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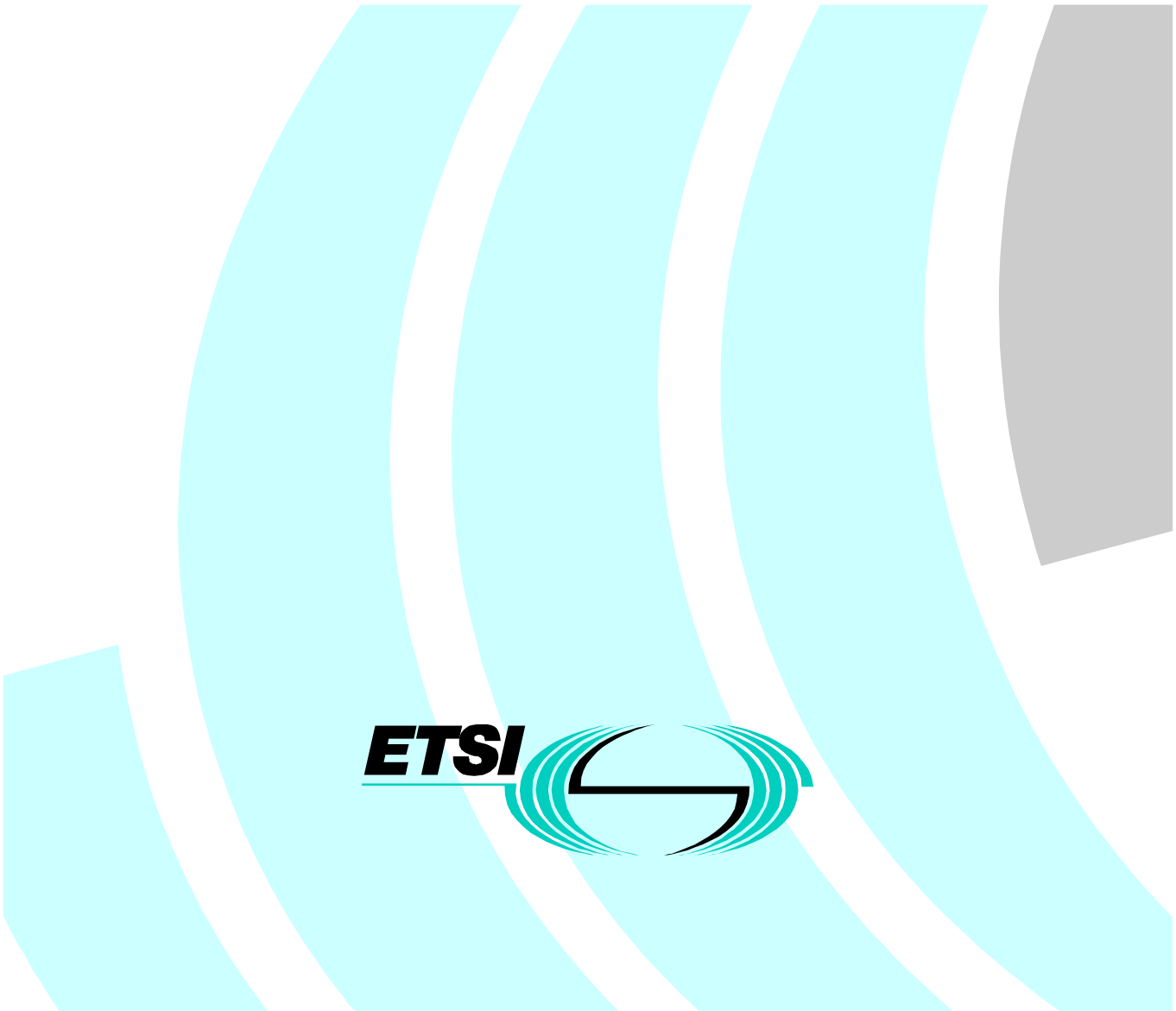
Technical Report

Telecommunications and Internet Protocols Harmonization Over Networks (TIPHON); Number portability and its implications for TIPHON networks



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Foreword

This Technical Report (TR) has been produced by ETSI Project Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON).

Introduction

The present document provides a general introduction to number portability and identifies various issues that need to be considered by the designers of TIPHON networks. The present document is co-ordinated with the main ETSI publications on number portability.

1 Scope

The present document gives an introduction to number portability and an overview of the current way in which number portability is being implemented in various countries. The objective of the present document is to inform the designers of Tiphon equipment and the implementers of Tiphon networks about:

- the various requirements that they may have to comply with in different countries;
- the implications for equipment and network design.

The present document concentrates on the actual implementations which have been developed rather than the descriptions given in other standardization documents because:

- the standardization work has been too late to influence many implementations;
- the objective is to help Tiphon networks fit into existing situations.

The present document focuses on the technical implementations. National strategies, responsibilities and charging are covered only to the extent necessary to outline the context for the technical solutions.

The present document gives most emphasis to number portability of national numbers in fixed networks; as such, portability of numbers for Global Services and for European Telephony Numbering Space (ETNS) numbers is not considered.

The present document is complementary to other deliverables on number portability produced by ETSI.

