Evolving Enterprise Architecture

Richard Martin

Tinwisle Corporation

Sandeep Purao

Penn State University

Edward Robinson

Indiana University

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Evolutions

- Concern conflicts
- Domain drift
- M
- Pe

- Financing
- Life cycle
- tion
- ce

- New Stakeholders
- Operational concepts
- Environment change

So when and how does Architecture of an Enterprise get created?

Architecting

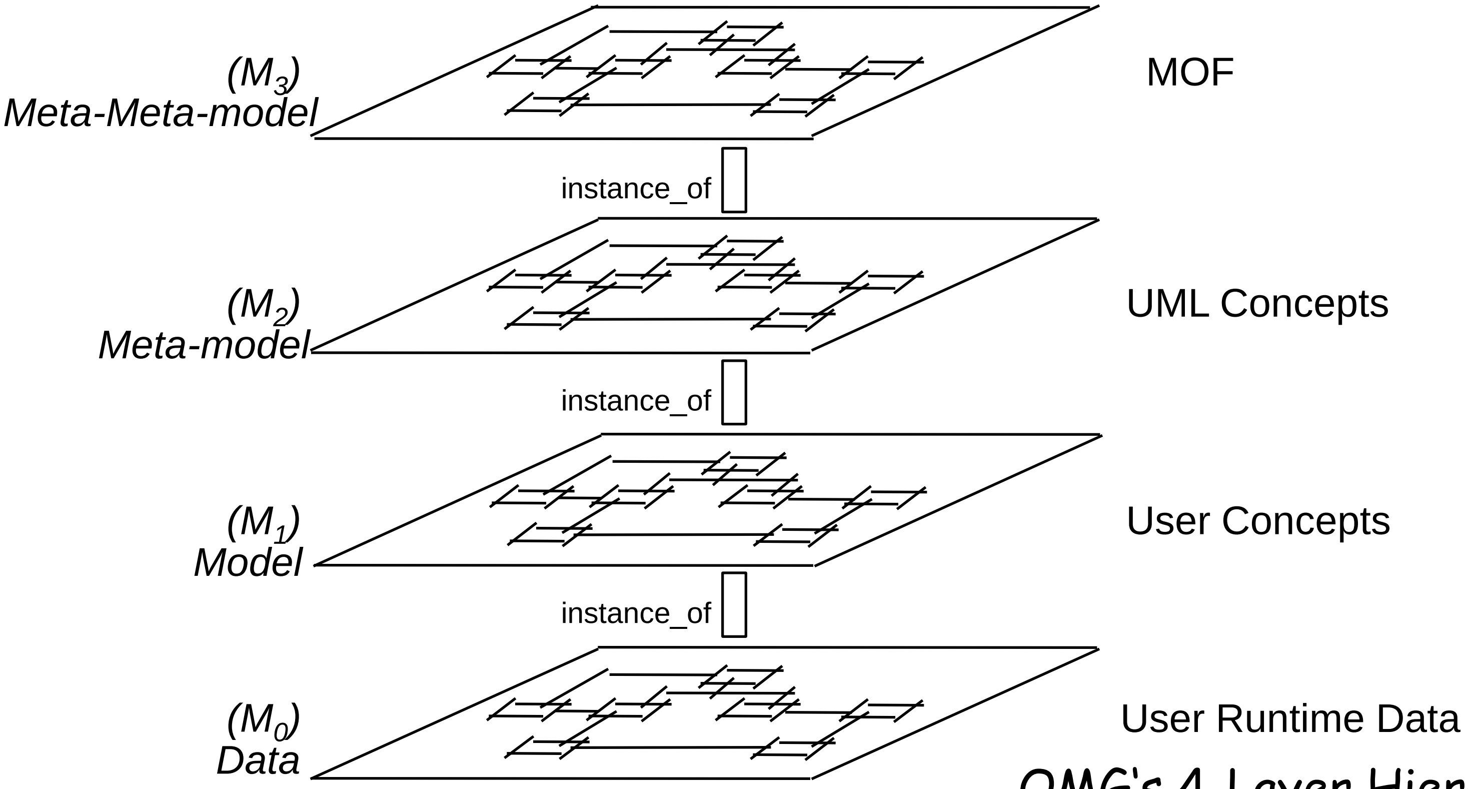
- Architecting – activity of specifying architecture
  - F. L. Wright, C. Alexander, E. Dijkstra, E. Rechtin
  - ISO/IEC 15288, EN/ISO 19439, TOGAF
  - Transitions from an abstract concept through elaboration of the concepts to descriptions of the form, function, and purpose that the system or enterprise is expected to exhibit.
- **IEC/ISO/WD 42010 - architecting**
  - process of conceiving, defining, describing, documenting, communicating, certifying proper implementation of, maintaining and improving an architecture throughout a system's life cycle.

