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TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

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Interworking between networks – IP-based networks

SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE AND INTERNET PROTOCOL ASPECTS

Internet protocol aspects – Interworking

General arrangements for interworking between Public Data Networks and the Internet

ITU-T Recommendation X.371/Y.1402

(Formerly CCITT Recommendation)

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ITU-T Recommendation X.371/Y.1402

General arrangements for interworking between Public Data Networks and the Internet

Summary

This Recommendation defines general arrangements for interworking between Public Data Networks and the Internet. It includes reference configurations, general packet handling and other general arrangements required for various interworking cases where PSPDNs and networks providing FRDTS are involved.

Source

ITU-T Recommendation X.371/Y.1402 was prepared by ITU-T Study Group 7 (2001-2004) and approved under the WTSA Resolution 1 procedure on 2 February 2001.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

ITU-T Recommendation X.371/Y.1402

General arrangements for interworking between Public Data Networks and the Internet

1 Scope

This Recommendation specifies general arrangements for interworking between the Internet and Public Data Networks (PDNs) among which PSPDN and FRPDN are considered. Three possible cases are defined:

– the case where the IP-TE connected to the PDN accesses the Internet via the PDN (access case);

– the case where two Internet subnetworks are concatenated via the PDN (Concatenation case 1);

– the case where two PDNs are concatenated via the Internet (Concatenation case 2).

The following arrangements are specified in this Recommendation:

1) reference configuration;

2) interface characteristics for UNI and NNI;

3) addressing mechanism;

4) functionality of the Access Unit (AU), InterWorking Function (IWF) and the Adapter.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

[1] ITU-T E.164 (1997), *The international public telecommunication numbering plan.*

[2] ITU-T E.166/X.122 (1998), *Numbering plan interworking for E.164 and X.121 numbering plans*.

[3] ITU-T I.112 (1993), *Vocabulary of terms for ISDNs*.

[4] ITU-T I.113 (1997), *Vocabulary of terms for broadband aspects of ISDNs*.

[5] ITU-T X.1 (2000), *International user classes of service in, and categories of access to, public data networks and integrated services digital networks (ISDNs)*.

[6] ITU-T X.25 (1996), *Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit*.

[7] ITU-T X.36 (2000), *Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) public data networks providing frame relay data transmission service by dedicated circuit*.

[8] ITU-T X.75 (1996), *Packet-switched signalling system between public networks providing data transmission services*.

[9] ITU-T X.76 (2000), *Network-to-network interface between public networks providing PVC and/or SVC frame relay data transmission service*.

[10] ITU-T X.115 (1995), *Definition of address translation capability in public data networks*.

[11] ITU-T X.115 (1995)/Amd.1 (1996), *Definition of address translation capability in public data networks – Refinements*.

[12] ITU-T X.116 (1996), *Address translation registration and resolution protocol*.

[13] ITU-T X.121 (2000), *International numbering plan for public data networks*.

[14] ITU-T X.200 (1994), *Information technology – Open Systems Interconnection – Basic reference model: The basic model.*

[15] ITU-T X.213 (1995), *Information technology – Open Systems Interconnection – Network service definition*.

[16] ITU-T X.300 (1996), *General principles for interworking between public networks and between public networks and other networks for the provision of data transmission services*.

[17] ITU-T RFC IETF 793 (1981), *Transmission Control Protocol*.

[18] ITU-T RFC IETF 2865 (2000), *Remote Authentication Dial In User Service (RADIUS)*.

[19] ITU-T RFC IETF 2866 (2000), *RADIUS Accounting*.

3 Terms and definitions

In addition to the terms and definitions contained in ITU-T I.112, ITU-T I.113, ITU-T X.200 and ITU-T X.300, the following term is defined:

3.1 Encapsulation: Occurs when the conversions in the network or in the terminals are such that the protocols used to provide one service make use of the layer service provided by another protocol. This means that at the interworking point, the two protocols are stacked. When encapsulation is performed by the terminal, this scenario is also called interworking by port access (see 3.2.11/X.300).

