



IPv6 Mobility Technology



The University of Tokyo / WIDE Project

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collaboration with Keio University

R&D Items (1/2)

- Mobility Support Protocols/Architectures
 - Mobile IPv6
 - NEMO
 - MANET
 - Multi-Homing
 - Seamless mobility
 - FMIPv6, HMIPv6, CARD, L2-trigger
 - Security: IPSec, IKE, etc. for (scalable) authentication with horizontal and vertical hand-over
 - Access Control: AAA, Radius, etc.
- Work around
 - Focusing on the professional operation
 - Standardization at IETF
 - Reference implementation
 - Testbed operation

R&D Items (2/2)

- Collaborating with Nautilus6 Project and SHISA Project in WIDE Project
 - <http://www.nautilus6.org/>
 - Collaborating with the following WGs in WIDE
 - KAME
 - USAGI
 - TAHI
 - InternetCAR
 - E-Care
 - SOI

Open source code is available ;-)

- SHISA (MIPv6 and NEMO) has integrated into KAME protocol stack (and USAGI protocol stack)
- <http://www.mobileip.jp>



SHISA: 移動体通信プロトコル実装

● 特徴

- フリーソフトウェア。KAME IPv6ソフトウェアの一部として配布
- 様々なグループで利用運用
- 目標は実装を公開することで移動通信プロトコルの普及
- Connectathon (Sun), ETSI Plugin Testにより、様々なベンダー実装との相互接続
- TAHI Testing toolによる実装の正確性の確認

● 動作プラットフォーム

- FreeBSD, NetBSD,
(OpenBSD)



● サポート仕様

- RFC3775 (Mobility IPv6)
- RFC3963 (Network Mobility)
- draft-ietf-mip6-mipext-advapi-03.txt
- draft-wakikawa-mobileip-multiplecoa-04.txt

● 参考情報

- <http://www.kame.net>
- <http://www.mobileip.jp>

● ソフトウェア実装メンバ

- 島慶一 (IJJ研究所)
- 百瀬慶一 (NEC)
- 湧川隆次 (慶應)
- 三屋光史朗 (慶應)
- 植原啓介 (慶應)

***“Practical”* QoS in Broadband Internet**

- QoS for individual micro flow would not be practical
 - ➔ For business development, we need “practical” flow management and account management, e.g., aggregated flow management and accounting among inter-domain systems
- Parameters
 1. Multi-Homing
 2. Interoperability, among TEs, Networks
 3. Resiliency
 4. Policy Routing and controllability
 5. Sender authentication, including effective roaming

Research Directions

- Scalable AAA architecture

While considering ;

- *Security and Privacy* ****new****
- Commercial operation
 - *Light-weight AAA using Kerberos* ****new****
- Global operation
 - Inter-domain operation
- Ubiquitous operation
 - Considering the integration with RF-ID
- Mobile operation
 - *Including disconnected/Ad-Hoc operation* ****new****
- Multi-Homing
 - Both vertical and horizontal
 - Integration of wired and wireless networks, aka FMC(?)

