PROJECT PERIODIC REPORT

Year 1 – January 1st to December 31st, 2008

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Periodic report: **1st** ☒ **2nd** □ **3rd** □ **4th** □

Period covered: **from January 1st, 2008 to December 31st, 2008**

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Abstract:

This document reflects the progress report of the MobiThin Project for the first period.
[P1 = January 1st, 2008 to December 31st, 2008].

Keyword List: Management, Periodic report

The **MOBITHIN Project Consortium** groups the following Organizations:

Interdisciplinary Institute for BroadBand Technology vzw	IBBT vzw	B
T-Systems Enterprise Services GmbH	T-Systems	G
Prologue Software	Prologue	F
Interuniversitair Micro-Electronica Centrum vzw	IMEC vzw	B
NEC Technologies (UK) Ltd	NTUK	UK
Groupe des Ecoles des Télécommunications (also referred to as IT)	GET	F
JCP-Consult SAS	JCP	F

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1 DECLARATION BY THE PROJECT COORDINATOR

I, as co-ordinator of this project and in line with my obligations as stated in Article II.2.3 of the Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period;
- The project (tick as appropriate):

  ☒ has fully achieved its objectives and technical goals for the period;

  ☐ has achieved most of its objectives and technical goals for the period with relatively minor deviations[1];

  ☐ has failed to achieve critical objectives and/or is not at all on schedule.

- The public Website is up to date, if applicable.
- To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 3.6) and if applicable with the certificate on financial statement.
- All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 5 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

Name of Coordinator: **Piet Demeester**

Date: .15/02./ 2009

Signature of Coordinator: .....

[1] If either of these boxes is ticked, the report should reflect these and any remedial actions taken.

2 PUBLISHABLE SUMMARY

FP7 MobiThin
Wide area thin client computing to deliver demanding services to constraint devices

1. Introduction

Over the past decade, fixed broadband access networks have known a tremendous evolution, resulting in successful deployment of bandwidth intensive, multimedia services (including IPTV, personal broadcast applications, P2P telephony, network gaming, etc.). This evolution towards higher bandwidths in fixed networks, has been paralleled with a similar trend in the mobile environment: UMTS deployments as well as availability of WiFi hotspots, with increasing aggregated capacity, has resulted in better use of the available spectrum.

However, unlike in the wired setting, major obstacles, intrinsically associated with the mobile environment, still jeopardize the successful deployment of advanced, services on mobile devices. These obstacles mainly relate to (i) the nature of the wireless link (offering possibly unstable, relatively expensive network bandwidth) and (ii) the nature of the wireless terminal itself (a resource constrained device, not able to process advanced applications observing the timing requirements, and hampered by limited battery power). Consequently, consuming advanced services anywhere, anytime on any mobile device is still an only partially fulfilled dream of many.

The solution envisaged by MobiThin to tackle this triple-ANY challenge, finds its roots in the well-known thin client computing paradigm. Here, applications are executed remotely, in well-equipped server farms, and the role of the terminal device is restricted to displaying graphical updates from the server and sending input from the user to this remote execution environment. In this way, the role of the terminal is restricted to pure input/output, relieving this device from computationally intensive operations (thereby facilitating access to computationally heavy applications and/or saving battery power). To accommodate for the wireless environment, characterized by highly dynamic context changes (induced by e.g. network variations, user movements …), MobiThin pursues an adaptive solution, able to offer the best services given the current context.

2. Project Objectives

The objective of MobiThin is to *allow **intelligent** and **flexible distribution** of **applications**, **services** and **content** to **mobile users** in a wireless WAN setting, mirroring the successes achieved with wired thin client solutions.*

From this high-level objective, following targets were identified, reflected in the work package structure of the project:

- Development of an adaptive, thin client protocol, able to adapt to context changes. These include: network induced context changes (e.g. network degradation), user induced context changes (e.g. mobility, startup of new applications, …) as well as adapting to application behaviour.
- Development of a service and resource management framework, ensuring service availability and offering capabilities to further optimize the service quality (e.g. by migrating the user processes between servers to avoid overloads).
- Identification of viable business models for the service, ensuring the adoption on mid-term.
- Standardisation to enhance the impact of the project and increase the opportunities for commercial deployment.

3. Project status

MobiThin started Jan. 1, 2008 and has now completed it's first project year. The main targets set out for this period were related to four major project tracks:

1. Design of a end-to-end system architecture, evaluated both from a technical and business viewpoint
2. Identify adaptation mechanisms and algorithms to achieve optimal operation
3. Identify and select (middleware) technologies, suitable to implement the various system building blocks
4. Implement and test early prototypes to provide early feedback to the architectural and algorithmic tasks.

As will be discussed in the next section of this summary, substantial progress was made on all activities, also formally reflected in the timely delivery of all due reports and on-track achievement of milestones.

4. Achievements

Architecture design

The project went through a typical requirements elicitation phase, based on domain analysis and market prospects. From this phase, a coherent set of 140 requirements was distilled, against which the system architecture is to be evaluated. After evaluating various architectural alternatives, the high-level architecture shown in Fig. 1 was identified. This symmetric client-server architecture was further detailed to ensure modularity and easy extendibility of the resulting system. Designs at various detail levels were made, eventually resulting in an interface and functionality description of each component of the architecture.

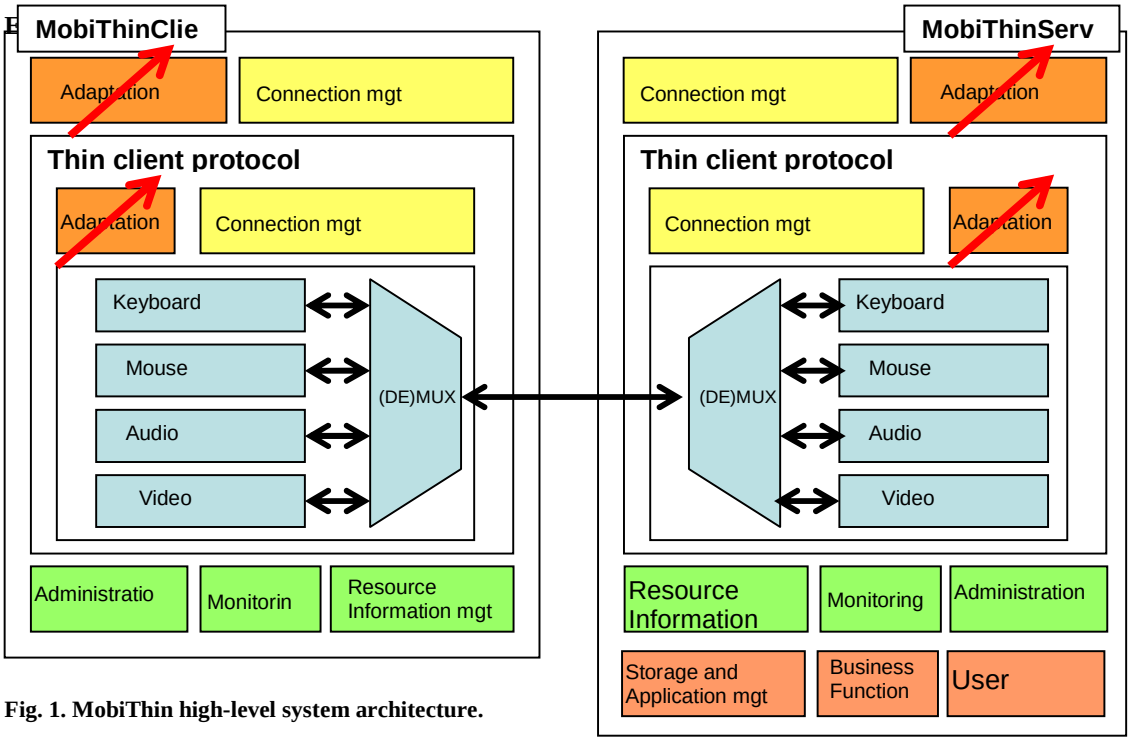

Fig. 1. MobiThin high-level system architecture.

Business analysis of the application allowed to identify four basic scenario's covering a wide spectrum of the thin client business eco-system. These scenario's mainly differ in the number of business players involved in the value network, ranging from the "single business player scenario" over the "telco oriented scenario" and "internet assisted scenario" to the "totally fragmented value system". The identified technical architecture was evaluated for these scenario's and recommendations were formulated allowing to realise the scenario's on a technical level.

Adaptation mechanisms and algorithms

To arrive at an optimal, cross-layer adaption strategy, first an inventory was made of available and novel adaption strategies, during various brainstorm sessions. This has resulted in a priority list (risks and potential benefits were analyzed to estimate these priorities) of adaptation mechanisms for further study.

Wireless link optimization

The wireless medium transmission optimization includes two challenges: supporting QoS (Quality of Service) on the inherently error-prone and time-varying wireless connection, and energy scalability, as the radio function takes a significant fraction of the overall client energy consumption. These challenges will be tackled by the definition of appropriate QoS classes for the different kinds of traffic to be transported (e.g. regular data, audiovisual data and upstream user events) and by including the capability of performance scaling, i.e. adapting the performance to the energy conditions. Figure 2 shows the breakdown fraction of the power consumed in each state of the wireless platform. It appears that most energy is spent in the idle state. By introducing dynamic sleep schedules, controlled through cross-layer communication with the application, and by scaling the physical link layer transmission parameters, energy savings can be realized.

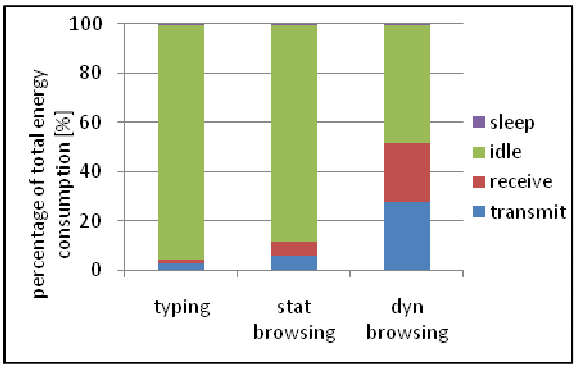

Fig. 2. Breakdown of power consumption of the wireless platform for different user scenarios

Frame caching

We have investigated graphical update caching as a method to reduce long term redundancies in thin client sessions.

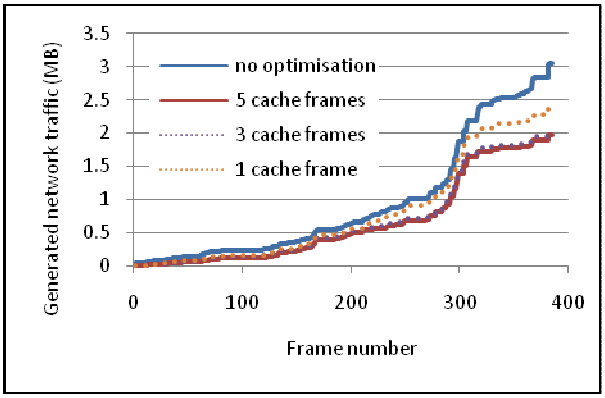

Fig. 3. Experimental results achieved with static frame caching.

Figure 3 presents the gradual increase in bandwidth gain caused by addition of one or more cached frame on the client. The graphical updates are differentially encoded to the best cache match, allowing to reduce bandwidth consumption. The protocol used is the wide-spread Virtual Network Computing's Remote FrameBuffer protocol (VNC-RFB). The figure shows that using five cache frames we achieved a bandwidth reduction of 34.40% compared to unoptimised VNC encoding. Furthermore, the traffic spikes could be reduced by 33.10%. Traffic spikes typically occur when large parts of the screen have to be updated, e.g. when the user minimizes his application.

Service management framework

In order to evaluate the soundness of the proposed architecture, a JEE (Java Enterprise edition) based implementation of the management subsystem was built. To allow end-to-end functionality testing, this implementation interfaces with a traditional thin-client protocol. The component interfaces identified during the architectural design were proven to be adequate to realize the required end-to-end system functionality.

It is clear that JEE is not the most suitable technology at each architectural level. Consequently, for the main building blocks of the management framework, software technologies and available tools were evaluated and selected. Subsequently, implementations of important subsystems were realized, as detailed below. Implemented subsystems include the monitoring subsystem and the authentication/authorization subsystem. In addition, different virtualization alternatives were investigated to optimize server farm performance and manageability.

Monitoring subsystem

The Monitoring Subsystem model is based on three main components:

- Sensor Agent: its role is to gather monitoring data from its source and hand it off to its local node monitoring service.
- Node Monitor Service (NMS). This is the monitoring core component. Its main roles are to centralize data coming from multiple sensor agents on a node, process those data and provide them to applications and to other monitoring nodes.
- Control Agent Library: This component is designed to be embedded in applications. The principal roles of a control agent library are to act as an interface between a node monitor service and applications. This hides to the monitoring consumers all the complex aspects of communication with NMS. The NMS might be local or remote.

Authentication/authorization subsystem
The connection set-up is done through the SIP protocol. SIP messages from clients are relayed by the OpenSips proxy to a back-end SIP application server. Authentication is handled by the OpenSips proxy in cooperation with a MySql database. When a SIP REGISTER message is received, OpenSips challenges the user in order to identify him. If successful, the authenticated user is stored into a MySql database.

Prototyping and testing

To provide early feedback on technical feasibility and performance, as well as to allow early dissemination of the project's results through showcases, MobiThin has spent considerable efforts in designing and building early-prototypes, most notably the hybrid streaming prototype and the first MobiThin client deployed on a smartphone.

Hybrid streamer
Heterogeneous types of visual content must be presented on the terminal: text, graphics, image and video. The restrictive network conditions, in terms of bandwidth availability and reliability, and the limited terminal hardware and software resource reinforce the need of a remote display system that adapts itself to the content type, the network environment and the terminal characteristics. Within MobiThin, a first achievement is the design of a hybrid remote display protocol. For rather static visual content, e.g. a text editor, a state-of-the-art remote display protocol is used (VNC). The rate and fraction of the pixel changes between subsequent frames is monitored, and for complex and fast updated graphics, the images are streamed as an H.264 video stream to the client. The switch between the two modes is transparent to the user. Figure 4 shows the bandwidth savings that can be achieved through this hybrid remote display protocol. For low motion scenarios, streaming takes as much bandwidth as VNC, but is much more CPU intensive. Continuously using the streaming mode would thus violate the thin client principle.

