Radboud Universiteit Nijmegen

MASTER THESIS
Plan of Approach

Information Architecture
'Creating a framework for measuring architecture'

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1. Introduction

This document is a plan of approach for the research project on the evaluation of architectures and reference architectures. It positions the research project in a theoretical framework, justifies its necessity, and defines the research questions and scope. Additionally the methods used to obtain the answers to the research questions are described.

A short description of the project organization is given in chapter 6, followed by a planning which encompasses the main activities and notes the main products to be delivered.

2. Problem area

Justification
While architecture is already a well known means in managing the increasing complexity of IT systems of organizations, this phenomenon is still an immature area of IT[???]. A goal of this research project is to contribute to the maturity process of architecture. There are already a lot of theories and frameworks for developing an architecture, like [Zachmann]. Greefhorst, Koning and de Vries already conducted research to all these frameworks [Greefhorst], but there seems to be no generic way of evaluating one[GJNM1]. A vision of architects is to be able to assign a degree of maturity to an architecture, in a way that is both objective and reproducible in order to compare the quality of architectures[???].Such an evaluation method will be used to asses the quality of an arbitrary architecture. Some architects did some good research on measuring frameworks but these frameworks are created to evaluate their own artifacts[GJNM2], like [Schekkerman1]. This assessment can be used as a starting point for quality improvement and maturation.

Theoretical framework
Architecture is a part of the study of Information Science. It encompasses a diverse collection of both practical as well as theoretical focus points in IT ranging from fields like Information and Domain Modelling to business IT alignment and from Technical Infrastructure to Work Processes and Business Roles.

Architecture is a part of the strategic IT plan. As such it describes many aspects of how IT can contribute to the business goals, and how IT is developed and applied in organizations.

There are a lot of areas (see figure 1) that could be evaluated such as implementation of an architecture, for example the compliance of the IT infrastructure to the organizations IT architecture. The main goal of this research is to put a non limitative collection of viewpoints of architecture together in an evaluation framework. This framework will be comprised of characteristics of a good architecture. These characteristics are parts of the overall viewpoints and will be called sub viewpoints. Every characteristic will have its own 'checklist' to determine whether an architecture complies with the characteristics. These 'checklists' describe in a complete and precise manner what the sub viewpoint should adhere to. Additionally it provides the evaluator with a procedure on how to evaluate which makes the process repeatable. Figure 1 shows how the concepts mentioned above are related.
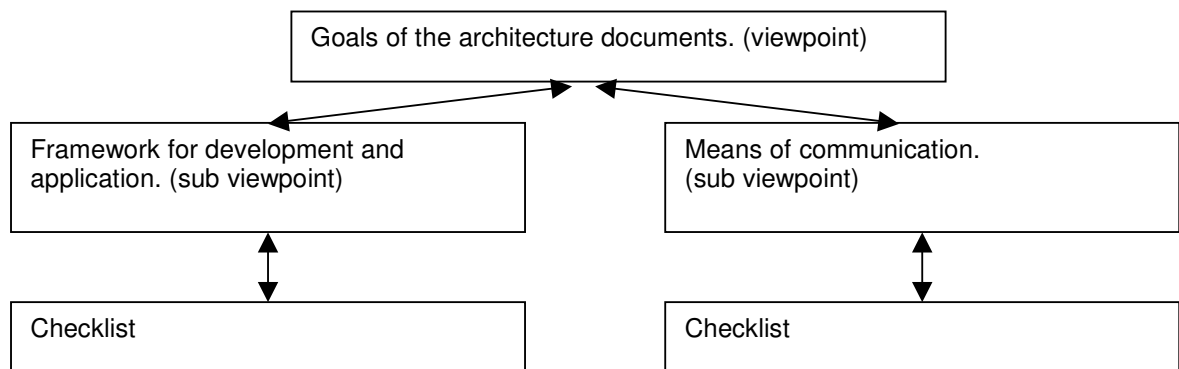
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┌─────────────────────────────────────────────────┐
│  Goals of the architecture documents. (viewpoint)│
└─────────────────────────────────────────────────┘
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┌──────────────────────────────┐      ┌──────────────────────────────┐
│ Framework for development and │      │ Means of communication.       │
│ application. (sub viewpoint)  │      │ (sub viewpoint)               │
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┌──────────────────────────────┐      ┌──────────────────────────────┐
│ Checklist                     │      │ Checklist                     │
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Figure 1: An example of a part of the evaluation framework

