Future Network & Mobile Summit 2012

4 - 6 July 2012, Berlin, Germany

Username: Pas

Welcome

Future Network and MobileSummit 2012 takes place in the Estrel Berlin, Germany, 04 - 06 July 2012. This is the twenty-first in a series of Annual Conferences supported by the European Commission, which regularly attracts over 500 delegates from industry and research to share experiences and research results, identify future trends, discuss business opportunities and identify opportunities for international research collaboration under the ICT Theme of Framework Programme 7 (FP7). It will thus contribute to showcasing European research in the field, and position it within the multiplicity of related initiatives supported in other regions of the world.

In the context of convergence and innovation, the 21st Future Network and MobileSummit will address the challenges of building the Future Internet Infrastructures, based on mobile, wireless and fixed broadband communications technologies.

Net!Works Video Blog - Published each day during event

Net!Works, through the NetWorld CA project, is supporting FutureNetworkSummit 2012 and is publishing a series of video blog clips during the event. Please go to http://www.networks-etp.eu/ to view short interviews with speakers and participants as they are published.

Programme

The Scientific Programme for Future Network and MobileSummit 2012 is based on an open Call for Papers which closed in December 2011. The Final Programme consists of four plenary sessions and 38 parallel sessions featuring different aspects of Radio Access and Spectrum, Converged and Optical Networks, Integrated Satellite Communications and Future Internet Technologies.

Plenary speakers confirmed to date include:

- Mario Campolargo, Director, Net Futures, DG Communications Networks, Content and Technology, European Commission
- Hossein Moiin, Chief Technology and Strategy Officer, Nokia Siemens Networks
- Prof Hans-Joachim Grallert, Director, Fraunhofer Heinrich-Hertz Institut
- Reiner Liebler, BnetzA, Germany
- Peter Meissner, NGMN Alliance
- Ruprecht Niepold, Adviser Radio Spectrum Policy, DG Information Society and Media, European Commission
- Dr Lutz Stobbe, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration IZM, Germany
- Mark Daly, ESB, Ireland
- Didier Bourse, Alcatel Lucent Bell Labs
- Prof. Paul Müller, University of Kaiserslautern, Germany
- Radoslaw Krzywania, Poznan Supercomputing and Networking Center, Poland
- Dai Davies, Dante, UK
- Rolf Sperber, Alcatel-Lucent

Exhibitors

Future Network Summit 2012 Agenda

Updated: 2012-07-02

To view the full programme for each day, click on the day link. To view the papers within a session, click on the session title (WS = workshop session).
To print the full programme, click Printable version.

Day 1: 04 July 2012

08:00	Registration
09:00	**Plenary: Opening Plenary** Prof Klaus David, University of Kassel, Germany (TPC Chair) Mario Campolargo, Director, Net Futures, DG Communications Networks, Content and Technology, European Commission Hossein Moiin, Chief Technology and Strategy Officer, Nokia Siemens Networks Prof Hans-Joachim Grallert, Director, Fraunhofer Heinrich-Hertz Institut
11:00	Coffee Break
11:30	6 Parallel Sessions Next-generation Radio System Architectures and Protocols **WS:** Cognitive Radio/Cognitive Networks **WS:** Optical Networks Standardization in FP7 projects Future Internet Architecture Quality in Future Internet FI Poster Session
13:15	Lunch Communications LTE Advanced Systems: PHY Layer Issues Optical Access Networks **WS:** Cloud Networking – Technical and Business Challenges I **WS:** Green Communications and Networks I RAS Poster Session
16:00	Coffee Break
16:30	6 Parallel Sessions Session 4a LTE Advanced Systems - Future Challenges and Way ahead Optical Technologies and Networking **WS:** Cloud Networking – Technical and

Day 2: 05 July 2012

09:00	**Plenary: Plenary II - Radio Spectrum Policy: Strategic Aspects and the link to R&D on Wireless** Peter Meissner, NGMN Alliance Reiner Liebler, BnetzA, Germany Ruprecht Niepold, Adviser Radio Spectrum Policy, DG Information Society and Media, European Commission Chris Woolford, Director of Spectrum and International Policy, OFCOM UK
11:00	Coffee Break
11:30	5 Parallel Sessions Enabling technologies for flexible spectrum usage Integrated Satellite Communications Optical Network Control Self Management Future Internet Experimental Facilities
13:15	Lunch
14:15	**Plenary: Plenary III - Sustainability** Green IT Evolution - From Energy Didier Bourse, Alcatel Lucent Bell Labs Prof. Klaus David, University of Kassel, Germany
16:15	Coffee Break
16:45	5 Parallel Sessions Cognitive and Reconfigurable Radio Systems I Content Distribution **WS:** FINSENY – Defining the Opportunities for ICT in Smart Energy Scalable Architectures for the Real World Internet Network Overlay, Virtualization and Federation

