3GPP TSG-T #5
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Source:	**TSG-T**
To:	**TSG-SA, TSG-CN, TSG-RAN**
Title:	**Definitions used for the Mobile Station/Terminal**

Introduction

Within 3GPP there seems to be no common view so far on how to define the piece of user equipment that we might call UE, terminal, MS or even TE. This paper gives in its annex an overview of the existing definitions as well as proposes a way forward.

Discussion

In S1 a report (cp. the annex) has been prepared on the terminology issue. In this report three *principles* are proposed:

Principle: use English words where possible   ....

Principle: don't use common words as technical terms

When it is necessary to introduce a specific term to express a specific technical concept, that term should be clearly identifiable as such. Combinations of two or more words achieve this, for example "home environment". Very general purpose English language words should not be used to represent specialised concepts, for example the word "number" appears far to often in other contexts to be used to denote a technical term (for example "chapter number"); in this specific case "International mobile user number" or IMUN is recommended. However it is acceptable to adopt less commonly used English language words as technical terms, for example "terminal".

Principle: re-use GSM terms

Where GSM already has an adequate term, for example PLMN, this term should be adopted by 3GPP.

The proposed *principles* seem quite reasonable, including the third that GSM definitions should be used wherever an adequate term already exists; the reason is of course to minimize the number of definitions as well as the potential misunderstandings.

Based on these principles above, the GSM definitions should be used when the 3GPP specifications need to refer to a Mobile Station / Terminal. Further, if the same terminology as in GSM is *not* used, it is ambiguous how in the specifications to denote "terminals" that can be active in more than one system.

In 3GPP a mixture of the GSM terms and new terms, some defined and some not, have been used. The group with the longest tradition of a separate vocabulary is TSG-RAN. This vocabulary, however, is in some conflict with the principles. Below the definitions are discussed based on the content of the annex.

A. From the GSM specifications (02.17) we find that a *Mobile Station (an MS)*, consists of a SIM card in combination with a *Mobile Equipment (an ME)*.

B. Further, the ME (we find by deduction from 04.02) is made up by *MT (Mobile Termination)* plus *TA (Terminal Adaptation)*, if applicable, plus *TE (Terminal Equipment)*, if applicable, i.e. ME= (MT) or (MT + TE) or (MT + TA + TE).

C. The MT can be of three different kinds: MT0, MT1 and MT2 (cf. 04.02, 27.001). An MT0 does not support external interfaces, but can very well include "complete" data terminal functions. An MT1 supports an ISDN interface, to connect to ISDN terminal equipment. Finally, an MT2 supports an interface that complies with the 07- (27-) series, and can thereby also interface to a PCMCIA card. All this implies that MT functions include for instance both FEC and ARQ error protection, flow control and rate adaptation as well as the functions that automatically would be expected, like the radio transmission termination.

D. Sometimes two abbreviations are used to make a distinction between TA= Terminal Adapt*or* and TAF= Terminal Adaptat*ion* Function.

E. A strict definition of Terminal Equipment has not been found (except by the UMTS Forum, which definition does not seem to be of relevance). Indirectly it is understood that this is equipment, for instance a PC, that interfaces to the TA or MT (depending on what is included in the MT).

F. *Terminal* has not been defined, but the S1 report has suggested a possible definition as "a device into which a UICC can be inserted and which is capable of providing access to UMTS services to users, either alone or in conjunction with a UICC". This would be how MS is defined but with different wording.

G. *UE, User Equipment*, is defined by TSG-RAN as "A Mobile Equipment with one or several UMTS Subscriber Identity Modules".

It seems that the GSM term MS has been re-invented as both Terminal and UE.

The problem with UE is that it appears to include the USIM/UICC, whereas the resembling term ME does not. This has been a source of confusion, since it has sometimes been taken to mean a "UMTS ME".

The term Terminal is, in turn, likely to be confused with Terminal Equipment, or not recognized as a precisely defined term at all.

Conclusions

TSG-T plenary endorses the usage of the well established terms *MS* and *ME* (cp. bullets A and B above), at the expense of the misleading term *UE* and the imprecise term *Terminal*,.

TSG-T further endorses the three principles for terminology definitions (underlined in the discussion section above) proposed in the S1 report "Terminology and Vocabulary within S1", dated 28.7.99.

