31st Annual INCOSE international symposium

virtual event

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Architecture Literacy

Agenda

1) Background

2) Motivation

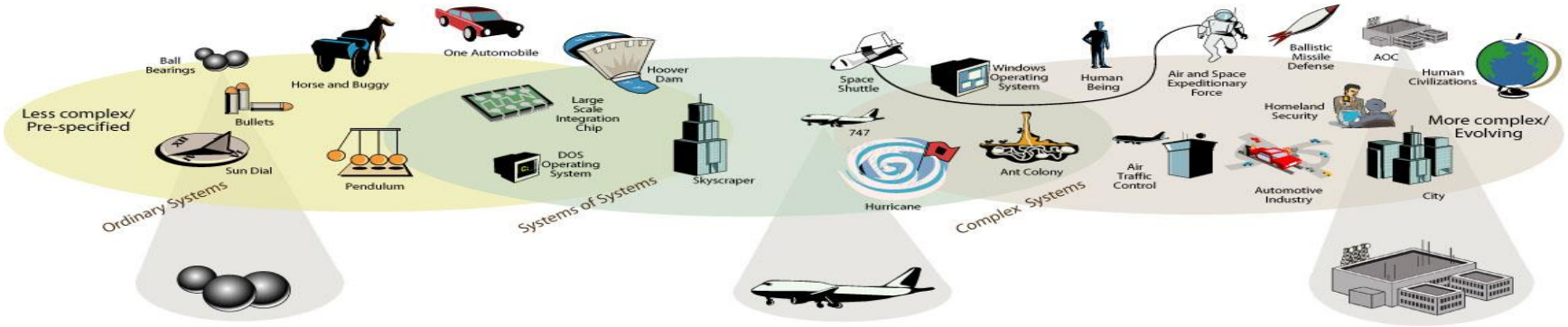
3) Inspiration

4) Literacy Principles

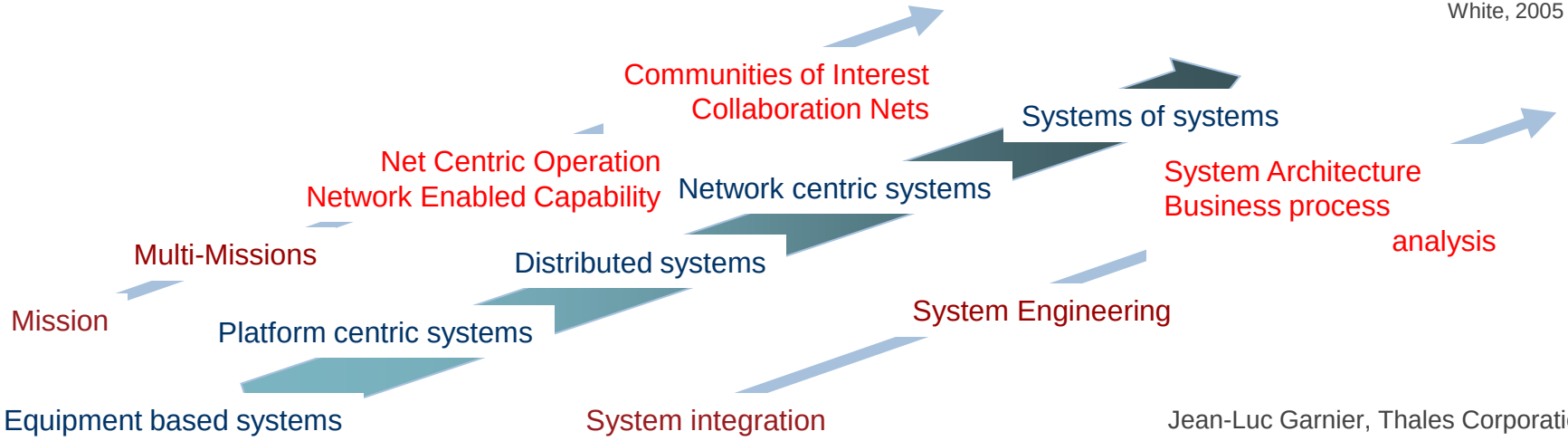
5) Concluding Remarks

Background

Systems are becoming more and more complex



White, 2005



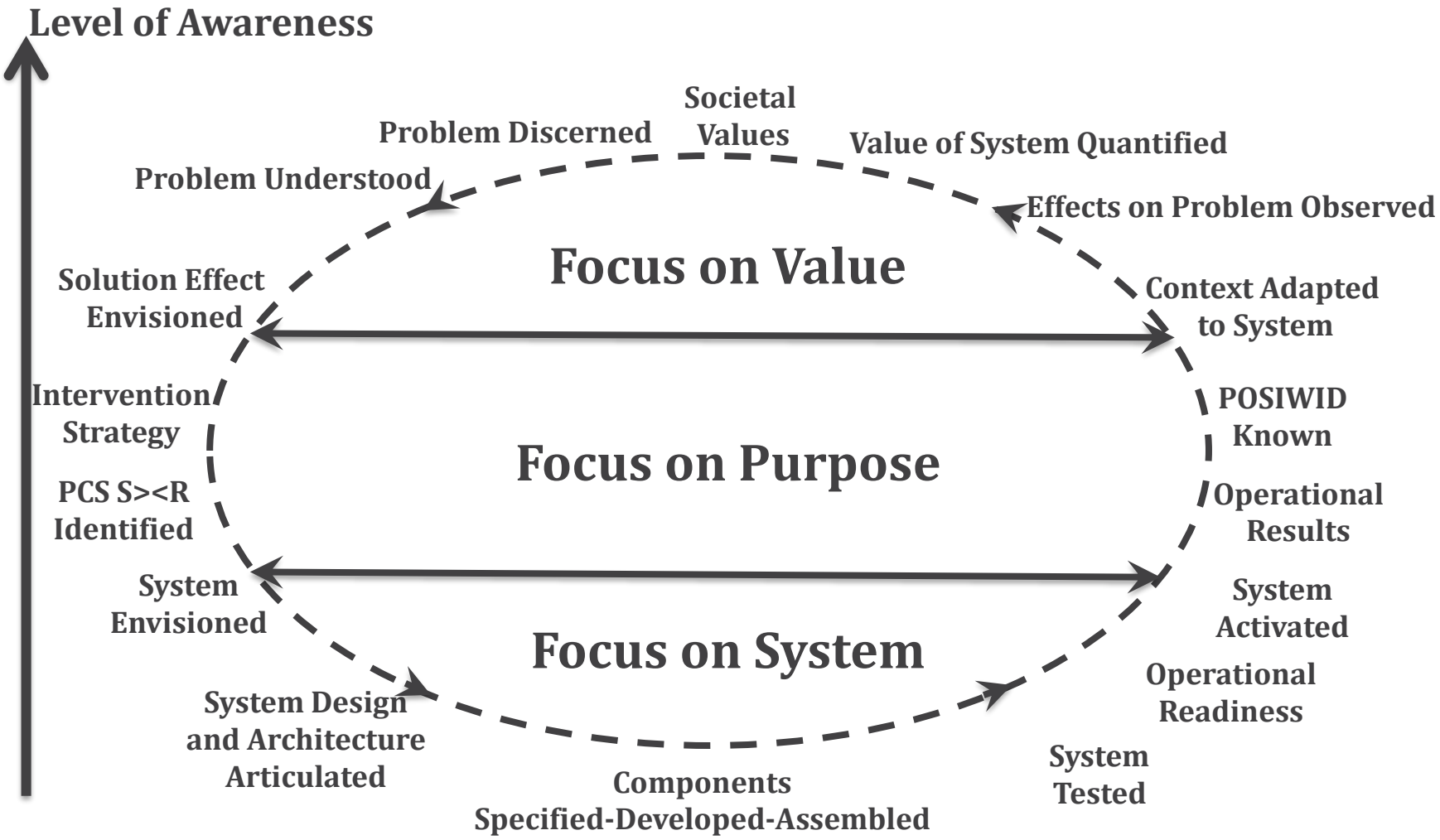
Jean-Luc Garnier, Thales Corporation

It is established that Architecture as a discipline helps address this Complexity

Architecture Landscape

- **Architecture Standards**
  - IEEE 1471 (2000, superseded by 42010)
  - 42010 (Expected in 2022)
  - 42020 (Published in 2019)
  - 42030 (Published in 2019)
- **Architecture Frameworks**
  - DoDAF, MoDAF, ZAF, NAF, UAF, DNDAF, IndEA, ToGAF, GERAM
- **Architecting Styles**
  - Supportive, Coordinative, Directive, Authoritative
- **Reference Architectures**
  - IoT, Cloud, Smart City, Banking Industry, Automotive, Industry
- **Handbooks**
  - INCOSE SE Handbook, Guide to 42020, UAF Process Guide

There is a paradigm shift in Architecting



(Jack Ring – 2004)

Motivation

Managers Perception

Architecture is unnecessary …

Given a problem, it is perfectly possible to engineer a good solution that meets all requirements without doing architecture

Architects talk in the Air and don't do real work

I would like to invest in a resource that would help bring value to the Customer

Organizations' Perception

- We are a large organization (~509,000 employees)
- We work on different kinds of customer engagements across multiple domains and geographies
- Over the last 5 years, we have trained more than 5000 Architects (5 – 20 years of experience)
- What does it mean to scale up to reach > 500,000 employees?
- What are the architecture related concepts that every employee should be aware of?

