



6rd Implementation & Case study

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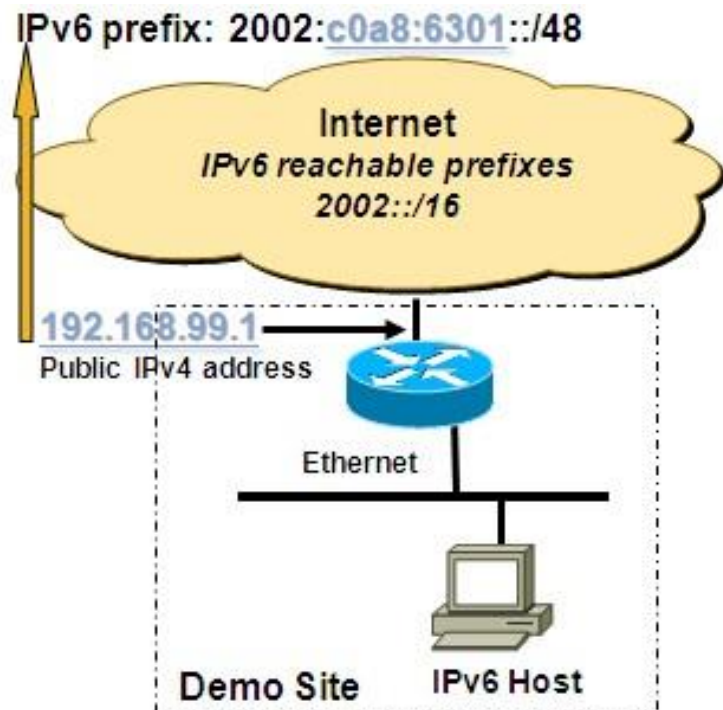
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Agenda

- **6rd overview**
- **6rd and related technology standard update**
- **6rd implementation and case study**

RFC3056(6to4)

