MOFI:
Mobile Oriented Future Internet

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Outline

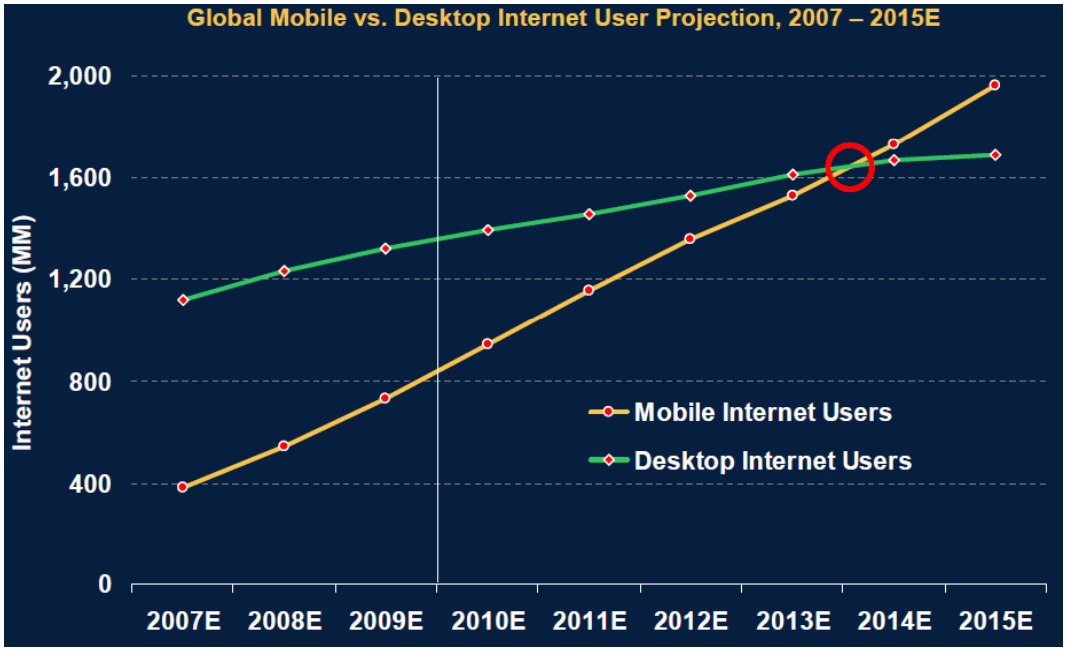
- Background
- MOFI Overview
- Possible Collaboration Topics
- Wrap up

Mobile Trends

- iPhone syndrome
  - Smartphone is becoming major way to access Internet
- Various kinds of wireless networks
  - HSxPA, WiFi, WiMAX, LTE, LTE-A, femto, B4G, …

Forecast

- Morgan Stanley report, April 2010



The number of mobile users will be more than 1.6 billion in around 2014 and thus exceed the number of desktop users

Envisioned mobile oriented network environment

Internet in Mobile

- We note that Internet was not designed for mobile environment
  - Optimized fixed environment
  - Has been good but …
- Mobile environment are supported by patch-on protocols
  - E.g., Mobile IP and its variations
- To support mobile oriented environment, more holistic approach is necessary

Problems in Mobile-(1)

- Overloaded sematic of IP address
  - IP address as ID and LOC
    - For moving node, ID should be kept but locator changed
  - IP allocation on host interface
    - Multi-interface requires multi-IP addresses
  - LOC (IP address) allocation to moving host
    - LOC is only temporary

- Host-based end-to-end protocols
  - Difficulty in terms of deployment, performance, manageability and locality
  - Network-based is practically preferred, e.g. MIP vs. PMIP

Problems in Mobile-(2)

- Single protocol for heterogeneous networks
  - Various kinds of networks having different characteristics
  - E.g. wireless access networks vs. optical backbone, various access networks from sensor/WiFi to LTE/B4G
- Integration of data delivery and control function
  - Both are treated equally
  - Control is more mission-critical
  - Mobile need more control and reliability
- Centralized mobility control
  - Centralized anchor is nightmare for mobile operators
  - Triangle routing and single point of failure

Problems in Mobile-(3)

- Others
  - Idle/sleep mode hosts
  - Intermittent connection
  - Power saving
  - AAA
  - …

