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TELEPHONE NETWORK AND ISDN

QUALITY OF SERVICE, NETWORK MANAGEMENT AND TRAFFIC ENGINEERING

TERMS AND DEFINITIONS OF TRAFFIC ENGINEERING

ITU-T Recommendation E.600

(Previously “CCITT Recommendation”)

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation E.600 was revised by the ITU-T Study Group II (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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CONTENTS

			Page
1	General theory		2
	1.1	communication	2
	1.2	connection	2
	1.3	resource	3
	1.4	user	3
	1.5	telecommunications traffic; teletraffic	3
	1.6	poisson traffic; pure chance traffic	3
	1.7	peakedness factor	3
	1.8	smooth traffic	3
	1.9	peaked traffic	3
	1.10	traffic intensity	3
	1.11	erlang	4
	1.12	traffic volume	4
	1.13	bid	4
	1.14	seizure	4
	1.15	idle (state)	4
	1.16	busy (state)	4
	1.17	release	4
	1.18	holding time	5
	1.19	blocked mode of operation	5
	1.20	delay mode of operation	5
	1.21	call congestion	5
	1.22	time congestion	5
	1.23	waiting time; queuing time	5
2	Calls		5
	2.1	call	5
	2.2	call intent	5
	2.3	call demand	6
	2.4	call attempt	6
	2.5	first call attempt	6
	2.6	repeated call attempt; reattempt	6
	2.7	call string	6
	2.8	blocked call attempt	6
	2.9	abandoned call attempt	6
	2.10	fully routed call attempt; successful call attempt	6
	2.11	completed call attempt; effective call attempt	7
	2.12	successful call	7
	2.13	completion ratio	7
	2.14	answer seizure ratio (ASR)	7
	2.15	answer bid ratio (ABR)	7
	2.16	calling rate	7
	2.17	dialling-time	7
3	Circuits		7
	3.1	circuit	7
	3.2	trunk circuit	8

			Page
	3.3	one way	8
	3.4	two way	8
	3.5	circuit group	8
	3.6	circuit subgroup	8
	3.7	first choice circuit group	8
	3.8	high usage circuit group	8
	3.9	final circuit group	8
	3.10	fully provided circuit group	9
4	Grade of service		9
	4.1	grade of service (GOS)	9
	4.2	quality of service variable	9
	4.3	dial-tone delay	9
	4.4	post-dialling delay	9
	4.5	answer signal delay	10
	4.6	incoming response delay	10
	4.7	exchange call set-up delay	10
	4.8	through-connection delay	10
	4.9	call release delay	10
	4.10	internal blocking	11
	4.11	external blocking	11
	4.12	end-to-end blocking	11
5	Traffic engineering		11
	5.1	busy hour	11
	5.2	average daily peak hour traffic	11
	5.3	time consistent busy hour	11
	5.4	day to busy hour ratio	11
	5.5	traffic carried	12
	5.6	traffic offered	12
	5.7	effective traffic	12
	5.8	overflow traffic	12
	5.9	blocked traffic	12
	5.10	lost traffic; abandoned traffic	12
	5.11	suppressed traffic	12
	5.12	origin (of a call)	12
	5.13	destination (of a call)	12
	5.14	traffic relation	13
	5.15	traffic matrix	13
	5.16	originating traffic	13
	5.17	terminating traffic	13
	5.18	internal traffic	13
	5.19	incoming traffic	13
	5.20	outgoing traffic	13
	5.21	transit traffic	13
	5.22	traffic distribution imbalance	13
	5.23	route	14
	5.24	traffic routing	14
	5.25	call routing	14
	5.26	alternative route; alternate route	14
	5.27	network cluster	14
	5.28	equivalent random traffic	14
	5.29	handover	14

INTRODUCTION

This Recommendation provides terms and definitions for use in the field of traffic engineering. Traffic engineering includes measurements, forecasting, planning, dimensioning and performance monitoring. Traffic engineering has a goal of ensuring trafficability performance objectives for telecommunications services. Trafficability performance is one of the major factors in Quality of Service (QOS). Recommendation E.800 explains the relation of various Quality of Service factors and gives terms and definitions for Quality of Service concepts and for availability and reliability aspects.

These terms and definitions have been developed, for the most part, from the practice of traffic engineering in traditional telephone networks. Many of these terms will continue to be applicable with their current definitions, in the ISDN era. Others might require modification or extension to deal with the new traffic engineering situations emerging in ISDNs. This is a subject for further study.

