



# Systems Engineering Value Stream Modelling

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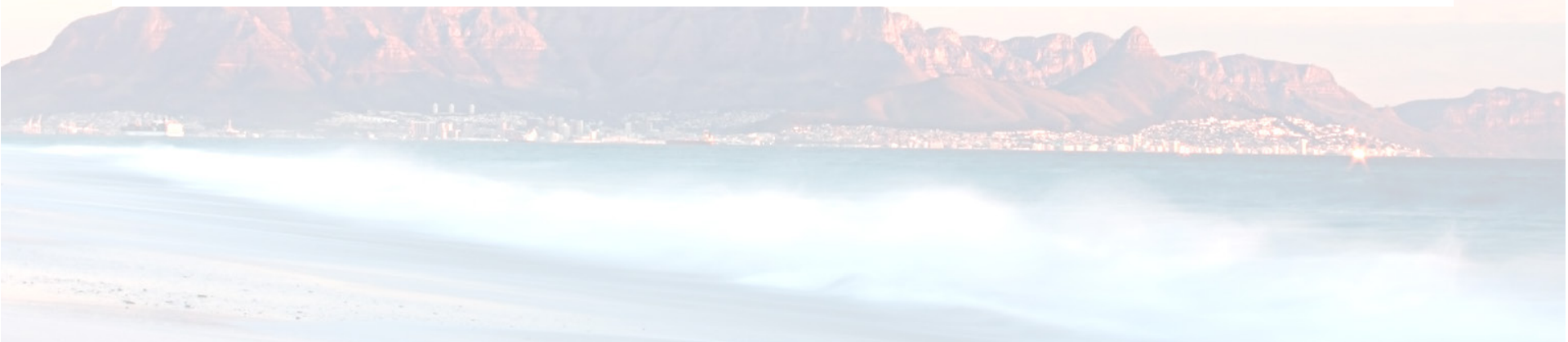




# Content



- Introduction
- The Precedence of the Value Stream Approach
- The Role of Configuration Management
- Definition of a Work Product Generation Sequence
- Conclusions

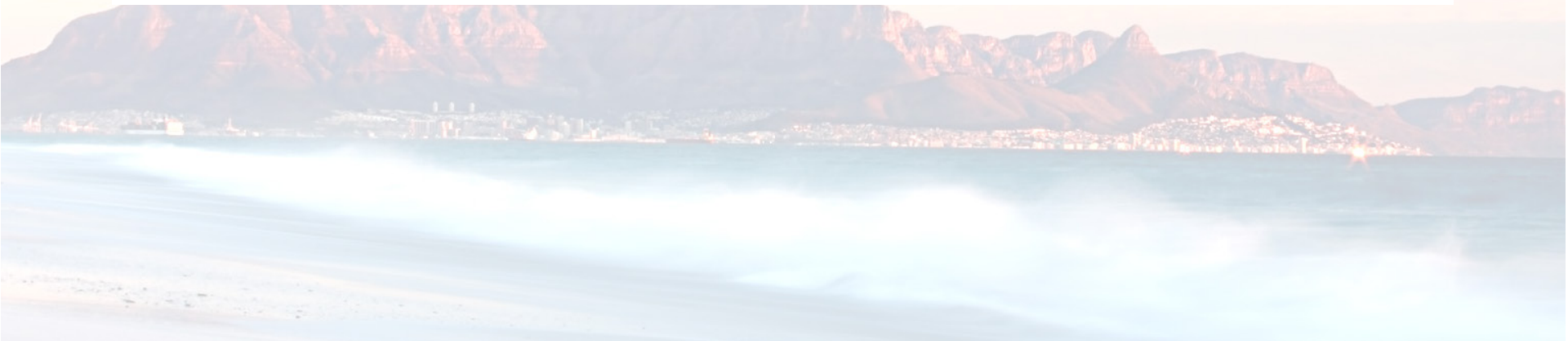




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# The Flow of Configuration Baselines in the Overall Systems Engineering Value Stream

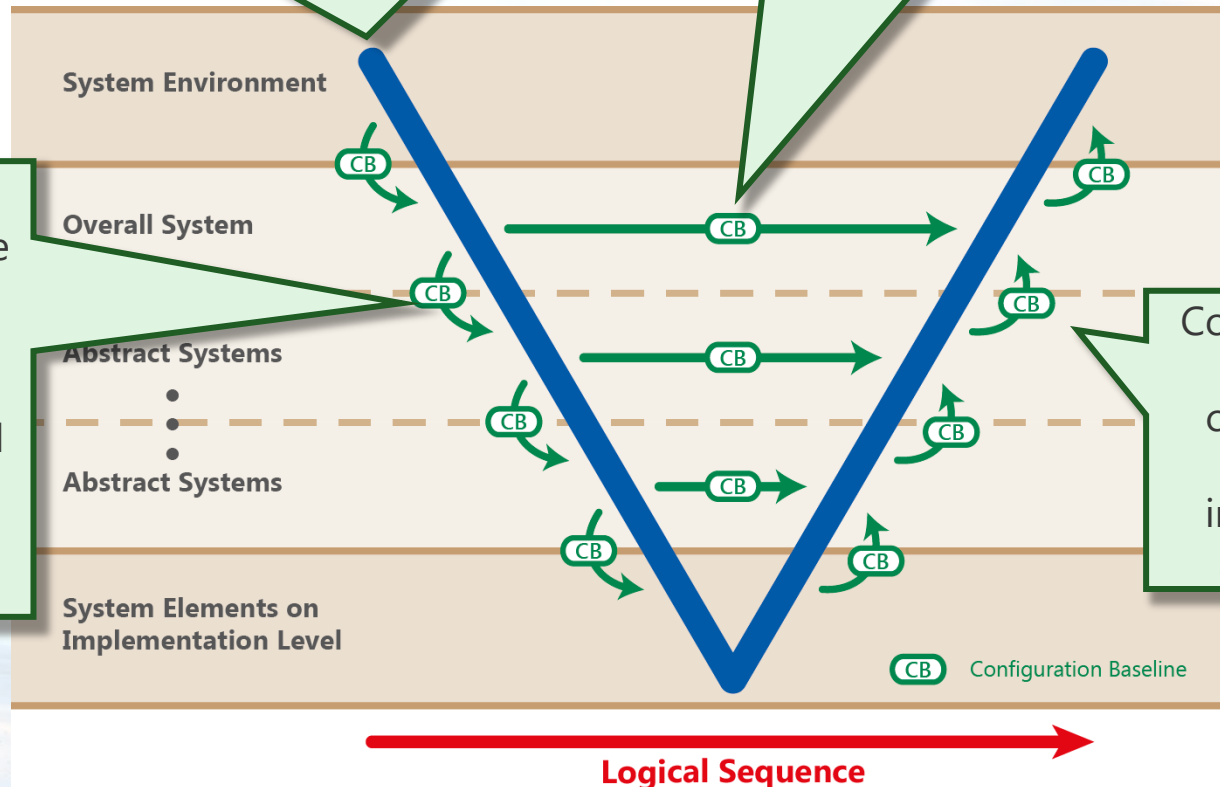


Configuration Baselines control and safe guard the flow of information between system and system elements across the system architecture

Configuration Baselines establish the basis for preparing system integration

Configuration Baselines ensure consistent sets of allocated requirements forwarded to all the system elements of a system

Configuration Baselines control the system integration sequence





# Work Product Generation Sequences



- Work Product Generation Sequences model the value streams for the development of each system or system element in a system architecture
- For ensuring consistent high-quality configuration baselines, it is important to focus the systems engineering management on the evolving configuration baselines of all systems and system elements up from project start
- A value stream based approach outperforms other systems engineering management techniques, especially
  - document centred approaches, and
  - process oriented approaches



