“Meta” Matters

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"Meta" Matters: Overview

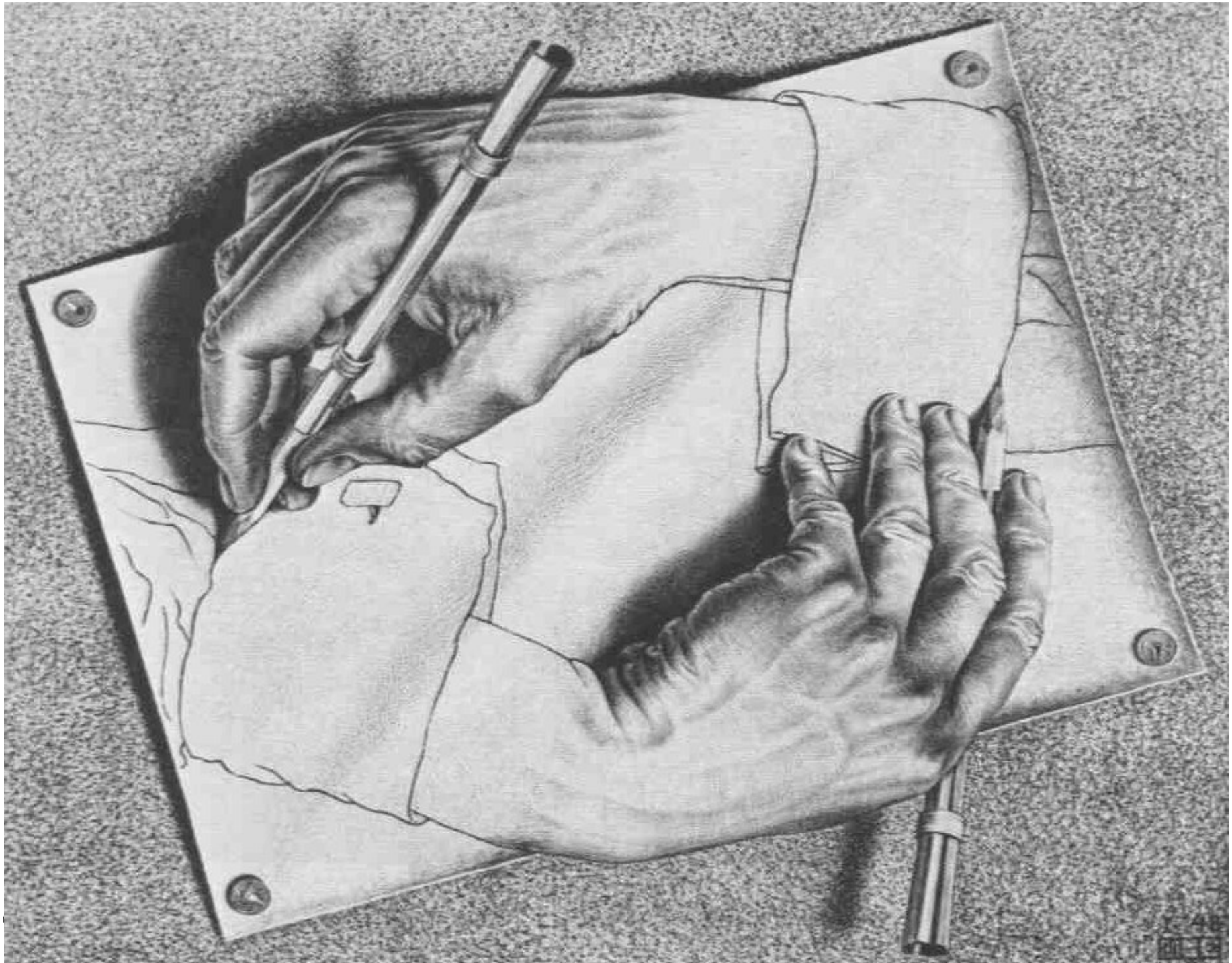
- Reflect upon use and ***misuse of*** *"meta-"*
- Focus on modeling and system architecting
- Consider how standards might help

