Nautilus6 Summary

2008-06-16 KT-WIDE Workshop

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Internet Initiative Japan / WIDE Project

IIJ
Internet Initiative Japan

WIDE
PROJECT

What is Nautilus6?

- Established in 2002
- In collaboration with many foreign organizations
  - ULP France, INRIA France, ENST Bretagne France, INT France, FT R&D France, SNU Korea
- Aiming at
  - Standardize, implement and deploy IPv6 mobility protocols
  - Provide protocol stacks and operation software
  - Operate IPv6 mobility protocols

Standardization

- IETF NEMO WG startup by Thierry Ernst
- IETF MONAMI6 WG startup by Thierry Ernst and Nicolas Montavont
- Many Internet-Drafts and RFCs contribution in mobility related WGs in IETF

Published I-Ds (Authored or Co-authored)

- Network Mobility Support Terminology (draft-ietf-nemo-terminology)
- Network Mobility Support Requirements (draft-ietf-nemo-requirements)
- Goals and Benefits of Multihoming (draft-ernst-generic-goals-and-benefits)
- Analysis of Multihoming in Network Mobility Support (draft-ietf-nemo-multihoming-issues)
- Analysis of Multiple Mobile Routers Cooperation (draft-tsukada-nemo-mr-cooperation-analysis)
- Evaluating Multiple Mobile Routers and Multiple NEMO-Prefixes in NEMO Basic Support (draft-kuntz-nemo-multihoming-test)
- Analysis of Multihoming in Mobile IPv6 (draft-montavont-mobileip-multihoming-pb-statement)
- Multiple Care-of Addresses Registration (draft-wakikawa-mobileip-multiplecoa)
- Route Optimization with Nested Correspondent Nodes (draft-watari-nemo-nested-cn)
- Using IPsec between Mobile Node and Correspondent IPv6 Nodes (draft-ietf-mip6-cn-ipsec)
- IPv4 Mobile Network Prefix Option for NEMO Basic Support Protocol (draft-shima-nemo-v4prefix)
- PF_KEY Extensions an Interface between Mobile Ipv6 and Ipsec/IKE (draft-sugimoto-mip6-pfkey-migrate)
- AND OTHERS
  - http://www.nautilus6.org/doc.php

Published Papers

- Designing and Implementing IPv6 Mobility stack on BSD Operating Systems, Computer Software
- A Practical Evaluation of the Nautilus6 Operational Home Agent Service, IPv6TD'07
- Simultaneous Usage of NEMO and MANET for Vehicular Communication, WEEDEV 2008
- Advantages of Flow Bindings: an embedded mobile network use case, TRIDENTCOM 2008
- E-bicycle demonstration on Tour de France, ICCGI '07
- Vehicle Communication Experiment Environment With MANET And NEMO, WONEMO
- Deploying reliable IPv6 temporary networks thanks to NEMO Basic Support and Multiple Care-of Addresses registration, WONEMO
- Building a Fault Tolerant Network using a Multihomed Mobile Router: A Case Study, AINTEC
- SHISA: The Mobility Framework for BSD Operating Systems, IPv6TD'06
- Operational Experiment of Seamless Handover of a Mobile Router using Multiple Care-of Address Registration, Journal of Networks
- Evaluation of NEMO Communications Using Hybrid Measurement, ITST
- AND OTHERS
  - http://www.nautilus6.org/doc.php

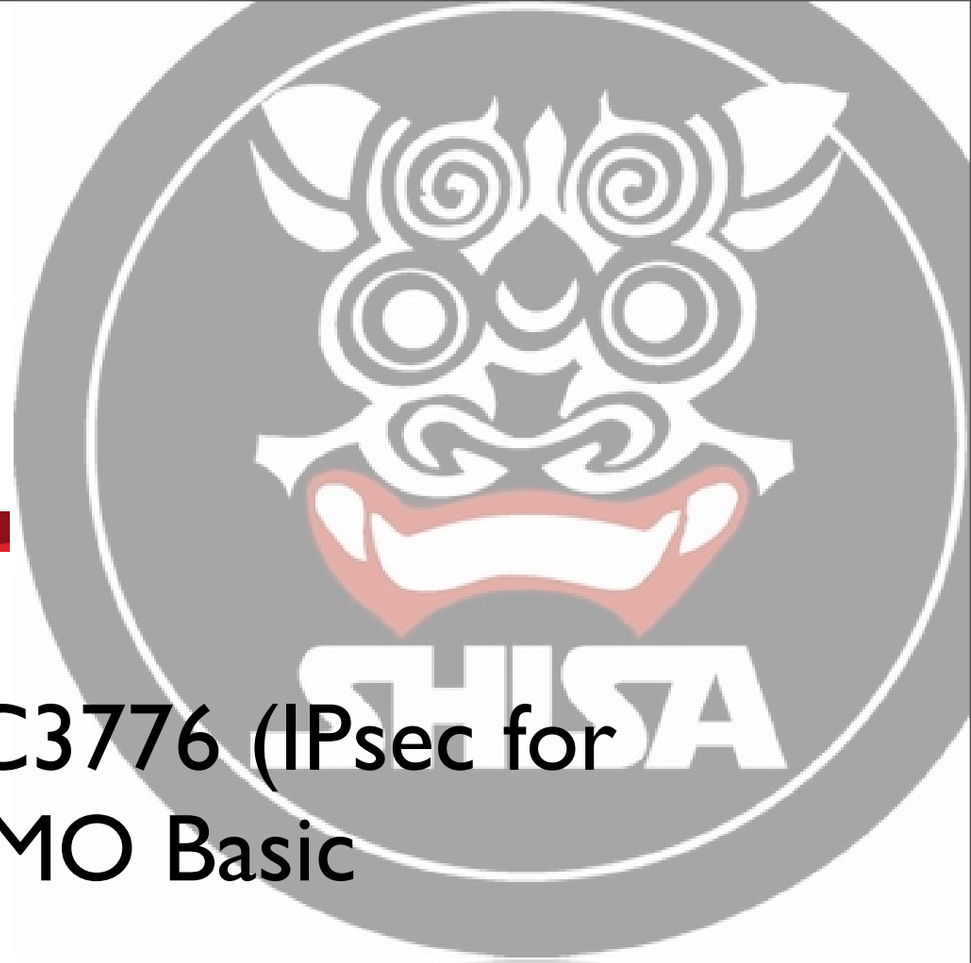
Implementation

- Mobility protocols
  - SHISA: BSD based implementation
  - NEPL: Linux based implementation
- IKEv2 extension for MIPv6
- L2 Trigger for optimized handoff
- DIAMETER / PANA

SHISA

- Mobile IPv6 / NEMO BS protocol stack for BSD operating systems
- Developed as a part of the KAME project originally
  - Now it continues as a standalone project
- Now focusing on integration to NetBSD
  - A part of the code is available as the ‘keiichi-mipv6 ‘ branch at NetBSD CVS

SHISA



- Supported features
  - RFC3775 (Mobile IPv6), RFC3776 (IPsec for Mobile IPv6), RFC3963 (NEMO Basic Support)
- Advanced features
  - Multiple Care-of Addresses Registration
    - draft-ietf-monami6-multiplecoa
  - Dual Stack Mobile IPv6
    - draft-ietf-mip6-nemo-v4traversal
  - Global HAHA
- http://www.mobileip.jp/

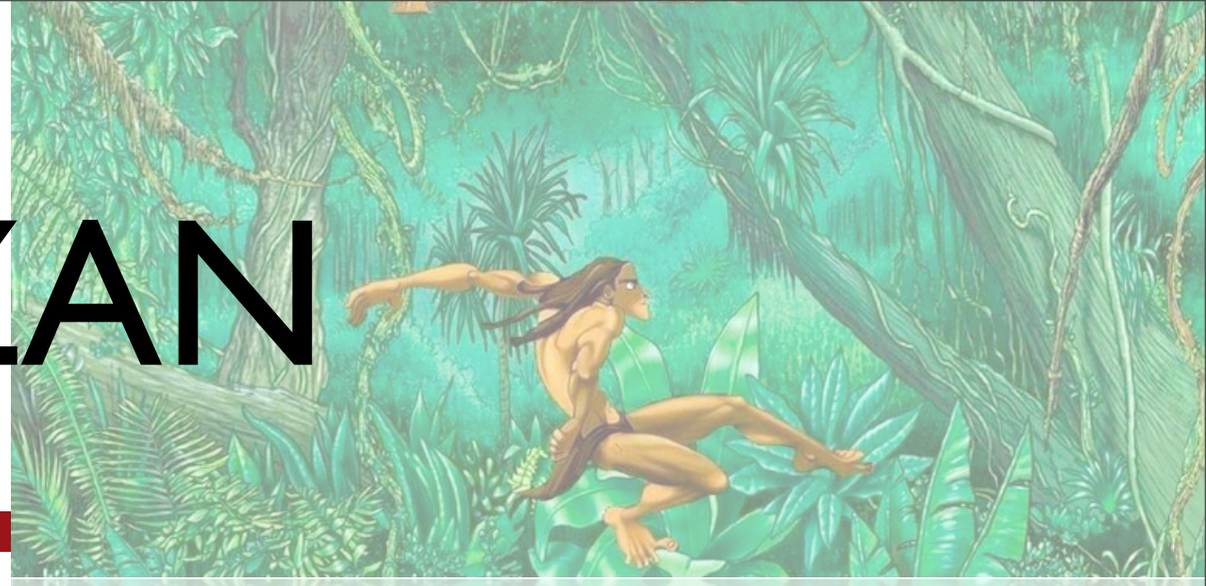
USAGI Mobile IPv6

- Mobile IPv6 protocol stack for Linux operating system
- Developed as a part of the USAGI Project
- Supports RFC3775 (Mobile IPv6) and RFC3776 (IPsec for Mobile IPv6)
- Code has merged to Linux kernel 2.6.19
  - CN function is running
  - Other functions follow

