



# Managing Requirements within the Context of Architecture: Logical Architecture and Functional Requirements

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Rockwell Collins

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Collins**

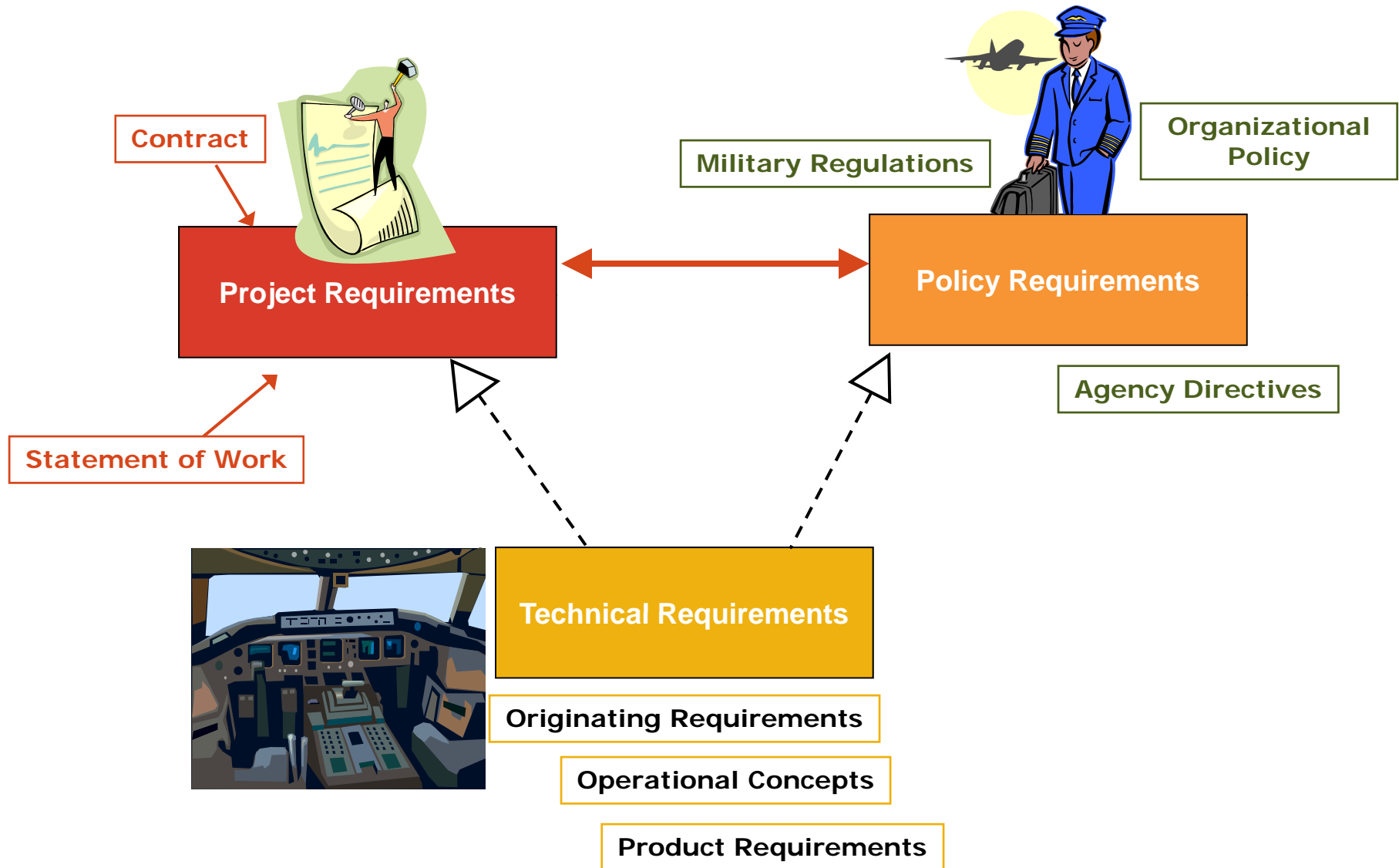


## Objectives

- Materials extracted from course “Requirements Analysis & Design”
- Understand ‘product requirements’ classification and derivation.
- Understand why we define product requirements and solution architecture
- Understand ‘requirements’ and ‘design’ and their complementary natures.
- Describe the relationship between functional requirements and functions or activities.
- Apply basic logical architectural diagramming concepts.
- Apply an effective structure for organizing functional requirements.



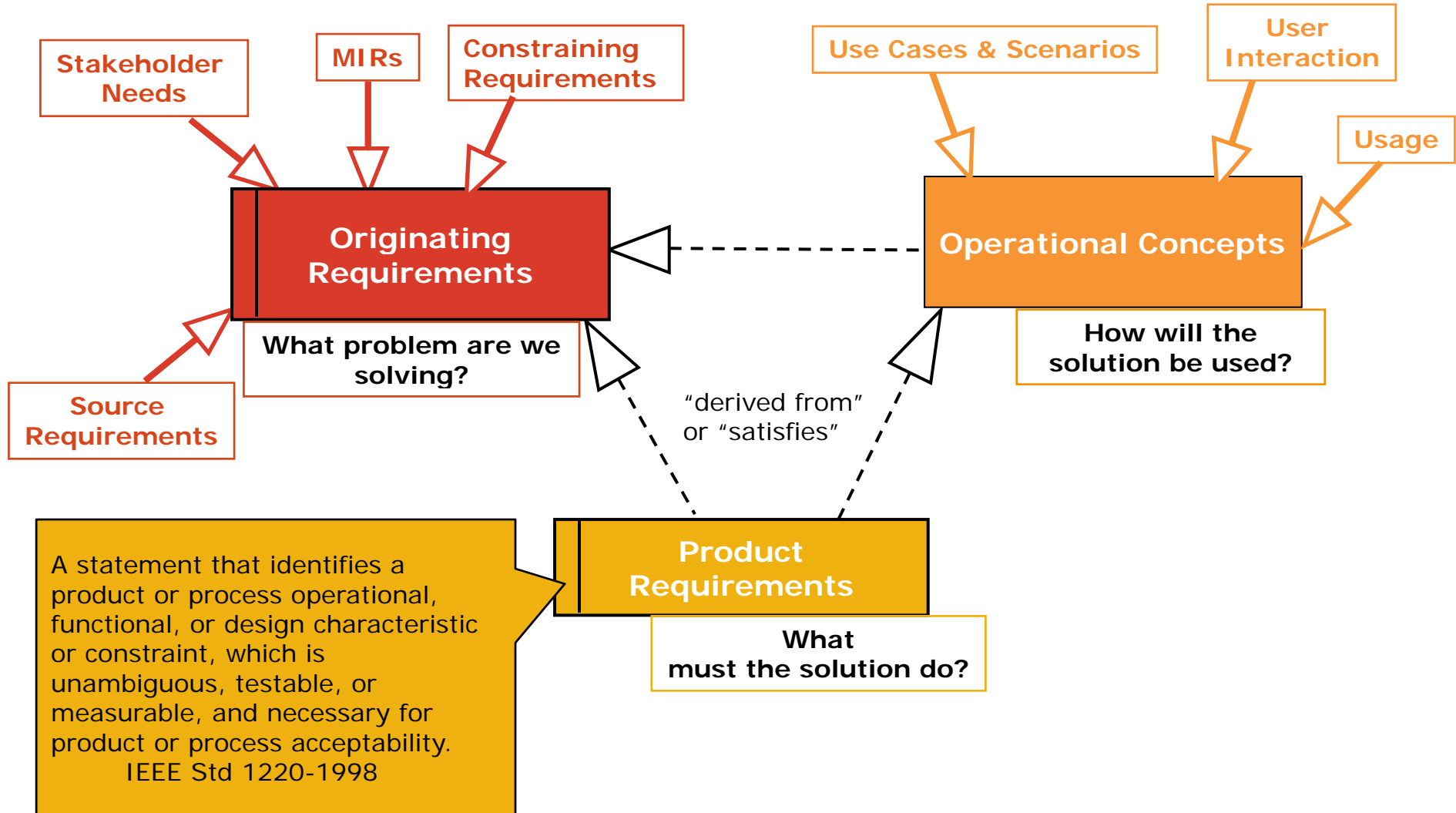
# Categories of Requirements





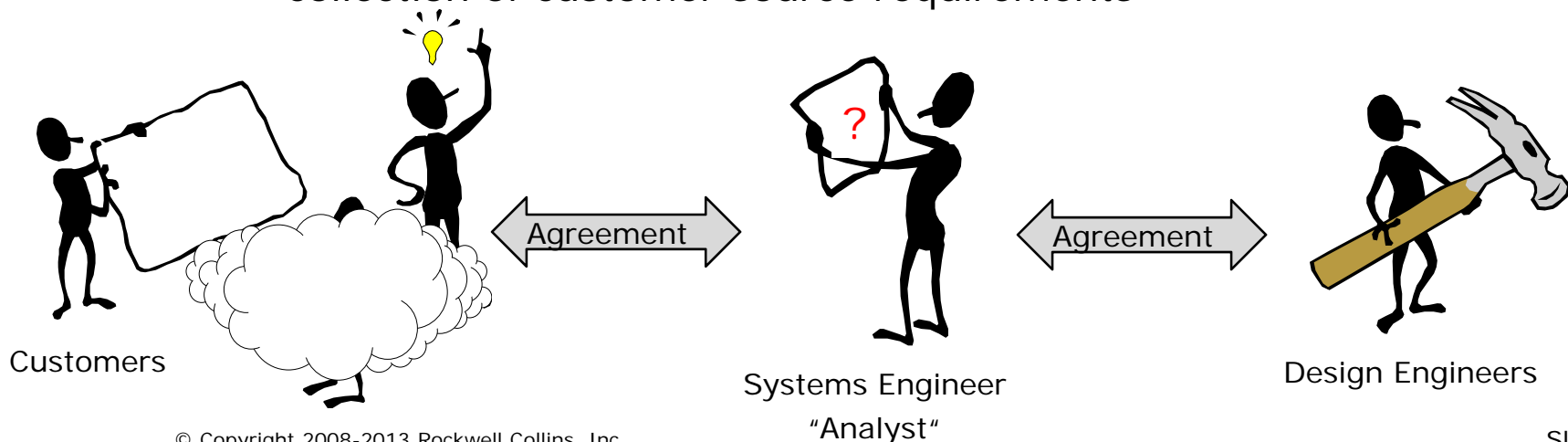
# Technical Requirements

Technical Requirements



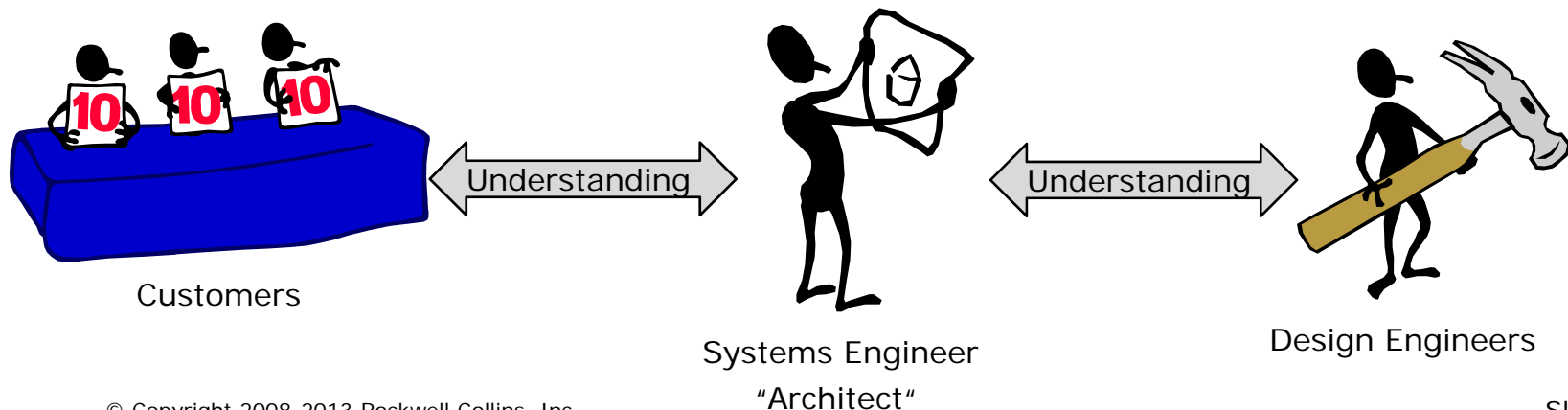
## Why Define Product Requirements?

