How Mobile IP uses IPv6
SHARE Anaheim Session 14503

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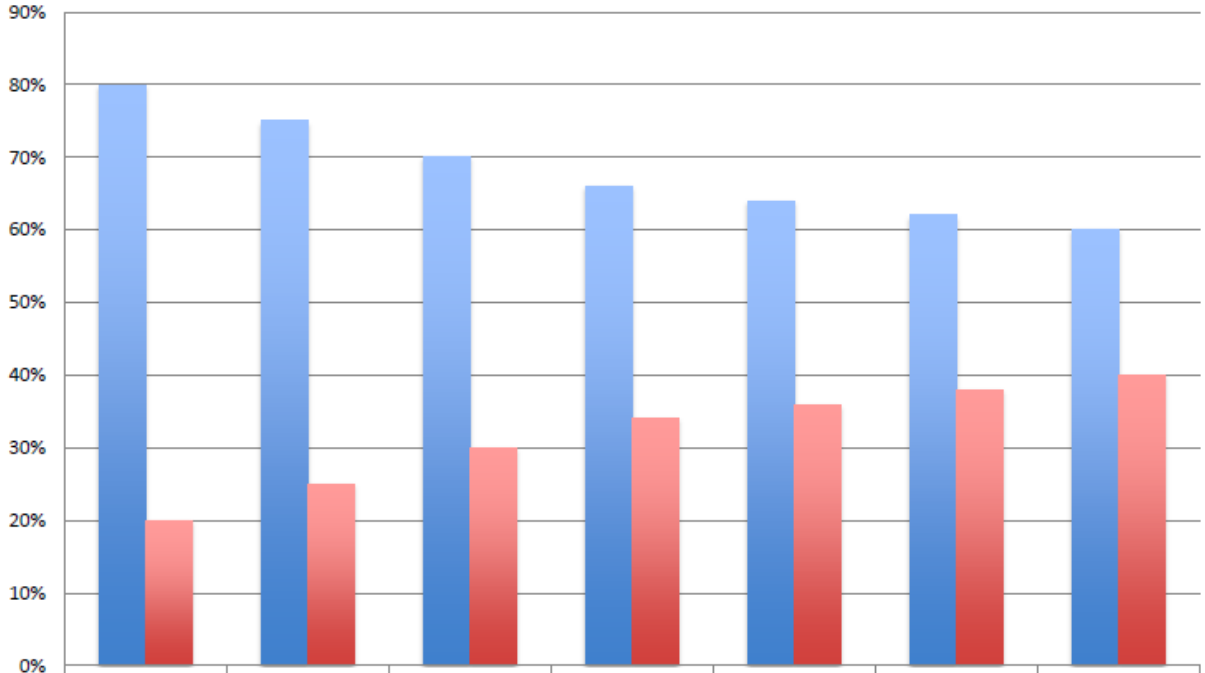
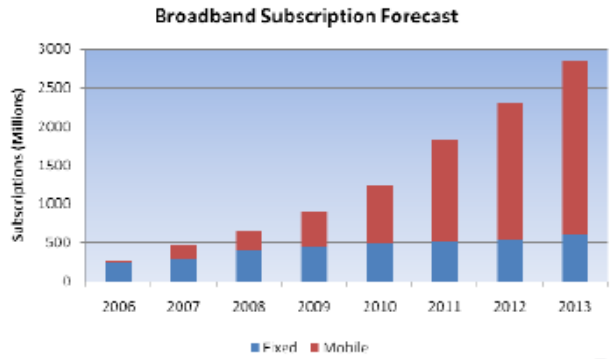
IPv6 Status?

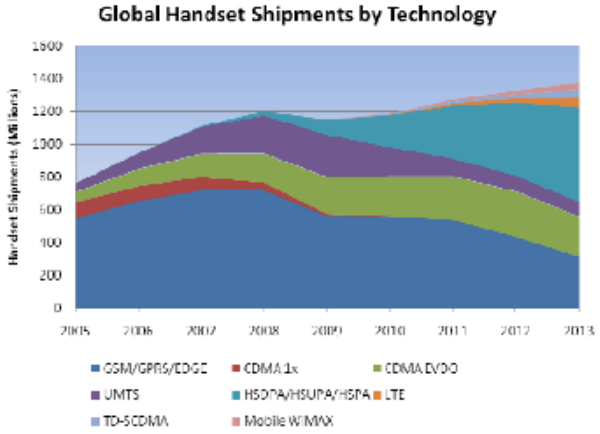
ARIN ISP Members with IPv4 and IPv6

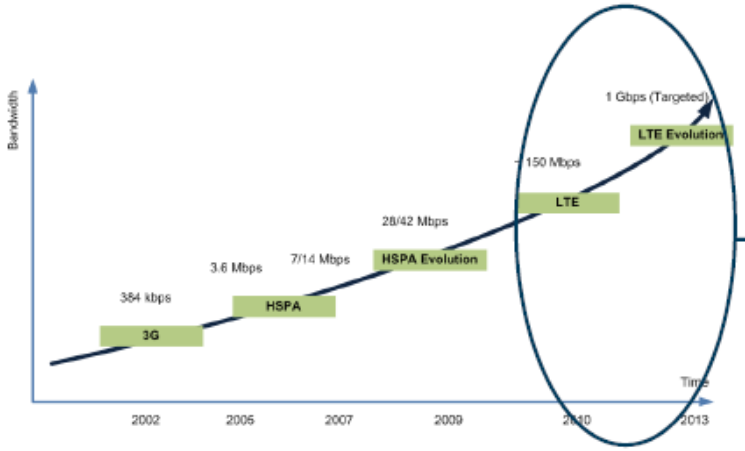


	2010Q1	2010Q3	2011Q1	2011Q3	2012Q1	2012Q3	2013Q1
% IPv4 Only	80%	75%	70%	66%	64%	62%	60%
% IPv4 and IPv6	20%	25%	30%	34%	36%	38%	40%

