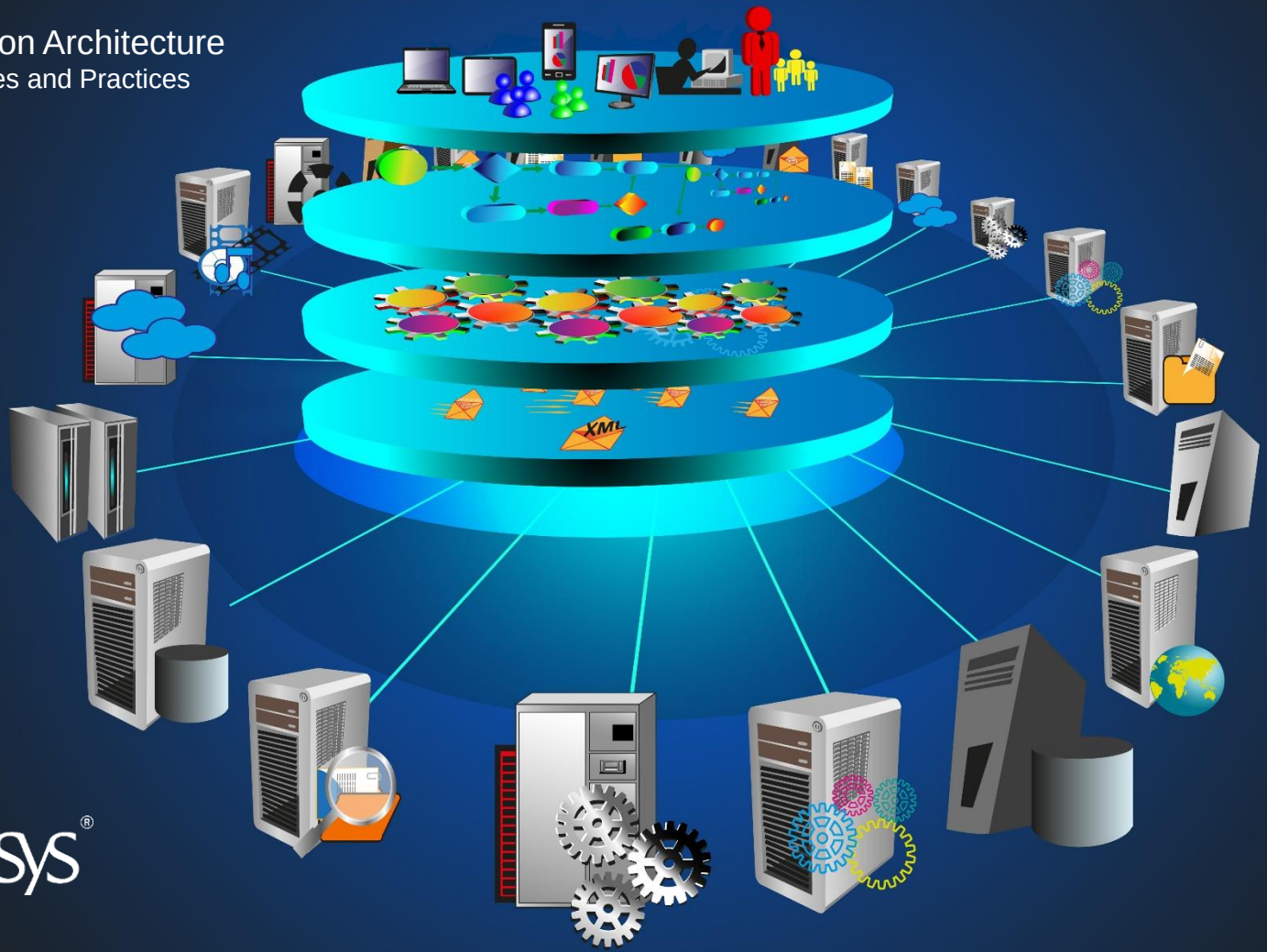
Application Architecture

Principles and Practices

Connect Architecture



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Session Plan

Connect Architecture

1. Definition, Architecture v/s Design
2. System Quality Attributes
3. Architecture Methodology
4. Role of an Architect

Usage Guidelines

Connect Architecture

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What is Architecture?

Connect Architecture

- ***Formal Definition:*** Architecture provides a *vision* and *path* for the creation of services and applications which conform to the fundamental principles of the system's design.

What is Architecture?

Connect Architecture

- Architecting is the process of designing and building systems, especially during the conceptual phases. It is generally synthesis-based, insightful and inductive (Eb Rechtin).
- An architecture is the structure of components, their relationships, and the principles and guidelines governing their design and evolution over time (Boeing).
- Architecture must consider the environment in which the system will operate (Bahill).
- Architecture is the fundamental structure of a system's components (physical or non-physical), their relationships to each other and the environment, and the guidelines or principles governing their selection and evolution (Maier).

Why Architecture?

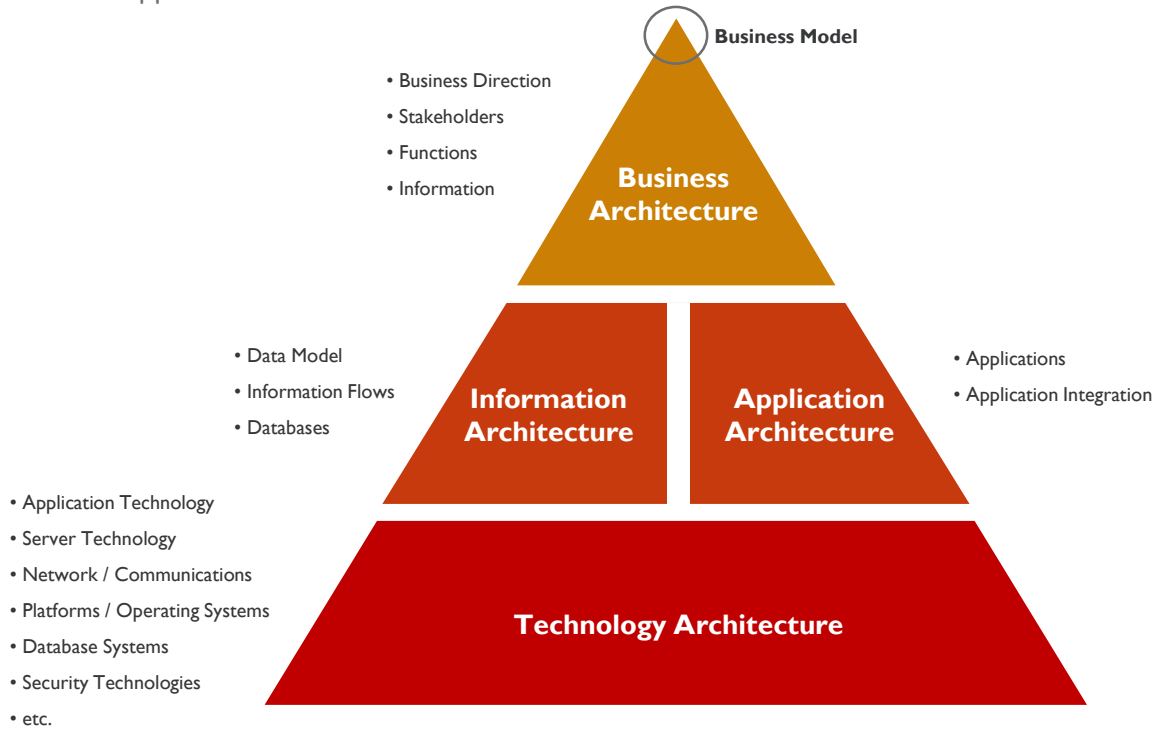
Connect Architecture

- Manage software development complexities
- Gap between problem and solution domains
- Bigger systems – More quality parameters
- Design techniques & tools inadequate to reason & evaluate quality parameters

