

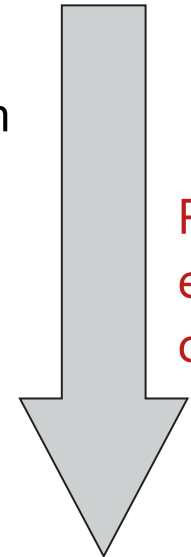


Enterprise architecture

A digital transformation governance instrument

Agenda for 8.3.2025

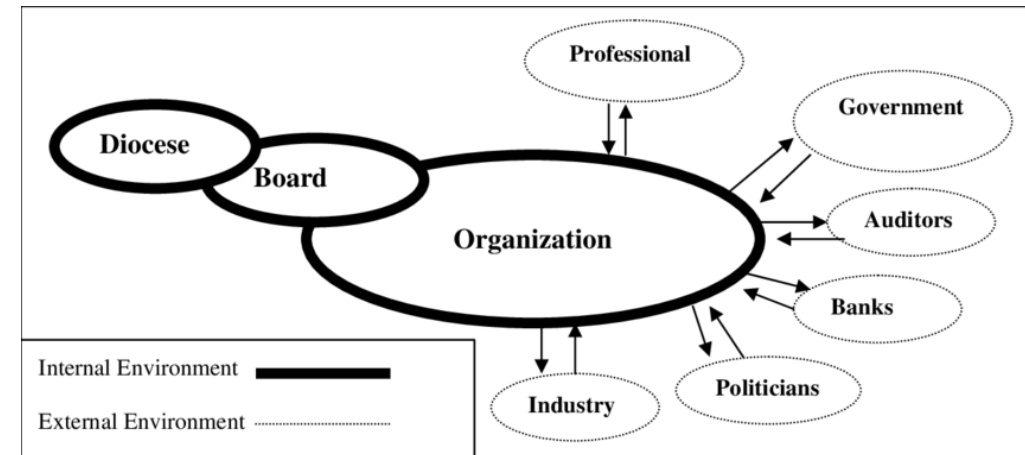
- Context for EA
 - Enterprise, transformation of enterprise, governance of transformation
 - EA as an answer to the challenge of governance
- Origins and evolution of EA as a discipline
- Key elements of EA
 - Modelling frameworks and languages
 - ArchiMate
- Introduction of the group project work



Running
example /
case study



Enterprise



Enterprise - **organisation**, part of an organisation, **organisation networks**

- The context and scope of transformation and legal entity responsible for its governance



Enterprise - some definitions

- An organization, especially a business, or a difficult and important plan, especially one that will earn money [Cambridge dictionary]
- The highest level (typically) of description of an organization and typically covers all missions and functions. An enterprise will often span multiple organizations [TOGAF]
- A complex socio-technical system that comprises people, information, and technology that interact with each other and their environment in support of a common mission [Giachetti, 2010]

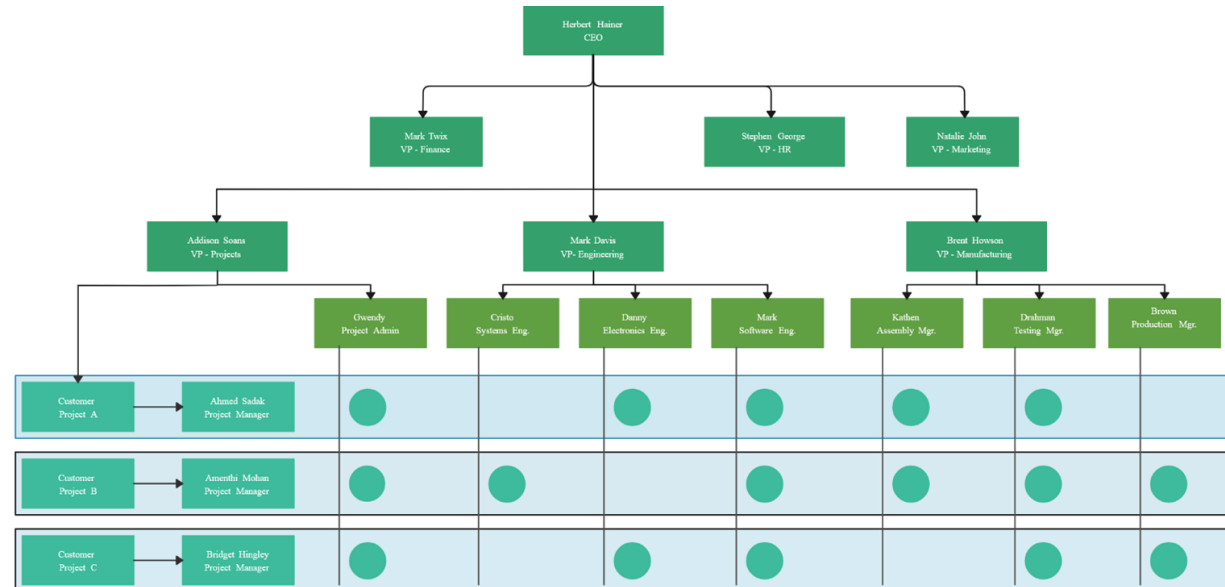
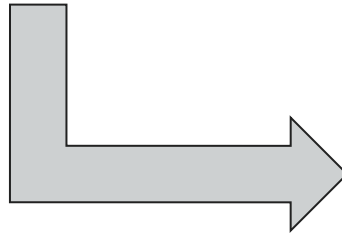


Asheesh Chatterjee

PYRAMID OF STRATEGY



Enterprise (should) exist with a clear **mission**, **vision** and **strategy**, which define the **objectives** and direction of actions to take in its functioning, as well as the ways to measure success of these actions (**KPI**).



Strategic objectives are realised through a particular configuration of enterprise's **ressources** and **capabilities** via **org. structure, functions, processes, information/data, technology** to deliver **products** and **services**.

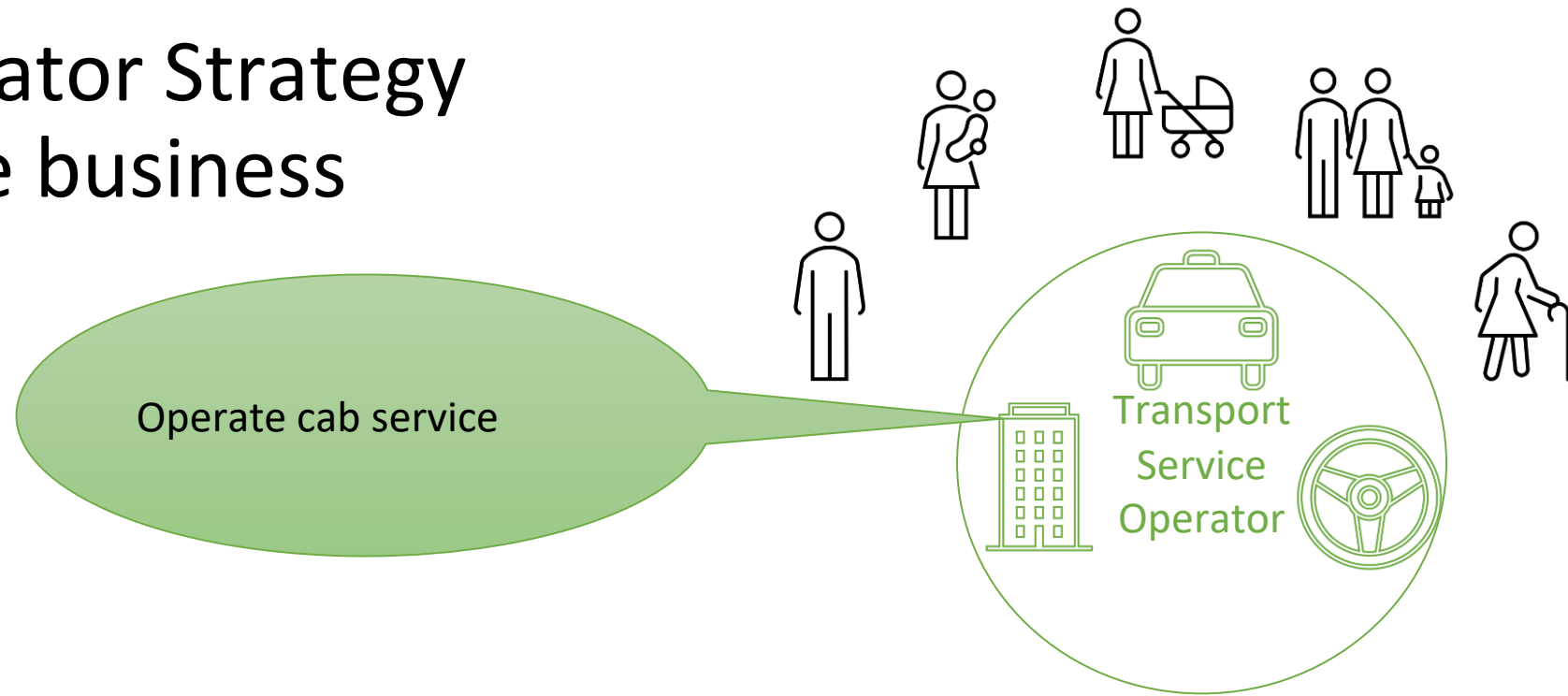


Enterprise Illustrated

From a business service to a (regulated) ecosystem

Operator Strategy

Make business



Regulator Strategy

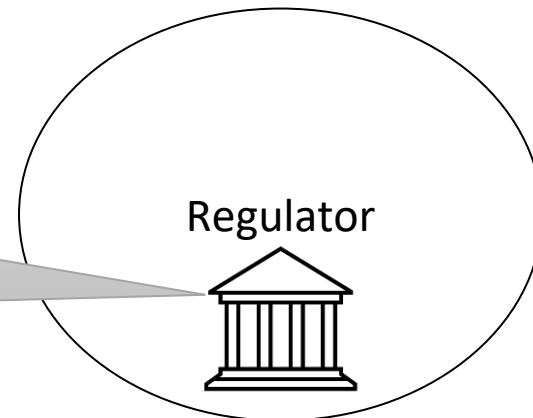
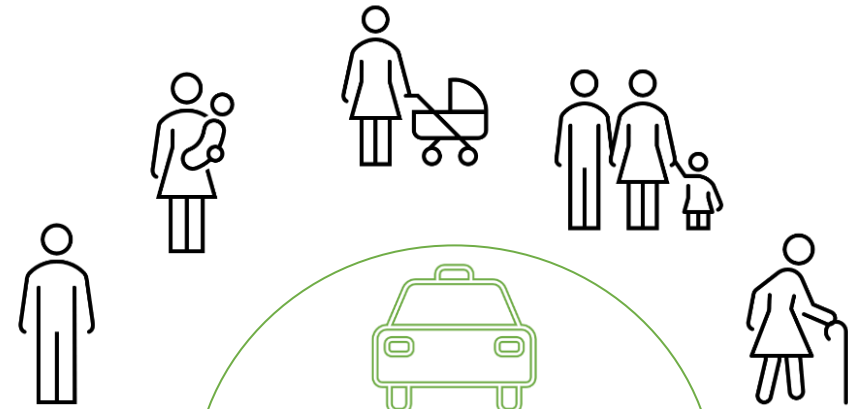
Public concerns