Layers of Architecting

- 1st – applying a meta-architecture (e.g. a framework) to create and use an architecture description for the Enterprise
- 2nd – creating the meta-architecture for use in 1st layer activities
- 3rd – a meta-meta-level that describes evolution of 'architecture' and includes changes to the 2nd level meta-architecture

'Meta-' is relative

- Use of meta-meta-data and meta-meta-model



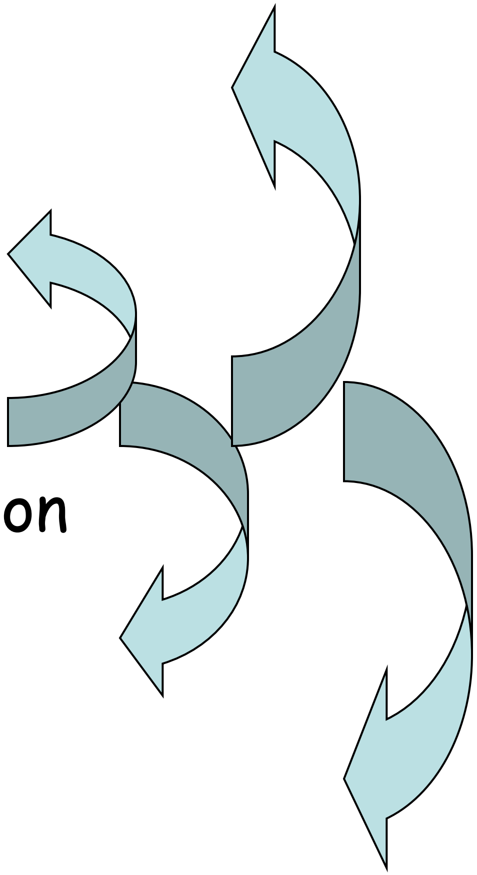
OMG's 4-Layer Hierarchy

1st layer evolution of utility

- As architecture description (**AD**) evolves it serves two distinct stakeholder communities
  - One delivering more abstract concepts that address their concerns
  - One expected to take the elaboration further toward a less abstract, more elaborated specification
- Elaboration evolves architecture from vague concept to formal descriptions for use by designers of enterprise details

Stakeholder community grows

- Line of business manager
  - Market Opportunity Assessment
- Enterprise concept team
  - Business concept of operations
- Enterprise architect
  - Enterprise architecture description
- Business design team
  - Enterprise specification
- Enterprise production implementation team
  - ....



Other architecting layers

- Components of detail need specifying and this too results in more rounds of architecting at the component level
- Life cycle, detail, and genericity dimensions all involve hand-off from one set of stakeholders to another as architecture evolves

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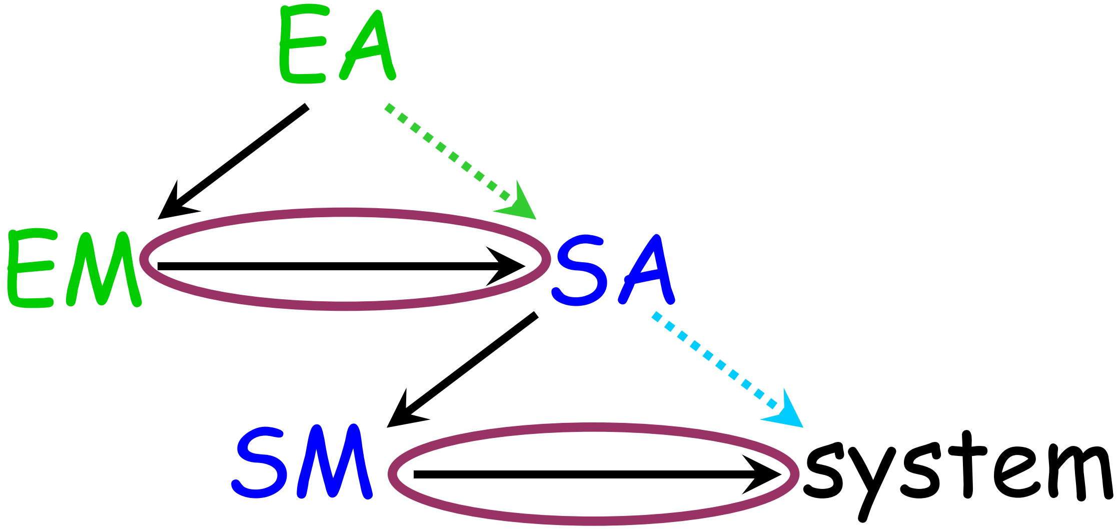
- A framework informs about expected stakeholders as the elaboration space increases

