Distributed Mobility Management: Current Practices and Gap Analysis

draft-ietf-dmm-best-practices-gap-analysis-01

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Current Status

- 01 version now
  - Updated based on last meeting's comments.

- Several comments received in the mailing list.
  - The authors appreciate the valuable comments.
  - No major concerns, could be resolved soon.

Outline of the Draft

- 1. Introduction
- 2. Terminology
- 3. Functions of existing mobility protocols
- 4. DMM practices
  - 4.1 Assumptions
  - 4.2 IP flat wireless network
    - 4.2.1 Host-based IP DMM practices
    - 4.2.2 Network-based IP DMM practices
  - 4.3. 3GPP network flattening approaches
- 5. Gap analysis
- 6. Security considerations

Section 3.
Functions of existing mobility protocols

- The existing mobility management functions of MIPv6, PMIPv6 and HMIPv6:
  - Anchoring Function (AF)
  - Mobility Routing (MR)
 - Location Management (LM)
  - Location Update (LU)

Section 4.
DMM Practices

- Wi-Fi network
  - Host based solution
  - Network based solution
- 3GPP network
  - Architecture
  - LIPA/SIPTO

4.2.1
Host-based DMM practices

```
<- INTERNET -> <- HOME NETWORK -> <---- ACCESS NETWORK ---->
 -------                           -------
| CN1 |            -------        | AR1 |-(o) zzzz (o)
 -------          | HA1 |          -------           |
                   -------    (MN1 anchored at HA1) -------
                               -------             | MN1 |
                              | AR2 |-(o)           -------
                               -------
                  -------
                 | HA2 |                 -------
                  -------               | AR3 |-(o) zzzz (o)
                                         -------            |
 -------                      (MN2 anchored at HA2) -------
| CN2 |                                  -------   | MN2 |
 -------                                | AR4 |-(o)  -------
                                         -------

CN1     CN2     HA1     HA2        AR1     MN1     AR3     MN2
 |       |       |       |          |       |       |       |
 |<------------->|<===============+=====>|   |       |       |
 |       |       |       |          |       |       |       | BT mode
 |       |       |       |          |       |       |       |
 |       |<---------------------------------------+---->| RO mode
 |       |       |       |          |       |       |       |
```
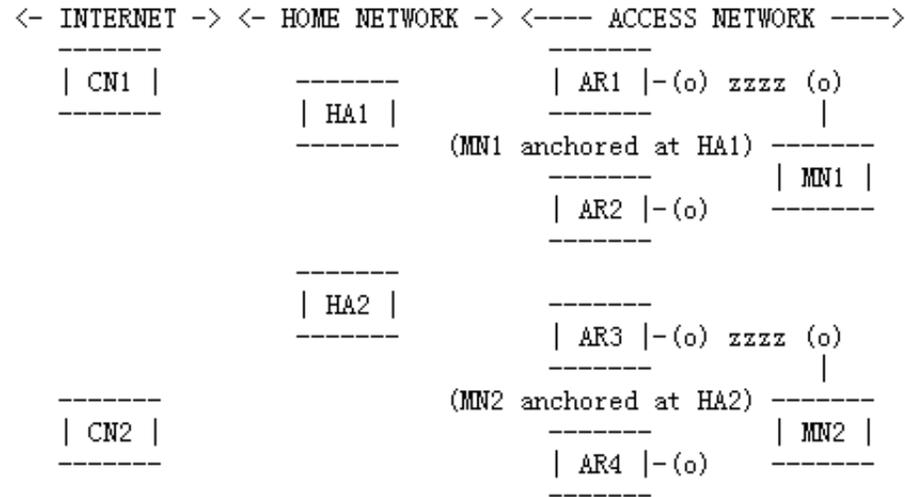
Select the nearest HA
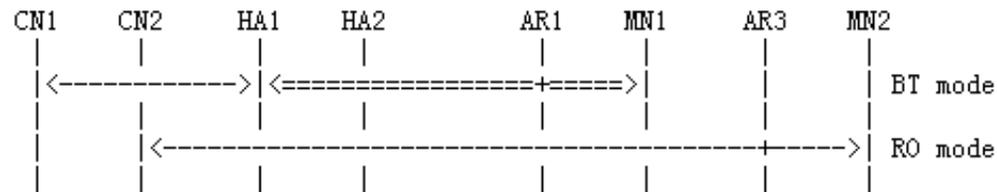
Distributed operation of Mobile IPv6

