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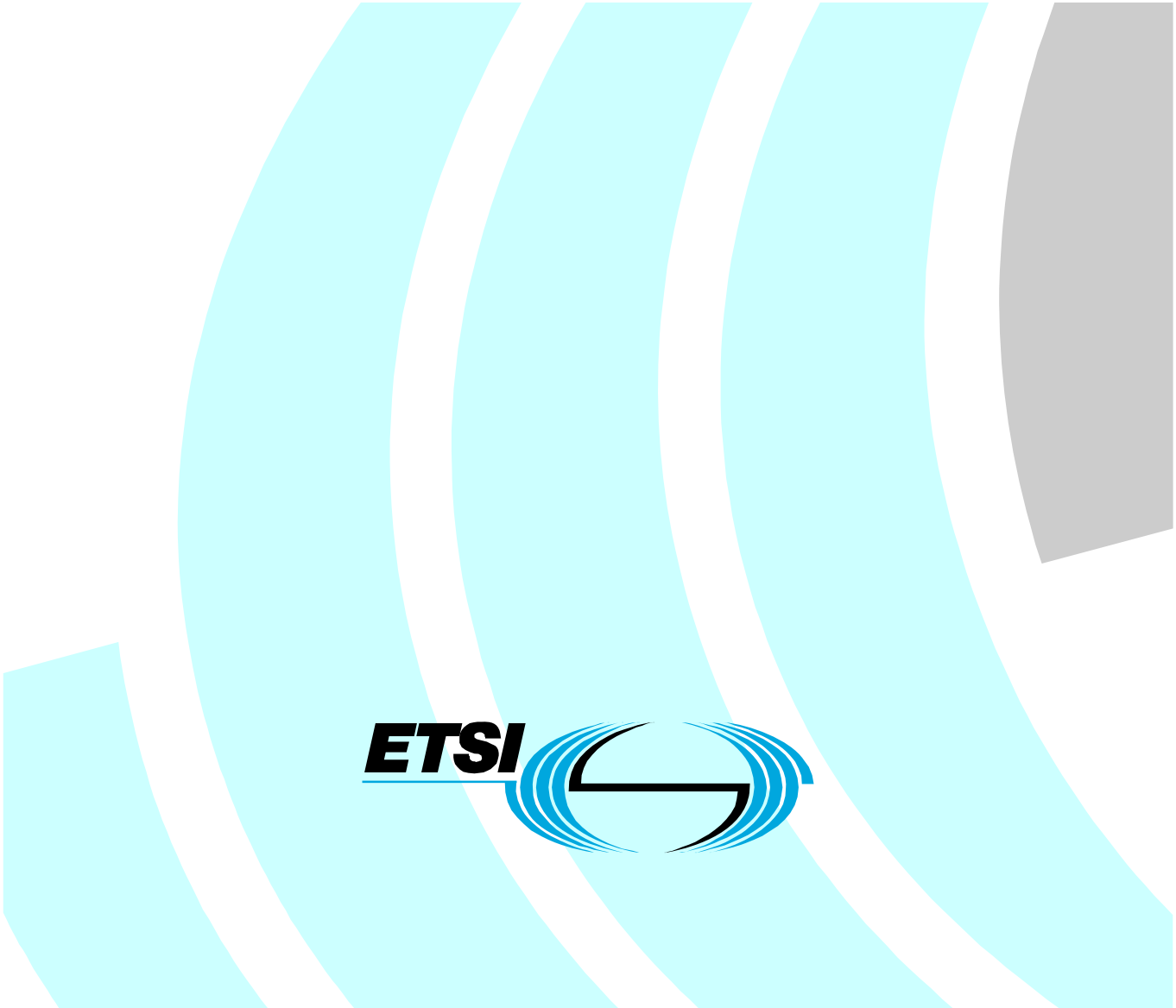
Technical Report

Human Factors (HF);
Web-based Guideline and Tutorial System for Real-time Communication Services;
QoE (Quality of Experience) expressed in QoS (Quality of Service) terms;
Supporting and maintenance information



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Contents

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Foreword

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

1 Scope

The present document provides documentation on the specification, implementation and maintenance of the WBGTS (Web-based Guideline and Tutorial System) for real-time communication services.

The WBGTS can be accessed from the ETSI site: http://portal.etsi.org/stfs/STF_HomePages/STF354/.

It contains guidelines from EG 202 670 [i.1]. It is based on a specification of user requirements described in TR 102 643 [i.3].

Like EG 202 670 [i.1], the Web-based system presents guidelines for real-time communication services that provide text communication, speech communication, video communication, multimedia communication, IP-TV, mobile-TV and real-time games. Unlike EG 202 534 [i.9], the Web-based system offers both greater detail of the empirical sources of each guideline and tutorials on key concepts to support understanding and applying the guidelines.

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.

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 202 670: "Human Factors (HF); User Experience Guidelines for real-time communication services expressed in Quality of Service terms".

[i.2] ETSI TR 102 535: "Human Factors (HF); Guidelines for real-time person-to-person communication services; Future requirements".

[i.3] ETSI TR 102 643: "Human Factors (HF); Quality of Experience (QoE) requirements for real-time communication services".

