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The Role of Architecture to Influence the Development Planning Trade Space

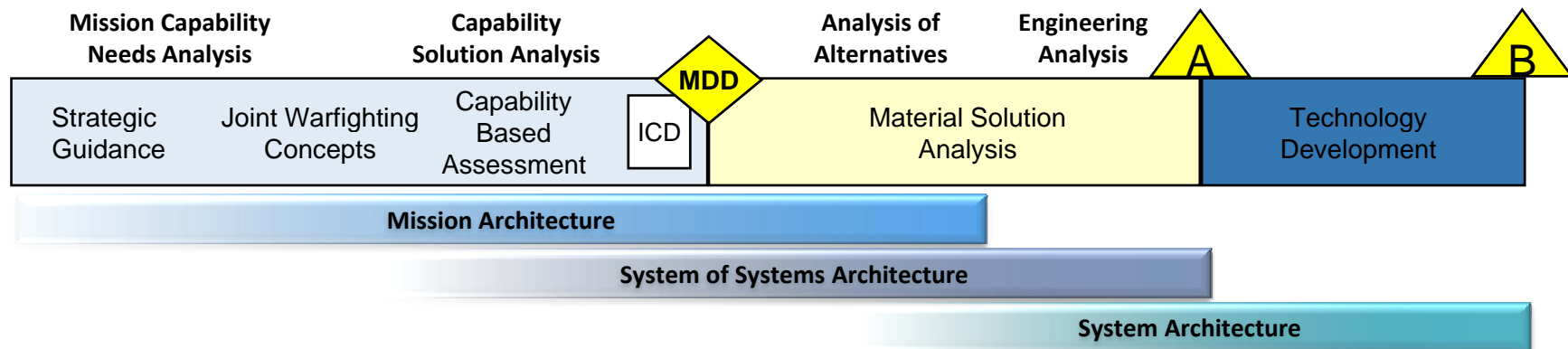
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Agenda

- Purpose
- Development Planning Process
- Types of Architecture
- Definition of Trade Space and Trades
- Elements Of Architecture
- How Architecture Defines Trade Space and Trades
 - Mission Capability Needs Analysis
 - Capability Solution Analysis
 - Analysis of Alternatives
 - Engineering Analysis
- Summary

