DELIVERABLE

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D 4.3 Deployment Scenarios and Manufacturing use cases

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1. Introduction

This deliverable describes the implementation of the use cases in two Living Labs and their partner SMEs in the cross-border network of Living Labs. Between the Living Labs, technical developers have collaborated and gathered experiences from deployment of the platform on their native systems & integrating with the other applications being used for use cases.

The use cases described in deliverable D4.2 were implemented in the Living Labs and partner SMEs of WP4. During the activities, bugs and errors of the platform were identified and reported back to the developers at Future Factory Living Lab of SAP Research Center Dresden, Germany. The platform related issues are addressed by the SAP Research Center Dresden and new version of platform is shared with the partners.

2. Implementation of Use cases

This section illustrates the activities carried in collaboration with WP4 partners and the involvement of each partner in implementation of use cases.

2.1 Activities at Future Factory LL (SAP Research) – Germany

The Future Factory living lab of SAP research Dresden is WP4 lead and its activities are exemplified below.

a) The activities at Future Factory Living Lab of SAP Research Center Dresden as WP4 lead comprises of Definition and introduction of the use cases, which can be implemented in collaboration with partner living labs and SMEs at their site(s), to all the stake holders of WP4. Discussions on uses cases and finalization of three use cases to be implemented. Each living lab, in Germany, Portugal and Hungary, together with partner SMEs will implement two of the three use cases.

b) Providing the prototype Middleware for Device integration and its documents to the living lab partners in Germany, Portugal and Hungary. The platform is also provided to the participating SMEs of the WP4 on eManufacturing and associated with respective living lab in their countries Germany, Hungary and Portugal.

c) Tutoring, Coordination and support the partner living labs and their associated SMEs with the technical know-how of the platform which enable them to use it or develop the agents for their use cases.

d) Since the provided middleware prototype is a work in progress prototype, therefore technical support for errors and bugs reported by the partners are fixed and or guidance is provided to overcome the errors.

e) Provide legal and administrative support for compliance with the SAP intellectual property right protection policy as the platform is SAP proprietary.

f) Implementation of Plant Energy Monitoring and Management use case and Tracking and tracing of tools and material in a factory environment use case at future factory living lab in Dresden in cooperation with partner German SMEs.

g) The coordination, contribution and quality control of the deliverables to EU.

2.1.1 Middleware for Device Integration

The prototype MDI platform is a work in progress to improve the performance, to add new functionalities and to fix the reported bugs and errors. The platform was introduced to all the stakeholders of WP4 in a face to face workshop organized in Dresden. After signing of consortium agreement, grant agreement and SAP required NDA and software development license agreement (SDLA) respectively the platform was shipped to the partners living labs and their partner SMEs via SAP tool SapMats. The shipment includes the software for use and development kit as well as documents to help the user

and developers. A SAP Research center Dresden researcher is designated with whom partners were given freedom to contact during working hours on working days (by email, phone or conference calls) in case of problem faced by them and or any bug or error occurs, so that the problem is reported back to SAP as early as possible and a solution can be provided. In addition to it a regular weekly conference call among the entire stakeholder takes place which also include the operational issues with the platform. The addressed issues and bugs are incorporated into monthly release of the platform and shipped to the stakeholders. To clarify the questions raised by the error reporter or more clarification sought by the SAP, need base discussion are taking place through conference calls. The detail information about the MDI had been included in the deliverable 4.1 and 4.2 of WP4.

2.1.2 Partners

a) SAP AG, Germany: SAP is the world's leading provider of business software, offering applications and services that enable companies of all sizes across more than 25 countries to become best run businesses. SAP Research is the global technology research unit of SAP AG. The group significantly contributes to SAP's product portfolio and extends its leading position in the market by identifying and shaping emerging IT trends and generating breakthrough technologies through applied research. SAP researchers explore opportunities that haven't yet been developed into products.

   In APOLLON project the SAP Research is contributing in the WP1, WP4 lead and WP6. In context of the project APOLLON SAP research Dresden is providing the Middleware for Device Integration prototype to partner living labs and their associated SMEs as described in previous section. It is also responsible for implementation of two use cases (listed below) with the partner SMEs.

b) Ubigrate (SME): Ubigrate is specialist for business activity monitoring, as well as the integration of heterogeneous device landscapes in logistics and production. It develops integration software modules that serve as powerful building blocks for IT-solutions. Ubigrate partnered in APOLLON's Plant Energy Monitoring and Management use case.

c) Agilion (SME): Agilion designs wireless radio technologies, communication infrastructures as well as integrates wireless interfaces to customized products. Agilion is partner in APOLLON's Tracking and tracing of tools and material in a factory environment use case.

