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GENERAL RECOMMENDATIONS ON TELEPHONE SWITCHING AND SIGNALLING INTELLIGENT NETWORK

INTRODUCTION TO INTELLIGENT NETWORK CAPABILITY SET 1

ITU-T Recommendation Q.1211

(Previously "CCITT Recommendation")

FOREWORD

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

ITU-T Recommendation Q.1211 was prepared by the ITU-T Study Group XI (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 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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SUMMARY

Intelligent network capability set 1 is the first standardized stage of the intelligent network (IN) as an architectural concept for the creation and provision of telecommunications services. This Recommendation gives an introduction to capability set 1 (CS-1) by providing an overview and definition of CS-1 and by describing its main characteristics and overall capabilities. It defines the service aspects, network aspects and functional relationships that form the basis of the CS-1 capabilities.

This Recommendation is the first in the Q.121x-Series Recommendations devoted to CS-1. It builds on the architectural principles of IN as described in the Q.120x-Series Recommendations.

The CS-1 Recommendations (Q.121x-Series) form a useful basis for achieving implementation experience. As with any project of this size and complexity, it can be anticipated that there may be some difficulties in interworking the various implementations of IN CS-1 physical elements. In order that the IN objective for working in a multi-vendor environment may be fully achieved, the IN CS-1 Recommendations text may go through some future revision in the light of implementation experience.

Recommendation Q.1211**INTRODUCTION TO INTELLIGENT NETWORK CAPABILITY SET 1***(Helsinki, 1993)***1 Introduction**

Intelligent network capability set 1 is the first standardized stage of the intelligent network (IN) as an architectural concept for the creation and provision of telecommunications services. This Recommendation gives an introduction to capability set 1 (CS-1) by providing an overview and definition of CS-1 and by describing its main characteristics and overall capabilities.

2 Phased standardization

The intelligent network (IN) is an architectural concept for creation and provisioning of new services which is characterized by:

- a) extensive use of information processing techniques;
- b) efficient use of network resources;
- c) modularization and reusability of network functions;
- d) integrated service creation and implementation by means of modularized, reusable network functions;
- e) flexible allocation of network functions to physical entities;
- f) portability of network functions among physical entities;
- g) standardized communications between network functions via service independent interfaces;
- h) service subscriber's control of some subscriber-specific service attributes;
- i) service user control of some user-specific attributes;
- j) standardized management of service logic.

The implementation of the IN architecture will facilitate the rapid introduction of new services. Its architecture can be applied to various types of telecommunications networks, which include: public switched telecommunications network (PSTN), public switched packet data network (PSPDN), mobile, and integrated services digital networks (N- and B-ISDN).

The ultimate IN is an evolving target, therefore in order to take full advantage of the technological possibilities at a given point in time it is necessary to define specific phases in the evolution to a target architecture. This phased approach is shown in Figure 1.

This Recommendation provides the description of CS-1 at time T₁ as represented in Figure 1.

3 General description and scope of CS-1**3.1 Criteria for CS-1**

CS-1 defines an initial subset of IN capabilities that meet the following general criteria:

- a) CS-1 is a subset of the target intelligent network architecture;
- b) CS-1 is a set of definitions of capabilities that is of direct use to both manufacturers and network operators;

