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Intelligent Network

**Distributed functional plane for Intelligent
Network Capability Set 4**

ITU-T Recommendation Q.1244

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SWITCHING AND SIGNALLING

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ITU-T Recommendation Q.1244

Distributed functional plane for Intelligent Network Capability Set 4

Summary

Intelligent Network Capability Set 4 (IN CS-4) is the fourth standardized stage of the Intelligent Network (IN) as an architectural concept for the creation and provision of services, including telecommunication services, service management services and service creation services. This Recommendation gives the Distributed functional plane for IN CS-4. It describes the main characteristics and overall capabilities of IN CS-4 and defines the network aspects and functional relationships that form the basis of the IN CS-4 capabilities.

This Recommendation is the second to be produced in the Q.124x series of Recommendations devoted to IN CS-4, which builds on the architectural principles of IN as described in the Q.121x, Q.122x and the Q.123x series of Recommendations.

The IN CS-4 Recommendations form a detailed and stable basis for implementing IN CS-4 telecommunication services. They also provide high level guidelines for supporting service management services, service creation services and some partially supported telecommunication services. The IN CS-4 Recommendations are intended to give the same degree of technical information as the IN CS-3 Recommendations.

Source

ITU-T Recommendation Q.1244 was prepared by ITU-T Study Group 11 (2001-2004) and approved under the WTSA Resolution 1 procedure on 13 July 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 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.

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Distributed functional plane for Intelligent Network Capability Set 4

1 Introduction

Intelligent Network Capability Set 4 (IN CS-4) is the fourth standardized stage of the Intelligent Network (IN) as an architectural concept for the creation and provision of network services, including telecommunication services, service management services and service creation services. This Recommendation gives the distributed functional plane for IN CS-4. It describes the main characteristics and overall capabilities of the IN CS-4 functional architecture, network aspects and functional relationships that form the basis for IN CS-4. Clause 4 describes the generic functional model at the control plane and illustrates how IN and IP may be seen to inter-work. Clause 5 describes the relationships and interfaces that are enhanced, when related to the previous IN Capability Sets. Clause 6 illustrates a number of important scenarios for inter-working and interoperability between IN and other networks not specified before in earlier IN Capability Sets. Annex B describes the relation between the generic control plane functional architecture and other allied functions that may be present in the underlying network.

2 Phased standardization

The phased approach of IN Capability Sets has been described in ITU-T Q.1201. IN CS-4 extends the service aspects, network aspects and management aspects of IN CS-3 as specified in the ITU-T Q.123x series of Recommendations. Definitions of IN CS-4 service features may be found in ITU-T Q.1241.

3 References

3.1 Normative 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 Recommendation Q.1241 (2001), *Introduction to Intelligent Network Capability Set 4*.
- [2] ITU-T Recommendation Q.1248.x (2001), *Interface Recommendation for Intelligent Network Capability Set 4*.
- [3] ITU-T Recommendation Q.1222 (1997), *Service plane for Intelligent Network Capability Set 2*.
- [4] ITU-T Recommendation Q.1223 (1997), *Global functional plane for Intelligent Network Capability Set 2*.
- [5] ITU-T Recommendation Q.1224 (1997), *Distributed functional plane for Intelligent Network Capability Set 2*.
- [6] ITU-T Recommendation Q.1225 (1997), *Physical plane for Intelligent Network Capability Set 2*.
- [7] ITU-T Recommendation Q.1228 (1997), *Interface Recommendation for Intelligent Network Capability Set 2*.

- [8] ITU-T Recommendation Q.1231 (1999), *Introduction to Intelligent Network Capability Set 3*.
- [9] ITU-T Recommendation Q.1236 (1999), *Intelligent Network Capability Set 3 – Management Information Model Requirements and Methodology*.
- [10] ITU-T Recommendation Q.1237 (2000), *Extensions to Intelligent Network Capability Set 3 in support of B-ISDN*.
- [11] ITU-T Recommendation Q.1238.x (2000), *Interface Recommendation for Intelligent Network Capability Set 3*.
- [12] ITU-T Recommendation Q.1290 (1998), *Glossary of terms used in the definition of Intelligent Networks*.
- [13] ITU-T Recommendation H.323 (2000), *Packet-based multimedia communications systems*.
- [14] ITU-T Recommendation H.248 (2000), *Gateway control protocol*.

3.2 Bibliography

The references listed in this clause provide informative background information for the reader and are not normative within this Recommendation.

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- [22] 3GPP Technical Specification 29.198 Technical Specification Group Core Networks; Mapping of Virtual Home Environment/Open Service Architecture to CAP/INAP.
- [23] 3GPP Technical Specification 23.127 Technical Specification Group Services and System Aspects; Virtual Home Environment/Open Service Architecture.
- [24] ETSI Guide EG 201 xxx-1 *Requirements on an API for Open Service Access (OSA)*; draft ETSI Guide SPAN 141606 part 1 (release 1999).
- [25] ETSI Guide EG 201 xxx-2 *Requirements on an API for Open Service Access (OSA)*; draft ETSI Guide SPAN 141606 part 2 (release 2000).
- [26] IETF Working Group draft *The SPIRITS Architecture* <draft-slutsman-spirits-architecture-00.txt>.

4 Distributed functional model for IN CS-4

The functional model proposed is an extension of the IN CS-2 functional model (see Figure 4-1). It is intended to support IN CS-4 benchmark services, Internet-based service customisation and termination of Voice over IP to reach users in the telephone domain, as well as general IN capabilities.

4.1 Functional entities to support IN CS-4 benchmark features

The option to have minimal support for accessing IN from H.323 Gatekeepers and SIP/SDP proxy redirection servers for implementing services that require explicit handling of the call configuration is agreed working assumption for IN CS-4, considered below:

For INAP CS-4 the following minimum capabilities are considered:

- redirection services,
- charging, the charging operations defined in ETSI [21] need to be restricted for H.323 and the exact definition of the control of the CDR's will be standardized.
- number translation services including the storage of related information (time of day) for e.g. portability and 800-based services.

NOTE 1 – It is further required to define the service capabilities INAP provides to H.323 or SIP call control. And also define the arming and configuration of Trigger conditions.

NOTE 2 – Triggering criteria can only be based on e.g. E.164 addresses in INAP CS-3 and, therefore, the limitation on the alias Address has to be indicated, or extension proposed.

For the H.323 architecture, the translation of alias addresses to IP transport addresses is to be performed by the gatekeeper. The gatekeeper will also map the specific H.323 parameters to the INAP parameters. Mapping analysis is therefore requested and specific information must be identified. It is proposed that the information should not be sent in a container e.g. Mapping of the cause values will be as specified in ITU-T H.225.0 with regards to the ITU-T Q.850 causes values.

The following lower layer protocol gateways, mapping functions may be required depending on the protocol Architectures employed in each domain:

- Signalling Gateway Function (S-GF);
- Service Control Gateway Function (SC-GF).

4.1.1 PINT server

A PINT server accepts PINT requests from PINT clients. It processes the requests and returns responses to the clients. A PINT server may perform these functions as a proxy server or a redirect server. A proxy server makes requests to another PINT server on behalf of its clients; a redirect server returns to its client's addresses of other PINT servers to which requests can be redirected. The gateway capability includes the ability to communicate with a so-called Executive System located outside the IP network domain that will actually perform the service call requested by a PINT Client.

Additionally, this function transfers data (e.g. fax, data) between IP-networks and the IN, and associates IP-network entities with the related entities in gateway function. This function is situated at the edge of the IP-network domain where the Application Association with PINT Client/Server is subject to standardization of the IETF and where the Application Association with SCF in the IN domain is subject to standardization.

The functions related to PINT Server are:

- In case the Executive System is an IN system, the PINT Server delivers received PINT requests to the SCF. It provides the SCF with the necessary information to control service requests, identify users and authenticate data, and protect the IN from misuse or attacks from the IP-network. Furthermore, it hides the SCF/SRF from entities in the IP-network domain and acts as a mediation device between the IP-network and the IN.
- It also relays requests from an SCF to the IP-network domain to perform services (e.g. user notification).

4.1.2 Service Application Gateway Function (SA-GF)

The Service Application Gateway Function allows inter-working

- between the service control layer in Intelligent and Distributed Service Logic applications (API based functions), and
- between the Call Manager Function and Distributed Service Logic.

NOTE – Inter-working of the CCF (representing specific functionality in a VoIP environment. e.g. SIP Proxy or GK) and the SA-GF in the particular VoIP environment is not subject of IN CS-4 standardization.

For IN CS-4, on the application level, the types of API based functionality may include:

- CORBA platforms;
- JAVA platforms;
- JAIN platforms;
- Other API based platforms.

Additionally, this functionality may provide protocol mapping/service mediation.

4.1.3 Call Control Function (CCF)

CCF is an enhanced functional entity, responsible for handling call signalling on either network. The CCF communicates with the SM using Registration and admission capabilities. To support ISUP signalling, the CCF has to implement Annex C/H.246. In that case, it appears to the IN side CCF as being another CCF. This functionality includes handling the management of the call processing, and call signalling.

This entity is responsible for passing service related information to and from IN service layer, namely the SCF, and managing the service control relationship. As such, the CCF may contain an SSF-like functionality or subset thereof, to model the pre and post conditions that are required to interact with an SCF.

A call control function could be seen as a logical switch. Call control signalling (e.g. ITU-T Recs. H.225.0 and Q.931-like) and connection control signalling (ITU-T Rec. H.245) for VoIP is transferred via the RM/MM, which makes network routing decisions.

A call control function can require SCF assistance for these routing decisions, e.g. for 1-800 numbers, number portability, user profile consultation and VPN support.

The functions related to the call control function are:

- Inter-working for:
 - Number Portability;
 - Freephone Translations;
 - VPN support;
 - O.A.&M.
- General functions that need to be supported by this function:
 - Data filtering/parsing/mapping;
 - Security/Authentication;
 - Real Time data collection (billing/parsing);
 - Configuration/dimensioning.
- Flow control;
- Circuit switching and ancillary processes are removed;
- The H.323 or SIP server inter-working functions are added.

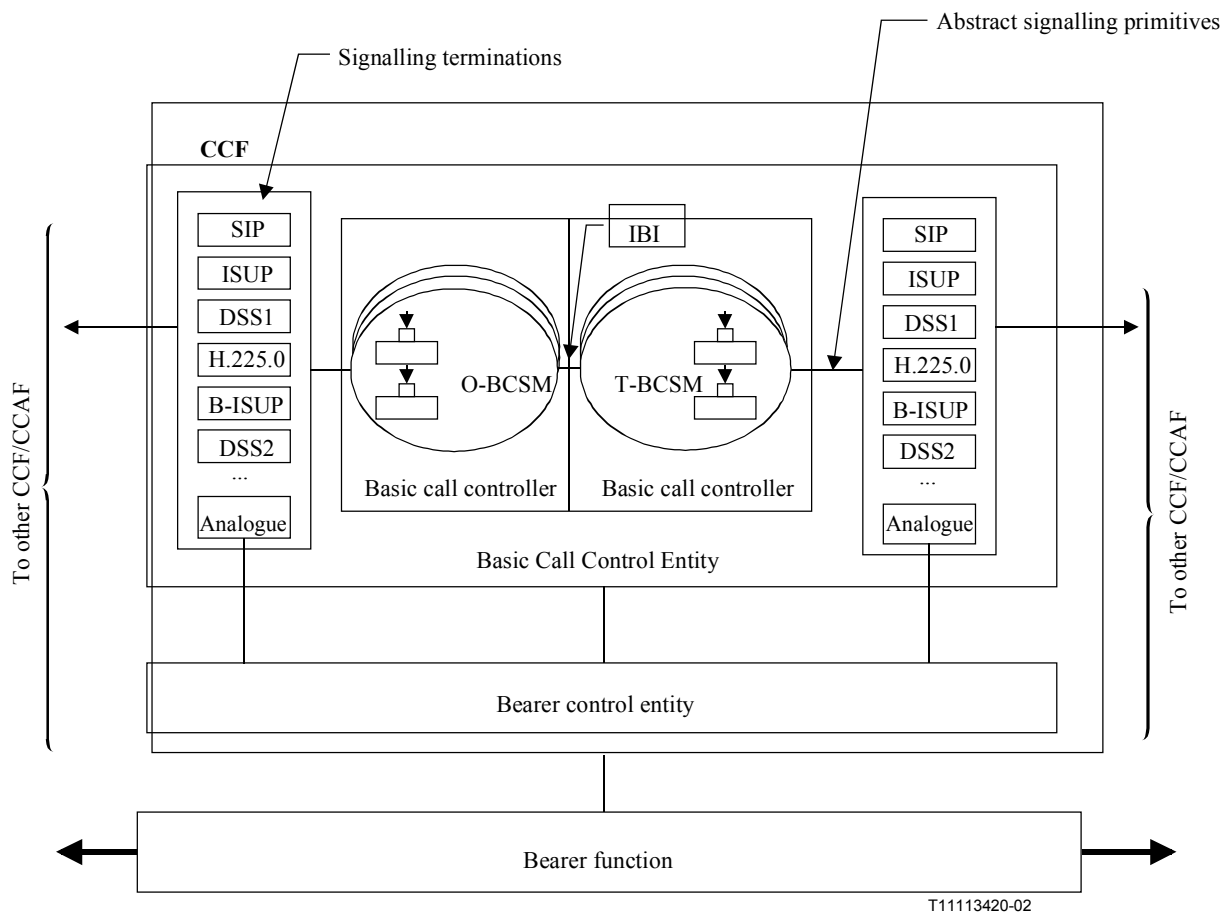


Figure 4-1/Q.1244 – CCF decomposition overview

The call control function, as shown in Figure 4-1, also contains a resource manager function analogous to the high layer resource control function in the decomposed H.323 version 4 (2000) gateway. This MGC-like function is responsible for controlling the lower layer resource control function in the decomposed H.323 version 4 (2000) gateway, commonly referred to as MG. An example of a protocol on this reference point is the H.248 Media Gateway Control Protocol. This functionality includes handling the management of the logical channels, e.g. H.245 control signalling.

The resource manager part of a call control function could be seen as a logical Bearer Control Function (BCF). When using connection control signalling (ITU-T Rec. H.245) for VoIP that is transferred via the CCF, the CCF makes network routing decisions.

It is agreed that INAP interacts with and maps to the underlying call control signalling (e.g. ITU-T Rec. Q.931, ISUP, BICC, ITU-T Rec. H.225.0 and SIP) in the SSF. The call control may invoke H.248 media and connection operations, for legs, media, packages independent of before or after the IN interaction. Where a Call Control protocol is encapsulated in an H.248 package, mapping to this package or to the embedded protocol, may also need to be specified.

NOTE 1 – Physical Location: The H.323 Gatekeeper/SIP Server and 'SSF', which is in Figures 6-1, 6-3, 6-4, 6-5 or 6-6, may be located in any network since INAP CS-4 signalling is standardized for international use. And is call control protocol independent.

NOTE 2 – Physical Realisation: From the control of VoIP viewpoint, the Service Capability Server and the H.323 Gatekeeper/SIP Server may be combined in one network entity, or may be separate in separate network entities. If they are separate, standardization of the interface may be required.

NOTE 3 – IP PDU Routing: For the routing of IP call control packets to/from the H.323 Gatekeeper/SIP Proxy Server it is simply assumed that appropriate addressing and routing takes place.

4.1.4 Session Manager (SM)

The session management function is responsible for managing the IP network services. On the IP side it exposes the Registration interface, but one cannot assume that service interactions are only based on Registration flows. The session manager may initiate activities caused by call control signalling events, in cases where session manager and call manager are collocated. The session manager shall participate in domain/zone management and call signalling.

General functions that need to be supported by this session manager:

- Service Profile Data filtering/parsing/mapping;
- Security/Authentication;
- Real-time data collection (billing/parsing) Triggering of services (in the IN domain or in the IP-network domain);
- Configuration/dimensioning;
- Flow control.

This entity is responsible for passing registration and admission related information to and from IN service layer, namely the SCF. As such, the session manager may contain a SSF-like functionality, or subset thereof, to model the pre- and post conditions that are required to interact with an SCF.

4.1.5 Service Switching Function (SSF)

The enhanced SSF interacts with the SCF (the INAP CS-4 Service Control Function (SCF)) and the CCF (The IP representation of the call control function) mapping the call control protocol into the INAP events trigger points and procedures, where applicable.

The relation of the SSF to the classical SSF is as follows:

- Many processes, such as call control, database and billing are retained or enhanced.
- Triggering of services (in the IN domain or in the IP-network domain).
- Feature Interaction Management.

The interface between the H.323 Gatekeeper/SIP Server and the SSF call control processes must:

- a) carry sufficient call data for the SSF to function correctly and to deliver the necessary information to the SCF so that service logic decisions can be made;
- b) allow the SCF (in combination with SSF and CCF Emulator) to control VoIP calls (e.g. change 'B' party address) and manipulate call information (such as presentation number).

It is proposed that the CCF to SSF interface should not, at present, be subject to standardization. However, a mapping of parameters may be required to demonstrate the mapping in the SSF to the H.323 Gatekeeper/SIP Proxy Server call control protocol, states and events thereby enabling the CCF to model either a H.323 Gatekeeper, or a SIP Proxy server.

This functional architecture is flexible enough to cover all underlying IP, media and bearer-independent call control protocols though it may be necessary to specify the specific mapping between the INAP procedures, trigger criteria and events against the procedures, conditions and call states of the underlying call control protocol. This mapping is technology dependent.

NOTE – Click-to-Dial type of services can be supported, based on IN CS-3 capabilities.

4.1.6 Specialized Resource Function (SRF)

This function has to be extended by capabilities to exchange data with gateway functions to IP-networks. Additionally, for some of the services it needs to support specialized resources with media transformation functions such as:

- Text-to-fax;
- Text-to-speech (already covered in 3.3.6.2/Q.1224 as TTS function);

- Speech-to-text;
- Fax-to-text.

4.1.7 Service Control Function (SCF)

Extensions or are *for further study*.

4.1.8 Service Data Function (SDF)

For some services there may be a need for the SCF to access a database type of entity with service-related information to be shared between the IN and the IP-network. For example, this may be the case for Internet dial-up access and Internet call waiting where the association between a PSTN number and an IP-address needs to be obtained.

Therefore, the following functionality needs to be added to the SDF description:

"SDF contains data pertaining to modem usage/available factor for Internet dial-up access."

4.2 Functional interfaces

The following interfaces are to be considered (Figure 4-2):

- IF1: PINT Server-to-Service Control Function interface;
- IF2: PINT Server-to-SRF interface;
- IF4: SCF-to-SRF interface;
- IF5: CCF-to-CCF interface;
- IF7: Service Control Function-to-SSF interface;
- IF8: SCF-to-Service Application Gateway Function interface;
- IF9: Service Application Gateway Function-to-GF for distributed service logic platforms interface.

There is a need for an interface between the service control in the IN, and the call control for VoIP, within the IP network to extend IN-based services in the IP-network domain.

4.2.1 IF1: PINT Server-to-Service Control Function (SCF) interface

This interface is used to trigger the SCF with service requests, to allow the SCF to instruct the collection of information necessary to execute the service (identity, charging and authenticity information), and to control the gateway during service execution.

The SCF should be able to send service or modification requests to the IP-network, possibly via the SC-GF, if used.

For example, for the Internet Call Waiting service, the SCF needs to notify the Internet user of an incoming call. IF1 should then allow the SCF to request Internet services.

This interface will relay requests either from the IN or the IP-network. This interface is modelling the information relay. The information transfer on this interface is specified in the SIP PINT extensions in [19].

The IETF PINT working group has developed a set of protocol extensions set based on the Session Initiation and Session Description Protocols (SIP and SDPs). The architectural configuration envisaged is that end users will make service requests. These requests will be marshalled and converted into SIP/SDP messages by a dedicated PINT client that will be sent to an optional PINT Server. The PINT Server will further relay the service requests to the service control function. From the perspective of the IP-network requesting user, this PINT Gateway with its connected executive system is responsible for processing and executing their service feature request; any entities (such as the IN entities) are "hidden" behind this PINT server function, and their operation is transparent to the IP-network users.

4.2.2 IF2: PINT server-to-SRF interface

This interface may not require standardization as it will be a data stream to e.g. the SRF text conversion function. IF2 is used to establish a data connection and to exchange data between the SRF and the PINT server (on request of the SCF). Data is to be exchanged if the respective service requires not only to control the PSTN/IN, but also to transfer data between the GF and the PSTN. The PINT RFC specifies extensions to file transfer to illustrate the use of this interface.

4.2.3 IF4: SCF-SRF interface

This interface will require enhancements to the existing ITU-T IN Recommendations for this reference point. This interface reflects an extension of the existing SCF-SRF relationship. It is used to request the SRF by the SCF to retrieve the appropriate data from the gateway function. This may require transfer of correlation information to address the GF and the appropriate data. In addition, the SCF instructs the SRF to transform the retrieved data into other formats and to transfer this data over the PSTN/PLMN to the end user.

4.2.4 IF5: CCF-to-CCF interface

This interface reflects the requirements pertinent to the IF5 interface. This is the requirement to carry an ISDN control plane signalling protocol for Multimedia services. This interface relays the IP Multimedia user plane received from the CCF (Call Control Function). This interface is required for Voice over IP-based services.

This interface may require standardization but is not expected to be IN specific. Work is progressing on this in ETSI TIPHON, IETF, ITU-T BICC and Annex C/H.246.

4.2.5 IF7: SCF – SSF interface

This interface reflects the requirements pertinent to the IF7 interface. This is the requirement to carry an IN-based signalling protocol for IP and Multimedia services. This interface relays the IP Multimedia control plane triggered events to and from the SCF.

This interface may require standardization.

This interface is required to trigger and control value added services from a SIP proxy or H.323 gatekeeper function in the IP network e.g. for multimedia access from the Internet "dial-up" access.

4.2.6 IF8: SCF – Service application gateway function interface

This interface reflects the requirements pertinent to the IF9 interface. However, the possibility of physically or functionally collocating these functional entities would remove this from standardization.

4.2.7 IF9: Service control gateway function-to-GF for distributed service logic platforms interface

SA-GF to distributed service logic platforms: this interface represents standard APIs allowing an Application Service Provider to control defined capabilities offered by the underlying network via the SA-GF. The service logic execution of the application offered by the ASP typically is located in a separated domain than the SA-GF offering the API.

4.3 Explanation of Figure 4-2

The following network architecture depicts the distribution of network intelligence.

