HEARTFAID

D43 – 3rd Periodic Report
(Activity and Management)

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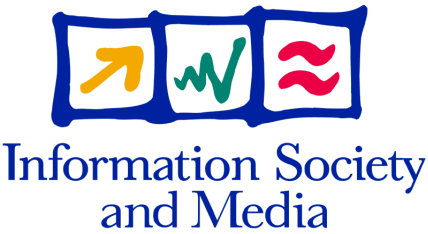

HEARTFAID

A KNOWLEDGE BASED PLATFORM OF SERVICES FOR SUPPORTING MEDICAL-CLINICAL MANAGEMENT OF THE HEART FAILURE WITHIN THE ELDERLY POPULATION

Project summary	
Project acronym:	HEARTFAID
Project identifier:	IST – 2005 – 027107
Duration of the Project:	01/02/2006 – 30/04/2009
Project Co-ordinator Name:	Domenico Conforti
Project Co-ordinator Organisation:	UNICAL University of Calabria (Italy)
Thematic Priority:	Information Society Technology-ICT for Health
Instrument:	Specific Targeted Research Project

Consortium

- UNICAL- Università della Calabria (Italy)
- UNICZ- Università degli studi Magna Graecia di Catanzaro (Italy)
- UNIMIB- Università degli studi di Milano Bicocca (Italy)
- JUMC- Jagiellonian University Medical College (Poland)
- VMWS- Virtual Medical World Solutions Ltd (United Kingdom)
- FORTHNET S. A.- Hellenic Telecommunications and Telematic Applications Company S. A. (Greece)
- SYNAP- Synapsis s.r.l. (Italy)
- CNR- Consiglio Nazionale delle Ricerche (Italy)
- FORTH-Foundation for Research and Technology Hellas (Greece)
- RBI- Rudjer Boskovic Institute (Croatia)
- AUXOL- Istituto Auxologico Italiano (Italy)

D43 – 3rd Periodic Report (Activity and Management)

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Short Description
The document describes project objectives and major achievements during its third year with an overview on the technical activities by WP and by partner involved with an overview of the financial efforts and costs occurred during the same period.

Change Record		
Version Number	Changes	Release date
1.0 **1.1** **1.2**	First draft of the Document Further contributions and final draft version Further Costs incurred after the end of the project- Final Version	20/04/09 15/06/09 22/07/09 29/07/09

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PERIODIC ACTIVITY REPORT

Section 1 – Project objectives and major achievements during the reporting period

1.1 - Overview of General Project Objectives

Healthcare is more and more relying on evidence based medicine delivered by multi-disciplinary, multiparty healthcare teams in a patient-centered approach, which is aimed at providing more effective, personalized health care management. The provision of specialized care regimes depends on the optimization abilities of care professionals to apply the necessary medical knowledge by also integrating the reading of diagnostic test results, medications availability and responses to past treatments. This can be a particularly burdensome task; further delivering patient care with the efficacy, consistency and safety, that the full range of current knowledge could now support, may be beyond the mental integration capabilities for unaided healthcare professionals.

To cope with these difficulties, a number of ICT solutions are being developed for aiding care operators in both relieving and making more effective and reliable their work and, at the same time, delivering care programs able to satisfy the evolving healthcare needs of a patient in the continuum of care.

E-Health is commonly considered to encompass the broad brand of ICT applications in supporting health care needs, including Electronic Health Record (EHR), health information portals and patient empowerment, remote patient monitoring (telecare or telemonitoring) and telemedicine, medical imaging and sensing with new modalities, Clinical Decision Support Systems (CDSS) and individual care, computer-assisted procedures and virtual surgery. Most of these applications require the advanced and interoperable integration of several healthcare centres, structures and functionalities, which are distributed over broad environments. Service oriented technologies offer an invaluable aid to cope with these aspects, especially Web Services, since based on the most successful information dissemination and sharing apparatus in existence – the World Wide Web.

Within the HEARTFAID project, starting from all the above mentioned considerations, an integrated platform of services has been developed for aiding clinicians, care operators and patients themselves in the long-term clinical and follow-up care processes of Chronic Heart Failure (CHF).

CHF is becoming one of the most remarkable global health problems for prevalence and morbidity, with a strong impact in terms of social and economic effects. For example, according to the European Society of Cardiology, at least 10 millions of patients have heart failure. About 78% of the total patients have at least two hospital admissions per year. The impact in other western developed countries is similar. Similarly, according to WHO, in developing countries, cardiovascular diseases will become the leading cause of death by 2010, and, due to an increase in the survival rate after heart attacks or strokes, the incidence of CHF will probably raise as well.

So far, several research projects have addressed the problem of CHF patients' management, by developing automated guidelines systems, decision support systems, or machine learning methods for automated diagnosis or prognosis.

A key issue of an effective management of CHF patients is their follow-up, which requires a continuous feedback to assess the patients' clinical conditions. In the clinical practice, this need is translated in a series of very expensive meetings between physicians and patients. Telemonitoring of the relevant vital and clinical parameters can help health providers to develop a home monitoring program for CHF patients, with a great saving of resources and a better service for them. In particular, the continuous monitoring of patients' signs and symptoms can help addressing the problem of early detecting their worsening and, then, prevent acute events such as decompensation. Decompensation refers to the heavy exacerbation of symptoms, such as dyspnea, venous engorgement, and pulmonary edema, which requires a prompt hospitalization to re-establish adequate perfusion and oxygen delivery to end organs by adequate therapeutic treatments.

Patients' telemonitoring is one of the main services of HEARTFAID Platform (HFP) and consists in the collection and processing of data acquired with personalized medical devices in a homecare environment.

Services provided by HFP are aimed at assisting CHF stakeholders in their routine workflows and to provide an optimal management of HF patients, by exploiting the most advanced technologies, compliant to medical standards, advanced instruments for diagnostic data processing, and significant and up-to-date knowledge, suitably formalized.

In terms of scientific and technological advances, HFP differs from other research projects since is specifically characterized by the following innovations:

- integration of biomedical data, relevant to the medical domain, of different structure and complexity and coming from different and several sources;
- integration of several approaches for coding the relevant medical knowledge and extract new knowledge: a knowledge based approach (deductive knowledge) for coding the clinical guidelines and the clinical best practice; a data mining approach (inductive knowledge) for extracting new knowledge from the practical clinical experience represented by suitable sets of cases;
- medical decision support level, characterized by functionalities regarding all the clinical management of HF patient: diagnosis, severity assessment, prognosis, therapy planning.

HFP consists of six main technological components able to provide the core platform services, i.e., patients' data storage and management, homecare data collection with connected alerting service, data analysis and interpretation, clinical decision-making support.

More precisely, as shown in Fig. 1, there are:

- a Patients Repository, which is a web-based Electronic Patient Record for insertion, editing, storage and management of patients related demographic and clinical data;

- a Telemonitoring System, which handles the storage and monitoring of observational data acquired by means of homecare sensing infrastructure;
- an Alarm & Alert System, which is in charge of warning the responsible care givers about worsening of patients' conditions when detected by the interpretation of telemonitored parameters;
- Signal & Image Analysis Toolkits, which consist of methods developed for semi-automated analysis of diagnostic signals, e.g., ECG, and images, e.g., echocardiographic or magnetic resonance images;
- a Clinical Decision Support System, which is a knowledge base system developed for aiding the main decisional processes of CHF stakeholders by interpreting patients' data, tuning some platform services (e.g., telemonitoring) and providing pertinent suggestions;
- a Web-based User Interface, which provides the access to all the services of the platform.

All these components are integrated by means of an Enterprise Service Bus (ESB), which serves for a loosely coupled, highly distributed and, thus, highly scalable integration network.

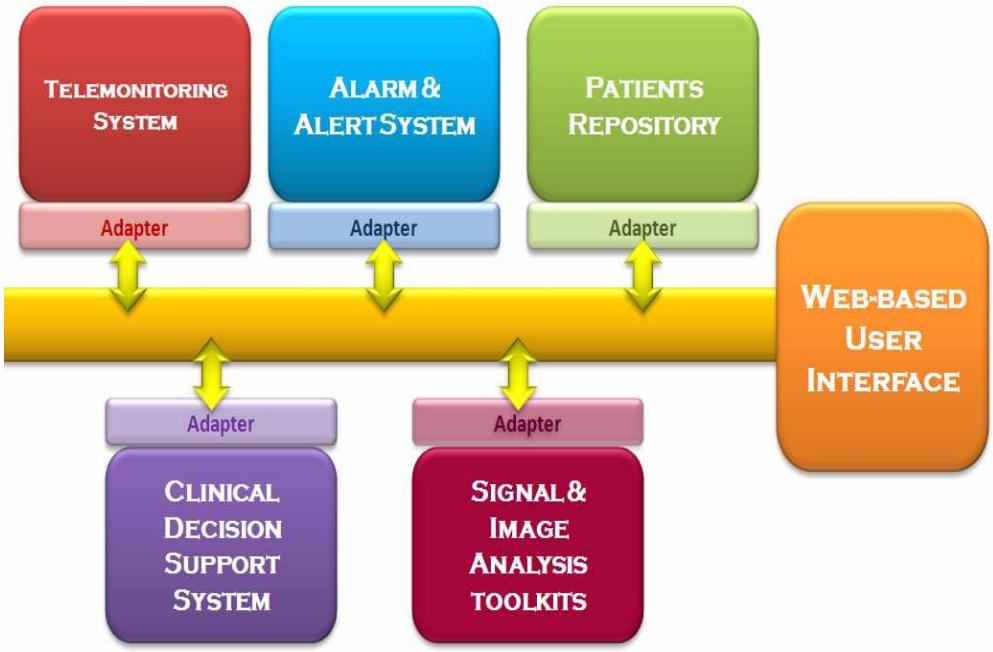


Fig. 1 HEARTFAID Platform and its main components

An ESB is the core component of a standards-based integration structure that combines messaging, web services, data transformation and intelligent routing, and coordinate the interaction of a significant number of diverse applications, across extended enterprises, with transactional integrity.
The routing and transformation mechanisms implemented by the ESB are highly configurable also remotely. Moreover, a big variety of different protocols including their secure implementations has been used to face different

heterogeneous entities that are able, in this way, to automatically and dynamically connect to the ESB without requiring necessarily a proxy software.
All the platform components communicate among each other by exchanging messages on the ESB. This way, thanks to the ESB services of message routing and transformation, the burden of implementing these communications at the component level is relieved. Suitable Adapters (see Fig.1) have been included for plugging the application modules to the ESB. The wrapped applications are thus able to loosely interconnect and communicate with the other modules through a message-passing infrastructure based on the ESB.
ESB has been devised by designing and configuring the interactions among the application modules, the data transformations, quality of service, synchronization, workflow specification, life-cycle management and so on, for granting the implementation of the services that want to be exposed at global platform level.

1.2 - Third Reporting Period (Months 25-39)

Project Objectives for the Reporting Period

As far as the scientific and technical objectives and activities are concerned, the third reporting period (months 25-39) of the HEARTFAID project has been mainly characterized by:

- final integration and tuning of the prototypal configuration of the several components of the platform;
- clinical testing and validation of the final prototypes.

In particular, the scientific and technical objectives have strongly concerned the following WPs:

- Fulfilment of patient's data collection (WP2).
- Final refinement of prototypal configuration of the interoperability middleware infrastructure (WP3).
- Final refinement of the Knowledge Base and prototypal configuration of inference models by the application of KDD methods (WP4).
- Final prototypal configuration of signal and image processing tools and clinical decision support services (WP5).
- Final prototypal configuration of the end-user web-based platform of services (WP6).
- Deployment of the platform services at the clinical sites for clinical testing and validation (WP7).
- Dissemination and definition of exploitation of the current results (WP8).

Recommendations from the 2° Periodic Report and Activity of the Reporting Period

The second periodic project evaluation from the revisers, pointed out the following recommendations and minor modifications of the project activities:

1. To focus more on end-users (patients, medical professionals and health care providers) in order to demonstrate the practical applicability on

patients at home and on the move, as well as clinical feasibility. In order to be successful, home monitoring as an innovative and important modality, should be demonstrated on elderly heart failure patients.

2. Regarding exploitation, it is important to define what the HEARTFAID result to be exploited is; not exploitation per partner work, but rather exploitation on project-basis. The project is now in the phase of implementing a HEARTFAID system, but should also consider the development of the HEARTFAID services.
3. Concerning evaluation, realistic clinical and home care scenarios need to be developed and the system should be evaluated in these contexts to collect feedback on the validity, usefulness and usability of the HEARTFAID services and the developed and applied knowledge sources (Heart Failure ontology). Sufficient sets of clinical data are needed to demonstrate the practical usefulness of the project results.
4. Openness with the health care environments and standard interfaces with legacy systems are important: open interfaces of the HEARTFAID platform to existing Electronic Health Records and devices in Europe are required.

During the reporting period, the above recommendations have been fully taken up by the HEARTFAID consortium. In fact:

1. End-user applications and services have been finalized and prototipally implemented as described in the Deliverable D37. User-friendliness and easy accessibility have been the basic criteria according to which the HEARTFAID web-portal has been developed. Moreover, a specific interface tool (Nurse@Home) has been developed, tested and demonstrated for the data acquisition and the support of patient at home and on the move. These functionalities will be extensively demonstrated during the final review meeting.
2. In the Deliverable D46, exploitation strategies, devised on project-basis, have been highlighted. Moreover, in the Deliverable D38, by presenting new models of health care delivery, the suitable embedding of HEARTFAID platform functionalities within innovative care programme, in order to delivery advanced services, has been proposed.
3. In the Deliverable D45, clinical and home care scenarios, clinical testing protocol and relevant validation results have been widely reported.
4. Interoperability strategies have been developed and prototypal implemented as described by Deliverable D28. The interoperability strategies have been mainly devised in order to guarantee an effective deployment of the HEARTFAID platform within existing health care environments, by assuring interoperability of services and platform components.

On this basis, the overall scientific and technical activities, carried out during the reporting period, can be summarized as follows:

- Completion of the data collection (WP2).
- Final development and prototypal implementation of “Nurse@Home”, specific tool for data acquisition and transmission within home care environments (WP2).

- Final refinement of the middleware infrastructure for data integration and management and systems and services interoperability (WP3).
- Final refinement and testing of the Medical Knowledge Base, by exploiting the clinical best practice and guidelines (WP4).
- Development, implementation and testing of the Model Base, by defining suitable decision making models extracted from the knowledge discovery activities (WP4).
- Prototypal implementation and testing of the Clinical Decision Support System (WP5).
- Prototypal implementation and testing of the Signal Analysis Toolkit and the Image Analysis Toolkit (WP5).
- Prototypal implementation and testing of the Heartfaid Web Portal for the end-user interaction functionalities (WP6).
- Dissemination activities mainly based on the publication of scientific and technical papers, participation to international conferences, organization of horizontal activities involving other EU FP6 and FP7 projects, and definition of exploitation strategies (WP8).

It is worth while to emphasize that the overall architecture of HFP was designed and developed after a careful analysis of the overall problems to be faced and the expectations of the medical and patient users. In particular, complete use cases were defined for guiding the prototypal development activity, by considering many of the integrated services of the platform.

Most Important Problems during the period and corrective actions undertaken

The third period of the project has been mainly characterized by the request of contract amendment aiming at extending the project duration of further three months. This postponed the final date of the project on April 30th, 2009.

As already reported on the Second Periodic Report, the activities of WP3 have been completed with some delay (two months) with respect to the GANTT of the project. This has been mainly caused by the development of further technical extensions concerning the adoption of suitable standards and protocols for the integration of external modules into the prototypes and for the exchange of data among the several components of the Heartfaid platform.

As consequences, the deployment of the developed platform services within the clinical sites for testing and validation (WP7 activities) has undergone a short delay (about three months).

Hence, with the aim to allow the fulfilment of the activities of “WP7 – Testing and Validation” and, more specifically, the demonstration activities concerning the task “T7.2 – Clinical Validation”, an extension of three months of duration of the Heartfaid project has been allowed.

Section 2 – Workpackage Progress of the Period

WP2 – BIOMEDICAL DATA IDENTIFICATION AND COLLECTION

WORK PACKAGE: 2
TITLE: BIOMEDICAL DATA IDENTIFICATION AND COLLECTION
START DATE: MONTH 3
WORK PACKAGE LEADER: VMWS
PARTNERS INVOLVED: UNICAL , UNICZ, UNIMIB, JUMC , FORTHNET , SYNAP, AUXOL

OBJECTIVES AND ACHIEVEMENTS OF THE TASKS DUE IN THE PERIOD

TASKS AND OBJECTIVES	ACHIEVEMENTS	ACTIVITIES
T2.3- Data Collection	The data collection has been completed inline with the work plan.	During this period, the clinical partners continued the homecare and healthcare data collection at all the clinical sites. The clinical partners have collected data in standardised manner both in clinical environment (using the hospital equipment and importing information into eCRF) and in home settings (using telemedicine technologies and comsumer healthcare devices). The collected data were used: a) In the knowledge discovery approach (WP4) b) In order to perform the final testing of the HEARTFAID platform Furthermore, the clinical partners in the scope of data collection suggested the patient recruitment in both home and healthcare scenarios. The data collection has been completed inline with the DoW.

STATUS OF DELIVERABLES AND MILESTONES OF THE PERIOD

DELIVERABLE	COMMENTS
D35- Summary on Data Collection	The deliverable (due date Month 28) was collectively composed by the partners participating in T2.3 and submitted on time. It includes a summary of the activities carried out by the clinical partners during the execution of T2.3

Description of the activities of the year

The activities of WP2 during the 3rd year of HEARTFAID project were related to the collection of the relevant biomedical data in all the identified environments. These activities are presented in the following paragraphs.

T2.3.1 Homecare Data Collection

For homecare environment UNICZ has collected, in a group of 51 patients the following parameters in a standardized manner: systolic blood pressure, heart rate, respiratory rate, % of body water and weight, body temperature, in order to achieve

an early diagnosis of heart failure decompensation, so as indicated in deliverable 5. The collection of these data was performed every two weeks during the data collection period and has been completed. The data were used in the knowledge discovery approach in WP4.

Both UNIMIB and AUXOL have performed data collection from patients with chronic heart failure by considering patients referred to their CHF clinic or those seen in the emergency service setting for acute decompensation. After obtaining their recompensation, some of these patients were included in a remote monitoring program through telemedicine facilities with the aim of increasing the information necessary to build a platform able to assist in the diagnosis of CHF and at identifying early decompensation symptoms. The collection of these data was used in both the definition of the platform of services and the development of the decision support engine (data obtained daily from 30 patients followed up at home through telemonitoring technologies over 12 months have been considered to develop the decision support system).

Data collected in the Home environment included systolic blood pressure, heart rate, respiratory rate, body weight, urine output and specific symptoms, all parameters known to be useful to achieve an early diagnosis of heart failure decompensation, as indicated in deliverable 5. The MagIC vest has also been used to collect additional data on the move also during physical exercise on a cycloergometer. UNIMIB and AUXOL have also performed research activities in order to improve this system of wearable sensors aimed at collecting data on ECG (and thus heart rate), physical activity and respiratory frequency in subjects monitored on the move. Further progress has also been made in the attempt to find better solutions for wireless communication between such a homecare device (for example Bluetooth technology) and for remote data transmission (e.g. through PDA or smartphone devices)

JUMC have performed a daily collection of clinical parameters in another group of patients which might be of particular importance for CHF decompensation prediction in home setting. Every day patients were collecting in standardized manner, according to questionnaires, the data including blood pressure values, heart rate, weight, respiratory frequency, changes in CHF symptoms and treatment.

