Contract No. 004420

eu-DOMAIN - enabling **u**sers for
Distance-working & **O**rganisational **M**obility
using **A**mbient **I**ntelligence **N**etworks

D7.3 User validation plan for eu-DOMAIN

Specific Targeted Research or Innovation Project

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1. Executive summary

1.1 Scope and Purpose of the document

The main aim of user validation is to assure that the eu-DOMAIN platform meets the needs and requirements of users and customers, and can be recommended for adoption and exploitation as seen from users' perspective.

The scope of this deliverable is to finalize the work done in previous phases of the project and define a plan for the validation activities that will be performed in the two domains described by the scenarios: Industrial Services (The European Service Network) and Healthcare (Healthcare for Tomorrow).

The target audience are the eu-DOMAIN technical partners (and over all, those involved in the validation of the developed scenarios) and user partners.

1.2 Contents of the deliverable

The deliverable is structured as follows: Chapter 1 gives a brief overview of the work reported in this deliverable. Chapter 2 includes a description of the document background, i.e. the relations and dependencies with other WPs and deliverables.

Chapter 3 introduces more specifically the user validation pointing out its purpose and objectives and describing the different stakeholders involved. Moreover the critical success factors identified by the partners are described. In Chapter 4 the project results which have to be validated are delineated.

Chapter 5 provides details on the validation approach, specifying the constraints (e.g.: available personnel, time, etc.), the context of use and the quality strategy and dimensions, identified with the support of the partners. In Chapter 6 the validation procedure is introduced, distinguishing between technical and socio-economic validation and presenting some tools.

2. Introduction to user validation

2.1 Background

This deliverable describes the planned validation process adopted in eu-DOMAIN. A number of previous eu-DOMAIN deliverables define the background for planning the user validation activities described in this document.

The plan for user validation described in this document is mainly based on the *D2.1 User validation framework plan,* which contains all the elements and guidelines used to structure the validation work.

Further information has been derived from *D2.3 - Functional user requirements specifications*, *D2.4 - Trust and security user requirements specifications* and *D2.5 - Societal user requirements specifications* under *WP2 – User requirements specifications.*

Furthermore *D6.3 – Public reports from the EASW® Workshops* and the work done under *WP6 – Socio-economic issues* have been inputs to the present deliverable.

2.2 Objectives of user validation

eu-DOMAIN has introduced a user-centred and iterative development process with participation of users in all phases.

There are three fundamental objectives, which are of the utmost importance to the overall success of the eu-DOMAIN project: 1) User acceptance, 2) availability of technology and 3) exploitability of the eu-DOMAIN platform. If the functionality and architecture of the eu-DOMAIN platform is not marketable, the project objectives have not been achieved.

The technology has already been proven to be available in the form of a series of well-functioning demonstration platforms, which have been demonstrated at review meetings and workshops and which will also be used for the final user validation.

The exploitability of the eu-DOMAIN platform has also been demonstrated. Formally, the project's user partners have validated the societal and business requirements for sustainable exploitation of the eu-DOMAIN platform in three EASW workshops. The conclusions from these workshops were overall positive. Further, a large number of dissemination and pre-exploitation activities has revealed a great deal of interest from potential customers and users.

The present work will therefore deal with the first, and most important, part of the overall validation of the projects ability to meet its goals: User acceptance. The eu-DOMAIN platform itself is not visible to end users. What these users see is the interface of service applications which are running on the eu-DOMAIN platform. Therefore, there is a need for validating the effectiveness of applications running on the eu-DOMAIN platform, their ease of use and the users' satisfaction with these applications.

2.3 Taking into account different stakeholders

The purpose of user validation is to assure that the results of the development project - i.e. the implemented result - are in agreement with the needs and requirements of customers and users, and are accepted by these in the end.

User validation, including such topics as analysis of user needs, contextual inquiry, ethnographic analysis, usability testing, or user satisfaction measurement, is a mature approach now, based on scientific knowledge, and proven and tested methods. The eu-DOMAIN project largely presents the same problems for user validation as any other software development project. The innovative challenge may be met by using care in the approach, and awareness of the fact that the eu-DOMAIN platform itself is not visible to the end users and that the comparison with existing applications, and the use of previous experience is not always possible.

User validation activities assume different forms in the phases of the lifecycle of a new service. While in the early phases the development results such as early application scenarios were inspected by experts (both technical as well as domain experts from the community of potential customers and users), at this stage of the project user validation takes the form of field trials. Ideally controlled conditions are needed to assure that valid and interpretable results are generated. Other applied methods should include subjective assessment of

system quality by users, and the collection of data, which can serve as performance benchmarks for customers. It is important to distinguish between two types of stakeholders, users and customers.

