

Document version #	Date	Change
V1.0	2015-12-03	Final Version

## Executive summary

At this moment huge efforts across the world are being put into developing healthcare concepts into the cloud. Companies are identifying the rules and regulations associated to storing and accessing medical data in and from the cloud. Many of these initiatives however do not take into account the possibility to collaborate on medical records and the integration of legacy applications into a cloud solution.

The design of a truly successful solution requires that specialized legacy applications and their associated data can be accessed from the newly developed cloud environment, giving the same level of collaboration and accessibility from anywhere as all the new innovative applications. MEDUSA solutions, concepts, tools and architectures are developed from that vision. The expected results can immediately be applied to the cloud based medical application products of the future and thus give Europe a strategic advantage in this world-wide new field.

This deliverable has been produced to describe how results from MEDUSA can be directed to the market, and takes as a starting point the description of which is the result that will be exploited. In this section every partner has identified an inventory of exploitable assets. These can come from different categories of results:

- Devices and Applications
- Knowledge
- Patents and Standards

Next, every partner has identified the market regarding results obtained in MEDUSA (markets, targets in each market, analysis of competitors, substitutive products, barriers, catalysts @) within an individual exploitation plan. These exploitation plans per partner include benefits resulting from MEDUSA in each organization, and identifies the exploitable areas of work and concludes with a summary of Action Plan and ROI.

This deliverable provides detailed explanation of exploitation actions that are going to be followed by each of the partners of the consortium. These individual plans can be taken as a referent for defining exploitation actions that can be directed to the market.

## 2.3 Relevance of MEDUSA

### 2.3.1 Market trends in Healthcare

As a market, healthcare, health & wellness represent up to 25% of the EU economy (when measured in terms of employment, expenditure and added value), making it the largest industry of the economy (source: EC, DG Information Society and Media, ICT for Health - Aug. 28, 2009). The size and growth of the healthcare market is driven by several global trends, leading to formidable challenges for society and healthcare at large:

- Global economic growth: increased spending on health related services, access to healthcare for a larger number of people and increased awareness of available healthcare options

- Dramatic changes in demographics; aging population
  - By 2045 more people will be over 60 than under 15 years, rising from 600 million to 2 billion.
  - Rise in number of patients with age-specific, chronic and degenerative diseases (cardiac, cancer, diabetes, Alzheimer's, Parkinson's). The number of US patients with a chronic illness is estimated to grow to 157 million in 2020.
- Healthcare professional staffing shortages rise, due to higher demand for patient attention
- Efficiency and effectiveness of healthcare: need to further improve hospital work flow efficiency, integration of diagnosis and treatment. E.g. the average length of stay for acute care has fallen in nearly all OECD countries - from 9 days in 1990 to 6 days in 2005
- Skyrocketing healthcare costs: global health care spending expected to grow from 9% of worldwide gross domestic product (GDP) in 2006 to 15% by 2015

MEDUSA takes up the challenge to:

- Improve work flow efficiency, effectiveness of medical treatments (and prevent unnecessary transport of vulnerable patients)
- Contribute to lower healthcare costs by sharing images and expertise
- Deal with healthcare professional staffing shortages by providing expertise through a dedicated virtual expert group

Chronic diseases are now responsible for the consumption of the vast majority of healthcare resources (more than 70% in developed countries) and are inflicting a transition in healthcare practice from acute to - much more expensive - chronic care. For example, cardiovascular diseases alone are responsible for 42% of all deaths in the EU, for 21% of productivity losses and cost the EU economy a staggering €192B a year (source: EC, DG Information Society and Media, ICT for Health - Aug. 28, 2009).

MEDUSA enhances the treatment of chronic diseases by saving time, sharing expertise and enabling novel treatments.

### 2.3.2 Market trends in Medical Imaging and Collaborative Systems

The global market for medical imaging (diagnostic and interventional imaging) is estimated to be \$20B (2007 TriMark study). The European market is about a quarter of this total and the US market almost half. The medical imaging market records solid growth percentages. Depending on the modality, the average compound annual growth rate (CAGR) is about 4% (for interventional imaging this is 8%). There are a few specific areas where growth is markedly higher than average.

