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Pre CRN discovery from proxy on candidate new path
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Status of this Memo

Abstract

NSIS WG has been discussing the ways to minimize/avoid QoS interruption during handover. One solution is to install new path before MN's move (fast state installation).
This document proposes a procedure of pre CRN discovery for fast state installation by using proxies on candidate new paths. An example of fast state installation is shown.

Conventions used in this document

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 [2].

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1. Introduction

When a MN performs L3 level handover with a QoS state, it is required to establish new QoS paths before handover to avoid/minimize QoS interruption in new subnetwork. Discussions on this topic are taking place in the NSIS WG and some drafts are proposing "Fast State Installation", by which new QoS paths are established in advance [3][5][6][8].

The goal of this draft is to initiate discussion on concrete solutions for Fast State Installation. An example is provided of a procedure that includes crossover node (CRN) discovery. This procedure utilizes a proxy entity on the candidate new path, to perform CRN discovery and QoS state installation along the new path prior to the MN's move to the new subnetwork.

Terminology definitions and assumptions in this document are described in the following section.

1.1 Terminology

Uplink data flow:
data flow from MN to CN

Downlink data flow:
data flow from CN to MN

UCRN and DCRN:
The same as defined in [6]

mQNE:
The NSIS aware node supporting QoS and mobility functionalities

1.2 Assumption

o Signaling messages are path-coupled [8]. Signaling messages from MN to CN are routed only through NEs that are in the Uplink data path, and signaling messages from CN to MN are routed only through NEs that are in the Downlink data path

o Network supports Mobile IPv6 [13]

o Only optimized route case is discussed in this document although several routes are possible such as triangle route, tunnel between OAR and NAR established by FMIP, and so on.

o MN and CN are mQNE

2. Proxy for Fast State Installation

MN cannot directly initiate resource reservation signaling on candidate new paths before it actually moves. Therefore NSIS proxy utilization will be necessary for fast state installation, as described in [3].

The proxy can be used for preparing new path installation, e.g. discovering CRN in advance of the MN's move(pre CRN discovery). Additionally the proxy may install the new path on behalf of the MN.

The following section describes a procedure for pre CRN discovery followed by fast state installation.

3. Proxy discovery

Either old (current) or candidate new adjacent mQNEs of MN (see Figure1) can act as a proxy.
An example of the former case is described in an appendix of [5]. Here we aim to consider the latter case, i.e. new adjacent mQNE acts as a proxy and prepares new path creation.

If candidate NAR(s) has mQNE functionalities, the NAR(s) acts as a proxy.

