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D5.3 Test Sites Deployment

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No confidential material is included therein.

Deliverable Summary

This document reports on the deployment of the test sites. The six test sites selected in this deployment phase are described detailing the required technical components considered at this stage.

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1 Introduction

1.1 Scope of the document

The document describes the deployment of the improved version of the GiraffPlus system in the first six test sites two in each country (Sweden, Italy, and Spain). This document covers a brief description of the test sites, the protocol to be followed in the deployment, and the characteristics of the version of the GiraffPlus system to be installed. The selection criteria considered at this stage comes from the results of task 6.2.

1.2 Deliverable structure

The document is structured in three parts:

Section 2 gives a common protocol on the test sites' deployment. It defines different roles and responsibilities aiming at achieving an efficient and discrete installation of the GiraffPlus system at each test sites. The final goal of this protocol is to minimize the invasion in the primary user's life.

Section 3 provides a brief description of the selected test sites for this initial deployment stage. More detail on the selection criteria and particularities of each one can be found in the result of task 6.2.

Section 4 and 5 present the improved version of the GiraffPlus system which will be installed, detailing the main hardware and software components considered.

1.3 Deviations with respect to the plan

Following the DOW, MS2 involves the deployment of the second prototype at six test sites by month 18. The test sites have been selected and the deployment process has been started in June 2013 (month 18) with a visit of the 6 test sites and the finalizing of the specific sensor configuration that is placed in each test site given the apartment topology and the wishes of the test person. The deployment process has then been paused due to the vacation period during July and August and the consequent unavailability of the test persons during this period. The actual system is installed in August in Sweden and in September in Spain and Italy.

2 Test site deployment protocol and users' roles

A list of actors involved in the deployment and management of the test sites has been proposed. First, three committees have been identified to design and manage test sites activities. Then, three different relevant roles have been considered: Test Site Contact Person, Test Site Engineer, Test Site Installer/Technician.

2.1 Committees

Scientific Committee (composed by all research partners)

- To define research objectives.
- To deploy provide suitable methodologies/solutions.

Ethical Committee (composed by all end users partners)

- To define ethical issues and suitable ethical guidelines.
- To select end users.

Technical Committee (composed by all technical partners)

- To design the deployment of the GP system.
- To provide technical guidelines.
- To contribute in configuring and managing test sites.

The committees are to coordinate with and report to the Technical Manager.

2.2 Roles

For each test site, a **Test Site Contact Person** is responsible to:

1. keep in touch and maintain contacts with PU and SU
2. supervise the test site activities
3. coordinate with the Committees
4. trigger and monitor actions (when needed)

Test Site Engineers are responsible to:

1. apply the Technical Committee guidelines
2. (re)configure the GP system (if needed/requested)
3. report on the status of the GP system (if requested)

GP Technicians are responsible to:

1. apply the deployment design
2. fix hardware problems (if needed/requested)
3. report on the status of the GP HW (if requested)

According to the GP sub-system, a person in the Technical Committee is identified (and will intervene in case of need) for playing the role of Engineer and/or Technician.

2.3 Deployment and Management Procedures

Once a test site is selected, representatives of the Ethical and Scientific Committees assess in cooperation with Primary and Secondary Users which are the needed functionalities of the

GiraffPlus system (e.g., the activities to may be monitored). Then, a "Test Site Requirements" document is generated, which serves as a basis for the technical analysis performed by the Technical Committee aiming at designing the GiraffPlus system to be deployed in the house (see Figure 1).

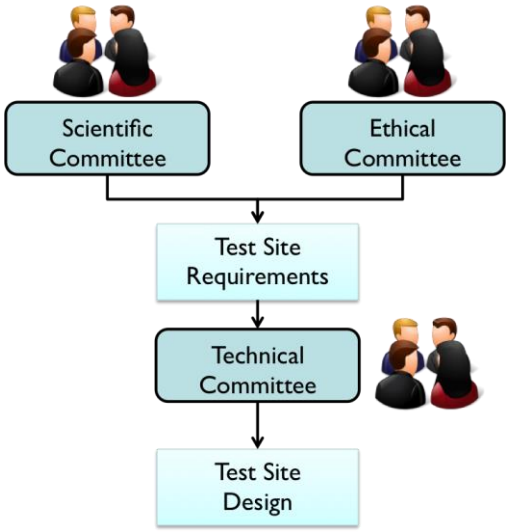

Figure 1 Test Site Requirements and Design

Following the test site design, the Technical Committee identifies engineers and technicians that are supposed to install the system. Before the actual deployment, the system and all its sub-components (sensors, the Giraff robot, the software services, etc.) are to be installed and configured in a laboratory setting. Once the system is properly configured and all the relevant services are working, the real deployment is initiated (a 2 hours max time reference has been discussed as temporal desiderata for the deployment duration).

