

# WIDE Internet Overview

-- Network TestBeds in WIDE Project --

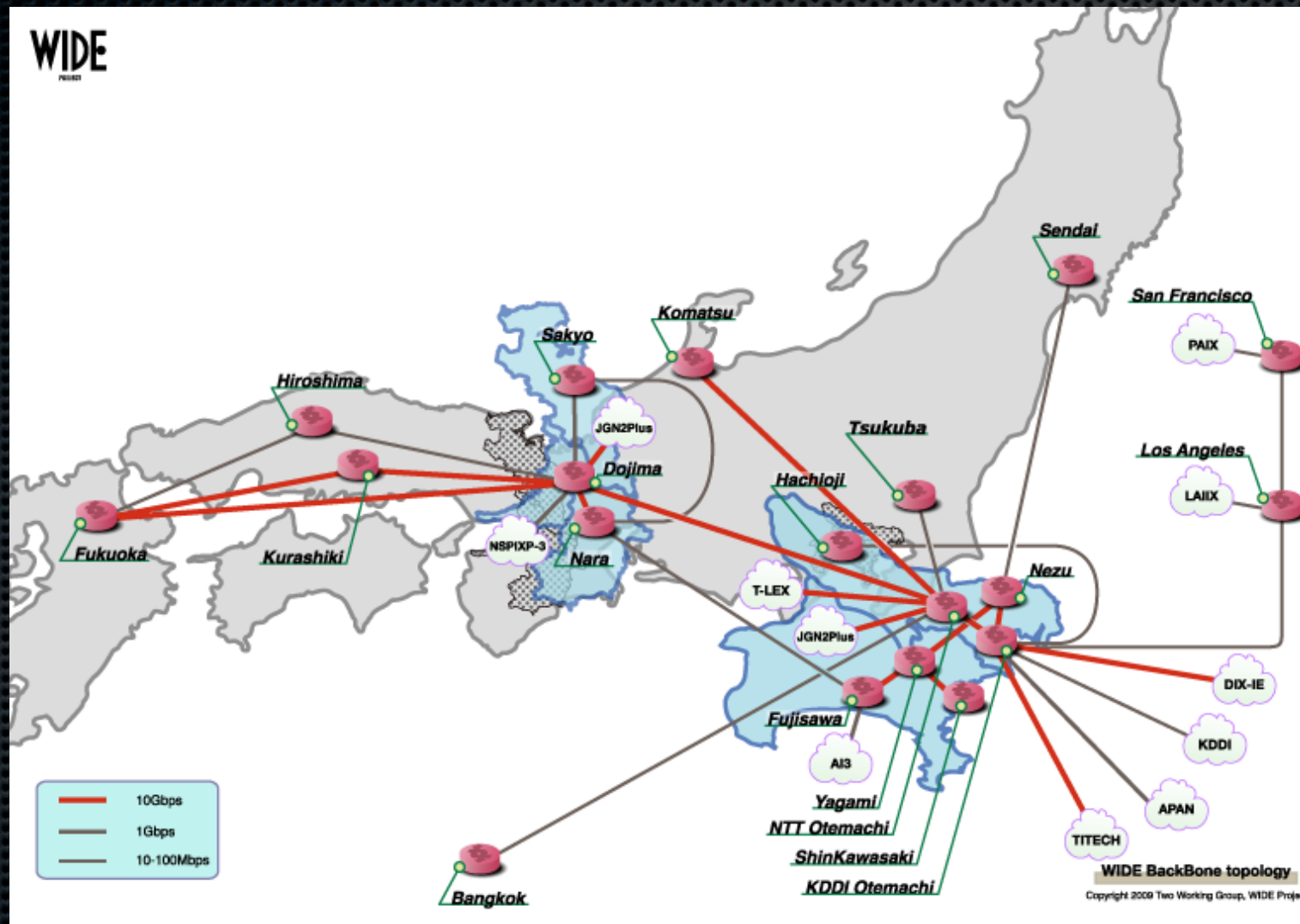


Yuji Sekiya [ The Univ. of Tokyo / WIDE Project ]

# WIDE Backbone

- ✦ We have nationwide Backbone in Japan.
- ✦ The universities and companies which joined in WIDE Project are connected to WIDE backbone
- ✦ Provide connectivity to
  - ✦ University / Industrial users and researchers.
- ✦ Large Scale Testbed in actual environments with
  - ✦ Real Traffic and Real User.

# Overview of WIDE backbone



# TestBed activities in WIDE

- ✦ IPv6 / IPv4 dual stack operation
- ✦ Public Services
- ✦ Traffic Measurements (Active and Passive)
- ✦ WIDE Cloud
- ✦ Traceback Technology
- ✦ WIDE camp experiments

