Proxy Mobile IPv6 Extensions to Support Flow Mobility
draft-bernardos-netext-pmipv6-flowmob-01

Carlos J. Bernardos (Ed.) – Universidad Carlos III de Madrid

Beijing, NETEXT WG, 2010-11-09
Changes from version -00

• Added text on the prefix deployment models
• Added text about the partial handoff scenario
• Corrections here and there
Goals and requirements

• Define PMIPv6 extensions to allow to move flows among different simultaneously attached MN interfaces

• Analyze the different prefix deployment scenarios to be supported

• LMA is the controlling entity
  • The solution defines the signaling between MAG and LMA
  • The specifics on how the network nodes obtain the policies are out of scope

• The MN is equipped with one logical interface as described in draft-ietf-netext-logical-interface-01
  • We don't support flow mobility across different logical interfaces
Prefix (deployment) models (I)

- Multiple prefix models under a flow mobility solution may work:
  1. At the time of a new attachment, the MN obtains a new prefix or a new set of prefixes. This is the default behavior with RFC 5213
  2. At the time of a new attachment, the MN obtains the same prefix or the same set of prefixes as already assigned to an existing session
  3. At the time of a new attachment, the MN obtains a combination of prefix(es) in use and new prefix(es). This is a hybrid of the above two scenarios
Prefix (deployment) models (II)

- Scenario 2 needs extensions to RFC 5213 signaling at the time of a new attachment
  - No further signaling required between LMA and MAG
- Scenario 1 requires flow mobility signaling for relocating flows between the different attachments
- MAGs should be aware of the prefixes for which the MN is going to receive traffic
  - Signaling is required if involved prefixes are not limited to those delegated to the MAG upon attachment of the new interface
Flow mobility scenarios

- Flow mobility signaling takes place whenever the LMA decides to move a flow from one access to another. At this point, either the prefix corresponding to the flow is already valid on the target MAG, or it needs to be signaled:
  - If already valid, LMA just moves the flow: “shared prefix” scenario
  - If not valid, LMA informs the MAG: “unique prefix” scenario
    - By default at prefix level, granularity MAY include detailed flow descriptors
Unique prefix per physical interface

LMA Binding Cache

<table>
<thead>
<tr>
<th>MN-ID</th>
<th>MN-LL-ID</th>
<th>PREFIX</th>
<th>MAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN 1</td>
<td>if1</td>
<td>pref1</td>
<td>MAG 1</td>
</tr>
<tr>
<td>MN 1</td>
<td>if2</td>
<td>pref2</td>
<td>MAG 2</td>
</tr>
</tbody>
</table>

Note: if1 and if2 may be the same (lif)

MAG1 routing state

<table>
<thead>
<tr>
<th>dest</th>
<th>next hop</th>
</tr>
</thead>
<tbody>
<tr>
<td>pref1::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
<tr>
<td>::/0</td>
<td>LMA</td>
</tr>
</tbody>
</table>

MAG2 routing state

<table>
<thead>
<tr>
<th>dest</th>
<th>next hop</th>
</tr>
</thead>
<tbody>
<tr>
<td>pref2::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
<tr>
<td>::/0</td>
<td>LMA</td>
</tr>
</tbody>
</table>
Unique prefix per physical interface

LMA

MAG1

MAG2

MN

Internet

flow X to pref1::lif

flow X to pref1::lif

flow Y to pref2::lif

flow Y to pref2::lif

LMA decision to move flow Y

FMI[MN1-ID,flow_info(Y),add]

FMA

LMA moves flow Y

FMI[MN1-ID,flow_info(Y),del]

FMA

This MAY include detailed flow descriptors

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

LMA decision to move flow Y

FMI[MN1-ID,flow_info(Y),add]

FMA

LMA moves flow Y

FMI[MN1-ID,flow_info(Y),del]

FMA

This MAY include detailed flow descriptors

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif

flow Y to pref2::lif
Unique prefix per physical interface

LMA Binding Cache

<table>
<thead>
<tr>
<th>MN-ID</th>
<th>MN-LL-ID</th>
<th>PREFIX</th>
<th>MAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN 1</td>
<td>if1</td>
<td>pref1</td>
<td>MAG 1</td>
</tr>
<tr>
<td>MN 1</td>
<td>if2</td>
<td>pref2</td>
<td>MAG 2</td>
</tr>
</tbody>
</table>

LMA flowmob state

<table>
<thead>
<tr>
<th>MN-ID</th>
<th>flow</th>
<th>MAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN 1</td>
<td>flow X</td>
<td>MAG 1</td>
</tr>
<tr>
<td>MN 1</td>
<td>flow Y</td>
<td>MAG 1</td>
</tr>
</tbody>
</table>

MAG1 routing state

<table>
<thead>
<tr>
<th>dest</th>
<th>next hop</th>
</tr>
</thead>
<tbody>
<tr>
<td>pref1::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
<tr>
<td>::/0</td>
<td>LMA</td>
</tr>
<tr>
<td>pref2::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
</tbody>
</table>

