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Generic user interface elements for 3G/UMTS
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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Human Factors (HF).

Intended users of the present document include user experience, interface and interaction design professionals, developers of mobile devices, services and applications, mobile network and service providers, terminal approvers, standard writers and developers and others.

> NOTE: Due to ever-evolving organizational and operational differences in professional responsibilities and roles, a stricter limitation of the intended users would be improper.

Introduction

ICT plays an increasingly important role in the daily activities of most people and promises a world where ICT resources improve further the quality of life. It is therefore increasingly important to ensure that ICT products are developed and designed in a usable and accessible manner, so that anyone, regardless of their abilities or age, can use and profit from them in the best possible way.

The global number of mobile subscriptions continues to grow and is now estimated to nearly 4 billion. According to the latest available subscriber data (sources: GSM Association, http://www.gsmworld.com/newsroom/market-data/market_data_summary.htm, the UMTS Forum, http://www.umts-forum.org/) and the CDMA Development Group, http://www.cdg.org/), the total number of global mobile subscribers by the end of 2008 is approximately 4 billion, with 3 billion GSM subscribers, 450 million 3G subscribers (and an additional 450 million CDMA2000 subscribers). GSM and W-CDMA stands for nearly 90 % market share of mobile communication subscriptions worldwide.

The mobile telephone has become the most successful and most widely spread personal ICT device. The user experience of mobile communication has become one of the decisive factors for the uptake and use and thus, the success of the service offering to a global user community. The capabilities offered by mobile solutions have evolved considerably during the past two decades, from basic telephony to video telephony to mass-market broadband access and services such as integrated, real-time data applications like navigational services or instant access to on-line, personalized media content and applications and have become a commodity of everyday life. "Consumers and business users are quickly getting used to megabit speeds on the move. And now the mobile broadband genie is out of the bottle…the new value chain we confidently predicted that 3G would create a decade ago is a flourishing reality" [i.28].

The "consumerisation" of ICT is increasingly driving ICT markets and development. This trend, strengthened by ever-increasing global penetration and the provision of access to information and communication services is leading to a continuous technology development and innovation to expand to all social spaces.

Connectivity and interoperability between telephony networks, personal computing, the Internet, and ever-smarter mobile devices and services offer a considerable potential for improving life. However, there is concern about whether these new products, services and their content will be fully accessible and efficiently usable to all people, including children, aging and disabled users. An effective *e*-society relies on the fact that as many citizens as possible are granted access. Users who i.e. cannot get over the hurdle of the first installation of their devices and services may perpetually be excluded from the *e*-society [i.23].

1 Scope

The present document addresses the user interfaces of 3G/UMTS-enabled devices, services and applications from the end users' perspective, and provides generic design, development, deployment and evaluation recommendations.

The applicability of the present document expands beyond EG 202 132 [i.1] and TR 102 125 [i.2], by taking into consideration some important, although not always technically unique characteristics of the 3G/UMTS mobile communication ecosystem, as experienced by the end users during their interaction with the technology (e.g. device UI characteristics, seamless connectivity between different kinds of networks, quality and continuity of services and their provisioning and the data-intensive service and application offering).

The user requirements and rationale for generic UI elements provided in [i.1] and [i.2] remain applicable to the systems and services addressed in the present document, as also the technologies covered by [i.1] remain an integral part of the 3G mobile communication environment. Furthermore, the present document, in the same way as [i.1], does only provide recommendations for UI elements and does not address complete UI designs, nor their implementations.

The present document does by any means not intend to restrict the ability of market players to define, develop or differentiate their products, nor does it in any way intend to limit their options to trademark UI designs and implementations, UI blocks or position the user experience of any (e.g. brand-or service-specific) UI designs or implementations as a competitive edge.

Wherever possible, a Design-for-All philosophy and inclusive design principles have been applied, taking the need of all users, including young and older people and users with sensory and functional limitations into account.

The considerations listed in the present document are intended to contribute to further improvements of the user experience of the future mobile communication environment, by complementing specifications from 3GPP, ETSI, OMA and others, with the intention to be considered during current and future development and deployment processes.

The addressing of costs and tariffs is outside the scope of the present document. However, as these closely relate to the establishment of end user trust in the mobile ecosystem, enabling more use in cases where uncertainties may lead to undesired user behaviors (e.g. no use), some advisory considerations are listed.

Any recommendations provided in the present document should without any exception be superseded by 3GPP specifications, in the case of any uncertainties or possible conflicts with current mobile standards and specifications.

Ergonomic issues related to hardware design and machine-to-machine interfaces are outside the scope of the present document.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:

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    - for informative references.

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> NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1   Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

Not applicable.

2.2   Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

[i.1]   ETSI EG 202 132: "Human Factors (HF); User Interfaces; Guidelines for generic user interface elements for mobile terminals and services".

[i.2]   ETSI TR 102 125: "Human Factors (HF); Potential harmonized UI elements for mobile terminals and services".

[i.3]   ETSI TS 122 011: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Service accessibility (3GPP TS 22.011)".

[i.4]   ETSI TS 122 101: "Universal Mobile Telecommunications System (UMTS); LTE; Service aspects; Service principles (3GPP TS 22.101)".

[i.5]   ETSI TS 122 071: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Location Services (LCS); Service description; Stage 1 (3GPP TS 22.071)".

[i.6]   ETSI EG 202 116: "Human Factors (HF); Guidelines for ICT products and services; "Design for All"".

[i.7]   ETSI TR 102 612: "Human Factors (HF); European accessibility requirements for public procurement of products and services in the ICT domain (European Commission Mandate M 376, Phase 1)".

[i.8]   ETSI TR 102 068: "Human Factors (HF); Requirements for assistive technology devices in ICT".

[i.9]   ETSI ES 202 130: "Human Factors (HF); User Interfaces; Character repertoires, orderings and assignments to the 12-key telephone keypad (for European languages and other languages used in Europe)".

[i.10]   ETSI ES 202 076: "Human Factors (HF); User Interfaces; Generic spoken command vocabulary for ICT devices and services".

[i.11]   ETSI EG 202 487: "Human Factors (HF); User experience guidelines; Telecare services (eHealth)".

[i.12]   ETSI TR 102 133: "Human Factors (HF); Access to ICT by young people: issues and guidelines".

[i.13]   ETSI EG 202 191: "Human Factors (HF); Multimodal interaction, communication and navigation guidelines".

[i.14]   ETSI ETR 329: "Human Factors (HF); Guidelines for procedures and announcements in Stored Voice Services (SVS) and Universal Personal Telecommunication (UPT)".

[i.15]   ETSI EG 202 416: "Human Factors (HF); User Interfaces; Setup procedure design guidelines for mobile terminals and services".

[i.16]   ETSI EG 202 417: "Human Factors (HF); User education guidelines for mobile terminals and services".

[i.17]   ETSI EG 202 421: "Human Factors (HF); Multicultural and language aspects of multimedia communications".

[i.18]   ETSI EG 202 423: "Human Factors (HF); Guidelines for the design and deployment of ICT products and services used by children".

[i.19]   ETSI EG 202 534: "Human Factors (HF); Guidelines for real-time person-to-person communication services".

[i.20]   ETSI EG 202 745: "Human Factors (HF); Guidelines on the provision of ICT services to young children".

[i.21]   ETSI SR 002 180: "Emergency communications; Requirements for communication of citizens with authorities/organizations in case of distress (emergency call handling)".

[i.22]   ETSI ETR 297: "Human Factors (HF); Human Factors in Video telephony".

[i.23]   Europe 2005: "An information society for all; Action Plan presented at the Sevilla European Council".

NOTE: Replaced by "i2010 - A European Information Society for growth and employment", see http://europa.eu.int/information_society/eeurope/2005/all_about/action_plan/index_en.htm, now replaced by http://ec.europa.eu/information_society/eeurope/i2010/index_en.htm.

[i.24]   GSM Association Official Document DG.11: "Field Trial Guidelines", version 4.9, September 2008.

NOTE: http://www.gsmworld.com/documents/DG11_4_9.zip.

[i.25]   GSM Association Official Document IR.65: "IMS Roaming and Interworking Guidelines". November, 2006.

NOTE: http://www.gsmworld.com/documents/ir65_36.pdf.

[i.26]   European Commission, Europe's Information Society Thematic Portal: "eSafety Website".

NOTE: http://ec.europa.eu/information_society/activities/esafety/index_en.htm.

[i.27]   TCeurope SecureDOC (2004): "Usable and safe operating manuals for consumer goods - A Guideline".

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[i.28]   UMTS Forum: "Annual Report 2007 and Directions for 2008".

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[i.29]   Tafazolli, R.(Ed.): "Technologies for the Wireless Future". Volume 2, Wireless World Research Forum (WWRF), 2006.

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[i.31]   W3C: "Web Security Experience, Indicators and Trust: Scope and Use Cases".

NOTE: http://www.w3.org/TR/wsc-usecases/.

[i.32]   ETSI TS 123 057: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Mobile Execution Environment (MExE); Functional description; Stage 2 (3GPP TS 23.057)".

[i.33]   3GPP Service requirements for the Internet Protocol (IP) multimedia core network subsystem (IMS); Stage 1.

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[i.34]   Cosquer, M.: "Design Guidelines for IMS User Interfaces". In Proceedings of the 21st Human Factors in Telecommunication Symposium, 2008.

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[i.38]   Hjälpmedelsintsitutet (HI): "User testing of 3G telephones- based on the needs of the deaf, the hearing impaired and the deaf-blind (2007)".

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[i.39]   ITU Activities on IMT-2000.

NOTE: http://www.itu.int/home/imt.html.

[i.40]   ESOP 2006, AMI-C-4002 2003, and AAM 2002.

[i.41]   ESOP 2006: Updated version of the "European Statement of Principles for Human-Machine Interaction (HMI) for in-vehicle information and communication systems".

[i.42]   AMI-C-4002: "AMI-C requirement and specifications for Human Machine Interfaces v 1.00". (AMI-C: Automotive Multimedia Interface Collaboration), 2003.

[i.43]   AAM 2002: "Statement of Principles, Criteria and Verification Procedures on Driver Interactions with Advanced In-Vehicle Information and Communication Systems".

[i.44]   W3C: "Mobile Web Best Practices 1.0 Basic Guidelines".

NOTE: http://www.w3.org/TR/mobile-bp/.

[i.45]   W3C: "MobileOK Basic Tests 1.0".

NOTE: http://www.w3.org/TR/mobileOK-basic10-tests/.

[i.46]   W3C: "Relationship between Mobile Web Best Practices (MWBP) and Web Content Accessibility Guidelines (WCAG)".

NOTE: http://www.w3.org/TR/mwbp-wcag/.

[i.47]   W3C Mobile Web Initiative homepage.

NOTE: http://www.w3.org/Mobile/.

[i.48]   W3C Mobile Web Best Practices Working Group.

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[i.49]   ITU-T Recommendation E.800: "Definitions of terms related to quality of service".

[i.50]   ETSI ETR 095: "Human Factors (HF); Guide for usability evaluations of telecommunications systems and services".

[i.51]   ISO 9241-11: "Ergonomic requirements for office work with visual display terminals (VDTs) - Part 11: Guidance on usability".

[i.52]   ETSI ETR 116: "Human Factors (HF); Human factors guidelines for ISDN Terminal equipment design".

[i.53]   ISO/IEC 8802.11: "Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications".

[i.54]   IEEE 802.16-2009: "IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Broadband Wireless Access Systems".

3   Definitions and abbreviations

3.1   Definitions

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

design for all: design of products to be usable by all people, to the greatest extent possible, without the need for specialized adaption

device: physical device which interfaces with a telecommunications network, and hence to a service provider, to enable access to a telecommunications service

> NOTE: A device also provides an interface to the user to enable the interchange of control actions and information between the user and the device, network or service provider.

end user: person who uses a telecommunications device to gain access to and control of a telecommunications service or application

> NOTE: The user may or may not be the person who has subscribed to the provision of the service or owns the device. Also, the user may or may not be a person with impairments.

generic: generalized set or general purpose set, often in the sense of basic or ordinary

ICT devices and services: devices or services for processing information and/or supporting communication, which has an interface to communicate with a user

Quality of Experience (QoE): user perceived experience of what is being presented by a communication service or application user interface

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

> NOTE: See ITU-T Recommendation E.800 [i.49].

spoken command: verbal or other auditory dialogue format which enables the user to input commands to control a device, service or application

usability: effectiveness, efficiency and satisfaction with which specified users can achieve specified goals (tasks) in a specified context and particular environments

> NOTE 1: See ETR 095 [i.50] and ISO 9241-11 [i.51].

> NOTE 2: In telecommunications, usability should also include the concepts of learnability and flexibility; and reference to the interaction of more than one user (the A and B parties) with each other and with the devices and the telecommunications system (see ETR 116 [i.52]).

User Interface (UI): physical and logical interface through which a user communicates with a telecommunications device or via a device to a telecommunications service (also called man-machine interface, MMI)

> NOTE: The communication is bi-directional in real time and the interface includes control, display, audio, haptic or other elements, in software or hardware.

user requirements: requirements made by users, based on their needs and capabilities, on a telecommunication service and any of its supporting components, devices and interfaces, in order to make use of this service in the easiest, safest, most efficient and most secure way

3.2   Abbreviations

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

2G	2nd generation, GSM-enabled mobile networks (see GSM)
2G+	evolved 2nd generation, GSM-and GPRS and/or EDGE-enabled mobile networks
3G	3rd generation mobile networks (see UMTS)
3G+	evolved 3rd generation, HSPA-enabled 3G networks (see UMTS and HSPA)
EDGE	Enhanced Data rates for GSM Evolution (the final stage in the evolution of the GSM standard)
GPRS	General Packet Radio Service
GSM	Global System for Mobile telecommunication
HSPA	High-Speed Packet Access
HSDPA	High-Sped Downlink Packet Access
HSUPA	High-Sped Uplink Packet Access
ICT	Information and Communication Technologies
IMS	IP Multimedia Subsystem
IMT-2000	International Mobile Telecommunications-2000 (standard family)
ITU-T	International Telecommunications Union - Telecommunication standardization sector
LTE	Long-Term Evolution

NOTE: Of 3G/UMTS mobile networks; also known as 4G.

MSD	Minimum Set of Data
NFC	Near Field Communication
NGN	Next Generation Network
OMA	Open Mobile Alliance
QoE	Quality of Experience
QoS	Quality of Service
SIM	Subscriber Identity Module
SMS	Short Message Service
UCD	User Centered Development
UI	User Interface
UMTS	Universal Mobile Telecommunications System

NOTE: The European entrant for 3G; now subsumed into the IMT-2000 family as the WCDMA technology.

USIM	Universal Subscriber Identity Module

NOTE: The 3G equivalent of the GSM SIM.

WCDMA	Wideband Code Division Multiple Access
WLAN	Wireless Local Area Network

NOTE: Commercially known as Wi-Fi, ISO/IEC standard family 8802.11 [i.53] x.

WIMAX	Worldwide Interoperability for Microwave Access

NOTE: IEEE 802.16 [i.54] and IMT-2000.

W3C	World Wide Web Consortium
W3C MWBP	Mobile Web Best Practices Working Group of W3C

4   Approach and introduction to 3G-specific aspects

4.1   Development and innovation

The recommendations provided in the present document have been developed and structured with the following aspects in mind:

1) The properties and capabilities of devices evolve, as technological improvements and innovations come to the market, when transferring from 2G to 3G (and 3G+ and foreseeably, LTE).

2) Users may need to cope with new challenges when using increasingly complex ICT devices and services.

3) Services and applications become increasingly ubiquitous; for those features used, users need to understand the opportunities offered by and consequences of using these services in different environments and locations.

4) The interdependencies between services, applications, networks and devices become more prominent. Perceived quality at the point of consumption is no longer only dependent on the processing capabilities of individual devices but rather on the overall performance of a complex ICT system.

5) Technical capabilities and constraints are well defined and have a considerable impact on the end user's mobile ICT environment.

The major changes in the developing mobile communication market can be examined through the characteristics of services, devices, media and applications, access to the Internet, system performance aspects, configuration and costs and tariffs aspects. These are addressed in clauses 4.4 - 4.10, following an overview of user and operator aspects and requirements (provided in clauses 4.2 - 4.3).

4.2   User aspects and requirements

3G, as well as LTE maintains most telecommunication functions known from earlier generations of technologies (with some exceptions, e.g. data and fax services). The technology evolution gives further enablers and opportunities for the mobile device users to handle personal digital content in the device and content located in other places. There are several improvements that are not defined by 3G as such, but follow as consequence of the development. For example, the user can typically:

- Store larger amounts of content in the device, due to an increased availability of memory solutions at lowered costs;

- More easily transfer the content between different devices and services, due to the availability of connectivity standards, memory cards, fast connections, etc.;

- Purchase, view and enjoy various types of media content (e.g. text, files, pictures, videos, music, etc.), and extend these capabilities, due to typical 3G device platform software add-on flexibility;

- Process and manage the data in the device, due to better user interfaces and processing capabilities (Edit, organize, search, filter);

- Update and extend the device software easily or with low effort, in many cases.

