Toward the IPv6 Mobile Internet

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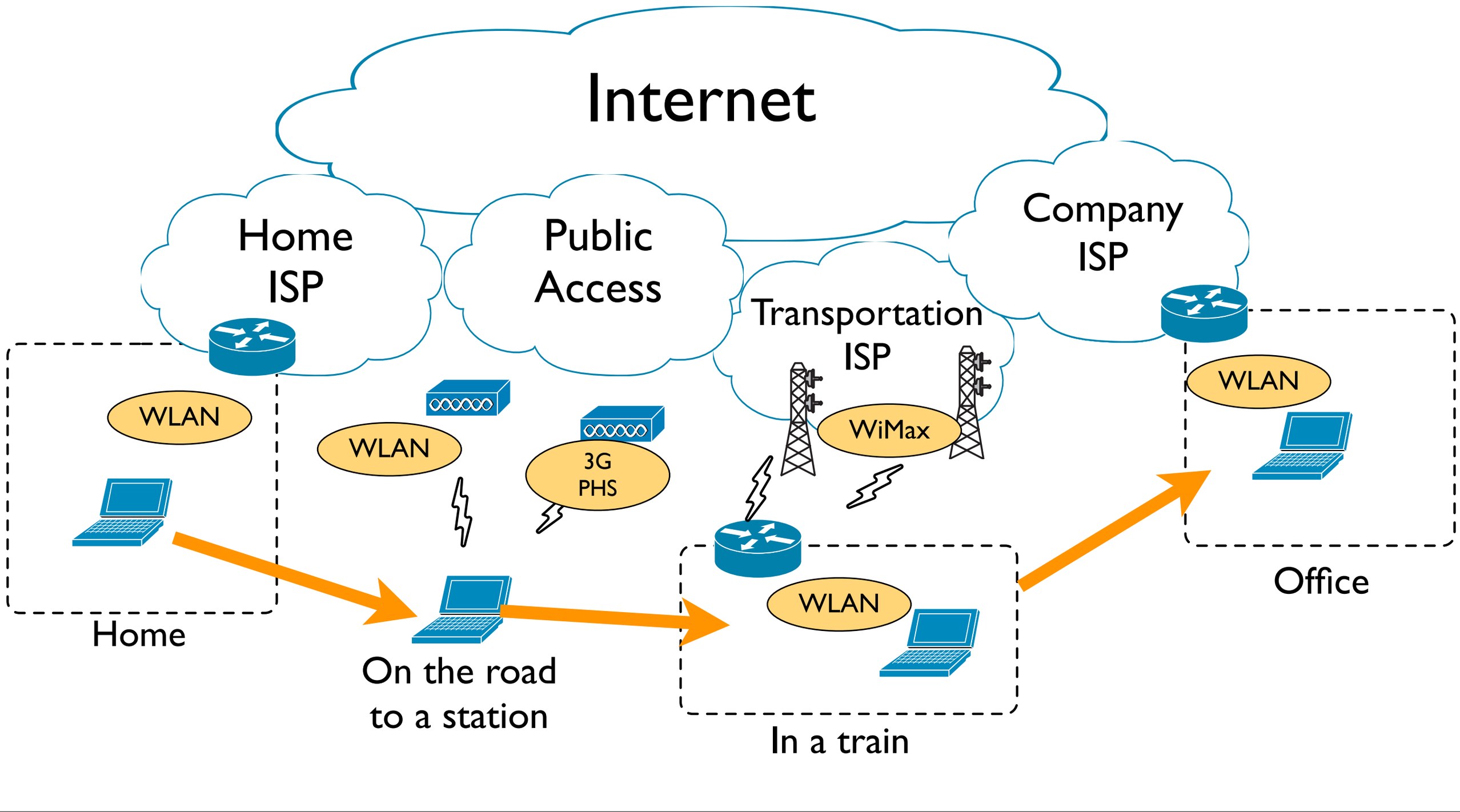
Background

- Widely deployed Internet
  - Available in almost everywhere in the world
- Improvement of Communication Technologies
  - Wireless LAN, Bluetooth, WiMax, etc
- Progress of Small Devices
  - Sensor nodes, Portable devices that have various communication media

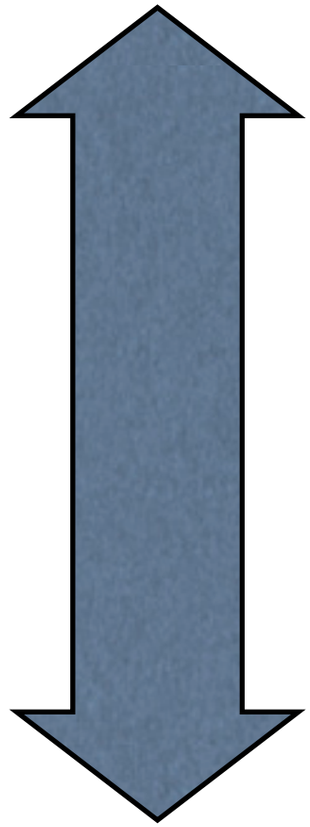
What will we see?



Which Technology?

- L2 Mobility
  - Cellular
- L3 Mobility
  - Mobile IPv6 / NEMO BS
- L3.5 Mobility (?)
  - Shim6
- L4 Mobility
  - SCTP
- L5 Mobility
  - SIP

Device dependent
Infrastructure update is required



Applications need to be modified
Terminals have to be updated

What does WIDE do?

- Realize the future Mobile Internet
  - Find all specification problems by implementing the spec
  - Provide free protocol stacks
  - Operate the service with the new protocol to find any operational problems and get experience
  - Demonstrate how can the technologies be applied

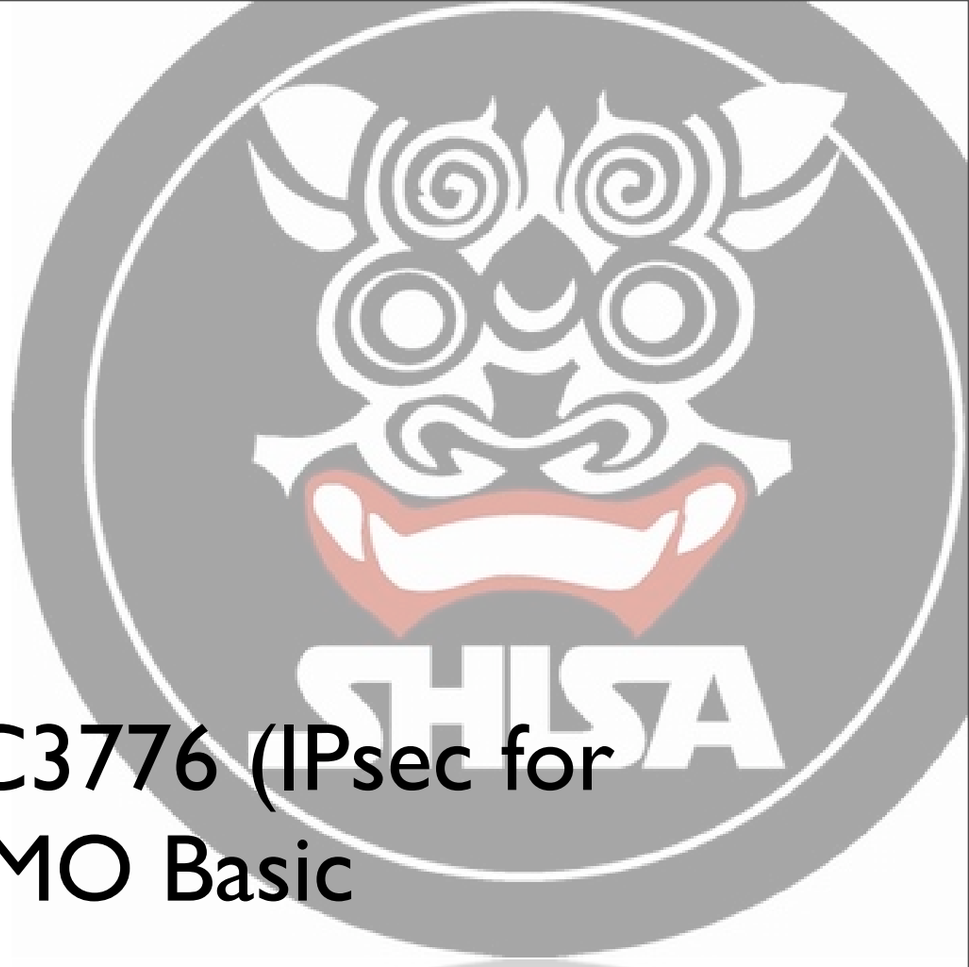
Prove the Technologies with real Implementations

- IPv6
  - KAME Project, USAGI Project
- Mobile IPv6 / NEMO BS
  - SHISA, USAGI Mobile IPv6 and NEPL
- Fast Mobile IPv6
  - TARZAN
- L2 Trigger
  - LIES (the Inter Layer Information Exchange System for Mobile Communication)

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
- The project is now focusing on integration to NetBSD