Number 1 Application Driver: Mobile IP



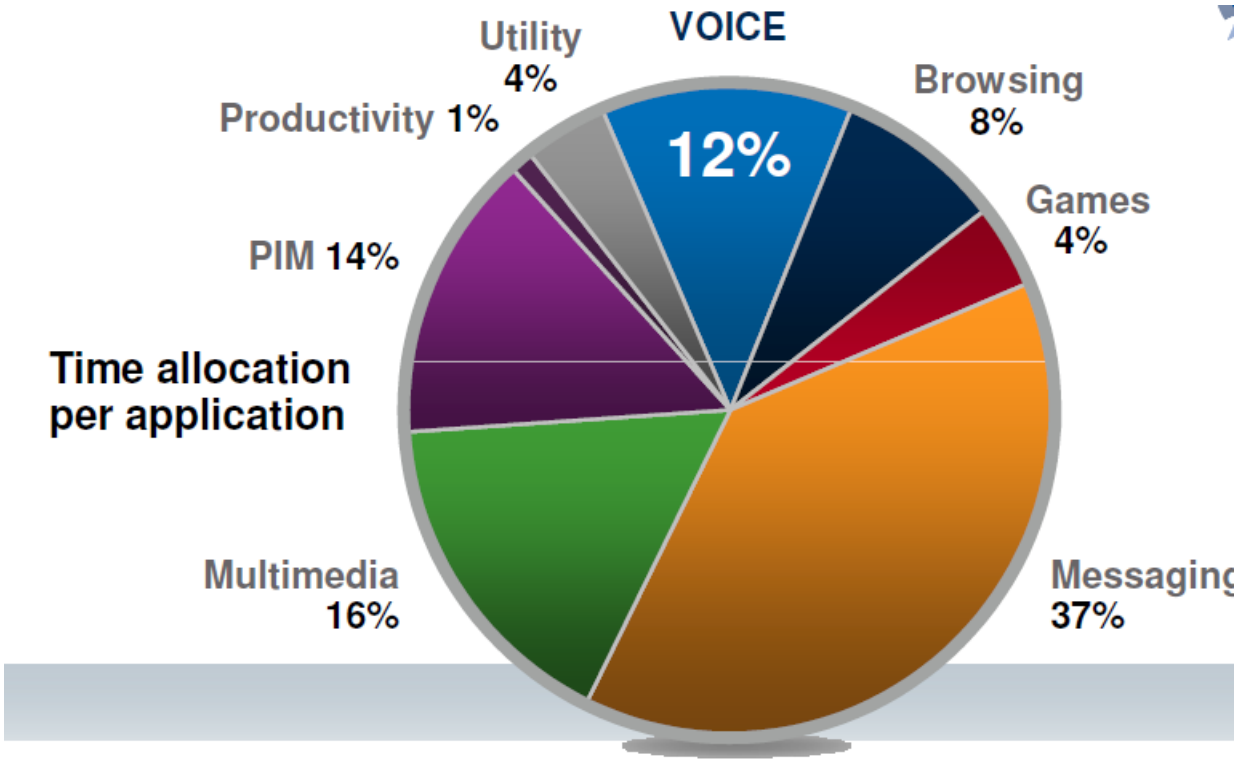




LTE stands for Long Term Evolution – Technology to provide all IP networking; In other words, IP from Mobile terminal to support growing mobile broadband needs