Architecture Competency Building	
Enterprise Architecture Certification	
• EA Star (5 day instructor-lead)	• ToGAF ADM
Architecture Leadership Program (3 months)	
• 40 hrs self Learning • 20 hrs instructor-led	• ISO Architecture standards • System Architecture • Enterprise Architecture • Architecture Frameworks
Mid-level Architecture Program (2 months)	
• 20 hrs self learning • 2 hrs Webinar • 18 hrs instructor-led	• Thinking like an Architect • Acting like an Architect • Software Architecture
Entry level Architecture Program (16 hours)	
• Nano (2 mins) Videos • Micro (6 mins) Videos • 12 hrs Virtual learning	• Architectural Thinking • Technical Architecture • Cloud, Digital Architecture

Customer's Perception

I am not sure what silos exists in my Enterprise, can the Architect help me identify it? How can I trust his/her capabilities?

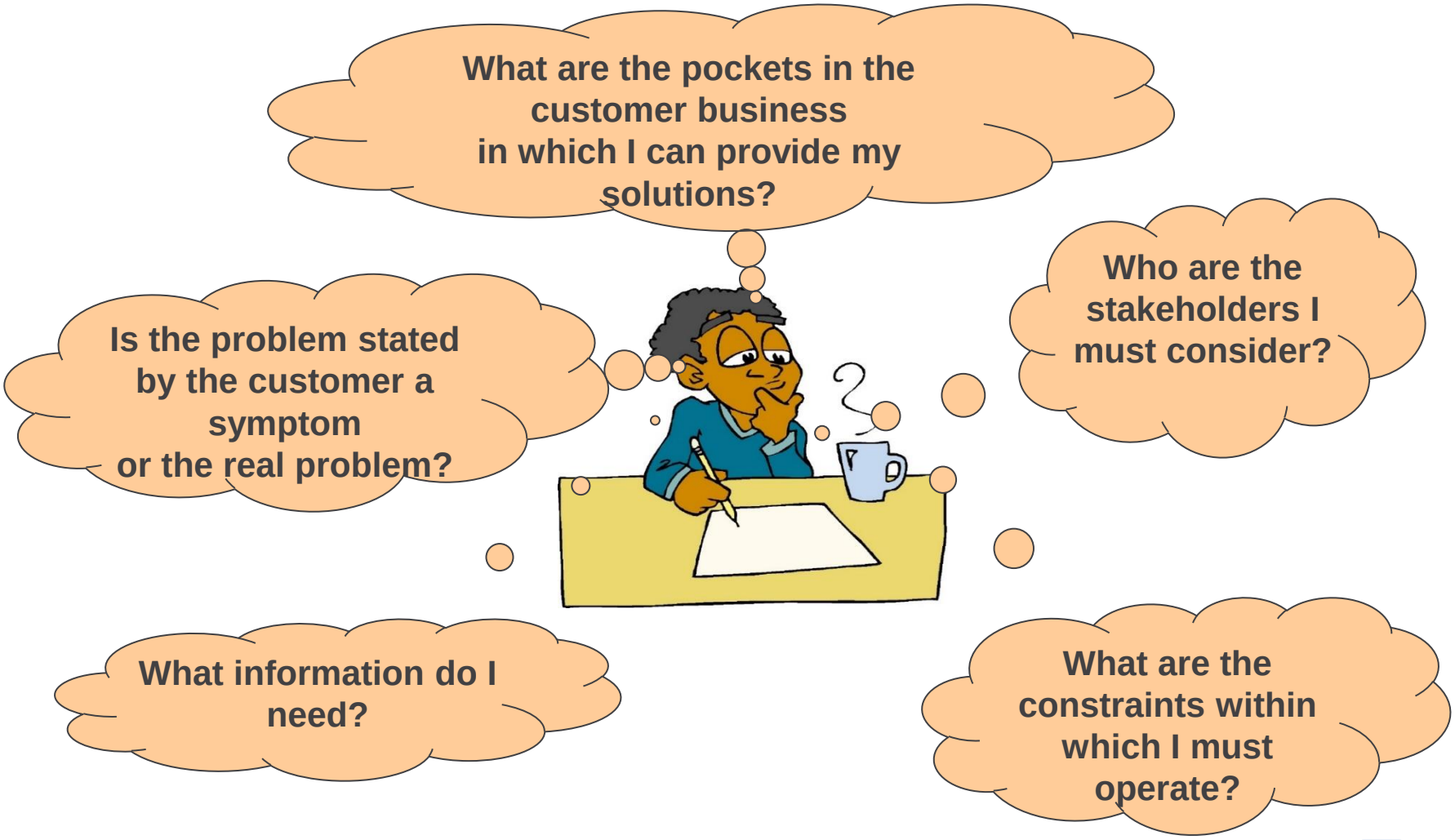
What does the architect know about my business?

What delta can I make by engaging this architect?

How can the architect support me to do my business better?

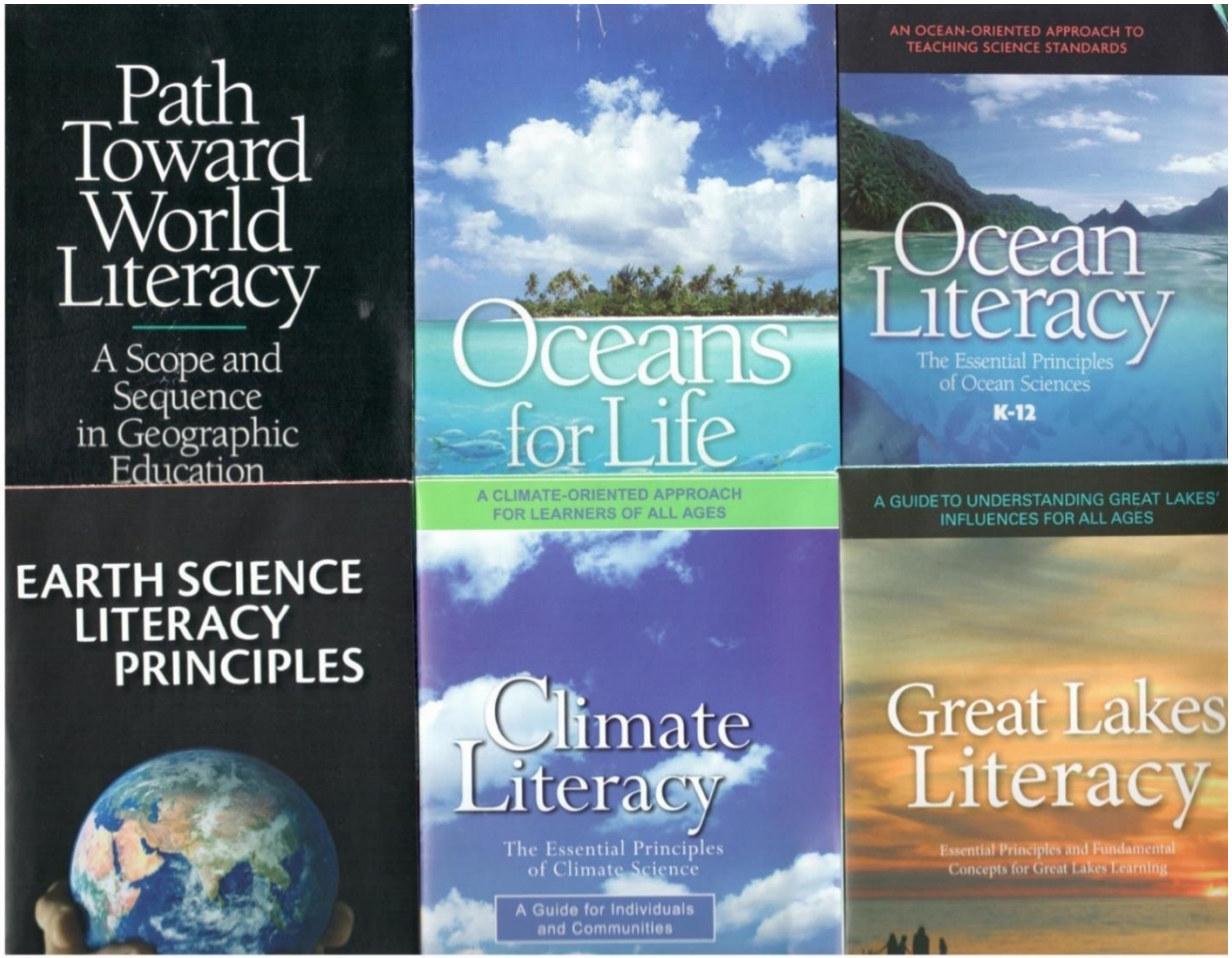
How much time will I need to spend with the architect?

Architects Perception



Inspiration

The Need for Systems Literacy



(Peter D Tuddenham – IW 2019)

The Need for Architecture Literacy

1. What is the minimal ontology and vocabulary that down-stream team should be aware of about the system of interest?

2. What are the concepts, properties, and principles that Stakeholders should know about the system of interest?

3. What are the concepts, properties, and principles that architects should utilize to communicate about the architecture?

4. What are the architectural concepts, properties, and principles, that architects should be aware of, for architecting the system of interest?

