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## D8.2 GiraffPlus Business Plan (final)

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## Disclaimer:

This document is confidential and should not be distributed outside the consortium and review committee.

## Deliverable Summary

This document reports on the final business plan for the GiraffPlus project. It is a comprehensive view of the commercial service description, business model, value proposition, IPR strategy, market analysis, consortium-wide exploitation plans, financial analysis and funding requirements for commercialization. This is a M36 and final deliverable.

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# 1 Introduction

## 1.1 Scope of the Document

The document is GiraffPlus deliverable D8.2, the final (M36) business plan for the exploitation and commercialization of the GiraffPlus project. Building upon the work of D8.1, the preliminary (M18) business plan, it provides a foundation for the creation and setup of a new organization that will lead the commercial market entry, and for the broader consortium-wide exploitation plans. It addresses not only the commercial plan (market strategy, value proposition, etc.) but also the business plan (financial requirements, operational requirements and setup, funding strategy, etc.) Section 5.3 includes specific funding plans based upon investor discussions and a pending investment offer. This document relies heavily upon the analyses of its predecessor D8.1 and refers to it often. We do not repeat that work here but simply restate its conclusions and invite the reader to refer to it for the details.

## 1.2 Deliverable Structure

The document is divided into three major sections. The first (Section 3) is the business vision, describing the planned commercial service based upon the GiraffPlus platform developed in this project and the associated business model for delivery. It follows with the resulting value propositions and service evolution, and then the intellectual property rights (IPR) strategy. Section 4 describes the market analysis including a region-specific analysis of the EU, USA and rest-of-world (RoW). The final section (5) describes specific exploitation plans including the Giraff commercialization plan and associated financial analysis and capital requirements.

# 2 Methodology

We have examined many tools and models for business plan development and analysis from various industries. Each is optimized for certain types of markets, businesses and key issues so in most cases no single model is a perfect match for the requirements of a specific business. We have chosen to combine 3 models as described below to address the elements required for this business plan:

### 1. Stakeholder Analysis<sup>1</sup>

This is the classic approach for understanding the market at both a broad and detailed level. It is particularly important for the GiraffPlus (AAL) space because the stakeholders are a large and complex group with subtle inter-connections. This analysis drives several components of the commercial plan including the value proposition, service definition and marketing messaging. Nearly all business models contain some version of this process. The stakeholder analysis is the foundation for the value propositions described in 3.4.

## 2. Market Discipline

Market Discipline theory<sup>2</sup> is a well-established model for determining the customer relationship, the company's approach to its customers and indeed the culture of the company itself. It is not as important an analysis for established companies but it (or a similar process) is mandatory for starting a new one. We chose it because it is simple and forces up-front decisions about the nature of the business, particularly its relationship to its customers (also a critical factor in the GiraffPlus space). Our market discipline choice is described in 3.2.

## 3. Business Canvas

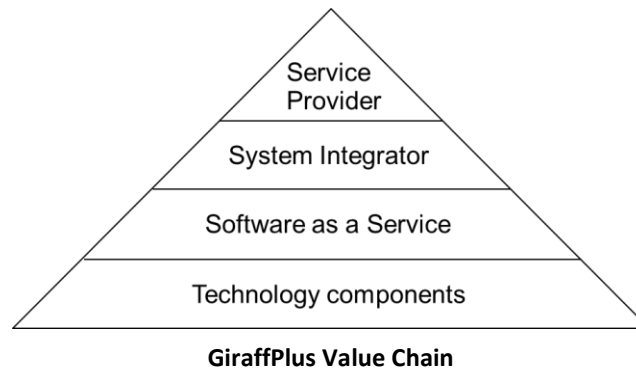
The Business Canvas<sup>3</sup> is a relatively new model that has become quite popular in the past few years and is one of the recommended models for the AAL industry. We use this model to summarize the overall business model in 3.2. Its value to this business plan is that it divides focus equally between strategic issues (such as value proposition and target customers) with tactical issues (such as staffing, financial modelling and key activities) which is especially important when starting a new company. The Business Canvas is the foundation model for this document and drives most of our work.

# 3 GiraffPlus Business Vision

## 3.1 Service Description

In D8.1 we analysed the nature of the GiraffPlus commercial offering, in particular whether it is a product or service. Because the Giraff avatar is such a central and visible part of the platform many potential customers often think of it as a product (e.g. "I want to buy a Giraff"). Based upon the initial input from WP1 (user requirements and functional specifications) and later in the project from WP6 (user evaluation and application assessment) as well as the real-world experience of deploying the platform in homes, it is exceedingly clear that this is a service, where the hardware (Giraff avatar, environmental sensors and physiological devices) are components of the solution but not products themselves. We may choose to charge an up-front fee to cover the costs of these devices but that is a financial consideration and not part of the service definition.

We also analysed previously the value chain for this space, and where the offering fits on the continuum between technology components and service provider (i.e. actual care delivery), as illustrated in the figure below:



In this analysis we concluded that the GiraffPlus offering is Software as a Service (SaaS), and all of our extensive subsequent dialogues with customers, industry experts and investors have validated this conclusion. Specifically we believe that this approach allows us to:

- Address customers at different levels in the value chain
- Focus on the unique strengths of the GiraffPlus solution
- More easily focus on the chosen market discipline (see description of this in the Business Model)
- Leverage the infrastructure already in place in each country (e.g. systems integrators who know how to procure and configure devices)
- Address (or at least have available) a global market from the beginning
- Greatly simplify the startup requirements for the offering
- Attract a broader array of investors who prefer software plays

As a SaaS provider we also avoid dealing with the entanglement of the upper value chain layers – systems integrators that are also service providers, service providers that are also care organizations, etc. In the SaaS model these are all potential customers depending upon what they themselves provide.

We also considered in D8.1 the possibility of offering technology components – at the base of the value chain. Subsequent analysis supports the original conclusion that this is not the main focus of the GiraffPlus offering. However, it could be a good exploitation strategy for some of the consortium partners who created those technology components. We will address this idea later in this section.

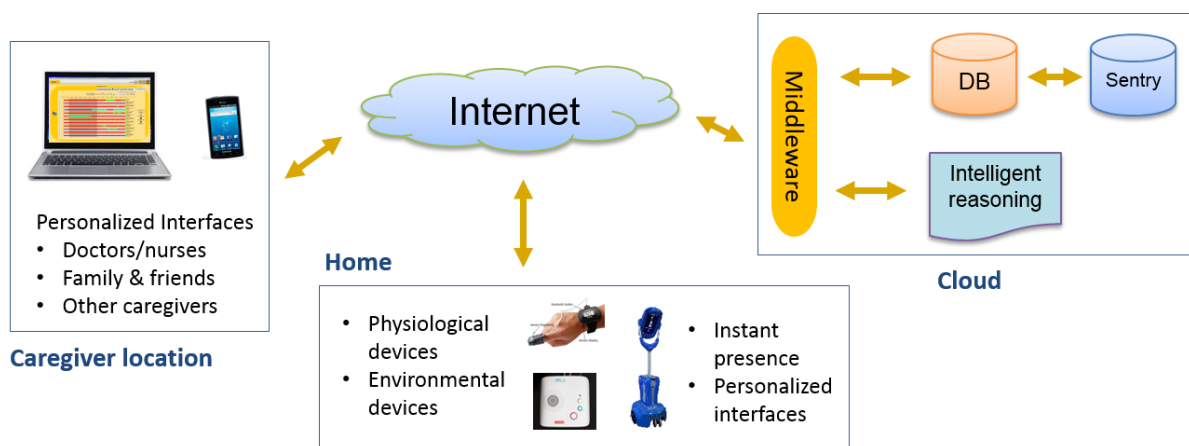
Finally, we now have the results of the User Evaluation and Application Assessment from WP6 (see D6.3) to validate the service concept. The long-term evaluation of the GiraffPlus system in 15 homes in Italy, Spain and Sweden shows that system proved to be relatively easy to implement and was not experienced as intrusive by the elderly users. Slight positive changes were found regarding less fear of falling and increased feelings of safety. All health care professionals and other caregivers welcomed the arrival of telehealth systems such as GiraffPlus. Across the whole set of professional caregivers there is a strong belief that telehealth will be part of future care.

With these conclusions validated we can now specifically define the GiraffPlus service offering. It is essentially a SaaS telehealth platform, likely branded as an “AAL” platform to

distinguish it from the many point solutions in the telehealth market today. This service offering is summarized as follows:

- Ambient Assisted Living platform
  - o Next-generation evolution of today's telehealth services, developed in Europe
  - o Creates a comprehensive care environment in the home – not a medical care environment formally, but certainly allows many medical protocols to be carried out in the home with the assistance of caregivers.
  - o Integrates environmental sensors, actuators and physiological devices
  - o Standards-based, plug-and-play, adaptable to many care scenarios
- Provides “instant caregiver presence” via Giraff avatar
  - o Response to urgent situations via Internet with full mobility, day or night
  - o Empowers elderly residents to help manage themselves, ask for help when needed
  - o Family and health care professionals can supervise health care protocols, chronic conditions, early dementia; check in, provide social interaction
  - o In the future, provides autonomous navigation support for caregivers
- Intelligent reasoning provides data analytics and care insight
  - o And dynamically customizes UIs for each caregiver
- Supports protocols for many different care scenarios
  - o Including integration with 24-hour call centre

The architecture of this SaaS offering is represented below:



The environmental and physiological devices this platform will support are region-dependent because they require regional certification, and for some physiological devices certification as medical devices. The portfolio of devices, based upon the GiraffPlus experience and subsequent user discussions, will be similar to that shown below (and most of these devices are now commodity elements that can be replicated in nearly any region):





## 3.2 Business Model

### Organizational philosophy

We have spent much of the past year discussing the business model and organizational requirements to deliver the GiraffPlus platform with customers, industry experts and investors. A clear "consultancy" model has emerged as the initial business model, where personnel within the service delivery organization work hand-in-hand with care organizations to plan, develop, implement and follow up on pilot projects. In fact, approximately the first 10 customer implementations will require dedicated project managers, and the first 2-3 will require full-time project managers for at least 90 days. These initial customer implementations will consist of 5-25 systems (homes) and the first 2-3 customers (that we have already identified) will likely be implemented in 3 stages:

1. Current Giraff commercial service
2. GiraffPlus with environmental sensors only
3. Full GiraffPlus with sensors and physiological devices

### Revenue

In terms of the revenue model there will be a transition over the first year. During the first implementations as described above the revenue model will look more like a consulting agreement, with an up-front fee to cover the cost of devices (including the avatar) and then a monthly fee that covers operational costs and salary for the support personnel involved. Once the organization has gained sufficient operational experience (up to 100 systems) the revenue model will transition to a traditional SaaS model with a smaller up-front fee to partially cover device costs, and then a monthly subscription to cover support costs and to amortize whatever device costs are not covered by the up-front fee. This is similar to telephone service providers who take an up-front fee to partly cover the cost of a mobile

device (especially if it is a premium device) and then a monthly fee to provide the service and pay for the rest of the device cost over time. Because the Giraff avatar is a major expense item, the business model also anticipates financing this equipment through a third party leasing company, such that it does not put an unreasonable up-front financial burden on either the customer or the service delivery organization.

### **Value discipline**

An important element of the business model is also the selection of a “value discipline.” As we examined in D8.1, value discipline marketing theory maintains that any commercialization strategy must start with an analysis of the organization and its market for the purpose of selecting a “dimension of excellence.” This is especially true for a new entity in a new market, and the GiraffPlus business plan is based upon this theory. Value discipline is also the strategic embodiment of the value proposition (described below) – i.e. it is the culture and philosophy that allows the commercial entity to deliver the described value.

The theory describes 3 possibilities and maintains that an organization must choose one *and only one* of these dimensions to focus on and excel at, targeting its customers and narrowing its focus until it can dominate the chosen market through the chosen market discipline. The organization must maintain threshold standards in the other dimensions of course, but must focus on only one in order to be a market leader.

We argued in D8.1 that “product leadership” is the best value discipline for this market, selected over “operational excellence” and “customer intimacy.” This implies that the service delivery organization will strive to always have the best product (in fact a service in this case) with all the right features, and that customers are willing to pay for those features. It means that the GiraffPlus service is constantly innovated to deliver leading-edge functionality to the market. This also means the service will likely be premium-priced compared to other telehealth solutions but considered worth it and “asked for by name.”

Looking back to this analysis with the benefit of over a year of customer discussions, we still believe this is the right approach. However, we have learned that just as the revenue model must transition from consultancy-based to subscription-based, so too must the value discipline transition from customer intimacy to product leadership. Indeed, we described in D8.1 a compelling argument for customer intimacy based on our AAL commercial experience, and understanding that “solutions like Giraff are only 20% of the total effort required, the rest being implementation challenges within the care organization.”<sup>4</sup> The consultative approach described above is by definition a customer intimate model and is the only way to establish credibility with a novel service.

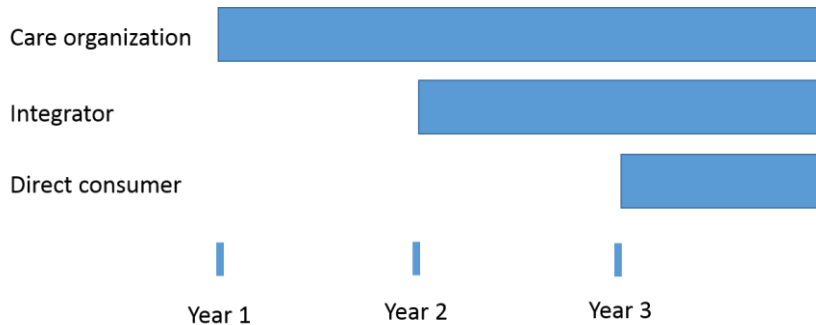
The problem with a customer intimacy value discipline in the long run is two-fold:

- i. It requires developing customer relationships one at a time, and therefore it is difficult to scale such a service.
- ii. Many of the individual components of the GiraffPlus solution – specifically alarms, sensors and physiological devices – are already well established in the market and

serve as an inevitable reference and comparison points. Therefore, as these telehealth platforms become more common, customers will expect their implementation to be “routine” and will be less willing to pay for a consultative approach.

## Distribution

The distribution model that has emerged over the past year is now clear. There will be 3 modes of distribution layered in over a period of 2 years:



In the first year the care organization will be the distributor to their clients. The service delivery organization will focus its efforts on supporting them, both technically and in terms of marketing messaging to their clients. In the second year we will add conventional integrators to the model, which will focus first on installation and first-level technical support but over time will become value-add resellers with their own customized services tailored to specific use cases.

Finally, in the third year we will add a direct-to-customer element to the distribution model. In D8.1 we considered this possibility – e.g. offering the service directly to families and individuals who are the primary home care providers for an elderly family member and want to keep them at home. This is a “do it yourself” approach and will work in the long term in regions where there is little formal elderly care provided by the state, but rather is the responsibility of individuals/families. This proposition may not make sense in Europe where most countries have at least some systematic form of social and elderly care (therefore, the individual has little motivation to implement their own solution). However, in the U.S. where there is an exceedingly high motivation to do exactly that it could open a massive direct market for families desperately seeking a way to keep their loved one at home. Local system integrators and even retailers could become distributors for the devices and the SaaS platform.