MOFI

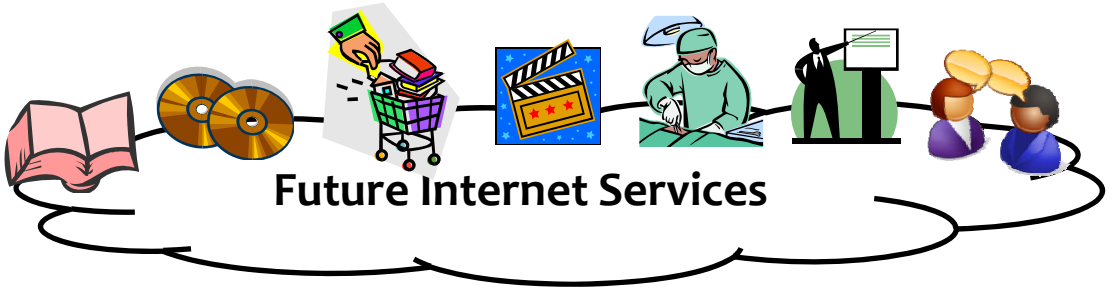
- MOFI is a new Naming, Addressing and Routing architecture for mobile environment
  - Holistically addresses current Internet problems in mobile environment
  - Still keeps host-based networking, rather than CCN

- Supported by national project funded by KCC
  - Member: ETRI & 7 Universities
  - PC: Heeyoung JUNG, ETRI

DPs and FBs for Problems

Problems of Current Internet	MOFI	
	Design Principles	**Functional Blocks**
Overloaded semantics of IP address	Separation of host identifier and network locator	Host ID and Network LOC (**HINLO**)
Host-based end-to-end protocols	ID-based global communications and LOC-based local delivery	Global ID-based Communication and Local LOC-based Delivery (**GIC-LLD**)
Single protocol for heterogeneous networks	Protocol separation for access and backbone networks	
Integration of data delivery and control function	Separation of control function from data delivery	Search-based Distributed Mobility Control (**SDMC**)
Centralized mobility control	Distributed mobility control	

Overall Architecture



Future Works

Current work scope

Data Plane
Global ID-based Comm. and Local LOC-based Delivery (**GIC-LLD**)

Control Plane
Search-based Distributed Mobility Control (**SDMC**)

ID-LOC Separation
Host ID and Network LOC (**HINLO**)

Design Principles-(1)

- Separation of host identifier and network locator
  - HID is used to identify a host itself in the network
    - Persistent ID, needs no address configuration
  - LOC is used to represent the current location of a host in the network
    - LOC of an access router that the host is attached to

- ID-based global communication and LOC-based local delivery
  - End-to-end communication between two hosts will be performed only with their global unique HIDs
  - In each network, data packets will be delivered by using the associated local LOCs

Design Principles-(2)

- Protocol separation for access and backbone networks
  - To support a variety of heterogeneous access networks in future mobile Internet
  - The protocols for access networks may be designed by considering the wireless link characteristics, whereas the protocols for backbone networks will be designed to be as simple as possible

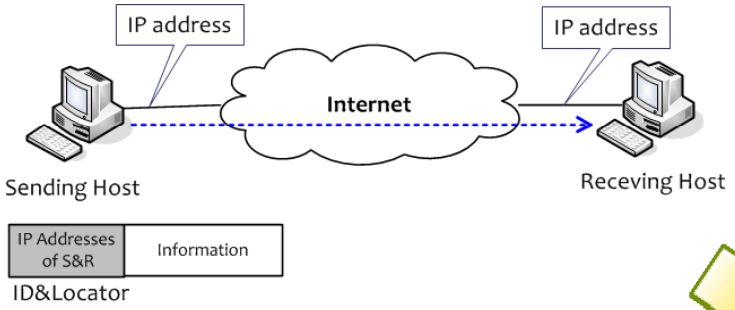
- Separation of control function from data delivery
  - To deal with mission-critical control information effectively, the control plane is separated from the data plane
  - In particular, the mobility control function will be performed as a network-based scheme to enhance deployment, resource utilization and protocol performance

Design Principles-(3)

- Distributed mobility control
  - Route optimization will be intrinsically supported
  - Reduce unnecessary traffics flowing into the core network
  - Also mitigate the problem of a single point of failure to a local network

HINLO-(1)