Figure 4-2 identifies the IN DFP model for IN CS-4. This diagram depicts the functional entities and relationships applicable to IN CS-4. This diagram is a subset of the generic IN DFP model described in clause 2/Q.1204. A general explanation of functional entities, relationships, and the diagram are contained in 2.1/Q.1204.

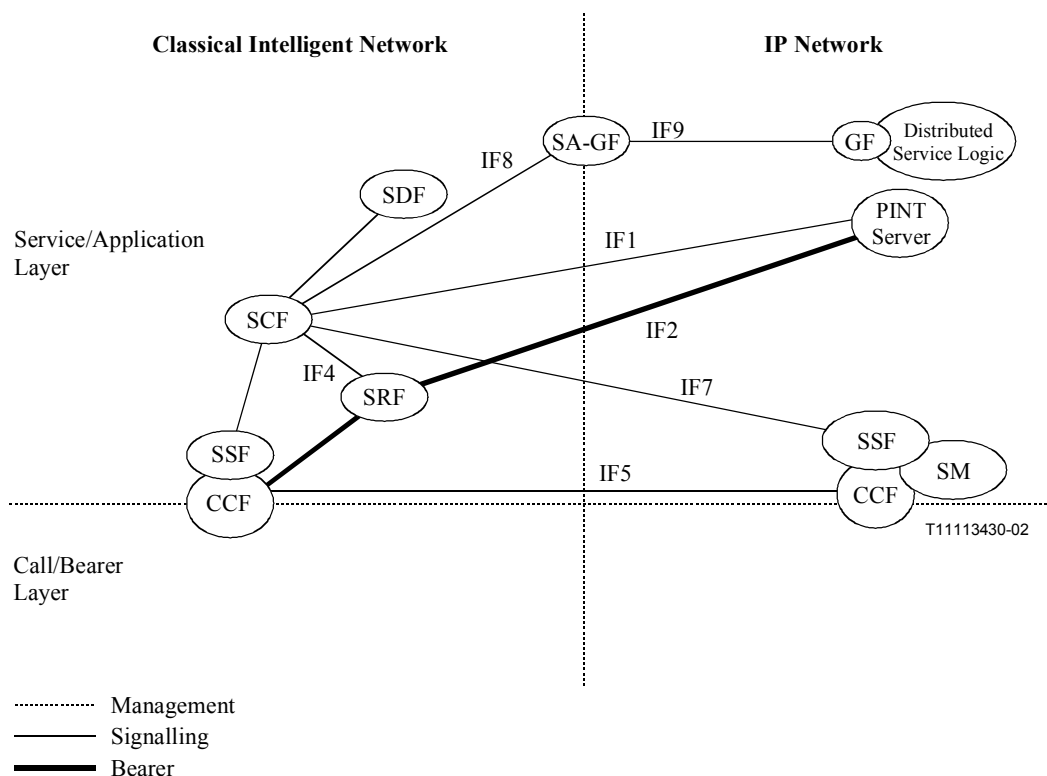


Figure 4-2/Q.1244 – Enhanced functional architecture for IN support of IP-networks

Table 1/Q.1244 – Interfaces

| Interface | Functional Entities | Protocols | Reference |
|-----------|-------------------------------------------------|------------------------------------------------|---------------------------------------------|
| IF1 | PINT Server to SC-GF | SIP(PINT) Protocol | Over (TCP)UDP/IP or Over SCCP/MTP |
| IF2 | PINT Server to SRF | FTP(PINT) Protocol | Relayed over(TCP)UDP/IP or Over SCCP/MTP |
| IF4 | SCF to SRF | INAP | Over TC/SCCP/MTP |
| IF5 | CCF to CCF | ISUP Control Plane/BICC or SIP call Control | Over MTP or SCTP/IP |
| IF7 | SCF to SSF | INAP Call or RAS related | Over TC/SCTP/IP or Over TC/SCCP/MTP |
| IF8 | SCF to SA-GF | Service Provider Application API | Over TC/SCCP/MTP |
| IF9 | SA-GF to GF for Distributed Service Logic | Service Provider Application API | Over TC/SCTP/IP |

NOTE 1 – That this architecture can be deployed entirely within an ISDN/PSTN or IP network or a combination of both.

NOTE 2 – The SRF is independent of the classical IN or IP Domain; it may be located on either side of the functional architecture. Its location will impact the protocol stack used to control this entity.

NOTE 3 – IF5: is illustrated since it indicates Call Control across this reference point. These Call Control requirements are required as they give rise to the Call States which result in the IN triggering conditions.

4.4 Lower layer protocol gateway and mapping functions

The following lower layer protocol gateways and mapping functions may be required depending on the protocol Architectures employed in each domain. If required, these functions will be implemented at the CSN/IP domain boundary.

4.4.1 Service Control Gateway Function (SC-GF)

The Service Control Gateway Function allows the inter-working between the service control layer in Intelligent Network and IP-networks. For IN CS-4 on the service control level, the relations between the IN and the following entities in the IP-network are supported:

- This is a layer 2 mapping and addressing function.
- The SCF will be able to select one or more appropriate SSF/SIP Proxies/H.323 GKs dependent on different parameters (class of service requested by the user, placement of gateways, tariff, etc.). The SC-GF will be able to perform correct lower layer protocol and address translation functions.
- The SC-GF will allow inter-working with several SSF/SIP Proxies/H.323 GK (Gatekeepers).
- PINT Server.
- SIP Proxy.
- H.323 GateKeeper Function.
- others are for further study.

4.4.2 Signalling Gateway Function (S-GF)

The Service Control Gateway Function allows the inter-working between the Call control signalling in the ISDN and IP-networks. This functional entity is optional, as it need not be required in all implementations. The following cases may be supported:

- This is a layer 2 mapping and addressing function.
- The S-GF will be able to perform correct lower layer protocol and address translation functions.
- The S-GF will be able to re-map between ISUP over SCCP/MTP and ISUP over SCTP/IP.
- The S-GF will allow inter-working with several SSF/SIP Proxies/H.323 GK/H.248 MGCs:
 - SIP Proxy;
 - H.323 Gatekeeper Function;
 - H.248 MGC functions;
- Other functions are for further study.

5 Functional Relationships and Interfaces

This clause describes the relationships between various Functional Entities identified earlier and Control Classes in IN CS-4.

5.1 Functional relationships and control classes

Five groups of control capabilities, called control classes, have been identified to support the functional relationships:

- 1) Bearer Connection Control: the class of capabilities to establish, and clear the bearer connections (e.g. voice paths through the network), and provide surveillance.

- 2) Non-IN Call Control: the class of capabilities to invoke the user and provide an end-to-end control required for the non-IN delivery of supplementary services. The non-IN delivery does not involve the structured separation of the CCF, SSF, and SCF.
- 3) IN Service-Control: the class of capabilities that involve the structured separation of the SSF from SCF.
- 4) Service Management Control: the classes of capabilities that involve service deployment, service provisioning, service operation control, and service monitoring.
- 5) Non-IN Call Unrelated Control: the class of capabilities to establish, provide monitoring, and clear a non-bearer connection (e.g. out-channel interaction via the DSS1 D-channel without a bearer connection).

Figure 5-1 depicts the classes of control capabilities required for the functional relationships. The following clauses further describe the control relationships for each control class, respectively. A control relationship is the relationship between a functional relationship and a control class.

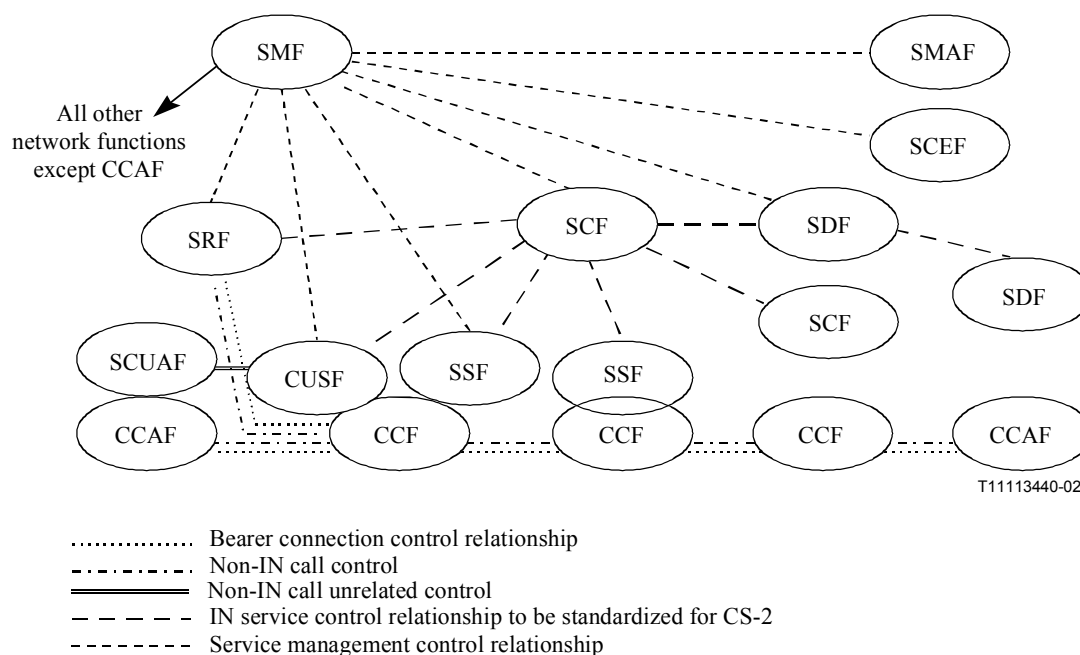


Figure 5-1/Q.1244 – Functional relationships and control classes for IN CS-4

5.1.1 Bearer connection control

Control relationships exist between the bearer connection control class and the CCAF-CCF, CCF-CCF, and CCF-SRF functional relationships, respectively. Standard interfaces are employed to realize these control relationships and are listed below by the involved functional relationships:

- CCAF-CCF: DSS1/Q.931
- CCF-CCF: SS7/ISUP
- CCF-SRF: DSS1/Q.931; SS7/ISUP

5.1.2 Non-IN Call Control

Control relationships exist between the non-IN call control class and the CCAF-CCF, CCF-CCF, and CCF-SRF functional relationships, respectively. Standard interfaces are employed to realize these control relationships and are listed below by the involved functional relationships:

- CCAF-CCF: DSS1/Q.932;
- CCF-CCF: SS7/ISUP;
- CCF-SRF: DSS1/Q.932; SS7/ISUP.

5.1.3 IN service control

Control relationships exist between the IN service control class and the SCF-CUSF, SCF-SCF, SCF-SDF, SCF-SRF, SCF-SSF, and SDF-SDF functional relationships, respectively. They can be realized through SS7/TCAP/INAP.

5.1.4 Service management control

Control relationships exist between the service management control class and the SMF-CUSF, SMF-SCF, SMF-SCEF, SMF-SDF, SMF-SMAF, SMF-SRF, and SMF-SSF functional relationships, respectively. They can be realized through CMIP/Q.812. No modification to INAP (i.e. ITU-T Q.1228) is foreseen for management aspects. In addition, no modification to the IN Physical Plane (i.e. ITU-T Q.1225) is foreseen; namely, no additional Physical Entities (PEs) are required assuming basic PEs exists for management aspects.

5.1.5 Non-IN call unrelated control

Control relationships exist between the non-IN call unrelated control class and the CCAF-CCF, CCF-CCF, and CCF-SRF functional relationships, respectively. Standard interfaces are employed to realize these control relationships and are listed below by the involved functional relationships:

- CCAF-CCF: DSS1/Q.931
- CCF-CCF: SS7/ISUP
- CCF-SRF: DSS1/Q.931; SS7/ISUP

5.2 Control Architecture Principles

As stated in 4.2/Q.1241 (Basic Features), the service scope of IN CS-4 includes multi-point of control services. The scope is however still restricted to single-ended services. This clause identifies principles for the control architecture of IN CS-4, in the context of this service scope.

This clause is organized around three control aspects:

- service invocation and control;
- end-user interaction with and without the SRF;
- feature interaction; and
- service management.

5.2.1 Service invocation and control

This control aspect involves the MGC, Gatekeeper, CCF, SSF and SCF.

As in IN CS-1, IN CS-2 and IN CS-3 the following key principles remain in force for IN CS-4:

- 1) The CCF, MGC and Gatekeeper retain ultimate responsibility for integrity and control of the local connection at all times.
- 2) The SSF to SCF relationship is, by definition, service-independent. Therefore the CCF (or MGC) and SSF should never contain service logic specific to IN CS-2 supported services.

- 3) In the event of SCF malfunction, or time-out in the SCF to SSF response, the SSF/CCF (or MGC/Gatekeeper) combination should be capable of reverting to a default 'call completion' sequence, with appropriate announcement(s) to the calling and/or called party.
- 4) The SSF should never have to interact with more than one SCF at any given time in order to complete a sequence of query/response interactions on behalf of a calling or called party.
- 5) Call hand-offs (transfer of responsibility) between SCFs, and between SSFs are permitted in IN CS-3. However, the hand-off must be explicit, and must not violate principle 4.

5.2.2 End-user interactions

As part of the process of formulating a response to the SSF, the SCF may need to enter into a dialogue with the calling or called party. This would take the form of a prompt and collection sequence with the aid of an SRF, or the form of call-unrelated/out-channel call-related interactions, which are consistent with IN CS-2.

Again, the following key principles apply, when the SRF is being used in IN CS-4:

- 1) The SCF has full IN-supported service control of instruction formulation and sequencing with respect to the SRF and SSF.
- 2) As a corollary to principle 1, there shall be no direct service control interaction between the SSF and SRF for IN CS-4-based services. The SSF and SRF have a peer-peer relationship for the control of IN CS-4-based services, and both are subsidiary to the SCF.
- 3) The SCF will require the capability of suspending processing of an IN CS-4 based service on behalf of a calling or called party, and then resuming on behalf of the same party at a later time.

5.2.3 Feature interactions

As in IN CS-1, the constraints placed on the IN CS-4 architecture have been put in place primarily to minimise and control feature interactions within single domains of responsibility.

The single-endedness of IN CS-4 based services means that all aspects of a call are under the control of one CCF/SSF and one SCF at any point in time. The SCF and SSF are therefore responsible for the handling of interactions between IN CS-4 based SSF/CCF capabilities, and non-IN features already provided in the basic network.

5.2.4 Service management

The control aspects covered in 5.2.1 and 5.2.2 address the real-time interactions between IN CS-4 functions on behalf of a particular calling or called party. In contrast, the service management aspect primarily addresses the network operator's interaction with the SSF, SCF, SDF, and SRF. This interaction normally takes place outside the context of a particular call or service invocation.

However, IN CS-2 must neither preclude nor constrain the capability of service customers to interact directly with customer-specific service management information (e.g. a personal service profile).

The following points capture key principles for IN CS-4:

- 1) The SMF may be used to add, change or delete IN CS-4-based service-related information or resources in the SSF/CCF, CUSF, SCF, SDF, and SRF. Such changes should not interfere with IN CS-4-based service invocations or calls that are already in progress.
- 2) The SMAF may be used to add, change, or delete appropriate customer-specific information. The mechanism and safeguards that are put into place by the network operator for this interaction may take advantage of IN CS-2 functions and capabilities.
- 3) Service providers who introduce new services may use the SCEF. The task of deploying the service is the role of the SMF and is initiated from within the SMF.

5.3 Internetworking

Internetworking is the process in which several networks (potentially of different types, such as IN-structured, non-IN-structured, public and private) co-operate to provide a service. The need for internetworking capabilities results from the fact that customers may want to access services that span multiple networks. A typical situation is when the data needed by a service (e.g. UPT, VPN and Global Network Services) reside in a network that is different from the one in which the call has originated.

IN CS-4 identifies the SCF-SCF, SCF-SDF, SCF-IAF, SDF-SDF and SMF-SMF relationships for internetworking purposes. Distributed service logic, but not distributed service control, is supported. Additionally, inter-network management interactions and distributed data handling processes are supported.

5.3.1 Internetworking between IN-structured networks

General requirements for internetworking capabilities are presented in 2.2.6/Q.1201.

Although the involved networks may have different access types (e.g. PSTN and ISDN), as well as different levels of IN structure, IN CS-4 internetworking services are to be provided to customers in a consistent way, regardless of such differences.

Similar to Figure 7-1/Q.1231, which depicts the functional relationships between the IN functions within one network, Figure 5-2 depicts possible functional relationships between the IN functions that are located in two different networks.

The following observations can be made concerning the applicability of Figure 5-2 to IN CS-4:

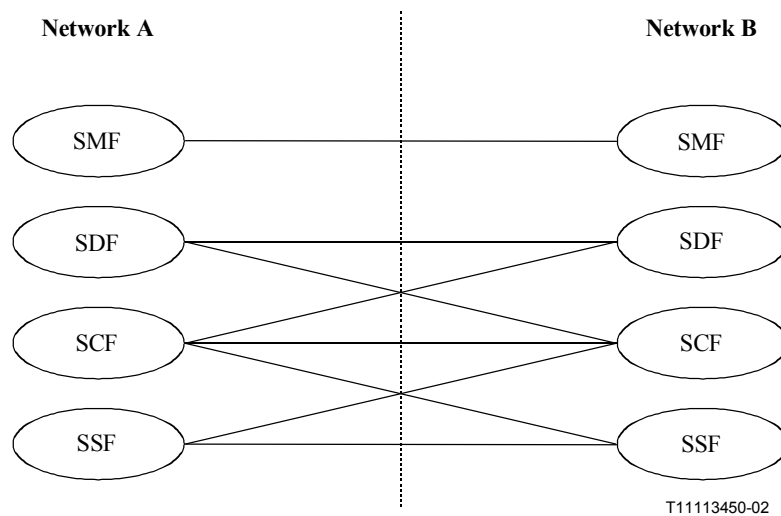


Figure 5-2/Q.1244 – Possible IN network inter-working functional relationships

5.3.2 Internetworking with non-IN-structured networks

The previous clause defines the internetworking relationships for two networks, both of which have a structure compatible with the IN functional architecture. For IN CS-4, the Intelligent Access Function (IAF) provides access between the SCF of an IN-structured network and an entity of a non-IN-structured network. This latter entity may be other networks or customers (e.g. private networks, simple databases used, for instance, in the Customer Call Routing service, terminals, and PABXs). It

- a) provides access to and from the SCF of the IN-structured network; and
- b) maps the information between the internal and external representation.

As such, for each subscriber's incoming call, information (for instance, dialled number, calling number, and caller entered digits) may be conveyed, for example, from a public network to a private one, for the latter to determine how that call will be handled. A private network is defined as a network that provides services only to a specific set of users.

Similar to Figure 5-2, which depicts possible functional relationships between the IN functions that are located in two different IN-structured networks, Figure 5-3, depicts a possible functional relationship between the SCF located in an IN-structured network and the IAF located in a non-IN-structured network.

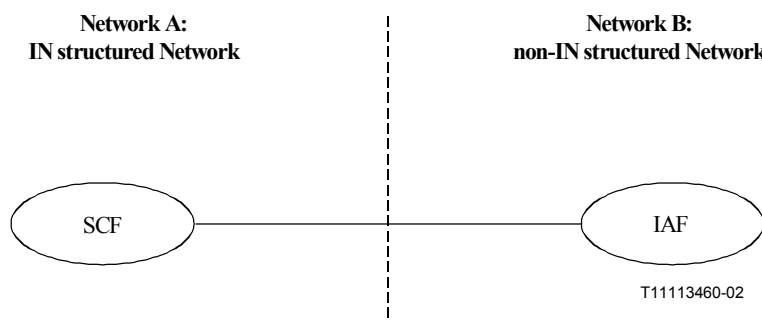


Figure 5-3/Q.1244 – IN to non-IN network inter-working functional relationship

5.3.3 Security

Security is a general property which relates to safe and reliable operation. The high level requirements of a secure system are:

- Confidentiality, which is defined in ITU-T X.800 as " the avoidance of the disclosure of information without the permission of its owner ". Thus, confidentiality may be considered as a property which ensures that conversations or interactions remain private.
- Integrity, which is defined in ITU-T X.800 as " the property that data has not been altered or destroyed in an unauthorized manner ". Integrity may then be considered as a property which ensures that operations occur as they are expected to.
- Availability, which may be considered as a property relating to the readiness of resources for authorized use.
- Accountability, which may be considered as a property which ensures that any operational request can be correctly attributed in case of doubt or dispute.

The components of an IN system must be assembled and operated in such a way as to provide a defined level of security.

To assist in this, any interface within the IN functional architecture may have the need to apply security assisting functions to the information flows passing across the interface such as:

- Network access security functions: This includes user/terminal authentication (i.e. the result of a process by which a service user proves his or her identity to an IN system), user profile verification (i.e. the verification that a user is authorized to use a functionality).
- Internetworking security functions: This includes peer entity authentication (i.e. a process which allows a communicating entity to prove its identity to another entity in the network), signalling data or TMN data integrity, non-repudiation, confidentiality, entity profile verification (i.e. the verification that an entity is authorized to use a functionality).

ITU-T Q.1228 defines a generic set of security mechanisms and procedures to offer some of the generic properties described above. In any particular circumstance, a set of network elements will be required to be configured according to some security scheme.

The definition of IN CS-2 offers the provision of certain security assisting functions at the SCF-SDF, SDF-SDF, and SCF-SCF interfaces. Additional security functions may be required depending on the security schemes in place.

5.3.4 Screening

Screening refers to the ability to filter the messages and the contents of the messages sent and/or received across the internetworking interfaces. The high level screening requirements are:

- INAP protocol screening, which ensures the control per inter-network relationship of the signalling capabilities and the handling of INAP operations, parameters and parameter contents.
- INAP Application Context screening, which ensures the control per inter-network relationship of the Application Context of the INAP capability set.

ITU-T Q.1248 defines screening requirements for internetworking interfaces. The definition of IN CS-4 offers the provision of certain screening functions at the SCF-SCF interface. Additional functions may be required depending on the security and screening schemes in place.

6 IN/IP implementation scenarios

6.1 IN/IP inter-working for IN CS-4 to support SIP systems

To provide a better understanding of the applicable SIP-based call control network architecture, the SIP-based call control functional entities are introduced, which may be contained within SIP entities as defined in the standard. This is an attempt to accommodate the new concept of a decomposed SIP Call Control Proxy, defined in ITU-T H.248, and the applicable bearer control Configurations, which may utilise bearer control protocols from BICC or H.245, as required from various protocol related studies.

