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## Foreword

This ETSI Technical Report (ETR) has been produced by the User Group (UG) of the European Telecommunications Standards Institute (ETSI).

In general, users consider that a Virtual Private Network (VPN) should offer the services usually available from Customer Premise Equipment (CPE)<sup>1)</sup> irrespective of the type of connection to VPN (simple terminal or Private Telecommunications Network Exchange (PTNX)). Their expectations must be met by both operators and manufacturers, since both of them contribute to the service.

In general, the concerns of VPN users are:

- Which significant savings could be made in comparison with the leased line or public networks solutions ?
- What should be the deregulation consequences regarding leased lines, public network, and VPN costs ?
- What type of services should be provided on the VPN by the VPN operator ?
- How would the VPN be transparent to the services provided by other suppliers ?
- How would CPE take advantage of the network services ?
- How should VPN expectations meet general expectations related to the Corporate Telephone Network (CTN) services and equipment ?

Taking into account these requirements and questions, the following statements aim to explore the possible consequences concerning standardization needs with respect to VPN operators and also CPE manufacturers.

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1) e.g. the connection to the user terminal may be achieved either as a simple PSTN or VPN subscriber or via a CPE connected to the VPN.

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## 1 Scope

The aim of the ETSI User Group is to formulate functional requirements and not to elaborate technical specifications.

The work done earlier in the VPN field by the following ETSI committees or external bodies has been taken into account:

- ETSI Strategic Review Committee N°5 on Corporate Networks (SRC5);
- ETSI VPN Task Group (VPN TG), the Swedish Government Open Telecommunication Systems Interconnection Profile (SOTIP);
- European VPN Users Association (EVUA), etc.

For simplicity and standardization, ETSI terminology has been used where feasible (TCR-TR 034 [23] from VPN TG and ETR 076 [1] from BTC).

The functional characteristics described later are from the VPN TG and should be considered as a minimum set required, due to the time limitation of the Work Group. This statement does not preclude more elaborate functions, for instance as those requested by EVUA or further highly desirable developments such as hybrid networks, mobile networks or multimedia, provided that inter-working of the selected minimum set of functions is safeguarded throughout the whole VPN.

## 2 References

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

- [1] ETR 076 (1995): "Integrated Services Digital Network (ISDN); Standards guide".
- [2] ETS 300 056 (1991): "Integrated Services Digital Network (ISDN); Call Waiting (CW) supplementary service Service Description".
- [3] ETS 300 089 (1992): "Integrated Services Digital Network (ISDN); Calling Line Identification Presentation (CLIP) supplementary service Service description".
- [4] ETS 300 128 (1992): "Integrated Services Digital Network (ISDN); Malicious Call Identification (MCID) supplementary service Service description".
- [5] ETS 300 136 (1992): "Integrated Services Digital Network (ISDN); Closed User Group (CUG) supplementary service Service description".
- [6] ETS 300 139 (1992): "Integrated Services Digital Network (ISDN); Call Hold (HOLD) supplementary service Service description".
- [7] ETS 300 183 (1992): "Integrated Services Digital Network (ISDN); Conference call, add-on (CONF) supplementary service Service description".
- [8] ETS 300 173 (1992): "Private Integrated Services Network (PISN); Specification, functional models, and information flows; Identification supplementary services".
- [9] ETS 300 178 (1992): "Integrated Services Digital Network (ISDN); Advice of Charge: charging information at call set-up time (AOC-S) supplementary service Service description".
- [10] ETS 300 179 (1992): "Integrated Services Digital Network (ISDN); Advice of Charge: charging information during the call (AOC-D) supplementary service Service description".

- [11] ETS 300 180 (1992): "Integrated Services Digital Network (ISDN); Advice of Charge: charging information at the end of the call (AOC-E) supplementary service Service description".
- [12] ETS 300 199 (1994): "Integrated Services Digital Network (ISDN); Call Forwarding Busy (CFB) supplementary service Service description".
- [13] ETS 300 200 (1994): "Integrated Services Digital Network (ISDN); Call Forwarding Unconditional (CFU) supplementary service Service description".
- [14] ETS 300 201 (1994): "Integrated Services Digital Network (ISDN); Call Forwarding No Reply (CFNR) supplementary service Service description".
- [15] ETS 300 202 (1994): "Integrated Services Digital Network (ISDN); Call Deflection (CD) supplementary service Service description".
- [16] ETS 300 237 (1993): "Private Integrated Services Network (PISN); Specification, functional models, and information flows; Name identification supplementary services".
- [17] ETS 300 256 (1993): "Private Integrated Services Network (PISN); Specification, functional models and information flows; Diversion supplementary services".
- [18] ETS 300 260 (1993): "Private Integrated Services Network (PISN); Specification, functional models and information flows; Call transfer supplementary service".
- [19] ETS 300 284 (1993): "Integrated Services Digital Network (ISDN); User-to-User Signalling (UUS) supplementary service Service description".
- [20] ETS 300 357 (1995): "Integrated Services Digital Network (ISDN); Completion of Calls to Busy Subscriber (CCBS) supplementary service Service description".
- [21] ETS 300 365 (1994): "Private Integrated Services Network (PISN); Specification, functional models and information flows; Call completion supplementary services".
- [22] ETS 300 367 (1995): "Integrated Services Digital Network (ISDN); Explicit Call Transfer (ECT) supplementary service Service description".
- [23] TCR-TR 034 (1995): "Business TeleCommunications (BTC); Virtual Private Networking (VPN); Services and networking aspects; Standardization requirements and work items".
- [24] ECMA TR/60: "Supplementary Services and Additional Network Feature in Private Telecommunication Networks".

### **3 Definitions, symbols and abbreviations**

#### **3.1 Definitions**

The descriptions of the VPN Supplementary Services are given in the following as they stand either in the clause 5 of Stage 1 description for service defined in ETR 076 [1] or in ECMA TR/60 [24]. Some minor changes to the original text (e.g. removal of references to other clauses) have been made for clarification. Services are listed in an alphabetical order.

For ETSI services, ETS Numbers are given in bracket for referencing. Further details can be found in these ETSS.



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

**Accounting Code (ACC):** This ACC service allows a calling user to assign a given code to different call direction for charging identification purpose.

**Advice of Charge - During the call (AOC-D) ( ETS 300 179 [10]):** The AOC-D supplementary service provides the served user with cumulative charging information during the call. The information can be sent for all calls, or on a per call basis. The charge information given relates to the charges incurred on the network to which the served user is attached.

**Advice Of Charge - at the End of the call (AOC-E) (ETS 300 180 [11]):** The AOC-E supplementary service provides the served user with charging information for a call when the call is terminated. The information can be sent for all calls, or on a per call basis. The charge information given relates to the charges incurred on the network to which the served user is attached.

**Advice Of Charge (AOC-S) - at call Set up time (ETS 300 178 [9]):** The AOC-S supplementary service provides the served user with information about the charging rates at call establishment. In addition, the served user is informed if a change in charging rates takes place during the call. The information can be sent for all calls, or on a per call basis. The charge information given relates to the charges incurred on the network to which the served user is attached.

NOTE 1: In some cases, e.g. due to off-line processing of charges, or timing considerations, the charge calculated by the user or the user's equipment may not precisely reflect the actual cost incurred.

#### **Completion of Calls to Busy Subscriber (CCBS):**

*ETS (ETS 300 357 [20]):* The CCBS supplementary service enables user A, encountering a busy destination B, to have the call completed without having to make a new call attempt when the destination B becomes not busy.

When user A requests the CCBS supplementary service, the network will monitor for destination B becoming not busy.

When destination B becomes not busy (i.e. access resources, e.g. at least one B-channel, are not busy) then the network will wait a short time in order to allow the resources to be re-used for originating a call. If the resources are not re-used by destination B within this time, then the network will automatically recall user A.

When user A accepts the CCBS recall, then the network will automatically generate a CCBS call to destination B.

*ECMA (ETS 300 365 [21]):* Completion of Call to Busy Subscriber (SS-CCBS) is a supplementary service which is offered to a calling user A. On encountering a busy called user B, it allows user A to request that the PTN monitors user B and notifies user A when user B becomes not busy. On response by user A to that notification, the PTN will attempt to complete the call to user B.

**Completion of Calls on No Reply (CCNR) (300 365 [21]):** The CCNR supplementary service enables user A, encountering a non-answering destination B, to have the call completed without having to make a new call attempt when the destination B becomes busy.

When user A requests the CCNR supplementary service, the network will monitor for destination B becoming busy.

When destination B becomes busy (i.e. at least one B-channel is busy) then the network will wait a short time in order to allow either the call waiting to be used at the destination B or, if the resources are not re-used by destination B within this time, to recall automatically user A.

When user A accepts the CCNR recall, then the network will automatically generate a CCNR call to destination B.

**Call Deflection (CD) (ETS 300 202 [15]):** The CD supplementary service enables the served user to respond to an incoming call by requesting redirection of that call to another user. The CD supplementary service can only be invoked before the connection is established by the served user, i.e. in response to the offered call, or during the period that the served user is being informed of the call. The served user's ability to originate calls is unaffected by the CD supplementary service.

The maximum number of diversions permitted for each call is a service provider option with an upper limit of five diversions. When counting the number of diversions, all types of diversion are included.

**CENTREX:** Equipment used to provide private switched services, generally by a Public Network Operator.

**Call Forwarding Busy (CFB):**

*ETS (ETS 300 199 [12]):* The CFB supplementary service enables a served user to have the network redirect to another user calls which are addressed to the served user's ISDN number and meet busy. The CFB supplementary service may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by the CFB supplementary service.

As a service provider option, a subscription option can be provided to enable the served user to receive an indication that the CFB supplementary service has been activated. This indication is provided when the served user originates a call if the CFB supplementary service has been activated for the served user's ISDN number and for the basic service requested for the call.

The maximum number of diversions permitted for each call is a service provider option with an upper limit of five diversions. When counting the number of diversions, all types of diversion are included.

*ECMA (ETS 300 256 [17]):* SS-CFB enables a served user to have the PTN redirect to another user calls which are addressed to the served user's PTN number and meet busy. SS-CFB may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by SS-CFB.

