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ETSI

European Telecommunications Standards Institute

ETSI Secretariat

Postal address: F-06921 Sophia Antipolis CEDEX - FRANCE
Office address: 650 Route des Lucioles - Sophia Antipolis - Valbonne - FRANCE
X.400: c=fr, a=atlas, p=etsi, s=secretariat - **Internet:** secretariat@etsi.fr

Tel.: +33 92 94 42 00 - Fax: +33 93 65 47 16

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Foreword

This ETSI Technical Report (ETR) has been produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI).

This ETR is based upon CCITT Q-series Intelligent Network Recommendations, Q.1201 [1] to Q.1290 [7], as given in CCITT COM XI-R 164, 1992.

Intelligent Network (IN) Capability Set 2 (CS2) is the second standardised stage of the IN as an architectural concept for the creation and provision of services, including telecommunications services, management services and service creation services.

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1 Scope

This ETSI Technical Report (ETR) addresses part of the Intelligent Network (IN) distributed functional plane for Capability Set 2 (CS2).

This ETR defines the enhancement to the modelling and capabilities of the Specialised Resource Function (SRF), extending the CS1 SRF to the needs of the CS2.

Reference services capabilities for the enhancement to the SRF are the targeted telecommunications services that should be supported by CS2.

These services are for reference purpose only: other services could be considered in identifying the SRF enhancement as work on CS2 progresses.

2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] CCITT Recommendation Q.1201 (1992), "Principles of intelligent network architecture".

[2] CCITT Recommendation Q.1205 (1992), "Intelligent network physical plane architecture".

[3] CCITT Recommendation Q.1211 (1992), "Introduction to intelligent network capability set 1".

[4] CCITT Recommendation Q.1214 (1992), "Distributed functional plane for intelligent network CS-1".

[5] CCITT Recommendation Q.1215 (1992), "Physical plane for intelligent network CS-1".

[6] CCITT Recommendation Q.1218 (1992), "Interface Recommendation for intelligent network CS-1".

[7] CCITT Recommendation Q.1290 (1992), "Glossary of terms used in the definition of intelligent networks".

[8] ETS 300 374-1: "Intelligent Network (IN); Intelligent Network Capability Set 1 (CS1); Core Intelligent Network Application Protocol (INAP); Part 1: Protocol specification".

3 Definitions

For the purposes of this ETR, the following definitions apply:

- Analog Display Services Interface (ADSI) Server: this is a functional entity that contains the functionality to create service scripts and to download them, for screen based Customer Premise Equipment (CPE).

- Extended User Interface (EUI) Server (ES): this is a functional entity that provides the functionality to interact with callers using speech recognition, DTMF, Text-To-Speech (TTS), context-sensitive announcements, and ADSI CPE with context-sensitive display.

4 Symbols and abbreviations

For the purposes of this ETR, the following abbreviations apply:

ADSI	Analog Display Service Interface
ASR	Automatic Speech Recognition
CPE	Customer Premise Equipment
DP	Data Part
ES	EUI Server
ESP	External Service Provider
EUI	Extended User Interface
FEAM	Functionality Entity Access Manager
ID	Identification
IMWD	Intelligent Message Waiting and Delivery service
MSR	Message Storage and Retrieval
NCA	Non Call Associated
PIN	Personal Identification Number
PNO	Public Network Operator
QoS	Quality of Service
RCP	Resource Control Part
RFP	Resource-Function Part
TCAP	Transaction Capabilities Application Part
TTS	Text-To-Speech
UI-Script	User Interaction-Script
VAD	Voice Activated Dialling
VANC	Voice Activated Network Control
VAPD	Voice Activated Premier Dialling
VOD	Video On Demand

5 The SRF model

This clause describes the SRF model providing the framework for the resources listed in clause 6.

The general aspects of the SRF model mainly refers to the CS1 SRF model given in CCITT Recommendation Q.1214 [4]; specific enhancements with respect to CS2 are identified as follows:

- at this moment, an effort to model the SRF as to allow a Public Network Operator's (PNO's) SRF to be accessed by an External Service Provider (ESP) function and an PNO's IN function to access an SRF offered by an ESP (e.g. for message transfer and message waiting notification capabilities used in voice mail services) is out of the scope of this ETR.

5.1 SRF components

Main CS2 SRF components are the same for the CS1 SRF given in CCITT Recommendation Q.1214 [4]; they are:

- Functional Entity Access Manager (FEAM);
- SRF resource manager;
- resources.

The SRF resource manager is contained in a block called Resource Control Part (RCP) along with the resource logic library and the resource logic instances; it is possible to split the resources in the following blocks:

- Resource Function Part (RFP);
- Data Part (DP).

Enhancement to the CS1 SRF components and new components for the CS2 SRF are described in subclauses 5.1.1 to 5.1.4.

Figure 1 shows the CS2 SRF model.

