Chapter 31
Enterprise Interoperability Science Base Structure

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ABSTRACT

A science base for enterprise interoperability was first proposed in 2006 as a mechanism to formalize knowledge being generated by researchers and applied by industry to facilitate collaboration between enterprises through mutual interoperability of their enterprise systems. Subsequently, the community of researchers and exploiters of Enterprise Interoperability research addressed this issue as a group, culminating in a project funded by the European Commission FP7 programme. In this chapter, the authors explore the structure for an Enterprise Interoperability Science Base defined in this project, based on analysis of its purposes, the knowledge already available from pragmatic research, and the lessons learned, both on interoperability and the theoretical structure of a science base. The resulting science base is now evolving from the body of knowledge used for its initial population to embrace new research results and issues. This chapter focuses on the structure devised for an Enterprise Interoperability Science Base capable of delivering benefit to a comprehensive range of stakeholders with research and industry interests.

INTRODUCTION

The significance of achieving interoperability between enterprise systems operated by independent enterprises, possibly operating in states divided by differences of language and culture, and grounded in hitherto unrelated industrial sectors became apparent during the 1970s as major international collaborative industrial projects emerged. The aerospace sector, both civil and military, provides good examples of such projects, and the Airbus programme (Airbus, 2013) is often quoted as typical. Although such projects were in part politically motivated, as governments competed to demonstrate how they could be lead players in such projects, they nevertheless had to be implemented, and since they were not actually government projects, had to generate real results in a finite time, and at costs which made the project financially viable.

There was a clear need to be able to exchange data between the design systems used by the

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partners of such project consortia, as typically the partners were responsible for major components, assemblies and systems which must ultimately fly (in the case of aerospace) in quite close formation. Perhaps not so obvious, but in fact equally critical to project success was the need for logistics and operational management systems, such as material requirements planning (MRP) and the then novel enterprise requirements planning (ERP) to work in concert across the consortium. The differing environments of partners (language, culture, industrial sector, etc.) ensured that not only was it rare for partners to actually use the same software systems, but that terminologies and especially business processes conflicted. These conflicts, at all levels, must be resolved effectively for a project to proceed successfully, and it was not untypical to find that a significant portion of the project budget was devoted to achieving interoperability between these enterprise systems.

By the 1990s it was apparent that at least some interoperability problems were predictable, and susceptible to similar resolution. Rather than resolve these issues anew in each project a body of knowledge, pragmatically developed, was emerging and could be applied to reduce the cost and time to implantation for each new project. It was also emerging that there were common issues of interoperability which had not yet been resolved well in any project, and that these should be the subject of research independent of any one project, to provide benefit to future projects. In response, the IDEAS project, funded by the European Commission in 2002, made a first, and very effective, attempt to recognize the state of the art and future research issues, and to structure these into a research roadmap (Doumeingts & Chen, 2013). At or about this time the research domain acquired the title Enterprise Interoperability (EI), and as a result of the roadmap a network of excellence, INTEROP-NoE was funded by the European Commission's Framework Programme 6. This became one of a cluster of EU projects working in the domain, and entitled the Enterprise Interoperability Cluster (now re-named the Future Internet Enterprise Systems Cluster) (FInES Cluster, 2013).

The EI Cluster updated the research roadmap in 2006 (Li, Cabral, Doumeingts, & Popplewell, 2006). By this time changes in the enterprise environment in Europe led to the conclusion that EI was becoming at least as important to the commercial health of small and medium sized enterprises (SMEs), as to the large enterprises who had first encountered a need for interoperability. Indeed the growing propensity for SME collaboration to address business opportunities in close collaboration across sector boundaries made systems interoperability essential to survival. Previously SMEs tended to tied into one industrial sector or even one OEM supply chain, and were obliged to use the same systems as their customers, but now, as SMEs increasingly served multiple supply chains, frequently across industrial sectors the balance of power changed: SMEs could dictate a need for interoperability to their customers, to at least some extent. However the multi-million euro budgets employed in achieving interoperability in the major projects of the 1990s were clearly beyond the reach of small companies.

As a result a major focus of the 2006 EI Roadmap was the delivery of EI technology through service models allowing for pay-per-use of software affordable to SMEs. The roadmap identified four grand challenges:

- **Interoperability Service Utility:** Delivering software services for EI as a utility for affordable SME access.
- **Web Technologies for Enterprise Interoperability:** Harnessing the range of emerging Web capabilities to support EI.
- **Knowledge Oriented Collaboration:** Working towards the next level of EI, sharing and understanding of knowledge.
- **Science Base for Enterprise Interoperability:** Collecting and structuring EI knowledge from past research and