Module Architecting Method Overview

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Abstract

This module described the overview of the complete architecting method.

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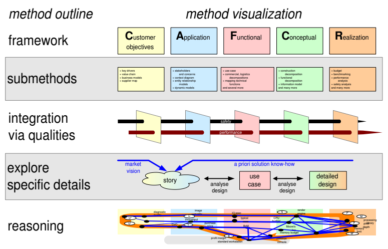
Contents

Chapter 1

Overview of CAFCR and Threads of Reasoning



1.1 Introduction

At the beginning of the creation of a new product the problem is often ill-defined and only some ideas exist about potential solutions. The architecting effort must change this situation in the course of the project into a well articulated and structured understanding of both the problem and its potential solutions. Figure 1.1 shows that basic methods and an architecting method enable this architecting effort.

The basic methods are methods that are found in a wide range of disciplines, for example to analyze, to communicate, and to solve problems. These basic methods are discussed in Chapter **??**.

An overview of the architecting method is given in Section 1.2. The architecting method contains multiple elements: a framework, briefly introduced in Section 1.3, and submethods and integrating methods, which are described in part II.

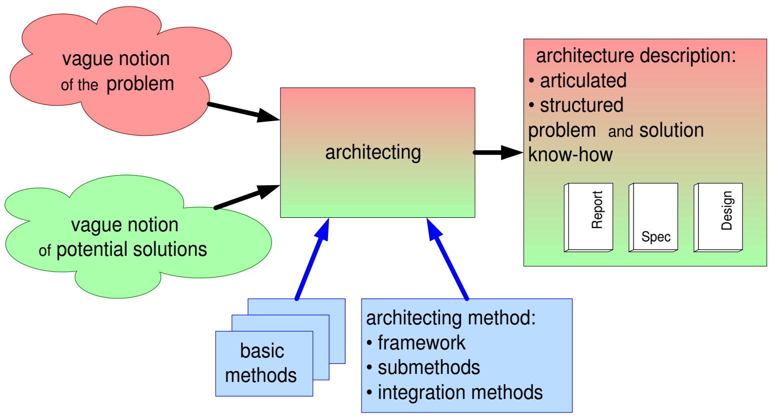


Figure 1.1: An architecting method supports the architect in his process to go from a vague notion of the problem and a vague notion of the potential solutions to a well articulated and structured architecture description

1.2 Architecting Method Overview

Figure 1.2 shows the overall outline of the architecting method. The right hand side shows the visualization as it will be used in the later chapters. The *framework* is a decomposition into five views, the "CAFCR" model, see Section 1.3.

Per view in the decomposition a collection of *submethods* is given. The collections of submethods are open-ended. The collection is filled by borrowing relevant methods from many disciplines.

A decomposition in itself is not useful without the complementing integration. *Qualities* are used as *integrating* elements. The decomposition into qualities is orthogonal to the "CAFCR" model.

The decomposition into CAFCR views and into qualities both tend to be rather *abstract*, *high level* or *generic*. Therefore, a complementary approach is added to *explore specific details*: story telling. Story telling is the starting point for specific case analysis and design studies.

These approaches are combined into a thread of *reasoning*: valuable insights in the different views in relation to each other. The basic working methods of the architect and the decompositions should help the architect to maintain the overview and to prevent drowning in the tremendous amount of data and relationships. The stories and detailed case and design studies should help to keep the insights factual.

