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# Enterprise Architecture Process of a Telecommunication Company – A Case Study on Initialization



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## ABSTRACT

Objectives such as business-IT-alignment, lower costs, higher quality, better time-to-market and greater customer satisfaction are some of the drivers for the development of enterprise architecture (EA) process. Several companies in Europe and the USA, and likely elsewhere, are currently developing their EA processes. The overall question in companies is how EA and architecture processes could give more value to business demands.

Despite the obvious need for research on companies' EA processes, to the date only a few case studies have examined EA processes in companies. The present study, therefore, attempts to address this need for further understanding of EA processes. The study examined and analysed the initial phase of EA process in Elisa, a Finnish telecommunications company. The objective of this study was to gain an understanding of some aims related to the EA process initialization phase.

The case company's EA process choices relating to communication practices, EA requirements management and, relationships and collaboration between the EA process and the company's other processes were described and analysed in terms of the aims in the initial EA phase.

These aims included identification and definition of the role and responsibilities for EA process, the process establishment in the organisation as well as the adaptation of process related work. In addition, it is important to achieve benefits of EA work quickly. It is suggested that these areas could also be relevant for other companies in the initial stages of an EA process. In addition, the waterfall approaches were identified not well suitable for the development of EA processes and EA.

## Keywords

Enterprise Architecture, Enterprise Architecture Process, Case Study

## INTRODUCTION

Currently, ICT-companies as well as other large companies have pressures to develop their own enterprise architecture (EA) processes. IFEAD has investigated why enterprise architecture is important for companies [11]. Expected benefits of EA approach are that EA delivers insight and overview of business and IT, it is helpful by

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mergers and acquisitions, it supports (out/in) sourcing and systems development as well as manages IT portfolio and delivers roadmaps for change. In addition, EA is expected to be helpful in decision making, managing complexity, business and IT budget prioritization. Enterprise architecture is seen as one of the solutions for these challenges and development needs.

ICT-companies and organisations' usage and developments of EA processes are examined to a certain extent. The surveys relating to a group of organisations are carried out, for example, by NASCIO, GAO and Institute for Enterprise Architecture Developments (IFEAD) and by Gotze and Christianssen. EA development situation in governmental organisations and departments is investigated by NASCIO and GAO in the United States [5, 20] and by Gotze and Christianssen in several countries [2]. In addition, IFEAD have gathered information about EA usage and implementations in organisations all over the world [11].

A few case studies on companies' EA processes have also been carried out. For example, relating to governmental organisations by Hjort-Madsen [7] and by Martin et. al. [17], UML-modeling by Armour et.al. [1], SOA practices development by Wong-Bushby et. al. [26] as well as relating to specific companies like Subaru by Merriman et. al, [18]. However, EA processes in European private sector organisations, in teleoperator-domain and especially the initialization phase of an EA process do not yet seem to be examined by case studies.

The study, presented in this paper, examined the EA process of a Finnish teleoperator company, Elisa Oyj. This study was executed in the initialization phase of the EA process. The case company's main choices relating EA process made during the period chosen (February – October 2006) and reasons for and experiences from these choices were identified and analysed. These choices relate especially to communication, enterprise architecture requirements management, and collaboration between the EA process and other organisation's processes. As a result, a group of aims to which the case company focused at the initialization phase of EA process were identified. These aims are suggested also to be central for other companies initiating their EA processes.

This study consists of the following sections. Firstly, existing enterprise architecture practices and the research method used in this study are presented. Secondly, the case company Elisa Oyj, market situation and changes in Finland, and Elisa's reasons for the development of the EA process are introduced. Thirdly, the EA process choices made in the case company, reasons for these choices and the analysis of these choices are presented. A suggestion of a group of aims, to which companies should be concentrated in the initialization of an EA process, is presented. Finally, the study is summarised and future research questions are presented.

## ENTERPRISE ARCHITECTURE

### **Enterprise Architecture Concept**

IEEE 1471 Standard [9] defines architecture as the fundamental organization of a system embodied in its components, their relationships to each other and to the environment, and the principles guiding its design and evolution.

