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Information Aspects of Services and Service Features in Intelligent Network Capability Set 1*

Kimmo E. E. Raatikainen

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University of Helsinki
Department of Computer Science
P. O. Box 26 (Teollisuuskatu 23)
FIN-00014 University of Helsinki, FINLAND

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Information Aspects of Services and Service Features in Intelligent Network Capability Set 1[†]

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Abstract. The concept of Intelligent Networks as specified in the current ITU-T Recommendations in Q.1200 Series presents a way of applying information processing technology in order to provide telecommunication services. The world-wide nature of telecommunication services requires that the systems are open distributed systems. We examined the services and service features described in ITU-T Capability Set 1 from the ODP information viewpoint.

Key Words: Telecommunication, Intelligent Networks, Open Distributed Processing, Information Viewpoint.

CR Classification: C.2.4, H.4.3, J.7

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1 Introduction

The database operations needed in services based on the concept of Intelligent Network (IN) are provided by functional elements called Service Data Functions (SDFs). An SDF is a database server the clients of which are the functional elements called Service Control Function (SCF) and Service Management Function (SMF). The Capability Set 1 (CS-1) specifications have an Application Service Element (ASE) called User Data Manipulation ASE that provides the necessary communication capabilities to access an SDF from an SCF. The ASE consists of two operations: `Query` and `UpdateData`.

Attempts to use the operations included in the ASE to support advanced services such as Universal Personal Telecommunication (UPT), Universal Mobile Telecommunication System (UMTS), or Virtual Private Network (VPN) have, according to Chatras and Gallant [1994], shown several shortcomings. When we look for the reasons why the database access in CS-1 Recommendations came to a dead-end, the explanation given most often is that the SDF operations were defined quite lately, on the fly, without any deep analysis of their use [Chatras and Gallant 1994]. However, we believe that the ultimate reason was the lack of an explicit information model in CS-1 Recommendations.

The ISO Reference Model of Open Distributed Processing[1] (RM-ODP) defines five viewpoints that are pragmatic tools. Each viewpoint — enterprise, information, computational, engineering, and technology — leads to a representation of the system with emphasis on on a specific concern. ITU-T Recommendation Q.1201 *Principles of Intelligent Network Architecture* [ITU 1993a] claims that within IN the notion of viewpoints has been adopted in the concepts of planes in the IN Conceptual Model (INCM). However, we have not found descriptions of IN from information viewpoint in the current recommendations in Q.1200-Series.

The database requirements for IN are recently examined in Kerboul *et al.* [1993] and in Eurescom [1993]. In Kerboul *et al.* [1993] the focus is on the engineering viewpoint. The Eurescom Project S23 [Eurescom 1993] named *Fact-finding Study on Requirements on Databases for Telecom Services* addressed the functional and operational requirements on databases. In ODP terms the focus was on engineering and technology viewpoints.

This report tries to characterize the information aspects of targeted services and service features of IN CS-1. Our analysis is based on the short prose descriptions given in Annex B of ITU-T Recommendation Q.1211 *Introduction to Intelligent Network Capability Set 1* [ITU 1993b]. The annex forms an integral part of the recommendation. However, should be noted that "*the prose descriptions in the annex are only a compilation of available descriptions from various sources of targeted services and service features. These were used to develop the current Q.121x-Series Recommendations as CS-1 is intended to support evolutionary services. The descriptions provided for the targeted services and service features are for the above-mentioned purposes only and are not to be used by service designers for service creation. There may be more than one prose description for each service/service feature. The descriptions are not necessarily consistent with each other.*" [ITU 1993b, p. 18]

The report is organized as follows. In Section 2 we present a generic information content for various telecommunication services. In the next two sections we repeat the ITU descriptions of the services

[1] A recent introduction can be found in Raymond [1993].

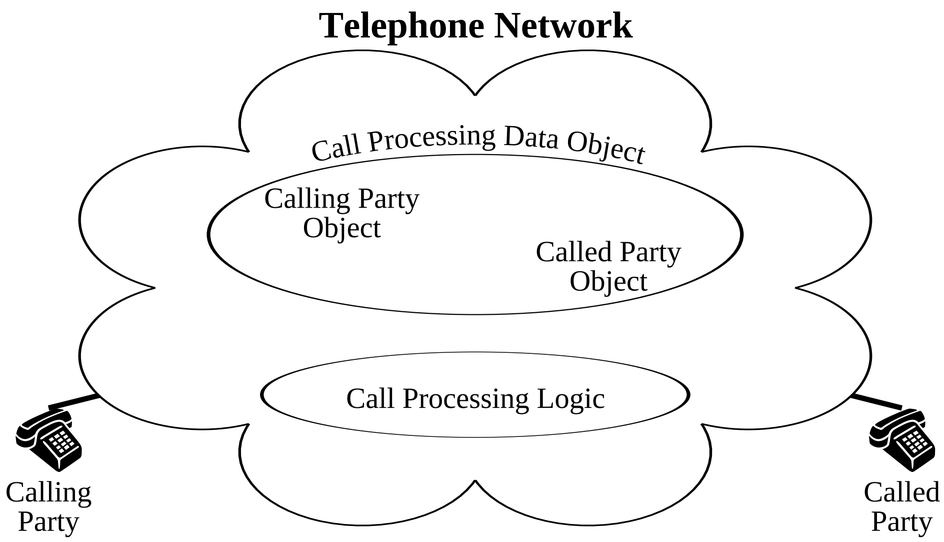

Figure 1: High-level Information Model for Telephone Call

(Section 3) and service features (Section 4). In addition, we characterize the information aspects each targeted service. The targeted service features are annotated only if they introduce new information aspects. In Section 5 we summarize our findings.