Live Demonstration at 2004 Nagoya ITS World Congress October 2004

Collaboration among



KDDI

KDDI
KDDI R&D LABS

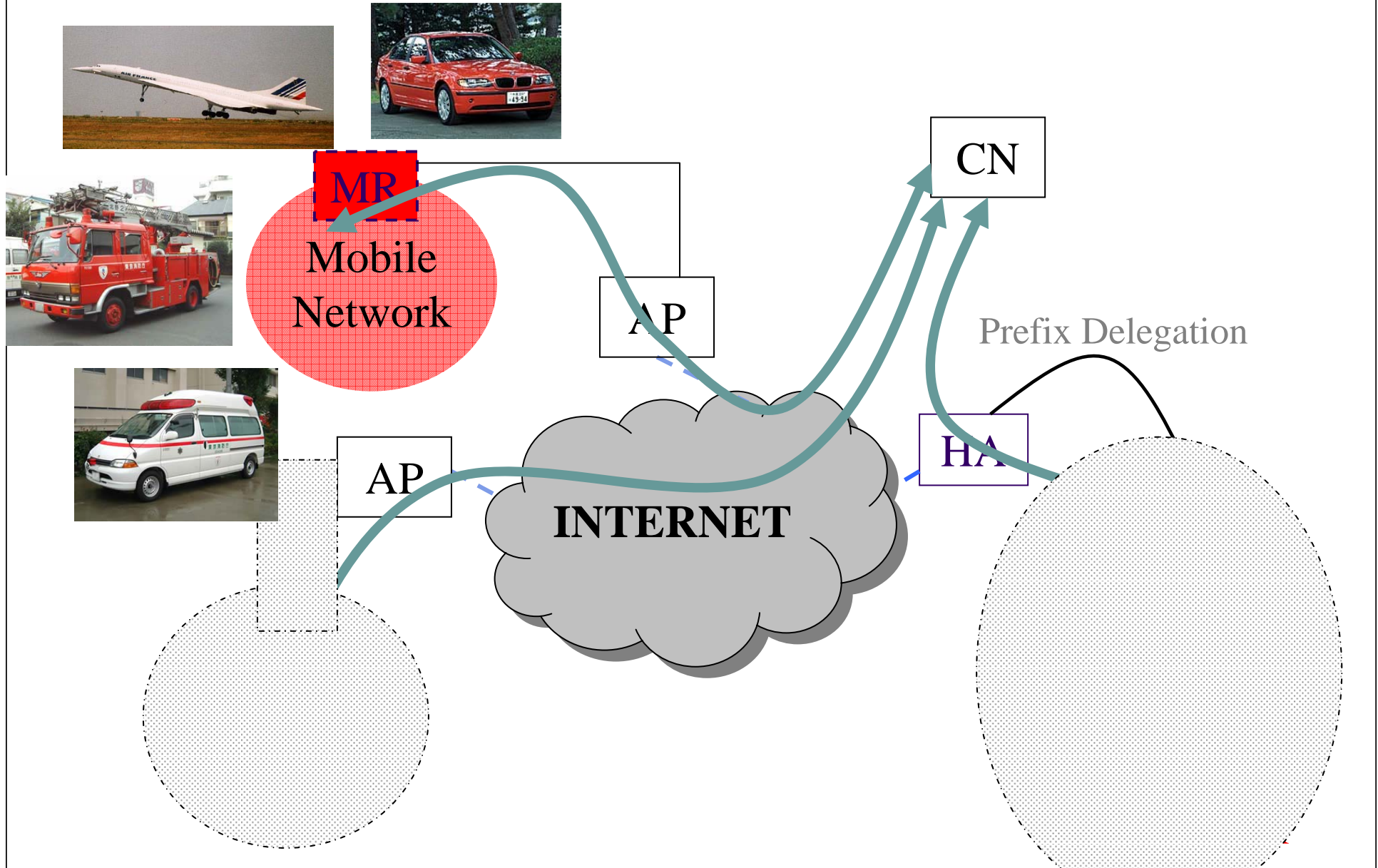


Omnisci Software, Inc.