Operate cab service
Regulatory compliance

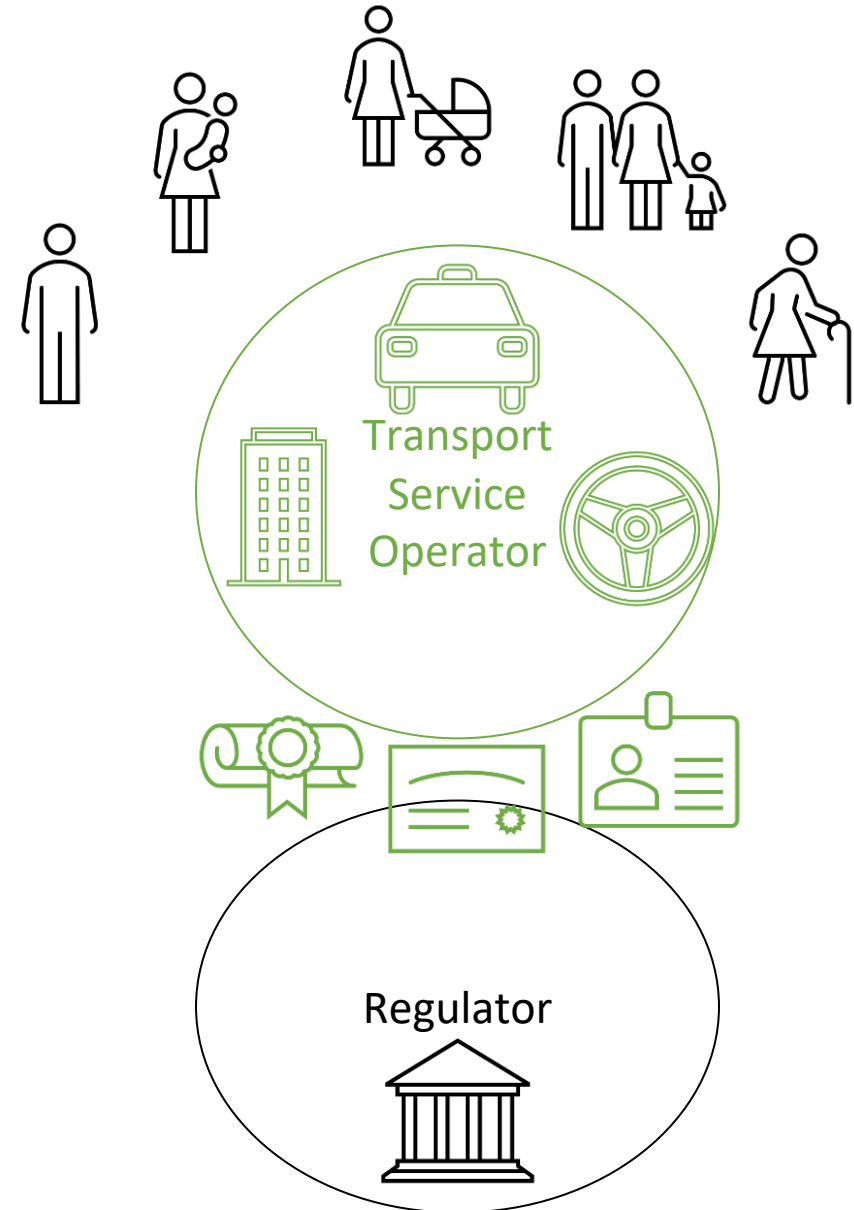
Transport
Service
Operator

Safe and secure service
Fair price
Social rules

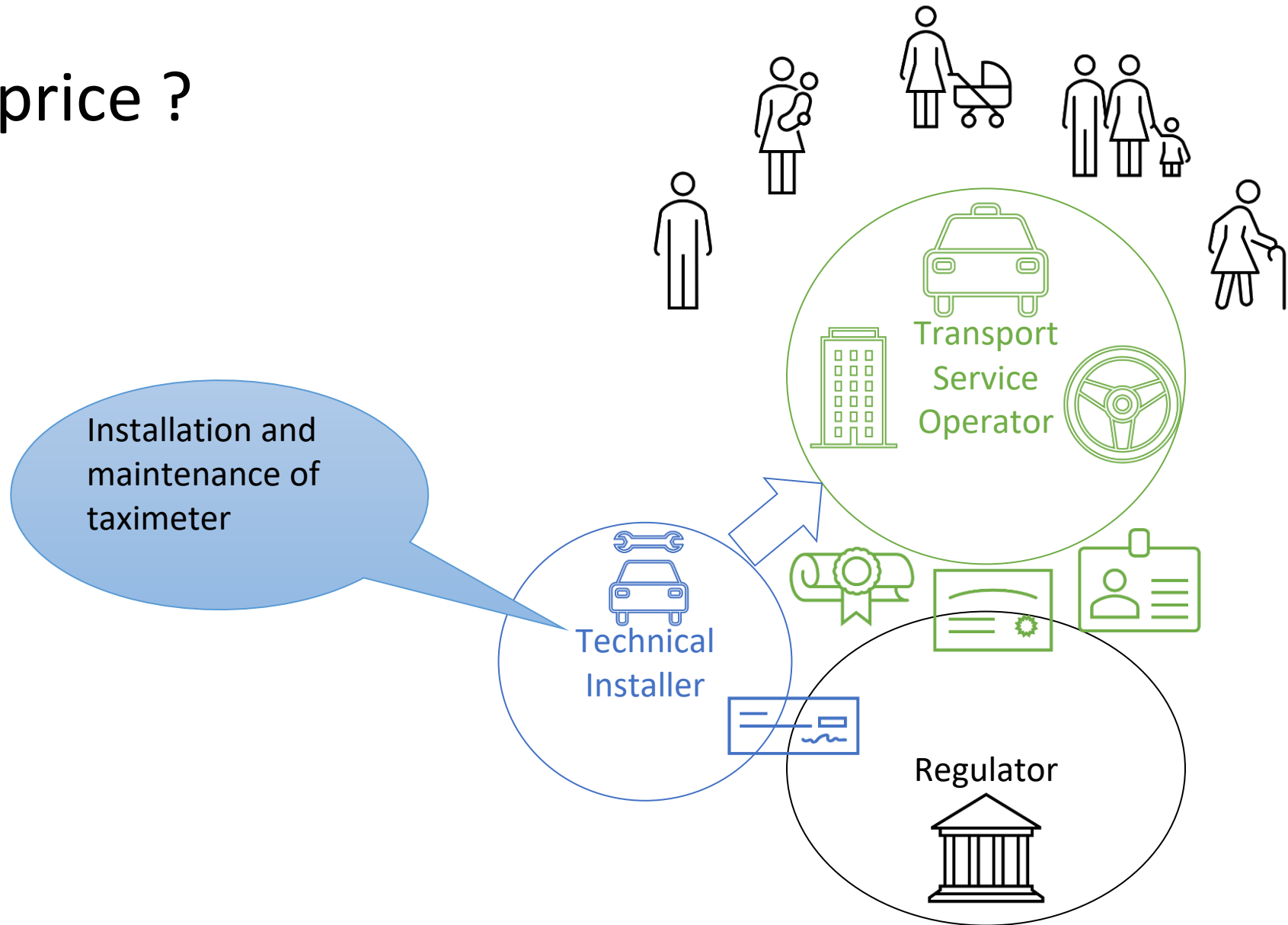
Regulator



Regulated service

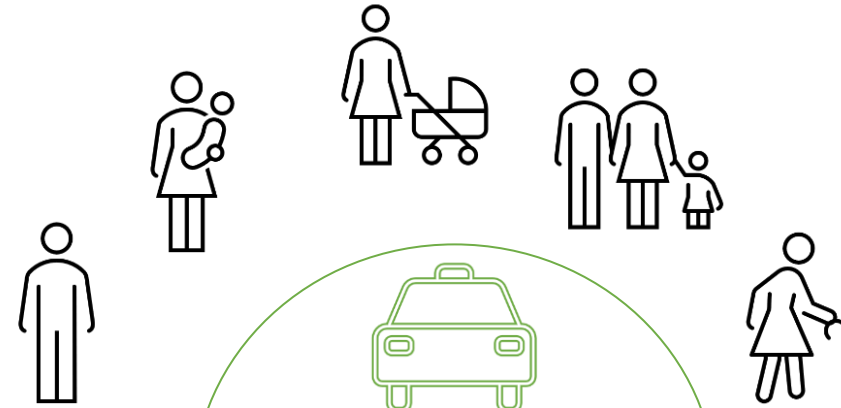
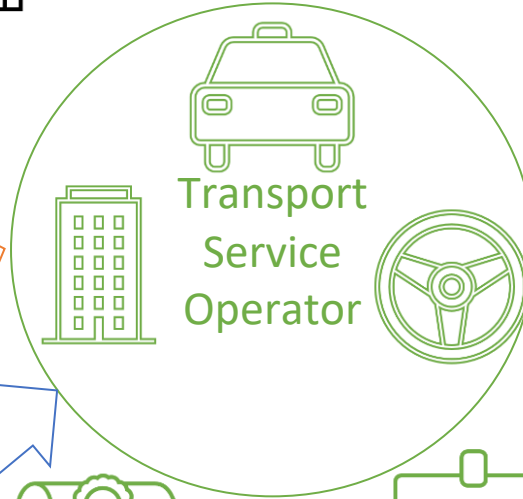
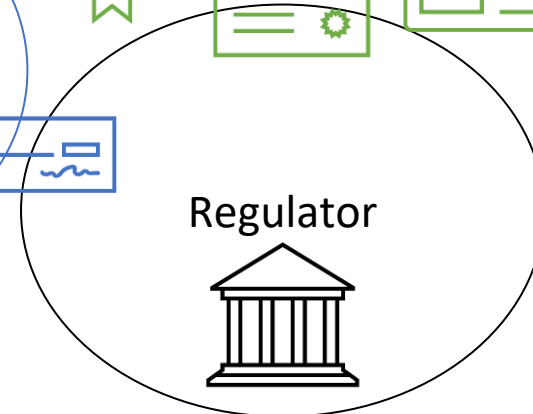
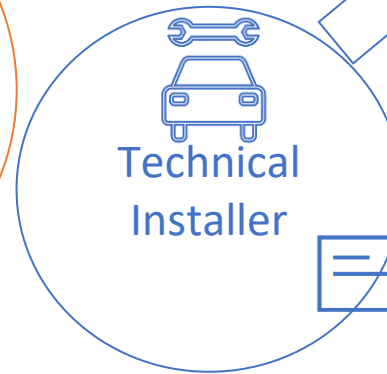
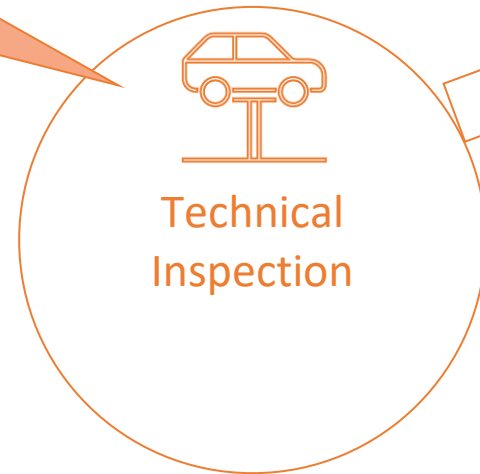


Fair price ?

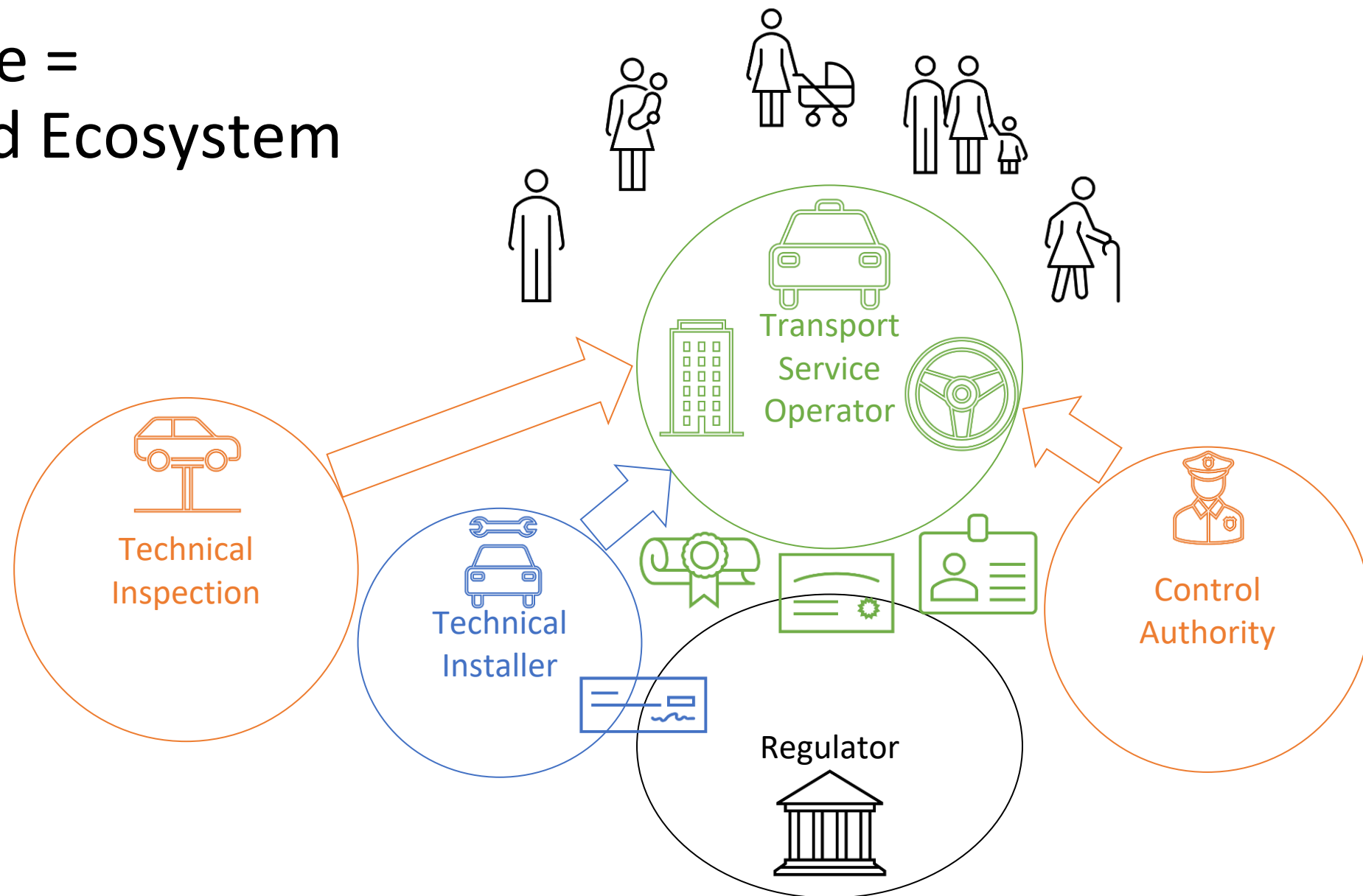


Safe and secure ? Social compliance ?

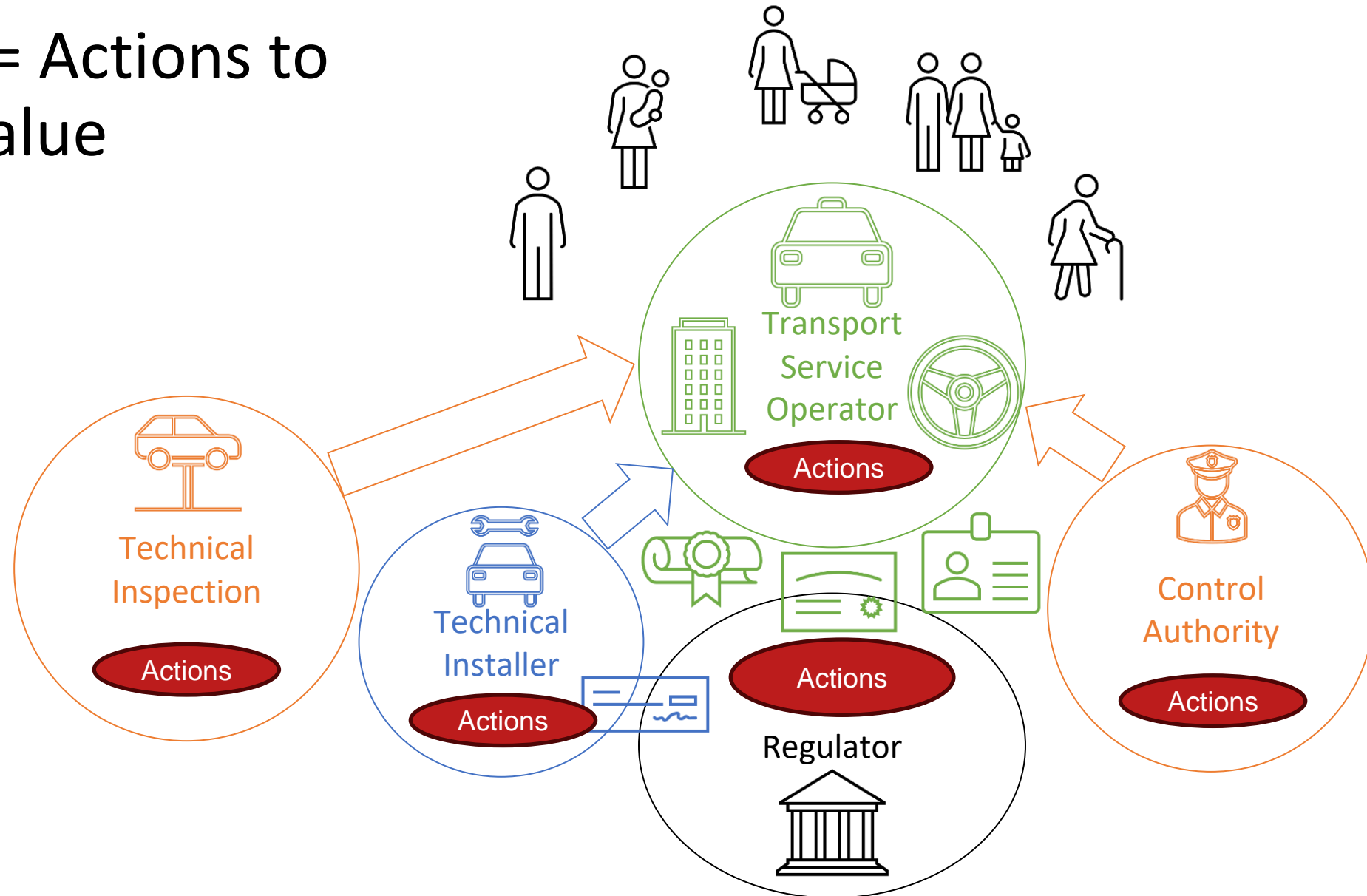
Periodic technical
inspection



Enterprise = Regulated Ecosystem



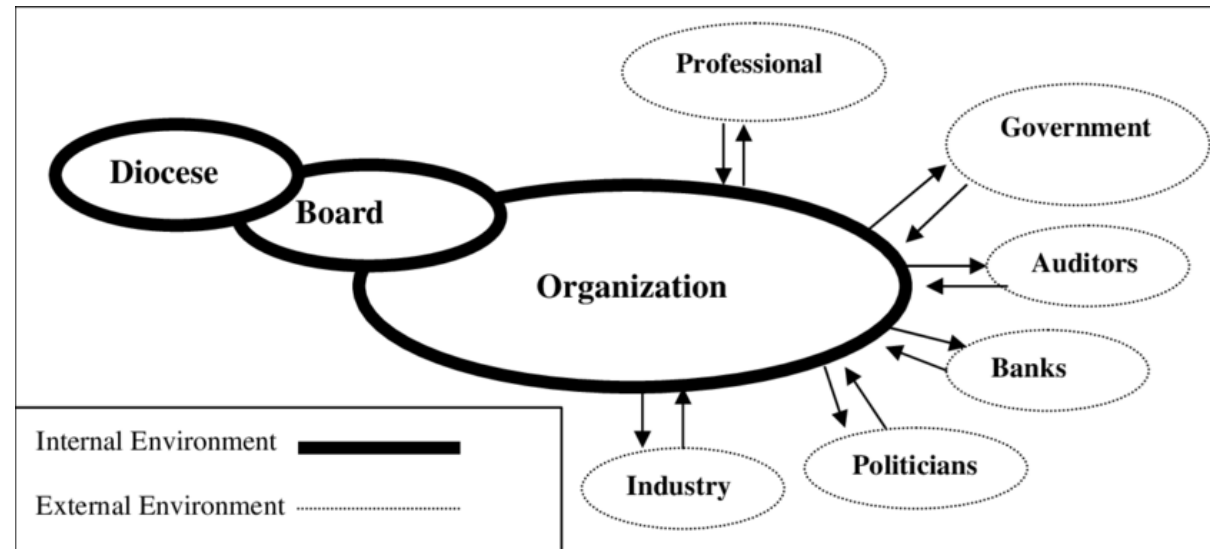
Strategy = Actions to
deliver Value





Enterprise transformation

Change is imminent in modern economy

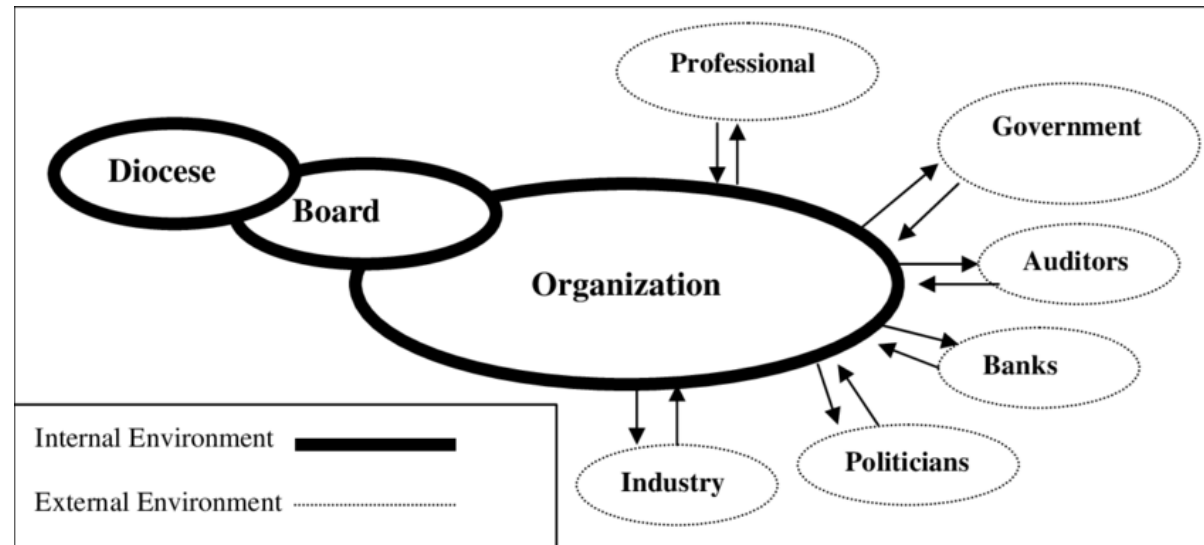


Capacity for **continuous adaptation** of enterprises to the new circumstances is crucial for their survival and competitiveness.