Models and architecture

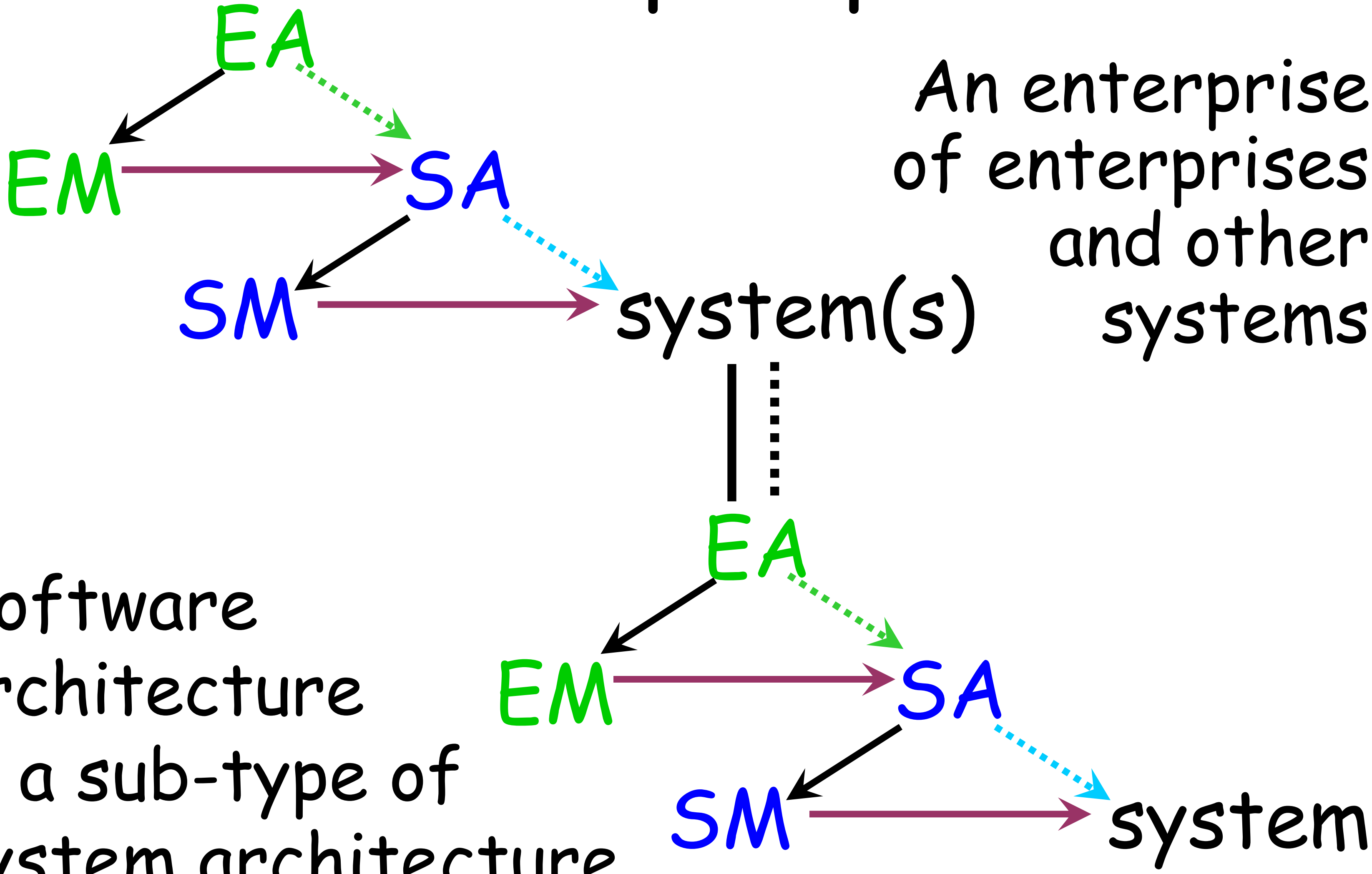
Architectural intent is embodied in enterprise models (EM).

Architectural realization is embodied in instance manifestations of those models.



Models are a utility of architecture

Different perspectives



EA

EM

SA

SM

system(s)

