

# **APRICOT 2013 @ Singapore**

## **The trend of IPv4 over IPv6 techniques, use cases and experience**

**Japan Internet Exchange Co., Ltd.**

**Masataka MAWATARI**

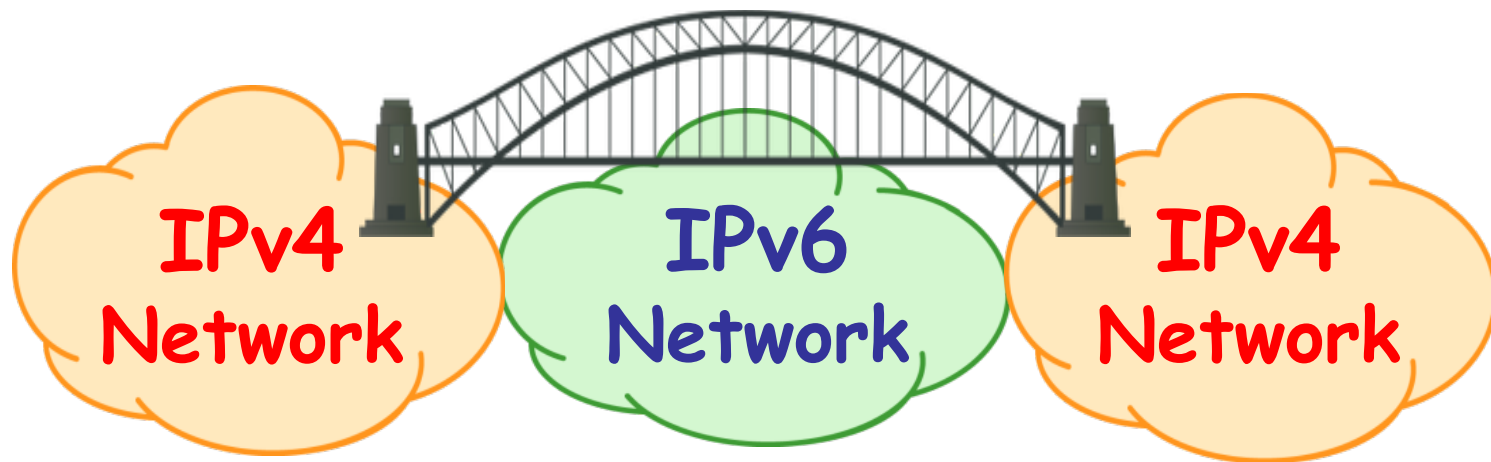
**<mawatari[at]jpix.ad.jp>**

- 1. Necessity of IPv4 over IPv6 technique**
- 2. Trend of standardization**
- 3. Comparison of IPv4 over IPv6 technique**
- 4. Use cases in each technique**
- 5. Trend of implementation**
- 6. Experience in JPIX**

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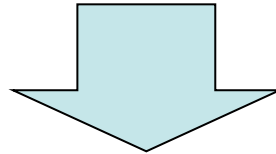
# What's IPv4 over IPv6 technique?

**It can connect**  
**isolated IPv4 networks**  
**across an IPv6-only**  
**network.**



# Why is IPv4 over IPv6 needed?

- **Lack of compatibility between protocols**
  - IPv4-only nodes can't directly communicate with IPv6-only nodes.
- **Expanding the IPv6 internet in a moment is impossible**
  - IPv6 unsupported nodes will remain in the internet for long
  - Introducing IPv6 for the legacy access service is unreasonable from a financial viewpoint

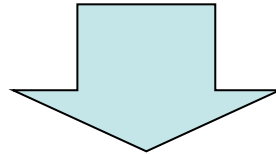


**Mechanism to work as a bridge  
between IPv4 and IPv6**

**is needed**

# Why is IPv4 over IPv6 needed?

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**IPv4 over IPv6 technique is needed**

- **Advantages**

- **Resolution of the IPv4 address exhaustion**

- **ISPs can solve it by sharing global IPv4 addresses**

- **Simple access network**

- **ISPs can migrate their access network to simple IPv6-only network**
    - **ISPs don't need to operate IPv4 access network**