Drivers of change

Shift of
powers in
value chain

Service
orientation
and
networked
organisations



Streamlining and
preparing for
growth and agility

Compliance, risk,
transparency
regulations

Changing role of IT
- digital platforms
and digital
economy

Rapid pace of
technological
innovation in the
society



Impact and scope of change

Evolutionary, gradual changes

Accumulative changes that do not affect business model or strategic orientation i.e. fundamental requirements of the enterprise, and mainly consist in localised optimisations of IT, processes etc.

Lesser scope, less dependencies and lesser complexity to manage in implementing change

(Enterprise) transformation

Disruptive and fundamental change (can be triggered internally or externally) that affects several aspects of the enterprise simultaneously and can even shift its strategic orientation

Change in fundamental requirements of the enterprise - more complexity and dependencies to manage in executing/implementing the change

Examples

Evolutionary, gradual changes

Introduction of digital/mobile communication channels to existing processes

Improvement of several processes

Introduction of a new business role to optimise responsibilities and tasks

(Enterprise) transformation

Strategic repositioning

Changes of business models

Mergers

Large scale outsourcing

Introducing or replacing core enterprise IS



Nature of transformation

“Enterprise transformation is about *fundamentally changing* the business, not about *running* the business.”

“Due to the related effort and risks, organisations only once in a while undergo enterprise transformations.”

Proper, Henderik A., et al., eds. *Architectural coordination of enterprise transformation*. Cham: Springer, 2017.

Digital transformation

Digital transformation is a company-wide phenomenon with broad organizational implications in which the core business model of the firm is subject to change through the use of **digital technology**.

Major drivers - digital technology innovations, dramatic change in competitiveness, changes in consumer behaviour

Netflix, Spotify, Amazon- the closest examples of how techn innovation + their business model disrupted markets in their respective sectors of activity

Verhoef, Peter C., et al. "Digital transformation: A multidisciplinary reflection and research agenda."

Journal of business research 122 (2021): 889-901.

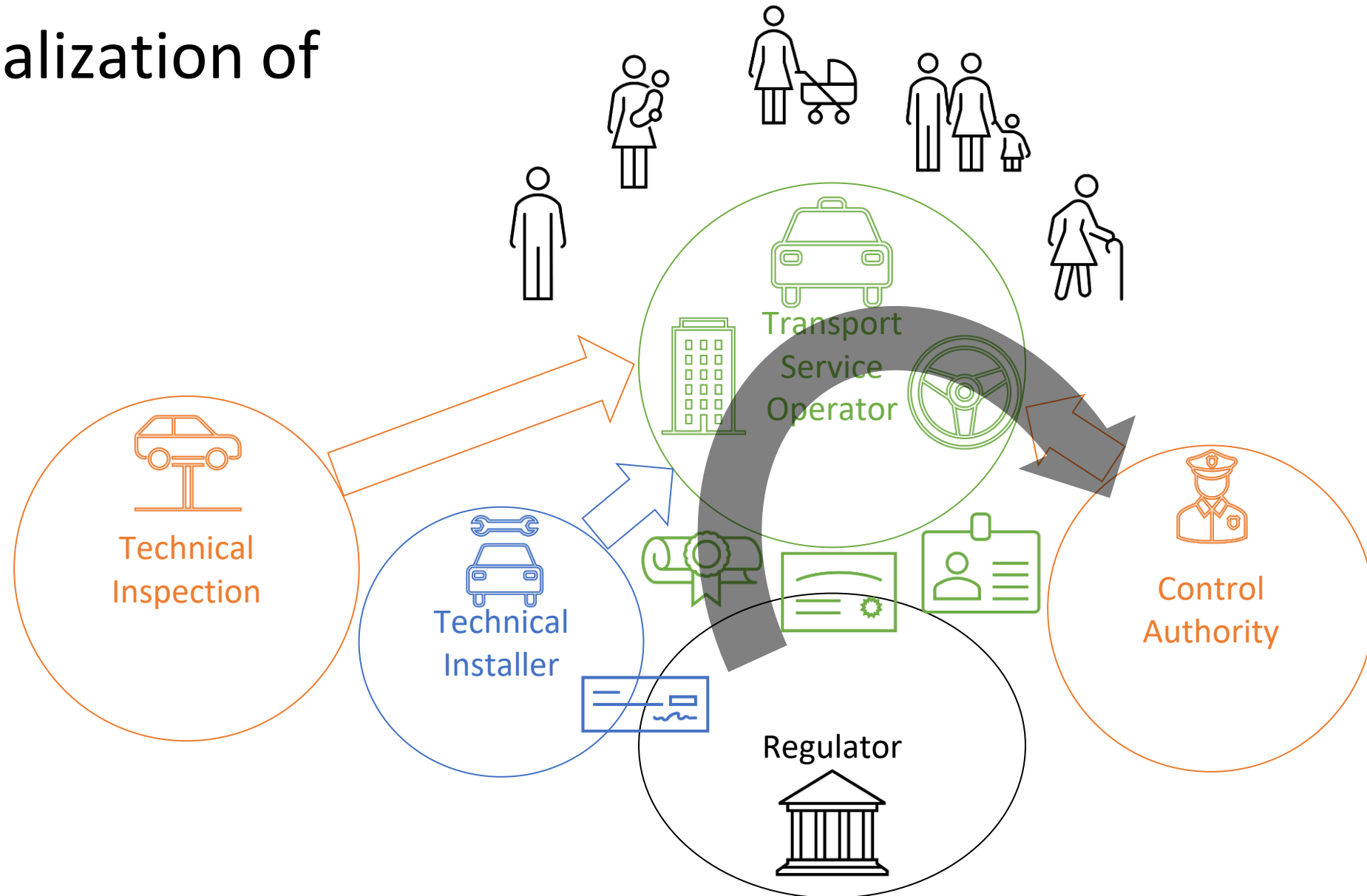
<https://doi.org/10.1016/j.jbusres.2019.09.022>



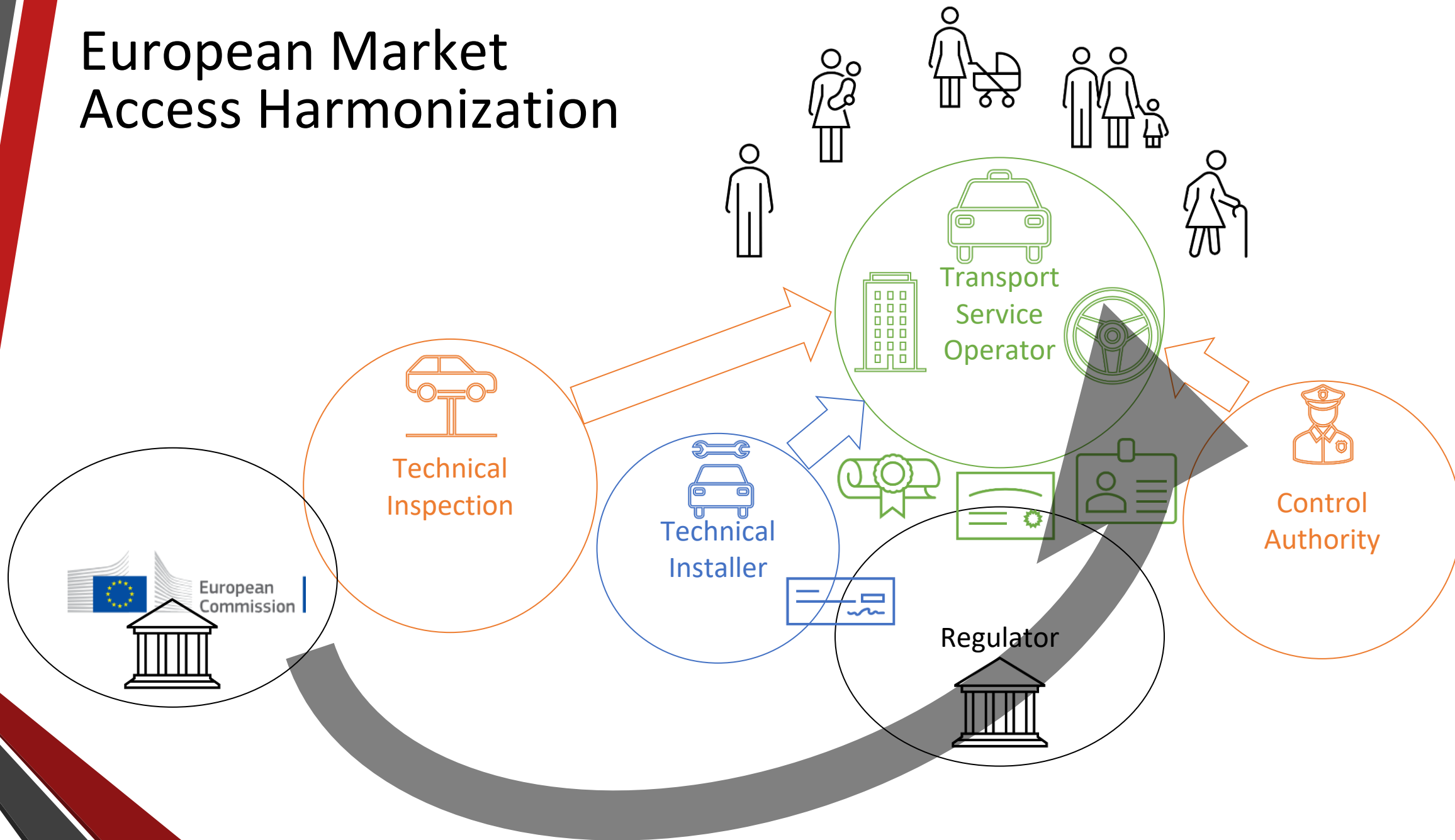
Transformation drivers illustrated

Impacts on the ecosystem

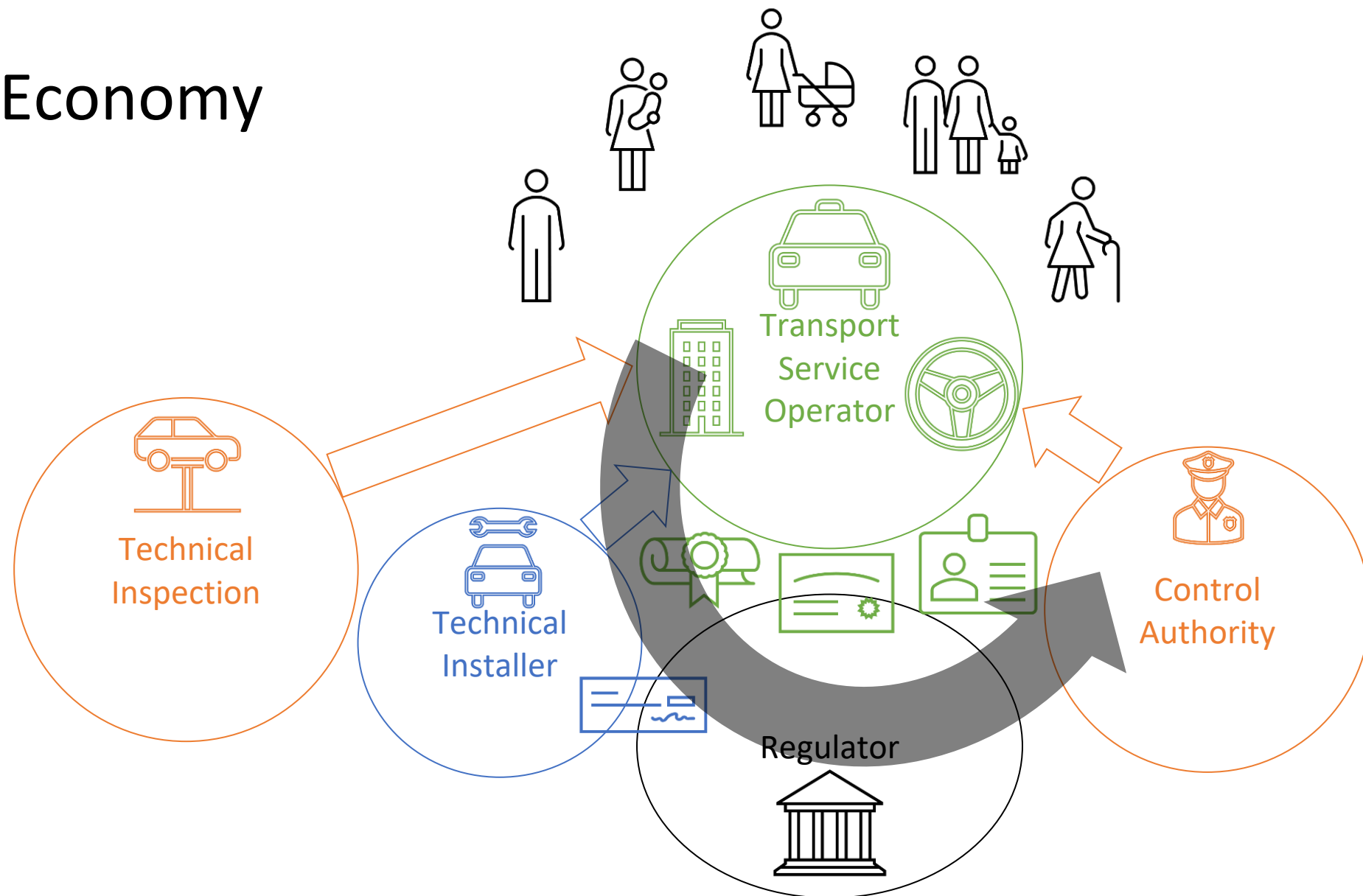
Dematerialization of license



European Market Access Harmonization



Platform Economy

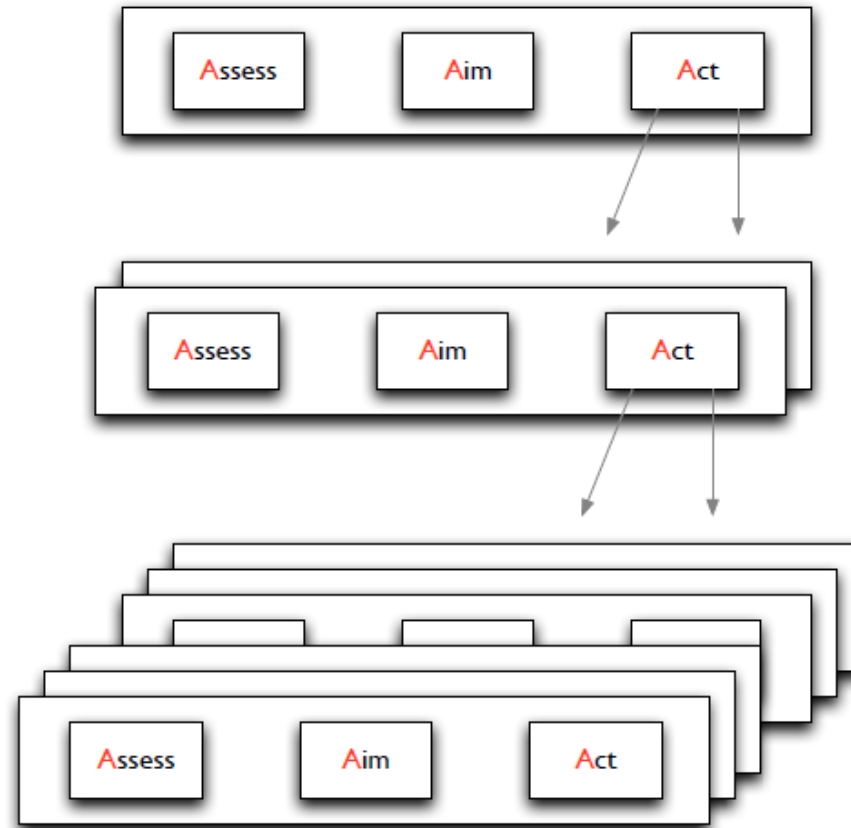
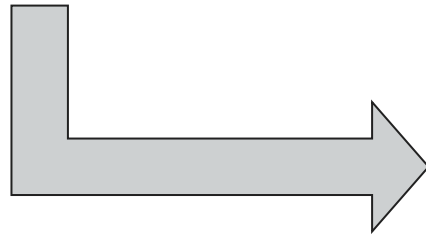




