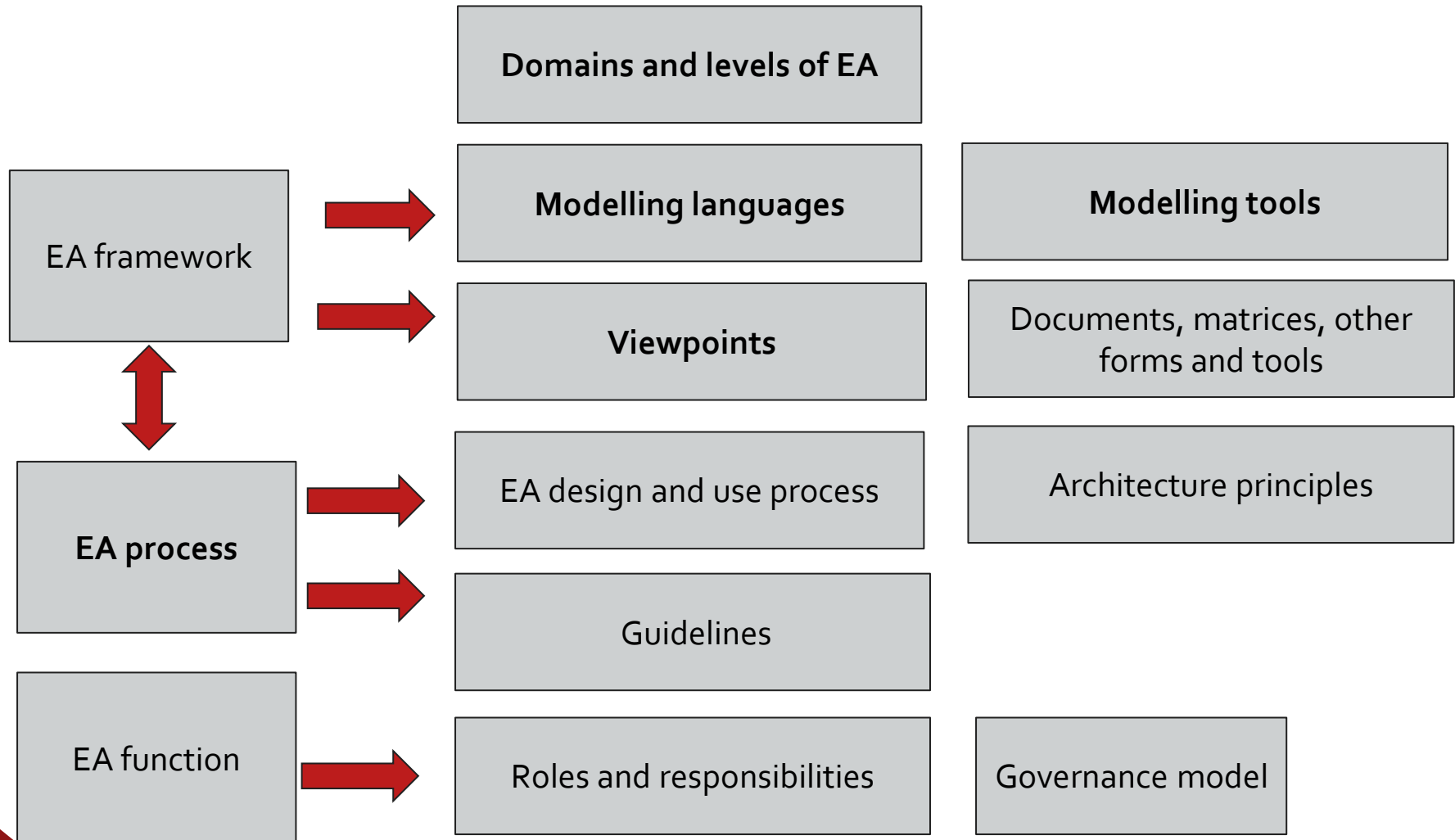




Key elements of EA








Modelling frameworks and languages

EA - Blueprint type of thinking about enterprise



Recommended reading - literature

<https://github.com/egrandry/missm-enterprise-architecture/tree/main/recommended-reading>

| Name |
|---|
|  .. |
|  2010 - Greefhorst - Architecture principles (first two chapters).pdf |
|  2017 - Kotusev - A_Frameworks_Free_Look_at_Enterprise_Arc.pdf |
|  2018 - Proper - Architectural coordination of enterprise transformation (book).pdf |
|  2019 - Kotusev -The Process View of Enterprise Architecture Practice.pdf |
|  2021 - Digital transformation - A multidisciplinary reflection and research agenda 2021.pdf |
|  2023 - Band et al - ArchiMetal case study version 3.2.pdf |



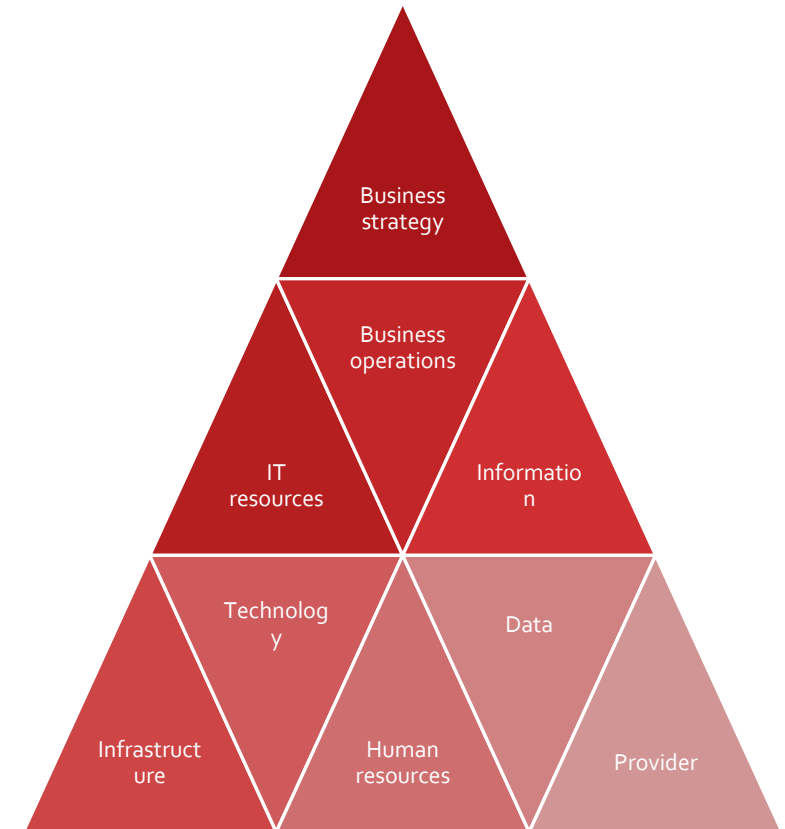
EA frameworks

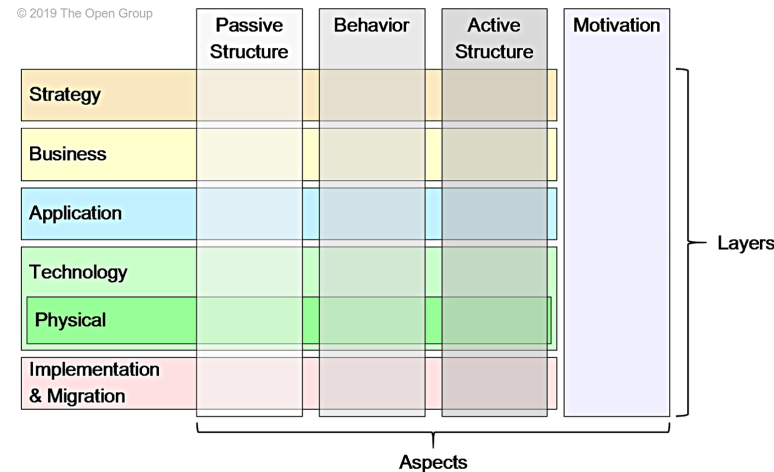
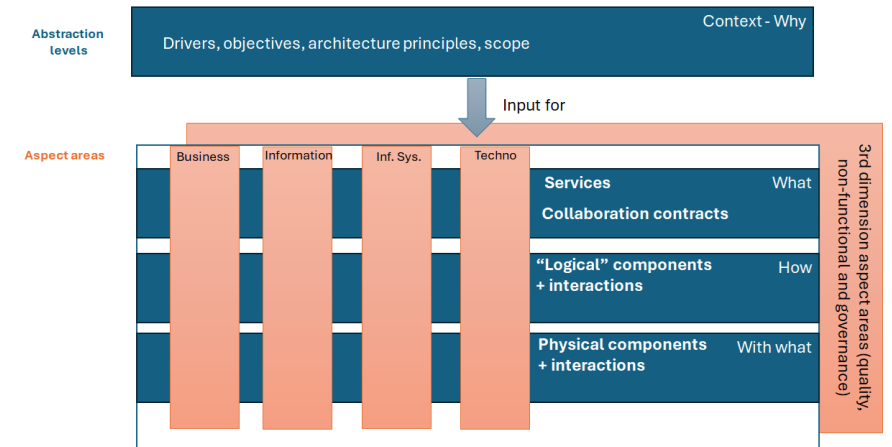
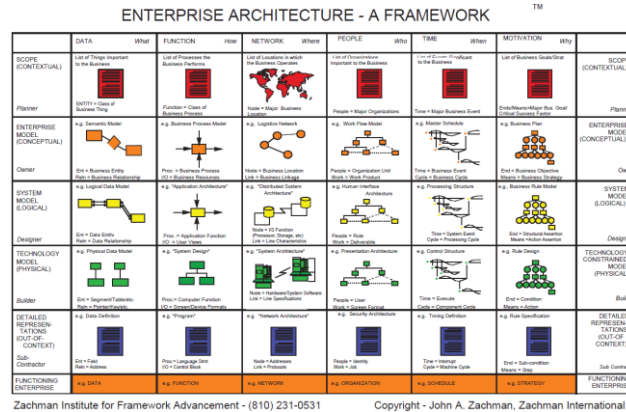
Organising the thinking about architecture of enterprises

Structuring the way of thinking of an enterprise

- Fundamental organisation of an enterprise
 - Coherence of all aspects of the enterprise
 - Holistic view with just enough details
- Relevant **domains, levels of architecture**
- Relevant **concepts** and **relationships**
 - modelling language

Foundation for the architectural approach





- Different frameworks embody different understanding of scope, relevant domains and aspects of enterprise for EA, and they each have been designed with a slightly different **purpose** in mind.



ArchiMate – An open standard

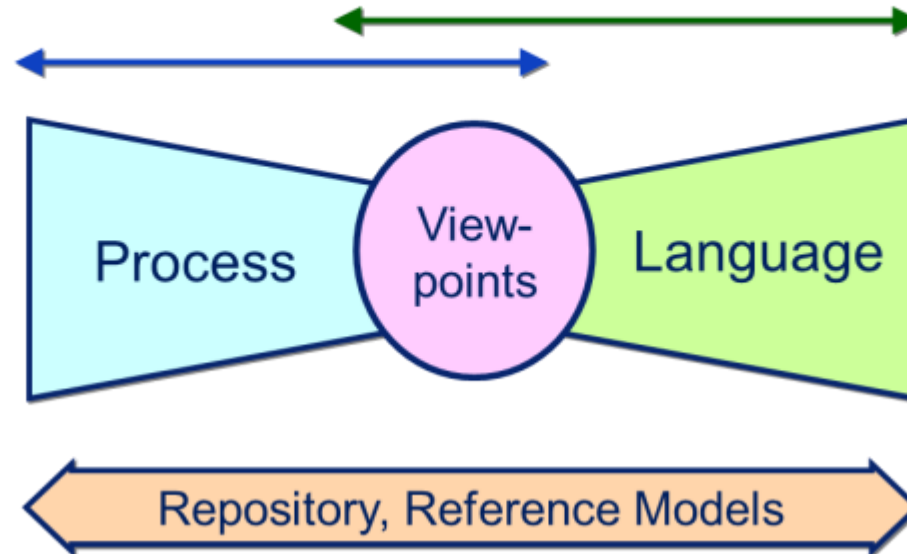
Architecture framework and modelling language for EA

De-facto reference modelling language for EA

TOGAF

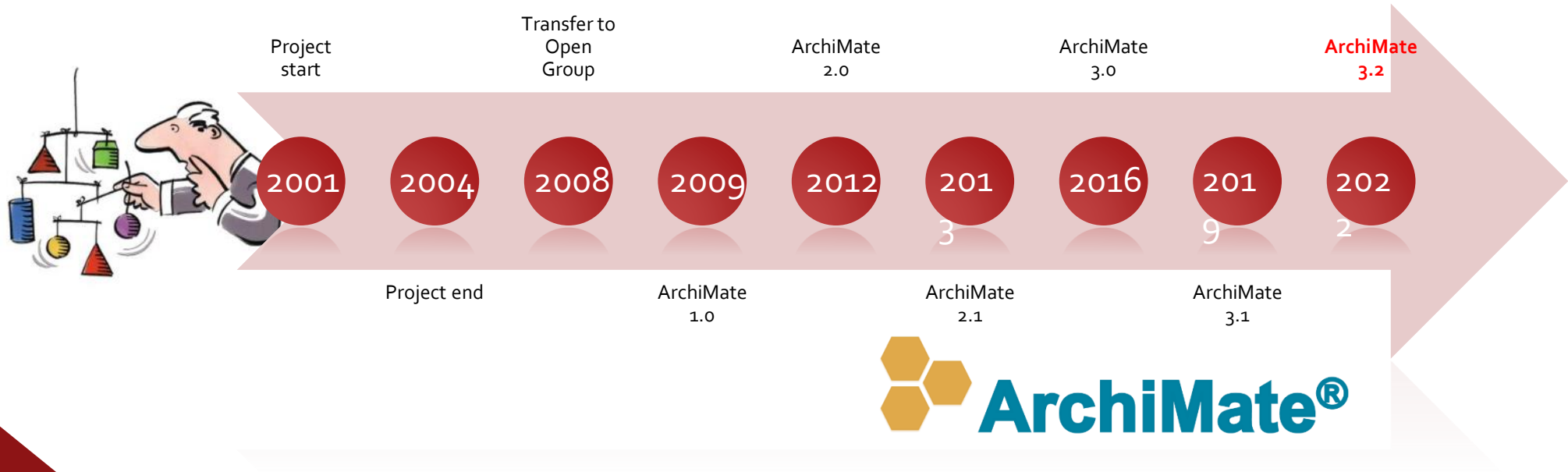


ArchiMate

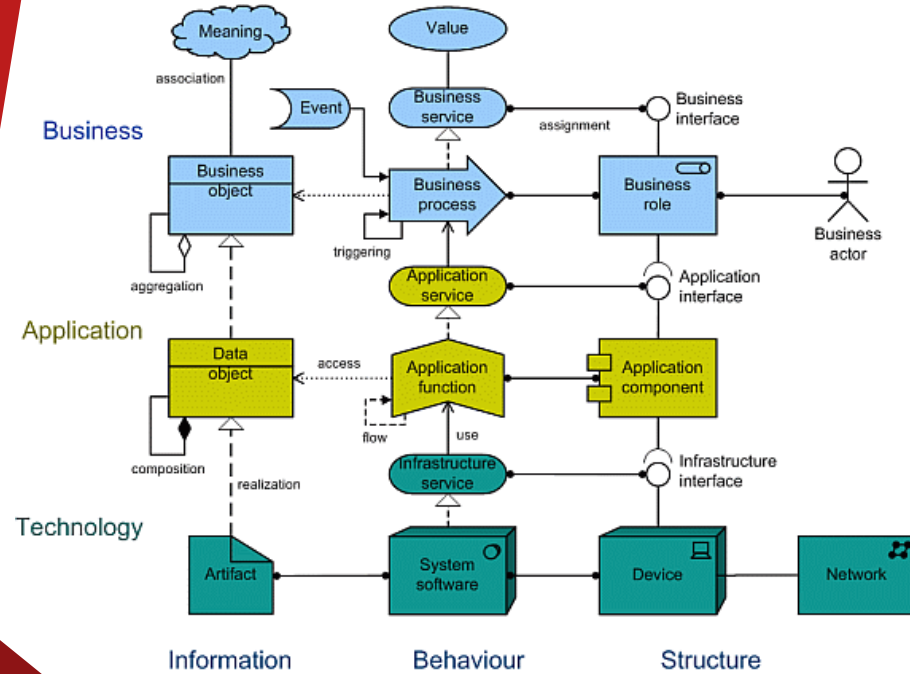


From research project to open standard

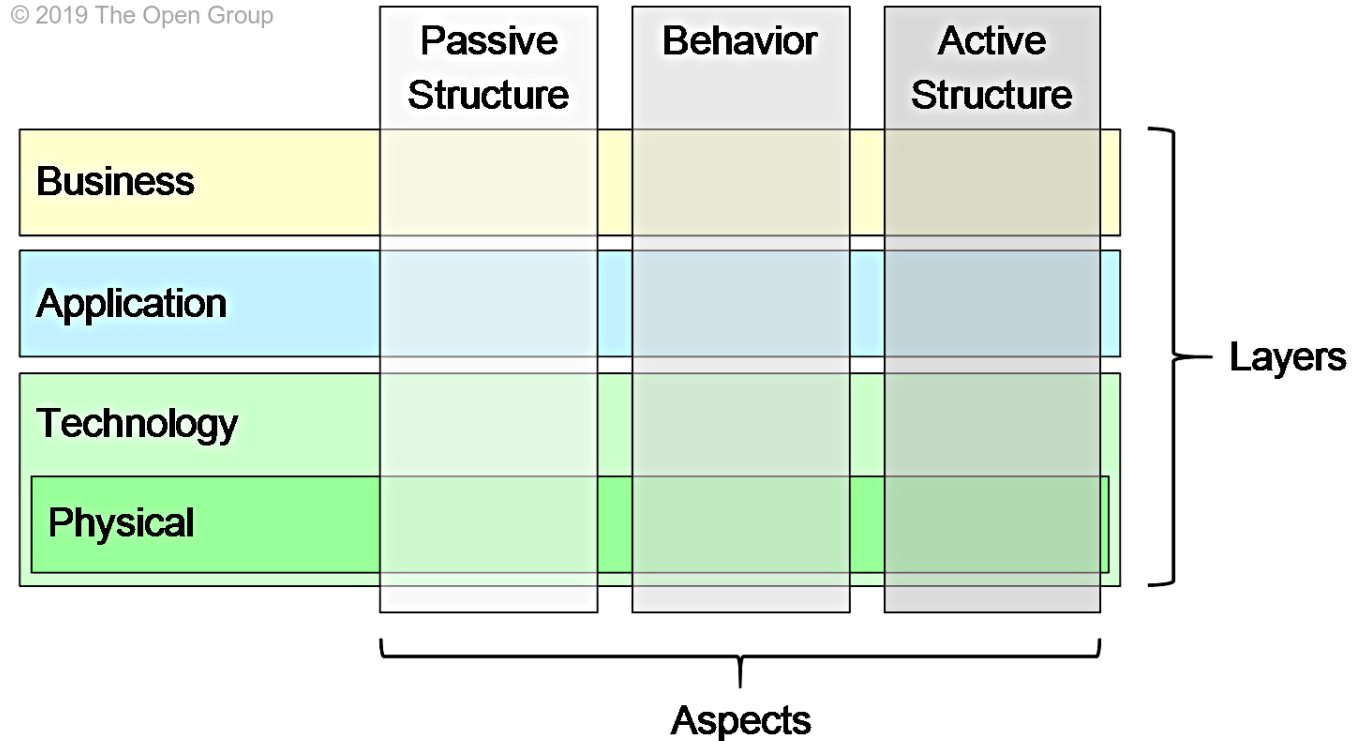
THE *Open* GROUP



ArchiMate language and framework (version 1.0)



