

Challenges and Opportunities of Enterprises Network Design and Services

Frank-Walter Jaekel¹

¹Fraunhofer Institute for Production Systems and Design Technology IPK, Pascalstr. 8-9, D-10587 Berlin, Germany

Abstract

Enterprise networks in terms of business partners cooperating to achieve common business objectives are challenged by communication and technical conditions. A usual way to manage these challenges is to look from a single enterprise perspective. If it is a large organisation it tries to force the partners to follow its strategy. In terms of small or medium size companies they try to follow standards or the requests of larger organisations. However, the investment to improve the business is located within single partners of the network. This raises the question of which technology and standard will be suitable in the future. The related technology changes can require high investments. The question arises which technology, standard, IT system, architecture, model should be used. The paper will discuss the use of enterprise models together with open source utilities to reduce the risk of loss of investments. Starting with the identification of requirements in the form of as-is models, the development of conceptual to-be models, the enrichment to implementation models and finally a realisation model that guides the implementation. In terms of a vision the paper will especially focus on the options for the software implementation and reduction of costs of change.

Keywords

Enterprise network, enterprise model, ecosystem, open source, standards

1. Introduction and challenges

Businesses need predictability and reliability in the standards and IT systems they use in terms of safeguarding the related investment. In the quickly changing environment with evolutions of business models and processes on one side and new technologies and IT solutions on the other side, companies as well as business networks have to react very quickly to ensure resilience and economic stability. IT applications and business processes should be invocated on demand and simply integrated in existing structures of process and supporting IT applications within the organisation. This still seems to be in conflict with the interests of software providers, as reported 12 years ago in “A Success Story: Manufacturing Execution System Implementation” [1]. IT vendors introduce their system understanding and solutions instead of business processes and IT services requested from the business demands of organisations.

This might encourage the checking of other opportunities in general such as open source solutions related with potential open platforms such as BASYS [2], GAIAX[3] and FIWARE[4] approaches. However, also these platforms might have the risk for companies of being bounded to the platform.

Standards are important to increase interoperability but it is difficult to see which standard will be the best for future development such as a decision to use OPC-UA [5], MQTT [6] or other approaches. Therefore, also standards should be seen as an exchangeable and evolving asset. The

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EMAIL: frank-walter.jaekel@ipk.fraunhofer.de (F-W. Jaekel)

ORCID: 0000-0003-4846-005X (F-W. Jaekel)



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target is to find approaches and solutions to decrease the dependency and to extend the flexibility in terms of the enterprise architecture.

For decades enterprise modelling and enterprise architecture models have been used to identify demands, weak points, optimisation potentials and to improve the process quality of companies and organisations. This already has been introduced into larger enterprises in terms of business process management units. But the use to monitor the IT solutions and their evolution in line with the evolution of the business processes seems less considered. Of course, models are used for the implementation of Enterprise-Resource-Planning (ERP), Manufacturing Execution System (MES), Supply-Chain-Management (SCM), Advanced Planning and Scheduling-System (APS) and other large systems but usually from a system function perspective such as “we need MES system” instead of “we have the following process and need IT support for this specific demand”. The result can be easily a system implementation with lots of functions only partially used and difficulties of how to further develop the related processes.

What is needed is the clear identification of demands and the gaps between demands and the current situation as well as the steps forward implementing new processes or IT applications. This includes the understanding of the available IT support and potential changes. The analysis and clearness of migration and replacement risks for new processes and IT applications has to be transparent. This requires a good understanding of information flows and data structures in use and the strategy of the further development of enterprise data model of information model. This would allow a more seamless interaction with different IT applications but also across organisations in enterprise and supply chain networks.