[i.4] Hestnes, B., Brooks, P., Heiestad, S. (2009): "QoE (Quality of Experience) - measuring QoE for improving the usage of telecommunication services", Telenor R&I R 21/2009.

[i.5] ITU-T Recommendation E.800: "Definitions of terms related to quality of service".

[i.6] ITU-T Recommendation P.10/G.100: "Amendment 2: New definitions for inclusion in Recommendation ITU-T P.10/G.100".

[i.7] Nielsen, J.: "Usability Engineering". Boston, MA: Academic Press, 1993.

[i.8] W3C Web Accessibility Initiative, online.

NOTE: Available at http://www.w3.org/WAI/.

[i.9] ETSI EG 202 534: "Human Factors (HF); Guidelines for real-time person-to-person communication services".

[i.10] ISO 9001: "Quality management systems - Requirements".

3 Definitions and abbreviations

3.1 Definitions

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

Quality of Experience (QoE) (1): measure of user performance based on both objective and subjective psychological measures of using an ICT service or product

NOTE 1: It takes into account technical parameters (e.g. QoS) and usage context variables (e.g. communication task) and measures both the process and outcomes of communication (e.g. user effectiveness, efficiency, satisfaction and enjoyment).

NOTE 2: The appropriate psychological measures will be dependent on the communication context. Objective psychological measures do not rely on the opinion of the user (e.g. task completion time measured in seconds, task accuracy measured in number of errors). Subjective psychological measures are based on the opinion of the user (e.g. perceived quality of medium, satisfaction with a service).

EXAMPLE: A service provider may conclude that a service with a certain level of QoS used for a particular communication situation offers users excellent QoE, whist with a different level of QoS provides poor QoE.

Quality of Experience (QoE) (2): overall acceptability of an application or service, as perceived subjectively by the end-user

NOTE 1: Quality of experience includes the complete end-to-end system effects (client, terminal, network, services infrastructure, etc.).

NOTE 2: Overall acceptability may be influenced by user expectations and context.

NOTE 3: ITU-T Recommendation P.10/G.100 Amendment 2 [i.6] definition.

Quality of Service (QoS): totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service

NOTE: ITU-T Recommendation E.800 [i.5] definition.

real-time communication service: service with which users expect to share information instantly and continuously with one or more other user

NOTE 1: A real-time communication service generates and delivers either text, audio, graphics, video and data or some combination of these communication media.

NOTE 2: The information sharing process occurs either by: (1) a person interacting via technology directly to another person (person-to-person) or; (2) a person interacting with a machine (person-to-machine).

EXAMPLE: An example real-time person-to-person communication service is videoconferencing and an example real-time person-to-machine communication service is Live TV.

3.2 Abbreviations

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

BC	Book Chapter
CP	Conference Proceedings
EP	Expert Panel
FAQ	Frequently asked questions
ICT	Information and Communications Technology
IP-TV	Internet Protocol Television
ITU	International Telecommunication Union
JA	Journal Article
QoE	Quality of Experience
QoS	Quality of Service
RA	Research Article
REF	Reference
RR	Research Report
STF	Specialist Task Force
WBGTS	Web-Based Guidelines and Tutorial System
WP	Workshop Proceedings

4 Overview of the System

The Web-Based Guideline and Tutorial System (WBGTS) addresses the Quality of Experience (QoE) of real-time communication services by providing guidelines developed from user test results. Each guideline includes one or more important Quality of Service (QoS) parameter that was tested with users. Therefore the web-based system provides QoE Guidelines expressed in QoS terms. A description of the concepts of QoE and QoS and how guidelines are developed is provided in [i.4]. An overview of the real-time communication services covered is provided in TR 102 643 [i.3].

The guidelines are from EG 202 670 [i.1] and the WBGTS is based on a specification of user requirements described in TR 102 643 [i.3].

4.1 The main facilities of the web-based system

The web-based System offers three main facilities:

- Navigation
- Education
- Dissemination

4.1.1 Navigation facility

The aim of the navigational facility is to assist guideline users to discover whether or not guidelines exist that cover the issue in which they are interested.

The navigation facility offers three paths to reach a specific guideline, via:

- Communication services
- Guideline topics

- User keyword *search*

EXAMPLE: A network provider is considering launching a new ADSL product for video calls. A Strategic network planner in this organization would like to determine the number of subscriptions that are possible on the same sub-network. By using the "Find a guideline" link it is possible to find guidelines about "Services" and then "Video communication" as a Service sub-set. Also, navigating through the Topic of "Technical parameters" will similarly lead to information on Packet loss.

If the need concerns one specific service, such as Speech communication, all other information is excluded. This is also the case when selecting a particular topic, such as "Purpose of communication". If the topic of "Purpose of communication" is chosen and then Negotiation task, then all guidelines from user tests based on a negotiation context will be presented for all the services for which there are test results.

If neither of these paths provide relevant information for a particular guideline user it is possible that the general search engine could identify additional information. There could be a problem with terminology; for example, between use of the words "Delay" and "Latency". Whilst navigating via Services and Topics enables a relatively simple but effective traverse through a relatively broad information space, the Search function is available as a final option to the user when necessary.