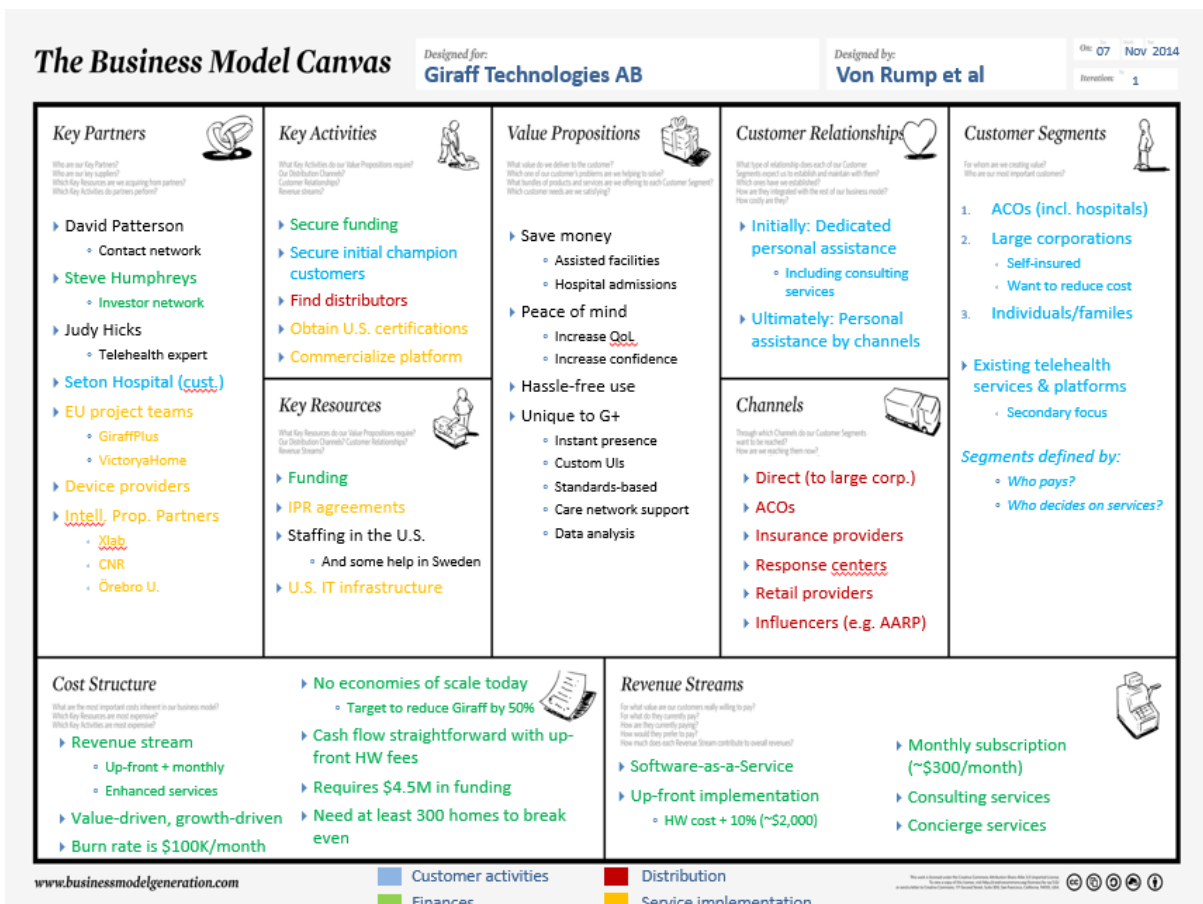
## Business Canvas

We summarize all the elements of the business model using the Business Canvas. We described the process and results in detail in D8.1, and simply update the canvas here:

- **Value propositions**
  - Save money
  - Peace of mind

- Hassle-free use
- Unique to GiraffPlus
- **Customer relationships**
  - Initially: Dedicated personal assistance
  - Ultimately: Personal assistance by channels
- **Customer segments**
  - ACOs (Accountable Care Organizations, typically organized around hospitals)
  - Large corporations (who in the U.S. are mostly self-insured)
  - Individuals/families
  - Existing telehealth services & platforms (secondary focus)
  - *Segments defined by who pays and who decides on services*
- **Channels**
  - Direct (to large corporations)
  - ACOs (to their patients)
  - Insurance providers (to their members/clients)
  - Response centres (to their members)
  - Retail providers
  - Influencers (e.g. AAL Forum in EU, AARP – American Association of Retired Person – in the U.S.)
- **Key partners**
  - David Patterson – U.S. telehealth consultant who will likely join the eventual U.S. organization
  - Steve Humphreys – Silicon Valley entrepreneur and investor
  - Judy Hicks – considered one of the top 3 telehealth experts in the U.S. and a likely Advisory Board member
  - Anthem Insurance (the largest health insurance provider in the U.S. and a likely pilot customer)
  - EU project teams – the consortium members who will continue contributing the commercial service
  - Device providers – including current partners Intellicare and Tunstall
  - IP Partners – including consortium partners who will contribute to the ongoing commercial service
- **Key activities**
  - Secure funding (nearing a term sheet)
  - Secure initial champion customers (first 3 identified)
  - Find distributors
  - Obtain U.S. certifications (including UL and HIPAA)
  - Commercialize platform

- **Key resources**
  - Funding
  - IPR agreements
  - Staffing in the U.S.
  - U.S. IT infrastructure
  
- **Cost structure**
  - Revenue stream – SaaS subscription
  - The business is value-driven, growth-driven
  - Burn rate will be \$100K/month
  - No economies of scale today
  - Cash flow straightforward with up-front HW fees
  - Requires \$4-5M in funding
  - Need at least 300 installations/homes to break even
  
- **Revenue streams**
  - Software-as-a-Service
  - Up-front implementation
  - Monthly subscription (~\$300/month)
  - Consulting services
  - Concierge services



### 3.3 Value Propositions

This market and the GiraffPlus value proposition, as with nearly all AAL solutions addresses a diverse and interconnected set of stakeholders; therefore a stakeholder-specific analysis is required to develop the right value proposition(s). We reported on this analysis in detail in D8.1 and simply update and summarize the results here:

The overall value propositions focus on *confidence* and *cost effectiveness*:

- Provide unobtrusive support in the home for independent living
- Allow for flexible integration of many different devices according to the resident's needs
- Provide easy-to-use instant presence for social inclusion, instruction and feedback on care processes (such as use of a physiological device) and to respond to potential emergency situations
- Provide intelligent reasoning to remove some of the burden of information interpretation and analysis by caregivers
- Include consultative support for the care organization and other organizations involved in implementing the solution
- Provide easy and personalized caregiver access to information

The value propositions and associated messages for each stakeholder group are:

#### 1. Elderly

- i. GiraffPlus keeps you socially connected on your terms; you can have visitors when you want them and control and privacy when you don't
- ii. It maintains quality of life by providing home and health care support as you need it. GiraffPlus gracefully expands with your needs.
- iii. It enables continued independent life at home
- iv. Increases financial security and reduces fear of become a burden to family by providing an economical solution to home care
- v. The technology is transparent and requires nothing of you. All communications place the burden on the caregiver, not you.

#### 2. Informal caregivers

- i. GiraffPlus helps maintain health and safety of your loved one, and can maintain or improve quality of life
- ii. It eases the burden of guilt by allowing you to participate in the care process no matter where you live or what time demands are placed on your life. It allows you to be instantly present in the home whenever you or they want.
- iii. Better control of your financial planning by keeping your loved on living longer at home
- iv. Avoids forcing compromising financial decisions between family and elderly loved ones
- v. Personalized UIs give you the ability to see and manage exactly what you want in caring for your loved one

### 3. Formal caregivers

- i. GiraffPlus makes you more efficient and increases the quality of care you deliver by leveraging technology while allowing you to focus more on the personal relationship.
- ii. It does so without undue technology burden on you. The system is easy to work with and the visits can even be fun.
- iii. It does not threaten or replace you but rather extends your presence; you are more, not less valuable than before (job security fear).
- iv. Personalized UIs give you the ability to see and manage exactly what you want in caring for your client/patient.

### 4. Social care organizations

- i. GiraffPlus gives you a way to maintain quality of care in the face of mounting financial pressure.
- ii. It does so without requiring additional staffing and the challenges that go with that
- iii. You will not be left behind by innovation; GiraffPlus is state of the art.
- iv. At the same time you will not be a “bleeding edge” adopter; from its first day in service the system will have already had at least 1.5 years of field experience.
- v. It does not replace people but rather extends them. It does not de-personalize because the system emphasizes personal communications.

### 5. Health care organizations

- i. GiraffPlus gives you a way to maintain quality of care in the face of mounting financial pressure (just as with social care organizations).
- ii. It provides a way to scale the increased demand for health needs of an aging population
- iii. It meets the required regulations and standards for security and confidentiality (region-specific, additional development required)
- iv. You will not be a “bleeding edge” adopter; from its first day in service the system will have already had at least 1.5 years of field experience.

We also summarize here the final results of WP6 here as it relates to value proposition.

- Growing older populations means a quantitative as well as qualitative change. The more we learn about ageing the more we understand that this is a heterogeneous group of people and cannot be categorized simply as “elderly.” In fact, one general conclusion from The Swedish Centre for Ageing and Health – AgeCap – is that differences between individuals actually increase with age. AgeCap has unique access to a large amount of longitudinal data followed up for over 40 years (see <http://agecap.gu.se/english>), covering a wide variety of aspects. These results gives support for the fact that the flexibility and personalization provided by the GiraffPlus

system is crucial to make these systems meet the needs of heterogeneous elderly populations, and therefore is an important part of the value proposition as described above.

- Beyond these user aspects there are important issues to be discussed in order to make use of telehealth systems in European (and elsewhere) elderly care. Defining the market and the way these kinds of solutions should be regulated and supported is one main challenge and which differentiates Europe from U.S. While the U.S. market is singularly characterised by the lack of a general welfare system, causing payers, providers and families to look for technology to reduce costs by keeping their elderly at home, the European systems are more diverse. The analysis of what drives innovations such as telehealth systems will have an immediate effect on the possibilities to realize the benefits of the GiraffPlus system. Section 4.3 discusses these drivers and regional differences in more detail.
- The GiraffPlus system is dependent upon an implementation strategy and the inclusion of the organization that will provide services to the elderly. Independent global commissions describe the mismatch between the care offered and users' demands and needs, lack of cooperation, discontinuous care chains, cumbersome hierarchies and especially technology focus without further understanding of the context in which it is used<sup>5</sup>. From the field of implementation science we learn that there are a range of factors that decides whether an implementation is successful or not. The Consolidated Framework for Implementation Research (CFIR) is an example of a systematic way to understand intervention characteristics, outer setting, inner setting, characteristics of the individuals involved and the process of implementation<sup>6</sup>. Hence, the next step to explore the value propositions of telehealth systems must be on the system level.

### 3.4 Future Development and Service Evolution

From WP6 we have the final evaluation of the platform in terms of the Technology Readiness Scale (Homeland Security TRL Calculator), which assesses the project moving from level 4 – existing components available and validated in laboratory environment, to level 6 – system integration and validated in real life environment. This assessment concludes that to advance the platform to level 9 (final commercial availability) requires a broader consideration of what user factors affect implementation. Therefore, the ongoing development plans described below will continue to follow a tight feedback loop between users and developers as it did during the project.

The service evolution is straightforward because it is based on enhancements to the existing prototype, and contains the following elements:

- Obtain hardware certifications in the U.S. (UL) and Canada (CSA), and ultimately elsewhere in the world
- Obtain data security and privacy certifications in the U.S. (HIPAA) and Canada (PIPEDA) and ultimately elsewhere in the world



- Harden (and most likely refactor over time) the entire software platform in terms of reliability and user friendliness
- Systematize the process by which a care organization (which can also be a family) plans, designs, implements and supports a care platform for someone living at home
- Continue to adopt industry standards for both devices and data record formats in order to make platform integration and deployment easier and more flexible
- Implement the configuration planner, and in particular develop a user-friendly interface via a wizard-based approach
- Integrate more deeply into the health care market by aligning our data formats with their systems (based upon emerging standards as much as possible)
- Integrate true robotic devices for physical assistance into the GiraffPlus platform

The last element is key to the future of home care and merits additional explanation. Robotic devices that provide physical assistance via lifting, transferring, retrieval and specialized tasks such as feeding or cooking will become an important element of home care in the future. These devices can enhance the GiraffPlus platform by adding a dimension of physical assistance to the existing supervisory care capabilities and protocols. At the same time the GiraffPlus platform can help speed these products to the market by easing the technical challenges associated with pure autonomous operation. The instant presence of the Giraff avatar can allow caregivers to supervise the operation of these devices without having to be physically present in the home. There is also opportunity here for rich integration with the GiraffPlus cloud for response to alarms and events in the home, including inferred events via the intelligent reasoning module. The cloud can also provide a control and management point for these devices, for example by creating schedule and reminders that cause these devices to activate without caregiver intervention.

### 3.5 IPR Strategy

#### 3.5.1 IP Agreements

Giraff Technologies is the initial organization that will bring to market the GiraffPlus concept. As such, the company plans for 4 (5 including end-user licensing agreements from Intellicare for their purchased software) and ultimately 6 software support and licensing agreements. The support portion of the agreement will engage the organization or individual who wrote the software in a consulting-type agreement on a per-hour or retainer basis (or possibly a combination of both) for technical support and debugging of the existing code, and also possible further development and enhancement of the code. The license agreement details are still to be determined, in particular sorting out what are open source versus proprietary licenses. In one sense this is relatively unimportant, though because even if it is determined that no license is needed in any particular agreement there is still a need for support for the existing software and possible ongoing development.

The specific agreements are planned as follows:

**Örebro University** – we envision here a support and license agreement for the context recognition software including its integration into the overall platform. Support will include technical support for the existing code as well as consulting support for configuration planning. Support may also include further development of the configuration planner to make it commercially viable. The source code is a mix of open source and proprietary code, so the nature of the license agreement itself is still to be determined.

**XLAB** – we envision here a support and license agreement for the database “cloud” that manages storage, security and access to data collected by the system. Again, the agreement will include support for the existing code as well as possible modifications and enhancements. The course code here is also a mix of open source and proprietary code.

**CNR (ISTC)** – we envision here a support and license agreement for the Data Presentation, Personalization and Interaction Services software (various DVPIS front-end modules and the back-end services). Support will include additional software development and refinement as well as a consulting role in further system design and system deployment activities. The support agreement will be similar to what is described above.

**CNR (ISTI)** – ISTI developed the middleware infrastructure and integration layer. It is a public research institute and generally cannot profit from research projects, and therefore plans to release their software as open source under the Apache Software License (ASL) program. Giraff Technologies will use this software according to ASL requirements, modifying and enhancing over time. We envision a short-term consulting agreement with ISTI to support this software until the entity supporting commercialization becomes self-sufficient.

**Intellicare** – the plan is for Intellicare to be a supplier of physiological devices and associated software. Therefore the end user licensing for the software will be included in the purchase price.

**University of Málaga** – the avatar navigation work that this organization has completed for the project is not yet ready for commercialization, both because of cost and maturity and stability of the software. However, it is an important future enhancement of the GiraffPlus platform and we envision an eventual agreement for this work similar to that described above.

### 3.5.2 IP Protection for Project as a Whole

The main IP protections for the project as a whole lie in the following basic “common sense” strategies:

- Continue to protect existing IP (especially “trade secrets” owned by commercial partners) according to the protections provided in the consortium agreement, specifically through confidentiality and management of that IP via

non-disclosure agreements, etc. This is of course true for both foreground and background.

- Establish license agreements where appropriate as described above
- Examine the existing patent space going forward as described in the next section (3.5.3)

### 3.5.3 Exploitation Strategy

There are three elements to the exploitation strategy:

- Commercialize the GiraffPlus concept as developed and demonstrated in the project. This plan is described in detail in 5.2.
- Each individual consortium partner has devised their own exploitation strategy around the results generated by the project. These plans are described in detail in 5.1.
- Giraff Technologies, as part of the commercialization described in 5.2 will conduct both “defensive” and “offensive” patent searches around the GiraffPlus concepts in the EU and the U.S. using consultants who are experts in this space. Defensively we will look for possible infringements of the commercial service against existing patents, and offensively we will look for opportunities to file new patents to protect the existing IP. Section 3.5.5 below describes specifically the patent opportunities.

### 3.5.4 Third-Party Licensing

As part of the commercial strategy there is an opportunity for licensing the platform to other providers who want to deliver a vertically-integrated service around it. However, this is not the main commercial focus, and otherwise it is expected that third-party licensing will be limited (at least initially) to standard end-user agreements that are a part of nearly any end-user application.