During the management of the test site, the contact person is supposed to behave as mediator between committees and end users. In case of need, the contact person is responsible to inform the committees and ask for a prompt intervention (see Figure 2).

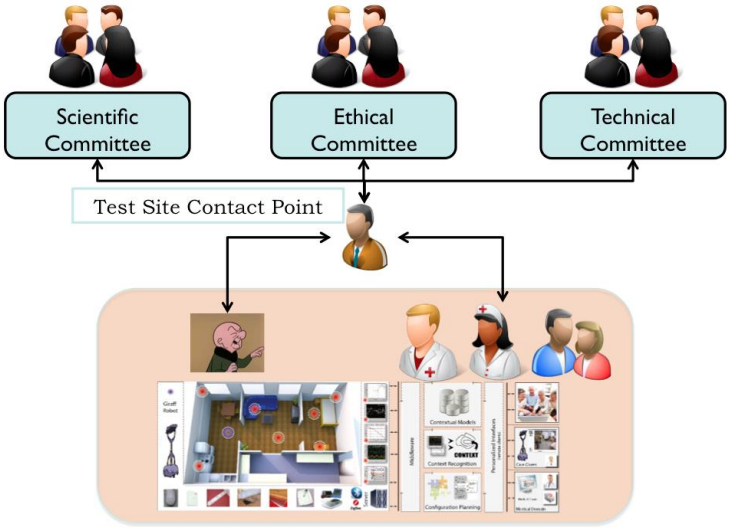

Figure 2 Test Site Management

3 Test sites description

Six test sites have been selected for this initial deployment, two in each country (Sweden, Italy, and Spain). From the user requirements' point of view, the criteria followed for the selection has been already reported in WP1 and WP6. From a technical point of view, relevant for the installation of the GiraffPlus system we have identified the following requirements:

- WIFI internet connection. Acceptable coverage within the major part of the home.
- An adequate electrical installation with a convenient number of plugs.
- Particular requirements for telepresence communication and semi-autonomous motion of the robot:
    - Bandwidth (minimum guaranteed): 2 Mb download; 512kb upload.
    - Absence of cluttered areas with pieces of furniture.
    - Absence of stairs.
    - Absence of carpets and steps, or at least not higher than 2cm.
    - Absence of transparent objects and mirrors below 0.5m over the floor.

Testsites fulfilling these requirements will facilitate the deployment of the GiraffPlus system. However, some of them are not strictly mandatory and the system can be tuned to be adapted to the particularities of each testsite, for example limiting the autonomous motion of the robot to only safe areas.

Next, a brief description and particularities of each test site is given.

3.1 Test sites in Sweden

Test site 1

1. Location: Örebro, Sweden

2. Primary end user:
    - A man (83 years) who lives alone
    - Medical History:
      difficulty in moving

- Secondary end user:
  - occupational therapists,
  - physiotherapist,
  - primary care physician,
  - relatives
- living conditions:
  apartment with two livingrooms, a bedroom, a kitchen and a bathroom

Additional Comments:
The occupational therapist and the physiotherapist will both connect about 1 time per week. The occupational therapist will mainly discuss experiences of the system but also daily activities. The physiotherapist will be interested in monitoring activities and mobility. The physician will connect occasionally monitoring physiological variables, mainly blood pressure. The inhabitant cooks for himself but not each day, he has troubles moving around, usually he is "kicking" himself around on a chair with wheels. He does not use his large diningroom very often. The person used to be a pilot and seems very interested in technology, he has a computer. He likes the area he lives in and seems to enjoy talking to his neighbors which are also elderly.

He has some friends that are potential end users, using the GiraffPlus for communication.