The navigation engine also enables guideline users to enter deeper into available data than in a traditional ETSI Standard, ETSI Guide or an ETSI Technical Report. Due to the constraints of a mainly "linear" paper or electronic document, these documents usually present single-sentence summary justifications for guidelines whereas detailed information for each empirical source is made available with the web-based system. These detailed justifications provide more comprehensive information about the test result from which it is derived (e.g. types of users, experimental design, complete technical set-up, statistical results). Some key original literature sources for the guidelines are also available for download directly by the user of the web-based system.

Table 1 shows the services and topics in which the Guidelines are grouped.

Table 1: Guideline topics per service

Service	Topic	Service	Topic
Text communication	Delay	Face-to-face video (continued)	Deaf or hearing impairment
	Duration		Speech impairment
	Negotiation	Remote inspection video	Audio-video asynchrony
	Person perception		Resolution
	Deaf or hearing impairment		Frame-rate
Speech communication	Delay		Packet loss
	Stereo		Cost-benefit
	Spatial speaker recognition		Self view
	Packet loss		Instruction task
	Media Quality		Problem solving task
	Business communication		Showing surroundings
	User performance		Object recognition task
	Listening task		Blind or visual impairment
	Negotiation task	Multipoint video	Window configuration
	Problem solving task	Multimedia communication	Audio-video asynchrony
	Instruction task		Appearance
	Person perception		Eye contact
	Elderly		Media Quality
	Deaf or hearing impairment		Urgency
Face-to-face video	Packet loss		Deaf or hearing impairment
	Audio-video asynchrony		Cognitive impairment
	Delay		Medical interview task
	Packet loss	Real-Time Games	Delay
	Resolution		
	Media Quality		Background noise
	Screen size		Person perception
	Reliability		Social wellbeing
	Cost-benefit	IP-TV	Frame-rate
	Urgency		Packet loss
	Negotiation task		Colour depth
	Problem solving task	Mobile TV	Frame-rate
	Instruction task		Resolution
	Decision making task		Packet loss
	Medical interview task		Bit-rate
	Group video communication		Screen size
	Human support		Content type
	Appearance		Pattern of use
	Eye contact		Viewing distance
	Person perception		

4.1.2 Education facility

The aim of the education facility is to assist guideline users to understand terms, expressions and concepts used. The guidelines deliberately incorporate multidisciplinary data (e.g. linking QoE and QoS aspects). Guidelines users working in technical areas may understand Packet loss, whereas persons working in more marketing and financial areas may benefit from an explanation of this term. On the other hand, the more technically-oriented guideline users may benefit from explanations of the more user-centred concepts, such as a communication task based on Negotiation.

EXAMPLE: A Human Factors specialist working at a service provider organization becomes responsible for considering user implications of packet loss. However, he does not understand the implications of packet loss sufficiently to immediately apply his knowledge of psychology. He chooses the lessons about packet loss and becomes informed about the causes of errors on a digital line and the measurement of Bit Error Rate. He also learns that when packets are transported over a digital line and a Bit Error damages the packet this results in either the packet repairing itself (if it has enough information) or the packet being lost. The packet may contain audio or video information and therefore damage or loss may lead to the user perceiving some type of distortion.

The education facility offers lessons within specific areas.

4.1.3 Dissemination facility

Dissemination is not a mechanism in the web-based system. Rather, the web-based system is used to enhance the dissemination process.

EXAMPLE: An equipment manufacturer developing 3G mobile terminals recognizes that it is necessary to know if the video quality of a new device is good enough. A Development engineer in this organization wonders if there could a Standard or published Guide to which she could refer and be able to state that the new product is quality assured for users. She uses a general search function and discovers a guideline that states that CIF with 15 frames per second is good for remote inspection.

The web-based system provides a tool by which persons responsible for improving user experience may become further informed about empirical knowledge and key concepts. It should be:

- **Findable** by searching of intentional users. The URL should be associated with ETSI, the key authors and with the supporting Standardization document. The web-based system is located within the ETSI web-site. Effort is made to index the system to be dominant search result when using a search engine (e.g. Google™).
- **Accessible** when the guideline users require. An automatic feature of a website is that it is available anytime and anywhere with a terminal and internet connection.

4.2 Types of Guidelines

Figure 1 shows the distribution of guidelines across the real-time communication services. As is to be expected from the availability of user test results, there are more guidelines within some services than others. The three services with the most guidelines are face-to-face video communication, speech communication and mobile TV.