- **Disadvantage**

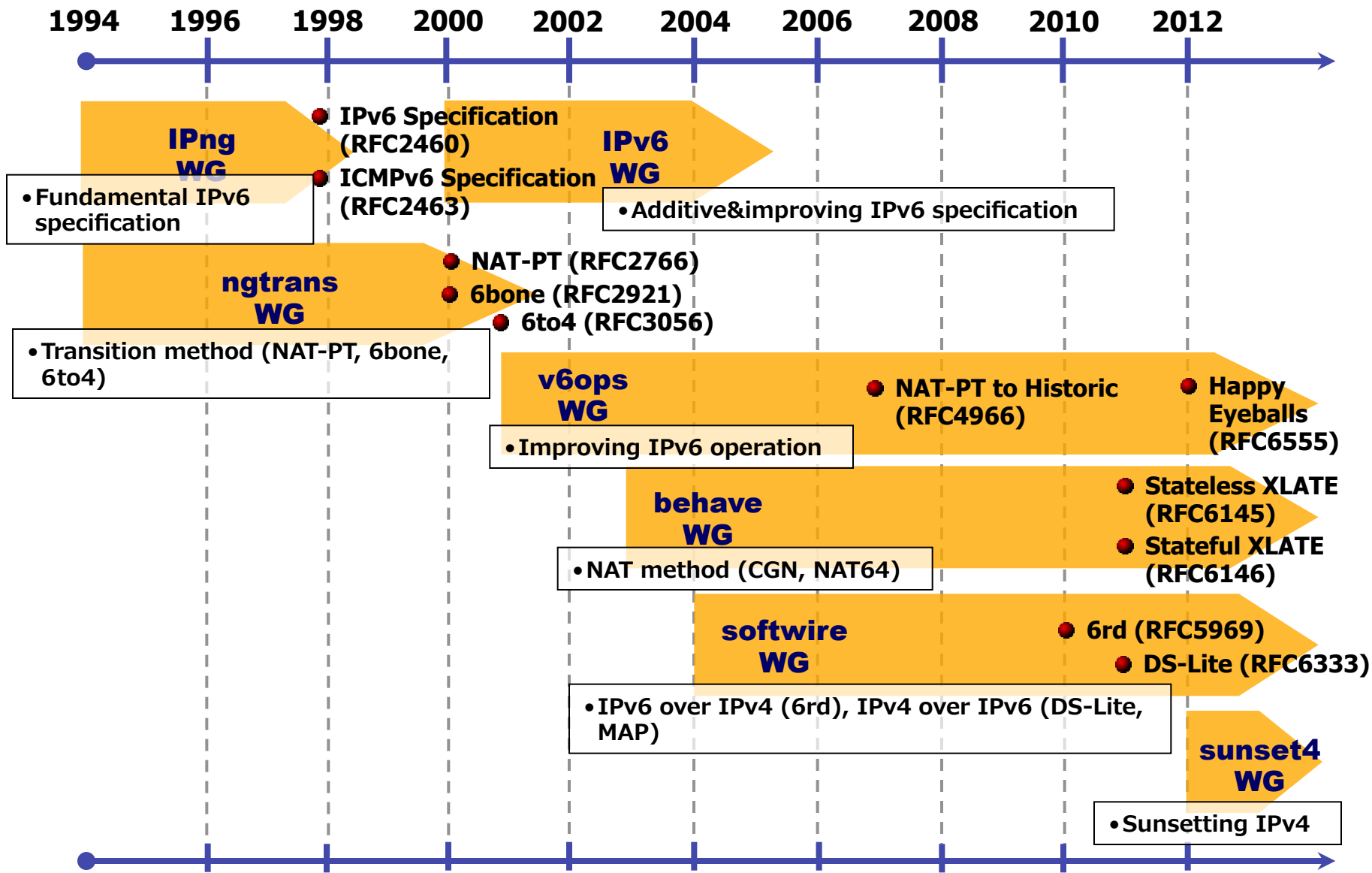
- **Initial cost**

- **ISPs need to deploy the IPv4 over IPv6 equipments including CPEs. However, it will be commodity soon.**

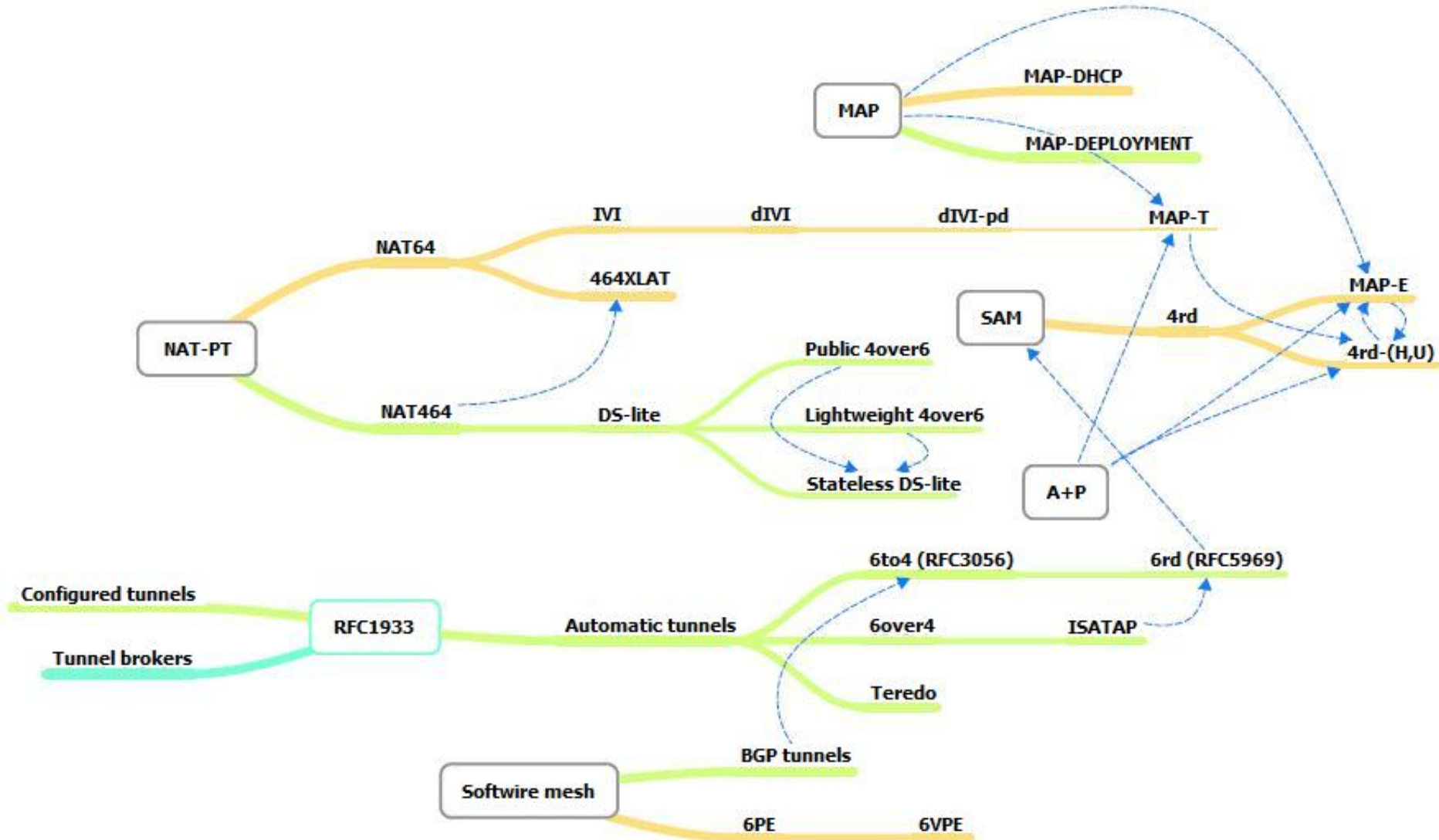
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# The history of IETF WG related to IPv6