The enterprise architecture is defined for example by Kaisler et al. [14] as follows " *the main components of the organization, its information systems, the ways in which these components work together in order to achieve defined business objectives, and the way in which the information systems support the business processes of the organization*". These components include staff, business processes, technology, information, financial and other resources, etc.

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Other definition for EA is presented by Lankhorts [15]: “*enterprise architecture is a coherent whole of principles, methods and models that are used in the design and realisation of an enterprise’s organisational structure, business processes, information systems, and infrastructure.*”

## **Methods and Practices for Enterprise Architecture**

Enterprise architecture is typically used as an instrument in managing a company’s daily operations and future development [15]. Currently, the field of enterprise architecture is evolving rapidly. Academia and ICT-industry actively develop methods and practices for the designing and management of enterprise architectures. Several books have been published on this field (e.g. [13], [15],[25]). Frameworks, methods, practices and maturity models for EA are introduced.

Architecture frameworks identify and sometimes relate different architectural domains and the modelling techniques associated with them [22]. They typically define a number of conceptual domains or aspects to be described [22]. Enterprise architecture frameworks are, for example, Zachman’s Framework for Enterprise Architecture [28], The Open Group Architecture Framework (TOGAF) [23], Archimate framework, ISO Reference Model of Open Distributed Processing (RM-ODP) [12], FEA, OMG’s Model Driven Architecture, DoDAF, GERAM and Nolan Norton Framework. Companies use these frameworks or develop their own ones.

A number of languages and tools for modelling organisations, business processes, applications, and technology are also developed. Languages include, for example, IDEF, Business Process Modelling Notation (BPMN), Testbed, ARIS and Unified Modeling Language (UML).

In addition, enterprise architecture maturity models are developed and can be used to support the development of EA process in organizations. Some enterprise architecture evaluation methods are, for example, the following enterprise architecture maturity models: OMB Enterprise Architecture Assessment Framework [24], The Enterprise Architecture Maturity Model [19], The Extended Enterprise Architecture Maturity Model [10], A Framework for Assessing and Improving Enterprise Architecture Management [6] and IT Architecture Capability Maturity Model.

Challenges relating to enterprise architecting (e.g. relating to modeling, managing, and maintaining EA) are also examined, for example, by Kaisler et. al.[14] and Hämäläinen and Ylimäki [8].

## **RESEARCH METHOD**

Research process used in this study is described in the table below.

**Table 1. Research method used in the analysis of case company’s EA process.**

Case company selection criteria	Elisa Oyj was selected for the case company because it is an example of private sector and teleoperator organisation initiating EA process. In addition, the case company, Elisa Oyj, was selected in accordance with its collaboration in the on-going research project.
Unit of analysis in company	Enterprise architecture process in the case company, especially the choices made and the experiences of these choices
Observation period	February – October 2006, the initialization of the EA process was on-going activity in the case company during this period.

Data collection	Participant observer: Participant observer observed the EA process in the case company during the defined period. Observer made especially observations relating EA process choices, reasons for these choices and experiences of these choices.  This observer works as an enterprise architecture –architect in the case company and participated in the EA process development and initialization during the observation period.
Research data	A group of qualitative data sources were used to triangulate research finding and confirm outcomes. The data sources used were, for example: <ul style="list-style-type: none"> <li>➤ Case company’s EA process descriptions</li> <li>➤ Other material relating to the EA process development <ul style="list-style-type: none"> <li>○ result materials from group meetings between architecture work stakeholders</li> <li>○ emails: e.g. news letters for EA interest group</li> </ul> </li> <li>➤ Discussions between architecture work stakeholders and observer</li> </ul>
Data documentation	Choices made, reasons for and experiences of these choices were documented partly by the observer and partly together by the researcher and the observer in a few meetings. The choices were categorized in this phase by the researcher and the observer.
Data analysis	The choices were analyzed. Main aims to which the case company focused at the initialization of EA process were identified.

#### ELISA AS A COMPANY AND ITS REASONS FOR EA PROCESS DEVELOPMENT

Elisa is second largest telecommunication company in Finland. The company's home market area is Finland and Estonia. Global market and international customer demands of Elisa are handled with partners of which main partners are Telenor and Vodafone. Company's amount of personnel was 4,090 in 2006 and revenue EUR 1.52 billion. Elisa's network has in the end of 2006 aprox. 2,2 million mobile subscribers, 852 300 fixed subscribers and over 469 000 broadband subscribers.