4 Abbreviations

This Recommendation uses the following abbreviations:

ARE Address Resolution Entity

AU Access Unit

DTE Data Terminal Equipment

ET Exchange Termination

FRPDN Frame Relay Public Data Networks

IP-TE Internet Terminal Equipment

IWF InterWorking Function

PSPDN Packet Switched Public Data Networks

PVC Permanent Virtual Circuit

QOS Quality Of Service

SVC Switched Virtual Circuit

TCP Transmission Control Protocol

VC Virtual Call

5 Conventions

No particular conventions are included.

6 Interworking between the Internet and PSPDNs

6.1 General arrangements for the access cases

6.1.1 Reference configuration

Reference configuration for the access cases is shown in Figure 6-1. In this case, Adapter and AU provide encapsulation function specified in ITU-T X.37. Encapsulation of IP packets is only provided to convey IP packets through the PSPDN. PSPDN may provide PVCs or VCs. In addition, Address Resolution Entity as specified in ITU-T X.115 and ITU-T X.116 may be equipped within the PSPDN to provide the Adapter and the AU with routing information. In this configuration, IP packets are transparently exchanged between the IP-TE and the Internet. Use of PVCs or VCs are not visible to the IP-TE and the Internet. The Adapter and the ARE may reside within the PSPDN, or may be outside the PSPDN.

NOTE – ITU-T X.115 and/or ITU-T X.116 may need enhancement for the purpose of this Recommendation.

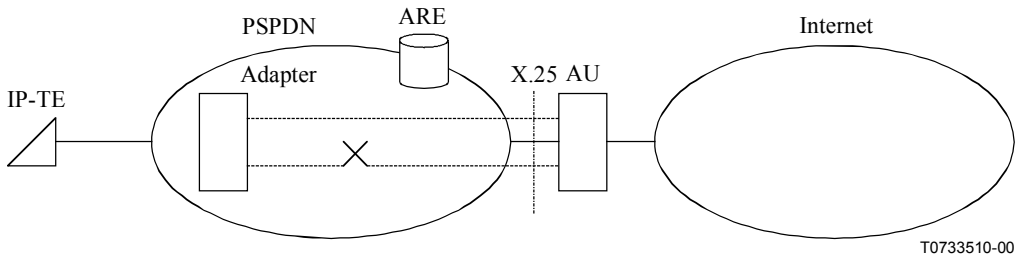

Figure 6-1/X.371/Y.1402 – Reference configuration for interworking between the Internet and PSPDN (access case)

6.1.2 IP packet handling

In case PVCs are provided through the PSPDN, the Adapter and the AU perform the following functions:

i) When the Adapter receives IP packets from the IP-TE, it shall transmit them onto the pre-established PVCs, and vice versa.

ii) When the AU receives IP packets from the PVC(s), it shall transmit them to a pre-assigned Internet port, and vice versa.

In case VCs are provided through the PSPDN, the Adapter and the AU perform the following functions:

i) When the Adapter receives IP packets from the IP-TE, it shall check if a VC has been already established toward the AU. If a VC has been established, the Adapter sends the received IP packets onto the VC. If no VC has been established, the Adapter shall set up a VC using the procedures as specified in ITU-T X.25. And then, the Adapter sends the received IP packets onto the established VC. The Adapter may clear the VC if it receives no IP packets from the IP-TE or from the AU during a certain amount of time.

ii) When the AU receives IP packets from the Internet, it shall perform similar functions as stated in the previous paragraph.

In the above cases, the IP-TE subscribes to the PSPDN, and an AU is assigned for the IP-TE on subscription.

There are also another case where different AUs or the IP-TEs are dynamically selected depending on the destination IP addresses. In this case, the Adapter and the AU perform the following functions:

i) The Adapter acquires a mapping relationship between the destination IP addresses received from the IP-TE and X.121 numbers allocated to the AUs using the procedures defined in 6.1.3. When the Adapter receives IP packets from the IP-TE, it shall check the destination address of the IP and derived X.121 addresses of the corresponding AUs from the destination IP address, and then transmit them towards the AUs according to the procedures for the PVC and VC cases described above.

ii) The AU acquires a mapping relationship between the destination IP addresses received from the Internet and X.121 numbers allocated to the ports of the IP-TEs using the procedures defined in 6.1.3.

