



# USER-FOCUSED SERVICE DEVELOPMENT

**IN FOCUS**  
**Telenor R&D**

**EVENTS**  
**Eurescom Summit 2002**

**A BIT BEYOND**  
**Ambient Intelligence**

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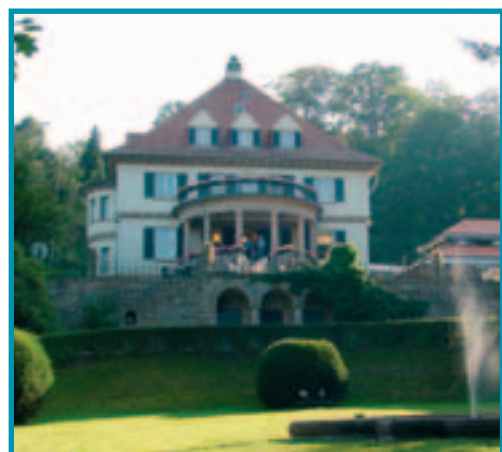
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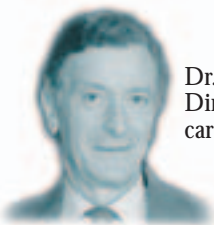
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# LET US FOCUS ON THE USER



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What could be useful does not necessarily have to be easily usable. Especially at Christmas, many people experience this. They find nicely designed devices under the Christmas tree, which are crammed with plenty of more or less useful functions. This year, they might get nice gadgets like digital still or video cameras and handheld PCs. This kind of Christmas gift, which offers tremendous functionality, will, in most cases, offer ease of use only to tech-savvy people, who enjoy studying the manual and the functions of the device while the others sing Christmas songs.

#### Ease of use

However, not everyone is happy reading the instructions of complex devices. The average user would be happy just to unwrap the device and start using it without ever looking at the manual. If you want to have success on the mass market, you need devices, which can be operated by just pressing some easily recognisable buttons. Think of toasters, microwave ovens, TV sets, and GSM phones.

#### The GSM experience

The example of GSM requires further consideration. GSM has been so successful, because its basic function – mobile phone calls – is so easy to use: You just press some buttons, and you can talk on the move to anyone in the world. The usability of GSM phones was negatively affected, when manufacturers and service providers tried to include some more technologies on GSM phones without re-thinking the interface. The first attempt to combine GSM and Internet on mobile phones was certainly not a success, because browsing Web pages on a tiny screen at slow bit rates was hardly usable and, therefore, not accepted by the users. This was a typical example of an easily usable device made complicated – consumers suddenly faced a high usability hurdle. The lesson is that the simple combination of successful and usable services does not necessarily lead to more success and better usability.

#### 2.5 and 3G – a chance for usability

The rollout of 2.5 and 3G on the mass market offers the telecoms industry a unique chance to increase functionality and usability of mobile devices at the same time. So far, users could experience digital multimedia content only in a fixed or an unconnected environment, which limited usability considerably. With the advent of these technologies, we are entering a new era in which multimedia services are offered for the first time on mobile devices. There is the opportunity to create and distribute multimedia content on mobile devices with ease. The ease of use will be crucial to convince consumers of the extra benefits of the new devices and services. Technology has to make their daily life more convenient. Making consumers accept new technologies requires high usability. Even a three-year-old child and its grandparents should be able to send and receive customised multimedia contents without trouble.

#### Challenges for R&D

Making life easier for the user makes it harder for researchers and developers. We have to design networks that are seamless, services that are ubiquitous, and interfaces that adapt to the needs of users. Though everyone in the telecoms industry has understood this challenge by now, this does not mean that user-focused development of services and devices has already become reality.

Making increasingly complex services on shrinking devices easily usable for everyone is probably the biggest challenge the ICT sector has ever faced. I am confident that we are on the right way. Awareness and understanding of usability issues has increased in the ICT sector. Several R&D projects in Europe, like Eurescom's projects DUS and MUST, have chosen the user-focused service development approach.

#### Positive expectation shocks

These efforts may lead to the 'positive expectation shock' Tony Houghton from BT has defined as a desirable goal in usability. I think we need to give users many positive expectation shocks to finally reach the goal of an inclusive information society, in which grandparents and grandchildren will benefit as much from advanced communications technologies as tech-savvy people do.

User-focused service development is, thus, the most promising approach we have for promoting a prosperous development of the global economy in general and the telecoms industry in particular. If we collaborate now for creating many positive expectation shocks, we have a good chance to overcome the economic gloom that overshadowed the telecoms sector this year.

*Antonio Carrelli*



## EDITORIAL REMARK

### Dear readers,

In the cover theme of this issue we explore the challenges and opportunities of user-focused service development covering various aspects of usability. We invited researchers and scientists to share their insights and experiences on the latest advances in this area. The related topic 'Ambient Intelligence' is covered under 'A bit beyond'. After the technology- and network-oriented issues in the first half of 2002, we thought it was about time to focus on the user-related aspects of R&D in telecoms.

For those, who are interested in technology issues, we have, of course, also some articles in store. In this issue, you will find contributions about network integration testing, IPv6, MPEG, and Model-Driven Architecture.

In October and November, important events took place, which are covered in this issue. You will find reports about the IST 2002 event in Copenhagen, the Eurescom Summit 2002, and the OSA/Parlay workshop in Heidelberg.

Recently, we were asked what the requirements are for a company to be featured in our regular section 'In focus'. The answer is quite easy: The company has to be involved in the R&D activities of Eurescom. Under this definition we are not strictly limited to Eurescom members, but they get preferential treatment. In the past issues, we have only covered Eurescom members, but next year, we will consider also other companies and organisations with close links to collaborative R&D in Europe. We are, of course, always open for suggestions, but the selection will be done by us in a non-biased way based on strictly editorial arguments.

We hope that this issue of Eurescom mess@ge will offer you plenty of useful and usable information. Please send us your feedback on the usability of our magazine so that we can keep it focused on the needs of our readers.

At the end of a challenging year for the telecoms sector and Eurescom, we would like to use the opportunity and say 'Thank you' to all our authors. Thanks to their

contributions, Eurescom mess@ge has become an important information platform for collaborative R&D in telecoms – in Europe and beyond. With this we would like to encourage everyone involved in R&D and the telecoms industry in general to discuss with us ideas for future contributions.

Wishing you a peaceful festive season and a secure and prosperous 2003.

**Your  
Eurescom mess@ge  
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## SN@PSHOT

**“OOPS – I THINK I JUST LOCKED  
DADDY IN THE GARAGE!”**

“Toy makers want high-tech Christmas”  
(Reuters headline, 8 November 2002)



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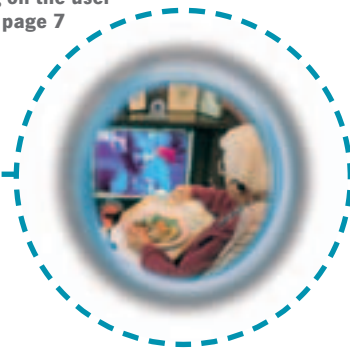
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## EURESCOM AT IST 2002 IN COPENHAGEN

From 4th to 6th November 2002, this year's most significant event for research and development in Information Society Technologies (IST) took place in Copenhagen. 'IST 2002 – Partnerships for the Future' was organised by the European Commission in co-operation with the Danish Ministry of Science, Technology and Innovation.

For the first time, the annual IST event opened its doors to all European research in the IT and communications sector, whether publicly or privately funded. "This is an event designed to capture the ideas and imagination of Europe's Information Society community, and to strengthen the European Research Area in the field of information and communications technologies", explained Erkki Liikinen, European Commissioner for Enterprise and the Information Society.

The IST event took place in the advent of the 6th European Framework Research Programme, which was officially launched a week later in Brussels. 3,800 delegates from Europe and beyond attended the event and saw up to 14 parallel sessions and a comprehensive exhibition, which were perfectly organised. One of the tech-



anical sessions was on 'Next Generation Broadband: Oasis or Mirage?'. A panel of distinguished speakers discussed the visions, roadmaps and barriers for the development of future broadband networks and services. David Kennedy, Senior Programme Manager at Eurescom, par-

ticipated in the panel and stressed the importance of appropriate user-friendly services for making broadband happen.

Further information on the event is available at:  
<http://2002.istevent.cec.eu.int/>

## EXPANDED SERVICE PORTFOLIO

**Eurescom has expanded its service portfolio. On 1 October, Eurescom started to offer its meeting rooms in Heidelberg under the brand name Eurescom Conference Centre (ECC) to selected organisers with a high affinity to information and communications technology. Shareholders of Eurescom have priority, if they would like to rent meeting rooms for their company events.**

In parallel, Eurescom has started to offer IT solutions for collaborative projects. The success of multi-disciplinary collaborative projects heavily depends on a reliable and flexible infrastructure that offers efficient administrative and technical support. Eurescom has developed a unique portfolio of such services upon an infrastructure that has proven to meet all project requirements with a minimum of overhead. Eurescom's IT and Web service portfolio consists of e-mail exploder lists, FTP, Web

and news services, audio and video conferencing, streaming media presentations, Web-based project management applications, dial-in services via PSTN and ISDN, CD-ROMs and mirror-servers.

Further information on Eurescom's new services is available in two recently published brochures, which can be ordered by sending an e-mail to [info@eurescom.de](mailto:info@eurescom.de).





# USER-FOCUSED SERVICE DEVELOPMENT



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It has become obvious that only services and terminals, which satisfy the needs of users in an easy-to-use way, will be successful in the marketplace. Since a few years, a paradigm shift has taken place: From a mainly technological-driven approach the development of communications services and devices has moved towards a more user-centric approach that is focused on the needs and the behaviour of the end-users. This user-centric approach has changed a number of established procedures. New strategies and methods became necessary. Eurescom contributed in a series of projects to the improvement and broadening of the user-centric approach. This cover theme gives some examples on how user-focused service development can make a difference for designing innovative services and products.

The consideration of user needs, user behaviour, and the usability of services and terminals have become a very important aspect during the development phase of a service or a terminal. A number of efficient and reliable methodologies have been developed to provide tools and knowledge for the development of sophisticated and successful new services and devices.

## Performance and user acceptance

One of the first Eurescom projects that investigated the various aspects of a user-focused service creation was the 'Jupiter' project (P605) in 1996. This project was actually composed of three different project proposals, and the merging of them was more coincidental than really intended from the start. However, it turned out very soon that the merging of the proposed three areas – the performance issue and the usability, as well as the overall acceptability of new services for users – opened a door to a new way of assessing user needs and user behaviour from a different perspective. The project helped in understanding how performance, service quality and usability are related and perceived by a user. It was quite surprising that, depending on a current work situation, a user was sometimes quite satisfied with a



rather low service quality while in some other cases even a good quality could not be satisfactory, for instance, if the usability of the service was not according to his expectations.

## Ways to enhance usability

The increasing complexity of new services has, consequently, also led to more complex user interfaces for the terminals. If new services shall be successful, they have to achieve more than just meet the technical user requirements, they must also be easily understandable and usable. Especially the often rather low quality of the tiny displays in mobile devices has forced researchers to investigate alternatives, such as speech

input, speech output, and voice-controlled services. Other ways to solve the dilemma of small displays could be services that can be used seamlessly with different devices. There are particular situations in everyday life, in which it is more convenient for the user to use another, better suited device for a specific task. The technical challenge is to achieve this without interrupting an existing session. The following articles about the Eurescom projects MUST and DUS present the latest R&D results, which address the aspects of multi-modality and seamless inter-connectivity under the new paradigm of user-focused service development.

# WORK, LEISURE AND LEARNING

## CREATING USAGE-CENTRED INTERACTIVE SERVICES



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The development of interactive services requires us to explore the user's environment, the context in which technology supports people. New input and output technologies are emerging, which integrate intelligent interactive devices seamlessly into a person's environment. This has motivated us to explore new design and evaluation methods. We will discuss several user-related topics for interactive services, illustrated by the example of a train passenger.

