White Paper

Agile Enterprise Architecture Modeling

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Enterprise architecture needs to be agile and have the ability to analyze and adapt to an ever-changing business and technology landscape. Agile enterprise architecture is an evolving and living artefact. It incorporates responsiveness, flexibility, and continuous learning or adaptation design principles (Gill 2013). An agile enterprise architecture can first be modeled at a high level and the low level details can emerge later to create an evolving agile enterprise architecture. It can be modeled both at the high enterprise level and low business process, application, and service level. However, it requires the adoption of a standard approach for modeling the artefacts and there are a number of modeling standards to choose from. The challenge is that each modeling standard differs in its notation and scope.

This white paper presents the review of the four well-known modeling standards: ArchiMate, BPMN (Business Process Model and Notation), UML (Unified Modeling Language), and SoaML (Service Oriented Architecture Modeling Language); and recommends the tailoring of a situation-specific modeling environment for describing and analyzing the agile enterprise architecture artefacts both at the high and low detailed level. A situation-specific modeling approach is imperative for the analysis and improvement of an agile enterprise architecture.

This white paper is organized as follows. Firstly, it discusses the modeling background and context. Secondly, it presents the review of the four modeling standards. Finally, it discusses the reviewed results and makes recommendations before concluding.

Modeling Background and Context

The continuous improvement and transformation of modern complex enterprises are largely dependent on the strategic agile enterprise architecture. An agile enterprise architecture is a service oriented architecture that can be described in terms of three main architecture domains or layers (Harrison 2011): business, application and technology. A standard language is required for modeling and analyzing the current transition, target business and application and technology layers of an agile enterprise architecture both at the high and low detailed level. There are a number of modeling standards and proto-standards to choose from such as ArchiMate, BPMN, UML, and SoaML etc. These standards can be used to model the different layers of the service-oriented agile enterprise architecture. Each of the modeling standards differs in its notation and scope. The challenge is when, how and where to use the specific standard. Consequently, an integrated approach to agile enterprise architecture modeling is imperative. Therefore, existing standards need to be reviewed and integrated for developing an integrated and hybrid modeling environment to support the agile enterprise architecture modeling and analysis. The following sections review the above mentioned four well-known modeling standards and their applicability for modeling the business, application and technology architecture layers at different level of details.

ArchiMate

ArchiMate (The Open Group 2012) is an emerging comprehensive enterprise architecture modeling language that has been developed for formally modeling and analyzing the architecture of an enterprise at a high level. It provides a standard graphical notation, which can be used for visually describing and analyzing the agile enterprise architecture in terms of its three architecture layers (business, application and technology). The business layer describes the elements and their relationships within the business architecture domain: business products, services, value, contract, actors, roles, processes, objects, collaboration, representation, meaning, event and location. The application layer describes the software application architecture elements and their relationships: application service, application function, application interface, application component, application collaboration and data object. An application architecture supports the business architecture. Finally, the technology layer describes the technology architecture domain elements and their relationships: infrastructure service, infrastructure function, infrastructure interface, node, communication path, network, device, system software and artefact. The technology architecture supports the business and application architectures.
In summary, ArchiMate provides an overarching standard modeling language and graphical notation that is useful to model the overall agile enterprise architecture at a high level (see Figure 1).

