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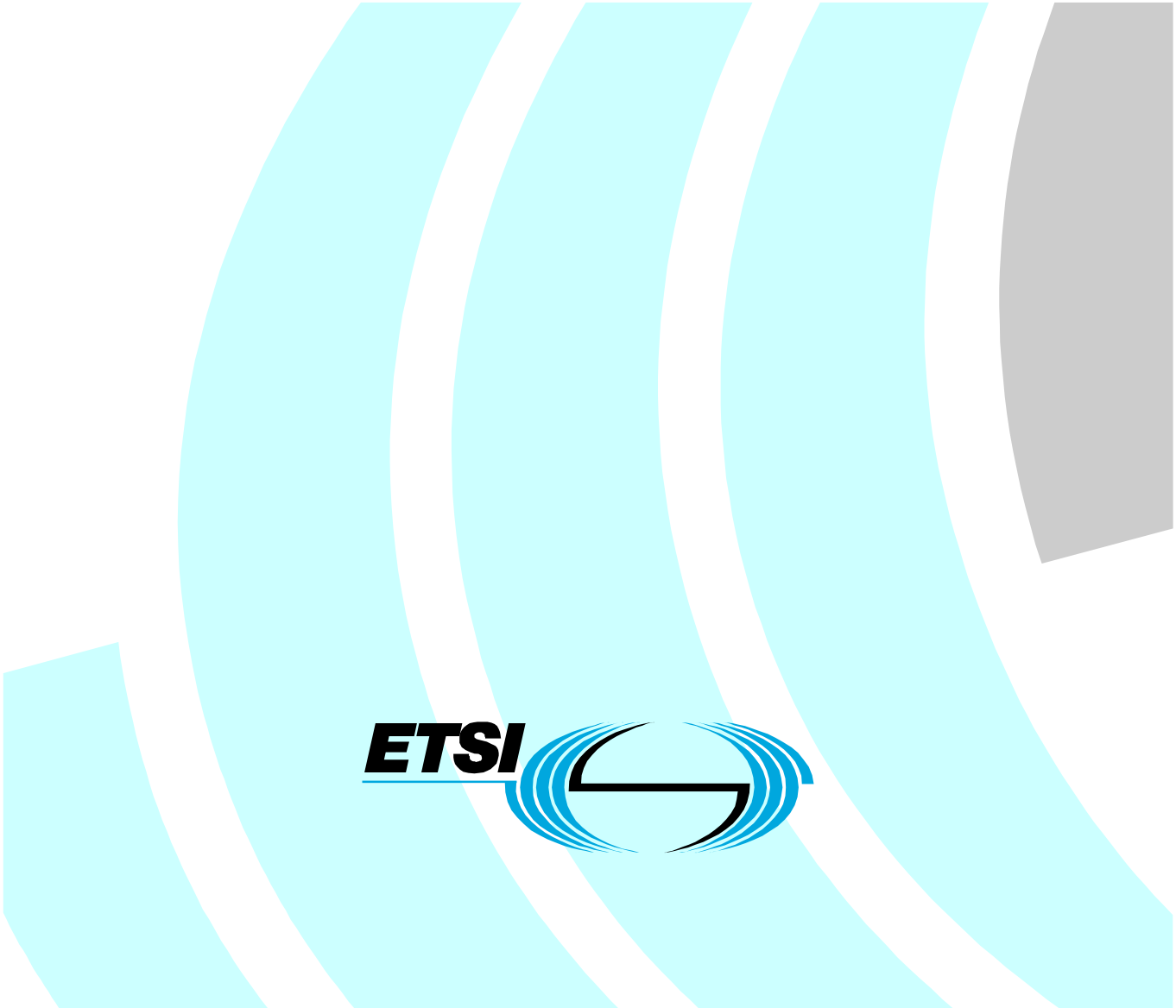
Technical Report

Speech Processing, Transmission and Quality Aspects (STQ); QoS parameter definitions and measurements for use in network-to-network narrowband interconnection



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Contents

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Speech processing, Transmission and Quality aspects (STQ).

The present document has been written to provide a balanced approach taking into account as far as practicable the following principles:

1) To be as realistic as possible, real traffic rather than test calls should be used as a basis of the measurements, wherever possible.

2) Where practicable, parameters should be capable of verification by independent organizations. This verification might be made by direct measurements or by audit of service provider's measurements.

3) The accuracy of QoS values should be set to a level consistent with measurement methods being as simple as possible with costs as low as possible.

4) The parameters are designed for both statistical and individual application. The statistical values should be derived by the application of a simple statistical function to the individual values. The statistical function should be specified in the standard. The standard should also contain guidelines on how statistically significant samples should be selected.

5) The statistical functions should be designed so QoS figures from different network operators can be compared easily by other network operators.

1 Scope

The present document contains harmonized definitions and measurement methods for a range of Quality of Service (QoS) parameters that relate to public network-public network interconnection. The purpose of these parameters is to define objective and comparable measures of the QoS for interconnection. Measurement of these parameters will show how well interconnection is working at an operational level.

The present document is intended to provide a menu from which individual items can be selected. Although the present document aims to include all the most relevant parameters, there is no obligation to use any or all of the parameters, the choice of what is used is entirely a matter for the interested parties.

The aim of the present document is to provide a common starting point for QoS issues and thereby to assist the preparation of contracts and publications of comparative performance. It is not the intention to cause documents that already have adequate definitions of parameters to be revised.

The establishment of target values for each parameter is outside the scope of the present document.

The present documenting arrangements, including which party is responsible for reporting, are outside the scope of the present document.

The Quality of Service parameters apply only to the interconnection of digital circuit switched connections provided over SDH or PDH transmission technologies. The present document may be revised or extended to cover packet based technologies at a future date.

The Quality of Service parameters apply for any services provided over digital circuit switched connections, including:

- Fixed to fixed
- Fixed to mobile
- Mobile to fixed
- Mobile to mobile
- All forms of services with special user tariff arrangements such as freephone, shared cost and premium rate

2 References

For the purposes of this Technical Report (TR) the following references apply:

[1] 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).

[2] 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.

[3] ITU-T Recommendation E.800: "Telephone network and ISDN quality of service, network management and traffic engineering: Terms and definitions related to quality of service and network performance including dependability".

[4] ITU-T Recommendation I.210: "Integrated Services Digital Network (ISDN) service capabilities: Principles of telecommunication services supported by an ISDN and the means to describe them".

[5] Directive 98/10/EC of the European Parliament and of the Council of 26 February 1998 on the application of open network provision (ONP) to voice telephony and on universal service for telecommunications in a competitive environment.

[6] Council Directive 90/387/EEC of 28 June 1990 on the establishment of the internal market for telecommunications services through the implementation of open network provision.

[7] Directive 97/51/EC of the European Parliament and of the council of 6 October 1997 amending Council Directives 90/387/EEC and 92/44/EEC for the purpose of adaptation to a competitive environment in telecommunications.

[8] ITU-T Recommendation E.425: "Internal automatic observations".

[9] ITU-T Recommendation E.801: "Framework for service quality agreement".

[10] ITU-T Recommendation Q.850: " Usage of cause and location in the Digital Subscriber Signalling System No. 1 and the Signalling System No. 7 ISDN User Part".

[11] ETSI EG 201 769: " Speech Processing, Transmission and Quality Aspects (STQ); QoS parameter definitions and measurements; Parameters for voice telephony service required under the ONP Voice Telephony Directive 98/10/EC".

3 Definitions and abbreviations

3.1 Definitions

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

carrier selection: process by which a customer can select the carrier to be used for the conveyance of a call beyond the access network

NOTE: There are two types of carrier selection:

- pre-selection, where the customer's selection is stored in the local switch;
- call-by-call, where the customer indicates, normally by a prefix, which carrier is to be used.

customer: party that pays for the telecommunication service(s) provided

NOTE: Customers can generally be categorized as business or residential; the definition of business and residential customers is left to individual service providers. Service providers who receive interconnect services from other service providers are not considered to be customers for the purpose of the present document. The term "customer" is equivalent to "subscriber", which is used in Directive 98/10/EC [5]. "Customer" is the more modern term.

direct service: service where the service provider that provides the telecommunication service(s) also provides the access network or rents an unswitched local loop (unbundled local loop) to use for the provision of the service to the customer

donor operator: in operator number portability, the operator who loses the customer and transfers the customer E.164 number to the operator who gains the customer

E1 interconnection circuit: E1 transmission link between two adjacent switching equipments that crosses the Point of Interconnection

NOTE: The link includes the interface ports on the switches and the path through all intermediate transmission equipment, cables and any radio transmitting or receiving equipment.

half E1 interconnection circuit: part of an E1 interconnection circuit that extends from one end to the point of interconnection

indirect service: service where the service provider that provides the telecommunication service(s) does not provide the access network but is selected by the customer or user using a form of carrier selection

interconnection circuit group: all the circuits that carry the same type of traffic in the same direction (e.g. call delivery or call collection) between the same two switches

interconnection link: transmission path across the Point of Interconnection between the transmission equipments nearest to the Point of Interconnection

NOTE: This is intended to be the path that supports the highest transmission rate at the PoI.

interconnection exchange: any exchange that can send calls directly to or receive calls directly from a Point of Interconnection, where 'direct' means without the calls passing through another exchange

NOTE: Within a requesting or providing operator's network, more than one interconnection exchange may be connected to a particular point of Interconnection.

network operator: organization that provides a network for the provision of a public telecommunication service. If the same organization also offers services it also becomes a service provider

network termination point: physical point at which a user is provided with access to a public telecommunications network

NOTE: The locations of network termination points shall be defined by the national regulatory authority and shall represent a boundary, for regulatory purposes, of the public telecommunications network; (copied from Directive 97/51/EC [2] which amended the original ONP Directive 90/387/EEC)

Point of Interconnection: physical point at which two networks are interconnected

NOTE 1: Although this term appears to be simple and precise it has to be applied to various different practical situations and it is very difficult to establish clear rules for how to apply it in all cases. Normally

- for Co-location, there is one Point of Interconnection for each operator who requests co-location at the site of another operator;
- for In Span Interconnection, there is one Point of Interconnection for each cable that is joined;
- for Customer Sited Interconnection, there is one Point of Interconnection for each site to which another operator brings their cable or cables.