Test site 2

- Location: Örebro, Sweden

- Primary end user:

  - A man (82 years) who lives alone
  - Medical History:
    difficulty in moving

- Secondary end user:
  - occupational therapists,
  - physiotherapist,
  - primary care physician,
  - relatives
- living conditions:
  large apartment with several rooms, including a bedroom, a kitchen, a workroom a bathroom, a livingroom, a garden and a large balcony.

Additional Comments:
The occupational therapist and the physiotherapist will both connect about 1 time per week. The occupational therapist will mainly discuss experiences of the system but also daily activities. The physiotherapist will be interested in monitoring activities and mobility. The

physician will connect occasionally monitoring physiological variables, mainly blood pressure. The man can move around using his crutches.

He has three sons that are potential end users, using the GiraffPlus mainly for communication.

3.2 Test sites in Italy

Test site 1

1. Location: Roma/Ostia
2. Primary user:
    - A woman (80 years)
    - Medical History:
        hypertension,
        risk of falls
        cognitive status: good,
3. Secondary users:
    - Medical Doctor
    - Nurse
    - Psychologist
    - Two children: one living not far from her and another living in center of Roma,
    - Three other children (two adopted): two living in Roma another in a town of north Italy
    - Many grandchildren
4. Living conditions:
    apartment with a bedroom, a living room, a kitchen, a bathroom

Test site 2

1. Location: Roma
2. Primary user:
    - A woman (72 years)
    - Medical History:
        hypertension, controlled pharmacologically
        atrial fibrillation
        risks of falls
        cognitive status: good,
3. Secondary users:
    - Medical Doctor
    - Nurse

- Psychologist
- Two children: one (designed caregiver), living in center of Roma,
- Friends

4. Living conditions:
   apartment with a bedroom, a living room, a kitchen, a bathroom

Additional Comments:
The psychologist will connect about 4 time per week to monitor the daily living. The nurse will connect every week to check up blood pressure and medicine use. The physician will connect occasionally for general control (needs and demands). Other relatives and friends will connect regularly.

3.3 Test sites in Spain

Test site 1

1. Location: Estepona (Malaga)
2. Primary user:
   - A man (67 years old).
   - Medical history:
     - High blood pressure.
     - Peripheral vascular disease as a result of which he underwent a low limb amputation 7 years ago. Currently he uses a prosthetic limb.
   - He has lived independently for the last few months, since one son who lived with him went away for working reasons.
2. Secondary users:
   - Medical doctor
   - Practice nurses
   - Community nurse
   - He has three sons, living in the same town. At least one of them would connect to him.
3. Living conditions:
   - 3 bedroom apartment with a kitchen, a bathroom and a living room.

Test site 2

1. Location: Estepona (Malaga)
2. Primary user:
   - A man (82 years old).
   - Medical history:
     - High blood pressure
     - High Cholesterol
     - Type 2 Diabetes Mellitus

- Stomach and prostate problems, on medical treatment.

3. Secondary users:
    - Medical doctor
    - Practice nurses
    - Community nurse
    - 2 children, living in the same town
    - 1 sister, living 600 Km away
    - 1 granddaughter living 100 km away
4. Living conditions:
    - 2 bedroom apartment with a bathroom, a kitchen and a living room.

4 Hardware components

In this section we describe the hardware components to be deployed in the test sites.

4.1 Hardware required in the house

- 1 ADSL modem if not provided by ISP
- 1 WiFi router
- 1 PC endowed with Windows 7 OS
- Lifeline Gateway, Tunstall USB Tapit and Sensors
- 1 OneCare Tablet and OneCare assessment kit
- 1 Android Smartphone and Oxymeter sensor
- 1 Giraff Robot with docking station and recharging pack
- A number of sensors from the set explained bellow according to the test site design.

In more detail, the list of hardware components considered for the first deployment is:

4.2 Tunstall sensors

Tunstall sensors are managed by the so-called Lifeline Vi+. It is a hub that receives the alarms triggered by the sensors considered based on the needs of each particular user.

Figure 3. Lifeline Vi+

The Lifeline is connected to a computer through the USB TAPIT. In this way, alarms triggered by the sensors are directly communicated to the GiraffPlus middleware.

Figure 4. USB Tapit. This device permits the connection of the Lifeline Vi+ unit to a computer.

