

PNO-ISC Information Document Number 007 — UK Interconnect use of SCCP & MTP

ICS 33.040.30

National foreword

This Published Document has been prepared by Technical Committee TCT/50. It supersedes PD 6627:2001 Issue 3 PNO-ISC Information document number 007-UK Interconnect user of SCCP and MTP, which is withdrawn. The information provided in this document covers provision and use of the interconnect SCCP specified in /3/; this being a subset of the latest edition SCCP recommendations which satisfies the SCCP requirements of the CCBS service specified in /1/. The subset is in essence for the connectionless service class of SCCP using Global Title Indicator GTI=4. The subset has no requirement for segmenting and re-assembly, or subsystem status management procedures associated with point code plus subsystem number addressing.

There are known difficulties in future enhancement of the SCCP specified in /3/ to provide a more complete White Book capability. Such development will have to take account of:

- continuing international requirements for Blue Book compatibility
- the need for the hop counter to be set at a value suitable for all applications
- the inability of applications using SCCP to know what network capabilities are available towards destinations.

These are subject to possible future studies within the PNO-ISC (MTP/SCCP WP). This document also provides information relating to the MTP specified in /5/ and covers the impacts and issues regarding the interconnect of MTP networks.

This Published Document has been produced with place markers for some sections, not yet available, which will be issued as amendments to this Published Document when they become available.

The Published Document contains ISC references to other documents, which are planned to be published as Published Documents. The following list cross references these against future PD publications:

- PD 6625 PNO-ISC/SER/001
- PD 6626 PNO-ISC/SER/003
- PD 6638 PNO-ISC/SPEC/003
- PD 6650 PNO-ISC/SPEC/004
- PD 6639 PNO-ISC/SPEC/005
- PD 6647 PNO-ISC/INFO/001
- PD 6664 PNO-ISC/SER/008
- PD 6665 PNO-ISC/SER/007
- PD 6646 PNO-ISC/SPEC/001
- PD 6623 PNO-ISC/SPEC/007

The Published Document is not to be regarded as a British Standard.

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UK INTERCONNECT USE OF SCCP & MTP

NETWORK INTEROPERABILITY CONSULTATIVE COMMITTEE

Office of Telecommunications

50 Ludgate Hill

London EC4M 7JJ

0.2 Normative Information

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0.4 History

Revision	Date of Issue	Updated By	Description
Issue 3	August 2000	Mike Luntz, Vodafone	Approved by PNO-IG
Issue 3.1	October 2001	Tom Hayden, Vodafone	Inclusion of SSNs specific to GSM network interconnection

0.5 Issue Control

SECTION	ISSUE	DATE
All	Issue 3.1	October 2001

0.6 References

- /1/ PD 6625 PNO-ISC/SER/001 Issue 1, Draft A UK Completion of Calls to Busy Subscriber (CCBS) Supplementary Service. Combined Service Description and Functional Description
- /2/ PD 6626 PNO-ISC/SER/003 Issue 1, Geographic Number Portability
- /3/ PD 6638 PNO-ISC/SPEC/003 Issue 2, C7 INTERCONNECT SIGNALLING CONNECTION CONTROL PART (SCCP)
- /4/ PD 6650 PNO-ISC/SPEC/004 Issue 1, C7 INTERCONNECT TRANSACTION CAPABILITIES
- /5/ PD 6639 PNO-ISC/SPEC/005 Issue 3, C7 INTERCONNECT MESSAGE TRANSFER PART
- /6/ PD 6647 PNO-ISC/INFO/001 Issue 1, Draft A POINT CODES - MANAGEMENT AND ALLOCATION BETWEEN UK PTOS
- /7/ ETS 300 134: December 1992 Transaction Capabilities (TC) signalling requirements in and between networks, for non circuit related services which use the CCITT Signalling System No.7, for inter-network dialogues
- /8/ ETS 300 356-18: February 1995 Integrated Services Digital Network (ISDN); Signalling System No.7; ISDN User Part (ISUP) version 2 for the international interface; Part 18: Completion of Calls to Busy Subscriber (CCBS) supplementary service
- /9/ ITU-T Q.713 (07/96) SCCP Formats and Codes
- /10/ ITU-T Q.714 (07/96) SCCP Procedures
- /11/ ITU-T Q.715 (07/96) SCCP User Guide
- /12/ Geographic Number Portability End to End Process Manual Issue 7a <http://www.oftel.gov.uk/isp/netint.htm>
- /13/ ITU-T Q.711 (07/96) SCCP Functional Description
- /14/ PNO-ISC/SER/008 Issue 1, Mobile Number Portability
- /15/ ITU-T Implementors' Guide (9/97) for Q.705 (1993)
- /16/ ITU-T Implementors' Guide (3/99) for Q.703 (1996)
- /17/ ITU-T Implementors' Guide (12/99) for Q.704 (1996)
- /18/ PNO-ISC/SER/007 Issue 1, Non Geographic Number Portability
- /19/ ETS 300 599: January 1998 Digital Cellular Telecommunications System (Phase 2) Mobile Application Part (MAP) Specification (GSM 09.02 ver 4.17.1)
- /20/ ITU-T Introduction to CCITT Signalling System No. 7 Q.700 (03/93)
- /21/ PD 6646 PNO-ISC/SPEC/001 Issue 1, Use of SS7 Point codes for network interconnect in the UK
- /22/ ITU-T Q.703 (07/96) Signalling Link