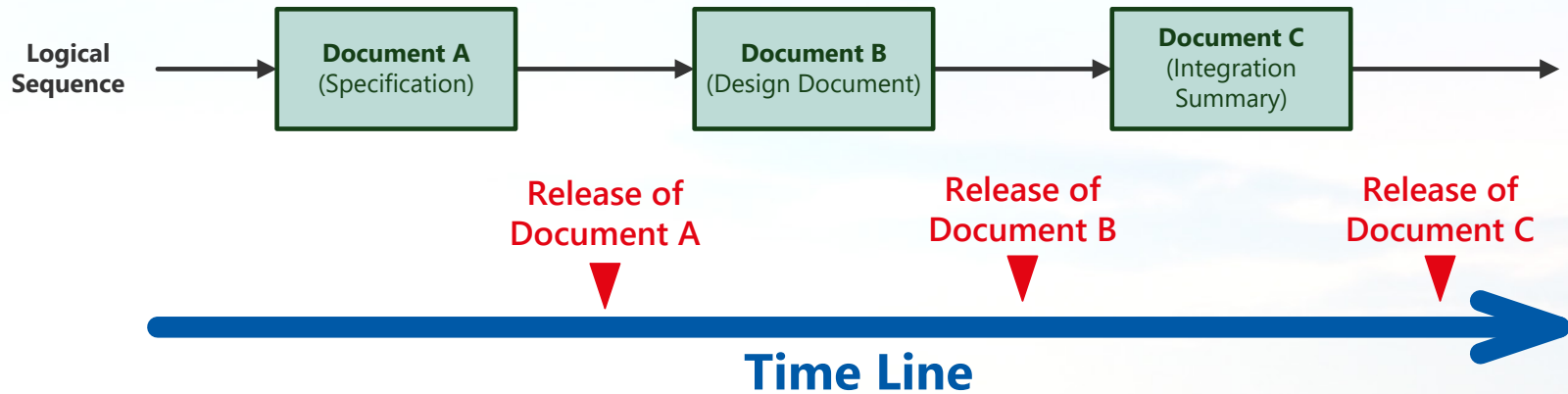
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# A Non-Practical Theory

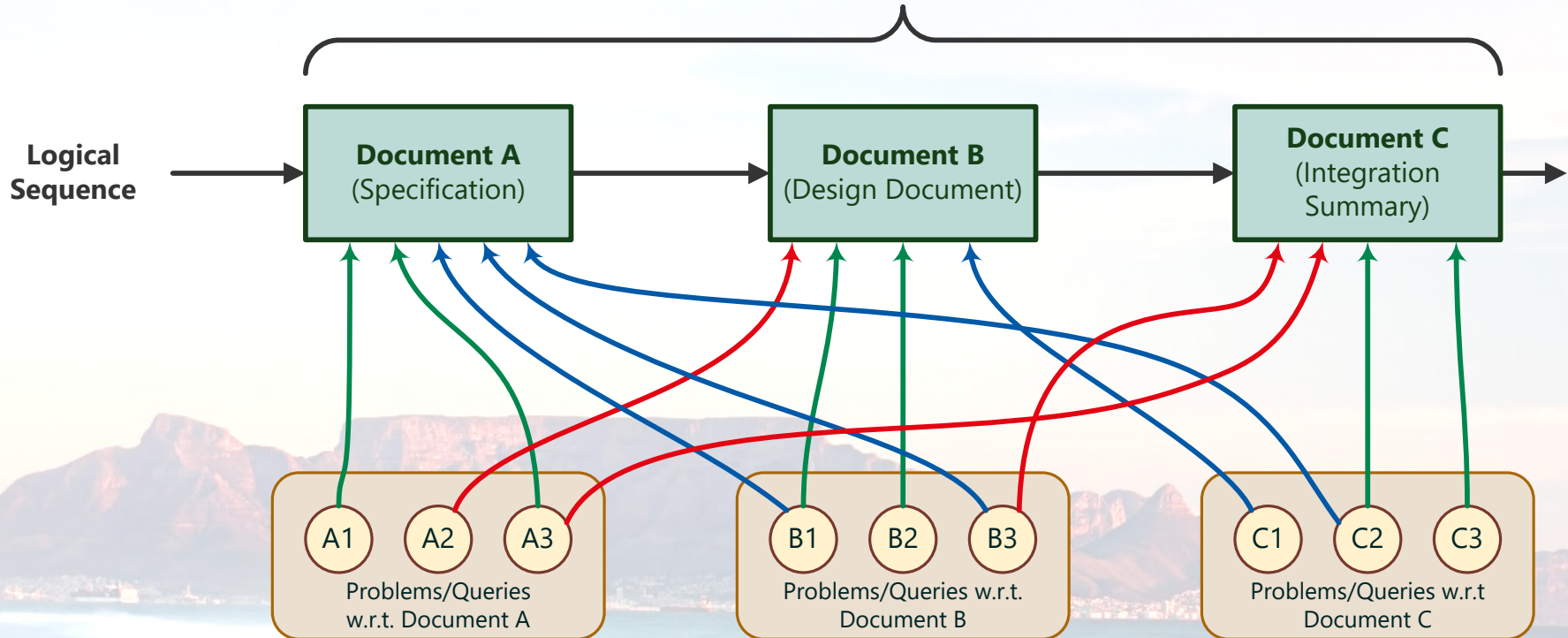


- A Work Breakdown Structure defines tasks to write documents A, B and C
- Responsible authors for compiling each document are appointed
- Due the expected content the documents have to be generated according to a logical sequence
- The tasks from the Work Breakdown Structure are directly translated into a Gant Chart defining delivery milestones for each document
- Project managers control adherence to the milestones

# The Document Centred Approach



Work performed concurrently – Snapshot at time  $t_i$



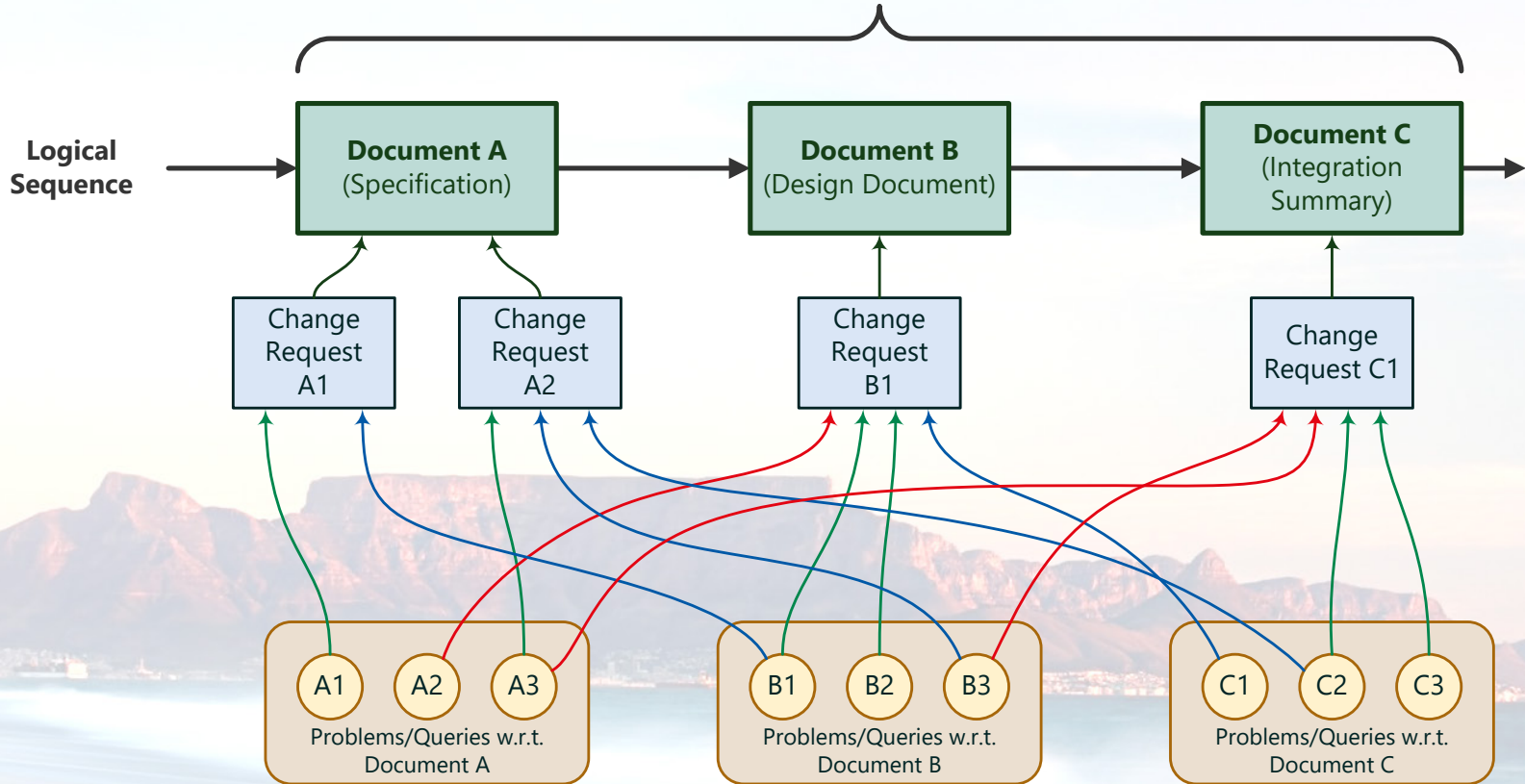
→ Problem/Query considered for Doc. it was raised against     
 → Problem/Query considered for downstream Document     
 → Problem/Query considered for upstream Document



