



## **Architecture Skills: Abstraction**

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- Consultant
  - IT Architecture and Strategy
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  - BA, EA, SOA, programs, implementation, strategy and training
  - 35+ years experience in distributed systems, software and architecture
- Author
  - Selected Orbus White Papers
    - Five Rules for Effective Architecture Models
    - Achieving Coherence in Architecture Models
    - The 7<sup>th</sup> Interrogative
    - Improving your Architecture Skills – Critical Thinking
    - Improving your Architecture Skills – Abstraction
  - IDC CIO Agenda Research – EA for the 3<sup>rd</sup> Platform
  - Books - SOA Applied: Architecture and Design Strategies, 2008, Wiley
- Thought Leadership
  - Business Architecture Guild – VP, Founding Member, BIZBOK, EABOK, BABOK contributor
  - Standards: OMG, The Open Group



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# Agenda

- 10 things an architect does to deliver value
- What is abstraction
- Levels of abstraction
- Tips for achieving abstraction in models
- Abstraction all around us
- Q & A

# What does an Architect do?

- Architecture is a relatively new, and not well defined role
- Many people have an architect title, but aren't really architects
- Some are doing architecture, but don't have the title
- Few people seem to understand the role or skills of an architect
  - Architects themselves
  - Others in IT
- This introduction will illustrate architecture skills from the perspective of a project lifecycle
  - But, does not assume that all architects work in this context
  - Believes that these skills apply to all architecture domains

# What is Architecture?

- Architecture is responsible for achieving commonality across the specific scope (e.g. enterprise) that is required to meet strategy and goals
  
- Architecture consists of:
  - Requirements gathering
  - Determining the overall structure of the 'system'
  - Definition of what must be common for efficiency and consistency
  - Definition of what must be variable for differentiation and competition
  - Definition of how the variable parts fit within the common environment
  - Communications
  - Formal specification and documentation
  - Processes for integrating architecture into enterprise processes (strategy, portfolio management, design, development, procurement)
  - Project assistance (consulting)
  - Governance
  - Measurement, monitoring and improvements
  
- Architecture must achieve three primary goals:
  1. Describe a solution to a specific set of problems and requirements.
  2. Effectively communicate the solution to all stakeholders.
  3. Enable the creation of systems that conform to the architecture.

# Requirements Elicitation and Analysis

## 1. Inquire

- Get to the core of the problem
- Solicit both specific requirements and goals, as well as an understanding of how those requirements fit into a broader context.
- Question assumptions that have been made, explicitly or implicitly.

## 2. Integrate

- Act as a bridge between a given project and how that project fits into the broader context
  - Business domain
  - Enterprise concerns
  - Industry standards
  - Established patterns
  - Best practices

## 3. Analyze

- Answers three architectural questions:
  1. What are the key elements of the problem or solution?
  2. What are the relationships between them?
  3. How do they combine together to meet requirements and provide value higher up?

# Solution Creation and Specification

## 4. Conceptualize

- Create a conceptual vision of the overall, integrated solution.
- The conceptual architecture serves to communicate the overall concepts to a broad audience.

## 5. Abstract

- Communicate the key details to specific audiences through the use of architectural viewpoints.
- Abstraction can be defined as the suppression of irrelevant detail.
- Within each perspective, the viewpoint will also be presented in different levels of abstraction, often referred to as “conceptual, logical and physical” architectures.