NOTE 2: There are examples in clause 4.6.

ported number: subscriber number (directory number) where the location of the NTP and/or the identity of the service provider has changed after the number was originally allocated

providing operator: operator who responds to a request for call delivery or call collection

Quality of Service: collective effect of service performance which determines the degree of satisfaction of a user of the service

NOTE: Taken from ITU-T Recommendation E.800 [3].

requesting operator: operator who requests call delivery or call collection

service provider: organization that offers a telecommunication service to the customer and/or user

NOTE 1: A service provider need not be a network operator.

NOTE 2: A service provider that is subject to the requirements of the ONP Voice Telephony Directive will in most cases also be a network operator.

user: individuals, including consumers, or organizations using or requesting publicly available telecommunications services

NOTE: Copied from Directive 98/10/EC [5].

3.2 Abbreviations

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

ISDN	Integrated Services Digital Network
LTE	Line Terminating Equipment
NTP	Network Termination Point
ONP	Open Network Provision

PDH	Plesiochronous Digital Hierarchy
PoI	Point of Interconnection
QoS	Quality of Service
SDH	Synchronous Digital Hierarchy

4 General considerations

4.1 Services covered

The Quality of Service parameters apply for any services provided over digital circuit switched connections, including:

- fixed to fixed;
- fixed to mobile;
- mobile to mobile;
- all forms of services with special user tariff arrangements such as freephone, shared cost and premium rate.

Interconnection agreements may include scope for the provision of higher levels of quality for higher charges such as faster provision of additional interconnection circuits. Where a significant proportion of the interconnection services are provided under such arrangements it may be appropriate to collect statistics separately for the basic and higher quality services.

4.2 Components of an interconnection service

Interconnection is regarded as a service that is provided by a "providing" operator to a "requesting" operator with a quality that can be defined in terms of the parameters in the present document.

There are several different components of an interconnection service. They include:

- provision of the interconnection link;
- provision of E1 interconnection circuits on an interconnection link;
- delivery of calls, i.e. handover of calls where an operator is unable to carry the call further;
- collection of carrier-selection calls, i.e. handover in accordance with the caller's choice of service provider;
- support of number portability.

For each component service, the operators are identified as either "requesting" or "providing". An interconnection service is provided by a providing operator to a requesting operator. However in many cases, interconnection normally involves the mutual provision of service between two operators and an individual operator may be a requesting operator for interconnection circuits for traffic in one direction and a providing operator for interconnection circuits for traffic in the other direction. Figure 1 shows an example of an interconnection for call delivery. The same interconnection link may be used for both categories of circuit and in this case the interconnection link may be ordered (requested) by either operator.

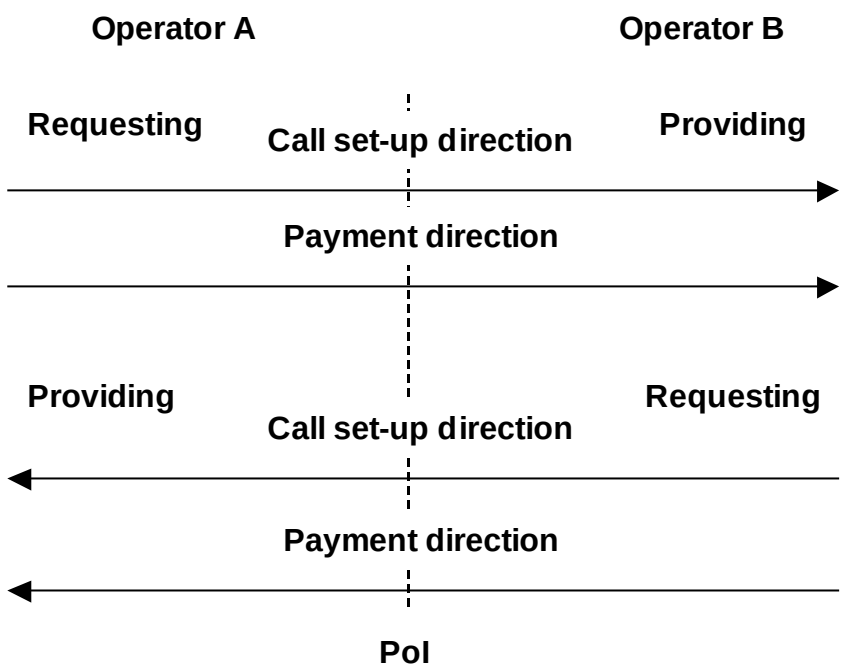


Figure 1: Operator roles in call delivery

Figure 2 shows responsibilities for call collection for carrier selection and pre-selection traffic. In this case the interconnection link would be ordered (requested) by Operator B and Operator A would collect the calls and hand them to Operator B. Also the direction of payment is opposite to the call set-up direction.

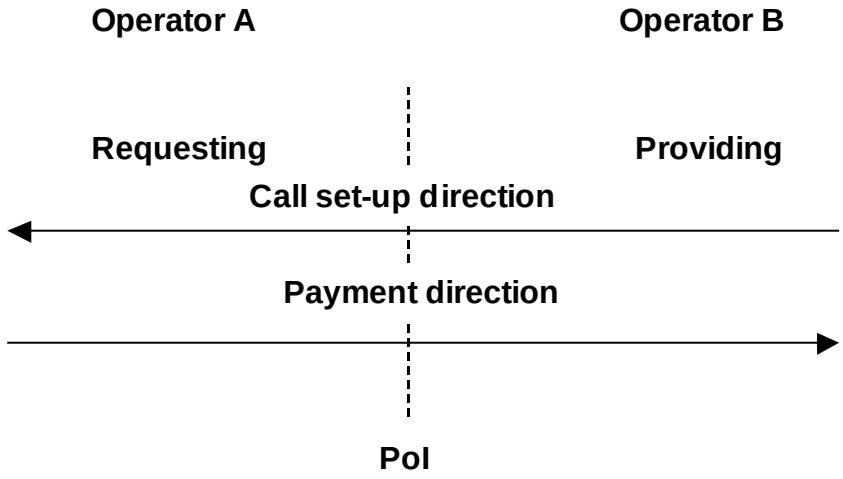


Figure 2: Operator roles in carrier selection call collection

The concepts of the requesting and providing operator may be difficult to understand, but they are the inevitable consequence of regarding the provision of interconnection as a service. The requesting operator asks for the service that is provided by the providing operator. The provision of this service has a quality that can be measured in terms of the parameters in the present document.

In practice during the early stages of the introduction of competition and the development of interconnection arrangements, the concepts of requesting and providing operator may not relate easily to the practical issues for a new entrant who has to establish interconnection with an incumbent. The difficulty arises over call delivery because in practice the new entrant may have to request interconnection for incoming calls that do not involve carrier selection as well as for outgoing calls. This is because the new entrant may have a much stronger motivation to ensure the delivery of incoming calls to their few but highly valued customers than the incumbent has to deliver all outgoing calls for all its many customers. This is a result of the relative size of the two operators distorting their perspective on the duty to ensure that all outgoing calls are delivered.

There is a different payment arrangement in Germany where the incumbent collects payment for carrier selected calls and passes the payment to the indirect operator. The diagrams above do not apply to this arrangement.

4.3 Forms of interconnection

The Quality of Service parameters in the present document apply where the form of interconnection uses PDH or SDH transmission provided over optical, radio or electrical transmission media.

The parameters define performance at various levels:

- switched services;
- physical interconnection;
- operational and administrative procedures.

Interconnection may be made by any of the following three methods:

- customer sited interconnection, where the providing operator provides cables or radio links to the premises of the requesting operator and terminates these cables on its own transmission equipment;
- co-location, where the requesting operator provides cables or radio links and its own transmission equipment on the premises of the providing operator;
- in-span interconnection, where compatible cables are joined at a location between the premises of the requesting and providing operators, or where the each operator uses its own compatible radio equipment.

These three forms of interconnection are shown in figure 3, including the limit of the interconnection link itself and the location of the point of Interconnection. The figure shows interconnection by cable, but radio may also be used in which case the Line Terminating Equipment (LTE) would be replaced by a radio transmitter/receiver.

The parameters apply for all these forms of interconnection, but the performance measured may be influenced by the form of interconnection.

