

## **Network Aspects (NA); Interworking framework**

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## Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Network Aspects (NA).

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# 1 Scope

The present document is part A of the ETSI SRC6 report [1] dealing with the European Information Infrastructure (EII). It comprises a number of recommendations indicating the need to develop standards in the area of interworking between a number of existing and emerging access networks and core network types. In particular:

- Recommendation 21 states: "SRC6 recommends that ETSI prepares those new interface standards which may be necessary to allow the federation of networks that will form the EII to interwork as efficiently as possible";
- Recommendation 24 addresses Internet and TCP/IP and the use of these platforms for the support of non-real time traffic in the EII.

A number of possible combinations of interconnecting access and core networks is given in Chapter B.5 and especially Figures 5.3 and 5.4. The scope of this report is restricted to the transport and control platform as defined in this section of the SRC6 report [1].

The primary objective of this report is to prepare the EPII Project 1.3 by analysing the state of the art and defining a master plan for further standardization work. It focuses a small number of interworking cases for which urgent action is required.

It is to be noted that a number of related aspects are covered by other EPII Projects, especially Project 1.4 on EBTN and Project 1.6 on IN/TMN support for the EII.

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# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] ETSI Report of the Sixth Strategic Review Committee (SRC6) on the European Information Infrastructure (June 1995)
- [2] Void.
- [3] ETS 300 602: "European digital cellular telecommunications system (Phase 2); Interworking between the Public Land Mobile Network (PLMN) and the Packet Switched Public Data Network (PSPDN) for Packet Assembly/Disassembly (PAD) facility access (GSM 09.05)".
- [4] ETS 300 603 including Amendment A1: "European digital cellular telecommunications system (Phase 2); Interworking between a Public Land Mobile Network (PLMN) and a Packet Switched Public Data Network/Integrated Services Digital Network (PSPDN/ISDN) for the support of packet switched data transmission services (GSM 09.06)".
- [5] ETR 128: "European digital cellular telecommunications system (Phase 2); ETSI object identifier tree; Common domain; Mobile domain; Operation and Maintenance (O&M), managed object registration definition (GSM 12.30)".
- [6] ETS 300 194: "Satellite Earth Stations and Systems (SES); The interconnection of Very Small Aperture Terminal (VSAT) systems to Packet Switched Public Data Networks (PSPDNs)".
- [7] ETS 300 473: "Digital Video Broadcasting (DVB); DVB Satellite Master Antenna Television (SMATV) distribution systems".

- [8] ETS 300 278: "Network Aspects (NA); Support of existing services with guaranteed constant bit rate and specified transfer delay on Metropolitan Area Network (MAN)".
- [9] ETS 300 479-1: "Network Aspects (NA); Connectionless Broadband Data Service (CBDS) over Asynchronous Transfer Mode (ATM); Protocol specification at the Network Node Interface (NNI); Part 1: Specification".
- [10] ETS 300 467: "Broadband Integrated Services Digital Network (B-ISDN); Support of Frame Relay Bearer Service (FRBS) in B-ISDN and frame relay interworking between B-ISDN and other networks".
- [11] ITU-T Recommendation I.571: "Connection of VSAT based private networks to the public ISDN".
- [12] ITU-T Recommendation I.580: "General arrangements for interworking between B-ISDN and 64 kbit/s based ISDN".
- [13] ITU-T Recommendation I.550: "General arrangements for interworking between Packet Switched Public Data Networks (PSPDNs) and Integrated Services Digital Networks (ISDNs) for the provision of data transmission services".
- [14] ITU-T Recommendation I.365.1: "Frame relaying service specific convergence sublayer (FR-SSCS)".
- [15] ITU-T Recommendation I.555: "Frame Relaying Bearer Service interworking".
- [16] ITU-T Recommendation X.361: "Connection of VSAT systems with Packet-Switched Public Data Networks based on X.25 [17] procedures".
- [17] ITU-T Recommendation X.25: "Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit".
- [18] ITU-T Recommendation X.325: "General arrangements for interworking between Packet Switched Public Data Networks (PSPDNs) and Integrated Services Digital Networks (ISDNs) for the provision of data transmission services".
- [19] ITU-T Recommendation Q.2660: "Interworking between Signalling System No. 7 – Broadband ISDN User Part (B-ISUP) and Narrow-band ISDN User Part (N-ISUP)".
- [20] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".
- [21] ETS 300 478-1: "Network Aspects (NA); Connectionless Broadband Data Service (CBDS) over Asynchronous Transfer Mode (ATM); Framework and protocol specification at the User-Network Interface (UNI); Part 1: Specification".
- [22] ETR 263: "Broadband Integrated Services Digital Network (B-ISDN); Specific interworking functionalities with B-ISDN".
- [23] ETR 244: "Intelligent Network (IN); ETSI workplan for IN; (Mandate BC-T-305, step 1)".
- [24] 97/33/EC: "Directive of the European Parliament and of the Council of interconnection in Telecommunications with regard to ensuring universal service and interoperability through application of the principles of Open Network Provision (ONP)".

## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**interconnection:** the physical and logical linking of telecommunication networks in order to allow users of one organization to communicate with users of another organization or to access services provided by another organization.

**interworking:** within the present document refers to "network interworking": Interactions between networks, or between parts thereof, with the aim of providing communication between entities.

### 3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AAL	ATM Adaptation Layer
ADSL	Asymmetrical Digital Subscriber Line
ATM	Asynchronous Transfer Mode
B-ISDN	Broadband-ISDN
CATV	Community Antenna TeleVision
CBDS	Connectionless Broadband Data Service
CSU	Channel Service Unit
DSS	Digital Subscriber Signalling
DSU	Data Service Unit
EBTN	European Backbone Telecommunications Network
ECTRA	European Committee for Telecommunications Regulatory Affairs
EIF	European Infrastructure Forum
EII	European Information Infrastructure
ESP	End of Speaker Identification
FTam	File Transfer Access and Management
FTP	File Transfer Protocol
GII	Global Information Infrastructure
GONOW	Globalising and Opening Networks; Overview and Workplan
HTTP	HyperText Transfer Protocol
IN	Intelligent Network
IP	Internet Protocol
IPX	Internetwork Packet Exchange
ISP	Information Service Provision
LAN	Information Service Provision
LLC	Low Layer Compatibility
MoU	Information Service Provision
MPEG	Moving Pictures Expert Group
MPOA	MultiProtocol over ATM
N-ISDN	Narrow-band ISDN
NNI	Network to Network Interface
NRA	National Regulatory Authority
NTP	Network Termination Point
NTTP	Network Termination Test Point Remote Procedure Call
OAM	Operation And Maintenance
ONP	Open Network Provision
OSI	Open System Interconnection
PH	Packet Handler
PLMN	Public Land Mobile Network
PPP	Point to Point Protocol
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
PTO	Public Telecommunication Operator

SLIP	Serial Line Internet Protocol
SMTP	Simple Mail Transfer Protocol
S-PCN	Satellite - Personal Communications Network
SRC	Strategic Review Committee (ETSI)
SSCF	Service Specific Co-ordination Function
SSCOP	Service Specific Connection-Oriented protocol
SSCS	Service Switching Control System
T&CP	Transport and Control Platform
TA	Terminal Adaptor
TMN	Telecommunications Management Network
UDP	User Datagram Protocol
UNI	User Network Interface
VTX	VideoTeX
WAN	Wide Area Network

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## 4 Reference model for Information infrastructure interworking and interconnection

To align the work on interworking and interconnection within the different projects and subsequent work items in ETSI NA (and ETSI SPS) on EII/GII, the reference model as depicted in Figure 1 shall be used as a base during the initial phase. Though this reference model may imply some simplifications with regard to possible interfaces and services, due to the inherent complexity of the subject, the reference model should be regarded as a clear guide for the identification of the key problems during the initial phase. It may help to understand the basic inter-networking problems with the potential to achieve some concrete results in the short term. I.e. the production of standards with solutions for these new interconnection relations and the associated interworking and interaction aspects. During the studies other interfaces may be considered as well (e.g. for IN based service support or special access) which should wherever possible re-use or enhance the interfaces identified.