4.2.1
Hierarchical Mobile IPv6

```
<- INTERNET -> <- HOME NETWORK -> <------- ACCESS NETWORK ------->
                                                     ------
                                                    /|AR1|-(o) zz (o)
                                    --------  / -----          |
                                    | MAP1 |<                -------
                                    -------- \ -----         | MN1 |
                                              \|AR2|         -------
  -------                                      -----   HoA anchored
  | CN1 |                                      -----     at HA1
  -------                                     /|AR3|  RCoA anchored
                         --------    -------- / -----    at MAP1
                         | HA1 |     | MAP2 |<        LCoA anchored
                         -------     -------- \ -----    at AR1
                                              \|AR4|
                                               -----
  -------                                      -----
  | CN2 |                                     /|AR5|
  -------                          --------  / -----
                                   | MAP3 |<
                                   -------- \ -----
                                            \|AR6|
                                             -----


CN1       CN2        HA1            MAP1      AR1          MN1
 |         |          |              |         |            |
 |         |          |              | -------- ---------   |
 |<------------------>|<============>|<_____+_____>|  HoA
 |         |          |              |         |            |
 |         |<------------------------------>|<============>| RCoA
 |         |          |              |         |            |
```
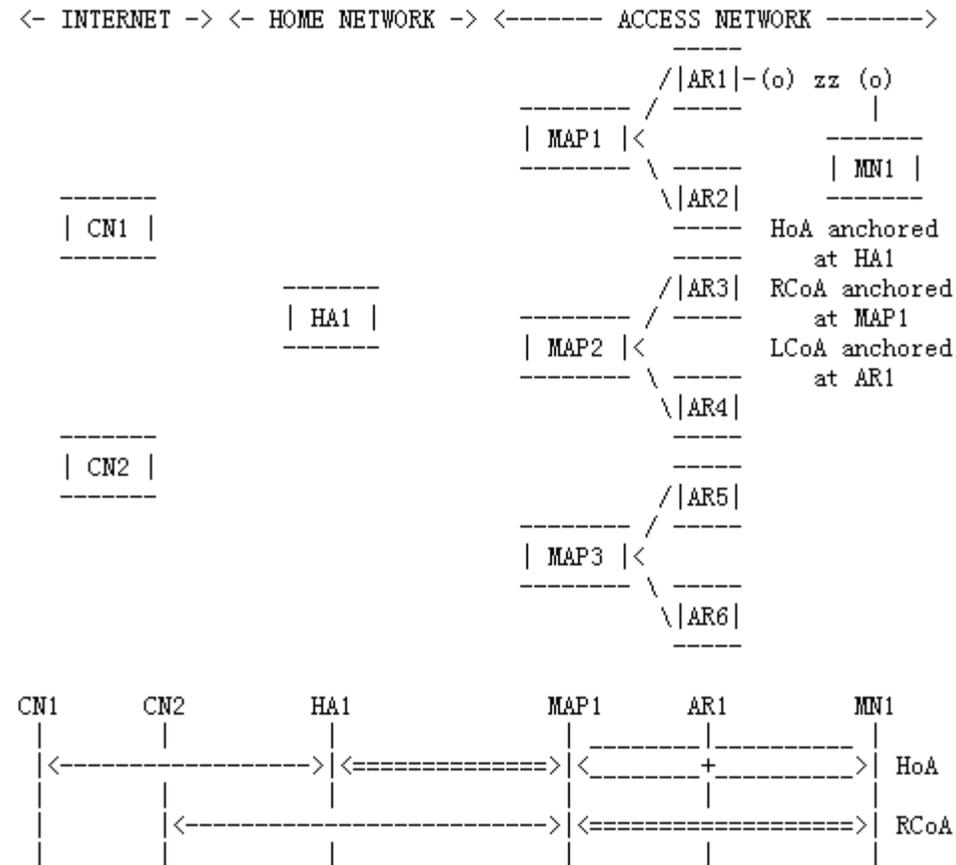
Hierarchical Mobile IPv6