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 TR 101 119 (V1.1.1): "Network Aspects (NA); High level description of number portability".

[2] ETSI TR 101 122 (V1.1.1): "Network Aspects (NA); Numbering and addressing for Number Portability".

[3] ETSI TR 101 118 (V1.1.1): "Network Aspects (NA); High level network architecture and solutions to support number portability".

[4] ETSI TR 101 697 (V1.1.1): "Number Portability Task Force (NPTF); Guidance on choice of network solutions for service provider portability for geographic and non-geographic numbers".

[5] ETSI EG 201 367 (V1.1.1): "Intelligent Network (IN); Number Portability Task Force (NPTF); IN and Intelligence Support for Service Provider Number Portability".

[6] ETSI TR 101 698 (V1.1.1): "Number Portability Task Force (NPTF); Administrative support of service provider portability for geographic and non-geographic numbers".

[7] Directive 97/33/EC of the European Parliament and of the Council of 30 June 1997 on interconnection in Telecommunications with regard to ensuring universal service and interoperability through application of the principles of Open Network Provision (ONP).

[8] Directive 98/61/EC of the European Parliament and of the Council of 24 September 1998 amending Directive 97/33/EC with regard to operator number portability and carrier pre-selection.

[9] ITU-T Recommendation Q.931: "ISDN user-network interface layer 3 specification for basic call control".

[10] ITU-T Recommendation Q.769.1: "Signalling system No. 7 - ISDN user part enhancements for the support of number portability".

3 Definitions and abbreviations

3.1 Definitions

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

donor network: initial network where a number was allocated by the numbering plan administration before ever being ported.

network routeing number: number that is derived and used by the network to route the call towards a ported number.

operator portability / service provider portability: where a customer changes network/service provider (without changing location) and keeps the same directory number.

originating network: network where the calling party is connected.

location portability: where a customer changes location (without changing network provider) and keeps the same directory number.

recipient network: network where a number is located after being ported.

service portability: where a customer changes service (without changing network provider or location) and keeps the same directory number.

transit network: network between two networks, e.g. . the recipient network and the donor network.

3.2 Abbreviations

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

ACQ	All Call Query
FCC	Federal Communications Commission (US)
IN	Intelligent Network
ISDN	Integrated Services Digital Network
ISUP	ISDN User Part
NOA	Nature Of Address
PSTN	Public Switched Telephone Network
QoR	Query on Release
SCN	Switched Circuit Networks
SIP	Session Initiation Protocol
ToN	Type of Number

4 Introductory overview

4.1 Types of number portability

Number portability is the ability for a customer to keep his directory number when changing his telecom network connection. Three types of number portability are often distinguished:

- **Operator portability** - where a customer changes network provider (without changing location) and keeps the same directory number.
- **Location portability** - where a customer changes location (without changing network provider) and keeps the same directory number.
- **Service portability** - where a customer changes service (without changing network provider or location) and keeps the same directory number.

These types may be combined. For example it may be possible to change operator and location while keeping the same number. In all cases, however, the fundamental objective is to spare customers the considerable inconvenience and/or cost of a number change, while enabling them to benefit from competition and service upgrades, or to minimize the disruption of a physical move.

4.2 National strategies

Many countries develop a national strategy on number portability. This strategy consists (ideally) of:

- A statement of the scope and requirements for number portability;
- Routeing rules and rules for the exchange of information;
- Charging rules;
- A definition of the role of an independent third party e.g. the operator of a national database (if needed);
- Implementation timescales;

and is developed through a process of consultation between the regulator and the operators. In forming the strategy, choices have to be made between the objectives of promoting competition and of promoting wider user interests, including benefits from competition.

An important issue is the extent to which the national strategy should define the technical solution to be used. Those countries that started first to develop number portability focused on the choice of technical solution to be implemented by all operators. Since then the trend has been to define the strategy by defining the responsibilities for routeing and charging and allowing the operators freedom to make their own decisions on the technology. This has the advantage that operators can:

- change their technical solution when it is cost effective to do so,
- use facilities provided by other operators, and
- take full account of possibilities for sharing facilities with other network functions, e.g. sharing IN capabilities.

For example:

- a basic technical strategy would define whether operators should use IN or data decode (re-routeing using number analysis in switch processors). It would define the charging separately.
- a more flexible strategy would define which operator has responsibility for routeing and what payments may be made and would allow operators to choose who does the routeing and what technology they use.

4.3 Consumer protection principles

Although competitive considerations often become dominant, the basic motive for introducing number portability is customer benefit. To ensure continuing consumer protection, most regulators have followed two basic principles:

- Callers should not face unexpected charges. This means that number portability should not reduce the tariff information that can be deduced easily from the number.
- Customers should retain full choice. This (together with competitive considerations) means that number portability between operators should be fully reciprocal. In other words, a number once ported should always be

able to be returned to its original operator and location. This rule should apply even where a chain of multiple portings has been undertaken.

Using these principles, regulators around the world have typically restricted the scope of number portability as follows:

- **Location portability** is typically restricted to the zone in which neither the price of calls nor the geographical significance of the telephone number is altered (i.e. normally, within a charging area at most).