- Product requirements...
  - Define the thing to be built – what are its expected capabilities & characteristics?
  - Establishes an agreement/ understanding between you and your customer about the definition of your product
  - Establishes an agreement/ understanding between you and your design team about the definition of your product
  - Defines the basis for product verification
  - Reconciles your product definition (or product family) with a diverse collection of customer source requirements



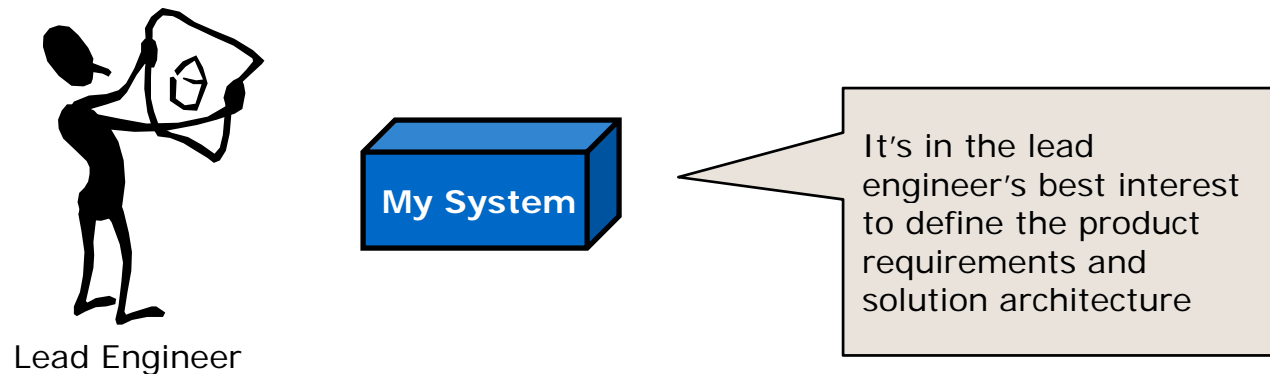
## Why Define Solution Architecture & Design?

- Solution Architecture...
  - Establishes the vision of the product solution – what are we building?
  - Assigns project participants to individual components – who is responsible for what parts?
    - Divide and conquer
    - Ownership and control
  - Bounds the context of each individual component – how does it fit into the greater whole?
  - Establishes common understanding of the solution to be created



## Who Defines Product Requirements and Solution Architecture?

- Commonly – systems engineers
  - Or any engineer on the project team serving in the role
    - Analyst – expose the problem statement – what should be built?
    - Architect – expose the solution space – how are we going to build it



- A lead engineer or any engineer assigned "ownership" of a product item

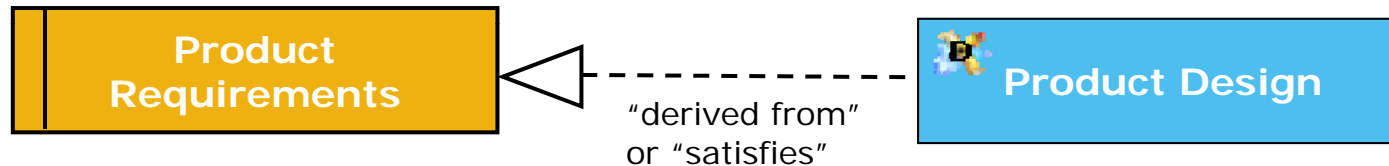
# Understanding Requirements & Design

- **Product Requirements**

- Express boundaries of the problem statement (**what**)
  - Capability
  - Behavior
  - Characteristics
  - Performance
  - Quality

- **Product Design**

- Define the solution to the problem (**how**)
  - Form
  - Structure
  - Composition
  - Relationships
  - Interaction



**Myth?**

"One product's design becomes another product's requirement."



**Truth?**

"One product's design provides the context and constraints for another product's requirements."

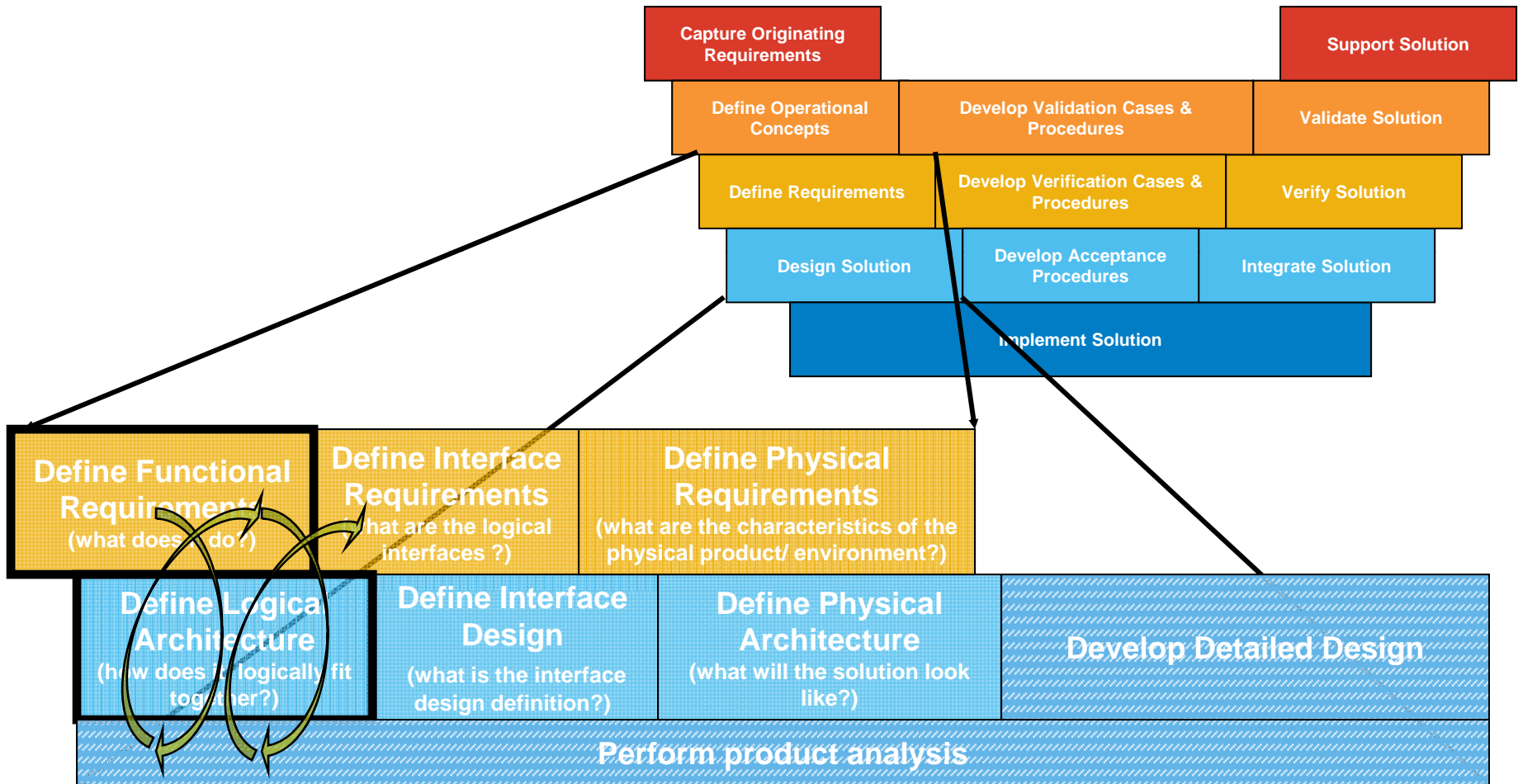
Requirements - Define the "Problem Space."

Design – Defines the "Solution Space."



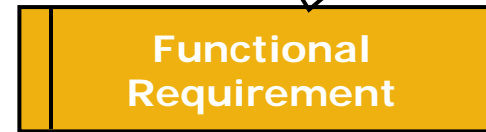


# Functional Analysis with Logical Design



## Functional Requirements

- Describe behavior: logical and mathematical
- Answer “**What** does this function do?”
- Must address each input / output interface introduced
- Derived from:
  - most important requirements (MIRs)
  - use cases & scenarios
  - source requirements
  - stakeholder needs
  - architectural context



A solution update SHALL be provided for application to the following Navigation Solutions:

