

# Managing Enterprise Architecture in Agile Environments

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**Abstract:** Throughout the last decade agile practices have become the de facto standard within many organizations to run especially complex IT projects where the solution is not fully understood when starting the project. Due to the distributed and self-organizing nature of agile environments, it is a challenge for organizations to ensure alignment and avoid local optimizations which contradict overarching enterprise goals. Enterprise Architecture (EA) supports organizations to ensure this alignment. However, in order to be effective in agile environments approaches to EA need to be adjusted. Given the recent mainstream adoption of agile practices addressing this challenge becomes increasingly important. This contribution reviews existing approaches to agile EA and derives hypotheses on how to design an EA methodology for agile environments.

**Keywords:** Enterprise Architecture, Agile Architecture, Decision Making

## 1 Introduction

In today's economy constant change has become the new normal. Since 1960, the average lifespan of companies on Standard & Poor's 500 has decreased from more than 60 to less than 20 years [Sa14], which serves as one vivid indicator for a business world with increasing dynamics. One answer of IT organizations to address these changing conditions are agile methodologies. According to the current state of agile report, 97% of organizations practice agile methods, while a quarter even run all of their teams completely agile [Ve17].

When applying agile practices, architecture deserves special considerations. While in traditional environments, applying waterfall methodologies, the architecture is defined upfront, it is developed and adjusted continuously when applying agile methodologies. Therefore, architecture in agile environments requires different approaches [Ma10].

While multiple existing publications already address the topic of Agile Architecture in the scope of individual projects, there are much fewer studies covering the topic from an overarching, enterprise point of view. Since the late nineteen eighties, the concept of Enterprise Architecture (EA) has evolved as a discipline to ensure overarching alignment [Za87]. In today's agile environments, it is important more than ever, especially for large organizations, since a lack of Enterprise Architecture in agile environments will likely lead to a number of problems such as unnecessary rework, inconsistent communication and locally focused architecture, design and implementation [Gi15]. Therefore, this work considers how the discipline of EA needs to be practiced addressing these potential problems. A particular focus in this work is put on the EA methodology and how a distributed decision process can be leveraged to improve EA effectiveness in agile environments.

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## 2 Related Work

Agile concepts are rooted in software development. With the Agile Manifesto released in 2001 the principles of agile development have for the first time been defined for and made popular to a wider audience. *Agile methodologies*, refer to the implementation of projects in short iterations typically with the goal to release a first version of the product as soon as possible to receive feedback [BE01]. They help organizations to accelerate delivery and enhance the ability to manage changing priorities which are key capabilities in current times of increasing dynamics [SP15].

Due to the nature and principles of an agile project, the work of an architect in such an environment is significantly different. Madison describes and structures architectural interactions in an agile setup. He concludes that the main challenge for architects is to drive long term outcomes using a series of short term events. In order to achieve this, the architect needs to ensure being influential at the following critical interaction points: Up-front planning, Storyboarding, Sprint and Working software [Ma10].

When applying Agile Architecture not only in the context of a single team but in an entire organization, there are further implications to be considered. The initial idea to apply architecture in the context of an entire enterprise to describe, understand, represent and design different dimensions, has been developed and made popular simultaneously by different groups in the late nineteen eighties and early nineties [Ko16, RV18]. This discipline is known today as Enterprise Architecture (EA). While multiple definitions for EA exist, this work embraces a commonly referenced one based on the ISO/IEC/IEEE 42010 definition and considers EA as a discipline which manages the architecture of an enterprise resulting in the following definition: “*Enterprise Architecture is a discipline which manages the fundamental organization of an enterprise, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution.*”

Taking a look at different levels architecture being practiced, these differ in terms of strategy and technology focus. EA has a long-term perspective by focusing on the strategy of an organization and not providing specific directions in regard to individual technology decisions. Solution architects, which are often appointed for specific projects, consume the high-level guidelines provided by EA to drive design and take more specific technology decisions. Detailed design and implementation are the responsibility of technical architects which have strong technology focus, see Figure 1 [Lm17].