- **Service portability** is typically restricted to similar service types. So, for example, fixed number portability might include the transfer of a number from an ISDN service to a PSTN service; and mobile number portability might include the transfer of a number from an analogue to a digital service. However, full number portability between service categories is not normally allowed, as it would remove key tariff, location and service information from the number. For example, portability between freephone and premium rate services would destroy the utility of either service.

4.4 Main applications of number portability

In practice there are three main applications for number portability:

- **Geographic number portability** refers to portability in the fixed geographic networks - the Public Switched Telephone Network (PSTN) and Integrated Services Digital Network (ISDN). It is primarily concerned at present with operator portability, but may include limited location portability and service portability. For example it may be possible to have location portability in the area served by the number block from which the number has been allocated, or in the whole local charge area. Longer term, with less distance-dependent tariffs, there may be wider location portability. Fixed number portability may also include an element of service portability, for example transfers from PSTN to ISDN;

- **Mobile number portability** refers to the transfer of numbers between mobile operators or service providers. It may also include service upgrade, for example from analogue to digital service;

- **Non-geographic number portability** refers to the transfer of numbers between operators or service providers of fixed non-geographic services. These services are ones where the directory number does not contain any information about the geographic location of the customer. They include freephone services (typically using the number prefix 800), shared cost services, and premium rate services.

Table 1 shows the relationships of the types and applications of number portability.

Table 1: Relationship of types and applications of portability

	Fixed	Mobile	Non-geographic
Operator	Applicable	Applicable	Applicable
Location	Applicable	Not applicable	Not applicable
Service	Applicable	Applicable to service upgrades	Not applicable

As the telecommunications market becomes fully liberalized, there may no longer be a direct relationship between a network operator and a customer. Instead there may be a multi-layer supply chain, which may feature service providers and resellers as well as the network operator. In this environment, the full benefits of number portability will only be obtained if it is applicable to every link in the service provision chain. This may be achieved by:

- placing requirements on service provision, or

- placing requirements on the network operators, together with an insistence that this obligation be reflected in contracts placed with service providers along the service provision chain.

This choice is influenced by the structure of the national legislation for telecommunications.

4.5 Number portability and personal numbering

Number portability is sometimes confused with the concept of "personal numbering" (a general description that includes the Universal Personal Telecommunications service). Personal number services enable users to register their presence at any terminal on any network. Once registered, the customer can make and receive calls to that terminal.

Outgoing calls would be billed to the personal number account regardless of originating terminal. There are four key differences between personal numbers and number portability.

- Personal numbering is a service whereas number portability is a feature of an existing service.
- Personal numbering requires the customer to have a new number in addition to the customer's existing numbers, enabling use of the personal number across a range of different network numbers without porting these network numbers. Number portability does not require a number change.
- Personal numbering routes calls to the customer, regardless of the physical network address of the terminal being used. Calls to a ported number are routed to a given physical network address regardless of the actual location of the customer.
- Personal numbering uses a temporary association between the personal number and the telephone number of the terminal to which a call is directed. With number portability, this association is semi-permanent.

Personal numbering is therefore not a substitute for number portability and does not address the competition and user related issues addressed by number portability. Depending on the method of allocation, personal numbers may be related to particular providers of personal numbering services, in which case the personal numbers themselves should be portable.

4.6 Number allocation

The method of number allocation interacts with the solution for number portability. For fixed services, numbers are currently normally allocated in blocks to each network operator and the operator allocates the individual numbers to the subscriber. With competing operators, allocations of blocks are normally made within the existing geographical structure in order to maintain the geographical information in numbers that users have learned.

Allocation through network operators means that the number indicates the operator to which the block allocation was made, even if the number is ported subsequently. This operator is the initial donor if the number is ported. Because of the allocations in blocks, the operator is called the "block" operator.

With block allocation, routeing needs only to examine the number to the depth of the block. In the longer term, users may prefer direct allocations of numbers that are independent of the operators. This implies that there would no longer be a "block" operator and that more detailed number analysis would be needed, increasing the need for IN. Direct allocation is already being used for non-geographic services in a few countries, and to improve the efficiency of use North America is planning allocations at levels below the normal block (called number pooling). The introduction of individual allocation is quite a major undertaking, requiring:

- a mechanism for allocating numbers to individuals
- a national reference database
- modified billing and support systems
- modified routeing methods, probably by introducing widespread use of IN

The examination below of fixed number portability assumes block allocation that follows the existing geographical structure.

4.7 Number portability in Europe and the USA

Number portability has been seen in Europe and the USA primarily as a stimulus to competition and the emphasis has been on operator portability.

The European Commission has addressed number portability in:

- the November 1996 Green Paper on a Numbering Policy
- the Interconnection Directive (97/33/EC [7]) followed by a specific Directive on Number Portability and carrier selection (98/61/EC [8]), which requires fixed and non-geographic number portability to be implemented by 1 January 2000 so that subscribers may choose to port their numbers. This means that all operators, including new entrants, have to implement portability.

The European Commission in its 1999 Review has recommended the introduction of a requirement for mobile portability but the outcome will be discussed at some length with member States. Some national regulators are already requiring mobile number portability, and others are likely to follow this example.

The solutions used for fixed number portability in Europe are quite diverse and are discussed later.