2 Information Model for Telecommunication Services

On abstract level we can interpret that a telephone call is controlled by call processing logic and data. The data can be termed as *Call Processing Data Object*. It is a dynamic object that is created during the call establishment. During the call the object may change as a result of the so-called mid-call service control actions. Logically the data object can be divided into two parts: *Calling Party Object* and *Called Party Objects*. Moreover, the data object may have attributes that trigger actions to modify and/or to create persistent data objects when the call is terminated.

Figure 1 summarizes our abstract information model of a telephone call. It should be noted that the call is not necessarily between two telephones. The called party may also be an information processing system. User management of services is a typical case in which the called party is an information processing system.

The Call Processing Data Object is typically created in two phases. The first phase consists of creating the Calling Party Object. When the switch detects that the hook is lifted up a query is triggered. The query builds up the object by retrieving the service profile for originating line from the persistent subscriber data object.

The Called Party Object is created in the second phase. This object depends on the access number dialled. Typically, the dialled digits are given as the key in the query that creates the Called Party

Object. The query builds up the object by retrieving the service profile for destination line from the persistent subscriber data object.

The persistent data objects needed in telecommunication services are managed by one SDF or by several SDFs. The distribution of persistent objects may be transparent or non-transparent to the SCF. In this paper our focus is on the information aspects. In ODP-terms we examine the services from the information viewpoint. Therefore, we can assume that the distribution is transparent.

3 Targeted Services

3.1 Abbreviated dialling (ABD)

ITU Description. This service is an originating line feature that allows business subscribers to dial others in their company using, e.g. only four digits even if the calling user's line and the called user's line are served by different switches. This capability extends switched based intercom calling beyond the switch boundary.

Typical scenarios might include:

(1) Caller A (location A) dials extension number of caller B (location B) and the network connects the call.

(2) Caller A forwards his line to called B (different location) using B's extension number. Caller C calls A and is forwarded to B.

Database scenario(s): *SDF translates the abbreviated number into actual destination number. Profile for the originating line includes abbreviated numbers.*

NOTE: *The subscriber must be able to update abbreviated line numbers. How the updates are protected? Scenario 2 implies that call can be forwarded to an abbreviated number.*

3.2 Account card calling (ACC)

ITU Description. **No. 1:** The account card calling service allows a user to make a call from any card reading telephone and have the charges for the call automatically debited to a domestic or business account number as defined by the card content. The user is given an access code and a personal identification number (PIN). The user invokes the service by dialling the access code and on request, enters his PIN and "wipes" the card through the reader. The system validates the information and gives the user an indication of acceptance. The user can then proceed in the usual manner of making a call.

No. 2: The account card calling service allows subscribers to place calls from any normal access interface to any destination number and have the cost of those calls charged to the account specified by the ACC number.

No. 3: This service allows the caller to be automatically charged on a telephone account subscribed with the network operator, for any type of outgoing call. The caller has to dial his card number and a PIN, then the called number.

As an option, forward calls may be allowed, without dialling again card number and PIN.

Database scenario(s): *SDF validates the PIN and returns a* `charge_id` *for the given account_info and PIN. The validation might be carried out in an SCF but can we trust (i.e. give the actual PIN to) an SCF in a foreign network. For security reasons, a* `charge_id` *(not the actual account_no) is returned. When the* `charge_id`*s are uniquely generated, we obtain a protection against replay attacks.*

On call completion, SDF receives the charge record with the `charge_id`*. The record is stored with the actual account_no.*

NOTE: *There may be restrictions on destinations that can be called!*

3.3 Automatic alternative billing (AAB)

ITU Description. **No. 1:** The AAB service enables a user to make a call from any telephone and for the call charge to be billed to the user's account which is specific to this service, and which does not refer either to the calling line or to the called line.

An account code and PIN are allocated to a service user by service management procedure.

To invoke the service, the user dials an access code as a free call. Different access codes could be used to identify the language to be used. The user then receives announcements asking for him to dial his account code and PIN. The account code and PIN are validated, and a check could be made for expired credit limits.

NOTE: Account/credit card calling is similar, with the account No. being supplied using a card wipe.

No. 2: This service allows a user to call another user and ask him to receive the call at his expenses. Two steps may be defined: the calling party is welcomed to record a brief message giving the caller's name and explaining the call reason, then the called party is alerted, receives the recorded message and is asked to accept to be charged for that call.

Database scenario(s): *Similar to ACC; see Section 3.2.*

3.4 Call distribution (CD)

ITU Description. This service allows a subscriber to have incoming calls routed to different destinations, according to an allocation law which may be real-time managed by the subscriber.

Three types of law may exist:

- circular distribution, where the calls are routed to the different locations with a uniform load;
- percentage distribution, where the calls are routed to the different locations according to a percentage;
- hierarchical distribution, where the first location to be chosen is the first met in the priority list.

In addition, congestion at one location may cause overflow calls to be rerouted to an alternate location.