資料提供：慶応義塾大学 湧川隆次氏

Toward the Network Mobility



Demonstration by WIDE at Nagoya ITS Congress

Application

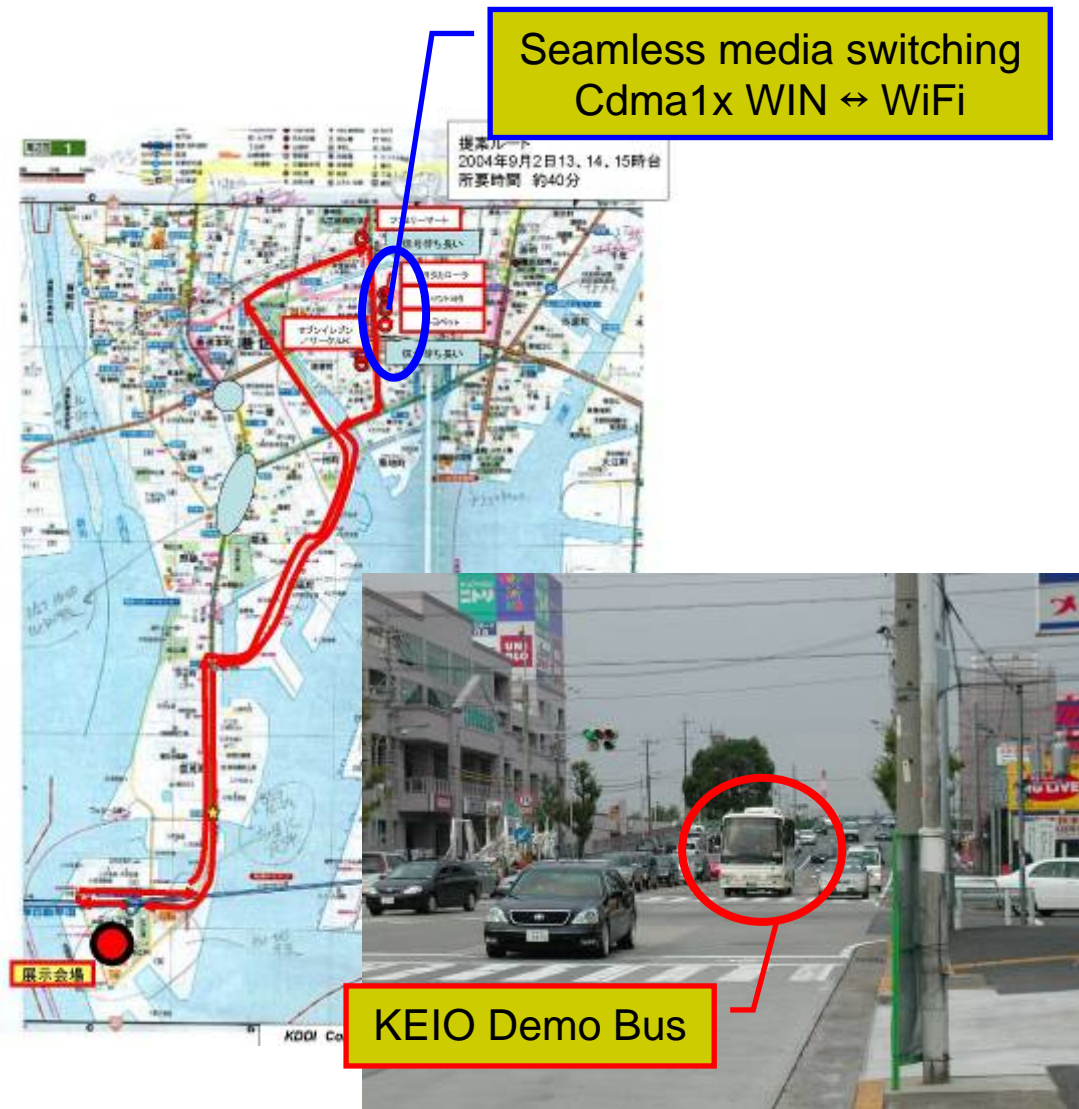
- Remote tour guide
- Real time remote camera
- Emergency measures