The functional names have been chosen with the intent of minimising confusion. They do not intend to imply a specific implementation.

6.1.1 The SIP architecture

The SIP architecture has 5 functional elements defined in [16], [17], [18]:

6.1.1.1 user agent client: The user agent client is the functional entity that may initiate a SIP request.

6.1.1.2 user agent server: The user agent server is the functional entity that may initiate a SIP response.

6.1.1.3 proxy server: This functional element is functionally similar to the user agent server, except it is not expected to retain significant call control state. In essence, the proxy server is comprised of both a SIP client and a SIP server.

6.1.1.4 redirect server: The redirect server is not responsible for call control but will simply respond to SIP requests with a new address.

6.1.1.5 registrar server: The registrar server simply responds to registrar requests. Typically this is collocated with either the proxy or the redirect server, and may be adapted to perform location-based services.

6.1.2 SIP state call models

In SIP-based systems, a SIP proxy with call control intelligence is defined. This intelligence will enable nominated SIP proxies to retain significant call control state. This will enable standards to be developed to synchronize the SIP Call State model with the IN Basic Call State model as defined in ITU-T Q.1224, Q.1237 and Q.1238. In essence, the proxy server is comprised of both a SIP client

and a SIP server. It is required to analyse which BCSM states have meaning in a SIP-based service context, and how bearer and multimedia support can be added to both this SIP call model, and understood in the extension of the IN call control model.

6.1.3 Functional model

Figure 6-1 shows the functional model involving IN and SIP inter-working. As indicated above, possible groupings in Intelligent SIP Proxy are depicted.

NOTE – The single Intelligent SIP Proxy as modelled in these figures can in fact represent several different physical instances in the network, for example, with one Intelligent SIP Proxy in charge of the terminal or access network/domain, and another in charge of the interface to the Switched Circuit Network.

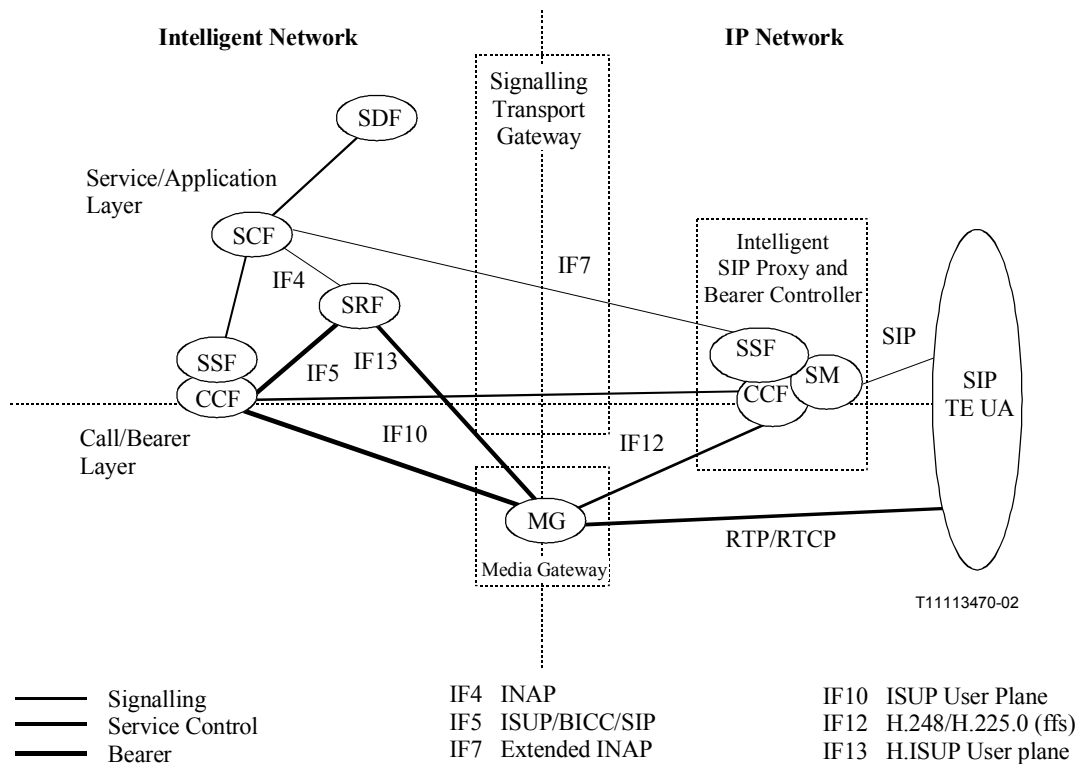


Figure 6-1/Q.1244 – A SIP-based call control configuration using an intelligent SIP proxy and bearer control function

6.1.4 Requirements for IN-interaction with SIP-based systems

Functional requirements for the IN Interaction with SIP-based systems are listed below:

- Currently, there is a lack of requirements showing the need to support the Registration, Call Control, Media Control (e.g. H.248) and H.245 Bearer Control, this must be addressed.
- It is considered vital to address the required service features and functional network capabilities for the support of inter-working at the various proposed functional entities.

Functional requirements for the IN Interaction with SIP-based systems are listed below (initial list for further study):

- Relationship of SSF and CCF to the new functional entities introduced in ITU-T Q.1244 (Distributed Functional Plane for IN CS-4) to decompose the SIP Proxy (i.e. Call Control Function (CCF)).
- Mapping of SIP Registration and Call Signalling messages to INAP operations.

- Exact set of SIP Registration functionality which needs to be visible to IN (i.e. need to be monitored or manipulated), if any. This includes the considerations on the kind of modelling required.
- Possible Separation of the SSF/CCF into different physical entities.
- The use of multiple SSFs, where one SSF may model the SIP Registration protocols and another SSF model the SIP Call Control procedures, requires consideration. These SSFs may be physically distributed.
- The configuration of trigger conditions in the SSF, use of manage trigger data from an SCP in IN domain.
- The same CCF/SSF triggering mechanism applies to processing SIP based IN-based call. SSF is located at Intelligent SIP Proxy to interact with SCP in IN domain.
- Mapping of the SM to the SSF (like IN FE) and mapping the CCF to the CCF.
- For a GW originated IN-based call, the SIP registration server and the SSF may be distributed in different Intelligent SIP Proxy entities. In this case, dynamic DP arming should be supported at MGC under the control of Intelligent SIP Proxy SM.
- The Definition of State Driven Events in the SIP Registration and SIP Call Control Protocols in their relationship to the SM/CM functions. How these states map into the current IN BCSM models; all require consideration.
- The SCF will be able to select one or more appropriate SSF/Intelligent SIP Proxies dependant on different parameters (class of service requested by the user, placement of gateways, tariff, etc.). The SC-GF will be able to perform correct lower-layer protocol and address translation functions.
- The SC-GF will allow inter-working with several SSF/Intelligent SIP Proxies.

User Interaction requirements for the IN Interaction with SIP Based systems are listed below (initial list for further study):

- Intelligent SIP Proxy enhancements for user interaction (e.g. does it provide control of speech path connection and information on tones and announcements).
- Handling of SRF functionality and necessary enhancements of H.248 to support this in case SRF functionality shall be provided as part of the Media Gateway.
- The user interaction with SIP User Agent at the terminal may be realised through a SIP Registration interface. The user interaction with PSTN user is realised using MGC relay mode. The information exchange path is Intelligent SIP Proxy to GW interface SIP Registration and H.248 respectively. SRF functionality resides in GW and is controlled by H.248.
- The SIP Registration interface may be modified to support user interaction information exchange. A SIP Registration interface between Intelligent SIP Proxy and SIP terminal could be upgraded to support call-unrelated user access service.
- User interaction using http is shown in Annex K/H.246, or by using the payload capabilities of SIP Call Control in SDP, these options for UI need consideration.

Initial working assumptions:

- In order to fully extend the IN based value-added services, it is recommended to use the Monolithic Intelligent SIP Proxy as shown in the example above.
- User interaction capability with SIP terminal is required. It may be realized by different options, e.g. by enhanced SIP Registration or by an enhanced SIP Call Control protocol.

6.1.5 SIP assumptions architecture and implementation issues

6.1.5.1 SIP-IN interaction

This clause provides information flows that illustrate the possible interaction of INAP CS-4 and SIP. In particular, it provides a proposal for the triggering of INAP CS-4 services as well as a mapping between the CS-4 call states and the call states of the Session Initiation Protocol (SIP).

An overall objective is to demonstrate that CS-4 control of VoIP services in networks can be readily specified and implemented by adapting standards and software used in the present networks. This approach leads to services that function in the same way when a user connects to present or future networks, simplifies service evolution from present to future, and leads to more rapid implementation. This clause investigates the possibility of INAP CS-4 service control based on the SIP proxy Server approach. This means that a locally configured proxy server is required for outgoing calls that require legacy service support based on existing INAP CS-4 services.

This clause is organized as follows: 6.1.5.2 briefly describes the concepts for IN service triggering based on INAP CS-3 Subscription Information and 6.1.5.3 briefly describes the assumptions made for IN service triggering. I.6.1 describes a registration process, I.6.2 deals with the detail of triggering services for Originated Calls, I.6.3 deals with the details for triggering Terminated calls. Figure 6-2 specifies the IP/IN proposed architecture based on the IETF IP architecture.

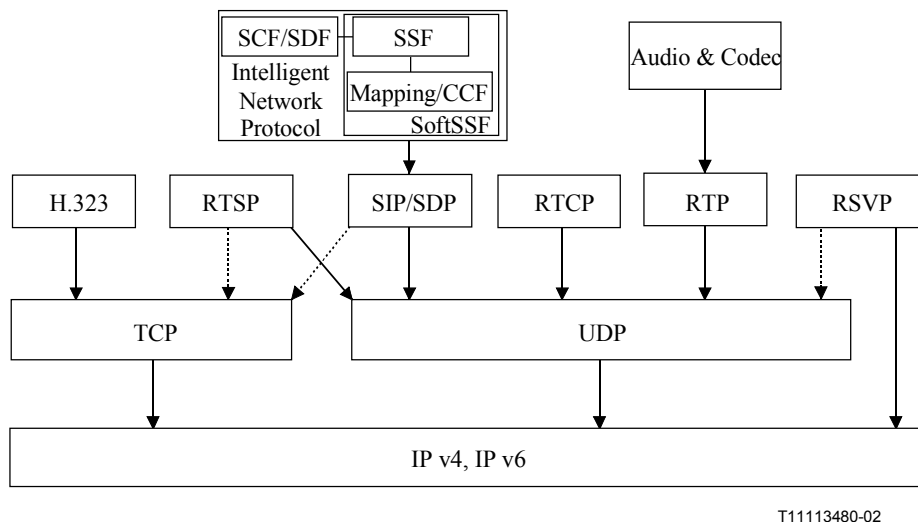


Figure 6-2/Q.1244 – IETF IP/IN proposed architecture

6.1.5.2 Basic concept of the proposal

The process of how to handle the registration process needs further study in conjunction with the API methods presently standardized, and the mapping to the SIP/SDP procedures and extensions.

Subscribers may register in the SIP network allowing the subscriber to receive incoming calls. A subscriber may use an additional identifier (e.g. MSISDN) in the registration process. Upon registration with the server, the subscription information for the subscriber is sent to the SSF by the SDF in the subscriber's home network. As incoming calls made to the subscriber terminate at the server the subscriber is registered with, the Terminating Subscription Information may be examined and, if necessary, the SCF may be invoked on a per incoming call basis. Similarly, calls made by a subscriber already registered with a proxy server, allow the Originating subscription information to be examined and potentially allow the SCF to be invoked. Callers not registered will not have any subscription information in the proxy server they are using to place the call. The proposal here is as follows: when the initial call request message (or the *INVITE* method) is received by the SIP proxy server, the SSF establishes a dialogue with the SDF of the home subscribers network to allow the

subscription information to be sent. The Originating subscription data may then be examined and, if necessary, the SCF may be invoked.

6.1.5.3 Assumptions

- a) All the call flows show that the SIP Proxy Server and the SSF have been collocated in order to avoid showing information flowing between the two entities. Standardization of the messages for this interface is for further study.
- b) Originating and terminating SIP Proxy servers must operate in a call-state aware mode.
- c) As registration with a SIP Proxy server is not mandatory, it shall be possible to determine whether a registration exists for that particular subscriber when a subscriber places an incoming call. This allows the subscriber data information to be fetched from the home SDF if the subscriber is not registered.

NOTE – The absence of the originating subscriber data does not necessarily mean that the user is not registered, merely that the originating subscriber data may not exist for that subscriber.

- d) The information flows make no consideration for inter-working with other networks (e.g. PSTN via gateways).

6.2 IN/IP inter-working for IN CS-4 to support H.323 systems

H.323 functional decomposition introduced new functional entities, these entities are mapped into these reference scenarios, within H.323 entities, as defined in the Recommendation. This is an attempt to accommodate the new concept of a decomposed gateway, defined in ITU-T H.248, and the applicable network configurations supporting the two call models of ITU-T H.323.

6.2.1 H.323 Call routing models

The location of the different functional entities in physical entities depends on the routing model used. In ITU-T H.323 two models exist, the so-called Gatekeeper-routed call (GRC) model, and the so-called Direct-routed call (DRC) model.

6.2.1.1 Gatekeeper-routed call (GRC) model

In addition to RAS, the terminals or gateways exchange call control signalling via the Gatekeeper, which acts as a signalling proxy. The Gatekeeper may alter the signalling information.

6.2.1.2 Direct-routed call (DRC) model

The terminals and gateways exchange Call Control signalling (ITU-T H.225.0 and H.245) directly with each other. Interaction between terminal/gateway and Gatekeeper is only via RAS signalling. This scenario is no longer considered in this Recommendation as it provides very limited ability for the Intelligent network to Control or Monitor Calls.

6.2.2 Functional model

Figures 6-3 and 6-4 show the functional model involving IN and H.323 inter-working. As indicated above, possible groupings in MGC and GK for the GRC are depicted. Decomposed gateways, as well as monolithic examples, are used.

NOTE – The single GK as modelled in these figures can, in fact, represent several different physical instances in the network; for example, with one GK in charge of the terminal or access network/zone, and another in charge of the interface to the Switched Circuit Network.

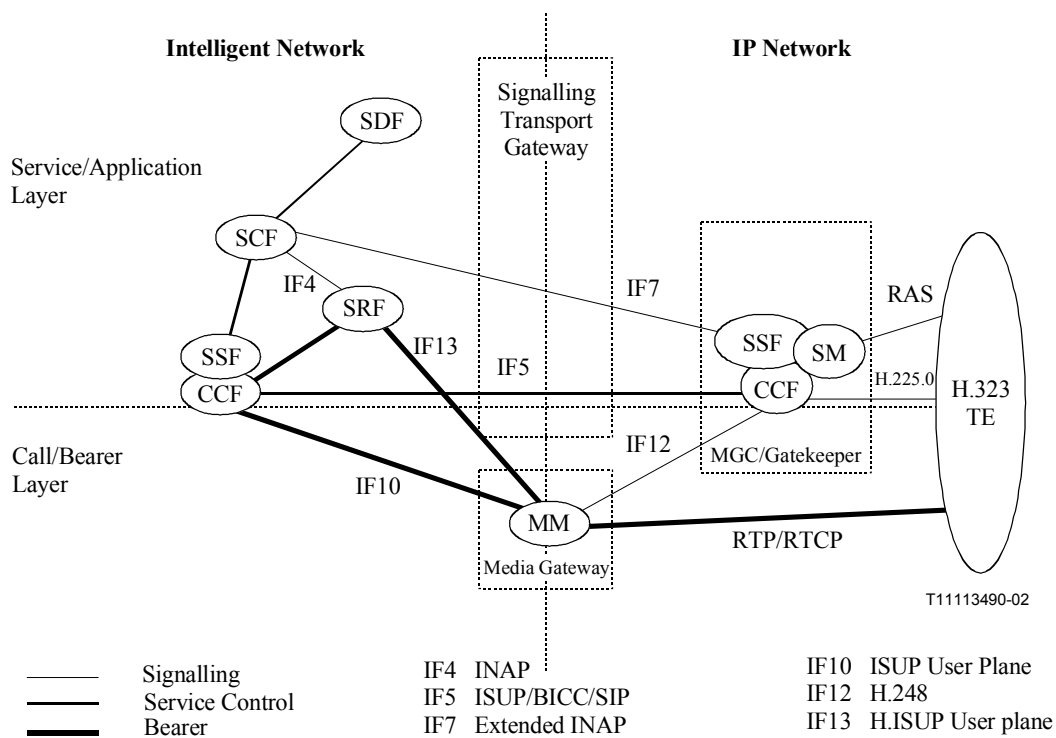


Figure 6-3/Q.1244 – A GRC configuration using a monolithic gateway

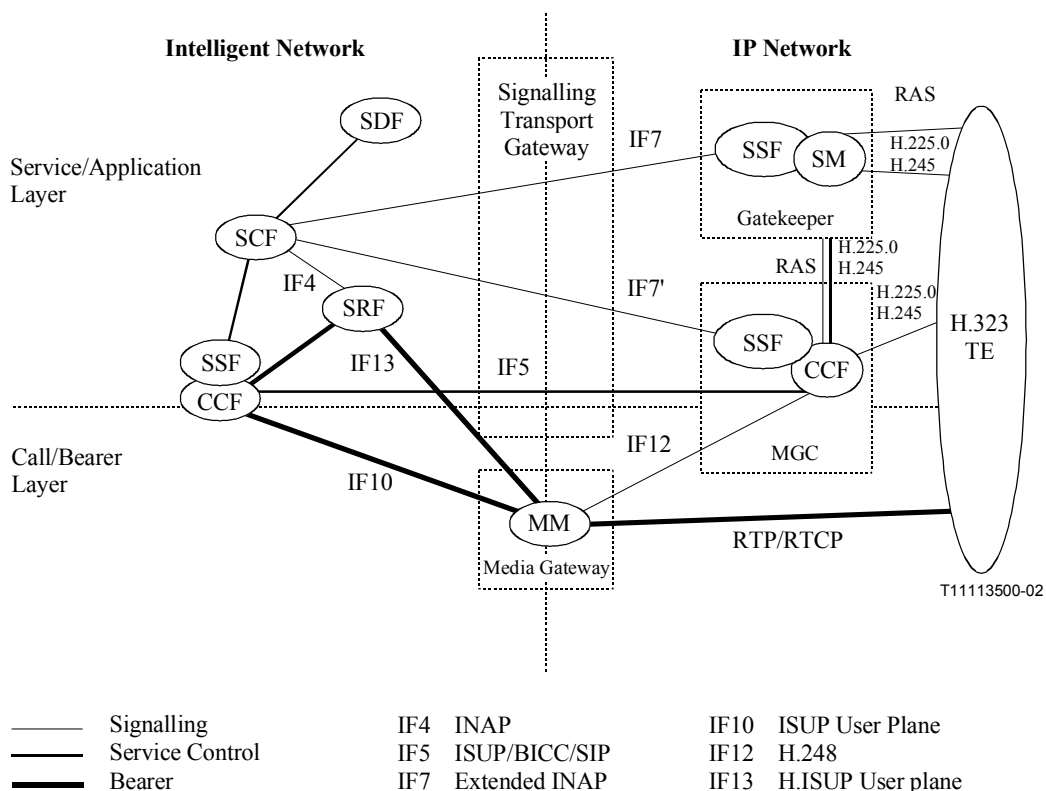


Figure 6-4/Q.1244 – A GRC configuration using MGC at the edge of the IP network

NOTE – According to H.323, the RAS and Call Control functionality may be separated into a Gatekeeper for Gatekeeper routed call control. The Media Gateway control part of the CCF is shown as a separate MGC.

6.2.3 Requirements for IN-interaction with H.323 systems

Functional requirements for the IN interaction with H.323 systems are listed below:

- Currently, there is a lack of requirements showing the need to support the Protocols, RAS, H.225.0 Call Control and H.245 Bearer Control, this must be addressed.
- It is considered vital to address the required service features and functional network capabilities for the support of inter-working at the various proposed functional entities and the states required.

Functional requirements for the IN Interaction with H.323 systems are listed below:

- Relationship of SSF and CCF to the new functional entities introduced in ITU-T Q.1244 (Distributed Functional Plane for IN CS-4) to decompose the Gatekeeper and Media Gateway Controller (i.e. Call Control Function (CCF)).
- Different functional interactions between CCFs, depending on the various scenarios of an H.323 call (i.e. GRC scenario, DRC scenario).
- Mapping of H.225.0 RAS and Call signalling messages to INAP operations.
- Exact set of RAS functionality which needs to be visible to IN (i.e. need to be monitored or manipulated), if any. This includes the considerations on the kind of modelling required.
- Possible Separation of the SSF/CCF into different physical entities.
- The use of multiple SSFs, where one SSF may model the RAS protocols and another SSF model the Call Control procedures requires consideration. These SSFs may be physically distributed.
- The configuration of trigger conditions in the SSF, use of manage trigger data from a SCP in IN domain.
- The same CCF/SSF triggering mechanism applies to processing an H.323 IN-based call. SSF is located at Gatekeeper to interact with SCP in IN domain. CCF may be located in Gatekeeper or MGC, depending on whether GRC or DRC mode is used.
- Mapping of the SSF and CCF functions in the CCF for RAS purposes.
- For GW originated IN-based call, SSF and CCF will be distributed in different entities if DRC mode is used. In this case, dynamic DP arming should be supported at MGC under the control of Gatekeeper CCF.
- The Definition of State Driven Events in the RAS and Call Control Protocols in ITU-T H.225.0, and their relationship to the CM Function. The Distribution of these "State Machines" between physical entities GK/MGC requires consideration. How these states map into the current IN BCSM models; all require consideration.
- The SCF will be able to select one or more appropriate SSF/H.323 Gatekeepers dependent on different parameters (class of service requested by the user, placement of gateways, tariff, etc.). The Signalling Gateway Function will be able to perform correct lower layer protocol and address translation functions.
- The Signalling Gateway Function will allow inter-working with several SSF/H.323 GK (Gatekeepers).

User Interaction requirements for the IN Interaction with H.323 systems are listed below (initial list for further study):

- GK-MGC interface enhancements for user interaction (e.g. does it provide control of speech path connection and information on tones and announcements).
- Handling of SRF functionality and necessary enhancements of H.248 to support this in case SRF functionality shall be provided as part of the Media Gateway.

