

IT-architecture and user driven software design (BUITA)

The software architect

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Architectural concepts



Role of the architect

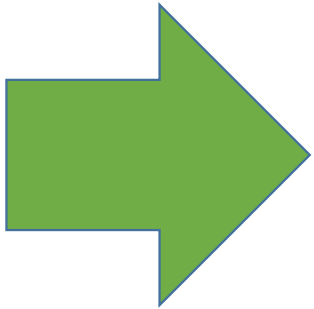


Status on groups and projects

Learning goals

- Know the role and the work process of a software and systems architect
- Know the core concepts of software and systems architecture such as *architecture, candidate architecture, elements, stakeholders, viewpoints, perspectives and architecture description*
- Be able to discuss and reflect on strengths and limitations of the above mentioned concepts

Course book: Software Systems Architecture



Part I: fundamentals (ch. 2-5)

Part II: the process of software architecture (ch. 6-14)

Part III: the viewpoint catalog (ch. 15-23)

Part IV: the perspective catalog (ch. 24-29)

Part V: putting it all together (ch. 30)

Architectural concepts

Architectural concepts



DEFINITION The **architecture** of a system is the set of fundamental concepts or properties of the system in its environment, embodied in its elements, relationships, and the principles of its design and evolution.

The elements that constitute a system and the relationships between them define the structure of the system that contains them. There are two types of structures that are of interest to the software architect: *static structure* (organization of design-time elements) and *dynamic structure* (organization of runtime elements).



DEFINITION The **static structures** of a system define its internal design-time elements and their arrangement.



DEFINITION The **dynamic structures** of a system define its runtime elements and their interactions.

The fundamental properties of a system manifest themselves in two different ways: *externally visible behavior* (what the system does) and *quality properties* (how the system does it).



DEFINITION The **externally visible behavior** of a system defines the functional interactions between the system and its environment.



DEFINITION A **quality property** is an externally visible, nonfunctional property of a system such as performance, security, or scalability.



DEFINITION An **architectural element** (or just element) is a fundamental piece from which a system can be considered to be constructed

Key attributes

- Defined set of responsibilities
- Defined boundary
- Defined interfaces

E.g. A database server, the .NET framework

(Allows the system to be more easily understood and encourages extensions to be made in a consistent way)



DEFINITION A candidate architecture for a system is a particular arrangement of static and dynamic structures that has the potential to exhibit the system's required externally visible behaviors and quality properties.

Exercise - architectures

1. In small groups, compare the two architectures for the airline booking system (figure 2.2 and figure 2.3 at p. 17 and p. 18)
2. Explain advantages and disadvantages of each architecture for selected quality properties

Exercise – identifying elements of the architecture

- In small groups, read through the InfoScreen technical description
- Identify *static elements* and type out the various architecture elements used for this **on post-its**
- Identify relationships between them
- How to group the elements

Stakeholders

- A person (or a group of persons) with something ***at stake***
 - ***stake, interest, concern***
 - ***users, developers, testers, maintainers, sponsors, suppliers/contractors, QA***
- Users – at many levels
 - Management user
 - Daily user, end-user
 - Indirect user



DEFINITION A **stakeholder** in the architecture of a system is an individual, team, organization, or classes thereof, having an interest in the realization of the system.



DEFINITION A **concern** about an architecture is a requirement, an objective, a constraint, an intention, or an aspiration a stakeholder has for that architecture.

Specifying the architecture is a key opportunity for the stakeholders to direct its shape and direction. You will find, however, that some stakeholders are more interested in their roles than others, for a variety of reasons that have little to do with architecture. Part of your role, therefore, is to engage and galvanize, to persuade people of the importance of their involvement, and to obtain their commitment to the task.