NEPL: NEMO Platform for Linux

- Collaborative work with the USAGI Project and the Go-core Project
- Supported specs
  - NEMO Basic Support (RFC3963)
  - Multiple Care-of Addresses Registration (draft-ietf-monami6-multiplecoa)
  - Dual Stack Mobile IPv6 (draft-ietf-mip6-nemo-v4traversal)
- http://software.nautilus6.org/

TARZAN



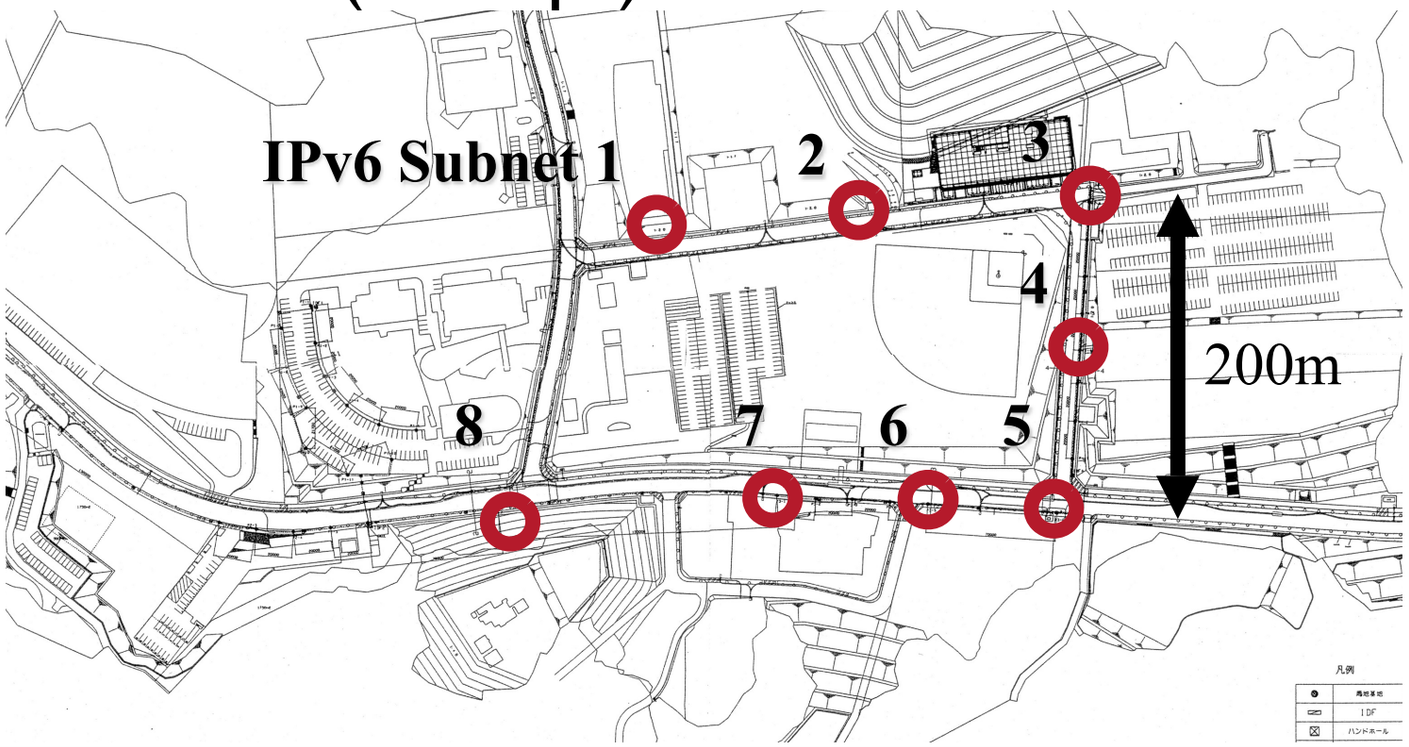
- Implementation of FMIPv6 for FreeBSD 5 operating system
  - Based on the SHISA mobility stack
  - draft-ietf-mipshop-fast-mipv6-03 base
  - Supports both Predictive & Reactive modes
- Development is currently suspended
- http://software.nautilus6.org/

LIES: the Inter Layer Information Exchange System

- L3 handover mechanism can be enhanced by utilizing L2 handover information
- A standard API to interact between L2 and L3 is necessary
- A draft proposal is submitted to the IRTF as draft-irtf-mobopts-l2-abstractions

LIES Demonstration

- Application: DVTS
  - Half rate: 15Mbps
  - from MN on a car to a fixed PC
- L3 Mobility: LIN6
- L2: IEEE802.11a (54Mbps)



- Disruption time 3~4ms
  - L2: 1~2ms (constant)
  - L3: 1~2ms (depends on the RTT)

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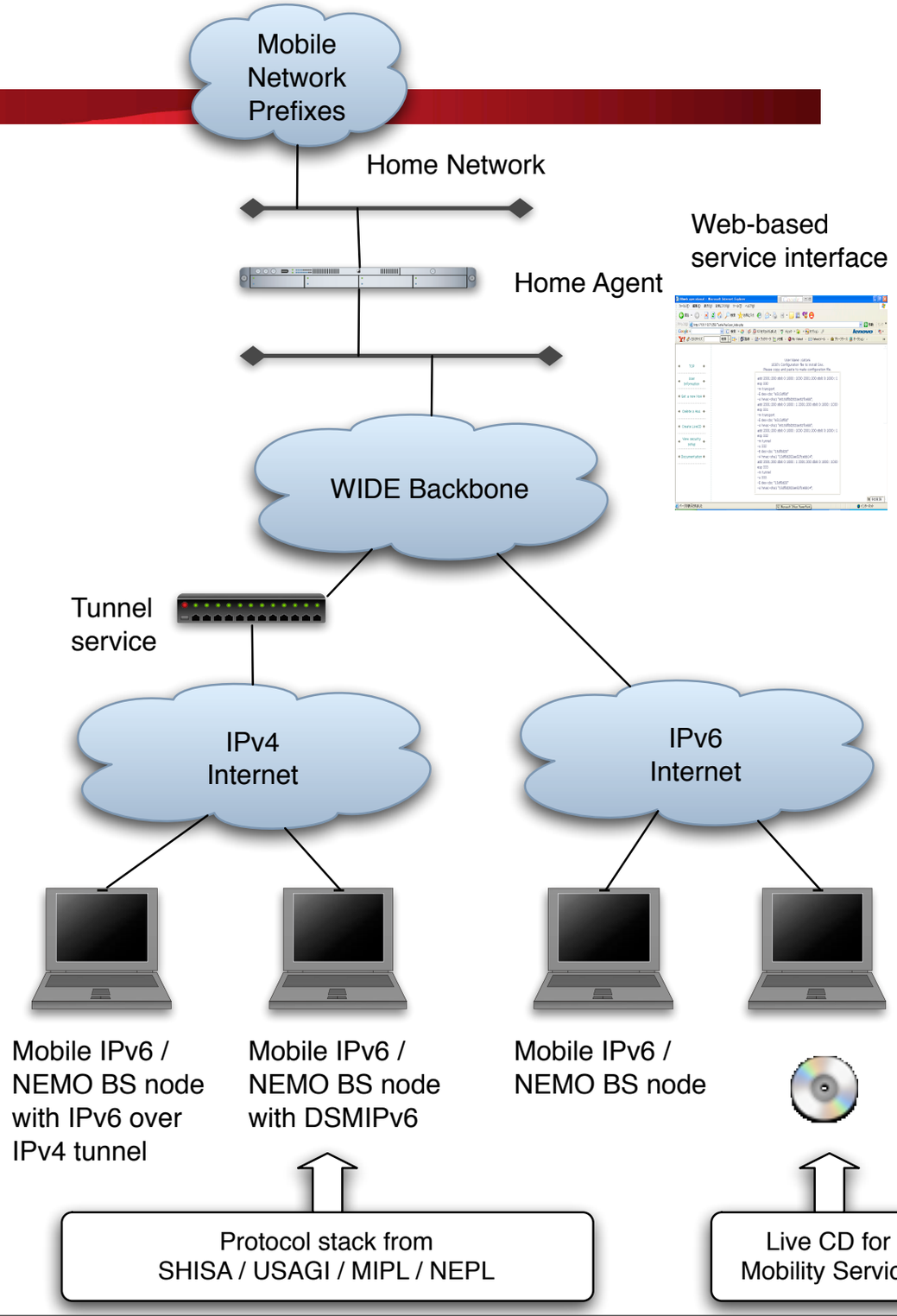
Operation

