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Tomoya Enokido *Editors*

# Complex, Intelligent and Software Intensive Systems

Proceedings of the 14th International  
Conference on Complex, Intelligent  
and Software Intensive Systems  
(CISIS-2020)

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Editors

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 Springer

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# Welcome Message of CISIS-2020 International Conference Organizers

Welcome to the 14th International Conference on Complex, Intelligent and Software Intensive Systems (CISIS-2020), which will be held from July 1st to July 3rd, 2020, at Lodz University of Technology, Poland, in conjunction with the 14th International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing (IMIS-2020).

The aim of the conference is to deliver a platform of scientific interaction between the three interwoven challenging areas of research and development of future ICT-enabled applications: software-intensive systems, complex systems and intelligent Systems.

Software-intensive systems are systems, which heavily interact with other systems, sensors, actuators, devices, other software systems and users. More and more domains are involved with software-intensive systems, e.g., automotive, telecommunication systems, embedded systems in general, industrial automation systems and business applications. Moreover, the outcome of web services delivers a new platform for enabling software intensive systems. The conference is thus focused on tools, practically relevant and theoretical foundations for engineering software-intensive systems.

Complex systems research is focused on the overall understanding of systems rather than its components. Complex systems are very much characterized by the changing environments in which they act by their multiple internal and external interactions. They evolve and adapt through internal and external dynamic interactions.

The development of intelligent systems and agents, which is each time more characterized by the use of ontologies and their logical foundations, builds a fruitful impulse for both software-intensive systems and complex systems. Recent research in the field of intelligent systems, robotics, neuroscience, artificial intelligence and cognitive sciences is very important factor for the future development and innovation of software-intensive and complex systems.

The CISIS-2020 is aiming at delivering a forum for in-depth scientific discussions among the three communities. The papers included in the proceedings cover all aspects of theory, design and application of complex systems, intelligent systems and software-intensive systems.

We are very proud and honored to have two distinguished keynote talks by Prof. Beniamino Di Martino, University of Campania “Luigi Vanvitelli,” Italy, and Prof. Chiba Institute of Technology, Japan, who will present their recent work and will give new insights and ideas to the conference participants.

The organization of an International Conference requires the support and help of many people. A lot of people have helped and worked hard to produce a successful CISIS-2020 technical program and conference proceedings. First, we would like to thank all the authors for submitting their papers, the Program Committee Members, and the reviewers who carried out the most difficult work by carefully evaluating the submitted papers. We are grateful to Honorary Co-chairs Prof. Makoto Takizawa, Hosei University, Japan, and Prof. Sławomir Wiak, Lodz University of Technology, Poland, for their guidance and advices.

Finally, we would like to thank Web Administrator Co-chairs and Local Arrangement Co-chairs for their excellent and timely work.

We hope you will enjoy the conference and have a great time in Lodz, Poland.

Aneta Poniszewska-Maranda  
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# **CISIS-2020 Keynote Talks**

# Semantics, Patterns and Compiler Techniques for Portable App Development in Multiple Cloud and Big Data Platforms

Beniamino Di Martino

University of Campania “Luigi Vanvitelli,” Aversa, Italy

**Abstract.** Cloud vendor lock-in and interoperability gaps arise (among many reasons) when semantics of resources and services, and of application programming interfaces is not shared. The same issue arises with Big Data platforms: different programming, deployment and execution models, many different machine learning libraries and related APIs. Standards and techniques borrowed from SOA and semantic web services areas might help in gaining shared, machine readable description of Cloud and Big Data offerings (resources, services at platform and application level, libraries and their API groundings), thus allowing automatic discovery, matchmaking, and thus selection, brokering, interoperability end composition of Cloud services among multiple Clouds, and seamless programming of analytics on multiple Big Data platforms. This talk will illustrate in particular the outcomes of the EU funded projects mOSAIC (<http://www.mosaic-cloud.eu>) and TOREADOR (<http://www.toreador-project.eu>).

