Enterprise Architecture modelling to support collaboration
The ArchiMate language as a tool for communication

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**Preface**

Few enterprises today have descriptive representations that depict how the enterprise works. Therefore, change can only be accommodated by trial and error. As complexity and the rate of change increase, risk of trial and error increases. Architecture provides the structure to predict the impact of change, reduce the risk and maintain enterprise viability in a changing environment.

John Zachman

This thesis has been submitted in partial fulfilment of the requirement for the degree of Master of Science in Business Process Management and IT (BPMIT). The BPMIT master program is an interfaculty master programme that combines courses from the faculty of Computer Science and the faculty of Management at the Open Universiteit Nederland (OU). I choose to graduate in the Enterprise Architecture discipline. The knowledge and insight obtained during the courses in the master program proved to be an excellent preparation for the graduation.

Ever since I followed the course Information and Process Architecture in the master programme, I had a personal objective to get more skills and knowledge in the Enterprise Architecture discipline. By the practical experience gained by working in IT for more than a decade, I recognized the added value that architecture could bring to the business and IT. The selected subject for this thesis enhanced my academic view, helped meet my personal objective and is a subject that is applicable in the real world. The Enterprise Architecture modelling language ArchiMate, proved to be ideal to introduce architecture at a financial service provider. As the potential benefits to an enterprise become clear from the very beginning you start modelling views for business, application and technology and their relationships.

I would like to thank Geoffrey Bohen for reviewing a draft of this thesis and for providing feedback and suggestions. I also want to thank the interviewees at the participating companies for taking time in their busy schedules to participate in interviews and to contribute to the creation of a model in ArchiMate. I also want to thank my supervisors Frans Mofers and Jaap van der Woude for coaching me and broadening my insight in scientific research. Their feedback kept me on track and provided me with new inspiration. And last but not least, I want to thank my wife An Hye, for creating the cover sketch and for supporting me in my ambition to get a relevant academic degree. Without her full support, it would have been impossible for me to combine my family, work and student life.
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Abstract

In this report I will present my research on the subject: Enterprise Architecture modelling to support collaboration, with the ArchiMate architecture language used as a tool for communication.

A general problem within organizations with complex business processes is that the communication is often not efficient between different departments or business units. I want to evaluate if using architecture modelling supports creating and maintaining shared understanding between business units and departments for organizations where the business processes are strongly dependent on IT-systems.

The central research question that is answered in this report is the following:
“Can an organization support communication and collaboration by using Enterprise Architecture modelling?”

A phased qualitative research approach was used to answer the question. The first step consisted of a literature review on Enterprise Architecture, EA modelling, communication, collaboration and shared understanding. The main research question for the literature review was:
“What are the main concepts and relations in Enterprise Architecture modelling and collaboration, in an organization which acts as a Service Provider?”

The answer to this question resulted in a shared understanding model which was used for the empirical research.

As a second step, I used the newly created shared understanding model for the categorisation of the questions in interviews at two organizations to get a baseline measurement for the current situation.

In a third step of the model, the main objective was to get the participants familiar with EA modelling and ArchiMate. At the FSP this was done by creating models in ArchiMate related to the E-commerce process. For the HRSP, this was done by comparing the current EA documents to EA models created in ArchiMate.

The fourth step is to present the model created in ArchiMate, followed by an interview to measure the effectiveness of the model in the context of the shared understanding model.

As a fifth step, the results of the interviews of the two organizations are combined to evaluate if the ArchiMate EA language can support the collaboration and communication by creating shared understanding.

Some important findings during the research were:
- For the communication aspect of things it was identified that the same language and an agreed convention could aid the shared understanding and collaboration.
- ArchiMate was considered as a useful tool to communicate on business processes, applications and technology.
• ArchiMate can support effective collaboration on an enterprise level.
• Not everyone agreed on the value of ArchiMate to identify or communicate concerns, the architects think this should be one of the goals of EA modelling but some of the interviewees think that the added value of modelling in ArchiMate is very limited for identifying or communicating concerns.
• The importance of a shared vocabulary for shared understanding.

The objective was to evaluate if the architecture modelling language ArchiMate could be used as a tool for efficient communication, to support effective collaboration over the different domains in an enterprise.

The answer provided to the research question, has shown a positive evaluation of ArchiMate as an enterprise architecture modelling language to support the collaboration in an enterprise. We can conclude that the ArchiMate Enterprise Architecture modelling language can be used as a tool for communication to support the collaboration throughout the departments in an organization but ideally it is to be combined with other initiatives that support the communication and collaboration. During the literature review I found no scientific articles that evaluate the ArchiMate language in this context, so this paper is another brick in the wall to support the ArchiMate language.

In practice my analysis and evaluation can be used to convince an organization in adopting an architecture modelling language like ArchiMate. The shared understanding model was validated during this research and can be used as a foundation for future research, where potentially the shared understanding model could include extra concepts like for instance an enterprise or business vocabulary. For the future it would be nice to research, if the extensions in ArchiMate 2.0 would improve the models by providing an even better alignment with the strategy, vision of an organization. More quantitative research could investigate to what extent the ArchiMate language as a tool for communication supports the collaboration in a larger population and to analyse if the conclusions formed in this research are applicable in a broader context.
1 Introduction

Enterprise systems need to be constantly and smoothly re-engineered to respond to changing market demand and technological evolution. Enterprise Architecture, considered as the foundation of enterprise systems engineering, has emerged as a ‘tool’ to help stakeholders to manage system engineering and changes. It is not only an IT issue, but first of all a strategic and organizational challenge (Chen, Doumeingts et al. 2008).

The problem of aligning and integrating business and IT is hampering many companies in their strategic and tactical development. Constructing integrated architecture models contributes to tackling this problem (Lankhorst 2004).

EA models are developed to give business managers a better understanding of the things the enterprise owns, how it operates and what it produces, so they can make better business decisions (Harrell and Sage 2010).

In the review of the scientific literature the most relevant concepts and relations were discovered for architecture modelling and collaboration. The main question used in the literature review was:

“What are the main concepts and relations in Enterprise Architecture modelling and collaboration, in an organization which acts as a Service Provider?”

The result of this literature review was the starting point for the empirical research. By the end of the research we can evaluate if the ArchiMate Enterprise Architecture modelling language can be used as a tool for communication to support the collaboration throughout the departments in an organization.

In the article “Designing the Enterprise Architecture Function” (van der Raadt and van Vliet 2008), there is a clear distinction of 3 concepts in Enterprise Architecture (EA): EA decision making, EA delivery and EA conformance as shown in Figure 1.

![Figure 1](image-url)
- EA decision making at strategic and tactical level is responsible for approving new EA products or changes in existing EA products, and for handling escalations regarding EA conformance.
- EA delivery is responsible for providing advice to guide EA decision making at strategic and tactical level. Additionally, EA delivery creates and maintains EA products, validates change results to see if they conform to the EA, as well as if they provide support in applying EA products.
- EA conformance is responsible for implementing organizational changes through solutions as described in the target architectures, complying with the EA policy, and providing feedback on the applicability of the EA products to the EA delivery function.

EA modelling acts on the three above concepts, but EA modelling is the core for the EA delivery concept.

I will sketch what Enterprise Architecture is and which two approaches are researched at the Open Universiteit. Then, I will select and discuss the EA modelling approach.

Next to EA concepts, I will investigate the concept collaboration in an Enterprise environment. During the review of the literature I discovered relevant concepts which I will summarize in a (shared understanding) model where the main concepts and the potential relationships will be investigated in the empirical research.

The main question that will be answered is: “Can an organization support communication and collaboration by using Enterprise Architecture modelling?”.

To be able to answer this main question, this question is divided in different questions. An empirical research is executed at the two companies who act as a service provider and have business processes that depend strongly on their information technology systems. The research strategy consists of two case studies.

The first case study is a leading European financial service provider (FSP) with international reach. More than 35,000 businesses worldwide use their service. The company is headquartered in Belgium, but also operates in India and maintains regional sales offices throughout the world, with offices in Belgium, the Netherlands, France, Germany, Austria, Switzerland, UK, UAE and the US. At the FSP there is no dedicated team for the development of an Enterprise Architecture.

The second case study is at a human resources service provider in Belgium specialised in advise, optimisation and handling of administrative processes related to payroll, social security, child benefit, starting formalities and professionalization of HR-policies.

At the HSRP they have an existing EA department in place for more than five years now.

The empirical research consists of four different phases summarized below:
- Phase 1: Initial Interviews with the different stakeholders and architects.
- Phase 2 first case: Observing and participating in creating EA models with stakeholders.
- Phase 2 second case: Comparing existing EA modelling techniques with modelling in the ArchiMate language.
- Phase 3: Interviewing the different stakeholders and architects.
- Phase 4: Combing the results of the participating companies and drawing conclusions.
1.1 Scope of the research

Within the Open Universiteit (Mofers and Woude 2011) the following approaches of EA get attention:

- The **setting of a framework through architecture** (EA principles) mainly for the business and information related to business rules and qualitative analysis, which is more or less comparable to a top down specification.

- The **architecture modelling** approach (ArchiMate, TOGAF) mainly used in the field of Information Technology and related to system design and quantitative analysis, which, in relation to the models, can have a more bottom-up structure.

The architecture modelling approach is the starting point for the thesis, but the goal is to go further than just the field of Information and Technology. There will be a focus on collaborating through the use of EA models not only for the ICT department, but for different departments within an enterprise.

2 Problem statement and objective

A general problem within larger organizations with complex business processes is that the communication is often not efficient between different departments or business units. I want to investigate if using EA modelling supports creating and maintaining shared understanding between business units and departments for organizations where the business processes are strongly dependent on IT-systems.

The objective is to check within the “EA delivery” concept if establishing architecture modelling can support the communication and collaboration throughout the organization.

This objective will be reached by combining the review of scientific literature and empirical research.

The main question that I want to answer is the following: “Can an organization support communication and collaboration by using Enterprise Architecture modelling?”

There is an evaluation if EA modelling contributes to collaboration in an enterprise by the use of the ArchiMate language as a tool for communication.
3 Theoretical point of departure for architecture modelling

After choosing the Enterprise Architecture discipline for the thesis, there was a provisional question based on a first review of scientific literature regarding Enterprise Architecture.

The provisional question was:
“Can a service provider improve the communication and collaboration in an organization by implementing Enterprise Architecture modelling?”. This question was the foundation for the next stage in the literature review.

The objective of the literature review was to gather the knowledge required on the Enterprise Architecture discipline and to introduce the EA discipline with a focus on the relevant aspects identified after exploring the literature and creating a provisional research question.

A secondary goal was to obtain a concepts and relations diagram that can be used as input for the empirical research. Later on, this concepts and relations diagram will be referred to as the shared understanding model.

3.1 Literature review research question

I derived the following question for the literature review:
“What are the main concepts and relations in Enterprise Architecture modelling and collaboration, in an organization which acts as a Service Provider?”. To formulate an answer for this question, the question was divided into the following sub-questions:

- What is Enterprise Architecture?
- Which EA frameworks are widespread used?
- Which modelling languages are in use and available for Enterprise Architecture?
- Is there a fit between EA frameworks and modelling languages?
- How does EA modelling relate to collaboration and communication?
- Which company attributes are specific for Service Providers?
- Are service providers representative for a bigger range of organizations?

3.2 Strategy for the literature review

The literature review started with reading books on Enterprise Architecture, to enhance my general knowledge on the EA discipline.

The following books were selected, as they were used in the introduction document for a thesis in the discipline of Enterprise Architecture (Mofers and Woude 2011):

- Enterprise Architecture at Work: Modelling, Communication and Analysis (Lankhorst 2009)
- Architecture Principles (Greefhorst and Proper 2011).

The book “Creating Value by Informed Governance” was in the same Enterprise engineering series as the two books mentioned previously and was used to provide guidance in the Enterprise Architecture discipline.

- Enterprise Architecture : Creating Value by Informed Governance (Land 2009)
The book on Dynamic Architecture was selected, because it was used in a course I studied at the Open Universiteit and because it had some nice examples for questionnaires.

- DYA: Stap voor stap naar professionele enterprise-architectuur (Berg and Steenbergen 2004)

The next step was gathering scientific literature that was relevant to the literature review research questions and that could help the empirical research. For this I used the Open Universiteit online library to gather recent articles (mostly >2007).

The main keywords that were used were the following:

- Enterprise Architecture
- Enterprise Architecture model(ing)
- Zachman, TOGAF, DYA
- ArchiMate
- Maturity model
- Service oriented
- Provider
- Communication
- Collaboration
- Project Start Architecture
- Shared Understanding

This resulted in the following quantity of articles as shown in Table 1, categorized in the location where the articles were found.

**Table 1: Overview articles found**

<table>
<thead>
<tr>
<th>Search Engine</th>
<th>Database/Location</th>
<th>Number of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>OU online library</td>
<td>Academic Search Elite</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>ACM Digital Library</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Business Source Premier</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>EBSCO</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Elsevier</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Emerald</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>IEEE</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Sage Journals online</td>
<td>2</td>
</tr>
<tr>
<td>Google</td>
<td>Internet</td>
<td>6</td>
</tr>
</tbody>
</table>

References of these articles were maintained in the application EndNote to keep an overview and make it easy to insert the literature references in my text. The application X-mind was used to create mind maps and to categorize the articles to the relevant topics. Examples of categorizations are:

- Introduction to Enterprise Architecture
- Enterprise Architecture model(ing)
- Collaboration
- EA and Collaboration
There was a focus on the research questions in the articles and the investigation methods that were defined as for its conclusions. One of the main articles discovered during the literature review is “Definition and validation of requirements for validation of requirements for collaborative decision-making in Enterprise Architecture creation” (Nakakawa, Van Bommel et al. 2011) which uses many of the same concepts.