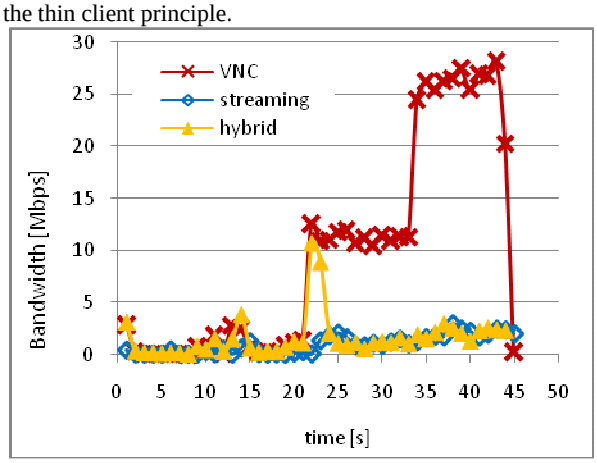

Fig. 4. Bandwidth consumption for a trace comprising text editing, watching a video (t = 21s) and watching a video full-screen (t = 35s)

This demonstrator was successfully shown at the NEM summit, September 2008, Saint-Malo.

MobiThin on Ocean
To exploit the possibilities of mobile platforms, VNC, an existing remote display application, was successfully ported on the NEC mobile phone named Ocean. During the port, a particular attention was given to adapt the application to the mobile device constraints such as the screen size, the specific pointing device similar to a mouse, and the limited keyboard. This achievement will allow the project to perform specific measurements on a mobile phone on a wireless network.

This demonstrator will be shown at the Mobile World Congress , February 2009, Barcelona.

Standardization
Standards are important to reach an adequate level of project impact, and the consortium has therefore spent efforts in identifying the most suitable standardization bodies and modalities for standardization. Currently, two standardization initiatives are taken by MobiThin: (i) standardization of requirements, architecture and component interfaces through a Industry Specification Group from ETSI, and (ii) standardization of the mapping of graphical primitives to LASER (an MPEG standard).

5. Aimed results and impact
The target results of MobiThin encompass a complete end-to-end system, allowing mobile users to effectively consume (complex) applications whilst optimally adapting to the current context conditions. This will allow bringing complex applications to a vast audience at low cost, thereby supporting the compute/consume/generate-anywhere, anytime paradigm. Clearly, this will entail business opportunities for key business players, including telecom operators, application providers, solution providers and mobile terminal manufacturers, illustrating the strategic importance of the MobiThin activities. Having impact on standardization (as highlighted above) is of key importance in this respect.

6. Conclusion

During it's first project year, MobiThin has succeeded in designing an E2E system architecture, capable of hosting the core functions (including advanced adaptivity mechanisms) of a wireless thin client service. Important subsystems of this architecture were prototyped and evaluated, confirming the soundness of the proposed architecture. Important adaptivity mechanisms were identified, and first algorithms for supporting adaptivity were evaluated.
Results of the project were disseminated trough publications/demonstrations (e.g. NEM summit, scientific conferences, …) as well as through standardization efforts.
The progress made has allowed to proceed to the implementation of the remaining system components, resulting (after an integration phase) into a fully functional platform at the end of the first project phase (i.e. after 18 months).

7. Further information

For further information, we refer to the MobiThin website (http://www.mobithin.eu). Additional information can also be obtained through mailing

- Jean-Charles Point: pointjc@jcp-consult.com
- Bart Dhoedt : bart.dhoedt@intec.ugent.be

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3 PROJECT OBJECTIVES FOR THE PERIOD

As stated in the technical annex, the MobiThin objective is to allow **intelligent** and **flexible distribution** of **applications**, **services** and **content** to **mobile users** in a wireless WAN setting, mirroring the successes achieved with wired thin client solutions.

In relation with the objectives of this first period, the deliverables - Table 1 - below were provided during the first period activity

Del. no.	Deliverable name	Lead participant	Delivered date	
D1.1	Project Reference Manual	**JCP**	31/03/2008	D1.1 incorporates all procedures concerning the technical and administrative management of the project, as well as the project rules and guidelines concerning management of foreground and IPR.
D2.1	System requirements	**T-Systems**	30/04/2008	D2.1 describes a coherent set of system requirements based on market analysis, various application scenarios for the MobiThin thin client system.
D6.1	Project web site set-up	**JCP**	30/03/2008	The website intends to provide information about concepts, vision, objectives and expected outcomes of MobiThin as well as public documents, originating from the project work.
D1.2	Project Quality Insurance Manual	**JCP**	01/07/2008	D1.2 sets the procedures to achieve deliverables and deliveries of adequate quality; also incorporates the Change Control Procedure.
D6.2	Project communication and dissemination plan	**JCP**	01/07/2008	This objective of this document is to set out the terms of Communication so as of the Use and Dissemination of the knowledge arising from the project
D2.2	System architecture	**T-Systems**	30/06/2008	D2.2 describes the MobiThin system architecture based on the requirements defined in deliverable D2.1. This includes basic building blocks, components, sub-components and the interfaces in-between. In addition D2.2 documents compliance and open points of the mapping between the 140 requirements and the architecture.
D5.1	POC demonstrator definition – first version	**NTUK**	30/06/2008	This document identifies the demonstrations [Eight] to be performed during the first phase of the Project with respect to the requirements and the architecture defined.
D3.1	Phase I component interfaces	**IBBT**	30/09/2008	D3.1 and D4.1 identify and describe the interfaces between the system components

D4.1	Phase I component interfaces	**Prologue**	30/09/2008	that will be developed in respectively WP3 and WP4 during Phase I.
D2.3	Business models – first version.	**T-Systems**	30/12/2008	D2.3 describes MobiThin business model scenarios, based a generic business model framework and real life examples of business models in the already existing commercial thin client realm, maps these scenarios to the MobiThin architecture and derives recommendations towards architecture and business interfaces.
D4.2	Service management framework	**Prologue**	30/12/2008	This deliverable presents the first prototype of MobiThin service management framework. It contains concrete aspects related to the architecture, the features and the interfaces implemented in the prototype.
D5.2	Simulation framework for the architecture	**IMEC**	30/12/2008	D5.2 identifies the simulators that will be used for the validation and assessment of the MobiThin system. The objectives, description, expected tests, and limitations of each one are explained, as well as the way they fit in the overall architecture.

Table 1- Period 1 deliverables

To achieve this goal, MobiThin has set out a set of technical goals, directly relating to the work plan of the project. These are summarized below:

1. Development of an adaptive, thin client protocol

Current thin client protocols including Virtual Network Computing (VNC), Independent Computing Architecture (ICA), and Remote Desktop Protocol (RDP) are clearly optimized for wired LAN environments, where bandwidth is high and where network degradation or loss of connectivity are rare events. The challenge here will be to develop a protocol specifically optimized for the wireless, constrained device context. This entails limited (and possibly expensive) bandwidth availability, limited terminal capabilities (e.g. display resolution), limited battery life time (necessitating power efficient solutions), whilst ensuring integrity of the thin client protocol semantics, in the presence of connectivity loss or network degradation. Requirements for the thin client protocol include:

- Ability to adapt to network degradation (at the expense of "image" quality) without loss of interactivity.
- Ability to adapt to connectivity loss: the protocol should be able to survive bursty network outages. In addition to guaranteeing the protocol semantics, the application interactivity will be optimized (at the expense of image quality).
- Ability to handle different wireless interfaces, and to select the proper interface in case of network events.
- Ability to interface with the application layer, in order to allow more intelligent, application-layer assisted strategies for optimizing the protocol behavior.

Relation to the work plan: task 3.3
Main contributors: Prologue, NTUK, IMEC and IBBT

2. Development of an adaptive wireless protocol
In order to realize its functionality, the thin client protocol will (heavily) depend on the facilities and reaction mechanisms offered by the underlying wireless protocol. This protocol should be able to adapt both to network events and to events originating from the thin client protocol. In addition to its functional requirements, the protocol will be optimized for low usage by the client, as the wireless transmission function takes a very significant fraction of the overall client side power consumption. Requirements for the wireless protocol include:

- Ability to react properly to network events on the last wireless hop, using built-in or customized priority mechanisms for different thin client traffic classes. The wireless link protocol will be able to switch between different pre-defined operating modes, to establish the required level of on-line responsiveness.
- Optimization of power efficiency, enhancing the wireless device autonomy.
- Interfacing with the thin client protocol, to have wireless protocol parameters set in an optimal way.

Relation to the work plan: tasks 3.1 and 3.3
Main contributors: IMEC and NTUK

3. Development of an adaptive image transmission protocol
An important component of the thin client service is image transmission to the wireless device. As various alternatives exist for varying bit rates and quality levels, choosing the right image transmission solution (addressing both the right technology as well as the proper parameter set) for the given network conditions and applications at hand, might have a severe influence on the quality of the overall solution. Requirements for the image transmission component include:

- Optimization of power efficiency, enhancing the wireless device autonomy.
- Interfacing with the thin client protocol, and application layer to allow intelligent cross layer decisions.

Relation to the work plan: task 3.2 and 3.3
Main contributors: GET, IMEC

4. Development of a service and resource management framework
The end-to-end solution for the thin client service will involve a management framework capable of allocating the proper resources (CPU power of the server, storage and network) to each terminal. As the solution should work in a WAN setting and offer a telco grade service, it should be scalable and robust. Basic requirements for this framework are:

- Interfacing to the network infrastructure and server farm (resource reservation, monitoring, diagnostics).
- Scalable to 100.000 simultaneous users.
- Selecting the most appropriate server for each user.
- Supporting sub-second fail-over as a premium service.

Relation to the work plan: tasks 2.1, 2.2, 4.1, 4.2, 4.3 and 4.4
Main contributors: T-Systems, Prologue, IBBT

5. Identification of suitable business models

Various business models for offering the thin client service will be defined and investigated. The objective here is to arrive at viable models. It is expected that the thin client service can be an important rationale for 3G and beyond wireless technologies.

Relation to the work plan: task 2.3
Main contributors: T-Systems, Prologue, NTUK

6. Validation

To validate the overall architecture and its implementation, as well as the various interacting optimizations, a proof-of-concept will be built. This will consist of a 100+ node environment, able to emulate more than 100 mobile users with varying network attachment points and network conditions.

Relation to the work plan: tasks 2.4, 5.1, 5.2, 5.3, 5.4, 5.5
Main contributors: IBBT, Prologue, NTUK, IMEC, GET and T-Systems

7. Standardization

Liaison with standardization bodies will be established to ensure that the MobiThin solutions are made visible to the relevant fora. These standardization bodies include the IETF, MPEG/Laser, ….

Relation to the work plan: WP 6
Main contributors: all partners will contribute, under co-ordination of JCP-Consult

As MobiThin is a 2-phase project (Phase I: M1 – M18, M19 – M30), these goals are achieved through two iterations. More specifically, for the first project year this translates into the following set of objectives for the different work packages:

WP1: PROJECT MANAGEMENT

The project management structure has the main goal of controlling the overall progress of the work. This work package ensures that the project is conducted in accordance with EC rules (D1.1); its main objectives are to reach the objectives of the project within the agreed budget and time scales,

to coordinate the work of, and ensure effective communication between the partners, to assess the quality of the work and the deliverables; (D1.2) to maximize the potential for exploiting results, so as to manage all technical, commercial, financial and administrative issues and particularly the identification of the actions needed to be taken in case of deviation from project plan;

WP2: SYSTEM ARCHITECTURE AND BUSINESS MODELLING

This work package specifies the system requirements (D2.1), completes the outline system design and specifies the component interfaces (D2.2); it also reviews the system design and performance (M2); finally it investigates and assesses business models (D2.3).

WP3: TECHNOLOGICAL COMPONENT DEVELOPMENT

Designing an optimal, adaptive cross-layer thin client protocol, comprising a wireless medium transmission protocol, and image transmission, making use of supporting network services. Specific focus in put on definition of component interfaces (D3.1) and algorithmic work to provide the required adaptivity.

WP4: SERVICE MANAGEMENT FRAMEWORK

This work package designs and develops all components needed to have the correct service management to deliver the thin client service in a scalable and robust way. It provides the necessary information and services, as defined in the requirements of WP2, to the Operations Support Systems and the Business Support Systems.

For the first project year, focus is put on component interface definition (D4.1) and developing a first prototype of the implementation (D4.2)

WP5: EXPERIMENTAL VALIDATION

Main objective here is to provide system-wide validation of the MobiThin concepts. During the first year, the objective was to identify the demonstrators (D5.1) and to put a simulation framework into place (D5.2) to allow early validation of the MobiThin concept.

WP6: DISSEMINATION OF RESULTS

The objective of this work package is to give appropriate visibility of the project results to the relevant fora.

In addition to publishing results in the scientific community, emphasis is put on identifying a suitable strategy (D6.2) and setting up a project website (D6.1). Also standardization was initiated, targeting MPEG and ETSI.

4 WORK PROGRESS AND ACHIEVEMENTS DURING THE PERIOD

4.1 WP2 - SYSTEM ARCHITECTURE AND BUSINESS MODELLING

Activity type	RTD	Starting at M1
WP Leader	**T-Systems**	
Sub-tasks	Task 2.1 Specification of system requirements [T-Systems]	
	Task 2.2 Architectural design [Prologue]	
	Task 2.3 Business modelling [T-Systems]	
	Task 2.4 System review [NTUK]	
Participants	T-Systems**,** IBBT, Prologue, IMEC, NTUK, GET	
Deliverables / Y1	D2.1 System requirements [M4]	
	D2.2 System architecture [M6]	
	D2.3 Business models – first version [M12].	

Participant MM expenses – Total Project (TP) / Cumulated expenses Year 1 (CE)																
IBBT		**T-Systems**		**Prologue**		**IMEC**		**NTUK**		**GET/IT**		**JCP**		**TOTAL Project**		
TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	%
7	3,10	17	9,70	9	7,95	5	4,17	12	9,54	6	2,48	0	0	56	36,95	66,91

Table 2 - WP2 Summary and MM expenses

The main objective of WP2 is setting out the overall architecture of MobiThin, together with assessing the mutual impact of different architectures and business models. Setting out the overall architecture is subdivided and organized in three different tasks.

First a coherent set of 140 system requirements were specified based on market analysis, various use cases and application scenarios. The technical constraints, covering those related to network technology (current and anticipated technologies) and to server technology was taken into account. The thin client device hardware and software, together with its evolution were of crucial importance for this requirements capturing process.

Based on the defined set of requirements the MobiThin system architecture was defined and described. The architecture description is organized in basic building blocks, such as the MobiThin server, - client, the service management framework, the network control and additional external resources (e.g. application image- and data storage service). Detailed components, sub-components and the interaction in-between are described by a three level recursive approach. In order to outline compliance and open points, a mapping between the previous defined 140 requirements and building blocks, components and sub-components was done.