Governance of transformation

Motivation of Enterprise Architecture as a discipline

PYRAMID OF STRATEGY



Enterprise Strategy

Strategic transformation level
(Overall enterprise transformation)

Tactical transformation level
(Programmes)

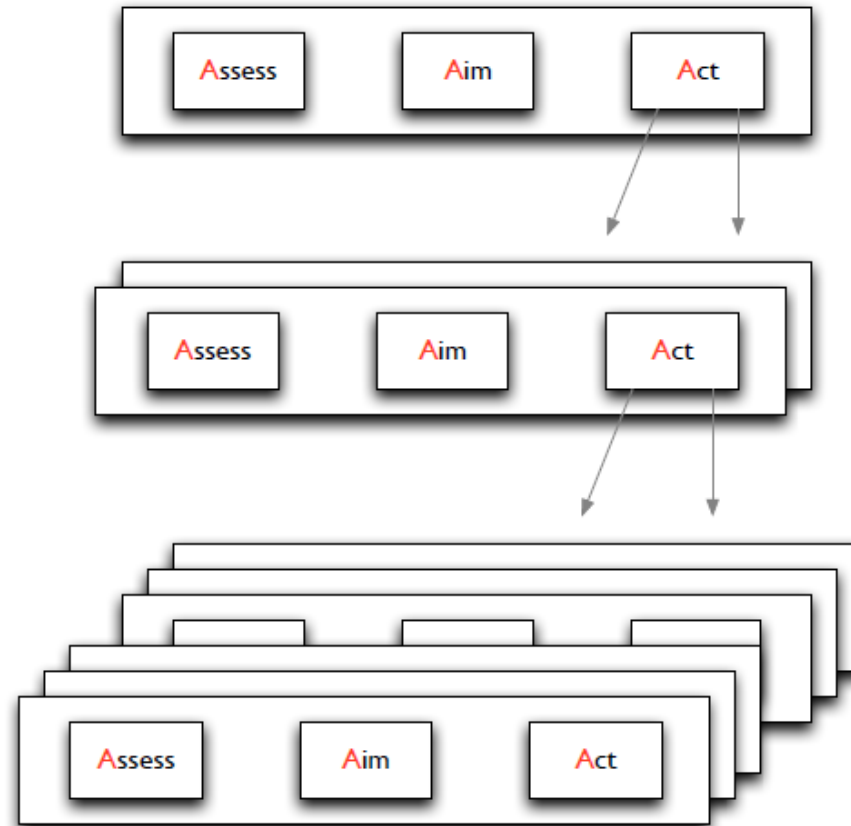
Operational transformation level
(Projects)

Transformations are typically split in programmes and projects

Need to coordinate/integrate the results of individual projects/programmes

Need to control the coherence and impact of changes across multitude of projects

PYRAMID OF STRATEGY



Enterprise Strategy

Strategic transformation level
(Overall enterprise transformation)

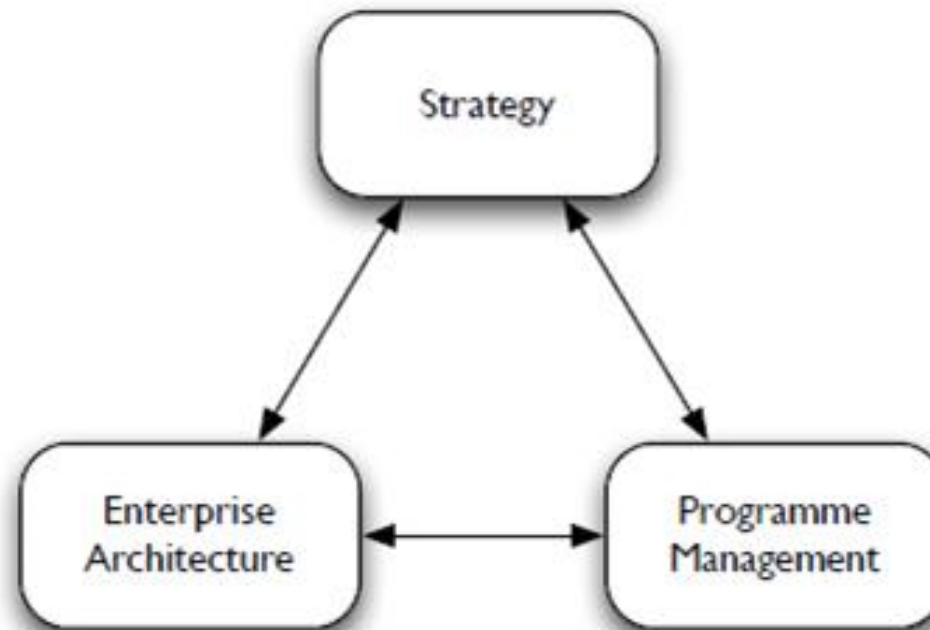
Tactical transformation level
(Programmes)

Operational transformation level
(Projects)

Have you witnessed transformation in an organisation?

(How) were the dependencies between separate projects/programs managed?

Programme management



Focus on budgets, deadlines, resource use, project risk management at the program/project level

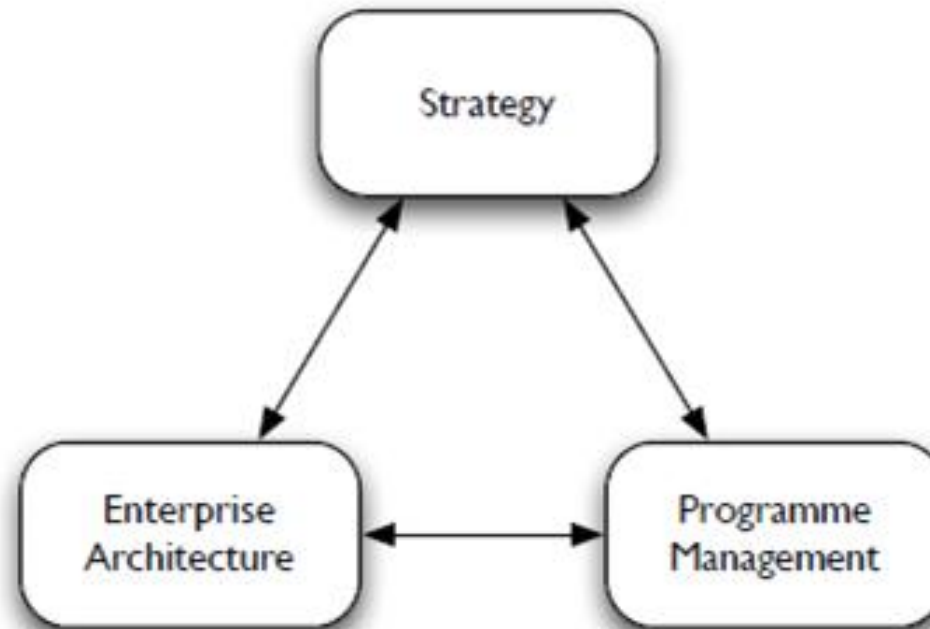
Risk of local optimisations - lack of explicit coherence/alignment beyond individual project/program scope

Danny Greefhorst, Erik Proper. Architecture Principles - The Cornerstones of Enterprise Architecture. The Enterprise Engineering Series 4, Springer 2011, ISBN 978-3-642-20278-0, pp. 1-

EA - engineering perspective

Top-down approach and **blueprint type of thinking** (like in buildings architecture)

Explicit focus on global coherence/integration between different aspects within an enterprise that transcend the scope of specific projects



Focus on budgets, deadlines, resource use, project risk management at the program/project level

Risk of local optimisations - lack of explicit coherence/alignment beyond individual project/program scope

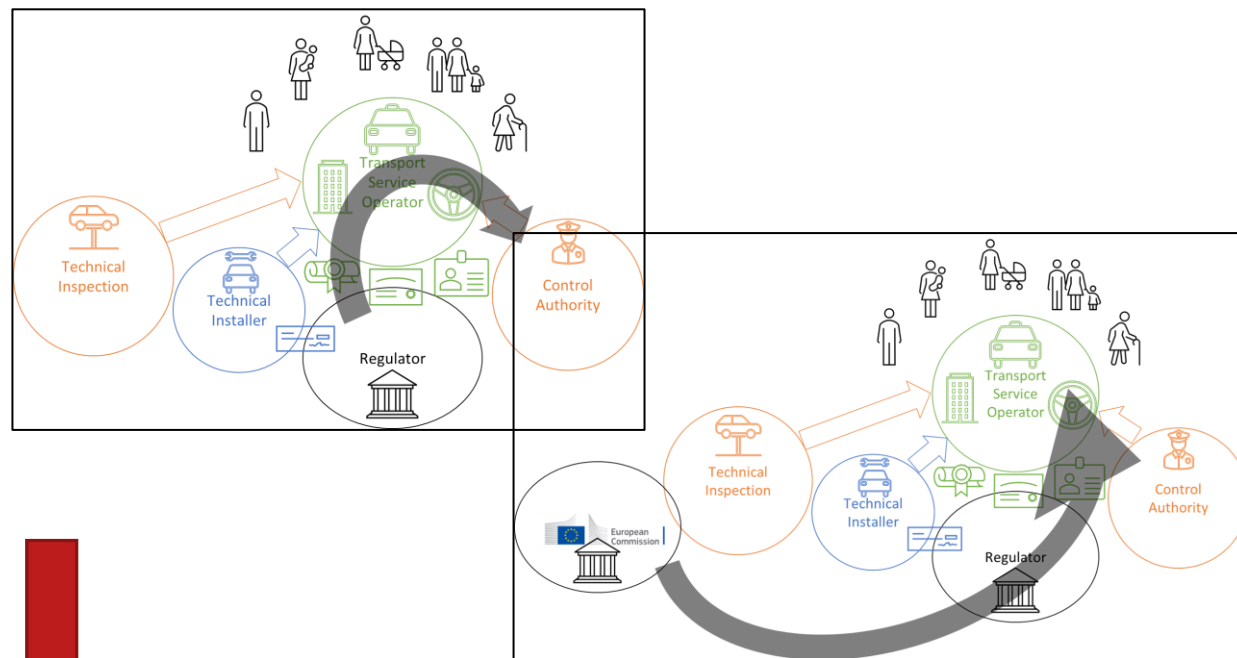
Danny Greefhorst, Erik Proper. Architecture Principles - The Cornerstones of Enterprise Architecture. The Enterprise Engineering Series 4, Springer 2011, ISBN 978-3-642-20278-0, pp. 1-



Governing transformation @MMTP

Why rolling out an EA initiative

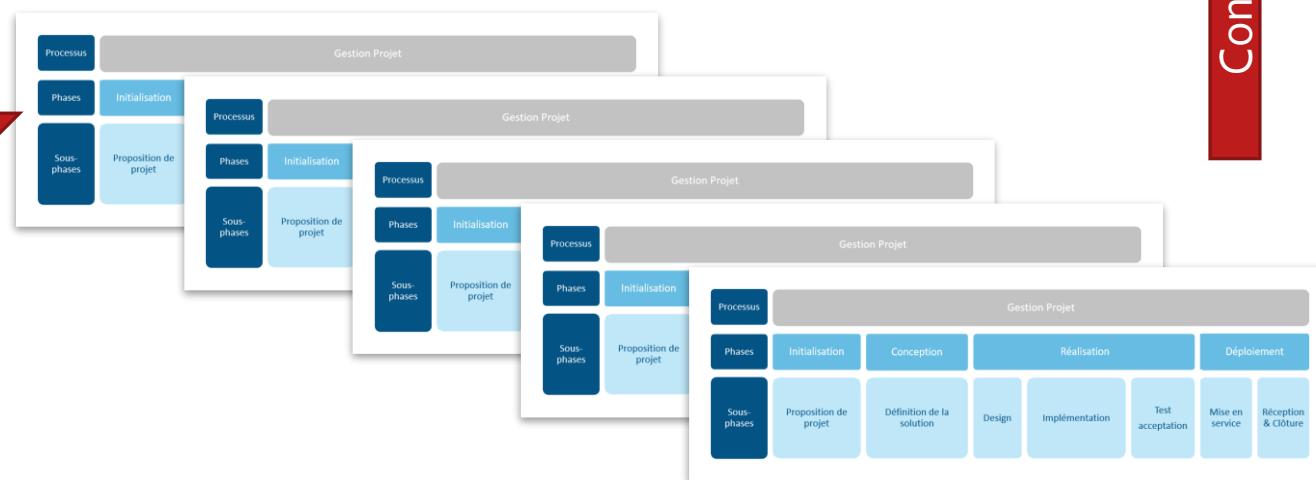
Regulator
Strategy



Initiation

Contribution

IT projects

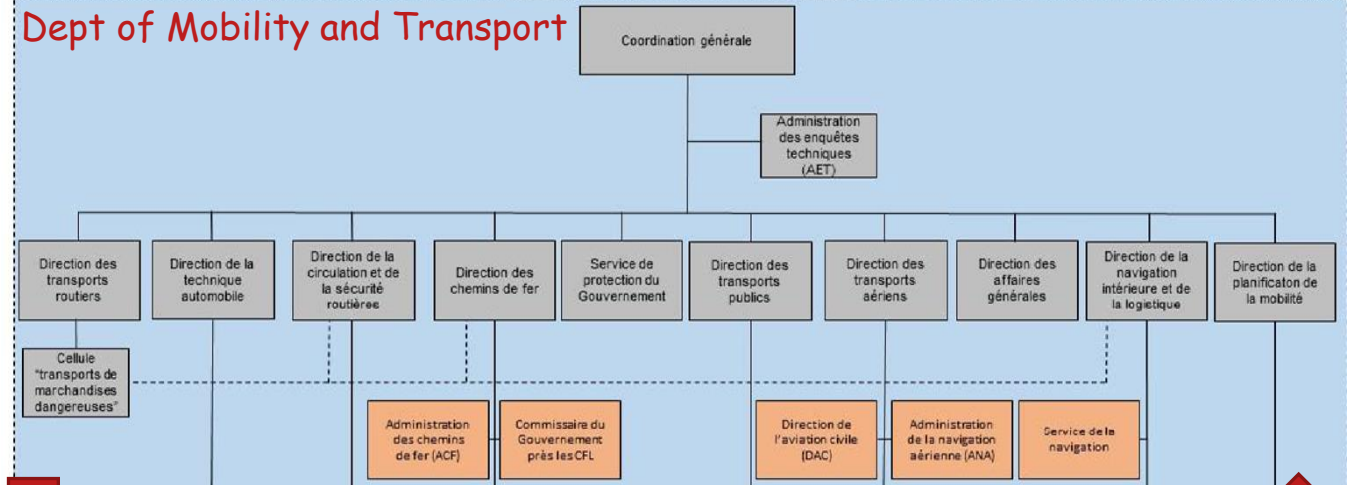


Business lines

- Segmented by transport mode
- Low level of digitalization
- High rate of evolution

