Routing Optimization with SDN
draft-yang-dmm-sdn-dmm-01.txt

Abstract

DMM is a mobility protocol which has mobility functions to solve the
existing problems in the current centralized ones. However, when a
mobile node moves to another anchor, the previous flow is forwarded
by the previous router. For this reason, the routing optimization
could be an issue. This draft proposes a routing optimization method
in distributed anchor architecture. In this draft, we applied the
SDN concept to DMM architecture for routing optimization.

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1. Introduction

   DMM is a technology for distributed network-based mobility
   management protocol, which has been proposed to solve the problems
   in the centralized mobility protocols such as PMIPv6 [RFC5213],
   MIPv6 [RFC6275]. In the current research of distributed mobility
   management, there are two methods for mobility management.

   One is the fully distributed mobility management method. The other
   is the partially distributed mobility method.

   In partially distributed method, it decouples the control plane and
   data plane. It uses a centralized method for control plane and uses
   a distributed method for data plane. In fully distributed method, it
   uses a distributed method for both control plane and data plane.

In Partially Distributed, there is one entity which that stores the
BCEs allocated for the MNs in the mobility domain. In the current
network, when mobile node moves to a new anchor, tunneling must be
used between the P-MAAR and a new anchor and the previous flow is
forwarded from the P-MAAR to the new anchor until the flow is
finished. Therefore, routing may not be optimized in term of
bandwidth overhead.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
document are to be interpreted as described in RFC-2119 [RFC2119].

Software Defined Networking (SDN)

The following terms are defined and used in this document:

DMM service (distributed mobility management service)

   Function that store the BCEs and support mobility management, it's
   running on controller.

The following terms used in this document are defined in A PMIPv6-
based solution for Distributed Mobility Management [draft-bernardos-
dmm-pmip-03]

Mobility Anchor and Access Router (MAAR)

Central Mobility Database (CMD)

Previous MAAR (P-MAAR)

Serving MAAR (S-MAAR)

3. Motivation of DMM Optimization

In current distributed mobility management, mobile node is allocated
IP from initiate anchor. if mobile node moves to another router,
mobile node received data through the tunneling between P-MAAR and
S-MAAR. that is, tunneling is necessary to receive data from
previous router and this method has still optimization routing

problem. In this draft, we propose a routing optimization scheme
that applied SDN concept to DMM architecture.

4. **DMM architecture with SDN concept for routing Optimization**

The purpose of this draft is to make optimized routing path from the
DMM architecture. If data path is controlled by SDN controller in
the DMM architecture with a DMM service that stored mobile node
status, mobile node data path is possible to set up by optimized
path. Moreover, tunneling is not necessary when receiving data from
previous router. The architecture of proposed method is shown in the
figure 1.

```
        +------+
        |  CN  |////////////Optimization routing/////////////
        +------+                                         /
           * +                                          /
           * +                                         /
           * +               +--------------+         /
           * +      ##########| DMM Service  |######### /
           * +      #         +--------------+       # /
           * +      #         +--------------+       # /
           * +      #         |SDN Controller|       # /
           * +      #         +--------------+       # /
           * +   flow table                  flow table /
           * +      #                             # /
           * +      #                             # /
        +--*-+-#######                        #----/-+
        |P-MAAR|+++++++++++++++data flow+++++++++++++|S-MAAR|
        +------+                              +------+


         +----+
         | MN |----------------move---------------------->
         +----+
```

                Figure 1. DMM architecture with SDN

In current distributed mobility management, Upon the MN's attachment
to initiate router, the binding update message is sent to CMD that
stored mobile node status and session DB replies to initiate router
with PBA including prefix. When the mobile node moves from its
current router to new router, new router sends a binding update
message to CMD. CMD sends to update information related to mobile
node. The previous router that received update information from CMD
establishes a tunnel with the new router to transmit data.