The first investigation and assessment of business models was tackled by a description of a generic business model framework and the development of enhanced definitions in the context of ICT approaches like the MobiThin system. Moreover, real life examples of business models in the already existing commercial thin client realm are given. Also within this task MobiThin business model scenarios were described, based on the defined business model framework. These scenarios are mapped to the MobiThin architecture and recommendations towards architecture and business interfaces derived.

The system review has been conducted, from two principle viewpoints:

(1) To ensure that all requirements were handled in the architecture and it's components

(2) To verify that component interfaces are consistent"

All objectives of WP2 scheduled for the first year of the project are achieved within the reported time period.

Deviations with regard to the DoW - Work plan

- No deviation occurred
- The deliverables and milestones due for the period were achieved and delivered on time

4.1.1 Task 2.1 – Specification of system requirements

The main objective of this first technical task of the MobiThin project was to build the foundation of all further achievements of the whole project by describing a complete set of requirements. This basic set of requirements is based on market analysis, market forecasts and various application scenarios for a mobile thin client system. Typical applications of mobile thin client systems in the areas of remote application access and nomadic users were defined and exemplarily described in four scenarios. For the definition of the requirements relevant aspects of the social, application and technical constraints were taking into account. It includes the different aspects from a network technology point of view, the necessary server technologies, the thin client mobile device, the thin client dedicated protocol stacks and the service management framework.

The market analysis of wired thin client solutions showed a steady increase of market shares compared to traditional solutions. This is mainly caused by the benefits of thin client solutions in the areas of initial hardware expenditure, reduction of IT operational costs, decrease of power consumption, increase of security as well as an increase of the staff productivity. Facing this with a still very dynamic market for mobile devices and nomadic/mobile system solutions, it can be admitted that bringing thin client computing functionality on mobile devices with or without telephony functions will be a promising new market segment.

Four MobiThin scenarios were defined to cover all important application aspects of mobile thin client solutions and illustrate them in real life situations: “Bringing the hospital to the patient’s home”, “Getting in touch with Paris”, “Keep scoring at school” and “Mobile thin office”. With respect to these scenarios social aspects are covering customer groups and the different types of social or business interaction. Important identified application areas are healthcare, entertainment, education, office applications and a whole range of well known legacy applications. Beside many other technical aspects of the defined four MobiThin scenarios the type of mobility is another parameter to distinguish the individual scenarios. Moreover specific features of the mobile client device (e.g. energy efficiency or lightweight

decoding to reduce hardware performance requirements) are characteristics to distinguish the scenarios.

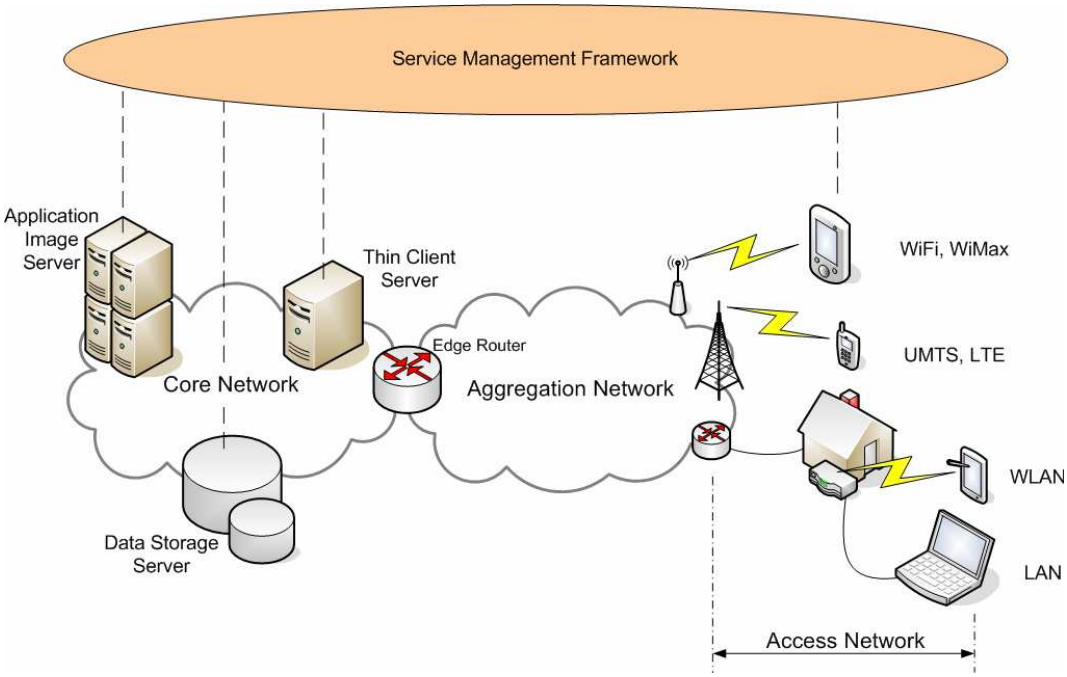


Figure 1: Overview on MobiThin system

The main achievement of this task is a complete set of 140 coherent requirements for a mobile thin client system, the MobiThin system, as presented in Figure 1. One of the basic considerations of this set of requirements is that the MobiThin system should work with the current available Internet and wireless communication network infrastructure. This communication network infrastructure includes the radio access network, the aggregation network and the core network. So the set of requirements is also defined with respect to all of this network partitions. Besides the network itself, additional infrastructural components and their related requirements are important and taken into account for the MobiThin system, too. The defined basic building blocks are the thin client server, the application image server, the data storage server, the mobile device running the thin client and the service management framework. Further detailing of the building blocks outlines demands on e.g. business support, user and infrastructure management. The set of defined requirements was categorized into mandatory and optional. 68 out of the 140 requirements were identified as mandatory.

The description of technical solutions was not part of this task. With this respect it was entirely focused on the definition and suitable documentation of the requirements. However, during the coming reporting timeframes of the project, new requirements can come up. Hence, from the start on, the set of requirements and the initial architecture are intended to be relevant and adequate for the full project duration, while exhibiting the necessary flexibility to cope with new requirements or adapt existing requirements to new scenarios situations.

The complete documentation of the work done can be found in the D2.1.

4.1.2 Task 2.2 – Architecture design

The task "Architectural Design" of work-package 2 is based on the results of the task "Specification of System Requirements". The main objective of this task was to cover the basic definitions, complete technical framework and a more detailed description of the overall MobiThin system architecture. That also includes the definitions of the constituent components and a high level specification of the external interfaces of these components. However, the detailed design of the architecture components themselves was done in work package 3 and work package 4.

Besides the description of the Service Management Framework and logical MobiThin system architecture, a description of how MobiThin can be integrated on IP Multimedia Subsystem (IMS) was provided. Two approaches were identified: the loose and the tight coupling IMS integration.

To elaborate on the MobiThin architecture in more detail, a two step approach was chosen. In addition to the high level description of the top level architecture layer, more detailed layers were developed in a recursive manner. Therefore each functional block of a more general layer was split into more detailed sub-blocks, according to the functionality they provide. Using this approach, the first three levels of numerous functional blocks and components (see Figure 2) were elaborated, starting with a basic client – server relationship: For the sake of simplicity, MobiThin architecture was considered as a traditional client-server architecture where the client is a piece of software running in its own environment and the server is also a piece of software running in its dedicated environment. The two pieces communicate with each other through the network.

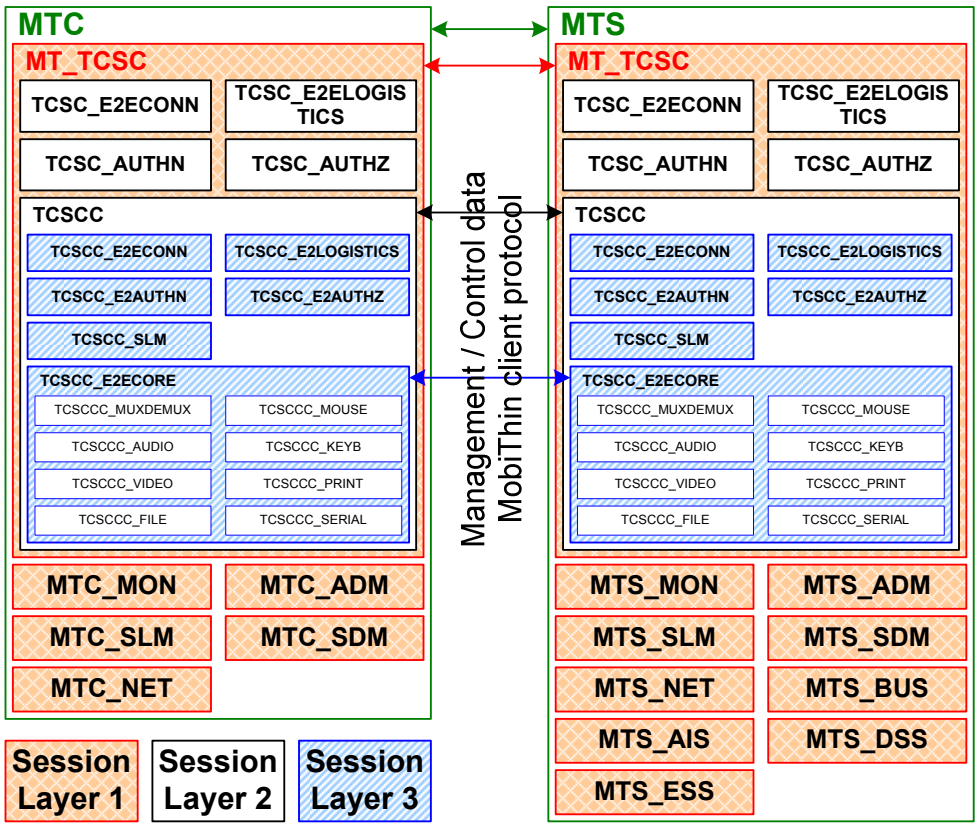


Figure 2: Three level MobiThin system architecture (Option 1)

The defined architectural components and sub-components allowed for the consideration of two options for the thin client service core component in the general architecture approach: Option 1, all data types go through one single channel of the thin client service core component (presented in Figure 2) and Option 2, each data type goes through its individual thin client service core component sub-component. The selection of the most appropriate option was an initial object of the tasks dealing with the implementation in work package 3 and work package 4.

Beside the description of the system architecture itself, a second objective of this task was also in strong relation to the "specification of system requirements" task of work package 2, which outlined requirements and scenarios for MobiThin. In order to outline compliance and identify potential open points, a mapping between the set of 140 requirements and building blocks, components and interfaces was done.

The complete documentation of the work done can be found in the D2.2.

4.1.3 Task 2.3 – Business Modelling

Beside the technical aspects, the business facets are essentials for a successful real-world deployment of a new system approach like the one developed within MobiThin. Especially the proper definition of business interfaces is of outstanding importance during the development phase in order to reduce integration effort and time to market. Therefore, the study of a mobile thin client service approach also has to cover business models and scenarios. To do so is the main objective of the task "business modelling". The first phase of the task was completed in the timeframe of this report and its major outcomes are described in the following. Those outcomes are the description of a generic business model framework and the development of enhanced definitions in the context of ICT approaches like the MobiThin system, the definition of a corresponding value network and complete business scenarios and moreover examples of business models in the already existing commercial thin client realm. IMS was presented as a possible service/network enabler for the MobiThin system as it provides some necessary mechanisms for network operators to deliver services according to some level of service agreements in a telecommunication network. An additional very important outcome is the derivation of recommendations towards architecture and business interfaces. To derive those recommendations the business scenarios were mapped to the MobiThin architecture.

The defined value network of the MobiThin architecture can be subdivided in different sub-value chains, namely an IT-based- and a mobile network sub-value chain (see Figure 3 left side). Based on the options of this sub-value chains and the degree of fragmentation (or number of business players) numerous different business scenarios can be defined. To outline the wide dimensions of potential scenarios, two extreme scenarios, named "single business player scenario" and "totally fragmented value system" were defined and give the limits of least and most complexity and number of potential players. To illustrate the spectrum in-between, two additional scenarios, called "telco oriented scenario" (see Figure 3 right side) and "internet assisted scenario" were defined exemplarily.

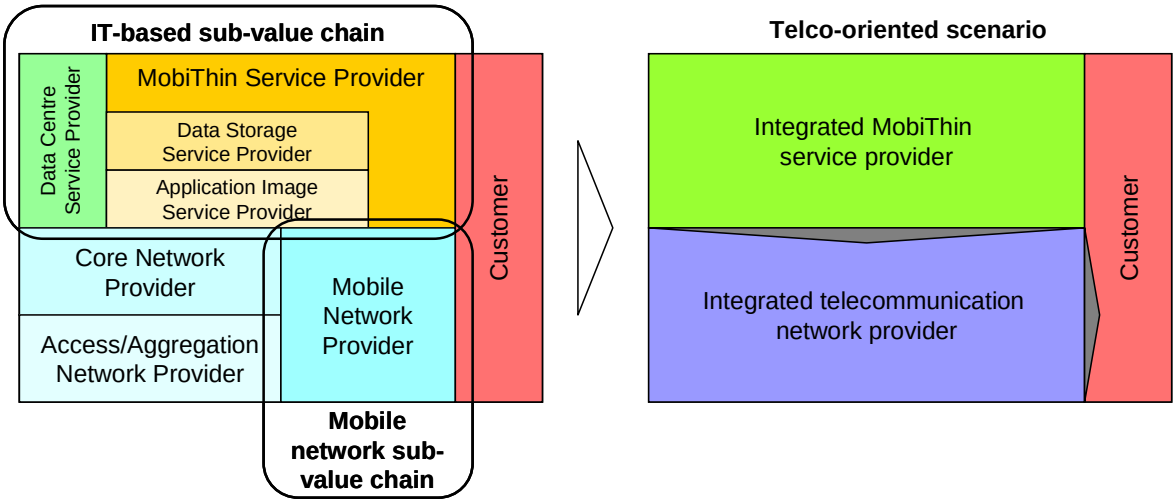


Figure 3: Value network of MobiThin with the two sub-value chains and the transformation into the Telco-oriented scenario

In addition to the defined basic business roles and possible business players, the generic interfaces were developed to align the business modelling work with the technical architecture as much as possible. These generic interfaces between two business partners, respective roles have to cover at least the four activities to check of the business relation, to check of user credentials, to check of charging data records and to check of technical configuration. These four generic interfaces were mapped on the "telco oriented–"and "internet assisted scenario" in order to detail the generic interfaces for the respective business relationship and to analyse possible open points concerning the architecture.

Finally consequences and recommendations towards the MobiThin architecture and its sub-components were derived from the findings of the preliminary business model studies. Those additional requirements will be used to complement the definition of the architecture and maximise the applicability of the developed solution across both the expected range of uses and value chains in the later phase of the project.