"Meta-" confusions

- Is a meta-operation
  1) an abstraction of operations or
  2) an operation that does a meta step?
- Use "meta" (in quotes) to distinguish 2) - "meta" as target of study

Meanings of "Meta"

- "Meta-" as used in GIS, Dublin core, *etc.*
- "Meta-" as used in expressing the relationship between classifiers along an abstraction gradient
- "Meta-" as used in describing the phenomenon of self-reference



"Meta"-confusion

- Misunderstanding "meta"
- Confusing various meanings of "meta"
- Modelling at wrong meta-level
- Model confounding two different "meta" directions

Bahill on meta-confusions

"The most common student mistake in modeling that I have observed in four decades of teaching is creating elements at different levels in the same model; for example writing a use case at a high level and a creating a class diagram at a low level."

A. T. BAHILL, F. SZIDAROVSZKY, R. BOTTA and E. D. SMITH, "Valid models require defined levels"

Original meaning

- Greek - "behind" or "after"
- Still used this way in anatomy, as in "metacarpal"
- Metaphysics came after Physics in Aristotle's work
- Hence . . .

Current meaning

- "Beyond, over, transcending"
- From `webster`
  - 3: more comprehensive: transcending <metapsychology> -- used with the name of a discipline to designate a new but related discipline designed to deal critically with the original one <metamathematics>

Sense of "Aboutness"

- Meta-X ~ X-about-X
- Metaphysics is philosophy about philosophy (physics was called 'natural philosophy')
- Meta-data is data-about-data
- Meta-model is model-about-model

Three Distinct Scales

- *Abstraction:* *Abstract* ↔ *Concrete*
  Generalization: General ↔ Specific
  Granularity: Course ↔ Fine
- Abstraction and Generalization both sometimes called "meta-"
  - We restrict to Abstraction
- Granularity seldom called "meta-"