4.1. Handover process and potential optimization routing

   In proposed architecture, mobile node is supported mobility
   management by binding update to controller with DMM service.
   Moreover, data path can be set up without data tunneling in our
   method. because data path is set up by flow table which made by SDN
   controller. That is, mobile node can be supported optimized path by
   flow table, without tunneling. There are several benefits and
   potential ways to support routing optimization.

```
       MN          P-MAAR          Controller          S-MAAR          CN
                                (with DMM service)
       |           |                  |                  |             |
       |           |---Packet in --->|                  |             |
       |           |     Message      |                  |             |
       |           |            BCE Creation             |             |
       |           |                  |                  |             |
       |           |<---Flow Modify--|                  |             |
       |           |<-Packet out-----|                  |             |
       |           |     Message      |                  |             |
       |           |                  |                  |             |
       |<--------->|<--------Flow 1 Data--------------------------->|
       |           |                  |                  |             |
     MN move       |                  |                  |             |
     to S-MAAR     |                  |                  |             |
       |           |                  |<-Packet in-----|             |
       |           |                  |  Message with  |             |
       |           |                  |(MN'sID,prefix1)|             |
       |           |                  | location)      |             |
       |           |                  |                  |             |
       |           |          BCE check / update        |             |
       |           |                  |                  |             |
       |           |<--Flow Modify --|--Flow Modify-->|             |
       |      Route update           |          Route update         |
       |           |                  |                  |             |
       |           |                  |--Packet Out--->|             |
       |           |                  |                  |             |
       |<----------|---------Flow 1 Data------------->|             |
       |           |<--------Flow 1 Data------------->|             |
       |           |<---------------|----Flow 1 Data-|---------->|
```
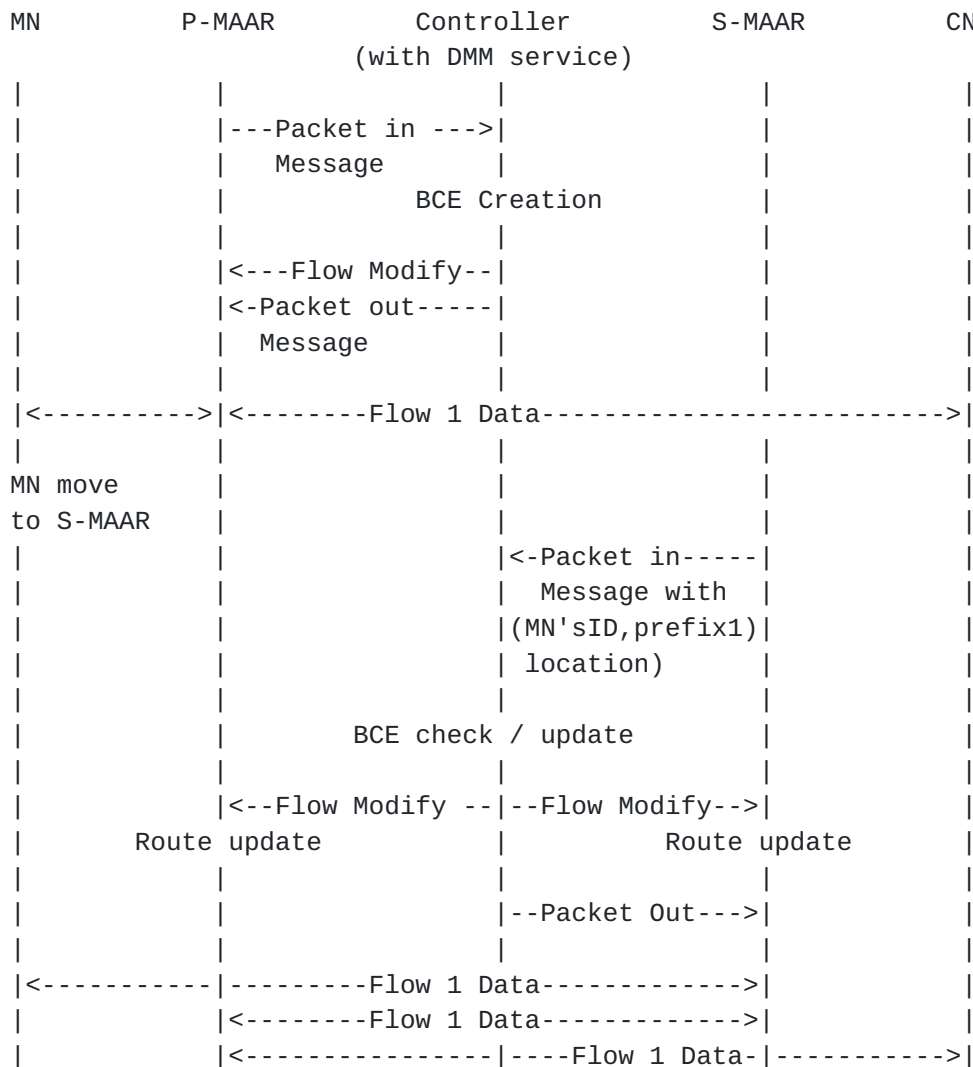
                 Figure 2. Procedure of DMM with SDN