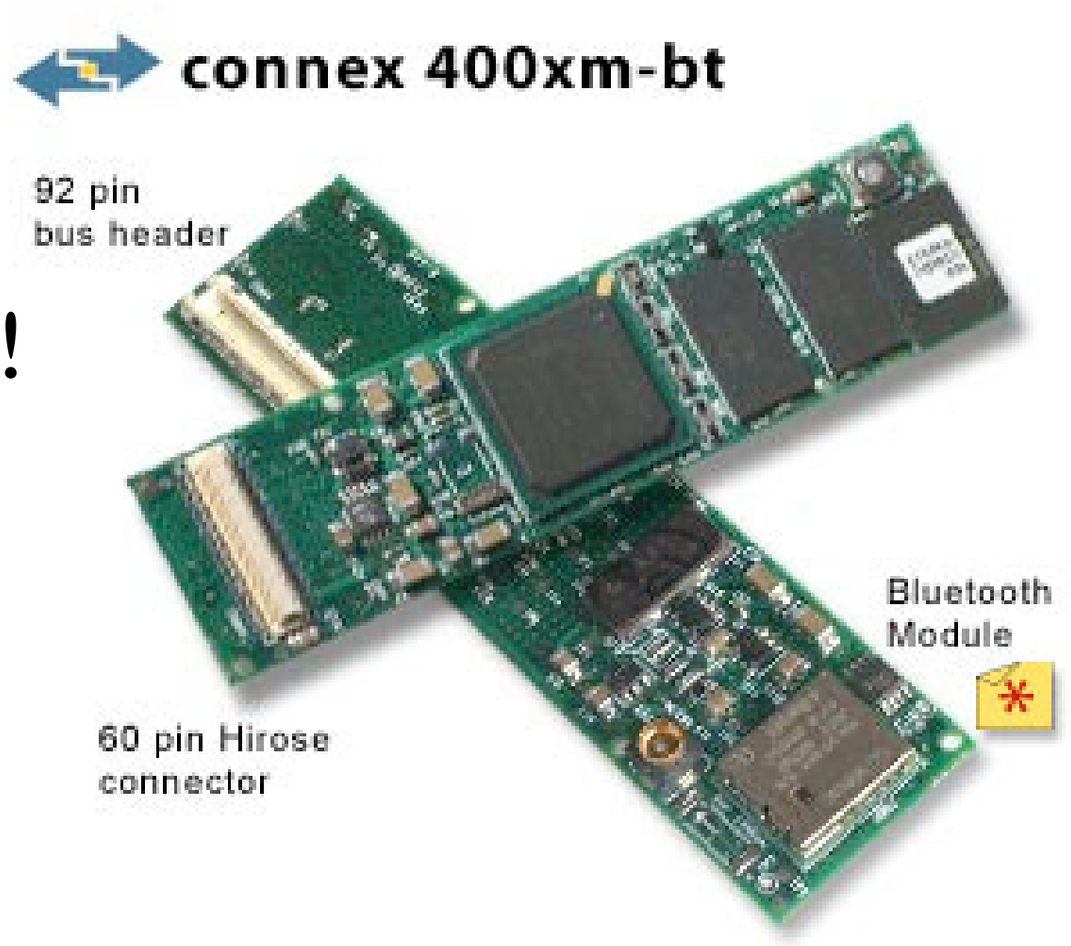
SHISA



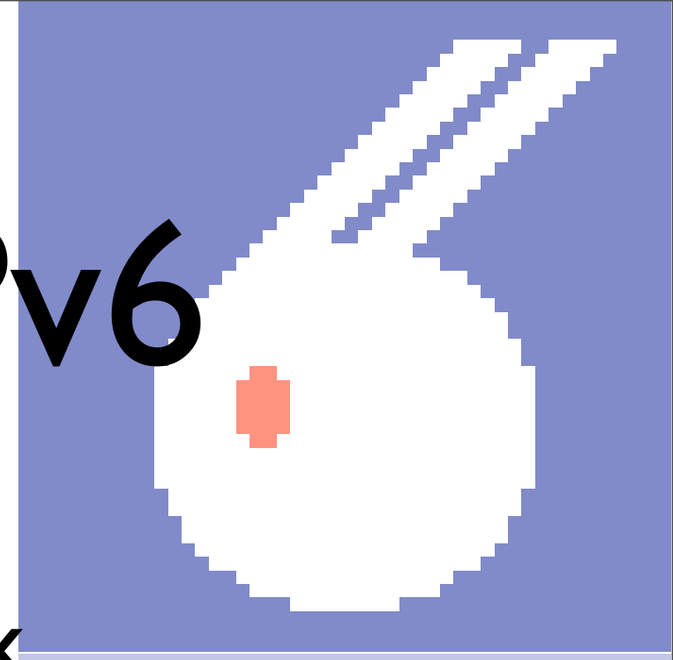
- Supported features
  - RFC3775 (Mobile IPv6), RFC3776 (IPsec for Mobile IPv6), RFC3963 (NEMO Basic Support)
- Advanced features
  - Multiple Care-of Addresses Registration
    - draft-ietf-monami6-multiplecoa
  - Dual Stack Mobile IPv6
    - draft-ietf-mip6-nemo-v4traversal
- http://www.mobileip.jp/

SHISA Gumstix

- SHISA runs even on incredibly small devices
- Gumstix Platform (http://www.gumstix.org/)
  - Same size as a gum stick!
  - Full SHISA functions are available with NetBSD/evbarm architecture



USAGI Mobile IPv6

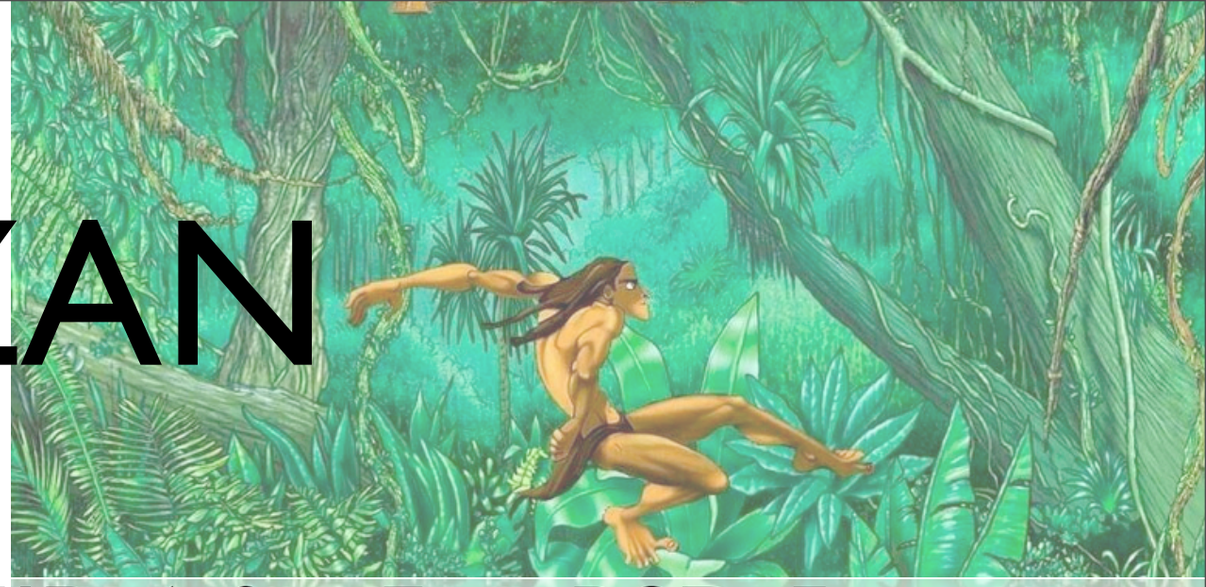


- Mobile IPv6 protocol stack for Linux operating system
- Developed as a part of the USAGI Project
- Supports RFC3775 (Mobile IPv6) and RFC3776 (IPsec for Mobile IPv6)
- Code has merged to Linux kernel 2.6.19
  - CN function is running
  - Other functions follow

NEPL: NEMO Platform for Linux

- Collaborative work with the Go-core Project
- Supported specs
  - NEMO Basic Support (RFC3963)
  - Multiple Care-of Addresses Registration (draft-ietf-monami6-multiplecoa)
- http://software.nautilus6.org/

TARZAN



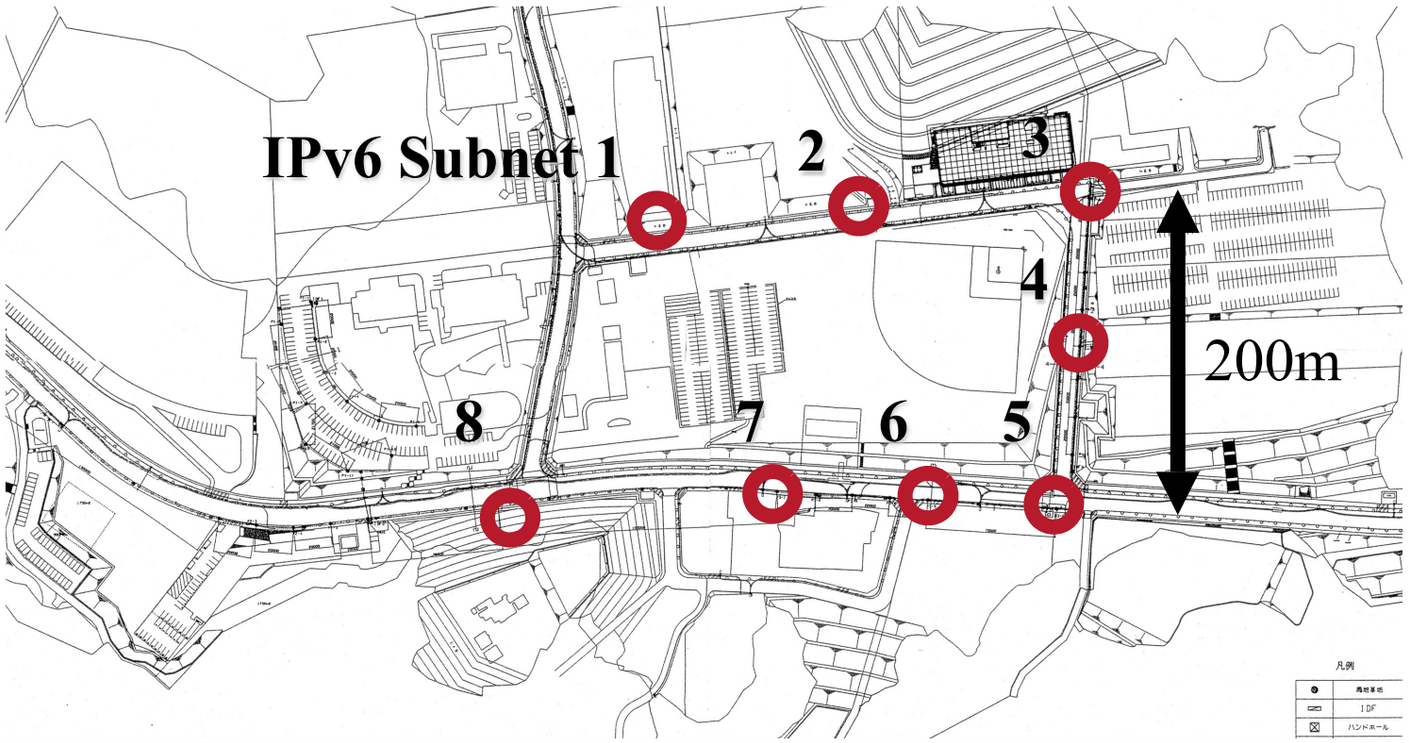
- Implementation of FMIPv6 for FreeBSD 5 operating system
  - Based on the SHISA mobility stack
  - draft-ietf-mipshop-fast-mipv6-03 base
  - Supports both Predictive & Reactive modes
- Development is suspended until RFC4068bis is published
- http://software.nautilus6.org/