Granularity of System

↘ Segment

↘ Element

↘ Element

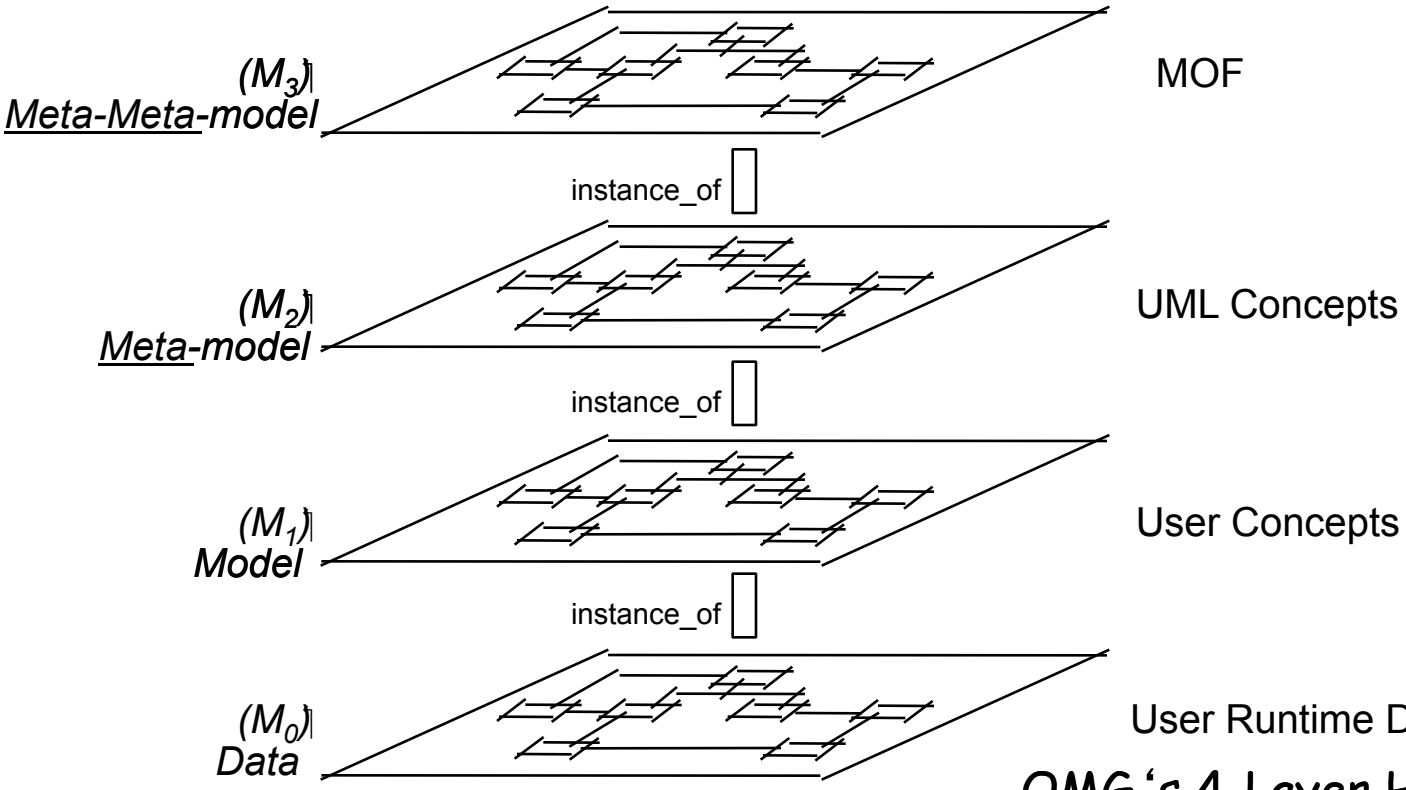
↘ Subsystem

↘ Component

↘ Subassembly

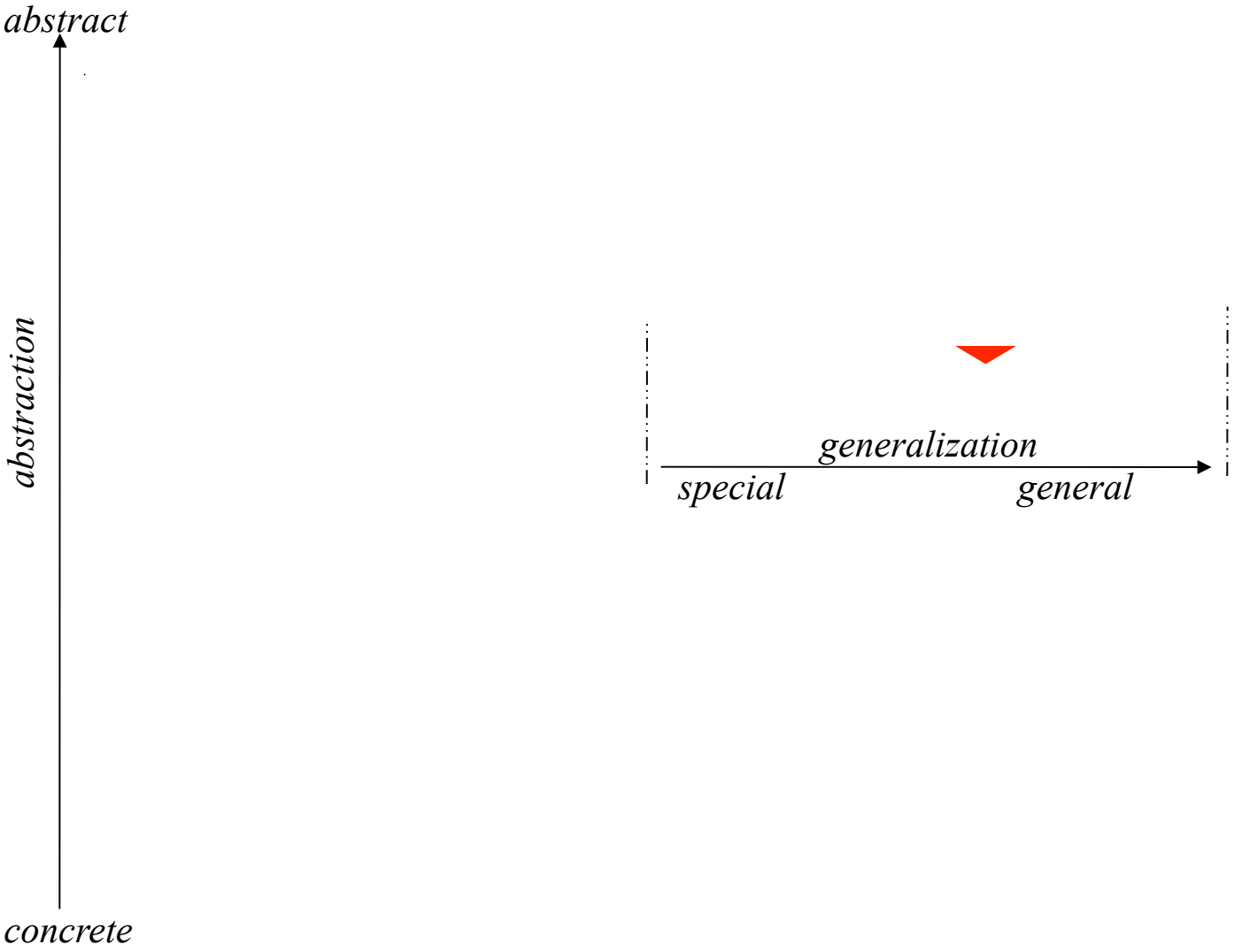
"Meta-" is relative

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

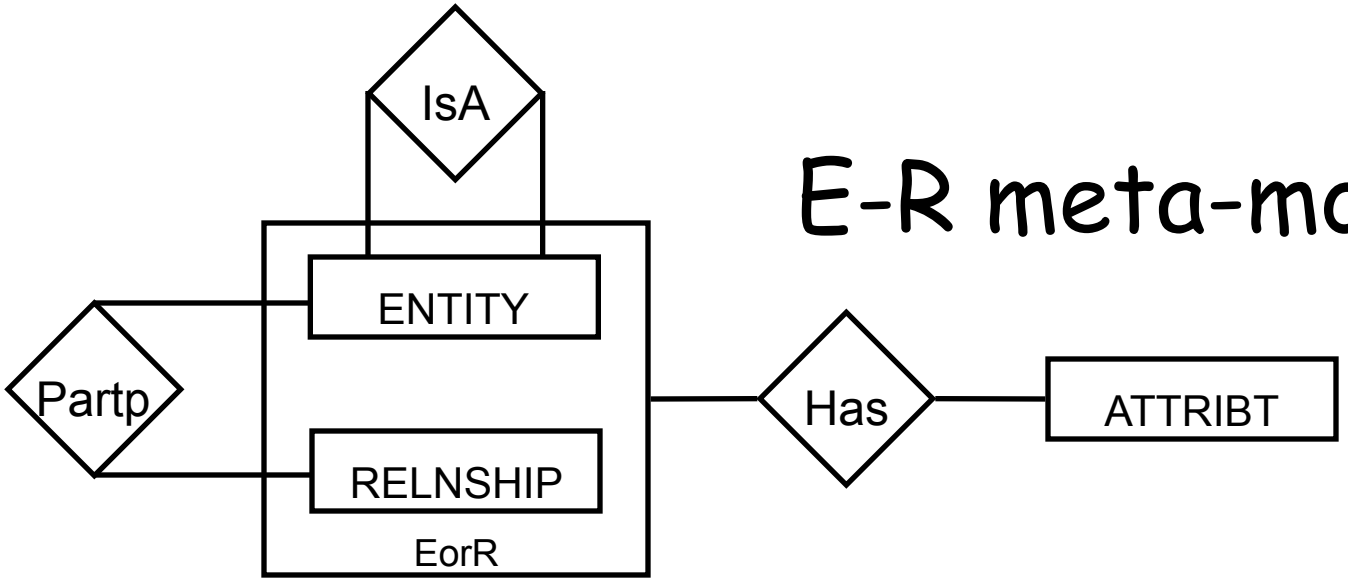


OMG's 4-Layer Hierarchy

‘Meta-’ as abstraction

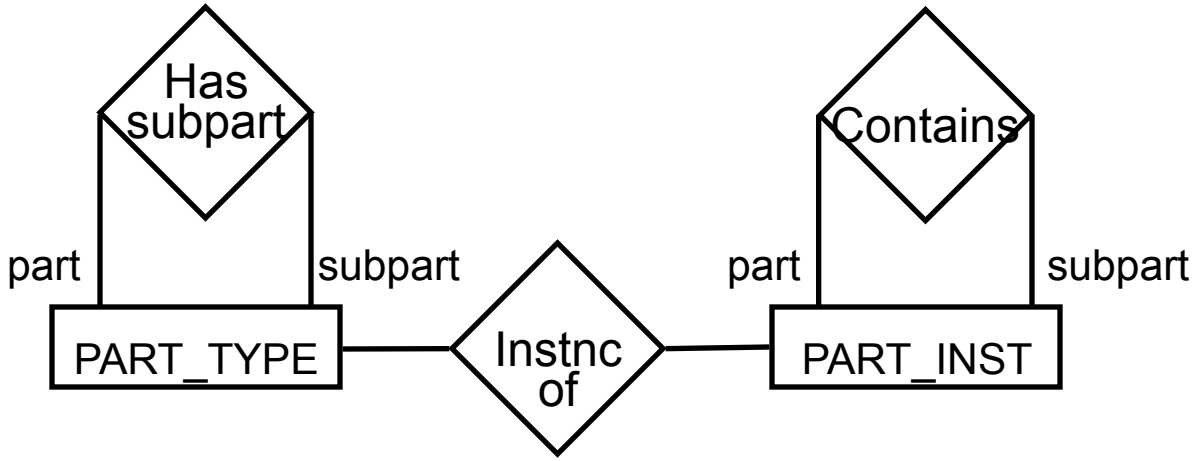


