

# Evaluating Integration Architectures

## A scenario-based Evaluation of Integration Technologies

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**Abstract.** A major aspect of complex Enterprise Architectures is the integration of existing heterogeneous IT-systems in a business process oriented way. Based on an empirical study the authors of the paper proved that there is no significant process orientation in information system integration projects today. Among other reasons this is due to deficits in mastering integration methodologies and technologies. This paper addresses the evaluation of diverse integration architectures. As a general differentiation of integration architectures the paper defines individually coded interfaces, centralized hub & spoke and distributed approaches based on standardized interface descriptions (Service Oriented Architecture–SOA). To assure a reliable evaluation the integration architectures have been implemented in the same scenario. The paper finally compares integration architectures with a set of 11 criteria.

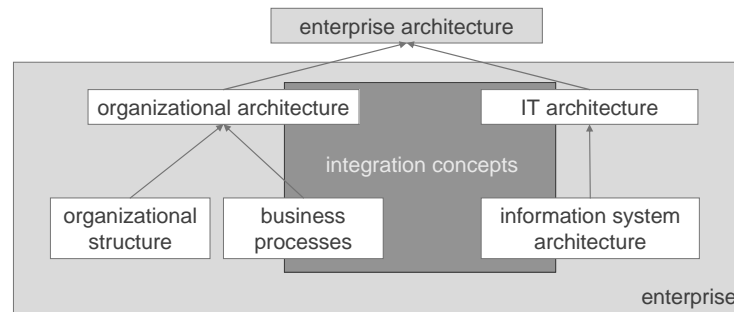
## 1 Harmonizing Business Process Orientation and IT Architecture

The current discussion about integrative enterprise architectures is not very structured. Both methodological and technology-oriented aspects are arbitrarily taken up referring on a specific context. Generic approaches are missing – an industry standard is far away. A precondition for a standardization of methods and technologies for the development and implementation of integrative enterprise architectures is the definition of generally accepted requirements and criteria. Only on the basis of those requirements and criteria one can evaluate the appropriateness of both methods and technologies.

This article first discusses the foundations concerning methodological and technological aspects. Thereafter we will focus on the evaluation of technology sets which are currently discussed for the design and implementation of integrative enterprise architectures. An important precondition for a fruitful discussion is a coherent understanding of *enterprise architecture*. Our understanding utilizes the term *integration concept* which refers to methods and technologies supporting the integration of information systems in a process oriented way.

An architecture can be understood as an abstract, holistic view on structures and patterns [1]. Architectures are usually the result of a planning process and thus represent a master plan for the holistic realization of future measures. These general char-

acteristics applied on enterprises become the enterprise architecture. Enterprise architecture is the combination of organizational, technical, and psychosocial aspects during planning and development of socio-technical business information systems [2]. In this article we will focus on organizational and technical aspects of enterprise architecture. Therefore we use the terms organizational architecture and IT architecture (fig. 1).



**Fig. 1.** Enterprise Architecture

*Organizational architecture* contains all non-technical components. It is similar to the concept of the organization as an instrument which comprises all explicit regulations for the structure and the business processes of an organization [3]. Accordingly we differentiate organizational architecture into organizational structure and business processes. *IT architecture* stands complementary to organizational architecture. It covers all technical components of enterprise architecture – especially it contains information systems with their individual information system architecture.