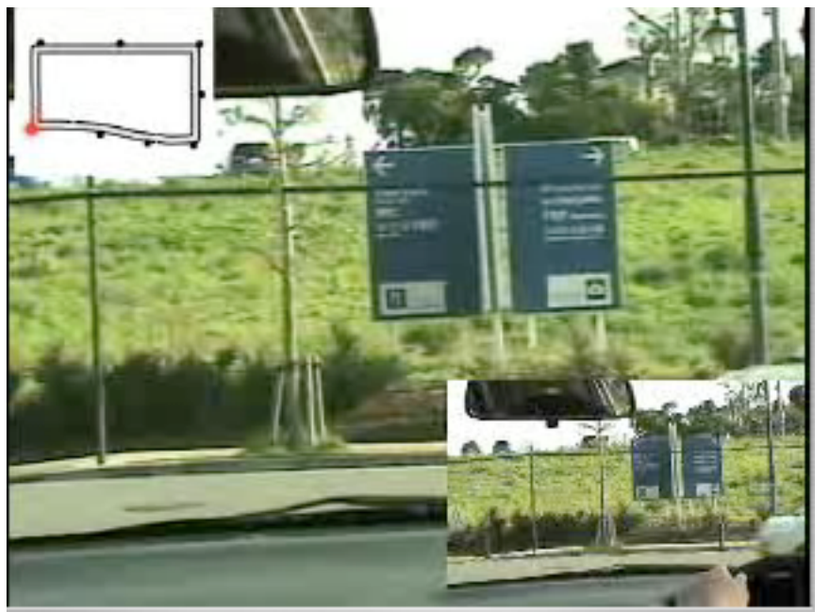
LIES: the Inter Layer Information Exchange System

- 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)
- 8 IPv6 subnets
  - 8 access routers
- Disruption time 3~4ms
  - L2: 1~2ms (constant)
  - L3: 1~2ms (depends on the RTT)



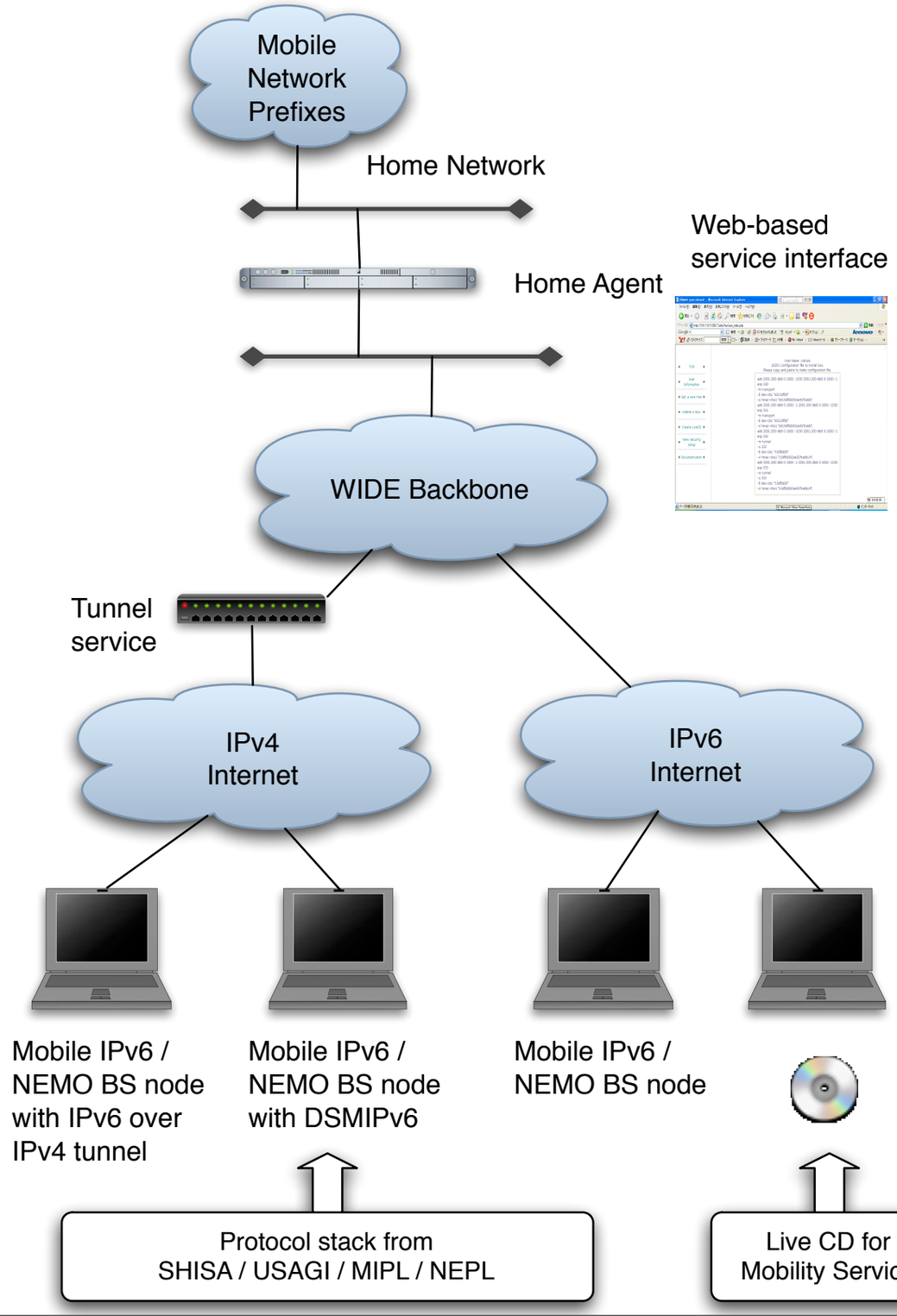


Operational Experience

- Using IPv6 mobility technology in a real environment is important
  - Find any potential problems
  - Prove scalability of the protocols
  - Acquire operational experience
- Two operational activities
  - Mobile IPv6/NEMO BS public home agent operation service
  - Mobile router operation with a large number of people

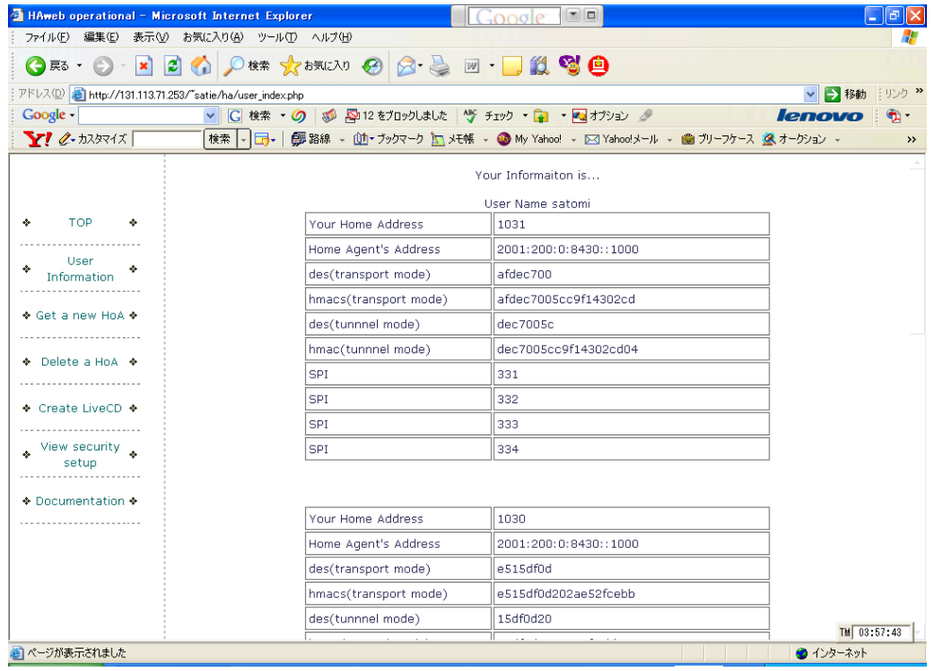
Home Agent Service

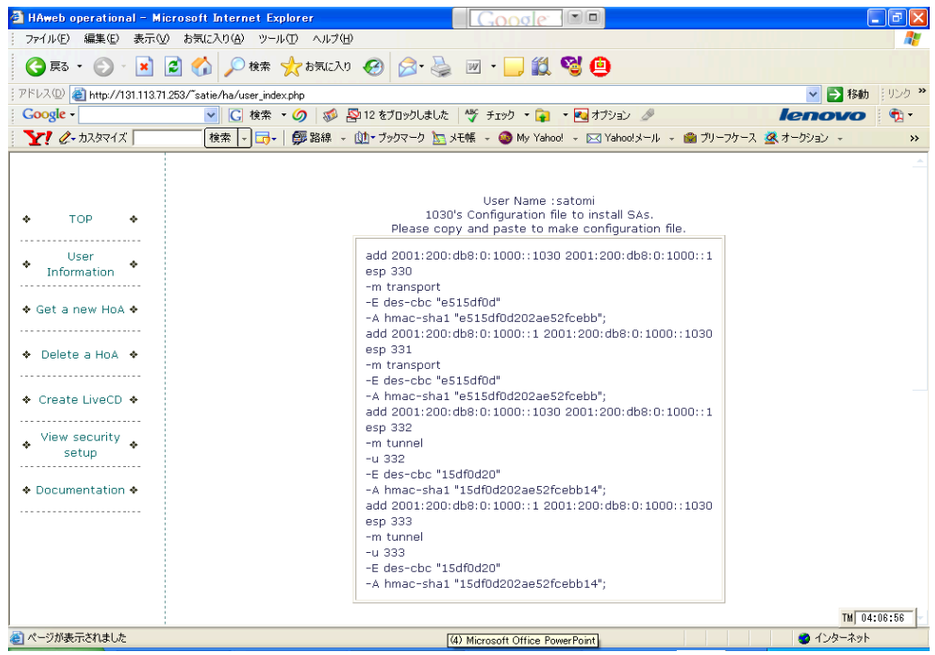
- Operate L3 mobility service as a Mobile Service Provider (MSP)
- Design goals
  - Easy to use Web-based service interface
  - Supporting both IPv4/ IPv6 access networks
  - Support full security defined in the specs
  - Distribute the system as an operation kit



