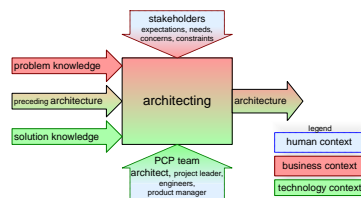# What is Systems Architecting in an Industrial Context?

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Abstract

Architecting is the creation of an architecture by the product creation team. The next question is: "What is an architecture?".

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1 Introduction

This thesis discusses the systems architecting of software and technology intensive products. Typical examples of software and technology intensive products are televisions, DVD-players, MRI scanners, and printers. The creation of these products is a multi-disciplinary effort by hundreds of engineers. The time between first product ideas and introduction into the market is in the order of a few months to a few years.

The concept *architecture* is borrowed from the building discipline. *Architecture* in building has a long history, with well known names as Vetruvius, Gaudí , Lloyd Wright, Koolhaas, and many many more. *System architecture* can be compared with building architecture. The architecture of a building is for a large part the experience that people get when they interact with the building, ranging from "how does it fit in the environment?", "what impression does it make?", "is it nice to be there?", to "is it useful?". In other words, the less tangible aspects of the perception of the building and the experience with the building are important aspects of the architecture. The technical aspects of the structure and the construction of the building are also part of the architecture. The feasibility of an architectural vision is enhanced or constrained by these technical aspects. The architecture is a dynamic entity that evolves during the life-cycle of the building. Every phase has its own particular needs. Early-on the constructibility is important; later the usability and adaptability, and finally the disposability, become the points of attention.

In this book the system architecture is a close metaphor of the building architecture. The system architecture covers both the external aspects, often intangible such as perception and experience, and the internal aspects, often more tangible such as structure and construction. Note that this definition of architecture is rather broad, much broader for instance than usual in the software architecture community, see the Software Engineering Institute (SEI) inventory [1] for a much wider variation of definitions for architecture. Essential in this definition is the inclusion of the user context in architecture.

The activity of creating an architecture is called architecting, see Figure 1. The process of creating a new product is called Product Creation Process (PCP). A multi-disciplinary team, the PCP team, creates the product. The input to the PCP comes from all stakeholders, with their needs, concerns, expectations, et cetera. The architect is responsible for the quality of the architecture: a system that meets the stakeholder's expectations, that provides the stakeholders with an attractive and useful experience, and that can be realized by the PCP team.

The architecting activity transforms problem and solution know how into a new architecture. In most cases the architecting is done by adapting preceding architectures. The preceding architecture is an input for the architecting effort. Green field architectures (problems without existing architecture, or where the existing architecture can be completely ignored) are extremely rare.

Gerrit Muller
What is Systems Architecting in an Industrial Context?
September 5, 2020   version: 1.4

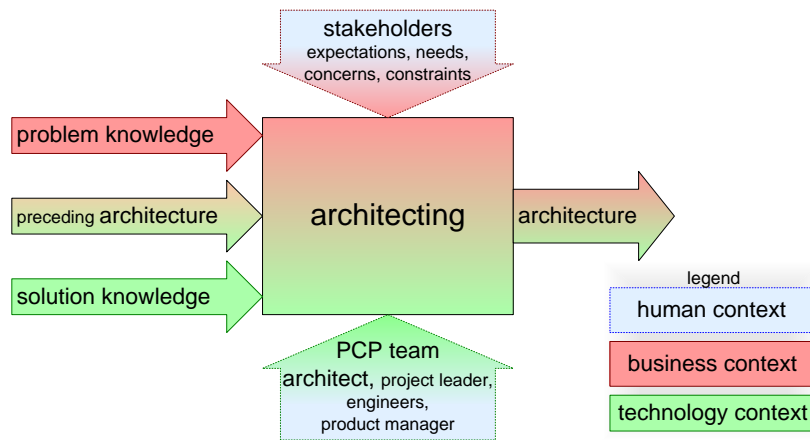University of South-Eastern Norway-NISE

page: 1

Figure 1: Architecting = creating an architecture

2 Description of the Business Context

Architecting methods are positioned in the business context by means of a variant of the "BAPO"-model [3]. The business objectives of the company are the main inputs for architecting: generating market share, profit, ratio between sales and investments, et cetera. The specific business objectives depend strongly on the domain: the type of product, customers, competition, application and market.
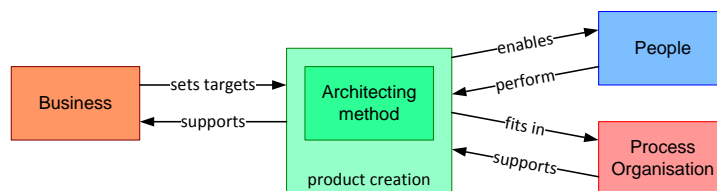