### Users

To support the user in his/her daily activities, be it work, leisure or learning, we first need to understand what tasks he/she performs. The service should not only act on request from the user, but also foresee people's needs. We should anticipate the user's future demands. Second, we recognise the user's ability to express his or her intentions, how he transforms them into actions, and how he perceives his environment and reacts to it. Sometimes, we are so immersed in what technology can do for the user that we forget what the user can do without support from technology when interacting with the computer. The user's characteristics, his knowledge and even emotions may affect his or her interaction with the services. One person may play different social roles, for instance as a teacher, a mother, and a student. A teacher has different needs than a mother. Two persons with the same needs and social roles may have different abilities. Technology should aim at compensating these differences.

Example: The passengers on the train have the same needs, but different abilities: Impaired sight, immobility, illiteracy, high or low travel frequency. On the train there are also people playing other roles, such as attendant and waiter.

### Stakeholders

Although a system is influenced largely by the users, they are not the only ones who affect its design. There are the user's co-workers, the system's owners, the implementers, the user's unions, family and friends, the governments and the general public. The system may affect the stakeholders' lives, and hence they want to influence how it will be built.

Example: A railway company, service providers and travel agents may be stakeholders of the train information system.

### Environment and context

A person interacts with its environment, including other persons, artefacts and nature. Human computer interaction is the synchronous or asynchronous interaction between persons, or between a person and artefacts with the help of intelligent devices. The environment, or context, consists of objects and their values. The objects can describe spatial, temporal, knowledge and logical characteristics. In the past, a system was typically used in one spatial context, the office, for example. Today, a system can be used in many different contexts, which dynamically affect its behaviour.

Example: The different spatial usage contexts of the train information system are my office, the train station, the track, and the train.

### Usage

A user transforms his intentions into tasks which he expects the computer system to help him with. The computer system may also foresee the user's needs and provide information or assurance. We learn about the user's domain by observation, interviews, and surveys. With these methods,

we analyse what goes wrong, what can be improved, or what we want to change. A person's actions are of varying criticality, if you think of air traffic control, fish processing, learning, and games. If a task is complex, done infrequently, or a matter of life or death, it needs special attention. A developer should have a clear goal regarding the quality of the system. Usability, as defined by ISO/IEC 9241-11:1998 on ergonomic requirements, is measured by effectiveness, efficiency, and satisfaction. Effectiveness means, you can complete the task without error; efficiency means, you can complete it in time; and satisfaction means, you can do it without discomfort and with positive attitudes.

### Methods for usage-centred design

There are many methods, which help us develop interactive systems (see Constantine/Lucy Lockwood and van Harmelen). According to the recommendations of ISO/IEC 13407 on human-centred design processes for interactive systems, we should develop design proposals with input from a multidisciplinary team, examine the context, analyse users and organisational needs, and present several design solutions.





It is also recommended that the life cycle should be iterative and, thus, the designs should be tested and evaluated early and often. The methods applied in user interface development are either abstract or concrete techniques.

It is generally easier for us to understand something that is concretely described, such as a photo. Scenarios, or examples of stories that illustrate how the system is used, are concrete textual descriptions. The actors in the scenarios are sometimes further described by persons that have needs and abilities. Storyboards are series of snapshots that illustrate how the user interface changes as the user interacts with the system. Prototypes of the user interface are a third example of a concrete technique. Prototypes allow us to test the system by asking the user to evaluate it. By presenting a concrete description of an interactive service to a user we can evaluate the user's perception and reaction to the system.

Examples of concrete models are prototypes, scenarios, usage cases, and storyboards.

The problem with concrete descriptions is that they often show an example of usage and we get tangled in details. Another problem with them is that users or developers may focus on details and exclude general cases. When using abstract methods, we create a very simple view first, and then refine and add little by little the details. Therefore, we emphasise building an overview of the service. We attempt to categorise so that we can look at classes of interaction objects and not instances. Thus we achieve consistency by using a general term instead of many specialised sub-terms. The user cannot easily comprehend abstract models, such as diagrams. Since abstraction is essential in presenting design solutions, better methods are required. Multidimensional technologies, meaning types of devices and multiple input and output, make design more complex and abstraction ever more important.

Examples of abstract models are navigation maps, state transition diagrams, object models, sequence diagrams, essential usage cases.

### User evaluation

A usability failure is a failure that occurs, when the user interacts with the system and the system departs from the required behaviour. The goals of the required behaviour can be specified in terms of the usability of the system in a certain context. Therefore, we need to validate the interaction with a system with the help of users. Since users are so different, one may be able to trigger a failure whereas another may not. There are expert testing methods that substitute user testing, but we do not fully know to what extent these methods produce false alarms or miss interaction failures.

## USAGE SCENARIO: TRAIN RIDE

I plan to go from Copenhagen to Aarhus, where I will attend the NordiCHI conference. Should I take the train or the plane? I decide to take the train. At work, I look at the train schedule on the web, decide which train I am going to take, and then reserve a seat. I get a reservation number that I note down on my mobile phone. When I arrive in Copenhagen, I show my reservation number to the clerk, who sells me the ticket. I consult the train information system and walk to the right platform. There, I look again at the train information system, which assures me that I am on the right platform. I enter the train and go to the right car, and there I am assured by the information system that the train is going to Aarhus. I walk to



my seat, where I am informed that the seat is reserved for someone going from Copenhagen to Aarhus. I must be in the right car at the right time and travelling to the right place. I am happy and the train departs. I show my ticket to an attendant, when she comes and asks for it. "In 45 minutes we will be arriving in Odense," a voice from the loudspeaker says. I have doubts – Odense is further away. The next minute, another voice from the loudspeaker says that there was an error in the information system and the train would be arriving in Odense later. There is nothing wrong with the train, just a failure in the information system. I buy a cup of coffee from the waiter. I enjoy the beautiful landscape, observe people returning home from autumn vacation and do some work on my laptop to prepare for the conference. I arrive on time in Aarhus.

This scenario helps us to analyse what can be improved. For example, it would be an improvement, if the system could enable me to buy the ticket on the move and receive it on my mobile phone.

Useful guidelines, general and specific, have been developed for various domains of user interface design, such as air traffic control, Web services, or mobile services. General guidelines require that the user should be in control and able to reverse his actions (Preece, Rogers, and Sharp). Required is also consistency in the user interface and with the user's world, visibility of the status of the system, and feedback to actions. Interpreting users' complaints and transforming test results into improved design is not easy and requires several iterations and design alternatives.

### Conclusion

The user should play a central role in the design of interactive services. When developers design human-oriented applications, they explore a person's needs and abilities, and the context of the activities. Since users have to evaluate designs throughout the development process, we need to use a combination of abstract and concrete methods that can illustrate designs to the user.

Designing interactive services is difficult, but also rewarding. To achieve the best results requires improved awareness and integration between the many areas of expertise that contribute to the design of human computer interaction.

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# DUS – USER-ORIENTED DEVELOPMENT OF ALWAYS-ON SERVICES



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Digital gadgets are increasingly becoming a part of our daily lives, enabling us to be online, inter-weaving our social fabric. New devices and networking technologies open wide spaces for telcos to develop and position possible services and products. However, the development of new products and services in dynamic markets is challenging. This is especially true for services based on platforms and technologies, which are not yet or just about to enter the market. How can such a product be planned, designed and produced in a way to be launched and positioned successfully?

To reduce the risk and cost of such developments and to increase their potential competitiveness, it has become increasingly important for developers to utilise a perspective for their development that is rather user-oriented than technology-driven. Considering the general market situation as well as the user's needs and opinions, the product's acceptance by the user, and, thus, its performance on the market, becomes more predictable. For this reason, a multi-phased international user trial was carried out by four European telcos within Eurescom project P1101 to gain insights into the user's perspectives and integrate these findings into the development.

## Eurescom project DUS

The project 'Device Unifying Service (DUS) aims at exploiting the characteristics of future broadband Always-On mass-market services. It was particularly explored how these new services can be accessed from any location and delivered to multiple heterogeneous devices, like cellular phones, laptops, PCs, PDAs, fixed line phones, MP3-players, digital cameras, and others. Though all the user's various devices have different functionality and capabilities, they can act together as one "virtual terminal" with multiple input and output options. DUS is a potential enabling technology that will allow users to seamlessly switch between devices so

that the same voice or data-oriented session may begin on one terminal and continue on another. Additionally, DUS offers the possibility to reduce the burden of terminal management, configuration, and customisation for the user. With the ever increasing number of these personal devices owned by individuals, the need to manage the complexity of communication, services, and devices and to tailor them to the individual's lifestyle becomes more relevant to an increasing number of users.

## Taking the view of the user

To start with, it was decided to accompany the overall technical development from the user's perspective: Firstly, by conducting a two-day workshop utilising the expert based method of SUNA (Strategic User Needs Analysis) to derive the user requirements through writing usage scenarios and cases, then extracting the user's needs taking the user's and market perspective and finally building a user-needs hierarchy for further requirement analysis and technical development.

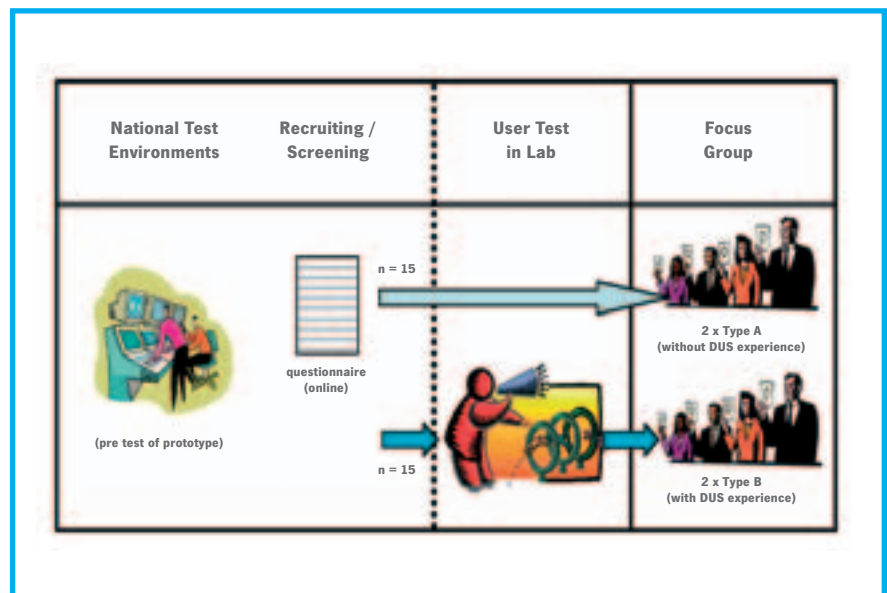
Secondly, by focussing the effort on an extensive common user trial, as soon as a functional prototype would be provided. The results could then be fed back into the further development of the prototype. A pan-European, multi-phased test design, comprising a mix of quantitative and qualitative methods, was designed by the four project partners BT, Deutsche Telekom, Iceland Telecom, and OTE. The aim was to draw from a broad basis of user experiences with today's communication tech-

nology to derive the users' needs and requirements, which the development of future services could possibly satisfy. In addition, it was of high interest to get the users' feedback to the concept, the prototype of DUS, including technical and graphical design issues as well as user acceptance, tariff models, pricing, possible areas for improvements, and extensions of functionality.

