31st Annual INCOSE international symposium

virtual event

July 17 - 22, 2021

Poster Session – Presented by James N Martin, Aerospace Corporation

Overview of the Revised Standard on Architecture Description – ISO/IEC 42010

www.incose.org/symp2021

Agenda

- Context of Architecture Description
- 42010 terms, concepts and definitions
- 42010 conformance and requirements

Status

ISO/IEC/IEEE DIS 42010 ed.2 - id.74393 ISO/IEC JTC 1/SC 7/WG 42

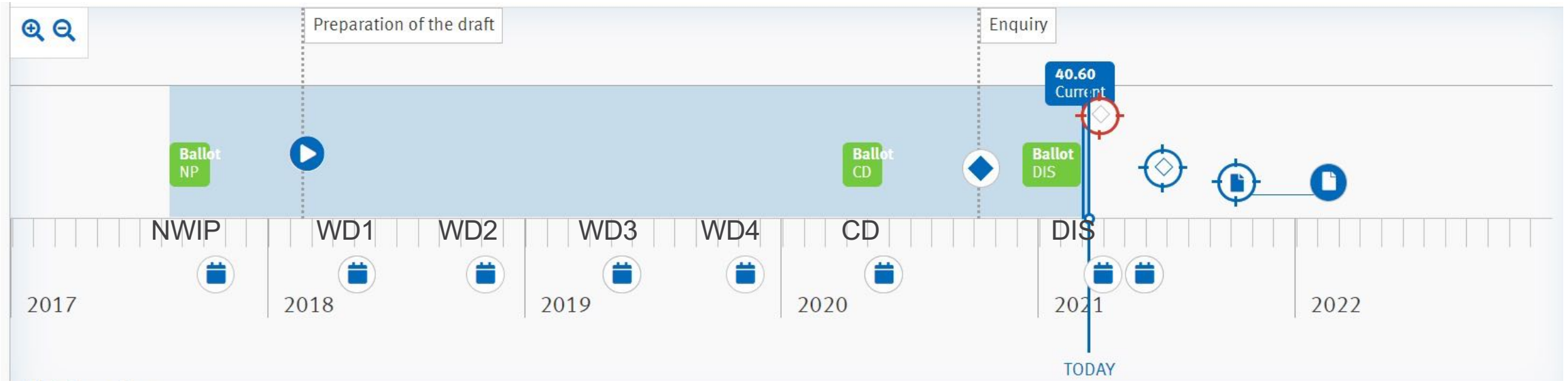
IEC IEEE

en Software, systems and enterprise — Architecture description

fr *Logiciels, systèmes et entreprise — Description d'architecture*

✓ *Started 2017*

✓ *Near final draft 2021*



Stage	Version	Description	Target date	Limit date	Started	Status
60.60		International Standard published	2021-10-13	2022-02-21		Awaiting

Results of the DIS Ballot

Result of ISO/IEC/IEEE 42010.DIS ballot
P-Members voting: 19 in favour out of 21 = 90 % (requirement >= 66.66%) (P-Members having abstained are not counted in this vote.) Member bodies voting: 2 negative votes out of 21 = 10 % (requirement <= 25%) **Result: DIS Ballot was Approved**

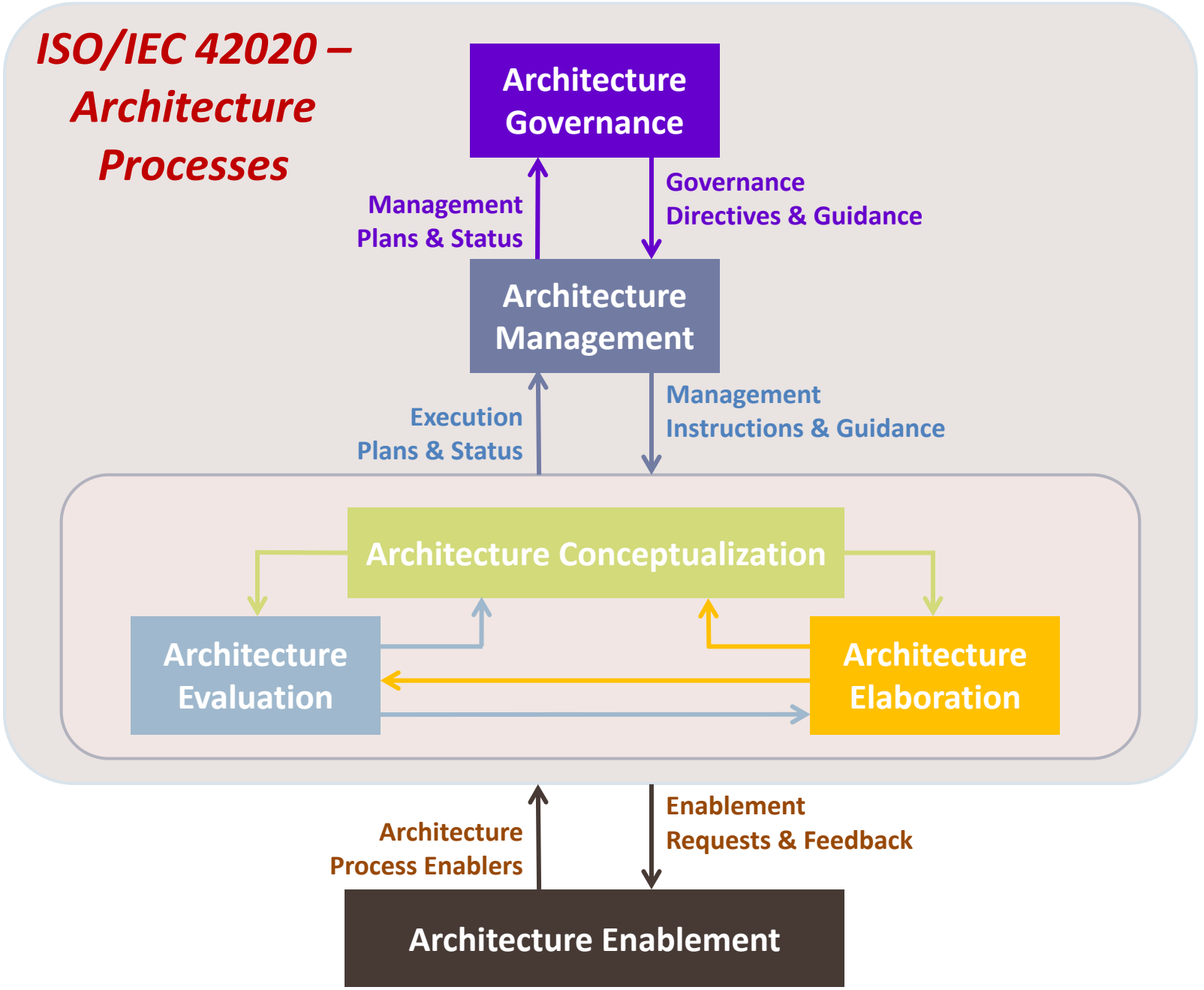
Expected Publication by Late 2021

Results of the DIS Ballot

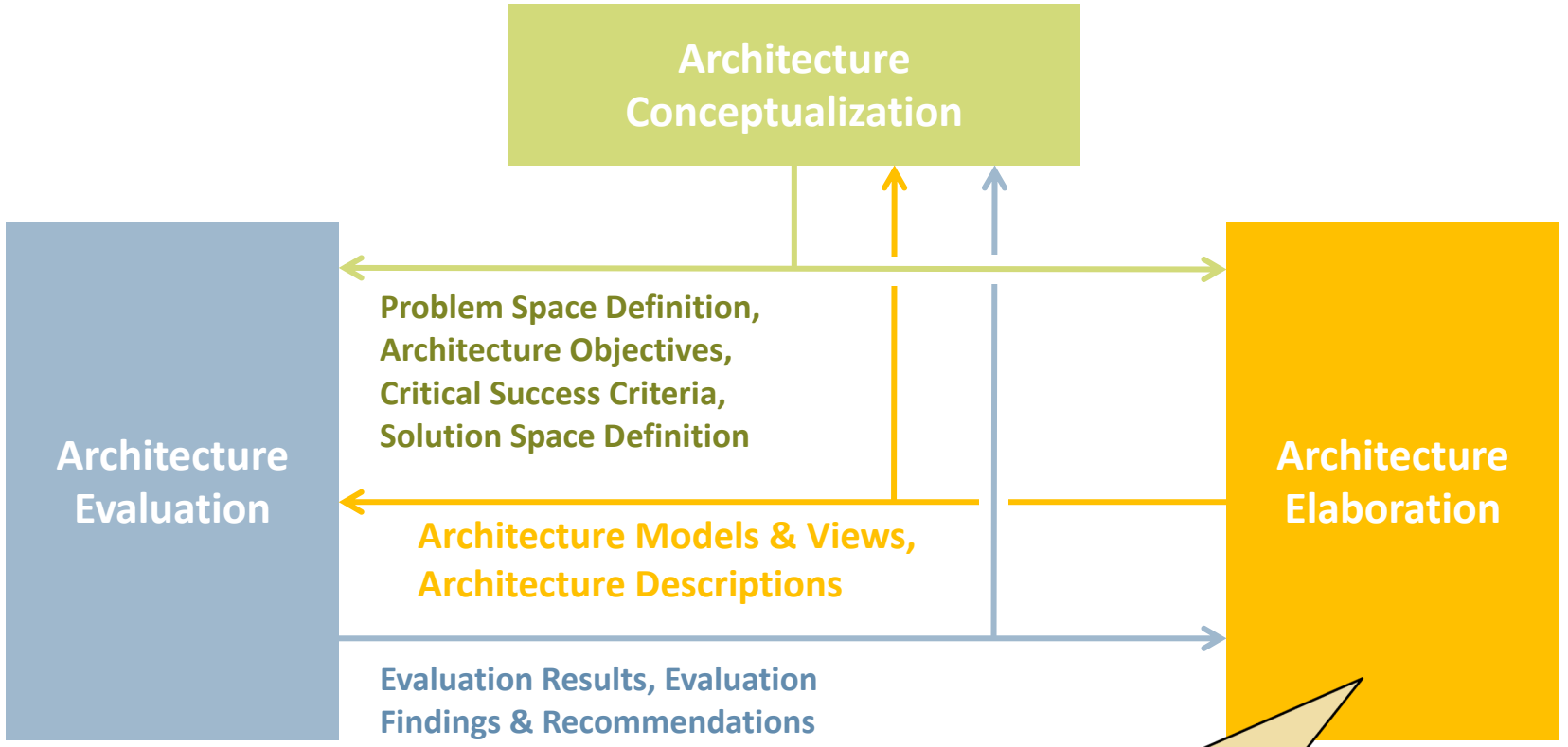
Reviewers	Comments
Australia	10
ISO CS	44
France	36
IEEE	166
INCOSE	601
India	62
IPR (IEEE)	88
Japan	6
OMG	**34**
USA	53
WG1	143
Total	1243

Type of cmts	**Comments**
General Ed.	20
Editorial	681
General Tech	1
Technical	539
N/A	2
Total	1243