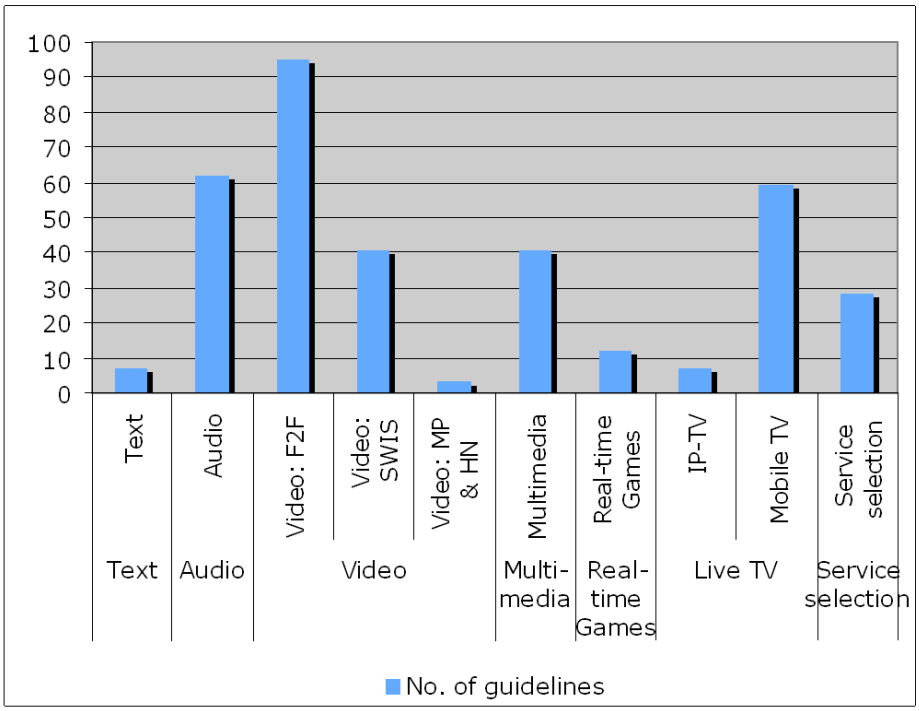

Figure 1: Distribution of guidelines across the real-time communication services

Figure 2 shows the distribution of guideline test results by the type of original source document. The two main sources are conference proceedings and research reports. This is consistent with the state-of-the-art nature of user testing of communication services, where research is disseminated by contract and company research reports and scientific conferences where the time-scales involved are less than, for example, journal articles and books. However, journal articles make up the third main source. Only 10 % of the guideline sources come from existing ETSI or ITU documents that have been found to be based on user tests.

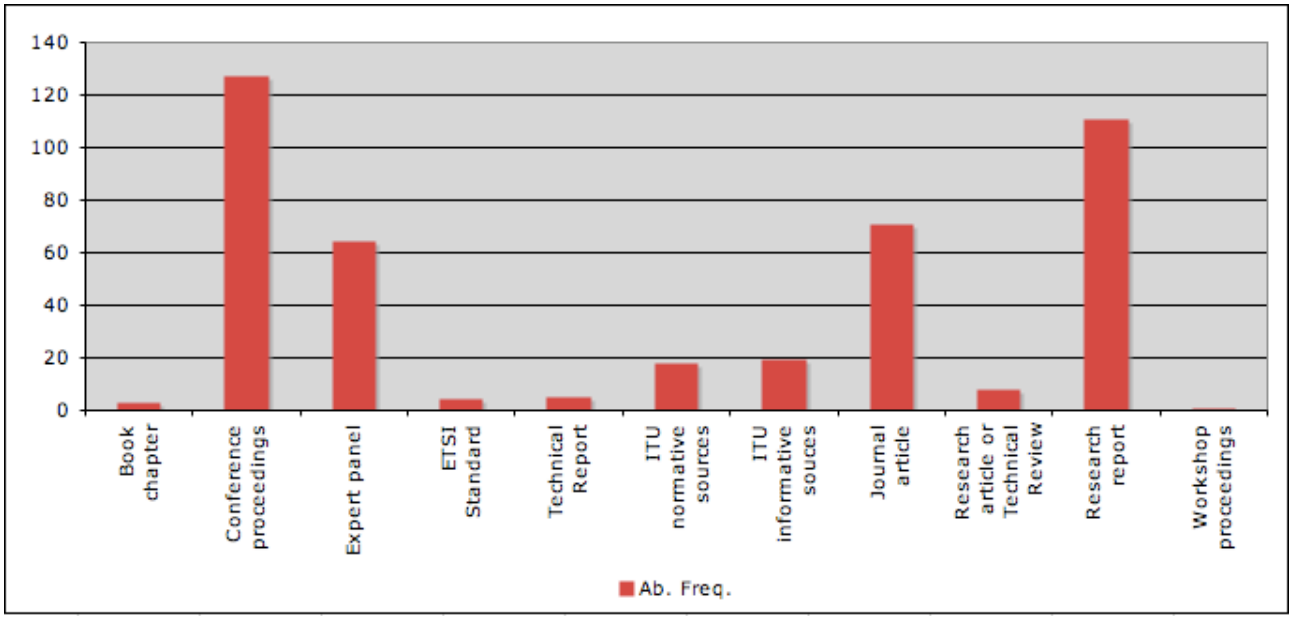

Figure 2: Types of empirical source

4.3 Types of tutorials

Tutorials are provided on some key technical and psychological areas to which the guidelines refer.

Examples are:

- Quality of Experience (QoE)
- User tasks
- User test measures
- Social presence
- Participant status influence
- Design for All
- Perceived reliability
- Heterogeneous network
- Frame-rate/resolution
- Lip-synchrony/asynchrony
- Packet Loss
- Jitter

5 Overview of the design

The web-based system contains the guidelines from EG 202 670 [i.1] plus:

- Additional navigation features enabled by a web-based implementation.
- Greater details of guideline empirical sources.

- Direct links to some of the key references from which guidelines were drawn.
- Tutorials on concepts and terminology contained within the guidelines.