Users are able to connect to the Internet at sufficient speed and bandwidth almost anytime and anywhere. The time needed for connection is typically measured in seconds, and the download/upload bandwidth is measured in megabytes per second.

Along the improving coverage of 3G networks, there are less connectivity barriers for the use of applications and services. In 3G environments, the user can, anywhere within the 3G coverage (and in fall-back situations, where GPRS or EDGE is available):

- Browse the Internet. Mobile Internet browsers can access any basic content. Typically there are some limitations related to specific data plug-ins, support for different versions of Java, Flash, etc.;

- Access dedicated Internet-based services either with the browser or with service specific applications;

- Upload and download content from online sources and even devices located in the user's environment, such as home computers and office servers;

- Conduct secure transactions, based on applications and standards already in use in the wire-line Internet domain and in 3G specifications;

- Conduct remote monitoring or remote control tasks (e.g. remote healthcare or building control).

However, the access to 3G services is not always guaranteed, and the quality of service may differ widely due to network set-up and attributes, roaming agreements etc. Due to the amount of data traffic it can sometimes be difficult to understand or predict the expected costs of using 3G services. Unpredictability of involved cost may become a major reason for the avoidance of 3G data services or a major slowdown for their uptake, and vice versa [i.23].

The applicable generic user (meta-) requirements on mobile communication have been examined and are reported in EG 202 132 [i.1]. These are considered still valid and remain applicable.

4.3   Mobile network operator aspects and requirements

In addition to the requirements reported in [i.1] and as mentioned in earlier clauses of this clause, designers of 3G applications and services should be aware that their products may be offered by different service providers with varying network capabilities. Interoperation of services and applications delivered over different networks to a multitude of devices on different software platforms may cause major usability problems and obstacles to the rapid uptake and acceptance of 3G services and applications. User interface designers need to be aware of the requirements and limitations imposed by networks and their operators.

A second aspect to be considered is the interest of network operators to express their brand identity through company-specific user interface design guidelines for services and applications. While these guidelines may help to enhance the ease of use of services in the general sense, mobile network operator-specific UIs should be designed to allow users to access services and applications in different network environments, or while roaming.

Interoperability across manufacturers, software platform providers and network operators is of significant importance and if full interoperability is overlooked, there may be a major obstacle to service acceptance and use.

4.4   Service aspects

3G networks are rapidly becoming main-stream, mass-market in a high variety of cultures and regions. Also the penetration of 3G devices is rapidly increasing accordingly.

According to the ITU IMT-2000 (3G) definition [i.39], 3G devices need to support:

- High bit rates and wideband connections;

- Services that require fixed bit rate and service that need to allow variations in the bit rates;

- Fluent transition between operator networks and countries (roaming);

- Geographical positioning of the device; and

- Multimedia services.

The main factors differentiating 3G from 2G services are:

- Higher bandwidth: Recommendations are provided on what might happen if the bandwidth is too low for a service.

- More transitions between different network types during usage; and

- The evolution of operator policies.

These factors have a considerable impact on the 3G user experiences and service adoption.

4.5   Device aspects

Typical 3G devices are often characterized by a large colour screen, a variety of input solutions (12-key, and/or a QWERTY keypads and/or touch user interfaces) and sufficient processing power and memory capabilities to perform basic and advanced multi-tasking computing and connectivity tasks, i.e. high interaction performance in a small and compact form factor. Simultaneously, the global competition is bringing the average retail device prices down.

The main factors differentiating recent evolutions in devices (including 2G to 3G development) are:

- The potential to deal with much larger amounts of data and information. Such devices should be able to organize efficiently and present this data in a way understandable to the user;

- Users may want to understand and control memory management and applications running in parallel, as well as the interdependencies between applications and data ("Lost in hyperspace");

- Blurring the separation of local and remote memory/applications: the user should be helped to understand where to modify preferences, etc.;

- Higher variability of device hardware: from PCs to embedded devices: users should be helped to understand how to transfer relevant, acquired usage know-how from one device type to another;

- Increased complexity leads to more possibilities to user errors: error recovery issues become much more important.

According to [i.29], 3G devices are characterized by:

- Higher processing power and more memory capacity;

- Larger and more powerful displays;

- Operating systems with multitasking abilities allowing for parallel user activities;

- Operating systems with the ability to handle several connections simultaneously.

These new or enhanced features allow for more complex application and software systems with new features as e.g. user-initiated or automated OTA software updates. These new functionalities may need to be understood and controlled by the user especially if they, as a consequence, are confronted with new icons or symbols which provide visual indications of system and application status; complex system and device messages which require attention or interaction; or messages caused by events in simultaneous connections or changing connection characteristics (QoS). Moreover, user interaction to set up features and understand and respond to errors may become much more complex than in the case of 2nd generation mobile devices.

Different 3G-enabled devices with the option of having multiple connections (cellular, WLAN, WIMAX, and NFC) require the user to be aware of and to control data and transmission security, privacy and date integrity issues which should be taken into account by UI designers developing these devices.

4.6   Media aspects

In the foreseeable future all media that can be digitized, will become digital. In fact, even today a major part of our activities and information is already in digital form. 3G is the environment where operators and service providers can distribute (in principle, at least) all digital media to customers, such as music, TV programs, games, advertisements, news, new applications and any digital documents. On the other hand, users are able to create and use interactive services, to upload and share content, and to create new behaviours based on mobility and communities.

Due to novelty of the 3G technology and mobile Internet services there are still limitations disabling the use of services and media, related to:

- Devices: interoperability with services and with other devices, varying capabilities, devices which are not fully optimized for the use of large and dynamic data content;

- (Internet) Services: availability, costs and tariffs, roaming limitations, accessibility, local vs. global availability;

- Networks: availability of 3G networks, quality of services, cost;

- Legal and national limitations and policies;

- Copyright legislation, both on the international, European and national levels.

4.7   Application aspects

3G enables and supports the development of new services, applications and smart environments. New functionality can be created by all stakeholders, such as manufacturers, users, service providers, and software companies, due to emerging options to program devices (open platforms), possibilities to search and install new functions, memory capacity, processing power and connectivity.

Although devices can store and handle large amounts of data, there are several related issues which may cause difficulties to the user: memories tend to become full, upload or download is not always possible or fluent, etc. In addition, the UI does not always support the proper handling of large numbers of data items, such as long music play lists or photo libraries.

In contrast to many 2nd generation devices, most 3G devices support multitasking, i.e. several applications or functions can run in parallel. The use of multitasking provides parallel facilities but decreases performance for each facility used. Multitasking also increases power consumption, and can make the overall device behaviour slower. This should be taken into account in application design.

Users expect that device functions work together and converge. For example, phonebook address information may be needed in a new application, or location information from a new function should be available for an old established function. Application design standard checklists and common sense need to be applied in linking functions together and to avoid "silo" design.

In development, there are numerous practical problems related to the evolution of software platforms. History has shown that binary compatibility breaks now and then. Applications that used to work with one software release, do not work anymore with the new release. Scalability of applications is required due to the rich world of different devices, display sizes, input capabilities etc. In other words, platforms should be able to adapt to a rich variety of applications and vice versa, in an ideal world.

Since mobile device manufacturers are free to develop their own versions of the Java (J2ME API) when developing device-specific features, it is more probable that applications will create runtime errors (there are other possible reasons, not detailed here) and interoperability issues.

Applications need to work across a multitude of network environments. The quality of service may be excellent, poor, or there may not be network available at all. In many areas, the available network tends to swap between 3G and other network types. If applications are designed to work in high-bandwidth network environments only, they may become useless in other environments.

4.8   Internet service and Web access aspects

Most Internet services can be offered also to 3G mobile devices. Services that have been developed for personal computers and desktop display devices with a full keyboard are increasingly used by mobile users, possibly with reduced functionality.

Services can hence be available via the Internet (using Internet protocols) or via "traditional" (using cellular, radio) connection protocols. Examples for these traditional protocols are radio, television, circuit-switched telephony and video conferencing. In some cases, Internet functions can enhance or support traditional communication channels, such as finding channel information for FM radio.

Table 1: Comparison of some functions that are available using both 3G and other technologies

Service	Cellular or radio implementation	Internet implementation
Radio	FM radio, local channels, need to be tuned, requires wire antenna	Internet radio, global channels, always tuned; for mobile use, requires wireless communication
TV	DVB-H (or related), local channels, analogue terrestrial channels, cable	Internet TV and video streaming, global channels; for mobile use, requires wireless communication
Video conference	Circuit-switched device to device video telephony	Device to any device IP video conferencing
Web browsing	Not applicable	PC-based Web browser; for mobile use, requires wireless communications

Sometimes, in order to offer the best possible level of usability and accessibility, it may make sense for Internet services to be scaled and adjusted for mobile devices (with discussions and work ongoing in the W3C Mobile Web Best Practices WG; see below). The adjustment may take place in the original service, in between the device and service, or in the device. Depending on the implementation the scaling can be automatic (for example using XHTML), or dedicated device software is provided to access the service. In any case, where adjustment is deployed, the overall service experience is typically different from the original concept.

Adaptation often causes problem to the use of services. Some functions may not work, some functions may work in a different manner, or the service may work only in certain devices. In addition, adaptation always has an impact on the layout of user interface components, and may require re-design of the interaction or user interface.

Third-generation protocols support much higher data rates than earlier cellular systems, now measured in megabytes per second. New services are increasingly combining Internet service with other functions. The usefulness or utility may be critically dependent on the *co-functioning* of service and function. For example:

- GPS navigation and online maps: There should be low delay in downloading map data, and subsequently showing the location on the display of the device;

- Video call: Sufficient synchronization of picture and audio in video call is required to provide understandable and fluent experience.

The W3C Mobile Web Initiative [i.47] and its Mobile Web Best Practices Working Group [i.48] was launched by W3C in 2005 to address "interoperability and usability problems that make the Web difficult to use for most mobile subscribers". While many of today's mobile devices already feature Web browsers and the demand for mobile devices continues to grow, browsing the Web from every mobile device has not become as convenient as expected. For example, it may be difficult to find product information, consult timetables, check email, transfer money; users often find that their favorite Web sites are not accessible or not as easy to use on their mobile device as on their desktop computer. Content providers have difficulties building Web sites that work well on all types and configurations of mobile devices offering Web access [i.30]. The aim is to make Web access from a mobile device as simple, easy and convenient as Web access from a desktop device. The initial focus of W3C MWI was on developing best practice recommendations in MWBP for "mobileOK"[TM] Web sites, providing device information needed for content adaptation, and marketing and outreach activities.

3GPP has also addressed the issue and has, through TS 123 057, defined and developed a Mobile Execution Environment (MExE, see [i.32]) that is a flexible and secure application environment covering a variety of technologies for 3G (and 2G+) mobile devices.

Last but not least, some recently launched high-end devices have raised the level considerably by providing a state-of-the-art user experiences (although possibly limited to certain browsers and/or content providers).

4.9 System performance aspects

3G environments provide an optimal user experience only if the performance of all components is sufficient to support services and applications smoothly and without interruption. As an example, the download of location information from a network-based service should, under normal circumstances, be fast enough that the user's device does not significantly change its location during the download process making the information potentially too outdated to be useful.

The evaluation, control and optimization of the overall system performance become a major design topic for 3G applications and services. Issues to be considered include:

- Performance of components individually may be sufficient while the entire system has no acceptable performance;

- Applications should be aware of potential performance problems and need the possibility to "fail gradually";

- The timing behaviour of applications, where relevant, should be indicated to the user, i.e. the user should get relevant information on foreseeable delays during start-up and use of applications, when relevant;

- Performance criteria defined by application and device designers should be used to point out performance problems.

Before acting on the recommendations in the present document, developers should carefully take into consideration the applicable standards and other specifications from 3GPP, 3GPP2, IETF, ETSI, OMA and others and optimize the user experience within the limits of applicable technical boundaries.

4.10   Setup and configuration aspects

The amount of set-up data increases together with the increase in service and application offerings. The functionality of devices becomes increasingly dependent on the proper configuration management, maintenance and recoverability of configuration settings.

In order to meet increasing setup and configuration needs, more and more service providers offer devices pre-configured for access of the service package or level selected by the customer. Furthermore, advanced methods are being developed for configuration management. The following options are currently being deployed:

- Configuration can take place in the device or in the network; devices can get their configuration information on application start-up or store settings permanently. For services which can only be used online, remote configuration of the network may a preferable choice. Service developers need to be aware that configuration located in the network is not accessible when offline or may have high access latency in 2G environments or when roaming;

- Configuration can be changed by the user, by the service, or by the operator. Operators and service providers may choose to prohibit the modification of specific settings to prevent the user from modifications which may prevent the intended operation of the service;

- One-and two dimensional barcode, Smart-card or RFID- based configuration is an alternative to over-the-air configuration of devices and services which provides all necessary setup information without user involvement.

4.11   Costs and tariffs aspects

The addressing of costs and tariffs is outside the scope of the present document. However, as cost transparency closely relates to the establishment of end user trust and usage, some advisory recommendations are provided, for consideration.

According to the UMTS Forum [i.28]: "It's no big surprise that realistic pricing for large or even uncapped data bundles has been the commercial enabler for HSDPA. With a subscription costing little more than a fixed broadband connection in some countries, it's no wonder that retailers report stocks of HSPDA devices flying off their shelves. Many of the takers are small business owners and entrepreneurs who aren't even bothering to install a fixed phone line in their home office - they're using mobile exclusively for all their communication needs."

If this trend continues and the 3G environment develops into directions of flat- or fixed-fee usage rates, well-implemented (and in some cases even regulated - e.g. in the European Union) roaming solutions and minor limitations on the available data rates, the users will be able to enjoy the benefits of 3G in full scale and new services will be rapidly developed. In this case, these recommendations can help in optimizing the user interfaces to support wide global practical adoption of 3G services.

However, during the transition to the above described environment, users may still worry about the cost of using data-intensive services using the transition period (and hence need more informative user interfaces to control the device connectivity status), and they may experience difficulties in getting services to work in the home network and abroad. For this scenario, these recommendations aim to provide help in finding the right user interface solutions, rather than restricting user control to the disabling of data roaming.

5   Recommendations for networks and devices

5.1   Managing Quality of Service (QoS) and costs of connectivity

The major reference documents applicable to this area are the 3GPP specifications [i.3], [i.4] and [i.5].

In addition, a few other recommendations have been developed and are provided below. These recommendations may further increase the user trust and contribute to the transparency of costs and tariffs, typically leading to an increased usage, if taken into consideration in future development and when supported by technology.

Quality of Service (QoS) relates, among other aspects, to data transmission speed and accuracy, network coverage and network loads, and is experienced by the user as a key element of the quality of interaction with the service through the device.

The concept of QoS is not clear to the user, nor is it undisputed whether an average user would like and be able to properly control it; most important is that the services and applications required work in a reasonable manner.

The use of data-intensive or data-dependent applications over the air depends heavily on the QoS available during the entire usage period.

In case of longer data transfer times, the user should be made aware of the progress of the data transfer, and the system should support the completion of the ongoing data transfer even if it was interrupted.

If the QoS level is or becomes too low to be enough supportive for the services used, the user should be informed about the changes. In any case which involves longer data transfer times, the user should be made aware of the progress of the data transfer during application or service usage, and systems should support the completion of the ongoing data transfer.

It is not always easy or even possible to estimate the data transfer volumes required to perform specific functions, for example in the case of GPS navigation with online maps. Users should have visibility to the amount of data transferred. This information is valuable especially to users who do not have flat data rate contracts and/or in roaming scenarios. The invisibility of data volumes may become a prohibiting factor to the service usage due to the user being afraid about too high costs or due to problems in paying incurred (and unpredictable) costs.

In 3G environments, users will have a number of different connection possibilities with varying costs and QoS properties (e.g. WCDMA, HSDPA, HSUPA, GPRS, EDGE, WLAN, WIMAX, Bluetooth, etc.). While travelling or roaming, both the cost aspect and the QoS will regularly change. Users may wish to be informed about and have the possibility to control changes in connectivity, either to improve the probability of achieving the required QoS or to control their cost.

One possibility to allow this control is the definition of priority lists for wireless connections, expressed as user-configured preferences. These lists might be pre-configured or constrained (e.g. based on the applicable subscription schemes). The device should then scan for available prioritized connections in regular intervals or when the current connection becomes unavailable. If provided via the subscription scheme, the user should be able to change connection properties instantly, manually.

Recommendations

Recommendation 5.1.1   The 3GPP QoS specifications (e.g. [i.3], [i.4] and [i.5]) are the primary reference documents to follow.

Recommendation 5.1.2   In addition, and if supported by technology (e.g. a service or application, when requested by the user, detects actual data transfer rates or latencies), the recommendations provided below should be considered.

Indicating QoS

Recommendation 5.1.3   If possible, indicate if the available QoS does not support or is insufficient for usage of the (intended) service.