2.1.3 Implemented use cases

a) **Plant Energy Monitoring and Management**: The representative block diagram of the implemented use case is shown in Figure 1. There are four smart energy meters connected to four different machines at future factory living lab in Dresden. The machines are milling machine, drill machine, another milling machine and a small assembly machine. The data of power consumption by each machine is measured by the smart meters and sent to the MDI through CC link and partner SME Ubigrate developed adapter (glasnost). The data can be accessed by the SAP energy dashboard for displaying the real time data and also stored in external database. The external database used is

the NewDB database of SAP although any other database can be used which is accessible through the agent facilitated by the middleware e.g. JDBC agent.

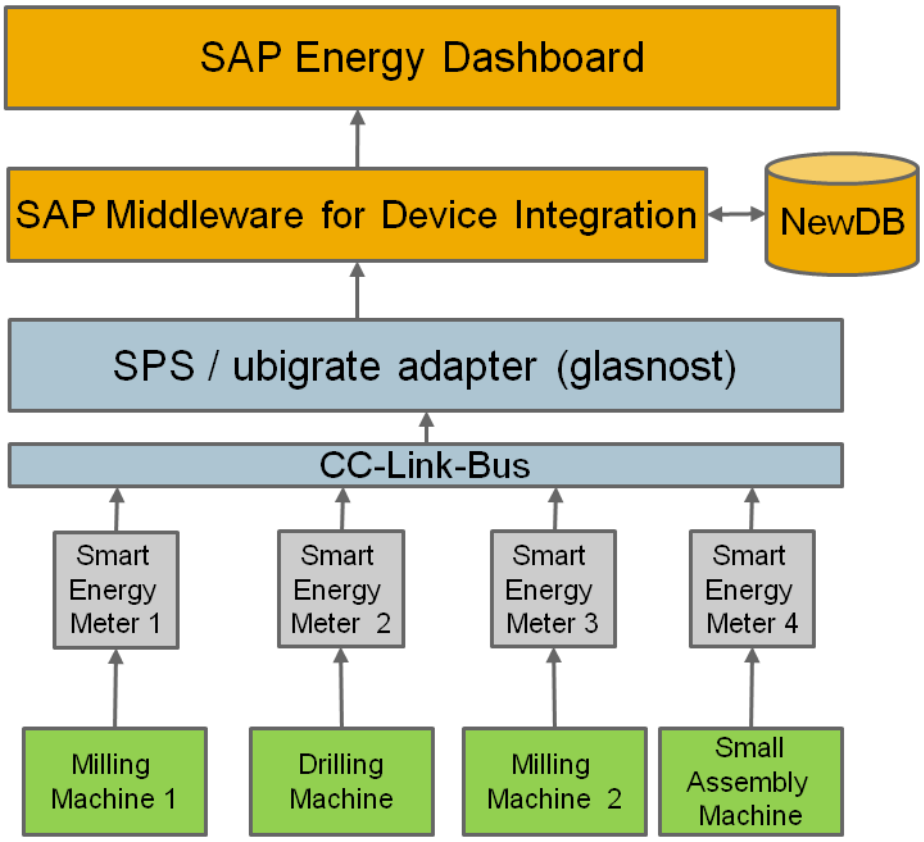

Figure 1: Representative Block Diagram of Implemented use case
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SAP energy Dashboard prototype (Figure 2) is a user interface based on Silverlight technology of Microsoft. It displays the list (and photo of selected equipment) of equipments/machines, current power consumption, current month power consumption and cost connected etc. It also displays the bar chart of current power consumption by various machines and pie chart of consumption of current month.