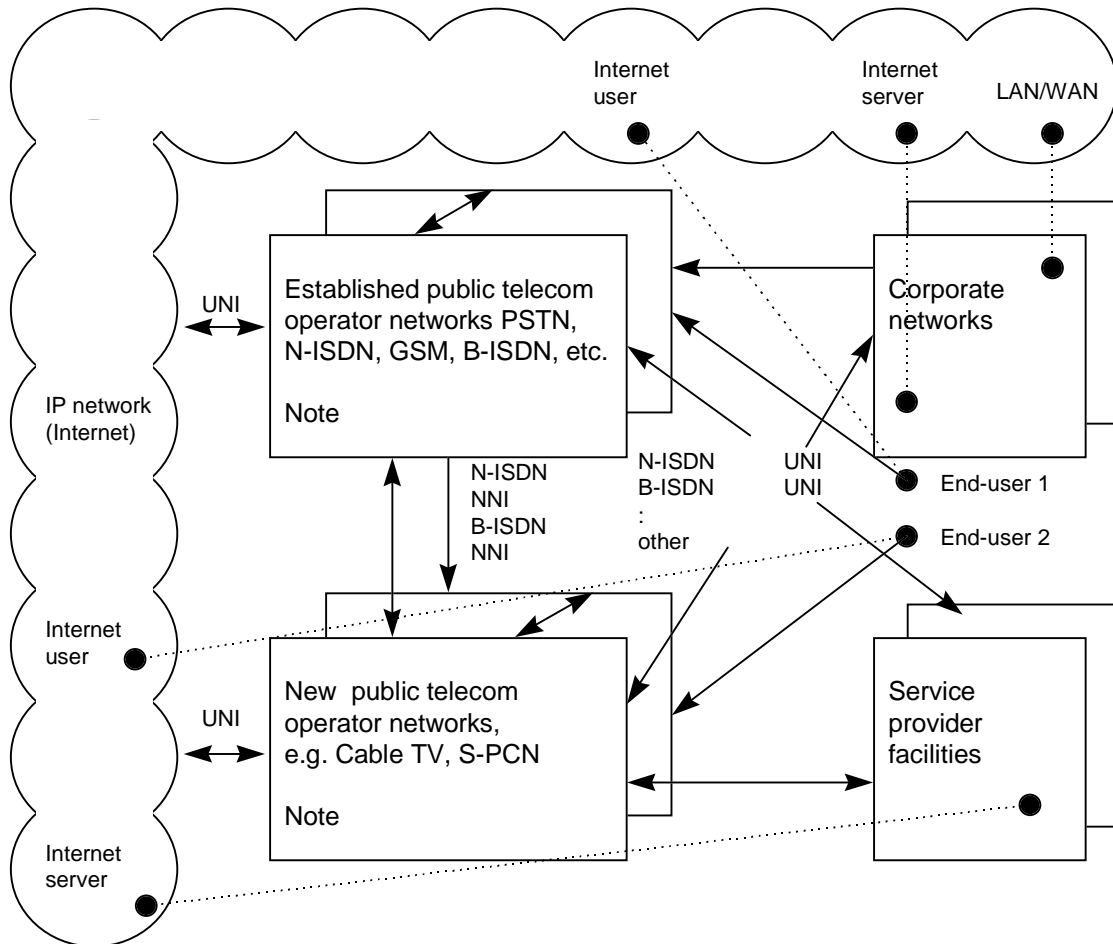
Firstly, the reference model reflects with the solid lines (interfaces for interconnection) the existing and emerging situation in the telecom network environment. The established public telecom operator networks are interconnecting individual end-users and corporate networks. As result of the evolving telecommunication environment also new public telecom operator networks and specialized service provider networks are looking for interconnection.

Both N-ISDN and B-ISDN interfaces are considered. In this respect UNI protocols (DSS1 and DSS2) are assumed for the interconnection of individual end-users, corporate networks and the service provider networks. Due to new regulatory requirements also special access shall be considered as a possibility for the interconnection of service provider networks. NNI protocols (SS7) are assumed for the interconnections between the public telecom operator networks. The establishment of new public telecom networks doesn't necessarily imply any deviation of existing standards, but new regulatory requirements for e.g. number portability and equal access shall be taken into consideration.

Secondly, the reference model outlines with the dotted lines (functional relationships) the co-existence of the IP network environment and the telecom network environment. In this respect Internet is regarded as an IP network that is modelled as an overlay network which includes internet users, internet servers and the LAN/WAN configurations within corporate networks. These Internet entities are making use of the bearer connection services of the public telecom operator networks (and possibly corporate networks) to access the IP network (router and storage facilities).

Individual end-users will normally get access to the IP network via a dial-up service of the UNI protocols whereas internet servers and LAN/WAN configurations are assumed to be interconnected to the IP network via leased lines. In future evolution steps (see clause 8) specific IP network functions are foreseen to be incorporated in the public telecom operator networks (and possibly corporate networks). This refers to e.g. the translation of Internet addresses towards ITU-T Recommendation E.164 [20] numbers and vice versa next to the support of IP network based router and storage facilities.





NOTE: It is not the intention to indicate that these two types of networks will be different from the technical point of view. The same technologies may be used for both networks. However there may be a difference for a given time period from the point of view of the commercial implementation and the regulatory framework.

**Figure 1: Reference model for II interworking and interconnection as a basis for the work during the initial phase**

## 5 Interworking and interconnection issues

### 5.1 Overview of Interworking and Interconnection cases

Subclause 5.2 of the ETSI SRC6 report [1] identifies 44 different interworking cases between various core networks and access networks, as well as the interworking between the respective core networks. An updated version of Figures 5.3 and 5.4 as well as Table 5.1 from the ETSI SRC6 report [1] is provided in Annex A to the present document.

For most of these cases standards have already been published or are being created. The major ones are indicated in the table. The table will be kept as a reference and updating is envisaged as appropriate. A few interworking cases that have been selected for the initial phase of the project are discussed in more detail below.

## 5.2 Cases selected for the initial phase of the project

In view of their importance and urgency the following cases were already selected for the EPII Project 1.3:

- Interconnection between telecom networks and access for service providers in order to support the new European competitive environment.
- Co-existence of Internet (IP based) and telecom networks (e.g. E.164 based).

Additional cases will be developed as need arises, based on further contributions.

## 5.3 Interworking aspects

Interworking between networks involves the definition/specification of the following:

- Reference Configuration and Functional Architecture with definition of reference point.
- Architecture with definition of interfaces.
- Functional interfaces.
- Signalling and Control.
- OAM (e.g. charging and billing).
- Numbering.
- Routing.
- Network integrity and Security.