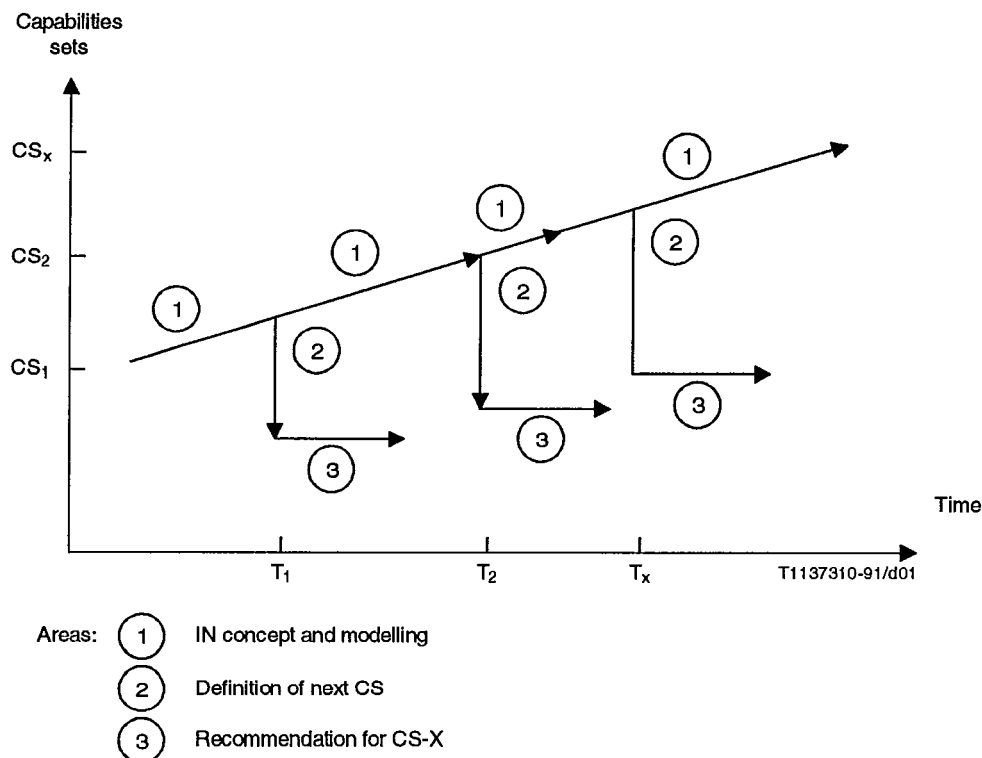


FIGURE 1/Q.1211
Sequencing of capability sets

- c) CS-1 provides network capabilities to support services either defined or in the process of being defined by CCITT (e.g. universal personal telecommunications service, freephone, and virtual private network services such as private numbering plan). CS-1 also provides capabilities to support the introduction of services which may neither be standardized by CCITT, nor be part of the proposed set of targeted services;
- d) CS-1 is the first standardized stage of evolution based upon the existing technology base and on evolvability requirements addressed in 3.2.

The CS-1 architecture may be supported over PSTN, ISDN, and mobile networks.

3.2 Evolution of CS-1

The CS-1 Recommendations (Q.121x-Series) form a useful basis for achieving implementation experience. As with any project of this size and complexity, it can be anticipated that there may be some difficulties in interworking the various implementations of IN CS-1 physical elements. In order that the IN objective for working in a multi-vendor environment may be fully achieved, the IN CS-1 Recommendations text may go through some future revision in the light of implementation experience.

The CS-1 architecture takes into account the evolution requirement, i.e., it supports the CS-1 targeted services but its functionalities are designed to evolve towards the future capability sets (CS-2 and beyond). Therefore, the CS-1 capabilities are defined without any assumptions that are known to limit their ability to evolve into future capability sets.

4 Overview of CS-1 Recommendations

Table 1 contains an overview of the Recommendations that are specifically related to CS-1:

TABLE 1/Q.1211

CS-1 Recommendations

Recommendation	Title
Q.1211	Introduction to intelligent network capability set 1
Q.1213	Global functional plane for intelligent network CS-1
Q.1214	Distributed functional plane for intelligent network CS-1
Q.1215	Physical plane for intelligent network CS-1
Q.1218	Intelligent network interface specifications for capability set 1
Q.1219	Intelligent network users guide for capability set 1

5 Service aspects

Although, by nature, the IN is a service independent architecture, it is relevant to describe the general CS-1 service capabilities. The services and service features that are to be supported by CS-1 are fundamental to the CS-1 service independent building blocks (SIBs), call processing model and service control principles.