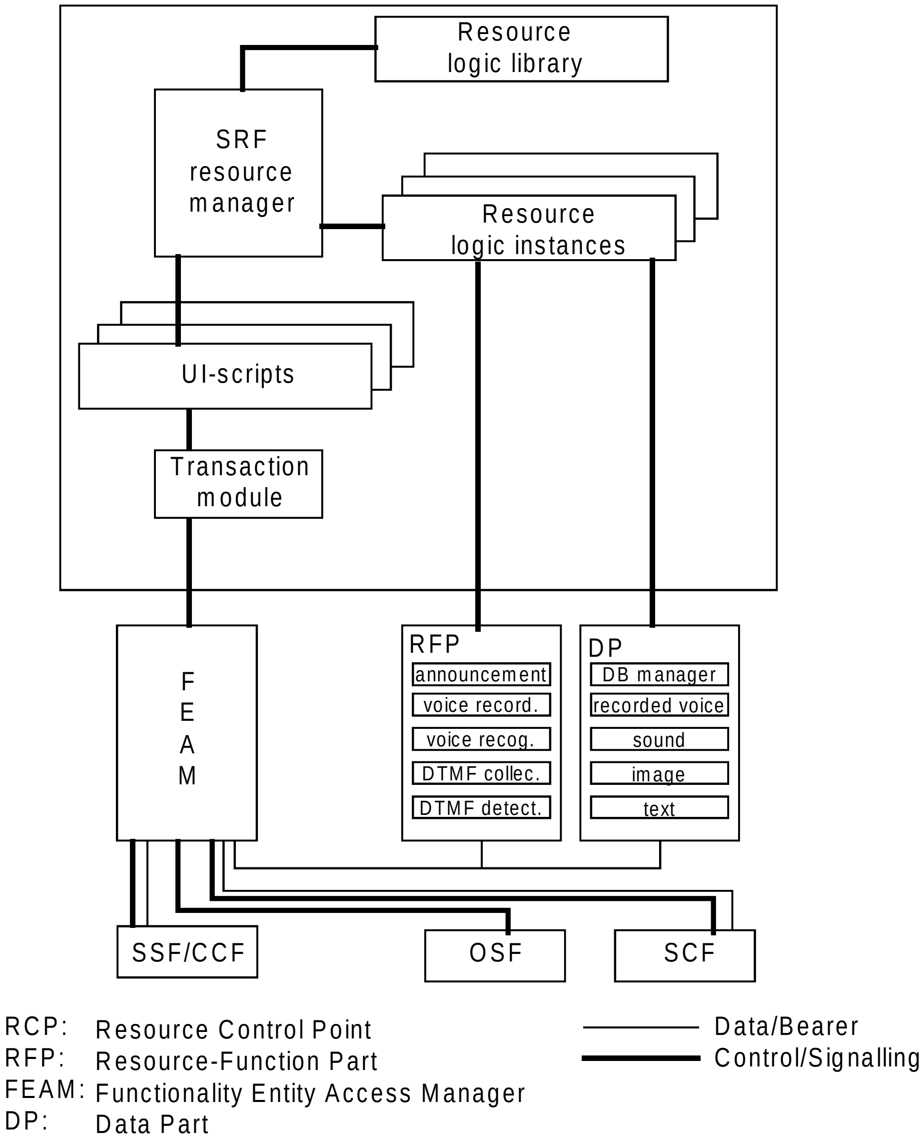

Figure 1: SRF model

5.1.1 FEAM

The FEAM provides the functionality necessary to exchange information with other functional entities:

- with SSF via the applicative protocol;
- with SCF via the direct protocol;
- with OSF via the direct protocol.

It also provides the functionality necessary to handle the voice connections.

5.1.2 RCP

The RCP contains SRF service logic, and controls the service procedure using the capabilities of other blocks. To offer a specialised resource, RCP uses resource-function pair in RFP and data in DP.

Whenever RCP receives a call requesting specialised resource-function pair, it invokes the internal resource controller, which manages the first needed resource function pair to make a decision of admission or rejection of the call. The SRF sends ACK or NACK messages according to the decision by the resource controller.

There are as many controllers as special resource function types. The controllers accept or reject calls requesting a resource-function pair on the basis of characteristic parameters. A controller consists of an interface unit and a decision unit. The first one encodes and decodes the messages from/to RM and makes the input patterns for the decision unit; the characteristic parameter permitting the acception or rejection of the calls controlled by an algorithm within the decision unit. Figure 2 shows the model of resource controller.

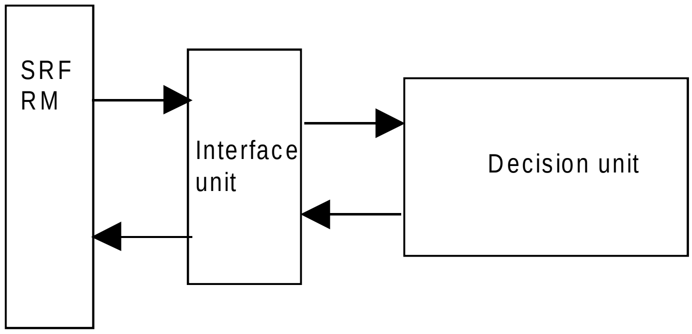

Figure 2: Resource controller model

5.1.2.1 SRF resource manager

The RM provides functionalities necessary for the SRF to manage the resources contained in it. The RM contains the capabilities to search for a resource, to allocate or deallocate it, to manage the status of a resource and to control its actions.

5.1.2.2 Transaction module

It provides the functionality necessary for:

- detection of transaction from the communication links;

- routeing of transactions to the right applications scripts.

5.1.2.3 User Interaction-Scripts (UI-Scripts)

It provides to the SCF a vision of the different specialised resources that the SRF can perform (see subclause 5.2.2.3). UI-Script is an aggregation of resource function.

5.1.2.4 Resource logic library

It indicates the SRF logic and physic resources necessary for a given UI-Script.

5.1.2.5 Resource logic instances

It instances the SRF resources that are necessary for the correct execution of the invoked specialised resource.

5.1.3 RFP

The RFP is a collection of resource-function pairs or functional element of resources. Resources in a resource-function pair for a service procedure are allocated and released together.

A preliminary set of CS2 SRF resources are described in clause 6. It should be noted that other resources could be identified as new services/service features are considered for the CS2. At the same time, the listed resources need to be prioritized as relevant services/service features will be for CS2.

5.1.4 Data part

The DP is composed of database manager and database which contains recorded voice, sound, image, text, etc.

5.2 SRF and other entity relationships

This subclause describes the relationships and the information flows between the SRF and other IN functional entities.

The general aspects of the SRF to other entities relationships mainly refers to the CS1 SRF to other entities relationships (see CCITT Recommendations Q.1214 [4] and Q.1218 [6]; specific enhancements with respect to CS2 are listed:

5.2.1 SRF-CCF relationship

At present, it is considered that the CCF is under control of the SSF: a SRF-SSF/CCF relationship exists for connection control to specialised resources; in CS1, this relationship is supported by the interface protocols identified in CCITT Recommendation Q.1218 [6], which would also be used for the CS2 SRF.

The relationship between the CS2 SRF and the CCF is for further study (e.g. in the case of releasing a connection on which a resource is used).

The SRF may contain functionality similar to the CCF to manage bearer connections to specialised resources, but no call model is specified.

5.2.2 SRF-SCF relationship

This subclause describes the relationship between the SRF and the SCF for connection to and control of specialised resources and UI-Scripts.

5.2.2.1 Call associated interaction

For all cases in which call associated interaction is considered, the establishment of this relationship needs to be preceded by the establishment of a relationship between the SCF and the SSF.

In CS1, the user-interaction is defined as a chain of "Questions & Answers", which result in the SCF sending several commands to the SRF in sequence. This process is optimised by making the SRF perform an indivisible block of "Questions & Answers" called a "UI-Scripts". This UI-Script offers "On-line" help, DTMF codes receipt anticipation and even "management by interruption".

Introducing the UI-Scripts concept extends SRF capabilities in such a way that the CS1 defined SRF capabilities are a subset of the new SRF capabilities.

The SRF is responsible for the whole user-interaction. In this way, the SCF has to tell the SRF to play a given UI-Script. The SCF waits for the result, which is returned at the end of the interaction. This kind of SCF/SRF relationship is illustrated by figure 3.