Elisa strategy (2003-) is based on three steps (see fig. 1) [4]:

- *Integrating One Elisa:* In this step, radical changes and consolidations in company structures, processes, brands, products and ICT-systems are carried out. For example, in company structure, the holding structure was changed to one company model.
- *Strengthening Market Position:* This means that the organisation should be more effective. Market position is main issue. In overall, this also means new company changes. For example, Elisa bought Saunalahti in 2005.
- *New Markets and New Services:* This step is in initial phase and involves searching and developing new services and markets. 3G- and broadband bundle products are produced as one part of the development of new services to strengthen Elisa's market position.

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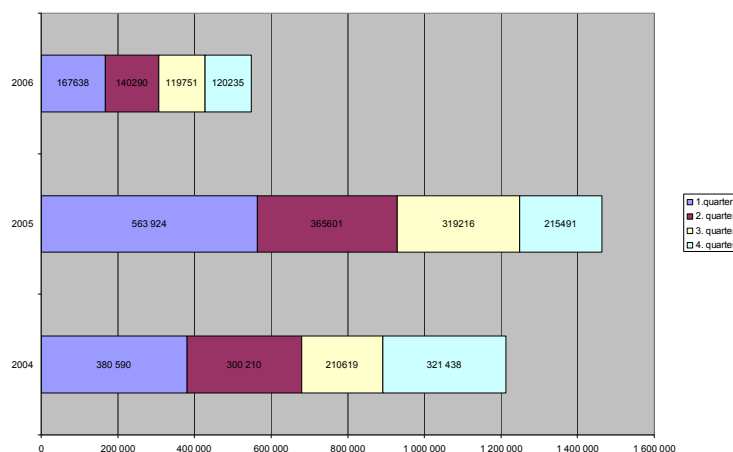
**Figure 1. Elisa strategy ([4])**

### Market Trends in Finland

The following trends existed in the telecom-market in Finland between 2004 and 2007. The fixed-line phone service market has been going down a quite long time. Market changes during this period were approx. -8% per year. Fixed line voice services are replaced by mobile services and data services are replaced by broadband services. This market is based on PSTN-technologies which are near the end of the lifecycle.

At the same time, fixed data services market grew about 4,2% per year. Phone services continued the transforming to the mobile markets, because demands of customers changed. In addition, the broadband penetration grew quite fastly.

During this period, the mobile number portability market also opened. Mobile number portability was launched in 2004. In addition, new virtual operators and service providers came to the market. Number portability was quite high success in Finland (see fig. 1). These factors brought about the pricing competition in the market.



**Figure 2. Number portability volumes 2004-2006 ([21]).**

Price erosion can be seen from that the average monthly revenue per user (ARPU) dropped from year 2000 to 2005 almost approx 9€ per month. At the same time, number of new content based services and data access was growing very slowly. Number of new services and data accesses started to grow when 3G bundle was allowed in Finland in 2006.

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### **Reasons for EA process Development in Elisa**

Why Elisa started to develop an EA-process? Reasons and drivers for this are based on Elisa's strategy steps as well as on changes in the market, technologies and regulations. These reasons are described in the following.

#### *Strategy Steps: The Development of Elisa*

In the first strategy step, many independent companies and their ICT-environment were needed to evaluate and check the overall life-cycle and functionalities of them. Several consolidations were carried out. First phases in consolidations are quite easy. Later it becomes more challenging to understand how different changes in the ICT-environment affect processes and products and vice versa. Thus, later consolidations not only involve shutting down old legacy systems. More and more communication is needed inside the company (e.g. between staff relating the development of processes, product management, decision makers of technology selections). In addition, the technology selections need coordination. In Elisa, these consolidations were also made quite fast and under hard cost effectiveness pressures. In the solving of this problem, it was noticed that this work needs the coordinating and the handling the general view of situation. The need for ICT-architecture work was thus identified.