2. Enterprise modelling to monitor evolution

The challenges of evolution in standards, competing standards, new technologies and new business processes even new business is reality. So, enterprises and network of enterprises have to manage this environment. An approach in this direction is a holistic blue print of the enterprise processes and structures using enterprise modelling which allows the creation of transparency of the as-is and to-be processes. It should express the effect of each change in terms of structures and technology also in an executable way such as scenarios and mock-ups. In this sense a simulation would be nice but might need too much effort. It also can be very difficult to identify every relevant parameter value within a chaotic environment. Scenarios of workflows and user interfaces like a movie seem more adequate to understand effects of changes. These scenarios should be integrated within the whole enterprise model including the cross organisational supply chain or enterprise network processes.

In this approach, the enterprise model is an asset of the organisation that is continuously used and developed according to the requirements and changes in structures and technologies (**Figure 1**). The model indicates demands and helps to monitor available IT applications to fulfil the demands. New process structures will automatically update the demands and support the identification of the relation between workflows and IT applications. Interfaces and data descriptions are managed in the information model of the enterprise model and therefore related to process and IT application descriptions.

New technologies are mapped initially into the enterprise model in terms of fulfilments of demands. The adaptations of the enterprise model together with the available IT applications are implemented into the workflow of the organisation.

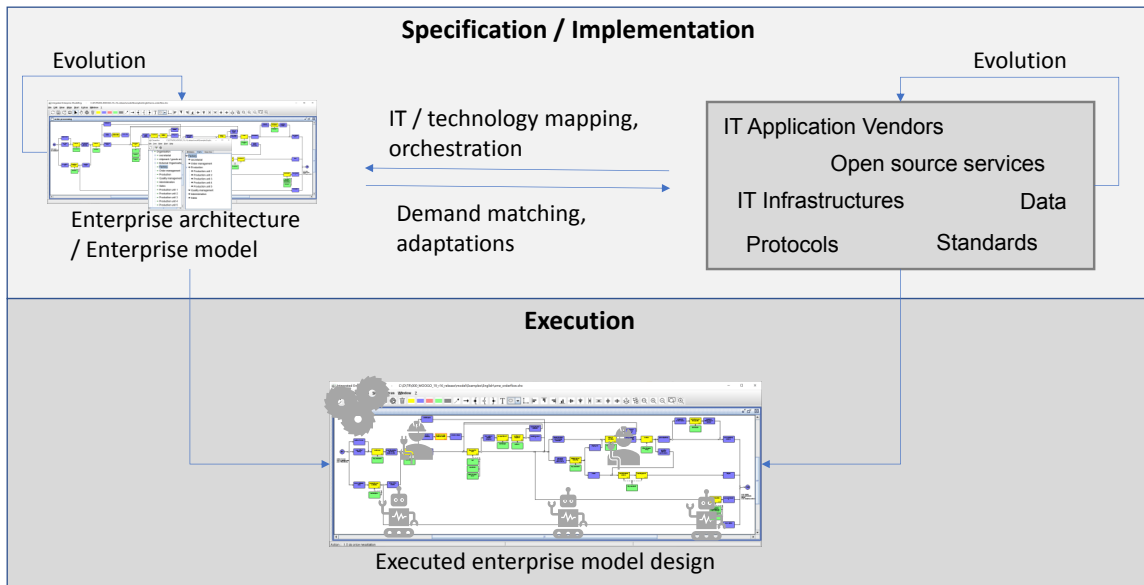


Figure 1: Use of enterprise model within the evolution of processes and technologies

In the context of IT application implementation projects in industry, the approach is implemented in several steps:

1. General demands and identification of potential technology
2. Holistic as-is model of an enterprise via interviews and document checks
3. Design of an initial to-be model covering standard pattern of supply chain, order management and manufacturing control
4. Training of staff in the company so that they can apply the modelling techniques themselves
5. Identifying pain points and creating appropriate scenarios to overcome them.
6. Developing executable scenarios expressing the paths across the model including the related data, IT function and interface demands
7. Integrating the real IT function and user interfaces from IT vendors
8. Identify potential adaptation regarding capabilities of the provided IT
9. The last but important step is the establishment of the model for every further activity. This allows to predict potential effects of changes and decrease the risk about technical changes by two aspects
 - a) The availability of documentation of interfaces, processes and constrains
 - b) The business effects regarding the scenarios or about further scenarios in the whole enterprise structure.