During the collection of data, there was a continuous collaboration between the clinical partners (UNIMIB, AUXOL, UNICZ and JUMC) and the technical partners that have developed the data acquisition and transmission infrastructure (VMWS, FORTH, FORTHNET and SYNAPSIS) who provided continuous guidance to the clinical partners in order to utilise the developed methods and tools in the most efficient way.

The patient recruitment (for monitoring both in the Hospital Environment and the home/on-the-move environment) was also suggested by the clinical partners. It included at least 7 patients in each center (total number: at least 21 patients from the 3 centers UNICZ, UNIMIB/AUXOL, JUMC). The criterion for the selection of the patients is the CHF severity which has to range from NYHA class II and NYHA class III. Data collection in the Home setting was suggested to be done either by using “Manual” acquisition procedures, or “Automatic” acquisition devices (using communication enabled Medical Devices). These parameters should be collected from patients’ home making use of methods available at the various clinical centers. The patients should be followed-up for 3 months, with the aim of comparing the indications on management provided by the platform with the decision spontaneously taken by the physicians in charge.

T2.3.2 Healthcare Data Collection

In this period UNICZ has collected clinical data from CHF patients and finalized the data collection in the Hospital setting by the end of the reporting period. Some patients are historical patients, already followed in our heart failure ambulatory; other patients have a recent diagnosis of heart failure. When in a new patient, referred to UNICZ Cardiovascular Disease Unit, the diagnosis of heart failure is confirmed, this patient is enrolled in Heartfaid project. The data of this population have been introduced in a database that contains all available list of biomedical signs and symptoms, list of parameters of selected tests so as: Electrocardiogram, Holter electrocardiography, Chest X-ray, Echocardiography, Clinical chemistry, and so on, that are useful for heart failure domain. All these data have been filled also in electronic CRF (eCRF), both basal assessments and additional clinical visits. The clinical assessment in these patients was performed every one-two months and also earlier if clinical conditions are worsening. Furthermore, every new change in clinical condition is reported in database.

By the end of the reporting period, UNICZ had a database with data from 103 patients with heart failure diagnosis. In addition, they have provided the storage of digital ECG files in SCP format, at the end of the reporting period they had more than 44 ECGs stored. Regarding the storage of echocardiography images in DICOM format, by the end of the reporting period they had more than 32 echocardiograms stored.

In the Hospital setting, the data from enrolled CHF patients have been introduced by UNIMIB/AUXOL in a database of the CHF clinic containing the biomedical signs and symptoms, and parameters of selected tests such as Electrocardiogram, Holter electrocardiography, Chest X-ray, Echocardiography, Clinical chemistry, Thoracic Impedance. Data have been obtained both from basal assessments (initial visits) and additional clinical visits. Furthermore, in the frame of CHF patient management, UNIMIB and AUXOL have combined data obtained daily from patients followed up at home through telemonitoring technologies, with data obtained in the CHF clinic. This has been done to in the perspective of the final testing of the HEARTFAID platform.

JUMC according to the project schedule officially was not participating in task T2.3 of WP 2 concerning data collection and all activity was performed as JUMC internal contribution. In collaboration with other clinical and technical partners JUMC have worked collecting the biomedical data from patients with congestive heart failure (CHF) according to the electronic Case Report Form (eCRF). The prototype of eCRF application was deployed at a JUMC's server and was accessible for registered clinical and technical partners on the Internet. The eCRF contained the patients' data being crucial for HF diagnosis, management, treatment and assessing the prognosis. These are including the patients' anamnesis, physical examination of CHF patients and results of additional tests taken mostly from devices, which cannot be, in the actual hospital premises, automatically integrated with the platform. The following results of tests were collected: cardiopulmonary exercise test, echocardiography (stored also in the DICOM format), chest X-Ray, results of laboratory tests, 24 h ECG monitoring, and quality of life questionnaire and for some cases tests important for further research development (continuous noninvasive blood-pressure monitoring). By the end of the reporting period more than 50 cases have been enrolled from JUMC site and the appropriate forms for baseline and follow-up visits for these patients have been fulfilled.

Finally for a selected group of patients also a daily questionnaire including the basal parameters (clinical symptoms, treatment, weight, respiratory rate, blood pressure,

heart rate) have been performed. It was the part of JUMC own contribution as according to DoW JUMC is not included in the task regarding data collection.

The summary of data collection activities was reported in D35 “Summary on Data Collection Activities” (submitted on time on Month 28), which was collectively composed by the partners participating in T2.3 under the supervision of VMWS as WP leader.

WP3 – MIDDLEWARE, INTEROPERABILITY AND INTEGRATION

WORK PACKAGE: 3
TITLE: MIDDLEWARE,INTEROPERABILITY AND INTEGRATION
START DATE: MONTH 2
WORK PACKAGE LEADER: SYNAPSIS
PARTNERS INVOLVED: VMWS, FORTHNET, CNR, FORTH

OBJECTIVES AND ACHIEVEMENTS OF THE TASKS DUE IN THE PERIOD

TASKS AND OBJECTIVES	ACHIEVEMENTS	ACTIVITIES
T 3.4 - Interoperability Middleware	The activities of Task T3.4, started at month M8, have been successfully completed during the reporting period. Although from the Gantt of the Project it was expected this task to be completed within the last reporting period, the activities have been concluded with a slight delay of two months on the timetable, in order to set up an adequate DEMO for the second year review, held in Milan on April 2008. Thanks to the recommendations provided by the Clinical Partners during the validation phase, the results have been successfully implemented in real settings with enthusiastically good results.	According to the outcomes of Subtask T3.3.2, the Interoperability Middleware architecture has been definitely refined. Some troubles have been encountered while integrating the different services available from the external/pre-existing modules into the platform. These problems have successfully been overcome within the review meeting, thus achieving the expected results of openness and versatility of the platform to integrate and dialogue with new external module adopting IHE/HL7 communication standards. Moreover, according to the suggestions provided by the clinical partners after the validation phase started, it was necessary to implement further improvements and modification to the preliminary prototyped developed.

STATUS OF DELIVERABLES AND MILESTONES OF THE PERIOD

		COMMENTS
Milestone	Title	
M.S.3.3	Middleware prototype	Successfully achieved with a slight delay of two months.

Description of the activities

During the reporting period, the activities of task T3.4, stated at month M8, have been successfully completed with enthusiastically good results. The progress of the work carried out is described in the following paragraph.

T3.4: Interoperability Middleware

As reported in the DoW, the Interoperability Middleware is responsible of guaranteeing a seamless integration among the end-user services of the HEARTFAID Platform. The activities of this task, started at month M8, have been successfully completed during the reporting period with a slight delay of two months from the expected deadline.

After having adopted the methods and technologies selected in the previous period as suitable for the purposes of the HEARTFAID project, such as *Message Oriented Middleware, Service Oriented Application, Enterprise Portals* and *Enterprise Service Bus*, the main components of the platform have been successfully integrated:

1. The **AmI-platform** (Ambient Intelligence Platform)
2. The **eCRF** (electronic Case report Form)
3. The **groupSMS**
4. The **CDSS** (Clinical Decision support System)
5. An image analysis and archiving toolkit based on the DICOM standard.

All these module are interacting on the basis of a single *Master Patient Index* to guarantee the unique identification of the patients, a *Documental Repository* to store the reports produced within the platform, a *Meta-data Registry* to locate the available resources, an *Orchestration service* to control the workflows within the platform and the *Heartfaid Enterprise Portal* to integrate the different functionalities and exhibit them to the final user in a friendly fashion.

Some troubles have been encountered in integrating the external eCRF, that is a Cardiovascular Medical Record developed in the context of the HEARTFAID but independently from the HFP itself.

The eCRF represents the Health Information Systems of a healthcare structure in a real context and it has been used to demonstrate the flexibility and the openness of the platform. In fact, we have successfully proven that all the clinical or demographic data needed by the different modules of the platform, can be accessed and retrieved from an external module that adopts standard interaction mechanisms (such as IHE profiles and HL7 messages) without the need to implement any specific integration module or mechanism.

Therefore, the HFP is able to retrieve the needed information on behalf of the modules that perform a request of data. In other words, the modules of the platform don’t even need to know where the data is stored, whether it is located inside or outside the platform, or if specific credentials are needed to access them; on the contrary, each module can perform a request of data directly to the platform that, using its orchestration services and data management modules, is able to retrieve the needed information in a completely transparent way for the requesting module.

WP 4 – KNOWLEDGE REPRESENTATION, DISCOVERY AND MANAGEMENT

WORK PACKAGE: 4
TITLE: KNOWLEDGE, REPRESENTATION, DISCOVERY AND MANAGEMENT
START DATE: MONTH 8
WORK PACKAGE LEADER: RBI
PARTNERS INVOLVED: UNICAL , SYNAP , CNR , FORTH

OBJECTIVES AND ACHIEVEMENTS OF THE TASKS DUE IN THE PERIOD

TASKS AND OBJECTIVES	ACHIEVEMENTS	ACTIVITIES
T 4.3 – Implementation of knowledge discovery in database processes	a) analysis of HF patients' data sequences collected by the platform b) a long and a short report about analysis of retrospective HF patient data collected by ANMCO c) dissemination of the results	a) formalization of the procedures for the transformation of data sequences into the form appropriate for knowledge discovery tasks and its implementation on real patient data b) comparative analysis of the methodology for the selection of most relevant attributes c) implementation of the techniques for the visualization of knowledge discovery results d) integration and critical evaluation of various results related to the ANMCO data sets into a single report prepared for publication e) testing of the developed methodology for subgroup discovery and selection of most relevant attributes on large real life domains f) preparation and submission of three journal papers and four conference papers

Description of the activities of the year

- **WP Objectives and starting point of work at beginning of reporting period**

In the previous period we have defined and performed data preparation and data transformation tasks including data understanding, data cleansing, and handling unknown values. In parallel we have prepared and tested knowledge discovery methodologies like Support Vector Machines, Subgroup Discovery rule learning, survival analysis, and Random Forest recognized as appropriate for the available datasets. The experiments have been performed and the results reported in D29.

The objective of the work that has remained for the third year has been to compare the performances of different KD methodologies on real HF patient data in order to define optimal approaches for the platform tasks. Finally, we had to try to integrate the elicited knowledge into the knowledge base and to start using it in decision support services. Dissemination of the results has been a constant task.

- **Progress towards objectives**

The work has been done in parallel on three tracks. The first concentrated on the formalization of the procedures for the transformation of data sequences into the form appropriate for knowledge discovery tasks and its implementation on real patient data. For this task we started from the KD methodology for analysis of short data sequences described in D29. After that, based on the approach for

accessing eCRF data developed for the decision support application in the hospital setting, we have implemented data extraction for real patient data available till October 2008. The resulting data set included information about 38 HF patients collected by UNICZ having in total 106 visits. On this data we have performed a series of experiments including NYHA class prognosis, worsening, improvement, and change in therapy modelling. The experiments have been repeated for the differential and the flattening approach for sequential data transformation. The results demonstrated applicability of the proposed methodology but medical evaluation of the results pointed out significant deficiencies caused mainly by the restricted size and bias of the available dataset. The work has been done by RBI, UNICZ, JUMC, and in consultations with external advisor Dr. G. Krstacic.

The second track worked on the comparative analysis of the methodology reported in D29 and on its testing on retrospective data, including large medical data sets outside the domain of HF (brain stroke, mammography). The work concentrated on the methodology for selecting most relevant attributes that can be obtained by combination of different machine learning approaches and on testing the contrast set and subgroup discovery techniques. Additionally, in the previous period we encountered the problem of the visualization of the KD results and we tried to improve this segment. This is known as a hard problem and a problem of constant research in the KD community. Our goal has been practical development and implementation of techniques which could be integrated into the online KD service. The work resulted in three approaches prepared for inclusion into the KD service. The work has been done by RBI and UNICAL.

The most of the effort has been invested in the dissemination of the results. This is mainly due to the fact that the results obtained for the retrospective data from the ANMCO repository have been recognized as potentially very relevant both for the project in the sense of integration of the results into the knowledge base and as a general result nicely demonstrating, among other facts, significant changes in HF management in the period of 10 years. This stimulated us to practically repeat all the experiments reported in D29 but now by using a unified data preparation framework. Stimulated by the comments of medical partners we have used the same methodology also for some additional object functions. At first the results have been integrated into a long report (about 50 pages) that has been recognized as inappropriate for dissemination. After that a shorter version on 9 pages has been prepared which is now used as a basis for writing papers after obtaining the explicit permission by ANMCO organization. In parallel we have prepared three journal papers (one already published) and four conference papers presenting the results related with knowledge discovery and knowledge representation activities on the project. The work has been done by RBI, UNICAL, FORTH, and UNICZ.

- **Deviation from the project work programme**

In respect to the Task 4.4 "Ontologies and medical knowledge representation in the domain" that ended in Month 18 we had to do some extra work that have not been foreseen by the description of work. The work was necessary in order to a) update the HF ontology in respect to the new version of HF guidelines published in August 2008, b) prepare the ontology and the related documentation describing its usage in the form that it can be used by other projects, c) improve procedural

part of the knowledge base in accordance with numerous comments obtained in the decision support service testing phase, and d) integrate the knowledge discovery results into the knowledge base. These tasks turned out as very relevant for the complete project and for the performance of the platform. They present a significant deviation from the plan. The reason that these tasks had not been included in the original plan is that during the proposal preparation phase we have not been aware of the significance of the HF ontology and the procedural knowledge for the platform and for other related EU projects, and the impact that KD results will have on the knowledge base. Now it is clear that the knowledge base requires constant maintenance and adjustments related with the changes in the health care workflow and with the changes of the best medical practice.

Concretely, we have prepared a completely new version of the HF ontology that includes all relevant terms added by the guidelines of European Society of Cardiology published on August 30, 2008. The ontology is on line at http://lis.irb.hr/heartfaid/ontology/. Additionally, we have prepared a dissemination package that besides the ontology in the OWL format includes description of the ontology construction concepts and its concrete implementation, installation instructions, and a set of four papers describing its application and underlying theory. The stimulation for this work has been the request from the EU FP7 project HeartCycle project for this ontology. The work has been done by RBI.

The experimental evaluation of the platform and its services in the third year demonstrated significant deficiencies of the knowledge mainly in the respect of the application of the procedural knowledge on real patient data and the integration of the procedural knowledge with the decision support service. The relevant problems have been estimation of the NYHA class when it is not explicitly specified from the patient's symptoms, acquisition and reasoning based on the last available patient data from the eCRF regardless in which visit they have been collected and recorded, and reasoning about actual medication doses (not only the fact that some medication is taken). The last modification means introduction of suggestions that some medication dose can increase, introduction of warning when the dose is too high, and warnings if two or more medications of the same type are used. Additionally, based on the new HF guidelines that stress the significance of BNP values for the diagnosis and estimation of the status of HF patients a few related rules have been introduced. Finally, the results of the knowledge discovery process integrated into the novel severity scale and the significance of the hemoglobin as a prognostic parameter have been included into the knowledge base. The work has been done by RBI.

WP 5 – DATA PROCESSING AND DECISION SUPPORT SERVICES

WORK PACKAGE: 5
TITLE: DATA PROCESSING AND DECISION SUPPORT DEVICES
START DATE: MONTH 5
WORK PACKAGE LEADER: CNR
PARTNERS INVOLVED: UNICAL, SYNAPSIS, FORTH, RBI

OBJECTIVES AND ACHIEVEMENTS OF THE TASKS DUE IN THE PERIOD

TASKS AND OBJECTIVES	ACHIEVEMENTS	ACTIVITIES
T5.4- Implementation of the Decision Support System	Prototype of HEARTFAID Clinical Decision Support System	The activity concentrated on the implementation of HEARTFAID Clinical Decision Support System (CDSS), according to the functional specifications and the design defined in the previous two years. This has required the integration of all the components of the CDSS architecture, which were developed separately by also combining the results of other WPs. Focus was, hence, given to the development and integration of (i) the Knowledge Base and the Inference Engine, by formalizing and querying different types of domain knowledge; (ii) the Model Base and the Model Manager, for the deployment, integration and query of computational models for early detecting patient's decompensation; (iii) the Strategy Controller, which was simplified into a switcher. The development activity was guided by a comprehensive use-case and resulted in the Data Processing and Decision Support Prototype released at month 30. For the integration into HEARTFAID Platform, several Web Services were included into HEARTFAID Web Portal: (i) CDSS service for the home-care environment; (ii) CDSS service for the hospital-care environment; (iii) the *EchoCardioLab* System – a Web-based application for the management of echocardiography workflows. In particular, for the realization of the *EchoCardioLab*, the following specific activities have been carried out: • Design and development of a parameters DB dedicated to echocardiography and standard-compliant adapters for its deployment • Development of a Java-to-OWL binder for automatically triggering the CDSS services related to the interpretation of echocardiographic findings. • Porting of the image processing algorithms for the segmentation of echocardiographic images and the estimation of left ventricular volumes from Matlab environment to Java • Integration of the Java image processing methods into the DICOM-compliant Web-Viewer Application • Integration of the services provided by the CDSS and the Image Web-Viewer Application in the *EchoCardioLab* and final integration into the HEARTFAID Web Portal • Testing of direct DICOM-compliant transfer of

		echocardiographic image studies from the Vivid 7 Pro echo device installed at UNICZ to the HEARTFAID Image Archive • Testing of direct parameters export functionalities of the Vivid 7 Pro echo device installed in UNICZ and development of a custom C# program to solve communication lacks of the echo device

STATUS OF DELIVERABLES AND MILESTONES OF THE PERIOD

DELIVERABLE	COMMENTS
D36- Heartfaid Decision Support System Prototype	D36, submitted on September 12th 2008, summarized the activity carried out within Task 5.4 to develop HEARTFAID CDSS. Starting from the functional specification and architectural design of the previous years, the document mainly focuses on the implementation of each components of the CDSS architecture and their integration into the system, and on the integration of the CDSS itself within the overall HEARTFAID platform (integration that has been realized mainly by means of the HEARTFAID Web Portal)
MS 5.2- Data processing and decision support system prototype	All the CDSS functionalities were implemented as Web Services and integrated according to the requirements of a comprehensive usecase. This resulted in the Data processing and decision support system prototype released on month 30.

Description of the activities of the year

- **WP Objectives and starting point of work at beginning of reporting period**

During the first two years of the project, the requirements and the functional specifications of HEARTFAID CDSS were carefully defined, as summarized in Deliverable D15 "*Functional Specifications of Data Processing and Decision Support Services*". Such a design was based on a deep investigation of CHF stakeholders' needs and expectations which resulted in a detailed list of CDSS functional requirements; while an accurate analysis of the methodological and technological foundations resulted in the detailed definition of the CDSS functional specifications. The CDSS was, then, devised by integrating, in functionally advanced settings:

a) deductive knowledge, elicited from guidelines and medical experts;
b) inductive knowledge, extracted by data mining techniques applied to significant sets of data;
c) computational methods for the analysis and interpretation of diagnostic data (i.e., ECG signals and Echocardiographic images).

This required the collection of some results of the activities carried out in other Tasks or WPs of the project. In particular, the deductive knowledge base has been formalized in WP4 and a precise description of its content can be found in Deliverable D22 "*Ontologies and Knowledge Representation*". Inductive models resulted from the activity of knowledge discovery and has been described more

precisely in Deliverable D29. Methods and algorithms for processing and analyzing diagnostic ECG and Echo images were developed in Task 5.2 and detailed in Deliverable D30 "*Models and Methods for Signals and Images Processing*".