1.3 The CAFCR Model

The "CAFCR" model is a decomposition of an architecture description into five views, as shown in Figure 2.1. The *customer objectives* view (**what** does the

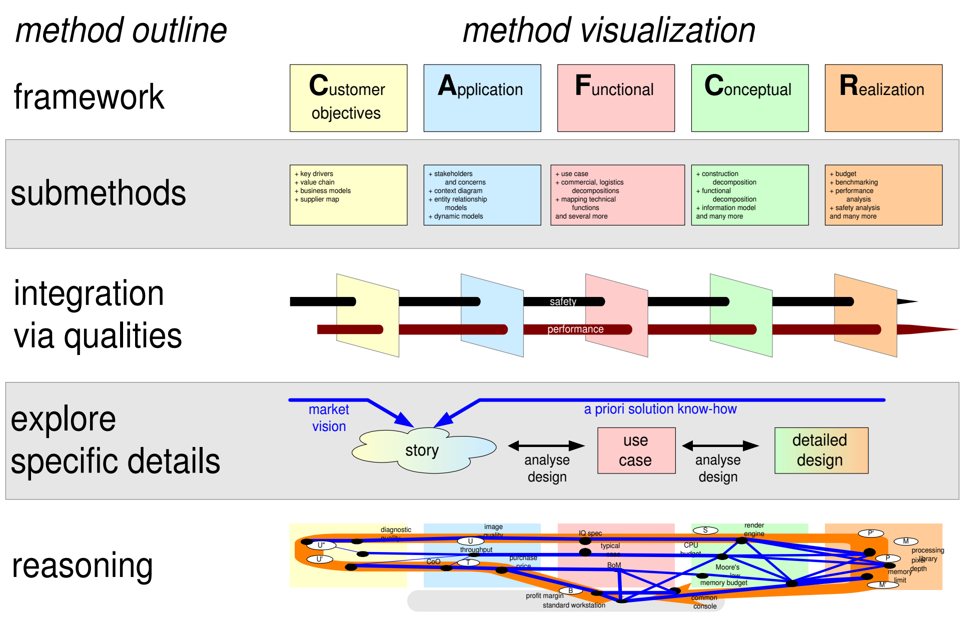


Figure 1.2: The outline of the architecting method with the corresponding visualization that will be used in the later chapters.

customer want to achieve) and the *application* view (**how** does the customer realize his goals) capture the needs of the customer. The needs of the customer (**what** and **how**) provide the justification (**why**) for the specification and the design.

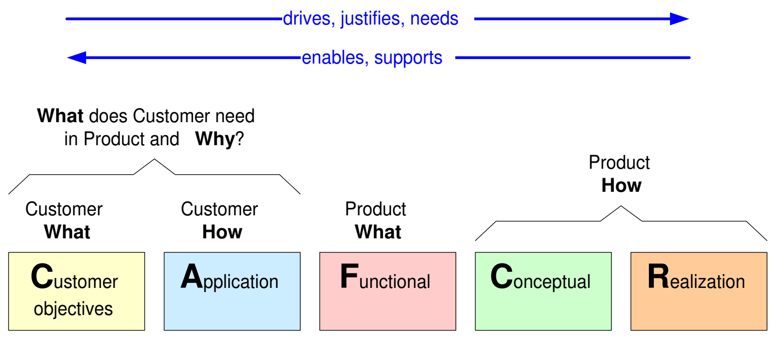


Figure 1.3: The "CAFCR" model

The *functional* view describes the **what** of the product, which includes (despite its name) the *non-functional* requirements.

The **how** of the product is described in the *conceptual* and *realization* views. The **how** of the product is split into two separate views for reasons of stability: the conceptual view is maintained over a longer time period than the fast changing realization (Moore's law!).