# IPv4 / IPv6 dual stack operation

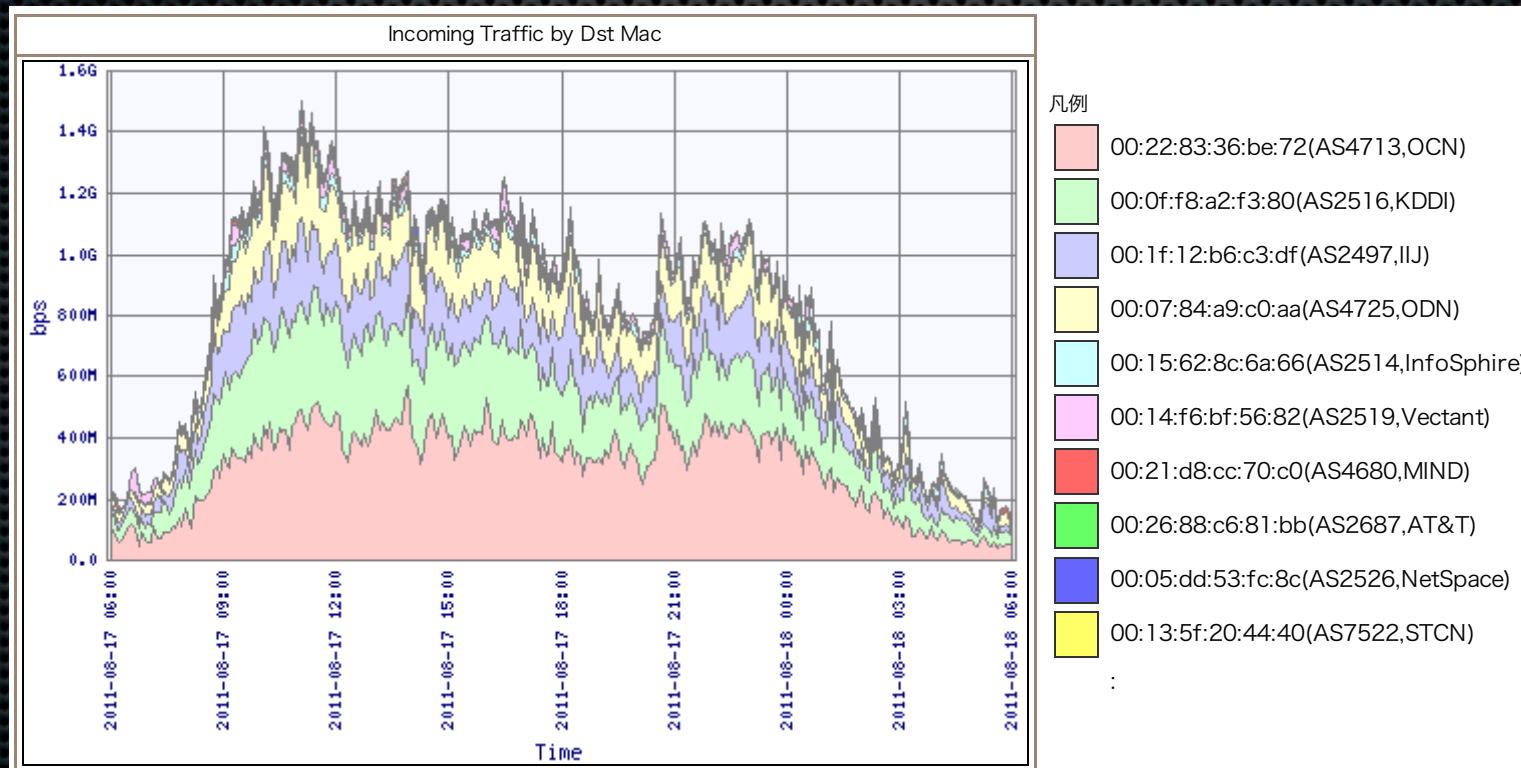
- Fully IPv6 / IPv4 dual stack environments
  - Fully Native IPv6, No tunnel
  - IPv6 Multicast (PIM-SSM)
- Operating two IXes
  - DIX-IE (Distributed Internet eXchange in Edo Area)
  - NSPIXP-3 (Osaka Area)

# Public Services

- ✦ WIDE Project accommodates public services
  - ✦ Large Scale dual stack FTP (<ftp://ftp.jaist.ac.jp/>)
  - ✦ 6to4 / Teredo Server (<http://www.tokyo6to4.net/>)
  - ✦ DNS
    - ✦ JP DNS Servers
    - ✦ Root DNS Servers ( <http://m.root-servers.org/>)
  - ✦ Providing Real Traffic data
    - ✦ <http://mawi.wide.ad.jp/mawi/>

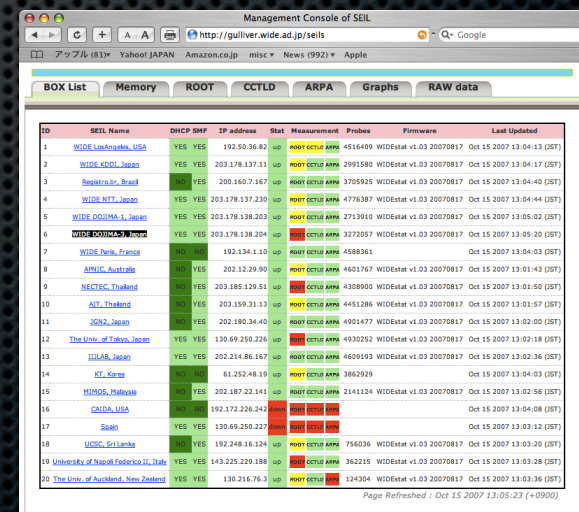
# Passive Traffic Measurements in WIDE

- ✦ Traffic Measurement at IX using sFlow
- ✦ Traffic from ftp.jaist.ac.jp when New FireFox was released.