> **Users** are the individuals who in the course of their work or other activity interact directly with the product or service, which is developed. The acceptance criterion of users is that they are able to carry out the intended tasks efficiently and successful, and without undue problems or stress, and that their subjective assessment of the innovation is positive.
>
> **Customers** are the organisations or individuals who decide the purchase, and who must be persuaded of the value of a new service or technology. The acceptance criterion of customers is the total cost/benefit advantage obtained by the introduction of innovative technology. This includes non-monetary factors (such as clinical improvements), as well as the consequences for human resource management and the positive acceptance by the personnel affected.

2.4 Users and customers

User validation activities in eu-DOMAIN include two different types of validation:

1) From the user's viewpoint: a user validation of the service applications on the eu-DOMAIN platform will be performed in terms of effectiveness, ease of use, user acceptance, satisfaction, and preferences
2) From the customer's viewpoint: a socio-economic validation of the eu-DOMAIN platform's performance in terms of efficiency of human resources, customer satisfaction and financial viability and sustainability, either in a business or in a cost/benefit context

The purpose of the user validation is to validate the technical performance of the platform to ensure that it will fully support the identified business needs at acceptable performance levels, including the ability to be integrated seamlessly with existing legacy systems and to implement the required security policies. The user validation will involve user testing of two prototypes (service applications running on the eu-DOMAIN platform), i.e. letting the users execute pre-defined user task scenarios on location, record their performance (e.g. time to perform task, successful completion of tasks) and analyse their experiences (e.g. problems encountered with task performance).

The socio-economic validation is intended to test whether eu-DOMAIN services meet the expectations and requirements of intended customers. The purpose of this kind of validation is to secure that the services reflect the identified business and/or political priorities and to validate them in reference to customer priorities and therefore implies also the validation of the economic feasibility of the services in the users business environment, including cost/benefit analysis.

The first results of the socio-economic validation are described in details in deliverable D6.3 – Public reports from the EASW® Workshops for the eu-DOMAIN project, which deals mainly with the validation of the concepts of the platform and the financial viability and sustainability of general business models.

The second leg of the socio-economic validation will, as recommended by the reviewers, involve comparative studies of eu-DOMAIN business models and business cases with similar business models from other fields[1], as well as in-depth interviews with users and customers to establish confidence levels and customer retention potentials of the services and product features offered by the eu-DOMAIN platform.

2.5 Critical success factors

As a research project promoting active collaboration between the stakeholders and in order to achieve a common view and a common approach to user validation, a common eu-DOMAIN vision has been developed and a set of priorities has been identified. Starting from the common vision, every partner has identified a list of critical factors that are considered fundamental for project's success. The following table collects an overview of these critical factors suggested by partners and grouped in macro-families.

Critical success factors (from technical partners)
1) Capability and easiness to integrate any device, external services, systems (e.g.:

[1] These studies are widely treated in D8.2 and D8.4.

hospitals, customers, etc.)
2) Capability and easiness to adapt / extend for any domain and customer and demonstration of a flexible framework
3) Ability to build new applications rapidly
4) Scalability of the system in real deployment
5) Capability of the managers to be programmed with a reasonable amount of intelligence
6) Support for Ambient Intelligence
7) User interfaces intuitiveness and usability
8) High user acceptance

Table 1 Critical success factors – indications from technical partners

Together with specific expectations some important common issues have been underlined by the partners:

Critical priorities for a successful outcome of the project are identified in the **flexibility** and **scalability** of the platform and in the **intuitiveness and usability** of interfaces.

Usability is also a key factor for eu-DOMAIN final users; their focus is on the ease of use (see Table 2) that together with user acceptance/ satisfaction and added value are relevant aspects to be considered for successful work.

The user-focus is a distinctive approach of a user-centred development process. The users' point of view has guided the design and development activities and will be a fundamental topic for validation too.

Critical success factors (from user partners)
Grundfos
9) Quality
10) Useful added value visible to customers
EBPCT
11) Reliability of the technology
12) User acceptability
13) Ease of use
14) Ability to improve health / enhance quality of life

Table 2 Critical success factors – indications from user partners

3. Description of the project results to be validated

3.1 The eu-DOMAIN platform and service applications

The eu-DOMAIN platform is an European Ambient Intelligence service platform for automatic, context sensitive offering and contracting of mobile services across heterogeneous networks. It will connect people, repositories, buildings, devices and machines in an interoperable way. The platform can enable mobile ambient intelligence awareness by allowing the user to integrate into any location thereby providing context aware decision support. Furthermore, eu-DOMAIN gives content providers the possibility of delivering "context aware services" to mobile users thus creating new collaborative work environments and new methods of working across geographically distributed organisations.