Enterprise Architecture Framework

Connect Architecture

Enterprise Architecture vs. Application Architecture



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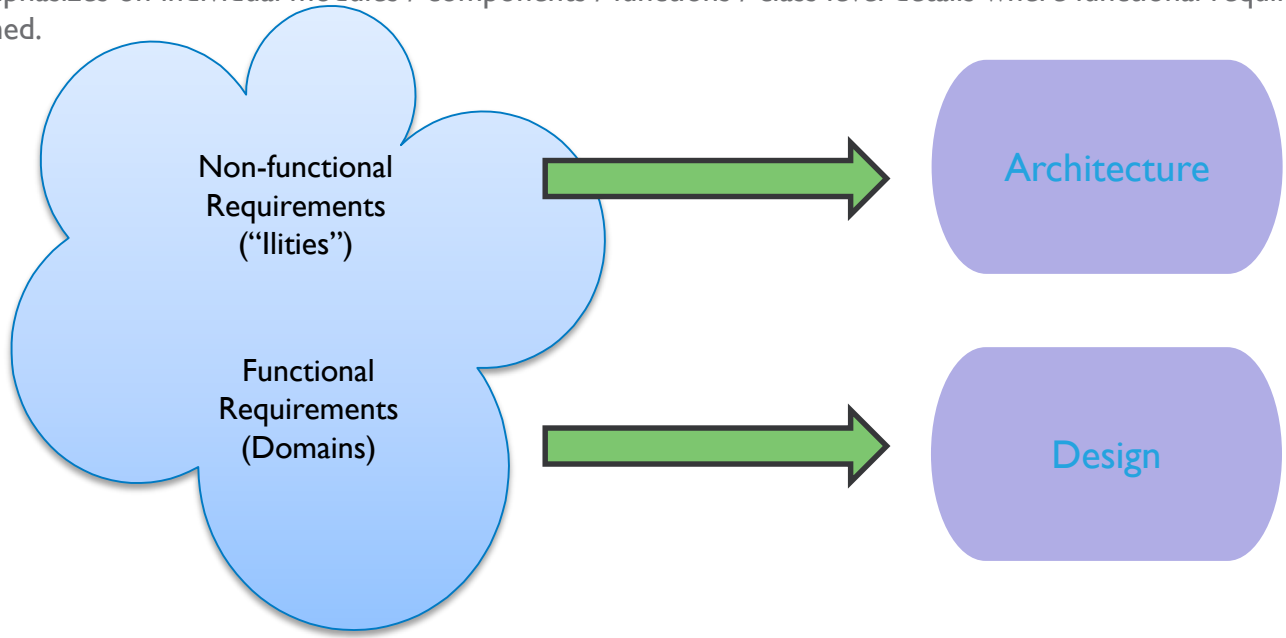
Architecture vs. Design

Architecture: Deals with highest level of abstraction of a system where non-functional decisions are cast, and functional requirements are partitioned.

Design: Emphasizes on individual modules / components / functions / class level details where functional requirements are accomplished.



Important : this is a general guideline – sometimes the borders are blurred

Architecture vs. Design

Connect Architecture

Continued…

Architecture	Design
Fundamental properties	Detailed properties
Define guidelines	Use guidelines
Cross-cutting concerns	Individual components
High-impact	Details
Communicate with business stakeholders	Communicate with developers
Manage uncertainty	Avoid uncertainty
Conceptual integrity	Completeness

Architecture vs. Design

Connect Architecture

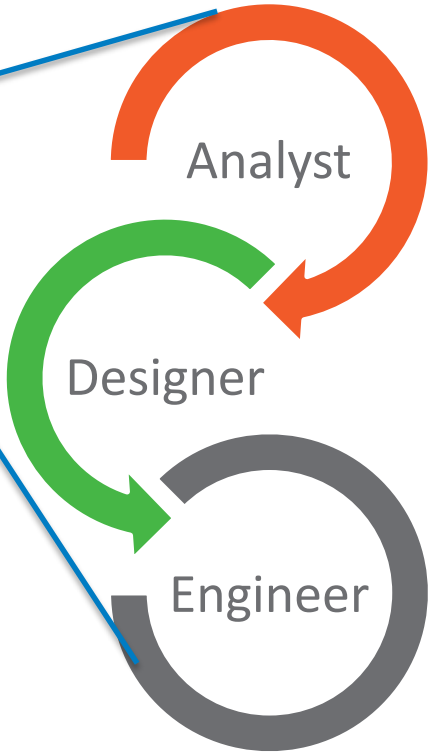
Data Modeling

Structured Analysis & Design

Object Oriented Analysis & Design

Designer

Architect



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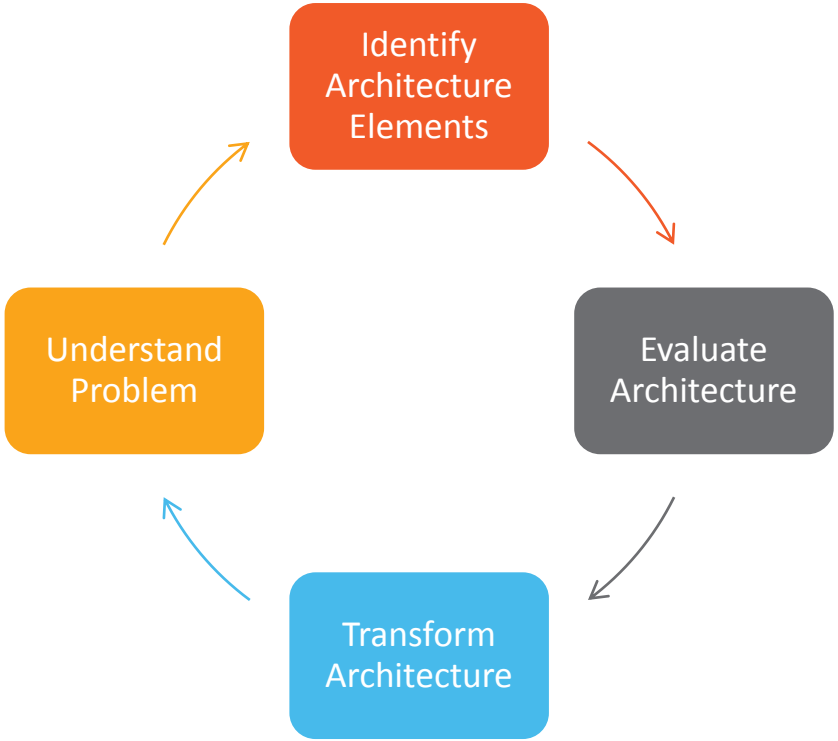
Architectural Cycle

Connect Architecture



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System Quality Attribute

Connect Architecture

- Performance
- Availability
- Usability
- Security

End User's view

- Maintainability
- Portability
- Reusability
- Testability

Developer's view

- Time To Market
- Cost and Benefits
- Projected life time
- Targeted Market
- Integration with Legacy System
- Roll back Schedule

Business Community view

A list of quality attributes exists in
ISO/IEC 9126-2001 Information Technology – Software Product Quality