In the USA, a requirement for number portability has been imposed by the FCC as a condition of allowing local carriers access to the long distance and international markets. There has been a rapid development of a sophisticated solution, implemented full IN. This solution has been chosen largely as a consequence of the segmentation of the market into local and long distance carriers. The USA has developed and implemented regional databases to support number portability and these databases are run by an independent organization.

4.8 Standardization

ETSI has developed several documents on number portability.

TR 101 119: "Network Aspects (NA); High level description of number portability".

TR 101 122: "Network Aspects (NA); Numbering and addressing for Number Portability".

TR 101 118: "Network Aspects (NA); High level network architecture and solutions to support number portability".

TR 101 697: "Number Portability Task Force (NPTF); Guidance on choice of network solutions for service provider portability for geographic and non-geographic numbers".

EG 201 367: "Intelligent Network (IN); Number Portability Task Force (NPTF); IN and Intelligence Support for Service Provider Number Portability".

TR 101 698: "Number Portability Task Force (NPTF); Administrative support of service provider portability for geographic and non-geographic numbers".

Unfortunately these documents were produced too late to assist most European countries in developing their plans for number portability.

5 Technical solutions for fixed number portability

5.1 Introduction

The technical solutions to implement number portability can be characterized by:

1) which network determines that a call is to a ported number, and which network derives the routeing information to route the call towards the ported number (this may or may not be the same network);

2) what the derived routeing information identifies;

3) how the routeing information is carried in the signalling.

5.2 Which network determines that a number is ported

In SCNs, this operation is normally carried out in one of the following ways:

- All Call Query(ACQ) – the originating (or transit) network examines calls to all numbers, uses a database to determine which numbers are ported, and derives a routeing number to route the call towards the recipient network. It should be noted that in the context of number portability, the "originating network" is commonly held to be the first network within the particular portability domain, e.g. for international calls, the first network within the destination country. In general, it is not possible for the absolute originating network in a distant country to carry out the number portability functions, because the routeing numbers employed is not usually internationally significant.

- Query on Release(QoR): calls are routed to the donor network, which determines that a call is to a ported number, and releases the call to the originating (or transit) network; this network then determines the routeing number. It should be noted that whilst this technique is defined in the standards, it has not (yet) been implemented *between* networks.

NOTE 1: There are numerous instances of these techniques being used within networks.

- Dropback: calls are routed to the donor network, which determines that a call is to a ported number, determines the routeing number and passes this back to the originating (or transit) network. As with QoR, it should be noted that whilst this technique is defined in the standards, it has not (yet) been implemented *between* networks.

NOTE 2: There are numerous instances of these techniques being used within networks.

- Onward routeing: calls are routed to the donor network, which determines that a call is to a ported number, and adds the routeing number used to pass the call to the recipient.

These scenarios are summarized in Table 2.

Table 2: Routeing solutions

	Determining that the number is ported	Determining and adding the routeing information	Routeing information typically obtained from
All Call Query	Originating network	Originating network	IN database
Query on Release	Donor network	The network that the call is released back to	IN database
Dropback	Donor network	The donor network determines the routeing information and sends it in a release message to the network that the call is dropped back to. This latter network then applies the routeing information to the call	Switch processor or IN database
Onward routeing	Donor network	Donor network	Switch processor or IN database

5.3 What the routeing information identifies

After a network has determined that the called number is ported, the information passed forward with the call determines the routeing capabilities needed in any transit networks and in the recipient local network.

Table 3 shows the options for the information sent with a call that is known to be to a ported number and implications for the subsequent handling of the call.

Table 3: Options for information to be sent between networks with calls to numbers known to be ported

Information	Implication for subsequent handling
A) None	Subsequent networks should determine that the number is ported
B) Indication only that the number is ported	Saves the problem of identifying the calls to ported numbers, but still the destination has to be determined
C) Identify the current terminating network, or point of interconnection	This removes the need for subsequent transit networks to determine the destination, but the recipient network may have to carry out a subsequent query to determine the location of the ported number
D) Identify the current location in the terminating network (e.g. recipient exchange)	This enables the current terminating network to route the call to its destination without needing to obtain any more information. However it may require the location information to be updated if the network is re-organized internally.

5.4 How the routeing information is carried

There are four main options for the form of the routeing information in SCNs:

- a prefix to the directory number using spare number ranges;
- a prefix with the C7 Nature of Address (NOA) field modified;
- the directory number is pushed to a separate parameter (the Called Directory Number parameter), the NOA modified, and the routeing number placed in the Called Party Number parameter;

NOTE: In one implementation (Austria), the routeing number is put in a separate field, the directory number left as it is.

- a separate routeing number carried in the signalling as the Network Routeing Number parameter, with the directory number remaining in the Called Party Number parameter field.

The routeing number may be a separate (non-portable) E.164 number that identifies the recipient network, switch or concentrator. E.164 numbers are used as routeing numbers because they are compatible with the existing routeing tables in the switches. However, the routeing number could equally not be an E.164 number, and may be only nationally significant.

After routeing information has been added to the call, the call is routed in the normal way using routeing tables. If prefixes are used for routeing, these prefixes should be added to the routeing tables in switches.