- /23/ ITU-T Q.704 (07/96) Signalling network functions and messages
- /24/ ITU-T Q.751.1 (10/95) Network Element Management Information Model For The Message Transfer Part (MTP)
- /25/ PD 6623 PNO-ISC/SPEC/007 Issue 2.3 ISDN User Part (ISUP)
- /26/ ETS 300 008 V1.3.1, December 1999 Message Transfer Part (MTP) to support international interconnection
- /27/ ITU-T Q.705 (03/93) Signalling System No 7 – Signalling Network Structure
- /28/ ITU-T Q752 (06/97) Monitoring and Measurement for Signalling System No 7 Networks

0.7 Glossary Of Terms

0.7.1 Abbreviations

AAL	ATM Adaptation Layer
ATM	Asynchronous Transfer Mode
BICC	Bearer Independent Call Control
BSSAP	Base Station Subsystem Application Part
C7	CCITT Signalling System Number 7
CC	Country Code
CCBS	Completion of Calls to Busy Subscriber (Service)
CLI	Calling Line Identification
CPN	Called Party Number
CR	Circuit Related
DPC	Destination Point Code
DUP	Data User Part (of C7)
ETS	ETSI Telecommunications Standard
ETSI	European Telecommunications Standards Institute
GCP	Gateway Control Protocol
GGSN	Gateway GPRS Support Node
GN	Generic Number
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
GT	Global Title
GTAI	Global Title Address Information
GTI	Global Title Indicator
INAP	Intelligent Network Application Protocol (of C7)
ISC	Interconnect Standards Committee
ISDN	Integrated Services Digital Network
ISUP	Integrated Services User Part (of C7)
ITCC	International Telecommunications Charge Card (Service)
ITU	International Telecommunications Union
ITU-T	ITU Telecommunications Standardisation Sector
LSSU	Link Status Signal Unit
MNP	Mobile Number Portability
MPOI	MTP Points Of Interconnect
MSU	Message Signal Unit
MTP	Message Transfer Part (of C7)
NCR	Non Circuit Related
NDC	National Dialling Code
NICC	Network Interoperability Consultative Committee
NNG	National Number Group
NSN	National Significant Number
NTP	Network Termination Point
O&M(BS S)	Operations and Maintenance (Base Station Subsystem)
OMAP	Operations, Maintenance and Administration Part (of C7)
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OSS	Operator Service Subsystem
PC	Point Code
PCI	Point Code Indicator
PCR	Preventive Cyclic Retransmission
PNO	Public Network Operators
PPOI	Physical Point Of Interconnect
PTO	Public Telecommunications Operator(s)
RI	Routing Indicator
RTB	Retransmission Buffer
SCCP	Signalling Connection Control Part (of C7)
SDL	Specification and Description Language
SEP	Signalling End Point
SGSN	Serving GPRS Support Node
SIB	Status Indication "Busy"
SP	Signalling Point
SPOI	SCCP Point Of Interconnect
SSN	Subsystem Number
SSNI	Subsystem Number Indicator
STP	Signalling Transfer Point
TB	Transmission Buffer
TC	Transaction Capabilities (of C7) (was TCAP)
TCAP	TC Application Part (of C7) (now just TC)
TUP	Telephony User Part (of C7)
UDT	Unitdata (message)
UDTS	Unitdata service (message)
UK	United Kingdom of Great Britain and Northern Ireland
UPU	User Part Unavailable (message)
XUDT	Extended UnitDaTa (message)
XUDTS	Extended UnitDaTa Service (message)

0.7.2 Terminology

The following definitions apply;

Called Party - The SCCP user to which the SCCP message is directed.

