Realization of Supply Chain Reference Architecture

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Abstract—In today’s global economy, businesses collaborate across multiple organizations that include customers and vendors in multiple geographies due to business growth and mergers and acquisitions. In general, larger companies have a greater number of systems with an average of 3.5 order capture and 3.3 order fulfillment systems [1]. This has led to a system landscape where there are multiple software applications that are implemented to serve both standard and customer specific business processes for a specific organization. This necessitates organization to embark upon the practice of Enterprise Architecture (EA) to organize the logic for business process and IT infrastructure reflecting the integration and standardization requirement of company’s operating model. [2]

However, there is a gap between the architecture and the solution domain. This paper explores how this gap can be bridged using right tools & techniques, a shared meta-data model and realize the architecture by orchestrating the solution based on Service Oriented Architecture (SOA). This paper also explains how this approach enables the business to realize supply chain reference architecture like Supply-chain operations reference-model (SCOR). This enables organization to adopt industry standard supply chain reference architecture with the benefit of monitoring the performance metrics.

Keywords—Supply chain reference architecture, SCOR, Orchestration, Service Oriented Architecture

I. INTRODUCTION

Traditionally companies were focused only on one organization where each function had its own source of data and systems – either off-line spreadsheets or an ERP system. Traditional ERP systems started facilitating collaboration at a transaction and operations level. However, these systems proved inadequate due to their tight integration of underlying system process and silo system processes are connected to realize the organization specific business processes instead of top-down approach. Collaboration has become a necessity as businesses started sourcing components from vendors or outsourcing some operations to vendors.

The modern virtual enterprises work on Boundaryless Information Flow™ [3] across multiple organizations that extends to customers and vendors. Modern ERP serving these virtual enterprises need to be built on top down architecture where the industry standard business processes are realized by application services encapsulating the system processes and support, round tripping between business and IT. This is achieved by orchestrating loosely coupled application services using Service Oriented Architecture (SOA) to realize the business processes. This allows the system to natively support collaboration as these are built on business processes rather than silo system processes.

II. NEED OF ORCHESTRATION

The following are the characteristics of a modern ERP system that enables realization of industry standard supply chain processes through orchestration:

- Multiple company Business process
- Multiple Enterprise Visibility
- Business rule driven
- Strong collaboration tools.
- Highly flexible and agile.
- Users should be able to see information from multiple sources and be able to respond to events across those sources.

![Fig. 1 Modern ERP platform](image)

Fig. 1 Modern ERP platform

Orchestration realizes the virtual enterprise value chain by a system designed to operate in a virtual way using SOA. It enables users to manage the processes and the stake holders across different organizations in a uniform way to deliver a consistent user experience while operating over heterogeneous, virtual enterprises.

Orchestration enables building a composite application business process for a set of interacting services, not just by bespoke development, but using a composition or business process modelling language, such as Business Process Execution Language (BPEL) of information and control through the individual services. Thus, the design and development of services is agile, and may be performed by developers under the close guidance of business analysts. [4]

III. ROLE OF REFERENCE ARCHITECTURE
Enterprise, as part of architectural continuum adopts the best practices and architectural style of Reference architecture specific to their industry which governs solution being realized.

Reference architecture is general in nature to some level of abstraction and provides concepts, components and their relationship used to direct/guide and constrain the instantiation of (repeated) concrete solutions. [5]

Below are the leading Supply chain Reference Architecture in the market:

TABLE 1: SUPPLY CHAIN REFERENCE ARCHITECTURE

<table>
<thead>
<tr>
<th>No</th>
<th>Entity</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SCOR</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>VRM</td>
<td>Medium</td>
</tr>
<tr>
<td>3</td>
<td>APQC -PCF</td>
<td>Low</td>
</tr>
</tbody>
</table>

IV. CHALLENGES IN REALIZING SUPPLY CHAIN REFERENCE ARCHITECTURE

Below are the challenges in adopting the Industry Reference Architectures to an enterprise’s own Organization-Specific Architectures that govern the solution being realized.

1) Architecture model address what are the best practices for a process where as the solution model addresses how to implement process.
2) Architecture model are efficient at Strategic level whereas solution model is efficient at tactical level.
3) Architecture and solution modeling languages are not common.
4) Meta-data model not shared between Architecture and Solution modeling tools.