5.1 Type A and Type B services

CS-1 capabilities are intended to support services and service features that fall into the category of "single ended", "single point of control" services referred to as Type A, while all other services are placed in a category called Type B. The following definitions apply:

A single-ended service feature applies to one and only one party in a call and is orthogonal (independent) at both the service and topology levels to any other parties that may be participating in the call. Orthogonality allows another instance of the same or a different single-ended service feature to apply to another party in the same call as long as the service feature instances do not have feature interaction problems with each other.

Single point of control describes a control relationship where the same aspects of a call are influenced by one and only one service control function at any point in time (see also 6.2.1).

CS-1 standards do not encompass "Type B" services for the following reasons:

a) Operational complexity

In Type B services, several IN subscribers may be associated within a single call. During the call, subscribers may be added or dropped. These associations take place physically in the switches involved in the call (SSF/CCF functions) under the control of an SCF. The SCF will need rules to handle feature arbitration between subscribers involved in the call (e.g. incompatible screening lists). This may have to involve real-time consultations between the SCFs that "represent" the various parties involved in the call. Rules will also be required to handle topological decisions (e.g. which physical switches should be chosen to "join" groups of subscribers scattered around a network?).

b) *Implementation complexity*

Type B services may involve manipulation of switch connection resources by service logic located in an SCF. This means that an “abstracted” view of the switch’s connection resources must be made available to external service logic. Models have been formulated to accommodate appropriate “abstracted” views, but to date these are theoretical proposals. A very large investment in switch software redesign may be required to realize such models. In contrast, the switch software modifications to accommodate Type A services are relatively modest in scope and are well understood.

c) *Control complexity*

Type A services are characterized by a relatively simple control relationship between SSF and SCF. The SSF is a “client” for service-related information provided by the SCF, however, the switch retains connection control at all times.

In contrast, the control relationship between SCF and SSF in Type B services may require the sharing of connection control between the switch and external service logic. The information flows need to be rich in parameters to manage what is essentially a peer-peer, distributed processing relationship.

As there are considerable differences in operational, implementation, and control complexity between Type A and Type B services, CS-1 is targeted to support Type A services only.

There are some circumstances in which it will be possible to apply “Type A” IN technology to certain aspects of “Type B” services. This applies to switch-based services in general, whether these services be of “Type A” or “Type B”, and to “Type B” services in general, whether these be switch-based or CS-x based. Further detail can be obtained from Recommendation Q.1214.

5.2 Target sets of CS-1 services and service features

Tables 2 and 3 contain the target sets of CS-1 services and service features. The target sets can be used to identify and verify the service-independent capabilities of CS-1. Examples of relationships and mappings between these CS-1 services and service features are shown in Annex A.

Annex B provides short prose descriptions of targeted services and service features. These were used to develop the current Q.121x-Series Recommendations as CS-1 is intended to support evolutionary new services. The descriptions provided for the targeted services and service features are for the above-mentioned purposes only and are not to be used by service designers for service creation.

Definitions of “service” and “service feature”:

A service is a stand-alone commercial offering, characterized by one or more core service features, and can be optionally enhanced by other service features.

A service feature is a specific aspect of a service that can also be used in conjunction with other services/service features as part of a commercial offering. It is either a core part of a service or an optional part offered as an enhancement to a service.

5.3 Network support of CS-1 services

The services are to be supported over various networks. For IN CS-1 applications the following networks are considered:

- i) PSTN;
- ii) ISDN (Public and private networks);
- iii) PLMN.