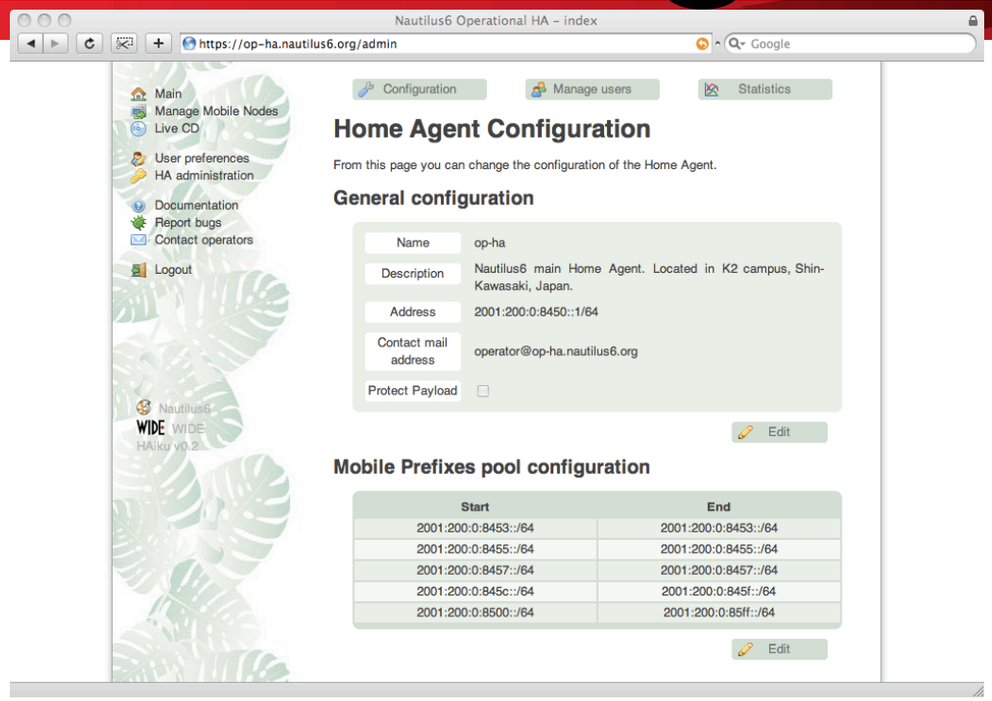
- Build a complete service to demonstrate the use of IPv6 mobility, including:
  - Reliable Home Agent service
  - Security aspects
  - Administration and monitoring
  - Packaging mobility software
  - Documentation

Home Agent Service

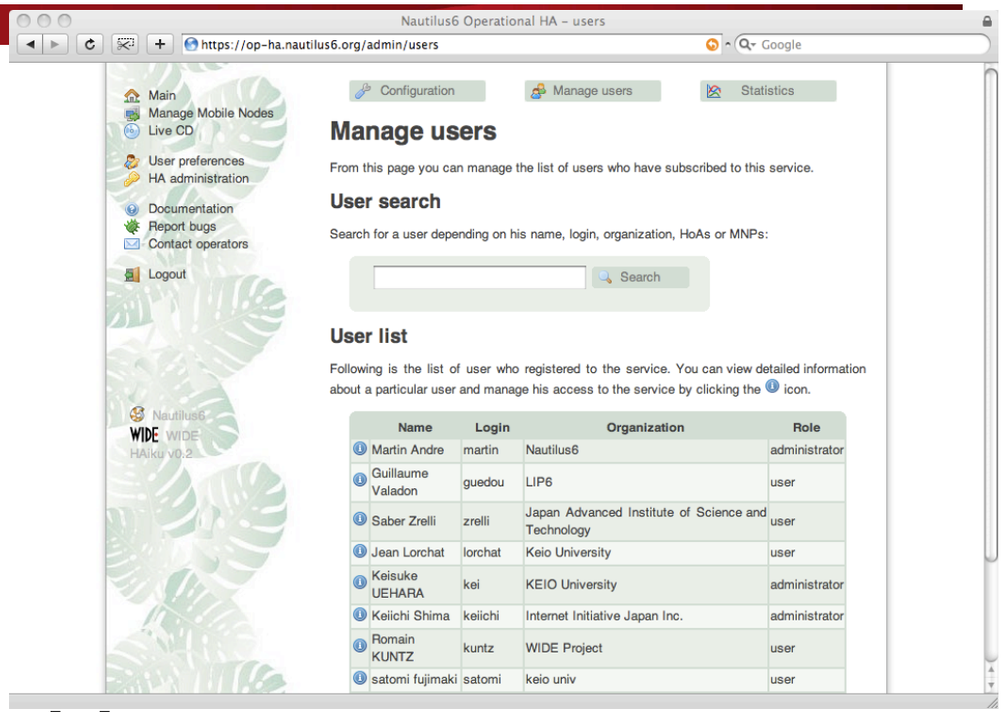
- Operate L3 mobility service as a Mobile Service Provider (MSP)
- Design goals
  - Easy to use Web-based service interface
  - Supporting both IPv4/ IPv6 access networks
  - Support full security defined in the specs
  - Distribute the system as an operation kit



HAiku: Web based management interface

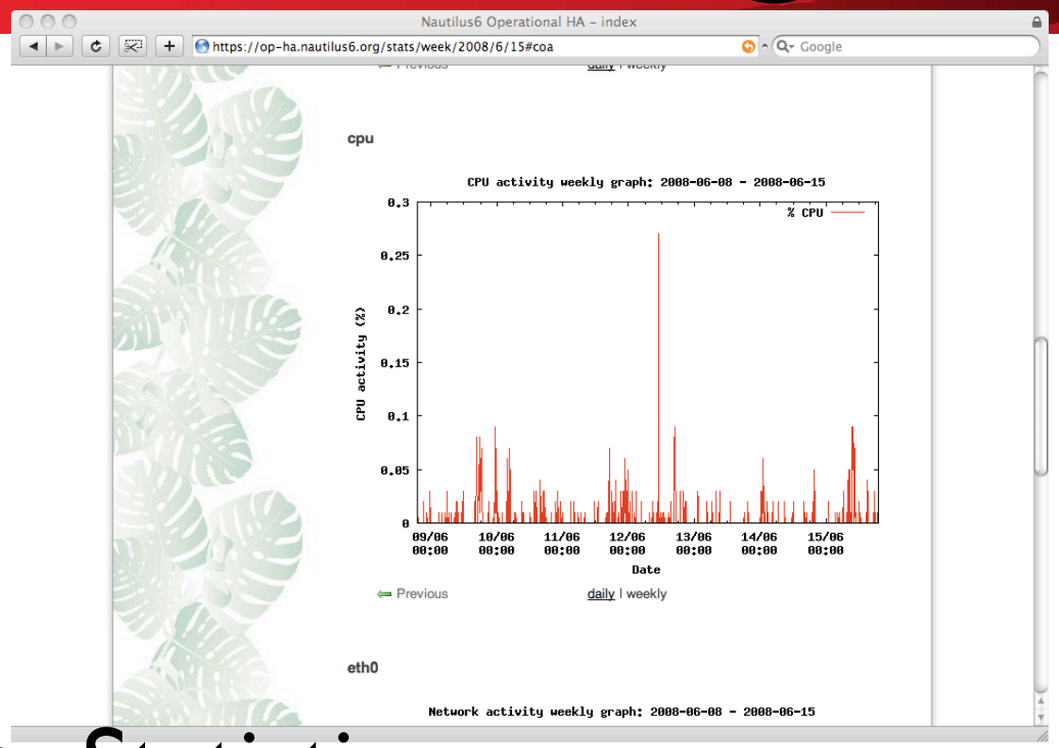


- Home agent management
  - Display and configure home agent
  - Manage network prefixes assigned to mobile routers

