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e-Health Technical Committee NewsLetter

March-April, 2017

On behalf of the e-Health Technical Committee (TC) of the IEEE Communications Society (ComSoc), we wish all our members a very instructive reading of this letter.

The contribution for this edition is coming from an EU research project called AEGLE. The AEGLE framework for Big Data analytics will improve translational medicine, facilitate personalized and integrated care services, and to promote data-driven research across Europe. AEGLE has chosen three medical use cases to focus the biomedical research and set the basis for bio-signal and bioinformatics analytics, multi-parametric pattern mining, and integrative predictive modelling. The use cases are Chronic Lymphocytic Leukemia (CLL), Intensive Care Unit (ICU) and Type 2 Diabetes (T2D).

Members of the e-Health community are invited to contact the author for further information or collaborations.

We also welcome all our members to share their research activities and field experiences through this open newsletter and to open up new opportunities for discussions and collaborations.

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RECONFIGURABLE COMPUTING FOR ANALYTICS ACCELERATION OF BIG BIO-DATA: THE AEGLE APPROACH

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I. INTRODUCTION

Nowadays, there is an obvious gap in the area of big data analytics for Health Bio-data. Data-driven services are still needed to cater for the data versatility, volume and velocity within the whole data value chain of healthcare analytics. A true opportunity exists to produce value out of big data in healthcare with the goal to revolutionize integrated and personalized healthcare services, which have been recently introduced for the management of complex medical conditions e.g. various chronic disease conditions, chronic malignant and non-malignant disorders.

The AEGLE project [1] targets to address the aforementioned open issues by implementing a full data value chain to create new value out of rich, multi-diverse, big health data. The project builds upon the synergy of heterogeneous High Performance Computing (HPC) exploiting reconfigurable architectures, Cloud and Big Data computing technologies, offering tools for a seamless use of different sorts of capacity across HPC, Cloud, Grid and Big Data computing for the benefit of all

areas of Horizon 2020. AEGLE will provide a framework for Big Data analytics for healthcare that will overall enable and promote innovation activities that place health at the spotlight.

II. HEALTH SCENARIOS FOR BIG BIODATA ANALYTICS

Chronic Lymphocytic Leukaemia (CLL): CLL is a chronic, incurable disease, leading to great distress for patients and their families as well as huge costs for the health care system. Analysis will be performed to address complex clinical questions and scenarios associating phenotypic data with personal genetic profiles. In addition, AEGLE will offer the possibility of proposing and evaluating health interventions towards the goal of integrated care e.g. identifying groups with specific profiles that will be considered as eligible or ineligible for certain treatments and, at the same time, evaluating the cost of this intervention.

Intensive Care Unit (ICU): In an Intensive Care Unit (ICU) context, patient bio-signals are continuously monitored and displayed towards recognizing alerting events. The recordings of clinical, laboratory data and physiologic waveforms could be analysed and displayed in an easy-to-understand manner for clinicians. AEGLE scalable data analytics will provide automated analysis of the fast changing multi-dimensional functions of variables for the detection of unusual, unstable or deteriorating states in patients. In this respect, early and personalized treatment will be feasible using AEGLE technology for higher survival in ICUs around European Hospitals.

Type 2 Diabetes (T2D): The risk of developing T2D can be increased by various factors; usually a mixture of modifiable and non-modifiable elements of age, weight, genetics and ethnicity. The AEGLE system will analyse the inter dependences of the factors including medication that are known to have a detrimental effect in type 2 diabetes to give a prediction on the potential deterioration. This would enable intervention to enable reduction of mortality, complications and hospitalization that would all lead to reduction in overall health costs.

III. THE AEGLE INFRASTRUCTURE

Figure 1 depicts the main building blocks of AEGLE big data analytics framework, which provides services at two levels:

Local level: The local level implements big data analytics services for real-time processing of large volumes, fast generated and multiple-formatted raw data originating from patient monitoring services. An example is the real-time analytics service that AEGLE will implement for the scenario of ICU to detect unusual, unstable or deteriorating states of patients given the fast changing multi- dimensional variables conveyed within the bio-signals generated by ICU dedicated equipment.