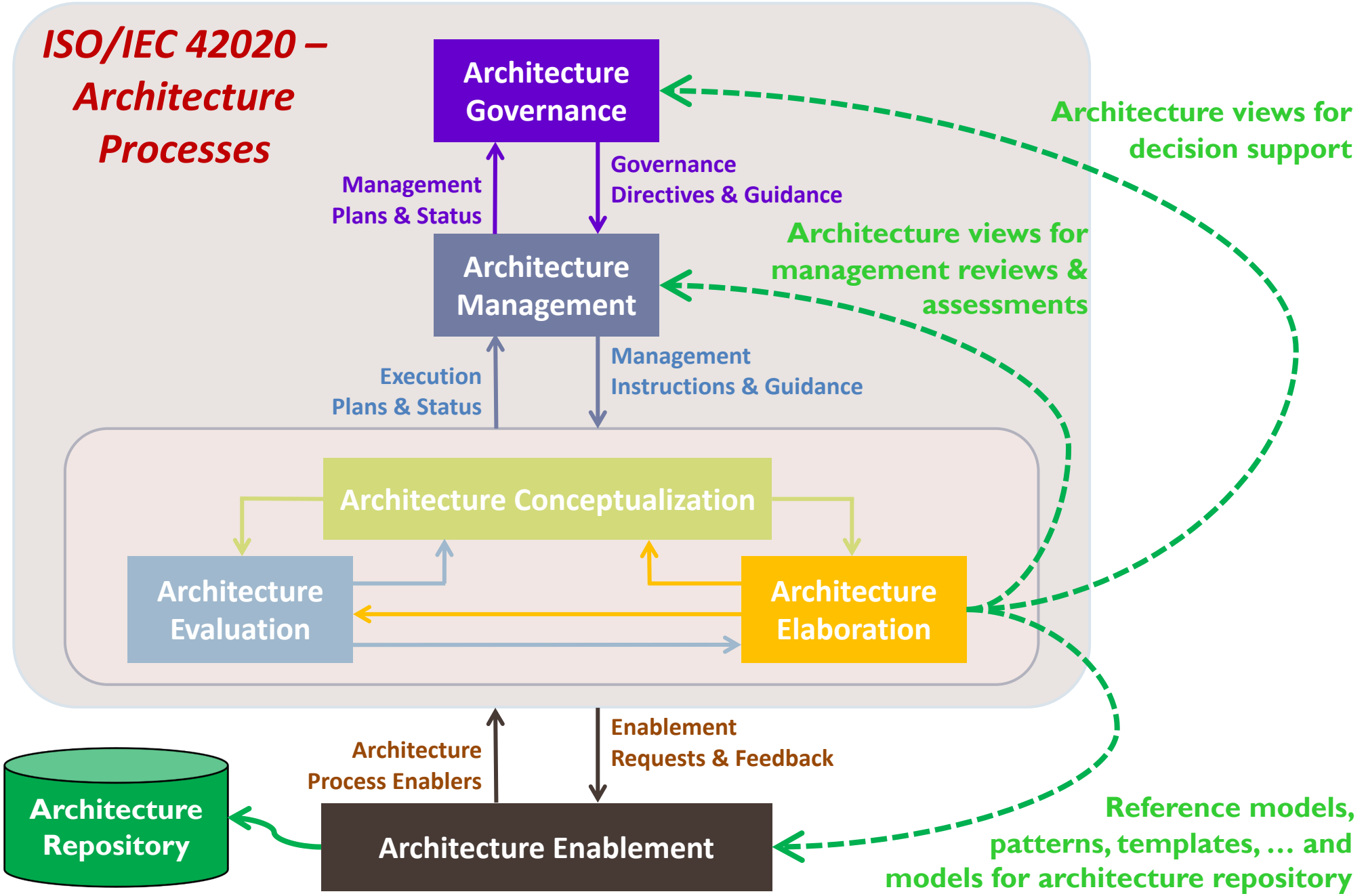
Sections	Start	Comments
General	0	23
Header	1	6
Foreword	63	20
Introduction	129	45
1 Scope	164	39
2 Normative references	191	0
3 Terms and definitions	193	152
4 Conformance	345	10
5 Conceptual foundations	364	391
6 Specification of an architecture description	805	214
7 Specification of an architecture description framework and architecture description languages	1079	43
8 Architecture viewpoints and model kinds	1140	35
Annex A - Notes on terms and concepts	1195	139
Annex B - Guide to specification of architecture viewpoints	1614	24
Annex C - Relationship to other standards	1728	20
Annex D - Uses of architecture descriptions	1845	5
Annex E - Architecture & arch. description life cycles	1888	8
Annex F - Architecture description frameworks	1952	37
Bibliography	2049	32


ISO/IEC 42020 – Architecture Processes
Architecture Governance
Management Plans & Status
Governance Directives & Guidance
Architecture Management
Execution Plans & Status
Management Instructions & Guidance
Architecture Conceptualization
Architecture Evaluation
Architecture Elaboration
Architecture Process Enablers
Enablement Requests & Feedback
Architecture Enablement

Interactions Between the Core Architecture Processes



Where ISO 42010 Mainly Applies


ISO/IEC 42020 – Architecture Processes
Architecture Governance
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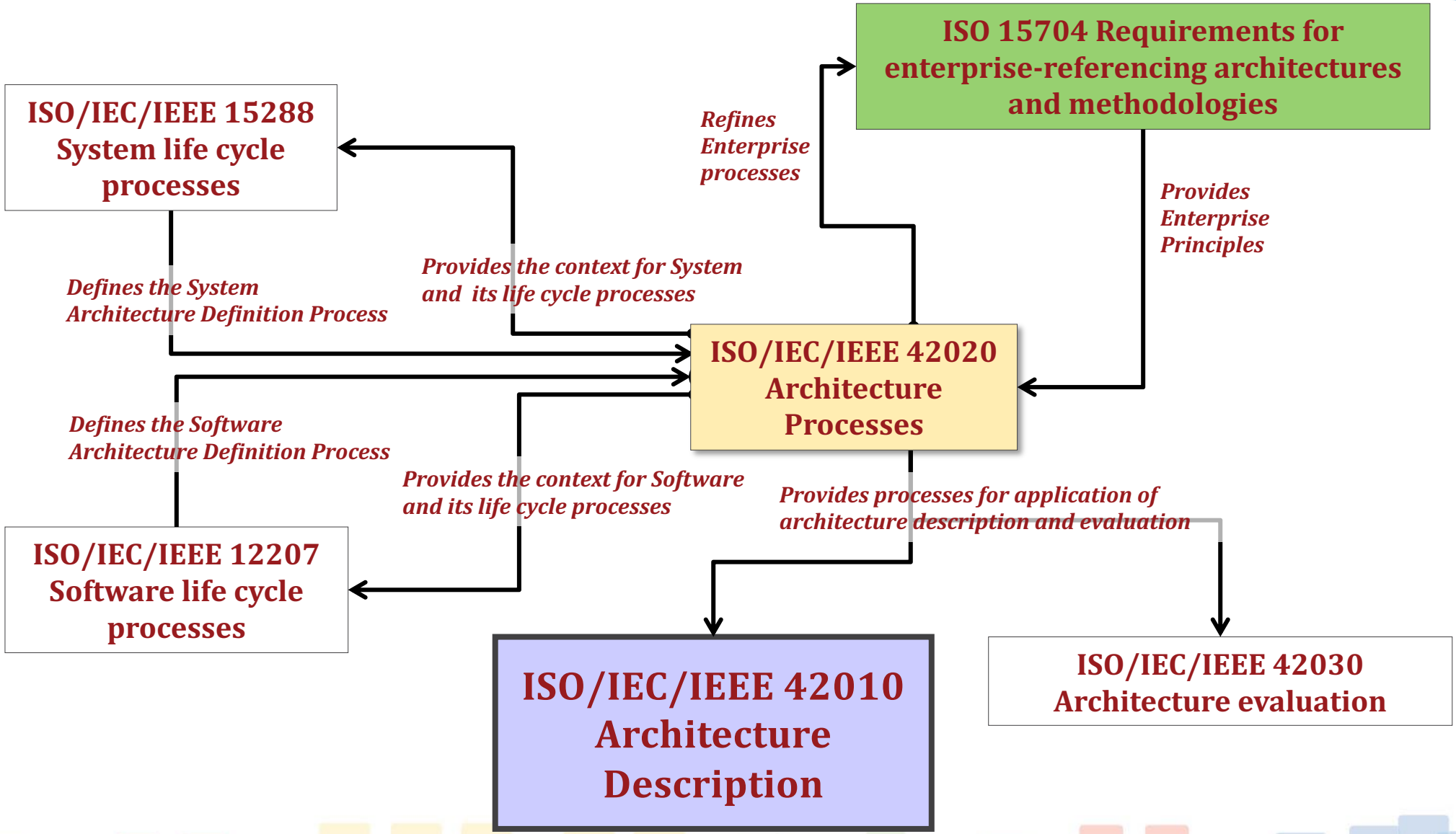
Architecture Evaluation
Architecture Elaboration
Architecture views for decision support
Architecture views for management reviews & assessments
Architecture Repository
Architecture Process Enablers
Enablement Requests & Feedback
Architecture Enablement
Reference models, patterns, templates, … and models for architecture repository

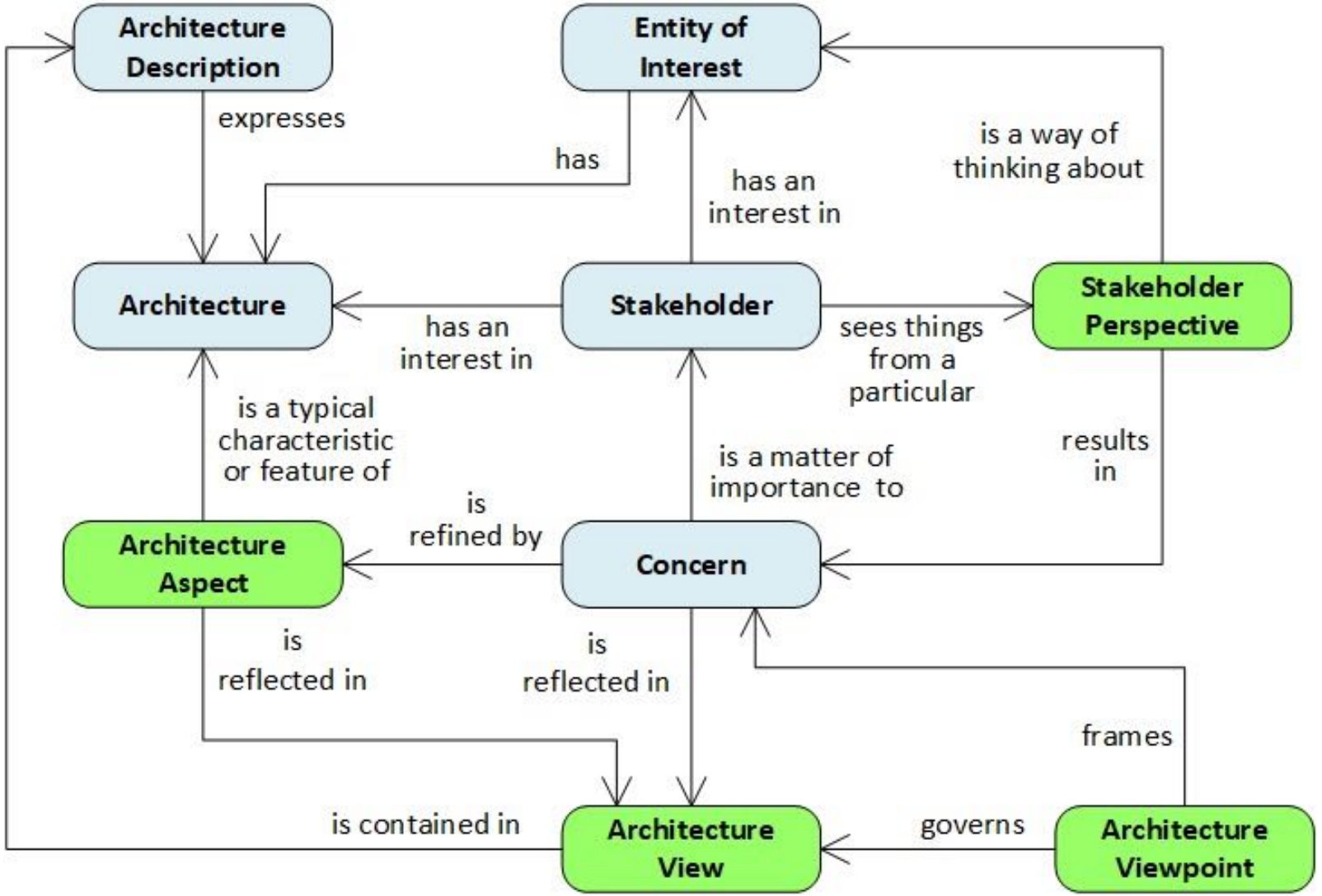
ISO 42010 context



Agenda

- Context of Architecture Description
- 42010 terms, concepts and definitions
- 42010 conformance and requirements

ISO 42010 – Architecture Description



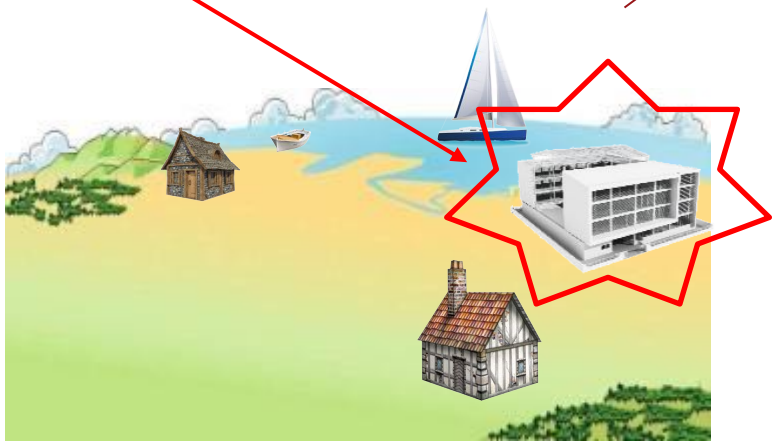
Setting the scene

The architecting work starts with the current or future reality.