TSG-SA, TSG-CN and TSG-RAN are asked to support this position in order to achieve an alignment of the vocabulary in 3GPP.

Annex: Overview of existing definitions

Below definitions from a number of documents are collected. The definitions of the Mobile Station/terminal, etc, reflect the complete picture in these documents, while the multi-mode definitions are only collected from some of them. The documents are:

A. GSM 01.04 v.5.0.1; Abbreviations and Acronyms

B. GSM 04.02 v.7.0.0; GSM PLMN Access Reference Configuration

C. 3G TS 27.001 v.3.0.0; General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS);

D. GSM 02.17 v.7.1.1; Subscriber Identity Modules (SIM); Functional characteristics

E. 3G 27.901 v.0.1.2; TSG-T; Report on Terminal Interfaces – An Overview

F. Terminology and Vocabulary within TSG-S1: Report and Recommendations; 28.7.99

F.1 Overview of Technical Vocabulary in 22.000 Series

F.2 Proposal for terms for use throughout 3GPP (3GPP-VOCAB). The same as TR 21.905 0.0.2; Vocabulary for 3GPP Specifications

F.3 Proposed Document: UMTS 22.vvv "Service Requirements Vocabulary for 22.000 series documents"

G. TR 25.990 V1.0.0 (1999-09); Technical Specification Group (TSG) RAN; Vocabulary

H. GSM MoU classifications: 3G Definitions, Ver. 3.0.0, 28th April 1998

H.1 Text from the body of the document

H.2 Annex 1 from G.: VOCABULARY OF TERMS (from UMTS Forum)

A. GSM 01.04 v.5.0.1; Abbreviations and Acronyms

"Terminal" is not defined in this report. The relevant abbreviations are given below.

DTE	Data Terminal Equipment
ME	- Maintenance Entity
	- Mobile Equipment
MS	Mobile Station
MT	- Mobile Terminated
MT (0,1,2)	- Mobile Termination
TA	Terminal Adaptor
TAF	Terminal Adaptation Function
TE	Terminal Equipment

B. GSM 04.02 v.7.0.0; GSM PLMN Access Reference Configuration

The text below consists of several cuts from GSM 04.02.

1. Scope

The present document describes the reference configuration for access to a GSM PLMN.

A user accesses a GSM PLMN via a number of interfaces, including the MS-BS interface. The purpose of this Technical Specification is to indicate the possible access arrangements that may be used in conjunction with the MS-BS interface.
....

1.2 Abbreviations

Abbreviations used in the present document are listed in GSM 01.04.

2. General definitions

The following definitions 2.1-2.3 are based on those used for ISDN.

2.1 Reference Configurations

Reference Configurations are conceptual configurations useful in identifying access arrangements to a network. Two concepts are used in defining reference configurations:

   reference points and functional groups.

2.2 Functional Groups

Functional Groups are sets of functions which may be needed in network access arrangements. In a particular access arrangement, specific functions in a functional group may or may not be present. Note that specific functions in a functional group may be performed in one or more pieces of equipment.

2.3 Reference Points

Reference Points are the conceptual points dividing functional groups. In a specific access arrangement, a reference point may correspond to a physical interface between pieces of equipment, or there may not be any physical interface corresponding to the reference point.
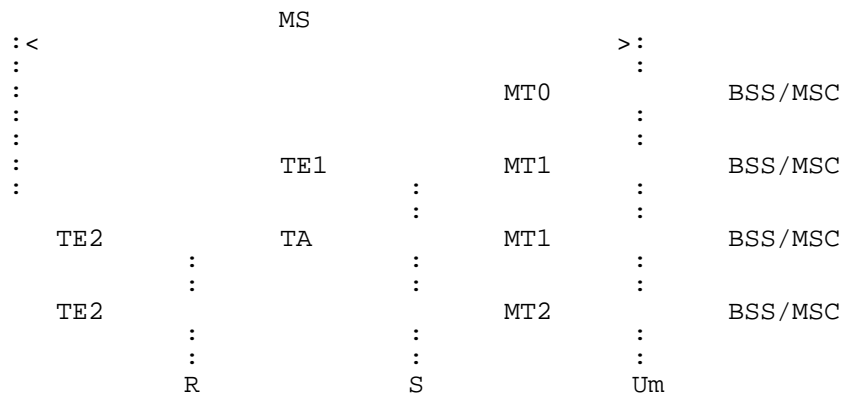
The following definition is used in the present document:

2.4 GSM Interface Points

GSM Interface Points are reference points within a GSM PLMN at which a GSM specified interface is always identified.