Calling Party - The SCCP user initiating the SCCP message.

UK interconnect network - that part of the UK network where point codes are allocated from the common interconnect range defined by ISC /6/.

Global Title - an element of SCCP called and calling party addresses having its inclusion and content signalled by the coding of the global title indicator.

Incoming Network - The network to which a C7 message is passed from a point of interconnection between two networks.

Originating Network - The network in which the Calling Party resides.

Outgoing Network - The network from which a C7 message is passed to a point of interconnection between two networks.

Terminating Network - The network in which the Called Party resides.

White Book - The ITU-T(03/93 or later) Recommendations.

0.8 Scope

The information provided in this document covers provision and use of the interconnect SCCP specified in /3/; this being a subset of the latest edition SCCP recommendations which satisfies the SCCP requirements of the CCBS service specified in /1/. The subset is in essence for the connectionless service class of SCCP using Global Title Indicator GTI=4. The subset has no requirement for segmenting and re-assembly, or subsystem status management procedures associated with point code plus subsystem number addressing.

There are known difficulties in future enhancement of the SCCP specified in /3/ to provide a more complete White Book capability. Such development will have to take account of:

- continuing international requirements for Blue Book compatibility
- the need for the hop counter to be set at a value suitable for all applications
- the inability of applications using SCCP to know what network capabilities are available towards destinations.

These are subject to possible future studies within the PNO-ISC (MTP/SCCP WP).

This document also provides information relating to the MTP specified in /5/ and covers the impacts and issues regarding the interconnect of MTP networks.

1 Introduction

This document provides specific information supplemental to that specified in /3/ for interconnect use of SCCP signalling between public networks operated in the UK. Included is a section describing the architectural options for provisioning such interconnect,

This document also contains supplemental information to that specified in /5/ for the interconnect use of MTP. It provides guidance for specific parameter settings and the use of MTP over interconnect for any 'user part'.

The information is intended for use by designers of applications which require use of SCCP or MTP as well as by network operators needing to engineer SCCP or MTP networks and configure those applications for network interconnect.

The information provided states the definitive requirements relating to those services which are standardised in the UK for national interconnect and dependent upon the application of MTP and SCCP for their operation. In particular the SCCP address codes standardised for use in the UK are listed. The International and UK network operator addressing assignments are also included in order to minimise the possibility of conflict when the capability of the UK national interconnect is extended.

Definitive requirements are specified for the interconnect use of SCCP as needed for the UK CCBS service to perform and function as intended in /1/. Advisory information is documented for other aspects of SCCP use made known to the ISC.

This document will be revised when necessary and in accordance with the NICC/PNO-ISC workplan to include information appropriate to enhancements to SCCP & MTP and additional services having a requirement to use MTP and SCCP.

2 Requirements On Applications Making Use Of SCCP

This section identifies and gives information on the parameters to be provided to SCCP and options to be set by the application for correct operation of the underlying SCCP layer.

Use of SCCP service and management primitives is described in line with their use in /13/ where this may be helpful to aiding the understanding. This document has no requirement for implementation of such primitives.

2.1 SCCP Return Message on Error Procedure

The SCCP connectionless class of service specified in /3/ provides the application using SCCP with the ability to transfer signalling messages via the signalling network without setup of a permanent signalling connection. Under certain conditions of network congestion, and unavailability of subsystems supporting the application and/or signalling points, SCCP connectionless messages could be discarded instead of being delivered. SCCP provides a return on error procedure as a means for the application to be informed about messages that SCCP cannot route to the end destination. If the application using SCCP wishes to use the SCCP Return message on error procedure, the Return Option parameter must be provided to SCCP. If the Return Option parameter is not provided to SCCP by the application then no error information will be provided by SCCP to the application.

When routing on Global Title, the return message on error procedure is the only way for the application using SCCP to be informed of messages encountering routing problems, and is a valuable means of receiving information quickly about routing problems in the network.

Applications shall always provide the Return Option parameter to SCCP. Wherever possible, applications shall take appropriate action on the Reason for Return parameter provided from SCCP.

Possible actions are given in Table 2.1.

