Architecture Design Methods

Literature

[Hofmeister et al., 2007]

– Hofmeister, C., Kruchten, P., Nord, R.L., Obbink, J.H., Ran, A., and America, P. (2007) A general model of software architecture design derived from five industrial approaches. *Journal of Systems and Software, 80(1), pp 106-126.*

[Falessi et al., 2007]

– Falessi, D., Cantone, G., and Kruchten, P. (2007) Do Architecture Design Methods Meet Architects' Needs? In *Proceedings of WICSA 2007*

Purpose

Look at various (industrial) architectural design methods

- Extract commonalities
- Describe general approach
- Derive evaluation grid

Architecture Design

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Goal

- Maintain intellectual control over the design of large software systems

Involves

- Stakeholder involvement
- Development by large (possibly distributed) teams
- Multiple conflicting goals and concerns
- Maintaining over a long period of time

Architectural Design Approaches

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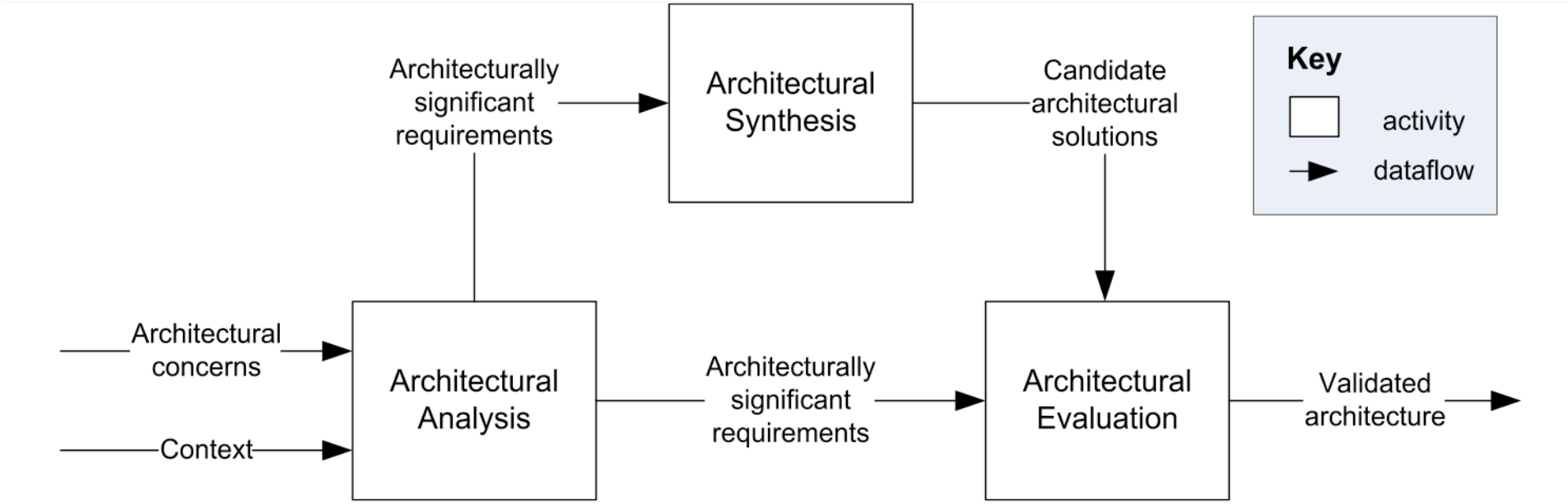
Well-known, used

- Attribute-Driven Design (ADD)
- Siemens' 4 View method (S4V)
- Rational Unified Process 4+1 (RUP4+1)

Less known, less used?

- Business Architecture Process and Organization (BAPO)
- Architectural Separation of Concern (ASC)
- Goals & Scenarios (G&S)
- Tropos
- ….

Architectural Design Activities



Model Elements

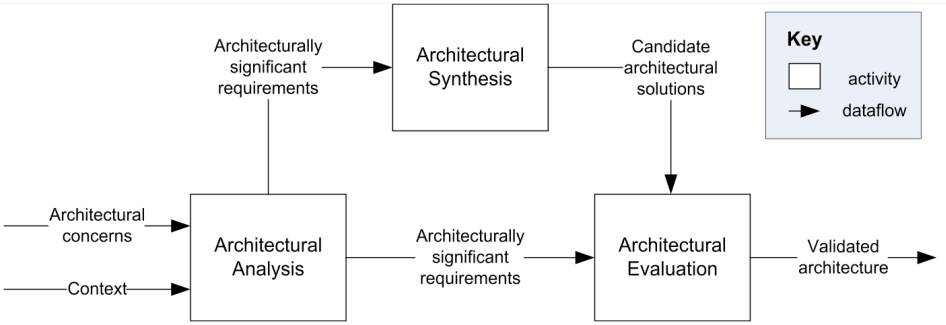
Architectural concerns
- Interests pertaining to the system's development