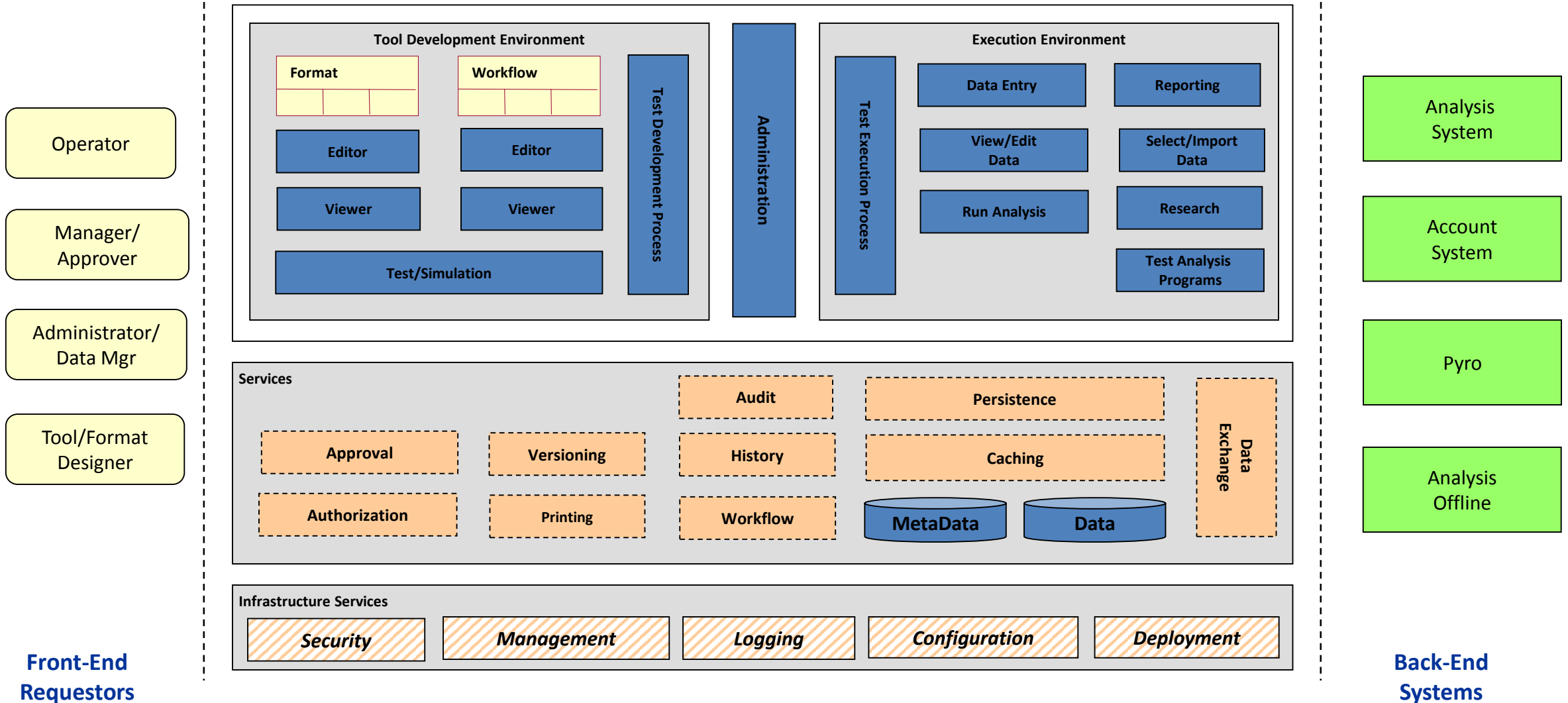
## 6. Visualize

- Create visual renditions of the different abstractions and viewpoints
- Drawings and Models

## 7. Formalize

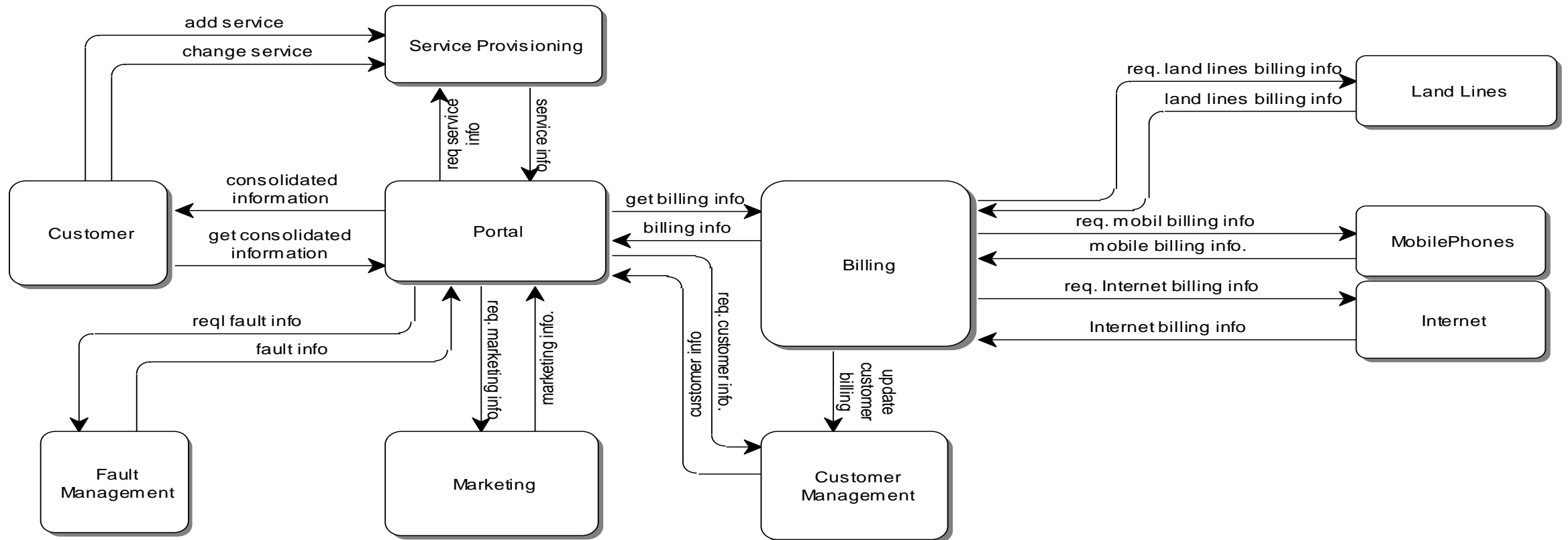
- Unambiguously communicate the details of the architecture specification.
- A complete and precise model, expressed in industry standard notation, may often be preferred to a document because a formal model can be implemented and enforced within a modeling tool or design framework.