Day 3: 06 July 2012

09:00	5 Parallel Sessions Cognitive and Reconfigurable Radio Systems II **WS:** Network Federation I - Architecture **WS:** Machine to Machine Communications: Maintaining User Capacity and Pursuing Energy Efficiency in the Internet of Things I **WS:** Future Network Stability: Threats and Challenges I **WS:** Fostering Programmability of Wireless Networks I
10:45	Coffee Break
11:15	5 Parallel Sessions Novel radio network technologies, including energy-efficiency **WS:** Network Federation II - Algorithms & Proof of Concept **WS:** Machine to Machine Communications: Maintaining User Capacity and Pursuing Energy Efficiency in the Internet of Things II **WS:** Future Network Stability: Threats and Challenges II **WS:** Fostering Programmability of Wireless Networks II **Beyond Bandwidth** Introduction G-Lab: A Software Defined Networking Perspective PL-LAB: Polish Distributed Laboratory for Testing Future Internet Solutions Bandwidth on Demand- The next Internet Innovation Federation of Data sets for Multinational Research Projects
16:00	**Plenary: Closing Plenary**
16:30	Conference ends

11:30 Session 2d: Future Internet Architecture

Chair: David Kennedy, Eurescom, Germany

A New Inter-networking Architecture for Mobile Oriented Internet Environment
Heeyoung Jung, Electronics and Telecommunications Research Institute (ETRI), Korea, Republic Of

On Converged Multidomain Management of Connectivity in Heterogeneous Networks
Michael Soellner, Alcatel-Lucent Deutschland AG, Germany

Research and Experimentation With the HIMALIS Network Architecture for Future Internet
Pedro Martinez-Julia, University of Murcia, Spain

Socioeconomic Tussles Analysis of the ETICS Approach for Providing QoS-enabled Inter-domain Services
Costas Kalogiros, AUEB-RC, Greece

11:30 Session 2e: Quality in Future Internet

Chair: Uwe Herzog, EURESCOM, Germany

Internet Interconnection Assured Quality Services: Issues and Strategic Impact
Manos Dramitinos, Athens University of Economics and Business, Greece

A Global Customer Experience Management Architecture
Jukka-Pekka Laulajainen, VTT Technical Research Centre of Finland, Finland

Service Level Management Convergence for Future Network Enterprise Platforms
Philip Robinson, SAP UK Ltd, United Kingdom

Modelling Quality of Experience in Future Internet Networks
Antonio Pietrabissa, Univ. Rome Sapienza, Italy

11:30 Poster Session 2f: FI Poster Session

Chair: Rui Aguiar, Instituto de Telecomunicacoes, Portugal

Supporting an Architecture for Cross-Layer Optimization
Gianmarco Panza, CEFRIEL, Italy

Design and Implementation of a Service Discovery and Composition Framework for Security, Privacy and Dependability Control
Antonio Pietrabissa, Univ. Rome Sapienza, Italy

Evaluating Secure Identification in the Mobile Oriented Future Internet (MOFI) Architecture
Pedro Martinez-Julia, University of Murcia, Spain

Virtualization of Real-world Objects for a full realization of the Internet of Things
Vera Stavroulaki, University of Piraeus, Greece

Managing Customer Experience through Service Quality Monitoring
Anderson Morais, Telecom SudParis, France

Network Architectures for End-to-End Business and Traffic Collaborations Among Carriers
Nicolas Le Sauze, Alcatel-Lucent Bell Labs France, France

12:15

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A New Inter-networking Architecture for Mobile Oriented Internet Environment

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Abstract: Internet environment is rapidly being migrated towards 'mobile', but the current Internet was historically designed for 'static' environment and thus it is inevitably subject to architectural limitations in the mobile-oriented Internet environment. In this paper, we propose a new inter-networking architecture for the mobile-oriented Internet environment. For this, we first identify a set of requirements by analyzing the problems of the current Internet in the viewpoint of mobile-oriented Internet environments. Based on the requirements, we describe the proposed architecture with the three functional building blocks: Host ID and Local Locator (HILL), Dynamic and Distributed Mapping System (DDMS) and Query-First Data Delivery (QFDD). Finally, the proposed architecture is compared with the existing ones in various aspects.