Considering an entity of interest
…and a set of stakeholders.

Stakeholders

Entity of Interest



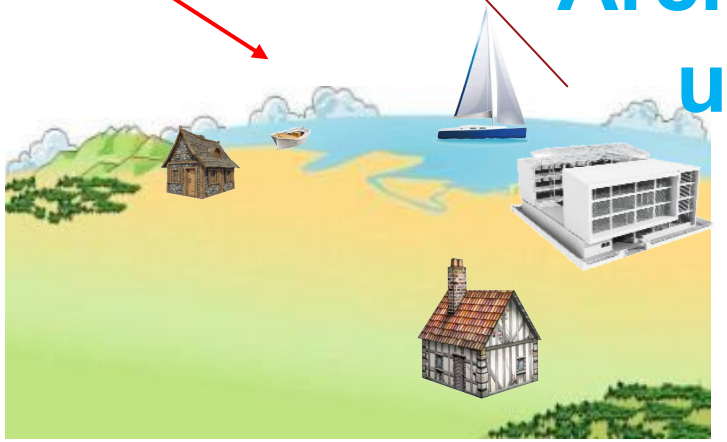
Key concepts and definitions (1/2)

42010 [2nd edition] Architecture
fundamental concepts or properties related to an entity in its environment and governing principles for the realization and evolution of this entity and its related life cycle processes

42010 [2nd edition] Architecting
conceiving, defining, expressing, documenting, communicating, certifying proper implementation of, maintaining and improving an architecture throughout the life cycle of an entity of interest

Stakeholders

Entity of Interest…has an Architecture



Key concepts and definitions (2/2)

42010 [2nd edition] Stakeholder
role, position, individual, organization or classes thereof, having an interest, right, share, or claim, in an entity or its architecture

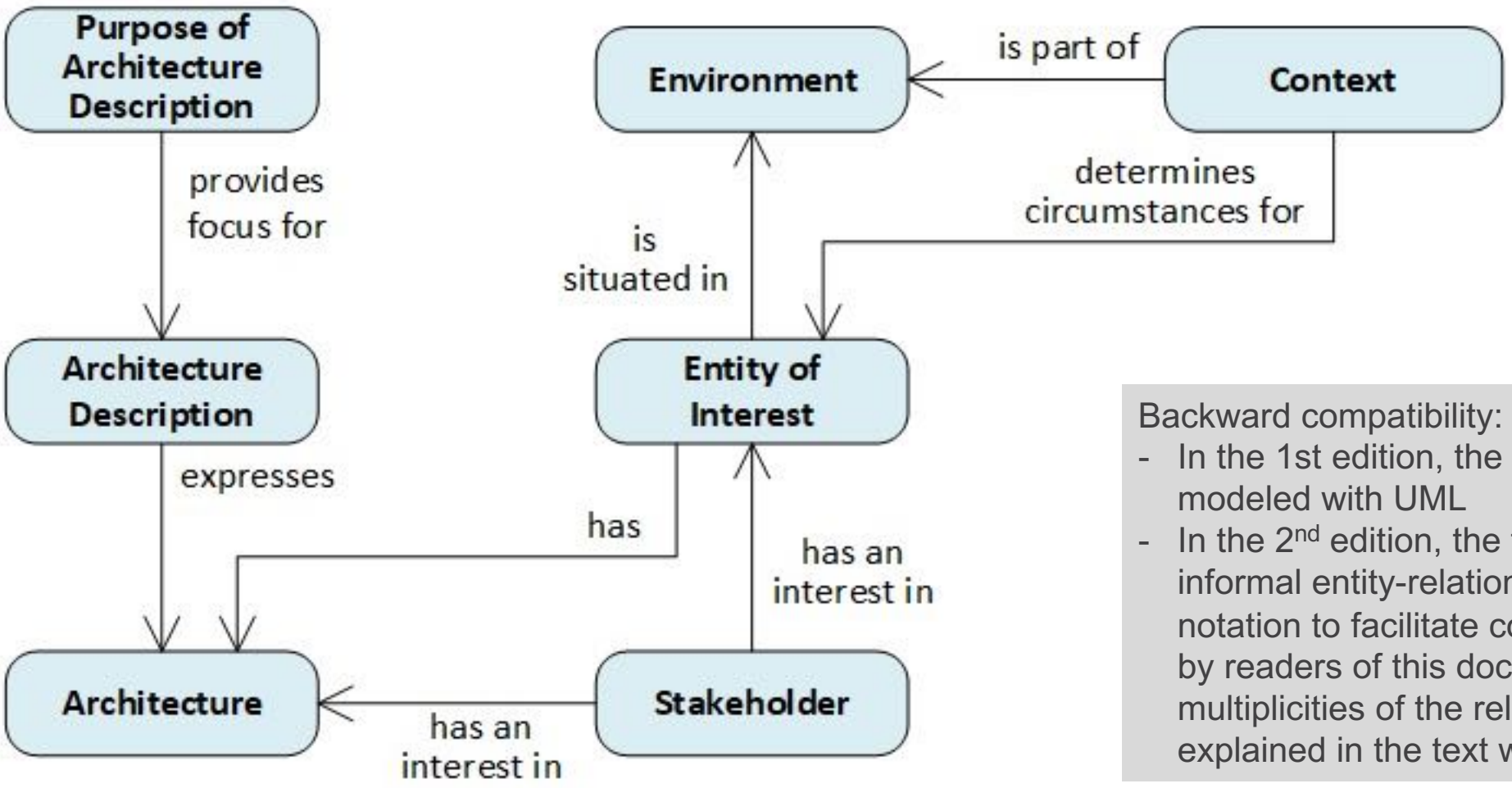
42010 [2nd edition] Concern
matter of relevance or importance regarding an entity of interest to a stakeholder

Examples: How is the system maintained? What system behaviors are safety-critical? Can the entity of interest achieve compliance with national regulations?

42010 [2nd edition] Architecture Description
work product used to express an architecture

Stakeholders … have interest in Entity of Interest

Concepts and relationships



Backward compatibility:
- In the 1st edition, the figures are modeled with UML
- In the 2nd edition, the figures use an informal entity-relationship diagram notation to facilitate comprehension by readers of this document. The multiplicities of the relationships are explained in the text when necessary.

Regarding this diagram:
In the 1st edition, zero or more “systems” “exhibit” zero or more “architecture”

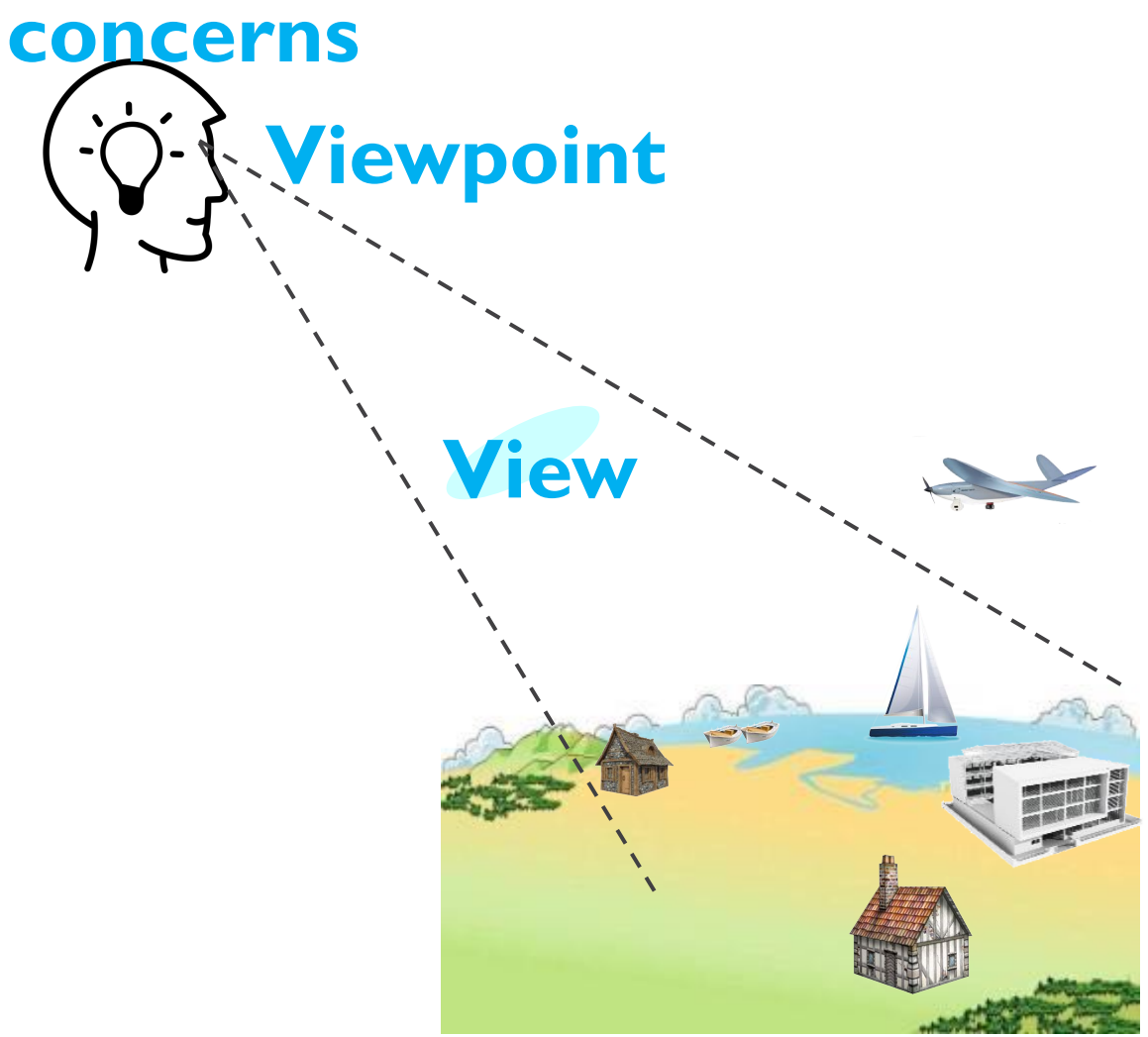
Key architectural description concepts

42010 [2nd edition] Viewpoint
conventions for the creation, interpretation and use of an architecture view to frame one or more concerns

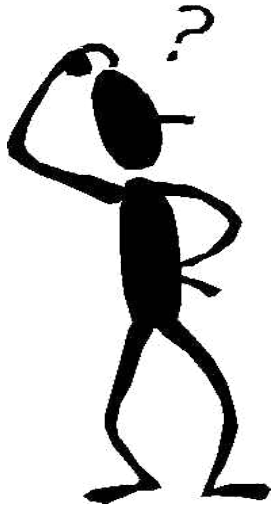
Examples: buyer viewpoint, builder viewpoint, user viewpoint