Source: Ericsson, ABI

IPv6 – New Information Types – Critical to LTE



Voice is 12% of usage

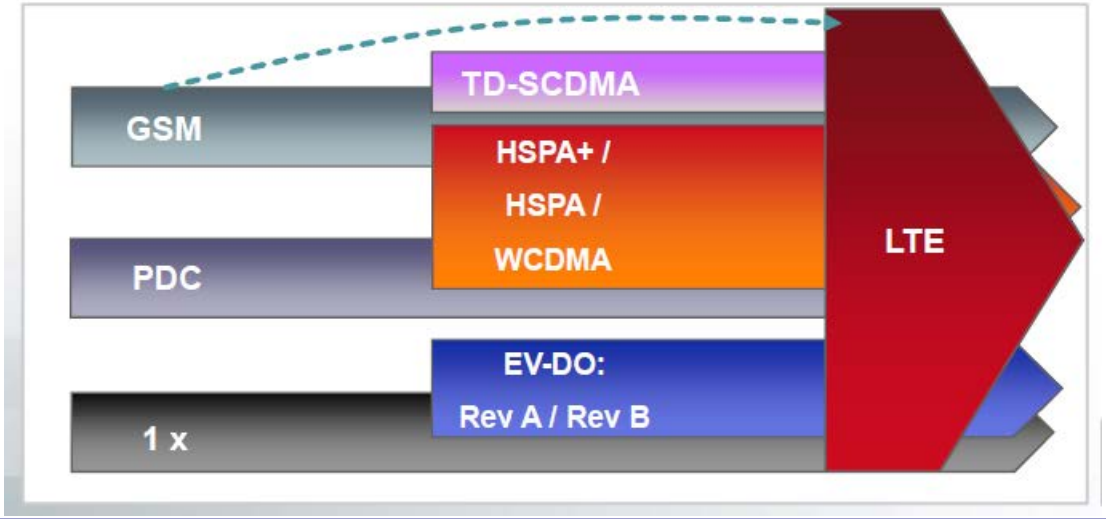
LTE – 4G

Flat IPv6 network

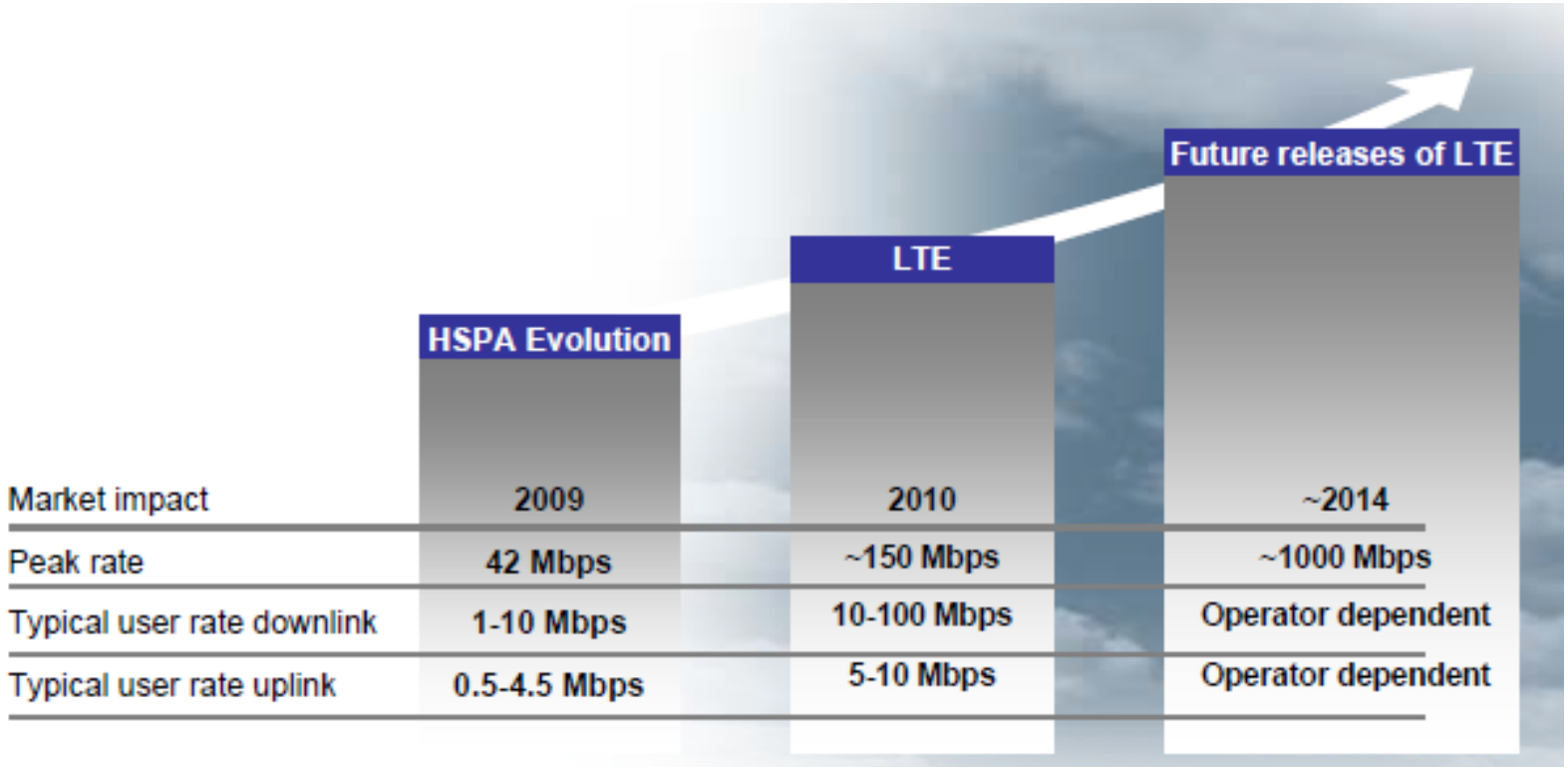
High Through-put

Low Latency

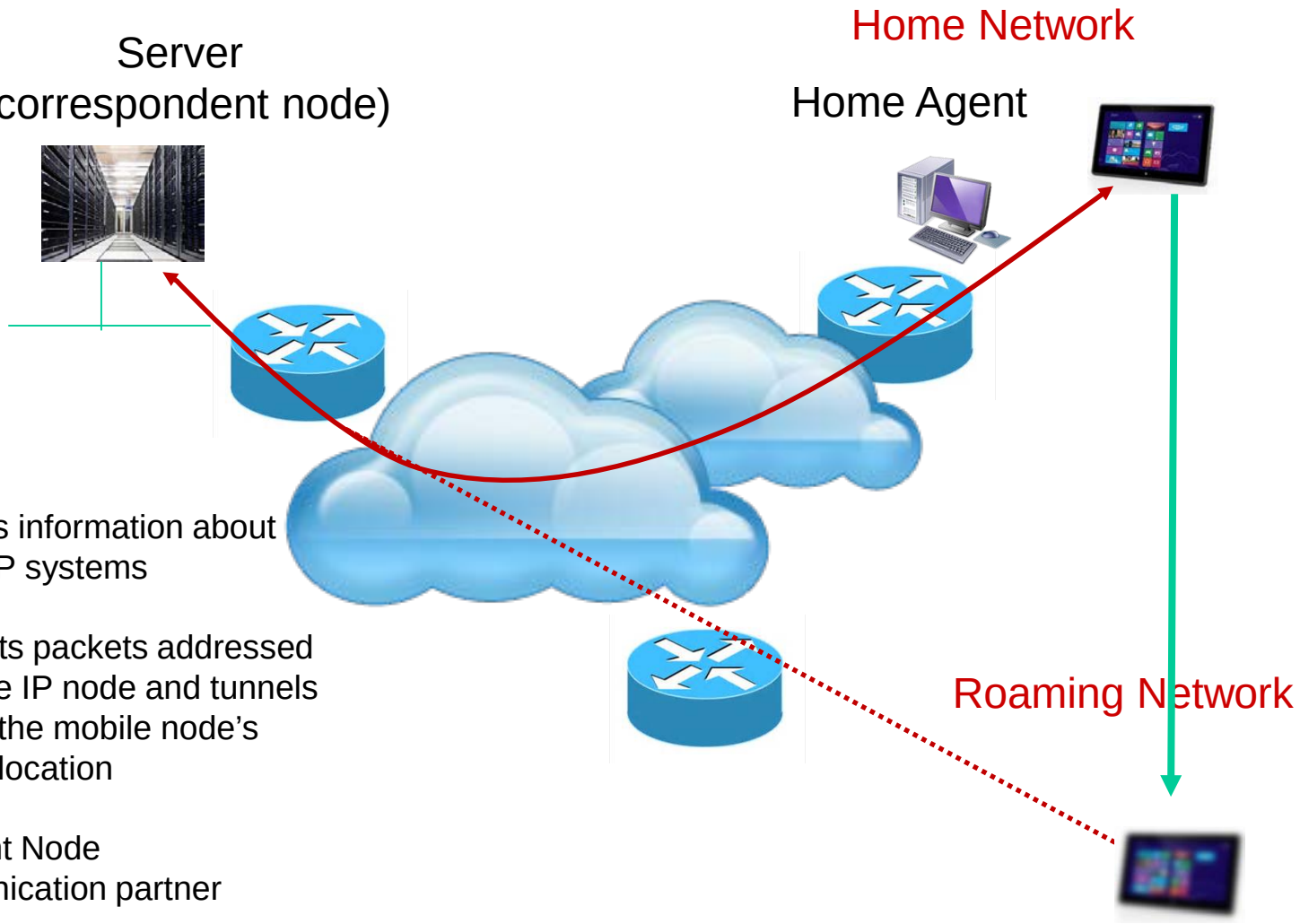
Increased spectrum flexibility



Future of LTE



Why Mobile IP?