# The Process Oriented Approach



Work performed concurrently – Snapshot at time  $t_i$

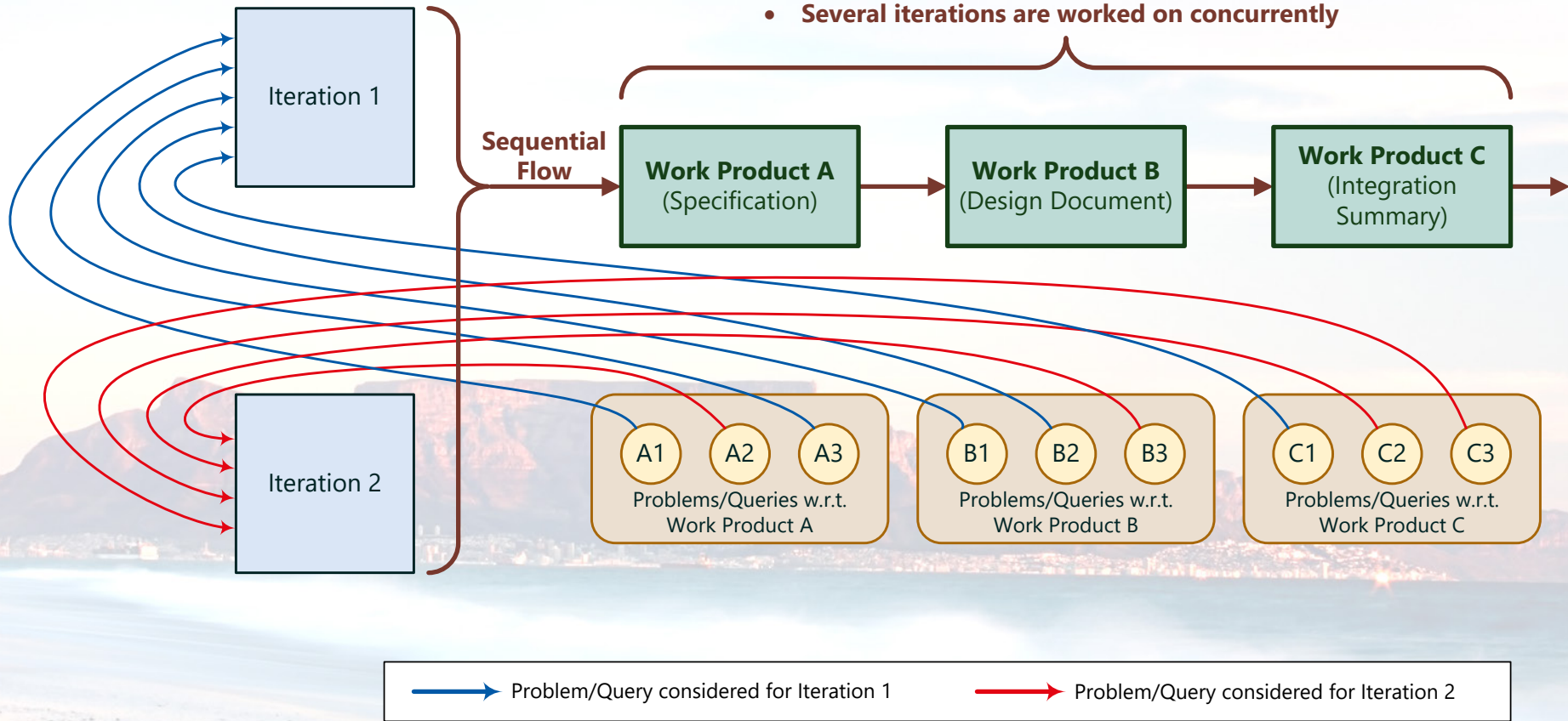


→ Problem/Query considered for Doc. it was raised against
 → Problem/Query considered for downstream Document
 → Problem/Query considered for upstream Document

# The Value Stream Based Approach



- Work performed sequentially for each iteration
- Several iterations are worked on concurrently

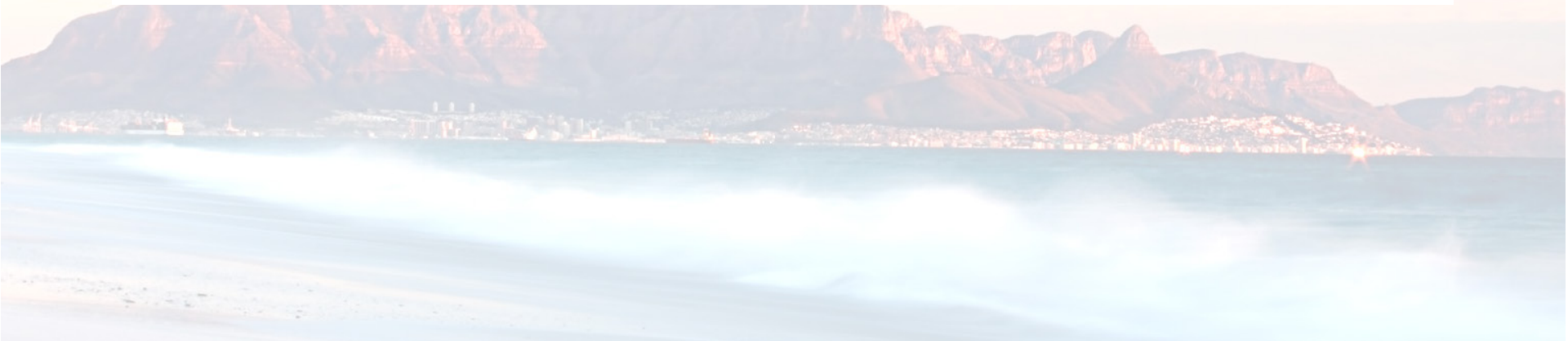




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# The Role of Configuration Management