- The user interaction with H.323 terminal may be realised through RAS interface. The user interaction with PSTN user is realised using MGC relay mode. The information exchange path is GK-MGC-GW with interface RAS and MGCP respectively. SRF functionality resides in GW and is controlled by H.248.
- RAS interface may be modified to support user interaction information exchange. A RAS interface between a GK and H.323 terminal could be upgraded to support call-unrelated user access service.
- User interaction using http is shown in Annex K/H.246, or by using the payload capabilities of Call Control in ITU-T H.225.0, these options for UI need consideration.

Initial working assumptions:

- In order to fully extend the IN based value-added services, it is recommended to use the Gatekeeper Routed Call (GRC) scenario. That is DRC Direct Routed calls are not considered for IN interaction.
- For an H.323 terminal-originated IN-based call, only basic IN service features (i.e. those triggered by access code) can be provided, if DRC mode is used.
- User interaction capability with an H.323 terminal is required. It may be realized by different options, e.g. by enhanced RAS or by an enhanced Call Control H.225.0 protocol.

6.2.4 H.323/SIP differences and implementation issues

6.2.4.1 Call Control

A call requires three crucial pieces of information, namely, the logical destination address, the media transport address and the media description.

- Logical Destination address (A): This is the SIP address in the To header or the destination alias address in the Q.931 SET UP message.
- Media Description (M): In SIP, M is the list of supported payload types as given by SDP media description ("m=") line. In ITU-T H.245, M is given by the Terminal Capability Set.
- Media Transport Address (T): The media transport address indicates the IP address and port number at which RTP/RTCP packets can be received. This information is available in the "c=" and the "m=" lines of SDP and the Open Logical Channel message of ITU-T H.245.

The difference between SIP and H.323 is that A, M, and T are all contained in the SIP INVITE message, while H.323 may spread this information among several messages.

In ITU-T H.323v4 (2000) two call establishments are possible: namely, with and without Fast Connect.

With H.323v4 (2000) FastConnect, the protocol translation is simplified because there is a one-to-one mapping between H.323 and SIP call establishment messages. Both the H.323 SET UP message with FastConnect and the SIP INVITE request have all three components (A, M and T).

6.2.4.2 Architecture and assumptions for IN interaction with H.323 call control

6.2.4.2.1 Introduction

This clause provides information flows that illustrate simple Originating and Terminating calls with INAP CS-3 interactions.

6.2.4.2.2 Assumptions

- a) The call flows presented are based on using the H.323 protocol between the ISDN Gateway/endpoint and the Gatekeeper.
- b) The gatekeeper and the SSF have been collocated in order to avoid showing information flowing between the two entities.
- c) The information flows make consideration for inter-working with PSTN/ISDN media gateways.

6.3 IN/IP inter-working for IN CS-4 to support PINT-based services

From IETF documents ([16], and [19]), there are a number of entities that can interact using the PINT IP protocol. These are a Proxy, a Redirect Server, a Registrar, an (end) User Agent Server, and, specific to PINT, a "pure" Client, a Gateway, and (potentially) a Notification Receiver. Of these entities, all are completely within the IP network, with the exception of the PINT Gateway, which exists at the edge of the IP network.

NOTE 1 – The PINT Gateway is a PINT Server which has the ability to deliver a PINT request received from the IP network to a "Executive System" located in the PSTN and to deliver PINT responses received from the "Executive System" to the IP network respectively.

As described in [19], the PINT Gateway terminates the message flows with the other IP network-based entities. It also communicates with the IN Service Control Function, presenting an abstraction of this to the IP network-based entities as an "Executive System". It transfers data objects (or "content") from the IP network along with requests, and returns responses to the IP network-based requesting PINT Clients. As such, it acts as a mediation device between the IP-network and the Intelligent Network; the PINT Gateway Function is required in all PINT service transactions.

There are a number of different configurations possible with this collection of entities, two of which are shown in Figures 6-5 and 6-6. The first configuration (Figure 6-5) has a Client sending a request to an intervening Server that routes the request to an appropriate PINT Gateway. The second (Figure 6-6) shows the simplest configuration possible, in which a PINT Client makes a request of a PINT Gateway (i.e. with no other entities involved on the IP-network).

NOTE 2 – In this case, no prior PINT Server (e.g. Proxy, Redirect Server) within the IP-network is used; only a PINT Client.

The SIP/SDP(PINT) protocols/service profiles are carried from IF1 and mapped over ISDN lower layer protocols SCCP and MTP, possibly including TC. SCCP routing can also be used to route control messages to the SCF, using the IP address by translating it to a SCCP SPC or GT. It may also route content-based messages to the SRF utilising the IP address, by translating it to an appropriate SCCP SPC or GT.

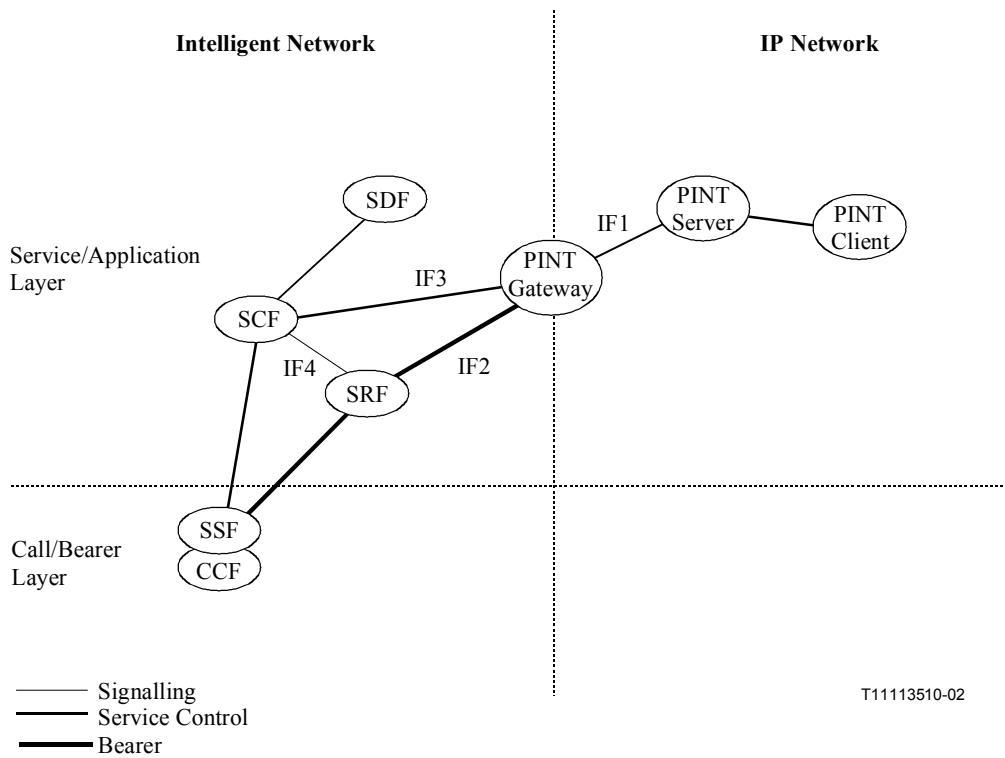


Figure 6-5/Q.1244 – PINT example configuration Case 1

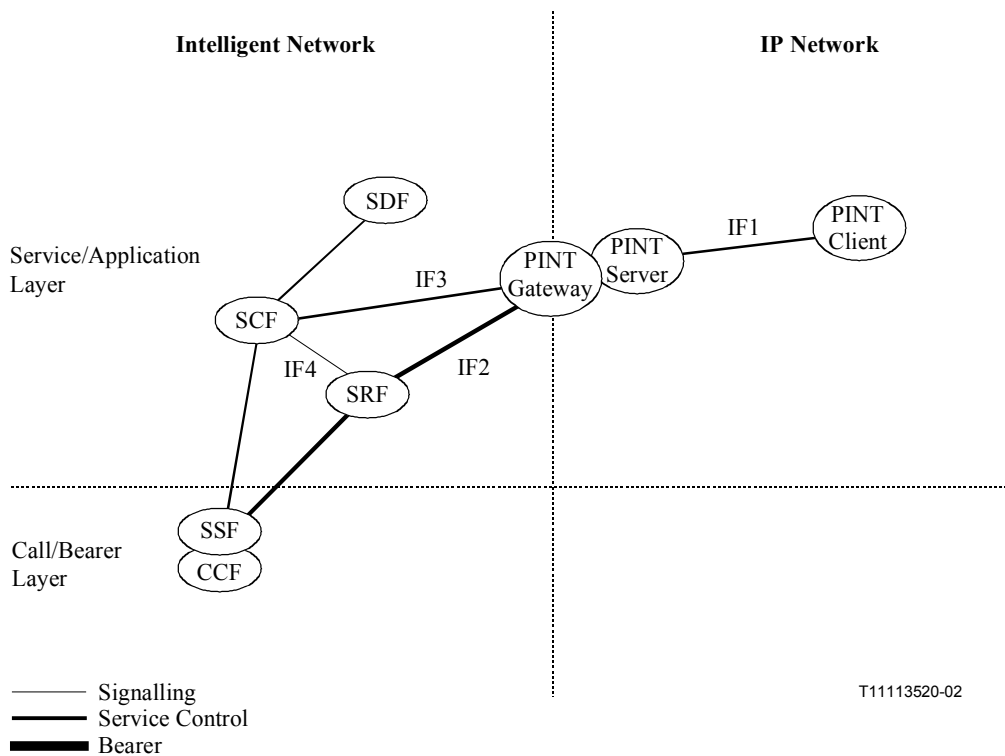


Figure 6-6/Q.1244 – PINT example configuration Case 2

An integral part of the PINT service protocol is the Managed Information Base (MIB). The associated MIB defines the parameters that can be monitored on the user or PINT client or PINT Gateway basis for security or performance purposes. It is under development in the IETF PINT Working Group.

6.4 IN/IP inter-working for IN CS-4 to support SPIRITS-based services

The SPIRITS Architecture [26] supports services originating in the PSTN and necessitating interactions between the PSTN and an IP network. To support these services (e.g. Internet Call Waiting, Internet Caller-ID Delivery, and Internet Call Forwarding), the following functional elements are introduced:

- SPIRITS Client, which is responsible for receiving PSTN requests from the SCF as well as sending responses back. It may be collocated with the SCF. If not, it communicates with the SCF over the IF15 interface.
- SPIRITS Proxy, which serves as an intermediary between the SPIRITS Server and SPIRITS Client and may be collocated with the PINT Gateway. It communicates with the SPIRITS Server over the IF17 interface and the SPIRITS Client over the IF16 interface.
- SPIRITS Server, which terminates PSTN requests and is responsible for all interactions (e.g. incoming call notification and relaying the call treatment) between the subscriber and the SPIRITS proxy.

Figure 6-7 depicts an inter-working configuration that involves these function elements. Specifically, the following interfaces are required:

- IF17 – This interface serves two main purposes:
 - 1) to notify the subscriber of incoming calls together with the calling number and name, if available; and
 - 2) to send to the SPIRITS Proxy the subscriber's choice of call disposition specified in real-time.
- IF16 – This interface is used for communications between the SPIRITS Client and SPIRITS Proxy. The SPIRITS Proxy may, in turn, communicate with the SPIRITS Server, or may act as a virtual server, terminating the requests without sending them down to the SPIRITS Server.
- IF15 – This interface is for communications between the SPIRITS Client and the SCF. Specifically, from the SCF to the SPIRITS Client, the parameters associated with the applicable IN triggers are sent. From the SPIRITS Client to SCF, the subscriber's call disposition is sent. The SCF "transforms" the user's disposition into appropriate actions, such as playing an announcement to the caller, and resuming the suspended call processing in the SSP.

It is important to note that the subscriber activates a SPIRITS service by an act of service registration for a later session, which can take place anytime after he (or she) is connected to an IP network (such as the Internet). The subscriber may specify the life span of the session. As soon as the session ends, the SPIRITS service is deactivated. Naturally, the subscriber should also be able to deactivate a SPIRITS service anytime during the service session. Service registration and Service deregistration are supported by PINT capabilities and PINT-related functional elements. See Figure 6-7 below.

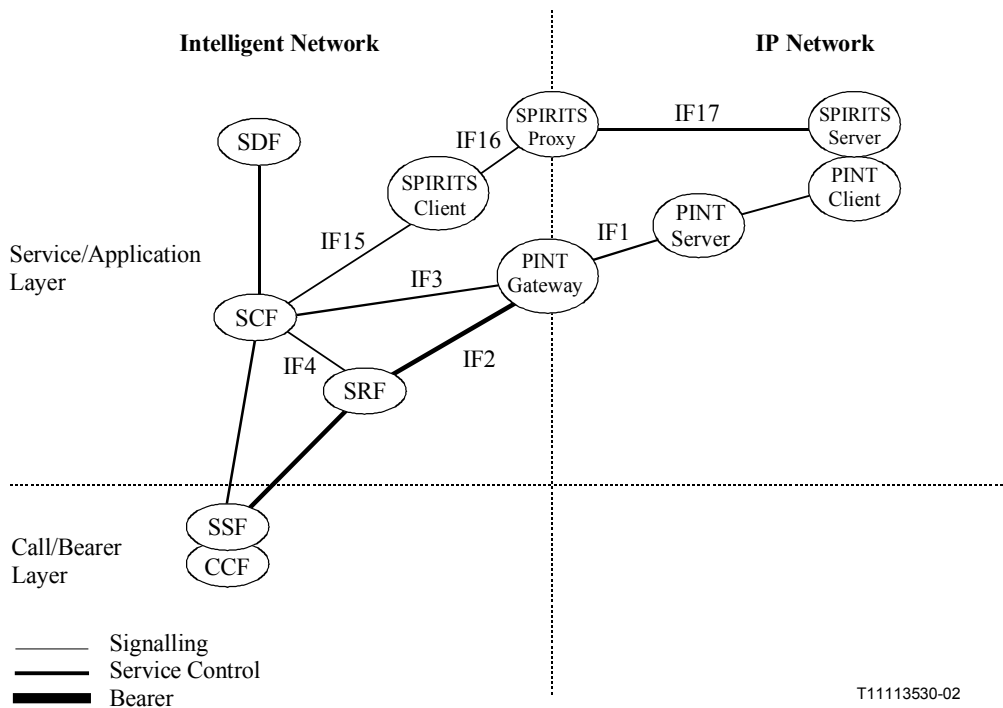


Figure 6-7/Q.1244 – SPIRITS example configuration

6.5 Support for distributed service logic servers in IN CS-4

6.5.1 SA-GF implementation

The SCF to SA-GF interface (IF8) is provided to allow access to distributed service logic via an API. As such, the "distributed service logic" may be resident within one Network Operators domain, or may be provided by a 3rd party such as a Service Provider. Either way, the SA-GF will provide the necessary firewall/security functions to protect both the IN network provider and the 3rd party service logic provider and any protocol mapping functionality deemed necessary. This is represented in Case 1 of Figure 6-8.

From an implementation point of view, the SA-GF functionality may be collocated with the SCF and a peer entity providing the necessary firewall capability collocated with the Distributed Service Logic. In this case, IF8 would be absorbed by the SCF. This is shown in Case 2 of Figure 6-8.

In Case 3, it is shown how IF9 can be used to provide access to Distributed Service Logic entities from Call Control Functions like, for example, a gatekeeper or a SIP proxy server.

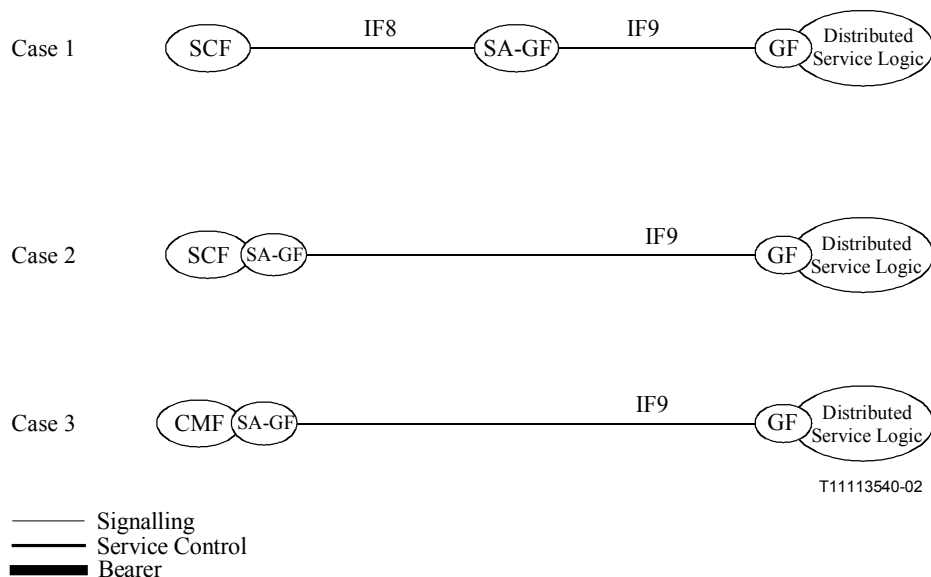


Figure 6-8/Q.1244 – SA-GF implementation cases

IF8: SCF to SA-GF interface: This interface reflects the requirements pertinent to the IF9 interface. However, the possibility of physically or functionally collocating these functional entities would remove this from standardization.

IF9: SA-GF to distributed service logic platforms: this interface represents standard APIs allowing an Application Service Provider to control defined capabilities offered by the underlying network via the SA-GF. The service logic execution of the application offered by the ASP typically is located in a separated domain then the SA-GF offering the API.

SA-GF: The Service Application Gateway Function allows either:

- inter-working between the Service Control layer in the Intelligent Network and the Distributed Service Logic;
- inter-working between the Call Control Function and Distributed Service Logic.

NOTE 1 – Inter-working of the CCF (representing specific functionality in a VoIP environment, e.g. SIP Proxy or GK) and the SA-GF in the particular VoIP environment is not subject of IN CS-4 standardization.

For IN CS-4 on the application level, the types of API based functionality may include, CORBA, JAVA, JAIN technologies or other API based platforms. Additionally this functionality may provide protocol mapping/service mediation.

GF: The Gateway function will provide firewall/security functions necessary for the distributed service logic platform.

Given the Interface between the "API for accessing Service Provider Applications" and the IP call control, the following network architecture depicts the distribution of network intelligence.

NOTE 2 – This architecture can be deployed entirely within an ISDN/PSTN or IP network or a combination of both.

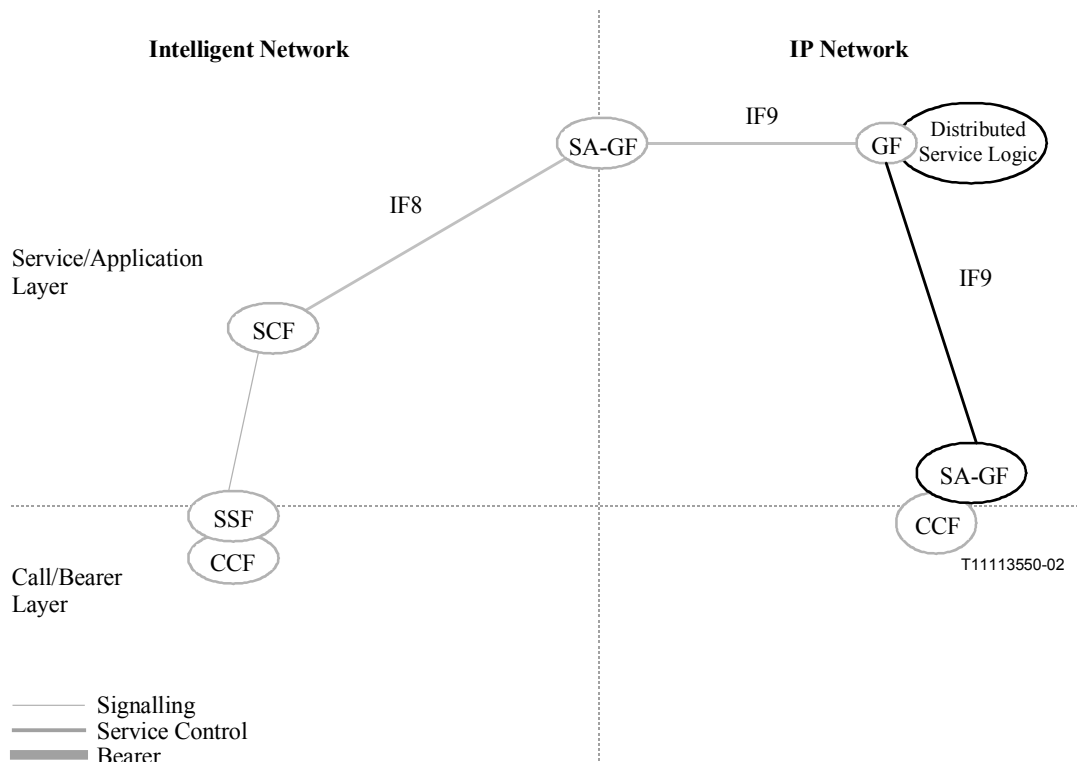


Figure 6-9/Q.1244 – SA-GF implementation Case 2

6.5.2 API Open Service Access (OSA)

The scope of this work is to consider the interface specification of an API: Open Service Access (OSA) for accessing Service Provider Applications. UML notation has been utilised for this purpose. The process by which this task is accomplished is through the use of Object modelling techniques described in the Unified Modelling Language (UML). UML is a combined tool and methodology that results in a comprehensive set of specifications representing, in this case, an interface between client and server applications. Further information can be found in the latest version of ITU-T Q.65.

This Recommendation captures the basic outline for the specification of an API for Open Service Access (OSA) to applications. At present, there are two different API specifications being developed, the first is designed for use within a mobile environment (access to applications within a Virtual Home Environment). This can be found in [22] and [23]. The other concerns a more general API whose design has not been limited to any one particular environment, as is the case in [22] and [23]. This specification can be found in [15]. The API specification within [15] contains the following parts:

Class diagrams

This part provides explanations of the classes involved and recommends how each individual class should be packaged to illustrate the structure and relationships of the services of the API specification. It addresses the framework and the following services: Generic call control, multi-party call control, multimedia call control, conference call control, mobility, messaging, generic and call user interaction, terminal capabilities and data session control.

Interface Descriptions

This subject is split into two parts:

- The first considers the Interface Class descriptions, both Service and Framework;
- The second considers State Transition diagrams pertinent to the Interfaces concerned.

Interface Data Definitions

This part details each of the Data definitions defined in the Methods associated with the Interface Classes.

