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Personal Number Service Development on the TDX-10 SSP

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Abstract

Personal Number(PN) service is the service which enables a subscriber to receive telephone calls with any telephone set, as he has a unique PTN(Personal Telecommunication Number). This service is categorized into two classes. One is the user call by which someone makes a phone call to the PN service subscriber, and the other is the subscriber call by which a subscriber changes his own service profile, for instance, the update of the destination location, the call screening activation or deactivation, and the change of the PIN(Personal Identification Number).

This paper presents the definition of PN service and the service features, and describes the TDX-10 SSP hardware and software architecture, the call flows of the service and the test environments for the PN service verification.

Keywords

IN, PN, PTN, Personal Number, personal, user call, subscriber call, SSP, TDX-10

1 INTRODUCTION

Personal Number service is the service that enables a person's telephone number not to be changed, even though the person moves into a new house or goes any other place on a business trip. A PN subscriber can receive his telephone calls with any telephone set connected with PSTN(Public Switched Telephone Network).

PN service is characterized by two key concepts: personal mobility and personalized service.

F. A. Aagesen et al. (eds.), *Information Network and Data Communication*

Personal Mobility

If a subscriber registers his location to any telephone set, he can always be through with one who calls him, for example, in the case of a business trip. In other words, PN service ensures the call connection to the subscriber wherever he goes.

Personalized Service

The service subscriber has a unique Personal Telecommunication Number which lasts life-long. And the subscriber only is able to access and update his own service profile.

In Korea, Korea Telecom(KT) began IN commercial services in March 1995 such as Free Phone(FP) service and Credit Calling(CC) service. The IN architecture using CCS No.7 has been introduced during this development of FP and CC service. Virtual Private Network(VPN) service has been already developed and we proved its functionality good through the development verification test. We are now preparing the VPN commercial service in the first half of 1996. Figure 1 shows the architecture of KT's intelligent network includeing FP, CC, VPN and PN services. We have started the development of the PN service from 1994 and finished the development verification self-test.

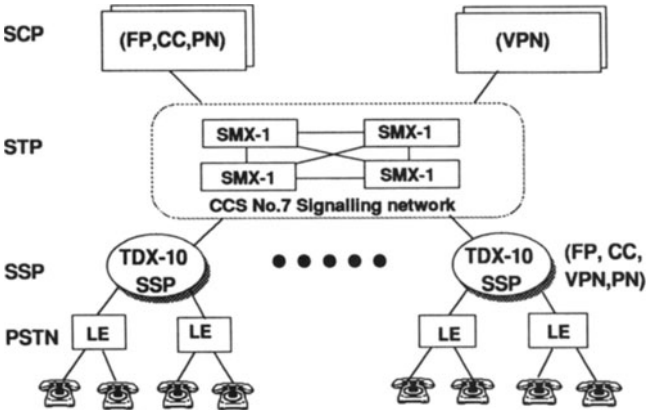

Figure 1 The Intelligent Network Architecture in Korea Telecom

2 CALL TYPES AND ITS FEATURES

PN service has two kinds of call, a user call and a subscriber call. The user call is the call to connect the PN service subscriber. And the subscriber call is the call to access and update his service profile such as the registered destination number, PIN, etc.

2.1 The User Call

The user call is the major call type of the service. A user can call a service subscriber by using the subscriber's PTN instead of the PSTN telephone number. If the subscriber activates the selective call screening function, the caller must input the AUTZ(Authorization code) according to the announcement of the AUTZ request.

2.2 The Subscriber Call

This is the call for the service subscriber to try to change or confirm his service profile. Different SAC(Service Access Code) is used to differentiate from the user call. PIN has to be entered to protect the access from other users. PTN is not changed even though the destination number is changed according to the location change of the subscriber. So the destination number has to be managed for each PTN. Whenever a PN call is requested, PTN is translated into the real destination number and then the call is established. The SCP takes charge of an information management such as the destination number management and translation, the management of PIN and AUTZ and a call screening feature. The SSP handles service recognition, proper announcement, inquiry to the SCP, call connecting and charging. The subscriber call has the following nine features, and provides with the proper announcement according to the call status.

Location Registration 1(current calling number to the destination number)
The location registration 1 is the easiest way by which a subscriber can register his location. He just needs to input the corresponding FAC(Feature Access Code) and then the system assigns the calling number to the destination number automatically .