CFB is provided on a per PTN number basis.

The maximum number of diversions to a single call is an implementation option. When counting the number of diversions, all types of diversions shall be included.

**Completion of Calls on No Reply (CFNR):**

*ETS (ETS 300 201 [14]):* The CFNR supplementary service enables a served user to have the network redirect to another user calls which are addressed to the served user's ISDN number, and for which the connection is not established within a defined period of time. The CFNR supplementary service may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by the CFNR supplementary service.

The CFNR supplementary service can only be invoked by the network after the call has been offered to the served user. And an indication that the called user is being informed of the call has been received.

As a service provider option, a subscription option can be provided to enable the served user to receive an indication that the CFNR supplementary service has been activated. This indication is provided when the served user originates a call if the CFNR supplementary service has been activated for the served user's ISDN number and for the basic service requested for the call.

The maximum number of diversions permitted for each call is a service provider option with an upper limit of five diversions. When counting the number of diversions, all types of diversion are included.

*ECMA (ETS 300 256 [17]):* SS-CFNR enables a served user to have the PTN redirect to another user calls which are addressed to the served user's PTN number and for which the connection is not established within a defined period of time. SS-CFNR may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by SS-CFNR.

CFNR is provided on a per PTN basis.

The maximum number of diversions to a single call is an implementation option. When counting the number of diversions, all types of diversions shall be included.

#### **Call Forwarding Unconditional (CFU):**

*ETS (ETS 300 200 [13]):* The CFU supplementary service enables a served user to have the network redirect to another user calls which are addressed to the served user's ISDN number. The CFU supplementary service may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by the CFU supplementary service. After the CFU supplementary service has been activated, calls are forwarded independently of the status of the served user.

As a service provider option, a subscription option can be provided to enable the served user to receive an indication that the CFU supplementary service has been activated. This indication is provided when the served user originates a call if the CFU supplementary service has been activated for the served user's ISDN number and for the basic service requested for the call.

The maximum number of diversions permitted for each call is a service provider option with an upper limit of five diversions. When counting the number of diversions, all types of diversion are included.

*ECMA (ETS 300 256 [17]):* SS-CFU enables a served user to have the PTN redirect to another user calls which are addressed to the served user's PTN number. SS-CFU may operate on all calls, or just those associated with specified basic services. The served user's ability to originate calls is unaffected by SS-CFU. After SS-CFU has been activated, calls are forwarded independently of the status of the served user.

CFU is provided on a per PTN number basis.

The maximum number of diversions to a single call is an implementation option. When counting the number of diversions, all types of diversions shall be included.

#### **Calling Line Identification Presentation (CLIP):**

*ETS (ETS 300 089 [3]):* The CLIP supplementary service provides the called party with the possibility of receiving identification of the calling party.

In addition to the ISDN number, the calling line identity may include a sub-address generated by the calling user and transparently transported by the network. The network cannot be responsible for the content of this sub-address.

The network delivers the calling line identity to the called party during call establishment, regardless of the terminal capability to handle the information.

The network delivers the connected line identity to the calling party on call acceptance regardless of the terminal capability to handle the information.

NOTE 2: In some situations, e.g. when a default number is used, the information may not precisely identify the connected party.

*ECMA (ETS 300 173 [8]):* The PTN provides the called party with the number of the calling party whenever an incoming call is presented. The number provided should be sufficient to enable the called party to return the call.

The calling party number may be accompanied by a sub-address.

**Calling Name Identity Presentation (CNIP) (ETS 300 237 [16]):** Calling Name Identification Presentation (SS-CNIP) is a supplementary service which is offered to the called user and which provides the name of the calling user (calling party name) to the called user.

The PTN provides the calling party name to the called user when an incoming call is presented.

The possible provision of the calling party name by the calling user to the PTN is outside the scope of this ETR.

**Call Offer (CO):** The CO service allows a calling user to request that the call be offered to the user. At a busy destination and that the called user be given the choice of accepting, rejecting or ignoring the waiting call. This service can be used in conjunction with CT to transfer another user into a state of waiting at the busy destination.

**Conference call, Add On (CONF) (ETS 300 183 [7]):** The CONF supplementary service enables a user to participate in and control a simultaneous communication involving a number of users.

The CONF supplementary service can be invoked from the idle state. As a network option, the CONF supplementary service can be invoked from an existing active call.

When the CONF supplementary service is invoked, conference resources are allocated to the served user. In the case of invocation from an active call, this call will be connected to the conference resources.

**Customer Premise Equipment (CPE):** Set of devices in the customer premises to provide the telecommunication services to the end-users.

**Customer Premise Networks (CPN):** Private Network inside a customer premises.

**Corporate Telecommunications Network (CTN):** A CTN consists of sets of equipment (Customer Premise Equipment (CPE) and/or Customer Premise Networks (CPN)) which are located at geographically dispersed locations and are interconnected to provide networking services to a defined group of users.

**Closed User Group (CUG) (ETS 300 136 [15]):** The CUG supplementary service enables users to form groups to and from which access is restricted. A specific user may be a member of one or more CUGs. Members of specific CUG can communicate among each other but not, in general, with users outside the group.

A CUG consists of a number of users. A CUG can have members from one or more public networks. In ISDN, each member of a CUG is identified by their ISDN number (see also subclauses 8.9 and 8.13 in ETS 300 136 [5]).

Subscription to a CUG shall be defined for all basic services, or in relation to one, or to a list of basic services.

CUG members can have additional capabilities that allow them to originate calls to the outside of the group, and/or to receive calls from outside the group. CUG members can have additional restrictions that prevent them from originating calls to other members of the CUG, or from receiving calls from other members of the CUG.

**Call Waiting (CW) (ETS 300 056 [2]):** The CW supplementary service permits a user to be informed of an incoming call (as per basic call procedures) with an indication that no interface information channel is available. The user has then the choice of accepting, rejecting or ignoring the waiting call (as per basic call procedures).

The CW supplementary service operates when all appropriate B channels of the access to the terminal(s) of subscriber B are busy.

Moreover, when at least one B-channel is free, any compatible busy terminal of subscriber B can react positively to an incoming call.

When a third party (calling user C) attempts to connect to that termination, subscriber B is given an appropriate indication of the waiting call.

The maximum number of calls that can be handled (e.g. active, held, alerting, waiting) for each ISDN number on a given interface shall be a network option.

NOTE 3: It is recognized that a small call-connect system or an active bus may be present at customers' premises and that an internal call may be in progress when the call waiting indication is applied. It is assumed that it is the responsibility of the customer's equipment to determine what action should take place in these circumstances.

**Do Not Disturb (DND):** The DND supplementary service allows all incoming calls to the served user, or just those relating to a specific basic service, are rejected by the PTN. The calling user is given an appropriate indication.

Users may be awarded different levels of protection against override of DND service by DNDO.

Activation, deactivation and interrogation of this service can be performed by the served user or by another authorized user.

**Explicit Call Transfer (ECT):**

*ETS (ETS 300 367 [22]):* The ECT supplementary service enables a user (user A) to transform two of that user's calls (an active call and a held call), each of which can be an incoming call or an outgoing call, into a new call between user B and user C.

Prior to transfer, the connection has been established on the call between user A and user B. On the call between user A and user C, either the connection has been established prior to transfer, or, as a service provider option, transfer can occur while user C is being informed of the call (i.e. the connection has not yet been established).

NOTE 4: Service providers may reject a request for the ECT supplementary service depending on criteria (e.g. for operational reasons under certain circumstances).

*ECMA (ETS 300 260 [18]):* SS-CT is a supplementary service which enables a served user (user A) to transform two of that users calls into a new call between the other two users of the two calls (user B and user C). Each call can be either an incoming call to user A or an outgoing call from user A. After successful invocation of SS-CT user B and user C will be able to communicate with each other and user A will no longer be able to communicate with user B and user C.

One of the calls may be an outgoing call that has not been answered by the other user (user C). After successful invocation of SS-CT user A will no longer be able to communicate with user B. User B and user C will be in a position to communicate with each other as soon as user C has answered.

NOTE 5: The establishment of either call as part of a request for transfer is outside the scope of this ETR. This ETR assumes that both calls have already been established when the request for call transfer is made. This does not preclude an implementation whereby a single user request causes the establishment of a call and its subsequent transfer.

**Call Hold (HOLD) (ETS 300 139 [6]):** The HOLD supplementary service allows a user to interrupt communications on an existing call and then subsequently, if desired, re-establish communications.

When the HOLD supplementary service is invoked, communication on a B-channel is interrupted and the B-channel is released from use by the existing call. A B-channel is reserved for use by the terminal used to invoke the HOLD supplementary service.

A B-channel on that user's interface is always available to the terminal used to hold the call to enable the user to:

- retrieve that call from hold;
- originate a new call;
- retrieve another call; or
- establish connection to an incoming call, e.g. a waiting call.

One B-channel is kept available for the user as long as the user has:

- 1) one or more calls on hold; and
- 2) is not currently connected to any other call.

The network only reserves one B-channel for the terminal used to invoke the HOLD supplementary service.

When the user wishes to reconnect to a held call, the retrieve operation is requested.

**Malicious Call Identification (MCID) (ETS 300 128 [4]):** The MCID supplementary service enables an incoming call to be identified and registered. The following call information is registered:

- called party number;
- calling party number;
- local time and date of the invocation in the network serving the called user; and
- as a service provider option: calling party sub-address (if provided by the calling user).

The information is not available to the terminal equipment under the control of the called user nor the calling user. The information is stored at a location(s) under the control of the network operator.

The MCID supplementary service can either be invoked during the active phase of the call, or after the active phase for a limited period but never after call termination by the served user.

**Manager/Secretary Switch (MSS):** This MSS service allows a calling user to call an associated user. By setting a function key instead of dialling the complete number.

**Message Waiting Indication (MWI):** This MWI service allows a called user already engaged in a call to be informed that there is another waiting call by flashing an indicator or ringing a special tone.