#### *Affect of the Changes in the Market to the Elisa*

Market situation seem to change out from pricing competition to service competition (e.g. Elisa's announcement of the changing its pricing model illustrates this [3]). In this situation, Elisa needs more modular and flexible products, processes and ICT-environments. This also means that partners have increasingly important role in Elisa's ICT-environment, processes and products.

#### *Coming Changes in Business Models and Technologies*

In addition, technology aspects become more and more complex. Flexibility demands are also increasing constantly. Convergence between telecommunication and IT-services has started and continues with increasing speed in the future. In addition, business models are based on partner networks, which means more and more distributed ICT-environments. Therefore, processes and products come more and more complex. Telecommunication network and traffics seem to change towards IP-based network in the future. Secondly, technology silo-based network structure transforms to layer based access-core –structures. In addition, network elements are more and more based on IT-based open systems than before. Previously, network elements were dedicated hardware and embedded software. IT-environment changes and moves to service-oriented and event based architectures. In summary, ICT is a critical part of today's basic infrastructure at many ways.

#### *Summary of Elisa's Reasons for the Development of EA process*

In summary, Elisa's main reasons for the development of EA and especially ICT-architecture process and practices were the followings:

- Complexity handling:  
How and where some changes have effects?
- Increasing knowledge:  
What and how should a project inform about its work and results to other projects? What are the dependencies between different processes, services, products, systems, networks etc? How are new technologies implemented in

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Elisa's ICT-environment?

- Increasing flexibility and effectiveness:  
How are Elisa's services made easier? How services are produced effectively?  
What parts of system are problematic? For example, what parts of a information system, product or process are problems?
- Customer aspects:  
What are customer demands and wants? When does customer want new services? How to use the existing environment in new innovative ways?

Thus, Elisa decided to start the development of a EA process at the autumn of 2005. Some architecture practices and architecture information had been developed and produced before. An EA team was established at the beginning of 2006. The following chapter describes EA process development work between February and October 2007.

## EA PROCESS IN ELISA

The enterprise architecture process related choices made in Elisa are described in the following. Aspects of communication practices, EA requirements management and collaboration between the EA process and other company's processes are discussed.

### Communication

Effective communication is essential in sharing knowledge, achieving a common understanding, agreement and a shared view of the EA scope, vision, and objectives, as well as of the developed models and other artefacts. Furthermore, communication is an important means of gaining commitment to the EA effort [27].

Aims of EA communication in Elisa are, firstly, to communicate and inform architecture work related persons and staff about aims of this work and the role of architecture work in Elisa. Secondly, the communication has the meaning of introducing the EA approach, practices and culture, as well as results of EA work (e.g. architecture plans, principles and target architecture). Thirdly, the aim of communication is to get feedback about EA work. In addition, communication increases contacts and familiarity between staff.

The representative from Elisa brought out that ideal situation in architecture communication is when:

*"the needed information is easy to find and to understand and it is opportunity to communicate with others about architecture questions".*

The practices and tools chosen for EA related communication in Elisa are:

- *Intranet*: All Elisa's employees and limited partner employees have access to Elisa's intranet. Firstly, aims of using intranet were to inform and communicate what EA work is, what staff is related to it and what practices are used in it. This material was added to the intranet at the initialization of the EA process. The experience was that this information was sufficient. So, more information was not needed in the intranet at the beginning of the EA process. It was also noticed that it had to be decided what material will be added to the intranet and how often the material will be updated. In addition, it was noticed that static information should be separated from information that will change often. This would have eased the updating of information.
- *News letter*: News letters were sent to the EA interest group (employees that had interests for or responsibility of architecture work). The news letters especially included information about the status of work (e.g. status of

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architecture principles), tasks under work and staff responsible for these tasks. The news letter was found useful. However, it was noticed that the news letters must be short. Therefore, links were provided to extra material in the news letters.

