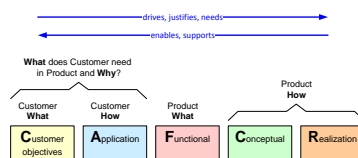# Short introduction to basic "CAFCR" model

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Abstract

The basic "CAFCR" reference model is described, which is used to describe a system in relation to its context. The main stakeholder in the context is the customer. The question "Who is the customer?" is addressed.

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. We keep the name constant, despite the fact that better names for some of the views have been proposed. The weakest name of the views is *Functional*, because this view also contains the so-called *non functional* requirements. A better name for this view is the Black-Box view, expressing the fact that the system is described from outside, without assumptions about the internals.

The model has been used effectively in a wide variety of applications, ranging from motor way 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 The CAFCR model

A useful top level decomposition of an architecture is provided by the so-called "CAFCR" model, as shown in figure 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!).
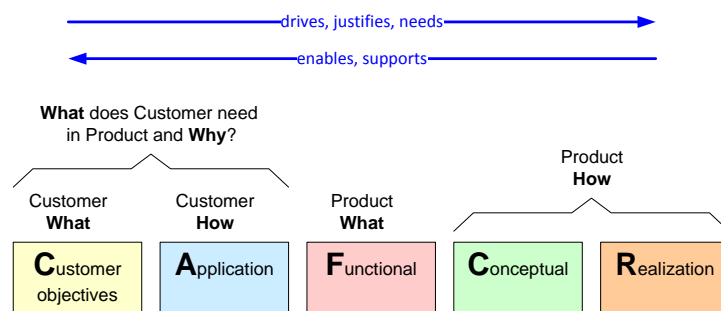

Figure 1: The "CAFCR" model

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.

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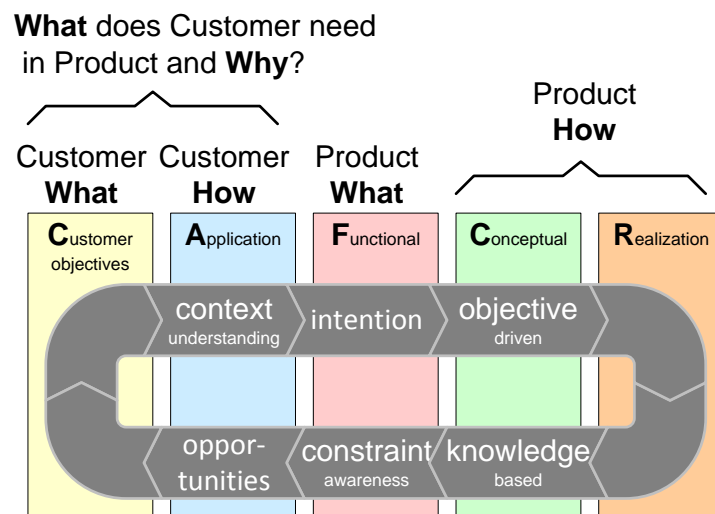

Figure 2: Five viewpoints for an architecture. The task of the architect is to integrate all these viewpoints, in order to get a *valuable*, *usable* and *feasible* product.

The model will be used to provide a next level of reference models and submethods. 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.

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 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. It is recommended to
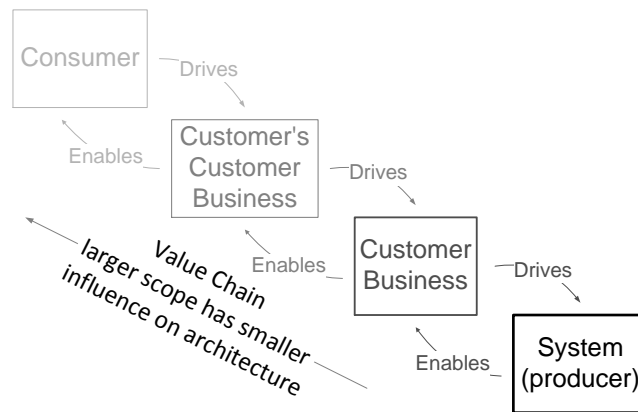
Figure 3: CAFCR can be applied recursively

start building up insight by making specific choices for the customer, for example by selecting specific market segments. Making early assumptions about synergy between market segments can handicap the build-up of customer understanding These kind of assumptions tend to pollute the model and inhibits clear and sharp reasoning.