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Transformation of Models

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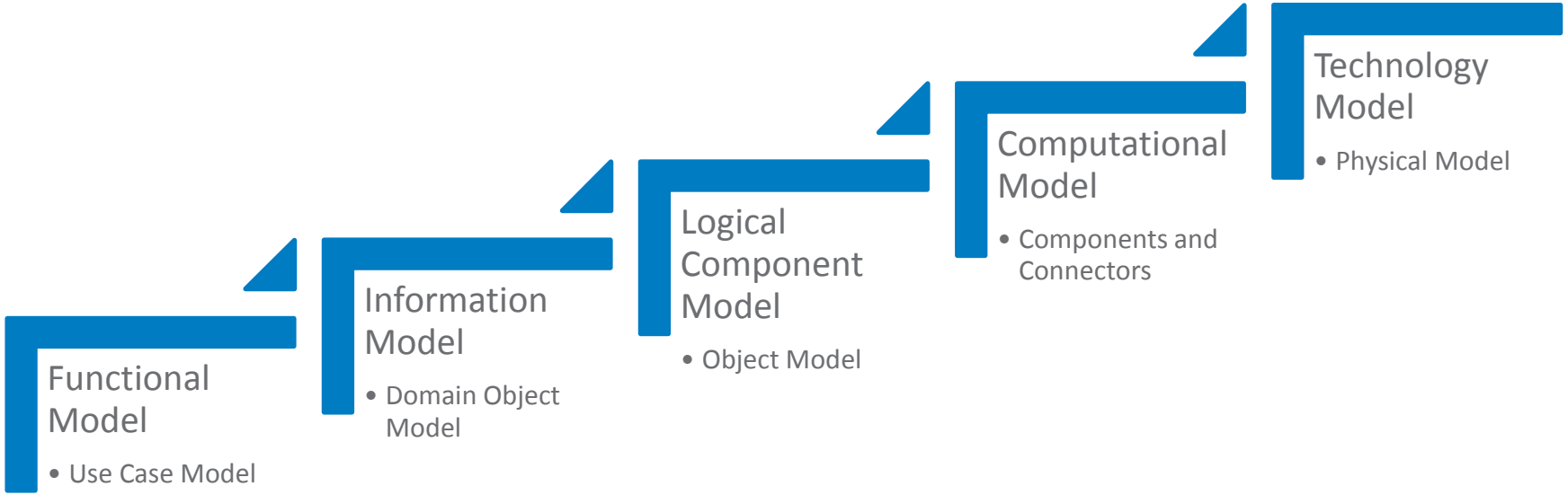

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Models

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- Abstractions focused on specific aspects ignoring the other aspects
- Three types of models
  - System Analysis Models
  - System Inference Models
  - System Design Models

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Why Models?

Connect Architecture

- Mode of communication across stakeholders
- Plan for implementation for software developers
- Evaluate design decisions
- Artifacts useful at time of future changes

Views

Connect Architecture

- Collection of models
- Common types of views
  - Objective Views
  - Behavioral Views
  - Data Views
  - Structure Views
  - Performance Views

Architectural Description

Connect Architecture

- Captures intermediate and final models from architecting
- Models are grouped into views
- Views are specified by Viewpoints

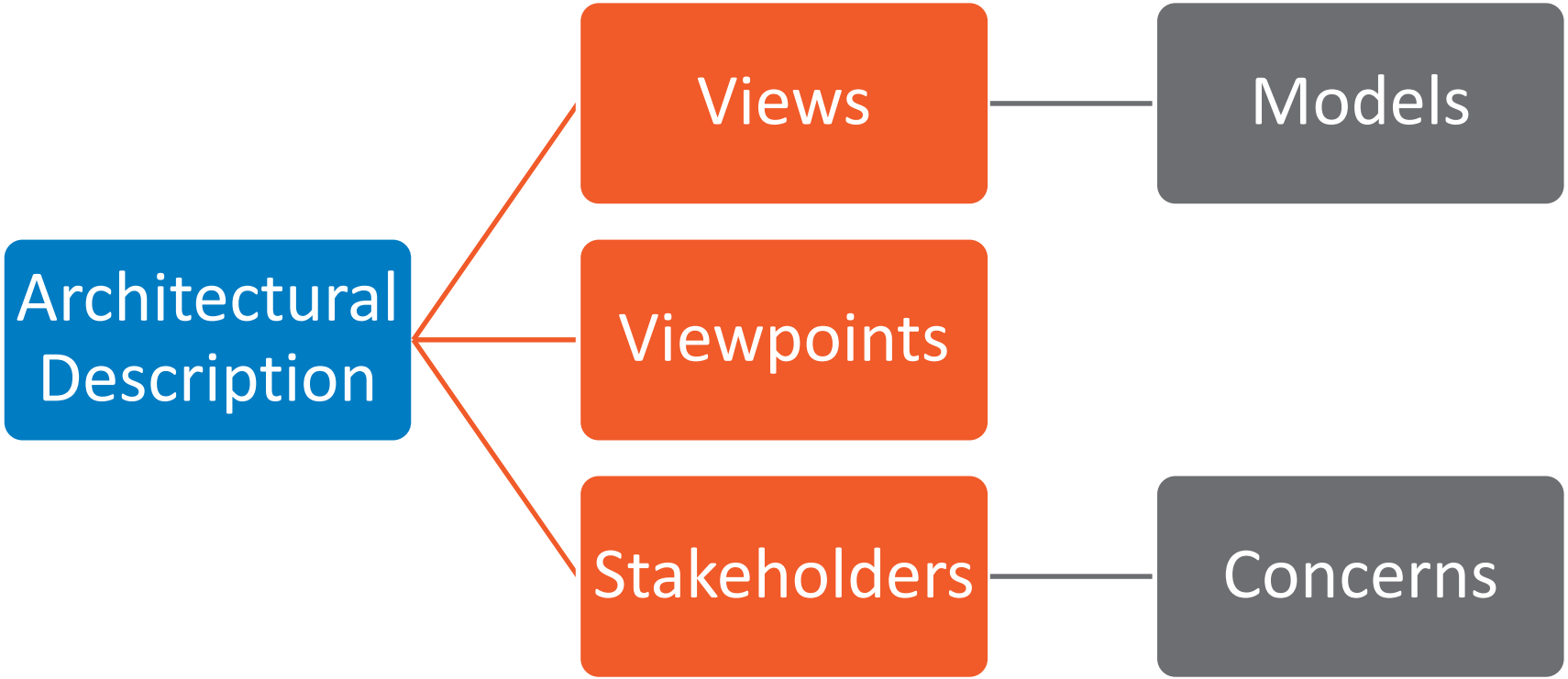
Architectural Standards

Connect Architecture

- A first important standard in the field of software architecture and system architecture is IEEE 1471, an IEEE Standard for describing the *architecture of a software-intensive system* approved in 2000.
- This standard has been adopted by the International Organization for Standardization (ISO) and published as ISO/IEC 42010:2007, still identical to the IEEE 1471:2000.
- In 2006 a technical committee of the ISO launched a revision of this standard, now published as ISO/IEC/IEEE 42010:2011.

IEEE 1471:2000

Connect Architecture



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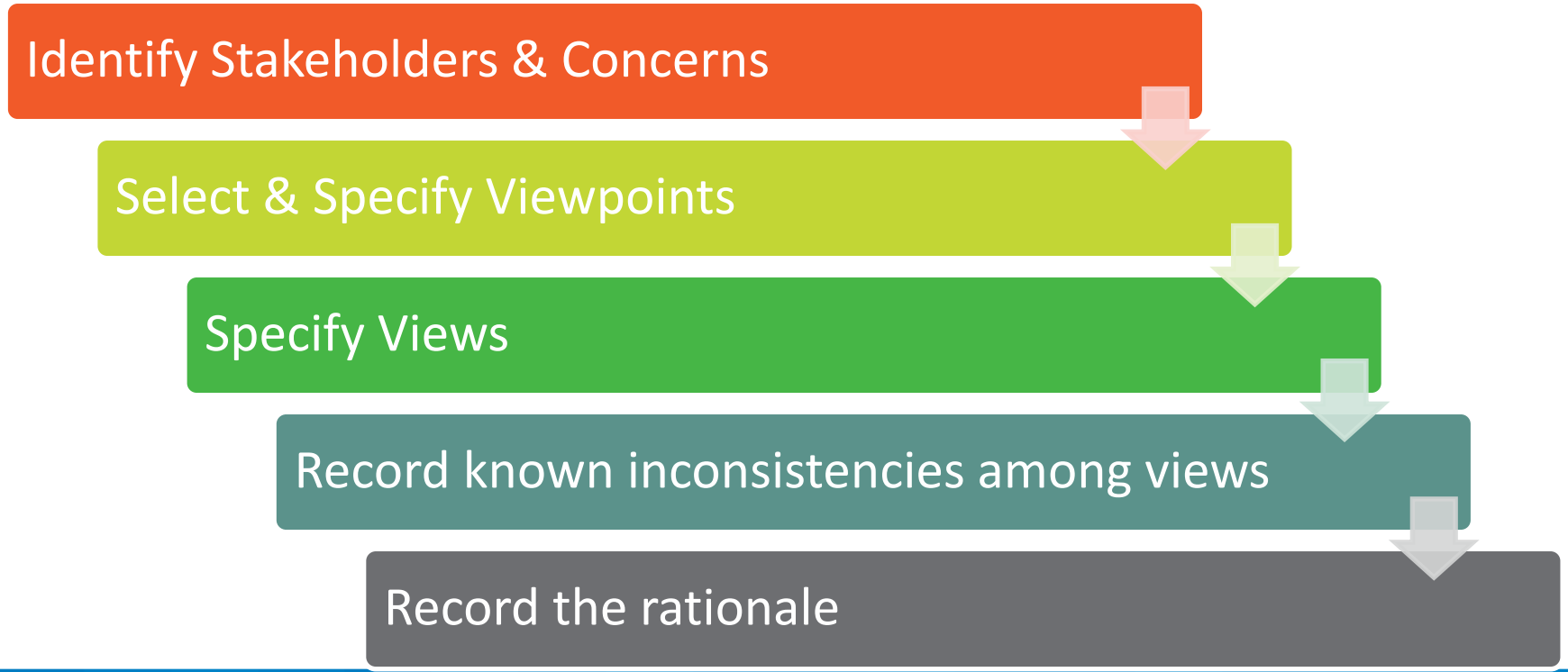
Creating Architectural Description