All these aspects have to be specified by the relevant Technical Subcommittees for each interworking case.

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# 6 ONP requirements

- 6.1 The aim behind ONP is to achieve open and efficient access to public networks and services and to harmonize these requirements across Europe. The ETSI report ETR 244 [23] provides a preliminary review of the ONP issues that need to be considered in the development of networks. This ETSI report was a response to the 1994 CEC IN mandate which required ETSI to investigate the standardization requirements that would enable independent service providers (Sips) to have access to functionality of public networks. A number of scenarios describing various ways in which Sips might require access was included in the original SEC IN mandate.
- 6.2 The concept of ONP has now moved on since this original report was prepared. Virtually all the ONP directives are being amended to bring them into line with the post 98 environment in which monopoly provision of networks and service is being swept aside to open up the markets to competition. Whereas in the previous directives ONP applied to organizations with special and exclusive rights it now becomes relevant in the context of significant market power which itself is not a straightforward concept and which has been defined in the directives.

- 6.3 The implications for ONP interfaces will now be more broader than what the original SEC IN mandate set out to do. The interconnect directive and the amended voice telephony directive will be the main vehicles which should set the scene on the regulatory principles that need to be followed in taking forward the technical work on access and interconnect.
- 6.4 Both the above directives include the requirements for special access provision. The Interconnect Directive places an obligation on organizations deemed to have significant market power to make special access available to requesting organizations subject to their requests being reasonable. Those organizations considered to have significant market power are likely to include the established Pots.
- 6.5 The organizations who may seek special access provision from the Pots are likely to include a wide mix of players in the service provision market. At the one end of the end of the market spectrum we may find organizations providing virtually no facilities themselves but requiring special access to management capabilities. At the other end there might be fairly large organization wishing to provide their own management and ESP platforms and seeking appropriate access or interworking capabilities to a PTO.
- 6.6 In between these two examples there could be many other special access scenarios. It may also be difficult to distinguish the interconnect requirements of large ISPs from new network operators and these differences will need to be elaborated when developing the appropriate interfaces.
- 6.7 Hence the requirements for ETSI to account for ISP ONP type interfaces in their work on developing network architectures should be primarily focused on the need to support special access at a functional level within the architecture. This implies that the interfaces required for special access should support the functional capabilities needed by ISPs to deliver a particular end user service. ISP interfaces are addressed in section 7.3.

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## 7 Interconnection between telecom networks

### 7.1 Interconnection between established operators

- 7.1.1 Established operators in this context are the traditional PTO's, that in most countries had or still have a monopoly to provide PSTN (and ISDN) services to the general public. In regulatory terms, they are the "dominant market players". The existing networks of the established operators include a wide range of traditional and new technologies and services.
- 7.1.2 The realization of standardized interfaces between different networks (e.g. PSTN, ISDN, PSPDN, PLMN, ...) of the same established operator (**intra-operator-connections**) has to be considered. This is the responsibility of the network operators.
- 7.1.3 In many cases, interconnection between networks of different established operators (**inter-operator-connections**) are international connections. These interfaces are standardized (e.g. by ITU) and supplemented by bilateral agreements (e.g. MOUs). Hence, for interconnection between networks of different established operators, one can rely on already existing standards and agreements, that only must be expanded for new services. The competitive environment has to be considered carefully.

7.1.4 For most of the interworking cases (identified in the context of EII), existing agreements are deemed sufficient and no additional standardization effort is proposed.: *(The following information can be added to the already existing draft overview)*

- interworking case 48: digital mobile telecommunication core network  $\Leftrightarrow$  PSPDN core network.

NOTE 1: No high value interworking cases identified.

- ETS 300 602 [3]: interworking between the PLMN and the PSPDN for PAD facility access (GSM 09.05).
- ETS 300 603 [4]: interworking between a PLMN and a PSPDN/ISDN for the support of packet switched data transmission services (GSM 09.06) including amendment A1.

7.1.5 For the following interworking cases no standards exist and/or no existing standards can be expanded easily (miscellaneous work item). Only as a second phase is actual standardization work needed.

- interworking case 46: N-ISDN core network  $\Leftrightarrow$  core network supporting CBDS;
- interworking case 47: N-ISDN core network  $\Leftrightarrow$  core network supporting frame relay service;
- interworking case 49: B-ISDN core network  $\Leftrightarrow$  PSPDN core network;
- interworking case 52: PSPDN core network  $\Leftrightarrow$  core network supporting CBDS;
- interworking case 53: PSPDN core network  $\Leftrightarrow$  core network supporting frame relay service.

NOTE 2: Some of these are already specified, but it is to be checked whether the available standards are sufficiently detailed to support a standard interworking interface.

7.1.5 For the provisioning of IN-implemented services between established operators, standards are being progressed already in the context of IN CS-2 and may need further consideration.

## 7.2 Interconnection to new operators

7.2.0.1 New operators in this context refers to organizations who might typically be providing infrastructure, intelligence platforms, management platforms, multimedia platforms etc as well as a wide range of services. Hence they could be providing facilities similar to that of the traditional PTOs. These new networks may be based on the latest broadband ATM technologies but could also include ISDN, fixed mobile, CATV etc.

7.2.0.2 The requirements for interfaces between these new operators and others (existing and new) would therefore be at a network to network interconnection level. New operators will seek interconnect facilities from other operators in order to enable customers on their network to invoke services with customers connected to different networks and vice versa. The interconnect interface should therefore support the appropriate message flows associated with the particular end user services.

7.2.0.3 These interfaces may in some circumstances be similar to that being developed for interconnection between established operators whilst in others it may well differ in its functional capabilities. The capabilities would depend on the range of services that new operators wish to introduce and on the appropriate security and network integrity considerations.

7.2.0.4 Development of these interfaces should be based on the following aspects:

- the basic services that new operators wish to introduce and therefore have supported over an NNI;
- the degree of network integrity and security that would need to be incorporated in such interfaces and which should accord with the level and type of facilities of the interconnecting party;
- the necessary functionality to support innovative charging capabilities;
- the idea of defining a minimum set (generic) of security and network integrity requirements on top of which could be placed sets of options which would be subject to the specific requirements of the interconnecting operator.

7.2.0.5 It should be noted that from a regulatory perspective those "new operators" which fall under one of the organization categories listed in Annex 2 of the Interconnect Directive would have both rights and obligations to negotiate interconnect with any other organization listed in the Annex (see B.1). This means that established operators (who have market power or control the means of access) would have an obligation under this directive to respond positively to such requests from new operators subject to the conditions laid out in the directive. It is therefore important that the technical requirements of such interconnect interfaces be defined by ETSI.

## 7.3 Service providers

7.3.1 Service providers in this context means an organization who establishes a contract for services with end users. The services they sell on to customers may be resourced by themselves and/or procured from other service provider or network operator organizations through administrative, contractual and technical interfaces. The services would be delivered to end users over one or more networks.

7.3.2 Those organizations falling under the broad category of "service provider" and requiring special access facilities from other PTO organizations could be either providers of infrastructure or non providers of infrastructure and would therefore be seeking some kind of special access facility as described in clause 6. The latter category would typically encompass the emerging range of new providers defined in this context as ISPs and the former might typically encompass existing vertically integrated PTOs perhaps seeking to offer services in other domains where they themselves do not own infrastructure. Hence in this case they take on the role of an ISP.