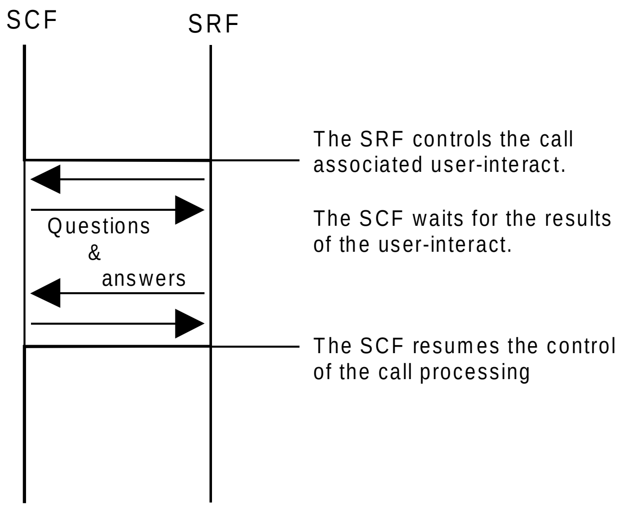

Figure 3

The SCF/SRF relationship is summarised by the following principles:

- the SCF is responsible for the Call Processing, e.g. it runs the service logic program. It tells the SRF to execute a given UI-Scripts and waits for the results;

- the SRF is responsible for the User-Interaction, e.g. it runs SRF Logic Programs, also known as UI-Scripts, invoked by the SCF.

The relative importance of the SLP and the SRF LP depends on the IN service invoked, i.e. on the relative importance of call processing and user interaction for this service.

NOTE: Depending on the implementation choices for a given service, the SRF may access the SDF (for instance, to retrieve the user's preferred language from his user profile), or this information may supplied to the SRF by the SCF in its invoking message.

5.2.2.2 Non-call associated interaction

The establishment of this relationship does not need to be preceded by the establishment of a relationship between the SCF and the SSF when a Non Call Associated (NCA) interaction is concerned.

NCA interaction is based on a set of procedures to exchange information with SCF when SRF is not processing a call. These procedures are generic in that they may be used for many services or operations, typically for management capabilities implementing in the logic. SRF could also use Non-Call Associated signalling during the processing of a call: this could be done independently of the call processing. Some examples of NCA interaction are provide as follows:

- the SCF monitoring the availability of resources at the SRF;

- the SCF requesting control of some SRF resources outside the context of a call, e.g. for automatic deletion of messages stored at the SRF (e.g. based on data/time parameters rather than commands from the user).

For the examples above, as well as for other not yet identified usage, the NCA interaction may require new operations between the SCF and the SRF (e.g. for establishing an NCA relationship between the SCF and the SRF new operations that could be defined are "NCA Request from SRF" and "NCA Data from SRF", at the SRF side, or "NCA Request from SCF" and "NCA Data from SCF", at the SCF side).

It could also be possible to allow the SRF to make some operations of updating, under the control of the SCF. The SCF could request some update user's profile parameters to the SRF; when the SRF has finished it will send back the new parameters to the SCF, which in turn will be able to pass them to the SDF; an example is described in the subclause 6.1.

In CS1, the SCF-SRF relationship is supported by the interface protocols identified in CCITT Recommendation Q.1218 [6]; specific enhancements with respect to CS2 will be based on information flows to be defined: in annex 1, some examples are given of new information flows which could be envisioned.

5.2.2.3 UI-Scripts

In the proposed architecture, the SCF delegates some of the service logic to the SRF, which executes a specialised type of service logic, known as *User Interaction-Scripts*. This architecture avoids long response times, which are unavoidable if functions are physically distributed over two networks nodes, the SCP and the IP.

UI-Scripts allow the grouping of the user interaction parts of the service into functional blocks which use SRF resources in the most efficient way. The transition from one to the other is triggered by internal results (e.g. error condition) or external decision (e.g. user choice, or result from a database interrogation).

Each of the UI-Scripts represents a generic action which may be parametrised. For instance, user authentication is a generic action, which may be described independently of, say, the length of the user identity and the length of the Personal Identification Number (PIN). These two numbers are parameters of the UI-Scripts.

UI-Scripts can take into account the experience acquired in the ergonomy of vocal services, thus offering state-of-the-art user interaction which can be re-used in new services.

5.2.2.4 SCF-SRF operations

The following operations are used by the SCF to control the state of UI-Scripts running on the SRF, these operations are dedicated to UI-Script instanciation:

- OPEN a UI-Script;
- CLOSE a UI-Script;
- RUN a UI-Scripts;
- STOP a UI-Script;
- PAUSE a UI-Script;
- RESUME a UI-Script.

Figure 4 summarises the four states in which a UI-Script can exist on the SRF and the transitions induced by each operation.

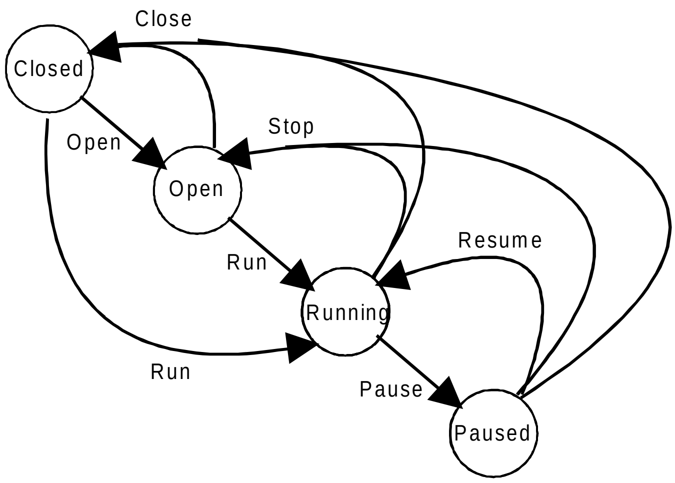

Figure 4

In addition, the following operations allow the SCF to query and modify information used by the UI-Scripts:

- READ a UI-Script parameter;
- WRITE a UI-Scripts parameter.

Each of the operations described above uses the following parameters:

- UI-Scripts ID;
- service ID;
- instance ID;
- other parameters, which are passed to the UI-Scripts.

A UI-Scripts running on the SRF returns information to the SCF on the results of the interaction with the user (yes/no/cancel, identifier+PIN, dialled number, etc.).

5.2.3 SRF-OSF requirements

The relationship between the CS2 SRF and the OSF deals with the management of the service specialised resources: a typical example could be the updating of stored announcements from a centralised management function in a co-ordinated manner with the logic updates of the service(s) using those announcements. Another case could be a process of collecting information on resources usage or resources availability in the network:

- the OSF is able to create, deploy and manage UI-Scripts on the SRF;
- the OSF is able to manage configuration data associated to the UI-Scripts on the SRF;
- the OSF is able to manage vocal data required by the SRF UI-Scripts.