Keywords: Inter-networking, Architecture, Mobile-oriented, Host Identifier, Local Locator, Query-First Data Delivery, Dynamic and Distributed Mapping System.

1. Introduction

In the Internet, the number of mobile hosts such as smart phones and laptop computers are rapidly growing. It is reported that the number of mobile users will be more than 1.6 billion in around 2014 and thus exceed the number of desktop users [1]. In this mobile-oriented Internet environment, the mobility of hosts is no longer special case but normal one. Therefore, the Internet is required to support the mobile hosts in the efficient manner.

However, we note that current Internet was just designed based on fixed hosts. The Internet basically sends data packets with the assumption that the receiving host is a fixed host and its location is always not changed. In fact, this assumption has been contributed the great success of the Internet, especially in the perspective of the scalability. However, the emergence of portable hosts, such as laptop computers, brings a problem of how to effectively deliver the packet to the moving hosts.

Some works have recently been done to address the mobility. First, the Mobile IP (MIP) is a promising approach to deal with this issue [2]. In Mobile IP, the moving host is considered as a special case. To address the variable location of moving hosts, an additional IP address is allocated to the hosts, named Care of Address (CoA). For moving hosts, the CoA is used for routing and the original IP address, home address (HoA), is used for identifier (ID) for the connection management. In addition, the tunnelling or IPv6 extensional header is used to keep a session for the moving hosts.

The Host Identification Protocol (HIP) can be considered as another idea to support the moving hosts [3]. In HIP, a new identifier, named Host Identity Tag (HIT), is assigned to a host, not the host's interface. Since a host has its own ID and a connection is identified by the ID, the change of IP address by movement does not affect the session continuity for moving hosts. To support host mobility, HIP requires an additional mechanism such as MIP because HIP itself does not support it.

The Distributed Mobility Management (DMM) is another approach for mobility support in the Internet [4]. The problem statement of DMM is that the mobility support mechanism using a centralized anchor, e.g. Home Agent (HA) in MIP, may introduce unnecessary traffic into the Internet. To avoid the problem, DMM insists that the mobility agents should be allocated in the distributed manner rather than in the centralized one. The DMM is a concept rather than a specific protocol. So, it can be applicable to various mobility support protocols including MIP and PMIP [5].

How to address the mobile environment is a big issue in Future Internet as well as in current Internet. Among the four Future Internet architectures projects funded by US National Science Foundation (NSF), MobilityFirst (MF) also tries to address the issue of effective support for mobile hosts [6]. MF rather focuses on the possibility of the connectionless of moving hosts. Therefore, the Delay Tolerant Networking (DTN) concept is the basement of the MF architecture. Also, the Globally Unique ID is used for network endpoint for not only a host but also other objects such as user, content, and context.

We note that even though many ideas have been proposed, they have inevitably some limitations because they are still based on the fixed host assumption that original Internet keeps. Therefore, for Future Internet, which is likely to be revolutionarily redesigned for internetworking, we need to design a more efficient architecture for the mobile-oriented Internet environment. In this paper, we propose a new inter-networking architecture for mobile-oriented Internet environment.

The remainder of this paper is organized as follows. First, we identify some requirements for the internetworking architecture in the mobile-oriented Internet environment in Section 2. In Section 3, we describe the proposed architecture and the packet delivery mechanisms in the architecture. Comparisons of the proposed architecture with the existing ideas are discussed in Section 4. Finally, Section 5 concludes this paper.

2. Requirements for Mobile-oriented Internet Environments

The problems of current Internet and the requirements for the architecture in mobile-oriented Internet environment can be summarized as follows [7].

2.1 – Static ID structure

IP address is almost a single identifier (ID) over network, transport and application layers in current Internet. In case of moving hosts, the ID for routing in the network layer should be updated for routing, but the one in the upper layers should be kept for session continuity. This discrepancy requires unnecessary indirect protocols to support mobile hosts.