The complete documentation of the work done can be found in the D2.3. For further studies, it is planned to modify the run time of task 2.3. This task will not be stopped after month 12 and restarted in month 28, but continuously executed during the whole project life time in order to proof the different developments in the technical WPs and tasks in a more timely and interactive manner

4.1.4 Task 2.4 – System Review

This task is a project wide activity in order to align developments in WP3 and WP4 with the general system requirements and architecture specification of WP2. Discovered conflicts and inconsistencies will be solved by ad hoc action when required.

Major results of the first period of this task were the compliance of the set of 140 requirements as described in task 2.2. All requirements are covered by at least one building block, component or interface. The second important aspect is the development of the phase 1 component interfaces in WP3 and WP4. After the design of the generic architecture in WP2 (see task 2.2 results in section 4.1.2), both work packages further detailed the system architecture in the area of the management server, the thin client server, the MobiThin client and the users session concepts. A close collaboration was established between both WPs

allowing the overall consistency of the whole system, thereby achieving the targets of M2 as scheduled.

During the work of task 2.3, consequences and recommendations towards the MobiThin architecture and its sub-components were derived from the findings of the business model studies. Those additional requirements need to be revised or implemented in the current definition of the architecture. Two activities are planned as next steps. First the requirements will be checked and if necessary the architecture revised accordingly. Necessary adoptions in WP3 and WP4 will be proofed. The business modelling task 2.3 seems to be from highest evidence and impact on the architecture. Therefore the second activity and first major derivation of the project plan is the modification of the run time of task 2.3 as explained in section 4.1.3.

The complete documentation of the work done will be available after month 18 in the D2.4.

4.2 WP3 – TECHNICAL COMPONENT DEVELOPMENT

Activity type	RTD	Starting at M4
WP Leader	**IBBT**	
Sub-tasks	Task 3.1 Wireless medium optimization [IMEC]	
	Task 3.2 Image transmission for thin clients [GET]	
	Task 3.3 Adaptive thin client protocol [IBBT]	
Participants	IBBT**,** Prologue, IMEC, NTUK, GET	
Deliverables / Y1	D3.1 Phase I component interfaces [M9]	

Participant MM expenses – Total Project (TP) / Cumulated expenses Year 1 (CE)																
IBBT		**T-Systems**		**Prologue**		**IMEC**		**NTUK**		**GET/IT**		**JCP**		**TOTAL Project**		
TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	%
30	11,7	0	0	19	8,11	48	17,6	35,5	11,9	25	11,7	0	0	157,5	61,03	38,75

Table 3 - WP3 Summary and MM expenses

The main objective of this work package is the design of a remote display protocol to offer graphically demanding applications on resource-constrained and wirelessly connected devices. The inherently time-varying dynamics of a wireless connection pose important research challenges, such as limiting the user delay and reducing bandwidth requirements. Furthermore, the protocol has to be optimized in terms of battery power consumption, in order not to harm the claimed energy efficiency of the thin client computing paradigm.

The work is divided into three tasks. In the first task, led by IMEC, new wireless link layer transmission technologies are explored, focusing on both Quality of Service and power consumption reduction. The second task covers the upper layers of the OSI protocol stack and focuses on efficient graphics encoding. The third task is concerned with the design of a cross-layer, network-aware remote display protocol stacks. By analyzing monitoring

information on the network status, and taking into account static and dynamic terminal device variations, optimal parameter settings for each layer can be selected.

The Year 1 progress is in line with the original objectives

Deviations with regard to the DoW - Work plan

- No deviation occurred
- The deliverables and milestones due for the period were achieved and delivered on time

4.2.1 Task 3.1 – Wireless medium optimization

This task concentrates on the optimization of the wireless transmission medium, since the wireless link is the most error-prone part of the network connection. This involves both the selection of the appropriate QoS class to transfer data, and an optimization of the transmission scheme of the wireless card. The wireless network card has several modes (transmit, receive, idle and sleep mode) and the time spent in each state influences the energy drain from the device battery. Scheduling algorithms will be designed, in order to send all intended data over the network in the most efficient way, reducing the energy consumption to the minimum.

In Year 1, this task has started with an analysis of supporting mechanisms for Quality of Service (QoS) in existing radio technologies and has then focused on a thorough characterization of the energy consumption due to remote display protocol traffic.

Regarding the QoS analysis, studies were performed to assess the QoS mechanisms and traffic/service classes over different radio technologies including Universal Mobile Telecommunication System (UMTS), Long Term Evolution (LTE) and WiFi 802.11e. This step was important to identify the QoS classes suitable for a thin client application.

In order to assess the wireless link layer, a WiFi link simulator was built based on theoretical models and validated by measurements. Parameters such as channel path loss, coherence time, data rate and terminal mobility can be altered in order to influence the radio link conditions in a controlled manner. Two link-layer control mechanisms are plugged into the system. The first one is a state-of-the-art solution, called Dynamic Burst Profile Control (DBPC). The data is transmitted as fast as possible, thus allowing the terminal to sleep the rest of the time. The second mechanism is called Cross-Layer Control (XL-ctrl) for which a database from a benchmark is used to select the most energy-efficient combination of constellation and coding rate for transmission. This simulator is integrated with a thin client set-up, so that a thin client viewer and server communicate over the simulated WLAN network. Virtual Network Computing (VNC) was selected as remote display protocol, as it is open-source and widely uses.

Besides acting as a WiFi link simulator, the framework contains energy consumption models of the different parts of a wireless platform. This allows the characterization of the energy consumption for a variety of user scenarios and WiFi channel parameters. The first scenario is focused on office applications and consisted of a user typing a text and an email. A second scenario represented static browsing, where simple image and text based web pages were visited. In the third scenario, dynamic browsing was investigated. In this scenario Flash pages were visited and a YouTube movie was played. Some results are depicted in Figure 4 and Figure 5.

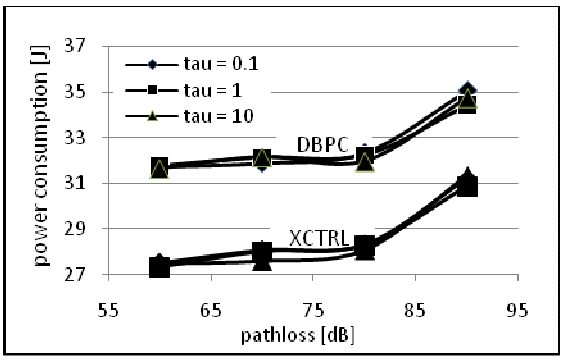


Figure 4 - Total power consumption for the dynamic browsing scenario

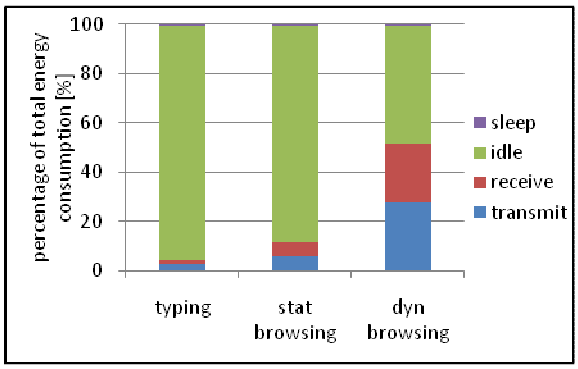


Figure 5 – Breakdown of the power consumption for a channel coherence time of 0.1s and a path-loss of 60dB. and the XL-ctrl algorithm. Only very few time is spent in sleep mode

The measurements give new insights in the impact of thin client traffic on the energy consumed by the wireless network interface. The channel path loss has a big impact, while the impact of the channel coherence time is rather minimal. The main share of the power consumption is spent in the idle state. As data may arrive at any moment, the wireless platform cannot go into sleep mode. Potentially high energy savings can be achieved if dynamic sleep time schedules would be introduced. The XL-ctrl algorithm is already a first step in this direction, with the platform going into sleep mode after sending data acknowledgements. In this case, this amounts for an energy saving up to 13 %. For all three scenarios, the transmission of data takes almost as much energy as data reception, although the very large majority of the traffic is downstream traffic. Energy saving schemes for wireless thin client terminals should thus not overlook an optimization of the energy transmission.

Lastly, VNC, an existing remote display architecture, was ported on the real NEC mobile phone named Ocean. This achievement will allow the project to perform during the second year specific measurements on a mobile phone within a wireless network test bed. The porting concerned the development and the adaptation of a original VNC software for Linux. A specific effort has been done to adapt the original source code to the constraints of the mobile device such as the screen size, the specific analogue pointing device similar to a mouse, and the integration to the phone applications management system. Then the components developed have been integrated as part of the task 5.3 and tested on the Ocean phone simulator.

Both the simulator and the Ocean platform are described in more detail in Deliverable 5.2 – Simulation Framework for the architecture. The results on energy consumption have been submitted to the WiOpts conference and will be included in Deliverable 3.2 – Phase I Components Ready For Integration (due in M15 – Year 2). The QoS studies can be consulted in the reviewer area on the collaborative tool, ProjectPlace.

4.2.2 Task 3.2 – Image transmission architecture

The main objective is to find a unitary and efficient way of representation and compression of the graphics to be displayed on the terminal, with an optimal trade-off between transmission bandwidth and decoder complexity. Because of the wide range of targeted applications, including even the most graphically demanding ones such as video editing software, the graphical content to be displayed is heterogeneous. The developed image transmission framework must be compliant with legacy applications and with the total MobiThin architecture, as defined in WP2.

In Year 1, two main achievements resulted from this task. The bandwidth requirements of VNC, a widely used remote display protocol, were drastically reduced by exploiting the redundancy in the graphics of subsequent display updates. Furthermore, the design and implementation of an image transmission framework, based on MPEG representation formats, was started.

The analysis of a sequence of graphical updates generated by a typical user session on a desktop computer has revealed a high level of redundancy. More specifically, a lot of updates resemble to a large extent to display updates transmitted earlier in the session. By storing well-chosen key display updates at the client, this redundancy is exploited and the required bandwidth is reduced. Figure 6 clearly shows how the amount of exchanged traffic is reduced by adding more key display updates to the client cache. A single cached display update yields already a bandwidth reduction of 20.56%. While the incremental benefit of additional cached display updates decreases, with 5 cached display updates the bandwidth reduction has increased to 34.40%. Another benefit from

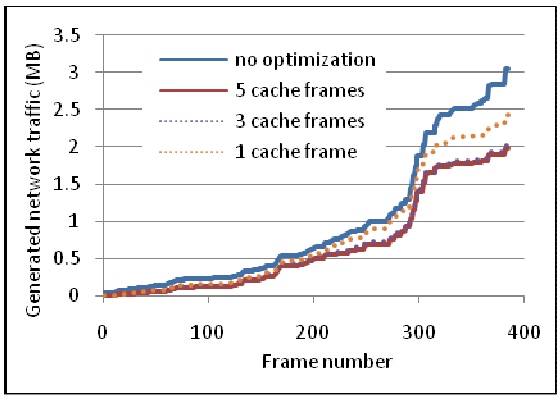


Figure 6 - Reduction in generated network traffic through the display update mechanism

the frame caching is the reduction of traffic spikes in the network traffic. Spikes are traffic peaks, typically occurring when large parts of the screen have to be updated, e.g. when the user switches to another application. Measurements indicated that traffic spikes are on average reduced by 33.10%. Traffic spikes typically occur when large parts of the screen have to be updated, e.g. when the user minimizes his application.
The mechanism of display update caching is only beneficial for office applications with major but infrequent screen updates, and cannot be applied as an overall solution. As a second contribution in this task, research and implementation started on a new architecture, making use of the MPEG BIFS and LASER representation formats. The MPEG compression schemes are nowadays efficiently exploited each and every time a particular multimedia content item (still image, video, audio, 3D…) should be compressed. Hence, the MobiThin consortium started by investigating their usefulness for heterogeneous visual content, typically for a desktop scene. By considering a set of four representative applications (text, static graphics, animated graphics and image), it was proved that the MPEG BIFS and LASER representations met the requirements of good user experience, low decoder complexity and strong compression. More specifically, a software convertor was built that translates the X11 content, generated by Linux applications, to MPEG BIFS. This is shown in Figure 7.

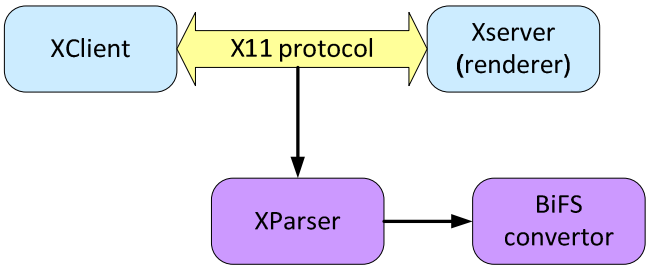


**Figure 7– X11 protocol messages are translated to BiFS
to demonstrate the suitability of the MPEG representation scheme for MobiThin purposes**

The graphical update caching mechanism has been published in the proceedings of the ATNAC 2009 conference and will be included in Deliverable 3.2 – Phase I Components Ready For Integration. The MPEG BiFS approach was presented and discussed on the MPEG meeting in February 2009, and will be described in detail in Deliverable 3.2 – Phase I Components Ready For Integration (due in M15 – Year 2).

4.2.3 Task 3.3 – Adaptive thin client protocol

The main objective for this task is to control the mode of the different protocols of the network communication stack. Depending on the thin client device activity and the network conditions, an optimal cross-layer setting of the protocols must be achieved with respect to energy consumption and user experience. Side objectives of this work package include the interface to the application of the adaptive protocol stack, handling connectivity loss and upstream user event communication. For Year I, two main achievements are highlighted: the development of a first adaptation mechanism, and the design of cross-layer framework and protocol architecture.

The developed adaptation mechanism chooses between two types of graphical encoding, depending on the amount of motion in the images to be sent from the server to the client.

Based on observations and measurements on the VNC-RFB protocol, it appeared that this wide-spread remote display architecture is not suited to relay multimedia data, such as video, to a thin client. The VNC protocol semantics are optimized for minor and infrequent screen updates, typical for office applications. However, applying VNC to relay fine-grained and complex color patterns, as generated by multimedia applications, leads to huge bandwidth requirements and a suboptimal user experience. For this type of graphics, the developed adaptation mechanism will encode the graphics through the H.264 video codec. The amount of motion in the graphics is continuously monitored, and based on a selection algorithm, the optimal encoding mode is chosen (VNC or H.264). Figure 8 shows the bandwidth reduction for multimedia applications when using the H.264 encoding for this type of graphics. From the figure, one could conclude that the streaming (H.264) mode takes less or only as much bandwidth as the VNC mode, even for static applications, and that consequently the streaming mode should always be activated. However, decoding a H.264 stream is much more CPU intensive than decoding VNC protocol messages. Operating continuously in streaming mode would thus violate the thin client principle.