   As a Figure2, When mobile node attach initiate router , MAAR1 sends
   a Packet in Message with MN's ID, for registration to the controller.
   Upon accepting this Packet in Message, the controller sends a Packet
   out Message including the mobile node's prefix1 and controller
   stored mobile node information in Binding cache entry.
   For set up the data path, the controller sends a Flow Modify message
    to set up the flow table in the P-MAAR.
   If the mobile node moves to the S-MAAR, the S-MAAR sends a Packet in
   Message with mobile node's ID, prefix1, new location of mobile
   node(S-MAAR). The controller which receives packet in message will
   check and update BCE.
   Upon receiving this Packet in Message, the Controller sends Flow
   Modify message to P-MAAR, S-MAAR to set up the new data path. On
   receiving flow modify messages, the S-MAAR and P-MAAR will update
   their routing tables. Then the data session will flow from P-MAAR to
   new S-MAAR and finally to the mobile node.

4.2. Advantage of DMM architecture with SDN

   SDN which has a flexible way to set up data flow can provide a
   solution to support efficient route in the DMM architecture. If the
   mobile node moves to another router, this method can solve the
   routing optimization problem by modifying flow tables. Besides, the
   SDN doesn't only allow us to control the data path but also the
   other kinds of messages between routers.

4.3. Optimization routing

As a Figure2, When mobile node attach new router, the data session
Will flow from P-MAAR to new S-MAAR. Even mobile node Move to
another router, data path will be formed through the P-MAAR.
It will be occur delay and make the non-optimization path. However,
In the SDN based DMM, the controller can modify flow table to make
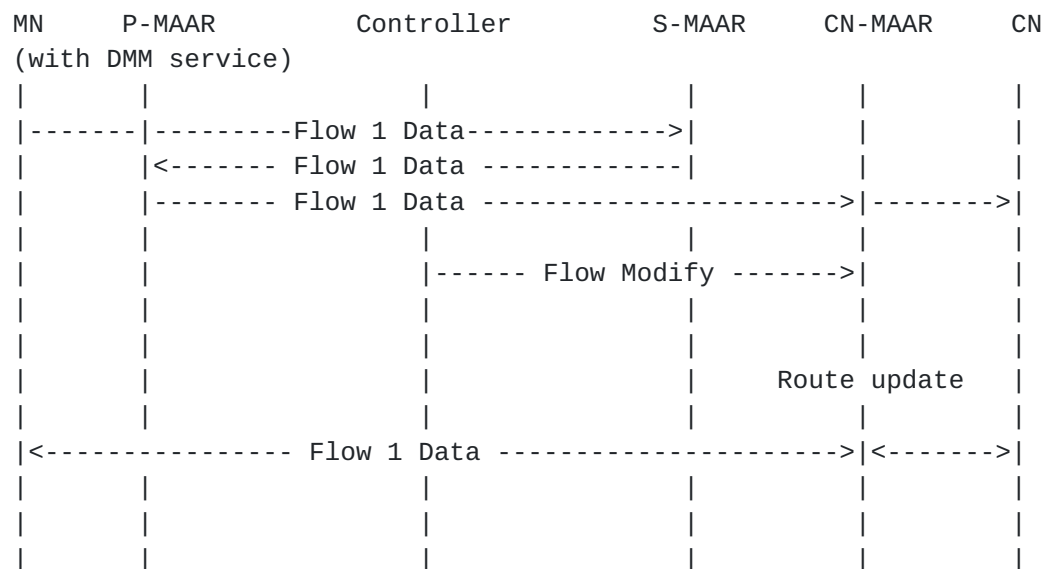the optimization data path.

```
MN      P-MAAR            Controller            S-MAAR     CN-MAAR     CN
(with DMM service)
 |       |                 |                     |           |         |
 |-------|---------Flow 1 Data------------->|           |         |
 |       |<------- Flow 1 Data -------------|           |         |
 |       |-------- Flow 1 Data ---------------------->|-------->|
 |       |                 |                     |           |         |
 |       |                 |------ Flow Modify ------->|         |
 |       |                 |                     |           |         |
 |       |                 |                     |           |         |
 |       |                 |                     |      Route update   |
 |       |                 |                     |           |         |
 |<--------------- Flow 1 Data ---------------------->|<------->|
 |       |                 |                     |           |         |
 |       |                 |                     |           |         |
 |       |                 |                     |           |         |
             Figure 3.Procedure of path optimization
```

As a Figure3, After packet redirecting, controller send the flow
Modify message to CN-router for routing optimization. Flow modify
Message has information that stored flow table between CN-MAAR and
S-MAAR. After Receiving Flow modify message, CN-MAAR send packet
to S-MAAR directly.

5. Security Considerations

TBD

6. IANA Considerations

This document makes no request of IANA.

7. References

7.1. Normative References

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7.2. Informative References

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