- INU
- ---/A/H or DEAD RECKON

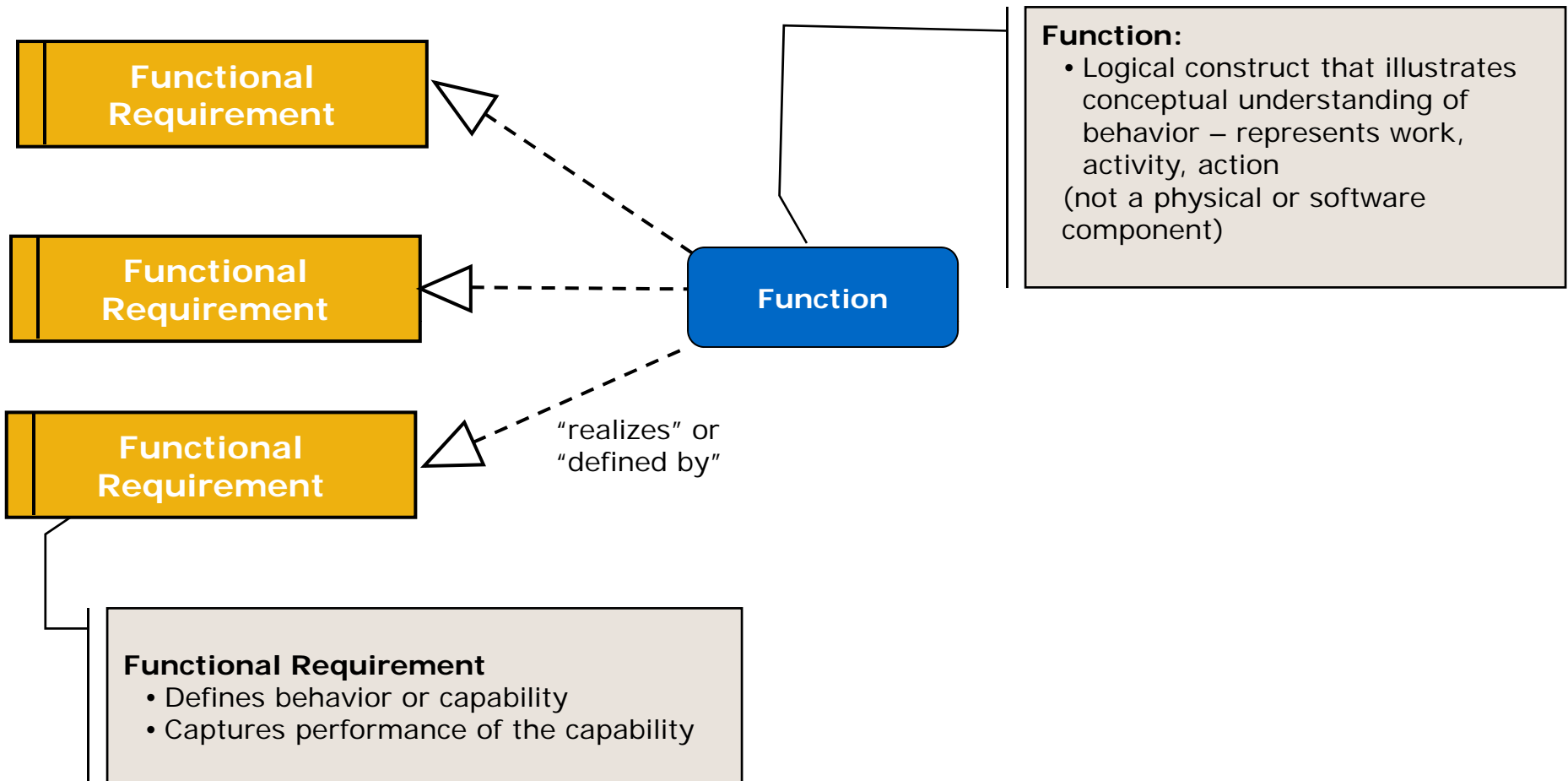


## Shout Out!

- What is a “function”?
- What is the difference between each of the following?
  - Function
  - Activity
  - Use Case
  - Scenario
  - Application
  - Component



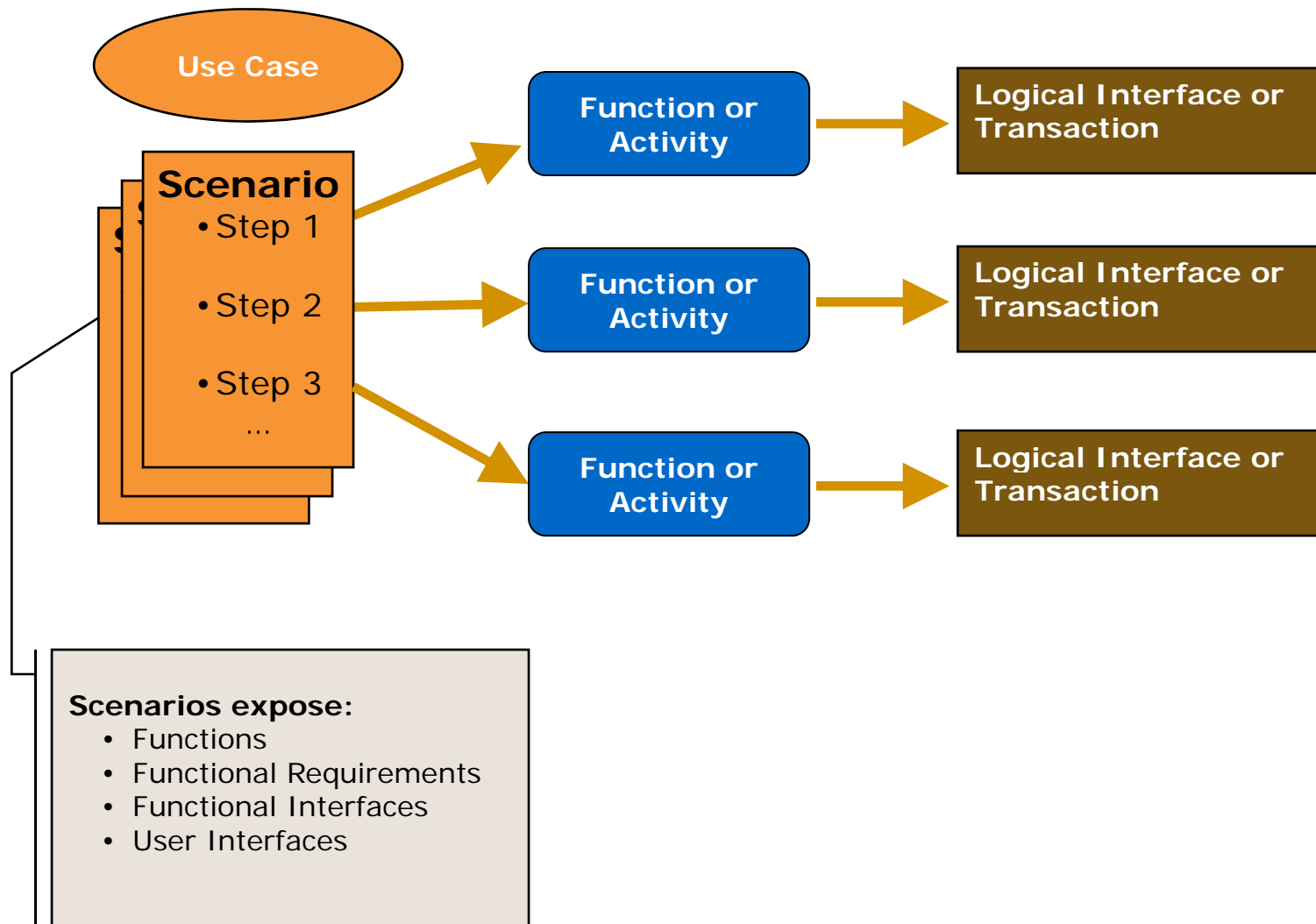
## What is a Function?



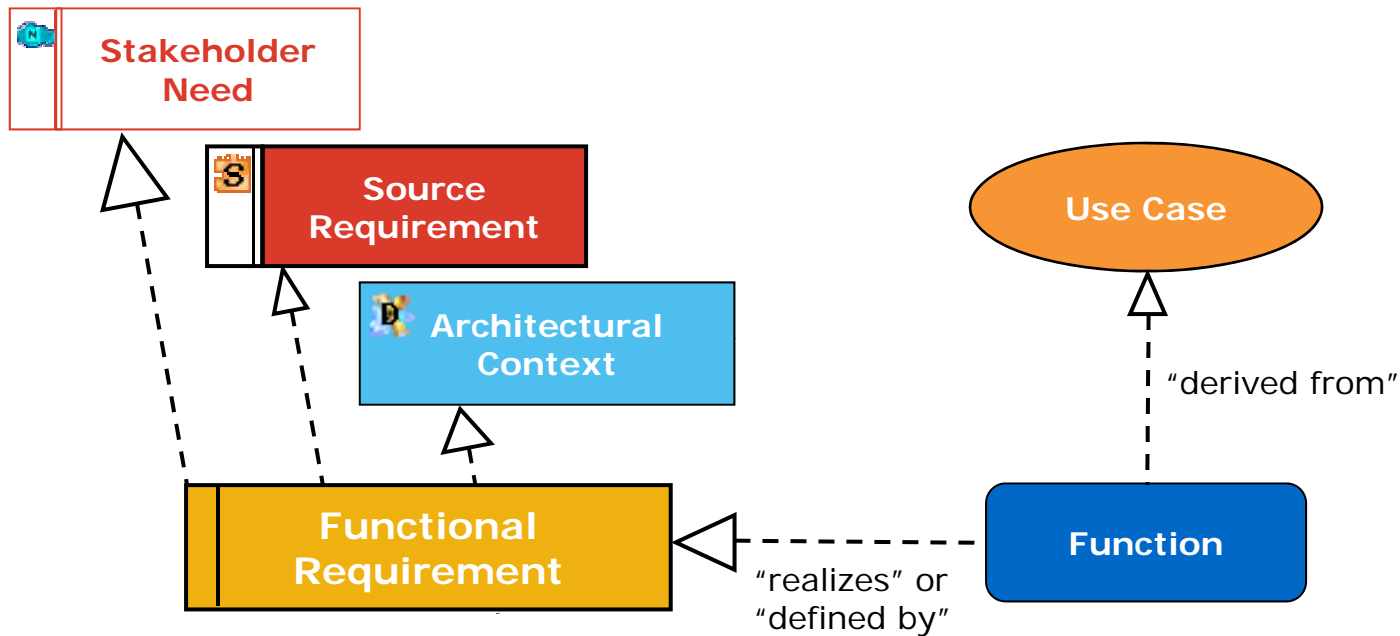
Functional definition must be independent of the physical architecture or implementation

"Form Follows Function"

## Exposing Functionality



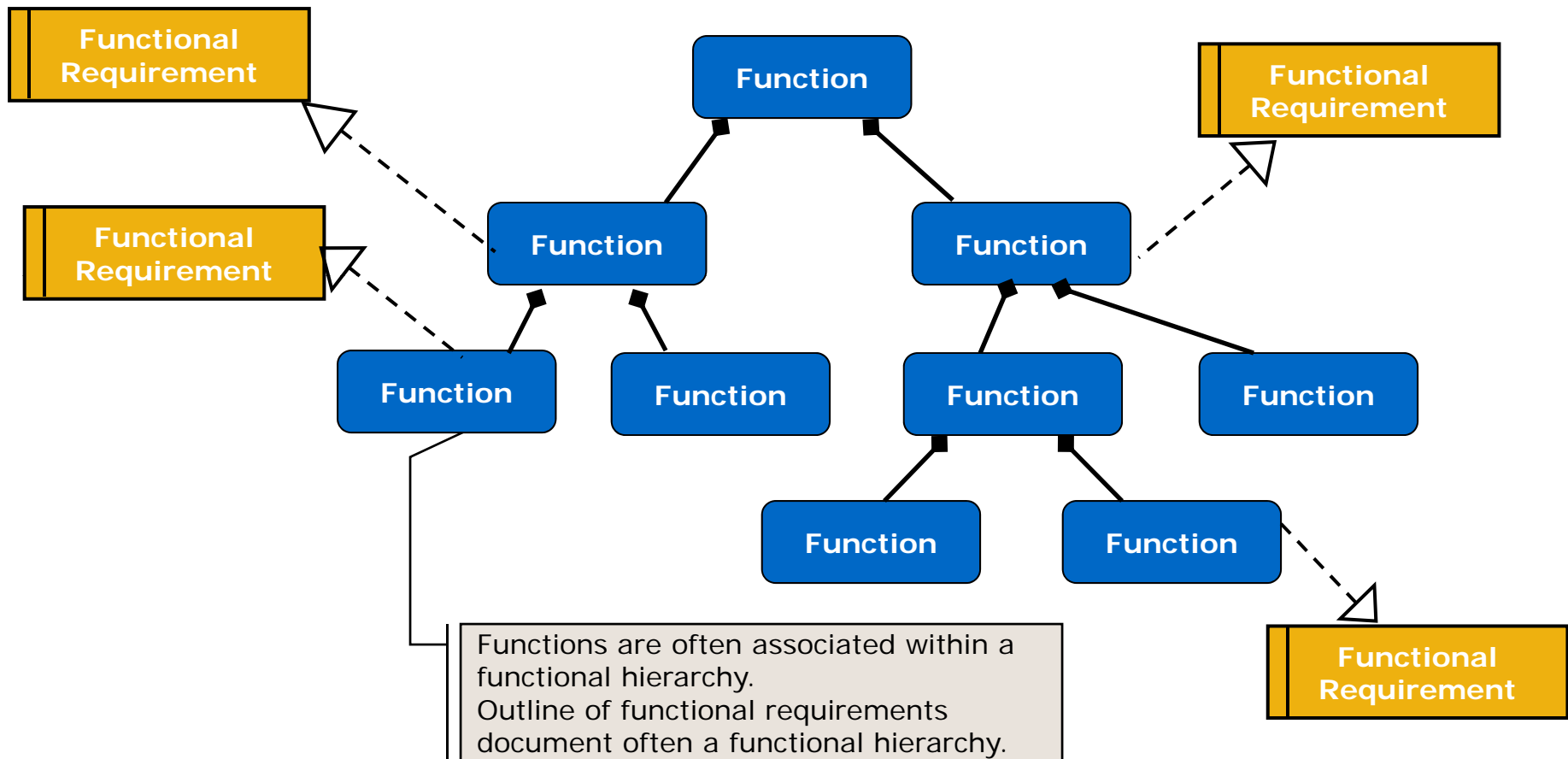
# Deriving Functionality



Which comes first? The function ... or the functional requirement?

