

Empowered by Innovation **NEC**



# 464XLAT Experiences

- Combination of Stateful and Stateless Translation -

2012 / 8 / 28

NEC AccessTechnica, Ltd.

Masanobu Kawashima

[kawashimam\[at\]vx.jp.nec.com](mailto:kawashimam[at]vx.jp.nec.com)

# Contents

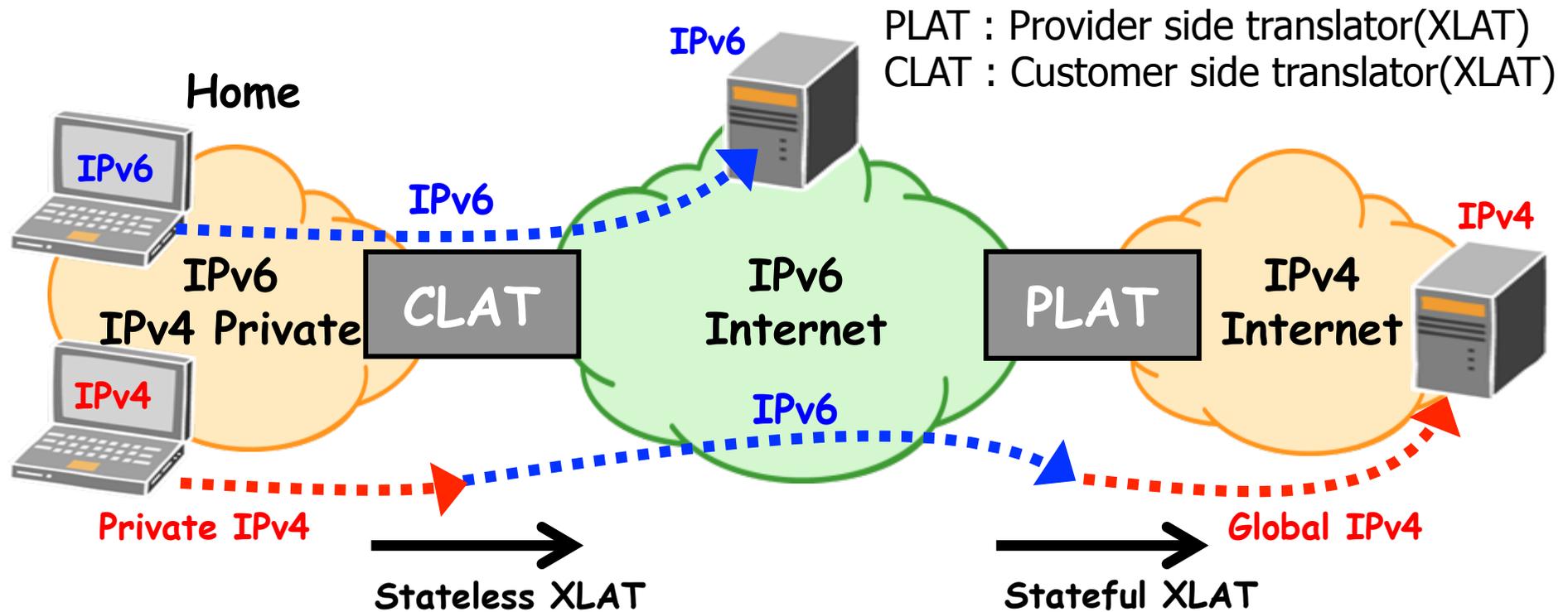
---

- What is 464XLAT?
- Motivation and Uniqueness of 464XLAT
- Comparison of 464XLAT and other technologies
- Status in the IETF
- WIDE Camp Spring 2012
- Restriction on Use of VPN Protocols
- IPv4/IPv6 Mixed Traceroute
- Interop Tokyo 2012

## Backup Slides

- IPv4/IPv6 Address Translation Flow
- History of Transition Technologies
- Simplicity (from a CPE perspective)
- Simplicity (Mapping)
- References

# What is 464XLAT?



464XLAT provides **limited** IPv4 connectivity across an IPv6-only network by combining existing and well-known **stateful** protocol translation [RFC 6146](#) in the core and **stateless** protocol translation [RFC 6145](#) at the edge.