Connection of IPv6 Domains via IPv4 Clouds

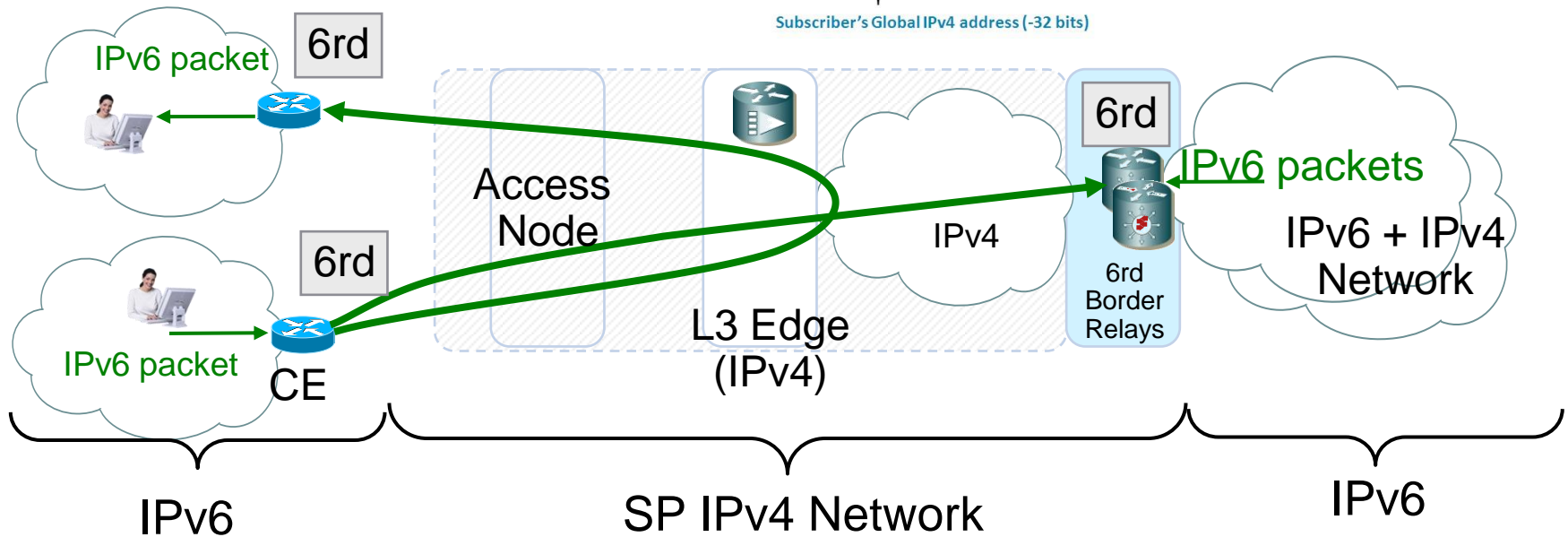


- 6to4 is IPv6 automatic/stateless tunnel technology in IPv4 network, it defined RFC3056.
- use 2002::/16 in IPv6 network as 6to4 prefix
- IPv6 prefix is made by convert decimal public IPv4 address to hexadecimal and add 2002.



In 6rd, can use IPv6 prefix which assign to service provider, so can control routing same as native IPv6.

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.
- Subscriber’s IPv6 prefix is built based on subscriber’s Global IPv4 address and ISP IPv6 prefix

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6rd and related technology's standard status

- [RFC3056](#):6to4
Connection of IPv6 Domains via IPv4 Clouds
February 2001
- [RFC5569](#):6rd Deployment Information
IPv6 Rapid Deployment on IPv4 Infrastructures (6rd)
Information RFC which described Free's 6rd deployment
January 2010
- [RFC5969](#):6rd Protocol Specification
IPv6 Rapid Deployment on IPv4 Infrastructures (6rd)
Standard RFC which define protocol spec of 6rd
August 2010

6rd and related technology's standard status *cont'd*

- [draft-ietf-v6ops-6to4-to-historic](#)

Request to move 6to4 to Historic status

[RFC3056](#) [RFC3068](#) move to Historic Status

1. IPv6 nodes SHOULD treat 6to4 as a service of “last resort”
2. Implementations capable of acting as 6to4 routers SHOULD NOT enable 6to4 without explicit user configuration.
3. 6to4 SHOULD be disabled by default.

IANA Considerations

Obsolete

2002::/16, 2.0.0.2.ip6.arpa domain(6to4 Reverse DNS)

192.88.99.0/24(6to4 anycast)



WGLC but it could not be reach final consensus.

Now DEAD Status. [draft-troan-v6ops-6to4-update](#)

What I would like to say in this section

- 6rd has 2 RFC(RFC5569 and RFC5969)
- If you would like to study 6rd,please refer RFC5969.
- 6to4 has a lot of issues,most of people would not like to use it. [RFC6343](#) would be useful.

- 6rd looks alike 6to4 as mechanism(automatic/stateless),**but** it is completely **different** in security,efficiency and so on.