The home page of the web-based system is shown in figure 3 (see clause 6 for design considerations). The main links accessible through the left-hand navigation menu are:

- Find a guideline - access to the navigation and filtering engine.
- Take a tutorial - access to the tutoring engine.

Additional links into the system from the left-hand navigation menu are:

- How to use - information on using the system, particularly with regard to the structure of the guidelines and tutorials.
- About us - background information on the rationale for the site and the responsible STF.
- Send feedback - encouragement for comments to be made via email or an on-line questionnaire.
- Definitions.
- Abbreviations.
- References.

Other important features of the web-based system intended to provide for a high level of usability, accessibility and conformity with the ETSI corporate identity and design include:

- The direct searching for content (see figure 3, upper right hand corner) as an alternative way to access content; this is an accommodation to the preferred way of interacting of some users with web-sites based upon directed (keyword-based) search instead of browsing and exploring content.
- A site overview and direct linking into sections with help of a "site map", allowing for accessible overview over all of the site from each (sub-)page.
- A so called "bread-crumb" dynamic navigation-status indication, i.e. clear textual, clickable information showing which section/page is currently active (see figure 3 underneath the ETSI logo); this is denoted with a "You are here:" guidance as label.
- Multiple small "supportive features" that allow, for example, printing of individual pages, book-marking or the emailing of information.
- Accessibility features such as customizable text font sizes and a link to the ETSI.org accessibility assistance (see footer in the interface, figure 3).
- Information and links leading to details of the official ETSI ISO certification, the privacy- and copyright statement (see footer in the interface, figure 3).

Figure 3: The web-based system home page

Further information is provided in clause 6 on the design considerations based primarily on usability and accessibility principles. The current clause focuses on the key functionality of the system (finding guidelines and taking tutorials) and expected maintenance issues.

5.1 Find Guideline module

In order to find guidelines the user has two options:

- Selecting **Find Guideline** in the left-had vertical menu. This initiates a dialogue designed to help users view the domain of guideline topics and filter out non-relevant topics and services. The default is for all topics and services to be selected, thus providing a complete listing of all of the guidelines upon clicking the "Find Guideline" button.

- Typing an entry in the **Search** function. If the user types a valid entry clicking "Search" will return a list of all of the guidelines related to that term.

The result of using either the Find Guideline or Search function is a list of numbered guidelines that have the same numbers and sequence as in EG 202 670 [i.1].

The guidelines obtained with the Find Guideline engine are grouped under headings of the topic and service to which the guidelines apply.

For each guideline it is possible for the user to view the empirical source(s) on which that guideline is based. By selecting **Show empirical source** the user is presented with:

- a **summary of the test result(s)** on which that guideline is based.

- the **reference(s)** to the source of the test result

- the option to **Show detail**.

Each **summary of the test result(s)** has a consistent construction of the basic form:

> <Communication service> *with* <QoS> *for* <Communication situation> *gives* <Usage outcome> *(compared with* <communication service or QoS>*).*

Each **reference** is presented as a link that if selected brings up a new window that presents the reference description. The reference link is an abbreviation that provides the additional information of the type of reference by using the following classification and abbreviations:

- BC Book chapter;
- CP Conference proceedings;
- EP Expert panel
  Further information about the expert panels is provided in Annex B;
- ETSI ETSI document
  ES: ETSI Standard
  TR: Technical Report;
- ITU ITU Recommendation
  In addition, the text "info" is added if the source is contained in an appendix or a supplement rather than the body or the annexe(s) of the Recommendation;
- JA Journal article;
- RA Research article or Technical Review;
- RR Research report
  Further information about research conducted deliberately to input to the guidelines is provided in annex B;
- WP Workshop proceedings.

Some of the original source references can be downloaded from the site if they are public documents for which permission has been given.

If the user selects **Show detail** the main known usage and technical parameters for a test result a presented in a new window. The parameters are structured according to the clause:

IF <communication situation>;

USING <service prescription>;

WITH <technical parameters>;

THEN <user experience>.

5.2 Take tutorial module

The education function offers lessons within specific areas.

Each lesson offers the ability to receive the tutorial:

- As **pre-recorded speech** accompanied with summary graphics and/or bulleted text summaries in the form presentation slides
- The pre-recorded **speech as text**, with the possibility to view the summary graphics and/or text summaries.

Each lesson has the same structure: a system of sub-lessons that in total cover the chosen area. Sub-lessons are:

- What is <topic name>?
- Why is <topic name> important?
- Lesson-specific sub-lesson(s)
- Conclusion
- Frequently asked questions

- References to relevant literature

For example, to run a tutorial the user selects **Take tutorial** and is presented with a list of available tutorials in the left-hand vertical menu. On selecting a tutorial (e.g. social presence) the left-hand menu expands to list the sub-lessons for that tutorial. The user can then has the option to proceed with a tutorial by:

- Selecting sub-lessons from the left-had vertical menu
- Selecting sub-lessons with the **Previous** and **Next** buttons within the sub-lesson window
- Choosing to have speech on or off with the **audio icon**
- Choosing to have the spoken material presented as speech by using the **Audio as text** button

5.3 Maintenance requirements of the web-based system

As with most websites, there is an issue of maintenance of the web-based system. Furthermore, this particular site can expect to require updating due to a number of reasons:

- Existing guidelines should be modified or removed - for example, due to new research findings and changes in technologies, media and services.
- New guidelines should be added - as new research findings become available.
- Tutorial elements should be modified - for example, due to changes in technologies, media and services.
- Further "Frequently asked questions" may be added to a tutorial as questions are received from users of the system.
- New tutorials should be added - as new terminology, expressions and concepts appear.
- User interface should be modified - as experience from use reveals difficulties.
- Errors should be corrected - as usage reveals poor and no functioning elements.