Cloud Level: The cloud level analytics services will offer an experimental big data research platform to data scientists, workers and data professionals across Europe. The platform consists of a large pool of semantically-annotated and anonymized healthcare data, a set of libraries implementing state-of-the-art big data analytics methods including the local level big data analytics AEGLE services and APIs for federating with public and private data sets. Advanced visualisation tools will be implemented by AEGLE, allowing data scientists to steer the cloud level analytics mechanisms with their own insights. SMEs across Europe will be given the ability to use of the AEGLE platform (according to the business model that AEGLE will define) in order to deploy and assess the validity of their innovative data analytics solutions which aim at creating new value in the field of healthcare.

IV. BIG DATA ANALYTICS ACCELERATION

BigData healthcare analytics operate on collections of large and complex data sets which are difficult to process using common database management tools. Several techniques and tools have been emerged for Big Data acceleration to address the increased complexity of applications' requirements. Within AEGLE, we target to go beyond state-of-the-art on Big Data services by

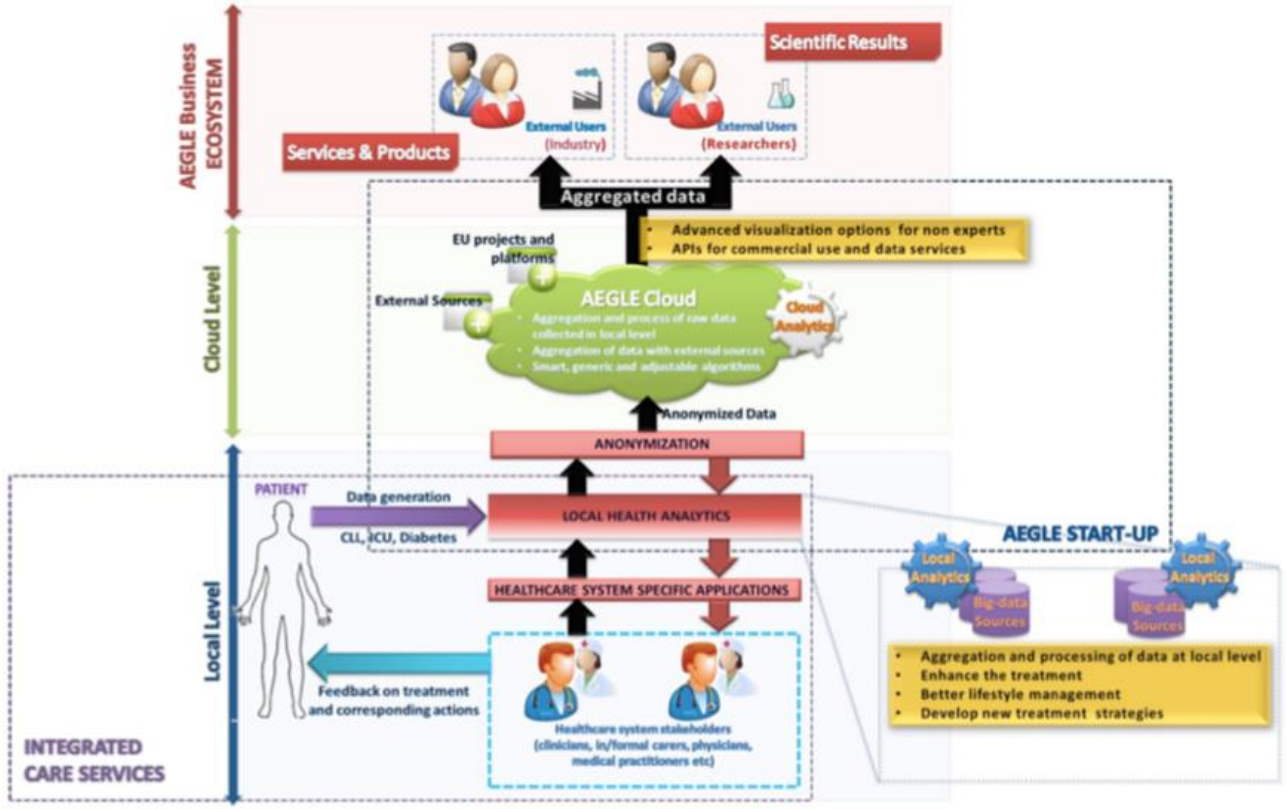

Figure 1: The AEGLE infrastructure

introducing an integrated infrastructure that exploits FPGA-based dataflow acceleration. Namely, customized DataFlow Engines (DFEs) will be developed in order to accelerate the:

- computation intensive kernels found in the targeted Big Data analytics procedures
- database management system (DBMS) that maintains the stored data.