Purpose

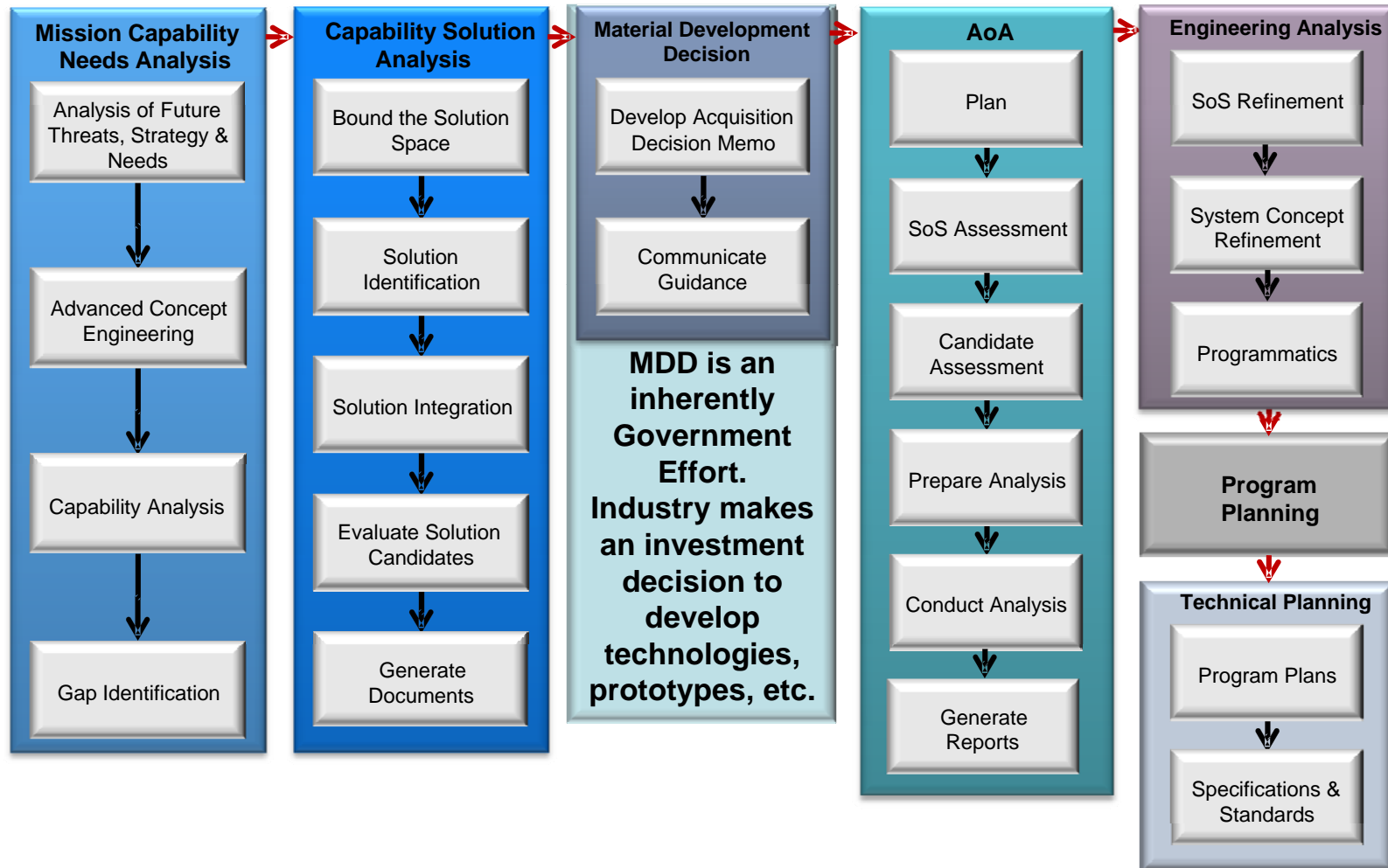
- The purpose of this paper is to;
 - Define the role architecture plays in defining trade space in Development Planning
 - Define the elements of architecture that influence the activities in the process
 - Discuss how those elements define the trade space boundaries