3 GSM Reference Configuration

The reference configuration for GSM PLMN access interfaces is shown in figure 1.

```
                               MS
         :<                                            >:
         :                                              :
         :                            MT0               :         BSS/MSC
         :                                              :
         :                                              :
         :                 TE1        MT1               :         BSS/MSC
         :                             :                :
         :                             :                :
      TE2         TA                   :        MT1     :         BSS/MSC
              :                        :                :
              :                        :                :
      TE2                                      MT2      :         BSS/MSC
              :                        :                :
              :                        :                :
              R                        S              Um
```

= reference point

[Editors note: TE1 = ISDN terminal, TE2 = V- or X-type terminal, TA = Terminal
Adaptor, BSS = Base Station System, MSC = Mobile Switching Centre]

Figure 1: GSM PLMN Access Reference Configuration

The terminal equipment functional groups TE1, TE2 and TA are conceptually the same functional groups as those in the ISDN. The two new functional groups are:

3.1   Mobile Termination (MT)

which performs the following functions:

-      radio transmission termination;
-      radio transmission channel management;
-      terminal capabilities, including presentation of a man-machine interface to a user;
-      speech encoding/decoding;
-      error protection for all information sent across the radio path. This includes FEC (forward
       error correction) and, for signalling and user data (except for transparent data services),
       ARQ (automatic request forretransmission);
-      flow control of signalling and mapping of user signalling to/from PLMN access signalling;
-      flow control of user data (except for transparent data services) and mapping of flow con
       trol for asynchronous transparent data services;
-      rate adaptation of user data between the radio channel rate and user rates;
-      multiple terminal support;
-      mobility management.

There are three types of MT:
- MT0 includes functions belonging to the functional group MT, with support of no terminal
   interfaces.
- MT1 includes functions belonging to the functional group MT, and with an interface that
   complies with the GSM recommmended subset of the ISDN user-network interface specifi-
   cations.
- MT2 includes functions belonging to the functional group MT, and with an interface that
   complies with the GSM 07.0x series Terminal Adaptation Function specifications. Accord
   ingly, the interchange circuit mapping at the MT2 to TE interface shall comply with the
   CCITT V.24 or X.21 recmmendations; while the physical implementation shall conform
   either to the CCITT V.28, or V.11, or to the IrDA IrPHY, or to the PCMCIA 2.1, or to the
   PC-Card 3.0 electrical specification, or to later revisions.

The MT plus any TE/(TE + TA) constitutes the Mobile Station, MS.

....

4   Physical Realisation

In a GSM PLMN, the reference point Um is a GSM interface point, i.e. it is always implemented as a physical interface (according to GSM Technical Specifications in the 04 and 05 series). The reference points S and R may be optionally implemented as physical interfaces. The implementation of interfaces at these reference points is according to Technical Specifications GSM 07.01, 07.02 and 07.03.

