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INTELLIGENT NETWORK

PHYSICAL PLANE FOR INTELLIGENT NETWORK CS-1

ITU-T Recommendation Q.1215

(Previously "CCITT Recommendation")

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The 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 Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation Q.1215 was revised by ITU-T Study Group 11 (1993-1996) and was approved under the WTSC Resolution No. 1 procedure on the 17th of October 1995.

NOTE

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

CONTENTS

SUMMARY

This Recommendation describes the physical plane of the IN architecture for CS-1. The physical plane identifies different Physical Entities (PEs), the allocation of functional entities to PEs, and the interfaces between the PEs.

The status of the text in this Recommendation is stable and there are no outstanding issues identified for further study.

Companion Recommendations include the Q.1200- and Q.1210-Series of Recommendations, especially that of Recommendation Q.1205, which describes the physical plane for general IN. The revisions that appear in the current text of this Recommendation were applied to make it consistent with the companion Recommendations.

PHYSICAL PLANE FOR INTELLIGENT NETWORK CS-1

(Helsinki, 1993; revised in 1995)

1 General

This Recommendation describes the physical plane of the IN architecture for CS-1. General IN physical plane information is contained in Recommendation Q.1205.

The physical plane of the IN conceptual model identifies the different physical entities and the interfaces between these entities.

The physical plane architecture should be consistent with the IN conceptual model. The IN conceptual model is a tool that can be used to design the IN architecture to meet the following main objectives:

- service implementation independence;
- network implementation independence;
- vendor and technology independence.

The I.130 stage 3 service description methodology may be used (which includes the functional specification of the node and detailed description of the protocol between the nodes) in developing the physical plane architecture.

2 Requirements and assumptions

2.1 Requirements

The key requirements of the physical plane architecture are:

- the functional entities in the CS-1 distributed functional plane can be mapped onto the CS-1 physical entities;
- one or more functional entities may be mapped onto the same physical entity;
- one functional entity cannot be split between two physical entities (i.e. the functional entity is mapped entirely within a single physical entity);
- duplicate instances of a functional entity can be mapped to different physical entities, though not to the same physical entity;
- physical entities can be grouped to form a physical architecture;
- the physical entities may offer standard interfaces;
- vendors must be able to develop physical entities based on the mapping of functional entities and the standard interfaces;
- vendors must be able to support mature technologies and new technologies as they become available.

2.2 Assumptions

The following assumptions are made for the development of the physical plane architecture:

- the IN conceptual model is used as a tool to develop the IN physical architecture;
- existing and new technologies can be used to develop the physical entities;

– the specification of functional entities in the distributed functional plane and standard interfaces in the physical plane will make the network vendor independent and service independent;

– for CS-1, a sufficient number of interfaces will be identified for support of services. Service creation and OAM functions will not be addressed.

3 Physical Entities (PEs)

This clause describes a selection of PEs to support IN CS-1. That selection is not intended to preclude or disallow the application of any other IN PE to support CS-1.

a) *Service Switching Point (SSP)*

In addition to providing users with access to the network (if the SSP is a local exchange) and performing any necessary switching functionality, the SSP allows access to the set of IN capabilities. The SSP contains detection capability to detect requests for IN-based services. It also contains capabilities to communicate with other PE(s) containing a Service Control Function (SCF), such as a Service Control Point (SCP), and to respond to instructions from the other PE. Functionally, an SSP contains a Call Control Function (CCF), a Service Switching Function (SSF), and, if the SSP is a local exchange, a Call Control Agent Function (CCAF). It also may optionally contain a Service Control Function (SCF), and/or a Specialized Resource Function (SRF), and/or a Service Data Function (SDF). The SSP may provide IN-based services to users connected to subtending Network Access Points.

b) *Network Access Point (NAP)*

An NAP is a PE that includes only the CCAF and CCF functional entities. It may also be present in the network. The NAP supports early and ubiquitous deployment of IN-based services. This NAP cannot communicate with an SCF, but it has the ability to determine when IN processing is required. It must send calls requiring IN processing to an SSP.

c) *Service Control Point (SCP)*

The SCP contains the Service Logic Programs (SLPs) and data that are used to provide IN-based services. The SCP is connected to SSPs by a signalling network. Multiple SCPs may contain the same SLPs and data to improve service reliability and to facilitate load sharing between SCPs. Functionally, an SCP contains a Service Control Function (SCF) and a Service Data Function (SDF). The SCP can access data in an SDP either directly or through a signalling network. The SDP may be in the same network as the SCP, or in another network. The SCP can be connected to SSPs, and optionally to IPs, through the signalling network. The SCP can also be connected to an IP via an SSP relay function.

d) *Adjunct (AD)*

The Adjunct PE is functionally equivalent to an SCP (i.e. it contains the same functional entities) but it is directly connected to an SSP. Communication between an Adjunct and an SSP is supported by a high speed interface. This arrangement may result in differing performance characteristics for an Adjunct and an SCP. The application layer messages are identical in content to those carried by the signalling network to an SCP.