- **Progress towards objectives (tasks worked on and achievements made with reference to planned objectives, identify contractors involved)**

The implementation activity of the CDSS Prototype followed largely the guidelines reported and discussed in Deliverable D15. In some cases slight deviations from the planned activities seemed convenient or necessary. All such cases have been well documented, motivated and discussed in Deliverable D36.
The functional characteristics of the architecture allowed a distributed implementation activity which concentrated on each component of the CDSS separately. Semantic Web Technologies (SWT) have been used as the most advanced tools for formalizing, re-using and sharing medical knowledge, and reasoning on it; while a service oriented approach has been adopted for the integration and easy access to a number of functionalities. A detailed list of the tools selected is reported in Deliverable D36.

The development of the *Knowledge Base* required the formalization of the different kinds of knowledge and medical information which resulted in three *structural components*:

- *Domain description*, which contains and defines all terms from the domain of heart failure in the form of an OWL (Ontology Web Language) ontology;
- *Procedural knowledge*, which describes decisions to be made according to patient's current state;
- *Factual knowledge*, which consists in active patient's data, gathered from the health information system (patient database) and from the feature extraction facilities (signals and images).

In order to test the quality of the developed knowledge base and in order to enable integration of the knowledge base into the decision support system, the *Closed World OWL Syntax Interpreter* was developed and integrated into the Protégé tool by RBI. The content of the knowledge base was thoroughly described in the deliverable D22 "*Ontologies and knowledge representation*".

The *Model Base* was conceived for maintaining and organizing the computational reasoning models derived from the Knowledge Discovery (KD) activities and the methods developed for processing diagnostic signals and images. The KD concentrated on two main problems, really important in the management of CHF patients:

- prognosis stratification
- early detection of patient's decompensation.

The ANMCO (the *Italian National Association of Cardiologists*) dataset was used for developing predictive models aimed at the evaluation of patient prognosis

after the first visit. The dataset was composed of a set of patients' records collected during the first visit or immediately before/after it. Modern machine learning classification techniques combined with state-of-the-art variable selection techniques have been adopted and applied as well as standard survival analysis techniques. Several algorithms have been developed by combining features selection methods and *Support Vector Machines* (SVM). The best prognostic models have been then selected according to their performance. A detailed description of them can be found in Deliverable D29 "*Models and methods for knowledge discovery*". The model for detecting decompensation onset has been devised by UNICAL by processing a dataset collected by UNICZ for "emulating", within the clinical environment, the data acquisition from the home environment, obviously with some differences. Decision tree and decision list methods have been firstly selected as methods able to extract knowledge in a form understandable by domain experts. The relations extracted from the data have been initially assessed by validation techniques, and then the most relevant models have been evaluated by the experts. Finally, methods like SVM and Radial Basis Function networks have been used for estimating the predictive accuracy that may be expected from methods that do not generate human interpretable results. The learning methodologies have been finally combined with cost sensitive classification approaches since classes in the dataset are highly unbalanced. Details can be found in Deliverable D29. These methods have been integrated into a Model Base able to handle any decision model. This way, any decision schema extracted through any KD process and tool can be easily "translated" and used by the HEARTFAID platform. This was assured by a specifically designed and implemented Model Manager.

The signal processing methods, developed by FORTH, mainly focused on the analysis of ECG examinations. To this end, algorithms for ECG waveform modeling, ECG pre-filtering and QRS detection have been designed and developed. The method features, in particular, a best channel selection algorithm based on a noise rating system. The method has been tested on MIT database, giving really satisfactory results and has been also adapted to process the ECG data acquired at the HEARTFAID validation site in Catanzaro with excellent results (no real false positive or false negative). The porting in C of the algorithm developed in MATLAB, originally planned for performance and integration purposes, has been considered unnecessary since a double check on both the available datasets revealed very satisfactory performances (sensitivity, Positive Predictive Value and execution time). In addition, an algorithm based on a two-step Decision Tree was designed and implemented for the identification of the dominant beats in the recording. The algorithm – tested on the MIT-BIH Arrhythmia database – has produced very satisfactory results with both very high sensitivity and specificity and significant positive/negative predictive values.
The developed algorithms for ECG processing have been integrated into a dedicated application, deployed at the clinical sites, which consists of a graphical ECG viewer endowed with specific tools like zoom and caliper, so that each ECG once processed could be displayed (and printed), also showing the average dominant beat estimated by the signal processing chain. Much more details about the functioning and implementation of all the signal processing algorithms can be found in Deliverable D30.

Minor adjustments were later performed to the algorithm for QRS detection, morphological classification and evaluation of the dominant beat centroid. The algorithm was integrated in the hospital gateway used in Catanzaro for the acquisition of ECG coming from the Esaote Archimed cardiograph. Each ECG is processed and the average dominant beat is stored in SCP-ECG format together with the raw data and other information. An ECG viewer installed on the gateway allows the cardiologist to view the ECG with the average dominant beat and to perform measurements of amplitudes and intervals on it.

In addition, part of the work focused on the processing of the data (ECG and chest movements) collected from the *MagIC Vest* (*Maglietta Interattiva Computerizzata*), by creating the *Heart Rate* (HR) series and *Respiratory Rate* (RR) series. Technical tests have been performed on a data set provided by the Don Gnocchi Foundation. The results have been presented at Computers in Cardiology 2008 in Bologna, Italy. The algorithms have been integrated in the Nurse@Home application, being able to create, from the incoming data, the HR and RR time series as well as the average RR, which are sent together with the other measurements to the HEARTFAID data repository.

Furthermore, FORTH has been involved in research of variable selection algorithms for survival analysis where the time-to-event may be right-censored. These algorithms are general but particularly important for the analysis of the ANMCO data and other HEARTFAID related data; the algorithms were directly inspired from and aim to address the analysis problems that emerged during the work for D29. The algorithms have been designed, optimized and evaluated against the state-of-the-art in the field on a large collection of high-dimensional biomedical datasets; publications are under preparation. This work is a joint activity with the University of Calabria.

Dealing with diagnostic imaging, the work by CNR was mainly devoted to the analysis of chest X-ray and ultrasound (US) images for extracting relevant diagnostic parameters. Such modalities are generally used within the routine clinical practice. More precisely, US image sequences (2 and 4 chambers views) were collected from clinical partners and elaborated by, first of all, segmenting the left ventricle. A suitable initialization method for an *active contour* was obtained by mimetic criteria. The image processing algorithms for the segmentation of the left ventricle cavity and the estimation of ejection fraction from echocardiographic images (described in D30), initially developed in the MATLAB environment, have been ported to Java through the use of MATLAB Java Builder. Then, the wrapped image processing methods have been used to develop a Web-based interface for the analysis of echocardiographic images, which has been integrated in the DICOM-compliant Web-Viewer Application, which has been introduced in the second year of the project and which relies on the HEARTFAID Image Archive. The Web-Viewer Application has also been improved by providing enhanced support for multi-frames images, which represent the key image format in echocardiography. Further, the Web-Viewer Application has been extended in order to perform several queries directly by composing a suitable URL string (in a way similar to DICOM WADO services). In this way, the Web-Viewer Application has been integrated with the other Web interfaces available in the HEARTFAID portal, and in particular with the *EchoCardioLab* System.

In addition, several connection sessions have been performed in order to test the DICOM transfer between echocardiography devices and the HEARTFAID Image Archive. Actually, in collaboration with the clinical partners from UNICZ, the VIVID 7 Pro echo device installed in Catanzaro is now able to directly transfer image studies to the HEARTFAID Image Archive, thus making superfluous the use of additional intermediate DICOM clients.

The integration of all the CDSS functionalities has been performed by CNR taking into account a realistic scenario defined in cooperation with the clinical partners. It mimics an actual situation which covers the clinical course of a patient, already enrolled in HEARTFAID platform, who is continuously telemonitored. This resulted in the CDSS Prototype released at month 30.

Later on, for integrating the CDSS into HEARTFAID Platform, a Web Services approach has been followed and different services have been included into HEARTFAID Web Portal:

- CDSS service for the home-care environment, which consists of:
  - the EDCC (Early Detection of Decompensation Conditions) based on both the Model Base and Ontological approaches. In particular, the Model Base provides an early prediction of possible worsening, whereas the Ontological approach assesses, under this respect, the current conditions of the patient;
  - Minnesota Test (assessment of the NYHA class);
- CDSS service for the hospital-care environment, which consists of querying the KB on the data collected during a patient's visit.
- the *EchoCardioLab* System for the application of image analysis methods to echocardiography and the CDSS interpretation of the results.

In particular, the *EchoCardioLab* was born with the aim of realizing a more complete and more useful system, taking into account the real hospital environments.
One of these environments is certainly the clinician one where clinicians visit patients; another is the echocardio laboratory where sonographers perform echocardiographies by using an echo device and where they can undertake actions on images and on the extracted clinical parameters. Each of these doctors works in his own environment that is personalized on the basis of his needs. Virtual personalized environments have been then developed, where each actor may work on his focus. All the environments are accessible through the HEARTFAID Web Portal.
With this respect, the *EchoCardio (Virtual) Lab(oratory)* has been specifically designed and developed for the echocardiographic environment.
The *EchoCardioLab* system includes a number of functionalities and components, precisely, (i) an echo device (GE Vivid 7 Pro) using DICOM standard communication; (ii) a custom Adapter Program, able to solve communication lack of the echo device by performing HTTP multipart connections; (iii) a dedicated Database collecting echo parameters, connected via HL7; (iv) a CDSS service, composed of a Knowledge Base and rules and an inference engine, connected via Web Services; (v) the HEARTFAID Image Archive; (vi) the DICOM-compliant Web-Viewer Application, extended with image analysis facilities; (vii) a Mail Server, used in order to send automatic notifications to users.

All these components have been integrated by means of the Middleware (developed by Synapsis), which serves for a loosely coupled and highly distributed integration infrastructure. This means that all the components communicate among each other by exchanging messages on suitably-defined middleware channels. To this end, standard protocols and messaging have been implemented, using in particular technological tools like Web Services, Mirth integration engine and HL7 adapters developed by CNR. The HEARTFAID Web Portal integrates all the graphic user interfaces accessible by clinicians, as reported in D37 Accompanied Document.

In particular a suitable parameters database has been designed and developed by CNR for storing echocardiography-related clinical parameters. The Web interface has been implemented using Java Server Faces in order to realize the Model-View-Controller pattern. The application server that has been selected is Sun Glassfish and this allowed using the Java Persistence API (JPA) to handle data according to the object-oriented paradigm. Among all the data handling phases, the fetching/storing and transformation cycles that required an accurate study have been (i) the HL7 to Parameters DB, (ii) the Parameters DB to OWL and (iii) the Excel worksheet (see below) to Parameters DB. Indeed, besides developing a suitable HL7 listener to receive directly parameters data from echo devices, a custom Adapter Program has been developed to cope with some lacks of the GE Vivid 7 Pro echo device, which has been used in the actual testing of the *EchoCardioLab*. Actually, GE Vivid 7 Pro does not provide HL7 export features, but permits to export parameters in an Excel worksheet to a local or remote shared directory. Aiming at providing direct parameters transfer in any case, GE Vivid 7 Pro functionalities have been extended by developing a C# Adapter Program that has been installed on the echo device itself; the Adapter Program scans the directories where the Excel files are exported and –once discovered a new file– is able to send it to a Java Servlet using an HTTP multipart connection. This Java Servlet then parses the file received and stores the extracted data to the Parameters DB using JPA.
In addition, CDSS functionalities are made available in the *EchoCardioLab* through the use of Web Services. In particular, each time the CDSS is automatically called during the usual clinical workflow, a Java module is triggered to find required information in the Parameters DB by using JPA fetching features and to transform these Java instances into OWL instances using an ad hoc developed Java to OWL-binder. In this way the inference engine (developed using Jena) is able to perform deductions using OWL classes and the so obtained OWL instances and the Jena rules. The results of such reasoning are suggestions to be presented to the final user in a friendly and easy way.

- **Deviation from the project workprogramme**

During the implementation activity, some changes to the plan were necessary. Some of them consisted in the simplification of the CDSS architecture, while others related to the integration of the CDSS into the platform. To this end, we required to shift 1.5 PM from WP6 (1 PM) and WP8 (0.5 PM) to Task 5.4.

WP 6 – END-USER APPLICATION AND SERVICES

WORK PACKAGE: 6
TITLE: END-USER APPLICATION AND SERVICES
START DATE: MONTH 10
WORK PACKAGE LEADER: FORTHNET
PARTNERS INVOLVED: UNICAL, UNIMIB, JUMC, SYNAP, CNR, FORTH, RBI

TASKS AND OBJECTIVES	ACHIEVEMENTS	ACTIVITIES
T 6.4-Integration of Services	All of the proposed functionalities and services have been incorporated to the HF Front-end successfully.	Following the completion of the integration activities, many tests have been performed, in order to ensure proper interoperability of the integrated services and functionalities. A number of further updates have also been applied to the HEARTFAID Front-end, following the test results, as well as discussions with other partners, especially considering the opinion of the medical partners, who are effectively the end users of the Front-end. An interface to medical data, collected by eCRF, has been developed for the KDD system within the Task 6.3 framework. The graphical design of the eCRF has been adjusted to the needs of the updated HEARTFAID Front-end.

STATUS OF DELIVERABLES AND MILESTONES OF THE PERIOD

DELIVERABLE	COMMENTS
D37-Heartfaid end-user applications and services prototype	Submission date: 15/09/08 Due date of document: 31/07/08 The Deliverable 37 has been essentially developed as a User-Manual documentation, for the end-users of the HEARTFAID Front-end, providing directions on how to navigate through the available on-line HEARTFAID applications and services.
MS 6.2-Heartfaid end-user services and application prototype	Submission date: 31/07/08 Due date of Milestone: 31/07/08 The deadline of the milestone, regarding the complete development of the Front-end prototype, was met and the prototype was distributed to all partners for official use. Some further updates had to be performed, after thorough discussions and testing, involving all the partners. These further updates were not part of the official development of the Front-end prototype (as it has been described in the DOW).

Description of the activities of the year:

T6.4-Integration of Services

During the last months of T6.4, some final decisions have taken place, regarding the integration of services and functionalities to the HEARTFAID Front – end.
The use of iFrames has been incorporated to the Front-end, so as to bypass possible double authorization requests from the various services that are invoked.

iFrames have been introduced into the platform since they solve the problem of a double user registration when various services, like the "eCRF" or the "EchoCardio Lab", are invoked. That offers not only an enhanced and friendlier to the user interface but also minimizes further security aspects associated with the transmission of personal sensitive data to a distant location, or exchanging data with the central middleware. The users get authenticated once, at the Front-end, and their session information will get propagated to the appropriate server. That is an efficient, time saving and an indeed secure technique that is being popularly employed and substantiated.
Furthermore, the design of the Front-end user interface has also been changed, in order to incorporate additional features, like a newsletter for informing registered users about forthcoming events, providing a more user-friendly interface at the same time. Front-end follows an intuitive hierarchical structure, in order to allow the end user (doctor) to reach the desired functionality with the minimum number of clicks.
A new menu item has also been added to the main menu of the Front-end, in order to provide access to the **Decision Support Services (DSS)**.

The following services and functionalities have been integrated to the Front-end, up to M27:

Patient Records
- General Patient Enrollment
- Electronic Case Report Form (eCRF)
- Search for a patient

Decision Support Services
- Hospital Care
- Home Care
- EchoCardio Lab (integration of the Front-end with CNR's EchoCardiography Laboratory system using iFrame)

Monitoring
- Assign / Change Decision Support Services
- Assign / Change monitoring resources

Medical Data Repository
- Patient Data Repository

SMS Dispatching
- Generate SMS

The XML requests which are being exchanged during the interconnection of the services and the central platform have been tested thoroughly, in terms of their propagation, speed and efficiency.

The use of iFrames also has some security related issues which have been dealt with, along with the general security principles that were a priori set for the platform to operate, by the introduction of the appropriate security policy. The security policy model that has been adopted by HEARTFAID, describes the

properties that a system should possess in order to implement a satisfactory secure transient association. Methods for the optimal device, user, and platform interaction have been considered and many tests have been performed involving computers and software (mainly web browsers) of various specifications and development vendors. More tests in that direction were considered towards Milestone 6.2 (prototype) and an improved model for better interoperability between software and hardware was evaluated.
Special provisions have been considered in order to ensure that the integrated platform would be **accessible anywhere/anytime** from either desktop or mobile devices. A variety of tests and verification analyses were also performed in that aspect.

The main principle behind the integration of the **Random Forest (RF)** engine as a web interface is the level of intuitiveness of the tool as well as the ease of use and the graspable display of the output. The **Knowledge Discovery (KD)** service is implemented as a series of interconnected web pages or web forms. The task scheduler executes data mining tasks on specified data in a given order and priority. The scheduler has the ability to execute multiple jobs at the same time (multitasking) depending on the number of processors and available memory.

Further updates performed on the HEARTFAID Front-end can be summarized as follows:

- Selected “Patient name” displayed at all times.
- “User name” displayed at all times.
- Rearrangement of the central menu, for easier portal navigation.
- Updated graphics on central menu with drop down lists.
- Additional static central menu at the bottom of the portal.
- iFrame enlargement – better visualization of integrated services.
- New images used.
- Newsletter of forthcoming events: Display information of future events / conventions, etc…
- Integration of the Echocardiography Laboratory System (EchoCardio Lab), providing integrated access to certified users.
- Updated Help / Contact details.
- Link for direct downloading of Front-end user manual (Help page)
- Medical Data Repository: End users are able to view through the Front-end all the acquired patient data log file, sorted according to date of acquisition.

Quite a few preliminary tests have been performed on the platform, in order to verify the interoperability between the original prototypes of the available HEARTFAID services. Those testing procedures have been systemized and expanded, in order to check as many access scenarios as possible. The XML requests which are being exchanged during the interconnection of the services have been tested in terms of their propagation, speed and efficiency.

By Month 28 of the project, the final version of the Front-end prototype, including all the available HEARTFAID services and functionalities had been made

available to all the partners through the internet, by uploading it on a Forthnet's server. More security issues have also been addressed, providing individual access accounts for a number of partners. Further tests have been performed, in order to ensure once more the proper operation and interoperability of the Front-end, this time including on-line tests (through the internet) by various partners.

WP 7 –TESTING AND VALIDATION

WORK PACKAGE: 7
TITLE: TESTING AND VALIDATION
START DATE: MONTH 25
WORK PACKAGE LEADER: UNIMIB/AUXOL
PARTNERS INVOLVED: UNICAL,UNICZ, UNIMIB, JUMC, VMWS,FORTHNET,SYNAP

OBJECTIVES AND ACHIEVEMENTS OF THE TASKS DUE IN THE PERIOD

T 7.1 – Deployment of the prototypes in suitable clinical settings	- The prototypes provided by the technical partners were deployed in clinical settings like the outpatient HF clinic and the patients' home. - Patients completed the follow up.	All of the users of the platform (health care providers, patients and patients' relatives) involved in the testing and validation phase of the project were trained on how to use the different functionalities of the platform. The platform was installed in the outpatient clinic and the patients' home. Qualifying patients attended educational sessions on how to follow at home the agreed clinical protocol for testing and validation. Qualifying patients entered the home follow-up phase under constant active monitoring by means of the hospital personnel. In case patients had some technical and/or medically related questions could always refer to a designated health care provider. The quality of the technique used by the patients at home to acquire the measurements and of the data (ECG signal) arriving into the platform were under constant control.
T 7.2-Clinical Validation	-The agreed clinical protocol for home data collection was implemented in the clinical sites. - Testing of usability and of available functionalities of the platform was performed in the hospital and at home.	Overall, the clinical validation has taken place in two scenarios: the hospital and the home one. After the clinical data were entered in the outpatient heart failure clinic, qualifying subjects were seen for follow up visits and were assigned a period of home monitoring. Data monitored at home were the same for all of the clinical sites; the selection of the sensors varied somewhat among the clinical sites to cover the entire spectrum of possibilities (manual entry from home, automatic entry from home, manual entry from the nurse in the hospital, automatic transmission of beat-by-beta and breath-by-breath recordings from home. In both of the scenarios the clinical decision taken by the cardiologist was compared with that of the platform.