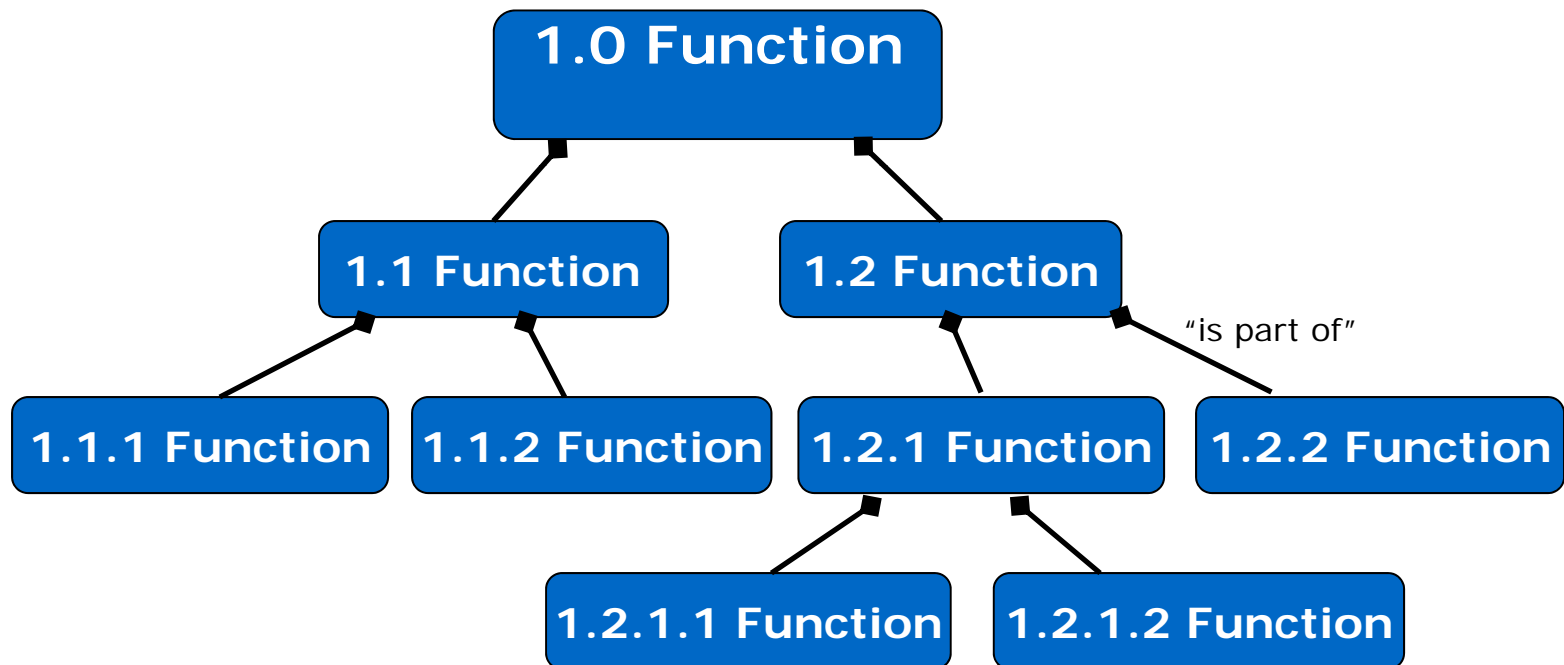
Where did the outline of the functional requirements section of your requirements document come from?

## Functional Analysis - Hierarchical Relationship



Logical hierarchy provides the basis for organization and order of functional requirements.

## Functional Analysis – Logical Hierarchy

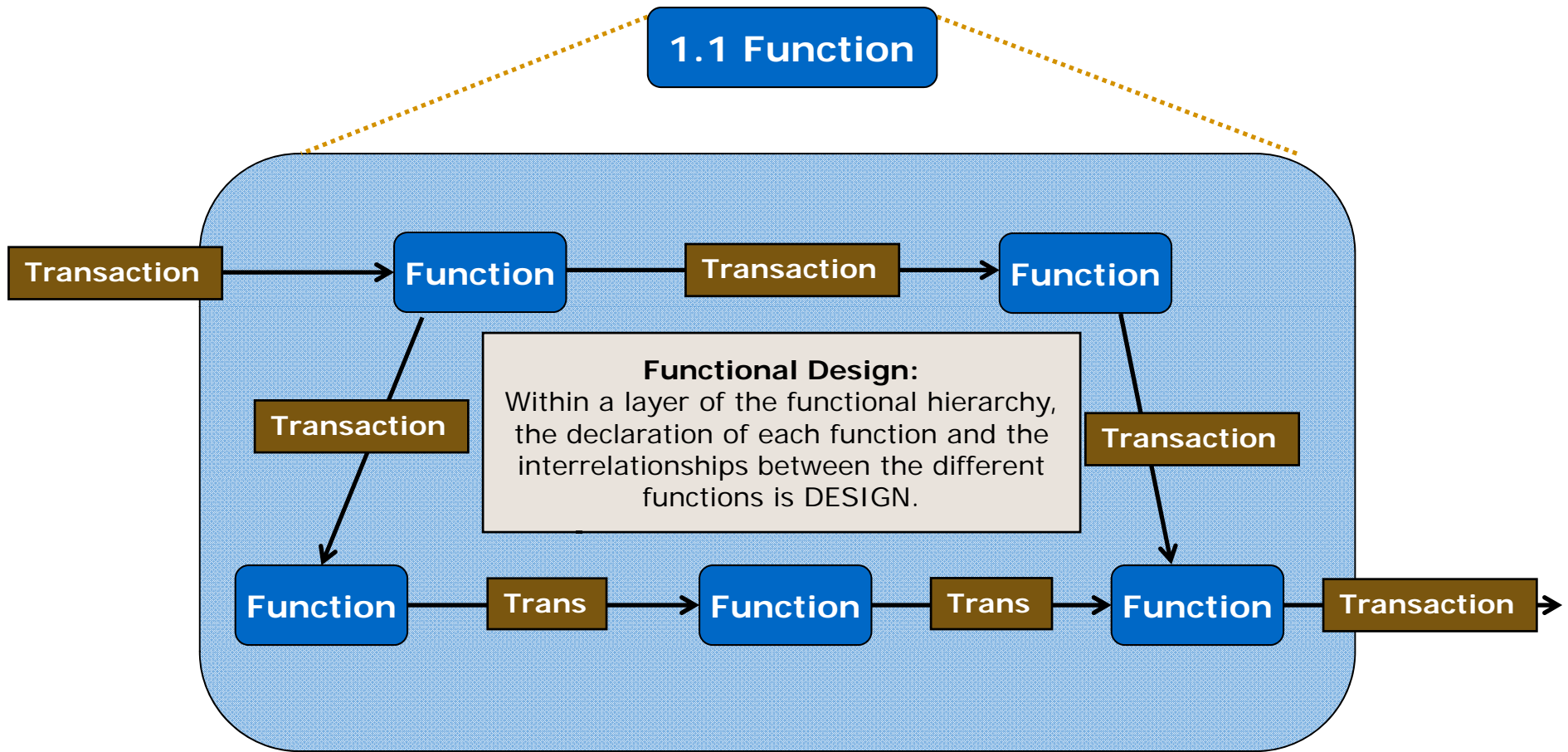


Functional Composition is a DESIGN activity –  
Breaking down and grouping similar functions



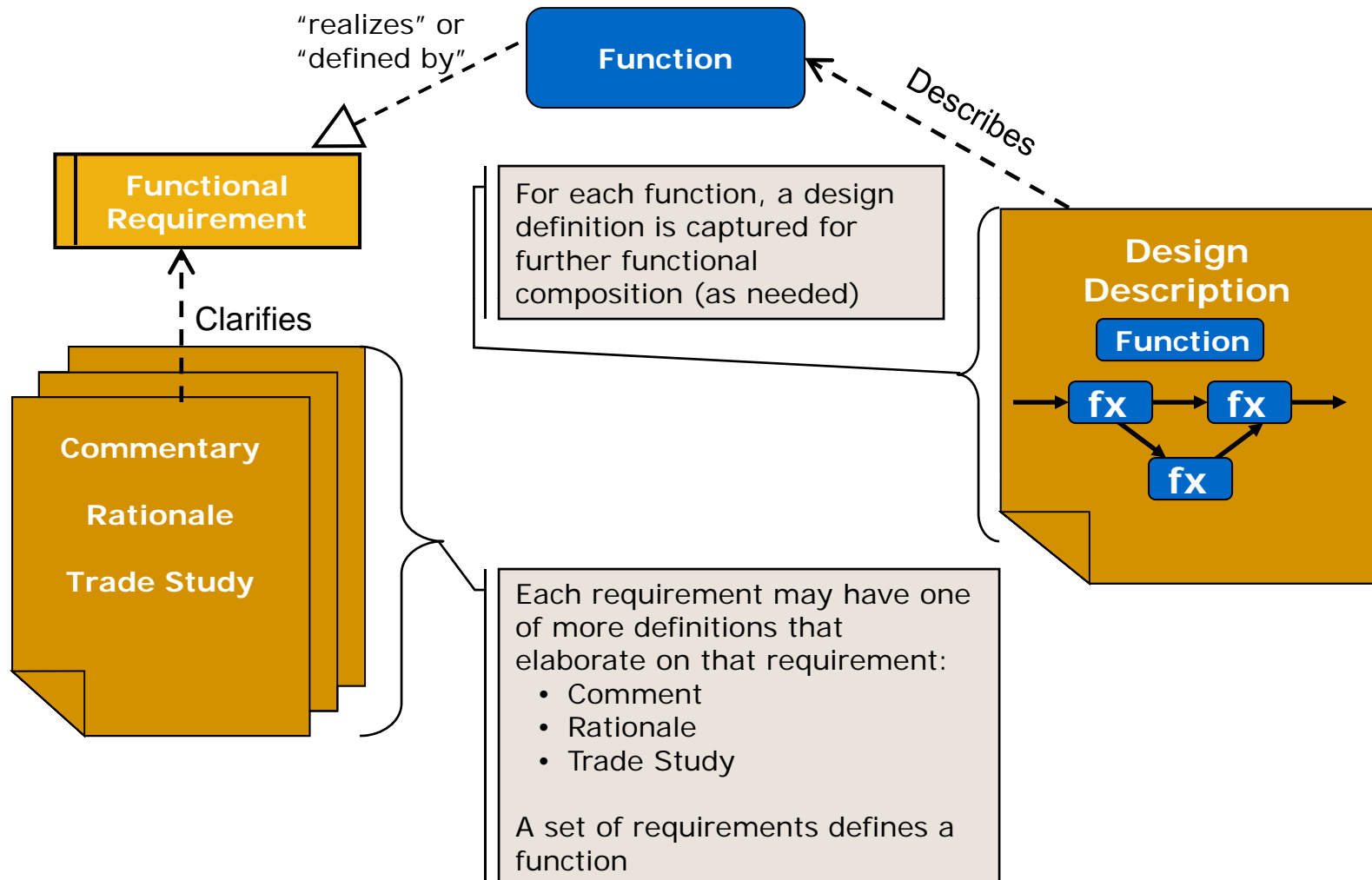
# Functional Analysis – Logical Architecture