TABLE 2.1 – Action taken by Application upon receipt of return reason

no translation for this specific address	stop requests and report problem
subsystem congestion	reduce requests and log problem
subsystem failure	pause requests and report problem
unequipped user	stop requests and report problem
network congestion	reduce requests and log problem
network failure	pause requests and report problem

Whilst SCCP is designed always to route correctly, it should be understood that the sent UDTs messages may themselves be mis-routed or discarded. Applications shall have internal mechanisms that ensure control is not lost in the event of failure to receive responses to messages sent.

2.2 SCCP Calling and Called Addresses Structure

The SCCP interconnect signalling specification /3/ states that the called and calling party address parameters are required but leaves open the selection of type of address information to be provided. An application requiring SCCP must provide sufficient information to enable the correct construction of SCCP message called and calling party addresses. The constituent parts of these addresses are identified in the following sub section. The formats to be used and values to be assigned are specified in sections 4 and 5.

2.2.1 Address Indicator (Octet)

The address indicator octet specified in /9/ indicates the type of address information contained in the address field. The following parameters require encoding:

- signalling point code indicator
- subsystem number indicator
- global title indicator
- routing indicator.

2.2.2 Global Title Contents

The specification /3/ restricts the Global Title Indicator to a value of four (GTI=4). According to specification /9/ this format means that global title fields must be populated with:

- translation type

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Documents

Document Sharing Hub

- numbering plan
- encoding scheme
- nature of address indicator
- global title address information.

2.2.3 Routing Indicator

Bit 7 of the address indicator octet is the Routing Indicator.

A "0" in bit 7 indicates that routing should be based on the Global Title in the address.

A "1" in bit 7 indicates that routing should be based on the destination point code in the MTP routing label and the subsystem number information in the called party address.

Routing in the UK interconnect SCCP network shall be based on Global Title.

2.3 Management of Address Information by the Transaction Capability Sub-Layer

Based on /7/ ETS 300 134 § 3.5

Although TC does not convey address information in any of its message parameters, the Transaction sub-layer must provide any necessary address information to the SCCP in every N-UNITDATA request primitive (e.g. global title and sub-system number with a "Global Title routing required" indication).

The procedures are intended to be analogous with those relating to Transaction IDs:

- i) The calling address information received in the first N-UNITDATA indication primitive in each direction of a transaction, shall be used as called address in all subsequent messages to the peer within that transaction.
- ii) Each SCCP application is responsible for providing its own address in the calling address information of every N-UNITDATA request primitive. This shall not change during the life of the transaction and shall be in a form which can be used by the SCCP to return messages, e.g. from the distant node.
- iii) Once the transaction is established, the address information provided to SCCP shall remain constant for the life of the transaction.

Because the calling party address in a response will not necessarily be the same as the called party address in the original TC-BEGIN message, it is the TCAP transaction IDENTITY and not SCCP address information that is used by TC for identifying related messages.

2.4 Protocol Class

The protocol class has to be set by the application. The classes allowed by /3/ are

- | | |
|---|--------------------------|
| 0 | basic connectionless |
| 1 | sequenced connectionless |

2.5 Sequence Information

Based on /10/ Q.714 1.1.2.2

If the sequenced connectionless protocol class 1 is to be used, the application must indicate this to SCCP by use of the sequence control parameter. SCCP will then encode the Signalling Link Selection field of the MTP routing label identically for all signalling messages of the sequence.

2.6 Quality of Service

These are parameters used for connection oriented procedures and are not covered by /3/.

2.7 Stream Identity

These are parameters used for connection oriented procedures and are not covered by /3/.

2.8 SCCP User Management

Because routing in the UK SCCP network is based on Global Titles, management, which is based on PC+SSN addressing, is not required. Exceptionally, where applications reside in the UK interconnect network and point codes are known to both parties, routing may be based on subsystem numbers by mutual agreement. In this case the following requirements may apply.

2.8.1 N-STATE Primitive

SCCP requires the application using SCCP to react to the N-STATE Indication primitive, taking into account the service characteristics and the status of its peer application using SCCP.

2.8.2 N-PCSTATE Primitive

SCCP expects the application using SCCP to react to the N-PCSTATE Indication primitive, taking into account the service characteristics and the status of the affected SP or SCCP.

2.8.3 N-COORD Primitive

If the application using SCCP requires use of the co-ordinated state change feature of SCCP, then SCCP requires the application using SCCP to respond to the N-COORD Indication primitive, taking into account its workload.