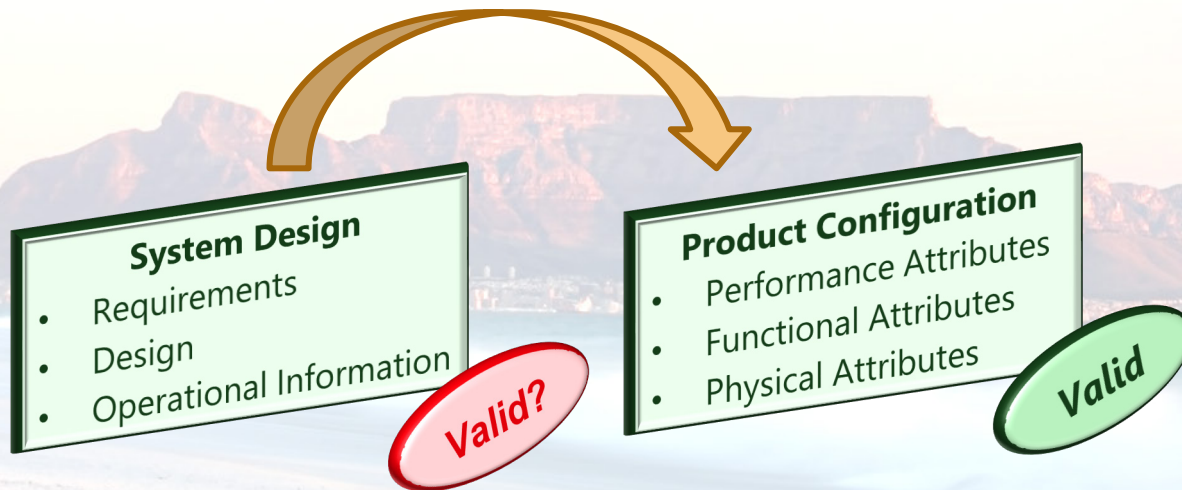


## Configuration Management

A technical and management process for establishing and maintaining consistency of a product's functional and physical attributes with its requirements, design and operational information throughout its life

*EIA-649-B, 2011.*

### Establishing and Maintaining Consistency



*What happens to configuration management, if requirements, design and operational information themselves are inconsistent*



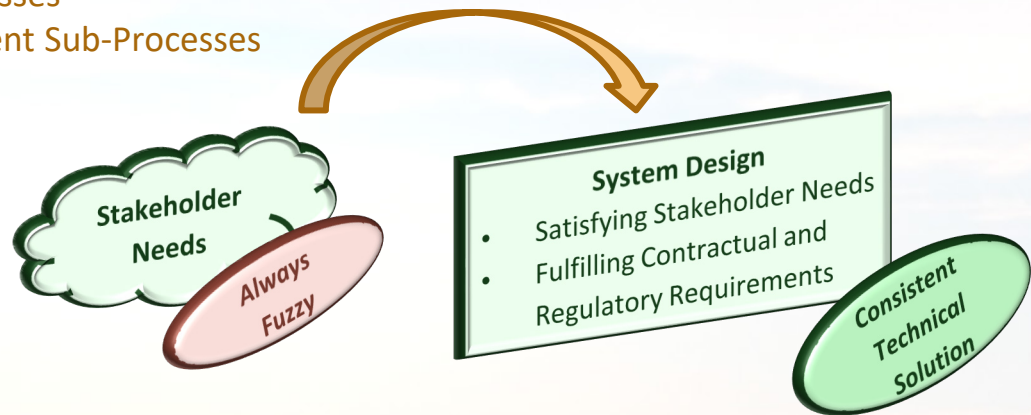
# The Scope of Systems Engineering



## Applying the Systems Engineering Process

- Development Sub-Processes
- Assurance Sub-Processes
- Technical Management Sub-Processes

Systems engineering needs configuration management in order to conclude in high-quality and consistent technical solutions



- Systems engineering needs the full range of configuration management support beyond just **Configuration Identification** of final results, e.g.
  - **Change control**
  - **Configuration Status Accounting**
  - **Configuration Verification**

# Terminology



- **Configuration Baselines**

- describe the overall content and status of a system or system element,
- refer to Work Products containing the actual information, and
- are released along the system life cycle

- **Work Products**

- contain information needed downstream the system life cycle,
- describe what the system is, and
- represent the value generated

- **Supporting Data**

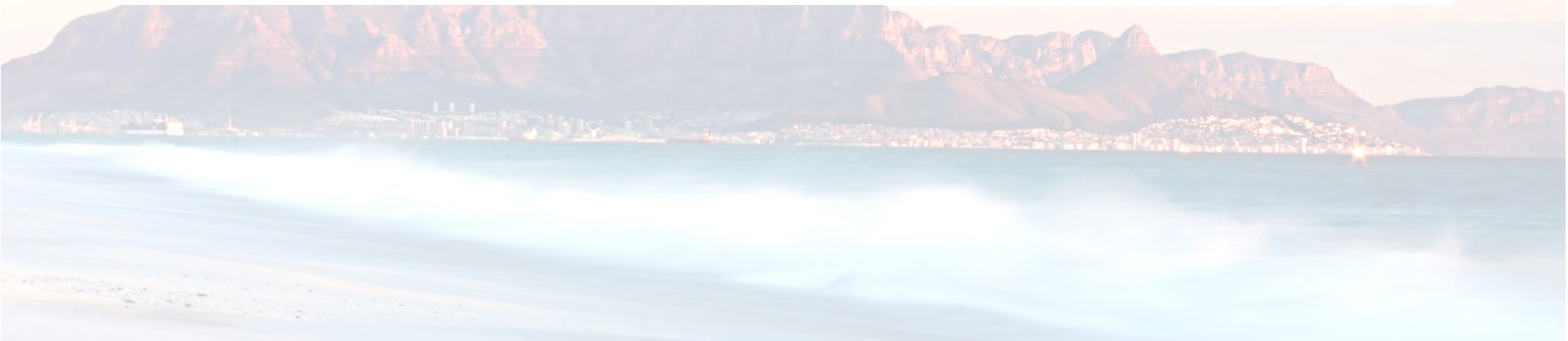
- contain information explaining why a system has evolved as is, and
- provide important evidence for ensuring appropriate process quality