## Design of a multi-phased user trial

All user trial phases were based on a jointly developed user testing procedure and materials with nearly equal test beds in each country. Each participant in all four partaking countries was recruited from the target group, users with a technical and business background, and then screened for socio-demographic data as well as for their job-related and private use of communication technology. Then the first half took directly part in a focus group, without getting to know the DUS-prototype (Type A). This was done to gain an understanding of the user's feelings, opinions, problems and expectations towards current communication technology – without interferences from the prototype. After these topics were covered, they were introduced to the DUS concept and resulting new types of services. Then they were asked to develop possible next-day scenarios of their personal DUS-usage to give feedback on their opinions and discuss them.

For the other half of the participants, the first DUS prototype was used to conduct scenario-based usage cases, in which



Multi-phased test design of user trials carried out in parallel by BT, Deutsche Telekom, Iceland Telecom, and OTE.

the user was asked to simulate real-life experiences and tasks in the lab. Along a common script, they played to be Peter, a business man who uses his different devices in his home, travel and office environment to organise his day and work. After each task they filled out a short questionnaire as well as a final questionnaire on overall satisfaction. They were then debriefed and re-invited for being a focus group. This Type B covered the same topics as Type A, but additionally going into more detail regarding their DUS experience and resulting ideas, expectations, and feedback.

#### Conclusions of the survey

The findings given here are of temporary nature as they reflect the current status (October 2002) of the analysis, which will be finalised by December 2002. The samples drawn by the different partners were quite heterogeneous regarding the distribution of gender and age, employment status, educational level, as well as technolo-

gy use and degree of mobility in their daily work. However, the users' perceptions of the DUS prototype itself and its capabilities, as experienced in the lab tests, were quite similar when viewed from a pan-European perspective. This apparent similarity of the user experience and feedback to the lab test contradicts the quite diverse user experiences and opinions found in the focus groups of each partner.

Users were keen on participating and helping companies to develop new solutions. Today's technology leaves the user with a strong demand for synchronising and managing data between devices, to have access to their personal data from anywhere at any time, and to filter and manage private, business and public communication. Most of all, they demanded ease of use.

Generally, it was difficult for Type A users – without prior hands-on experience with the prototype – to fully understand DUS as a concept and the benefits it could

provide in daily life. This needs to be considered in the marketing and communication strategy for the launch of such a complex service. On the other hand, the DUS experience proved to be a valuable basis to trigger fruitful discussions with Type B users. Both groups agreed on ease of use and moderate pricing as key demands. Privacy, data security, automatic profile management, emerged as well from the discussion.

Interestingly enough, quite a number of DUS users (Type B) – no matter of which national, professional or socio-demographic background – agreed that DUS seemed to be a possible solution for at least some of the daily problems they encounter.

You can find more technical information on the DUS project (P1101) at [www.eurescom.de/public/projects/P1100-series/p1101/](http://www.eurescom.de/public/projects/P1100-series/p1101/)

# EURESCOM PROJECT MUST DESIGN AND USER EVALUATION OF A MULTIMODAL TOURIST GUIDE



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Mobile Internet access is expected to grow very fast in the near future. Given the properties of mobile terminals – small screens and small keyboards – many believe that the success of mobile Internet access will depend on the availability of easy and natural user interfaces. It is well known that most people prefer to use their native language for interaction. Therefore, information services offered in the mobile networks must support multilinguality, allowing every customer to use his preferred language. Clever use of multilingual automatic speech recognition for inputting textual information together with other input modes like pen input for pointing at objects on the screen should help to obtain these user-friendly interfaces.

Today, little knowledge is available on the technical and usability issues related to

combinations of speech, text and graphics in user interfaces. Therefore, substantial Human Factors research is still needed to understand the opportunities and limitations of multimodal interfaces. Currently, many research groups are working on issues related to multimodal interaction and technology. Most of them use proprietary solutions and dedicated technologies. For telecom companies, developing multimodal services is only of interest, if these can be built on standard architectures and off-the-shelf components, which work in real-time and can be accessed from small mobile terminals by ordinary users.

#### The goal of the project

The Eurescom MUST project focuses on the technical implications of building a multimodal, real-time application, and on user research that aims to get more insight in the human factors issues related to multimodal interaction. This article focuses on the user interface and usability aspects. However, some words should be spent on the technical issues. After the project team had specified the demonstrator, a multimodal tourist guide to Paris (figure 1), it



Figure 1: Multimodal terminal



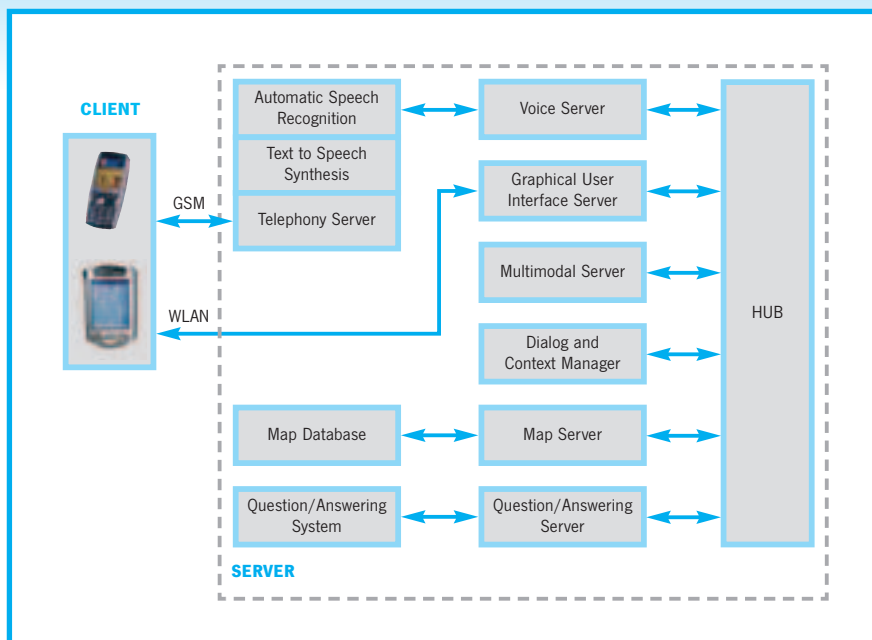


Figure 2: The architecture of the MUST demonstrator

was not too difficult to integrate existing language and speech technology into a publicly available multimodal architecture. A multidisciplinary team of speech and language technology, human factors, and computer specialists was necessary to tune the technology and to write scripts to properly combine the different modules of the application. Figure 2 shows the architecture of the MUST demonstrator.

### The MUST Demonstrator

The MUST demonstrator uses as application example a multimodal tourist guide to Paris. It is organised in the form of small sections of Paris around 'Points of Interests' (POI's), such as the Eiffel tower, the Arc de Triomphe, etc. These POI's are the major entry points for navigation. The maps show not only the street plan, but also pictorial representations of major buildings and monuments. When the user selects one of the POI's, a detailed map of the surroundings of that object is displayed on the screen of the terminal (figure 3). Many map sections contain additional objects that might be of interest to the visitor.

A golden rule for designing multimodal interfaces is that specific modalities should be used for the items they are particularly appropriate for. Pen gestures are extremely good for pointing at objects on the screen and for drawing. Speech is the best solution for fast entry of complex textual information. In MUST we concentrated on collecting knowledge about behaviours of untrained users. They had to use both pen and speech to obtain the information they were looking for. The pen is used for pointing at objects on the screen (e.g. the Eiffel Tower). This turns this Point of Interest (POI) into the topic of the conversation; and speech is then used to ask questions about these objects, or to address

objects that are not shown on the screen (e.g. "Are there any restaurants around?"). On the latter question icons for restaurants will appear on the display, which can be turned into the topic of conversation by pointing at them and asking questions, for example about the type of food offered, the price range, or opening hours.

The information returned by the system is rendered in the form of text, graphics (maps, and pictures of hotels and restaurants), and text-to-speech synthesis.

As an additional feature users can also ask questions about POI's for which the answers are not in the database of the service (e.g., "Who is the architect of this building?" or "What other buildings has he designed in Paris?"). The answers to these questions are being provided by a multilingual Question/Answering (Q/A) system, developed by France Télécom R&D, which tries to find the answers on the Internet.

### The user evaluation

Usability experts evaluated the first version of the demonstrator. The second improved version was tested with untrained users. The usability experts were asked to indicate the most important usability problems they would expect to occur with untrained users. Most experts expected that untrained users would not combine pen and speech in an optimal way, because they are not used to speak to a device.

Since the focus of the user research was on how users combine pen and speech input, we decided to put special attention in the test with the untrained users on how to introduce them to the service. Half of the users got a textual explanation of the service on the screen, and the other half saw a video in which someone showed how to best use the service by combining pen and speech, i.e. pointing at an object and asking a question at the same time. The analyses of the user evaluation are still under way. However, we already noticed that the two introductions evoked different interaction styles. Most of the users



Figure 3: All along the Eiffel Tower – the MUST demonstrator in action

who only got a textual introduction did not try simultaneous pen and speech interaction, whereas most of the users who saw the video did. The users of the last group were also more verbose (like the user in the video), whereas the users of the first group mostly used short command-like expressions. For both groups of users it holds that they needed time to familiarise with the service and to feel comfortable in using it. These results show the importance of the learning effect of using new interaction modes and of the way in which these interaction modes should be introduced to the users.

#### Conclusion

The MUST project team managed in a quite short time with limited resources to implement a multimodal, multilingual demonstrator. As application example a tourist guide of Paris had been chosen.

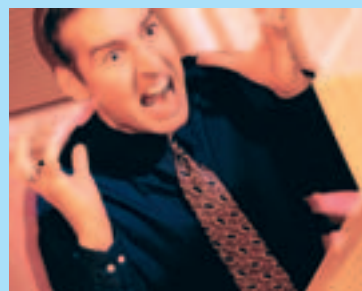
The first results of the user tests suggest that new users of multimodal services have to learn the most effective way of combining the different modes, in this case speech and pen. It helps if they see an experienced user at work, for example in the form of a short video clip.

You can find more information on the MUST project at [www.eurescom.de/public/projects/P1100-series/P1104/](http://www.eurescom.de/public/projects/P1100-series/P1104/)



## GIVING CUSTOMERS A POSITIVE EXPECTATION SHOCK

### INTERVIEW WITH BT EXACT'S USABILITY EXPERT TONY HOUGHTON



**Usability is a central factor for the success of new applications and services. In recent years, the telecoms industry has become increasingly aware of this. Eurescom mess@ge asked BT's usability expert Tony Houghton, what could be learned from user survey and what his vision on usability is.**

#### What are your criteria for usable communications devices?

I have one simple criterion: you should be able to just use it without thinking about,

just like a phone or a car. Unfortunately, this is rarely the case with communications devices. Sophisticated, yet technology-jaundiced and weary, customers actually have very low expectations of technology. We can leverage this by trying to offer a perceived usability better than their, often very low, expectations.

So there are no absolutes here, we just have to do better than the user would expect. I call this an 'expectation shock', where, in the terms of one of my customers, she was "pleasantly surprised and shocked"

with the immediacy of the response, which was significantly above her expectation. I have found similar expectation-related comments in my work on Broadband, 3G, and the Eurescom DUS project; typically: "It sets a new expectation, you can't live without it!".

I use four generic key criteria for usability, summarised in the acronym LISA:

Location independence – the ability to use a device or service independent of the location.

Interface – ease of use, including visual appearance of the display, clarity of instructions, and navigation.

Speed – rapidity of response including response time, time for information to appear on screen and time to undertake transaction.

Always on – immediate availability of the service without the need to dial up.

These are generic and chosen to cover all communications devices, and, of course, some are not relevant to certain devices. I use these in my customer behaviour questionnaire analysis method to ask: ‘Which of these criteria are important to you, the user?’, ‘What is your expectation?’, ‘What is your perception?’. So, these are not absolutes but vary according to customers.

**How usable do you consider today’s mobile devices in the light of your criteria?**

The answer must be “very poor”. We have very low expectations of mobile devices – we accept poor interfaces, slow speed, poor voice quality, losing the connection. We would never put up with it with a fixed phone.