EA

EM

SA

SM

system

An enterprise
of enterprises
and other
systems

Software
architecture
is a sub-type of
system architecture

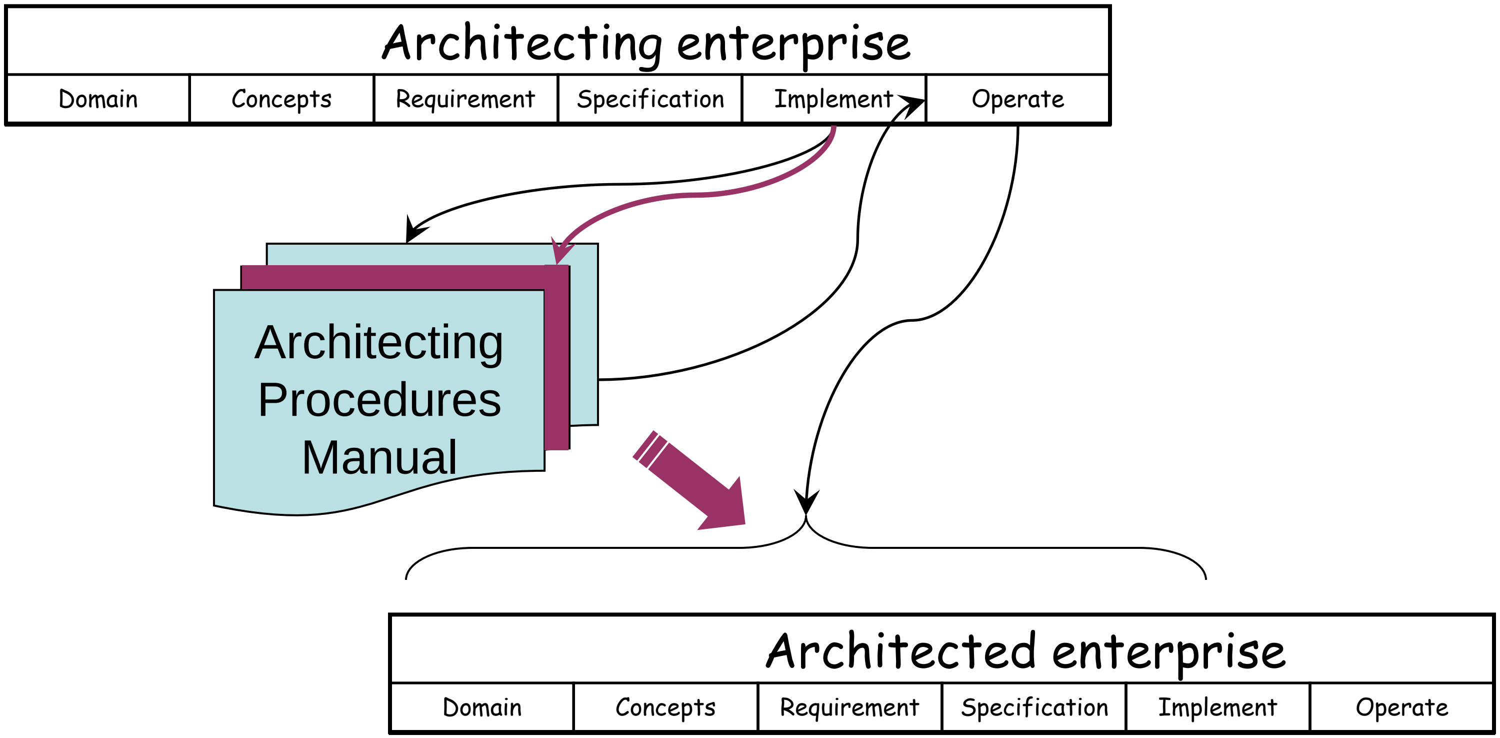
Elaboration Hierarchy

- Decomposing results in new architecture opportunity/specification raising issues of consistency and coherence between levels:
  - Enterprise, family of systems, system, segment, element, subsystem, component, subassembly, parts
- Transformations occur as context shifts focus in use of both meta-architecture for each level and creation of enterprise architecture

Life cycle evolution

- Within a life cycle phase, **AD** is an artifact of previous phases and serves as a guide for subsequent phases
- Systems and enterprises exhibit common life cycle patterns, not the same life cycle
- Instability is caused by overlap in life cycle phases across meta-levels
- Stability is enhanced by overlap in artifacts across meta-levels

Stability and instability



Architecting enterprise

Domain | Concepts | Requirement | Specification | Implement | Operate

Architecting Procedures Manual

Architected enterprise

Domain | Concepts | Requirement | Specification | Implement | Operate

Meta- vs. time

- Meta-architecture specifies system life cycle processes that occur over time
- Tend to think of complete architectures as static but meta-level architecture use changes over the course of a project
- Different meta-levels have different time spectra; lower-level activity is continuous with respect to higher-level activity that is perceived as discrete, i.e. it has a more granular clock

Expressive limits of architecture

The Intension/Locality Thesis (Eden & Kazman 2003)

Architecture	*Intentional*	*Non-Local*
Design	*Intentional*	*Local*
Implementation	*Extensional*	*Local*
Trouble	*Extensional*	*Non-Local*

Architecture more formally

A specification is intentional iff there are infinitely-many possible instances thereof. Conversely, all other expressions are extensional

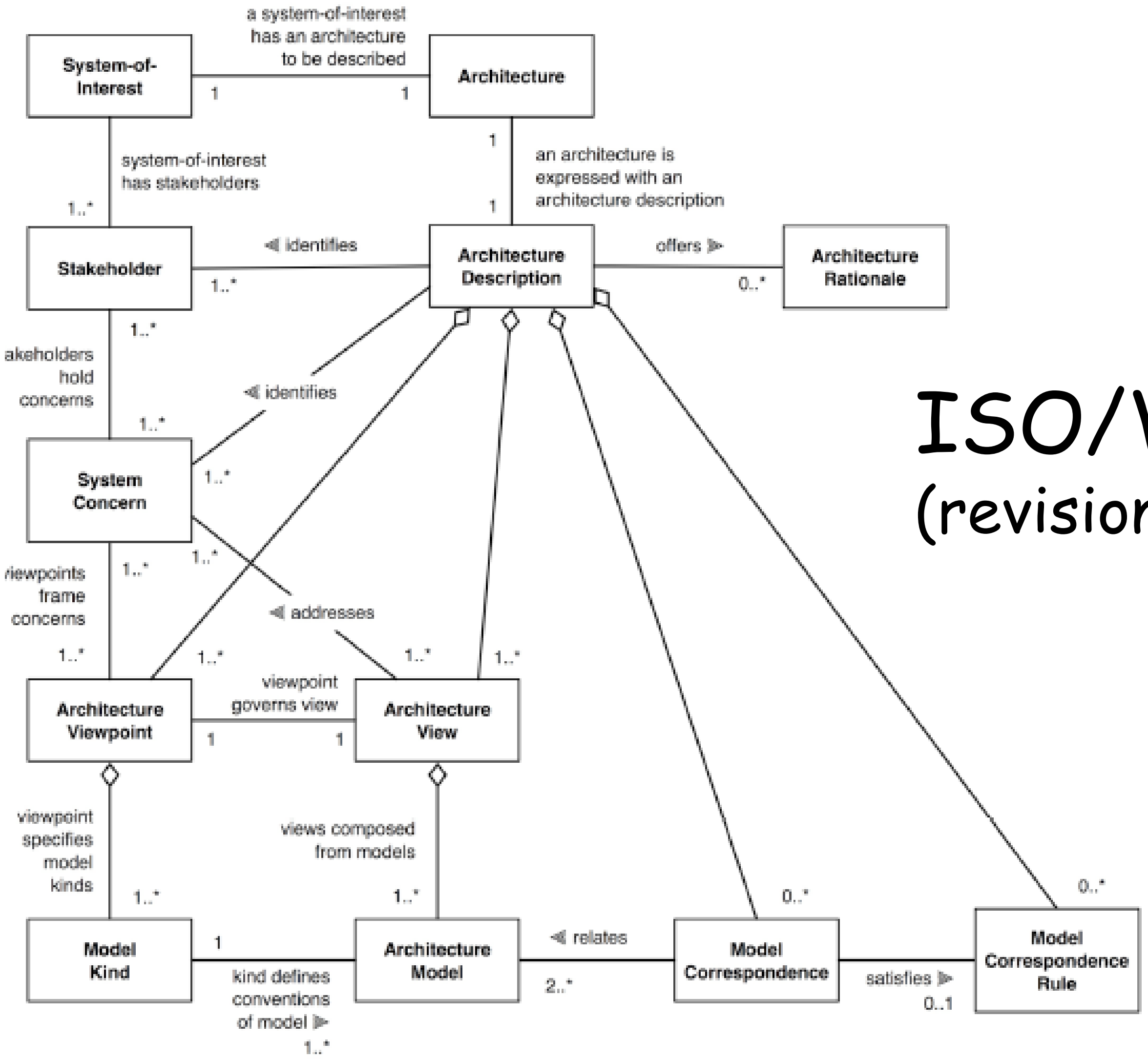
A specification **S** is local iff the following condition holds:

If **S** is satisfied in some design model **m** then it is satisfied by every design model that subsumes **m**.