4.2.2
Network-based IP DMM practices

```
<- INTERNET ->< - HOME NET ->< ------------ ACCESS NETWORK ------------>
   -------
  | CN1 |                               --------        --------        --------
   -------        --------            | MAG1 |        | MAG2 |        | MAG3 |
                 | LMA1 |              ---+----        ---+----        ---+----
   -------        --------               |               |               |
  | CN2 |                               (o)             (o)             (o)
   -------        --------               x                               x
                 | LMA2 |                x                               x
   -------        --------              (o)                             (o)
  | CN3 |                                |                               |
   -------                            ---+---                         ---+---
                 Anchored            | MN1 |        Anchored         | MN2 |
                 at LMA1 ->           -------        at LMA2 ->        -------


CN1      CN2      LMA1     LMA2        MAG1    MN1      MAG3    MN2
 |        |        |        |           |       |        |       |
 |<------------>|<===============>|<---->|       |        |
 |        |        |        |           |       |        |       |
 |        |<------------>|<======================>|<---->|
 |        |        |        |           |       |        |       |
 |        |        |        |           |       |        |       |
```
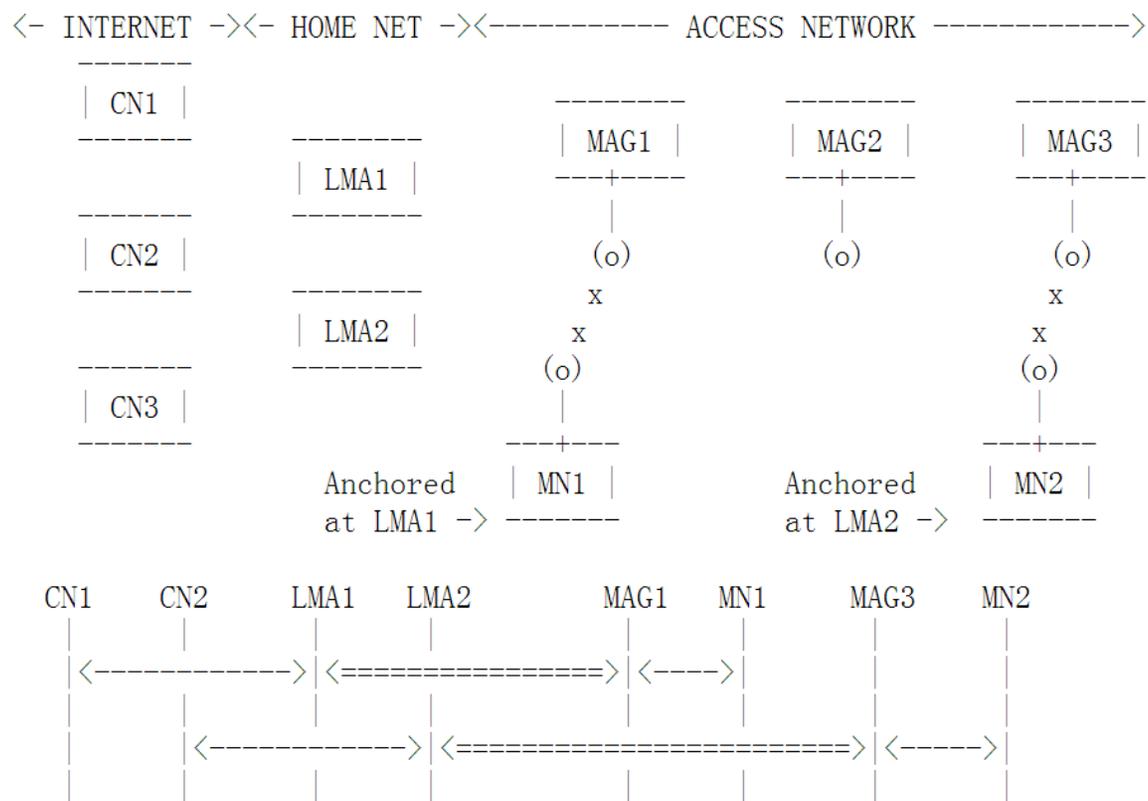
Distributed Operation of Proxy Mobile IPv6