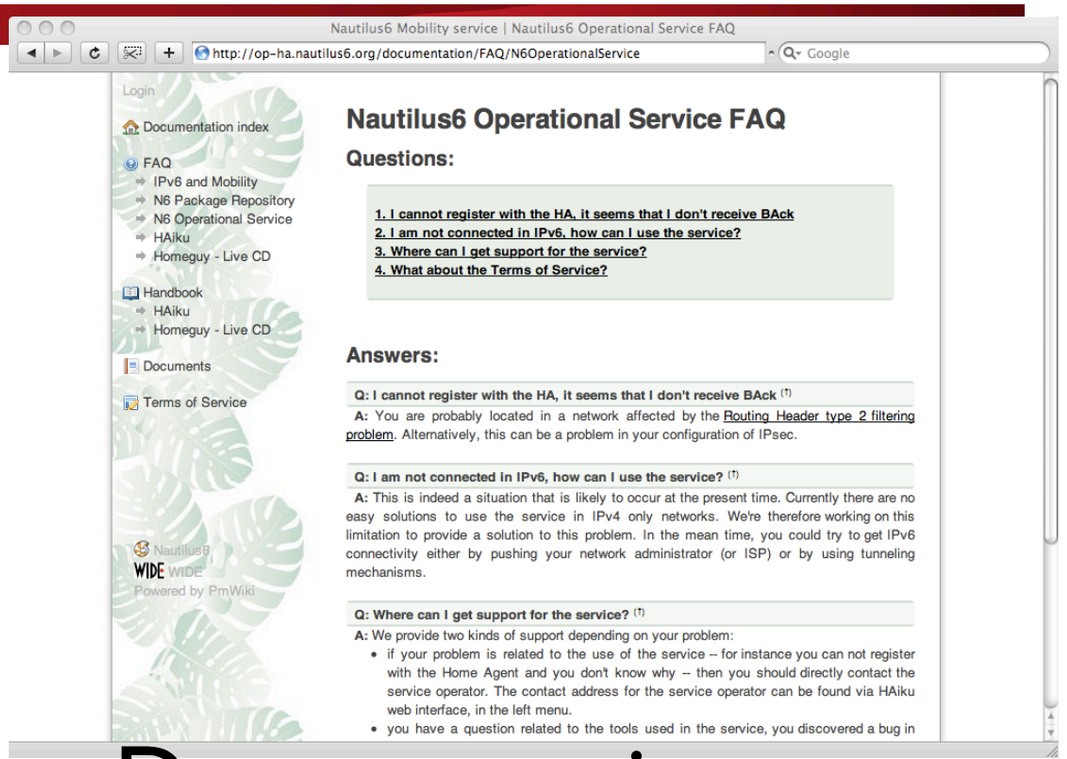


- User management
  - browse all registered users
  - administrative operation on them

HAiku: Web based management interface



- Statistics
  - Display daily/weekly stats of home agent
  - # of registered nodes, traffic, CPU usage, memory usage, etc



- Documentation
  - Briefly summarized documents for HA administrators and HA service users

Homeguy - Live CD for MIPv6 experience

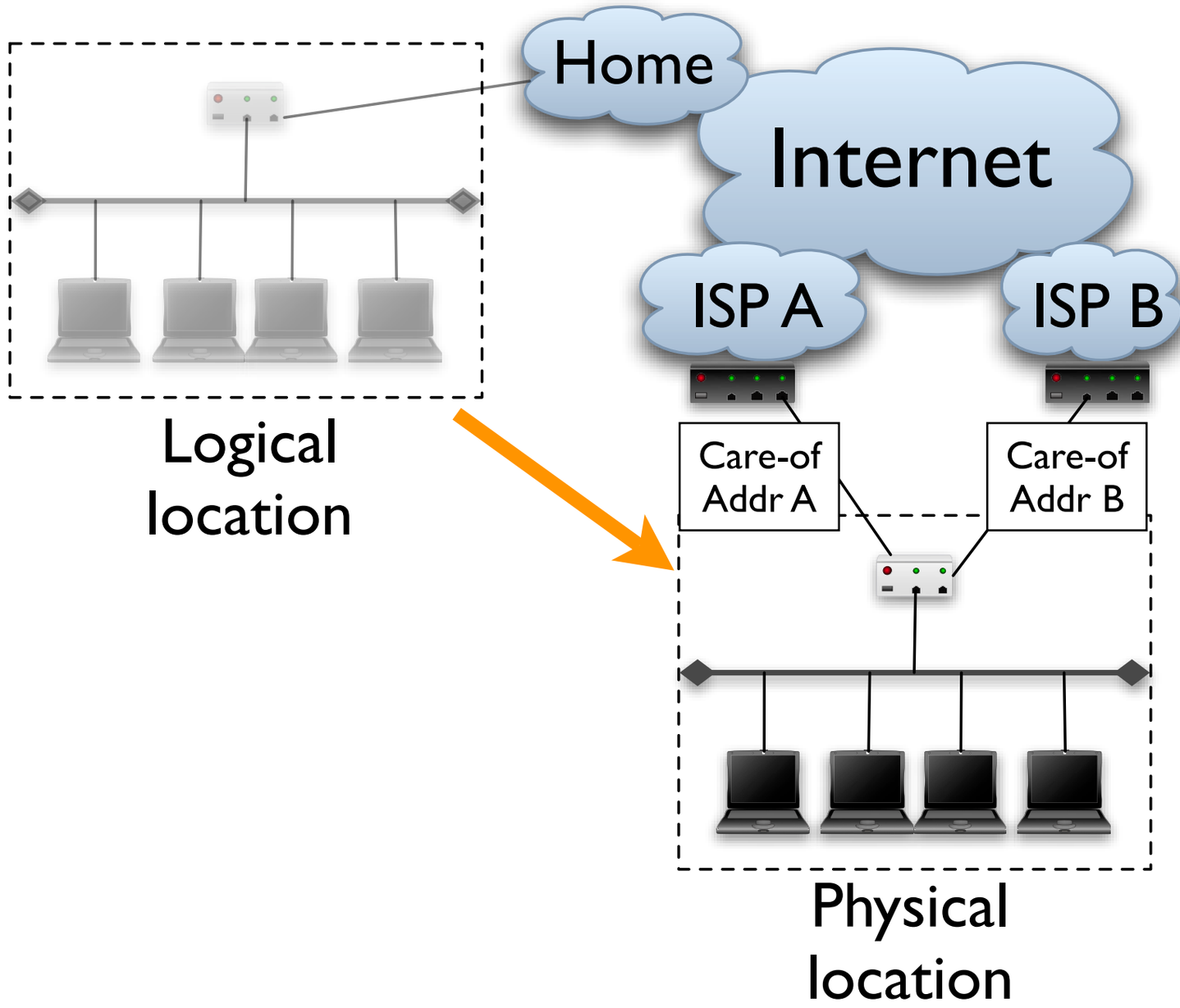
- MIPv6-ready LiveCD
  - http://software.nautilus6.org/homeguy/
- Based on Ubuntu Gutsy and UMIP/NEPL
- Can be used together with HAiku
  - Customized LiveCD is also available
- IPv6 and MIPv6-related software are bundled
- Installable on hard drive

Package Distribution

- Debian and Ubuntu packages repositories:
  - http://software.nautilus6.org/packages/debian/
  - http://software.nautilus6.org/packages/ubuntu/
- Ease installation of MIPv6 environment:
  - MIPv6-ready kernel
  - UMIP MIPv6 daemon (with various patches)
- Other useful software (racoon2, scapy6, ...)

Fault Tolerant Network using NEMO BS

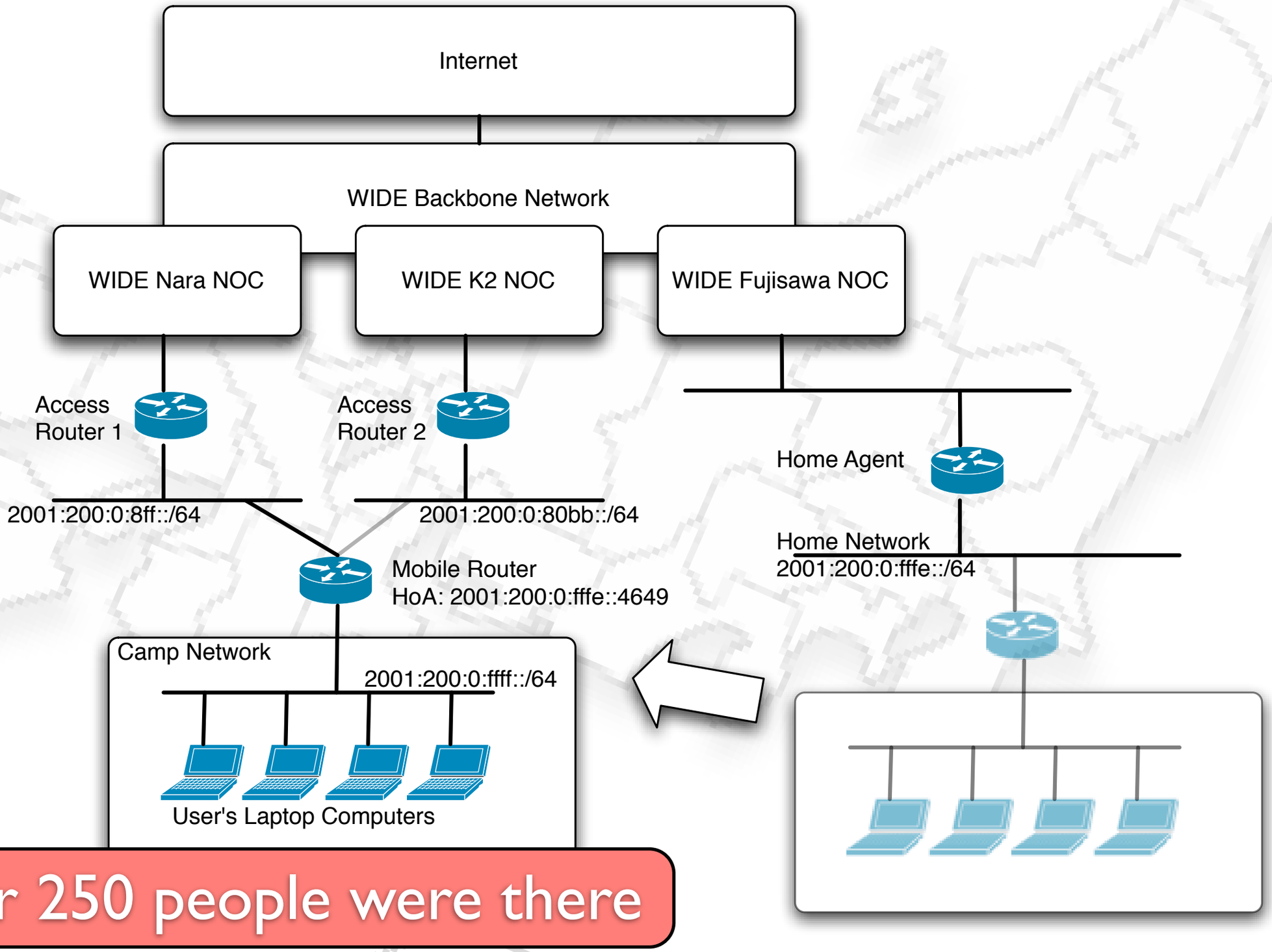
- Put a mobile router at the network boundary
- Subscribe multiple ISPs
- When one of the ISPs fails, the mobile router "moves" to another ISP
- Local fixed nodes are unaware of the movement