Architecture Influences Development Planning Trade Space and Trades

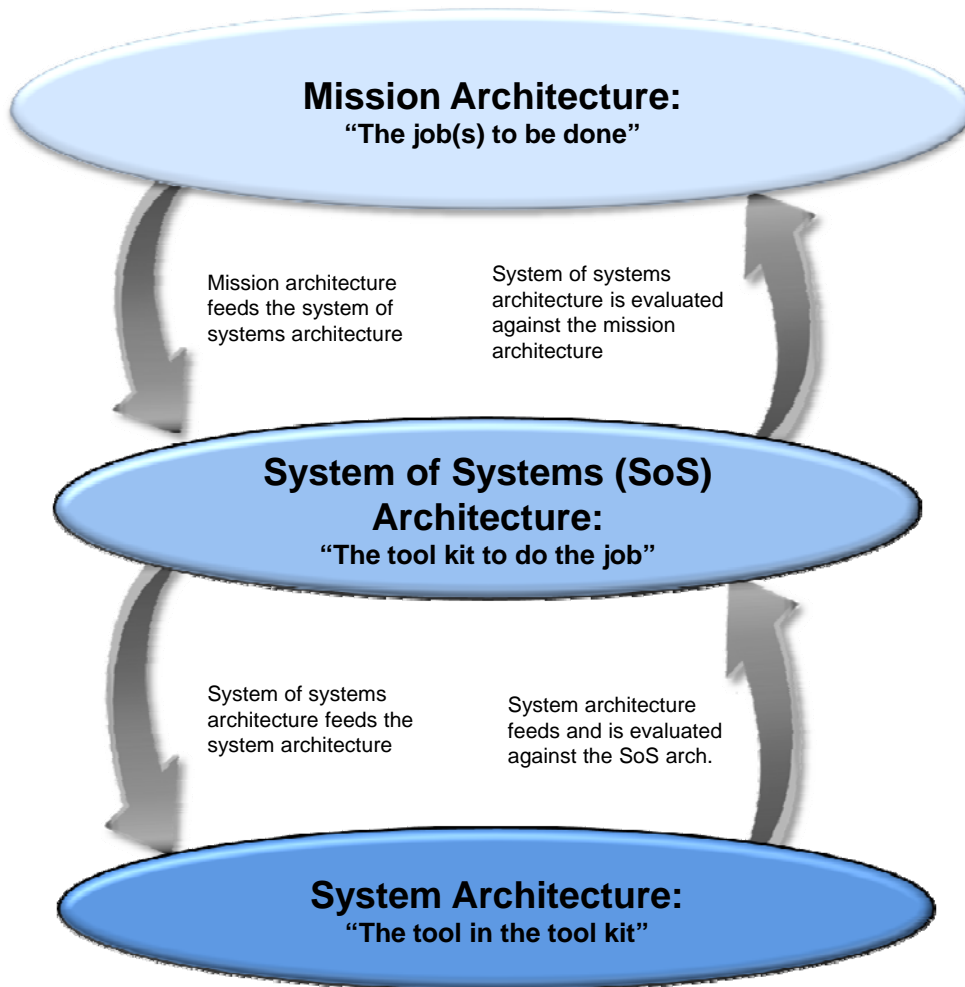
NDIA Development Planning Process

- An Industry View of Development Planning



From NDIA Development Planning Working Group

Levels Of Architecture in Development Planning



- Understand the Job**
- Identify mission capabilities/needs
 - Capture how operations are executed
 - Understand the mission flow and activities
 - Identify mission interactions
 - Identify mission nodes/relationships
 - Identify information exchanges

- Understand the SoS Interactions**
- Identify SoS capabilities and needs
 - Capture SoS interaction
 - Understand the system flow and states within the SoS
 - Identify system nodes/interactions/relationships within the SoS
 - Identify message exchange

- Understand the System**
- Identify the system capabilities/gaps
 - Capture how the components interact
 - Understand the internal system flow and activities

Trade Space and Trades

- Trade space is the solution space to be investigated
 - Is essential in obtaining the executable solution
 - Must be broad enough for completeness
 - Must be bounded enough to exclude non-solutions

- Trades are the methods and activities used in that investigation
 - Used to define and evaluate solution candidates
 - Allows selection of the most viable solution
 - Must investigate essential aspects of solution requirements
 - Must not exclude viable solutions

Trades Investigate the Trade Space

Key Elements Of An Effective Architecture

There is a consistent set of elements present in architectures

Mission Architecture Elements	SoS Architecture Elements	System Architecture Elements
Mission Definition / Objective	SoS Definition / Objective	System Definition/Function
Mission Threat Definition	(as identified in the Mission Architecture)	System Threat Definition
Mission Graphical Overview	SoS Graphical Overview	(as identified in the SoS Architecture)
Mission Functional Flow/Activity and State Diagrams	SoS Functional Flow/Activity and State Diagrams	System Function Flow/Activity and State Diagrams
Mission Timelines	SoS Timelines	System Timelines
Mission Nodes and Interactions	SoS Nodes and Interactions	System Nodes and Interactions
Mission Function Node Task Table	SoS Function Node Task Table	System Function Node Task Table
Mission Operation Resource Flow	SoS Operation Resource Flow	System Operation Resource Flow
Mission Attributes and Measures	SoS Attributes and Measures	System Requirements and Measures

Architectural Elements

- **Definition/Objective**
 - The description of what is to be accomplished
 - May or may not require a materiel development
- **Threat Definition**
 - The reasons or expected situations which drive the need
 - The threat is defined by the adversary
 - Motivations
 - Methods
 - Structure of the Adversary
- **Graphical Overview**
 - Graphical representation of the mission
 - Captures the elements and relations

Architectural Elements

- **Functional Flow**
 - The list of the tasks that are required to be executed in order
 - Captures the relationship between the tasks and the order of execution
- **Timelines**
 - Capture the timing required
 - Urgency of each function
 - Timing of the threat
- **Nodes and Interactions**
 - Representation of the high level elements
 - How they interact
- **Operation Resource Flow**
 - Captures the inputs and output of each node
 - Where each input comes from and where each output goes

Architectural Elements

- Attributes and Measures
 - How we know the mission and tasks are being performed
 - How well this is being accomplished