Regarding the use of the literature, I relied on the fact that main search engine only provided peer-reviewed articles, the reputation of the author and publisher, the method and the literature references that were used in the articles.

3.2.1 Conceptual model

I started with a provisional model based on the research questions: the final conceptual model as shown in Figure 2 was created iteratively during the review of literature. This conceptual model was used as a framework to write the literature review.

Figure 2: Conceptual model literature review
3.3 Enterprise Architecture description

Enterprise Architecture is a new field or discipline which guides the design of business processes and information systems for an enterprise. Compared to other fields, for example the construction industry, architecture has been used in the design and construction of all size buildings. Architects use standard symbols that can be recognized and understood by all members of their industry to carry out the construction work (Chen, Doumeingts et al. 2008). The discipline EA is still much in development and no accepted standards exist today throughout different enterprises. As an organizational role, EA is positioned between IT and business strategy formulation on the one hand, and project-focused solution architecting (sometimes called system architecting) on the other (Tamm, Seddon et al. 2011).

Dynamic Architecture (DYA) uses the following definition: "A coherent whole of principles and models that provide guidance to the design and realization of processes, organizational structure, information management and technical infrastructure of an organization" (Berg and Steenbergen 2004).

TOGAF 9.1 provides the following definition for architecture:
1. A formal description of a system, or a detailed plan of the system at component level, to guide its implementation (source: ISO/IEC 42010:2007).
2. The structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time.

For an enterprise the definition is: “The highest level (typically) of description of an organization and typically covers all missions and functions. An enterprise will often span multiple organizations.”(Haren 2011).
So an EA is where the system of interest is the enterprise itself.

The ArchiMate Foundation defines enterprise architecture to be “A coherent whole of principles, methods, and models that are used in the design and realization of an enterprise’s organizational structure, business processes, information systems, and infrastructure” (Lankhorst, Proper et al. 2010).

When reviewing the previous definitions, we discover that there is a main common factor: supporting the design trough models and principles.
When selecting a definition it’s recommended to select or create a definition that matches closest to the goal and scope of the architecture (Berg and Steenbergen 2004).
It’s not my goal to add an extra definition in this paper, but specifically for this thesis I could describe enterprise architecture modelling and it’s relation to EA as follows: “Enterprise Architecture modelling provides models that are coherent with the whole of principles and methods of the enterprise. Enterprise Architecture modelling limits the design freedom and reinforces the realization of an enterprise’s organizational structure, business processes, information systems and infrastructure.”
With guidance of Figure 3 Adding Architecture Framework to the meta model (Emery and Hilliard 2008) the description of Enterprise Architecture will become more tangible. The business processes and information systems of an enterprise are in this case the system of interest.

As main concepts for the Architecture Description we encounter: Stakeholder, Concern, View, Viewpoint, Model (OpenGroup 2011).

- **Stakeholder**: An individual, a team, or an organization (or classes thereof) with interests in, or concerns relative to, a system.
- **Concerns**: The key interests that are crucially important to the stakeholders in a system, and that determine the acceptability of the system. Concerns may pertain to any aspect of the system’s functioning, development or operation, including considerations such as performance, reliability, security, distribution, and evolvability.
- **View**: The representation of a related set of concerns. A view is what is seen from a viewpoint. An architecture view may be represented by a model to demonstrate to stakeholders their areas of interest in the architecture. A view does not have to be visual or graphical in nature.
- **Viewpoint**: A definition of the perspective from which a view is taken. It is a specification of the conventions for constructing and using a view (often by means of an appropriate schema or template). A view is what you see: a viewpoint is where you are looking from - the vantage point or perspective that determines what you see.
- **Model**: A representation of a subject of interest. A model provides a smaller scale, simplified, and/or abstract representation of the subject matter. A model is constructed as a "means to an end". In the context of enterprise architecture, the subject matter is a whole or part of the enterprise and the end is the ability to construct "views" that address the concerns of particular stakeholders: i.e., their "viewpoints" in relation to the subject matter.

![Figure 3: Adding Architecture Framework to the meta model (Emery and Hilliard 2008)]
3.3.1 The goal of Enterprise Architecture

The dream of every CEO is to have one standardized, integrated, flexible and manageable landscape of aligned business and IT processes, systems and procedures. Having complete control over all projects implementing changes in that landscape so that they deliver solutions that perfectly fit the corporate and IT change strategies, makes this dream complete (van der Raadt and van Vliet 2008).

Today many organizations are struggling with changes due to the increasing complexity of IT systems and business processes, and have problems keeping an overview of how the enterprise functions.

Enterprise Architecture is a discipline that can assist in creating a clear understanding between stakeholders about the processes, IT infrastructure, technology and applications within an enterprise.

This clear understanding will make an enterprise agile and flexible and grants them the opportunity to adapt to the ever changing market and can assist in maintaining compliance.

Compliance in terms of a regulatory framework, e.g. Sarbanes-Oxley: strategic planning including corporate strategy planning, business process optimization, business continuity planning, IT management (Clark, Barn et al. 2011).

When a company becomes larger and more complicated, good architectural practice becomes indispensable (Lankhorst 2009).

The task of EA is to translate the broader principles, the capabilities, and the goals defined in the strategies into systems and processes that enable the enterprise to realize these goals (Tamm, Seddon et al. 2011).

To accomplish this task, one of the first steps will need to be creating shared understanding amongst the different stakeholders.

In a business environment, “dynamics is the only constant while the ability to adapt is the natural variable”. Thus, for an organization to survive, it has to deal with challenges or changes in its business environment, and strategic management (i.e. strategy formulation, implementation, and evaluation) is one of the traditional approaches it may use. However, strategic management often fails due to inadequate strategy implementation, rather than unforeseen circumstances (Nakakawa, Van Bommel et al. 2011).

3.3.2 Architecture products

In order to define Enterprise Architecture products, I will use the EA frameworks as shown in appendix 1 as guidance. In Figure 17 the products of the Zachman EA are shown in the cells of the first five rows. In the last row the ideal result of the EA products is shown as a functioning enterprise.

In Figure 18 the TOGAF ADM is shown, with the respective steps in the cycle where we can get an overview of the EA products throughout the steps. The clearest overview of the EA products can be seen in the DYA framework (Figure 19) where every open box in the table is an EA product.
As I summarize, I see the following range of EA products for the different frameworks which all have the goal to reach an efficient functioning enterprise.

1. Architecture guidelines for business, systems and technology.
3. Enterprise architecture control or governance.

These products will provide a means for EA delivery, decision making and conformance and will guide managers in designing business processes and system developers in building applications in a way that is in line with business objectives and policies (van der Raadt and van Vliet 2008: Lankhorst 2009).

3.3.3 Architecture process

The architecture process consists of the usual steps that take an initial idea through design and implementation phases to an operational system, and finally changing or replacing this system, closing the loop. In all of the phases of the architecture process, clear communication with and between stakeholders is indispensable. The architecture descriptions undergo a life cycle that corresponds to this design process as seen in Figure 4 (Lankhorst 2009).

![Figure 4: The architecture description lifecycle (Lankhorst 2009)](image)

The EA process does a lot more than just creating an EA product other aspects that are expected of the process are the following (Lankhorst 2004: Nakakawa, Van Bommel et al. 2011):

- Creating shared understanding (of the organization’s problem and intended solution) among stakeholders and architects.
- Building consensus on the concerns, requirements, solution scenarios, and quality criteria that the enterprise architecture must address.
- Collaboratively evaluating design alternatives for the enterprise architecture.
- Selecting the most appropriate design alternative for realizing the planned transformation.
3.4 Enterprise Architecture Modelling

An enterprise model is an abstraction of how the enterprise conducts its business and it is built from various points of view, namely: business vision view, business process, business structure and business behaviour (Adigun and Biyela 2003).

3.4.1 EA modelling approach

As systems supporting business become increasingly more significant and complex, an important approach to management and planning of systems that has gained prominence, is model-based Enterprise Architecture.

The first step in EA analysis is to construct a model of a business. The model should describe features such as constraints, alternatives, impact or feasibility which will help in decision making processes. If the EA cannot support such rational decision-making, then it cannot be seen as a good model (Clark, Barn et al. 2011).

A meta model is the “model of the model.” It defines the essential elements, syntax, and structure of the models. In an EA, the meta model of the EA provides assistance in managing and designing the EA (Chae, Choi et al. 2007). An example of such as meta model is shown in Figure 5 which shows an object-oriented model. The object-oriented model provides the advantages of model compactness and the ability to drill down to detailed implementation.

![Figure 5: Object-oriented model as an EA (Chae, et al., 2007)](image)

Another approach is the fact-oriented approach as shown in Figure 6: Fact-oriented model as an EA (Kang, et al., 2010), essential elements of the fact-oriented approach are facts. Facts build on fact types, and fact types build on concepts as expressed by terms. The approach is less compact, however, it has advantages of human-readability, semantic stability, expressiveness, extensibility, changeability and so on (Kang, Lee et al. 2010).

![Figure 6: Fact-oriented model as an EA (Kang, et al., 2010)](image)
3.4.2 Modelling languages

When every domain speaks its own language, draws its own models, and uses its own techniques and tools. Communication and decision making across domains is seriously impaired (Lankhorst 2004). The requirements for a EA modelling can be summarized as the following (Clark, Barn et al. 2011)

- To support decision making, an EA language requires that the notation will support the decision-makers goals, the domain in which the decision is required and the causal relations between that which is controlled and the decision.
- The language must display precision such that there is clarity on any of the represented concepts.
- The language must exhibit behavioural semantics – that is support how concepts affect each other as a result of actions.
- The language must support representation of concepts at different levels of abstraction.

The Semantics of Business Vocabulary and Business Rules (SBVR) is an Object Management Group (OMG) standard to support interchange of business vocabularies and rules among organizations. The SBVR is based on fact-oriented approach (Kang, Lee et al. 2010). SBVR is more related to the guiding trough architecture approach as defined within the OU.

ArchiMate proposes an integrated modelling framework for Enterprise Architecture including organizational structure, business processes, information systems and infrastructure. This framework proposes three layers – namely, business layer, application layer and technology layer (Lê and Wegmann 2012)

The ArchiMate language uses the object-oriented approach.

3.4.3 The ArchiMate language

ArchiMate was developed to enable expression of business processes and their IT support in an easily understandable way (without low-level implementation details): visualization, analysis, communication, realization and management of architectures. ArchiMate also complements TOGAF by offering generic concepts that enable creation of consistent and integrated models that appropriately communicate TOGAF architecture views and enable communication and decision making across organization domains (Nakakawa, Van Bommel et al. 2011).

It is clear that TOGAF and ArchiMate can easily be used in conjunction and that they appear to cover much of the same ground as shown in Figure 7, although with some differences in scope and approach. The most important disparity we observe between TOGAF and ArchiMate is that it appears that the ArchiMate viewpoints that deal with the relationships between architectural layers, such as the product and application usage viewpoints, are difficult to map onto TOGAF’s structure, in which views are confined to a single architectural layer (Lankhorst 2009).
ArchiMate also complements TOGAF by offering generic concepts that enable creation of consistent and integrated models that appropriately communicate TOGAF architecture views and enable communication and decision making across organization domains (Nakakawa, Van Bommel et al. 2011).

In a short time, ArchiMate has become the open standard for architecture modelling in the Netherlands, it is also fairly well known in the international EA community, and recently it has been brought under the aegis of The Open Group (OpenGroup 2011). Now with the most recent release ArchiMate 2.0 that was published by The Open Group, there is even a better match between TOGAF and ADM by incorporating extensions like “Implementation and Migration” and Motivation in the language.

More details on the ArchiMate notation, the extension of the language in version 2.0, the meta model and a practical example of an ArchiMate model can be found in appendix 2. As the ArchiMate language is an EA modelling language it needs to be clear that it’s the idea to use these types of models on abstract enterprise level. There is still room for other languages like UML for software engineering and BPMN for the detailed analysis of business processes.
3.5 Shared understanding

Reaching (and maintaining) shared understanding is defined as the process (multidisciplinary) team members employ to gain new understanding or correct, improve, or enrich the current team understanding, and thus collaboratively learn and collaboratively reflect (Mulder 2004). Creating shared understanding is a key result in a collaboration process, and may be difficult. Yet, if the content of the process is simple or if the group already has a shared language and shared understanding this activity might not be necessary.

We distinguish several types of shared understanding:

- Shared knowledge
- Mutual learning
- Mutual differences

The level of shared understanding or its quality is difficult to determine and improve as people can be unaware of differences in meaning based on asymmetry of information, assumptions and perceptions (Kolfschoten 2007).

This shared understanding can be divided into three parts related to Enterprise Architecture (Veldhuijzen van Zanten, Hoppenbrouwers et al. 2004: Nakakawa, Van Bommel et al. 2011)

- Processes
- Systems
- Concerns

Enterprise Architecture is an ongoing endeavour to develop a shared understanding of the enterprise and to capture the knowledge that is the basis of that shared understanding. But if the amount of information that must be captured becomes too onerous, the magnitude of the task becomes a liability (Harrell and Sage 2010).

Architecture projects involve professionals with different backgrounds, who build a shared understanding of the IT solution structures. As a result such projects will benefit significantly from a unified modelling language that can be used to model all aspects of an enterprise (Khoury, Simoff et al. 2005).

