Experiences from an IPv6-Only Network in the WIDE Camp Autumn 2011

draft-hazeyama-widecamp-ipv6-only-experience-00

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WIDE camp 2011 autumn

- **The camp was held on Sep. 6th to Sep. 9th**
  - We tried to provide an IPv6 only connectivity as the main connectivity on the camp, and we got feed backs from participants
  - 153 participants joined in this camp and reported various TIPS and troubles to the NOC team

External Network settings

- **As an external link, we used a commercial IPv6 Internet service in Japan**
  - The commercial IPv6 Internet service was provided by NTT East (FTTH), Internet MultiFeed (VNE) and IIJ (IPv6 ISP)

Internal Network settings

- **From Sep.6th to the noon of Sep. 7th, the NOC team provided only an IPv6 only connectivity through DHCP6 with NAT64/DNS64 translation**
  - Like as IETF IPv6 only experiment

- **From the afternoon of Sep. 7th, the NOC team offered two dual stack connectivity**
  - IPv4 connectivity through **SA46T** 464 encapsulation in addition to the IPv6 only connectivity described above
    - Global IPv4 addresses were provided
  - IPv6 connectivity and IPv4 connectivity by **4RD** 464 encapsulation through the commercial IPv6 internet service
    - Private IPv4 addresses were provided

Users experiences on setting up the IPv6 only connectivity

- **Laptop PCs**
  - Windows 7 and Mac OS Lion users were comfortable
    - They were bothered only from waiting fallback / connectivity check routines
    - Many Windows 7 / Mac OS Lion users turned off IPv4 property
  - Of course, Linux / BSD users were comfortable
    - and they were not bothered from waiting fallback routine
  - Other older OS users met many troubles
    - Lack of DHCP6 support
    - Set up local proxy
  - Finally, most participants could set up the connectivity
- **Smart Phones**
  - iOS (ver. 4.3.2 or 4.3.3) could set up IPv6 only
  - However, Android OS (ver. 2.2.3) could not work in IPv6 only setting
    - DNS query of the Android OS might be carried on IPv4 at that moment

Reported troubles in the IPv6 only environment

- **Most of them were same troubles described in draft-arkko-ipv6-only-experience-04**
  - Lack of IPv6 support
  - IPv4 Address literals
  - Non HTTP / XMPP based Instant messaging and VoIP

Other troubles in the IPv6 only environment

- **VPN (IPSec, PPTP, etc.) to IPv4 servers could not be available**
  - Many participants had to set up VPN connections to their companies to read emails, but they could not set up VPNs until the IPv4 connectivity were offered
  - This was one of **the Protocol, Format, and Content Problems** mentioned in draft-arkko-ipv6-only-experience-04

- **We observed inappropriate AAAA replies mentioned in RFC4074**
  - When a DNS64 server received an inappropriate AAAA reply, the DNS64 server stopped the fallback to A query
  - Most of troubles due to such inappropriate AAAA replies were observed in browsing on the search result pages of travel reservation web sites

Inappropriate AAAA replies mentioned in RFC4074 actually occurred !!

- **Observed wrong AAAA replies were as follows;**

✓ **Return "Name Error" (in Section 4.2)**

– An authoritative server returned RCODE 3 (**NXDOMAIN**) to AAAA

✓ **Return "Other Erroneous Codes" (in Section 4.3)**

– An authoritative server returned an **A record** to AAAA

✓ **Return "a Broken Response" (Section 4.4)**

– An authoritative server returned a broken reply to AAAA with **NOERROR** but **Authority section is 0**

Reported Troubles on 464 encapsulation

- **MTU mismatch problems might occur**
  - PPTP to IPv4 servers could be achieved both on SA46T and on 4RD
  - However, some VPN users reported that big volume contents could not be available either on SA46T or on 4RD
  - We considered that an MTU black hole was created, which might be due to PMTUD failures
  - Due to the lack of TIPS, we could not find the mismatch point or causes
- **IPSec VPN was not available on some user environment**
  - Some participant reported that Apple Mobile Me PKI based IPSec to an IPv4 server was not available either on SA46T or on 4RD
  - We could not analyze what was actual cause