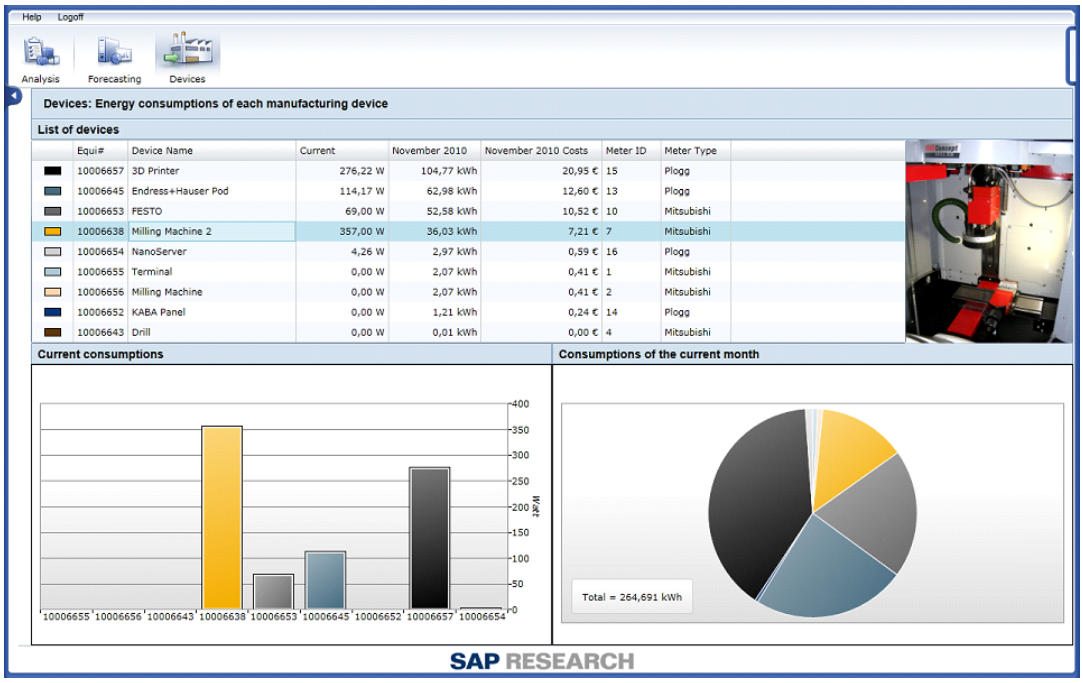

Figure 2: Energy Dashboard prototype © SAP AG, 2010

b) Tracking and tracing of tools and material in a factory environment:

The tracking and tracing of tools and material in a factory environment use case is implemented at the Future Factory living lab in collaboration with SME partner Agilion. Agilion supported with the wireless tags, anchors, Gateway and related software. The block diagram of the use case is shown in the Figure 3.