In this case, the IP-TE may or may not subscribe to the PSPDN. In case the IP-TE subscribes to the PSPDN, authentication, authorization and accounting functions (as specified in IETF RFC 2865 and RFC 2866) shall be performed by the ARE. In case the IP-TE does not subscribe to the PSPDN, there shall be a contract between service providers of the PSPDN and that of the Internet.

6.1.3 ARE procedures

There are two kinds of procedures related to the ARE functions:

a) registration procedures;

b) inquiry and response procedures.

Registration procedures enable the ARE to get information about mapping between IP addresses and X.121 addresses from the Adapter or the AU according to the following mechanisms:

i) The Adapter and the AU have normal router functions of the Internet and perform as routers outside the PSPDN. Therefore, the Adapter and the AU can route IP packets towards the IP-TE and the Internet, respectively. In addition, the Adapter and the AU have information related to X.121 numbers allocated to the IP-TEs and the AUs.

ii) The Adapter and the AU periodically communicate with the ARE to inform it of updated information about mapping between X.121 numbers and IP addresses on which the Adapter and the AU have knowledge.

NOTE 1 – Communication procedures between the Adapter/AU and the ARE are for further study.

iii) The ARE collects the mapping information from all the Adapters and the AUs to form a centralized database. Depending on the amount of information that the ARE collects, distributed ARE architecture may be necessary.

NOTE 2 – Mechanisms for distributing the ARE functions are for further study.

Inquiry and response procedures enable the Adapter or the AU to get X.121 addresses corresponding to the destination IP addresses according to the following mechanisms:

i) When the Adapter or the AU receives IP packet with a destination address that is not relevant with the established VCs, it sets up a new VC according to the procedures defined in ITU-T X.116.

ii) Upon setting up a new VC, the Adapter or the AU will get new information relevant with mapping between the destination IP address and the VC. This new information may be kept by the Adapter or the AU for later processing of the IP packets. It is an implementation matter what amount of information may be cached at the Adapter or the AU.

6.2 General arrangements for the concatenation case 1 (Concatenation of two Internet subnetworks via a PSPDN)

6.2.1 Reference configuration

Reference configuration for the concatenation case 1 is shown in Figure 6-2. In this case, the IWF provides an encapsulation function specified in ITU-T X.37. Encapsulation of IP packets is only provided to convey IP packets through the PSPDN. The PSPDN may provide PVCs or VCs. In addition, Address Resolution Entity as specified in ITU-T X.115 and ITU-T X.116 may be equipped within the PSPDN to provide the IWF with routing information. In this configuration, IP packets are transparently exchanged between the IWFs. Use of PVCs or VCs are not visible to the Internet. The IWF may reside within the PSPDN, or may be outside the PSPDN.

NOTE – ITU-T X.115 and/or X.116 may need enhancement for the purpose of this Recommendation.

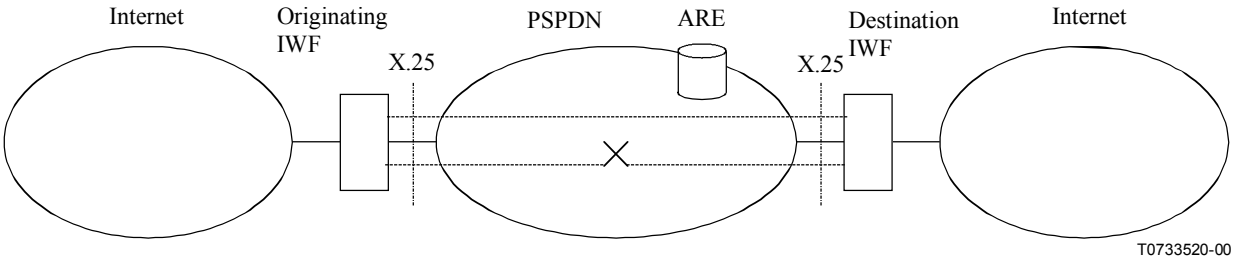

Figure 6-2/X.371/Y.1402 – Reference configuration for interworking between the Internet and PSPDN (Concatenation case 1)

6.2.2 IP packet handling

In case PVCs are provided through the PSPDN, the IWF performs the following functions:

i) When the IWF receives IP packets from the Internet, it shall transmit them onto the pre-established PVCs.

ii) When the IWF receives IP packets from the PVC(s), it shall transmit them to a pre-assigned Internet port.