7.3.3 Given that the above definition could encompass a wide range of organizations each providing different degrees of network facilities and each requiring a wide range of different capabilities from the PTO it seems unlikely that a single interface will suffice. There is more likely to be a requirement for a range of interfaces which can be customized to suit the needs of a wide body of ISP organizations.

7.3.4 The ETSI ONP IN report ETR 244 [23] mentioned in clause 6 provides some useful ideas on how to take forward the development of ISP interfaces within ETSI. It particularly highlights:

- that networks throughout Europe differ in their specific implementations and will not necessarily migrate at the same rate. The ISP interfaces should therefore as much as possible be detached from specific architectures or implementations;
- that ISP interfaces should be degrees of functionality which are described broadly as interbased on the levels of functionality that ISP organizations will wish to procure from network operators. These connecting services would be the basis on which functional specifications for ISP interfaces could be developed.

7.3.5 The ECTRA TRIS group mentioned elsewhere in this report is also expected shortly to present their views to ETSI on short and medium term requirements for standards and access. GONOW understands that the expected TRIS report will include ECTRA's views on how service provider interfaces should be addressed in ETSI and that it will include the following aspects:

- SP interfaces be modular, flexible and capable of meeting a wide range of market requirements;
- the interfaces be functionally specified and capable of being expanded in a modular fashion in accordance with market needs;
- access to control and various support functionality be made available;
- security and network integrity features be incorporated into the interfaces to accommodate an access mode rather than an interconnect mode;
- interface should be sufficiently open at a high functional level to support a wide range of modular service functions;
- its modularity should enable a simple structure for charging for the functions used;
- architecturally independence for network operator and service provider. Evolution of service provider interface requirements can be detached from evolution of network platforms and systems;
- the modular type interfaces should be employed in conjunction with interworking functions.

7.3.6 At this stage GONOW would recommend that the above principles be taken into account in taking forward an approach to developing service provider interfaces. A functional model approach would seem to be an appropriate methodology to deal with an emerging incremental demand for service provider special access facilities.

7.3.7 At the time of preparing this report reference should also be made to the ONP Platform EIF group who are currently charged to investigate the technical requirements of a code of conduct between network operators and service providers - the latter seeking special access from the operators. The outcome of this task seems likely to have an impact on the proposed ETSI work.

## 8 Co-existence of Internet and telecom network domains

NOTE: This clause to be further developed taking into account the output from EP Tiphon.

### 8.1 Comparison between Internet and telecom network domains

#### 8.1.1 A comparison based on the OSI 7 layer model

The world of Internet is compared to the more conventional world of Telecom. They are compared, using the OSI 7 layer model as a reference. Please note that this figure is only a rough comparison.

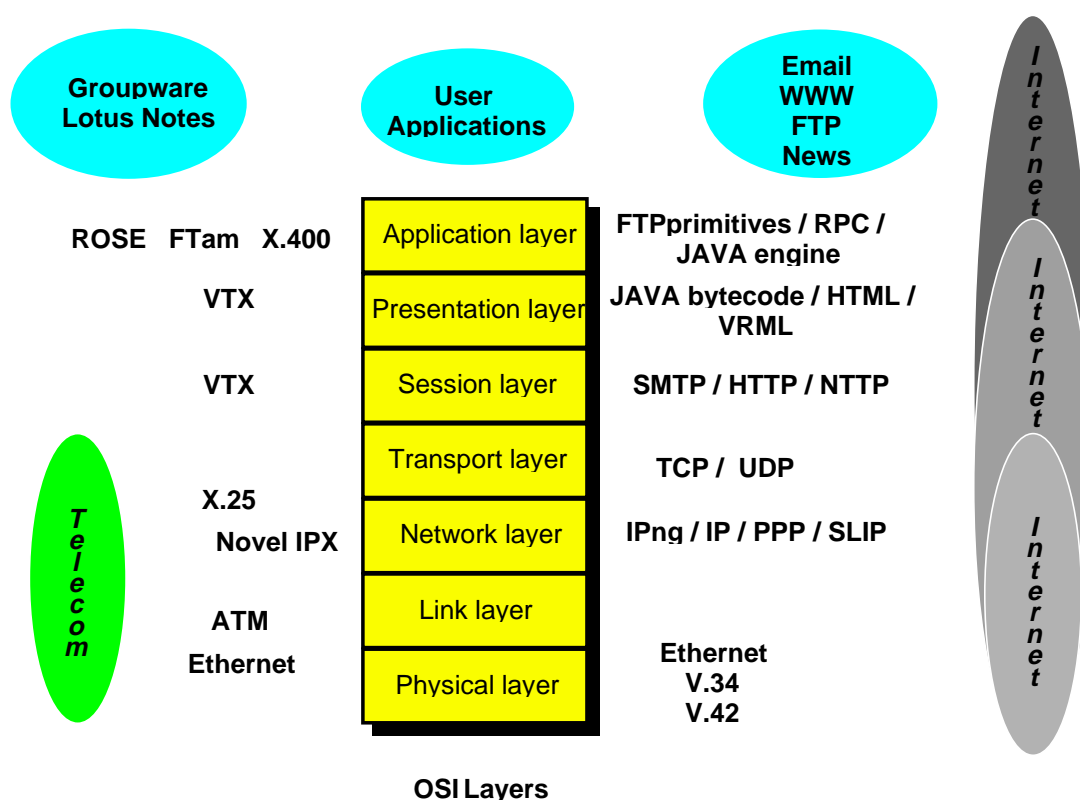


Figure 2: Internet and Telecom and the OSI 7 layer model

From Figure 2 we can learn two things. First, the name Internet can mean something different to different people (some only think of the network, others also include other layers, even including user applications). Second, at the moment Telecom does not cover the same OSI layers.

## 8.1.2 A comparison of their characteristics

Table 1 lists the main characteristics of Internet and of Telecom. Per item the possible relationship is identified.

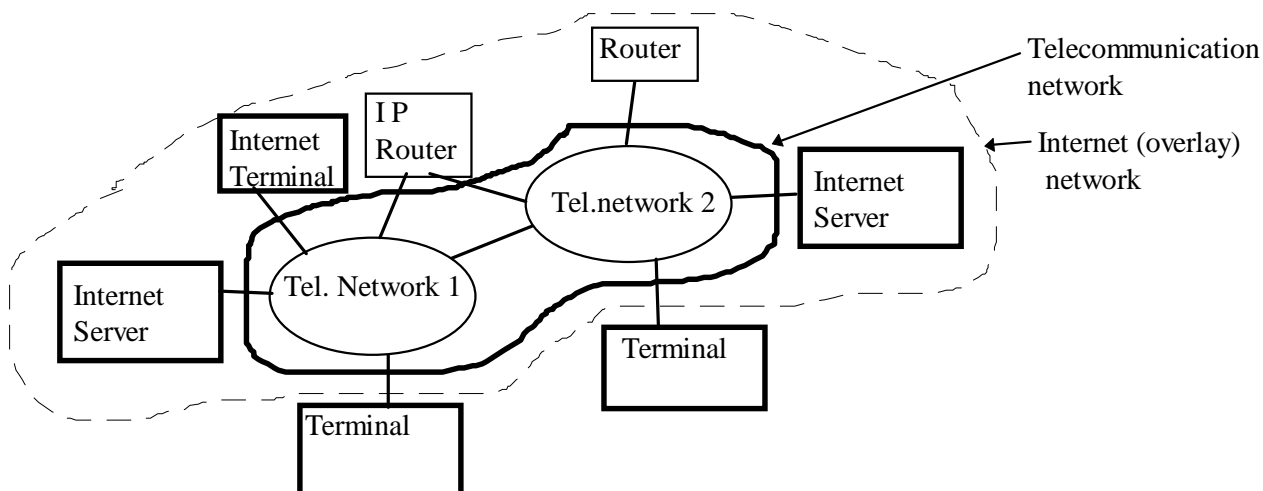
**Table 1: Internet and Telecoms Characteristics**