Figure 2: The business context of architecting methods

The business context is shown in Figure 2. The business will set targets for the architecting methods, the architecting methods will support the business. The product creation uses an architecting method to develop new products. The architecting method must fit in the processes and the organization. People do the real work, the method should help people to architect the desired system.

Gerrit Muller
What is Systems Architecting in an Industrial Context?
September 5, 2020   version: 1.4

University of South-Eastern Norway-NISE

page: 2

3 Internal Stakeholders

Many stakeholders in the business context are involved in the creation, production, sales and service of the products. All these operational stakeholders have their own concerns. These concerns translate into needs that influence the product specification. Figure 3 shows the internal stakeholders as annotation to figure 2.
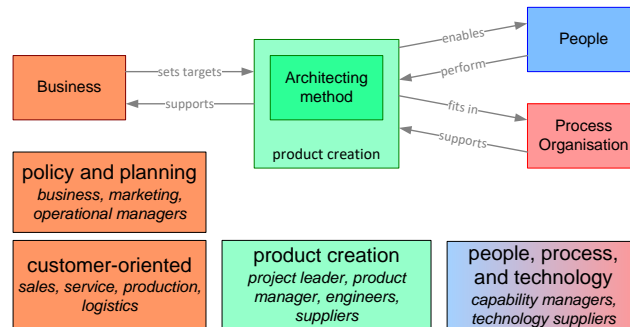

Figure 3: Stakeholders of the product creation within a company itself

The *policy and planning process* sets the strategy and anticipates on the longer term future. The scope of this process is at portfolio level. The *policy and planning process* has the overview and strategic insight to allow decisions about product synergy and optimizations across products and product families. Also decisions about involving partners and the degree of outsourcing are taken here. These internal strategic considerations also translate into operational requirements.

The *customer-oriented process* covers the entire order realization process as well as the sales and life-cycle support (service) processes. Manufacturability, serviceability, and many more requirements are determined by these stakeholders.

All specification and design work is done in the *product creation process*. Many contacts with internal and external suppliers take place during product creation. The operational needs of this process, such as work breakdown, test models, et cetera, also result in operational requirements.

The *people, process, and technology management* is concerned with processes, methods, tools, skills of people, intellectual property, and technology development. These concerns will sometimes result in operational requirements. Care should be taken that the justification of these requirements is clear. From a business point of view these issues are means that must serve the business goals, not the other way around.

4 Acknowledgements

Gerrit Muller
What is Systems Architecting in an Industrial Context?
September 5, 2020   version: 1.4

University of South-Eastern Norway-NISE

page: 3

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

[3] 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: 1.4, date: June 2, 2004 changed by: Gerrit Muller
- Corrected the spelling of *Lloyd Wright*

Version: 1.3, date: April 5, 2004 changed by: Gerrit Muller
- extended the text about the definition of architecture
- small textual changes
- changed status to finished

Version: 1.2, date: March 16, 2004 changed by: Gerrit Muller
- small textual changes
- changed status to concept

Version: 1.1, date: November 21, 2003 changed by: Gerrit Muller
- many small textual changes
- removed figure about tangible and intangible architecture

Version: 1.0, date: July 28, 2003 changed by: Gerrit Muller
- changed title in "What is systems architecting in an industrial context?"
- added paragraph to set the scope to software and technology intensive products.
- described the PCP team
- integrated "Positioning Architecting Methods in the business" in this chapter

Version: 0.1, date: March 26, 2003 changed by: Gerrit Muller
- Minor layout change in introduction

Version: 0, date: March 20, 2003 changed by: Gerrit Muller
- Created, no changelog yet

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What is Systems Architecting in an Industrial Context?
September 5, 2020   version: 1.4

University of South-Eastern Norway-NISE

page: 4