

Chapter 8

Integrating SMEs Through Cloud: An Industrial Revolution

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ABSTRACT

In the fourth industrial revolution, one of the major driving force is cloud computing which helps in integration of cloud concepts in manufacturing sectors. Most of the high-end factories have started to adopt industrial automation by incorporating smart manufacturing technologies by incorporating cloud technologies, artificial intelligence, internet of things, big data analytics, cyber physical systems, and several other advanced manufacturing technologies. But, most of the SMEs across countries have not been standardized using such new technologies. This chapter discusses on a scheduling model using grey wolf optimization (GWO) for integrating all SMEs on to Cloud, such that proper decision support can be made for effective resource selection and job completion can be provided to the end users dynamically without any flaws.

INTRODUCTION

The concept of Industry 4.0 is a transformation of factories from production-oriented model to smart factories by incorporating advanced technologies like Internet of Things (IoT), Cloud Computing, Cyber-physical system and other advanced manufacturing technologies. It is sometimes referred to as Industrial Internet of Things (IIoT). Currently, factories have started to adopt advanced technologies and they are becoming highly automated and self-monitoring. Hence a clear framework, architecture

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for bridging the gap between physical industrial assets and digital technologies is required. Industry 4.0 focuses on three major aspects like digitization, integration of horizontal & vertical value chains, digital product descriptions & service offerings and providing opportunities for innovative business models (Geissbauer et al. 2014).

This industrial era enables manufacturing industries to make smart, real-time, timely and efficient decisions by communicating with man-man, man-machine, machine-machine, sensors and so forth. This transformation to intelligent manufacturing helps to improve the business, production and industrial value. Hence, it creates smart, intelligent, flexible, cost effective and reconfigurable production lines to meet the dynamic and global market. These technologies help the stakeholders to make smart decisions and solve problems in an adaptive manner.

There are four phases in industrial revolution starting from phase 1, which involves usage of steam and water for production, followed by the next industrial revolution which involves electric power for mass productivity. The third industrial revolution is automation of manufacturing sectors through digitization by usage of IT and electronic sectors. Finally, the fourth phase is the Industry 4.0, utilizes IoT, cloud computing, cyber physical systems and other advanced manufacturing models to automate and analyze the business process and this is depicted in Figure 1. Internet of Things (IoT) is a network of internet connected objects like physical devices, home appliances, mechanical or digital machines, vehicles, humans and other different objects for enabling connection, integration and data exchange. Even the human issues are also taken in to account very carefully. Because in a manufacturing system, the efficiency, experience, timing, etc. of the workers are also playing a vital role. In addition, the psychological influences of human give unpredictable results which attracts stress relieving cycles.

Design Principles

The design principles which support and guide companies to identify and implement Industry 4.0 standards are as follows.

Bauer et al. (2015) proposed four principles used for supporting companies to identify and implement Industry 4.0 scenarios.

- **Interoperability:** This is the capability of physical devices, machines, sensors, and human to connect and communicate via Internet of Things (IoT), Internet of People (IoP).
- **Data/Information Transparency:** This is the application of virtualization concept to transform the physical components as digital models using advanced technologies like IoT, cloud computing etc. The raw data received from sensor are combined to generate higher valued information.
- **Technical Support:** The support systems are used to assist humans for problem solving and quick decision making by combining and visualizing the information. The cyber physical systems are used to physically provide assistance to humans to perform large range of tasks which are risky, unpleasant for the humans.
- **Decentralized Decision Making:** These system has the ability to make decisions autonomously so the decision making is distributed. The tasks are assigned to the higher level decision making systems, only in-case of exceptions, other interference and conflicting tasks.
- **Service Orientation:** This is a design principle which helps the factories to understand and recognize the needs of customers before they are articulated.
- **Modularity:** The companies are adaptable as smart factories by scaling the different modules.

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