

# Comparison of Mobile Number Portability Schemes

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**Abstract**— Mobile Number Portability is an important issue for a telephone user especially when there are a number of routing techniques with different advantages and disadvantages. Changing one’s telephone numbers can be a major inconvenience and a potential barrier preventing the general public from taking advantage of the options available in a developed competitive telecommunications market. While changing from one mobile network to another, users retain their mobile telephone numbers. This paper represents the various routing schemes and compares their pros and cons.

**Keywords**—MNP, NPDB, Query on Release

## I. Introduction

Number portability is the ability of end users to change service providers (SPs), locations, or service types without changing their telephone numbers.

Number portability is driven by local-loop competition. A recent survey indicated that 90 percent of business customers would not change their service providers if they had to change telephone numbers [1]. A similar survey determined that residential customers, for the most part, agreed. Thus, number portability for wire line was implemented.

## II. Routing Schemes

Number portability brought dynamic routing issue to our telecommunication networks, so four basic routing schemes for SPNP, the primary form of number portability, were deployed to ensure effectively delivering calls to ported number based on different cases.

As illustrated in the internet draft about NP overview [2], all intermediate or transit networks are not considered. Thus, only the five basic components are included: donor network, originating network, recipient network and two forms of NPDB. Let’s assume that User X makes a call to User Y, Y used to be with donor network, but currently moves to the recipient network.

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### A. Onward Routing (OR)

OR scheme, as shown in Fig. 1, uses internal NPDB instead of centralized NPDB [3]. When generating a call from X to Y, the originating network will firstly deliver the call to the Donor Network as if Y were not ported out. The Donor Network realizes that the Y has been ported out, so it sends a query request to its Internal NPDB. The Internal NPDB then returns a message containing the dialled ported number and its routing numbers to the Donor Network. After that, the Donor Network uses the routing information to forward that call to the Recipient Network and finally set up the call from X to Y.

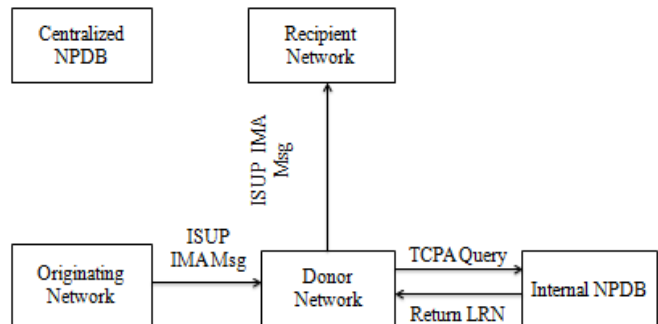


Figure 1: Onward Routing

### B. Call Dropback (CD)

The Call Dropback scheme is somewhat similar to OR as shown in Fig. 1. The only difference is the Donor Network won’t forward the call to Recipient Network after getting the routing information from Internal NPDB, but it will send an SS7 REL message back to the Originating Network to release the circuit, and inform it the routing information as well [4]. Then the Originating Network will route the call to the Recipient Network where Y resident.

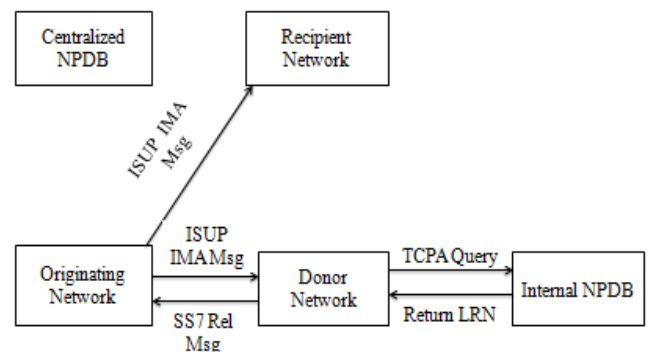


Figure 2: Call Dropback

### C. Query on Release (QoR)

Fig. 3 shows the delivering steps in QoR scheme. The Originating Network generates a call to Y, and routes it to the Donor Network by assuming it were not ported yet. After detecting that Y has been ported out, Donor Network informs Originating Network That Y is no longer subscribed, and sends SS7 REL messages back to release the circuit. Then the Originating Network sends TCAP Query messages to query Centralized NPDB, and the Centralized NPDB responses [4] [2] with the routing number of Y. By learning routing information from the NPDB, the Originating Network forwards the call to the Recipient Network where X stays.

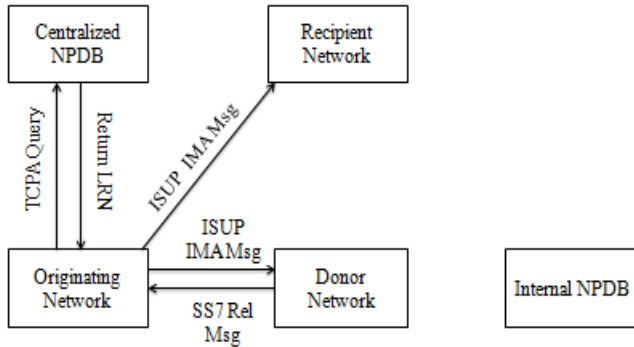


Figure 3: Query on Release

### D. All Call Query (ACQ)

Fig. 4 shows the fourth routing scheme. In ACQ scheme, both Donor Network and Internal NPDB are not involved, but Centralized NPDB is used instead [5]. Therefore, when the Originating Network generates a call to Y, it will send a TCAP message to the Centralized NPDB to retrieve the routing information associated with the dialled number Y, and then the Originating Network route the call to the Recipient Network directly. We can see that ACQ scheme doesn't check if Y is ported or not, but just send query to Centralized NPDB where contains the routing information for all numbers. This might cause a high traffic on the links between Originating Network and Centralized NPDB.

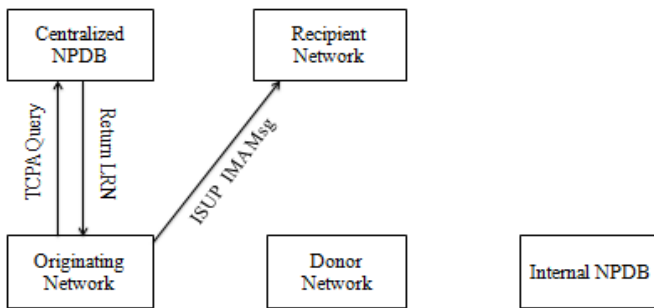


Figure 4: All Call Query

## III. Qualitative Comparison

Here we have introduced some comparisons in different routing schemes for number portability, that what are their benefits and drawbacks respectively?

### A. Facilities Cost

Initiating a call requires a series of facilities to be prepared simultaneity both in trunk network and SS7 network. For example, holding a call segment would reserve trunks and circuits as well as multiple switches resources. From the routing schemes we introduced above, except for the ACQ scheme, the other three schemes all have to set up two call segments, and for QoR and Dropback schemes, the call segment between Originating Network and Donor Network is temporary, while in OR scheme, the circuits have to be reserved all the time, until the call is routed to the Recipient Network [6]. However, ACQ scheme doesn't involve the Donor network, so it only initiates one call segment from Originating Network to Recipient Network directly after fetching routing information of ported number from Centralized NPDB. Therefore, ACQ is the most efficient scheme if we consider the expense of transmission facilities, and OR is the most expensive one.

### B. Sustainability

Number portability is a developing technology, we can expect more and more subscribers would like to choose this service in the coming future in countries all over the world, so which scheme will be a better long-term solution? We already know that OR and Dropback schemes both use Internal NPDB as the storage for routing information of numbers ported from Donor Network, so as more numbers are ported out from Donor Network, the traffic to the Internal NPDB would be significantly increased, which will cause much more delay in that scheme. Compared to the OR and Dropback schemes, QoR and ACQ schemes both use Centralized NPDB instead. As a third-party provided service, "Centralized NPDB contains the ported number information from multiple network" [2], so it would be keeping updated when a new number is ported. In this way, QoR and ACQ have better Sustainability than the other two schemes.

## IV. Qualitative Comparison

From the discussion above we can compare the benefits and drawbacks of each routing schemes. This is summarised in table 1. The main comment we would like to add is that the number portability comes at the price of the setup cost for the portability architecture and the database needed. This setup cost can vary depending upon scheme.

TABLE I.

Method	Benefits	Drawbacks
ONWARD ROUTING (OR)	<ol style="list-style-type: none"> <li>1. No centralized database needed</li> <li>2. Internal NPDB can be stand alone and contains only the ported number from the donor network</li> <li>3. Good solutions for short term or if a small percentage of subscribers chooses to do number portability.</li> </ol>	<ol style="list-style-type: none"> <li>1. Completely relies on donor network during call setup.</li> <li>2. Requires setting up two call segments</li> </ol>
QUERY on RELEASE (QoR)	<ol style="list-style-type: none"> <li>1. Centralised number portability database used for call routing decisions</li> </ol>	<ol style="list-style-type: none"> <li>1. Involves the donor network during call set</li> </ol>

Method	Benefits	Drawbacks
		up. 2. Circuits are reserved temporarily during call setup.
Call Dropback /Return To Pivot (Cd/Rtp)	1. Centralised number portability database not needed 2. Internal NPDB can be stand alone and contains only ported number from donor network	1. Involves the donor network during call set up. 2. Circuits are reserved temporarily during call setup.
All Call Query (ACQ)	1. Centralised number portability database used for call routing decisions. 2. Does not involve the donor network. 3. Efficient in usage of switch, port and circuits. 4. Good long term solution, especially when most subscribers choose number portability.	1. Relatively high portability set up cost. 2. High ISUP TCAP traffic to NPDB from originating switches.

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