The allocation of locator (LOC), such as IP address, is also inappropriate in the mobile environment. In case of moving host, the LOC, which indicates the attachment point to the Internet, is likely to change. So, it may be meaningless to assign a changeable ID to a host in the fixed form.

IP address is also allocated to a node’s interface. It means that multiple interfaces need multiple IP addresses. In the multi-homing context, it is very inefficient in the current and future network environment where multiple accesses coexist.

[Requirement 1] ID for identification should be separated from LOC for routing.
[Requirement 2] Static LOC should not assigned to mobile hosts.
[Requirement 3] ID should be allocated to host itself, not host interface.

2.2 – Patch-on and centralized mobility support

In mobile host dominant environment, the mobility support is an essential requirement, not an additional feature. Existing TCP/IP protocols have so far focused on fixed hosts, and thus the mobility support has been considered as just a special or additional functionality. This leads to the development of some mobility protocols in the form of patch-on the TCP/IP protocols. Such mobility control tends to induce unexpected performance degradation such as triangle routing, overuse of proxy agent, etc.

In addition, most of the current mobility schemes are based on a centralized anchor, such as HA. One big problem is that the centralized anchor introduces a large volume of unnecessary traffic to the Internet. In the context of performance, it also tends to make the routing path longer, which results in non-optimal routes and performance degradation. Moreover, the centralized approach is vulnerable to a single point of failure or attack.

[Requirement 4] Mobility support should be provided in the form of built-in rather than patch-on.

[Requirement 5] Forwarding for mobile hosts should be provided in the distributed form.

2.3 – Integrated control with data message

The control messages are usually more mission-critical than normal user data messages. Nevertheless, in most of current Internet protocols, data delivery and control function are integrated and implemented at the same devices, and the data and control traffics are routed along the same path, as shown in the IP and ICMP protocols. Generally mobile environment requires more control messages in more critical conditions. Accordingly, if the control messages are affected according to the user data traffic condition, the performance degradation may be out of boundary for specific services.

[Requirement 6] Control plane should be separated from data plane.

2.4 – A common delivery mechanism for heterogeneous and diverse networks

For data delivery, current Internet assumes a common IP protocol stack over all Internet nodes, according to the famous hourglass model. However, the networks environment will be more heterogeneous, which are ranged from simple lightweight networks to highly reliable networks. For instance, wireless networks are likely to have quite diverse characteristics from sensor networks to cellular networks. Also, the backbone network is evolved to the full optical network with very high bandwidth. Accordingly, a single common delivery mechanism, such as IP protocol, may not effectively support the network heterogeneity and diversity.

[Requirement 7] Use of different protocols should be allowed according to the characteristic of networks.

2.5 – Host-based end-to-end protocol

The host-based end-to-end argument has been a driving force to the success of current Internet. However, this principle also has some disadvantages from the deployment of new technologies, management of networks, and performance perspective. To overcome these obstacles, the network-based protocol or control operations need to be considered in the design of Future Internet.

[Requirement 8] Not only host-based protocol but also network-based protocol should be considered.

2.6 – Routing scalability

Routing scalability is recognized as the most imminent problem of the Internet [8]. The host/network mobility tends to make the current routing scalability problem more critical, since the prefix aggregation may not be achieved in inter-domain routing due to the mobility.
[Requirement 9] Mobility should be considered together with scalability in the new routing and addressing architecture design.

3. Architecture and Data Delivery

Considering the requirements described in Section 2, we propose a new architecture for the mobile-oriented Internet environment. The proposed architecture consists of three main functional blocks: Host ID and Local Locator (HILL), Dynamic and Distributed Mapping System (DDMS), and Query-First Data Delivery (QFDD) as shown in Fig. 1. The brief description for each block is given as follows.

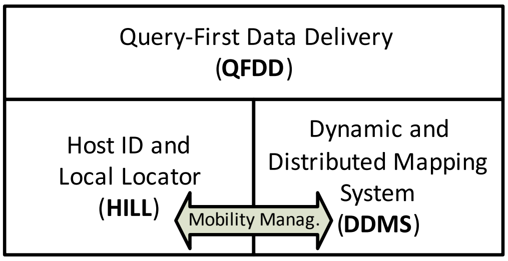


Figure 1: Proposed architecture with three functional blocks

3.1 – Host ID

The proposed architecture is designed with HID-based communication. Therefore, how to design the HID is a key element of this architecture. In this paper, we assume that a HID includes "Domain Name" and "Subscriber ID". The Domain Name is used to address the scalability issue and the Subscriber ID is used to identify host itself within the domain. We suggest the 128-bit HID to provide compatibility with IPv6 address, as shown in the figure below.

