PSTN－PSDN連動裝置 서비스
(Service Integration via PSTN-PSDN Interworking System)

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〈Abstract〉

This paper describes on the interworking services, interworking issues and the design concepts in the Interworking System (IWS) between Public Switched Telephone Network (PSTN) and Packet Switched Data Network (PSDN), which has been developed at the Electronics and Telecommunications Research Institute (ETRI). As a gateway between PSTN and PSDN, IWS provides the interconnection services for the compatibility of communication between PSTN and PSDN. In addition to the provision of basic interconnection services (i.e. dial-in/dial-out services), IWS provides the Maintenance and Administration (M&A) services for system itself and the supplementary services such as the call barring, direct call and closed user group.

The architecture of IWS is based on the multiprocessor system with single system bus. And a multiprocessor real time kernel is used to support the inter-board communication as well as the inter-process communications. Especially, the operation and maintenance functions of IWS are treated in detail.

I . Introduction

In Korea, public telephone network is operated by the Korea Telecommunications Authority(KTA) and the capacity of PSTN has

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exceeded 10 million subscriber lines in 1987. Packet network is operated by the Data Communication Corp. of Korea (DACOM) since 1984 and the number of subscribers using this service reached a total of 2000. The network topology of PSDN consists of 6 packet switching nodes interconnected in a mesh structure using digital transmission facilities of 56Kbps.

As users of those networks increase and spread widely, PSTN-PSDN interconnection has been identified as the most important and urgent problem. In the interconnection of PSTN-PSDN, the following two approaches are suggested by CCITT: the interworking at the network layer and the interworking by the port access method. In the port access method, telephone network is regarded as the access network to packet, providing only a transparent path between telephone network subscriber and packet network access point. The interconnection at the network layer overcomes the disadvantage of the port access method by inserting the interworking system between telephone and packet network.

The improvement can be seen in many areas: short dialing procedure, symmetry between telephone and packet network users, supplementary services to telephone network subscriber, support of packet data users at telephone network, enhanced network operation etc. The interworking system adopted the subscriber level interworking method, a kind of the interconnection at the network layer, in order not to modify the telephone network and the packet network.

This paper describes PSTN—PSDN IWS under development at ETRI. The commercial service was announced by KTA for the near future. In this paper, section II describes the interworking services which are composed of the dial-in/dial-out service, supplementary services and user data management. Section III describes the interworking issues such as subscriber level interworking, interworking connection connection procedure, addressing & routing, charging and Data Terminating Equipment (DTE) speed and modes. Finally, section IV describes the design concepts of IWS; the architecture, capacity and the M &A functions.

II. Interworking Services

The Korean PSDN now is accessible by the use of X.25 for synchronous packet mode terminal and PAD (Packet Assembly and Disassembly) with switched or leased line for asynchronous start/stop mode terminals. However with IWS, not only the interconnection service between two networks with X.25 and PAD, but also the supplementary services for telephone network subscribers, and M&A function services will be available.

1. Dial-in/Dial-out Services

As a basic interconnection service, IWS will provide the dial-in and dial-out services. Dial-in service allows PSTN data users to access PSDN by means of the selection procedures for PSTN. As a gateway between two networks, interworking system will provide interconnection services to both network for the equivalence of communication services. Interworking system will support the start/stop terminal as well as packet mode terminal for telephone network subscribers.

2. Supplementary Services

In addition to the basic interworking service of dial-in and dial-out, IWS will provide
the telephone network users with the supplementary services such as the CUG (Closed User Group), direct call, call barring, secure dial-back service and abbreviated address call. In realizing these services, user profile management and charging method are examined.

3. User Data Management Services

IWS user data are managed by M&A services of IWS. Each of IWS users has user data profile which includes X.3 parameters, password, DTE type, speed, range of supplementary services and so on. User data profiles can be modified by operator at the request of IWS users.

III. Interworking Issues

This section presents interworking issues considered for the development of IWS.

1. Subscriber Level Interworking

There are two methods in the interworking between PSTN and PSDN. The first is trunk level interworking, and the other is subscriber level interworking. The trunk level interworking interconnects two networks at the trunk interface and uses the one stage selection method at the call connection stage. The subscriber level interworking interconnects two networks at the subscriber access interface and uses the two stage selection method; the IWS is selected at first and the called terminal after. Although the trunk level interworking method has an advantage at the call connection stage, it needs modifications of the existing networks. In addition, it is only suitable when the interworking demand is large.

In the interworking at the subscriber level interface, a subscriber should give all the information such as user identification and password from his terminal. In the PSTN-PSDN IWS, the subscriber level interworking is applied in order to provide interworking services without the modification of two networks.

2. Interworking Connection Procedures

CCITT Recommendation X.121 specifies the numbering plan for public data networks. For the X.25 PSTN access to and from PSDN, the addressing should be in accordance with the CCITT Recommendation X.122. In the dial-in/dial-out services, the addressing format and the call connection procedure from the packet mode terminal or start/stop terminal are identified as follows.