The products to be validated are:

1. The eu-DOMAIN service platform
2. The eu-DOMAIN web service components

Figure 1 illustrates eu-DOMAIN Ambient Intelligence (AmI) Service Platform, and a web based service that offers all eu-DOMAIN functionalities to Service Providers. Two prototype demonstrators (also called prototype service applications) will be subject to user validation:

- Industrial Services (The European Service Network)
- Healthcare (Healthcare for Tomorrow).

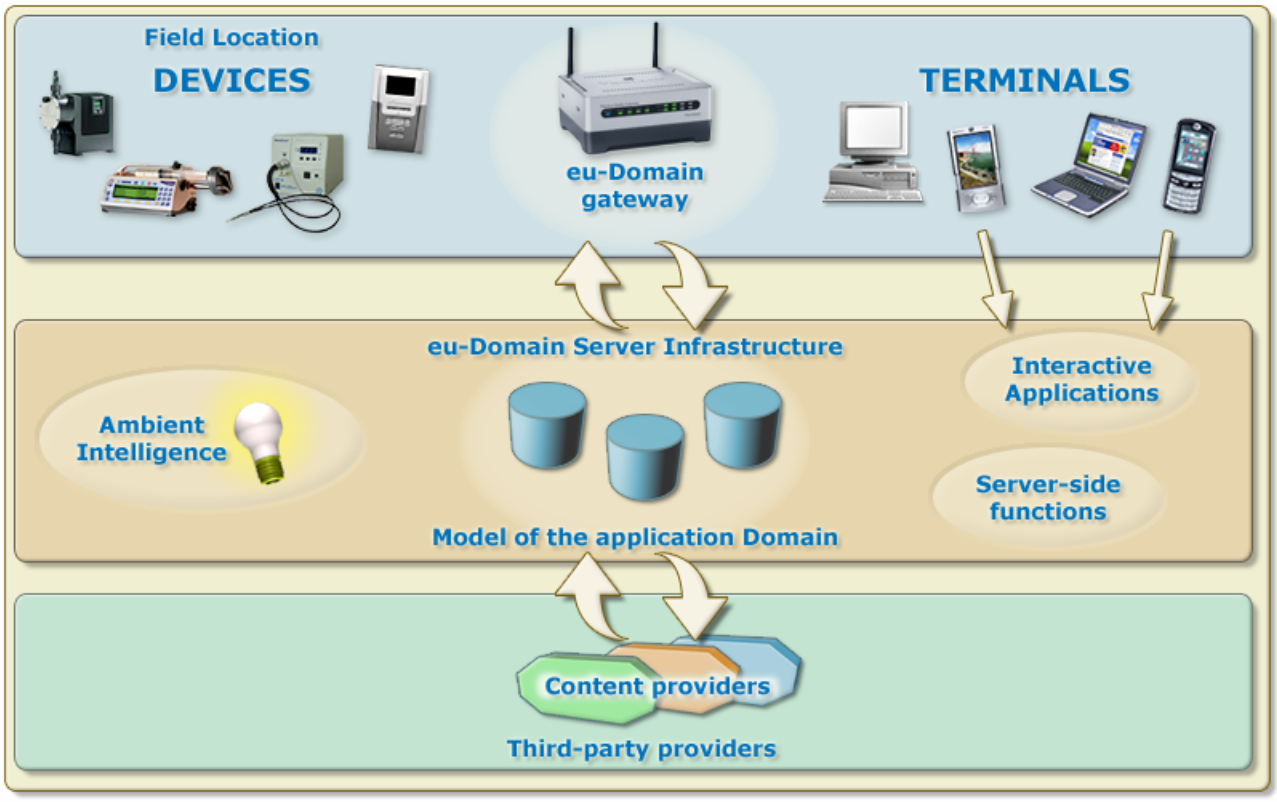

Figure 1 Logic overview of eu-DOMAIN architecture

3.2 Objectives, requirements and constraints of the development project

The overall objective of the eu-DOMAIN project is to define and develop the eu-DOMAIN mobile Ambient Intelligence services platform, to prototype service applications on this platform and to validate potential business opportunities with focus on these service applications.