Recommendation 5.1.4   If possible, indicate the availability of alternative networks open for access and use in a way which helps users understand their QoS and/or supported services (e.g. key network attributes), when applicable.

Recommendation 5.1.5   It may show useful to support users to require certain QoS parameters (e.g. deaf users who need to use video calls for signing and lip reading), as long as it does not compromise basic applications (such as a voice call).

Recommendation 5.1.6   If technically possible, consider providing means to assist users who so require making an informed choice of available networks, by offering QoS and related cost information (such as special tariffing, if available).

Recommendation 5.1.7   QoS should be shown in relation to the services that it supports and enables (e.g. voice calls or voice and video calls), rather than in abstract forms, when applicable.

QoS when roaming

Recommendation 5.1.8   It is recommended to offer the user the option to prioritize connectivity options which will then be used to optimize connectivity properties when the user is out of the range of the home network.

Recommendation 5.1.9   The QoS-related information should be provided in the users' preferred language, when possible.

Recommendation 5.1.10 Functional application limitations (e.g. due to roaming) should be indicated to the user when they have an impact on the use of services (e.g. when a 3G subscription is registered with a lower-bandwidth 2G network), when possible.

Recommendation 5.1.11 Users should preferably be provided with some information and control options when the cost of use changes considerably, e.g. due to roaming (e.g. a "Welcome" SMS message carrying additional information).

Application performance changes due to changing QoS

Recommendation 5.1.12 Functions should be able to gracefully adapt to changes in QoS, e.g. reduce image resolution or frame-rate, when supported.

Recommendation 5.1.13 If appropriate, applications should be designed considering both a high and low data rate user experience (e.g. video turned off in the case of low data transmission rates).

Recommendation 5.1.14 Where possible, imminent changes in QoS should be communicated to the user, especially if the user is involved in real-time communication or there is a cost implication.

Recommendation 5.1.15 If possible, the user should be notified if an application is using too much of the available data bandwidth, and, for example, considerably limits the performance of other services used simultaneously.

Recommendation 5.1.16 Reasons for (temporary) QoS limitations and changes should be communicated to the user in a meaningful way, if possible.

Costs and QoS

Recommendation 5.1.17 Users should be allowed to change the level of QoS, if the feature is supported (e.g. for reasons of cost).

Recommendation 5.1.18 If possible, users should be advised of the best cost/QoS relationship available from the available networks.

5.2   Internet connectivity and access

5.2.1   Internet connectivity

The Mobile Internet is in principle open to everyone, everywhere and anytime, and constant mobile access to services is a key feature of 3G. Furthermore, in many developing markets or in the case of young subscribers, it may be the only way available to access the Internet, possibly in addition to PIAPs.

During the 2G era and early days of 3G, some mobile network operators aimed to allow browsing only inside well defined "walled gardens", within service domains selected by the operator. Now, the "walled gardens" are gone, and mobile users can use the devices to freely browse the Internet. 3G mobile devices may support 3G only or both 3G and 2G or any further variation of wireless access.

Some mobile devices provide configuration options to select between the use of 3G only (for example UMTS), 2G only (for example GSM), or use of both cellular systems (in addition to Wi-Fi).

3G Internet connectivity is non-exhaustively characterized by:

- A relatively fast establishment of data connection;

- Relatively high data speeds, dependent on the technical implementation, available QoS and the availability of the 3G service (or a fall-back access);

- Capability of being constantly connected, without the need to re-establish the connection on a session-to-session basis;

- Capability to use voice and data connections simultaneously;

- Capability to have connections simultaneously (for example, e-mail and browser can run at the same time);

- Capability to support other functions through online data access;

- Typically faster download than upload speeds.

The connection from mobile devices to the Internet can be achieved in multiple ways, for example using 2G, 3G, Wi-Fi or WiMAX technologies. In areas of cellular coverage, 2G and 3G methods are most often available. Other methods are available occasionally or in specific locations only. In addition, cellular access may be limited or not available when the device is roaming, when service agreements define limitations, or when there is no cellular coverage.

In case of cellular connectivity or handover problems, accidental "hang-ups" may occur under some circumstances. Due to this, some functions using the connection (e.g. an e-mail client) may behave in an abnormal manner.

It is important to support the user's need for a well-functioning and reliable access, especially in roaming situations. Due to roaming restriction, Internet connectivity may be possible through one operator, but not possible with another (due to a variety of reasons). Basic 3G Internet connectivity should be pre-configured for all parameters and delivered with the service (possibly, together with the handset) or automatically delivered over the air, (e.g. Internet Access Point, use of packet data or application specific settings).

5.2.2   Internet access

Users want to utilize their mobile handsets to access information and services anytime, anywhere, while system interoperability and practical usability problems may make mobile Internet access and browsing unnecessarily difficult for many users. Sufficient information should be offered to ease the use of a given service. For example, if a registration is needed before a mobile service can be accessed and used, such as mobile TV, can be accessed, this should be communicated properly to the users as part of other product communication material.

Most 3G devices have pre-installed mobile browsers and other applications that use services through Internet. In addition to traditional web browsing, task specific applications are emerging, such as applications for navigation, podcasting, and music download. The use of mobile Internet is rapidly increasing and becoming a mainstream activity. Still, many are not actively using the mobile services on their handsets due to usability problems, concerns about cost and other reasons.

Industrial research evidence indicates that when asked their reasons for not making use of the mobile browsers on their handsets, many users describe an unsatisfactory user experience with mobile browsing when they have tried it, such as pages loading too slowly, or poor formatting or functionality of pages. Some, but not all, of the problems described may be solved by having better browsers on handsets. However, many of the problems can be solved by content providers working harder to make their content "mobile friendly" or "mobile considerate".

Some industry organizations and standards organizations provide specifications and conformance criteria related to various aspects of mobile data services:

- The Open Mobile Alliance (OMA) has developed specifications addressing mobile browsing; and

- The W3C Mobile Web Initiative [i.47] Best Practices Working Group [i.48] is unique among such organizations in providing specific guidelines to optimize the usability and accessibility of the mobile Web (e.g. [i.44] - [i.46]).

5.2.3   Computer-based Internet connectivity and access

Due to lack of devices, in most countries (except Japan), the very first 3G networks were launched with a 3G PC(MCIA) card or USB dongle offering, for connecting laptops to the Internet. This was in the true spirit of 3G, even if inferior data speeds and a data-centric user experience did not always immediately deliver upon the promises of 3G. Nowadays, this access is still used, although computers with embedded, native 3G access are also available.

Computer access remains one of the most useful and data-intensive application areas of 3G, nowadays competing with fixed-line broadband offerings by means of cost as well as connection, up-time and data speed attributes.

Among the specific UI aspects, we note issues related to installation, configuration and setup; network discovery, attributes, alternatives and selection; traffic monitoring, including data volumes and errors; machine-to-machine connections (outside the scope of the present document); and access through external devices used as a modem. Most of the recommendations provided below are equally applicable, although some specific recommendations are also provided at the end of this clause.

5.2.4   Embedded access

3G-enabled mobile broadband modules can be embedded in a large variety of portable consumer electronic devices (such as e-book readers, media players or GPS navigators) and enable their mobile broadband access. User interface issues are foreseen to be addressed directly, through the main UI of the device.

Recommendations

General

Recommendation 5.2.1   Inform the user about available connectivity options, if applicable and possible.

Recommendation 5.2.2   Assist the user in finding the optimum connection method (e.g. through the support of pre-defined user preferences), and provide default values for these, if possible.

Recommendation 5.2.3 In case a connection cannot be established, provide alternative methods to connect (if available), supported by sufficient explanation, and/or informative error handling.

Recommendation 5.2.4 Internet connectivity setup and configuration should be automated to the largest possible extent.

Recommendation 5.2.5 Default values should be provided in the device that require minimal configuration by the user.

Recommendation 5.2.6 Default values should be provided in the application/ functions that require minimal configuration by the user, if possible.

Recommendation 5.2.7 Internet applications should handle connectivity issues in a useful and self-explanatory way.

Recommendation 5.2.8 In roaming situations, indicate which networks provide 3G Internet access, if possible.

Recommendation 5.2.9 If an existing connection is closed, explain the user why the connection was closed, and provide help to recover the connection, if possible.

Recommendation 5.2.10 Recovery from network failures should be automatic, if possible.

Recommendation 5.2.11 In seamless networking situations, the transition between different network systems should be as fluent as possible. For example, do not require user confirmation every time the network is changed, if supported in the implementations.

Recommendation 5.2.12 During first use, or if otherwise preferred by the user, ask for user confirmation when accessing the Internet.

Recommendation 5.2.13 In roaming (or other potential higher-tariff) situations, support user confirmation for accessing the Internet, if possible (unless this is disabled by the user).

Recommendation 5.2.14 The device should, through supported means, indicate the connection status (e.g. "The device is online", or "Connection has been timed out").

Recommendation 5.2.15 Users should have control over their connections, i.e. users should be able to initiate and close any connection.

Recommendation 5.2.16 The most recent versions of applicable guidelines from industry associations and consortia, available from the GSM Association, OMA, W3C (e.g. [i.39] - [i.41] and others should be followed).

Recommendation 5.2.17 If possible, try to optimize the data traffic flow, especially with functions and applications that are frequently used.

Recommendation 5.2.18 If possible, ensure that sufficient and accurate guidance is provided for easy service access, especially if service elements from different providers are bundled with the product (e.g. a media package).

Recommendation 5.2.19 The user should not be required to provide passwords etc. every time when Internet-based activities are initiated, unless entry of passwords for every use is desired by the user (e.g. making a VoIP call should be as straightforward as making a plain telephone call).

Recommendation 5.2.20 Traffic monitoring information should be provided, if available. Such information should include statistics of use (volumes, speeds, and sessions), information about pre-agreed and available data volumes, costs and/or usage time.

Computer access

Recommendation 5.2.21 External data cards or dongles enabling mobile Internet access should complement but not interfere (by means of functionality) with the computer's native (e.g. Wi-Fi) access.

Recommendation 5.2.22 The user should be informed about the possible use (and related costs, if any) of integral SIM cards, to ease the handling of the connection, if possible.

Recommendation 5.2.23 The cost for multiple access packages (e.g. telephone and computer) should preferably be presented through one entity to the user.

Recommendation 5.2.24 The above recommendations should apply also in the case when a mobile device is used as a modem to connect a computer to the Internet, if supported.

Error handling and user guidance

Recommendation 5.2.25 User guidance and error handling support should be provided for the most obvious and known Internet connectivity error situations.

5.3   Always-on, always on-line

In this clause we address the mobile always-on, and being constantly on-line. The key related areas addressed are power consumption, cost, availability of content, possibility for data search, and problem and error situations.

Power: Mobile devices are typically on, by their nature. They are always ready for use and also actively used. Stand-by times for mobile devices are typically measured in days or weeks, and effective operating times are between several hours to several days. Usage patterns have evolved with the mass-market, with the increased device and network capabilities offered. Similar trends apply to 3G services. While earlier (2G) usage was mostly about specific time-limited tasks, such as telephone calls and text messaging, 3G provides more continuous usage, such as listening to music, relying upon navigational services or continuous communication through push emails. New behaviours have considerable impacts on the design and optimization of power consumption and management.

Cost: 3G devices can be on-line and connected to the Internet all the time or for longer periods of time. Being on-line as such does not create any costs to the user (if no automatic updating or downloading activities are scheduled). Only transferring data (or having the agreement to transfer data) costs. Users are not always aware of this difference. A considerable barrier for the active and frequent use of 3G mobile data services is related to the uncertainty of possibly generated costs in the home or roaming networks. User should be offered the control to manually end all active connections.

Availability of active content: Users of 3G devices have practically access to all content and services that are available through the Internet, for example the:

- Possibility to synchronize or transfer data constantly (e.g. navigation);

- Capability for being ready and alert for a incoming triggers or events (e.g. push email); or

- Capability to instant service access (e.g. browsing).

Being constantly online provides also the capability to constantly publish information about the user such as presence or location status. In some cases it is important to understand and detect how well the data transfer is functioning in order to understand current device behaviour and also to make predictions about the conditions for further activities.

Possibility for data search: Some devices support a local and/or Internet search function. Internet search is a fast and powerful tool, especially in situations when the device is in online state or can quickly establish a connection.

Problem situations: Certain services and applications may rely on continuous Internet access. Services and applications should be designed to accommodate for changes in network type and occasional disruptions in the service. Being online can lead to undesired situations, including:

- The connection may drop without notice;

- The connection may not be able to re-establish automatically after being dropped;

- The connection type may be changed between 2G/3G/Edge/3.5G/Wi-Fi connection types without notice;

- Higher power consumption than in idle mode;

- Connections are paused or stopped during other communication, such as voice calls;

- Internet services that instruct the device to refresh the content periodically, such as twice per minute, may create more data traffic than user notices (e.g. automatic homepage content refresh every 30th second expressed through the script HTML: <meta http-equiv="refresh" content="30">.). Such services also decrease battery life.

Recommendations

Recommendation 5.3.1   An indication about being online should be provided to the user.

Recommendation 5.3.2   Information whether one or more functions are online simultaneously should be provided to the user.

Recommendation 5.3.3   If possible, provide information about the current network attributes (e.g. "3G now available; using 3G").

Recommendation 5.3.4   Both automatic and manual methods to monitor and control the power consumption should be provided to the user, but not to the extent that the user is unable to make proper use of services (e.g. a location service needs a connection even if the device is unused so automatic connection dropping after lack of user activity is not always recommended).

Recommendation 5.3.5   An option to close all on-going communication connections should be provided to the user.

Recommendation 5.3.6   User-controlled presence information/status indicators should be supported across applications, if applicable and possible.

Recommendation 5.3.7   Information about the online related system activity, such as the upload / download data rates (speed) and amounts (bytes transferred) should be provided to the user.

Recommendation 5.3.8   Search functionality for both local and remote content (e.g. content that locates on the Internet) should be provided to the user.

Recommendation 5.3.9   An option to create a priority list of preferred communication connections should be provided to the user.

Recommendation 5.3.10 The selected communication channel should be indicated to the user.

Recommendation 5.3.11 Design functions and applications to handle changes and disruptions in the connection should be provided.

Recommendation 5.3.12 System functions to recover automatically from lost connections should be provided.

Recommendation 5.3.13 The user should be informed, if a function will perform automatic content refreshes.

5.4   Specific (dedicated) UIs

In the field of portable devices, it is not realistic to assume harmonization similar to that which has led to fairly uniform computer user interfaces. Rather, a multitude of different dedicated devices with specialised user interface are to be expected: music players and radio receivers, mobile TV sets, navigation devices, or game consoles are just some examples of mobile devices with dedicated user interfaces. In addition to software functionality, there will also be considerable variations in form factors and input/output capabilities.

Specific, dedicated UIs may be implemented through hardware solutions (as e.g. the remote control of Hi-Fi systems), or software, such as mobile Internet browsers available on an on-demand basis.

To ease the use of such dedicated devices, the UI functionality presented under "Recommendations" should be provided.

Recommendations

Recommendation 5.4.1   A user interface for connectivity setup and control should be provided, supporting the definition of user preferences.

Recommendation 5.4.2   A dedicated UI should be implemented in a way that it can be adapted to changes in connectivity setup.

Recommendation 5.4.3   Main device UI components and style guidelines developed for and/or applicable to the specific product should be examined and applied to the reasonable extent.

Recommendation 5.4.4   The functionality and UI should be optimized for the task/purpose/context.

Recommendation 5.4.5   The device-native UI should be available even in on-line mode.

Recommendation 5.4.6   If the UI of a device does not have the necessary hardware for offering a UI for connectivity setup, the connectivity procedure should be offered through a computer or through other mobile devices (e.g. using NFC procedures).

Recommendation 5.4.7   If the device does not have an integrated display, then provide alternative ways to inform the user about the status of connectivity (e.g. through the use of LEDs).

6   Recommendations for services and applications

6.1   Data-intensive services and applications

The higher data rates offered by 3G networks and the development of handsets with faster processors, more memory and larger colour screens allow for the use of data-intensive applications in the mobile, work, public space and home contexts. Examples of these include video calls, on-line maps and navigation services, imaging, music and video downloads (and upload/viewing of services), community spaces with peer-peer file sharing, on-line games and virtual communities or access to community and public services.

Many of the above mentioned and other services are also increasingly often accessed in the home and public spaces via Wi-Fi and WiMAX access points. Combined cellular and Wi-Fi/ WiMAX handsets may allow seamless transition from home-based, private 3G networks to public 3G networks, allowing service access and services to follow users wherever they are.

Whilst 3G applications can also operate on GPRS and/or EDGE networks, the user experience may be hampered by insufficient data speeds and capacity and its consequences such as poor image quality due to lower frame rates.

Recommendations

Background/ foregrounding

Recommendation 6.1.1 The user/system should be able to run applications in the background without interrupting the user's current task.

Recommendation 6.1.2 The data rate required for the use of certain applications should be indicated before they are started (e.g. for Internet-based applications), if supported.