All consortium partners will continue to seek opportunities for third-party licensing as part of their general exploitation plans as described in 5.1. Some partners may choose to offer their software under an open source license framework such as Apache.

### 3.5.5 Patent Opportunities

There have been no patents filed so far for any of the work done in the GiraffPlus project. In most regions (speaking specifically here for the EU and U.S.) there is overall little opportunity for filing of any fundamental concepts because there is too much prior art and existing patents. In particular, the mobile telepresence space has a great deal of prior art, and indeed many mobile telepresence patent claims in the U.S. have been rescinded by the USPTO (the

organization responsible for patent and trademark issuances in the U.S., similar to the EPC in the EU) when prior art came to light. The same holds true of basic telehealth concepts such as integrating devices in the home into a care platform, as this has been done many times before in the EU and U.S. Furthermore, software patents in general are difficult to enforce and filed less and less because it is too easy for others to work around them, writing new code to accomplish the same task.

That being said, there are notable exceptions to the above and opportunities to file narrower claims around novel integration of components (especially the Giraff avatar) into a care platform. Specifically, the intelligent reasoning techniques (both configuration planning and context recognition) developed at Örebro University are still novel and well beyond anything in the market today (it appears that all other such efforts are simple rules-based algorithms with no true intelligent reasoning). Also, the navigation work developed at University of Málaga is also novel and there are no filings in this space as far as we know. Finally, certain aspects of the Giraff avatar and surrounding software may have narrow claim opportunities with the home care / telehealth space because nobody else has done this before. There may also be business process patent opportunities in the U.S. around the overall integration of the various elements of the GiraffPlus platform, although much of this has been published so may be rendered public domain.

## 4 Market Analysis

### 4.1 Market Overview

We quote from the introduction of the original GiraffPlus proposal because it is still a good summary of the problem we are addressing:

*The prolongation of independent living for promotion of a healthier society is a social and economic challenge. Elderly people wish to remain in their homes as long as possible as this is in general conducive of a richer social life and paramount to maintaining established habits. To adhere to this wish is also positive from an economic perspective as the cost of care at home is almost always much less than the cost of residential care.*

The challenge of elderly care is well understood at nearly all levels of the industry today and in all regions of the world. Social and medical care organizations, informal and formal caregivers, politicians and policy makers, technology and service providers are all pursuing diverse solutions to this problem in earnest, and globally.

Any detailed discussion of the market must be in the context of a region or country, and in the case of the U.S. it must be defined even at the state level. Therefore, most of the market discussion is in 4.3, the region-specific analysis. There are some high-level region-independent concepts, though, that we can describe here.

It is useful to describe the current problem from two perspectives – *social* care and *health* care – and how the solution spaces for these are evolving to a single space that GiraffPlus addresses. *Social* care is concerned with providing physical and supervisory care, as well as

social connection for elderly in their home as long as possible – as long as they can maintain reasonable independence with a good quality of life. The measures for this are primarily around safety and ability to deal with health problems in the home, all balanced against the cost and risk of doing so compared to full-time nursing home care.

As the population ages and the burden of elderly care increases, many technology solutions have been proposed, developed and tested to assist with this task and some are even on the market. These include ICT support solutions such as partner Giraff's current commercial service, home monitoring solutions such as provided by partner Tunstall, physiological device support such as provided by partner Intellicare, while others provide specific physical help such as eating via products like Bestic (Sweden). Much attention is now on integrating these discrete devices and services into more comprehensive telehealth platforms such as GiraffPlus.

*Health care* is concerned with both acute and chronic medical problems as well as lifestyles (diet, activities, social connection, etc.) that promote well-being. This industry also faces the challenge of an increased elderly population with increased acute and chronic health conditions. It approaches the problem from several perspectives – improved medication, clinical procedures and monitoring – and also is focused on home care as an alternative to frequent hospital and doctor's office visits.

Many technology solutions have also been proposed, developed, tested and commercialized in this space as well as related to health care in the home. Communications tools and services to increase contact between resident and health care professional is a major area of innovation, as are physiological devices that can monitor bodily functions and transmit that information to the health care provider. As referenced above, Intellicare is an example of a vertical system and service based upon physiological devices in the home. With the advance of such solutions the home is more and more becoming a health care delivery environment, as a less expensive alternative to clinical care and usually with a better quality of life.

The problems and solutions between these two aspects of elderly care are different but they share the same fundamental goals – care cost reduction, improved quality of life and to keep elderly living independently at home for as long as possible. Because they obviously share the same target environment (the home) and end user (the elderly person) it is inevitable that these two solutions spaces (social and health care) are beginning to merge. Elderly with less care needs may be served well by what are traditionally considered social care solutions, but as their needs grow they require assistance that deals with health needs as well as basic care.

The collision of these two solutions spaces has a profound impact on elderly care all over the world. As described in 3.4 the organizations that provide these services have vastly different infrastructures, cost and payment models, histories and cultures. Some countries have robust state-supported systems for one type of care while the other is virtually non-existent.

This merging of the home as both a social and health care environment is challenging the disparate organizations described above to work together. They share the following common challenges in the home (summarized from D8.1):

- Early detection of possible health problems for elderly living at home, that can be remediated faster and more cost effectively
- Timely involvement of caregivers, both formal/professional and informal/family and friends, that is not bound by physical distance and travel time
- Adaptive support in the home that can grow and adjust according to the resident's age-related needs
- Preventive medicine practices in the home that contributes to a healthy lifestyle and delayed onset of age-related illness.

These four challenges are a concise description of the elderly home care problem that faces Europe and the entire world today, a concise summary of the market opportunity, and the problems that GiraffPlus attempts to address. It also represents the evolution of the AAL market as we know it today.

## 4.2 Target Markets

Similarly, target markets (use cases) can only be meaningfully described in a regional context. We summarize here the basic use cases and the target customers (i.e. who pays for the care) in each case, and then describe in detail in the regional context in the next section.

There are three categories of use cases for platforms such as GiraffPlus:

- Extending the time that elderly can live at home safely and with a good quality of life. This is the fundamental goal of all AAL programs, projects, products and services. There are many specific objectives depending upon the person and living situation, including social contact, assistance with daily activities, physical assistance, monitoring, etc. The target customers depend upon region and include individuals and families, care organizations and other payers such as insurance companies.
- Managing chronic conditions in the home. This is an emerging use case in many regions where the cost and difficulty of transporting frail patients to and from clinical facilities creates a strong motivation to make the home a health care delivery point. The target customers here include individuals and families, health care providers of all sorts, and other payers.
- Managing acute and post-acute conditions in the home. This is also an emerging use case driven by mostly the same objectives as with chronic conditions, but with quite different target customers that include hospitals and other acute care providers, as well as rehabilitation service providers and specific kinds of payers related to acute conditions or accidents.

## 4.3 Region-Specific Analysis

### 4.3.1 EU

We summarize the general market situation in the EU as follows:

- AAL goals are well understood and embraced at all levels – cost savings and Quality of Life
- The AAL vision is broadening to include health care including avoiding hospital admissions and managing chronic conditions
- It contains leading-edge care organizations in numerous countries including Sweden, Netherlands and UK, who are willing to try home care technology and invest in its deployment, at least at the trial level
- Mainstream adoption of home care technology (AAL and telehealth) is still slow. It is improving, but slowly.
- The EU is an excellent environment for innovation. It has tremendous program support (AAL, FP7, Horizon 2020, national and regional programs, etc.)
- The Giraff commercial service and the GiraffPlus project both enjoy EU-wide visibility far beyond their size
- **The investor environment for startups in this space is nearly non-existent.** This point has been validated via dozens of investor dialogues and invited presentations at investor conferences, including even the heavily-attended MEDICA EXPO, arguably the EU's largest gathering of investors in the health care space.

The scope of the elderly care problem (both social and health care) is not contested by anybody in this space. In the EU today<sup>7</sup>, 17.4% of the population is >65 years old, and that number will exceed 20% by 2020. Of that population, 51% live at home with their partner and 32% live alone or with family/friends; only 4% live in an elderly home or institution. These statistics imply that the number of homes in the EU with elderly residents as a percentage of total population is 10.0%, or 49.3 million homes (based on an EU population of 493 million). This staggering number represents the total target market in the EU for a home solution such as the GiraffPlus concept.

The addressable market can be extrapolated from statistics in countries that are known to be representative of the EU as a whole. In Sweden, for example, 10% of people >65 receive some level of formal/professional homecare, and another 12% some level of homecare assistance by friends/family. This implies that 22% of the estimated elderly homes or 10.9 million homes in the EU is the current addressable market for a home care and social connectivity solution.

These statistics apply only to elderly care at home and do not explicitly include use cases for clinical care as described above. However, there is obviously much overlap in these numbers because chronic condition management is usually done in the home (until the elderly person transitions to a nursing home), and most of the post-acute care scenarios involve elderly already counted in the home care statistics above.

Therefore it is difficult to estimate a specific Target Available Market (TAM) for the EU because the use scenarios are different in each country. For countries with weaker (or

weakening) elderly care systems such as Spain, Portugal and Italy we will probably focus on the use case of postponed transition to elderly institutional care, and therefore as the market entry point families who bear the cost of elderly care – i.e. it will be a consumer service (regardless of what distribution strategy we use to reach them). Based upon the above statistics we can estimate that 3.4 million elderly live in institutions, which seems reasonable compared to 1.5 million in the U.S. – a number we do know with certainty – based on comparing the populations and knowing that a greater percentage of European elderly live in institutions simply because they can afford to (i.e. the State pays a large portion of the cost). Following the analysis in 4.3.2 below for the U.S. market, this suggests an **EU TAM for postponed elderly institutional care at €3.85B.**

For countries with stronger health care systems such as Sweden we will probably focus on the use case of reduced hospital admissions, and therefore as the market entry point regional and national health care organizations. We do not have statistics on this market size in the EU (number of elderly admissions and percentage of readmissions that are the target use case), so the best estimate we can make on the TAM is to extrapolate from U.S. statistics (which are well-documented, described in 4.3.2 below) based upon the ratio between the two populations. This suggests an **EU TAM for reduced elderly hospital readmissions at €10.0B.**

Of course, a proper market sizing exercise must be done per country because the situation and outlook is different in each one. We do not have the resources for such an exercise but qualitatively we look briefly here at the situation in 3 countries that represent a good cross section of the characteristics that describe the EU in general, and then make some conclusions about the EU market as a whole.

### **Sweden**

Sweden is a good representation (very roughly speaking) of northern European countries that tend to have social and health care systems where more of the cost is paid the State. In Sweden, social care including elderly care is the responsibility of the municipality (there are 290 in Sweden); this includes both home and nursing home care. The municipalities have broad authority to organize care as they choose. Funding is provided through local taxes that amount to 2.6% of the GDP. Individuals typically pay a small portion themselves amounting to ~5% of total costs.

Medical care is the responsibility of the county (21 in Sweden), including support aids of a medical nature such as a hearing aid. ~9% of the GDP is spent on medical care including doctors' office visits, hospital and emergency care. Individuals pay a small portion amounting to ~3% of total costs.

Elderly have the right to choose between municipal and private care. ~10% of elderly care is provided by private organizations that compete with the municipalities via contracts and are funded by the same local taxes. Most elderly live alone (or with their partner) in their own homes and receive services from the municipality or other care organization as needed. A slightly higher percentage (12%) of elderly receive "informal" care (from family and friends) than the percentage (10%) that receive "formal" care (from the municipality) so it is



reasonable to conclude that well over half of the care situations in Sweden involve some level of informal care.

Sweden has clearly shown innovation in AAL and telehealth services, and certainly has produced a number of technology providers including Giraff. It seems that it would be a vibrant market, and we believe it will be, but experience has shown there is a wide gap between the innovation phase and broad commercial deployment – what entrepreneurs often call the “valley of death.” There are two reasons for this; first, the municipalities are cumbersome organizations that are slow to change. Individual or department champions can drive initial innovation through projects, but come to a grinding halt when they try to make these solutions a standard part of care delivery. And second, there is a relatively hard line between social and health care and the municipalities and counties do not have a strong history of cooperation. As a result, the market in Sweden is slow but shows signs of progress.

## **Portugal**

Portugal is a good representation (very roughly speaking) of southern European countries where elderly care services tend to be less accessible. In Portugal all citizens have the right to health care that is provide through a national health service with a co-payment. There are three components to the system:

- the National Health Service (NHS) - all health care providers are under the Ministry of Health and provides universal coverage available to all citizens
- Health subsystems - social insurance systems for certain special situations that cover 25% of the population
- Voluntary private health insurance that covers 17% of the population

Portugal has recently been under an FMI bailout program that imposed austerity measures with changes in health policies with the explicit objective of containing spending growth but also to address the changes in the needs for health care motivated by the increase life expectancy, progressive aging of the population, higher incidence and prevalence of chronic diseases. Partly as a result, the co-payments referenced above have increased, making it more difficult for, or even preventing some citizens form accessing health care services.

The support for the elderly is provide by financial transfers in the form of pensions and supplements. Social and health resources are provided in the form of equipment and services and also tax exemptions. There is an emphasis on home support services.

Demographically, 60% of the total elderly population lives alone or in the company of other seniors. The highest percentages of the elderly population are in Lisbon (22%), Alentejo (22%) and Algarve (21%). There are not enough nursing homes – public or private – to meet demand. The capacity of assisted living/nursing homes is virtually 100% and in fact most elderly must go into a queue when it is decided they should transition to a nursing home. This is one reason why elderly care services are less accessible than in other EU countries.

The opportunity for telehealth services in Portugal is constrained by the fact that the country is under significant economic stress. The national system does not have the funding to

explore and invest in home care technologies and most citizens cannot afford to pay for them privately. As more and more burden is pushed back to the individuals and families, there could be a private market here in the future.

## **Netherlands**

The Netherlands is interesting because it is representative of a country whose health care system is “in transition.” Healthcare in the Netherlands is financed by a dual system. Severe and long-term care needs, especially those that involve semi-permanent hospitalization and also disability support such as a wheelchair are covered by a state-controlled mandatory insurance program. All regular (typically short-term) medical treatment is provided by a system of obligatory health insurance with private health insurance companies. These insurance companies are obliged to provide a package with a defined set of insured treatments. Clients can decide themselves about additional optional health insurance packages.

An important emerging trend is that emphasis is placed upon the patient’s overall wellness – their “journey” – rather than just upon treatment of a disease, clearing the way for an increased focus on well-being, prevention, and behavioural change.

The role of the district nurse is also becoming more important, this in close cooperation with the General Practitioner (GP). They are beginning to stimulate the use of innovative methods like telehealth services. Additionally the role of the municipalities will increase since they are better capable of aligning care with the needs of their residents.

Demographically, there is an increasing number of one-person households especially in the group aged 65+. The policy has been for many years to encourage people to live in their own home as long as possible. It is estimated that about 3.5 million persons provide informal elderly care. Of these, 33% provide intensive and long-term support, and this need will rise due to longer waiting lists for healthcare, which will likely motivate more self-management and independent living, and an increased focus of governmental policies on the responsibility of citizens.

The provision of health care is divided into 3 echelons (and evolving to 4):

- The first echelon is care that can be directly accessed by the patient; e.g. a GP, a pharmacist, a district nurse, a dentist, etc.
- The second echelon of care is more specialized care that can only be accessed when referred to by a care professional from the first echelon.
- The third echelon can be used by professional caregivers for their own care delivery, for example specialised labs or university hospitals.
- Many are now using the term “zero echelon” to refer to non-professionals who assist persons in need of care, and help guide them to the best source of care. These caregivers are family members, friends and community volunteers.

The Netherlands is an innovative country with regard to health care, and at the same time is pressuring citizens to self-manage their care more and more. Indeed, the new U.S. care

system (described below) was modelled to some extent on the Dutch system. The two biggest opportunities here are 1. Private telehealth services paid for by the family, and 2. Insurance providers who offer premium packages to its members beyond the basic package reimbursed by the state. The market is still developing slowly because it is driven by incremental changes (in contrast to the U.S. as described below) but is still promising, and could become a market leader within the EU.