Connect Architecture



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Identify Stakeholders

Connect Architecture

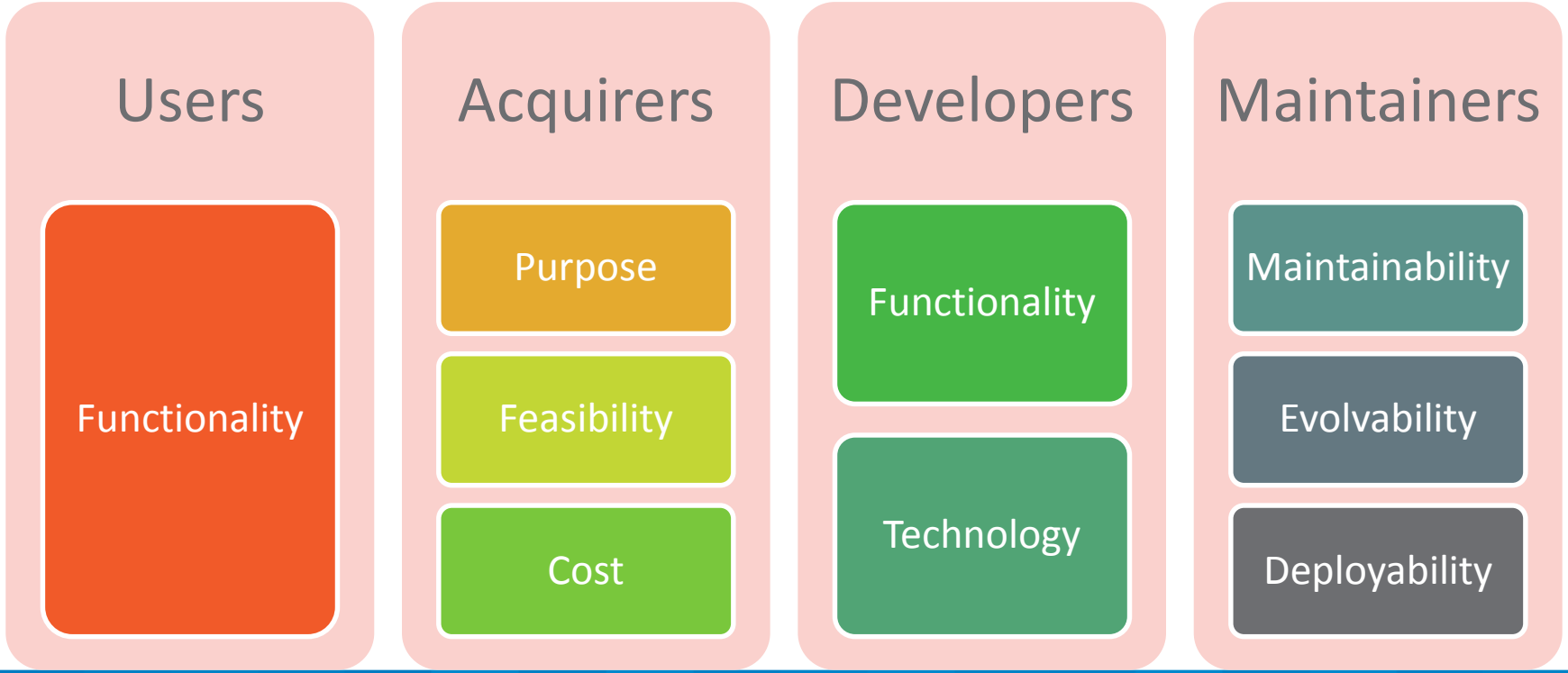
- Users
- Acquirers
- Developers
- Maintainers

Identify Concerns

- Purpose of the application
- Appropriateness of application in fulfilling the purpose
- Feasibility
- Risks in development & operations
- Maintainability, Evolvability, and Deployability of the application

Example Stakeholders & Concerns

Connect Architecture



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Select Viewpoint

Connect Architecture

- Select viewpoints based on stakeholders & concerns
- Selection can be based on methodology / framework followed

Specify Viewpoint

Connect Architecture

- Name of the viewpoint
- Stakeholders addressed by the viewpoint
- Concerns addressed by the viewpoint
- Methodology used for constructing views
- Source of the viewpoint

Specify Views

Connect Architecture

- One view for each viewpoint selected
- Each view contains a collection of models

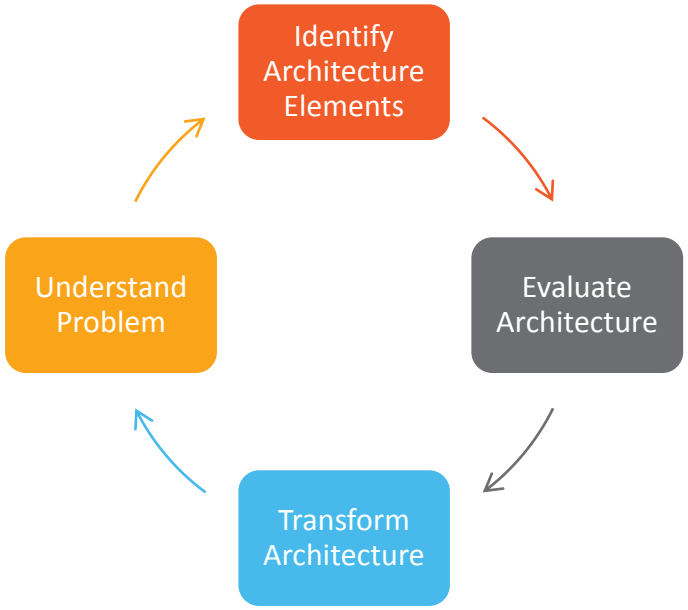
Record known inconsistencies

Connect Architecture

- Non – trivial mapping of elements across views
- Hidden elements

Record architectural rationale

Connect Architecture



- Capture why intermediate transformations in the architecture cycle were dropped