**Network manager:** Manager in charge of users' telecommunication equipment in a company.

**Operator:** Generic term generally used to refer to Public Telecommunication Operators (PTOs) or Public Network Operators (PNOs).

**PTNX:** Private Telecommunication Network EXchange. Such equipment encompasses all types of exchanges: PBX, PABX and data exchanges. PTNX Type 1 refers to PTNX conforming to QSIG & PTNX Type 2 to PTNX conforming to DSS1.

**Transit node:** Equipment by which voice or data communications are routed from one end to another end.

**User:** Generic term used to refer to people or organizations who use telecommunication services. In this paper, users include mainly business and corporate users. In fact, a user may have different expectations whether he is a "Network Manager" ("Telecom Manager") or a "End-User".

**User-to-User Signalling (UUS) (ETS 300 284 [19]):** The UUS supplementary service allows the user to send/receive a limited amount of user generated information to/from another user-network interface. This information is passed transparently (i.e. without modification of contents) through the network. The network does not interpret or act upon this information.

Services 1, 2 and 3 allow the transmission of 128 octets per message as a maximum.

NOTE 6: During an interim period of time, some networks may support 32 octets on one or more of the services; 32 octets will always be supported. Restrictions may apply to calls requesting UUI of more than 32 octets.

Limitations are also placed on the number of messages per time unit for service 3. The flow control of each direction is operated independently.

**Virtual Private Network (VPN):** The ETSI Technical Report TCR-TR 034 [23] that considers only the case where the shared network infrastructures are provided by fixed public networks, defines a VPN as follows:

"A VPN is that part of a Corporate Telecommunication Network (CTN) that provides corporate networking using shared switched network infrastructures. This is split into VPN architecture and VPN services.

The VPN architecture is that part of a CTN that provides corporate networking between customer equipment where:

- the shared switched network infrastructure takes the place of traditional analogue or digital dedicated leased lines and the function of the transit node, irrespective of the network type whether it be the Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), mobile communications network, or a separate network;
- the customer premises may be served in terms of end node functionality with any combination of PBX, Centrex, LAN router, or multiplexor;
- the CTN user may also be served by terminal equipment connected to end node functionality residing on customer premises, or provided by public network equipment; and
- the VPN architecture in one network, or multiple networks, comprises a part of the total national or international CTN.

VPN services offered by the switched network infrastructure provide:

- VPN end-user services to CTN users;
- VPN networking services to support the interconnection of PTNXs;
- service inter-working functionality;
- inter-VPN services to provide co-operation between the VPN services of two networks; and
- VPN management services to enable service subscribers management to control and manage their PN resources, facilities, functions and capabilities."

### 3.2 Symbols

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

- a0: The a0 service entry point for an access to the VPN via a CPE. This is referred to as "private access". At this entry point, a set of end-user services provided either by the VPN provider, the public operator or the CPE is available.
- a1: The a1 service entry point for an access (within a specific CTN) which is dedicated to the utilization of VPN services. This is referred to as "dedicated VPN access". At this entry point, a pre-defined set of VPN end-user services is permanently available.

- a2: The a2 service entry point for a public network access which is registered as able to utilize VPN services within a predetermined CTN<sup>2)</sup>. This is referred to as "registered VPN access". At this entry point, the user can use either their pre-defined set of VPN end-user services, or the public network services.
- a3: The a3 service entry point for a public network access which is not registered for the utilization of VPN services. This is referred to as "non-registered VPN access<sup>3)</sup>". By means of an appropriate authentication procedure a pre-defined set of VPN end-user services become available for the CTN user. The a3 service access point has been split into two cases:
- a31: services depending from the individual on a "call-by-call" basis: phone box or any public or private phone (e.g. a customer phone during an appointment).
- a32: services depending from the individual (REFER OF4 in annex A) possibly temporarily associated to a physical connection with a login/logout (REFER OF35) procedure (e.g. airport business center, temporary location, etc.). After logout, these services will come back to the "registered" user location.
- b: The b service entry point for PTNX type 2 and PTNX type 1. At this entry point, VPN networking services are provided to PTNX type 2 and PTNX type 1 for the provision/support of services to its end-users.
- c: The c service entry point for the provision of inter-VPN services between different VPN services providers. At this entry point co-operation between VPN service providers enable VPN services to span multiple public networks.
- d: The d service entry point between the VPN service provider and the VPN service subscriber for the offering of VPN management services. They allow the VPN service subscriber to manage resources and capabilities related to its CTN.

### 3.3 Abbreviations

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

ACC	Accounting Code
AOC-D	Advice of Charge - During the call
AOC-E	Advice Of Charge - at the End of the call
AOC-S	Advice Of Charge - at call Set up time
BERT	Bit Error Rate Test
CCBS	Completion of Calls to Busy Subscriber
CCNR	Completion of Calls on No Reply
CD	Call Deflection
CFB	Call Forwarding Busy
CFNR	Call Forwarding No Reply
CFU	Call Forwarding Unconditional
CLIP	Calling Line Identification Presentation
CNIP	Calling Name Identity Presentation
CO	Call Offer
CONF	Conference call, Add On
CPE	Customer Premises Equipment
CPN	Customer Premises Networks
CTN	Corporate Telecommunications Network
CUG	Closed User Group
CW	Call Waiting
DND	Do Not Disturb
DPNSS	Digital Private Network Signalling System.

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2) In the following text, the a2 service access point has been considered as linked to a user physical connection.

3) or " remote CTN access.



DSS1	Digital Signalling System #1.
ECT	Explicit Call Transfer
HOLD	Call Hold
IN	Intelligent Network.
MCID	Malicious Call IDentification
MMI	Man-Machine Interface
MSS	Manager/Secretary Switch
MWI	Message Waiting Indication
OF	Organizational/Features
PABX	Private Automatic Branch EXchange.
PBX	Private Branch EXchange.
PSTN	Public Switched Telephone Network.
PTNX	Private Telecommunication Network EXchange
SCF	Service Control Function.
SDF	Specialized Database Functions
UPT	Universal Personal Telecommunication.
UUS	User-to-User Signalling

## **4 Types of Information to transmit**

### **4.1 Voice**

This type of information represents the major percentage of general telecommunication traffic, and consequently offers the greater cost saving potential at current tariffs.

### **4.2 Facsimile/Fax**

Generally considered as a voice transmission, it is used extensively by corporate and private individuals. The network should support facsimile transmissions at 9 600 bit/s or faster. If taken into account by a messaging service, it can be converted into data on a large part of the transmission.

The related volume represents also a large saving potential.

### **4.3 Data at transmission speed < 64 kbit/s**

This type of data can be transmitted via ISDN without problem and corresponds to the main offerings. Nevertheless, since today an important part of information transmission is still usually transmitted using normal voice circuits, a high level quality path is required to minimize transmission time and errors.

### **4.4 Data at transmission speed < 2 Mbit/s**

The VPN shall provide the possibility to establish consecutive nx64 kbit/s channels between two users' terminals for nx64 kbit/s communication purposes. The aggregation of the n channels shall be made possible by the users' equipment.

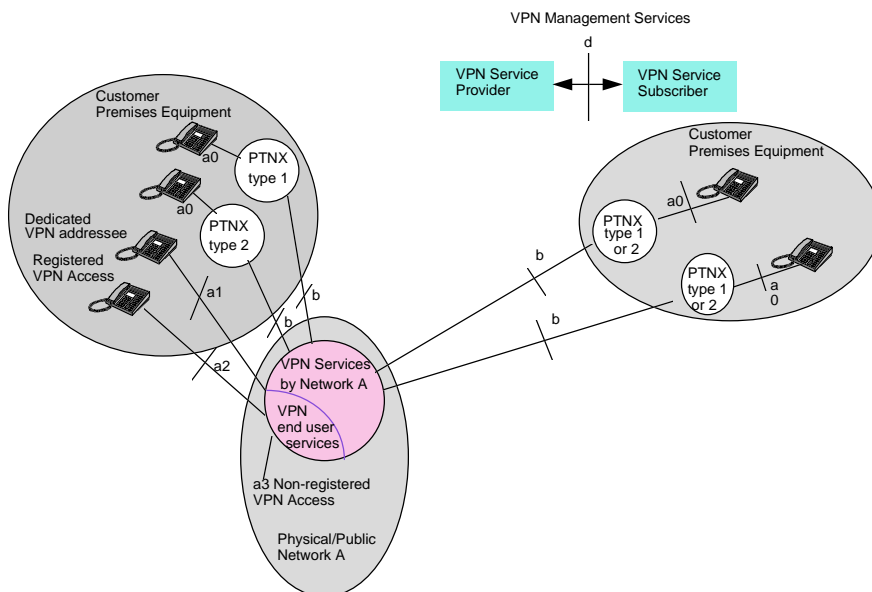
### **4.5 Data at transmission speed > 2 Mbit/s**

The VPN shall be able to support and migrate smoothly towards transmission paths including bit rate offerings higher than 2 Mbit/s.

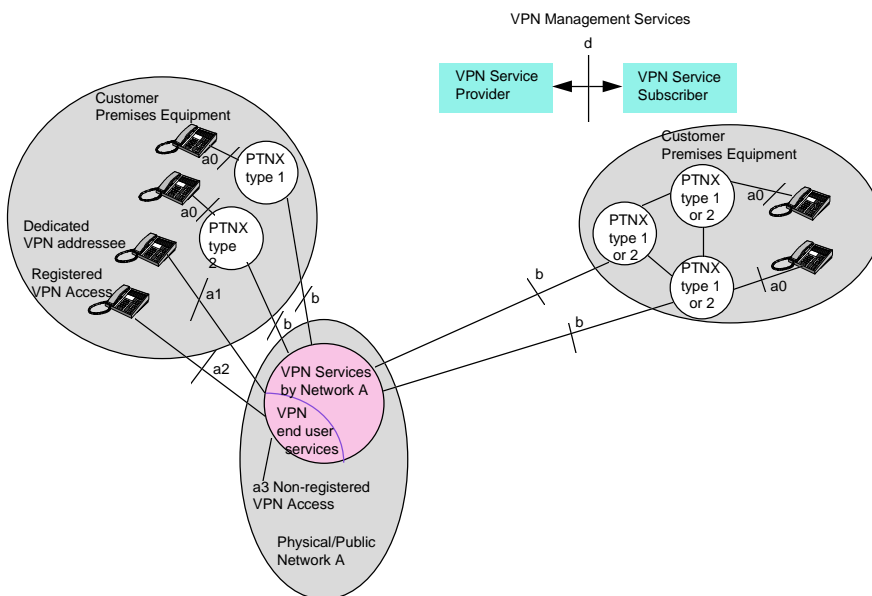
Inter-working between < 2 Mbit/s and > 2 Mbit/s applications shall be made available.