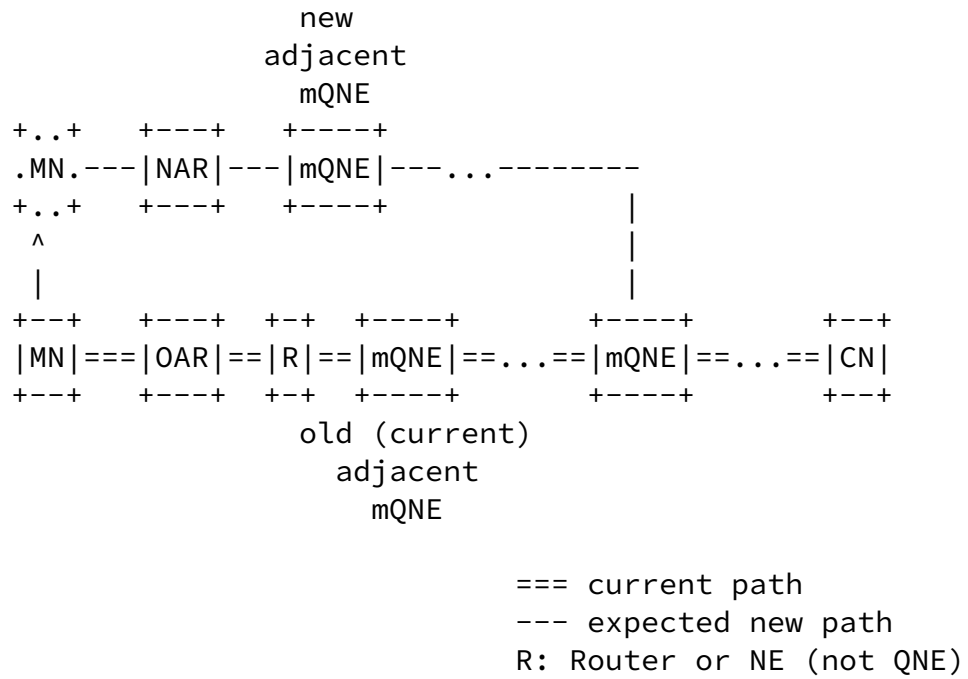


Figure1: New and old adjacent mQNE

If MN and network support suitable mobility protocol, such as

CARD [12], MN can obtain proxies information through the CARD server.

When the network does not support CARD, the MN may have to rely on pre-stored information. This information could be in the form of tables contains mapping information between APs and their connecting ARs, and neighboring mQNEs (proxies) of the ARs. The MN would then be able to associate the information on candidate APs to mQNEs that will likely be on the new path and would be able to act as proxies. Given though that determining whether an mQNE router will be on a data path to an arbitrary CN is difficult, it is proposed that only access routers with mQNE capabilities are used as proxies as described in [6]. This has the added advantage that these routers will be able to perform DAD on prospective new CoAs which would enable them to also perform the state installation on behalf of the MN.

4. Pre CRN Discovery

The idea of pre CRN (both UCRN and DCRN) discovery is as follows.

a. After determining proxies, MN sends PROXY_INIT message to the proxies. The PROXY_INIT message is a NSLP signaling message and contains current flow identifier and session identifier (for both uplink and downlink, or either) information.

b. On receipt of PROXY_INIT message, each proxy sends a DCRN_DISCOVERY message to CN. A DCRN_DISCOVERY is NSLP signaling message and containing the flow identifier and session identifier received from the MN. An IP address of CN is contained in flow identifier.

c. Each QNE belonging to the signaling path from proxy to CN intercepts DCRN_DISCOVERY, and checks if any interface has resource reservation for the pair of flow identifier and session identifier for uplink. If one of interface has the reservation, the QNE appends IP address of the interface to DCRN_DISCOVERY.
When DCRN_DISCOVERY message arrives to CN, DCRN_DISCOVERY message contains the information of all overlapping interfaces

belonging to current uplink QoS path (from MN to CN) and expected new uplink path (from proxy to CN) in order.