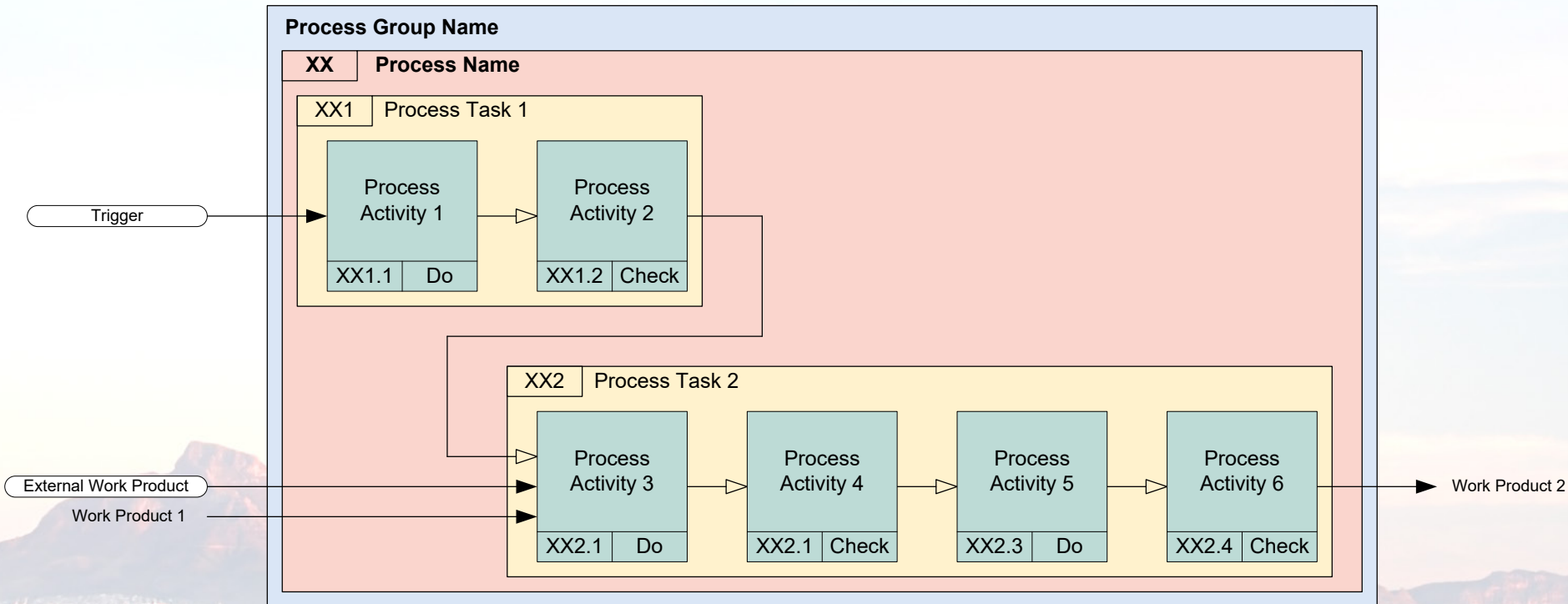
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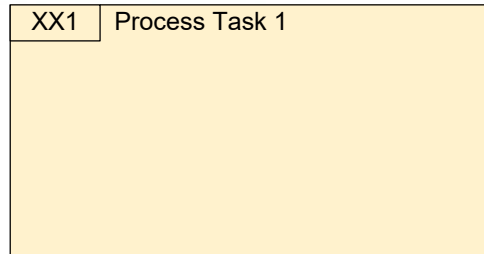
# Process Definition Model



- Four distinct architectural levels
- Each level featuring specific semantics
- Supporting a well balanced process definition



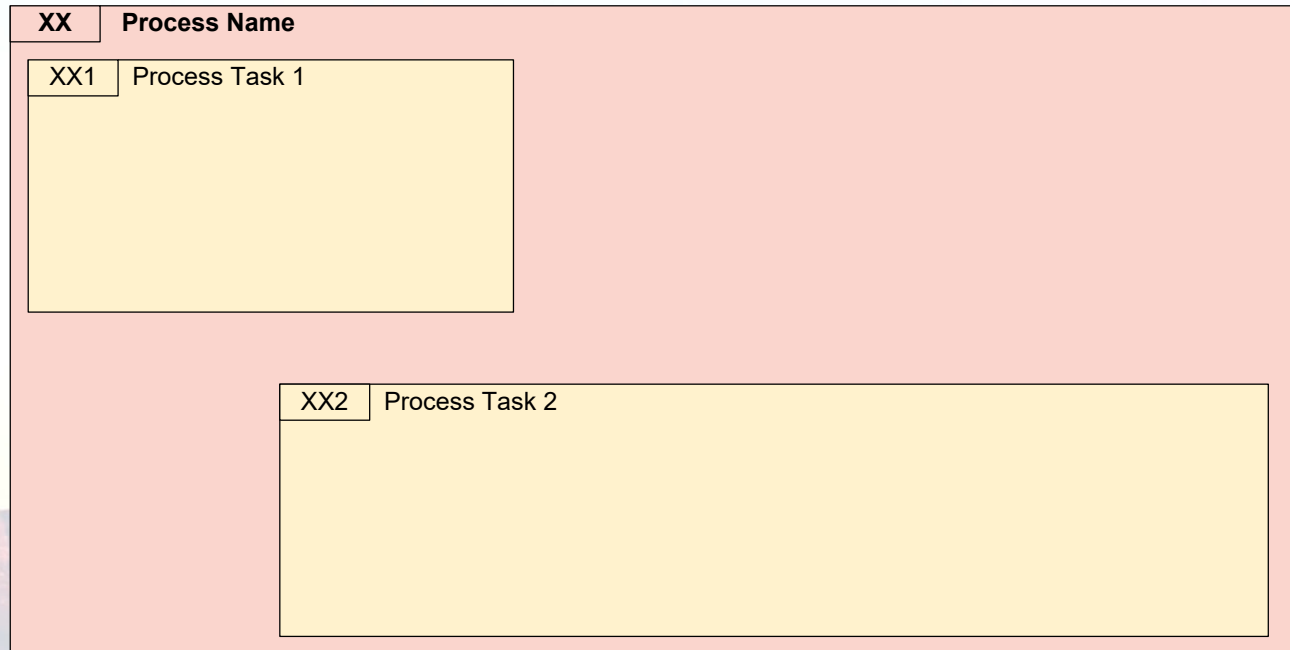
# Process Tasks



- Process Tasks are concerned with generating and maintaining an individual work product or a group of work products with the same input dependencies and output usages
- Process Tasks are also used to cover some evaluation and conceptual work that are not associated with a specific work product

