Introduction to Mobile IPv6

III IPv6 Global Summit Moscow

Dr. Dimitrios Kalogeras dkalo@grnet.gr

GRNET





Outline



Introduction

- Relevant Features of IPv6
- Major Differences between MIPv4 and MIPv6
- Mobile IPv6 Operation
- Home Agent Discovery Mechanism

Handover

- Quality of Service
- Conclusions
- References



Introduction



- Mobile IPv6 is intended to enable IPv6 nodes to move from one IP subnet to another
- Routing protocol for mobile stations
 - Nothing more nothing less
 - Transparent to upper layers
- 'Strange' routing protocol
 - No intermediate routers involved
 - Routing information state is updated by the end stations
 - Mobile nodes
 - Correspondent nodes
 - Except from the Home Agent
- While a mobile node is away from home
 - It sends information about its current location to a home agent
 - The home agent intercepts packets addressed to the mobile node and tunnels them to the mobile node's present location

Introduction (cont.)



Mobile IPv6 scenario



Correspondent Node



Relevant Features of IPv6

Address Autoconfiguration

- Stateless autoconfiguratoin
 - Network Prefix + Interface ID
- Stateful autoconfiguration
 - DHCPv6
- Neighbor Discovery
 - Discover each other's presence and find routers
 - Determine each other's link-layer addresses
 - Maintain reachability information



Relevant Features of IPv6 (cont.)

- Extension Headers
 - Routing header
 - For route optimization
 - Destination Options header
 - For mobile node originated datagrams

Major Differences between MIPv4 and MIPv6



No FA in Mobile IPv6

- Mobile IPv6 requires every mobile node to support
 - IPv6 Decapsulation
 - Address Autoconfiguration
 - Neighbor Discovery

Major Differences between MIPv4 and MIPv6 (cont.)



Packets delivery

- MIPv6 mobile node uses care-of address as source address in foreign links
 - No ingress filtering problem
- Correspondence Node uses IPv6 routing header rather than IP encapsulation

Supports "Route Optimization" naturally

Mobile IPv6 Messages and Related Data Structures



- All new messages used in MIPv6 are defined as IPv6 Destination Options
 - These options are used in IPv6 to carry additional information that needs to be examined only by a packet's destination node

Next Header	Hdr Ext Len				
Options					

Mobile IPv6 Messages and Related Data Structures (cont.)



Four new Destination Options

- Binding Update
 - Used by an MN to inform its HA or any other CN about its current care-of address
- Binding Acknowledgement
 - Used to acknowledge the receipt of a Binding Update

Mobile IPv6 Messages and Related Data Structures (cont.)



Binding Request

- Used by any node to request an MN to send a Binding Update with the current care-of address
- Home Address
 - Used in a packet sent by a mobile node to inform the receiver of this packet about the mobile node's home address

Mobile IPv6 Messages and Related Data Structures (cont.)



Data Structures

- Binding Cache
- Binding Update List
- Home Agent List

• i.e.

Home Address	Care of Address	Lifetime	Agent
3ffe:2101:0:b00::10	3ffe:2101:0:a00:260:97ff:fe8b:4c56	120	Yes
3ffe:2101:0:b00::15	3ffe:2101:0:b00:a00:6aff:fe2b:137c	43	NO

Mobile IPv6 Operation



Home Agent Registration

- An MN performs address autoconfiguration (stateful or stateless) to get its care-of address
- The MN registers its care-of address with its home agent on the home link
 - Use "Binding Update" Destination Option
- The HA uses proxy Neighbor Discovery and also replies to Neighbor Solicitations on behalf of the MN



Home Agent Registration



Correspondent Node



To avoid triangle routing



Correspondent Node

GRZH

EAET





Correspondent Node

GRZH



MN-Terminated Packet Delivery





MN-Originated Packet Delivery



Src: MN's care-of address Dst: CN's address

Destination Optoins header – Home Address Option: MN's home address

Move MN's home address to Source Address

Src: MN's home address Dst: CN's address

MN at home:

Src: MN's home address Dst: CN's address

MN at visited network:

Src: MN's care-of address Dst: CN's address

Destination Optoins header – Home Address Option: MN's home address





- While away from home, an MN selects one router and one subnet prefix advertised by that router to use as the subnet prefix in its primary care-of address
- To wait for the periodically sent Router Advertisements



Binding Management

- To trigger Binding Acknowledgement, the MN sets the Acknowledge bit in the Binding Update
 - Retransmitting the Biding Update periodically until receipt of the acknowledgement
- An MN MUST set the Acknowledge bit in Binding Updates addressed to an HA
- The MN MAY also set the Acknowledge bit in Binding Updates sent to a CN

Home Agent Discovery Mechanism

(1) Binding Update to Home-Agents anycast address(2) Binding Acknowledgement including the Home Agents List; rejects the registration request



Home Agent Discovery Mechanism (cont.)



(1) Binding Update to Home Agents 3(2) Binding Acknowledgement, registration OK



Handover

Horizontal without router change

Vertical with router change

Handover

Router-Assisted Smooth Handovers

(1) MN sends a Binding Update to an HA on previous network

(2) HA returns a Binding Acknowledgement

(3) HA tunnels packets to MN

(4) MN sends a Binding Update to CN

Handover (cont.)

Three kinds of handover operations

- Smooth Handover
 - Minimizes data loss during the time that the MN is establishing its link to the new access point
- Fast Handover
 - Minimizes or eliminates latency for establishing new communication paths to the MN at the new access router
- Seamless Handover
 - Both Smooth and Fast Handover

Handover + AAA

Quality of Service

IPv6 header has two QoS-related fields

- 20-bit Flow Label
 - Used by a source to label sequences of packets for which it requests special handling by the IPv6 routers
 - Geared to IntServ and RSVP
- 8-bit Traffic Class Indicator
 - Used by originating nodes and/or forwarding routers to identify and distinguish between different classes or priorities of IPv6 packets

Geared to DiffServ

Quality of Service (cont.)

New IPv6 option – QoS Object

- QoS Object describes QoS requirement, traffic volume and packet classification parameters for MN's packet stream
- Included as a Destination Option in IPv6 packets carrying Binding Update and Biding Acknowledgment messages

MIPv6 Status

• RFC 3775

Implementation

- Linux, MIPL http://www.mobile-ipv6.org/
 - 2.4.x kernel versions, 2.6 coming
- BSD, KAME stack <u>http://www.kame.net</u>,FreeBSD 4.9, NetBSD 1.6.2, OpenBSD 3.4
- Cisco, IOS technology preview available by request
 'ohanami' EFT
- Microsoft, Expect beta release sometime in Q4 2004

Remote Network Support

Mobile Library

Conclusions

Mobile IPv6 is

- An efficient and deployable protocol for handling mobility with IPv6
- Lightweight protocol
- To minimize the control traffic needed to effect mobility

References

- C. Perkins, "Mobility for IPv6," *Internet Draft*, June 2002.
- K. Zhigang et al., "QoS in Mobile IPv6," in *Proc. of International Conferences on Info-tech and Info-net* 2001, vol. 2, pp. 492 -497.
- N. Montavont and T. Noel, "Handover Management for Mobile Nodes in IPv6 Networks," *IEEE Communication Magazine*, pp. 38-43, Aug. 2002.
- Deliverables 6net (http://www.6net.org)
 - D.4.1.1 Survey and Evaluation of MIPv6 Implementations
 - D.4.1.2, Initial MIPv6 Support Guide
 - D.4.1.3 Final MIPv6 Support Guide

Questions???