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6rd deployment customer

☐ SoftBank

free



swisscom



http://en.wikipedia.org/wiki/IPv6_rapid_deployment

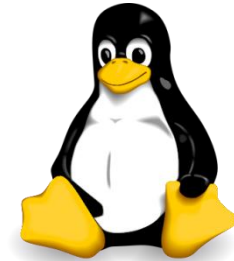
6rd supported platform



IOS-XE 3.1S



IOS 15.1(3)T



Linux Kernel 2.6.33

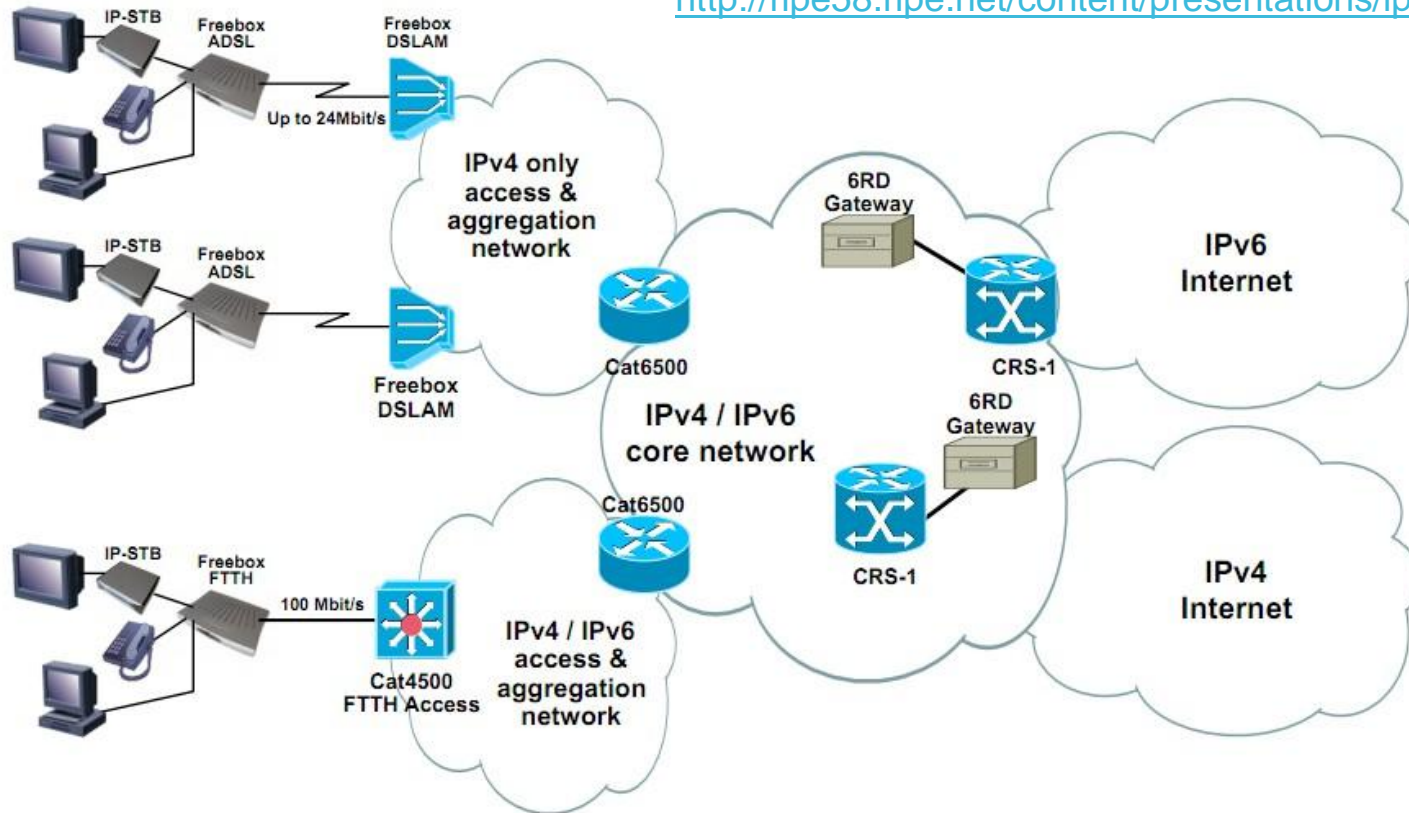


IOS-XR 4.1



Case Study #1 *free*

<http://ripe58.ripe.net/content/presentations/ipv6-free.pdf>



- Free is the developer and the first deployment SP of 6rd.
- The reason of 6rd:DSLAM did not support IPv6
- About 4 years passed from the development of the prototype of 6rd.