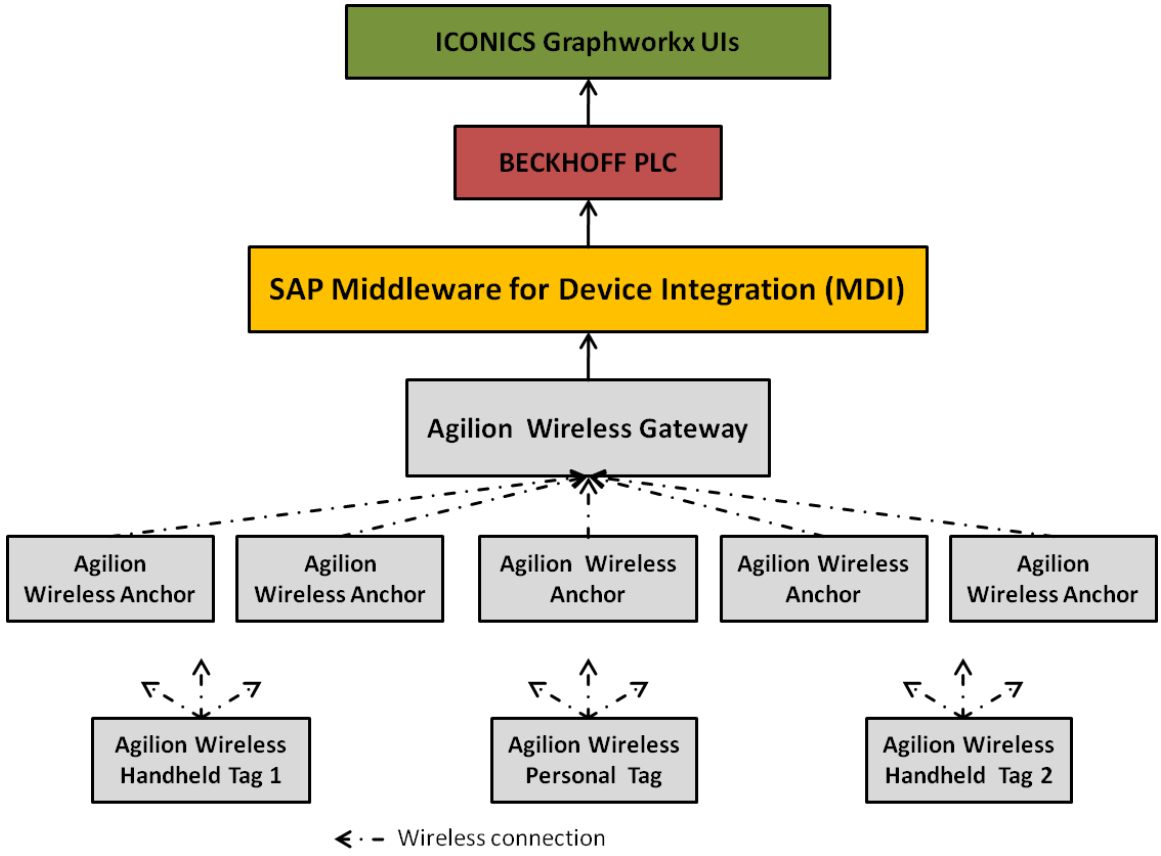

Figure 3: Block Diagram of Implemented use case
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Two types of wireless tags are used; personnel tag and handheld tags. One personnel tag is carried by the personnel working in the Future Factory and other two handheld tags attached with the tools and material (e.g. tool cart). At present only three tags are being used, but more tags can be used with the existing setup. The location of tag is calculated with respect to the five anchors mounted on the roof of the future factory. These anchors calculate and communicate the geographical location of the tag and subsequently the object on which tag is attached. These five anchors cover the entire area of future factory living lab. If the premise of the shop floor is big then higher numbers of anchors may be required to cover the entire floor area and also to provide the precise location of the tagged object being tracked. All the anchors communicate with the Middleware software through the Agilion gateway. The data processed by MDI and communicated to the BECKHOFF PLC and finally to the ICONICS GraphWorkX UIs. The ICONICS GraphWorkX UIs present the location data in user friendly format (Figure 4).

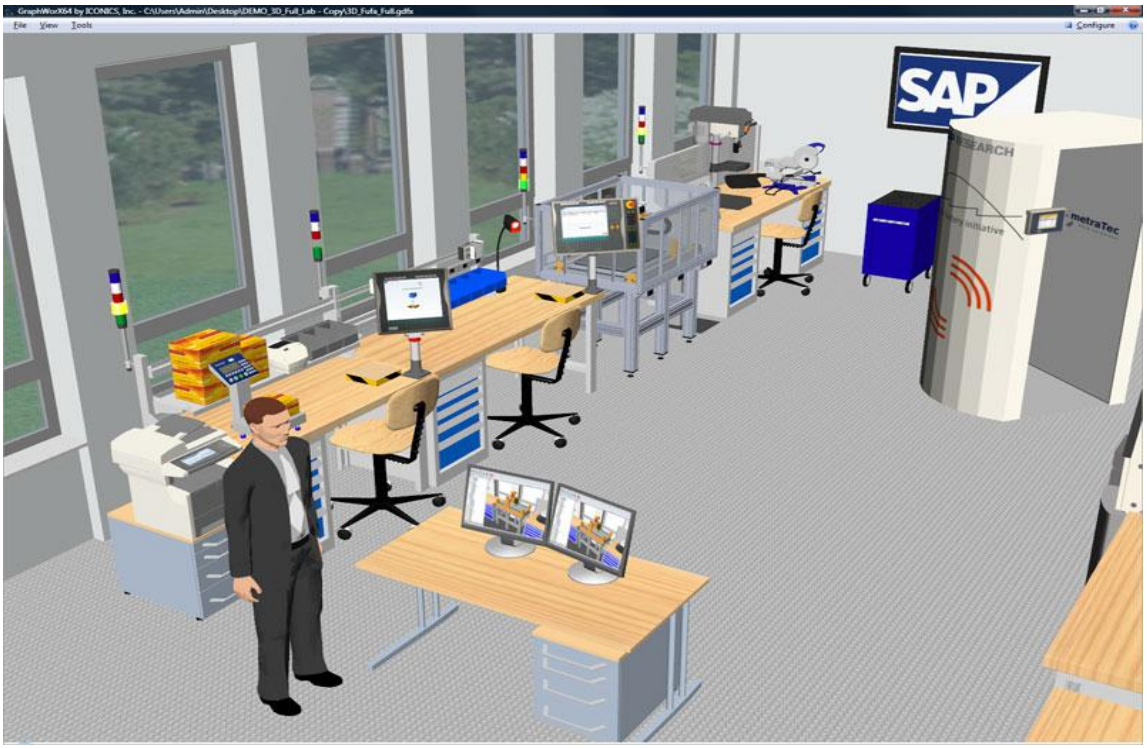

Figure 4: User Interface showing the location of tagged person in the Future factory Living lab © SAP AG, 2010