Context
- Setting and circumstances of influences on the system
- Developmental, operational, political, organizational

Architecturally significant requirements (ASRs)
- A requirement upon a software system that influences its architecture

Candidate architectural solution
- Candidate or partial architectures
- Reflect design decisions

Validated architecture
- Architectural solution consistent with ASRs



Model Elements

Architectural analysis

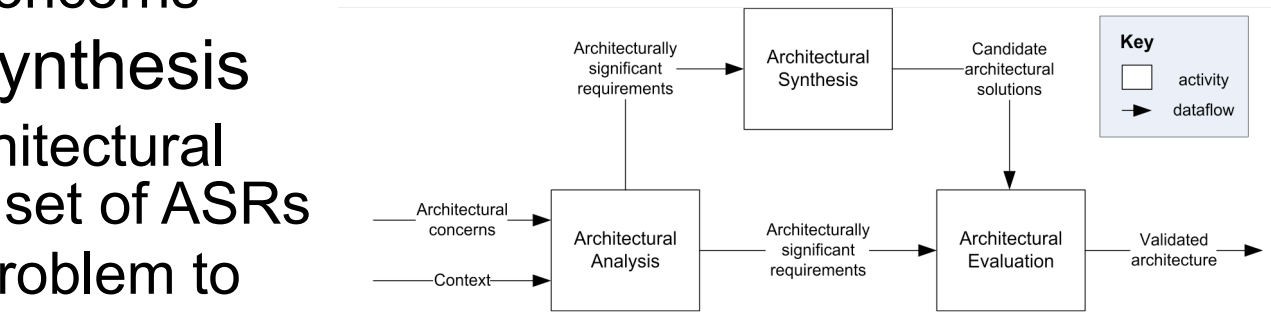
- Define the problems that the architecture must solve
- Filters/reformulates context and concerns

Architectural synthesis

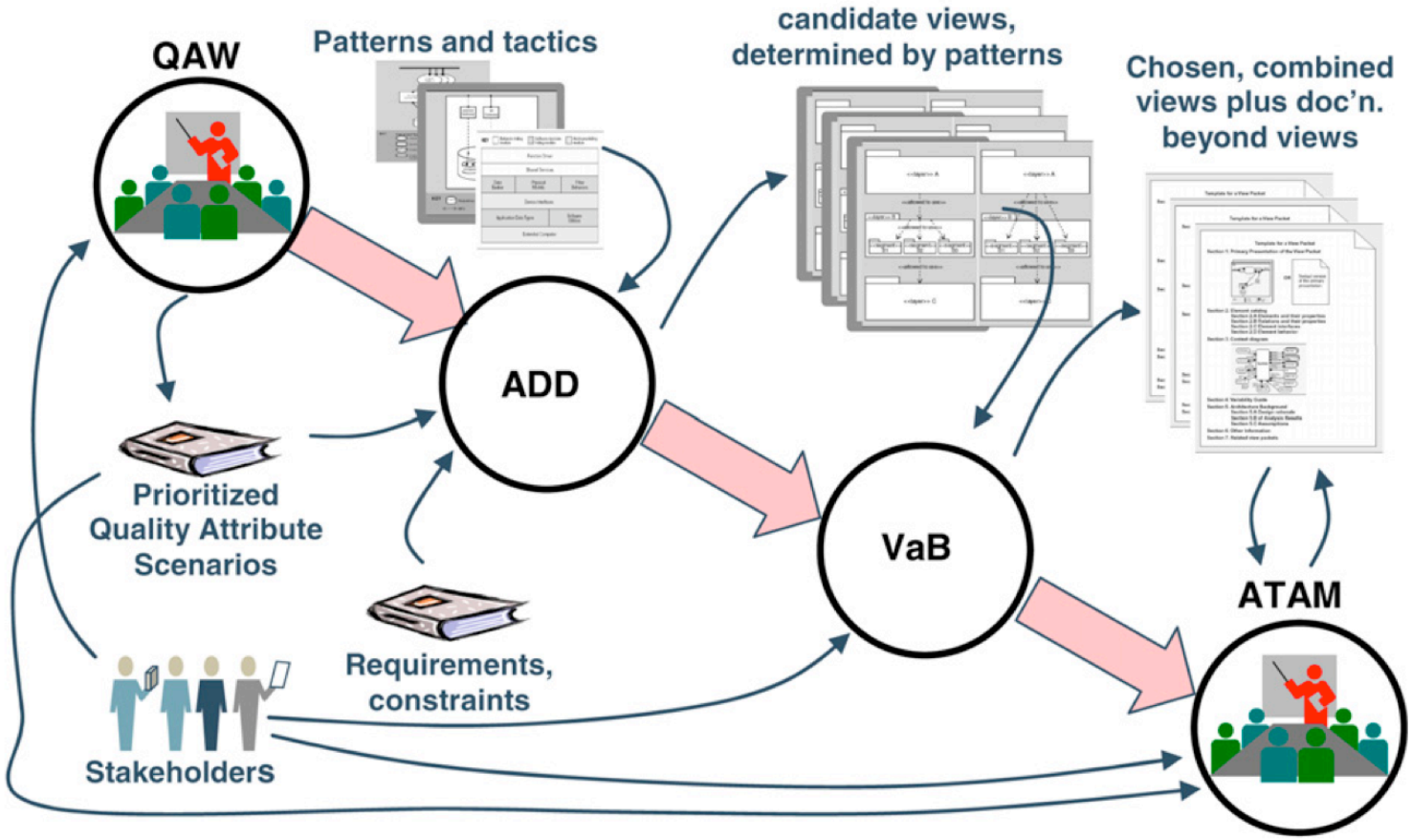
- Proposes architectural solutions to a set of ASRs
- Moves from problem to solution space