IPv6 adoption



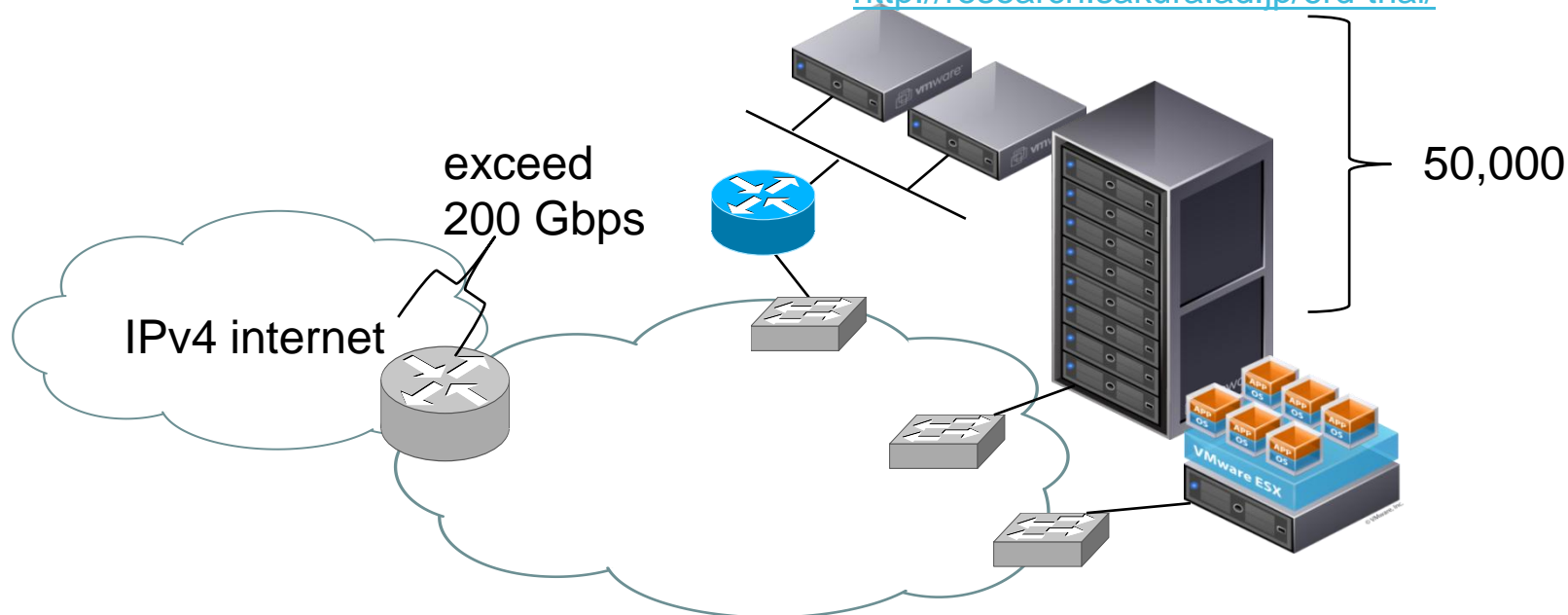
<http://www.google.com/intl/en/ipv6/statistics/>

- Sep.2008:Native 0.04%→Today 0.32% **x8** Increase
- IETF81 Technical Plenary ” [World IPv6 Day: Observations](#)”
“Still 0.3%,but France **3.4%**” *google*
“0.229% user visits to Y!IPv6.” “France led the pack with **over 3%**.” *Yahoo*
- [RIPE Measuring IPv6 at Web Clients and Caching Resolvers](#)
“native IPv6 client capability in France of **over 4%**. This is mainly caused by [free.fr](#) that accounts for 70% of the native IPv6 clients measured. ”
- France $\hat{=}$ free.fr is completely IPv6 leader in the world wide now.

Case Study #2

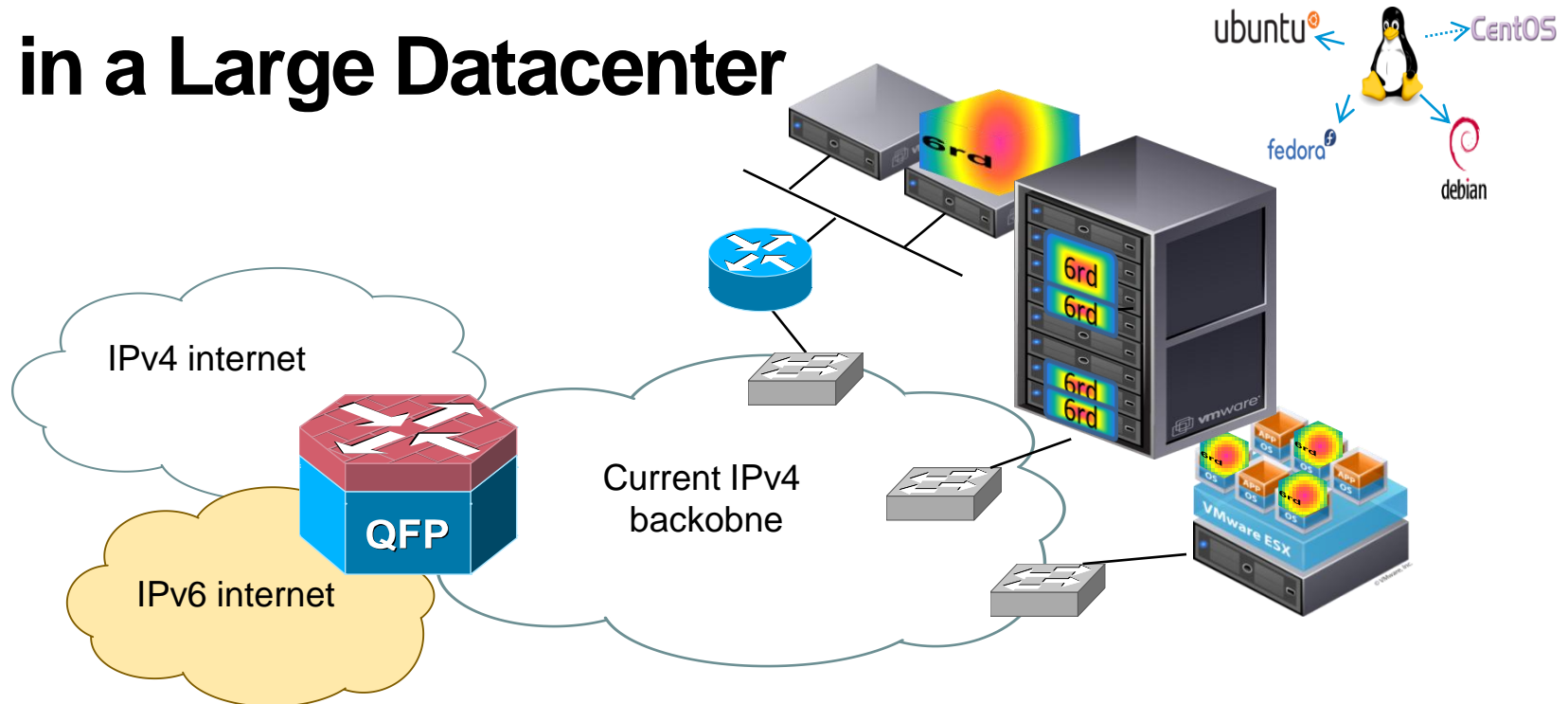
<http://tools.ietf.org/html/draft-sakura-6rd-datacenter-01>