5.5 Implementation Techniques used in various countries

The following is a list of examples:

1) The UK uses onward routeing, with a routeing number that identifies the recipient concentrator provided from the switch processor and carried as a prefix, with the format 5xxxxx. Dropback is used by the incumbent in some parts of its own network.

2) France uses onward routeing, and a routeing number that identifies the recipient exchange, which is carried as a prefix, format z0xxx.

3) Norway uses All Call Query, and a routeing number that identifies the recipient network, which is carried as a prefix with a modified NOA.

4) The USA uses a form of All Call Query implemented by the last but one ("n-1") network, and an E.164 routeing number that identifies the recipient switch, which replaces the directory number (which is carried in a separate field). A bit is set to indicate when a database dip has been performed.

5) The Netherlands uses All Call Query with originating network responsible for routeing but able to pass this task to a transit network. There is no routeing number and therefore each network in the call path should perform a database query to determine that the number is ported. The incumbent uses Query on Release between the transit and local exchanges within its own network.

6) Denmark uses All Call Query, with no routeing number, but the NOA modified to indicate that a number is ported.

7) Japan uses onward routeing but with the routeing number provided by an IN query from the donor switch.

8) Germany requires the originating network to do the appropriate re-routeing but the incumbent initially uses an onward routeing technique based in the local exchange.

9) Italy uses onward routeing between operators and dropback within the incumbent network. At the interface between operators, routeing number and directory number are concatenated in the Called Party Number field; within the incumbent network, the directory number is carried in a new ISUP parameter. The format of the routeing number exchanged between operators is "C600abcde", where "abcde" uniquely identifies the recipient network by block number.

10) Austria uses onward routeing between operators. At the interface between operators, routeing number and directory number are concatenated in the Called Party Number field. The format of the routeing number exchanged between operators is "86xx", where "xx" uniquely identifies the recipient network.

6 Application to Tiphon

6.1 Introduction

Tiphon networks differ from SCNs in that they have no separate switches. The signalling systems used by the SCNs (e.g. ISUP) are supported at the gateways to the SCNs but a separate protocol is used within the Tiphon network. This may be H.323 or SIP.

A Tiphon network needs to satisfy the number portability requirements that apply to the services that it offers in the country where it is located. A Tiphon network may have roles as any or all of the following:

- originating network;
- transit network;
- donor network;
- recipient network.

The roles of originating, donor and recipient commonly occur together (i.e. a network may be an originator, donor and recipient for different calls) and may or may not be combined with the role of a transit operator. Table 4 summarizes whether a network is affected by its role according to the technical solution in use.

Table 4: Relationship between network role and number portability solution

	All Call Query	Query on Release	Dropback	Onward routeing
Originating network	Determines that the called number is ported and determines and adds the necessary routeing information	Determines and adds the necessary routeing information when receives a release message	Takes the routeing information received from the donor and uses this to re-route the call towards the recipient	Not affected
Transit network Note: - In some implementations the transit network may undertake the functions shown for the originating network	Interprets and uses the routeing information	Interprets and uses the routeing information	Interprets and uses the routeing information	Interprets and uses the routeing information
Donor network	Not affected	Detects that the called number is ported and releases the call	Detects that the called number is ported, determines and sends the necessary routeing information back to the transit or originating network	Detects that the called number is ported, determines and adds the necessary routeing information and routes the call onward
Recipient network	Delivers the call to a number that does not appear to be its own	Delivers the call to a number that does not appear to be its own	Delivers the call to a number that does not appear to be its own	Delivers the call to a number that does not appear to be its own

We now consider the implications of the different roles in more detail.

6.2 Originating network

The TIPHON network as an originating network is shown in Figure 1.

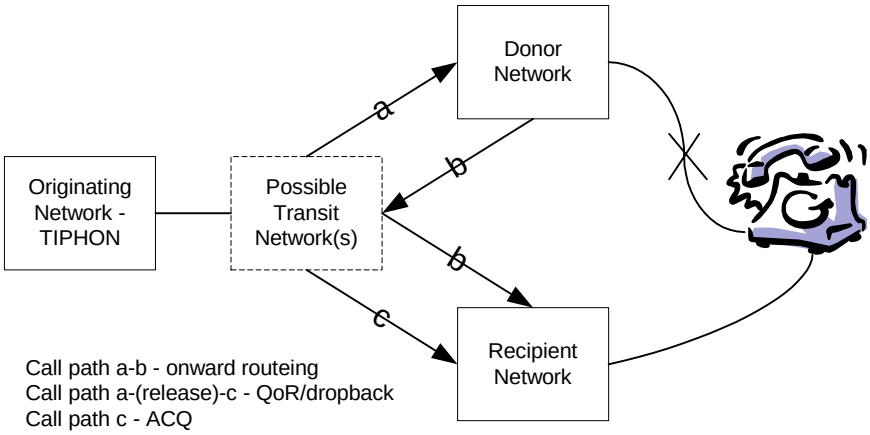

Figure 1

Once again, the requirements placed on the TIPHON network depend upon the solution deployed.

All Call Query

In the ACQ model, the originating network should check all calls against a database of ported numbers. For TIPHON networks, this could be built into the E.164/IP resolution process, so that if a call is to a ported number, the returned IP address would reflect the appropriate egress point, and a mechanism could be incorporated such that the destination number could be appropriately modified to reflect the routeing number.