Internet	Telecom (PSTN/ISDN/GSM)
"Best effort" quality (IP V6 offers RSVP, Resource Reservation Protocol, to offer guaranteed QoS).	Quality of Service-guaranteed (Service Level Agreements are possible).
Billing usually "flat rate". In combination with the RSVP-protocol, it may be possible to charge customers for "higher quality". E.g., an application may contain an "ACCELERATE" button, which activates a "guaranteed bandwidth" option.	Billing & Accounting is taken care of (complex!).
Service provider: everyone can be a service provider. Access to services is not geographically restricted. Therefore it is easy to build services for niche markets.	Service provider: "restricted".
Internet telephony: you can not be reached if your computer is switched off.	Telephone terminal has no on-off switch (except for mobile terminals).
Integration services: voice, documents, pictures are easily integrated into services.	
Uniform/easy user interface.	
Intelligence outside the network, in the terminals.	
authorization of user.	authorization of access (authorization of users also for mobile).
JAVA; Nortel makes a JAVA telephone.	
Addressing different, and depending on provider.	Number portability.
Mobile IP.	Mobility.
Firewalls / Provider subscription as basis for "Closed User Groups".	Closed User Group.
"Call Completion to Busy Subscriber" (e.g.) is not an "Internet-standard". I.e. it can only be used when the other party that is involved in the call uses the same software.	Services are standardized.
ITU standards are being studied in order to adopt them when appropriate.	ITU standards for speech encoding, video encoding.
Limited backward compatibility	ITU standard design rules (stages 1 .. 3).
Technical / sophisticated users	Backward compatible.
	Everyone is a user.
	Interaction between ISDN supplementary services and Internet (e.g. Call Waiting on an analogue access during Internet session; use of MWI to indicate arrival of an Internet e-mail).
	With respect to using MWI for indication of Internet e-mail arrival: it should be possible to manipulate/operate ISDN supplementary service via a WWW interface. In that case, the Internet service provider should be able to manipulate ISDN supplementary service setting from a remote ISDN interface.
W.R.T. Internet telephony, domain name servers are necessary to translate E.164 numbers into IP-addresses.	

From Table 1 we can view that the world of Internet and the world of Telecom are rather distinct but that on some items a synergy is possible. A possible synergy between the two worlds can be anticipated in the fields of Quality of Service, Billing & Accounting, reachability, authorization, naming and addressing, mobility, compatibility and user friendness.



## 8.2 Internet over existing telecom networks



**Figure 3: Network architecture: Internet as an overlay network on existing networks**

The telecommunication network (or any other connection oriented network) is a **support network** for communication of the Internet service providers and terminals.

With regard to IP, the information is transported from terminal A to server, over routers, servers..., to terminal B.

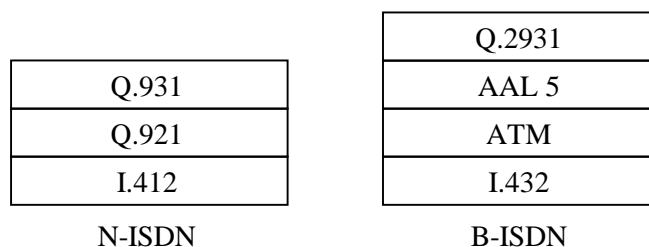
According to Internet, a terminal may be, or may not be located in the Internet network.

With regard to a telecommunication network, point-to-point connections have to be setup between network terminal equipments. The terminals are terminals suited for interfacing to the appropriate telecommunication network, and having the IP capability (only for terminals located in the Internet network).

A main issue is the translation of the IP address to the telecommunication network address, e.g. E.164 and reverse.

### Setting up a connection For IP communication

To set up a connection for IP (or for any other U-plane channel), the signalling for that particular network has to be used. Some example protocol stacks are shown below.



**Figure 4: Examples of protocol stacks for setting up connections in some networks**

Since the signalling for the particular networks is standardized, it is expected that **no further work** is needed, except for normal evolution of the protocols.

**A number of connections for Internet are on semipermanent or permanent basis**, and so signalling is not necessary.

To give you an idea of possible equipment needs, here are three sample scenarios for providing Internet over the Telephone Network, based on possible solutions found in the United States. Keep in mind that these are very general examples.

**Low-end:** (LOGON terminal, terminal outside Internet).

You could subscribe to some kind of Internet dial-up service. You will need a computer which allows terminal emulation, terminal emulation software, and a modem which is compatible with your dial-up service.

**Mid-range:** (Terminal belonging to Internet).

You could subscribe to a dial-up service that provides Serial Line Internet Protocol (SLIP) or Point to Point Protocol (PPP). The Point-to-Point Protocol (PPP) software is required to provide a TCP/IP connection over the serial link. Most systems are set up to dial-on-demand. This means the link is automatically brought up when traffic arrives for the Internet. The link usually is closed down after some period of inactivity (e.g. 3 minutes). This means that most software can be used as if the connection to the Internet was permanent. You will need a computer with SLIP or PPP software, telecommunications applications software (to allow you to use telnet and FTP-File Transfer Protocol), and a modem which is compatible with your dial-up service.

**High-end:**

You could subscribe to a service that provides a full Internet connection to the department's local area network. This allows all the computers on the local area network access to the Internet. You will need a router and a connection to a network access provider's router. Typically the connection is a leased line with a CSU/DSU (Channel Service Unit/Data Service Unit). A leased line is a permanent high speed telephone connection between two points; this allows you to have a high quality permanent Internet connection at all times. A local area network, which may consist only of the router and a computer system, is also needed, and your computer(s) will need some special software: a TCP/IP (Transmission Control Protocol/Internet Protocol) stack, as well as TCP/IP based communications software such as Telnet and FTP.

**It is a question whether (some or more of) the above mentioned protocols have to be accepted by ETSI.**

#### **Connections for IP communication.**

Some connection types for Internet may be:

- Dial-up Modem;
- V32bis (14.4Kbps) or V.34 (28.8Kbps) modem;
- Dial-up N-ISDN (B-channel).

This offers identical services to a dial-up modem but with a higher (64K) bandwidth. This would suite sites with a larger number of simultaneous users. The equipment generally used is a combined ISDN TA (Terminal Adaptor) and router. This connects to the ISDN wall socket and to an Ethernet LAN. It provides a transparent dial-on-demand TCP/IP Internet service (with security filtering).

#### **64K Leased Line:**

This is the most common method of corporate Internet connection. It offers a reliable permanent service enabling companies to provide services on the Internet world-wide (e.g. ftp or the World Wide Web (WWW)). The equipment required is a TCP/IP router with a 64K Wide Area Network (WAN) port and a connection to your Local Area Network (LAN). It is common to use routers which provide security features (packet filtering).