5. What information does managers need to make informed decisions about the architecture and the system of interest?

Architecture Literacy

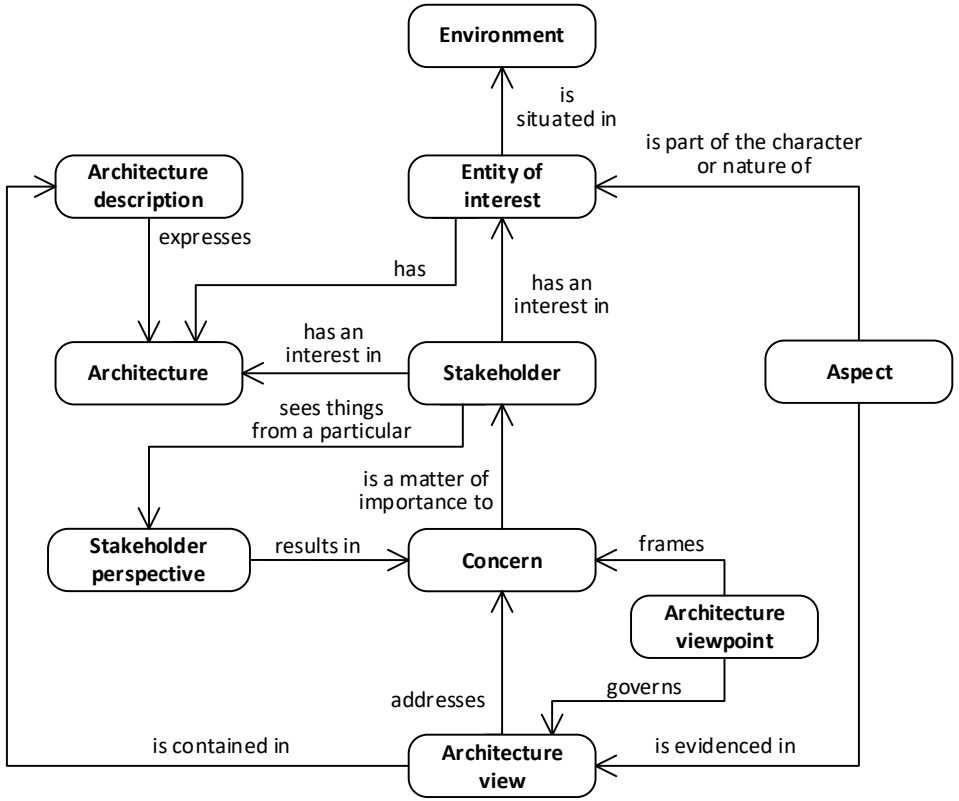
Architecture Literacy Principles

Principle 1

<u>Architecture constructs</u> are **<u>domain</u>** and **<u>method agnostic</u>**

Not just systems, can be

- Enterprise
- System of systems
- Collection of systems
- Class of systems
- Family of systems
- Individual system
- Portion of a system
- Product line
- Product (or) Service
- Hardware or software item
- Any other entity that is amenable to architectural definition
  - data, doctrine, organization, process, method, technique, policy, facilities, …

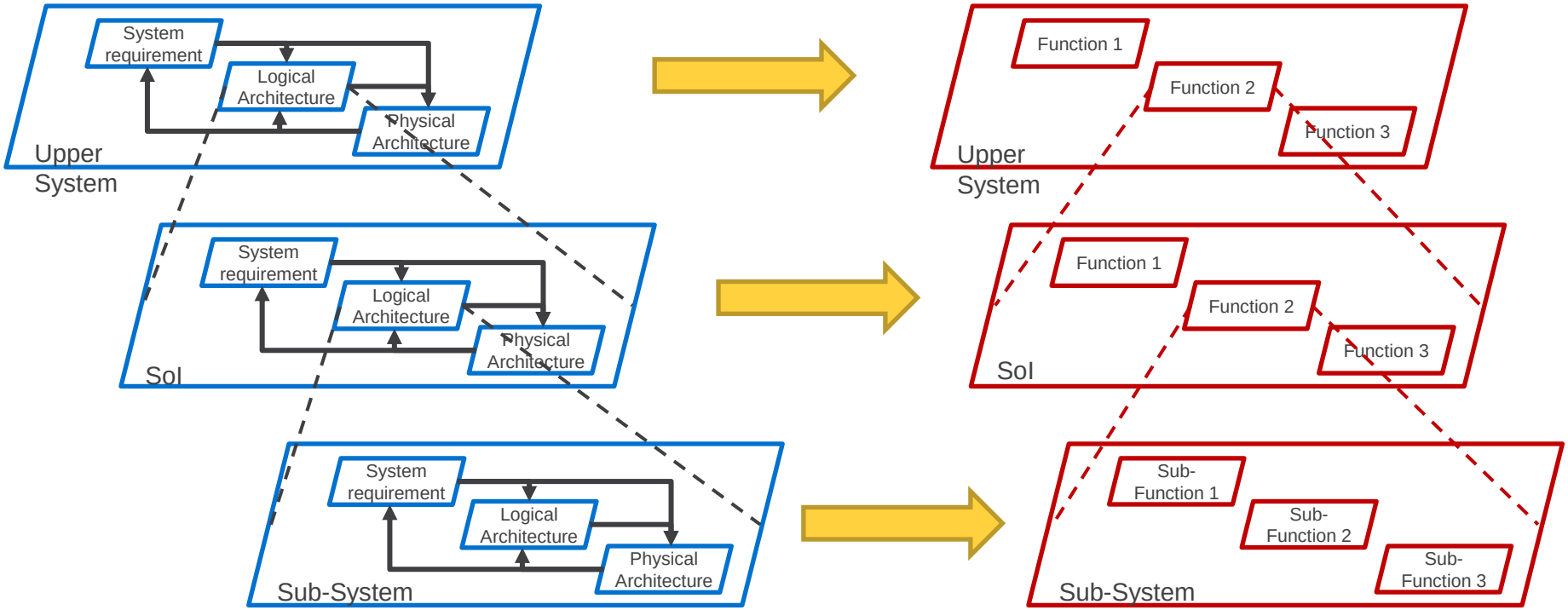


ISO/IEC/IEEE 42010 Ed2

Principle 2

Architecting is **iterative**

- Iterative process of applying simple rules to architect systems



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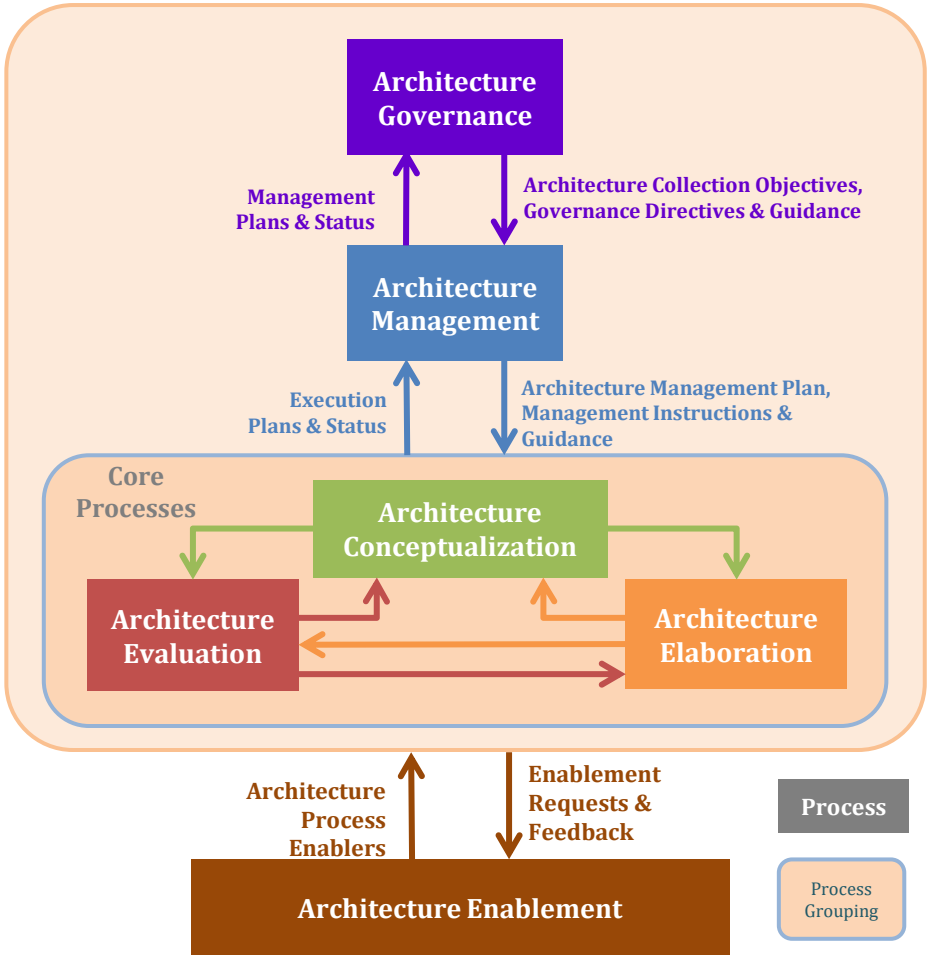