Architectural evaluation

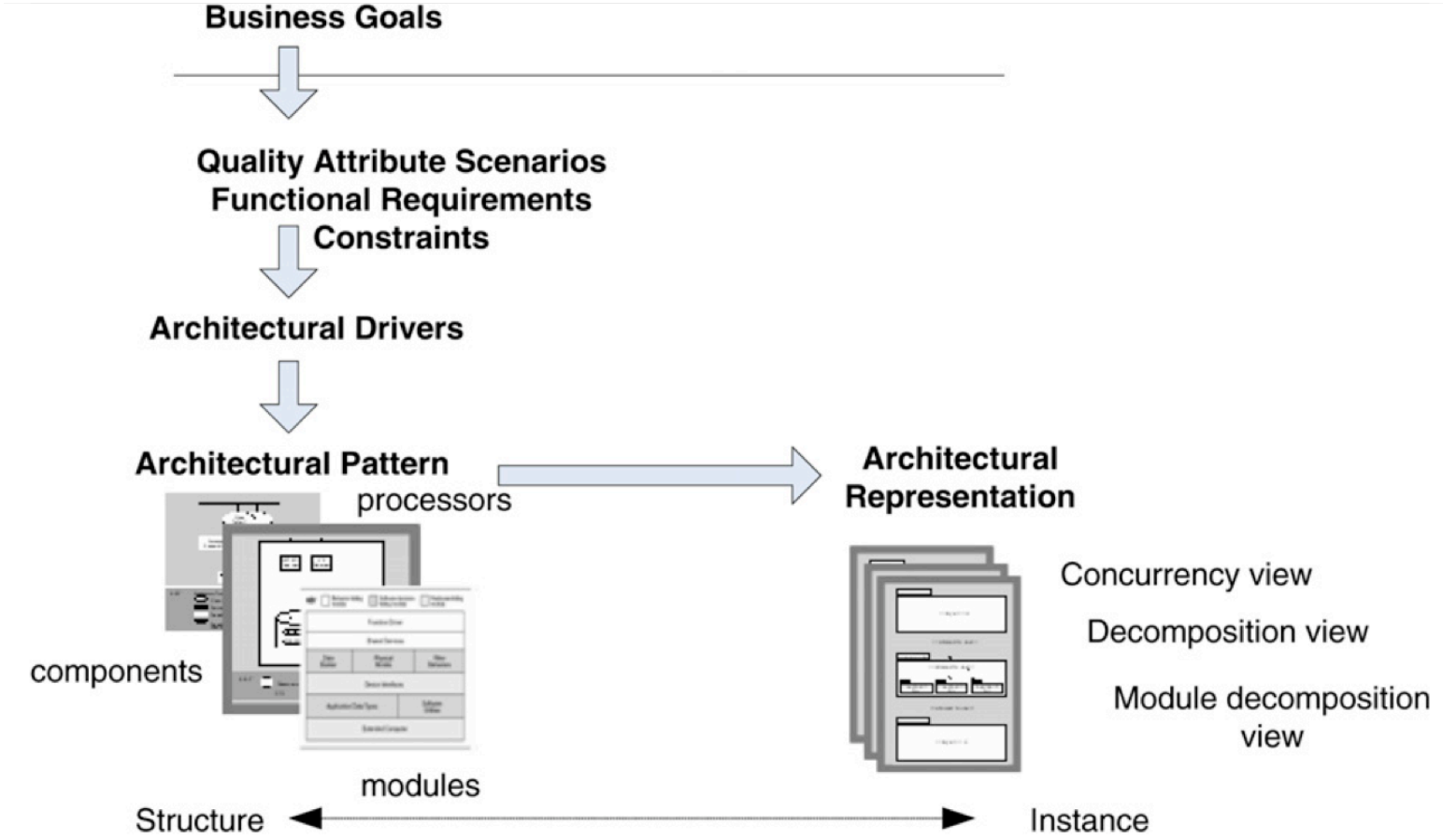
- Ensure design decisions are the right ones
- Validate against ASRs