# What is 464XLAT? (cont.)

---

- **What it is**

- Combined RFC 6145 and RFC 6146
- Easy to deploy and available today, commercial and open source shipping product
- Effective at providing basic IPv4 service to consumers over IPv6-only access networks
- Efficient use of very scarce IPv4 resources

- **What it is NOT**

- A perfect replacement for IPv4 or Dual-stack service

**We should focus on IPv6 deployment rather than IPv4 life support.**

# Motivation and Uniqueness of 464XLAT

---

## **1. Minimal IPv4 resource requirements, maximum IPv4 efficiency through statistical multiplexing**

- Stateful NAT64 translation in PLAT. Each IPv4 can mask  $n \times 64,000$  flows.
- ISPs can efficiently and effectively share limited IPv4 global address pool.

## **2. No new protocols required, quick deployment**

- It is only necessary to use standard technologies based on RFC already published.
- Most ISPs do not have a lot of time to make a new protocol
- Multi-vendor inter-op already proven (Cisco, Juniper, A10, and F5 as a PLAT)

# Motivation and Uniqueness of 464XLAT (cont.)

---

## **3. IPv6-only networks are simpler and therefore less expensive to operate**

- When combined with DNS64, ISP can provide sharing IPv4 address and IPv4/IPv6 translation at same time. (Less NAT than NAT444)
- ISPs can do IPv6 traffic engineering and billing without deep packet inspection devices.
- If the other ISPs operate PLAT as PLAT providers, ISPs for IPv6 consumers can independently do IPv6 traffic engineering on common backbone routers.
- Single stack network operations
- Limits the need to buy IPv4 addresses

# Comparison of 464XLAT and other technologies

---

Stateless Solution

CPE : Restricted NAPT44

Stateful Solution (CGN or NAT64)

CPE : no NAPT44

**MAP-T**

**464XLAT**

Translation

**MAP-E**

**DS-Lite**

Tunnel

# Status in the IETF

---

Timeline

2012/03/26 Discussed in v6ops WG IETF 83 (Paris)

2012/04/17 Published draft-ietf-v6ops-464xlat-02

2012/05/08 Published draft-ietf-v6ops-464xlat-03

2012/06/25 Published draft-ietf-v6ops-464xlat-04

2012/07/03 Published draft-ietf-v6ops-464xlat-05

2012/07/30 Discussed in sunset4 WG IETF 84 (Vancouver)

» We got feedbacks from the community that this draft should stay in v6ops WG.

2012/08/03 Discussed in v6ops WG IETF 84 (Vancouver)

» We got rough consensus from the community regarding WGLC.