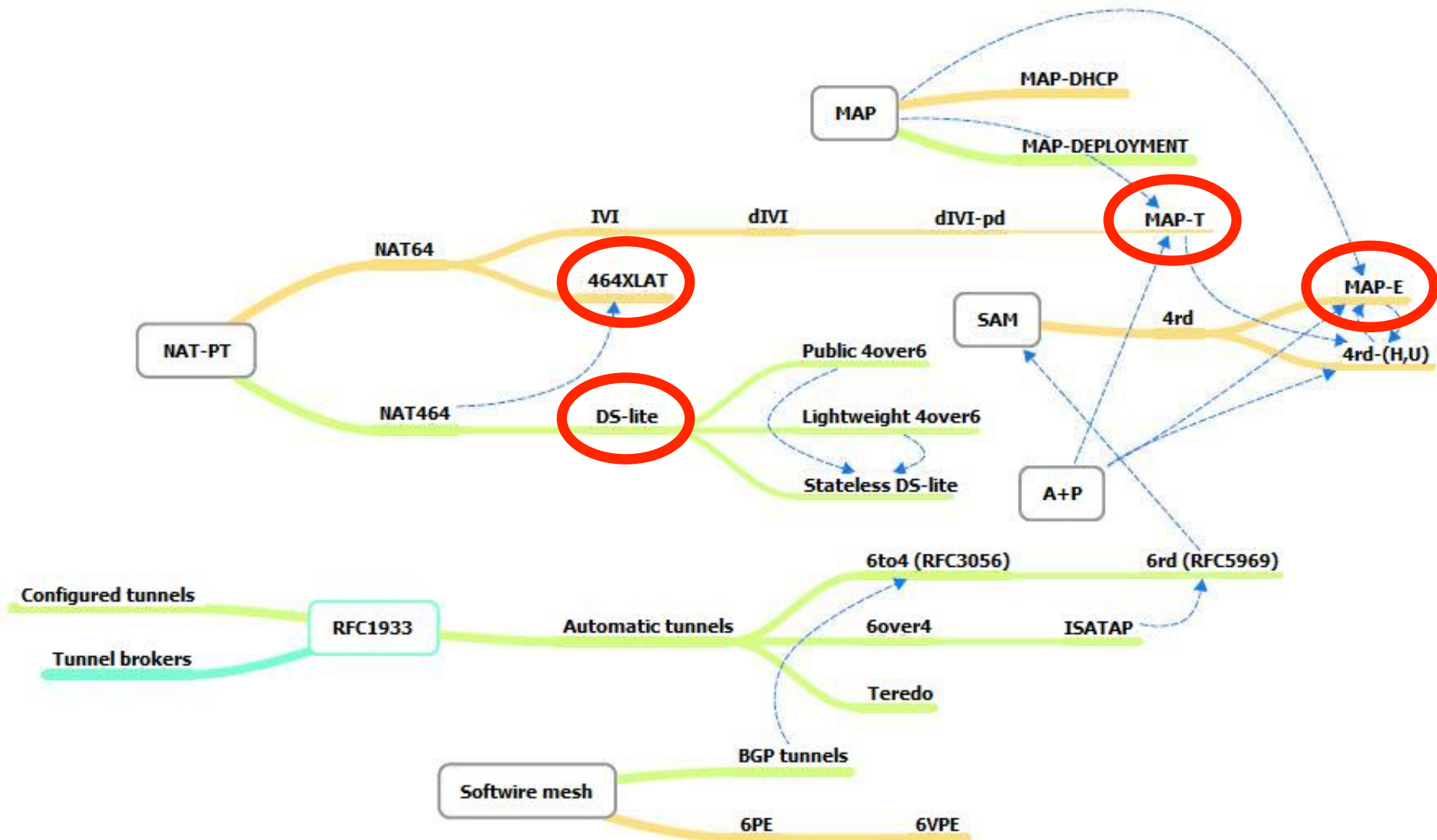


# The progress of IPv4 over IPv6



<https://ripe65.ripe.net/presentations/91-townsley-map-ripe65-ams-sept-24-2012.pdf>

# The progress of IPv4 over IPv6



<https://ripe65.ripe.net/presentations/91-townsley-map-ripe65-ams-sept-24-2012.pdf>

# Standardization status in IETF

- **DS-Lite**
  - **Status**
    - **Publication was done as a RFC 6333 (Aug, 2011)**
  - **Document Category**
    - **Standards Track**
  
- **464XLAT**
  - **Status**
    - **IETF Last Call was done**
    - **RFC editor queue currently in progress**
  - **Document Category**
    - **Informational**
  
- **MAP-E, MAP-T**
  - **Status**
    - **Rough consensus on separating into MAP-E draft and MAP-T draft at softwire WG in IETF 84**
      - **Until just before this, MAP-E and MAP-T was compiled in a draft.**
    - **Discussing further at softwire WG**
  - **Document Category**
    - **MAP-E : Standards Track**
    - **MAP-T : Experimental**