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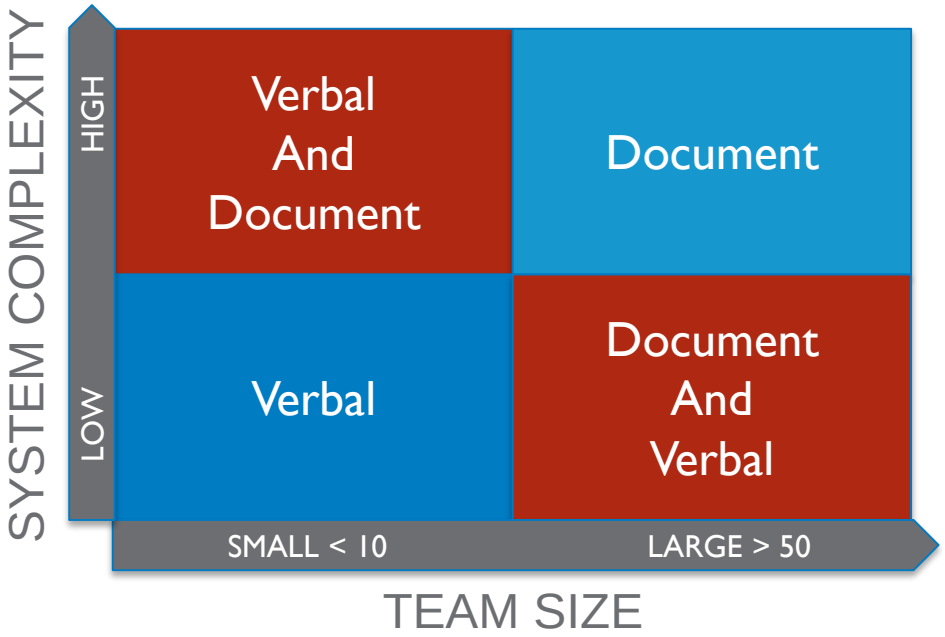
Record Architectural Decision
How to Share Architecture?

Connect Architecture



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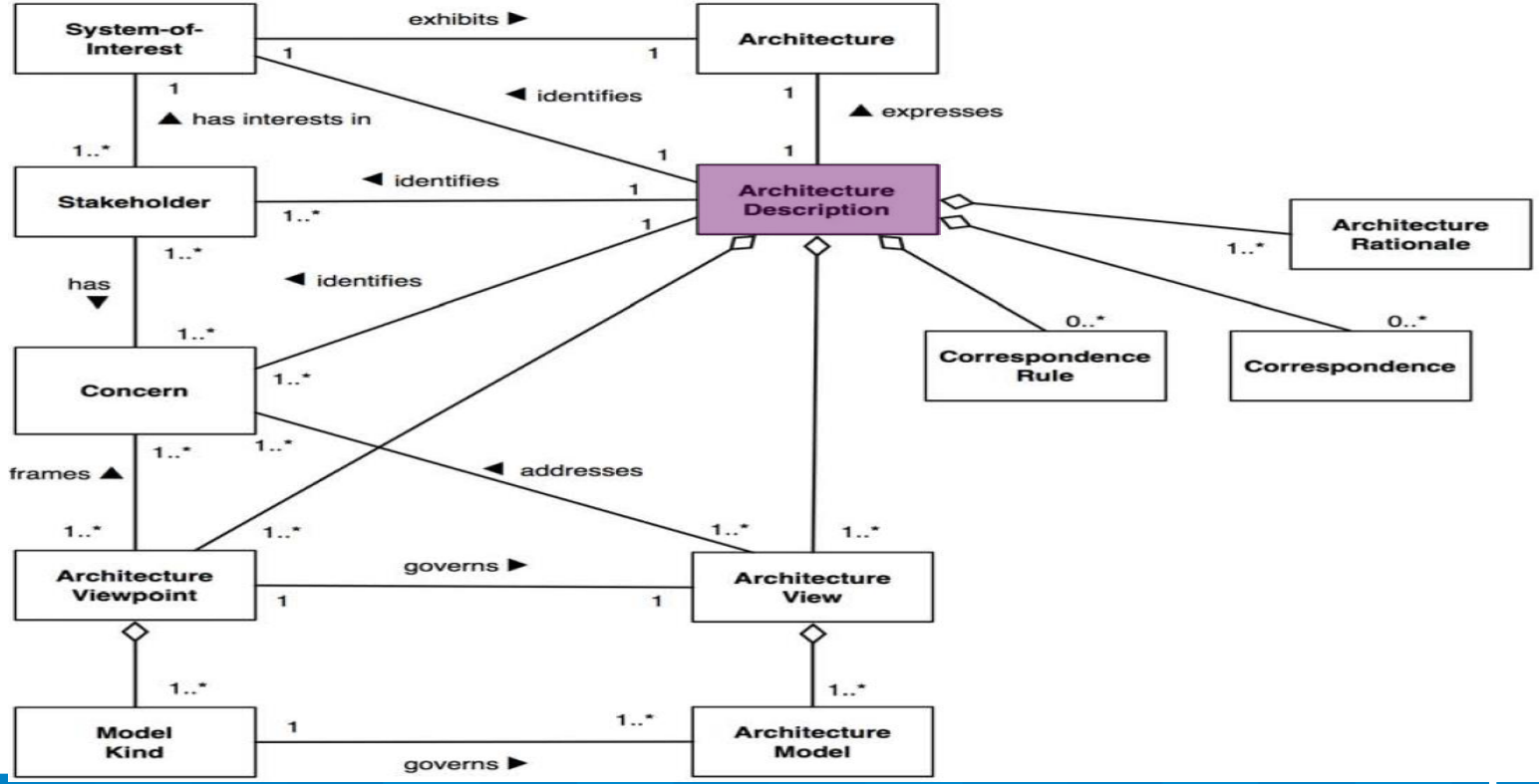
Connect Architecture

ISO/IEC/IEEE 42010 (2011)

Systems and software engineering — Architecture description



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Architecture Frameworks & Methodologies

Connect Architecture

- Architecture Frameworks
  - Templates for architecture descriptions
  - Specify the viewpoints & relationship among views
  - Ex – TOGAF, RM-ODP
- Architecture Methodology
  - Specifies techniques, diagram notations, and viewpoints
  - Ex – 4+1 methodology, OMT, RUP

4+1 Architecture Methodology

Connect Architecture

- Logical Viewpoint
- Process Viewpoint
- Development Viewpoint
- Physical Viewpoint
- + Scenario Viewpoint

Logical Viewpoint

Connect Architecture

Captures functional requirements

Class diagrams & Entity Relationship diagrams

- Acquirers – Purpose of system is fulfilled
- Developers – Understand the problem domain, and how it is mapped to solution components
- Maintainers – Understand the existing functions and their realizations

Connect Architecture

Process Viewpoint

Captures concurrency, synchronization, and distribution

Class diagrams, collaboration diagrams, activity diagrams, and state diagrams

- Acquirers – Quality requirements such as performance, availability, and fault tolerance are fulfilled
- Developers – Software implementation details
- System Integrators – How the application interoperates with existing and new systems

Connect Architecture

Development Viewpoint

Static structure model of the application

Components on hierarchical layers

- Acquirers – Quality requirements such as buildability, maintainability, and reusability are fulfilled
- Developers – Partitioning of functions into subsystems and implementation details
- Maintainers – Partitioning of system and maintainability

Connect Architecture

Physical Viewpoint

Maps the different software components into hardware components

Mapping on hardware nodes

- Acquirers – Quality requirements such as availability, reliability, performance, and scalability are fulfilled
- System Engineers – How to deploy the system

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Scenario Viewpoint

Tie the 4 views' model components

Object scenario diagrams

- All stake holders and multiple concerns

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Views, views and more views

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- RUP – 4 + 1
- RM-ODP – 5
- DODAF – 3 (top level)
- Zachman – 36(!)