Technology

- IPv6
- Media switching
- Adaptive application
- MANET
- Interoperability

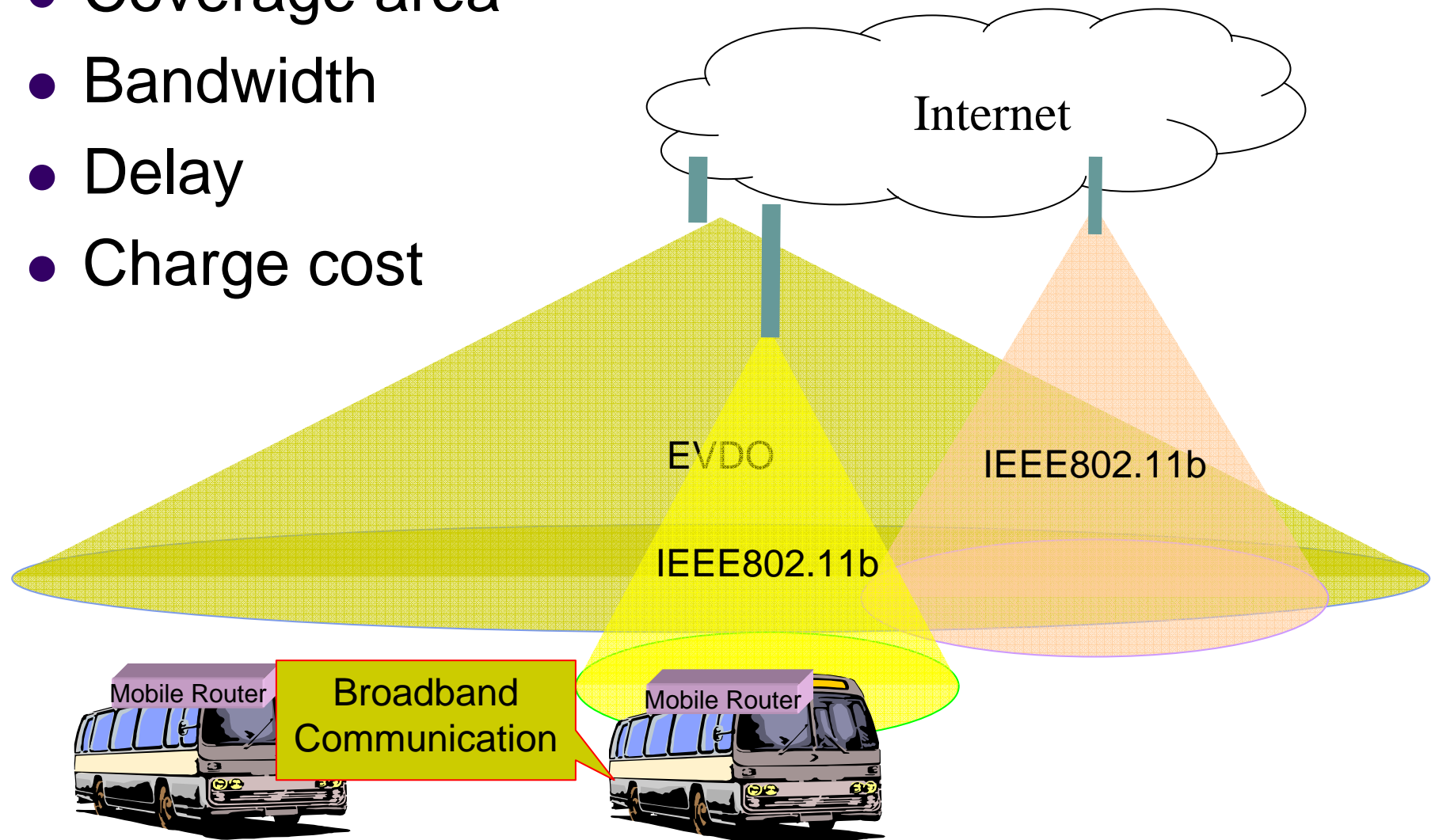
General Information

- Reservation can be made at KEIO booth
- Takes about 40min



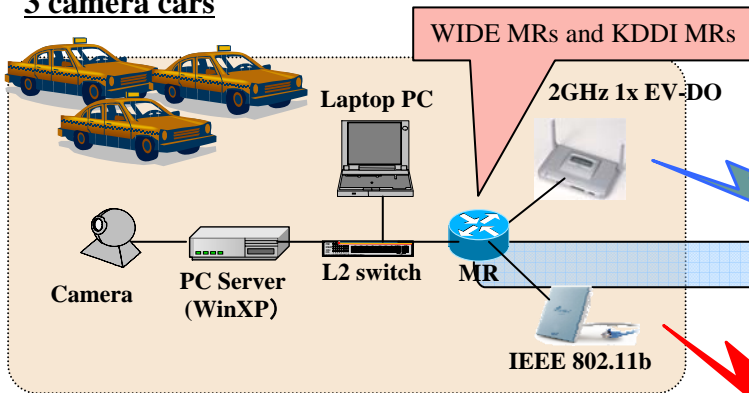
Switching interfaces + MANET

- Coverage area
- Bandwidth
- Delay
- Charge cost