The purpose of this vocabulary is to aid in the understanding of traffic engineering and related Recommendations. The terms defined here may also be defined differently for applications outside the area of traffic engineering.

Alternatives for the preferred terms are given following a semi–colon.

TERMS AND DEFINITIONS OF TRAFFIC ENGINEERING

(Melbourne, 1988; revised at Helsinki, 1993)

LIST OF TERMS

1 General theory

1.1 Communication
1.2 Connection
1.3 Resource
1.4 User
1.5 Telecommunications traffic; teletraffic
1.6 Poisson traffic; pure chance traffic
1.7 Peakedness factor
1.8 Smooth traffic
1.9 Peaked traffic
1.10 Traffic intensity
1.11 Erlang
1.12 Traffic volume
1.13 Bid
1.14 Seizure
1.15 Idle (state)
1.16 Busy (state)
1.17 Release
1.18 Holding time
1.19 Blocked mode of operation
1.20 Delay mode of operation
1.21 Call congestion
1.22 Time congestion
1.23 Waiting time; queuing time

2 Calls

2.1 Call
2.2 Call intent
2.3 Call demand
2.4 Call attempt
2.5 First call attempt
2.6 Repeated call attempted; reattempt
2.7 Call string
2.8 Blocked call attempt
2.9 Abandoned call attempt
2.10 Fully routed call attempt; successful call attempt
2.11 Completed call attempt; effective call attempt
2.12 Successful call
2.13 Completion ratio
2.14 Answer seizure ratio
2.15 Answer bid ratio
2.16 Calling rate
2.17 Dialling-time

3 Circuits

3.1 Circuit
3.2 Trunk circuit
3.3 One way
3.4 Two way
3.5 Circuit group
3.6 Circuit subgroup
3.7 First choice circuit group
3.8 High usage circuit group
3.9 Final circuit group
3.10 Fully provided circuit group

4 Grade of service

4.1 Grade of service

4.2 Quality of service variable

4.3 Dial-tone delay

4.4 Post-dialling delay

4.5 Answer-signal delay

4.6 Incoming response delay

4.7 Exchange call set-up delay

4.8 Through-connection delay

4.9 Call release delay

4.10 Internal blocking

4.11 External blocking

4.12 End-to-end blocking

5 Traffic engineering

5.1 Busy hour

5.2 Average daily peak hour traffic

5.3 Time consistent busy hour

5.4 Day to busy hour ratio

5.5 Traffic carried

5.6 Traffic offered

5.7 Effective traffic

5.8 Overflow traffic

5.9 Blocked traffic

5.10 Lost traffic; abandoned traffic

5.11 Suppressed traffic

5.12 Origin (of a call)

5.13 Destination (of a call)

5.14 Traffic relation

5.15 Traffic matrix

5.16 Originating traffic

5.17 Terminating traffic

5.18 Internal traffic

5.19 Incoming traffic

5.20 Outgoing traffic

5.21 Transit traffic

5.22 Traffic distribution imbalance

5.23 Route

5.24 Traffic routing

5.25 Call routing

5.26 Alternative route; alternate route

5.27 Network cluster

5.28 Equivalent random traffic

5.29 Handover

1 General theory

1.1 communication

F: communication
S: comunicación

Transfer of information according to agreed conventions. The information flow need not be bidirectional.

1.2 connection

F: connexion
S: conexión

An association of resources providing means for communication between two or more devices in, or attached to, a telecommunication network.

1.3 resource

F: ressource
S: órgano

Any set of physically or conceptually identifiable entities within a telecommunications network, the use of which can be unambiguously determined.

1.4 user

F: utilisateur
S: usuario

Any entity external to the network which utilizes connections through the network for communication.

1.5 telecommunications traffic; teletraffic

F: trafic de télécommunication: télétrafic
S: tráfico de telecomunicación; teletráfico

A process of events related to demands for the utilization of resources in a telecommunication network.

1.6 poisson traffic; pure chance traffic

F: trafic poissonnien: trafic de pur hasard
S: tráfico poissoniano

Traffic that has a Poisson distribution of arrivals.

NOTE – Poisson traffic has a peakedness factor equal to 1.