# Active Measurements in WIDE

- ✦ Gulliver Project
  - ✦ Active Measurement Framework
  - ✦ Performing DNS Active Measurement since 2006
  - ✦ <http://gulliver.wide.ad.jp/>
- ✦ Probes DNS reachability from worldwide locations
  - ✦ RTT, Query Timeout
  - ✦ Node ID (hostname.bind or server.id)
  - ✦ 34 Probe Locations as of Feb. 2011
  - ✦ Including South/East Asia and Africa countries



ID	SEIL Name	DHCP	SNMP	IP address	Stat	Measurement	Probes	Firmware	Last Updated
1	WIDE.LosAngeles_USA	YES	YES	192.50.36.82	up	HOOT CCTUA APP	4516409	WIDeStat v1.03 20070817	Oct 15 2007 13:04:13 (ST)
2	WIDE.KDDI_Japan	YES	YES	203.178.137.11	up	HOOT CCTUA APP	2991580	WIDeStat v1.03 20070817	Oct 15 2007 13:04:17 (ST)
3	Brazil.br_Brazil	YES	YES	200.160.7.167	up	HOOT CCTUA APP	3705925	WIDeStat v1.03 20070817	Oct 15 2007 13:04:40 (ST)
4	WIDE.NTT_Japan	YES	YES	203.178.137.230	up	HOOT CCTUA APP	4776387	WIDeStat v1.03 20070817	Oct 15 2007 13:04:44 (ST)
5	WIDE.DOJIMA_1_Japan	YES	YES	203.178.138.203	up	HOOT CCTUA APP	2713610	WIDeStat v1.03 20070817	Oct 15 2007 13:05:02 (ST)
6	WIDE.DOJIMA_2_Japan	YES	YES	203.178.138.204	up	HOOT CCTUA APP	3272057	WIDeStat v1.03 20070817	Oct 15 2007 13:05:20 (ST)
7	WIDE.Park_France	YES	YES	192.134.1.10	up	HOOT CCTUA APP	4588361	WIDeStat v1.03 20070817	Oct 15 2007 13:04:03 (ST)
8	AWIC_Australia	YES	YES	202.12.29.90	up	HOOT CCTUA APP	4601767	WIDeStat v1.03 20070817	Oct 15 2007 13:01:43 (ST)
9	NETEC_Thailand	YES	YES	203.185.129.51	up	HOOT CCTUA APP	4308906	WIDeStat v1.03 20070817	Oct 15 2007 13:01:50 (ST)
10	AIT_Thailand	YES	YES	203.159.31.13	up	HOOT CCTUA APP	4451286	WIDeStat v1.03 20070817	Oct 15 2007 13:01:57 (ST)
11	SON2_Japan	YES	YES	202.180.34.40	up	HOOT CCTUA APP	4901477	WIDeStat v1.03 20070817	Oct 15 2007 13:02:00 (ST)
12	The Univ. of Tokyo_Japan	YES	YES	130.69.250.226	up	HOOT CCTUA APP	4930252	WIDeStat v1.03 20070817	Oct 15 2007 13:02:18 (ST)
13	UIAAB_Japan	YES	YES	202.214.86.167	up	HOOT CCTUA APP	4609193	WIDeStat v1.03 20070817	Oct 15 2007 13:02:36 (ST)
14	KT_Score	YES	YES	61.252.48.19	up	HOOT CCTUA APP	3862929	WIDeStat v1.03 20070817	Oct 15 2007 13:04:03 (ST)
15	MIMOS_Malaysia	YES	YES	202.187.22.141	up	HOOT CCTUA APP	2141124	WIDeStat v1.03 20070817	Oct 15 2007 13:02:56 (ST)
16	CAIDA_USA	YES	YES	193.172.226.242	up	HOOT CCTUA APP	4588361	WIDeStat v1.03 20070817	Oct 15 2007 13:04:08 (ST)
17	Sooni	YES	YES	130.69.250.227	up	HOOT CCTUA APP	4588361	WIDeStat v1.03 20070817	Oct 15 2007 13:03:12 (ST)
18	UCSC_SciLabs	YES	YES	192.248.16.124	up	HOOT CCTUA APP	756036	WIDeStat v1.03 20070817	Oct 15 2007 13:03:20 (ST)
19	University of Naacki Federico II_Italy	YES	YES	143.225.229.188	up	HOOT CCTUA APP	362215	WIDeStat v1.03 20070817	Oct 15 2007 13:03:28 (ST)
20	The Univ. of Auckland, New Zealand	YES	YES	130.216.76.3	up	HOOT CCTUA APP	124304	WIDeStat v1.03 20070817	Oct 15 2007 13:03:36 (ST)



