

**Human Factors (HF);
User Experience;
3G and Mobile Broadband Interoperability Plugtest:
Approach, scenarios and test specification;
Outcomes, conclusions and recommendations**

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Reference

DTR/HF-00083

Keywords

3G, HF, interface, interoperability, UMTS, user

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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 (as well as event participants) includes user experience and interaction design professionals, designers and developers of mobile networks, terminals, services and applications, mobile network and system providers and operators, terminal approvers, private and public requirement writers, consumer associations and user organizations, roaming managers, marketing, product management, industry associations and their members, policy makers and other interested stakeholders.

The event was addressed to infrastructure developers, mobile and broadband network operators, service providers, handset manufacturers, application providers and others interested.

Introduction

Mobile ICT plays an increasingly important role in the daily life and activities of many people. There is enormous potential for improving the user experience, if connectivity and interoperability between 3G devices, services, applications and the Internet is designed and developed in a way that makes them usable by and accessible to all end users.

People travel more than ever before both in business and for leisure and expect their mobile information and communication services to work seamlessly across borders and continents. The success story of GSM voice and text communication has also built expectations that are projected to more sophisticated services enabled by GPRS and 3G infrastructures. In the mean time, there is also pressure from various sources to decrease the differences between the cost of communication in the home network and foreign networks that further contributes to this trend. Therefore, the roaming user experience is more important than ever before and should offer automated interoperability with similar functional access, under full user control.

An effective e-society relies on the fact that all citizens are granted equal access. Ensuring interoperable access to mobile ICT services for all is a common goal for vendors, operators, service providers, user associations, consumer groups and policy makers. Achieving this will pave the way for a successful uptake of future, more advanced application areas of public interest such as telecare services, community focused applications or video telephony services targeting impaired users.

Mobile communication is a significant commercial and public policy success in eEurope. GSM and GPRS-based products have contributed significantly to the take-up of telephony among previously unconnected households, decreased social exclusion and the digital divide. This is in line with the "eEurope 2005 Mid-term review" (COM(2004) 108 [i.45]), stating that "...stimulating use and creating new services has become the central goal of eEurope 2005" and "...interoperable pan-European services...is a match with EU policy objectives and the needs of European citizens".

With the advent of more advanced and sophisticated services enabled by 3G/UMTS networks, terminals, applications and services, there are concerns that an increasing number of consumers may experience difficulties due to the increased complexity and an often sub-optimized user experience of mobile communication terminals and services. In order to overcome these serious potential risks, "Interoperability is critical for the deployment of mobile broadband services". Furthermore, "...industry to take steps towards interoperability for mobile broadband services as a matter of urgency" (the key conclusion of the European Commission's Communication COM(2004) 447 [i.46] on "Mobile broadband services").

Important user requirements such as easy, accessible and successful setup, configuration and access, excellent usability and accessibility, high reliability, fair stability, reliable and understandable security, seamless connectivity and interoperability are quickly becoming decisive success criteria for the uptake and usage of communication, information access, applications and services, a necessity in today's *e*-European society.

The on-going paradigm shift towards a knowledge-intensive Information Society has brought about radical changes in the way people work and interact with each other and with information.

Since the launch of the "eEurope - Information Society for All" initiative of the European Commission in 2000, the European Union (EU) has adopted a policy towards ensuring that all its citizens benefit from the changes the Information Society is bringing. This commitment is now further continued and enhanced in the i2010 (European Information society in 2010) initiative, which aims to provide an integrated approach to information society in the EU, covering regulation, research, and deployment and promoting cultural diversity, with the objective to ensure that Europe's citizens, businesses and governments make the best use of ICTs in order to improve industrial competitiveness, support growth and the creation of jobs and to help address key societal challenges.

Several human factors deliverables including technical reports, guidelines and standards developed by ETSI under the and co-sponsored by the above mentioned initiatives, are directly applicable to product implementations. This Plugtests event will, based on realistic scenarios and in the context of a body of best practices, examine the level of interoperability, user support and knowledge transfer offered by 3G-compatible products.

Ensuring interoperable access to mobile communication services for all is a common goal for vendors, operators, service providers, user associations, consumer groups and policy makers. Achieving this will pave the way for a successful uptake of future, more advanced application areas of public interest such as telecare services, community focused applications or video telephony services targeting impaired users.