WIDE Camp as a Practical Network

- What's WIDE Camp?
  - A 4-day meeting where the WIDE members get together one place and discusses various kinds of Internet topics
  - A temporarily network is prepared for both infrastructure and experimental purposes
  - 200~250 people participate

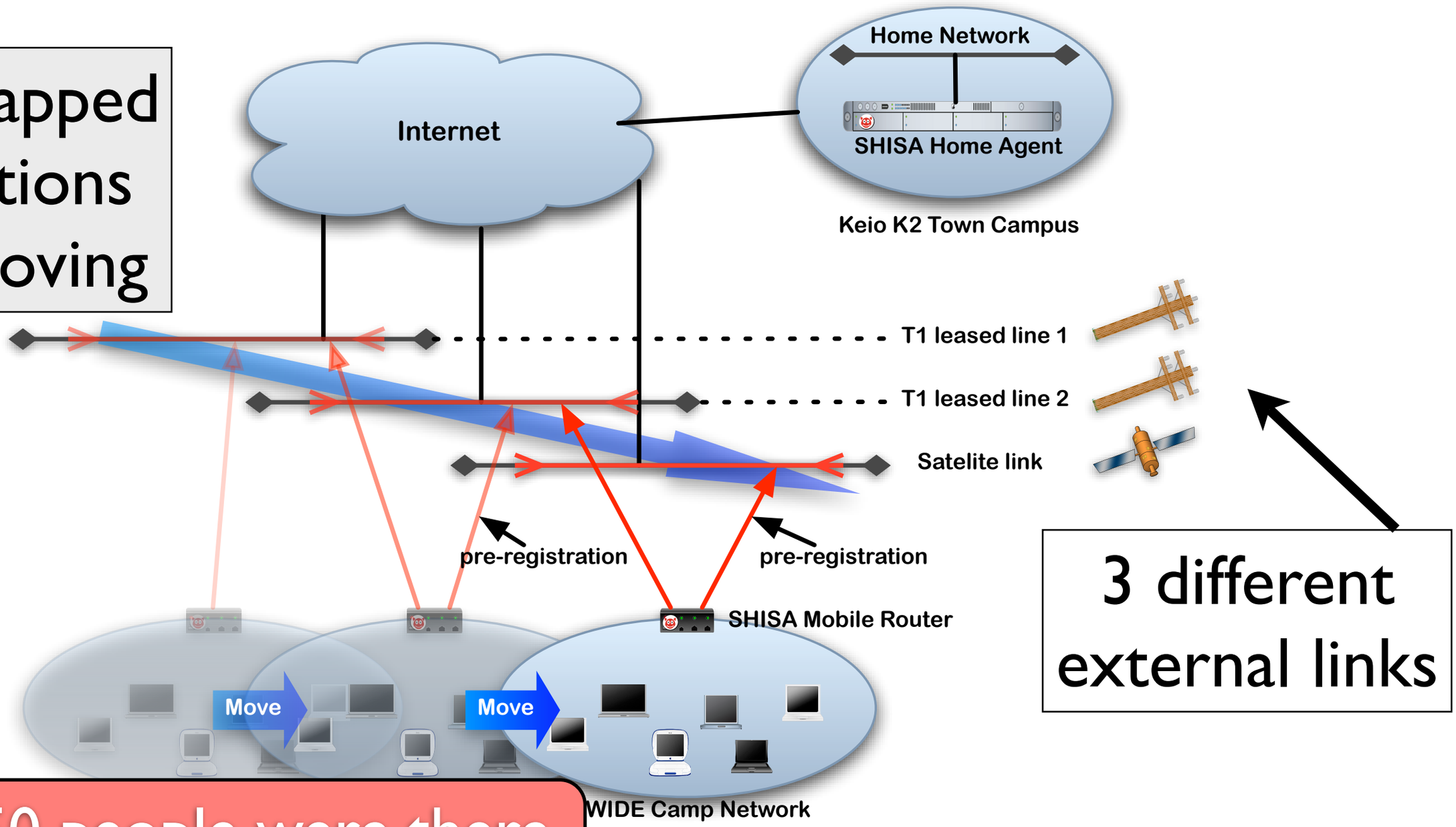
Network Topology at WIDE camp (Sep. 2005)



Over 250 people were there

Network Design at WIDE camp (Mar. 2006)

Overwrapped connections while moving



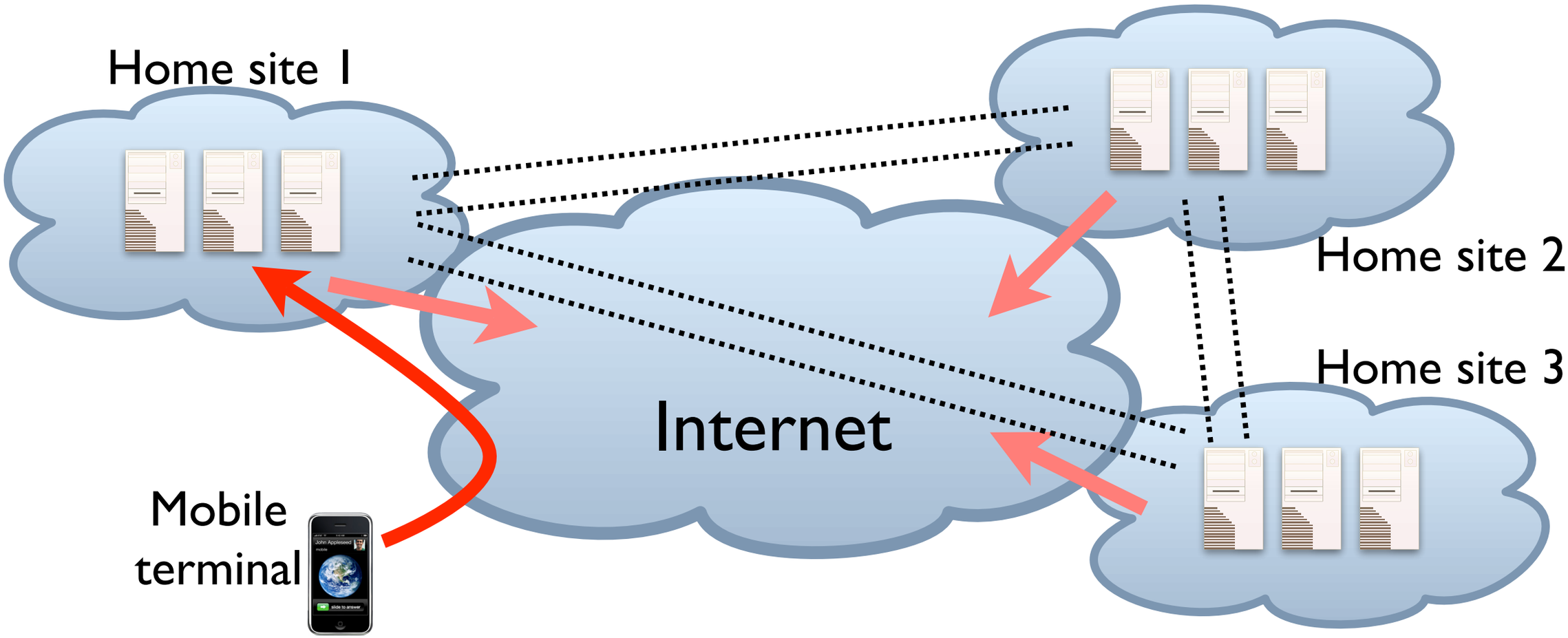
3 different external links

Over 250 people were there

Global HAHA

- Solution to solve Mobile IPv6's single point of failure problem
- Distribute many home networks around the Internet (in geographically and routing point of view)