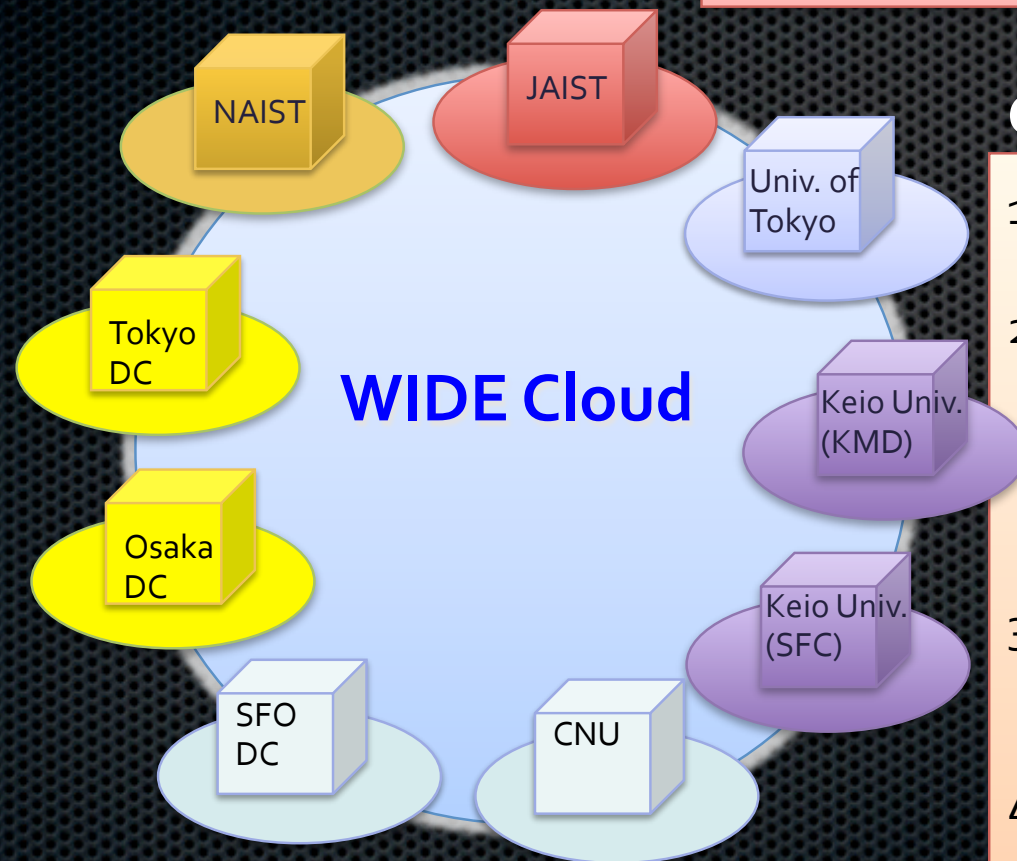
# WIDE Cloud



- ✦ Distributed IaaS Environments
  - ✦ Inter-university / Datacenter IaaS cloud
  - ✦ Share the computing and networking resources
- ✦ Large-Scale Testbed with real users
  - ✦ University and Industrial users
  - ✦ Testbed for advanced technologies
- ✦ <https://wcc.wide.ad.jp/>

# Overview of WIDE Cloud

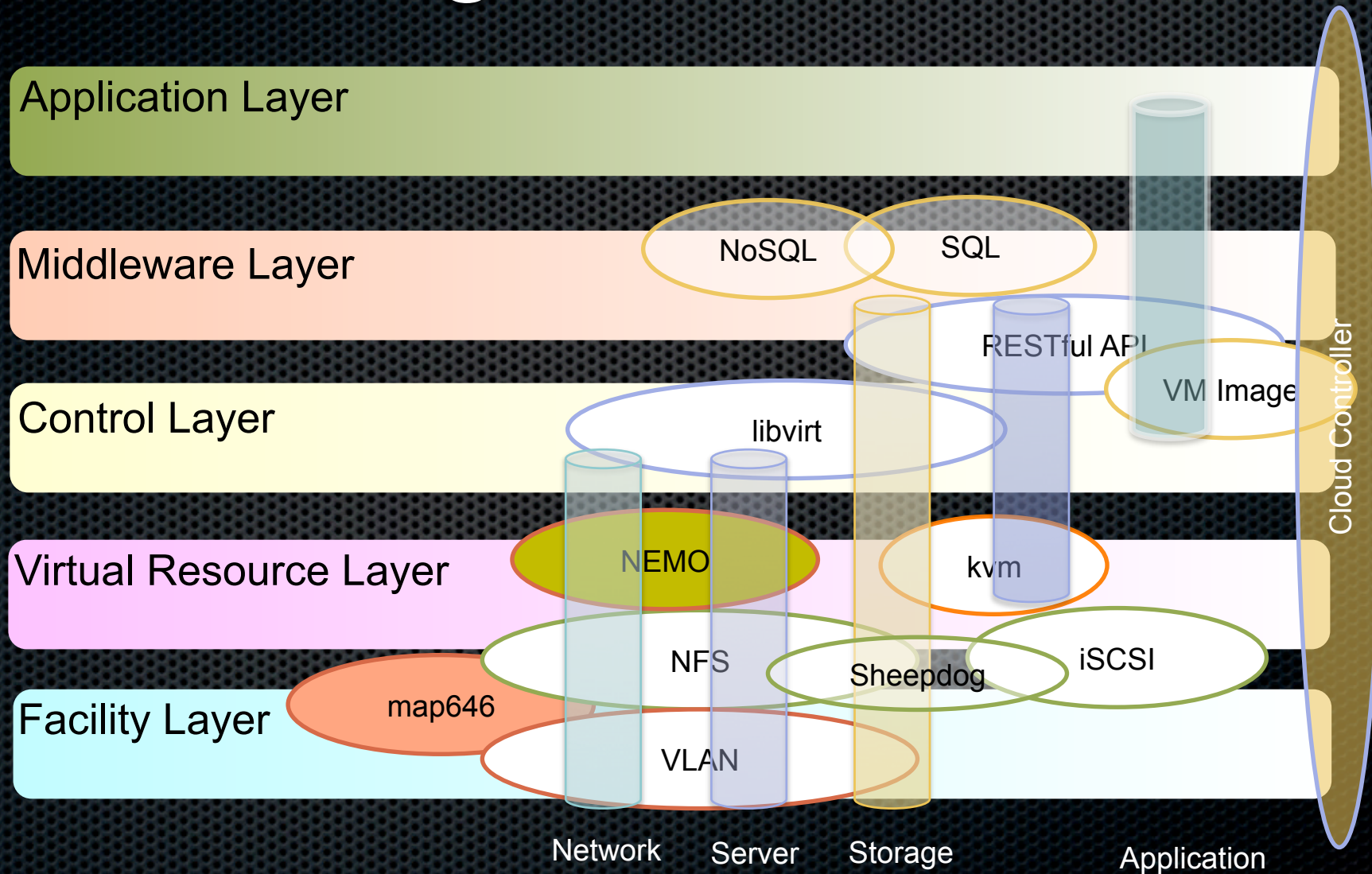
Inter-University Cloud  
Sharing the resources on each private cloud