In case SVCs are provided through the PSPDN, the IWF performs the following functions:

i) When the IWF receives IP packets from the Internet, it shall check if a VC has been already established toward the destination IWF. If a VC has been established, the IWF sends the received IP packets onto the VC. If no VC has been established, the IWF shall set up a VC using the procedures as specified in ITU-T X.25. And then, the IWF sends the received IP packets onto the established VC.

ii) The IWF may clear the VC if it receives no IP packets from the Internet during a certain amount of time.

In the above cases, the Internet port of the IWF subscribes to the PSPDN, and a destination IWF is assigned for the Internet port on subscription.

There is also another case where different destination IWFs are dynamically selected depending on the destination IP addresses received by the originating IWF. In this case, the originating IWF performs the following functions:

i) The originating IWF acquires a mapping relationship between the destination IP addresses received from the Internet and X.121 numbers allocated to the destination IWF using the procedures defined in 6.2.3.

ii) When the originating IWF receives IP packets from the Internet, it shall check the destination address of the IP and derived X.121 addresses of the corresponding destination IWFs from the destination IP address, and then transmit them towards the destination IWFs according to the procedures for the PVC and VC cases described above.

In this case, the IWF may or may not subscribe to the PSPDN. In case the IWF subscribes to the PSPDN, authentication, authorization and accounting functions (as specified in IETF RFC 2865 and RFC 2866) shall be performed by the ARE. In case the IWF does not subscribe to the PSPDN, there shall be a contract between service providers of the PSPDN and that of the Internet.

6.2.3 ARE procedures

Clause 6.1.3 applies with replacement of the Adapter and the AU with the IWF.

6.3 General arrangements for the concatenation case 2 (Concatenation of two PSPDNs via the Internet)

6.3.1 Reference configuration

Reference configuration for the concatenation case 2 is shown in Figure 6-3. In this case, the IWF converts X.75 interface to the Internet protocols and vice versa. X.75 packets are encapsulated in a TCP connection established between IWFs. In addition, Address Resolution Entity as specified in ITU-T X.115 and ITU-T X.116 may be equipped within the PSPDNs to provide the IWF with routing information. In this configuration, the Internet is used as a datalink on which X.75 layer 3 procedures are running and is not visible to the DTE that communicates with the PSPDN conforming to ITU-T X.25. X.75 packets are transparently exchanged between the IWFs. Use of X.75 PVCs or VCs are not visible to the Internet. The IWF may reside within the PSPDN, or may be outside the PSPDN.

In this case, end-to-end QOS characteristics may be limited by that of the Internet. Further study is needed for the definition of end-to-end QOS characteristics for this case.

NOTE – ITU-T X.115 and/or ITU-T X.116 may need enhancement for the purpose of this Recommendation.

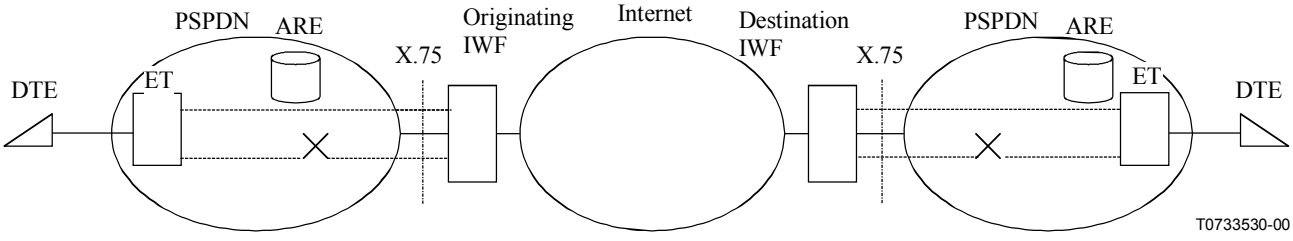

Figure 6-3/X.371/Y.1402 – Reference configuration for interworking between the Internet and PSPDN (Concatenation case 2)

6.3.2 IP packet handling

In case PVCs are provided through the PSPDN, there shall be a pre-established TCP connection between the originating and destination IWFs. In this case the IWF performs the following functions:

i) When the IWF receives X.75 packets from the PSPDN, it shall transmit them onto the pre-established TCP connection.

ii) When the IWF receives TCP packets containing X.75 packets from the Internet, it shall decapsulate the TCP packets and transmit X.75 packets onto the PVC.

