GUEST EDITORIAL PREFACE

Special Issue on Service-Oriented Architecture in the Era of Big Data

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1. INTRODUCTION

In recent years, volumes of data produced by a variety of heterogeneous sources have increased around the world. As a result, both Information Technology (IT) and business users need to efficiently collect and process this data in real time to discover relevant situations which will allow driving successful business decisions and actions.

In this regard, big data is an approach which helps to process this huge amount of data. It is characterized in terms of the three V's: Volume, Velocity and Variety. Volume refers to the amount of data that can be managed and stored every day. Velocity is the big data dimension which deals with measuring how fast data can be collected and analyzed. Variety means the different existent data types: audio, video, text etc. However, big data normally focuses on data previously collected and stored in databases. For that reason, it would not be the best solution to process data from different sources in real time. To solve it, big data can be complemented with fast data, an approach which allows to continuously analyze data and which can be characterized by a new dimension known as Value. This dimension aims to determine why such data is important for business.

Therefore, cutting-edge IT systems will need to sense and respond to an enormous amount of signals sourced from different entities in real-time. In this context, an event would be detected if, for example, there is non-existence of a signal which normally occurs, affecting the execution of other services. These events would be produced by Internet of Things (IoT), which provides a large amount of data which can be shared or consumed by thousands of individuals and organizations around the world. These organizations can be connected using Service-Oriented Architectures (SOAs), which have emerged as an efficient solution for modular system implementation allowing easy communications among third-party applications; however, SOAs do not provide an efficient solution to consume IoT data for those systems requiring on-demand detection of significant or exceptional situations.

In order to build business level events, Complex Event Processing (CEP) technology may be used. CEP allows detecting complex and meaningful events and inferring valuable knowledge for end users. For that purpose, the conditions describing the situations to be detected must be specified by using special templates known as event patterns, which are implemented using so-called event processing languages developed for this purpose. These patterns will be added into an event processing engine, the software responsible for analyzing and correlating the events received from different sources, as well as for raising alerts to users or systems interested in complex events (situations) generated by the detected event patterns. In that way, CEP is performed in 3 stages: 1) event capture –it receives events to be analyzed by CEP technology–, 2) analysis –from the event patterns previously defined in the CEP engine, it will process and correlate the information in the form of events in order to detect critical or relevant situations in real time–, and 3) response –after detecting a concrete situation, it will be notified to the system, software or device in question–. The main advantage of using CEP to process complex events is that the latter can be identified and reported in real time, reducing the latency in decision making, unlike the methods used in traditional software for event analysis. Due to its benefits, CEP has already been applied to several domains such as location-based services, health care, home automation, network analysis and surveillance, maritime traffic management, transportation and traffic management, and operational intelligence in business.

With the aim of responding to events that occur as a result of business processes, Event-Driven Service-Oriented Architectures (ED-SOAs or SOAs 2.0) have been proposed as a solution. Therefore, SOA and EDA are not exclusive software architecture types but complementary. In particular, SOAs 2.0 will ensure that services do not only exchange messages between them, but also publish events and receive events notifications from others. For this purpose, Enterprise Service Buses (ESBs) will be necessary to process, enrich and route messages between services of different applications. Thus, combining CEP and SOA 2.0, the detection of relevant events in complex and heterogeneous systems will be reached.

This type of software architecture has several application domains, in particular context-awareness proposals may profusely benefit from SOA 2.0, since the access to context information and its integration in the system flows can be more easily accomplished. SOA is also key for making available distributed Internet-based resources in cloud computing; business can therefore take advantage of the synergies between service-orientation and cloud computing.

The aim of this Special Issue is to collect and compile the most representative approaches in current research which tackle the different faces of Event-Driven SOAs. In this regard, readers will be able to acquire a panoramic overview of existing solutions for dealing with big amounts of data in real time in different development scopes.

2. CONTRIBUTIONS OF THE SPECIAL ISSUE

Each submission of this special issue was reviewed by at least three international experts. Those papers accepted in the first round followed a second reviewing round by the editors to ensure that the papers were thoroughly improved with the reviewer comments. Finally, out of 16 received submissions, 5 articles came together for this special issue of the International Journal of Systems and Service-Oriented Engineering, therefore with an acceptance rate of 31%:

- *Rapid Development of Service-based Cloud Applications: The Case of the Cloud Application Platforms*, by F. Gonidis (South East European Research Centre), I. Paraskakis (South East European Research Centre) & A. J. H. Simons (University of Sheffield). In this paper, a development framework assisting the design of service-based cloud applications is proposed. The main goal of this framework is to allow the consistent integration of services as well as the seamless use of concrete providers.
- *A Scalable Big Stream Cloud Architecture for the Internet of Things*, by L. Belli (University of Parma), S. Cirani (University of Parma), L. Davoli (University of Parma), G. Ferrari (University of Parma), L. Melegari (University of Parma), M. Montón (WorldSensing) & M. Picone (University of Parma). In this paper, a novel cloud architecture for big stream applications is presented. This architecture can efficiently handle data from smart objects through a graph-based processing platform and also deliver processed data to consumer applications with low latency.
- *Fast Data Processing for Large-Scale SOA and Event-Based Systems*, by M. Tilly (European Microsoft Innovation Center) & S. Reiff-Marganiec (Leicester University). In this paper, a new approach that combines classical request-response paradigms with event-based approaches is described. The main aim of this approach is to enable fast processing of data in hyper-scale and distributed setups.
- *Event Pattern Discovery in Multi-Cloud Service-Based Applications*, by C. Zeginis (ICS-FORTH), K. Kritikos (ICS-FORTH) & D. Plexousakis (ICS-FORTH). In this paper, a novel monitoring and adaptation framework for service-based applications deployed on multiple clouds is proposed. The main functionality of this framework is to discover critical event patterns within monitoring event streams.
- *Model-Based Relationship Management for Service Networks*, by A. Kabzeva (University of Kaiserslautern), J. Götze (University of Kaiserslautern) & P. Müller (University of Kaiserslautern). In this paper, a service network modeling approach is presented. This approach, which allows capturing the topology of a service network at design time, is mainly composed of a generic and adaptable modeling structure, a classification of service network entities and relationships, and a modular management framework automating the modeling process.

3. REFEREES

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