An Adjunct may be connected to more than one SSP and an SSP may be connected to more than one Adjunct.

e) *Intelligent Peripheral (IP)*

The IP provides resources such as customized and concatenated voice announcements, voice recognition, and Dual Tone Multi-Frequencies (DTMF) digit collection, and contains switching matrix to connect users to these resources. The IP supports flexible information interactions between a user and the network. Functionally, the IP contains the Specialized Resource Function (SRF). The IP may directly connect to one or more SSPs, and/or may connect to the signalling network.

An SCP or Adjunct can request an SSP to connect a user to a resource located in an IP that is connected to the SSP from which the service request is detected. An SCP or Adjunct can also request the SSP to connect a user to a resource located in an IP that is connected to another SSP.

f) *Service Node (SN)*

The SN can control IN-based services and engage in flexible information interactions with users. The SN communicates directly with one or more SSPs, each with a point-to-point signalling and transport connection. Functionally, the SN contains an SCF, SDF, SRF, and an SSF/CCF. This SSF/CCF is closely coupled to the SCF within the SN, and is not accessible by external SCFs.

In a manner similar to an Adjunct, the SCF in an SN receives messages from the SSP, executes SLPs, and sends messages to the SSP. SLPs in an SN may be developed by the same service creation environment used to develop SLPs for SCPs and Adjuncts. The SRF in an SN enables the SN to interact with users in a manner similar to an IP. An SCF can request the SSF to connect a user to a resource located in an SN that is connected to the SSP from which the service request is detected. An SCF can also request the SSP to connect a user to a resource located in an SN that is connected to another SSP.

g) *Service Switching and Control Point (SSCP)*

The SSCP is a combined SCP and SSP in a single node. Functionally, it contains an SCF, SDF, CCAF, CCF and SSF. The connection between the SCF/SDF functions and the CCAF/CCF/SSF functions is proprietary and closely coupled, but it provides the same service capability as an SSP and SCP separately.

This node may also contain SRF functional capabilities (i.e. SRF as an optional capability).

The interfaces between the SSCP and other PEs are the same as the interfaces between the SSP and other PEs, and therefore will not be explicitly stated.

h) *Service Data Point (SDP)*

The SDP contains the customer and network data which is accessed during the execution of a service. Functionally, the SDP contains an SDF.

4 Mapping requirements

– physical plane architecture requirements listed in 2.1 should be met;

– functional entities should be mapped to physical entities in a manner which will support the identified benchmark CS-1 services;

– functional entity to physical entity mapping must allow efficient implementation in existing physical entities;

– functional entity to physical entity mapping must allow for standard communications between network functions via service independent interfaces.

5 Mapping the distributed functional plane to the physical plane

5.1 Mapping of functional entities to physical entities

This subclause gives a mapping of functional entities into physical entities for CS-1, and describes the reference points between the PEs. In so doing, an appropriate distribution of functionality for CS-1 is identified, and functional interfaces suitable for standardization are highlighted. The PEs described in this subclause are for illustrative purposes only, and do not imply the only possible mapping of functionality for CS-1.

This subclause describes a flexible physical architecture made up of several PEs. Each PE contains one or more functional entities, which define its IN functionality. PEs included in the physical architecture shown in Figure 1 are Service Switching Point (SSP), Network Access Point (NAP), Service Control Point (SCP), Intelligent Peripheral (IP), Adjunct (AD), Service Switching and Control Point (SSCP), Service Data Point (SDP), and Service Node (SN).

Typical scenarios of functional entity mapping to physical entity are shown in Table 1.