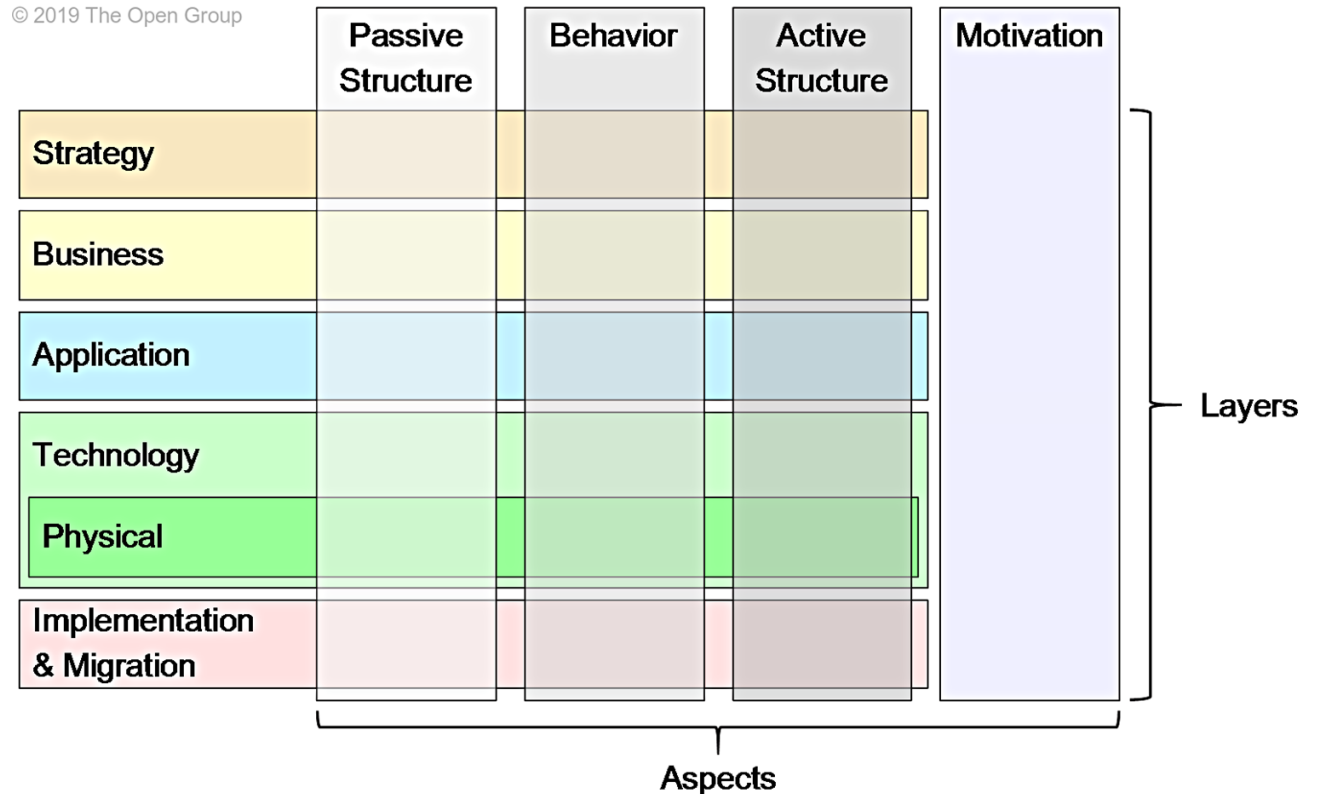
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Extended language and framework (version 3.2)

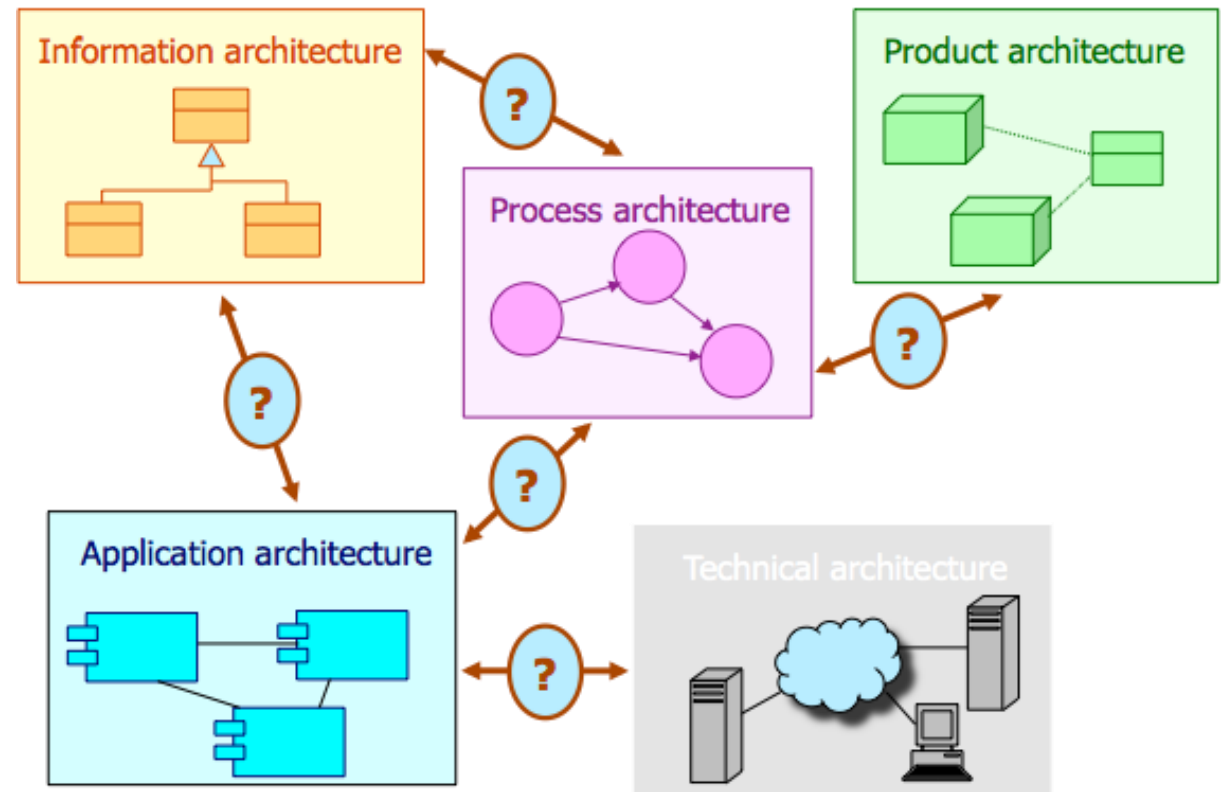
- Additional layers
 - Strategy
 - Implementation & Migration
- Additional aspect
 - Motivation

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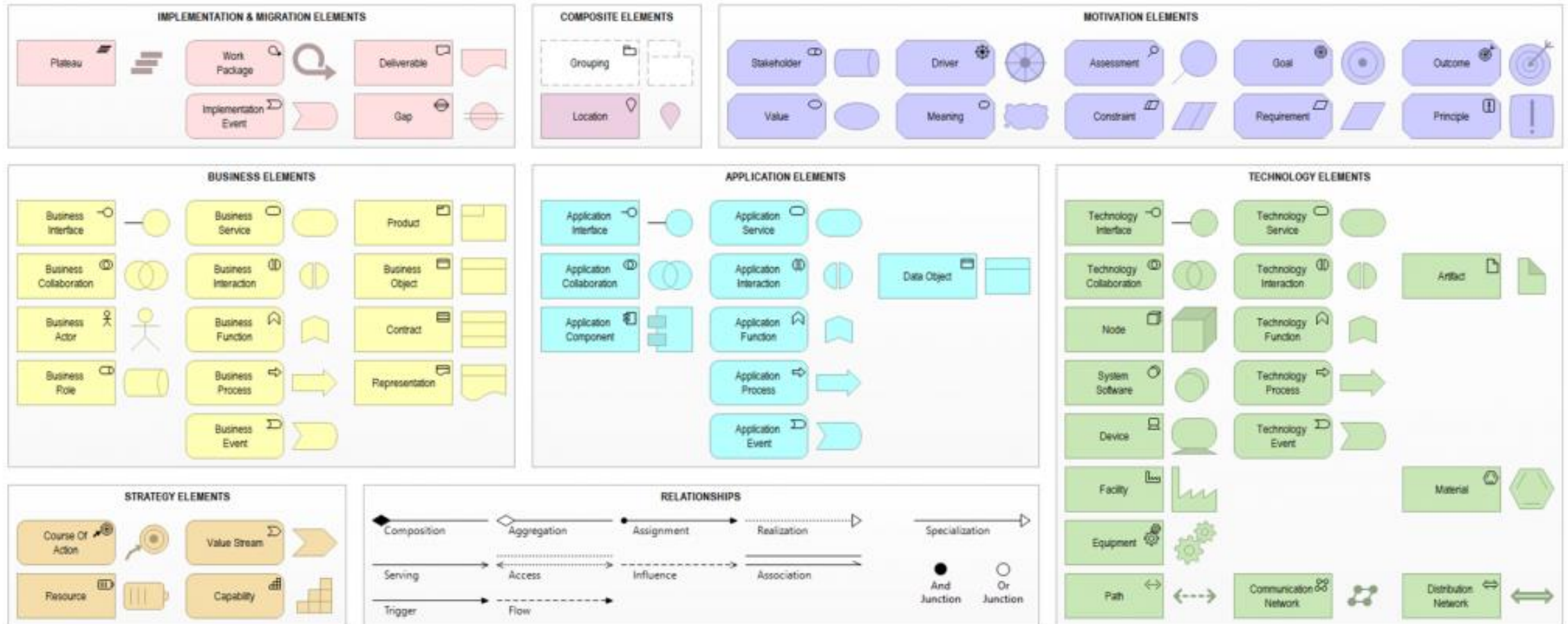


Archimate - EA modeling framework

- Supporting multiple layers of architecture
- Correspondence between cross-layer concepts



Modelling palette



Tool support for Archimate

<https://certification.opengroup.org/register/archimate-tool>

ArchiMate® Tool Certification Register

[HOME](#)

ArchiMate® 3 Certified Tools

There are 11 tools from 11 organizations.

All tools listed below are certified for conformance to the ArchiMate® Version 3.0.1 Specification or ArchiMate® Version 3.1 where advised.

| Organization | Tool Name |
|--|--|
| Avolution | ABACUS 5.0 or later |
| BiZZdesign BV | Enterprise Studio and HoriZZon, version 4 and above: conformant with ArchiMate 3.1 |
| BOC Products & Services AG | ADOIT® |
| DAIN | ArchiREPO |
| Mega International | HOPEX for the ArchiMate® Framework (HOPEX V4.1) |
| Obeo | Obeo SmartEA |
| Orbus Software | iServer 2019 or later |
| QPR Software Plc | QPR EnterpriseArchitect 2019.1 |
| SHENZHEN TECSOON INFORMATION TECHNOLOGY CO.,LTD. | Archimate® Based Enterprise Architecture Asset Development Tool |
| SOFTEAM / MODELIOSOFT | Modelio BA - ArchiMate EA - Version 5.1 |
| Visual Paradigm International Ltd. | Visual Paradigm Enterprise Edition 14.0 above |

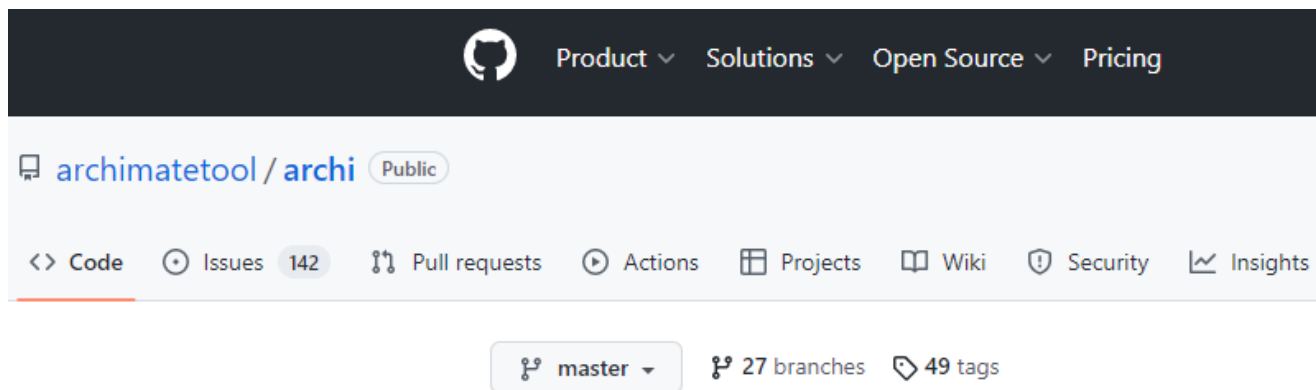
Open source modelling tool

- Open source product
- MIT Licence <https://opensource.org/license/mit/>
- Maintained by mainly 1 person... (Phil Beauvoir)



Archi
archimate modelling

<https://www.archimatetool.com/>

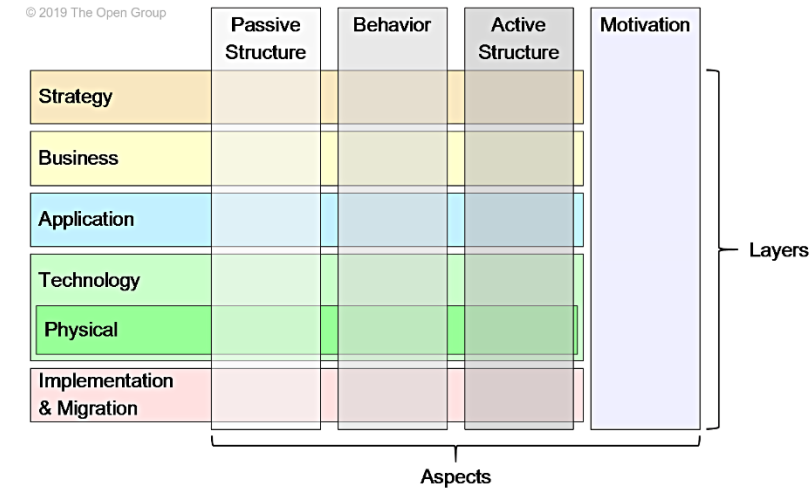


<https://github.com/archimatetool/archi>

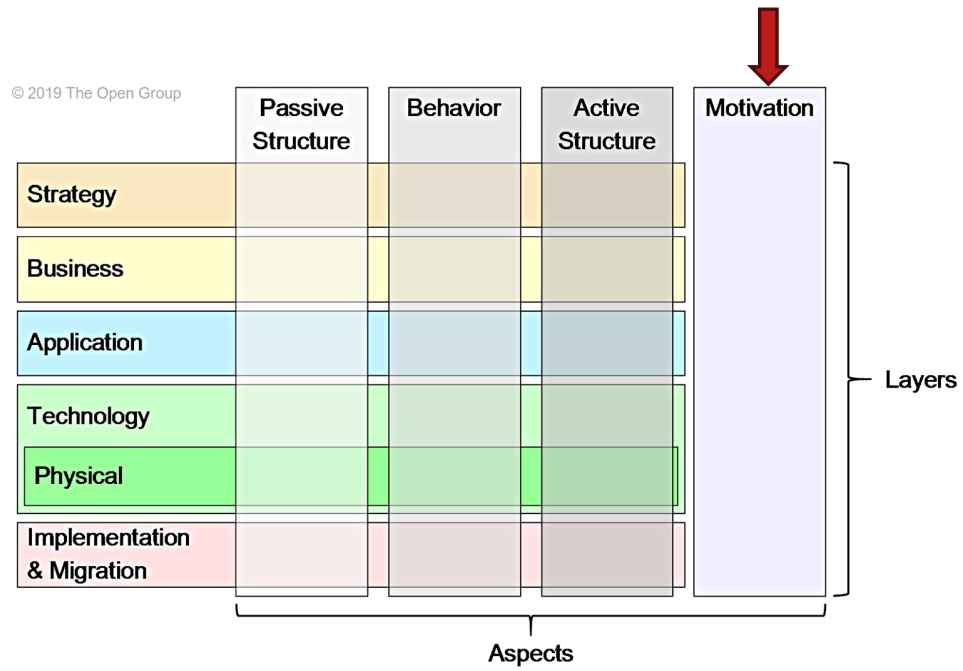


Group project

Overview of the standard



- Layer by layer
 - What do we model about the architecture of an enterprise
 - What are the modelling elements provided by ArchiMate
 - Cross-layer relations
- Illustration
 - ArchiSurance case study <https://archimate-models.github.io/archisurance/>
 - ArchiMetal case study <https://pubs.opengroup.org/architecture/case-study-models/archimetal.html>
 - Live « demo » with Archi



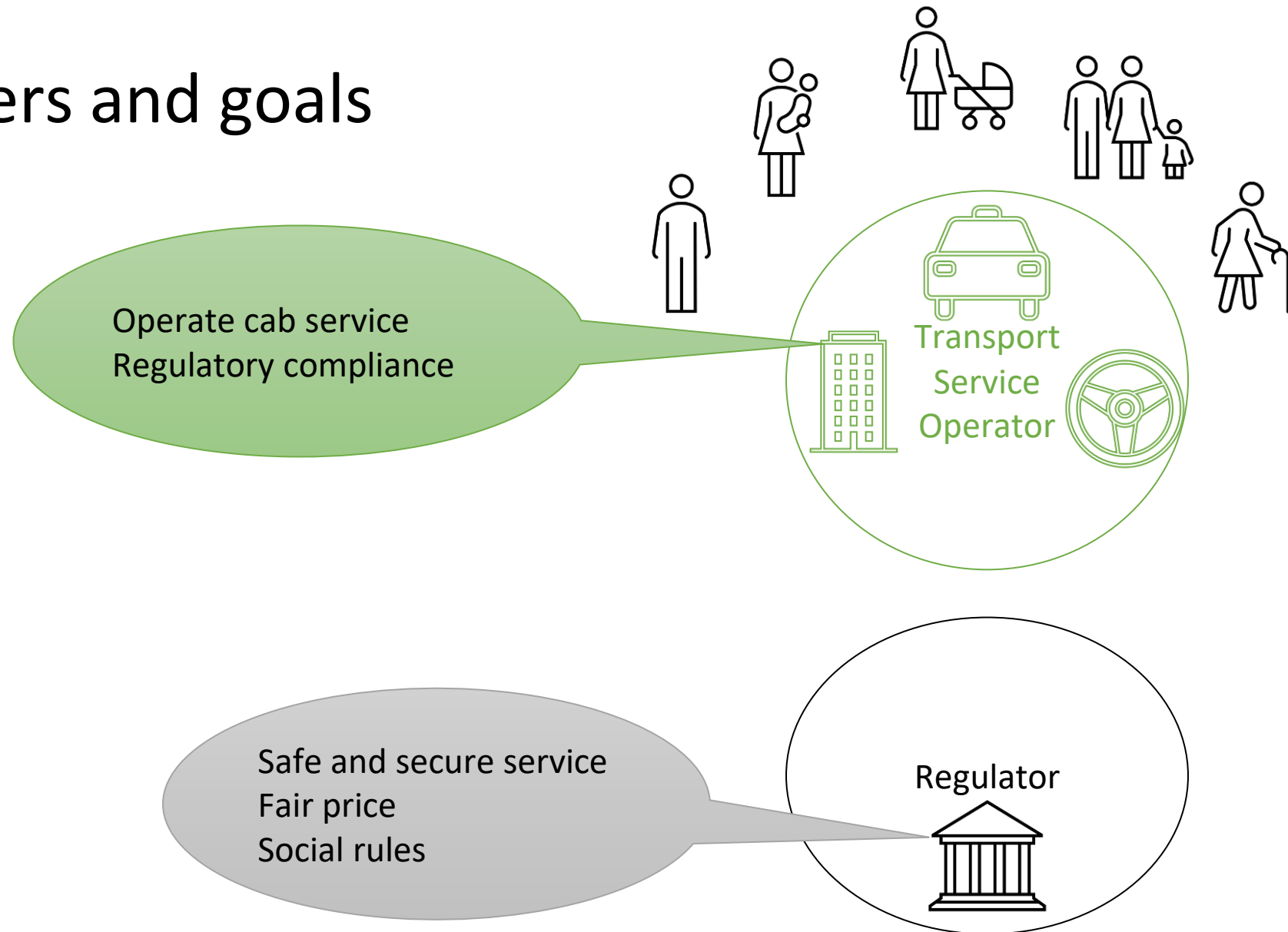
Motivation aspect





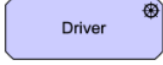

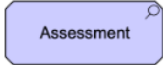



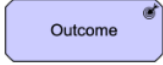

What do we model

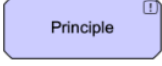

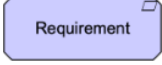

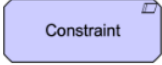

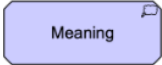



- Rationale that guides the design (or change) of an Enterprise Architecture
- **Drivers** are motivating (changes of) enterprise
- **Goals** are responses of the enterprise to drivers