This is in one sense an opportunity, because, for example, 3G gives us a terrific opportunity to give a much better perceived usability and thus an expectation shock. My Isle of Man 3G users of Europe’s first 3G financial service received a speed expectation shock – “You can’t live without it!” – and an interface shock – “It’s the difference between DOS and WINDOWS”.

**What are the economic effects of lacking usability in the ICT sector?**

We know that poor interfaces stop people buying and stop people working efficiently. We have confidential cost benefit benchmark data on this. I suspect we only see the tip of the iceberg. We only see people dropping off or complaining during a task, session, or process. We don’t see the

people who never bother, because they are put off even trying to use a device.

There is a well-known horror story of a well-known supplier, whose mobile phone is known to have lost 30 per cent traffic due to a negative change in user interface.

Japanese FOMA 3G sales are only 10 per cent of predicted, because the usability perception is no greater than the expectation. So, there’s no reason for the high expectation I-mode user to move. It doesn’t mean that it’s bad in absolute terms.

**Which options does the industry have to improve user interfaces?**

We have to define target groups and start with their customer or user requirements. People are different: male/female, age, socio-economic, but also multicultural and environmental differences. We can, then, use concept demonstrators and prototypes to iteratively define and meet this requirement. We must look for the expectation shock.

**How can different usability requirements from high-tech freaks and less tech-savvy users be taken into account?**

In targeting customer groups, we include the technophobe/technophile aspect. I ask this in my customer behaviour questionnaire: “I’d like to know about your behaviour when a new technology becomes available, for example, Internet, Digital TV, or WAP. When this happens, please tick the statement below that most applies to your behaviour.” Then five alternatives are given ranging from “I am always one of the first to try it” to “I don’t tend to try anything new”. We have also used this on Eurescom’s DUS project.

**Which methods are used to explore the different usability requirements, and how reliable are they?**

You have to have a cost-effective way to do this. I think of three levels, but the more

you put into it the more you get out of it: First, a snapshot of five users; five doesn’t seem a lot, but its surprisingly effective and better than none. Second, a ten-day customer or user life cycle analysis, which is a mix of quantitative and qualitative methods. Third, a long-term strategic, business and customer-focus approach to usability leading to requirement specification, concept demonstrators and prototypes leading to development and delivery.

**How important will be interactive devices, which adapt to the user’s emotions?**

It will happen, but it is like other adaptive devices – they are not clever enough yet. Keep things simple until we get them right! But it will come.

Years ago in French Human Factors/Ergonomics, psycho-physiological criteria were being examined – like EEG and ECG – to determine emotional states. This did not appear in US-centric human factors. It is now rightly being studied at MIT, for example.

**What is the role of standardisation for usability?**

Essential. There are now many often de-facto standards. And if you don’t meet the standard, you get a negative expectation shock.

**What is your vision for improving the usability of ICT devices and interfaces?**

That we start by the obvious: Ask people what they want! There are still too many times when we think we know but still don’t bother to ask. Remember that people are different! We then undertake the activities I described. It is not fundamentally about technology, it is about people!

*The interview was conducted by Milton Gupta.*



**TONY HOUGHTON**

Tony Houghton works for BT exact Technologies advising major national and international private and public organisations. He has been participating in Eurescom’s project on device unifying services, DUS, and is author of the recent case study ‘Expectation Shock!!’ on conversion rates and customer experience. Mr Houghton was BT’s systems strategy and programme manager for customer service systems in eight European countries, and technical advisor to BT’s international customer call

centre in Bristol. He is a graduate of the University of Cambridge, Magdalene College, Ecole Superieure de Commerce de Lyon, and University College, London. With the latter, he is currently undertaking an engineering doctorate on predicting multi-channel consumer behaviour, which is based in BT exact’s Asian research centre in Cyberjaya, Malaysia, and covers users in the UK, Japan, and Malaysia.



# TELENOR R&D

AN ACTIVE PROPONENT OF COLLABORATIVE RESEARCH



Telenor is the leading telecoms network operator and service provider in Norway and one of the largest companies listed on the Oslo Stock Exchange. The international communications group with headquarters in Fornebu near Oslo is Norway's largest supplier of fixed and mobile communication networks. As a founding member of Eurescom, Telenor has also contributed to the development of collaborative R&D in Europe.

At the beginning of 2002, Telenor had more than 22,000 employees. The group had operational activities in 14 countries and was present in more than 30 countries. Telenor has an extensive international company portfolio. The largest operations are in mobile communication, via companies in 12 countries in Europe and Southeast Asia.

Telenor is the world's largest supplier of mobile satellite communication and the leading satellite broadcaster in the Nordic region. Telenor is the world's third largest supplier of satellite services via the Inmarsat system and one of the leading TV distributors in the Nordic region.

#### Four business areas

The Telenor group's operational organisation mainly consists of the group management and four business areas. The current division of the business areas came into force on 1 July 2001, after a re-organisation, which particularly established a clearer distinction between services for the private market through Telenor Plus and for the business market through Telenor Business Solutions. The mobile activities are located at Telenor Mobile, while Telenor Networks is responsible for the network services. The core activities are managed through these business areas, other activities are managed through other companies.

#### History

Telenor can look back on 147 years of telecommunications history in Norway. On 1 January 1855, the Norwegian Telegraph Administration established Norway's first telegraph line between Drammen and Kristiania. The telegraph lines were spread throughout the entire country, and in 1870, Norway's nation-wide coverage was complete.

#### Bell in Norway

Alexander Graham Bell demonstrated his telephone set at the stock exchange in Drammen in August 1877, one year after its invention. In 1893, Norway's first international telephone connection was established between Kristiania and Stockholm. The first telephone sets were privately owned, but they were eventually taken over

by the Norwegian Telegraph Administration.

Further milestones of telecoms in Norway were the first wireless telegraph line between Røst and Sørvågen (Lofoten) in 1906, the first automated telephone exchange in 1920, the introduction of the telex service in 1946, and the expansion of direct distance dialing in 1951.

The mobile telephone service was introduced in 1966. This was the forerunner of the automatic NMT system, which was introduced in the 1980s. The digital successor, GSM, was launched in 1993.



Happy Norwegians in Telenor's Home of the Future.

When data transmission via telecoms networks was introduced in 1969, the Norwegian Telegraph Administration changed its name to Norwegian Telecommunications (Televerket). The deregulation of the telecoms monopoly began in 1995: Operations were re-organised, and the company name was changed to Telenor AS. During the late 1990s, Telenor expanded extensively abroad. Telenor AS was partly privatised on 4 December 2000. The listing of the company was the largest in Norway's history and the largest partial sale of a Norwegian public corporation ever.

#### Research activities

Research activities are organised in Telenor R&D, which actively participates in a number of collaborative R&D projects by the European Union and by Eurescom. In 1991, Telenor co-founded Eurescom and has ever since been one of the most active members in its work programme. The list of recent Eurescom projects in which Telenor R&D has participated is an impressive proof of Telenor's high level of involvement in collaborative R&D.

This is in accordance with the company's R&D vision, as stated by Berit Svendsen, CTO Telenor and Vice President R&D: "Telenor R&D's mission is to refine and make full use of our own research results as well as those of others, and to create commercial opportunities for Telenor at an early stage."

### Recent Eurescom projects in which Telenor R&D has participated:

- 4G – The next frontier
- Always on – Device Unified Services
- E-Commerce – Impacts on Service and Network Operations and Management
- LUPA – Local provision of 3G and 3G+ services
- Model Driven Architecture – Impacts of changes in enterprise software construction for telecommunications
- MobilUS – Next generation Mobile Information Services on UMTS
- MUST – Multimodal, multilingual information Services for small mobile terminals
- Open Service Access – Advantages and opportunities in service provisioning on 3G Mobile Networks
- OSA – Open Service Access: Advantages and opportunities in service provisioning on 3G Mobile Networks
- Public Bluetooth Access – A promising Access Technology to Ubiquitous Computing Services
- SALTAMONTES – Selected Quality of Services Provision in a Multi Protocol Label Switching/Differentiated Services Internet
- SCORPION – Scalable Optical IP Transport Networks
- TSUNAMI – The Tsunami IPv6 Project
- UMTS radio access – SDR and HFR for low cost radio independent access
- VENUS – Virtual Environment with Next Generation Multimedia Systems

## Research programmes 2002

Telenor R&D's research programmes in 2002 have covered a wide spectrum of topics. There are currently ten programmes:

### 1. Peer-to-Peer Computing

This research programme, started in 2001, is examining the usage patterns, platforms and technology typical of spontaneous network communities that interact with or without limited central resources. The aim is to develop concepts and prototypes that can be developed into products.

### 2. The Professional Organisation

How can Telenor help its corporate customers gain advantages in the market, and how can ICT solutions renew and improve public services, for instance through mobile solutions? These are the fundamental issues in this research programme, which is based in Tromsø and Stavanger.

### 3. The Future Wireless World

This research programme is identifying and developing technological solutions and service concepts for future mobile communications.

### 4. Broadband Networks

This research programme is working on issues at the interface between new interactive broadcasting services and PC-centred broadband services. One principal focus is the realisation of cost-effective broadband access solutions for all types of services.

### 5. Flexible Communities

The distinction between what people do at work, at home and on the move is becoming increasingly blurred. There is a growing need for flexible solutions across traditional boundaries. Through user-driven research, the Flexible Communities programme aims at encouraging knowledge, development and use of such services and products among Telenor's customers.

### 6. Future com Business

This research programme develops sustainable business models that will strengthen



en Telenor's future position. This is done by analysing markets and competition, monitoring and analysing regulatory trends, and assessing the potential of technological developments.

### 7. Future Media

This research programme provides input to Telenor's efforts to devise business models for future media. R&D's role is to develop ideas for new services, and to demonstrate and describe how future media will be used in the private sphere, in public spaces and on the move.

### 8. Internet Network Architecture

The information networks of the future will use Internet technology. IP traffic is growing significantly faster than conventional phone traffic, and already exceeds it in volume in some areas. R&D is assisting Telenor in building network solutions that are optimised for IP traffic and can

transmit data, text, images, sound and video.

### 9. Security and Mobility

A forward-looking phone company has to be able to offer products and services that are perceived as secure and technically sound. This programme is focusing on security in selected areas relating to the Internet, organisational structures, and 3G/4G mobile systems. In addition, the programme acts as Telenor's centre of expertise for risk analysis and risk management.

### 10. Service Platforms

Open service platforms allow services to be realised irrespective of the underlying network technology and operated across different networks. This reduces development costs, opening up new business opportunities in the national and the global market.

## TELENOR'S HOME OF THE FUTURE

The Home of the Future has been built on Telenor's property at Fornebu. It is intended for laboratory and demonstration use. Flexibility is key: the house is built so that inner walls and fittings may easily be altered. Telenor R&D and the Norwegian State Housing Bank have jointly studied how technical solutions and the utilisation of floor space influence each other.

Developments in the home are influenced by major changes in society such as flexible work, mobility and individualisation.

The external networks in the house are terminated in a home network, a so-called Residential Gateway. The home network works as a firewall and carries out routing between external and internal networks. The internal network uses cable-based 100 Mbit/s switched Ethernet and 11 Mbit/s radio LAN. In addition, Telenor R&D used the Bluetooth technology to implement new solutions. All cabling in the house enters and exits the machine room, which also houses computers and multimedia servers.

The security system alerts in case of burglary, water leakage or fire, and also comprises camera surveillance. Lighting, heating and ventilation are controlled by nodes in a separate network connected to the control unit by a web server. This way the functions can be controlled from a separate web page.

The distribution of multimedia information uses a switch with 16 entry ports and 16 exit ports with special cabling to various outlets around the house. Thus, programmes can be distributed from any source to any outlet.