1.7 peakedness factor

F: facteur d'irrégularité
S: factor de irregularidad

The ratio of variance to mean of traffic intensity.

1.8 smooth traffic

F: trafic régularisé
S: tráfico con distribución uniforme

Traffic that has a peakedness factor less than 1.

1.9 peaked traffic

F: trafic survariant
S: tráfico con distribución en pico

Traffic that has a peakedness factor greater than 1.

1.10 traffic intensity

F: intensité de trafic
S: intensidad de tráfico

The instantaneous traffic in a pool of resources is the number of busy resources at a given instant of time.

NOTES

1 Statistical moments may be calculated for a given period of time, for instance the mean traffic intensity $\overline{A}(t_1, t_2)$ is related to the instantaneous traffic intensity $A(t)$ as

$$\overline{A}(t_1, t_2) = \frac{1}{t_2 - t_1} \int_{t_1}^{t_2} A(t)\, \mathrm{d}t$$

In applications, the term traffic intensity usually has this meaning of mean traffic intensity.

2 Traffic intensity is equivalent to the product of arrival rate and mean holding time.

3 The unit usually used for traffic intensity is the erlang (symbol: E).

1.11 erlang

F: erlang
S: erlang

Unit of traffic intensity (symbol: E). 1 erlang is the traffic intensity in a pool of resources when just one of the resources is busy.

1.12 traffic volume

F: volume de trafic
S: volumen de tráfico

The traffic volume in a given time interval is the time integral of the traffic intensity over this time interval.

NOTES

1 Traffic volume is equivalent to the sum of the holding times in the given time interval.

2 A unit of traffic volume is the erlang hour (symbol: Eh).

1.13 bid

F: tentative de prise
S: intento de toma; tentativa de toma

A single attempt to obtain the use of a resource of the type under consideration.

NOTE – In a network management context, the absence of a qualification implies a bid to a circuit group, a route or a destination.

1.14 seizure

F: prise
S: toma

A bid that obtains the use of a resource of the type under consideration.

1.15 idle (state)

F: libre
S: reposo (estado de); estado libre

Condition of a resource that is free to be seized.

1.16 busy (state)

F: occupé
S: ocupado (estado de)

Condition of a resource following its seizure.

1.17 release

F: libération
S: liberación

The event which changes the condition of a resource from busy to idle.

1.18 holding time

F: durée d'occupation
S: tiempo de ocupación; tiempo de retención

The time between the seizure of a resource and its release.

1.19 blocked mode of operation

F: mode d'exploitation avec blocage
S: modo de operación con bloqueo

A mode of operation in which bids which find no suitable resources idle and accessible are not permitted to wait.

1.20 delay mode of operation

F: mode d'exploitation avec attente
S: modo de operación con espera

A mode of operation in which bids which find no suitable resources idle and accessible are permitted to wait.

1.21 call congestion

F: encombrement d'appel
S: congestión de llamadas

The probability that a bid to a particular pool of resources will not result in an immediate seizure.

1.22 time congestion

F: congestion temporelle
S: congestión temporal

The proportion of time that a particular pool of resources does not contain any idle resource.

1.23 waiting time; queuing time

F: temps de mise en attente
S: tiempo de espera; tiempo de cola

In delay mode of operation, the time interval between the bid for a resource and its seizure.

2 Calls

2.1 call

F: appel
S: llamada

A generic term related to the establishment, utilization and release of a connection. Normally a qualifier is necessary to make clear the aspect being considered, e.g. call attempt.

2.2 call intent

F: intention d'appel
S: intención de llamada

The desire to establish a connection to a user.

NOTE – This would normally be manifested by a call demand. However, demands may be suppressed or delayed by the calling user's expectation of poor Quality of Service performance at a particular time.

2.3 call demand

F: demande d'appel
S: demanda de llamada

A call intent that results in a first call attempt.

2.4 call attempt

F: tentative d'appel
S: intento de llamada;tentativa de llamada

An attempt to achieve a connection to one or more devices attached to a telecommunications network.

NOTE – At a given point in the network a call attempt is manifested by a single unsuccessful bid, or a successful bid and all subsequent activity related to the establishment of the connection.

2.5 first call attempt

F: première tentative d'appel
S: primer intento de llamada; primera tentativa de llamada

The first attempt of a call demand that reaches a given point of the network.