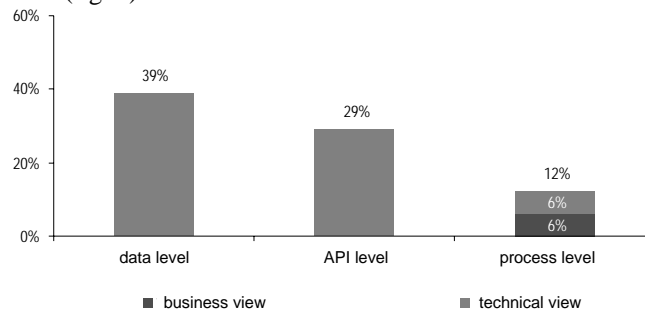
In literature the terms organizational architecture and IT architecture are frequently used, however, they are usually defined differently. Depending on the respective authors background organizational architecture also covers technical aspects [4] and IT architecture covers organizational questions too [5]. However, we will use both concepts separately to emphasize their equal importance. This makes sense, since there are complex interdependencies between both of them and they significantly influence operational efficiency of an enterprise [6-10]. Despite its up-to-dateness this field of research outlined here largely lacks academic, empiric and generic approaches. That is why we accomplished a descriptive/explorative study on integration concepts in the context of enterprise architecture. In the descriptive part we showed a summary of over 300 measurable characteristics and its values. In the explorative analysis we further aggregated the data to reveal structures and formulate hypotheses.<sup>1</sup> The study is a non-experimental cross-section survey over a short period of time.

Altogether 104 EAI User, 109 EAI Consultants and 84 EAI Vendors has been chosen to be contacted and questioned. Finally there was a feedback of 30,8% within the EAI Users, 21,4% within the EAI Vendors and 8,3% within the EAI Consultants. Based on the results of this analysis a second questioning has been made mostly by oral expert interviews hold individually or in small groups. The second evaluation was meant to verify the quantitative results and identify underlying structures. This

<sup>1</sup> The results of our study will be extensively published at another place.

explorative qualitative analysis refined the descriptive results and revealed further structures which led to five main hypotheses.

For this article we address the most astonishing and in the paper context most relevant statement referring to the actual process orientation of integration projects. System integration is hardly business process oriented implemented in practice. If people talk about integration on process level they usually mean technical processes – not business processes (fig. 2).



**Fig. 2.** Process Orientation in Integration Projects

However, in most cases integration projects cause business process changes. These projects shall lead to better, more efficient and faster business processes. The most important process changes are automation and consolidation. These process adaptations result in more formalization of organizational structures. Hence integration approaches are indirect enablers for business processes which only become feasible through such projects.

Finally it has to be stated that the harmonization of the business process world and IT architecture in the meaning of a holistic enterprise architecture utilizing integration concepts could not be realized yet.

## 5 Conclusion

Beyond the criteria used here there are definitely further important individual arguments not affecting all three types of architecture and that it is why they were not mentioned here. EAI approaches for instance show the disadvantage of rather moving than reducing complexity while of course gradually replacing point-to-point interfaces. Thus the often centrally modeled hubs become a bottleneck causing performance problems. Another point is that most EAI concepts are directly attached to only a few commercial vendors which results in a disadvantageous dependence. SOA concepts still suffer from technological shortcomings of evolving standards which primarily becomes visible in a poor methodology in the field of design. Until now there are no generic service frameworks, service management is in the making but not validated yet. But most of all there is a lack of practical experiences implementing a SOA. Web service technology used here has various potentials but is not established yet and thus not a safe investment.

Integrative enterprise architectures need appropriate methodologies and technologies. In this field there are too few generic approaches guiding the practitioner towards a sustainable architecture management. This paper delivers first ideas for the technology aspect and hence shows first of all the need for further research than complete concepts.