Exercise - stakeholders and *dynamic* elements

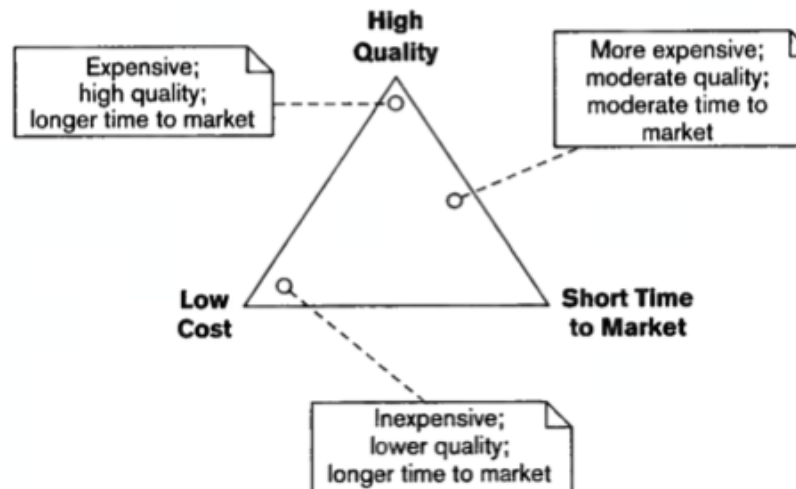
1. In small groups, read through the InfoScreen technical description
2. Extrapolate/speculate on possible stakeholders
3. Identify *dynamic* elements
4. Identify concerns for the top three stakeholders



PRINCIPLE Architectures are created solely to meet stakeholder needs.



PRINCIPLE A good architecture is one that successfully addresses the concerns of its stakeholders and, when those concerns are in conflict, balances them in a way that is acceptable to the stakeholders.



Exercise – using the quality triangle

- Discuss the architectures in figure 2.2 and 2.3 using the quality triangle



PRINCIPLE A good architectural description is one that effectively and consistently communicates the key aspects of the architecture to the appropriate stakeholders.

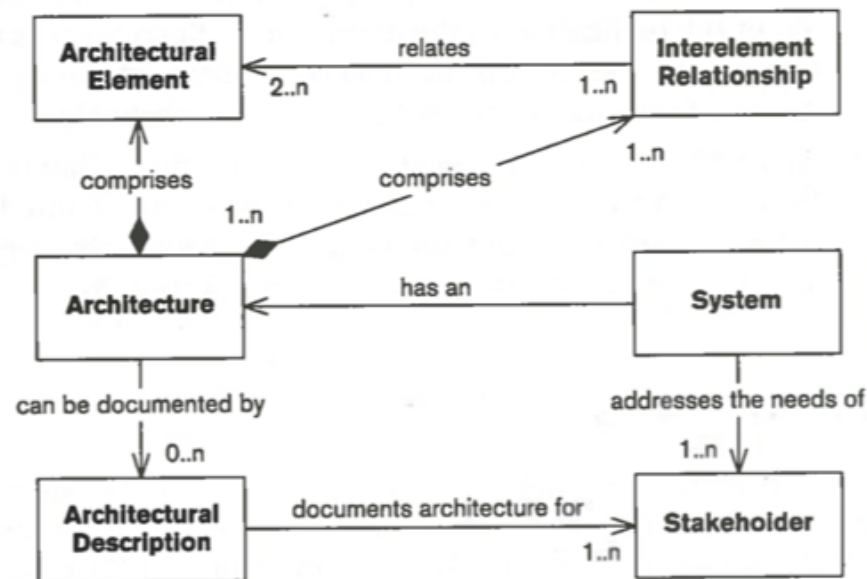


FIGURE 2-5 CORE CONCEPT RELATIONSHIPS

Exercise – reading UML diagrams

- Explain figure 2.5 to your neighbor(s)

Viewpoints and views



PRINCIPLE It is not possible to capture the functional features and quality properties of a complex system in a single comprehensible model that is understandable by, and of value to, its stakeholders.

A widely used approach – the only successful one we have found – is to attack the problem from different directions simultaneously ... the AD is partitioned into a number of separate but interrelated views, each of which describes a separate aspect of the architecture (p. 33)

DEFINITION A view is a representation of one or more structural aspects of an architecture that illustrates how the architecture addresses one or more concerns held by one or more of its stakeholders.

Viewpoints and views

DEFINITION A **view** is a representation of one or more structural aspects of an architecture that illustrates how the architecture addresses one or more concerns held by one or more of its stakeholders.

What to include in a specific view? (pp. 34f)

View scope: What structural aspects to represent ?

Element types: What elements are you trying to categorise?

Audience: Who is the stakeholder?

Audience expertise: What technical understanding do the stakeholder have?

Scope of concerns: What stakeholder concerns should the view address?

Level of detail: How much do the stakeholder need to know?