As pointed out shared understanding will always be an ongoing process and not an end product. The EA modelling discipline is an important tool to aid in the process of reaching and maintaining shared understanding. It’s important to find an efficient way to facilitate the shared understanding process so the result is worth the effort. EA modelling has the potential to support this process.
3.6 Communication

There is a substantial relation between communication and organizational commitment. However, the link between the two varies strongly depending on the type of communication. Horizontal communications (informal, with proximate colleagues, of socio emotional content) are less strongly related to levels of commitment at both organizational and unit level, than are vertical communications (strategic information and communication with management). With regard to organizational commitment, then, organizations may not be able to reach their social objectives only by using interpersonal means (Postmes, Tanis et al. 2001).

According to Gartner, a successful implementation of architecture development highly depends on effective communication and virtual teams that create and agree on enterprise architecture content. A lack of stakeholder understanding and support arises when business stakeholders are not involved in developing the enterprise architecture: the architecture content is not being used in other projects in the organization and management is not understanding the value of Enterprise Architecture. What triggers these issues is the failure to explain the architecture (i.e. the process and content or products) in a simple business language (not technical) that stakeholders understand and the failure to communicate enterprise architecture content with organizational stakeholders early and frequently. (Nakakawa, Van Bommel et al. 2011).

Architecture at high level of abstraction is a means of communication with and among stakeholders. It allows representing stakeholders’ expectations in terms of features of enterprise system rather than documenting detailed requirements on functions, data or resources that will be specified in the later stage (Chen, Doumeingts et al. 2008). If every domain speaks its own language, draws its own models, and uses its own techniques and tools, communication and decision making across domains is seriously impaired (Lankhorst 2004). The ArchiMate language has potential to provide the high level of abstraction to communicate the EA with and among stakeholders on a horizontal level and vertical level. It can also bind different domains together, and translate organizational objectives to lower levels such as the business, application and technology levels.

3.7 Collaboration

Collaboration is important for knowledge creation and innovation and therefore for the competitiveness of organizations in a knowledge economy. We define collaboration as joint effort towards a goal. Collaboration is challenging and groups cannot overcome the challenges of collaboration by themselves. In order to increase the quality of collaboration, collaboration support is required (Kolfschoten 2007). In the article “How to make your enterprise architecture management endeavor fail!” (Buckl, Ernst et al. 2010), there is an important distinction between company-wide versus team-wide consultation for the collaborative task, creation of an enterprise-specific information model.
This is strongly influenced by the participating stakeholder group. Hence, the question on the size of the stakeholder group applies, i.e. the question whether only the EA team should participate in the construction or stakeholders from the remainder of the company. In the context of EA modelling, EA development for the purpose of systems evaluation is inherently collaborative in nature. Members of an EA development team share different perspectives and facets of the enterprise with each other (Fernandes, Li et al. 2009).

Architecture modelling in ArchiMate can potentially support this collaboration be it in company-wide or in a team-wide approach.

3.8 Service provider

On the subject service provider there was little relevant literature to be found. For the relationship between EA and service provider there was even less relevant literature to be found.

The article “An Engineering Approach to Enterprise Architecture Design and its Application at a Financial Service Provider” (Stephan Aier 2008) investigates the Enterprise Architecture Design in relationship to the Financial Service Provider. Reviewing his approach and conclusions, I was not able to discover what is specific for service providers compared to another type of company.

So it seems that EA is not substantially different for service providers compared to other companies, my assumption that they need to be agile and customer-oriented, applies to many modern organizations and not just service providers. In the empirical phase I remained sceptical on this initial conclusion but no clear deviations specific for service providers were detected.
3.9 Shared understanding model

In Figure 8 the main concepts and relations are shown for EA modelling that were discovered during the iterative literature research. As explained previously, the concept of service provider has been dropped and the concept ArchiMate has become one of the central concepts as it seems to become one of the more known languages for EA modelling.

A subset of the concepts and relationships will be used in the empirical research. The focus here will be on the concepts:

- EA modelling
- ArchiMate
- Effective collaboration
- Efficient communication
- Stakeholders and architects
- Shared understanding
  - Processes
  - Systems
  - Concerns

Figure 8: Shared understanding model based on a literature review
4 Research design and approach

In this research design and approach topic there is a description of the methods that are used. There will be an explanation on why the different methods were selected and how they will lead to answering the empirical research questions.

The approach will be divided in four parts:

- Conceptual design
- Technical design
- Material
- Empirical research

The conceptual design is related to the results of the literature review and the final problem statement. The design contains the concepts and relations (shared understanding model), created during the literature review and the questions linked to the main problem statement.

Technical design is more about the strategy used, such as: experiment, survey, case study, action research, grounded theory, ethnography and archival research (Lewis, Saunders et al. 2007). In the technical design, there is an explanation on why case study was considered as an appropriate strategy.

The raw material can be in the form of secondary data and primary data: Observation, semi-structured interviews, in-depth interviews, group interviews and/or surveys. The secondary data is based on existing scientific literature and documents and models used in the participating organizations is used in combination with primary data obtained through interviews. The collected primary data is evaluated on reliability and validity.

The qualitative analysis of the primary data was done, based on the “shared understanding” model and the research question by the categorization of questions and answers in concepts used in the model and the research questions.

In the actual empirical research there is: the collection of data, analysing the qualitative data, formulating conclusions by confronting the results with the research questions and formulating recommendations for future work.

4.1 Conceptual design

By doing a literature review in the Enterprise Architecture (EA) discipline, the required knowledge was obtained to start an empirical research. The empirical research that follows the literature review would be based on architecture modelling in relationship to collaboration. In the literature review ArchiMate was identified as the main language for architecture modelling. The ArchiMate language was compared to other approaches for modelling and documenting.

In the literature review the main concepts and relations in Enterprise Architecture modelling and collaboration was identified by creating a “Shared Understanding” model. Where the main concepts next to EA modelling and collaboration are:

- Communication
- Shared understanding
- ArchiMate
- Stakeholders
An overview of the concepts and relations for the conceptual research are shown in Figure 9, the shared understanding model.

The model is used as foundation for the creation, categorization of interview questions. As well as for the analysis of and answers to the interview questions related to the questions mentioned next.

4.1.1 **Can an organization support communication and collaboration by using Enterprise Architecture modelling?**

This main question is divided into the following questions:

- “Can EA modelling contribute to effective collaboration over different departments?”
- “Will shared understanding based on EA models contribute to more effective collaboration?”
- “Can the ArchiMate language be used to communicate about processes, technology and concerns in the organization?”
- “Can the ArchiMate language as a means for communication support shared understanding?”
- “Will creating and using EA models improve involvement of stakeholders?”
- “Does an organization see the benefits of having a common architecture modelling language for different departments?”
- “Can architecture modelling truly support creating and maintaining shared understanding for stakeholders of:”
  - Processes, systems and concerns
4.2 Technical design

The design can be divided in three layers: research strategies, research choices and time horizons (Lewis, Saunders et al. 2007). With these layers in mind we will go from a research question to a research project. The technical design will be the plan of how I will go about answering the research questions.

The case study strategy was selected and will be executed in different phases:

- Phase 1: Initial Interviews with the different stakeholders and architects.
- Phase 2 first case: Observing and participating in creating EA models with stakeholders.
- Phase 2 second case: Comparing existing EA modelling techniques with modelling in the ArchiMate language.
- Phase 3: Interviewing the different stakeholders and architects.
- Phase 4: Combining the results of the participating companies and drawing conclusions.

The research choice is a multi method study, where the goal is to obtain the best possible understanding of EA modelling and its relationship to communication and collaboration for the two cases. The following methods are used; interviews, archival research and observation.

4.2.1 Strategy

The strategies that can be considered as a research strategy are (Lewis, Saunders et al. 2007):

- Experiment
- Survey
- Case study
- Action research
- Grounded theory
- Ethnography
- Archival Research

The following strategies were considered initially as a strategy: Survey, case study, archival research and action research. A survey was excluded as this method seemed less appropriate to answer the main questions. By setting up a survey and presenting it to people who have little knowledge on EA and which are less sceptical on the subject of EA, it is easy to make the case for EA modelling to improve collaboration and get a very positive but irrelevant result. Archival research was excluded as EA modelling is a new field and there is insufficient data publicly available. This does not mean I didn’t use existing documents (to prepare for interviews) but it was not the principal source of data. Action research was considered, in this case there would be a repetition of cycles diagnosing, planning, taking action, and evaluating. Although this cycle can partly be recognized in the research, there won’t be multiple repetitions of this cycle; because of this the research can’t be categorized as action research.
4.2.2 Case study

The case study strategy was selected as this will provide a richer understanding of the context for the researcher and the people involved. The strategy is depicted below for both cases the semi-structured interviews are used in the initial phase to analyse the current situation by using the “shared understanding” model. There is a different strategy in the “taking action” phase for the two cases. For the HR service provider there is a comparison of current models with models created using the ArchiMate language by working together with the architects. At the FSP there was a model created in the ArchiMate language by working together with the participants.

The last step for data collection in the study is the same for both cases and consists of semi-structured interviews based on research questions and findings in the previous steps of the cases. Triangulation or the use of different data collection techniques document analysis and semi-structured interviews are applied in both cases. The investigations are based on organizations as a whole and therefore can be considered as a holistic case study.

Figure 10: Case study strategy
4.2.3 Practitioner-researcher

As I participated in creating the models at the FSP, my role is clearly defined as practitioner-researcher which has advantages like access to relevant documents and people. As I’m familiar with the enterprise, I don’t have to invest time in getting to know the organization. There is however a risk involved in knowing the organization in advance, it might prevent exploring issues that could enrich the research (Lewis, Saunders et al. 2007). This was kept in mind and this will be countered by an open mind and by being acceptable for input from the participants and from the supervisors at the Open Universiteit.

4.2.4 Research choice

The choice was a multi method study, where the goal is to obtain the best possible understanding of EA modelling and its relationship to collaboration for the two cases. This involves the following methods:

- Analysing existing documents and models.
- Observing and participating in the creation of EA models with the stakeholders.
- Comparing EA modelling techniques.
- Interviewing the different stakeholders and architects.

With this multi-method qualitative research, it is expected to get a better understanding and to obtain valuable data on how EA modelling by using the ArchiMate language can support collaboration.

4.2.5 Time horizon

The research was cross-sectional (snapshot in time), the study took place during a particular time and data was collected during a limited period and the conclusions of the study will be based on this moment in time. The study took place from December of 2012 to February of 2013.

4.2.6 Reliability an validity

Reliability relates to the extent to which your data collection techniques or analysis procedure will yield consistent findings. Four main threats exist for reliability:

- Subject or participant error
- Subject or participant bias
- Observer error
- Observer bias (Lewis, Saunders et al. 2007)

Participant error would be likely if the participants had no knowledge in the field, the stakeholders in case one assisted in creating and reviewing an EA model to get more knowledge on the matter. The participants for the second case are architects with experience in EA modelling.
There is no interest for the participants in being dishonest, as they have nothing to gain or lose no matter what the outcome of the investigation is. I limited the risks for observer bias or error, by using semi-structured interviews and I asked the interviewees to review the answers in the interview transcript. Validity is concerned with whether the findings are really about what they appear to be about. Is the relationship between two variables a causal relationship?

Following threats for validity are identified:
- History
- Testing
- Instrumentation
- Mortality
- Maturation
- Ambiguity about causal direction (Lewis, Saunders et al. 2007)

History is not a real risk as the ArchiMate Language is new for the FSP, the architects do have some previous experience with ArchiMate but not in this specific scope. Testing or instrumentation are not at risk as there are no measurements of performance of individuals nor is a change in behaviour required. It is not expected that people change their behaviour or opinions. Mortality and maturation are not at risk because of the limited time frame that research is conducted.

Ambiguity about causal direction, this is more difficult to avoid this, the concepts and relationships were split as much as possible in the shared understanding model. To avoid ambiguity on relations even further I’m open to feedback of the supervisors of the thesis for their objective opinions when I draw my conclusions. External validity is the concern about to what extent your results are generic: that is, whether your findings may be equally applicable to another setting such as other organizations (Lewis, Saunders et al. 2007). This concern is valid as there are only two cases, one middle-sized and one large organization. The investigations are related to organizations where the business processes depend strongly on information technology, as clearly communicated in the introduction of the thesis.

4.2.7 Access to data and ethical issues

My credibility as a researcher was a critical factor in gaining access to the required data or sources. I’m known as system engineer with a strong technical background, not as somebody who will do academic and scientific research. This is why I presented a brief overview to the sponsors in the participating companies of courses followed during the master program, to demonstrate newly developed academic skills in different disciplines next to my skills as a system engineer.

Getting access to the FSP sources was in a phased approach, first I presented the subject in an informal context to the head of technology to gain his support. Next I presented the subject to members of the management team: Head of Technology, Chief Communications Officer and the Head of HR.
In this presentation there was a focus on concepts and relations for the research. The following topics were covered:

- Introduction of myself as an academic
- Intro to EA
- Intro to EA modelling
- Examples of ArchiMate based on a fictional company Archisurance (See appendix 2)
- Research question
- Research goal
- Research approach
- Expected involvement of the FSP
- Intro to the next steps, creating models and getting people (participants) on-board for the research

A concern identified during the presentations was, that in parallel another initiative was started to improve collaboration over the different teams in the organization. So it was agreed that I clearly present my research as my own to avoid confusion for the participants.

A brief report was created at the end, specific for the FSP, parallel to the final written report for the thesis. Confidentiality is a major concern at the service provider, so it was agreed to keep the company anonymous.

Getting access to the human resources service provider (HRSP) was more difficult, as I had no official ties to this company. I only know this company from years back when I worked there as a consultant (system engineer). I selected this company because there was an EA department active for more than 5 years. I was introduced by an architect, which I knew from my previous experience in the company.