Home Agent

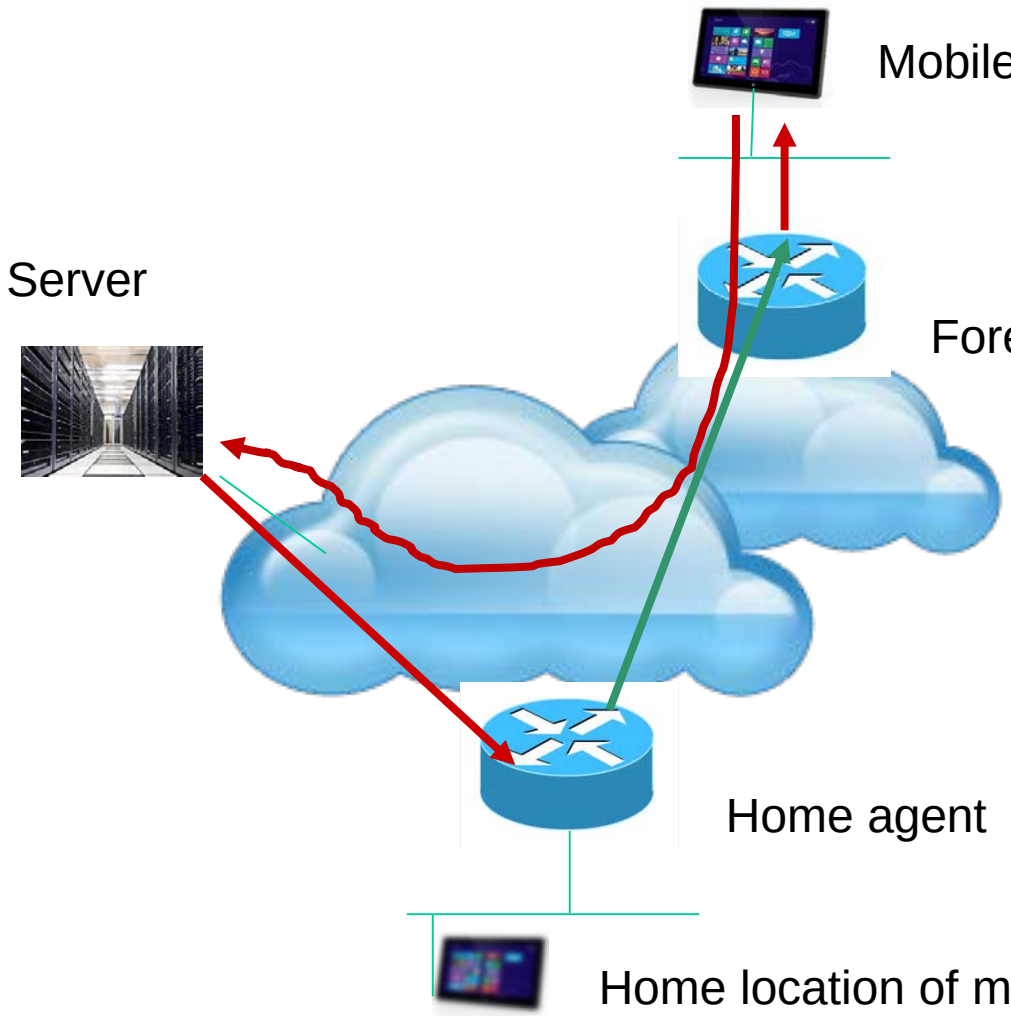
Contains information about mobile IP systems

Intercepts packets addressed to mobile IP node and tunnels them to the mobile node's present location

Correspondent Node

Communication partner

IPv4 Mobile IP



IPv4 Mobile IP Problems

Performance

Triangulation increases response times

Firewalls

Normally block external packets that emanate from ‘internal computers’

Routers

Ingress filtering discards packets coming from within the enterprise if the packets do not contain a source IP address configured for one of the enterprise’s internal networks

Security Issues

Insider, DDOS, and replay attacks

Passive eavesdropping

Session stealing

IPv6 Functions to Exploit

Mobile IPv6 (MIPv6) nodes must support
- IPv6 decapsulation
- address autoconfiguration
- neighbor discovery

