

# Chapter 13

## Internet of Things–Based Service–Oriented Architecture for Industrial Applications

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### **ABSTRACT**

*The industrial world has witnessed rapid development and popularity of the Internet of Things (IoT) based information systems that provide various services to business applications (e.g., manufacturing, supply chain management). These information systems use pervasive computing, ubiquitous computing and unique data communication protocols to sense industrial applications in an environment where the physical and digital worlds work together. The new information system can serve various business service categories through continuous symbiotic interactions. These interactions exchange data and information to create services that benefit the industrial world and help smooth business operations. This chapter describes the Apparel Business Decentralized Data Integration (ABDDI) information system architecture that requires a description of a logic-based knowledge representation scheme for information modelling and reasoning to provide web services semantic interoperability with the help of ontology. The chapter also presents an example of the service composition ontology's similarity assessment based on an algorithm.*

### **1. INTRODUCTION**

Humanity dwells on the Earth with ambitious goals to manage and mitigate unprecedented social, economic, and environmental challenges. Science, technology, and innovation play an enormous role in realizing these ambitious goals to improve human living conditions. The process of creative progress started by technological, and its evolution can help change economies and improve living conditions by increasing productivity, reducing production costs and goods prices, and helping to raise real benefits

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for the world. Thus, one of the essential ingredients to create a better world is using technology to move forward and unprecedented change in the scope and pace of daily human life.

Harnessing the frontier of technologies can help create and deliver innovations (including non-technological and new forms of social innovation) that could be transformative in creating sustainable development goals and producing more prosperous, inclusive, and healthy human societies. In this way, society gets the required solutions and chances for future sustainable development that are essential, cheaper, faster, scalable, and easy to use. The extent of technological development impact has already ushered in the transformative implications of information and communication technologies (ICTs) in many countries worldwide. However, these new technologies often threaten to outpace the capability of societies and policymakers to adapt to the changes they can create, giving rise to widespread anxiety and ambivalence or hostility to some technological advances.

One of the central questions of where ideas come from is on the mind of researchers visiting a research laboratory, a painter's workshop, or an inventor's experimental laboratory. It is the secret human society hopes to see – the magic that happens when new things are born. In this way, it is possible to provide creativity, like the discovery of millimetre radio waves by Professor Jagadish Chandra Bose (Sarkar, 2006).

Today, the world is witnessing the tremendous influence of wireless communication technology on daily working activities. Three great scientific minds heavily influence modern wireless telecommunications - James Clerk Maxwell (Mahon, 2004), Jagadish Chandra Bose (Sarkar et al., 2006), and Tim Berners-Lee (Berners-Lee, 2000). James Clerk Maxwell provided the theoretical foundation of electromagnetic wave propagation; Jagadish Chandra Bose showed his colleagues the transmission of millimetre waves by transmitting this new type of waves in the Presidency College (Kolkata, India) laboratory; and Tim Berners-Lee created the World Wide Web at CERN (Geneva, Switzerland). Today's Computer data communication network is at once intangible and constantly mutated, growing larger and more complex with each passing second. Many of the world's business community uses this incredible network of networks for daily business-related work and relevant services.

The advent of development and adoption of new technologies in recent decades is continuing, and this continuation is driven by: (i) the cumulative nature of technological change; (ii) the exponential nature of technologies such as microchips that are doubled in power every two years for more than half a century; (iii) the convergence of technologies into new combinations; (iv) drastic reduction in costs of production; (v) the emergence of digital “platforms of platforms” – most prominently the Internet; and (v) adoption of artificial intelligence (AI) techniques, the Internet of Things (IoT), and cognitive technologies have successfully been applied to various industrial applications (Zhao & Kumar, 2021). In addition, IoT has paved the way for many industrial application domains while posing several challenges as many devices, protocols, communication channels, architectures, and middleware exist. Big data generated by these devices calls for advanced machine learning (ML) and data mining techniques to understand, learn effectively, and reason with this volume of information, such as cognitive technologies. Cognitive technologies play a significant role in developing successful cognitive systems which mimic “cognitive” functions associated with human intelligence, such as “learning” and “problem-solving”.

AI-based applications now help to solve real-world problems, it includes image recognition, problem-solving, and logical reasoning that sometimes exceed human performance. AI applications, particularly robotics, can transform production processes and business activities, specially manufacturing. Big data technologies are opening new opportunities and enabling breakthroughs related to, among others, manufacturing data analytics addressing different perspectives: (i) descriptive to answer what happened, (ii)

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