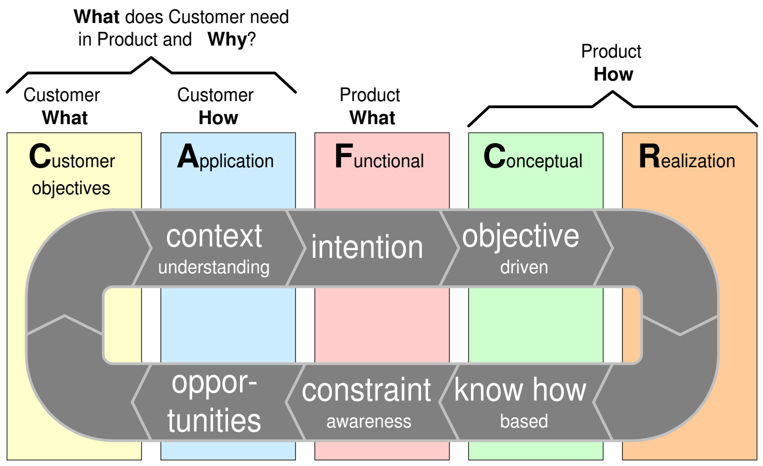


Figure 1.4: Iteration over the CAFCR views and the operational view. The task of the architect is to integrate all these viewpoints, in order to get a *valuable*, *usable* and *feasible* product.

The job of the architect is to integrate these views in a consistent and balanced way, in order to get a *valuable*, *usable* and *feasible* product. Architects do this job by continuously iterating over many different viewpoints, sampling the problem and solution space in order to build up an understanding of the business. This is a top-down approach (objective driven, based on intention and context understanding) in combination with a bottom-up approach (constraint aware, identifying opportunities, know-how based), see Figure 1.4.

The CAFCR model in Figure 1.4 is focused on the relation between the customer world and the product. Another dimension that plays a role in specification and design is the *operational* view. The operational view describes the internal requirements of the company: what is needed for the operation of the company? The CAFCR model is focused on the customer world: what determines *value* and *usability* of a product? The business *feasibility* of a product is largely determined by the operation of the company: satisfactory margins, service levels, potential for the future. Strategic requirements of the company, which are important for the long term operation, are also part of the *operational* view.

The customer views and operational view are asymmetric. The customer world is outside the scope of control of the company. Customers have a free will, but act in a complex environment with legislation, culture, competition, and their own customers, who determine their freedom of choices. The operational way of working of a company is inside the scope of control of the company. The company is also constrained by many external factors. Within these constraints, however, the company decides itself how and where to manufacture, to sell, and to provide service. The operation of the company is organized in such a way that it supports its customers. The asymmetry is that a company will never tell its customers to organize in a way that eases the operation of the company[1]. The operational view is subject to the customer views.

The CAFCR views and the operational view must be used concurrently, not top down as in the waterfall model. However, at the end of the architecting job a consistent description must be available, see [3]. The *justification* and the *needs* are expressed in the Customer Objectives View, the Application View, and the operational view. The technical solution as expressed in the Conceptual View and the Realization View *supports* the customer to achieve his objectives and support the company in the operation. The Functional View is the interface between problem and solution world.

The CAFCR model will be used in this thesis as a framework for a next level of submethods. Although the five views are presented here as sharp disjunct views, many subsequent models and methods don't fit entirely into one single view. This in itself is not a problem; the model is a means to build up understanding, it is not a goal in itself.

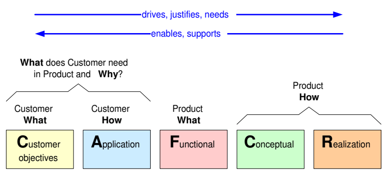
The "CAFCR" model can be used recursively: many customers are part of a longer value chain and deliver products to customers themselves. Understanding of the customer's customer improves the understanding of the requirements.

The notion of **the** customer is misleading. Many products have an extensive set of stakeholders in the customer domain. One category of customer stakeholders are decision makers such as: CEO (Chief Executive Officer), CFO (Chief Financial Officer), CIO (Chief Information Officer), CMO (Chief Marketing Officer) and CTO (Chief Technology Officer). Another category are people actually operating the system, such as users, operators, and maintainers. A last category mentioned here are the more remotely involved stakeholders, such as department chiefs and purchasers.

[1]In practice it is less black and white. A company interacts with its customers to find a mutual beneficial way of working. Nevertheless, the provider-customer relationship is asymmetric. If the provider dictates the way of working of the customer then something unhealthy is happening. Examples of unhealthy relations can be found in companies with a monopoly position.