- *Document management system:* A network drive was used to store and distribute architecture work documents in Elisa because it was generally used for document sharing in Elisa. There was limited access to this drive: nearly the same group had access rights that were included in the newsletter distribution. Documents were various documents which had to be organised and stored to somewhere. Experience was that the network drive filled the document management requirements in this case.
- *Boards:* Managers do not usually have much time to examine material. Therefore, material was produced for and presentations were given in board meetings to help managers to be aware of the architecture work (status of and its results). These boards convened regularly. It was seen that it is important that decision makers in boards know about what they are deciding and what the possible consequences of the decisions are.
- *Workshop:* Workshops were organised to carry out architecture work related tasks. Persons from the EA interest group participated in these workshops. The amount of participants in the workshops varied. The smallest groups were 8-10 persons and the biggest ones 100 persons. Participants felt that they had the opportunity of participating in architecture work in the workshops. This increased the commitment of staff to EA work.
- *Interpersonal communication:* Interpersonal communication had the meaning of gaining the commitment of staff and managers to EA work. Interpersonal communication and workshops are used actively in Elisa. Thus, these are included in Elisa's organisational culture. So called "management by walking around" is thus also vital part of the architecting.

In summary, EA communication should be adjusted for the dominated organization culture, practices and tools used in a company. In addition, it was noticed that the company has to make choices in which situations to use face-to-face communication and in which situation communication that is supported by technical tools. In addition, the order between communication and content production in the company has to be decided. The company can firstly concentrate on communication and collaboration and then on content production. On the other hand, it can also firstly concentrate on content production and then on communication and collaboration.

### **EA Requirements Management**

Requirements for enterprise architecture were also identified in the initialization of the EA process in Elisa. In Elisa, main sources for enterprise architecture requirements were especially the followings:

- Elisa's strategy information
- Technology road maps, standardization
- Business information:
  - existing and future products and services
  - roadmaps of products and services
  - customer and market researches and studies
- Existing business processes and aims of these processes

In addition, the following sources were also used



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- interviews of specialists and
- identification of existing and used principles in the development of architectures / products / services.

It was identified that there exist long-term architecture requirements, that should be taken into account in the long-term planning (taken into account e.g. in business planning), and short-term architecture requirements, that should be taken into account in short-term planning (in the current projects).

The process for the identification of EA requirements was the following. Firstly, data from sources presented previously was gathered and it was produced a list from information that seemed to include relevant information about requirements. From this list, potential EA requirements were identified and based on these potential EA requirements, a list of EA requirements was produced.

The experiences of EA requirements gathering and analysis were the followings. It was difficult to identify or define what the EA requirements are. This seems to be a problem in general. It thus seems that a definition for EA requirements is lacking. In addition, questions were met about how the requirements should be described so that “users of requirements information” understand what the requirements are. In addition, it was not clear how to use and utilize EA requirements and in which processes to use and utilize them.

In summary, the identification and analysis of EA requirements differs from the requirements engineering in system development. EA requirements can be used for example to argue for why a certain EA related choice or principle is made. EA requirements are thus not meant to describe what a system should be able to do.

### **Collaboration between EA process and Other Company’s Processes**

Enterprise architecture is typically used as an instrument in managing a company’s daily operations and future development [15]. It has to fit in with other established management practices and instruments. According to Lankhorst [15] management areas relevant to EA process are strategic management, strategy execution, quality management, IT governance, IT delivery and support and IT implementation. With these areas EA process may collaborate.

In Elisa, collaboration ways between EA process and strategy management and investment management were planned and defined. In addition, collaboration with project definition and support was planned and defined. Relating to this collaboration it was decided, for example, that the existing decision making practices and methods of other processes are used also in EA work. The EA work and other processes in Elisa were linked in this way.

EA work was organized at the same organizational level as R&D work in Elisa. Elisa has the management of communication networks that also have to be taken into account in EA work. Therefore, EA work was not organized and included in IT governance or business units. Experience was that this organization structure supported the co-operation with different processes and stakeholders. EA work has thus “neutral” position in organization.

### **Limitations in This Study**

In this paper, all aspects of Elisa’s EA process were not described. Three aspects were chosen to be analysed and discussed. These aspects were chosen because they were essential in the initialization phase.

## CONCLUSION

Currently, the initialization of an EA process is on-going task in many organisations. However, a little of public information exists about experiences of the initialization of EA processes. In this study, we examined the starting of an EA process in a Finnish telecommunication company, Elisa. EA process related choices, reasons for and experiences of these choices were especially examined. Choices relating to communication issues, EA requirements management and collaboration between the EA process and company's other processes were especially analyzed.

