Design Guidelines for Better 3G User Interfaces

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ABSTRACT

This paper presents the development and content of two guideline documents developed by the European Telecommunications Standards Institute (ETSI), Specialist Task Forces (STF) 231 and 322 of the Technical Committee Human Factors (TC HF):

1. The initial approach taken in the ETSI Guide (EG) 202 132: Generic User Interface Elements for Mobile Terminals and Services [1], with a focus on 2G technologies; and
2. Considerations and issues addressed in the 3G centric expansion (under development until October 2008), ETSI Guide (EG) 202 974: Generic User Interface Elements for 3G/UMTS Mobile Devices, Services and Applications [2].

The two sets of guidelines, when applied in product development and to implementations, are expected to considerably improve the general usability, consistency and accessibility of mobile solutions, including terminal-, service- and application-related aspects of the mobile user experience.

Categories and Subject Descriptors

H.1.2 [**User/Machine Systems**]: Human Factors, User Education – user guides, setup procedures - *mobile computing, e-services, device setup*

General Terms

Human Factors, Standardization.

Keywords

Guidelines, User experience, User interface, Mobile Internet.

1. INTRODUCTION

Information and communication technologies (ICT) play an increasingly important role in the daily activities of many people. With the technical development offering seamless and more continuous wired and wireless access to broadband networks, the vision of a world where ICT resources around us improve the quality of our lives is more realistic than ever.

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The mobile telephone is a highly successful device that also corresponds to a deep human communication urge. 3G technologies provide a major upgrade to wireless data capabilities of terminals, wider bandwidths to transfer information in wireless networks, and efficient means to bring for example Internet based services to mobile environments.

Connectivity and interoperability between telephony networks, personal computing, the Internet, and ever-smarter mobile devices and services offer enormous potential for improving life. However, there is concern about whether these new products, services and their content will be fully accessible and understandable to all people. Ensuring access to mobile communication for all is a common goal of vendors, operators, service providers, user associations as well as politicians.

1.1. Related Work

Our development of 3G-specific user interface design guidelines is based on several sets of existing guideline documents:

The first set of UI design guidelines has been developed jointly by handset manufacturers, service providers and telecommunication standardization organizations [3]. Many of the guidelines are mainly directed to specific hardware and software platforms and are device- or communication-centric [4, 6].

The second set of sources has been IT standardization organizations (W3C, [7]) and the Internet community [8]. The Mobile Web Best Practices and mobileOK [7] developed in W3C are recommended by the ETSI Guide, which additionally addresses other aspects related to mobility (e.g. roaming, setup, QoS and accessibility issues).

Based on these sources we have collected additional relevant guidelines for user interfaces in the 3G environment taking into account the changing characteristics of device usage related to high-bandwidth mobile connectivity.

2. WHY GENERIC 3G UI SOLUTIONS?

The feature-richness of mobile networks, systems, services and applications is constantly on the increase, enabled by the convergence between voice and data services, provision of media content, and the migration from second to third generation mobile networks.

The work on which we focus here takes into consideration the 3G-specific UI characteristics, and addresses areas such as seamless connectivity between different kinds of networks, quality and continuity of service and provisioning and presentation of data-intensive services and applications. We provide generic user interface design guidelines applicable to all user interfaces of 3G-enabled devices, services and applications.

The earlier guidelines provided for 2G remain applicable to the systems and services addressed in the current document as the technologies covered remain an integral part of 3G networks.

2.1. Commercial Attractiveness

The main scope of the new work is to emphasize opportunities for simple but generic service solutions that are commercially attractive to network operators and equipment and service providers for delivery as a sustainable revenue generating activity, which opens access to information and communications technologies to consumers who might otherwise be excluded. The full potential of these services will, however, remain hidden and un- or under-used, if their users are unable to get access or make use of the service and application functionalities.

2.2. A Reduced Usability Gap

Two important and conflicting trends can be observed in mobile communications: the complexity of mobile terminals, services and applications and underlying technology is on the increase, while the segmentation and spectrum of end users broadens globally.

Complexity. Technological advances and market pressures have made telecommunications and ICT products and systems technically and perceptually increasingly complex, feature rich and miniaturized. The situation is further worsened by underlying dependencies between services, applications, devices and contextual device behavior (e.g. roaming). Dealing with error situations is increasingly difficult. Research results (e.g. the Mobinet surveys [5]) indicate that both novices and advanced users are equally afraid of the high complexity of new technologies.

Users. The number and variety of 3G technology users increases rapidly. Applications and functions which earlier may have required special training or good technology literacy become accessible to mainstream users who are not enabled to make full use of the potential of these applications.

This increase in product complexity with a parallel decrease in user specialization has created so-called “usability gaps” (Fig. 1). Generic UI solutions will help closing these usability gaps by e.g. reducing training requirements for new applications and services.