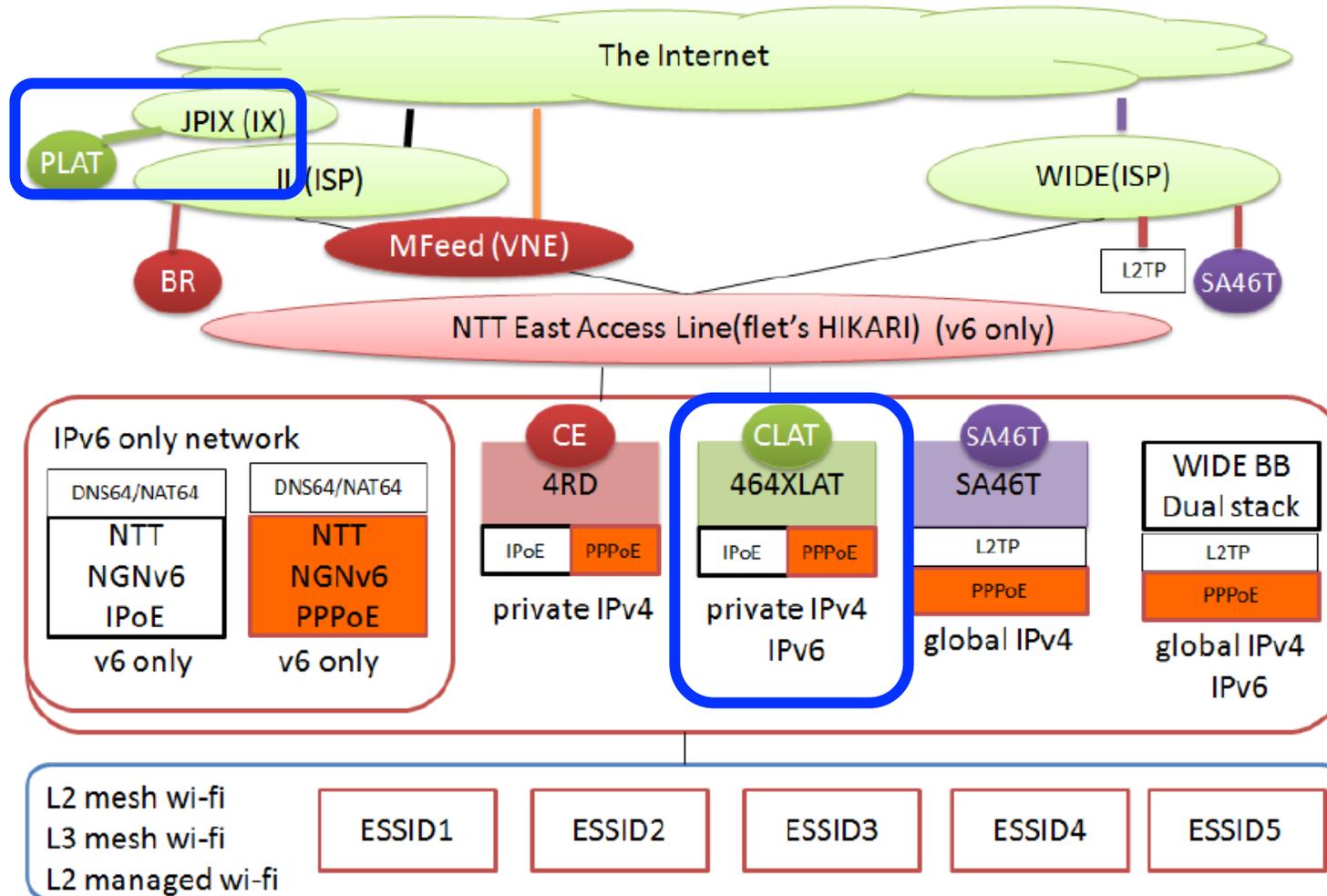
2012/08/07 Published draft-ietf-v6ops-464xlat-06

2012/08/20 Published draft-ietf-v6ops-464xlat-07

2012/08/21 WGLC is opening until Sep 4 in v6ops WG.

# WIDE Camp Spring 2012

We tried to use in commercial IPv6 networks with four kinds of technologies, DNS64/NAT64, 4RD, **464XLAT** and SA46T.



[source] <http://www.ietf.org/proceedings/83/slides/slides-83-v6ops-0.pdf>

# WIDE Camp Spring 2012 (cont.)

NAT Behavioral test results by KONAMI Digital Entertainment.