Once again, however, this raises the question of the carriage of both directory number and the network routeing number across the TIPHON network, and of how to modify the NOA fields if this mechanism is used to indicate the presence of a routeing number.

Given that the database to be queried would be one of all ported numbers in a given country, interfaces would need to be developed between the databases associated with the E.164/IP resolution process and the master number portability databases.

It should be noted that it would probably only be possible to derive a usable routeing number where the TIPHON originating network is in the same country as the directory number, as the routeing numbers are usually only nationally significant. To illustrate : simply adding the E.164 country code to a nationally significant routeing number would not necessarily work. For example, if country code "44" was added to a typical UK number portability routeing number of 512345 01344 713246, this would yield +44 512345 01344 713246, which would misroute to the UK national number 05123 501344 (see Note) (the 713246 being ignored). This matter is exacerbated due to the lack of harmonization of the value of NOA used for number portability.

NOTE: As it happens in this particular scenario, the UK number in question is not used. However, generically this is not the case, so portability routeing numbers can only be used nationally.

Query on Release

The purpose of QoR, when compared to ACQ, is to minimize the volume of database queries that an originating SCN needs to make, as this is a processor hungry activity. For TIPHON networks, however, a database look-up is inherent to network operation (i.e. the E.164/IP resolution process), so it follows that there would be little merit in invoking the QoR process. It is therefore unnecessary for TIPHON networks to support QoR as an originating network.

Dropback

Although superficially the same arguments apply for dropback as for QoR, this is not the case, as in the case of Dropback, there is unlikely to be a central database of ported numbers, rather this will be distributed across donor networks. Therefore, if the TIPHON network is operating in a country that supports dropback – and, as above, there do not currently appear to be any – the TIPHON network will have to support dropback.

To support dropback, the TIPHON network will have to initiate a call as normal, but on receipt of a backward signalling message indicating ported number, re-initiate the call to the routeing number. From this point on, the network requirements are similar to those for ACQ.

Onward routeing

In general, onward routeing places no requirements on a TIPHON originating network. However, there is one situation where there is an additional requirement, namely where there is a regulatory requirement that calls originating on a recipient network may not transit via a donor network (e.g. in the UK). Satisfaction of this requirement will probably not be problematic, however, as there seems to be a ready solution whereby the E.164/IP resolution process would return a terminating IP address for an imported number when queried, rather than the address of the egress point from the TIPHON network towards the donor that would have otherwise been returned.

6.3 Transit network

The TIPHON network as an originating network is shown in Figure 2.

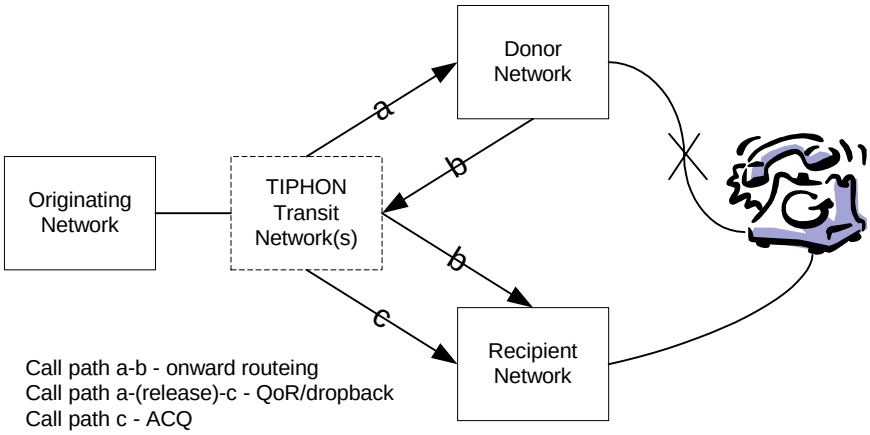

Figure 2

Once again, the requirements of this scenario are very much driven by the solution deployed.

Onward Routeing and All Call Query

For onward routeing, there will be no requirements placed on a TIPHON network if it is a network transited prior to the donor network; for networks between the donor and recipient networks, the requirements are the same as for the remaining text which refers to any transit network in an ACQ implementation.

The requirements on TIPHON networks depend upon the nature of the routeing number solutions:

- Where no routeing number is used (e.g. Netherlands, Denmark), it is necessary to query each call to determine which network to route to. However, once again this should be inherent in the E.164/IP resolution process, in that the number portability database would be used to determine the IP address of the egress point to the correct recipient network;
- Where a routeing number is used, this implies that the E.164/IP resolution process should not just work on strict E.164 numbers, but on number portability routeing numbers, be they conveyed as prefixes, as a substitute in the Called Party Number parameter, or as a special parameter for the routeing number in the network routeing number parameter.

Dropback/QoR

In the forward direction, no requirements are placed on TIPHON networks, other than to potentially pass on any forward signalling indicators about support for call dropback/QoR unaltered. In the reverse direction, two approaches could be taken:

- pivot the call at the transit network, in which case the requirements of the transit network are as per those set out for originating networks in Scenario III;
- pass the dropback/QoR messages transparently.