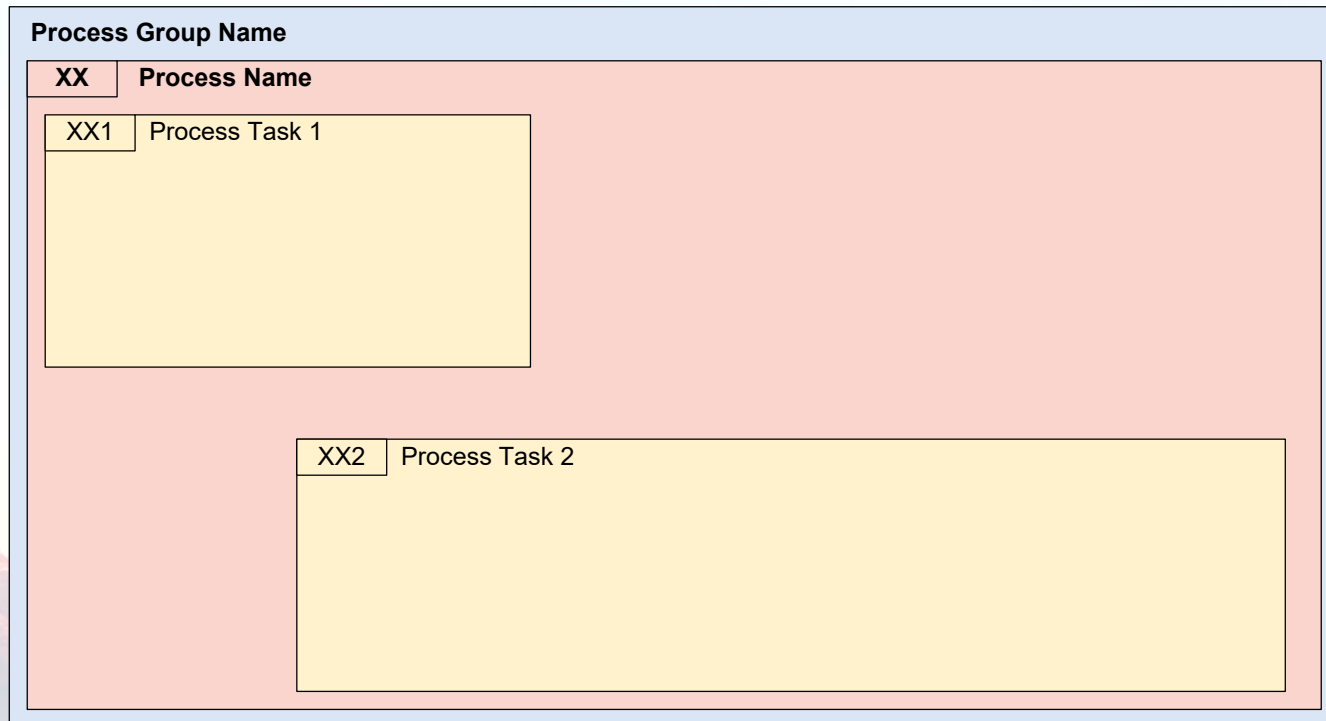


# Elementary Process



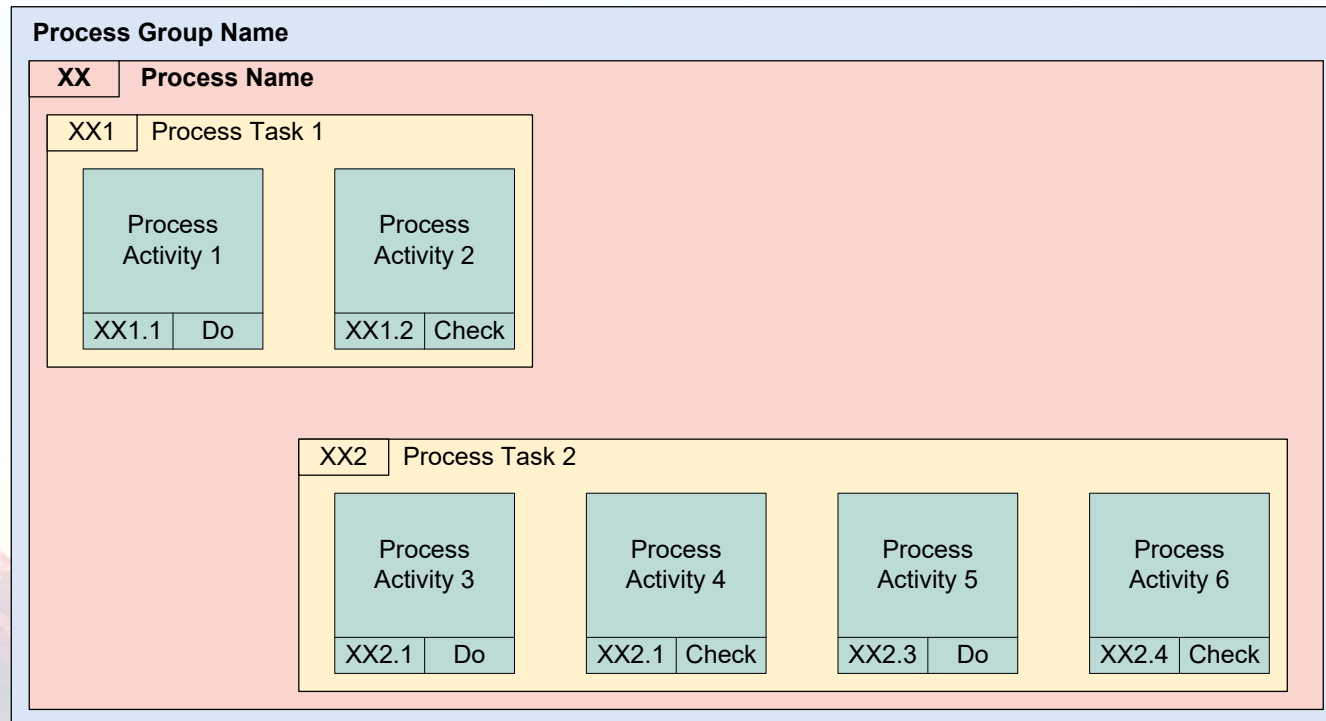
- Elementary Processes group Process Tasks that have a close relationship with manifold dependencies
- Only released versions of Work Products are allowed to cross Elementary Process boundaries

# Process Group



- Process Groups group Elementary Processes due to organisational considerations
- Process Groups may be nested in arbitrary depth, if this adds value to the process definition

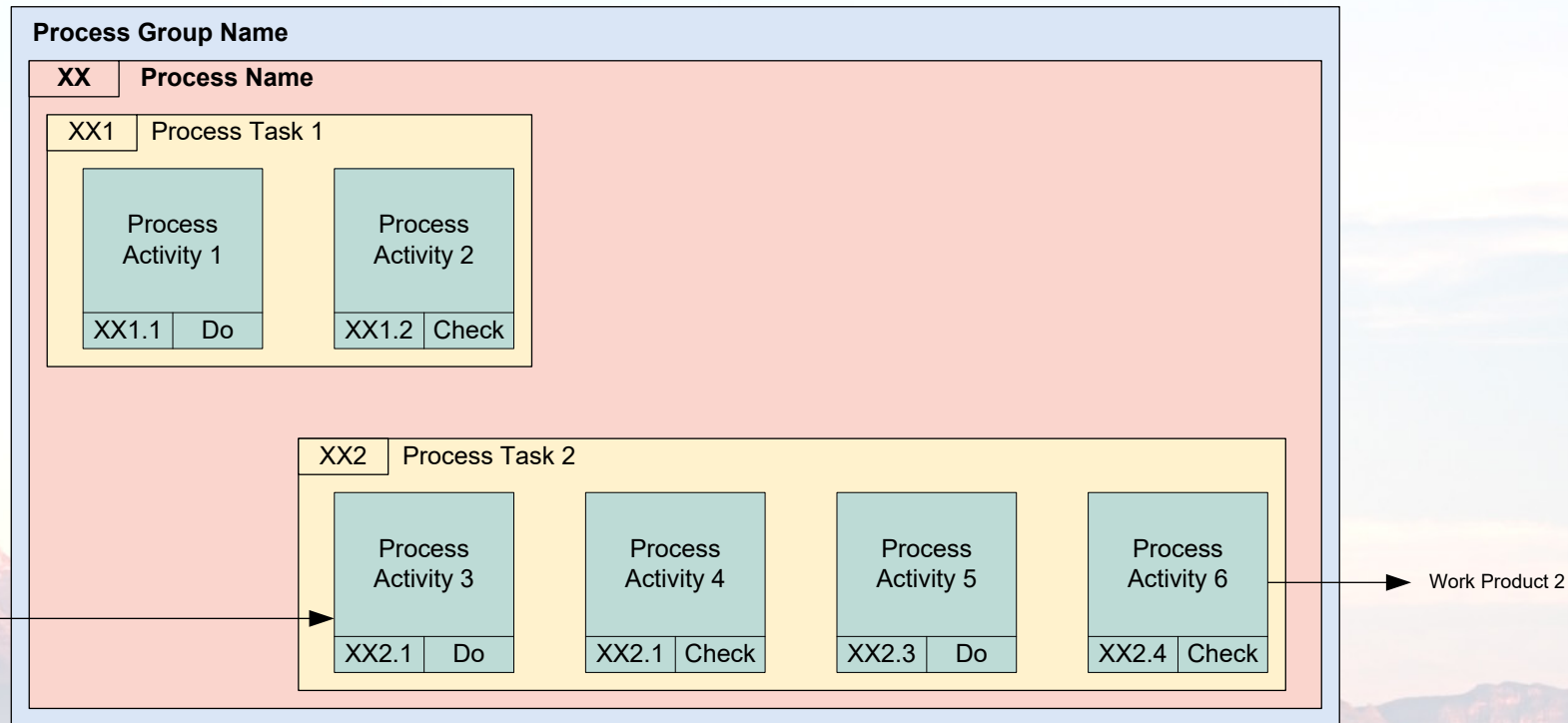
# Process Activity



- Process Activities are exclusively either concerned with do or check activities
- Process Activities provide important low level process definitions, but are not contributing to the definition of the Work Product Generation Sequence itself