Stakeholder utility

- *Architecture accommodates succession* of stakeholders
- Utility of **AD** is response to intentional concerns of input stakeholders
- Utility of **AD** is request for extending concerns of new stakeholders
- Utility of architecture is realized by service to stakeholders

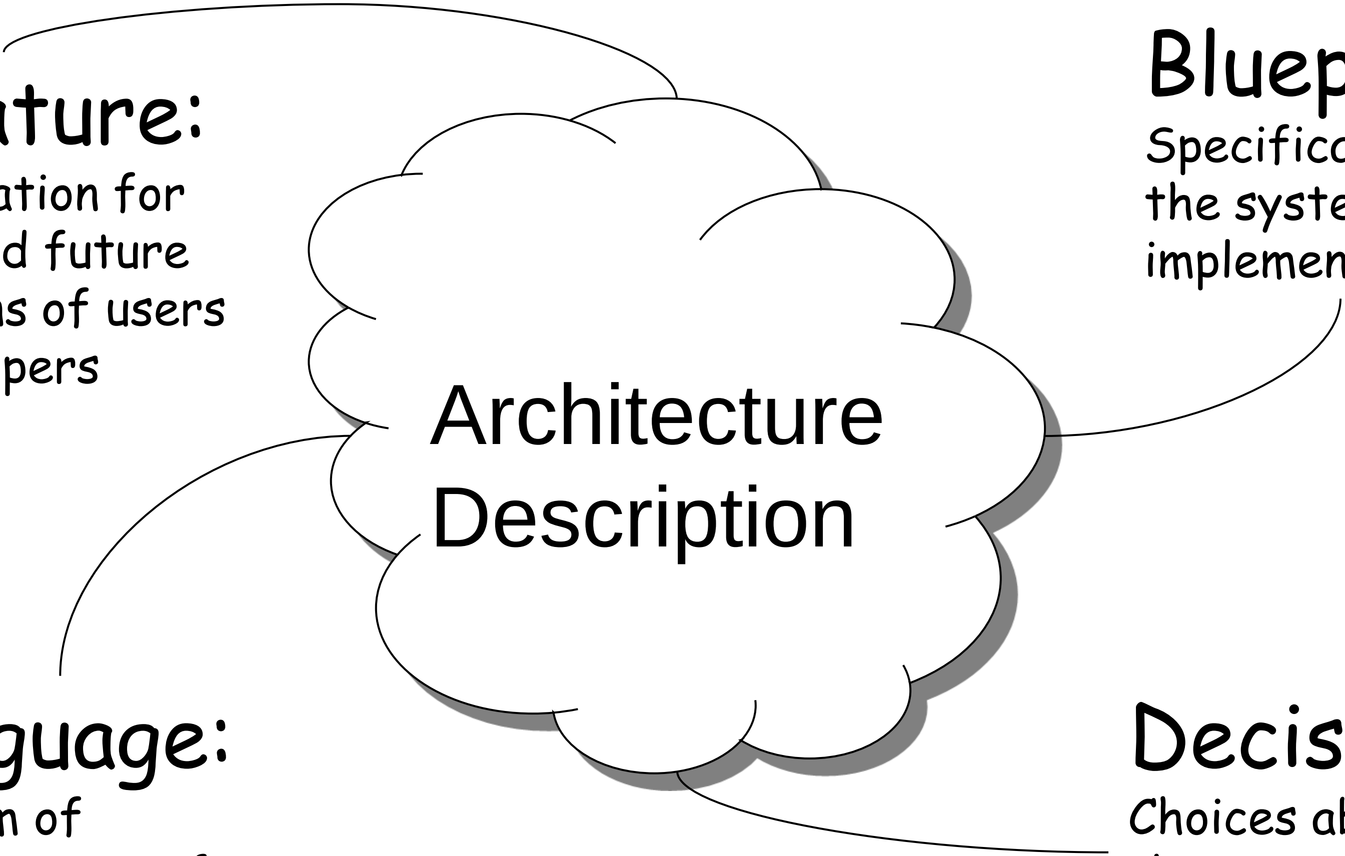
AD Meta-model



ISO/WD 42010

(revision of IEEE 1471)

AD as boundary object



Architecture Description

Literature:

Documentation for current and future generations of users and developers

Blueprint:

Specification of the system to be implemented

Language:

Medium of communication for achieving common understanding

Decision:

Choices about the system to be implemented and rationale

Evolutionary transformations

- Architecting involves executing a methodology to produce a set of artifacts
- The methodology transforms abstractions into more concrete realizations using:

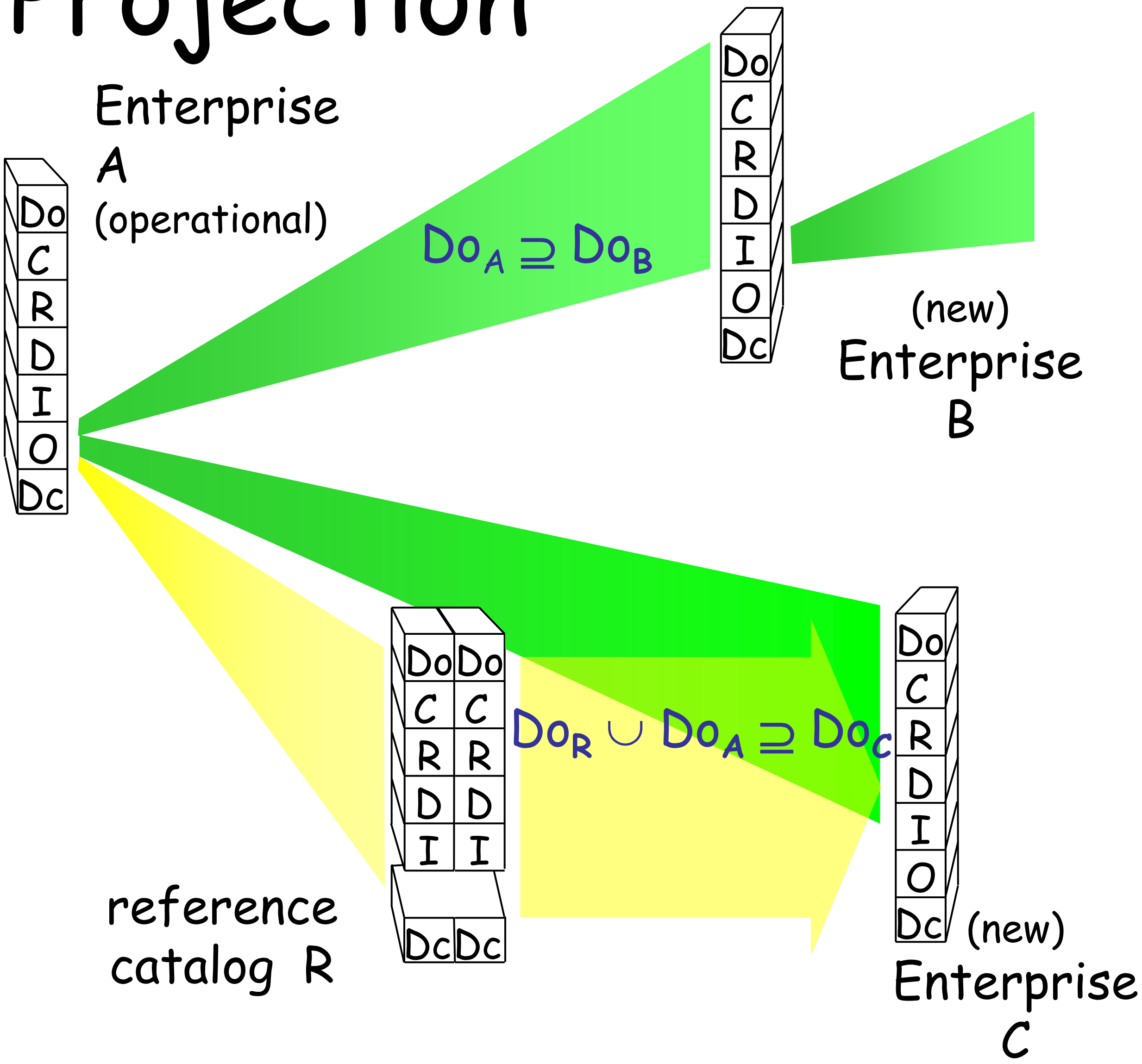
Projection **Instantiation**

Specialization **Refinement**

Mapping

Projection

From the set of architectural models, select a sub-set that is useful to a set of tasks during a life cycle phase.



Enterprise A (operational)