- Dial-in Procedure

Two stage Selection Method is adopted. At the first stage, the PSTN user dials the "015" or "016", a kind of abbreviated E.164 address to access the IWS. The address "015" is used when the terminal type of calling PSTN user is start/stop terminal, and the address "016" is used when the terminal type of calling PSTN user is packet mode terminal. After dialing the address "015" or "016", PSTN user inputs user identification and password. At the second stage, PSTN user forwards the called PSDN user address.

- Dial-out Procedure

Single stage selection method is adopted. PSDN user sends all the information in Call Request (CR) packet. In this case, the called address field of the CR packet contains the escape code "9" and the PSTN subscriber address. Fig. 1 shows the connection proce-
3. User Identification

IWS users in PSTN are divided into 2 groups: the first one is the registered user group in IWS and the other is the non-registered user group. The IWS should register the profiles of the registered user group such as user identification, user DTE type, transmission speed, supplementary services and so on. The supplementary services can be supplied only to the registered user group. For the registered user group, the processing for the identification is carried out by IWS directly. For the non-registered user group, the processing for the user identification is as follows. When IWS receives a call request from a user, IWS requests the user to hook on. After the user hooks on, IWS dials back to the non-registered user, thus accomplishing user identification.

4. DTE Mode and Speed

Various kinds of data terminals can be supported by IWS. The characteristics of data terminal at the PSTN side are as follows.

- The operating modes of terminal are start/stop mode and packet type mode.
- Data transmission rates are 300, 600, 1200 and 2400 bps for start/stop terminal plus 1200 and 2400bps for packet mode terminals.
- Modems follow CCITT Recommendations V.21, V.22, V.22 bis and V.23.

5. Charging Issues

Generally, PSTN and PSDN have different charging policies. Charging elements for the interworking call consist of the telephone network charges based on call connection time and frequency, and the packet network charges based on transferred information volume.
IWS stores billing tickets which carry information on call start time, call release time, packet volumes and use of supplementary services per call basis. The charging policy for the interworking call will be made by the bilateral agreement between KTA and DACOM in Korea.

IV. Design Concepts of IWS

IWS is composed of the packet network interface module, telephone network interface module and M&A module. In this section, architecture, capacity and M&A functions of IWS are described.

1. Architecture of IWS

Interworking system can be considered as a communication processor with heavy input/output (I/O) loads from the network interfaces. For the processing of heavy I/O loads, IWS uses multiprocessor architecture with shared memory system and adopts a real time multiprocessor kernel, which supports the buffer management, real timer, event driven task scheduling, interprocess communication, I/O drivers and so on. Multiple processor boards, one for each function, share the common system bus, and the global memory is used in passing data between boards. Also IWS executes the system-level fault recovery function by employing the stand-by system which takes over the full interworking function when an error occurs at the active system. The X.25 link connecting the PSDN with IWS and the PSDN interface module were also duplicated. For the system level recovery, the messages between active system and stand-by system are transferred periodically through serial ports. Fig. 2 shows the functional architecture of IWS.

2. Capacity

The interworking system handles the 64 simultaneous calls from PSTN; 48 ports for start/stop and 16 ports for packet mode
terminal. IWS is interfaced to PSDN with 56 Kbps X.25 links. The performance of IWS will not exceed 150 data packets per second (DPPS).

3. M&A Functions

M&A functions of IWS ensure the stable operation of IWS. They accept and process the operator requests and network related information. M&A functions of IWS are divided into maintenance and administration functions. Maintenance function detects and reports the major fault in IWS, and processes faults for the proper operation of IWS itself. It also prevents faults by periodic or Man-Machine Communication (MMC) requested tests. Administration function of IWS manages the billing data and the MMC between IWS and operator. The major functions of MMC are summarized as follows:

- System cold start and restart
- Fault detection and recovery
- Statistics and recovery
- Report of IWS status via message and speaker
- Management of user data profile which includes X.3 parameters, password
- DTE type, speed, range of supplementary services and system parameters
- Self-testing and self-checking
- Gathering of charging informations
- Operator interfaces with MMC command

V. Conclusion

PSTN-PSDN Interworking system will provide improved interconnection services between PSTN data users and PSDN users. Interworking system may be considered as the gateway between PSTN and PSDN through which the service provision and the network operation for each network can be harmonized.

PSTN-PSDN IWS is planned to be used in the transition period toward ISDN in Korea. IWS will ultimately satisfy the demands for the sophisticated use of networks and correspond to the growth of data communications. However if the user demands for interworking grow faster than predicted, it may be necessary to expand the IWS capacity and to move to the trunk level interworking. The remaining issues in the development of PSTN-PSDN IWS are:

1) IWS to IWS communications and capacity expansion.
2) Enhanced signalling at IWS-PSTN and IWS-PSDN interfaces.
3) Diversification of the supplementary IWS services.

In Korea, the commercialized interworking service between PSTN and PSDN will be provided through this PSTN-PSDN interworking system in the near future.

REFERENCES


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