## 1.1 Function



Functional Design – the relationships between each of the functions – provides the basis for the Logical Architecture

# Functional Definition

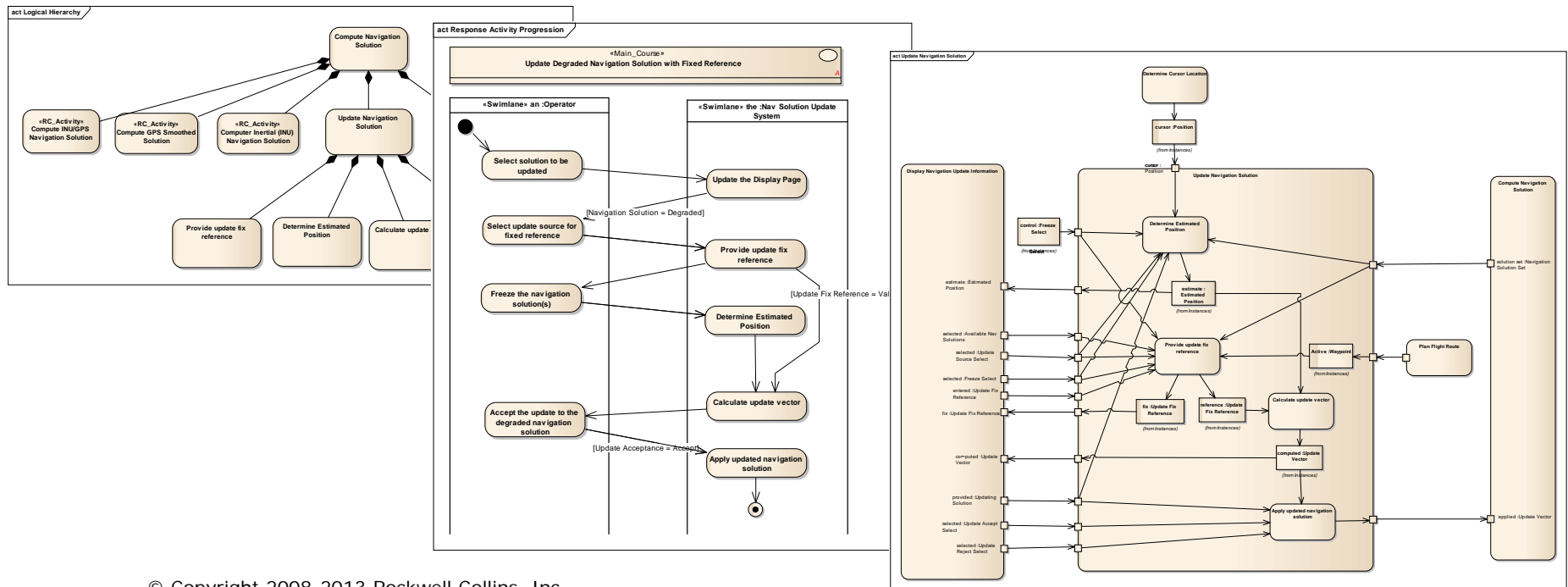




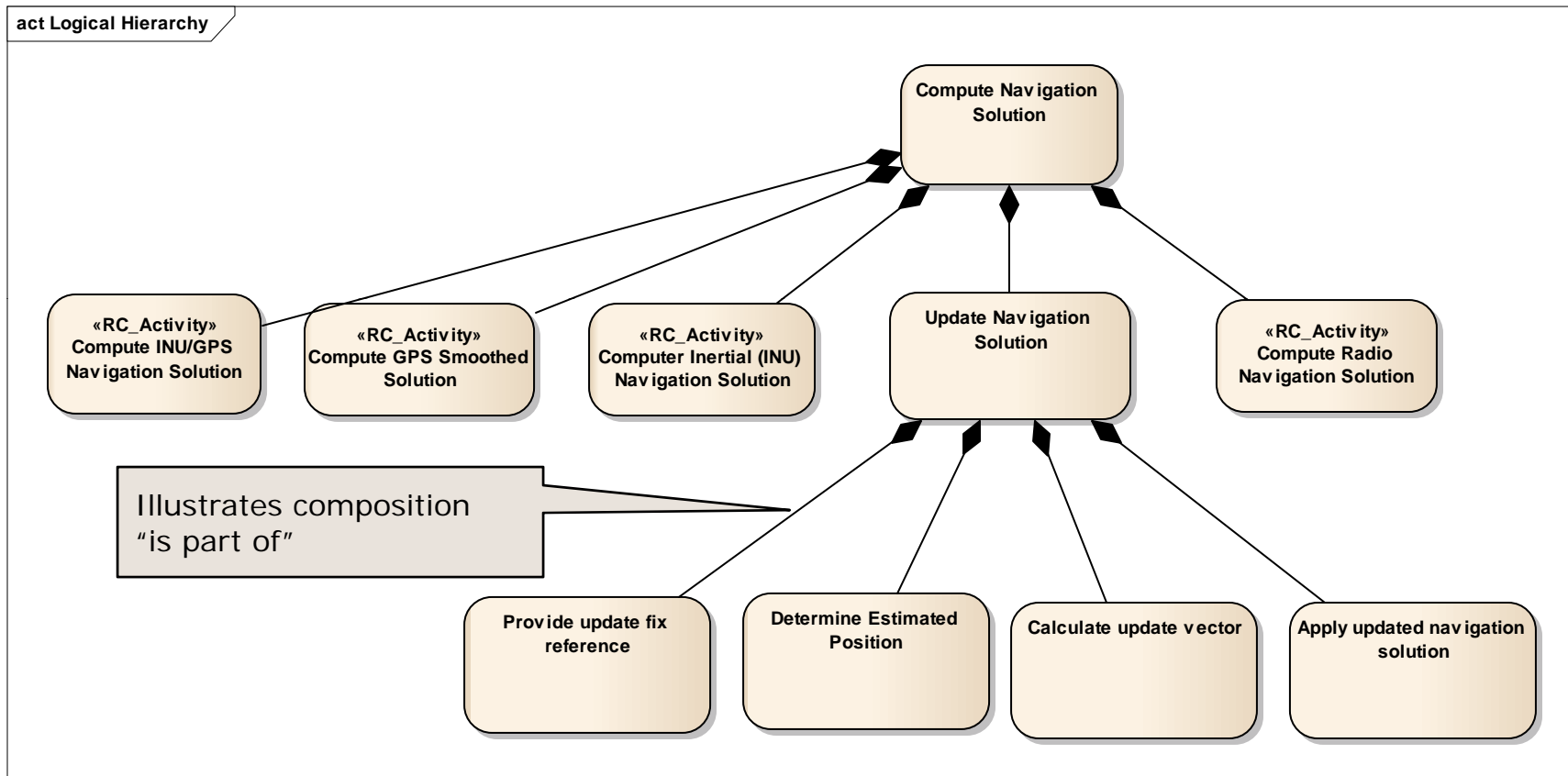
Four key relationships between activities (functions)

## Logical Representation Diagrams

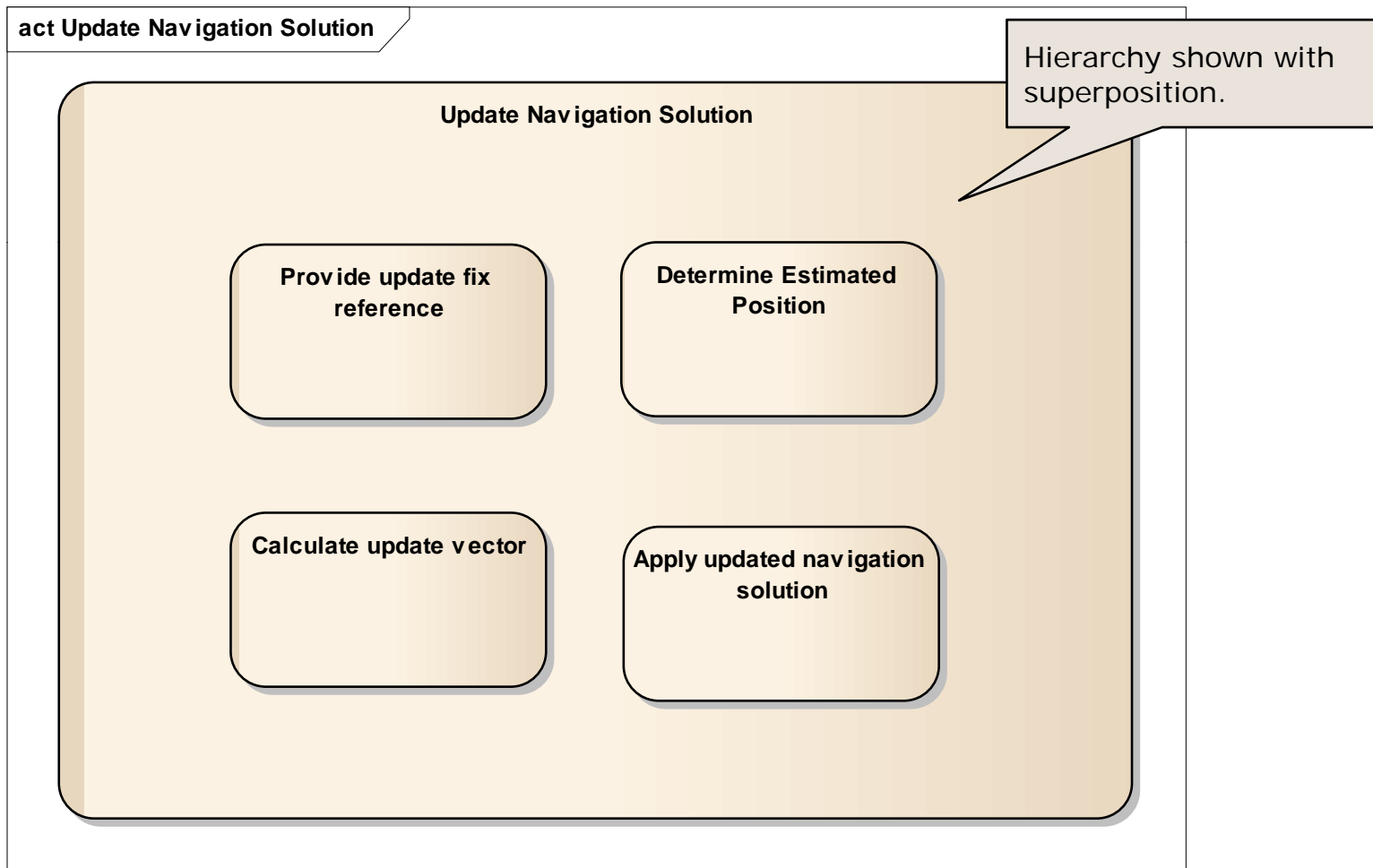
- Hierarchical Perspective– diagrams showing composition
- Chronological Perspective – diagrams showing timing, flow, or sequence
- Transactional Perspective– diagrams showing object or transactional flows
- Allocation Perspective– diagrams showing allocation of function to physical element