Database scenario(s): *Profile for destination number has attributes needed in call distribution. There are two alternative ways to support this service. Firstly, SDF may return the CD-profile to SCF and later receives an update. Secondly, SDF may return the actual destination line number. In this case the update can be done simultaneously with the query.*

NOTE: *If busy/no reply statistics are to be maintained, the SDF may later receive an update request.*

3.5 Call forwarding (CF)

ITU Description. **No. 1:** Call forwarding allows the called user to forward calls to another telephone number when this service is activated. With this service, all calls destined to the subscriber's number are redirected to the new telephone number. This service is under control of the subscriber and can be activated/deactivated by the subscriber. When this service is activated, the subscriber's line will receive an alerting ring, "reminder ring", to indicate that the service is activated.

No. 2: This service permits the user to have his incoming calls addressed to another number, no matter what the called party line status is. The user's originating service is unaffected, even for charging.

Database scenario(s): *Profile for destination number has attributes needed in call forwarding. SDF returns the actual destination line number.*

NOTE: *The management of CF must be carefully done. Particularly, is CF allowed to the actual destination? Future regulations may require that the subscriber of the actual destination may cancel the CF. This implies that the profile for the actual destination should contain a list of numbers from which the calls are forwarded.*

3.6 Call rerouting distribution (CRD)

ITU Description. This service permits the subscriber to have his incoming calls encountering a triggering condition (busy, specified number or rings, queue overload or call limiter) rerouted according to a predefined choice: the calls may be rerouted to another destination number (including pager or vocal box), rerouted on a standard or customized announcement, or queued.

Database scenario(s): *SCF must learn if the destination has a triggering condition for CRD. SDF may return the whole data object needed in CRD. If rerouting statistics are needed, the SDF may latter receive an update. Alternatively, the SDF may first return the condition alone. If the condition fires, the SCF makes the number translation query.*

OBSERVE *that the new destination may have the same service. How circles are avoided?*

3.7 Completion of calls to busy subscriber (CCBS)

ITU Description. This service allows a calling user encountering a busy destination to be informed when the busy destination becomes free, without having to make a new call attempt.

Database scenario(s): *Profile for the called busy number has a list of numbers that have tried to call during the current ongoing call. If the calling party has CCBS service activated, then the number of calling party is inserted into the list in the profile for the destination number. During the call termination an action to establish a new call is triggered.*

3.8 Conference calling (CON)

ITU Description. Conference calling allows the connection of multiple parties in a single conversation. The number of parties allowed to be connected simultaneously will vary based on transmission bridging requirements to ensure Quality of Service.

Database scenario(s): *For prearranged conferences the database contains access code, conference bridge, reservation time, and a screening list of allowed incoming calls. When the access code is called, the call establishment is similar to ordinary destination numbers having a screening list. The prearrangement requires a management interface.*

In order to support online establishment of conference calls, the database must have reservation information about all available conference bridges. This kind of support is very similar to management of objects in the class of conference bridges through TMN.

3.8.1 Conference calling add-on

ITU Description. This service allows the user to reserve a conference resource for making a multiparty call, indicating the date, time and conference duration. Once the conference is active, the user controls the conference, and may add, drop, isolate, reattach or split parties.

3.8.2 Conference calling meet-me

ITU Description. This service allows the user to reserve a conference resource for making a multiparty call, indicating the date, time and conference duration. In due time, each participant in the conference has to dial a special number which has been attached to the booked conference, in order to access to the conference bridge.

3.9 Credit card calling (CCC)

ITU Description. **No. 1:** The credit card calling service allows subscribers to place calls from any normal access interface to any destination number and have the cost of those calls charged to the account specified by the CCC number.

No. 2: This service allows the caller to be automatically charged on a bank card account, for any type of outgoing call. The caller has to dial his card number and a PIN, then the called number.

As an option, forward calls may be allowed, without dialling again card number and PIN.

Database scenario(s): *In principle, similar to ACC; see Section 3.2. However, the fundamental difference is that the credit card info and PIN are not managed by the teleoperator but by a bank or a credit company.*

SDF may access the verification center of the bank/credit company. On call completion, the charge is sent to the bank/credit company.

In this service, there several open questions because the card is from a third party.

3.10 Destination call routing (DCR)

ITU Description. **No. 1:** This service allows customers to specify the routing of their calls to destinations according to:

a) time of day, day of week, etc.;
b) area of call origination;
c) calling line identity of customer;
d) service attributes held against the customer;
e) priority (e.g. from input of a PIN);
f) charge rates applicable for the destinations;
g) proportional routing of traffic.

No. 2: Destination call routing allows a subscriber to have incoming calls routed to different destinations, based upon the geographic locations of the calling parties. There are also optional reports which provide the subscriber with data on all their incoming calls and can include details such as date and time of call.

Typical call scenarios might include:

(1) Calling user A dials subscriber's published directory numbers (DN) and, based upon geographic criteria, is routed to subscriber's location C.
(2) Calling user B dials subscriber's published DN and, based upon geographic criteria, is routed to subscriber's location D.

Database scenario(s): *Profile for the destination line number has the routing information. In order to report the routing, the database must update routing statistics.*

3.11 Follow-me diversion (FMD)

ITU Description. **No. 1:** Follow-me diversion allows the service subscriber to remotely control the redirection (diversion) of calls from his primary telephone number to other locations. The subscriber is allowed to update the diversion location telephone number, from a standard telephone instrument, as he moves from location to location.

No. 2: This service allows the subscriber to remotely control his call forwarding capabilities, basically the number to which the calls are forwarded, from any point in the network.

No. 3: With this service, a user may register for incoming calls to any terminal access. When registered, all incoming calls to the user will be presented to this terminal access. A registration for incoming calls will cancel any previous registration. Several users may register for incoming calls to the same terminal access simultaneously. The user may also explicitly deregister for incoming calls.