# Pharma Conceptual Architecture



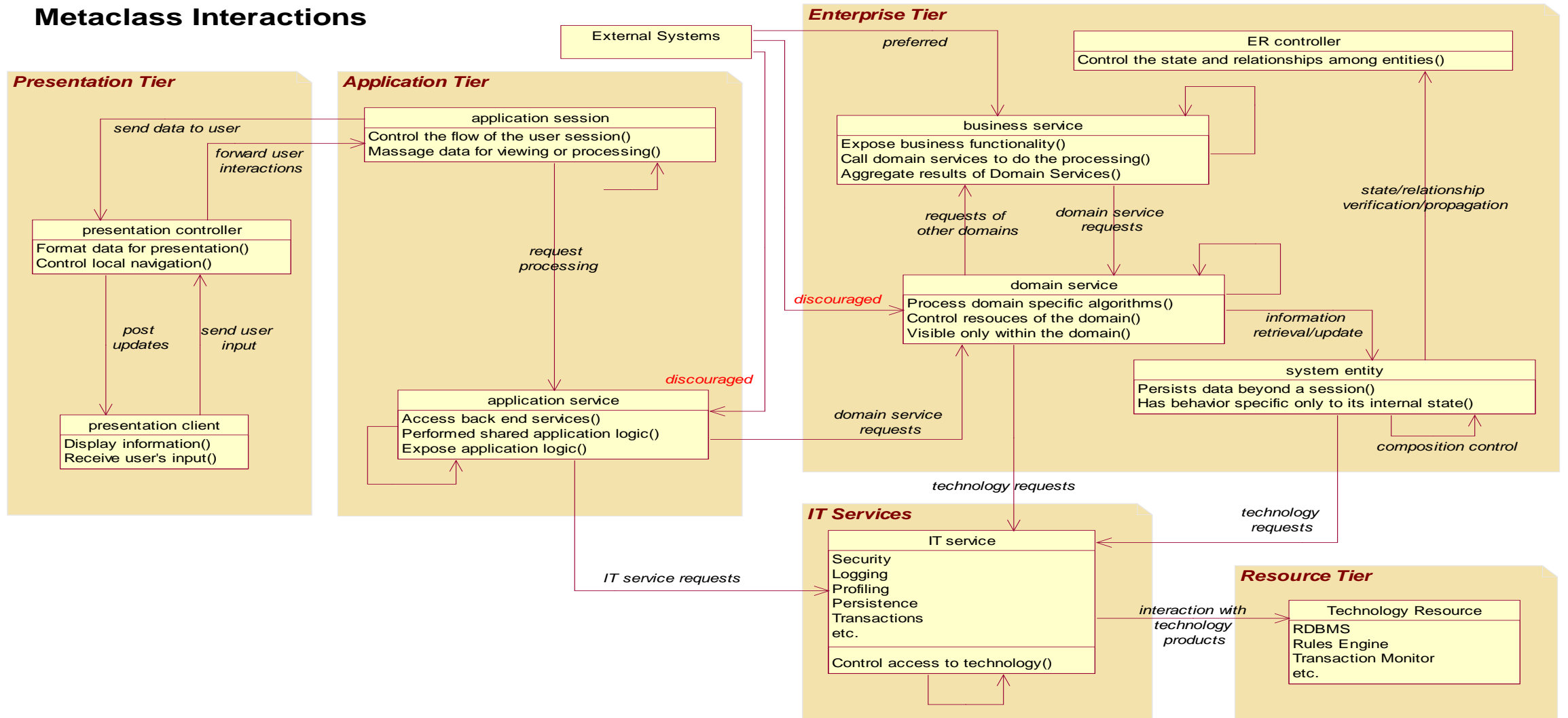


# Abstraction -- Business Context Diagram



# Formal Reference Architecture

## Metaclass Interactions



# Architectural Influence

## 8. Communicate

- The most important aspect of an architect's job
- After establishing and formalizing a solution, architects communicate that solution and value throughout the organization

## 9. Enable

- The equation for architecture value is actually pretty straightforward
  - If using architecture will make someone's job easier, they'll use it
  - If it adds extra steps without adding extra value, it will be ignored
- The key to architectural influence depends on the extent to which architects enable the target audience to easily use the architecture

## 10. Assist

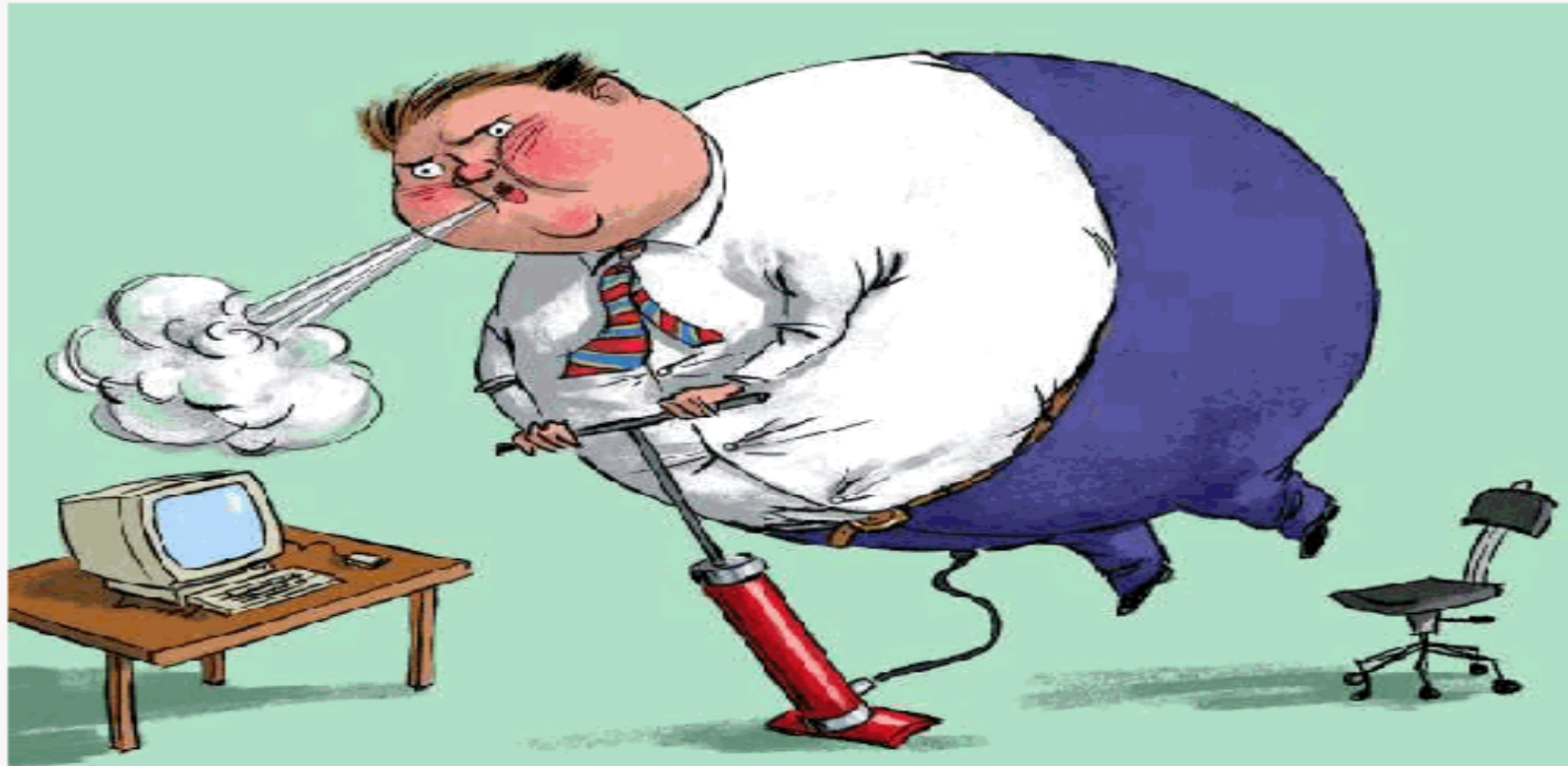
- The single most important activity an architect can do to make their architecture real.
- Actively assist projects in using it
- But, remember your role is to *assist*