RFC 4787 NAT Behavioral Requirements	IPv4					IPv6	
	4rd	464XLAT	SA46T (fa)	SA46T (fk)	SA46T (ko)	IPoE	PPPoE
REQ-1 Endpoint-Independent Mapping	×	○	— (no NAT)				
REQ-3 Port overloading	×	○	— (no NAT)				
REQ-9 Hairpinning	×	×	— (no NAT)				
REQ-13,14 Fragmentation	×	×	○	×	×	○	○
Path MTU	1280	1260	1460	1460	1460	1500	1452

# WIDE Camp Spring 2012 (cont.)

---

## **REQ-9. Hairpinning support**

- Hairpinning function did not work in the PLAT by implementation matter. However, if your PLAT fully comply with RFC 6146, hairpinning function will work well.

## **REQ-13, REQ-14. Fragmentation support**

- The CLAT could not generate fragmented packets, even if IPv4 sender does not set the DF bit.
- Since many participants were using the CLAT in that time, its capacity was overloaded.
- When less than 30 nodes were using the CLAT, it could generate fragmented packets.  
It is a reasonable capacity as a home router.

# Restriction on Use of VPN Protocols

---

## **PPTP : ×**

- Signaling(TCP 1723) is **OK**
- Transport(GRE = IP protocol 47) is **NG**

## **IPsec : Δ**

- IKE(UDP 500) is **OK**
- ESP/AH(IP Protocol 50/51) are **NG**
- NAT Traversal(UDP 4500) is **OK**

## **SSL : ○**

## **SSH Port Forward : ○**

## **L2TP : ○**

- UDP 1701(General case) is **OK**
- IP Protocol 115(rare case) is **NG**

IPv4 Address Sharing Technologies such as MAP-E/T, 4rd, and DS-Lite have originally same restrictions.

# IPv4/IPv6 Mixed Traceroute

## CLAT Web-GUI Screenshot

```
traceroute6 to 8.8.8.8 (2400:3000:1000:4646::808:808)
  from 2001:240:2002:6d30::cafe, 18 hops max, 12 byte packets
 1 2001:240:2002:6d10::2  2.099 ms
 2 2001:240:bb40:4001::4001  10.881 ms
 3 2001:240:bb40:5001::1  10.127 ms
 4 tky001bb10.IIJ.Net  14.711 ms
 5 tky009bf01.IIJ.Net  9.77 ms
 6 tky001ix01.IIJ.Net  10.21 ms
 7 2001:268:fc02:6::1  10.106 ms
 8 6v6-oteEDGE01.int-gw.kddi.ne.jp  10.129 ms
 9 2001:268:fe00:14::2  11.975 ms
10 210.171.225.160  407.813 ms
11 210.171.225.229  482.745 ms
12 210.171.226.35  587.79 ms
13 210.171.226.237  610.998 ms
14 210.171.224.96  531.503 ms
15 209.85.241.139  528.32 ms
16 8.8.8.8  544.612 ms
```