It should be noted that architectures are subjective entities. The output of an architecture evaluation for a certain architecture should give a relative judgment of the architecture taking into regard the fact that whether it is useful highly depends on what is it used for[Schekkerman1].

Because architecture is not an exact science it is hard to measure whether an architecture complies exactly to an evaluation framework. There are parts of an architecture that are specified according an architect's own fashion. These parts are hard to measure because of their subjectivity. Therefore the final product for this project will not cover a full maturity model for architecture but instead will provide the basis for further research towards a more complete and objective way to measure and compare architectures.
Because of the broadness of architecture it is not an attainable goal to cover and fill in every aspect of the proposed evaluation framework during the time reserved for this project. Some parts of the framework, such as sub viewpoints and 'checklists', will be left for further research.

The first goal of the research project is to sketch an architecture landscape which covers an extensive but non limitative list of aspects of architecture and select some aspects which will be filled in. These aspects will then serve for an mini evaluation of a specific part of two reference architectures, NORA and EGEM, which is the second goal of this project. This test should be a reflective one to evaluate the framework that is created so far.

3. Problem definition

The scope of this research project originates from the theoretical knowledge of architecture. This section outlines the scope of the first major phase of this project.

Architecture is a very broad concept which is being reflected in many theories[Rijsenbrij], [Archimate]. The evaluation method will be geared towards reference architectures. In this project a norm will be distilled from many theories and ideas about architecture by means of literature study and interviews conducted with architects.

Note: It is important that this norm is scientifically sound and justified in order to be susceptible for critique. Therefore it is important that this justification plays a central role throughout the entire research.

Overview

The plethora of theories on architecture are reflected in different architecture frameworks, like [Zachman] and [IAF]. A lot of organizations create a reference architecture based upon ideas from these frameworks. The creators of these reference architectures combine all the elements that are deemed important in his/her perception into that document. One of the goals of our project is to discover and organize these aspects and turn this into a measuring instrument.

Architecture theory is depicted as a cloud on purpose in figure 2 because the architectural theory which is reflected in the architecture framework is not entirely the same as the theory on which the norm is based. The architecture theory cloud is a collection of all theories.

Specific organizations (Rijksgebouwendienst) create a particularized architecture for themselves, based on a reference architecture (Dutch government with NORA). The result of this particularization is an architecture description tailor made for this organization. Such a document will mainly describe the architectural principles for this organization, particularized to tangible things as rules, guidelines and standards.

The norm will contain the most important aspects of architecture. The architecture of a particular organization is a particularization (from global to specific) of the reference architecture and will contain on an abstract level many similarities with the reference architecture it was based on. The most important aspects of the reference architecture will most certainly have to be incorporated in this particularized architecture. From this it follows that the organizations architecture can be evaluated with the same norm. These two architectures are on an abstract level the same, which is illustrated with the vertical block "Architecture" in figure 2.