The SRF could also provide for some procedures to allow service subscriber to directly manage the resources they have subscribed to, which are located onto the SRF; in this case, the OSF managing procedures are offered to a user connected to the SRF within the context of an IN call.

5.2.4 Integration of the SRF in the physical plane

The SCF/SRF relationship and SCF/SSF relationship are based on ETS 300 374-1 [8]. This ETS (subclause 4.2) explains that the SCP could communicate with the IP directly or indirectly via the SSP. Both types of network architecture have got advantages and disadvantages.

5.2.4.1 Direct link between the SCF and the SRF

The SCF sets up a dialogue with the SRF via the SSF (*EstablishTemporaryConnection* IF) and then it dialogues directly with it a through a Transaction Capabilities Application Part (TCAP) direct link.

Advantages:

- the SSF and the SRF/SSF signalling links are only used during the initiating and the terminating phases of the call;
- no limitation on message number between SRF and SCF.

Disadvantages:

- the initiating and terminating phases of the "User-Interaction" are complex.

  At the beginning of the "User-Interaction", it is necessary to correlate the first message sent by the SCF through the indirect path via the SSF with the following messages sent through the direct path.

  At the end of the "User-Interaction", it is necessary to verify that all the resources used for the "User-Interaction", and especially the SCF/SRF direct path, have been released;
- due to the correlation, the processing (protection, resources release) when a machine breaks down is complex;
- from the user point of view, the SCF SRF/SSF has an action before the SRF action and this could be delayed the SRF first announcement.

5.2.4.2 Indirect link between the SCF and the SRF

The SCP sets up a dialogue with the IP via the SSP (*ConnectToResource*) and then it dialogues with it on the same path.

Advantages:

- given that a correlation between the first message and the following messages is "naturally" present, the initiating and terminating phases of the "User-Interaction" are "simple";

- given that a correlation between the first message and the following messages is "naturally" present, the processing (defence, resources release) when a machine breaks down is "simple";

- it is possible to reduce the Waiting time of the user by embedding the first applicative order (play a given "user-interaction" scenario) within the first connection order *ConnectToResource*.

Disadvantages:

- there could be a limitation on number of message between SRF and SCF.
  Given that the user-interaction is defined as an indivisible block, the SSF additional traffic and the SCF-SRF message transfer time do not seem to be very limitative elements.

6 SRF resources

This clause describes the SRF resources requested by the CS2 targeted services/service features.

It should be noted that other resources could be identified as new services/service features are considered for the CS2. At the same time, the listed resources need to be prioritised as relevant services/service features will be for CS2.

SRF resources identified for CS1 CCITT Recommendation Q.1214 [4] are included, but not described in detail hereafter, except in the case where enhancements to them are requested.

SRF resources for CS1 are specifically related to "Play Announcements" and "Prompt and Collect user information" capabilities CCITT Recommendation Q.1214 [4], namely:

a) DTMF receiver;

b) tone generator;

c) standard and customised announcements generator;
   SRF resources for CS2 targeted services/service features are:

   1) Message Storage and Retrieval (MSR) device;
   2) conference bridge;
   3) protocol converters;
   4) display service interface handler;
   5) video information handler;
   6) bearer control for B-ISDN;
   7) data collection;
   8) ADSI server;
   9) ES;
   10) Automatic Speech Recognition (ASR) device, for both speaker independent and speaker dependent speech recognition;
   11) speaker verification.

   NOTE 1: Some SRF resources for CS2 were already defined for CS1 and listed as "for further study" (e.g. TTS in subclause 6.3).

Currently identified SRF resources for CS2 are briefly described in the following.

   NOTE 2: For particular information flows, the different specialised resources in the SRF may be needed within the same call, and functionally connected with each other.

6.1 MSR

This subclause describes the MSR resource of the CS2 SRF.

In this subclause, the term "message" applies to different media:

- voice (an example of the use of the MSR resource can be the remote recording of announcements; other examples apply to voice mail services);

- image (e.g. for fax or static photographs mail services);

- data (e.g. E-mail);

- video (this is for further study).

It is recognised that, depending on message media, some Quality of Service (QoS) issues could be raised (e.g. compressing voice information for storage from previously compressed sources).

SRF provides the capabilities to store, retrieve and delete the messages; these capabilities are provided to parties connected to SRF by means of procedures either controlled by the SCF or directly performed by SRF with no intervention by the SCF; in this case, SRF will inform the SCF of the result of the operation, if this has been requested by the SCF.

As an example, stored messages are maintained until they are deleted:

- automatically by SRF following internal predefined procedures; such procedures operate based on parameters whose values are either SRF internally predefined or dynamically defined at storing time; the parameters are either sent to SRF by the SCF or entered by the user who sent the message: in this case the parameter entering procedure is performed by the SRF with no control from the SCF;

- by SRF upon commands from SCF;

- by SRF upon commands from the connected user by OSF managing procedures: in this case the message delete procedure is performed by the SRF with no control from the SCF, which will be informed about the result of the operation.

Messages are stored in an SRF internal format from the source format presented to the network accesses of the node in which SRF is allocated.

Messages are stored by using *real time* encoding techniques; both proprietary and standard encoding are allowed.

Message retrieval is the capability to allow a party connected to SRF to access the message storage and have the message provided in its source format. If the message needs to be provided in a different format, an SRF protocol conversion capability should have been invoked .

If there are more messages stored and the user retrieves only some of them, the SRF will inform the SCF which are the messages not retrieved, so that SCF will be able to update the user's profile in the SDF. Same operations could be done to delete only the messages already retrieved. It could be also possible that the SCF passes to SRF all parameters needed to perform a specific user's profile update; when the SRF has finished its updating operations, the new parameters will send back to the SCF which in turn will be able to pass them to the SDF.

6.1.1 Message transfer

In this subclause, the SRF capability for transferring information (i.e. messages and associated "descriptors") between nodes onto which the SRF is allocated, under the control of a co-ordinating functionality, is covered.

This feature could be considered in some cases of multimedia session.

6.1.2 Intelligent message waiting and delivery service

This is the capability to allow a party connected to have expanded information (i.e. number of messages, Name and Directory Numbers of message-leavers, types of messages and priorities) to the end user about waiting messages.

The Intelligent Message Waiting and Delivery service (IMWD) would be available to users with ADSI CPE. The IMWD would be written to a reserved space in the pre-defined display page of a service script resident in the ADSI CPE.

6.2 Conference bridge

This subclause describes the conference bridge resource of the CS2 SRF.

In this subclause, the term "conference bridge" applies to different bridge types:

- broadcasting bridges (e.g. for the so-called "live feed" function);

- two-way bridges (e.g. for audio conference services).

