Chapter 3
Ontology-based Patterns for the Integration of Business Processes and Enterprise Application Architectures

Veronica Gacitua-Decar
Dublin City University, Ireland

Claus Pahl
Dublin City University, Ireland

ABSTRACT
Increasingly, enterprises are using service-oriented architecture (SOA) as an approach to enterprise application integration (EAI). SOA has the potential to bridge the gap between business and technology and to improve the reuse of existing applications and the interoperability with new ones. In addition to service architecture descriptions, architecture abstractions like patterns and styles capture design knowledge and allow the reuse of successfully applied designs, thus improving the quality of software. Knowledge gained from integration projects can be captured to build a repository of semantically enriched, experience-based solutions. Business patterns identify the interaction and structure between users, business processes, and data. Specific integration and composition patterns at a more technical level address enterprise application integration and capture reliable architecture solutions. We use an ontology-based approach to capture architecture and process patterns. Ontology techniques for pattern definition, extension, and composition are developed and their applicability in business process-driven application integration is demonstrated.

1 INTRODUCTION
Software applications are built or acquired to provide specialised functionality required to support business processes. If new activities and applications are created and integrated into existing business processes and infrastructures, new architecture and information requirements need to be satisfied. Enterprise Application Integration (EAI) aims to link separate applications into an integrated system.
Driven by business models and the goals they implement.

Business process management (BPM) aims to improve productivity, product quality, and operations of an enterprise. BPM encompasses methods, techniques, and tools to support the analysis, design, implementation, and governance of operational business processes. Processes models have a critical role in the redesign of business processes. However, business analysts and software developers often face difficulties managing challenges such as discovering, modeling, and understanding business processes in the context of their implementation through software applications.

Increasingly, enterprises are using Service-Oriented Architecture (SOA) as an approach to EAI. SOA has the potential to bridge the gap between business and technology and to improve the reuse of existing applications and the interoperability with new ones. Software services are the building blocks of SOA. They can be composed to provide more complex functionality and to automate business processes. However, if applications are created without a structured architectural design, integrating these into a coherent architecture closely aligned with the business processes becomes a significant challenge. Business processes do not map one-to-one to service architecture processes. This gap has turned out to be difficult to approach systematically and to automate.

Abstraction and knowledge representation are principles that can address these challenges. Architecture abstractions like patterns and styles capture design knowledge and allow the reuse of successfully applied designs, thus improving the quality of software. Abstraction is a central driver in software engineering approaches; at the business level the reuse of successfully business designs is equally important. The development of integrated enterprise-wide application architectures is a continuous process. To improve the process and overall quality, the experience of analysts, architects and developers should be captured and reused. Knowledge gained from integration projects should be captured to build a repository of semantically enriched, experience-based pattern solutions.

Reusing proven solutions in a semantically enriched form reduces costs and development time and ensures coherently integrated and architectured application systems aligned with business processes. Using patterns enables architects to implement successful application integration solutions.

- Business patterns identify the interaction and structure between users, business processes, and data.
- Architectural patterns at a technical level address enterprise application integration and capture reliable architecture solutions.

A framework is required that can capture architectures and patterns as models and that can integrate representations from the different perspectives of business and software technology. We use an ontology-based approach to capture process and architectural patterns. A set of ontology-based pattern languages and techniques is developed and its applicability in business process-driven enterprise application integration demonstrated. A number of benefits of an ontology-based solution can be identified:

- enhanced extensibility through a taxonomical framework,
- alignment with ontology-based domain models and integration frameworks,
- use of ontologies as a semantical modeling notation,
- exploitation of the logical aspect of ontologies to infer additional knowledge from facts asserted in ontologies,
- use of ontologies as a formal reasoning framework to support architecture activities such as discovery and matching.