My introduction of the subject to the manager of the architecture teams, was months before the actual research and therefore I was not clear on the requirements, as my work was still in the initial phase.

The response took a long time and was cautious by the EA manager, as he didn’t want to lose time of his team, by letting them participate in an investigation that was not relevant for them. Before the first meeting with the EA manager I sent a mail with sufficient info to prepare for the meeting and to point out some potential benefits for his organization. After the mail there was a follow-up on the email with a phone conversation.

As an extra, I provided a brief report after the interviews specific to the HR-company next to the full paper, so I provided an extra benefit for the company and the EA team. Another benefit is that people were heard and feedback can be given to peers and management about architecture modelling, communication and collaboration. The people involved are restricted to members of the architecture teams, and the involvement in research was limited to a number of interviews. Looking back on this I’m not sure if it was the best approach to contact the HRSP so early in the process.
Nevertheless, the interviews were extremely valuable combined with the result of the interviews at the FSP, as the architects gave their expert opinion based on years of experience in EA.

Only two case studies limit the external validity of the study, on the other hand there is a nice synergy between both companies. Business processes are dependent on information technology: one company has extensive experience in EA and the other is new to the EA discipline.

Another criterion for the selection of the companies is the willingness to cooperate, based on my familiarity with the companies. The time frame of 400 hours to complete the thesis also limited me to investigate only two cases.

Ethical issues are limited by the fact that there is an evaluation if by using ArchiMate modelling the collaboration could improve, the idea was not to evaluate or enforce a way of working for the participating companies.

So the idea is in no way to cause embarrassment or any other disadvantage for the participants or the participating companies. The research was announced as my own private initiative, so that it’s clear that it is independent from other initiatives within the company.

Collecting the data was done through interviews, due to the nature of the qualitative research a number of ethical principles are of importance to avoid damaging the reputation of the researcher, participants and participating companies.

The following ethical principles are to be respected by the researcher:

- Objectivity of the researcher
- Limit myself to the agreed time frame and possibilities offered by the participating companies
- Respect confidentiality and anonymity
- The researcher avoided asking intrusive questions.
- The researcher informed the participants at the beginning of the interview how the questions will be used
- Don’t force the participants to answer a question they do not want to answer.

Next to the previously mentioned ethical principles, there is an attempt to avoid the use or collecting of any personal data to make sure I don’t conflict with the directives of data protection by the European Union.

“Within the European Union, issues of data protection have assumed an even greater importance with the implementation of Directive 95/46/EC. This provides protection for individuals in relation to the processing, storing and movement of personal data (Lewis, Saunders et al. 2007).”

During the analysis and reporting of the data, it’s important to represent reality, to avoid subjectivity and not to be selective in the choice of data that is reported. Not respecting this could seriously impair the value of the entire research by having conclusions based on invalid or incomplete data.

With reporting the data, it’s important to respect the anonymity of the participating companies, so special attention needs to be given to the reporting so that the reader can’t identify the companies.
Another risk with the reporting of the data is that some conclusions could potentially have a negative impact for the participants. One example is exposing a lack of knowledge to answer interview questions or to participate in creating models. Although the anonymity of the participants counters this risk partially, it remains a difficult ethical issue. Another way of countering this is by formulating the questions and models in a way that they are appropriate for the target audience. Alternatively, a positive effect of the reporting of the data could be identifying the skills and knowledge of the participants.

4.2.8 Method

As it is impossible to collect and analyse all data for every possible case (census), I selected to use a sampling technique. Where I selected a subset (sample) of organizations and within the organizations I selected another sample for the participants.

The population at the FSP consisted of managers and professionals in different departments. The population of the sample at the HR service provider consisted of an enterprise architect and the manager of the architecture team.

This small size of the population has the advantage that in a limited amount of time there can be a more in-depth review and analysis of the collected data, and offers the opportunity to produce results quicker. This sampling with a limited population negatively impacts the external validity and makes it less representative for an entire population of organizations (where business processes have a strong dependency on information technology).

Non-probability sampling means that we don’t select the sample at random but that there is a subjective selection of samples. Which is mostly the case when you do case studies: the selection was based on the characteristics of the companies (critical case sampling) and familiarity of the researcher with the companies. The HR service provider is seen as a critical case not just because of the characteristics of the company but also because of the expertise of the architects in the EA discipline. For the homogeneous sampling of the case at the FSP the focus is on an in-depth investigation linked to the research questions.

The combination of critical case and homogeneous non-probability sampling improved the general applicability which is in general considered low in a case study approach.

4.3 Material

The material consists of secondary and primary data. The secondary data was used to enhance the knowledge, of the enterprises and their current use of modelling. The primary data that was gathered through interviews with the objective of answering the main questions and reaching the objective.

4.3.1 Secondary data

Documentary secondary data such as written materials in the form of documentation and models was searched on the internet sites, intranet sites and documentation on file shares by participants and the researcher as preparation for the interviews.
This data related to research questions and concepts identified in the literature review is used as discovery or as means for exploring in a first phase, the data is expected to be in a compiled data or summaries form no raw data was available or shared by the organizations. For the FSP, full access to secondary data has been obtained early in the process. For the HR service provider, getting access was a two phase process, in a first phase publicly available secondary data was analysed in the second phase secondary data will be identified and analysed after the initial interview. As they did not present everything (all documentation and models) this only provided a basic framework for the second interview round.

The reliability of this secondary data will not be at scientific level, but has some basic formal value that a document contains last update time, name of author and reviewer. Measurement bias is unlikely as there is no gain for the professionals in falsifying the models and because of the validation of the documents by a reviewer.

The advantage of researching this secondary data:
- Less resource requirements
- Unobtrusive

Disadvantages:
- Might have been collected for other needs
- Access might be difficult
- Ethical issues like confidentiality
- No control over the quality
- Initial purpose might affect how it is presented

4.3.2 Primary data

The main method for collecting primary data will be the interviews. There are many situations in which the use of non-standard (qualitative) interviews as a method of data collection may be advantageous. These can be grouped into four aspects related to interview:
- The purpose of the research
- The significance of establishing personal contact
- The nature of the data collection questions
- The length of the time required and completeness of the process (Lewis, Saunders et al. 2007)

In both cases there were two interview rounds, where in the first round the interview will be used to set a baseline measurement using a semi-structured interview. The second round at the FSP was started after getting experienced with modelling in the ArchiMate language. For the HRSP the second round started shortly after the exploratory interview and analysing their existing models. This second round of interviews was more structured, but can still be considered semi-structured as the participants are still allowed to express their opinion outside the interview questions.
Some of the questions may be omitted and the order of the questions may be changed during the interviews, to keep the flow in the interviews and to avoid limiting the feedback of the experts to the questions and topics identified by the researcher. A number of data quality issues can be identified in relation to the use of semi-structured and in-depth interviews, related to (Lewis, Saunders et al. 2007):

- Reliability
- Forms of bias
- (External) validity

Reliability of qualitative research using interviews requires the necessary attention certainly related to bias of the interviewer or interviewee bias. To limit the reliability issues and to improve the validity, it is important for the researcher to communicate clearly the reason for the choice of strategy, methods used and the data that was obtained.

4.3.3 Analysing the data

The data collected trough the interviews is qualitative data as it is:

- Based on meanings expressed trough words
- Collection of results in non-standardized data requiring classification into categories
- Analysis conducted through the use of conceptualization (Lewis, Saunders et al. 2007)

The meaning expressed trough words (audio) in the interviews were recorded when the participant agreed, or transcribed to paper in detail when recording is not allowed. In all cases some data was transcribed on paper during the interviews, to avoid losing data due to failure of for instance of an audio recording device. The participants always got a transcript of the interview for validation and correction if needed.

The non-standardized data was classified in categories. These categories are based on concepts in the shared understanding model. In the next figures, there is an example of the categories related to the concepts: collaboration, communication, shared understanding, stakeholders.

Identified categories based on the concepts:

- COL-SU-ALT: Collaboration, shared understanding, alternative method to ArchiMate EA modelling
- COL-SU-AEAM: Collaboration, shared understanding, ArchiMate EA modelling
- COM-SU-ALT: Communication, shared understanding, alternative method to ArchiMate EA modelling
- COM-SU-AEAM: Communication, shared understanding, ArchiMate EA modelling
- STA-SU-ALT: Stakeholders, shared understanding, alternative method to ArchiMate EA modelling
- STA-SU-AEAM: Stakeholders, shared understanding, ArchiMate EA modelling
- SU-PROC-ALT: Shared understanding, processes, alternative method to ArchiMate EA modelling
- SU-PROC-AEAM: Shared understanding, processes, ArchiMate EA modelling
- SU-SYS-ALT: Shared understanding, systems, alternative method to ArchiMate EA modelling
• SU-SYS-AEAM: Shared understanding, systems, ArchiMate EA modelling
• SU-CON-ALT: Shared understanding, concerns, alternative method to ArchiMate EA modelling
• SU-CON-AEAM: Shared understanding, concerns, ArchiMate EA modelling

An example of how these categories are used for the interview questions is shown in the appendices “Interview round 1 and 2”.
In the first interview round the current approaches in the form of documents, models and presentation are analysed, to create the baseline measurement. After the first interview round and after the participants get more familiar with the ArchiMate language and architecture modelling, a second interview was done where data was collected more specifically related to the main questions. With this approach the results can be evaluated after the 2nd interview round by comparing these results with results in the 1st interview round.
5 An empirical search on EA modelling and collaboration

As mentioned previously, the empirical research consists of two case studies: The first case study is a financial service provider (FSP): there is no official team for the development of EA. There was an identified need within the company to improve the collaboration throughout the different departments in the organization. The second case study is an HRSP: there is an existing EA department in place for more than five years now. Here I can surely take advantage from the lessons learned, related to EA modelling, and got valuable input of the architects. For the FSP I involved people from different departments:

- Software developer
- System engineer
- Knowledge worker for documentation
- Head of product management
- Head of technology

For the HR service provider I relied on the expert opinions of an architect and the manager of the architecture team.

5.1 Model

A model was created based on the general strategy, Figure 11 shows the steps involved in the empirical research.
The first step consisted of a literature review on Enterprise Architecture, EA modelling, communication, collaboration and shared understanding which resulted in basic knowledge in the EA discipline.

As a second step, I presented the shared understanding model in as shown in Figure 12 to the participants in both organizations. The presentation is followed by a discussion to see if the concepts and relations are clear and if they can be identified in current documentation and models. After the presentation there was an interview to get a baseline measurement for the concepts in the “Shared understanding” model.

In a third step, the main objective was to get the participants familiar with EA modelling and ArchiMate. At the FSP this is done by creating models in ArchiMate related to the main business process. For the HRSP, this is done by comparing the current EA documents to EA models created in ArchiMate. The baseline measurement created in the previous step helped identify the relevant documents/models, which can be used as input for creating models in ArchiMate or comparing current models to models created with the ArchiMate language.

The fourth step is to present the models created in ArchiMate, followed by an interview to measure the effectiveness of the models in relationship to the concepts in the main questions.

As a fifth step, I combined the results of the interviews of the two organizations to evaluate if the ArchiMate language (EA modelling) can support shared understanding by communication and collaboration.
5.2 Expectations

The expected result is a positive evaluation of the ArchiMate language in the context of supporting communication and collaboration over departments within an organization. The results provided need to be more than a “yes or no” answer, there is a validation of the shared understanding model and there will be basic measure for shared understanding of processes, systems and concerns.
6 Results

In this chapter, the results are shown for interview round 1, the modelling actions, the comparison of EA modelling and interview round 2. The goal of interview round 1 is setting the stage (baseline measurement) for the empirical research, by judging importance for concepts like communication, collaboration and shared understanding and rating these concepts for the current way of documenting and modelling. The results for importance contain a rating from low, moderate or high. The scoring for the concepts is:

1. Very poor (--)
2. Poor (-)
3. Neutral (o)
4. Good (+)
5. Very good (++)

Next the modelling practice in ArchiMate was started for a main process at the FSP, the main goal here was to get people accustomed with a new language. There is a comparison between EA modelling in a format specifically defined at the HRSP with modelling in ArchiMate, the obtained result here is the list of similarities and differences between the two. For interview round 2, or the final interview round the goal is to obtain a measurement for the EA modelling language ArchiMate and the rating for supporting communication, collaboration and shared understanding. The scoring for these concepts is the same as for interview round 1.

6.1 Results of interview round 1

The analysis is done based on the different categories set in the interview questions. These categories are based on concepts in the shared understanding model. An example of how these categories are used for the interview questions is shown in the appendix “Interview questions round 1”, to guarantee the anonymity the answers of different interviewees are shown. The collected data is analysed from the perspective of the FSP and the HRSP. For the FSP this is done in two groups’ management versus specialists, the HRSP is one group containing an architect and the manager of the architecture team. Every category is measured for importance and scored for one or some of the concepts on the current method of modelling with shared understanding as the central concept.

6.1.1 Collaboration and shared understanding

The interview questions were formulated to get a better comprehension of how models and documents are used for shared understanding and how this contributes to effective collaboration. For this analysis, we investigate if the current approach aids in shared understanding in the department versus shared understanding throughout the enterprise.
All interviewees identified that shared understanding amongst stakeholders will be beneficial for the collaboration. In the architects’ opinion, models are an important aspect to get tacit knowledge written down or modelled. For the FSP the departmental models and documentation is considered good, but there is little exchange of models throughout the different departments. Most of the models are not suited for exchanging between departments although management sometimes uses more abstract models to communicate, but they are often not known or used by the specialists.