Depending on the size and structure of an organization, there can be additional architecture roles such as data architect, application architect, etc. The unique characteristic of EA that represents the architecture discipline with the strongest strategy focus, has the broadest scope and highest level of abstraction.

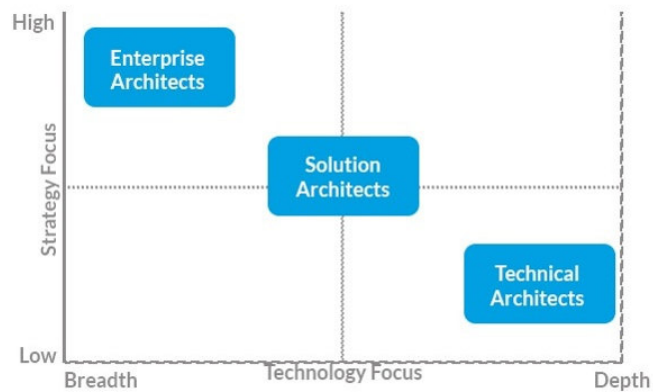


Figure 1: Comparison of architecture levels in terms of strategy and technology focus [Lm17]

Since EA initially gained popularity before agile concepts did, early EA aligns mostly with traditional, waterfall approaches. After the release of the agile manifesto however, there is a significant number of scientific EA publications addressing the subject. While this number decreased again after 2004, there is recently a visible spike again from 2015 [GJ18], see also Figure 2. One reason for this could be the increasing mainstream adoption of agile practices [PD17, Ve17].

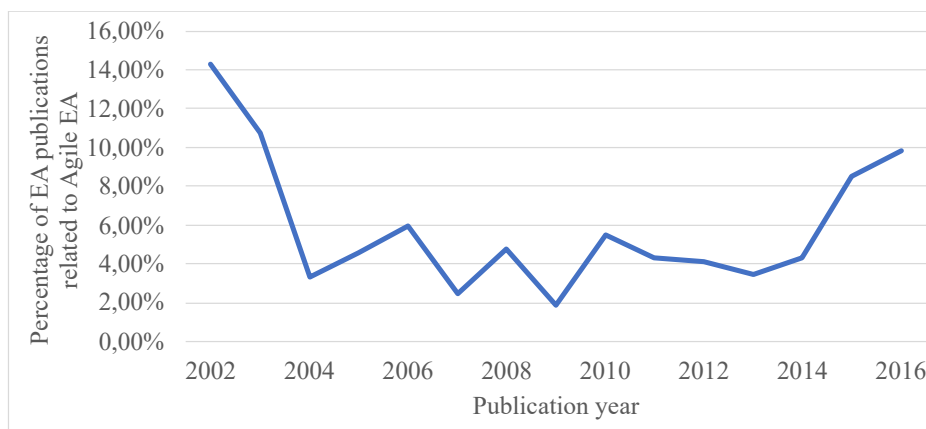


Figure 2: Share of EA publications related to agile concepts over time (adapted from [GJ18])

In order for EA to support agile environments multiple facets need to be considered. Supporting agile has implications for EA in terms of methodology, organization, technology [KL16]. As shown by Speckert et. al. today's most popular EA frameworks, TOGAF, Zachman and FEA, do not yet incorporate distributed methodologies which align with the requirements of an agile environments [SR13]. Therefore, this work focuses on the methodological part and in particular on how running it in decentralized manner can help to address the requirements of agile environments.

### 3 Requirements of Agile Environments towards EA Methodology

The Agile Manifesto [BE01] already includes a guiding principle for architecture, which states: “The best architectures, requirements, and designs emerge from self-organizing teams.” This approach is in contrast to traditional methodologies which relied on architecture being defined upfront – often by single individuals – and are afterwards enforced throughout the delivery of a project.