In case VCs are provided through the PSPDN, the IWF performs the following functions:

i) When the IWF receives X.75 call request packet from the PSPDN, it shall check if a TCP connection has been already established toward the destination IWF. If a TCP has been established, the IWF sends the X.75 call request packet onto the TCP connection and the rest of X.75 procedures shall continue over the established TCP connection. If no TCP connection has been established, the IWF shall set up a TCP connection using the procedures as specified in RFC 793. After the TCP connection has been established, X.75 procedures shall operate between two IWFs over the established TCP connection.

ii) The IWF may clear the TCP connection if no X.75 VCs towards the destination IWF exist during a certain amount of time.

iii) When the IWF receives IP packets containing X.75 call request packet from the Internet, it shall establish an X.25 VC towards the called DTE. Then, normal X.75 and X.25 procedures shall follow using the established VC.

In the above cases, the DTE subscribes to the PSPDN, and an IWF is assigned for the DTE on subscription.

There is also another case where the DTE subscribes to the PSPDN, but different IWFs are dynamically selected depending on the destination X.121 addresses. In this case, the IWF performs the following functions:

i) The originating IWF acquire mapping relationship between the destination X.121 numbers received from the PSPDN and IP addresses allocated to the destination IWF using the procedures defined in 6.3.3.

ii) When the originating IWF receives X.75 call request packets from the PSPDN, it shall check the destination numbers of the X.75 packets and derive IP addresses of the corresponding destination IWFs, and then transmit them towards the destination IWFs according to the procedures described above in this clause.

6.3.3 ARE procedures

Clause 6.1.3 applies with replacement of the Adapter and the AU with the ET and the IWF, respectively. In addition, AREs of the originating and destination PSPDN shall communicate each other to exchange routing information.

NOTE – Procedures for communication between AREs are for further study.

7 Interworking between the Internet and FRPDNs

7.1 General arrangements for the access cases

7.1.1 Reference configuration

Reference configuration for the access cases is shown in Figure 7-1. In this case, Adapter and AU provide an encapsulation function specified in ITU-T X.36. Encapsulation of IP packets is only provided to convey IP packets through the FRPDN. FRPDN may provide PVCs or SVCs. In

addition, Address Resolution Entity as specified in ITU-T X.115 and ITU-T X.116 may be equipped within the FRPDN to provide the Adapter and the AU with routing information. In this configuration, IP packets are transparently exchanged between the IP-TE and the Internet. Use of PVCs or SVCs are not visible to the IP-TE and the Internet. The Adapter and the ARE may reside within the FRPDN, or may be outside the FRPDN.

NOTE – ITU-T X.115 and/or ITU-T X.116 may need enhancement for the purpose of this Recommendation.

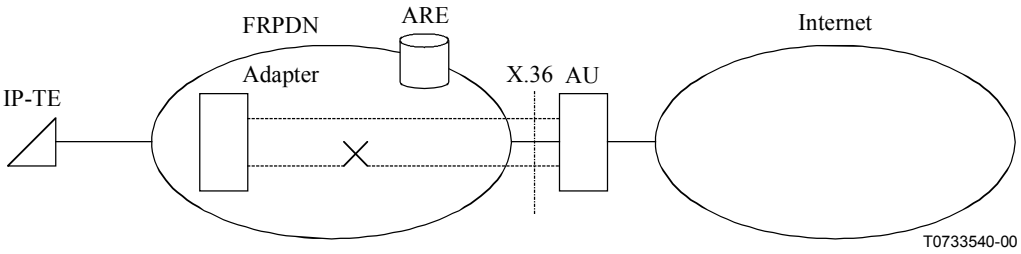

Figure 7-1/X.371/Y.1402 – Reference configuration for interworking between the Internet and FRPDN (access code)

7.1.2 IP packet handling

In case PVCs are provided through the FRPDN, the Adapter and the AU perform the following functions:

i) When the Adapter receives IP packets from the IP-TE, it shall transmit them onto the pre-established PVCs, and vice versa.

ii) When the AU receives IP packets from the PVC(s), it shall transmit them to a pre-assigned Internet port, and vice versa.