- **DS-Lite**

- <http://tools.ietf.org/html/rfc6333>

- **464XLAT**

- <http://tools.ietf.org/html/draft-ietf-v6ops-464xlat>

- **MAP-E**

- <http://tools.ietf.org/html/draft-ietf-softwire-map>

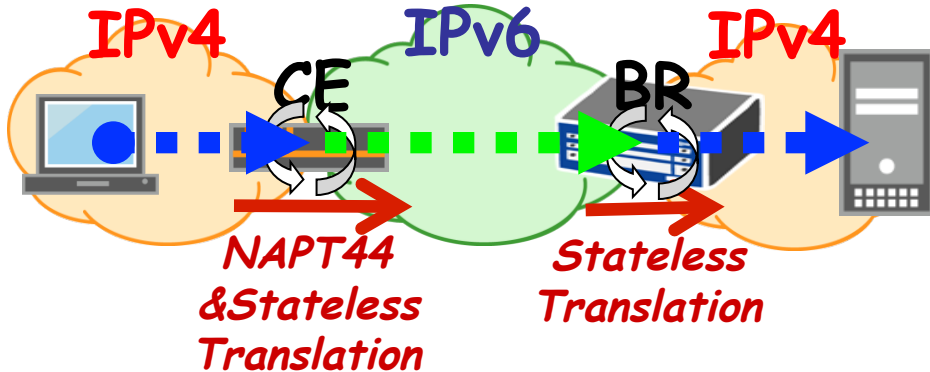
- **MAP-T**

- <http://tools.ietf.org/html/draft-ietf-softwire-map-t>

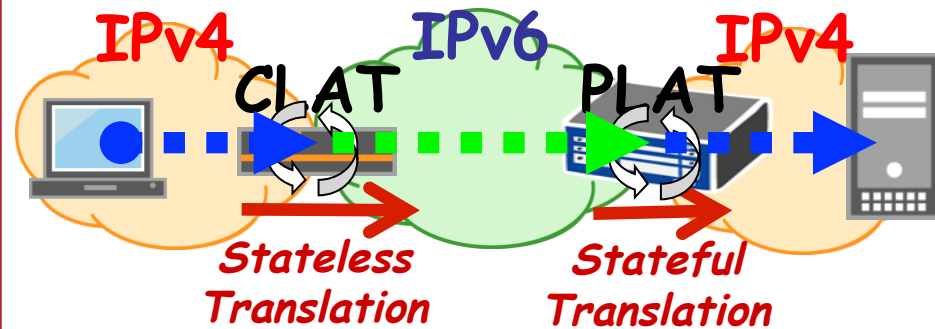
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# The survey of IPv4 over IPv6

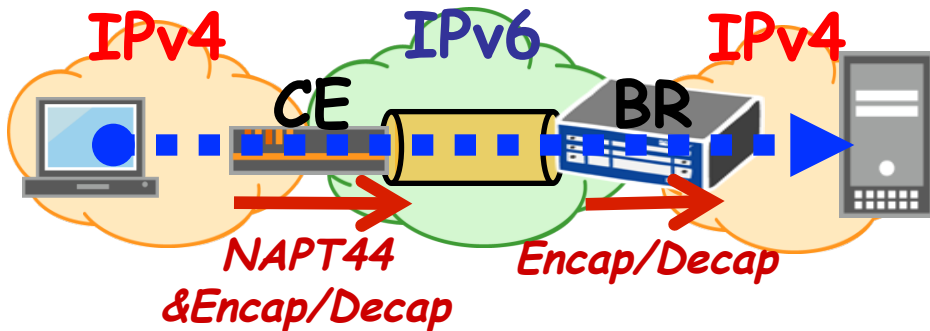
## MAP-T Stateless IPv4 sharing Translation method



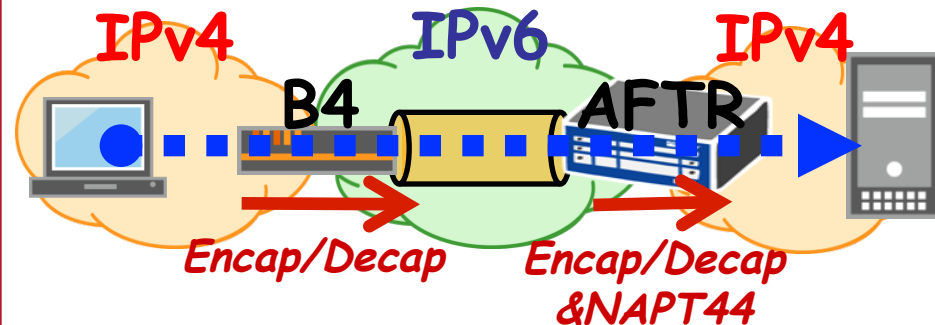
## 464XLAT Stateful IPv4 sharing Translation method