## **5 Examples of corporate network schemes**

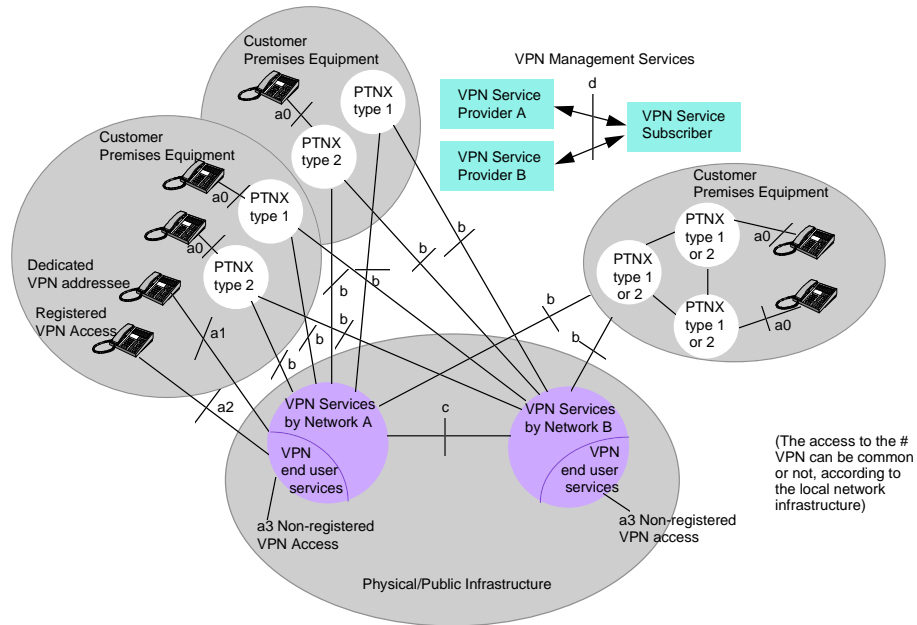
In these examples, the service entry points are identified, according to TCR-TR 034 [23] with addition by the Topic Group of the service entry point a0 (refer to subclause 3.2):



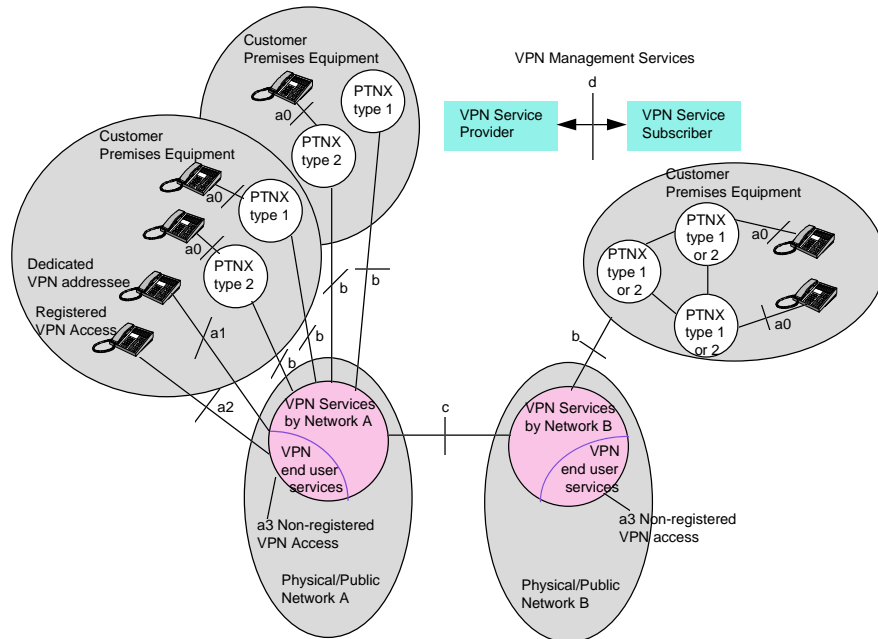
**Figure 1: Case of a Corporate Network with all sites connected through the same VPN global operator**



**Figure 2: Case of a hybrid Corporate Network**



**Figure 3: Case of a Corporate Network with all sites connected by two different VPN operators (The access to the different VPN can be common or not, according to the local network infrastructure)**



**Figure 4: Case of a Corporate Network with some sites connected via a transit between two different VPN operators**

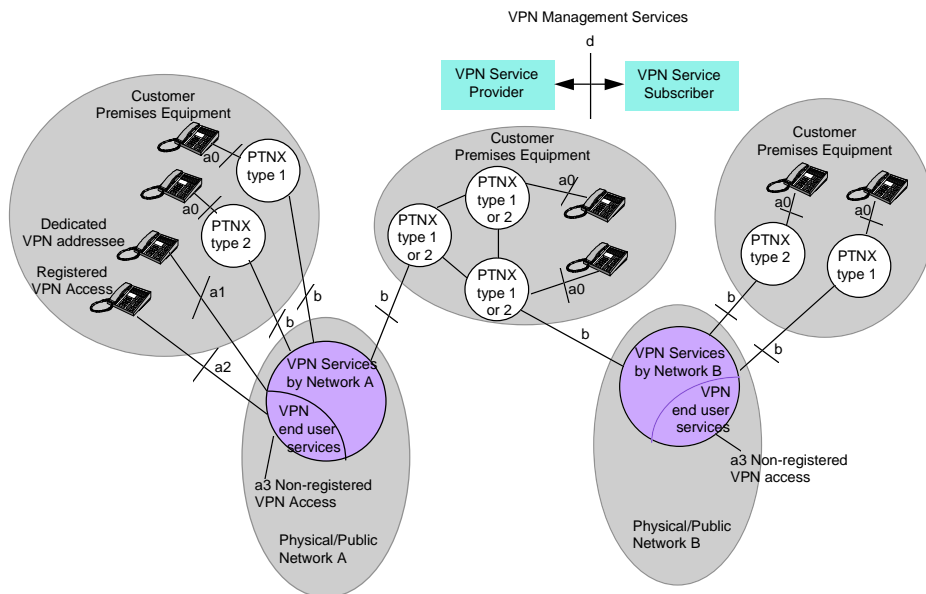


Figure 5: Case of a Corporate Network with all sites connected via a transit by a Private Network

## 6 Main general user's requirements

A detailed survey of the users' requirements was given in the paper presented to the VPN conference on 12 October 1994 as an introduction to the VPN Topic Group. In summary, here are the main features which some operators, suppliers and users stressed during their interview:

- a shared infrastructure;
- a software defined network, enabling a user group with possible sub-groups to be defined;
- the transparency for the user who has a private network at his disposal;
- the availability of a minimum level of service depending of the access mode;
- specific features can be defined for each user;
- voice or data transmission, or both;
- the services independence of the physical architecture of the network.

From the users' testimony and interviews made for this Topic Group, the main identified requirements appear to range in three categories:

### 6.1 Cost reduction

- 1) Flexible numbering plan and connection standardization (voice and data) in order to reduce equipment and operation costs and to enable reversibility of choice of supplier without induced costs;
- 2) Least cost routing;
- 3) Forced on net calls;
- 4) Economy of scale through voice-data integration (fixed cost reduction as a first step);
- 5) Minimal granularity of solutions (from a single subscription to large CPE).

## 6.2 Service and monitoring improvement

- 1) transparency of features and functions;
- 2) support of all the supplementary services suitable for the improvement of the call completion rate across the whole CTN;
- 3) inter-networking with public networks (fixed, mobile, national and international);
- 4) inter-networking with other VPN (fixed, mobile, national and international);
- 5) Inter-networking with private networks (fixed, mobile, national and international);
- 6) Mobile workers services:
  - teleworking;
  - call cards;
- 7) transparency to service offers whether they are provided by the VPN supplier or another supplier (e.g. Directory service);
- 8) High Performance Network Management:
  - Access and subscriber configuration;
  - Flexible charging;
  - Quality of service monitoring;
  - Interoperability with other Network Management Systems;
  - Standard call record.

## 6.3 Security

High level of transmission security and reliability (especially for data) is required.

Most of these features are needed as soon as possible. Nevertheless, high data rates and sophisticated supplementary services are expected as medium or long term solutions.

CTNs, whether they are based on VPN on shared public switched networks or on hybrid VPN, should provide On-Net/Off-Net, break-out/break in, virtual On-Net functionality with common ergonomics and high inter-working capability.

The details of these different issues are given in the following chapters. The Topic Group has identified four general parts to work on:

- 1) basic services: the services related to the basic communication (voice or data) including the bearer services and teleservices as defined in ETSI Technical Report on ISDN (ETR 076 [1]);
- 2) supplementary services: these services include those defined in ETR 076 [1], which are directly related to the call, but also those services provided by the VPN provider or optionally, when possible by another external provider or Customer Premise Equipment. Each category is analysed in a separated clause;
- 3) network management: the services needed by the customer to manage his network properly and effectively;
- 4) security: the features that ensure that nobody else than the authorized people is able to access to any equipment or interfere in any communication.

## 7 Basic services.

As indicated above, this chapter deals with the basic connection (voice or data) features that users expect from a VPN.

A description of organisational features to fulfil in the VPNs, which was put forward by the Swedish Administration, is given in annex A.1. Reference to this document is given where appropriate.