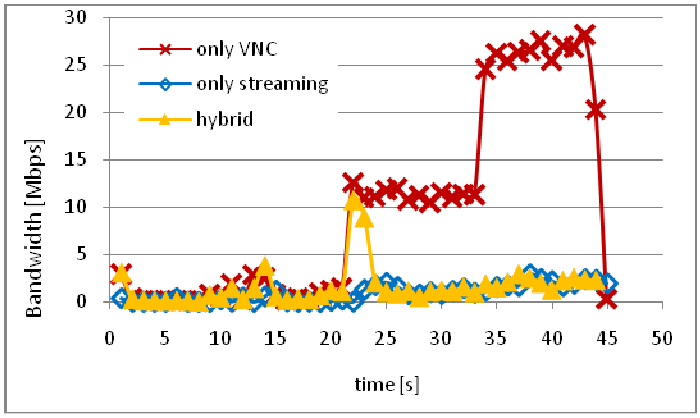


Figure 8- Bandwidth reduction achieved by the hybrid approach. between t = 0 and t = 20s, an office application is executed. At t = 20s, a video is started, and maximized to full-screen on t = 35s.

A second main achievement within this task was the design of a framework for the thin client protocol architecture, in accordance to the architecture defined by WP2. The thin client protocol is composed of different channels. Each channel can transport a different type of graphics, and can have a different network QoS. The channel based architecture allows for fine-grained control over different encodings and protocol settings. Furthermore, as the channel architecture is defined in a general way, legacy thin client protocols can be included, ensuring backwards compatibility of the MobiThin system. The cross-layer optimisation of the thin client protocol is organized through a Self Logistic Management (SLM) component for each user session. This SLM communicates with the SLM components of the channels, and the SLM components located at higher architectural levels. More details on the interfaces between these components can be found in Deliverable 3.1 – WP3 Component Interfaces.

As a last achievement in this task, a scan of possible cross-layer optimization tasks was performed. For every layer of the stack, from the physical layer up to and including the application layer, possible actions were defined. Every action was evaluated on its potential benefits, complexity and novelty. The investigations will continue in the first quarter of Year

2. In Phase II of the project (starting Q3), the most promissing algorithms will be implemented.

The hybrid protocol architecture has been published in the proceedings of the ATNAC 2009 conference and will be included in Deliverable 3.2 – Phase I Components Ready For Integration. The channel architecture was presented in Deliverable 3.1 – Phase I Component Interfaces. The complete WP3 architecture will be described in Deliverable 3.2 – Phase I Components Ready For Integration (due in M15 – Year 2)

4.3 WP4 – SERVICE MANAGEMENT FRAMEWORK

Activity type	RTD	Starting at M7
WP Leader	**Prologue**	
Sub-tasks	Task 4.1 Design and implementation of management framework [Prologue]	
	Task 4.2 Implementation of infrastructure management components [Prologue]	
	Task 4.3 Implementation of user management components [IBBT	
	Task 4.4 Implementation of business support components [Prologue]	
Participant	Prologue, IBBT, T-Systems, NTUK	
Deliverables / Y1	D4.1 Phase I component interfaces [M9]	
	D4.2 Service management framework [M12]	

Participant MM expenses – Total Project (TP) / Cumulated expenses Year 1 (CE)																
IBBT		**T-Systems**		**Prologue**		**IMEC**		**NTUK**		**GET/IT**		**JCP**		**TOTAL Project**		
TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	%
24	8,79	6	1,82	25	16,4	0	0	1	0	0	0	0	0	56	27,02	48,25

Table 4 - WP4 Summary and MM expenses

The goal of the activities in WP4 is to translate the management related components of the system architecture developed in WP2 into a service management framework. Functions needed to facilitate efficient service delivery are designed and developed in this WP. Important functions to be provided are related to proper management of the infrastructure, management of the users (and their current context), as well as to offering business support. As for the telecom market, components fulfilling these functions in part exist (e.g. billing, accounting, session management, …), emphasis in this WP will be put on components dedicated to the thin client service. These components, also entailing algorithmic design include

- User/application profiling in terms of typical CPU usage (in order to allow proper reservation on the server side)
- Selecting the most appropriate server farm for each thin client
- Migration of processes for load-balancing

The investigations on the management framework architecture design were carried out.

The deliverable **D4.1 – Phase I Component Interfaces** was the first deliverable of work package 4. It identifies and defines the interfaces between the WP4 system components that will be designed and developed during phase I of the project. In parallel, the same has been done for the WP3 system components, resulting in D3.1. These deliverables form a complete interface description of the MobiThin system architecture that was presented in D2.2. Figure 9 shows the list of components that compose MobiThin service management framework. They are responsible for handling all management data that the client and the server exchange.

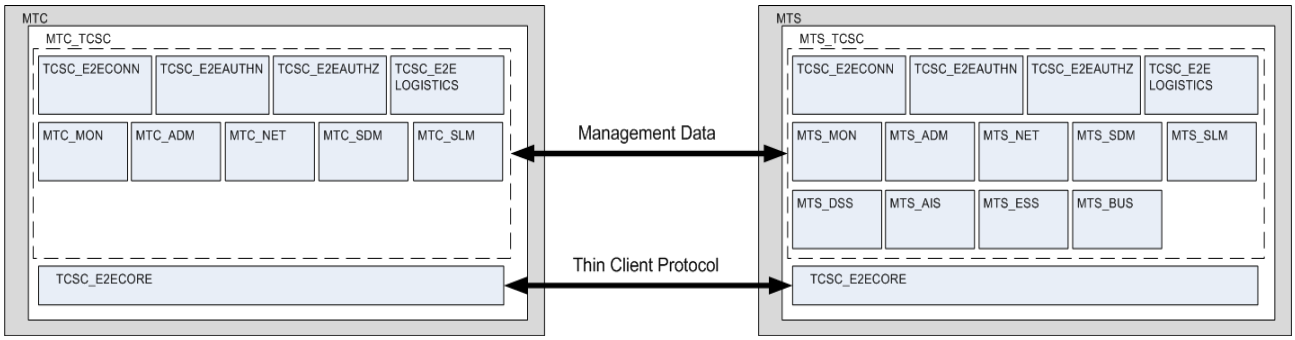


Figure 9 – Service management framework components

The analysis of existing frameworks and the definition of the component interfaces lead to the implementation of the first prototype of the MobiThin service management framework. This prototype is described in deliverable **D4.2 – Service Management Framework**. The deliverable describes supported features and implemented interfaces. It also provides all necessary information to install, configure and use implemented MobiThin components and interfaces.

Deviations with regard to the DoW - Work plan

- No deviation occurred
- The deliverables and milestones due for the period were achieved and delivered on time.

4.3.1 Task 4.1 Design and implementation of management framework

This task focuses on the analysis of the differences with existing wired thin client management frameworks and on providing the necessary inputs for modifications. The design of the components developed in tasks 4.2, 4.3 and 4.4 are also performed in this task, for consistency purposes.

Investigations on existing external components and frameworks were continued in parallel with the work on D4.1 and D3.1 deliverables. The goals were mainly to cope with the following tasks:

- Election of the more appropriate existing software that can be useful for MobiThin. For each functionality, the work consists in:
  - Finding the existing software,
  - Evaluating the software,(testing, review based, …)

  - Identifying whether it needs to be complemented or used as is. When the elected software needs to be complemented then an additional work consists in specifying how to complement it for MobiThin needs. When the elected software can be used as is then an additional work consists in specifying how to interface with it.
- Clear identification of the MobiThin building blocks to develop from scratch
- Continuous keep in touch with the state of the art technologies that may be of interest for MobiThin project.

Taking into account the requirements established in deliverable D2.1- System Requirements and the technical suggestions resulting from the market analysis and trends, this work was focused on the following functionalities and technologies:

- Administration, this functionality concerns the configuration of user settings, server settings, session settings, etc…
- Authentication, Authorization and Accounting, this functionality concerns the user management and the business support aspects.
- Monitoring, this functionality concerns the infrastructure management, including management servers, thin client servers and terminals,
- Virtualisation technologies, particularly Xen and Linux KVM are of interest to MobiThin project,
- IP-Multimedia Subsystem (IMS) technologies.

Regarding the selection of the existing software to build MobiThin components upon, our approach was to privilege existing open source software solutions, for both technical and economic advantages they offer. But we didn't exclude account proprietary and commercial solutions for functionalities either missing or not well supported by open source solutions.

At this time, analysis of a number of existing thin client management frameworks is finalized. Both existing wired oriented and wireless oriented frameworks were investigated. During this phase the following technologies and frameworks were adopted:

Technology/Framework	**Comment**
Linux Debian	Elected Linux distribution as the operating system on management servers, on thin client servers and on client devices. However the implementation should take into account possible portability to other platforms in the future.
OpenSIPS	This framework provides a mature Open Source implementation of a Session Initiation Protocol (SIP) framework. OpenSIPS is one of the fastest SIP servers suitable to dealing with the MobiThin requirements related to the authentication, authorization and accounting aspects.
Xen	**Xen** is an Open Source virtual machine monitor. It allows several operating systems to run concurrently on the same computer hardware.
Linux KVM	This technology provides a pure Linux kernel virtualization infrastructure. This technology appears to be very promising for its thinness, its easy set-up and its complete integration

	with the Linux Kernel.
Adaptive Communication Environment (**ACE**)	**ACE** is an open-source framework designed to provide abstraction and simplification of various aspects of system and network programming for multiple operating systems.
MySQL	**MySQL** engine and its related tools were chosen as Database Management system. **MySQL** works on many operating systems and is popular for both traditional and web oriented applications.
Java Platform, Enterprise Edition (Java EE)	**Java EE** had been elected to be used as a development and deployment platform for server management.

Table 5: Elected technologies and frameworks

Table 6 provides the list of the self service management framework components currently under development:

Component	Description
MobiThin self data manager (**MT_SDM**)	The first version is delivered in the deliverable **D4.2-Service management framework**. The **SDM** components provide access to MobiThin specific data (e.g. monitoring information, configuration information). This data can be stored in regular files or in a database. The **SDM** components provide access to MobiThin information, without the need to know how and where this data is stored.
MobiThin self logistics manager (**MT_SLM**).	The first version is delivered in the deliverable **D4.2 - Service management framework**. The Self Logistics Management (SLM) components are the steering components, making intelligent decisions on the configuration of thin client protocol parameters to optimize user experience, and to ensure proper functioning of the MobiThin system.

Table 6 : Self management components under development

4.3.2 Task 4.2 Implementation of infrastructure management components

Infrastructure management components aim to provide the QoS to the device, therefore they must be able to ensure proper load balanced server selection is done, as well as proper network selection. The implementation of such components is critical since thin client devices are monitored by the servers, and is significantly different compared to the wired scenario, where network availability is significantly more stable.

Table 7 provides the list of the MobiThin infrastructure management components currently under development:

Component	Description
administration sub-system (**MT_ADM**)	This task consists in the design and implementation of necessary functionalities that help administrators to cope with traditional administrative tasks. Main objects in concern with the management here are system services, terminal devices, user sessions, the network and the infrastructure servers. Typical useful management operations are the commands that allow starting an object, stopping an object and getting a status of an object. The architecture of this

	component is detailed in **D4.1 - Phase I Component**. Implementation is still in its very early status.
monitoring sub-system (**MT_MON**)	The first version of this component is delivered in **D4.2 Service management framework**. The architecture is detailed in **D4.1 - Phase I Component**. It is mainly built on top of **ACE** framework **and STL** library. The Monitoring Subsystem model is based on three main components: • **Sensor Agent:** The principal role of a sensor agent is to gather monitoring data and hand it off to its local node monitoring service. • **Node Monitor Service** (NMS). This is the monitoring core component. Its main roles are to catch data from sensor agents, process them then handle them off to control agents or to other nodes. • **Control Agent Library:** This component is currently designed to be embedded in applications (called here monitoring consumers). Its main role is to act as an interface between a node monitor service and applications.

Table 7: Infrastructure management components under development

Currently, the Monitoring sub-system implements several functions of low level interfaces specified in **D4.1 - phase I Component interfaces**. They are needed for the development of higher monitoring interfaces already described in deliverable **D4.1 – phase I component interfaces**. Those high level interfaces will be developed and included in **D4.3 – Components ready for integration**, scheduled for the end of March 2009.

The following activities are scheduled for phase II:

- Implementation of resources reservation sub-system (**MT_RSVMAN**).

4.3.3 Task 4.3 Implementation of user management components

Important functions to be developed in this task are related to proper management of the user accounts and their sessions. Existing ubiquitous resilience in the wired scenario will be extended to the wireless case, enabling the user to act seamlessly in the wired and wireless scenario. In addition advanced application provisioning of "thin client" applications or services will be performed, depending on user profiles and usage patterns, to deliver the right service at the right time.
Table 8 provides the list of the MobiThin user management components currently under development:

Component	**Description**
Connection, Authentication and Authorization managers (**MT_CONN**,	The first versions of these components are delivered in **D4.2 - Service management framework**. Authentication is handled externally by the **db_auth** module of the **OpenSIPS** proxy in cooperation with a **MySql** database. The **MT_AUTHN** component is implemented as an EJB3 bean in the Service management

MT_AUTHN, **MT_AUTHZ**)	archive. Connection set-up is done through the **SIP** protocol. SIP messages from clients are relayed by OpenSIPS proxy to the **WeSIP** application server. Authorization is handled by the EJB3 **MT_AUTHZ** component. Details on the design and implementation of all previous components are provided in the deliverable **D4.1 – Phase I Component interfaces** and in the deliverable **D4.2 - Service management framework**.
Data Service Manager (**MT_DSS)**	This component maintains the personal data of the users (e.g. Word-documents, photos, etc). As stated in D2.1 and D2.2 deliverables, the **DSS** can be provided by an external Data Storage provider. Since a user's session is not always started on the same MobiThin server, the user's data should be maintained on some kind of network attached storage. Furthermore, session migration requires that the user's data is stored on a location that can be accessed both from the original server and the destination server. The MobiThin project does not aim to design an optimized **DSS**. However, the MobiThin project has to provide the required interfaces to support a Data Storage Service. The current implementation only has limited functionality concerning user data storage. In fact, the **DSS** is implemented as a standard **NFS**-server, without additional features.
Session manager component (**MT_SESMAN**)	The first version of this component is finalized in **D4.2 – Service management framework**. The session manager is a component distributed on all MobiThin end-points (Management server, Thin Client Terminal, Thin Client Server). It interacts strongly with the other Service management framework components. At this time, as these interacting components are still under development, the interfaces they would provide to the session manager are emulated. The session manager is implemented using a Java EE platform. Details on the architecture and implementation of this component are provided in the deliverable **D4.1 – Phase I Component interfaces** and in the deliverable **D4.2 - Service management framework**.