## Logical Representation – Hierarchical Perspective



## Logical Representation – Hierarchical Perspective

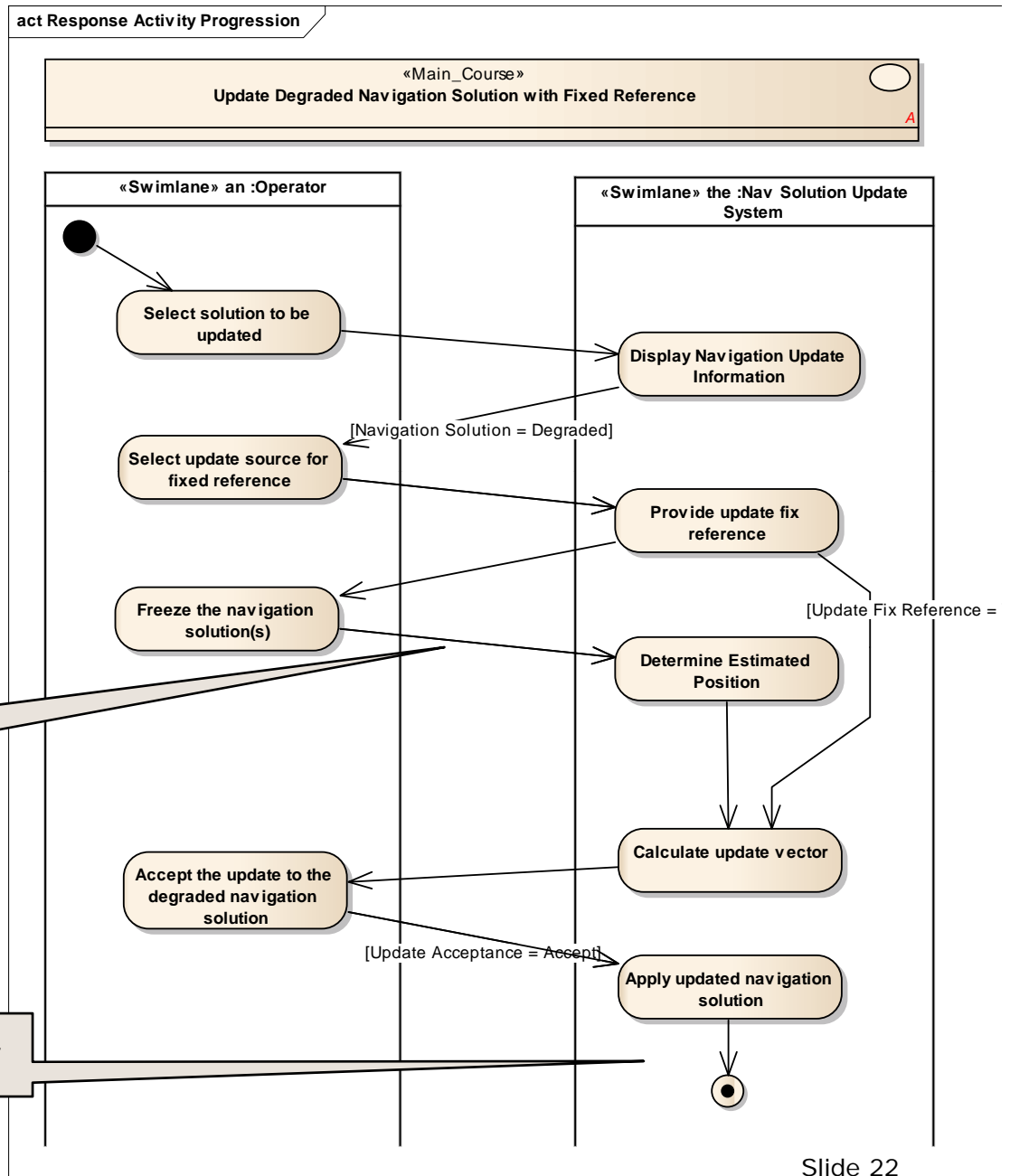


## Logical Representation – Chronological Perspective

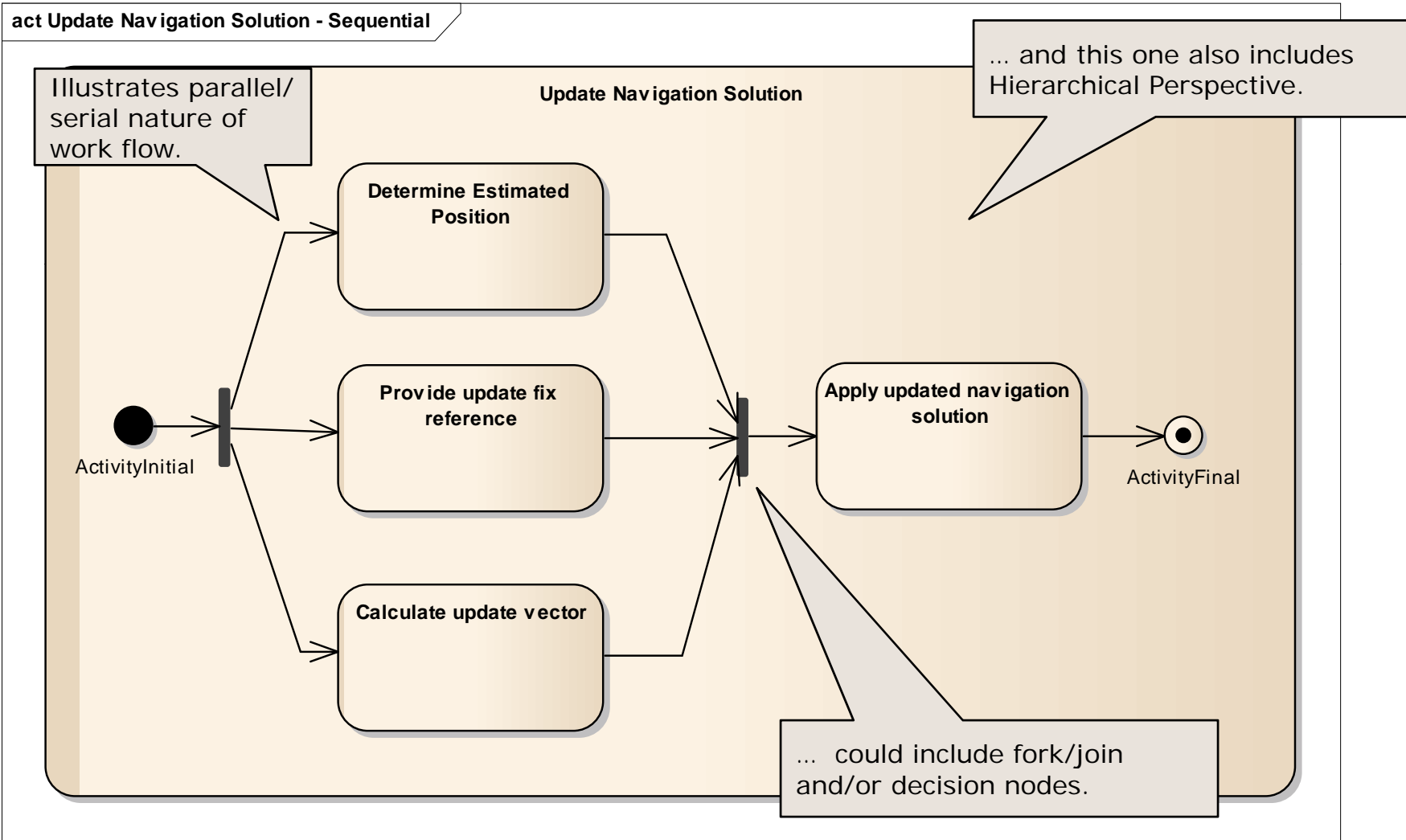
- Illustrates sequence of activities
- Captures activity order – parallel or serial work

Illustrates sequence or control flow  
“...and then ...”

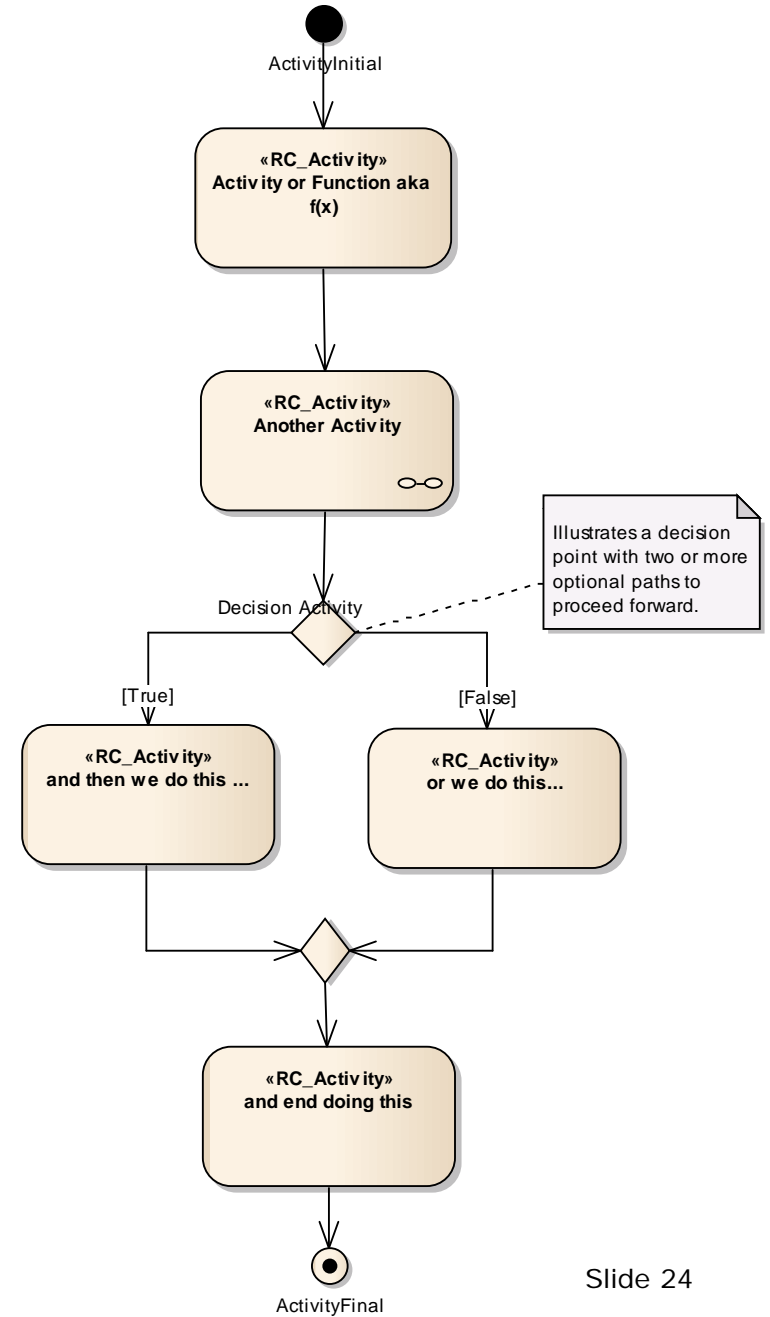
Note also combined “Allocation Perspective”