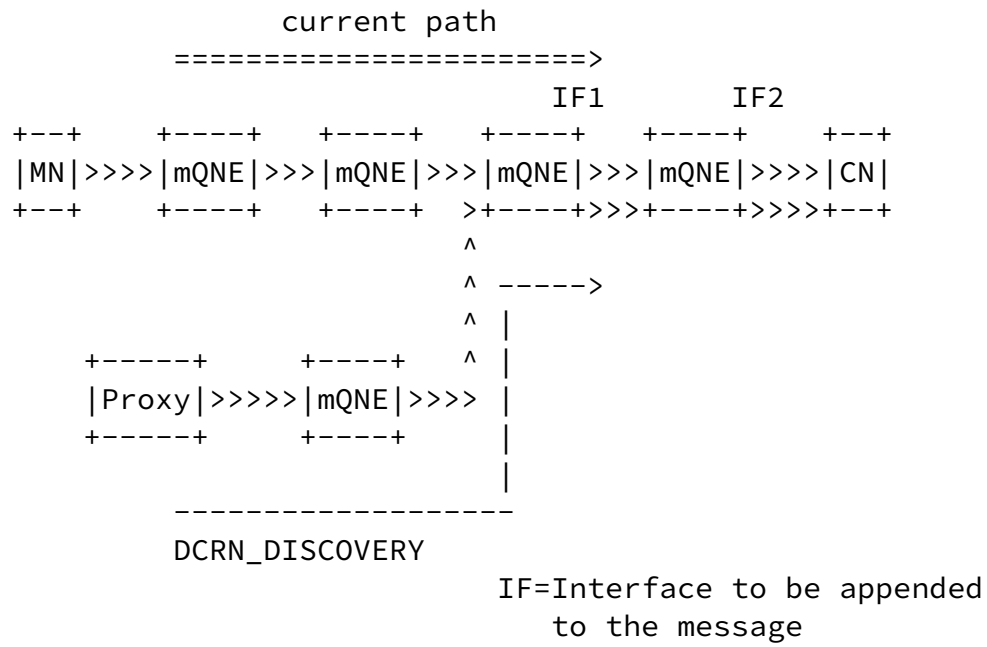


Figure2: Interfaces' information collected by DCRN_DISCOVERY

d. On receipt of DCRN_DISCOVERY message, CN sends a UCRN_DISCOVERY to the proxy. A UCRN_DISCOVERY message is NSLP signaling message and containing the flow identifier and session identifier received from MN via DCRN_DISCOVERY message. A UCRN_DISCOVERY message also contains the information of IP addresses appended to DCRN_DISCOVERY message.

e. Each QNE belonging to the signaling path from CN to proxy intercepts UCRN_DISCOVERY, and checks if any interface has resource reservation for the pair of flow identifier and session identifier for downlink. If one of interface has the reservation, the QNE appends IP address of the interface to UCRN_DISCOVERY.

When UCRN_DISCOVERY message arrives to proxy, UCRN_DISCOVERY message contains the information of all overlapping interfaces belonging to current uplink QoS path (from MN to CN) and expected new downlink path (from proxy to CN) in order.

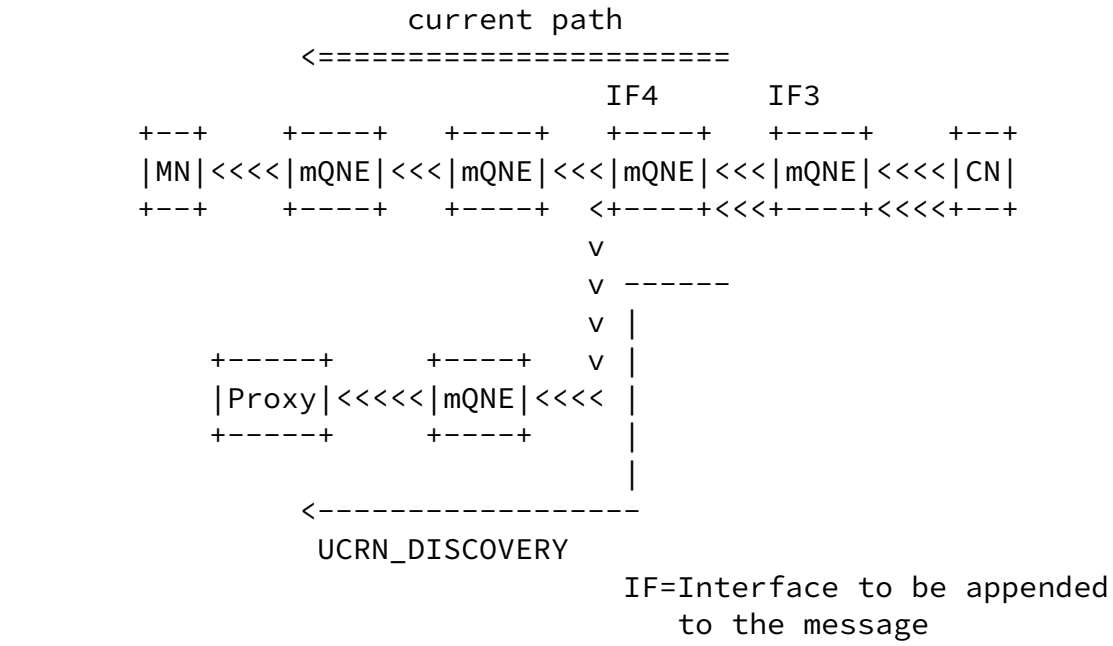


Figure3: Interfaces' information collected by UCRN_DISCOVERY

f. The proxy receiving UCRN_DISCOVERY from CN checks appended information in UCRN_DISCOVERY and decides CRN(s). The first interface IP address appended to DCRN_DISCOVERY (and set into UCRN_DISCOVERY) is DCRN, and the last interface IP address appended to UCRN_DISCOVERY is UCRN.

