Chapter 6
IT Systems for the Digital Enterprise

Souvik Barat
TCS Research, Tata Consultancy Services, India

Asha Rajbhoj
TCS Research, Tata Consultancy Services, India

ABSTRACT

Modern digital enterprises operate in a dynamic environment where the business objectives, underlying technologies, and expectations from the end-users change over the time. Therefore, developing agile and adaptive IT systems is a critical need for most of the large business-critical enterprises. However, it is observed that the traditional IT system development approaches are not capable of ensuring all desired characteristics. This chapter discusses a set of established concepts and techniques that collectively help to achieve the desired agility and adaptiveness. The chapter reflects on the core concept of model-driven engineering for agility, technology independence, and retargetability; focuses on component abstraction to introduce divide-and-concur and separation of concerns; and proposes the use of variability and the concept of productline for developing configurable and extensible IT system.

INTRODUCTION

Enterprises use IT systems as automatons for well-defined repetitive operational tasks. With past dynamics of business environment being low, the IT systems were expected to deliver a fixed set of capabilities for a static operating environment. But the business dynamics has changed significantly over the years. The modern enterprises need to be agile and adaptable to support new business capabilities, technology stacks, and operating environment in a cost effective manner to stay competitive (Kulkarni, 2019). However, most of the existing IT systems fall short of the agility and adaptability as they have been implemented by considering a fixed set of requirements along a layered architecture paradigm. The traditional IT systems can be seen to encode specific choices along five dimensions, namely: Functionality (F), Business process (P), Design decisions (D), Architecture (A) and Technology platform (T) in a

DOI: 10.4018/978-1-7998-0108-5.ch006

scattered and tangled manner. These scattering and tangling are the principal obstacles to realise desired agility and adaptation. Large size further exacerbates the problem.

Component based IT system design and development (Heineman et al., 2001) that enables *separation of concerns* (Kulkarni et al., 2003) is a pragmatic step in the direction to achieve the desired agility and adaptation in IT systems. Business process management (BPM) (White, 2004) initiative that separates business process (P) dimension from functionality (F) dimension is the next step for solving the problem. The software product line concept (Pohl et al. 2005) and variability modelling (Berger et al., 2013) are further progress in software engineering (SE) to introduce agility and adaptableness along functionality (F) and business process (P) dimensions. The product line approaches and variability modelling collectively advocate systematic approach for configurability (*i.e.*, selecting one of the many available variants) and extensibility (*i.e.*, addition of a new variant) to achieve the desired characteristics. The Model Driven Development (MDD) (Selic, 2003) techniques detangle the functionality aspect (F) from design decision (D), architecture (A) and technology platform (T) by introducing the notion platform independent model (PIM), platform specific model (PSM), and model based code generation. They help to introduce new choice along design decision (D), architecture (A) and technology platform (T) dimensions without impacting the specification related to functionality and business processes. Introduction of product line concept to specify the code generator in an MDE technique as presented in (Kulkarni et al., 2012) is another advancements towards required agility and adaptation of IT systems. This chapter argues that an IT system with desired agility and adaptability can be developed by combining these existing concepts, techniques and approaches. The chapter first discusses the tenets of the modern IT systems that elaborate the problem space. The solution space that highlights the art of possibilities in the form concepts, techniques and approaches for agile and adaptable IT systems is discussed next. The chapter finally presents a pragmatic recommendation to use them in a systematic and coordinated manner using a conceptual framework. Essentially, an overarching meta-modelling framework that supports an advanced form of component abstraction, business process model, concept of productline architecture and variability modelling as an approach to realise the needs of modern enterprise in seamless manner is discussed.

PROBLEM SPACE: TENENTS OF MODERN IT SYSTEMS

The business-critical IT systems are often characterised by high business functionalities, low algorithmic complexity, significant database intensive operations, large size, and conforming to a distributed architecture (Kulkarni et al, 2004). Being business critical in nature, the system needs to be delivered quickly and is expected to be in use for a long time. The rich in functionality and large size expect suitable approach for functional decomposition, modularity and reusability so as to leverage large distributed development team. The choice of distributed architecture paradigm necessitates multiple technologies to be managed effectively and an interoperable manner. Moreover, a generic industrial experience is no two solutions, even for the same business intent, such as straight-through-processing of trade orders, back-office automation of a bank, automation of insurance policies administration, are identical. Though there exists a significant overlap across functional requirements for a given business intent, the variations are manifold too. Therefore, the developed IT systems are expected to be cognizant of commonality and variability. It is also expected a suitable approach to configure and extend the range of variants to support evolving requirements. In this chapter, we visualise an IT system along two broad dimensions: