Mobile Number Portability system in Korea

Young Sic Jeong*, Hyeong Ho Lee*, Whan Woo Kim**

ABSTRACT

Mobile number portability(MNP) means currently number portability among the 2G cellular phone in Korea and subscriber can change his mobile phone system operator without change his phone number. MNP system use QoR(Query on Release) method in call processing. We shows that the realization and performance of MNP system and the problems that is related with MNP system.

Key Words: MNP, NPDB, NPCDB

I. Introduction

Mobile number portability(MNP) means currently number portability among the 2G cellular phone in Korea and subscriber can change his mobile phone system operator without change his phone number. MNP system use QoR(Query on Release) method in call processing.

We shows that the realization and performance of MNP system and the problems that is related with MNP system.

II. Mobile Number Portability system

We can divide MNP system into two parts, one for call processing and the other for database system. The call processing system can connect NP calls to a recipient network. Database system can process various services such as NP certification, record, change, and delete of various data including routing number of Master NPDB and Local NPDB system.

1. Call processing system

1.1 Basic Call processing system

NP call processing system is for processing of calls which is originated at wireless network or

wired network and go to the number which is ported out.[1][2] It consist intelligent network exchanges, local NPDB systems and so on in hardware. MNP call processing by QoR method is a obligation of the telecommunication operators and forced by law. In figure 1, the donor network receives an incoming call. It then detects that the called number has been ported out to another network. It then transmit release message to originating network that means ported out. The originating network which is received release messagequery to their local NPDB and acquire routing number of recipient network. It then connects the call to the recipient network by using acquired routing number. The routing number which is used in MNP system was allotted to each telecommunication operator uniquely. Therefore, we can identify recipient network by seeing routing number.
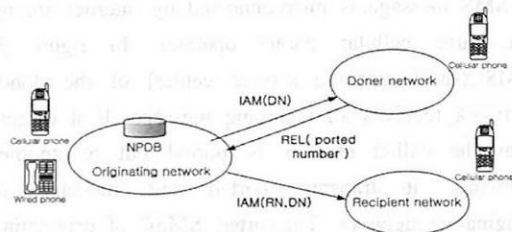

Figure 1. Basic call processing structure of QoR method

* Electronics and Telecommunications Research Institute
** Chungnam National University

47

1.2 Information flow of Call Processing of QoR

Information flow of the call processing system of QoR is as follows.

- If the user of originating network make a call, CCF(Call Control Function) of Originating network try to connect a call to doner network.
- CCF of the doner network make a query of its HLR to locate called user and if it finds the called user was ported out, then it send the result of query to CCF of originating network.
- CCF of originating network make a np-trigger and CCPF(call control portability function) and NPCF(Number Portability Control Function) search the routing number of final recipient network at NPDB.
- If CCF receives routing number from CCPF, it connect the call to the recipient network by using dialed number and routing number.
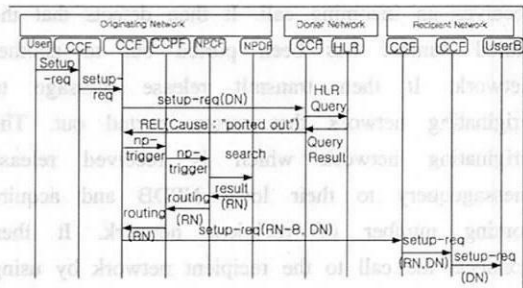

Figure 2. Call processing information flow by QoR

1.3 SMS processing structure

SMS message is interconnected by internet among the three cellular phone operator. In figure 3, SMSC(short message service center) of the donor network receives an incoming message. If it detects that the called number is ported out to another network, it transmit ported out message to originating network. Thereafter, SMSC of originating network query to their local NPDB and acquire routing number of recipient network. It then send SMS message to the SMSC of the recipient network through the internet by using acquired
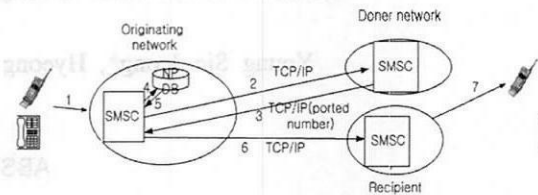
routing number.[3][4]

Figure 3. SMS call processing structure

1.4 Increasing of call set up time

The procedure to connect a call to the number which is ported out takes some more time than the case of a call connection to the number which is not ported out in QoR system. MNP system in Korea, the release delay which is a time interval between IAM(initial address message) message receive and transmit of release message of donor network is 0.5 second at the average and the maximum is less then 1.0 second. The time interval to acquire routing number from the local NPDB in originating network is less then 0.1 second. Therefore, a call setup time to number ported phone number may be longer one second at the maximum than not ported number but anyone cannot feel the delay by QoR, so has no inconvenience with MNP by QoR.