# This Isn't You...

Sunday, December 03, 2006

## Architects who don't code...

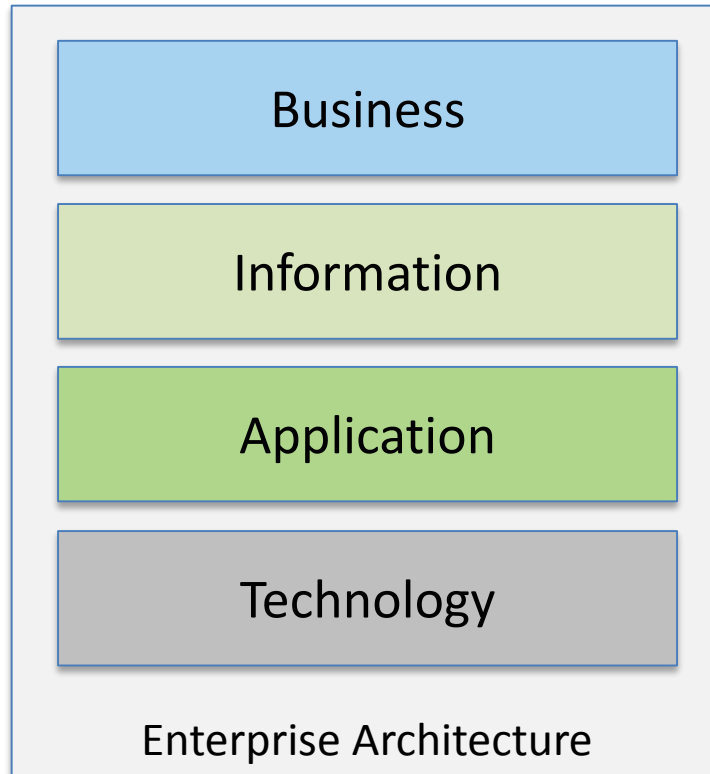
How can someone who never writes a line of code be responsible for how that code will be written?...



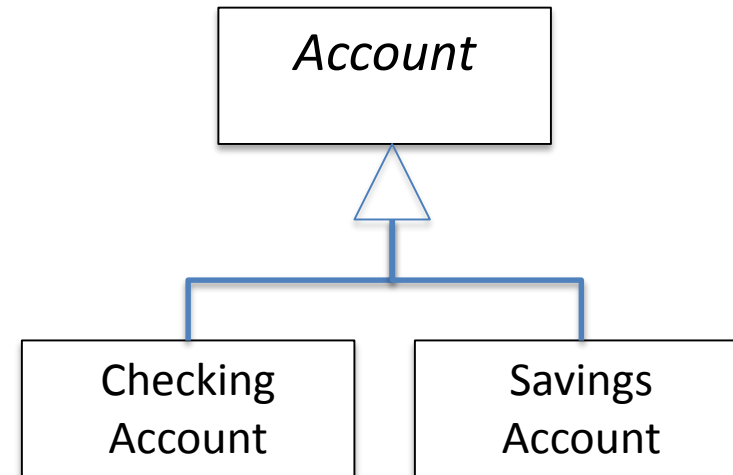
# Abstraction *(from Wikipedia)*

- Abstraction is a process or result of generalization, removal of properties, or distancing of ideas from objects.
  
- This may refer in particular to one of the following:
  - Abstraction (computer science), a process of hiding details of implementation in programs and data
    - Abstraction layers, an application of abstraction in computing
    - Hardware abstraction, an abstraction layer on top of hardware
  - Abstraction (linguistics)
  - Abstraction (mathematics), a process of removing the dependence of a mathematical concept on real-world objects
    - Lambda abstraction, a kind of term in lambda calculus
  - Abstraction (sociology), a process of considering sociological concepts at a more theoretical level
  
- **Abstraction** may also refer to:
  - Abstract art, a movement in 20th-century Western art

# Abstraction Examples



*Partition*



*Subtype*

# Abstraction Principles

Source content quoted from:

Antonelli, A. (2011) *“The Abstraction Mystique”* [slidedeck, slide 3] UC Davis

- The notion of a “classifier” is known from descriptive set theory:
- Definition:  
If  $R$  is an equivalence relation over a set  $X$ , a *classifier* for  $R$  is a function  $f: X \rightarrow Y$  such that  $f(x) = f(y) \leftrightarrow R(x, y)$
- An *abstraction operator* is a classifier  $f$  for the specific case in with  $X = P(Y)$ , i.e., an assignment of first-order objects to “predicates” (subsets of the first-order domain), which is governed by the given equivalence relation.
- Abstraction operators are particular functional terms that take predicates (“concepts,” in Frege’s sense) as input. The statement that an operator  $f$  assigns objects to concepts according to an equivalence  $R$  is called an *abstraction principle*:

$$f(X) = f(Y) \leftrightarrow R(X, Y)$$

# Why Abstraction?

Source content quoted from:

Antonelli, A. (2011) “*The Abstraction Mystique*” [slidedeck, slide 4] UC Davis

- Philosophers often view abstraction principles as the preferred vehicle for the delivery of a special kind of objects – *abstract entities* – whose somewhat mysterious nature includes such properties as non-spatio-temporal existence and casual inefficacy.
- One particular abstraction principle, known as *Hume’s Principle* (HP) plays a crucial role in the neo-Fregean program initiated by Crispin Wright and Bob Hale.
- HP assigns objects to concepts on the basis of the *equinumerosity* relation  $\approx$  between concepts:

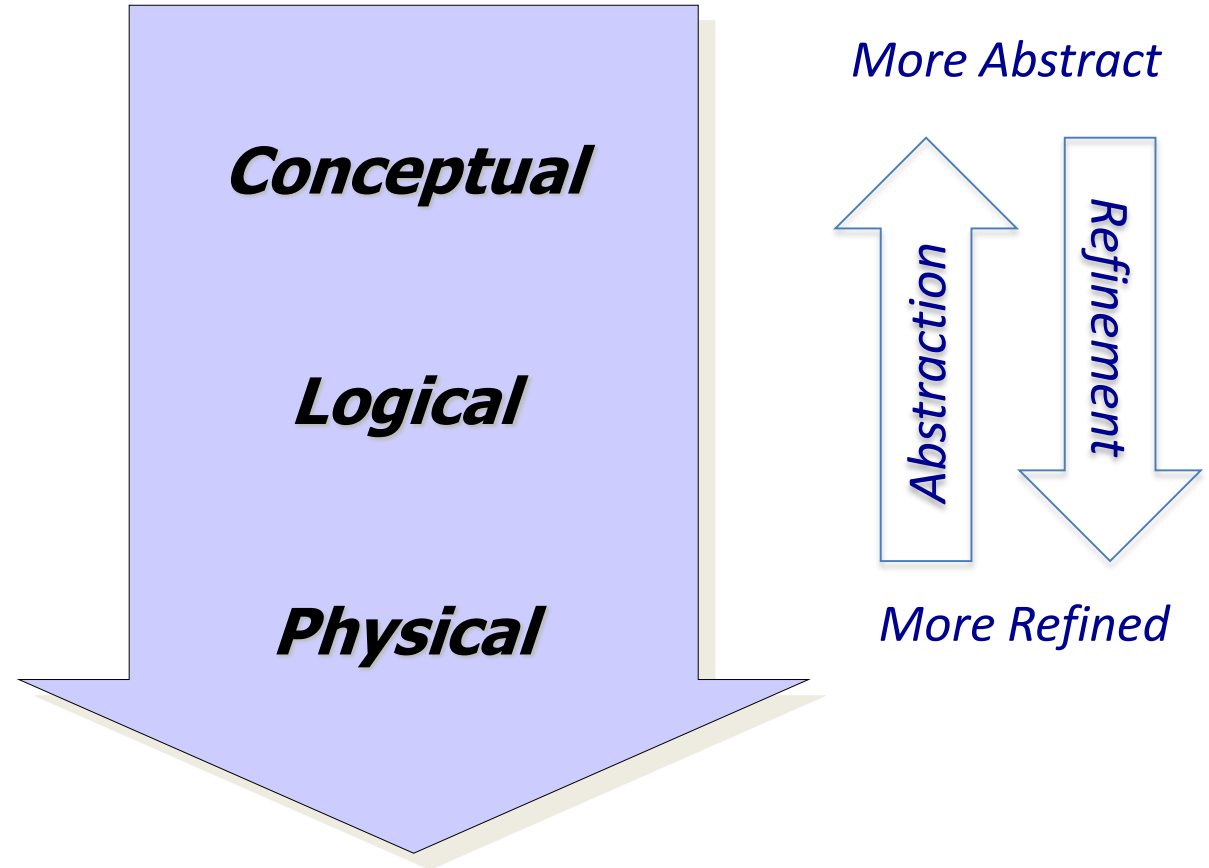
$$N(X) = N(Y) \leftrightarrow X \approx Y$$

- Where the object  $N(X)$  assigned to  $X$  is interpreted as “the number of  $X$ ,” and HP is variously advertised as being *logically true*, *analytic*, or *constitutive* of the notion of number.