A fundamental aim of the project is to develop in a user-oriented way. During the whole project the eu-DOMAIN platform was developed with respect to user and customer needs such as productivity (efficiency and effectiveness), user satisfaction and preferences, and quality of life.

In the early phase of development, guidelines (D3.3 Design guidelines and navigation structure for device interaction) helped to shape the system to be conform with user interface standards.

Later, when the eu-DOMAIN platform was already built in part, it was demonstrated with the 1st and 2nd demonstrator (Table 5 in Chapter 5) on various occasions at review meetings and workshops. Customer and user feedback to these demonstrators was collected in focus groups and workshops.

The final validation is aimed at verifying the success in terms of quality of use, user acceptance and satisfaction of eu-DOMAIN platform. For this validation process, two new demonstrators will be made available (described in detail in the deliverables D8.1 Validation report: The European Service Network and D8.2 Validation report: Healthcare for tomorrow).

4. Validation approach and methods

The user validation approach defines the goals and conceptual background for user validation, while the methods applied to implement the approach are selected from a repertoire to fit the specific project parameters. The general approach for the eu-DOMAIN project is described in D2.1 User validation framework, but the selection of specific methods for the two domains will be made in the following sections.

4.1 Constraints for successful user validation

In order to plan validation activities, a clear overview of the main constraints will facilitate the choice of validation methods based on the amount of information that can realistically be gathered. In particular, the availability of resources in terms of competences, time and budget is a basic condition for defining a feasible work plan considering the approaching end of the project.

4.1.1 Available personnel

As defined in previous phases of the project the validation has been carried out by project user partners as well as members of the development team, who must develop the validation scenarios and also be available for supporting users in their validation activities.

Most technical partners (IN-JET, TID, TCON, SAG, UAAR, CNET(ACIT)) have committed at least one person, for the validation work, with software competences, mainly software architects and developers.

A highly critical issue is the number of available users for the tests:

- for the industrial domain, the user partner Grundfos (GMA) is determined to involve a number of field technicians, support engineers, product managers and customers in order to carry on validation of the platform in an authentic environment;
- in the healthcare domain, the user partner East Birmingham PCT (EBPCT) is determined to act as supervisor of the validation process in order to ensure the clinical relevance. It is foreseen to involve different stakeholders (i.e.: patients and GPs) in various European countries for ensuring a pan-European scope; in particular six people from three different countries seem to represent a good compromise between using too few subjects to be useful and too many to be practicable.

It's worth stressing that neither the industrial domain validation nor the healthcare validation may result in real field tests under controlled conditions due to the limited number of test persons (users) that may be available. In particular, the healthcare validation is not in any way related to clinical validation. Clinical trials require ethical approval, a very large number of subjects and long duration, which is far outside the scope and time frame of this project.

Further it should be noted that a critical constraint is the availability and interest of all users in the entire evaluation process, both exploitation of platform functionalities and support to validation process (running usability tools, filling out questionnaires).

4.1.2 Time

Time constraints are critical, in order to have a working system available in two test sites: one for validating the industrial scenario, and one for the health care scenario.

Furthermore issues related to the completion of preliminary work, of technical test of single modules and related to user constraints have to be taken into account.

4.1.3 Other constraints

A main constraint, obviously, is the budget available for these late phases of the project. Developer partners have exhausted most of development resources, thus a significant amount of development work will involve additional costs incurred.

A final, but not less important issue, is the presence of a working system ready in time for validation in the two scenarios; this requires timely support from developer partners in the set-up activities and appropriate communication structures to provide feedback from users and other stakeholders to the members of the development team.

4.2 Users, tasks, and context of use

Analysing and understanding user groups, tasks and the context of use in a sufficiently detailed and concrete format is another basic requirement for defining a meaningful and sound validation plan.

Groups of users with homogeneous characteristics within a group and different characteristics between groups must be identified. The characteristics must be relevant for the user domain.

The rationale for the description of users, tasks and the context of use is the need to define precise, concrete tasks and operations, which are a condition for precise, meaningful and interpretable tests. Tasks are identified in a top-down manner, from the definition of system objectives, use cases or scenarios of use, down to detailed procedures.

The definition of users and their context of use must draw upon the conclusions and findings derived from previous deliverables; in particular the D6.1 Proposed business models and cases, D9.6 Exploitation plans (preliminary version) and D2.5 Societal user requirements specifications (Annex).

The (groups of) users who will participate in the field tests will be described in more detail in D8.1 and D8.2.