In case SVCs are provided through the FRPDN, the Adapter and the AU perform the following functions:

i) When the Adapter receives IP packets from the IP-TE, it shall check if an SVC has been already established toward the AU. If an SVC has been established, the Adapter sends the received IP packets onto the SVC. If no SVC has been established, the Adapter shall set up an SVC using the procedures as specified in ITU-T X.36. And then, the Adapter sends the received IP packets onto the established SVC. The Adapter may clear the SVC if it receives no IP packets from the IP-TE or from the AU during a certain amount of time.

ii) When the AU receives IP packets from the Internet, it shall perform the similar functions as stated in the previous paragraph.

In the above cases, the IP-TE subscribes to the FRPDN, and an AU is assigned for the IP-TE on subscription.

There is also another case where different AUs or the IP-TEs are dynamically selected depending on the destination IP addresses. In this case, the Adapter and the AU perform the following functions:

i) The Adapter acquires a mapping relationship between the destination IP addresses received from the IP-TE and X.121 or E.164 numbers allocated to the AUs using the procedures defined in 7.1.3. When the Adapter receives IP packets from the IP-TE, it shall check the destination address of the IP and derived X.121 or E.164 addresses of the corresponding AUs from the destination IP address, and then transmit them towards the AUs according to the procedures for the PVC and SVC cases described above.

ii) The AU acquires a mapping relationship between the destination IP addresses received from the Internet and X.121 or E.164 numbers allocated to the ports of the IP-TEs using the procedures defined in 7.1.3.

In this case, the IP-TE may or may not subscribe to the FRPDN. In case the IP-TE subscribes to the FRPDN, authentication, authorization and accounting functions (as specified in IETF RFC 2865 and RFC 2866) shall be performed by the ARE. In case the IP-TE does not subscribe to the FRPDN, there shall be a contract between service providers of the FRPDN and that of the Internet.

7.1.3 ARE procedures

There are two kinds of procedures related to the ARE functions:

a) registration procedures;

b) inquiry and response procedures.

Registration procedures enable the ARE to get information about mapping between IP addresses and X.121 or E.164 addresses from the Adapter or the AU according to the following mechanisms:

i) The Adapter and the AU have normal router functions of the Internet and perform as routers outside the FRPDN. Therefore, the Adapter and the AU can route IP packets towards the IP-TE and the Internet, respectively. In addition, the Adapter and the AU have information related to X.121 or E.164 numbers allocated to the IP-TEs and the AUs.

ii) The Adapter and the AU periodically communicate with the ARE to inform it of the updated information about mapping between X.121 or E.164 numbers and IP addresses on which the Adapter and the AU have knowledge.

NOTE 1 – Communication procedures between the Adapter/AU and the ARE are for further study.

iii) The ARE collects the mapping information from all the Adapters and the AUs to form a centralized database. Depending on the amount of information that the ARE collects, distributed ARE architecture may be necessary.

NOTE 2 – Mechanisms for distributing the ARE functions are for further study.

Inquiry and response procedures enable the Adapter or the AU to get X.121 or E.164 addresses corresponding to the destination IP addresses according to the following mechanisms:

i) When the Adapter or the AU receives IP packet with a destination address that is not relevant to the established VCs, it sets up a new SVC according to the procedures defined in ITU-T X.116.

ii) Upon setting up a new SVC, the Adapter or the AU will get new information relevant to mapping between the destination IP address and the SVC. This new information may be kept by the Adapter or the AU for later processing of the IP packets. It is an implementation matter what amount of information may be cashed at the Adapter or the AU.