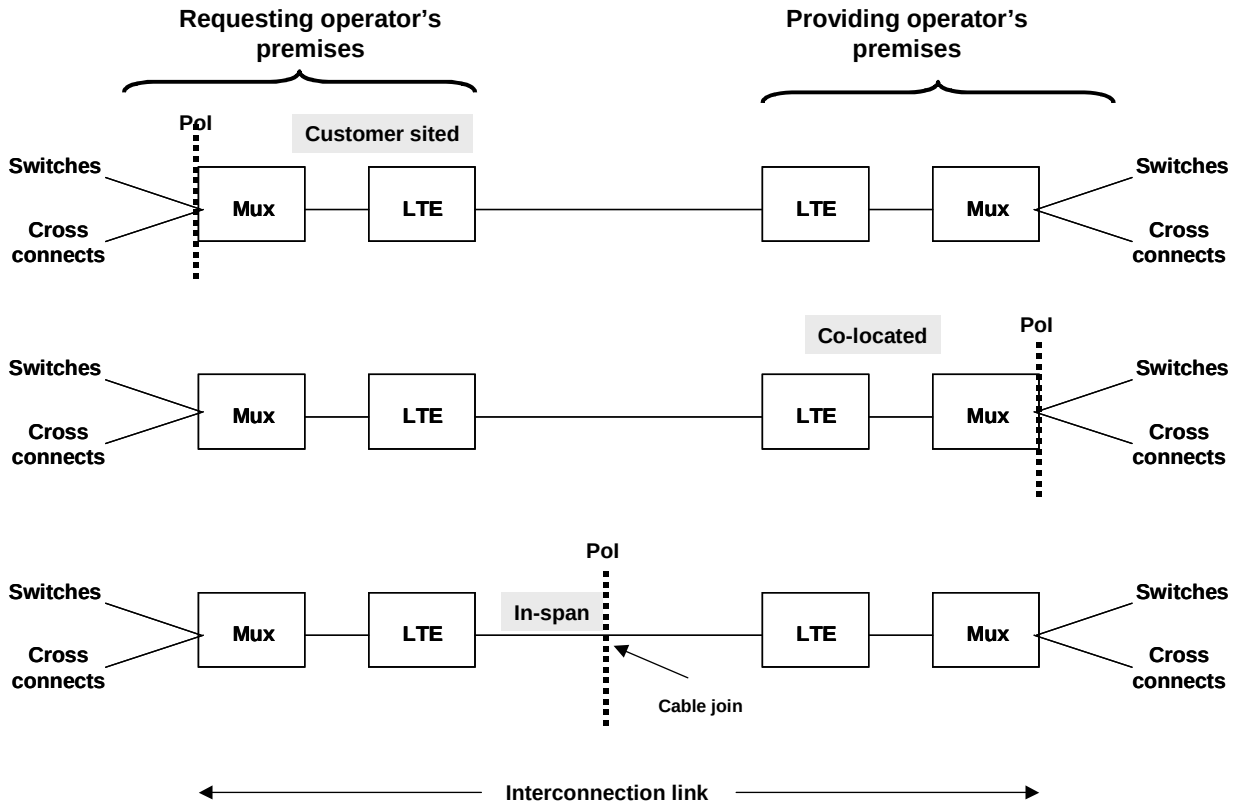


Figure 3: Forms of interconnection

4.4 Interconnection links and circuits

An interconnection link is defined as the transmission path across the PoI between the transmission equipments nearest to the PoI.

NOTE: This is intended to be the path that supports the highest transmission rate at the PoI.

An E1 interconnection circuit is an E1 transmission path across the PoI between two interconnected switches including the E1 switch ports. This term is used only for interconnection that supports switched services.

Figure 4 shows an interconnection link.

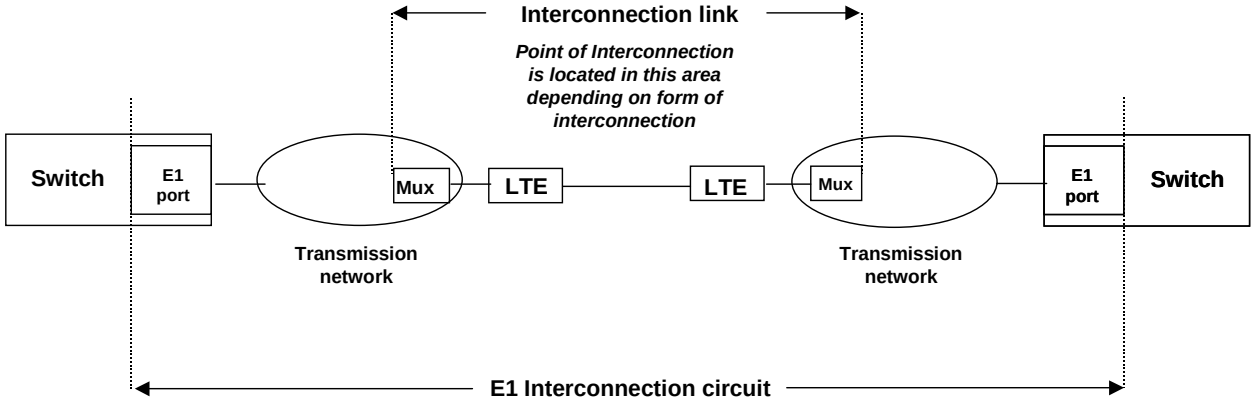


Figure 4: Interconnection link and E1 interconnection circuit

The total number of E1 Interconnection circuits may be less than the capacity of the Interconnection link.

4.5 Responsibility for call delivery and origination

Call delivery and origination interconnection services apply from the point of Interconnection to the distant Network Termination Point. The path from the point of Interconnection to the Network Termination Point may go beyond the network of the providing operator, however the providing operator is responsible for the service on the part of the path for which it collects a charge service. This path would normally extend right up to the NTP. To fulfil this responsibility, the providing operator would normally need to include QoS requirements in the interconnection agreements with other operators.

Figure 5 illustrates the provision of a call delivery interconnection service.

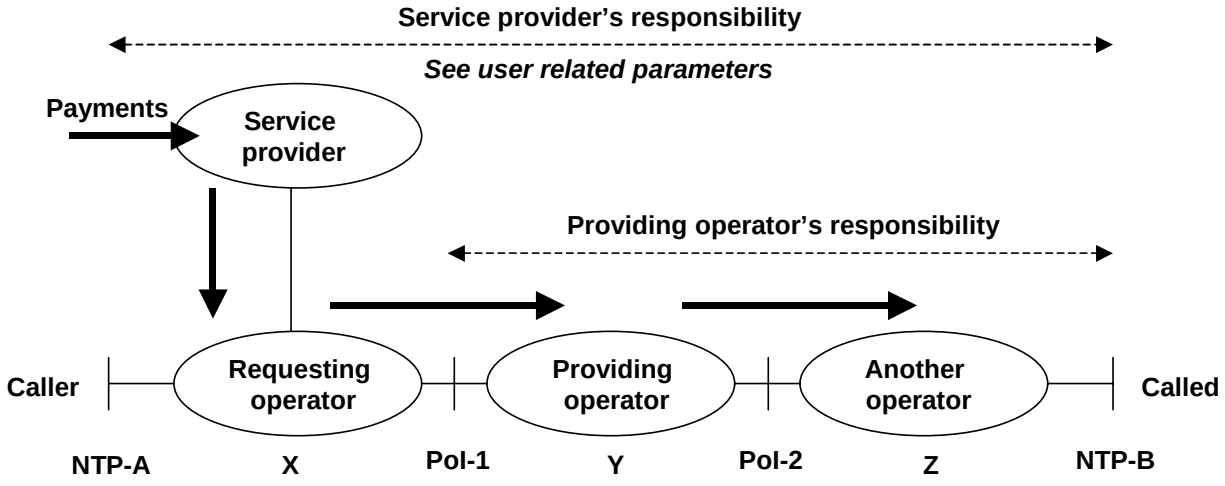


Figure 5: Example of responsibilities for call delivery

The service provider has responsibility for the call from NTP-A to NTP-B because it takes payment for this section of the overall call path. Operator X has responsibility to the service provider for the same NTP-NTP segment.

Operator Y provides the call delivery to operator X at PoI-1 and has responsibility for the segment from PoI-1 to NTP-B. However operator Y needs to obtain call delivery from operator Z and so is also the requesting operator for the interconnection service at PoI-2, for which Z is the providing operator. The roles of requesting and providing for PoI-2 are not shown in the diagram.

Figure 6 illustrates the provision of a call collection interconnection service, where the customer pays the service provider for the whole call.

NOTE 1: Germany has different arrangements for payment with carrier selection.

NOTE 2: There is a different arrangement for payment carrier selection in Germany where the incumbent collects payments for carrier selection in a first step and passes the payment to the indirect operator. DT is not responsible for end users refusing to pay there bill of any indirect operator.

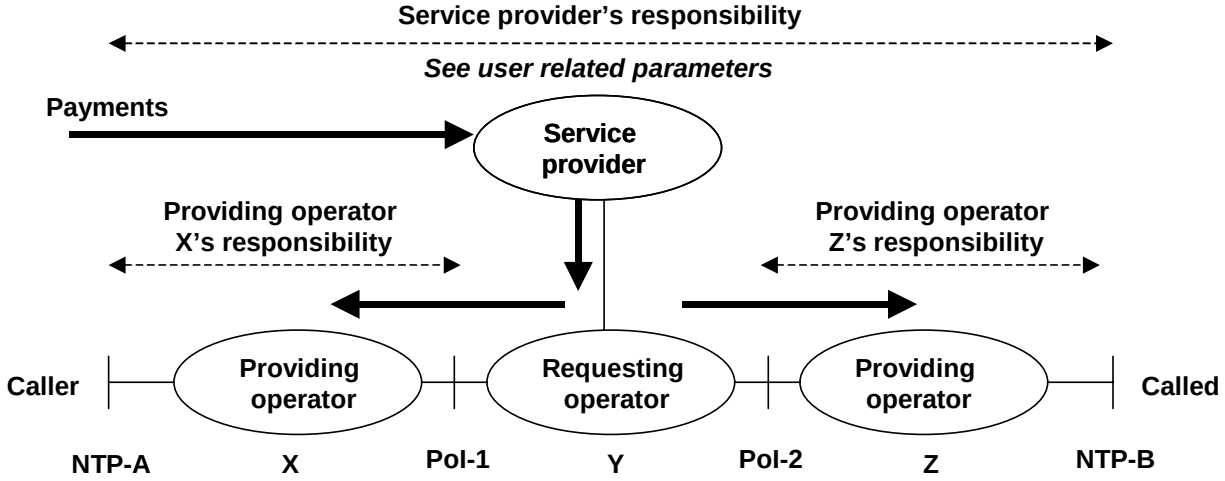


Figure 6: Example of responsibilities for call collection

In this case Operator Y has responsibility from NTP-A to NTP-B. Operator X is paid by operator Y and is the providing operator for the call collection service.