Sequence Diagrams

This part provides example use of the API services, through the use of sequence diagrams, to illustrate typical sequences with which the application programmer may have to comply, that can be derived using version 1 of the API.

Architecture under consideration

The interface under consideration can be found represented by IF8 and IF9 in Figure 4-2.

A detailed text highlighting the Requirements for the above API can be found in [24] and [25].

6.6 IN/IP inter-working to support IN CS-4 signalling transport functionality

The SCF to SC-GF interface (IF3) is provided to allow access to Service Control functionality via an IP-based network. The SC-GF will provide the necessary firewall/security functions to protect both the IN SS#7 signalling network and the IP-based protocol network. The main functions of this gateway are to provide inter-technology firewall functionality and lower layer protocol adaptation. That is, mapping from an IP based lower layer protocol (e.g. SCTP/UDP/IP) to an SS#7 based lower layer protocol (e.g. SCCP/MTP). The inter-technology firewall functionality may be intra-network or inter-network provider. In the case of Inter-network firewall functionality, the availability of security functions in this entity is critical. This is represented in Case 1 of Figure 6-10 below.

From an implementation point of view, the SC-GF functionality may be collocated with the SCF in the IN domain, or an IP server in the IP domain. In this case, IF3 would be incorporated into the SCF. This is shown in Case 2 of Figure 6-10 below:

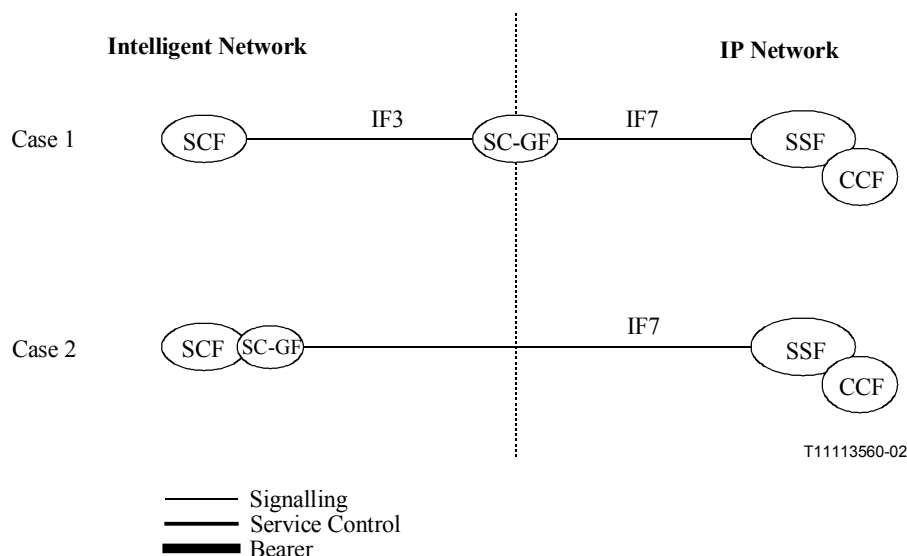


Figure 6-10/Q.1244 – SC-GF implementation cases

IF3 SCF to SC-GF interface: This interface reflects the requirements pertinent to the TC Application Part interface (e.g. INAP) carried over an SCCP/MTP transport interface. However, the possibility of physically collocating these functional entities would remove the exposure of this transport layer.

IF7 SC-GF to H.323 Gatekeeper: distributed service logic platforms: This interface reflects the requirements pertinent to the TC Application Part interface (e.g. INAP) carried over a TCP/IP or SCTP/UDP/IP transport interface. However, the possibility of physically collocating these functional entities would remove the exposure of this transport layer.

SC-GF: The Service Application Gateway Function allows interoperability between the Service Control function in the Intelligent Network and the H.323 Gatekeeper in the IP domain. For IN CS-3, the standard allowed the SSP to SCP INAP TC interface to be transported over TCP/IP or UDP/IP. These options depended on the services and guarantees provided by the IP network architecture that is used to transport the signalling. This case was not specified but not precluded in IN CS-1.

- The SCF will be able to select one or more appropriate SSF/CCF dependent on different parameters (class of service requested by the user, placement of gateways, tariff, etc.). The SC-GF will be able to perform correct lower layer protocol and address translation functions.
- The SC-GF will allow inter-working with several SSFs/CCFs.

GF: The basic Gateway function will provide firewall/security functions necessary for policing and screening of the transport, transaction capabilities and the application protocol.

6.7 ISDN/IP inter-working to support signalling transport functionality

The CCF to S-GF interface (IF5) is provided to allow access to Call Control functionality via an IP based network. The S-GF will provide the necessary firewall/security functions to protect both the IN SS#7 signalling network and the IP based protocol network. The main functions of this gateway are to provide inter-technology firewall functionality and lower layer protocol adaptation. That is, mapping from an IP-based lower layer protocol (e.g. SCTP/UDP/IP) to an SS#7-based lower layer protocol (e.g. SCCP/MTP). Inter-technology Call control signalling translation may also be required in certain circumstances. The inter-technology firewall functionality may be intra-network or inter-network provider. In the case of Inter-network firewall functionality, the availability of security functions in this entity is critical. This is represented in Case 1 of Figure 6-11 below.

From an implementation point of view, the S-GF functionality may be collocated with the CCF in the ISDN domain, or an IP server in the IP domain. In this case, IF5 would be incorporated into the CCF. This is shown in Case 2 of Figure 6-11:

- SCF addressing;
- Service Key information;
- Default handling of error cases (e.g. call release).

The VHE related information within the user profile is transferred between the HLR and VLR environment by means of the Mobility Management protocol operations. Typical scenarios when this profile is inter-exchanged are:

- Roaming into a new area (e.g. location registration/update);
- Changed subscriber data and triggered information, etc.

Another aspect of VHE is the retrieval of information on the mobile subscriber during the service logic execution. This information is inter-exchanged between the HLR and the SCF and/or VLR and SCF. Four mechanisms need to be supported:

- Interrogation of user/service related information;
- Modification of service related information;
- Notification of user status or location information;
- Notification when the user's service profile has been changed.

Annex A

Composite Functional Architecture

The complete functional model proposed is an extension of the IN CS-3 functional model incorporating media and bearer functions (see Figure A.1). It is intended to support IN CS-4 benchmark services, Internet-based service customization, and termination of Voice over IP to reach users in the telephone domain, as well as general IN capabilities.

A.1 Functional entities to support IN CS-4 benchmark features

The option to have minimal support for accessing IN from H.323 Gatekeepers and SIP/SDP proxy redirection servers for implementing services that require explicit handling of the call configuration is an agreed working assumption for IN CS-4, and is considered below:

For inclusion in the Core INAP CS-4, the following minimum capabilities are considered:

- redirection services;
- charging: the charging operations defined in ETSI [21] need to be restricted for H.323 and the exact definition of the control of the CDR's will be standardized.
- number translation services, including the storage of related information (time of day), for example, portability and 800-based services.

Triggering criteria can only be based on, e.g. E.164 addresses in INAP CS-3 and, therefore, the limitation on the alias Address has to be indicated, or extension proposed.

For the H.323 architecture, the translation of alias addresses to IP transport addresses is to be performed by the gatekeeper. The gatekeeper will also map the specific H.323 parameters to the INAP parameters. Mapping analysis is therefore requested, and specific information must be identified. It is proposed that the information should not be sent in a container: e.g. Mapping of the cause values will be as specified in ITU-T H.225.0 for the Q.850 causes values.

The IN infrastructure shall be independent of the IP telephony signalling protocol (e.g. SIP, H.323).

The following new functional entities are required:

- PINT Server;
- Service Application Gateway Function (SA-GF);
- Call Control Function (CCF);
- Service Switching Function (SSF);
- Dial Access Gateway Function (D/A GF);
- Media Gateway (MG).

Necessary extensions to existing functional entities are required; these include:

- Specialized Resource Function (SRF);
- Service Control Function (SCF);
- Service Data Function (SDF);
- Service Switching Function (SSF);
- Call Control Function (CCF).

The following lower layer protocol gateways and mapping functions may be required, depending on the protocol Architectures employed in each domain:

- Signalling Gateway Function (S-GF);
- Service Control Gateway Function (SC-GF).

A.1.1 PINT Server

A PINT server accepts PINT requests from PINT clients. It processes the requests and returns responses to the clients. A PINT server may perform these functions as a proxy server or a redirect server. A proxy server makes requests to another PINT server on behalf of its clients; a redirect server returns addresses of other PINT servers to which requests can be redirected, to its client's. The gateway capability includes the ability to communicate with a so-called Executive System located outside the IP network domain, that will actually perform the service call requested by a PINT Client.

Additionally, this function transfers data (e.g. fax data) between IP-networks and the IN, and associates IP-network entities with the related entities in a gateway function. This function is situated at the edge of the IP-network domain where the Application Association with PINT Client/Server is subject to standardization by the IETF PINT work group, and where the Application Association with SCF in the IN domain is subject to standardization by Working Party 4 of ITU-T Study Group 11.

The functions related to PINT Server are:

- In case the Executive System is an IN system, the PINT Server delivers received PINT requests to the SCF. It provides the SCF with the necessary information to control service requests, identify users and authenticate data, and protect the IN from misuse or attacks from the IP-network. Furthermore, it hides the SCF/SRF from entities in the IP-network domain and acts as a mediation device between the IP-network and the IN.
- It also relays requests from an SCF to the IP-network domain to perform services (e.g. user notification).

A.1.2 Service Application Gateway Function (SA-GF)

The Service Application Gateway Function allows inter-working:

- between the service control layer in Intelligent and Distributed Service Logic applications (API based functions);
- between the Call Control Function and Distributed Service Logic.

NOTE – Inter-working of the CCF (representing specific functionality in a VoIP environment. e.g. SIP Proxy or GK) and the SA-GF in the particular VoIP environment, is not subject to IN CS-4 standardization.

For IN CS-4, on the application level, the types of API based functionality may include:

- CORBA platforms;
- JAVA platforms;
- JAIN platforms;
- Other API based platforms.

Additionally, this functionality may provide protocol mapping/service mediation.

A.1.3 Call Control Function (CCF)

CCF is an enhanced functional entity, responsible for handling call signalling on either network. The CCF communicates with the SM using Registration and admission capabilities. To support ISUP signalling, the CCF has to implement Annex C/H.246. In that case, it appears to the IN side CCF as being another CCF. This functionality includes handling the management of the call processing, and call signalling.

This entity is responsible for passing service-related information to and from IN service layer, namely the SCF, and managing the service control relationship. As such, the CCF may contain a SSF-like functionality or subset thereof, to model the pre- and post conditions that are required to interact with an SCF.

A Call Control function could be seen as a logical switch (CCF). Call control signalling (e.g. ITU-T H.225.0, Q.931-like) and connection control signalling (ITU-T H.245) for VoIP is transferred via the RM/MM, which makes network routing decisions.

A Call Control Function can require SCF assistance for these routing decisions, e.g. for 1-800 numbers, number portability, user profile consultation, VPN support.

The functions related to the Call Control Function are:

- Inter-working for:
 - Number Portability;
 - Freephone Translations;
 - VPN support;
 - O.A.&M.
- General functions that need to be supported by this function are:
 - Data filtering/parsing/mapping;
 - Security/Authentication;
 - Real Time data collection (billing/parsing);
 - Configuration/dimensioning.
- Flow control;
- Circuit switching and ancillary processes are removed;
- The H.323 or SIP server inter-working functions.

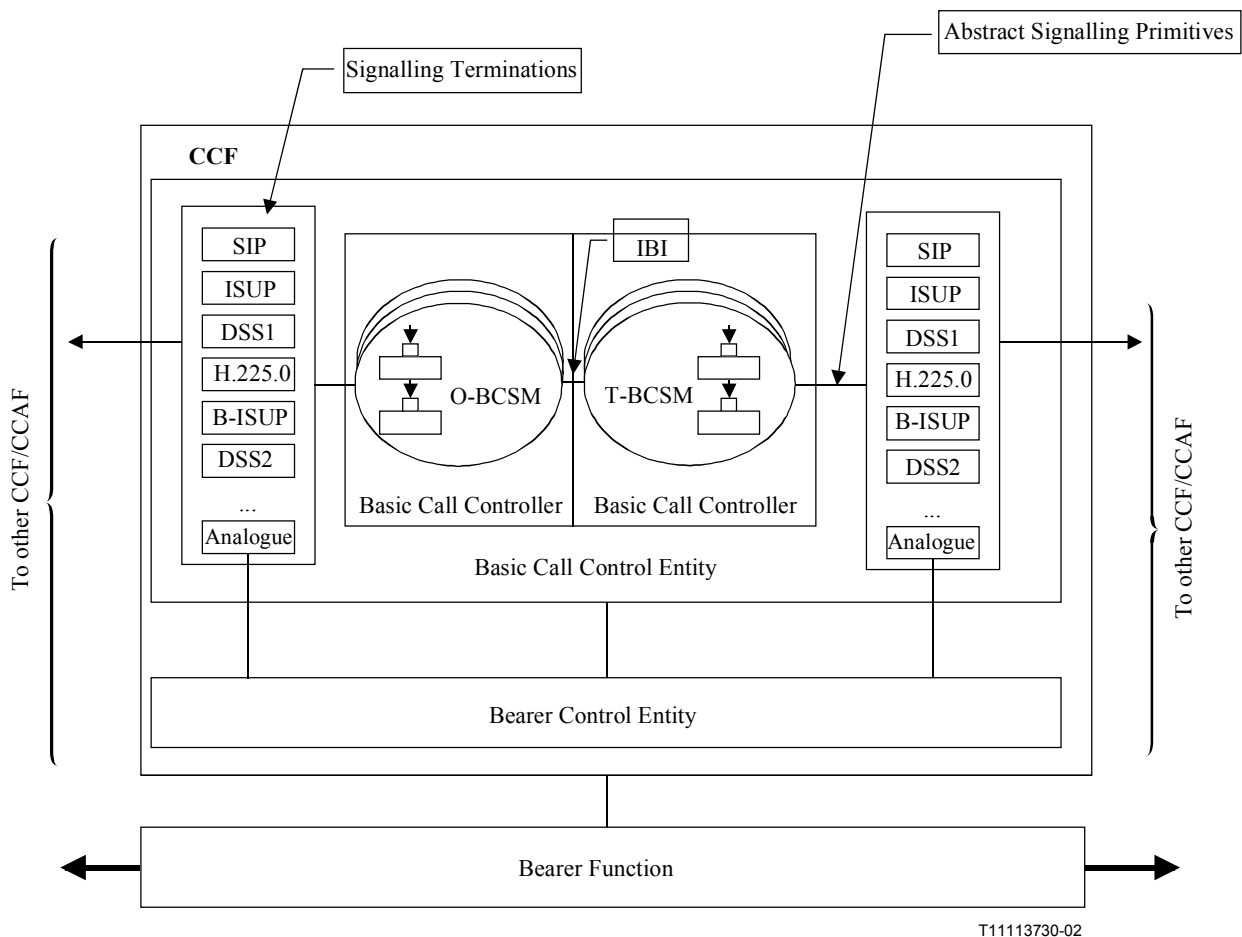


Figure A.1/Q.1244 – CCF decomposition overview

The Call Control function, shown in Figure A.1, also contains a resource manager function analogous to the high layer resource control function in the decomposed H.323 version 4 gateway. This MGC-like function is responsible for controlling the lower layer resource control function in the decomposed H.323 version 4 gateway, commonly referred to as MG. An example of a protocol on this reference point is the H.248 Media Gateway Control Protocol. This functionality includes handling the management of the logical channels, e.g. H.245 control signalling.

The resource manager part of a Call Control function could be seen as a logical Bearer Control Function (BCF). When using connection control signalling (ITU-T H.245) for VoIP that is transferred via the CCF, the CCF makes network routing decisions.

It is agreed that INAP interacts with, and maps to, the underlying call control signalling (e.g. ITU-T Q.931, ISUP, BICC, ITU-T H.225.0 and SIP) in the SSF. The call control may invoke H.248 media and connection operations for legs, media, packages independent of the before or after IN interaction. Where a Call Control protocol is encapsulated in a H.248 package, mapping to this package, or to the embedded protocol, may also need to be specified.

NOTE 1 – Physical Location: The H.323 Gatekeeper/SIP Server and 'SSF', see Figures 6-1, 6-3, 6-4, 6-5 or 6-6, may be located in any network since INAP CS-4 signalling is standardized for international use and is call control protocol independent.

NOTE 2 – Physical Realisation: From the control of VoIP viewpoint, the Service Capability Server and the H.323 Gatekeeper/SIP Server may be combined in one network entity, or may be separate in separate network entities. If they are separate, standardization of the interface may be required.

NOTE 3 – IP PDU Routing: For the routing of IP call control packets to/from the H.323 Gatekeeper/SIP Proxy Server, it is simply assumed that appropriate addressing and routing takes place.

A.1.4 Session Manager (SM)

The Session Management function is responsible for managing the IP network services. On the IP side, it exposes the Registration interface but it cannot be assumed that service interactions are only based on Registration flows. The session manager may initiate activities caused by call control signalling events, in case of collocated session manager and call manager. The session manager shall participate in domain/zone management and call signalling.

General functions that need to be supported by this session manager:

- Service Profile Data filtering/parsing/mapping;
- Security/Authentication;
- Real-time data collection (billing/parsing) triggering of services (in the IN domain or in the IP-network domain);
- Configuration/dimensioning;
- Flow control.

This entity is responsible for passing registration and admission-related information to and from IN service layer, namely the SCF. As such, the session manager may contain an SSF-like functionality, or subset thereof, to model the pre- and post conditions that are required to interact with an SCF.

A.1.5 Service Switching Function (SSF)

The enhanced SSF interacts with the SCF (the INAP CS-4 Service Control Function SCF) and the CCF (The IP representation of the Call Control Function), mapping the Call Control Protocol into the INAP events trigger points and procedures, where applicable.

The relation of the SSF to the classical SSF is as follows:

- Many processes, such as call control, database and billing are retained or enhanced.
- Triggering of services (in the IN domain or in the IP-network domain).
- Feature Interaction Management.

The interface between the H.323 Gatekeeper/SIP Server and the SSF call control processes must:

- a) carry sufficient call data for the SSF to function correctly, and to deliver the necessary information to the SCF so that service logic decisions can be made;
- b) allow the SCF (in combination with SSF and CCF Emulator) to control VoIP calls (e.g. change 'B' party address) and manipulate call information (such as presentation number).

It is proposed that the CCF to SSF interface should not, at present, be subject to standardization. However, a mapping of parameters may be required to demonstrate the mapping in the SSF to the H.323 Gatekeeper/SIP Proxy Server call control protocol, states and events. Thereby enabling the CCF to model either a H.323 Gatekeeper, or a SIP Proxy server.

This Functional Architecture is flexible enough to cover all underlying IP, Media and bearer independent call control protocols, though it may be necessary to specify the specific mapping between the INAP procedures, trigger criteria and events against the procedures, conditions and call states of the underlying call control protocol, may need specification. This mapping is technology dependent.

NOTE – Click-to-Dial type of services can be supported, based on IN CS-3 capabilities.

A.1.6 Specialized Resource Function (SRF)

This function has to be extended by capabilities to exchange data with gateway functions to IP-networks. Additionally, for some of the services, it needs to support specialized resources with media transformation functions such as:

- Text-to-fax;
- Text-to-speech (already covered in 3.3.6.2/Q.1224 as TTS function);
- Speech-to-text;
- Fax-to-text.

A.1.7 Service Control Function (SCF)

Extensions or impacts are *for further study*.

A.1.8 Service Data Function (SDF)

For some services there may be a need for the SCF to access a database type of entity with service-related information, to be shared between the IN and the IP-network. For example, this may be the case for Internet dial-up access and Internet call waiting where the association between a PSTN number and an IP-address, needs to be obtained.

Therefore, the following functionality needs to be added to the SDF description:

"SDF contains data pertaining to modem usage/available factor for Internet dial-up access."

A.1.9 Dial Access Gateway Function (D/A GF)

This gateway supports the following functions:

- access to a packet network through the PSTN, e.g. Internet dial-up access via a modem connection;
- dynamically assigning IP address for access user;
- providing access authentication, authorization and accounting.

A.1.10 Media Gateway (MG)

MG is the functional entity, representing a gateway or MG, which is responsible for transforming CSN media (i.e. voice) to H.323 media (RTP/RTCP).

The Media Management Gateway Function supports the following functions:

- Inter-working of VoIP calls with PSTN calls;
- Service transcoding; e.g. for VoIP calls to PSTN telephony.

Connection of this gateway function to other entities in the IP-network and its internal tasks is *for further study*; work is progressing on this in ETSI TIPHON, IETF and ITU-T.

A.2 Functional Interfaces

The following interfaces are to be considered (Figure A.2):

- IF1: PINT Server-to-Service Control Function interface;
- IF2: PINT Server-to-SRF interface;
- IF4: SCF-to-SRF interface;
- IF5: CCF-to-CCF interface;
- IF6: SDF-to-Dial Access Gateway interface;
- IF7: Service Control Function-to-SSF interface;
- IF8: SCF-to-Service Application Gateway Function interface;

- IF9: Service Application Gateway Function-to-GF for distributed service logic platforms interface;
- IF10: CCF-to-Media Gateway (MG) interface;
- IF12: CCF-to-Resource Manager interface;
- IF13: SRF-to-Media Gateway interface;
- IF14: CCF-to-D/A GF (Dial-up Access Gateway function).

There is a need for an interface between the service control in the IN, and the call control for VoIP within the IP network, to extend IN-based services in the IP-network domain.

A.2.1 IF1: PINT Server-to-Service Control Function (SCF) interface

This interface is used to trigger the SCF with service requests, to allow the SCF to instruct the collection of information necessary to execute the service (identity, charging and authenticity information), and to control the gateway during service execution.

The SCF should be able to send service or modification requests to the IP-network; possibly via the SC-GF, if used.

For example, for the Internet Call Waiting service, the SCF needs to notify the Internet user of an incoming call. Then, IF1 should allow the SCF to request Internet services.

This interface will relay requests either from the IN or the IP-network. This interface is modelling the information relay. The information transfer on this interface is specified in the SIP PINT extensions in [19].