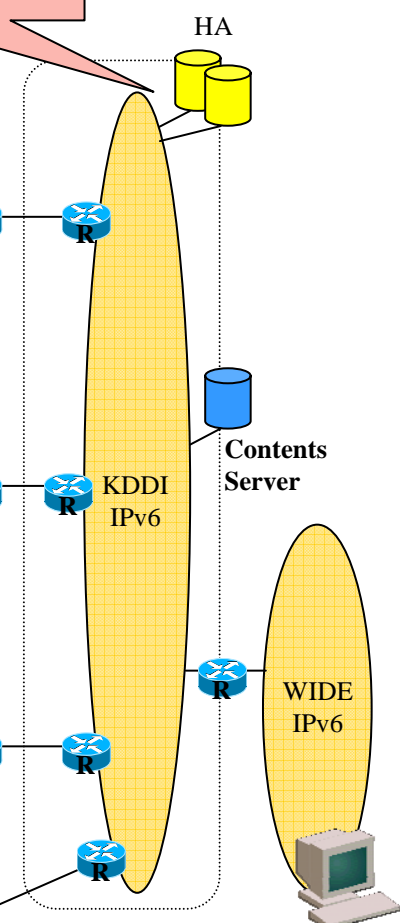
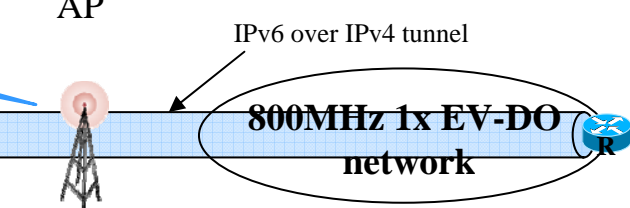
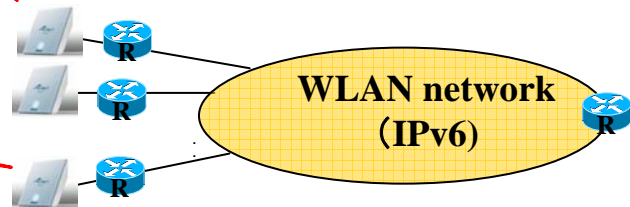
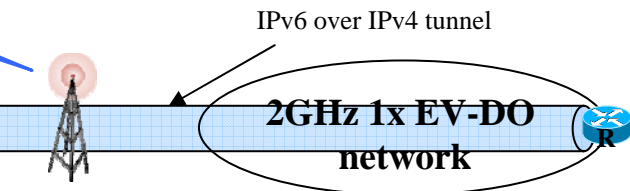
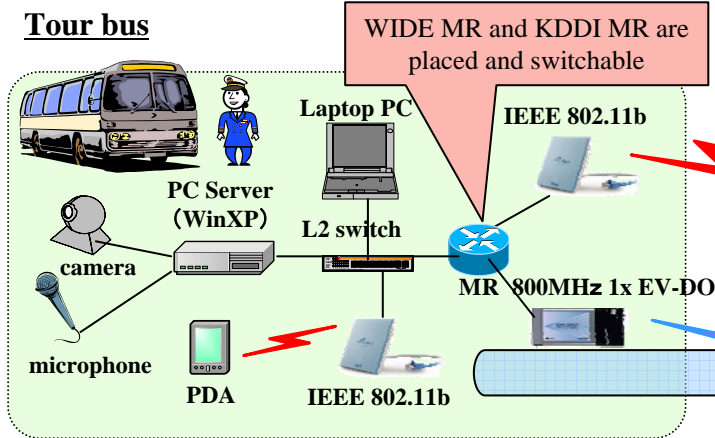
System Configuration

3 camera cars

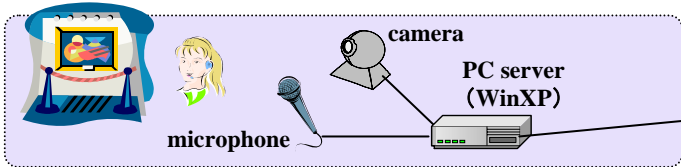


WIDE HAs and KDDI HAs, each can accommodate any MRs.