Viewpoints and views

DEFINITION A **viewpoint** is a collection of patterns, templates, and conventions for constructing one type of view. It defines the stakeholders whose concerns are reflected in the viewpoint and the guidelines, principles, and template models for constructing its views.

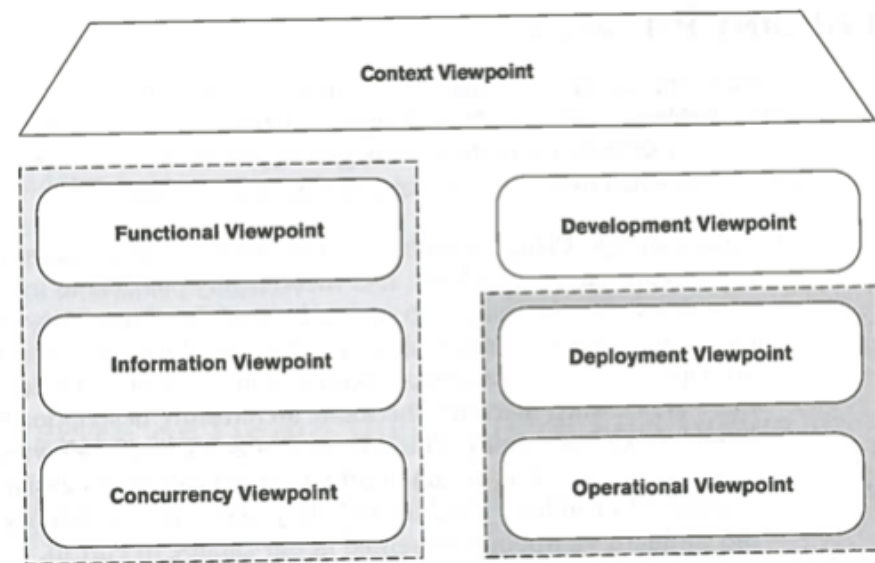


FIGURE 3-2 VIEWPOINT GROUPINGS

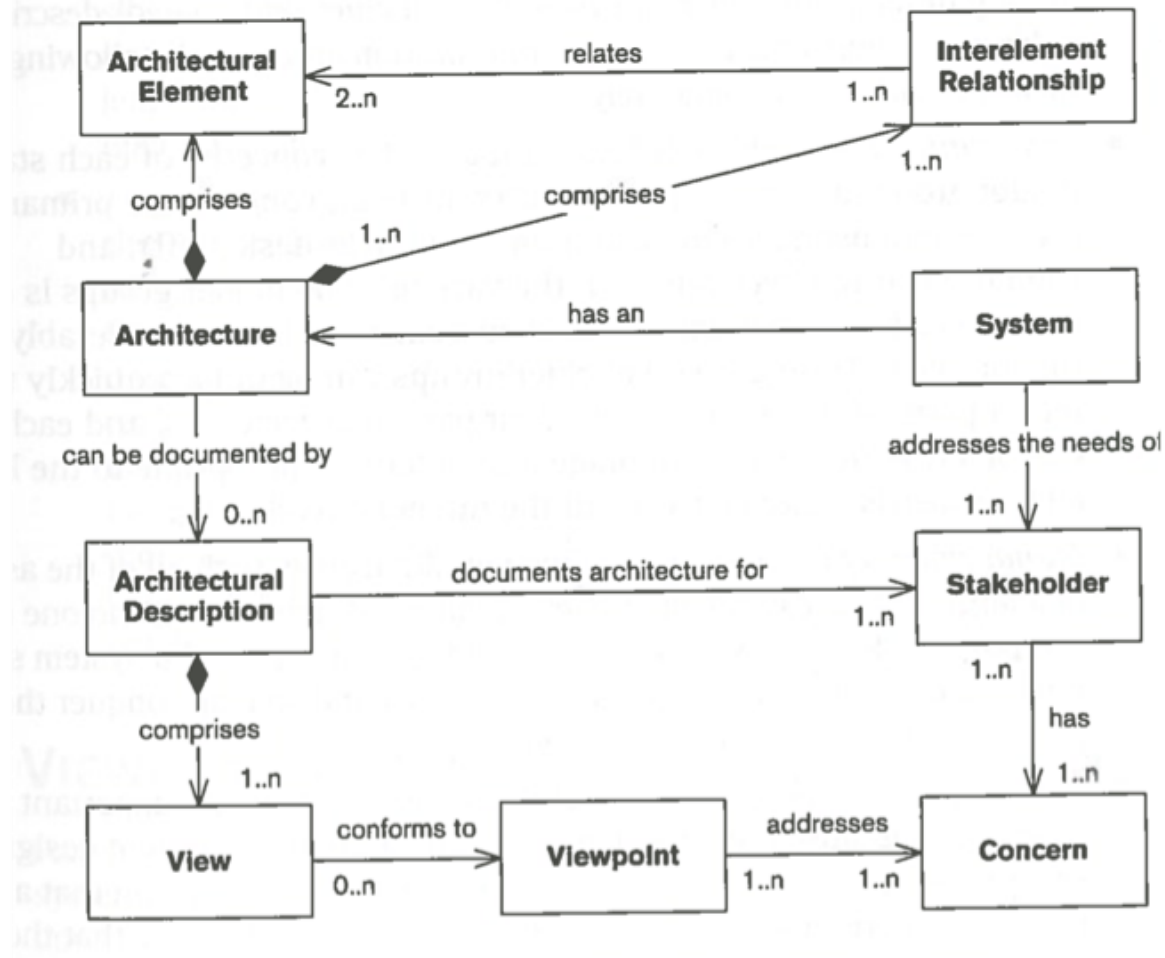


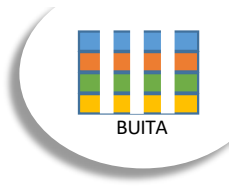
FIGURE 3-1 VIEWS AND VIEWPOINTS IN CONTEXT

Exercise – reading UML diagrams

- Explain figure 3.1 to your neighbor(s)

Viewpoints and perspectives

Perspectives/ Viewpoints	Security	Performance+ Scalability	Availability Resilience	Evolution	Location	Development resouce	Internalization
Context							
Functional		<div>(access control, access classes, object-level security)</div>				<div>(extension points, flexible interfaces, meta-approaches)</div>	
Information							
Concurrency							
Development			<div>(shared resources, blocking, locks, syncing, version control)</div>				
Deployment							
Operational							



Exercise – choosing viewpoints for different types of systems

- Discuss Table 3.2 (p. 42) with your neighbor(s)
- See if you can identify relevant viewpoints and/or perspectives based on the InfoScreen case!

Role of the software architect

Engage organisational change as a system architect

- Defining the project and scope
- Engaging stakeholders in the organisation
- Building understanding between multiple stakeholders (e.g.):
 - Top management, middle management, users and developers
 - Sales people, business analysts, and technical operations
 - Network architecture, database management, software suites and graphical user interface design
 - Being the design authority, team manager and tester of the new architecture

The architect's role

- Identify and engage stakeholders
- Understand and capture stakeholders' concerns
- Create and take ownership of the definition of an architecture
- Take a leading role in the realization of the architecture