#### **2Mb Leased Line:**

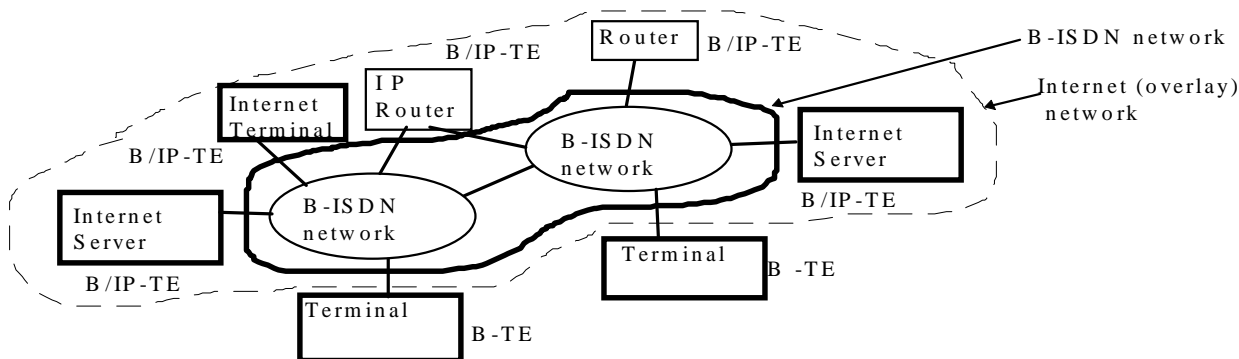
Two additional options to cover Internet access using ADSL plus access to Internet using Cable modems.

Standards required until 1997 (Standardization Program 1) in the areas:

- direct access to Internet from the customer access (Internet POP);
- interworking between PSTN/ISDN, mobile networks, etc.& Internet;
- naming, addressing, and routing issues related to Internet.

### 8.3 Internet over ATM networks

#### Network architecture



**Figure 5: Network architecture: Internet as an overlay network on the B-ISDN network**

With regard to B-ISDN, point-to-point connections have to be setup for every B/IP-TE to B/IP-TE connection-oriented communication. The B/IP-TE is a B-ISDN terminal B-TE with IP service capability (protocol stack to be supported, see further).

A main issue is the translation of the IP address to a B-ISDN E.164 address and reverse.

#### B/IP-TE IP Signalling Protocol stack (C-plane)

AAL5 consists of Common part AAL5 and service specific convergence sublayer (SSCS). SSCS consists of SSCOP and SSCF.

Q.2931	RFC 1755
SSCF UNI	
SSCOP	
AAL 5	
ATM	
PH	

**Figure 6: Protocol stack for setting up point-to-point connections for IP info transfer**

This stack is used to set up the U-plane connections needed for IP.

#### B/IP-TE IP information Protocol stack (U-plane)

Common part AAL5 (i.e Service specific Convergence sublayer part of AAL 5 is null)

	Higher layer protocols needing IP
IP	RFC 1577
LLC	RFC 1483
AAL 5	
ATM	
PH	

**Figure 7: Protocol stack for Internet Information transfer**

The Logical Link Control (LLC) allows to multiplex multiple protocols over a single virtual circuit. This method is identified as **multiprotocol encapsulation**.

This means that besides IP other protocols can run on top of LLC.

This stack is used to set up the U-plane connections needed for IP.

## 8.4 Internet integrated into B-ISDN

Items proposed for study: the benefits and technical implications resulting from a convergence of advanced networking platforms and ATM networks , e.g.:

- Multi-protocol over ATM (MPOA);
- direct interconnection of "end routers" via ATM dial-up connections.

Recommendations should be available until 1998 (Standardization Program 2).

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## 9 Identification of additional interworking cases

Clauses 6 to 8 have identified detailed analysis of specific interworking cases. If additional interworking cases (reference SRC6 report [1] - see above) have to be addressed the following body is proposed as the lead body for carrying out the work:

e.g. LAN interworking.

(See ATM pilot network results).

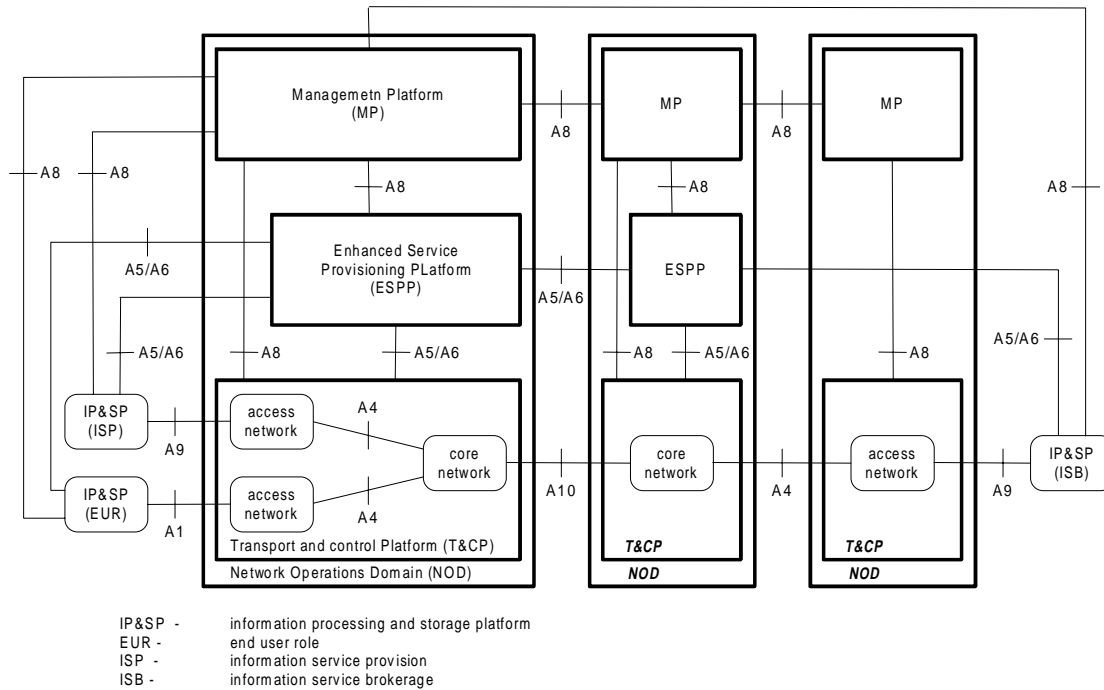
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## 10 Workplan for fulfilling the requests expressed in the SRC6 report

The workplan has to include a detailed list of tasks, plus responsible technical groups as far as identified.

## Annex A (informative): Interworking cases identified by ETSI SRC6

Figure A.1 is extracted from SRC6 report [1] part B.4 and is the reference model of the telecommunications networks in EII showing the functional blocks. The different Network Operator Domains (NODs) are shown. The interfaces between NODs are A4 and A10 and the transport and control platform. A Transport and Control Platform (T&CP) provides basic transport capabilities.