Moreover, the conference bridge resource can be used for different media:

- voice;

- video (this is for further study).

In this subclause, the SRF capability for allocating and controlling bearer capabilities is also covered.

One-way channel bridges (broadcasting bridges) are typically used to distribute in-channel information received from a linked virtual resource to all the other linked virtual resources. Any virtual resources which receive distributed information can be split from the connection resource. Any new virtual resources can be joined to the connection resource.

Two-way channel bridges (conference bridges) are typically used to mix in-channel information received from any linked virtual resources and send mixed information to all the linked virtual resources. Any virtual resources which receive mixed information can be split from the connection resource. Any new virtual resources can be joined to the connection resource.

It is recognised that handling of both one-way channel and two-way channel bridges could be requested at the same time within the same multi-party call.

The two type of bridges above may have different control characteristics from the SRF point of view.

6.3 Protocol converters

This subclause describes the Protocol converter resource of the CS2 SRF.

The protocol converter resource allows the conversion of different media sources. Some examples could be:

- converting data to image (e.g. E-mail into fax), and vice versa;

- converting data to voice: this is usually referred to as TTS;

- converting voice to data: a particular application of this is the Automatic Speech recognition (ASR, see below).

For TTS, it is recognised that multilingual support is at this time being a non standardised capability which is for further study.

The protocol converter resource also applies to converting formats within a specified medium. Some examples could be:

- protocol conversion for interfacing with radio paging systems;

- signalling protocol conversion.

An example of the use of this SRF resource could be the exchange of information (in the form of <query-response>) with existing external data-bases, i.e. existing data repositories owned by external services providers, which use the external data-bases for their service offerings: to access them, some protocol conversion would be needed.

6.4 Display service interface handler

This subclause describes the display service interface handler resource of the CS2 SRF.

In this subclause, the SRF capability for handling user interaction through interface to "screen phone"-like CPE is also covered.

The display interface applies to both in-band and out-band channel communication with the user.

The ADSI server and ES could be developed also with this resource of SRF.

6.5 Video information handler

This subclause will describe the Video Information handler resource of the CS2 SRF.

In this subclause, the SRF capability for storing and forwarding video information related to both broad band and narrow band service will also be covered.

The Video On Demand (VOD) service could be developed using also this resource of SRF.

This resource is for further study.

6.6 Bearer control

This subclause describes the bearer control resource for B-ISDN support.

A Resource Control (RC) layer could be introduced in the B-ISDN functional model which handles complex calls involving specialised resources (such as multimedia and multiparty calls). This RC layer shows many similarities with the enhanced SRF, so that an SRF capability could be envisioned which acts as an RC entity.

This ETR will be enhanced to incorporate requirements on this matter coming from on-going activities on the impact of B-ISDN on the IN when they are available.

6.7 Data collection

This subclause describes the data collection resources of the CS2 SRF.

This can be used to provide the SRF with the capability of collecting data on resources usage; such data can be passed to the SCF which will use them for, for example, billing purposes.

This resource could be used for access to a multimedia database.

6.8 Announcement generator

This subclause describes the enhanced usage of the announcement generator resource for the CS2 SRF.

The SRF would provide the capability for handling multilingual announcements, i.e. announcements of the same content stored in different languages (the languages available could be defined by the network operators on a bilateral agreement basis or standardised, at least as a minimum set: this arrangement could have different impacts on the SRF resource).

The language selection feature could be performed by either the SCF or the SRF in autonomy.

In the former case some language indicator would be needed to direct the SRF to handle the multilingual announcement.

In the latter case the SRF would be able to identify the requested language by handling some interaction with the user without the control of the SCF. Moreover, some fall-back procedure would be needed if the requested language where not available at the SRF.

The above indications apply to both cases of announcement generation using pre-stored coded speech and announcement generation based on TTS synthesis.

6.9 Digit collection

This subclause describes the enhanced usage of the digit collection capability for the CS2 SRF.

This capability is based on both the DTMF receiver and the announcement generation resources. It should be noted that the enhancement considered does not refer to the resources themselves, rather to the overall "logic" in the SRF to control the digit collection.

The syntax of the information element specifying the characteristics of the digits to be collected in a "Prompt and Collect User Information" operation would need to be enhanced for, for example, receiving from the SCF the "list" of the allowed (or not allowed) digits input by the user. In this way, the SRF would be able to handle in autonomy any error treatment specified by the SCF, improving the user procedure and eliminating overloading exchanges of operations between the SRF and the SCF. The SRF would apply the error treatment in autonomy, an example of which follows:

- the wrong entry is discarded in the SRF, while the prompt is interrupted by the SRF itself;
- the SRF gives the user an indication that the entry was not allowed (this could be an option);
- the SRF restarts the initial prompt from the beginning;
- a limited (predefined) number of repetitions is allowed, based on either a count of the repetitions at the SRF or some other time out mechanism (at the SRF as well as at the SSF).

This procedure specifically applies to the case of digit collection based on a menu of choices (e.g. "x for feature a, y for feature b, etc."), but could also be used for other situations (e.g. input with predefined structure or sequence of digits).

Moreover, though DTMF digit collection has been considered, the logical structure of the above procedure could also apply to input collection based on automatic speech recognition.

6.10 ADSI server

The SRF capabilities are ideally suited to perform the ADSI server functions. The SRF can provide the specialised resources required to create scripts, and negotiate and download scripts over bearer channels. The functions performed by an ADSI server are:

- receive ADSI script update requests from the OSF to construct scripts and initiate downloads;
- receive and associate the Features Download Number (FDN) and Feature Version Number (FVN) with the ADSI script requests received from the OSF;
- create customised service scripts for individual customers;
- store and administer customised service script;
- schedule downloads to ADSI CPE;

- request access to customer CPE;
- negotiate service script download with ADSI CPE;
- download service script to the ADSI CPE;
- notify the OSF of the successful or unsuccessful script download. When unsuccessful, provide the reason;
- terminate script download attempts if an error is reached and notify the OSF.

The ADSI server in the SRF exchanges information with the SCF. The SRF will encode and decode new messages exchanged between SRF and SCF. Messages exchanged between SRF and SSF that are destined for the SCF or SSF itself will be carried in the facility Information Element of ISDN call and ISDN non-call-associated messages.

Services applications and resources to support the ADSI Server FE need to be developed.

The SRF Voice Activated Dialling (VAD) application may be expanded to include the option to collect, from the user, alternate billing information and/or a preferred carrier in order to correctly allocate the billing of the second leg of the call (from the home SSF to the called party).

This resource is for further study.

6.11 ES

The ES (like ADSI Server) needs a transmission path to the end user, as well as a communication path to the Extended User Interface (EUI) service control. It also requires specialised resources to interact with voice-input subscribers. For these reasons this FE is allocated to an SRF.