$Do_A \supseteq Do_B$

(new) Enterprise B

reference catalog R

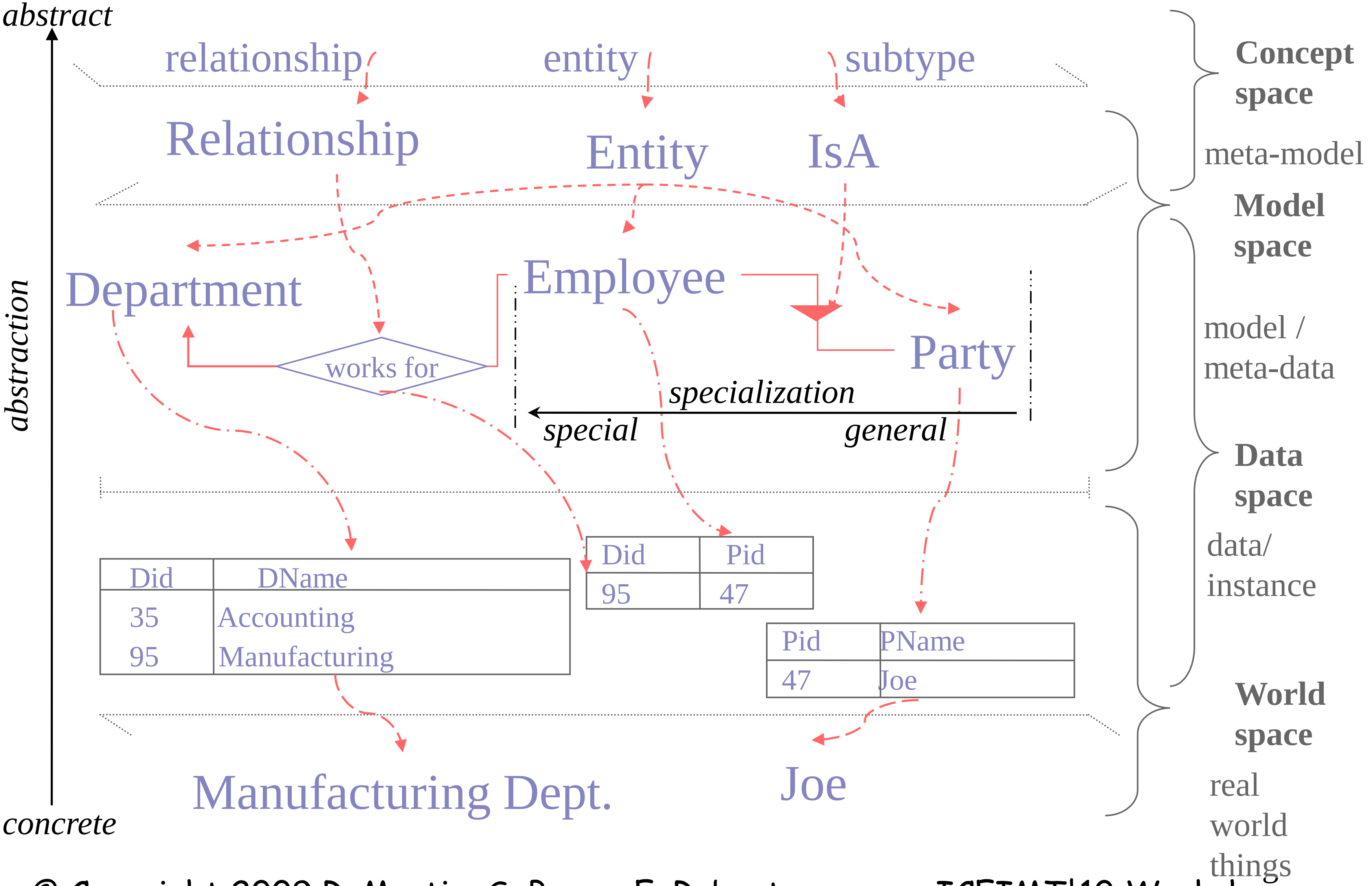
$Do_R \cup Do_A \supseteq Do_C$

(new) Enterprise C

Instantiation

- The fundamental meta- transformation: architecture is an instance of meta-architecture
- Instantiate an architectural model(s) to a particular sub-domain that allows its use for a task during the life cycle phase.

'Meta-' as abstraction



Did	DName
35	Accounting
95	Manufacturing

Did	Pid
95	47

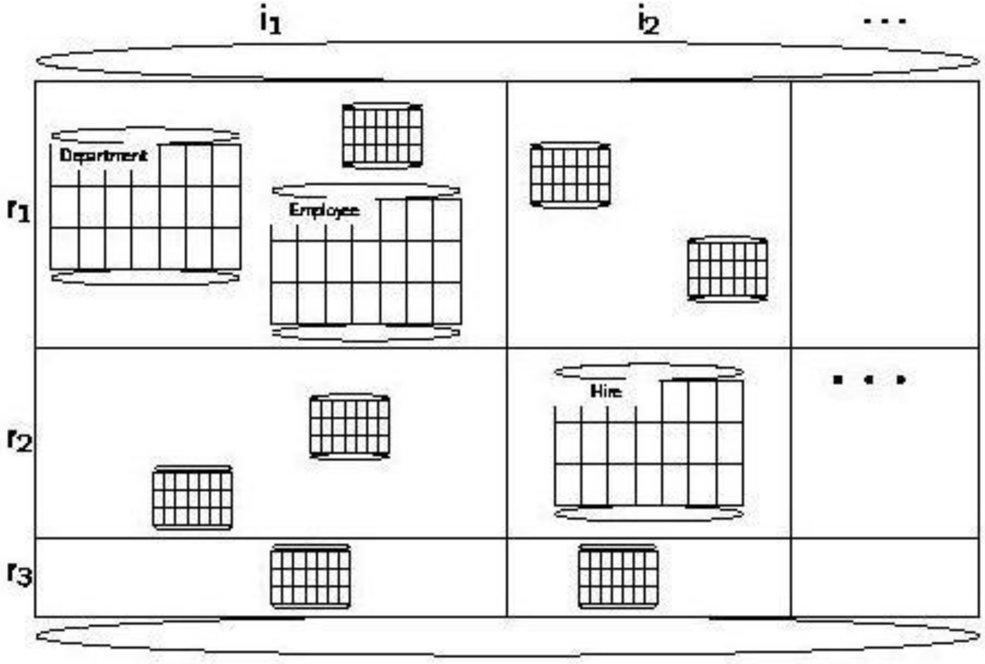
Pid	PName
47	Joe

Specialization

- Specialize an architectural model by adding further attribute definitions and/or domains, e.g., range of permissible values relevant for a task during a life cycle phase.