2.6 repeated call attempt; reattempt

F: tentative d'appel répétée
S: intento de llamada; tentativa de llamada repetida

Any of the call attempts subsequent to a first call attempt related to a given call demand.

NOTE – Repeated call attempts may be manual, i.e. generated by humans, or automatic, i.e. generated by machines.

2.7 call string

F: chaîne d'appel
S: cadena de llamada

All the call attempts related to a single demand.

2.8 blocked call attempt

F: tentative d'appel bloquée
S: intento de llamada bloqueado; tentativa de llamada bloqueada

A call attempt that is rejected owing to a lack of resources in the network.

2.9 abandoned call attempt

F: tentative d'appel abandonnée
S: intento de llamada abandonado; tentativa de llamada abandonada

A call attempt aborted by the calling user.

2.10 fully routed call attempt; successful call attempt

F: tentative d'appel acheminée
S: intento de llamada totalmente encaminado; intento de llamada fructuoso; tentativa de llamada totalmente encaminada; tentativa de llamada fructuosa

A call attempt that receives intelligible information about the state of the called user.

2.11 completed call attempt; effective call attempt

F: tentative d'appel ayant abouti; tentative d'appel efficace
S: intento de llamada completado; intento de llamada eficaz; tentativa de llamada completada; tentativa de llamada eficaz

A successful call attempt that receives an answer signal.

2.12 successful call

F: appel ayant abouti
S: llamada fructuosa

A call that has reached the wanted number and allows the conversation to proceed.

2.13 completion ratio

F: taux d'efficacité
S: relación respuesta/toma; tasa de compleción; tasa de eficacia

The ratio of the number of completed call attempts to the total number of call attempts, at a given point of a network.

2.14 answer seizure ratio (ASR)

F: taux de prise avec réponse
S: tasa de tomas con respuesta

On a route or a destination code basis, and during a specified time interval, the ratio of the number of seizures that result in an answer signal, to the total number of seizures.

2.15 answer bid ratio (ABR)

F: taux de tentatives de prise avec réponse
S: tasa de intentos de toma con respuestas; tasa de tentativas de toma con respuesta

On a route or a destination code basis and during a specified time interval, the ratio of the number of bids that result in an answer signal, to the total number of bids.

2.16 calling rate

F: taux d'appel
S: tasa de llamadas

The number of call attempts at a given point, during a specified time interval, divided by the duration of the interval.

2.17 dialling-time

F: durée de numérotation
S: tiempo de marcación

Time interval between the reception of dial tone and the end of dialling of the calling user.

3 Circuits

3.1 circuit

F: circuit (de télécommunication)
S: circuito

A transmission means which allows communication between two points.

3.2 trunk circuit

F: circuit (commuté)
S: circuito (entre centrales)

A circuit terminating in two switching centres.

3.3 one way

F: à sens unique
S: en un solo sentido

A qualification applying to traffic or circuits which implies that the establishment of a connection always occurs in one direction.

3.4 two way

F: à double sens
S: en ambos sentidos

A qualification applying to traffic or circuits which implies that the establishment of a connection may occur in either direction.

NOTE – The term both way is sometimes used with the meaning of two way.

3.5 circuit group

F: faisceau (de circuits)
S: haz de circuitos

A group of circuits which are traffic engineered as a unit.

3.6 circuit subgroup

F: sous-faisceau
S: subhaz de circuitos

A part of a circuit group with similar characteristics (e.g. type of signalling, type of transmission path, etc.).

3.7 first choice circuit group

F: faisceau de premier choix
S: haz de circuitos de primera elección

With respect to a particular traffic relation, the circuit group to which this traffic is first offered.

3.8 high usage circuit group

F: faisceau débordant
S: haz de circuitos de gran utilización

With respect to a particular traffic relation, a circuit group that is traffic engineered to overflow to one or more other circuit groups.

3.9 final circuit group

F: faisceau final
S: haz final de circuitos

With respect to a particular traffic relation, a circuit group from which there is no possibility of overflow to another circuit group within the routing scheme currently in effect.

3.10 fully provided circuit group

F: faisceau totalement fourni
S: haz de circuitos totalmente provisto

With respect to a particular traffic relation, a circuit group which is the first choice circuit group for this traffic and which is traffic engineered as a final circuit group.