The actual implementation of the architecture in the operational status of the company does not belong to the scope of this project because this is not closely related to the norm. This is however a very important evaluation phase for which methods of evaluation have already been created(IT-Auditing).
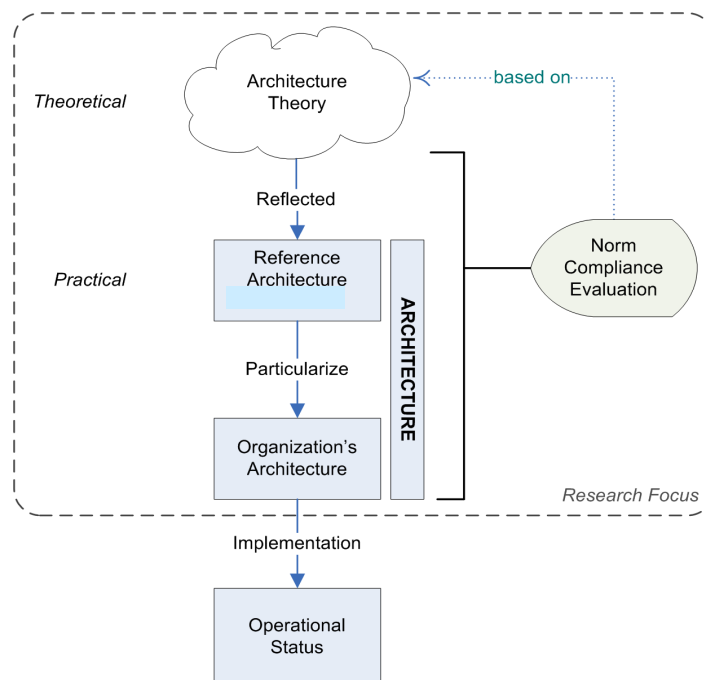

Figure 2 : Schematic representation of the focus area of the project.

4. Research Questions

The previous chapters have emphasized the niche in the area of architecture regarding a proper, and moreover an objective evaluation method. In this chapter the problem at hand is stated followed by a discussion of the various more fundamental questions that underlie that problem. In order to create an architecture evaluation framework the first issue that surfaces is as below.

What characterizes a good architecture evaluation?

This question is too vague to answer all at ones. Instead it is split up into two different questions, each dealing with the characteristics of the two main entities in the above question, Architecture and evaluation.

1. What characterizes a good architecture?
2. What characterizes a good evaluation?

Knowing what a good architecture is provides a norm to which architectures can be compared. Additionally, having a good view of various evaluation methods in combination with knowledge of how they are to be deployed provides a basis on which to choose how to go about evaluating something like an architecture in a reproducible and objective way. By combining the architecture norm found while answering question one with the most effective way in which an evaluation can be preformed in case of architectures the main question can be answered.

What characterizes a good architecture?
Again this question leaves unclear what exactly the answer is expected to be. It is necessary to identify the areas within which the various aspects of architecture are placed. Some will be aspects of architecture as a communication method, others will be main principles that define good architecture, and yet other aspects will say something about the usefulness of architecture. It is highly likely that during the information gathering process even more aspects will be found that can be placed in yet other categories. This will lead to a list of questions of the following form which, if combined will provide an answer to what characterizes a good Architecture.

1. Which communication characteristics are important for architectures?
2. Which Architectural principles are important for architectures?
3. …

What characterizes a good evaluation?
This question is more explicit. There is much theory on how to evaluate a wide variety of products and processes. A combination of theory and best practices in the area of evaluation of products or processes that bare a resemblance, at least in some aspect, to architecture should provide a sound basis for the evaluation methods that shall be incorporated into the evaluation framework of this project.

5. Research Methodology

Overall strategy

The research questions defined in the previous chapter will be answered using both theoretical and practical methods. Researching theory provides a solid basis for scientific reasoning about the wide definition of 'architecture' and 'evaluation'. This results in insight into important aspects of architecture evaluation. These aspects will then be put to the test in a practical sense by applying them on existing reference architectures.

The development of a theory must be completed prior to testing it in practice. This leads to a logical division in phases:

Phase 1: Defining an architecture evaluation framework.
Phase 2: Evaluating part of an existing reference architecture using the defined evaluation framework.

This division in phases is *not* the same as the division in research questions. Each research question is answered by both phases. In other words: the division in phases is orthogonal to the division in research questions.