Location Registration 2(any destination number)
The location registration 2 can be used when the system can not find the calling number such as in the PABX. This is also used when the subscriber wants to register the new location before the location change or when the subscriber hopes to register any destination number at any place. The subscriber must input the destination number, which is additional procedure comparing to that of the location registration 1.

Location Registration Cancellation
A PTN has a default destination number when a PTN has no location registration or a

subscriber cancels location registration. In most cases, a subscriber sets the main and frequently used destination number to the default destination number. When a subscriber wants to be called by the default destination number, he just selects the FAC of location registration cancellation.

Location Registration Confirmation

The location registration confirmation is used when the subscriber wants to confirm the registered location. The subscriber inputs the corresponding FAC and the destination number he wants to confirm.

Call Screening Activation

The call screening activation is for protection against malicious calls or harassing calls. When a subscriber activates this feature, the service user has to input an additional AUTZ to establish a call. If the AUTZ is not correct, the call will be failed. The PTN other than a PSTN number, has the everlasting feature during the whole life. If anyone is troubled by a harassing call, he can protect himself by using this call screening feature. If a subscriber lets some persons know his AUTZ, they only can call the subscriber. This feature can be also used as "do not disturb" feature when the subscriber does not want to answer the call.

Call Screening Deactivation

The call screening deactivation is to deactivate the call screening feature by choosing the corresponding FAC. After deactivation, there is no request of the authorization code for a PN user call.

Default Destination Number Change

A subscriber can change it directly via a telephone set without an operator's help, for example, in case that the main destination number is changed by the subscriber's move.

Personal Identification Number Change

The serious problem may be happened in case that PIN, which is essential to the subscriber call, is disclosed to someone. So the subscriber has to manage the PIN carefully. He can change it directly via a telephone set at any time. When a PIN is changed, a new PIN is asked to input two times to prevent from the user's mistake because of its importance. The PIN is changed only when the the two input numbers are identical.

Authorization Code Change

A subscriber can change it directly in order that the authorization code is not to be disclosed to someone.

3 DESIGN AND IMPLEMENTATION

3.1 Hardware Architecture

The TDX-10 SSP is a digital switching system which can be used for pure tandem and toll exchange. It is composed of the distributed modules as shown in figure 2: Access Switching Subsystems(ASS), Central Control Subsystem(CCS) and Interconnection Network Subsystem(INS).

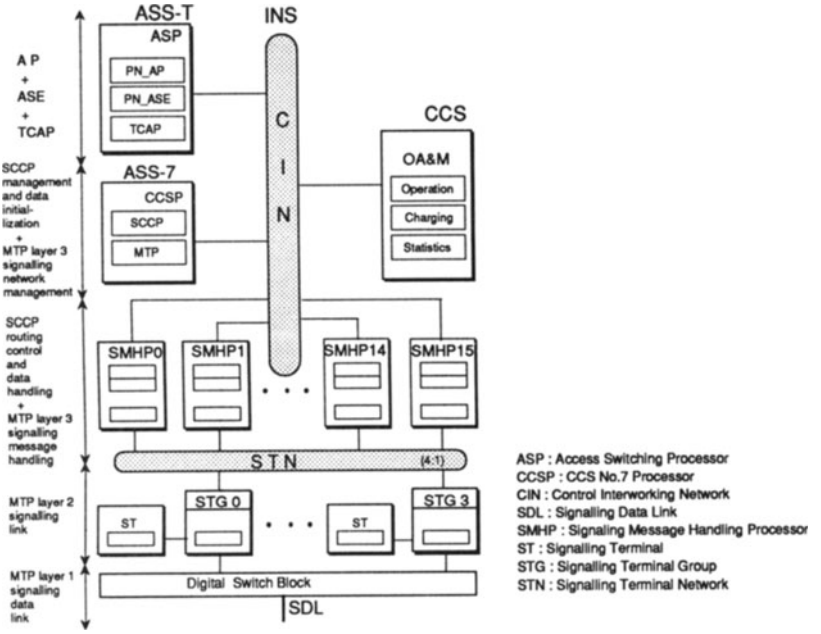

Figure 2 TDX-10 SSP Hardware Architecture

The CCS No.7 software of TDX-10 SSP which consists of two parts - MTP(Message Transfer Part) and SCCP(Signalling Connection Control Part) - has been implemented in ASS-7 rack. The signalling network management function of MTP, SCCP management function, and SCCP data administration function have been implemented in CCSP(Common

Channel Signalling Processor). The signalling message handling function of MTP, SCCP routing control function and SCCP data handling function are located in SMHP(Signalling Message Handling Processor). The Transaction Capabilities(TCAP) and Application Service Elements(ASE) function served by MTP and SCCP layers are performed in ASP(Access Switching Processor).