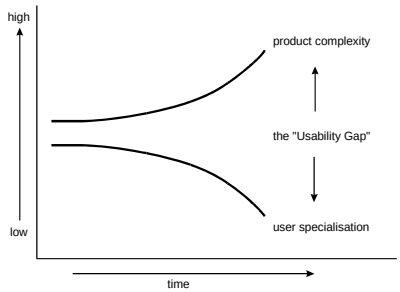

Figure 1: The usability gap

3. WHAT IS UI HARMONIZATION?

Manufacturers, operators and service providers differentiate their products and services by trying to make them unique, or at least different from and better than those of their competitors. Areas in which such differentiation can be achieved include industrial and screen design, feature sets and also the UI design. In this light, the UI is not an obvious candidate for the definition of generic UI elements across manufacturers and service providers.

The emergence and possible harmonization of basic, generic UI elements, an important goal of the work described here, is the result of either de-facto standards (as in the case of the graphical UI elements) or of standardization (as in the case of the keypad arrangement on public telephones).

Developers of new applications aimed at mobile usage currently have to consider many different hardware and software UI solutions. This has been a major obstacle to the delivery of new and innovative mobile applications [9] which may be overcome by UI standardization. Harmonization benefits many groups, as:

- End users don’t have to (re-)learn new UI essentials as they move between devices and services;
- Manufacturers don’t have to (re-)invest resources in areas that don’t return revenue by increasing their sales, nor provide a competitive advantage;
- The range of applications being delivered to mobile devices expands through standardized UI design.
- Service providers may save in customer support activities and related costs, as they don’t have to cover a vast diversity of specific UI implementations.

What UI harmonization should absolutely not do is to restrict the manufacturer or service provider in expressing their brand identity or in coming up with particularly good solutions. Neither should UI harmonization be an obstacle to novel and innovative solutions (e.g. the emergence of new input mechanisms such as double-finger gestures on touch screens).

4. 3G-SPECIFIC UI DESIGN GUIDELINES

3G maintains all telecommunication functions known from earlier technologies, and provides new enablers and opportunities for the mobile device users to handle personal digital content in their device the network, and other devices. The differences between 2G and 3G devices and environments must be considered at the UI level and will lead to design guidelines relevant for 3G user interfaces, in particular in relation to mobile Internet access.

While the ETSI Guide provides design guidelines for many aspects of 3G-related user interface, we will concentrate here on areas relevant for the user experience of mobile internet access.

Validation of Guidelines: The guidelines that follow were the result of numerous consultations between a variety of experts in the fields of mobile user interface design and mobile communications technologies. The guidelines were validated by use case analysis and consultation workshops in international fora.

4.1 Connectivity, Cost and Quality of Service

In a 3G environment users may have instant Internet connectivity almost anytime and anywhere. Download/upload channels may

provide capacities up to several megabytes per second. Along with the improving coverage of 3G networks, there are less connectivity barriers for the use of applications and services, even in roaming contexts.

Access to 3G services is, however, not always guaranteed, and the quality of service may differ due to network set-up, roaming agreements, etc. Due to the amount of data traffic it can be difficult to understand or predict the expected costs of using 3G services, easily leading users to avoid the use of 3G services. Factors differentiating 3G from 2G services are higher bandwidth requirements (although bandwidth may be reduced considerably in 2G fall-back scenarios) and more frequent transitions between different network types during usage. It is therefore important for the user to be informed about and able to control the connection used to access the Internet from a mobile device.

Sample UI design guidelines for connectivity issues:

- Provide user support for finding the optimal connection (cost, speed, reliability).
- If an existing used connection is closed, provide the reason for this to the user.
- In roaming situations, explain to the user which network provides 3G bandwidth and data rates for Internet access.
- Each application should clearly indicate its connectivity options and on-line status at all times.
- Network changes should not require user involvement if there are no cost implications.
- Transmission efficiency should be considered (e.g. the use of compressed, lower-resolution pictures) and, when reasonable, optimized for the browser.
- If content cannot be displayed due to missing browser plug-ins this should be indicated to the user.
- If dedicated browsers are used (e.g for YouTube content), their limitations should be indicated to the user.

Sample UI design guidelines for cost and data rate/QoS issues:

- The cost of using data-intensive applications should be made clear prior to the application being activated.
- The charging scheme for data transmission should be made clear to the user.
- Roaming charges should, to the largest possible extent, be indicated to the user.
- If an application depends on minimum data rates (e.g. location based information services) the available data rate should be indicated to the user and insufficient data rates should be clearly flagged.
- Functional application limitations due to roaming should be indicated to the user.
- All applications should “degrade gracefully” if the available data-rate decreases.
- An option for limiting cost of data transfer should be available at all times. User-controlled cancellation of data transfer when reaching this limit should be a standard feature of the device.
- Indicate if the available QoS does not support or is insufficient for usage of the intended service.
- Show the availability of networks in a way which helps users understand their QoS.
- Allow users to adjust QoS parameters in whatever way they wish (as long as it does not compromise basic applications such as voice call).
- Help users to make an informed choice of available networks by offering QoS and related cost information, such as special tarrifing.
- QoS should be shown in relation to the services that it enables, rather than in abstract forms.