3 Requirements On SCCP Networks

This section gives guidelines for network operators and designers in order to avoid and correct the following known potential problems that may otherwise occur.

3.1 Use of the Return Option

The following sub-sections describe how to avoid known potential problems.

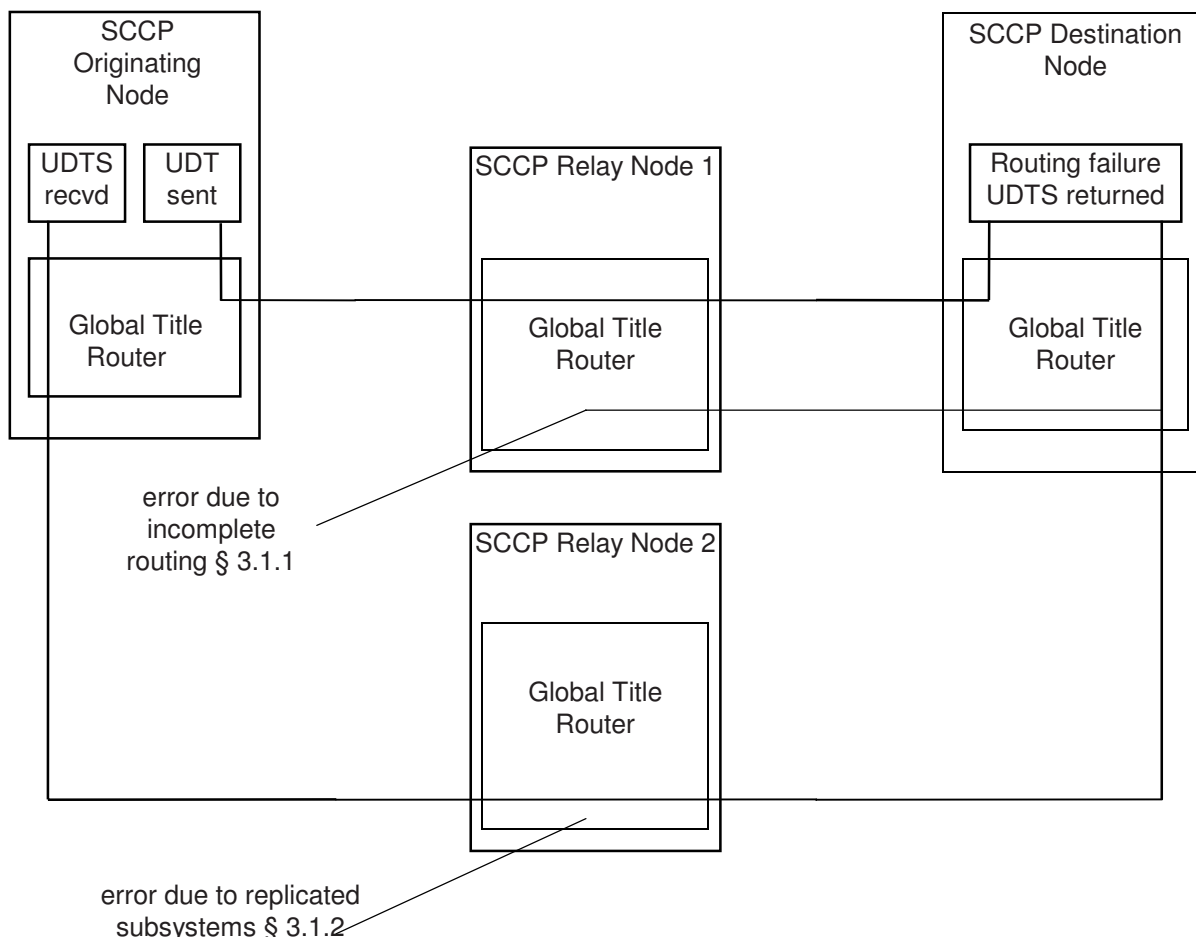


FIGURE 3.1 – Errors Due to Routing Failures

3.1.1 Incomplete Routing

Based on /11/ Q.715 §8.3.1.1

Every node on an outward route must know a valid route on which to return the message. All nodes on the outward route must be configured to be able to perform global title translation of the Global Title Address Information of returned messages formed from the calling party address of the outward message.

3.1.2 Replicated Subsystems

Based on /11/ Q.715 §8.3.1.2

The calling party address of UDT messages, and the called party address of UDTs messages, must unambiguously identify the node where the UDT message originating subsystem is located.