Figure 2 gives examples of configurations illustrating combinations of physical interfaces at reference points R and S. The examples shown are not exhaustive, but only serve to illustrate possible implementations of the respective functional blocks.
Example (**a**) of figure 2 illustrates a fully integrated MS including data terminal functions within the mobile station equipment.
Example (**b**) of figure 2 illustrates the connection of a TE1 in accordance with Technical Specifications GSM 07.02/07.03 (and CCITT Recommendation I.420). In this example the speech service is offered via the TE1.
Example (**c**) of figure 2 illustrates the connection of a TE2 by a CCITT X or V series interface according to Technical Specifications GSM 07.02 and 07.03.
Example (**d**) of figure 2 illustrates the connection of a MT2 PCMCIA card to a TE2 by a PCMCIA 2.1 interface according to the Technical Specifications GSM 07.02 and 07.03.
Example (**e**) of figure 2 illustrates the connection of a TE2 by means of an ISDN TA to the MT equipment.
Example (**f**) of figure 2 illustrates the connection of a speech only MS.

```
            +--------------------+          +----------+
            |       Mobile       |          |          |
      (a)   |        Data        +-----//--| Base      |
            |   Terminal [MT0]   |          | Station   |
            +--------------------+          +----------+


      +------------------+          +-------+     +----------+
      |      ISDN        |          |       |     |          |
      (b) |  speech + data  +-------//--| [MT1] +--//--| Base     |
      | workstation [TE1] |          |       |     | Station  |
      +------------------+          +-------+     +----------+


      +----------------+          +-------+     +----------+
      | X.21 and V.11  |          |       |     |          |
      (c) |      DTE       +----------//--| [MT2] +--//--| Base     |
      |     [TE2]      |          |       |     | Station  |
      +----------------+          +-------+     +----------+


      +----------------+              +-------+     +----------+
      |      V.24      |              |       |     |          |
      | and PCMCIA 2.1 |              |       |     |          |
      (d) |      DTE       +------------//-| [MT2] +-//-| Base     |
      |     [TE2]      |              |       |     | Station  |
      +----------------+              +-------+     +----------+


      +----------------+   +------+   +-------+     +----------+
      |    V- or X     |   |      |   |       |     |          |
      |                |   | ISDN |   |       |     |          |
      (e) |      DTE       +-//-|  TA  +-//-| [MT1] +-//-| Base     |
      |     [TE2]      |   | [TA] |   |       |     | Station  |
      +----------------+   +------+   +-------+     +----------+


            +--------------------+          +----------+
            |   Speech-only MS   |          |          |
      (f)   |                    +-----//--| Base      |
            |        [MT0]       |          | Station   |
            +--------------------+          +----------+
```
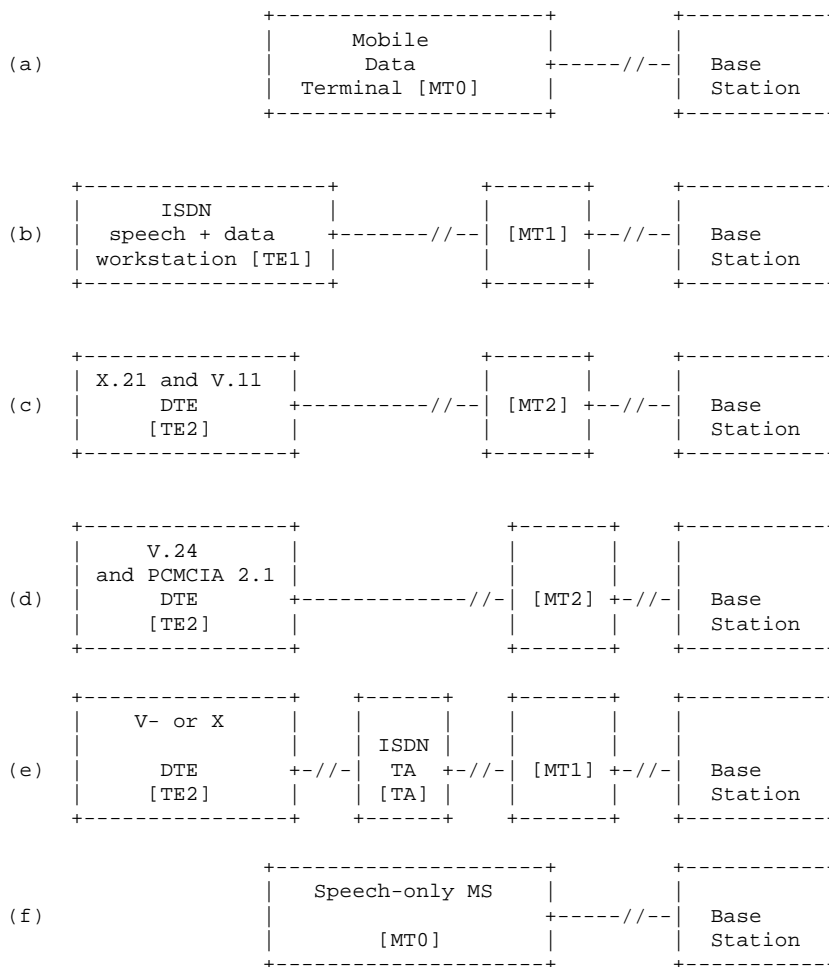
Figure 2: Examples of physical implementations

C. 3G TS 27.001 v.3.0.0; General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS);

The text below consists of excerpts from 3G 27.001 v.3.0.0.