Further information about Telenor R&D is available at [www.telenor.com/rd](http://www.telenor.com/rd)



# EURESCOM SUMMIT 2002

THE BUSINESS OPPORTUNITIES OF  
ADVANCED NETWORK TECHNOLOGIES



Cautious optimism dominated the atmosphere at the Eurescom Summit 2002 in Heidelberg from 21 to 24 October. A number of advanced network technologies and applications were presented that nourish hopes for future profits. However, in view of the current financial crisis of the telecoms sector and the efforts towards consolidation, the underlying question in all discussions was 'How can we earn revenues with new network technologies and applications?' Besides the discussion of strategies for achieving profits, also complex technical subjects were covered. Not all questions could be answered, but the 140 international delegates went home with plenty of new insights on the future of telecommunication networks.

The Eurescom Summit 2002 was the second event of its kind for Eurescom and co-organiser VDE, the German electronics association. Renowned international experts presented first-hand insights on technologies for future networks, at the same time putting networks into a broader context by adding business-related service aspects. The conference brought together the telecoms research and development community and decision-makers

from business units of major telecoms and IT companies, who shared their ideas and developed common visions.

#### Turning technology into business

The first day of the Summit was dedicated to a set of four tutorials, covering subjects such as the way towards global mobility, service portability using protocol interworking, transport and control issues in the optical layer, and peer-to-peer networks. The following three days contained a series of presentations and discussions, with the underlying theme, how to turn technological advances into genuine business successes.

According to the opening speech by Dr. Claudio Carrelli, director of Eurescom, the telecoms sector is currently in a consolidation phase. To get back on the growth path, new services and applications would be of key importance. He added that there were plenty of opportunities for broadband and mobile applications. "Humans are visually oriented, and with all the digital photo and video cameras being sold, everybody becomes his own director," Dr. Carrelli said. Thus, a huge amount of content is being created, he explained, that leads to a lot of broadband traffic as people would like to share the product of their creativi-

Good-humoured panel participants, from left: David Kennedy (Eurescom), Andrew Houghton (European Commission), Joachim Claus (Deutsche Telekom), Michael Bartholomew (ETNO), Scott Robinson (Alcatel). On the right: Claudio Carrelli (Eurescom).



Kurt Dahm from Cisco Systems giving his keynote speech.



Visitors from Korea: Sang-Hyun Choe, director of the R&D department of the Korea Telecommunication Operator Association, and In Suk Hwang from Korea Telekom, together with David Kennedy, senior programme manager at Eurescom.



Leila Lamti, Swisscom, presented results on MPLS traffic engineering.



Carsten Brockmann (Hughes Software Systems) and Sigrun Gunnarsdóttir (Iceland Telecom).



Keynote speaker Shane Wall from Intel.



Keynote speaker Christian Huitema (Microsoft) drawing prizes at the end of the conference.



Nuno Beires from Portugal Telecom Inovação was elected best speaker for his MUST presentation.

ty among their family members and friends.

The first keynote speaker, Kurt Dahm from Cisco Systems, stressed the importance of controlling the operational costs in order to be profitable. "We must maintain the margins by keeping the operational costs to a minimum, and at the same time increase the portfolio of managed services" he said. In his view, packed-switched networks are the key factor for achieving low operational costs.

Shane Wall from Intel, the second keynote speaker, focused on seamless roaming between all kinds of different networks. "Silicon radio", a single, small low-cost radio chip for WAN, LAN and PAN (Personal Area Network) is a must to achieve this vision, he said.

**Wide range of topics**

The conference offered 48 high-quality presentations, which covered a broad range of subjects. The topics ranged from optical networking and wireless access, including seamless mobility, to network and service evolution and Next Generation Networks. As diverse issues as network and service management, OSS, traffic engineering, quality of service, performance and security, multicast, and terminal and user aspects were also covered.

The presentations did not only focus on technical issues, but also on business aspects and what needs to be done to ensure a sustainable level of revenues, including sufficient R&D resources for future innovations.

**Discussion on broadband access**

After two days of interesting presentations, a high-level panel of decision-makers in European communications technology discussed the business perspectives of broadband services. For Scott Robinson, Director of Carrier Service Market Development at Alcatel, broadband is already a success, given the fact that there are 6.4 million DSL lines installed in Europe. DSL access coverage, meaning the percentage of people who can have DSL access, has already reached a level between 60 and 90 per cent in Europe. However, broadband is only at the end of the early-adopter phase, according to Mr Robinson. To make broadband a success in the mass market several requirements have to be met, he explained: "Compelling content drives end-user adoption". He expects that music and games will drive broadband in the consumer market. He cautioned that correct pricing is crucial. Pricing should be attractive to the customer and at the same time ensures sufficient revenue for the operator to retain its profitability. In his opinion the price should be about 30 per cent higher than that of narrow-band Internet access.

Andrew Houghton, who represented the General Directorate 'Information Society' of the European Commission, underlined that broadband access has become an important policy issue in the European Union.

The important role of broadband for the whole economy was supported by Michael Bartholomew, director of ETNO, the European telecoms operators organisation. "We believe that broadband will be an engine to promote the European econo-





my.” As a pre-condition for the successful introduction of broadband services he demanded “regulatory coherence across Europe”.

Joachim Claus, senior executive vice president of innovations management at Deutsche Telekom, made clear in the discussion that he rejects any kind of state intervention in the market for broadband services, including subsidies for building the broadband infrastructure. This view was not fully shared by Mr Houghton from the European Commission, who argued: “Where markets don’t work, subsidies to develop the infrastructure make sense.”

During the lively discussion, peer-to-peer services emerged to be among the potentially lucrative services of the future. In a family, for instance, grandparents could send images and videos to their grandchildren and vice versa. To do this in real-time would require a symmetrical network infrastructure.

All panel participants stressed the crucial importance of advanced but simple interfaces for the successful deployment of broadband services. “We need easy communication. The ease-of-use is the key to success,” said Joachim Claus. Josef Noll from Telenor Research stated that it must become possible that a three-year-old child can say to the home communication unit “I want to talk to grandma!”, and all necessary steps for an audio-video connection to grandmother are happening automatically.

The conference was closed with a keynote address by Dr. Christian Huitema from Microsoft. He stressed the importance of peer-to-peer applications and described that the IPv4 protocol does not allow to make this possible because of the limited address space. The IPv6 protocol could solve the problems, is technically available, but there is a “chicken and egg” problem as whether the network or the



Raban von der Malsburg, First Mayor of Heidelberg, Claudio Carrelli (Eurescom) and Kurt Dahm (Cisco) at the opening session.

applications should start implementing it. To break this problem, he proposed to start implementing IPv6 in the applications and to use a tunnelling mechanism to convey the new protocol over IPv4 networks.

**Technical demonstrations**

To provide a “look and feel” of some of the technologies presented in the sessions, the Summit hosted a showroom with technical demonstrations. Amongst them were three presentations of the Eurescom projects “MUST – Multimodal, Multilingual Information Services for Small Mobile Terminals”, “DUS – Device Unified Services”, and “E-commerce Impacts on Service and Network Operations and Management”. The Summit participants enjoyed to have a look at the real devices, equipment and applications behind the different projects and to discuss more details with the experts who showed the demonstrations.

**Visiting the future**

After the Summit two technical visits took place. At Deutsche Telekom’s FutureLab, the Summit visitors saw a high-tech showroom for visions and innovations in all areas of telecommunications such as vir-

tual worlds, mobile teleshopping, and biometric security systems, for instance iris recognition. The second group visited Siemens’ production site in Bruchsal where DSLAMs, DSL modems and Bluetooth units are made. Siemens proudly referred to the fact that they were able to quickly respond and supply on time the large volume of equipment Deutsche Telekom needed to roll out its broadband T-DSL service.

Presentations, press releases and photos from the Summit are available on the Eurescom Web site at [www.eurescom.de/summit2002](http://www.eurescom.de/summit2002). Streaming media presentations with synchronised slides and audio files from the Summit are available on a set of five CD-ROMs. Please send an e-mail to [hauer@eurescom.de](mailto:hauer@eurescom.de), if you would like to receive more information on how to get the Summit 2002 CD-ROMs.

Sara Oueslati-Boulahia, France Télécom R&D, presented cost-effective QoS solutions for the Internet.

Press conference on the future of telecoms networks. From left: Josef Noll (Telenor), moderator Milon Gupta (Eurescom), Claudio Carrelli (Eurescom), and Roberto Clemente (Telecom Italia Lab).



Panel discussion on broadband access.



# PARLAY/OSA AT THE THRESHOLD TO DEPLOYMENT

## EURESCOM WORKSHOP PRESENTED LATEST API SOLUTIONS



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The Eurescom workshop 'OSA and Parlay @ Work - Moving towards deployment' took place at the Eurescom Conference Centre in Heidelberg from 13-14 November 2002. It attracted nearly 100 attendees, who represented network operators, manufacturers, solution providers, regulator and academia from Europe, America, and Asia. At an exhibition area several vendors and network operators were showing their latest developments, products, and trial results.

**Keynote speaker Ard-Jan Moerdijk:**  
"Parlay/OSA is more than IN:  
It supports multiple business models  
and a lot more horizontal APIs."



**Keynote speaker Zygmunt Lozinski:**  
"Multiple analyst reports are now projecting a billion dollar Parlay/OSA business by 2006/2007."



The objective of the workshop was to present experiences from trials and deployments of Parlay/OSA technology and to discuss benefits and business opportunities of a wide deployment of Parlay/OSA in the Open Services Market. In an open services market, network operators will have to provide highly secure, open, standard interfaces to their networks. It becomes apparently more and more accepted that the way for operators to do so is to provide Parlay/OSA interfaces. These Application Interfaces (APIs) give third party service providers a set of high quality, reliable capabilities on which to base their services.

The new business opportunities for network operators comprise increased revenue based on an increased traffic volume and selling access to the capabilities offered by the interfaces. In addition, the technologies supporting Parlay/OSA might facilitate the migration to Next Generation Service Platforms, leading to reductions in overall platform costs and reduced development time-scales.

At a previous Eurescom workshop on Parlay/OSA in February 2002, the question of how and when to start first deployments was discussed. Later during the year, a number of deployments have been announced by Turkish operator Telsim, Telecom Italia Mobile, Swisscom Mobile, Telia's fixed-line branch Skanova in Sweden, and Irish mobile operator Meteor. The focus of the workshop in November was on experiences from these deployments and also from other trials with Parlay/OSA products and prototypes.

In the first keynote speech, Zygmunt Lozinski, president of The Parlay Group, pointed out that there are now Parlay/OSA products from more than 25 vendors available. He expects the bulk of deployments taking place in 2003, based on Parlay version 3. Ard-Jan Moerdijk, chairman of the 3GPP OSA work group, presented in a second keynote the state-of-the-art and latest news from the standardisation bodies. He highlighted again the role of Eurescom in

Parlay/OSA standardisation by giving credit to the various contributions from Eurescom project P1110 towards these standardisation bodies.

The majority of presenters who reported about their experience from first deployments said they were using Parlay/OSA in the first step for internal applications only. However, the provisioning of the interface to external service providers was declared a clear goal. Most deployments are still in a test phase, but commercial service offerings based on these Parlay/OSA products are planned for early 2003. Giuliano Muratore, telecommunications services director at Telecom Italia Mobile, explained that a major value his company sees in Parlay/OSA is the "increase of the application developer base and the reduction of development costs". Anders Elleby, head of strategy affairs of Swisscom Mobile, said that with opening the network to third parties there is of course a risk of giving away a key business asset, but that this also needs to be balanced against the additional revenue opportunities from third party service development.

An impressive example for fast installation of a Parlay/OSA product was given by Stephen Young, director advanced services at Meteor. He expects to complete the still ongoing installation within three and a half months. He also expects that they will be able to make most service developments within two to three months: "If the service development would take one year, then the customer interest in the service might already have gone until the service offering can be started."