The above reasons lead to a gap between the Architecture and Solution being realized during implementation.

V. PROPOSED MODEL TO REALIZE SUPPLY CHAIN REFERENCE ARCHITECTURE

A solution to the above challenges is to bridge the gap between the architecture and solution domain using right tools & techniques, a shared meta-data model and realize the architecture by orchestrating the solution based on Service Oriented Architecture (SOA).

Supply chain Reference Architecture can be classified based on their meta-data model level of details and entity they represent and relationship between them as follows: -

TABLE 2: SUPPLY CHAIN REFERENCE ARCHITECTURE LEVEL TYPE

<table>
<thead>
<tr>
<th>No</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strategic</td>
</tr>
<tr>
<td>2</td>
<td>Business Process</td>
</tr>
</tbody>
</table>

TABLE 3: SUPPLY CHAIN REFERENCE ARCHITECTURE ENTITY TYPE [6]

<table>
<thead>
<tr>
<th>No</th>
<th>Entity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Owners View</td>
</tr>
<tr>
<td>2</td>
<td>Models of the Business</td>
</tr>
</tbody>
</table>

Below is the model to select fit for purpose tools & technique appropriate to realize the supply chain reference Architecture based on their meta-data model level & entity: -
Fig. 3 Proposed Model to realize Supply Chain Reference Architecture

Fig. 3 shows the proposed model to realize the Supply chain Reference Architecture by mapping the right tools and techniques based on their metadata level and entity.

Below table provide the details of tools and technique for the combination of Supply chain Reference Architecture level and entity.

| TABLE 4: TOOLS AND TECHNIQUE FOR COMBINATION OF SUPPLY CHAIN REFERENCE ARCHITECTURE LEVEL AND ENTITY |
|---------------------|-----------------|-----------------|
| Level – Entity Combinatio n | Tool | Technique |
| C1 High-Conceptual | BPA Suite | Business Architecture & Business Process Analysis (BPA) |
| C2 Medium-Logical | BPM Suite | Business Process Modelling (BPM) |
| C3 Low-Physical | SOA Suite | Business Process Orchestration |
| | | Notation |
| | | Business Motivation Model (BMM), Strategy Map, Value Chain |
| | | Business Process Modelling Notation (BPMN) |
| | | Business Process Execution Language (BPEL) |

A. Applying proposed model to SCOR

Supply-chain operations reference-model (SCOR) is the industry leading architecture reference model for supply chain to reuse the build blocks namely plan, source, make, deliver and return with further drill down based on the level.

Fig. 4 Supply-chain operations reference-model

SCOR reference architecture meta-data model level can be mapped to proposed model as follows:

| TABLE 5: MAPPING OF SCOR META DATA MODEL |
|------------------|-----------------|-----------------|
| SCOR Level – Entity | Proposed Model Combination |
| C1 High-Conceptual | C2 Medium-Logical | C3 Low-Physical |
| 1 | Top Level (Process Type) | |
| 2 | Configuration Level (Process Category) | |
| 3 | Process element Level (Decompose Process) | |
| 4 | Implementation Level (decompose process element) | |

Below diagram depict the fit for purpose tools and techniques by applying the suggested model to realize the SCOR reference architecture.
VI. CONCLUSIONS

The modern agile ERP application provides challenge of grounded upon standard business process recommended by industry supply reference models with realization of loosely coupled application services. The solution is to select right tools & techniques with shared metadata between the two domains and realize the architecture by orchestrating the solution based on Service Oriented Architecture (SOA) as recommended.

- This will enable organizations to adopt Supply chain reference Architectures like SCOR, VRM, APQC-PCF to an enterprise’s own Organization-Specific Architectures which governs the solution being realized without re-inventing the wheel.
- This will in turn benefit organization in agility by loosed coupled application services and better control by inferring the KPI metrics from realized transaction.

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REFERENCES

[3] The Open Group
[4] The Open Group Services Integration Maturity Model (OSIMM)
[5] Steven J Ring, Role of Reference Architecture, MITRE, p10

DISCLAIMER

Views or opinions presented in this paper are solely those of the authors and do not necessarily represent those of his employer Oracle Solution Services (India) Private Limited or Oracle Corporation US or subsidiary firms and companies.

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