4.3
3GPP Network Flattening Approaches

```
+------------------------------------------------------+
|                        PCRF                          |
+------------------------------------------------------+
      |                          |            |
+----+   +------------------+    +------------------+  +--+
|    |   |            +-+    |    | Core Network     |  |  |
|    |   | +------+   |S|__  |    | +--------+ +--+  |  |  |
|    |   | |GERAN/|_ |G| \   |    | |  HSS   |  |  |  |  | E
|    +-----+ UTRAN|  |S|  \  |    | +--------+  |  |  |  | x
|    |   | +------+  |N| +-+-+|    |     |       |  |  |  | t
|    |   |        +-+ / |MME||    | +--------+   |  |  |  | e
|    |   | +--------+ / +--+ |    | |  3GPP  |   |  |  |  | r
|    +-----+ E-UTRAN |/      |    | |  AAA   |   |  |  |  | n
|    |   | +--------+\       |    | | SERVER |   |  |  |  | a
|    |   |            \ +---+|    | +--------+   |  |  |  | l
|    |   | 3GPP AN     \|SGW+----- S5-----------+ P|  |  |
|    |   |              +---+|    |             | G|  |  | I
|    |   +------------------+|    |             | W|  |  | P
| UE |                       |    |             |  |  |  |
|    |   +------------------+ |    |            +----+ |  | n
|    |   |+--------------+ +-------+|            |      |  | e
|    |   || Untrusted    +-+ ePDG +-S2b---------+      |  | t
|    +---+| non-3GPP AN  | +------+|            |      |  | w
|    |   |+--------------+        ||            |      |  | o
|    |   +------------------+     ||            |      |  | r
|    |                             |            |      |  | k
|    |   +------------------+      |            |      |  | s
|    +---+ Trusted non-3GPP AN +-S2a-----------+      |  |
|    |   +------------------+        |          |      |  |
|    |                               |        +-+-+    |  |
|    |   +------------------------S2c-----------|      |  |
|    |                               |                 |  |
+----+   +------------------------------------+      +--+
```
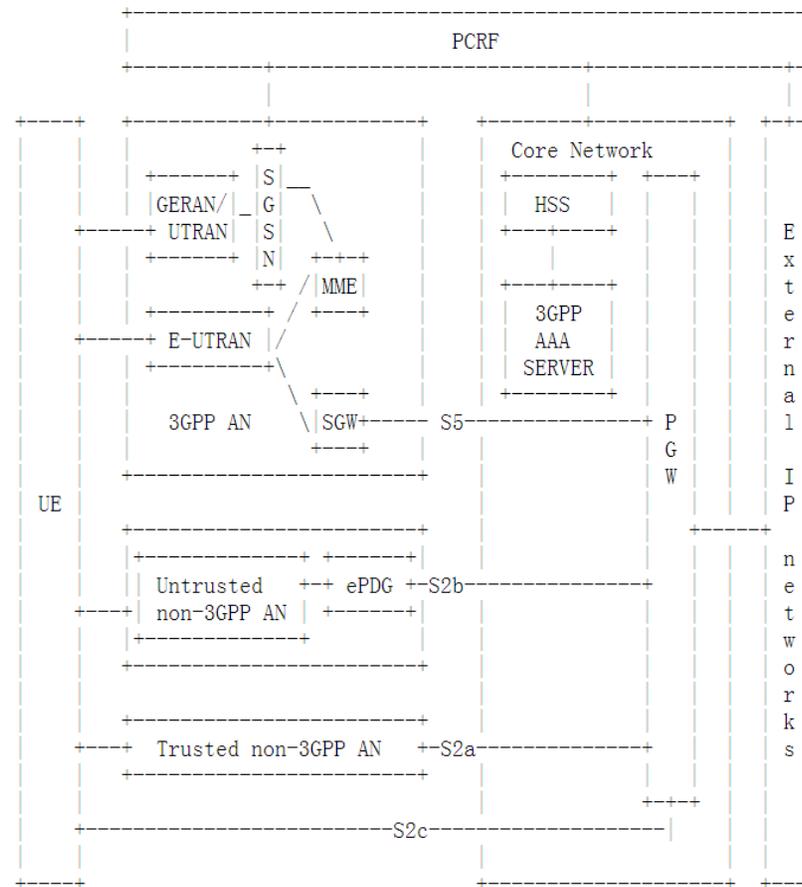
EPS architecture overview