2.2 Activities at Fiapal LL – Portugal

The Fiapal Living Lab coordinated the activities in Portugal as described below:

a) Evaluation of technical conditions and requirements for platform deployment in the local partner SMEs

b) To understand the platform: characteristics, limitations and potentialities. Developing and or configuring agents for additional communication systems e.g. web services and Bluetooth for the Fiapal LL responsible use cases.

c) Maintain coordination weekly meetings with WP4 PT team: Fiapal, Ydreams, Alfamicro, CENI, Imeguisa and ISA.

d) Keep an open and reliable flow of information between all participants locally and with partners in Germany. Foster direct communication between technical developers in both Living Labs.

e) Implementation of Energy Consumption Monitoring use case at Imeguisa. Close monitoring and support to the team to overcome any problems and difficulties.

f) Implementation of Asset Viewing and Management use case at CENI. Close monitoring and support to the team to overcome any problems and difficulties.

2.2.1 Partners

a) Fiapal (LL): Fiapal LL is a network for business in the Portuguese automotive engineering and manufacturing industries and services in the supply chains of the industry. Fiapal LL provides the support for its members to integrate into the global mobility industry and to improve the range of products and services.

   In APOLLON project Fiapal has developed activities related to the selection of SMEs and preparation of the experiments. Fiapal is a facilitator between Future Factory LL of SAP Research Center, Dresden and local SMEs in the Portugal and coordination of all related WP4 activities in Portugal.

b) Alfamicro (SME): Alfamicro was founded in 1983 and over the years it has also developed applied research with the aim of further develop the technologies utilized in the implementation of new working paradigms such as electronic commerce, digital collaborative business, dynamic virtual work environments, innovation networks, living labs, energy efficiency, e-learning and semantic GRID with the objective of supporting companies to achieve sustained global competitiveness. Alfamicro has participated and coordinated a large number of ICT projects applied to SMEs in Portugal and beyond. It is currently the project coordinator of SAVE ENERGY, and the project coordinator of PERIPHÈRIA. Alfamicro is also a founding member of the European Network of Living Labs.

   In the APOLLON project, Alfamicro is contributing in WP3 lead, WP4 and WP6. In the context of WP4, it has been promoting the Living Lab methodology and solutions in the eManufacturing experiment.

c) Ydreams (SME): YDreams is a global company that researches and develops proprietary/patented technologies in areas such as image processing, augmented reality and gesture-based interfaces, resulting in best of breed solutions that are integrated into projects and products, or licensed to partners.

   In Apollon, YDreams is responsible for the implementation of the use cases in Portugal. Mainly the integration of the technical solution established for these two use cases with the SAP´s MDI platform.

d) Imeguisa (SME): Imeguisa is an industrial SME conceiving and producing special solutions for materials management for the automotive industry e.g. specific containers, racks and handling devices.

   In Apollon project Imeguisa has participated in the implementation of Energy monitoring use case, in coordination with the partners. It supports all the activities of installation and use of the smart meters from company ISA.

e) CENI (R&D Center): Centro de Integração e Inovação de Processos, is a private and not for profit R&D association for research in the area of Industrial Logistics and Organizational Processes. Ceni is involved in research projects,

at national and EC level, developing areas of excellence in Simulation of manufacturing systems; Production and process planning; Analysis of materials flow and energy; Environmental, quality and safety; Process design; Performance measurement and evaluation. Ceni is also transferring best practices in direct projects with industrial companies and training human resources through its Learning Factory.

In Apollon project CENI has participated in the design of the asset viewing use case and selection of parameters to measure, in coordination with the partners. Definition of technical specifications of the use case and testing of data acquired from the devices, Design of dashboards with Ydreams.

2.2.2 Implemented use cases

a) Energy Consumption Monitoring Use Case

This use case in the Fiapal Living Lab has been implemented in the SME Imeguisa. The representative block diagram of the implemented use case is shown in Figure 5. The energy consumption monitoring is done with three smart energy meters. One meter is connected to the main electricity board through which all the machines are powered and two meters are connected to the two key machines; CNC milling machine and Pipe forming machine individually.

The data is collected from the smart meters by an ISA proxy; it is then cached and made available to the MDI web service agents. The MDI then process and save the data in the external database or communicate to the energy monitoring UI.