Image-based software applications that support intervention processes in healthcare

The MEDUSA consortium is active in several medical imaging software segments such as for 3D/4D medical imaging software, clinical decision support systems (CDSS), navigation software and user interfaces. To illustrate these growth opportunities, take a look at historical growth:

- The European market for 3D/4D imaging software has a CAGR of 14% from 2004-2014
- The global CDSS market has grown from €159M to €289M during 2006-2012

Collaborative work is becoming more and more important in almost all the domains of economic life and this in addition to the rising portion of mobile workers. Facing the rapid evolution of technology, and ever increasing competition and constraints, the human capital is considered to be an essential competitive advantage for business entities. Traditional enterprise "static" organizations, aiming at optimization of efficiency and productiveness, move

their focus towards creativity. This may be illustrated, for example, by the development of so-called Professional Virtual Communities, built on some kind of collective intelligence with the objective of promoting innovation and maximizing the realization of expert resources. A recent study<sup>1</sup> has shown that workplace innovations account for 89% of multifactor productivity gains.

According to an IDC study the size of the market for collaborative environments in 2004 was \$1.9B. Western Europe had the largest market share with 41.4%. Another study by Gartner Group in March 2006 (Figure 4 below) illustrates foreseen evolution of working styles that will impact the requirements for collaborative interactions between individuals. At the same time, the study highlights the trend in the percentage of individual's performance that will depend on group input up to some 70% in 2015.

MEDUSA leaps into the new possibilities offered by advanced image processing techniques, real-time processing and exchange of huge data sets, in collaborative environments.

### 2.3.3 Market impact of MEDUSA

Research<sup>2</sup> (in six countries on avoidable medical examinations) show that between 6% and 18% of all patients experience multiple examinations. For trauma care we face 38,000 patients each year, 20% of which require transfer to another hospital (7,600). If 12% of these patients received a double CT-scan that could have been avoided by MEDUSA, we would save 900 CT-scans with a cost of approximately €1,000 per scan. We could annually save €900,000 for trauma in these countries, not including costs for personnel etc.

The total cost for neurological and neurosurgical diseases (including direct medical and indirect cost caused by productivity loss etc.) in Europe is estimated to be €92B each year<sup>3</sup>. If MEDUSA could decrease the cost for these diseases by just 0.5% (time in brain, faster treatment will lead to better outcome), MEDUSA has the potential of saving more than €40M each year.

The market impact of MEDUSA is particularly relevant for the stakeholders in healthcare:

## 2.4 Project results

The MEDUSA project results can be summarized as:

- A proof point for hosting advanced image processing as a service in a cloud accessible environment
- A proof point for hosting legacy medical applications in a cloud accessible environment
- A proof point for enabling collaborative capabilities to new and legacy applications
- A proof point for enabling development of new medical applications in a cloud based environment
- A proof point for enabling enrichment of (new) medical applications with cloud enabled technologies
- A proof point for securing data, access and collaboration from and to medical applications in a cloud environment

---

<sup>1</sup> source: Black and Lynch, San Francisco Federal Reserve, 2004.

<sup>2</sup> Peter T. Sawicki, Qualität der Gesundheitsversorgung in Deutschland Ein randomisierter simultaner Sechs-Länder-Vergleich aus Patientensicht, in Medizinische Klinik, 2005;100:755–68 (Nr. 11), Urban & Vogel, München

<sup>3</sup> Costs of Disorders of the Brain in Europe, European Journal of Neurology, Volumen 12, Supplement 1, June 2005

## 2.5 MEDUSA consortium

The MEDUSA consortium (see Table 1) is composed of 12 companies from 2 countries with relevant experience in the domains related to the development of the MEDUSA concepts and services. This experience is based upon their business activities or from their participation in other European projects.

	Countries	
	NLD	France
Industry	Philips	Bull
		Cassidian      CyberSecurity (CCS)
		Prologue
SME	Sopheon	Imstar
	Technolution	DOSIsoft
University	Academic Medical Center, University of Amsterdam (AMC)	Institut Gustave Roussy (IGR)
		Institut Mines & Telecom (IMT)
		Pité    Salpêtrière    Hospital (HSP)

Table 1: MEDUSA Consortium Overview

The composition and capabilities of the consortium (see Table 2) with industrial partners, SME and Universities gives the project a good consistency to MEDUSA in the following areas:

- Exploitation plans in several sectors of activity
- Dissemination activities that will reach different markets

### 3.2.2 SME

#### 3.2.2.1 Sopheon

Sopheon provides an Enterprise Innovation Management (EIM) platform called Accolade that is designed to help companies to innovate and achieve revenue growth and profitability. The Decision Support component developed in Medusa will enable Sopheon to offer smarter portfolio management capabilities as part of EIM solutions. Portfolio management is a dynamic decision making process, whereby a business list of product investments is continuously updated, revised, rebalanced and reprioritized. This ensures the optimal investment mix for an organization - the optimal 'portfolio value' - and optimal usage of an organization's resources. As the portfolio management process is always coping with uncertainties and changing information, with dynamic opportunities and with multiple decision makers spread geographically, it draws many parallels to the medical collaboration processes that are in the heart of Medusa. Like in an acute care scenario, portfolio decision makers need:

- Instant access to accurate, and actual data collected from a variety of sources
- Alerts in potential risk situations
- Tools to configure alert conditions and messages
- Tools to communicate decisions into relevant other processes.