Figure 2: Abstract format of HID

3.2 – Host ID and Local Locator (HILL)

The ID-based communication is a crucial requirement of future networks. Fig. 3 shows the proposed Host ID and Local LOC (HILL) architecture. HILL is basically in pursuit of host ID-based communication and ID/LOC split. In HILL, end-to-end communication is accomplished with globally unique HID. Note that, a global unique locator/address is no longer needed. That is, address/locator has only to be unique within each network.

The HID-based communication has many advantages in terms of multi-homing, mobility and secure communication. Also, the allowance of the use of local locators helps to realize the network diversity and is helpful for the depletion problem of IP address.

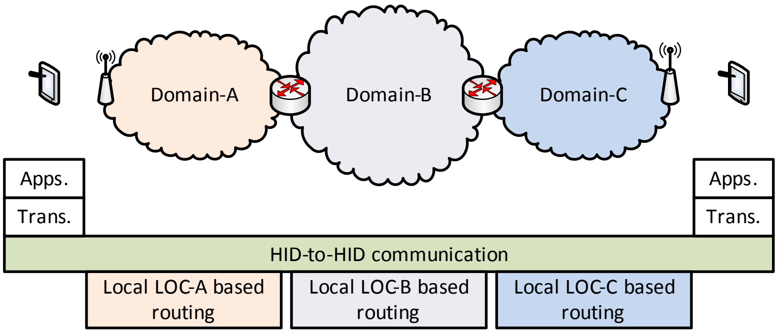


Figure 3: Global HID-based communication and Local Locator-based routing

3.3 – Dynamic and Distributed Mapping System (DDMS)

In the ID/LOC split architecture, the mapping system between ID and LOC is inevitably required. Since the mapping system should be established in the global scale, the scalability becomes the most crucial issue in the mapping system. In addition to the scalability, the mobility should also be treated as an important point for mobile oriented Internet environment.

Fig. 4 shows the structure of Dynamic and Distributed Mapping System (DDMS). For scalability, the mapping system has the two-level hierarchy for intra-domain and inter-domain operation. If the communication is done between the two hosts within a domain, the LOC searching operation for the destination host is achieved by intra-domain operation among Edge Routers (ERs). On the other hand, if the communication is done between different domains, inter-domain searching is necessary among the ERs that represent their domains, Gateway ERs (GERs).

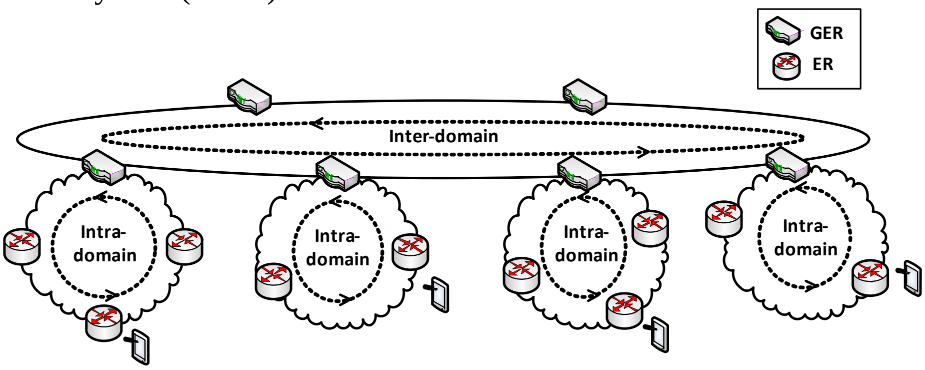


Figure 4: Dynamic and Distributed Mapping System

DDMS has a lot of valuable features for internetworking in the mobile oriented environment such as scalability, mobility and optimal path. The hierarchical structure separates intra-domain and inter-domain operation so as to support scalability. The search operation for distributed ERs will support the dynamics due to the host mobility and provide an optimal path between two communicating hosts.

3.4 – Query-First Data Delivery (QFDD)

If mobile hosts are dominant, the legacy data-driven delivery mechanism may bring inefficiency because the destination ERs will forward the data packets again toward the changed location, and it can incur a huge amount of unnecessary traffic in the Internet.