### 7.1 Performance

In general, the end to end communication quality has to be at least at the same level as the one on the public networks (bearer services and teleservices). That is to say for analogue communications a bandwidth of 300-3 400 Hz for voice communications, minimum 9 600 bit/s for G3 fax, and, for ISDN, n times 64 kbit/s for data or video transmissions with a bit error rate  $<10^{-8}$  at the higher specified data speed rate. H320/H261 is to be allowed without restrictions.

Should VPN operator use compression technology, then it is the operators' responsibility to disconnect it in case of incompatibility or data speed reduction with the user application.

### 7.2 Numbering plan

See OF1 Individual number, OF2, OF3 Multiple Number, OF5 Geographically Independent Number, OF37 Integrated Numbering Plan, OF38 Dual Identity Numbers, OF39 Number Conversion, OF40 Fixed Off-Net Access.

The current VPNs show some limitations in the numbering plans, for example:

- ten digits for BT/MCI;
- seven digits with possibility of five to ten, for France Télécom;
- seven digits for AT&T;
- etc...

In addition some other restrictions exist concerning use of digits such as 0 or 1 as the first digit etc...

The consequences of these incompatibilities may penalize or constrain the users.

A telephone network numbering plan implementation is a significant investment and is difficult to change at a later date.

Changing a user numbering plan to meet the new VPN supplier requirements is a major obstacle to level competition between providers.

The users need a rational telephone numbering plan with a flexible digit quantity in accordance with their needs and including the use of all digits from "0" to "9" without restriction. The "\*" and "#" keys should be kept available for any use that users may need e.g. for VPN access (escape code?) or services.

The existence of different numbering plans used by various networks should, if required, be transparent to the users.

Different prefixes used by the caller or CPE should be sufficient for a comprehensive identification of the call and its destination.

The VPN transparency to the numbering plans should include suffixes, and over dialing - where additional digits are dialled after the initial call set up.

In addition a set of abbreviated numbers is needed to address some specific functions (Transfer, Call Pickup, Emergency call, Directory Service, Help Desk, etc...). These numbers need to be flexible for a free customer choice with the only limitations (if any) due to public abbreviated numbers.

### **7.3 VPN Access**

The access to the VPN can be dedicated or common with the public switched network. This subclause covers issues related to the VPN operator selection, equal access and to the means to achieve VPN access.

#### **7.3.1 VPN operator selection**

Selection of the VPN operator through a non-dedicated access to the first network switch by dialling a prefix, is the users' preferred solution. The design of public and private networks and equipment has to allow for that.

#### **7.3.2 Dedicated access**

This type of access should ensure simple and standardized codes and procedures. Since the Leased Line connection costs are high in most countries, non-dedicated access via the public network is often a better solution.

#### **7.3.3 Common access with the public switched network**

From a financial view point, this type of access is significantly the best solution, especially for small sites or individual locations. In such cases the type of access to the network can be analogue or digital depending on the existing Customer Premises Equipment.

#### **7.3.4 Connection of customer premises equipment to VPN**

Depending on the type of VPN:

- software defined on a public network;
- overlay upon the public network;

the connection will be:

- virtual, using dynamically the existing connection to the public network and the Service Control Point (SCF/SDF); or
- dedicated and born on leased circuits between the CPE and the closest point of presence of the VPN offer.

Users' preference is for software defined VPNs, due to it's lower cost for company wide solutions. The software defined VPN connections could be either analogue or digital.

#### **7.3.5 Interfaces**

The statements in the above paragraphs mean that VPN should be capable of providing different interfaces at any service entry point with due consideration to the corresponding type of network, technology and access: CPE or PSTN or ISDN or GSM or DECT or CT2, etc.

Standards should be developed to allow inter-working between simple extension and CPE.

This means also that the CPE (PTNX) has to support the interface appropriate to the corresponding reference point T0, T2, S0, S2.

At the "a" service entry points, the interface between the equipment and the end-user terminal has not yet been standardized, thus hindering any inter-working between such a terminal and the offering by different public operators or manufacturers.

Furthermore, terminals do not yet offer any standardized Man-Machine Interface (MMI). Users consider the standardization of a "feel and shape" user interface for a minimum set of services of great importance, as outlined by the ETSI Human Factor TC.

In the area of mobile radio-terminals, the situation is even worse. Not only the portability from one manufacturer to another is questionable but also the ergonomics (function keys, function codes) is different. The standardization of the MMI for a minimum set of the services as described by this paper is a prerequisite for their implementation at a CTN level.

At the "b" service entry point, 2 M bps connections from public equipment to CPE should be standardized.

At the "d" service (VPN management services) the VPN interface should conform to CMIP/SNMP protocols.

#### **7.4 Access mode**

The access mode for the features defined in:

- OF4 Private User Mobility;
- OF34 Roving Off-Net Access;
- OF35 Remote Login and Logout;
- OF38 Dual Identity Numbers (Virtual On Net Calling);
- OF39 Number Conversion (Forced On-Net Calling);
- OF40 Fixed Off-Net Access;
- OF42 Full Public Network Access;
- OF43 Break Out; and
- OF47 On Net-On Net

should be offered, specified and standardized, on public networks, private networks and also PTNX.

##### **7.4.1 Permanent virtual circuit**

The users VPN should if required provide an agreed, predefined path between end points/user equipment for faster call set up.

##### **7.4.2 Switched virtual circuits**

The normal call path between the users equipment is switched between the CPEs under the providers control to provide the necessary bandwidth as and when required.

##### **7.4.3 Call overflow**

The user network manager should have the capability to be able to configure his network so that a call could still be successfully connected by overflow to the Public Switched Telephone Network should the VPN path be congested.

##### **7.4.4 Signalling**

Users are not concerned with the current debate concerning the signalling systems in ITU-T and ECMA but need full transparency between public and private networks and want useful improvements rather than any regression when the services are provided by the VPN instead of the existing networks.

The communication path should be set up as quickly, economically, and directly as possible. After completion of the call, the communication path should be cleared down in clean and orderly manner.

The calling party information should be as complete as possible, and carried without hindrance to the called party.

The signalling system used should be to industry standards such as Digital Private Network Signalling System DPNSS, Q931, Q Sig, DSS1 and so on. The signalling could be In Band or Out of Band.



## **8 Connection Related Selected Supplementary Services (ETR 076 [1])**

The set of services available to the end-user may be dependent on the service entry point (PSTN, ISDN, VPN, PTN, PTNX) but these services should be expandable without any regression from public networks to PTNX and vice versa (e.g. the transition from one environment to another that offers a larger set of services should not introduce the loss of any service previously provided).

The availability of these services, which are mainly designed to improve the call completion, is directly related to the type of connection. Annex A.2 shows a list of services selected by the users as those most interesting.

In table A.2, the "a2" service access point has been considered as associated to a user physical connection. The "a3" service access point has been split into two cases:

a31: Services accessed by the individual on a "call-by-call" basis: For example, a company employee using any public (e.g. a phone box) or private phone (e.g. a customer phone during an appointment).

a32: Services accessed by the individual (REFER OF4 Private User Mobility) possibly temporarily associated to a physical connection by a recognized login/logout (REFER OF35 Remote Login and Logout) procedure (e.g. airport business center, temporary location, etc.). After logout, these services will restore to the "registered user location".

For further clarification, a short description of the standardized services is given in subclause 3.1.

The list of services hereafter is not exhaustive but provides some additional information concerning the users' expectations.

### **8.1 Advice of Charge (AOC-D/AOC-S/AOC-E)**

AOC-D provide information to the user during the call.

AOC-E and S are for charging control and Network Management purposes.

### **8.2 Accounting Code (ACC)**

This code may be permanently assigned to a user, a terminal or may be dialled during Call Set Up in order to assist in managing the company communication cost. See OF36 Account codes. Using such a code is a possible answer to the requirement for a separate billing of the personal communications in particular in a teleworking situation.

### **8.3 Call Hold (HOLD)**

With tone, music or/(and) message.

### **8.4 Routing**

Planned routing of calls according to time of day or service provider tariffs is to be managed by the customer (Network Manager).

See OF7 Computer Supported User Information, OF19 Automated Attendant, OF20 Information-Based Routing, OF22 Diversion to Answering Service, OF25 Return Call Control and OF35 Remote Login and Logout.

### **8.5 Call Forwarding/Transfer (CFB/CFNR/CFU)**

To be managed by the customer (possibly the Network Manager).

#### **8.5.1 Call Forwarding on Busy (CFB)**

To be managed by the customer (possibly the Network Manager).

### **8.5.2 Call Forwarding on No Reply (CFNR)**

See OF21 Message Center, OF22 Diversion of Service.

### **8.5.3 Call Forwarding Unconditional (CFU)**

To be managed by the customer (possibly the Network Manager).

### **8.6 Calling Line/Name Identity Presentation (CLIP/CNIP)**

True end to end calling line/name identification is needed. This information has to provide the telephone number to enable the called party to return the call. This should include data for national, and international calls, where possible/legal. The latest update of this information should be distributed to all relevant interfaces.

### **8.7 Night Service (NS)**

This supplementary service is particularly applicable to attendants positions / switchboard operator.

When night service mode is activated, all incoming calls to the served user are given one of the following treatments, depending on implementation and/or user requirements:

- reject the call, with an indication to the calling user that Night Service mode has been encountered;
- attempt to forward the call to a pre-nominated Night Answer Point, indicating this new action to the calling user and the forwarded user that Night Service mode has been encountered.

The above actions could apply also to any calls waiting to be answered by the attendant position when Night Service mode is activated.

### **8.8 Recall (RE)**

This supplementary service provides for the redirection of a call, transferred by a network user, back to the same user if that call is unanswered.

### **8.9 Direct Inward System Access (DISA)**

DISA is a facility allowing external users (voice calls) to call into a PBX and obtain access to the PBX features as if they were local users.

## **9 Other supplementary services**

These services may be provided either by the VPN operator, the CPE or another independent service provider.

### **9.1 Announcements**

See OF16 Simple Announcement, OF17 Queue Status and OF18 Simple Announcement plus Voice Messaging.

### **9.2 Voice message Service**

See OF11 Voice Message Service, OF12 Paging, OF13 Cordless Caller and OF21 Message Centre.