Web Interface

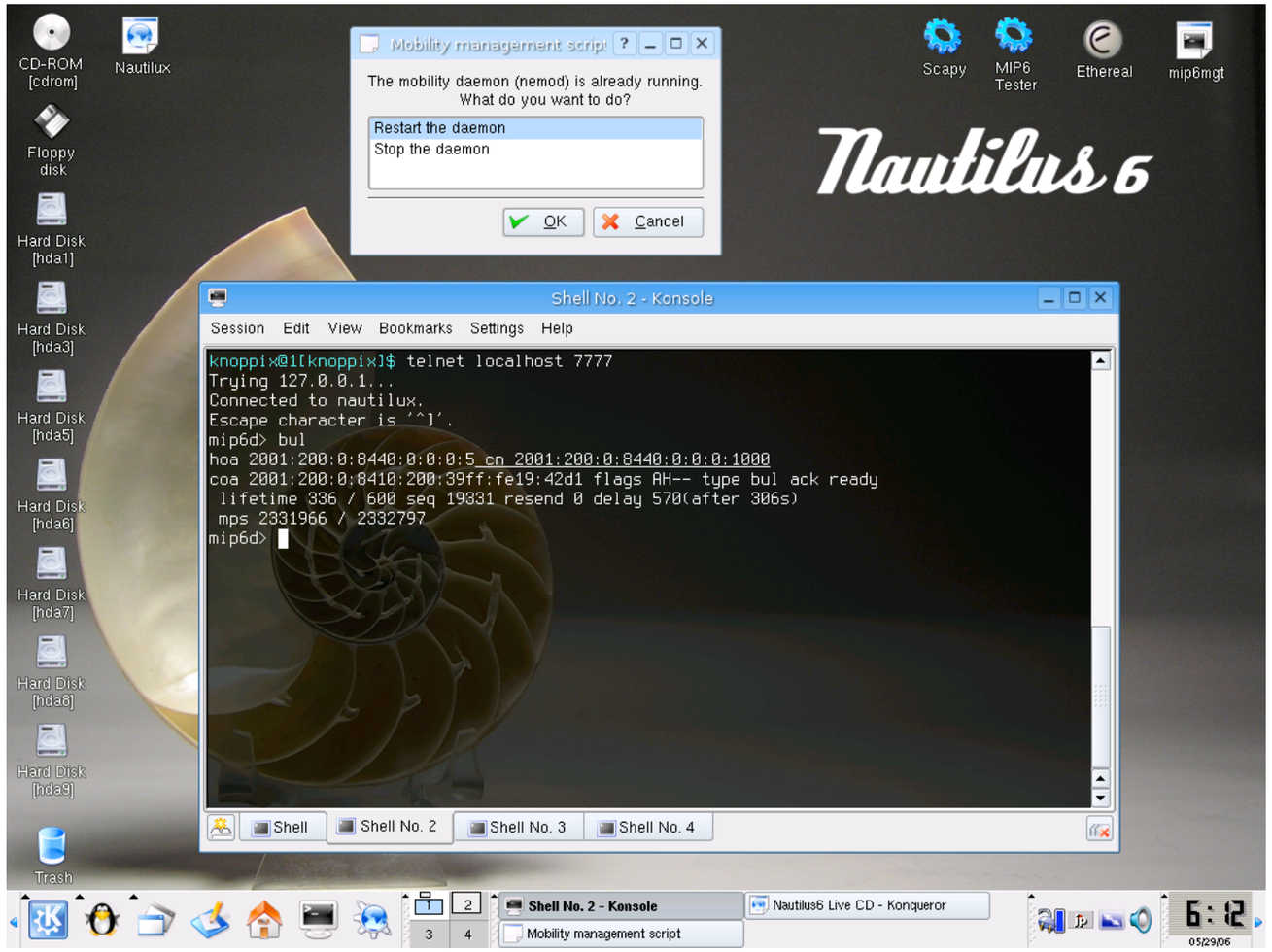
- Currently only Mobile IPv6 is supported
- Available functions
  - Mobile node registration
  - Home address assignment
  - Security parameters setup
  - Live CD creation
- Next version is under preparation
  - Supports NEMO BS
  - Publicly available





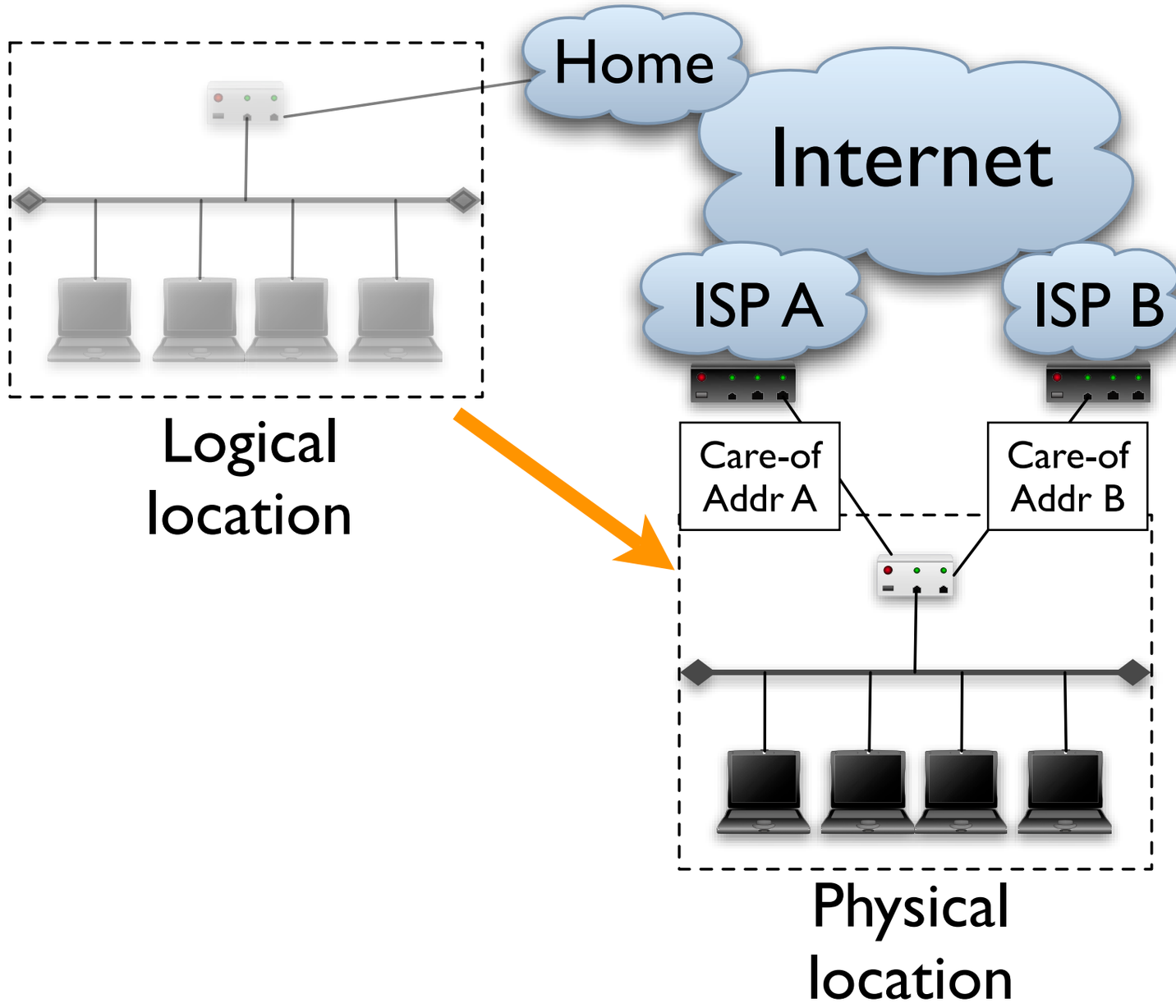
Live CD for Technology Advertisement

- Can be burned from the Web interface
- Kernel and necessary mobility programs are integrated
- All initial configuration has already done
- Not so useful, however the easiest way to try mobility functions



Fault Tolerant Network using NEMO BS

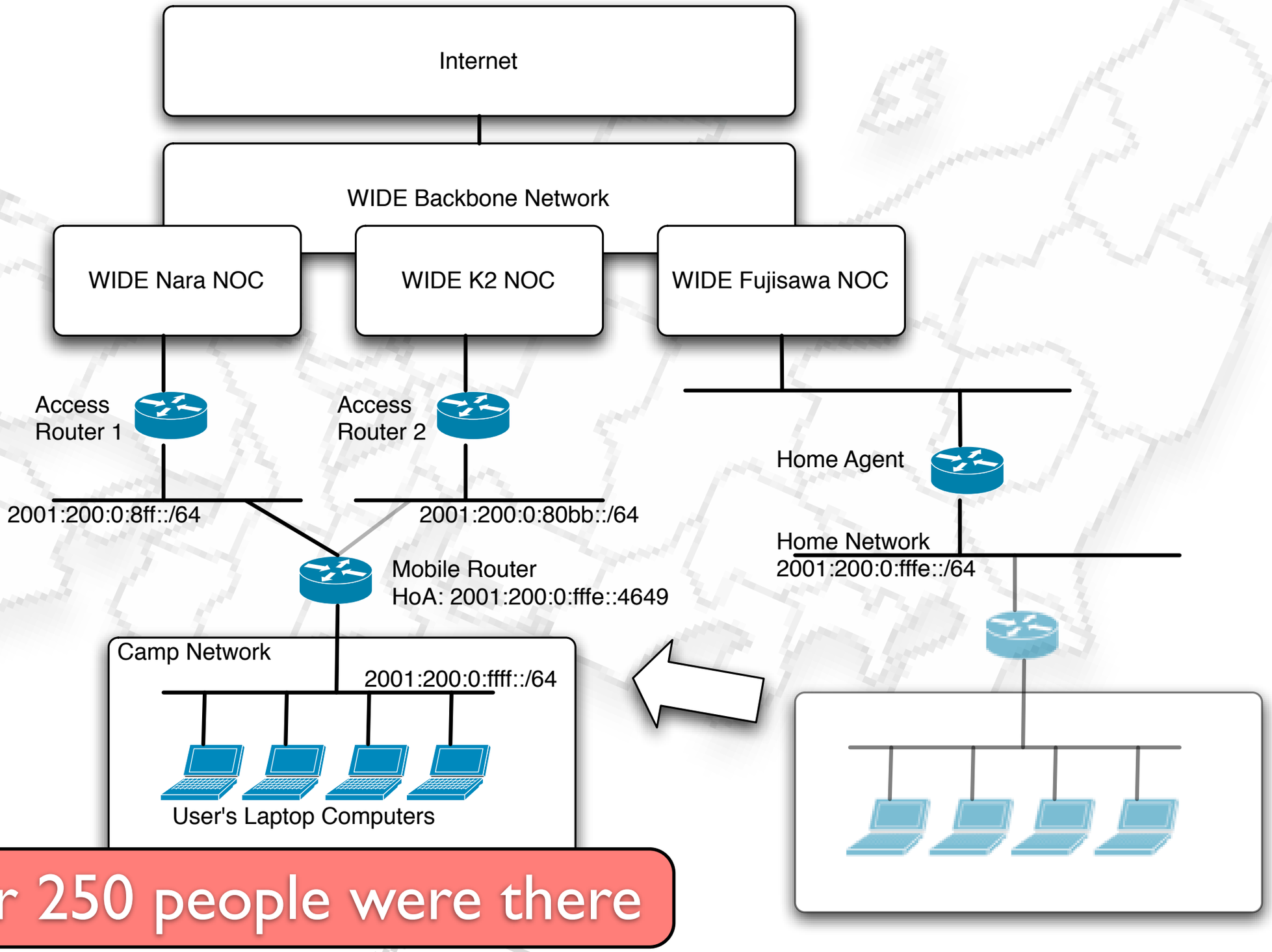
- Put a mobile router at the network boundary
- Subscribe multiple ISPs
- When one of the ISPs fails, the mobile router "moves" to another ISP
- Local fixed nodes are unaware of the movement