3GPP/LIPA

```
+---------+ IP traffic to mobile operator's CN
|  User   |.....................................(Operator's CN)
| Equipm. |.................
+---------+               . Local IP traffic
                          .
             +-----------+
             |Residential|
             |enterprise |
             |IP network |
             +-----------+
```
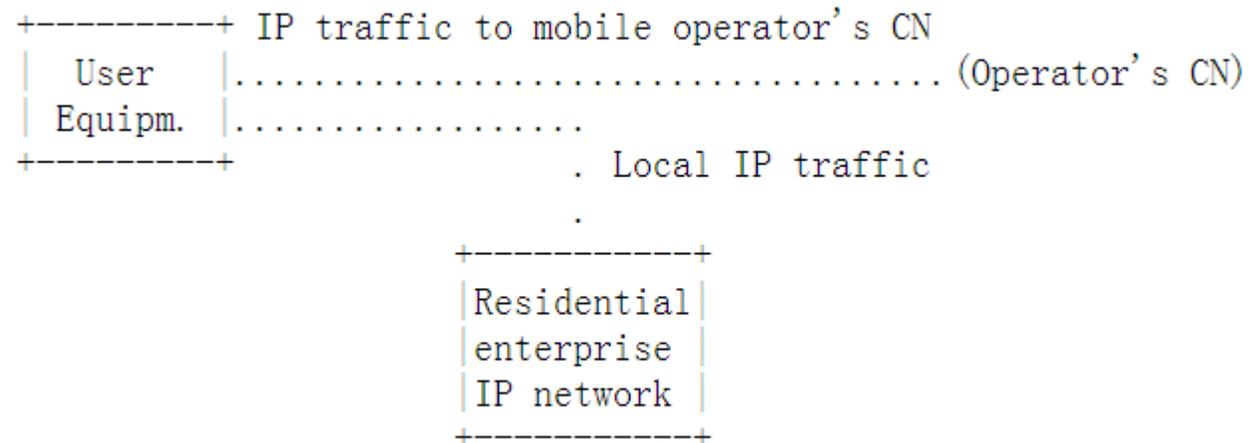
3GPP LIPA Scenario