The final GT translation of the called party address in a UDTs message must result in the UDTs message being routed to the node hosting the UDT message originating subsystem, and must therefore be subjected neither to backup routing nor loadsharing.

3.1.3 Changes to Calling and Called Party Addresses.

In order to help minimise possible problems with the return message on error procedure described in 2.1 above, neither the calling nor called party addresses shall be changed as they pass through the UK network, including and up to end nodes, except as described in /2/, /14/ and /18/ for number portability.

3.1.4 Scope of Calling Party Address

Based on /11/ Q.715 §8.3.1.3

The calling party address of the subsystem originating the message must be valid in every network through which the message passes.

3.1.5 Calling Party Addresses in UDTs Messages.

Based on /11/ Q.715 §8.3.1.4

When the routing indicator in messages received at end nodes has been set to RI = 'route on SSN', the called party address will then include the SSN of the destination application and possibly the DPC of the end-node. Potentially, these address parameters could then form the calling party address in a returned UDTs message. However, if DPCs and perhaps national specific SSNs were derived from the final GT translation, these may be valid only in the destination network, and therefore should not be used for the calling party address in a returned UDTs message.

Problems of this nature are minimised in the UK network by not permitting changes to the calling and called party addresses (see 3.1.3).

3.1.6 Conversion of Called Party Address

Based on /11/ Q.715 §8.3.1.5

The calling party address sent back in a UDTs message may contain any intermediate result of translation of the called party address in the UDT message, and have no apparent relation to it. It cannot therefore be used as a reliable indication for such purposes as accounting, measurements, or traffic management activity.

If screening of calling party address is applied to UDTs messages, many messages could be blocked because their calling party address is not valid. Also, many messages might be rejected or discarded, since the calling party address was originally the called party address in a UDT that could not be routed. Problems of this nature are minimised in the UK network by not permitting changes to the calling and called party addresses (see 3.1.3). Care should be taken that the screening of calling party address does not impair the normal operation of the UK SCCP network.

To achieve a meaningful calling party address, the international component of the Global Title Address Information shall be included and retained for UK interconnect.

3.1.7 Syntax Checks

Based on /11/ Q.715 §8.3.1.7

Syntax checks in a relay node are permitted to be less stringent than in end-nodes. Only the 'necessary' routing data are required to be checked (See /10/ Q.714 §4.3). If the return option is now applied, the danger exists that a message is returned that is corrupted, but is 'repaired' through the reformatting of the UDTs message, although containing complete nonsense. It would be advisable to perform a more complete syntax check of the received UDT message before using its information to format the UDTs message. In addition, called party addresses that are not reliably decodable should be treated as 'syntax errors' (as it is now described in /10/ Q.714, § 3.10). The appropriate action is to discard them (i.e. not to subject them to the return procedure), otherwise complete nonsense may be returned in the message, especially in the calling party address.

3.2 Corrective Action for Message Returned on Error Reasons

At present there are no actions specified for SCCP to take other than to pass on the Reason for Return parameter to the application. The consequences of errors are anticipated to be at a level where the normal operation of the SCCP network is unimpaired. However, it should be a requirement of interconnect agreements that SCCP errors be recorded and action taken to find and rectify their cause.

3.3 Checking for Ported Numbers in Own Node or Network

Before an SCCP message is sent from a node in an Outgoing Network to an Incoming Network, the Outgoing Network should first check whether the called party has been ported to the sending node in the Outgoing Network. If such a check shows that porting has occurred then the Outgoing Network shall not send the message to the

Incoming network. The donor network from which the address has been ported shall not rely on such checks being made and shall route all SCCP messages to their correct destination.

3.4 Checking for Circular Routing of Messages to Ported Numbers

Number portability increases the possibility that messages could be routed into a loop. This is because subsystem routing would not be performed at a donor exchange (now an intermediate point (where routing is on Global title), not an end node as was the case prior to porting). An operator could be alerted to loops by monitoring for excessive frequency of messages relayed to individual addresses.

3.5 Management of SCCP

Subsystem status management of SCCP itself is optionally allowed by /3/ and permits the status of the SCCP management at a node to be determined. In particular, the subsystem status test procedure of /10/ Q.714 § 5.3.4.2.b may be used to verify the status of the remote SCCP, thereby ensuring that messages are only sent to nodes where a SCCP is able to process them.