- Host ID and Network Locator

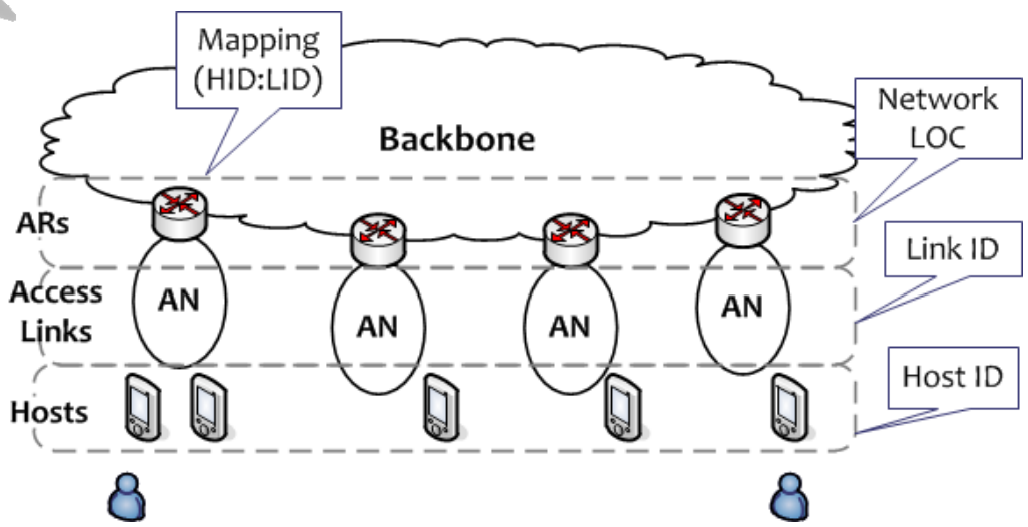


Legacy Internet

IP address which is allocated host i/f is used ID and LOC

HINLO

Hosts have HIDs and Network has LOCs

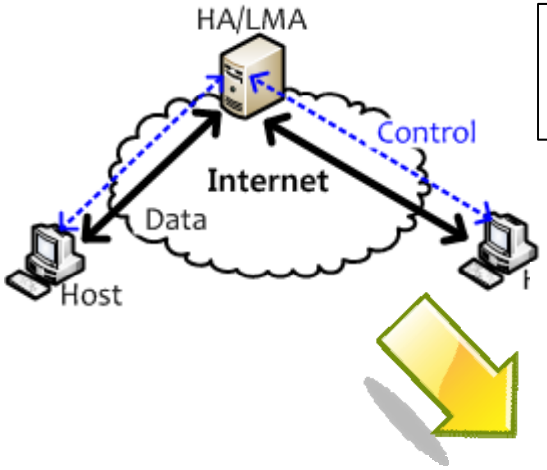


HINLO-(2)

- Notable feature
  - Host does not have locator anymore (locator-free host)
    - Replaced by network-resident locator
  - HID is global unique fixed-sized host ID
    - 128 bit is assumed for compatibility with IPv6
    - May be allocated by international SDO (like IMSI in 3GPP)
  - Specific format of locator is not necessary
    - Currently IPv4/v6 is used for locator in BB
    - AN specific locator can be used for each AN
  - Mapping system
    - [HID:BB LOC] by SDMC
    - [HID:AN LOC] by AR

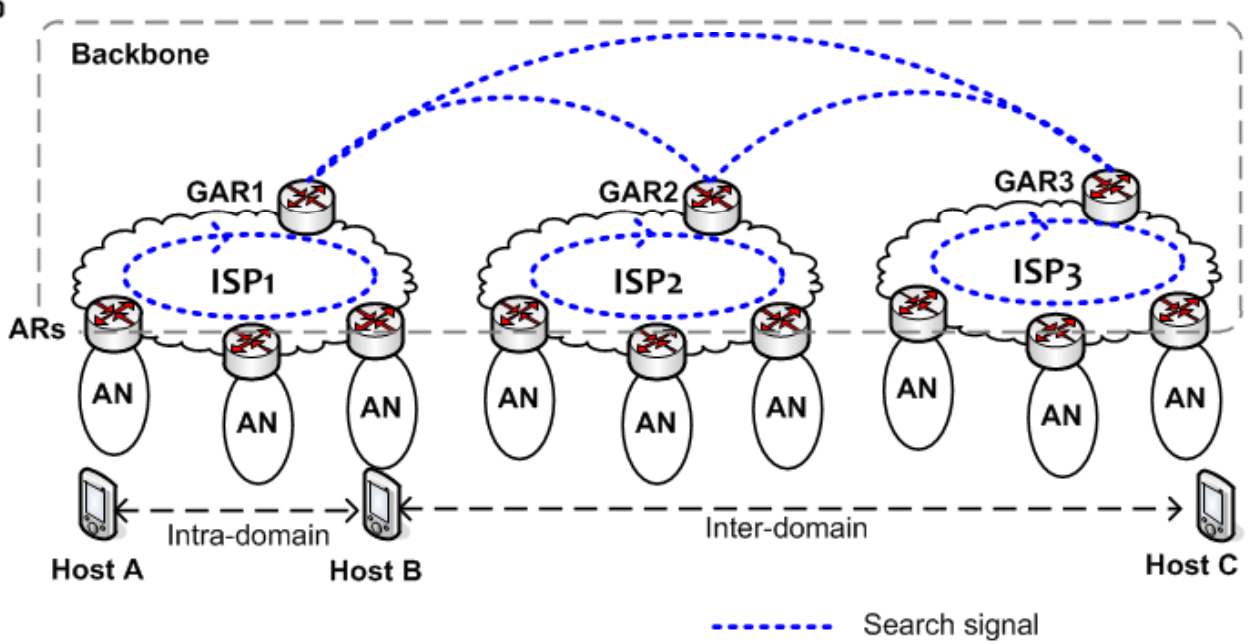
SDMC-(1)

