ArchiMate Cookbook

Patterns & Examples

Document information	
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1. Introduction

1.1 Purpose And Scope

This document covers ArchiMate -patterns and examples, those of which can be used for modelling concepts and solutions related to the development work of an organization.

Almost all the business relevant behavioral and structural elements of an organization can be modelled with the ArchiMate. ArchiMate is a comprehensive and powerful notation, with a wide range of elements and relationships. However, only a subset of ArchiMate-elements and only a small set of diagram types are enough for most of the modelling purposes (80% of the cases).

This document introduces the most useful diagram types and related ArchiMate-elements. This subset of ArchiMate-elements is grouped into the layers of ArchiMate Framework (figure below).

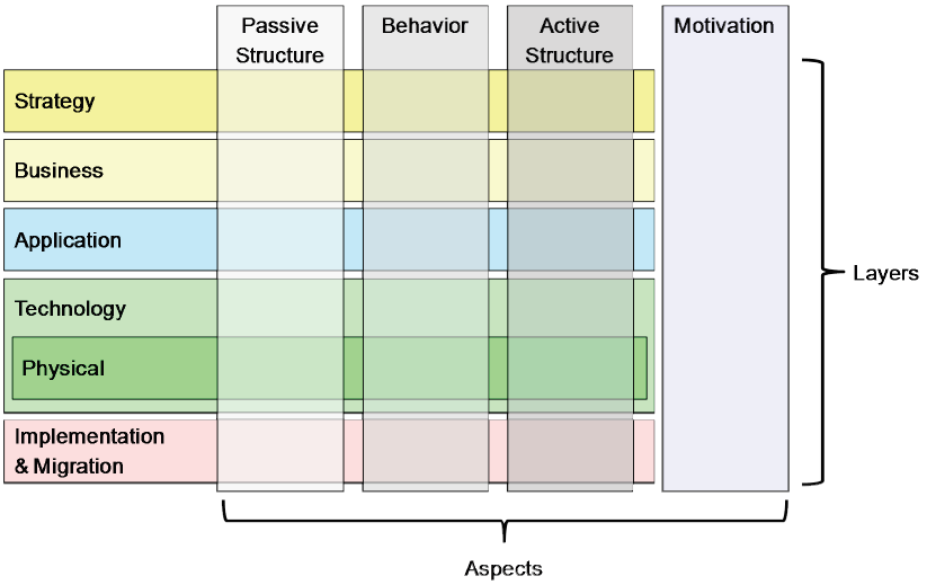


Figure 1: ArchiMate Framework.

The diagrams in this document are modelled according to ArchiMate specification [1]. More ArchiMate -examples can be found from the blog [2].

1.2 References

[1] *ArchiMate 3.1*, Open Group, 2019. https://pubs.opengroup.org/architecture/archimate3-doc/

[2] *Enterprise Architecture at Work*, 4th Edition, Marc Lankhorst et al., Springer, 2017.

[3] *Mastering ArchiMate*, Edition III, Gerben Wierda, 2017.

[4] *Lean Enterprise Architecture Method For Value Chain Based Development In Public Sector*, Hosiaisluoma et al, 2018. https://www.hosiaisluoma.fi/blog/lean-enterprise-architecture-method-for-value-chain-based-development-in-public-sector/

[5] “ArchiMate Examples” blog, Eero Hosiaisluoma. https://www.hosiaisluoma.fi/blog/archimate-examples/

[6] “Holistic Enterprise Development” blog, Eero Hosiaisluoma https://www.hosiaisluoma.fi/blog/

[7] “ArchiMate Cookbook” blog, Eero Hosiaisluoma https://www.hosiaisluoma.fi/blog/archimate-cookbook/