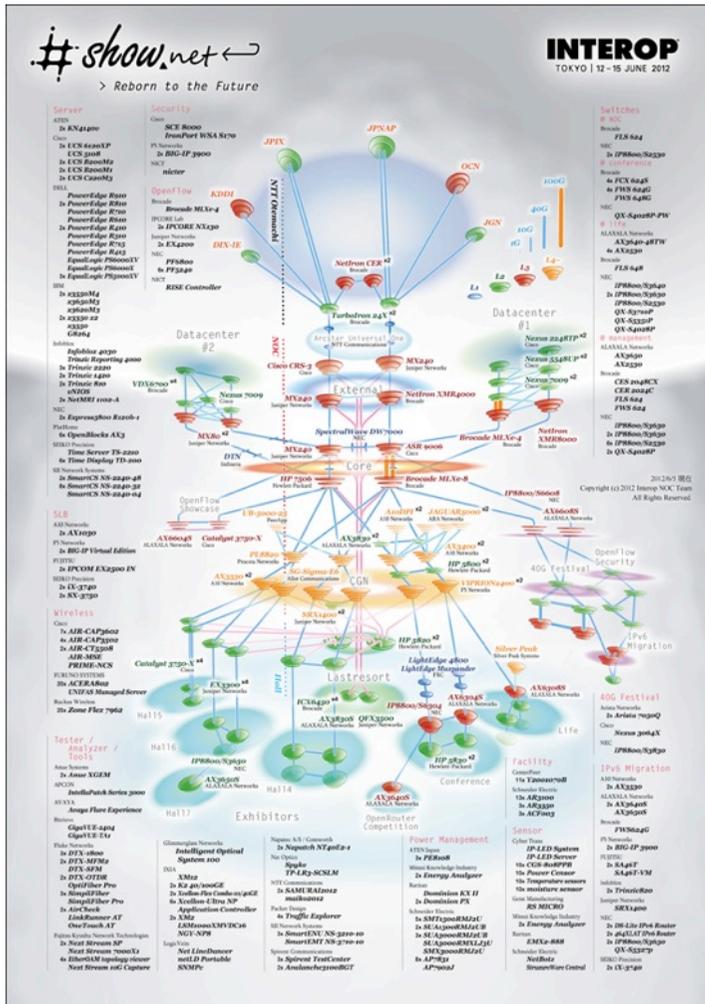
**IPv6**

**IPv4**

This user interface is useful to do trouble shooting.

# Interop Tokyo 2012

We've finished interoperability test between CLAT(NEC