The ES provides the functionality to interact with callers using speech recognition, context-sensitive announcements, and ADSI CPE with context-sensitive displays. Functions performed by this FE are:

- provide voice recognition of spoken command;
- send a CPE Alerting Signal to ADSI CPE (determine if terminal is available);
- collect DTMF digits including soft-key return string;
- construct virtual pages for ADSI CPE screen display;
- provide ADSI messages to ADSI CPE;
- receive, store and administer speech templates;
- access VAD directory;
- send service requests to EUI service control;
- receive service data from EUI service control;
- provide operations a notification of the following failures:
    - play announcement;
    - DTMF collection;
    - recognition of spoken command;
    - ADSI message download.

This resource is for further study.

7 SRF resources functions

In this clause, the functions of two SRF resourcesare classified, the first one being the automatic speech recognition.

7.1 Automatic speech recognition

This subclause describes the enhanced usage of the ASR resource for the CS2 SRF.

The ASR resource allows the IN services user to input commands and data in his/her own voice.

ASR can be both speaker-independent and speaker-dependent. In case of speaker-dependent ASR, a mechanism should be provided which enables the user to directly manage his/her voice templates used for recognising commands and data: such a mechanism should allows the user to review, update, delete and insert both:

- the voice templates; and
- the correspondences between the templates and the SRF internal format of the recognised voice (e.g. between a voice input name and the corresponding string of ASCII characters).

This mechanism could be either controlled by the SCF or directly performed by SRF with no intervention by the SCF; in this case, SRF would inform the SCF of the result of the operation, should this have been requested by the SCF.

Though the ASR resource can evolve following the advances of the underlying technology, it is recognised that the basic ASR resource should provide for the recognition of isolated words (i.e. the ten digits and a number of basic commands such as "yes" and "no" spoken at least in the local network provider language) in a speaker-independent manner over the PSTN.

Word spotting and talk-through are two speech-recognition techniques that could help make the interaction between the users and the service efficient. The first one allows users to speak naturally; the second one allows users to break-in conversationally and make a menu selection as soon as it is mentioned without waiting for the end of the menu description.

Considering that multilingual ASR could also be useful, it is recognised that the SRF should handle the indication of the requested language to be used for voice inputs, in the same way as announcement generation described above.

In the following, some services which use voice dependent speech recognition and voice independent speech recognition are described; the first one is VAD, the second one is Voice Activated Network Control (VANC) and the third is Voice Activated Premier Dialling (VAPD).

7.1.1 VAD service

The VAD service is a particular application of the voice activated services family, which allows users to access and manage the features of different services by means of a "speech interface", based on Automatic Speech Recognition techniques.

The VAD service allows customers to place a call by simply saying the name (name dialling) or the digits of the telephone number of the party they wish to call. Upon recognising the spoken input, the VAD service will dial the requested telephone number for the subscriber. For name dialling, the recognised input can be played back to the customer for confirmation, possibly along with the associated number. Each customer has a VAD personal directory, which, for name dialling, consists at least of a set of voice templates (the spoken names recorded in the subscriber's own voice) associated with the telephone numbers. The customers can manage their directory so they have the ability to add, delete or modify entries (i.e. the voice templates with associated telephone numbers) as required. The customers can access the VAD service either:

a) from their base line at every off-hook; or

b) from their base line by dialling a specific short code; or

c) from any telephone in the network, by dialling an access code and validating themselves with a PIN code.

For the utilisation of the service will be necessary the speaker dependent speech recognition.

7.1.2 VANC

The VANC service is a new user interface technology that provides users with the capability to activate and deactivate services by saying the equivalent of a Services Code (SC), based on Automatic Speech Recognition techniques.

The VANC service allows customers to use one access code to reach a menu of all custom-calling services and then request the desired service by name. After dialling the access code, users are asked for the name of the desired service. The user commands the system to activate the service simply by saying its name. If users ask for help, the service describes the services available and gives instructions for using them.

The customers can access the VANC service either:

a) from their base line by dialling a specific code; or

b) from any telephone in the network, by dialling an access code and validating themselves with a PIN code.

For the utilisation of the service will be necessary the speaker independent speech recognition.

7.1.3 VAPD service

The VAPD service allows the users to speak a keyword/name associated with a business or agency. Such names are preregistered into the network, the VAPD service uses the recognition of the word and translate it in the subsequent dialling. For the utilisation of the service will be necessary the speaker independent speech recognition.

Customers can access the VAPD service from any telephone in the network by dialling a specific access code.

The speech recognition function required by advanced IN services should accomplish the following requirements:

a) should recognise the speech of users;

b) should have a speech synthesis function for guiding the user;

c) should control the dialogue between the user and the system.

7.2 Text to speech

The TTS function required by advanced IN services could consist of several elementary functions contained into two modules that works sequentially. The first one (high level) should execute linguistic operations to convert the input text in a phonetics-prosodic representation. The second one (low level) should produce the synthesised voice signal, processing and connecting elements of voice stored to construct the prosodic characteristics specified.

Annex A: How to use the SRF UI-Script

A.1 The SRF enhanced functions

This clause presents all the possible actions the SRF is able to perform. As far as possible, a standard input and output has been provided.

First, the elementary actions are described, which are then combined to build the enhanced functions.

A.1.1 Elementary actions

Three elementary actions have been identified:

- **prompt playing:** the purpose is to play a message, followed by silence of adjustable duration. This can be interrupted by DTMF detection, speech detection, hang up, external message from a distant unity;

- **speech recording:** the purpose is to record in a file the user's voice during a specific time and as long as no event occurs: (DTMF detection, silence detection, hang up, external message) or the end of allowed recording time;

- **data manipulation:** like operation on numbers, lists, strings or tables. For example, the purpose is to control the number of prompts repetition or the data format.

A.1.2 Enhanced functions

The purpose is to define some standard enhanced functions. Some examples are given, but not the entire set of enhanced functions.

> **Remarks:** Some of the possible cases like user hang up (Result=HgUp), user inaction (Result = Inaction), external event (Result = External), etc. are not shown. Some are taken into account by the SCF, some are first processed by the SRF which need to afterwards advise the SCF (e.g. user inaction).
>
> Not all of the possible enhanced functions are defined. In fact, only some families are defined. The enhanced function has to be customised to the service. For example each information diffusion had to be adapted with the context.
>
> The name of each enhanced function lets the specifications reader know what is achieved by the services. But in reality, the user interface is only depending on human factors choices which don't impact the global service logic (the SCF).

- **Information diffusion:** to indicate to the user the state he is currently in. The information can be played several times with a variable degree of details.

  The possible exits are:

  - DTMF action (Result = name of key pressed);

  - speech detection (Result = Detection);

  - end of work (Result = End);

  - external event (Result = External).

- **Get an information:** to allow the user to enter an information like a card number, a pin code or a phone number to be called. This allows procedure cancellation and error recovery.

  It is divided into three phases:

  - prompt the user to dial a number. In this case the user can cancel e.g. by pressing "star". The enhanced function exits with result = cancel;

  - the dial number phase. The SRF is waiting for the keyed-in DTMF. Depending on the input, the enhanced function can:

    - exits with Result = OK and the number is given to the SCF;

    - go to the error handling phase, if some errors occur;

    - return to the dial number phase.

  - error management phase monitors the number of errors. If the user exceed the number allowed, the application exits with Result = ErrForm, otherwise the user is informed of the type of his mistake and the application asks again for the number.

The enhanced function architecture is shown in figure A.1.

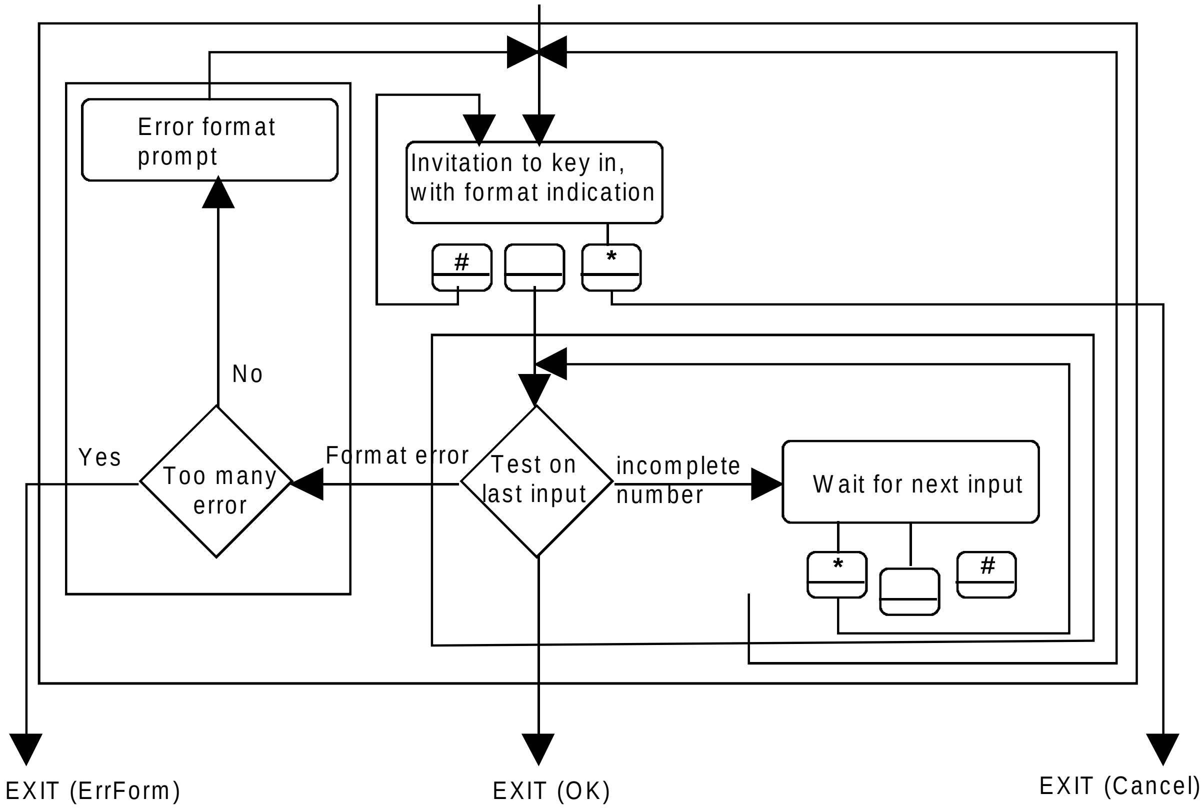

Figure A.1: Enhanced function architecture

A.2 Example: A card calling service

A.2.1 Assumptions

As an example, a calling card service on a IN architecture which shares service logic between the SCF and the SRF is described. The SCF runs the global service logic and the SRF runs the service logic dedicated to user interaction. It is assumed that:

- the SCF calls the card databases. During this time, SRF entertains the user by playing a message (or music);
- the service phases are named: AskCardNum, AskTelNum, Menu, WarningEnd, which are the enhanced functions run by the SRF;
- the service phases are named: AskcardNum, AskTelNum, Menu and WarningEnd, which are SCF state of the services;
- SCF sends several messages to the SRF using the SCF-SRF operations: Open, Close, Run, etc.;
- SRF answers using Information message;
- one enhanced function running on the SRF is stopped each time a new one is launched by the SCF. For example, when the SCF asks databases for user authentication, the SRF plays a waiting music until the SCF requests it either to prompt the user of a wrong number or to get a phone number;
- the SCF manages all evens like user hang up, network congestion, no-answer;
- in case of user hang up, the SRF is hung up and loses all communication information.

The SCF service logic could reach several states which are:

- **Authentication:** the SCF asks databases. Depending on its response, there are the following states: Card OK, Card NOK (in this case the SCF manages the number of tries), In service card (people is using the card), too many attempts, etc.;
- **Call:** SCF tries to reach the correspondent. During the ring the following events could occur: answer the phone, no answer (after delay), busy, congestion, too many attempts, restriction on the dialled number, etc.;
- **Comm:** the user has reached his correspondent. The end of this state are: hang up of the correspondent, credit limit.

A.2.2 Enhanced functions

The dedicated enhanced function on the SRF are:

- **AskCard:** the purpose is to get the user card number. The SRF controls the waiting duration and the number of repetition of each prompt. The SRF has to collect the card number managing user attempt, controlling the data format, the cancellation, etc.;

  The possible exits are:

  1) OK with card number; or
  2) NOK with the cause (errors, cancellation, etc.).

  In case 1), SRF will stay on line and will entertain the user with music. In case 2), the SRF hang up after an information prompt like "sorry too many mistakes (response NOK, cause = ErrorNum);

  Remark: User is not allowed to anticipate the phone number entry. This could be possible but it is much more complicated for this first study.

- **AskTel:** the SRF asks phone number;

  Remark: User is not allowed to anticipate the phone number entry. This could be possible but it is much more complicated for this first study.

- **Menu:** the SRF depending on the call progression needs to prompt the user to know what to do. For example in case of no answer, after a specific time waiting, the SRF needs to prompt the user and ask him if he wants to wait any longer or stop ringing and call latter. In the case of asked user hang up the enhanced function will ask user if he want to make an other call and get phone number;

- **WarningEnd:** will prompt the user of the next end of the service.