- Architecture Governance
  - Establishes and maintains alignment of architectures in a collection
- Architecture Management
  - Implements the governance directives
- Architecture Conceptualization
  - Understanding, Synthesizing & Formulating architectures
- Architecture Evaluation
  - Bridge the gap between Stakeholder, requirements and architectures
- Architecture Elaboration
  - Detailing the architecture to a sufficiently complete and correct manner
- Architecture Enablement
  - Provide capabilities to support other architecture processes

Core Processes **Conceptualization, Evaluation & Elaboration** are iterative

ISO/IEC/IEEE 42020

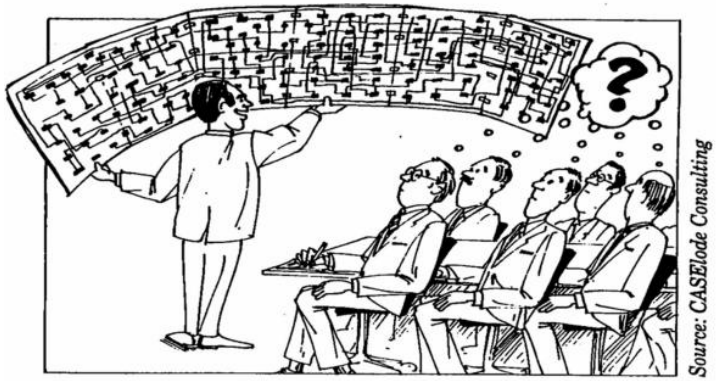
Principle 3

Architecture is **Formless**

- The work product of architecting is an architecture description
- Architecture descriptions are used to communicate architectures to different stakeholders
- An architecture description is an expression of the architecture
- An architecture description includes one or more architecture views

Source: © fabiomax/Fotolia

Implementation of an Architecture

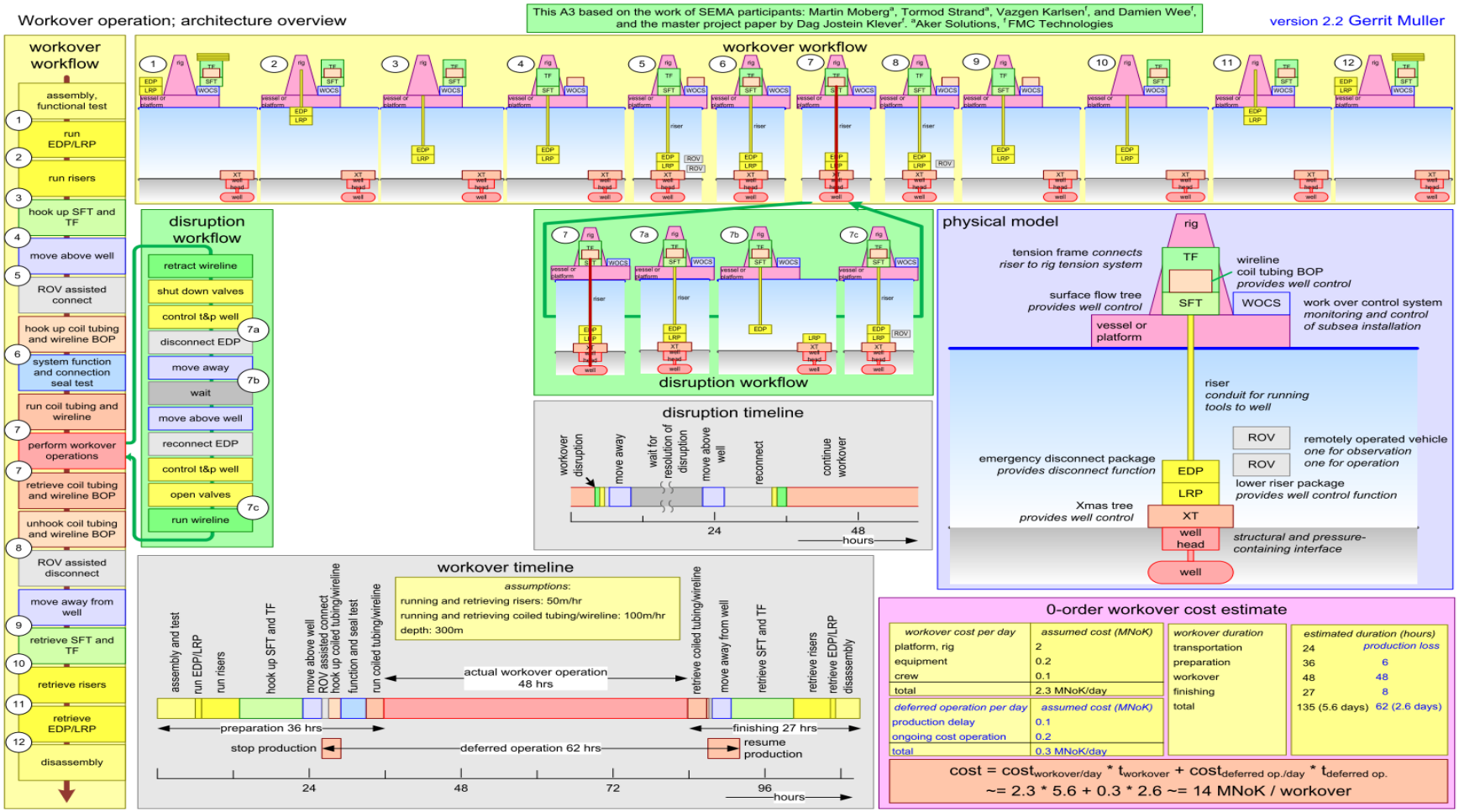


Source: CASElode Consulting

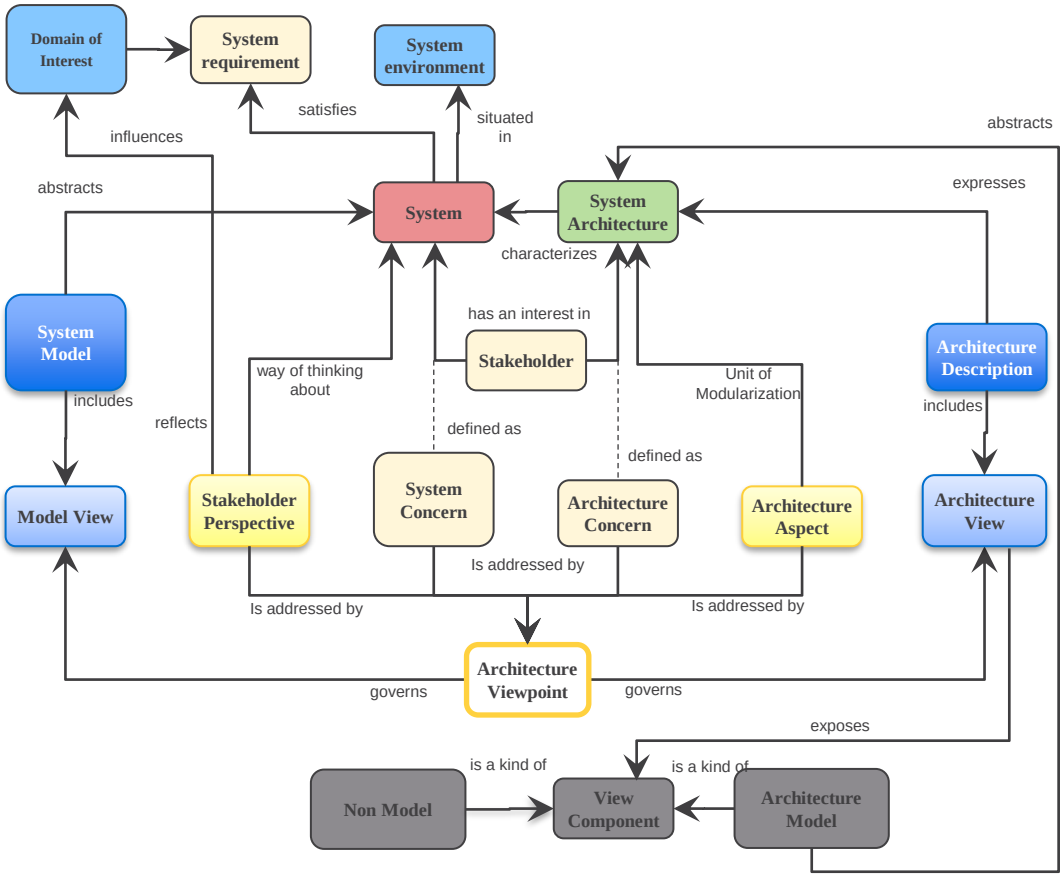
"Gentlemen, here is your data model. Any questions?"

Principle 3

Architecture is **Formless**



Principle 4



<u>Architecture</u> is conceptualized as **<u>concepts, properties</u>** and **<u>principles</u>**

- of the thing being architected
- of the design of the thing being architected
- of the evolution of the thing being architected
- of the evolution of the design of the thing being architected

fundamental concepts or properties of an entity in its environment embodied in its elements, relationships, and in the principles of its design and evolution (ISO/IEC/IEEE 42020)

Principle 5

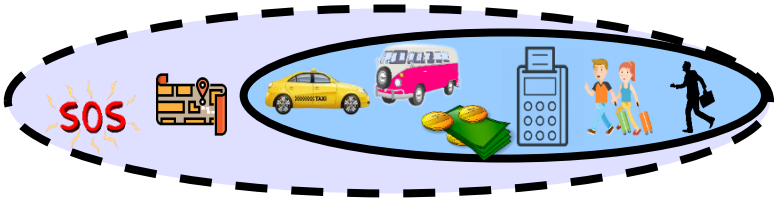
Architecting is a way of being **concerned** about a **human-made thing**

- **Means** to engage with different aspects of the thing
- **Ends** in aiding the thing achieve its intended purpose
- **Delivers value** to all stakeholders interested in that thing
- **Delivers value** to all stakeholders interested in the architecture
- **Determines quality** characteristics that the thing should possess in order to achieve its purpose and deliver value

Architecting effort starts with the current or future reality..