Access Technica) and PLAT(Juniper, A10, F5) at ShowNet of Interop Tokyo 2012.



---

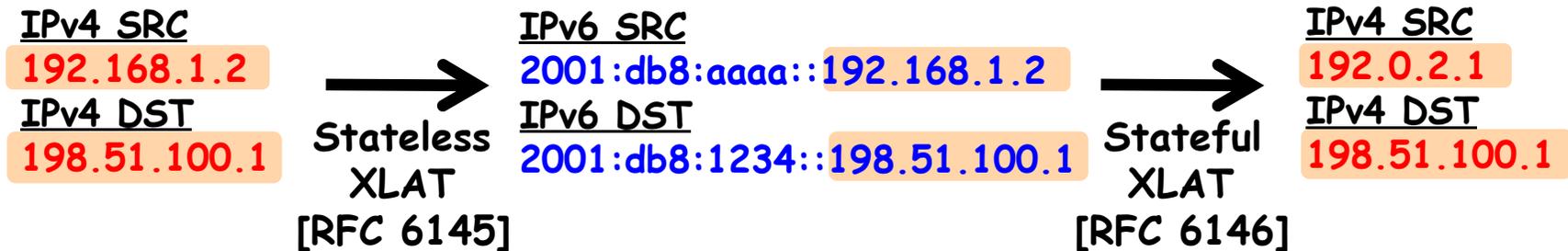
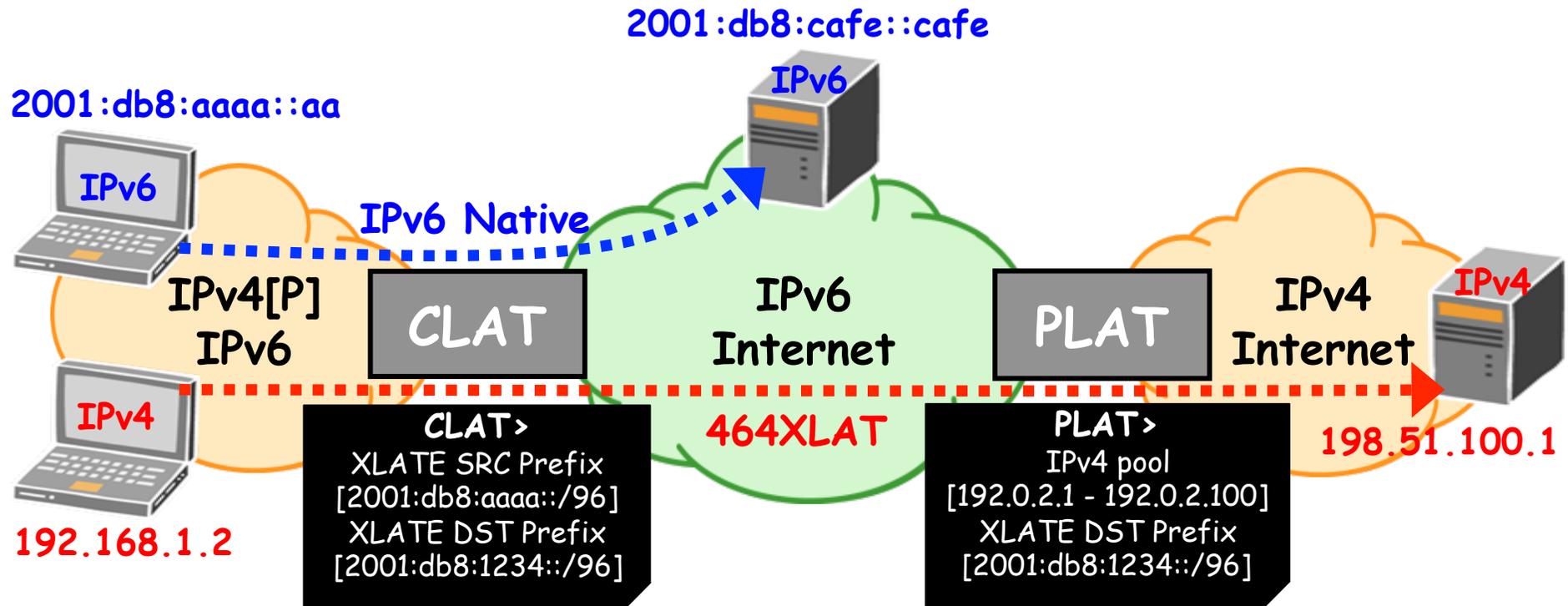
# Any Questions?