**Figure A.1: Reference model taken from the ETSI SRC6 report [1]**

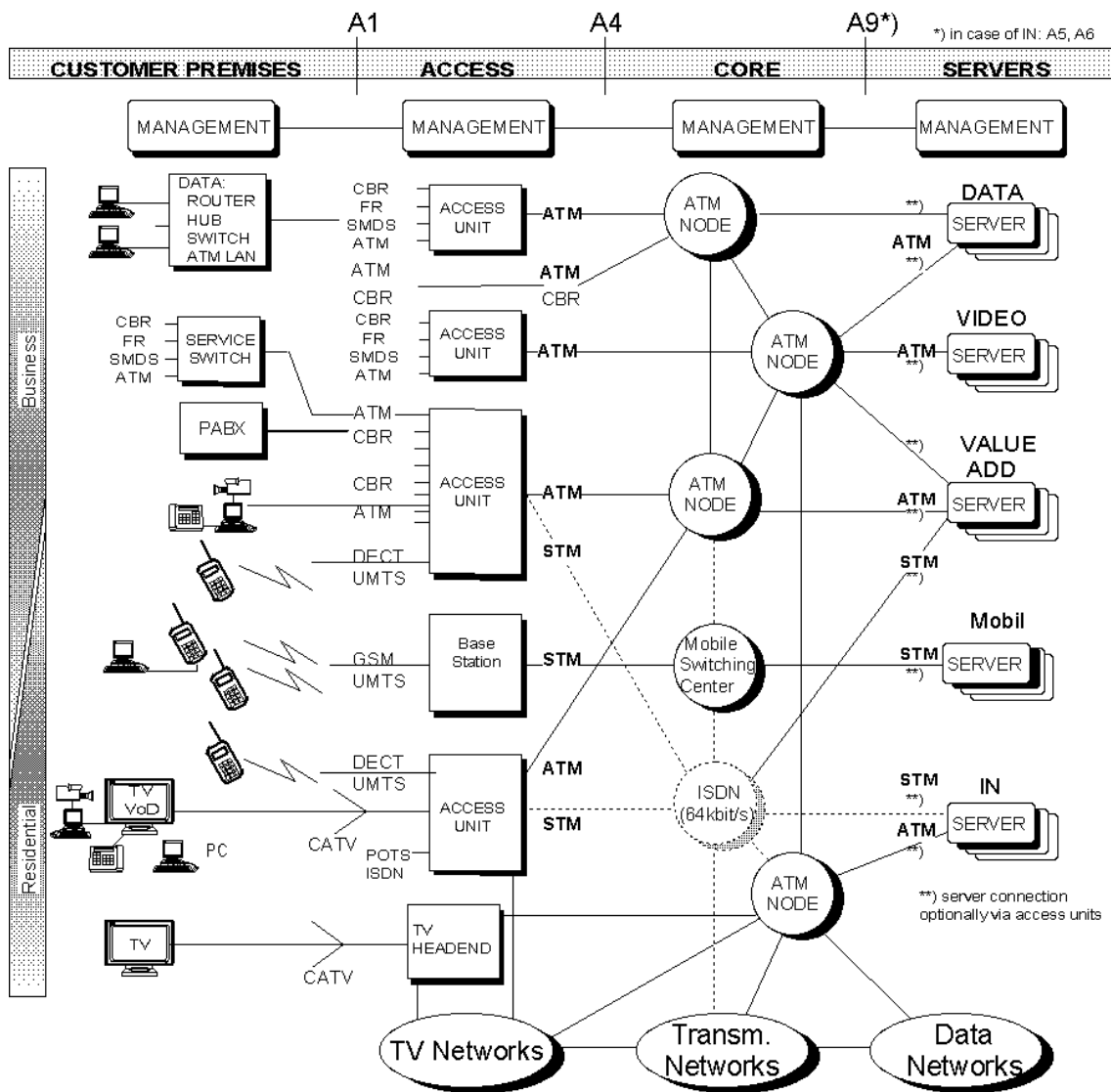


Figure A.2: Example of telecommunications network supporting the EII

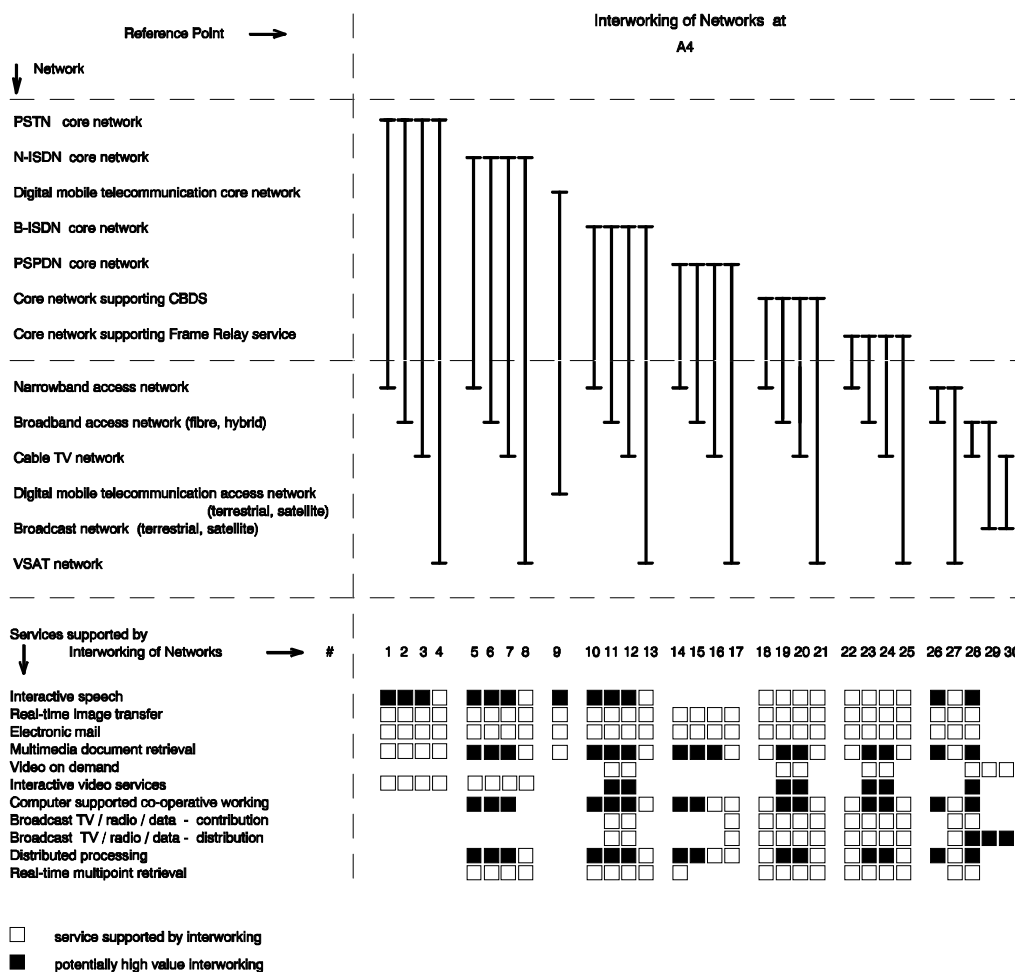


Figure A.3: Interworking between various core networks at reference point A10 (from ETSI SRC6 report [1])