## MAP-E Stateless IPv4 sharing Encapsulation method

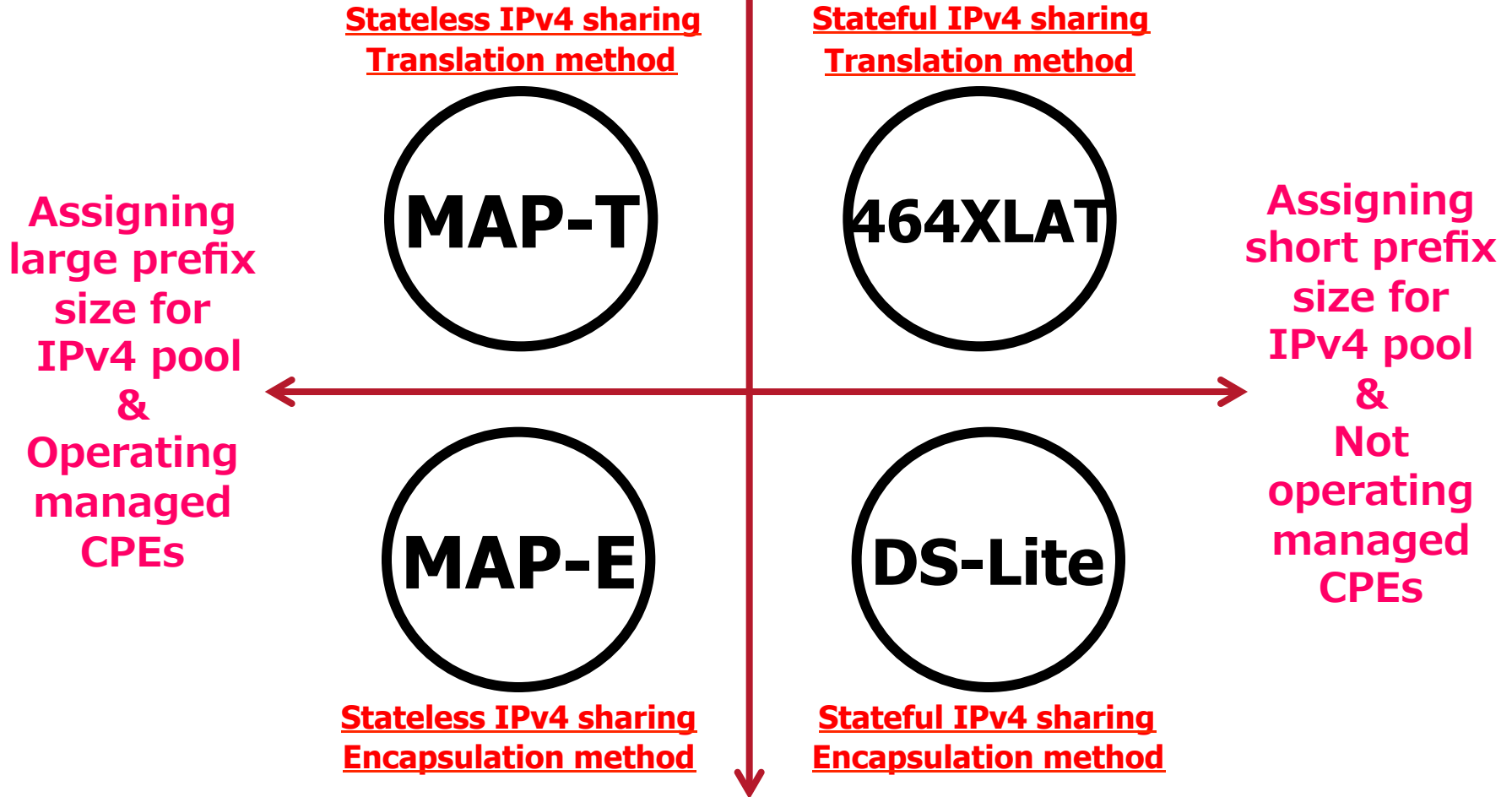


## DS-Lite Stateful IPv4 sharing Encapsulation method



# Appropriate situation for techniques

Separating organization between  
operating IPv6 access network and sharing global IPv4 addresses



One organization does both of  
operating IPv6 access network and sharing of global IPv4 addresses



- **Traffic engineering operation**
  - **Translation**
    - **Figuring out IPv4 address from translated IPv6 packet header is practicable in the IPv6-only network**
  - **Encapsulation**
    - **ISPs need to install the DPI devices in the IPv6-only network, if needed**
  
- **Transparency of packet header**
  - **Translation**
    - **The lack of transparency to IPv4 packets due to IPv4/IPv6 translating**
  - **Encapsulation**
    - **little impact on the lack of IPv4 header information**

- **Global IPv4 address utilization**
  - **Stateless**
    - **ISPs must drive the right compression ratio, so they have to get enough global IPv4 addresses**
  - **Stateful**
    - **ISPs can efficiently share limited IPv4 addresses**
  
- **Address mapping logging**
  - **Stateless**
    - **Logging facility is not needed**
  - **Stateful**
    - **Logging facility is needed**

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## [Question]