Next the particular sensors considered in the initial deployments are described. Part of them were used in the lab deployment at M12 and briefly described in D5.1.

Passive Infrared detectors (PIR)

The passive infrared detectors are wireless movement detectors that can be used to detect the presence of the user in a particular room. Once a movement is detected, the PIR sensor generates an alarm which is communicated to the Lifeline. This information is essential to register and monitor the activity of the user.

Figure 5. Presence sensor. It must be strategically placed in the home to properly capture the primary user movements.

Electrical Usage Sensor

This sensor sends a radio signal to the Lifeline home unit, and therefore to the GiraffPlus middleware, when a connected electrical appliance is switched on/off. It is intended to indicate when primary users have used a particular appliance, such as a kettle, microwave, etc. This sensor is activated when the power consumption is higher than 30W

Figure 6. Electrical power consumption.

Occupancy Sensor (bed/sofa/chair)

Occupancy sensors are pressure pads that can be placed on mattresses, sofas, chairs, etc. to check the time the user is resting. They need to be connected to a universal sensor to transmit the information to the Giraffplus middleware.

Figure 7. Occupancy sensor. This pad requires an universal sensor to wirelessly transmit the information.

Door Contact

This sensor detects when two objects are close. It is typically used for doors, windows, cabinets, etc. to detect when they are opened/closed. It needs to be linked to a universal sensor in order to transmit the information to the middleware.

Figure 8. Placed in two objects triggers an event when they are close enough.

Universal sensor

The Universal sensor enables wired devices and other equipment to raise wireless alarm calls and appropriate radio messages to home units using Plug and Play functionality. When the attached device is triggered, the Universal sensor sends the appropriate message to the ViLife unit, permitting the elements connected to the GiraffPlus middleware, e.g. the Context Recognition module, to be aware about the current situation.

Figure 9. Universal sensor. It permits any compatible device to wirelessly communicate to the GiraffPlus middleware.

4.3 Intellicare kit

The Intellicare Kit is composed by an android tablet and assessment kit that measures weight, blood pressure and glycaemia. The sensors communicate with the tablet over a Bluetooth channel. The tablet sends data to the middleware over Wi-Fi channel. More details can be found in D5.1.

4.4 Android-based sensors

Complementary monitoring system deploying an android-based mobile phone and a pulse oximeter is integrated into the GiraffPlus environment. The main purpose of the integration is a continuous monitoring of physiological parameters (pulse rate and oxygen saturation) and fall detection. Apart from the hardware integration (middleware on the phone connects to the mqtt broker running on the home service), we implement a joint reasoning approach. Context recognition of the home environment is communicating with the android device regarding the fall risk probability and informs secondary users in case of emergency..

4.5 Giraff robot

The Giraff robot is a telepresence device that allows remote user to connect and make a visit. It includes a camera with a fisheye lens, microphone, speaker and a 13.3" LCD screen mounted on top of a base that you can control remotely and move around in the remote location. The 13.3" LCD can turn 180 degrees to let the user see who is calling and to interact with the Giraff.
The user interface on the Giraff robot contains an answer button, hang-up button, volume knob and a touchscreen so the user can interact with the DVPIS system, everything else is controlled by the remote user to simplify the robot usage. The Giraff robot also includes a charging station where it charges its battery when not in a call.

On both the pilot and the robot side a plug-in API exist so the DVPIS application and the robot autonomy are able to interact directly with the Giraff system. This allows instant access for the user that needs to connect to the Giraff.

5 Software components

The software components deployed in each test site is installed in the home server computer, the secondary user computer and on the Giraff robot.

5.1 DVPIS@Office

The alpha release of the Data Visualization, Personalization and Interaction Service (DVPIS@Office) software will be provided as freely downloadable from Internet for secondary users: (1) formal caregivers (e.g., doctors, social workers); (2) informal caregivers (e.g., relatives). Then, secondary users will be able to install the DVPIS@Office on their own computers to gain access to the GiraffPlus system.

The DVPIS@Office provides access to different kind of information/services: (a) long term data analysis, for example, to observe trends for creating regular reports for different users, (b) short term reactive services, like in the case of alarms, to detect emergencies (e.g., fall detection sensors, emergency call buttons, etc.), (c) continuous asynchronous dialogues (e.g., in the case of social network channels, reminding services, etc.).