7.2 General arrangements for the concatenation case

7.2.1 Reference configuration

Reference configuration for the concatenation cases is shown in Figure 7-2. In this case, the IWF provides encapsulation function specified in ITU-T X.36. Encapsulation of IP packets is only provided to convey IP packets through the FRPDN. FRPDN may provide PVCs or SVCs. In addition, Address Resolution Entity as specified in ITU-T X.115 and ITU-T X.116 may be equipped within the FRPDN to provide the IWF with routing information. In this configuration, IP packets are transparently exchanged between the IWFs. Use of PVCs or SVCs are not visible to the Internet. The IWF may reside within the FRPDN, or may be outside the FRPDN.

NOTE – ITU-T X.115 and/or ITU-T X.116 may need enhancement for the purpose of this Recommendation.

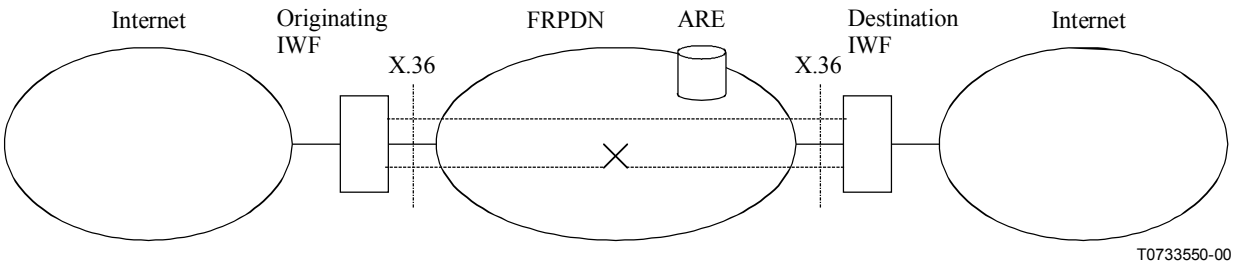

Figure 7-2/X.371/Y.1402 – Reference configuration for interworking between the Internet and FRPDN (Concatenation case 1)

7.2.2 IP packet handling

In case PVCs are provided through the FRPDN, the IWF performs the following functions:

i) When the IWF receives IP packets from the Internet, it shall transmit them onto the pre-established PVCs.

ii) When the IWF receives IP packets from the PVC(s), it shall transmit them to a pre-assigned Internet port.

In case SVCs are provided through the FRPDN, the IWF perform the following functions:

i) When the IWF receives IP packets from the Internet, it shall check if an SVC has been already established toward the destination IWF. If an SVC has been established, the IWF sends the received IP packets onto the SVC. If no SVC has been established, the IWF shall set up an SVC using the procedures as specified in ITU-T X.36. And then, the IWF sends the received IP packets onto the established SVC.

ii) The IWF may clear the SVC if it receives no IP packets from the Internet during a certain amount of time.

In the above cases, the Internet port of the IWF subscribes to the FRPDN, and a destination IWF is assigned for the Internet port on subscription.

There is also another case where different destination IWFs are dynamically selected depending on the destination IP addresses received by the originating IWF. In this case, the originating IWF performs the following functions:

i) The originating IWF acquires a mapping relationship between the destination IP addresses received from the Internet and X.121 or E.164 numbers allocated to the destination IWF using the procedures defined in 7.2.3.

ii) When the originating IWF receives IP packets from the Internet, it shall check the destination address of the IP and derived X.121 or E.164 addresses of the corresponding destination IWFs from the destination IP address, and then transmit them towards the destination IWFs according to the procedures for the PVC and SVC cases described above.

In this case, the IWF may or may not subscribe to the FRPDN. In case the IWF subscribes to the FRPDN, authentication, authorization and accounting functions (as specified in IETF RFC 2865 and RFC 2866) shall be performed by the ARE. In case the IWF does not subscribe to the FRPDN, there shall be a contract between service providers of the FRPDN and that of the Internet.

7.2.3 ARE procedures

Clause 7.1.3 applies with replacement of the Adapter and the AU with the IWF.

7.3 General arrangements for the concatenation case 2 (Concatenation of two FRPDNs via the Internet)

7.3.1 Reference configuration

Reference configuration for the concatenation case 2 is shown in Figure 7-3. In this case, the IWF converts X.76 interface to the Internet protocols and vice versa. X.76 frames are encapsulated in a TCP connection established between IWFs. In addition, Address Resolution Entity as specified in ITU-T X.115 and ITU-T X.116 may be equipped within the FRPDNs to provide the IWF with routing information. In this configuration, Internet is used as a datalink on which X.76 procedures are running and is not visible to the DTE that communicates with the FRPDN conforming to X.36. X.76 packets are transparently exchanged between the IWFs. Use of X.76 PVCs or SVCs are not visible to the Internet. The IWF may reside within the FRPDN, or may be outside the FRPDN.