4.2 Distributed Applications, Multitasking and Distributed Memory

3G supports the development of new services and applications. New functionality can be created by all stakeholders, such as manufacturers, users, service providers and software companies [10]. The enablers for this are programmability of the devices, possibilities to search and install functions, enhanced memory capacity, processing power and connectivity.

3G protocols support much higher data rates than earlier cellular systems. New services are increasingly combining Internet services with some other local function. The usefulness or utility may be critically dependent on the synchronous *co-functioning* of online service and local function. An example for this is GPS navigation combined with and online maps. For the user this will only work well if there is not more than a negligible delay in downloading map data, and showing the location on a device. Other areas in which this co-functioning becomes crucially important are video calls and mobile CSCW applications.

Internet service designers should consider:

- Lack of common form factor and UI standards –devices are not consistent;
- Varying availability of network quality and services;
- Limited input and output capabilities of the devices;
- Cost of using the services
- Size optimization of the content that needs to be uploaded / downloaded.

Most 3G devices support multitasking, i.e. several applications or functions can run in parallel. Multitasking decreases device performance, increases power consumption, and makes the overall device behavior slower. In application design this must be taken into account – functions should be designed to work in cases when other tasks share the same resources and bandwidth.

Another aspect to be considered is the co-existence of traditional telephony functionality and conventional device features as e.g. the telephone directory with new service and Internet access.

Sample UI design guidelines dealing with device functionality and coordination issues:

- Emergency call functionality should always be available and prioritized.
- Applications and services should still be useful to the user in off-line mode. If this is not possible the status of the applications should be communicated to the user
- Indicate delays caused by running parallel applications.
- Indicate delays caused by connection limitations
- Applications not available in off-line mode should be clearly marked.
- Indicate power consumption and remaining battery lifetime based on current estimates.

- Indicate if data may be unavailable in off-line mode.
- Mobile Web content should be mobileOK[7] compliant.

4.3 Device Size, Display and Input Options

3G mobile devices are data- and display-intensive products, often characterized by higher processing power larger memory capacities and larger displays than typical for 2G devices. Manufacturers can design better user interfaces, provide more flexible software including software updates, and apply technologies based on intensive communication. Many platforms and operating systems also support multitasking, parallel activities and multiple simultaneous connections.

Although devices can store and handle large amounts of data, there are several disablers. Device memory tends to get full, upload or download is not always possible or fluent, etc. In addition, the small-screen user interface does not always support handling large amounts of data items, such as photo libraries.

Sample UI design guidelines related to device limitations:

- Provide UI functionality for an overview and the zooming of pages larger than the available display.
- Ensure that controls for zooming and scrolling are always available to the user.
- Provide alternate means to navigate the data displayed on the device.
- Provide means to control data storage (local/remote).
- Clearly indicate where data is stored in the system.
- Ensure that software updates are not interrupted through network failures in unrecoverable failure mode.

4.4 Privacy, Data Integrity and Security Issues

New connectivity functions and services bring along new requirements related to security issues, some of which are familiar from the Internet environment and some are specific for mobile devices.

Fast data connections and the increasing memory capacity of 3G end user devices has led to possibilities of remote and local storage of sensitive user data. Both the integrity of 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, e-health applications).

Sample UI design guidelines dealing with privacy issues in 3G networks:

- The security and protection status of a data connection should be displayed.
- External attempts to tamper with secure data connections should be indicated to the user.
- The user should always be in control of any access rights to sensitive and private data.
- Indicate unavailability of secure data connection to protected data.
- The reasons for unavailability of protected data connections should be indicated to the user.
- The user should be in control of which personal data is made available to other parties (e.g. location information of the device).

In addition to the areas described above, the document also contains UI design guidelines related to:

- Traditional telephony, video and IP-based telephony
- Application installation and software updates
- Failure recovery
- Product exchange (moving data and applications) and
- Accessibility applications enabled through 3G

Due to space limitations, we will not discuss the sample guidelines listed here in detail. A more detailed discussion of the reasoning behind these guidelines can be found in [2].

5. CONCLUSIONS AND FUTURE WORK

We have described ETSI work in progress for developing common 3G UI design guidelines. Simplifying end-user access to a wide range of applications and services through harmonized UI components will lead to easier adoption of new technologies. Common UI elements add value through faster and wider deployment and adoption of device functionality and online services.

Emerging interaction technologies such as voice and touch input, haptic output and ubiquitous interfaces will require their own, dedicated and more detailed guidelines to be developed in the future, work that is outside the scope of these projects.

We invite the stakeholder community to contribute to consider using and deploying these guidelines as a reference document and/or checklist in their research, design, development and deployment activities. We also invite feedback from in-field validation on the utility of our guidelines.

6. REFERENCES

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