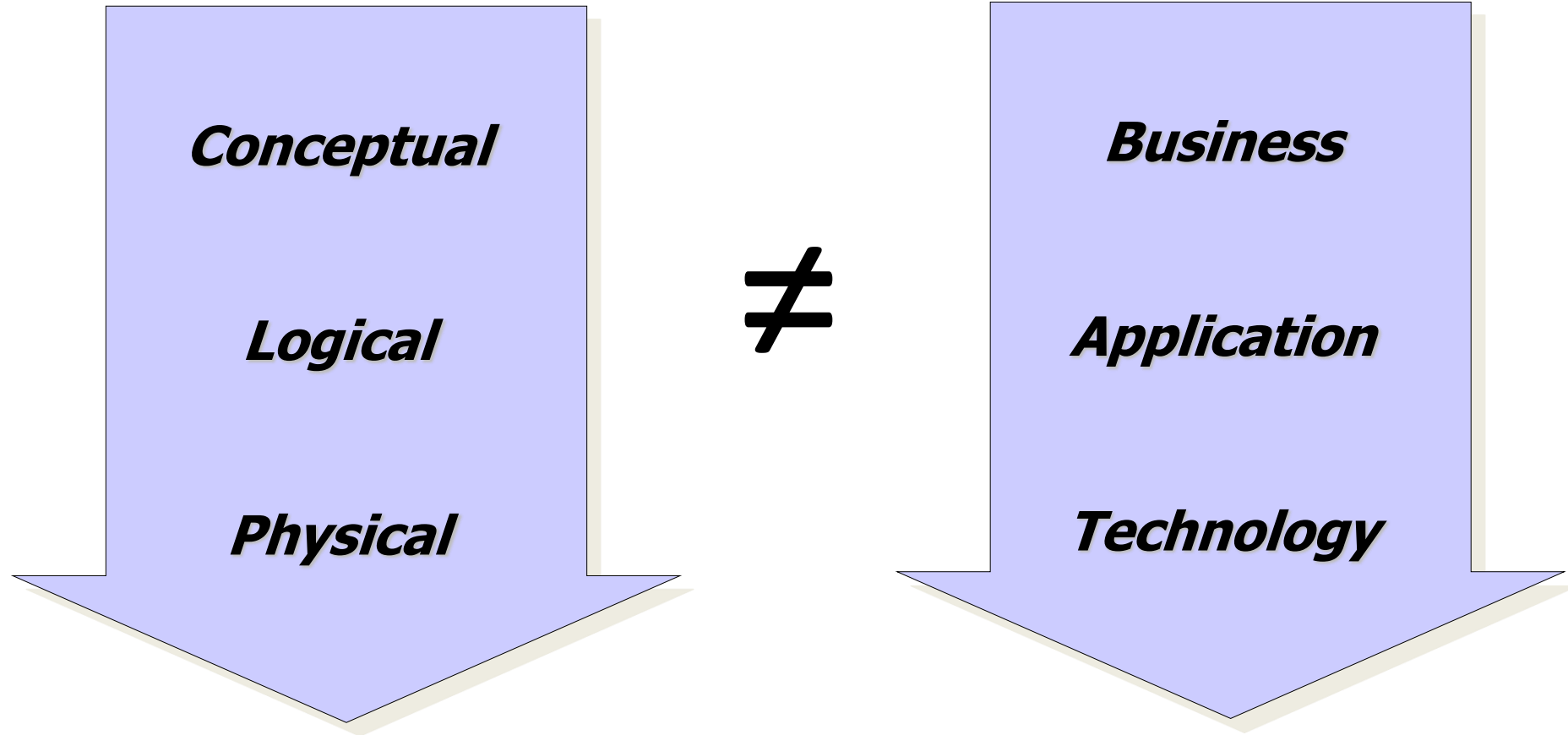


# Levels of Abstraction

- **Abstraction** — the suppression of irrelevant detail
  - “Irrelevant” is respective to the intended audience
- **Refinement** — the addition of specific detail
  - We choose which specific details to include based on separation of concerns



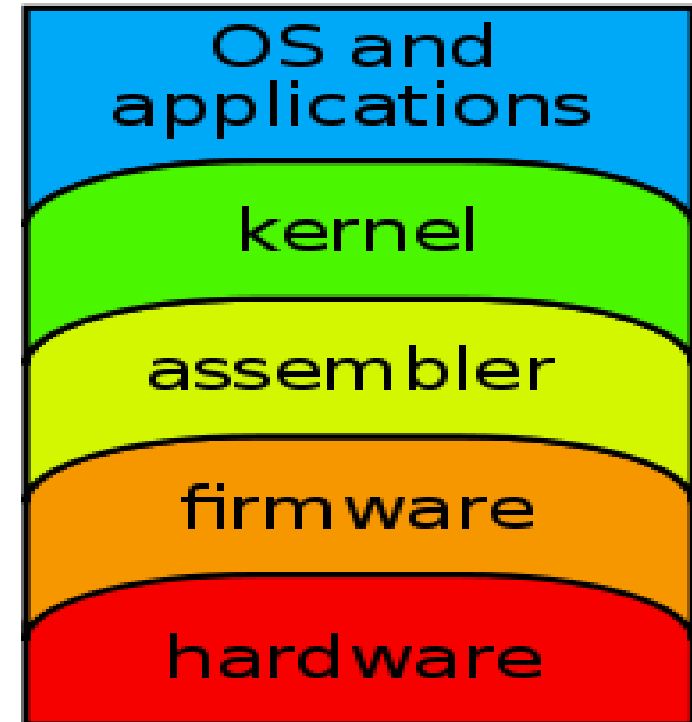
# Don't Confuse Domains and Abstraction



# Typical Computer Abstraction

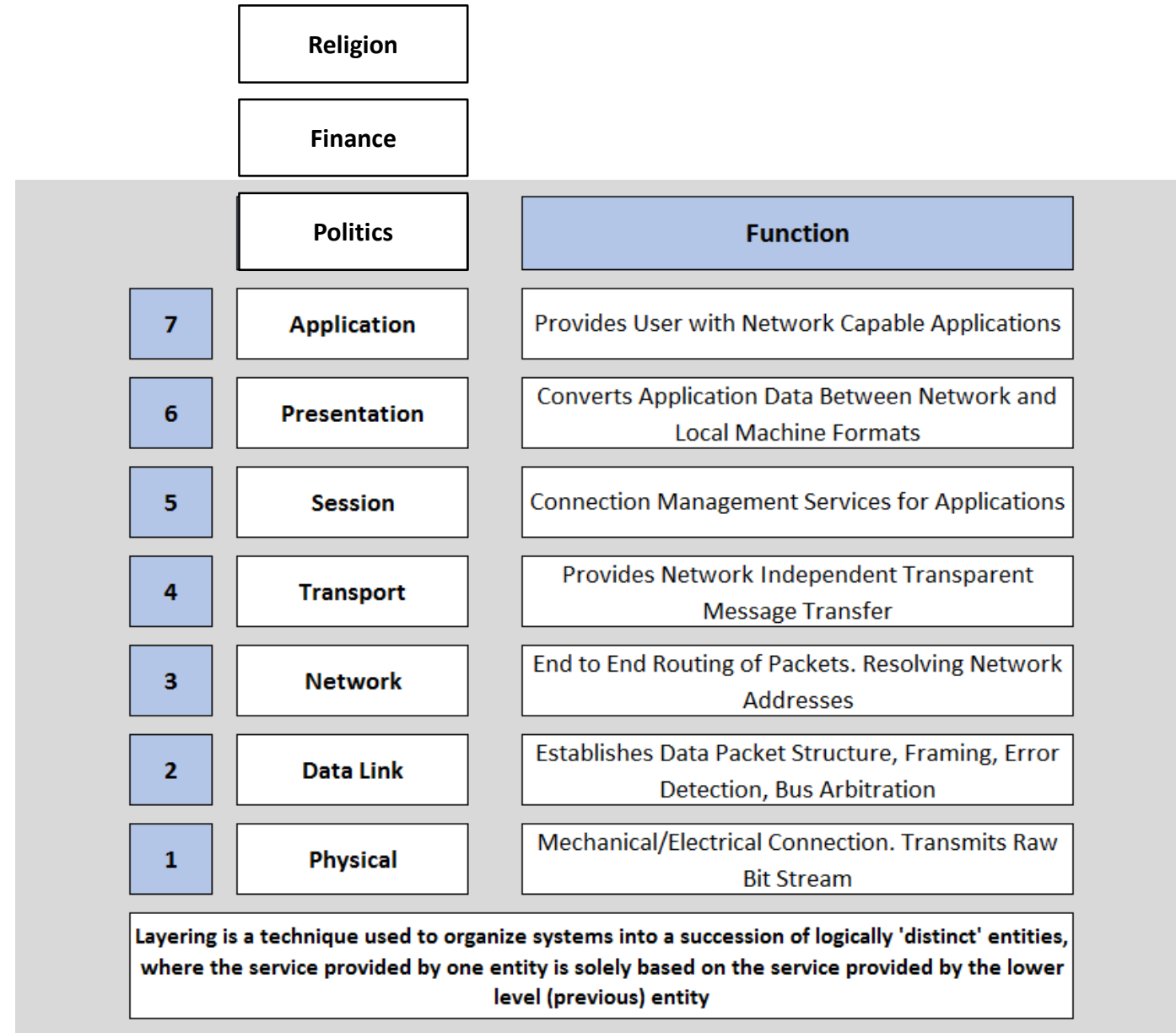
- An **abstraction layer** or abstraction level, or a layer of abstraction is a way of hiding the implementation details of a particular set of functionality. Software models that use layers of abstraction include the OSI 7-layer model for computer network protocols...