Next to the Decision Support component, Sopheon developed a video component and a 3D viewer making use of new web technologies, WebGL and WebRTC. These technologies will be exploited in the Intelligence tools that are part of the Accolade suite.

Overview of Sopheon's exploitable assets in Medusa:

Decision Support component

- A new Accolade configuration for protocol management, available through the Cloud, that includes the new Rule Engine as well as export mechanisms for realtime usage
- Rule Engine: application specific business rules and logic
- Rule Editor: UI to create and edit rules
- Rule Runner: backend for executing the rules

New Accolade API

- Connects Protocol Management System with Decision Support
- Allows collaboration of Accolade with other external apps

Sensor apps

- Communication of real-time sensor data via mobile apps to the cloud

New technologies to support cross-platform mobile applications

- Browser-based apps
- HTML5

WebRTC-based video component

- Real-time audio and video communication that improves the experience of participants in virtual collaboration sessions (in the medical or business world)

WebGL-based 3D Viewer

- Provides new analysis capabilities, specifically for knowledge association based innovation research

Software-as-a-Service (SaaS)

- New distribution models are relevant for next generation Accolade

#### *4.2.2.1 Sopheon*

Sopheon's target market consists of a variety of industries, the most important of which are: Aerospace and Defense, Chemicals, Consumer Goods, Food and Beverage, High Tech and Electronics, Industrial Manufacturing. For companies in all of these industries, Portfolio management is at the heart of their innovation competence. It forms the 'switch' process between business strategy and actual product development and it is the decision making process for current product innovation investments within the overall strategic plan. All these industries are candidates for using the user configurable decision support system developed in Medusa. Sopheon's solutions have been implemented by over 200 customers with over 70,000 users in over 55 countries.

## 5 Exploitation plans

### 5.1 General exploitation plans

The MEDUSA project contributes in a positive way to the employment by actively stimulating research and cooperation in several of the fastest growing businesses of the coming decennia. A broad spectrum of applications and services can be build using the MEDUSA knowledge, models and proof points. It enables a new competitive edge to existing businesses and gives companies aiming at opening new business lines based on the products, applications and services developed and demonstrated in MEDUSA an excellent starting point. Next to that it provides opportunities for starting up new businesses, known for their high social value and job potential. More specific, the partners plan to exploit the MEDSA results through:

- Setting up inter-hospital networks of regional hospitals for care and image exchange for patients with acute ischemic stroke
- Creating an AMC-spin off for cloud-base image analysis on large amounts of image data, typically collected for randomized and controlled trials
- Enabling advanced medical image processing in the cloud
- Enable remote patient monitoring by utilizing video conferencing capabilities in a secure and stable way
- Establishing and increasing open innovations on a broad and solid imaging platform to enable researchers and developers the capability to focus on specific medical algorithm developments and validation
- Offering new and enhanced services in the field of medical applications, design, consulting and development
- Integration of new cloud architectures and middleware products, services and medical environments
- New options for future products and services. The expectation is that the project will generate a large potential of future product options that will find their way to commercialization directly by the consortium partners or during a later stage.
- The promotion of the emergence of new companies, since many of the partners in the consortium have an excellent track record of working in close cooperation with technology centers, new campus companies, research groups, high tech SMEs, university partners and technology villages aiming at the conversion of research ideas into business.
- The consortium includes large companies, smaller companies and SME's with a large joint turnover. All partners expect that participation in MEDUSA will, and has strengthened their position in the dynamic field of cloud-based medical application technology and products, and increase their turnover through joint and individual exploitation after the end of the project.

The project has the overall aim to ensure exploitation and dissemination of the MEDUSA results. Into the project is chosen for a way of working and approach that will maximize the exploitable possibilities after the project, and is characterized by:

- Parallel development of the technical solutions and the assessment of business opportunities; by benchmarking, market research and by contacts with business stakeholders on requirements, needs and future interest.
- Careful selection of the most attractive concepts for the demonstrators. People, technology, market and business inputs will be taken into account in this selection process.
- Co-design and validation of the demonstrators with users of the solutions.