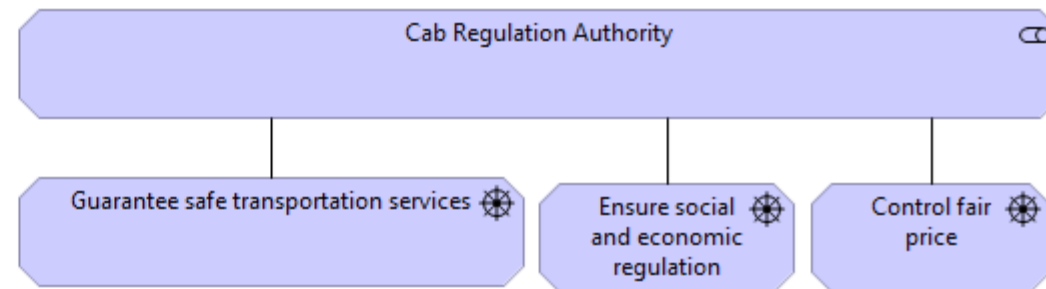
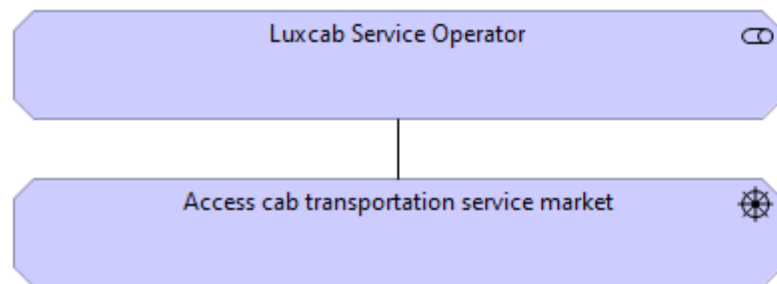
Drivers and goals

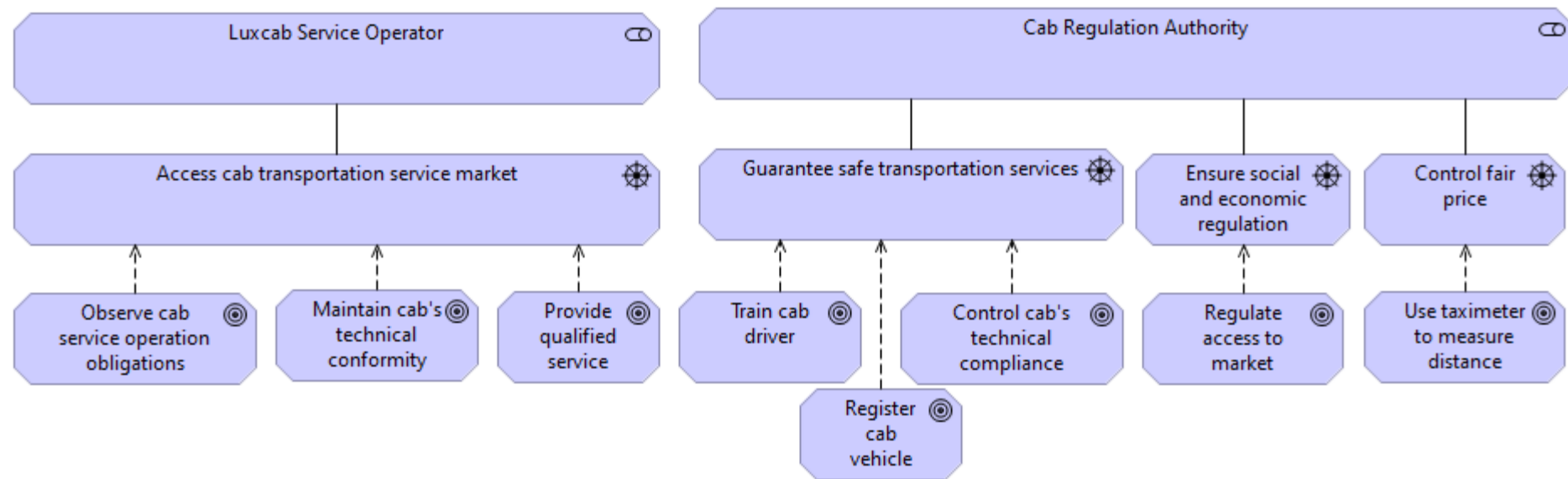


Modelling elements

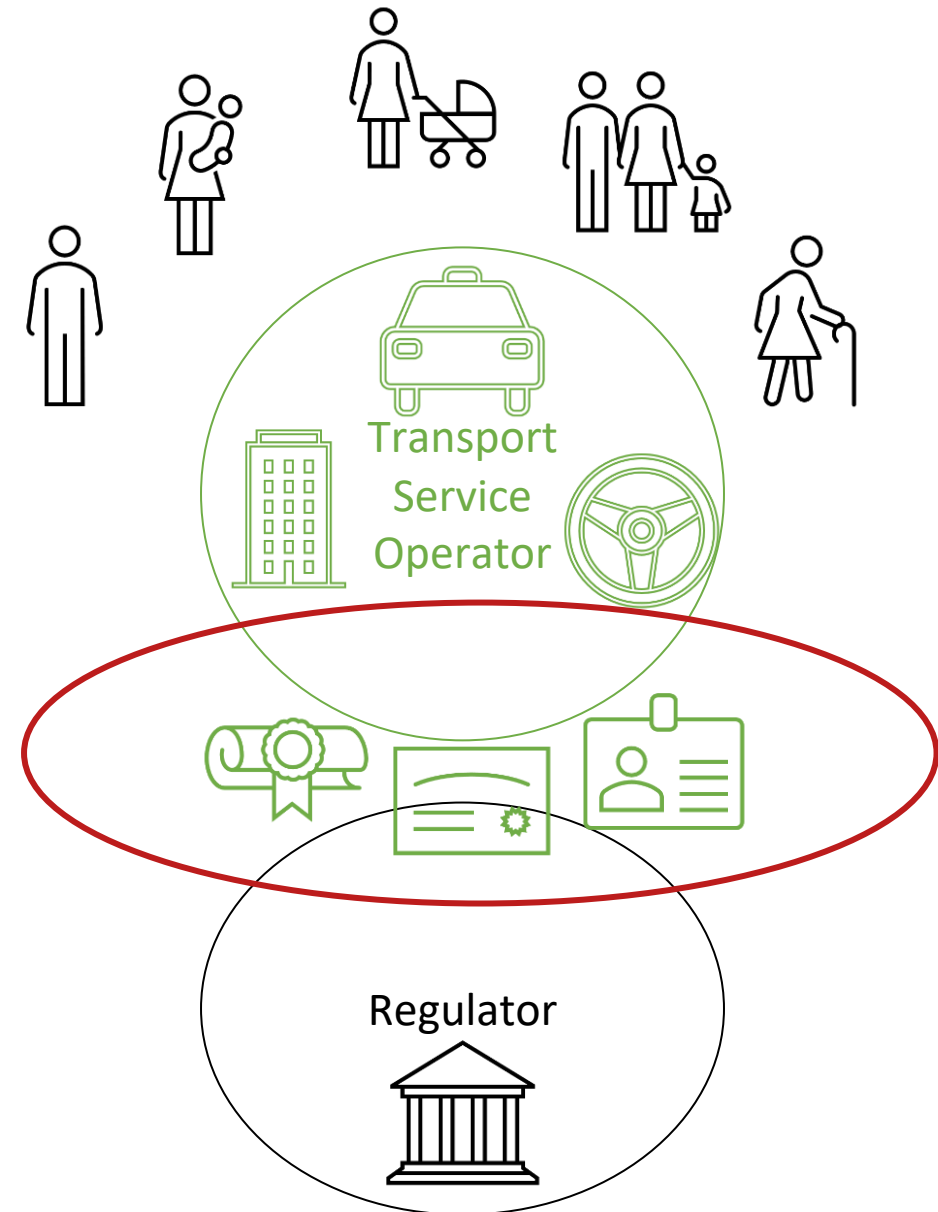
| Element | Definition | Notation |
|-------------|--|---|
| Stakeholder | Represents the role of an individual, team, or organization (or classes thereof) that represents their interests in the effects of the architecture. |   |
| Driver | Represents an external or internal condition that motivates an organization to define its goals and implement the changes necessary to achieve them. |   |
| Assessment | Represents the result of an analysis of the state of affairs of the enterprise with respect to some driver. |   |
| Goal | Represents a high-level statement of intent, direction, or desired end state for an organization and its stakeholders. |   |
| Outcome | Represents an end result, effect, or consequence of a certain state of affairs. |   |

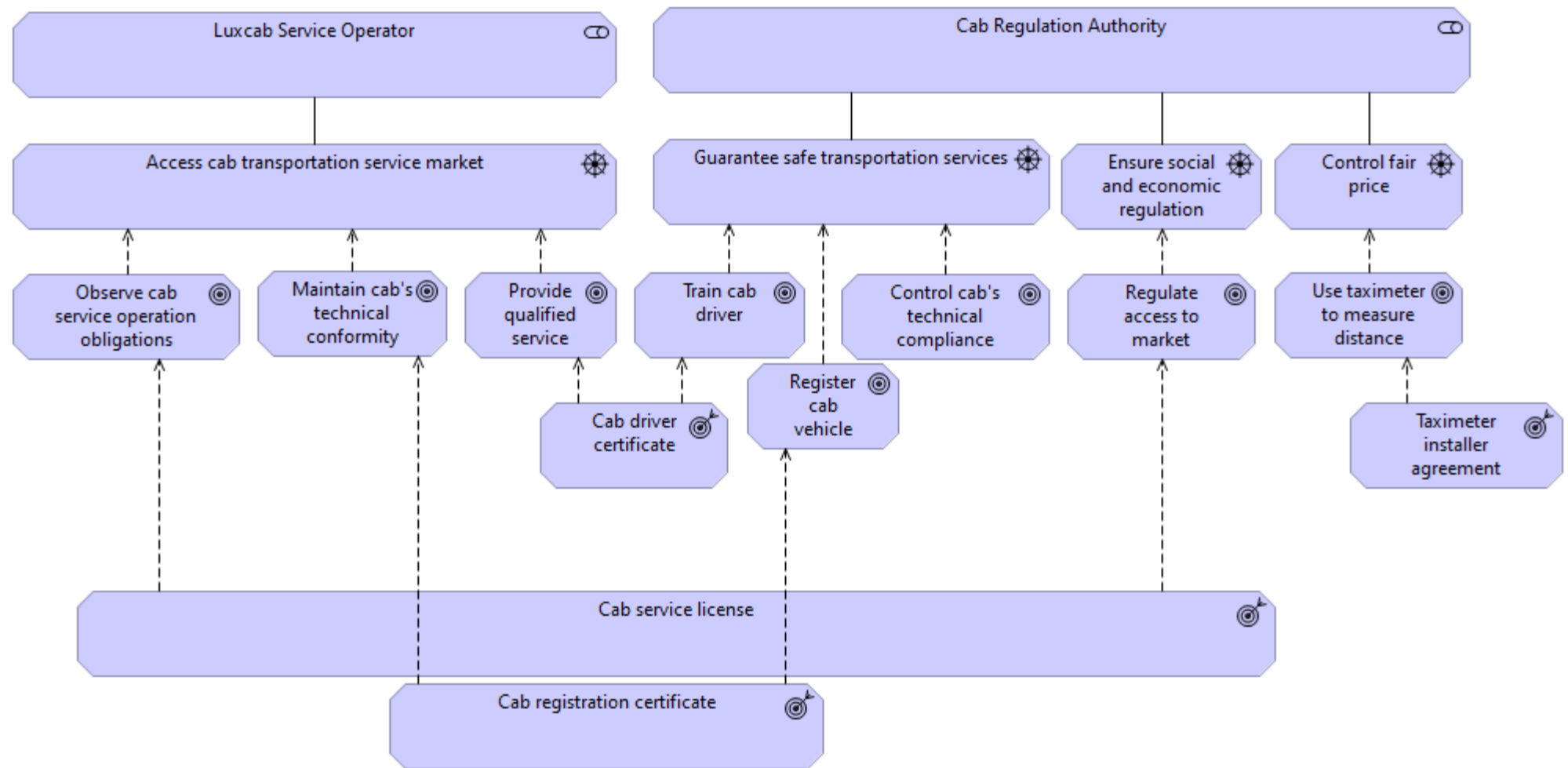
| Element | Definition | Notation |
|-------------|---|---|
| Principle | Represents a statement of intent defining a general property that applies to any system in a certain context in the architecture. |   |
| Requirement | Represents a statement of need defining a property that applies to a specific system as described by the architecture. |   |
| Constraint | Represents a limitation on aspects of the architecture, its implementation process, or its realization. |   |
| Meaning | Represents the knowledge or expertise present in, or the interpretation given to, a concept in a particular context. |   |
| Value | Represents the relative worth, utility, or importance of a concept. |   |