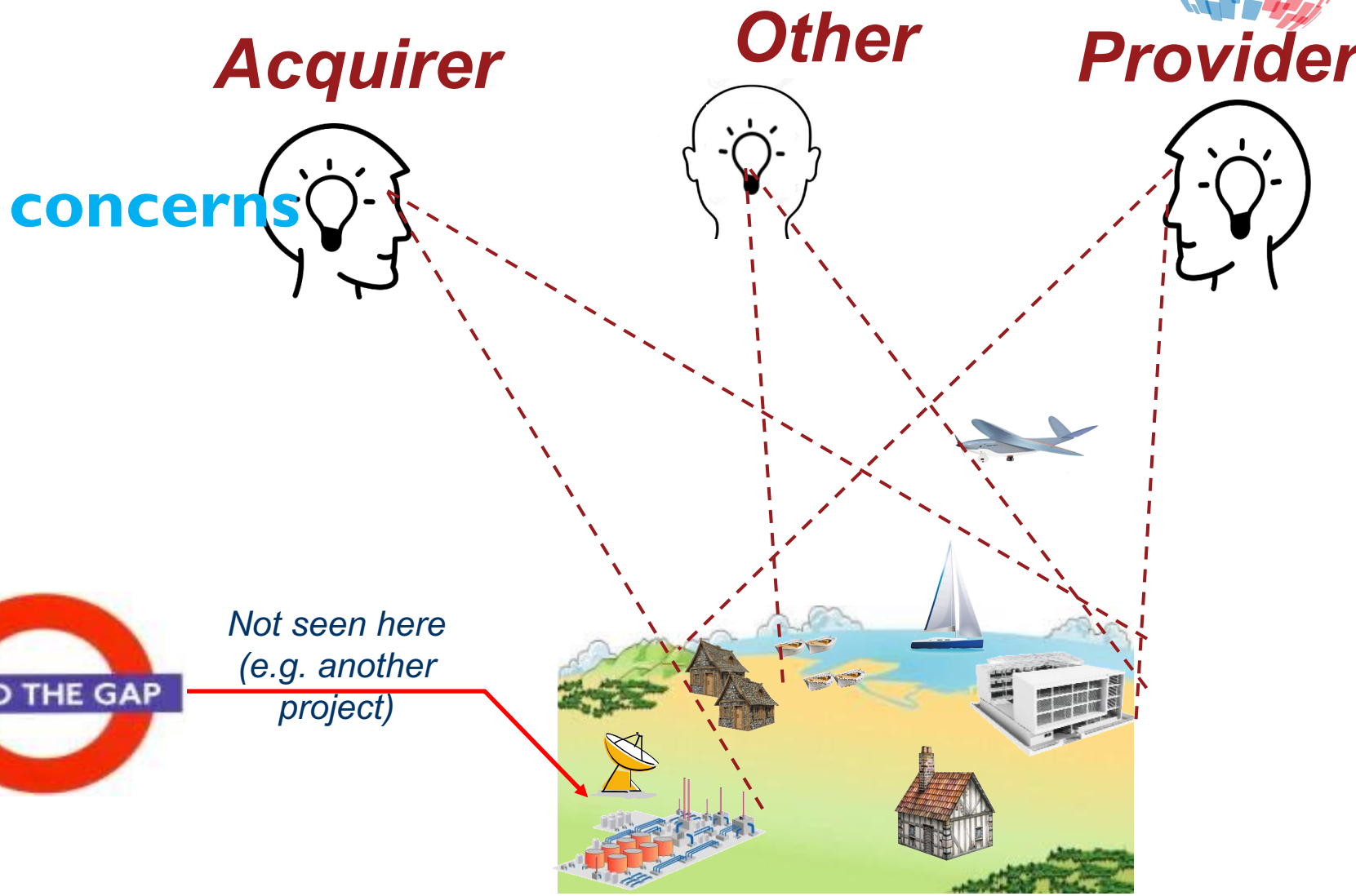
42010 [2nd edition] View
information item comprising part of an architecture description that expresses the architecture of an entity of interest and that is governed by an architecture viewpoint

Note: *Viewpoint Specification is the set of requirements for the conventions of a viewpoint*



Key architectural description concepts





Key architectural description concepts

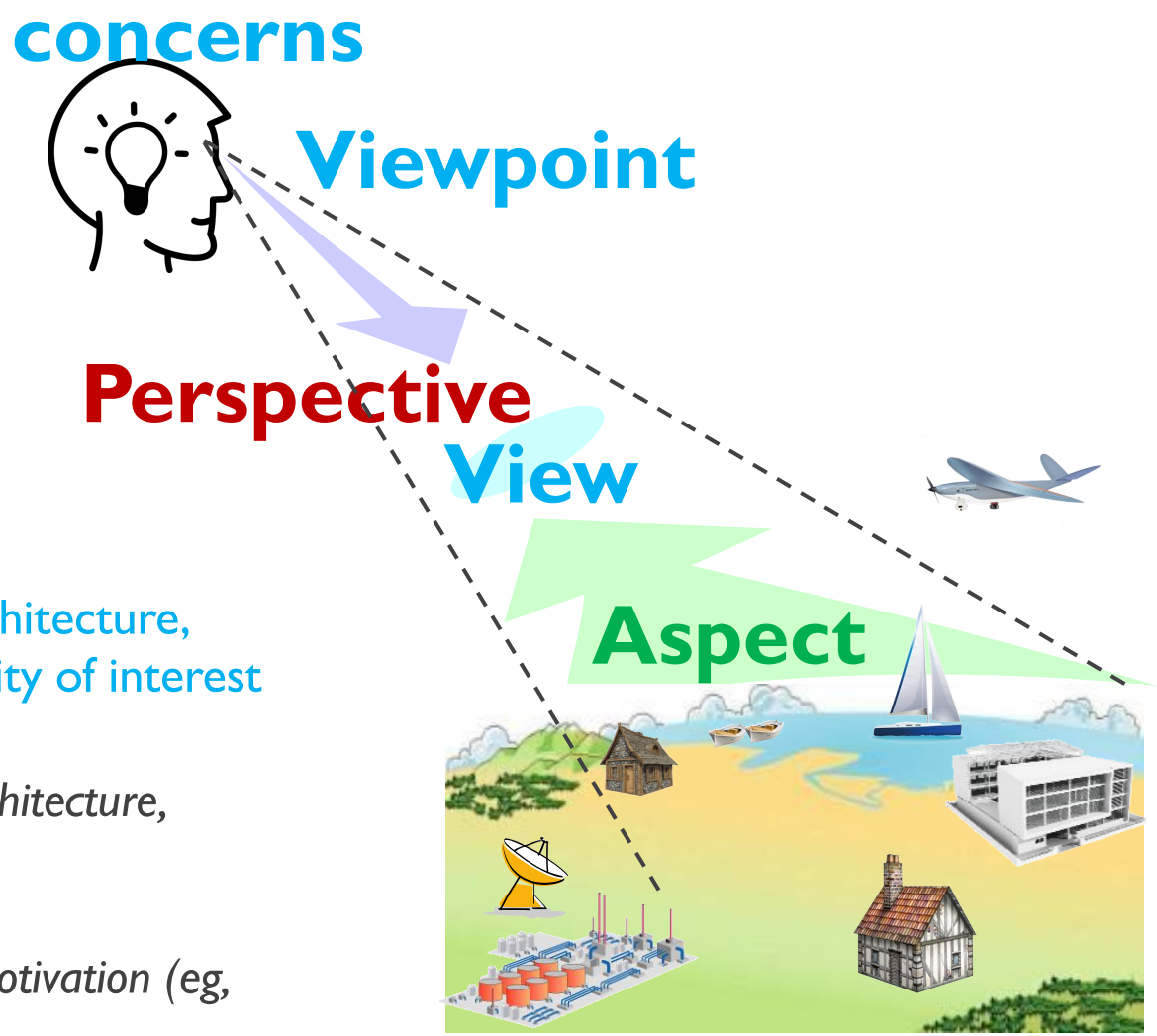
42010 [2nd edition] Stakeholder Perspective
way of thinking about an entity, especially as it relates to concerns

Examples: Viability, cost, risk, usability or operability, legal compliance, ease of maintenance, market acceptability, market share, ease of implementation

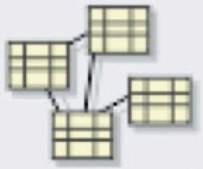
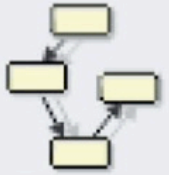
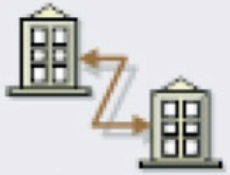
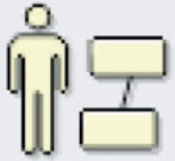
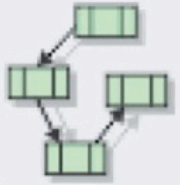
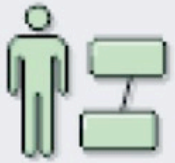
42010 [2nd edition] Architecture Aspect
part of an entity's character or nature
…that deals with particular concerns within an architecture, capturing key characteristics or features of the entity of interest

Examples: Functional & Structural aspects of an Architecture, Informational & Parametric aspects

Also, Connectivity, Evolution, Traceability, Taxonomy, Motivation (eg, Requirements, Policy), Location, Timelines

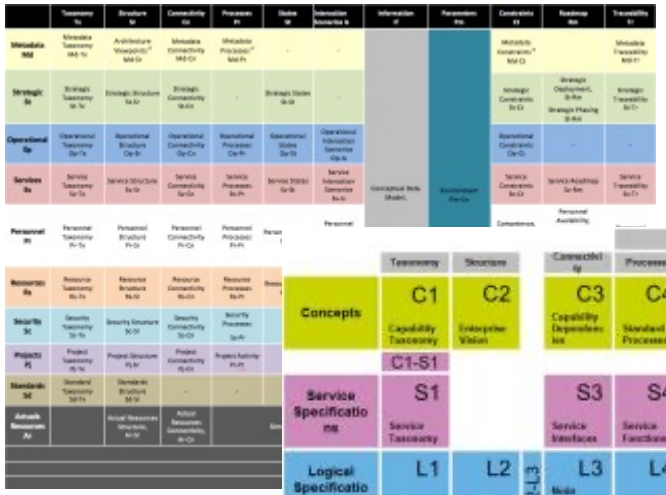


Unified Architecture Method (UAM)

Perspective	Aspect: Data	Aspect: Activity	Aspect: Location	Aspect: People
Business	 Business Entity Model	 Business Process Model	 Business Locations Model	 Business Roles Model
Logical	 Logical Entity Model	 Logical Process Model	 Logical Locations Model	 Logical Roles Model
Technical	 Technical Entity Model	 Technical Process Model	 Technical Locations Model	 Technical Roles Model

AD Frameworks with multi-dimensional approaches

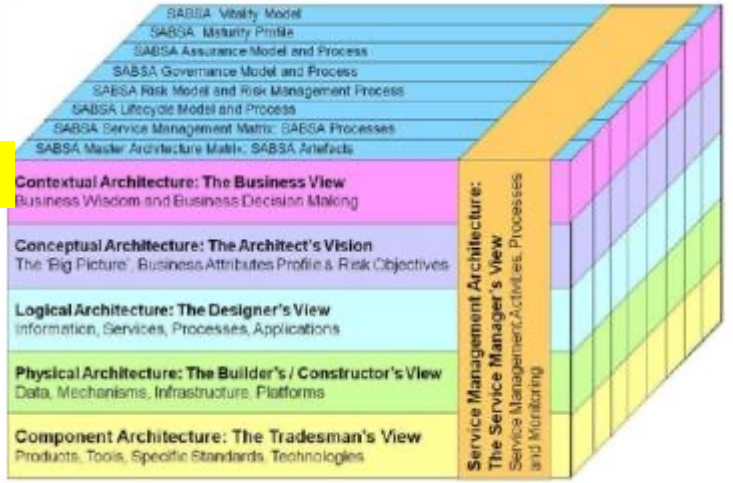
2D: (Source: OMG/Unified Architecture Framework) (UAF)

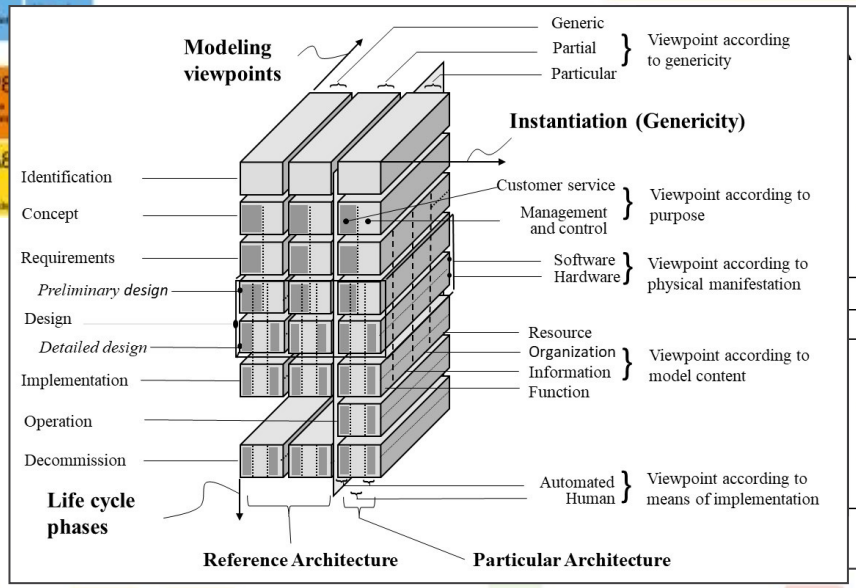


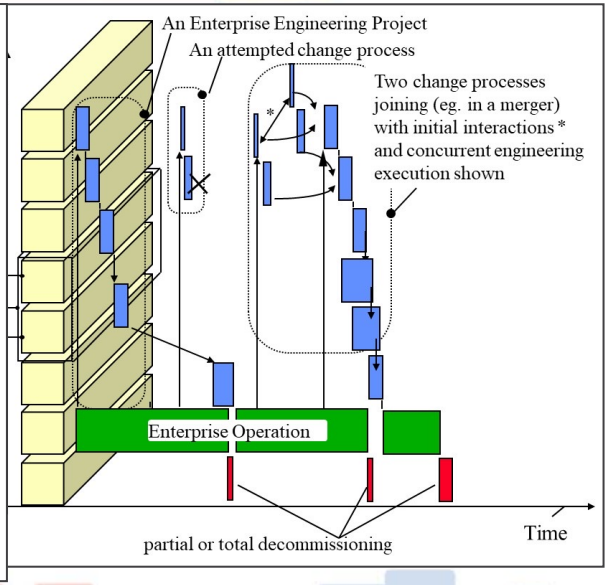
2D: (Source: NATO Architecture Framework)