**– We found that we have some available solutions.**

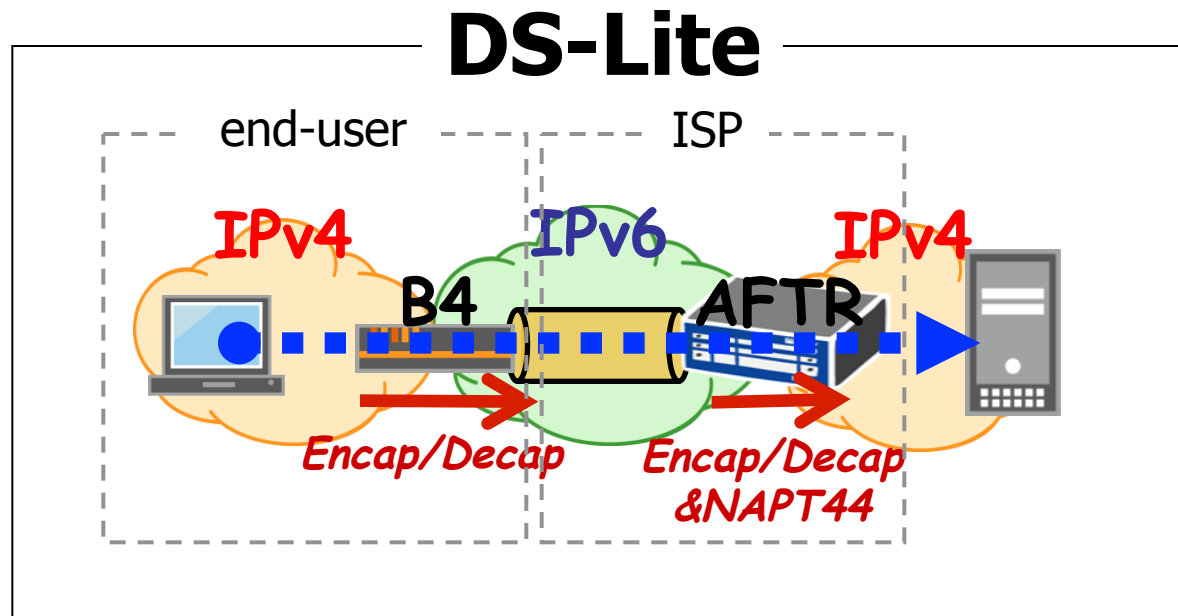
**What is the best solution for us?**

## [Answer]

**– It depends on your situation.**

# Use cases of DS-Lite

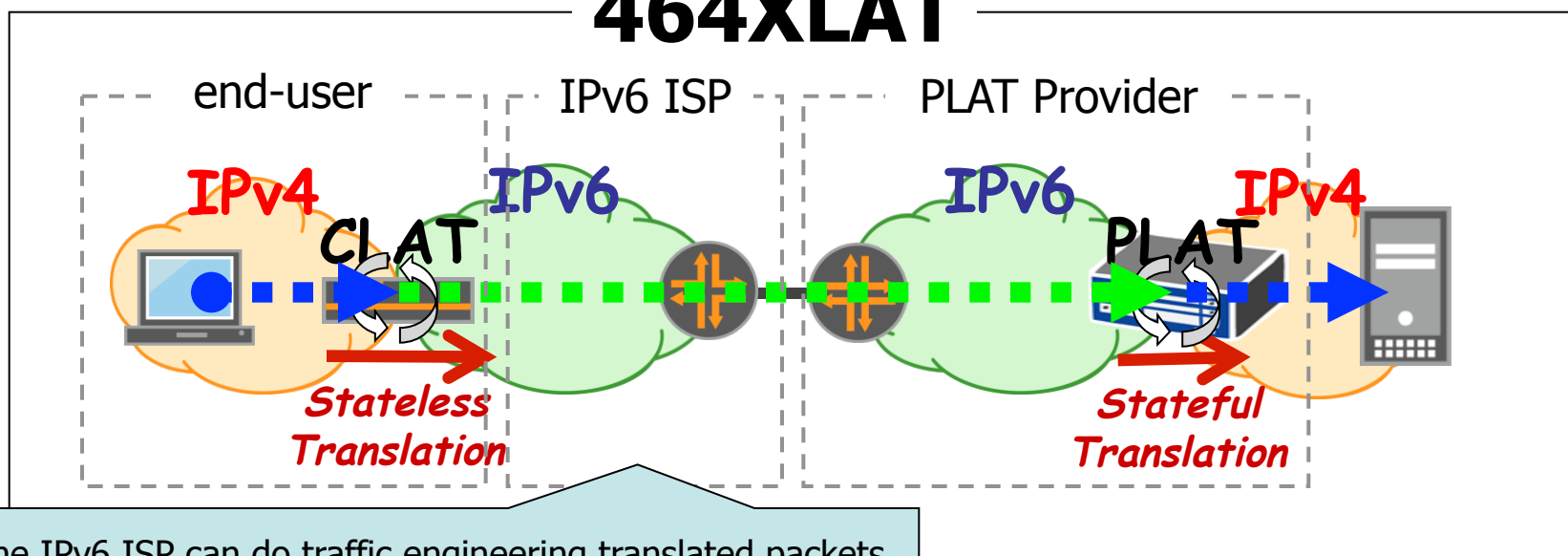
- If the ISP hasn't enough global IPv4 addresses,
- If the ISP will operate both of IPv6 access network and global IPv4 address sharing,
- **DS-Lite fits for that.**



# Use cases of 464XLAT

- If the ISP hasn't enough global IPv4 addresses,
- If the ISP will operate simple IPv6 access network only and another ISP will operate global IPv4 address sharing,
- If IPv6 ISP wants to monitor IPv4 address from translated IPv6 packet header in the IPv6 access network,
- **464XLAT fits for that.**

## 464XLAT



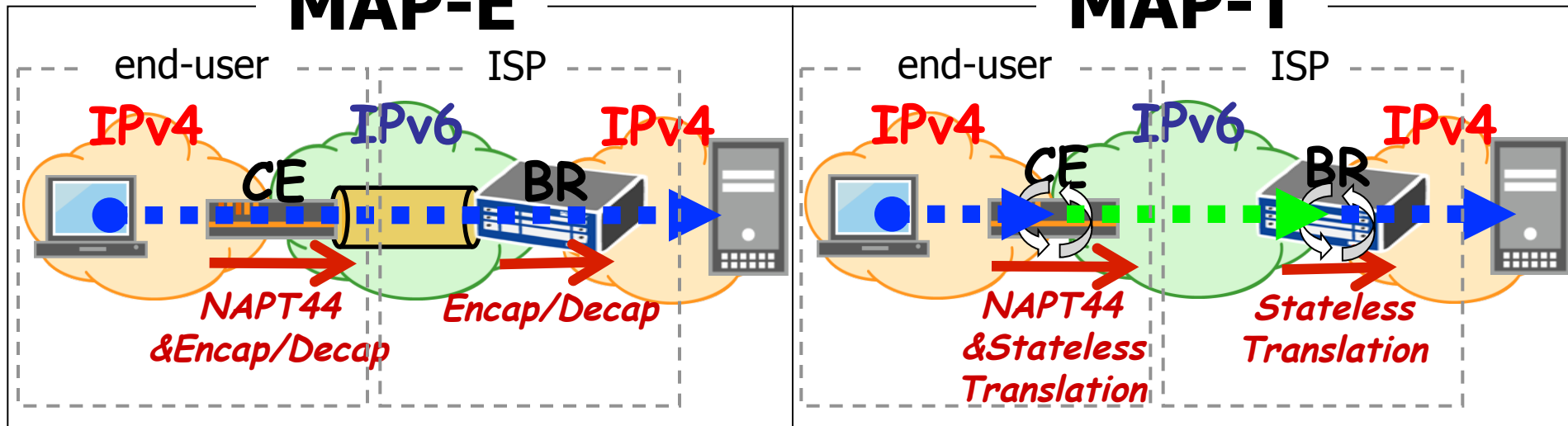
The IPv6 ISP can do traffic engineering translated packets without installing the DPI devices in the IPv6 network

# Use cases of MAP-E and MAP-T

- If the ISP has sufficient global IPv4 addresses, and provision global IPv4 addresses for end-users,
- **MAP-E and MAP-T fits for that.**

## MAP-E

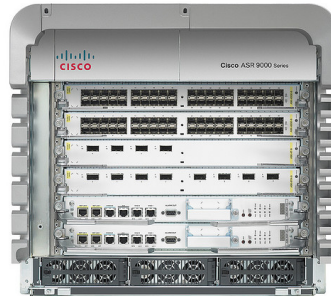
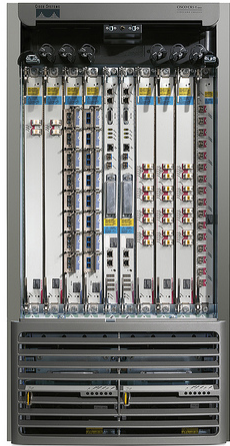
## MAP-T