2. ArchiMate Diagram Types

2.1 Motivation View (Goals View)

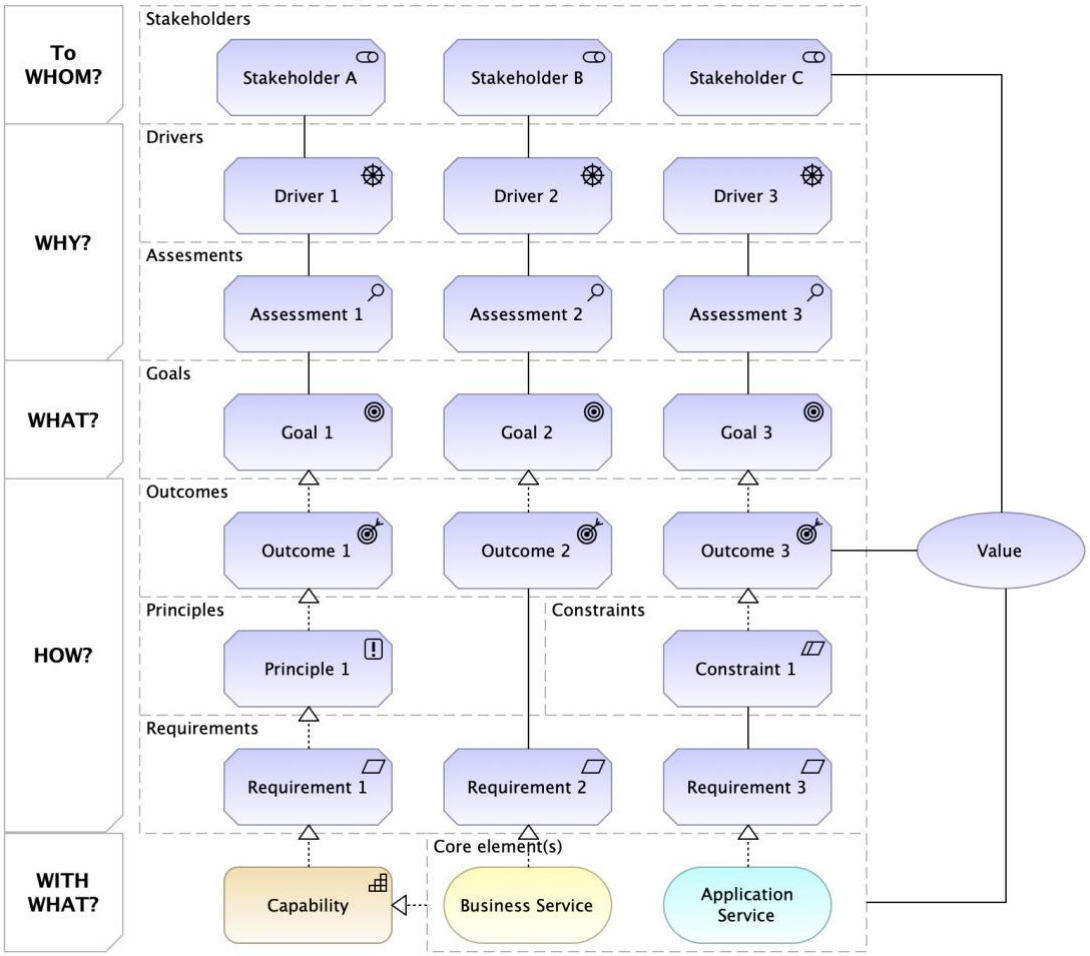


Figure 2: Motivation View - Design Pattern.

A *Motivation View* (a.k.a. *Goals View*) can be used for to depict why a demand is meaningful: WHY this change is needed. With the *Motivation View* it is possible to model crucial drivers and root causes behind the demand, actual goals and related outcomes, as well as concrete requirements for further development. The *Motivation View* answers the questions to WHOM, WHY and WHAT. Whenever appropriate, a Value can be associated with the *Motivation View*, if it is important to illustrate the concrete benefits of the demand (development target).

This diagram type is modelled with ArchiMate Motivation- and Strategy -elements.