4 Grade of service

4.1 grade of service (GOS)

F: qualité d'écoulement du trafic
S: grado de servicio

A number of traffic engineering variables used to provide a measure of adequacy of a group of resources under specified conditions. These grades of service variables may be probability of loss, dial tone delay, etc.

NOTES

1 The parameter values assigned as objectives for grade of service variables are called grade of service standards.

2 The values of grade of service parameters achieved under actual conditions are called grade of service results.

4.2 quality of service variable

F: variable de qualité de service
S: variable de la calidad de servicio

Any performance variable (such as congestion, delay, etc.) which is perceivable by a user.

NOTE – For a description of the relations of quality of service factors see Recommendation E.800.

4.3 dial-tone delay

F: durée d'attente de tonalité
S: demora del tono de invitación a marcar; tiempo de espera al tono de invitación a marcar

Time interval between off hook and reception of dial tone.

NOTE – In ISDN, the equivalent term is designated **pre-selection delay** and is defined as

pre-selection delay (overlap sending)

Pre-selection delay (overlap sending) is defined as the time interval from the instant the first bit of the SABME message is passed by the calling terminal to the access signalling system until the last bit of the SETUP ACK message is received by the calling terminal.

4.4 post-dialling delay

F: attente après numérotation
S: demora después de marcar; tiempo de espera después de marcar

Time interval between the end of dialling by the user and the reception by him of the appropriate tone or recorded announcement, or the abandon of the call without tone.

NOTE – In ISDN, the equivalent term is designated **post-selection delay** and is defined as

a) **post-selection delay (overlap sending)**

Post-selection delay (overlap sending) is defined as the time interval from the instant the first bit of the INFORMATION message containing the last selection digit is passed by the calling terminal to the access signalling system until the last bit of the first message indicating call disposition is received by the calling terminal (ALERTING message in case of successful call).

b) **post-selection delay (en-bloc sending)**

Post-selection delay (*en-bloc* sending) is defined as the time interval from the instant the first bit of the initial SETUP message containing all the selection digits is passed by the calling terminal to the access signalling system until the last bit of the first message indicating call disposition is received by the calling terminal (ALERTING message in case of successful call).

NOTE – In case of automatic answering terminals the ALERTING message is replaced by the CONNECT message.

4.5 answer signal delay

F: délai du signal de réponse
S: demora de la señal de respuesta

Time interval between the establishment of a connection between calling and called users, and the detection of an answer signal at the originating exchange.

NOTE – In ISDN, the analogous term carrying the same designation is defined slightly differently in that the end of the interval is defined at the calling terminal. The ISDN definition is

answer signal delay

Answer signal delay is defined as the time interval from the instant that the called terminal passes the first bit of the CONNECT message to its access signalling system until the last bit of the CONNECT message is received by the calling terminal.

4.6 incoming response delay

F: durée de présélection
S: demora de la preselección; duración de la preselección

The interval from the instant when an incoming seizure is recognizable at the incoming side of the exchange to the instant when the proceed to send signal is sent to the preceding exchange by the receiving exchange.

NOTE – This definition is only applicable in the case of channel associated signalling.

4.7 exchange call set-up delay

F: durée de sélection d'un commutateur
S: demora de establecimiento de la comunicación por una central; tiempo de establecimiento de la comunicación por una central

The interval from the instant when the address information required for setting up a call is received at the incoming side of the exchange to the instant when the seizing signal or the corresponding address information is sent to the subsequent exchange.

4.8 through-connection delay

F: durée d'établissement d'un commutateur
S: demora de conexión en una central; tiempo de establecimiento en una central

The interval from the instant when the information required for setting up a through–connection in an exchange is available for processing in the exchange, to the instant when the switching network through–connection is established and available for communication.

4.9 call release delay

F: temps de libération de la communication
S: demora de liberación de la llamada

Call release delay is defined as the time interval from the instant the *first bit of the* DISCONNECT message is passed by the user terminal which terminated the call to the access signalling system, until the *last bit of the* RELEASE message is received by the same terminal (indicating that the terminals can initiate/receive a new call).

4.10 internal blocking

F: blocage interne
S: bloqueo interno

The probability that a connection cannot be made between a given point in a network and any suitable idle resource in an external pool of resources owing to call congestion within the portion of the network being considered.

4.11 external blocking

F: blocage externe
S: bloqueo externo

The probability that a connection cannot be made between a given point in a network and any suitable resource in an external pool of resources owing to call congestion within the pool of resources.