4.3 The quality strategy

The quality strategy aims at identifying a quality space with quality dimensions rated by their importance by eu-DOMAIN partners. The idea is that quality spaces are not absolute and quality must correspond to a user need, and some attributes are more important in a given domain than others. For this reason all partners have contributed to the identification of relevant quality issues, which can help defining validation criteria, needed to select appropriate evaluation methods. The partners have also rated the priority of the quality dimensions: 1 = low priority; 2 = medium priority; 3 = high priority. The results of this rating are shown in table 3.

	Quality Dimensions grouped according to importance	
	by tech partners	**by users**
High priority	Productivity and performance	Productivity and performance
	Errors and error correction	Errors and error correction
	Integration into product family	Standards and minimum requirements
	Added Value	Added Value
	Security, safety, privacy	Security, safety, privacy
Medium priority	Standards and minimum requirements	Engagement (and 'stickiness')
	Appeal and attractiveness	Appeal and attractiveness
	Learning and practice	Learning and practice
	Cognitive workload	Cognitive workload
Low priority	Pleasure and fun	Integration into product family
	Engagement (and 'stickiness')	Pleasure and fun
Other dimensions suggested	Scalability	
	Functionality	
	Other Usability issues	

Table 3 Validation dimensions grouped by priority

The table shows the substantial agreement between technical partners' and users' view. There is only one significant difference, related to the dimension called "Integration into product family", considered of low priority. This is easily understandable, since developers and potential providers derive greater benefits than users from platform aspects related to scalability and product portfolio flexibility of the eu-DOMAIN platform.

4.4 Quality dimensions and assessment criteria

It follows from the considerations described in the previous paragraph and from the user-centred approach that each of the domains will have to define the most important quality dimensions, which are considered relevant by their users and customers. Next it is important to describe how these quality issues will be measured and what quality requirements must be fulfilled (determination of critical, required, and optimal assessment values).

The following schema defines the common set of quality dimensions to be used in the validation. The assessment criteria and specific quality targets are to be defined separately in each domain.

Quality dimension	Measure	Unit of Measure	Methods	Critical Value*	Required Value*	Optimal Value*
Security and Privacy	Rating by users and experts Number of vulnerabilities	Global rate Vulnerabilities Number	Questionnaire		No vulnerabilities	No vulnerabilities
Added Value	Number of benefits mentioned by users	Number	Questionnaire		Users / customers see added value / benefit of the new application	
Errors correction	Number of user errors on number of task executed	Number	Testing measurements and statistical analysis	>0,01	0,01	0
Integration	Inspection by experts and developers	Integration problems detected	Programming of simple applications including domain model and rules			
Performance	Time to perform a given task	Minutes	Performance measurements			Faster performance with eu-DOMAIN application compared to traditional work
Productivity	Number of tasks performed with eu-DOMAIN services / total number of tasks	Number	Performance measurements			More tasks can be performed with eu-DOMAIN application compared to traditional work
User Acceptance	User satisfaction	Global User Satisfaction, Affect, Helpfulness, Learnability, Efficiency, Control	standardised questionnaire	average	Above average	

Table 4 Quality dimensions and assessment criteria

The dimensions listed in Table 4 are referred to different types of users or, better, stakeholders. It is more likely that technical experts and service providers will evaluate issues related to Integration, Security and privacy.

* To be determined/verified during the validation process

We then have a distinction between what we define customers and users. Customers are defined as organisations or individuals who decide the purchase, and who must be persuaded of the value of a new service or technology.

The acceptance criterion of customers is the total cost/benefit advantage obtained by the introduction of the eu-DOMAIN platform and application. This includes non-monetary factors, as well as the consequences for human resource management and the positive acceptance by the personnel affected.

Users are individuals who in the course of their work or other activity interact directly with the eu-DOMAIN prototype application. The acceptance criterion of users is that they are able to carry out the intended tasks efficiently and successful, and without undue problems or stress, and that their subjective assessment of the eu-DOMAIN prototype application is positive.

In general we can see the parameters identified as an attempt to define a “quality space” which is basically composed by two distinct but complementary sub-spaces: one is an *objective space* composed by dimensions which could be assessed with criteria shared between all the users; the other is a *subjective space* created by dimensions which are also perceived and measured with more subjective parameters (i.e. user experience, personal feelings).

Furthermore another interesting observation regards the measurement of a *subjective* dimension as the Acceptability; this implies a personal assessment of system quality but reflects also to more objective parameters such as Performance or Productivity.

We can then conclude observing how the dimensions define two distinct but correlated and complementary sub-spaces both fundamental for a quality assessment of eu-DOMAIN platform.