STATUS OF DELIVERABLES AND MILESTONES OF THE PERIOD

DELIVERABLES	COMMENTS
D40 - Integration and Configuration of the Prototype	Due date: 31 October 2008 Actual submission date: 15 June 2009 As a consequence of the delay accumulated at the end of the previous reporting period, the deliverable is being delivered with a delay of six months.
D45-Clinical testing protocol and validation results	Due date: 30 April 2009 Actual submission date: 15 June 2009
MS 7.1-Validated Final Prototype	Due date: 30 April 2009 Actual submission date: 15 June 2009

Description of Activities

T 7.1- Deployment of the prototypes in suitable clinical settings

The main activities performed are related to the technical support provided to each validation site in order to have a smooth start of the validation and an effective support for any problem should have been arisen. FORTH has officially released Nurse@Home and the ECG acquisition system to the entire consortium, including their installation, configuration and user manuals. Training has been performed for the technical people responsible of the validation sites in Catanzaro (UNICZ), Milan (UNIMIB/AUXOL) and Krakow (JUMC). Technical support has been provided to technicians and clinicians by email, phone calls and Skype conferences. Technicians have worked on installing the software provided on the PC located in the medical environments and on the PCs used at home by the patients.
The installation and setting, manual or automatic (using bluetooth devices), of the application on the patient's nootebook has been made and successively has been explained how to send data. The control of data from Nurse@Home application has been made by the doctor using the front-end of the platform daily.
For EchocardioLab service UNICZ has sent the echocardiographyc data, patient's images and report, using the functionalities of echocardiograph (VIVID 7/Pro VIVID 7) that we have activated and integrated in the platform. This concerns the HL7 transmission of echo measurements and it allows to test the suggestions of CDSS on each patient enrolled. Echocardiographic images can also be automatically sent from the echocardiograph to DICOM server, allowing to evaluate the automatically detection of measurements by integrated "Echocardiolab " service through the use of the front-end of the platform.

T 7.2- Clinical Validation

JUMC
A prototype plan of the HEARTFAID platform testing and validation proposed by UNIMIB/AUXOL have been agreed and accepted by all clinical partners. According to the proposal, JUMC has selected a group of CHF patients in NYHA class II- III who have been enrolled into the platform and followed the plan of clinical validation. The patients were at elderly age (> 65yr), with available internet at home, ability to operate PCs and have agreed to participate the study. The Nurse@Home application software developed for the clinical validation and testing have been installed at patients' home PCs and patients have been trained to use the software (manual insertion of the data) and appropriate perform the measurements. The following measurements have been daily performed: blood pressure, heart rate, respiratory rate, body weight, temperature, Minnesota questionnaire. The consecutive collected parameters have been used by the HEARTFAID system to predict the early CHF decompensation. Within the clinical validation phase we observed improvement at patient's care through better monitoring and prevention of CHF decompensation as the system allowed on available every-day monitoring of clinical patient's status. Moreover the HEARTFAID platform increased interest and awareness of the disease within CHF patients improving self control and independency status.

UNICZ

According to the proposal accepted by all clinical partners, UNICZ activities have been focused to test and validate the home and hospital services of HEARTFAID platform.

Home care:

The first phase of testing and validation has been focused on the evaluation of the patient condition by Home Care telemonitoring. According to the protocol UNICZ has selected a group of 10 elderly CHF patients, 9 males and 1 female, who currently have been enrolled into the platform. The patients were enrolled for home care monitoring if they have available internet at home, possibility to use PCs (patient or patient's relatives), if they have given informed consent for the study. These patients have been selected with a CHF severity ranging from NYHA class II and NYHA class III. All patients manually acquired Minnesota questionnaire, once a week, and every morning body temperature and respiratory rate, 8 patients every morning manually acquired blood pressure, heart rate and body weight, but for three patients the acquisition was automatic, by appropriate bluetooth devices (A&D UA-767PBT and A&D UC-321PBT). The patient's selection has been made with particular attention; all patients or their relatives had a sufficient ability to use PC. The installation and setting, manual or using bluetooth devices, of the application on the patient's nootebook has been made in the hospital, and successively has been explained how to send data also using a manual in italian language. The control of data from Nurse@Home application was made by the doctor using the front-end of the platform daily. The evaluation of data coming from Nurse@ Home has been useful to check a possible cases of decompensation. Through the acquisition of data derived from Nurse@Home, an alarm system, implemented using the email and SMS notification, has been able to advice the doctor about the clinical condition of the patients enrolled in the platform. An email suggests a possible risk of patient's decompensation through the allocation of a level of risk. We observed improvement at patient's care through an easier and better management of the disease. In addition the HEARTFAID platform increased interest and awareness of the disease within CHF patients improving self control.

Hospital care:

The second phase of testing and validation has been focused on evaluation of the Hospital Care services of Heartfaid platform. In particular among decision support services UNIZ has been tested "Hospital Care" and "EchoCardio Lab", based on features of CDSS. For Hospital care we have tested and controlled the considerations suggested by the Heartfaid Platform, through the knowledge base, for patients enrolled in eCRF. For EchocardioLab service we have sent the echocardiographyc data, patient's images and report, using the functionalities of our echocardiograph (VIVID 7/Pro VIVID 7) that we have activated and integrated in the platform. This concerns the HL7 transmission of echo measurements and it allows to test the suggestions of CDSS on each patient enrolled. Also echocardiographic images can be automatically sent from the echocardiograph to DICOM server, allowing to evaluate the automatically detection of measurements by integrated "Echocardiolab " service through the use of the front-end of the platform. Through an e-mail notification, it's possible to

verify the correct procedure for sending the DICOM server. The evaluation of the CDSS results was evaluated and confirmed by the clinician.

AUXOL/UNIMIB

In this period at UNIMIB both the clinical and the technical components of the team have continued working on the activities connected with WP7 i.e. activities regarding implementation of testing and validation of the platform. The clinical components have selected 7 patients with the characteristics defined in the clinical protocol and shared with the other clinical partners and have requested them to sign the written informed consent that has been approved by the Institution's Ethical Committee. A subgroup of 3 patients has been assigned to test the NURSE@HOME application by means of home self collected biological parameters in combination with parameters collected by a special vest developed by UNIMIB (and AUXOL) focussing on ECG (and the derived heart rate signal) and respiratory activity. Such patients have been instructed on blood pressure and heart rate self measurement, on how to wear and operate the vest, on how to transmit both manually and automatically the measured biological parameters, and on how to answer to the Minnesota questionnaire. Finally, they have been provided with written material summarizing such instructions, the protocol for measurements and contact information. ECG and respiration were assessed for 3 minutes every day by such innovative platform including the textile-based signal monitoring system, named MagIC, and a touchscreen PC running software applications for data reception from MagIC and for collection of selected measurements.Another subgroup of 4 patients has been selected and instructed for data collection in the home setting by means of either the "Manual" acquisition procedures, or "Automatic" acquisition devices (using the blood pressure recorders and scales). A timeline on the actual simultaneous start and conduct of the period of home monitoring has been set pending the internal full technical testing. The technical components of our team have worked on installing the software provided by the other technical partners of this project on the PC located in the medical environment and on the PCs used at home by the patients. They have also verified the correct functioning of data transmission from the home environment. Finally, both the clinical and technical components have performed together with the involved partners of the consortium the validation of the platform DSS with respect to both the Hospital and Home environments.

WP 8 – DISSEMINATION AND EXPLOITATION

WORK PACKAGE: 8
TITLE: DISSEMINATION AND EXPLOITATION
START DATE: MONTH 1
WORK PACKAGE LEADER: UNICAL
PARTNERS INVOLVED: UNICZ, UNIMIB, JUMC, SYNAP, CNR, FORTH, RBI, AUXOL

OBJECTIVES AND ACHIEVEMENTS OF THE TASKS DUE IN THE PERIOD

TASKS AND OBJECTIVES	ACHIEVEMENTS	ACTIVITIES
T 8.1 – Dissemination Activities	Scientific publications. Participation to conferences and workshops. Interaction with professional medical associations. Project Web Site.	The dissemination activities of the third reporting period of the project have been carried out according to the planning defined in the deliverable D6.
T 8.2- Exploitation Activities	Exploitation plan	Analysis and evaluation of exploitable “parts” of the project’s results.

STATUS OF DELIVERABLES AND MILESTONES OF THE PERIOD

DELIVERABLES	COMMENTS
D 38- Investigation on new models for health care delivery	Due date: 31 October 2008 Actual submission date: 15 June 2009 As a consequence of the delay accumulated at the end of the previous reporting period, the deliverable is being delivered with a delay of six months.
D46- Report on dissemination activities and Exploitation activities Plan	Due date: 30 April 2009 Actual submission date: 15 June 2009
D47-Report on Raising Public Participation and Awareness	Due date: 30 April 2009 Actual submission date: 15 June 2009
MS 8.2-Exploitation Plan	Due date: 30 April 2009 Actual submission date: 15 June 2009

Description of Activities

T 8.1 Dissemination Activities

The HEARTFAID consortium has carried out dissemination activities which have been developed and upgraded along the entire duration of the project. These activities concern the wide diffusion and distribution of knowledge and information related to the project and to the establishment of a close cooperation with potential end-users, the scientific community and professional organizations. The consortium tried to balance the need of a capillary diffusion of the

information that was better done using individual efforts by all the partners with the provision of a uniform image of the consortium itself.

According to the early plan for using and disseminating knowledge (deliverable D6), the dissemination activities have been mainly organized on the basis of the following items:

- The members of the HEARTFAID consortium have raised awareness of their own project but have also actively participated in activities that have raised the profile of the HEARTFAID initiative in general. The partners have collaborated and cooperated amongst each other, and also have participated in some "clustering" activities, e.g. workshops or joint review meetings.
- A project website has been created and it has been maintained during the project period and beyond it in order to inform the public worldwide about the aims and the main results of the HEARTFAID project. Public deliverables are making available on the web site.
- Dissemination activities beyond the consortium: publications, conferences, workshops and web-based activities aiming at disseminating the knowledge and technology produced.
- The project is promoting both the coordinated publication in research journals as well as in sector oriented magazines.
- Each partner has operated its own dissemination activity as well using its web site and its dissemination channels mainly on a geographical base.
- As it is already established in the Project Handbook, if the Work Package Leaders Group has agreed a Project Deliverable to be available to the public, any partner may publish information included in such Project Deliverable without any notifications to the other partners and without any other partners' consent.

The dissemination activities carried out during the third reporting period are summarized in the following table.

DISSEMINATION EVENTS

Date	Channel	Event	Place/ Country	Partner Respons.	Nature and size of audience
26.-27. March 2008.	invited presentation	Fifth international workshop on knowledge technologies	Bohinj/Slovenia	RBI	35 computer scientists from Slovenia and Croatia
25.-28. May 2008.	oral presentation at the conference	Conference Medical Informatics in Europe (MIE 2008)	Goeteborg Sweden	RBI	200 scientists mainly from Europe
23.-26. June 2008.	oral presentation at the conference	International Conference on Information Technology Interfaces	Cavtat/Dubrovnik Croatia	RBI	150 scientists mainly from Croatia and Slovenia
14.-17. September 2008.	Poster presentation	Conference Computers in Cardiology	Bologna, Italy	RBI+dr. Goran Krstacic	About 200 conference participants
17.-19. October 2008.	Organization and oral presentation	Workshop on Knowledge Discovery Applications	Porec, Croatia	RBI	28 Croatian scientists in the field of artificial intelligence
15.-19. December 2008.	Oral presentation	Tenth Pacific Rim International Conference on Artificial Intelligence	Hanoi, Vietnam	RBI	computer scientists mainly from Asia, USA, and Australia, 300 participants
24. December 2008.	Invited talk	Presentation at Faculty of Computer Science of Ho Chi Minh City University of Technology	Ho Chi Minh City, Vietnam	RBI	professors and computer science students, 25 persons
5. February 2009.	Invited talk	Professional meeting at Clinic of Cardiovascular Diseases, Clinical Medical Centre Rebro	Zagreb, Croatia	RBI	30 medical doctors working in the hospital
2.-4. March 2009.	Oral presentation	Sixth International Ljubljana-Zagreb Workshop on Knowledge Technologies	Bohinj, Slovenia	RBI	50 scientists in computer science mainly from Slovenia
3. April 2009.	Oral presentation	RBI seminar	Zagreb, Croatia	RBI	20 scientists mainly from RBI
14 July 2008	Oral presentation	Int. Conf. on Mass-Data Analysis of Images and Signals in Medicine, Biotechnology, Chemistry and Food Industry	Leipzig, Germany	CNR, FORTH	35 international Computer Scientists
16-18 July 2008	Oral Presentation	8th Industrial Conference on Data Mining ICDM´2008	Leipzig, Germany	CNR	100 International Computer Scientists
14-17 July 2008	Oral Presentation	the 2008 International Conference on Semantic Web and Web Services	Las Vegas, USA	CNR, UNICAL, VMWS	International

14-17 Sept 2008	Poster Presentation	35th annual Computers in Cardiology Conference	Bologna, Italy	CNR, FORTH, UNICZ	100 International medical & technical audience
14-17 Sept 2008	Oral Presentation	35th annual Computers in Cardiology Conference	Bologna, Italy	UNICAL CNR, FORTH, UNICZ	100 International medical & technical audience
16 Decembe r 2008	Seminar	Workshop: Multimodal and Multidimensional Content and Media – CNR ICT Department Project	Genova, Italy	CNR	80 industrial and academic audience
14 January 2009	Seminar	ECSON Project Seminar	University of Central Lancashire, UK	CNR	10 Engineer and Computer Scientists
5-8 Februar y 2009	Paper Presentation	Second Workshop on Image Mining. Theory and Applications; within Int. conf. on Computer Vision: Theory and Application	Lisboa, Portugal	CNR	About 100 participants
13.02.20 09	*Scientific event*	*Meeting of Department's staff and Cracow Division of Polish Hypertension Society*	*Cracow, PL*	*JUMC*	*Physicians , about 20 persons*

T 8.2 Exploitation Activities

As far as exploitation issues are concerned, since HEARTFAID is a project mostly implementation oriented, theoretical and methodological work are currently being rapidly converted to experimental and practical applications. Furthermore, the knowledge and experiences gained from practical experiments are going to be used by the HEARTAFAID partners for defining the next generation of products and services in the relevant domain.

In order to devise and form a clear exploitation strategy, the HEARTFAID Consortium has developed (and is still developing) the following activities.

1. Clearly state the results of the project and identify the exploitable knowledge (see the following Overview Table). What has been reported in the Overview Table concerns the identification and the very preliminary assessment of the expected most promising exploitable "parts" of the project results.

2. Definition of direct and indirect "selling points" out of the produced results.

3. Definition and assessment of the objective of marketing the overall HEARTFAID platform. In particular, identification of the appropriate collaborating marketing schemes for maintaining shared objectives and common interests. Moreover, marketing management (market research, identification of competitors, SWOPT and PEST analysis).

4. As far as the individual partners are concerned, exploitation plans are mainly based on specifically taking into account the "owning of results" and the exploitable parts of these results. In particular:

    a. Academic and research partners:
        i. Collaboration with other companies for exploiting the relevant result owned by the individual partner.
        ii. Foundation of spin-off companies.
        iii. Academic and research oriented exploitation (e.g., new research topics, PhD dissertations, etc.).
    b. Industrial partners:
        i. Use results in advancing existing products or solutions.
        ii. Creation of new products or solutions.
        iii. Adaption of results to cover solutions offered in other fields.
        iv. Use the new knowledge gained by the project as a new base level for further R&D.
        v. Define future company's R&D objectives for participation in new projects.

More details will be presented in the Appendix 1.

Table 1: Deliverables List

Del. N.	Deliverable Name	Work Package	Due Date	Delivery Date	Lead Contractor
D26 Revised	2nd Periodic Report	WP 0	Month 24	28/05/08	UNICAL
D34	9th Quarterly Managerial Report	WP 0	Month 27	23/06/08	UNICAL
D 35	Summary on Data Collection	WP 2	Month 28	12/07/08	VMWS
D36	HEARTFAID Decision Support System prototype	WP 5	Month 30	12/09/08	CNR
D37	HEARTFAID end-user applications and services prototype	WP 6	Month 30	12/09/08	FORTHNET
D38	Investigation on new models for health care delivery	WP 8	Month 33	15/06/09	UNICAL
D39	10th Quarterly Managerial Report	WP 0	Month 30	15/09/08	UNICAL
D 40	Integration and Configuration of the prototype	WP 7	Month 33	15/06/09	UNIMIB/AUXOL
D 41	11th Quarterly Managerial Report	WP 0	Month 33	17/12/08	UNICAL
D 42	12th Quarterly Managerial Report	WP 0	Month 36	18/03/09	UNICAL
D43	3rd Periodic Report (activity and management)	WP 0	Month 39	29/07/09	UNICAL
D44	3rd Periodic Report on the Distribution of the Community Contribution	WP 0	Month 39	15/06/09	UNICAL
D45	Clinical Testing and Validation	WP 7	Month 39	15/06/09	UNIMIB/AUXOL
D46	Report on Dissemination Activities and Exploitation activities plan	WP 8	Month 39	15/06/09	UNICAL
D47	Report on Raising Public Participation and Awareness	WP 8	Month 39	15/06/09	UNICAL
D 48	13th Quarterly Managerial Report	WP 0	Month 39	15/06/09	UNICAL
D 49	Final Report	WP 0	Month 39	29/07/09	UNICAL

Table 2: Milestones List

Milestone N.	Milestone Name	Work Package	Due Date	Delivery Date	Lead Contractor
MS 0.3	3rd Periodic Report	WP 0	Month 39	29/07 /09	UNICAL
MS 5.2	Data Processing and Decision support System Prototype	WP 5	Month 30	12/09/08	CNR
MS 6.2	HEARTFAID End-user services and application prototype	WP 6	Month 30	12/09/08	FORTHNET
MS 7.1	Validated Final Prototype	WP 7	Month 39	15/06/09	UNIMIB/AUXOL
MS 8.2	Exploitation Plan	WP 8	Month 39	15/06/09	UNICAL

Section 3 – Consortium Management

WP0 – PROJECT MANAGEMENT

WORK PACKAGE: 0			
TITLE: MANAGEMENT			
START DATE: MONTH 1			
WORK PACKAGE LEADER:UNICAL			
PARTNERS INVOLVED:UNICZ, UNIMIB, VMWS , FORTHNET, SYNAPSIS, CNR, RBI			
MEETINGS	PLACE	DATE	ATTENDANTS
MB & STAB Meeting	London	June 10th-11th	UNICAL/UNICZ/CNR/SYNAP/FORTHNET/FORTH/RBI Hosting: VMWS
MB & STAB Meeting	Crete	October 9th-11th	UNICAL/UNICZ/JUMC/VMWS/CNR/SYNAP/RBI/AUXOL Hosting: FORTH/FORTHNET
MB & STAB Meeting	Catanzaro	April 6th-8th	UNICAL/UNIMIB/JUMC/CNR/FORTH/FORTHNET/CNR/SYNAP RBI/AUXOL Hosting:UNICZ

TASKS AND OBJECTIVES	ACHIEVEMENTS	ACTIVITIES
T 0.1 Overall management of the Consortium	Good interaction and coordination among all the partners.	The task has been carried out satisfactory insuring a good communication of management information to the Consortium, collection of management reports and feedbacks from all partners. Thanks to the cooperation and contribution of the entire Consortium through WP leaders, it has been possible to forward the due documents on time, except for a delay in D38 and D40, mainly motivated by the approved request of extension of project duration.
T 0.2 Coordination of the Consortium Activities	Definition of the coordination strategies within each WP and interaction between WP leaders and coordinator.	The task has included the co-organisation of the steering meeting and the collection of all reports. Overall management of Deliverables of all WPs, collection of all related material with the contribution of all WPs and of the entire Consortium.
T 0.3 Management of contractual, legal, financial and administrative procedure of the consortium.	Effective interaction with the EU Commission and the PO. Effective coordination among the partners	The task has been carried out in the third period starting from the handling of the second review, its outcome and the handling of the third pre-financing from the Commission The procedure of the project amendment for the extension of the project of 3 months has been carried out and finally the management of the issues in view of the 3rd reporting period has been performed.
T 0.4 Internal Communication infrastructure	Development of the Project web Site	The communication infrastructure for supporting the overall project management has been established by the improvement and extension of the services and functionalities provided by the project web site. The internal communication infrastructure has been realized by the services and functionalities provided by the Internal side of the Project Web Site. Further support has been realized by audio conference services.