### **9.3 Voicemail**

In addition to the service described above this service provides the capability to re-route a received voice message to one or more users or to dispatch the same message to several users. The network should allow the passage of voice mail tones without distortion.

Although being today quite difficult, the interconnection between voicemail services from different manufacturers and providers is highly desirable and hence a common interface need to be standardized.

#### **9.4 Computer Telephony Integration (CTI)**

See OF7 Computer Supported User Information.

#### **9.5 Automatic Call Distribution (ACD)**

See OF14 Distribution of calls.

#### **9.6 Attendant deflection**

This service (sometimes called "Follow the sun") directs the incoming call to different locations depending on the company organization and the time of day or the day of the week, to ensure an appropriate response to the caller. This service may be associated to OF19 Automated Attendant or OF20 Information-Based Routing.

#### **9.7 Paging**

See OF12 Paging.

#### **9.8 Cordless terminal**

See OF13 Cordless Caller.

#### **9.9 Emergency call in**

Local or distant: see OF23 Emergency Call In.

#### **9.10 Videoconferencing**

The videoconference service is achieved with suitable terminals, usually conforming to H320/H261 standards. Therefore the VPN and PTNX have also to be fully transparent to these standards.

#### **9.11 Audioconference**

Users want to conduct multi-user telephone conversations between different locations. The network should be capable of carrying audioconferencing on On Net & Off Net calls.

The network should be capable of interconnecting different proprietary conferencing equipment, which may be provided by the user or service provider. This should enable interconnection of local audioconference systems to constitute a larger conference between different sites in order to reduce the communication costs.

#### **9.12 Email**

A standardized interface between Email servers and the CTN could be useful by providing the Email subscriber with voice and visual information of a waiting message. This would be especially useful for mobile workers.

### **10 Network management**

The VPN management services are to be provided with real time and historical information at service access point d. The objective is to use this information, in standardized format, either on dedicated terminals or by using existing customer equipment (Network management station or other computer).

#### **10.1 Performance and quality of service monitoring**

Network performance and quality of service are crucial to users. Therefore, the Network Management tools should supply indicators for performance monitoring and contractual provider or operator commitments control.

These tools have, on one hand, a proactive role of performance monitoring and, on the other hand, a reactive role when performance or quality of service indicators are under the specified level. Report production should be user configurable, and available periodically or on demand.

In addition, the Network Management tools supplied by the operators should allow the transmission of information, alarms or events from the network devices. The protocol needed for that should be of the Open type and should conform to the most common "de jure" or "de facto" standards, such as CMIP or SNMP. In the same way, they should be available on the most common Network Management stations, that is to say: HP Openview, SunNet Manager or IBM AIX NetView 6 000, etc...

**Table 1**

<b>Performance / Quality of service Indicators</b>	<b>Voice</b>	<b>Data</b>
Connection load rate	X	X
End to end availability		X
Local loop availability	X	X
Number of Service Interruptions (e.g. number of micro-cut with production outage during a session)		X
Bit Error Rate Test (BERT)		X
Network crossing time		X
Number of calls overflowed onto PSTN (if relevant)	X	
Call completion rate within the VPN	X	
Duration of call set-up	X	X

**10.1.1 Traffic measurements**

The VPN should provide any information enabling the User Network Manager to actively manage his network, including dealing with any desirable reorganisation.

The information should contain in particular the percentages of network resource utilization at peak half hours, the daily mean and the standard deviation value.

Fifteen minute statistics in common computer usable format for the incoming and outgoing traffic, blockage and also the rate of loss on every access is requested from the operator.

**10.2 Alarms and faults reporting**

Alarms to agreed equipment should be generated as soon as agreed parameters are no longer satisfied with respect to the agreed level.

In addition the following indicators are needed:

**Table 2**

<b>Alarm / Fault on event:</b>	<b>Voice</b>	<b>Data</b>
Group of lines saturated	X	
Line or group of line broken	X	X
Unavailability of a distant PTNX	X	
Direction unavailability	X	
Excessive bit error rate		X
Switched to backup support (PSTN, ISDN, Leased Line, ...)	X	X

The type of treatment for each alarm should be configurable by the user.

For every alarm occurrence, a fault ticket should be issued, provided in electronic format and permanently updated by the VPN operator, according to the fault handling procedure with appropriate messages sent to the relevant responsible user.

### 10.3 Faults management

The manager should have the information available so that he can:

- recognize that the network is not performing in the user agreed way;
- identify where and why the fault has occurred;
- plan a method to correct the fault;
- implement the plan;
- document the actions taken;
- advise users of progress of fault rectification and clearance in an agreed manner;
- make any necessary financial payments.

The network provider(s) should have adequate equipment and personnel to ensure that the network performs as expected by the user.

The user should be able to trace a call path so that the performance of the network can be measured.

There should be a single point of contact to report faults, and an agreed procedure for resolving faults.

The user should be advised of progress in resolving the fault, and of its resolution.

There should be end to end support.

### 10.4 Cost information

The user should be made aware by the Network Provider of any initial payment required.

The cost related information, provided by the VPN operators, should make possible (in addition allowing for the payment of the supplier), an internal cost breakdown between the company cost entities, the consolidation of the company accounts, the contractual provider or operator commitments control and possibly allow for tuning the parameters of the least cost routing facility.

This information should be provided electronically in a call record file (in ASCII or other popular format) giving the following elements:

- date/hour of the beginning of the call or session (hour reference to the country of originating end);
- date/hour of the end of the call or session;
- duration of the communication or session (in seconds);
- caller number;
- called number;
- translated number at the starting point;
- translated number at the ending point;
- "On Net/Off Net" Indication;
- accounting Code;
- operator identifier;
- traffic type (voice/data);
- number of kbytes sent;
- cost billed;
- call completion indicators: No Response, Busy, Network Congestion, etc...;
- spare available field ....

In addition, this information should be available for electronic recording and use in accordance with the legislation in use.

Where a call is carried by more than one carrier, there should be a single call item of cost and information.

### 10.5 Configuration

#### 10.5.1 Numbering plan

The Network Management system should enable the User Network Manager to manage every task on the numbering plan that users wish.

### **10.5.2 Configuration management**

The user should be able to reconfigure the network so that it supports his current and/or planned business needs.

Changes to the network should only be made once.

Changes should only be made if they have had appropriate approval.

The provider should advise the user of any changes to the network that will impact the user in carrying out business.

Moves, adds, and changes should be implemented without impacting on business, and in a cost efficient manner.

Documentation should be automatically produced to reflect the current arrangement.

### **10.5.3 Subscriber profile management**

The terminal configurations should be managed by the user (possibly by the centralized manager of the customer). The data that characterize them should be under his responsibility (Network Object features).

The configuration update should be propagated automatically along the network from site to site without restriction.

For all these operations the VPN should be transparent.

In addition, the Network Management tool should allow an extensive right of access control.

### **10.5.4 Site management**

The VPN provider is responsible for any modification in the network configuration (site addition or cancellation, channel number modification, ...). Such modification should be fully transparent to the User Network Manager who should have a comprehensive and up-to-date view of his network.

## **10.6 Directories**

In a multi-site company, the best way to ensure the corporation directory reliability and accuracy is to consolidate local directories that have been updated on the sites.

The VPN could be an appropriate means to organize this consolidation. To perform this action, a standardized interface between the CPE and the VPN (PABX, LAN, etc...) is needed; X500 should be the most appropriate standard for that.

## **11 Security**

The VPN utilization should be fully transparent and supportive to the company security policy. Specifically, the user should have a complete freedom to use any encoding technology conforming to the possible legal limitations. These codes should be transmitted through the VPN without any distortion or hindrance.

In addition to the encoding technology, the usual precautions for identification and password should be accepted by the network and the operator without restriction.

The VPN supplier should respect the user defined access rights and privileges (global, by site or individual access rights).

To prevent fraud, the operator should take and demonstrate all safety measures to prevent any intrusion on the VPN. The VPN provider should ensure a strict leak-tightness between his different customer VPNs using the same infrastructure.

The security should be supported by an audit trail such as permanent recording of the communications parameters (time-ticket, logging and intervention).

In addition, the connection to the Network Management tool should require a strong authentication by all appropriate means (card or procedure).

## Annex A: Organisational Features and Supplementary Services

### A.1 Description of Organisational Features (OF)<sup>4)</sup>

Table A.1

Identifier	Service Name	Description
OF1	Individual number	A single number that uniquely identifies the individual user. This could be: <ul style="list-style-type: none"> <li>- an extension number;</li> <li>- a DDI number (which is based on the extension number);</li> <li>- a UPT number.</li> </ul>
OF2	Group Number	The numbering plan allows a user to be a member of a group (or a number of groups) where the group itself has a number in the numbering plan.
OF3	Multiple Number	The numbering plan allows a user to be a member of one or more groups where each group has a number in the numbering plan.
OF4	Private User Mobility	Network users are able to identify themselves at compatible terminals within the network so that calls to their individual number arrive at the visited terminal. Calls may also be made from the visited terminal with the level of service allocated to the "Mobile" user.
OF5	Geographically Independent Number	A published directory number that has the same cost for any caller, regardless of their geographical location. There are three types of number in this category: <ul style="list-style-type: none"> <li>- FreePhone (Calls paid for by the called organisation);</li> <li>- Low Cost Calling (Call subsidized, with costs shared between calling and called party);</li> <li>- Premium Rate Call (Calls are paid for by the caller and a surcharge is added. A proportion of this surcharge is passed to the called organisation by the network operator).</li> </ul>
OF6	Co-ordination With Other Communications Services	The ability to send and receive messages to and from other communications services under the control of the user's terminal. Such services include: <ul style="list-style-type: none"> <li>- FAX, facsimile;</li> <li>- E-Mail;</li> <li>- Voice-Mail;</li> <li>- Paging.</li> </ul> It should be possible for this service to provide a single number for all methods of communication with a certain user. Callers are offered alternatives so that they can choose which service to use in the event that the called user is unavailable. When linked with the Computer Supported User Information service (OF7 Computer Supported User Information) this can provide a powerful and flexible communication facility. As a basic minimum service, callers to this type of users must receive an indication of which alternative services can be used if the user is busy or otherwise not available. The caller is then required to release the call and to call back to the number indicated for the alternative service. Enhanced variants of this service are: <ul style="list-style-type: none"> <li>- callers to an unavailable user are offered the ability to select which alternative service to use by pressing an indicated key (e.g. "Press "1" to switch to FAX, "2" to send X. 400 E Mail, "3" to speak to Secretary"). The call is then switched immediately to the alternative service and a caller with a compatible terminal thus only needs to make a single call to be sure of making contact with the called user;</li> <li>- callers to an unavailable user are automatically switched to a pre-defined alternative service. The alternative service can be specified:                             <ul style="list-style-type: none"> <li>- by the user as and when a change is required;</li> <li>- by the user on a call-by-call basis;</li> </ul> </li> </ul>

(continued)

4) These descriptions of OF are extracted from SOTIP with amendments from the Topic Group. They are given to clarify the users' expectations but do not intend to give any standardized definition.