Considering an entity of interest and a set of Stakeholders

Taxi Aggregator System



Drivers:
- Wait time
- Price
- Payment options
- Commission

Riders:
- Cost efficiency
- Payment options
- Route trace
- Safety

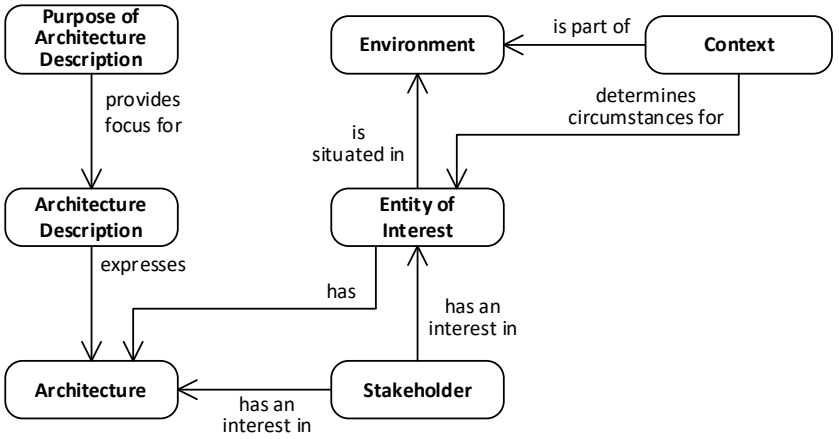
Regulatory Bodies:
- Safety
- Commission
- Rate
- Exploitation

Principle 6

Architecture is **Contextual**

Digitization Context in Energy Services

- Service provider processes the Energy bills of Consumers across different geographies
  - Number of Energy units consumed is fetched from a Database
  - Billing rules are encoded and available as emulated applications
  - Service agents run scripts that generate the bills
  - Bills are dispatched to respective customers (PDF/Hard-copy)
- Mobile or a Web App that displays the last bill along with Payment details
  - A new channel is opened for communication with Customers
  - A new way of interacting with the customer has been opened up



ISO/IEC/IEEE 42010: Ed2 DIS

Principle 6

Architecture is **Contextual**

Digital Transformation Context in Energy Services

- A mobile App or Web Interface that dynamically generates the unbilled amount
  - Know how much energy they have consumed and what is the total cost so that it can be budgeted
  - Plan energy utilization for the rest of the period as there were visitors
  - Need not wait for the billing cycle to be complete to know the cost
  - On demand unbilled amount !!!
  - Customer centric view of Billing

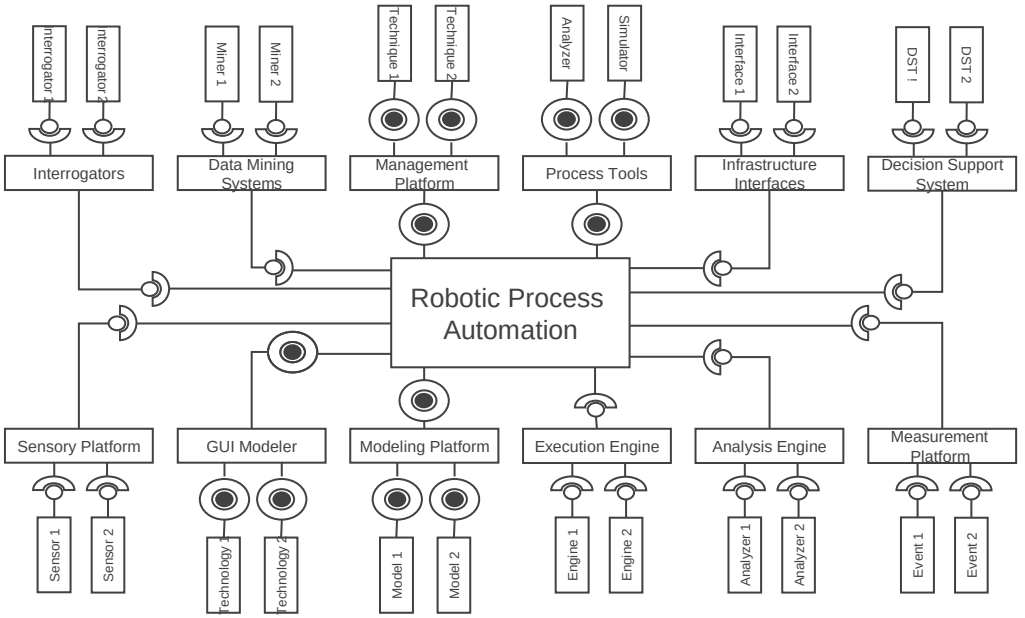
Digital Reimagination Context in Energy Services

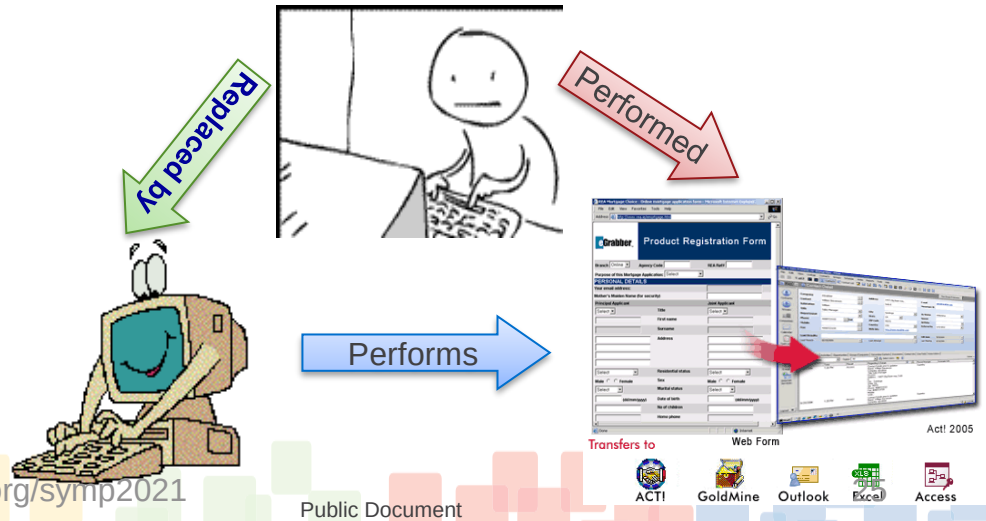
- Device specific Billing
  - Sensors for every energy consuming device
  - Controllers to manage how much each device consumes
  - Integrating all of this together
  - MyPlan for every device or category of devices
    - Charged based on usage (Post-Paid)
    - Dynamically reconfigurable (Many MyPlans in a cycle)
    - Charged based on a Plan (Pre-Paid)

Principle 7

A **thing** is an **instance** of its **architecture implementation**

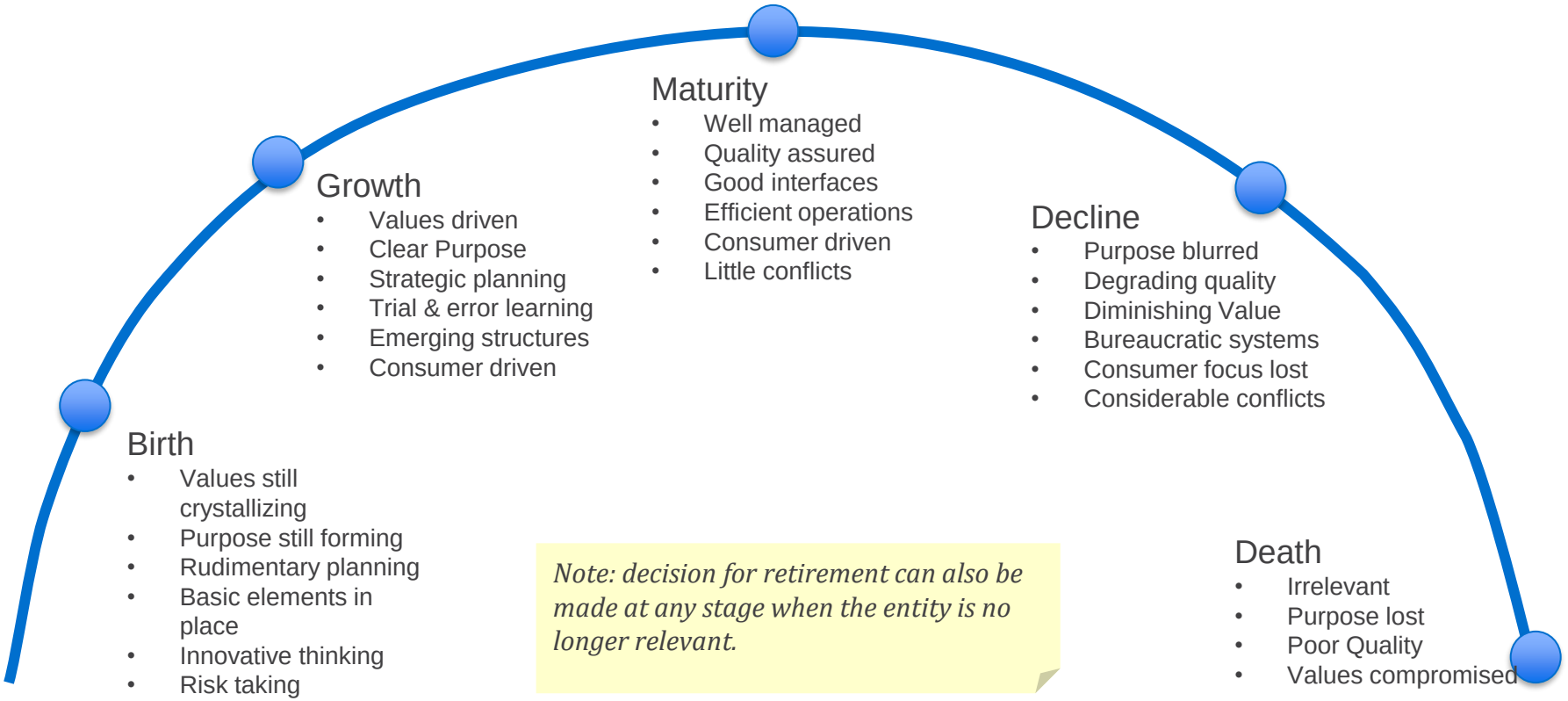
- System is an instance of a system architecture implementation
- Software is an instance of a software architecture implementation
- Implementation is the realization or orchestration of a scheme of things