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# DS-lite (AFTR) supported products



- **Cisco Systems**  
**Cisco CRS**  
**(IOS-XR 4.2.1 or later)**  
**Cisco ASR 9000 Series**  
**(IOS-XR 4.2.1 or later)**



- **A10 Networks**  
**AX Series**  
**(ACOS 2.6.1 or later)**



- **Juniper Networks**  
**MX/M/T Series**  
**(JUNOS 10.4 or later)**

\* Please refer to release notes of the vendors

# 464XLAT (PLAT) supported products



- **Cisco Systems**  
**Cisco ASR 1000 Series**  
**(IOS-XE 3.4.0S or later)**



- **A10 Networks**  
**AX Series**  
**(ACOS 2.6.4 or later)**



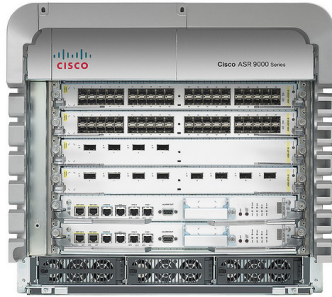
- **Juniper Networks**  
**SRX Series**  
**(JUNOS 10.4 or later)**  
**M/MX Series**  
**(JUNOS 10.2 or later)**



- **F5 Networks**  
**BIG-IP Series**  
**(OS 11.1 or later)**

\* Please refer to release notes of the vendors

# MAP-T (BR) supported products



- **Cisco Systems**  
**Cisco ASR 9000 Series**  
**(IOS-XR 4.3.0 or later)**  
**Cisco ASR 1000 Series**  
**(IOS-XE 3.8.0S or later)**