1 Scope

The present document provides:

- the background, approach, scenarios, test specification and other necessary information for the performance of an ETSI "3G & Mobile Broadband Interoperability Plugtest" event (held during April 24-26, 2008); and
- a summary of the event's results, achievements, outcomes, conclusions and recommendations.

The event, the very first of its kind, addressed the user experience of mobile ICT services, based on realistic scenarios and ETSI Human Factors standards, guidelines and recommendations. In the context of a body of best practices human factor enablers and the level of interoperability, user support and knowledge transfer offered by 3G-compatible products throughout the most relevant phases of use (addressed through a product/use lifecycle perspective) were examined, discussed and concluded.

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:
 - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
 - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

For online referenced documents, information sufficient to identify and locate the source shall be provided. Preferably, the primary source of the referenced document should be cited, in order to ensure traceability. Furthermore, the reference should, as far as possible, remain valid for the expected life of the document. The reference shall include the method of access to the referenced document and the full network address, with the same punctuation and use of upper case and lower case letters.

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 201 472: "Human Factors (HF); Usability evaluation for the design of telecommunication systems, services and terminals".

- [i.2] ETSI EG 202 132: "Human Factors (HF); User Interfaces; Guidelines for generic user interface elements for mobile terminals and services".
- [i.3] ETSI EG 202 416: "Human Factors (HF); User Interfaces; Setup procedure design guidelines for mobile terminals and services".
- [i.4] ETSI EG 202 417: "Human factors (HF); User education guidelines for mobile terminals and services".
- [i.5] ETSI TS 102 511: "Human Factors (HF); AT Commands for Assistive Mobile Device Interfaces".
- [i.6] ETSI TR 102 068: "Human Factors (HF); Requirements for assistive technology devices in ICT".
- [i.7] ETSI ES 202 076: "Human Factors (HF); User Interfaces; Generic spoken command vocabulary for ICT devices and services".
- [i.8] ETSI EN 301 462: "Human Factors (HF); Symbols to identify telecommunications facilities for the deaf and hard of hearing people".
- [i.9] ETSI EG 202 116: "Human Factors (HF); Guidelines for ICT products and services; "Design for All"".
- [i.10] ETSI TR 102 133: "Human Factors (HF); Access to ICT by young people: issues and guidelines".
- [i.11] ETSI EG 202 423: "Human Factors (HF); Guidelines for the design and deployment of ICT products and services used by children".
- [i.12] ETSI EG 202 191: "Human Factors (HF); Multimodal interaction, communication and navigation guidelines".
- [i.13] ETSI TR 101 767: "Human Factors (HF); Symbols to identify telecommunications facilities for deaf and hard of hearing people; Development and evaluation".
- [i.14] ETSI ETR 095: "Human Factors (HF); Guide for usability evaluations of telecommunications systems and services".
- [i.15] ETSI TR 102 202: "Human Factors (HF); Human Factors of work in call centres".
- [i.16] Void.
- [i.17] ETSI TR 102 415: "Human Factors (HF); Telecare services; Issues and recommendations for user aspects".
- [i.18] ETSI EG 202 421: "Human Factors (HF); Multicultural and language aspects of multimedia communications ".
- [i.19] ETSI SR 001 996: "Human Factors (HF); An annotated bibliography of documents dealing with Human Factors and disability".
- [i.20] ETSI EG 201 103: "Human Factors (HF); Human factors issues in Multimedia Information Retrieval Services (MIRS)".
- [i.21] ETSI ETR 297 Edition 1: "Human Factors (HF); Human Factors in Videotelephony".
- [i.22] ETSI ES 201 275: "Human Factors (HF); User control procedures in basic call, point-to-point connections, for Integrated Services Digital Network (ISDN) videotelephony".
- [i.23] ETSI ES 202 432: "Human Factors (HF); Access symbols for use with video content and ICT devices".
- [i.24] ETSI EG 202 048: "Human Factors (HF); Guidelines on the multimodality of icons, symbols and pictograms".
- [i.25] ETSI ETS 300 375: "Human Factors (HF); Pictograms for point-to-point videotelephony".
- [i.26] ETSI ETR 070: "Human Factors (HF); The Multiple Index Approach (MIA) for the evaluation of pictograms".