Recommendation 6.1.3 The progress of necessary data transfers in the UI should be indicated to the user, if the down- or upload time exceeds 3 seconds to 5 seconds.

From on-line to off-line mode

Recommendation 6.1.4 Applications and services should be made useful to the user even in off-line mode (by using mechanisms such as caching).

Recommendation 6.1.5 Applications/services not available in off-line mode should be indicated.

Recommendation 6.1.6 The On-line/Off-line status of an application should be clearly indicated.

Payment for services and applications

Recommendation 6.1.7 The possible costs of using data-intensive applications should be indicated to the user, to the possible extent, preferably prior to the application being activated.

Recommendation 6.1.8 If an error occurs during a service payment process, the user should be notified and returned to the last complete step in the payment process.

Broadcast media

Recommendation 6.1.9 Channel changing should be rapid (ideally between 3 and 5 seconds) If additional payment is required for a channel, a preview should be available.

Real-time media handling

Recommendation 6.1.10 Real-time video or video-on-demand (streaming) applications should actively offer the quality best matching the available bandwidth, i.e. a high and a low data-rate ready video stream should be made available.

Recommendation 6.1.11 The user should always be asked for acceptance before media is tagged with position information, e.g. photographs (due to integrity reasons), unless otherwise preset.

Recommendation 6.1.12 If data is downloaded to the device, its storage/access/control locations should be made clear to the user.

Recommendation 6.1.13 If preconfigured media storage locations for different media types are available on a device, these should be used as the default location for downloaded content.

Recommendation 6.1.14 Temporary data, downloaded by an application should be deleted when the application closes, if possible (e.g. by automatically emptying the memory cache).

Navigational and location-based services

Recommendation 6.1.15 Unless legally otherwise required, user consent should always be asked for the disclosure of information relating to the user's position (including 3rd party services).

Recommendation 6.1.16 Position updates should be sufficiently frequent and precise (to the best possible extent), to be accurate and useful to the user.

Communication-based services

Recommendation 6.1.17 The status of group-based communication service members (broadcast or synchronous) should be made available to the user (matter of pre-consent).

Security of personal data and content

Recommendation 6.1.18 The level of security of data should be communicated to users prior to data transfers.

Recommendation 6.1.19 During communication of data, the maximum level of encryption should be offered to users, unless otherwise requested.

Use of specific certificates for access and/or identification

Recommendation 6.1.20 When the use of specific certificates is required for access and/or identification purposes, the user should be provided with clear information and guidance on how to get, register, activate and use it, including any possible addition of user-specific information.

Recommendation 6.1.21 If a certain certificate has expired or is not usable as intended, the user should be clearly informed about the reason(s) to it and be offered access to renewal/support information.

Integrity of personal data and content

Recommendation 6.1.22 In the case of distributed storage (data stored both on the device and in the network/service/application); the integrity of users' personal data and content should be safe-guarded.

Recommendation 6.1.23 Users should be kept informed and aware of the status of data protection and should be given the option to control distributed data storage of personal data.

Recommendation 6.1.24 Users should be notified if and when personal data is stored remotely and/or for the first time, unless otherwise regulated (e.g. legally).

Recommendation 6.1.25 The user should always be kept informed about the status and protection/integrity of personal data. In problematic situations, redundant indicators (e.g. symbols and auditory signals) should be used.

Recommendation 6.1.26 The user should always be asked if they wish or give permission to store data in remote network locations or service databases.

Recommendation 6.1.27 The user should always have an option to explicitly remove remotely stored personal data, unless otherwise regulated (e.g. by legislation).

Recommendation 6.1.28 The user should be made aware when information related to or contained within their device (e.g. location, presence) is made available or accessed by third parties.

Recommendation 6.1.29 Users should be able to protect the integrity of personally generated content before sharing, e.g. through the possibility of adding DRM rights.

Recommendation 6.1.30 The possibility to provide evidence of performed actions (e.g. a transaction) should be offered to the user through available means (e.g. a printed, SMSed, emailed or mailed confirmation, preferably with a unique identifier), if possible.

Multi-platform access

Recommendation 6.1.31 If access to services is provided through multiple platforms, devices and/or modalities, the available functionality should be presented consistently by means of interaction, UI design and operational functionality (e.g. using the same terminology and symbols).

Recommendation 6.1.32 In circumstances when access through a certain platform, device or modality is not available, the user should be informed about alternative access options.

Application interoperability

Recommendation 6.1.33 Where applications compete for the same bandwidth (e.g. two simultaneous video calls), the user should be notified prior to application activation about the foreseen degradation in QoS due to the existing load.

Recommendation 6.1.34 Access limitations should be clearly stated and explained in "walled garden" environments.

Recommendation 6.1.35 A try-out mode should be offered to allow users to sample services before subscribing to them.

Recommendation 6.1.36 If a third party service provider is used, the provision of the information should be considered.

Roaming between networks

Recommendation 6.1.37 Users should be notified when moving between private and public networks. The notification should summarise changes in billing, services and QoS.

Recommendation 6.1.38 The user should have the ability to deactivate voice or data roaming (in order to avoid undesired behaviours, save cost or battery life).

Recommendation 6.1.39 The user should not have to manage complex account login or setup, when roaming between Wi-Fi and cellular networks.

Recommendation 6.1.40 When entering an area where both Wi-Fi and cellular systems are available, users should be able to view all available networks that can be accessed. Previously accessed networks, if asked to be remembered, should be given priority.

Recommendation 6.1.41 The UI should indicate in a subtle way a change in the user's network environment.

Recommendation 6.1.42 Private home network access should take priority over similar pay-to-use services of public networks, if requested by the user (and not contradicting with possible contractual agreements).

Using 3G devices in the home

Recommendation 6.1.43 3G devices intended solely for in-door, home-based use should be clearly indicated.

Recommendation 6.1.44 In home areas, where both private and public 3G services are available, the device should default to the home network/service environment. The user should be able to (pre)select this default behaviour.

Applications and data sharing using Wi-Fi

Recommendation 6.1.45 Data intensive applications available on home Wi-Fi networks (e.g. video streaming of security cameras) should be made available to users, QoS permitting, as they roam onto public 3G networks.

6.2   Distributed (non-device-native) UIs

With the broader bandwidth of mobile communication networks, the "monopoly" of the handset manufacturers to define the characterizing user interface elements of devices and applications disappears. In certain cases, the functionality as well as the UI may be provided from multiple sources, in real-time, in a context-dependent way. For the user of 3G devices and services it becomes increasingly difficult to identify the origin of the UI used.

For handset manufacturers, this implies a strong pressure towards the standardization of user interface hardware. As long as this hardware standardization is not in place, application and service providers have to design their user interfaces to be compatible with a variety of device UI designs, or alternatively to be locked in with a limited number of handset manufacturers, possibly only one.

For application and service UI designers it will be become increasingly important to define and use standardized methods to define and describe the characteristics of device UIs (hardware, display characteristics, etc.) and to access device UI elements.

Recommendations

Recommendation 6.2.1   The use of device-independent UI specifications is recommended for 3G applications, to the largest possible extent, when developing distributed UIs.

Recommendation 6.2.2   If on-line access may be established during the use of a service, information should be provided to the user

Recommendation 6.2.3   If on-line access is established during the use of a service, the user should be offered selectable access options.

Recommendation 6.2.4   Appropriate help functionality should be provided, which also contains access information to helpdesk.

Recommendation 6.2.5   Information about whom to contact in error situations or when requiring additional information during usage should be provided to the user, on request or depending on the context.

Recommendation 6.2.6   Pre-selected user preferences, if available (e.g. the choice of language) should be the guiding principles for the integration of the device native and non-native UI elements.

Recommendation 6.2.7   If technical limitations (e.g. low data speed) impact the intended use of a service, it should be clearly indicated to the user through the integrated UI.

6.3   Customization, personalisation and bundled packages

Customization and branding of mobile user experiences by operators, manufacturers and service providers was a characteristic of the 2G world.

Current trends include:

- Pre-installation for easy, direct access to and/or upgrade of applications and services; search, navigation, IP telephony, instant messaging, location-based services, etc. Such application will enhance the communication capabilities of a device;

- Customisation and personalisation of the device UI (audio-visual or interaction flow);

- The exclusive provision of some devices (even if for a limited time only).

With the addition of always-on high speed connectivity, over-the-air download and updates are also possible, enabling a highly dynamic 3G user experience.

Recommendations

Recommendation 6.3.1   The use of documentation distinguishing between customisation (options determined prior to shipping the product) and personalisation (options determined by the user) is recommended.

Recommendation 6.3.2   No personalisation options should render the device unusable. An option to reset all settings to the default values should be offered.

Recommendation 6.3.3   Customizations should be validated for usability and accessibility. Particular attention should be paid to consistency between the native user interface and the customisation provided.

Recommendation 6.3.4   Third party applications should be assessed by providers for their consistency in operation and their usability.

Recommendation 6.3.5   Consequence of personalisation options should be offered for preview, to allow the user to explicitly accept changes. Restore to default (factory) settings should always be an option.

Recommendation 6.3.6   Over-the-air updates should be made with the users' explicit consent (either per update or as a blanket approval), unless otherwise preset by the user.

Recommendation 6.3.7   The user should be able to roll back the result of updates (including over-the-air).

Recommendation 6.3.8   The user guide should cover any customised functions provided, rather than only pre-customization, standard features.

Recommendation 6.3.9   If customization is applied, possibly highlighted applications (e.g. parts of a promotional package such as a tag code or an Internet telephony application client) should be uploaded to the handset before delivery to the user, for direct access and use (to the possible extent).

Error handling and user guidance

Recommendation 6.3.10 User guidance and error handling support should be provided for the most obvious and known customization error situations.

6.4   Corporate use

Business and enterprise users have, by tradition, cared less about cost aspects of devices and services than consumers. Employers, on their part, care less about usability rather focusing on cost and security. A consequence is that enterprise products are often over complicated requiring detailed training and long learning times. Employees may be frequently provided with new communication, fleet and information management systems with little consultation and often without sufficient training [i.16].

Difficulties experienced, reported by enterprise users include pre-setup and configuration, access, reliability and availability, always accessible customer care and helpdesk services, multi-device and multi-modal access, synchronization and backup.

Employees are also increasingly comparing their consumer products and services with their professional systems; or attempting to informally integrate the two into their working life. For example the use of text messages, instant messaging and private and personal email is common within a working context.

For business users, access to 3G services via network cards/devices remains one of the most useful and data-intensive application areas of 3G, nowadays competing with fixed-line broadband offerings by means of cost as well as connection, up-time and data speed attributes.

The large screen available on laptops or handheld PCs allows more information about connections and services to be displayed.

Recommendations

User support

Recommendation 6.4.1   Easily and globally accessible technical support should be provided (with a
                        particular emphasis on the stages of early usage), with regard to the user's context
                        (e.g. time zones).

Configuration

Recommendation 6.4.2   Where possible, automatic configuration (based on pre-stored data for access to
                        corporate communication and data services (e.g. for VPN access)) should be
                        provided.

Access to services

Recommendation 6.4.3   One-step authentication (single log-on) to all corporate communication services
                        should be supported.

Recommendation 6.4.4   Mechanisms should be provided for password/security code retrieval.

Access to 3G services through network cards and USB-connected dongles

Recommendation 6.4.5   Access to 3G services through network cards and USB-connected dongles should,
                        to the largest possible extent, be auto-configured.

Recommendation 6.4.6   Alternative connection options should be indicated to the user, together with
                        applicable key network attributes.

Recommendation 6.4.7   Data volume and connection history information should be provided (at least, upon
                        user request) through the software client used to access and control the network card
                        or USB dongle, if the functionality is supported.

Configuration

Recommendation 6.4.8   Installation and configuration should be automatic, based on the users' SIM card and system settings. For further recommendations, see [i.15].

Recommendation 6.4.9   Any need for additional installation and configuration should be indicated and assisted. Missing or incorrect information should be signalled and examples of correct information given, the best possible.

Recommendation 6.4.10 The use of user profiles or other pre-defined, context and/or location-based usage preferences should be supported, as specified in main-stream standard documents, if available.

Recommendation 6.4.11 Options should be provided to allow a choice between mobile and Wi-Fi networks, if supported and available, matter of the user's control and preference. Where possible, native features of the users' computer should be used, rather than add-ons providing redundant UIs.

Recommendation 6.4.12 Applications should be provided to allow traffic monitoring, data and privacy management, and network monitoring and selection, if available.

Recommendation 6.4.13 Applications should be provided to monitor upload and download data volumes. Thresholds should be available and/or configurable which, when reached, may trigger notifications to the user of impending charging increases, if supported.

Support knowledge transfer from consumer products

Recommendation 6.4.14 Where possible, user interfaces of corporate systems should be made similar to popular consumer services of the same type (e.g. instant messaging).

Recommendation 6.4.15 Where possible, open protocols should be used to allow easy interoperation with consumer systems such as Instant Messaging and e-mail.

Back-up

Recommendation 6.4.16 Backup facilities for all data and communication threads should be provided (as legally required in some countries).

Recommendation 6.4.17 The user should be notified if a third party accesses their backed-up data.

6.5   Application installation and software updates

Many 3G devices have the capability to allow for software installations and updates. These operations can be done using memory devices (e.g. memory card), wirelessly (over Bluetooth, Wi-Fi or a 3G connection) or through a cable connection. Regardless of the method, the basic flow of installation or update should be always consistent.

As with computers, the user typically can update the software directly after device purchase. On one hand, software update is a good method to provide the best possible software and error fixes to the user. On the other hand, most users are not familiar with software updates and may be afraid of such operations, especially with mobile devices.

Software update and installation of new software presents several potential error possibilities. A special attention need to be paid to safe solutions, error handling and good support. In addition to technical problems users may encounter difficulties related to licenses and passwords, copyright issues and other legal aspects, and digital rights management.

Typical questions from users related to software updates and installations are: How long does the update take? Is it possible to update without data connection? What is wrong when I get this error message "XYZ"? Where can I find more information about update? How do I know if there is a newer software version available? Do I need to update the application? What should I do when installation failed?

The below recommendations address pre-installation, installation and first use after installation. For more detailed guidelines, see EG 202 416 [i.15].

Recommendations

Pre- installation

Recommendation 6.5.1   Provide sufficient and essential system information about what can be updated and installed (e.g. latest available software release in the device and available memory), key limitations and potential risks (e.g. the loss of settings or content without a backup).

Recommendation 6.5.2   The user should be reminded to consider data back-up before installation and inform about its benefits.

Recommendation 6.5.3   Clear documentation and guidance about the installation steps should be provided.

Recommendation 6.5.4   Information about the expected size and duration of an installation should be provided.

Recommendation 6.5.5   The available bandwidth should be verified before the installation of an application and the information should be provided to the user, if possible.

Recommendation 6.5.6   The availability of updates and/or new applications should be indicated to the user in some helpful, continuous or periodic way.

Installation

Recommendation 6.5.7   Installation procedures should only be initiated after user confirmation.

Recommendation 6.5.8   Users should be offered the choice of download options (fastest, cheapest, instant availability), when available.

Recommendation 6.5.9   When updates are offered over the air, the user should be informed about the cost/time/feature consequences and available options if these features are supported.

Recommendation 6.5.10 Communication interruptions and file corruptions should be monitored and alternative options provided according to the outcome (e.g. cancellation of the installation, continuation of the download after the connection has been re-established).

Recommendation 6.5.11 Problem solving assistance for the different phases of an installation should be provided (e.g. if over-the-air installation does not function properly).

Recommendation 6.5.12 The system performance should be optimized, to maintain an existing connection during software installation. For example, switching between 3G and Wi-Fi network during installation may lead to data corruption.

Recommendation 6.5.13 The device should be designed in a way that failure to complete an upgrade process do not render the device completely unusable and non-recoverable by the user.

Post- installation

Recommendation 6.5.14 The completeness of an installation should be verified and confirmation or support information should be provided to the user.

Recommendation 6.5.15 An installation log should be provided and maintained, indicating what was installed, how, the source of the data and other applicable information.

7   Recommendations for other areas

7.1   IMS-based applications

According to [i.29]; [i.30] and [i.36], IP Multimedia Subsystem (IMS), standardized by 3GPP and OMA is an access network independent unified reference architecture that supports the convergence of voice, video, data and mobile network technology over an IP-based infrastructure. This set of specifications describes the Next Generation Networking (NGN) architecture necessary to implement IP-based mobile telephony and multimedia services.

IMS will not fundamentally change the user experience of 3G [i.25], [i.34] - [i.35] but users are expected to have access to a larger variety of services The main benefits foreseen include easier rollout of multimedia services, available anywhere, with Quality of Service.

Typical IMS applications may include presence information enabled services, full duplex video telephony services or unified messaging supporting an integrated contact list for all types of communication, together with more easily developed charging models.

As no IMS clients have been launched so far, it may be too early to provide a set of specific recommendations for this area. However, some of the issues foreseen relate to:

- Access to a service from a multitude of access points and devices that may lead to inconsistencies in the user interaction and/or access to the features provided;

- Increased complexity due to the more complex functionality and convergence; and

- Even more unclear user's mental models, not being able to understand or know how and where to isolate errors in the event of technical problems (comparable to the device- service- network paradigm of today).