The related projects are performed by the use of the integrated enterprise modelling (IEM) and the MO²GO system [7], which provides an easy way to learn user interfaces because of few but extendable modelling constructs. The IEM in MO²GO provides an extendable object-oriented information model interlined with the process view. This gives the possibility to build the required views especially for the mock-ups by specific clients on the same enterprise model.

So far, the projects rely on large application providers for systems such as MES, ERP, SCM, APS or warehouse management. This creates a dependency to the IT provider and reduce the freedom of supporting the business processes. This effects also the master data management and the integration between different other systems of an organisation because the IT provider invents its data structures and interface protocols. The question here is whether an open source concept, which identifies a set of IT applications that are extended and maintained over time and become a standard after a while, could be an alternative solution. Approaches such as FIWARE, BASYS and now GAIAX started in a similar direction but became a platform by its own in terms of the business model. The question remains whether we can develop a more decentralised concept that enables different business models without reverting to a leading platform model and involving specific providers.

3. Initial ideas increase open source involvement

Open source solutions for enterprise applications exist since a long time like Odoo (www.odoo.com). They are already platforms and require software components from these platforms to run single IT functions. Another approach might be the creation and usage of fully independent small IT functions for enterprises such as a check of OPC-UA interfaces (**Figure 2**), matching of demands and suppliers, getting profile information of suppliers.

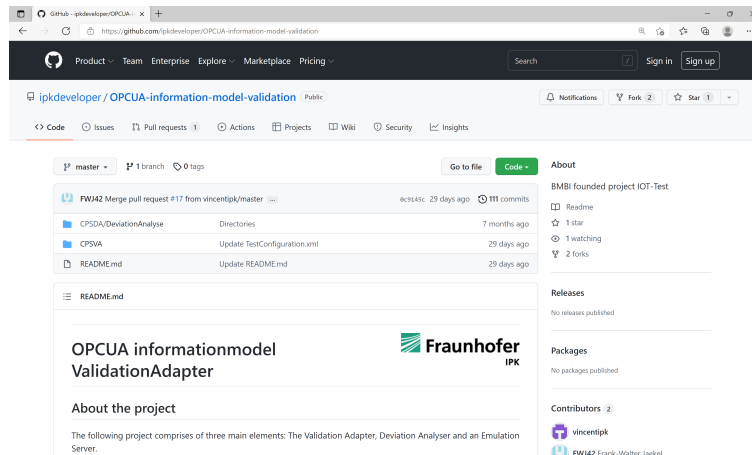


Figure 2: Small function for enterprises – CPS validation adapter [8, 9]

A target to discuss is an increasing set of such functions including interoperability by using standards and quasi standards. This would allow a very flexible support of business processes by IT applications and also a faster step from design to implementing this support. But the feasibility seems still not finally clarified.

4. Conclusion and outlook

An approach has been drafted to implement new IT application in a way which allows the monitoring and further evolution of processes and IT applications. The approach outlined poses some questions about feasibility and applicability that need to be discussed further:

- Companies hesitate to use open source. A potential barrier is the business responsibility for the solution. But on the other side examples such as the LINUX operation system shows possibilities to overcome such barriers. What are the drivers to enable a wider successful use of open source application for enterprises or will be just a small number of vendors more sufficient to provide the requested solutions from industry?
- The use of enterprise models can allow an adequate and flexible orchestration of IT functions building an appropriate enterprise application for an organisation. What are the drivers which might enable and motivate the approach?
- In terms of partnership between enterprises within different kinds of networks information needs to be exchanged as well as functions of IT application that need to work seamlessly, especially related to cross-organisational processes. Is there a chance instead of a common large ontology to standardise sets of open source applications which are continued further developed but which are able to work on different information models?

The questions and especially the answers can create a first roadmap for further developments.

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