### **Conclusions for the EU market**

Overall, there is a good understanding of the elderly social and health care problem and there are many programs and projects intended to develop and trial technology solutions. There is clearly a good market opportunity as described above, but it will take time to develop, as public service providers are constrained by economics, organizational structure and politics. It is a market we must address but we must also be prepared for a long market development time.

How we address this market will also be country-dependent. We will need a “country partner” in each one that understands the care systems and has access to the customer base. In fact there will likely be multiple partners in some countries – e.g. one focused on the social care system, one on the health care system and one of the consumer market. As we gain the resources to address these markets at the right time, our first step will be of course to assess the opportunity in each country including the target use cases and customers. However, it is likely that our second step will be to identify these country partners.

### **4.3.2 USA**

In D8.1 we described the legacy care system in the U.S. Social care is nearly always provided by individuals/families or by private organizations that are paid for by the individual/family. Health care is nearly always provided by a private health care practice and funded by a combination of the individual and private insurance (but that historically was not mandated as it is in some EU countries; therefore millions of people in the U.S. had no health care system at all). We observed that that such a “system” does not encourage health management and wellness but rather only “fixing what is broken,” or worse, only “fixing what has been broken for a long time and continues to get worse.” We also pointed out that this is an economically inefficient system and is a main reason why health care costs in the U.S. are amongst the highest in the world.

Much has changed since we completed D8.1. The Affordable Care Act (ACA – commonly known as “ObamaCare”) and related legislation is in full force now and is driving major changes in the relationships between patients, care providers, hospitals and payers. Health insurance is now mandated and affordably so; therefore care providers cannot focus their services only on those wealthy enough to pay for them regardless of cost efficiency. They must find more cost-effective ways to deliver care to everyone. And because elderly consume a disproportionate amount of health care services compared to the rest of the population, and because there are other reasons why it is desirable to provide more services in the home, the ACA legislation has perhaps its greatest impact on elderly and home care.

Furthermore, insurance providers can no longer exclude pre-existing conditions; e.g. they cannot refuse to insure a new plan member because they have high cholesterol or are a cancer survivor. Such exclusions in a health plan are beyond the comprehension of many Europeans but prior to ACA it was a universal practice in the U.S. Therefore care providers and payers must find affordable ways to care for everyone regardless of their condition. In other words, the U.S. system is starting to look in some ways like the socialized systems in Europe.

But ACA goes even further. Hospitals who do not manage their readmission rates (a major problem with elderly in all health care systems, sometimes referred to by hospitals as the “elderly revolving door”) can be severely penalized by the government. No longer can a hospital send a patient home without proper care follow up, reasoning that they can make more revenue with a new patient, while the previous patient is “someone else’s problem now.” They must implement solutions that provide for management of both acute and chronic conditions in the home.

Perhaps most importantly, these changes have driven the emergence of an entirely new kind of organization in the U.S. known as an Accountable Care Organization (ACO). An ACO is a payment and care delivery model that ties reimbursements to quality metrics and reductions in the total cost of care. A group of coordinated health care providers forms an ACO which then provides care to a group of patients. These providers are defined by a certain geography (e.g. a metropolitan area), are typically “anchored” by one or more hospitals, and consist of primary care providers, specialists, social care organizations and even pharmacies. Their responsibility for “total cost of care” dramatically changes the priorities between “overall wellness” and “fixing what is broken.” Because ACOs are accountable for end-to-end care they are keenly interested in home care solutions like GiraffPlus. Indeed, as discussed in 4.4 an entire suite of GiraffPlus-like solutions (now including Giraff itself) has already emerged in the U.S. and has the close attention of the new ACO industry.

It is tempting to conclude from these legislative changes that the U.S. is simply “catching up” to Europe. In some ways that is certainly true but it misses the point of the market opportunity and the sense of urgency these changes create. In Europe the economic problem of elderly social and health care is “chronic” – ever present and slowly increasing – as described above. But in the U.S. the economic problem is “acute” because the new legislation has created an entirely new set of economic drivers and problems for care providers and payers. The U.S. cannot rely upon existing systems to continue addressing the problem because those systems no longer exist (or never did). The U.S. cannot look to incremental improvements but rather must find radical solutions not considered before. The emergence of ACOs – which can be described from a European perspective as an integration of social and health care – will likely achieve in the private sector in the U.S. in just a few years what public organizations in Europe have struggled to achieve for many years. Therefore, one can argue that the U.S. system has actually “leapfrogged” Europe in some ways. By no means do we assert that the U.S. system is a health care “Utopia.” It is chaotic and fraught with problems, but in terms of describing the market opportunity for concepts such as GiraffPlus, the point is that it drives rapid change and rapid decisions from all the players in the system.

The chart below summarizes the differences between the European and the U.S. system, not just in terms of health care delivery but the entire socio-economic system that supports it:

Element	EU	U.S.
Public funding	Excellent	Poor
Elderly care system	Good-excellent	Almost non-existent
Health care system	Mostly state funded	Mostly privately funded
Social/health care coordination	Different institutions	Fragmented but improving rapidly
How financial pain is felt	"Chronic" - gradually increasing	"Acute" - driven by specific events
Motivation to innovate	Incremental	Immediate
Venture capital	Scarce	Abundant

We now describe the specific market size and opportunity for the GiraffPlus concept in the U.S. First, we summarize the current situation in the U.S. specifically in the context of elderly care:

- Most elderly care in U.S. today is ad hoc, a “patchwork quilt”
  - >80% provided at home by spouse, local family & friends
  - Assisted by point products (e.g. panic button, fall detector)
  - Caregiver-to-elderly ratio is shrinking from 4:1 to 2:1 over next 30 years
- Families suffer devastating financial and emotional distress
  - Nursing home transition can wipe out family savings in just a few years
  - While their employers lose \$33B/year in resulting lost productivity
  - And their elderly loved ones are powerless to affect the situation
- Treatable chronic conditions receive costly acute care
  - Over half of elderly hospital visits are readmissions (“revolving door”)
  - 80% live at home with at least 1 chronic condition, manageable with proper care
  - Elderly account for >40% of health care budget but just 13% of population

From this baseline we focus on two use cases – long-term elderly care (which includes management of chronic conditions in the home) and post-acute care (in the home instead of in clinical facilities):

### Long-term elderly care

Who pays?

- Individuals/families – finance 22% of costs in U.S. today
  - Transition to a nursing home often a financially devastating event
  - Care costs can increase 10x (e.g. \$500 to \$5,000/month)

- Medicaid (a government funded organization) – finances 40%
  - Going bankrupt; pays for “impoverished” elderly who have given their assets to their children
- Medicare – finances 23% (primarily post-acute care)
  - Going bankrupt; costs increasing as people live longer with more chronic conditions

All of these categories are highly motivated to keep elderly at home longer, as there is large gap between the cost of home and facility-based care, and therefore a large window of opportunity for solutions like GiraffPlus.

What is the market opportunity?

- 1.5M current nursing home residents in U.S.
  - At average cost of \$5K/month = \$90B annual cost in today’s paradigm
  - Average stay is 835 days (=> churn is 656K/year)
- Result – **\$2.0B annual Target Available Market (TAM) for AAL services**
  - Assuming an average of just 12 months service per resident @ \$250/month (the ultimate target price for GiraffPlus as a monthly subscription service)
- Most nursing home transitions can be deferred
  - Driven by gradual decline in confidence, which can be slowed
  - And inability to properly monitor chronic conditions, which can be managed
- How does GiraffPlus keep elderly out of nursing homes?
  - By maintaining confidence, allowing more supervision, managing chronic conditions
  - By building a care network replicating care level provided by nursing home, but at home
- Result
  - **1-year Giraff subscription at \$4K is less than the cost of 1 month in a nursing home**
  - An easy financial decision – even measured over a few months

### **Avoidance of hospital (re)admissions**

Who pays?

- Commercial payers (in the new era of ACA)
  - Allows for reduced hospital admissions and greater efficiency across the continuum of care to post-acute care
  - ACOs enabled by ACA to optimize total care; rewarded for reducing costs

- Self-insured corporations (typically >1,000 employees)
  - Carry all the risk of unforeseen expenses but with no visibility
  - Losing \$33B/year in employee productivity as they care for elderly
  - Need to offer employees, dependents and pensioners better options for home care
- Medicare and Medicaid (same reasons stated previously)
  - They are now in trial with a bundled payment scheme with 6500 providers to optimize total care costs (a perfect financial motivation for solutions like GiraffPlus)
  - And are gradually passing new legislation to cover telehealth and remote monitoring services (also a perfect fit for GiraffPlus)

All of these payers are highly motivated to invest in providing more effective care in the home

What is the market opportunity?

- Average hospital visit for patients >65 in the U.S. is \$24,800
  - 13.2M visits/year = \$329B in today's paradigm
  - Over half due to the elderly "revolving door" – over \$150B in avoidable costs
  - 20% of elderly discharges are back within 30 days
- Result – **\$7.9B annual TAM** (virtually no overlap with previous market)
  - And this is just the market for the most critical group – the 30-day re-admission crowd
- Most readmissions due to inadequate protocol management in the home
- How does Giraff keep elderly out of hospitals?
  - By building a care network that provides proper chronic condition management, and post-acute follow up
  - By leveraging free family resources who can manage simple clinical protocols with basic training
  - Extends care to most cost effective patient care location while producing required outcomes
- Result:
  - **1 avoided hospital (re)admission pays for 6 years of GiraffPlus service**
  - A virtual lifetime in this use scenario

Giraff Technologies have been in discussion with customers in categories as described above (and various sub-categories that fall under these two broad opportunities), and have identified numerous other care scenarios too detailed to describe here. However, we have identified one specific scenario – that falls broadly under long-term elderly care scenario described above – that makes the GiraffPlus concept so compelling it could be the entry point into them market. A new trend the U.S. driven in part by the ACA is called "liberation." Health care case managers identify borderline nursing home residents – those whose care needs sit

at the boundary between what home care and nursing home care can provide – and look for new home care technology that could “liberate” that person and allow them to move back to a private home again. The payer – whoever it is – is highly motivated financially to identify these residents, and in a Medicare payment structure the care organization *keeps the difference between what Medicare reimburses them for nursing home care and what they save by moving that patient back home*. This use case may present the single most compelling financial argument for a telehealth solution like GiraffPlus of all.

We also make a comment about Canada, to explain that market and why we sometimes refer to the U.S. market and sometimes the North American market. Canada’s health care system is generally “European” in structure, highly socialized and includes elderly care at a certain level. However, Canada is heavily influenced by its “neighbour to the south” (the U.S.) in terms of innovation, and even competes with the U.S. to some extent to be first in health care technology innovation. Its population is little more than a tenth of the U.S. so it is a relatively small market, but customer discussions there indicate that the same telehealth innovations like GiraffPlus that are embraced in the U.S. will also be embraced in Canada; therefore we often think of them as the same market.

To summarize, the Target Available Market in the U.S. is \$10B (€8.5B) just for the mainstream use cases of delayed nursing home transition and reduced hospital admissions. While it is too early to call this a “forecast” we can say that we identified a specific “opportunity” with 13 organizations including care providers and payers (both government and insurance providers) that total 135 systems in the first quarter that we establish a service in the U.S. and a total of 1,520 systems in the first year. This far exceeds the projection in 5.3.2 of just 100 systems in the first year.

### 4.3.3 Rest-of-World

We have not done any rigorous analysis of other regions beyond Europe and the U.S., as these regions seem by far the most compelling in the near term. However, we do receive frequent queries from organizations in the Rest-of-World (RoW), and have had some discussions with customers, distributors or other strategic partners in the following RoW countries, listed here along with a brief summary of the outlook for that region:

#### Asia

- China
- India
- Japan
- Mauritius
- South Korea

There are clearly opportunities in the affluent Asian countries for telehealth services. The most interesting country is China because of its sheer size and the fact that economic growth is rapidly creating a mobile, affluent class of adults who no longer live near their aging parents but can afford to pay for technology that can assist them. There are two problems in this region; first, Internet connectivity is excellent in some areas but virtually non-existent in



others. And second, in some countries elderly tend to live in very small homes – even studio apartments, for example in Japan – which diminishes the value of mobile telepresence. However, one could envision a version of GiraffPlus without the avatar (and perhaps a fixed videoconferencing solution like Skype) that provides all the value propositions we have described.

**Pacific Rim**

- Australia
- Philippines
- New Zealand
- Singapore

There are also opportunities here, at least in the more affluent countries. Australia is perhaps the most innovative and indeed there is already a small telehealth market there, driven in large part by the vast physical size of the country and the distances families are spread out. The problem with this region in the near term is that the population of most of these countries are generally small and will take a lot of resource to address a limited market.

**South America**

- Brazil
- Mexico
- Uruguay

Several organizations in these countries have contacted us to discuss both home care and clinical care opportunities. The problem in this region in terms of market opportunity is that most of this region simply does not have the economic strength to support the overall technology and people infrastructure required for telehealth solutions. Perhaps as prices come down over time the opportunity will become more compelling. Certainly the market is large – with a population of over 500 million including Mexico, South America is equal in size to the EU.

**Middle East**

- Israel
- United Arab Emirates
- Saudi Arabia
- Qatar

Most Middle East states are very wealthy, or at least have a very wealthy ruling class. There is clearly a private market here for families who would pay for such a service as GiraffPlus even as a novelty, an indulgence for themselves and their parents, even if it delivers only marginal value. Still, addressing these markets requires special distribution channels and strong local support to deal with language and cultural differences.

Overall, the most compelling markets are the EU and the U.S. Giraff Technologies is a European company and as such will certainly address the EU market. However, the radical changes in the U.S. health care system are driving an urgent market that exists today and is

growing at over 50% per year. This coupled with the much greater availability of venture capital makes it the most compelling market in which to start.

#### 4.4 Competitive Assessment

As described in D8.1 there are many commercial solutions containing one or more components of the GiraffPlus solution already in the market in Europe and the U.S. Some solutions are emerging in Europe but are hampered by different economic forces and the sharp line between social and health care as described in 4.3. Most of the commercial solutions have emerged in the U.S. because of the dramatically different economic forces in play there (also described in 4.3).

We track 9 commercial services in Europe, and well over 40 in the U.S. We also track 12 mobile telepresence products (mostly in the U.S.) although none of these have an integrated telehealth platform or even focus on the home care market at all. These services play at all levels of the value chain and most are point products or play in niche applications (e.g. diabetes care). The distribution of the U.S. telehealth players we track is as follows:

- Infrastructure plays (12)
  - Mostly software for back office, health care enterprise management, data management
  - Some focused on specialized processes such as post-acute care
  - Not solutions by themselves
  - Interesting to track as potential partners
- Staff-based (5)
  - Not telehealth platforms but specialized home services provided by staff
  - Some use of remote devices but only for support
  - Interesting to track as potential customers
    - Infinity Home Healthcare
    - Net Medical
    - ComForcare
    - Hospital at Home
    - Living Well
- Specialized services (3)
  - Philips Community Without Walls – customized solutions based upon care organization needs
  - Ideal Life – biometric support for congestive heart failure and diabetes
  - Oakwood Living – have created several point solutions for specific chronic conditions
  - Interesting to track as potential customers or partners
- Point products (7)
  - Specific products, e.g. medication dispenser, fall detector, kit for biometric devices

- Interesting to track as potential suppliers
  - Manage My Pills (Philips) – medication dispenser
  - Zephyr Technology – physical status monitoring technology; a device provider
  - Vivify – biometrics kit plus UI and back-end (cloud) software
  - Carematix – biometrics kit plus UI, similar to Vivify
  - Home Helpers / Direct Link – PERS and medication management
  - Provena Life Connection – PERS and medication management, plus biometric monitoring for certain conditions
  - Presence Home Care – fall prevention, very basic
- Communications solutions (5)
  - Messaging and/or videoconferencing
  - Both software-based and via dedicated appliances (fixed in all cases)
  - Do not integrate with other telehealth elements
  - They are telehealth platforms only in the sense that they allow contact between elderly residents and caregivers
    - AttentiveCare
    - Claris Companion
    - Independa
    - AFrameDigital
    - Time Warner Virtual Visit
- Environmental monitoring (7)
  - Provide a platform with environment sensors (and in one case actuators as well)
  - Hub and cloud software to integrate, with various UIs for caregivers
    - Good Robot (Canada) – no idea why they call this a robot
    - Healthsense
    - BeClose
    - SaferAging
    - WellAware
    - Essence
    - SmartCare (not commercial, just a living lab)
- Comprehensive platforms (5)
  - Provide some combination of environmental and biometric support
  - Along with communications tools and flexible UIs
  - Legitimate competitors to Giraff AAL platform
  - Both software-based and via dedicated appliances (fixed in all cases)
  - Do not integrate with other telehealth elements
  - They are telehealth platforms only in the sense that they allow contact between elderly residents and caregivers
    - Ericsson Mobile Health
    - Cardiocom (contrary to name, appears to be a general care platform)
    - Care Innovations (Intel-GE)
    - Care Technology

- Grand Care

We describe the two most compelling of the comprehensive platforms in more detail:

### Care Technology Systems (USA)

<http://www.caretechsys.com/>

Care Technology is a typical example of a truly integrated home monitoring solution and begins to look more like a competitor to GiraffPlus than a component provider. The system also offers physiological devices including a blood pressure cuff, weight scale, glucometer and pulse oximeter. The entire system is integrated with a personalized interface and monitoring service. They also offer a nurse call system that allows a resident to simply pull a cord on a device to receive assistance. Perhaps most importantly, Care Technology offers a complete Software-as-a-Service (SaaS) solution for care organizations.