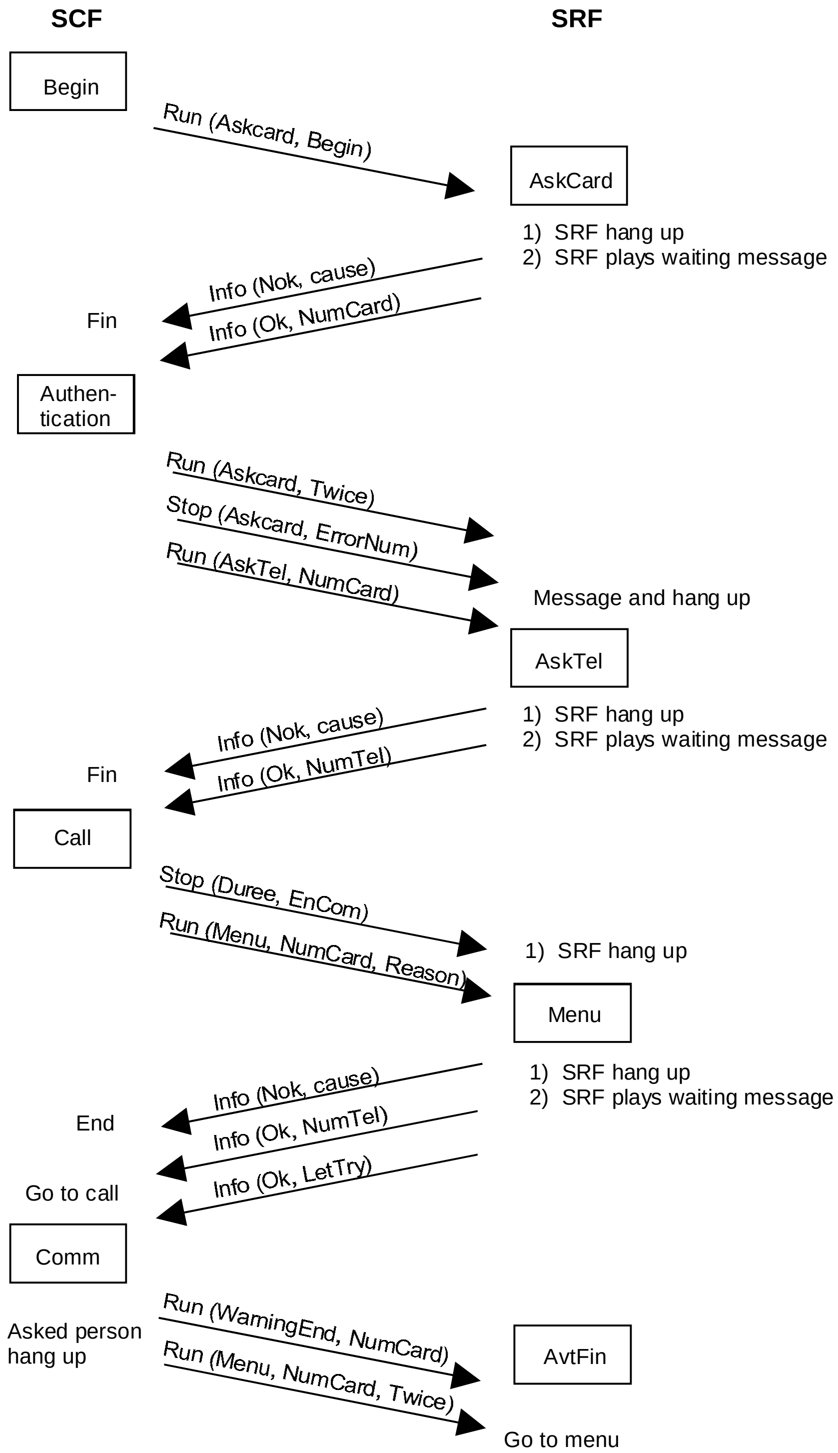

Figure A.2

Annex B: Speaker Verification (SV)

Speaker Verification is the process of verifying a person's claimed identity by analysing a sample of that person's speech. This form of security is based on the premise that humans can, to some degree of confidence, be identified by their speech. For telephone-based applications requiring access authorisation, speaker verification can be used to identify or validate the caller. Before gaining access, however, the caller is required to have previously enrolled in a reference database. This enrolment is typically accomplished by repeating a multidigit password several times.

Many varieties of applications can benefit from speaker verification technology. For example, banks and other financial service companies can greatly enhance the security of existing telephone-based account access system. The technology provides secure access to all callers, including rotary telephone users, and performs verification transparently during ordinary transactions, rather than requiring entry of supplemental phrases or PINs. The secure access is obtained much more quickly and easily than is possible with commonly used or suggested methods requiring supplemental keypad entry of PIN's or spoken entry of additional phrases for speaker verification.

An example of speaker verification decision strategy is shown in figure B.1.

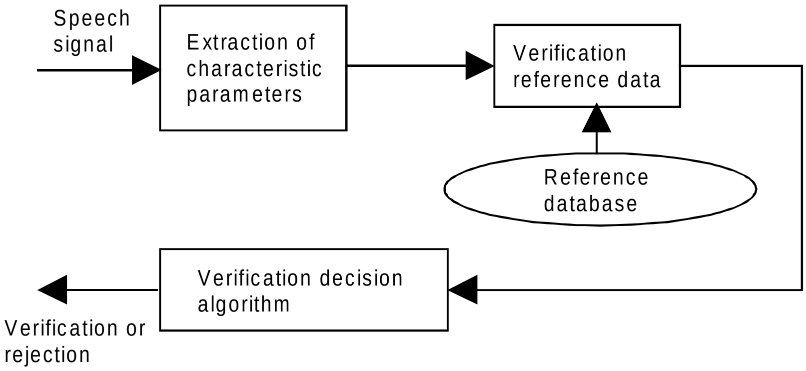

Figure B.1: Speaker verification decision strategy

All reference parameters for each enrolled user are initialised on the first enrolment call, during which the password is typically spoken several times. Reference parameters could be gradually and cautiously updated upon each subsequent call. The reference parameters represent a sort of signature or "voiceprint" of each enrolled user, several other parameters are used to adjust the general strictness of verification; some parameters are global in effect, other are user-specific affecting only individual enrolled users.

This resource is for further study.

An example of the implementation of this function could be a feature like voice Identification (ID). It allows the users to place outgoing call from anywhere, using their calling card. The user dial an access code and after the procedure of ID, by a keyword or general word, the user will be able to speak the number desired, or the name with procedures like VAD. ID procedures are based on Speaker Verification function in the SRF.

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