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

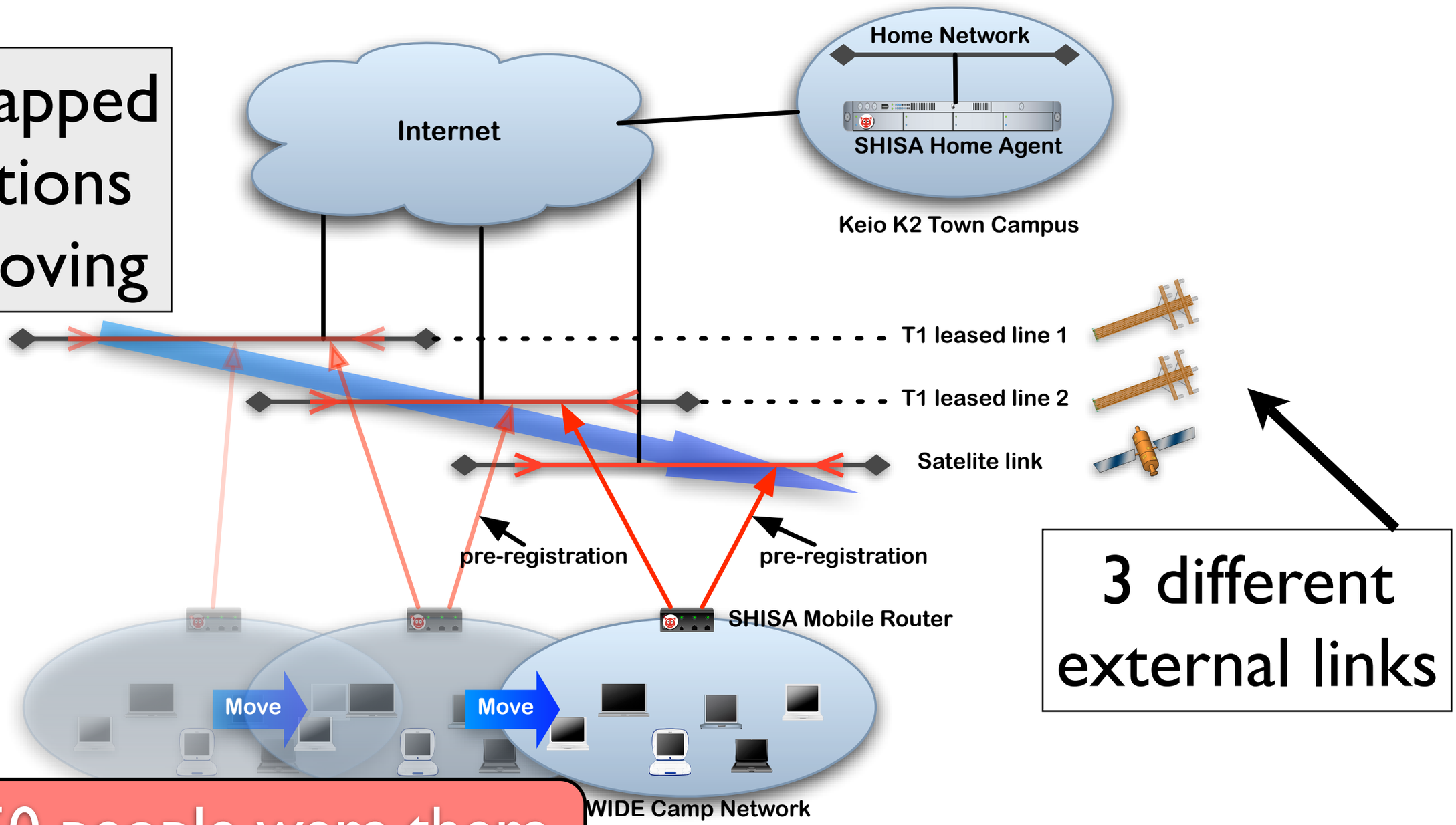
Network Topology at WIDE camp (Sep. 2005)



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

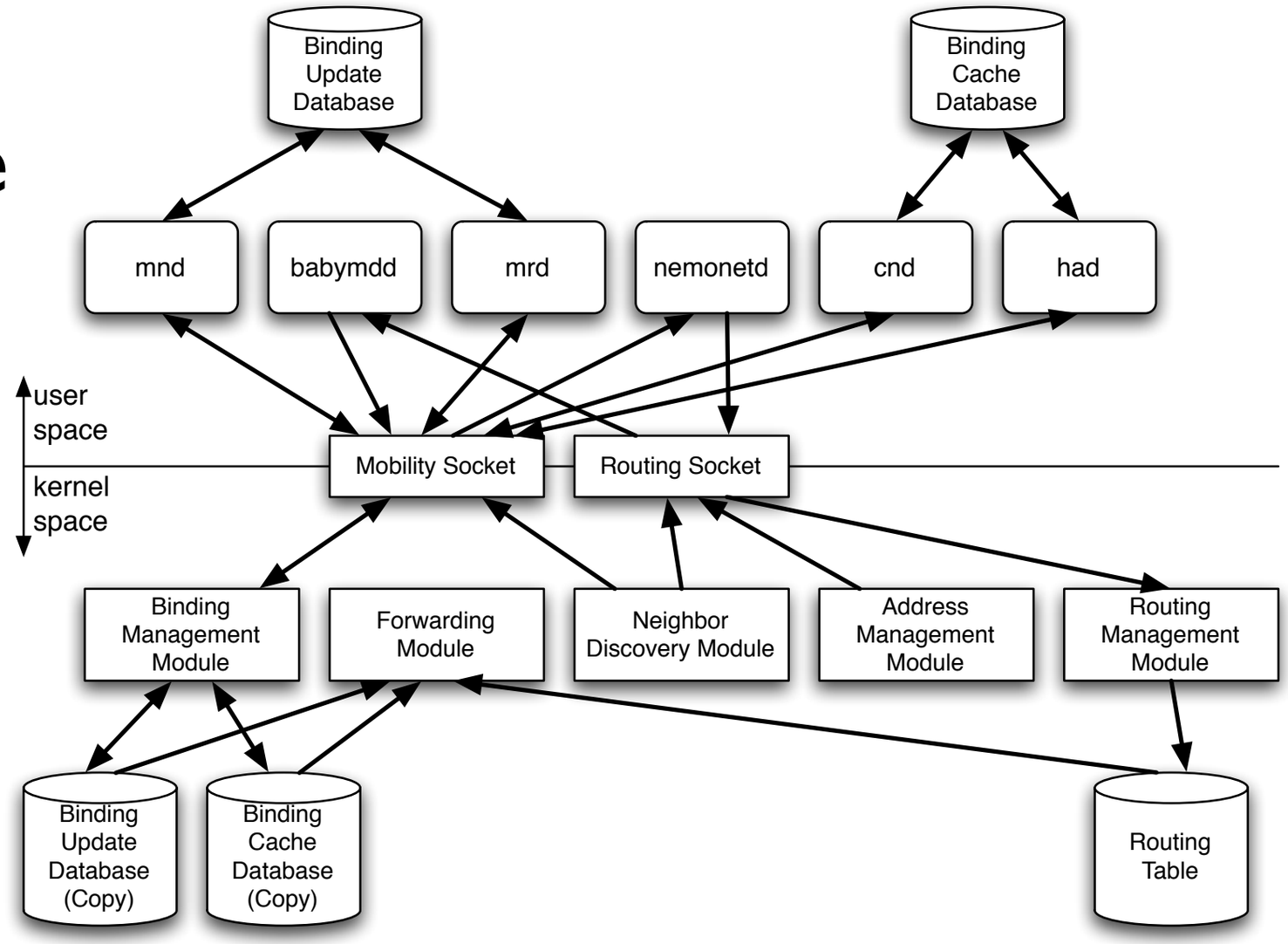
Conclusion

- Mobility technologies are getting mature
  - IETF standard protocols are available
  - High performance wireless communication
- Implementing and operating the technology is important as well as designing protocols
  - It is a lot of fun :-)
- We have to prepare the coming Mobile Internet

Thank You!