Operator Z is the providing operator for the call delivery at the distant end.

4.6 Practical examples

Figure 7 shows a practical example of a new entrant connected to an incumbent with In Span Interconnection.

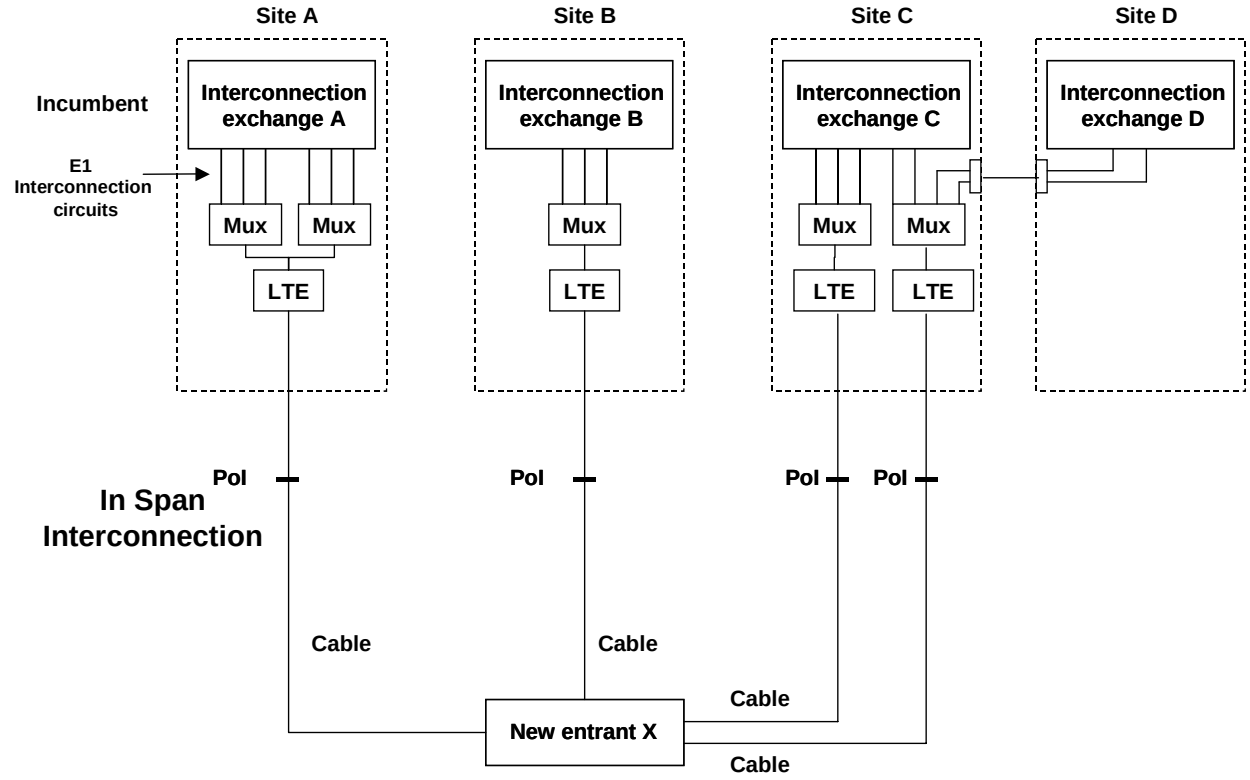


Figure 7: Example of In Span Interconnection

There is one point of interconnection to Sites A and B and two to Site C, because two cables are interconnected. Some of the E1 interconnection circuits at Site C are terminated on an exchange at Site D after passing through a further cable provided by the incumbent.

Figure 8 shows a practical example of a new entrant connected to an incumbent with Co-location Interconnection.

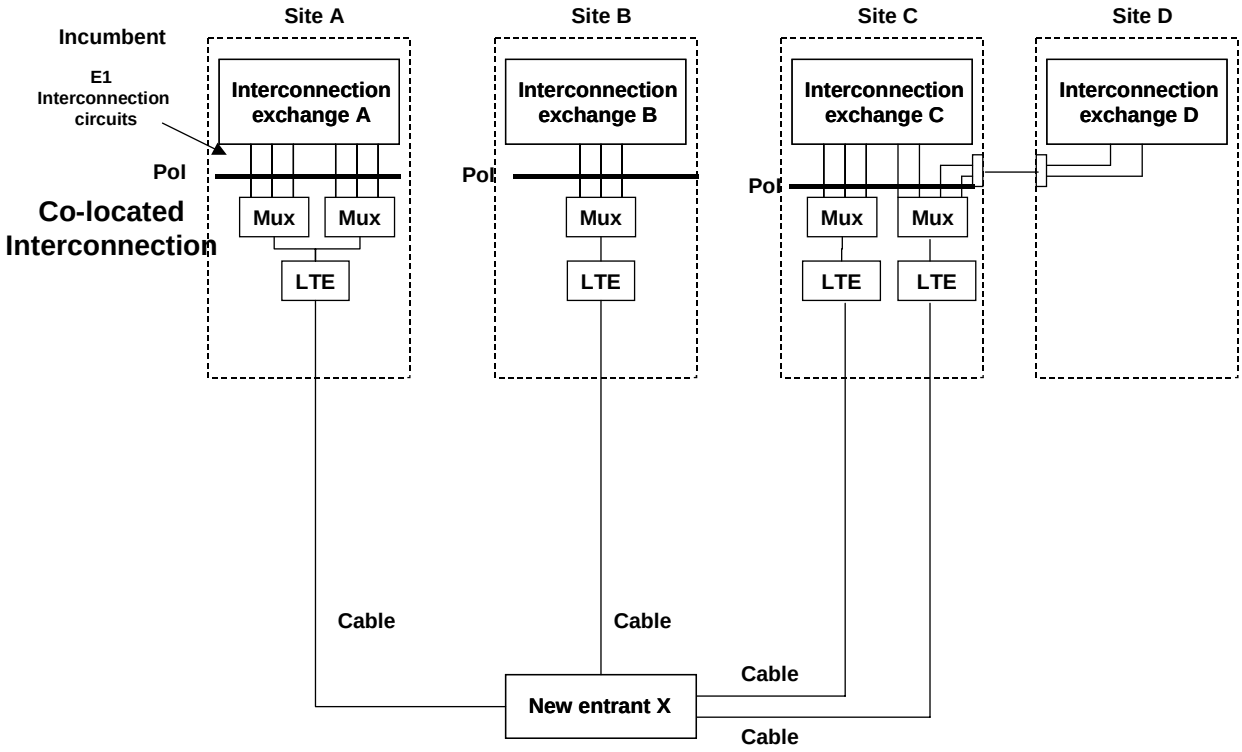


Figure 8: Example of Co-location Interconnection

With this form of interconnection, there is one point of interconnection to Sites A, B and C, because each site counts as a Point of Interconnection. Again, some of the E1 interconnection circuits at Site C are terminated on a switch an exchange at Site D after passing through a further cable provided by the incumbent.

4.7 Reporting

The present documenting procedures and frequency are a matter for agreement between the operators concerned. They are outside the scope of the present document. However it is recommended that reference is made to ITU-T Recommendation E.801 [9] which specifies typical procedures and reporting processes.

The parameters have been formulated for reporting by the providing operator, and are designed to be used either for

- the interconnection services provided to one particular requesting operator; or
- the aggregate performance provided to all interconnecting operators.

The first case could be used in interconnection agreements, the second in monitoring by a national regulatory authority. The basis of self reporting has been chosen because it best provides for reporting to meet regulatory requirements and can be strengthened by auditing and random inspections.

Despite the design for self reporting, some parameters may also be compatible with measurement by the requesting operator, or an independent third party.

4.8 Data processing issues

Providing operators may prefer to process data on a weekly or monthly basis, discard the detailed data and use a statistical method such as that specified in annex A and B for combining the weekly or monthly results.

For several parameters the statistic required is "the time by which the fastest X % is .....". This statistic is explained in annex B.

Providing operators should agree with other relevant parties how instances of data loss, corruption or incompleteness should be handled.

5 QoS parameters for interconnection

Table 1 summarizes the QoS parameters in this section.

Unless otherwise stated, all statistics should be provided by the providing operator of the relevant interconnection service.

Table 1:Summary of narrowband interconnection QoS Parameters

Parameter	Measure
5.1 Supply time for initial physical interconnection at a site	Individual results for each combination of operator and site, or Times fastest 90 %, or % by agreed date
5.2 Supply time of additional E1circuits on an established interconnection link	Times fastest 90 %, or % by agreed date
5.3 Supply time for a call by call carrier selection facility to another operator	Times fastest 90 %, or % by agreed date
5.4 Supply time for a carrier pre-selection facility to another operator	Times fastest 90 %, or % by agreed date
5.5 Supply time for handling customer originated carrier pre-selection requests from another operator	Times fastest 90 %
5.6 Availability of E1 interconnection circuits	Average for all links
5.7 Fault rate per E1 interconnection circuits	Average for all links
5.8 Fault repair time on E1 interconnection circuits	Times for fastest 80 % and 95 % on interconnection links Percentage of faults cleared by agreed time
NOTE: Many of the parameters have several subtleties associated with their definition, applicability and measurement. The parameters are fully explained in clause 5.	