5. The validation procedure

An acceptance test with users provides the information for subsequent decisions on eu-DOMAIN exploitation. The acceptance has to be performed with realistic user trials and field trials. Careful planning helps considerably to reach interpretable and valid results. The validation conditions, training of users, data analysis procedures and benchmarks for comparison have to be defined.

The selection of the measures, methods, and the planning of the field trials should be done by experts in the field. This will be documented in the user validation reports (D8.1, D8.2) for the two applications.

Each validation activity thus has to go through the following procedure:

1) Use this validation plan
2) Define and briefly describe the subject of the validation, i.e. the technical platform and application to be validated
3) Describe the actors, i.e. the test persons, and recruit them (make sure to have their commitment as early as possible)
4) Develop the corresponding user scenarios that the actors need to go through as part of the validation
5) Refine the quality space with assessment criteria values
6) Customise the validation procedure, i.e. select from the suggested methods the ones you consider appropriate and define any domain specific augmentation
7) Perform the validation
8) Analyse the results and formulate the conclusions

Further comments to items 1) through 6) will be presented here. The other activities will be reported in deliverables: D8.1 Validation report: The European Service Network and D8.2 Validation report: Healthcare for tomorrow.

5.1 Analyse the validation plan

The present plan for user validation only defines a framework for user validation in each domain. Some validation boundaries have been pre-set (such as the subject of validation, the user and actors, the validation methods, etc.). Other validation elements are to be defined as part of the validation work (such as validation scenarios, quality requirements, etc.).

Based on the user validation framework, the validation procedure in each domain must contain the following main activities:

- Planning of the validation activities
- Identifying resources in terms of time and persons
- Carrying out the validation and analysing the results
- Making recommendations on the basis of the validation results (e.g. redesign, error correction, start of implementation, release)

5.2 Subject of the validation

The eu-DOMAIN infrastructure represents a Europe-wide, mobile, Ambient Intelligence services platform that integrates users into intelligent surroundings and supports new methods of collaborative working with seamless delivery-on-demand of services from content repositories to people, machines and devices. The validation should be seen in this context and the explicit advantages of the eu-DOMAIN platform compared to existing solutions (e.g. network intelligence, rule engine, SOA structure, service gateways, etc.) must be clearly identified and validated in each user domain.

5.2.1 Technical validation

During the course of the project's development work, two partly completed demonstrators have been developed and a third, full demonstrator is being finalised for the final review. The following table shows the main technical innovation in each demonstrator.

Issue	1st Demonstrator	2nd Demonstrator	3rd Demonstrator
Server infrastructure	Rudimentary & distributed	Almost integrated	Robust platform
Client infrastructure	First implementation	Robust platform	Robust platform
Interoperability	WS calls	WS calls & integration	WS calls & integration (unchanged)
Security	User certificates	None	Online authorisation and certificates
Mobility	Mobile Worker (PDA)	None	Mobility, mobile gateway (PDA)
Ambient intelligence	Simple rules	Simple rules	Complex AmI rules with existing devices
External Content Provider	Grundfos (pdf file)	Columna & WS calls	Add another legacy system
Multimodal interfaces	PDA	PC	PC + PDA + perhaps two-way SMS
Localization	None	Simple	Context awareness
Configurability	None	User configurability	Configurability and modifiability
Semantic	None	WS integration (with Columna)	None

Table 5 Progress in technical innovation in the developed demonstrators

None of the demonstrators has caused any reason for concern in terms of availability and deployability of the involved technologies or in the functionalities and services that can be developed on the basis of the eu-DOMAIN platform.

Further, the socio-economic validation performed in the EASW workshops did not reveal any real differences in the potential of eu-DOMAIN exploitability within each of the domains.

Consequently there have been only minor adjustments necessary to the functional and extra-functional features of the eu-DOMAIN platform, as it was planned in initial requirement specification and there is still a high level of confidence about future potential of eu-DOMAIN.

Several requests, recommendations and comments have been received from the projects external reviewers during the two reviews. These inputs have been dealt in details in other deliverables and are mostly related to the deployment of the eu-DOMAIN platform in existing environments such as Facility Management and Healthcare systems. Besides from the impact on security architecture, which is implemented in the 3rd demonstrator, the comments have mostly influenced the socio-economic aspects of eu-DOMAIN. The recommendations of the second review meeting must thus be taken into consideration in the planning of the individual validation processes in each domain.