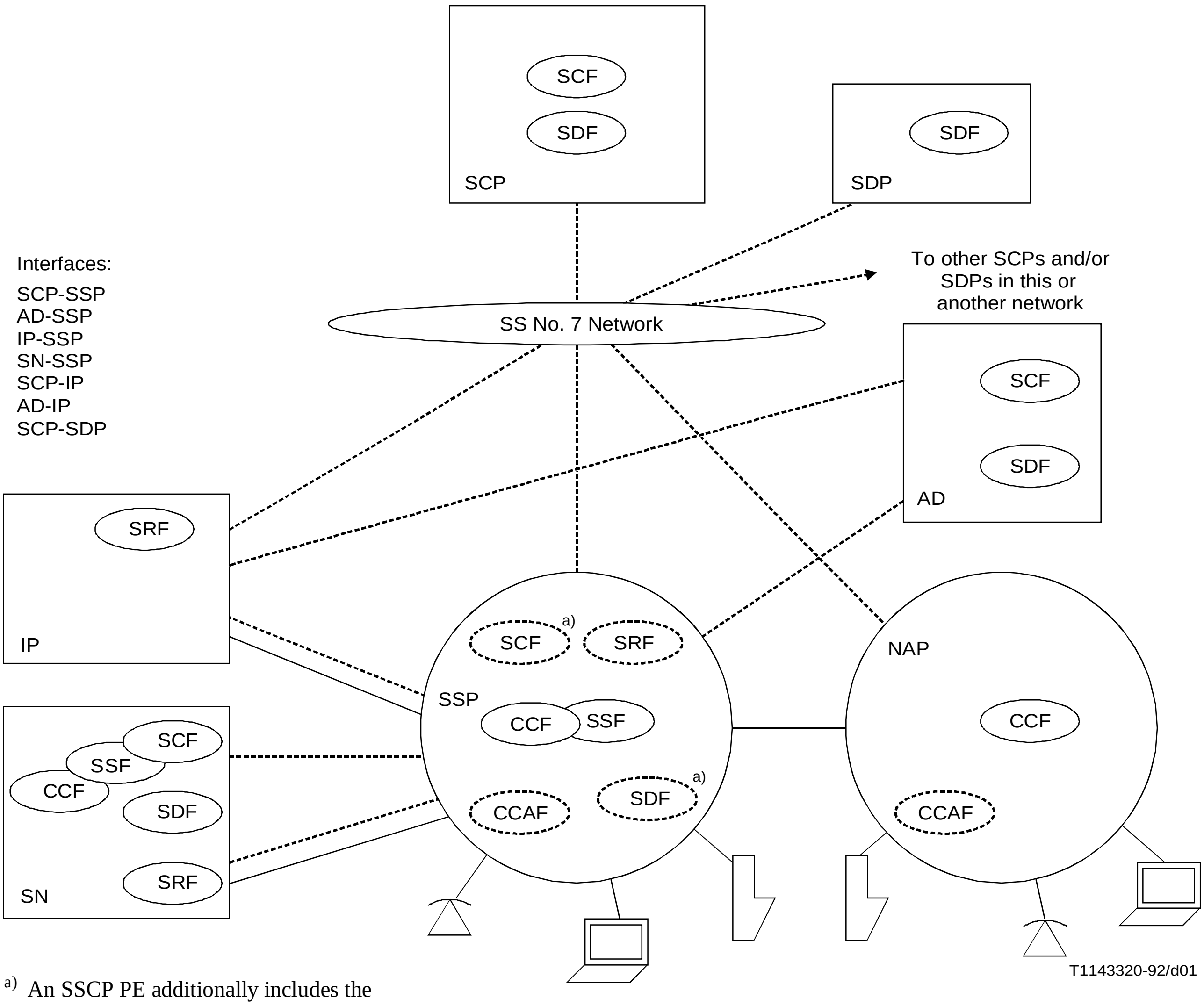
TABLE 1/Q.1215

Typical scenarios of FE to PE mapping

PEs	FEs			
	SCF	SSF/CCF	SDF	SRF
SSP	O	C	O	O
SCP	C	–	C	–
SDP	–	–	C	–
IP	–	–	–	C
AD	C	–	C	–
SN	C	C	C	C
SSCP	C	C	C	O
NAP	–	C (CCF only)	–	–
C Core O Optional – Not allowed				

There is no intention that the table should disallow any other combination of functional entities that would result in a PE not shown in the table.

The above mappings are shown in Figure 1. Each PE has certain functional entities mapped into it. The solid lines on the figure show transport paths that may exist between the PEs, and the dotted lines show signalling paths that can carry application layer messages for IN-based services.



a) An SSCP PE additionally includes the SCF and SDF FEs as core elements.

Transport

Signalling

Optional FE

Physical entities (PEs)

AD	Adjunct
IP	Intelligent Peripheral
SSP	Service Switching Point
SCP	Service Control Point
SN	Services Node
NAP	Network Access Point
SDP	Service Data Point
SSCP	Service Switching and Control Point

Functional entities (FEs)

CCF	Call Control Function
CCAF	Call Control Agent Function
SCF	Service Control Function
SDF	Service Data Function
SRF	Special Resource Function
SSF	Service Switching Function

FIGURE 1/Q.1215

Scenarios for physical architectures

5.2 Mapping of FE-FE relationships to PE-PE relationships

The FE-FE interfaces that fall within the scope of CS-1 are:

1) SSF-SCF;

2) SCF-SDF; and

3) SCF-SRF.

A mapping to the PE-PE interfaces is provided in Table 2.