Database scenario(s): *Maintenance; see CF in Section 3.5. In order to protect against unauthorized usage, the subscriber must give the PIN.*

3.12 Freephone (FPH)

ITU Description. **No. 1:** This service allows a reverse charging, the subscriber accepting to receive calls at his expenses and being charged for the whole cost of the call.

No. 2: Freephone allows the served user having one or several installations to be reached from all or part of the country, or internationally as appropriate, with a freephone number and to be charged for this kind of call.

Database scenario(s): *SDF returns the actual destination number and* `charge_id`. *The subscriber may want to have various statistics!*

OBSERVE *that the access may be restricted! Call distribution (Section 3.4) and/or destination call routing (Section 3.10) service may also be present.*

On call completion, SDF receives the charge record and stores it; see ACC in Section 3.2.

3.13 Malicious call identification (MCI)

ITU Description. **No. 1:** Malicious call identification allows the service subscriber to control the logging (making a record) of calls that are received that are of a malicious nature.

No. 2: This service enables a user to request that the source of an incoming call is identified and registered in the network. The following information at least is to be registered: called party number, calling party number, time and date of the request. The service may be invoked either during or after the active phase of the call, but before the called user has cleared; as an option, it may be invoked by the network on all calls that are not answered.

As an option, the holding of the connection may be provided until the intervention of the service provider.

Database scenario(s): *SDF receives the log record and stores it. It may be later required that the authorities have an interactive access to these records. Regulations may restrict the service. Security and protection requirements may be many-sided.*

3.14 Mass calling (MAS)

ITU Description. **No. 1:** Using this service, the network operator can temporarily allocate a single directory number to the served user. Each time a call is made to this number by an end user, the user will be played an announcement and asked to input a further digit to indicate a preference. The choice made will be recorded and a count incremented. When the service has ceased, the network operator will supply details of the total "votes" cast for each preference will be supplied to the served user and the special number will be reallocated. Calls made to this special number may be charged at varying rates.

No. 2: Mass calling involves instantaneous, high-volume traffic which is routed to one or multiple destination(s). Calls can be routed to these destination numbers based on various conditions, such as the geographical location or time of day. The calling party will be charged for this kind of call.

Database scenario(s): *SCF/SSF may count "votes" and SDF receives a block of updates. The updates must serialize! Due to the high volume, the charging may be problematic.*

In the future, the service may be sophisticated; e.g. only one call from one destination. In this case the stress on the SDF may be extremely high. Mass calling and Televoting (description in Section 3.23) may need an SDF tailored for these services.

3.15 Originating call screening (OCS)

ITU Description. **No. 1:** Originating calls may be controlled by the originating call screening capability. This allows the subscriber to specify that outgoing calls be either restricted or allowed, according to a screening list and, optionally, by time of day control. This can be overridden on a per-call basis by anyone with the proper identity code.

Typical scenarios might include:

(1) Calling user A attempts to make a call. The call is screened via the screening list assigned to the originating line. The call is allowed to complete and is connected.

(2) Calling user A attempts to make a call to a line with deactivated override feature. The call is screened via the screening list assigned to the originating line. The call is not allowed to complete. Since the override option is not active, there are no override prompts.

(3) Calling user A attempts to make a call to a line with an activated override feature. The call is screened via the screening list assigned to the originating line. The call is not allowed to complete. Since the override option is active, the user is prompted for the identity code and enters the proper code. The call is connected.

No. 2: This service allows a subscriber to authorize outgoing calls, through the use of a screening list. This list may be managed by the subscriber. The user may override the restriction by giving a PIN.

Database scenario(s): *Subscriber's profile contains screen list. If the destination is on the list and override feature is activated, the PIN is to be verified.*

NOTE: *If the destination is forwarded, should the actual destination be check against the screen list. What about the case, when the called destination is on the list but the actual destination is not.*

3.16 Premium rate (PRM)

ITU Description. **No. 1:** This service allows to pay back a part of the call cost to the called party, considered as an added value service provider.

No. 2: Premium rate allows the served user having one or several installations to be reached from all or part of the country, or internationally as appropriate, with a premium rate number. The calling party will be charged with a premium rate for this kind of call.

It is a service that can be available in the public telephone network whereby, a service provider having connections to the public network can be allocated a special telephone number by a network operator, known as a premium rate number.

The provider is able to earn revenue for each call successfully made to his premium rate number. In return he provides callers with some form of information service via the call connection. Calls to the premium rate number are charged to the caller at special rates to cover the price of the call and the price of the information service. The network operator Administration collects the revenue for each call and shares it with the provider.

The geographical location of the provider is unrelated to his premium rate number i.e., he can be located anywhere in the network. The provider may specify the catchment area from which he wishes to receive calls. In the case of multi- site providers, the site to which the caller is connected can depend on the catchment area in which the call originated.

Database scenario(s): *The basic database services are number translation and charging. The database may provide* `charge_id` *(see Section 3.2) to protect against replay attacks.*

The called party may want to have call statistics. Particularly, the service provider may be interested in the hourly counts of busy/no reply.

These numbers are typical on the originating call screen list. It may also be needed that the account balance of calling party is check. (According to the current regulations in Finland, the operator is not allowed to close the telephone line even if the premium rate charges are not paid.) The "credit limits" may be needed to each premium rate number.

It may also be needed that the called party is paid only when the calling party has paid to the operator.