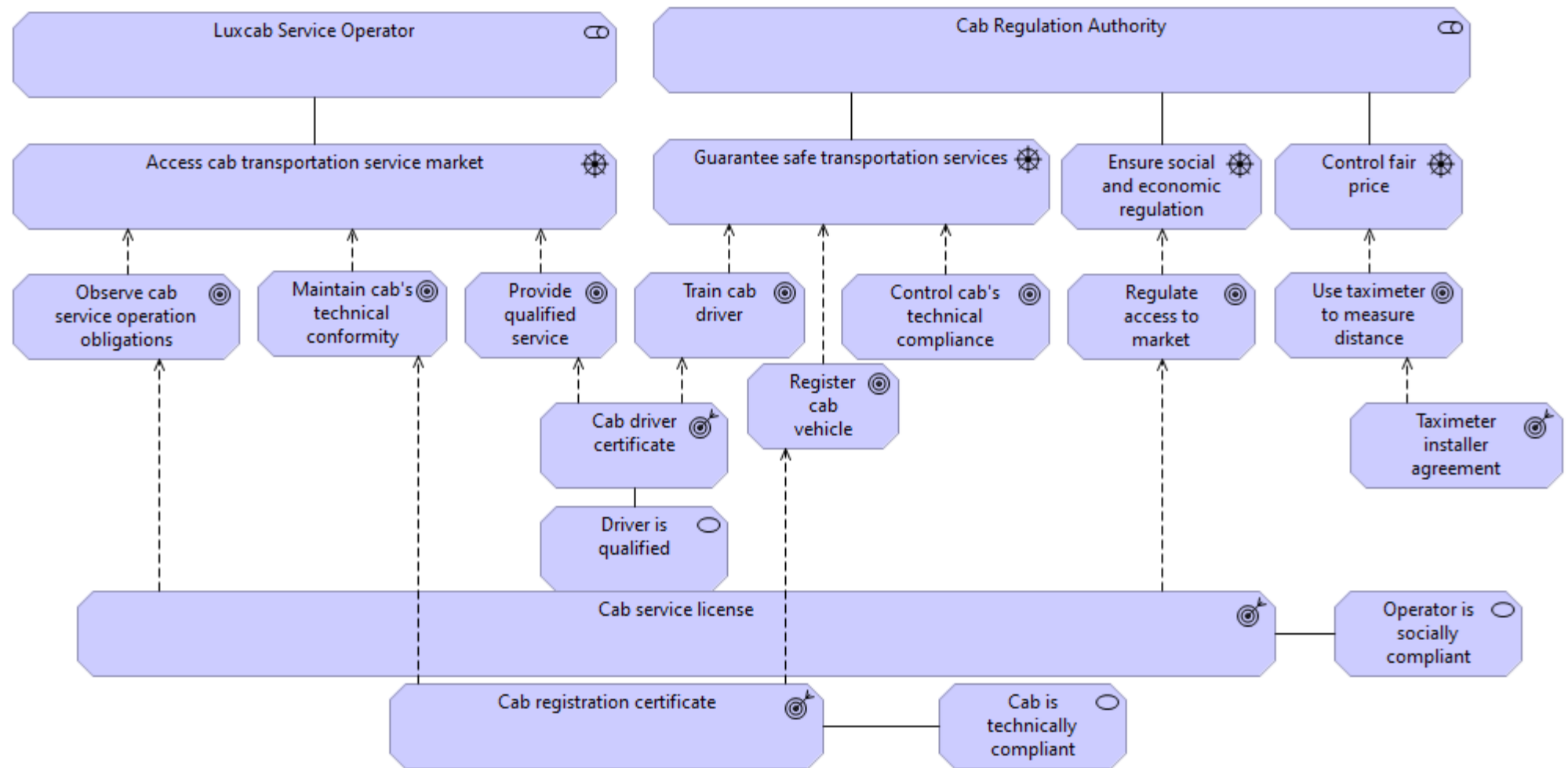


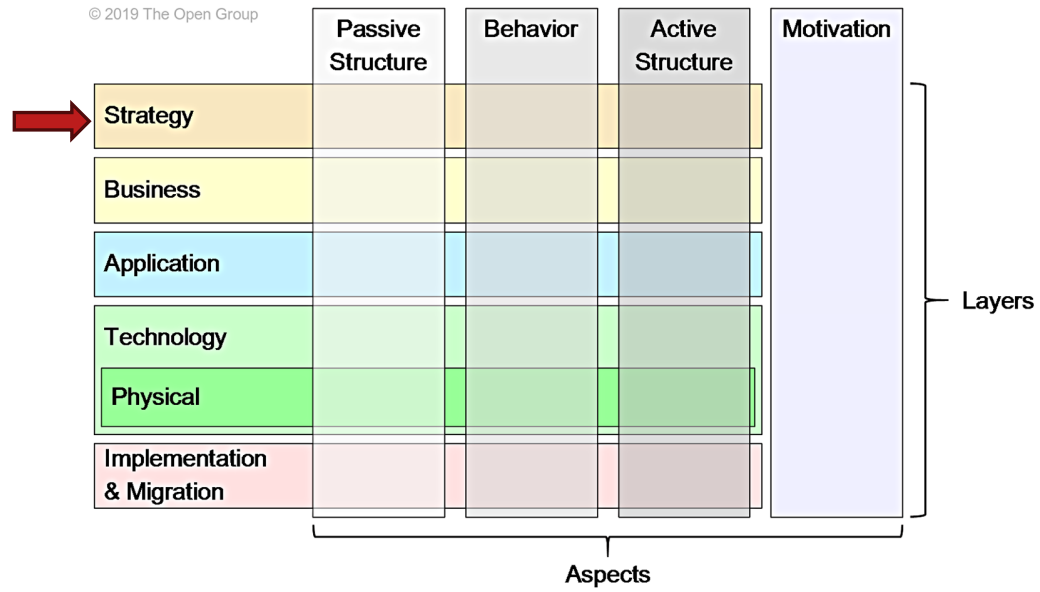


Outcomes and value









Strategy layer

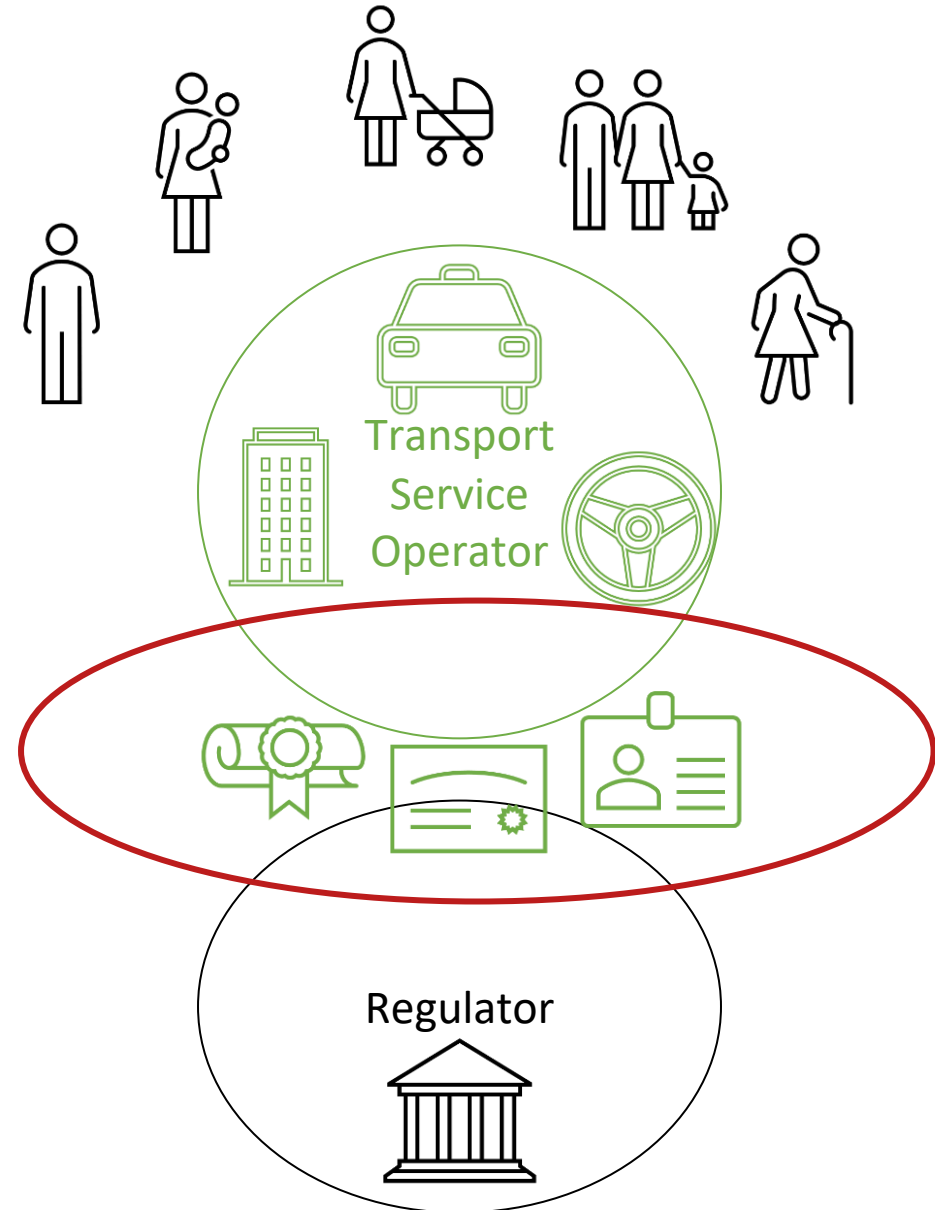


What do we model here



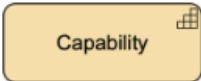



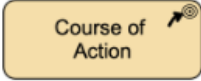

- The strategic direction and choices of an enterprise.
- Express **how** the enterprise wants to create value for its stakeholders

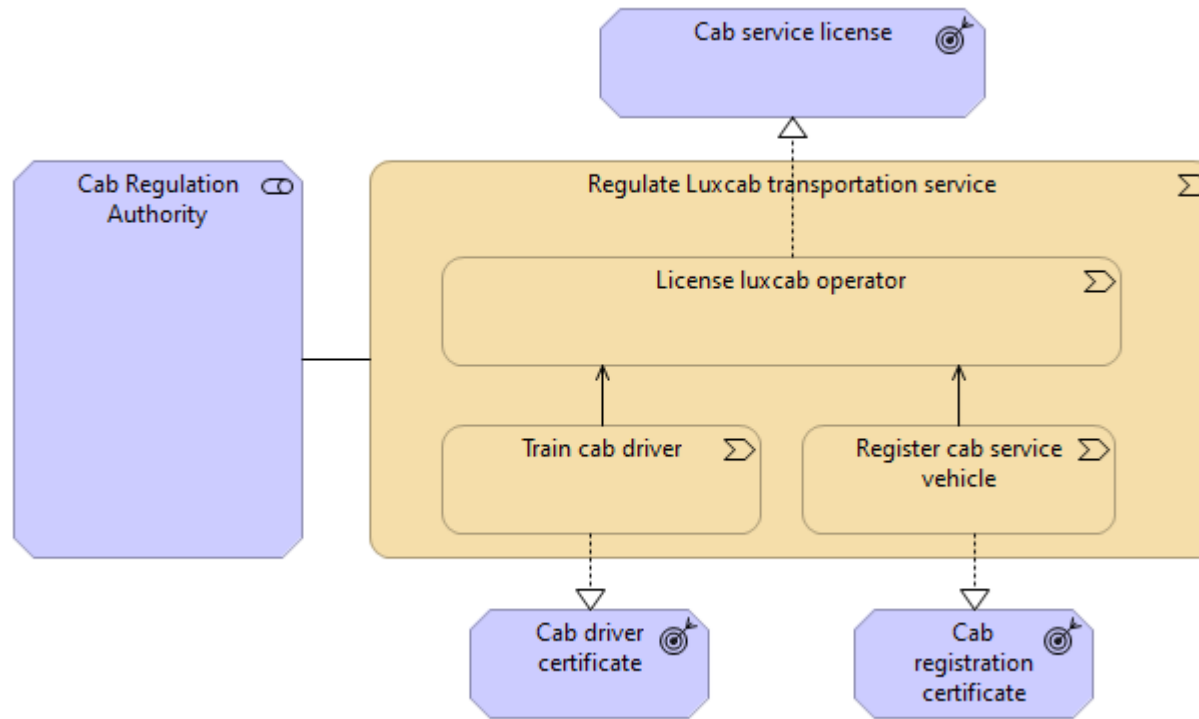
Strategy

How the outcomes are delivered

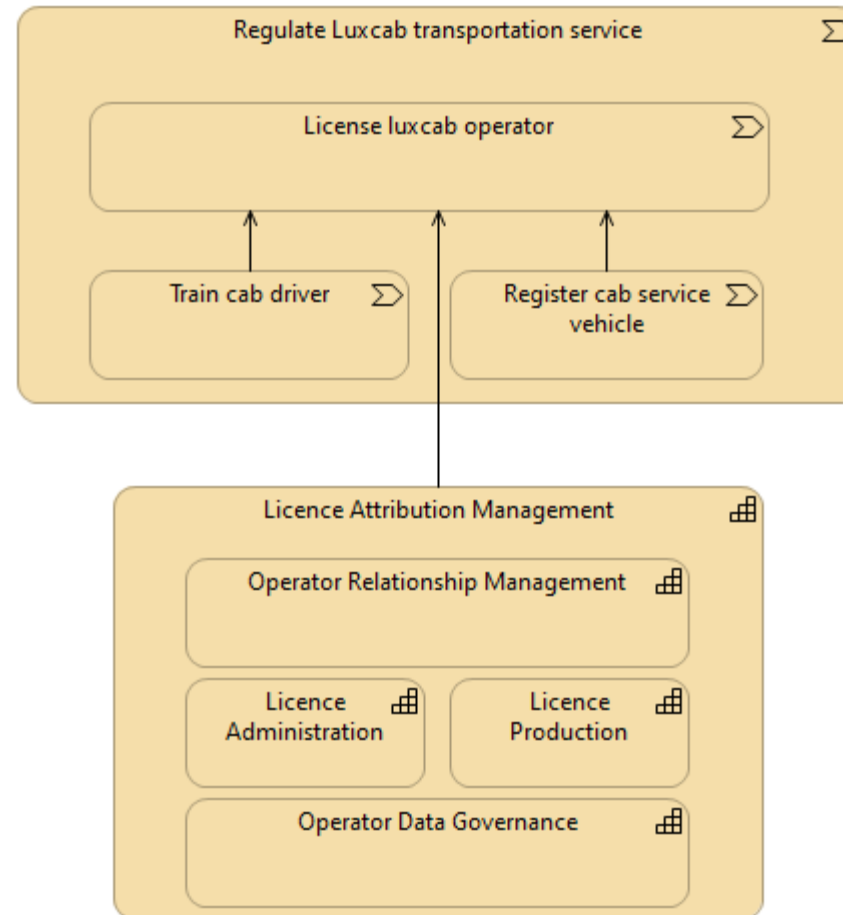


Modelling elements

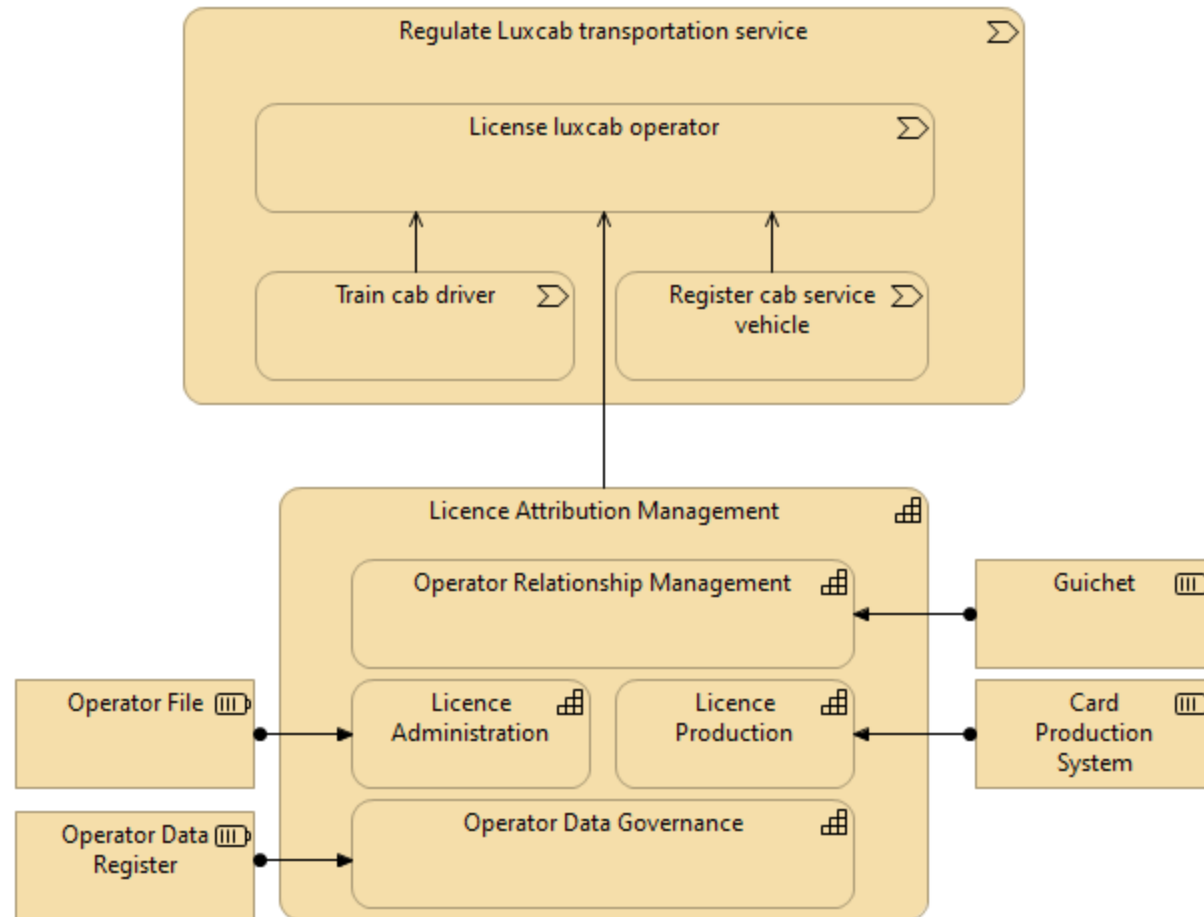
| Element | Description | Notation | |
|------------------|---|---|---|
| Resource | Represents an asset owned or controlled by an individual or organization. |  |  |
| Capability | Represents an ability that an active structure element, such as an organization, person, or system, possesses. |  |  |
| Value Stream | Represents a sequence of activities that create an overall result for a customer, stakeholder, or end user. |  |  |
| Course of Action | Represents an approach or plan for configuring some capabilities and resources of the enterprise, undertaken to achieve a goal. |  |  |



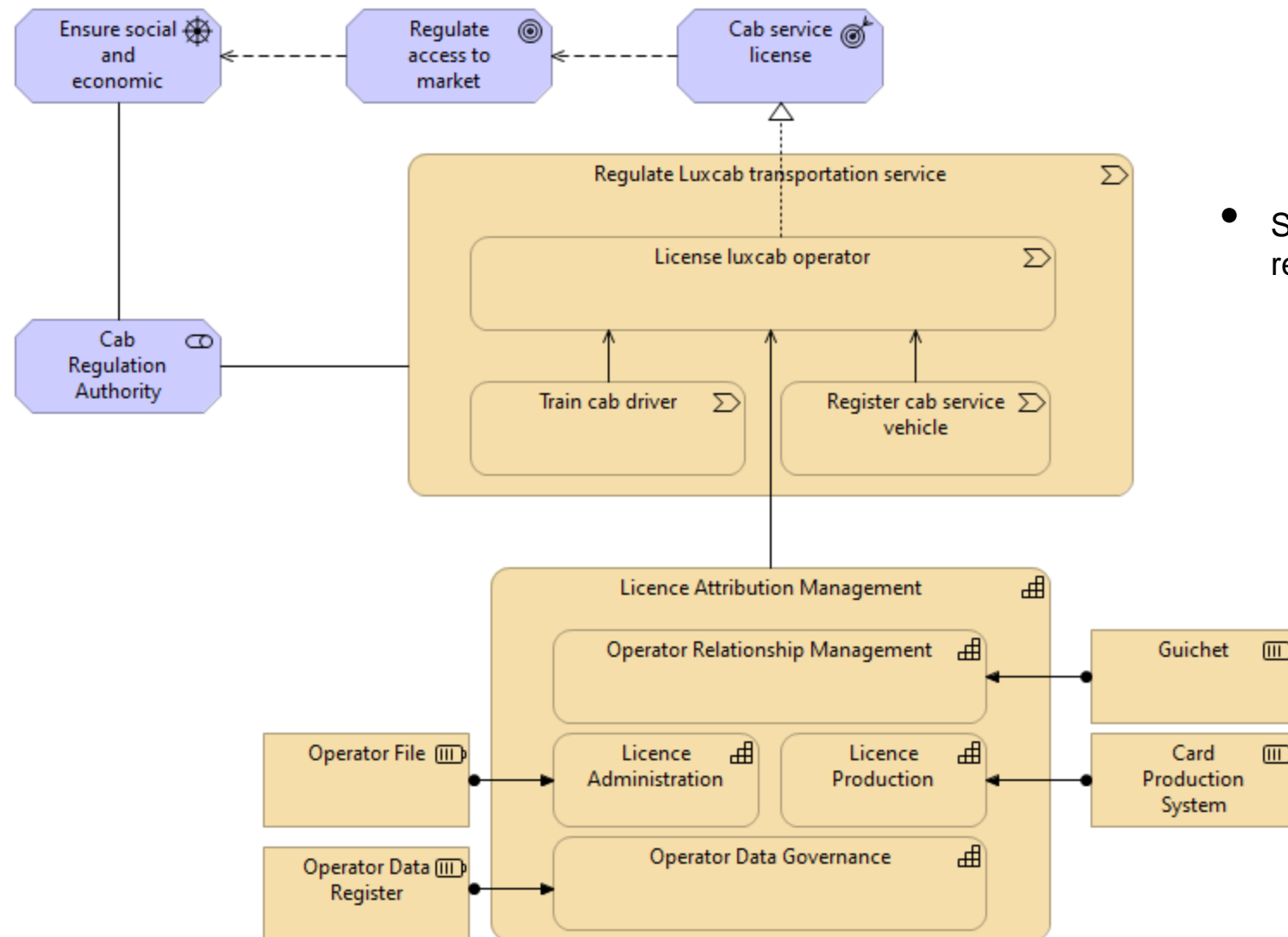
The enterprise deploys value streams to creates the value (through outcomes)



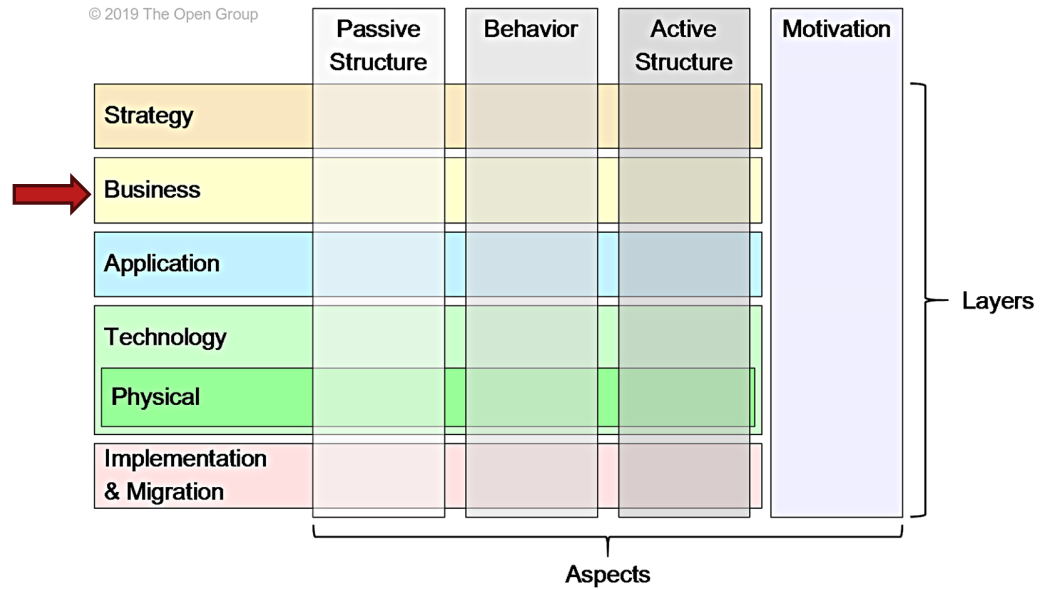
The enterprise requires capabilities to deploy the value streams (and create value)



The enterprise requires resources to support the capabilities



- Strategy without Motivation does not really make sense
 - Drivers and Goals are integral part of Strategy
 - If environment changes, then Strategy should be adapted




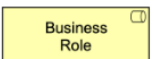
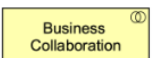
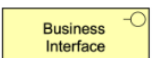
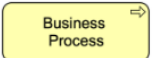
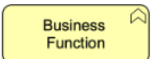
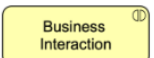
Business layer

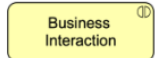


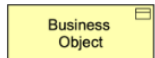
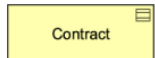
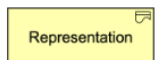
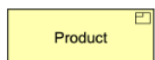