The IETF PINT working group has developed a set of protocol extensions based on the Session Initiation and Session Description Protocols (SIP and SDP). The architectural configuration envisaged is that end users will make service requests. These requests will be marshalled and converted into SIP/SDP messages by a dedicated PINT client that will be sent to an optional PINT Server. The PINT Server will further relay the service requests to the Service Control Function. From the perspective of the IP-network requesting user, this PINT Gateway, with its connected Executive System, is responsible for processing and executing their service feature request; any entities (such as the IN entities) are "hidden" behind this PINT Server function, and their operation is transparent to the IP-network users.

A.2.2 IF2: PINT Server-to-SRF interface

This interface may not require standardization as it will be a data stream to e.g. the SRF text conversion function. IF2 is used to establish a data connection and to exchange data between the SRF and the PINT Server (on request of the SCF). Data are to be exchanged if the respective service requires not only to control the PSTN/IN, but also to transfer data between the GF and the PSTN. The PINT RFC specifies extensions to file transfer to illustrate the use of this interface.

A.2.3 IF4: SCF-SRF interface

This interface will require enhancements to the existing ITU-T IN Recommendations for this reference point. This interface reflects an extension of the existing SCF-SRF relationship. It is used to request the SRF by the SCF to retrieve the appropriate data from the gateway function. This may require transfer of correlation information to address the GF and the appropriate data. In addition, the SCF instructs the SRF to transform the retrieved data into other formats and to transfer this data over the PSTN/PLMN to the end user.

A.2.4 IF5: CCF-to-CCF interface

This interface reflects the requirements pertinent to the IF5 interface. This is the requirement to carry an ISDN control plane signalling protocol for Multimedia services. This interface relays the

IP Multimedia user plane received from the CCF (Call Control Function). This interface is required for Voice over IP-based services.

This interface may require standardization but is not expected to be IN specific. Work is progressing on this in ETSI TIPHON, IETF, ITU-T BICC and Annex C/H.246.

A.2.5 IF6: SDF-to-Dial Access (D/A) gateway interface

This interface may require standardization.

This interface is required to control Internet access (availability control, etc.) for Internet dial-up access.

A.2.6 IF7: SCF – SSF interface

This interface reflects the requirements pertinent to the IF7 interface. This is the requirement to carry an IN-based signalling protocol for IP and Multimedia services. This interface relays the IP Multimedia control plane triggered events to and from the SCF.

This interface may require standardization.

This interface is required to trigger and control value added services from a SIP proxy or H.323 gatekeeper function in the IP network e.g. for multimedia access from the Internet "dial-up" access.

A.2.7 IF8: SCF – Service Application Gateway Function interface

This interface reflects the requirements pertinent to the IF9 interface. However, the possibility of physically or functionally collocating these functional entities would remove this from standardization.

A.2.8 IF9: Service Control Gateway Function-to-GF for distributed service logic platforms interface

SA-GF to distributed service logic platforms: this interface represents standard APIs allowing an Application Service Provider to control defined capabilities offered by the underlying network via the SA-GF. The service logic execution of the application offered by the ASP typically is located in a domain separate from that of the SA-GF offering the API.

A.2.9 IF10: CCF-to-Media Manager (MG) interface

This interface reflects the requirements pertinent to the IF10 interface. This is the requirement to carry an ISDN user plane protocol for Multimedia services. This interface relays the IP Multimedia user plane received from RTP/RTCP.

This interface may require standardization but is not expected to be IN specific. Work is progressing on this in ETSI TIPHON, IETF, ITU-T Study Group 11, BICC and ITU-T Study Group 16.

This interface is required for Voice over IP-based services.

A.2.10 IF12: Media Manager-to-Resource Manager interface

This interface reflects the requirements pertinent to the IF12 interface. This is the requirement to carry an IP Media Gateway Control Protocol (e.g. H.248) for Multimedia services. This interface relays the ISDN Multimedia user plane received from IF10.

This interface may require standardization but is not expected to be IN specific. Work is progressing on this in ETSI TIPHON, IETF, IETF, ITU-T Study Group 11, BICC and ITU-T Study Group 16.

This interface is required for Voice over IP-based-services.

A.2.11 IF13: SRF-to-Media Manager interface

This interface reflects the requirements pertinent to the IF13 interface.

A.2.12 IF14: CCF-to-D/A GF (Dial-up Access Gateway function)

This interface reflects the requirements pertinent to the IF14 interface.

A.3 Explanation of Figure A.2

The following network architecture depicts the distribution of network intelligence.

Figure A.2 identifies the IN DFP model for IN CS-4. This diagram depicts the functional entities and relationships applicable to IN CS-4. This diagram is a subset of the generic IN DFP model described in clause 2/Q.1204. A general explanation of functional entities, relationships, and the diagram are contained in 2.1/Q.1204.

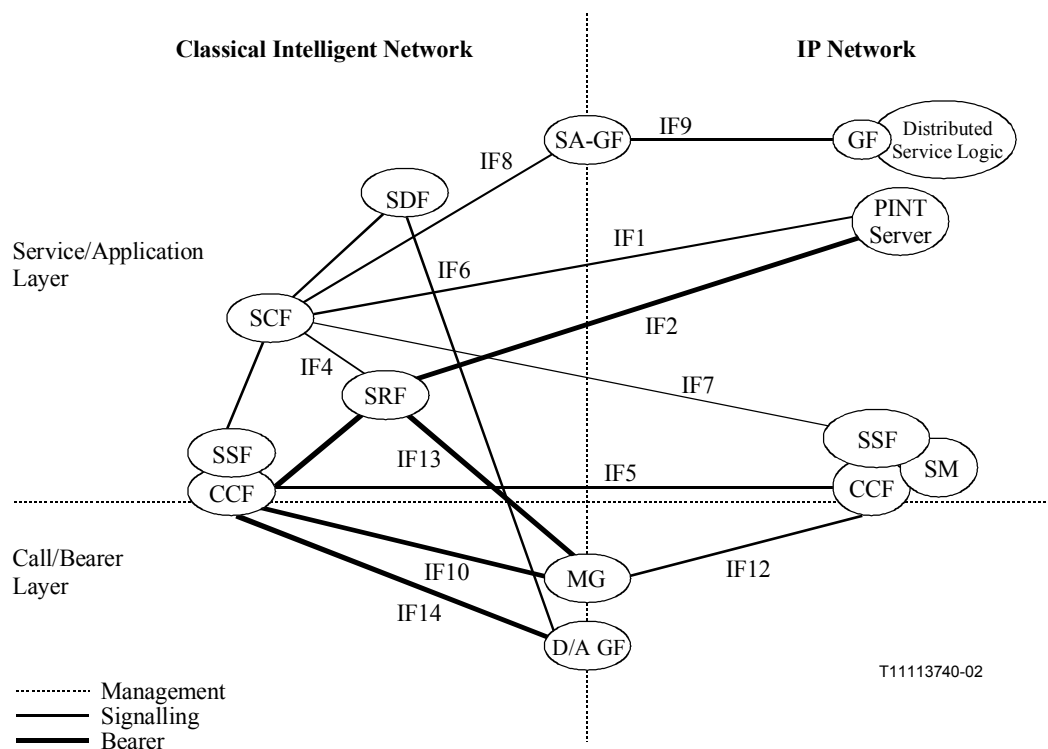


Figure A.2/Q.1244 – Enhanced Functional Architecture for IN support of IP-networks

Table A.1/Q.1244 – Interfaces

| Interface | Functional Entities | Protocols | Reference |
|-----------|----------------------|---------------------------------------------|-------------------------------------------|
| IF1 | PINT Server to SC-GF | SIP(PINT) Protocol | Over (TCP)UDP/IP or Over SCCP/MTP |
| IF2 | PINT Server to SRF | FTP(PINT) Protocol | Relayed over (TCP)UDP/IP or Over SCCP/MTP |
| IF4 | SCF to SRF | INAP | Over TC/SCCP/MTP |
| IF5 | CCF to CCF | ISUP Control Plane/BICC or SIP call Control | Over MTP or SCTP/IP |
| IF6 | SDF to D/A GF | Data Retrieval | e.g. X.500/SNMP |

Table A.1/Q.1244 – Interfaces

| Interface | Functional Entities | Protocols | Reference |
|------------------|----------------------------------------------|---------------------------------------------|---------------------------------------------|
| IF7 | SCF to SSF | INAP Call or RAS related | Over TC/SCTP/IP or Over TC/SCCP/MTP |
| IF8 | SCF to SA-GF | Service Provider Application API | Over TC/SCCP/MTP |
| IF9 | SA-GF to GF for Distributed Service Logic | Service Provider Application API | Over TC/SCTP/IP |
| IF10 | CCF to MG | ISUP User Plane | Over MTP |
| IF12 | MG to RM | H.248/RFC 2026 (text)/ RFC 2025 (binary) | Over SCTP/IP |
| IF13 | SRF to MG | User Interaction/Content | ISDN User Plane/MTP or RTP(RTCP)//TCP/IP |
| IF14 | CCF to D/A GF | ISUP | Over MTP |

NOTE 1 – This architecture can be deployed entirely within an ISDN/PSTN or IP network or a combination of both.

NOTE 2 – The SRF is independent of the classical IN or IP Domain: it may be located on either side of the functional architecture. Its location will impact the protocol stack used to control this entity.

NOTE 3 – IF5: is illustrated since it indicates Call Control across this reference point: these Call Control requirements are required as they give rise to the Call States which result in the IN triggering conditions.

NOTE 4 – The Media Gateway function and the D/A GF will relay the ISDN user plane information in an IP RTP/RTCP stream over TCP/IP.

A.4 Lower layer protocol gateway and mapping functions

The following lower layer protocol gateways, mapping functions may be required depending on the protocol Architectures employed in each domain. If required, these functions will be implemented at the CSN/IP domain boundary.

A.4.1 Service Control Gateway Function (SC-GF)

The Service Control Gateway Function allows the inter-working between the service control layer in Intelligent Network and IP-networks. For IN CS-4 on the service control level, the relations between the IN and the following entities in the IP-network are supported:

- This is a layer 2 mapping and addressing function.
- The SCF will be able to select one or more appropriate SSF/SIP Proxies/H.323 GKs dependent on different parameters (class of service requested by the user, placement of gateways, tariff, etc.). The SC-GF will be able to perform correct lower layer protocol and address translation functions.
- The SC-GF will allow inter-working with several SSF/SIP Proxies/H.323 GK (Gatekeepers).
- PINT Server.
- SIP Proxy.
- H.323 GateKeeper Function.
- others are for further study.

A.4.2 Signalling Gateway Function (S-GF)

The Service Control Gateway Function allows the inter-working between the Call control signalling in the ISDN and IP-networks. This functional entity is optional as it may not be required in all implementations. The following cases may be supported:

- This is a layer 2 mapping and addressing function.
- The S-GF will be able to perform correct lower layer protocol and address translation functions.
- The S-GF will be able to re-map between ISUP over SCCP/MTP and ISUP over SCTP/UDP/IP.
- The S-GF will allow inter-working with several SSF/SIP Proxies/H.323 GK/H.248 MGCs.
- SIP Proxy.
- H.323 GateKeeper Function.
- H.248 MGC functions.

Appendix I

Example information flows between IP-networks and IN

I.1 IN-based service for Dial-up Internet Access

The service considered is an IN-based value added service to access to the Internet through the PSTN (dial-up access). In this example, several D/A GF are/may be geographically distributed in the network and a single number is used (e.g. an 800 freephone number) to access them. Dialling this number triggers service logic in the SCP that routes the call to the appropriate D/A GF. This is based on the geographical location of the calling party, and on the availability of dynamic (near real-time) information of D/A GF usage and availability.

In the following subclauses, several possible solutions to this problem are discussed, with their consequences on functional interfaces.

Solution 1: Query to a database

This solution makes the following assumptions:

- A functional entity, A, monitors the states of the various D/A GFs (e.g. modem usage/busy).
- An SCF-SDF-type of interface exists between SCF and SDF which allows the SCF to query SDF about the states of the various D/A GFs (usage, etc.).

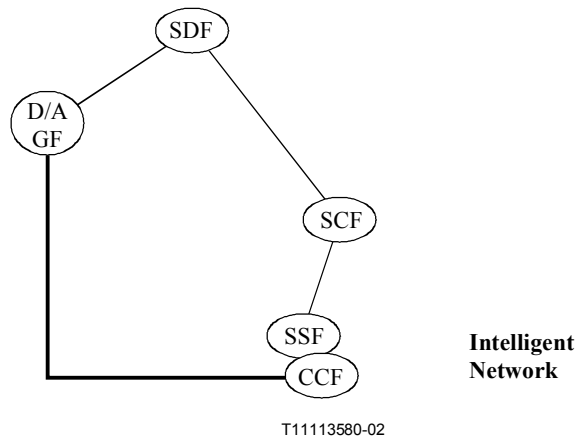


Figure I.1/Q.1244 – Database query

In order to get the status of the D/A GFs, queries from the SCF to SDF could take place on either a periodic basis, or when a busy signal is encountered. This solution requires an interface between a SCF and a SDF.

Information flows in that case would be:

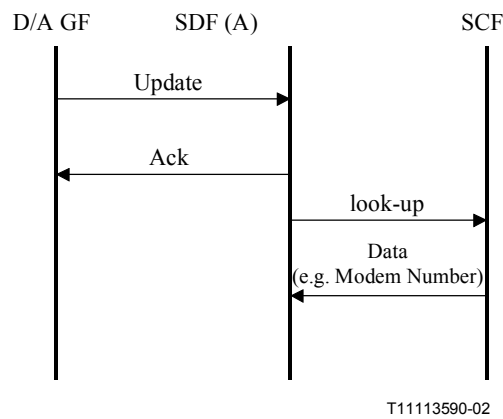


Figure I.2/Q.1244 – Information flows

The contents of the data in the information flows are for further study.

Solution 2: Management Solution

The SMF collects information from the D/A GF and stores it in an internal database for providing the data for the IN-based service dial-up for Internet access.

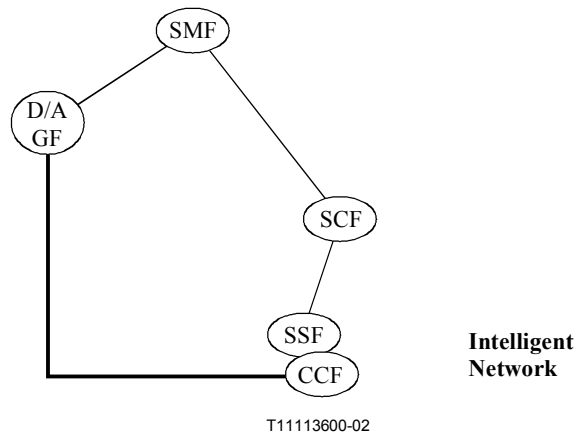


Figure I.3/Q.1244 – Management solution

I.2 Information Flow for Click-to-Dial (CTD) Service

The information flow for CTD (phone-to-phone) is shown in Figure I.4. The detailed information between SC-GF and SCF (IF3) can be deduced from the mapping of IETF-defined in the SIP Extended protocol for PINT. This flow chart applies to CTFB as well. This example represents stable requirements based on IN CS-2 though inter-working is not defined for IN CS-3 operations.

A brief description of the information flow sequence is as follows:

- 1) PC user requests for CTD service;
- 2) Server sends CTD request;
- 3) SC-GF relays CTD service request to SCF;
- 4) SCF initiates call attempt to DN1 and requests DN1_answered event report;
- 5) and 6) Connection established between SSF/CCF and phone A using existing ISDN signalling;
- 7) SSF/CCF reports to SCF phone A answered;
- 8) SCF instructs SSF/CCF to connect phone A and SRF;
- 9) SCF instructs SRF to play announcement;
- 10) SCF initiates call attempt to DN2 and requests DN2_answered event report;
- 11) and 12) Connection established between SSF/CCF and phone B using existing ISDN signalling;
- 13) SSF/CCF reports to SCF phone B answered;
- 14) SCF instructs SSF/CCF to disconnect phone A and SRF and to merge phone A and phone B legs.

Notifications from the IN/ISDN domain to the PINT server may be possible.

Support of conference services by these capabilities may be possible.

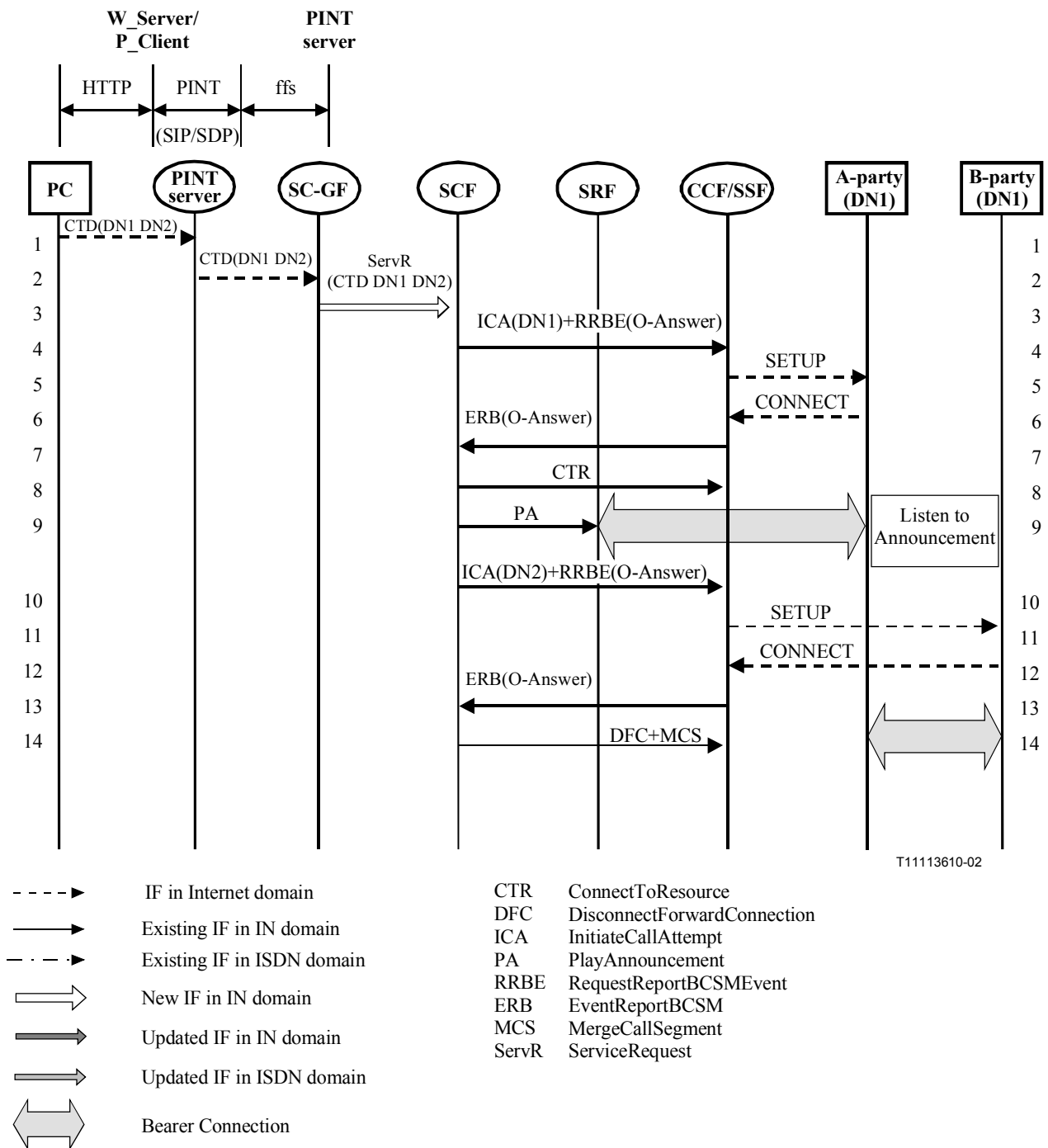


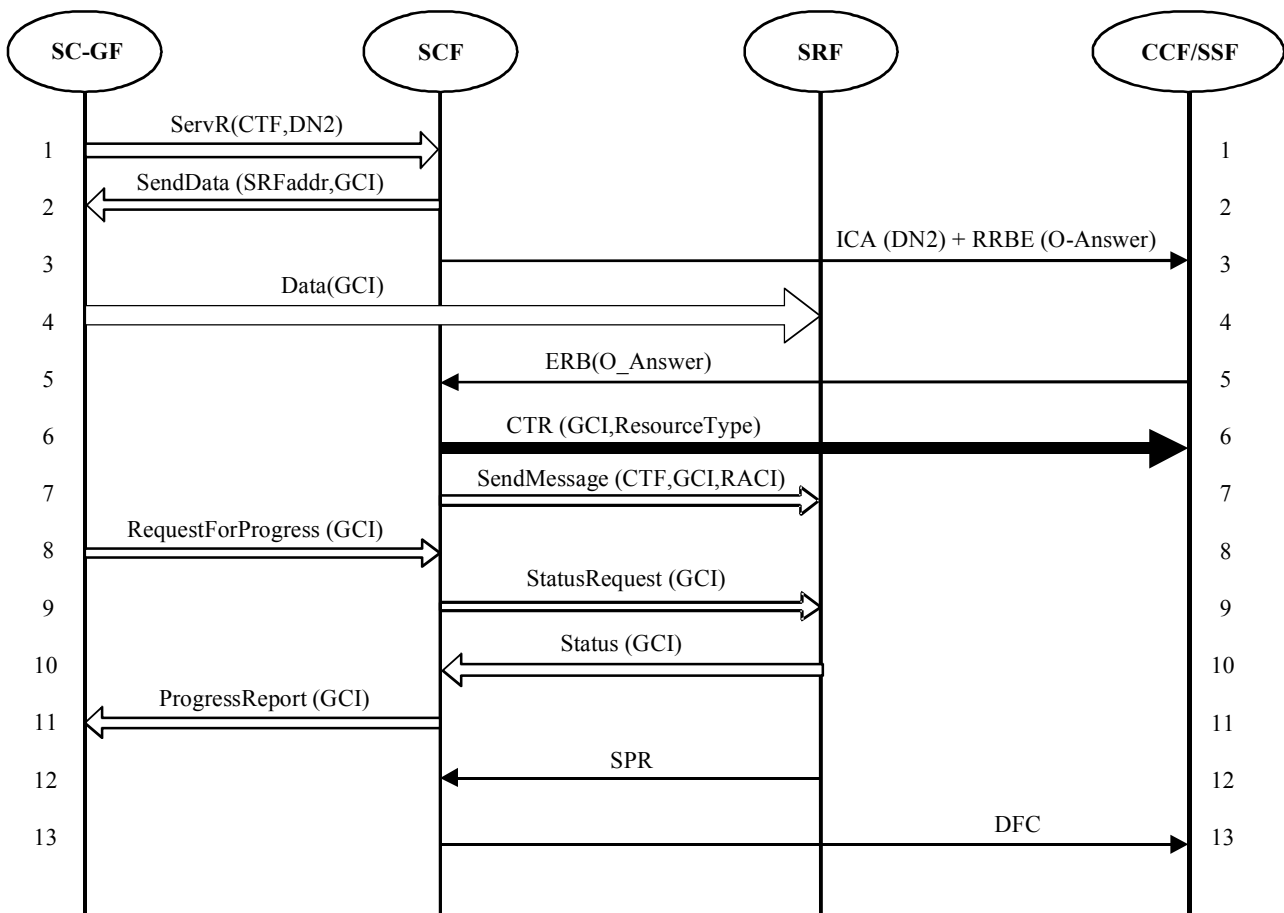
Figure I.4/Q.1244 – Information flow for Click-to-Dial (phone-to-phone) service

I.3 Information flow for Click-to-Fax (CTF) service

The information flow for CTF service in the IN domain is shown in Figure I.5. IF2 between SC-GF and SRF is used to transfer data. It can use any available data transport medium and does not need to be standardized. This flow chart also applies to "Voice Access to Content". A number of additional features are proposed in this example; these questions and this example requires further study.