TABLE 2/Q.1211

Target set of CS-1 services

Abbreviated dialling	ABD
Account card calling	ACC
Automatic alternative billing	AAB
Call distribution	CD
Call forwarding	CF
Call rerouting distribution	CRD
Completion of call to busy subscriber ^{a)}	CCBS
Conference calling ^{a)}	CON
Credit card calling	CCC
Destination call routing	DCR
Follow-me diversion	FMD
Freephone	FPH
Malicious call identification	MCI
Mass calling	MAS
Originating call screening	OCS
Premium rate	PRM
Security screening	SEC
Selective call forward on busy/don't answer	SCF
Split charging	SPL
Televoting	VOT
Terminating call screening	TCS
Universal access number	UAN
Universal personal telecommunications	UPT
User-defined routing	UDR
Virtual private network	VPN

^{a)} These services and service features might be partially supported in CS-1, because they require, beyond Type A capabilities, additional Type B capabilities. Parts of these service and service features are considered in CS-1 as long as these parts belong to Type A and do not impose capabilities additional to those required for other services and service features in the list.

NOTES

1 Above service names apply to the descriptions of targeted services (see Annex B), and not to the user-network interface descriptions provided by CCITT SG I.

2 Network implementation aspects may be important for some services.

6 Network aspects

This clause provides an overview of the IN network functions, and sets guidelines for the control architecture of CS-1. It also describes how the issues of feature interaction and service-feature consistency are handled in CS-1.

Figure 2 summarizes the IN network functions and their functional relationships.

6.1 Network functions

The network functions are described here.

6.1.1 Call control related functions

SSF – service switching function – this function interfaces with CCF and SCF. It allows the CCF to be directed by the SCF.

SRF – specialized resources function – this function provides a category of resources for access by other network entities. Examples of resources include DTMF sending and receiving, protocol conversion, speech recognition, synthesized speech provision, etc.

CCF – call control function – this function refers to call and connection handling in the classical sense (e.g., that of an exchange).

CCAF – call control agent function – this function provides the user access to the network.

TABLE 3/Q.1211

Target set of CS-1 service features

Abbreviated dialling	ABD
Attendant	ATT
Authentication	AUTC
Authorization code	AUTZ
Automatic call back ^{a)}	ACB
Call distribution	CD
Call forwarding	CF
Call forwarding on BY/DA	CFC
Call gapping	GAP
Call hold with announcement ^{a)}	CHA
Call limiter	LIM
Call logging	LOG
Call queueing	QUE
Call transfer ^{a)}	TRA
Call waiting ^{a)}	CW
Closed user group	CUG
Consultation calling ^{a)}	COC
Customer profile management	CPM
Customized recorded announcement	CRA
Customized ringing	CRG
Destinating user prompter	DUP
Follow-me diversion	FMD
Mass calling	MAS
Meet-me conference ^{a)}	MMC
Multi-way calling ^{a)}	MWC
Off net access	OFA
Off net calling	ONC
One number	ONE
Origin dependent routing	ODR
Originating call screening	OCS
Originating user prompter	OUP
Personal Numbering	PN
Premium charging	PRMC
Private numbering plan	PNP
Reverse charging	REVC
Split charging	SPLC
Terminating call screening	TCS
Time dependent routing	TDR

^{a)} These services and service features might be partially supported in CS-1, because they require, beyond Type A capabilities, additional Type B capabilities. Parts of these service and service features are considered in CS-1 as long as these parts belong to Type A and do not impose capabilities additional to those required for other services and service features in the list.

NOTE – Above service feature names apply to the descriptions of targeted service features (see Annex B), and not to the user-network interface descriptions provided by CCITT SG I.