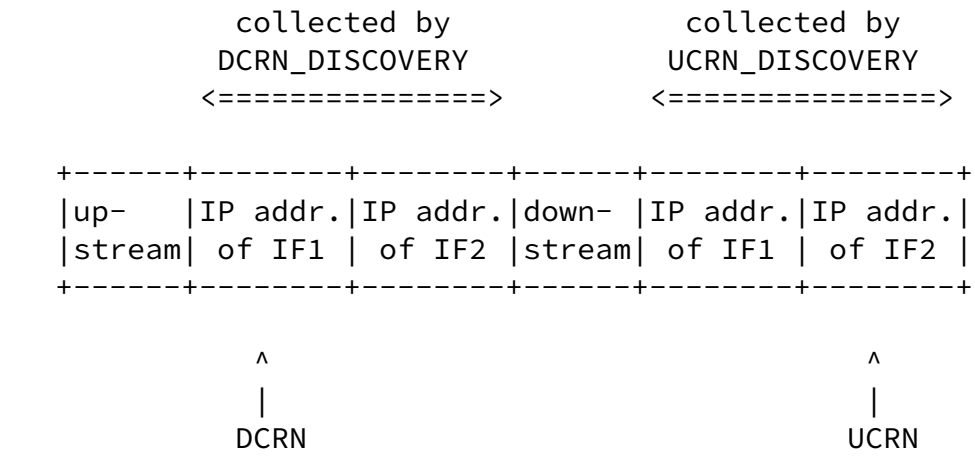


Figure4: collected information and DCRN/UCRN

The proxy sends PROXY_INIT_ACK message to the MN. PROXY_INIT_ACK message is NSLP message and used for informing whether pre CRN discovery is successfully done or failed.

5. New path installation

DCRN/UCRN discovered by proxy can be used for fast state installation. For this purpose, it is required that RESERVE message contains IP addresses of DCRN/UCRN. When the RESERVE message reaches the DCRN, it is also required for the DCRN to translate the RESERVE (create) message into RESERVE (update) message and vice versa for UCRN in order to avoid duplicate reservation of common QoS path (CN-UCRN/DCRN).

This section describes an example of fast state installation.

5.1 Fast state installation for downlink data flow

The following scenario assumes that the data flow is downlink only.

a. When the MN listens to neighboring AP's beacons, MN refers a proxy table (see Chapter 3). This table has mapping information between APs and their connecting ARs, and whether the ARs have mQNE functionalities. MN selects target subnetwork of which AR has mQNE (proxy) functionalities.

b. MN configures NCoA from the AR's information in the table, i.e. AR's IP address and prefix length.

c. MN sends PROXY_INIT message with NCoA to the new AR (NAR). This PROXY_INIT message may contain IP address of MN's old (current) mQNE as well.

d. The NAR executes DAD for NCoA.

e. Simultaneously with d., the NAR performs pre CRN discovery as described in Chapter 4 and discovers UCRN.

f. If the NCoA is valid, the NAR send RESERVE message with UCRN to CN. QSpec information may be obtained form mQNE in old (current) path such as MN or old adjacent mQNE of MN.