Updating the web-based system could be primarily driven by the responsible ETSI Technical Body. In addition, it can be expected that users of the web-based system will provide requests for changes and additions. Indeed, this should be actively encouraged by the **Send Feedback** link that is always present in the left-had vertical menu.

Whereas this clause concerns maintenance, information on proposed new development of the web-based system is provided in TR 102 643 [i.3].

6 Design considerations

The design considerations for the Web-based System are based upon previous usage experience and recommendations for change, for example, as published in ETSI TR 102 535 [i.2]. Additionally, Heuristic Evaluations [i.7] have been conducted to investigate possible improvements prior to the conceptualization and design of the current version. Here the rational, realisation and implementation of the current design is described.

6.1 Rationale for the design

The following design principles were established:

1) Main intended users have a professional interest in user experience for their work in network operator, equipment manufacturer and service provider organisations. They have medium-to-high computer literacy and high motivation to use the system. Users are expected to be repeat users; i.e. regular and sometimes frequent visits to the site by the same persons.

2) Update, redesign and improve the look-and-feel, information structuring, and navigation of the existing prototype system [i.2].

3) Minimum requirements for hard- and software needed were specified as:

   a) XGA (Extended Graphics Array) resolution of 1024x768 pixels resolution, at least high colour (16 bit) support.

   b) For the tutorials providing audio-files with explanations the hardware (speaker) and application software to play audio-files is required.

   c) The following web browsers were included in testing: Microsoft Internet Explorer (PC) - version 6 and 7; Mozilla Firefox (PC) version 2 and 3, and Safari (Apple Macintosh version 4).

4) Design for highest achievable accessibility - WAI 2.0 [i.8] - where possible.

5) Very high level of usability for the intended stakeholders.

6) As hosting on of the system on ETSI.org was targeted, the ETSI Corporate Design & Identity was jointly discussed with ETSI representatives and followed.

7) Frequent communication and inter-working between design and engineering (both within the STF 354 team and with ETSI.org administration).

8) Navigation was to be improved, in parts in order to make the distinction between (the finding of) Guidelines and Tutorials more visible, improve consistency and the understanding of the site's structure.

9) The extension of content in guidelines and tutorials was to be provided; i.e. a scaling of content was necessary to be designed.

10) Tight coupling to ETSI.org in design, navigation, interactive behaviour, overall design and selection of colour schemes, and provided features in order to make the system an integral, while at the same time self-contained, part of ETSI.org.

11) Early and iterative cycles of design and evaluations with different stakeholders (including [expert] users) established as the design process.

6.2 Realisation and Implementation

The underlying principles listed in clause 6.1 were followed during the design realisation and implementation of the system. The current clause describes and explains here how this can be visualised in the actual system in order to communicate the logic of the implemented system. Where possible, the described implementation(s) are linked to their respective design rationale in clause 6.1.

Figure 4 gives an overview of the system as a conceptual wire-frame model, where numbers denote different features described in text below.