Several of the parameters and statistics refer to "agreed dates". These are normally the supply dates agreed between the operators on a voluntary basis. Where there is a regulatory requirement to supply a service within a specific period there may be no negotiation of an "agreed date" and is this case the date required by regulation should be taken as the agreed date. The existence of regulatory requirements may affect performance and comparability.

5.1 Supply time for initial physical interconnection at a site

5.1.1 Definition

The duration from the instant of a valid order being received by the providing operator to the instant when the interconnection is made available to the requesting operator for operational traffic. (i.e. the time when half E1 interconnection circuits can be ordered, see clause 5.2).

NOTE: This is primarily the provision of the interconnection link and the establishment of procedures for ordering E1 interconnection circuits.

A valid order may be made in writing or in any other mutually agreed form.

In the case of co-location and customer sited interconnection, each cable shall count as one interconnection, irrespective of the number of circuits activated.

In the case of in-span interconnection, each interconnected cable shall count as one interconnection, irrespective of the number of fibres interconnected or circuits activated.

In the case of interconnection by radio, each interconnected pair of sites shall count as one interconnection, irrespective of the number of frequency channels or circuits activated.

5.1.2 Measurement and statistics

The following statistics may be provided:

a) individual results for each combination of operator and site;

and/or

b) the times by which the fastest 90 % of interconnections are made available;

and/or

c) percentage of interconnections completed by the date agreed with the requesting operator.

The time should be measured in elapsed days (including all public holidays etc).

Network operators may exclude cases where delays to provision are requested by the requesting operator and cases where supply is requested on a specific date later than the standard supply time.

Network operators may exclude cases where essential access to premises is not provided by the requesting operator on the agreed date and time.

5.1.3 Comparability

In general the supply time for initial set up does not provide good comparability because it may be influenced by delays that are outside the responsibility of the providing operator (e.g. times for permits, approvals by authorities, delays caused by the requesting operator). In case the agreed date of a valid order for an initial interconnection can not be met by the providing operator, because of delays caused by the requesting operator:

- a new date could be agreed. This case should count as completed by agreed date, if this new agreed date is met;
- the providing operator may subtract the delay time caused by the requesting operator from the supply time for initial set up;
- the providing operator may exclude from figures under a) and b) the cases where delays to provision are requested by the requesting operator.

The exclusion of above mentioned cases or delay times may have major impact on comparability of statistics. Therefore, if figures are compared, operators should agree on how the cases delayed by the requesting operators are handled.

Taking into account the above recommendations, the figures according to b) provide measures that can be compared between operators in the same or different countries. Because the measure under b) does not indicate the statistical spread of performance, operators may wish to calculate additional values such as the time for the fastest 50 %, or 80 % to provide a more comprehensive picture of performance. A general comparison between operators should be based on as many sites as possible.

Figures under c) provide a measure that is useful to judge the fulfilment of contracts and can also be compared between operators in the same or different countries. Such comparisons should be based on as many sites as possible.

5.2 Supply time of E1 Interconnection circuits on an established interconnection link

5.2.1 Definition

The duration from the instant of a valid order being received by the providing operator to the instant when the additional E1 Interconnection circuits are made available to the requesting operator for operational traffic.

A valid order may be made in writing or in any other mutually agreed form.

NOTE: Circuits may be ordered and made available a long time before they are used for traffic.

5.2.2 Measurement and statistics

The statistics shall be measured in terms of orders rather than circuits.

The following statistics may be provided:

a) the times by which the fastest 90 % of orders for additional capacity are made completed;

and/or

b) percentage of orders completed by the date agreed with the requesting operator.

The time should be measured in elapsed days (including all public holidays, etc.).

Operators may exclude cases where delays to provision are requested by the requesting operator.

These statistics may be provided either separately for each site and each requesting operator, or may be aggregated across sites and/or requesting operators.

5.2.3 Comparability

In general the supply time for individual E1 interconnection circuits at a site where interconnection has been set up does not provide good comparability because it may be influenced by delays that are outside the responsibility of the providing operator (e.g. delays caused by the requesting operator). In case the agreed date of a valid order can not be met by the providing operator, because of delays caused by the requesting operator:

- a new date could be agreed. This case should count as completed by agreed date, if this new agreed date is met;
- the providing operator may subtract the delay time caused by the requesting operator from the total delay time;
- the providing operator may exclude from figures under a) the cases where delays to provision are requested by the requesting operator.

The exclusion of above mentioned cases or delay times may have major impact on comparability of statistics. Therefore, if figures are compared, operators should agree on the methods how cases delayed by the requesting operators are handled.

Taking into account the above recommendations, the figures according to a) provide measures that can be compared between operators in the same or different countries. Because the measure under a) does not indicate the statistical spread of performance, operators may wish to calculate additional values such as the time for the fastest 50 %, or 80 % to provide a more comprehensive picture of performance. A general comparison between operators should be based on as many sites as possible.

Figures under b) provide a measure that is useful to judge the fulfilment of contracts and can also be compared between operators in the same or different countries. Such comparisons should be based on as many sites as possible.

5.2.4 Further considerations

The supply of capacity may be a complex process consisting of forecasting 2-3 years ahead with regular updates to the forecasts. This parameter applies only to firm orders, i.e. orders that are associated with a financial commitment, and excludes forecasting.

In some cases, an obligation to supply may apply only where the order is related to previous forecasts, and there is no obligation to supply capacity outside the limits forecast plus some margin of tolerance. In this case it is recommended that:

- all orders, irrespective of their relationship to forecasting, should be measured in order to obtain information on the actual supply times being achieved;
- if individual results are used, they should be marked as inside or outside the limits allowed by forecasting;
- if statistics are used, separate figures should be calculated for orders inside or outside the limits allowed by forecasting.

An order that takes capacity from below the limit allowed by forecasting to a level above that limit should be treated as two separate orders, one wholly within and the other wholly outside the limit

5.3 Supply time for a call by call carrier selection facility to another operator

5.3.1 Definition

The duration from the instant of a valid order being received by the providing operator to the instant when the carrier selection facility is available for operational traffic.

A valid order may be made in writing or in any other mutually agreed form.

NOTE: A carrier selection facility may be ordered and made available before the carrier selection service is offered to customers.

5.3.2 Measurement and statistics

The statistics shall be measured in terms of local exchanges from which carrier selection can be used.

The following statistics may be provided:

a) the times by which the fastest 90 % of local exchanges are made ready for carrier selection;

and/or

b) percentage of local exchanges where carrier selection is made available by the date agreed with the requesting operator.

The time should be measured in elapsed days (including all public holidays etc).

Operators may exclude cases where delays to provision are requested by the requesting operator.

5.3.3 Comparability

Carrier selection may only be offered by one or a few operators in any given country and so comparability at the national level may not be relevant. Comparability between operators in different countries could be good but could be affected by differences in national arrangements.

5.4 Supply time for a carrier pre-selection facility to another operator

5.4.1 Definition

The duration from the instant of a valid order being received by the providing operator to the instant when the carrier pre-selection facility is available for operational traffic.

A valid order may be made in writing or in any other mutually agreed form.

NOTE: A carrier pre-selection facility may be ordered and made available before it is offered to customers.

5.4.2 Measurement and statistics

The statistics shall be measured in terms of local exchanges from which carrier selection can be used.

The following statistics may be provided:

a) the times by which the fastest 90 % of local exchanges are made ready for carrier pre-selection;

and/or

b) percentage of local exchanges where carrier preselection is made available by the date agreed with the requesting operator.

The time should be measured in elapsed days (including all public holidays, etc.).

5.4.3 Comparability

In general the supply time for a carrier selection facility does not provide good comparability because it may be influenced by delays that are outside the responsibility of the providing operator (e.g. delays caused by the requesting operator). In case the agreed date of a valid order can not be met by the providing operator, because of delays caused by the requesting operator:

- a new date could be agreed. This case should count as completed by agreed date, if this new agreed date is met;
- the providing operator may subtract the delay time caused by the requesting operator from the total delay time;
- the providing operator may exclude from figures under a) the cases where delays to provision are requested by the requesting operator.

The exclusion of above mentioned cases or delay times may have major impact on comparability of statistics. Therefore, if figures are compared, operators should agree on the methods how cases delayed by the requesting operators are handled.

Taking into account the above recommendations, the figures according to a) provide measures that can be compared between operators in the same or different countries. Because the measure under a) does not indicate the statistical spread of performance, operators may wish to calculate additional values such as the time for the fastest 50 %, or 80 % to provide a more comprehensive picture of performance. A general comparison between operators should be based on as many sites as possible.

Figures under b) provide a measure that is useful to judge the fulfilment of contracts and can also be compared between operators in the same or different countries. Such comparisons should be based on as many sites as possible.

5.5 Supply time for handling customer originated carrier pre-selection requests from another operator

5.5.1 Definition

The duration from the instant of a valid order being received by the providing operator to the instant when the carrier pre-selection facility is enabled for operational traffic from the customer concerned.

A valid order may be made in writing or in any other mutually agreed form.

5.5.2 Measurement and statistics

The times by which the fastest 90 % of carrier pre-selection orders are completed may be provided.

The time should be measured in elapsed days (including all public holidays, etc.).

5.5.3 Comparability

In general the supply time for customer originated carrier pre-selection requests at a site where pre-selection has been set up does not provide good comparability because it may be influenced by delays that are outside the responsibility of the providing operator (e.g. delays caused by the requesting operator or his customer). In case the agreed date of a valid order can not be met by the providing operator, because of delays caused by the requesting operator:

- a new date could be agreed. This case should count as completed by agreed date, if this new agreed date is met;
- the providing operator may subtract the delay time caused by the requesting operator from the total delay time;
- the providing operator may exclude from figures under a) the cases where delays to provision are requested by the requesting operator.