Tour bus



ITS World Conference Exhibition Booth (PORT MESSE)



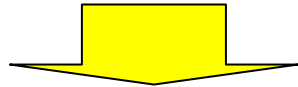
MR by WIDE



MR by KDDI

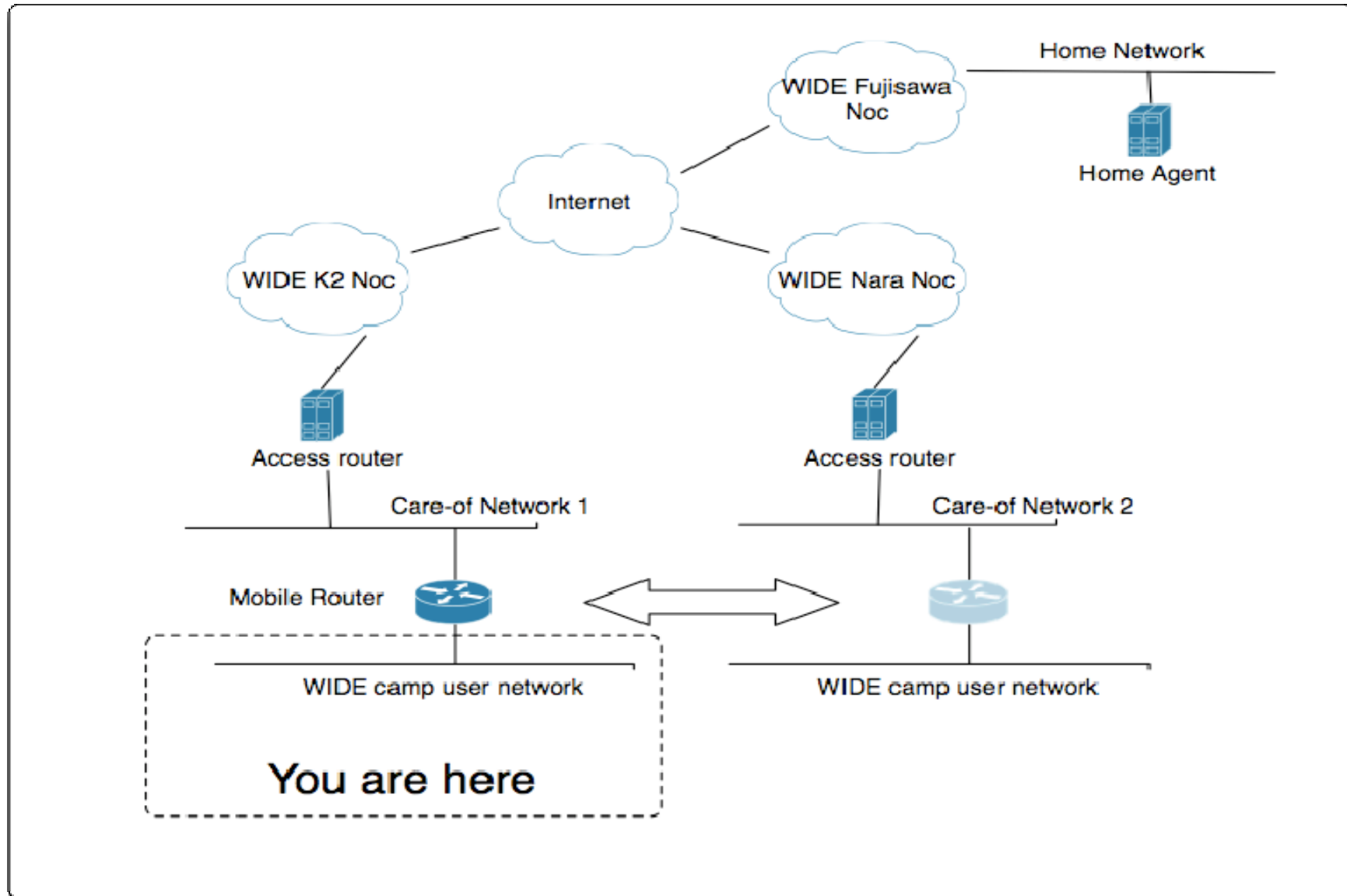
Lessons on NEMO/MIP architecture

- Original objective was to improve connectivity, such as smooth handover..... But..