6.4 Donor network

The TIPHON network as a donor network is shown in Figure 3.

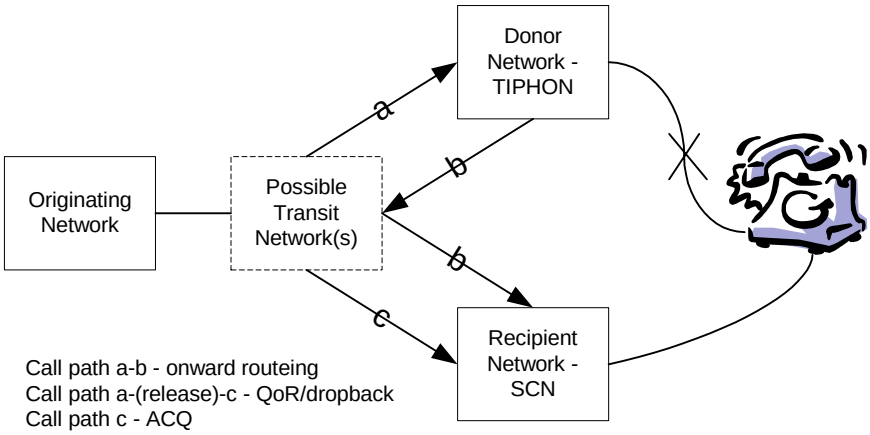

Figure 3

For this role, if ACQ techniques are being used, there is no involvement of the TIPHON network, other than if it is an originating or transit network (see Scenarios III and IV). However, if the solution deployed in the country concerned involves onward routeing or QoR/dropback, the TIPHON network will be involved in the call path.

6.4.1 Onward routeing

If Onward routeing is employed then the TIPHON network should:

1) Determine that the call is to a ported number rather than one terminating on it;

2) Determine the routeing number for the ported number;

3) Deal with the routeing number. This could imply:

   a) Routeing the call to the appropriate egress point from the TIPHON network with no change to the Called Party Number parameter (for solutions as per Netherlands, with no routeing number);

   b) As per (a), but with a modified NOA (for solutions as per Denmark, with no routeing number but a "ported number" NOA);

   c) As per (a), but routeing the call with a modified directory number consisting of a prefix plus the original directory number (NB this should be in national format) and an appropriately modified NOA (for solutions as per the UK, Norway etc);

   d) As per (a), but egressing the call with a modified directory number consisting of a routeing number, with the original directory number in the Called Directory Number parameter and an appropriately modified NOA (for solutions as per the USA).

In delivering the call to the appropriate egress point, item 3d) implies that the TIPHON network should be able to convey a separate information element being the routeing number, as well as the directory number. One method is to use the Called Party Number parameter with a new NOA for the routeing number and the Called Directory Number parameter for the directory number, and the other method is to use the network routeing number parameter for the routeing number and the Called Party Number parameter for the directory number.

It should be noted that the requirement to modify the NOA, or indeed to use a routeing prefix may present problems with the current TIPHON model.

These requirements imply that the interconnection between TIPHON and SCNs should be C7 signalling rather than a customer interface such as ITU-T Recommendation Q.931 [9] . ITU-T Recommendation Q.931 [9] has a parameter Type of Number (ToN) that seems to serve the same purpose, but there is no value to indicate ported numbers, and it is unclear how network switches map this to NOA, if at all.

Additionally, the prefix solutions such as that in the UK are based upon unused directory number values at the inter-switch level. Although these values may be spare at this level, they may not be at the customer access level – for example, the UK solution of a 5xxxxx prefix is possible at the interswitch level as these values are unused; however, at a customer interface, such a digit string would be interpreted as a call to local number 5xxxxx.

6.4.2 QoR/Dropback

If QoR/Dropback is employed, then the TIPHON network should:

1) Determine that the call is to a ported number rather than one terminating on it;

2) Determine the routeing number for the ported number (Dropback only);

3) Release the call with an appropriate cause value (QoR or Dropback), and routeing number (Dropback only).

Once again, these requirements imply that the signalling between the TIPHON network and the SCN should support the appropriate cause values and information elements, which may only be present within C7.

6.4.3 Additional comments

If the TIPHON networks are not directly interconnected and calls to ported numbers have to transit via the SCN, then the solution to be used should match with that deployed for the SCNs of the country in question. Therefore, in the UK and onward routeing approach with the routeing number being a 5xxxxx prefix would be used, in Denmark an all call query approach with there being no routeing number and the NOA being set to "ported" would be used and so on. The relevant functions required of the TIPHON networks in this situation have already been described in Scenarios I and II.

6.5 Recipient network

The TIPHON network as a recipient network is shown in Figure 4.