2D: (Source: Zachman Framework)

3D: (Source: Sherwood Applied Business Security Architecture (SABSA) institute)

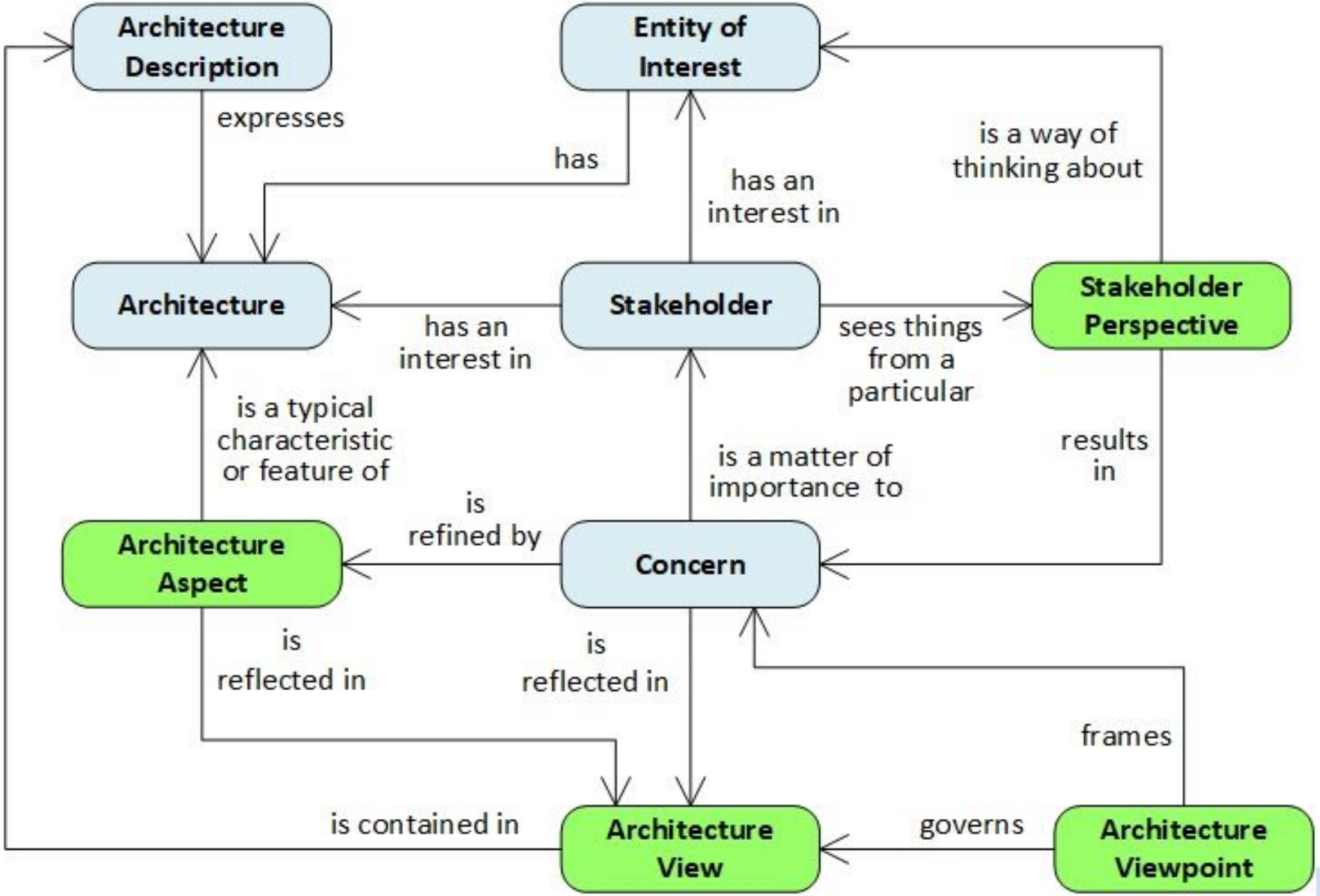






4D: (Source: ISO 15704 Ed2 (Generalized Enterprise Reference Architecture and Methodology))

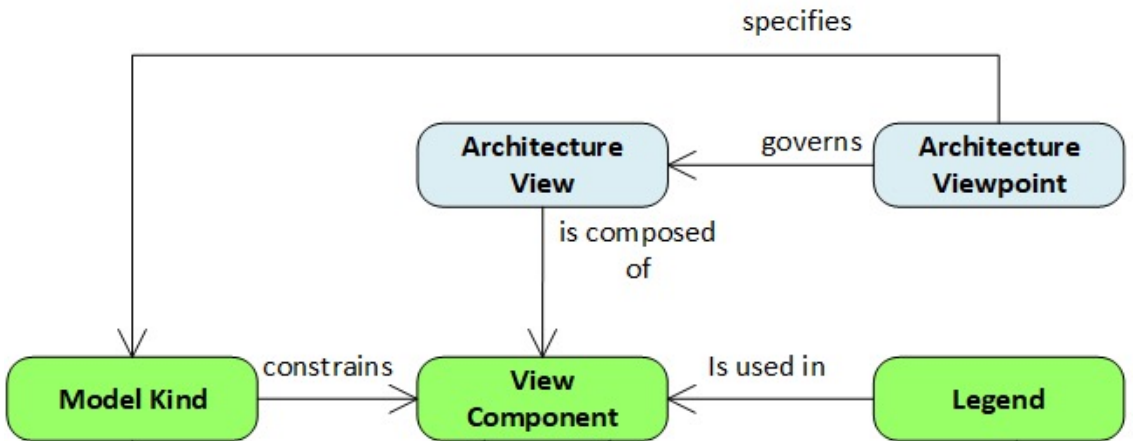
Other relationships



Other relationships

42010 [2nd edition] View Component
separable portion of one or more architecture views that is governed by the applicable model kind or legend

Example: an architecture view component describing an activity can be used in several views of an architecture description to explain functional flows, behaviors and security features of an entity.



42010 [2nd edition] Model Kind
category of model distinguished by its key characteristics and modeling conventions

Examples: Functional models, structural models, performance models, geopolitical models, cost models, and economic models.

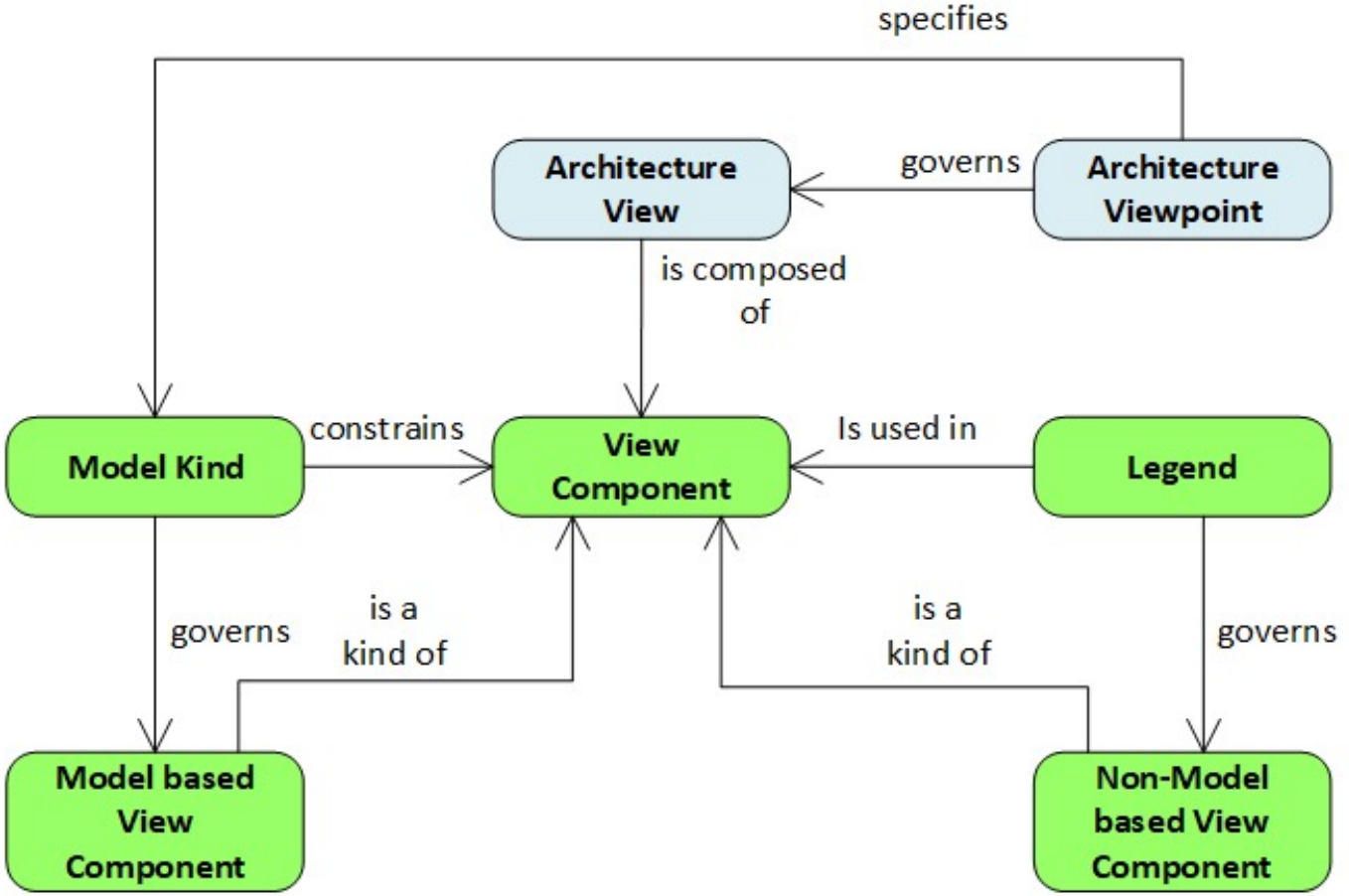
42010 [2nd edition] : A legend denotes the category of explanations or interpretations.

View Components

42010 [2nd edition] does not prescribe the level of formality of view components to be used in an AD. While model-based view components that have a formal specification of semantics and syntax may be less ambiguous, non-model based view components can also be used effectively.

Non-model based View examples:

- Narrative that goes with a behavior diagram
- Use Case template filled in
- List of responsibilities
- List of locations



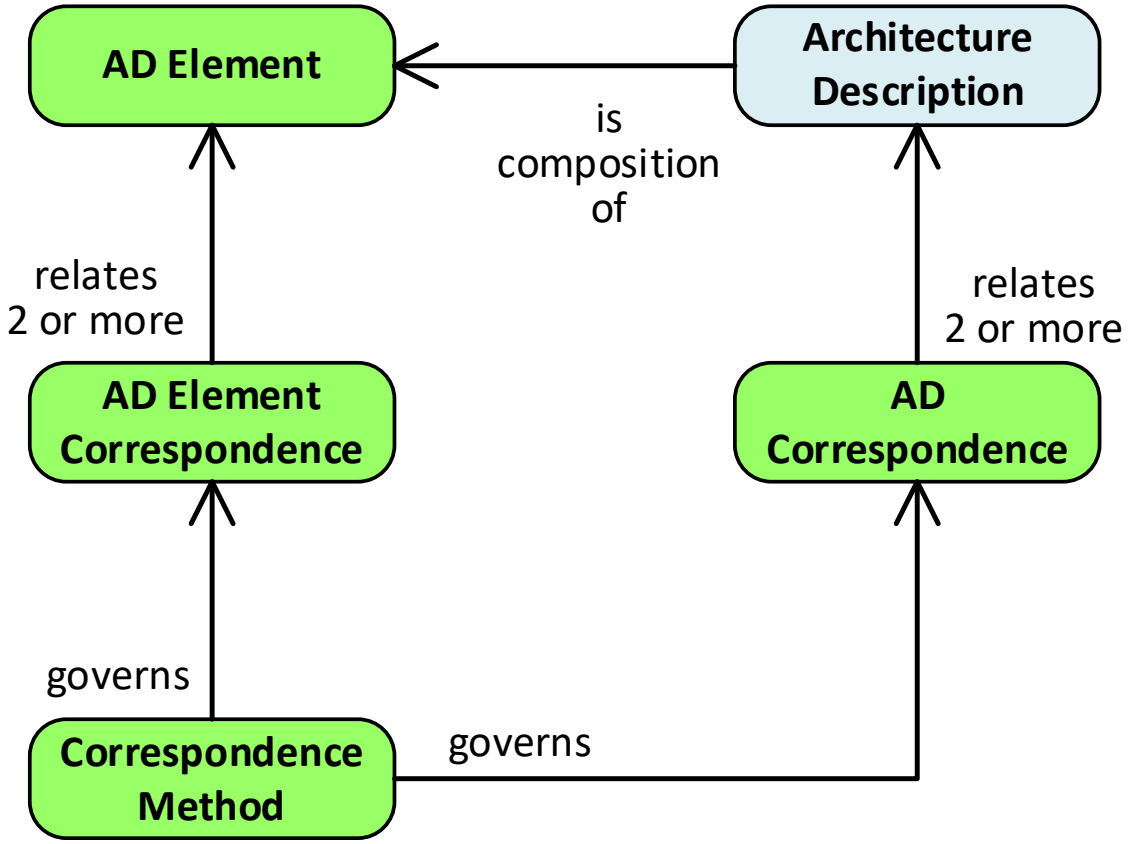
Correspondences

42010 [2nd edition] Correspondence
relationship between architecture description elements or between architecture descriptions

Examples: Correspondences can include a wide range or relationship types, such as equivalence, composition, refinement, consistency, traceability, dependency, constraint, satisfaction, and obligation.