*(from Wikipedia)*



# ISO Open System Interconnection (OSI) 7 Layer Model

- OSI is hierarchical structure of seven layers
- Abstract model
- Divides host-to-host networking, traditionally called internetworking, into layers
- Layers 1-4 are concerned with the flow of data from end to end through the network
- Layers 5-7 are concerned with services to the applications

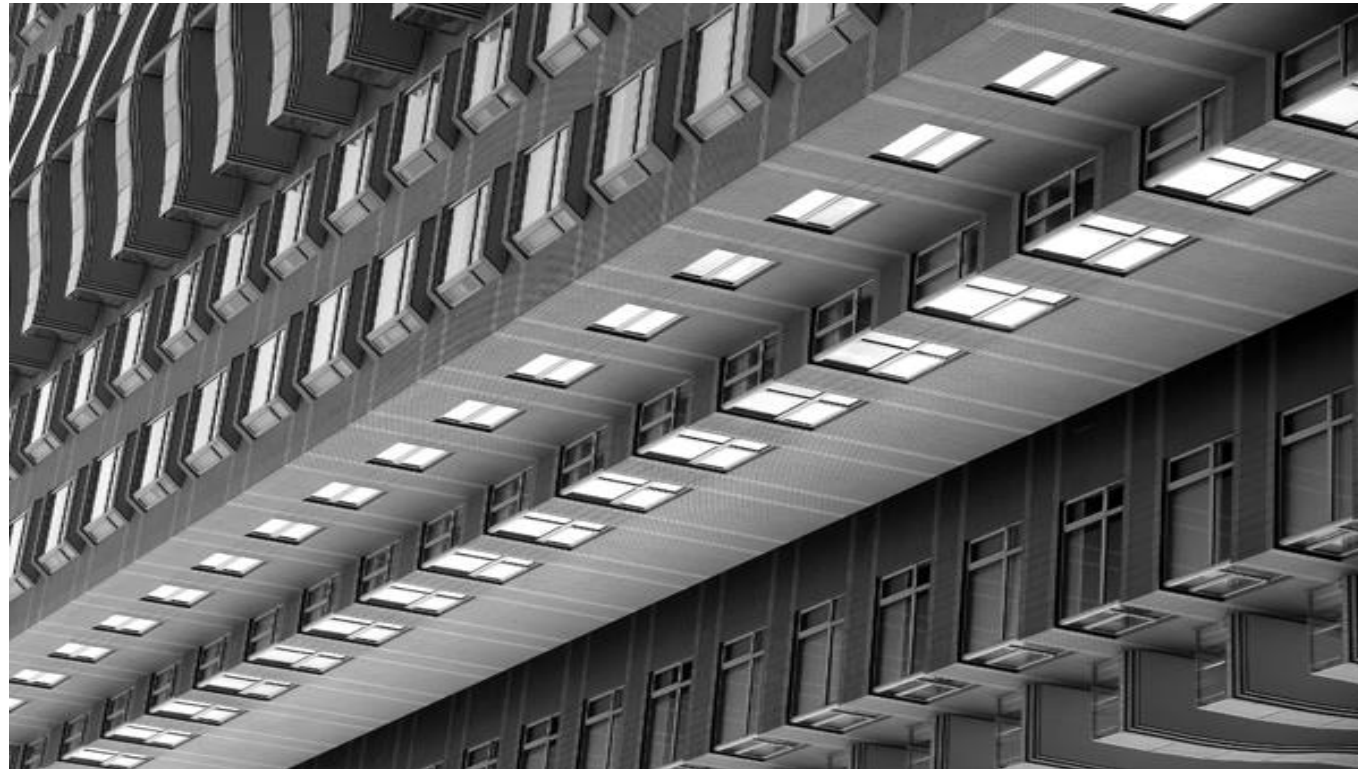


# 5 Tips for Better Abstract Architecture

Photo credit:

<http://photo.tutsplus.com/articles/inspiration/80-amazing-abstract-architecture-shots-and-how-to-shoot-your-own/>