Table 2 is not meant to be an exhaustive list of all possible PE-PE relationships that may be covered by the CS-1 Recommendations.

TABLE 2/Q.1215

FE-FE relationships to PE-PE relationships

FE-FE	PE-PE
SSF-SCF	SSP-SCP SSP-AD SSP-SN
SCF-SDF	SSP-SCP SCP-SDP
SCF-SRF	SCP-IP SCP-SSP-IP AD-IP

5.3 Selection of underlying protocol platforms

This subclause describes the candidate interfaces for CS-1 between the elements of the physical architecture. The interfaces are identified below.

- SCP-SSP;
- AD-SSP;
- IP-SSP;
- SN-SSP;
- SCP-IP;
- AD-IP; and
- SCP-SDP.

Existing lower-layer protocols are proposed for these candidate interfaces to carry the application layer messages required by IN-based services. As such, the focus of the standardization effort for CS-1 is on the application layer protocols. At the application layer, the message sent that the different interfaces carry should reflect the same semantic content, even though the application layer messages may be encoded or formatted differently. For example, the messages between the SSF in an SSP and the SCF in an SCP, Adjunct or SN should contain the same information. The following subclauses give some proposed protocols for use on these interfaces.

5.3.1 SCP-SSP interface

The proposed underlying protocol platform for the interface between an SCP and an SSP is Transaction Capabilities Application Part (TCAP) on Signalling Connection Control Part (SCCP)/Message Transfer Part (MTP) of SS No. 7.

5.3.2 AD-SSP interface

The proposed underlying protocol platform for the AD-SSP interface is TCAP. The physical interface has not been specified, but a number of alternative standard protocols could be used.

5.3.3 IP-SSP interface

This interface is used for communications between an IP and an SSP as well as for communication between an IP and an SCP which is being relayed through an SSP.

The proposed underlying protocol platform for the interface between an IP and an SSP is ISDN Basic Rate Interface (BRI), Primary Rate Interface (PRI) (or both), or SS No. 7.

If a BRI or PRI is used, the ISDN D-channel connecting an IP to an SSP carries application layer information between an SCF and an SRF, and supports the setup of B-channel connections to the IP. Information passed from an SCF to an SRF (e.g. announcement number and number of digits to collect) and vice versa (e.g. collected information and billing measurements) is embedded in the facility information element. The facility information element can be carried by some Q.931 messages, such as SETUP and DISCONNECT. The facility information element can also be carried by the FACILITY message of Recommendation Q.931. This possibility provides for the flexibility to convey application layer information without affecting the call connection establishment.

5.3.4 SN-SSP interface

The proposed underlying protocol platform for the interface between an SN and an SSP is ISDN Basic Rate Interface (BRI), Primary Rate Interface (PRI) (or both). An SN and an SSP exchange application layer messages over an ISDN D-channel using the common element procedures of Recommendation Q.932. This communication may occur on a separate D-channel from the channel that carries the common element procedure messages. Figure 1 shows the case where these channels are separate.

5.3.5 SCP-IP interface

The proposed underlying protocol platform for an interface between an SCP and an IP is Transaction Capabilities Application Part (TCAP) on Signalling Connection Control Part (SCCP)/MTP of SS No. 7.

5.3.6 AD-IP interface

The proposed underlying protocol platform between an AD and an IP is TCAP. The physical interface has not been specified, but a number of alternative standard protocols could be used.

5.3.7 SCP-SDP interface

The proposed underlying protocol platform for the interface between an SCP and an SDP is Transaction Capabilities Application Part (TCAP) in Signalling Connection Control Part (SCCP)/MTP of SS No. 7. For SDPs outside the network (e.g. credit card validation database at credit card company), an interworking unit can be used which is inside the network and performs translation of SS No. 7 TCAP to a public or private data transfer protocol (e.g. Recommendation X.25).

5.3.8 User interfaces

A user is an entity external to the IN that uses IN capabilities. IN users may employ the access interfaces described below to invoke various IN service capabilities. For example, users can affect the routing of a call, send and receive information from the network, screen calls, and update service parameters. Users are served by existing network interfaces.

It is important to ensure that IN should continue to support existing services and capabilities. In addition, the current restrictions imposed by each of the interface technologies described below must be considered when deploying IN-based services. For example, calling party information may or may not be available at a given interface and, therefore, may or may not be provided to the SCF.

End users use analogue interface signalling, or ISDN access signalling arrangements. IN user-network interactions include providing stimuli, such as off-hook or DTMF digit signalling, which determine further IN action.

Out-of-band (i.e. D-channel) signalling provides ISDN users with additional capabilities for accessing potential IN-based services. When originating a call, an ISDN user identifies the bearer capability to be associated with the call. IN service logic can use this information to determine how the call should be handled (e.g. how to route the call).