The exclusion of above mentioned cases or delay times may have major impact on comparability of statistics. Therefore, if figures are compared, operators should agree on the methods how cases delayed by the requesting operators are handled.

Taking into account the above recommendations, the measure that can be compared between operators in the same or different countries. Because the measure does not indicate the statistical spread of performance, operators may wish to calculate additional values such as the time for the fastest 50 %, or 80 % to provide a more comprehensive picture of performance. A general comparison between operators should be based on as many sites as possible.

5.6 Availability of E1 interconnection circuits per interconnection link

5.6.1 Definition

The proportion of time that the provider's segment of an E1 interconnection circuit (i.e. the segment from the PoI to the providing operator's end) is available. The provider's segment is XY in figure 9.

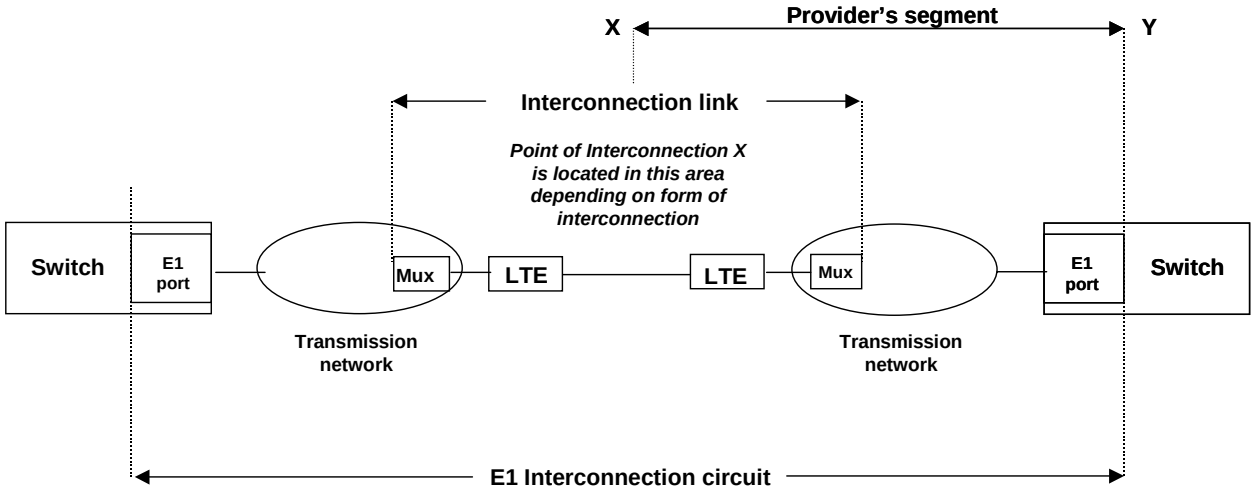


Figure 9: Interconnection link and E1 interconnection circuit

The provider's segment of an E1 interconnection circuit is considered to be available at all times except:

- periods when it is withdrawn from service by the providing operator;
- periods between the instant when a fault report is detected by either operator and the instant when the fault has been cleared.

5.6.2 Measurement and statistics

The average availability of the provider's segments of the E1 interconnection circuits should be provided.

This statistic should be calculated as:

$1 - t_{uch}/t_{ch}$

The total unavailable circuit hours t_{uch} are calculated according $t_{uch} = \sum_{i=1}^{n} t_{ui}$, with

- n as the number of E1 interconnection circuits in operation in the data collection period at that specific interconnection link; and
- t_{ui} as the unavailable time for the i-th circuit in the data collection period.

The total circuit hours t_{ch} are calculated according $t_{ch} = \sum_{i=1}^{n} t_i$.

Where the i-th circuit is intended to be in service for the whole data collection period, t_i will be the length of the data collection period.

Where the i-th circuit is brought into service or taken out of service during the data collection period, t_i will be the time from when the circuit is brought into service to the end of the data collection period, or the time from the start o f the data collection period to the time when the circuit is taken out of service, respectively.

This kind of averaging is necessary because the number of E1 interconnection circuits may vary during the data collection period.

Statistics should include all interconnection links operational in the data collection period. Where a providing operator provides different types of interconnection (customer sited, co-location and in-span interconnection), separate statistics should be provided for each type of interconnection.

5.6.3 Comparability

The above statistics provide good comparability between operators in the same or different countries. Such comparisons should be based on as many interconnection arrangements as possible.

5.7 Fault rate per E1 interconnection circuit

5.7.1 Definition

A fault is an instance of abnormal operation on an E1 interconnection circuit. Abnormal operation includes both total failure and operational performance below the level specified in the interconnection agreement.

NOTE: For these interconnection parameters, faults are defined in terms of achieved performance because it is likely that there the links will be monitored continuously by network management functions. In contrast, for user related parameters where most faults are likely to occur on unmonitored access lines, faults are defined in terms of fault reports.

Where a fault affects "n" E1 interconnection circuits, it should count as "n" faults.

5.7.2 Measurement and statistics

The number of faults occurring on the provider's segment of an half E1 interconnection circuit during the data collection period should be provided.

This statistic should be calculated by dividing the number of faults observed during the data collection period (see clause 4.6) by the average number of interconnection links in the network under consideration during the same data collection period. The averaging is necessary because the number of E1 interconnection circuits may vary during the data collection period.

Statistics should include all faults in the data collection period.

Where a providing operator provides different types of interconnection (customer sited, co-location and in-span interconnection), separate statistics should be provided for each type of interconnection.

5.7.3 Comparability

The above statistics provide good comparability between operators in the same or different countries. Such comparisons should be based on as many interconnection arrangements as possible.

5.8 Fault repair time for the E1 interconnection circuits

5.8.1 Definition

The duration from the instant when a fault is detected by the providing operator to the instant when the fault is cleared.

5.8.2 Measurement and statistics

The following statistics may be provided:

a) the time by which the fastest 80 % and 95 % of valid faults on the provider's segment of an E1 interconnection circuit are repaired (expressed in clock hours);

and/or

b) the percentage of faults cleared by any time stated as an objective by the service provider.

5.8.3 Comparability

In general the fault repair time does not provide good comparability because it may be influenced by delays that are caused by the requesting operator.

Cases where:

- repair depends upon access to the premises or co-location cages of the requesting operator and this access is not possible at the desired time; or

- the requesting operator requests a delay.

may be excluded from the statistics. When calculating the repair time, providing operators who choose to include these cases may subtract from the measured time the delay introduced by the requesting operator.

The exclusion of above mentioned cases or delay times may have major impact on comparability of statistics. Therefore, if figures are compared, operators should agree on the methods how cases delayed by the requesting operators are handled.

Taking into account the above recommendations, the figures according to a) provide measures that can be compared between operators in the same or different countries. Because the measure under a) does not indicate the statistical spread of performance, operators may wish to calculate additional values such as the time for the fastest 50 %, or 80 % to provide a more comprehensive picture of performance. A general comparison between operators should be based on as many sites as possible.

Figures under b) provide a measure that is useful to judge the fulfilment of contracts and can also be compared between operators in the same or different countries. Such comparisons should be based on as many sites as possible.

5.8.4 Further considerations

Cases where:

- repair depends upon access to the premises of the requesting operator and this access is not possible at the desired time; or
- the requesting operator requests a delay

may be excluded from the statistics. When calculating the repair time, providing operators who choose to include these cases may subtract from the measured time the delay introduced by the customer.

6 QoS parameters for call delivery and collection

Table 2 summarizes the QoS parameters in this section.

Table 2: Summary of QoS Parameters for call delivery and collection

Parameter	Measure
6.1 Unsuccessful call ratio for call delivery (termination) applies from provider switch to end of call	% of unsuccessful calls
6.2 Unsuccessful call ratio for call collection with carrier selection	% of unsuccessful calls
6.3 Blocking at Busy Hour on the interconnection circuit groups	Probability of a call being lost during the busy hour

6.1 Unsuccessful call ratio for call delivery

6.1.1 Definition

Unsuccessful call ratio for call delivery is defined as the ratio of unsuccessful call delivery attempts to the total number of call delivery attempts in a specified time period.

An unsuccessful call delivery attempt is a call delivery attempt to a valid number measured at the point of Interconnection, that is deemed a failure by the algorithm in annex E.

NOTE: A call may be unsuccessful due to blocking because of inadequate dimensioning of the terminating network.

6.1.2 Measurement and statistics

The following statistics should be provided separately for each interconnection exchange:

- the percentage of unsuccessful calls measured at each interconnection exchange to numbers that require the call to pass though the interconnection point.

The statistics should be calculated from:

- measurements on all real traffic; or
- measurements on real traffic for calls incoming to the providing operator in an agreed set of interconnection exchanges to a representative set of destinations; or
- test calls to an agreed set of interconnection exchanges to a representative set of destinations; or
- a combination of the above.

NOTE 1: These alternative methods each have different advantages and disadvantages. The use of test calls is expensive and provides only an estimate of the actual performance but one can be sure that a call is successful if a message from the (well-known) far end is received at the access line side of the local exchange. Observations performed on real traffic at the interconnection exchange processor are cheaper and more data can be obtained giving more accurate estimates, but one can not be sure that the data one derive from the signalling (e.g. cause) is correct.

The parties involved should agree on either the accuracy (statistical interval) that should be achieved or the number of measurements to be used.

Annex C gives information on how to calculate the number of measurements needed to achieve a specific level of accuracy with 95 % confidence. Measurements should then be scheduled so as to reflect accurately traffic variations over different services, the hours of a day, the days of the week, the months of the year.

The number of observations should be stated together with the unsuccessful call ratio measured.

Notwithstanding the accuracy objectives given above, the number of test calls should not exceed 1 in 1 000.