3GPP/SIPTO

```
                          SIPTO Traffic
                               |
                               .
                               .
                          +------+          +------+
                          |L-PGW |   ----   | MME  |
                          +------+     /     +------+
                               |      /
+-------+      +------+    +------+/          +------+
|  UE   |.....|eNB    |....| S-GW |..........| P-GW |...> CN Traffic
+-------+      +------+    +------+          +------+
```
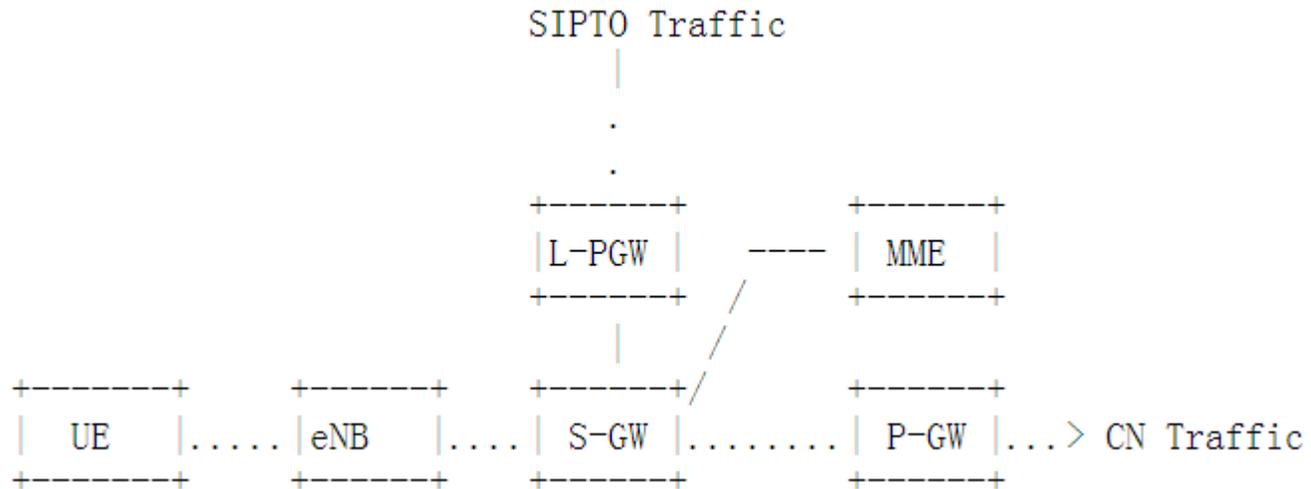
3GPP SIPTO Scenario

5. Gap Analysis

- Functions that DMM needs:
  - Multiple anchoring
  - Dynamic anchor assignment/re-location
  - Multiple IP address management