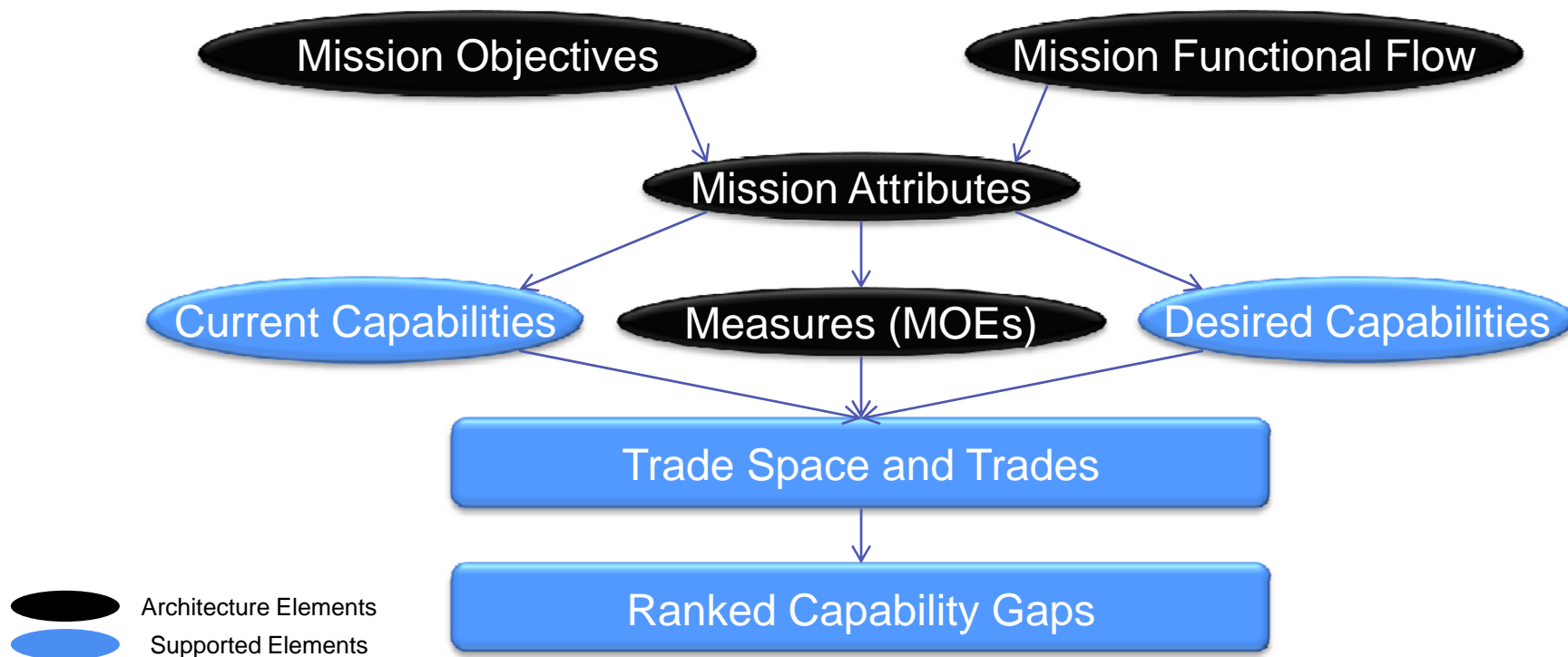
 - Attributes
 - Characteristics that describe the ability to execute the mission in a satisfactory manner
 - Measures
 - How this ability is evaluated

 - Each attribute has one or more measures
 - Are derived from the other architecture elements
 - Provide a direct mapping to the trade space and trades

The Link to the Trade Space and Trades

Mission Capability Needs Analysis

- The current or “as-is” Mission Architecture is understood
- Trade Space and Trades driven by;
 - Current Capabilities, Measures, and Desired Capabilities
- Ranked Capability Gaps derived from the Trade Space through the Trades



Capability Solution Analysis

- The “as-is” and “to-be” System of Systems (SoS) Architectures are understood
- Mission Functional Flow mapped to the systems that execute