### GrandCare Systems (USA)




<http://www.grandcare.com/>

GrandCare is perhaps the closest direct competitor to GiraffPlus and serves as an excellent reference point for identifying the key solution gaps and advantages of the GiraffPlus solution. The system integrates wireless sensors and alarms as well as physiological devices and dose management, and provides personalized interfaces for activity monitoring and health information. GrandCare also provides some very basic context inference capabilities, for example “IF (door is open) AND (it is after 21:00) THEN (send SMS text to neighbour).” The system also provides a “socialization” feature that allow caregivers to add photos, messages, music, video etc. to the resident’s online portal. It also offers videoconferencing via Skype.

A comparison matrix between these platforms and GiraffPlus is shown here:

Feature	Ericsson	Care Innov.	Care Tech.	Cardio com	Grand Care	Giraff
Environmentals	Partly provides	Partly provides	Provides	Does not provide	Provides	Provides
Biometrics	Provides	Partly provides	Partly provides	Provides	Provides	Provides
Plug-and-play	Does not provide	Partly provides	Does not provide	Does not provide	Does not provide	Provides
Cloud-based	Provides	Provides	Provides	Provides	Provides	Provides
Real-time communication	Provides	Provides	Does not provide	Does not provide	Partly provides	Provides
Personalized UIs	Provides	Provides	Provides	Provides	Provides	Provides
Mobile UIs	Provides	Provides	Does not provide	Provides	Provides	Provides
Intelligent reasoning	Does not provide	Partly provides	Partly provides	Does not provide	Partly provides	Provides
Instant presence **	Does not provide	Does not provide	Does not provide	Does not provide	Does not provide	Provides
Call center support	Partly provides	Provides	Provides	Provides	Provides	Provides
Caregiver support tools	Provides	Provides	Provides	Provides	Provides	Provides
Interactive content	Does not provide	Provides	Partly provides	Partly provides	Provides	Provides

\*\* Mobile telepresence  
via an avatar

	Provides
	Partly provides
	Does not provide

It becomes immediately clear from this comparison matrix that the GiraffPlus project has great market potential, but also that it must deliver on its unique capabilities to be competitive in that market.

#### 4.5 SWOT Analysis

The SWOT analysis is straightforward based upon our understanding of the technology, the market and what is needed to execute in that market:

##### Strengths

- Strong and unique knowledge of the home care market
- Only mobile telepresence system specifically designed for home care
- Excellent visibility in the EU, with industry organizations, academia and care orgs.
- Extensive end-user experience
- Flexible development platform

##### Weaknesses

- Lack of funding, very tight cash flow management, no room to manoeuvre
- Small staff, no ability to expand into other markets
- No sales and marketing resource
- Expensive platform
- Platform still in prototype form

##### Opportunities

- Expansion into U.S. (North American) market
- Win early customers who are highly interested in our plans
- Creation of a unique telecare platform
- Obtain U.S. funding

##### Threats

- Funding and cash flow, survival of the core business
- Market entry by competitor with more resources (e.g. Suitable Technologies)
- Possible U.S. patent infringement (InTouch)
- Difficulty in obtaining EU and US certifications, especially around security and privacy
- Prototypes are farther away from commercial readiness than we think

## 5 Exploitation Plans

### 5.1 Individual Partners

Following are the exploitation plans for each consortium partner, divided into three categories; academic and research, care (end user) organizations and business/industry partners.

#### 5.1.1 Academic and Research Partners

### **Örebro University**

#### *About:*

Örebro University has developed from a regional “university college” to a university with national and international importance. Currently, the university has over 17,000 students and 1,200 employees. It includes a number of strong research environments, of which the Centre of Applied Autonomous Sensor System (AASS) is one. The GiraffPlus project is hosted by this centre, and as such the exploitation of the project's results at Örebro University will be led by this centre. Further, AASS will leverage from internal organizations and structures to promote the results of GiraffPlus.

These structures include the university's innovation office. The office is the platform for an interregional cooperation between Örebro University, Linnaeus University, Mid Sweden University and Karlstad University. The four universities have their own innovation offices but collaborate on the support and experience. Örebro University's Innovation Office is in charge of the development of processes for utilization and for collaboration tasks. It provides also access to the university's holding company, Örebro University Holding AB, and to the regional Science Park.

#### *Mission:*

In general, Örebro University's mission is about raising the level of education, discovery and disseminating new knowledge through research, and to interact with society to create better conditions for growth and development in the city, region and country. This mission comes from the Swedish government and parliament. Within the framework of the mission we have at Örebro University created our own vision and set your own goals. We aim to be a prominent university with subject breadth, courage to rethink and ability to develop.

On the educational front, we achieve these goals by designing attractive and innovative programs with high quality, so as to appeal to a broad group of students. Örebro University has a large number of professional programs which attract many applicants each year. Students at Örebro University get in-depth subject knowledge, education and critical training while developing practical knowledge and skills that are valuable in professional life. Our educational programs are under constant scrutiny, to evolve in pace with external requirements and University requirements.

On the research front, Örebro University, and in particular AASS, have shown strong growth, which in turn has been very important for the quality of education and research. Örebro University strives to establish several nationally and internationally leading research, a goal that has been partially achieved. The university wants to attract outstanding scientists and is looking for partnerships that develop quality of research. An ambition is that research should be multidisciplinary, so that different perspectives and experiences can come together and create new knowledge.

On the collaborative front, the university's role in society is to represent development and innovation. The university aims to be an engine through active exchange with businesses, organizations and the public sector helps to strengthen region. Örebro University strives to be an accessible and natural part of the city and the region. Through national and international linkages the university can in many cases be a portal to greater knowledge and opportunities. The goal is that through broad cooperation, characterized by mutual benefit, the university shall contribute to the elevation of the level of education, increased social welfare and sustainable economy.

*General exploitation strategy:*

Given the University's mission and its support system, the general exploitation strategy for Örebro University will be to exploit the project in the following three ways. First, as an educational provider, it is natural to leverage from GiraffPlus in order to develop master and doctoral dissertations in the area of computer science. This has been done during the project but will also continue after the project using the University's own funding. The turnover of such activities are indirect profits typically through spin-offs.

A secondary avenue for exploitation is to extend the research which has been done in GiraffPlus to provide a unifying framework for context recognition and for configuration planning. This will allow the collaboration with companies and other academic institutions, and will result in joint publications, papers and new software developments. The funding in GiraffPlus has been essential to achieve a starting point and the continued development will be done under other funding (research grants) with indirect profits.

Finally, the last strategy for exploitation is to make direct use of the results from the context recognition. In the following, we describe how this will be done.

*GiraffPlus exploitation plans:*

The principal technical results developed in GiraffPlus by Örebro University are connected to context recognition and configuration planning. The configuration planning algorithms developed so far are deemed still too early in development in order to be ready for direct exploitation. However, the context recognition algorithms developed in the project have proven to be well suited for the GiraffPlus system, both for scientific and market exploitation.

Specifically, we will exploit the developed algorithms to achieve a customizable monitoring system that can be installed with off-the-shelf sensors such as those developed by Tunstall.

The idea is to build the “core Artificial Intelligence” underlying the monitoring system, its fundamental capability being that of inferring the occurrence over time of modelled patterns of behaviour, through the temporal reasoning algorithms developed in the project. Our starting point will be to understand how the software licensing of the context recognition component in the GiraffPlus system can be made.

For this, it will be important to understand the software life cycle and legal requirements for software deployment and data maintenance as they relate to different geographical deployments of the system. As the GiraffPlus system is modular and different aspects of the system can be picked and selected depending on user needs, the context recognition software should adhere to the modularity philosophy. The large integration effort spent in the project has in part already addressed this issue, providing precious know-how related to modular software design, deployment and maintenance.

The algorithm underlying context recognition in GiraffPlus consists in a novel form of temporal reasoning with uncertainty. This result can be further exploited for research, and applications beyond context recognition hold promise: temporal reasoning with uncertainty is crucial in planning and plan execution monitoring for complex systems (e.g., space missions, service robots, and autonomous industrial vehicles). Örebro University will employ temporal reasoning in the context of a coordination and planning system that is currently being developed in the Semantic Robots project (2014–2018, funded by the Swedish Knowledge Foundation). The project is strongly industry oriented, and is co-funded by industrial partners Volvo CE, Atlas-Copco, Kollmorgen Särö AB, CNET, SAAB-Dynamics, and other Swedish companies. Our first use of GiraffPlus results here will be to develop efficient execution monitoring techniques for use in fleet coordination and intra-logistics solutions for forklifts and mining vehicles.

## **CNR ISTC**

### *About:*

The National Research Council (CNR, [www.cnr.it](http://www.cnr.it)) is the major governmental research institution in Italy. The CNR Institute for Cognitive Science and Technology (CNR-ISTC, <http://istc.cnr.it>) covering research fields related to human cognition and cognitive technologies, is the reference institution for cognitive science in Italy and a leading institution for artificial intelligence research. CNR-ISTC participated in the GiraffPlus project with the Ambient Assisted Living Group associated to the Planning and Scheduling Technology Lab (PST), founded in 1997 as a research group focused on automated and interactive techniques for problem solving.

CNR-ISTC has made a significant investment in the GiraffPlus project contributing in a concrete way to user requirements elicitation, system architecture design, software services development, system deployment and user evaluation. Such investment has been made with the precise goal of opening a possibility for new application areas with these technologies. We also underscore that the cognitive system area, the main focus of CNR-ISTC as an institute, is focusing a lot on robotics systems of new types using a combination of recent technology and cognitive research to obtain innovative results.



*Mission:*

The main aim of the PST Lab is to create and develop end-to-end applications that leverage its AI research knowledge and skills in order to be effectively applied in real world contexts. In this regard, the PST Lab has achieved research excellence in several areas related to automated problem solving and interactive systems for decision support, human-computer interaction and human-robot interaction. The group has been involved for over ten years in a long collaboration with the European Space Agency (ESA). During the last five years the PST Lab has broadened the research interests toward new areas thus acquiring competences in robotics, ambient assisted living, cognitive systems for training, and healthcare systems for aging well. In FP7 and H2020 the PST Lab has projects in different topics (Space, ICT, Security, and AAL). The AAL@ISTC is currently involved in one FP7, 2 AAL-Call2 and one H2020 project.

*General exploitation strategy:*

The general exploitation strategy of the PST Lab has a two-fold goal. On one hand, new and more challenging scientific and research objectives are pursued aiming at enlarging the experiences and knowledge of the group as well as disseminating the results in both international scientific communities (e.g., presenting papers at international conferences and publishing works on high-profile peer-reviewed scientific journals/magazine). On the other hand, plans to write new project proposals in the area of technological support for healthcare with elderly (e.g., in subareas of ICT) are ongoing. More specifically, the latter is a crucial point as most of the research activities developed within the PST Lab are exclusively supported by external economic sources such as EU funded research projects and consultant activities performed for ESA.

*GiraffPlus exploitation strategy:*

As said before the investment of the PST Lab in GiraffPlus has been significant. We have been on the critical path of the project for its whole duration, we have moulded our technology for the specific uses in the GiraffPlus environment, we have spent significant time also in achieving operational maturity in order to serve the need of the final evaluation and we have served the project for deploying and managing technology in Italian test sites. For all these reasons we are looking forward to continue our work in this area in general and on the GiraffPlus system in particular. This is the reason we agree to develop a consortium for the exploitation of the GiraffPlus system. For this specific aspect, we are investigating possible ways (e.g., spin-off) to participate in the commercialization of the GiraffPlus system.

Also, we strongly aim to gather new funding opportunities within new projects to pursue the more innovative part of the work. Being a research group that lives on the basis of external funds from international research competition, we are interested in bidding again in project proposals that allow us to build on top of the experience accumulated within GiraffPlus. It is worth underscoring that CNR is particularly willing to continue working with members of the GiraffPlus consortium. It is important to comment explicitly how the GiraffPlus success, its convergence to a product, the synthesis of an advanced robotic healthcare system are strongly connected to the positive work environment that has been created within the

project. For this reason we are interested in pursuing joint work with the GiraffPlus partners. The technical contributions designed and developed during the project constitute also a solid result to be exploited in commercial ways and to foster new collaborations with industrial and academic partners. The general aim is to find ways to leverage the knowledge and experience accumulated during the project and further develop them in order to create new opportunities both on scientific and real world contexts.

The GiraffPlus project has offered PST Lab the possibility to open up this new area, specifically allowing to explore and to contribute to new terrains of research. In this respect we consider particularly relevant the achievements on these aspects:

- **Architecture:** our group has a previous experience in space technology field to develop ground level support for decision makers in mission planning and to contribute in successful EU-funded research projects. In GiraffPlus we have significantly tested our know how in a different settings. We have again produced an end-to-end system around a set of users that can continuously work on a main task facilitated by a software layer. Additionally, we have experienced with the synthesis of personalized services for end users that allows them to interact and take advantage from the presence of the system also dynamically adapting to changing user needs. In general, the idea of the architecture that offers services through software/robotic means and creates a continuous monitoring loop around with the humans offering support in different healthcare scenarios has represented a significant broadening of research experience.
- **Design and development of services:** According to the project DoW the contribution of WP4 was expected into two main services: The **Interaction and Visualization Service (IVS)**, that has synthesized a well-organized set of functionalities to allow different users the access to the GiraffPlus environment; the **Personalization Service (PerS)**, that has contributed with new functionalities that continuously guarantee fine-grained personalization to the healthcare professionals, to the informal caregivers and to the specific elderly at home. During the architectural design phase of GiraffPlus (see the description in D1.3) the user interaction services are allocated to the Data Visualization, Personalization and Interaction Service (DVPIS) with the aim to cover the complete issue of bringing data in the right form to each category of users. In particular, three different instances of the DVPIS have been designed, implemented and provided: two devoted to the secondary users (DVPIS@Office and DVPIS@Mobile), and another dedicated to the primary users (DVPIS@Home). Further information can be found in D4.3. It is worth noting that a specific direction for further work concerns the personalization engine that produces proactive interactions. This is a specific aspect we are targeting for broadening future impact.
- **Technology evaluation with end users:** Also relying on the experience gathered in past research projects, the PST Lab has extended its knowledge playing a crucial role in the GiraffPlus evaluation activities. The PST Lab has been in charge of: the full design of the long-term evaluation plan for secondary users and to provide a contribution to the design of the one for primary users; the full design the cross-cultural evaluation plan and the management of the whole data analysis process: the synthesis of the cross-

cultural aspects of the final evaluation result; the full design, management and analysis of the evaluation sessions with secondary users on the DVPIS tool.