2.1.1 Motivation View - Example

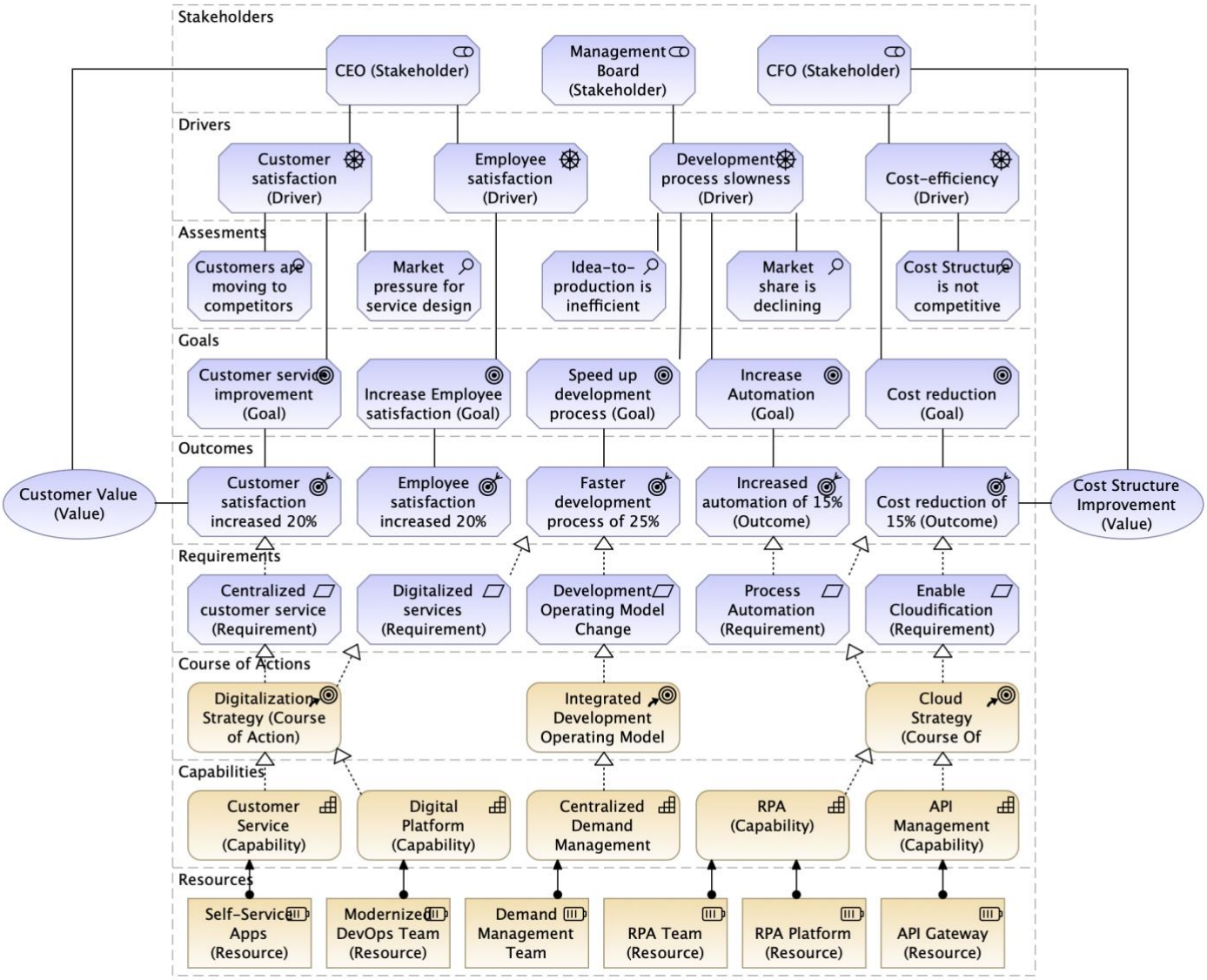


Figure 3: Motivation View - Example.

The *Motivation View* can be applied to many kinds of purposes, such as to depict a strategy of the whole organization or to define the business case or requirements of a single development target.