Chapter 2

Short introduction to basic "CAFCR" model



2.1 Introduction

A simple reference model is used to enable the understanding of the inside of a system in relation to its context.

An early tutorial[2] of this model used the concatenation of the first letters of the views in this model to form the acronym "CAFCR" (Customer Objectives, Application, Functional, Conceptual, Realization). This acronym is used so often within the company, that changing the acronym has become impossible. Although better names for some of the views have been proposed, the names are not changed. The weakest name of the views is *Functional*, because this view also contains the so-called *non functional* requirements.

The model has been used effectively in a wide variety of applications, ranging from motorway management systems to component models for audio/video streaming. The model is not a silver bullet and should be applied only if it helps the design team.

2.2 The CAFCR model

A useful top level decomposition of an architecture is provided by the so-called "CAFCR" model, as shown in figure 2.1. The *customer objectives* view and the *application* view provide the **why** from the customer. The *functional* view describes the **what** of the product, which includes (despite the name) also the *non functional* requirements. The **how** of the product is described in the *conceptual* and *realization* view, where the conceptual view is changing less in time than the fast changing realization (Moore's law!).

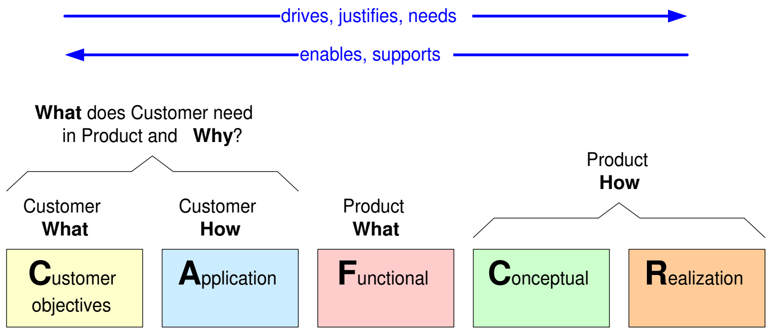


Figure 2.1: The "CAFCR" model

The job of the architect is to integrate these views in a consistent and balanced way. Architects do this job by *frequent viewpoint hopping*, looking at the problem from many different viewpoints, sampling the problem and solution space in order to build up an understanding of the business. Top down (objective driven, based on intention and context understanding) in combination with bottom up (constraint aware, identifying opportunities, know how based), see figure 2.2.

In other words the views must be used concurrently, not top down like the waterfall model. However at the end a consistent story must be available, where the justification and the needs are expressed in the customer side, while the technical solution side enables and support the customer side.

The model will be used to provide a next level of reference models and methods. Although the 5 views are presented here as sharp disjunct views, many subsequent models and methods don't fit entirely in one single view. This in itself not a problem, the model is a means to build up understanding, it is not a goal in itself.

2.3 Who is the customer?

The term *customer* is easily used, but it is far from trivial to determine the customer. The position in the value chain shows that multiple customers are involved. In figure 2.3 the multiple customers are addressed by applying the CAFCR model recursively.

The customer is a gross generalization. Marketing managers make a classification of customers by means of a market segmentation. Figure 2.4 shows a number of examples of market segmentation axis and related segments.