Entity – Relationship Models

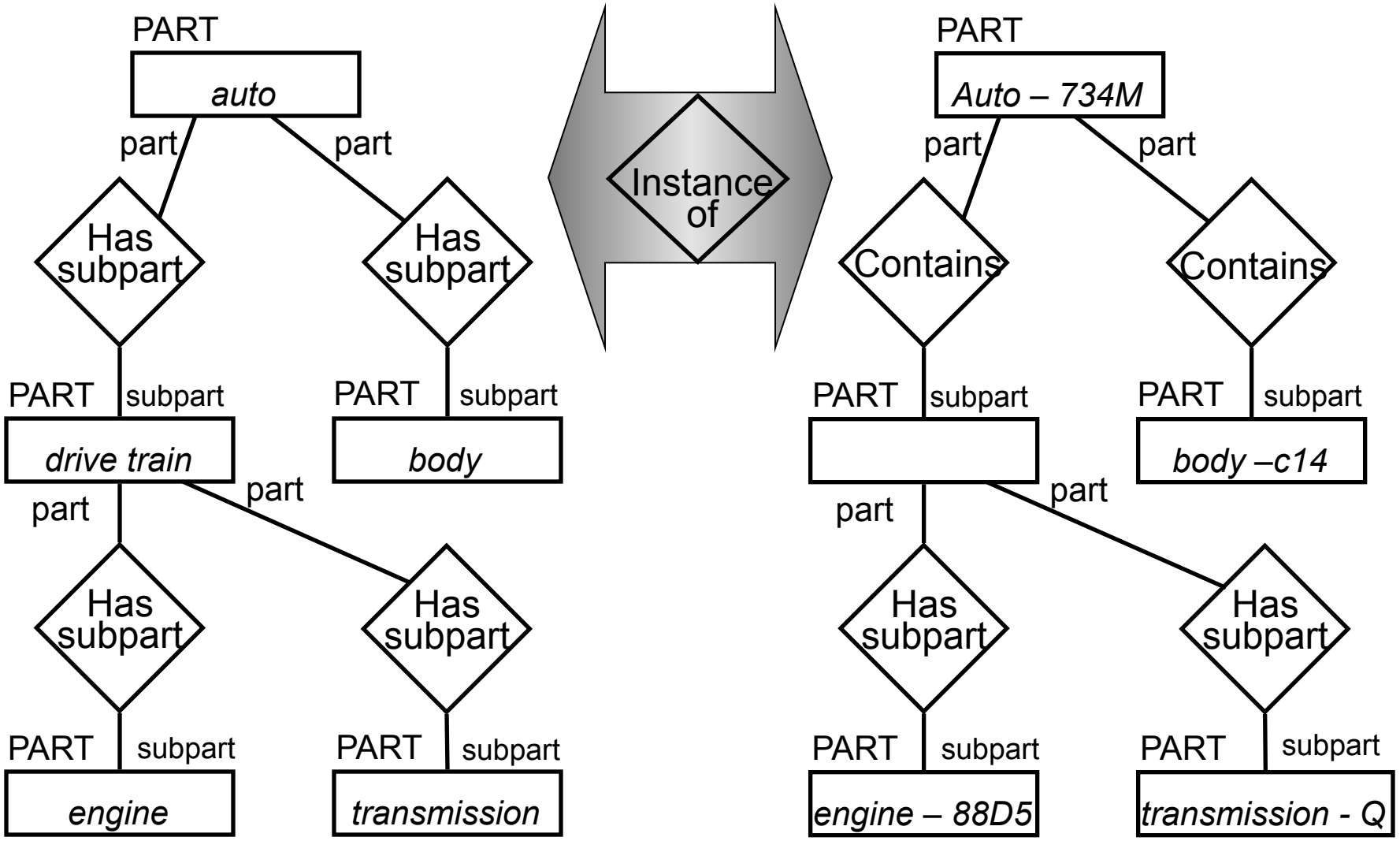


E-R meta-model

E-R model



Instance of model



Meta-data Levels ≈ ANSI/SPARC

"Meta" steps not always parallel

- Data *instantiates* model
  - Data *instantiates* model

Views and Meta-levels

- Views & viewpoints prominent in IS
  - model level – construct, populate
  - instance level – subset, extract
  - ISO 42010 (... architectural description ...)
- Views exist at all meta-levels
- View of structure is meta- with respect to view of data
- Views & viewpoints prominent in IS
- Viewpoints may cross meta-levels
- View updates often cross meta-levels

Views and Meta-levels II

- View definition

  propagate to lower meta-levels
  - View definition
  - best defined at one meta-level, may dimensions

propagate to lower meta-levels

  - should never skew meta-levels
    - should never conflate two “meta-”

"Meta" Failures in Analysis

- Users ignore "meta" boundaries
- Users conflate abstraction and generalization
- Propensity to slip from big issues to details (land use planning slips to my neighbours pig farm)
- Propensity to slip to "meta" levels (ER model with entities for all part types)

