

Brief presentation of FI-STAR

Nowadays, there is an increasing consensus that the impact of Information and Communications Technologies (ICTs) on healthcare organizations could be considerable due to the emergency of the Future Internet concept that is established over innovative technologies such as cloud computing and Internet of Things (IoT). This work presents the FI-STAR project that aims to implement the next generation of healthcare supporting applications, based on 7 Use Cases in Europe, utilizing FIWARE state-of-the-art services.

FI-STAR:

- It will offer new opportunities for cloud providers, web entrepreneurs and Small & Medium Enterprises (SMEs) to commercialize their products and services and
- It will allow healthcare providers to improve efficacy by implementing services based on FIWARE. FI-STAR offers a public cloud development platform allowing enablers to be instantiated at customer's private clouds.

Read more (<http://www.sotiriadis.gr/publications>):

- Sotiriadis, S., Petrakis, E.G.M. and Covaci, S. "Advanced healthcare provisioning based on Future Internet technologies", EURESCOM message, The magazine for telecom insiders, Summer 2015
- Vakanas, L., Sotiriadis, S. and Petrakis, E. (2015) Implementing the Cloud Software to Data approach for OpenStack environments, Adaptive Resource Management and Scheduling for Cloud Computing, Held in conjunction with PODC-2015, Donostia-San Sebastián, Spain, on July 20th, 2015
- Sotiriadis, S., Bessis, N., and Petrakis, E. (2014). An inter-cloud architecture for future internet infrastructures. In Pop, F. and Potop-Butucaru, M., editors, Adaptive Resource Management and Scheduling for Cloud Computing, Lecture Notes in Computer Science, pages 206-216. Springer International Publishing
- Sotiriadis, S., Petrakis, G.M.E., Covaci, S., Zampognaro, P., Georga, E., Thuemmler, C. (2013) "An architecture for designing Future Internet (FI) applications in sensitive domains: Expressing the Software to data paradigm by utilizing hybrid cloud technology", 13th IEEE International Conference on BioInformatics and BioEngineering (BIBE 2013), November 10-13, Chania, Greece

Advanced Healthcare provision in ICT domain based on Future Internet developments of FI-STAR project

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Nowadays, there is a increasing consensus that the impact of Information and Communications Technologies (ICTs) on healthcare organizations could be considerable high due to the emergency of the Future Internet (FI) concept that is established over innovative technologies such as cloud computing and Internet of Things. FI-STAR is fundamentally based on this, as a EU FP7 project that aims to implement the next generation FI applications in the area of healthcare by taking advantage of FIWARE state-of-the-art services. These are cloud applications and services for healthcare provision centered on the needs of the patient. However due to personal, private and confidential information, FI-STAR builds a software to data platform to prevent disclosure or misuse of sensitive data. The project establishes early trials in the healthcare domain building on FI technology. It is expected to highlight new opportunities in the area of health care provision including new personalized applications and services that utilize Internet of Things devices acting as the integration and orchestration strategic plan for secure FI healthcare services.

Personalized Health Care using the Future Internet concept

In recent years cloud computing has been fostered as the technology to offer virtualized resources to Internet users on a bespoke manner. This includes hardware, software and platform that could be delivered as a service. For many areas such as industry, agriculture etc. this has been served as an efficient approach with regards to the minimization of operational costs and increased elasticity; yet not in the healthcare domain. Data stored in cloud are usually available over the Internet and could contain confidential and private health information. Today there are various standards, regulations and recommendations such as national legislation, ISO standards (ISO 80001) and the need to comply with security standards (ISO 27000), thus there are severe restrictions to data transfer and storage. As a result, cloud computing that is profoundly based on the Internet and openness, becomes a hurdle to its adoption in health care. To overcome it, the FI-STAR project designs and

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implement suitable software to data solutions based on Generic Enabler (GE) technology provided by FIWARE to build secure healthcare applications. In future, it is expected that the FI-STAR platform will (a) highlight new opportunities in the area of health care provision in combination to the IoT and (b) will define the integration and orchestration strategy for secure FI healthcare services. In such cases data will be collected from the IoT devices of the user (e.g., wearable sensors that are connected to a smart device) for allowing personalized and user-tailored healthcare. The data will be processed on the patient's smart device, and will be transferred through secure data connections to a private data storage on the private cloud which makes it accessible to the health care application provider. The application will be composed from private cloud services in the form of ready to use Software as a Service instances offered by the cloud providers.

The FI-STAR platform and beyond

The FI-STAR platform is made by a set of software modules, namely as Specific Enablers (SEs) that fulfill the requirements of the health domain. It makes the shift to an innovative technology that incorporates (a) a cloud platform with available SEs and (b) a software to data cloud model for secure SE deployment. Since health care APIs have been characterized as one of the very resistant areas to be hosted on public clouds this approach ensures a future global adoption. In FI-STAR, we are driven by the opportunities of utilizing FIWARE solution in the health domain for enabling adaptation of new standards. The advantages are twofold, (a) it will offer new openings for cloud providers, web entrepreneurs and Small-Medium Enterprises (SMEs) to commercialize their products and services and (b) it will allow health care providers to improve efficacy by implementing services based on FIWARE. FI-STAR platform offers a public cloud to allow GEs and SEs to be instantiated at consumer private clouds. Figure 1 demonstrates the FI-STAR platform model that includes the FI-STAR use cases that utilize the FI-STAR platform components as front-end and back-end Specific Enablers (SEs) such as Event Service etc. deployed in Technical University of Crete (TUC) and in Technical University of Berlin (TUB) to build healthcare applications. The lower level is the FIWARE platform that provides the GEs such as Context Broker etc. as general building blocks for SE developments.