Example of a conceptual DMM solution deployment

```
(                                                              )
 +-----------------------------------------------------+
  /                       |                      \
 /         * Internet     |      x Internet       \         Internet
 /       * / access       |      x / access        \       / access
 /      * / (IP a)        |      x / (IP b)          \     /
--+-----+-----      ----+-----+----      -----+---+----
 | distributed | * * *| distributed |      | distributed |
 |  anchor 1   |      |  anchor i   |      |  anchor n   |
--+----------      --+----------      --+----------
   |                   |                   |
  (o)                 (o)                 (o)
         session X   * x   session Y
         anchored  * x    anchored
           at 1    * x      at i
         (IP a)  (o)      (IP b)
                   |
                +--+--+
                | MN1 |
                +-----+
```
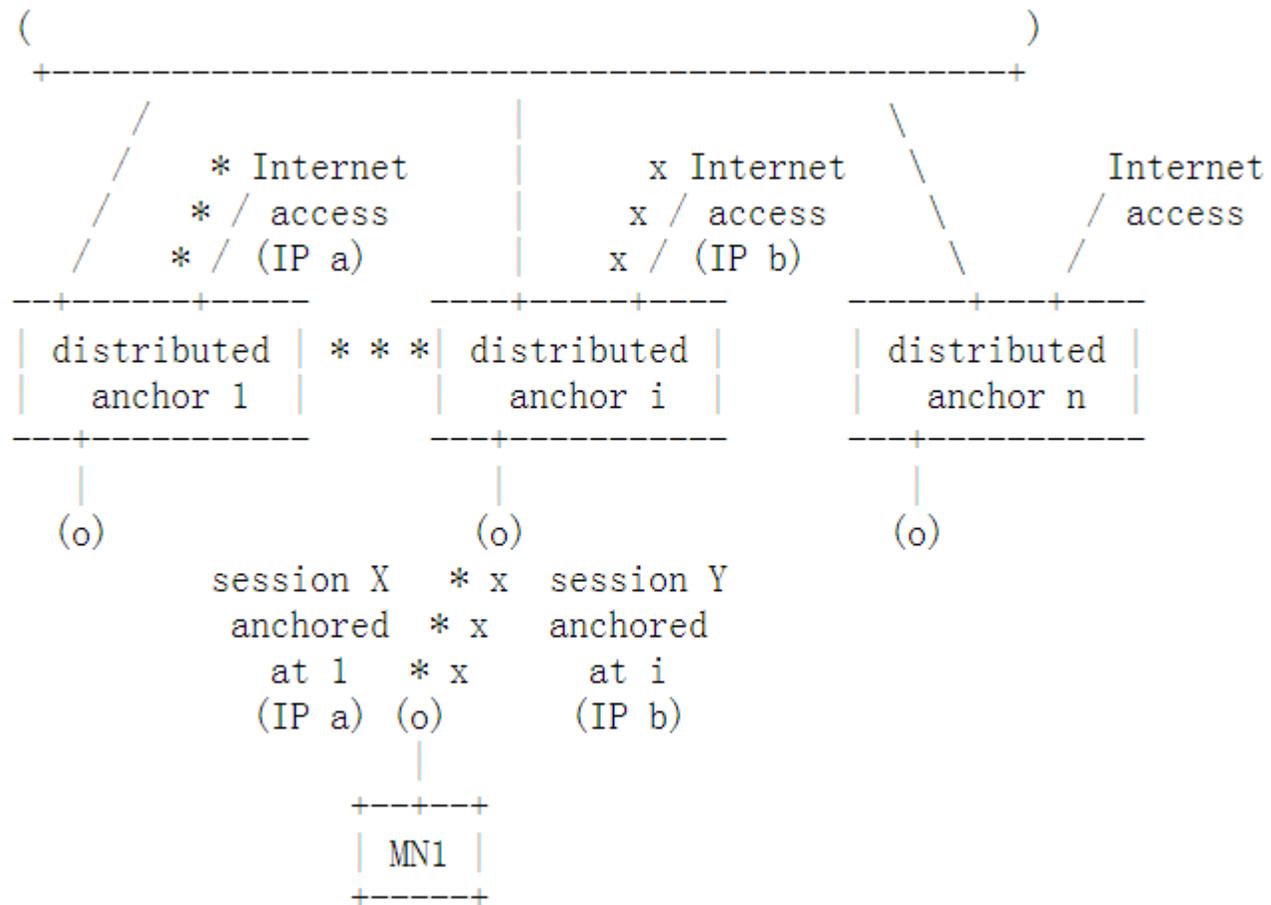
Comments Received

- Several comments were received after the new version was post to the list.

- The authors appreciate the valuable comments.

Comments from Alper/Park

- Section 4.1
  - "It is typically the role of a connection manager to distinguish application capabilities and trigger the mobility support accordingly"
  - Comments:
    - "I'm not sure if this is really a connection manager issue. This is more of a source address selection issue."
  - Resolution:
    - Accepted.

- Section 4.1:
  - " Mobility management and traffic redirection should only be triggered due to IP mobility reasons, that is when the MN moves from the point of attachment where the IP flow was originally initiated."
  - Comment
    - "Mobility management and traffic redirection may also be triggered due to load balancing. Maybe we should acknowledge such non-mobility related triggers, and state that they are outside the scope of this document."
  - Resolution
    - Accepted.
    - "when the MN moves from the point of attachment/ when the MN changes the point of attachment"

- Comment
  - "Should we described the terms IP session continuity and IP address reachability? This document is solely focusing on the former, we should state that."

- The DMM charter says:
  - "Although the maintenance of stable home address(es) and/or prefix(es) and upper level sessions is a desirable goal when mobile hosts/routers change their point of attachment to the Internet, it is not a strict requirement"
  - So IP address reachability may not in the scope.

- Comment
  - "When doing the gap analysis, we better break down the benefits we are seeking and evaluate existing solutions with respect to them (e.g., signaling reduction, use of most direct data-path, etc.). For example, regular use of HMIP helps with the former, but not the latter. But, using RCoA as source address helps with both (but it has other issues -- when MN moves outside the local domain)."