ArchiMate Motivation- and Strategy -elements are quite self-descriptive when illustrated within the titled groups (as shown in the figure above). Diverse stakeholder groups (managers, process- and software developers etc.) can read the *Motivation View* without deep knowledge of ArchiMate. As a result of this, the *Motivation View* is very multipurpose diagram type. It would be important and valuable to create a *Motivation View* for each and every demand for change - before any (“build or buy”) actions are to be taken.

2.1.2 Risk Analysis View

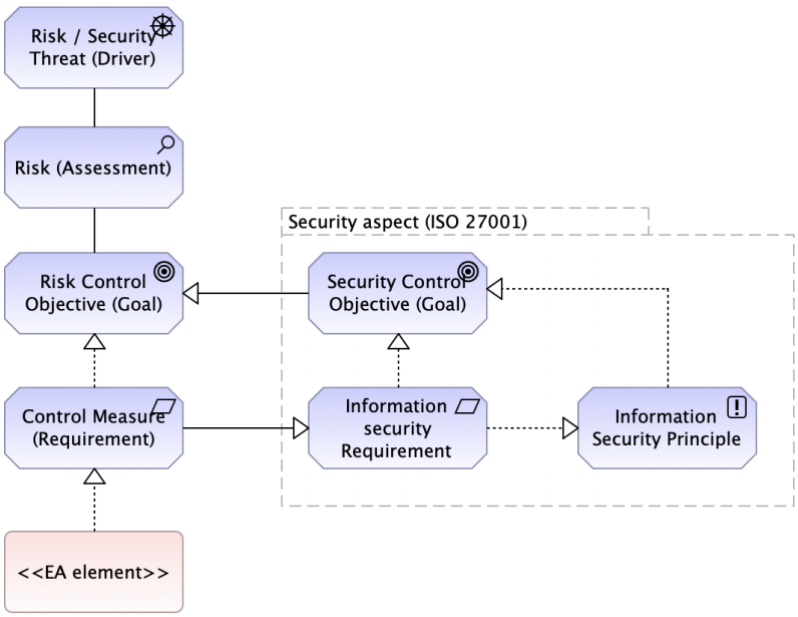


Figure 4: Risk and Security View - Pattern.

Risk and Security View. Mapping of Risk and Security Concepts to the ArchiMate. Security and data protection matters are part of the risk management. This modelling approach covers them both.

This diagram type is modelled with ArchiMate Motivation -elements.

References:

- How to Model Enterprise Risk Management and Security with the ArchiMate® Language, Open Group, DocumentNo: W172, 2017.
- Modeling Enterprise Risk Management and Security with the ArchiMate® Language, Open Group, 2015.