Table 8: User management components under development

The following activities are scheduled for phase II:

- Design and implementation of application image service (**MT_AIS**)
- Design and implementation of profiling manager (**MT_PROFMAN**)

4.3.4 Task 4.4 Implementation of business support components

Based on the WP2 requirements work and task 4.1, components will be developed to:

- Log service usage
- Provide the necessary information to Telco Business Support System framework (monitoring, accounting, billing, perceived user QoS, etc.)

Design and specifications of business models is now finalized within the task 2.3. The resulting work states some suggestions and recommendations on the design and implementation of business support components to develop in this task. Details are provided in the deliverable D2.3 – Business models first version. This will be used as an input for task 4.4.
The design and implementation of MobiThin business sub-system (**MT_BUS**) is scheduled for phase II of MobiThin.

4.4 WP5 – EXPERIMENTAL VALIDATION

Activity type	RTD	Starting at M5
WP Leader	**NTUK**	
Sub-tasks	Task 5.1 Definition of POC demonstrators [NTUK]	
	Task 5.2 Simulation driven validation [IMEC]	
	Task 5.3 Component Integration [NTUK]	
	Task 5.4 Emulation driven validation [IBBT]	
	Task 5.5 Lab-trials [IBBT]	
Participant	NTUK, IBBT, T-Systems, Prologue, IMEC, GET	
Deliverables / Y1	D5.1 POC demonstrator definition – first version [M6]	
	D5.2 Simulation framework for the architecture [M12]	

Participant MM expenses – Total Project (TP) / Cumulated expenses Year 1 (CE)																
IBBT		**T-Systems**		**Prologue**		**IMEC**		**NTUK**		**GET/IT**		**JCP**		**TOTAL Project**		
TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	%
18	4,12	6	0,13	27	6,64	20	12,5	20	7,98	9	3,06	0	0	100	34,42	34,42

Table 9 -WP5 Summary and MM expenses

The main objective of WP5 is the validation of the MobiThin System. The validation is done by simulation, emulation and lab trials tests. The WP5 is split in 5 tasks, aiming to specify the tests, to define the test environments with simulation or emulation of parts of the MobiThin system, to integrate the developed components and to perform tests.

The work is divided in 5 tasks. The objective of Task 5.1 consists of specifying the proof of concept demonstrators to be realised during the first phase of MobiThin. The task 5.2 objective is to define the simulators to be used for the validation and assessment of the MobiThin system. The objective task 5.3 aims to integrate the components developed in WP3 and WP4 in order to build significant parts of the Mobithin system that will then be tested in other WP5 tasks.
The latter tasks are not yet started. The objective of task 5.4 will be to test the MobiThin system on wide scale distributed environments. Finally the objective of task 5.5 will be to

assess the MobiThin system behaviour in realistic environments in order to gain insight in potential issues when deploying a MobiThin infrastructure.

The Year 1 progress is in line with the original objectives

Deviations with regard to the DoW - Work plan

- No deviation occurred
- The deliverables and milestones due for the period were achieved and delivered on time.

4.4.1 Task 5.1 Definition of POC demonstrators

The main objective of this first task of WP5 was, based on the requirements identified in WP2, to identify the main use cases that will be demonstrated during the first phase of the project.

Brainstorm sessions were handled by each partner and then reviewed, and consolidated during the consortium meeting handled in Berlin, in order to identify the demonstrations able to meet the project objectives. In particular, the aim of the demonstration identified was to meet the requirements as defined in the System requirement document (D.2.1), and to be in line with the system architecture (D.2.2).

The demonstrations identified have two goals:

- First, they will allow identifying the limitations of the current Thin Client system over wireless links,
- Secondly they will allow validating and measuring the improvements studied and developed during the first phase of the project.

As a main achievement of this task, several demonstrations where identified to meet the different project objectives and recorded in the document “Proof Of Concept Demonstrator Definition” document (D5.1).

For identifying the current limitations of the thin client system over wireless links, a first demonstration will focus on the characteristics of existing thin client protocols over a wireless network. A second demonstration will consist of porting a thin client protocol to work on a mobile device. This will also allow identifying the limitations of mobile thin client, and will allow having a baseline of a real mobile thin client that will then be used in the next phase of the project to validate the protocol optimizations.

For validating and measuring the improvement of the mobile thin client protocols, a first demonstration related to the wireless link optimization will allow measuring the energy consumption of the wireless components and to compare it with other state-of-the-art solutions. A second demonstration will focus on the image transmission and will investigate the benefits of new MPEG standards (LASeR, BiFS) for thin client. A third demonstration will focus on the adaptive protocols validation in order to cope with the changes in the environment and the improvement of QoE, the limitation of the bandwidth usage as well as the CPU loads.

For validating the Service Management Framework function that is defined during the first phase of the project, a first demonstration will focus on the user configuration and user session management. A second demonstration will focus on the Session Migration from one

thin client server to another with minor impact on the user's QoE. A final demonstration will focus on the management of peripherals connected on the Thin Client.

4.4.2 Task 5.2 Simulation driven validation

The main objective of this task was to identify the different simulators that will be used during the MobiThin project. Each of the simulators is presented with individual goals, description, expected tests, and limitations of its use.

As a main achievement of this task, five simulators have been identified. Each partner has identified what suitable simulator will be used during the project. Each simulator has been described in the document titled "Simulation framework for the architecture" (D5.2). The following information has been identified:

- The objectives of each simulator. Each simulator has a different role and goals for the validation of the MobiThin system.
- The framework description: an overview of the functioning of the simulator.
- The expected tests: they will serve to assess and validate the performance of the MobiThin environment.
- The limitations: the boundary conditions under which the simulator gives reliable results.

The five simulators identified are:

- Remote Display Protocol Testbed: This adaptable platform allows to asses the performance of the MobiThin protocol under different scenarios of network impairment, applications, and terminals.
- MPEG Content Representation (BIFS, LASER): This framework consists of two applications: a Converter at the Server that transforms graphical content into MPEG, and a player at the Terminal side.
- Thin Client Mobile Device Simulator (OCEAN): It simulates the porting of a Thin Client application to a mobile phone environment.
- WiFi NS2 Simulator: It consists of a simulator built in NS2 that provides support for simulation of the lower layers and wireless link of the MobiThin protocol. It profits from an energy-optimized solution that outperforms the available state-of-the-art solutions.
- Architecture Simulator: It is a discrete-event based simulator that performs multi-user, multi-server, performance, and scalability tests of the MobiThin software hardware nodes.

The general goal of the simulation framework, comprising individual simulators, is first to provide a validation to the MobiThin system, and then to assess its performance. Besides the simulation framework will be used to evaluate the scalability and robustness of the MobiThin system.

4.4.3 Task 5.3 Component Integration

The main objective of this task is to integrate the components developed in WP3 and WP4. The output of this task will end up in integrated and tested software components that will be used in the task 5.4 Emulation driven validation and 5.5 Labs trials.

It should be noted that this task is not completed. Thus this report gives the progress reached until the end of December 2008.

As a main achievement, the development environments (i.e. the required tools and testing software) were set-up, and the integration of the components developed as part of WP3 and WP4 has started to be integrated thereby enabling to perform tests and verify the correct behavior of the integrated components.

The development of components developed as part of the task named "Wireless medium optimization" (Task 3.1) has started to be tested in the NS2 simulator. This NS2 simulator has further been integrated with a PC-based thin client. The work is still under progress.

The development of components developed as part of the task named "Image transmission architecture" (Task 3.2) has started to be integrated into the MobiThin system. The work is still under progress.

The development of components developed as part of the task "Adaptive thin client protocol" (Task 3.3) has started to integrated into the MobiThin system. Components relating to the adaptation mechanism have been integrated and tested. The work is still under progress.

The integration of the VNC Viewer modified to be integrated with the OCEAN mobile simulator has been achieved. First the Thin Client Mobile Device Simulator was set-up. Then the VNC components and some platform components needed to support the VNC Viewer, were updated, integrated and debugged for the OCEAN mobile platform. .

The Ocean target platform was then set-up. The VNC application was then ported and integrated on this target mobile platform. An Integration phase was performed to test and assess the application behaviour in the OCEAN embedded mobile device. Finally a test platform was put in place consisting of: the OCEAN mobile phone, a PC running a VNC server, and either a wired Ethernet network or a wireless WIFI environment. This testing environment was used to verify the integrated component in an end-to-end system.

Regarding WP4 components, the first step engaged was the integration of third party components needed for the development and the execution of MobiThin components. In this phase ACE, OpenSIPS, Xen, Linux KVM, MySQL and Java NetBeans were integrated in Linux Debian.

Some of these frameworks required straightforward installation and configuration. Some others, such as Xen, required complete build process, with additional patches, to support newer functionalities and to make them compatible with the version of Linux Debian and the hardware we are working on.

The second step consisted in the beginning of the integration of the MobiThin components with each other and also with the external components. During this phase the integration of the MobiThin authentication manager with the MobiThin connection manager and with the MobiThin authorization manager was achieved. Their integration with the other MobiThin components has not yet started. The integration of the other WP4 components with the third party components they depend on has started. The complete integration of these components with each other and with the third party components will be continued and finalized during phase I and phase II of MobiThin project.

4.5 WP6 –DISSEMINATION OF RESULTS

Activity type	RTD/Others	Starting at M1
WP Leader	JCP	

Sub-tasks	Task 6.1 Dissemination Material & Publication Policy **[JCP]**
	Task 6.2 Standardisation **[JCP]**
Participant	JCP / IBBT / T-Systems / Prologue / IMEC / NTUK / GET
Deliverables / Y1	D6.1: project web site set-up [M4]
	D6.2: project communication and dissemination plan [M6]

Participant MM expenses – Total Project (TP) / Cumulated expenses Year 1 (CE)																
IBBT		**T-Systems**		**Prologue**		**IMEC**		**NTUK**		**GET/IT**		**JCP**		**TOTAL Project**		
TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	TP	CE	%
4	2,67	2	0,08	4	0,19	2	1,42	2	0,06	2	0,39	4	1,94	20	6,75	33,73

Table 10 - WP6 Summary and MM expenses

The main objective of WP6 is to give appropriate visibility of the projects results through several actions. Both sub-tasks described below were dedicated to achieve this main objective.

Deviations with regard to the DoW - Work plan

- No deviation occurred
- The deliverables and milestones due for the period were achieved and delivered on time.

4.5.1 Task 6.1 Dissemination Material & Publication Policy

In addition to D6.2 (Project Communication and Dissemination Plan) that has been delivered on July 1st, 2008, the following actions can be pointed out:

The MobiThin factsheet has been produced and, at the same time, a poster presenting MobiThin "at a Glance" was designed and printed. It was presented during the "Future Internet Assembly" organised in BLED [Slovenia -April 1st - 2nd, 2008], MobiThin being one project signing the Bled declaration.

MobiThin has been actively involved in the FIRE and EIFFEL initiatives of the EC. Piet Demeester and Jean-Charles Point participated to the Future Internet Assembly in Bled (31 March - 1 April 2008) and Madrid (9 - 10 December 2008), to the EIFFEL think tank meeting (Frankfurt, 30 September - 1 October 2008) and to the FIRE technical expert group meetings (Paris, 10-11 Sept 2008, Brussels 8-9 Jan 2009)

MobiThin objectives were presented to the NEM platform through their newsletter N^{r} 9 issued in March 2008.

Two technical posters were also printed allowing the presentation of WP3 & WP4's activities during the NEM Summit. Besides the IBBT presentation, entitled "Bringing Thin Clients to the Mobile World", a booth has been booked and demonstrations were performed. Through posters of the WP3 and WP4 activities and an attractive demo with state-of-the-art thin client devices (Asus EEE), visitors were attracted mainly from academia and universities. It has been the occasion to identify other related projects, e.g. Surrey University VISNET II.

The website described in 6.1.8 is an important tool for the MobiThin dissemination actions.

The Tables of Publications, conferences and contributions to standards below summarize our main disseminating actions.

Authors	**Paper title/ Tutorial title**	**Name of journal, conference, etc.**	**Vol., no., pages, location**	**Date**	**Ref ? (Y/ N)**
W. Vereecken, L. Deboosere, P. Simoens, B. Vermeulen, D. Colle, Ch. Develder, M. Pickavet, B. Dhoedt, P. Demeester.	Power Efficiency Of Thin Clients	ETT2008 European Transactions on Communications	**Submitted for review on September 25, 2008**		Y
B. Vankeirsbilck, P. Simoens, L. Deboosere, B. Dhoedt, F.-J. Westphal, T. Plantier, B. Lecroart, F. Preteux, A. Dejonghe, J.-C. Point.	Bringing Thin Clients to the Mobile World	NEM Summit 2008 Saint-Malo, France	*Published in proceedings on CD-ROM*	October 13-15, 2008	Y
P. Simoens, P. Praet, B. Vankeirsbilck, J. Dewachter, L. Deboosere, F. De Turck, B. Dhoedt, P. Demeester.	Design and implementation of a remote display protocol to optimize multimedia experience on thin client devices	Australasian Telecommunications Networks and Applications Conference ATNAC 2008 - Adelaïde, Australia	*Published in proceedings on CD-ROM*	December 8 - 10, 2008	Y
B. Vankeirsbilck, P. Simoens, J. De Wachter, L. Deboosere, F. De Turck, B. Dhoedt, P. Demeester.	Bandwidth Optimization for Mobile Thin Client Computing Through Graphical Update Caching	Australasian Telecommunications Networks and Applications Conference ATNAC 2008 - Adelaïde, Australia	*Published in Proceedings on CD-ROM*	December 8 – 10, 2008	Y
B. Vankeirsbilck, P. Simoens, L. Deboosere, F. De Turck, B. Dhoedt, P. Demeester.	Demanding Applications on Resource constrained Mobile Devices	ICT MobileSummit 09 10-12 June 2009 Santander, Spain	**Under review/Acceptance process**		N