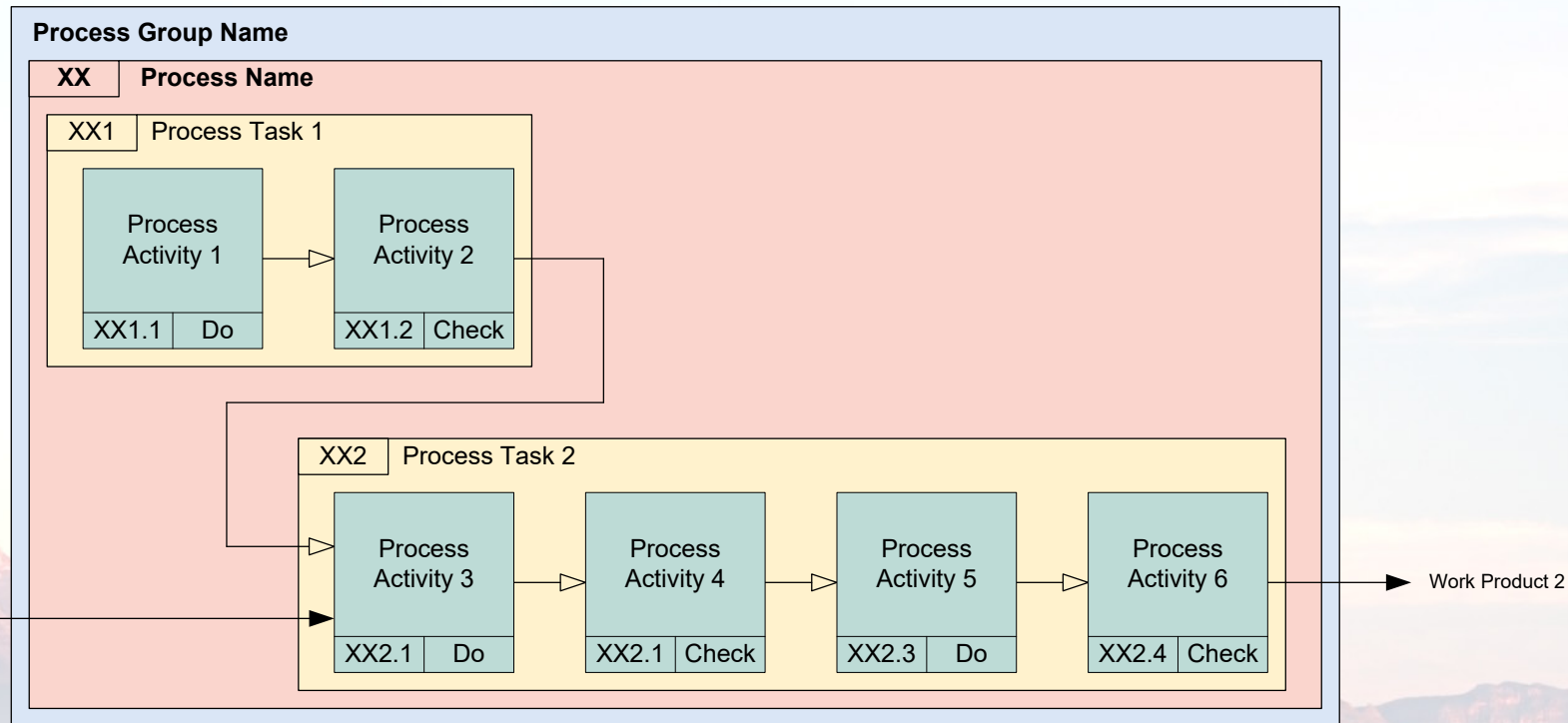


# Work Product Flows



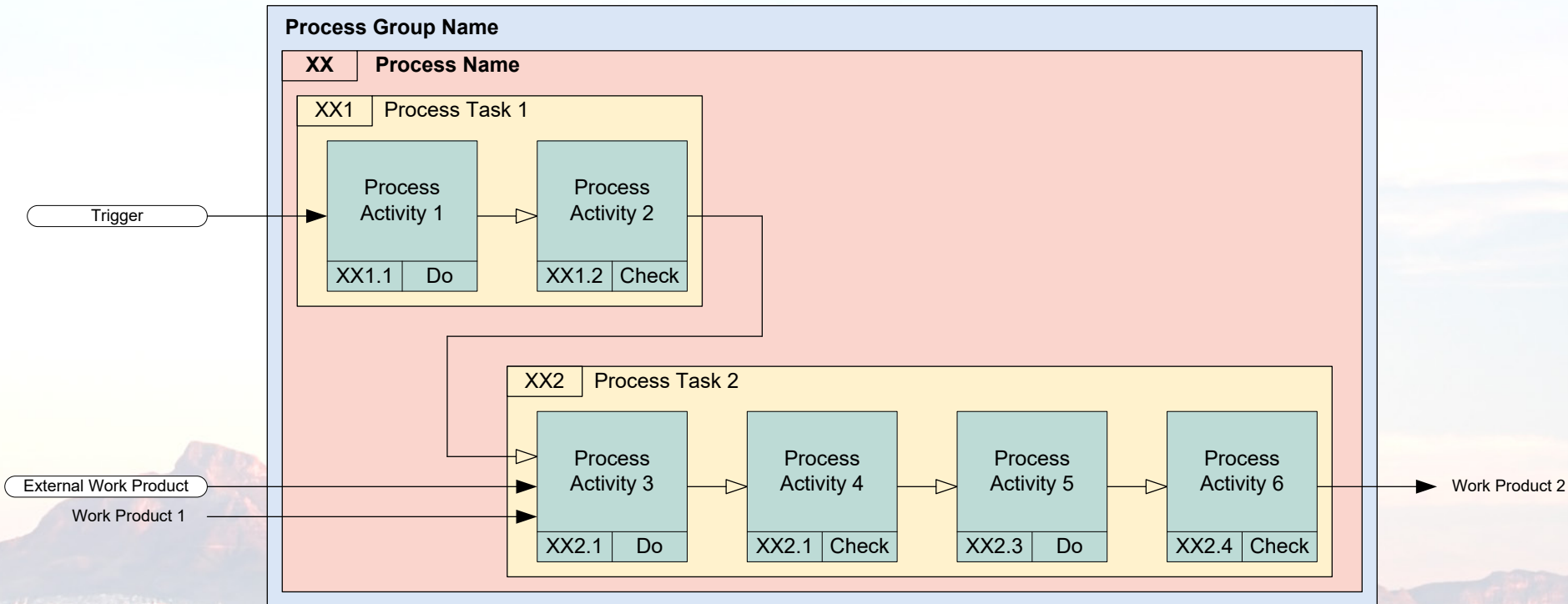
- Work Product Flows represent released versions of Work Products
- Work Product Flows connect Process Tasks hosted by different Elementary Processes

# Dependencies



- Dependencies define the release sequence of Work Products
- Dependencies connect Process Tasks within an Elementary Process and Process Activities within a Process Task

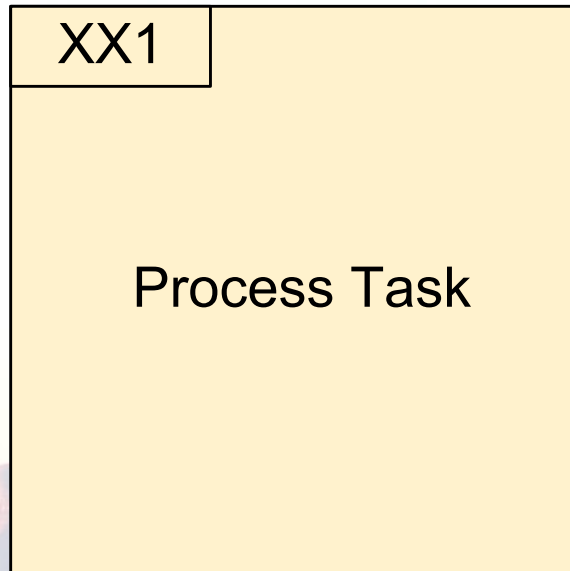
# External Inputs



- External inputs represent either Work Products from other Work Product Generation Sequences, or
- Feedback information triggering further iterations