The Query-First Data Delivery (QFDD) provides a more efficient data delivery mechanism for mobile-oriented Internet environment, which is similar to the mechanism used in the current mobile communication networks [9]. In QFDD, each host should register its location to DDMS, whenever it moves to another place. The host initiating communication firstly queries the location of corresponding host to DDMS before sending data packets.

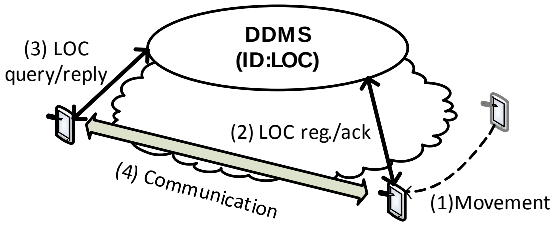


Figure 5: Query-First Data Delivery

In QFDD, since the location of the destination host is known to the initiating host before communication, the optimal path is automatically given and prevents the generation of unnecessary traffic in the Internet.

3.5 – Packet delivery

In the proposed architecture, roughly the three kinds of packet delivery scenarios could be considered: intra-domain, inter-domain and roaming as shown in Fig. 6. For each scenario, the brief descriptions are given in the following.

A. Intra-domain

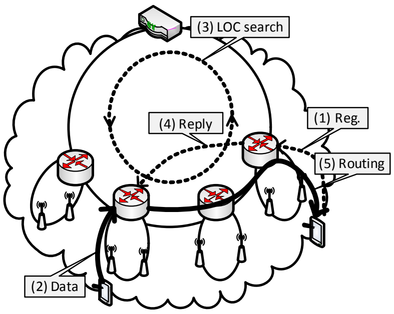
Intra-domain scenario means the communication between the two hosts which are in the same domain. The overall procedure is shown in Fig. 6 (a). Firstly, each host which is newly attached to an access network should be registered to the ER with its HID (1). After that, if a host wants to communicate with the other host, it simply sends a packet with the destination HID to the ER that serves the host (2). The ER receiving the sending packet searches the corresponding LOC based on the destination HID (3). This LOC search operation can possibly be achieved with several mechanisms. When the ER of the destination host receives the search message, it replies to the sending ER with the LOC information of the destination host (4). Now, since the sending ER knows the destination LOC, it can forward the data packets towards the destination host (5).

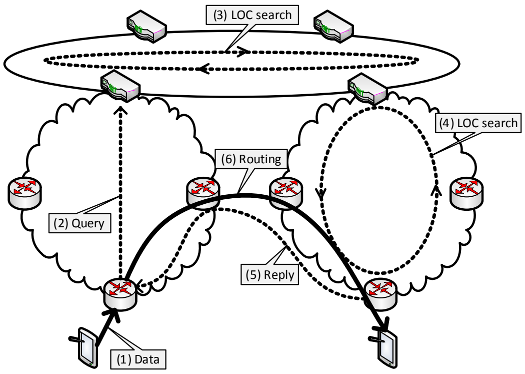
B. Inter-domain

Inter-domain scenario supports the communication between the two hosts that are located in different domain. As shown in Fig. 6 (b), the inter-domain operation is similar with the intra-domain operation. In this figure, it is assumed that the registration procedure of each host is already completed. If a host sends a packet (1), the serving ER checks whether the HID of the destination host belongs to the same or different domain, in which the domain name information of the HID is used. Then, the ER sends a search query to GER of the domain (2). The GER does the search operation over the inter-domain layer with the GERs of other domains (3). The GER, which is the gateway in the domain where the destination host locates, performs the search operation within its domain (4). The ER of the destination host replies to the ER of the initiating host (5). Now, the communication between two hosts can start (6).