<http://research.sakura.ad.jp/6rd-trial/>



- Most of service provider deployed 6rd with their residential gateway in the access network.
- But Sakura internet is datacenter provider, they are providing housing/hosting/dedicated server/VPS services.
- Their layer3 switches are pretty old, so they needed cost and network downtime to support IPv6.

6rd in a Large Datacenter



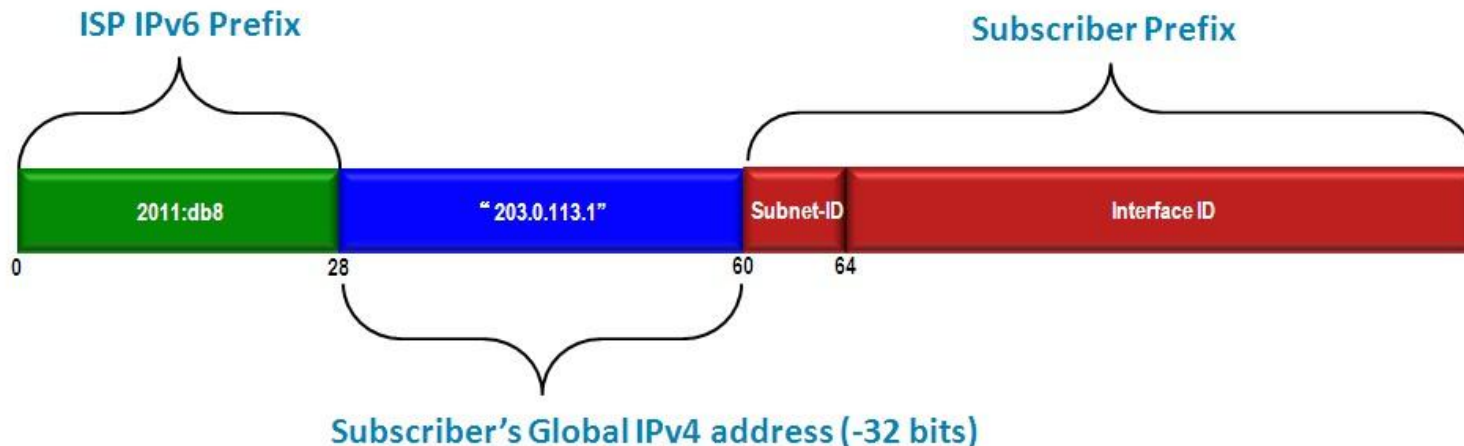
- To support IPv6, Sakura internet considered server-based 6rd.
- Because most of today's operating systems are Linux distribution, and Linux kernel already supported 6rd in 2.6.33.
- FreeBSD and CentOS could not provide 6rd in default, but the patch exists.
- Sakura provide IPv6 internet reachability. 6rd BR & information of server-based 6rd.