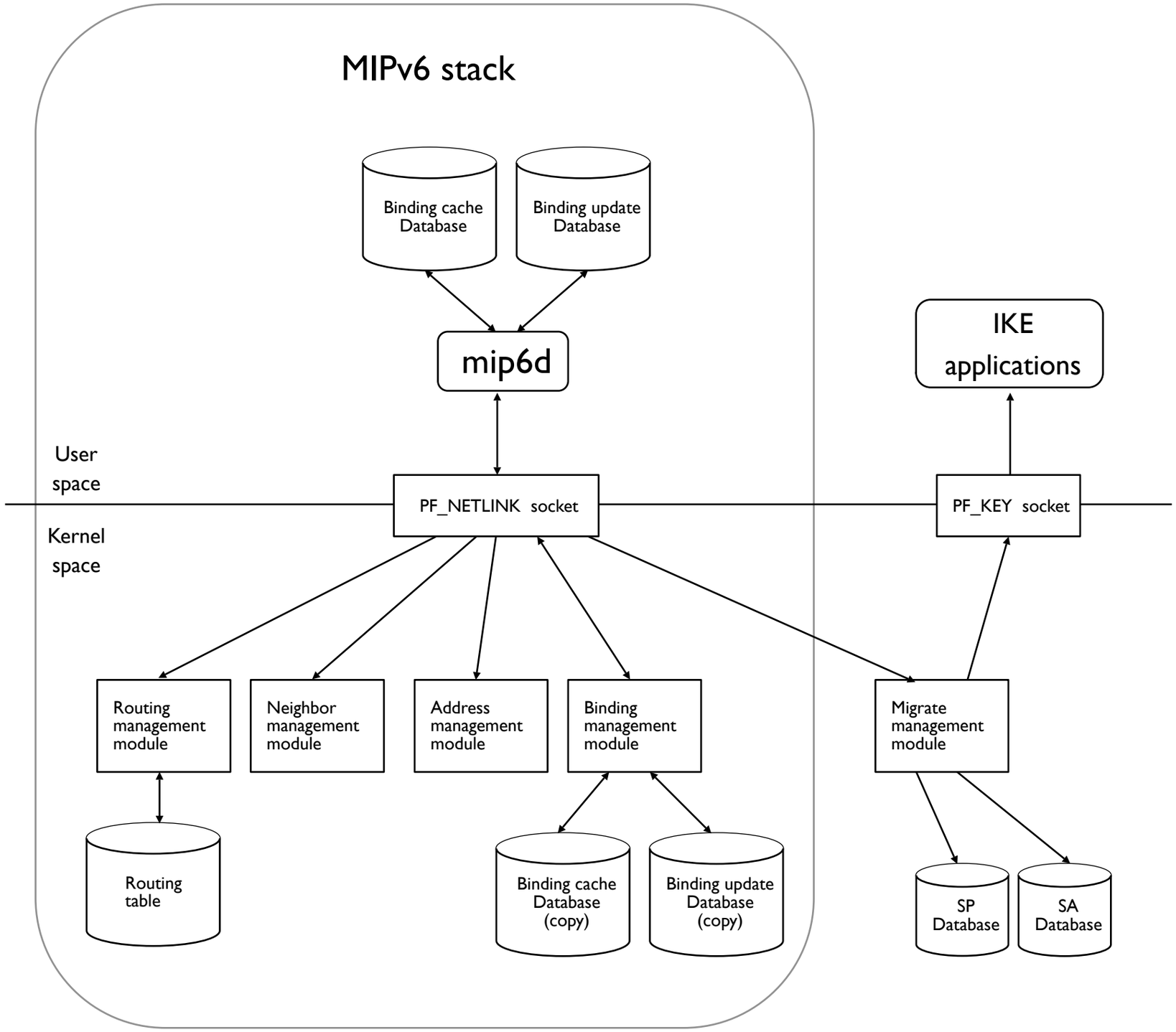
SHISA System

- Mobility functions are provided by the combination of small programs
- MIPSOCK socket interface provides communication method between them

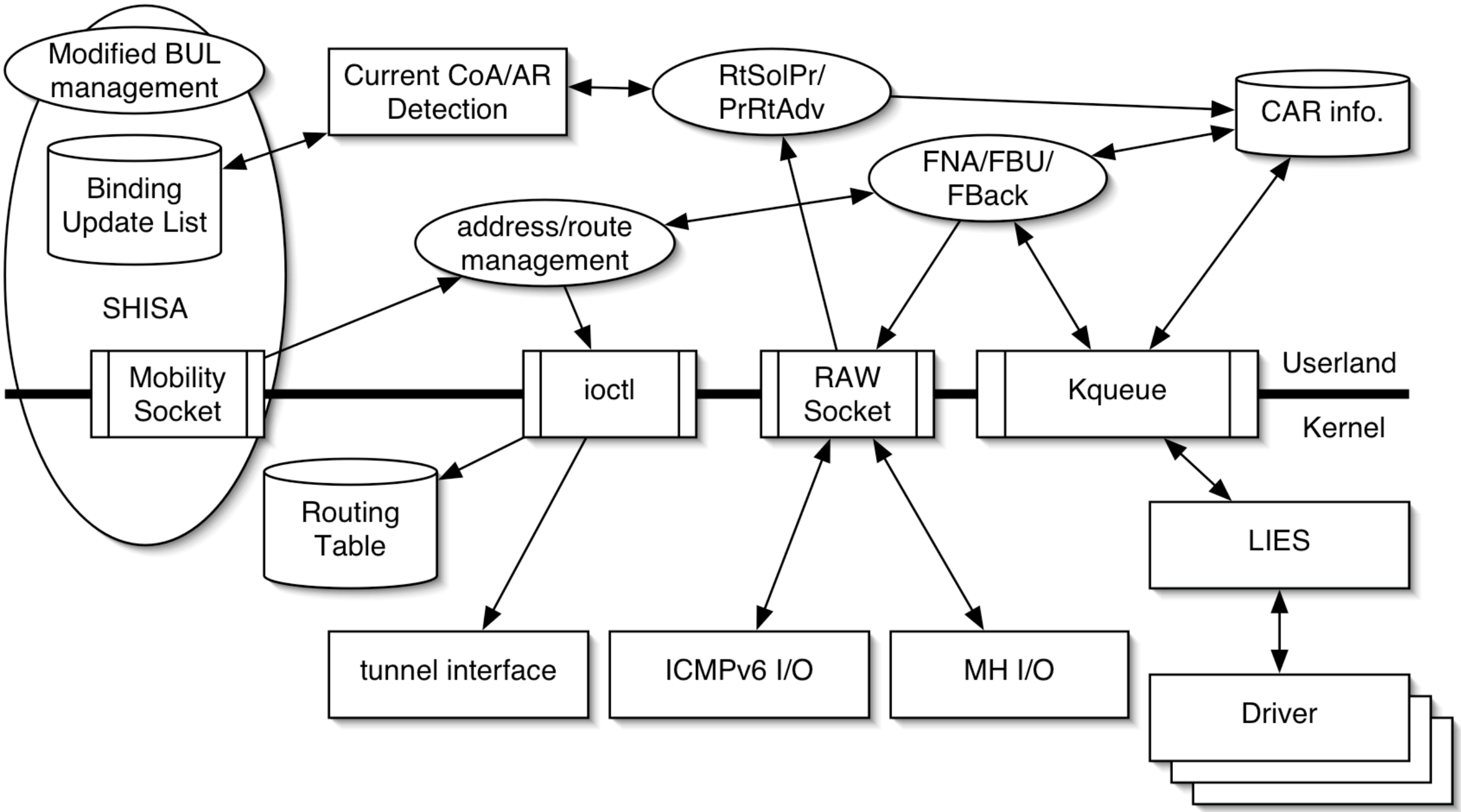


UMIP Systems

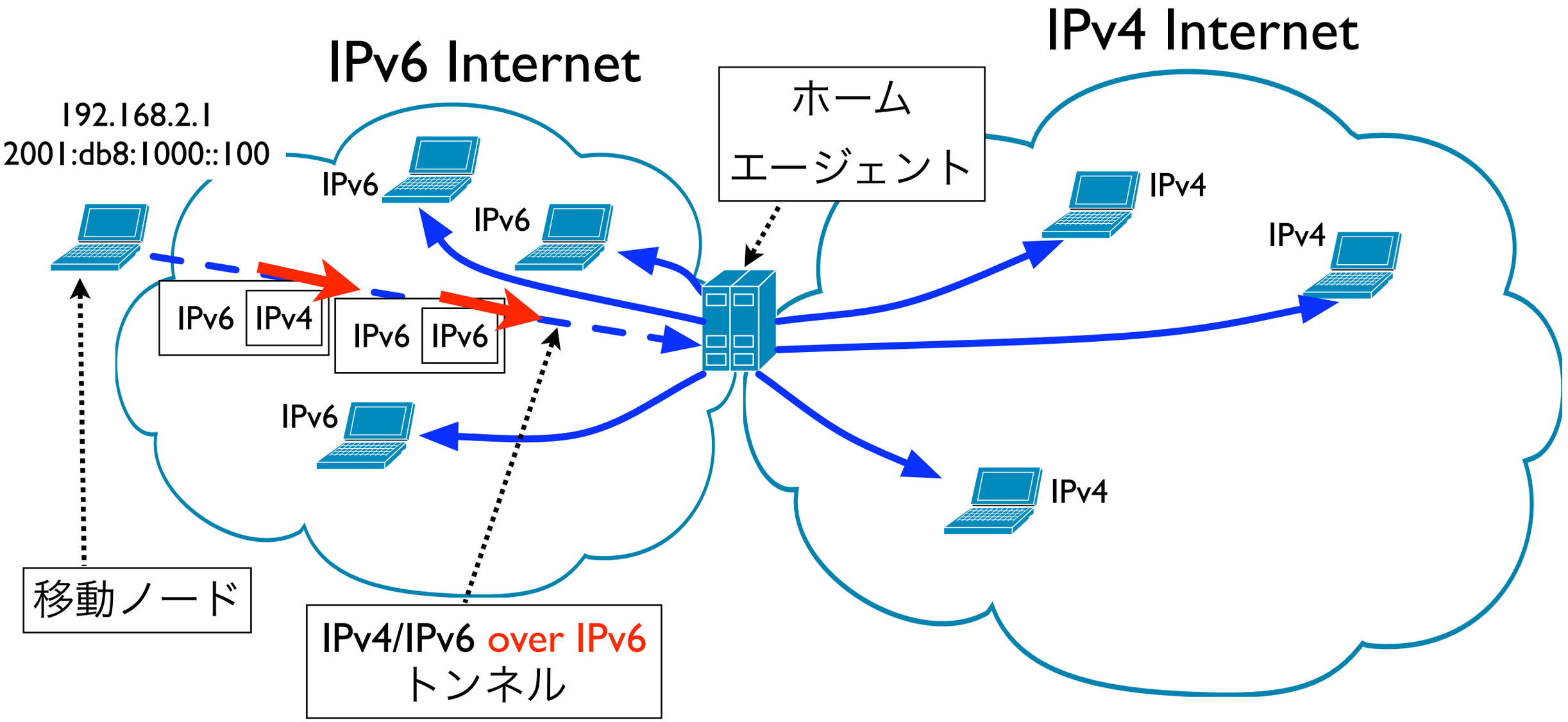
- Mobility functions are provided by a daemon (mip6d)
- PF_NETLINK is used as an interface between user and kernel space
- MIGRATE interface is used to update endpoint address of IPsec tunnel through PF_KEY socket when MN moves