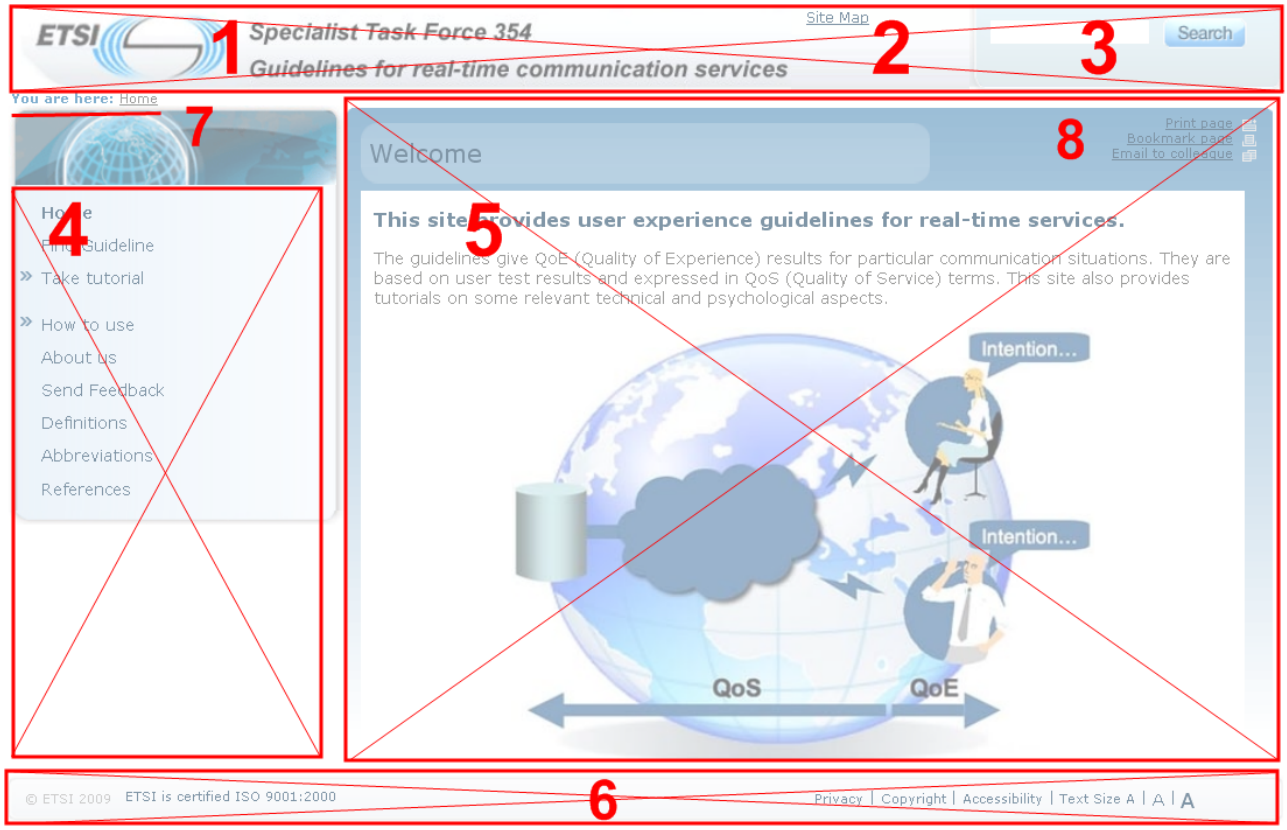

Figure 4: Overview of the system (evaluation version) as a conceptual wire-frame model, where numbers denote different features described in the main text

The system is made-up of 4 main areas (depicted as boxes with diagonal crossing lines):

- "Header" - holding components "1", "2", and "3" in figure 4;
- "Left-hand navigation menu" - numbered "4" in figure 4;
- "Content-pane" in the middle - number "5" in figure 4;
- "Footer" at the bottom - number "6" in figure 4.

The header and the footer hold different, static elements; i.e. the content of these two areas is consistent and does not change when different content is shown. This consistency is intentional, providing literally a stable frame of reference to users. This is in opposition to the more dynamic areas of the left-hand navigation menu and the content-pane: In both of these areas users are given different choices to select from and interact with; i.e. the content is changing depending upon how the system is used.

Overall, this provides for a very "classical" and likely already experienced design and (navigation) structure. Therefore most of the intended users should find this intuitive to use effectively upon first encounter. This design also achieves the rationale of being compliant with the look-and-feel of ETSI.org. For a comparison, the section "About ETSI" section can be visited (URL: http://www.etsi.org/WebSite/AboutETSI/AboutEtsi.aspx Visited: 2010-01-08).

This close resemblance can also be experienced in the left-hand navigation-menu that is identical in look and behaviour with the ETSI "About Us" site; i.e. the interaction for users is identical.

The header has three important components providing functions to users:

- The ETSI logo and system title provide a link to the responsible Specialist Task Force (STF); i.e. clicking this logo/link will navigate to the STF-page. This is again an example how the tight coupling between ETSI and the system has been implemented.

- The site-map text-link ("2" in figure 4) will bring up an overview site-map. This provides orientation over the available content as well as direct links into the site's sub-pages for intended effortless navigation. The site-map will be shown in the content pane, from the different pages. It can be activated again at any time, enabling the jumping between overview and individual sub-sections of the system at all times. This provides an important navigation alternative to using the left-hand navigation menu.

- The Search function is component "3" in the header. This supports users who prefer to navigate a site with a directed search; for example, users who do not want to browse the content because they come already prepared with a clearly formulated keyword-question.

The footer provides more functions to users in the form of clickable text links:

- A clear frame of reference to ETSI's ISO 9001 [i.10] commitment, the ETSI privacy and the copyright statement are accessible.

- Advice on the accessibility of the site is given

- Size of text can be adjusted by users.

The footer components are (again) directly linking into features provided by the ETSI site - this ensures that if any of the described features change (are getting updated) at ETSI.org, the correct information and functionality is also shown and used for the WBGTS.

There are two more features realized in the WBGTS interface that deserve an explicit description here:

Located between the header and the left-hand navigation menu area is a so-called "breadcrumb" navigation-aid representation (denoted with number "7" in figure 4). The term "breadcrumb" has its origin in the "Hansel and Gretel" fairytale in which Hansel uses crumbs of bread to mark the way home rather than be lost in the forest. In the WBGTS the breadcrumbs are a textual representation of where the user is located in the system. This is a well-known and recommended way of providing users with information on their navigational path through content. Breadcrumbs are clickable links that will open the page indicated, they will grow in relation to the user navigating deeper into the site's content, and provide a simplifying trace-back to where the user came-from within the hypertext-space structure of the system.

Other small, but helpful features are found in the main, content-pane (see number "8" in figure 4). Represented as three clickable links (augmented with graphical icons) are the functions for:

- "Print page";

- "Bookmark page";

- "Email to colleague".