The workshop participants expressed their great satisfaction with the workshop. The best speaker award went to Martin Yates from BTextact for his presentation on 'Status and opportunities from Parlay-X'.

For those who missed the event, there is a CD available with audio/video streams of all presentations. Details can be found at [www.eurescom.de/OSAatWork](http://www.eurescom.de/OSAatWork).



Nearly 100 participants  
attended the workshop.

[mess@ge](mailto:mess@ge) 4/2002



# TSUNAMI PREPARING FOR IPv6 DEPLOYMENT



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The Eurescom project ‘Tsunami’ – the Japanese expression for ‘tidal wave’ – got its name from Vint Cerf’s famous saying, that “the tidal wave of IPv6 is going to hit the coast soon”. In order to be prepared for the challenges that will go along with the introduction of the next generation Internet protocol – IPv6 – Eurescom project P1113 investigated the planning and building of IPv6 networks, continuing the work of Eurescom’s Armstrong project (P1009).

The aim of P1113 was to provide practical recommendations for network planners on selected aspects of IPv6. This was done by functional experimentation with available IPv6 products. The Tsunami project focused on five issues:

- IPv6 over Multi Protocol Label Switching (MPLS) core networks, with a focus on routing aspects,
- IPv6 addressing and DNS for ISP scenarios (mainly on number planning and renumbering),
- Mobile IPv6,
- IPv6 network security (security of translation mechanisms, IPsec, firewalls), and
- Preparation of input to IETF on transition mechanisms.

## IPv6 in MPLS backbones

Multi-Protocol Label Switching (MPLS) core networks provide means of traffic engineering and Virtual Private Network (VPN) services provision. Over the last years, many ISPs and telecom operators have invested in setting up MPLS networks. With IPv6 the question emerged, what kind of update, upgrade, or transient solution will enable MPLS core networks to transport IPv6 traffic. There is a range of different techniques available, from simple tunnelling to vendor-specific solutions. A guideline for the usage of IPv6 over MPLS has been described by P1113, and the pros and cons have been compared. The type of usage of IPv6 in MPLS backbones will have implications on costs, network management, and flexibility, depending on the existing network environment. The comparison prepared by P1113 can help to make the right decisions.

## Addressing and DNS

The extended address space is one of the main advantages of IPv6. Address space can be allocated by the Regional Internet Registries (RIPE in Europe). The discussion about ideal allocations of addresses for various types of networks is ongoing. In Tsunami, typical network scenarios – large ISP, mobile operator, large corporate network and dial-up networks – have been outlined, and principal addressing guidelines for these scenarios were described.



Special addressing cases were considered and focal attention was given to automatic network renumbering – we performed practical tests with stateful and stateless renumbering techniques.

In the area of DNS (Domain Name System), we looked at operational issues during the transition. In the transition phase from IPv4 to IPv6, a mixed environment of IPv4 and IPv6 will exist for a long period of time. In this period, the DNS servers will evolve from an IPv4-only state into a dual-stack server, and potentially at the end into a pure IPv6 stack. In every state a server should be reachable by the specific transport protocol: IPv4, IPv6, or both. To achieve this, various mechanisms could be used. One of the experimental ideas is DNS bridging; DNS servers forward requests from IPv4 to IPv6 and vice versa. In Tsunami, we looked at DNS bridging, but we

had to realise that currently available DNS software implementations (BIND9) do not support practical DNS bridging with IPv6, therefore we could not perform practical experiments.

## Secure mobility

There are two more features of IPv6 besides the larger address space that are often considered as the big advantages of IPv6: The enhanced mobility support and the inherent security support (IPsec). Together, they enable a better support for nomadic Internet users than IPv4. In the context of the project, a Europe-wide, IPsec-based IPv6 VPN has been established between the project participants for practical experimentation with several IPv6 IPsec implementations. The available implementations have shown that the technology is ready for use. Secure mobility will certainly become a common feature of IPv6 applications, which is not available on the IPv4 Internet today.

## Contributions to IETF

The project task with the greatest impact so far has been the continued work in the Next Generation Transition working group of the IETF. In the framework of the Tsunami project, discussions on the mailing list with other active members of the IETF as well as a presentation at the Minneapolis IETF meeting and input for the Yokohama meeting have been provided.

One of the main concerns of the project participants was that a plethora of transition mechanisms has potentially severe implications on operational aspects of the transition process from IPv4 to IPv6, particularly for network operators. Additionally, there are technical concerns about the interaction of all mechanisms, which has not been investigated by the IETF in depth. Meanwhile, the IETF has recognised that continued work on – partially



academic – transition mechanisms could slow down the transition phase from IPv4 to IPv6. Therefore, it was decided in mid-2002 that a new working group should push a stronger consideration of operational IPv6 aspects. The 'v6ops' working group was started in the IETF, taking over some work of the 'NGTrans' working group, but giving stronger emphasis to operational aspects. While the Tsunami work was certainly only a minor contribution for stronger consideration of operators' concerns, this development in the

IETF is certainly a progressive step from an operator's point of view.

#### Conclusion

This article cannot outline all the achievements of the project, as further work was done, e.g. on routing aspects and Internet telephony. The recent announcements and activities from software and hardware vendors, service providers, and the project participants indicate that the introduction of IPv6 will speed up in 2003. The experience gained and the practical guidelines

elaborated by the Tsunami project team are available to help the project participants' companies and all Eurescom shareholders to master the challenges of the arrival of the tidal wave of IPv6.

More information on P1113 'Tsunami' and all project reports are available partly in web format and partly as downloadable documents at: [www.eurescom.de/public/projects/P1100-series/p1113](http://www.eurescom.de/public/projects/P1100-series/p1113)

# NETWORK INTEGRATION TESTING

## EURESCOM'S MINIT RESULTS NOW WIDELY ADOPTED



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Already in 1991, Eurescom started to develop a common test methodology for the increasingly complex telecommunications networks. Until today, network integration testing has been a permanent topic in our work programmes. The remarkable point about this series of projects is that they have never been related to research or strategic studies – the core domain of Eurescom's work. The success of these projects showed already very early that Eurescom, as an organisation of European operators, is well suited to support its shareholders also in the operational work.

#### Challenges of network integration

Since the introduction of ISDN, it has become obvious that the integration of new networks and the diversity of their implementation represent a real challenge for the operators. Interoperability testing of new network technologies with legacy systems or alternative networks became increasingly costly and time consuming. In addition, the introduction of new, very complex and challenging services that required short time to market increased the pressure on the operators. It became obvious that manual testing or conformance testing alone was not sufficient anymore. What was urgently needed was a new methodology that enabled operators to run their tests in an automated way. Eurescom project P412 developed a new standardised test methodology that could

readily be implemented by operators. This methodology was called Network Integration Testing (NIT), a terminology which has also been adopted by ETSI.

Over the last 11 years, about 580 person months have been invested to develop Eurescom's NIT methodology. NIT has been developed not only for testing Euro-ISDN networks but had been extended also for ATM, Frame Relay, IN, GSM, GPRS and, most recently, also for UMTS and IP networks.

#### Testing methodology

The basic principles and steps of the NIT methodology are shown in figure 1.

Each Test Case is associated with a cor-

responding Test Purpose (TP), for example, verifying that the network has a required capability such as the ability to support certain packet sizes or that it exhibits required behaviour in response to a specific event in a particular state. A collection of Test Cases is known as a Test Suite. The structure of the Test Suites and the purpose for each test are given in the Test Suite Structure and Test Purposes (TSS&TP) document.

The Abstract Test Suite (ATS) is a standard automatic test methodology, which can be run independently of any specific test tool implementation. ATS that are customised for a test tool are called Executable Test Suite (ETS) and are generally pro-

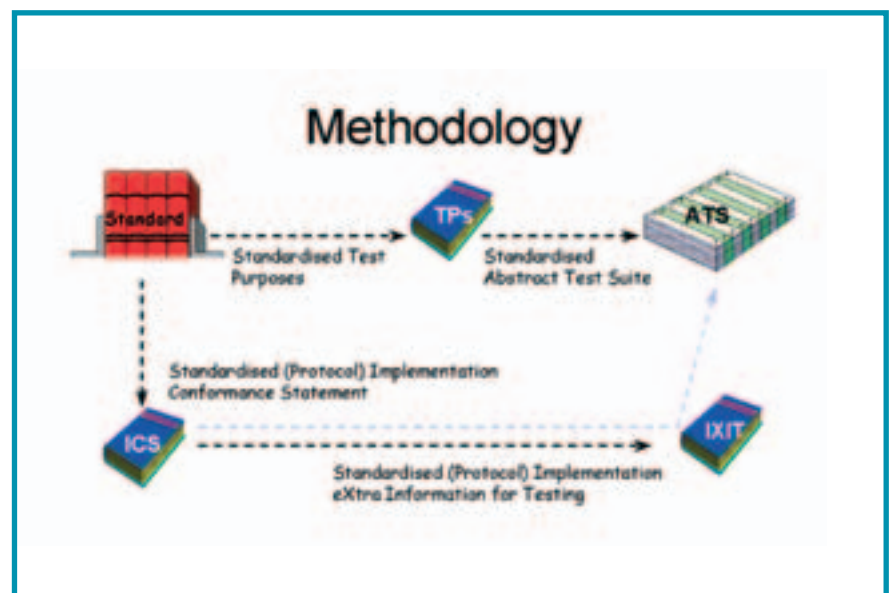


Figure 1: Network Integration Testing Methodology

vided by test tool manufacturers. The ATS is specified as a collection of Test Cases together with required declarations and components. It is written in the Tree and Tabular Combined Notation (TTCN).

The MINIT project ('Mobile and IP Network Integration Testing' P1016) implemented and carried out a number of automatic test sessions (see example in figure 2).

#### End-to-end network solutions

Operators spend significant time and resources ensuring that features and services work end-to-end on their networks. This often necessitates a close working relationship with vendors to resolve unforeseen problems and interface incompatibilities. This, in turn, may imply hardware reconfiguration and software tuning, or implementation of software patches and other provisional solutions to resolve problems. The result is often a delayed introduction of services and even an impact on the brand, with increased costs due to the need to handle customer complaints. Software upgrades and new version releases also pose notable challenges for operators, who must ensure interoperability within and between networks based on different system vendors and architectures. Primary contributors to interoperability problems are the increasing complexities of wireless networks and the diversity of available options to achieve end-to-end 3G-network solutions.

Network Integration Testing is recommended as the preferred approach to 3G network/GSM testing. Experience with GSM has indicated automated execution rates of some 50 test cases per hour at the radio (Um) interface and rates of up to 500 test cases per hour at the Mobile Switching System (A) interface. The test suites

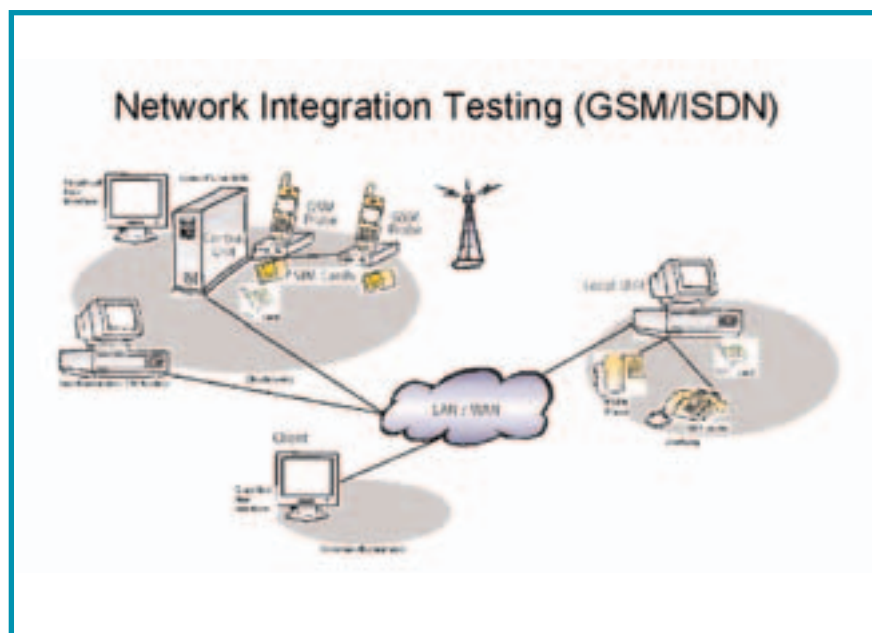


Figure 2: Network Integration Testing

developed by the Eurescom MINIT project and standardised by ETSI will be of benefit to operators of GSM and UMTS networks world-wide, promoting service integrity and reducing the costs of testing. The technical specifications are also of interest to test laboratory managers and test tools implementers dealing with fixed/mobile integration issues. Test probe manufacturers should now be encouraged to produce suitable test probes for GPRS and UMTS.