LIST OF WP0 DELIVERABLES AND MILESTONES OF THE PERIOD

DELIVERABLE	DUE DATE	COMMENTS
D 34- 9th Quarterly Managerial Report	Month 27	On time
D 39-!0th Quarterly Managerial Report	Month 30	On time
D41-11th Quarterly Managerial Report	Month 33	On time
D42-12th Quarterly Managerial Report	Month 36	On time
D43-3rd Periodic Report (activity and management)	Month 39	On time
D44-3rd Periodic Report on the Community Contribution	Month 39	On time
D48-13th Quarterly Managerial Report	Month 39	On time
D49-Final Report	Month 39	On time
MILESTONE	DATE	COMMENTS
MS 0.3 – 3rd PERIODIC REPORT	Month 39	Achieved on time

Description of the Activities

Management activities for the third period have concentrated on the tasks above mentioned.

In particular the work focused on the handling of the second review and its outcome, handling of deliverables of all WPs of which only D38 and D40 have not be sent on time, the amendment procedure for the 3 months extension and the handling and preparation for the third and final review.

Involvement from the Consortium: all partners have been actively involved in WP0 activities during the year, in particular UNIMIB, AUXOL , VMWS, FORTH, FORTHNET and UNICZ have organized and hosted HEARTFAID MB & STAB meetings during this year .

Appendix 1 – Plan for using and disseminating the knowledge

HEARTFAID is a research and development project aimed at devising, developing and validating an innovative knowledge based platform of services, able to improve early diagnosis and to make more effective the clinical management of heart diseases within elderly population.
In very general terms, the project aims at a broader availability and extension of IST applications and services. In particularly, by exploiting the up-to-date scientific achievements on knowledge representation, management, discovery and decision support systems, the main project goal is to develop new systems and services that are able to effectively integrate and process relevant biomedical data and information for improving medical knowledge and processes related to the clinical management of Heart Failure (HF) patients.
Moreover, according to the overall vision of the IST priority in FP6, HEARTFAID project proposal aims to contribute in developing innovative intelligent environments that enable ubiquitous, effective and efficient management of citizens' health conditions and supporting health professionals in coping with major health challenges. In particular, HEARTFAID provides healthcare professionals with access to timely relevant information at the point of need (i.e. different types of health care delivery environments), with a set of functionalities and services for acquiring up-to-date relevant medical knowledge that will provide a reliable support to healthcare professionals in their daily medical and clinical operations, enabling new ways of working as well as improved patient quality.

Under this respect, it is of strong strategic importance for HEARTFAID to devise and effectively implement exploitation and dissemination strategies, with the aim to emphasize the overall impact of the project's results.

Section 1 - Exploitable knowledge and its Use

As far as the "***using knowledge***" issues are concerned, since HEARTFAID is a project mostly implementation oriented, theoretical and methodological work are currently being rapidly converted to experimental and practical applications. Furthermore, the knowledge and experiences gained from practical experiments are going to be used by the HEARTAFAID partners for defining the next generation of products and services in the relevant domain.
More specifically, the industrial partners are developing an exploitation plan, based on the following steps: identification and evaluation of the most promising exploitable "parts" of the project results; identification of the market segments; detailed business plan; detailed identification of the potential markets and the competitive environment; assessment of benefits by end-users; establishment of a commercial agreement among partners on the joint commercialization and exploitation after project end; after project completion, development of the prototypes into industrial products.

Exploitation Activity: Overview Table

Exploitable Knowledge (description)	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable for commercial use	Patents or other IPR protection	Owner & Other Partner(s) involved
Data acquisition and transmission infrastructure from home care environment	1. Ambient Intelligence Systems 2. Nurse@Home	1. Health Care 2. Ambient Assisted Living	2009-2010	Software license agreement	VMWS SYNAP FORTH
e-CRF (electronic-Case Report Form): integrated informative tool for the collection and storing of all the clinical data and information of the Heart Failure patient	Heart Failure Electronic Patient Record	Clinical management of chronic Heart Failure patients	2009-2010	Software license agreement	JUMC
Medical Knowledge Base: integrated tool which implements and codes the descriptive and procedural medical knowledge of the heart failure domain.	Clinical Decision Support Systems	Clinical management of chronic Heart Failure patients	2009-2010	Software license agreement	RBI CNR
Medical Model Base: integrated tool which implements and codes the new medical knowledge of the heart failure domain by tailored application of innovative KDD methods	Clinical Decision Support Systems	Clinical management of chronic Heart Failure patients	2009-2010	Software license agreement	UNICAL RBI CNR FORTH
Signal Analysis methods for the management, processing and features extraction of the ECG signals	Clinical Decision Support Systems	Clinical management of chronic Heart Failure patients	2009-2010	Software license agreement	FORTH
Image Analysis Toolkit for the management, processing and features extraction of the EcoCG images	Clinical Decision Support Systems	Clinical management of chronic Heart Failure patients	2009-2010	Software license agreement	CNR

Exploitable Knowledge (description)	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable for commercial use	Patents or other IPR protection	Owner & Other Partner(s) involved
Knowledge Discovery System for Web-Based Data Extraction and Analysis	Clinical Decision Support Systems	Clinical management of chronic Heart Failure patients	2009-2010	Software license agreement	FORTHNET RBI SYNAP
Methods and technologies for the implementation of instant Alert and Notification system	Clinical Decision Support Systems	Clinical management of chronic Heart Failure patients	2009-2010	Software license agreement	FORTHNET SYNAP

What has been reported in the Overview Table concerns the identification and the very preliminary assessment of the expected most promising exploitable "parts" of the project results.

All the mentioned exploitable results are related to the developed technological components and functionalities of the Heartfaid Platform, about which all the consortium has been involved.
Even though the Industrial Partners (VMWS, FORTHNET and SYNAP) have the responsibility to define the Exploitation Plan, they equally share the roles about the exploitation activities with all the consortium.
At the moment, we foresee that the results might be commercially exploited indirectly by some form of licensing agreement. On the other hand, the scientific and methodological results of the project might be mainly exploited in some other forthcoming national and international projects.

Section 2 – Dissemination of knowledge

As far as the "***disseminating knowledge***" issues are concerned, it is of strong interest to the HEARTFAID project and its partners to spread the knowledge, results, information and ideas related to the project as wide as possible. Dissemination is an important interactive interface for the project for establishing a close cooperation with end-users, scientific and professional communities and getting continued feedback on ideas and concept refinement.
The dissemination activities of the third reporting period of the project have been carried out according to the planning defined in the deliverable D6. In particular, the activities have been run on the basis of the following issues:

- Internal Dissemination: each partner has organised internal dissemination activities (seminars, press releases, relevant information published on the own web site), with the aim to improve the general awareness about Heartfaid within their own institutions.
- Project Web Site: the project web site has been established and is currently under revision and improvement. All public deliverables will be available on the site. Special pages are under construction and will be devoted to the dissemination of the results of the project.

- Conferences Exhibitions and Scientific Publications: as it has been reported in the next table, many partners have presented the project at European and national conferences and exhibitions. Moreover, some scientific papers have been already published or submitted to peer review journals.
- Clustering and Concertation Meetings: the coordinator partner has participated in clustering and concertation meetings organized by the Commission.
- Intermediaries: contacts have established with the following health care professional associations with the aim to keep informed about the Heartfaid activities: ANMCO (Italian Association of Hospital Cardiologists), SIC (Italian Society of Cardiology), SIMI (Italian Society of Internal Medicine), EMA (European Medical Association).
- Links with other projects: very interesting relationships have been established with other FP6 projects (MYHEART, ACGT and @neurIST).
- During the last reporting period an agreement has been established with the FP7 project "HEARTCYCLE" (www.heartcycle.eu) for sharing the Heart Failure Ontology developed by Heartfaid consortium within the activities of WP4.

Specific details about the relevant dissemination activities carried out by the partners have been given in the table of the Dissemination Events given in the description of WP8.

The plan for the next future activities is mainly characterized by the further improvement and realization of the following specific activities:

- Heartfaid Project Web Site, with improvement of the pages dedicated to dissemination and community.
- Conference Exhibitions and Scientific and Technical Publications.
- Professional Associations, by enhancing and consolidating the contacts at national and European levels.

Dates and Place	Event	Type	Type and Size of Audience	Countries addressed	Partner responsible /involved
14-17 July 2008 Las Vegas, USA	*the 2008 International Conference on Semantic Web and Web Services*	*Oral Presentation*		*Internatio nal*	*CNR, UNICAL, VMWS*
14-17 Sept. 2008 Bologn, Italy	*35th annual Computers in Cardiology Conference*	*International Conference*	*100 International medical & technical audience*	*Internatio nal*	*CNR, UNICAL, UNICZ, UNIMIB, JUMC, AUXOL, FORTH, RBI*
14-17 Sept 2008 Bologna Italy	*35th annual Computers in Cardiology Conference*	*International Conference*	*100 International medical & technical audience*	*Internatio nal*	*CNR, UNICAL, UNICZ*
14-17 Sept. 2008 Bologn, Italy	*35th annual Computers in Cardiology Conference*	*International Conference*	*100 International medical & technical audience*	*Internatio nal*	*CNR, UNICAL, UNICZ, UNIMIB, JUMC, AUXOL, FORTH, RBI*
14-17 Sept 2008 Bologna Italy	*35th annual Computers in Cardiology Conference*	*International Conference*	*100 International medical & technical audience*	*Internatio nal*	*CNR, UNICAL, UNICZ*
October 25-28, 2008 Genova, Italy	*The National Congress of the Italian Society of Internal Medicine (SIMI)*	*Poster presentation*		*Italy*	*UNICZ, UNICAL*
14-17 Sept. 2008 Bologn, Italy	*35th annual Computers in Cardiology Conference*	*International Conference*	*100 International medical & technical audience*	*Internatio nal*	*CNR, UNICAL, UNICZ, UNIMIB, JUMC, AUXOL, FORTH, RBI*
14-17 Sept. 2008 Bologna Italy	*35th annual Computers in Cardiology Conference*	*International Conference*	*100 International medical & technical audience*	*Internatio nal*	*CNR, UNICAL, UNICZ, UNIMIB, JUMC, AUXOL, FORTH, RBI*
13.02.20 09	*Meeting of Department's staff and Cracow*	*Scientific event*	*Physicians , about 20 persons*	*Cracow, PL*	*JUMC*

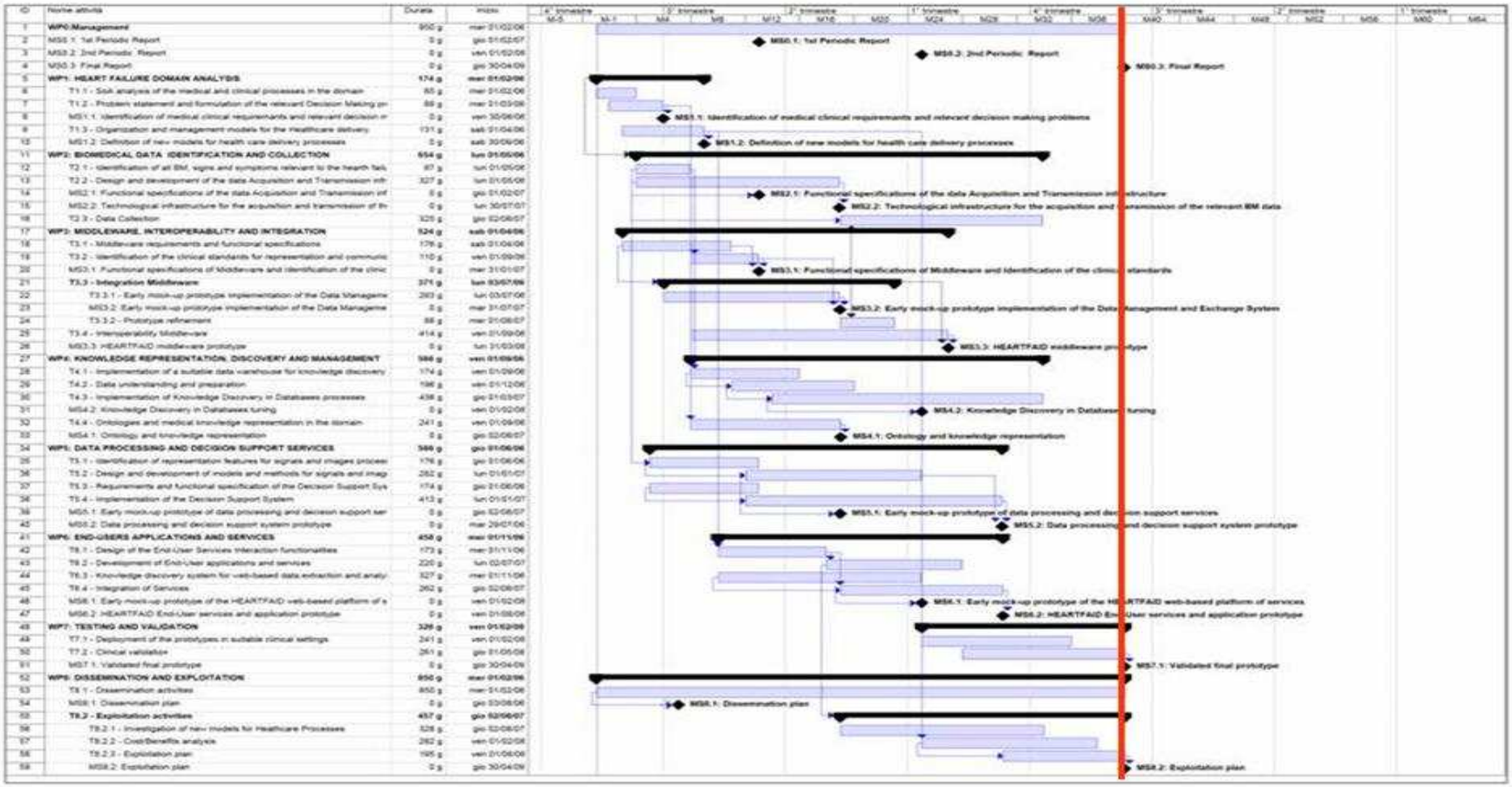
	Division of Polish Hypertension Society Scientific event				
14-17 July 2008 Las Vegas, USA	*the 2008 International Conference on Semantic Web and Web Services*	*Oral Presentation*		*International*	*CNR, UNICAL, VMWS*
9-11 July 2008 London, UK	*The Leading International Event on ICT in Medicine and Care - the annual platform of the International Council on Medical and Care Compunetics*	*International Conference*		*International*	*VMWS*
14-17 July 2008 Las Vegas, Nevada, USA	*WORLDCOMP'08 - The 2008 World Congress in Computer Science, Computer Engineering, and Applied Computing*	*Conference*	*over 2,000 computer science and Engineering researchers from 82 countries*	*All the world*	*VMWS*
16-19 October 2008, Fiuggi (IT)	*World Academy of Biomedical Sciences and Technologies, Best for Health, World WABT Forum, Fuggi, Italy*	*International Forum*	*General Purpose*	*International*	*VMWS*
14 July 2008 Leipzig, Germany	*Int. Conf. on Mass-Data Analysis of Images and Signals in Medicine, Biotechnology, Chemistry and Food Industry*	*Oral presentation*	*35 international Computer Scientists*	*International*	*CNR, FORTH*
16-18 July 2008 Leipzig, Germany	*8th Industrial Conference on Data Mining ICDM´2008*	*Oral Presentation*	*100 International Computer Scientists*	*International*	*CNR*

14-17 July 2008 Las Vegas, USA	the 2008 International Conference on Semantic Web and Web Services	Oral Presentation		International	CNR, UNICAL, VMWS
14-17 Sept. 2008 Bologn, Italy	35th annual Computers in Cardiology Conference	International Conference	100 International medical & technical audience	International	CNR, UNICAL, UNICZ, UNIMIB, JUMC, AUXOL, FORTH, RBI
14-17 Sept 2008 Bologna Italy	35th annual Computers in Cardiology Conference	International Conference	100 International medical & technical audience	International	CNR, UNICAL, UNICZ
November 18-20, 2008 NATO-NURC La Spezia, Italy	Geospatial Data in the Operational Decision Making Process	Presentation	30 among Computer Scientists and Engineers from US, Italy, UK	International	CNR
16 December 2008 Genova, Italy	Workshop: Multimodal and Multidimensional Content and Media – CNR ICT Department Project	Seminar	80 industrial and academic audience		CNR
January 14, 2009 University of Central Lancashire, Preston, UK	Engineering and Computational Science for Oncology Network (ECSON) Seminars	Seminar	20 among Computer Scientists and Mathematicians	International	CNR
5-8 February 2009 Lisboa, Portugal	Second Workshop on Image Mining. Theory and Applications; within Int. conf. on Computer Vision: Theory and Application	Paper Presentation	About 100 participants	International	CNR
14 July 2008 Leipzig, German	Int. Conf. on Mass-Data Analysis of Images and	Oral presentation	35 international Computer Scientists	International	CNR, FORTH

y	*Signals in Medicine, Biotechnology, Chemistry and Food Industry*				
14-17 Sept. 2008 Bologn, Italy	*35th annual Computers in Cardiology Conference*	*International Conference*	*100 International medical & technical audience*	*Internatio nal*	*CNR, UNICAL, UNICZ, UNIMIB, JUMC, AUXOL, FORTH, RBI*
26.-27. March 2008. Bohinji/ Slovenia	*Fifth international workshop on knowledge technologies*	*invited presentation*	*35 computer scientists from Slovenia and Croatia*	*Slovenia/ Croatia*	*RBI*
25.-28. May 2008. Goetebo rg Sweden	*Conference Medical Informatics in Europe (MIE 2008)*	*oral presentation at the conference*	*200 scientists mainly from Europe*	*Europe*	*RBI*
23.-26. June 2008. Cavtat/ Dubrovn ik Croatia	*International Conference on Information Technology Interfaces*	*oral presentation at the conference*	*150 scientists mainly from Croatia and Slovenia*	*Croatia and Slovenia*	*RBI*
14.-17. Septe mber 2008. Bologna Italy	*Conference Computers in Cardiology*	*Poster presentation*	*About 200 conference participants*	*All the World*	*RBI+dr. Goran Krstacic*
17.-19. October 2008. Porec, Croatia	*Workshop on Knowledge Discovery Applications*	*Organization and oral presentation*	*28 Croatian scientists in the field of artificial intelligence*	*Croatia*	*RBI*
14-17 Sept. 2008 Bologn, Italy	*35th annual Computers in Cardiology Conference*	*International Conference*	*100 International medical & technical audience*	*Internatio nal*	*CNR, UNICAL, UNICZ, UNIMIB, JUMC, AUXOL, FORTH, RBI*
15.-19. Decemb er 2008. Hanoi, Vietnam	*Tenth Pacific Rim International Conference on Artificial Intelligence*	*Oral presentation*	*computer scientists mainly from Asia, USA, and Australia, 300 participants*	*Internatio nal*	*RBI*
24. Decemb er 2008. Ho Chi	*Presentation at Faculty of Computer Science of Ho*	*Invited talk*	*professors and computer science students, 25*	*Internatio nal*	*RBI*

Minh City, Vietnam	*Chi Minh City University of Technology*		*persons*		
5. Februar y 2009. Zagreb, Croatia	*Professional meeting at Clinic of Cardiovascula r Diseases, Clinical Medical Centre Rebro*	*Invited talk*	*30 medical doctors working in the hospital*	*Croatia*	*RBI*
2.-4. March 2009. Bohinj, Slovenia	*Sixth International Ljubljana-Zagreb Workshop on Knowledge Technologies*	*Oral presentation*	*50 scientists in computer science mainly from Slovenia*	*Slovenia*	*RBI*
3. April 2009. Zagreb, Croatia	*RBI seminar*	*Oral presentation*	*20 scientists mainly from RBI*	*Croatia*	*RBI*
14-17 Sept. 2008 Bologn, Italy	*35th annual Computers in Cardiology Conference*	*International Conference*	*100 International medical & technical audience*	*Internatio nal*	*CNR, UNICAL, UNICZ, UNIMIB, JUMC, AUXOL, FORTH, RBI*

PROJECT BARCHART AND STATUS



PERIODIC MANAGEMENT REPORT

Section 1 - Justification of Major Cost Items and Resources

UNICAL

UNICAL Costs (for the third reporting period)

	EU contribution	UNICAL contribution
Personnel	**82.881,20**	**32.858,00 (7 MM)**
of which subcontracting	**4.608,29**	**0,00**
Equipment	**2353,91**	**6.000,00**
Travelling	**11.207,88**	**3.000,00**
Other costs	**962,83**	**0,00**
Indirect costs	**18.559,50**	**0,00**
Management (Subcontracting Audit)	**2.600,00**	**0,00**
TOTAL	**118.565,32**	**41.858,00**
Delta Costs	**4.341,78**	
Total After Delta Costs	**122.907,10**	

UNICAL personnel by work-package (Man/Months)

WP's	**EU Contribution**	**UNICAL Contribution**
WP0	6 planned 4	2
WP4	6 planned 5	1
WP5	6 planned 3	1
WP6	1 planned 1	1
WP 7	4 planned 2	1
WP8	5 planned 4	1
TOTAL	**28 planned 19**	**7**

Work performed

WP0: management activities (5 MM) as coordinator of the consortium, according to what has been detailed in the description of WP0. Further activity has been required for the development of the contract amendment related to the extension of project duration.