MIPv6 must use care-of-address as source address in foreign links

Correspondence Node uses IPv6 routing header rather than IP encapsulation

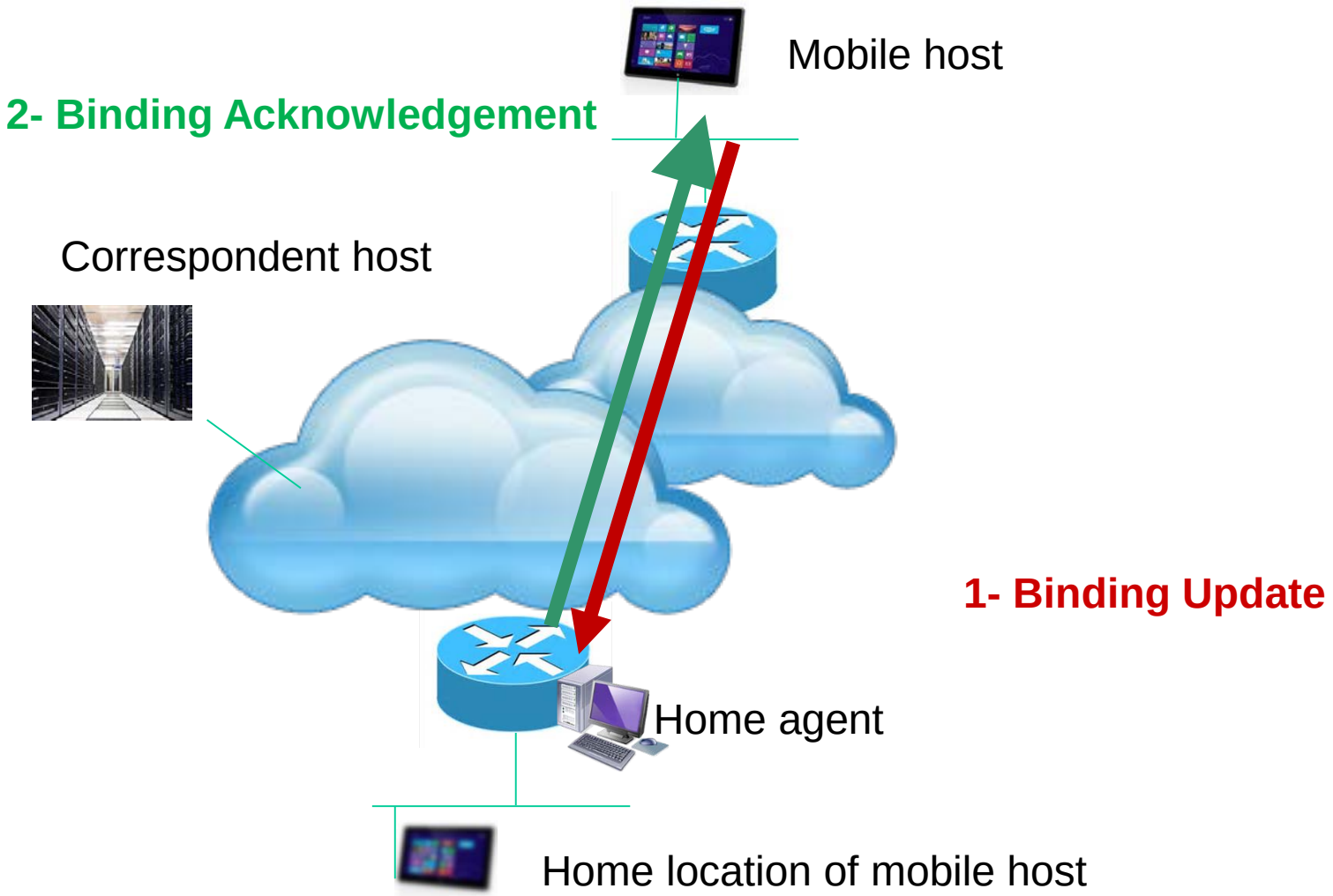
All new messages in MIPv6 are defined as IPv6 Destination Options
- Binding update – Update Home Agent of care-of-address
- Binding acknowledgement – Acknowledge receipt of binding update
- Binding request – Node requests current care-of-address
- Home address – MIPv6 node relays information of its hone address

Data Structures
- Binding cache, binding update list, home agent list

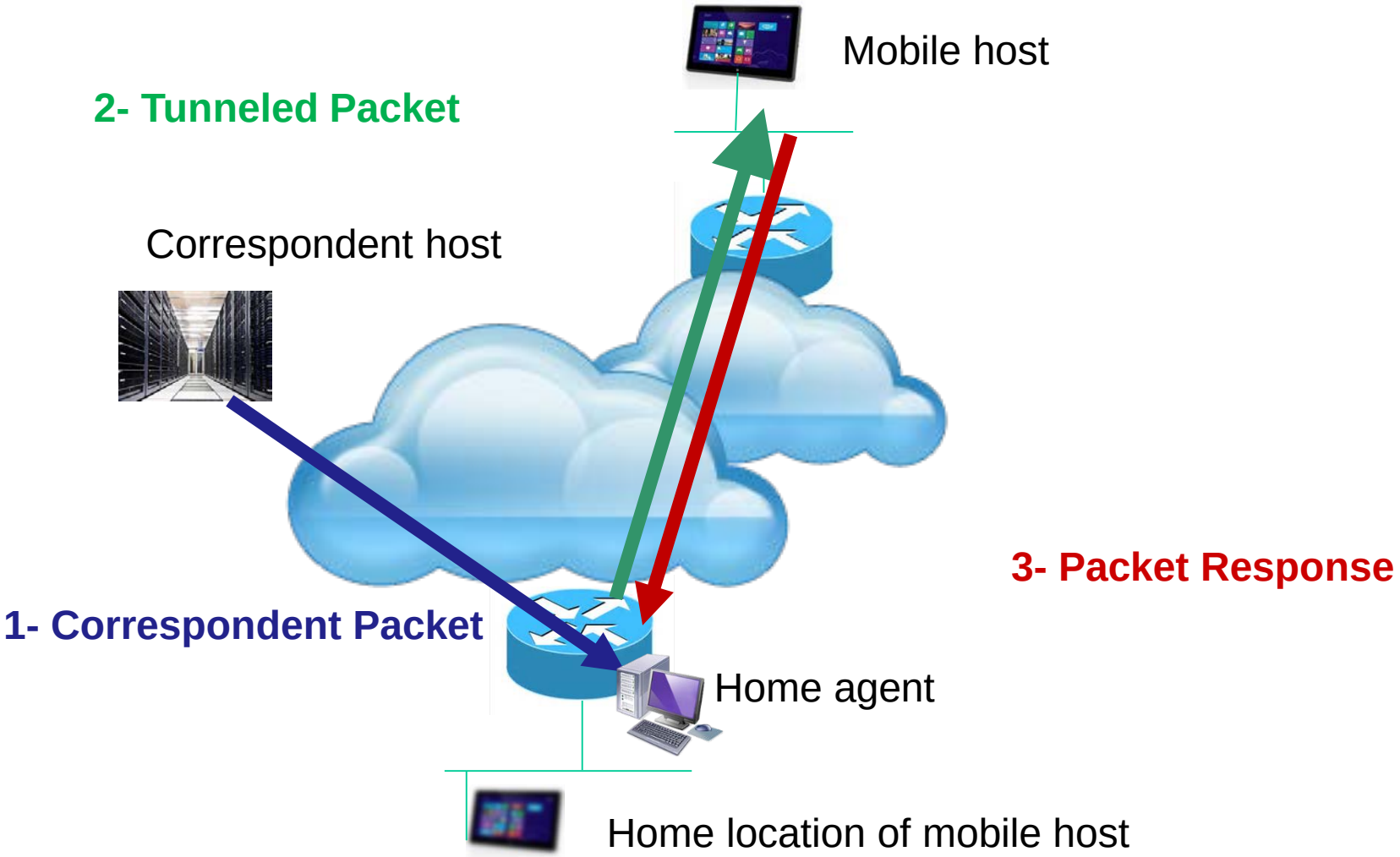
MIPv6 Operation

- Will have one or more home address
- Will acquire a care-of address when it discovers it is in a foreign network
  - uses auto-configuration
  - registers the care-of address with a home agent
    - Binding update destination option
- Packets sent to the MIPv6 home address(es) are intercepted by the home agent and forwarded to the care-of address, using encapsulation
- Home agent uses proxy Neighbor Discovery and Neighbor Solicitations on behalf of the MIPv6 node
- Mobile IPv6 hosts sends binding-updates to correspondent to remove home agent from flow

