

# SOFTWARE ARCHITECTURE

Lecture 1: Introduction

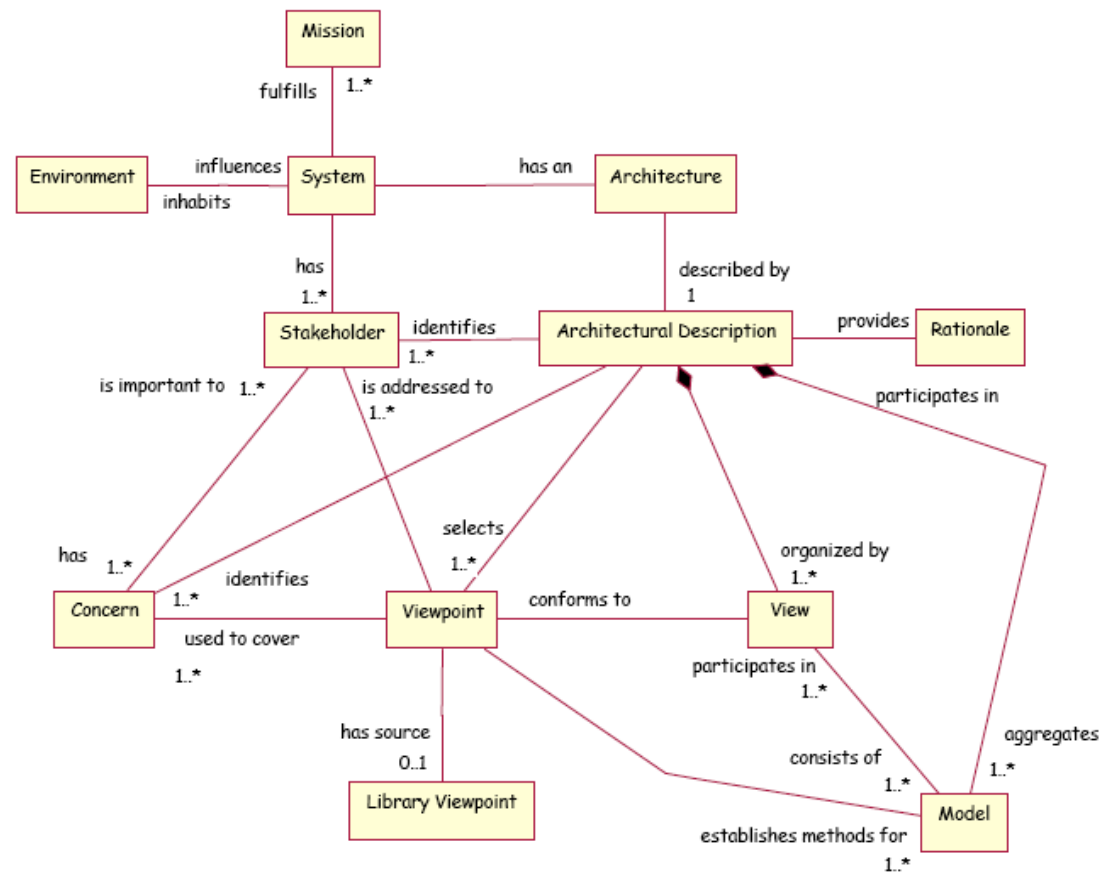
# What?

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- Definition 1 (Bass, Clements, Kazman, Software Architecture in Practice, 2nd edition. 2003):
  - ▣ The software architecture of a program or computing system is the structure or structures of the system, which comprise software components, the externally visible properties of those components, and the relationship among them
- Definition 2 (ANSI/IEEE Std 1471, ISO/IEC 42010):
  - ▣ The fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution.

# The IEEE 1471 Conceptual Framework

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# Stakeholders

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- Stakeholder:
  - ▣ an individual, team, or organization with interests in, or concerns relative to, a system
  - ▣ established in the requirements analysis community
- Possible stakeholders:
  - ▣ Client, Acquirer, Owner,
  - ▣ User, Operator, System Engineer, Maintainer,
  - ▣ Planner, Architect, Developer, Designer, Builder,
  - ▣ Service Provider, Vendor, Subcontractor

# Concerns (*Interests*)

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- Concerns:
  - ▣ those stakeholders' interests which pertain to the development, operation, or other key characteristics of the system (e.g., performance, reliability, security, evolvability, distribution, ...)
- Many non-functional requirements/aspects based on specific stakeholders

# Architectural Description

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- Architectural description (AD):
  - ▣ a collection of products to document an architecture
  - ▣ is addressed to the system's stakeholders to answer their architectural concerns about the system
- An AD addresses all identified stakeholders' concerns. If not, it is by definition, incomplete

# Architectural Views

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- View:
  - ▣ a representation of the whole system from the perspective of a related set of concerns issued by at least one stakeholder
  - ▣ reduces perceived complexity through separation of concerns
- An AD consists of one or more (consistent) views
- Views are not “orthogonal” but each view generally contains new information
- Views are modular:
  - ▣ A view may contain one or more architectural models