WP4: the activities (6 MM) have concerned the contribution in the selection, development, tuning and application of KDD methods for the analysis of relevant medical data sets.

WP5: the activities (6 MM) have concerned contributions in the development of the CDSS prototype, in particular in the software development of: Strategy Controller, Inference Engine, Model Manager, Model Base; contribution in the preparation of Deliverable D36.

WP6: the activities (1 MM) have concerned: contribution in the testing and assessment of the end-user services; contribution in the preparation of Deliverable D37.

WP7: the activities (4 MM) have concerned: contribution in the deployment of the platform prototypes; contribution in the development of clinical testing protocols; support to the clinical partners in the execution of clinical testing ad validation; contribution in the preparation of Deliverables D40 and D45.

WP8: the activities (5 MM) have concerned: contribution in the preparation of joint scientific papers; maintenance, upgrading and improvement of the project web site; contacts and interactions with Italian health care professional associations (SIC: Italian Association of Cardiology, SIMI: Italian Association of Internal Medicine); contribution in the preparation of Deliverables D38, D46, D47.

Explanatory note on major costs

Major costs have been for personnel costs and travelling. Direct Costs refer to:

- **Personnel** costs for additional supporting of research and technological development innovation activities and consortium management activities. They concern about the establishment of 4 temporary contracts for 4 external personnel contribution (27 MM), with a total gross amount of **Euro 82.881,20**. The subcontracting of **Euro 4.608,29** is motivated by an external technical contribution for software development activity related to WP5.
- **Travelling** costs for the participation of internal and external personnel to the Steering Meetings of the project, to specific technical and management meetings with other partners, to national and international conferences and workshops related to the activities of the project, to the participation of clustering and consultation meetings. The total amount is **Euro 11.207,88**.
- **Equipment** costs have been charged according to the following depreciation formula (typically used by UNICAL): **A/B x C x D**, where A period of use, in months, for the project; B depreciation period; C equipment cost; D use, in percentage, of the equipment for the project. The amount for the third reporting period is equal to **Euro 2353,91**.
- **Other costs**, related to consumables and services, amount for **Euro 3.562,83**. This includes also the subcontracting for the audit certificate related to the first and second reporting period (**Euro 2.600,00**).
- **Delta Costs:** related to Audit Certificate for the third year (2080) , travel costs for final review (41,50), management personnel needed for drawing the final reports 1MM (1843,32).

It is important to observe that the total costs reported for the third reporting period include also some costs related to activities carried out during the second reporting period but effectively charged during the third year.

The contribution of UNICAL to the project in this second year was the following:

- The internal personnel contributed of total 7 MM: 4 MM of associate professors, 1 MM of assistant professor, 1 MM administrative director and 1 MM administrative secretary.
- Travelling costs for the participation to steering meetings, technical and management meetings, international conferences.
- Partial usage of already available equipments: 4 Personal Computers, 2 Laser Printer, 1 Video Projector.

Deviations from the cost budget and from person-month budget

The deviations from the cost and person-month budget are related to more effort in terms both of financial and personnel resources dedicated to the various WPs, mainly due to the extension of the project duration.

UNICZ

	EU contribution	UNICZ contribution
Personnel	**47.657,10**	**66.000,00**
Equipment	**0**	**55.000,00**
Travelling	**6.925,67**	**0**
Consumables	**1.215**	
Indirect costs	**11.159,54**	**0**
TOTAL	**66.957,31**	**121.000,00**
Adjustment	**- 1211,16**	
TOTAL	**65.746,15**	
Delta Costs	**11550,54**	
Total after Delta Costs	**77296,69**	

UNICZ personnel by work-package

WP's	EU Contribution	UNICZ Contribution
WP0	0,5 (planned 0.5)	1
WP2	1 (planned 1)	5
WP4	3 (planned 0)	0
WP5	3 (planned 0)	0
WP7	15 (planned 8)	2
WP8	2,5 (planned 2.5)	4
TOTAL	**25 (planned 12)**	**12**

Work performed (Brief Description)

WP2: the activity has been concerned the enrollment of heart failure patients and collection of relevant clinical data: Electrocardiogram, Holter electrocardiography, Chest X-ray, Echocardiography, Clinical chemistry with the aim to test and validate Heartfaid platform . The data have been filled also in eCRF, both basal assessments and additional clinical visits. The clinical assessment in the enrolled patients is scheduled every one-two months, and also earlier if clinical conditions are worsening. Moreover, for Home monitoring environment, we have continued to collect, every two weeks, in a smaller group of patients the following parameters: systolic blood pressure, heart rate, respiratory rate, % of body water, body temperature, in order to achieve an early diagnosis of heart failure decompensation, so as indicated in Deliverable D5. The collection of these data has been amplified and completed for supporting Heartfaid platform functionalities. Moreover we have provided storage of digital ECG files in SCP format and echocardiography images in DICOM format.
WP4: the activity with additional, not planned, 3 MM, for contributing to the final development of ontology and knowledge base for early detection of heart failure decompensation.
WP5: the activity has concentrated on clinical support to implementation of methods for processing and analysing diagnostic signals and images. We have actively contributed to develop the echocardioLab decision servise (DS) of the platform.
WP7 According to the proposal UNICZ activities have been focused to test and validate the home and hospital services of HEARTFAID platform. The first phase of testing and validation has been focused on the evaluation of the patient condition by Home Care telemonitoring. UNICZ has selected a group of 10 elderly patients, 9 males and 1 female, with a CHF severity ranging from NYHA class II and NYHA class III, who currently have been enrolled into the platform. The patients were enrolled if they have available

internet at home, possibility to use PCs (patient or patient's relatives), if they have given informed consent for the study.All patients manually acquired Minnesota questionnaire, once a week, and every morning body temperature and respiratory rate, 8 patients every morning manually acquired blood pressure, heart rate and body weight, but for three patients the acquisition was automatic, by appropriate bluetooth devices (A&D UA-767PBT and A&D UC-321PBT). The control of data from Nurse@Home application was made by the doctor using the front-end of the platform daily. The evaluation of data coming from Nurse@ Home has been useful to check a possible cases of decompensation. The second phase of testing and validation has been focused on evaluation of the Hospital Care services of Heartfaid platform. In particular among decision support services UNIZ has been tested "Hospital Care" and "EchoCardio Lab", based on features of CDSS. For Hospital care we have tested and controlled the considerations suggested by the Heartfaid Platform, through the knowledge base, for patients enrolled in eCRF. For EchocardioLab service we have sent the echocardiographyc data, patient's images and report, using the functionalities of our echocardiograph (VIVID 7/Pro VIVID 7) that we have activated and integrated in the platform (transmission in HL7 and in DICOM format).
WP8: UNICZ has carried out its own internal dissemination activities, by increasing the awareness of Heartfaid activities and current results within its own institution. In particular UNICZ website (www.unicz.it) has been utilized as dissemination knowledge channel. Moreover, UNICZ has consolidated the interactions with several health care professional associations with the aim to keep informed about the Heartfaid activities. In particular, in the Cardiovascular Disease Unit several meetings with cardiologists and other specialized doctors and general practitioners have been performed involving also specialized nurse personnel for illustrating the Heartfaid platform functionalities. Finally for the 3rd year of the project, UNICZ has presented, directly as partner responsible or in collaboration with the other partners, the Heartfaid current results during several national and international events.

Explanatory note on major costs

Major costs have been personnel costs and travel costs. Direct costs refer to Research and Technological development innovation and Demonstration activities.
The costs for personnel were used to pay scientific researchers and technical personnel involved in the above mentioned WPs of the project, in particular WP7.
Moreover as UNICZ contribution we had three permanent fixed position doctors involved for a total of 12 man/months, with a budget of 66.000,00 euro. It was completely in line with planned budget as stated in the DoW in Annex I.
We haven't costs for equipment because we have used UNICZ contribution.
Traveling costs include journeys to official project meetings: Milan, Italy, London, UK, Heraklion, Creete and second review meeting in Milan. Only one staff member, Doctor Angela Sciacqua, has travelled.
Delta Costs refer to the Audit Certificate for the 3 years (5200) and expenses for organizing the final pre-review and review meeting.

Deviations from the cost budget and from person-month budget

We had to add MM for supporting WP4 activity, with additional, not planned, 3 MM, for supporting the development of ontology to early detection of heart failure decompensation; we added 3MM for WP5 activity for clinical support to implementation of methods for processing and analysing diagnostic signals and images. Finally we added 7 MM for WP7 activity for testing and validation of the platform in Home and Hospital environment.

Explanatory note:
Adjustment: following the AUDIT certificate an adjustment of Euro -1.211,17 on previous reports has been done, due to a wrong calculation of other costs in P2 .

UNIMIB

	EU contribution	UNIMIB contribution
Personnel	26.899,41	**56.050,04**
Equipment	1.497,00	**20.000,00**
Travelling	171,39	
Consumables	12.875,00	
Subcontracts	1.820,55	
Indirect costs	**8.288,56**	
TOTAL	**51.551,91**	**78.050,40**
Adjustment	**- 1.172,45**	
Total After Adjustment	**50.379,45**	

WP's	**EU Contribution**	**UNIMIB Contribution**
WP0	0,5 planned 0,5	1
WP2	4 planned 1	2
WP7	8 planned 5	7
WP8	1,5planned 1,5	
TOTAL	**14 planned 8**	

Work performed

WP2: Biomedical data identification and collection
UNIMIB has continued (together with AUXOL) collecting data obtained daily from patients followed up at home through telemonitoring technologies, with data obtained in the CHF clinic. Both UNIMIB and AUXOL have completed data collection from patients with chronic heart failure after obtaining their recompensation, some of these patients were included in a remote monitoring program through telemedicine facilities. Data were collected according to a previously agreed protocol. The MagIC vest has also been used to collect additional data from the home scenario. This has allowed further improvement of the system of wearable sensors (MagIc vest) aimed at collecting data on ECG (and thus heart rate), physical activity and respiratory frequency. Further refinement has also been made in solutions allowing for wireless communication between such a homecare device (for example Bluetooth technology) and for remote data transmission (e.g. through PDA or smartphone devices).
In the Hospital setting, the data were obtained both from basal assessments (initial visits) and additional clinical visits.

WP7: Testing and validation
In this period at UNIMIB both the clinical and the technical components of the team have continued working on the activities connected with WP7 i.e. activities regarding implementation of testing and validation of the platform.

The clinical components have selected 7 patients with the characteristics defined in the clinical protocol and shared with the other clinical partners and have requested them to sign the written informed consent that has been approved by the Institution's Ethical Committee.

A subgroup of 3 patients has been assigned to test the NURSE@HOME application by means of home self collected biological parameters in combination with parameters collected by a special vest developed by UNIMIB (and AUXOL) focussing on ECG (and the derived heart rate signal) and respiratory activity. Such patients have been instructed on blood pressure and heart rate self measurement, on how to wear and operate the vest, on how to transmit both manually and automatically the measured biological parameters, and on how to answer to the Minnesota questionnaire. Finally, they have been provided with written material summarizing such instructions, the protocol for measurements and contact information. ECG and respiration were assessed for 3 minutes every day by such innovative platform including the textile-based signal monitoring system, named MagIC, and a touchscreen PC running software applications for data reception from MagIC and for collection of selected measurements.

Another subgroup of 4 patients has been selected and instructed for data collection in the home setting by means of either the "Manual" acquisition procedures, or "Automatic" acquisition devices (using the blood pressure recorders and scales). A timeline on the actual simultaneous start and conduct of the period of home monitoring has been set pending the internal full technical testing.

The technical components of our team have worked on installing the software provided by the other technical partners of this project on the PC located in the medical environment and on the PCs used at home by the patients. They have also verified the correct functioning of data transmission from the home environment.

Finally, both the clinical and technical components have performed together with the envolved partners of the consortium the validation of the platform DSS with respect to both the Hospital and Home environments.

WP8: Presentation of the HEARTFAID project during local seminars and at the time of University lectures.

Explanatory note on major costs

UNIMIB contribution

Personnel
Prof. G. Parati c/m eur 68.649,32/11*7= eur 43.685,93
Dott. M. Bombelli c/m eur 46.857,31/11*2= eur 8.519,51
Dott. Giancarlo La Petra lordo complessivo 41.432*/11 mesi * 1= eur 3.766,54

Total eur **55.971,98**

Equipment
Eur 20.000,00 for usage of computer systems developed for remote monitoring of heart failure patients and for testing the suitability of a number of biomedical signals for the project. This has included use of device for nocturnal polysomnography

EC contribution

Personnel
Assegno di ricerca dott. G. Bilo dal 01/02/08 al 30/06/08 eur 9.399,40

Collaborazione professionale “intra muros” dott. LISI, GIULIANO, GREGORINI, BILO DA 1/1/2009 A 31/3/2009 EURO 17.500

Equipment

Equipment Atcor medical ft 00012418 del 12/10/2007 eur 9.980,00/60*15 months*60%usage= **1.497**

Deviations from person-month budget:

The increase in the overall personnel budget at UNIMIB in the last part of the project is related to the planned greater involvement of this Unit in the activities related to definition of clinical parameters for setting the machine intelligence and in those devoted to clinical validation and testing of the platform. This has included more work in preparing devices and software for data collection, both in the hospital setting and at home, in properly training the patients to use of the home devices, and in creating a working link between our systems for data collection and the HEARTFAID platform. IN the last part of the project, more work has been devoted to data collection for platform validation, as well as to data analysis and interpretation. Overall, however we exceeded the personnel budget by only € 418.28.

JUMC

	EU contribution	JUMC contribution
Personnel	6094,25	5200,00 (4 MM)
Equipment	-	8000,00
Travelling	11796,16	-
Consumables	-	-
Indirect costs	3578,08	-
TOTAL	21468,48	13200,00
Delta Costs	819,68	
Total After Delta Costs	22288,16	

JUMC personnel by work-package

WP's	EU Contribution	JUMC Contribution
WP7	6 planned 6	4
WP8	1.5 planned 1.5	-
TOTAL	**7.5 planned 7.5**	**4**

Work performed

WP7:

During the third year JUMC has participated in the following HEARTFAID WP:

- WP 7 Clinical testing and validation
- WP 8 Dissemination and exploitation

JUMC is one of four clinical Partners of the Project aimed at a support with medical knowledge related to heart failure, in order give an input support for technological Partners to develop Heart Failure Platform (HFP).

In collaboration with other clinical and technical partners we have continued our work on a prototype plan of the HEARTFAID platform testing and validation proposed by UNIMIB/AUXOL. According to the proposal, JUMC has selected a group of CHF patients in NYHA class II- III who have been enrolled into the platform and followed the plan of clinical validation **(WP7).** The Nurse@Home application software have been installed at patients' home PCs and patients have been trained to use the software (manual insertion of the data) and appropriate perform the measurements. The following measurements have been daily performed: blood pressure, heart rate, respiratory rate, body weight, temperature, Minnesota questionnaire. The consecutive collected parameters have been used by the HEARTFAID system to predict the early CHF decompensation.

WP8:

During the third year of the project JUMC has contributed to the dissemination of HEARTFAID (**WP8**) through presenting its design and results at scientific meetings of personnel staff serving as an update on ongoing research activities of the Department and progress in cardiovascular science scientific news and meeting of the Krakow Division of Polish Cardiac Society and Polish Hypertension Society

The information on HEARTFAID is placed on the web pages of the I Cardiac Department at JUMC (http://www.kardiologia1.cm-uj.krakow.pl/) and official JUMC www.cm-uj.krakow.pl websites as dissemination knowledge channel.

Explanatory note on major costs:

Major costs have been personnel costs and travel costs.

We have spent about 6.000 EUR for *personnel* working on the project. With this money we paid for 7.5 MM for scientific researchers and technical personnel. Moreover as JUMC contribution we have spent 4.0 MM for 2 academic researchers and 1 person working as technical staff.
It was completely in line with planned budget as stated in the DoW in Annex I for the first year.

We have spent about 11.000 EUR for *traveling*. We have traveled to project-related meetings (Catanzaro, Milan, Crete) and conferences related to the project issues. We have also covered the costs of the travel to Revision Meeting in Catanzaro. The following staff members have participated: Prof. K. Kawecka-Jaszcz, K. Styczkiewicz MD, Olszanecka A. MD, Kononowicz A. Eng, Jędrychowski M .
As JUMC own contribution we have spent also 8000 euro for the medical equipment used for the project needs (echocardiography, ECG, Holter monitoring).

Delta Costs refer to the Audit Certificate.

Deviations from the cost budget and from person-month budget
We have no significant deviations with above

VMWS

Eligible costs	Amount (Euro)
Personnel	**79,040.00**
Travelling	**146.88**
Other costs	**0.00**
Indirect costs	**15,837.38**
TOTAL	**95024,26**
Adjustments	**-31.42**
TOTAL	**94,992.84**
Audit	**1,009.80**
TOTAL after Audit	**96,002.64**

VMWS personnel by work-package

WP's	
WP0	1 planned 0,5
WP2	2.85 planned 4
WP7	5.8 planned 8
WP8	3.6 planned 3.5
TOTAL	**13.25 planned 16**

Explanatory note on major costs

During this reporting period, the major costs are related to R&D activities. The total travel costs during this period are 146.88 Euros (covering the travel costs of Dr. Biniaris for the STAB meeting in Crete).