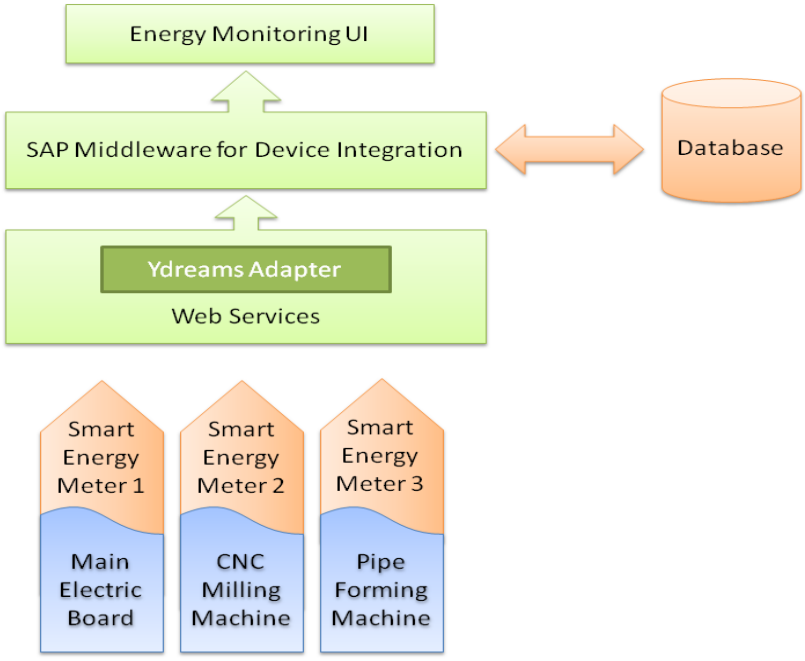

Figure 5: Block diagram for Energy Monitoring use case

Prototype for User Interface is presented in Figure 6. The data available to the end user reflects effective consumption and additional measurements required for improvement activities in energy saving.

Displayed data as received from the smart meters and calculated for cumulative figures:

Active energy, reactive energy, power factor

Active power, reactive power, apparent power

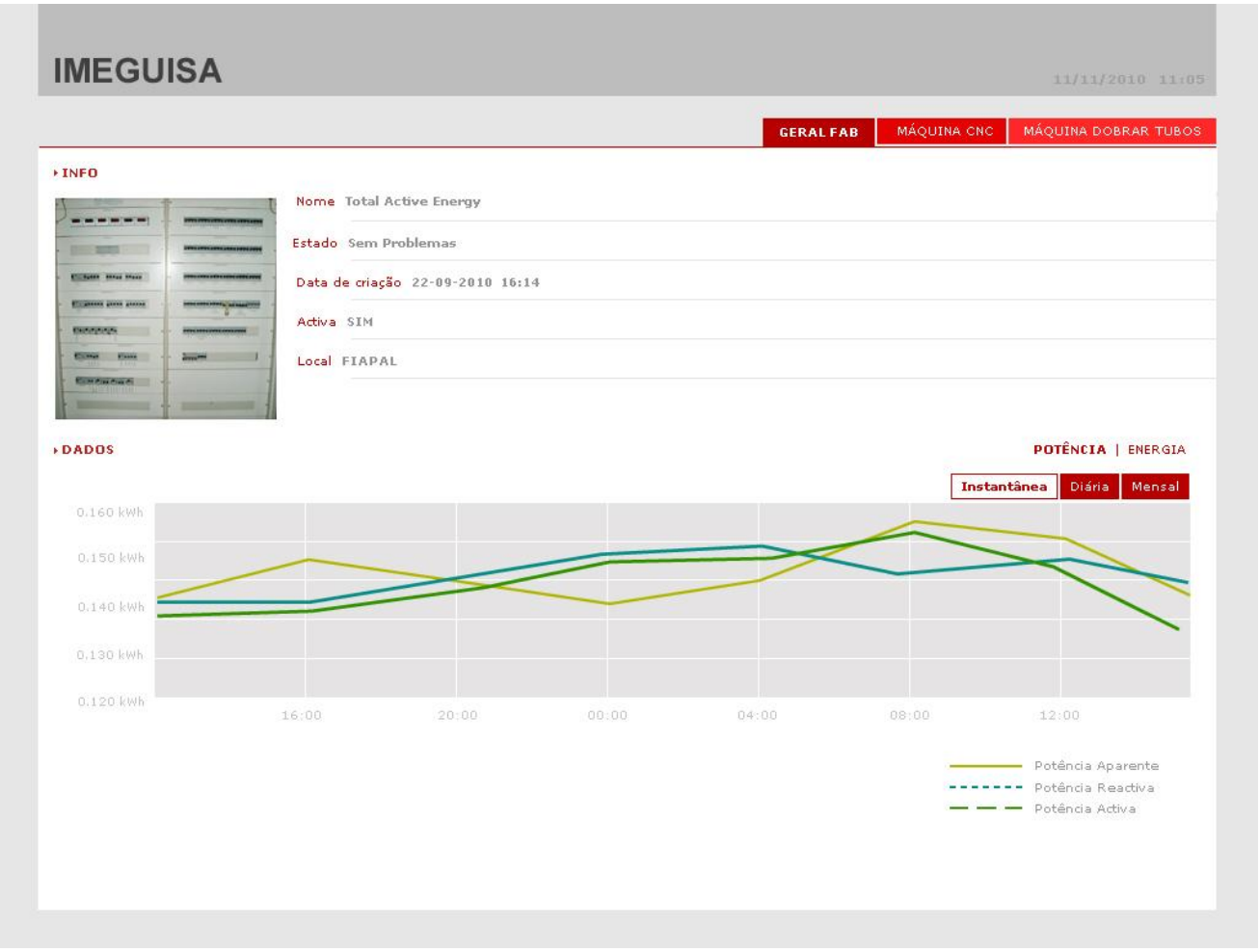

Figure 6: UI prototype for Energy Monitoring

b) Asset Viewing and Management Use case

This use case is being implemented in CENI. The representative block diagram of the implemented use case is shown in Figure 6.

Each workstation is equipped with an electronic interface module that reads the device default protocol and communicates through Bluetooth to the central server. This solution intends to provide workstation´s mobility in a factory environment.

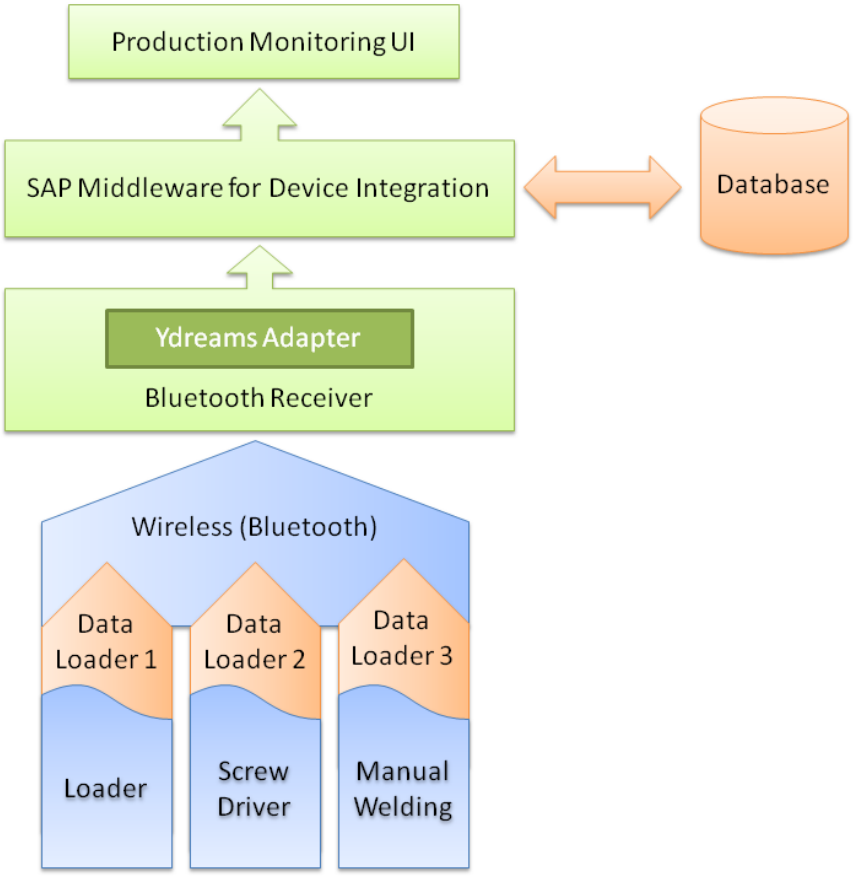

Figure 6: Block diagram of implemented use case

The data available to the end user enables a reliable monitoring of the production of the three assembly stations. Data processed per station is shown in real time and in cumulative figures as follows:

Loader – equipment status, production output and cycle time;

Screw driver – equipment status, production output, cycle time and not OK parts;

Manual welding – equipment status, production output and cycle time.