Strategy of Phase 1

phase product Phase 1 results in a documented evaluation framework. This document contains a broad overview of al possible viewpoints that can be used to evaluate an architecture. For a selection of those viewpoints precise criteria are researched that determine how well an architecture matches the norm. Later projects can complete the evaluation framework.

data acquisition Relevant data is acquired using an extensive literature study on existing theory of architecture in the world of information and communication technology. Published material like books, scientific papers and framework manuals are the primary source of data. In between, interviews with domain experts can give more insight in specific matters. Research papers from academic students, press releases and presentations and workshops from conventions and symposia could proof very useful in exploring the general problem area.

data analysis Data collected is never exactly wrong or right. There is no scientific truth in aspects about architecture and evaluation. Collected data is therefore compared mostly with each other. Weighing these differences and similarities ultimately reveals what aspects are important to include in an evaluation framework. This framework will be distributed to various domain experts in order to reach a consensus about the correctness of the framework.
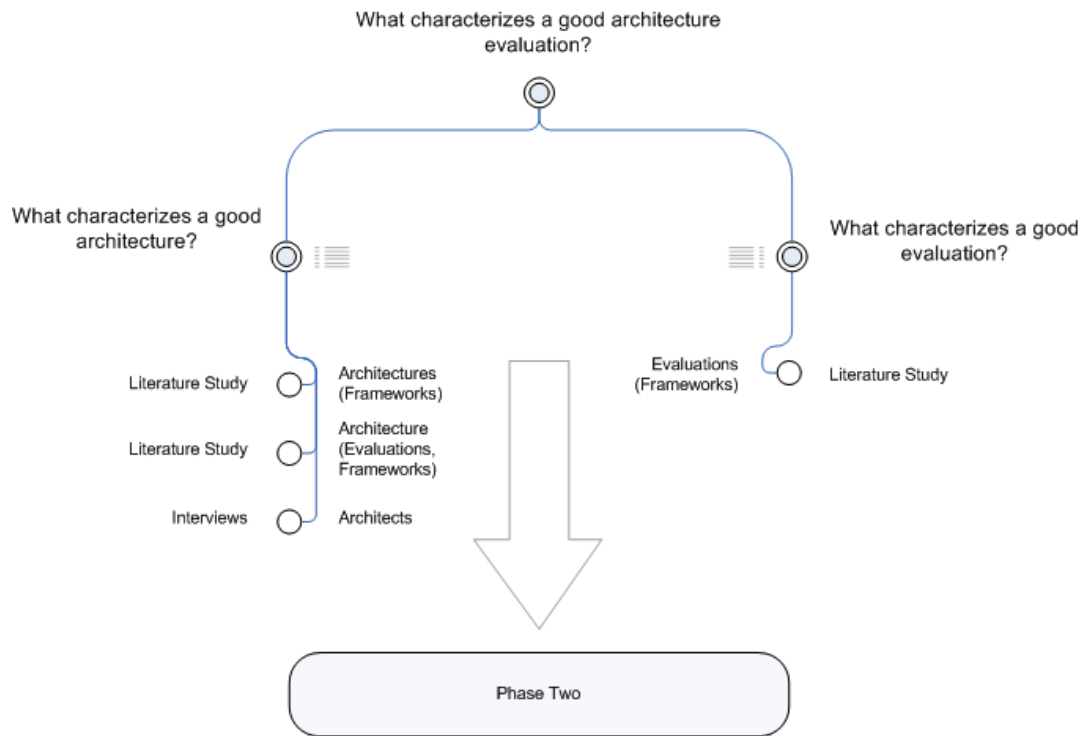
Figure 3: A schematic representation of Phase 1 of the project.

Strategy of Phase 2
   phase product   Phase 2 results in a documented architecture evaluation. This evaluation is performed on an existing architecture or reference architecture. The evaluation covers only a limited number of viewpoints due to limited time and resources.

   data acquisition   Relevant data is acquired by performing an actual evaluation on an architecture or reference architectur. This is done by applying the formulated criteria from the evaluation framework, constructed in phase 1.

   data analysis   The results from applying the evaluation on a specific viewpoint gives a measure on how well an architecture, or reference architecture, conforms with the norm of that specific viewpoint. By combining the individual results of the evaluation of each viewpoint of the subject architecture, an overall idea of its quality is given. In this research project however not all viewpoints can be evaluated because the evaluation framework shall not be complete, thus a satisfying *overall* quality cannot be determined.