Hence, a key characteristic in agile teams is the decision-making which is not the responsibility of a single person but rather of the whole team. Taking group-based decisions can help to improve the quality of decisions and consequently the quality of the results. However, conducting them efficiently requires suitable practices as pointed out by Lopes and Junior point [LJ17]. One example of these practices is presented in the Scaled Agile Framework, which is a knowledge base of agile patterns [Sc17].

When enterprise architects and agile teams collaborate, there are interactions and potential conflicts between intentional architecture, defined by an overarching enterprise architect and the emergent design which is driven by agile teams, see Figure 3. Initially, the intentional architecture provides constraints on how a solution should be built. Throughout the execution of a project, the emergent design should correct any architectural constraints which are not viable in reality. Moreover, future intentional architecture should be inspired by the work of agile teams [Sc17].

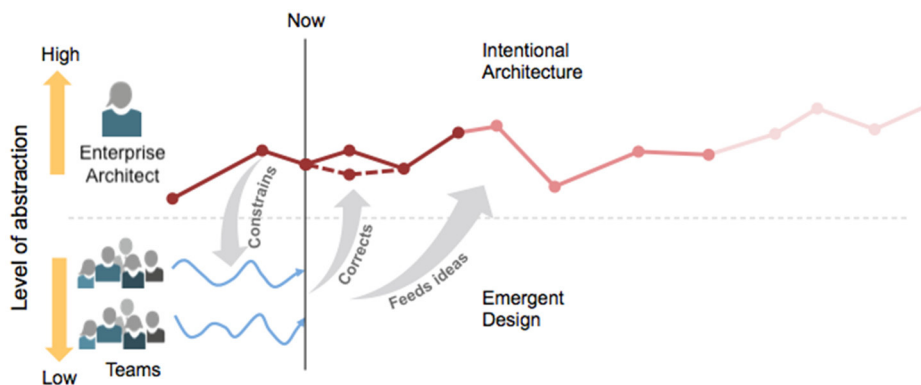


Figure 3: Intentional architecture and emergent design (adapted from [Sc17])

### 4 An EA Methodology to Support Agile Environments

Given the requirements of agile environments a key challenge for an EA methodology is how to ensure effective distributed decision making, which aligns to the overall enterprise goals. Madison concludes that communication between EA and agile teams is best achieved by physically decentralizing architects and having them incorporate EA concerns at the interaction points. Moreover, a communication among the architects is best achieved by having a centralized EA practice and formal EA processes. However, the emphasis needs to be on the community of collaborating individuals not just a process or a collection of artifacts [Ma10].

In addition to the suggestion of Madison, Speckert et. al. introduce the idea of peer-to-peer concepts for EA to increase effectiveness of decentralized decision making. While in classical EA approaches typically a centralized architecture board is overseeing architectural decisions, a peer-to-peer review could be used to better decentralize decision making [SR13].

As a result, the following hypothesis are derived related to practicing EA in agile environments:

1. In agile organizations, a decentral EA methodology is more effective than a central one
2. A decentral EA methodology requires a centralized EA practice which ensures alignment among the architects
3. Applying peer-to-peer concepts in EA helps to accelerate decision making while maintaining alignment

These hypotheses may serve as principles for designing an EA practice for agile environments.

## 5 Conclusion and Outlook

This work provides a brief overview on the current state of EA methodologies which support agile environments, which is increasingly relevant due to the growing mainstream adoption of agile practices.

The presented requirements provide the required foundation for further research activities in this area. As a next step the presented hypotheses for the design of an EA methodology need to be validated and checked for completeness. Therefore, it is planned to conduct a series of expert interviews to further refine the hypotheses.

Moreover, the work presented here is part of a PhD research project which assesses the future of EA in increasingly dynamic environments. Identifying how EA can best support and enable agile approaches is one facet of this research project, while overall goal is to provide a reference architecture for EA in dynamic environments. The results of this work will feed in the overall PhD research project.

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