The joint effort for the creation of user stories by the product management and development department is considered as a big added value to create shared understanding between the departments. These User stories can be considered as a part of a bigger project or a small project that can be completed in less than 3 weeks. A need for improvement was identified at the FSP, identified problems were:

- Missing shared enterprise vocabulary.
- By the lack of models the dependency on key players is too high.
- Documentation is often created only from the perspective of the department itself.

For the HRSP they started a new approach of documenting using enterprise architecture documentation and models, which allows them to collaborate over the different departments. The value of this is expected to be high, but has not been evaluated in this phase. Needs for improvements that were identified:

- The use of templates for models and documentation to formalize the creation of models.
- The use of an enterprise business vocabulary.
- Experience and skills for modelling.

A summary of the results is shown in the table below, which shows that the FSP is doing OK for the departmental level but is missing models and documents to collaborate on an enterprise level. The HRSP is doing good on both aspects, but is still in the process of getting this approach accepted and used by more people in the organization.

<table>
<thead>
<tr>
<th>Importance</th>
<th>Business and IT Specialists (FSP)</th>
<th>Management (FSP)</th>
<th>Architects (HRSP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Departmental</td>
<td>High</td>
<td>++</td>
<td>High</td>
</tr>
<tr>
<td>Enterprise</td>
<td>--</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>

### 6.1.2 Communication and shared understanding

The interview questions were formulated to get a better comprehension of how models and documents are used to communicate efficiently to create shared understanding. For
this analysis, we investigate if the current approach aids in shared understanding throughout the department versus the enterprise.

All interviewees agreed that improving the communication between the different stakeholders in the organization, would lead to a better understanding of how the enterprise works and would help create and maintain shared understanding.

For the FSP the focus is today on departmental documentation and every department has its own way of documenting and modelling with the exception of the previously mentioned user stories.

In general the documents used are detailed and often lack an abstract view on things. Management uses from time to time more abstract models in the form of web sequence diagrams but this is on an ad-hoc basis and are not always introduced and shared with the rest of the organization.

A need for improvement was identified by everyone at the FSP, identified problems were:

- The specialists are missing a view on the future of “new” products or features.
- Documents and models are created in isolation from each other.
- Missing an abstract level of documentation.
- No single language or conventions for models and documents.

For the HRSP the new approach of documenting and modelling is considered effective, based on these models they can analyse the impact of changes in the environment and link different domains to some extent. Different views are used for the models to adapt to the target audience.

The following needs for improvement were identified:

- Further improvement on adapting the views to the target audience.
- A clearer distinction between main concepts and trivial concepts needs to be made in the documents/models.

A summary of the results is shown in Table 3, which shows that the FSP is doing good for the departmental level but is missing models and documents to communicate on an enterprise level. Management is using more abstract models as a means for communications but this is only used ad-hoc.

The HRSP is doing good on both aspects, but is still in the process of getting this approach accepted and used by more people and departments in the organization.

<table>
<thead>
<tr>
<th>Importance</th>
<th>Business and IT Specialists (FSP)</th>
<th>Management (FSP)</th>
<th>Architects (HRSP)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Departmental</td>
<td>+</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Enterprise</td>
<td>-</td>
<td>0</td>
<td>+</td>
</tr>
</tbody>
</table>
6.1.3 Stakeholders and shared understanding

The interview questions were formulated to get a better comprehension of how models and documents are used to create and maintain shared understanding for stakeholders. For this analysis, we investigate if the current process aids in creating and maintaining shared understanding for stakeholders and if stakeholders can be identified by the current documents and models (product).

All interviewees agreed that the organization would benefit and can improve shared understanding by more involvement of stakeholders in the process of creating models and documents. Models or documents (products) were in general not considered important to identify stakeholders directly, only one of the specialists thought this would be a considerable added value.

A need for improvement was identified by everyone at the FSP, identified problems were:
- Missing customer point of view
- Lack of formalized process for creating models
- Lack of models or documentation for the business side of things

For the HRSP the involvement of business and IT-architects is considered good, involvement (and reporting) to MGMT can be improved.

A summary of the results is shown in the table below, which shows that the importance is not always rated high but this is due to the fact that identification of stakeholders is considered less important than the involvement. The HRSP has an active involvement of stakeholders in the different domains, but there is still room for improvement.

Table 4: Analysis results stakeholders, shared understanding, current method.

<table>
<thead>
<tr>
<th>Importance Identification</th>
<th>Business and IT Specialists (FSP)</th>
<th>Management (FSP)</th>
<th>Architects (HRSP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>o</td>
<td>o</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>
6.1.4 Shared understanding of processes, systems and concerns

In Figure 13 the concepts and relations are shown as a combination of the following categories:

- SU-PROC-ALT: Shared understanding, processes, alternative method to ArchiMate EA modelling
- SU-SYS-ALT: Shared understanding, systems, alternative method to ArchiMate EA modelling
- SU-CON-ALT: Shared understanding, concerns, alternative method to ArchiMate EA modelling

This way the analysis can be done for the relationships between the different domains versus analysing the above categories individually.

The interview questions were formulated to get a better comprehension of how models and documents are used today to create shared understanding on processes, systems and concerns.

![Diagram](image)

**Figure 13: Creating and maintaining shared understanding for processes, systems and concerns**

All interviewees agreed that improving the knowledge of the business processes is very important for the shared understanding amongst stakeholders.

The concept systems can be divided in two different concepts namely:

- Application
- Technology

There is a big difference in the importance, whereas application is considered very important the technology or infrastructure is considered less relevant for shared understanding between the different domains and is more left to the infrastructure or systems departments. The HRSP sees the infrastructure side of things as a commodity. For the FSP the stakeholders can contact the system team in the rare occasions that this collaboration is needed.

At the FSP the concept concerns is considered as important, but based on documents or models it is still difficult to identify the concerns, according to management the user stories have an added value in project scope for defining requirements and identifying concerns.

Room for improvement was identified by everyone at the FSP, identified problems were:

- Insufficiently able to identify common pitfalls at the initiation phase of project.
- Missing guidelines, check lists and lessons learned.
- Lack of technical requirements.
- Insufficiently challenging business requirements.
For the HRSP the new approach of documenting and modelling is considered effective for identifying major pitfalls like to avoid missing important aspects at the initiation phase of a project. The following needs for improvement were identified:

- Better quality of the models will help identify concerns.
- Further improvement cost/benefit and risk analysis.

A summary of the results is shown in Table 5, which shows that the FSP sees the importance of modelling on an enterprise level to get and maintain shared understanding, but still needs to start this initiative. The HRSP is already taking advantage of modelling on enterprise level but still has room for improvement.

Although the importance of a customer point of view was identified in the interviews, there is no reason to believe documenting or modelling would be substantially different for service providers compared to other companies.

<table>
<thead>
<tr>
<th>Importance</th>
<th>Processes</th>
<th>Processes</th>
<th>Systems</th>
<th>Systems</th>
<th>Concerns</th>
<th>Concerns</th>
<th>Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business and IT Specialists (FSP)</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>--</td>
<td>--</td>
<td>+</td>
</tr>
<tr>
<td>Management (FSP)</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>--</td>
<td>--</td>
<td>+</td>
</tr>
<tr>
<td>Architects (HRSP)</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

In the next interview round, questions will be based on the findings in this first interview round, the experience gained while modelling in ArchiMate and the main questions identified in literature review and the research approach.

### 6.2 Modelling in ArchiMate

The creation of a qualitative model in the ArchiMate language for the E-commerce process at the FSP proved to be difficult, mainly because the current documentation is more project oriented and not so much organised around the business processes. As the quality of the model is an important aspect for judging the potential of the ArchiMate language, I involved a Quality Assurance engineer in the initial phase of creating the model who has more expertise in the E-commerce process on the business and application domain. With his help a draft model was created, this model was reviewed and corrected by the business and IT specialist who were interviewed in round 1.

The model that was created in ArchiMate language with the tool Archi consisted of the views as depicted in Figure 14.
The E-commerce Actor Cooperation view consists of the FSP as a central actor and how the FSP cooperates with the different roles like: merchant, cardholder, acquirer and issuer. This view is depicted below and was focused on the cooperation in the business domain.

![E-commerce Actor Cooperation view](image-url)
The E-commerce Business Product view shows which products are contained in the E-commerce service provided to customers and that it is supported by a policy document as shown in the figure below.

The E-commerce Business Process view is a view on the different business processes and their relations.

The E-commerce Application Cooperation and structure view is the most advanced view, which shows:
- Application services
- Different application components
- The data or information that is used
- The interfaces that are used
- The relationships between all components, interfaces, services and information.

The E-commerce Application Cooperation and structure view shows:
- infrastructure services
- different technology and infrastructure components
- the location
- the interfaces that are used between components and datacenters
- and the relationships between all components.

The E-commerce layered view show at the highest abstraction level possible the different domains for Business, Application and Technology and how they are related to the E-commerce services and processes.
In the background of these views there is one ArchiMate model which consists of the following categories.

- **Business**
  - Actors
  - Functions
  - Information
  - Processes
  - Products
- **Application**
  - Applications
  - Data
- **Technology**
- **Relations**

In the different views the objects in the above categories are used, this has the advantage that when an object or relationship is changed that this is reflected in all views.

Because of confidentiality the full model for the FSP is not published in this document but an example of a model in ArchiMate is published as shown in appendix 2. This model was included in the tool Archi as an example for the modelling of an organization.

### 6.3 EA modelling comparison

At the HRSP different frameworks are used, in a project there are generally two phases: preliminary study and project execution. The intent of the project execution is to deliver the result of a project in a fixed time and price. The preparation for this is done in preliminary study, which is a project in itself.

In the preliminary study the WVF (werkvoorbereidings framework) is used, which is a framework based on the Integrated Architecture Framework (IAF) of Capgemini. Next to the WVF there is another method used within business architecture, which is based on value chain but this is still in development and will be adapted to the needs of the HRSP.

In the modelling tool MEGA, the business architecture, ICT architecture and technical architecture deliverables are documented in a notation specific for the HRSP. For the technical design, models based on UML are used.

Compared to models in ArchiMate the EA documents created in MEGA contain a text notation next to the graphical presentation. These documents contain similar domains as in ArchiMate:

- Business versus business
- ICT versus application
- Technical versus technology.

The link between the different the domains is more difficult to identify in the MEGA documents compared to ArchiMate models.
6.4 Results of interview round 2

As in interview round 1, the analysis is done based on the different categories set in the interview questions. The difference with interview round 1 is that now EA modelling and the ArchiMate language is evaluated in the context of the shared understanding model. An example of how these categories are used for the interview questions is shown in the appendix “Interview questions round 2”.

6.4.1 Collaboration and shared understanding

The interview questions were formulated to get a better comprehension if views in ArchiMate can contribute to shared understanding and how this contributes to effective collaboration throughout the enterprise.
All interviewees identified that the presented model in ArchiMate is suited for linking different domains like product management, application and development, but that next to this an EA mentality needs to be adopted and a pragmatic approach is required to get the organization to adopt the ArchiMate language. The interviewees agreed that by getting tacit knowledge modelled in ArchiMate you could lower a major dependency on key players and that this will have a positive impact on the collaboration.
For the FSP the ArchiMate model has an added value next to the departmental models and documentation, to get the big picture of how the enterprise works and to identify relationships between domains. The HRSP shares this idea but emphasis that also stakeholders in the organization need to be ready for this approach.
Management at the FSP considered that modelling in ArchiMate could lead to a more structured collaboration process for modelling.
A comment on the model in ArchiMate is that the relationship between the technology and application layer is not always clear but this is not considered as a problem as the main focus is on the business and application domain.

Table 6: Analysis results collaboration, shared understanding, ArchiMate EA modelling

<table>
<thead>
<tr>
<th>Effective Collaboration</th>
<th>Business and IT Specialists (FSP)</th>
<th>Management (FSP)</th>
<th>Architect (HRSP)</th>
</tr>
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<tr>
<td></td>
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<td>++</td>
<td>++</td>
</tr>
</tbody>
</table>

6.4.2 Communication and shared understanding

The interview questions were formulated to get a better comprehension of how views in ArchiMate can be used for efficient communication and create shared understanding throughout the enterprise.
All interviewees identified that the views in ArchiMate are understandable by the target audience as long as the abstraction level remains high enough. The model is suited to communicate on changes in the environment and the impact of the change. The interviewees believe that having a common architecture modelling language for the different departments has a positive influence on the efficiency of the communication.
Everyone agreed that the ArchiMate language as a means for communication will support shared understanding.

At the FSP one of the business and IT specialists referenced that the language can be used for presentations, where there is a repetition of the same model over and over again and you zoom in on the relevant aspects for the meeting. For the FSP the modelling in ArchiMate is considered as a more proactive approach of modelling and will have a positive impact on the efficiency of the communication by having correct models and avoiding the need to recreate the same models over and over again during meetings or brainstorm sessions.

A summary of the results is shown in Table 7, which shows that the FSP and the HRSP rated the ArchiMate language high as a tool for communication to create shared understanding.

<table>
<thead>
<tr>
<th>Efficient communication</th>
<th>Business and IT Specialists (FSP)</th>
<th>Management (FSP)</th>
<th>Architects (HRSP)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
</tbody>
</table>

6.4.3 Shared understanding of processes, systems and concerns

In Figure 13 the concepts and relations are shown as a combination of the following categories:

- SU-PROC-AEAM: Shared understanding, processes, ArchiMate EA modelling
- SU-SYS-AEAM: Shared understanding, systems, ArchiMate EA modelling
- SU-CON-AEAM: Shared understanding, concerns, ArchiMate EA modelling

The interview questions were formulated to get a better comprehension if the ArchiMate EA modelling language can create and maintain shared understanding on processes, systems and concerns.