NOTE 2: The requesting operator may have to pay the providing operator to make measurements or special test calls from the local exchange.

NOTE 3: Care should be taken not to degrade the customer's service by making an excessive number of test calls in periods of high traffic levels.

NOTE 4: No intrusive measurements should be made by the access network operator without the agreement of the indirect service provider.

6.1.3 Comparability

The above statistics provide good comparability between operators in the same or different countries. Such comparisons should be based on as many sites as possible.

6.2 Unsuccessful call ratio with carrier selection

6.2.1 Definition

Unsuccessful call ratio for call collection is defined as the ratio of unsuccessful calls to the total number of call attempts in a specified time period.

An unsuccessful call is a call attempt to a valid number, properly dialled following dial tone, where either:

- the call is deemed a failure according to the criteria of annex E; or
- neither called party busy tone, nor ringing tone, nor answer signal, is recognized on the access line of the calling user within 30 seconds from the instant when the address information required for setting up a call is received by the network.

NOTE: A call may be unsuccessful due to blocking because of inadequate dimensioning of the originating network.

6.2.2 Measurement and statistics

The following statistics should be provided separately for an agreed set of local exchanges:

- the percentage of unsuccessful calls measured at an agreed set of local exchanges to numbers that will require the call to pass though the interconnection point.

The statistics should be calculated from:

- measurements on all real traffic; or
- measurements on real traffic for outgoing calls to points of interconnection from an agreed set of local exchanges; or
- test calls in a representative population of local exchanges; or
- a combination of the above.

NOTE 1: These alternative methods each have different advantages and disadvantages. The use of test calls is expensive and provides only an estimate of the actual performance but one can be sure that a call is successful if a message from the far end is received. Observations performed on real traffic at the exchange processor are cheaper and more data can be obtained giving more accurate estimates, but the data does not come from so close to the NTP.

The parties involved should agree on either the accuracy (statistical interval) that should be achieved or the number of measurements to be used.

Annex C gives information on how to calculate the number of measurements needed to achieve a specific level of accuracy with 95 % confidence. Measurements should then be scheduled so as to reflect accurately traffic variations over different services, the hours of a day, the days of the week, the months of the year.

The number of observations should be stated together with the unsuccessful call ratio measured.

Notwithstanding the accuracy objectives given above, the number of test calls should not exceed 1 in 1 000.

NOTE 2: The requesting operator may have to pay the providing operator to make measurements or special test calls from the local exchange.

NOTE 3: Care should be taken not to degrade the customer's service by making an excessive number of test calls in periods of high traffic levels.

NOTE 4: No intrusive measurements should be made by the access network operator without the agreement of the indirect service provider.

NOTE 5: The performance measured will be a combination of the performance of the networks of the requesting and providing operators. If there is a high ratio of unsuccessful calls, the requesting operator should compare the performance with measurements made from its side of the interconnection point to check which side of the interconnection point is contributing most to the poor performance.

6.2.3 Comparability

The above statistics provide good comparability between operators in the same or different countries. Such comparisons should be based on as many sites as possible.

6.3 Blocking at Busy Hour on the interconnection circuit groups

6.3.1 Definition

The probability during the busy hour of a call of a particular interconnection circuit group being lost because the interconnection circuits are full.

An interconnection circuit group is all the channels that carry the same type of traffic in the same direction (e.g. call delivery or call collection) between the same two switches.

It is assumed that the highest blocking appears at in the Busy Hour when the network resources have their highest load.

The Busy Hour is defined as the four consecutive quarters of an hour which have as a sum the highest traffic in a day.

NOTE 1: This parameter applies only to blocking on the interconnection circuits, i.e. on the circuits between the switches each side of the Point of Interconnection. The parameter may be more useful for call collection traffic as it provides an indication of the extent of lost traffic when the capacity of the interconnection link is not increased ahead of growth in demand.

NOTE 2: Congestion problems that may occur beyond the exchange at the end of the interconnection circuits is best measured by the unsuccessful call ratio.

6.3.2 Measures and Statistics

Measurements should be made separately for each traffic type (e.g. call collection and call delivery).

Blocking may be measured using data from the switches or by a calculation using the Erlang formula as explained below.

The traffic of a given type should be measured during the Busy Hour. The traffic in Erlangs is the sum of the total traffic seconds in the Busy Hour divided by 3 600. The blocking, B, is then given by Erlang's formula:

$$B = t^n / (n! \times (t^0/0! + t^1/1! + ... + t^n/n!))$$

Where:

- t is the traffic in Erlangs;
- n is the number of 64 kbit/s interconnection circuits in the interconnection group being measured.

NOTE: Erlang's formula applies only to a single circuit group and not to a series of separate circuit groups.

6.3.3 Comparability

The above statistics provide good comparability between operators in the same or different countries. Such comparisons should be based on as many sites as possible.

7 QoS parameters for other services

Table 3 summarizes the QoS parameters in this clause.

Unless otherwise stated, all statistics should be provided by the providing operator of the relevant interconnection service.

Table 3: Summary of QoS Parameters for other services

Parameter	Measure
7.1 Response time for answering fault reporting line	Mean time to answer % answered in 20 seconds
7.2 Billing queries	% of bills queried
7.3 Billing amendments	% of bills amended
7.4 Time to confirm that a number can or cannot be ported	Times for fastest 90 % % sent within agreed time

7.1 Response times for answering fault reporting line

7.1.1 Definition

The duration from the instant when the address information required for setting up a call is received by the network (e.g. recognized on the requesting provider's line) to the instant the human operator answers the calling party to provide the service requested. Services provided wholly automatically, e.g. by voice response systems, are excluded.

NOTE: The period in this definition includes waiting times because operators are busy, and times for going through voice response systems to reach the operator. However it excludes the handling of the call by the operator, e.g. conversation with the operator The reasons are that the variety of issues to be handled is too wide and that it is too difficult/costly in practice to measure the operator's performance precisely.

7.1.2 Measurement and statistics

The following statistics should be provided:

- mean time to answer; and
- percentage of calls answered within 20 seconds.

NOTE: The first statistic gives the more comparable measure of overall performance, and the second statistic indicates the proportion of calls where the waiting time is unacceptably long. The percentage of calls answered within 20 seconds was chosen rather than the time to answer the fastest 90 % because the calculation does not require large quantities of data to be stored.

Statistics should either

- include all calls to interconnection fault reporting lines in the data collection period; or
- be based on a representative sample, in which case the number of observations should be provided.

Annex D gives a formula for calculating the number of observations needed.

7.1.3 Comparability

In general this parameter does not provide good comparability because the access arrangements for call centres may be different between different operators.

7.2 Billing queries

7.2.1 Definition

The proportion of bills that are queried by the requesting operator.

7.2.2 Measurement and statistics

The percentage of bills that are queried should be provided. Statistics should include all billing queries received in the present documenting period, regardless of whether or not the bills are amended and regardless of the dates of calls or any other occurrences that are the subject of the queries.

NOTE: Where there are many billing queries that are caused by backdated changes to interconnection charges required by regulators, this parameter may not be worth using.

7.2.3 Comparability

In general this parameter does not provide good comparability because the billing arrangements may be different between different operators.

7.3 Billing amendments

7.3.1 Definition

The proportion of bills that are amended by the providing operator either on their own initiative or as a result of a billing query. Amendments that are caused solely by backdated changes to interconnection charges required by regulators are excluded.

NOTE: In some cases most billing amendments are caused by these backdated changes and in these cases this parameter may not be worth using.

7.3.2 Measurement and statistics

The percentage of bills that are amended should be provided.

Statistics should include all bills amended received in the present documenting period, regardless of the dates of calls or any other occurrences that are the subject of the amendments.

7.3.3 Comparability

In general this parameter provides good comparability.

7.4 Time to confirm that a number can or cannot be ported

7.4.1 Definition

The time from the donor operator receiving a request for a number to be ported to the time when confirmation is sent that the number can or cannot be ported.

7.4.2 Measurement and statistics

The following statistics may be provided:

a) the times by which the fastest 90 % of order confirmations are sent;

and/or

b) percentage of confirmations sent by within an agreed time window.

The time should be measured in elapsed hours (including nights, weekends and all public holidays etc).

7.4.3 Comparability

In general this parameter does not provide good comparability because the checks on whether a number can be ported may be different between different operators and may be subject to national regulatory requirements or codes.

Annex A:
Combination of weekly or monthly results

Mean values and percentages produced weekly or monthly may be aggregated into quarterly statistics using one of the following formulae:

a) For weekly statistics:

$$S_{quarterly} = (\sum N_i.S_i) / (\sum N_i) \text{ where } i = 1, 2...13$$

and

N_i = The number of events in each week.

S_i = The statistic for each week.

b) For monthly statistics:

$$S_{quarterly} = (\sum N_i.S_i) / (\sum N_i) \text{ where } i = 1, 2, 3$$

and

N_i = The number of events in each month.

S_i = The statistic for each week.

For aggregating the median or the 95 %-quartile into quarterly statistics, one has to apply the same procedure as explained in annex B.

Annex B:
Further explanation of "fastest X %"

Several parameters require a statistic of the form:

"the time by which the fastest X % of <relevant event>".

This annex explains what is meant.

The measurements give a list of times recorded for the events, for example a list of supply times. This list of times should be counted and sorted into ascending order.

X % of the total number of measurements counted should be calculated giving an number, say "n" which would be rounded down to the nearest integer.

The n'th time in the sorted ascending list will then be "the time by which the fastest X % of <relevant event>" occurred and is the statistic to be reported.