There is no hardware change in developing the PN service.

3.2 Software Architecture

For providing the PN service, the function of service control and ASE protocol was newly implemented. Also, the function of basic call processing, charging, measurement and statistics were modified from the existing TDX-10 SSP software. Figure 3 shows the software architecture of PN service. PN service software is mainly composed of three parts: Basic Call Processing Part(BCPP), Intelligent network Service Control Part(ISCP) and Operation, Administration and Maintenance part(OA&M). The BCPP handles digit collection, routing and call connection. The ISCP handles service control and No.7 protocol, and the OA&M handles charging, measurement, statistics, etc.

The detailed functions of each part are as follows:

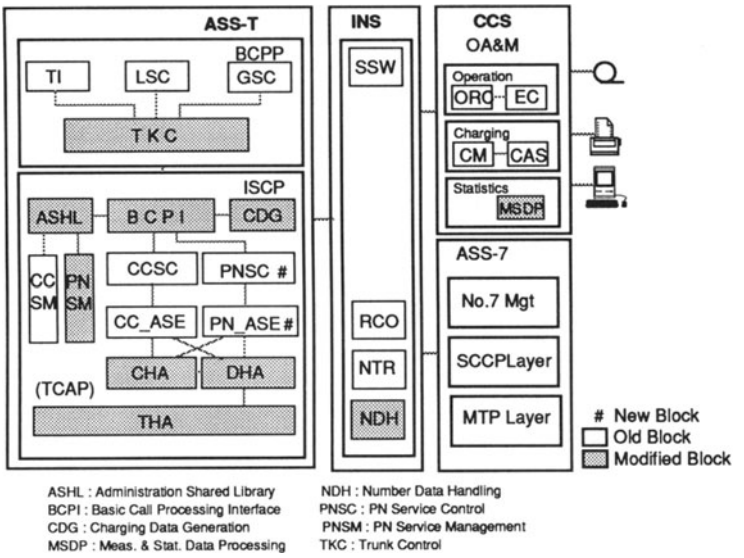

Figure 3 TDX-10 SSP Software Architecture for PN Service

3.2.1 Basic Call Processing Part(BCPP)

The BCPP is composed of a trunk control, a local service control, a global service control, and other blocks. The trunk control block controls and processes primarily a incoming or outgoing call by interacting with the other blocks of BCPP. It also supports operation and maintenance function of trunk by reporting the trunk status to the operation and maintenance blocks.

We modified the block to meet the need of PN service call processing. It recognizes the PN service from the incoming digits, analyzes the call type and requests the PN service control to the ISCP. It also gathers additional information from the user requested by the ISCP and reports it to the ISCP.

3.2.2 IN Service Control Part(ISCP)

The ISCP has two main functions: IN Service Control Function and No.7 Protocol Function.

1) IN Service Control Function

To implement the PN service, we modified and developed functions listed below on the application process of the ISCP.

The Service Logic Control Function

This is a main function of ISCP, which has a service logic and controls PN calls with the information from SCP. It sends query to SCP and receives the response from SCP, and processes the call according to the SCP message.

It manages the status of signaling point and subsystem and initializes the data between local No.7 protocol layers. It also gathers statistics data and supports operator commands.

The Interface Function with BCPP

The ISCP requests the digit collection, the announcement connection and various signal tone connections to BCPP for PN service call processing according to the call procedure. It completes the PN service call control when requesting the call connection or fail announcement according to the response from SCP.

The Automatic Call Gapping(ACG) Function

When a PN service call occurs, the ISCP sends a query message to the SCP and processes the call according to the response message from SCP. The SCP overload makes the ISCP to execute the call gapping according to the gapping call count, gapping time and gapping time interval decided by SCP overload class and other factors. The operator can delete the registered gapping information.

2) No.7 Protocol Function

For the PN service, PN ASE block was newly implemented, which receives a query message from the PN SC(Service Control) block. PN ASE block receives a query message by a service primitive. Then it initiates a dialogue between peer ASEs of SSP and SCP through

TCAP protocol by a dialogue primitive.