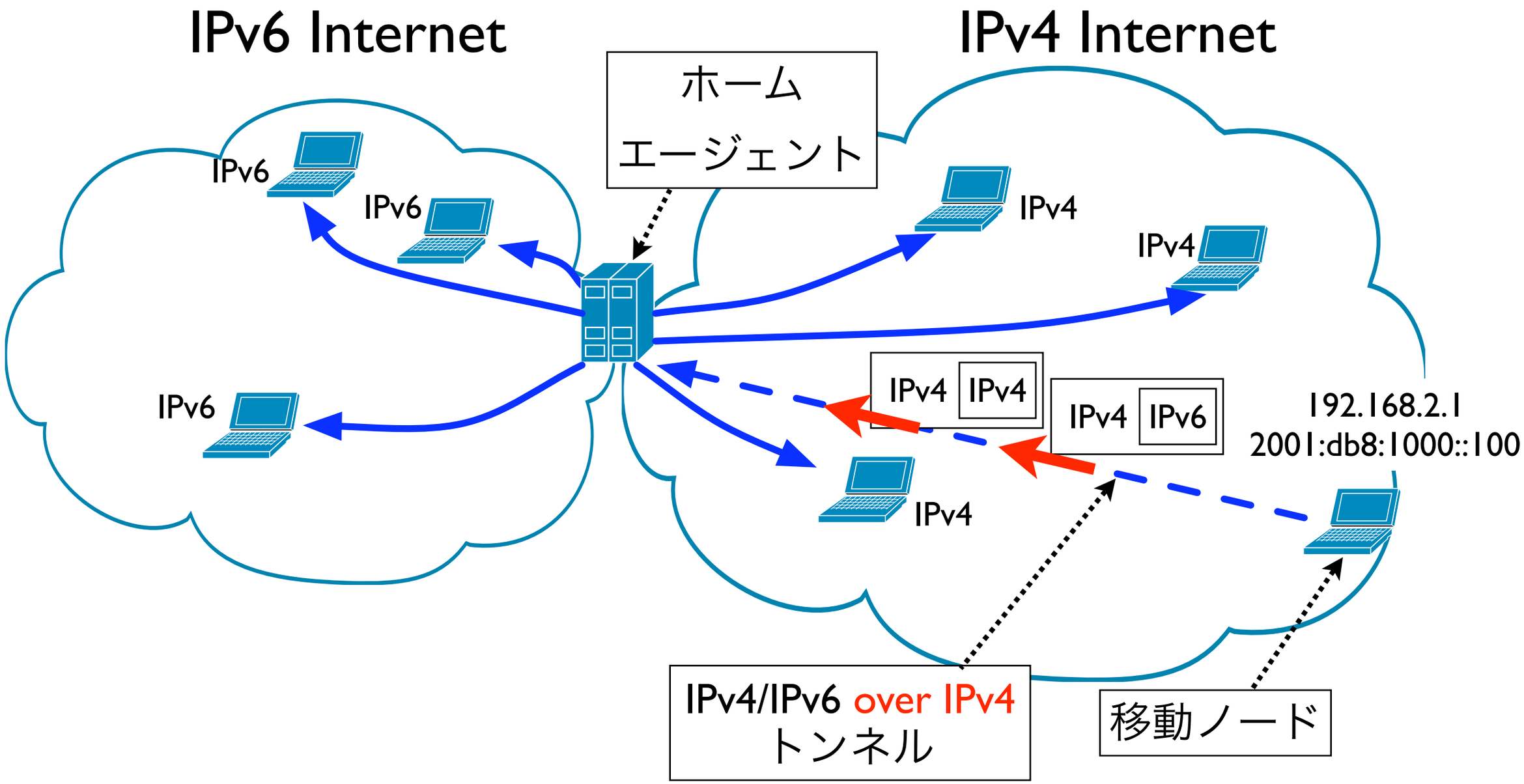
TARZAN System



IPv6ネットワークを移動

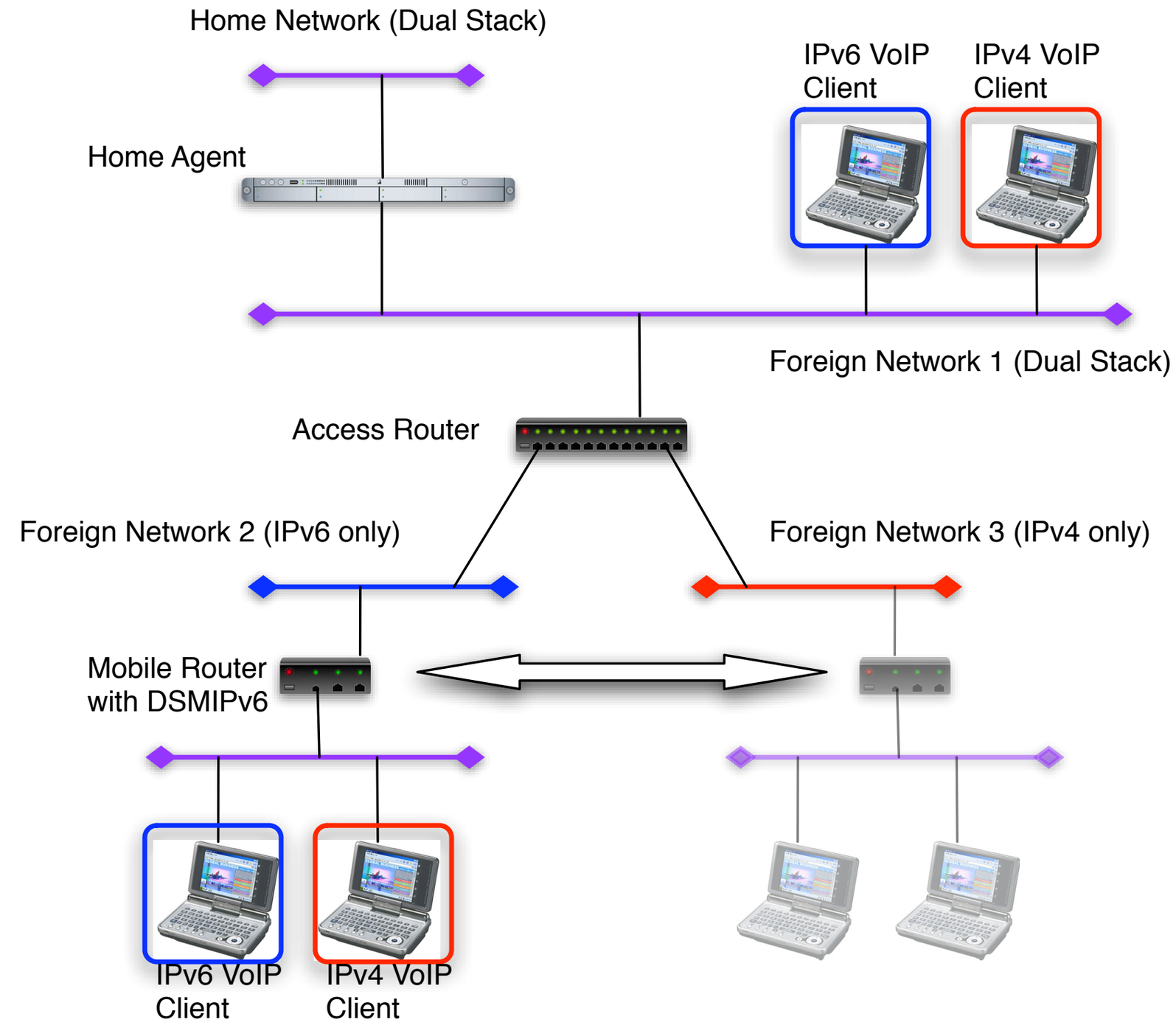


IPv4ネットワークに移動



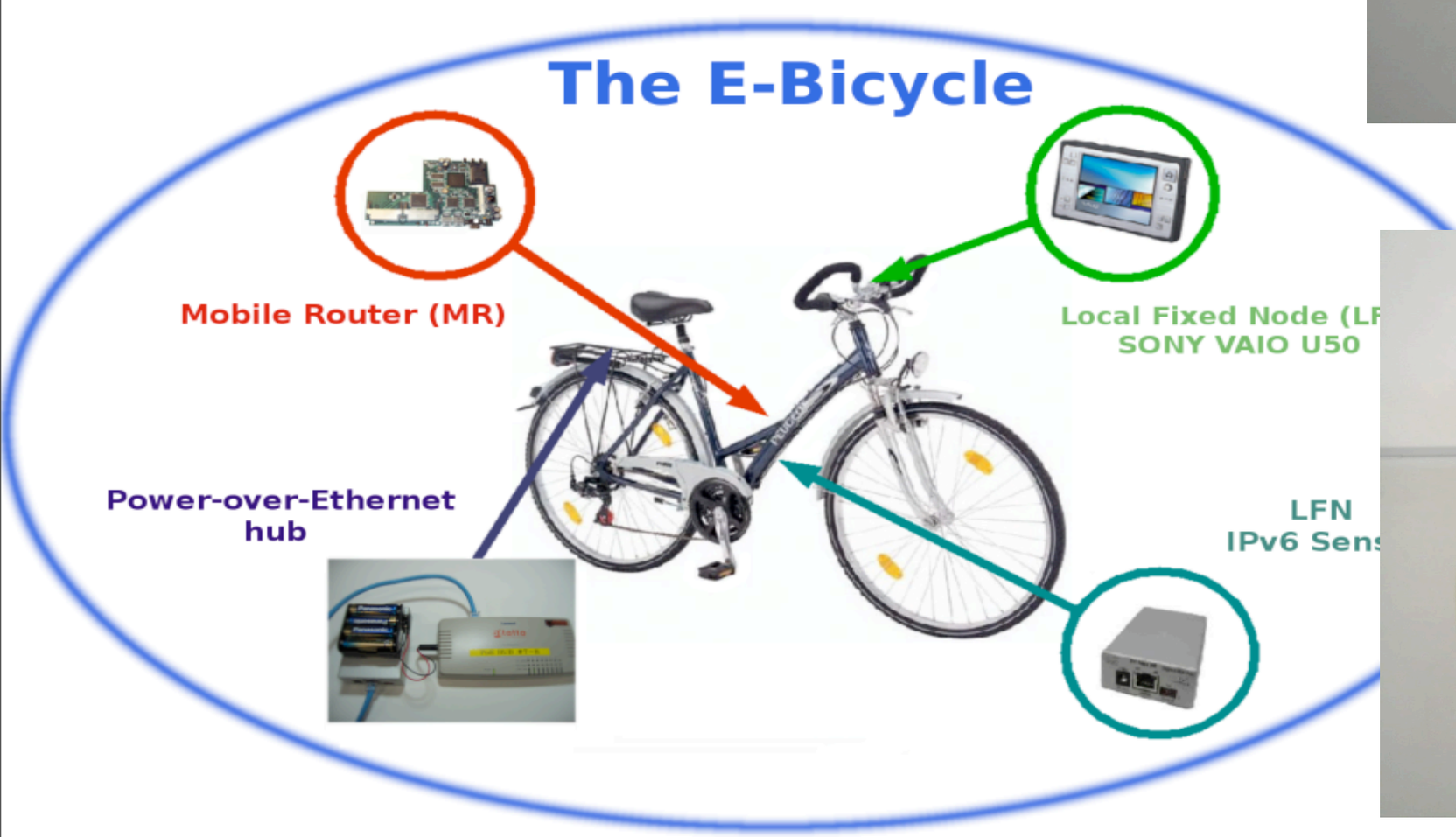
DSMIPv6 Demo Topology

- IPv4 VoIP client and IPv6 VoIP client are located in a mobile network
- The clients can communicate with their peer nodes regardless of the attachment point of their mobile router, thanks to DSMIPv6
- Demonstration was performed at the 1st IPv6 Summit in Thailand, May 2006



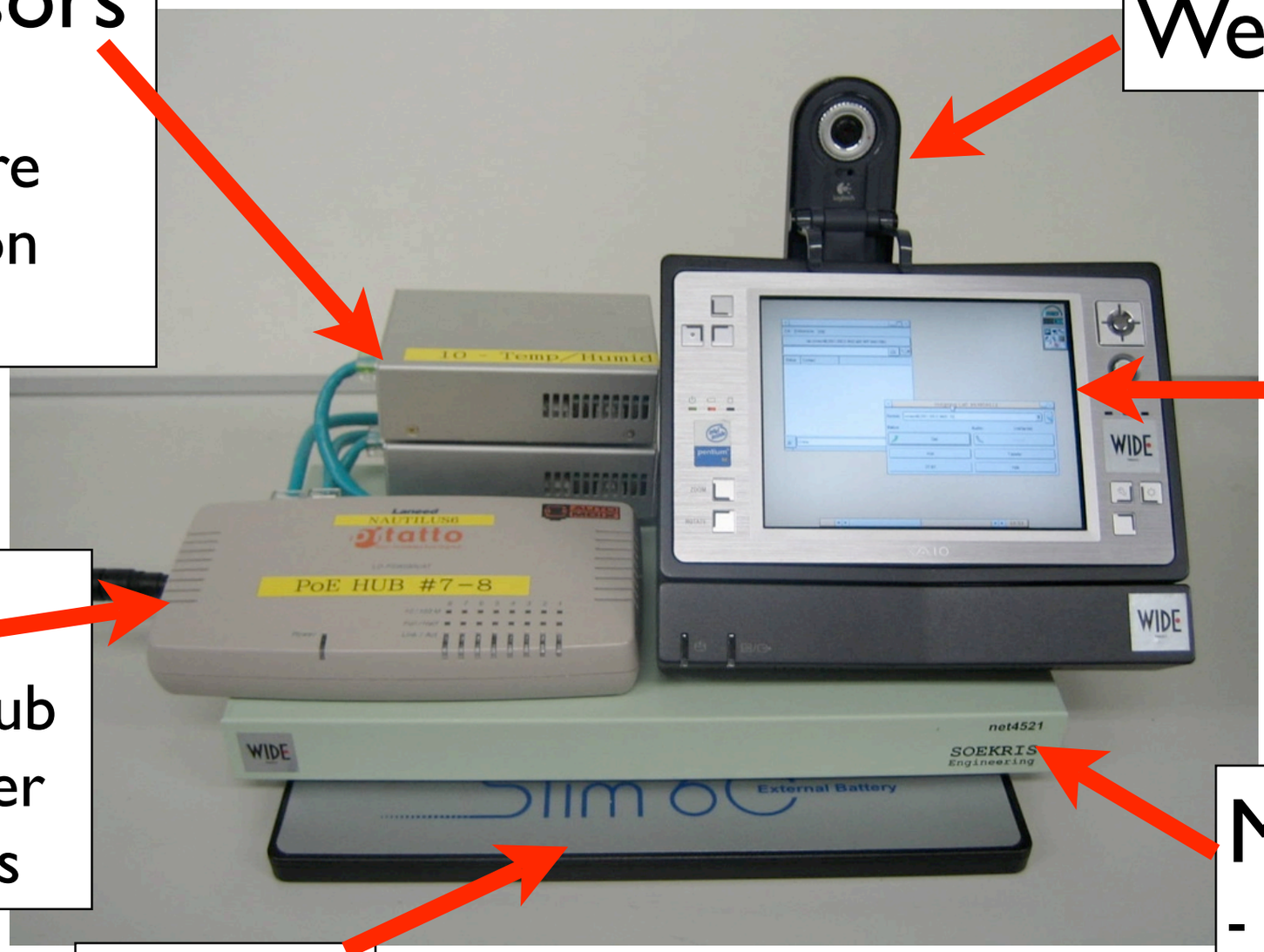