Attribute-Driven Design (ADD)



Attribute-Driven Design (ADD)



Siemens' 4 Views (S4V)

Develop four views based on Global Analysis

Views

- Conceptual
  - Essentially C&C view
- Execution
  - Runtime platform elements
- Module
  - Module organized into decomposition and layered structures
- Code
  - Organization of software artifacts

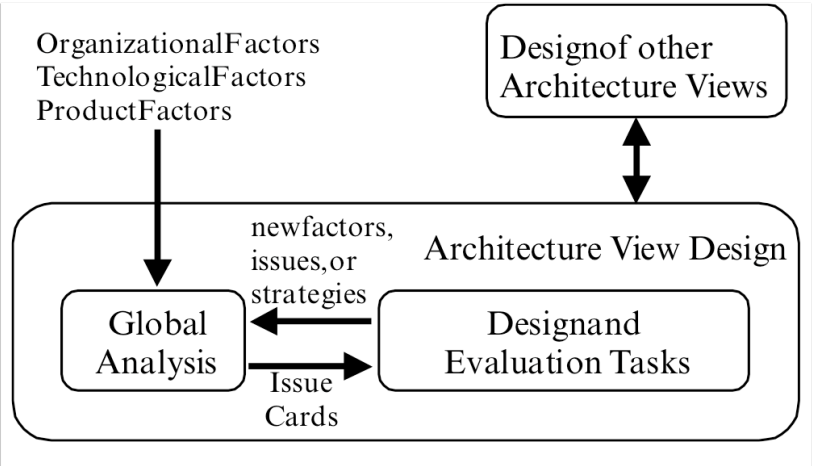
Global Analysis

- Identify organizational, technological and product factors that influence the architecture

Identify key architectural issues based on Global Analysis

Propose design strategies

- Applied to one or more views



Rational Unified Proces 4+1 Views (RUP4+1)

Primarily a concern of the elaboration

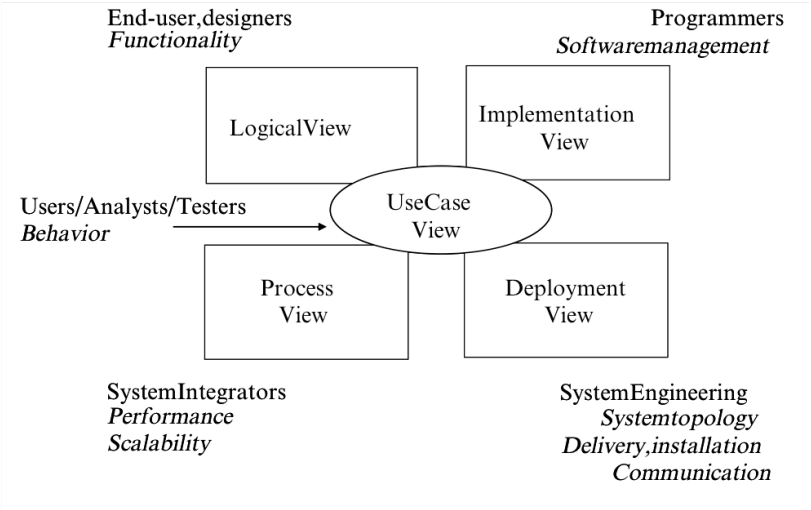
- Goal is an executable architectural prototype