1   Scope

This TS is based on the principles of terminal adaptor functions presented in the CCITT I-series of recommendations (I.460 - I.463).
The GSM PLMN supports a wide range of voice and non-voice services in the same network. In order to enable non-voice traffic in the GSM PLMN there is a need to connect various kinds of terminal equipments to the Mobile Termination (MT). The target of this ETS is to outline the functions needed for the terminal adaptation.
In the GSM 02.02 (ETS 300 904) the bearer services are described. The general network configuration is described in GSM 03.02 and the GSM PLMN access reference configuration is defined in GSM 04.02. The various connection types used in the GSM PLMN are presented in GSM 03.10. Terminology used in this ETS is presented in GSM 01.04 (ETR 350). For support of data services between GSM PLMN and other networks see GSM 09-series of Specifications.
....

4   Access reference configuration

Figure 1 presents the reference configuration for access to a GSM PLMN (**see GSM 04.02**).
....
Within the scope of this ETS the Mobile Termination MT0 means a fully integrated MS including data terminal and its adaptation functions. MT1 includes ISDN terminal adaptation functions and MT2 includes CCITT V- or X-series terminal adaptation functions among other MT functions.

5   Functions to support data services

The main functions of the MT to support data services are:

- functions to ensure conformity of terminal service requests to network capability;
- physical connection of the reference points R and S;
- flow control of signalling and mapping of user signalling to/from GSM PLMN access signalling;
- rate adaptation of user data (see GSM 04.21);
- flow control of non-transparent user data and mapping of flow control for asynchronous data services;
- support of data integrity between the MS and the interworking function in the GSM PLMN;
- end-to-end synchronization between terminals;
- filtering of status information;
- functions to support non-transparent bearer services e.g. termination of the Radio Link Protocol (RLP) and the Layer 2 Relay function (L2R) including optional data compression function (where applicable);
- terminal compatibility checking;
- optional support of local test loops.

In addition, functions to support autocalling and autoanswering are optionally specified in accordance with CCITT Rec. V.25 bis or with ITU-T Reccomendation. V.25 ter (although the use of other autocalling/auto-answering procedures are not prohibited provided that mapping in a functionally equivalent way to GSM 04.08 call control is also provided).
Other functional entities can be envisaged apart from the TAF. One of the physical interface to all these functions is the DTE/DCE interface to the MT. Normally, this DTE/DCE interface is associated with the TAF, if available. Therefore the access to any of these other functional entities, if implemented, via the DCE/DTE interface must be triggered by appropriate command sequences which are described in the applicable specifications (although the use of other procedures is not prohibited provided that mapping in a functionally equivalent way is also provided). These command sequences can be issued by the DTE only when the MT is in the appropriate command status and there is no data connection pending. They are interpreted by an MT internal control function and result in an association of the DTE/DCE interface with the addressed function, if available.
....

D. GSM 02.17 v.7.1.1; Subscriber Identity Modules (SIM); Functional characteristics

The text below is a cut from 02.17.

The SIM is the entity that contains the identity of the subscriber. When placed in a Mobile Equipment (ME), together they become a Mobile Station (MS) which may then register onto a GSM network.

E. 3G 27.901 v.0.1.2; TSG-T; Report on Terminal Interfaces – An Overview

The text below is taken from the TSG-T report, that is agreed in principle at the day of writing this paper.

4.1.1   The 3GPP terminal model

The area of external and internal interfaces for 3GPP MEs have been studied and Figure 1 shows the model that has been used. The external interface, other than the radio and USIM interfaces, is the TE-ME interface. An example of an internal interface is the TA-MT interface, as illustrated.
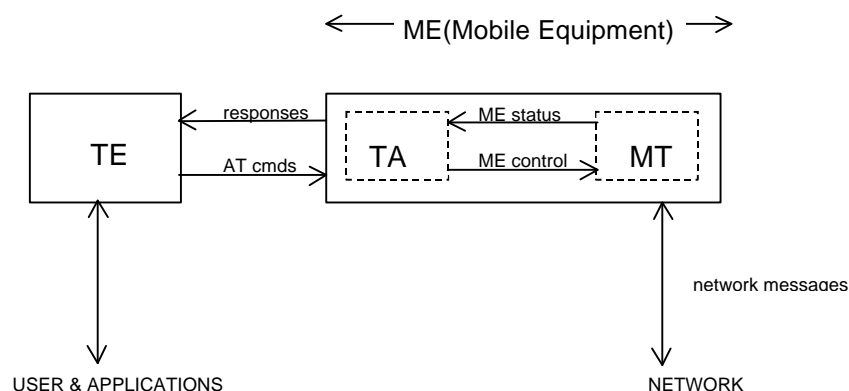
Figure 1: The 3GPP terminal model.