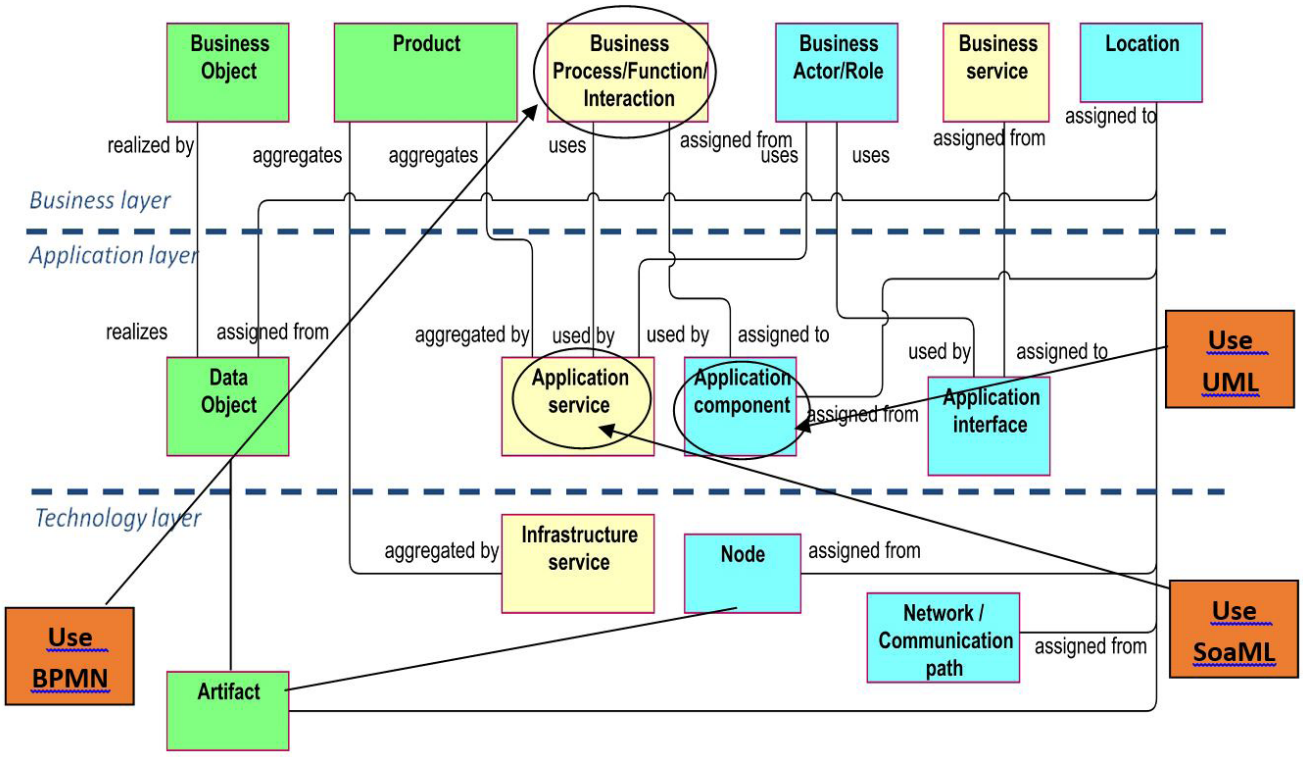

Figure 1: Archimate key cross layer elements and their relationships. Adapted from Archimate 2.0 specifications (The Open Group)

However, here the question is where, when and how to model the low level details of each of the element specified in the business, application and technology layers of ArchiMate such as business process, application component and service level details. The following sections address these concerns and further reviews some other well-known modeling languages such as BPMN, UML and SoaML in conjunction with ArchiMate to model the end-to-end agile enterprise architecture.

BPMN

BPMN (OMG 2011) is a well-known business process modeling language. It provides a standard business process model notation for formally modeling and analyzing business processes in detail (see Figure 1). It provides five types of elements: flow, data, artefact, swim lane and connector for visually describing and analyzing business processes in detail. Flow elements model business process activities, tasks, events and gateways. Data elements model business data objects and data stores. Artefact elements model business process-related textual descriptions, annotations and groups (e.g. representing a grouping of elements). Swim lane elements model business process orchestration and choreography patterns by using pool and lane elements. Connector elements model the associations, message flows and sequence flows between different elements. The scope of BPMN is strictly limited to the modeling of business processes; hence business strategy, organizational structure, functional breakdowns, data, information and rule models are considered to be out of scope for BPMN.