OBSERVE *that a premium rate number may have call distribution service activated.*

3.17 Security screening (SEC)

ITU Description. **No. 1:** This capability allows security screening to be performed in the network before an end-user gains access to the subscriber's network, systems, or applications. Access code abuse detection is a capability which will generate a report on the invalid access attempts: how many, over what time period, by whom, and from where. This provides an added layer of security.

The following are typical call scenarios for these capabilities:

(1) Caller A dials subscriber's DN, enters correct personal identification number (PIN) when prompted, clears network screening and is connected. Call data is recorded.

(2) Caller B dials subscriber's DN, enters invalid PIN on first and subsequent prompts, fails network screening, and is connected to announcement. Call data is recorded and reports of invalid codes attempted are printed.

(3) Caller C dials subscriber's DN, initially enters incorrect PIN, but corrects it upon re-prompt, clears network screening, and is connected. Call data is recorded along with re-prompts/re-entries.

No. 2 This service asks the user to dial a pin code, which allows the verification of the user identity before giving the user access to the subscriber's network, systems or application. As an option, the invalid access attempts may be registered.

Database scenario(s): *PIN verification. For security reason, the SDF should not give the actual PIN to a foreign SCF. The SDF must maintain a permanent usage log of this service.*

3.18 Selective call forwarding on busy/don't answer (SCF)

ITU Description. **No. 1:** Selective call forwarding — busy/don't answer (SCF-BY/DA) allows the called user to forward particular pre-selected calls if the called user is busy or does not answer within Y seconds or X rings. The calls will be pre-selected based upon an SCF-BY/DA list. This list will have 1 to 5 or 1 to 10 numbers with a default call forward number for calling users not in the list. There will also be remote access and time of day indicators for this capability.

Typical scenarios may include:

(1) Called user B has SCF-BY/DA assigned. Caller A dials B's number, called B does not answer the phone within Y seconds. Based upon the SCF-BY/DA list, caller A is forwarded to user C.

(2) Called user B has SCF-BY/DA assigned. Caller D dials called B's number, called B is busy with called user C. Based upon the SCF-BY/DA list, caller D is forwarded to user E.

(3) Called user B has SCF-BY/DA assigned. Caller A and caller C dial called B's number, called B does not answer the phone within Y seconds. Based upon the SCF-BY/DA list entry for caller A, caller A is forwarded to user D. Caller C is not in list, therefore caller C is forwarded to default user E.

Database scenario(s): *Profile for the destination line has the information. The SDF may return the default SCF destination or assigned SCF destination to an SCF as a part of result of destination number translation. Most probably this service is implemented using a screening list in the basic call forwarding service (Section 3.5).*

3.19 Selective call forwarding

ITU Description. This service permits the user to have his incoming calls addressed to another number, no matter what the called party line status is, if the calling line identity is included in, or excluded from, a screening list. The user's originating service is unaffected, even for charging.

Database scenario(s): *Profile for the destination line has the information. The SCF must make a query for destination number translation.*

3.20 Call forwarding on busy

ITU Description. This service permits the user to have his incoming calls addressed to another number if they encounter a busy condition. The user's originating service is unaffected, even for charging.

Database scenario(s): *Profile for the destination line has the information. The SDF may return the destination on busy to an SCF as a part of result of destination number translation.*

3.21 Call forwarding on don't answer (no reply)

ITU Description. This service permits the user to have his incoming calls addressed to another number, if they encounter no reply. The user's originating service is unaffected, even for charging.

Database scenario(s): *Profile for the destination line has the information. The SDF may return the destination on no reply to an SCF as a part of result of destination number translation.*

3.22 Split charging (SPL)

ITU Description. **No. 1:** This service allows a split charging, the calling and the called party being each charged for one part of the call.

No. 2: This service enables a network operator to distribute the charges for a call between the two parties involved.

No. 3: Split charging allows the service user having one or several installations to be reached from all or part of the country, or internationally as appropriate, with a split charging number. Both the calling party and the served user will be charged with a split charging rate for this kind of call.

Database scenario(s): *Special charge record. How the service is activated? Is it possible that the service the "permanent" between two points?*

3.23 Televoting (VOT)

ITU Description. **No. 1:** This service allows the subscriber to propose a phone voting, the user being asked either to ring a specific number according to his choice, or to ring a unique number and, after prompting, to give his choice by keyboard or by voice dialogue.

No. 2: Televoting enables subscribers to survey public opinion using the telephone network. Persons wishing to respond to an opinion poll can call advertised televoting numbers to register their votes. The charging is to the discretion of the service subscriber.

No. 3: Using this service, the network operator can temporarily allocate directory numbers to the served user. Each time a call is made to one of the numbers by an end user, the user will be played an announcement acknowledging the call, and a count of calls made to this number will be incremented. When televoting has ceased, the network operator will supply details of the total numbers of calls made to each number to the served user and the special numbers will be reallocated. Calls made to these special numbers may be charged at varying rates.

Database scenario(s): *Similar to Mass calling; see Section 3.14.*

3.24 Terminating call screening (TCS)

ITU Description. Terminating calls may be controlled by the terminating call screening capability. This allows the subscriber to specify that incoming calls be either restricted or allowed, according to a screening list and optionally, by time of day control.

Typical scenarios might include:

(1) Calling user A attempts to make a call to B. The call is screened via the screening list assigned to B's line. The call is allowed to complete and is connected.

(2) Calling user A attempts to make a call to B. The call is screened via the screening list to B's line. The call is not allowed to complete and is connected to an announcement.