42010 [2nd edition] AD element
part of an architecture description that expresses concepts or properties of the architecture

Note to entry: AD elements include stakeholders, concerns, perspectives, aspects, identified in an AD and views, view components, viewpoints and model kinds included in an AD

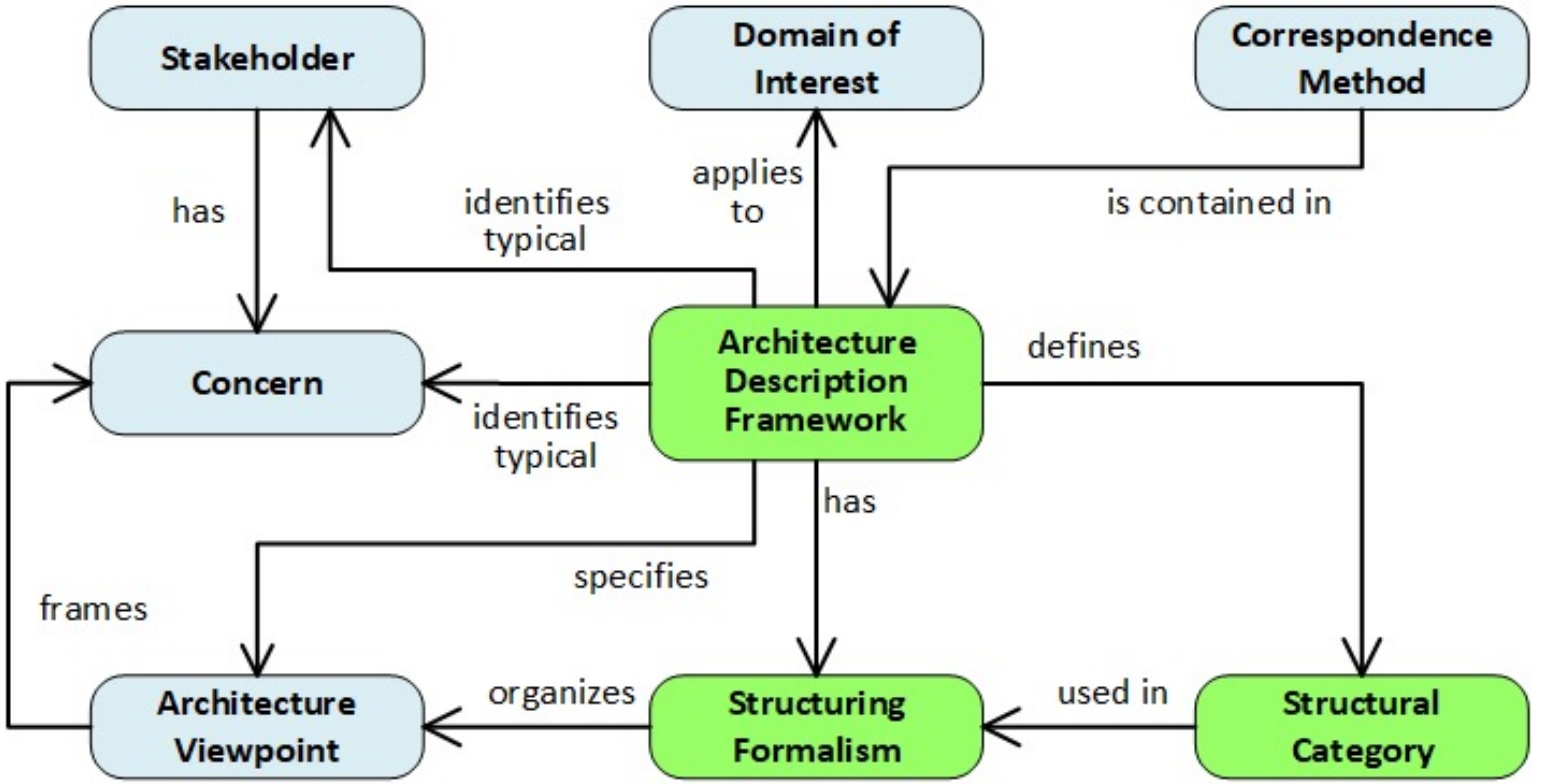


An AD can be an AD element in another architecture.

Architecture Description (AD) Frameworks

42010 [2nd edition] AD Framework conventions, principles and practices for the description of architectures established within a specific domain of application or community of stakeholders

Examples: GERAM Framework, RM-ODP, UAF, DODAF, NAF



42010 [2nd edition]

- **Structuring formalism** is a set of rules for using architecture considerations and correspondences between them, to organize the architecture viewpoints used to generate associated views, e.g. a grid framework
- An ADF can define **structural categories** used in the structuring formalism. Sometimes these categories are represented by "dimensions" in a graphic portrayal, such as the rows and columns used in several frameworks, e.g. Zachman, UAF and NAF.

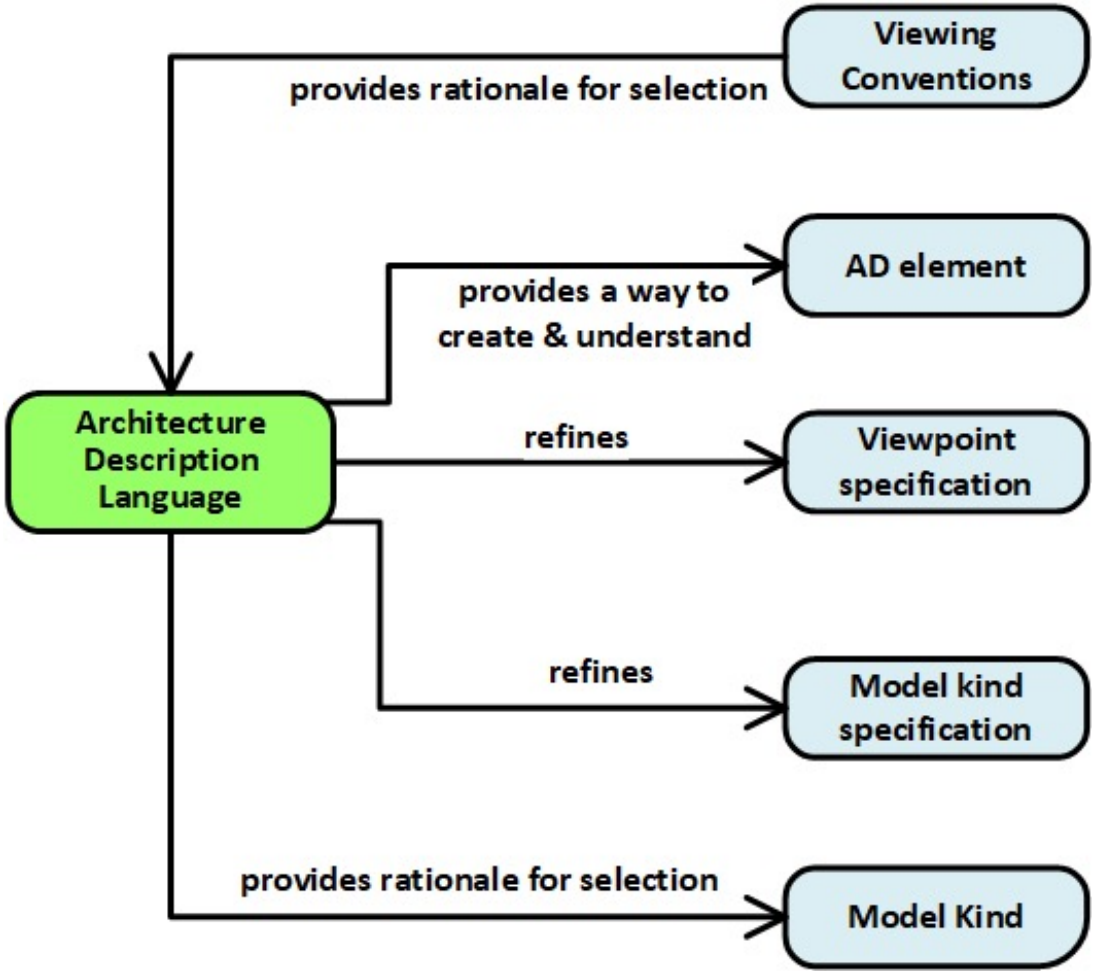
Architecture Description (AD) Languages

42010 [2nd edition] AD Language
means of expression, with syntax and semantics, consisting of a set of representations, conventions, and associated rules intended to be used to describe an architecture

Examples: AADL, ArchiMate, SysML, UML, UAF Profile

42010 [2nd edition]

- **Viewing conventions** can include languages, notations, specifications of model kinds, metamodel classes and relationships, and view construction methods expressing design rules, modeling methods, analysis techniques and other operations on views.



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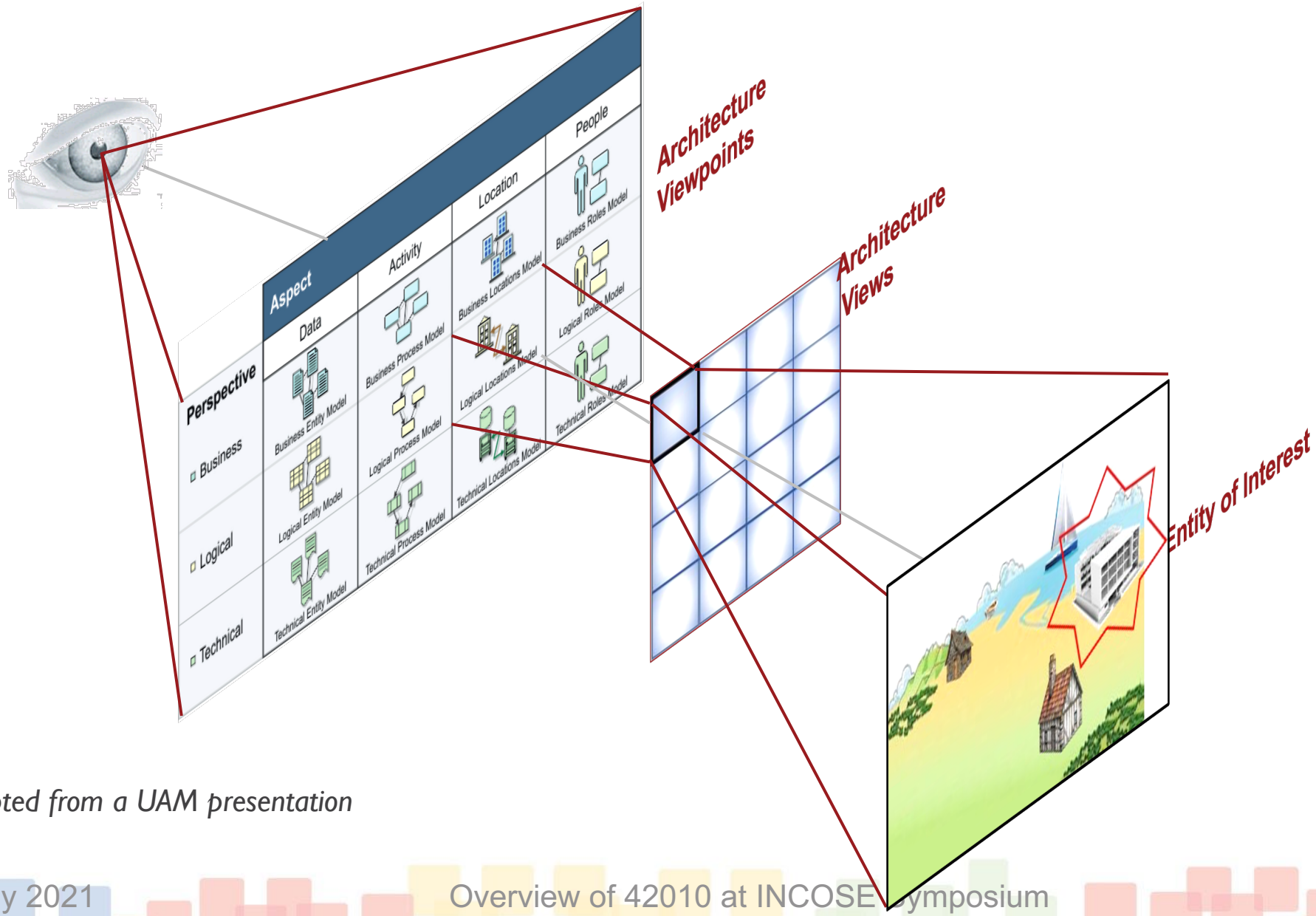
Summary of the 42010 concepts



Adapted from a UAM presentation

Conformance

- Five situations in which claims of conformance with the provisions of ISO/IEC/IEEE will apply:
  - Architecture Description
  - Architecture Description Framework
  - Architecture Description Language
  - Architecture Viewpoint
  - Model Kind

For each item, the claim shall demonstrate that the specification of this item meets the 42010 requirements related to this items.