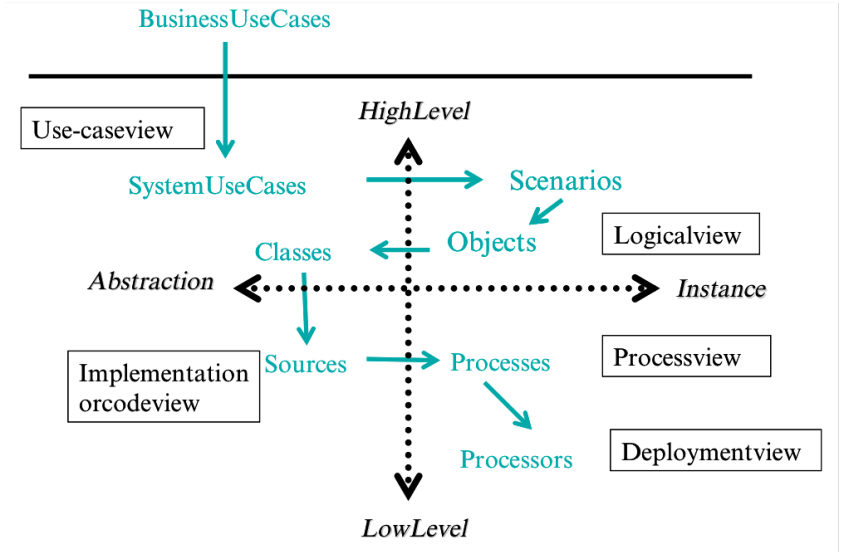
Input

- Vision document
- Use case model (functional)
- Supplementary specification (non-functional)

Activities

- Define a Candidate Architecture
- Perform Architectural Synthesis
- Refine the Architecture
- Review the Architecture





The Backlog

All processes proceed iteratively and “grow” an architecture

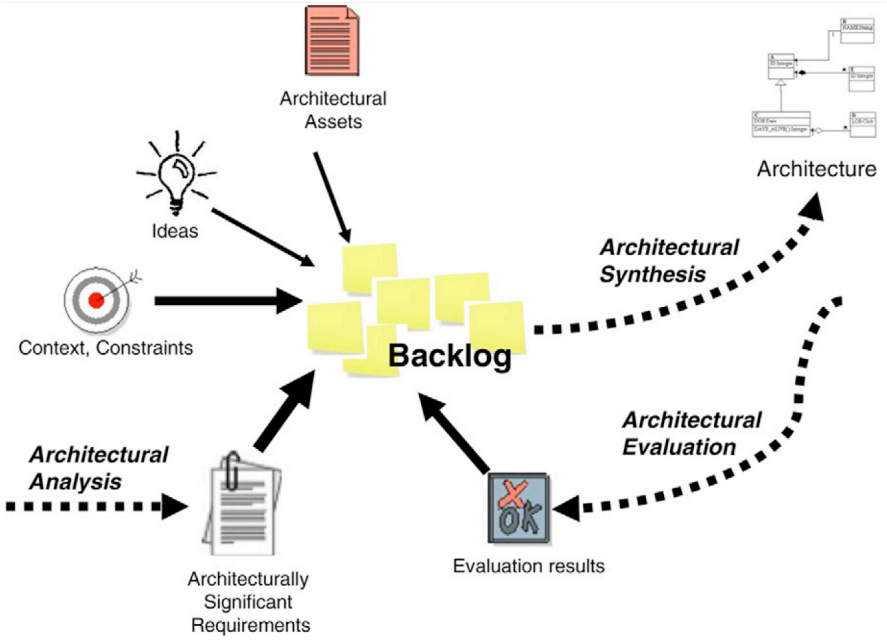
- Not possible to handle all concerns at the same time

Need to track the process

- Architects implicitly or explicitly use a *backlog*

Contents

- Needs
- Issues
- Problems to be tackled
- Ideas
- …



Analyzing Software Architecture Development Methods

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Table 4
A grid to analyze a software architecture design method

	Generic artifacts	Artifacts in X	Activities in X	Techniques and tools in X
		Has the method X provision for the following artifacts? How are they named and represented?	*Is the method X providing activities to produce these artifacts? How are these activities named and documented?*	*What specific tools and technique is associated with the method X?*
Architectural analysis	– Context – Requirements, and – Architecturally significant requirements (ASR)			
Architectural synthesis	Candidate architectural solutions – Architectural design (e.g., views, perspectives) – or Prototypes – Rationale			
Architectural evaluation	– Quality attributes – Architectural assessment			
Overall process driver	– Backlog			
Other		*Other key artifacts of the method X, not matching the generic ones*	*Other key activities of the method, not fitting in the boxes above.*	

Summary

A plethora of architectural design methods exists

- E.g., ADD, S4V, RUP4+1

There are a number of commonalities

- In the artifacts used and produced
- In the activities performed

All iterative, incremental

- Need to track this, e.g., using backlog