Principle 8

Lifecycle of an **Architecture** extends **beyond** lifecycle of the **entity of interest**



Life-cycle of an Entity

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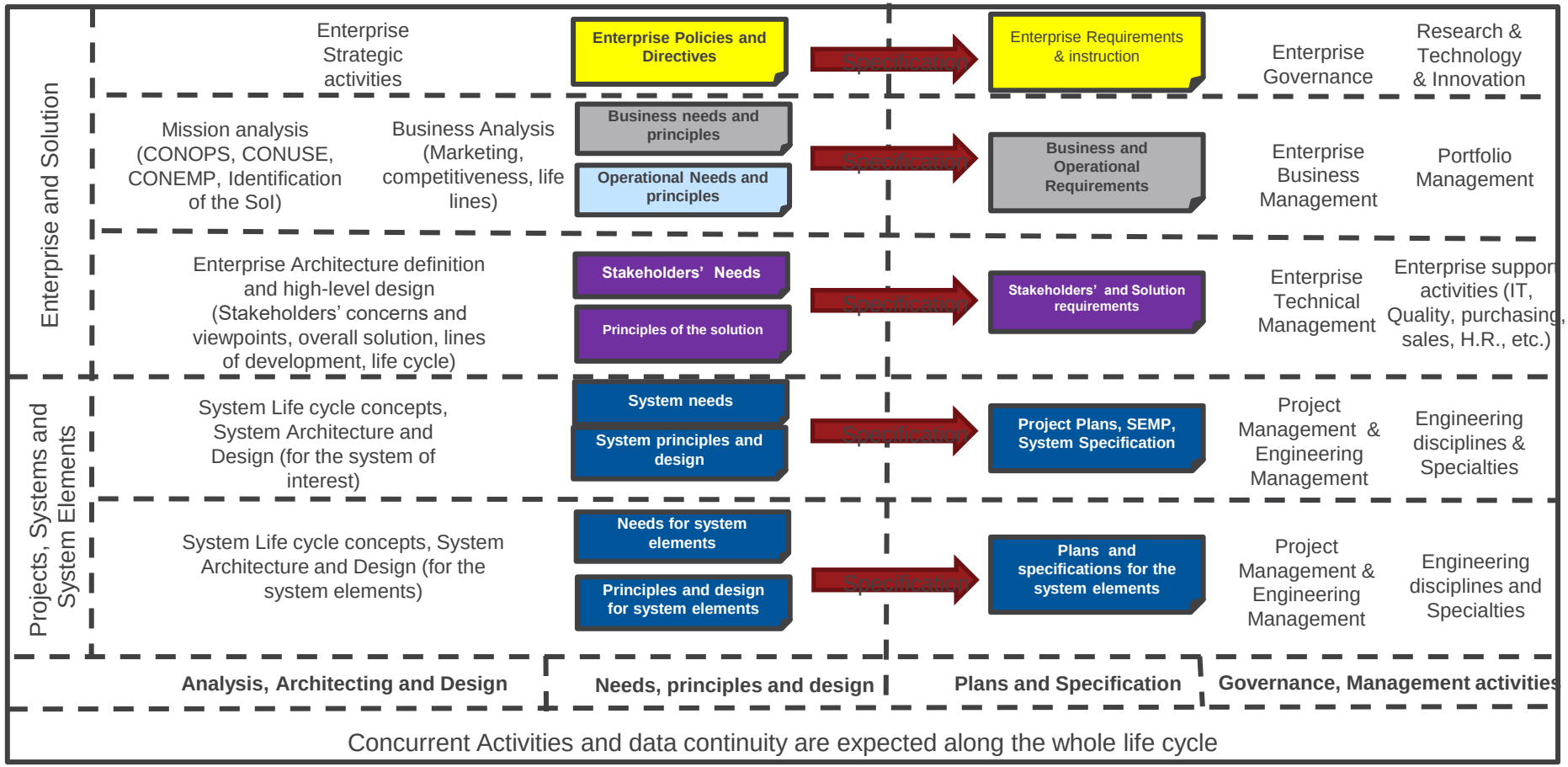
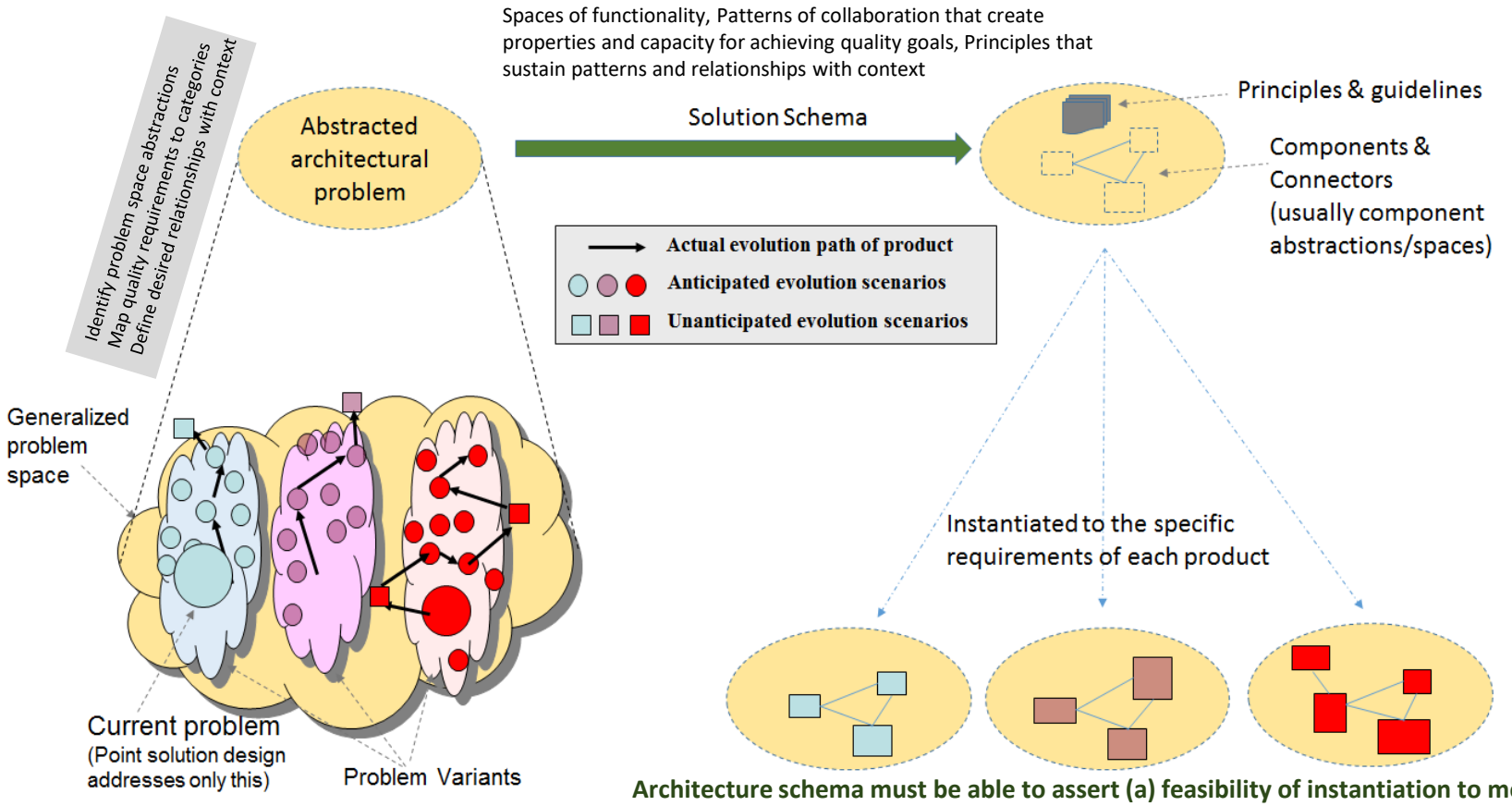