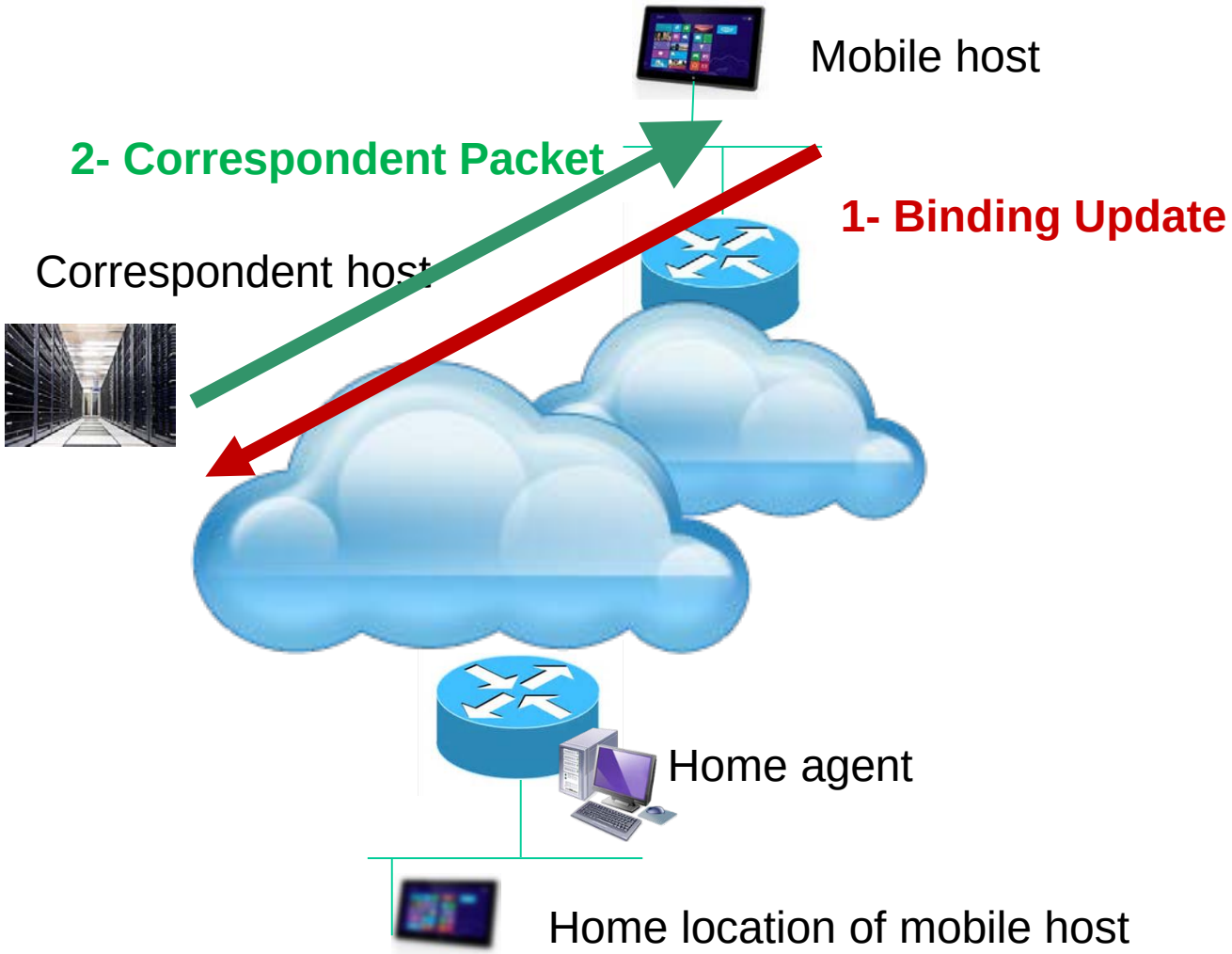
MIPv6 Home Registration



MIPv6 Route Optimization



MIPv6 Route Optimization



MIPv6 Terminated Packet Delivery

Correspondent 

MIPv6

Src: CN's address
DST: MIPv6 home address

Binding cache hit

Src: CN's address
DST: MIPv6 Care-of-Address
Routing Header: MIPv6 home address

Src: CN's address
DST: MIPv6 Care-of-Address
Routing Header: MIPv6 home address

Src: CN's address
DST: MIPv6 home address