4.12 end-to-end blocking

F: probabilité de blocage de bout en bout
S: bloqueo extremo a extremo

The probability that any call attempt will be unsuccessful due to a lack of network resources.

NOTES

1 Blocking because of lack of B-channels between the customer premises equipment and the network is not part of this definition.

2 The lack of control plane resources during the call setup phase may also contribute to end-to-end blocking. This aspect is for further study.

5 Traffic engineering

5.1 busy hour

F: heure chargée
S: hora cargada

The continuous 1-hour period lying wholly in the time interval concerned for which the traffic or the number of call attempts is greatest.

5.2 average daily peak hour traffic

F: moyenne du trafic des heures chargées
S: tráfico medio de las horas punta

The average busy hour traffic of several days. It is usually not related to the same hour each day.

5.3 time consistent busy hour

F: heure chargée moyenne
S: hora cargada media repetitiva o sistemática

The 1-hour period starting at the same time each day for which the average traffic of the resource group concerned is greatest over the days under consideration.

5.4 day to busy hour ratio

F: rapport du trafic journalier au trafic à l'heure chargée
S: relación del tráfico diario al tráfico en la hora cargada

The ratio of the 24-hour day traffic volume to the busy hour traffic volume.

NOTE – Busy hour to day ratio is also used.

5.5 traffic carried

F: trafic écoulé
S: tráfico cursado

The traffic served by a pool of resources.

5.6 traffic offered

F: trafic offert
S: tráfico ofrecido

The traffic that would be carried by an infinitely large pool of resources.

5.7 effective traffic

F: trafic efficace
S: tráfico eficaz

The traffic corresponding only to the conversational portion of effective call attempts.

5.8 overflow traffic

F: trafic de débordement
S: tráfico de desbordamiento

The part of the traffic offered to a pool of resources which is not carried by that pool of resources.

5.9 blocked traffic

F: trafic bloqué
S: tráfico bloqueado

The part of the overflow traffic that is not carried by subsequent pools of resources.

5.10 lost traffic; abandoned traffic

F: trafic perdu; trafic abandonné
S: tráfico perdido; tráfico abandonado

That part of the blocked traffic which does not result in reattempts.

5.11 suppressed traffic

F: trafic non exprimé; trafic supprimé
S: tráfico suprimido

The traffic that is withheld by users who anticipate a poor quality of service (QOS) performance.

5.12 origin (of a call)

F: origine (de l'appel)
S: origen (de una llamada)

The location of the calling network termination. This may be specified to whatever accuracy is necessary.

5.13 destination (of a call)

F: destination (de l'appel)
S: destino (de una llamada)

The location of the called network termination. This may be specified to whatever accuracy is necessary; in international working, the area or country code is usually sufficient.

5.14 traffic relation

F: flux de trafic
S: relación de tráfico

The traffic between a particular origin and a particular destination.

5.15 traffic matrix

F: matrice de trafic
S: matriz de tráfico

A structured presentation of the traffic between a number of origins and destinations.

5.16 originating traffic

F: trafic de départ
S: tráfico de origen

Traffic generated within the network considered, whatever its destination.

5.17 terminating traffic

F: trafic d'arrivée
S: tráfico de destino

Traffic which has its destination within the network considered, whatever its origin.

5.18 internal traffic

F: trafic interne
S: tráfico interno

Traffic originating and terminating within the network considered.

5.19 incoming traffic

F: trafic entrant
S: tráfico entrante

Traffic entering the network considered, from outside it, whatever its destination.

5.20 outgoing traffic

F: trafic sortant
S: tráfico saliente

Traffic leaving the network considered, destined for sinks located outside it, whatever its origin.

5.21 transit traffic

F: trafic de transit
S: tráfico de tránsito

Traffic passing through the network considered.

5.22 traffic distribution imbalance

F: déséquilibre interne de trafic
S: desequilibrio de la distribución interna de tráfico

Unevenly distributed traffic among similar resources.

5.23 route

F: voie d'acheminement
S: ruta

One or more circuit groups providing a connection between switching centres.

5.24 traffic routing

F: acheminement de trafic
S: encaminamiento de tráfico

The selection of routes, for a given traffic relation. This term is applicable to the selection of circuit groups by switching systems or operators, or to the planning of routes.