Life-cycle of an Architecture

Principle 9

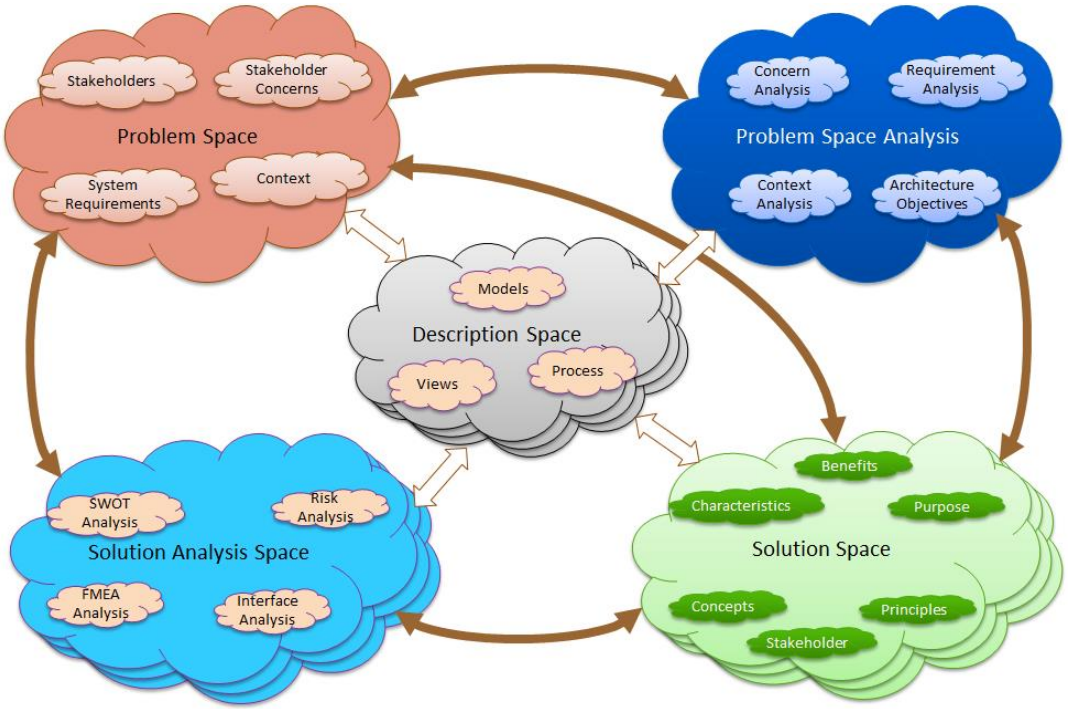
Architecture provides **solution schemas** for a **class of problems**



Architecture schema must be able to assert (a) feasibility of instantiation to meet anticipated requirements and scenarios (b) satisfaction of architectural

Principle 10

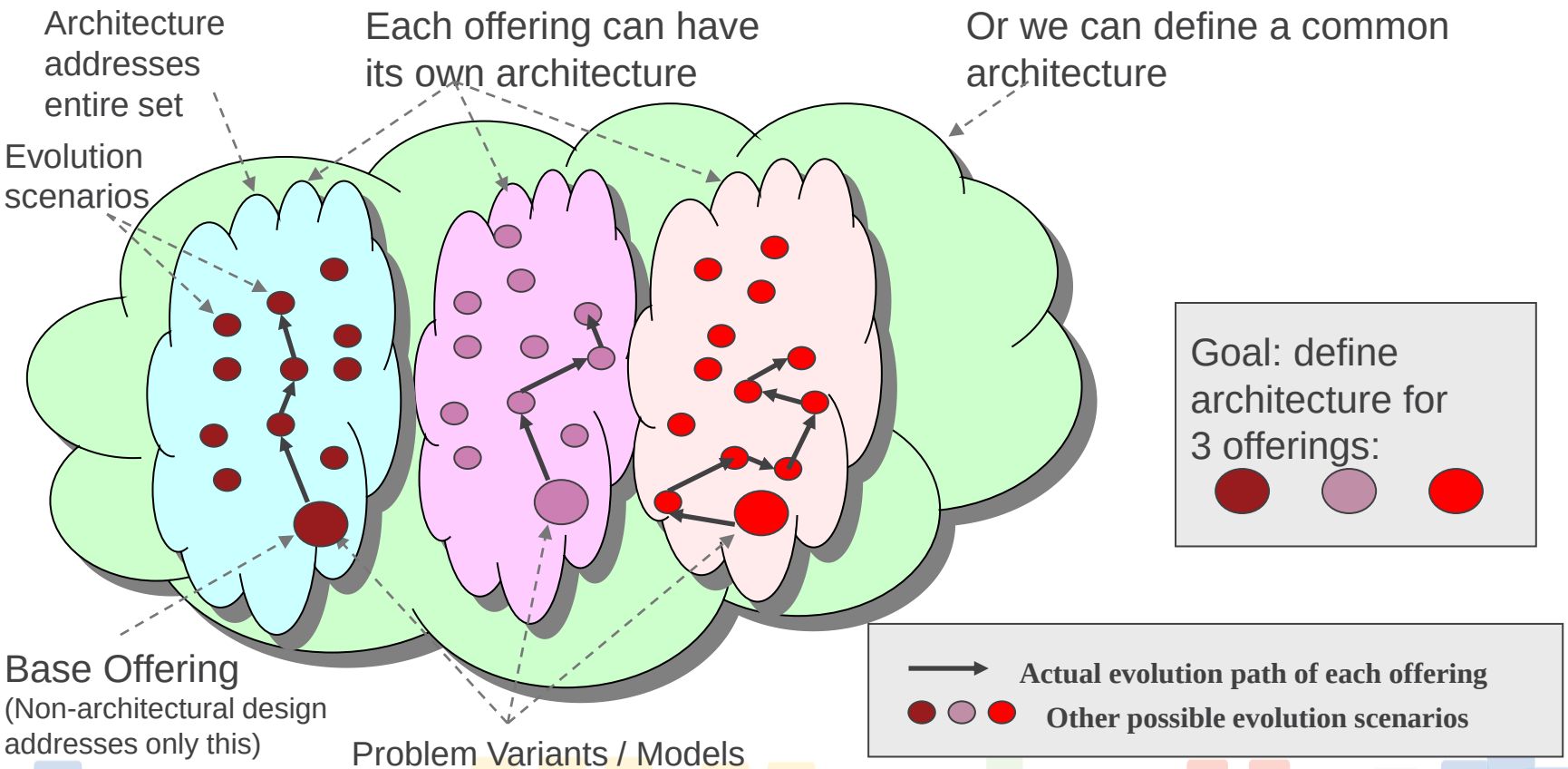
Architecture utilizes a **spatio-temporal configuration** of **spaces** and **flows**



Problem Space	• Transform into a well-defined problem
Problem Space Analysis	• Analyze & detail out the problem
Solution Space	• Synthesize candidate solutions
Solution Analysis Space	• Establish preferred solution alternatives
Architecture Description Space	• Capture the architecture description