Summary

- **IPv6 only connectivity was provided for 153 participants in 4 days**
  - 20% of participants lived only in the IPv6 only connectivity
- **The IPv6 only connectivity was more usable than participants' thought**
- **However, various troubles and problems raised, especially on older OSs or on VPN applications**
- **Inappropriate AAAA replies and MTU mismatch problems would be obstacles on the transition from IPv4 / dual stack to IPv6 only**

Next

- **We are planning further evaluation in next wide camp in march 6th to 9th 2012**

- **Your participation is welcome**

Appendix

External Connectivity

- **IPv6 only Satellite link to WIDE backbone**
  - WIDE backbone has been operated IPv6 since 1995
  - Uplink 512 Kbps, Downlink 1.5 Mbps
- **IPv6 only FTTH**
  - ``Flet's Hikari Next with IPv6 option'' by NTT East
  - ``IIJ mio's FiberAccess/NF for IPv6 native service''by IIJ
  - L2TP over IPv6 tunnel to WIDE backbone provided
    - To utilize a NAT64 service in WIDE backbone

Two configurations

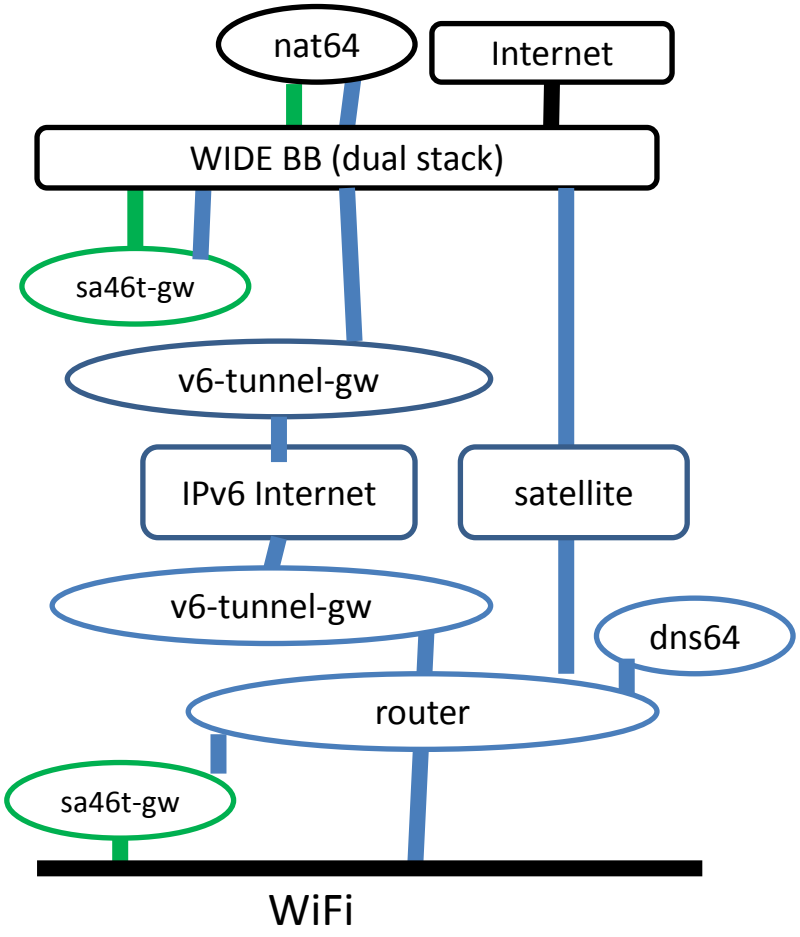
WIDE

1. **IPv6 only connectivity and SA46T**
   - /64 prefix was served from NTT East through RA
   - L2TP tunnel to WIDE backbone was configured
   - NAT64/DNS64 were prepared for IPv4 external services
   - SA46T tunnel was prepared for IPv4 only OSs or apps.
   - IPv4 and IPv6 were routed from WIDE backbone
2. **with 4RD**
   - /48 prefix was served from NTT East through DHCP6
   - 4RD-BR on WIDE backbone was prepared by vyatta
   - 4RD-CE on the hotel prepared by IIJ's SEIL router
   - IPv6 was routed through IIJ
   - IPv4 was routed from WIDE backbone