Table A.1 (continued)

Identifier	Service Name	Description
OF7	Computer Supported User Information	<p>- on a time-of-day or other programmed basis.</p> <p>Access to computer-based user information for interaction with a Message Centre, attendant or secretarial Service. The user is able to select pre-defined messages (for example, "In A Meeting Until 3 pm", "On Vacation Until 27 June") which are used to cause calls to be diverted to an alternative answering point and to provide useful information to the answering user.</p>
OF8	Co-ordination Between Voice Service and Other User Information	<p><b>Description</b></p> <p>A service that enables an employee to quickly retrieve data for local presentation (computer display) based upon the identity of the other user in a call. This identity can be entered:</p> <ul style="list-style-type: none"> <li>- manually by the employee;</li> <li>- automatically by the telecommunications network using: <ul style="list-style-type: none"> <li>- the Calling Line Identification service or some other identifying service if the call is incoming;</li> <li>- the dialled number if the call is outgoing (e.g., as part of the Call Sequencing feature, OF32).</li> </ul> </li> </ul> <p>If the identification is automatic, the data is displayed immediately upon making or answering the call.</p> <p>Transferring an established call with associated data will cause the data to be transferred with the call. Also, if a conference call is established involving a call with associated data, the data will be available to all other taking part in the call.</p>
OF9	Attendant / Operator Services	<p>A comprehensive range of services provided by Attendants/switchboard operators to ensure that the appropriate level of service can be given to callers and to all other users.</p> <p>The individual supplementary services that might be offered by Attendants are to defined on a case by case basis.</p> <p>The co-ordination of Attendant Services with other answering services (OF7) is essential in ensuring that callers to users within the organisation always receive the most appropriate and most effective service available if the called user cannot be immediately contacted.</p> <p>Calls to the attendant may enter the network at any point. Centralized attendant/operator working should be possible where full information is presented to the operator for effective answering. Calls released by an attendant to an extension and not answered should be returned to the original attendant, with notification of the unsuccessful previous call connection.</p> <p>Calls answered by an attendant should have the shortest call path once the attendant drops out of the connection.</p>
OF 10	Secretarial Services	<p>A range of services to ensure that calls to users are answered by a secretary whenever possible or necessary. These services include:</p> <ul style="list-style-type: none"> <li>- Call Interception;</li> <li>- Call Diversion;</li> <li>- Ringing Group;</li> <li>- Group Pickup.</li> </ul> <p>In smaller organisations, many of the functions performed by Attendants would be carried out by secretarial staff.</p>

(continued)

Table A.1 (continued)

Identifier	Service Name	Description
<b>Messaging Services</b>		Services that can be used to alert users who are unable to answer an incoming call as a result of being logged out, busy or otherwise unavailable. An indication on the voice or data terminal of a waiting message is desirable (light or message) should the user be in his office or elsewhere using the PUM (OF4).
OF11	Voice Message Service	A service allowing callers to leave simple voice messages for an unavailable user. The called user is then able to retrieve these messages using any terminal in the private network or in a public network.
OF12	Paging	The ability to provide indications to a logged-out or otherwise unavailable user that a caller is waiting to be called back or that a message has been taken for them at a paging centre. More sophisticated paging equipment is able to display short textual messages on a small screen.
OF13	Cordless Caller	The use of a mobile telephone for outgoing calls only. When combined with paging to indicate that a response is required to an incoming call attempt, this can provide a cost-effective alternative to full mobility, particularly for those users who do not need to operate outside the private network.
OF14	Distribution of calls.	<p>The automatic distribution of queued incoming calls. Distribution methods differ but each has the main purpose of ensuring that incoming calls are answered in the most efficient way. The algorithms used for selecting the destination of the next call can be based on a number of parameters but, typically, would involve one of the following:</p> <ul style="list-style-type: none"> <li>- a fixed pattern (circular or linear);</li> <li>- member with the longest waiting time;</li> <li>- member with lowest active time.</li> </ul> <p>Different mechanisms can also be used for indicating that a member is available to receive a new call. These are:</p> <ul style="list-style-type: none"> <li>- immediately on clearing the previous call;</li> <li>- after a fixed "Wrap-up" period at the end of the previous call to allow the necessary clerical activities to be completed;</li> <li>- after a manual indication from the agent that data processing for the previous call is complete;</li> <li>- after an automatic indication from the associated computer system that data entry for the previous call is complete.</li> </ul> <p>Features should exist for routing queued incoming calls to alternative answering positions if waiting times become excessive, if queues are full or for any other operational reason (such as out of normal office hours). Members of a call distribution group may be required to log in and log out by entering a password or other personal authorisation code to indicate to the network that they are or are not available for receiving calls. As an extra security measure to prevent unauthorized access to the network, group members can be forced to enter an additional personal identification number (PIN) on logging in. They may also be required to provide their PIN at other times, not only at login.</p>
OF15	Flexible Response	In the event of an emergency or some other situation causing a temporary sharp increase in incoming call traffic, priority is given to answering these particular calls. This can involve the suppression of all other incoming calls (by providing a "Busy" indication or a recorded announcement to callers) and, in those cases where the increase in traffic is known in advance, the provision of large numbers of additional staff and equipment to answer the calls.

(continued)

Table A.1 (continued)

Identifier	Service Name	Description
<b>Announcement Features</b>		Under certain circumstances it is desirable to provide an incoming caller with a pre-recorded message or announcement so that they are able to take appropriate action (for example, wait for the call to be answered or hang up and try again later).The following three sections describe alternative announcement services.
OF16	Simple	An incoming call is diverted to a fixed announcement with no interaction or intelligence. The message played, such as "All agents are busy, please try later", may vary depending upon the criteria for diversion but all callers encountering a specific set of conditions will hear the same announcement.
OF17	Queue Status	An informative announcement is played to incoming callers without removing the call from the queue. The contents of the announcement are modified with each call according to the status of the call queues. Information provided in the message can include the number of calls queued ahead of the caller or an estimate of the length of time the caller is likely to wait before answer.
OF18	Simple plus Voice Messaging	An incoming call is diverted to a fixed announcement. The caller is prompted to leave a voice message containing specific information that can be acted upon before a return call is made.
<b>Caller-Directed Routing</b>		To ensure that a caller is routed to a user who can most effectively deal with their query, the caller is prompted by recorded or synthesized voice to provide information that is used to direct the call to the appropriate queue. There are two very similar services used for this purpose and these are described below.
OF19	Automated Attendant	Callers are prompted to indicate the department they wish to speak to by pressing one of the telephone keypad keys (for example; "Press 1 to speak to Finance; press 2 to speak to Personnel, etc.").This service works well in organisations operating a number of call centres each dealing with distinct sections of the business. It depends on the caller having a push-button telephone and having some knowledge of which service required. Normal practice is that if no key is pressed in a pre-set time, the call is routed to a human attendant.
OF20	Information-Based Routing	Callers are prompted to provide some information relating to their call. This information is entered on the caller's telephone keypad and so must be restricted to numerical data only. The following are examples of information items that could be used: <ul style="list-style-type: none"> <li>- personal identity;</li> <li>- social security number;</li> <li>- tax reference number;</li> <li>- reference number allocated during a previous call;</li> <li>- location;</li> <li>- region identifier;</li> <li>- postal code.</li> </ul> Once the information has been collected, the call is routed to the office best suited to dealing with the enquiry.
OF21	Message Centre	A service that enables callers to leave messages for an unavailable user and for that user to be able to receive an indication that a message has been taken and to collect the message at a convenient time.
OF22	Diversion to Answering Service	The ability to divert incoming calls to an Attendant service or to a simple announcement with recording if the called telephone terminal is busy or is not answered. This service could have value in organisations where some users are not supported by other users (Secretary).
OF23	Emergency Call In	A service that enables individual users to identify their current location to a central reporting point (for example, a Security Office) and to request assistance in an emergency situation. Activation of the service is achieved by a single keystroke or by a short sequence of keys. Users management should have the facility to know from where and when the call was generated.