The following recommendations are made:

Recommendations

Recommendation 7.1.1   The deployment of User Centered Development (UCD) work models is foreseen to become even more important in the IMS environment and is therefore strongly recommended.

Recommendation 7.1.2   Innovative UIs based on technologies including multimodality, natural language processing or touch and 3D interaction should be considered to overcome issues related to the complexity of further converging ICT.

Recommendation 7.1.3   If multiple UIs (possibly in multiple modalities) are developed for accessing the same information, functional consistency and integration is recommended.

Recommendation 7.1.4   UI standards and guidelines, such as those specified in [i.9] - [i.21] should be applied consistently across all devices and clients, where applicable.

Recommendation 7.1.5   Personalization and individual user settings should be consistently supported, regardless the access network, access modality or device used.

Recommendation 7.1.6   The interoperability across different handsets, software platforms and network elements should be verified to the largest possible extent and ensured for all elements related to the functionality of the IMS client, according to some well established guidelines (e.g. as those specified in [i.24] and [i.25]).

Recommendation 7.1.7   Setup and configuration procedures of the service elements necessary for the use of the service should be automatic to the largest possible extent, integrated and consistent, while allowing the user full control.

Recommendation 7.1.8   The information used by IMS services should always be refreshed and updated according to multi-terminal access principles, regardless the access network, access modality or device used.

Recommendation 7.1.9   The interoperability across different handsets, software platforms and network elements should be verified to the largest possible extent and ensured for all elements related to the functionality of the IMS client.

7.2   In-car use

3G devices are increasingly used in cars and also integrated into or connected with the car electronics. In this clause we provide 3G- and communication-specific recommendations that are specific to car context.

Modern cars may contain several computer networks, electronic control units, and software. Car ICT has traditionally been a closed system, controlling functions such as braking, climate, engine and transmission. New solutions, however, may include telematics services and open systems.

Cars have increasing amount of embedded consumer electronics, such as a car computer or a GPS navigator. Also 3G devices and 3G (or some other connectivity) capabilities are getting integrated to cars. This integration means that 3G user interfaces are embedded for example to the general control panel, and the interfaces for handling 3G related tasks may be very different from mobile terminals.

In addition, there may be competing user interfaces for connectivity and entertainment. 3G technology in cars also enables new activities, such as the provision and use of Internet-based services (podcasting, Internet news, location specific information, telematics services). Many of the recommendations presented in other parts of the present document should be applied, with special emphasis on safety.

There are generic requirements for legal aspects and guidelines for safety, outside the scope of the present document (e.g. [i.40] - [i.43]). These should be applied and followed to the applicable extent.

A draft ETSI Technical Report addressing ICT in Cars (under development) provides a detailed analysis and description of the in-car environment and related topics. Issues with services and devices related to both the driver and passengers are addressed, including devices which are:

- mounted rigidly in the vehicle, either from the production date or later (e.g. navigation, entertainment, games);

- communicating with the in-vehicle network e.g. for connecting devices, navigation equipment;

- portable equipment used in the vehicle.

The European Commission's request for support of wireless emergency communication [i.26], eCall, is an emergency call either generated manually by vehicle occupants or automatically via activation of in-vehicle sensors when an accident occurs. When activated, the in-vehicle eCall system establishes a 112-voice connection directly with the relevant PSAP (Public Safety Answering Point), which is a public authority or a private eCall centre that operates under the regulation and/or authorisation of a public body. At the same time, a minimum set of data (MSD) - including key information about the accident such as time, location and vehicle description - is sent to the PSAP operator receiving the voice call. The minimum set of data may also contain the link to a potential Service Provider by including its IP address and phone number. If the user is subscribed to a Service Provider, additional information can be sent from the service provider to the PSAP as illustrated below. In some EU Member States, a valid SIM is required to be able to initiate an emergency call.

The most common situation is when the mobile terminal is brought into the car and used for telephone calls, messaging and navigation purposes. It is common that there is no dedicated place, nor holder for the device in the car, while it resides somewhere near the driver even if dedicated holders are available for most mobile terminals.

The device may be connected to the car audio system or car computer wirelessly (e.g. through Bluetooth) or through wires (e.g. connection through a dedicated holder or USB port). In such a case, the two systems should work together and take into account specifics of the situations, such as incoming calls during the use of navigation services. The mobile should detect the car context and adapt accordingly. There are also dedicated accessories available for in-car telephony and navigation, required to be used in some countries and recommended due to their ergonomic suitability.

The following list gives an overview of typical 3G and communication related events in the car:

- Connect and disconnect mobile devices to/from the car system;

- Move to an area with different network availability and roaming conditions;

- Make or receive phone calls with mobile device;

- Make or receive phone calls with integrated car computer;

- Send or receive messages with mobile device;

- Send or receive messages with car computer;

- Navigate with the mobile device;

- Navigate with the integrated car system;

- Play (stream, broadcast) music or video from the mobile device to the built-in car audio system;

- Transfer or synchronize information between a mobile device and a car computer;

- Download/ upload/synchronize information to the network while driving (data, content, service info), manually or automatically;

- Provide critical information (alerts, warnings, etc.) in mobile UI, in the car computer UI or in both UIs, simultaneously and redundantly;

- Provide status information (system, location, etc.) in the mobile UI, in the car computer UI or in both UIs simultaneously and redundantly.

Recommendations

Safety and error prevention

Recommendation 7.2.1   Safety critical UI activities should always be prioritized over other UI events.

Recommendation 7.2.2   Safety, readability and glanceability should be prioritized for all in-car devices.

Recommendation 7.2.3   Available safety guidelines should be applied and followed.

Recommendation 7.2.4   Generic safety guidelines developed for in-car use should be followed.

Recommendation 7.2.5   All critical functions and safety mechanisms should function properly, also when out of the coverage.

Recommendation 7.2.6   The cognitive load on the driver should be minimized and overloads avoided.

Recommendation 7.2.7   The need for long attention should be decreased.

Recommendation 7.2.8   Readability and noticeability should be optimized for in-car use (e.g. through the use of voice control, larger fonts, good visibility of connectivity icons, longer visibility of notifications, etc.).

Recommendation 7.2.9   UIs should not require instant feedback or user confirmation, for example when establishing a connection or waiting for selection. Longer user response times should be supported.

Recommendation 7.2.10 Simultaneous information in mobile device and car computer displays should not be conflicting or drawing attention to two places.

Mobile devices used in cars

Recommendation 7.2.11 Device holders and other equipment, suitable for use due to its ergonomic properties, should be used, if the connectivity is through a cable.

Recommendation 7.2.12 Automated means to establish a connection between the relevant functions in the car and the mobile device without user involvement is recommended.

Recommendation 7.2.13 Automated and safe disconnection between the car and the mobile device is recommended.

Recommendation 7.2.14 If speaker-independent voice commands are supported, the ETSI Standard ES 202 130 [i.9] should be applied for the applicable (user preferred) language(s).

Recommendation 7.2.15 A consistent practice of established guidelines for the handling and co-functioning of mobile devices and in-car functions (e.g. the handling of an incoming call while listening to music through the car stereo) should be followed.

Recommendation 7.2.16 Consistent practices or specific recommendations for the handling of mobile device behaviours while driving (e.g. the handling of an incoming call in the middle of street navigation) should be applied.

Recommendation 7.2.17 The mobile device should be able to access user content in the user's car computer (e.g. phonebook data), after user (pre-)authorization, and vice versa.

Recommendation 7.2.18 Sufficient status information should be provided in cases when the navigation information (e.g. location on the map) is not updated in real time or there are other difficulties.

Car-integrated 3G functions

Recommendation 7.2.19 Mechanisms to establish and disconnect connections automatically should be provided. However, this is naturally dependent on the user preference and should be configurable.

Recommendation 7.2.20 3G and connectivity indicators should be balanced to be noticeable among the other information in car computer displays.

Recommendation 7.2.21 Physical controls for handling the online / offline status of the car communication system should be provided.

Recommendation 7.2.22 A straightforward logic for dealing with mobile connections with a SIM or USIM (car 3G system uses phone number defined in mobile terminal's SIM) should be provided. Both the start of USIM usage (start car electronics) and the end of USIM usage (power down car) should be considered.

Recommendation 7.2.25 If on-screen projection is supported, the most essential information should be included (matter of driver preferences).

Recommendation 7.2.26 Navigation systems should provide output through redundant, multimodal means.

Recommendation 7.2.27 The interaction necessary to handle navigation services should be minimized.

Recommendation 7.2.28 If user input is required for the handling of navigation services, enough time should
be given to the user.

7.3   Accessibility applications (enabled through 3G)

The mobile development enables, directly or indirectly, new application areas that may contribute to, or even
considerably improve the accessibility of the mobile ICT environment for certain disabilities and assist young and older
people in unprecedented ways in their everyday lives. Such examples include (but are not limited to):

- Multimodal input/output:

    - supported by assistive text input;

    - capabilities to enlarge text and set colours for vision-impaired users;

    - provide multimodal input, output; and

    - support of TTY (teletypewriter) or similar, improved functionality;

- Multimodal positioning, navigation and guidance;

- Mobile Web access;

- Text-to-speech readers;

- Mobile text telephony services;

- Access to *e*-Services; and

- Video call functionality usable for signing.

Some of the new capabilities provide excellent means to support the requirements and user needs of older people and
people with disabilities. [i.6], [i.7] and [i.8] identify and present an exhaustive documentation of user needs of people
with disabilities, also mapping the user to a list of relevant functional requirements.

The possibility of using sign language in video calls enabled by 3G has been of paramount importance for many signing
deaf people, enabling them to make telephone calls on the go, instead for one fixed location (a fixed text or video
telephone, provided at a considerable cost, typically in the home) or being restricted to SMS.

Service providers, manufacturers or user associations may, from time to time, perform comparative studies and
evaluations of the capabilities and features best supported by certain communication solutions. Such an example is the
excellent study, reported in [i.38], performed in 2007 (but not followed up since). These qualitative, comparative tests
performed in Sweden with the involvement of end users in everyday life situations in 2007 [i.38], investigated three
main issues:

- The quality of video calls in relation to sign language communication, lip reading or cued speech;

- Compatibility with hearing aids through the option to use induction loops instead of headsets and the option to
  suspend usage of the GSM network (not supporting video calls); and

- The option to use screen readers, e.g. for the use of speech synthesis.

The result of such studies may provide two major benefits:

- Insight into the needs of disabled people that can be applied to future development (see below); and

- Recommendations and advice to end users, applicable to the selection and purchase of equipment, or when
  selecting and subscribing to a service (see below).

However, in order to keep these tests up-to-date, given the frequent software and hardware updates and the relatively short life cycle of a mobile device, tests should be more or less continuous in order to keep the results and recommendations up-to-date and accurate. Furthermore, in order to avoid the use of outdated information, it should be made available through some well-known, easily accessible sources (e.g. the Web, customer support, etc.).

In the mean time, it is a fact that some devices will be more appropriate for certain tasks in certain specific contexts than others. This may even vary between devices offered by the same manufacturer, carrying different design characteristics or developed for certain contexts of use. It may also be that the effective use and operation of certain devices may require some minimal level of visual acuity, motor skills and certain abilities to operate mechanical buttons, where the use of audible and tactile input is not enough, nor recommended, see [i.37]

In such cases, it is recommended to clearly declare the capabilities offered and make them openly available to all interested parties, preferably using some common industry format.

Access to 3G services may vary and cannot always be guaranteed, nor assumed continuous, while the available quality of service may show considerable QoS variations (although it is expected to improve over time, as these systems mature). The design of assistive services should take this fact into account and not offer the 3G service as the only option.

In the mean time, accessibility applications enabled through the capabilities of 3G systems enable location-independent, instant mobile access to services and applications provide considerable benefits to young, older and disabled people that should be supported and made available to the largest possible extent. These capabilities may further benefit from dedicated design considerations during the development of the technology.

Recommendations

Recommendation 7.3.1   Product information and recommendations (if available) should be provided and used to indicate the accessibility capabilities of a product or service, to assist users to more easily identify supported features and capabilities. The use of some common industry format is recommended.

Recommendation 7.3.2   Users should be allowed to try out the equipment or services and verify them, if possible, before purchase.

Recommendation 7.3.3   When procuring ICT services for disabled people, it is recommended to consider [i.6], [i.7] and [i.8].

Recommendation 7.3.4   User education guidelines provided in [i.16] and [i.27] should be applied to the largest possible extent, to provide timely and accurate information to end users through their preferred media.

Recommendation 7.3.5   Main stream user experience and accessibility guidelines (e.g. developed in the GSM Association, W3C Web Accessibility Initiative and Mobile Web Initiative, e.g. [i.19] - [i.20], [i.39] - [i.41]) should be applied and supported in their most recent, available versions, to the largest possible extent.

Recommendation 7.3.6   Services provided over 3G, addressing accessibility needs of older people and disabled users should be carefully designed and deployed, as full 3G availability cannot be assumed. Therefore, no absolute dependencies should be created and there should always be a fall-back option to get human assistance, e.g. in the case of technical failures or emergencies.

Recommendation 7.3.7   When designing and developing new technologies, it is recommended to address and assign some dedicated focus to identify and foresee accessibility applications on the service level, in order to optimize their future capabilities and usability (e.g. to ensure that the required frame rates are provided, if technically possible, in both the mobile system, as well as in the device or specify devices supporting video telephony, used for one-handed signing, to support adjustable camera angles and focus).

Recommendation 7.3.8   Assistive device main stream connectivity and compatibility should be declared and supported, to the largest possible extent.

Recommendation 7.3.9   Typical services, addressing older and disabled people typically offered through fixed-line access should, whenever possible and applicable, be made available and accessible through 3G devices, to adapt the communication needs of these people to their requirements (e.g. monitoring, safety applications or e-Services including e-Health, e-Government or Relay services).

Recommendation 7.3.10 Options required allowing users to select the size and color of the text and background themselves should be provided.

Recommendation 7.3.11 Multimodal access to emergency communications, e.g. through 112, should be supported to assist people to communicate with voice, sign language or real-time text in emergency situations. For further details, see [i.21].

Video calls used for signing

Recommendation 7.3.12 Based on [i.22] and [i.38], it is recommended to, to the largest possible extent consider the below requirements, preferably during the main development process:

1. Support a higher frame rate frequency during video calls, if possible, to improve the rendering of rapid movements.

2. Synchronize sounds and images, to enable lip reading and cued speech.

3. Support the highest picture resolution possible, so that finger movements and facial expressions can be seen well.

4. Standardize headset interfaces, to facilitate the use of induction loops or other hearing aid devices.

5. Provide a large camera angle in cameras used for video calls (for sign language usage), and a zoom option, to facilitate lip reading.

6. Improve the screen illumination (if achievable without negative side-effects on any of the points mentioned above).

NOTE: Recommended values are a minimum of 15 frames per second, QCIF(176x144 pixels) resolution, and a latency of less than 400 milliseconds, in order to provide sufficient quality and fluency that will support real time video communication in which one or more parties are using sign language through video calls.

7.4   Trust (security, privacy and integrity) issues

Instantly available, fast data connections and the increasing memory capacity of 3G end user devices have led to possibilities of instant access and remote and local storage of sensitive user data, e.g. used for *e*-Health services.

Both the integrity of the data stored in the device, on network servers or private servers at home and the integrity and security of data transmission in the 3G network need to be guaranteed and appropriately indicated to the user.

Protected data connections for the upload and download of data will become a necessity for many *e*-Service applications (e.g. e-Government, e-Banking or e-Health).

In some cases, dedicated guidelines may be available, such as those provided in [i.10] and [i.11], applicable to *e*-Health services. When available, such guidelines should be used for the specific application area to the largest possible extent.

Otherwise, or in addition, the following recommendations apply:

Recommendations

Recommendation 7.4.1   For private data on the user's device, appropriate protection mechanisms (passwords, biometric, etc.) should be provided. The options for data protection on the device should be displayed to the user.

Recommendation 7.4.2   The user should be in control of the extent of his private and protected data (i.e. should be able to decide which data is protected).

Recommendation 7.4.3   Encryption options should be provided both on the server and device side for protected data transmission.

Recommendation 7.4.4   If the user data transmission is not secure, it should clearly be indicated to the user.

Recommendation 7.4.5   Reasons for the unavailability of protected data connections should be indicated to the user.

Recommendation 7.4.6   Specific security, privacy and integrity guidelines developed to a specific application area should be applied to the largest possible extent.

Recommendation 7.4.7   The security status of a data connection should be displayed, if available.

Recommendation 7.4.8   External attempts to tamper with secure data connections should be indicated to the user.

Recommendation 7.4.9   The user should always be in control of any access rights to sensitive and private data.

Recommendation 7.4.10 Indicate unavailability of secure data connection to protected data.