5.25 call routing

F: acheminement d'appel
S: encaminamiento de la llamada

The selection of appropriate circuit subgroups or individual circuits for a particular call attempt.

5.26 alternative route; alternate route

F: voie d'acheminement détourné
S: ruta alternativa

A second, or subsequent choice route between two switching centres usually consisting of two or more circuit groups in tandem.

5.27 network cluster

F: faisceau de faisceaux; réseau élémentaire
S: agrupación de haces

A final circuit group and all the high usage circuit groups which have at least one traffic relation for which the final circuit group is in the last choice route.

5.28 equivalent random traffic

F: trafic equivalent
S: tráfico aleatorio equivalente

The theoretical poisson traffic that, when offered to a theoretical circuit group (equivalent random circuit group) produces an overflow traffic with a mean and variance equal to that of a given offered traffic.

NOTE – The equivalent random traffic and circuit group represent the traffic impact of a more complex arrangement of offered traffics and high usage circuit groups.

5.29 handover

F: transfert automatique intercellulaire
S: transferencia

In mobile cellular systems, a system-driven change of the current association between an established connection and a channel (mobile to base station and/or base station to mobile channel) in the radio segment spanned by one cell. The change may result in an association between the connection and a new channel either in the same cell or in a different cell.

A handover request may be issued due to deteriorated transmission quality of the channel, as determined on the basis of a quality criterion (signal strength, carrier-to-interference ratio, etc.), a process for measuring the quality, and a decision algorithm for determining when the quality target is no longer met. A handover request initiates a procedure for the selection of a new channel.

ALPHABETICAL INDEX

Abandoned call attempt	2.9	Completion ratio	2.13
Abandoned traffic	5.10	Connection	1.2
Alternate route	5.26	Day to busy hour ratio	5.4
Alternative route	5.26	Delay mode of operation	1.20
Answer bid ratio	2.15	Destination (of a call)	5.13
Answer seizure ratio	2.14	Dial-tone delay	4.3
Answer signal delay	4.5	Dialling-time	2.17
Average daily peak hour traffic	5.2	Effective call attempt	2.11
Bid	1.13	Effective traffic	5.7
Bidirectional	3.4	Equivalent random traffic	5.28
Blocked call attempt	2.8	Erlang	1.12
Blocked mode of operation	1.19	Exchange call set-up delay	4.7
Blocked traffic	5.9	External blocking	4.11
Busy (state)	1.16	Final circuit group	3.9
Busy hour	5.1	First call attempt	2.5
Call	2.1	First choice circuit group	3.7
Call attempt	2.4	Fully provided circuit group	3.10
Call congestion	1.21	Fully routed call attempt	2.10
Call demand	2.3	Grade of service (GOS)	4.1
Call intent	2.2	Handover	5.29
Call release delay	4.9	High usage circuit group	3.8
Call routing	5.25	Holding time	1.18
Call string	2.7	Idle (state)	1.15
Calling rate	2.16	Incoming response delay	4.6
Circuit	3.1	Incoming traffic	5.19
Circuit group	3.5	Internal blocking	4.10
Circuit subgroup	3.6	Internal traffic	5.18
Communication	1.1	Lost traffic	5.10
Completed call attempt	2.11	Network cluster	5.27

One way	3.3
Origin (of a call)	5.12
Originating traffic	5.16
Outgoing traffic	5.20
Overflow traffic	5.8
Peaked traffic	1.9
Peakedness factor	1.7
Poisson traffic	1.6
Post-dialling delay	4.4
Pure chance traffic	c1.6
Quality of service variable	4.2
Queuing time	1.23
Reattempt	2.6
Release	1.17
Repeated call attempt	2.6
Resource	1.3
Route	5.23
Seizure	1.14
Smooth traffic	1.8
Successful call	2.12
Successful call attempt	2.10
Suppressed traffic	5.11
Telecommunications traffic	1.5
Teletraffic	1.5
Terminating traffic	5.17
Through–connection delay	4.8
Time consistent busy hour	5.3
Time congestion	1.22
Traffic carried	5.5
Traffic distribution imbalance	5.22
Traffic intensity	1.10
Traffic offered	5.6
Traffic matrix	5.15
Traffic relation	5.14
Traffic routing	5.24
Traffic volume	1.12
Transit traffic	5.21
Trunk circuit	3.2
Two way	3.4
User	1.4
Waiting time	1.23