F. Terminology and Vocabulary within TSG-S1: Report and Recommendations; 28.7.99

The quotations given here are cuts from different sections of relevance in this report.

F.1 Overview of Technical Vocabulary in 22.000 Series

This is an excerpt from a table in this chapter, including proposed S1 actions.

Mobile termination : the mobile termination is the component of the mobile station which supports functions specific to management of the radio interface (Um).	22.105	Defined, used in this sense 22.105. No action.
Terminal	Not defined	This is widely used but not defined. Action: define in 3GPP-VOCAB.
UMTS mobile termination : part of the UMTS Mobile Station which provides functions specific to the management of the radio interface (Um).	22.100	This conflicts with 'terminal'. Action: delete this definition, replace with UMTS terminal.
User Equipment (UE):		Not defined. Sometimes used, synonymous with 'terminal'. Action: replace all uses with 'terminal'

F.2 Proposal for terms for use throughout 3GPP (3GPP-VOCAB). The same as TR 21.905 0.0.2; Vocabulary for 3GPP Specifications

This is the only term of relevance to this input paper that was proposed in the S1 report for a 3GPP global vocabulary and subsequently adopted in 21.905:

terminal: a device into which a UICC can be inserted and which is capable of providing access to UMTS services to users, either alone or in conjunction with a UICC.

F.3 Proposed Document: UMTS 22.vvv "Service Requirements Vocabulary for 22.000 series documents"

No relevant definitions are included in this S1 proposed document.

G. TR 25.990 V1.0.0 (1999-09); Technical Specification Group (TSG) RAN; Vocabulary

Nothing on Terminal, TE, TA or Mobile Equipment is defined in this report. The following can be found:

Adaptive terminal: An "adaptive terminal" is terminal equipment with the capability of adapting to more than one type or variation of network.

Mobile Station: A "Mobile Station" (MS) is an entity capable of accessing a set of UMTS services via one or more radio interfaces. This entity may be stationary or in motion within the UMTS service area while accessing the UMTS services, and may simultaneously serve one or more users. A user of a Mobile Station may also have several simultaneous connections with the network. (Editors Note: This is not clear.)

Mobile Termination: The "Mobile Termination" (MT) is the part of the Mobile Station which terminates the radio path at the mobile side and adapts the capabilities of the radio path to the capabilities of the terminal equipment. (Editors note: Is this terms used ??)

User Equipment: A Mobile Equipment with one or several UMTS Subscriber Identity Modules(s).

ME   Mobile Equipment
MS   Mobile Station
MT   Mobile Terminated
UE   User Equipment
UE_R User Equipment with ODMA relay operation enabled

H. GSM MoU classifications: 3G Definitions, Ver. 3.0.0, 28th April 1998

H.1 Text from the body of the document

This text is copied from the 3GIG defintions.

Mobile Terminal For the purpose of these series of documents this term includes both the radio communication equipment, specific service equipment (e.g., telephone (handset) fax machine) and user identity module (UIM). Several types of terminal equipment (e.g., ISDN TE) may be connected to a mobile terminal.
Note: Further study is required to align the terminology within IMT 2000.

H.2 Annex 1 from G.: VOCABULARY OF TERMS (from UMTS Forum)

"These are not 3GIG definitions, but parts of this annex may come into TG08 after discussions."

Adaptive terminal Terminal equipment with the capability of adapting to more than one type of network.
NOTE   Adapting to different networks could be accomplished by using a combination of techniques such as analogue-to-digital/digital-to-analogue conversion, multiband antennas and/or software radio architectures.

Mobile station (MS) A station in the mobile service intended to be used while in motion or during halts at unspecified points.

Multi-mode terminal Terminal equipment with the capability of accessing services using different radio interfaces and/or techniques.

Terminal The equipment which interfaces the end user with a network.

Terminal equipment A device or functionality which provides the capabilities for user applications, e.g. telephony, including the user interface.