- [i.27] ETSI ETR 329: "Human Factors (HF); Guidelines for procedures and announcements in Stored Voice Services (SVS) and Universal Personal Telecommunication (UPT)".
 - [i.28] 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.29] ETSI ES 201 381: "Human Factors (HF); Telecommunications keypads and keyboards; Tactile identifiers".
 - [i.30] ETSI EG 202 325: "Human Factors (HF); User Profile Management".
 - [i.31] ETSI EG 202 067: "Universal Communications Identifier (UCI); System framework".
 - [i.32] ETSI ETR 333: "Human Factors (HF); Text Telephony; Basic user requirements and recommendations".
 - [i.33] ETSI TR 101 806: "Human Factors (HF); Guidelines for Telecommunication Relay Services for Text Telephones".
 - [i.34] ETSI EG 202 320: "Human Factors (HF); Duplex Universal Speech and Text (DUST) communications".
 - [i.35] ETSI EG 202 534: "Human Factors (HF); Guidelines for real-time person-to-person communication services".
 - [i.36] ETSI White Paper No. 3: "Achieving Technical Interoperability - the ETSI Approach".
 - [i.37] European Commission Mandate M 376: "Mandate M 376 (Standardization mandate to CEN, CENELEC and ETSI in support of European accessibility requirements for public procurement of products and services in the ICT domain)".
- NOTE: Available at http://www.etsi.org/Website/document/aboutETSI/EC_Mandates/m376en.pdf.
- [i.38] ISO 9241-11: "Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 11: Guidance on usability".
 - [i.39] ETSI ETR 116: "Human Factors (HF); Human factors guidelines for ISDN Terminal equipment design".
 - [i.40] ETSI ETR 175: "Human Factors (HF); User procedures for multipoint videotelephony".
 - [i.41] ISO 20282: "Ease of operation of everyday products".
 - [i.42] ETSI TS 100 900: "Digital cellular telecommunications system (Phase 2+) (GSM); Alphabets and language-specific information (GSM 03.38)".
 - [i.43] IETF RFC 4103: "RTP Payload for Text Conversation".
 - [i.44] ETSI EG 202 487: "Human Factors (HF); User experience guidelines; Telecare services (eHealth)".
 - [i.45] COM(2004) 108: "Communication from the commission to the council, the European Parliament, the European economic and social committee and the committee of the regions".
 - [i.46] COM(2004) 447: "Communication from the commission to the Council, the European Parliament, the European economic and social committee and the committee of the regions".
 - [i.47] ITU-T Recommendation T.140: "Protocol for multimedia application text conversation".

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 adoption

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

impairment: any reduction or loss of psychological, physiological or anatomical function or structure of a user (environmental included)

operator: entity perceived by the user as offering the physical mobile service

NOTE: This includes mobile virtual network operators and traditional operators.

service: ICT service that provides the complete capability, including terminal equipment functions, for communication between users, systems and applications, according to agreed protocols

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

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

usability: effectiveness, efficiency and satisfaction with which specified users can achieve specified goals (tasks) in a specified context and particular environments, see ETR 095 [i.14] and ISO 9241-11 [i.38]

NOTE: 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 terminals and the telecommunications system, see ETR 116 [i.39].

user: person who uses a telecommunications terminal 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 terminal. Also, the user may or may not be a person with impairments.

user education: any information provided to users of a product or service on the functionality provided by the product or service and any instructions on how this functionality is to be used

NOTE: User education can be provided through a range of media from paper to multimedia.

user guide: technical communication documents, intended to give assistance to users using a particular product

NOTE: They are written by a technical communicator and are also known as "manual".