#### Conclusion

It is unlikely that the deployment of all-IP core networks will reduce the need for network-integrated testing. The introduc-

tion of TCP/IP-based protocols for functions previously associated with the user plane (e.g., RTP/RTCP) does not necessitate a shift in testing paradigms. Applications can be readily validated using the well-established Network Integration Testing methodology.

Adoption of MINIT project results by ETSI stresses the value and importance of Eurescom project work. To date, five ETSI Technical Specifications have been approved with two others expected shortly.

Further information is available on the Web at:  
[www.eurescom.de/public/projects/P1000-series/p1016](http://www.eurescom.de/public/projects/P1000-series/p1016)

## MPEG IN A NUTSHELL



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**MPEG is a compression standard for audio, video, and data established by the International Telecommunications Union (ITU) and the International Standards Organisation (ISO). MPEG stands for Moving Picture Experts Group, a working group of ISO in charge of the development of standards for coded representation of digital audio and video.**

Established in 1988, the group has produced widely used standards such as MPEG-1 and MPEG-2. Furthermore, it defined MPEG-4, the standard for multimedia for the fixed and mobile web and MPEG-7, the standard for description and search of audio and visual content. Work on the new standard MPEG-21 'Multimedia Framework' has started in June 2000.

#### How MPEG works

A video stream is a sequence of video frames. Each frame is a still image. A video player displays one frame after another, usually at a rate of 30 frames per second. The basic idea behind MPEG video compression is to remove spatial redundancy within a video frame and temporal redundancy between video frames. To reduce

spatial redundancy a mechanism similar to JPEG, the standard for still image compression, is used. Motion compensation is used to exploit temporal redundancy. The images in a video stream usually do not change much within small time intervals. The idea of motion compensation is to encode a video frame based on other video frames temporally close to it. Frames are encoded in three types: intra-frames (I-frames), forward predicted frames (P-frames), and bi-directional predicted frames (B-frames).

- An I-frame is encoded as a single image, with no reference to any past or future frames.
- A P-frame is encoded relative to the past reference frame. A reference frame is a P- or I-frame. The past ref-



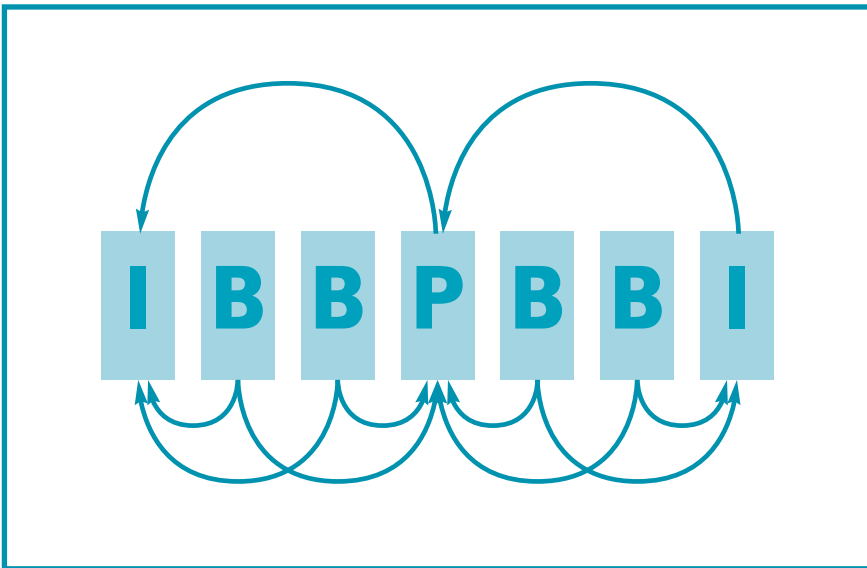


Figure 1: Typical MPEG-1 encoding pattern and dependencies.

reference frame is the closest preceding reference frame.

- A B-frame is encoded relative to the past reference frame, the future reference frame, or both frames. The future reference frame is the closest following reference frame (I or P).

A typical IPB sequence is shown in Figure 1. The arrows represent the inter-frame dependencies. Frames do not need to follow a static IPB pattern. Each individual frame can be of any type. Often, however, a fixed IPB sequence is used throughout the entire video stream for simplicity.

### MP3 and MPEG-1

The MPEG standards are published in several parts. In the case of MPEG-1 there are 5 parts that constitute the standard. Part 1 is combining one or more video and audio data sources with timing information to form a single stream. Part 2 specifies a coded representation for compressing video sequences. Part 3 specifies a coded representation for compressing audio sequences. MP3 encoded audio files are simply files complying to Part 3 of the MPEG-1 standard. Part 4 specifies a compliance and testing framework. Part 5 is technically not part of the standard, but a reference implementation of the first 3 parts.

MPEG-2 is a standard currently in 9 parts. The first three parts of MPEG-2 have reached standard status and are comparable to the three first parts of MPEG-1. The other parts of MPEG-2 are at different levels of completion.

### Applications

The MPEG-1 (ISO/IEC 11172) standard, established in 1992, is designed to produce images of reasonable quality and sound at low bit rates (e.g., 352x288 images with VHS quality at 1.5 Mbits/sec).

MPEG-1 is the standard on which such products as Video CD and MP3 are based.

The MPEG-2 (ISO/IEC 13818) standard, established in 1994, is designed to produce images of higher quality at higher bit rates (e.g., 720x480 studio quality images at up to 15 Mbits/sec). MPEG-2 is the standard on which such products as Digital Television set top boxes and DVD are based.

MPEG-4 (ISO/IEC 14496), became a standard in early 1999 and is especially well suited for mobile and PSTN applications at video bit rates from 5-64 Kbits/sec and up to 2 Mbits/sec for TV, and movie applications. Beyond its extended bit-rate range, MPEG-4 extends the previous standards to many more application areas through features like scalability, error resilience, seamless integration of different types of 'objects' in the same scene, interfaces to digital-rights management systems and its ways to build interactivity into the content.

MPEG-7 (ISO/IEC 15938) is a standard for describing the multimedia content data. This standard supports some degree of interpretation of the information's meaning, which can be passed on to, or accessed by, a device or a computer code. MPEG-7 offers tools for structuring information about content (so-called metadata).

Audio-visual archives are hard to search, because content owners currently employ their own proprietary metadata schemes. With MPEG-7, information can be added to broadcasts; personal video recorders and search engines can use this information to facilitate multimedia content management in interoperable ways.

### Interoperability and its pitfalls

MPEG-1 and MPEG-2 provide interoperable ways of representing audio-visual content, and the experiences to date are promising. However, as multimedia plat-

forms as well as transmission speed and storage capacity costs decrease, digital rights management (DRM) becomes necessary to protect the value of the content. In its current form though, DRM is defeating interoperability, because it locks up standardised content using non-standardised protection mechanisms. The MPEG group understood very early that more interoperability in DRM is crucial and included 'hooks' in MPEG-4 as a set of standardised interfaces to proprietary Intellectual Property Management and Protection (IPMP) systems. Interoperability in DRM is a very difficult issue that requires standardised trust and a trust infrastructure that is not readily available.

### MPEG-21 Multimedia Framework

The goal of MPEG-21 is nothing less but to describe the digital content world as such. It is largely about describing how different elements build an infrastructure for handling digital content. The first delivery of MPEG-21 is:

- The digital item declaration, an XML-based schema for declaring digital assets. Additional planned deliveries down the roadmap include:
  - More interoperable IPMP than in MPEG-4.
  - Digital item identification and description, for uniquely identifying content.
  - The Rights Expression Language (REL), allowing for a standardised expression of rights, using standardised terms defined in the Rights Data Dictionary (RDD).
  - A unified description of environments in which content is being used.

The timetable for MPEG-21 standardisation suggests that some parts of MPEG-21 should become an international standard in late 2002, while some other parts should become a standard in the second half of 2003.

### Conclusion

The MPEG family of standards has proven to be one of the most successful standards. A multi-billion-euro industry would be unthinkable today without such widely used standards as MPEG-1 and MPEG-2. Currently, MPEG-4 is entering the market as an open standard for multimedia, and MPEG-7 will help managing the growing abundance of content. Finally, MPEG-21 will make trusted interaction with content more transparent creating a truly global multimedia content marketplace.

### Links:

- <http://mpeg.telecomitalia.com>  
The MPEG home page
- <http://www.m4if.org>  
The MPEG-4 Industry Forum
- <http://www.mpeg-industry.com/>  
The MPEG-7 Alliance

## 20 SOUND PROJECT PROPOSALS – THE EURESCOM **PROJECT PROGRAMME 2003**



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For the Eurescom Project Programme 2003 twenty good and sound Project Proposals have been made. The Programme somewhat reflects the overall situation of the IT market. Many researchers are very involved in the preparations of the European 6th Framework Research Programme, and there are severe cost constraints on human resources at our member companies. Therefore, the Project Proposals for next year's Project Programme need to be very focused and take business opportunities into account. We will call our members for participation

concerning all 20 Project Proposals, and we will launch the Projects as they have sufficient support to run.

Just to highlight some interesting project proposals:

- Enterprise-to-Enterprise Business Process Communications using ebXML
- Multiple devices service Delivery (MultiDeli): exploring techniques to keep the user profile definition across technologies such as XML, SIP, Bluetooth, etc.
- GMPLS and MPLS in Enhanced IP Networks – GENIE: development of MPLS into a generalised MPLS in IP networks and how to evolve current MLPS infrastructures to GMLPS considering the interoperability of technologies and interfaces

- OSA from Lab to Live – bringing OSA/Parlay equipment from the laboratory to commercial deployment

Due to the interleaving of the preparation of the Eurescom Project Programme 2003 and the preparation of the 6th Framework Programme we will ask our members for additional Project Proposals as soon as the results of the first 6th Framework Programme Call will be known. We also accept new Project Proposals at any time. So, if challenging topics emerge, please do not hesitate to send them to us.

For more details on the Projects for the Eurescom Project Programme 2003 please visit the following Web site:  
<http://www.eurescom.de/secure/workprogrammes/WP2003/default.asp>

## NEW **EURESCOM STUDIES** HAVE STARTED

During the difficult business situation, the telecommunications industry currently has to face, it is of great benefit for the Eurescom member companies that they can profit from the multiplying factor and the synergy effects, which can be achieved by collaborative research. This explains the overwhelming interest we had for our newly started study programme. The available budget allowed us to immediately start five of the 17 proposals. More will be started in December and January. The ones, which were just started, are briefly introduced below. Results of these Studies will be available to the subscribers of the Study Programme in February 2003.