MIPv6 Originated Packet Delivery

Correspondent 

MIPv6

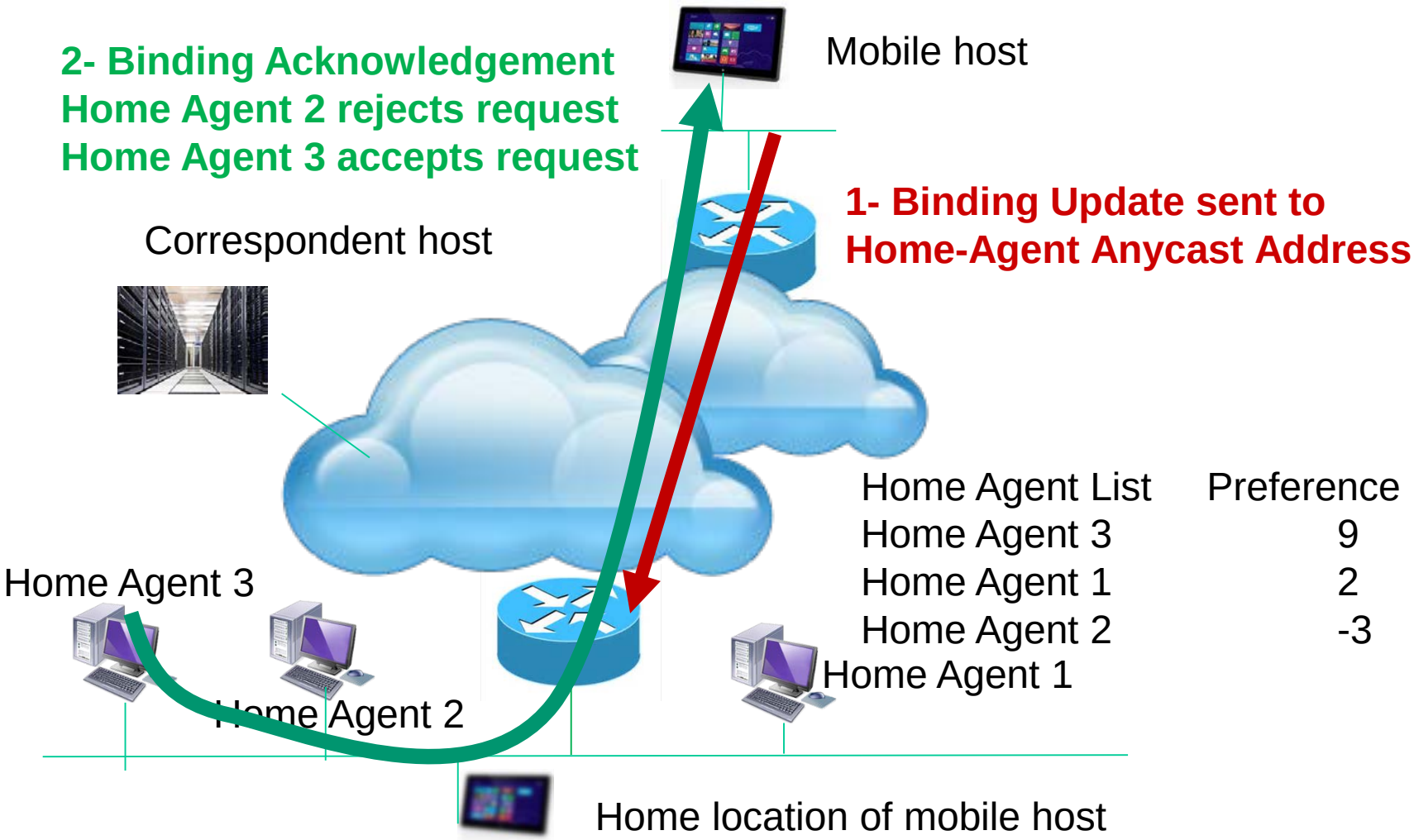
Src: MIPv6 Care-of Address
DST: CN;s address
Destination Options – Home Address Option: MIPv6 home address

Src: MIPv6 home address
DST: CN's address

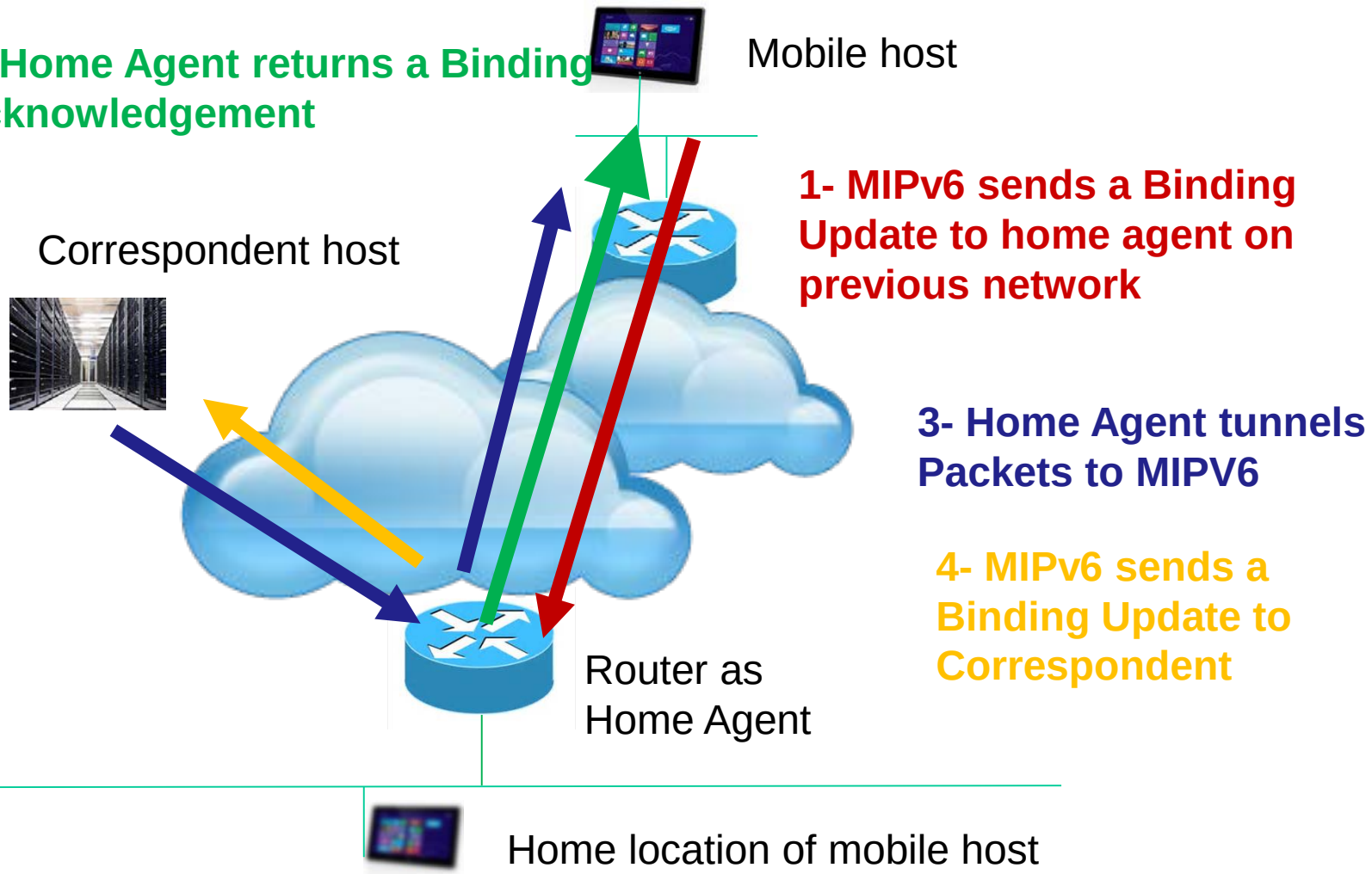
Src: MIPv6 home address
DST: CN's address

Src: MIPv6 Care-of-address
DST: CN's address
Destination options – Home Address Option: MIPv6 home address