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

NOTE: The communication is bi-directional in real time and the interface may include 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, terminals 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:

3G	Third Generation Mobile Communication Systems, also known UMTS and IMT-2000
COCOM	European Communication Committee
GPRS	General Packet Radio Service
HF	Human Factors
ICT	Information and Communication Technologies
IMT-2000	International Mobile Telecommunications-2000
INCOM	Inclusive Communication
ISO	International Organization for Standardization
MIRS	Multimedia Information Retrieval Systems
MMS	Multimedia Messaging Service
PC	Personal Computer
SIM	Subscriber Identity Module
SMS	Short Message Service
TC	Technical Committee
UCI	Universal Communications Identifier
UI	User Interface
UMTS	Universal Mobile Telecommunication System
WAP	Wireless Application Protocol
Wi-Fi	Wireless-Fidelity (ISO/IEC local area network standard family 802.11, also known as WLAN)
XML	eXtensible Mark-up Language

4 Background

4.1 The importance of a good ICT user experience for interoperable services

The capabilities offered by mobile communication solutions evolve, from only being able to make a call, use voice-mail and possibly send and receive text messages to downloadable personalization achieved through ring signals, software programs such as games and the introduction of multimedia information services such as mapping and directions, traffic information, messaging and e-mail access, TV broadcast and video streaming and quasi-cordless functionality or video call services.

Technological advances and market pressures have made telecommunications and ICT products and systems increasingly complex, feature rich and miniaturized. Research results indicate that novice as well as advanced users are equally worried for the high complexity of new technologies.

An effective e-society relies on the fact that all citizens are granted fair access. Ensuring interoperable access to mobile ICT services for all is a common goal of vendors, operators, service providers, user associations, consumer groups and policy makers. Achieving this will pave the way for a successful uptake of future, more advanced application areas of public interest such as telecare services, community focused applications or video telephony services targeting impaired users.

Human Factors standardization does not restrict the ability of market players to further improve and develop their terminals and services, nor does it limit their options to trademark user interface elements or profile the user experience of brand-specific user interface implementations as a competitive edge.

In the recent past, the expenses of a far-too technology-centric development have been experienced by the mobile industry and valuable lessons have been learned from the development and launch of e.g. WAP, GPRS and MMS access and services, including their roaming capabilities. These technologies did not quickly enough achieve the envisaged market penetration among end users necessary to cover the cost of investments in the infrastructures and led to an increase of the customer care costs, damaged visions and disappointed end users, also influencing operational results.

It is our hope that by addressing the roaming user experience in a more dedicated way, this work can contribute to the identification of potential issues and highlight necessary and beneficial actions to further improve it.

4.2 ETSI Technical Committee Human Factors (TC HF)

Human Factors is the scientific application of knowledge about human capacities and limitations in order to make products, systems, services and environments effective, efficient and easy for everyone to use. It is a key factor for the commercial success of any ICT product or service in the digital networked economy.

The Human Factors Committee is the Technical Body within ETSI, responsible for Human Factors issues in all areas of Information and Communications Technology (ICT). It produces standards, specifications, guidelines and reports that set the criteria necessary to build optimum usability into the emerging digital networked economy.

The HF committee co-operates with other groups within ETSI and outside to assist them to produce standards, or other deliverables, which are in accordance with good Human Factors practice. Within ETSI it has a special responsibility for "Design for All" addressing the needs of all users, including young children, seniors and disabled people.

An important goal of TC HF's operations is to ensure that at least minimum levels of common and specific user requirements are known, understood, specified and well supported in industry-wide technical ICT standards, technology platforms and product implementations, leading to an improved overall user experience, satisfying established usability and accessibility criteria. This goal is achieved through careful balancing, not to limit innovation, nor influence the company-and brand-specific user experience.

Since its establishment in 1990, ETSI TC HF has developed numerous requirement, guideline and standards deliverables, addressing many areas of ICT. Since 1998, ETSI and TC HF has worked in close collaboration with the European Union, European Commission and the European Free Trade Association, assisting the implementation of the "eEurope - Information Society for All" initiative through the eEurope 2002 and 2005 action plans for a better used and a more accessible fixed and mobile ICT environment. This commitment is now further continued and enhanced in the i2010 (European Information society in 2010) initiative, which aims to provide an integrated approach to information society in the EU, covering regulation, research, and deployment and promoting cultural diversity, with the objective to ensure that Europe's citizens, businesses and governments make the best possible use of ICTs.

For a full listing of and more information about these deliverables and their applicability, see clause 6, [i.19] and www.etsi.org (where all deliverables are available free of charge).