The key function of PN ASE block includes:

- interface with PN SC block;
- id(dialogue, invoke, local) management;
- encode/decode component parameter;
- definition of operation classes and timer values;
- dialogue handling with TCAP.

3.2.3 Operation, Administration and Maintenance(OA&M) Part

1) Charging Function

A charging record in PN service is generated by the ISCP and transmitted to the OA&M part after call completion. A charging record which has 52 bytes data per call is recorded with detailed charging format and stored temporarily at memory buffer. In normal case, these are backed up to disk and MT. If MT or disk is abnormal, the charging records not stored are transmitted to the operator terminal and printer.

2) Statistics and Measurements

We modified and newly implemented the statistics and measurements function for the PN service. The ISCP collects and accumulates the statistics data and transmits them to the OA&M part, which manipulates the data for statistics and operation.

The statistics items for the PN service are as follows.

PN service call statistics

- PN service call request/connection/completion count;
- PN service call gapping count;
- incomplete PN call count by system interior cause;
- incomplete PN call count by system exterior cause.

No.7 protocol statistics

- No.7 operation generation count

3.3 Call Control Flow

The PN service request is triggered from BCPP after SAC analysis at the digit reception state. After the calling information is collected, the first query message is sent to SCP through an ASE, TCAP and lower layer signaling control blocks for either qualification of the service and number translation. SCP requests additional information depending on a call type. If SSP receives the real destination number translated by SCP, it makes routing and call connection, which is the same procedure as non-IN calls.

The call control flows of the user call and the subscriber call are different. As an example in this paper, only the call control flow for the PN service user call is shown in Figure 4. In

this figure, a user originates a call to a PN service subscriber when the inter-exchange signal is R2-MFC in the PSTN.

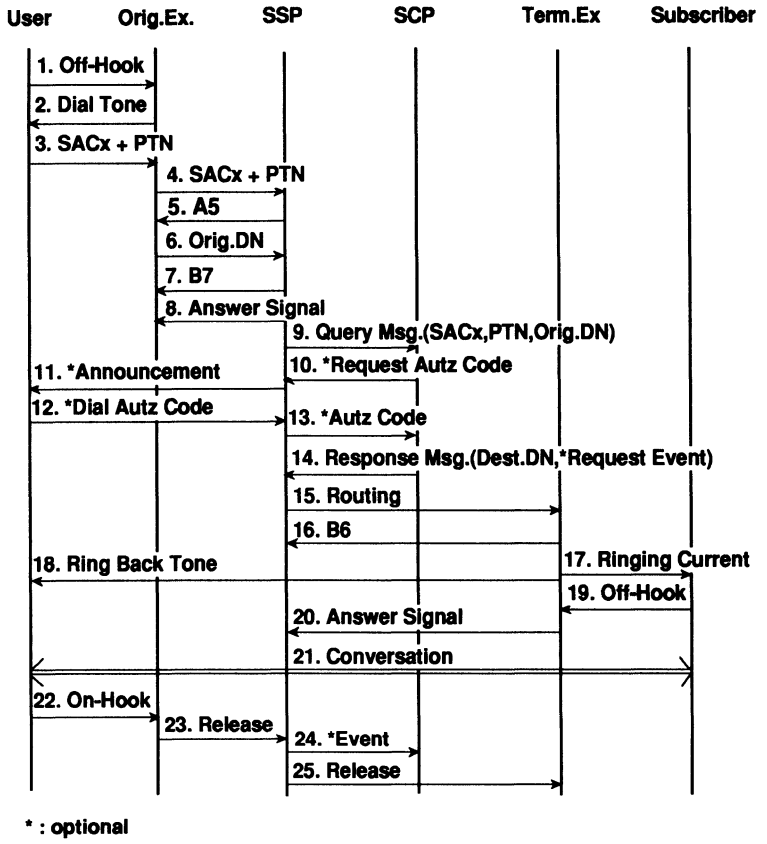

Figure 4 The PN User Call Control Flow

4 ESTABLISHMENT OF TEST ENVIRONMENTS

The test of PN SSP functions includes a protocol test, a functionality test, and an SSP-SCP interworking test. The protocol test checks PN ASE protocol behavior, the functionality test checks service functions, and the interworking test checks each function in the interworking environments. We defined test items and test sequences which describe the function criteria and interworking requirements.

We developed a AP/SCCP simulator in order to test PN ASE, and also a SCP simulator on the HP 9000/827 for the purpose of interworking test. This environment with a SCP simulator apart from SSP shown in Figure 5 is very similar as real operation environment.