Case Study #3

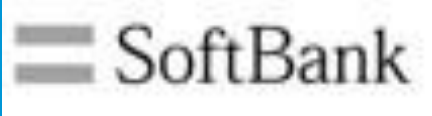




Norway
Founded:2000
Service : Telephony ,Broadband,IPTV
Employees:250

- NextGenTel is the second largest Internet service provider in Norway.
- They are planning 6rd in their residential network.






6rd address allocation method

	 SoftBank	 free	 Comcast
6rd SP Prefix	2400:2100::/24	2a01:0e30::/28	2001:55c::/32
IPv4 prefix-length	32	32	32
customer IPv6 prefix	/56	/60	/64
customer IPv6 network	256	16	1

Softbank has /20 ipv6 address space.
Customer can has 256 IPv6 networkes.

http://www.kokatsu.jp/blog/ipv4/data/interop2010/S-01_innami_100609.pdf
<http://ripe58.ripe.net/content/presentations/ipv6-free.pdf>
<http://www.comcast6.net/6rd-config.php>

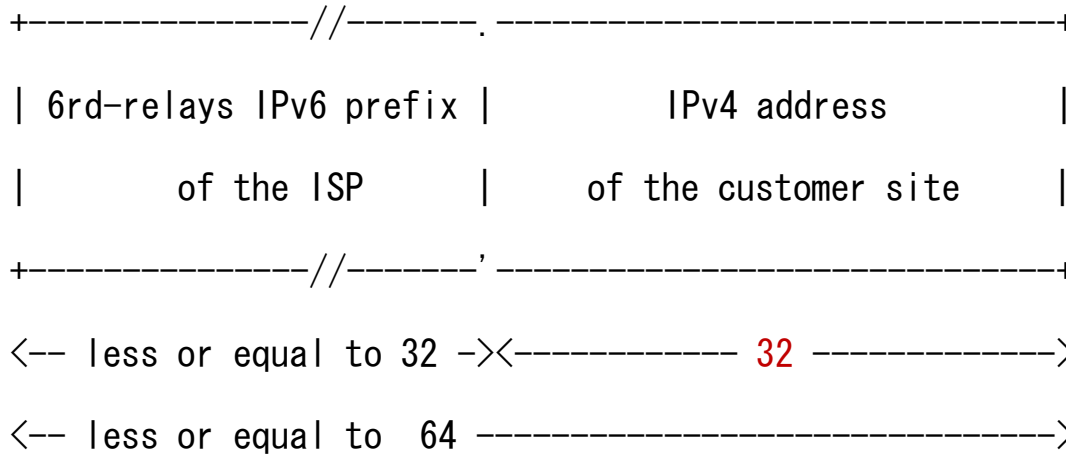
6rd address allocation method

			
6rd SP Prefix	2a02:1200:/28	2001:e41::/32	2001:20a0:8000::/40 2001:20a0:8100::/40
IPv4 prefix-length	32	32	16
customer IPv6 prefix	/60	/64	/56
customer IPv6 network	16	1	256

NextGenTel use /40 for 6rd SP Prefix.
But provide /56 prefix to customer same as Softbank.

http://www.swinog.ch/meetings/swinog22/p/03_IPv6-swinog.ppt
<http://research.sakura.ad.jp/6rd-trial/>

Difference [RFC5569](#) and [RFC5969](#)



[RFC5569](#)



[RFC5969](#)

Common IPv4 block can abbreviate in a 6rd domain.

IOS 6rd Configuration Command

- **tunnel mode ipv6ip 6rd**
Configures as 6rd tunnel
- **tunnel 6rd prefix <V6 address>/<length>**
Specifies the common IPv6 prefix on 6RD tunnels.
- **tunnel 6rd ipv4 {prefix-length length} {suffix-length length}**
Specifies the prefix length and suffix length of the IPv4 transport address common to all the 6RD routers in a domain.
- **tunnel 6rd br *BR IPv4 address***
Specifies 6rd BR address.