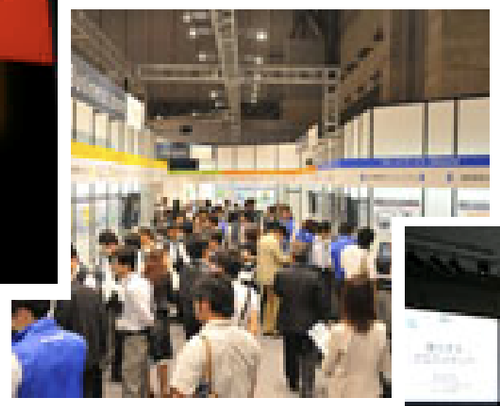
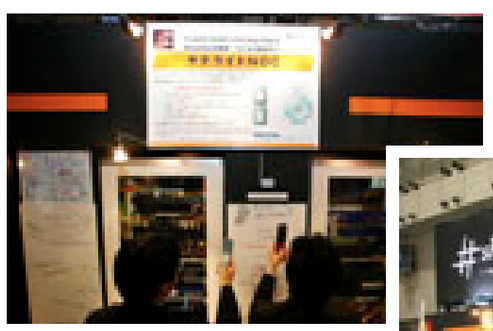
Global HAHA Concept

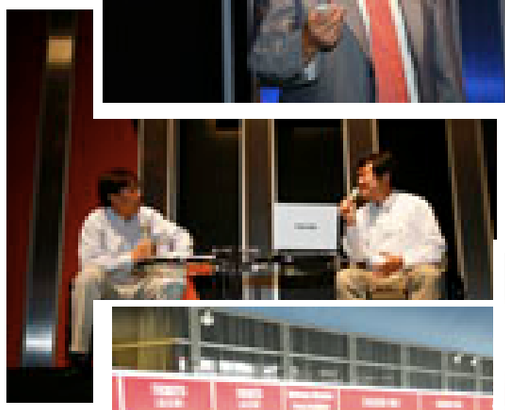
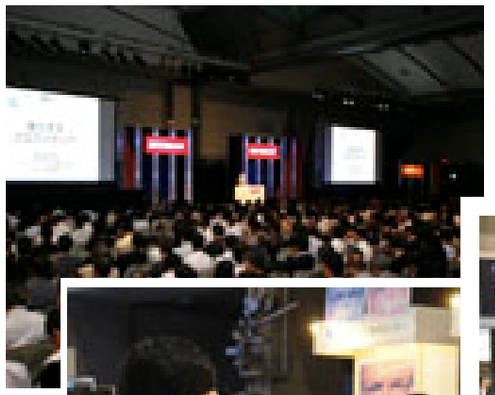
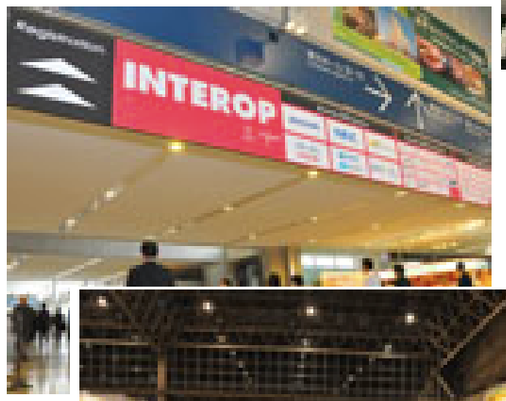


- The same route information is advertised to the global Internet
- Nearest agents will serve mobility requests

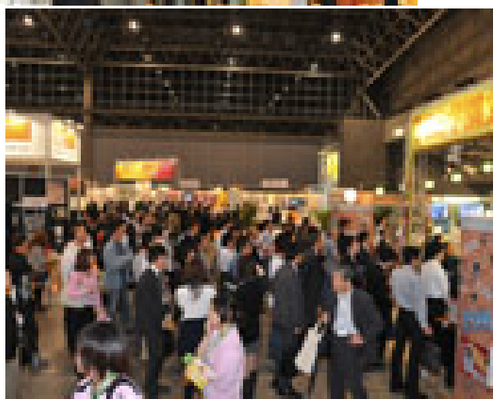
Interop Tokyo 2008

- One of the biggest exhibition/conference for network equipment/service vendors

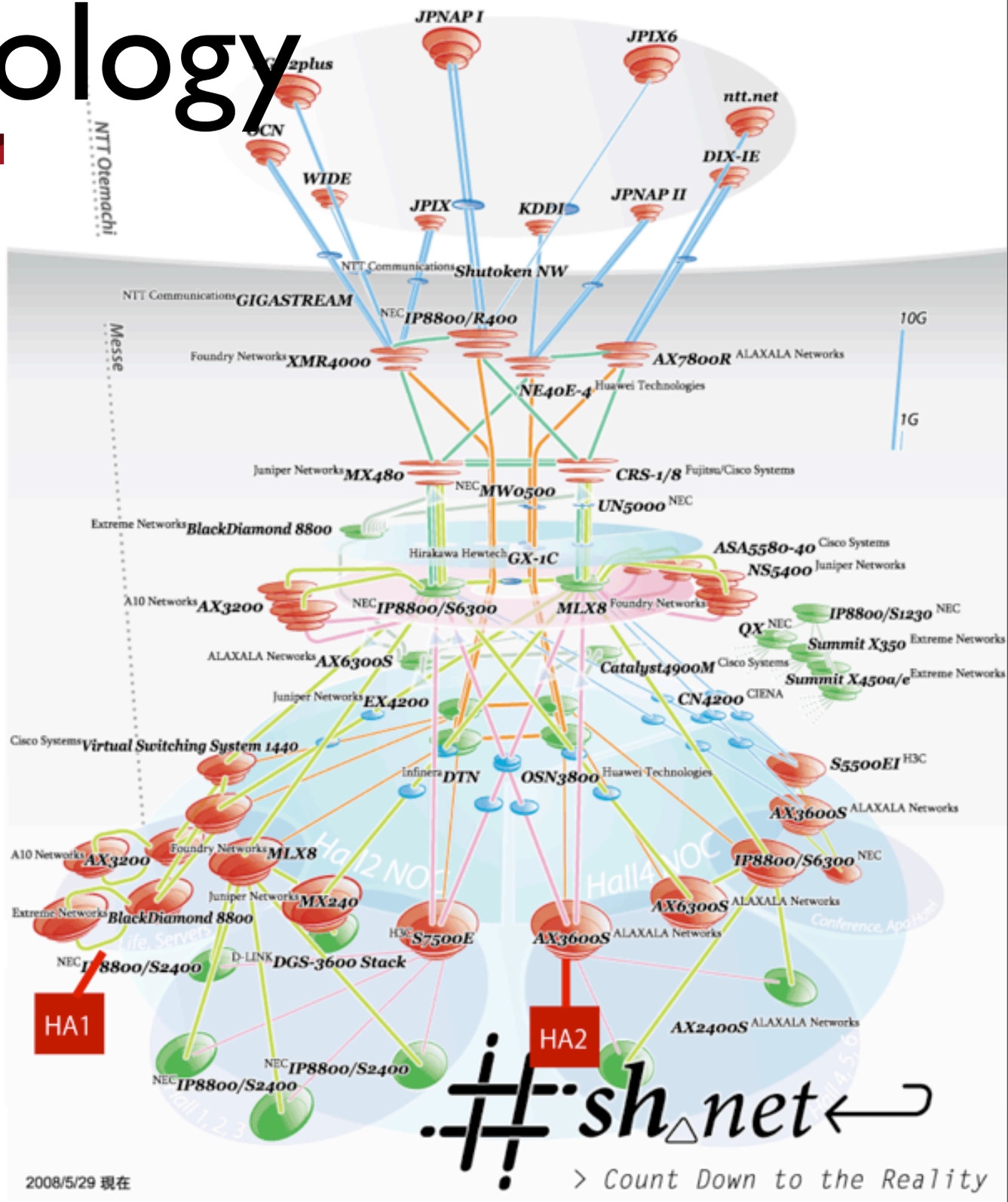







Interop Tokyo 2008 Topology

- Interop-jp 2001:3e8::/32
- Several peering connections to realize real Internet
- Roughly divided into 2 parts, Hall 123 and Hall 45
- Home agents are located at each hall