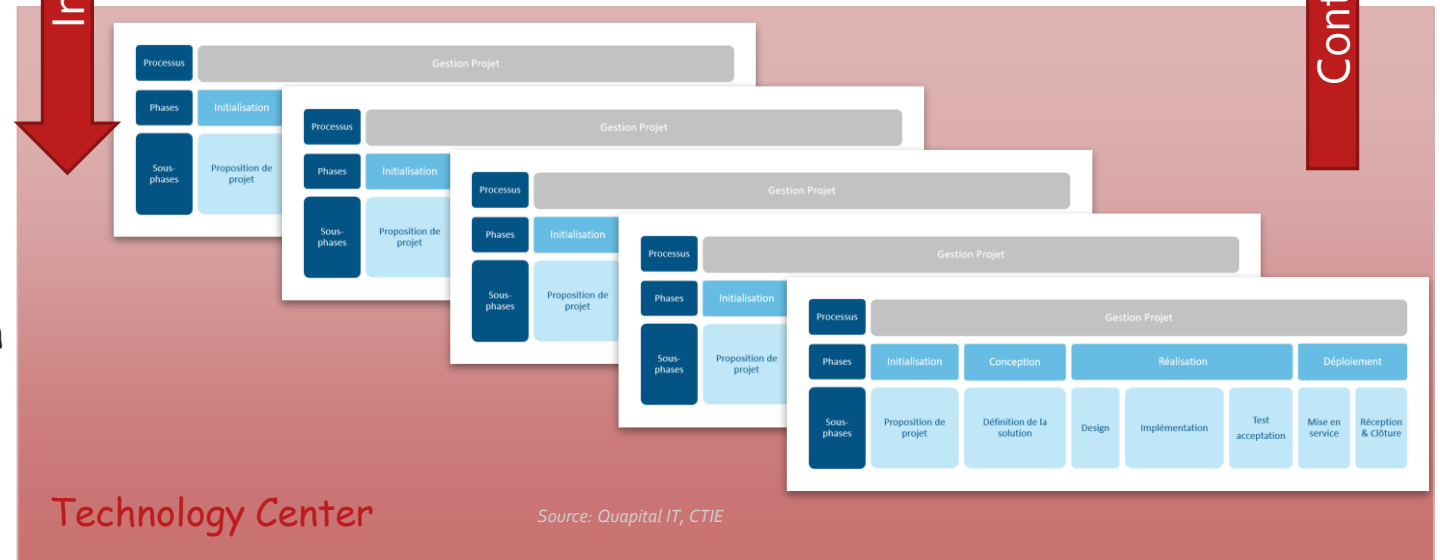
Public procurement

- Multitude of providers
- Fragmentation of solutions
- Tunnel effect on implementation



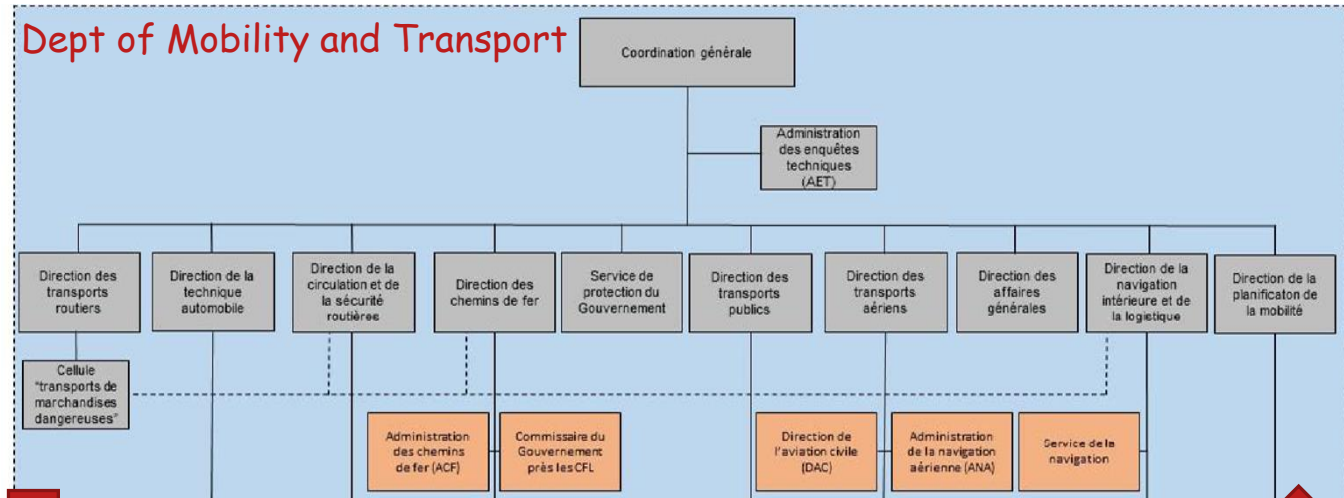
Initiation

Contribution



Steering of digital transformation

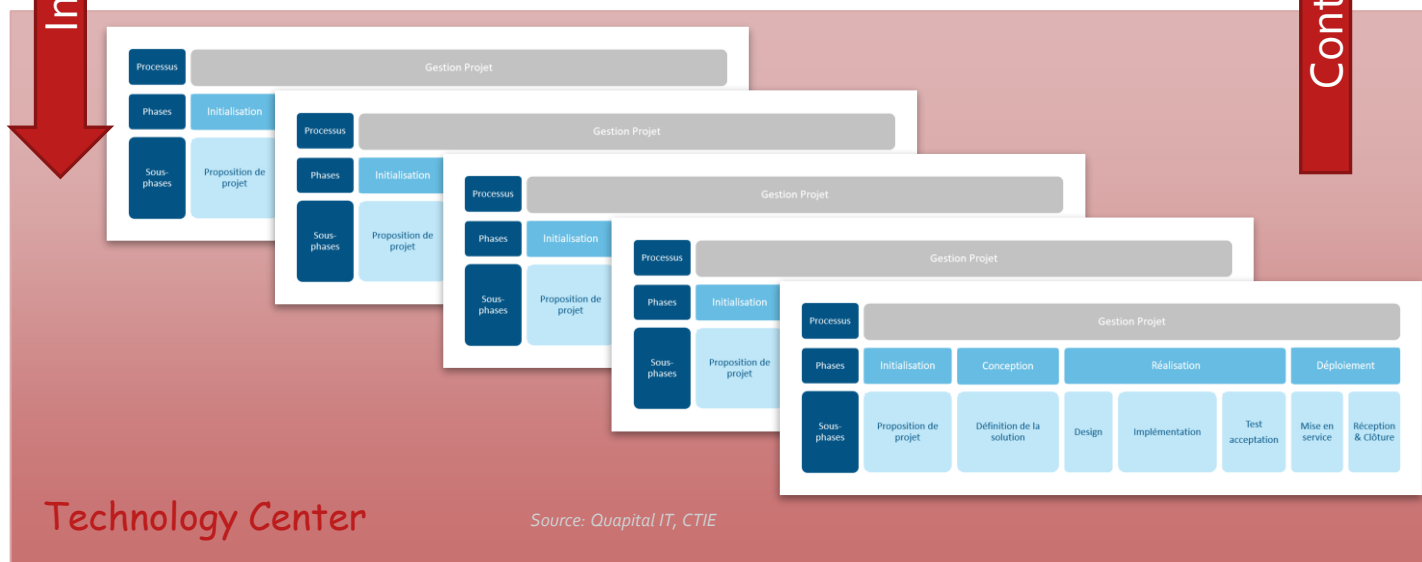
- New function (2018)
- Centralised decision
- Very limited capacity (4 agents)



Initiation



Contribution



Technology Center

Value Creation

Any digital transformation project creates business value

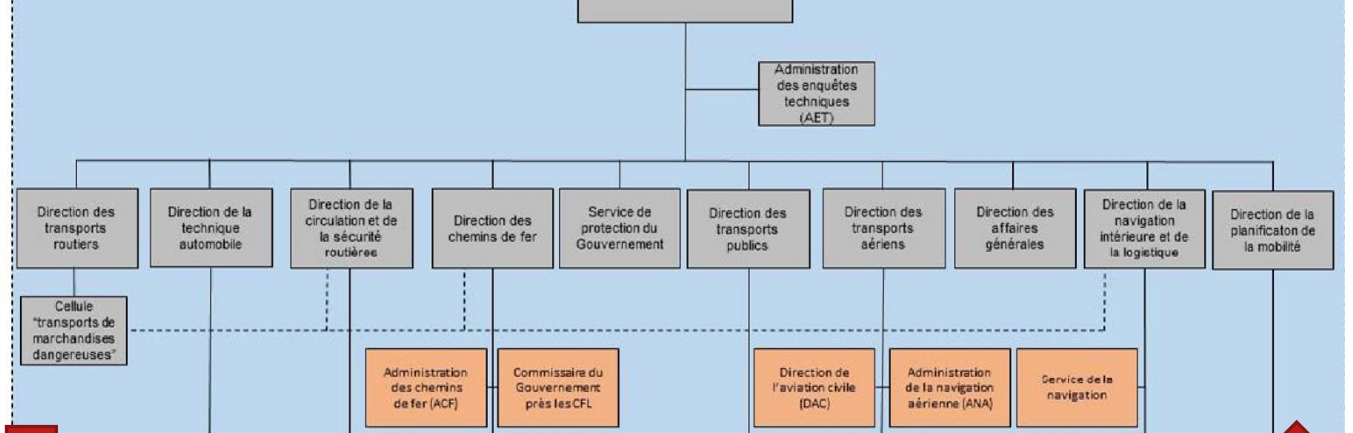
Informed Decision Making

Digital transformation decisions are based on facts and measures

Industrialisation

Digital transformation is operated systematically and relies on common solutions across the Department

Dept of Mobility and Transport



Initiation

Enterprise Architecture Management

Contribution

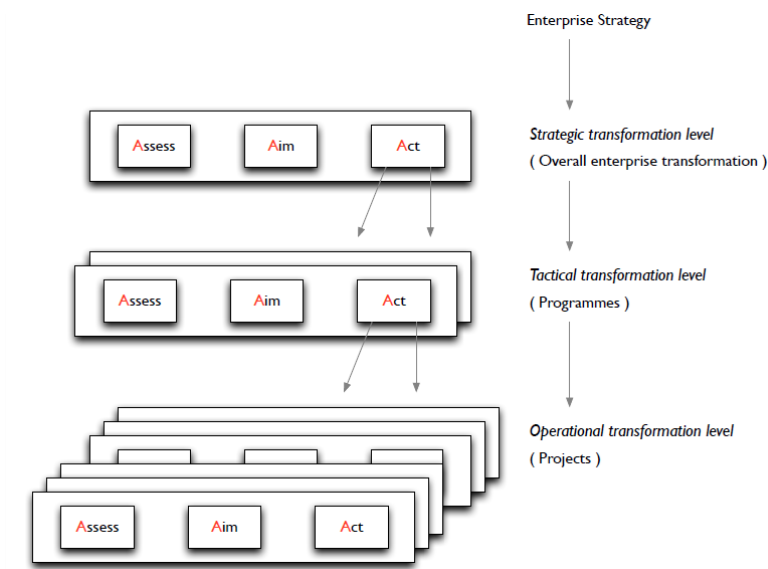
Technology Center

Source: Quapital IT, CTIE



What is Enterprise Architecture?

Questions at the heart of EA



How to enable monitoring if the transformation goes in the desired direction across all programmes and projects?

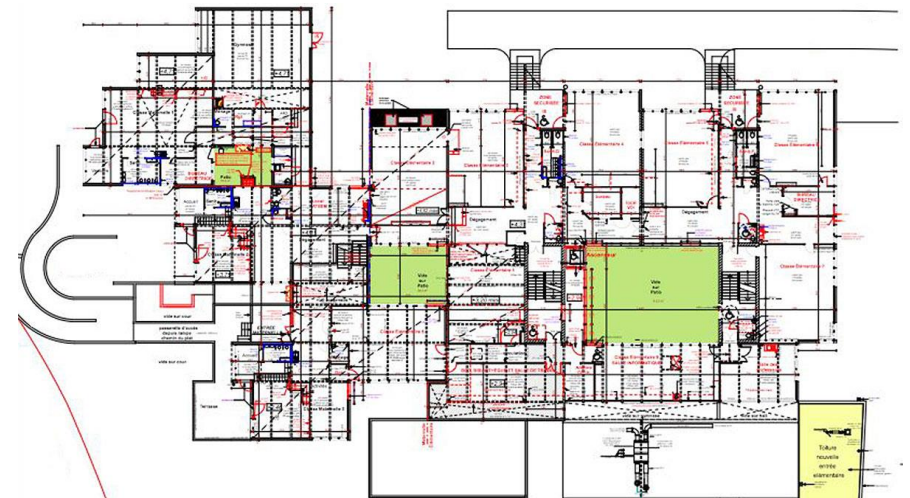
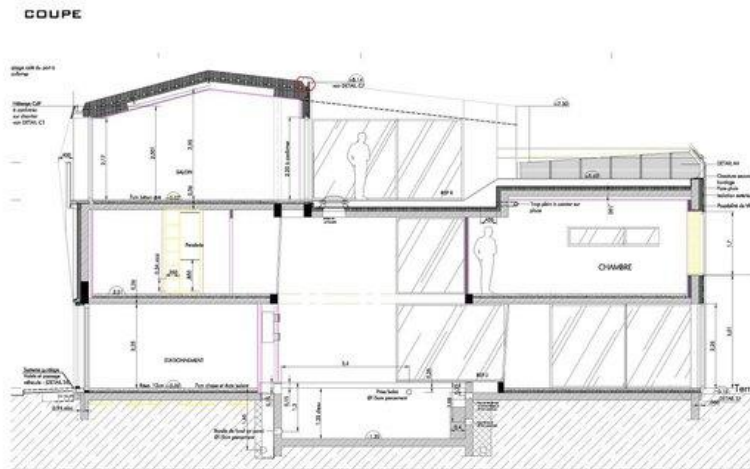
How to identify mutual relationships and dependencies in terms of content, assess the impacts and prioritise and coordinate projects in realisation of transformation?

What is the appropriate lens for this analysis?

- What **level of analysis** to adopt and at what level of detail to consider the enterprise for this purpose ?
- What is **stable** in enterprise, regardless of scope and complexity of changes to be executed and common across individual projects ? What is a **fundamental** organisation - i.e. architecture - of an enterprise?

Enterprise architecture

inspiration from other engineering disciplines





Architecture

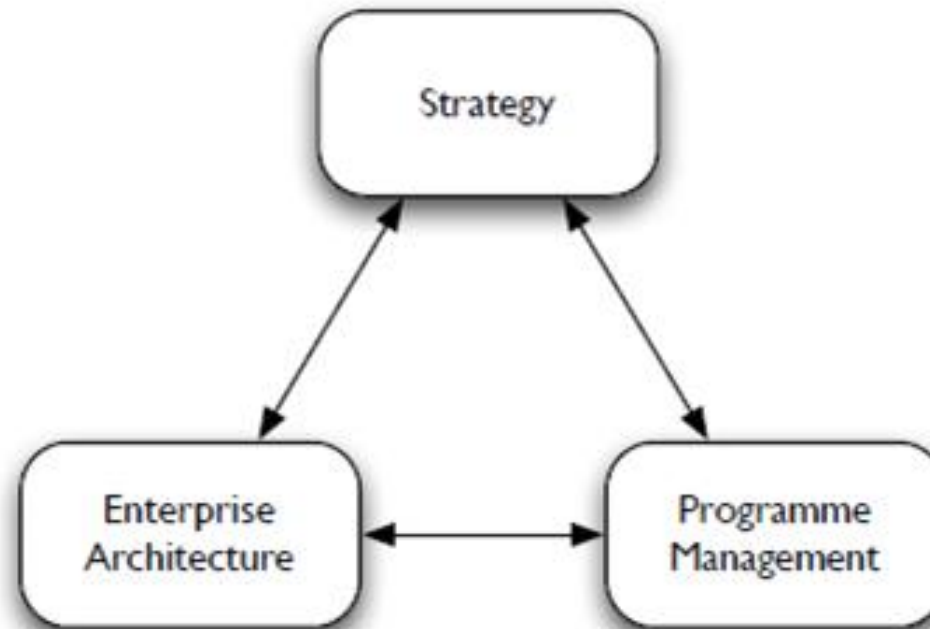
The **fundamental concepts or properties of a system** in its environment embodied in its elements, relationships, and in the **principles of its design and evolution** [ISO/IEC/IEEE 42010]

The art and technique of designing and building, as distinguished from the skills associated with construction. It is both the **process** and the **product** of sketching, conceiving, planning, designing, and constructing buildings or other structures [Encyclopedia Britannica]

EA - engineering perspective

Top-down approach and **blueprint type of thinking** (like in buildings architecture)

Explicit focus on global coherence/integration between different aspects within an enterprise that transcend the scope of specific projects



Focus on budgets, deadlines, resource use, project risk management at the program/project level

Risk of local optimisations - lack of explicit coherence/alignment beyond individual project/program scope