# Logical Representation – Chronological Perspective



# Logical Representation – Chronological Perspective

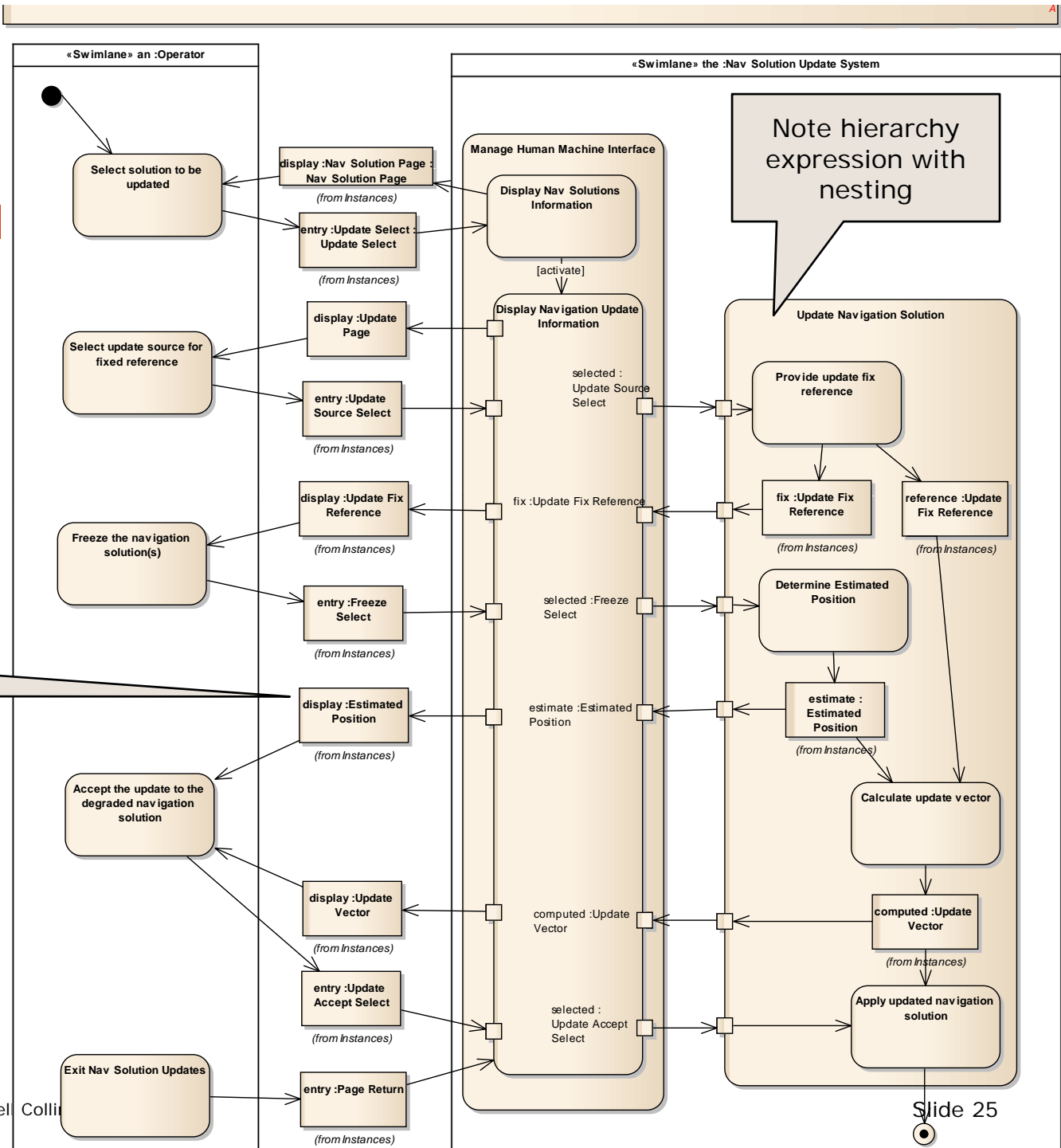




# Logical Representation – Transactional Perspective

- With implied sequence/order
- With hierarchical nesting

Illustrates transaction or object flows



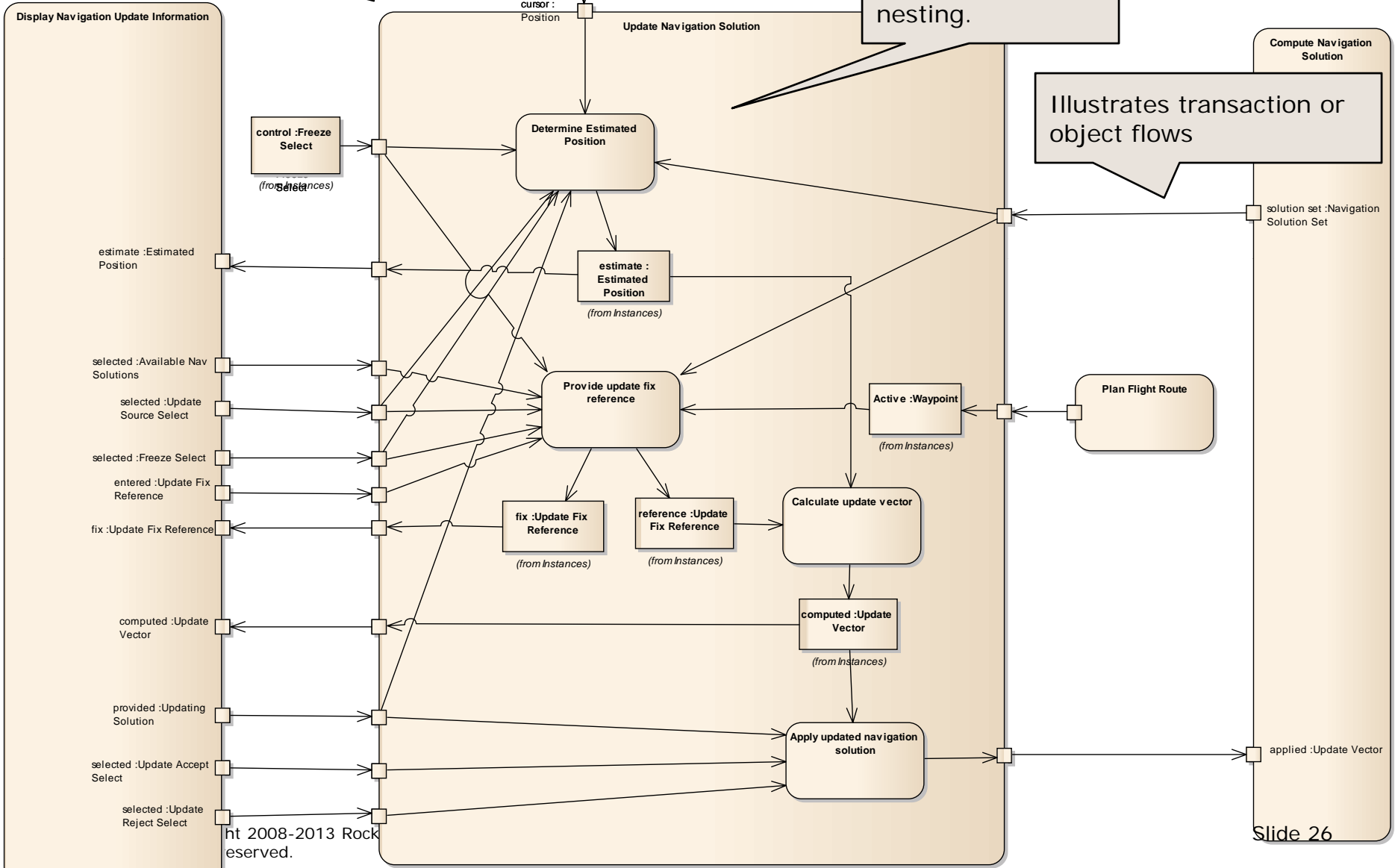


# Transactional Perspective

Composite view of many object flows from all scenarios

... with hierarchical nesting.

Illustrates transaction or object flows



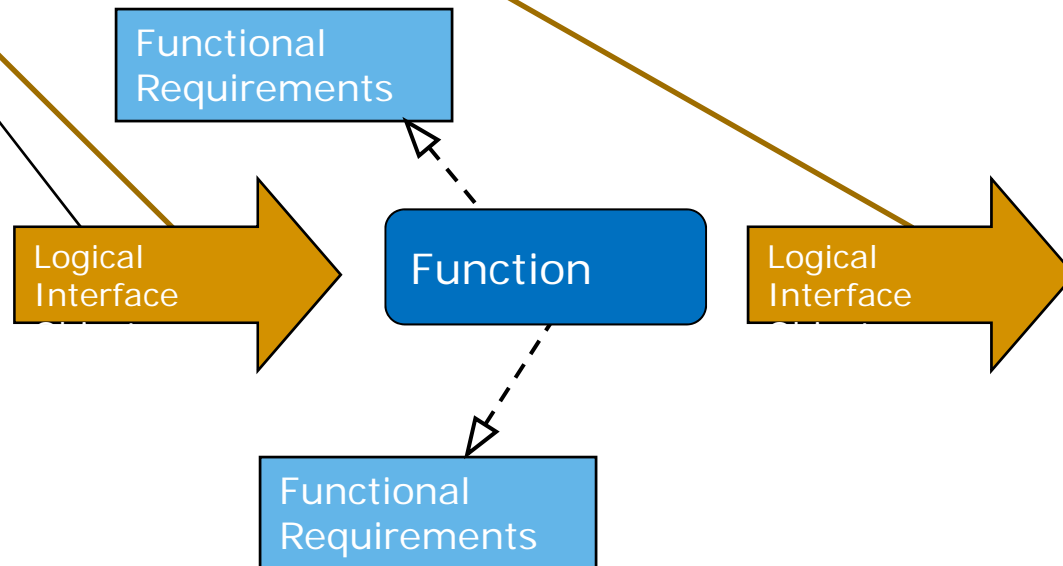
# Functional Requirements Referencing Logical Interface Objects

Functional requirements should consider inputs and outputs, and how the product acts on the inputs to produce the outputs

[When **<input>** <conditional clause> ,] the solution shall <function, action, behavior> [**<output>** <conditional clause>]

When an interface identifier name is referenced within a requirement statement, the reference should be made directly to the actual logical interface object.

A relationship should exist between the reference and the interface itself.