- The definition and development of a clear business framework for the commercial exploitation of the MEDUSA products, framework and architectures.
- The definition of exploitable strategies highlighting the unique selling points of the MEDUSA results.
- Workshops will be established in which the results of the project will be presented to industry, consulting firms and potential users.
- The demonstrators as build during the project showcase the total outcome of all the work packages. They have been carefully selected, designed and communicated with potential users of MEDUSA, that through their functional appearance and application domain, they will be appealing examples of the exploitation of the MEDUSA results.

## 5.2 Individual exploitation activities

This section gives insight in the exploitation activities that every partner of the consortium has identified to carry out during and after the finalization of the project. It addresses views from each of the partners to questions such as the benefits for the organization, identifies exploitable areas (new products, product upgrades, software packages, tools, methodologies and such) but also gives insight in possible return on investments and commercialization and developments of products.

### 5.2.2.1 Sopheon

From Sopheon's perspective, the main benefit of Medusa is that it opens up the market for real-time portfolio management. Sopheon is a market leader in collaborative innovation portfolio management and develops software for the decision making processes related to this. Today portfolio management is not real-time or pro-active. It always analyzes historical data over a certain period, like a month or a quarter. With the user configurable decision support system developed in Medusa we can realize realtime portfolio management, whereby the system receives product and market data (big data), and analyses on the fly the position of the portfolio - for example product managers see the buying behavior of consumers and can react instantly.

Another benefit is that Medusa may provide Sopheon with new opportunities in the Healthcare market, esp. in the field of protocol-based decision support.

This is how Sopheon plans to exploit the Medusa results:

Exploitable new area	Exploitation
Decision support for project and portfolio management <ul style="list-style-type: none"> <li>• Ability for users to configure personal alerts at deliverable, project or portfolio level</li> <li>• Instant Portfolio Management</li> </ul>	To be added to Sopheon's innovation management platform Accolade.
Communication with external apps <ul style="list-style-type: none"> <li>• Ability to provide users with smart services through external apps</li> </ul>	To be added to Sopheon's innovation management platform Accolade.
Internet of Things <ul style="list-style-type: none"> <li>• Ability to use real-time sensor data via mobile apps in decision support calculations</li> </ul>	To be explored for integration in Sopheon's innovation management platform Accolade.

Real-time communication <ul style="list-style-type: none"> <li>Enhance communication between e.g. gatekeepers through secure video and audio communication in the browser</li> </ul>	To be added to Sopheon's innovation management platform Accolade.
3D Viewer	Currently being explored for use in Sopheon's search and text mining tool. To be explored for integration in Sopheon's innovation management platform Accolade.
New distribution models: SaaS	To be explored for next generation Accolade

## 6 Dissemination plans

### 6.1 Dissemination activities

All partners have disseminated the results of the MEDUSA project in order to strengthen their reputation, attract potential customers, attract high potential personal and students and/or stimulate the exchange of valuable research results and standardization.

Dissemination into the project has been carried out mainly through publications into internet, papers to international and national conferences and seminars, newspaper and technical magazines as well as coverage on television. Further dissemination activities after the project can be characterized in the next points:

- MEDUSA brings together partners from different countries, regions and disciplines. While respecting the intellectual property rights of each of the partners (consistent with the ITEA guidelines) the MEDUSA consortium will commit to a maximum transfer of information within and outside of ITEA).
- The research institutions and companies with strong links to (or alliance with) universities will setup university courses on the subject and disseminate the results through their networks of other research institutes, SME's, new start-ups and industrial contacts.
- The internet will be a major vehicle for publishing and disseminating relevant project results. A MEDUSA website will be established, summarizing the most relevant results of the project. This website will consist of private and public sections. The private part will contain the consortium-confidential information; while the public part will contain all freely available material, such as published papers, proposals to standardization bodies, conference contributions, showcases etc.
- Next to the public part of the MEDUSA website, several partners plan to setup local websites aiming at dissemination specific work package results to their internal, national and international networks.
- Technical workshops will be organized in which participants will explore user requirements and present their work, ideas and results with the aim of sharing relevant knowledge with all people involved in the project. Some of these workshops might also be open to the public.
- A set of reference designs and proposals will come out of the project with which industries can be supported to carry out their projects.

### 6.2 Conferences

IMT actively disseminated its research results among the scientific international community.



### **6.3 Press releases**

IMT made an initial press release for the MEDUSA project.

### **6.4 Standardization**

The AMC has developed automated tooling for determining the infarct volume on followup CT. This software has been used in a large multicenter trial and is currently being evaluated by 3 other trials. As such this software has the potential to become the standard for this type of analysis.

IMT had an active standardization activity (more than 20 technical reports) related to the ISO/IEC efforts on user description (ISO/IEC 21000-22) and the emerging ISO standard related to wearable devices and Internet of things.