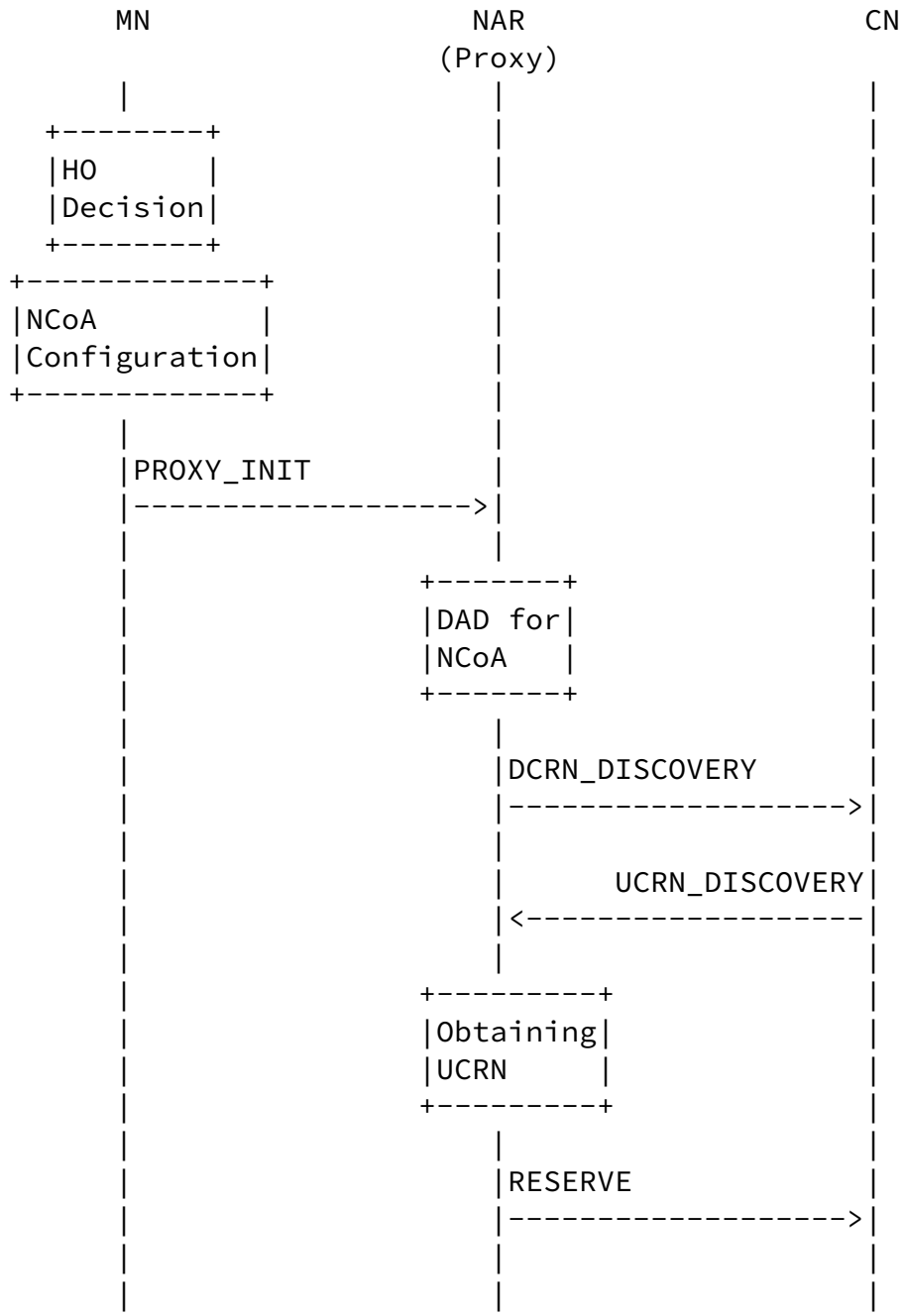
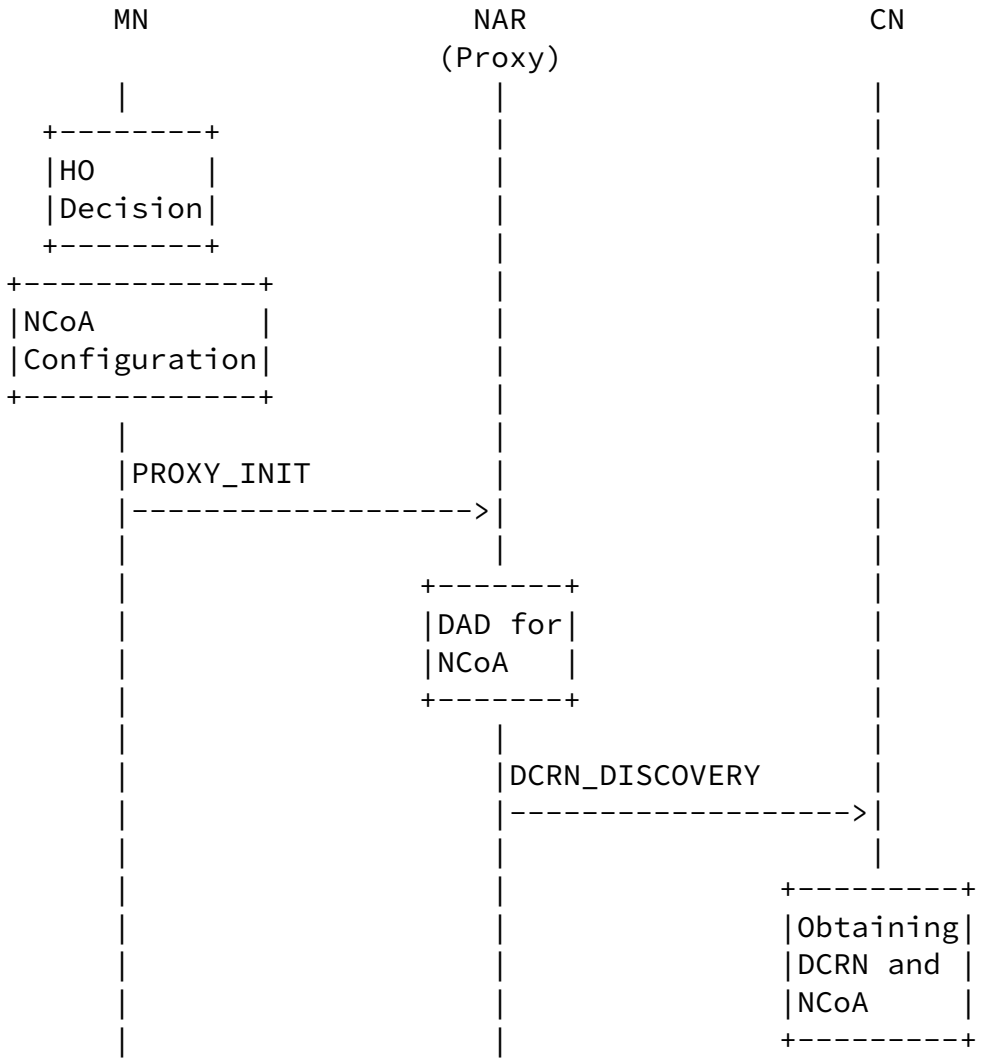