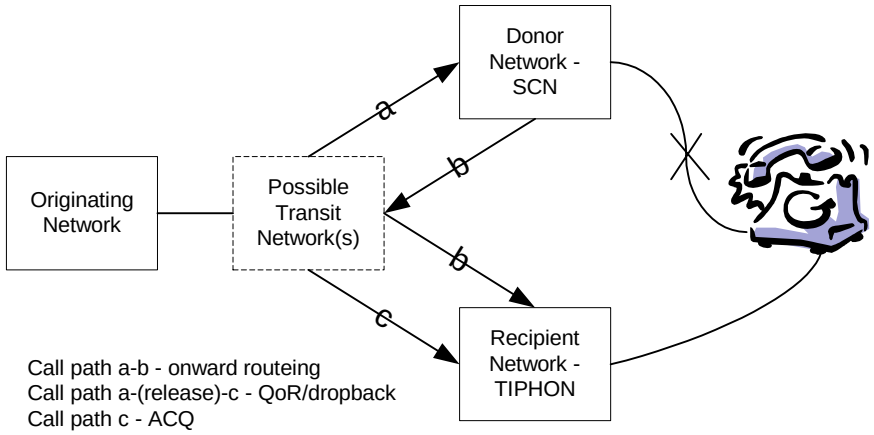

Figure 4

The following comments apply to all number portability solutions.

In this role, the TIPHON network should be capable of sensing that a call is being delivered to it as a recipient network, and route the call to the relevant termination. This could be accomplished using the E.164/IP resolution process, but there are some complications in that the destination number field may not contain (only) the directory number, and safeguards should be put in place to prevent any call looping. Therefore, the general approach should be:

- If the solution uses no routeing number or indication – handle call as usual (i.e. E.164/IP resolution etc);
- If the solution uses a prefix, then this should be checked to verify that it identifies the TIPHON network (if not, this is a transit call), and if so should be deleted and the remainder of the directory number used to invoke normal call handling. NB that the use of a prefix would be detected either via the format of the significant digits, or the value of the NOA field;
- If the solution uses the Separate Directory Number Addressing method according to ITU-T Recommendation Q.769.1 [10] , section 6.1 with two parameters, then the contents of the Called Party Number parameter should be checked to verify that it identifies the TIPHON network (if not, this is a transit call), and if so the contents of the Called Directory Number parameter should be used to invoke normal call handling. NB that the use of the Called Directory Number parameter would be detected via the value of the NOA field;
- If the solution uses the Separate Network Routeing Number Addressing method according to ITU-T Recommendation Q.769.1 [10] , Annex B with two parameters, then the contents of the network routeing number parameter should be checked to verify that it identifies the TIPHON network, and if so the Called Party Number parameter should be used to invoke normal call handling.

In some countries, the routing information identifies the recipient switch (e.g. France, UK) and so recipient networks may have many routing numbers, but as a Tiphon network does not have separate switches it would only need one routing number.

7 Conclusions for Tiphon

Number portability is a requirement in many countries and if TIPHON networks support services for which number portability is required then they will be required to implement number portability. Where a TIPHON network is present in more than one country it may have to support more than one number portability solution. The requirements highlighted within the present document are complex, and vary widely according to the number portability solution deployed in a given country. However, the main points can be summarized as follows.

E.164/IP resolution process

- TIPHON networks should always be able to resolve number portability routeing numbers where they are present either as:
  - a prefix,
  - the entirety of the Called Party Number parameter, rather than the E.164 directory number, or
  - the network routeing number parameter.
- Tiphon networks should accommodate all the formats of routeing numbers used by networks to which they may be interconnected including the use of hexadecimal notation and the indication of the presence of a routing number via special values of the C7 NOA parameter.
- Equipment designed for use in Tiphon networks should accommodate all the formats of routing numbers in order to be suitable for any context.
- The resolution process in all TIPHON networks should be able to return the routeing number, and/or the NOA (as appropriate) as well as the Contact ID.
- Unless there are special circumstances, TIPHON networks that are recipient networks (i.e. the routing number identifies the TIPHON network that is handling the call) should use the called party number and not the routeing number for the E.164-Contact ID resolution. However, to protect against call loops caused by number portability data that is not fully updated, safeguards should be put in place to ensure that where the routing number indicates the network that is handling the call, the call will be routed only to a terminal on that network.
- The resolution process should be able to interface with the number portability database(s) for the country in question.

Carriage of information elements through TIPHON networks

TIPHON networks should be able to carry:

- routeing numbers (either as prefixes or as separate fields),
- indicators that a number portability database interrogation has taken place, and
- NOA values according to ITU-T Recommendation Q.769.1 [10],

in addition to the called party number.

Carriage of information elements between TIPHON and other networks

The signalling at the interconnection points between TIPHON and other networks should be able to handle:

- routeing numbers (either as prefixes or as separate fields),
- indicators that a number portability database interrogation has taken place, and
- NOA values according to ITU-T Recommendation Q.769.1 [10].

It is important to note that signalling systems designed for user-network interfaces are not normally able to support this information and that signalling systems designed for network-network interfaces will have to be used.

QoR/Dropback

If and when QoR or dropback is used, TIPHON networks should be able:

- as the donor network to generate backward messages indicating that a number is ported;
- as the originating or transit network to react to backward messages and re-route the call towards the recipient network;
- as the transit network to transport backward messages if appropriate.

Bibliography

The following material, though not specifically referenced in the body of the present document (or not publicly available), gives supporting information.

ETSI TR 102 081 (V1.1.1): "Network Aspects (NA); Number Portability Task Force (NPTF); Signalling requirements to support number portability".

History

Document history		
V1.1.1	September 2000	Publication