Case Study #4

Deploy enterprise customer

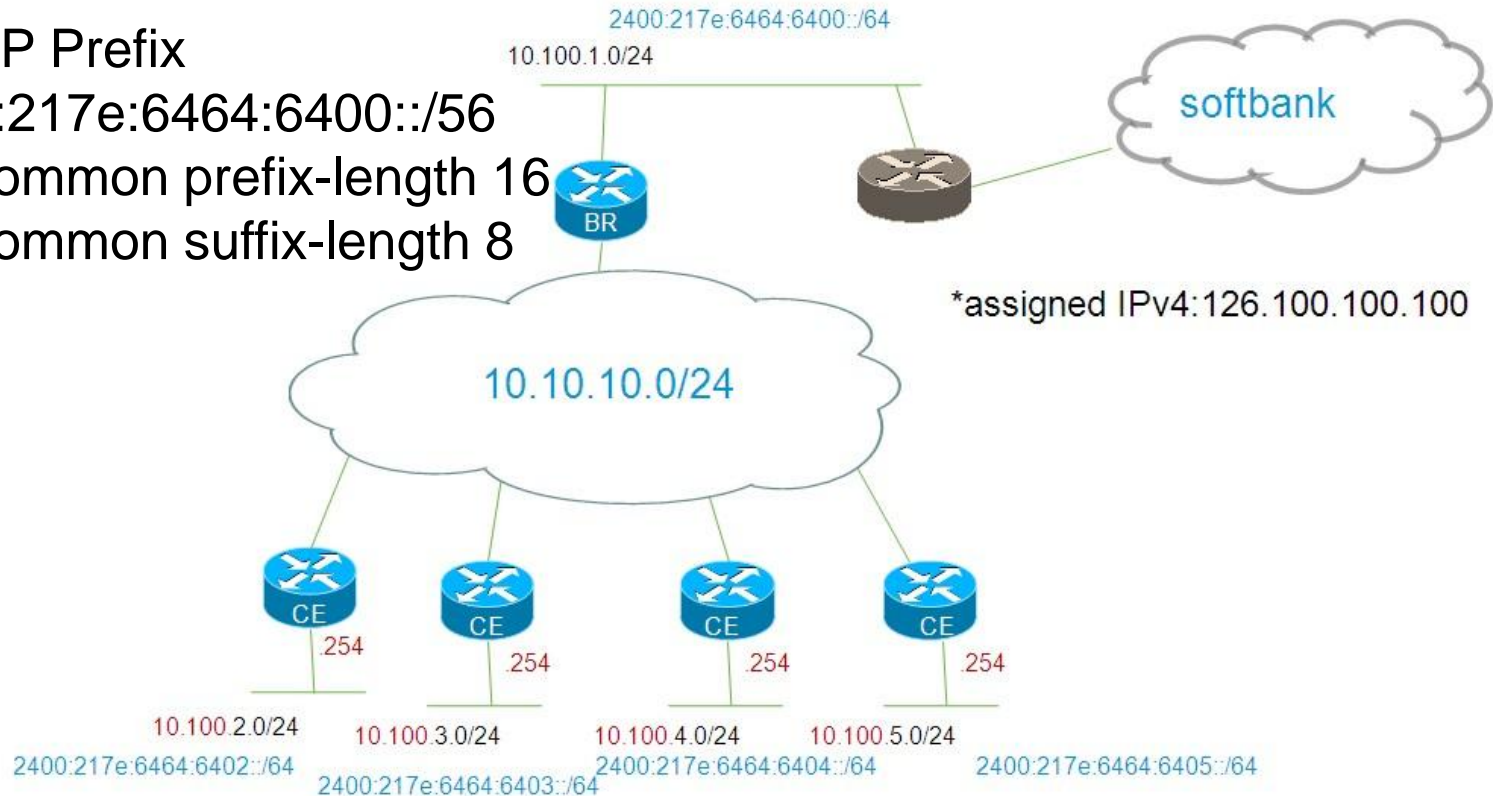
Potential
Solution

6rd SP Prefix

2400:217e:6464:6400::/56

6rd common prefix-length 16

6rd common suffix-length 8



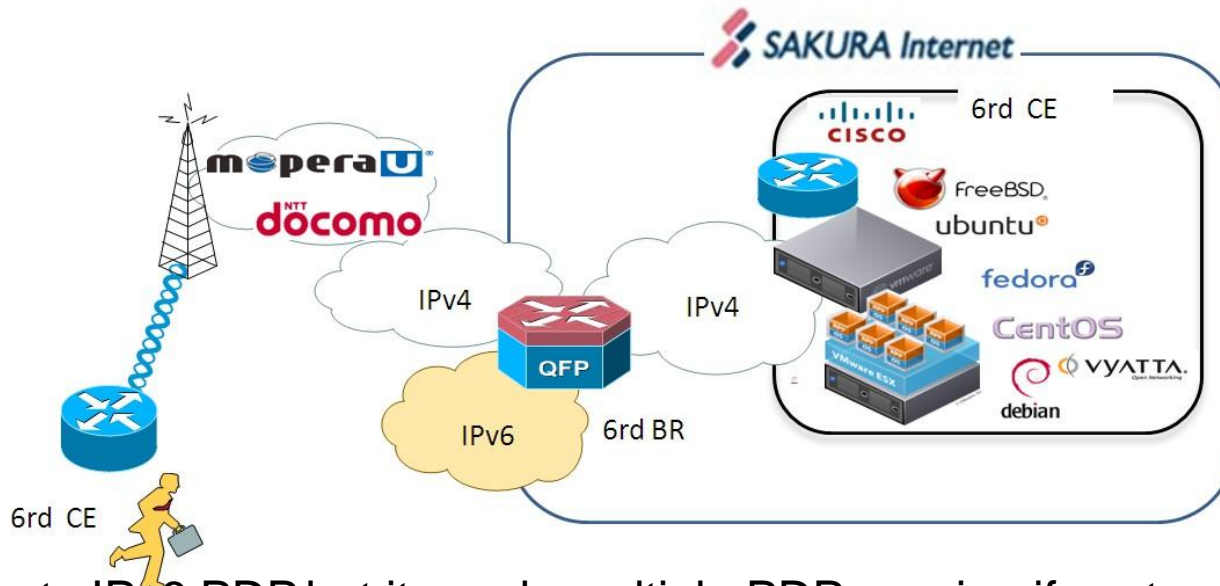
- Enterprise network which uses IPv4 address has many common parts.
- /56 would be enough to deploy IPv6 to their network.

Case Study #5

IPv6 on Mobile internet!?

Potential
Solution

<http://tools.ietf.org/html/draft-ietf-v6ops-3gpp-eps>



- 3GPP supports IPv6 PDP, but it needs multiple PDP session if customer requests IPv4/IPv6 dual stack.
- LTE supports IPv4v6 PDP which supports DS on a single bearer. But most of operators still not ready LTE service.
- 6rd provides IPv6 internet even if mobile operator does not support multiple PDP and IPv4v6 PDP.
- *NOTE* NTT DoCoMo already supported IPv4v6 PDP for their LTE users.

<http://ipv6-test.com>



IPv6-test.com is a free service that checks your IPv6 and IPv4 connectivity and speed. Diagnose connection problems, discover which address(es) you are currently using to browse the Internet, and what is your browser's protocol of choice when both v6 and v4 are available.

When both protocols are available, your browser uses

IPv6

Your internet connection is **IPv6** capable

2001:e41:6e9e:d0e7:5a55:caff:fe23:a6f1

Apnic-ap Portables3

Address type is

Global Unicast / Native IPv6

Auto-configured from MAC **58:55:ca:23:a6:f1** (vendor **Unknown**)

Your internet connection is **IPv4** capable

110.158.208.231

u708231.xgsnu3.imtp.tachikawa.mopera.net

Maps



110=>6e
158=>9e
208=>d0
231=>e7

Summary

- 6rd support platforms are expanding since Linux kernel has been supported 6rd from 2.6.33.
 - ✓ Managed 6rd(6rd BR with HGW)
Free, Softbank, Swisscom, comcast, Videotron and Nextgentel
 - ✓ User on demanded 6rd(6rd BR with Server and so on)
Sakura internet and Chater
- If you use Common Prefix/Suffix, you can provide a lot of network to a customer even if have small IPv6 prefixes range. => see Nextgentel case
- Of course should consider migrate from IPv4 to IPv6. But even if there are equipment impossible of upgrade to IPv6, you can rapid deployment of IPv6 by 6rd.
=> all user case

Thank you.