6. Project Organization

Participants

The research project consists of six students, one supervisor, one reviewer and several domain experts. Fore these six students this research project is their master thesis research in their Information Science study. To make working in such a large setting more manageable, the students are divided in two groups. See figure 4.
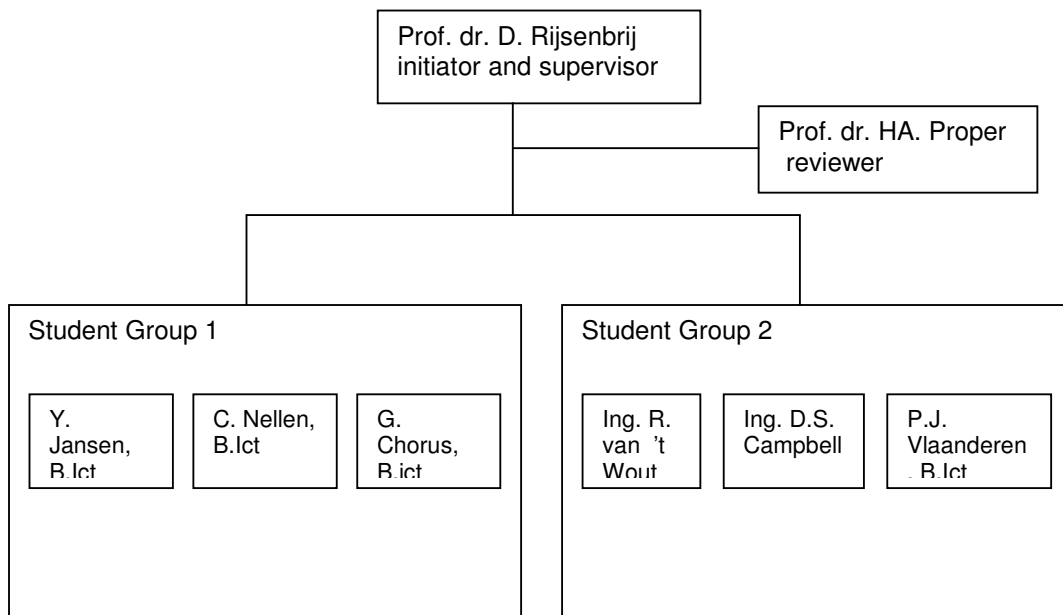

Figure 4 : Organizational diagram

In Phase 1 of the research project the student groups will generally work together to achieve a evaluation framework that is agreed upon by all students. In Phase 2 each student group will evaluate a separate architecture or evaluation architecture. In turn, each student evaluates from a separate viewpoint.

At the moment two reference architectures have been proposed by the project initiator Daan Rijsenbrij. These are two reference architectures related to the Dutch government: NORA and EGEM.

Domain experts

The project initiator has also put forward two domain experts. These domain experts are available to the student groups, mainly for data acquisition and criticizing findings. The domain experts are:

Ing. Jaap Schekkerman   (EGEM, or other t.b.d.)
Mark Paauwe   (NORA)

Communication

The student groups maintain close communications with each other. This is to ensure a single mindset about the subject at hand. Regular meetings with the supervisor will be held to discuss the project progress.

Contact information
Both student groups: architecture@boukoul.nl
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[GJNM3]
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7. Project Planning

Will be online shortly

8. Terminology

Architecture:	A collection of principles, standards and rules and guidelines. There are various definitions available, such as [IEEE] and [Rijsenbrij]
Architecture theory:	Various mindsets and theories on the subject of architecture, often placed within an architecture framework.
Architecture framework:	A model of concepts out of architecture theory, illustrating relations between concepts often containing best practices. An architecture framework does not contain principles, but instead describes how a principle should be formed.
Evaluation framework:	A framework created for the purpose of evaluating reference architectures, subsets of these reference architectures, or architectures. Often based upon one or more architecture frameworks.
Reference architecture:	Highly abstract architectures which is used by organizations as reference to create tailored architectures specified for a particular section/department/business/process/etc.

9. Literature

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