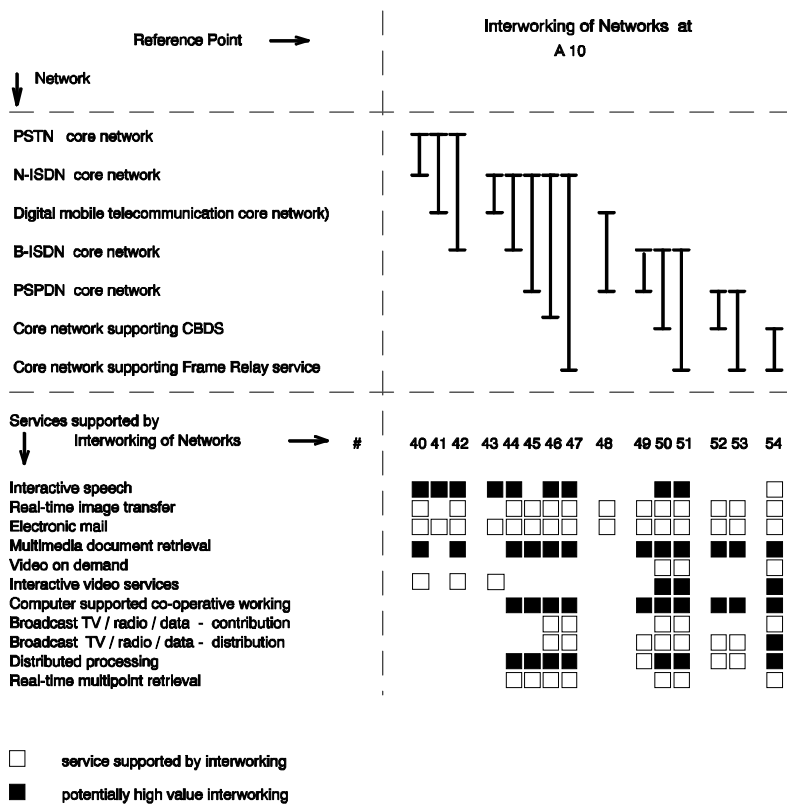


Figure A.4: Interworking between various core networks at reference point A10 (from ETSI SRC6 report [1])



**Table A.1: Standards to support interworking between Core networks and Access networks (from SRC6 with updates)**

Inter-working case no.	Standards	Status	Remarks
1		available	
2			
3	- - -		no standard available
4			ITU-T activities planned in SG13 or SG14
5		available	
6			
7	- - -		no standard available
8	ITU-T Recommendation I.571 [11]	available	Approved by ITU-T SG 13 in May 1996
9		available	ETR 128 [5] approved Feb.95 by TC-SES Requires further studies
10			
11			
12	MPEG, ETSI Codec 34 Mbit/s		
13			
14		available	
15	- - -		no standard available
16	- - -		no standard available
17	ITU-T Recommendation X.361 [16] ITU-T Recommendation X.25 [17]	available	Approved by ITU-T SG7 April 1996
	ETS 300 194 [6]	available	to be revised by TC-SES
18			
19			ETS 300 478-1 [21]
20	- - -		no standard available
21			
22			
23			
24	- - -		no standard available
25			
26			
27			
28	- - -		no standard available
29			ETR 263 [22]
30	ETS 300 473 [7]	available	Developed by EBU/ETSI JTC in the framework of DVB

Table A.2: Standards to support interworking between Core networks (from SRC6 with updates)

Inter-working case no.	Standards	Status	Remarks
40		available	
41		available	
42			
43		available	
44	ITU-T Recommendation I.580 [12] ITU-T Recommendation Q.2660 [19]	published approved by SG11 in Sept 94	
45	ITU-T Recommendation I.550 [13] ITU-T Recommendation X.325 [18]	published	
46			ETS 300 278 [8]
47			ETS 300 278 [8]
48			
49			
50	ETS 300 479-1 [9]	available	
51	ETS 300 467 [10] ITU-T Recommendation I.365.1 [14]	available	further work to be done on service interworking (ITU-T Recommendation I.555 [15])
52			
53			
54			

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## Annex B (informative): Regulatory Framework for Inter-Networking

- B.1 Clauses 6 and 7 have already touched on some of the regulatory factors which will govern future interconnection between networks. It was indicated in these clauses that the 97/33/EC [24] ONP Interconnection Directive will be the prime regulatory vehicle used to harmonize interconnecting conditions throughout Europe. Such a framework for interconnection is seen as an essential tool in ensuring end to end interoperability of services for community users.
- B.2 From the ETSI perspective the directive is of importance in terms of its implications on the technical interconnection requirements that need to be supported between certain types of organizations. For instance those organizations defined in **Annex 2** of the 97/33/EC ONP Interconnection Directive [24] (**providers of fixed and/or mobile public networks and /or services controlling the means of access to one or more NTPs; providers of Leased Lines to user premises; providers of international telephone circuits; providers of services permitted to interconnect in accordance with national licenses**) would have both rights and obligations to negotiate interconnect with each other as per article 4.1 of directive.
- B.3 In addition to above those organizations deemed to have significant market power and who provide public networks and/or services in accordance with **Annex 1** of the 97/33/EC ONP Interconnection Directive [24] (**e.g. fixed public switched networks supporting voice telephony, fax and modems; Leased line facilities; public mobile networks and services**) are obligated to (i) facilitate all reasonable requests for special access at points other than conventional NTPs offered to majority of users, (ii) adhere to principles of non discrimination and transparency with regard to interconnection offered to others, and (iii) adhere to principles for interconnection charges and accountancy.
- B.4 In other words those Annex 2 of the 97/33/EC ONP Interconnection Directive [24] organizations (summarized in B.2 above) who may not necessarily have significant market power, would still nevertheless fall under the general obligation to negotiate interconnect with each other (as per art 4.1 of directive) whereas those organizations deemed by NRAs to have significant market power and who provide Annex 1 of the 97/33/EC ONP Interconnection Directive [24] type networks/service (summarized in B.3 above) would have other obligations placed on them as per B.3 above.
- B.5 Both Annex 2 of the 97/33/EC ONP Interconnection Directive [24] organizations (B.2) and organizations providing Annex 1 of the 97/33/EC ONP Interconnection Directive [24] type facilities (B.3) would therefore need to negotiate network interconnect agreements which are underpinned by technical interface requirements at the point of interconnect. These NNI interface requirements would need to be based on ETSI standards and if these are not available should be developed by ETSI. Subclauses 7.1 and 7.2 outlines the general requirements and considerations for developing these type of interfaces.
- B.6 Those organizations with significant market power providing Annex 1 of the 97/33/EC ONP Interconnection Directive [24] type networks and/or services (B.3) would be obligated to provide special access facilities. This means that they would be required to respond to all reasonable requests from organizations which may not necessarily be from those with significant market power or those simply controlling the means of access (these would typically be seeking network interconnect facilities as opposed to special access). They could originate from a wide range of service provider type organizations some examples of which are given in subclause 7.3. The technical requirement here will be develop interface standards at the point of special access and an approach to developing such requirements is outlined in subclause 7.3.

B.7

Although Special Access is a requirement of the Interconnect Directive which is expected to be in force by 1998 it is also a requirement of the unamended Voice Telephony directive which is expected to be in force in member states by end of 1996 beginning of 1997. This means that there will be obligation on those providers of fixed voice telephony networks and services stipulated in the unamended Voice Telephony directive to comply with special access requests very shortly. This suggests that ETSI technical committees should treat the development of special access requirements with some priority.

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## History

<b>Document history</b>		
V1.1.1	March 1999	Publication