# Process Task Attributes



## Standard Attributes

- Identifier
- Name
- Responsible
- Description
  - Content of Work Product

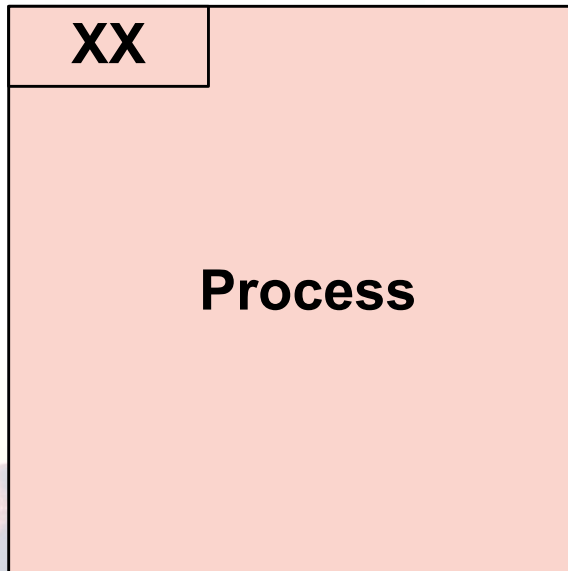
## Further Attributes

- Work Product
  - Prepared By
  - Approved By
  - Released By
  - Authorised By
  - Agreed By





# Elementary Process Attributes



## Standard Attributes

- Identifier
- Name
- Responsible
- Description

## Further Attributes

- Objectives
- Input
  - Work Products or
  - External Inputs
- Output
  - Work Products



# Process Group Attributes

**Process Group**

## Standard Attributes

- Identifier
- Name
- Responsible
- Description

## Further Attributes

- Change Control Board
  - Description
  - Triggers
  - Chairman
  - Change Controller
  - Members



# Process Activity Attributes

Process Activity	
XX1.1	Do

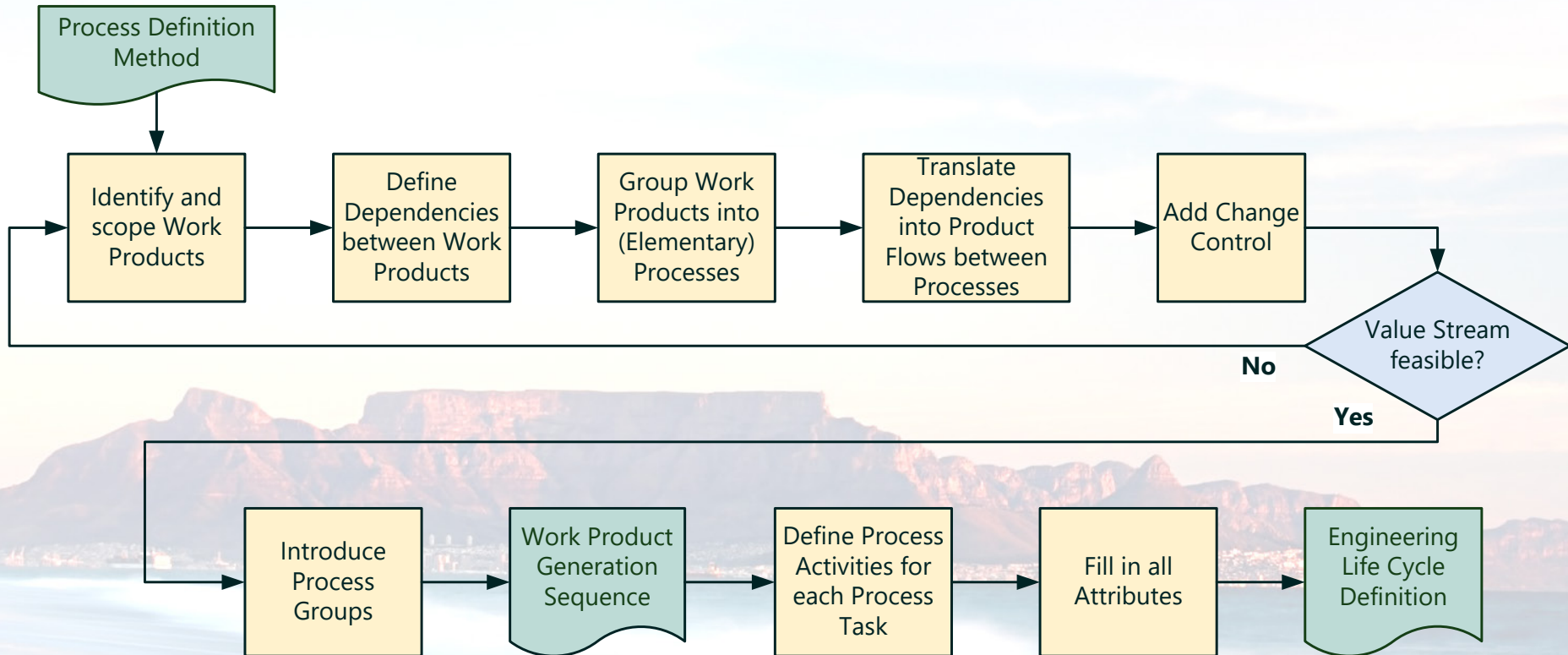
## Standard Attributes

- Identifier
- Name
- Responsible
- Description

## Further Attributes

- Participants
- Inputs
- Outputs
- Applied Standards
- Applied Tools

# Establishing a Work Product Generation Sequence

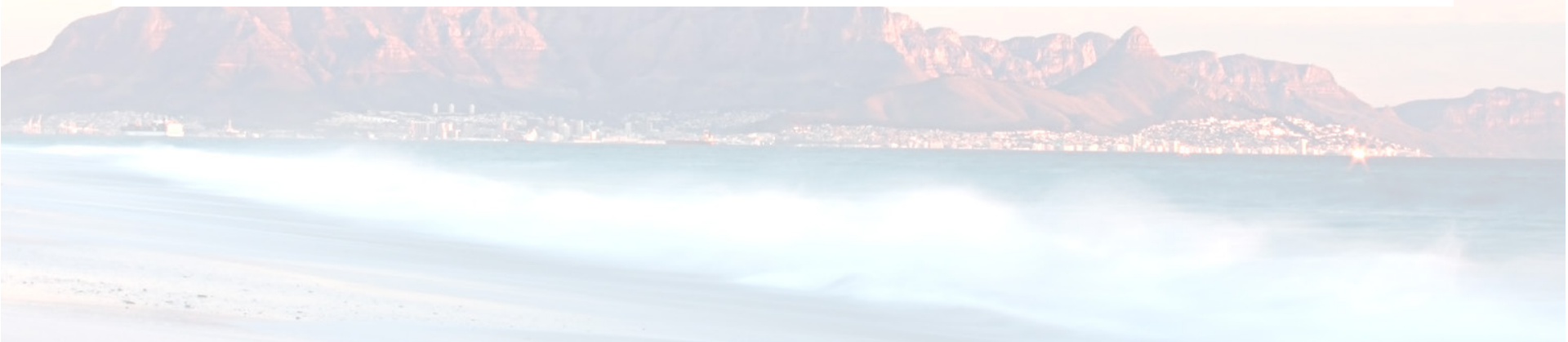




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## Conclusions



- A complete and consistent value stream approach to systems engineering demands
  - controlling the flow of configuration baselines according to the Overall Systems Engineering Value Stream, and
  - controlling the evolution of consistent high-quality configuration baselines for each system and system element according to appropriate Work Product Generation Sequences
- Configuration Management is demanded for controlling the flow according to Work Product Generation Sequences beyond the traditional scope of Configuration Management
- The proposed process definition model with distinct description levels leads to a well balanced process definition



# END

Systems Engineering • Training • Coaching • Consulting



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