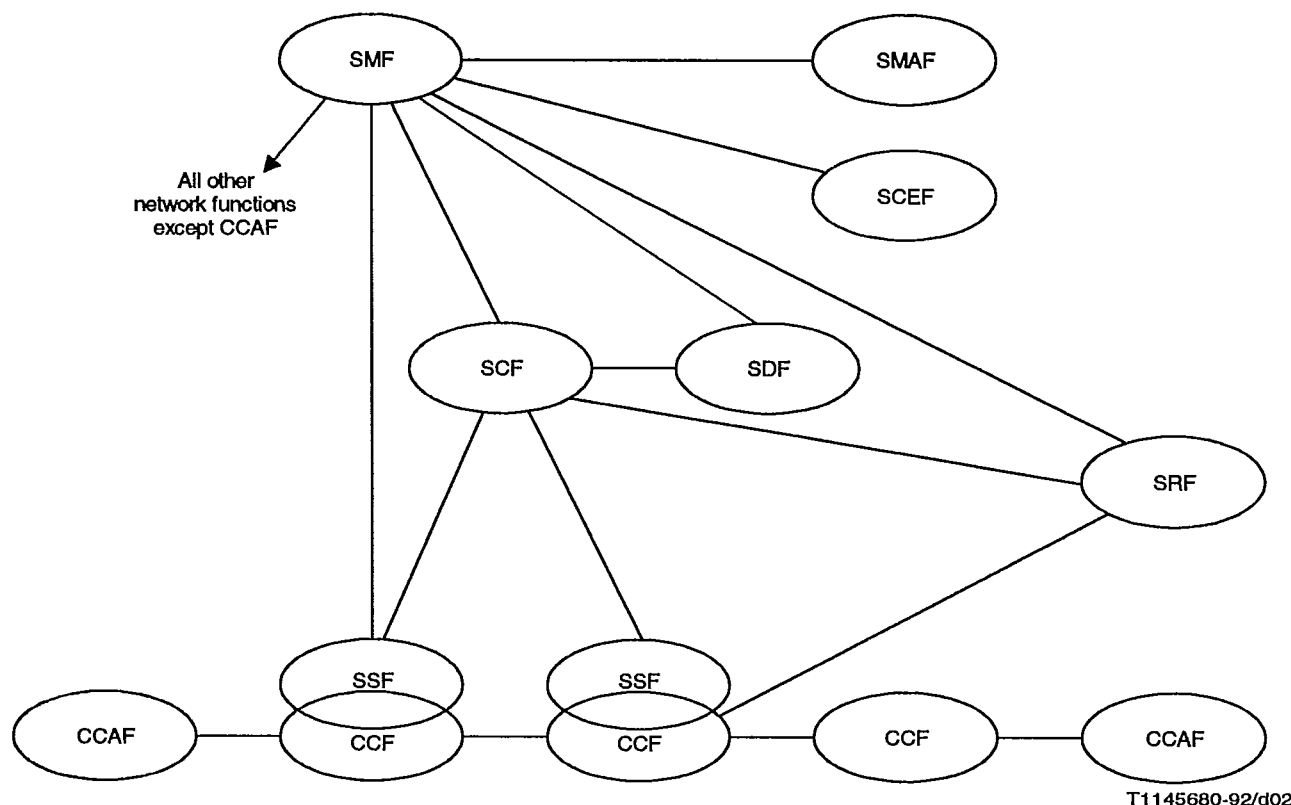
6.1.2 Service control related functions

SCF – service control function – this function contains the IN service logic and handles service-related processing activity.

SDF – service data function – this function handles access to service-related data and network data and provides consistency checks on data. It hides from the SCF the real data implementation and provides a logical data view to SCF.

6.1.3 Management related functions

SCEF – service creation environment function – this function allows an intelligent network service to be defined, developed, tested and input to the SMF. The output of this function involves service logic and service data templates.



CCAF Call control agent function
 CCF Call control function
 SCEF Service creation environment function
 SCF Service control function
 SDF Service data function
 SMAF Service management access function
 SMF Service management function
 SRF Specialised resource function
 SSF Service switching function

FIGURE 2/Q.1211
 IN functions and functional relationships

SMAF – service management access function – this function provides an interface (e.g. screen presentation, ...) to the SMF.

SMF – service management function – this function involves service management control, service provision control and service deployment control.

6.2 Control architecture principles

As stated in 5 (Service aspects), the service scope of CS-1 shall be restricted to single-ended, single-point-of-control services. This subclause identifies principles for the control architecture of CS-1, in the context of this service scope.

This subclause is organized around three control aspects:

- service invocation and control;
- end-user interaction with the SRF, and
- service management.