Database scenario(s): *Profile for the destination line has the information.*

3.25 Universal access number (UAN)

ITU Description. **No. 1:** This service allows a subscriber with several terminating lines in any number of locations or zones to be reached with a unique directory number. The subscriber may specify which incoming calls are to be routed to which terminating lines, based upon the area the call originated.

No. 2: This service enables a service provider to publish a national number and have incoming calls routed to a number of different destinations based on the geographical location of the caller. One typical scenario might have the published national number as a freephone number. There should be an option to provide the service provider with subscriber data on all incoming calls such as date and time of call and the service provider's location that the call was routed to.

Database scenario(s): *Highly similar to Freephone; see Section 3.12*

3.26 Universal personal telecommunications (UPT)

ITU Description. **No. 1:** UPT is a mobility service which enables subscribers to make use of telecommunication services on the basis of a unique personal telecommunication number (PTN) across multiple networks at any network access. The PTN will be translated to an appropriate destination number for routing based on the capabilities subscribed to by each service subscriber.

No. 2: This service provides personal mobility by enabling a user to initiate any type of service and receive any type of call on the basis of a unique and personal network-independent number, across multiple networks, at any user-network access (fixed, movable or mobile), irrespective of geographic location, limited only by terminal and network capabilities.

Database scenario(s): *Subscriber's profile includes the current actual destination. Highly similar to call forwarding. UPT also includes automatic alternative billing (AAB in Section 3.3). Various other options (see service features in Section 4) may lead to quite a complex data objects.*

3.27 User-defined routing (UDR)

ITU Description. This capability allows the subscriber to specify how outgoing calls, from the subscriber's location, shall be routed, either through private, public, or virtual facilities or a mix of facilities, according to the subscriber's routing preference list. These lists will apply to individual lines or to several lines at the subscriber's location.

Typical scenarios might include:

- Calling user A dials from the subscriber's line; the subscriber's routing list specifies the call will only be routed over private facilities.
- Calling user A dials from the subscriber's line and the subscriber's routing list allows public facilities between 1600 and 0800 and private facilities from 0800 to 1600. Time is 1531, so call is routed only over private facilities to location. Calling User A now dials from subscriber's line at 1608 and so call is routed over public route to the destination.

Database scenario(s): *Profile for outgoing line has the information.*

3.28 Virtual private network (VPN)

ITU Description. **No. 1:** This service permits to build a private network by using the public network resources. The subscriber's lines, connected on different network switches, constitute a virtual PABX, including a number of PABX capabilities, such as private numbering plan (PNP), call transfer, call hold, and so on.

As an option, to each private user, either a class of service or specific rights and privileges may be attributed. As another option, a private user may access his private network from any point in the network keeping, after authentication, his class of service or his specific rights and privileges.

No. 2: This service permits the use of public network resources to provide private network capabilities without necessarily using dedicated network resources. The subscriber's lines, connected to different network switches, constitutes a virtual private network that may include private network capabilities, such as dialling restrictions, private numbering plan, hold, call transfer, and so on.

A PNP may provide a group of users the capability to place calls by using digit sequences having different structures and meaning than provided by the public numbering plan, or PNP may utilize the public numbering plan's digit sequences, structures and meaning.

No. 3: VPN allows a subscriber to define and use a private numbering plan for communication across one or more networks between nominated user access interfaces. A PNP provides a group of users the capability to place calls by using digit sequences having different structures and meanings than provided by the public numbering plan.

Database scenario(s): *Most features that are needed to provide VPN-service are also available as separate services. Therefore, the primary problem in database is the management actions that the customer can carry out. The security and protection are the ultimate concerns.*

4 Targeted Service Features

4.1 Abbreviated dialling (ABD)

ITU Description. **No. 1:** This feature allows the definition of abbreviated dialling numbers with a VPN. For the users of the VPN, the abbreviated dialling numbers are not subjected to call restrictions, e.g. a VPN user may not be allowed to access the Off-net Calling service feature but can reach an off-net number via this feature.

No. 2: This feature allows the definition of abbreviated dialling digit sequences to represent the actual dialling digit sequence, i.e., a two digit sequence may represent a complete dialling sequence for a private or public numbering plan.

No. 3: This service feature is an originating line feature that allows business subscribers to dial others in their company using a short numbering, even if the calling user's line and the called user's line are served by different switches.

Database scenario(s): *See Section 3.1.*

4.2 Attendant (ATT)

ITU Description. This service feature allows VPN users to access an attendant position within the VPN for providing VPN service information (e.g. VPN numbers). The attendant(s) can be accessed by dialling a special access code.

Database scenario(s): *Special case of abbreviated dialling (Section 3.1).*

4.3 Authentication (AUTC)

ITU Description. This service feature allows for the verification that a user is allowed to exercise certain options in a telephone network. In other words, the request made by the user is authentic and should be granted.

Database scenario(s): *See Sections 3.2 and 3.17*

4.4 Authorization code (AUTZ)

ITU Description. This service feature allows a VPN user to override calling restrictions of the VPN station from which the call is made. Different sets of calling privileges can be assigned to different authorization codes and a given authorization code can be shared by multiple users.

Database scenario(s): *PIN verification. If successful, a new set of privileges become effective. In other words, the SCF receives a new profile for the outgoing line.*

4.5 Automatic call back (ACB)

ITU Description. This service feature allows the called party to automatically call back the calling party of the last call directed to the called party.