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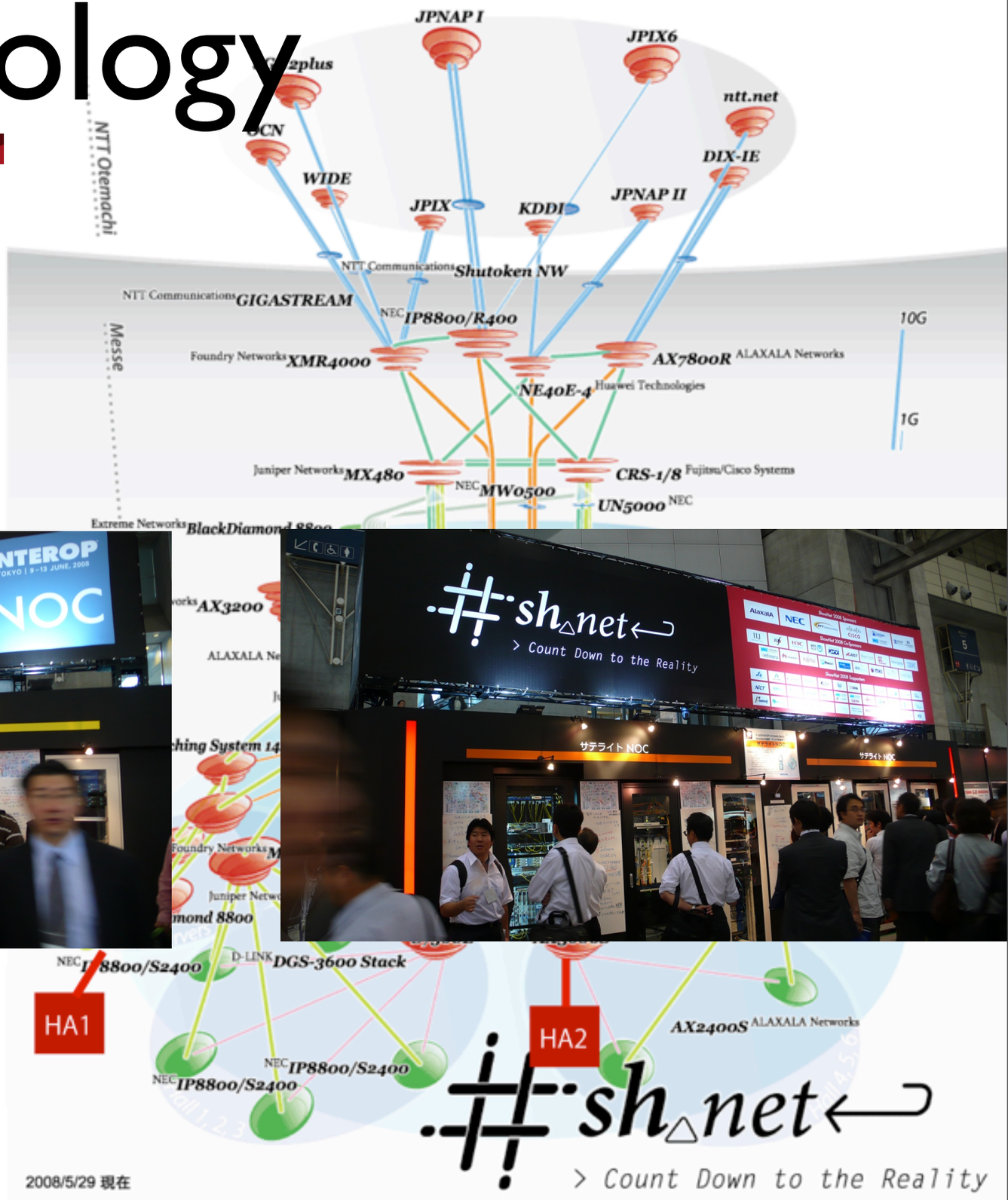
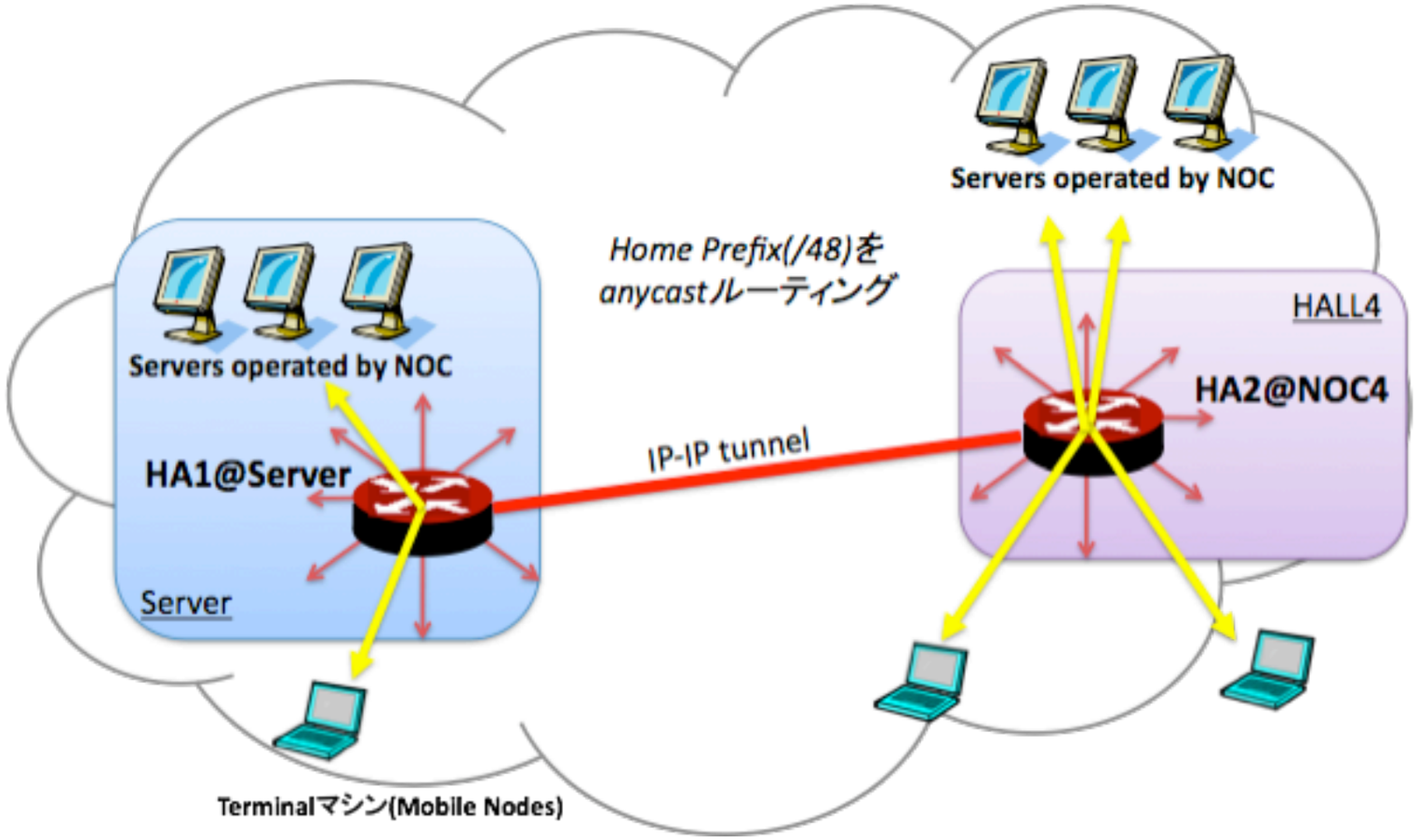


Interop Tokyo 2008 Global HAHA experiment

- Global HAHA home prefix 2001:3e8:ff55::/48 is anycasted
- Home network prefix 2001:3e8:ff55::/64
- Assign fixed HoAs to NOC members to ease ACL definition of management terminals



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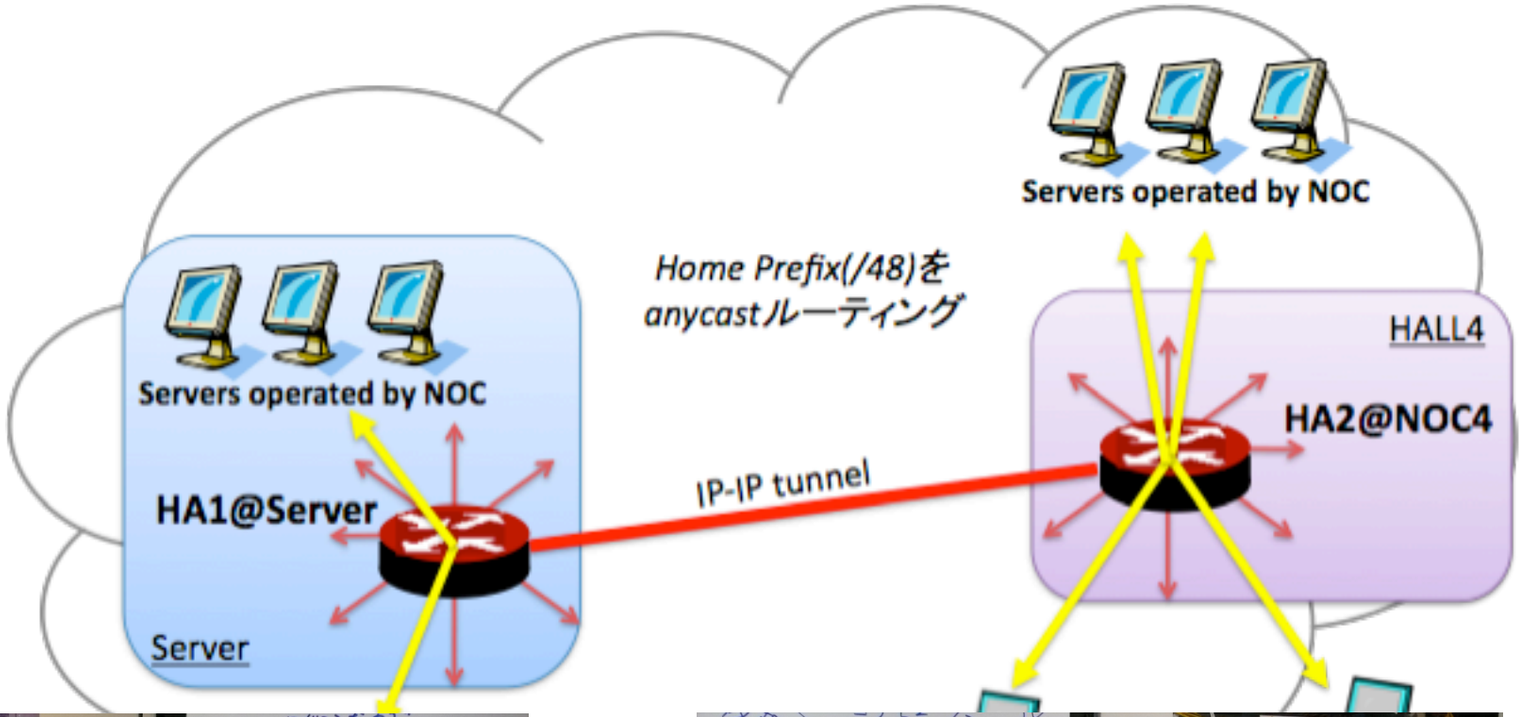

