP IPv4 space is not contiguous…
- If ISP offers "several" /64 subnets per home, there is a need for more than a /32 IPv6 prefix.
- An IPv6 /28 prefix enables 16 subnets per customer

/28 6rdIPv6 Prefix

16 /64 Customer IPv6 Prefixes

2011:100	129.1.1.1		Interface ID

0   28   60   64

4 bits
Subnet ID

Customer IPv4 Address

Potential Policy Proposal

- If you have disjoint IPv4 blocks, you automatically qualify for a /32 for 6rd

- If you want more (up to a /28), you need to justify why (eg: multiple LANs in the home)

- Allocation to be reviewed every 3 years

- May be folded into your normal IPv6 allocation

- Considering to submit this policy proposal as emergency request as some people may need this immediately.

Policy Statement

If you have IPv4 addresses then you automatically qualify for IPv6 space for 6rd. A minimum of a /32 will be provided for 6rd. If IPv6 addresses are already allocated to the requestor then an effort will be made to give them an IPv6 allocation that is preferably contiguous to the prior existing one. The use of this address space will be used for 6rd and returned to ARIN when 6rd is no longer used on the network. Justification for use of IPv6 for 6rd will be reviewed every 3 years and reclaimed if it is not in use. Requestor will be exempt from returning all or a portion of the address space when 6rd is no longer used if they can show justification for need of more address space for other exiting IPv6 addressing requirements.

Rationale

6rd is intended to be an incremental method for deploying IPv6 and bridge the gap for End Users to the IPv6 Internet. The method provides a native dual-stack service to a subscriber site by leveraging existing infrastructure. If an entity already has a /32 of IPv6 they can not use the same /32 for native IPv6 as they do for the 6rd routing and a seperate minimum size of a /32 must be utilized.

The 6rd prefix is an RIR delegated IPv6 prefix. It must encapsulate an IPv4 address and must be short enough so that a /56 or /60 can be given to subscribers. This example shows how the 6rd prefix is created based on a /32 IPv6 prefix using RFC1918 address space from 10.0.0.0/8:

    SP IPv6 prefix: 2001:0DB8::/32
    v4suffix-length: 24 (from 10/8, first octet (10) is excluded
                  from the encoding)
    6rd CE router IPv4 address: 10.100.100.1
    6rd site IPv6 prefix: 2001:0DB8:6464:0100::/56