Database scenario(s): *Requires that the profiles for outgoing line and destination line shares the number of last incoming call. Should the number be the dialled or the actual?*

4.6 Call distribution (CD)

ITU Description. This service feature allows the served user to specify the percentage of calls to be distributed among two or more destinations. Other criteria may also apply to the distribution of calls to each destination.

Database scenario(s): *See Section 3.4.*

4.7 Call forwarding (CF)

ITU Description. This service feature allows the user to have his incoming calls addressed to another number, no matter what the called party line status may be.

Database scenario(s): *See Section 3.5.*

4.8 Call forwarding on busy/don't answer (CFC)

ITU Description. This service feature allows the called user to forward particular calls if the called user is busy or does not answer within a specified number of rings.

Database scenario(s): *See Sections 3.20 and 3.21.*

4.9 Call gapping (GAP)

ITU Description. **No. 1:** This service feature allows the service provider to automatically restrict the number of calls to be routed to the subscriber.

No. 2: This service feature allows to restrict the number of calls to a served user to prevent congestion of the network.

Database scenario(s): *The profile for the dialled destination (actual destination ?) has the information. It is typically used with Mass Calling and Televoting services, perhaps also with Premium rate service. This is a tool for the teleoperator to protect against transient network overloads.*

4.10 Call hold with announcement (CHA)

ITU Description. The call hold with announcement service feature allows a subscriber to place a call on hold with options to play music or customized announcements to the held party.

Database scenario(s): *This feature can be activated by both parties. Information belongs to both profiles.*

4.11 Call limiter (LIM)

ITU Description. **No. 1:** This service feature allows a served user to specify the maximum number of simultaneous calls to a served user's destination. If the destination is busy, the call may be routed to an alternative destination.

No. 2: This service feature enables to count the running calls to the subscriber and to reject all the new calls when a threshold of simultaneous calls is reached. As an option, this threshold may be real-time managed by the subscriber.

Associated with call volume distribution or call distribution, it allows the rerouting of the new calls.

Database scenario(s): *The profile for destination line has the information.*

4.12 Call logging (LOG)

ITU Description. This service feature allows for a record to be prepared each time that a call is received to a specified telephone number.

Database scenario(s): *The profile for destination has the information; restrictions possible; see e.g. Section 3.13.*

4.13 Call queueing (QUE)

ITU Description. **No. 1:** This service feature allows a served user to have calls meeting busy at the scheduled destination to be placed in a queue and connected as soon as free condition is detected. Upon entering the queue, the caller hears an initial announcement informing the caller that the call will be answered when a line is available.

No. 2: This service feature enables the subscriber, when a call encounters a terminating trigger such as a busy condition or a specified number of rings to queue that call, a specific announcement being sent to the calling party.

Database scenario(s): *The profile for destination line has the information.*

4.14 Call transfer (TRA)

ITU Description. The call transfer service feature allows a subscriber to place a call on hold and transfer the call to another location.

Database scenario(s): *None.*

4.15 Call waiting (CW)

ITU Description. This service feature allows the called party to receive a notification that another party is trying to reach his number while he is busy talking to another calling party.

Database scenario(s): *The profile for destination line has the information.*

4.16 Closed user group (CUG)

ITU Description. This service feature allows the user to be a member of a set of VPN users who are normally authorized to make and/or receive calls only within the group. A user can belong to more than one CUG. In this way, a CUG can be defined so that certain users are allowed either to make calls outside the CUG, or to receive calls from outside the CUG, or both.

Database scenario(s): *A list valued attribute that restricts outgoing and/or incoming calls.*

4.17 Consultation calling (COC)

ITU Description. The consultation calling service feature allows a subscriber to place a call on hold, in order to initiate a new call for consultation.

Database scenario(s): *None.*

4.18 Customer profile management (CPM)

ITU Description. This service feature allows the subscriber to real-time manage his service profile, i.e., terminating destinations, announcements to be played, call distribution, and so on.

Database scenario(s): *Access control to the data objects that are to be managed is essential.*

4.19 Customized recorded announcement (CRA)

ITU Description. This service feature allows a call to be completed to a (customized) terminating announcement instead of a subscriber line. The served user may define different announcements for unsuccessful call completions due to different reasons (e.g. caller outside business hours, all lines are busy).

Database scenario(s): *The profile for destination line has the information.*

4.20 Customized ringing (CRG)

ITU Description. This service feature allows the subscriber to allocate a distinctive ringing to a list of calling parties.

Database scenario(s): *The profile for destination line has the information.*

4.21 Destinating user prompter (DUP)

ITU Description. This service feature enables to prompt the called party with a specific announcement. Such an announcement may ask the called party to enter an extra numbering, e.g. through dual-tone multi-frequency (DTMF), or a voice instruction that can be used by the service logic to continue to process the call.

Database scenario(s): *Profile for the calling party includes the information.*

4.22 Follow-me diversion (FMD)

ITU Description. **No. 1:** This service feature allows a VPN user to change the routing number of his/her VPN code via a DTMF phone. The updated number can be another VPN code or a PSTN number.

No. 2: With this service feature, a user may register for incoming calls to any terminal access. When registered, all incoming calls to the user will be presented to this terminal access. A registration for incoming calls will cancel any previous registration. Several users may register for incoming calls to the same terminal access simultaneously. The user may also explicitly deregister for incoming calls.

Database scenario(s): *See Section 3.11.*

4.23 Mass calling (MAS)

ITU Description. This service feature allows processing of huge numbers of incoming calls, generated by broadcasted advertisings or games.