## Tip 1: Find the Fantasy



*What are the fundamental elements and relationships?*

# 5 Tips for Better Abstract Architecture

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## Tip 2: Master Symmetry



*A good model must be clear and easily understandable*

# 5 Tips for Better Abstract Architecture

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## Tip 3: Look Up



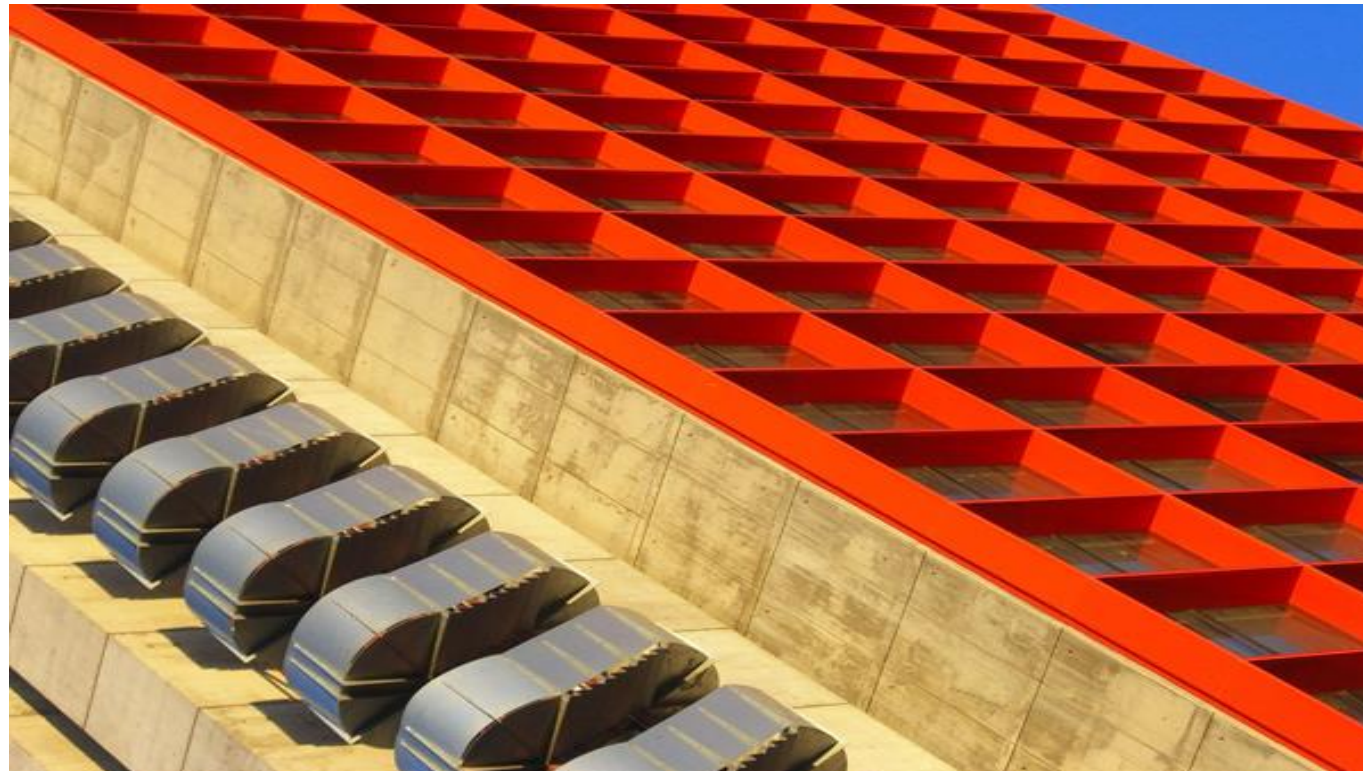
*Capture the view of the big picture, put things in context*

# 5 Tips for Better Abstract Architecture

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## Tip 4: Twist the Camera



*Explore different perspectives to capture the right elements and relationships*



# 5 Tips for Better Abstract Architecture

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## Tip 5: Lighting is Everything



*The diagram must appeal to the stakeholder and highlight their viewpoint*

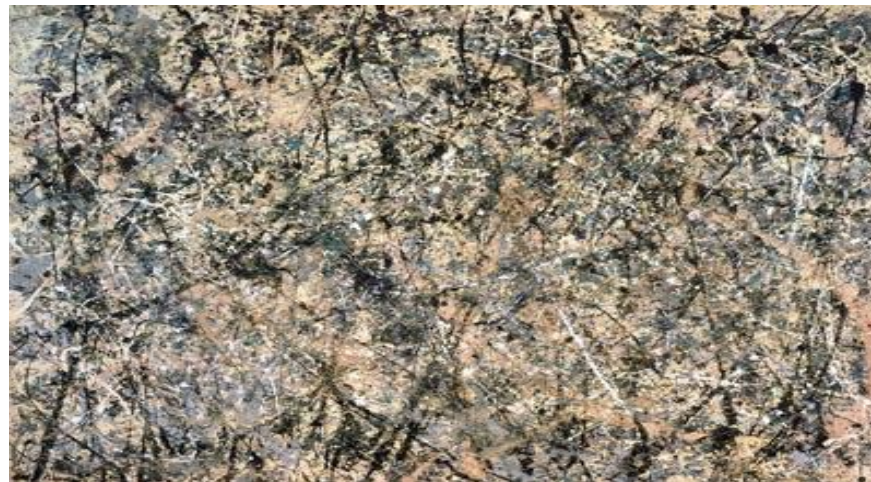
# Abstract Art



"Water Lilies (The Clouds)" [1903] by Claude Monet



Blue #1" [2000] by Harley Hahn



"Lavender Mist" [1950] by Jackson Pollock

# Understanding Abstract Art

- To truly appreciate a work of art, you need to see it as more than a single, isolated creation: there must be context
  
- Every painting is created within a particular environment, and if you do not understand that environment, you will not be able to appreciate what the artist has to offer you
  
- So, the fundamental principles of abstraction apply:
  - Target a stakeholder's view
  - Highlight important elements
  - Suppress unimportant elements
  - Have a consistent level of detail

# Food for Thought

- Do you see how abstraction is key to creating appropriate and effective models?
- Can you recognize abstraction all around you?
- Can you see where the concepts and skills discussed here are a useful foundation for architecture?

# Any Questions?



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