## Functional Requirements: Logical Interface Objects Reference

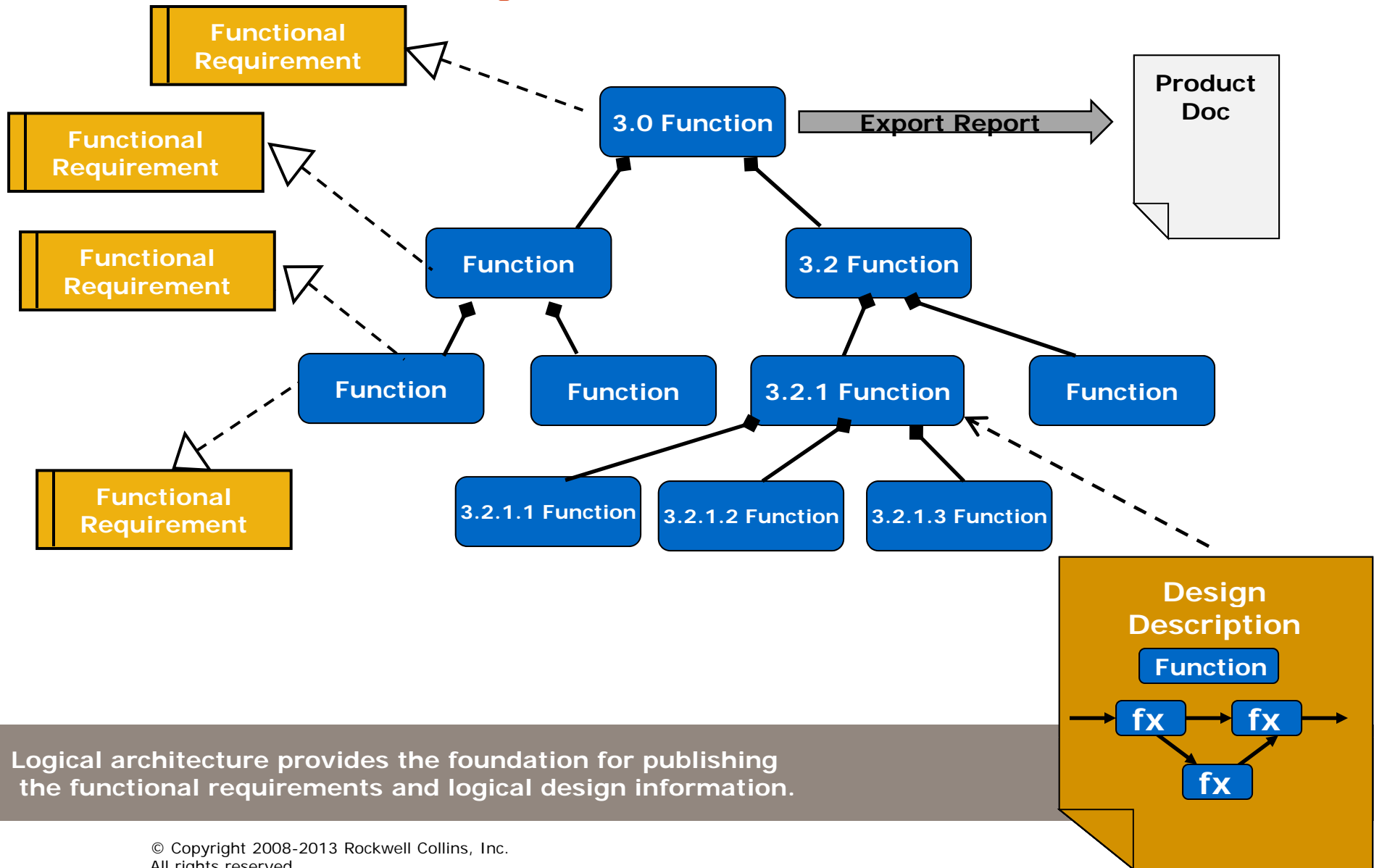
Reference Logical Interface Objects explicitly

Use a technique to call attention to the referenced logical interface object – bold, italics, different font, etc.

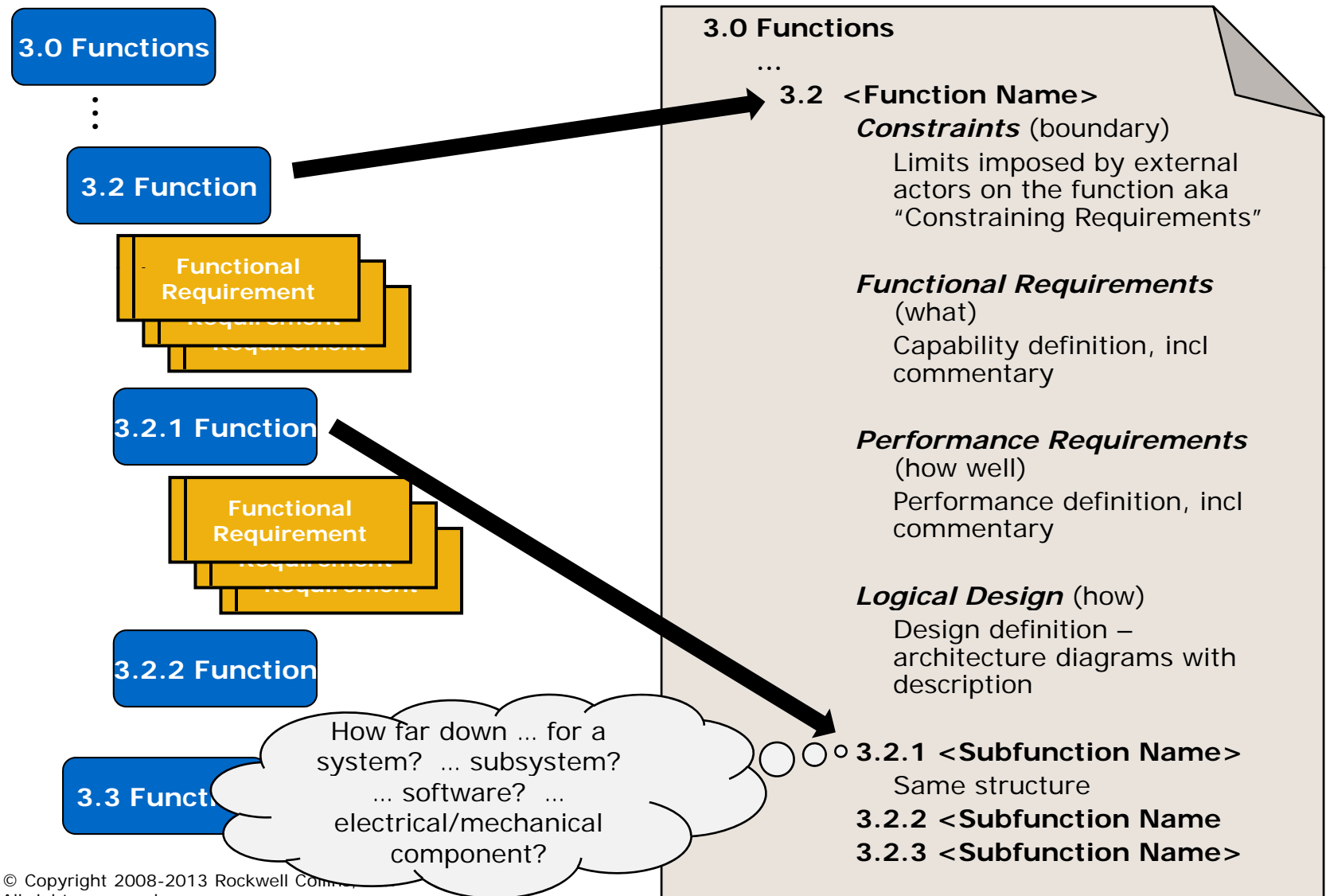
1. When a CURRENT **Inventory Request** is requested, the solution shall present a **Current Inventory** report listing.
2. When a SHORTAGE **Inventory Request** is requested, the solution shall present an **Inventory Shortages** report listing.
3. When an **Updated Item** inventory modification is submitted, the **Current Inventory** will be updated to account for the adjusted item.



# Functional Analysis Publication

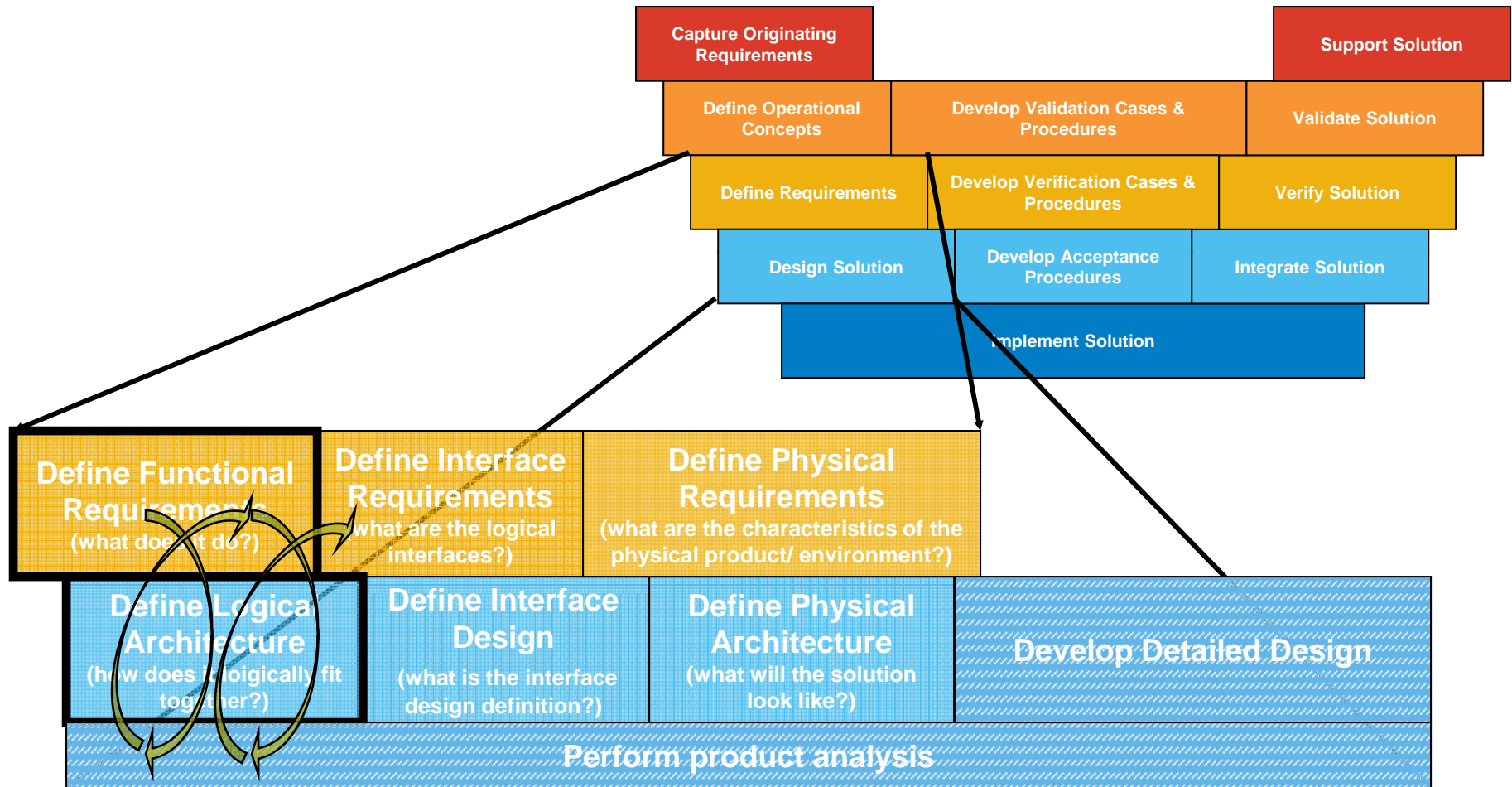


# Functional Requirements Publication





# Functional Analysis & Logical Design





## Summary

- Understand 'product requirements' classification and derivation.
- Understand why we define product requirements and solution architecture
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- Describe the relationship between functional requirements and functions or activities.
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## Conclusions

- Definite synergy between functional requirements, functions (activities), and logical architecture (functional composition)
- Consider the following:
  - Where did the outline of your functional requirements come from?
- How can you more effectively express the structure of your requirements?
- Functional requirements more effectively expressed within context of the logical architecture



## Presenter Information

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