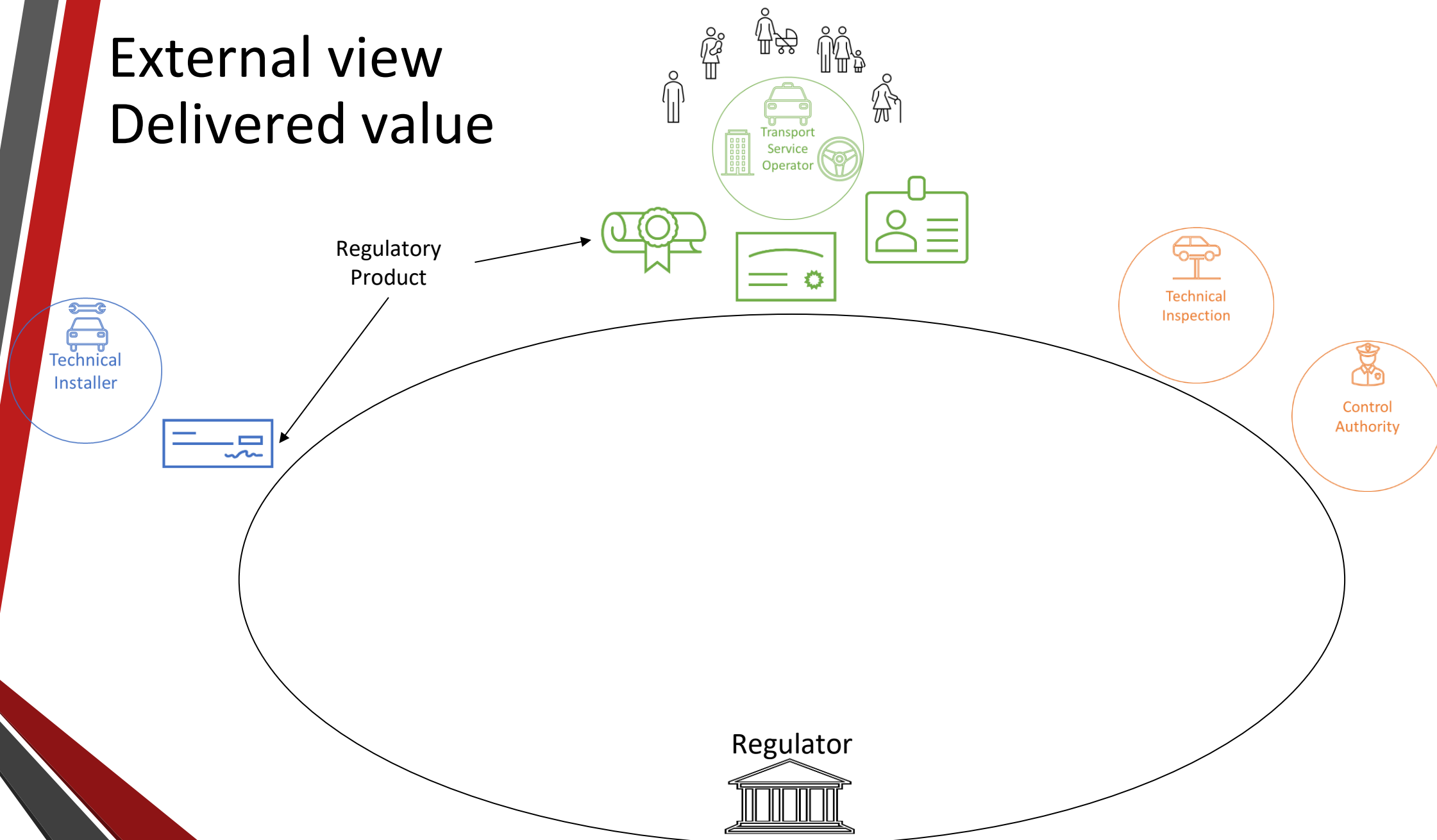
Danny Greefhorst, Erik Proper. Architecture Principles - The Cornerstones of Enterprise Architecture. The Enterprise Engineering Series 4, Springer 2011, ISBN 978-3-642-20278-0, pp. 1-



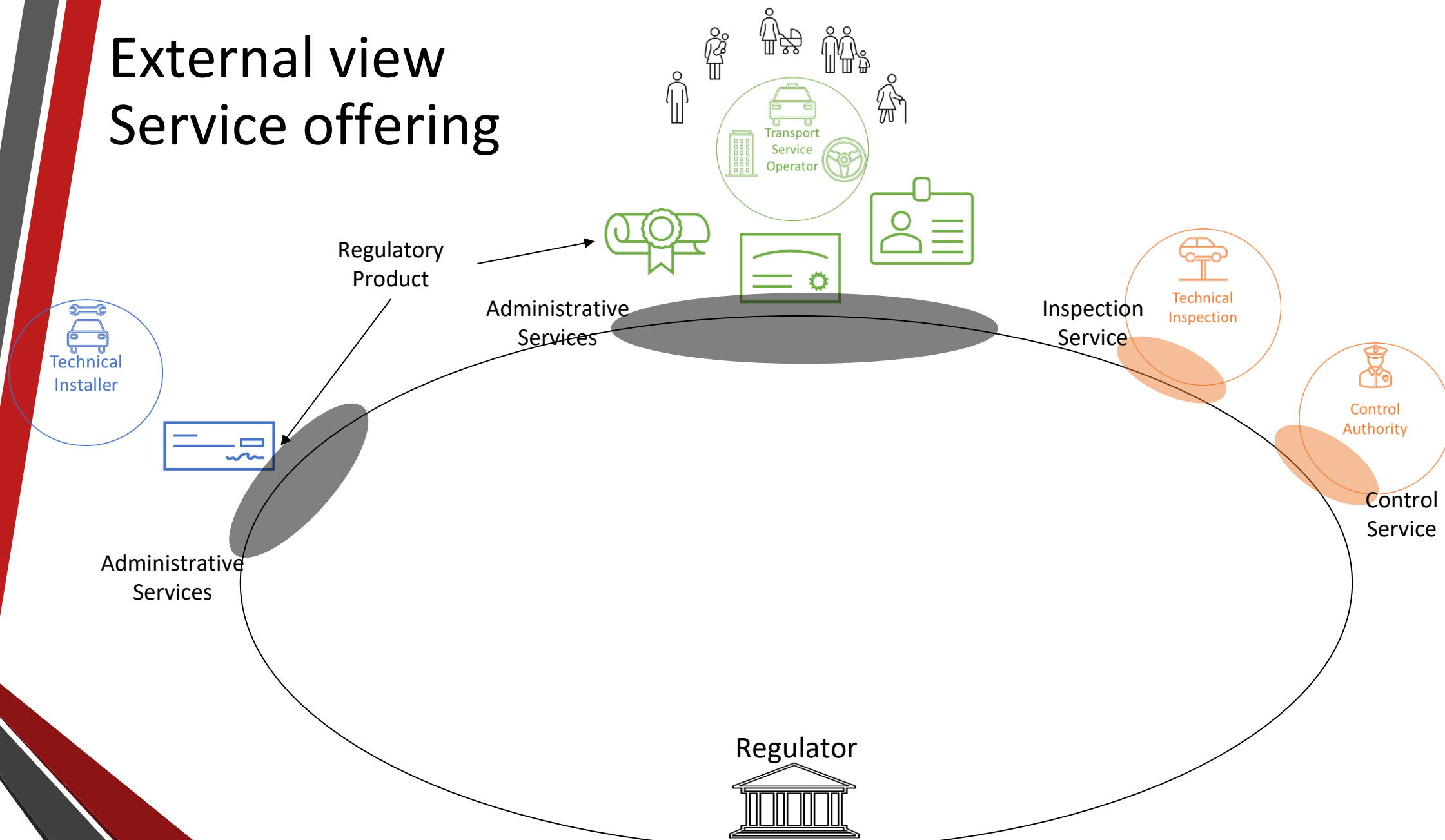
Fundamental concepts in EA illustrated

Fundamental organisation of enterprise - core elements of an EA description

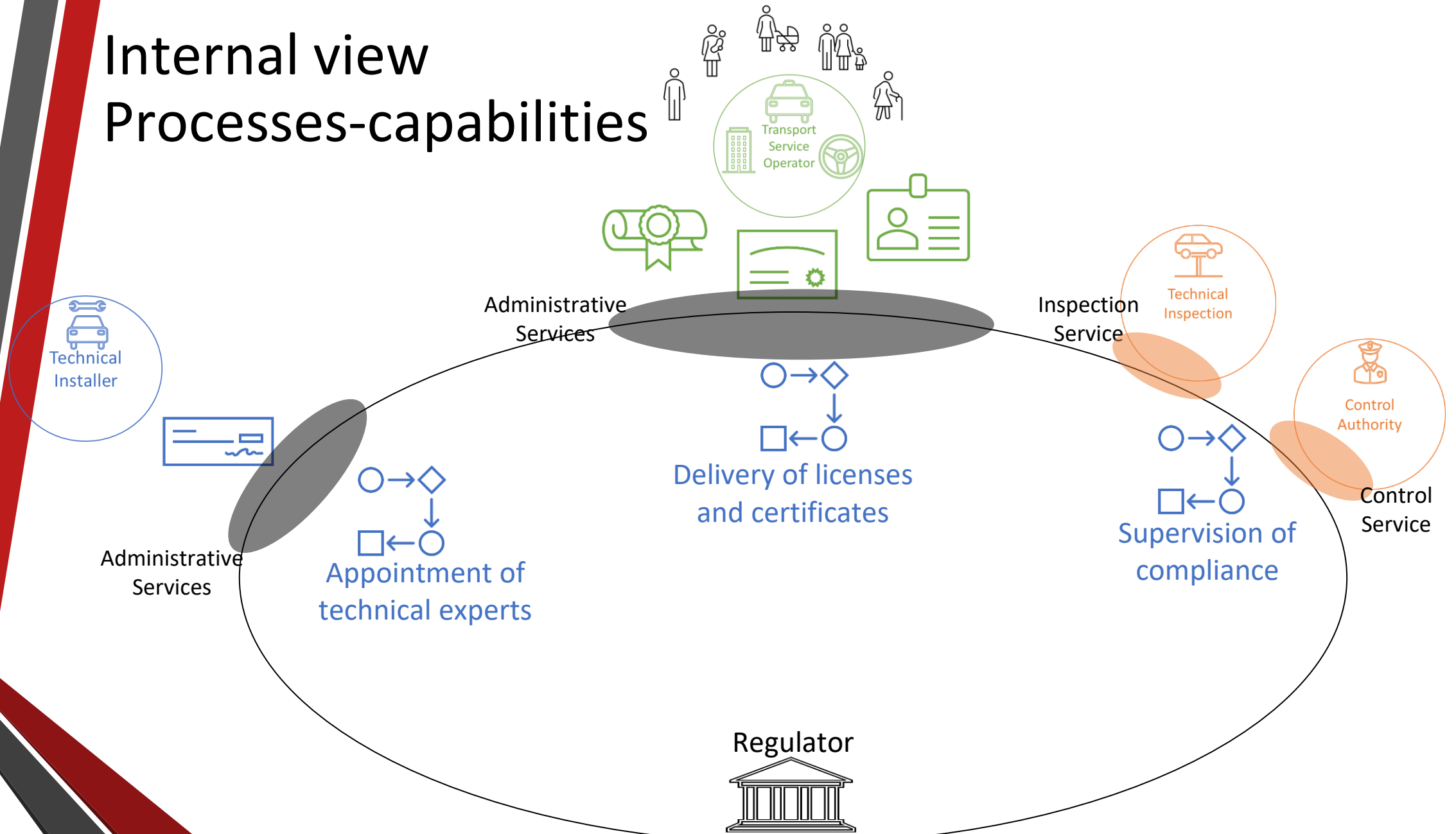
External view Delivered value



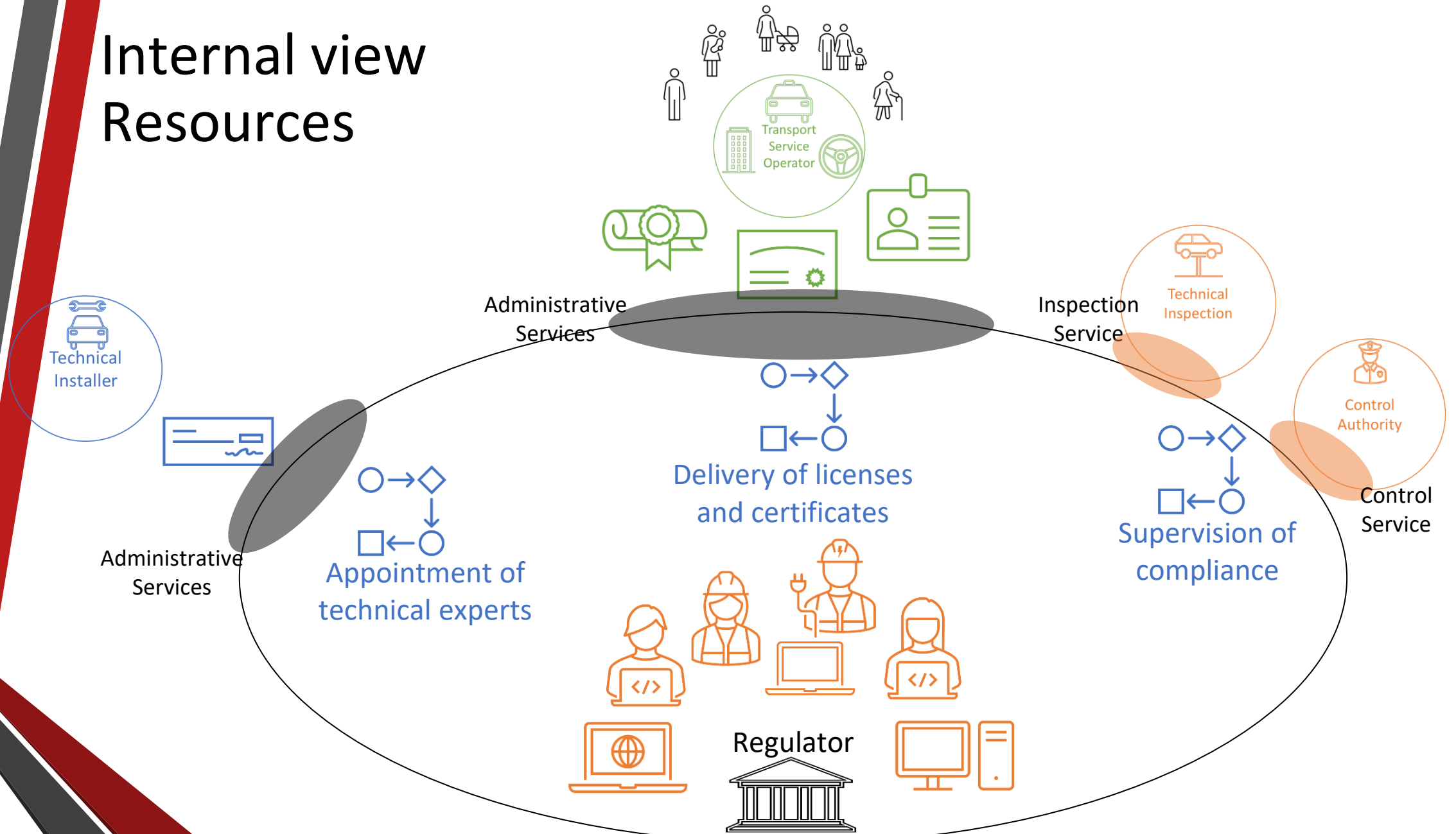
External view Service offering



Internal view Processes-capabilities



Internal view Resources





Evolution of EA as discipline

*From **enterprise-wide IT architecture**
to **architecture of the enterprise***



Positioning EA and similar disciplines in IS

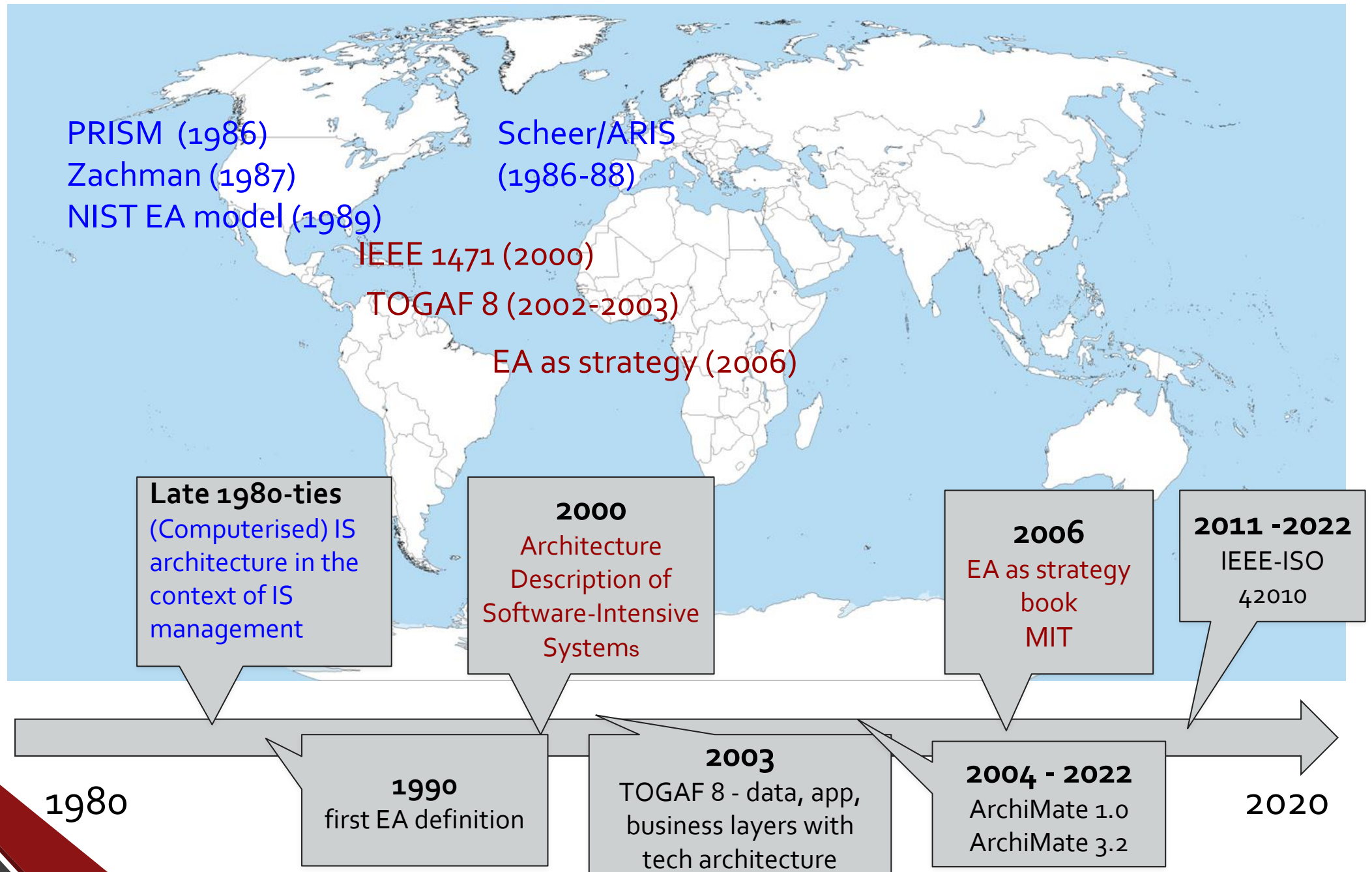
How is it different from **software architecture** ?