Authors	Paper title/ Tutorial title	Name of journal, conference, etc.	Vol., no., pages, location	Date	Ref ? (Y/ N)
L. Deboosere, M. Kind, A.Taguengayte, P. Simoens, B. Vankeirsbilck, FJ. Westphal, T. Plantier, F. De Turck, B. Dhoedt P. Demeester	MobiThin Management Framework: Design and Evaluation	MobiSys09 22-25 June 2009-01-29 Krakow, Poland	**Under review**		Y
W. Vereecken, L. Deboosere, D. Colle, B. Vermeulen, M. Pickavet, B. Dhoedt, P. Demeester	Energy Efficiency in Telecommunication networks	Networks & Optical Communications (NOC) 2008 1-3 July, 2008, Krems, Austria	*Published in proceedings on CD-ROM*	July 1-3, 2008	Y
P. Simoens, B. Vankeirsbilck, L. Deboosere, F. De Turck, B. Dhoedt P. Demeester, R. Torrea-Duran, C. Desset	Characterization of Energy Consumption in thin clients due to protocol data transmission over	WIOPTS 2009 International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks June 23-27, 2009, Seoul, Korea	**Under review**		Y
W. Vereecken, W. Haerick, C. Develder, D. Colle, B. Vermeulen, M. Pickavet, B. Dhoedt P. Demeester	Power Consumption Of Mobile and Wireless Thin Clients	WWRF Wireless World Research Forum Meeting 21 13-15 October 2008, Stockholm, Sweden	Published in proceedings on CD-ROM	October 13-15, 2008	N
M. Mitrea, P. Simoens, B. Joveski, B. Vankeirsbilck, A. Tanguengayte, F. Preteux	BiFS based approaches to remote display for mobile thin clients	Mathematics of Data/Image Coding, Compression, and Encryption with Applications XII part of the SPIE Optics & Photonics, San Diego CA, August 2009	**Under review**		

Table 11 - MobiThin Year 1 publications

Authors	Conference title	Place	Date
B.Vankeirsbilck P. Simoens, J. De Wachter, L. Deboosere, F. De Turck, B. Dhoedt, P. Demeester	Bandwidth Optimization for Mobile Thin Client Computing	Australasian Telecommunication Networks and Applications Conference **ATNAC 2008 - Adelaïde, Australia**	December 7-10, 2008
P.Simoens P. Praet, B.Vankeirsbilck, J. De Wachter, L. Deboosere, F. De Turck, B. Dhoedt, P. Demeester	Presenting multimedia on thin client devices	Australasian Telecommunication Networks and Applications Conference **ATNAC 2008 - Adelaïde, Australia**	December 7-10, 2008
P. Simoens, B.Vankeirsbilck	Bringing Thin Clients to the Mobile World	**2008 NEM Summit - Saint-Malo, France**	October 13-15, 2008
W. Vereecken, L. Deboosere, D. Colle, B. Vermeulen, M. Pickavet, B. Dhoedt, P. Demeester	Energy Efficiency in Telecommunication Networks	Networks & Optical Communications (NOC) 2008, Krems, Austria	1-3 July, 2008

Table 12– MobiThin Year 1 Conferences presentations

Authors	Contribution title	references	Date
M. Mitrea, P. Simoens, B. Joveski, B. Vankeirsbilck, A. Taguengayte, F. Preteux	Novel approaches to remote display representations: BiFS-based solution and its deployment within the FP7 MobiThin project	MPEG Meeting: ISO/IEC JTC 1/SC 29/WG 11 M16058	Lausanne, Feb. 2009

Table 13– MobiThin Year 1 Contributions to standards

4.5.2 Task 6.2 Standardisation

Liaison and dissemination in the appropriate standard bodies were identified and run as follows:

Regarding MPEG, the four 2008 meetings (Antalya in January, Archamps in April, Hanover in July, and Busan in October) allowed the MobiThin consortium member to monitor the technological developments connected to the MPEG-4 in general and to the BIFS and

LASER in particular. Under this framework, the most representative for the project are the documents M15732 (connected to the amendments on scene representation) and M15793 (about the Rich Media UI framework).

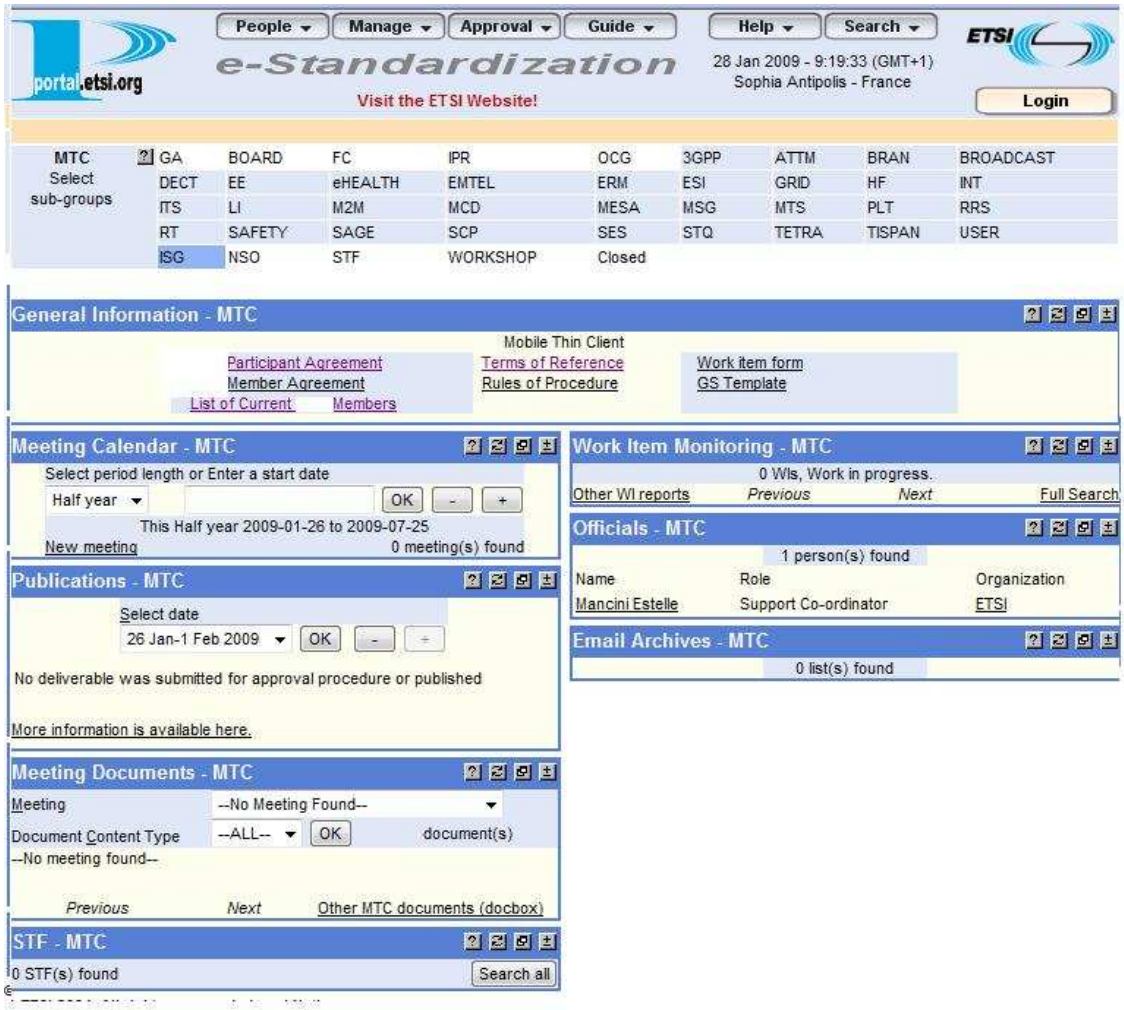
Contacts were also taken with ETSI and several meetings organized between JC. Point and Ultan Mulligan who attended the Berlin meeting [April 2008] to present the whole process.

A draft of "Term of References" was agreed in Summer 2008; due to the legal aspects for partners to agree on, the whole process took more time that initially forecasted but the ISG will be created [Mobile Thin Client Computing (MTC)] at least with four partners of MobiThin: IBBT, T-Systems, GET/IT and JCP;

IMEC could join the process as a participant due to his ongoing membership status.

The advances of the MobiThin project concerning a novel MPEG-based remote viewer are to be presented at the following MPEG meeting (to be held in Lausanne in February 2009), cf. document ISO/IEC JTC 1/SC 29/WG 11 M16058 entitled **"Novel approaches to remote display representations: BiFS-based solution and its deployment within the FP7 MobiThin project**" authors Mihai MITREA, Pieter SIMOENS, Bojan JOVESKI, Bert VANKEIRSBILCK, Abdeslam TAGUENGAYTE and Françoise PRETEUX.

Regarding the ETSI ISG, the process is in its last stage (under signature) and the kick-off meeting is now planned for May 20, 2009 to be held in Sophia-Antipolis (ETSI premises).



- **Deviations from Annex I**

No deviation to be reported

- **Use of resources**

With regards to a theoretical split of human resources, WP6 has slightly under spent but with the ETSI ISG launching, the period 2 should balance the related MM expenses.

5 DELIVERABLES AND MILESTONES TABLES

5.1 DELIVERABLES (EXCLUDING THE PERIODIC AND FINAL REPORTS)

Del. no.	Deliverable name	WP no.	Lead participant	Nature	Dissemination level	Due delivery date from Annex I	Delivered Yes/No	Actual / Forecast delivery date	Comments
D1.1	Project Reference Manual	1	**JCP**	R	RE	M3	Y	31/03/2008	An updated version (V2.0) has to be provided on Feb 16th, 2009
D2.1	System requirements	2	**T-Systems**	R	PU	M4	Y	30/04/2008	*
D6.1	Project web site set-up	6	**JCP**	P	PU	M4	Y	30/03/2008	*www.mobithin.eu
D1.2	Project Quality Insurance Manual	1	**JCP**	R	RE	M6	Y	01/07/2008	*
D6.2	Project communication and dissemination plan	6	**JCP**	R	PU	M6	Y	01/07/2008	*
D2.2	System architecture	2	**T-Systems**	R	RE	M6	Y	30/06/2008	*
D5.1	POC demonstrator definition – first version	5	**NTUK**	R	PU	M6	Y	30/06/2008	*
D3.1	Phase I component interfaces	3	**IBBT**	R	PU	M9	Y	30/09/2008	* D3.1 & D4.1 are complementary in covering architecture and components
D4.1	Phase I component interfaces	4	**Prologue**	R	PU	M9	Y	30/09/2008	
D2.3	Business models – first version.	2	**T-Systems**	R	PU	M12	Y	30/12/2008	*

D4.2	Service management framework	4	**Prologue**	P	RE	M12	Y	30/12/2008	Files compiled in the prototype uploaded under ProjectPlace
D5.2	Simulation framework for the architecture	5	**IMEC**	P	RE	M12	Y	30/12/2008	Files compiled in the prototype uploaded under ProjectPlace

Table 14 – DELIVERABLES

* Deliverables that are identified as PU (public) are presented in the website (www.mobithin.eu): an executive summary is available for download and our contact emails are given allowing interested people to request for the full text.

5.2 MILESTONES

Milestone no.	Milestone name	Due achievement date from Annex I	Achieved Yes/No	Actual / Forecast achievement date	Comments
M1	**MobiThin system requirements specification ready**	**M4**	**Yes**	**/**	**Availability of D2.1**
M2	**MobiThin system architecture review**	**M9**	**Yes**	**/**	**Verification against requirements D2.1 / 2nd review planned / spring 2009**
M3	**Simulation framework available**	**M12**	**Yes**	**/**	**Simulation results available on sample scenarios**

Table 15 – MILESTONES

6 PROJECT MANAGEMENT

6.1.1 Consortium management tasks and achievements

WP1	**Project management**	
Activity type	MGT	Starting at M1
WP Leader	**JCP**	
Sub-tasks	Task 1.1 Project Organization and Management	
	Task 1.2Project Quality Management	
Participant	JCP, IBBT, Prologue, GET	
Deliverables / Y1	D1.1: Project Reference Manual	
	D1.2: Project Quality Insurance Manual	
	D1.3: First period Progress Report [M12]	

The WP1 is devoted to ensure an efficient project management in accordance with the FP7 rules, including interfacing to the European Commission. It addresses budget and contractual obligations follow-up, communication between partners and good quality of the work performed and also push to maximize the potential of exploiting results.

	WP1 (M1-M30)			WP2 (M1-M30)			WP3 (M4 - M30)			WP4 (M7 - M30)			WP5 (M5-M30)			WP6 (M1-M30)			total project			
	total project	Theoric year1	cumul M12	total project	Theoric year1	cumul M12	total project	Theoric year1	cumul M12	total project	Theoric year1	cumul M12	total project	Theoric year1	cumul M12	total project	Theoric year1	cumul M12		Theoric year1		% total project
IBBT	5,5	2,2	2,17	7	5,43	3,10	30	14,21	11,66	24	14,77	8,79	18	4,19	4,12	4	1,6	2,67	88,5	42,4	32,52	36,74
T-Systems	0	0	0,00	17	12,46	9,70	0	0	0,00	6	3,69	1,82	6	1,49	0,13	2	0,8	0,08	31	18,44	11,73	37,85
Prologue	4	1,6	1,90	9	7,81	7,95	19	9	8,11	25	10,38	16,40	27	7,25	6,64	4	1,6	0,19	88	37,64	41,21	46,83
IMEC	0	0	0,00	5	4,2	4,17	48	22,7	17,62	0	0	0,00	20	9,3	12,49	2	0,8	1,42	75	37	35,70	47,60
NTUK	0	0	0,00	12	7,7	10,06	35,5	16,8	11,90	1	0,2	0,00	20	5,8	7,98	2	0,8	0,06	70,5	31,3	30,01	42,56
IT	1	0,4	0,33	6	4,43	2,48	25	11,84	11,74	0	0	0,00	9	2,82	3,06	2	0,8	0,39	43	20,29	17,99	41,84
JCP	14	5,6	5,24	0	0	0,00	0	0	0,00	0	0	0,00	0	0	0,00	4	1,6	1,94	18	7,2	7,19	39,93
	24,5	9,8	9,65	56	42,03	37,47	157,5	74,55	61,03	56	29,04	27,02	100	30,85	34,42	20	8	6,75	414	194,27	176,34	
Forecasted in Dow	D1.1 = 0,5 MM D1.2 = 0.5 MM D1.3 = 8 MM			D2.1 = 13,5 MM D2.2 = 13,5 MM D2.3 = 4 MM			D3.1 = 32 MM			D4.1 = 14 MM D4.2 = 11 MM			D5.1 = 6 MM D5.2 = 31,5 MM			D6.1 = 1 MM D6.2 = 2 MM						
							D3.2 = 51 MM but for M15			D4.3 = 14 MM but for M15												

Table 16 – WP1 Summary and total project MM expenses

Deviations with regard to the DoW - Work plan

- No deviation occurred
- The deliverables and milestones due for the period were achieved and delivered on time.

Task 1.1 - Project Organization and Management

During this first reporting period, WP1 coordinated the financial, legal and administrative work in the consortium.

The WP1 has firstly addressed all the administrative matters relative to the launching of the contract:

- The distribution of the contract and Consortium Agreement,
- The budget distribution (agreement and payment)
- The installation of the Collaborative tool,
- The mailing lists,
- The templates of documents to be used during the project time life.