- Search-based Distributed Mobility Control



Legacy Internet

Centralized, combined data/control and server-based (e.g. Mobile IP, PMIP)



SDMC

Distributed, separated control and search-based

SDMC-(2)

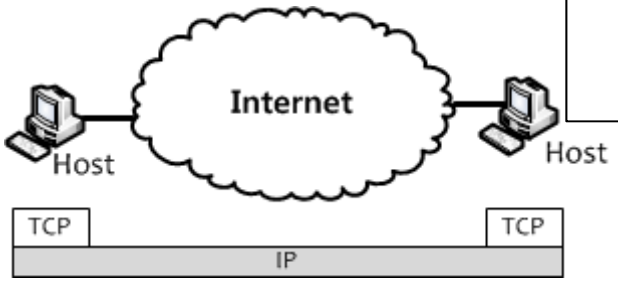
- Notable features
  - Plane separation is basically assumed (pre-signaling based)
  - Mobility control become a part of routing (built-in mobility)
    - Static host should be treated as a special case
  - Distributed approach rather than centralized one
    - Refer DMM activity in IETF
  - Search-based rather than server-based

GIC-LLD-(1)

- Global ID-based Communication and Local Locator-based delivery

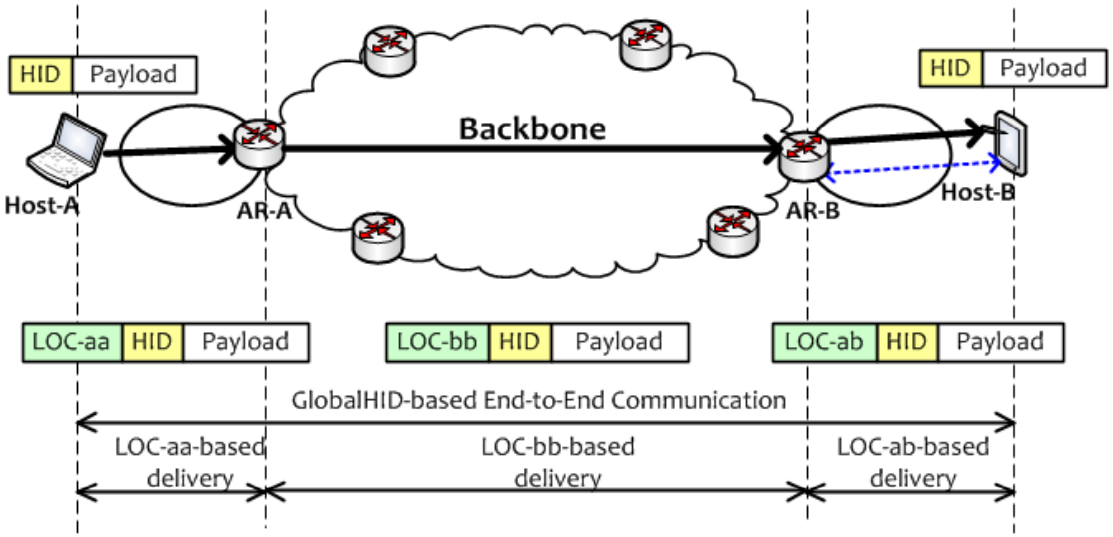
Legacy Internet

IP, ID & LOC, is a single common protocol stack for all nodes



GIC-LLD

A common ID and local LOCs



GIC-LLD-(2)