A brief description of the information flow sequence is as follows:

- 1) SC-GF relays a CTF service request from the IP domain, to SCF;
- 2) SCF provides SC-GF with SRF address and GCI, and requests SC-GF to relay data to SRF;
- 3) SCF initiates call attempt to DN2 and requests DN2-answered event report;
- 4) SC-GF relays data from the IP domain. (No proposal has been agreed to standardized this procedure in the IN domain; reuse of existing ISDN capabilities may be possible; this reuse and protocol selection require further contribution.);
- 5) SSF/CCF reports to SCF DN2 answered;
- 6) SCF instructs to connect DN2 with SRF, with GCI included for correlation and ResourceType setting to Text-to-Fax;
- 7) SCF instructs SRF to send converted data to user and report the completion of data sending. GCI is included to identify the data to be converted;
- 8) SC-GF relays the request for the fax sending progress during the course of transfer;
- 9) SCF relays the request to SRF;
- 10) SRF sends back the progress status;
- 11) SCF relays the status to SC-GF;
- 12) SRF reports to SCF the completion of fax sending;
- 13) SCF instructs to disconnect the connection between DN2 and SRF.



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Figure I.5/Q.1244 – Information flow for Click-to-Fax in the IN domain

I.4 Information flow for Internet Call Waiting (ICW) service

To consider the Internet Call Waiting feature, the Internet access needs to be under the control of the IN:

- The Intelligent Network should know that the called telephone number is busy with an Internet Access.

Therefore, the information that an Internet session is in progress must be available to the IN.

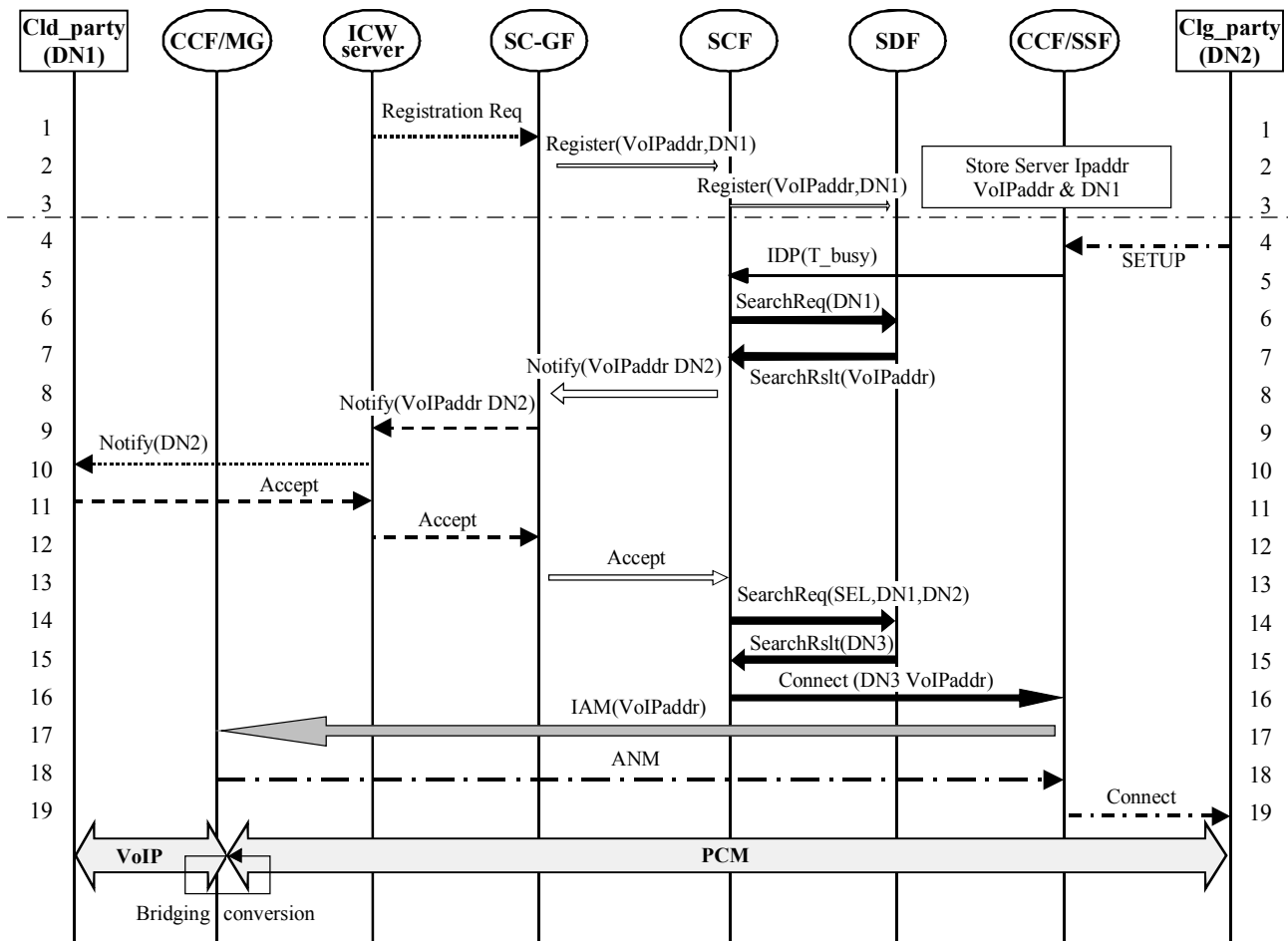
One solution could be as follows:

- When a user connects to the Internet using a dial-up procedure the IN recognizes an IAP/ISP number or through some other means.

It happens either at the CCF/SSF level, if the IAP/ISP number is specific, or after an interrogation of the SDF if those numbers are not specific. (In the latter case, the SMF is then responsible for updating the data in the SDF.)

DPs are then positioned in order to trigger the address (phone/IP) conversion when an incoming call for the Internet dial-up user is to be terminated.

The information flow for ICW is shown in Figure I.6. The service is triggered by an armed TDP at the Called Party T_Busy DP.



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Figure I.6/Q.1244 – Information flow for Internet Call Waiting

GLOSSARY

VoIP Voice over Internet Protocol

IAP Internet Access Provider

ISP Internet Service Provider

A brief description of the information flow sequence is as follows:

- 1) PC user (or ISP) sends registration request to register the VoIP_address to DN relationship, and the VoIP address¹ to the DN relationship, as a result of dial-up access to Internet (ICW server to SC-GF).

NOTE 1 – The Internet Point of Presence Server (PoP) need not necessarily be the same as the ICW Server.

- 2) SC-GF relays the user registration information to SCF. The SCF stores the IP address relating to the ICW Server for the DN1, and the VoIP address¹ to DN1 relationship. Therefore, mapping the data for later on translation (direct PC User IP-addressing to DN1 support is under study and requires further contribution).

- 3) SCF commits the user registration information to SDF. The SDF stores the IP address relating to the ICW Server for the DN1, and the PC user's VoIP address to DN1 mapping data for later translation.

- 4) The calling party (a telephone user) makes a call to the called party (PC user) with DN1. The Connection is set up using existing ISDN signalling.

- 5) SSF/CCF is triggered on at Called Party T_Busy and sends IDP (T_Busy) to SCP.

NOTE 2 – The SSF/CCF is located at the local exchange serving the DN1 line and a TDP is armed at T_Busy for the line registered for the Internet Call Waiting service.

- 6) SCF queries SDF for the IP relation, to obtain the IP address relating to the ICW Server of DN1.

- 7) SDF returns the IP address relating to the ICW Server of DN1.

- 8) SCF sends incoming call notification to SC-GF.

- 9) SC-GF relays the notification to the ICW Server.

- 10) The ICW Server relays the notification to PC user.

- 11) The PC user chooses to accept the incoming call and sends indication to the ICW Server.

- 12) The ICW Server relays the Accept message to SC-GF.

- 13) The SC-GF relays the Accept message to SCF.

- 14) The SCF queries the SDF for an appropriate for the VoIP address¹ relating to DN1.

NOTE 3 – This address is used to select the CCF/MG to address the resource of the VoIP gateway to access VoIP to DN1. SEL is the CCF MG selection criterion parameter. DN2 is the optional parameter used, for example, to select CCF MG nearest to the calling party.

- 15) The SDF returns the selected PC user's VoIP address¹. The CCF MG is then addressed using DN3 and this directory number VoIP address is used to reach DN1. The SCF instructs SSF/CCF to route the call to DN3 (the VoIP gateway); including the selected VoIP address.

- 16) The SCF instructs SSF/CCF to route the call to DN3 (the VoIP gateway); including the PC user's VoIP address¹.

¹ The VoIP address may be a specific E.164 address or a Dynamic IP address: this requires further study.

- 17) The SSF/CCF initiates the connection Set-up to DN3 using ISDN signalling. The NNI/UNI Set-up message including the selected VoIP address¹ of the called party (PC user).
NOTE 4 – This connection set-up, as an option, may be translated at the CCF/MG into an H.245/H.225.0 set-up request, to be handled by a GateKeeper Function. Where used, the GateKeeper function controls the resource of the CCF/MG and the set up request to the PC User for Voice over IP. The H.245/H.225.0 Connection Complete message is then returned to the CCF/MG.
- 18) The Connection completion message returned to SSF/CCF.
- 19) The Connection completion message returned to the originating exchange.

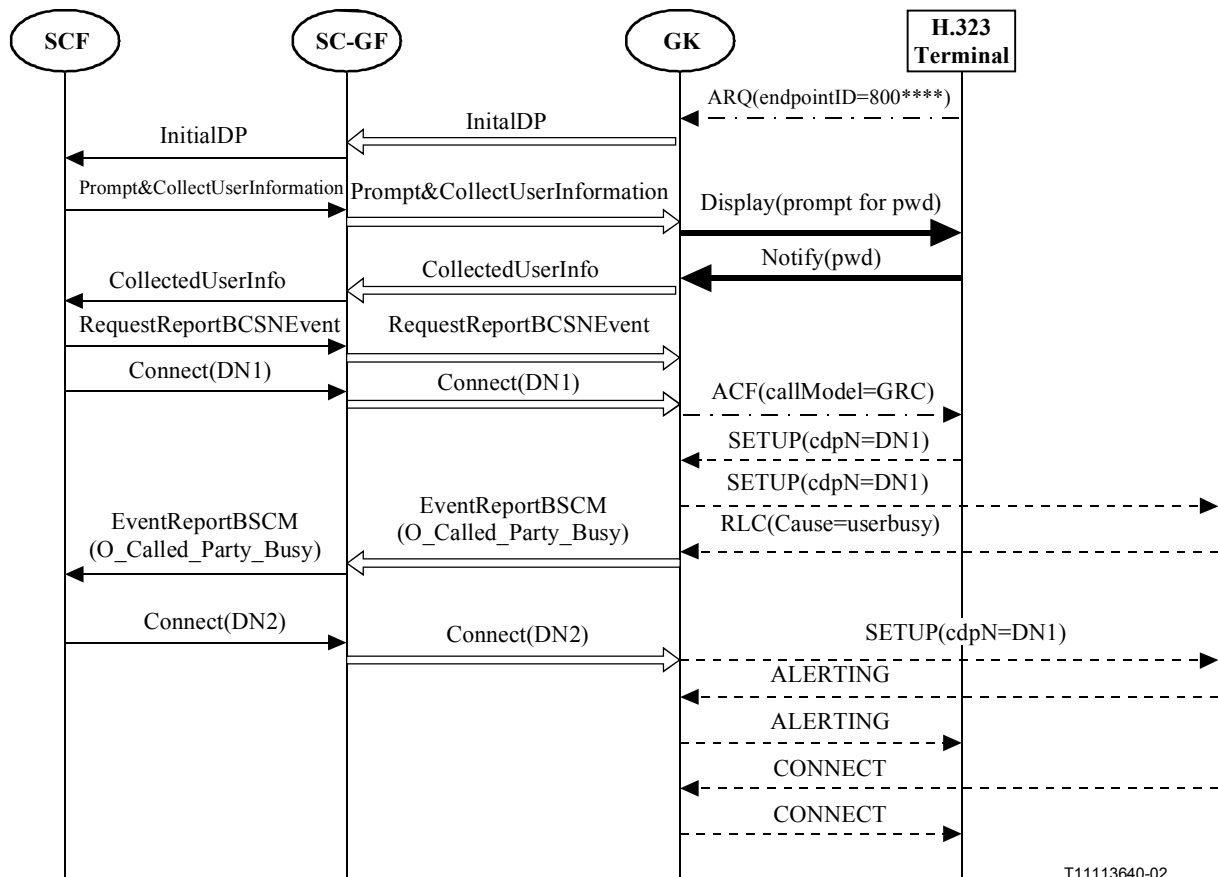
I.5 Example information flows of IN-IPT inter-working

Two example information flows are given to illustrate the above concepts.

I.5.1 Information flow for H.323 terminal-originated 800 call

Assuming that the example 800 (FreePhone) service requires user authentication, the prompt indication, and the user input password, is exchanged through RAS interface between GK and the terminal. O-busy EDP-R is dynamically armed at CCF in GK under the control of SCF. GRC mode is used for call control.

The information flow is shown in Figure I.7.



- > Existing IF in IN domain
- =====> New IF (INAP over TCP/IP)
- > Updated RAS IF
- - - - -> Existing RAS IF
- - - - -> Existing H.225.0 control IF

Figure I.7/Q.1244 – Information flow of H.323 terminal-originated 800 service

I.5.2 Information flow for GW-initiated 800 call

The service assumption is the same as above. DRC mode is used for call control.

The information flow is shown in Figure I.8.

The same CCF/SSF triggering mechanism applies to processing H.323 IN-based call. SSF/CCF may be located in MGC for DRC mode call control. The following example assumes that the Gatekeeper is enhanced to relay INAP-like Call Control, Admission and User Interaction, operations to, and from, the MGC for the support of IN triggering for triggering from the MGC via Gatekeeper.

- In this case, dynamic DP arming should be supported at MGC under the control of Gatekeeper SM.
- New service control interface between GK and MGC should be defined to support information exchange between SM in GK and CCF in MGC in case that DRC mode is used.

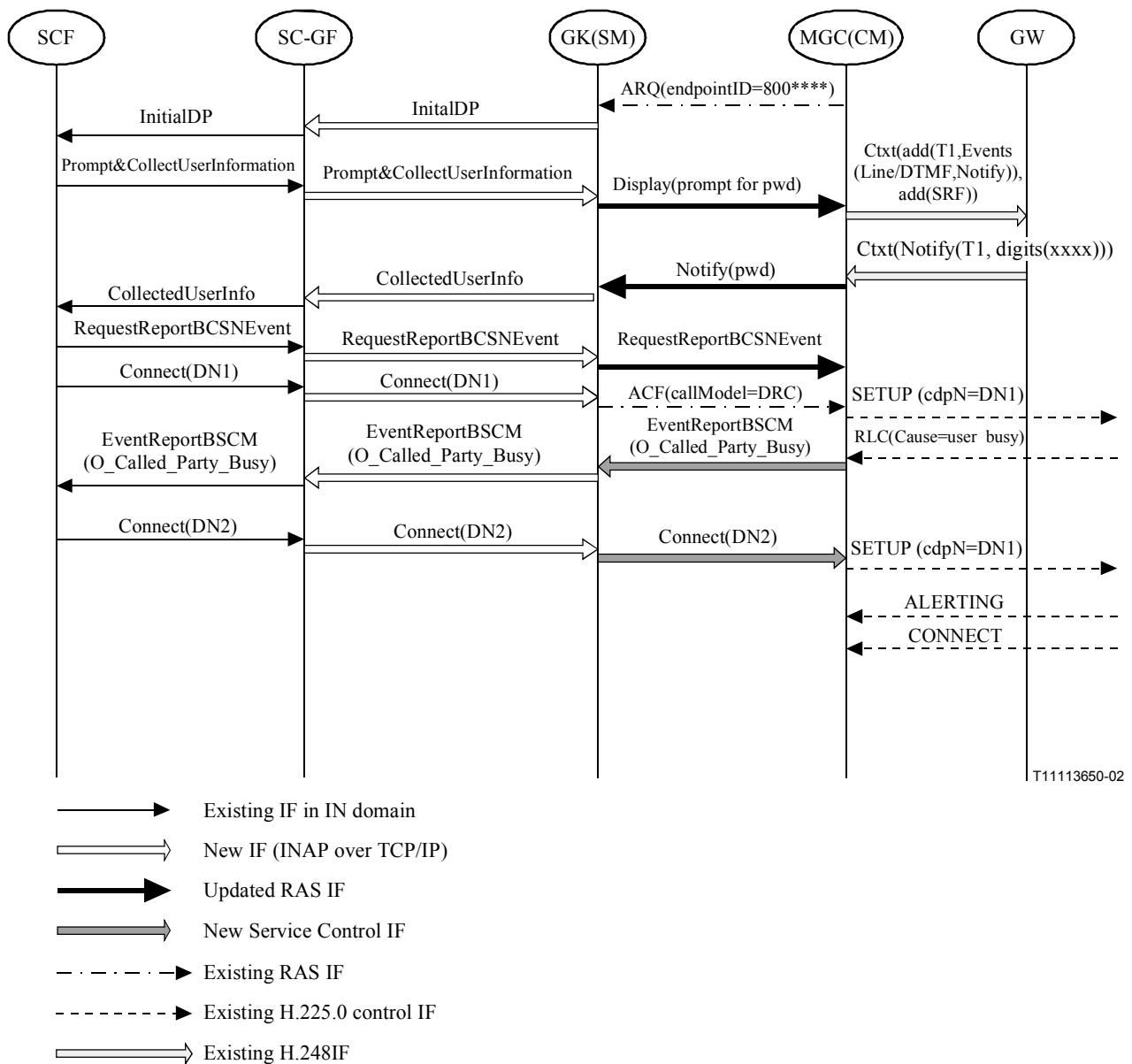


Figure I.8/Q.1244 – Information flow of GW-originated 800 service

I.6 IN interaction with SIP call control message flows

I.6.1 Proposed registration process

This clause is intended to define the registration process based on the SIP *REGISTER* method, which allows subscription information to be stored in the SIP Proxy Server/SSF.

IETF RFC 2543 [16] and [18] defines the term Registrar for registration purposes and it is the SIP registrar that accepts the *REGISTER* method. With the SIP *REGISTER* method, it is assumed that registration with a location server takes place.

Unlike H.323, registration with a server is not mandatory. Only users that wish to receive incoming calls need to register with a SIP Proxy server and a location server. Callers placing calls are not required to register.

I.6.2 Originating call with INAP CS-3 interaction

This clause deals with the originating calls that require interaction with INAP CS-3.

The call flows are shown in Figure I.9 and are further explained below:

- 1) The Calling User Agent Client initiates a SIP request by issuing an *INVITE* method to the SIP Proxy server.
- 2) The SDF/LDAP functionality in the SSF is checked to determine if the calling party has previously registered. If no registration found, then step 3) is followed. If the SSF determines that the calling user has a valid registration then step 4) is followed.
- 3) The SSF establishes a dialogue with the SDF or LDAP of the subscriber's network. The exact procedures of how this is performed require further study.
- 4) The originating subscriber data is analyzed and, if the necessary triggering criteria are met, the SCF is invoked via an *InitialDP* message.
- 5) The SIP Proxy server will route the call based on the instructions received by the service logic in the SCF. The remainder of the information flows will vary according to the service logic and are not shown.