"Meta" in Standards

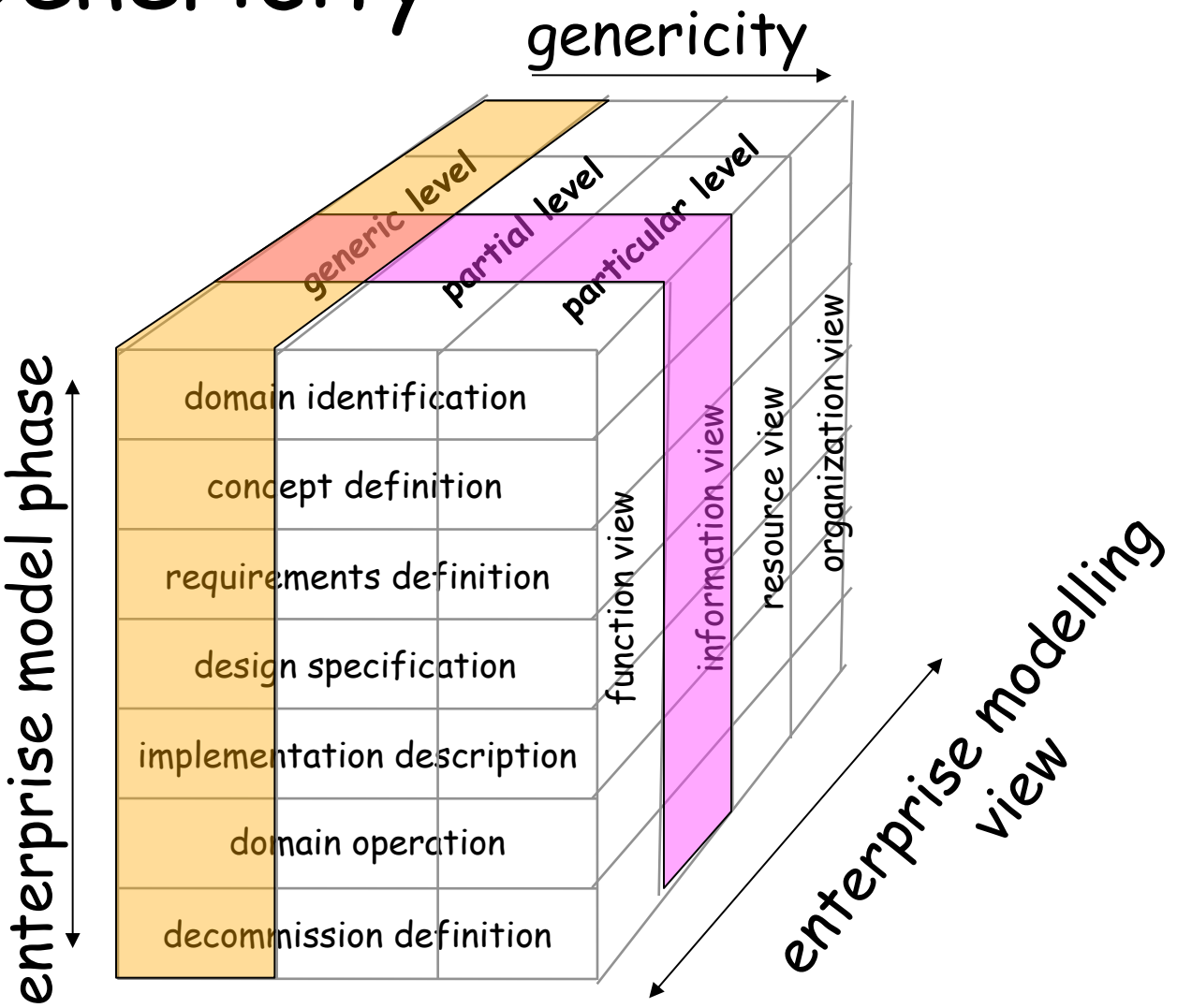
- Understanding "meta" issues clarifies standards
- "Meta" issues addressed in standard norms
- Standards writers must give extra attention to "meta" issue
  - Standards writers are meta-analysts
  - Especially with frameworks as they are already "meta"

Clarify: Framework vs. architecture

- Framework is the architecture of an architecture
- Hence, a framework is a meta-architecture

Clarify: Genericity

ISO 15704



Genericity II

- Orange slice is an architecture
- Hence ISO 15704 is not an enterprise architecture but a framework about architectures
- In other words, ISO 15704 is a meta-framework

Prescriptions for Standards Makers

- Explicit recognition of meta-levels
  - especially where compliance is "meta-" to models
- Standard development often a meta-process
  - INCOSE to ISO: "distinguish life-cycle through which architecting happens from life-cycle of architected system

Prescriptions for Standards Users

- Explicit recognition of meta-levels
  - warning for known "meta" pitfalls
- "Meta-ness" of model content must be consistent

"Meta" summary

- "Meta" an important factor, but one of many, impacting systems architectures
- Must understand these factors and communicate this understanding
- Assistance in developing and promulgating standards always appreciated

"Meta" summary (cont.)

- To create coherent models, the "meta-ness" of model content must be consistent for all scales of elaboration
- The usefulness of models to describe collections of systems is relative to coherence across scales of elaboration
- Standards target different extents of elaboration with architecture standards focusing on the structure and behavior of application domains, including the modelling domain