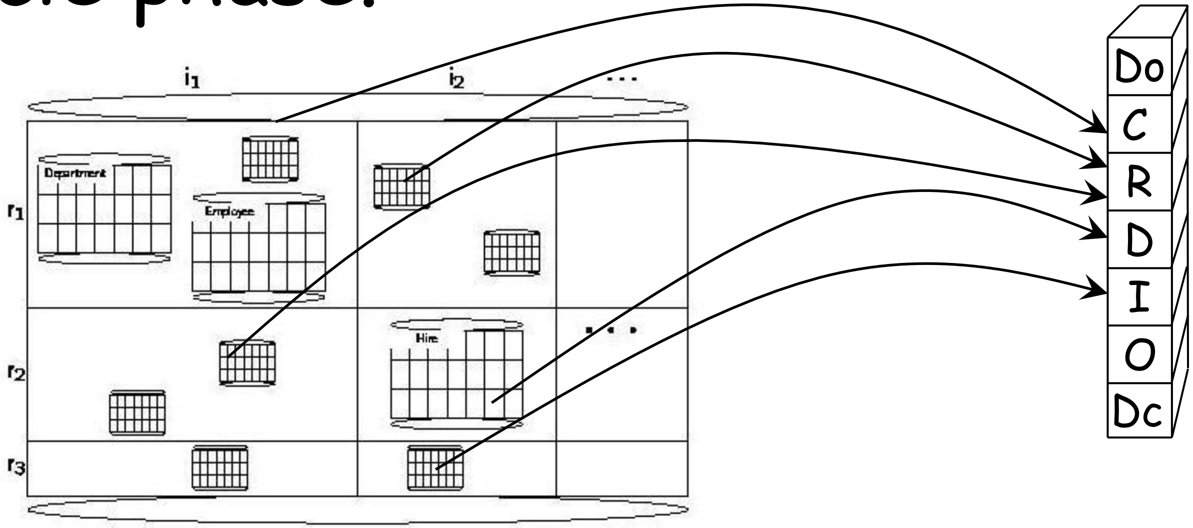
Refinement

- Refine an architectural model by addition of significantly more detail to ensure its use for a task during the life cycle phase.

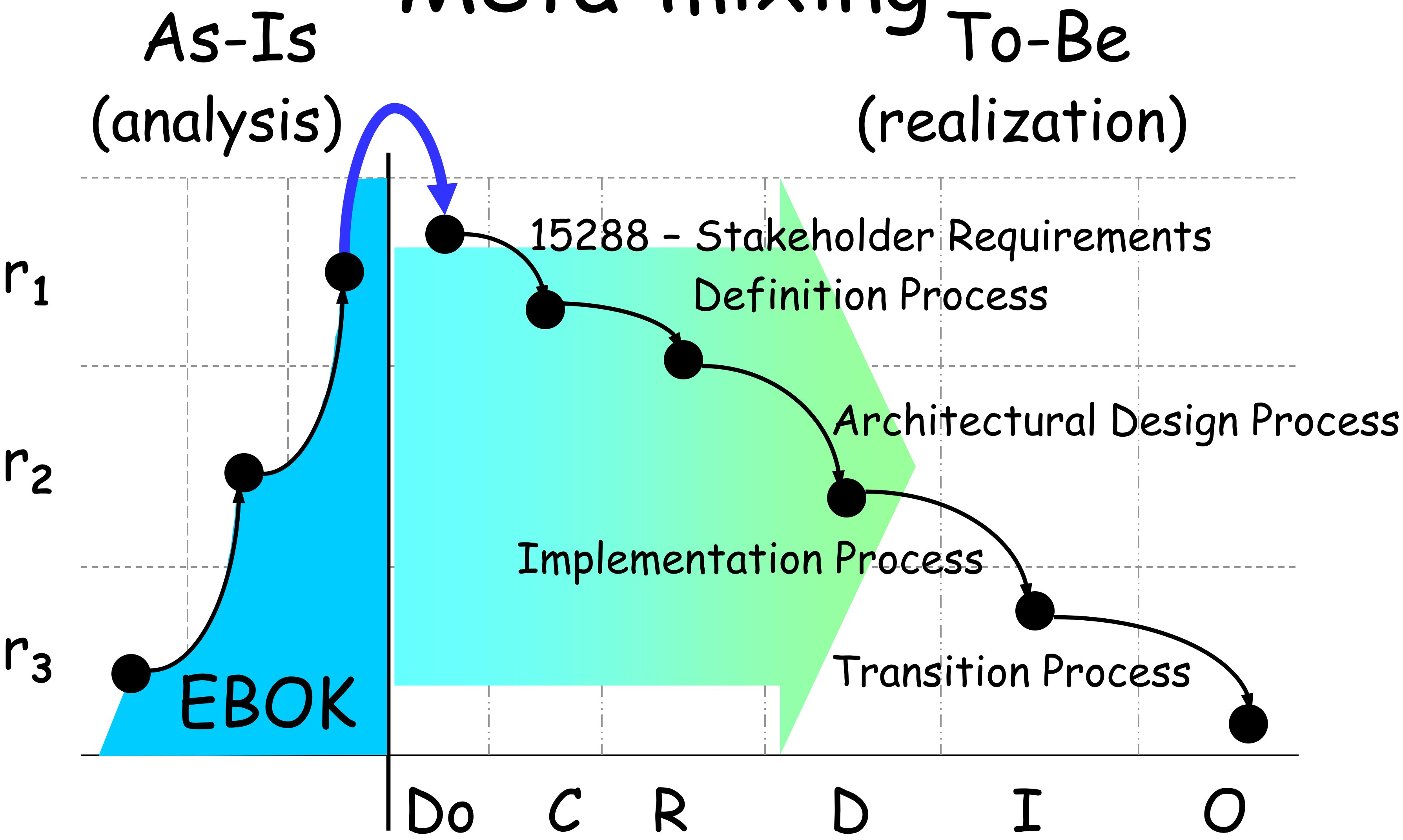


Mapping (other transformations)

- Take elements from different architectural models to satisfy data or decision needs for a task during the life cycle phase.



Meta-mixing


As-Is
(analysis)
To-Be
(realization)
r_1
r_2
r_3
EBOK
15288 – Stakeholder Requirements
Definition Process
Architectural Design Process
Implementation Process
Transition Process
Do
C
R
D
I
O

Discussion