How is it different from organisation design/scientific management?

How is it different from process modelling ?

or from..... ?

More details https://en.wikipedia.org/wiki/Enterprise_architecture_framework



Enterprise architecture

- **(First definition)** an architecture that "defines and interrelates **data, hardware, software, and communications resources**, as well as the **supporting organization** required to maintain the overall physical structure required by the architecture" (1990, Richardson et al)

Richardson, G.L.; Jackson, B.M.; Dickson, G.W. (1990). "A Principles-Based Enterprise Architecture: Lessons from Texaco and Star Enterprise". *MIS Quarterly*. **14** (4): 385–403. doi:[10.2307/249787](https://doi.org/10.2307/249787). JSTOR [249787](https://www.jstor.org/stable/249787).

The discipline started as enterprise-wide IT architecture....

Enterprise architecture

- **(First definition)** an architecture that "defines and interrelates data, hardware, software, and communications resources, as well as the supporting organization required to maintain the overall physical structure required by the architecture" (1990, Richardson et al)
- "Enterprise architecture (EA) is the practice of **analyzing, designing, planning, and implementing enterprise analysis to successfully execute on business strategies**. EA helps organizations structure IT projects and policies to achieve desired business results, to stay agile and resilient in the face of rapid change, and to stay on top of industry trends and disruptions [...]" – cio.com

....to become architecture of the enterprise

By 2023, 60% of organizations will depend on EA's role to lead the business approach to digital innovation.

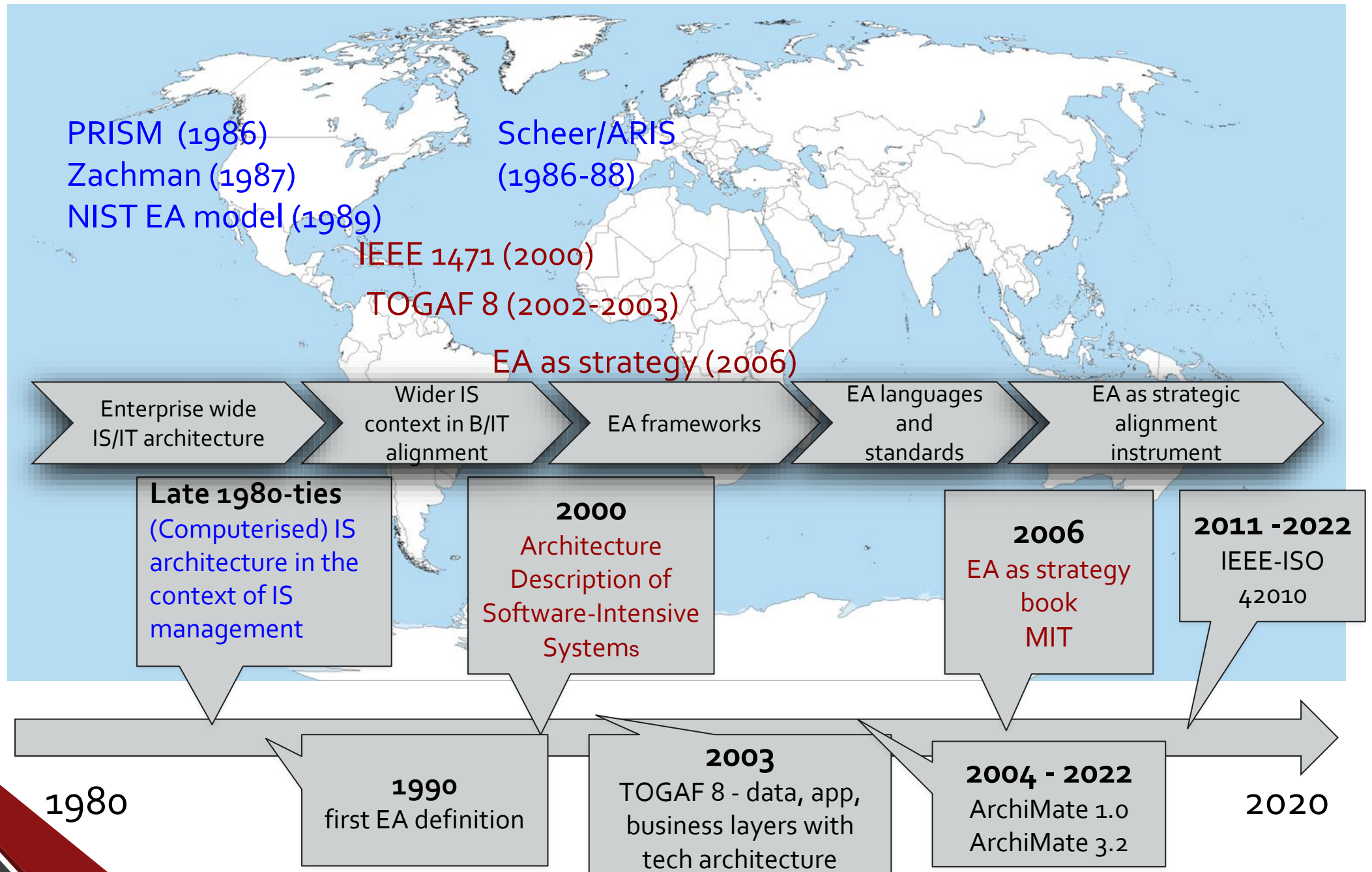
Source: Gartner

Enterprise architecture

- **(First definition)** an architecture that "defines and interrelates data, hardware, software, and communications resources, as well as the supporting organization required to maintain the overall physical structure required by the architecture" (1990, Richardson et al)
- "Enterprise architecture (EA) is the practice of analyzing, designing, planning, and implementing enterprise analysis to successfully execute on business strategies. EA helps organizations structure IT projects and policies to achieve desired business results, to stay agile and resilient in the face of rapid change, and to stay on top of industry trends and disruptions [...]" – cio.com
- "Enterprise architecture (EA) is a discipline for **proactively and holistically leading enterprise responses** to disruptive forces by identifying and analyzing the execution of change toward desired business vision and outcomes. [...]" - Gartner

....and become a key element of strategic management for some....

More details https://en.wikipedia.org/wiki/Enterprise_architecture_framework








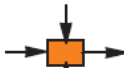

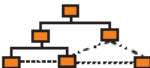


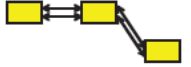
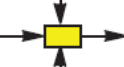
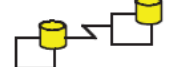
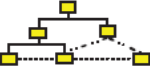
















Zachman Framework (1987)

ENTERPRISE ARCHITECTURE - A FRAMEWORK TM

Classification of
artefacts describing
information systems

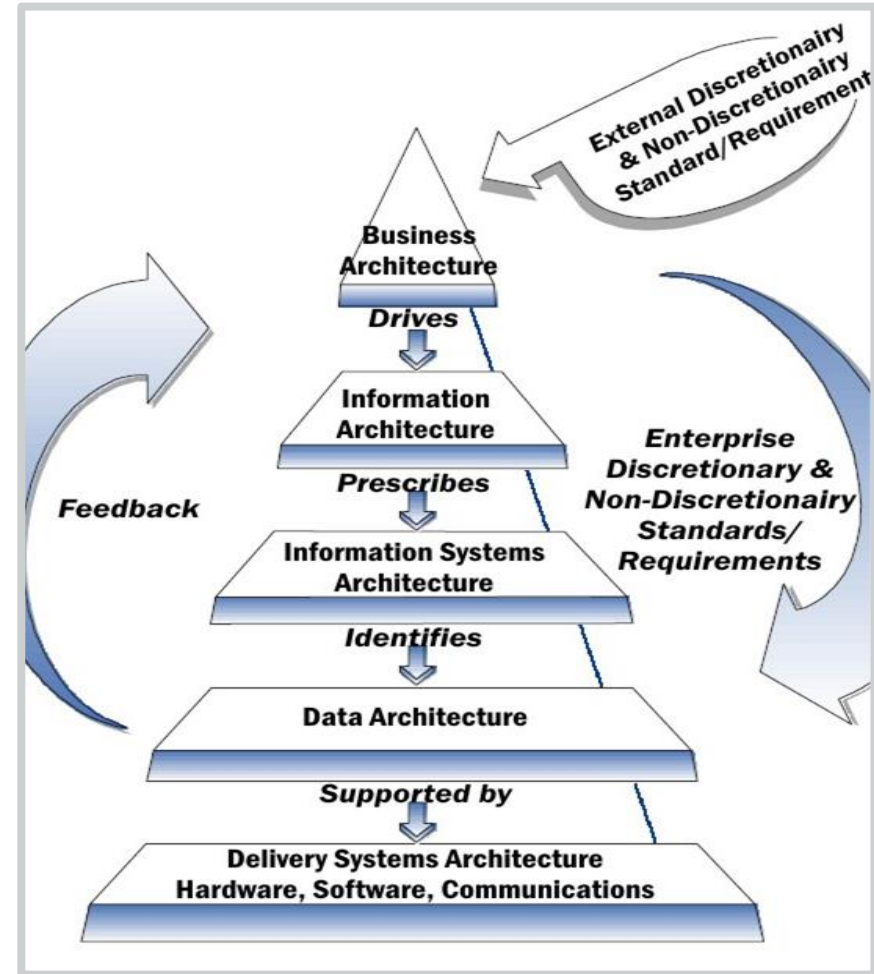
- Domains
- Concerns

	DATA <i>What</i>	FUNCTION <i>How</i>	NETWORK <i>Where</i>	PEOPLE <i>Who</i>	TIME <i>When</i>	MOTIVATION <i>Why</i>	
SCOPE (CONTEXTUAL)	List of Things Important to the Business 	List of Processes the Business Performs 	List of Locations in which the Business Operates 	List of Organizations Important to the Business 	List of Events Significant to the Business 	List of Business Goals/Strat 	SCOPE (CONTEXTUAL)
<i>Planner</i>	ENTITY = Class of Business Thing	Function = Class of Business Process	Node = Major Business Location	People = Major Organizations	Time = Major Business Event	Ends/Mean=Major Bus. Goal/ Critical Success Factor	<i>Planner</i>
ENTERPRISE MODEL (CONCEPTUAL)	e.g. Semantic Model 	e.g. Business Process Model 	e.g. Logistics Network 	e.g. Work Flow Model 	e.g. Master Schedule 	e.g. Business Plan 	ENTERPRISE MODEL (CONCEPTUAL)
<i>Owner</i>	Ent = Business Entity Rein = Business Relationship	Proc. = Business Process I/O = Business Resources	Node = Business Location Link = Business Linkage	People = Organization Unit Work = Work Product	Time = Business Event Cycle = Business Cycle	End = Business Objective Means = Business Strategy	<i>Owner</i>
SYSTEM MODEL (LOGICAL)	e.g. Logical Data Model 	e.g. "Application Architecture" 	e.g. "Distributed System Architecture" 	e.g. Human Interface Architecture 	e.g. Processing Structure 	e.g. Business Rule Model 	SYSTEM MODEL (LOGICAL)
<i>Designer</i>	Ent = Data Entity Rein = Data Relationship	Proc. = Application Function I/O = User Views	Node = I/S Function (Processor, Storage, etc) Link = Line Characteristics	People = Role Work = Deliverable	Time = System Event Cycle = Processing Cycle	End = Structural Assertion Means = Action Assertion	<i>Designer</i>
TECHNOLOGY MODEL (PHYSICAL)	e.g. Physical Data Model 	e.g. "System Design" 	e.g. "System Architecture" 	e.g. Presentation Architecture 	e.g. Control Structure 	e.g. Rule Design 	TECHNOLOGY CONSTRAINED MODEL (PHYSICAL)
<i>Builder</i>	Ent = Segment/Table/etc. Rein = Pointer/Key/etc.	Proc. = Computer Function I/O = Screen/Device Formats	Node = Hardware/System Software Link = Line Specifications	People = User Work = Screen Format	Time = Execute Cycle = Component Cycle	End = Condition Means = Action	<i>Builder</i>
DETAILED REPRESENTATIONS (OUT-OF-CONTEXT)	e.g. Data Definition 	e.g. "Program" 	e.g. "Network Architecture" 	e.g. Security Architecture 	e.g. Timing Definition 	e.g. Rule Specification 	DETAILED REPRESENTATIONS (OUT-OF-CONTEXT)
<i>Sub-Contractor</i>	Ent = Field Rein = Address	Proc. = Language Stmt I/O = Control Block	Node = Addresses Link = Protocols	People = Identity Work = Job	Time = Interrupt Cycle = Machine Cycle	End = Sub-condition Means = Step	<i>Sub Contractor</i>
FUNCTIONING ENTERPRISE	e.g. DATA	e.g. FUNCTION	e.g. NETWORK	e.g. ORGANIZATION	e.g. SCHEDULE	e.g. STRATEGY	FUNCTIONING ENTERPRISE

Enterprise wide
IS/IT architecture

Wider IS
context in B/IT
alignment

NIST EA Model (1989)

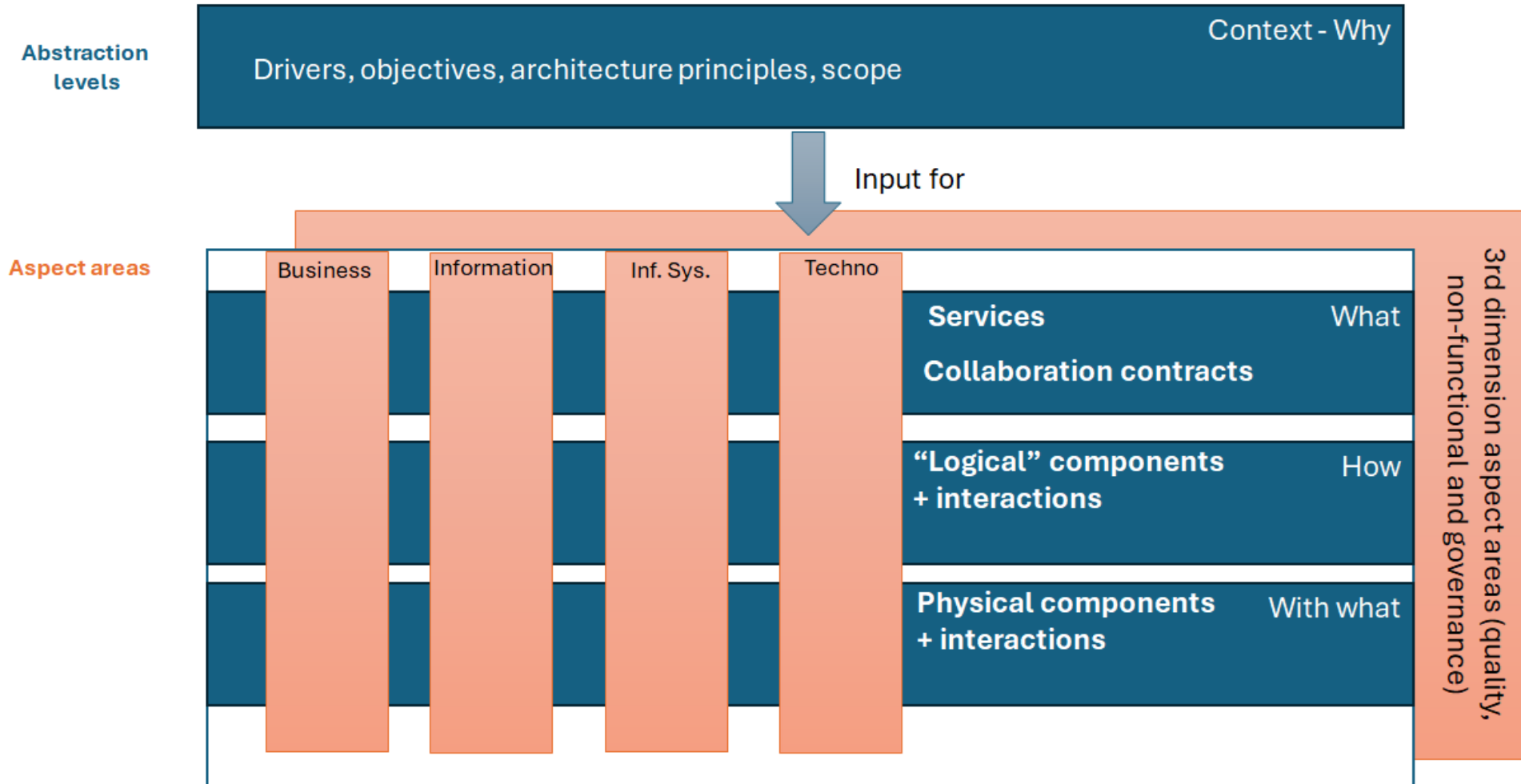


Enterprise wide
IS/IT architecture

Wider IS
context in B/IT
alignment

A light blue arrow pointing to the right, containing the text "EA frameworks".