Recommendation 7.4.11 Storing of sensitive data on a server outside the user's control should be indicated to the user and only done with the consent of the user.

Recommendation 7.4.12 Users should be made aware if they are required to provide sensitive data.

Recommendation 7.4.13 Technical limitations for data protection mechanisms should be explained to the user to the largest possible extent.

Recommendation 7.4.14 Appropriate, automatic backup mechanisms should be provided for remotely stored data to allow for recovery in case of data corruption or interrupted connectivity during storage, if available in the network.

Recommendation 7.4.15 Changes in sensitive data should be logged to allow for roll-back mechanisms in case of malfunctioning change processes.

Recommendation 7.4.16 The strength of protection mechanisms should be displayed to the user to enhance user trust in the system.

Recommendation 7.4.17 Critical data should be regularly backed up from the user's device to remote network storage.

Recommendation 7.4.18 Recovery for inadvertent data modification on the user's device and in remote storage should be available.

Recommendation 7.4.19 Phishing and virus attacks should be indicated to the user, if recognized.

Recommendation 7.4.20 A log of all tampering incidents should be kept and available to the user.

Recommendation 7.4.21 Users should be informed about the possibility of virus infections when downloading publicly available data.

Recommendation 7.4.22 Appropriate authentication and identification should be provided for 3G-enabled devices.

Recommendation 7.4.23 When delivering content for 3G devices, information about the author and the origin of the content should be provided, at least upon request.

Recommendation 7.4.24 Security usability guidelines from W3C [i.31] should be followed.

8   Recommendations for terminology, symbols, auditory signals and user education and product reference documentation

The recommendations presented in this clause complement those specified in EG 202 132 [i.1] with specific additions applicable to the 3G environment.

8.1   Terminology

For general issues, existing recommendations and methodologies, proposed areas and the evaluation and selection of terminology, see [i.1].

As a complement to the Terminology tables (table 1a - table 1j) presented in [i.1], the below additions in table 2 apply.

Table 2: Terminology

Concept	Recommended name	Description / Definition	Comment
Presence information or status	presence (status)	Provides access to or activates the provision of information about a user's (network) presence status to other users/applications	Does not necessarily correspond to the user's (true) status
Location	location	Provides access to or activates the provision of information about a USIM's physical, geographical location	Does not necessarily correspond to the user's (true) location
Search	search	Provides access to or activates a search function (local or remote)	
Quality of Service	QoS	Provides access to the QoS information (a guaranteed throughput level); a defined measure of performance (in IP-based communication systems)	Becomes increasingly important in IP-based (packet-switched) networks.
Navigation	navigation	Provides access to or activates a navigation services	
Upload	upload	Initiates the provision of data from a device, over a network, into a server	
Download	download	Initiates the provision of data from a server, over a network, into the device	
Refresh, Update or Reload	update	Activates a reload of the same information (but with a more recent timestamp, if available)	
QWERTY	QWERTY	Selects input through a computer keypad (hardware or on-screen)	Or corresponding national/local arrangement

Concept	Recommended name	Description / Definition	Comment
Touch input	touch	Provides access to the selection or activates interaction and input possibilities through direct touch (of a touch screen)	This typically implies the invocation of other touch commands, too
Background application	hidden application	Provides access to or information about an application running without being visible to the user	
Foreground application	main application	Provides access to or information about an application with which the user is currently interacting	
On-line	on-line	Activates a connection to the Internet	
Off-line	off-line	Terminates a connection to the Internet	
Complete payment	payment completed	Activates the processing of a payment	
Store in network	storage in network or remote storage	Initiates storage of data in the network (at some pre-defined or other selectable location)	
Store in device	storage in device	Initiates storage of data in the device (at some pre-defined or other selectable location, in the device or on a storage unit in the device)	
Roll back	previous version	Initiates return to the previous version	
Validate	validate	Initiates validation	
Show free memory	available memory	Activates the reporting of available, free memory space	As pre-selected or requested
In device	in device	Activates the reporting of available, free memory space in the device	
In storage media	on memory card	Activates the reporting of available, free memory space on storage media inserted into the device	
Over air connection	over 3G	Selects connection over the air	
Over cable connection	over cable	Selects connection over cable	
Data corruption	bad data format	Indicates a bad (damaged) data format	
Reconnect	reconnect	Initiates connection back to the network from where the connection has (recently) been interrupted.	
Download and replace/ update/ install	download and replace/ update/install	Initiates the download and replacement or installation of an application	
Select network type	select connection	Provides access to or selects the network type	
EDGE	EDGE data connection	Indicates a slower-than-3G (2G+) data connection through EDGE (Enhanced Data Rates for GSM Evolution)	Maximum theoretical data transmission rate: 474 kbit/s
Turbo-3G	HSPA data connection	Indicates a faster-than-3G (3G+) data connection through HSPA (High Speed Packet Access)	Theoretical minimum data transmission rate: 3,6 Mbit/s (may be lower in reality)
Wi-Fi	Wi-Fi (wireless) data connection	Provides access to the wireless data menu	
Data log	data usage log	Provides access to a log of data usage or access	
AT	assistive technologies	Provides access to the control of assistive technology or devices	
Pair	pair	Initiates the establishment of a connection between the device and accessories (typically over Bluetooth)	May require a PIN
Accessibility settings	accessibility settings	Provides access to accessibility settings	
Synchronize (voice and data in video calls)	synchronize voice and picture	Initiates a synchronization process (typically pre-configured)	

Concept	Recommended name	Description / Definition	Comment
Frame rate	picture frame rate	Provides picture frame rate information or selection	Typically used for video calls - often for signing and lip reading purposes
Connect to the Internet	Connect to the internet	Activates a connection to the Internet	
Camera	camera	Selects or activates the camera	
USB	USB	Selects or activates a USB connection	May also be charging of the battery

8.2   Symbols

The recommendations presented in this clause complement those specified in EG 202 132 [i.1].

For general issues, existing recommendations and methodologies, proposed areas and the evaluation and selection of terminology, see [i.1].

As a complement to the Symbols tables (table 3a - table 3c) presented in [i.1], the below additions in table 3 apply.

Table 3: Referents for proposed recommended symbols

Function	Description	Comment
Accessing Internet	For devices, to indicate the ongoing establishment of an Internet connection	Additional attributes (e.g. connection speeds or type of network) may be indicated
Online- connected	Indicator of connection to the Internet	
Offline- disconnected	Indicator of no connection to the Internet	
Uploading	Indicates the provision of data from a device, over a network, into a server	In addition, some status indicator (e.g. remaining time or progress bar) should be shown to the user.
Downloading	Indicated the provision of data from a server, over a network, into the device	In addition, some status indicator (e.g. remaining time or progress bar) should be shown to the user.
Roaming	Indicates connection and registration to another network than the home network	
Wi-Fi on	Wireless network connection active indicator	
Wi-Fi off	Wireless network connection not active indicator	
Video on	Video (image) capabilities active indicator	Important to indicate in video call mode
Video off	Video (image) capabilities not active indicator	
Bandwidth	Supported data volume throughput capacity indicator	Can be provided as intervals (from minimum to maximum)
Quality of Service	Indicates the guaranteed throughput level	
High level of quality	High available service quality level indicator	Enough to use the service
Medium level of quality	Medium available service quality level indicator	Probably enough to use the service
Low level of quality	Low available service quality level indicator	May be enough to use the service
Quality of service warning	Indication of expected reduction of service quality level	Carries a time estimate and is an anticipation
Presence information on	Indicates that the presence information is on	
Presence information off	Indicates that the presence information is off	

Function	Description	Comment
Location	Indicates that the location information is on	
Location sharing	Indicates that the location position information is being shared	
Location accuracy	Indicates the accuracy of the location positioning	May be performed through triangulation (in-doors; less precise) or GPS (outdoors; more precise)
Search	Indicated an ongoing search process	
Navigation	Indicates ongoing navigational aid activities	
Refresh	Indicates ongoing refresh of information	
QWERTY keypad	Indicates the availability of input through a physical or on-screen QWERTY keypad	
Special QWERTY (1/2QWERTY,Blackberry)	Indicates the availability of input through a physical or on-screen half-QWERTY keypad	
Touch interaction (capacitive)	Indicates that touch control is enabled and selected	
Flat/fixed-rate charging applied	Indicates that the current charging scheme allows free data usage	Certain limitations agreed in the subscriber's contract may apply
Payment completed	Indicates that a payment has been completed	
Error in payment process	Indicates that a payment sequence has not been completed	
Multiple, selectable audio/video levels available	Indicates the availability of multiple, user selectable levels of audio/ video quality	
Level of security	Indicates the security level (encryption level) applied	
Remote storage	Indicates that the user's data is/has been remotely stored	
Open data	Indicates remote access possibility to user data	
Application trustmark (or certificate)	Indicates that an application has been properly tested	This information may be provided through the use of certificates

8.3   Auditory signals

The recommendations presented in this clause complement those specified in EG 202 132 [i.1].

For general issues, existing recommendations and methodologies, proposed areas and the evaluation and selection of terminology, see [i.1].

As a complement to the auditory signals specified in [i.1], table 5, the below additions in table 4 apply.

Table 4: Referents for proposed recommended auditory signals

Function	Description	Comment
Disconnected	Indicates that a device is disconnected from a network	
QoS is about to be reduced	Indicates a foreseeable reduction of the QoS	
QoS is about to be increased	Indicates a foreseeable increase of the QoS	
Personal data security or integrity settings have changed	Indicates changed data security or integrity settings	
Data transfer allocation is about to be reached	Indicates that the allocated data transfer is about to be reached	According to some settings, agreements or configuration.

8.4   User education and product reference documentation

End users often fail to make use of the full potential and benefits of mobile telecommunications devices, applications and services because of the growing complexity of the offered features. While in a perfect world, communication concepts and user interfaces are fully self-explanatory to both novice and expert users, reality shows that users have to rely on instructions such as user guides.

In the absence of minimum standard requirements, providers tend to invest less and less in good user documentation. In many cases, detailed instructions are only provided on-line, via the Internet or on CD-ROMs. User guides are often not adapted to the needs of people with sensory or cognitive impairments on an easy-to-use format for even basic functionalities and are seldomly suited for young or elderly users.

A lower uptake of interactive services caused by users not coping with the complexity of terminals and services also has economic consequences and presents a burden to the creation of a European knowledge-based society.

Therefore, a dedicated ETSI Guide has been developed, addressing these topics: EG 202 417: "Human Factors (HF); User education guidelines for mobile terminals and services" [i.16]. The content of this ETSI Guide is not repeated here but the guidelines provided by the document are exhaustive and should be applied.

Annex A:
A listing of all recommendations

In the below, all the recommendations presented in previous clauses of the present document are collected and listed.

The recommendations carry a reference about their application area and the clause they can be found in, in the present document.

No new requirements are introduced.

5 Recommendations for networks and devices

5.1 Managing Quality of Service (QoS) and costs of connectivity

Recommendation 5.1.1   The 3GPP QoS specifications (e.g. [i.3], [i.4] and [i.5]) are the primary reference documents to follow.

Recommendation 5.1.2   In addition, and if supported by technology (e.g. a service or application, when requested by the user, detects actual data transfer rates or latencies), the recommendations provided below should be considered.

Indicating QoS

Recommendation 5.1.3   If possible, indicate if the available QoS does not support or is insufficient for usage of the (intended) service.

Recommendation 5.1.4   If possible, indicate the availability of alternative networks open for access and use in a way which helps users understand their QoS and/or supported services (e.g. key network attributes), when applicable.

Recommendation 5.1.5   It may show useful to support users to require certain QoS parameters (e.g. deaf users who need to use video calls for signing and lip reading), as long as it does not compromise basic applications (such as a voice call).

Recommendation 5.1.6   If technically possible, consider providing means to assist users who so require making an informed choice of available networks, by offering QoS and related cost information (such as special tariffing, if available).

Recommendation 5.1.7   QoS should be shown in relation to the services that it supports and enables (e.g. voice calls or voice and video calls), rather than in abstract forms, when applicable.

QoS when roaming

Recommendation 5.1.8   It is recommended to offer the user the option to prioritize connectivity options which will then be used to optimize connectivity properties when the user is out of the range of the home network.

Recommendation 5.1.9   The QoS-related information should be provided in the users' preferred language, when possible.

Recommendation 5.1.10 Functional application limitations (e.g. due to roaming) should be indicated to the user when they have an impact on the use of services (e.g. when a 3G subscription is registered with a lower-bandwidth 2G network), when possible.

Recommendation 5.1.11 Users should preferably be provided with some information and control options when the cost of use changes considerably, e.g. due to roaming (e.g. a "Welcome" SMS message carrying additional information).

Application performance changes due to changing QoS

Recommendation 5.1.12 Functions should be able to gracefully adapt to changes in QoS, e.g. reduce image resolution or frame-rate, when supported.

Recommendation 5.1.13 If appropriate, applications should be designed considering both a high and low data rate user experience (e.g. video turned off in the case of low data transmission rates).

Recommendation 5.1.14 Where possible, imminent changes in QoS should be communicated to the user, especially if the user is involved in real-time communication or there is a cost implication.

Recommendation 5.1.15 If possible, the user should be notified if an application is using too much of the available data bandwidth, and, for example, considerably limits the performance of other services used simultaneously.

Recommendation 5.1.16 Reasons for (temporary) QoS limitations and changes should be communicated to the user in a meaningful way, if possible.

Costs and QoS

Recommendation 5.1.17 Users should be allowed to change the level of QoS, if the feature is supported (e.g. for reasons of cost).

Recommendation 5.1.18 If possible, users should be advised of the best cost/QoS relationship available from the available networks.

5.2   Internet connectivity and access

General

Recommendation 5.2.1   Inform the user about available connectivity options, if applicable and possible.

Recommendation 5.2.2   Assist the user in finding the optimum connection method (e.g. through the support of pre-defined user preferences), and provide default values for these, if possible.

Recommendation 5.2.3   In case a connection cannot be established, provide alternative methods to connect (if available), supported by sufficient explanation, and/or informative error handling.

Recommendation 5.2.4   Internet connectivity setup and configuration should be automated to the largest possible extent.

Recommendation 5.2.5   Default values should be provided in the device that require minimal configuration by the user.

Recommendation 5.2.6   Default values should be provided in the application/ functions that require minimal configuration by the user, if possible.

Recommendation 5.2.7   Internet applications should handle connectivity issues in a useful and self-explanatory way.

Recommendation 5.2.8   In roaming situations, indicate which networks provide 3G Internet access, if possible.

Recommendation 5.2.9   If an existing connection is closed, explain the user why the connection was closed, and provide help to recover the connection, if possible.

Recommendation 5.2.10 Recovery from network failures should be automatic, if possible.

Recommendation 5.2.11 In seamless networking situations, the transition between different network systems should be as fluent as possible. For example, do not require user confirmation every time the network is changed, if supported in the implementations.

Recommendation 5.2.12 During first use, or if otherwise preferred by the user, ask for user confirmation when accessing the Internet.

Recommendation 5.2.13 In roaming (or other potential higher-tariff) situations, support user confirmation for accessing the Internet, if possible (unless this is disabled by the user).

Recommendation 5.2.14 The device should, through supported means, indicate the connection status (e.g. "The device is online", or "Connection has been timed out").

Recommendation 5.2.15 Users should have control over their connections, i.e. users should be able to initiate and close any connection.

Recommendation 5.2.16 The most recent versions of applicable guidelines from industry associations and consortia, available from the GSM Association, OMA, W3C (e.g. [i.39] - [i.41] and others should be followed).

Recommendation 5.2.17 If possible, try to optimize the data traffic flow, especially with functions and applications that are frequently used.

Recommendation 5.2.18 If possible, ensure that sufficient and accurate guidance is provided for easy service access, especially if service elements from different providers are bundled with the product (e.g. a media package).

Recommendation 5.2.19 The user should not be required to provide passwords etc. every time when Internet-based activities are initiated, unless entry of passwords for every use is desired by the user (e.g. making a VoIP call should be as straightforward as making a plain telephone call).

Recommendation 5.2.20 Traffic monitoring information should be provided, if available. Such information should include statistics of use (volumes, speeds, and sessions), information about pre-agreed and available data volumes, costs and/or usage time.

Computer access

Recommendation 5.2.21 External data cards or dongles enabling mobile Internet access should complement but not interfere (by means of functionality) with the computer's native (e.g. Wi-Fi) access.

Recommendation 5.2.22 The user should be informed about the possible use (and related costs, if any) of integral SIM cards, to ease the handling of the connection, if possible.

Recommendation 5.2.23 The cost for multiple access packages (e.g. telephone and computer) should preferably be presented through one entity to the user.

Recommendation 5.2.24 The above recommendations should apply also in the case when a mobile device is used as a modem to connect a computer to the Internet, if supported.

Error handling and user guidance

Recommendation 5.2.25 User guidance and error handling support should be provided for the most obvious and known Internet connectivity error situations.

5.3 Always-on, always on-line

Recommendation 5.3.1 An indication about being online should be provided to the user.