If clicked, the Print link will open the operating-system's dialog for printing-out a page, the Bookmark link will activate and show the web browser's system for saving/organizing web pages as bookmarks. Finally, the email-link will attempt to open an e-mail client application with a new e-mail message with text provided as:

```
Subject: Thought you might be interested - Guideline and Tutorial System for
Real-time Communication Services
```

and message-body text:

```
I thought you might be interested in this page - Guideline and Tutorial System
for Real-time Communication Services. You can view it at:
http://www.tutorialsystem.net/Default.aspx?Selection=References
```

This example was activated from the "References" section of the system, i.e. the link is context-sensitive and generated dynamically.

7 Internal data model

The database design is shown graphically in Figure 5 and the file format for the tutorials is presented with examples.

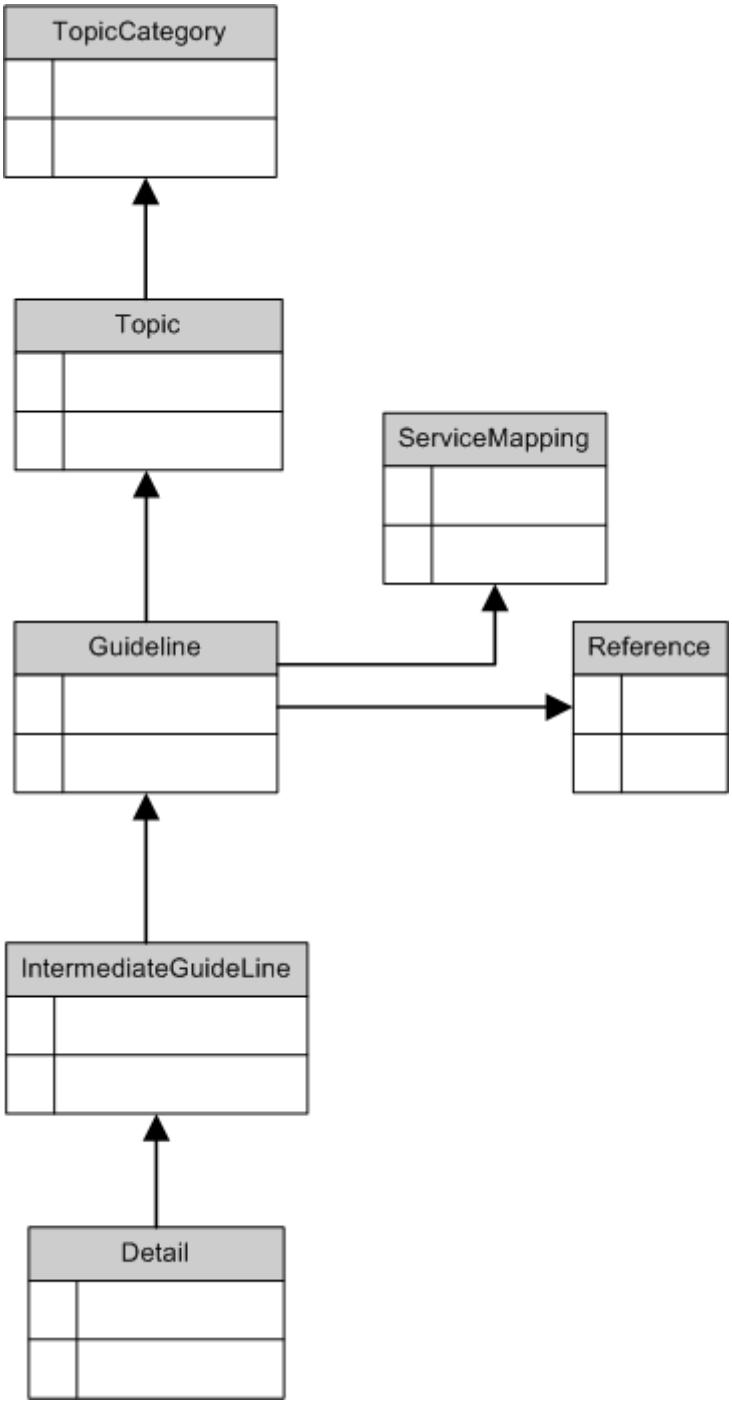

Figure 5: Database design

File name format for the tutorials

L_<2-letter identification>_<Sub-lesson number>_<Sub-lesson text>_<Optional: Version in 2 digits>_<Optional: Remarks>.<file type>

<2-letter identification>

AS: Lip-synchrony / asynchrony

DA: Design for All

DJ: Delay Jitter

FR: Frame-rate / resolution ratio

HT: Heterogeneous transcoding

IP: Influence of participant status

PL: Packet loss

QE: Quality of Experience

SP: Social presence

UM: User communication modes

UM: User measures

UR: User perceived reliability

UT: User task types

<Sub-lesson number>

01

02 .. 10

(Sub lessons are numbered subsequently, including FAQ and REF)

<Sub-lesson text>

What is

Why is

FAQ

Ref

<Optional: Version in 2 digits>

00 .. 20

<Optional: Remarks>

<Whatever>

<filetype>

ppt

jpg

mp3

wav

vma

doc

Examples

L_PL_01_Whatis_02_Onlytest.mp3

L_MS_08_FAQ.doc

L_UT_11_REF.doc

History

Document history		
V1.1.1	March 2010	Publication
V1.1.2	March 2010	Publication