## Challenges of WIDE Cloud

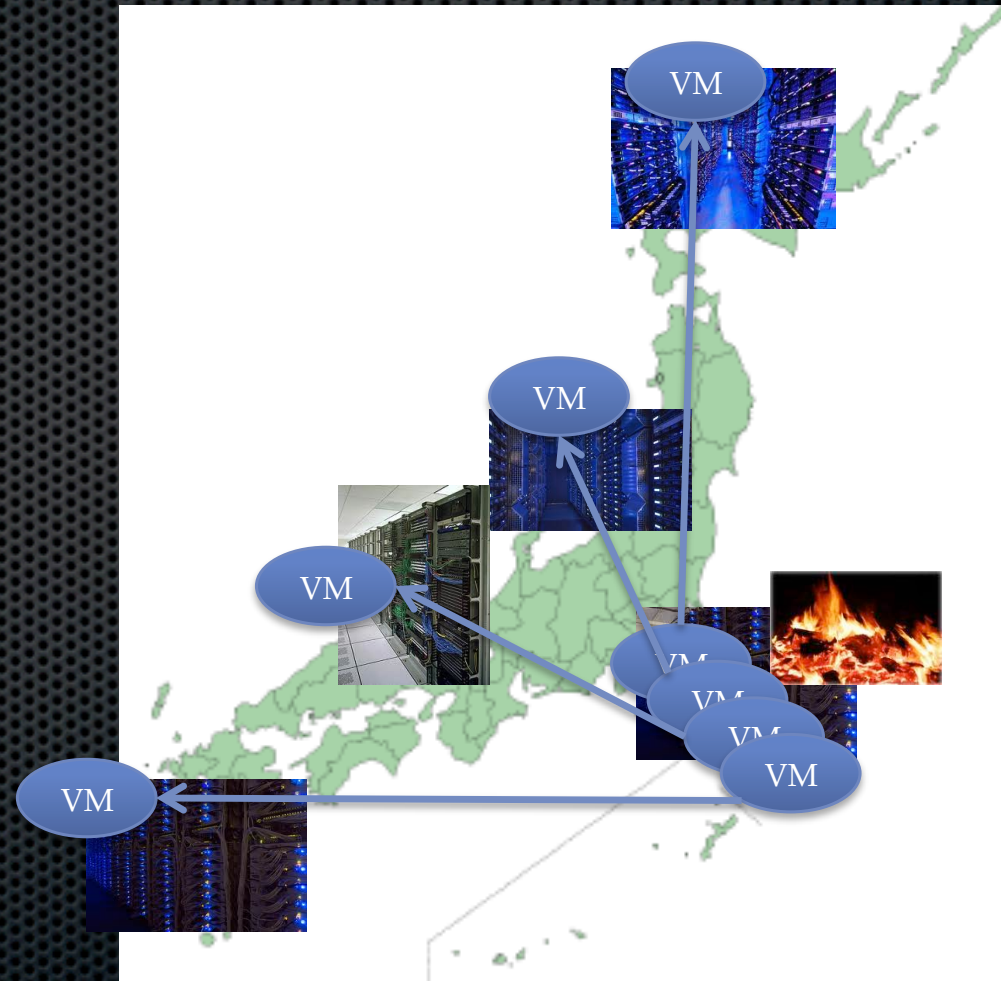
1. Widely Distributed IaaS
2. Constructed using commodity Internet Reachability, not dedicated circuits.
  - Full IPv6
3. Resource sharing based on the policies of each organization
4. Redundant Architecture
  - Disaster Recovery