# Distributed Systems of the Day for Efficient Digital Data Exchange and Sharing: A System Transition from Peer-to-Peer to Cloud-Fog-Edge Computing

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**Abstract.** With the recent increase of bandwidth for communication networks, the major improvement of computing processors and the spread of cloud computing, the exchanges or sharing of various types and huge amount of data or digital contents has become very active among a great many users on a large-scale network represented by the Internet. For this, various distributed systems have been used so far and major system architecture has been continuously changing according to the functions and purposes required at each time period. In this talk, we describe the historical changes and classifications of distributed systems used for searching, exchanging, storing and sharing data deployed on networks and their respective advantages. We introduce examples of actually implemented systems. Furthermore, we discuss the possibility of future development of distributed systems for data sharing.

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# Digital Transformation of Organizations: Perspectives from Digital Citizenship and Spiritual Innovative Leadership

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**Abstract.** Digital transformation of organizations is an important issue in recent era. Technologies including the internet are needed to transform traditional business systems into modern ones. Previous research has shown the relationship between digital transformation of organizations and the abilities of leaders and employees to use technologies; however, very little empirical research has focused on their ethical behavior and motivation in using such technologies. In this study, it is believed that both building employee's awareness as digital citizenships as well as practicing spiritual innovative-leadership are important drivers in triggering digital transformation of organization. This research aims at filling the knowledge gap by offering a discussion on digital transformation of organizations from the perspective of digital citizenship behavior and innovative-spiritual leadership.

**Keywords:** Digital transformation · Digital citizenship · Spiritual-innovative leadership · Digital era

## 1 Introduction

Technology and digitalization such as internet have changed the way businesses operation of an organization. Traditional operation and information system have moved into digital and virtual systems. Working with new technologies, such as cloud, big data, machine learning, as well as cognitive computing is emerging, and this promises complete transformation of traditional business operations. The transformation into a digital organization requires the transformation of skills and abilities of all organizational members especially in using technological devices. This enables the companies, group, and individual employees to work, communicate and create value through the use of technologies [13]. In developing a digital organization, it is important to create more connections and networkings between inter and intra-organization to effectively and efficiently access organization's resources and capabilities [6, 9]. Such relationships potentially influence performance and sustainable competitive advantage of the organization.

The skills in using technological devices, however, often unaccompanied with the awareness of organization's members as digital citizenships. There is a lack of research

which includes digital citizenship as part of work ethics despite the wide proliferation of citizens' participation in digital organization. Previous research on digital citizenship has given more focus on education sector, curriculum and pedagogy, with less research has been conducted in organization and business sectors. The employees of digital organizations play significant role as digital citizens who have inherited rights and associated responsibilities as members of online communities. The employees are expected to be able to manage their behaviors and be responsible to the community. Moreover, their behaviors are potentially inspired by their leaders which typically spiritual innovative leadership. Therefore, this study aims at proposing a research model of digital citizenship and spiritual-innovative leadership toward maximizing digital transformation and organizational performance.

## **2 Literature Review**

### **2.1 Digital Citizenship Behavior**

Digital citizenship is understood as the norms of behaviors related to usage of technology [14]. Digital citizens are people who can participate effectively in virtual spaces by sorting electronic information appropriately and utilizing that information for personal and social development [2]. They have general behaviors such as etiquette, norm in communication, responsibility, right, safety, and security [14]. Those behaviors contribute to faster settlement of digital transformation. The digital citizenship dimensions consist of nine general areas of behavior, including: etiquette, communication, education, access, commerce, responsibility, rights, safety and security or self-protection [14]. The higher the level of digital citizenship behavior, the higher the awareness of ethical conducts that will support faster settlement of digital transformation of an organization.

### **2.2 Spiritual-Innovative Leadership**

In the context of digital transformation process, leadership plays as a pivotal key in directing all organization members to change their mindset and behavior. Innovative leadership becomes most relevant in current circumstances where technologies grow rapidly and dynamically. As an agent of change, innovative leadership is expected to have a strategic vision and work flexibility in responding to a dynamic business environment [15].