# Architectural Viewpoints

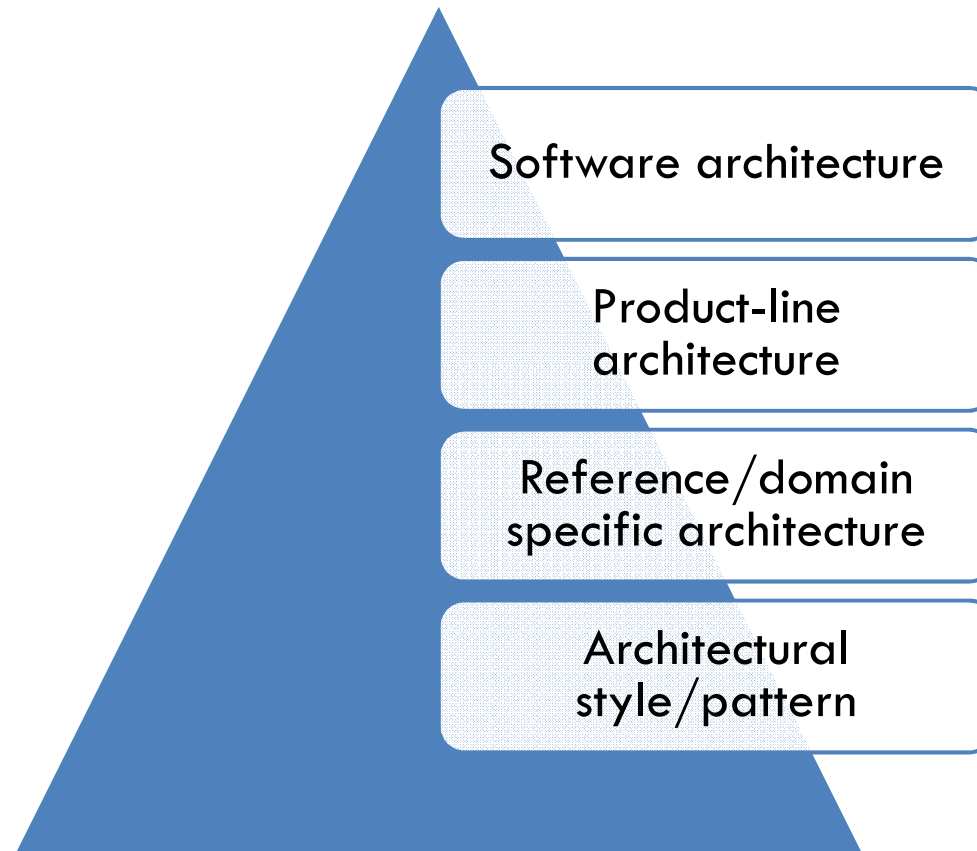
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- Viewpoint:
  - ▣ the set of resources and rules for constructing a view
- Each viewpoint is determined by:
  - ▣ Viewpoint name
  - ▣ The stakeholders addressed by the viewpoint
  - ▣ The architectural concerns “framed” by the viewpoint
  - ▣ The viewpoint language, or modeling techniques, or analytical methods used to construct, depict and analyze the resulting view
  - ▣ The source, if any, of the viewpoint (e.g., author, literature citation)



# How?

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# *Architectural Style / Pattern*

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- Architectural style/pattern:
  - ▣ defines element types and how they interact
  - ▣ sometimes defines a mapping of functionality to architectural elements

# *Reference / Domain Specific Architecture*

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- Reference/domain specific architecture
  - ▣ defines element types and how they interact
  - ▣ applies to a particular domain
  - ▣ defines how the domain functionality is mapped to architectural elements

# Product-line Architecture

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- Product-line architecture
  - ▣ applies to a set of products within a company
  - ▣ defines element types, how they interact, how the product functionality is mapped to them
  - ▣ may also define some of the instances of the architectural elements
    - E.g.: error-reporting components would be common to many products of the product line

# Software Architecture

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- ❑ Software architecture
  - ▣ applies to one system
  - ▣ describes element types, how they interact, how the product functionality is mapped to them
  - ▣ describes the instances that exist in the system
  - ▣ level of specificity needed to design a system
- ❑ Software architecture
  - ▣ is an abstraction that helps in managing the complexity of the system
  - ▣ provides a design plan of the system

# Abstraction

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- Architecture means not a comprehensive decomposition of the system
  - ▣ Implementation details abstracted away, encapsulated into elements of the architecture
- Architecture should describe elements at a coarse level of granularity
  - ▣ How elements fulfill the requirements
  - ▣ Element interactions
  - ▣ Element dependencies on the environment

# Design Plan

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- ❑ Structural plan
  - ▣ Describes the elements of a system and
  - ▣ How they fit together
  - ▣ How they work together to fulfill requirements
- ❑ Used as a “blueprint” during development process
- ❑ Used to negotiate system requirements
- ❑ Used to set expectations with
  - ▣ Customers
  - ▣ Marketing/management personnel
- ❑ Project manager uses the design plan as input to the project plan

# Why?

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- Cope with complexity of software systems
  - ▣ need “standard” solutions to common problem types - **reuse**
  - ▣ need some way to talk about them - **understanding, communication**
  - ▣ need some way to organize them - **construction, evolution**
  - ▣ need some way to reason about them - **analysis, management**
  - ▣ **large scale decisions** are more important than data structures and algorithms