What do we model

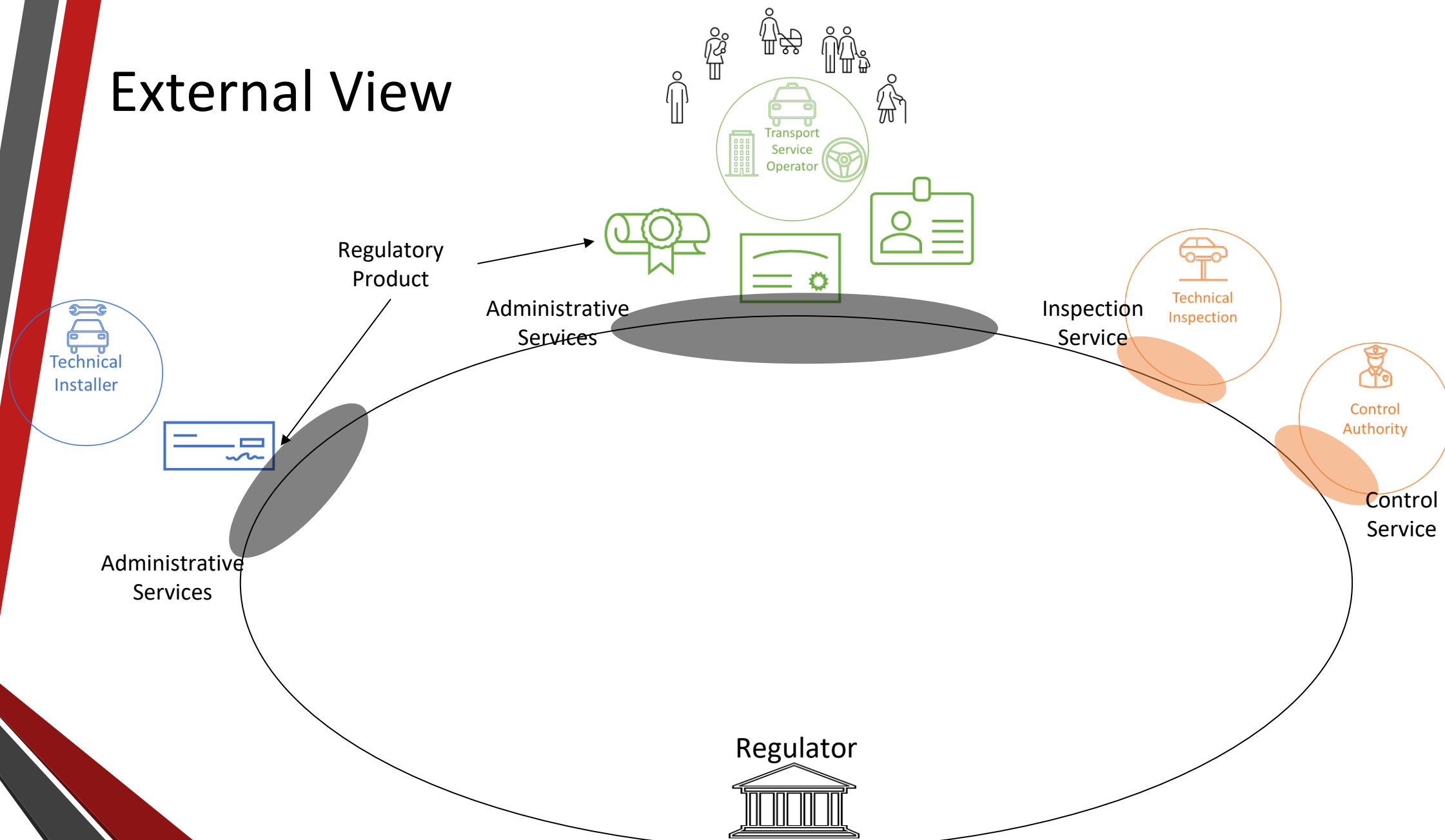
- Business Architecture
- The operationalization of the strategy
 - Product and services
 - Internal processes and function
 - Organizational structure

Modelling elements

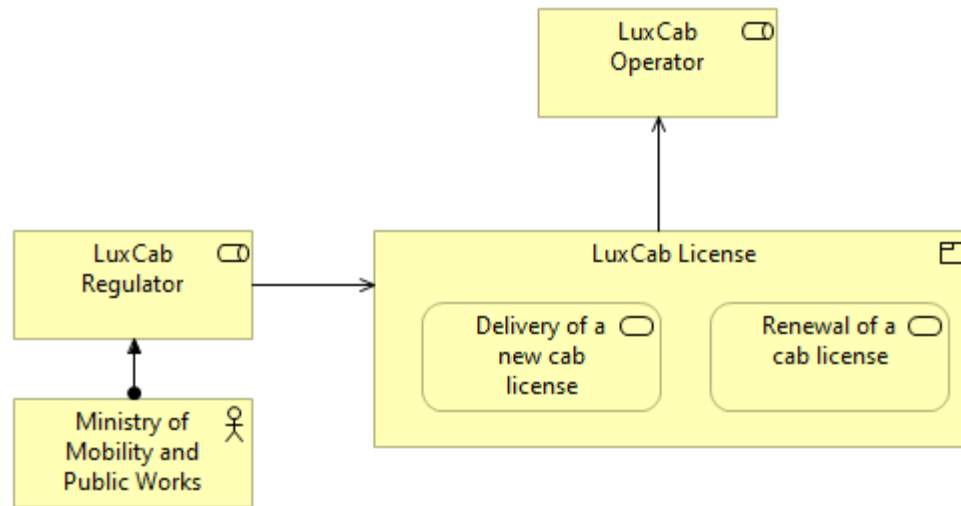
| Element | Description | Notation |
|--|---|--|
| Business Actor | Represents a business entity that is capable of performing behavior. |  |
| Business Role | Represents the responsibility for performing specific behavior, to which an actor can be assigned, or the part an actor plays in a particular action or event. |  |
| Business Collaboration | Represents an aggregate of two or more business internal active structure elements that work together to perform collective behavior. |  |
| Business Interface | Represents a point of access where business services are made available to the environment. |  |
| Business Process | Represents a sequence of business behaviors that achieves a specific result such as a defined set of products or business services. |  |
| Business Function | Represents a collection of business behavior based on a chosen set of criteria such as required business resources and/or competencies, and is managed or performed as a whole. |  |
| Business Interaction | Represents a unit of collective business behavior performed by (a collaboration of) two or more business actors, business roles, or business collaborations. |  |

| Element | Description | Notation |
|--------------------------------------|---|---|
| Business Interaction | Represents a unit of collective business behavior performed by (a collaboration of) two or more business actors, business roles, or business collaborations. |  |
| Business Event | Represents a business-related state change. |  |
| Business Service | Represents explicitly defined behavior that a business role, business actor, or business collaboration exposes to its environment. |  |
| Business Object | Represents a concept used within a particular business domain. |  |
| Contract | Represents a formal or informal specification of an agreement between a provider and a consumer that specifies the rights and obligations associated with a product and establishes functional and non-functional parameters for interaction. |  |
| Representation | Represents a perceptible form of the information carried by a business object. |  |
| Product | Represents a coherent collection of services and/or passive structure elements, accompanied by a contract, which is offered as a whole to (internal or external) customers. |  |

External View

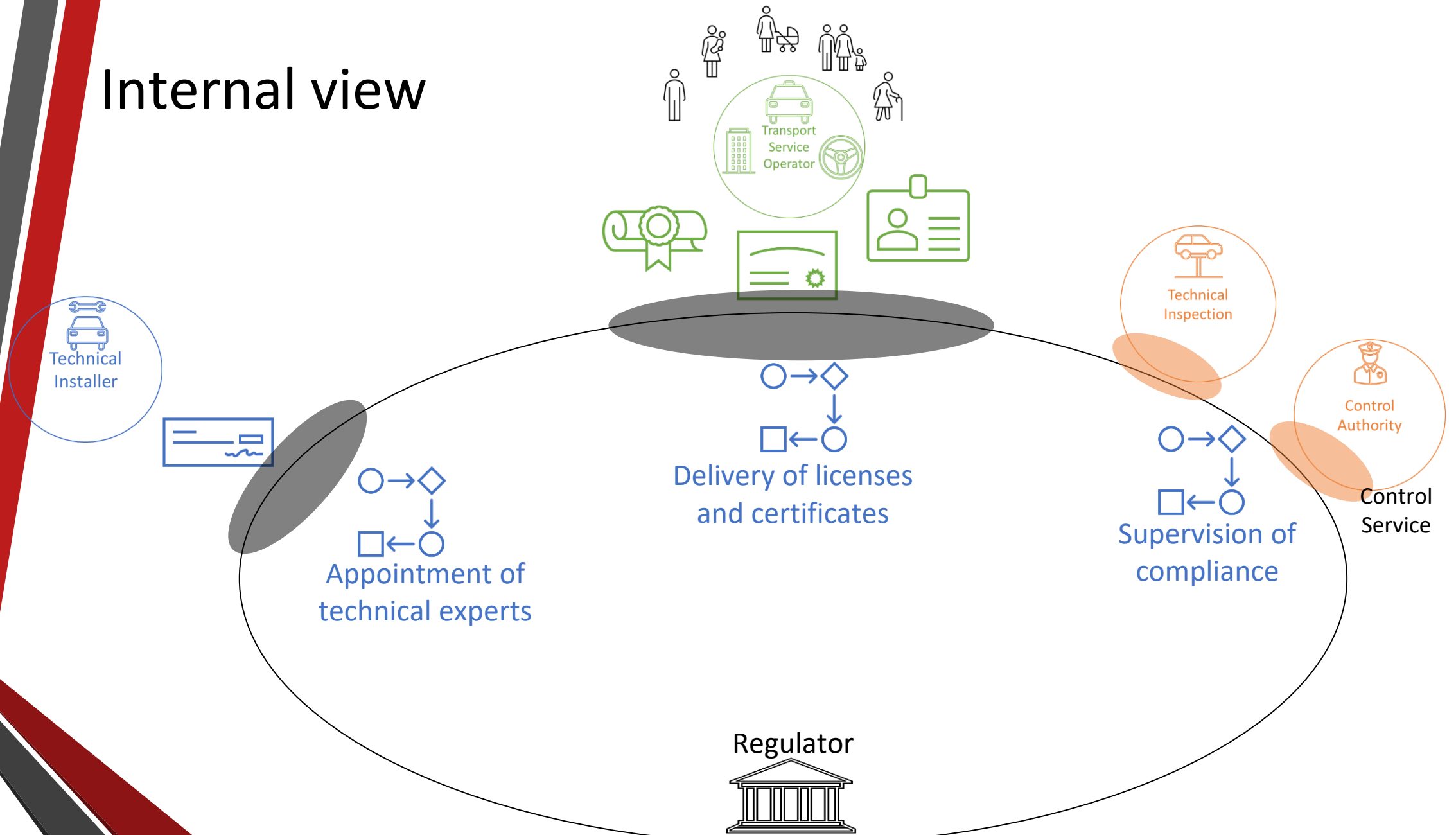


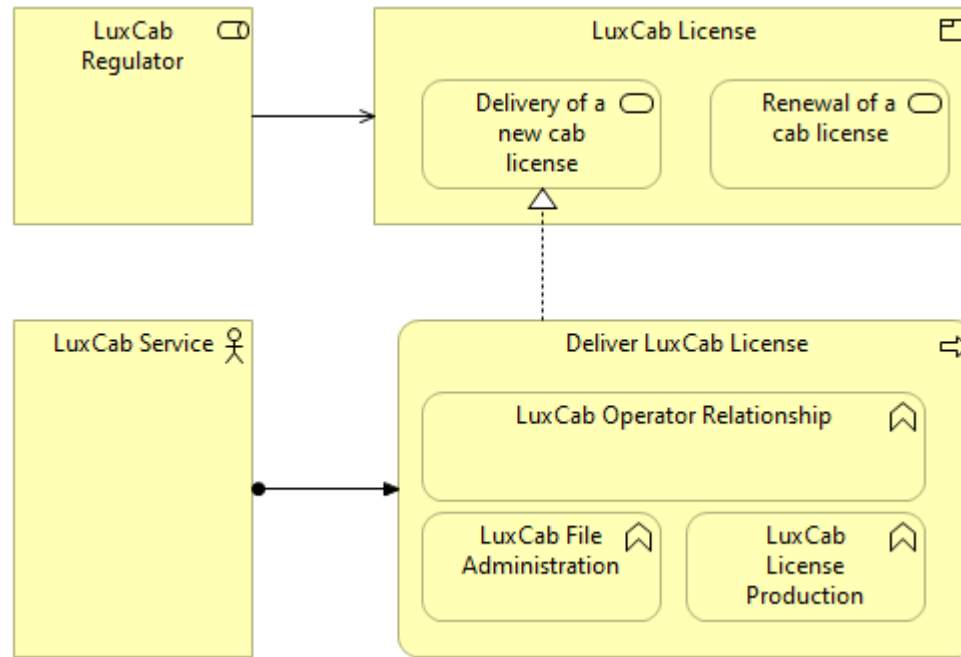
Taxi operator licence - Guichet.lu - Luxembourg



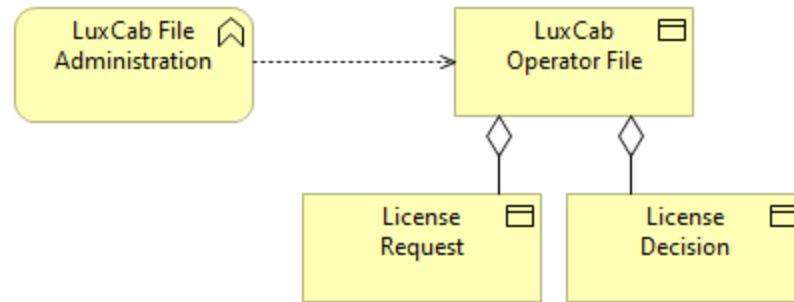
The enterprise provides products and services to its customers

Internal view

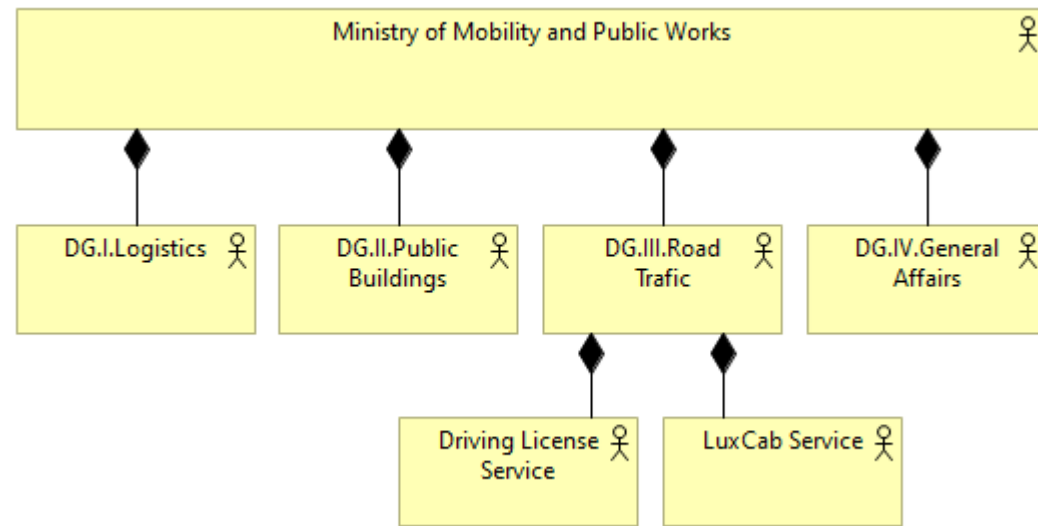




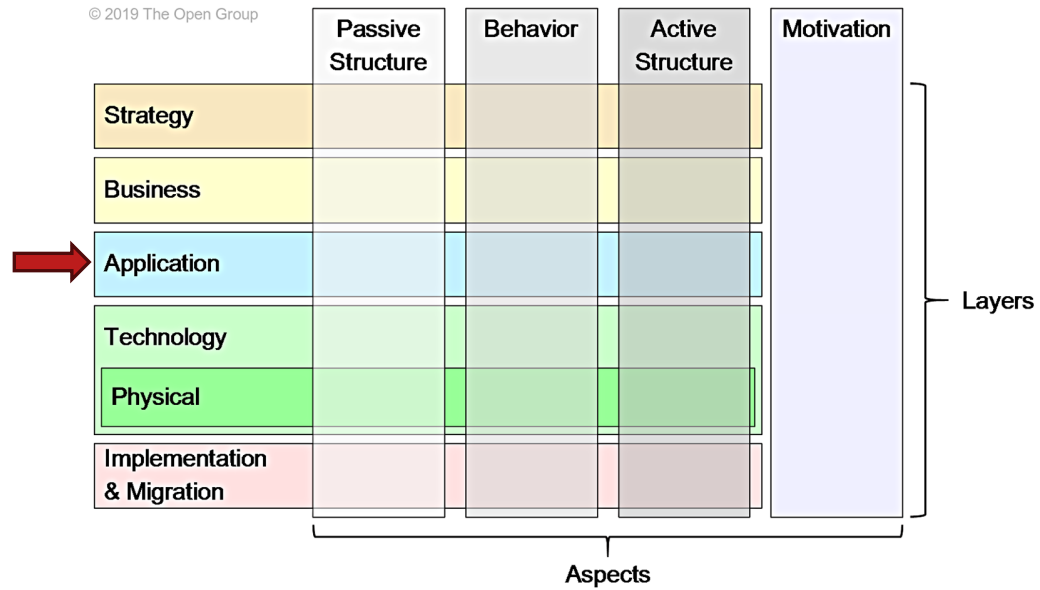
The enterprise deploys business processes/functions to deliver the products and services



The enterprise manages business objects in its internal activities



The enterprise structurally organizes its activities (Org Chart)











Application layer




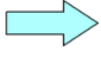

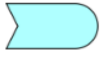






What do we model

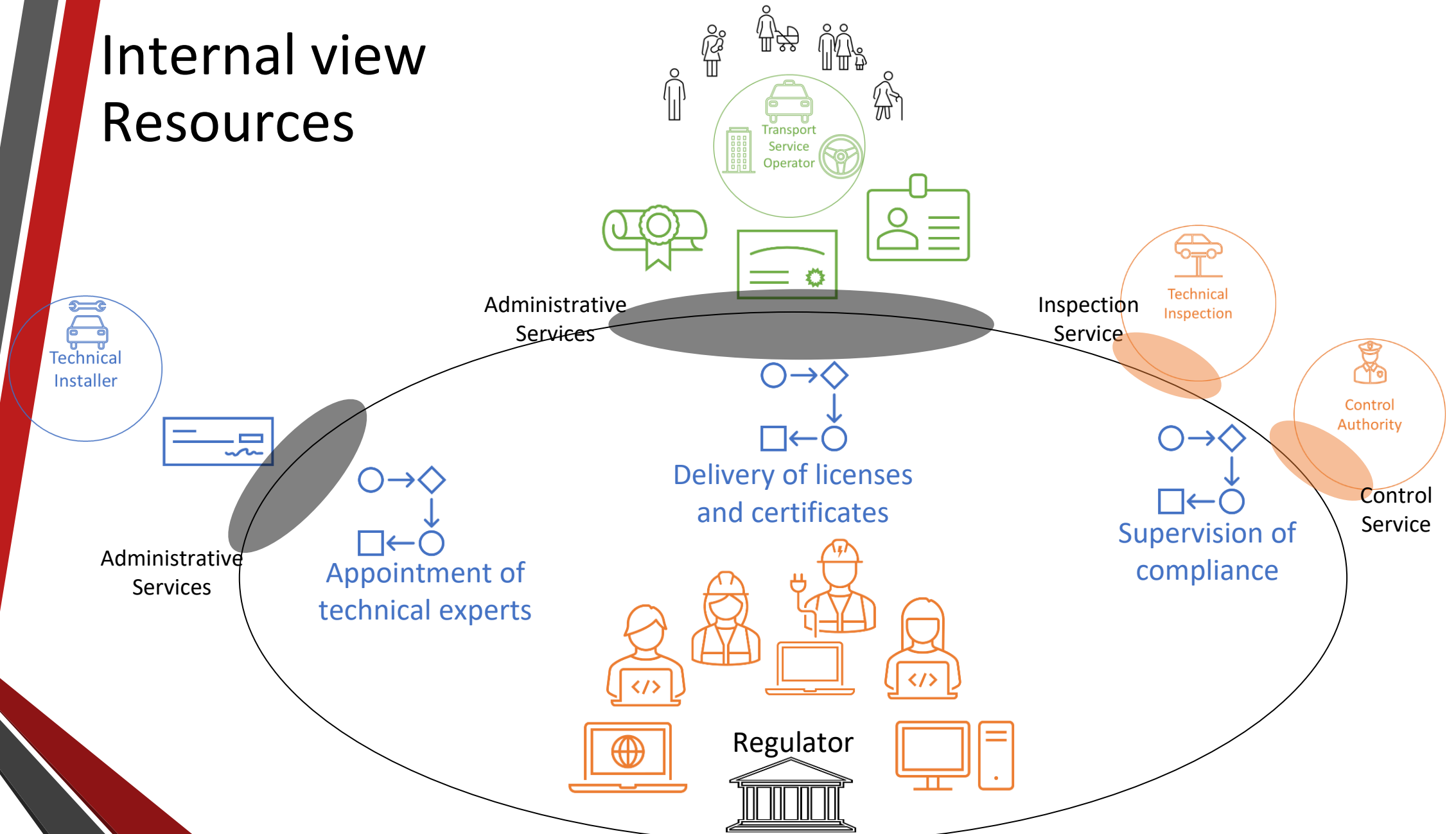
- Applications Architecture
- The software/application resources used by the enterprise activities
 - Application services and interfaces
 - Application component and functions, data objects