- MS – Well…

RUP

- Design Viewpoint (Logical)
- Process Viewpoint
- Implementation Viewpoint (Development)
- Deployment Viewpoint (Physical)
- Use case viewpoint (Scenario)

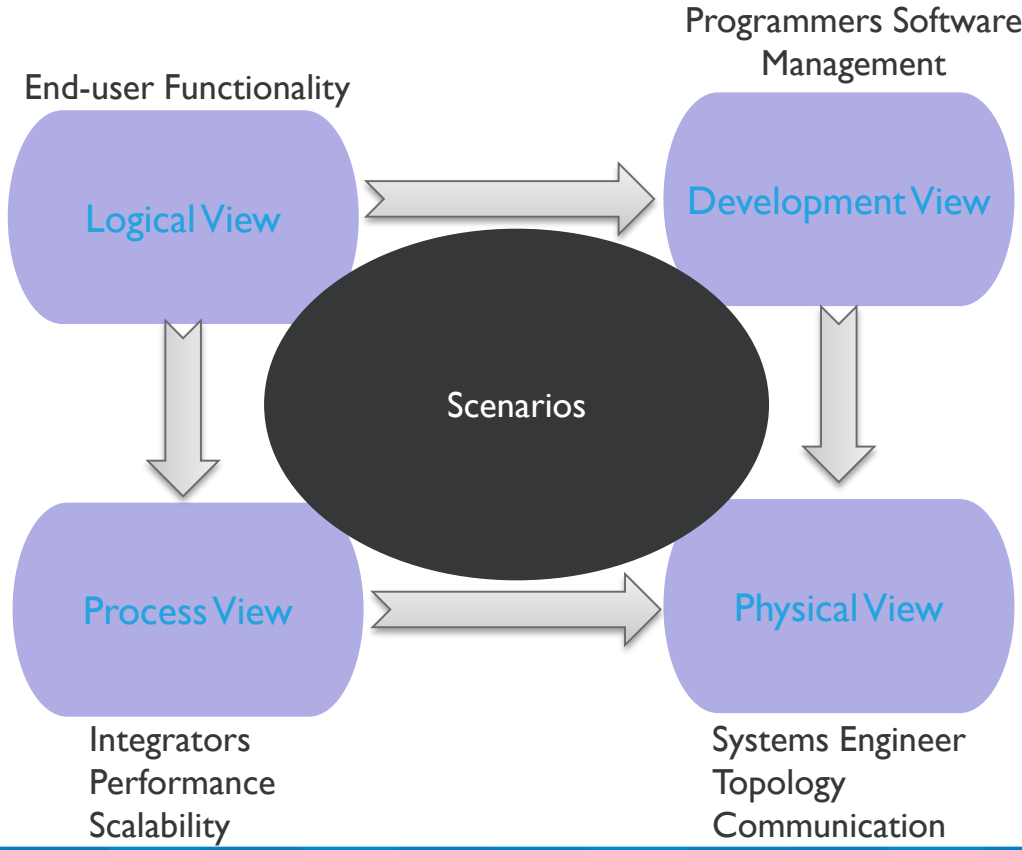
RUP Models

Connect Architecture

- Design & Process – Class, Object, interaction, state-chart, activity diagrams
- Implementation – Component, interaction, state-chart, activity diagrams
- Deployment – Interaction, state-chart, activity diagrams
- Use Case – Use case model

RUP – 4+1 Viewpoint - 4+1 Architectural Methodology

Connect Architecture



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RM-ODP Viewpoints (2001)

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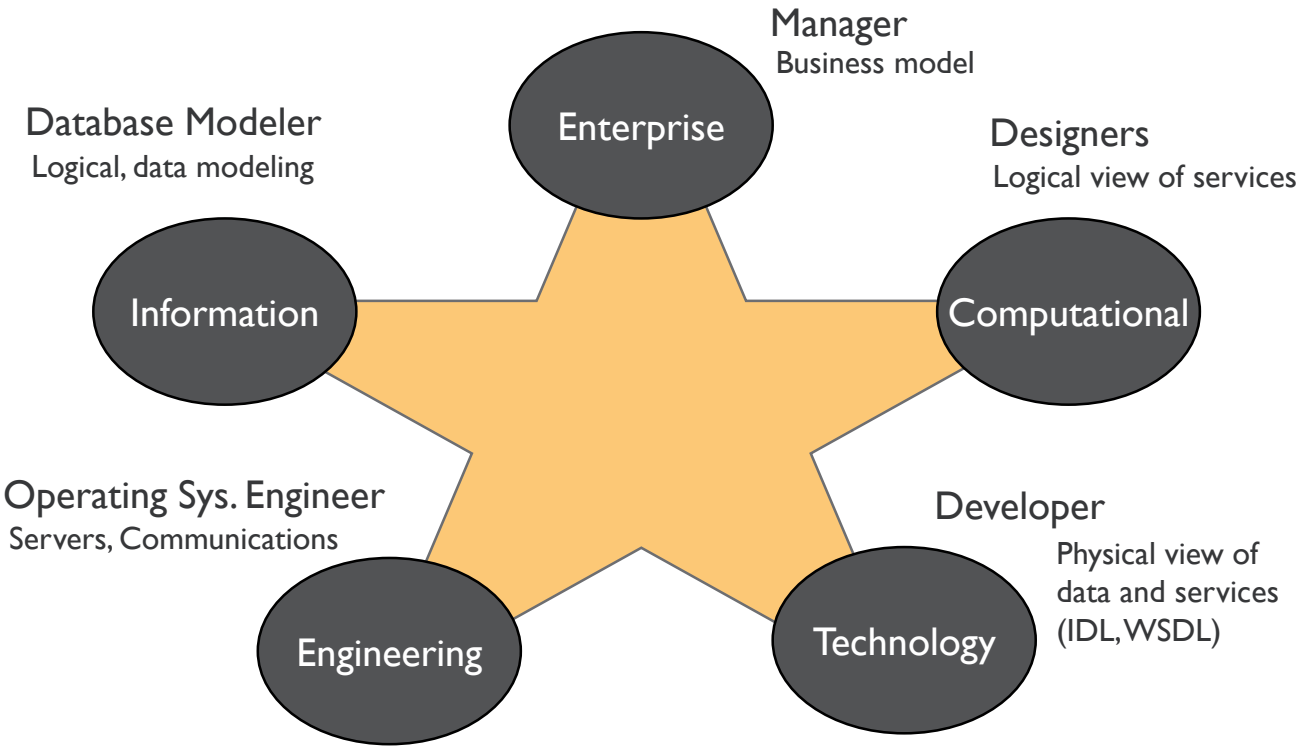

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RM-ODP Viewpoints

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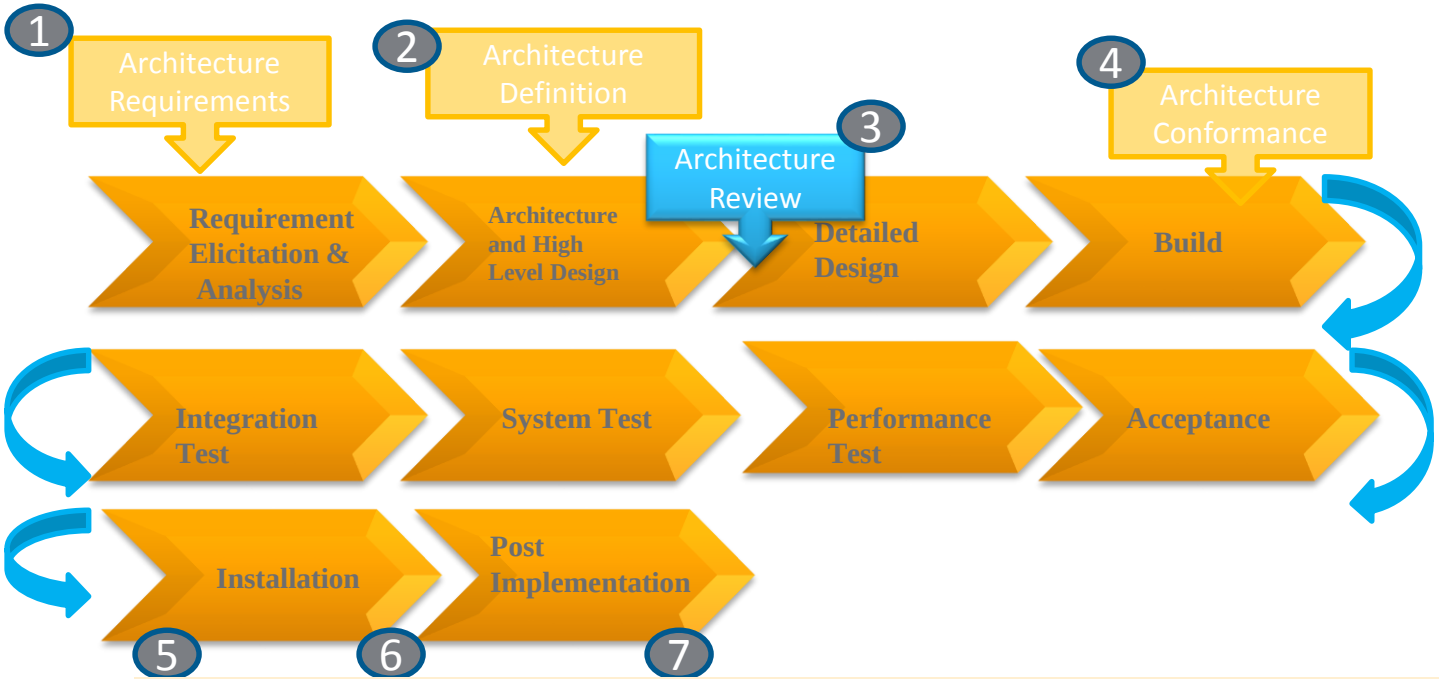
- Enterprise
- Information
- Computational
- Engineering
- Technology