- Resolution
  - " It is in the 00 version (http://tools.ietf.org/html/draft-ietf-dmm-best-practices-gap-analysis-00#section-5.1.2). In this update version, the table is not included yet. We can include it if folks believe it is useful. But we need have consensus on the conclusion of the table"

Comments from Jouni

- Section 4.2:
  - " Since WiFi is the most widely deployed wireless access technology nowadays"
  - Comment
    - "Do you have some data/reference to backup your claim?"
  - Resolution
    - Accepted. Remove "most".

- Section 4.2.1
  - "at different point of attachment. However there is no mechanism specified to enable an efficient dynamic discovery of available"
  - Comment
    - "I would add a clarification here that there is no such mechanism available within IETF specifications. Other SDOs do have such mechanism (e.g. 3GPP)."
  - Resolution
    - Accepted.

- Comment
  - "Furthermore, around the bulleted list for the MIPv6 RO discussion, I would mention that nothing prevents a MN to use its CoA directly when communicating CNs on the same link or anywhere in the internet. Of course there is no mobility in that case but it is a valid scenario to mention IMHO (and also part of our charter). I recon the HMIPv6 text mentions at least the use of RCoA already."
  - Resolution
    - Accepted.

- Comment
  - "In Section 4.2.2. where the text describes RFC6463, I would also reference to RFC6097 since that has quite a bit of text regarding the discovery procedure of the LMA."
  - Resolution
    - Accepted.

- Comment
  - "While I found Section 4.2. good in general I was somehow expecting to see text regarding MOBIKE (RFC4555). We can safely assume MOBIKE is probably the most deployed client mobility enabling technology out there today."
  - Resolution
    - Accepted.

- Comment
  - "In Section 4.3. it says: "GPRS Tunnelling Protocol (GTP) [3GPP.29.060] is a network-based mobility protocol specified for 3GPP networks (S2a, S2b, S5 and S8 interfaces)."While 29.060 is about GTP, for the above referenced interfaces 29.281 and 29.274 are probably more appropriate."
  - Resolution
    - Accepted.

- Comment
  - " "A Local IP Access (LIPA) and Selected IP Traffic Offload (SIPTO) enabled network [3GPP. 23.829] allows offloading some IP services at" I would say referencing to e.g. 23.401 on LIPA/ SIPTO is more appropriate these days, since the TR23.829 is somewhat left behind and the LIPA/ SIPTO
  functionality is part of the main stage-2 specs already."
  - Resolution
    - Accepted.

- Comment
  - "I found Section 4 in general quite nice. However, I was somehow expecting to see a bit of text of WiMAX. Or can we safely state that no IPv6 deployments ever took place in WiMAX? Anyway, at least a reference to WiMAX would be nice, since they spent quite a bit of time developing both CMIPv6 and PMIPv6 functionality into their architecture"
  - Resolution
    - Accepted.

- Comment
  - " In Section 4.3. I would reference to 3GPP TS29.303 and say something
    about 3GPP's heavy use of DNS as the
    "gateway location database" and
    how that is used to discover gateways with
    both topological and gateway
    collocation in mind"
  - Resolution
    - Accepted.

- Comment
  - "In Section 5. it is stated:
    "The dynamic anchor relocation needs to ensure that IP address continuity is guaranteed for sessions that need it at the relocated anchor. "

    Since our charter _allows_ solutions where mobility is used "when needed" that fact should be reflected above. Even if there is mobility supported only locally within a limited area, it might meet the requirements from the MN or the application point of view i.e. when the MN or the application
    does not care about a "full longstanding mobility" to be provided."
  - Resolution
    - Accepted.

- Comment
  - " "Dynamic discovery and selection of anchors. There might be more than one available anchor for a mobile node to use. Currently, there is no efficient mechanism that allows to dynamically discover the presence of nodes that can play the role of anchor, discover their capabilities and allow the selection of the most suitable one."

    Within 3GPP TS29.303 makes that possible and is deployed."
  - Resolution
    - Accepted.
    - We can scope the statement in IETF?

Next step

- Refine the wording/part of the content
  - Add WiMax part

- Read for WGLC?

- Comments?