All interviewees agreed that modelling processes in ArchiMate could improve the understanding of the business processes. For the shared understanding on systems people were convinced of the added value for the application domain and the relationships to the business domain. They also agreed on the added value for modelling the technology domain but the relationships between the technology and the application domain were not always clear in the presented model. For shared understanding on concerns there is a bigger gap between the thoughts of the architects at the HRSP and the people at the FSP. The architects consider that being able to identify concerns is one of the main drivers for EA modelling whilst some management, business and IT specialist at the FSP don’t think that models in ArchiMate can contribute a lot to identifying concerns.
As identified by one of the specialists at the FSP, the collaboration process when creating models can identify concerns. It’s not just the model as a product that is important but also the modelling process itself.

A summary of the results is shown in Table 8, which shows that there is an important difference in the scoring of the value of ArchiMate EA modelling for identifying concerns.

Table 8: Analysis results shared understanding processes, systems, concerns, ArchiMate EA modelling

<table>
<thead>
<tr>
<th></th>
<th>Business and IT specialists (FSP)</th>
<th>Management (FSP)</th>
<th>Architect (HRSP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processes</td>
<td>++</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Systems</td>
<td>+</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Concerns</td>
<td>+</td>
<td>0</td>
<td>++</td>
</tr>
</tbody>
</table>

6.4.4 Stakeholders and shared understanding

The interview questions were formulated to evaluate if EA models in ArchiMate can create and maintain shared understanding for stakeholders. For this analysis, we evaluate if the current process aids in shared understanding for stakeholders. All interviewees agreed that ArchiMate can support the process of creating models and that it would improve the involvement of stakeholders. As pointed out during the first interviews to get to a shared understanding an enterprise vocabulary has a central role. In general it was considered that when modelling you should make use of such a vocabulary, but ArchiMate on its own is not enough to create an enterprise vocabulary other initiatives are required for this. A summary of the results is shown in the table below, which shows that the involvement of stakeholders can be very good when using ArchiMate.

Table 9: Analysis results stakeholders, shared understanding, ArchiMate EA modelling

<table>
<thead>
<tr>
<th></th>
<th>Business and IT Specialists (FSP)</th>
<th>Management (FSP)</th>
<th>Architects (HRSP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stakeholders</td>
<td>++</td>
<td>+</td>
<td>++</td>
</tr>
</tbody>
</table>
### 6.5 Summary of results

Some important findings were:

- The importance of a shared vocabulary.
- The technology view or infrastructure view is considered less important, the focus is for both cases on business and application perspectives.
- At the FSP, high level overviews that depict different domains and interactions are missing.
- At the FSP, the user stories are an important tool for creating shared understanding among product management and application development on project level.
- At the FSP for the communication aspect of things it was identified that the same language and an agreed convention could aid the shared understanding and collaboration. Ideally models would be created in a single language and used to compare the models over time.
- That there is no need to directly identify stakeholders based on models.
- ArchiMate was considered as useful tool to communicate on business processes, applications and technology.
- ArchiMate can support effective collaboration on an enterprise level.
- Not everyone agreed on the value of ArchiMate to identify or communicate concerns, the architects think this should be one of the goals of EA modelling but some of the interviewees seem to think that the added value of modelling in ArchiMate is very limited.

The current approach of documenting and modelling is very different for the two cases, at the FSP the documents and models that are used throughout different domains are very limited.

On a project level the documentation is better, for the different domains an abstract level of documents or models is often missing for the business and the application domain. This proved to be a challenge for creating models in the ArchiMate language. At the HRSP they are already using EA documents and models and they score a lot better for the abstract views on things and the relationships between the different domains. But they identify room for improvement, but this is more related to getting the approach embedded in the organization than the presentation or models that are used.

An overview for the scoring is shown the table below. This table shows the potential of ArchiMate, other factors will of course influence the obtained result for collaboration, shared understanding and communication.

<table>
<thead>
<tr>
<th></th>
<th>Today</th>
<th>Potential with ArchiMate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FSP</td>
<td>HRSP</td>
</tr>
<tr>
<td>Effective collaboration</td>
<td>--</td>
<td>+</td>
</tr>
<tr>
<td>Shared understanding</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Efficient communication</td>
<td>-</td>
<td>+</td>
</tr>
</tbody>
</table>
7 Conclusions and recommendations

The objective was to evaluate if the architecture modelling language ArchiMate could be used as a tool for efficient communication, to support effective collaboration over the different domains (business, application and technology) in an enterprise.

The central questions, that was answered was: “Can an organization support communication and collaboration by using Enterprise Architecture modelling?”.

The first interviews showed that the organization where EA documentation was already in use, that this type of documentation was suited for communication and collaboration on an enterprise level. The method of documenting at the financial service provider (FSP) was more suited to support communication and collaboration on a departmental level or on smaller sized projects.

By creating and reviewing the model in ArchiMate for an existing process it was proven that the language is suited to create a model on an enterprise level. The comparison between EA documents and the model in ArchiMate shows that the relevant domains are treated (business, application and technology) and that the possibility to create relationships between the different domains is one of the major benefits of ArchiMate.

The second interview round showed that all the interviewees agreed that the ArchiMate language has a lot of potential to support shared understanding on an enterprise level. The main inconsistency was in the rating of ArchiMate for creating shared understanding on concerns, were architects are convinced that this one of the major benefits. Not all the specialists and managers share this opinion; some think that the contribution for shared understanding on concerns will be limited.

The view of management and specialist at the FSP are mostly very similar, only small differences were identified for instance management estimates the knowledge on business processes in the enterprise slightly higher than the specialists do. In the following chapters the research question will be answered in more detail by formulating an answer to the sub-questions.
7.1 ArchiMate as a tool for communication to support collaboration

Can EA modelling contribute to effective collaboration over different departments?

There was a general consensus in the interviews that the EA modelling language ArchiMate contributes to effective collaboration over the different domains. A considerable value was the ability to identify the relationships between different domains like: business, application and technology.

Will shared understanding based on EA models contribute to more effective collaboration?

Shared understanding will lead to better collaboration between stakeholders, but for the collaboration to be truly effective it’s crucial that the models are aligned with the strategy and vision of the organization.

Can the ArchiMate language be used to communicate about processes, technology and concerns in the organization?

There was a consensus that the language was suited for the communication on processes and technology on an abstract level. For the communication on concerns, other initiatives would be valuable to complement ArchiMate. The architects believed however that one of the major drivers for Enterprise Architecture models is the ability to identify concerns.

Can the ArchiMate language as a means for communication support shared understanding?

ArchiMate has the potential to support shared understanding for stakeholders by creating the required views that represent the viewpoints of the stakeholders.

Will creating and using EA models improve involvement of stakeholders?

By the process of collaborative creating models the involvement of stakeholders will be increased. The product which is the model with relevant views contributes to seeing the big picture and can show how the enterprise works.

Can architecture modelling truly support creating and maintaining shared understanding for stakeholders of: processes, systems and concerns?

Architecture modelling by using the ArchiMate language can support and maintain shared understanding for processes, systems and concerns to some extent. But it’s not a silver bullet: you will not perfectly align the different domains or department by introducing the ArchiMate language. An “Enterprise Architecture” mentality, together
with high quality models are needed to get started and truly support shared understanding.

**Does an organization see the benefits of having a common architecture modelling language for different departments?**

Having a common modelling language to model on an abstract level is seen as big benefit, but having a common enterprise vocabulary was also identified as being very important.

Deciding if it’s worthwhile to start using a common architecture modelling is highly dependent on the balance between the costs and benefits. A pragmatic approach is recommended for starting the use of a common architecture modelling language, like linking it to a project where the need for modelling an abstract level is required.

### 7.2 Contribution to science and practice

The answers provided to the research questions, have shown a positive evaluation of ArchiMate as an enterprise architecture modelling language to support the collaboration in an enterprise. During the literature review I found no scientific articles that evaluate the ArchiMate language in this context, so this paper is another brick in the wall to support the ArchiMate language. So I can truly say I contributed to the scientific knowledge on ArchiMate as an EA modelling language.

Furthermore the shared understanding model was validated and can be used in the context for investigating EA modelling in relationship to collaboration and communication. This model can be a foundation for future research, where potentially the shared understanding model could include extra concepts like for instance an enterprise vocabulary.

In practice, my analysis and evaluation can be used to convince an organization in adopting an architecture modelling language like ArchiMate.

We can conclude that the opinion of Marc Lankhorst is very accurate and that without a common language the communication between different parties can be seriously impaired.

### 7.3 Limitations and usability

The result are only applicable for enterprises where business processes are strongly dependent on information technology, only two case studies limit the external validity of the study. Another limiting factor was the quality of the created model in ArchiMate, as it was limited to one important business process and it needed to be completed in a tight timeframe. This could have lead to implication that it’s not always clear how the application domain relates and interfaces with the technology domain.

The concepts in the shared understanding model were based on literature in the EA discipline, so this narrowed the view on things. To see to what extent other initiatives like for instance business vocabulary or business rules could have had, the model would need to be extended.
The extensions that were added in ArchiMate 2.0 such as principles, goals, requirements and constraints were not taken into account. For the future it would be nice to research, if the extensions in ArchiMate 2.0 would improve the models by a better alignment with the strategy, vision of an organization. More quantitative research could investigate to what extent the ArchiMate language as a tool for communication supports the collaboration in a larger population to analyse if the conclusions formed in this research are applicable in a broader context. A big added value would be to check and compare results for companies who are using ArchiMate and companies that don’t use ArchiMate. This sort of quantitative research on the same subject would certainly increase the external validity.

8 Reflection

The research approach was a balance between what I would like to accomplish and what is achievable with the amount of time and resources available to me. An initial shared understanding model contained related concepts and relations for the enterprise strategy and vision, to check that the improved communication and collaboration is on subjects that are in line with enterprise goals. I simplified the shared understanding model to include only the core concepts linked to modelling, communication and collaboration. This was to avoid:

- Combining the two approaches of Enterprise Architecture researched at the Open Universiteit like setting of a framework through architecture and architecture modelling
- The need to enhance my knowledge on architecture frameworks like TOGAF
- The involvement of participants at executive level, like CEOs or CIOs

I started with the idea to identify Critical Success Factors (CSF) for improving communication and collaboration by the use of the ArchiMate language for modelling. This was too ambitious, to accomplish this I would need to try several different approaches which were not possible in the scope of this master thesis. The objective was changed to evaluate if modelling in ArchiMate can support communication and collaboration, after this change there was more focus in the research and it was followed by a pragmatic research approach. During the graduation process, my view on scientific research did not change much, it was already influenced by the courses on academic skills and by the master courses. For me scientific research is valuable when you are exploring new things, where a step-by-step practical approach is unavailable or it doesn’t fit your needs. Scientific research can in some cases provide you the edge needed compared to limiting yourself to books and material with only a practical view on things. The scientific literature will often provide you with a more in-depth knowledge compared to more commercial literature.

8.1 Getting started

After completing all the courses in master program, it started out with selecting and requesting the discipline in which I would like to graduate. For me the selection in the discipline was easy, Information and Process Architecture was the first course I completed at the Open Universiteit and was an eye opener.
Thanks to the practical experience I gained by working in IT for more than a decade, I could recognize the added value of architecture for business and IT. As the gap between the business and IT ideas seems to be present in so many organizations. So I wanted to explore during my thesis how Enterprise Architecture can be used to combine the ideas and views. I personally wanted to enhance my skills further in the EA discipline.

After the acceptance by the Open Universiteit to graduate in the Enterprise Architecture, I started working on a provisional research statement. In this statement I started developing my central question and a first draft research model. As in general, I have a practical mindset, I needed to pay close attention that the focus remained on providing scientific and academic value. The idea was to get results that were valuable in a broader context and not just a practical result that was relevant for the organizations that participated.

After sending in the provisional statement to the supervisors at the Open Universiteit a face-to-face meeting was organised to discuss and evaluate this document. In this first meeting we agreed on things that could be improved on this provisional statement and what the planning would be for completing the graduation program. It was agreed that I would send a monthly progress report to the supervisors and I could always contact them when I needed extra support next to accompanying course books included with the graduation course.

Time management and focus was an important aspect for me as I had to combine a busy job, family life and the thesis. So it was agreed that I would commit to an average of 10 hours a week to work on my thesis. As the amount of time I could invest and the proposed duration of 400 hours for completing the graduation project was limited. It was very important to keep the scope focused and to work in a pragmatic and structured way towards realistic goals.

8.2 Literature review

I started the literature review based on the report where I created a provisional research question, related to EA modelling. Initially, I started searching for articles and reading books on Enterprise Architecture. Although most references in this literature review point to scientific articles instead of the books I used. I’m convinced reading these books broadened my view on EA and it helped me to select the most relevant articles. It might not have been the most time efficient approach, but the value of the gathered knowledge can only be seen as an extra benefit.

The literature review resulted in a collection of books and articles relevant for EA modelling which was inventoried. About half of the articles were referenced in the literature review. I also know now who the authoritative authors are in the discipline. The discovered concepts and relations in the literature review would be used as a foundation for the subsequent steps. I developed this way of thinking and analysing things during previous courses (like business rule management) in the master program. The literature review based on generic concepts in architecture modelling and more
specifically related to my provisional problem statement proved to be a sound base to develop my final research questions.

8.3 Empirical research

The empirical research was based on the final research model which was created iteratively, based on the scientific literature of Enterprise Architecture and the feedback of the supervisors.