1. Applicable not only for wireless networks, but also for wired networks, for unique protocol
2. Can hide the c/o address, where actually the node is, i.e., keeping the location privacy against the public, and traceability for private network.
3. Do not need re-configuration at nodes, reflecting to the operational cost
 - ➔ Providing “Portable” address space is a key.
 - When we need configuration, waiving the re-configuration contributes to the cost reduction for network operation
 - Full auto-configuration is not easy, but is difficult

Topology of the WIDE CAMP net, in Sept.2005



SIP vs MIP/NEMO

- FMC is discussed at ITU-T
 - SIP will be the technical solution for NGN at ITU-T and for 3GPP
 - SIP with mobile realized as dynamic DNS
 - Naïve directory service.....
 - Can SIP satisfy the privacy and security ?
 - Privacy : expose of current IP address to end-stations
 - Security : fall into Peer-to-Peer communication....
- MIP/NEMO
 - Privacy : only home address is exposed to end-stations
 - Trace-ability : Home Agent (HA) can act as Firewall Router

Scalable AAA service

- Issues and requirements on mobile environment
 - ✓ Aggregation of node-ID (space)
 - ✓ Distributed processing
 - ✓ Light-weight mechanism
- Solution
 - ✓ MIP/NEMO
 - ✓ Distributed and aggregated operation for mobile nodes
 - ✓ XKDCP based on Kerberos architecture

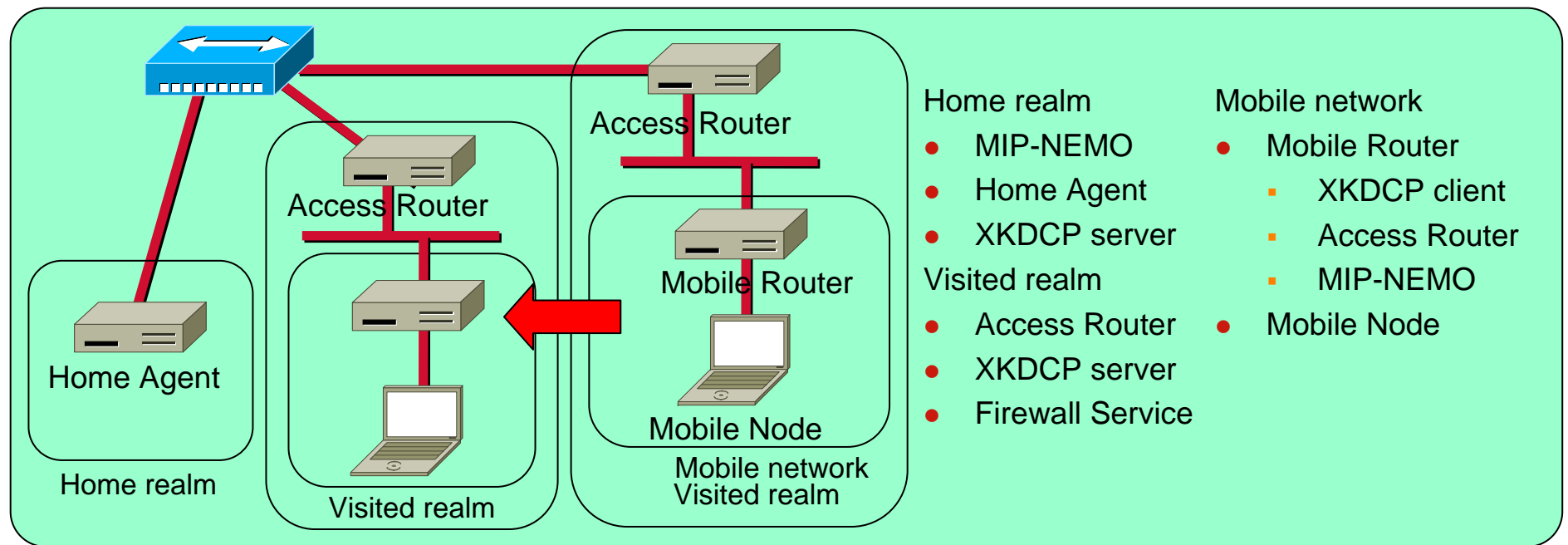
Demonstration network

Construction

Demonstration network contains; (1) Home realm, (2) Visited realms and Mobile network. Each realm is assumed to be different administrative realm from another. All machines are connected by fixed line and they communicate by IPv6.