E-Bike / E-Bag

- A good example of Personal Area Network
- IPv6 sensors and a camera connected to small mobile router driven by battery



E-Bike / E-Bag Equipments

IPv6 Sensors
- Humidity
- Temperature
- Acceleration
- Direction



Web Camera

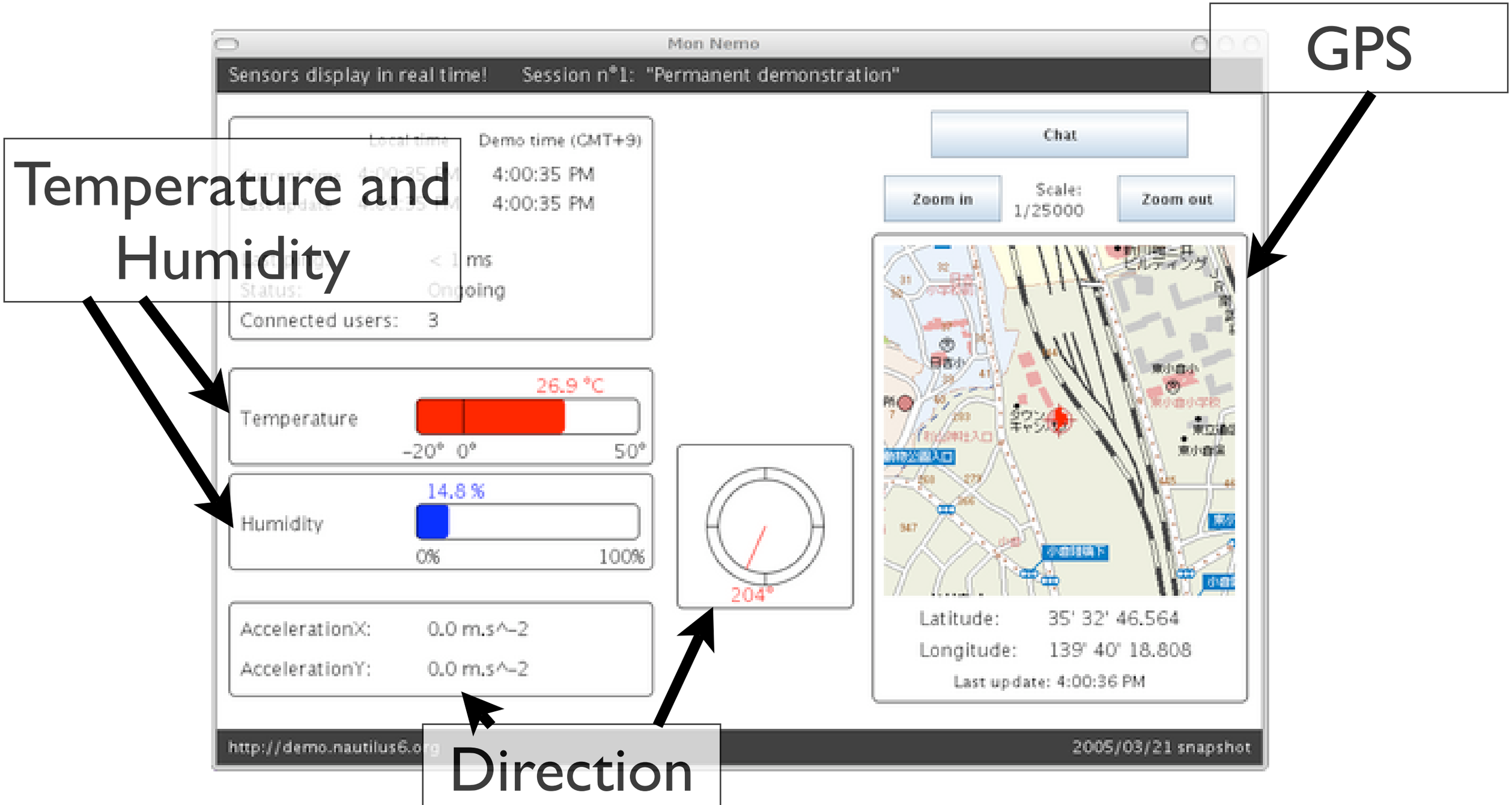
Applications
- MonNemo
- VoIP

PoE Hub
- A modified hub to supply power to IPv6 sensors

Battery

Mobile Router
- Soekris based SHISA MR

Mon Nemo
(IPv6 Sensor Monitor)



ZMS
(IPv6 Sensor Monitor)

Temperature and Humidity

GPS

Direction