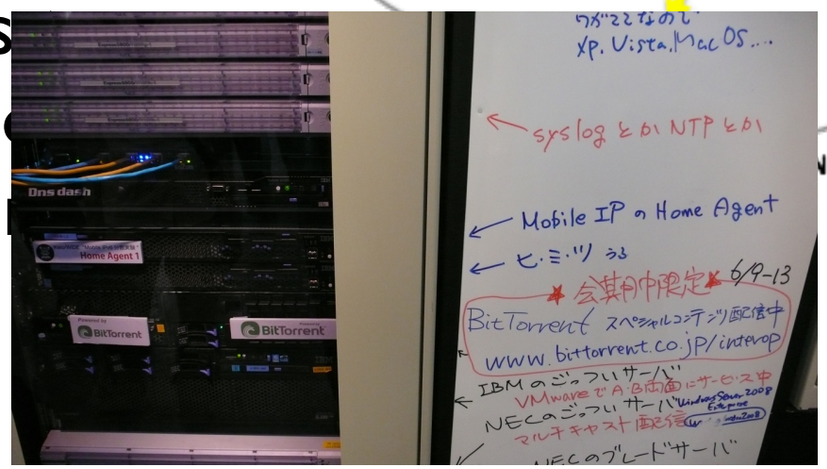

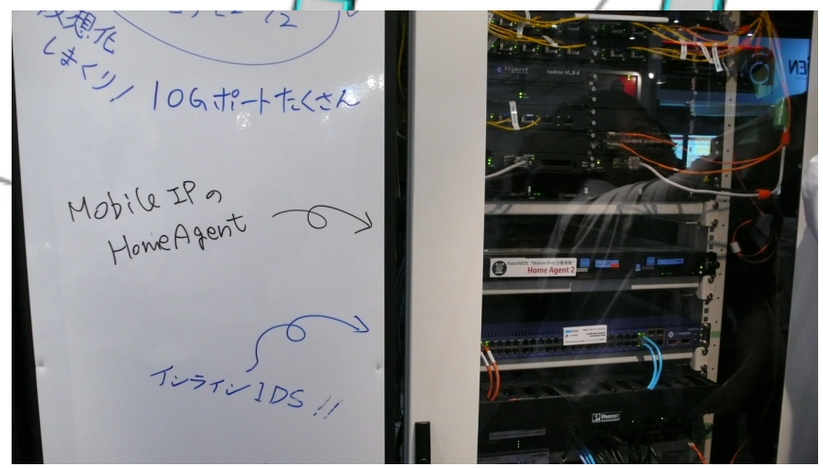

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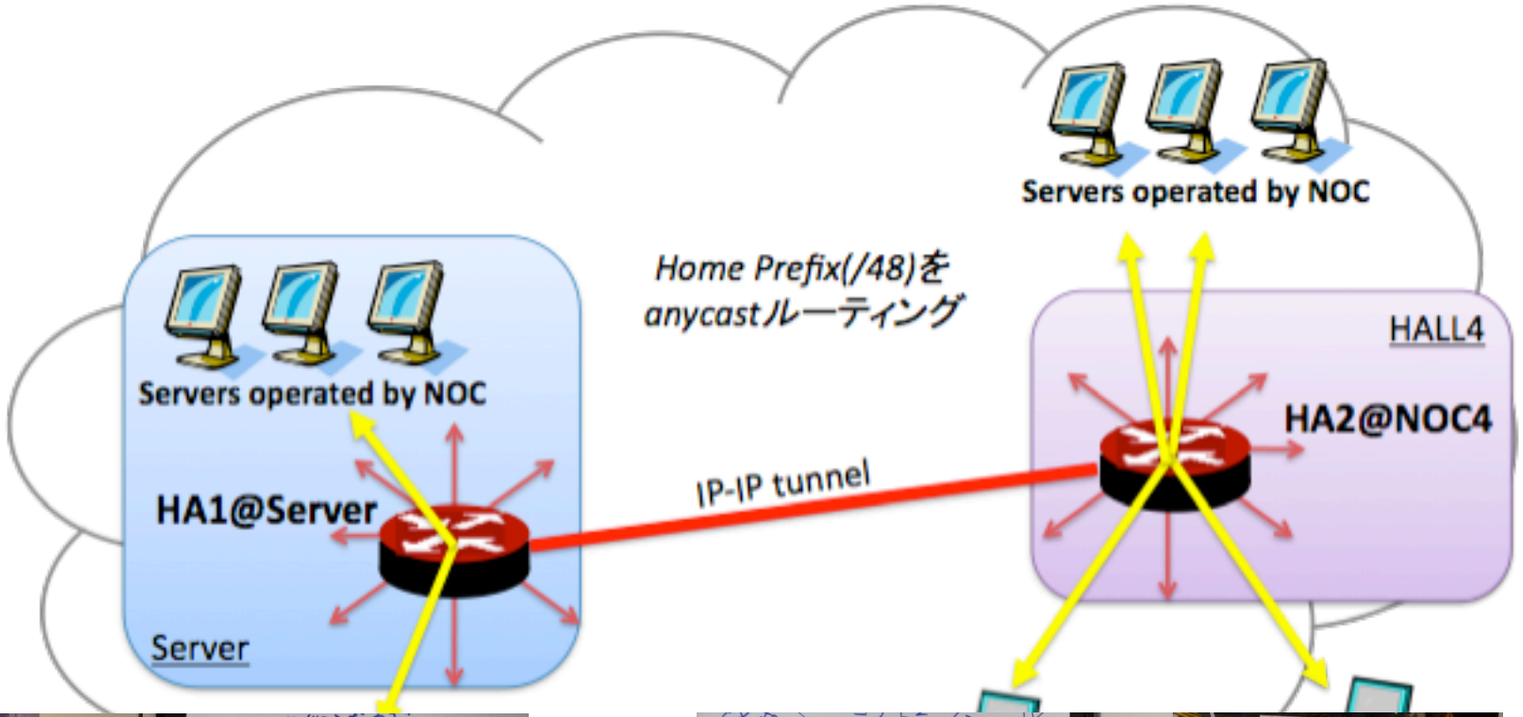

Global HAHA Stats

- Operated during 2008-6-11(Wed)~13(Fri)
- 2 of SHISA based NetBSD home agents
- 6 of SHISA based NetBSD mobile nodes
- Several UMIP based Ubuntu mobile nodes
- Traffic analysis is now ongoing ...

Summary

- Contribution to IETF mobility protocols standardization
  - NEMO BS, MIPv6, Multihoming, Layer 2 signaling, Dual stack technologies, Global operation, etc.
- Implementation of protocols
  - MIPv6, NEMO BS, Multiple CoA, DSMIPv6, Fast MIPv6, L2 signaling, DIAMETER, IKE extension for MIPv6, Global HAHA
- Worldwide home agent operation
- Demonstration
  - Interop Tokyo 2008, CEATEC 2006, Ubiquitous Network Symposium, IPv6 summit in Thailand, WIDE internal meetings

Useful links

- Nautilus6: http://www.nautilus6.org/
- SHISA: http://www.mobileip.jp/
- UMIP: http://www.linux-ipv6.org/
- NEPL: http://software.nautilus6.org/
- HA operation: https://op-ha.nautilus6.org/
- Homeguy: http://software.nautilus6.org/homeguy/
- Packages: http://software.nautilus6.org/packages/debian/, http://software.nautilus6.org/packages/ubuntu/
- Nautilus6 output: http://www.nautilus6.org/doc.php