  - NOTE 42010 is designed such that “tailoring” is neither required nor permitted for its use when claims of conformance are made

Specification of an Architecture Description (AD)

Specification of an AD includes or references the following items:

- AD **identification**, overview and supplementary information;
- identification of the entity of interest's **stakeholders**;
- identification of the relevant **concerns**;
- identification of the relevant **architecture aspects**;
- identification of the relevant **stakeholder perspectives**;
- a definition or a reference for each **architecture viewpoint** used in the AD;
- architecture **view(s)** for each architecture viewpoint used:
- architecture **view component(s)** that are shared across the architecture views;
- a record of known **inconsistencies** among the AD's required contents;
- applicable **AD correspondences** and AD correspondence methods;
- applicable **AD element correspondences** and AD elements correspondence methods;
- **rationales** for architecture decisions made.

Note: in a project, Specification of an AD also includes or refer applicable architecting **stages, domains, key concepts, key features, and applicable principles**.

Specification of an Architecture Description Framework (ADF)

Specification of an ADF shall include or reference :

- information **identifying** the ADF and its intended scope of applicability;
- the identification of one or more **typical stakeholders**;
- the identification of one or more **typical concerns** held by typical stakeholders;
- the identification of one or more **architecture aspects**, if applicable;
- the identification of one or more **stakeholder perspectives**, if applicable;
- the definition of one or more **structuring formalism** to organize viewpoints;
- the specification of one or more **architecture viewpoints** that frame those typical concerns;
- the specification of one or more **model kinds** that apply to these architecture viewpoints, if applicable;
- the definition of one or more **legends** that apply to these architecture viewpoints, if applicable;
- identification of **ADLs** that can be used to create views;
- any applicable **correspondence methods**;
- any applicable **view methods**.

Specification of an Architecture Description Language (ADL)

Specification of an ADL shall include or reference :

- the identification of one or more **viewing conventions** to be selected by the ADL;
- one or more **model kinds** implemented by the ADL which frame the relevant concerns or reflect the relevant architecture aspects;
- any architecture **viewpoints** implemented by the ADL;
- **correspondence methods**;
- one or more **view methods**.

An ADL **may** identify one or more **typical stakeholders** and their **concerns**.

Specification of an Architecture Viewpoint

Specification of an architecture viewpoint shall include or reference:

- one or more **concerns** framed by this architecture viewpoint;
- any **perspectives** associated with this viewpoint;
- one or more **aspects** refining those concerns;
- known **typical stakeholders** holding those concerns which are framed by this architecture viewpoint;
- a specification of each **model kind** and **legend** used by this viewpoint;
- references to **any sources**.

A specification of an architecture viewpoint **should identify view methods** used to create, interpret or analyze views governed by the associated architecture viewpoint; and one or more model kind.

Specification of an Model Kind

Specification of a Model Kind shall include or reference:

a) one or more architecture **concerns**, **perspectives** and **aspects**;
b) definition of a **language, notation, convention, or modelling technique** comprising the model kind;
c) any **view methods** to be used on view components of this kind;
d) any sources.

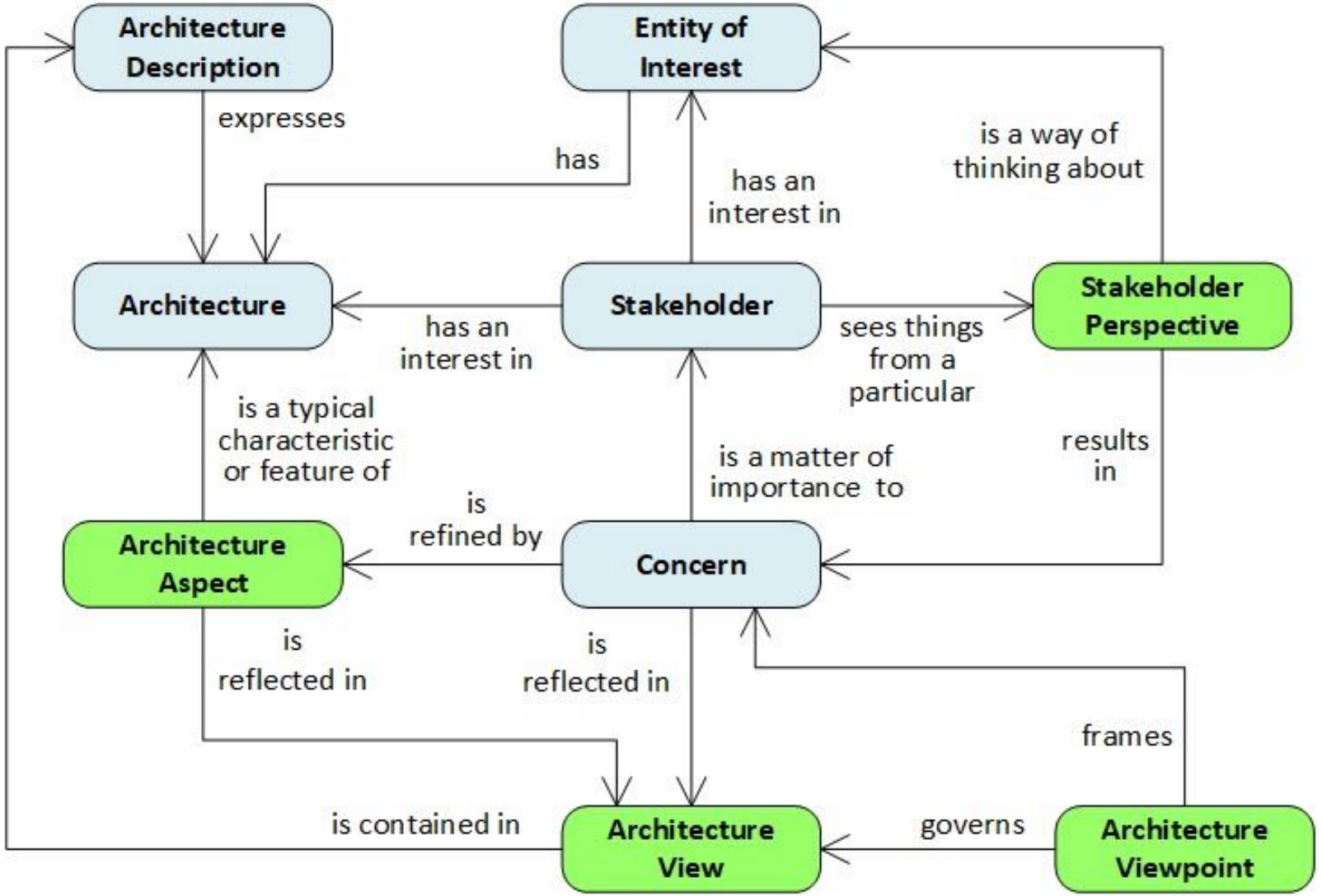
Note: Item **b) can be met** in a number of ways such as with a **metamodel, grammar or template** for the specification of a model kind that defines the structure and interpretation of its models.

Additional notes on the 2nd edition

- Annex A extends the concepts with:
  - Architecture Aspects and Perspectives
  - Some others consideration of architecture views, architecture viewpoints and their specification (UAF example)
- New annexes describe:
  - D: A few uses of ADs throughout the life cycle of their entities of interest
  - E: Architecture life cycles and AD life cycles
  - F: Architecture Description Frameworks usage of architecture concepts

Note: in Annex D, item g) of clause D.2 describes that an AD can be used to specify "a group or family of entities sharing common features (such as could be codified as a **reference architecture**, reference model or product line architecture)".

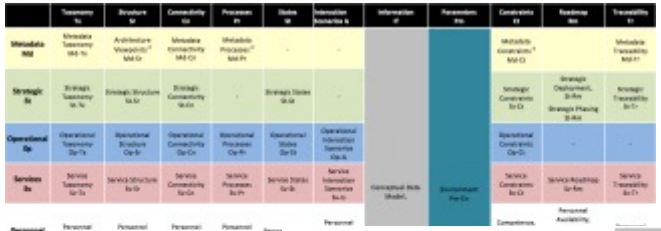
ISO 42010 – Architecture Description



ANNEX - ADFs

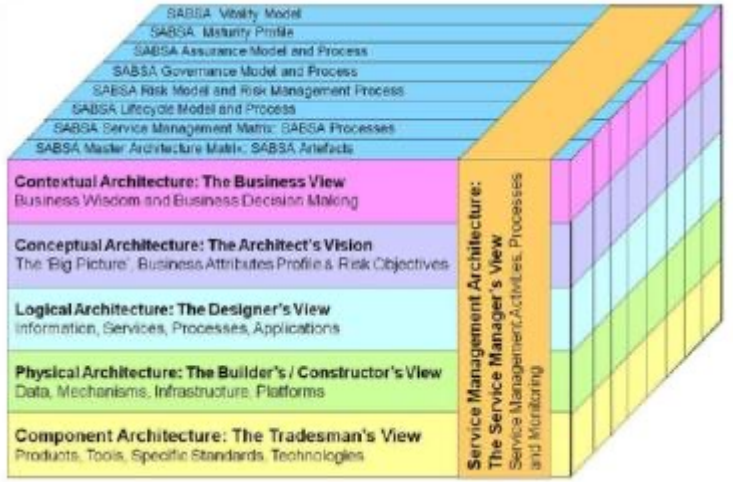
AD Frameworks propose multi-dimensional approaches

2D: (Source: OMG/Unified Architecture Framework) (UAF)

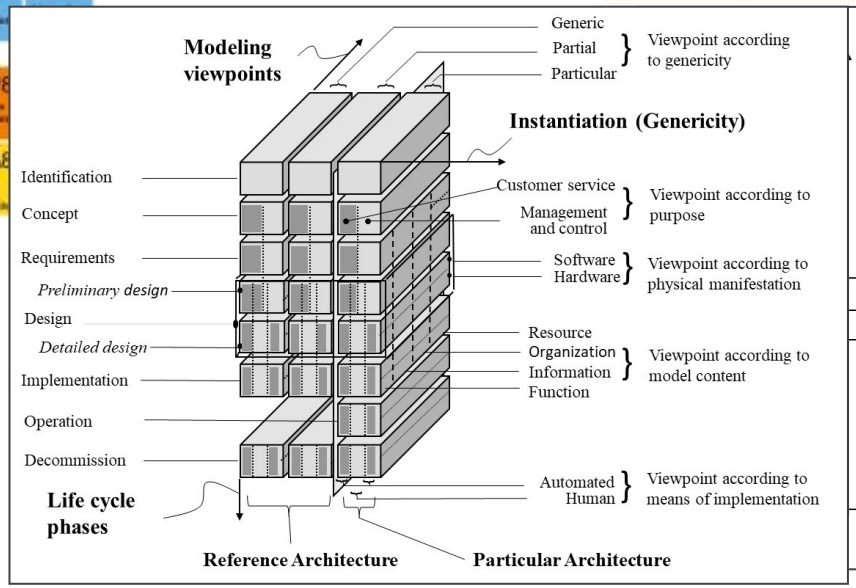


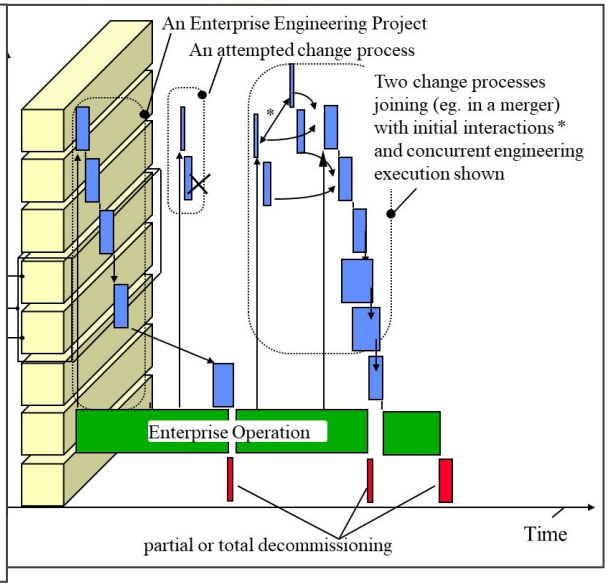
2D: (Source: NATO Architecture Framework)