MIPv6 Home Agent Discovery



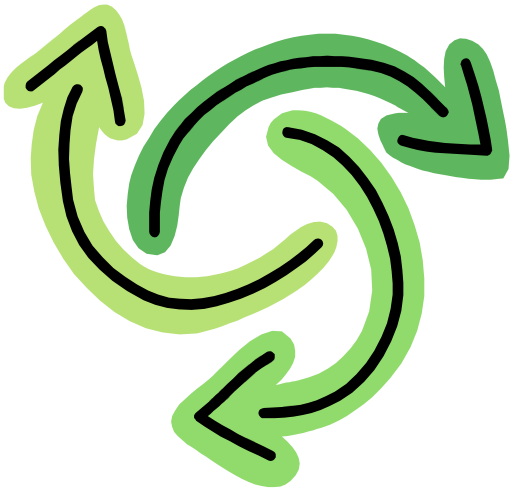
MIPv6 Handover



Handover

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



Quality of Service

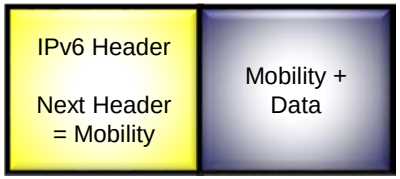
IPv6 header has two QoS-related fields

- 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

New IPv6 option – QoS Object

- QoS Object describes QoS requirement, traffic volume and packet classification parameters for MIPv6 packet stream
- Included as a Destination Option in IPv6 packets carrying Binding Update and Biding Acknowledgment messages

IPv6 Mobility Header



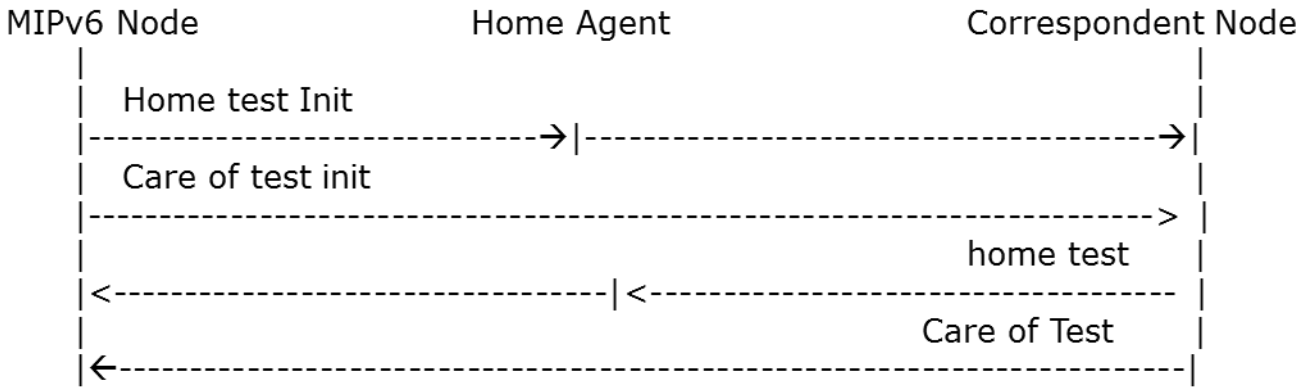
Mobility Messages

Type	Description	References
0	BRR, Binding Refresh Request.	RFC 3775
1	HoTI, Home Test Init.	RFC 3775
2	CoTI, Care-of Test Init.	RFC 3775
3	HoT, Home Test.	RFC 3775
4	CoT, Care-of Test.	RFC 3775
5	BU, Binding Update.	RFC 3775, RFC 4140
6	Binding Acknowledgement.	RFC 3775
7	BE, Binding Error.	RFC 3775
8	Fast Binding Update.	RFC 4068
9	Fast Binding Acknowledgment.	RFC 4068
10	Fast Neighbor Advertisement.	RFC 4068
11	Experimental Mobility Header.	RFC 5096
12	Home Agent Switch Message.	RFC 5142
13	Heartbeat Message.	RFC 5847
14	Handover Initiate.	RFC 5568
15	Handover Acknowledge.	RFC 5568
16	Binding Revocation Message.	RFC 5846

Return Route Verification

Purpose : Enables the correspondent node to obtain some reasonable assurance that the mobile node is in fact addressable at its claimed care-of address as well as at its home address**.**

Only with this assurance is the correspondent node able to accept Binding Updates from the mobile node.



MIPv6 Headaches

Biggest vulnerability is authorization of Binding Updates

Firewalls and Mobile IPv6 do not work well together

Number of Problems for securing Neighbor discovery

Problem arises when roaming with a dual-stack architecture and interoperating between Mobile IPv4 and Mobile IPv6

Mobility – IPv4 versus IPv6

Mobile IPv4	Mobile IPv6
Mobile node, home agent, home link, foreign link	(same)
Mobile node's home address	Globally routable home address and link-local home address
Foreign agent	A "plain" IPv6 router on the foreign link (foreign agent no longer exists)
Collocated care-of address	
Care-of address obtained via Agent Discovery, DHCP, or manually	Care-of address obtained via Stateless Address Autoconfiguration, DHCP, or manually
Agent Discovery	Router Discovery
Authenticated registration with home agent	Authenticated notification of home agent and other correspondent nodes
Routing to mobile nodes via tunneling	Routing to mobile nodes via tunneling and source routing
Route optimization via separate protocol specification	Integrated support for route optimization

Conclusion

Mobile IPv6 is

An efficient and deployable protocol for handling mobility with IPv6

Lightweight protocol

To minimize the control traffic needed to effect mobility

ありがとうございました

Grazie

Danke

Merci

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Obrigado

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IPv6 References

IPv6 Home Page

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http://www.getipv6.info/index.php/IPv6_Presentations_and_Documentshttp://www.6ren.net

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http://ipv6.or.kr/english/natpt.overview

http://www.research.microsoft.com/msripv6

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Books

New Internet Protocol - Prentice Hall - ISBN 0-13-241936-x
IPNG and the TCP/IP Protocols - John Wiley and Sons - ISBN-0-471-13088-5
IPv6 The New Internet Protocol - ISBN-0-13-24-241936
IPNG Internet Protocol Next Generation - ISBN-0-201-63395-7
Internetworking IPv6 with Cisco Routers - ISBN 0-07-022831-1

IPv6 RFCs

View any IPv6 RFC

http://datatracker.ietf.org/doc/search/