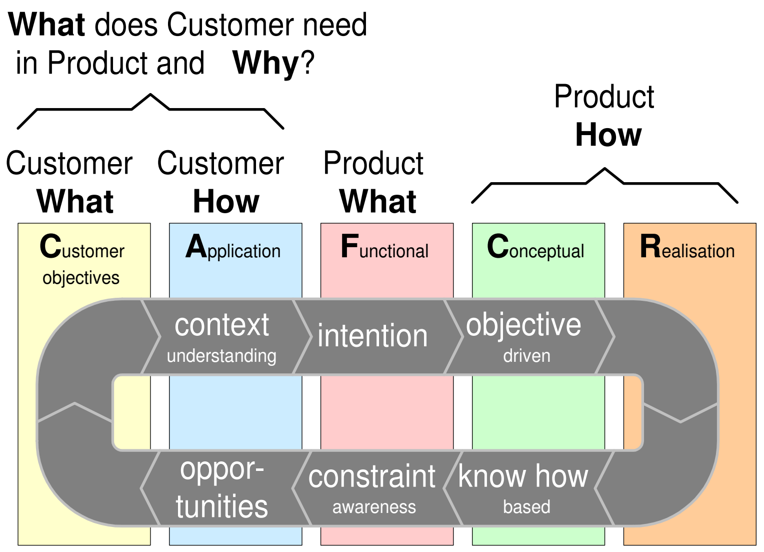


Figure 2.2: Five viewpoints for an architecture. The task of the architect is to integrate all these viewpoints, in order to get a *valuable*, *usable* and *feasible* product.

It is recommended to start building up insight by making specific choices for the customer. Sometimes the model has to be made several times for different customers. In the beginning it should be avoided to make a priori re-use assumptions between different market segments. These kind of assumptions pollute the model and inhibits clear and sharp reasoning.

Once we have determined the customer as a family or a company, it becomes clear that again multiple people are involved as customers. Figure 2.5 shows an example of the people involved in a small company. Note that most of these people have different interests with respect to the system.

Of course market segments are still tremendous abstractions. The architect has to stay aware all the time of the distance between the abstract models he is using and the reality, with all unique infinitely complex individuals.

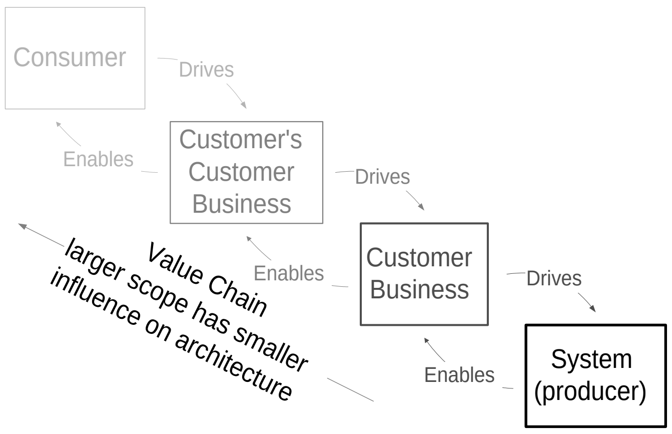


Figure 2.3: CAFCR can be applied recursively

segmentation axis	examples
geographical	USA, UK, Germany, Japan, China
business model	profit, non profit
economics	high end versus cost constrained
consumers	youth, elderly
outlet	retailer, provider, OEM, consumer direct

Figure 2.4: Market segmentation

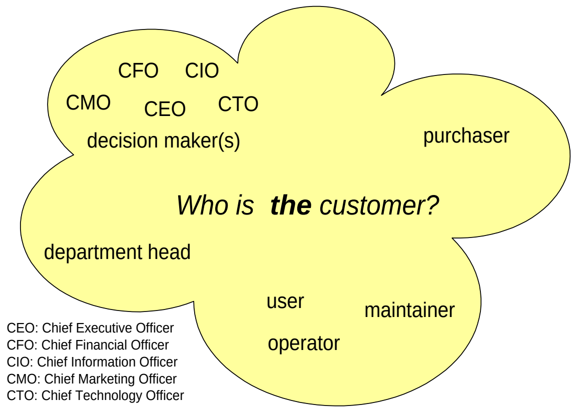

CFO
CIO
CMO
CEO
CTO
decision maker(s)
purchaser
Who is **the** customer?
department head
user
maintainer
operator
CEO: Chief Executive Officer
CFO: Chief Financial Officer
CIO: Chief Information Officer
CMO: Chief Marketing Officer
CTO: Chief Technology Officer

Figure 2.5: Which person is **the** customer?

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History
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