Further to the emails exchanges requested by the daily activity of the project (assistance to partners), WP1 assisted those who hosted the project meetings in organizing them (practical aspects as hotels, ..., attendance & agenda)

WP1 took care of the completion of the Minutes and Action Items follow-up.

In addition to the physical meetings, WP1 helped in setting-up (nearly) weekly Conference calls on technical matters, and, when needed, on administrative matters.

With regards to the reporting matters, WP1 organized the monthly (internal purposes) and quarterly (contractual) reporting tools (templates and follow-up);

- the 1st Quarterly Management report (QMRM1-M3) has been delivered to the EC on May 23rd, 2008,
- the 2nd Quarterly Management report (QMRM4-M6)/released version has been delivered to the EC (draft version on July 25th, 2008)on August 29th, 2008
- the 3rd Quarterly Management report (QMRM7-M9) has been delivered to the EC on November 25th, 2008.

MobiThin being a project issued from FP7 - Call1, some new rules and processes with regards to FP6 had to be explained, the main ones concerning the URF process (Unique Registration Facility) and the NEF portal.

With regard to the legal aspect of the project, two General Assemblies have been held during this first reporting year through teleconferences: both were mainly dedicated to financial decisions regarding payments. The pre-payment has been received by IBBT on 29/1/2008 and a first payment corresponding to the first year activity has been paid on 27/2/2008. The decision to proceed to the 2nd payment was taken during the 2nd GA held on December 18, 2008.

Task 1.2 - Project Quality Management

As from the kick-off meeting, the consortium is very keen to maintain a high communication level which is one key factor of a collaborative project success; therefore regular project meetings were planned (see point 6.1.4) but also (nearly) weekly teleconferences using a web tool that allows share of documents. Thus, technical decisions could be debated and progress towards deliverables achievements could be followed and improved.

The decision to provide internally a monthly report was agreed with the same objective: it allows each partner to check briefly that the work performed is on line with the DoW not

only from a MM expenses point of view but also with the contractual deadlines and the technical orientation.

To assure the best quality level and respect of deadlines in its production, the consortium agreed on rules and procedures to achieve deliverables and deliveries. The D1.2 "project Quality Insurance Manual" delivered on July 1st, 2008 describes them so as the procedures to be followed if changes to the agreed specifications become necessary, during the course of the developments.

For instance, it has been decided that for each deliverable to be produced, at least 2 reviewers would be appointed inside the consortium companies: preferably, they are not directly implicated in the project or at least they don't have been active in the deliverable to be produced. The Table 17 below summarizes the reviewers' participation.

The PMC designate also a "Quality Dedicated Person» within Prologue; his role is more specifically to follow all the prototypes productions and to make sure that the quality process is assured at all level of merged components.

References & Deliverable name		Reviewer's name	Organisation
D1.1	Project Reference Manual	All partners acting as reviewers	
D1.2	Project Quality Insurance Manual		
D6.1	Project Web Site Set-Up		
D6.2	Project Communication And Dissemination Plan		
D2.1	System Requirements	B. Dhoedt	IBBT
		J.C. Point	JCP
D2.2	System Architecture	all technical members	
D5.1	POC Demonstrator Definition – First Version	B. Dhoedt	IBBT
		J.C. Point	JCP
D3.1	Phase I Component Interfaces	all technical members	
D4.1	Phase I Component Interfaces	all technical members	
D2.3	Business Models	S. Verbrugge	IBBT
		J. Van Ooteghem	IBBT
		J.C. Point	JCP
D4.2	Service Management Framework	B. Dhoedt	IBBT
		M. Kind	T-Systems
D5.2	Simulation Framework For The Architecture	C. Desset	IMEC
		F-J. Westphal	T-Systems
D1.3	First Period Progress Report	P. Demeester	IBBT
		J.C. Point	JCP

Table 17 - Period 1 deliverables reviewed table

6.1.2 Problems which have occurred and how they were solved or envisaged solutions

No specific issue is to be reported; the project is running according to the DoW.

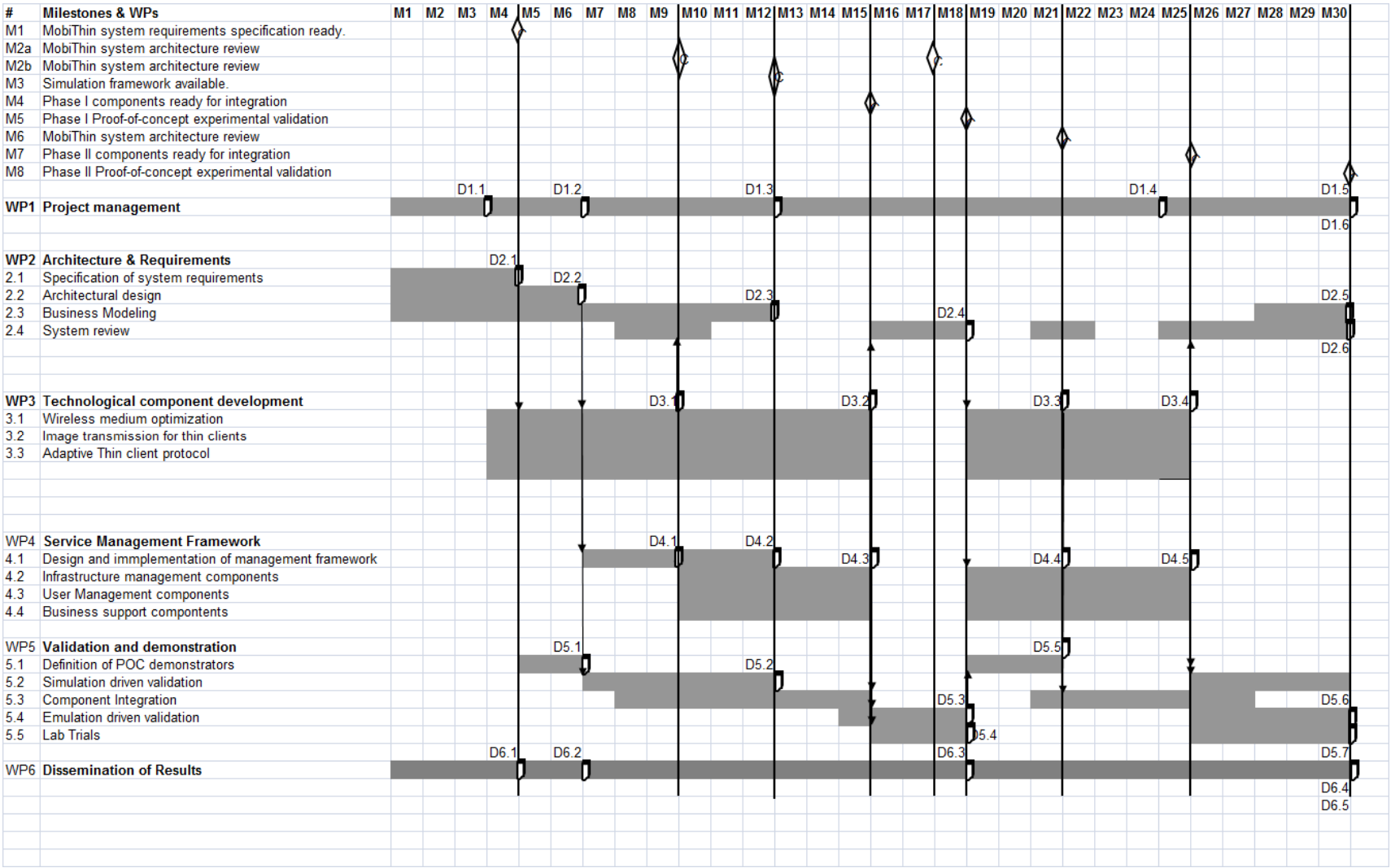
6.1.3 Changes in the consortium

No change to be reported.

6.1.4 List of project meetings, dates and venues

- Kick-off in Gent (January 8 & 9, 2008) - hosted by IBBT
  Interdisciplinary Institute for BroadBand Technology vzw
  Gaston Crommenlaan 8, 9050 Gent, Belgium
- Evry (February 11 & 12, 2008) - hosted by IT,
  Groupe des Ecoles des Télécommunications/INT,
  9 rue Charles Fourier - 91011 Évry France
- Berlin (April 7-8-9, 2008) - hosted by T-Systems
  T-Systems International GmbH
  Goslarer Ufer 35 - 10589 Berlin - Deutschland
- Brussels (technical meeting on May 7, 2008) - hosted by "Région-Bretagne"
  Espace Interrégional Européen
  Bretagne / Pays de la Loire / Poitou-Charentes
  14, rond point Schuman 1040 Brussels
- Leuven (June 16-17-18, 2008) - hosted by IMEC,
  Interuniversitair Micro-Electronica Centrum vzw
  Kapeldreef 75 – 3001 Leuven – Belgium
- Brussels (technical meeting on July 9, 2008)- hosted by "Région-Bretagne"
  Espace Interrégional Européen
  Bretagne / Pays de la Loire / Poitou-Charentes
  14, rond point Schuman 1040 Brussels
- Rennes (October 16-17, 2008) - hosted by JCP
  ETI (Espace des Technologie innovantes)
  Campus de Beaulieu (avenue du Général Leclerc)
  35000 RENNES
- Brussels (December 2 - 3, 2008) - hosted by "Région-Bretagne"
  Espace Interrégional Européen
  Bretagne / Pays de la Loire / Poitou-Charentes
  14, rond point Schuman 1040 Brussels

6.1.5 Project planning and status



6.1.6 Impact of possible deviations from the planned milestones and deliverables

No deviation to be reported

6.1.7 Beneficiaries legal status

No change to be reported.

6.1.8 Project website

The MobiThin website (www.mobithin.eu) has been set-up just after the kick-off meeting and was officially delivered to the EC (Deliverable D6.1) on March 30, 2008.

Its goal is to appeal to a large audience to get them involved within the wireless thin client environment and development area.

Our intention is to present valuable information about the general news in the area, the events in the domain and the important headings of the European Commission and other related projects.

The web site / Deliverables page also present our public deliverables: an executive summary is available for download and our contact emails are given allowing interested people to request for the full text

6.1.9 Use of foreground

No use of Foreground to be reported for this 1st period.

7 EXPLANATION OF THE USE OF THE RESOURCES

TABLE 3.1 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR COST ITEMS FOR BENEFICIARY 1 [IBBT] FOR THE PERIOD 1			
Work Package	Item description	Amount	Explanations
WP2 to WP6	Personnel costs	153 580 €	RTD effort
WP1	Personnel costs	19103 €	management WP1 effort
	Subcontracting	-	
	Remaining costs	12818 €	Travel Costs
TOTAL DIRECT COSTS AS CLAIMED ON FORM C		185501€	

TABLE 3.2.PERSONNEL, SUBCONTRACTING AND OTHER MAJOR COST ITEMS FOR BENEFICIARY 2 [T-SYSTEMS] FOR THE PERIOD 1			
Work Package	Item description	Amount	Explanations
WP2, WP4, WP5, WP6	Personnel costs	78825 €	RTD effort
	Subcontracting	-	
	Major cost item 'X'	10615 €	Travel costs
TOTAL DIRECT COSTS AS CLAIMED ON FORM C		89 216,58 €	

TABLE 3.3. PERSONNEL, SUBCONTRACTING AND OTHER MAJOR COST ITEMS FOR BENEFICIARY 3 [PROLOGUE] FOR THE PERIOD 1			
Work Package	Item description	Amount	Explanations
WP1 TO WP6	Personnel costs	220 611 €	Personnel costs
	Remaining costs	9 711 €	Travels and development plateform (PC)
TOTAL DIRECT COSTS AS CLAIMED ON FORM C		230 322 €	

TABLE 3.4 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR COST ITEMS FOR BENEFICIARY 4 [IMEC] FOR THE PERIOD 1			
Work Package	Item description	Amount	Explanations
WP2, WP3, WP5, WP6	Personnel costs	250 139,36 €	
	Subcontracting	-	
	travel costs	7 678,88 €	
TOTAL DIRECT COSTS AS CLAIMED ON FORM C		257818,24 €	

TABLE 3.5 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR COST ITEMS FOR BENEFICIARY 5 [NTUK] FOR THE PERIOD 1			
Work Package	Item description	Amount	Explanations
WP2 – WP3 – WP5	Personnel costs	224 856 €	RTD effort
	Subcontracting	-	
	travel costs	5462 €	
TOTAL DIRECT COSTS AS CLAIMED ON FORM C		230318 €	

TABLE 3.6 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR COST ITEMS FOR BENEFICIARY – [IT] FOR THE PERIOD 1			
Work Package	Item description	Amount	Explanations
WP1, WP2, WP3, WP5, WP6	Personnel costs	103 831,60	RTD effort (Françoise Prêteux, Mihai Mitrea, Marius Preda, Bojan Joveski, Ivica Arsov)
	Subcontracting	0.00	
	Travel and subsistence	4 476.45	meeting attendance
	Meeting organisation	1 004.69	consortium and technical meetings organised by IT
	Durable equipment depreciation	487.42	cf. the cost declaration
TOTAL DIRECT COSTS AS CLAIMED ON FORM C		109 800.16	

TABLE 3.7 PERSONNEL, SUBCONTRACTING AND OTHER MAJOR COST ITEMS FOR BENEFICIARY – [JCP] FOR THE PERIOD 1			
Work Package	Item description	Amount	Explanations
WP1 & WP6	Personnel costs	53612 €	
WP6	Subcontracting	2500 €	Website set-up
WP1	Travel Costs	8643 €	
Wp1	Collaborative Tool	2500	
TOTAL DIRECT COSTS AS CLAIMED ON FORM C		67255 €	

8 FINANCIAL STATEMENTS – FORM C AND SUMMARY FINANCIAL REPORT

A separate financial statement from each beneficiary together with the summary financial report which consolidates the claimed Community contribution of all the beneficiaries in an aggregate form, based on the information provided in Form C (Annex VI) by each beneficiary is provided separately.

9 CERTIFICATES

No Certificates are due for this period, in accordance with Article II.4.4 of the Grant Agreement.

Beneficiary	Organisation short name	Certificate on the financial statements provided?	Any useful comment, in particular if a certificate is not provided
1	IBBT	no	Expenditure threshold not reached
2	T-Systems	no	Expenditure threshold not reached
3	Prologue	no	Expenditure threshold not reached
4	NTUK	no	Expenditure threshold not reached
5	IMEC	no	Expenditure threshold not reached
6	IT	no	Expenditure threshold not reached
7	JCP	no	Expenditure threshold not reached

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