# Technologies of WIDE Cloud



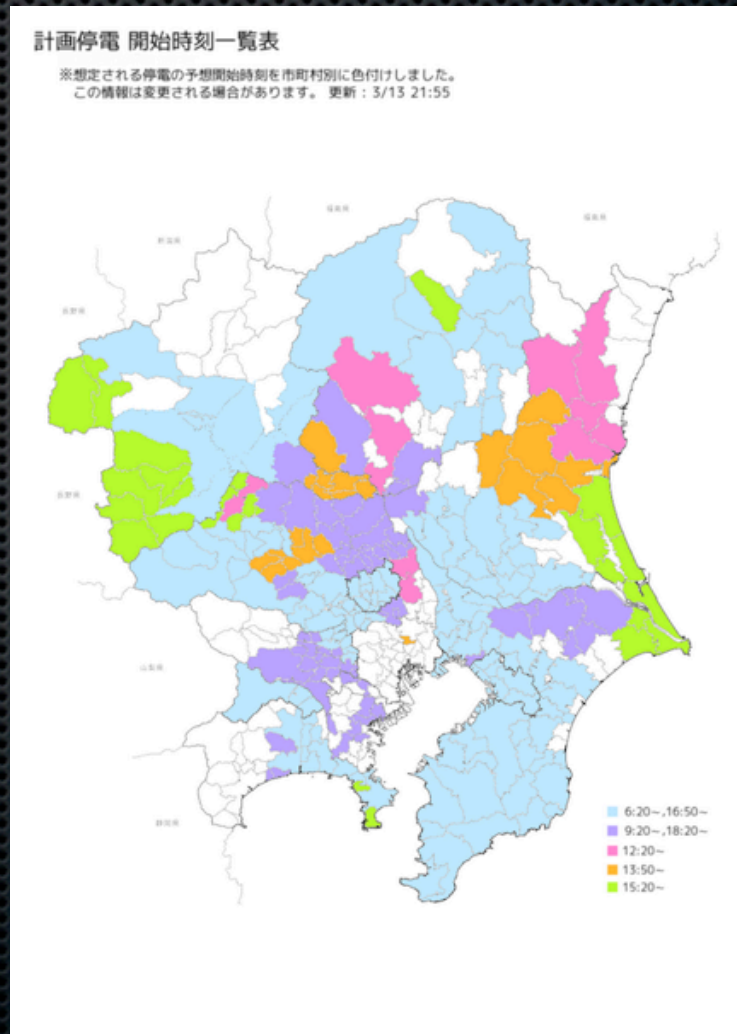
# Why we need location-level redundancy ?

- In Japan, we had a big earthquake on Mar. 11th.
  - We encounter a serious problem of power supply in Tokyo and Tohoku areas.
- In March, there were scheduled blackouts in Tokyo Area
  - Unfortunately, Keio University had two hours blackout twice a day.
  - There are several important servers in Keio University.
  - Need to shutdown servers or use UPS / Generator



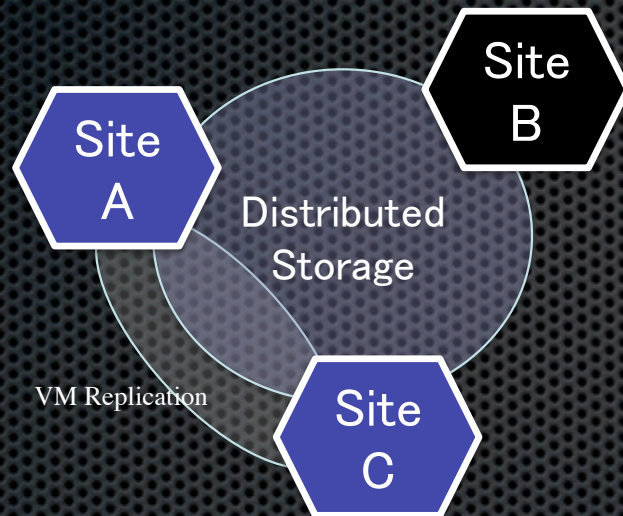
# Rolling Blackout

- ✦ 3/13 Announcement from TEPCO
  - ✦ from 3/14 early morning
- ✦ Fujisawa, Hiyoshi, Yagami, K2, and other NOCs were affected
  - ✦ Fujisawa-NOC has many servers of WIDE Project



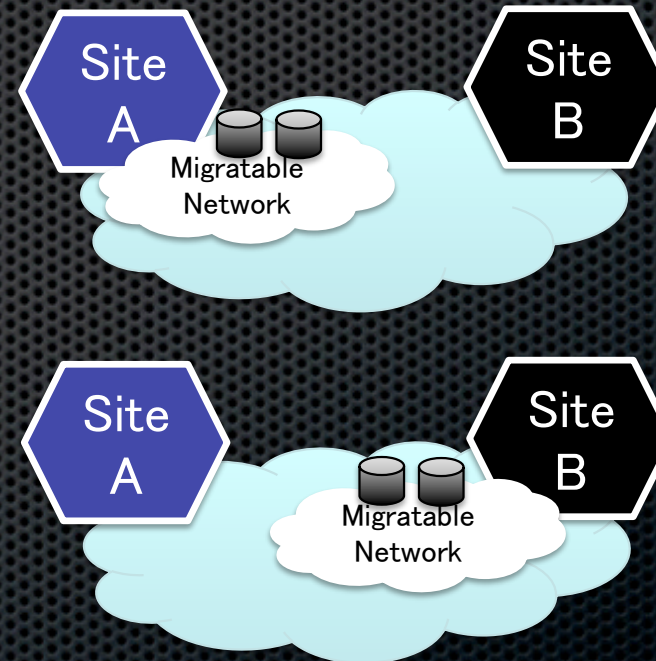
# Challenges of WIDE Cloud

## Recovery from site trouble



- VM real-time replication
- DHT based distributed filesystem
- Differential Filesystem