## **CNR (ISTI)**

### *About:*

About 160 researchers are employed at CNR (ISTI), plus a great number of PhD students. CNR (ISTI) is committed to producing scientific excellence and to playing an active role in technology transfer, and it comprises 14 research laboratories and 3 technological centres. CNR (ISTI) is involved in national and international ICT projects, and the Wireless Networks Laboratory (WNLAB), the group involved in GiraffPlus has experience in wireless sensor networks, distributed and mobile middleware for context-aware applications and activity and pattern recognition.

### *Mission:*

The WNLAB from CNR (ISTI) conducts fundamental and applied research covering mobile and wireless communication networks, broadband satellite networks, sensor networks, and integration of communication systems, supported by government and industrial grants. It is also involved in educational and scholar activities, involving graduate and undergraduate students.

### *General exploitation strategy:*

CNR (ISTI) is founder member of the AALOA initiative (AAL Open Association) and the institute is actively supporting AALOA by allocating resources for the management of the incubated projects. CNR (ISTI) is also committed in the EIP-AHA Action C2 on development of interoperable independent living solutions, and it is member of EIT ICT Lab node of Trento.

### *GiraffPlus exploitation plans:*

As a governmental research institution, CNR (ISTI) embraces the Open Source values when developing new software and tools. The developed middleware infrastructure adheres to the ASL license and it is planned to give the source code to the community of developers under that license. CNR (ISTI) is interested in the development and application of the research work initiated within the universAAL, ReAAL and ZB4O projects, which is relevant for the middleware and the sensor access layer of GiraffPlus.

Furthermore, CNR (ISTI) plans to exploit the scientific results of GiraffPlus to expand its know-how on data fusion and activity recognition starting from the experience in the integration of environmental, wearable, and physiological sensors. GiraffPlus also gives the opportunity to CNR (ISTI) to reinforce its place in the fields of Ambient Intelligence and Ambient Assisted Living and in the EIPAHHA Action C2 on development of interoperable independent living solutions. To this purpose, CNR (ISTI) plans to develop the components developed in GiraffPlus as incubated projects in the Ambient Assisted Living Open Association (AALOA), which will ensure a wider spread of the achieved results and the consolidation of its industrial

contacts (and possibly the acquisition of new ones). Lastly, CNR (ISTI) plans to exploit the innovative results of GiraffPlus to open new Ph.D. theses on the topic.

## **Lund University**

### *About:*

Lund University seeks to be a world-class university that works to understand, explain and improve our world and the human condition. The University is ranked as one of the top 100 in the world. We tackle complex problems and global challenges and work to ensure that knowledge and innovations benefit society. We provide education and research in engineering, science, law, social sciences, economics and management, medicine, humanities, theology, fine art, music and drama.

Our 47 700 students and 7 500 employees are based at our campuses in Lund, Malmö and Helsingborg. The University has a turnover of around SEK 7 475 million (EUR 844 million), of which two thirds is in research and one third in education. We are an international university with global recruitment. We cooperate with 680 partner universities in over 50 countries and are the only Swedish university to be a member of the strong international networks LERU (the League of European Research Universities) and Universitas 21.

### *Mission:*

Lund University is along with The Royal Institute of Technology (KTH) in Stockholm investing in a national agenda on social robotics on behalf of the Swedish Board for Innovation Systems. The investment is justified as we now face an important step towards the future of healthcare. Robots in human environments are a challenge different from the experiences in using robots for industrial purposes. In human environments robots need abilities that enable them to communicate with people or with other robots in an intuitive and socially acceptable manner. This requires new knowledge and new technical solutions. A key issue is to understand when robotics is useful in health care and when they are not. The GiraffPlus project has confirmed the importance of understanding the implementation of telehealth robots in human environments and the development of the organization in which robotics can support various activities.

### *General exploitation strategy:*

Lund University will continue to develop knowledge on social robotics and the development of design. Lund University is highly ranked in many international comparisons of higher education and has been consistently placed in the world's top 100 universities in recent years (among the top 0.4% of the world's universities). It was among the top 100 international universities in Engineering and Technology (79th) and the highest ranked university in Sweden 2014. The Industrial design program is of special importance running PhD programs and along with rehabilitation technology focusing the interplay between human, technology and design.

### *GiraffPlus exploitation plans:*

The GiraffPlus project has become an important part of a springboard for Swedish research and program development around social robotics. The exploitation plan at the Department of Design Sciences concerning the GiraffPlus project includes:

- Enhancing the faculty's undergraduate programs in civil engineering and industrial design.
- Enriching the department wide research programs in Ageing and design and Health design.
- Enhancing the collaboration with KTH, The School for Technology and Health mainly concerning the new research area Technology and Health Care which include the collaboration within engineering and nursing.
- Enhance the Swedish National agenda for Social Robotics 2015-2016.

## **Mälardalens University**

### *About:*

Mälardalen University (MDH) is one of the major education establishments in Sweden for engineers, nurses, teachers and business administrators. MDH has about 1,000 employees organized in 4 schools. Specifically for the GiraffPlus project, research activities involve the School of Innovation, Design and Engineering, the most research intensive school at Mälardalen University, with more than 200 employees and a track record of collaboration with industry and community.

### *Mission:*

In the context of this project, MDH's mission is primarily about research. Research is performed in the prioritized area of embedded systems with a proven track record of R&D for national and international projects performed in close collaboration with companies and end-user organisations. MDH is currently hosting a research profile financed by the Swedish Knowledge Foundation (ESS-H), performing research on embedded sensor systems for health in close collaboration with industry. This includes activities in reliable acquisition of physiological parameters, signal processing, decision support and wireless communication, all areas of relevance for the GiraffPlus project. MDH is also one of the driving partners in the EU objective 2 project NovaMedTech, which is specializing on commercialisation of research results within biomedical engineering.

### *General exploitation strategy:*

Given the University's mission and its support system, the general exploitation strategy for Mälardalen University is as follows:

- First, as an educational provider, it is natural to leverage from projects like GiraffPlus in order to develop master and doctoral dissertations in the area of health technology. This is done during the projects and can continue afterward using other funding (research grants). The turnover of such activities are indirect profits typically

through spin-offs.

- Further, the research which has been at MDH to develop sensor systems for monitoring of physiological parameters in home environment will be continued and expanded, especially by funding from the research profile at MDH called Embedded Sensor Systems for Health. This includes close collaboration with companies and other academic institutions, and will result in joint publications, papers and new sensor system developments. The funding in projects like GiraffPlus has been essential to achieve a starting point and the continued development will be done under other funding (research grants) with indirect profits.

#### *GiraffPlus exploitation plans:*

Our specific plans consist of four elements:

- We plan to continue the development and refinement of the android-based sensor and monitoring system developed during the GiraffPlus project, and to use it in continued research studies financed by our research profile Embedded Sensor System for Health. The system today allows activity monitoring and fall detection with alarm, and the physiological parameters available from the system are pulse rate, oxygen saturation, body movement, and fall event. Especially, body movement and fall might have potential to be developed further by deriving new algorithms adapted for various diseases and movement pattern.
- MDH was also invited as the only international partner to Spain at the start of the Spanish national network of Accessible Houses (REDDA). The meeting was held at CRMF (centre devoted to support people with physical disabilities) in San Fernando, Cádiz, Spain, and the result of the GiraffPlus project was presented. We intend to continue the work on accessible homes with the result from the GiraffPlus project as an important ingredient.
- We will also continue the work on security and safety of data transfer. Within the GiraffPlus project, we have derived schemes handling data dependency and security of communication. Confidentiality, integrity, and availability, plus authenticity and non-repudiation have been dealt with, as legality. These findings within the GiraffPlus project will be further explored and refined within our research profile Embedded Sensor System for Health.
- We also hope for a continuation of the EU objective-2 project NovaMedTech, and through this project we will have the opportunity to also commercialise parts of the above mentioned results.

## **Málaga University**

### *About:*

The University of Málaga is one of the most dynamic and fast growing research and education institutions in Spain. It presents 18 faculties, 51 degrees, 36,400 students (among them 25%

in engineering and 14% in experimental and health sciences) and 2,400 researchers. Its most active research field that is connected with entrepreneurship is ICT. The latter matches the fact that the ICT sector is actually one of the most productive areas in the Andalusia region, in particular in Málaga. As a representative example, 40% of the companies located at the Andalusia Technology Park in Malaga can be classified within the ICT sector. Hence, the ICT enterprises constitute a dynamic environment that is able to laterally support almost all the business transactions of the industrial sectors and social services that collaborate towards the economic, technological and social development of the Province of Málaga.

*Mission:*

Research is a main mission of the university. The high-quality research carried out by the university's groups joins the area companies' dynamism of this sector, anticipating a promising future for the development and the business applications of modern ICT: bio-computation, mobile multimedia and electronic systems design; cognitive networks for planning and optimisation of traffic scenarios; embedded intelligence and mobile systems; human-computer interfaces; virtual and augmented reality; sensor networks and ambient intelligence, among many others.

*General exploitation strategy:*

It is clearly understood that in this day and age the university is not an institute completely isolated from its surrounding environment; rather, it could be thought of as a model in which it is just one of the driving forces within the socio-economic change. It is within this model that the transfer of knowledge is considered social work, by way of incorporating new knowledge into the production environment to produce innovation. In this regard, the University of Málaga has become fully aware of this challenge, so much so that its strategic plan is to "Investigate for progress and Innovate to change society". This indicates the importance of this university in the generation of knowledge for economic and social progress.

As effective elements of this transfer we find the Bureau of Transfer of the research's Results (OTRI) whose main objective is based on transferring scientific-technical offers from the university to the productive sectors. To this end, there are two classical stages: (i) to identify the results of research generated, and (ii) to distribute and facilitate its transfer to promote innovation.

Additional work undertaken by Málaga University in relation to transfers is the rejuvenation of businesses. In 1997 the first competition for business ideas was launched to create university spin-offs. The objective is to encourage entrepreneurial activity not only in the faculty and administration personnel, but also among university students. It is a comprehensive plan to generate companies that are then offered a start-up period in the Academic Institute premises, as well as training, guidance and the creation of a business plan. Thanks to the existing agreements with the Technological Park of Andalusia, these micro-companies can continue their growing period in the premises of the PTA. In this way, 11 companies are established per year and are supported until they are able to access seed capital such as from the Andalusian Autonomous Government's (Junta de Andalucía) CAMPUS Program. Up to now a total of 16 projects of this type have been obtained.

### *GiraffPlus exploitation plans:*

The specific exploitation plan for University of Málaga includes the following four elements.

- First, as a higher educational provider, we will use results and experience from the GiraffPlus project to enrich engineering and computer science courses and as well as doctoral students with a real and applied perspective to different subjects: robotics, human-machine interface, sensor networks, etc. In particular, we have already included the GiraffPlus application as a case study in a subject called “Medical robotics” in a degree of “Informatica de la salud” (Computer science for health services). Also, we are currently using both a simulator and some real Giraff robots for practical sessions within the “Robotics” subject, in the degree of Computer science (Mention in AI).
- Second, in a more technological transfer spirit, we have initiated some contacts with a main Spanish company (CLECE S.A.) in the field of social service provider, for collaboration in new initiatives they are addressing for the near future.
- Third, thanks to the GiraffPlus international visibility and the good results achieved during the project, the UMA group has been invited to participate in several new EU proposals for H2020 where a robot navigational autonomy is pursued.
- And finally, we hope that as the cost of implementing the avatar navigation enhancements we achieved in the GiraffPlus projects come down over time, and therefore become commercially viable, to establish a technology transfer agreement with the GiraffPlus commercial provider to enhance the existing platform.

## 5.1.2 Care Organization Partners

### **ASL RMA**

#### *About:*

The local health authority (Azienda Sanitaria Locale or ASL) represents the contact points between the health network and the citizen for health services. There are eight ASL offices covering Rome’s metropolitan area (from ASL RMA – to ASL RMH) subdivided into districts. In every district operates a Unity for Disabled Adults and Elderly.

ASL RMA formerly included 4 municipalities and 4 health district but is now reduced to three. It has a population of almost 506,000. ASL RMA adopts a medium- and long-term plan focused on the cooperation between the public health system and the social services, concentrating the attention on the citizen in terms of user of health services aimed to:

- Promote healthy lifestyles tailored to the safeguarding of sexual, pediatric and elderly health



- Offer primary care, continuous care, primary medical and paramedical assistance, territorial medical assistance, integrated home care (with particular focus on elderly and disable people), pharmaceutical assistance, care and prevention of drug addiction
- Organize and coordinate arrangements of the different levels of health response based on citizens' real health needs
- Inform and engage the citizen-user in the process of solving their own health problems

In addition the ASL RMA puts effort toward a constant process of improvement of health network through a continuous drive for innovation and for the improvement of citizens' quality of care and assistance.

*Mission:*

The 4th District of ASL RMA is involved in the GiraffPlus project. It covers a territory of 9,781 hectares and serves a population of 208,635 persons. The district is in charge of all the actions foreseen in national health care. The UOS (Unity for Disabled Adults and Elderly), involved in social-health in the 4th District of ASL RMA, promotes actions towards frail elderly (in close collaboration with the social assistants of the fourth town hall) and disabled citizens to encourage the recovery of function, to prevent the onset of further involutions, to contrast states of exclusion, to prevent institutionalization and to improve the quality of life. It runs a day care centre, a home-family (a group home where up to 8 people with physical or mental disabilities live together, independently but with professional supervision), organizes home care and summer camps, and enhances the social-health integration. It works in a net with other health (home care assistance department) and social organizations of municipality.

*General exploitation strategy:*

The GiraffPlus project has provided the possibility to investigate the usefulness and feasibility of use of a socio-technical system based on mobile telepresence and a health care real-time monitoring system for multiple sensors data collection for elderly assistance. The 4th District of ASL RMA will continue to participate in evaluations of real-time, long-term and nonintrusive assisted living technology for remote healthcare services for elderly citizens.

The main benefits of the use of assisted living technology as GiraffPlus system may guarantee the possibility to offer continuity of care without distance limits, to integrate data obtained at distance with those of the patient's clinical records and the reduction of the burden of the patients to cover big distances to periodically reach the reference health and assistance centre. In addition, such technologies can help family members, other caregivers and older adults and communicate with each other.

*GiraffPlus exploitation plans:*

The 4th District of ASL RMA is still involved in the management and the monitoring through the GiraffPlus system of three test sites that are still running in our metropolitan area, in order to collect additional input and requirements on the integration and the functionality of the system in healthcare field. Such effort will be valuable also for the improvement of the design and the evaluation of interface elements and activities for the context recognition.

In addition the specific exploitation plan for the 4th District of ASL RMA includes:

- Carrying on the vocational and manual training for health care professionals in elderly care assistance for declaring potential and benefits of a socio-technical system based on mobile robotic telepresence and health care real-time monitoring system like as GiraffPlus
- Establishing a network of contacts with cooperatives and voluntary associations delivering home care services and telehealth for elderly people with the aim of evaluating an integration between their resources and the system

## **Örebro County Council**

### *About:*

Örebro County is situated in the centre of Sweden. The County Council's principal task is to organize and provide medical and health care to improve quality of life of all its 278,000 residents. It cooperates closely with other partners to ensure positive development in health matters as a whole, to tackle inequalities in health, to ensure good health among children and young people, and to support and strengthen initiatives taken to promote well-being and prevent illness. Support and service to the disabled, such as assistive devices for persons who have movement-, cognition- or communication disability, are provided by the county council. The County Council is also responsible for dental care, research, culture, education and regional growth. On January 1, 2015 the county council and the regional development council became one organization, the Region Örebro County. The Region Örebro County corporates with the Örebro municipality and the Örebro University in a test site project called "Smarta Äldre" in which technical solutions and products that aim to prolong independent living for elderly persons are tested.