---

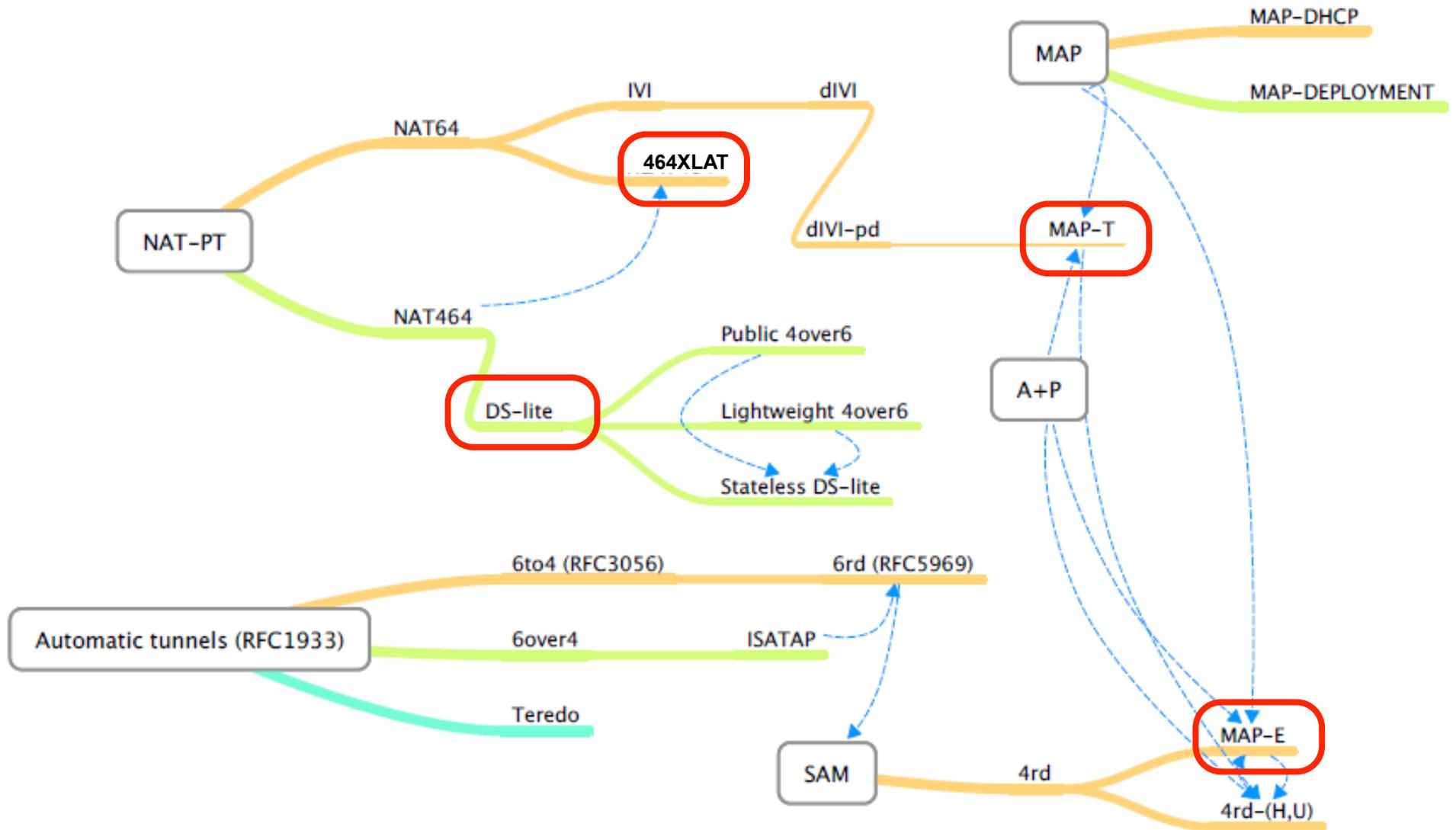
# Backup Slides

# IPv4/IPv6 Address Translation Flow



- This architecture consist of CLAT and PLAT have the applicability to wireline network (e.g. xDSL, FTTH) and mobile network (e.g. 3GPP).

# History of Transition Technologies



[source] <http://www.ietf.org/proceedings/83/slides/slides-83-softwire-10.pdf>

# Simplicity (from a CPE perspective)

Current IPv4 CPE



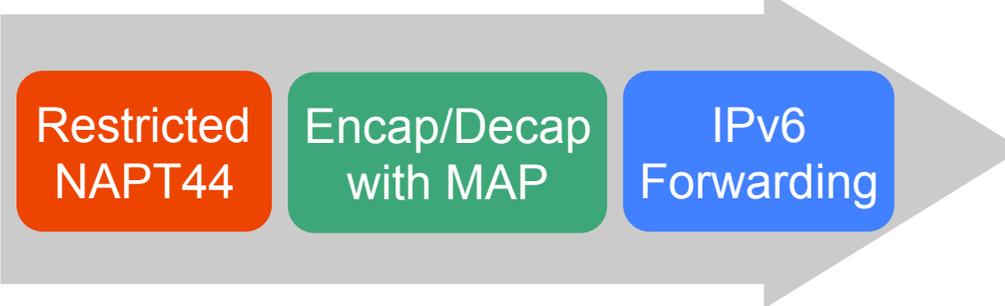
How do we operate CPEs?  
Can we deploy it broadly?