PRIDE

Connect Architecture



Compliance, Architecture Audit & Evaluation based on the selection criteria

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PRIDE Changes

Connect Architecture

- Architecture requirement process strengthened
- Architecture definition, Key Decision and Fit Gap Analysis Templates
- SQA compliance updated, Architecture review and Audit process
- Architecture Evaluation Model
- Standardization across organization with guidelines, templates & repository

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PRIDE – Req. Elicitation & Analysis

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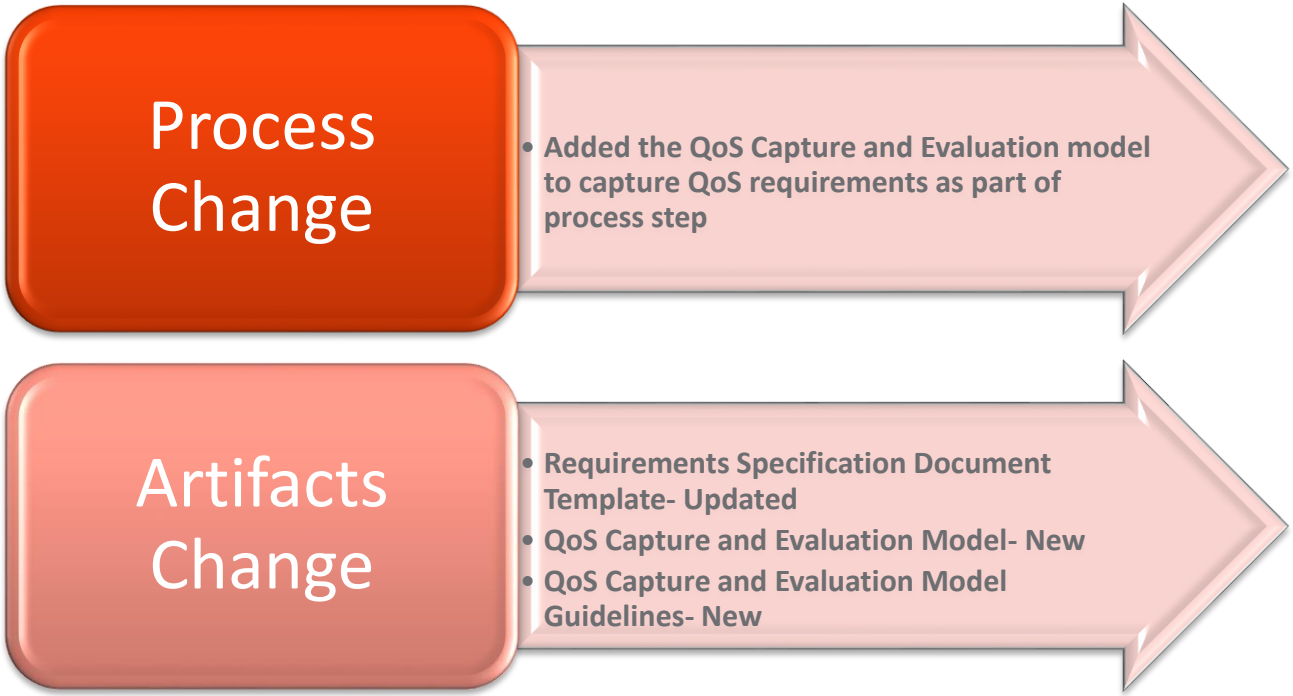

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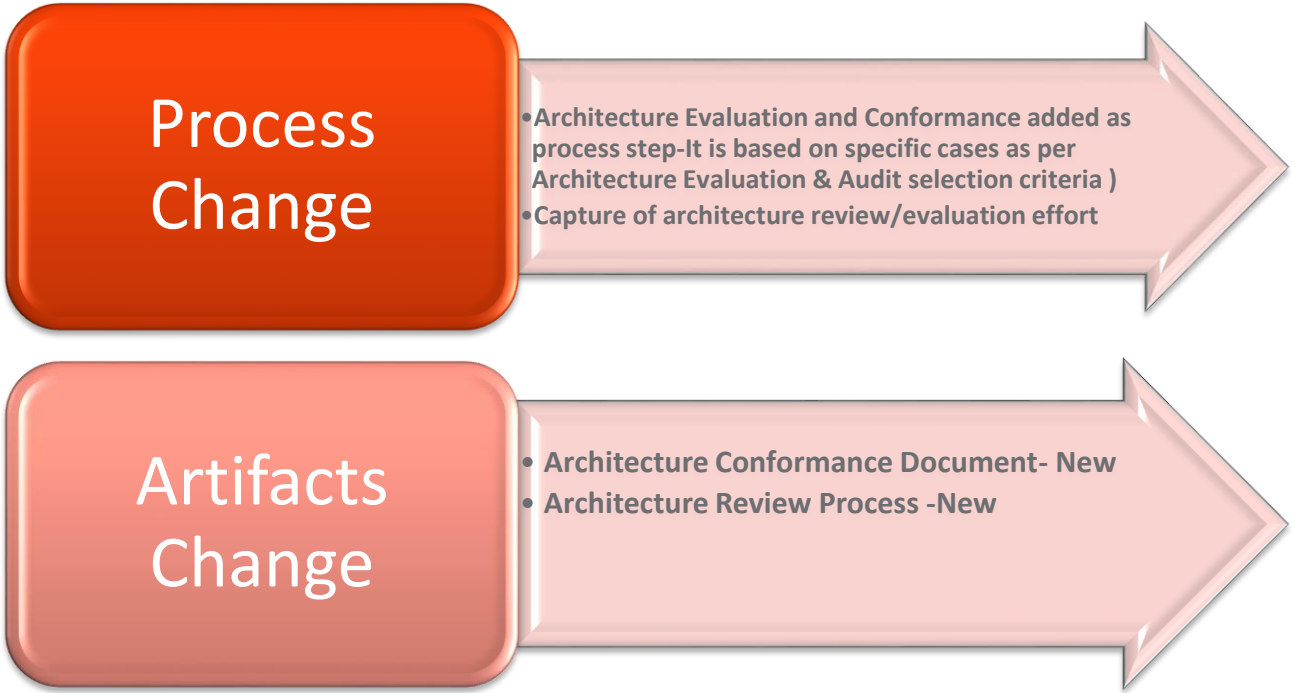
PRIDE – Detailed Design