1.5 QoR method and increment of call processing capacity

The number of call setup request is increased unnecessary in call processing by QoR so that the telecommunication operator must increase the call processing capacity of their system. It takes money and time. We presume that the number of ported out subscriber is 30 percent of all subscriber and call setup request rate to this subscriber is equal with non ported subscriber, then the call processing capacity of MNP system by QoR must be 130 percent of the capacity of the non MNP system. Furthermore, in the case of wired line, if 30 percent of wired line network originating call is toward to the wireless network and 30 percent of this call go to the number ported subscriber, then

9% more call processing capacity is needed Most of the telecommunication operator has 20 percent more capacity than needed for most busy hour call traffic processing Therefore, wired line operator don't need to increase the capacity of call processing at the case of that the ported out number is about 30% of all subscriber but wireless operator must expend the call processing capacity of their system including exchanges at that case. At that situation, it is profitable that use ACQ(All Call Query)method to process MNP calls. In ACQ method, originating network query about all possible MNP calls and routing directly to the recipient network so that it doesn't exist unnecessary call setup request [5] Therefore, expend of the capacity of call processing is not needed but the capacity of local NPDB must be increased to process calls The expend of the processing capacity of local NPDB needs initial investment but it will be more economical method than QoR method when the number ported number is more than 30 percent of all cellular phone subscriber

2. Database system for Number Portability

2 1 Function of database system

Number portability database system can process such service as number portability certification, record, change and delete of the record which contains information such as routing number of MNP subscriber of local NPDB and master NPDB It also described as a system to reflect of data that contains various information needed to process MNP calls to master database and local database Master database system was duplicated for stable operation and firewall was adapted to protect itself from outside hacking.[6][7] Master database which is located at KTOA(Korea Telecommunications Operators Association) was divided into two parts, one is master NPDB and the other is master NPCDB(NP customer database) as figure 4
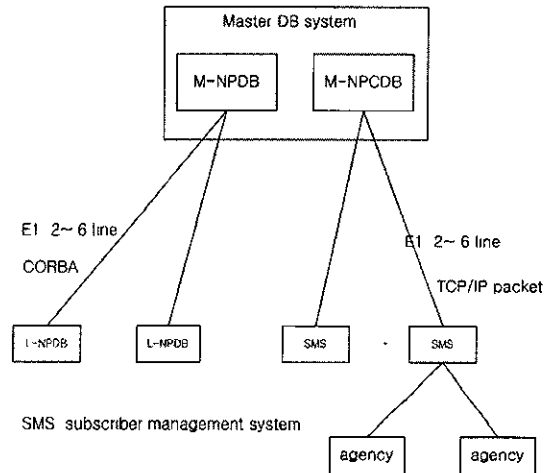

Figure 4 database system for number portability

2 2 Master NPCDB system

NPCDB(NP customer database) was connected with customer management systems of telecommunication operator by several E1 class line and it was directly connected their intranet Anyone who wants to use number portability service, he must go to agency of recipient network and fill up the apply form for MNP and most of the MNP procedure will be processed automatically. Therefore, all procedure for NP will be ended in 30 minute and it is highest speed in the world for MNP

NPCDB transmit and receive interface packet for MNP according to the interconnection standard with customer management systems which is interconnected with NPCDB by exclusive line of cellular operators. NPCDB processing capacity of the system installed in Korea is 30 TPS(transaction per second) and to process one NP, we need 10 transaction Therefore, 3 NP per second can be processed by this MNP system If we assume that we process of NP by 10 hours per day, we will be capable of processing 108000 NP per day Of course, if we consider transfer error, that figure will has some lower value. If NP request is concentrated in a special time band and over the capacity of MNP system, it will be accumulated in buffer and processed later Currently, approximately