In this case, end-to-end QOS characteristics may be limited by that of the Internet. Further study is needed for the definition of end-to-end QOS characteristics for this case.

NOTE – ITU-T X.115 and/or ITU-T X.116 may need enhancement for the purpose of this Recommendation.

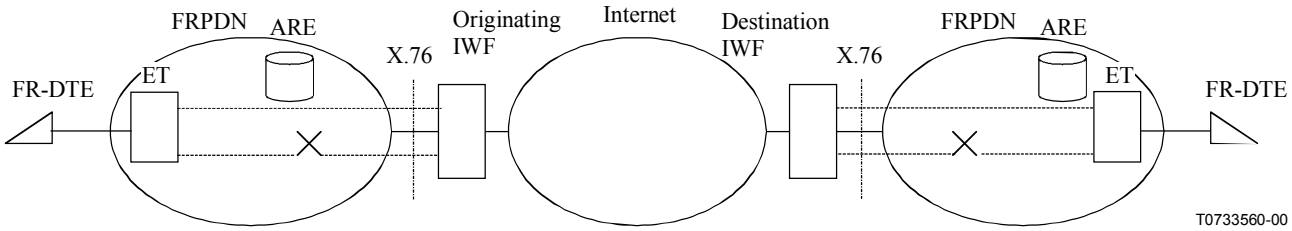

Figure 7-3/X.371/Y.1402 – Reference configuration for interworking between the Internet and FRPDN (Concatenation case 2)

7.3.2 IP packet handling

In case PVCs are provided through the FRPDN, there shall be a pre-established TCP connection between the originating and destination IWFs. In this case the IWF performs the following functions:

i) When the IWF receives X.76 frames from the FRPDN, it shall transmit them onto the pre-established TCP connection.

ii) When the IWF receives TCP packets containing X.76 frames from the Internet, it shall decapsulate the TCP packets and transmit X.76 frames onto the PVC.

In case SVCs are provided through the FRPDN, the IWF performs the following functions:

i) When the IWF receives X.76 SETUP messages from the FRPDN, it shall check if a TCP connection has been already established toward the destination IWF. If a TCP has been established, the IWF sends the X.76 SETUP messages onto the TCP connection and the rest of the X.76 procedures shall continue over the established TCP connection. If no TCP connection has been established, the IWF shall set up a TCP connection using the procedures as specified in RFC 793. After the TCP connection has been established, X.76 procedures shall operate between two IWFs over the established TCP connection. The IWF may clear the TCP connection if no X.76 SVCs towards the destination IWF exist during a certain amount of time.

ii) When the IWF receives IP packets containing X.76 SETUP messages from the Internet, it shall establish an X.36 SVC towards the called FR-DTE. Then, normal X.76 and X.36 procedures shall follow using the established SVC.

In the above cases, the FR-DTE subscribes to the FRPDN, and an IWF is assigned for the FR-DTE on subscription.

There is also another case where the FR-DTE subscribes to the FRPDN, but different IWFs are dynamically selected depending on the destination X.121/E.164 addresses. In this case, the IWF performs the following functions:

i) The originating IWF acquire mapping relationship between the destination X.121/E.164 numbers received from the FRPDN and IP addresses allocated to the destination IWF using the procedures defined in 7.3.3.

ii) When the originating IWF receives X.76 SETUP messages from the FRPDN, it shall check the destination numbers of the X.76 SETUP messages and derive IP addresses of the corresponding destination IWFs, and then transmit them towards the destination IWFs according to the procedures described above in this clause.

7.3.3 ARE procedures

Clause 7.1.3 applies with replacement of the Adapter and the AU with the ET and the IWF, respectively. In addition, AREs of the originating and destination FRPDN shall communicate each other to exchange routing information.

NOTE – Procedures for communication between AREs are for further study.

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