many stakeholders are involved for any given customer. Multiple stakeholders are involved even when the customer is a consumer, such as parents, other family, and friends. Figure 4 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.
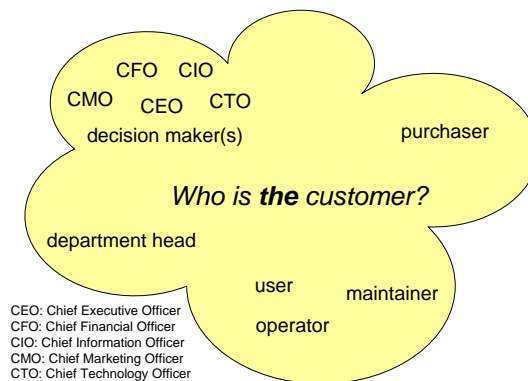

Figure 4: Which person is **the** customer?

Market segments are also still tremendous abstractions. Architect have to stay aware all the time of the distance between the abstract models they are using and the reality, with all unique infinitely complex individuals.

4   Life Cycle view

The basic CAFCR model relates the customer needs to design decisions. However, in practice we have one more major input for the system requirements: the life cycle needs. Figure 5 shows the CAFCR+ model that extends the basic CAFCR model with a *Life Cycle view*.
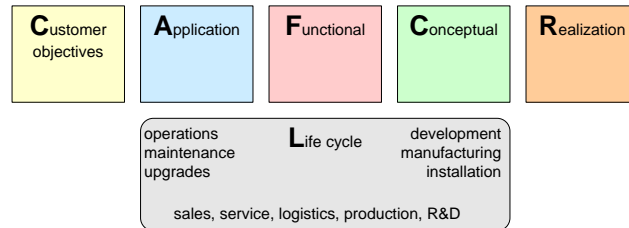

Figure 5: CAFCR+ model; Life Cycle View

The system life cycle starts with the conception of the system that trigger the development. When the system has been developed then it can be reproduced by manufacturing, ordered by logistics, installed by service engineers, sold by sales representatives, and supported throughout its life time. Once delivered every produced system goes through a life cycle of its own with scheduled maintenance, unscheduled repairs, upgrades, extensions, and operational support. Many stakeholders are involved in the entire life cycle: sales, service, logistics, production, R&D. Note that all these stakeholders can be part of the same company or that these functions can be distributed over several companies.

References

[1] Gerrit Muller. The system architecture homepage. http://www.gaudisite.nl/index.html, 1999.

[2] Henk Obbink, Jürgen Müller, Pierre America, and Rob van Ommering. COPA: A component-oriented platform architecting method for families of software-intensive electronic products. http://www.hitech-projects.com/SAE/COPA/COPA_Tutorial.pdf, 2000.

History
Version: 0.4, date: June 30, 2010 changed by: Gerrit Muller

- textual updates
- changed status in draft
- removed market segmentation as diagram

Version: 0.3, date: August 28, 2008 changed by: Gerrit Muller
- added life cycle as CAFCR+ model

Version: 0.2, date: July 8, 2002 changed by: Gerrit Muller
- small updates

Version: 0.1, date: July 3, 2002 changed by: Gerrit Muller
- updated CAFCR diagrams
- added outlet to segmentation table
- added CMO to "who is the customer"

Version: 0, date: March 26, 2002 changed by: Gerrit Muller
- Created, no changelog yet