### *Mission:*

In the GiraffPlus project, research activities have involved the Family Medicine Research Centre, a research organization within the primary health care. In Örebro County there are 29 primary health care centres that form the bases of the health care. All centres are staffed with physicians, nurses, physiotherapists, midwives, nursing assistants, and laboratory personnel. For elderly patients there is close collaboration with the municipalities in the county. The municipal health care includes care in the home, and in specialized nursing homes given by nurses and occupational therapists. The Family Medicine Research centre has its focus is on clinical research, for the major patient groups in the primary health care such as diabetes, stroke, and chronic obstructive lung disease. Several research projects focus on improving health care and quality of life for elderly persons.

### *General exploitation strategy:*

The GiraffPlus project has provided a possibility to investigate usefulness of communicating through a mobile robot and to get individualized data of elderly participants' activity behaviours. The Region Örebro County will continue to participate in evaluations of

technical solutions and products for elderly persons. Having different technical products in health care is important as it provides possibilities for individualized solutions, and may have an impact of the quality of life of elderly persons.

#### *GiraffPlus exploitation plans:*

Several research projects focus on improving health care for elderly persons. However, further development is needed before the GiraffPlus system can be applied in clinical settings. The exploitation plan concerning the GiraffPlus project includes:

- Enhancing the county's participation in projects investigating technical products such as the Smarta Äldre project, in collaboration with the municipality and the university
- Enriching research within the Family Medicine Research centre

## **SAS**

#### *About:*

Servicio Andaluz de Salud or Andalusian Health Service (SAS) is an autonomous body attached to the Ministry of Health of the Government of Andalusia in the South of Spain. Its mission is to provide public quality health care to the citizens, seeking efficiency and optimum use of resources. SAS has a network of integrated care services and it is organized to ensure the accessibility of the population. There are 1,491 primary care centres, 29 hospitals and 84,706 employees. The GiraffPlus project involves one of its health districts covering the west coast of the Málaga province. It serves a population of over 400,000 including more than 50,000 people over 65 years old. It is divided in 4 Areas: Benalmadena, Fuengirola- Mijas, Marbella, and Estepona with 24 health centres organised in 12 clinical management units.

#### *Mission:*

The SAS mission is to provide various services including:

- Medical consultations, specific clinical care of chronic conditions, home visits
- Nursing care
- Child and adolescent care
- Home care for patients discharged from the hospital and housebound patients
- Care of the elderly
- Sexual health care
- Care of the woman (cancer screening and pregnancy)
- Accidents and emergencies

This organization also has the advantage of its privileged localization: Costa del sol has been a popular holiday destination over the last forty years. We receive visitors from inland and abroad. It is also a very popular area for ex-patriates from all over Europe and rest of the world. There are more than 55 different nationalities among our patients. We have an important foreign community residing in Costa del Sol, mainly from United Kingdom, France,

Germany, Netherlands and Scandinavian countries. Many of them are retired people and people with disabilities with not much family and social support and living independently. There are also rural areas with a high rate of aged population. This makes home care an important part of our activity. We also have a residential care unit, supervising the care of the elderly in residential homes.

*General exploitation strategy:*

The GiraffPlus project has supplied important data about the elderly participants' daily routines and activities and the possibility of using telehealth solutions to offer them independent living for a longer time. Our organization will continue to participate in evaluations of technical solutions and products for elderly persons that can help us in our mission of providing public quality health care to the citizens, seeking efficiency and optimum use of resources.

*GiraffPlus exploitation plans:*

Development of a partnership agreement to continue with validation and evaluation activities in situ in the expected development until the final version (TRL9) is out. This agreement could be continued in the implementation, where we could offer installation support and resolving common mistakes and FAQs.

Being part of the agreement of ownership or/and exploitation of DVPIS software, by the participation in the input and advice on design and evaluation of interface elements and activities for the context recognition, as well as generation of different user and installation manuals.

### 5.1.3 Business Partners

#### **Intellicare**

*About:*

Intellicare is an ICT provider for AAL and telehealth markets. The *OneCare* product line is the brand name for the software products from which Intellicare developed several solutions already in the market. *OneCare Safe* addresses indoor and outdoor assistance requests using a panic button, fall detector or activity recognition. *OneCare Sensing* provides monitoring of physiological data.

*Mission:*

The Intellicare mission is to develop state of the art ICT systems to support Active and Assisted Living services provided by our partners. All our products and services are developed in partnership with end users, formal and informal caregivers and service providers to ensure maximum satisfaction.

*General exploitation strategy:*

Intellicare established partnerships with universities in Portugal and Europe to develop new products and services. Especially relevant are the partnerships with University of Coimbra: Computer Science and Physics departments, Polytechnic Institute of Coimbra: Computer Science department and University of Aveiro: Health School. It was in the context of these partnerships that we developed the *OneCare* software product line and are developing new ICT solutions and sensors for pulmonary and cardiac deceases.

*GiraffPlus exploitation plans:*

We are committed to be a part of the GiraffPlus exploitation plan and will support the deployment of new applications and sensors for the GiraffPlus infrastructure. The GiraffPlus enhancements for usability, availability and reliability that were made to the *OneCare Tablet* application (named *GiraffPlus Edition*) will be integrated into the *OneCare Tablet* application.

**XLAB***About:*

XLAB is a Slovenian R&D SME with a strong commercial background and a corresponding research group. XLAB Research is recognized as one of the strongest computer science research teams outside the academic world in Slovenia. It employs 35 people including 12 with a PhD and the vast majority with MSc or BSc degrees. XLAB research also runs a program for young researchers from various fields (economics, machine learning, computer science, etc.) XLAB as a whole employs 62 people and closely collaborates with more than 30 external experts, providing the whole company with access to more than 100 experts in the fields of computer science, electronics and mathematics as well as design and marketing.

XLAB is primarily an SME, with a strong R&D group. XLAB has participated (as WP-, Task-leader) in the following relevant FP projects: Contrail (open computing infrastructures for elastic services), mOSAIC (Open source API and platform for multiple clouds), Fortissimo (Accessible HPC-based Cloud Infrastructure, expertise, applications and visualization tools in one place and on a pay-per-use basis) and eBadge (energy management mechanisms, SmartGrids and virtual power plants).

XLAB's products show that XLAB is capable of providing state-of-the-art development expertise, which is transferred into the EU projects, while the experience and knowledge gained is applied to the solutions provided to XLAB's customers and to the development of XLAB's products. Specifically, XLAB's work in Contrail (responsible for monitoring and accounting, also for continuous integration), mOSAIC (responsible for implementing cloud and file system connectors to support abstract API) and eBadge (experience with an increasing inflow of data and its management.).

*Mission:*

XLAB conducts research and development in cloud computing, service-oriented architectures, security of distributed systems (cloud, multi-cloud and federated cloud in particular), SLAs (Security SLAs in particular) and HPC-related disruptive approaches. With our strong emphasis on distributed systems we closely follow and research the IoT paradigm, especially in the area of SmartGrids and connected (BigData) analytics. Additionally we are working in the fields of computer vision and human-computer interaction (context-awareness, natural user interfaces, usability evaluation).

XLAB is primarily a software development company with four key products: remote collaboration family of tools ISLOnline ([www.islonline.com](http://www.islonline.com)), business software kernel and libraries (main developers for europa3000, [www.europa3000.ch](http://www.europa3000.ch)), 3D medical imaging software (OEM solutions MedicView, [www.medicimaging.com](http://www.medicimaging.com)) and geographic information systems, civil protection solutions, spatial planning and tourism (GAEA+, NASA awarded GIS '13 [www.gaeaplus.eu](http://www.gaeaplus.eu)).

In continuous search for the next product, XLAB utilizes R&D and industrial experience in order to foster creativity and innovation. Within our stable and supportive environment a strong research and entrepreneurial team delivers tangible and innovative results: Koofr ([koofr.net](http://koofr.net) - hybrid storage solution), Olaii (<http://olaii.com> - event discovery app), Smarthousekeeping (<http://smarthousekeeping.com/> - easy workflow organization application), PHOV (<http://www.phov.eu/> - a 3D reconstruction of models from photos), Datafy.it (<http://datafy.it> – business contacts search service) and 8memo (<http://8memo.com/> - an intelligent photo organization app).

#### *General exploitation strategy:*

XLAB is committed to bridging the gap between science and research on one side and the commercial world on other side. The strategy with our research activities are to use the newly gained knowledge into commercially viable products and services. Our main markets are closely related to the cloud computing and related fields, where we have the most knowhow. In the last years we have realized, that having expertise in just one domain is often not enough therefore we have started to acquire knowledge also in other fields like smart grids, IoT, etc.

#### *GiraffPlus exploitation plans:*

XLAB is one of the smaller technology providers in the project as far as the range of tasks go, but we cover some vital core functionalities. Coming from this fact it is virtually impossible that we would devise new products and services solely on our IP. This is the reason why we believe we must form a partnership with other partners, who hold IP in other domains and are complementary to our expertise. To summarize our involvement in the project, please observe a list of accomplished tasks:

- Design and implement storage capabilities for all data gained during the project
- Implement REST services for said data and make data available to all middleware components

- Design and implement a DVPIS@mobile web application, which allows quick data overview on mobile devices
- Setup and maintain the whole technical infrastructure supporting the abovementioned and services from other tasks

## **Tunstall**

### *About:*

Established in the UK in 1957, Tunstall Healthcare Group is the world's leading provider of telehealth solutions. Operating in more than 30 countries and employing nearly 2,000 people globally, Tunstall supports over 2.5 million people around the world. Tunstall develops solutions that address the challenges faced by its customers, gearing its significant resources towards supporting people's independence and helping providers to deliver best value services.

Tunstall has research facilities around the world, each with dedicated teams developing solutions to support people throughout the full pyramid of care, and in every living environment.

### *Mission:*

Tunstall's mission is to protect, support and care for people by providing health care technology and services that enable anyone requiring support and reassurance, such as older people or those with long-term needs, to lead an independent life with dignity and reassurance. Tunstall provides complete and fully-integrated telecare and telehealth solutions for home, assisted living and specialist care environments, hospital communication systems, associated support services, response centre software systems and monitoring services.

### *General exploitation strategy:*

Tunstall envisages a future where older people, and people with long-term health and care needs, are empowered to choose where they live, have control over the services they receive, and the freedom to live life to the full. We believe that combining the right solutions with the right support can make this future possible now. Therefore, our strategy is to take what we learn from our service delivery experience, our research and our partnerships with organizations such as the GiraffPlus consortium and apply it to services that support our vision of independent life for those with long-term care needs.

### *GiraffPlus exploitation plans:*

Tunstall provided the sensor kit and supporting software for the GiraffPlus platform. We benefitted from the learning experience of integrating our hardware into a comprehensive telehealth platform and also from the visibility that the extensive dissemination activities provided. We plan to apply this experience to our existing service portfolio, and hope to

continue benefitting from the project by providing sensors for the commercial service. We are also open to the possibility of a commercial partnership in the future.

## **Giraff**

### *About:*

Giraff Technologies AB, located in Västerås, Sweden current develops, manufactures and markets a home care system focused around the Giraff mobile telepresence avatar that has been very much at the centre of the GiraffPlus project. It currently has 6 employees and has deployed nearly 140 avatar systems in EU and Australia. The current offering consists of the Giraff avatar including electronics and software, a user application called *Pilot* that allows caregivers to remotely visit a home, and a web-based administration and management system called *Sentry* that allows care organizations to configure and manage all aspects of the telepresence service.

### *Mission:*

Giraff is the only mobile telepresence developer in the world that is exclusively focused on home care (AAL), and the company's mission is to continue focusing on this market. Nearly every aspect of the current offering has been designed based upon requirements and user feedback from the AAL market. Giraff wants to be very much a part of the expansion of the AAL vision from social to health care, exactly what the GiraffPlus project is all about.

### *General exploitation strategy:*

Giraff has been fortunate to be part of several EU projects that have enabled us to develop and prepare for market a commercial service, and our exploitation plans mostly revolve around these projects. Indeed, the current offering is the direct result of the AAL JP project *ExCITE*, the predecessor to the GiraffPlus project. We plan to introduce further enhancements to the service next year by commercializing work done in the AAL JP project *VictoryaHome*. And of course, the company has ambitious plans for commercializing GiraffPlus.

### *GiraffPlus exploitation plans:*

Giraff Technologies intends to bring to market in 2015 the platform developed in the GiraffPlus project. The remainder of this document describes in detail this plan.

## **5.2 GiraffPlus Exploitation Plan**

Giraff Technologies AB ("Giraff Sweden") plans to evolve its current Giraff commercial service to include the concept and vision of the GiraffPlus platform in 2015, as well as other planned enhancements to the existing service as described in 3.4. There are many details still to be confirmed but a clear picture of how Giraff Sweden will pursue the market is emerging and is described here. Based upon the market analysis in Section 4 the initial focus will be on the U.S., and secondarily on Canada. Giraff Sweden will continue to market the GiraffPlus concept



in Europe but will not staff aggressively for the market at this time, but instead will focus on supporting the U.S. activities.

Extensive discussions with U.S. and Canadian venture capital investors over the past year have made it clear that such an approach requires a stand-alone U.S. organization. Even though it is well understood that this technology was developed in Europe and is provided by a European organization, investors want to invest in a U.S. entity. Therefore Giraff Sweden will set up a separate Limited Liability Corporation (LLC) in the U.S. ("Giraff U.S.") to serve as a distribution organization for North America. The exact nature of this organization is still to be determined based upon investor discussions, but our best understanding of it at this time can be described as follows:

- Giraff U.S. will provide marketing, sales, project management and first-level technical support for the GiraffPlus platform for the North American market
- Giraff U.S. will have an ownership structure and Board of Directors separate from Giraff Sweden
- Giraff Sweden shareholders will also be shareholders in Giraff U.S. This will be a minority position over time as their ownership is diluted by outside investment in Giraff U.S.
- Giraff U.S. will not own or provide any IP related to Giraff or GiraffPlus, but will be a North American distribution organization for Giraff Sweden.
- Giraff Sweden will provide the Giraff avatar, software and other technology to Giraff U.S. This includes technology provided by other GiraffPlus partners as described below via support and license agreements.

The previous version of this document described three possible scenarios for "Newco," the entity that would deliver GiraffPlus to the market:

1. A new EU entity funded by venture capital
2. An organization within a large strategic partner
3. An existing company that is sufficiently funded by new capital

Interestingly, the Newco that has emerged over the past year does not directly match any of those descriptions. It is similar to 3. in that Giraff Technologies will bring the GiraffPlus concept to market, but this only strictly true in Europe (and ultimately RoW). In North American it will be a separate organization with a close strategic tie to Giraff Sweden.

## 5.2.1 Organization

The planned initial organizational structure is as follows:

- Giraff Sweden organization will not change initially, but during 2015 it will add a sales person to drive sales of the existing Giraff service as well as introduce the new GiraffPlus concept. The plan also calls for the Giraff Sweden CEO to transition to the U.S. organization and be replaced by a new CEO in Sweden in roughly the middle of 2105. Going forward, Giraff Sweden will expand primarily its marketing and sales force (something it has never had before) in the EU (and ultimately RoW) and set up country partner agreements to deliver service in each country.
- The Giraff U.S. organization will initially (in 2015) consist of the following personnel (for titles marked with a \* a specific person has been tentatively identified):
  - An executive manager\*, responsible for establishing the organization, establishing and developing the relationships with Giraff Sweden and other organizations
  - An operational manager\*, responsible all financial, administrative and other operational tasks
  - A sales manager\*, responsible for all marketing, sales and business development activities (in the early days of a startup, all sales activities are in a sense business development)
  - A project manager\*, responsible for the implementation and management of the first customers projects
  - A second project manager to be brought on in 2Q 2015
  - A technical support person to be brought on in 3Q 2105
  - A second technical person to be brought on in 4Q 2015
- Technical support and development roles will be fulfilled by project partners including CNR, XLAB and Örebro University via support and license agreements with Giraff Sweden
- Physiological devices supply provided by Intellicare

It is difficult to say how Giraff U.S. will evolve over time, but it is reasonable to assume that it will ultimately expand to include more advanced support and development work, presuming that platform requirements will be significantly different between North America and EU (and RoW). Certainly the hardware and software certification requirements will be different; for example, the hardware certification counterparts to the EU CE mark in the U.S. and Canada are UL and CSA, respectively, and the counterparts to the EU data privacy and security requirements are HIPAA and PIPEDA, respectively. Features and functions, value chains and UI requirements will likely diverge to some extent over time, as will technical support requirements. Therefore Giraff U.S. will likely include more core development functions over time.