Annex C:
Relationship between the accuracy of the estimator of the unsuccessful call ratio and the number of calls to be observed

This annex explains that there is a four sided relationship between:

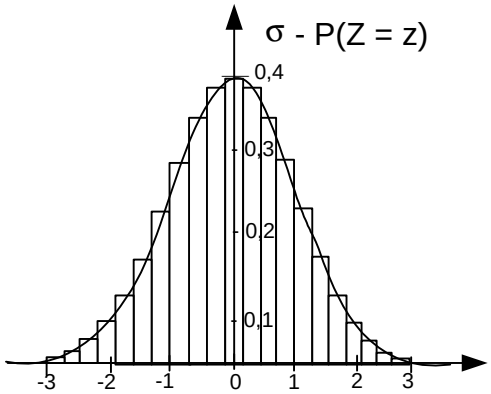
- the percentage of unsuccessful calls;
- the number of observations used in the measurements;
- the statistic interval (accuracy) required of measurements;
- the confidence level of that interval

and gives guidance on how operators should determine the number of observations that they need to make.

C.1 Theory

In general, any measurement can provide only an estimate of the quantity being measured. Therefore a measurement is performed several times to build up an average out of all the individual measurements. The measured values make up an interval and it is assumed that the real value μ - which is most probably neither the average nor any one of the measured values - lies inside this interval. In the following some mathematics is provided to show the relationship between

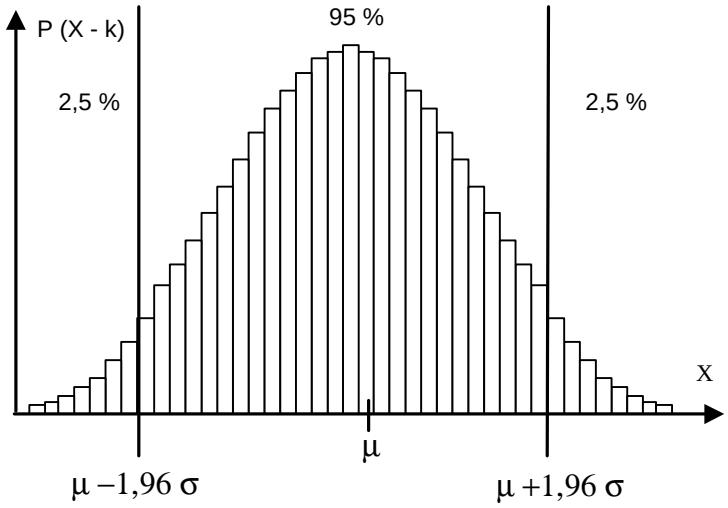
- the average of the measured quantity (in the case of the present document the quantity is the percentage of unsuccessful call ratio *p*;
- the number of measures;
- the statistic interval (later in this annex called accuracy); and
- the confidence (probability) that the real value lies inside the interval (95 % is assumed throughout this annex).



The starting point of the considerations is the assumption that the single measured values are distributed according a normal distribution around μ. This can be seen in a histogram (the pillars in the left picture). This assumption is correct for most natural processes, which are the result of a combination of individual more detailed processes.

If the number of values is sufficient (see Laplace criteria below) the pillars can be approximated by the Gaussian density distribution φ(z) – also called "Normal distribution". At the maximum of the function (at $z = 0$) lies μ. The values of the abcissa are the multiple of the standard deviation σ. The area beneath the graph can be interpreted as the totality of all possible (obtained by experiment) values, (i.e:

$$\int_{-\infty}^{\infty} \varphi(z)dz = 100\ \% \tag{1}$$



For a measurement according to the normal distribution it is known that 95 % of the measured values are lying in the interval [μ-1,96σ;μ + 1,96σ] around μ. This results, with formula (1), from:

$$\int_{\mu-k\sigma}^{\mu+k\sigma} \varphi(z)dz = 95\ \% \Rightarrow k = 1{,}96 \tag{2}$$

Now, one can easily say that the relative accuracy is $\Delta p / p$, and – looking at the diagram – it is 1,96 σ / μ.

NOTE: The unit of σ and μ is "number of unsuccessful calls".

This leads to:

$$\frac{1{,}96\sigma}{\mu} = \frac{\Delta p}{p} \tag{3}$$

By combining this equation (3) with the formulas $\mu = np$ and $\sigma^2 = np(1-p)$, which are valid since we assume that the binomial process can be approximated to a normal distribution, one obtains the absolute accuracy

$$\Delta p = 1{,}96\sqrt{\frac{p(1-p)}{n}} \tag{4}$$

which is the same formula as in annex C of EG 201 769 [11].

By dividing formula (4) by p one obtains the relative accuracy

$$\Delta p \Big/ p = 1{,}96\sqrt{\frac{(1-p)}{pn}} \tag{5}$$

Because of the approximation of the binomial by the normal distribution, the number of observations must be "large" which is defined by the Laplace criterion, $\sigma^2 > 9$. Therefore the number of observations, *n*, should always exceed 9 / (*p*(1-*p*)). These limits are given in table C.1.

Table C.1: Minimum number of observations, n, for proportions of unsuccessful calls, p

p	n >
0,5 %	1 809
1 %	909
2 %	459
4 %	234

C.2 Guidance

There is a trade-off between the accuracy (statistic interval) to be achieved and the number of observations needed and higher accuracy involves additional costs. The difficulty is that this trade-off itself depends on the percentage of unsuccessful calls that is being measured.

- For a given **relative** accuracy, **more** observations are needed when the percentage of unsuccessful calls is lower;
- for a given **absolute** accuracy, **fewer** observations are needed when the percentage of unsuccessful calls is lower.

When contracts for interconnection are prepared, the parties need to decide whether to specify:

- absolute accuracy;
- relative accuracy; or
- number of observations

and they also need to state that they are using 95 % confidence (or a different specified level).

Practices vary and relative accuracy is quite commonly used. However operators who are unfamiliar with statistics could be unaware of the implications in terms of numbers of observations and hence costs if they specify high accuracy and have good performance. Therefore it is recommended that either the number of observations should be specified in the contracts, or an upper limit to the number of measurements should be specified.

When making measurements to achieve a specific accuracy, operators should therefore proceed by first obtaining a rough estimate of the proportion of unsuccessful calls so that they can use this value to calculate the number of observations required for a given accuracy. This rough estimate can be obtained either by making some initial observations or by using past data.

For relative accuracy, a value of 10 % (= $\Delta p/p$ = 0,1). is commonly used This value leads, with equation (5), to the equation:

$$n = 384\left(\frac{1}{p} - 1\right) \qquad (6)$$

which can be used to calculate the number of observations needed. Some values calculated with this formula are given in table C.2.

Table C.2: Number of observations, *n*, for proportions of unsuccessful calls, *p*, for 10 % relative accuracy

p	N
0,5 %	76 416
1 %	38 016
2 %	18 816
4 %	9 216

Annex D:
Method of calculating the number of observations required for measures of time

The number of observations for quantitative variables depends on the variability of the measurements. It can be calculated by the formula

$$n = \frac{z_{1-\alpha/2}^2}{a^2} \times \left(\frac{s}{mean(x)} \right)^2$$

Where

$z_{1-\alpha/2}$: is the 1-α/2-percentile of the standard normal distribution

s: is the expected standard deviation of the call setup time (calculated from former measurements)

mean(x): is the expected mean value of the call setup time (calculated from former measurements)

a: is the relative accuracy

Even though there is no requirement to provide the standard deviation, an estimate should be available for use in this formula.

The following table gives the resulting values where:

$z_{1-\alpha/2}$ = 1,96 for a confidence level of 95 %

a = 2 %

s/mean(x)	observations
< 0,1	100
0,1 - 0,3	1 000
>0,3 - 0,5	2 500
>0,5 - 0,7	5 000
>0,7 - 0,9	7 500
> 0,9	10 000

Annex E:
Algorithm for decision about the success of a call attempt

Deciding whether a call attempt is successful or not is relatively easy for test calls made from a user's premises, because the equipment simulates a customer and therefore it can decide in a similar way (indicators are: answer from far end, busy or ringing tone).

In practise, the measurements are normally made by machines. For real traffic measured at exchanges, user tones are not available and another source of information is needed. This should be the Signalling System No. 7 between the switches. This annex defines a simple, but appropriate, form of an algorithm based on the information element Cause Value (see ITU-T Recommendation Q.850 [10]).

In principle, the Causes are not very reliable, because their setting (in the switches) in a living network may not be always correct. Normally they should be used as described in Q.850 [10] but it is in each operator's own responsibility. For these reasons, the proposed algorithm contains only a minimum set of Causes that are very frequently used. To make the algorithm more reliable the setting of the Cause can be part of a bilateral agreement.

The algorithm reads:

A call which ends with the Cause:

16 Normal call clearing; or

17 User busy; or

18 No user responding; or

19 No answer from user (user alerted)

should be add to the total number of call attempts.

A call which ends with the Cause:

34 No circuit/channel available; or

38 Network out of order; or

41 Temporary failure; or

42 Switching equipment congestion; or

44 Requested circuit/channel not available; or

46 Precedence call blocked; or

47 Resource unavailable; unspecified

should be add to the total number of call attempts and should be add to the total number of unsuccessful calls.

A call which ends with the Cause:

31 Normal, unspecified, and its duration is 1 second or longer

should be add to the total number of call attempts.

A call which ends with the Cause:

31 Normal, unspecified, and its duration is less than 1 second

should be add to the total number of call attempts and should be add to the total number of unsuccessful calls.

A call that ends with any other Cause should be ignored.

If any other Cause arise in a remarkable amount (e.g. > 1 %) the network operators should negotiate how to handle it.

This algorithm is a recommendation. The interconnected network operators may use an alternative algorithm such as is described in draft ITU-T Recommendation E.425 [8].

History

Document history		
V1.1.1	July 2002	Publication