Recommendation 5.3.2 Information whether one or more functions are online simultaneously should be provided to the user.

Recommendation 5.3.3 If possible, provide information about the current network attributes (e.g. "3G now available; using 3G").

Recommendation: 5.3.4 Both automatic and manual methods to monitor and control the power consumption should be provided to the user, but not to the extent that the user is unable to make proper use of services (e.g. a location service needs a connection even if the device is unused so automatic connection dropping after lack of user activity is not always recommended).

Recommendation 5.3.5 An option to close all on-going communication connections should be provided to the user.

Recommendation 5.3.6 User-controlled presence information/status indicators should be supported across applications, if applicable and possible.

Recommendation 5.3.7 Information about the online related system activity, such as the upload / download data rates (speed) and amounts (bytes transferred) should be provided to the user.

Recommendation 5.3.8 Search functionality for both local and remote content (e.g. content that locates on the Internet) should be provided to the user.

Recommendation 5.3.9 An option to create a priority list of preferred communication connections should be provided to the user.

Recommendation 5.3.10 The selected communication channel should be indicated to the user.

Recommendation 5.3.11 Design functions and applications to handle changes and disruptions in the connection should be provided.

Recommendation 5.3.12 System functions to recover automatically from lost connections should be provided.

Recommendation 5.3.13 The user should be informed, if a function will perform automatic content refreshes.

5.4 Specific (dedicated) UIs

Recommendation 5.4.1 A user interface for connectivity setup and control should be provided, supporting the definition of user preferences.

Recommendation 5.4.2 A dedicated UI should be implemented in a way that it can be adapted to changes in connectivity setup.

Recommendation 5.4.3   Main device UI components and style guidelines developed for and/or applicable to the specific product should be examined and applied to the reasonable extent.

Recommendation 5.4.4   The functionality and UI should be optimized for the task/purpose/context.

Recommendation 5.4.5   The device-native UI should be available even in on-line mode.

Recommendation 5.4.6   If the UI of a device does not have the necessary hardware for offering a UI for connectivity setup, the connectivity procedure should be offered through a computer or through other mobile devices (e.g. using NFC procedures).

Recommendation 5.4.7   If the device does not have an integrated display, then provide alternative ways to inform the user about the status of connectivity (e.g. through the use of LEDs).

6 Recommendations for services and applications

6.1 Data-intensive services and applications

Background/ foregrounding

Recommendation 6.1.1   The user/system should be able to run applications in the background without interrupting the user's current task.

Recommendation 6.1.2   The data rate required for the use of certain applications should be indicated before they are started (e.g. for Internet-based applications), if supported.

Recommendation 6.1.3   The progress of necessary data transfers in the UI should be indicated to the user, if the down- or upload time exceeds 3 seconds to 5 seconds.

From on-line to off-line mode

Recommendation 6.1.4   Applications and services should be made useful to the user even in off-line mode (by using mechanisms such as caching).

Recommendation 6.1.5   Applications/services not available in off-line mode should be indicated.

Recommendation 6.1.6   The On-line/Off-line status of an application should be clearly indicated.

Payment for services and applications

Recommendation 6.1.7   The possible costs of using data-intensive applications should be indicated to the user, to the possible extent, preferably prior to the application being activated.

Recommendation 6.1.8   If an error occurs during a service payment process, the user should be notified and returned to the last complete step in the payment process.

Broadcast media

Recommendation 6.1.9   Channel changing should be rapid (ideally between 3 and 5 seconds) If additional payment is required for a channel, a preview should be available.

Real-time media handling

Recommendation 6.1.10 Real-time video or video-on-demand (streaming) applications should actively offer the quality best matching the available bandwidth, i.e. a high and a low data-rate ready video stream should be made available.

Recommendation 6.1.11 The user should always be asked for acceptance before media is tagged with position information, e.g. photographs (due to integrity reasons), unless otherwise preset.

Recommendation 6.1.12 If data is downloaded to the device, its storage/access/control locations should be made clear to the user.

Recommendation 6.1.13 If preconfigured media storage locations for different media types are available on a device, these should be used as the default location for downloaded content.

Recommendation 6.1.14 Temporary data, downloaded by an application should be deleted when the application closes, if possible (e.g. by automatically emptying the memory cache).

Navigational and location-based services

Recommendation 6.1.15 Unless legally otherwise required, user consent should always be asked for the disclosure of information relating to the user's position (including 3rd party services).

Recommendation 6.1.16 Position updates should be sufficiently frequent and precise (to the best possible extent), to be accurate and useful to the user.

Communication-based services

Recommendation 6.1.17 The status of group-based communication service members (broadcast or synchronous) should be made available to the user (matter of pre-consent).

Security of personal data and content

Recommendation 6.1.18 The level of security of data should be communicated to users prior to data transfers.

Recommendation 6.1.19 During communication of data, the maximum level of encryption should be offered to users, unless otherwise requested.

Use of specific certificates for access and/or identification

Recommendation 6.1.20 When the use of specific certificates is required for access and/or identification purposes, the user should be provided with clear information and guidance on how to get, register, activate and use it, including any possible addition of user-specific information.

Recommendation 6.1.21 If a certain certificate has expired or is not usable as intended, the user should be clearly informed about the reason(s) to it and be offered access to renewal/support information.

Integrity of personal data and content

Recommendation 6.1.22 In the case of distributed storage (data stored both on the device and in the network/service/application); the integrity of users' personal data and content should be safe-guarded.

Recommendation 6.1.23 Users should be kept informed and aware of the status of data protection and should be given the option to control distributed data storage of personal data.

Recommendation 6.1.24 Users should be notified if and when personal data is stored remotely and/or for the first time, unless otherwise regulated (e.g. legally).

Recommendation 6.1.25 The user should always be kept informed about the status and protection/integrity of personal data. In problematic situations, redundant indicators (e.g. symbols and auditory signals) should be used.

Recommendation 6.1.26 The user should always be asked if they wish or give permission to store data in remote network locations or service databases.

Recommendation 6.1.27 The user should always have an option to explicitly remove remotely stored personal data, unless otherwise regulated (e.g. by legislation).

Recommendation 6.1.28 The user should be made aware when information related to or contained within their device (e.g. location, presence) is made available or accessed by third parties.

Recommendation 6.1.29 Users should be able to protect the integrity of personally generated content before sharing, e.g. through the possibility of adding DRM rights.

Recommendation 6.1.30 The possibility to provide evidence of performed actions (e.g. a transaction) should be offered to the user through available means (e.g. a printed, SMSed, emailed or mailed confirmation, preferably with a unique identifier), if possible.

Multi-platform access

Recommendation 6.1.31 If access to services is provided through multiple platforms, devices and/or modalities, the available functionality should be presented consistently by means of interaction, UI design and operational functionality (e.g. using the same terminology and symbols).

Recommendation 6.1.32 In circumstances when access through a certain platform, device or modality is not available, the user should be informed about alternative access options.

Application interoperability

Recommendation 6.1.33 Where applications compete for the same bandwidth (e.g. two simultaneous video calls), the user should be notified prior to application activation about the foreseen degradation in QoS due to the existing load.

Recommendation 6.1.34 Access limitations should be clearly stated and explained in "walled garden" environments.

Recommendation 6.1.35 A try-out mode should be offered to allow users to sample services before subscribing to them.

Recommendation 6.1.36 If a third party service provider is used, the provision of the information should be considered.

Roaming between networks

Recommendation 6.1.37 Users should be notified when moving between private and public networks. The notification should summarise changes in billing, services and QoS.

Recommendation 6.1.38 The user should have the ability to deactivate voice or data roaming (in order to avoid undesired behaviours, save cost or battery life).

Recommendation 6.1.39 The user should not have to manage complex account login or setup, when roaming between Wi-Fi and cellular networks.

Recommendation 6.1.40 When entering an area where both Wi-Fi and cellular systems are available, users
                            should be able to view all available networks that can be accessed. Previously
                            accessed networks, if asked to be remembered, should be given priority.

Recommendation 6.1.41 The UI should indicate in a subtle way a change in the user's network environment.

Recommendation 6.1.42 Private home network access should take priority over similar pay-to-use services
                            of public networks, if requested by the user (and not contradicting with possible
                            contractual agreements).

Using 3G devices in the home

Recommendation 6.1.43 3G devices intended solely for in-door, home-based use should be clearly
                            indicated.

Recommendation 6.1.44 In home areas, where both private and public 3G services are available, the device
                            should default to the home network/service environment. The user should be able to
                            (pre)select this default behaviour.

Applications and data sharing using Wi-Fi

Recommendation 6.1.45 Data intensive applications available on home Wi-Fi networks (e.g. video streaming
                            of security cameras) should be made available to users, QoS permitting, as they roam
                            onto public 3G networks.

6.2   Distributed (non-device-native) UIs

Recommendation 6.2.1   The use of device-independent UI specifications is recommended for 3G
                            applications, to the largest possible extent, when developing distributed UIs.

Recommendation 6.2.2   If on-line access may be established during the use of a service, information should
                            be provided to the user

Recommendation 6.2.3   If on-line access is established during the use of a service, the user should be
                            offered selectable access options.

Recommendation 6.2.4   Appropriate help functionality should be provided, which also contains access
                            information to helpdesk.

Recommendation 6.2.5   Information about whom to contact in error situations or when requiring additional
                            information during usage should be provided to the user, on request or depending on
                            the context.

Recommendation 6.2.6   Pre-selected user preferences, if available (e.g. the choice of language) should be
                            the guiding principles for the integration of the device native and non-native UI
                            elements.

Recommendation 6.2.7   If technical limitations (e.g. low data speed) impact the intended use of a service, it
                            should be clearly indicated to the user through the integrated UI.

6.3   Customization, personalisation and bundled packages

Recommendation 6.3.1   The use of documentation distinguishing between customisation (options
                            determined prior to shipping the product) and personalisation (options determined by
                            the user) is recommended.

Recommendation 6.3.2   No personalisation options should render the device unusable. An option to reset
                            all settings to the default values should be offered.

Recommendation 6.3.3   Customizations should be validated for usability and accessibility. Particular attention should be paid to consistency between the native user interface and the customisation provided.

Recommendation 6.3.4   Third party applications should be assessed by providers for their consistency in operation and their usability.

Recommendation 6.3.5   Consequence of personalisation options should be offered for preview, to allow the user to explicitly accept changes. Restore to default (factory) settings should always be an option.

Recommendation 6.3.6   Over-the-air updates should be made with the users' explicit consent (either per update or as a blanket approval), unless otherwise preset by the user.

Recommendation 6.3.7   The user should be able to roll back the result of updates (including over-the-air).

Recommendation 6.3.8   The user guide should cover any customised functions provided, rather than only pre-customization, standard features.

Recommendation 6.3.9   If customization is applied, possibly highlighted applications (e.g. parts of a promotional package such as a tag code or an Internet telephony application client) should be uploaded to the handset before delivery to the user, for direct access and use (to the possible extent).

Error handling and user guidance

Recommendation 6.3.10 User guidance and error handling support should be provided for the most obvious and known customization error situations.

6.4   Corporate use

User support

Recommendation 6.4.1   Easily and globally accessible technical support should be provided (with a particular emphasis on the stages of early usage), with regard to the user's context (e.g. time zones).

Configuration

Recommendation 6.4.2   Where possible, automatic configuration (based on pre-stored data for access to corporate communication and data services (e.g. for VPN access)) should be provided.

Access to services

Recommendation 6.4.3   One-step authentication (single log-on) to all corporate communication services should be supported.

Recommendation 6.4.4   Mechanisms should be provided for password/security code retrieval.

Access to 3G services through network cards and USB-connected dongles

Recommendation 6.4.5   Access to 3G services through network cards and USB-connected dongles should, to the largest possible extent, be auto-configured.

Recommendation 6.4.6   Alternative connection options should be indicated to the user, together with applicable key network attributes.

Recommendation 6.4.7   Data volume and connection history information should be provided (at least, upon user request) through the software client used to access and control the network card or USB dongle, if the functionality is supported.

Configuration

Recommendation 6.4.8   Installation and configuration should be automatic, based on the users' SIM card and system settings. For further recommendations, see [i.15].

Recommendation 6.4.9   Any need for additional installation and configuration should be indicated and assisted. Missing or incorrect information should be signalled and examples of correct information given, the best possible.

Recommendation 6.4.10 The use of user profiles or other pre-defined, context and/or location-based usage preferences should be supported, as specified in main-stream standard documents, if available.

Recommendation 6.4.11 Options should be provided to allow a choice between mobile and Wi-Fi networks, if supported and available, matter of the user's control and preference. Where possible, native features of the users' computer should be used, rather than add-ons providing redundant UIs.

Recommendation 6.4.12 Applications should be provided to allow traffic monitoring, data and privacy management, and network monitoring and selection, if available.

Recommendation 6.4.13 Applications should be provided to monitor upload and download data volumes. Thresholds should be available and/or configurable which, when reached, may trigger notifications to the user of impending charging increases, if supported.

Support knowledge transfer from consumer products

Recommendation 6.4.14 Where possible, user interfaces of corporate systems should be made similar to popular consumer services of the same type (e.g. instant messaging).

Recommendation 6.4.15 Where possible, open protocols should be used to allow easy interoperation with consumer systems such as Instant Messaging and e-mail.

Back-up

Recommendation 6.4.16 Backup facilities for all data and communication threads should be provided (as legally required in some countries).

Recommendation 6.4.17 The user should be notified if a third party accesses their backed-up data.

6.5   Application installation and software updates

Pre- installation

Recommendation 6.5.1   Provide sufficient and essential system information about what can be updated and installed (e.g. latest available software release in the device and available memory), key limitations and potential risks (e.g. the loss of settings or content without a backup).

Recommendation 6.5.2   The user should be reminded to consider data back-up before installation and inform about its benefits.

Recommendation 6.5.3   Clear documentation and guidance about the installation steps should be provided.

Recommendation 6.5.4   Information about the expected size and duration of an installation should be provided.

Recommendation 6.5.5   The available bandwidth should be verified before the installation of an application and the information should be provided to the user, if possible.

Recommendation 6.5.6   The availability of updates and/or new applications should be indicated to the user in some helpful, continuous or periodic way.

Installation

Recommendation 6.5.7   Installation procedures should only be initiated after user confirmation.

Recommendation 6.5.8   Users should be offered the choice of download options (fastest, cheapest, instant availability), when available.

Recommendation 6.5.9   When updates are offered over the air, the user should be informed about the cost/time/feature consequences and available options if these features are supported.

Recommendation 6.5.10 Communication interruptions and file corruptions should be monitored and alternative options provided according to the outcome (e.g. cancellation of the installation, continuation of the download after the connection has been re-established).

Recommendation 6.5.11 Problem solving assistance for the different phases of an installation should be provided (e.g. if over-the-air installation does not function properly).

Recommendation 6.5.12 The system performance should be optimized, to maintain an existing connection during software installation. For example, switching between 3G and Wi-Fi network during installation may lead to data corruption.

Recommendation 6.5.13 The device should be designed in a way that failure to complete an upgrade process do not render the device completely unusable and non-recoverable by the user.

Post- installation

Recommendation 6.5.14 The completeness of an installation should be verified and confirmation or support information should be provided to the user.

Recommendation 6.5.15 An installation log should be provided and maintained, indicating what was installed, how, the source of the data and other applicable information.

7   Recommendations for other areas

7.1   IMS-based applications

Recommendation 7.1.1   The deployment of User Centered Development (UCD) work models is foreseen to become even more important in the IMS environment and is therefore strongly recommended.

Recommendation 7.1.2   Innovative UIs based on technologies including multimodality, natural language processing or touch and 3D interaction should be considered to overcome issues related to the complexity of further converging ICT.

Recommendation 7.1.3   If multiple UIs (possibly in multiple modalities) are developed for accessing the same information, functional consistency and integration is recommended.

Recommendation 7.1.4   UI standards and guidelines, such as those specified in [i.9] - [i.21] should be applied consistently across all devices and clients, where applicable.

Recommendation 7.1.5   Personalization and individual user settings should be consistently supported, regardless the access network, access modality or device used.

Recommendation 7.1.6   The interoperability across different handsets, software platforms and network elements should be verified to the largest possible extent and ensured for all elements related to the functionality of the IMS client, according to some well established guidelines (e.g. as those specified in [i.24] and [i.25]).

Recommendation 7.1.7   Setup and configuration procedures of the service elements necessary for the use of the service should be automatic to the largest possible extent, integrated and consistent, while allowing the user full control.

Recommendation 7.1.8   The information used by IMS services should always be refreshed and updated according to multi-terminal access principles, regardless the access network, access modality or device used.

Recommendation 7.1.9   The interoperability across different handsets, software platforms and network elements should be verified to the largest possible extent and ensured for all elements related to the functionality of the IMS client.

7.2   In-car use

Safety and error prevention

Recommendation 7.2.1   Safety critical UI activities should always be prioritized over other UI events.

Recommendation 7.2.2   Safety, readability and glanceability should be prioritized for all in-car devices.

Recommendation 7.2.3   Available safety guidelines should be applied and followed.