Function

Each Access Router has Key Distribution Center (KDC) Function and Firewall Controller Service (FCS) Function. Once the Mobile Router (MR) attaches another realm, XKDCP operation (authentication of the MR) is handled between KDCs. If authentication succeeds, FCS sets the firewall to pass all packets to and from Mobile network. Then the MR can send Binding Update message to the Home Agent.



Overview of XKDCP system for MIP/NEMO

Overview

The demonstration system consists of MIP-NEMO and XKDCP. On one side MIP-NEMO provides network-oriented mobility, on the other side XKDCP provides inter-realm authentication function.

What is XKDCP?

XKDCP is an extension of the Kerberos protocol that provides cross-realm functionalities suitable for roaming situations. ASP, which is used for this demonstration, is one part of XKDCP. Figure 2 illustrates the authentication mechanism of an MR which moved to visited realm.

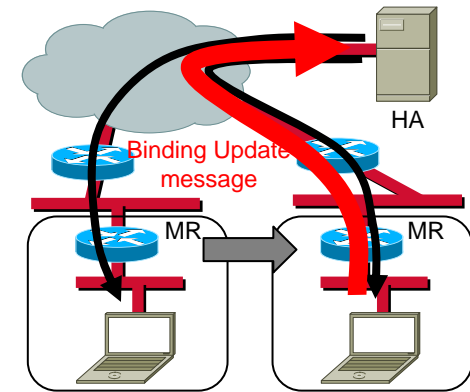


Figure 1

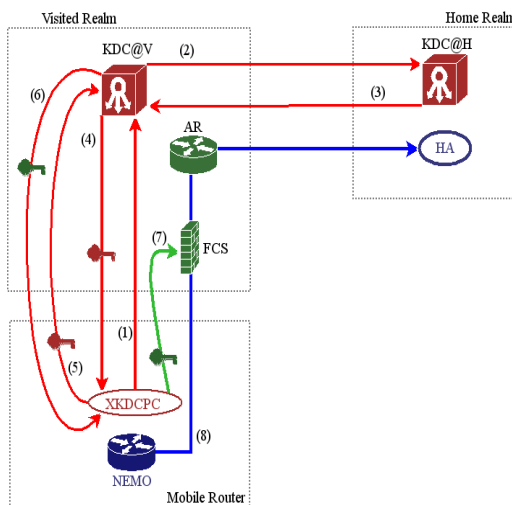


Figure 2

- (1) The MR sends a request for a Global Ticket.
- (2) KDC@V sends an ASP request to KDC@H including the ID of the MR.
- (3) KDC@H replies by sending materials necessary for KDC@V to build the Global Ticket.
- (4) KDC@V builds the Global Ticket and send it to the MR.
- (5) The MR uses the Global Ticket to ask for FCS Ticket.
- (6) After checking the validity of the Global Ticket, KDC@V issues an FCS Ticket and send it to the MR.
- (7) The MR uses the FCS Ticket to configure the firewall of the access router.
- (8) NEMO network stack sends a BU to the HA and network connectivity is established.

*The MR performs (1)-(4) steps only once in each visited realm.

Disconnected/Ad-Hoc Operation

- Many key applications, such as Email, Web, Chat, do not work, when the local network lost the global Internet connectivity.....
 - ✓ DNS (Domain Name System)
 - ✓ Modify the existing DNS architecture
 - ✓ New directory service
 - ✓ Email
 - ✓ Managing user account information and routing
 - ✓ Chat
 - ✓ Pure p2p, hybrid p2p and Client-Server