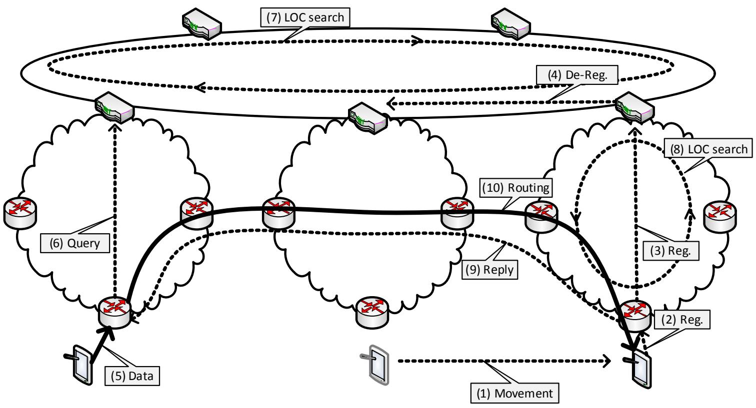
C. Roaming

If a host moved to a visited domain, then the roaming case is applied, as shown in Fig. 6 (c). First, a mobile host moves from a domain to another one (1). In the new domain, the host performs the registration (2) and the registration message is relayed to the GER of the domain (3). The GER in the visited domain sends a de-registration message to the home GER (4). When a host wants to send a data packet to the moved host (5), the search query is delivered to the GER serving the sending host (6). The search operation is done in the inter-domain layer (7), and the GER of the destination host does the search operation within its domain (8). Now, the ER serving the host replies to the sending ER (9). After that, the two hosts can communicate each other (10).





(a) Intra-domain *(b) Inter-domain*



(c) Roaming

Figure 6: Data delivery scenarios

4. Comparison

Table 1 compares the basic features of the proposed architecture and the existing ones. For ID, HIP and DMM in PMIP use an IP address, whereas the other schemes use the pure ID, not an IP address. For LOC, the proposed scheme uses ‘local’ LOC, whereas the other schemes are based on ‘global’ LOC, i.e. IP address, which induces limitations to the routing scalability. In terms of mapping support, HA of MIP, Rendezvous Server (RVS) of HIP are regarded as ‘centralized’ server, the other schemes as ‘distributed’ servers or system. In data packet delivery, the proposed scheme is based on the ‘query-first’ data delivery for optimal routes, whereas the other schemes can be viewed as are ‘data-driven’ approaches which tend to induce ‘non-optimal’ routes. Finally, the proposed scheme, DMM in PMIP and MF use the distributed mobility control, whereas the other schemes use the centralized mobility control.

Table 1: Comparison of the proposed architecture with the existing architectures

Features	MIP	HIP	DMM in PMIP	MobilityFirst	Proposed
ID	Host: IP address(HoA)	Host: Hashed public key	Host: IP address (HoA)	Host, content, etc.: GUID	Host: 128-bit HID
LOC	Global: IP address(CoA)	Global: IP address	Global: IP address(CoA)	Global: IP address	Local: L2/L3 LOC
Mapping	Agent: HA	Server: RVS	Gateway: MAG	System:GNRS	System:DDMS
Packet delivery	Data-driven	Data-driven	Data-driven	Data-driven	Query-First
Optimal Routes	Not Supported	Supported	Supported	Partly supported	Supported
Mobility Control	Centralized	Centralized	Distributed	Distributed	Distributed

Table 2 shows how each of the candidate schemes satisfies the requirements specified in Section 2. Note that the existing schemes do not support all or some of those requirements, but the proposed scheme meets all the requirements.

Table 2: Comparison in terms of the requirements

Req. No	MIP	HIP	DMM in PMIP	Mobility-First	Proposed
1	Yes	Yes	Yes	Yes	Yes
2	No	No	No	No	Yes
3	No	Yes	No	Yes	Yes
4	No	No	No	Yes	Yes
5	No	No	Yes	Yes	Yes
6	No	Yes	Yes	Yes	Yes
7	No	No	No	No	Yes
8	No	No	Yes	Yes	Yes
9	No	No	No	No	Yes

5. Conclusions

In this paper, we propose a new inter-networking architecture for the mobile-oriented Internet environment. For this, we first identify a set of requirements by analyzing the problems of the current Internet in the viewpoint of mobile-oriented Internet environments. Based on the requirements, we describe the proposed architecture with the three functional building blocks: HILL, DDMS, and QFDD. From the analysis, we can see that the proposed architecture shows necessary features and satisfies the requirements for in mobile-oriented environment.

This work is being progressed as a part of a Korea government funded project on future Internet [10]. For future works, we plan to implement the architecture on top of Linux platform and eventually over Future Internet Experimental Facilities, such as the FIRST testbed of Korea, and further the global testbed of GENI and FIRE.

Acknowledgments

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