### CoolTown – like architectures and telecom networks (P1241)

This study analyses two types of architectures:

- Local, Web based, CoolTown-like architectures for context based information retrieval
- Information Technology (IT) and telecom Internet Protocol (IP) networks and architectures for IP services (particularly UMTS)

The CoolTown-like architecture seem to have good and simple soft- and hardware interfaces for relating the information content to the context (location, exhibit at museum, item in shopping mall, etc.). It supports local web-based and also peer-to-peer type of interactions. It is oriented towards Personal Digital Assistants (PDAs), cameras and other accessories nomadic user might have. It gives a good framework for collecting information and creation of so-called content clipboards.

Content clipboards can be processed, improved, completed, uploaded to a user's home or business domain. They can also

be a basis for e-commerce activities. The role of IT and telecom IP networks could be multiple, e.g. content delivery, e-commerce, etc. The study will suggest which research and development activities are needed to achieve the most promising types of services discussed, giving a problem definition for the future research and development projects, supported by a business case.

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### Web Services Orchestration (P1242)

Web service technologies provides the means to describe, locate and invoke a web service as an entity in its own right. What the basic technologies do not give us, however, is the rich behavioural detail that describes the role the service plays as part of a larger, more complex orchestration. The vision of web services assumes a loosely-coupled environment, where services compete and collaborate with each other over the Internet. There is a need, there-





fore, for web services-specific orchestration specifications to support this vision. Currently, there are a number of proprietary orchestration specifications that are not interoperable.

This study will analyse the orchestration specifications and how they support the implementation of complex web services orchestrations between businesses. The study will assess the emerging trends in terms of standardisation and the means by which interoperability will be achieved.  
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**Perspectives and Potentials of ebXML-standards for SMEs (P1243)**

The ebXML (electronic business XML) standard is to enable enterprises, independent of size and location, to meet and conduct electronic business through the exchange of XML-based messages. As all companies that have established the standard are global players, the standard has the potential to become the dominant standard in the domain of B2B (Business to Business) electronic commerce. ebXML defines a unified terminology. As a consequence one B2B-language is established that can be used and understood by all involved stakeholders.

This study will investigate the relevance of the ebXML for small- and medium-sized enterprises (SME) with regard to the telcos' business. The goal is to assess the expected "diffusion rate" and market potentials of ebXML for SMEs. Especially the question "How far does the standard meet the real requirements and needs of SMEs in the context of virtual electronic market-places and unification of business processes?" is in the focus of this study.

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**Homogeneous Infrastructures for Hot Spot Scenarios (P1244)**

The provisioning of data services to mobile users in hot spot areas will be investigated. The approach is to submit a proposition of a homogeneous infrastructure providing content to hot spots as well as the distribution of data within hot spots. Mobile and fixed hot spot feeding scenarios independent of hot spot size and access technologies will be analysed.

Normal access to the Internet, additional services for communities or ad hoc networks can be realised. These services can be provided always and everywhere at fairs, events, conferences, busses and trains, tourist regions, hotels, airports, cruise ships, and shopping centres.

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**Ethernet based Access Networks (P1245)**

Ethernet has proven itself in the corporate Intranets/IP networks in a LAN environment as a layer 2 transport technology. Recently, Ethernet made its way into the metro part of the network, so it is present at the edge of the core network. Furthermore, Ethernet is also the technology of choice to connect customer devices such as, for example, PCs to the network. This makes Ethernet a natural choice for the access network as a layer 2 transport technology.

Ethernet is already widely deployed in the DSL (Digital Subscriber Line) broadband access network, but only in conjunction with ATM (Asynchronous Transfer Mode). The study will investigate the potential future role of Ethernet in the absence of ATM and its add-on functionalities such as, for example, VLAN in the access network, also in conjunction with other emerging technologies such as MPLS (Multi Protocol Label Switching). It will survey the various newly proposed Ethernet based access network solutions and provide a basic economic analysis to assess the benefits of Ethernet in the access network.

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# BLUEPRINTS FOR TELECOMS SYSTEMS

»IST« PROJECT »MODA-TEL« WORKS ON MODEL DRIVEN ARCHITECTURES FOR NETWORK INFRASTRUCTURES



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**In September 2002, a European collaborative project started, which is as abstract as it is important. The project MODA-TEL aims at nothing less than delivering blueprints for more effective telecommunications systems. MODA-TEL is co-funded by the European Union and coordinated by Eurescom.**

Telecommunications services depend on a reliable network infrastructure. Ever more, telecommunications systems are based on complex software. Managing this complexity effectively could be a matter of life or death, if you think of emergency calls. The integration of different business models, user requirements and technologies requires thorough software architecture.

## Motivation

Model Driven Architectures (MDA) promise to overcome today's system integration and interoperability problems resulting from different used software infrastructures, from different non-interoperable techniques for software development, from different data models and from system and integration difficulties. Software infrastructures for distributed systems come and go, each claiming to be the only open architecture; the most flexible and only long term solution. Model driven architectures claim the same, at a much higher level of abstraction. They promise to serve as the integrated environment for system design, construction and integration.

Could these approaches be applied in the telecommunications domain and to what extent? This basic question needs to be explored soon. A positive answer together with guidelines on technology usage, methodology recommendations and in-depth application studies would significantly improve the business opportunities of organisations applying these techniques.

## How to use MDA?

MDA is a rather young approach and is kept intentionally very abstract, so that it is applicable in several domain and problem areas. An abstract framework needs to be specialised for each domain and problem space, and a methodology has to be

developed, which explains the application of MDA in specific domains.

The main goal of the MODA-TEL project is to develop and deliver to the industry the methodology to apply model driven architectures and related technologies. To prove its usability, the project will actually apply this methodology on telecom specific applications, including the development of platform independent models for these applications. It is also within the objectives of the project to specify and prototype the tool chain extensions necessary to support the automation of the software development and operation processes, as well as information integration and management.

Furthermore, the project aims to advance the current state-of-the-art by conducting research in areas that have not been addressed so far, like business modelling, QoS awareness, model transformations and their traceability as well as necessary improvements to UML. Last but not least, the project will contribute to industrial standardisation bodies in order to obtain standards suitable for telecommunications applications in this area.

## The stakeholders

Since the MDA is of concern to all players in the telecommunications domain, the MODA-TEL project has been set up as a joint effort of European stakeholders in the telecommunications industry. The availability of this kind of methodology and tools would be beneficial to all players.

Users, like network operators and service providers, would be able to develop and deploy new services faster as well as manage and operate them with higher effi-

ciency. System developers and integrators would be able to deliver easily complex, interoperable solutions to their customers. Tool vendors would be able to satisfy the demand for high quality development environments, supporting quality of service awareness. Customers would benefit from the rapid availability of flexible and tailored services.

## Outlook

The project is scheduled to finish in 2004. The total budget amounts to approximately 3 million euro; about 1.5 million euro are co-funded by the EU.

The partners in the consortium include network operators and service providers such as France Télécom and Telenor, tool vendors such as Softeam and Interactive Objects, systems integrators such as T-Systems and Intracom as well as research institutes, like Eurescom and the University of Twente.

The first results of the project will already be available at the end of 2002 and will include a description of the foundations and key technologies. Early next year, the project will publish a first version of the methodology under development as well as guidelines for the application of MDA including the technologies covered by it. Later in 2003, a tool chain specification for supporting MDA driven development will be available.

More information about MODA-TEL including a detailed list of planned deliveries is available at [www.modatel.org](http://www.modatel.org). See also Eurescom mess@ge 2/2002 as well as [www.omg.org/mda](http://www.omg.org/mda) for more information on Model Driven Architectures.

# new project results

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# WALLS WITH EARS AND BRAINS

## THE UNOBTRUSIVE INTRUSION OF AMBIENT INTELLIGENCE



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**If you see someone talking to the wall today, you would say he is a lunatic. In eight years time you won't even notice, because you and everybody else will be doing the same every day. Why? Because your wall and all other things that surround you will have become intelligent and quite communicative by 2010.**

This vision of the near future is summarised under the term Ambient Intelligence. It means the convergence of ubiquitous computing, ubiquitous communication, and interfaces adapting to the user. Humans will be surrounded all the time wherever they are by unobtrusive, interconnected intelligent objects. Furniture, vehicles, clothes, roads, even paint will be equipped with Ambient Intelligence.

### ISTAG's world

The term Ambient Intelligence was coined in 1999 by the Advisory Group to the European Community's Information Society Technology Programme (ISTAG). Two years later, in February 2001, ISTAG published 'Scenarios for Ambient Intelligence in 2010', which show concrete visions how life in tomorrow's user-friendly information society could be like. In ISTAG's world we meet Maria, who travels to the Far East with great ease: self-arranged visa, automated ID check without queuing, a rental car waiting to be driven to the hotel without key, and a hotel room, which adapts automatically to her favoured room temperature and music choice.

In another scenario we see Dimitrios, whose alter ego 'Digital Me', embedded in his clothes, handles his communication intelligently by selecting the appropriate action for each call. Scenario 3 shows the perfect day of Carmen, who smoothly drives around the city and gets the ingredients for her cake thanks to an intelligent traffic system and her e-fridge. Scenario 4 lets us join the social learning experience of Annette and Solomon in the Ambient, where they meet fellow learners a thousand miles away, give 3-D presentations to the others, and get their individual homework from the Ambient.

### Social challenges

The ISTAG scenarios imply a bunch of social, economic and technological challenges. The basic question is: Would people like to have Ambient Intelligence around them? Social acceptance will depend on many factors. Ambient Intelligence can only succeed, if it makes everyday life easier, offers additional opportunities for personal expression and facilitates human interaction. However, this is not enough.



You do not necessarily have to be paranoid for getting a little bit uneasy, if you think of all the interconnected smart things that surround you in your future e-home having a combined IQ far above yours. In a way, it is quite a relief to know that today all things in your home, including your PC and your heating system, are dumb. They give you the feeling that you are always in control. This feeling is in danger, if fridges, toasters, lamps, and wall paint suddenly turn smart. The very advantage of Ambient Intelligence could become paradoxically reverted: Devices and applications, which have become physically unobtrusive, could turn out to be psychologically obtrusive. The bottom-line: Ambient Intelligence has to be controllable – even by people who have not graduated 'Summa cum laude' in computer science.

### Technological challenges

The technological challenges are at least as demanding as the social aspects. Unobtrusive hardware requires a major step further in miniaturisation. This involves

molecular processing, new power solutions, like micro-power usage and self-generating power, and seamless interfaces, which invisibly enable users to interact with their intelligent environment. As there are billions of ambient-intelligent devices required for making the technological environment in just one city smart, the production cost for an ambient-intelligent device has to decrease to a few cents to make Ambient Intelligence economically feasible.

Ambient Intelligence puts also high demands on networks that let current 3G networks appear as a communications system from the stone age. Fred Boekhorst, senior vice president of research at Philips, in February presented a concrete idea of what the bandwidth requirements will be like: "There will be the need to interface large HDTV displays with data rates as high as 5 Gb/s." Ambient intelligence, he added, will require sub-systems that span 9 orders of magnitude in bandwidth. Intuitive music retrieval – you hum a song, and your ambient intelligent HiFi system finds and plays it – requires an estimated computing power of 3 giga-ops, 300 billion operations per second, to search a database of 20,000 songs with a half-second response time, Mr Boekhorst explained. 3D television or even 3D real-time holographic videoconferencing would certainly need a lot more computing power.

To cope with such an enormous traffic load in a seamless way, fully converged core and broadband networks are needed, which require a highly sophisticated dynamic network management and advances in middleware and agent technology.

To make the interface intuitive and adapted to human behaviour, advanced technologies for pattern recognition, including both speech and gestures, will be needed. Above all, Ambient Intelligence systems have to be safe, robust, and secure. Trust technologies are essential to make users accept ambient-intelligent environments.

For the time being you can still talk and hum to the walls of your home without causing action by some smart devices. However, you should better start getting accustomed to the thought that in some years, when you cry out "Oh, Lord!" your HiFi system could start playing spiritual tunes.

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