UML

UML (OMG 2005) is also a well-known software application modeling language. It provides a general purpose language that has been developed under the auspices of the Object Management Group (OMG) for modeling software applications in detail. OMG provides UML specifications in two parts: UML infrastructure and superstructure. UML infrastructure describes the foundational elements that are required to create the UML. The UML superstructure describes UML from a usage and user perspective, which is aimed at creating actual model diagrams. The UML metamodel provides three types of key diagrams: behavior, interaction and structure diagrams for visually describing and analyzing the applications. Behavior diagrams model the activity (including swim lanes), use case (including actors) and event or state transitions. Interaction diagrams model object collaboration and sequencing. Structure diagrams model object class, object, component (including interfaces and operations) and deployment nodes. The scope of the UML is limited to the modeling of applications such that business strategy, organizational structure, functional breakdowns and rule models are out of scope. Although business processes can be described by using UML activity diagrams, BPMN provides a much richer set of elements and greater depth and detail in the modeling of business processes. Therefore, it is not generally recommended to use UML as the sole modeling language for business processes.

SoaML

SoaML (OMG 2012) is also an emerging general purpose modeling language that has been developed under the auspices of OMG. SoaML extends UML for modeling service-oriented software application architecture in detail. The SoaML metamodel provides the support for modeling service, service provider interface, service consumer interface, service protocol, service information, service consumer, service provider, service policy, service organization, service constraint and service usages. The scope of SoaML is limited to the modeling of service-oriented software application architecture. Although business services can be described by using SoaML service elements (e.g. human, department), ArchiMate provides a much richer set of elements and greater support and detail in the modeling of business services. Therefore, it is not generally recommended to use SoaML as the modeling standard for business services. UML can be used to model object-oriented software application architecture in detail; and SoaML can be used to model service-oriented software application architecture in detail (see Figure 1).

Analysis and Recommendations

ArchiMate provides an overarching comprehensive set of modeling elements that can be used to support modeling of all three layers of the agile enterprise architecture at a high level (see Figure 1). BPMN only supports some elements of the business architecture layer in comparison to ArchiMate. BPMN is not designed for modeling the application and technology layers of the agile enterprise architecture. It is also noted in the Archimate specifications that it is appropriate for the high-level identification and modeling of the business processes within the overall business architecture context. However, detailed business process modeling requires much richer elements and therefore BPMN can be used in in detail (see Figure 1). The scope of BPMN is strictly limited to the modeling of business processes of the business architecture domain. This means that other aspects of the business architecture, which are not in the scope of BPMN, can be modeled using ArchiMate.

UML supports software application modeling in detail, some of the UML elements can also be used for describing some of the ArchiMate business architecture layer elements. Similarly to BPMN, UML can be used for detailed business process modeling by using a combination of business activity and business use case diagrams. However, UML is not a specialized language for modeling business processes when compared to BPMN. Therefore, it is appropriate to use BPMN for describing the business processes identified in the business architecture of an enterprise. It is also noted in the ArchiMate specifications that it is appropriate for identifying the application elements, interfaces, usages and their modeling at the highest level. However, the detailed internal structure, interactions and behavior of an individual software application is beyond the scope of ArchiMate, which can instead be modeled by using UML and SoaML (see Figure 1).

The application portfolio of an organization can have a number of software applications. These applications could be object-oriented and service-oriented. If all or some components of a software application are object-oriented abstraction specific, then UML is a specialized standard for modeling object-oriented software applications in detail (e.g. UML behavior, interaction and structure diagrams); therefore, it seems to be appropriate to use UML in combination with ArchiMate at the application architecture layer level. If all or some components of a software application are service-oriented abstraction specific, then SoaML (e.g. service, service interface) can be used to model the service-oriented components of the software application in detail. Here, individual software ”Application” modeling is a possible integration point between ArchiMate application architecture (enterprise level or high level modeling) and UML and SoaML (application detail level). Furthermore, ArchiMate provides a richer set of elements for modeling the technology architecture in detail in comparison to UML and SoaML. Therefore, ArchiMate is the better option for modeling technology architecture artefacts.

Conclusion

This review of the four well-known modeling standards [other relevant standards can also be reviewed (e.g. BMM, SBVR, SysML, etc.) indicated that each standard differs in its notation and scope, and a combination of standards can be used to support the modeling needs of all three layers of an agile enterprise architecture both at the high and low detailed level. Therefore, existing modeling standards can be integrated to support the agile enterprise architecture modeling environment.

References

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