The User Interface prototype is presented in Figure 7.

Figure 7: UI prototype for Production Monitoring

3. Collaboration Methodology

The collaboration in this first stage of the project has been done in a very open and direct way. Coordination meetings and Project follow-ups have been done on a regular basis using the project's MyBBT portal, weekly telephone and Skype conference calls and email communication. Direct communication between technical developers has been of extreme importance for the resolution of issues and use cases' successful implementation. The sense of trust between team members created in this phase is a sound basis for the progress of project and next challenges in this project.

In close cooperation with *Work Package 1 – APOLLON Methodology;* the manufacturing experiment is developing tools and methodologies that will drive the next level of cross-border Living Lab collaboration.

Two of the APOLLON methodology elements, namely the Research and Evaluation Framework are currently being applied in the pilots. Starting with an initial session the Research Framework analyzed the manufacturing experiment starting point

and established a common approach in terms of collaboration methodologies amongst the vertical pilots. Progress is monitored and evaluated in subsequent cyclic 3-monthly sessions of which the first has been executed with the manufacturing liaison person from Work Package 1.

Along the 4 phases of the Living Lab network lifecycle (Connect, Set Boundaries and Engage, Support and Govern, Manage and Track) requirements and early solution prototypes have been derived. The requirements in particular from the perspective of SMEs in the manufacturing sector are mainly driven by six KPIs:

1. Acquisition of new customers
2. Supplier relationship management
3. Public visibility and marketing
4. Sensing and identification of market demands and customer requirements
5. Co-innovation with partners
6. Tracking of technical improvements

The following depicts the main activities and findings in terms of methodologies and tools from the manufacturing perspective that are associated with the distinctive LL networking phases.

Connect

The current engagement in the manufacturing Living Labs misses any advanced mechanism to get further Living Labs or partners on board. As an example about 25 partners form part of the Living Lab in Dresden and the synchronization between them is mainly based on personal communication between individuals. There is no systematic awareness of similar activities in other globally distributed Living Labs that offer synergies or further business opportunities.

This challenge is being tackled by the so called 'lab finder' and 'living lab profiles' that form part of a comprehensive Living Lab Knowledge Center, see figure 8. The Knowledge Center adds other useful information in particular for SME's, e.g. a best practices section that is going to be developed also taking lessons learned from the manufacturing pilot into account.

Figure 8: The early prototype of a Living Lab Knowledge Center

Set boundaries and engage

SMEs desperately need a clear and open communication on the strategic direction of the Living Labs they are participating in. In particular short and midterm commercialization opportunities and plans are of utmost importance. Because of limited resources a short term Return on Investment is the key for sustainable participation of SMEs.

A systematic information management (e.g. on news) that is not only built on personal relationships is highly desirable. A structured communication plan combined with basic communication means (email, teleconferences etc.) has been sufficient so far to stay in sync.

More advanced online communities or dedicated social networking tools are considered for the future. As a next step a LinkedIn group will be set up also to let a wider community participate and collaborate in the use case development. In cooperation with Work Package 1 feedback on the APOLLON methodology could be collected more easily, faster and immediate. In a more advanced stage the publishing of RSS-Feeds with updates from the Knowledge Center to the LinkedIn Groups would be possible and add value to the manufacturing experiment community.

Support and govern

In terms of contractual agreements the consortium agreement and a SW development license agreement has been prepared and applied. The negotiations took lots of efforts and a more automated procedure is necessary. Certain limitations on IPR, public communication, logo usage etc. impedes on the success of new product and service development. Public dissemination, e.g. via Blogs, websites etc. could achieve higher impact if legal restrictions are low.

Manage and track

The technical deployment of services on top of MDI requires continuous tracking and synchronization on development cycles, release strategy, addressed customers or target market. On the other hand SAP providing MDI need to be able to track implementation and configuration of MDI instantiations in particular at customers and service developers. For this purpose a communication platform on technical deployment and usage is needed (e.g. alerting, notification, status tracking on platform configuration, service development etc.). The platform has to be web based and scales with the number of participating partners that built services on top of MDI.

4. Summary

In this document we have briefly described the use cases implemented or being implemented in the Living Labs in Germany and in Portugal and the collaboration. During implementation an active collaboration has been achieved between all team members across the border. The middleware clearly facilitates the collaboration among the SMEs at different locations. The developments skills actually existing in the SMEs in Germany and Portugal enable the interchange of services e.g. an agent developed in Portugal can be used in Germany and vice versa. The transnational WP4 team is prepared for the next challenges in this project.