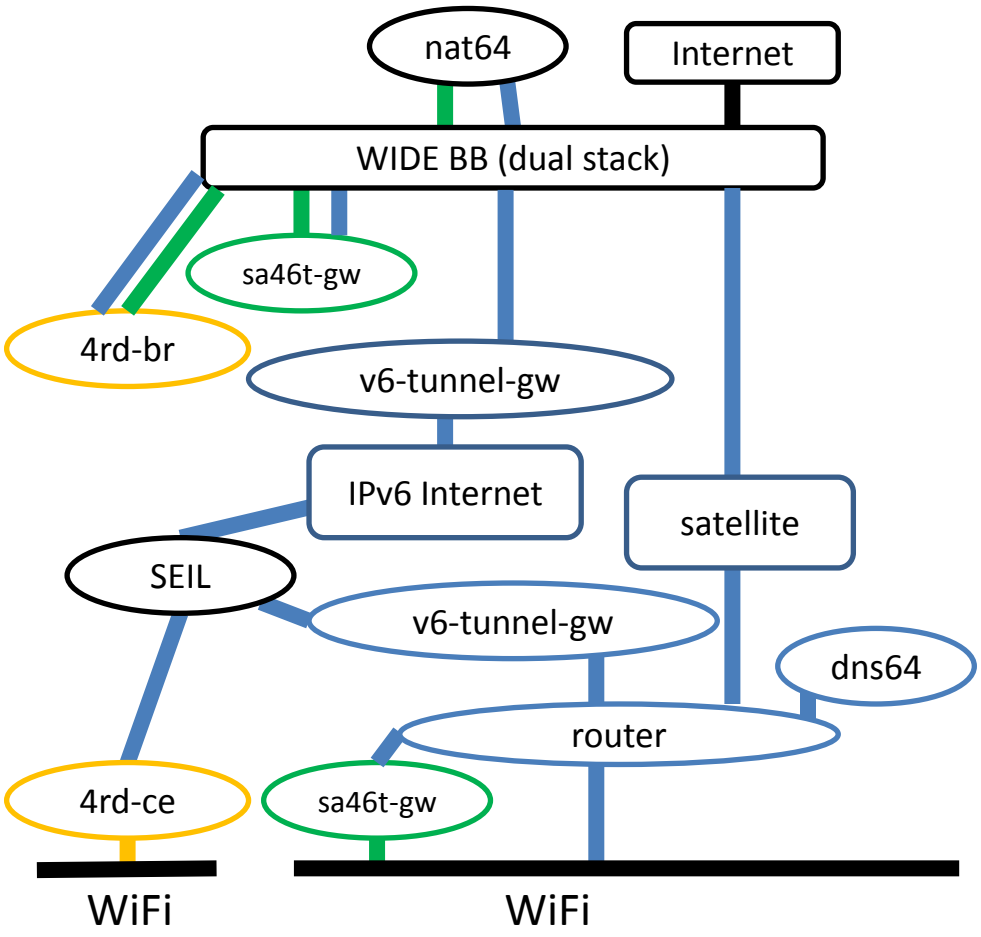
Topologies on IPv6 exp.

WIDE

[Configuration 1]



[Configuration 2]



Implementations employed in the WIDE camp

- **NAT64**
  - linuxnat64
  - http://linuxnat64.sourceforge.net/
- **DNS64**
  - ISC bind 9.8p4
  - http://www.isc.org/software/bind
- **DHCP4 / DHCP6**
  - ISC dhcp
  - http://www.isc.org/software/dhcp
- **SA46T**
  - Software implementation by Fujitsu and Keio univ.
- **4RD**
  - Vyatta 4RD extension (4RD-BR)
    - http://bougaidenpa.org/masakazu/archives/176
  - IIJ SEIL implementation (4RD-CE)
- **L2TP over IPv6**
  - git clone git://quina.sfc.wide.ad.jp/git/v6tun.git