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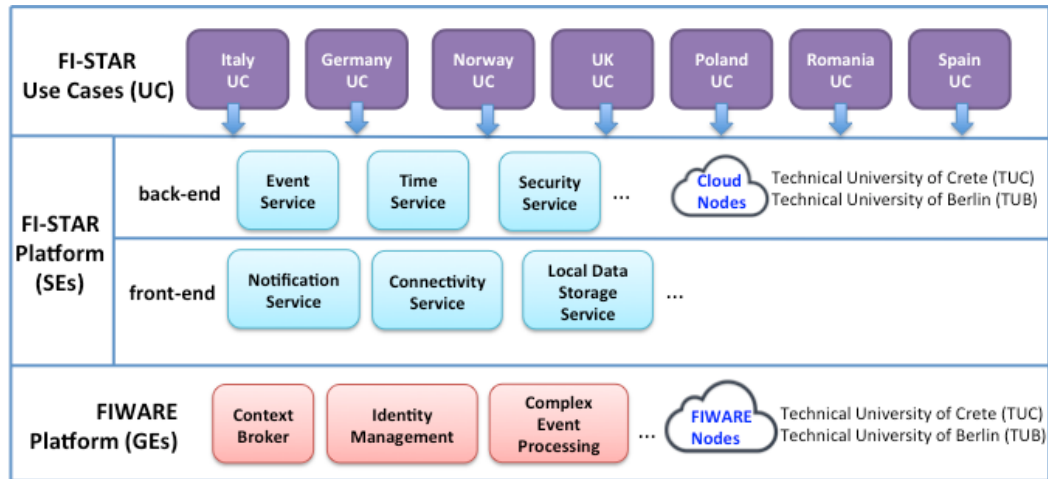


Figure 1: The FI-STAR platform model

In FI-STAR we expect to allow next generation healthcare systems to emerge naturally. Particularly, a crucial aspect of future healthcare is the personalization and user-tailored services in order to deliver a high quality customer experience that is individual-based, handy, appropriate and convenient. In detail, solutions utilizing FI-STAR platform will design FI applications to improve the quality of the health care services provided while at the same time to assist on reduction of the cost of healthcare since adaptive monitoring will allow patients to spend less time in the hospital. By this way we can ensure constant health observation of health data will be measured by wearable sensors as they go about their daily activities. This will include tele-monitoring, personalization of health and care plan including communication, trust and privacy of sensitive data, knowledge creation and sharing for collective intelligence purposes, and advanced decision taking processes for caregivers, patients and information providers.

Innovative developments: FI-STAR use cases

FI-STAR develops advanced FI applications for healthcare provision use cases. These are: (a) the tele-health network (Norway) for diabetes patients that use smart phones, (b) the 2-D bar-coding reverse supply chain (in UK) will for preventing errors and counterfeiting, (c) the FI based service for people with mental-health (Spain), (d) the integrated network of different application and devices for general practitioners and specialists to monitor real-time data (Italy), (e) the virtualization of the operating theatre for reduction of errors (Germany), (f) the e-health services for treatment of cancer patients (Poland) and (g) the cardiology real-time service for people with heart failures (Romania). The use cases demonstrate a diverse set of scenarios where FI-STAR expects to enhance systems intelligence and performance. In addition, it is expected to act as a trigger for more advanced developments as the straightforwardness of the FI technology will made easier than ever to deliver efficiently personalized digital experience that moves beyond the basics and offers a unified experience. This will happen through improvements of the monitoring of patients in terms of better access to information and communication between doctors, caregivers and patients.

Conclusions

FI-STAR highlights new opportunities and openings for wider adoption of FI technologies in the health healthcare domain. Potential future solutions will aim to offer an innovative infrastructure demonstrating improved usability and adaptability in integrated and personalized healthcare, taking advantage of improved interactions between patients and their carers. This could include more active participations of patients and persons from their social context (family and health carers) during the care processes. The technological solutions that will be based on the FI-STAR platform will be reconfigurable and interoperable by accommodating future needs for the application domain including new IoT sensor technology and adapt to the needs of different application domains (demonstrated by the diversity of FI-STAR use cases). Also it will be scalable with no limitations to the number of users or to the amounts of data it can serve while it will be secure by applying certain procedures enabling privacy and secure data handing over the Internet. FI-STAR will impact on improved utilization of human and technology resources for providing personalized medical care in real time and on effective utilization of reinforced medical knowledge in a generalized manner. This will be useful for a large number of people that can be supported remotely based on highly accessible, low-cost and clinically effective service models.