\* Please refer to release notes of the vendors

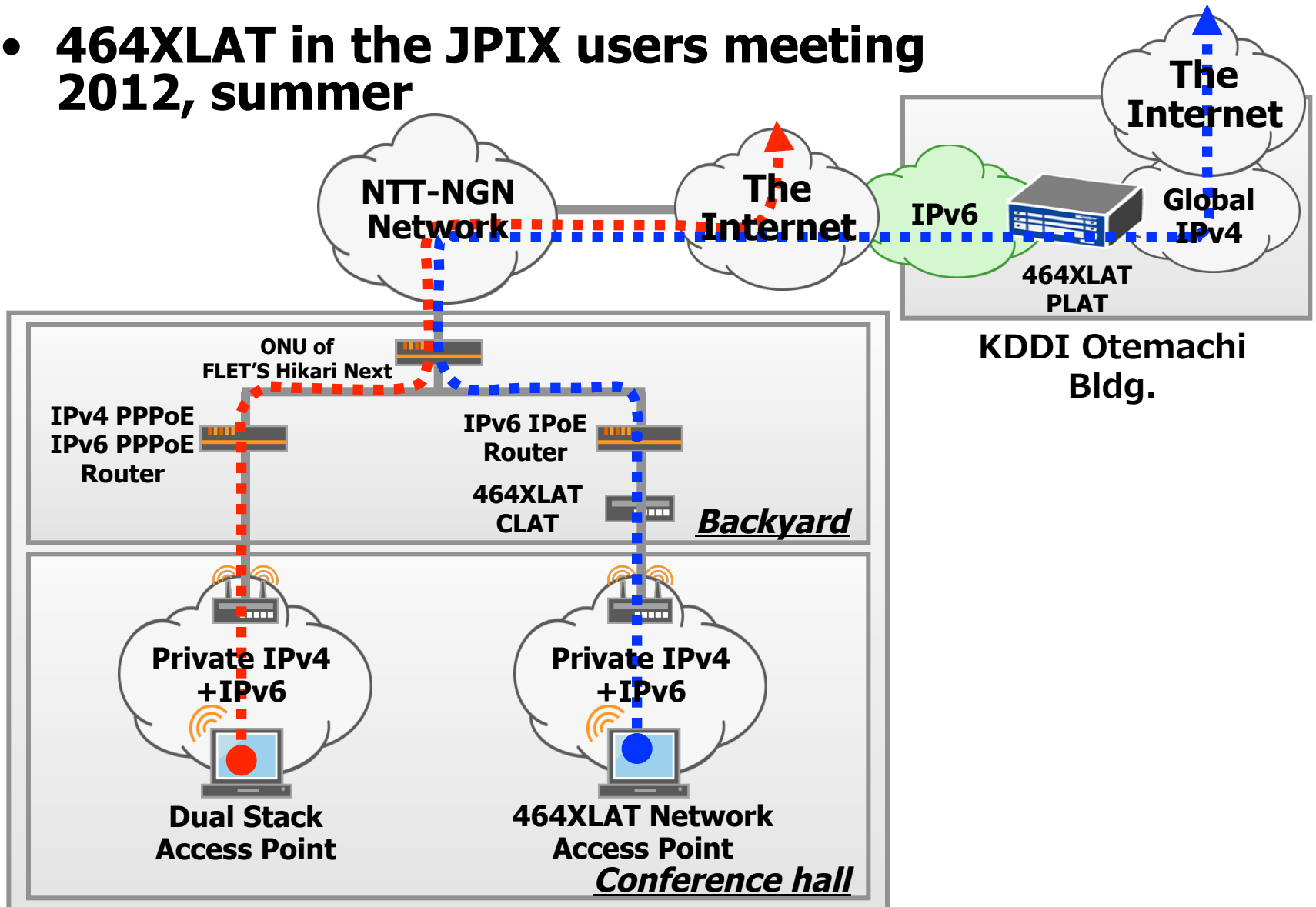
# The other implementations

- **DS-Lite**
  - **AFTR**
    - **ISC AFTR (OSS)**
      - <http://www.isc.org/software/aftr>
  - **B4**
    - **D-Link DIR-835、DIR-865L**
      - [http://files.dlink.com.au/Products/DIR-835/Manuals/DIR-835\\_A1\\_Manual\\_v1.01\(DI\).pdf](http://files.dlink.com.au/Products/DIR-835/Manuals/DIR-835_A1_Manual_v1.01(DI).pdf)
      - [http://files.dlink.com.au/Products/DIR-865L/Manuals/DIR-865L\\_A1\\_Manual\\_v1.00\(DI\).pdf](http://files.dlink.com.au/Products/DIR-865L/Manuals/DIR-865L_A1_Manual_v1.00(DI).pdf)
- **464XLAT**
  - **PLAT**
    - **Ecdysis NAT64 (OSS)**
      - <http://ecdysis.viagenie.ca/>
    - **linuxnat64 (OSS)**
      - [http://en.sourceforge.jp/projects/sfnet\\_linuxnat64/](http://en.sourceforge.jp/projects/sfnet_linuxnat64/)
    - **OpenBSD PF (OSS)**
      - <http://www.openbsd.org/51.html>
  - **CLAT**
    - **Android-clat (OSS)**
      - <http://dan.drown.org/android/clat/>
    - **NEC AccessTechnica CL-AT1000P (Trial)**
      - [http://www.necat.co.jp/press/2010/pre\\_0721.html](http://www.necat.co.jp/press/2010/pre_0721.html)
- **MAP-E, MAP-T**
  - **BR/CE**
    - **ASAMAP/Vyatta (OSS)**
      - <http://enog.jp/~masakazu/vyatta/map/>
      - ASAMAP has compatibility functions with DS-Lite AFTR/B4 and 464XLAT PLAT/CLAT.
    - **IIJ SEIL/X1 (Trial)**
      - <https://www.seil.jp/community/node/71>

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# JPIX experiences (464XLAT trial)

- 464XLAT in the JPIX users meeting 2012, summer

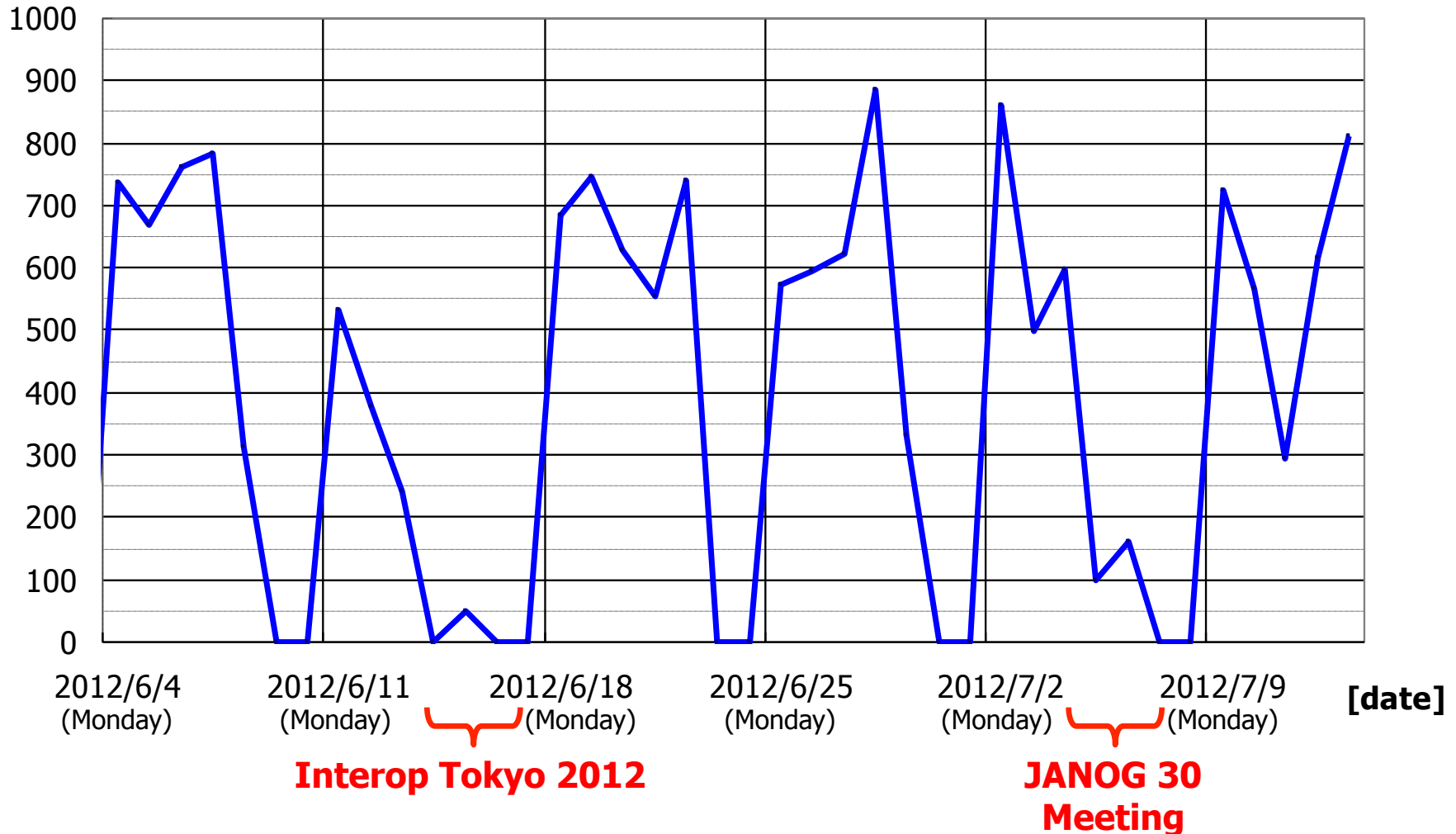


## JPIX Users Meeting Venue

# JPIX experiences (464XLAT trial)

## • Statistics of max session per 1 client

[session]



- **The IPv4 over IPv6 technique...**
  - is a bridge technology between IPv4 network and IPv6 network
  - is a solution to reasonably extend IPv6 internet without major impacts
  - requires an eye for choosing the technique fits for your situation





Japan Internet Exchange Co., Ltd.