Other costs

No other costs were declared by VMWS during this reporting period.

Deviations from the cost budget and from person-month budget

There are no significant person-month deviations regarding the involvement of VMWS in WP2, and WP8

Adjustment to previous period

As a result of financial audit UK 07-BA44-040, an adjustment due to unaccepted costs of €26.18 plus 20% indirect costs totaling €31.42 has been deduced from personnel costs.

Work Performed

WP2
T2.3 Data Collection
Declared (according to DoW): 4 MMs
Actual: 2.85 MMs

In the scope of T2.3, the major activity of VMWS was related to the support of clinical partners during the data collection process regarding the use of tools and techniques developed earlier in WP2 as well as the monitoring of progress and the preparation of D35 as WP leader.

WP7

T7.1 Integration of the prototypes in suitable clinical settings

Declared (according to the DoW): 8 MMs Actual: 5.8 MMs

The major activity in this task involved the preparation of the solutions developed by VMWS during WP2 and demonstrated in the second review, for deployment in a clinical setting. The solutions involved acquisition of medical data over Bluetooth from consumer healthcare devices (A&D UA767PBT Blood Pressure Monitor, A&D UC-321PBT Weighing Scales, Nonin Bluetooth Pulse Oximeter and FRWD Sports computer) using a mobile phone or PDA and subsequent transmission of the data to the HEARTFAID platform over GPRS connection. The integration of these solutions in a clinical setting involved the following sub-activities

- In-house usability trials were performed by non technical personnel, which provided minor (mainly GUI related) feedback for technical revisions. As a result of this feedback, the GUI of the application executed on the mobile device was partially redesigned in order to remove much of the text and replace it by pictures, as well as to utilise the capabilities of the touch interfaces offered by modern handheld devices.
- Furthermore, behaviour studies and analysis were performed by potential users within controlled environments, focusing on the user interface and the overall functionality of the mobile application.
- Finally there was collaboration with clinical personnel in order to examine the feasibility of the developed solutions within clinical settings.

WP8

T8.1 Dissemination Activities

Declared (according to the DoW): 0.5 MMs Actual: 1.5 MMs

The dissemination activities performed by VMWS during the 3rd reporting period are described as follows:

ICMCC Conference: VMWS arranged a European Projects' Session dedicated to healthcare. In addition, HEARTFAID Consortium presented the results of the project's research activities.

WORLDCOMP'08 - The 2008 World Congress in Computer Science, Computer Engineering, and Applied Computing: VMWS Arranged a session on Internet services in healthcare, where HEARTFAID project's results where presented.

World Academy of Biomedical Sciences and Technologies, Best for Health, World WABT Forum, Fuggi, Italy. HEARTFAID project's results were presented by VMWS.

T8.2 Exploitation Plan

Declared (according to the DoW): 3 MMs Actual: 2.1 MMs

As a direct result of the expertise gained in the scope of HEARTFAID project VMWS has identified the market potential for IP connected medical devices and interoperable connectivity services. Consequently, VMWS has realigned its R&D roadmap towards this objective. Furthermore, to promote the outcomes of HEARTFAID project, both collectively and from a VMWS perspective:

- VMWS has opened discussions with the Continua Alliance to become a Contributing Member.

- VMWS is in discussions to become part of the Mobile Health Alliance to promote IP connected medical devices.
- VMWS is in discussions with WABT (UNESCO NGO) to collectively exploit the outcome of HEARTFAID to provide services for South-East Europe as part of the UNESCO/ESA Space for Science Initiative.

FORTHNET

CATEGORY	€
PERSONNEL	65955.91
TRAVEL	9366.70
SOFTWARE	3296
OTHER COSTS	1633,83
MANAGEMENT	2020
INDIRECT	52764.72
TOTAL	**135.037,16**
Delta Costs	**3.135,30**
Total after Delta Costs	**138.172,46**

WP's	
WP0	0.5 planned 0.5
WP2	6 planned 3
WP6	7 planned 7
WP7	2 planned 6
WP8	1.5 planned 3.5
TOTAL	**17 planned 20**

Work performed (Brief Description)

WP2

The interface of the Nurse@Home application has been updated, with the aim of providing a more user-friendly application. Furthermore, some functionalities of the Nurse@Home application have also been updated and improved, in order to provide a more transparent application to the end-user (patient), requiring less interaction on his behalf. These updates have been performed after considering the limited IT background of the end users and especially the elderly (patients).

WP6

A completely new Graphical user interface (GUI) has been developed and a large number of updates and changes have been performed for the HEARTFAID Front-end, in order to integrate all the available services and functionalities to the Front-end, creating at the same time a more user friendly interface.

WP7

Quite a few preliminary tests have been performed on the platform, in order to verify the interoperability between the original prototypes of the available HEARTFAID services, which are integrated at the Front-end, in different environments (hospital – home). Further tests performed on the Front-end included on-line tests (through the internet) by various partners.

WP8

Exploitation issues considered by Forthnet:

- Exploitation of the individual software modules. These will derive from the technological expertise that has been gained from the research activities of the project, integrated with the core competences and business interests of the company.

- Mid- and long- term commercial exploitation of the integrated HEARTFAID platform is being investigated.

- Previous experience in combination with Forthnet's large customer base is expected to benefit the HEARTFAID prototype.

Explanatory note on major costs

Other costs (meeting expenses and registration fee): 1633.83 €
Software (applications and licenses): 3296.00 €
Delta Costs: Audit Certificate of last year (1000 €), travel expenses for the pre-review and review meeting.

Deviations from the cost budget and from person-month budget

No significant deviation to be declared.

SYNAPSIS

CATEGORY	
PERSONNEL	125.918,74
EQUIPMENT	112,91
TRAVEL	3.314,36
OTHER	624,00
INDIRECT	25.869,20
TOTAL	**155.839,22**
Delta Costs	**1920,41**
Total After Delta Costs	**157.759,63**

SYNAPSIS personnel by work-package

WP's	
WP3	5 planned 0
WP5	4 planned 2
WP6	8 planned 4
WP7	6,40 planned 3
WP8	10,47 planned 5
TOTAL	**33,87 planned 14**

Work performed (Brief Description)

WP3

SYNAPSIS participated in TASK T3.3 and T3.4, carrying out the following activities:

- Finalization of the Integration Middleware
- Coordination of the activities for the interoperability of the services developed during the first two years of the project activity
- Refinement of the modules prototype according with the feedbacks and suggestions provided by the doctors during the validation phase
- Technical support during the deployment of the HEARTFAID services both in the hospital environment and home settings
- Technical real-time support during the validation phase, to overcome the problems encountered by the clinical staff while using the HEARTFAID Platform during their daily activity

WP5

SYNAPSIS participated in TASK T5.4, carrying out the following activities:

- Integration of the DSS related to both home-care and hospital-care into the HEARTFAID-Platform
- Refinement of the integration and communication protocol
- Refinement of the alerting mechanisms

WP6

SYNAPSIS participated in TASK T6.4, carrying out the following activities:

- Implementation of improved integration mechanisms, able to guarantee generality and scalability of the HEARTFAID-Platform
- Refinement of the end-user services usability
- Coordination and supervision of the end-user services integration activities

WP7
SYNAPSIS participated in TASK T7.1, carrying out the following activities:

- Coordination and supervision in the deployment of platform for the validation phase
- Support the clinical domain experts for the validation activities
- Implementation of the changes to the end-user services request by the doctors during the validation of the platform, in order to improve usability and effectiveness of the platform

WP8
SYNAPSIS participated in TASKS T8.1 and T8.2, carrying out the following activities:

- Participation to the 9th International HL7 Interoperability Conference, held in Crete in October 2008
- Participation in the identification of the potential markets and target groups, and definition of an exploitation plan, as well as identification of the most suitable pricing solutions that could be adopted by the healthcare structures that will offer the HEARTFAID services.

Explanatory note on major costs
The major costs afforded by SYNAPSIS are related to travels and labour activity.
As far as the travels are concerned, they are related to the Review Meeting held in Milan on April 2008, and General Assembly meetings, held in:

- London: June 2008
- Crete: October 2008

other internal technical meetings have been held in Pisa on July 2008.

Concerning the personnel costs (total of 33,87 person/months with respect to the planned 14 person/months), SYNAPSIS has been strongly involved in the activities of WP3, WP5 WP6, WP7 and WP8. In particular, it was necessary to finalise the prototypes developed during the previous reporting period, to complete the integration and the interoperability of the software modules developed, and to refine the services according to the changes requested by the clinical partners during the validation phase to improve the usability and effectiveness of the Platform.

Other costs
Audit costs related to the first two years of the project lifetime.

Delta Costs: Audit Certificate for the 3rd year, travel expenses for the pre-review and final review meeting

Deviations from the cost budget and from person-month budget
There are no major deviations from the cost budget.

As far as the person-month budget is concerned, we report a higher effort with respect to the effort expected. In fact, after the validation phase started, the clinical partners involved in this activity reported a

set of desiderata, i.e. improvements to the Platform that would had significantly improved the results achieved by the project as well as the usability of the services within their daily practice. Therefore, it was necessary to perform a set of adjustments and modification to refine the Platform prototypes according to the recommendations received.
Moreover, it was necessary to provide an unexpected "continuous" technical assistance, especially during the first months when the services have been adopted both in hospital and home settings, in order to overcome all the installation and connection problems that have been encountered by the technical staff of the clinical Partners.
In particular, connection problems appeared to have a significant incidence, especially at home of the patients. In order to avoid losing any of the measurements acquired, anytime the web connection was failing, the technical staff of Synapsis was available to import manually the data collected from the patient.

We put into evidence that connection problems are not related to the platform functionalities. Moreover, at the end of the validation phase, after a running period, we have noticed a radical reduction in the occurrence of technical problems.

In order to cover this additional effort, Synapsis had to involve junior software engineers that have a lower productivity, thus requiring a higher effort in terms of man-months with respect to our estimation.

CNR

CATEGORY	
PERSONNEL	12.103,53
TRAVEL	4.244,19
MANAGEMENT(AUDIT)	1.200
INDIRECT	9.622,31
TOTAL	27.170,03
Delta Costs	1.705,39
Total after Delta Costs	28.875,42

CNR personnel by work-package

WP's	MM
WP5	1.52 planned 0
WP6	1 planned 2
WP8	0.5 planned 1
TOTAL	**3.02 planned 3**

Work performed (Brief Description)

WP5
- Realization of the EchoCardioLab system – a Web based application for the management of echocardiography workflows. It includes i) porting to Java of the image processing algorithms, ii) development of a dedicated DB and standard compliant adapters and iii) integration of specific CDSS services.
-Integration of the CDSS Web Services in the HEARTFAID Platform.
-Preparation of Deliverable D36.

WP6
- Integration of the CDSS services in the HEARTFAID Web Portal.
- Preparation of Deliverable D37, including the "Accompanied Document".

WP8
- Participation to 4 international conferences and several academic and industrial seminars.

Explanatory note on major costs
Total Person Month: 3,02 RTD
Personnel Costs: 21.725,84 (including Overhead)
Major Costs: Travel - 4.244,19 (Milan April 2008, London June 2008, Heraklion October 2008, Catanzaro April 2009)
Audit Certificate P2:1200

Delta Costs: Audit Certificate for last year, travel expenses to the pre-rebiew and final review meeting

Deviations from the cost budget and from person-month budget

With respect to the planned activities, a shift of effort has been made from WP6 and WP8 to WP5, for a total of 1.52 PM. This slight deviation (which leaves practically unchanged the total effort by the partner) was motivated by the realization of the EchoCardioLab system and by the final general integration of the CDSS prototype into the HEARTFAID platform.

FORTH

CATEGORY	
PERSONNEL	48622.73
TRAVEL	14035.35
OTHER	500.00
INDIRECT	47593.21
TOTAL	**110751.29**
Delta Costs	**3949,15**
Total after Delta Costs	**114.700,44**

WP's	
WP5	4.95 planned 3
WP6	3 planned 3
WP7	4.05 planned 0
WP8	1.93 planned 1
TOTAL	**13.93 planned 7**

Work performed in months 25-39

The work has been performed around the following topics: medical device integration, interoperability and standards for interoperability, data security, knowledge discovery, data processing, decision support systems and technical support to the clinical validation.

The work of the third year was related to the following WPs: WP2, WP3, WP4, WP5, WP6, WP7, WP8.

WP2

The final version of a flexible home acquisition module Nurse@Home has been implemented and deployed in the clinical validation sites. This module allows the home data acquisition in automatic and manual way. In automatic way it integrates the following devices: a pulse-oxymeter (Nonin 4100), an Ambulatory Blood Pressure Monitor (A&D UA-767PBT) and an electronic scale (A&D UC-321PBT). Also the integration of the MagIC Vest in the home acquisition module has been successfully performed (for the research workflow). The module supports different ways of working used in the different validation sites including the data acquisition using a hospital phone center.

Furthermore, a module for the acquisition of the ECGs recorded with the Esaote Archimed cardiograph used in the hospital setting of Catanzaro has been designed and successfully deployed in the validation site of Catanzaro.

WP3

In WP3, FORTH's activity in support of interoperability worldwide has accomplished the goal of the acceptance of SCP-ECG as an international ISO standard (ISO 11073-91064:2009 - First edition 2009-05-01) in the family of the x73 standards. In fact, FORTH has strongly contributed to the working group involved in the preparation of the ISO documentation and to the support to the first edition. In such respect, FORTH's ECG viewer for SCP-ECG can be theoretically used for any ECG devices compliant with the SCP-ECG storage format (even from other manufacturers). A further advantage is that also

dialectal implementations of the standard (like the one present in the Esaote Archimed cardiograph) can be supported with reasonable modifications in terms of man power. Thus, the solution implemented for the Esaote cardiograph is theoretically an open-standard solution that can be easily extended to whatever device supports the SCP-ECG standard.

WP4

In WP4, FORTH has been involved in research of variable selection algorithms for survival analysis where the time-to-event may be right-censored. These algorithms are general but particularly important for the analysis of the ANMCO data and other HEARTFAID related data; the algorithms were directly inspired from and aim to address the analysis problems that emerged during the work for D29. The algorithms were designed, optimized and evaluated against the state-of-the-art in the field on a large collection of high-dimensional biomedical datasets; publications are under preparation. This work is a joint project with the University of Calabria.

WP5

Minor adjustments have been performed to the algorithm for QRS detection, morphological classification and evaluation of the dominant beat centroid. The algorithm has been integrated in the hospital gateway used in Catanzaro for the acquisition of ECG coming from the Esaote Archimed cardiograph. Each ECG is processed and the average dominant beat is stored in SCP-ECG format together with the raw data and other information. An ECG viewer installed on the gateway allows the cardiologist to view the ECG with the average dominant beat and to perform measurements of amplitudes and intervals on it.
The signal processing on the data (ECG and chest movement) collected from the MagIC vest has been completed (for the research environment). Technical test has been performed on a data set provided by Don Gnocchi Foundation. The results have been presented at Computers in Cardiology 2008 in Bologna, Italy. The algorithm has been integrated in the Nurse@Home application being able of creating from the incoming data the HR (heart rate) and RR (respiratory rate) time series and the average RR is evaluated and sent together with the other measurements to the data repository.

WP6

The activities performed in this WP are mainly related to the implementation of the final version of Nurse@Home:

1) Review and discussion with clinical and technical partner about the user interface and functionalities
2) Corrections and adjustments to the device interface modules
3) Implementation of the communication protocol with MagIC vest (research workflow)
4) Integration of the MagIC vest post-processed data in Nurse@Home
5) Technical test and first test with local users of the final application
6) Writing of the user manual for the installation, configuration and troubleshooting
7) Training to the reference technical person of each validation site.

WP7

The main activities performed in this WP are related to the technical support provided to each validation site in order to have a smooth start of the validation and an effective support for any problem should arise. Technical support was provided by email, phone or Skype conference.

WP8

In WP8 FORTH has carried out dissemination activities according to the general plans defined in the deliverable D6. In particular FORTH has carried out its own internal dissemination activities, by increasing the awareness of HEARTFAID activities and current results within its own institution.
A demo session has been organized at IHIC 2008. In the demo session done at FORTH booth, the demo has been performed by many participants in IHIC. Among them Mr. Yun Sik Kwak, Chairman-designate of ISO TC215, Health informatics.
A special session in cooperation ISTI-CNR and other EU projects like ACGT and ContraCancrum has been organized at ISDA 2009 (Pisa, Italy, November 2009). This special session titled "Intelligent Systems Design and Applications in the Health Domain" will aim to present, analyze and discuss new research trends about the design and application of intelligent advanced systems for medical ontologies, medical knowledge discovery, representation and management, signal and image processing, efficient clinical decision support systems, multilevel modelling of pathologies, therapy simulation and virtualization of the human physiology.

Explanatory note on major costs

Major costs have been travel and personnel costs.
FORTH has spent about 14000 EUR for traveling and subsistence. We have traveled to project steering meetings (Milan, London and Catanzaro) and at all these meetings we participated with more than one staff member: Franco Chiarugi and Giorgos Zacharioudakis in Milan, Franco Chiarugi and Ioannis Tsamardinos in London and Franco Chiarugi, Giorgos Zacharioudakis and Ioannis Karatzanis in Catanzaro. We have also traveled to international conferences for dissemination purposes (CinC 2008 and IHIC 2008) where the FORTH's participant was Franco Chiarugi. We have also participated in the second annual review held in Milan (Franco Chiarugi, Giorgos Zacharioudakis and Ioannis Karatzanis). Finally FORTH has also organized together with FORTHnet a steering meeting in Heraklion, Crete, Greece jointly with the IHIC 2008 conference.
FORTH has spent about 500 EUR for other costs (management). This cost is referred to the audit certificate of the second year that was paid in March 2008.
FORTH has spent about 48600 EUR for personnel. With this money we paid about 13.9 men/months mainly of high-profile people for the reasons explained in the "Deviations from the cost budget and from person-month budget".

Delta Costs: Audit Certificate for the last period, travel expenses for the pre-review and final review meeting

Deviations from the cost budget and from person-month budget
Activities in WP2, WP3 and WP4 have been performed with graduate or master student and also with staff personnel not formally accounted on this project. Thus, the overall effort in this last year is superior to the formally reported one. This effort has been necessary in order to successfully complete the technical development in full agreement with the different needs of the several pilto centers in such a way to be able to start smoothly a successfull clinical validation in each pilot center. We experienced that at the beginning some technical support was necessary but very quickly each validation center was able to work autonomously and to perform effectively the clinical validation.
However the accounted extra effort in this last year does not overcome the total effort estimated in the DoW and also in terms of total personnel cost the total amount is comparable with the estimation made in the DoW for the whole duration of the project.

Workpackage progress

The work performed for the all WPs has been successfully completely quite in line with DoW. The most significant deviation is the contribution offered to WP2 in order to integrate several home devices and the MagIC Vest for the research environment. Furthermore the work performed in CDSS for WP5 has been partially done also for WP4 considering that WP4 and WP5 have several overlapping points.