In conclusion, the subject of the user validation will be the developed eu-DOMAIN platform in the state as of the 3rd demonstrator. The subject of the socio-economic validation will be planned in detail for each domain.

Finally, the usage scenarios to be used in the validation need to be defined (in *D8.1* and *D8.2*) and the development and setting up these scenarios coordinated with the relevant technical partners.

5.2.2 Socio-economic validation

A main objective of the validation with real users is to inform about the sustainability and the competitiveness of the solutions which can be developed. This information is needed by decision makers who are involved in the implementation of new solutions based on the eu-DOMAIN platform.

The data to be provided should inform about:

- Efficiency and effectiveness of the work procedures.
- Quality of the results obtained by using the eu-DOMAIN service platform and its applications.
- Motivating effect on users.
- Direct and indirect value for the owner of the applications.

In addition the elasticity of demand exhibited in the behaviour of users may be an issue to observe: the trade-off between added value and security, and the cost of the application.

The validation can provide initial data, which may be analyzed and discussed with decision makers. As a result some of the important tradeoffs will be recognized: A question raised may be "How much more efficient must the work procedure be in order to justify an investment of XXXX EURO?".

Also comparative studies of other, similar services and the economic and social foundations for the implementations of these services can be helpful in validating the socio-economic potential of eu-DOMAIN. This was also recommended by the reviewers with special focus on the Healthcare domain and will be covered in D8.2 Validation report: Healthcare for tomorrow and D8.4 Take-up guideline and technology watch report.

5.3 User Satisfaction measurement

In this paragraph we highlight again the importance of User Satisfaction (also called User Acceptance) and we introduce a questionnaire aimed at measuring users' satisfaction with a software application in terms of Global Usability, Efficiency, Learnability, Control, Helpfulness and Affect. This method has been selected for the measurement of User Satisfaction because it is a standardised and proven method which has been in use for more than 15 years and therefore should be used in both validation domains.

Even though the chosen methodology is the same, each domain will still have to add a questionnaire with specific questions related to the specialized requirements for that specific domain.

5.3.1 User Satisfaction revisited

A question raised frequently is whether the same methods which were developed in the context of office software, transaction processing, or devices such as communication and navigation tools are applicable to products and services which focus on information and content, and which are highly innovative.

eu-DOMAIN largely presents the same problems for user validation as any other software development project. The innovative challenge may be met by using care in the approach, and awareness of the fact that:

1) User validation in eu-DOMAIN requires to assess a structured platform (i.e. software and services). The eu-DOMAIN platform itself is not visible to users; what they can see is the interface provided by service applications, running on the platform.

2) Comparison with existing applications or the use of previous experience is not possible.

User Satisfaction is definitely a very interesting and useful aspect to be considered for user validation because it will help to assess the user-perceived quality of the eu-DOMAIN platform and applications which can be different compared to an expert objective evaluation.

5.3.2 The SUMI questionnaire

For the measurement of user satisfaction, the SUMI[2] questionnaire has been chosen as the most suitable vehicle for measuring user satisfaction. SUMI (Software Usability Measurement Inventory) has been developed at the University College Cork, Ireland[3] and is claimed to be the de facto industry standard evaluation questionnaire for assessing quality of use of software by end users.

SUMI is a validated instrument for measuring user satisfaction (not to be confused with ad-hoc opinion surveys!). It is designed to be used with end users of a software product under evaluation.

SUMI enables experts concerned with the usability of a product (e.g. project manager, software developers, and other stakeholders), to obtain objective and trustworthy data about the subjective assessment of the product by users.

Trying to identify the perceived quality of use of the complex structure of eu-DOMAIN services is an interesting challenge but the SUMI methodology seems to be able to measure the required parameters. Even though SUMI was designed to be used primarily to evaluate those systems which are generally known as office software; in practice it has been used to measure a wide variety of software (from space station control systems to games).

Computer users are likely to implicitly compare their level of satisfaction with any kind of software to the standard office software suites of which they have routine experience. When using SUMI to assess the usability of a prototype during development, a SUMI profile can indicate the weak aspects of such prototype.

SUMI is a proven questionnaire which measures the satisfaction of users with a software application on five empirically identified factors, which are described as follows:

- “The Affect subscale measures the user's general emotional reaction to the software - it may be glossed as Likeability.
- Efficiency measures the degree to which users feel that the software assists them in their work and is related to the concept of transparency.
- Helpfulness measures the degree to which the software is self-explanatory, as well as more specific things like the adequacy of help facilities and documentation.
- The Control dimensions measures the extent to which the user feels in control of the software, as opposed to being controlled by the software, when carrying out the task.
- Learnability, finally, measures the speed and facility with which the user feels that they have been able to master the system, or to learn how to use new features when necessary.”