- Notable features
  - Allows network diversity
    - Multi-protocols are possible
  - Edge (or AR) of BB is responsible for interworking b/w edges (or ANs) and a BB
  - End host is required to have globally unique HID
  - Allows each network to have their own locator regardless of layers (L2 or L3 locator)
  - Similar current "MAP & ECAP" scheme

Related G-Lab Projects

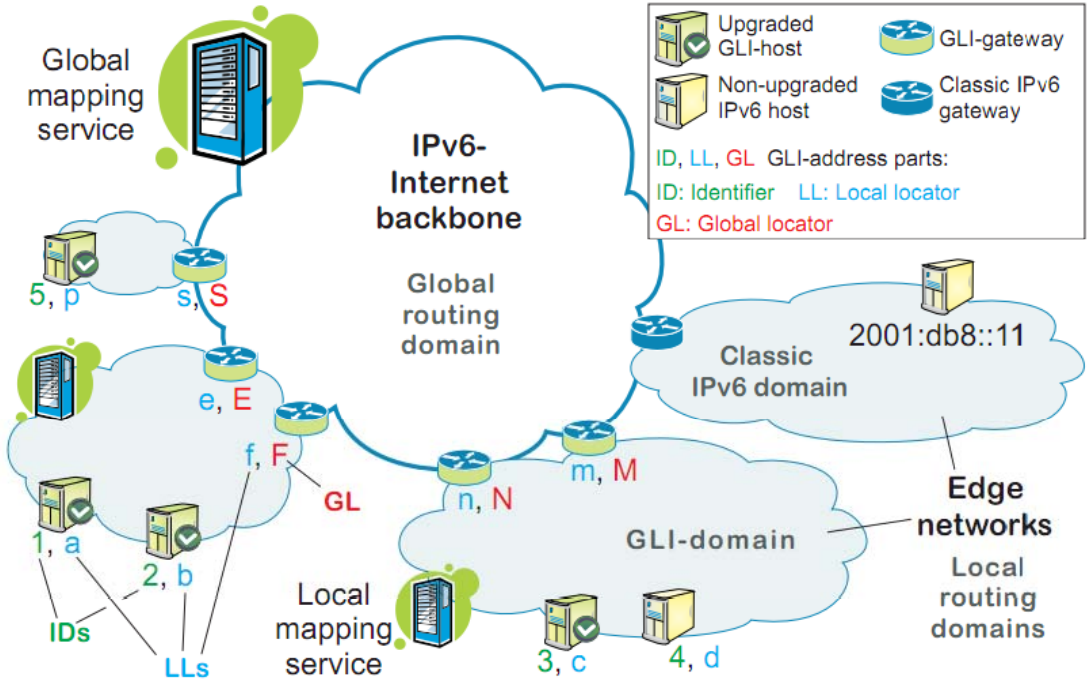
- Referred G-Lab homepage (http://www.german-lab.de/)

- CICS (Convergence of Internet and Cellular Systems)
  - Develop **architectures to support mobility** and quality of service
  - Develop **protocols to support mobility** and quality of service

- FoG (Forwarding on Gates)
  - **'Edge-based' approach** in contrast to the common 'node-based' of today's Internet
  - Forward plane with **interconnected functional blocks called 'Gates'**
  - Incremental routing based on network policies and QoS
  - Universal management framework for network and services

Related G-Lab Outputs

- GLI-Split
  - New ID/LOC separation architecture
  - Similar MOFI-HINLO
- FIRMS
  - ID and LOC mapping system
  - Similar functionality with SDMC



Wrap Up-(1)

- MOFI is a new NAR architecture for future mobile oriented environment
  - A part of a Korea government funded project
  - Three major functional blocks; HINLO, SDMC and GIC-LLD

- Works are still on-going
  - Refining three function blocks
  - Developing NS-3 platform and PC-based testbed for verification

Wrap Up-(2)

- We found similar works in G-Lab
  - CICS and FoG projects have almost the same target as MOFI
  - GLI-Split and FIRMS is very similar with HINLO, SDMC & GIC-LLD
- Internet is "Inter-Networking" technology in global scale
  - Global collaboration is highly required to build global consensus
- Strongly hope close relationship with G-Lab

www.mofi.re.kr

Thank you!

Q & A