RBI

	EU contribution	RBI contribution
Personnel	**33012.95**	**36764.22**
Travelling	**17495.22**	**3504.88**
Other Costs		**3507.12**
Management	**2495.85**	
Indirect costs	**10600.80**	
total	**63604.82**	**43776.22**
adjustment to previous periods	**- 273.41**	
requested EC contribution	**63331.41**	
Delta Costs	**2586,89**	
Total After Delta Costs	**65.918,30**	

RBI personnel by work-package

WP's	**EU Contribution**	**RBI Contribution**
WP0	0.5 (planned 0.5 MM)	0
WP4	18.5 (planned 5 MM)	10
WP5	2 (planned 2 MM)	2
WP8	1 (planned 1 MM)	4
TOTAL	22 (planned 8.5 MM)	**16**

Work Performed (Brief Description)

WP4

Knowledge discovery on data sequences collected by the platform during the experimental phase has been performed and the long and the short report about retrospective ANMCO data have been prepared from the previously obtained results. New version of the HF ontology has been developed based on the new version of HF guidelines. A package for the distribution of the ontology has been built and the corresponding documentation has been prepared. Based on comments of medical partners using platform's decision support service in the experimental phase, manifold improvements of the knowledge base have been done. Finally, some relevant knowledge discovery results have been integrated into the knowledge base.

WP5

A new version of the integration of patient data from the eCRF with the knowledge base has been implemented and tested. A few new categories of messages resulting from the decision support service for the hospital care have been introduced.

WP8

A lot of effort has been invested into dissemination of the results. In total we have prepared and presented four papers at international conferences, we have prepared three journal papers (one already published) we had three presentations at Workshops, one invited talk at the university (Ho Shi Min City, Vietnam) and one invited talk at the hospital (Clinical Center Zagreb, Croatia). We have organized a local project meeting with a few presentations for Croatian artificial intelligence community. We have given the package with the HF ontology and corresponding documentation to the EU FP7 HeartCircle project.

Explanatory note on major costs

In the third project year the greatest cost has been personnel. It has been used for 2 PhD students (Prcela and Bosnjak) and in total for their 22 men-months. Please note that the sum of 33012.95 EUR corresponds to the payment of in total 24 men-months, 2 of which have been actually done and reported as men-months in the second period but they have been practically paid during the third period and because of that they are included as the cost of the third year.

Traveling costs include journeys to official project meetings: Milan, Italy (Gamberger, Smuc, Horvat), London, UK (Gamberger, Smuc, Horvat, Prcela), Heraklion Greece (Gamberger) and Catanzaro, Italy (Gamberger), and second review meeting in Milan, Italy (Gamberger, Prcela). We also participated on a few conferences: "Medical Informatics in Europe" Gothenburg, Sweden (Prcela), "Information Technologies" Cavtat, Croatia (Gamberger, Jovic), "Computers in Cardiology" Bologna Italy (Gamberger). Additionally, we organized a Workshop on Knowledge Discovery Porec, Croatia (Gamberger, Prcela, Bosnjak, Jovic, Horvat). The travel to Vietnam and participation on "Pacific Rim International Conference on Artificial Intelligence" has been paid by a Croatian project and is reported as traveling cost contributed by RBI (3504.88).

Other costs

There are management costs (2495.85 EUR) which have been used as personnel cost for permanent staff (1942.40 EUR) and the remaining 553.45 EUR has been the cost of the organization of a local Workshop on which we disseminated the project results.

The adjustment is due to VAT costs in hotel bills declared by mistake in periods P1 (2006.-2007.) and P2 (2007.-2008.) in the amount of -273.41 EUR.

We have bought a server computer for knowledge discovery tasks which has been paid by Croatian Ministry of Science (3507.12 EUR) and reported as RBI contribution in other costs.

Delta Costs: Audit Certificate for the whole project period, travel expenses to the pre-review and final review meeting.

Deviations from the cost budget and from person-month budget

The most significant deviation is the increased number of 22 engaged person-months compared to planned 8.5 person-months but without increase in respect to the cost budget. The main reason is that for the third year we have planned for WP4 only activities related to the integration and testing of knowledge discovery methodology. But already in the previous year it became clear that the developed knowledge base will need constant improvements, especially during the testing phase in the third year. Besides that, it happened that in the year 2008 European Society of Cardiology published new version of HF guidelines

what required significant improvements and publication of the new version of the developed HF ontology. It must be noted that in spite of the increase of engaged person-months we have remained in the frames of the planned budget what has been possible due to the fact that engaged personnel has been young PhD students with low monthly income. Also please note that the work required high contribution of the RBI permanent staff which has been also significantly larger than planned

AUXOL

	EU Contribution	AUXOL Contribution
Personnel	26.978,46	44.000,00
Equipment	4.816,47	60.000,00
Travelling	1.879,68	
Other Specific Costs	2.225,27	
Mangement	0	
Adjustment previous periods	1.484,27	
Indirect Costs	7.476,83	
TOTAL	**44.860,98**	**104.000,00**
Delta Costs	**7.130,40**	
Total After Delta Costs	**51.991,38**	

AUXOL personnel by work-package

WP's	**EU Contribution**	**AUXOL Contribution**
WP2	5,4 planned 1	1,5
WP7	8,6 planned 7	2,5
WP8	0 planned 3,5	1
TOTAL	**14 planned 11.5**	**5**

Work performed (Brief Description)

WP2: Biomedical data identification and collection (Man/Month: Mariaconsuelo Valentini 1,5; Miriam Revera 5,4)
AUXOL (together with UNIMIB) have continued collecting data obtained daily from patients followed up at home through telemonitoring technologies, with data obtained in the CHF clinic. Bothauxol AND UNIMIB have completed data collection from patients with chronic heart failure after obtaining their recompensation, some of these patients were included in a remote monitoring program through telemedicine facilities. Data were collected according to a previously agreed protocol. The MagIC vest has also been used to collect additional data from the home scenario. This has allowed further improvement of the system of wearable sensors (MagIc vest) aimed at collecting data on ECG (and thus heart rate), physical activity and respiratory frequency. Further refinement has also been made in solutions allowing for wireless communication between such a homecare device (for example Bluetooth technology) and for remote data transmission (e.g. through PDA or smartphone devices).
In the Hospital setting, the data were obtained both from basal assessments (initial visits) and additional clinical visits.

WP7: Testing and validation (Man/Month: Mariaconsuelo Valentini 2,5; Miriam Revera 4,6; Andrea Faini 4)

In this period AT AUXOL both the clinical and the technical components of the team have continued working on the activities connected with WP7 i.e. activities regarding implementation of testing and validation of the platform.

The clinical components have selected 7 patients with the characteristics defined in the clinical protocol and shared with the other clinical partners and have requested them to sign the written informed consent that has been approved by the Institution's Ethical Committee.

A subgroup of 3 patients has been assigned to test the NURSE@HOME application by means of home self collected biological parameters in combination with parameters collected by a special vest developed by AUXOL and UNIMIB focussing on ECG (and the derived heart rate signal) and respiratory activity.
Such patients have been instructed on blood pressure and heart rate self measurement, on how to wear and operate the vest, on how to transmit both manually and automatically the measured biological parameters, and on how to answer to the Minnesota questionnaire. Finally, they have been provided with written material summarizing such instructions, the protocol for measurements and contact information. ECG and respiration were assessed for 3 minutes every day by such innovative platform including the textile-based signal monitoring system, named MagIC, and a touchscreen PC running software applications for data reception from MagIC and for collection of selected measurements.

Another subgroup of 4 patients has been selected and instructed for data collection in the home setting by means of either the "Manual" acquisition procedures, or "Automatic" acquisition devices (using the blood pressure recorders and scales). A timeline on the actual simultaneous start and conduct of the period of home monitoring has been set pending the internal full technical testing.

The technical components of our team have worked on installing the software provided by the other technical partners of this project on the PC located in the medical environment and on the PCs used at home by the patients. They have also verified the correct functioning of data transmission from the home environment.

Finally, both the clinical and technical components have performed the validation of the DSS of the platform with respect to both the Hospital and Home environments.

WP8: (Man/Month: Mariaconsuelo Valentini 1) Presentation of the HEARTFAID project during local seminars and at the time of University lectures.

Explanatory note on major costs
Major costs have been personnel, equipment, and traveling.

1. Personnel: 15.203,19 EUR for a PhD research grant (a junior cardiologist), largely involved in the research activities listed above. 11.775,27 EUR for a Bio-engineer mostly involved in the validation and testing activity (technical and informatics aspects).
2. Equipment: 2.783,20 EUR: correspondent to the second year percentage of the depreciation (40% of the asset value), usually applied by Istituto Auxologico Italiano. The equipments purchased are a System for Biomedical signal acquisition and a portable PC. 2.033,27 EUR for informatic hardware used during the validation and testing activity.
3. Travel: 809,43 EUR for the participation of Mariaconsuelo Valentini to the project meeting that took place in Heraklion (Crete) in order to design the protocol for clinical testing and validation.

4. 581,25 EUR for the participation to the project Steering Meeting in Catanzaro, Italy, with the object of finalizing all the issued concerning the testing and validation phase of the project, the final review (with particular regard to all of the WP presentations and demos).
5. 489,00 EURO are some expenses reimbursed by Auxologico to Mariaconsuelo Valentini during the third period, but regarding the meeting in Zagabria that took place during the second year of project.

Other costs

1. 1.011,27 EUR: costs (coffee breaks, lunch and dinner) sustained for one of the periodic meetings that was held in Milan on February 18 and 19, 2008.
2. 1.214,00 EUR: costs (coffee breaks, lunch and dinner) sustained for one of the annual review Meetings with UE Representatives that took place on April 9, 10, 11, 2008.
3. 1.781,12 EUR (1.484,27 of direct costs plus 296,85 of indirect costs) are for an adjustment about the travel costs of the first period that were wrongly calculated caused by a simple error of computing.

Delta Costs: Audit Certificate for the whole project period, travel expenses to the pre-review and final review meeting

Deviations from the cost budget and from person-month budget

There are no deviation from the cost budget of the three years of project.
The most significant deviation from expectations has been the increased number of engaged person-months (19 instead of 11.5 planned). This deviation during the third year is justified by the heavier engagement in the testing and validation activities, as programmed in the workplan. This has included more work in preparing the tools for data collection in the hospital setting and at home, the necessary training of the patients, the need to link our systems for data collection with the HEARTFAID platform and finally the actual data collection itself with the associated time required for data analysis and interpretation and for preparation of the related deliverables.

Table 3: Budget vs. Actual Costs

Updated Cost Budget Follow-up Table							
Contract Nº:	IST-2005-27107	Acronym:HEARTFAID					
PARTICIPANTS	TYPE of EXPENDITURE (as defined by Annex 1)	BUDGET	ACTUAL COSTS			Pct.spent	Remaining Budget (EUR)
			Period 1	Period 2	Period3	Total	
		e	a1	b1	c1	(a1+b1+c1)/e	e-a1-b1-c1
UNICAL	**Total Person-month**	**70**	26	29.80	28.00	120%	**-13.80**
	Personnel costs	**165000**	36453.42	85129.00	82881.20	124%	**-39463.62**
	Other costs	**86484**	21322.24	15109.37	21089.44	67%	**28962.95**
	Indirect Costs	**49096**	9896.15	19826.48	18936.46	99%	**436.91**
	Total Costs	**300580**	**67671.81**	**120064.85**	**122907.10**	103%	**-10063.76**
UNICZ	**Total Person-month**	**35**	19.5	6.50	25.00	146%	**-16.00**
	Personnel costs	**54200**	14387	7690.92	47657.10	129%	**-15535.02**
	Other costs	**51167**	1462.01	2534.65	17766.12	43%	**29404.22**
	Indirect Costs	**20073**	3169.8	2045.11	13084.63	91%	**1773.46**
	Total Costs	**125440**	**19018.81**	**12'270.68**	**78'507.85**	88%	**15642.66**
UNIMIB	**Total Person-month**	**24**	0	6.00	14.00	83%	**4.00**
	Personnel costs	**43064**	0	13082.93	26899.41	93%	**3081.66**
	Other costs	**35461**	551.22	2506.12	8288.56	32%	**24115.10**
	Indirect Costs	**14505**	110.24	3117.81	16363.94	135%	**-5086.99**
	Total Costs	**93030**	**661.46**	**18706.86**	**51551.91**	76%	**22109.77**
JUMC	**Total Person-month**	**26**	15.5	3.00	7.50	100%	**0.00**
	Personnel costs	**50000**	22368.92	3073.53	6094.25	63%	**18463.30**
	Other costs	**28337**	13086.97	19863.54	12615.84	161%	**-17229.35**
	Indirect Costs	**15267**	7091.17	4587.41	3578.08	100%	**10.34**
	Total Costs	**93604**	**42547.06**	**27524.48**	**22288.17**	99%	**1244.29**
VMWS	**Total Person-month**	**63**	27.36	27.87	13.25	109%	**-5.48**
	Personnel costs	**360000**	158720	167200.00	79040.00	112%	**-44960.00**
	Other costs	**24518**	14614.23	11231.60	1156.68	110%	**-2484.51**
	Indirect Costs	**75704**	32826.76	36226.52	15837.38	112%	**-9186.66**
	Total Costs	**460222**	**206160.99**	**214658.12**	**96034.06**	112%	**-56631.17**
FORTHNET	**Total Person-month**	**66**	36.1	16.00	17.00	105%	**-3.10**
	Personnel costs	**288000**	143058.68	90577.97	65955.91	104%	**-11592.56**
	Other costs	**42714**	6519.58	11543.19	19451.83	88%	**5199.40**
	Indirect Costs	**237600**	114446.94	72462.37	52764.72	101%	**-2074.03**
	Total Costs	**568314**	**264025.2**	**174583.53**	**138172.46**	101%	**-8467.19**
SYNAP	**Total Person-month**	**80**	24.2	75.00	33.87	166%	**-53.07**
	Personnel costs	**429000**	132556.69	209683.57	125918.74	109%	**-39159.00**
	Other costs	**47933.33**	6405.62	4054.34	5716.61	34%	**31756.76**
	Indirect Costs	**94186.67**	27792.46	42747.58	26124.27	103%	**-2477.64**
	Total Costs	**571120**	**166754.77**	**256485.49**	**157759.62**	102%	**-9879.88**
CNR	**Total Person-month**	**48**	25.96	19.82	3.02	102%	**-0.80**
	Personnel costs	**197800**	113'019.48	93919.60	12103.53	111%	**-21242.61**
	Other costs	**28400**	6'421.55	11231.02	7149.58	87%	**3597.85**
	Indirect Costs	**165120**	76428.92	66967.32	9622.31	93%	**12101.45**
	Total Costs	**391320**	**195'869.95**	**172117.94**	**28875.42**	101%	**-5543.31**
FORTH	**Total Person-month**	**43**	10.98	17.44	13.93	98%	**0.65**
	Personnel costs	**141900**	45895.92	58436.57	48622.73	108%	**-11055.22**
	Other costs	**18236**	6486.63	10510.69	18484.50	195%	**-17245.82**
	Indirect Costs	**170280**	53239.27	62569.80	47593.21	96%	**6877.72**
	Total Costs	**330416**	**105621.82**	**131517.06**	**114700.44**	106%	**-21423.32**
RBI	**Total Person-month**	**46**	21.5	26.50	22.00	152%	**-24.00**
	Personnel costs	**72800**	21717.06	31899.15	33012.95	119%	**-13829.16**
	Other costs	**88666**	35728.85	14706.72	22369.38	82%	**15861.05**
	Indirect Costs	**31573**	11489.18	9321.17	10809.38	100%	**-46.73**
	Total Costs	**193039**	**68935.09**	**55927.04**	**66191.71**	99%	**1985.16**
AUXOL	**Total Person-month**	**24**	9	8.00	14.00	129%	**-7.00**
	Personnel costs	**50000**	13500	12216.33	26978.46	105%	**-2694.79**
	Other costs	**28525**	5986	5183.93	17387.69	100%	**-32.62**
	Indirect Costs	**14505**	3897.2	3480.05	7625.23	103%	**-497.48**
	Total Costs	**93030**	**23383.2**	**20880.31**	**51991.38**	103%	**-3224.89**
TOTAL	**Total Person-month**	**525**	**216.1**	**235.93**	**157.70**	116%	**-84.73**
	Personnel costs	**1851764**	**701677.17**	**772909.57**	**555164.28**	110%	**-177987.02**
	Other costs	**480441.33**	**118584.9**	**108475.17**	**151476.23**	79%	**101905.03**
0	Indirect Costs	**887909.67**	**340388.09**	**323351.62**	**222339.61**	100%	**1830.35**
0	**Total Costs**	**3220115**	**1160650.16**	**1204736.4**	**928980.12**	102%	**-74251.64**

Table 4: Person-Months Status Table

Person-Month Status Table

CONTRACT Nº: 27107		Partner - Person-month per Workpackage												AC - own staff						
ACRONYM: HEARTFAID																				
PERIOD: 1/2/08 30/4/09		TOTALS	UNICAL	UNICZ	UNIMIB	JUMC	VMWS	FORTHNET	SYNAP	CNR	FORTH	RBI	AUXOL	AC TOTALS	UNICAL	UNICZ	UNIMIB	JUMC	RBI	AUXOL
Workpackage 2:	**Actual WP total:**	**19.25**	0.00	1.00	4.00	0.00	2.85	6.00	0.00	0.00	0.00	0.00	5.40	**8.5**	0	5	2			1.5
	Planned WP total:	**10.00**	0.00	1.00	1.00	0.00	4.00	3.00	0.00	0.00	0.00	0.00	1.00	**0**						
Workpackage 3:	**Actual WP total:**	**5.00**	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	**0**	0					
	Planned WP total:	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0**						
Workpackage 4:	**Actual WP total:**	**27.50**	6.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.50	0.00	**11**	1	0			10	
	Planned WP total:	**10.00**	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	**0**						
Workpackage 5:	**Actual WP total:**	**21.47**	6.00	3.00	0.00	0.00	0.00	0.00	4.00	1.52	4.95	2.00	0.00	**3**	1	0			2	
	Planned WP total:	**10.00**	3.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	3.00	2.00	0.00	**0**						
Workpackage 6:	**Actual WP total:**	**20.00**	1.00	0.00	0.00	0.00	0.00	7.00	8.00	1.00	3.00	0.00	0.00	**1**	1		0	0	0	
	Planned WP total:	**17.00**	1.00	0.00	0.00	0.00	0.00	7.00	4.00	2.00	3.00	0.00	0.00	**0**						
Workpackage 7:	**Actual WP total:**	**59.85**	4.00	15.00	8.00	6.00	5.80	2.00	6.40	0.00	4.05	0.00	8.60	**16.5**	1	2	7	4		2.5
	Planned WP total:	**45.00**	2.00	8.00	5.00	6.00	8.00	6.00	3.00	0.00	0.00	0.00	7.00	**0**						
Workpackage 8:	**Actual WP total:**	**29.50**	5.00	2.50	1.50	1.50	3.60	1.50	10.47	0.50	1.93	1.00	0.00	**10**	1	4	0		4	1
	Planned WP total:	**28.00**	4.00	2.50	1.50	1.50	3.50	3.50	5.00	1.00	1.00	1.00	3.50	**0**						
Workpackage 0:	**Actual WP total:**	**9.00**	6.00	0.50	0.50	0.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	**4**	2	1	1		0	
Management	**Planned WP total:**	**6.50**	4.00	0.50	0.50	0.00	0.50	0.50	0.00	0.00	0.00	0.50	0.00	**0**						
	Actual total:	**191.57**	**28.00**	**25.00**	**14.00**	**7.50**	**13.25**	**17.00**	**33.87**	**3.02**	**13.93**	**22.00**	**14.00**	**54**	**7**	**12**	**10**	**4**	**16**	**5**
Total Project Person-month	**Planned total:**	**126.50**	**19.00**	**12.00**	**8.00**	**7.50**	**16.00**	**20.00**	**14.00**	**3.00**	**7.00**	**8.50**	**11.50**	**0**						