Database scenario(s): *See Section 3.14.*

4.24 Meet-me conference (MMC)

ITU Description. This service feature allows the user to reserve a conference resource for making a multi-party call, indicating the date, time, and conference duration. At the specified date and time, each participant in the conference has to dial a designated number which has been assigned to the reserved conference resource, in order to have access to that resource, and therefore, the conference.

Database scenario(s): *See Section 3.8.*

4.25 Multiway calling (MWC)

ITU Description. This service feature allows the user to establish multiple, simultaneous telephone calls with other parties.

Database scenario(s): *None.*

4.26 Off-net access (OFA)

ITU Description. This service feature allows a VPN user to access his or her VPN from any non-VPN station in the PSTN by using a personal identification number (PIN). Different sets of calling privileges can be assigned to different PINs, and a given PIN can be shared by multiple users.

Database scenario(s): *The profile for destination line has the information. In addition, PIN verification.*

4.27 Off-net calling (ONC)

ITU Description. This service feature allows the user to call outside the VPN network. Calls from one VPN to another are also considered off-net.

Database scenario(s): *The profile for outgoing line has the information.*

4.28 One number (ONE)

ITU Description. This feature allows a subscriber with two or more terminating lines in any number of locations to have a single telephone number. This allows businesses to advertise just one telephone number throughout their market area and to maintain their operations in different locations to maximize efficiency. The subscriber can specify which calls are to be terminated on which terminating lines based on the area the calls originate.

Database scenario(s): *See Section 3.4.*

4.29 Origin dependent routing (ODR)

ITU Description. This service feature enables the subscriber to accept or reject a call, and in case of acceptance, to route this call, according to the calling party geographical location. This service feature allows the served user to specify the destination installation(s) according to the geographical area from which the call was originated.

Database scenario(s): *Highly similar to Call distribution service; see Section 3.4.*

4.30 Originating call screening (OCS)

ITU Description. This service feature allows the served user to bar calls from certain areas based on the District code of the area from which the call is originated.

Database scenario(s): *The profile for destination line has the information.*

4.31 Originating user prompter (OUP)

ITU Description. **No. 1:** This service feature allows a served user to provide an announcement which will request the caller to enter a digit or series of digits via a dual-tone multi-frequency (DTMF) phone or generator. The collected digits will provide additional information that can be used for direct routing or as a security check during call processing.

No. 2: This service feature enables to prompt the calling party with a specific announcement. Such an announcement may ask the calling party to enter an extra numbering (e.g. through DTMF) or a voice instruction that can be used by the service logic to continue to process the call.

Database scenario(s): *The profile for destination line has the information.*

4.32 Personal numbering (PN)

ITU Description. This service feature supports a UPT number that uniquely identifies each UPT user and is used by the caller to reach that UPT user. A UPT user may have more than one UPT number for different applications (e.g. a business UPT number for business calls and a private UPT number for private calls), however, a UPT user will have only one UPT number per charging account.

Database scenario(s): *See Section 3.26.*

4.33 Premium charging (PRMC)

ITU Description. This service feature allows for the pay back of the part of the cost of a call to the called party, when he is considered as a value added service provider.

Database scenario(s): *See Section 3.16.*

4.34 Private numbering plan (PNP)

ITU Description. This service feature allows the subscriber to maintain a numbering plan within his private network, which is separate from the public numbering plan.

NOTE: See also definition under VPN description.

Database scenario(s): *Similar to abbreviated dialling (Section 3.1) but the numbers are shared by all lines in the private network.*

4.35 Reverse charging (REVC)

ITU Description. This service feature allows the service subscriber (e.g. freephone) to accept to receive calls at its expense and be charged for the entire cost of the call.

Database scenario(s): *See Section 3.12.*

4.36 Split charging (SPLC)

ITU Description. This service feature allows for the separation of charges for a specific call, the calling and called party each being charged for one part of the call.

Database scenario(s): *See Section 3.22.*

4.37 Terminating call screening (TCS)

ITU Description. This service feature allows the user to screen calls based on the terminating telephone number dialled.

Database scenario(s): *See Section 3.15.*

4.38 Time dependent routing (TDR)

ITU Description. **No. 1:** This service feature enables the subscriber to accept or reject a call, and in case of acceptance, to route this call, according to the time, the day in the week and the date.

No. 2: This service feature allows the served user to apply different call treatments based on time of day, day of week, day of year, holiday, etc.

Database scenario(s): *The profile for destination line has the information.*

5 Summary of Database Scenarios

In the previous two section the services and service features in the ITU-T IN CS-1 were annotated from the information aspects. Many services and service features have quite similar needs for database support. We identified the following five basic types of database services needed to support IN CS-1.

(1) Retrieval of structured objects from persistent subscriber data objects. Some of the retrievals trigger a later update. For example, if Freephone service provides call routing statistics to the subscriber, an update is necessary.

(2) User management actions that modify persistent subscriber data objects. These actions must be protected against unauthorized use. Some updates may also have to be verified against other criteria. For example, the owner of a telephone number must have the possibility to cancel or prohibit call forwarding to his or her number.

(3) Verification of Personal Identification Number. For security reasons the PIN verification must be done in the database system when services are globalized. The actual PIN cannot be delivered into a foreign network.

(4) Writing sequential log records.

(5) Mass calling and Televoting. They need high-volume small updates that must be serialized. A special aspect of these updates is that they can be done in large blocks.

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