49

30000 NP was processed in a day without congestion.

2 3 Master NPDB system and local NPDB system

The master NPDB is a part that is recorded data which must be transferred to Local NPDB of telecommunication operators among the NPCDB data It is connected with local NPDB by CORBA and its physical connecting line is E1.[8][9] Each telecommunication operator may have independent 10 local NPDB systems The master NPDB store only 4 fields such as telephone number, donor network's routing number, recipient network's routing number, changed day of NP. The master NPDB has auditing function so that it can force upload of all data to local NPDB and can compare it with master NPDB. The master NPDB inform the abnormal data to local NPDB as a result of comparing. The local NPDB system be able to request downloading to master NPDB of all or parts of data of Master NPDB whenever it find its own data is somewhat abnormal. Master NPDB has always same data with local NPDB by download data whenever completed of NP process To process a NP call of MNP system,it connects a call to donor network firstly and it received a ported out message Therefore, it makes a query to local NPDB and acquires recipient networks routing number then, connect a call to recipient network. Therefore, if the connection between Master NPDB and local NPDB was disabled, then database such as master NPDB and local NPDB update will be stopped but NP call processing will be continued

III. Conclusion

Mobile number portability system in Korea can be divided into two parts, one is call processing system and the other is database system QoR method is a standard and forced by law in Korea for MNP. ACQ is optional and any telecommunication operator can select it for call processing but QoR must be supported in that case also [10] QoR method processing of NP call

increase call setup time but that increment is less than 1 second so that anyone hardly perceives the delay All the systems which are related with MNP are duplicated but DR(disaster recovery) system is required for more stable operation of MNP

Number portability database system can be used without change although that the NP call processing method is changed into ACQ But, the change of the software of call processing system that consists of exchanges and local NPDB is needed to adapt ACQ NP completion (from NP applying of subscriber to port in to a recipient network) is possible in 30 minutes only in Korea Because the most of NP process was automated by software and neural network is a foundation for call processing in Korea, It is possible.

Reference.

[1] ITU-T Recommendations (Draft), Q 769 1, "SS7 ISUP Enhancements for the Support of Number Portability", COM11-R162, 1999 6.

[2] TIA/EIA, IS-41D, "Cellular Radio telecommunications Intersystem Operations", 1997 12.

[3] TIA/EIA, IS-95B, "Mobile Station-Base Station Compatibility Standard for Dual-Mode Spread Spectrum Systems", 1998, 12

[4] TIA/EIA, IS-771, "Wireless Intelligent Network", 1999 7

[5] ITU-T Recommendations, Q 701 ~ Q 708, "MTPSpecifications of SS7", 1993.

[6] ITU-T Recommendations, Q.711 ~ Q.716, "SCCPSpecifications of SS7", 1993.

[7] ITU-T Recommendations, Q.761 ~ Q.764, "ISUP Specifications of SS7", 1993.

[8] ITU-T Recommendations, Q 1200 series, "INAP Specifications of SS7", 1993

[9] ITU-T Recommendation, Q.699, "Interworking between ISDN Access and Non-ISDN Access over ISUP", 1997.

[10] TTAS KO-01 0030, "Network functional standard for Mobile number portability by QoR", 2002
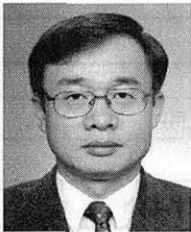
50

정 영 식(Young Sic Jeong)　　　　정회원

1991년 2월 : 영남대학교 전자공학과 졸업

1993년 2월 : 포항공과대학교 전자전기공학과 석사

2000년 3월~현재 : 한국전자통신연구원 선임연구원

<관심분야> 번호이동성, 통신공학, 신호처리

이 형 호(Hyeong Ho Lee)　　　　정회원

1979.2 한국과학기술원 전기 및 전자공학과 석사

1983.8 한국과학기술원 전기 및 전자공학과 박사

1983.9 ~ 현재 한국전자통신연구원 표준연구센터장

<관심분야> 정보통신표준화

김 환 우(Whan Woo Kim)　　　　정회원

1977년2월: 서울대학교 전자공학과 학사

1979년2월: 한국과학기술원 전기 및 전자공학과 석사

1988년6월: University of Utah 전자공학과 박사

1980년6월 ~현재 충남대학교 전기정보통신공학부 교수

<관심분야> 초고속 디지털 통신, 디지털 신호처리, binary CDMA