Modelling elements

| Element | Definition | Notation | |
|---------------------------|--|---|---|
| Application Component | Represents an encapsulation of application functionality aligned to implementation structure, which is modular and replaceable. |  |  |
| Application Collaboration | Represents an aggregate of two or more application internal active structure elements that work together to perform collective application behavior. |  |  |
| Application Interface | Represents a point of access where application services are made available to a user, another application component, or a node. |  |  |
| Application Function | Represents automated behavior that can be performed by an application component. |  |  |

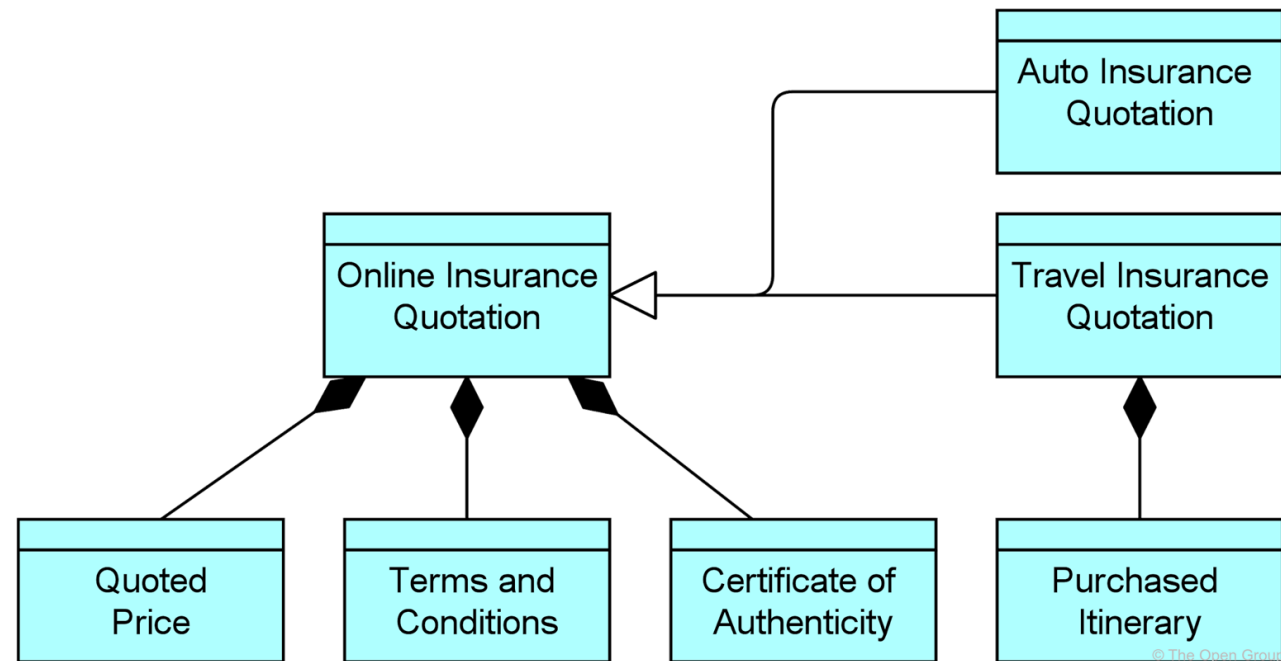
| Element | Definition | Notation | |
|-------------------------|--|--|--|
| Application Interaction | Represents a unit of collective application behavior performed by (a collaboration of) two or more application components. |  |  |
| Application Process | Represents a sequence of application behaviors that achieves a specific result. |  |  |
| Application Event | Represents an application state change. |  |  |
| Application Service | Represents an explicitly defined exposed application behavior. |  |  |
| Data Object | Represents data structured for automated processing. |  |  |

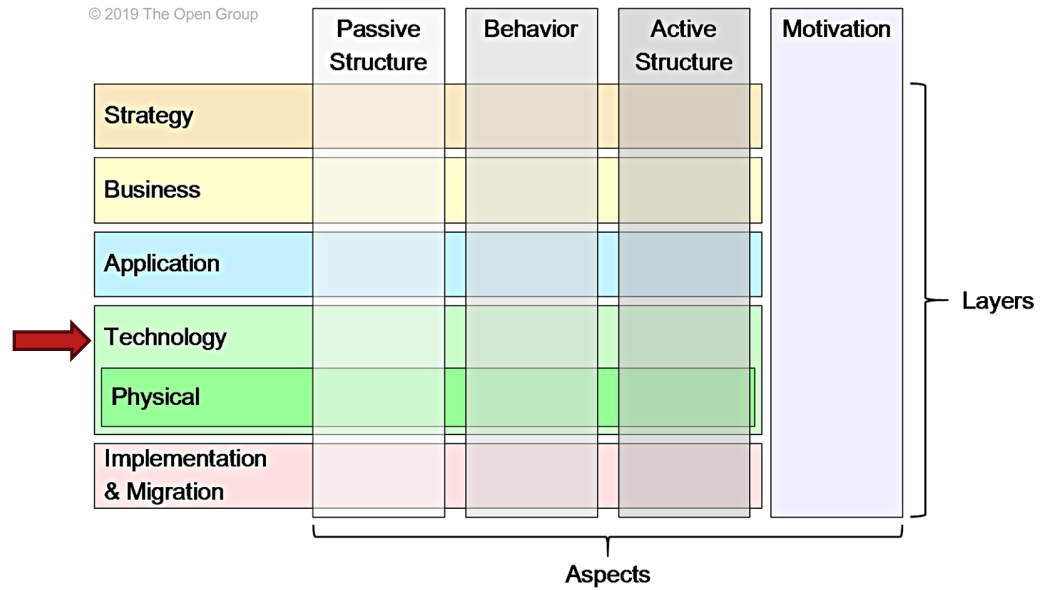
Internal view Resources





Data architecture





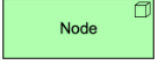
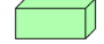

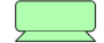
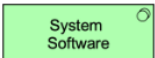

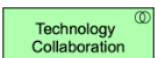
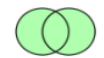
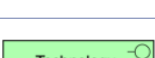

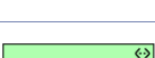





Technology layer

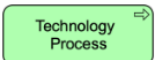



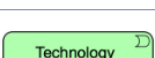

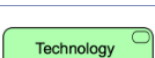

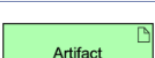
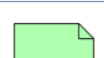
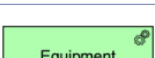

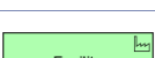

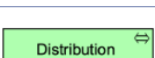

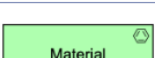



What do we model

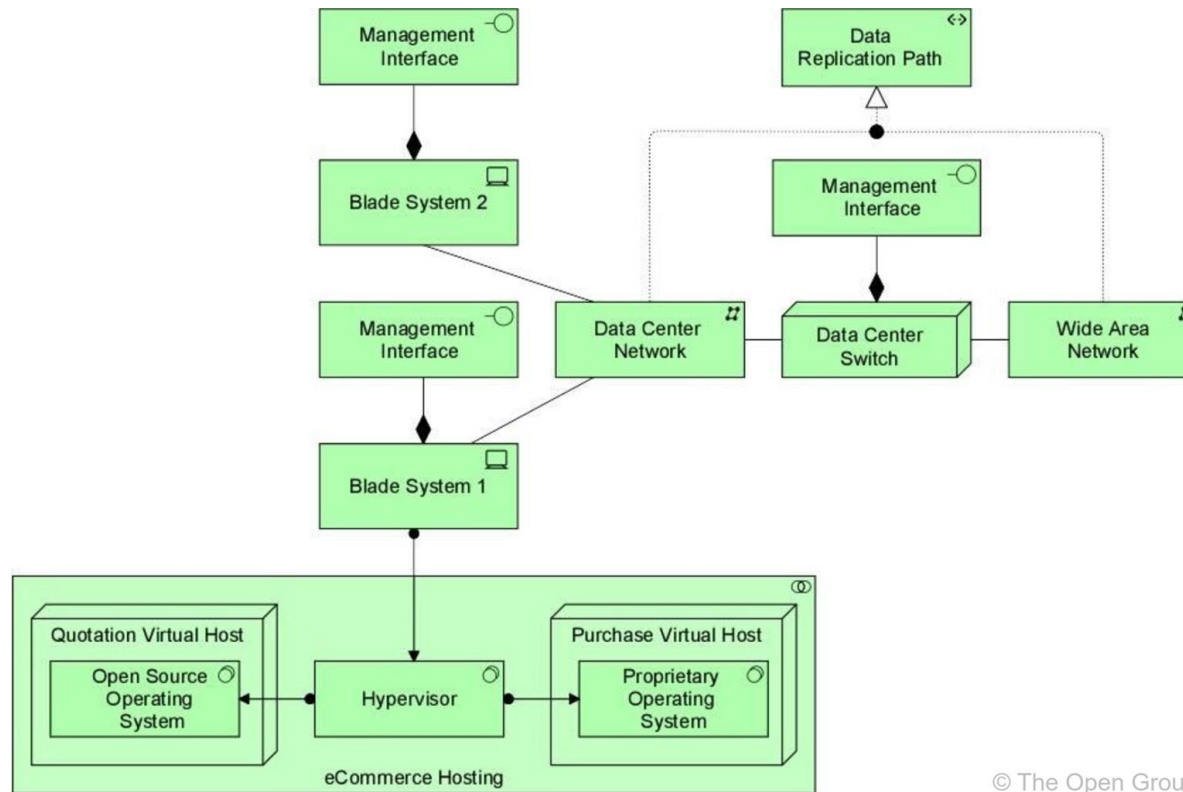
- Technology Architecture
- The infrastructure required to execute the applications
 - Server, node, network

Modelling elements

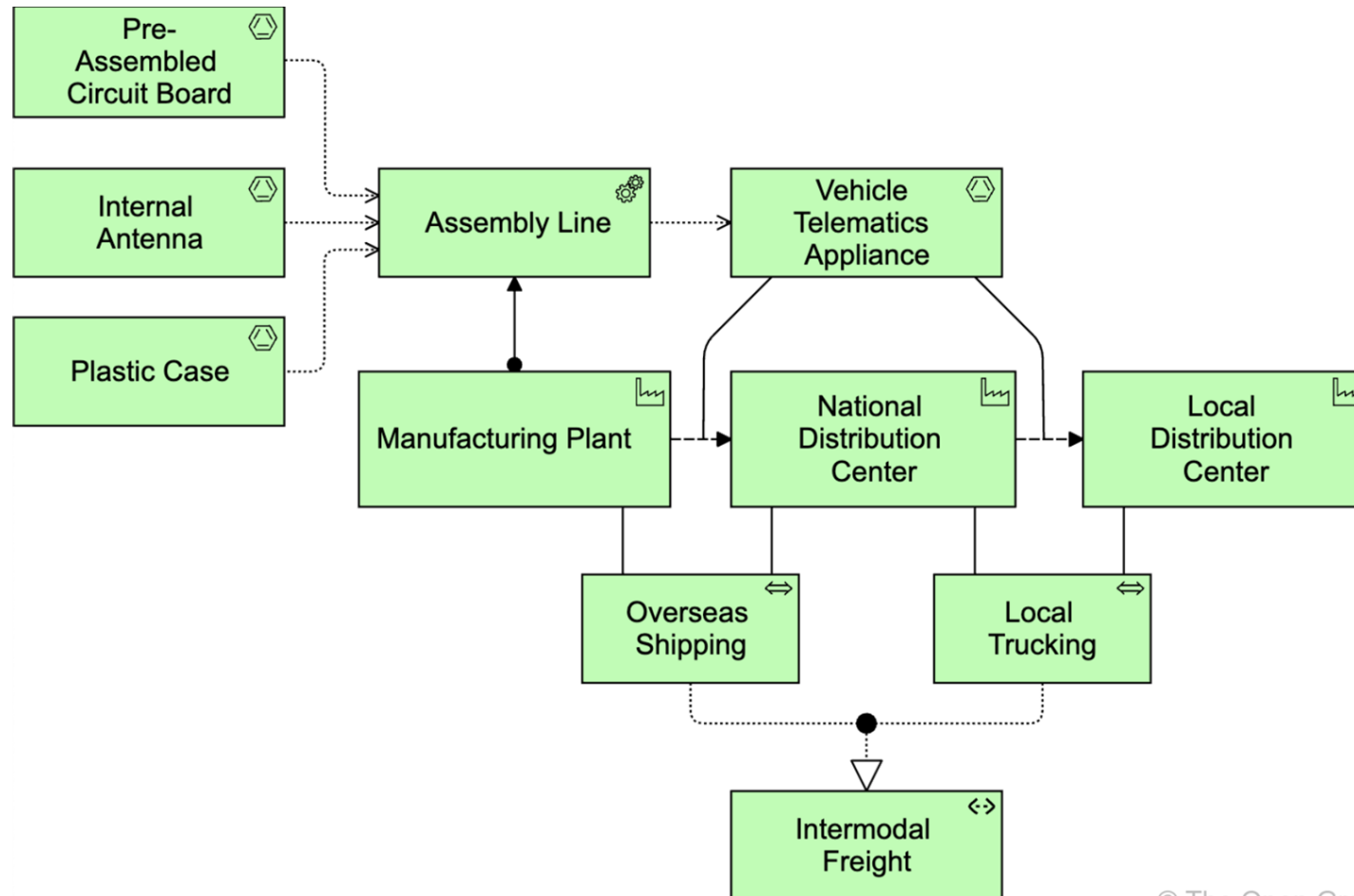
| Element | Definition | Notation |
|--------------------------|---|---|
| Node | Represents a computational or physical resource that hosts, manipulates, or interacts with other computational or physical resources. |   |
| Device | Represents a physical IT resource upon which system software and artifacts may be stored or deployed for execution. |   |
| System Software | Represents software that provides or contributes to an environment for storing, executing, and using software or data deployed within it. |   |
| Technology Collaboration | Represents an aggregate of two or more technology internal active structure elements that work together to perform collective technology behavior. |   |
| Technology Interface | Represents a point of access where technology services offered by a technology internal active structure can be accessed. |   |
| Path | Represents a link between two or more technology internal active structure elements, through which these elements can exchange data, energy, or material. |   |
| Communication Network | Represents a set of structures that connects devices or system software for transmission, routing, and reception of data. |   |
| Technology Function | Represents a collection of technology behavior that can be performed by a technology internal active structure element. |   |

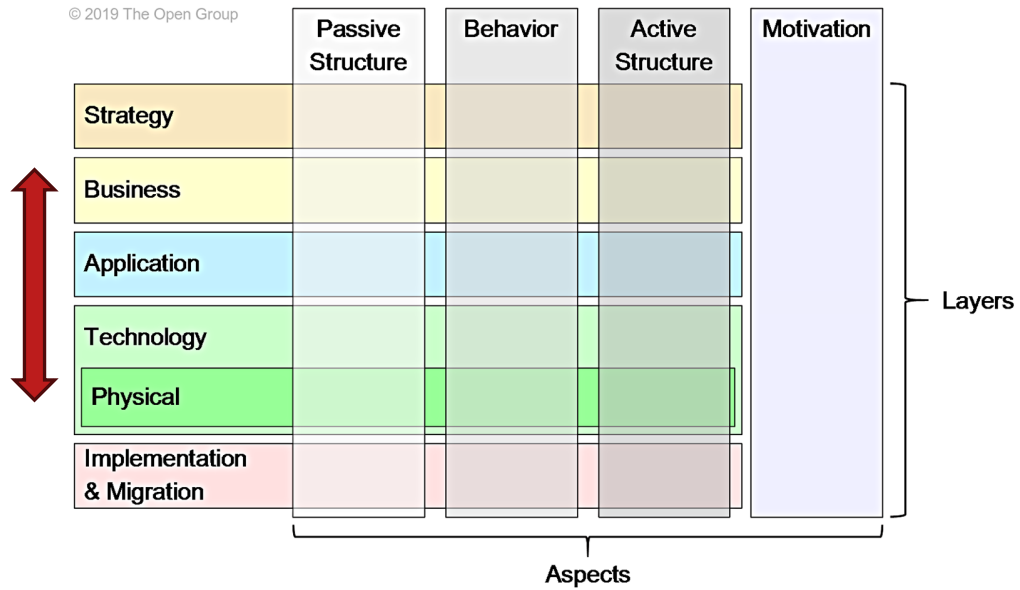
| Element | Definition | Notation |
|------------------------|--|---|
| Technology Process | Represents a sequence of technology behaviors that achieves a specific result. |   |
| Technology Interaction | Represents a unit of collective technology behavior performed by (a collaboration of) two or more technology internal active structure elements. |   |
| Technology Event | Represents a technology state change. |   |
| Technology Service | Represents an explicitly defined exposed technology behavior. |   |
| Artifact | Represents a piece of data that is used or produced in a software development process, or by deployment and operation of an IT system. |   |
| Equipment | Represents one or more physical machines, tools, or instruments that can create, use, store, move, or transform materials. |   |
| Facility | Represents a physical structure or environment. |   |
| Distribution Network | Represents a physical network used to transport materials or energy. |   |
| Material | Represents tangible physical matter or energy. |   |