3D: (Source: Sherwood Applied Business Security Architecture (SABSA) institute)



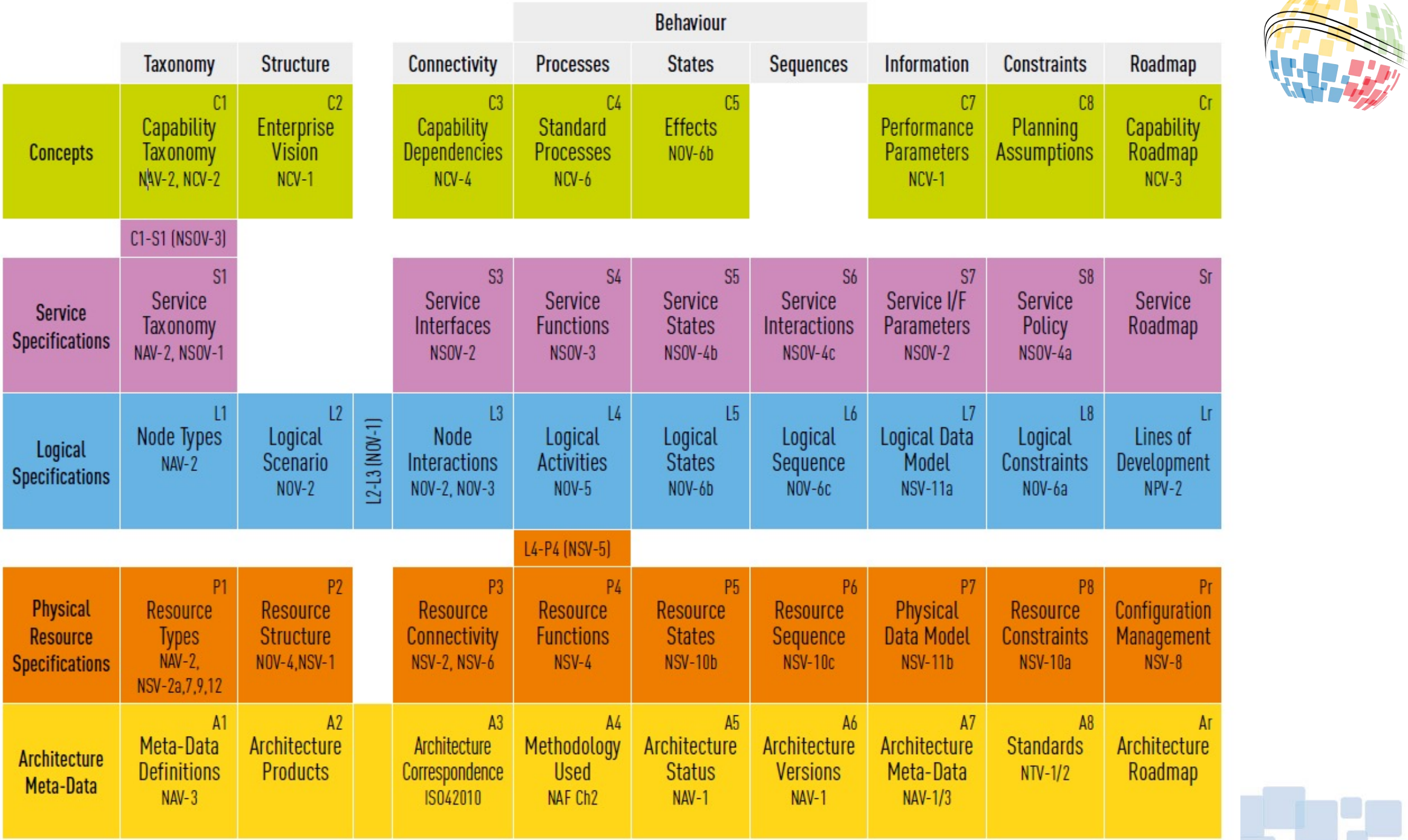
2D: (Source: Zachman Framework)





4D: (Source: ISO 15704 Ed2 (Generalized Enterprise Reference Architecture and Methodology))

	Taxonomy Tx	Structure Sr	Connectivity Cn	Processes Pr	States St	Interaction Scenarios Is	Information[c] If	Parameters[d] Pm	Constraints Ct	Roadmap Rm	Traceability Tr
Metadata[a] Md	Metadata Taxonomy Md-Tx[f]	Metadata Structure Md-Sr	Metadata Connectivity Md-Cn	Metadata Processes Md-Pr	Metadata States Md-St	-			Metadata Constraints Md-Ct	Metadata Roadmap Md-Rm	Metadata Traceability Md-Tr
Strategic St	Strategic Taxonomy St-Tx	Strategic Structure St-Sr	Strategic Connectivity St-Cn	-	Strategic States St-St	-			Strategic Constraints St-Ct	Strategic Deployment, St-Rm Strategic Phasing St-Rm	Strategic Traceability St-Tr
Operational Op	Operational Taxonomy Op-Tx	Operational Structure Op-Sr	Operational Connectivity Op-Cn	Operational Processes Op-Pr	Operational States Op-St	Operational Interaction Scenarios Op-Is			Operational Constraints Op-Ct	-	Operational Traceability Op-Tr
Services Sv	Service Taxonomy Sv-Tx	Service Structure Sv-Sr	Service Connectivity Sv-Cn	Service Processes Sv-Pr	Service States Sv-St	Service Interaction Scenarios Sv-Is	Conceptual Data Model,	Environment Pm-En	Service Constraints Sv-Ct	Service Roadmap Sv-Rm	Service Traceability Sv-Tr
Personnel Pr	Personnel Taxonomy Pr-Tx	Personnel Structure Pr-Sr	Personnel Connectivity Pr-Cn	Personnel Processes Pr-Pr	Personnel States Pr-St	Personnel Interaction Scenarios Pr-Is	Logical Data Model,		Competence, Drivers, Performance Pr-Ct	Personnel Availability, Personnel Evolution, Personnel Forecast Pr-Rm	Personnel Traceability Pr-Tr
Resources Rs	Resource Taxonomy Rs-Tx	Resource Structure Rs-Sr	Resource Connectivity Rs-Cn	Resource Processes Rs-Pr	Resource States Rs-St	Resource Interaction Scenarios Rs-Is	Physical schema[e], real world results	Measurements Pm-Me	Resource Constraints Rs-Ct	Resource evolution, Resource forecast Rs-Rm	Resource Traceability Rs-Tr
Security Sc	Security Taxonomy Sc-Tx	Security Structure Sc-Sr	Security Connectivity Sc-Cn	Security Processes Sc-Pr	-	-			Security Constraints Sc-Ct	-	Security Traceability Sc-Tr
Projects Pj	Project Taxonomy Pj-Tx	Project Structure Pj-Sr	Project Connectivity Pj-Cn	Project Processes Pj-Pr	-	-			-	Project Roadmap Pj-Rm	Project Traceability Pj-Tr
Standards Sd	Standard Taxonomy Sd-Tx	Standards Structure Sd-Sr	-	-	-	-			-	Standards Roadmap Sd-Rm	Standards Traceability Sd-Tr
Actual Resources Ar		Actual Resources Structure Ar-Sr	Actual Resources Connectivity Ar-Cn	Simulation[b]					Parametric Execution/ Evaluation[b]	-	-
Dictionary Dc											
Summary & Overview Sm-Ov											
Requirements Req											


Behaviour
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Structure
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States
Sequences
Information
Constraints
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C2 Enterprise Vision NCV-1
C3 Capability Dependencies NCV-4
C4 Standard Processes NCV-6
C5 Effects NOV-6b
C7 Performance Parameters NCV-1
C8 Planning Assumptions NCV-1
Cr Capability Roadmap NCV-3
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S4 Service Functions NSOV-3
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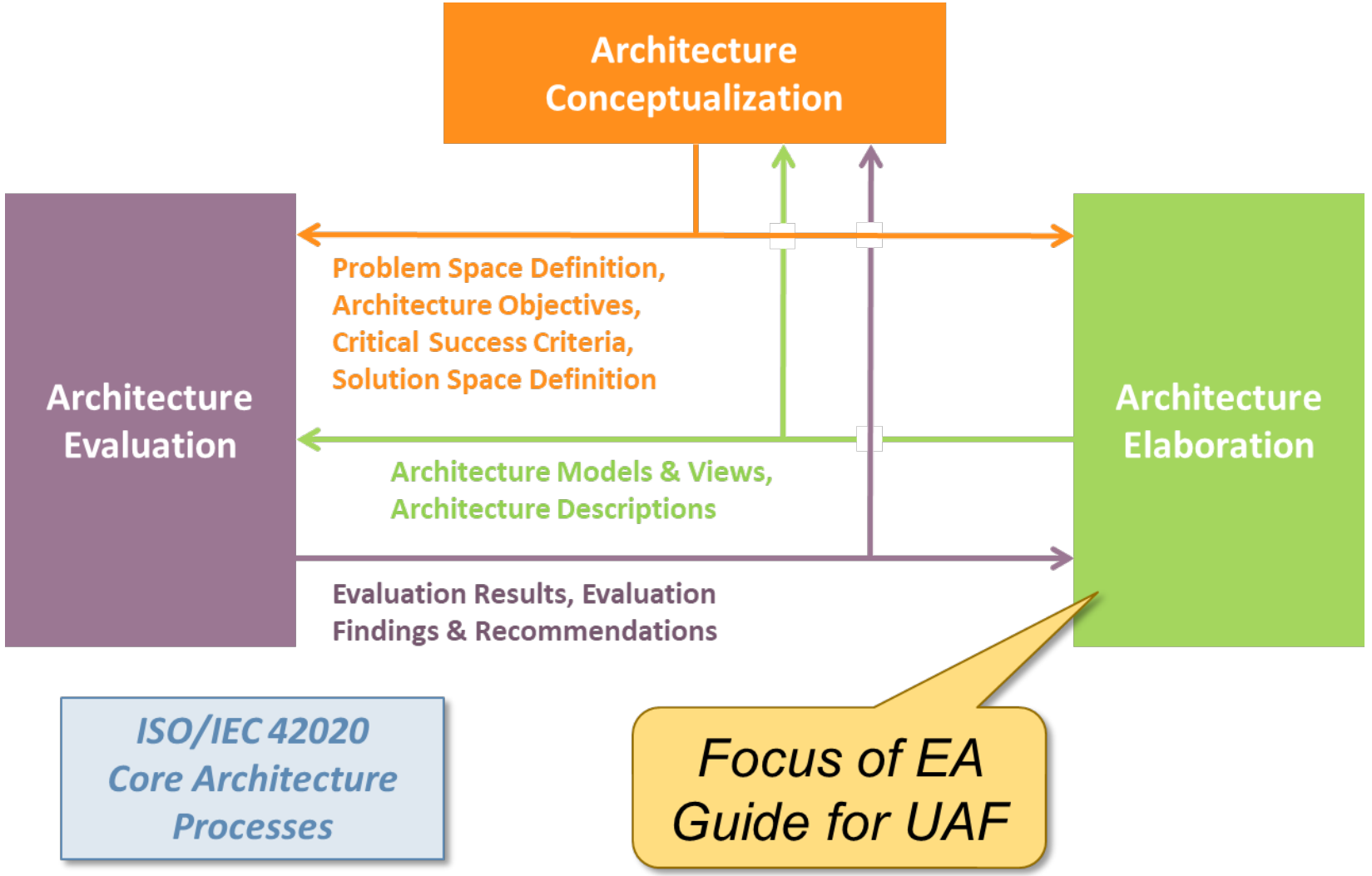
ISO 42020 Processes

EA Guide focus on "elaboration" of architecture with Models & Views



Architecture Used by Other Processes

Governance & Management as a Basis for Enterprise Decisions