4.3 Interoperability and the ETSI Plugtests™ concept

The goal of ETSI is to ensure that instances of non-interoperability are not caused by poor or insufficient standardization, as clearly stated in [i.36]. Within the current competitive market environment, the risk of non-interoperability is increasing, because of e.g. small windows of opportunity due to fast evolution of technology, the use of non-open standards. The main aim of standardization is to enable interoperability in a multi-vendor, multi-network, multi-service environment. The absence of interoperability should not be the reason why final services for which there is great demand do not come into being.

The ETSI Whitepaper on Interoperability [i.36] describes the following levels of interoperability:

- **Technical interoperability:** usually associated with hardware/software components, systems and platforms that enable machine-to-machine communication to take place. This kind of interoperability is often centred on (communication) protocols and the infrastructure needed for those protocols to operate.
- **Syntactical interoperability:** usually associated with data formats. Messages transferred by communication protocols need to have a well-defined syntax and encoding, even if it is only in the form of bit-tables. Many protocols carry data or content, and this can be represented using high-level transfer syntaxes such as HTML, XML or ASN.1.
- **Semantic interoperability:** usually associated with the meaning of content and concerns the human rather than machine *interpretation* of the content. Thus, interoperability on this level means that there is a common understanding between end users of the meaning of the content (information) being exchanged. User experience can be regarded as mainly belonging to this level, even if it will also play an important role on the other levels.
- **Organizational interoperability:** the ability of organizations to effectively communicate and transfer (meaningful) data (information) even though they may be using a variety of different information systems over widely different infrastructures, possibly across different geographic regions and cultures. Organizational interoperability depends on successful technical, syntactical and semantic interoperability.

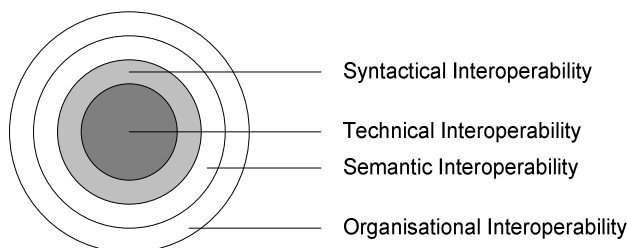


Figure 1: Different levels of interoperability

The most common reasons to why a standard fails on interoperability are, according to [i.36]:

- incompleteness;
- inadequate interfaces;
- poor specification, consistency and implementation of options; and
- lack of clarity;
- poor maintenance.

It can easily be concluded that most reasons relate to human factors and will most probably have a considerable influence on the user experience of the service.

By the time this work was originally planned and performed, the ETSI Plugtests Service was a professional unit of ETSI specializing in organizing and running interoperability test events for a wide range of telecommunications, Internet, broadcasting and multimedia converging standards.

Plugtests events are open to all companies, organizations, working and study groups implementing a standard (regardless of their ETSI Membership), including:

- Operators, Vendors or Equipment manufacturers, who are about to place their product on the market, want to be sure of the interoperability of their products and feel comfortable with the technologies but still want to improve their know-how.
- Standardization bodies (ETSI, IETF, ITU, etc.) or any forum or interest group, that are developing an important standard or specification, want to check the coherence of the specifications implemented, need to check progress in using their specification or want to let their members get useful feedback for quickly and efficiently adapting or improving their specifications.

Plugtests events aim at improving interoperability by creating an opportunity for companies to test their prototypes against a standard with their partners and competitors. That will typically contribute to:

- Enhancing the quality of specifications;
- Speeding up the standardization process;
- Reducing time to market;
- Supporting the deployment of a technology;
- Improving the overall product use experience.

For further details, see the ETSI Whitepaper on "Achieving Technical Interoperability" [i.36].

In 2008, ETSI has launched "INTEROPOLIS", a product-enabling service, ETSI now offers 'Idea to Product' solutions for all issues related to standardization. Efficient interoperability is a crucial challenge within ICT and the launch of INTEROPOLIS acknowledges the complexity of ICT standardization, which increasingly comprises not only of multiple technologies but also of multiple organizations and structures which have to cooperate with each other. Its creation draws on many years' of experience in interoperability acquired through ETSI's former Protocols and Testing Centre (PTCC) and PlugtestsTM.