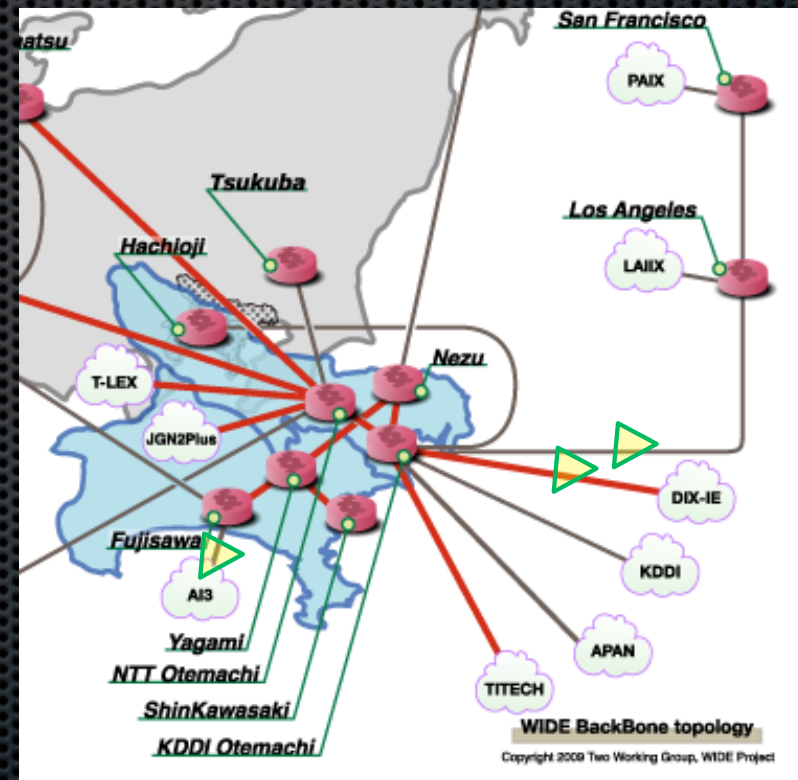
## Flexibility of networks attached to VMs



- Mobile IPv6 based NEMO
- VXLAN
- LISP

# Traceback Technology

- ✦ Using Hash-based IP Traceback as an internal out band management tool
  - 3 software capture probes on the borders on WIDE-BB with optical splitters
  - Developing and debugging through a long run field test



▶ Monitoring Point

# Traceback Probes

- ✦ Implementation : InterTrack

<http://intertrack.naist.jp/>

- Servers

## **KDDI Otemachi NOC (DIX-IE <-> WIDE )**

One JCS server (Xeon 2 core) with two myri 10G-LR cards

Capturing optical-split traffic

## **NTT Otemachi NOC (NTT-America <-> WIDE)**

One Dell server (Xeon 8core x 2) with two intel 1G-LX cards

Capturing optical-split traffic

## **Fujisawa NOC (AI3 <-> WIDE)**

One Amaze Blast server with one intel 1G-SX card

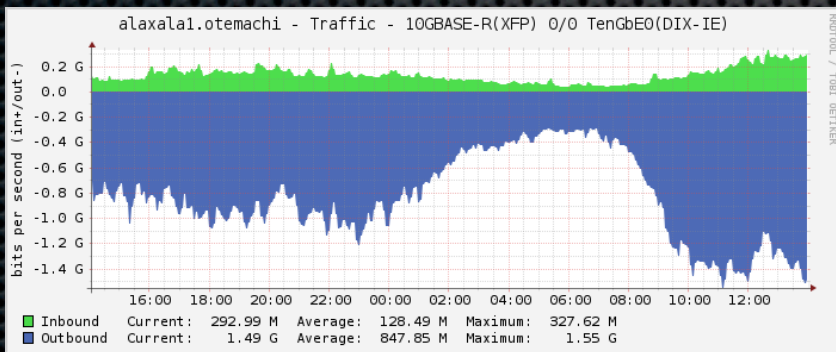
capturing port mirror traffic



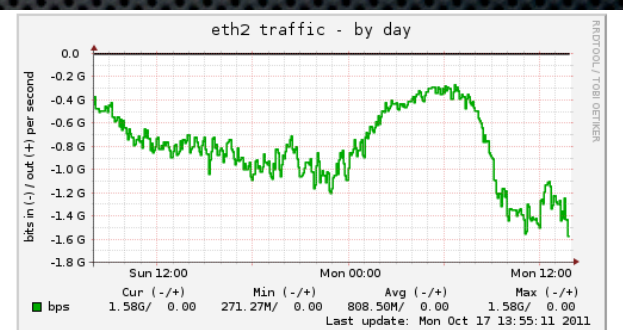
# Usage: Out band Traffic Monitoring

- Packet Counter on DIX-IE Border Router

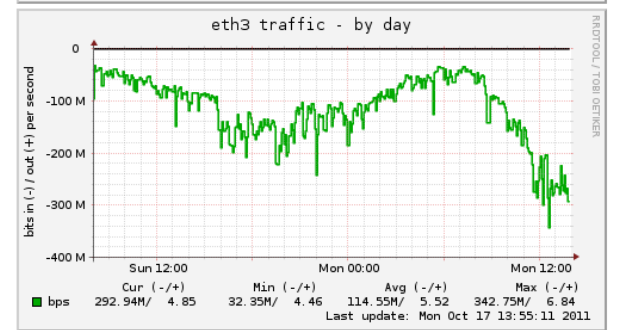
- Captured Packet Counter on DIX-IE Traceback probe