Principle 11

Architecting results in **complex configurations** of **configuration items**



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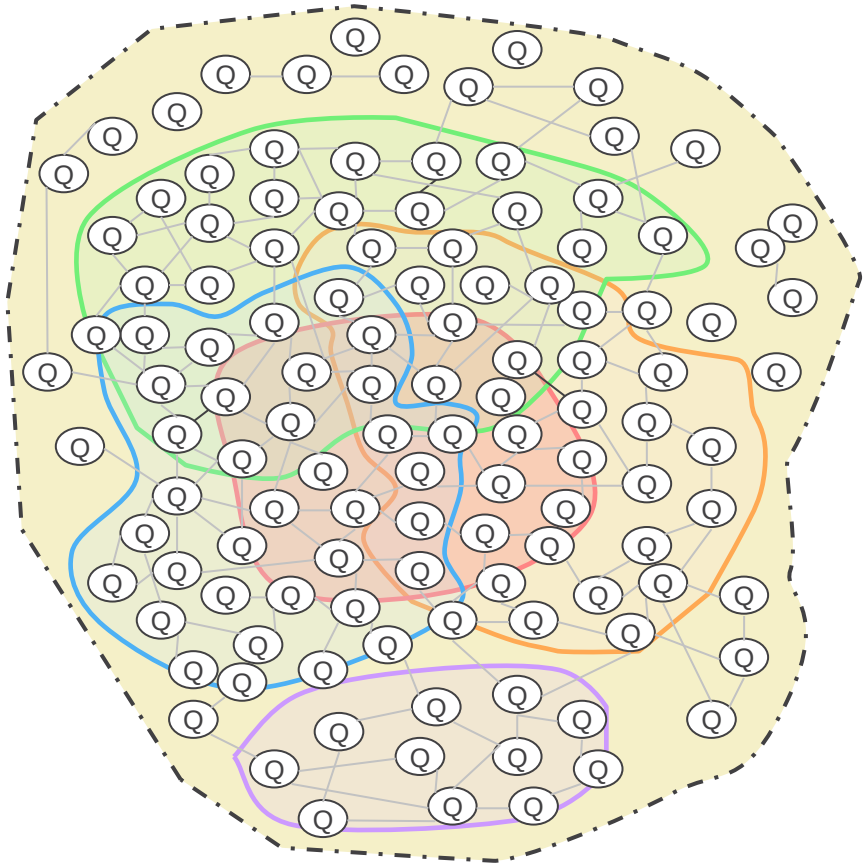
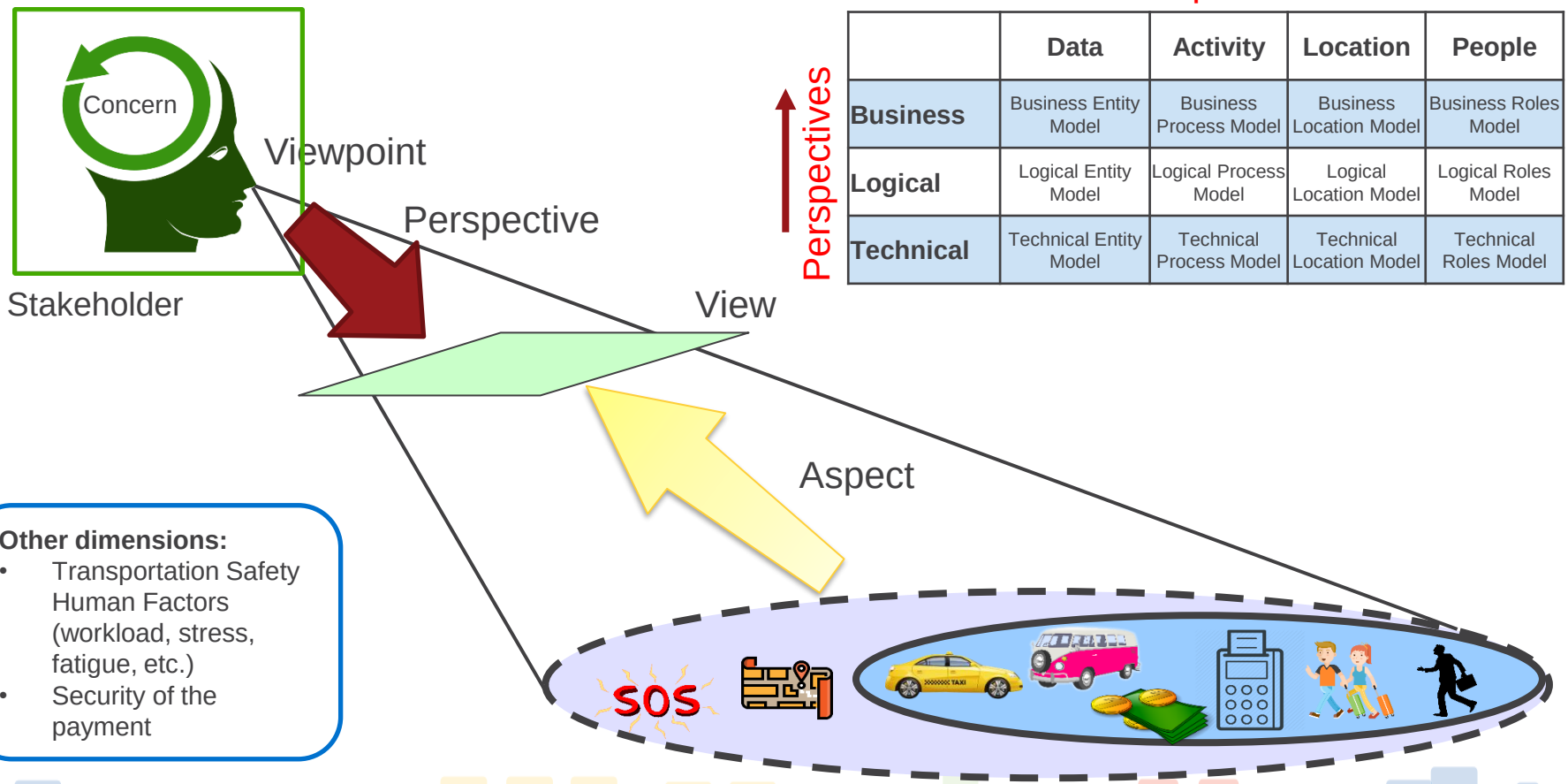


Legend:

- Configuration Item
- Correspondence
- Configuration
- System Boundary

Principle 12

A **view** is a **snapshot** from a particular **viewpoint**



Aspects

Perspectives

	Data	Activity	Location	People
Business	Business Entity Model	Business Process Model	Business Location Model	Business Roles Model
Logical	Logical Entity Model	Logical Process Model	Logical Location Model	Logical Roles Model
Technical	Technical Entity Model	Technical Process Model	Technical Location Model	Technical Roles Model

Other dimensions:

- Transportation Safety Human Factors (workload, stress, fatigue, etc.)
- Security of the payment

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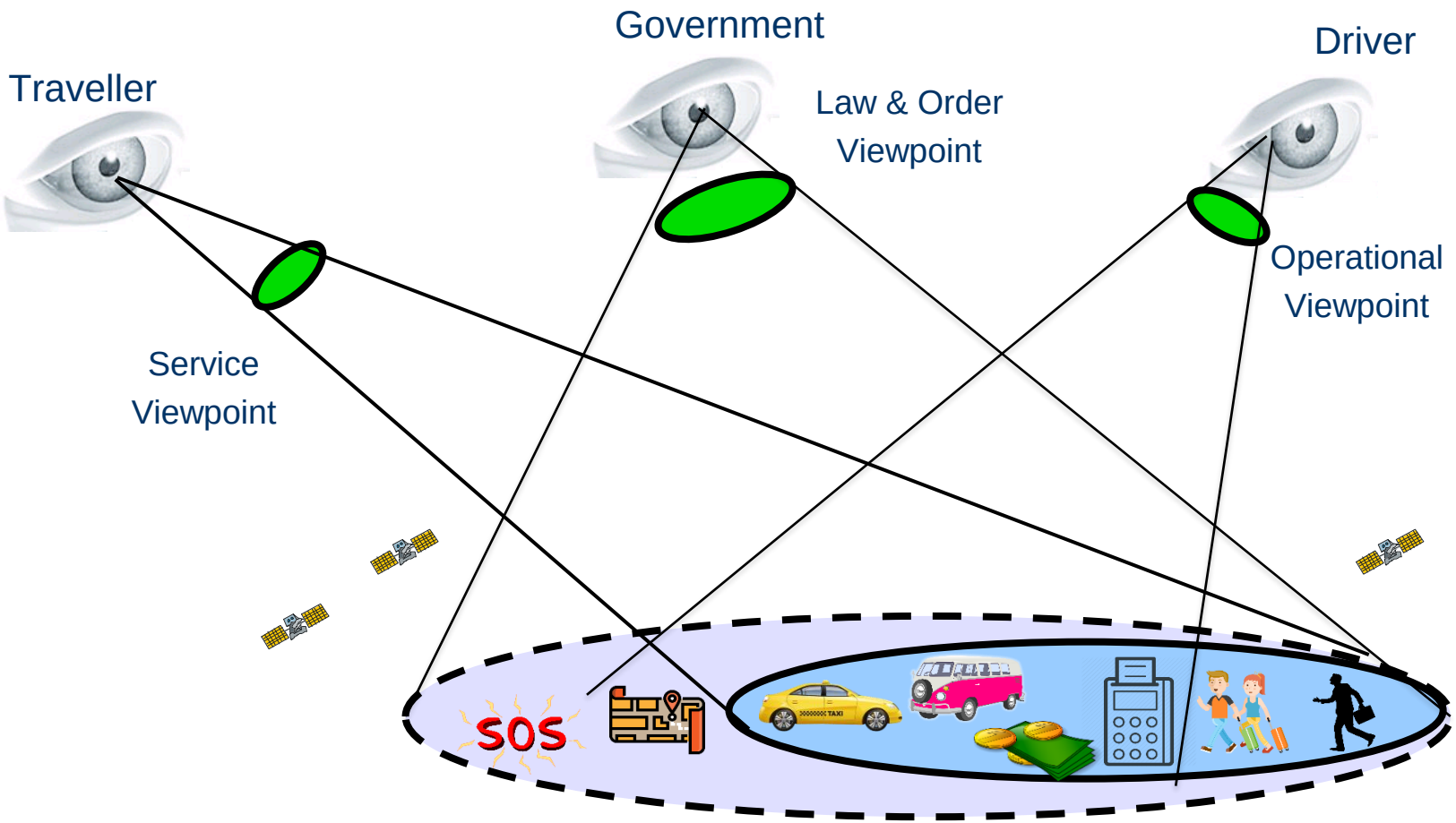

Concluding Remarks

Summary

1. Architectural constructs are domain and method agnostic
2. Architecting is iterative
3. Architecture is formless
4. Architecture is conceptualized as concepts, properties and principles
5. Architecting is a way of being concerned about a human-made thing
6. Architecture is contextual
7. A thing is an instance of its architecture implementation
8. Lifecycle of an Architecture extends beyond lifecycle of the entity of interest
9. Architecture provides solution schemas for a class of problems
10. Architecture utilizes a spatio-temporal configuration of spaces and flows
11. Architecting results in complex configurations of configuration items
12. A view is a snapshot from a particular viewpoint

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Thank You

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