IV. EXPECTED SCIENTIFIC AND SOCIETAL BENEFITS

AEGLE will provide more advanced mechanisms for analysis of data, while offering predictive modelling especially in critical situations. This could lead in short term evaluation of patient's condition estimation of evolution for any type of illness and at the same time facilitate the doctor's role by providing significant assistance via pattern recognition of the severity and the countermeasures for patient's condition. The social benefits in terms of integrated care and the use of big-data are the following:

- Improved interaction between patients, their relatives and carers, facilitating more active participation of patients and relatives in care processes
- Improved cooperation between the providers of health, social and informal care
- Reinforced medical knowledge with respect to efficient management of comorbidities
- Increased confidence in decision support systems for disease/patient management
- Increased level of education and acceptance by patients and care givers of ICT solutions for personalised care
- Reduced admissions and days spent in care institutions, improved disease management and treatment at the point of need, actual improvements in the daily activities of patients through the effective use of ICT and the better coordination of care processes

REFERENCES

[1] AEGLE: An analytics framework for integrated and personalized healthcare services in Europe. http://www.aegle-uhealth.eu

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CALL FOR TECHNICAL & INDUSTRY SUBMISSIONS

The 2018 IEEE International Conference on Communications (ICC) will include a Technical Program comprised of 13 specific symposia, tutorials and workshops as well as an Industry Program featuring panels, demonstrations, tutorials and workshops.

TECHNICAL SYMPOSIA PAPERS: Due 15 October 2017

Original technical papers are sought in the following areas:

- Selected Areas in Communications
- Access Systems and Networks
- Big Data
- Cloud Communications and Networks
- Data Storage
- E-Health
- Internet of Things
- Molecular, Biological and Multi-scale Communications
- Smart Grid Communications
- Powerline Communications
- Social Networks
- Satellite and Space Communications
- Smart Cities
- Ad Hoc and Sensor Networking
- Cognitive Radio and Networking
- Communications and Information System Security
- Communications QoS, Reliability and Modelling
- Communications Software and Services
- Communication Theory
- Green Communications
- Next Generation Networking and Internet
- Optical Networks and Systems
- Signal Processing for Communications
- Wireless Communications
- Wireless Networking

Technical Workshop Proposals

Proposals are sought that emphasize current topics of particular interest to the community on the latest technical and business issues in communications and networking.

Technical Tutorial Proposals

Proposals are sought for new and emerging topics within the scope of communications.

IF&E Proposals

Proposals are sought that focus on latest topics, products and innovations of particular interest to industry and government in communications and networking.

Industry Demonstrations

Hardware and/or software demonstrations are sought that are meant to showcase new and innovative technology.

IMPORTANT DATES

Technical Symposia Papers	Technical Workshop Proposals	Technical Tutorials Proposals	IF&E Proposals	Industry Demonstrations
Due 15 October 2017	Due 15 July 2017	Due 15 September 2017	Due 10 November 2017	Due 5 January 2018

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For more information, visit

http://icc2018.ieee-icc.org/

THE WINNERS WERE ANNOUNCED

Of the 300 teams that joined the pursuit of the Qualcomm Tricorder XPRIZE, Final Frontier Medical Devices and Dynamical Biomarkers Group were both announced winners at the Qualcomm Tricorder XPRIZE awards ceremony on April 12, 2017 http://tricorder.xprize.org/ . Final Frontier Medical Devices was announced the highest performing team and received $2.5M for their achievement and Dynamical Biomarkers Group received $1M for 2nd place. Both teams exceeded the competition requirements for user experience, nearly met the challenging audacious benchmarks for diagnosing the 13 disease states, and with their prototypes, have taken humanity one step closer to realizing Gene Roddenberry's 23rd century sci-fi vision. Cloud DX was also recognized as XPRIZE's first Bold Epic Innovator receiving $100,000, sponsored by Qualcomm Foundation.