Architecture definition problem space – solution space

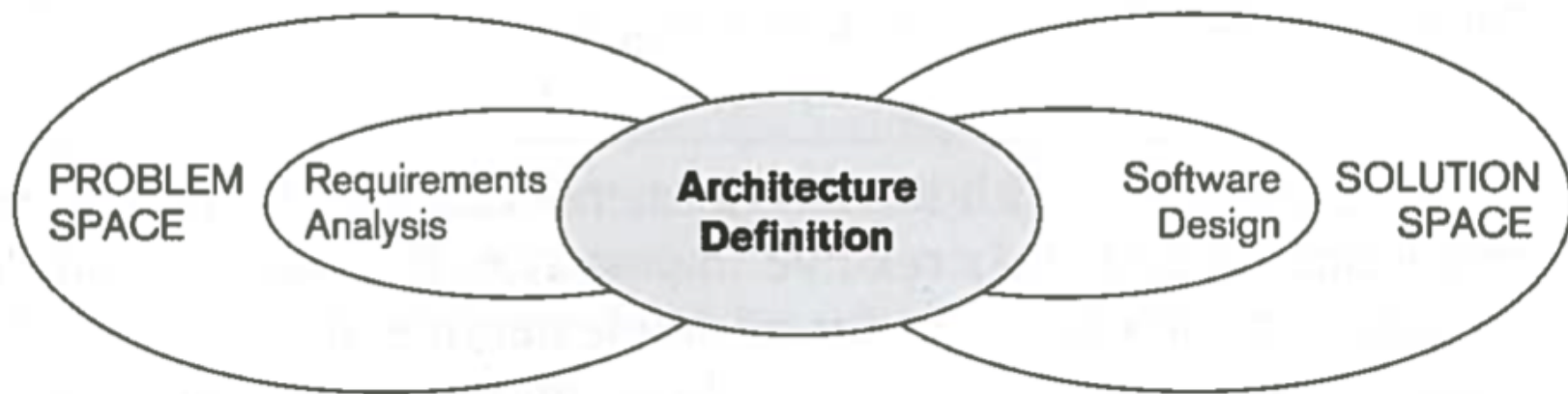


FIGURE 5-1 ARCHITECTURE DEFINITION, REQUIREMENTS ANALYSIS, AND SOFTWARE DESIGN

The architect's involvement

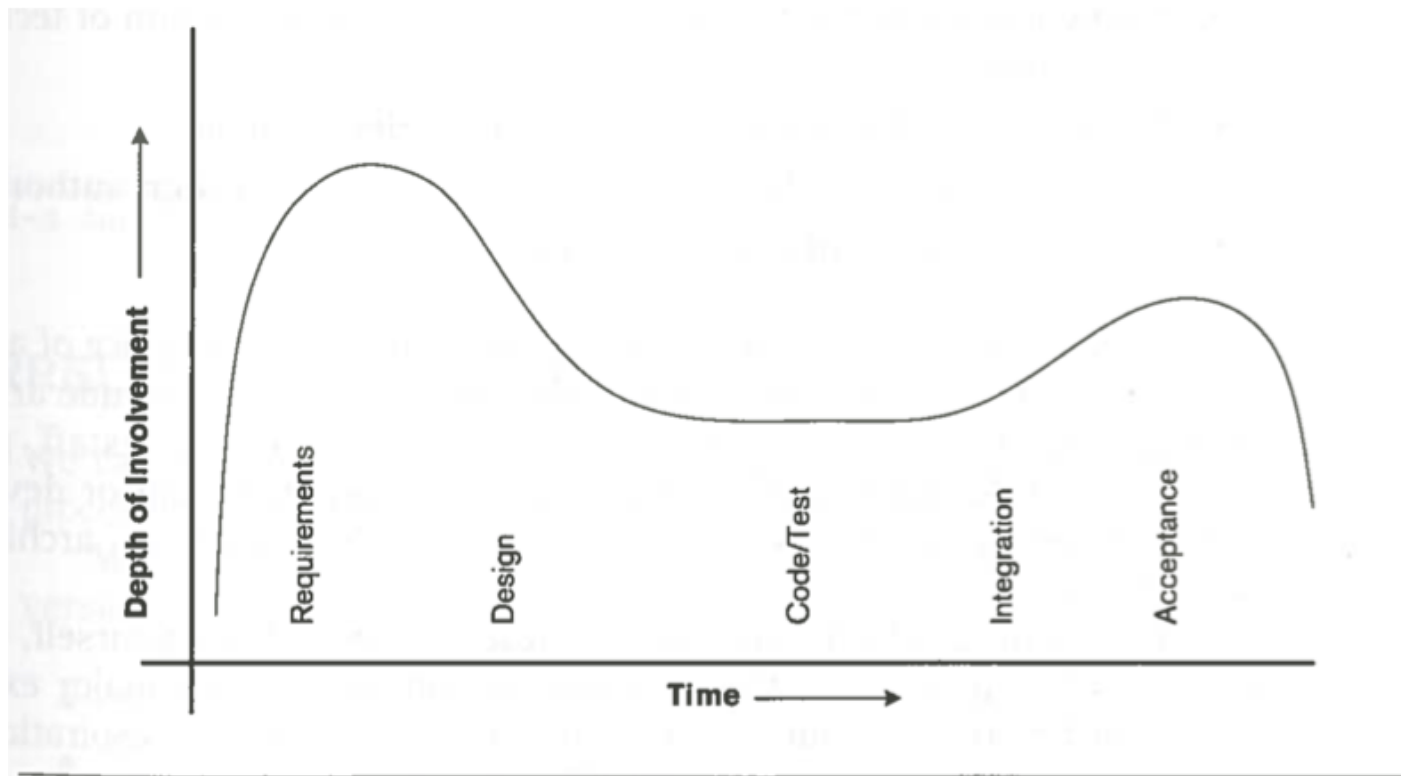
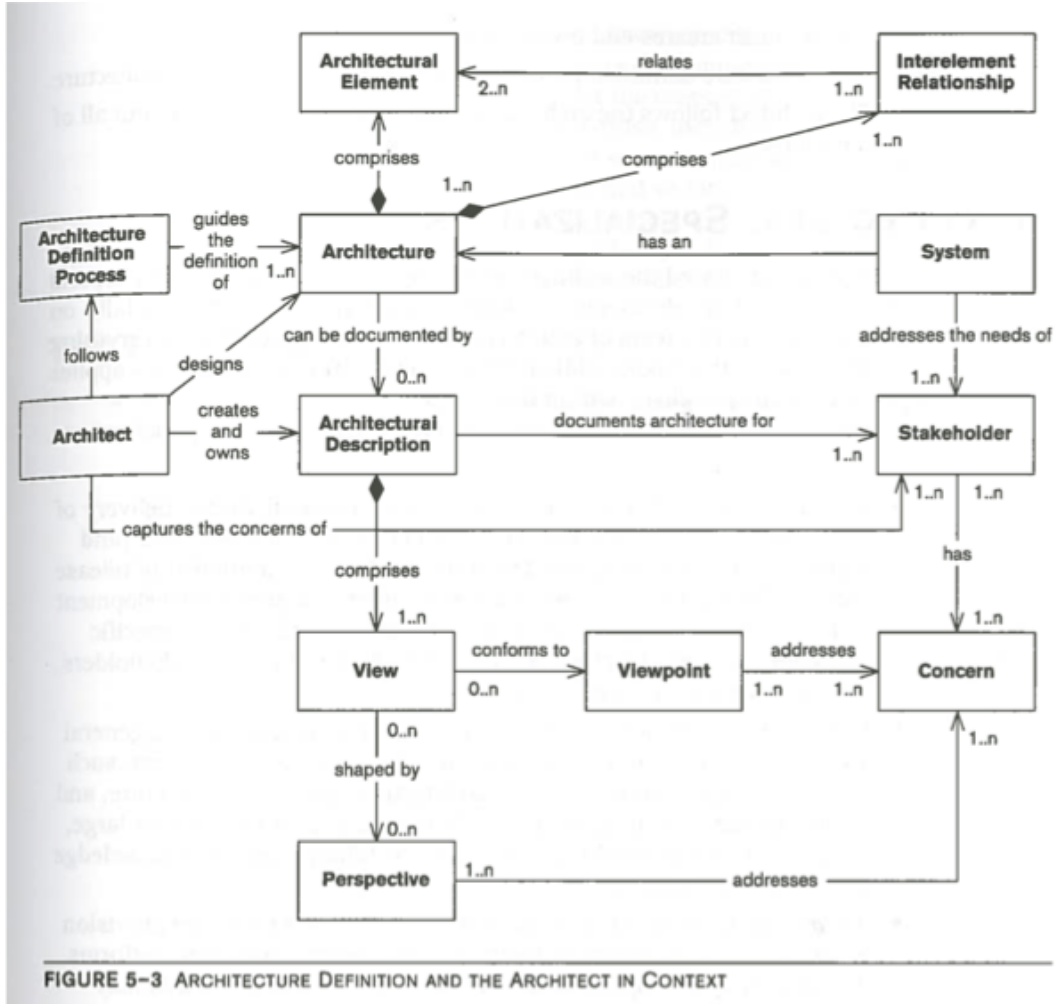


FIGURE 5-2 THE ARCHITECT'S INVOLVEMENT



Exercise – the architect's role

- In small groups, find job announcements for it-architect or software architect (for example using "jobindex.dk")
- Select two or three announcements of particular interest to you
- Describe the competence requirements for each position
- Compare the requirements to the list of architectural specializations in RW, chapter 5, p. 72 ff

Exercise – the architect's role

- In small groups (3x3), find the list architectural specializations in Rozanski & Woods, chapter 5, p. 72-77 ff
- Which competencies do you prefer/have used prior?

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Architectural concepts



Role of the architect



Groups and projects