### **Aims in EA process Initialization**

During the process of examination of the EA process, the following observations were made. The case company seemed to focus especially on the following aims.

*To identify and define the role and responsibilities for the EA process*

The case company defined relationships between the EA process and other company's processes. In this definition, it had to be decided what responsibilities the EA process and company's other processes have. It's very important to define and recognize the role of the EA stakeholders and take them for an active role and part in EA work and responsibilities.

*To establish the EA process and to adapt EA work in the company*

The communication practices were developed especially to support the adaptation of EA process work. Communication practices were especially developed for gathering information from the EA stakeholders and for sharing information to support carrying out architecture work.

*To achieve benefits of EA work (to achieve so called "quick wins").*

In Elisa, the identification of existing architecture practices and principles was used as a method to quickly achieve benefits of EA work. Especially, principles that are already used in the development of products, services and processes in Elisa were identified and acknowledged.

### **Observations Made and Questions Met in EA process Initialization**

As a whole, the experience of Elisa was that waterfall approaches do not seem to be well suitable for the development of EA and EA processes. We mean as a waterfall approach an approach in which all the phases of the process are cascaded to each other so that the second phase is started as and when a defined set of goals are achieved for first phase and it is signed off. Once a phase thus has been completed, its results are frozen. Backtracking is impossible and nothing can be revised based on changing needs or fresh insights. In addition, until the results of the current phase are complete and approved, any work that properly belongs to the next phase or any later phase many not be started. In the software development area, waterfall approach is criticized especially because the requirements always change and this is not taken into account in this approach.

Some of the approaches that are presented for the development of an EA process seem to have similarities with the waterfall approach. For example, Forrester Research presents the following approach for the initialization of an EA process [16]:

*"... early tasks of a new or newly restarted EA program are creating a mission and an operating model for the EA program, articulating near-term goals, and validating these with the EA sponsor and key stakeholders. Once the EA leader has confirmed that all key stakeholders see the value of the EA program to attaining their own goals, the next tasks are building the team and creating a detailed plan."*

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This approach appears to have similarities with waterfall approach because it does not encourage the iterative development. Firstly, Elisa tried in its EA process initialization an approach that was similar to the waterfall approach. However, Elisa's EA team noticed quite fast that this type approach is too slow, because when the first results are ready, the overall goal and results are already "out of date" and not valid anymore in many aspects as well. In this approach, the planning phase is thus too long. Goals and targets are defined quite well but these are not updated in this approach. In brief, changes in requirements (e.g changes in business) and goals thus can not be thus taken into account in this approach.

One of the challenges met in the development of the EA process was also how to achieve the whole picture of current state of the company. Currently, it seems that the knowledge and practices of the gathering the information and knowledge of the current state of companies' architectures efficiently and reliably are lacking.

In addition, it was noticed that the company has to balance between the achieving quickly benefits of the EA work and the carrying out the long-term EA work. This question was met in the case company. As a whole, communication and collaboration between the EA process and other processes were identified to be the most important tasks in the initialization of the EA process.

### **Summary**

In this study, the following questions arise: Is it possible to use agile and iterative methods to develop EA and EA processes? Can the theories of the agile software development be applied in the EA domain in a way or other? How to choose, execute and combine the tasks in the initialization phase of an EA process? For example in Elisa case the question was how to combine the defining (probably "dirty") EA-level framework and target architecture quite fast, defining and starting the first part of EA work, the making first main implementation of the process and of the target architecture and the collecting feedback for a new planning iteration.

Initialization phase is essential for the future of an EA process. The main responsibilities of this process, its role in a company and practices used in it are defined and developed in this phase. In addition, EA work information is communicated actively.

In this study, we identified aims that one case company had in the initialization of the EA process as well as questions that were met in this phase. We suggest that these aims could also be relevant for other companies in the initial stages of the EA process. In the initialization of the process, we recommend to start doing actual EA work and communicating the purpose and first tasks of it as soon as possible, instead of only focusing on producing detailed plans about the EA process or architectures.

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