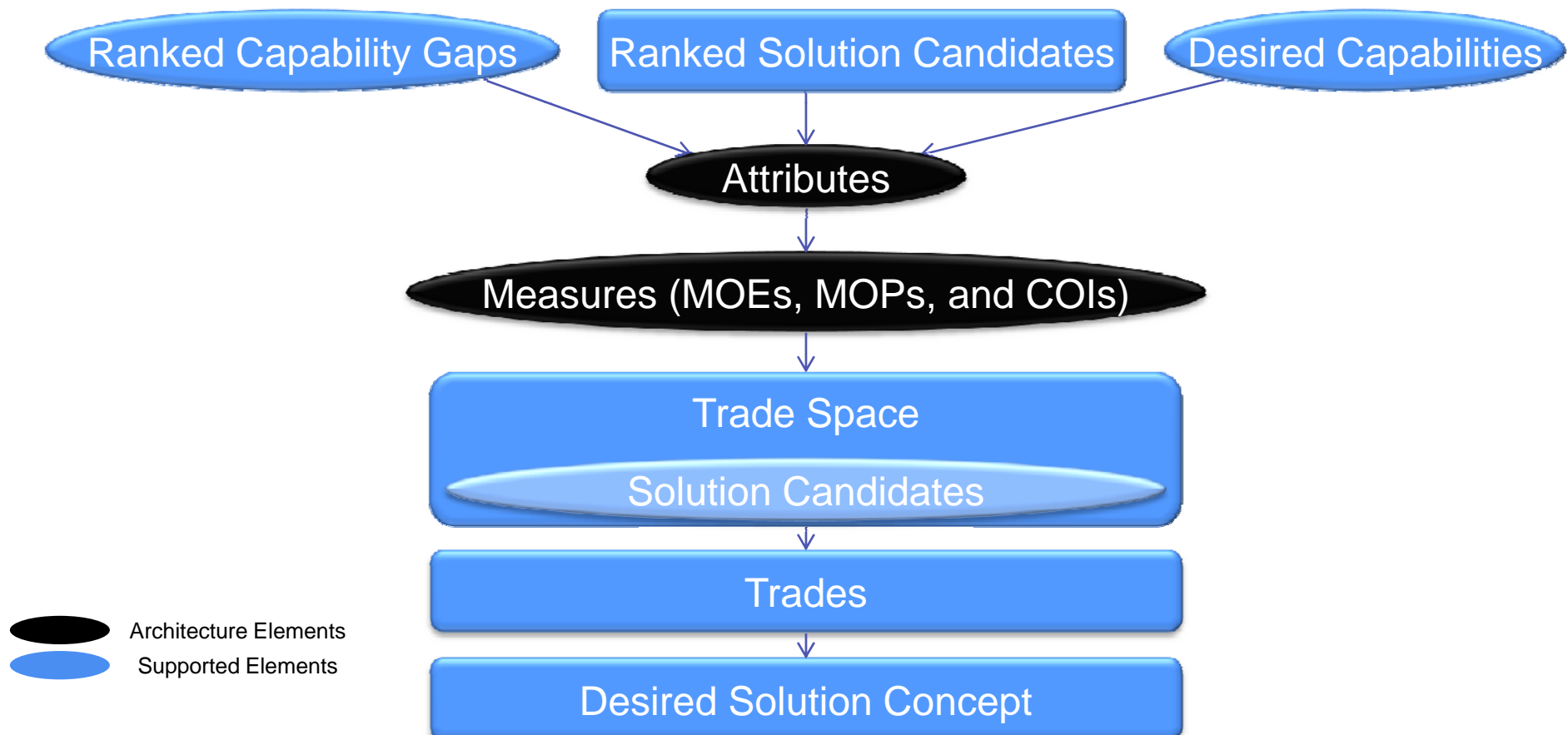
Analysis of Alternatives

- A Government function
 - Mirrored by Industry in preparation for and anticipation of a subsequent Request For Proposal (RFP)
- Investigate the solutions candidates
- Evaluate candidates against a pre-described set of criteria
- Select the desired solution
- Consists of:
 - Relevant trade studies
 - Evaluation criteria and critical success factors
 - Each candidate to be evaluated in the AoA is integrated into the “as-is” Mission and SoS Architectures to create a series of “to-be” Architectures
 - Integration readiness assessment
 - SoS architecture identifies the interfaces that need to be assessed