Outgoing to dix-ie



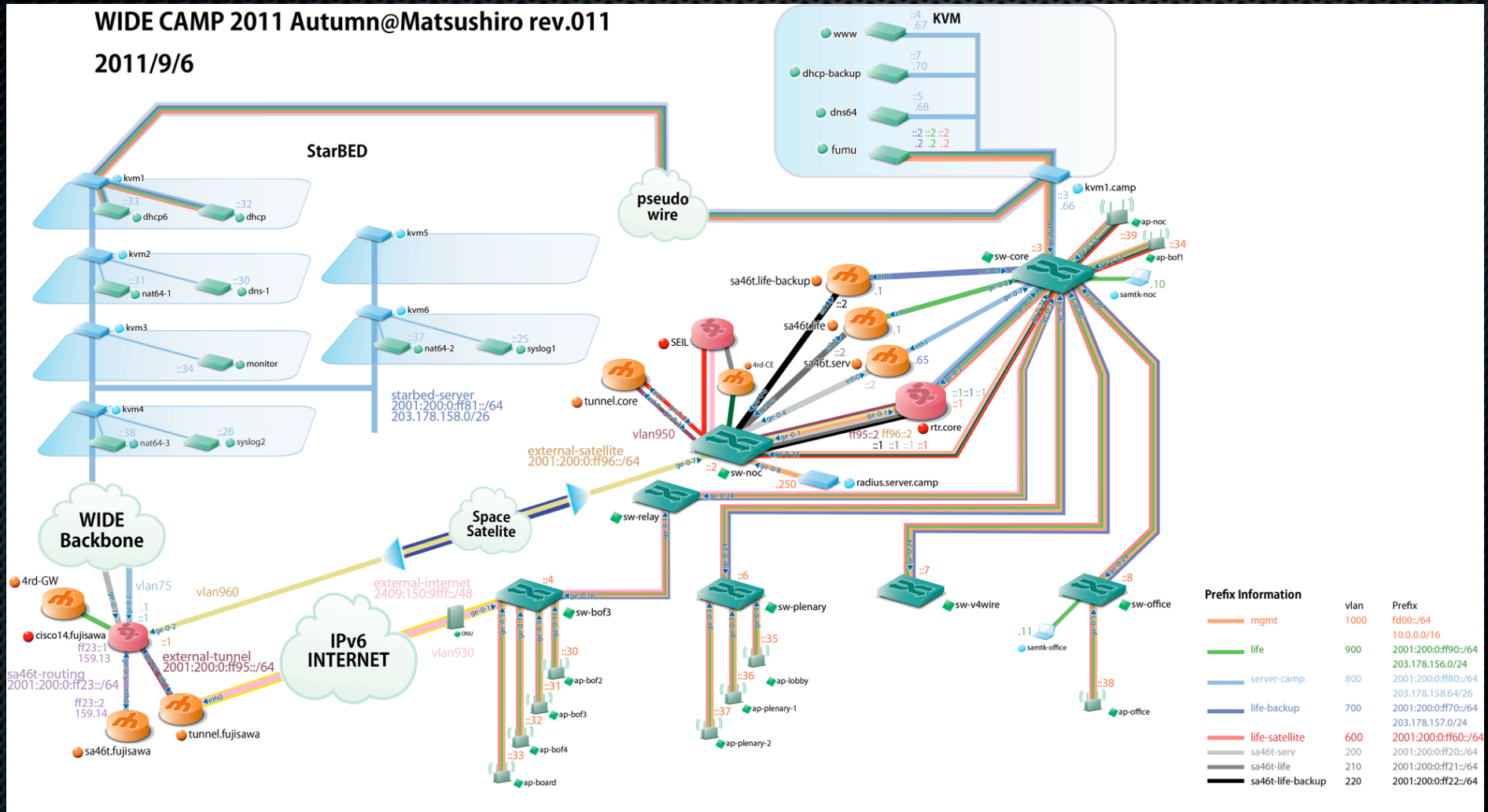
Incoming from dix-ie



# WIDE camp 2011 autumn

- **At Matsushiro Royal hotel (Nagano Prefecture)**
  - 151 participants discussed new research topics, joined experiments, developed some applications, wrote his/her paper, and so on.
- **The purpose of the WIDE Camp network**
  - Constructing an experimental network (camp-net) with new ideas / new perspectives / new technologies by younger researchers / students
  - Testing and debugging the experimental network with participants' live feedbacks.
- Paper are available : Hiroaki Hazeyama, et al., "How much can we survive on an IPv6 network? - Experience on the IPv6 only connectivity with NAT64/DNS64 at WIDE camp 2011 autumn", Asia Workshop on Future Internet Technologies (AWFIT2011)

# Network Topology in WIDE Camp



# NAT64 implementations

- We evaluated 3 implementations of NAT64 in pre-hotstage days (from July.1st to Aug 30th)
  - Linuxnat64
    - Stateful
    - Works well on the camp-net design
    - <http://linuxnat64.sourceforge.net/>
  - Tayga
    - Stateless
    - <http://www.litech.org/tayga/>
  - ecdysis
    - Stateful
    - Collapse TCP payloads
    - <http://ecdysis.viagenie.ca/>

# DNS64 implementations

- We also evaluated 3 implementations of DNS64 in pre-hotstage days (from July.1st to Aug 30th)
  - Bind 9.8 p4
    - Work well
    - <http://www.isc.org/software/bind>
  - ecdysis' bind
    - Did not work
    - <http://ecdysis.viagenie.ca/>
  - ecdysis' Unbound
    - Did not work
    - <http://ecdysis.viagenie.ca/>

# Thank you !

- ✦ Any comments and questions ?