## 5.2.2 Marketing and Sales

The marketing and sales strategy follows directly from the business model described in 3.2, the value propositions in 3.3 and the market analysis in 4. The strategy has strong region and time dependencies and we describe it along those dimensions:

### Europe

Over the next 1+ years most sales activity in Europe will focus on the current Giraff commercial service. For the first time Giraff Sweden will have explicit sales resources and marketing materials toward this effort. The Giraff Technologies web site will be updated and used as a real marketing tool (it has been largely irrelevant over the past few years because of lack of resource). Giraff Sweden will also use social media to focus specifically on informal caregivers, as they are a main (in some cases *the* main) target audience in most EU countries.

The main sales strategy will be the establishment of country partners who are AAL market experts within their country and know how to reach customers in both the public domain (state care organizations) and private domain (private care organizations including those funding by state-mandated insurance, and at the consumer level). We will pursue these partnerships even in Sweden (where the first one is already established) because it is more efficient for a small entity such as Giraff Technologies than staffing a direct sales force.

During this phase the GiraffPlus concept will be communicated as a standard part of all marketing materials and sales presentations (as it is today). Giraff Sweden will look for opportunities to establish pilot projects and the initial commercial market for GiraffPlus as it focused on the existing commercial service.

In 2016 and beyond there is hope that the EU market will begin adopting telehealth solutions on a broader basis, and that the GiraffPlus will still be a market-leading solution via its continued development for the U.S. market. As social and health care organizations learn how to cooperate more efficiently in the home care domain, and private organizations learn how to market services that are paid for by individuals and families, Europe will eventually have a vibrant telehealth market. Certainly the fundamental drivers as described in 4. will only increase in intensity over time.

### U.S.

The marketing and sales strategy in the U.S. is as complex as it is rich in opportunity. All dimensions of the market are complex and require dedicated marketing strategies as summarized here:

- The service plays at different levels of the value chain. The target customer (and therefore the marketing and sales strategy) can be a care organization, a system integrator, a traditional distributor (who is already in the market and has the required expertise and customer relationships) or an individual/family. Giraff U.S. will develop

messaging for each level similar to the value propositions described in 3.3.

- As described in 3.3, the messaging varies significantly for each user type, and in some cases is even in conflict (e.g. improved quality of life versus cost savings, which is often interpreted as diminished quality of service). The strategy here will be to identify media channels that focus on each user group and optimize the messaging for them.
- The use cases are diverse and each requires a different marketing approach – even within the same use case at times. For example, the use case of extended life at home (postponing the transition to a nursing home) is targeted at two distinct customers in the U.S. – the family and the ACO (or other organizations that behave like ACOs in terms of financial drivers). The messaging for the ACO is solidly focused on cost savings whereas the messaging for the family must balance between cost savings and the softer values of confidence and peace of mind. And for example in the use case for post-acute care – targeted primarily at hospitals (as individual entities or as anchors to ACOs) – Giraff U.S. must target the messaging on improved care outcomes based on carefully designed care protocols as implemented in the GiraffPlus platform, where clinical validation will be the most important element.
- The industry influencers are diverse and also each require a different marketing message. For example, AARP focuses mostly on elderly residents (primary users) and tends to cater to more self-sufficient members who are able to interact with technology – who tend to be on the early edge of the GiraffPlus target user group. The messaging here must focus on the evolutionary nature of the platform and its ability to gracefully and even transparently grow along with the resident’s needs. The ATA (American Telemedicine Association) on the other hand reaches out mostly to care organizations as a general telehealth advocate. The messaging to this organization is exactly the opposite – it thrives on technical descriptions, clinical protocols and focuses on the unique features of the GiraffPlus platform. We understand who the relevant influencing organizations in the U.S. are and what role they play with the various user groups. The marketing task of Giraff U.S. is to develop specific messaging for each one.

## RoW

Most other world regions represent only niche markets for telehealth technology at this time. In Eastern Europe, Russia and most of Asia where there is little formal elderly care, it is a mostly consumer play for families who are wealthy enough to be geographically dispersed and provide such technology for aging parents back home. This is even truer for historically underdeveloped regions such as large parts of South America and Africa. We have some indications that a market exists in the numerous wealthy Middle East countries but this requires specialized distributors that we have yet to gain access to.

There is clearly a telehealth market in the Far East, particularly in Japan, Korea and China. A rapidly growing affluent class (especially in China) with its associated geographical dispersion provide an opportunity for the value propositions described in 3.3, especially for informal caregivers. However, many elderly in this region live in very small homes – in Japan for

example they are often one-room studio apartments – where the value proposition for mobile telepresence is diminished. We have received many queries from distributors in all three countries mentioned above (most frequently China) but have yet to find any willing to make a hard commitment to market development and staffing.

Canada is unique as a telehealth market opportunity because its social and health care systems look more like Western Europe – suggesting there would not be a great sense of urgency for change and innovation – yet they are influenced by the rapid changes happening in the U.S. and want to be a part of that innovation. Indeed, it is almost certain that at least one of the first Giraff U.S. customers will be a large Canadian home care organization, and there are others in dialogue. For this reason we often combine the U.S. and Canada markets into a single “North American” market but it is important to remember that Canada’s system is much different than the U.S.

### 5.3 Financial Analysis and Capital Requirements

In D8.1 we said the following tasks need to be accomplished in order to begin serious investor discussions and attract venture capital. All of these tasks were completed by the end of 2013 or in early 2014:

- Begin GiraffPlus field trials
- Complete an investor perspective
- Complete an investor presentation
- Finalize the GiraffPlus system architecture and create a definitive system description.
- Complete a COGS analysis of the system so that we can begin to create a revenue model.
- Assess the development effort estimated between the project end and commercial launch.
- Select a target investor list and make the initial approaches.
- Decide on the initial target market

Further to these milestones, our market understanding is now sufficient to complete a detailed Year 1 plan including a financial analysis and capital requirements, and to also make a reasonable longer-term projection of these requirements and the path to profitability. We summarize here the 1-year and longer-term outlook.

#### 5.3.1 1-Year Outlook

We have developed a detailed plan for the first year of operation – this is necessary for any startup organization, especially one that requires major outside financing. The goal in the first year is to implement and support projects with “foundation” customers (care organizations in the first year) that will become reference points for others. Therefore to understand the 1-year outlook we must first understand the process of moving a care organization from first contact to trial validation – the point where they would be ready for

expanded service and true commercial deployment. This determines how much time and resource we need to achieve a certain level of revenue.

We now have enough experience with customer dialogues in North America to map that process:

**Implementation Timeline (from introduction to validation)**

<u>Giraff early account development stages (On-boarding)</u>	<u>Cumulative time</u>
Identify early adopter account where immediate need can be defined	Day 0
Determine early use for Giraff based on defined patient care related requirements (define demographics and value creation opportunities)	Day 30
Schedule on-site demo of platform inclusive of meeting with key stakeholders to define potential use cases & pilot process as required (identify pilot team members within the account)	Day 60
Schedule pilot team meeting to further define use cases, # of systems required, protocols if any to be developed and special requirements (integration, software development, sensors/physiological devices ...etc.)	Day 75
Complete pilot agreement and prepare schedule for implementation with all components and shared responsibilities for approval	Day 90
Pilot implementation including installation, training and initial operation	Day 120
Trial and validation of objectives; customer ready for expanded service	Day 180

As one can see from this timeline it takes 6 months to bring an organization all the way to validation, and for the first customers at least 2 months of that time requires a dedicated project manager. Based upon this schedule we can also map out the dedicated project management resource required in Year 1, making certain assumptions (listed below) about increased efficiency over time. It shows that we require 2 dedicated project managers (PMs) to implement 10 customers in the Year 1:

Activity	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Customer #1	PM #1											
Customer #2			PM #2									
Customer #3					PM #1							
Customer #4						PM #2						
Customer #5							PM #1					
Customer #6								PM #2				
Customer #7									PM #1			
Customer #8										PM #2		
Customer #9											PM #1	
Customer #10												PM #2

Assumptions
- Assumes that all other non-project tasks (in Milestone tab) are managed by initial 3 staff (and/or outside resource)
- Assume that most technical support initially comes from Europe
- Timeline below shows just implementation phase that requires PM and tech. support (i.e. 120 not 180 days)
- First 60 days are managed by S&M manager et al
- Assumes PM and implementation becomes more efficient and faster over time, such that PMs can back away faster and cover multiple customers

Based on customer and other industry dialogues, we can also map out now the major tasks/milestones that must be executed in Year 1 to achieve this growth:

### 1. Establish first customer implementations

<u>Task/milestone</u>	<u>Date/month</u>
Establish LLC	M1
Initial web site up	M2
First 10 units available	M1
Complete initial IP searches	M1
UL/CSA hardware approval complete	M2
First support personnel on board	M2
Customer documentation available	M2
N.A. cloud online	M2
Call centre online	M3
Initial sensor portfolio ready	M4
Initial physiological device portfolio ready	M5

### 2. Scale

<u>Task/milestone</u>	<u>Date/month</u>
Pricing plan in place	M9
Manufacturing transition	M6
HIPAA/PIPEDA certifications complete	M9
Leasing program in place	M12

Based upon these assumptions we can determine the resources needed in Year 1 for the North American market by month (this in addition to the staff of 6 that currently exists in Sweden):

Resources on board	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Chief	1	1	1	1	1	1	1	1	1	1	1	1
S&M/ BD manager	1	1	1	1	1	1	1	1	1	1	1	1
Ops manager	1	1	1	1	1	1	1	1	1	1	1	1
Project manager #1	1	1	1	1	1	1	1	1	1	1	1	1
Project manager #2			1	1	1	1	1	1	1	1	1	1
Tech support #1					1	1	1	1	1	1	1	1
Tech support #2									1	1	1	1
<b>Total Staff</b>	4	4	5	5	6	6	6	6	7	7	7	7

Calculating the expected revenue and expenses (primarily for salary, and secondly for support, license and development resources from the consortium partners) for Year 1 shows that Giraff U.S. needs ~ USD 2.5 million from outside investors to establish the market and

prepare for scale and full commercial deployment. A Canadian-led consortium is considering exactly such a proposal and term sheet as of this writing.

### 5.3.2 4-Year and Beyond Outlook

The long-term pro forma depends heavily on certain assumptions that are not yet validated, so it must be understood in that light. In particular it assumes that:

- An investment of at least USD 1 million is available in early 2015
- A total investment of at least USD 4.5 million is available by 2016
- The investors are committed to the operational plan required to achieve the pro forma including staffing; in particular, that they are willing to staff ahead of revenue
- Modest cost reductions can be achieved in the Giraff avatar hardware (some believe that much more aggressive targets can be reached)
- Giraff hardware costs can be financed over 3 years by a third party

With that in mind, the current 4-year pro-forma result for North America is projected as follows (note that currency here is USD):

(USD)	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>
<b># Installs (cum)</b>	100	1,080	3,864	11,091
<b>Total Revenue</b>	270,000	3,024,000	11,599,200	26,432,800
<b>Gross Margin</b>	90,582	1,240,875	5,802,036	11,851,065
<b>Expenses</b>	2,022,375	3,370,375	5,534,750	7,579,750
<b>Headcount</b>	11	21	32	42
<b>EBITDA</b>	-1,931,793	-2,129,500	267,286	4,271,315
<b>EBITDA %</b>			2%	16%
<b>Investment</b>	2,500,000	2,000,000	0	0
<b>Net cash</b>	568,207	438,707	705,993	4,977,308

Some comments on how this model was developed and the numbers are derived:

- The pro forma shown above is only for the North American market. We show a combined N.A. + EU pro forma below.
- The # of installs is derived from 3 considerations: direct customer dialogues that already show an opportunity for over 1,500 system, the overall TAM and what penetration we believe we can achieve, and the practical constraints of scaling such an organization and operation (regardless of market opportunity).
- The revenue is based upon an up-front payment for equipment between \$500-900 (which certainly does not cover the cost of the avatar) and monthly subscription rate between \$250-400. These numbers vary according to configuration and reduce over time. This also assumes an annual “churn” of 20% - the percentage of existing installations that terminate each year (we



expect a high number here because of the nature of elderly care).

- The gross margin is calculated based on the COGS (cost of goods sold) of the hardware and infrastructure (cloud) required to provide the service. It does not include customer support, although in a service organization this is also often included in COGS. It also assumes that we internally finance the avatar production cost over 3 years via a 3<sup>rd</sup>-party finance organization.
- The expenses are driven mostly by personnel, and also include all the infrastructure and services necessary to run the business (office space, IT systems, travel, insurance, support costs from participating consortium partners, etc.) Because personnel is by far the greatest cost and staff growth is mostly driven by the customer base, about 80% of the expenses are variable and only 20% are fixed.

As the table indicates, the N.A. business can become a profitable by Year 3 (2017 in this pro forma) and can grow to 16% EBITDA in the following year. Projecting out years shows the EBITDA, to go well into the 20s, typically of a SaaS business. Hardware manufacturing is obviously a major cost but we assume this is financed by a third party; therefore the financial model looks mostly like a SaaS business.

If we combine this with the EU pro forma for the same time period, and using the same modelling assumptions as described above, the total pro forma is as follows (note the currency here is EUR):

(€)	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>
<b># Installs (cum)</b>	100	1,188	4,637	14,419
<b>Total Revenue</b>	229,500	2,827,440	11,831,184	29,208,244
<b>Gross Margin</b>	76,994	1,160,218	5,918,077	13,095,427
<b>Expenses</b>	1,919,019	3,151,301	5,645,445	8,375,624
<b>Headcount</b>	17	30	46	62
<b>EBITDA</b>	-1,842,024	-1,991,082	272,632	4,719,803
<b>EBITDA %</b>			2%	16%

This pro forma assumes that N.A. and EU are the only markets addressed (it does not include any RoW opportunities, that certainly exist but are undefined at this time). It also includes additional expenses in the Sweden organization that increase the cash burn and losses in the first 2 years, but not enough to require additional investment beyond the \$4.5M stated above.

## 6 Conclusions

The fundamental drivers for the AAL market – the aging population, shrinking available caregivers, rising health care costs and a strong motivation to keep elderly living at home are beyond question, both today and projecting forward. In some regions the nature of the health care system is such that it is difficult for the system to respond quickly to these trends,

and the resulting slow market development is well understood by care organizations and technology suppliers alike.

However, in the U.S. this is not true, as evidenced by an existing \$300 million telehealth market that is growing over 50% per year. It is also clear that the point solutions currently available in the U.S. are not meeting all the market needs and that nothing like the GiraffPlus concept currently exists (in the U.S. or anywhere else in the world). Judith Hicks, CEO of Beechwood Health Solutions and one of the U.S. foremost telehealth experts and a pioneer of the industry is quoted as saying that "Giraff has a tiger by the tail" when describing the near-term market opportunity for the GiraffPlus concept. Nearly every customer dialogue we have engaged in the U.S. indicates the same. The opportunity for unique technology such as what GiraffPlus brings – and, by the way, other technologies currently under development in the EU, many funded by EC programs – is vast and it is now.

At the same time, the current systemic obstacles to market uptake in Europe will be able to resist the same fundamental drivers for only so long. The opportunity in Europe – and ultimately elsewhere in the world – is inevitable, it is just a question of time. We believe that by developing and refining the GiraffPlus platform in an existing and vibrant market such as the U.S. will make it that much more compelling when the time comes to market it in Europe.

## References and Notes

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