A Detailed Investigation of Trade Space and Trades

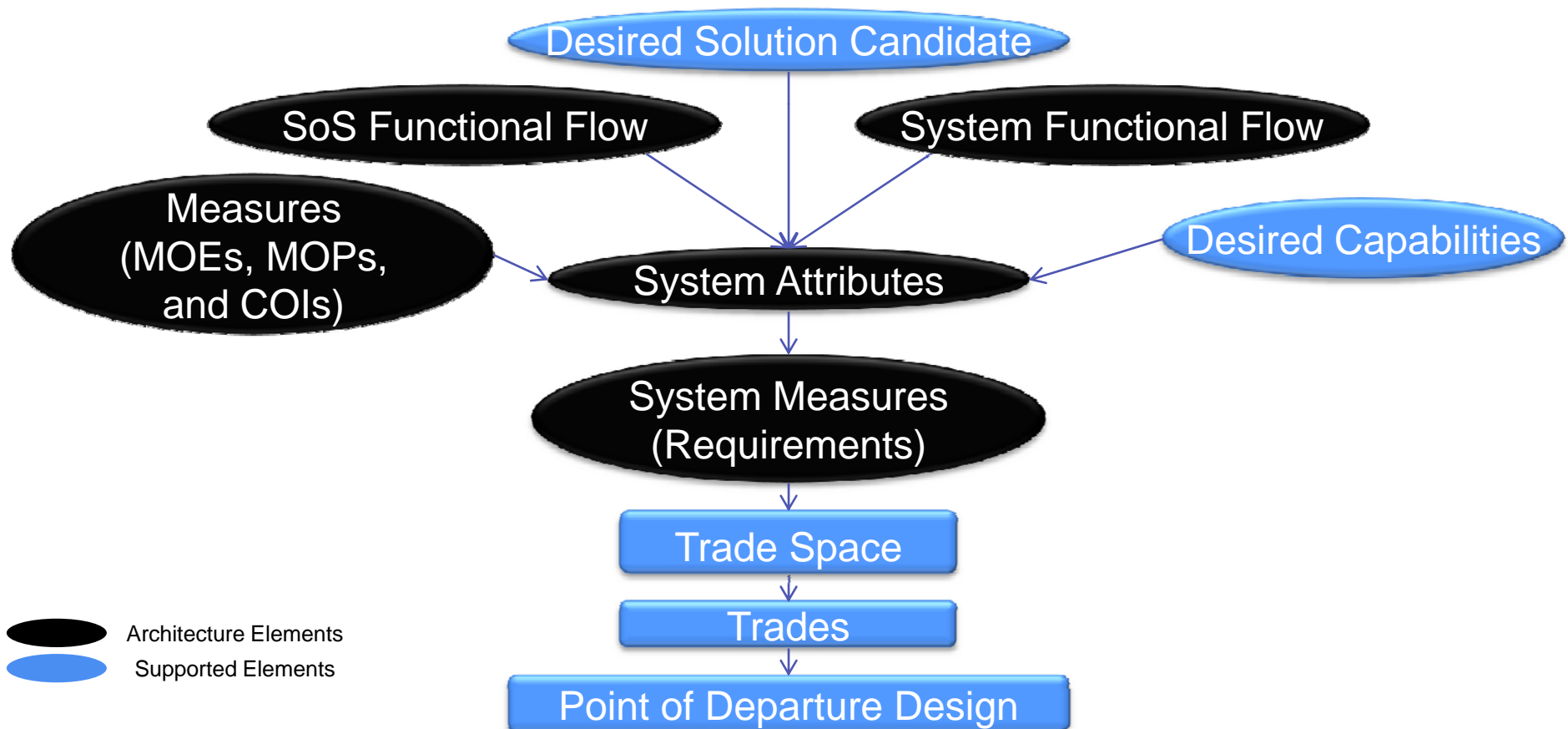
Analysis of Alternatives

- Driven by Mission and SoS Architectures
- Measures (MOEs, MOPs, COIs) drive the Trade Space