Connect Architecture



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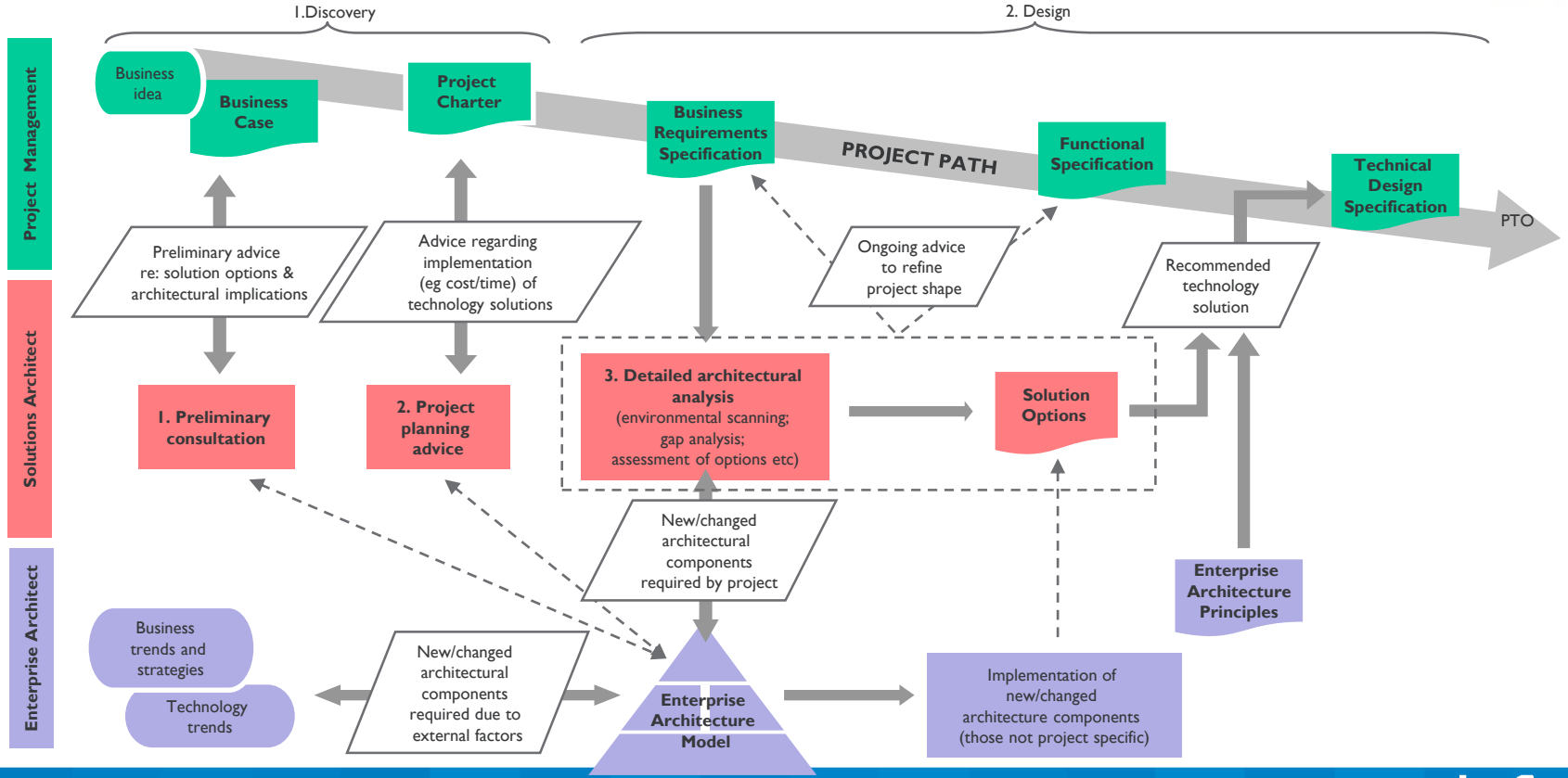
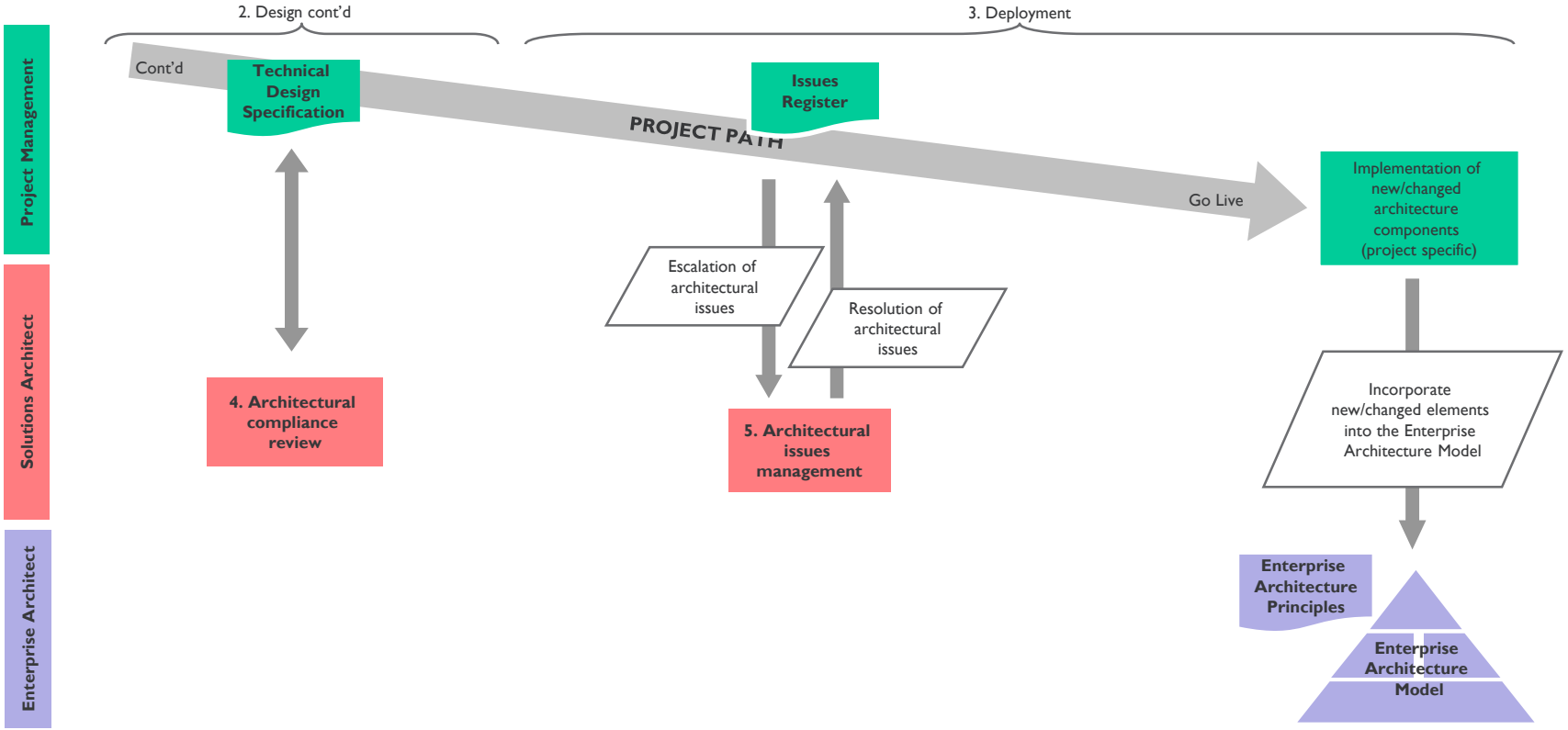
Architecture Services for Projects



Architecture Services for Projects



Role of an Architect?

1. Role of an Architect?
2. Solution Architect?
3. Enterprise Architect?
4. Technology Architect?
5. Database Architect?
6. Domain Architect?

Architect Persona's

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Power of Knowledge

Connect Architecture

1. Knowledge of various tools, technologies, frameworks, Ready made solutions available in the market
2. Capabilities available in-house, with in the unit, Organization.
3. Solutions, Products, frameworks, Ready to use components available within Infosys
4. Comparative analysis of various available options.
5. Ability to identify and recommend a Technology stack for a given business problem.
6. Networking with in the Architecture Community
7. Knowledge on Latest happening and Developments in the industry.

Thank You

This is a connect Architecture initiative

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