464XLAT(CLAT)



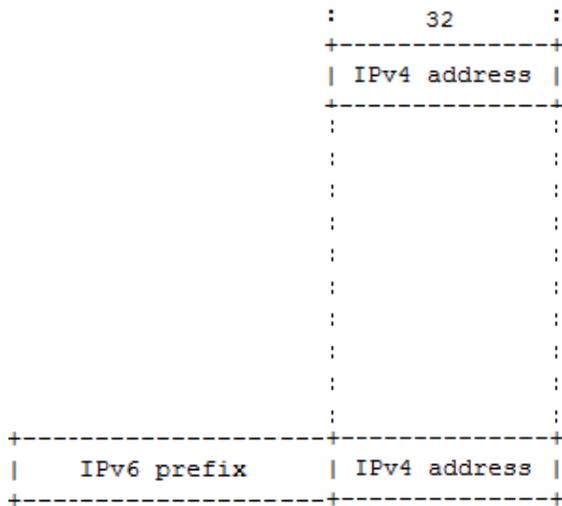
Real solution, and simple!  
Similar to current CPE.  
Easy trouble shooting.

MAP-E



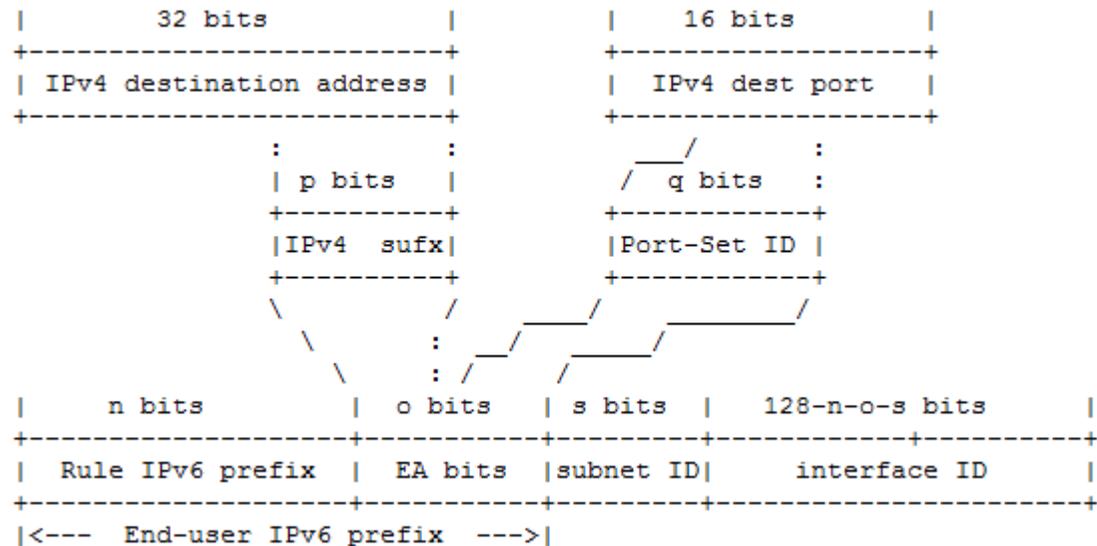
Ideal solution, but complex.  
Fat CPE.  
Complicated trouble shooting.

# Simplicity (Mapping)



464XLAT

We don't need any tools. 😊



MAP

MAP Simulation Tool  
<http://map46.cisco.com/>

# References

## PLAT

- Cisco Systems ---- Cisco ASR1000 Series (IOS-XE 3.4.0S~)
- Juniper Networks ---- SRX Series (JUNOS 10.4~)
- A10 Networks ---- AX Series (ACOS 2.6.4~)
- F5 Networks ---- BIG-IP Series (11.1~)
- OSS ---- Ecdysis NAT64, linuxnat64, OpenBSD PF

## CLAT

- NEC AccessTechnica
  - CL-AT1000P (JPIX IPv6v4 Exchange Trial Service Model)
  - RG-A45i (Global Model : Prototype)
- Android-CLAT (CLAT code for Android)
  - <https://android-review.googlesource.com/#/c/34490/>
- n900ipv6 (CLAT code for Nokia n900)
  - <https://code.google.com/p/n900ipv6/wiki/README>



CL-AT1000P



RG-A45i

Empowered by Innovation

**NEC**