The investigation ended up to be more practical than I imagined at first, as I did some architecture modelling together with the people involved at the FSP case. This makes the interviews more relevant than just giving a theoretical introduction in EA modelling and interviewing based on that introduction. But this practical approach proved to be challenging as I was new to modelling in ArchiMate and the existing documentation on which I could base my model was scarce. The empirical research took considerably longer than in the estimation provided by the Open Universiteit in the course book.

8.4 Reporting

The reporting or the creation of this document was done in a lot of iterations. I used information of different milestone documents, combined with documents I created during the empirical research and the progress reports that were shared with the supervisors.

I started out with creating a provisional table of contents, where I used the information I previously mentioned and made an attempt to fill in the gaps to create one clear report. Reporting took more time (>70 hours) as was estimated by the Open Universiteit, but was not too complex, as I had a sound foundation for the report based on the main questions, the research model and the shared understanding model.
9 Appendices

9.1 Appendix 1: Overview Enterprise Architecture frameworks

Commonly frameworks define a meta model used to describe the EA data, organizational best practices and governance mechanisms. In the practice of EA, the corresponding EA models can grow very large and expose complex relationships between EA model elements. Also, these large and complex models continuously need to be aligned with the real–world enterprise which they are supposed to represent, in order to be most effective (Farwick, Agreiter et al. 2011).

Generally speaking, the main purpose of a framework is to provide an organizing mechanism so that concepts, problems and knowledge on enterprise interoperability can be represented in a more structured way (Chen, Doumeingts et al. 2008; Tamm, Seddon et al. 2011).

There are many different approaches to Enterprise Architecture frameworks. The most famous framework for the definition of enterprise architectures is the original Zachman framework for EA (Figure 17). Zachman takes two dimensions of viewpoints to describe the enterprise models: perspectives and abstractions. Based on the Zachman framework, business managers and IT specialists can describe their own interests in enterprise models and can communicate the information about enterprise models with each other. However, Zachman framework does not provide any place for the technology view, and the business and application views are mixed into a function view (Younghwan, Dongwoo et al. 2008).

![Figure 17: Original Zachman Information Systems Architecture framework (Zachman, 1992)](image)

EA has its origins in Zachman’s original EA framework, while other leading examples include the Open Group Architecture Framework (TOGAF) (Clark, Barn et al. 2011).
The TOGAF 9.1 Architecture Development Method is depicted in Figure 18, this framework deals with the following architectures:

- **The Business Architecture** defines the business strategy, the governance, the organization, and the key business processes.
- **The Data Architecture** describes the structure of an organization's logical and physical data assets and data management resources.
- **The Application Architecture** provides a blueprint for the individual applications to be deployed, their interactions, and their relationships to the core business processes of the organization.
- **The Technology Architecture** describes the logical software and hardware capabilities that are required to support the deployment of business, data, and application services. This includes IT infrastructure, middleware, networks, communications, processing, standards, etc.

![Figure 18: Architecture Development method of TOGAF (Open group, 2009)](image)

The Architecture Content Framework is TOGAF’s own architecture framework. It specifies the different types of architecture products and provides a Content Metamodel which can be related with the phases of the ADM (Antunes, Barateiro et al. 2011).

The Dynamic Architecture (DYA) framework, which is Sogeti’s architectural approach. Development on DYA started in 2001 and there is ongoing development on this approach to this very day. DYA has grown into one of the most important architectural standards in the Netherlands and has been adopted by numerous organizations (Berg and Steenbergen 2004).

DYA offers the following components:

- Working within an architectural structure, the foundation of DYA
- DYA|Infrastructure – An approach to infrastructural architecture
- DYA|Software – An approach to software architecture
- DYA|Business - An approach to business architecture
- DYA|Governance - An approach to IT governance
- DYA|Principles - An approach to the development of architectural principles
The architectural framework of DYA is depicted in Figure 19, where we see the different architecture products of the different architecture domains.

![Figure 19: The DYA framework (Sogeti, 2004)](image)

The Integrated Architecture Framework (IAF), which is the architectural approach of Capgemini. In 1993, the architecture approaches that were to become the basis for the Integrated Architecture Framework were developed by Capgemini in the UK, France and the Netherlands in response to specific engagements. The value of a repeatable and portable architectural approach in these areas was quickly recognized, leading to the development of the first version of the Integrated Architecture Framework (IAF) and the first formal training for IAF offers the following architectures (Capgemini 2007):

- Enterprise Architecture
- Enterprise Business Architecture (or Business Architecture)
- Enterprise IT Architecture
- Solution Architecture
- Governance Architecture
- Security Architecture

The architectural framework of IAF is depicted Figure 20, where we see the different architecture domains.

![Figure 20: The Integrated Architecture Framework](image)

The focus in this literature review was limited to the EA frameworks of Zachman, TOGAF, DYA and the IAF. As these frameworks are widely accepted by the industry and are well known in the Netherlands and Belgium. More EA frameworks exist, sometimes more specifically designed for the type of organizations, or frameworks that are still in development and searching for support of the professional world.
9.2 Appendix 2: Overview ArchiMate language

In the following sub chapters, an overview of the ArchiMate is shown to get a better understanding what the language looks like and how it can be used for modelling.

- The ArchiMate graphical notation, shows what the symbols look like.
- The ArchiMate 2.0 notation extensions, shows which symbols were added in version 2.0.
- The ArchiMate language meta model, shows how the symbols can be used for the creation of a model.
- The ArchiSurance example, shows a practical implementation by depicting a model with the different views for a fictional company.

9.2.1 The ArchiMate graphical notation

The symbols of the ArchiMate language are shown in Figure 21 (Lankhorst 2009). Note that several concepts can be denoted either by a ‘box’ with an icon, or by the icon itself.

![Figure 21: Symbols of the ArchiMate language](image-url)
9.2.2 The ArchiMate 2.0 notation extensions

The symbols added to the language in ArchiMate 2.0 are shown in Figure 22 (OpenGroup 2012).

![Diagram showing new symbols in ArchiMate 2.0]

Figure 22: New symbols in ArchiMate 2.0
9.2.3 The ArchiMate language meta model

A summary of the concepts and their relationship in the ArchiMate language is shown in the Figure 23 below (Lankhorst 2009).

Figure 23: Overview of the ArchiMate concepts and main relationships.
9.2.4 The ArchiSurance example

Example of a fictional company called ArchiSurance modelled in ArchiMate using the tool Archi.

9.2.4.1 Layered view
9.2.4.2 Service Realisation view

Customer

- Insurance Application Service
- Claim Registration Service
- Claim Payment Service
- Customer Information Service
- Premium Payment Service

- Close Contract
- Handle Claim
- Inform Customer
- Collect Premium

9.2.4.3 ArchiMate view

Goal and Principle View

Layered View

- Information Structure View
- Business Function View
- Organisation Structure View
- Application Behaviour View
- Application Structure View
- Technical Infrastructure View

Business Product View

Service Realisation View
9.2.4.4 Business Product view

9.2.4.5 Business Function view
9.2.4.6 Business Process view

[Diagram of business process flow, showing steps such as Claim Form, Damage Claim, Register, Accept, Valuate, Pay, and Customer File.]

[Another diagram showing Request for Insurance, Close Contract, Formalise Request, Create Contract, Check and Sign Contract, with steps like Negotiation, Insurer, Intermediary, Customer, and Contracting.]
9.2.4.7 Organization Structure view

Archisurence

Front Office
- Customer Relations
- Intermediary Relations

Back Office
- Home & Away
- Car
- Legal Aid

Finance
- Product Development
- HRM

Document Processing SSC

9.2.4.8 Organization Tree view

Board
- Product Development
- HRM

Director of Sales
- Customer Relations
- Intermediary Relations

Director of Operations
- Home & Away
- Car
- Legal Aid
- Document Processing
- Finance
9.2.4.9 Information Structure view

9.2.4.10 Application Structure view
9.2.4.11 Application Behaviour view

9.2.4.12 Technical Infrastructure view
9.2.4.13 Actor Cooperation view

[Diagram of Archisure Arch insurance system showing interactions between customers, intermediary relations, document processing, and back office departments such as house, car, legal aid, HR, product development, and finance.]
9.3 Appendix 3: Presentation interview round 1

Next the slideshow is shown which was used for the preparation of the interviewees for interview round 1.
Introduction

- Thesis supervisors
  - dr. ir. F.J.M. Mofers (Frans)
  - dr. J.C.S.P. van der Woude (Jaap)
- Examinator dr. ir. F.J.M. Mofers (Frans)
- Education BPMIT – Computer Science
- Enterprise Architecture modelling to support collaboration
  The ArchiMate language as a tool for communication

Introduction

- Step by step
  - Step 0: Request to start the thesis
  - Step 1: Provisional research proposal (5%)
  - Step 2: Literature study (35%)
  - Step 3: Final research proposal (5%)
  - Step 4: Formulating research approach (20%)
  - Step 5: Executing the empirical research (17.5%)
  - Step 6: Writing the report (16%)
  - Step 7: Presenting the report (Examination)
Research

- Creating a baseline measurement.
- Testing concepts & relations (Without ArchiMate).

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Research

- Financial Service Provider → By doing
  - System engineer
  - Application developer
  - Business Process documentation expert
  - Head of technology
  - Head of product management

- Human Resources company → By comparing modelling technique
  - Enterprise Architect
  - Manager Enterprise architecture team

Enterprise Architecture modelling to support collaboration - The ArchiMate language as a tool for communication
Research

Initial interview

Research design

Enterprise Architecture modelling to support collaboration - The ArchiMate language as a tool for communication
Research

- Comparing to baseline measurement.
- Testing concepts & relations (With ArchiMate).

Enterprise Architecture modelling to support collaboration - The ArchiMate language as a tool for communication.
9.4 Appendix 4: Interview round 1

This appendix contains the setting, questions and answers for interview round 1. The goal of this interview is to get a baseline measurement for the current way of documenting and modelling in respect to the shared understanding model. To guarantee the anonymity of the interviewees, only one relevant answer per question of one of the interviewees was selected and shown.

9.4.1 Setting
- Primary business processes.
- Starting of projects related to the primary processes.

9.4.2 COL-SU-ALT
1. Do you have general overview of the documentation/models used in other departments?
   No I don’t, I had a look at their shared public folder out of curiosity. To search for templates and general high level documentation. But did not really find information that was useful for me. We currently only share a project and process template with the different departments (word document with some predefined tables).

2. When do you currently use documentation/models for collaborating?
   (For example during the initiation of a project, checking compliancy, troubleshooting …)
Within the team user stories (US) are mainly used for collaboration. A US will describe a unit of work containing a minimum of text and a diagram so it’s clear at first view. Every sprint (3 week time frame), a User Story captures the essence of the needs and is an agreement based on a discussion between the Product Owner and the development team. A user story contains the usercard " as a user I want, acceptance exact statement".

3. Are the documents/models previously mentioned used only within your team or are they used over the different teams in the enterprise? For my team there are not a lot of models/documents in use I hope this documentation exists within the IT departments. If it exists, we should start using it. What we are already doing is to gather information for all the acquirers in a list (db), this is a joined effort of product management, IT and the corporate support team.

4. Do the models/documents support collaboration over multiple teams? No, the visio diagrams we create are often to technical. The documentation is not suitable for cross team collaboration.

5. Is it clear how these models/documentation link together with other models/documentation? (For example with the product management, system, application overviews. Can dependencies be identified?) As we currently model by using a layered structure dependencies are identified throughout these layers and the different “building” blocks. The idea is that design documents/models are based on the EA models and documents.

6. If shared understanding is maintained or obtained by models/documents, do you expect that the collaboration between stakeholders would be more effective? (For example when implementing changes or starting projects…) Certainly, collaboration will not get any worse by creating shared understanding (laughing). For example:
   - Document what the business needs in for instance a flow diagram. (Click method, select pay…)
   - Create an implementation view for DEV and SYS based on the flow diagram, to identify the security components, redundancy needs… FPI->This would help getting clear requirements from the start and avoid different departments working on different things (Different goals).

7. Is there a need to improve the current approach and documenting in relationship to collaboration?
There is a need for improvement: we need to get help from key players in the organization to often. The organization has grown so fast that there is need to get better documentation to improve the collaboration with sales and support. Which is one of the main goals for 2013 for our department.

9.4.3 COM-SU-ALT

1. How do you currently use documentation/models for communication?
   Meetings, reuse the same models on whiteboard and in documents.

2. Are these models/documents used as a means for communication with partners, customers and employees?
   Yes, even with customers. Transaction flows, user stories (US) are shared.

3. What is represented in these documents/models?
   (For example: Network schemes, business processes, UML, workflows, policies and rules…)
   Models and written text, these can be considered as Enterprise Architecture documents.
   Also, more detailed, technical oriented models are developed.(Application architectures, …)

4. What level of detail are the models? (High level of abstraction versus detailed views)
   Detailed level as it is based on work that can be completed in a sprint. The essence of the needs, always supported by a schema.

5. Are the models suited for the purpose of analysing the impact of changes in the environment? (What, why and who is impacted by changes.)
   Yes, because as US needs to meet the invest criteria. Because of preparation and the small change, we can analyse and estimate the impact of changes in the environment.
   *I Independent The user story should be self-contained, in a way that there is no inherent dependency on another user story.
   *N Negotiable User stories, up until they are part of an iteration, can always be changed and rewritten.
   *V Valuable A user story must deliver value to the end user.
   *E Estimable You must always be able to estimate the size of a user story.
   *S Sized appropriately or Small User stories should not be so big as to become impossible to plan/task/prioritize with a certain level of certainty.
   *T Testable The user story or its related description must provide the necessary information to make test development possible

6. Do you think that improving the communication between the different stakeholders in the organization would lead to more shared understanding?
   *Creating a consensus on the importance and priority of changes and projects
within the organization.
*Getting a better understanding how the enterprise works.AHO->Important, concepts need to be shared.Decrease the risk of misunderstanding
Sure, one language is crucial. Business processes are complex, without proper communication the different departments are not sufficiently aware of activities outside their own department.