The DVPIS@Office. module is dedicated to secondary users strongly relying on query for the data storage service (see Section 5.4) through the exploitation of middleware services (see Section 5.3). Additionally access to the telepresence robot via its external interface is possible within the same comprehensive layout. At the time being, the DVPIS implements an interaction front-end to be executed on a personal computer but the technological choices allow us to develop also App-style versions for other mobile platforms like tablets or smartphones.

Currently, different services are provided for formal and informal caregivers. The personalization for a doctor or a social worker takes into account the fact that these workers may connect to multiple patients at home. Hence, the DVPIS environment manages different houses and helps the user to maintain information on the different cases he/she follows. The formal caregiver may

access data over time, although the specialized visualization environment allows a combination of queries that are able to generate different graphical views. The personalization for an informal caregiver (the current target is a relative of the person at home) is far straightforward. Such a person needs a more synthetic information and just report about warning over an interval of time. At present it is possible to ask for daily reports that contain a summary of the information of the day.

5.2 Remote Access

It is vital to enable remote support to all the test sites. Since we cannot account for specifics of all internet providers we install the following two components at each test site.

At each test site we install an OpenVPN client, which connect to the central VPN server (described in deliverable D5.1) running at giraffplus.xlab.si. In this fashion the server at each home becomes a part of the GiraffPlus Virtual Network, with a static IP.

A certificate consisting of a public and a private key is created using the GiraffPlus VPN Certificate Authority, which enables encrypted communication with other computers in the GiraffPlus Virtual Network, thereby taking care of communication security.

We recognize the importance of remote access and support in case of problems on the home server computer. To alleviate this problem XLab has provided necessary licenses for their ISL Online remote support and access software for the GiraffPlus project. This is an enterprise level software used by over 100000 businesses worldwide and will enable us to remotely connect to the home server computer through almost any network configuration we might encounter. In case of problems XLab will offer their full support in resolving any outstanding issues

5.3 Middleware

A middleware software layer will be installed on each home server computer. The middleware (described in details in D2.1 and D2.2) provides communication functionalities between software components deployed at home and on secondary user's personal computer.

Heterogeneity and distribution of both hardware and software resources is hidden by the middleware. Instead of providing different components at different levels of the system to access storage and context recognition functionalities, the current middleware architecture includes dedicated modules at the same level. Similarly, any device configured at home can be accessed in a homogeneous way by local and remote services.

The buses used to announce and discover resources installed at home (service bus) and the buses to access sensors' readings (context bus) need to be managed by a message broker that will be installed on the same home server and it will be accessed through the VPN by the remote clients. A test message broker is available at CNR-ISTI lab (146.48.81.82:1883).

In addition to communication capabilities, the current middleware layer presents APIs to retrieve historical and real-time sensor data and to query for activities in the monitored home environment. The following Sections will describe these dedicated modules.

5.4 Data storage

To enable all GiraffPlus components to store data (e.g. configuration data, logs, etc.) and to retrieve data from the GiraffPlus LTS[1] Web Service we install the GiraffPlus LTS component in the local middleware. This component takes care of all serialization and deserialization of data and efficient communication with the web service.
To secure communication with the Web Service we created the GiraffPlus Certificate Agency, which creates public and private key pairs for all components and servers in the GiraffPlus ecosystem. The web service thus requires each client application to present a valid certificate issued by the aforementioned certificate agency to authenticate that it is being accessed by a valid GiraffPlus component. In this way the communication security is independent from VPN if we ever decide to abandon the VPN in favor of another solution.

In addition to the GiraffPlus LTS Middleware component we deploy a GiraffPlus Data Listener Middleware component, which connects to the Middleware and automatically store all relevant published messages to the LTS database. In this manner all sensor data, which are published to the Middleware by corresponding Sensor components are automatically and efficiently stored in the database and thus reachable by other components through the GiraffPlus LTS Middleware component.

5.5 Context Recognition and Configuration Planning

New versions of the context recognition and configuration planning components are installed in the test sites. These new versions are described in Deliverable 3.2. Their integration is more advanced than at M12, and they have now been integrated as a single software unit. Their interfacing with the rest of the GuraffPlus system has been adapted to the new version of of the middleware and the database.

[1] Long Term Storage