MAG2 routing state

<table>
<thead>
<tr>
<th>dest</th>
<th>next hop</th>
</tr>
</thead>
<tbody>
<tr>
<td>pref2::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
<tr>
<td>::/0</td>
<td>LMA</td>
</tr>
</tbody>
</table>
Unique prefix per physical interface
(partial handoff to a new interface)

<table>
<thead>
<tr>
<th>MN-ID</th>
<th>MN-LL-ID</th>
<th>PREFIX</th>
<th>MAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN 1</td>
<td>if1</td>
<td>pref1</td>
<td>MAG 1</td>
</tr>
<tr>
<td>MN 1</td>
<td>if2</td>
<td>pref2</td>
<td>MAG 1</td>
</tr>
</tbody>
</table>

Note: if1 and if2 may be the same (lif)

<table>
<thead>
<tr>
<th>dest</th>
<th>next hop</th>
</tr>
</thead>
<tbody>
<tr>
<td>pref1::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
<tr>
<td>pref2::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
<tr>
<td>::/0</td>
<td>LMA</td>
</tr>
</tbody>
</table>

PMIPv6 domain

IP
lif
if1
if2

79th IETF, Beijing
draft-bernardos-netext-pmipv6-flowmob-01
NETEXT WG, 2010-11-09
Unique prefix per physical interface
(partial handoff to a new interface)

Internet

LMA

flow X to pref1::lif
flow Y to pref2::lif

flow X to pref1::lif
flow Y to pref2::lif

flow X to pref1::lif
flow Y to pref2::lif

flow X to pref1::lif
flow Y to pref2::lif

flow X to pref1::lif
flow Y to pref2::lif
if1

LMA moves pref2 to new BCE for if2

PBU(pref2, HI=IANA-1)
PBA(pref2, HI=IANA-1)

if2

MN

MN powers on if2, performs L2 attach.

BRI(pref2)
BRA

(optional)
Unique prefix per physical interface
(partial handoff to a new interface)

<table>
<thead>
<tr>
<th>MN-ID</th>
<th>MN-LL-ID</th>
<th>PREFIX</th>
<th>MAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN 1</td>
<td>if1</td>
<td>pref1</td>
<td>MAG 1</td>
</tr>
<tr>
<td>MN 1</td>
<td>if2</td>
<td>pref2</td>
<td>MAG 2</td>
</tr>
</tbody>
</table>

**MAG1 routing state**

<table>
<thead>
<tr>
<th>dest</th>
<th>next hop</th>
</tr>
</thead>
<tbody>
<tr>
<td>pref1::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
<tr>
<td>::/0</td>
<td>LMA</td>
</tr>
</tbody>
</table>

**MAG2 routing state**

<table>
<thead>
<tr>
<th>dest</th>
<th>next hop</th>
</tr>
</thead>
<tbody>
<tr>
<td>pref2::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
<tr>
<td>::/0</td>
<td>LMA</td>
</tr>
</tbody>
</table>
Shared prefix across physical interfaces

Note: if1 and if2 may be the same (lif)

LMA knows that it has to assign the same prefix to upon attachment of different interfaces (TBD)
Shared prefix across physical interfaces

79th IETF, Beijing
draft-bernardos-netext-pmipv6-flowmob-01
NETEXT WG, 2010-11-09
Shared prefix across physical interfaces

LMA Binding Cache

<table>
<thead>
<tr>
<th>MN-ID</th>
<th>MN-LL-ID</th>
<th>PREFIX</th>
<th>MAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN 1</td>
<td>if1</td>
<td>pref1</td>
<td>MAG 1</td>
</tr>
<tr>
<td>MN 1</td>
<td>if2</td>
<td>pref1</td>
<td>MAG 2</td>
</tr>
</tbody>
</table>

LMA flowmob state

<table>
<thead>
<tr>
<th>MN-ID</th>
<th>flow</th>
<th>MAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN 1</td>
<td>flow X</td>
<td>MAG 1</td>
</tr>
<tr>
<td>MN 1</td>
<td>flow Y</td>
<td>MAG 1</td>
</tr>
</tbody>
</table>

MAG1 routing state

<table>
<thead>
<tr>
<th>dest</th>
<th>next hop</th>
</tr>
</thead>
<tbody>
<tr>
<td>pref1::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
<tr>
<td>::/0</td>
<td>LMA</td>
</tr>
</tbody>
</table>

MAG2 routing state

<table>
<thead>
<tr>
<th>dest</th>
<th>next hop</th>
</tr>
</thead>
<tbody>
<tr>
<td>pref1::/64</td>
<td>p2p-iface-with-MN1</td>
</tr>
<tr>
<td>::/0</td>
<td>LMA</td>
</tr>
</tbody>
</table>

79th IETF, Beijing  
draft-bernardos-netext-pmipv6-flowmob-01  
NETEXT WG, 2010-11-09
Next steps

• Some design choices are still open for discussion
  • Feedback from the WG very welcome

• Ask for WG adoption