In digital era, particularly, innovation becomes a prominent factor to support the resilience and development of a digital organization [8]. Therefore, innovative leadership is expected to inspire and play as a role model for their subordinates in implementing many creative ideas [1, 8, 11].

On the other side, abuse behavior and misuse of technology are considered unethical conducts in digitalized context (i.e. copyright) which is likely to be influenced by spiritual factors of the leaders [4]. Previous research revealed that ethical decision making is influenced by the norms of religiosity of the leader [4] as these norms have an important function in ethical judgement. The combined characters between spirituality and innovativeness will set up spiritual innovative leadership, which are prominent characters of both innovation and spirituality.

### 2.3 Digital Transformation

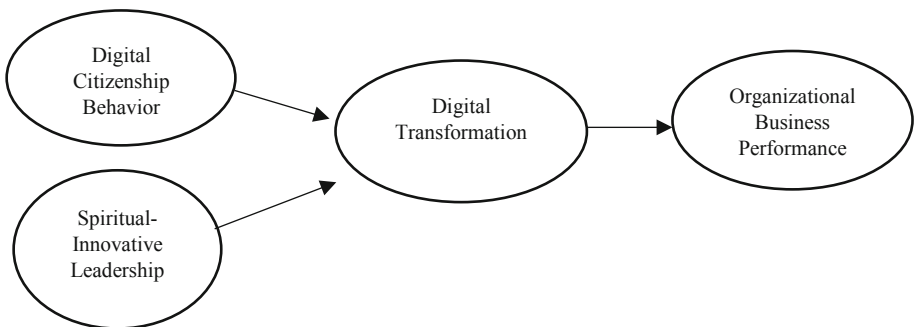
Digital business has become a new style in today’s dynamic business activities, and has influenced almost every aspects of business activities. Advanced technologies and emerging e-business applications promise new chances for companies to innovatively consider and reformulate their business strategies [16]. Digital transformation is a transformation process from traditional business system into digital system to increase value creation [12] by triggering significant changes to its properties using a combination of information, computing, communication, and connectivity of technology.

The emerging of the concept is at least caused by two factors. The first is the changing of personal life style and the corporate’s needs of information technology, and the second is the emerging effect of new digital devices and applications towards social interaction, mobile, analytical, cloud technology and the Internet of Things [5, 18]. Digital transformation is also presented as an integration of digital technology and business processes in a digital economy [10]. Moreover, this transformation is related to innovation usage for executing businesses strategies in a radical manner [17] which results in changes in the company’s business model and increases on company’s performance [7].

The company’s performance will potentially increase as the organization works efficiently by saving some costs and resources in many aspects such as in human resource’s investment, transaction process, sharing knowledge and information exchange [3, 12, 16]. During work processes, some benefits such paperless, smart procedures and automatic tasks are obtained by digital companies in addition to increased value in providing consumers’ satisfaction and collaboration with business partners [16].

### 3 Conceptual Model

Based on the literature review above, thus this paper proposes a conceptual model of relationships of digital citizenship, spiritual-innovative leadership and digital transformation. The higher the awareness of digital citizenship the better the process of digital transformation of an organization. The higher the level of spiritual-innovative leadership, the better the process of digital transformation of an organization. The better the



**Fig. 1.** Conceptual model of digital citizenship behavior, spiritual innovative leadership, digital transformation and organization performance



process of digital transformation of an organization the higher the level of organizational performance (Fig. 1).

## 4 Conclusion and Further Research

Digital transformation of business organization is required in this digital era to transform a conventional operational system into digital one. The success of digital transformation's process of an organization is influenced by the roles of its employees who work ethically as digital citizenship and by the spiritual-innovative leadership of its leaders. Managing the causal factors of digital transformation needs to consider human's aspects in terms of both the employees and the leaders. In the next research agenda, spiritual-innovative leadership need to be explored more deeply.

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