Recommendation 7.2.4   Generic safety guidelines developed for in-car use should be followed.

Recommendation 7.2.5   All critical functions and safety mechanisms should function properly, also when out of the coverage.

Recommendation 7.2.6   The cognitive load on the driver should be minimized and overloads avoided.

Recommendation 7.2.7   The need for long attention should be decreased.

Recommendation 7.2.8   Readability and noticeability should be optimized for in-car use (e.g. through the use of voice control, larger fonts, good visibility of connectivity icons, longer visibility of notifications, etc.).

Recommendation 7.2.9   UIs should not require instant feedback or user confirmation, for example when establishing a connection or waiting for selection. Longer user response times should be supported.

Recommendation 7.2.10 Simultaneous information in mobile device and car computer displays should not be conflicting or drawing attention to two places.

Mobile devices used in cars

Recommendation 7.2.11 Device holders and other equipment, suitable for use due to its ergonomic properties, should be used, if the connectivity is through a cable.

Recommendation 7.2.12 Automated means to establish a connection between the relevant functions in the car and the mobile device without user involvement is recommended.

Recommendation 7.2.13 Automated and safe disconnection between the car and the mobile device is recommended.

Recommendation 7.2.14 If speaker-independent voice commands are supported, the ETSI Standard ES 202 130 [i.9] should be applied for the applicable (user preferred) language(s).

Recommendation 7.2.15 A consistent practice of established guidelines for the handling and co-functioning of mobile devices and in-car functions (e.g. the handling of an incoming call while listening to music through the car stereo) should be followed.

Recommendation 7.2.16 Consistent practices or specific recommendations for the handling of mobile device behaviours while driving (e.g. the handling of an incoming call in the middle of street navigation) should be applied.

Recommendation 7.2.17 The mobile device should be able to access user content in the user's car computer (e.g. phonebook data), after user (pre-)authorization, and vice versa.

Recommendation 7.2.18 Sufficient status information should be provided in cases when the navigation information (e.g. location on the map) is not updated in real time or there are other difficulties.

Car-integrated 3G functions

Recommendation 7.2.19 Mechanisms to establish and disconnect connections automatically should be provided. However, this is naturally dependent on the user preference and should be configurable.

Recommendation 7.2.20 3G and connectivity indicators should be balanced to be noticeable among the other information in car computer displays.

Recommendation 7.2.21 Physical controls for handling the online / offline status of the car communication system should be provided.

Recommendation 7.2.22 A straightforward logic for dealing with mobile connections with a SIM or USIM (car 3G system uses phone number defined in mobile terminal's SIM) should be provided. Both the start of USIM usage (start car electronics) and the end of USIM usage (power down car) should be considered.

Recommendation 7.2.25 If on-screen projection is supported, the most essential information should be included (matter of driver preferences).

Recommendation 7.2.26 Navigation systems should provide output through redundant, multimodal means.

Recommendation 7.2.27 The interaction necessary to handle navigation services should be minimized.

Recommendation 7.2.28 If user input is required for the handling of navigation services, enough time should be given to the user.

7.3   Accessibility applications (enabled through 3G)

Recommendation 7.3.1   Product information and recommendations (if available) should be provided and used to indicate the accessibility capabilities of a product or service, to assist users to more easily identify supported features and capabilities. The use of some common industry format is recommended.

Recommendation 7.3.2   Users should be allowed to try out the equipment or services and verify them, if possible, before purchase.

Recommendation 7.3.3   When procuring ICT services for disabled people, it is recommended to consider [i.6], [i.7] and [i.8].

Recommendation 7.3.4   User education guidelines provided in [i.16] and [i.27] should be applied to the largest possible extent, to provide timely and accurate information to end users through their preferred media.

Recommendation 7.3.5   Main stream user experience and accessibility guidelines (e.g. developed in the GSM Association, W3C Web Accessibility Initiative and Mobile Web Initiative, e.g. [i.19] - [i.20], [i.39] - [i.41]) should be applied and supported in their most recent, available versions, to the largest possible extent.

Recommendation 7.3.6   Services provided over 3G, addressing accessibility needs of older people and disabled users should be carefully designed and deployed, as full 3G availability cannot be assumed. Therefore, no absolute dependencies should be created and there should always be a fall-back option to get human assistance, e.g. in the case of technical failures or emergencies.

Recommendation 7.3.7   When designing and developing new technologies, it is recommended to address and assign some dedicated focus to identify and foresee accessibility applications on the service level, in order to optimize their future capabilities and usability (e.g. to ensure that the required frame rates are provided, if technically possible, in both the mobile system, as well as in the device or specify devices supporting video telephony, used for one-handed signing, to support adjustable camera angles and focus).

Recommendation 7.3.8   Assistive device main stream connectivity and compatibility should be declared and supported, to the largest possible extent.

Recommendation 7.3.9   Typical services, addressing older and disabled people typically offered through fixed-line access should, whenever possible and applicable, be made available and accessible through 3G devices, to adapt the communication needs of these people to their requirements (e.g. monitoring, safety applications or e-Services including e-Health, e-Government or Relay services).

Recommendation 7.3.10 Options required allowing users to select the size and color of the text and background themselves should be provided.

Recommendation 7.3.11 Multimodal access to emergency communications, e.g. through 112, should be supported to assist people to communicate with voice, sign language or real-time text in emergency situations. For further details, see [i.21].

Video calls used for signing

Recommendation 7.3.12 Based on [i.22] and [i.38], it is recommended to, to the largest possible extent
consider the below requirements, preferably during the main development process:

1. Support a higher frame rate frequency during video calls, if possible, to
   improve the rendering of rapid movements.

2. Synchronize sounds and images, to enable lip reading and cued speech.

3. Support the highest picture resolution possible, so that finger movements and
   facial expressions can be seen well.

4. Standardize headset interfaces, to facilitate the use of induction loops or other
   hearing aid devices.

5. Provide a large camera angle in cameras used for video calls (for sign
   language usage), and a zoom option, to facilitate lip reading.

6. Improve the screen illumination (if achievable without negative side-effects on
   any of the points mentioned above).

NOTE: Recommended values are a minimum of 15 frames per second,
QCIF(176x144 pixels) resolution, and a latency of less than
400 milliseconds, in order to provide sufficient quality and fluency that will
support real time video communication in which one or more parties are
using sign language through video calls.

7.4   Trust (security, privacy and integrity) issues

Recommendation 7.4.1   For private data on the user's device, appropriate protection mechanisms
(passwords, biometric, etc.) should be provided. The options for data protection on the
device should be displayed to the user.

Recommendation 7.4.2   The user should be in control of the extent of his private and protected data
(i.e. should be able to decide which data is protected).

Recommendation 7.4.3   Encryption options should be provided both on the server and device side for
protected data transmission.

Recommendation 7.4.4   If the user data transmission is not secure, it should clearly be indicated to the
user.

Recommendation 7.4.5   Reasons for the unavailability of protected data connections should be indicated to
the user.

Recommendation 7.4.6   Specific security, privacy and integrity guidelines developed to a specific
application area should be applied to the largest possible extent.

Recommendation 7.4.7   The security status of a data connection should be displayed, if available.

Recommendation 7.4.8   External attempts to tamper with secure data connections should be indicated to
the user.

Recommendation 7.4.9   The user should always be in control of any access rights to sensitive and private
data.

Recommendation 7.4.10 Indicate unavailability of secure data connection to protected data.

Recommendation 7.4.11 Storing of sensitive data on a server outside the user's control should be indicated to the user and only done with the consent of the user.

Recommendation 7.4.12 Users should be made aware if they are required to provide sensitive data.

Recommendation 7.4.13 Technical limitations for data protection mechanisms should be explained to the user to the largest possible extent.

Recommendation 7.4.14 Appropriate, automatic backup mechanisms should be provided for remotely stored data to allow for recovery in case of data corruption or interrupted connectivity during storage, if available in the network.

Recommendation 7.4.15 Changes in sensitive data should be logged to allow for roll-back mechanisms in case of malfunctioning change processes.

Recommendation 7.4.16 The strength of protection mechanisms should be displayed to the user to enhance user trust in the system.

Recommendation 7.4.17 Critical data should be regularly backed up from the user's device to remote network storage.

Recommendation 7.4.18 Recovery for inadvertent data modification on the user's device and in remote storage should be available.

Recommendation 7.4.19 Phishing and virus attacks should be indicated to the user, if recognized.

Recommendation 7.4.20 A log of all tampering incidents should be kept and available to the user.

Recommendation 7.4.21 Users should be informed about the possibility of virus infections when downloading publicly available data.

Recommendation 7.4.22 Appropriate authentication and identification should be provided for 3G-enabled devices.

Recommendation 7.4.23 When delivering content for 3G devices, information about the author and the origin of the content should be provided, at least upon request.

Recommendation 7.4.24 Security usability guidelines from W3C [i.31] should be followed.

8 Recommendations for terminology, symbols, auditory signals and user education and product reference documentation

The recommendations presented in this clause complement those specified in EG 202 132 [i.1] with specific additions applicable to the 3G environment.

8.1 Terminology

For general issues, existing recommendations and methodologies, proposed areas and the evaluation and selection of terminology, see [i.1].

As a complement to the Terminology tables (table 1a - table 1j) presented in [i.1], the below additions in table 2 apply.

Table 2: Terminology

Concept	Recommended name	Description / Definition	Comment
Presence information or status	presence (status)	Provides access to or activates the provision of information about a user's (network) presence status to other users/applications	Does not necessarily correspond to the user's (true) status
Location	location	Provides access to or activates the provision of information about a USIM's physical, geographical location	Does not necessarily correspond to the user's (true) location
Search	search	Provides access to or activates a search function (local or remote)	
Quality of Service	QoS	Provides access to the QoS information (a guaranteed throughput level); a defined measure of performance (in IP-based communication systems)	Becomes increasingly important in IP-based (packet-switched) networks.
Navigation	navigation	Provides access to or activates a navigation services	
Upload	upload	Initiates the provision of data from a device, over a network, into a server	
Download	download	Initiates the provision of data from a server, over a network, into the device	
Refresh, Update or Reload	update	Activates a reload of the same information (but with a more recent timestamp, if available)	
QWERTY	QWERTY	Selects input through a computer keypad (hardware or on-screen)	Or corresponding national/local arrangement)
Touch input	touch	Provides access to the selection or activates interaction and input possibilities through direct touch (of a touch screen)	This typically implies the invocation of other touch commands, too
Background application	hidden application	Provides access to or information about an application running without being visible to the user	
Foreground application	main application	Provides access to or information about an application with which the user is currently interacting	
On-line	on-line	Activates a connection to the Internet	
Off-line	off-line	Terminates a connection to the Internet	
Complete payment	payment completed	Activates the processing of a payment	
Store in network	storage in network or remote storage	Initiates storage of data in the network (at some pre-defined or other selectable location)	
Store in device	storage in device	Initiates storage of data in the device (at some pre-defined or other selectable location, in the device or on a storage unit in the device)	
Roll back	previous version	Initiates return to the previous version	
Validate	validate	Initiates validation	
Show free memory	available memory	Activates the reporting of available, free memory space	As pre-selected or requested
In device	in device	Activates the reporting of available, free memory space in the device	
In storage media	on memory card	Activates the reporting of available, free memory space on storage media inserted into the device	
Over air connection	over 3G	Selects connection over the air	
Over cable connection	over cable	Selects connection over cable	
Data corruption	bad data format	Indicates a bad (damaged) data format	
Reconnect	reconnect	Initiates connection back to the network from where the connection has (recently) been interrupted.	

Concept	Recommended name	Description / Definition	Comment
Download and replace/ update/ install	download and replace/ update/install	Initiates the download and replacement or installation of an application	
Select network type	select connection	Provides access to or selects the network type	
EDGE	EDGE data connection	Indicates a slower-than-3G (2G+) data connection through EDGE (Enhanced Data Rates for GSM Evolution)	Maximum theoretical data transmission rate: 474 kbit/s
Turbo-3G	HSPA data connection	Indicates a faster-than-3G (3G+) data connection through HSPA (High Speed Packet Access)	Theoretical minimum data transmission rate: 3,6 Mbit/s (may be lower in reality)
Wi-Fi	Wi-Fi (wireless) data connection	Provides access to the wireless data menu	
Data log	data usage log	Provides access to a log of data usage or access	
AT	assistive technologies	Provides access to the control of assistive technology or devices	
Pair	pair	Initiates the establishment of a connection between the device and accessories (typically over Bluetooth)	May require a PIN
Accessibility settings	accessibility settings	Provides access to accessibility settings	
Synchronize (voice and data in video calls)	synchronize voice and picture	Initiates a synchronization process (typically pre-configured)	
Frame rate	picture frame rate	Provides picture frame rate information or selection	Typically used for video calls - often for signing and lip reading purposes
Connect to the Internet	Connect to the internet	Activates a connection to the Internet	
Camera	camera	Selects or activates the camera	
USB	USB	Selects or activates a USB connection	May also be charging of the battery

8.2   Symbols

The recommendations presented in this clause complement those specified in EG 202 132 [i.1].

For general issues, existing recommendations and methodologies, proposed areas and the evaluation and selection of terminology, see [i.1].

As a complement to the Symbols tables (table 3a - table 3c) presented in [i.1], the below additions in table 3 apply.

Table 3: Referents for proposed recommended symbols

Function	Description	Comment
Accessing Internet	For devices, to indicate the ongoing establishment of an Internet connection	Additional attributes (e.g. connection speeds or type of network) may be indicated
Online- connected	Indicator of connection to the Internet	
Offline- disconnected	Indicator of no connection to the Internet	
Uploading	Indicates the provision of data from a device, over a network, into a server	In addition, some status indicator (e.g. remaining time or progress bar) should be shown to the user.
Downloading	Indicated the provision of data from a server, over a network, into the device	In addition, some status indicator (e.g. remaining time or progress bar) should be shown to the user.
Roaming	Indicates connection and registration to another network than the home network	
Wi-Fi on	Wireless network connection active indicator	

Function	Description	Comment
Wi-Fi off	Wireless network connection not active indicator	
Video on	Video (image) capabilities active indicator	Important to indicate in video call mode
Video off	Video (image) capabilities not active indicator	
Bandwidth	Supported data volume throughput capacity indicator	Can be provided as intervals (from minimum to maximum)
Quality of Service	Indicates the guaranteed throughput level	
High level of quality	High available service quality level indicator	Enough to use the service
Medium level of quality	Medium available service quality level indicator	Probably enough to use the service
Low level of quality	Low available service quality level indicator	May be enough to use the service
Quality of service warning	Indication of expected reduction of service quality level	Carries a time estimate and is an anticipation
Presence information on	Indicates that the presence information is on	
Presence information off	Indicates that the presence information is off	
Location	Indicates that the location information is on	
Location sharing	Indicates that the location position information is being shared	
Location accuracy	Indicates the accuracy of the location positioning	May be performed through triangulation (in-doors; less precise) or GPS (outdoors; more precise)
Search	Indicated an ongoing search process	
Navigation	Indicates ongoing navigational aid activities	
Refresh	Indicates ongoing refresh of information	
QWERTY keypad	Indicates the availability of input through a physical or on-screen QWERTY keypad	
Special QWERTY (1/2QWERTY,Blackberry)	Indicates the availability of input through a physical or on-screen half-QWERTY keypad	
Touch interaction (capacitive)	Indicates that touch control is enabled and selected	
Flat/fixed-rate charging applied	Indicates that the current charging scheme allows free data usage	Certain limitations agreed in the subscriber's contract may apply
Payment completed	Indicates that a payment has been completed	
Error in payment process	Indicates that a payment sequence has not been completed	
Multiple, selectable audio/video levels available	Indicates the availability of multiple, user selectable levels of audio/video quality	
Level of security	Indicates the security level (encryption level) applied	
Remote storage	Indicates that the user's data is/has been remotely stored	
Open data	Indicates remote access possibility to user data	
Application trustmark (or certificate)	Indicates that an application has been properly tested	This information may be provided through the use of certificates

8.3   Auditory signals

The recommendations presented in this clause complement those specified in EG 202 132 [i.1].

For general issues, existing recommendations and methodologies, proposed areas and the evaluation and selection of terminology, see [i.1].

As a complement to the auditory signals specified in [i.1], table 5, the below additions in table 4 apply.

Table 4: Referents for proposed recommended auditory signals

Function	Description	Comment
Disconnected	Indicates that a device is disconnected from a network	
QoS is about to be reduced	Indicates a foreseeable reduction of the QoS	
QoS is about to be increased	Indicates a foreseeable increase of the QoS	
Personal data security or integrity settings have changed	Indicates changed data security or integrity settings	
Data transfer allocation is about to be reached	Indicates that the allocated data transfer is about to be reached	According to some settings, agreements or configuration.

8.4   User education and product reference documentation

The guidelines provided in EG 202 417: "Human Factors (HF); User education guidelines for mobile terminals and services" [i.16] should be applied.

History

Document history		
V1.1.1	October 2009	Publication