7. Is there a need to improve the current approach of documenting in relationship to communication?
Yes, document and models need to be adapted better to the audience. No technical jargon for management, no business jargon for the engineers. **However I don’t think it is possible to create models that are suited for everyone.**

9.4.4 STA-SU-ALT
1. Based on existing documentation/models can you identify who (stakeholders) needs to be involved during the initiation of a project?
   *I can for the technical teams, based on transaction flows. For the business teams it’s more based on experience.*

2. Can all stakeholders understand the models and documentation?
   *Only, to some extent, for instance development will not always understand the business documents. This creates a gap for shared understanding, what is developed or implemented because of this might be different what was wished for. Translation throughout the steps can cause mistakes, again a shared dictionary could assist in this.*

3. Where relevant stakeholders involved with the creation of the documentation or models?
   *It is not so much that stakeholders are not involved but that people in business and IT often struggle with creating a helicopter view (models and documents) and have trouble with synthetic thinking. Business and IT both struggle with this on their own domain.*

4. Is the documentation easily retrievable for the stakeholders?
   *Published on the intranet.*

5. Is there a need to improve the current approach of modelling and documenting in relation to getting more involvement of stakeholders? (Process)
   *Yes, certainly for the IT side of things it is important to get more of the knowledge of the key players in the organization documented.*

6. Is there a need to improve the current approach of modelling and documenting in relation to be able to identify stakeholders in projects? (Product)
   *Non issue, there is no need to do this based on models or documents.*
9.4.5 **SU-PROC-ALT**

1. Do you think that other stakeholders know about, agree on and understand the documentation/models of the most important business processes in the organization?
   
   *No, we should have book of knowledge where we for instance identify the interaction between acquirers, banks, merchants.*

2. Do you know about, agree on and understand the documentation/models of the most important business processes in the organization?
   
   *Not all of them, I know the basics but If I were to explain them I would probably use names and words for concepts that are not used by everyone in the organization (missing central vocabulary).*

3. Is there a need to present models with a high level of abstraction of the most important business processes to stakeholders?
   
   *Yes, to avoid the segmentation of department in different silo’s. Identify how each department contributes to the other.*

9.4.6 **SU-SYS-ALT**

1. Do you think that other stakeholders know of, agree on and understand the documentation/models of application components and technology or infrastructure related to the main business processes?
   
   *(Datacenters, Networks, Server/storage infrastructure, Intrusion Protection/detection, application components, application features.)*
   
   *No, most people in the organization don’t have a generic overview. This knowledge is contained in the systems department.*

2. Do you know of, agree on and understand the documentation/models of application components and technology or infrastructure related to the main business processes?
   
   *I only have less than a basic understanding, and don’t know of or have no access to the documents.
   The lack of models of application components and there interaction was identified as a big problem for the migration of the code for the platform. ( Forced to look at the code, which component, what is the component, is it always available, logs…, )*

3. Is there a need to present to present models with a high level of abstraction for application (components) and technology used in the most important business processes?
   
   *Yes, for example when a project requires cooperation of different teams. Product management and even the legal department should have a basic understanding, so there are no rules/SLAs broken without them knowing.*
9.4.7 SU-CON-ALT

1. Can stakeholders concerns be identified in the models and documentation during the initiation of a project?
   (In which documents is this listed, for instance in policy documents.)
   Yes, requirements can be identified. Depends type of project, based on User stories, requirements are written down by the stakeholders. Policies listing the requirements.

2. Can the following be identified during the initiation of a project based on current models and documents?
   - Related business processes (services)
   - Related applications (components, services)
   - Related infrastructure (artifacts, services)
   No, these things are missed there is for instance no project checklist and lessons learned of previous projects.

3. Can common pitfalls be identified using existing models or documents?
   (For example during the initiation of a project.)
   Partly, too many hypothesis in agile we go through the cycle of Do, Inspect and adapt. This is countered by acceptance criteria, the iteration trough smaller document.
   The use of different words for the same concepts is often a pitfall in itself.

4. Is there a need to improve the current approach of modelling and documenting in relationship to identifying potential concerns of stakeholders?
   Yes, would be interesting to have models to have potential concerns and to identify pitfalls in advance. For instance PCI, patch MGMT, encryption, costs, dependencies on certificate providers…
   We should state the goal or objective and state the concerns like boundaries, legal, budget, compliance, operational, technology, … during the initiation of the projects so we can avoid common pitfalls.
9.5 Appendix 5: Presentation interview round 2
Next the slideshow is shown which was used for the preparation of the interviewees for interview round 2.

Enterprise Architecture in a nutshell

- Enterprise Architecture is a new field or discipline which guides the design of business processes and information systems for an enterprise.

- As an organizational role, EA is positioned between IT and business, strategy formulation on the one hand, and project-focused solution architecting (sometimes called system architecting) on the other (Tamm, Seddon, Shanks, & Reynolds, 2011).
Enterprise Architecture modelling

- Enterprise Architecture modelling provides models that are coherent with the whole of principles and methods. To limit the design freedom and to reinforce the realization of an enterprise’s organizational structure, business processes, information systems, and infrastructure.

- If every domain speaks its own language, draws its own models, and uses its own techniques and tools. Communication and decision making across domains is seriously impaired (Marc M. Lankhorst, 2004)

Archimate

- ArchiMate is a modelling language for describing enterprise architectures
- Broader scope than UML, as this is more concentrated on software engineering.
Archimate

Concepts

Enterprise Architecture modelling to support collaboration - The ArchiMate language as a tool for communication

Research

Research design

Enterprise Architecture

EA modeling

Communication

Collaboration

Shared understanding

STEP 1

STEP 2

STEP 3

STEP 4

STEP 5

Enterprise Architecture modelling to support collaboration - The ArchiMate language as a tool for communication
Research

- Second interview
  - Comparing to baseline measurement.
  - Evaluating concepts & relations (With ArchiMate).

Enterprise Architecture modelling to support collaboration - The ArchiMate language as a tool for communication

Models...

- Second interview
  - ....
  - ...

Enterprise Architecture modelling to support collaboration - The ArchiMate language as a tool for communication
9.6 Appendix 6: Interview round 2
This appendix contains the setting, questions and answers for interview round 2. The goal of this interview is to get a measurement for the potential of EA modelling in ArchiMate in respect to the shared understanding model. To guarantee the anonymity of the interviewees, only one relevant answer per question of one of the interviewees was selected and shown.

9.6.1 Setting
- Primary business processes. (E-commerce)
- Starting of projects related to the primary processes.

9.6.2 COL-SU-AEAM

1. Do you think that models in ArchiMate can be created that are suited to link different domains like Product management, application development and infrastructure?
   Yes, it would help, but beyond ArchiMate there needs to be an EA mentality in the organization.

2. Can models created in ArchiMate be used to show the different perspectives that are required for effective collaboration?
   Yes, it helps if the technology layer is standardized. (Commodity infrastructure/technology)

3. Do you believe that creating models ArchiMate could lower the dependency on key players in the organization? (Initiation and duration of the project.)
The head of IT is involved in almost all projects, this could lower the dependency, by starting with an overview. The models can give a better overview of the impact and the added value of a change.

4. In your opinion can EA modelling contribute to effective collaboration over different departments on a day to day base, during the course of projects or organizational changes?
Not sure on day to day, but certainly for projects and potentially for organizational changes.
Models can be the path in a project, going down the different layers (BAT): the visual notation makes things easier.

5. Do you see any aspects for modelling in ArchiMate missing related to collaboration and relationships between the different domains?
No, the identification of relationships between domains is one of the big values of ArchiMate.

6. How does ArchiMate measure up to the current modelling or documenting approach for collaboration and relationships between the different domains?
Currently the big picture is often missing and how everything is connected, ArchiMate could have an added value. But in the end it’s not so that only about the language or technique used but also a way of working that needs to be adapted.

9.6.3 COM-SU-AEAM

1. Do you think that the different viewpoints or understandable by the target audience?
Yes, when multiple views are created and adapted to the target audience.

2. Can the ArchiMate language be used to communicate about processes, technology and concerns in the organization?
Yes, for processes, technologies.
Concerns are less obvious, but ArchiMate gives a context or maps for relationships that are impacted. But for concerns there is lot of interpretation of the models that needs to be done.

3. Do you see benefits of having a common architecture modelling language for different departments?
We have experienced by creating the models that different department can communicate about components. So the advantage for communication has been shown already with the creation of the model.

4. Are the models suited for the purpose of analysing the impact of changes in the environment? (What, why and who is impacted by changes.)
Yes, you can tell what is impacted but the size of the impact cannot be
5. Can models in ArchiMate be used to create views on the future of “new” product or features. 
   *Certainly, in the same way as an architect creates plans for a house.*

6. Can the ArchiMate language (as a means for communication) support shared understanding? 
   *In the same way as agile, if we all speak the same language shared understanding will be supported.*

7. Do you see any aspects for modelling in ArchiMate missing related to communication and viewpoints for the different domains? 
   *Yes, a glossary of definitions of concepts needs to exist for (side by side with) the model.*

8. How does ArchiMate measure up to the current modelling or documenting approach for communication and viewpoints for the different domains? 
   *The language is easier to understand. By combining the different domains, we avoid different meaning for the same components. The fact that it is a visual presentation makes it easier to use than a textual description. Would be ideal to combine with user stories.*

9.6.4 **SU-PROC-AEAM**

1. Do you think models with the correct views could help stakeholders agree and understand the most important business processes in the organization? 
   *Yes, the models will help create shared understanding, and can be used as a framework. The visual overview is very valuable to give an overview. But it needs to be supported by text to describe the details.*

2. Do you think models with the correct views could help you agree and understand the most important business processes in the organization? 
   *I'm convinced, today we draw abstract models on the whiteboard when we need the model.*

3. Do you see any aspects for modelling in ArchiMate missing related to modelling business processes on an abstract level? 
   *The level of importance of concepts is not documented in the language.*

4. How do you think EA modelling in ArchiMate measures up to alternative methods used for creating and maintaining shared understanding for business processes? 
   *Very good, for instance in BPMN only 5% of the toolbox is used, and the relationship between the different domains is not as clear.*
9.6.5 SU-SYS-AEAM

1. Do you think models with the correct views could help stakeholders agree and understand the application components and technology or infrastructure related to the main business processes?
   (Datacenters, Networks, Server/storage infrastructure, Intrusion Protection/detection, application components, application features.)
   
   Models are OK and understandable but the relationship to the technology are harder to identify.

2. Do you think models with the correct views could help you agree and understand the application components and technology or infrastructure related to the main business processes?
   Yes.

3. Do you see any aspects for modelling in ArchiMate missing related to modelling application components and technology or infrastructure related to the main business processes at an abstract level?
   At a high level, the language fits the purpose.

4. How do you think EA modelling in ArchiMate measures up to alternative methods used for creating and maintaining shared understanding for application components, infrastructure and technology?
   At infrastructure level a detailed visual representation is also required next to this high level overview.
   At application level, different views for backend, frontend and even products and relationships documented in a common model/tool will provide an added value.

9.6.6 SU-CON-AEAM

1. Can models help stakeholders concerns be identified in the models and documentation during the initiation of a project?
   Some constraints can be identified. The process of collaboration when creating models can also potentially identify concerns.

2. Can the following be identified during the initiation of a project based on the EA models and documents?
   - Related business processes (services)
   - Related applications (components, services)
   - Related infrastructure (artifacts, services)
   For businesses processes and applications you can at an abstract level, for infrastructure (technology) you need more details.

3. Can common pitfalls be identified using models created in ArchiMate?
   (For example during the initiation of a project.)
   Yes, that is one of the main goals of the models. If this wouldn’t be possible you could question the need for the models.
4. Do you see any aspects for modelling in ArchiMate missing related to identifying concerns?
   Yes, all the external influences to the model for instance legal changes, interoperability issues. This is more part of the project management.

5. How do you think EA modelling in ArchiMate measures up to alternative methods used for listing concerns (defining requirements, acceptance criteria)?
   OK, but a tool or language can only do so much...

9.6.7 STA-SU-AEAM

1. Will creating and using EA models improve involvement of stakeholders?
   Yes, by collaboratively creating models, the shared understanding will improve amongst stakeholders.

2. Could ArchiMate models help formalize the process for creating models?
   Yes, the need for people to collaborate in creating shared understanding based on a model could help in formalizing the process of creating models.

3. Can a proper customer point of view be created in ArchiMate?
   Yes, the cooperation view is already a good example of this. But more than this is required for the customer point of view, video’s, written text, examples of the GUI...

4. Do you think the models in ArchiMate help create and/or support enterprise vocabulary throughout the organization?
   The notation in ArchiMate will help, but it also needs to be embedded in the organization. There is much more needed to fully support an Enterprise Vocabulary.

5. How do you think EA modelling in ArchiMate measures up to alternative methods used for creating and maintaining shared understanding?
   Collaboration over departments will be better if we all use the same ArchiMate language. Refers to a high level overview of the business. Provides a common ground to speak with other departments.

6. Can architecture modelling truly support creating and maintaining shared understanding for stakeholders of:
   o Processes
   o Systems
   o Concerns
   Yes, mainly for processes and systems, less suited for identifying concerns it will only have an indirect function. High level models can be a stepping stone to more detailed models. Architecture modelling is useful at the start of new projects.
10 References