4.1. The Development of AP/SCCP Simulator

TCAP, SCCP and MTP of No.7 protocol layers, which are commonly used in all IN services, have been already developed at the development stage of FP and CC service. Since ASE should be developed for each service, AP and SCCP simulator are necessary for developing and verifying PN ASE. Such an ASE verified by these simulators is considered as error-free and provides stability for a test of PN service function step by step. Both AP and SCCP simulator are developed to test PN ASE and emulate a higher layer AP and a lower layer SCCP. AP simulator provides a top down menu-driven interface for ASE test in the cases of normal and abnormal calls with all the expected test items.

When an item is chosen, the AP simulator encodes the test sequence of a selected item and writes it in the originating number field of PROVIDE or UPDATE operation. Then the operation is transferred to ASE to inform SCCP simulator of the test sequence.

After the SCCP simulator receives this message through ASE and TCAP and decodes the test sequence in the originating number field of the message, it proceeds a test according to the test sequence.

4.2. The Development of SCP Simulator

The SCP simulator consists of SS7 module of MTP, SCCP and TCAP function and PN ASE and application program developed on the upper layer of SS7 module which resides on the HP 9000/827 computer system. It is menu-driven and processes normal PN calls. It also performs abnormal calls for failure announcements, protocol error detection and statistics.

For normal call, we defined a subscriber database including subscriber and PTN information. In the case of abnormal call such as the inconsistency of PIN or AUTZ, the SCP simulator checks those numbers and performs abnormal call procedures. In addition it continues to monitor 10 types of call and locates the problem between SSP program and SCP simulator, which enables easy error correction.

The abnormal call function is performed in menu-driven method and so you can select the test item easily. It includes failure announcements, 6 items of ACG and NOTIFY operations and 10 items of the statistics test of protocol errors in interworking environments. It is possible to add test items as you need because it is designed flexible.

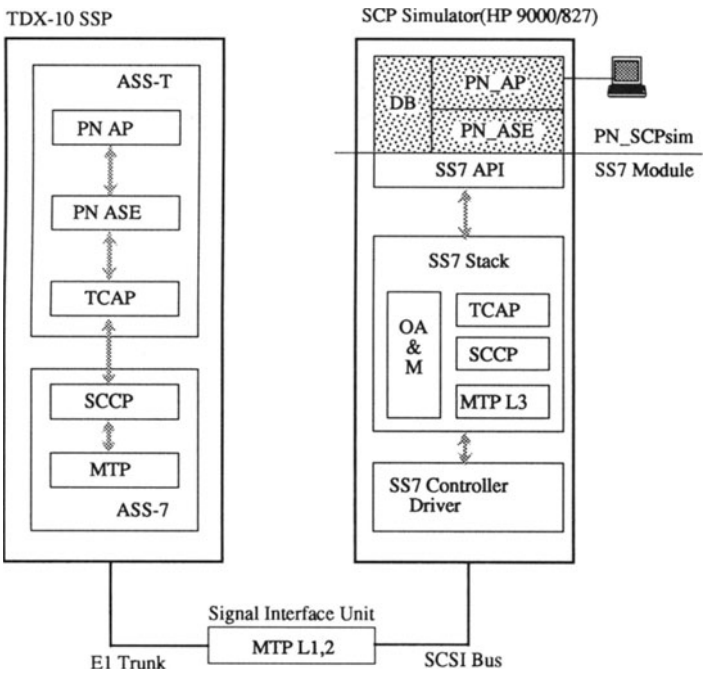

Figure 5 Interworking Test Environment with a SCP Simulator

5 CONCLUSION

This paper described the definition of PN service and the service features, and describes the TDX-10 SSP hardware and software architecture, the call flows of the service and the test environments for the PN service verification.

The PN service enables a subscriber to receive a call easily wherever he goes. It is also possible for the subscriber to manage his own service profile for himself.

Even though this service has been developed mainly for wire-line communication based on IN platform, it will make a baseline to the personality and mobility service in the future. In order to cover the wireless networks and progress eventually toward a UPT(Universal Personal Telecommunication) service, the AIN(Advanced Intelligent Network) platform is essential. Moreover we acknowledge the AIN platform gives flexibility and convenience for developing new IN services. So we are now studying on the evolution to the AIN platform.

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7 BIOGRAPHY

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