## References

1. Bass, L., Clements, P., Kazman, R.: *Software Architecture in Practice*. 2. Auflage, Pearson Education Inc., Boston (2003)
2. Gronau, N.: *Wandlungsfähige Informationssystemarchitekturen – Nachhaltigkeit bei organisatorischem Wandel*. Gito, Berlin (2003)
3. Bleicher, K.: *Organisation: Strategien, Strukturen, Kulturen*. 2. Auflage, Gabler, Wiesbaden (1991)
4. Nadler, D.A., Gerstein, M.S., Shaw, R.B.: *Organizational architecture – designs for changing organizations*. 1st ed. Auflage, Jossey-Bass, San Francisco (1992)
5. Zachmann, J.A.: A Framework for Information Systems Architecture. In: *IBM Systems Journal* **26** (1987) pp. 276–292
6. Markus, M.L., Robey, D.: Information Technology and Organizational Change: Causal Structure in Theory and Research. In: *Management Science* **34** (1988) pp. 583–589
7. Leavitt, H.J., Whisler, T.L.: Management in the 1980s: New Information Flows Cut New Organization Flows. In: *Harvard Business Review* **36** (1958) pp. 41–48
8. Lewin, A.Y., Hunter, S.D. Information Technology & Organizational Design: A Longitudinal Study of Information Technology Implementations in the U.S. Retailing Industrie, 1980–1996. In: Glaser, H., Schröder, E.F., Werder, A.v. (Hrsg.) *Organisation im Wandel der Märkte*. Gabler, Wiesbaden (1998) pp. 251–286
9. Venkatraman, N.V. IT-Induced Business Reconfiguration. In: Scott Morton, M.S. (Hrsg.) *The Corporation of the 1990s. Information Technology and Organizational Transformation*. Oxford University Press, New York (1991) pp. 122–158
10. Aier, S. Sustainability of Enterprise Architecture and EAI. Soliman, K.S. ed. *Information Technology and Organizations in the 21<sup>st</sup> Century: Challenges & Solutions*. Proceedings of The 2004 International Business Information Management Conference, International Business Information Management Association (IBIMA), Amman, Jordan, 2004, pp. 182–189.
11. Strüver, S.-C. Mehrdimensionales Komplexitätsmanagement als kritischer Erfolgsfaktor für EAI. In: Aier, S., Schönherr, M. (Hrsg.) *Enterprise Application Integration – Serviceorientierung und nachhaltige Architekturen*. Gito, Berlin (2004) pp. 301–334
12. Wall, F.: *Organisation und betriebliche Informationssysteme – Elemente einer Konstruktionslehre*. Gabler, Wiesbaden (1996)
13. Schekkerman, J.: *How to survive in the Jungle of Enterprise Architecture Frameworks*. Trafford, Victoria, Canada (2004)
14. Noran, O.S. A Mapping of Individual Architecture Frameworks onto GERAM. In: Bernus, P., Nemes, L., Schmidt, G. (Hrsg.) *Handbook on Enterprise Architecture*. Springer, Berlin (2003) pp. 65–212
15. Schönherr, M. Enterprise Architecture Frameworks. In: Aier, S., Schönherr, M. (Hrsg.) *Enterprise Application Integration – Serviceorientierung und nachhaltige Architekturen*. Gito, Berlin (2004) pp. 3–48
16. Fowler, M. (Hrsg.). *Patterns of Enterprise Application Architecture*. MITP, Boston (2003)
17. Hohpe, G., Woolf, B.: *Enterprise Integration Patterns*. Addison-Wesley, Boston (2004)
18. Brown, W.J., Malveau, R.C., McCormick, H.W., et al.: *Anti Patterns*. mitp, Bonn (2004)
19. Eilebrecht, K., Starke, G.: *Patterns*. Spektrum Akademischer Verlag, Berlin (2004)

20. Linthicum, D.S.: Enterprise Application Integration. Addison-Wesley Longman, Amsterdam (2000)
21. Kaib, M.: Enterprise Application Integration: Grundlagen, Integrationsprodukte, Anwendungsbeispiele. DUV, Wiesbaden (2002)
22. Keller, W.: Enterprise Application Integration – Erfahrungen aus der Praxis. Dpunkt, Heidelberg (2002)
23. Juric, M.B., Basha, S.J., Leander, R., et al.: Professional J2EE EAI. wrox, Birmingham (2001)
24. Hammerschall, U.: Verteilte Systeme und Anwendungen. Pearson, München (2005)
25. Aier, S., Schönherr, M. (Hrsg.). Enterprise Application Integration – Management komplexer Architekturen. Gito, Berlin (2003)
26. Aier, S., Schönherr, M. (Hrsg.). Enterprise Application Integration – Serviceorientierung und nachhaltige Architekturen. Gito, Berlin (2004)