General Technical Presentation of the Mobile IP Protocol
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Mobile IP
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General Information
Traditional IP routing

IP = a.b.c.d

Internet

Correspondent Node (CN)

IP @ = network location
CN uses IP address to find its contact in the global Internet
While moving…

IP = a.b.c.d

Internet

???

Correspondent Node (CN)

IP = ?

P1013 FIT-MIP, The Mobile IP Protocol
Mobile IP - Global and transparent

Correspondent Node (CN)

Mobile IP

Internet

IP = a.b.c.d

IP = a.b.c.d
Mobile IP
First Solution: Mobile IPv4

- IETF RFC 2002: IP mobility support in IPv4

- Allow a mobile terminal to use two IP addresses:
  - Permanent home address
  - Temporary care-of address

- Three new functional entities:
  - Mobile Node (MN)
  - Home Agent
  - Foreign Agent
Mobile IPv4 procedures

- **Movement Detection**
  - Thanks to Mobility Agent Advertisements (modified ICMP messages)

- **Acquisition of Care-of Address (CoA)**
  - From a foreign agent's advertisements (a foreign agent CoA),
  - By some external assignment mechanism such as DHCP (a co-located CoA).

- **Registration**
  - Exchange of a Registration Request and Registration Reply message between MN and HA, possibly via a FA
IP-within-IP Encapsulation

Original IP Packet  Tunneled IP Packet

Source: CN’s IP @  Destination: MN’s home @

Source: HA’s IP @  Destination: MN’s CoA
While at Home...

Home network

Home Agent

IP NETWORK
INTERNET
EXTRANET
INTRANET

Foreign network

Foreign Agent

Correspondent
Movement Detection

Home network

Home Agent

Foreign network

Foreign Agent

IP NETWORK
INTERNET
EXTRANET
INTRANET
Mobile IPv4 Registration phases in FA-mode

Home network

Home Agent

Foreign network

Foreign Agent

Home network

INTERNET

EXTRANET

INTRANET

IP NETWORK
Mobile IPv4 Routing using Tunneling

[Diagram showing the relationship between Home network, Home Agent, IP NETWORK, Correspondent, Foreign network, Foreign Agent, INTERNET, EXTRANET, INTRANET]
Mobile IPv4 Drawbacks

- Triangular routing
- Extra resource consumption because of Mobile IP overhead
- Complex support of QoS with tunneling
- Ingress filtering requiring reverse tunneling
- Fixed/public IP @ vs dynamic/private IP @
Solution for Triangular Routing: MobileIPv4 Route Optimization

- IETF draft (not a RFC for the moment!)

- Idea
  - Inform correspondents (CN) of the current CoA of the MN
  - And CN tunnel datagrams directly to the MN’s CoA

- Drawback:
  - The CN have to be upgraded to support:
    - Binding cache
    - Security associations with HA and MN
Mobile IP in IPv6

- IPv6: new version of IP with several improvements to IPv4

- Mobile IPv6 shares many features with Mobile IPv4, but:
  - Protocol fully integrated into IPv6
  - Provides many improvements over Mobile IPv4.
    - No Foreign Agent
    - Intrinsic "Route Optimization" mechanism
    - Automatic procedures for acquiring CoA
    - No ingress filtering problems
Mobile IPv6 strengths

- Use of Binding Update and Binding Ack messages (Destination Header option) for location information exchange
- Binding Request from CN for location information from Home Agent before sending
- Use of new IPv6 Routing Header option for avoiding triangular routing
- HA possibly tunnels first few IP packets using IPv6-in-IPv6 encapsulation
Mobile IPv6 Registration

Home network

Home Agent

IP NETWORK

INTERNET

EXTRANET

INTRANET

Foreign network
Mobile IPv6 Routing

Home network

Home Agent

IP NETWORK
INTERNET
EXTRANET
INTRANET

Foreign network

Correspondent
Conclusions
Mobile IPv4 Conclusions

- **Major advantage**: Supported by **stable** standards,
  - Therefore a lot of MIPv4 implementations are available on different OS
  - Few interoperability problems

- **Relevant limitations** are
  - too small address space.
  - lack of support for Integrated Route Optimisation
  - Control messages not included inside IPv4 datagrams of data traffic
  - Inclusion of security mean usage complementary components

P1013 FIT-MIP, The Mobile IP Protocol
Mobile IPv6 Conclusions

- **Major advantages**
  - Route optimisation
  - Address space (128 bit)
  - Header structure
  - QoS treatment
  - Compatibility with IPv4
  - Security when using air interfaces

- **Relevant limitations** are
  - Not enough and stable Standards
  - Lack of supported security methods
Mobile IPv4 Standardisation

- Standards are stable since 1996 (RFC 2002)
- Mobile IPv4 is mandatory in 3GPP2 architecture
- Mobile IPv4 is still intensively discussed by the IETF for further improvement sustaining various deployment scenarios (mobile VPNs, fast handovers)
- After feedback from various sources and for improvement reasons an update of RFC2002 (RFC2002bis) is expected before the end of the year
Mobile IPv6 Standardisation

- IPv6 is mandatory in 3GPP architecture (but not Mobile IPv6)

- The IETF Mobile IP WG is the place where Mobile IPv6 is being standardized and improved

- A standard is not foreseen in a near future mainly due to security considerations (authentication and scalability limitation of the Binding Updates)
## Mobile IP (v4) Products

<table>
<thead>
<tr>
<th>Univ./Company</th>
<th>Implementation</th>
<th>CS</th>
<th>IPv Ver.</th>
<th>Security (details)</th>
<th>Status</th>
<th>CoA</th>
<th>Multicast</th>
<th>Portfolio</th>
<th>NAT Support</th>
<th>MIP over PPP</th>
<th>Reverse Tunnel</th>
<th>Firewall traversal</th>
<th>RFC 2002</th>
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<tbody>
<tr>
<td>HUT (University of Helsinki)</td>
<td>Dynamics</td>
<td>Linux</td>
<td>4 &amp; 6</td>
<td>Free</td>
<td>FA &amp; Co</td>
<td>Agents &amp; Nodes</td>
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<td>No</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td>?</td>
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<tr>
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<td>WinMIP</td>
<td>Linux</td>
<td>4</td>
<td>Free</td>
<td>FA &amp; Co</td>
<td>Agents &amp; Nodes</td>
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<td>No</td>
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<td>Agents &amp; Nodes</td>
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<td>SKIP</td>
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THANK YOU

More Information about the project and its results can be founded at:
http://www.eurescom.de