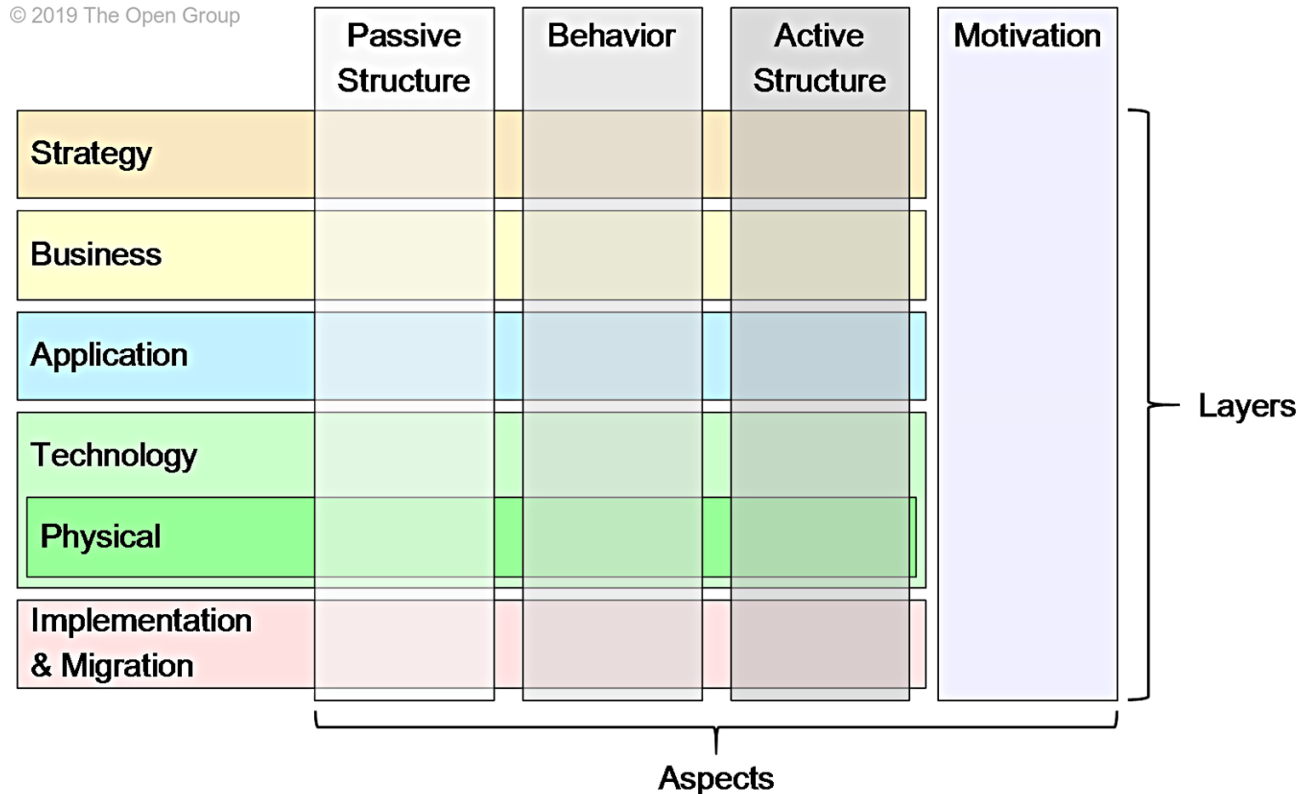
Integrated Architecture Framework by CapGemini (1993)





Archimate framework (2004-2022)

© 2019 The Open Group

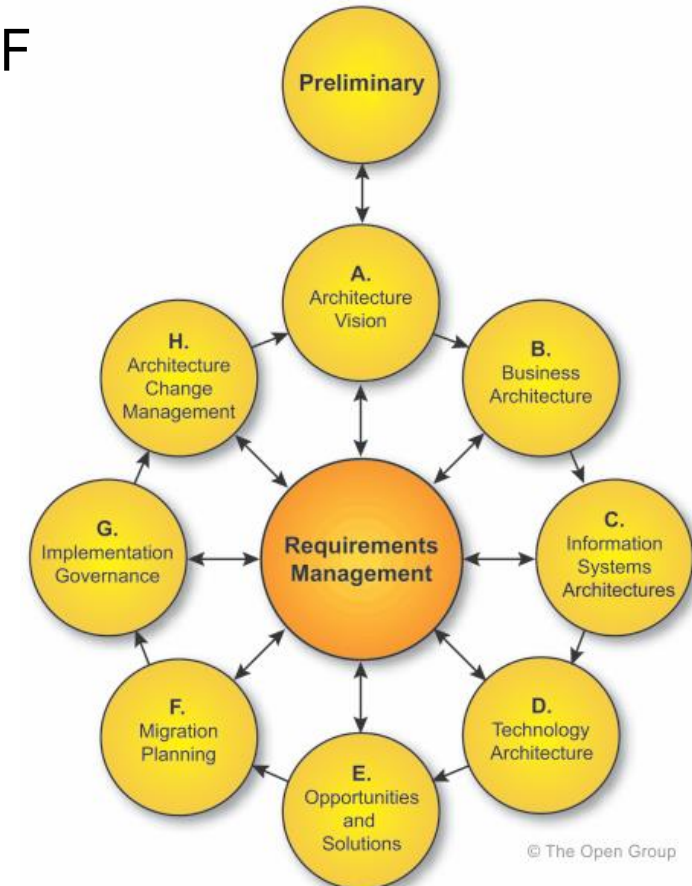
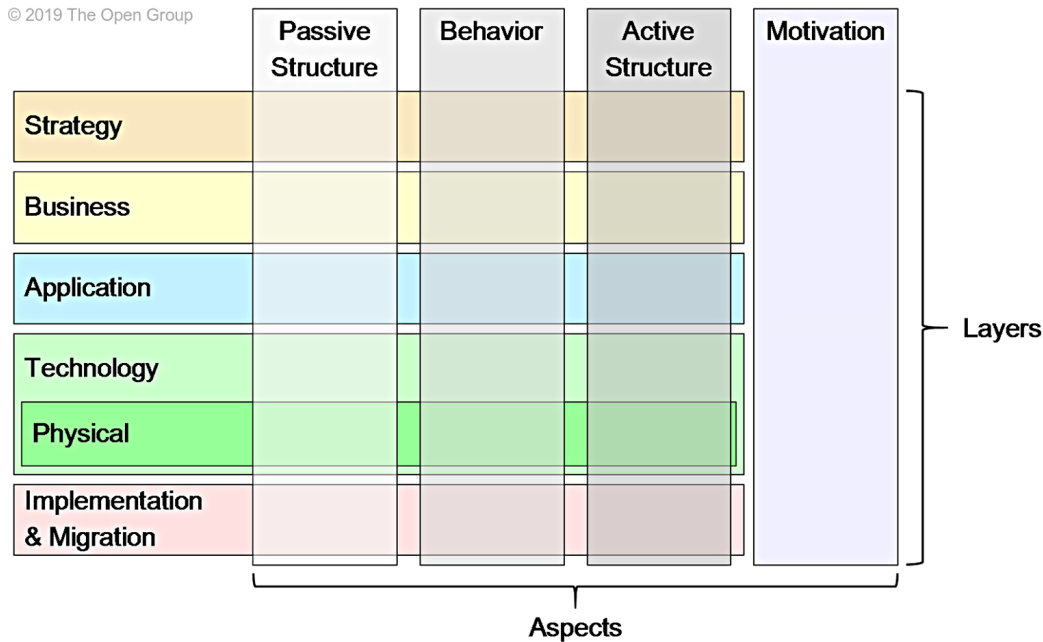


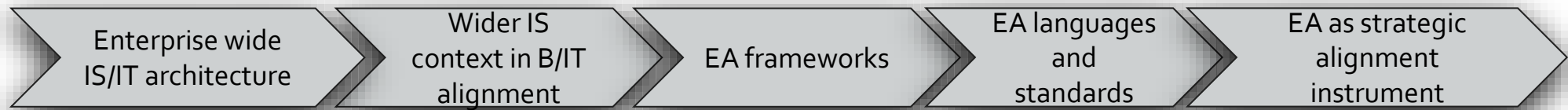


EA standardisation by The Open Group

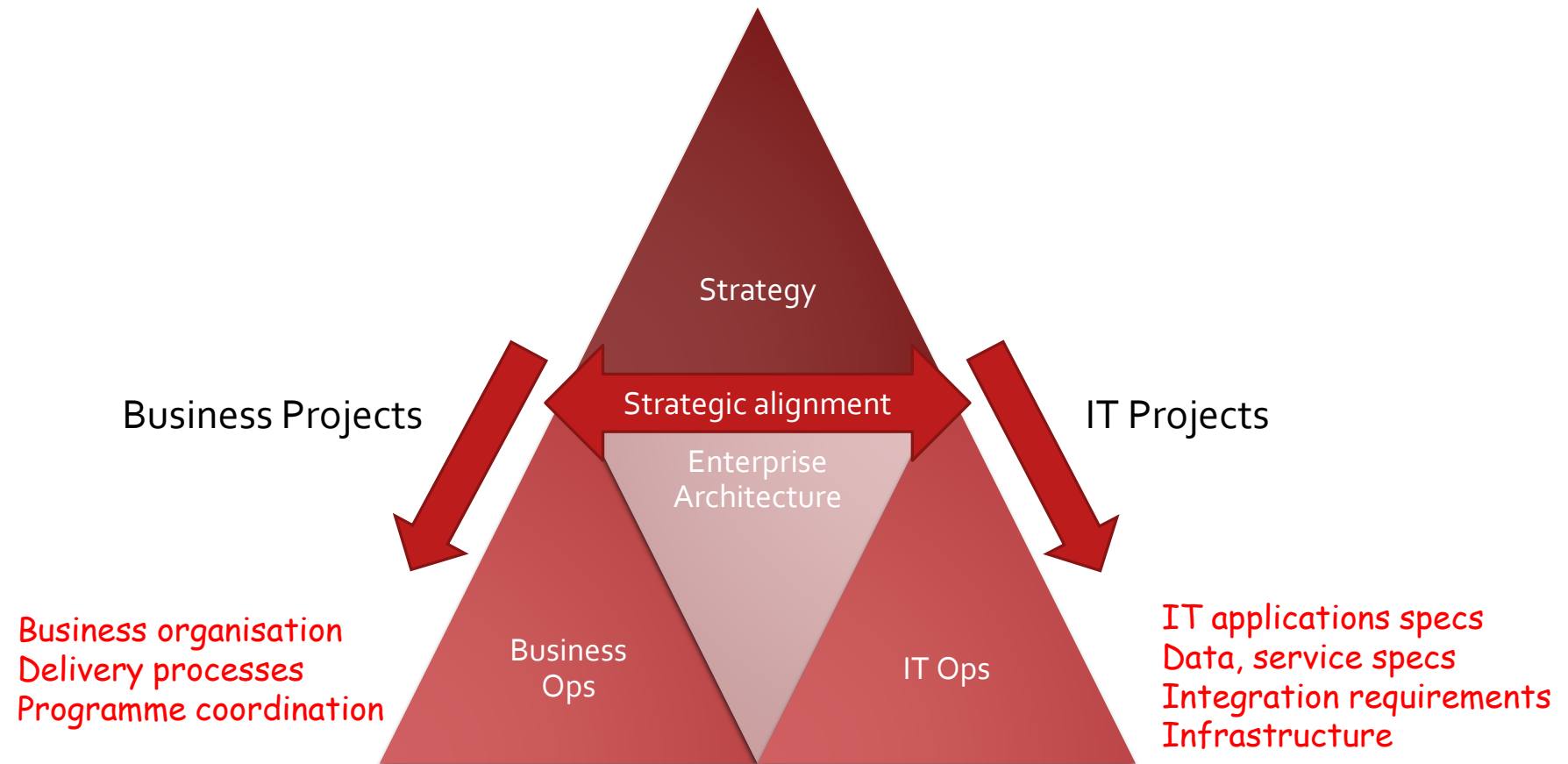
ArchiMate and TOGAF

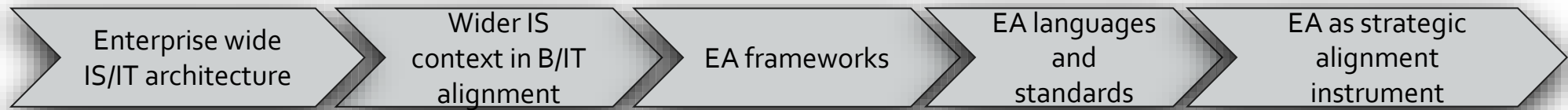
© 2019 The Open Group



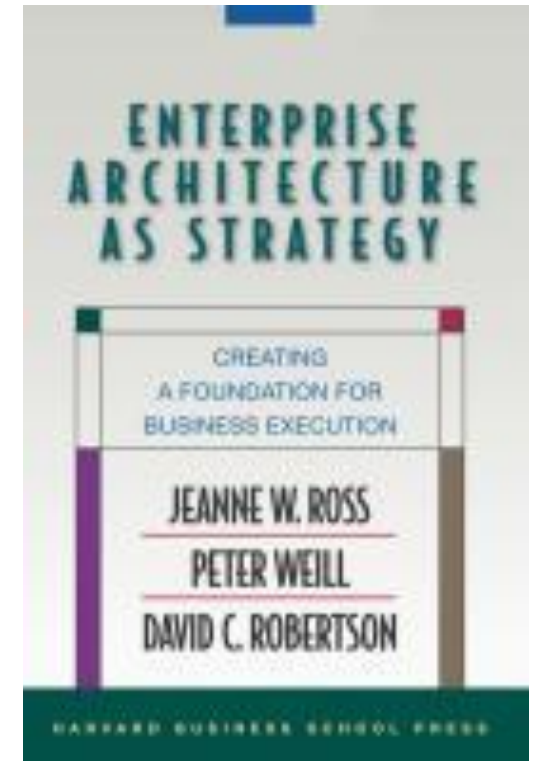


EA as strategic alignment instrument





2. *Enterprise architecture.* The *enterprise architecture* is the organizing logic for business processes and IT infrastructure, reflecting the integration and standardization requirements of the company's operating model. The enterprise architecture provides a long-term view of a company's processes, systems, and technologies so that individual projects can build capabilities—not just fulfill immediate needs. Companies go through four stages in learning how to take an enterprise architecture approach to designing business processes: Business Silos, Standardized Technology, Optimized Core, and Business Modularity. As a company advances through the stages, its foundation for execution takes on increased strategic importance.



Ross, J. W., Weill, P., & Robertson, D. (2006). *Enterprise architecture as strategy: Creating a foundation for business execution*. Harvard business press.



Positioning EA and similar disciplines in IS

How is it different from **software architecture** ?

How is it different from organisation design/scientific management?

How is it different from process modellingzw ?

or from..... ?