(continued)

Table A.1 (continued)

Identifier	Service Name	Description
OF24	Automated Transaction	A service primarily intended for the interchange of structured data. The caller is prompted to provide some form of identification (password or PIN) using the telephone keypad. Then, by keying in the necessary additional items of information, the caller can complete the transaction without the assistance of a human operator. Such a system can be used to query the balance in a tax account or to book a maintenance visit from the regional government office.
OF25	Return Call Control	<p>Queued calls are diverted to a voice messaging service after a pre-defined waiting period or as a result of some specific action by the caller. The caller is prompted to provide identification, telephone number and a time of day at which it would be convenient for the call to be returned. A list is prepared of all the return calls to be made categorized by the time of day and this list is used as a guideline for those employees returning the calls. The service can be enhanced further by linking the return call list with a predictive or power dialling service. The incoming call need not be answered by a human agent or operator and different types of call require different handling of the return call:</p> <ul style="list-style-type: none"> <li>- No Reply Necessary: the caller is routed to an Automated Transaction service and is able to extract the required information directly.</li> <li>- Reply Necessary: the call is restored and a response is scheduled to be sent. As examples, this may be:               <ul style="list-style-type: none"> <li>- Messaging;</li> <li>- FAX;</li> <li>- Standard Post;</li> <li>- X.400 E-Mail;</li> <li>- Synthesized/pre-recorded Voice;</li> <li>- Human Response;</li> <li>- Customer dedicated operators make the return call when all the information to answer the original call has been collected.</li> </ul> </li> </ul>
OF26	Call Filtering (Boss/Secretary)	In a traditional "Boss/Secretary" arrangement it can be important to have calls that were originally directed towards a user (boss) answered by a supporting user (secretary). There is a number of ways in which this can be achieved and the following sections describe a few of them.
OF27	Key Line Appearance	The use of a special telephone terminal that indicates the status (Busy/Ringing/Free) of other specific users and which enables the Secretary to answer an incoming call to any of the indicated lines by pressing a single key. The call can subsequently be transferred to the called Boss.
OF28	On Going Group	The indication of an incoming call on the telephone terminals of all the users in a pre-defined group. The call is answered by the first user to go "off hook". In this secretarial support application, the group can be arranged so that incoming calls are indicated first on the Secretary's telephone terminal and are only indicated on the Boss' terminal if not answered within a pre-defined period.
OF29	Forced Diversion	<p>The re-routing of incoming calls for a Boss to an associated Secretary. Diversion of calls can occur under any combination of the following circumstances:</p> <ul style="list-style-type: none"> <li>- if the Boss is busy;</li> <li>- if the Boss does not answer.</li> </ul>
OF30	Group Pickup	The use of a short code (one or two digits) on a telephone terminal to answer an incoming call ringing at another user terminal. Both users must be members of the same pre-defined group.

(continued)

Table A.1 (continued)

Identifier	Service Name	Description
OF31	Called Party Identification	An indication of the identity of the called user when an incoming call is answered by another user. This service is used to enable a Secretary to respond correctly to each incoming call when providing secretarial support to more than one Boss.
OF32	Outgoing Call Sequencing	<p>The automatic calling of individuals outside the network from a stored list such that each call is set up as the previous one is cleared. Waiting times between calls can be reduced if predictive algorithms are used to control the sequence of calls. The selection of the next call to be made can be made on a wide range of different criteria but the parameters considered might include:</p> <ul style="list-style-type: none"> <li>- time of Day specified by the called party in their initial call to the company;</li> <li>- status of the original enquiry or report from the person to be called;</li> <li>- a financial value (such as the amount owed to the company);</li> <li>- a company specific priority rating.</li> </ul> <p>Different mechanisms can also be used for indicating that an employee is available to process a new outgoing Call. These are:</p> <ul style="list-style-type: none"> <li>- immediately on clearing down the previous call;</li> <li>- after a fixed "Wrap-up" period at the end of the previous call to allow the necessary clerical activities to be completed;</li> <li>- after a manual indication from the agent that data processing for the previous call is complete;</li> <li>- after an automatic indication from the associated computer system that data entry for the previous call is complete.</li> </ul>
OF33	Backup Answering Function	<p>A user is able to answer incoming calls if all normal answering stations are either busy or vacant. Examples of services that could be used to provide this function are:</p> <ul style="list-style-type: none"> <li>- terminal hunting with the user at the end of the Hunt Group;</li> <li>- Group Pickup;</li> <li>- Call Diversion from the answering user or group on Busy and No Reply;</li> </ul> <p>The operation of these services has to be described in detail.</p>
OF34	Roving Off-Net Access	<p>Company staff who spends much of their time travelling away from their home office generally has access to a direct connection to the public network but not to the company's own network. They can be given the same network capabilities as the staff directly connected through a PTNX to the private network in two different ways:</p> <ul style="list-style-type: none"> <li>- access to DISA by means of a FreePhone number;</li> <li>- access to DISA or work-related public network numbers by using a company calling card. Credit card access can be limited by restricting use by individuals to a daily or weekly credit amount.</li> </ul> <p>General access to a DISA service should be controlled by requiring a password or other authorisation code to be entered before the features of the service are made available to the caller.</p>
OF35	Remote Login and Logout	<p>The ability of users to indicate to the network that they are or are not available for receiving calls by entering a password or other personal authorisation code.</p> <p>For users who do not have a mobile telephone, logging in has the additional effect of identifying the user's location (i.e., the telephone number on which they can be called) so that incoming calls can be diverted to them directly.</p>
		(continued)

**Table A.1 (concluded)**

Identifier	Service Name	Description
OF36	Account Codes	The ability of a called user to enter a numeric identifier on making an outgoing call or after answering an incoming call. This identifier can then be used for cost and time accounting and for the segmentation and analysis of telephone charge accounts.
OF37 OF38	Integrated Numbering Plan  Dual Identity Numbers (Virtual On-Net Calling)	The numbering plan is defined by the company, not the service provider, and this can have any number of digits. Users can have a private numbering plan number that has been assigned by the company and also an unrelated public network number. It should be clear to the user which method is used to call their telephone number (ringing patterns or some other visual indication). EXAMPLE: An employee of a particular department of the company works from home and has only one telephone line to the house. Dialling 4156 within the company's network will cause the employee's telephone to ring. Dialling 087151839 on a public network line will have the same effect. Call barring services could be used to give priority to business calls during working hours. This can be achieved either on a predetermined time-of day basis or on when the user is logged into the network.
OF39	Number Conversion (Forced On-Net Calling)	Where possible under normal operating conditions (not overflow), public network numbers dialled from the private network are connected using the VPN so that public network tariffs are not applied to the call.
OF40	Fixed Off-Net Access	Company staff working at remote sites or working permanently at home (Teleworking) has dedicated access to the company's private network via the public network (i.e. their public network telephone appears to be directly connected to the private network). Access arrangements can be as follows: - permanently enabled; - periodically enabled: - at pre-defined times of day where working hours are predictable; - while the user is logged in.
OF41	Authorisation Codes and Passwords	Multi-digit codes that can be entered by specific users to override restrictions and to provide access security to company calls originating off the network. Passwords can also be used by mobile staff establishing their location for receiving further incoming calls and for overriding call barring restrictions.
<b>Access To Public Networks</b>		
OF42	Full Public Network Access	All sites within the private network are capable of accessing any national and international directly dialled location using the public switched network or the public ISDN (including On Net/Off Net functionality).
OF43	Breakout	Calls to the public network from the private network are carried through the network as far as possible before being converted to a public network call
OF44	Multi-Operator Access (Equal Access)	It is now quite common for private networks to have access to and from more than one public network. The selection of which to use can either be made by the caller on a call-by-call basis or it can be programmed within the private network based upon a range of tariff related parameters, such as: - The time of day; - The destination of the call; - Traffic volumes.
OF45	Call Barring	On a user-by-user basis determined by the user network manager, cost or number related restrictions can be made on the destinations (either specific or general) called from the private network. These restrictions can be automatically modified by time of day and/or day of the week and/or day of the year, by call charge accumulation or by the total length of time in use.
OF46	Abbreviated Dialling	A range of numbers that are commonly called from throughout the organisation is stored within the private network and these numbers are dialled out when the short access code is entered. It is possible to have abbreviated dialling numbers retained for a specific time period such that when this period has elapsed, the short code no longer has any effect.
OF47	"On Net-On Net" call	A call from the CTN to the CTN but which can involve different VPN operators.
OF48	Short Code Dialling	A set of number generally of 1 to 2 digits, dialled to access to general services (operator, information, paging system, pick up group, etc...).

## A.2 Selected supplementary services

Table A.2

Acronym	Supplementary Service	Service Entry Point			
		a0-1-2	a31	a32	b-c
ABD	Abbreviated Dialling <sup>1)</sup>	Y	Y	Y	N
ACC	Accounting Code <sup>2)</sup>	Y	Y	Y	Y
AOC-D	Advice of Charge (during call)	N	N	N	Y
AOC-E	Advice of Charge (end of call)	Y	?	Y	Y
AOC-S	Advice of Charge (call set-up)	N	N	N	Y
CCBS	Completion of Calls to Busy Subscriber <sup>3)</sup>	Y	N	Y	Y
CCNR	Completion of Calls on No-Reply <sup>4)</sup>	Y	N	?	Y
CD	Call Deflection	Y	N	Y	Y
CFB	Call Forwarding Busy	Y	N	Y	Y
CFNR	Call Forwarding No-Reply	Y	N	Y	Y
CFU	Call Forwarding Unconditional	Y	N	N <sup>5)</sup>	Y
CLIP	Calling Line Identity Presentation	Y	N	N	Y
CNIP	Calling Name Identity Presentation	Y	Y	Y	Y
CO	Call Offer (on busy called party)	Y	Y	N	Y
CONF	Conference Call Add On	Y	Y	Y	Y
CW	Call Waiting	Y	N	Y	N
DISA	Direct Inward System Access	Y	Y <sup>6)</sup>	Y	Y
DND	Do Not Disturb	Y	N	N <sup>7)</sup>	Y
ECT	Explicit Call Transfer	Y	?	Y	Y
HOLD	Call Hold	Y	Y	N	N
MCID	Malicious Call Identification <sup>8)</sup>	Y	N	N	Y
MSS	Manager/Secretary Switch <sup>9)</sup>	Y	N	Y	N
MWI	Message Waiting Indication (Light or Signal)	Y	N	Y	Y
SCDI	Short code dialling individual	Y	Y	Y	N
SCDS	Short code dialling <sup>10)</sup> system based	Y	Y	Y	N
UUS	User-to-User Signalling	Y	N	Y	Y

? indicates when the Topic Group opinion was not clear or when the technical feasibility was uncertain.

- 
- 1) see a detailed definition in OF46.
  - 2) see a detailed definition in OF36.
  - 3) idem above.
  - 4) the characteristics of the called equipment define the service availability.
  - 5) the same service is provided by log-out.
  - 6) with VPN authentication
  - 7) the same service is provided by log-out.
  - 8) the characteristics of the calling equipment define the service availability.
  - 9) see a detailed definition in OF26-27-28-29-30.
  - 10) see a detailed definition in OF48.

## Annex B: Contributors

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## History

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