Users normally require about ten minutes completing the inventory after having used the software for at least an hour.

SUMI yields reliable information when used with appropriate sample sizes. A sample of ten or more users per system being evaluated is required to obtain statistically reliable results. Although SUMI has been used on samples as small as 3 or 4, its use in these circumstances was primarily for diagnostic purposes. On the other hand, sometimes it may only be possible to get a small handful of users. A small amount of information is better than no information at all, but results from small samples must be interpreted cautiously and critically with common sense.

The statistical analysis can be carried out with the scoring program SUMISCO. The output of SUMISCO can be divided into three components: Scale scores (Profile Analysis), User scores, and Item Consensual Analysis.

5.4 Questionnaires

In addition to the standardised SUMI questionnaire, we will need tailor-made questionnaires for each user group where we ask the users specific questions regarding the provided functionality and the added value. This kind of questionnaires will give us some other information for depicting a quality space through performance, productivity and added value dimensions from a user point-of-view.

[2] http://www.ucc.ie/research/hfrg/questionnaires/sumi/index.html.
[3] SUMI is a commercial tool which is sold by Jurek Kirakowski, University College Cork.

Some possible questions to be integrated in the whole validation questionnaire are as follows:

Questions about the functionality of the eu-DOMAIN applications

Q1: How valuable would it be to you if you are supported by an alert function?

Answers: Very valuable, valuable, of minor value, of no value, no opinion.

Q2: How much use do you think you would make of an alert function?

Answers: Considerable use, some use, minimal use, no use, no opinion.

Q3: How useful would you consider a function that notices you have health problems and informs you to consult the doctor?

Answers: Very useful, useful, of minor use, not useful, no opinion.

Q4: How valuable would it be to you if the system automatically configures itself?

Answers: Very useful, useful, of minor use, not useful, no opinion.

Q5: How useful would it be if you could modify alert settings?

Answers: Very useful, useful, of minor use, not useful, no opinion.

Q6: How useful would you consider a notification function that suggests … (to be completed)?

Answers: Very useful, useful, of minor use, not useful, no opinion.

Q7: How useful would you find a notification function that took into account your personal criteria when … (to be completed)?

Answers: Very useful, useful, of minor use, not useful, no opinion.

Questions about the work procedures which support the eu-DOMAIN applications

Q8: How important is it for you to be able to access your doctor from a range of different devices, e.g. via your mobile phone, PDA, computer?

Answers: Very important, important, of minor importance, not important, no opinion.

Q9: How important is it for you to be able to have access to medical on-line support?

Answers: Very important, important, of minor importance, not important, no opinion.

Questions about the added values of eu-DOMAIN applications

Q10: What is the most desirable single improvement which you would like to see in the new HealthCare system?

Q11:Please add any further comments or feedback which you consider important here (feel free to give some additional information that has not been taken into account yet):

Demographic questions

Questions about the subjects age, IT knowledge background, special needs, etc. may be helpful. The answers provide information about the users involved in the validation.

Some examples of questions that will be included in the questionnaire are listed below:

Q12: How many years of experience with medical IT do you have?

Answers: Less than 3 months, 1 year, 2 years, 5 years or more.

Q13: How often do you currently see and treat your patients?

Answers: once a week, once a month, once in a quarter of a year.

Q14: How often do you go to the doctor?

Answers: once a week, once a month, once in a quarter of a year.

5.5 Interviews

Interview is an informal technique for the investigation of the users' opinions about features of the eu-DOMAIN application (e.g. added value, critical incidents, anxieties), which are hard to measure objectively. It is a useful method for studying which application features users particularly like or dislike.

Three types of interviews can be distinguished: unstructured, semi-structured and structured interviews. The type, detail and validity of the collected information vary with the type of interview.

The validity of results varies with the experience of the interviewers. The interviewer needs domain knowledge in order to ask the right questions and there is always the risk of bias in what questions the interviewer asks and how the user interprets them.

Interviews are demanding in terms of the number of representative users needed. It is preferable to use questionnaires where possible.

Because of the unstructured nature of an interview the result is just a report summing up the comments made by the users in the interview.

6. References

6.1 SUMI References

http://sumi.ucc.ie/whatis.html.

Porteous, M., Kirakowski, J. & Corbett, M. (1993). SUMI User Handbook. Human Factors Research Group, University College Cork, Ireland.

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