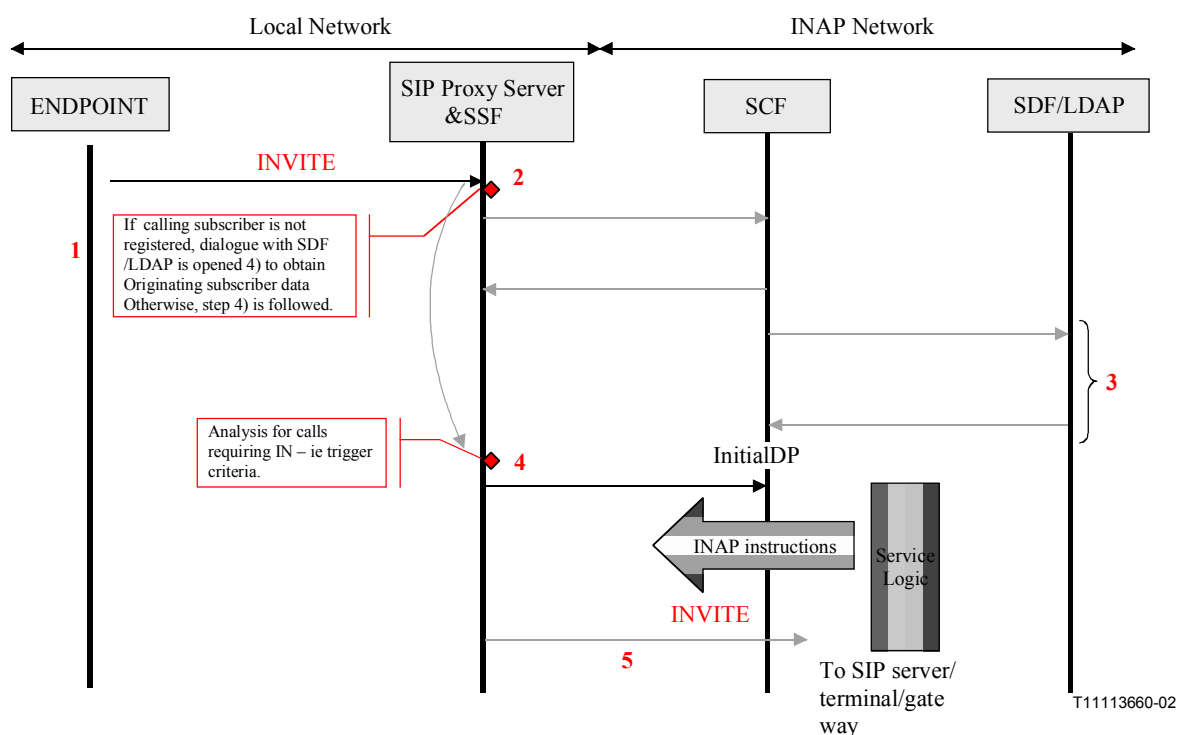


Figure I.9/Q.1244 – Originating call with INAP interaction

I.6.3 Terminating call with INAP CS-3 interaction

This clause deals with the INAP interaction for terminated calls. An INAP service is triggered if the triggering criteria, held in the called subscriber's data matches the characteristics of the incoming call. The information flows are shown in Figure I.10 and further explained below:

- 1) The terminating SIP Proxy server receives an *INVITE* method.
- 2) The Terminating subscriber data is analysed, and the triggering criteria are checked against the particulars of the incoming call. A terminal must register with a server to be able to accept an incoming call and it has to be assumed that, since this registration has taken place, the Terminating Subscriber data is available at the server.
- 3) If the necessary triggering criteria are met, the SCF is invoked and an INAP dialogue established between the SSF and the SCF.
- 4) Instructions are received from the SCF on how the call is to be routed.
- 5) The SIP Proxy server will route the call based on the instructions received by the service logic in the SCF. As the rest of the information flows will vary according to the service logic, the remainder of the information flows are not shown.

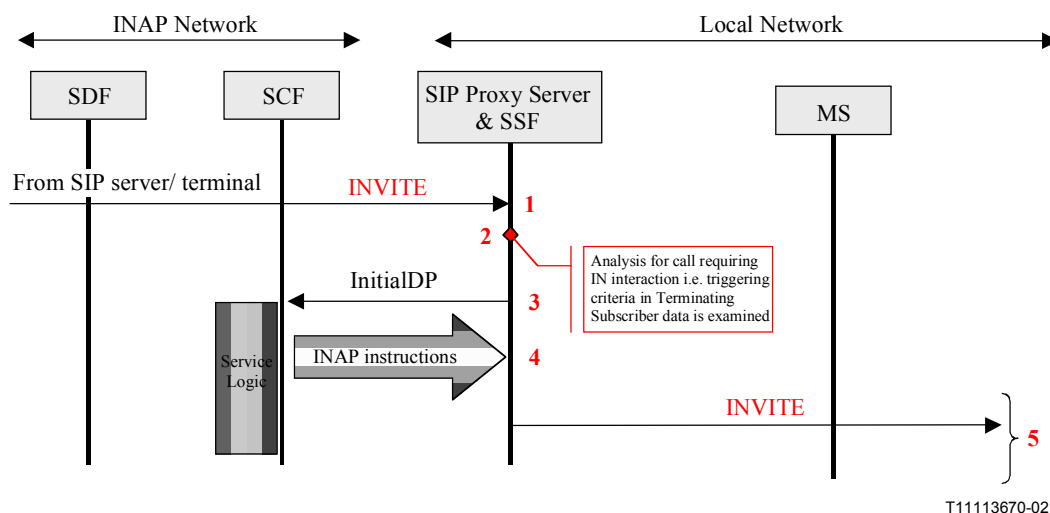


Figure I.10/Q.1244 – Terminating call with INAP interaction

I.7 H.323 IN interaction message flows

I.7.1 Registration

Further investigation is required on the INAP support for the registration and location update process that must exist within a multimedia service network.

I.7.2 Originating call requiring INAP interaction

The call flows for an originated call are shown in Figures I.11a and I.11b and are further explained below.

Figure I.11a shows the example when the SSF triggers on the RAS Admission Request message.

- 1) The H.323 Endpoint wishes to place an IP call and checks that it is allowed to place a call via RAS *Admission Request* message. When the *Admission Request* message is received at the gatekeeper, if the profile for the calling user is present, it would be possible to analyse its contents and, if necessary, invoke the SSF. The SSF is now assumed capable of implementing the INAP CS-3 O-BCSM. The SSF starts a call-related dialogue with the SCF. The SCF address and service key to invoke are obtained from the triggering criteria.

- 2) The SCF sends the instructions to the SSF according to the service logic invoked.
- 3) If the H.323 Endpoint is allowed to place the call (gatekeeper routed), an H.225.0 *Set up* message is sent to the gatekeeper.
- 4) When the *Set up* message is received at the gatekeeper, the *Set up* message is sent to the destination address based on the routing information.
- 5) Dialogue between the SCF and the SSF may continue according to the service logic. The remainder of the information flows will vary according to the service logic and are not shown.

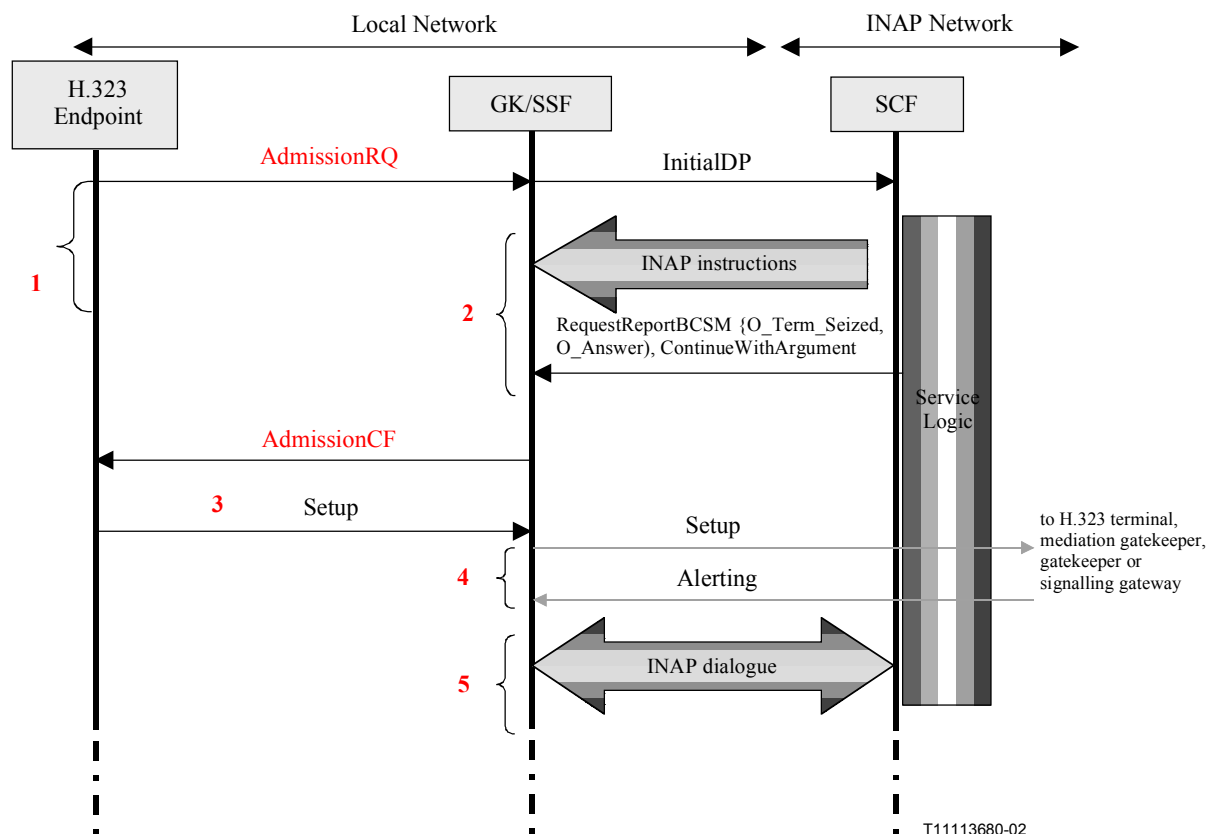


Figure I.11a/Q.1244 – Originating call with INAP CS-3 interaction

Figure I.11b shows the example when the SSF triggers on the H.225.0 *Set-up* message.

- 1) The H.323 Endpoint wishes to place an IP call: the Gatekeeper checks if the H.323 Endpoint is allowed to place a call via RAS *Admission Request* message.
- 2) If the H.323 Endpoint is allowed to place the call (gatekeeper routed), an H.225.0 *Set up* message is sent to the gatekeeper.
- 3) When the *Set up* message is received at the gatekeeper, if the profile for the calling user is present, it would be possible to analyse its contents and, if necessary, invoke the SSF. The SSF is now assumed capable of implementing the INAP CS-3 O-BCSM. The SSF starts a dialogue with the SCF. The SCF address and service key to invoke are obtained from the triggering criteria.
- 4) The SCF sends the instructions to the SSF according to the service logic invoked.
- 5) The gatekeeper forwards the call according to the instructions received from the SCF. H.225.0 *Set up* message is sent to the destination address.

- 6) Dialogue between the SCF and the SSF may continue according to the service logic. The remainder of the information flows will vary according to the service logic and are not shown.

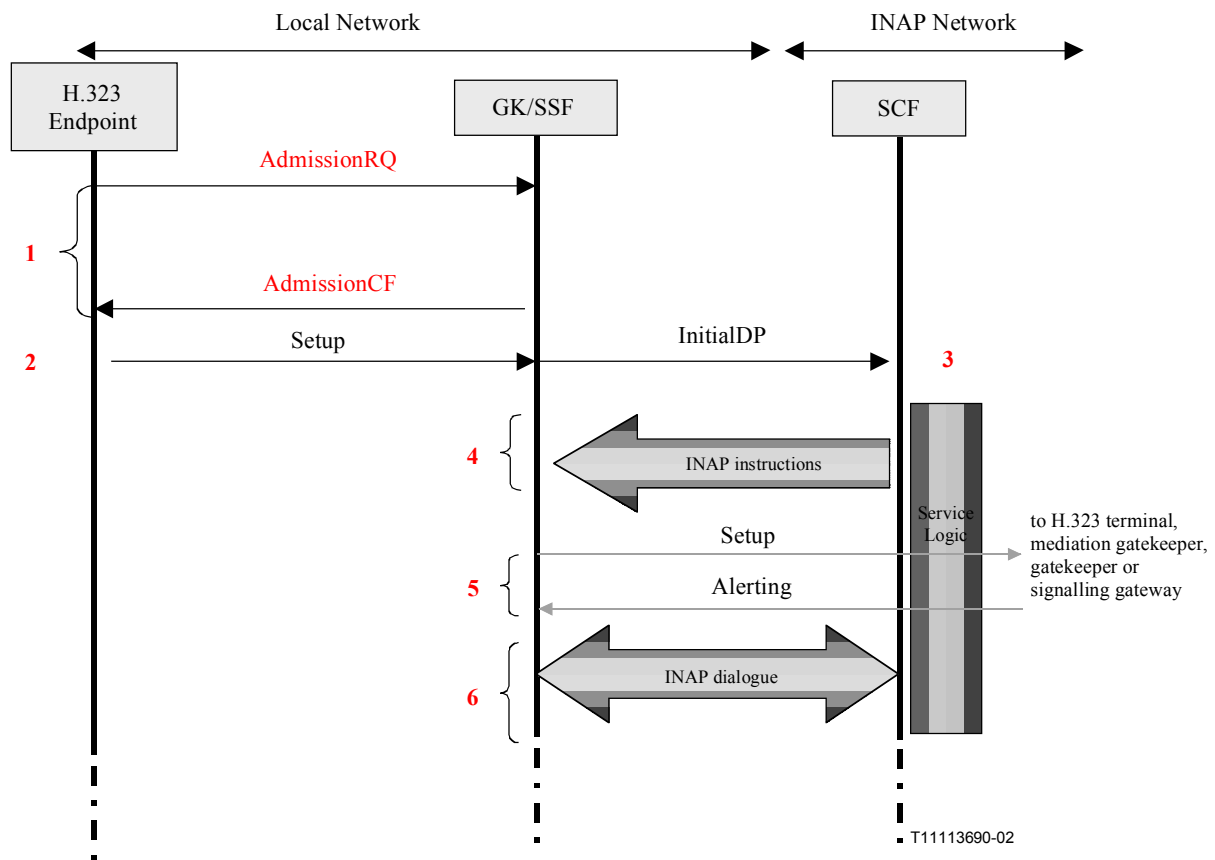


Figure I.11b/Q.1244 – Originating call with INAP CS-4 interaction

I.7.3 Terminating call requiring INAP CS-4 interaction

The call flows for a terminating call are shown in Figure I.12 and is further explained below:

- 1) The mediation gatekeeper in the network of the called subscriber receives an incoming H.225.0 Set-up message. (The incoming call could be from another H.323 gatekeeper, or an H.323 signalling gateway, representing a call originating from external networks, such as the PSTN.)
- 2) The mediation gatekeeper queries the IP address of the gatekeeper that the called user is registered with.
- 3) The mediation gatekeeper forwards the call to the required gatekeeper by sending a *Set up* message.
- 4) The gatekeeper receives the H.225.0 *Set up* message and checks the service profile of the called user to determine whether any INAP services should be invoked.
- 5) If analysis of the service profile shows that the triggering criteria are met, the SSF is invoked to create a T-BCSM and the SSF initiates a dialogue with the SCF in the network of the called user. Instructions are received from the SCF on how the call is to proceed.
- 6) The gatekeeper will route the call according to the instructions received from the SCF and will send an H.225.0 *Set up* message to the destination party.

- 7) Dialogue between the SCF and the SSF may continue according to the service logic. The remainder of the information flows will vary according to the service logic and are not shown.

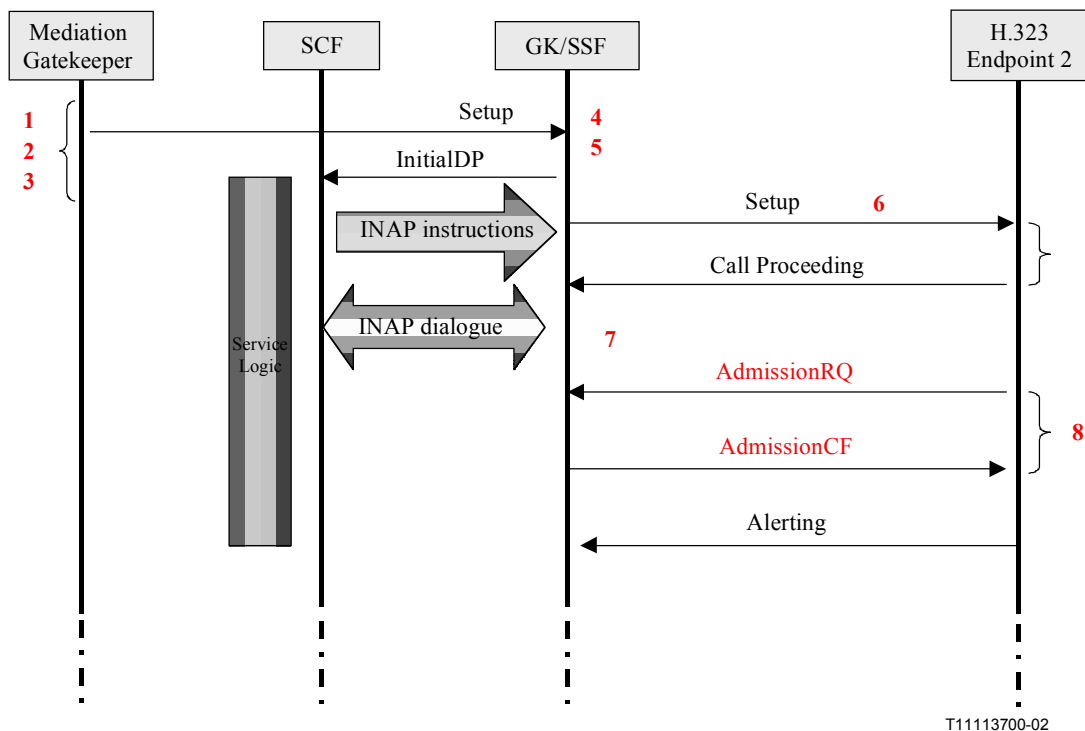


Figure I.12/Q.1244 – Terminating call with INAP CS-3 interaction

I.8 SIP INAP personal mobility service message flows

I.8.1 IN-IP personal mobility service definition

Depending on the personal mobility of a service subscriber, whether he uses a PSTN terminal (e.g. telephone) or an IP terminal (e.g. PC), he can receive a message delivery or call arrival notification at the terminal where he explicitly or implicitly registered. This service definition is basically the same as the UPT service (ITU-T F.851), as it permits the initiating and receiving of calls on the basis of a person's ID. The basic functions of the IN-IP personal mobility service are those of the essential UPT features, which are as follows:

- User ID authentication;
- Incoming Call registration;
- Outgoing call;
- Incoming call (message) delivery

I.8.2 IN-IP personal mobility service information flows

I.8.2.1 IN-IP UPT/PINT registration information flows

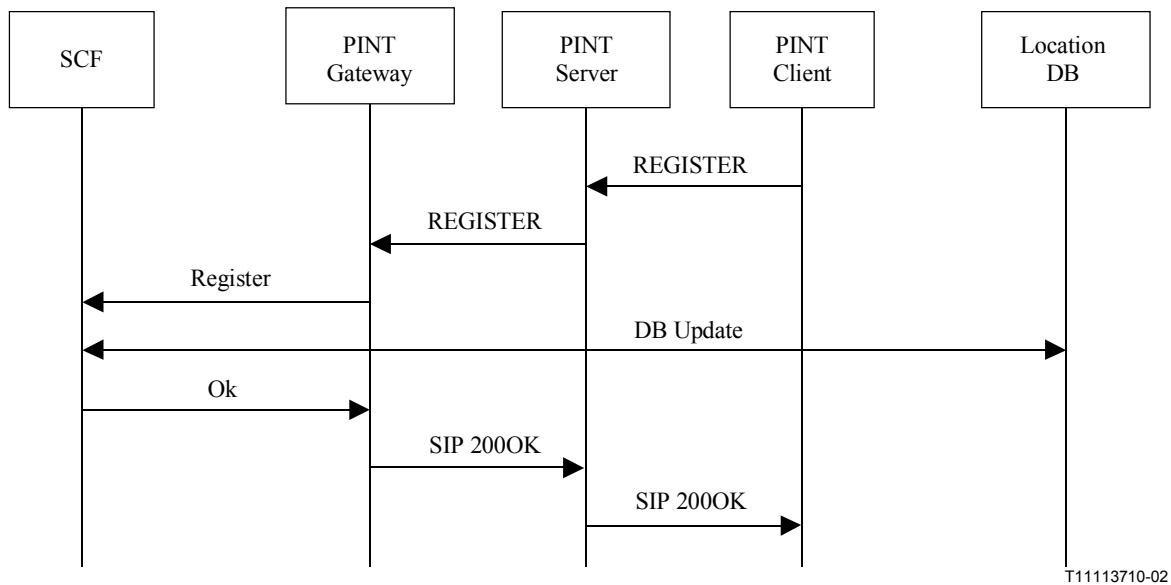


Figure I.13/Q.1244 – IN-IP UPT/PINT registration procedure

IN-IP UPT/PINT subscriber in Internet registers with PINT registration procedure (REGISTER if SIP). The registration information is delivered to SCF in which location DB(SDF) updates the registration.

I.8.2.2 IN-IP UPT/SPIRITS notification information flows

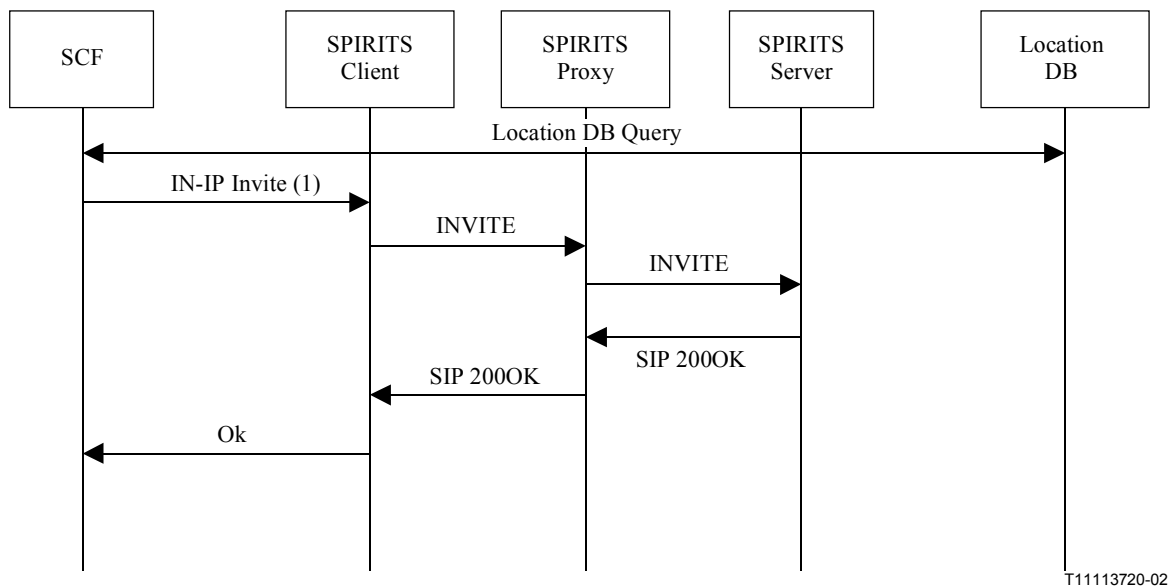


Figure I.14/Q.1244 – IN-IP UPT/SPIRITS notification procedure

When a call arrives from a PSTN Caller to the UPT/SPIRITS subscriber who is currently engaged in an IP session, the notification is delivered to the UPT/SPIRITS Client.

NOTE – The IN-IP Invite (1) may be a SIP Invite or an internal message use in SPIRITS.

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