Infrastructure



Physical network and facilities

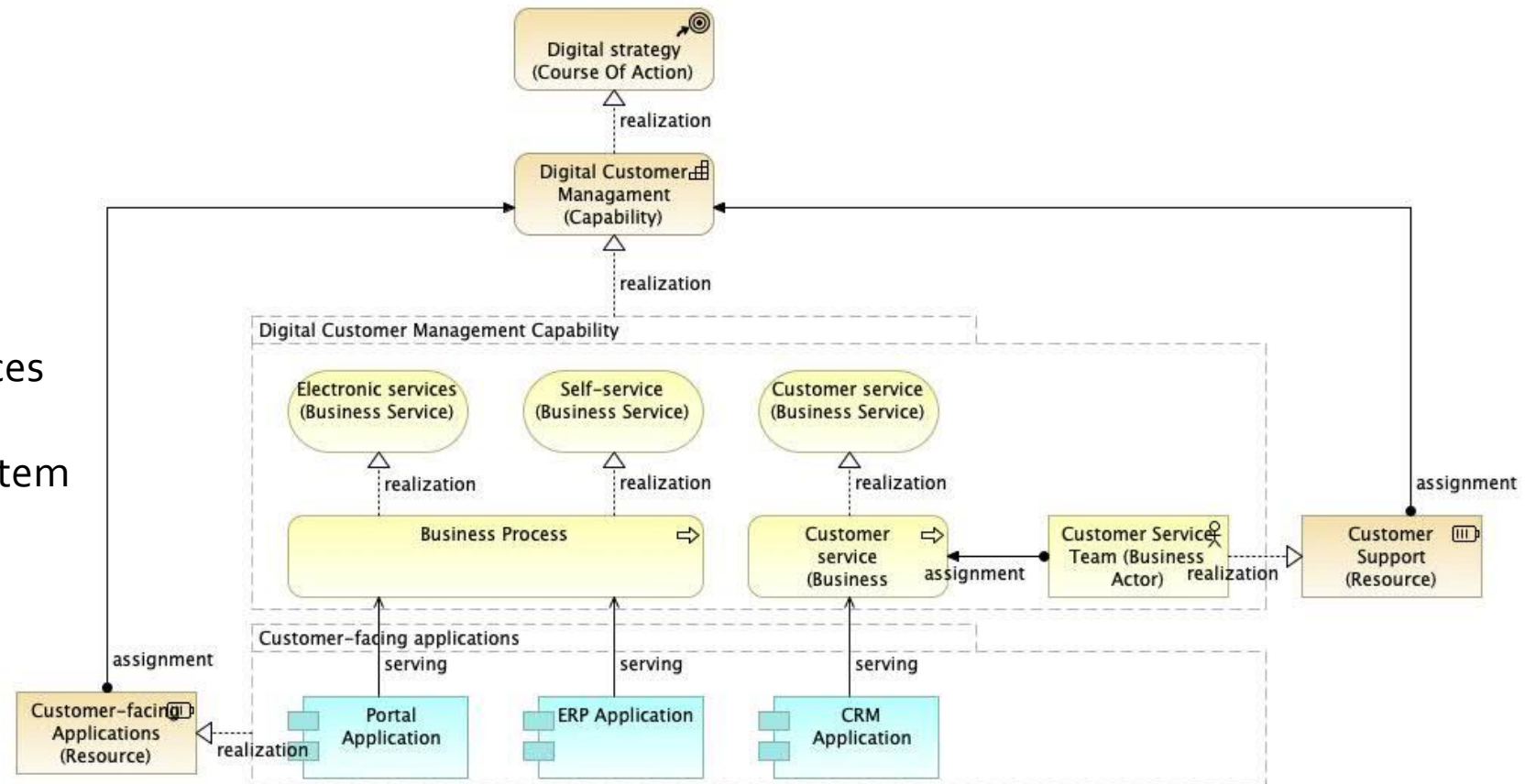




Cross-layer relations

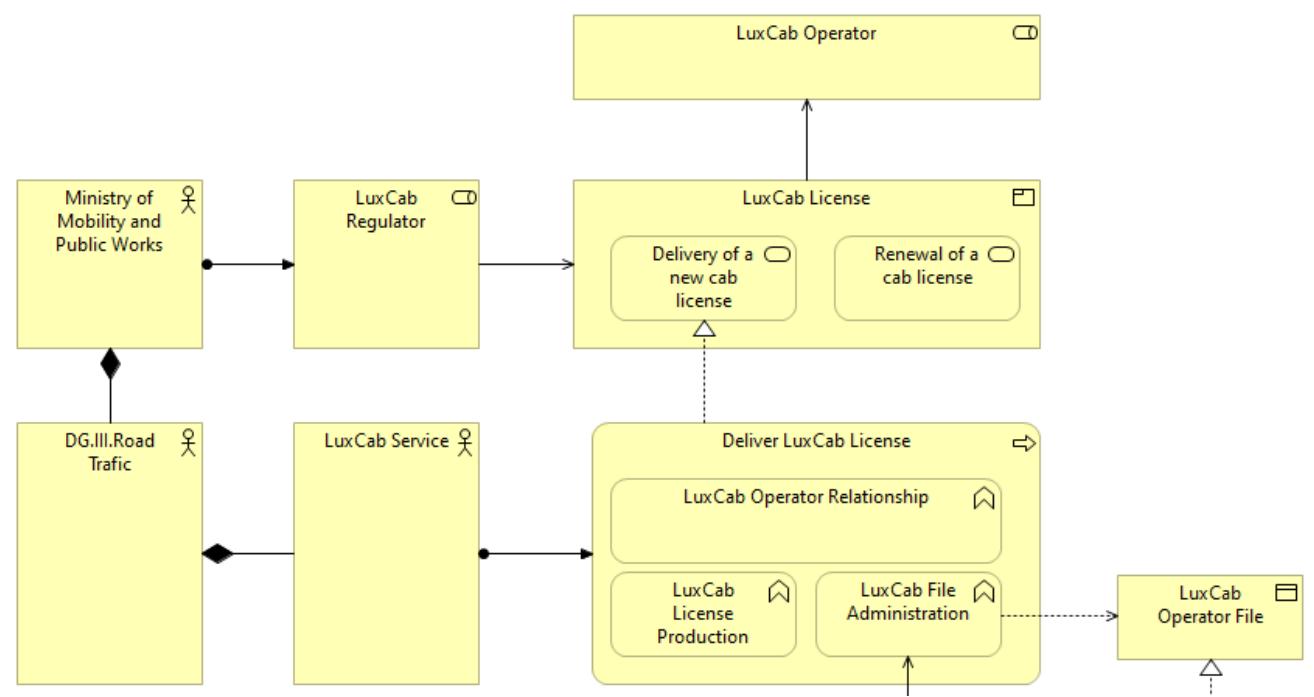
Strategy execution

- Capabilities and Resources are realized by the (architecture of the) System

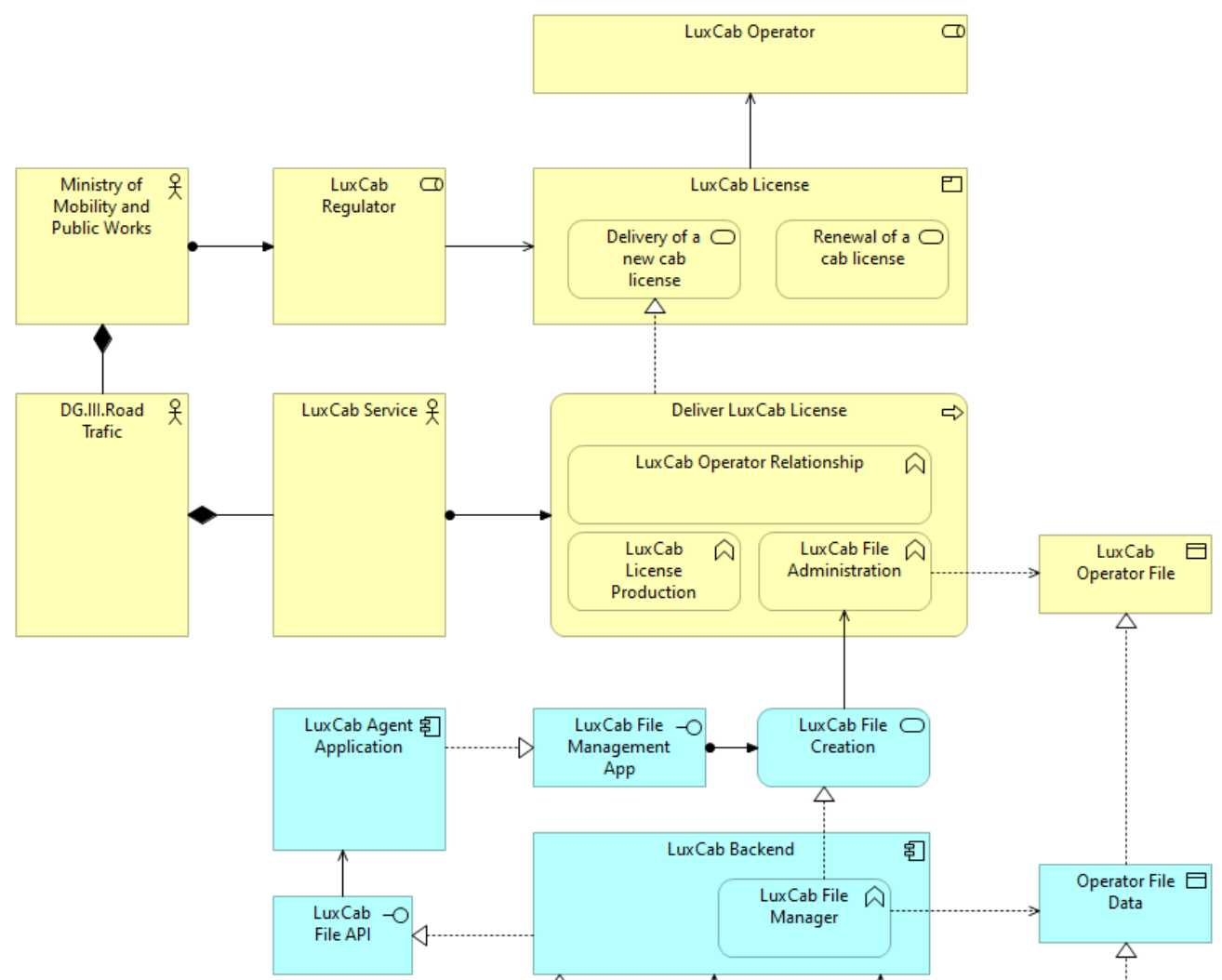


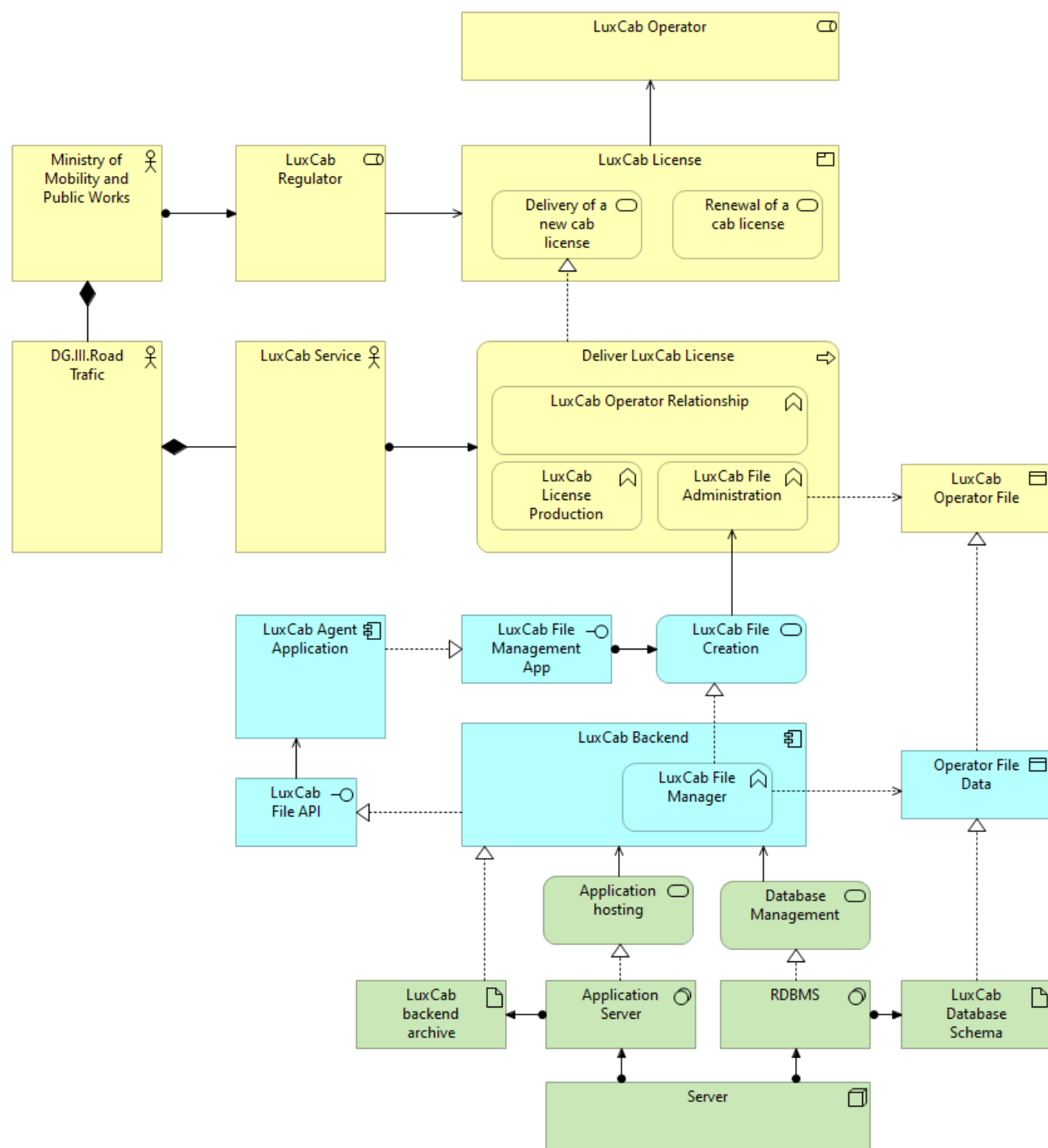
<https://www.hosiaisluma.fi/blog/strategy-modelling-archimate/>

Business Operations



Application supporting business operations







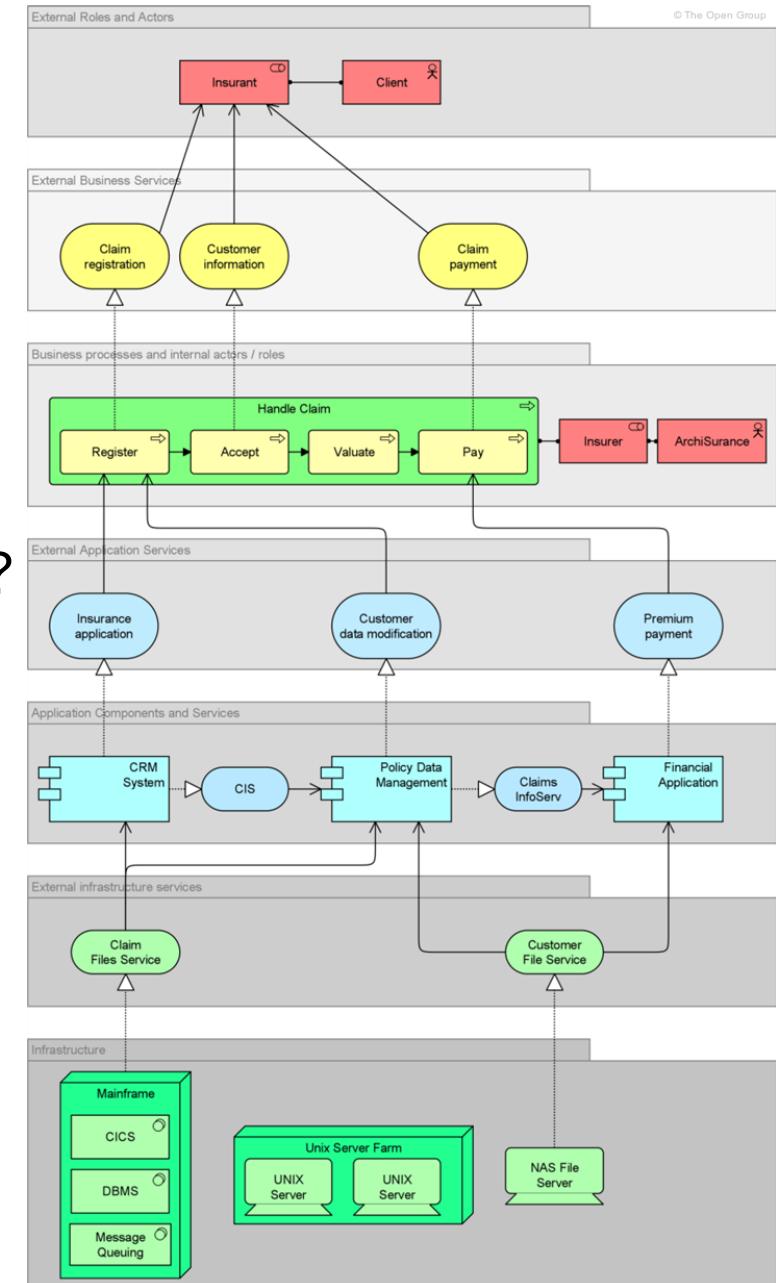
Viewpoints

Valuable concerns

- What is the value of a « complete » EA description ?
 - From strategy end to technology end
- Stakeholders of EA models
 - Strategy end
 - Technology end

What is the value of EA models for stakeholders other than an enterprise architect?

An EA model



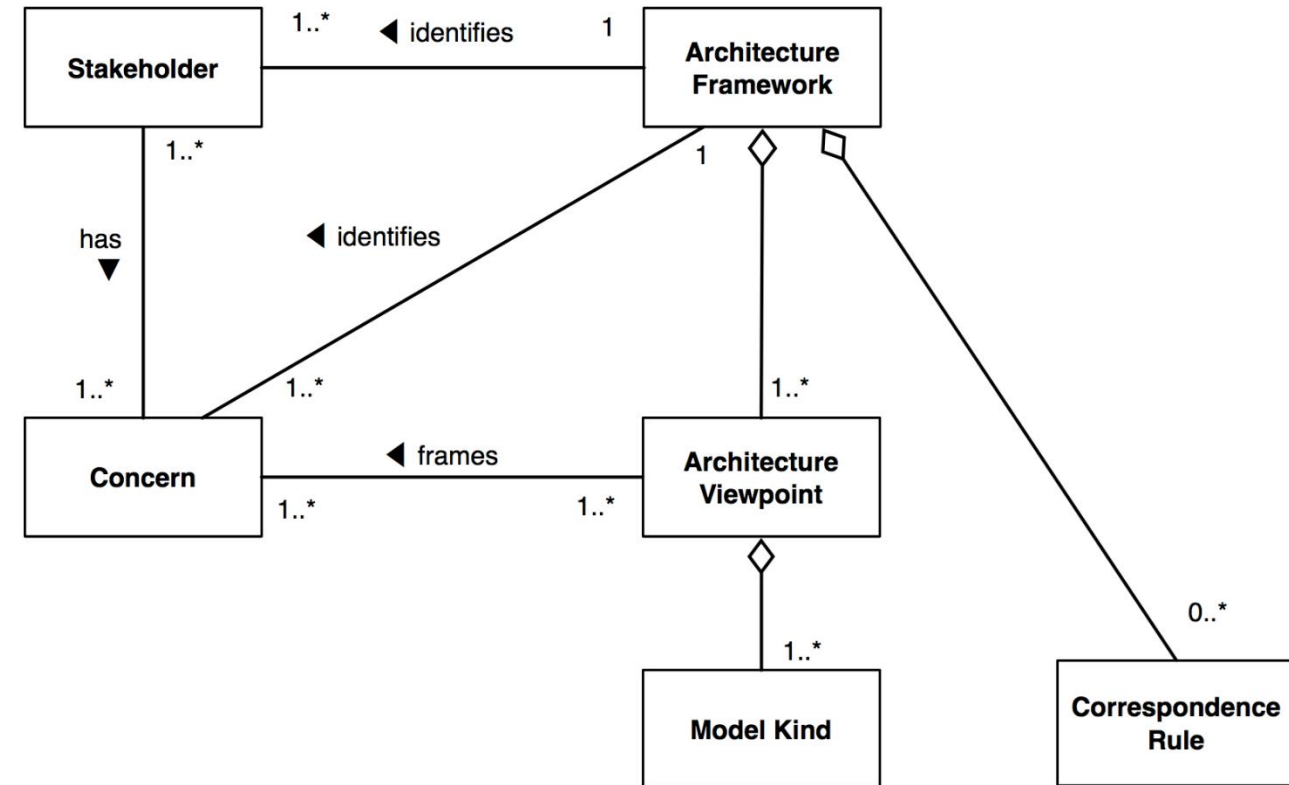
Stakeholders and concerns

- Shareholders
- User
- Supplier
- Designer
- CEO
- DPO
- Enterprise architect
- Software architect
- System purpose
- Customer satisfaction
- Structure
- Cost/Profitability
- Interoperability
- Compliance
- Security