Figure5: An example of Fast state installation for downlink

5.2 Fast state installation for uplink data flow

If data flow is uplink only or duplicate, the following procedure can be used in addition to downlink case.

- o DCRN_DISCOVERY message contains NCoA (which is valid).
- o The CN receiving DCRN_DISCOVERY message performs RESERVE message to NAR (proxy) for uplink, as it can obtain DCRN and MN's NCoA.



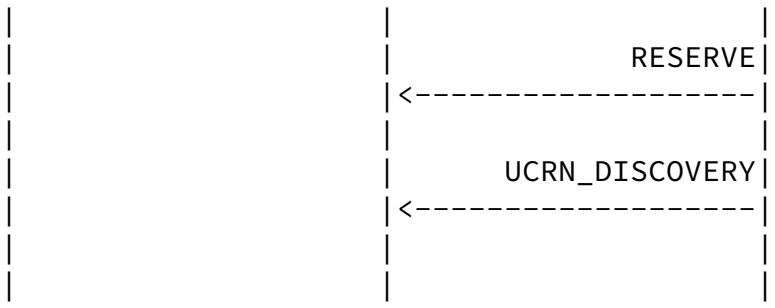


Figure6: An example of Fast state installation for uplink

6. Signaling messages for fast CRN discovery

PROXY_INIT, DCRN_DISCOVERY, UCRN_DISCOVERY and PROXY_INIT_ACK may be extended existing QoS NSLP message, such as QUERY, RESPONSE and NOTIFY [7]. If DCRN_DISCOVERY and UCRN_DISCOVERY are QUERY and RESPONSE respectively, proxy can obtain downlink path information simultaneously with UCRN discovery.

7. Security Considerations

Security issues are addressed in section 12 of [6] but they are not covering candidate proxies (mQNEs) which are described in this document. Proper security handling must be provided in candidate proxy discovery. It is also required to consider the issues caused by sending PROXY_INIT which includes session and flow identifiers from MN to candidate proxies, such as session/reservation ownership.

Future draft will include these issues.

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