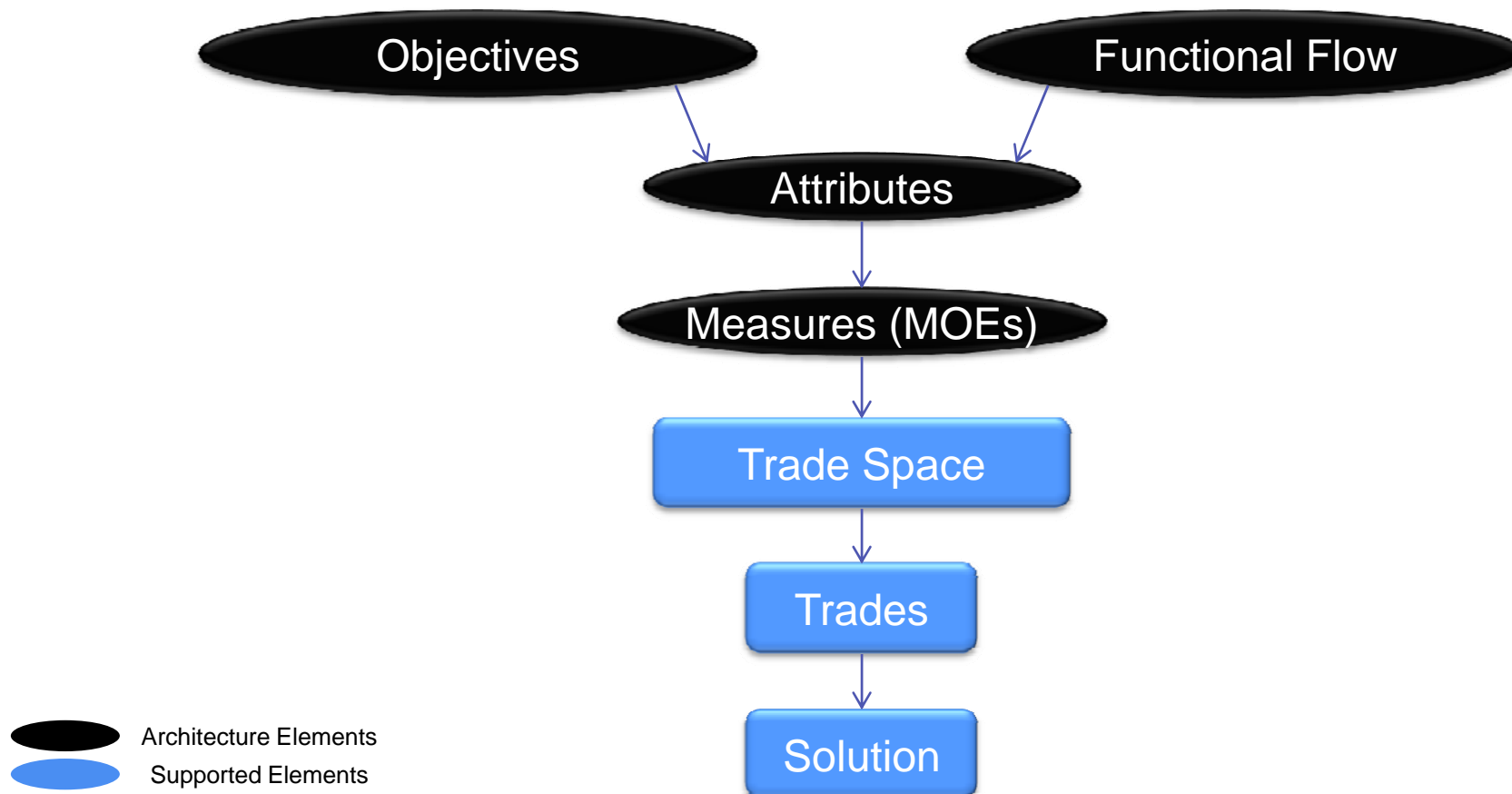
Engineering Analysis

- System Architectures are developed or refined
- Bounds the systems to be changed or developed
- Defines the System Measures as requirements



Architecture's Influence

- Elements of the Architecture Define the Attributes and Measures
- Attributes and Measures directly define the Trade Space and Trades



Summary

- Utilization of Architecting
 - Provides the foundation for defining the Trade Space and Trades
 - Insures the completeness and relevance of the trade studies
 - Reduces irrelevant trades
 - Allows focus on the trades of primary importance

Architecting Defines the Trade Space and Trades

Questions?

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