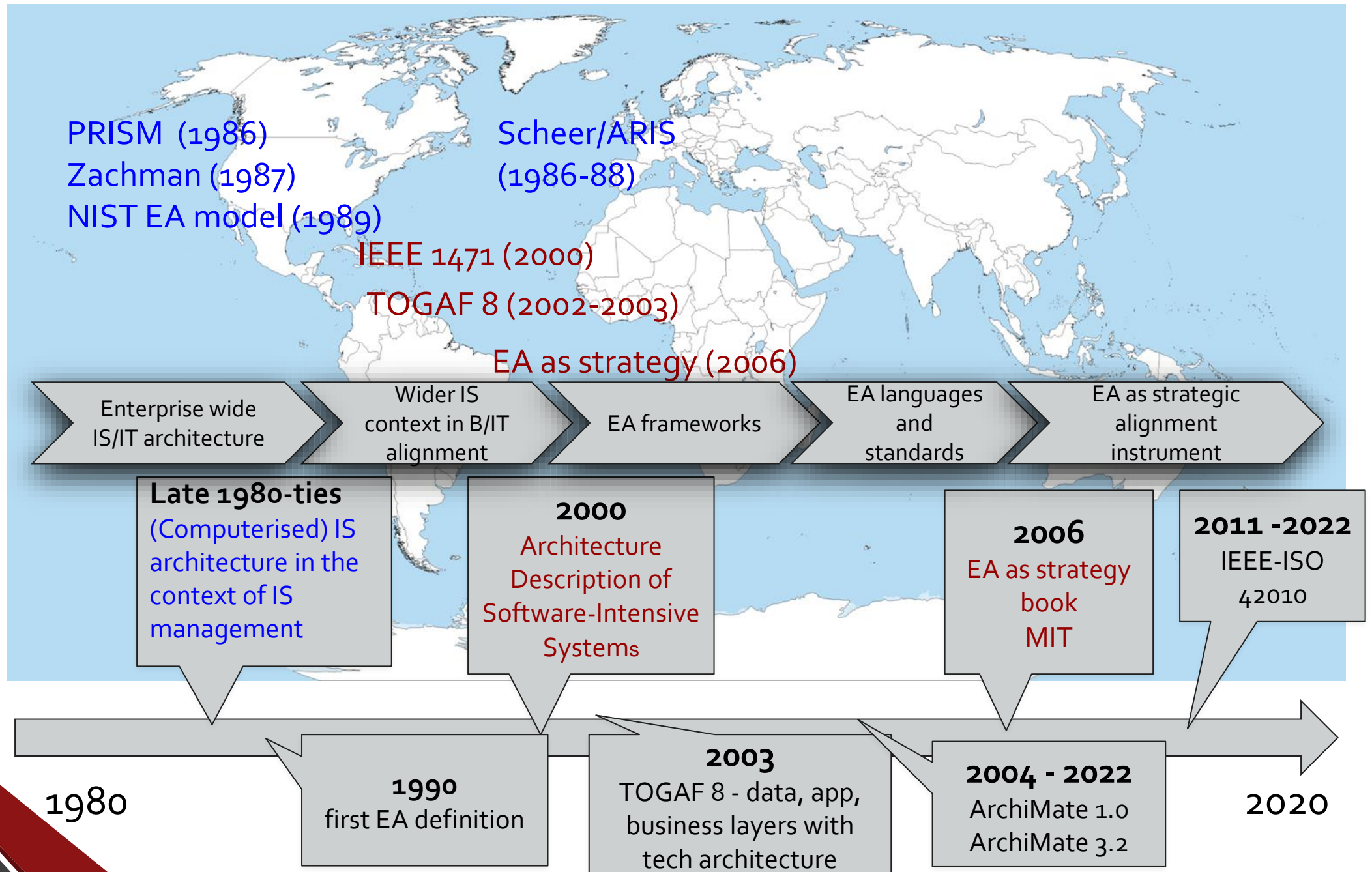
Stakeholders want/need to deal with only their own concerns within the enterprise architecture context ...

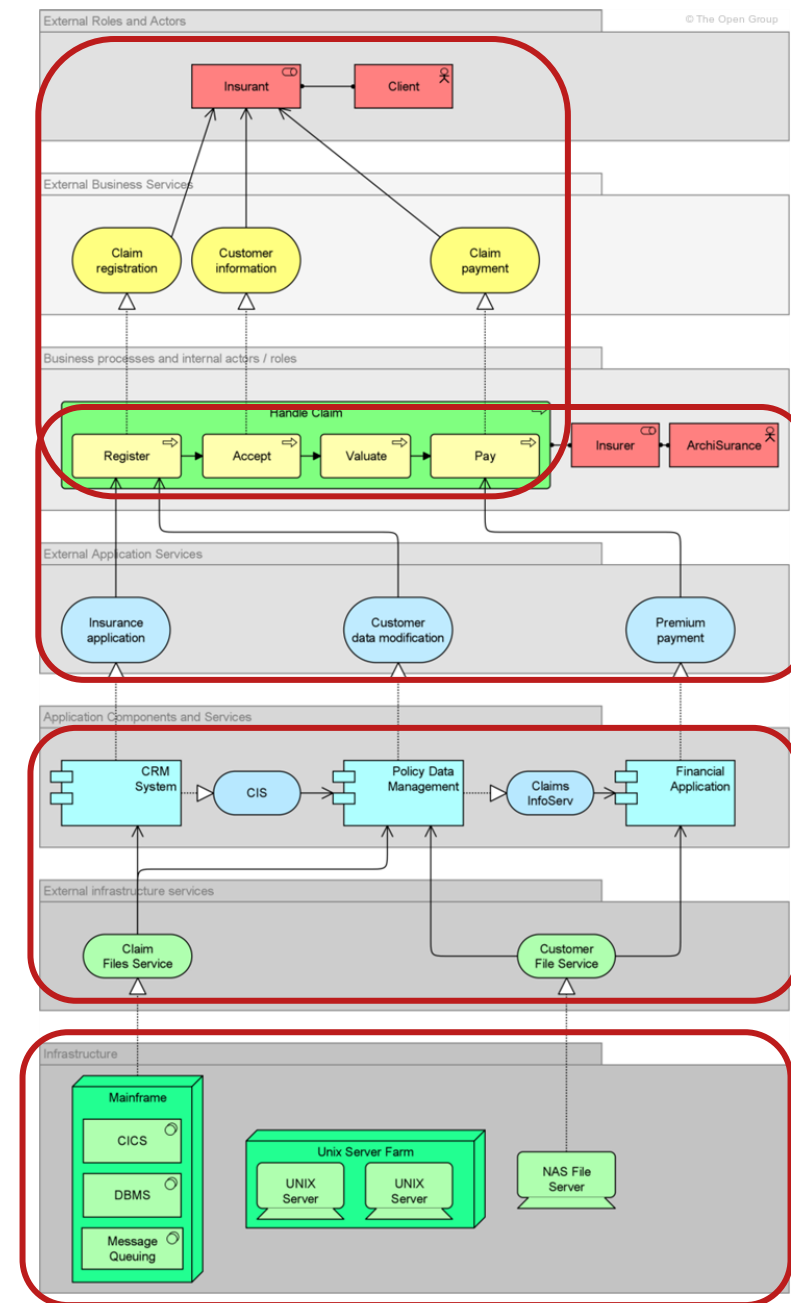
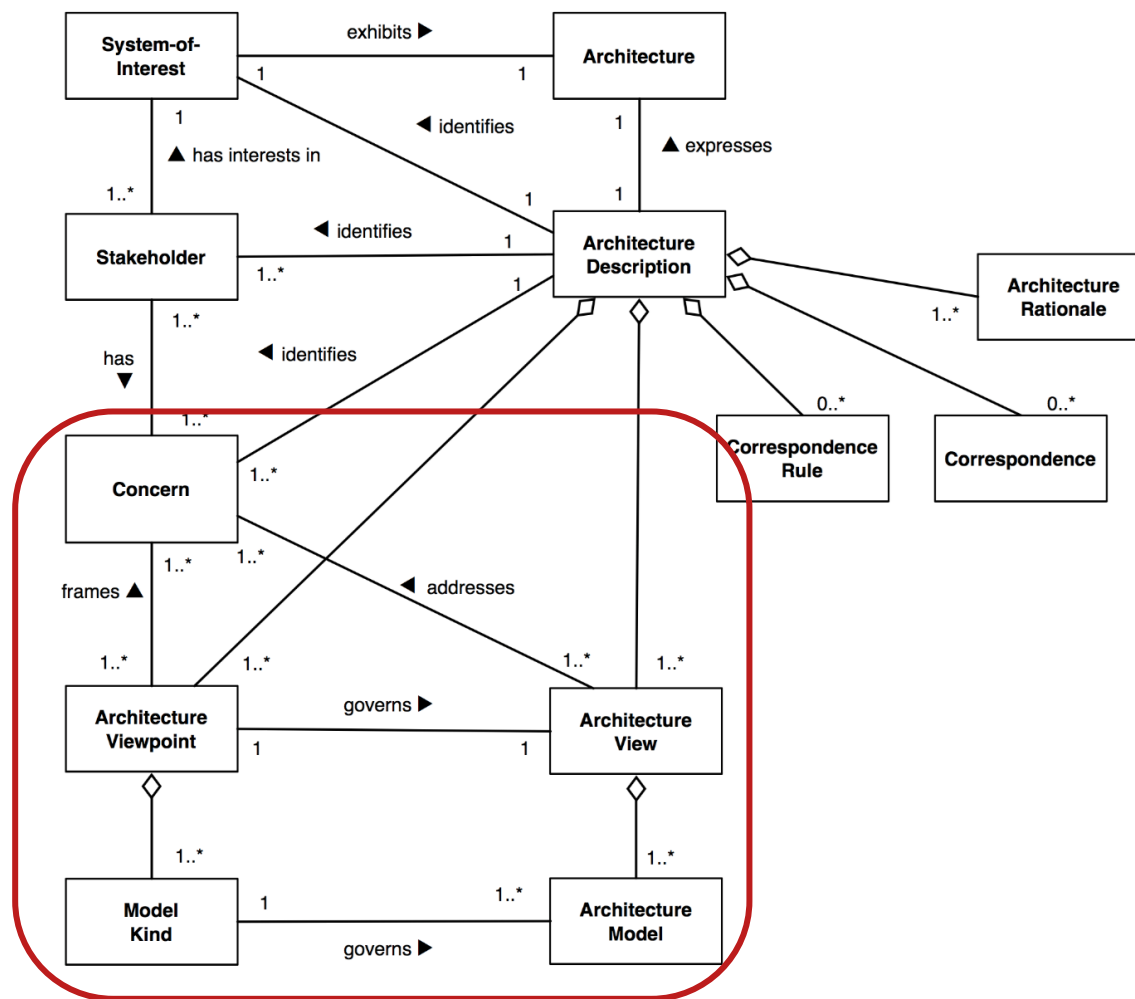
Architecture Framework


- An architecture framework establishes a common practice for creating, interpreting, analyzing and using architecture descriptions within a particular domain of application or stakeholder community



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



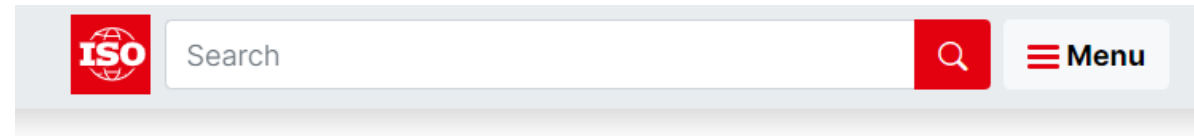




| Viewpoint | Concern | Model Kind |
|-------------------------------|---|---|
| Organisation structure | The hierarchical structure of the organisation | Organizational chart Attribution chart |
| Product offering | Product development, value offered by the products of the enterprise | Products and services catalogue Customer subscription and contract |
| Business process cooperation | Dependencies between business processes, consistency and completeness, responsibilities | Business process model Value chain diagram |
| Service realization | Added-value of business processes, consistency and completeness, responsibilities | Service model Business process model |
| Data structure | The structure of the data maintained by the IT system | Relational data model |
| Implementation and deployment | Structure of application platforms and how they relate to supporting technology | Implementation model Deployment diagram |

Standardizing architecture description

- Initiated in Software Architecture community
- Convergence with systems architecture and enterprise architecture
- First version in 2007, based on standard IEEE 1471:2000
- Revisions in 2011 and 2022

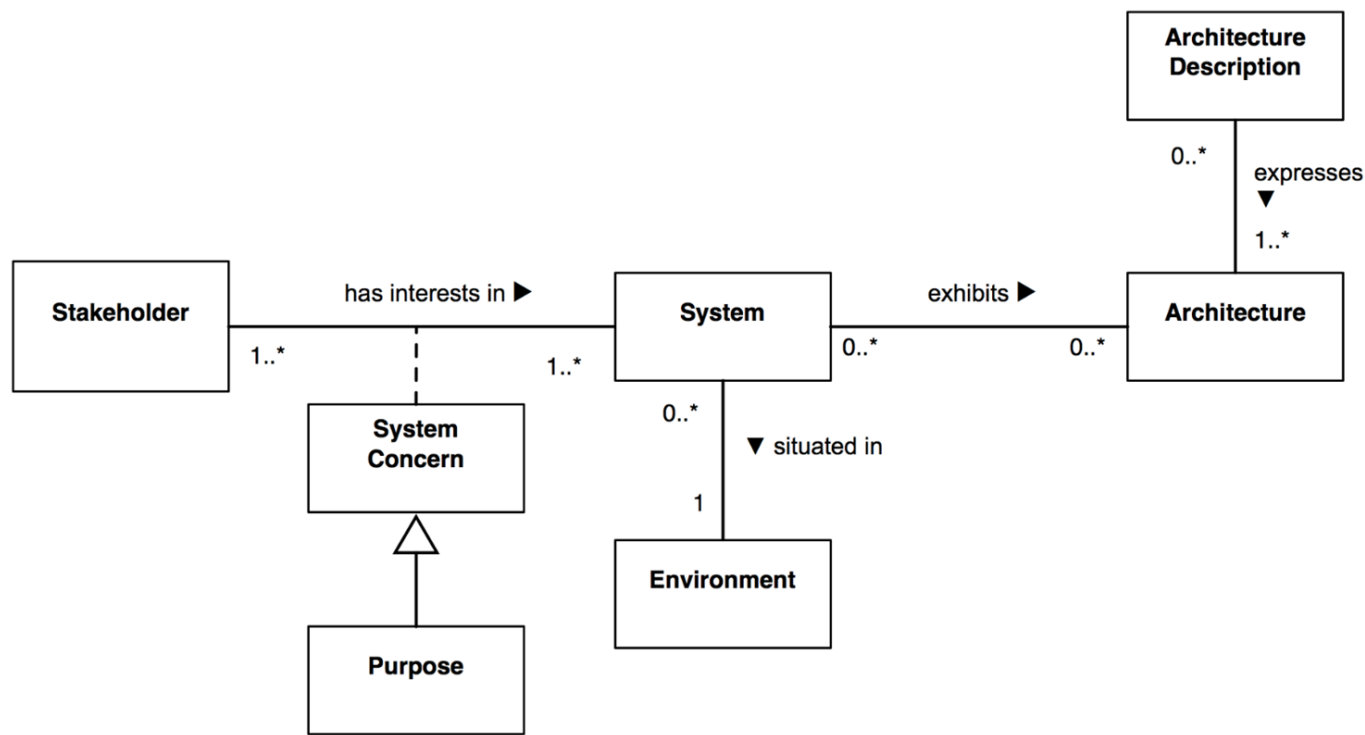


← ICS ← 35 ← 35.080

ISO/IEC/IEEE 42010:2022
Software, systems and enterprise
— Architecture description

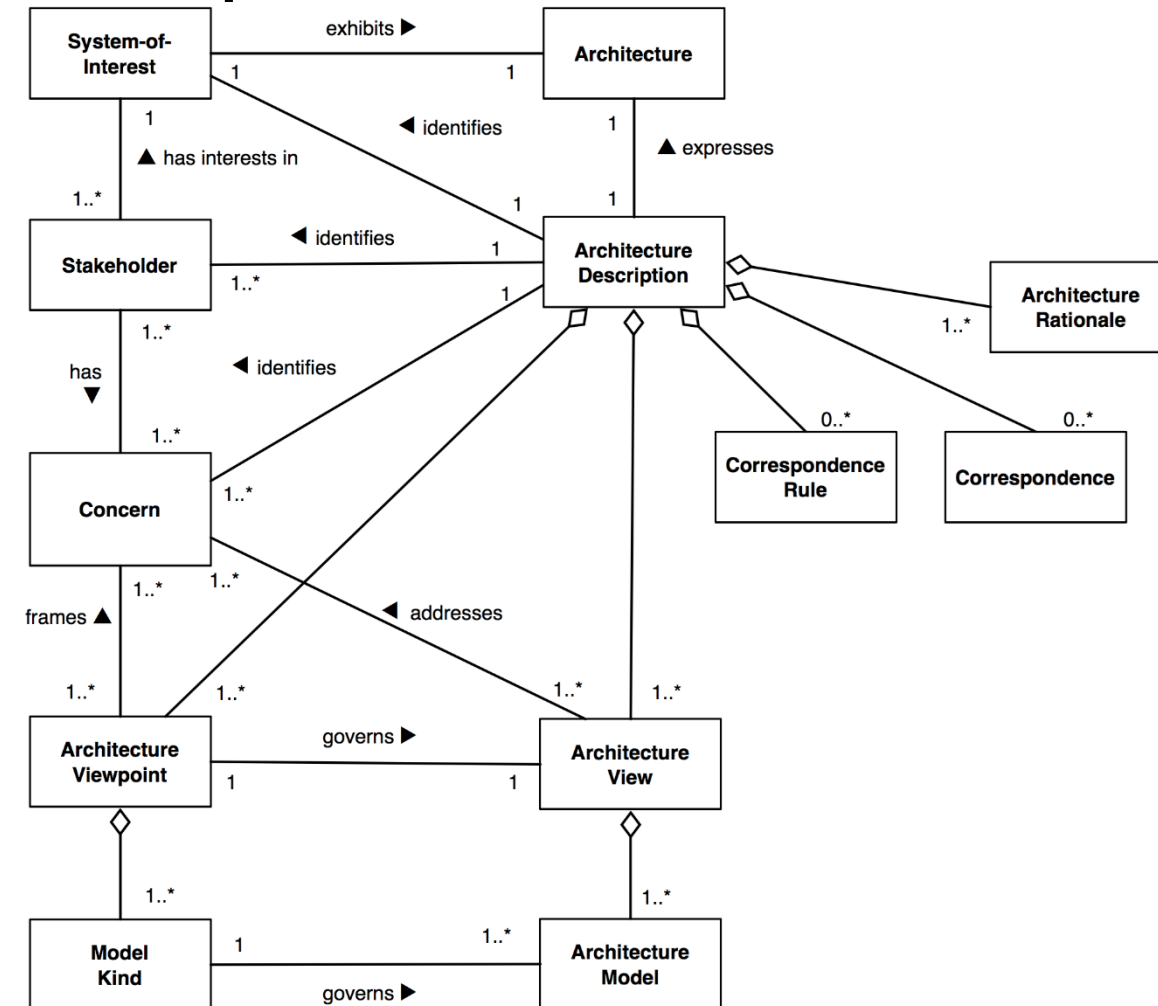
Architecture Description

- An Architecture Description is a work product used to express the Architecture of some System Of Interest.
- An AD may take the form of a document, a set of models, a model repository, or some other form.



Views and Viewpoints

- An Architecture Viewpoint is a set of conventions for constructing, interpreting, using and analyzing one type of Architecture View.
- A viewpoint includes Model Kinds, viewpoint languages and notations, modeling methods and analytic techniques to frame a specific set of Concerns.



ADL

- An ADL is *any form of expression* for use in Architecture Descriptions.
- An ADL might include a single Model Kind, a single viewpoint or multiple viewpoints.
- Examples of ADLs: Rapide, SysML, **ArchiMate**, ACME, xADL.