2.2 Business Model View

2.2.1 Business Model Canvas (BMC)

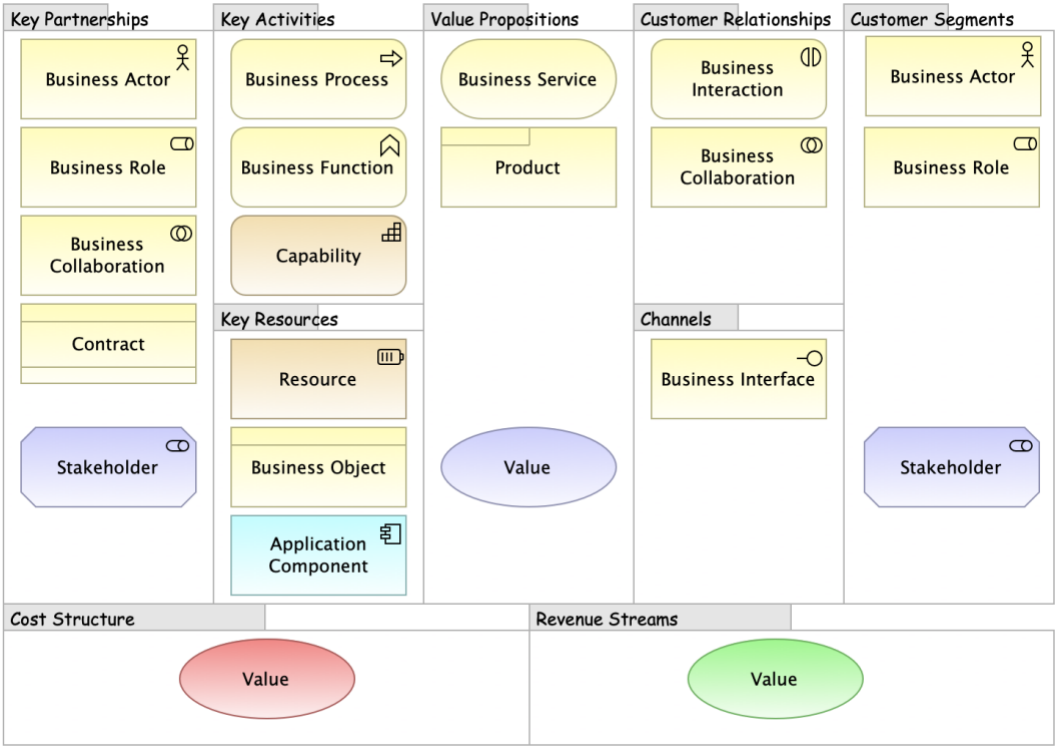


Figure 5: Business Model - *Business Model Canvas* (BMC).

A *Business Model Canvas (BMC)* -diagram can be used for modelling a business model or a business case.

This diagram type is modelled primarily with ArchiMate Business Layer -elements together with certain Motivation- and Strategy -elements.

2.2.2 SWOT Analysis View

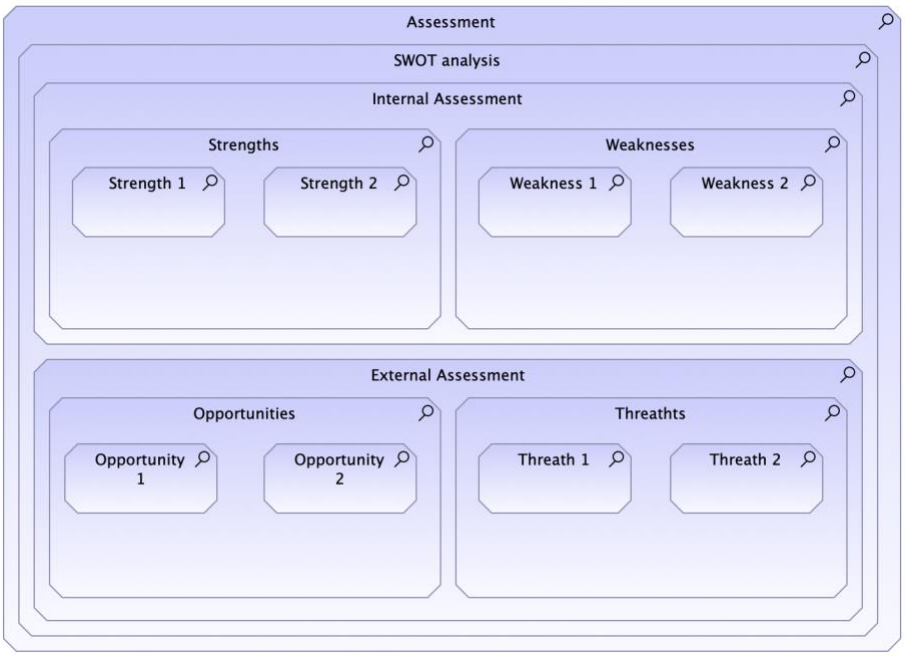


Figure 6: SWOT Analysis - Design Pattern.

A development target can be analyzed and depicted with the SWOT View -diagram. (SWOT stands for Strengths, Weaknesses, Opportunities and Threats.)

This diagram type is modelled with ArchiMate Assessments -elements.

2.2.3 Value Stream View

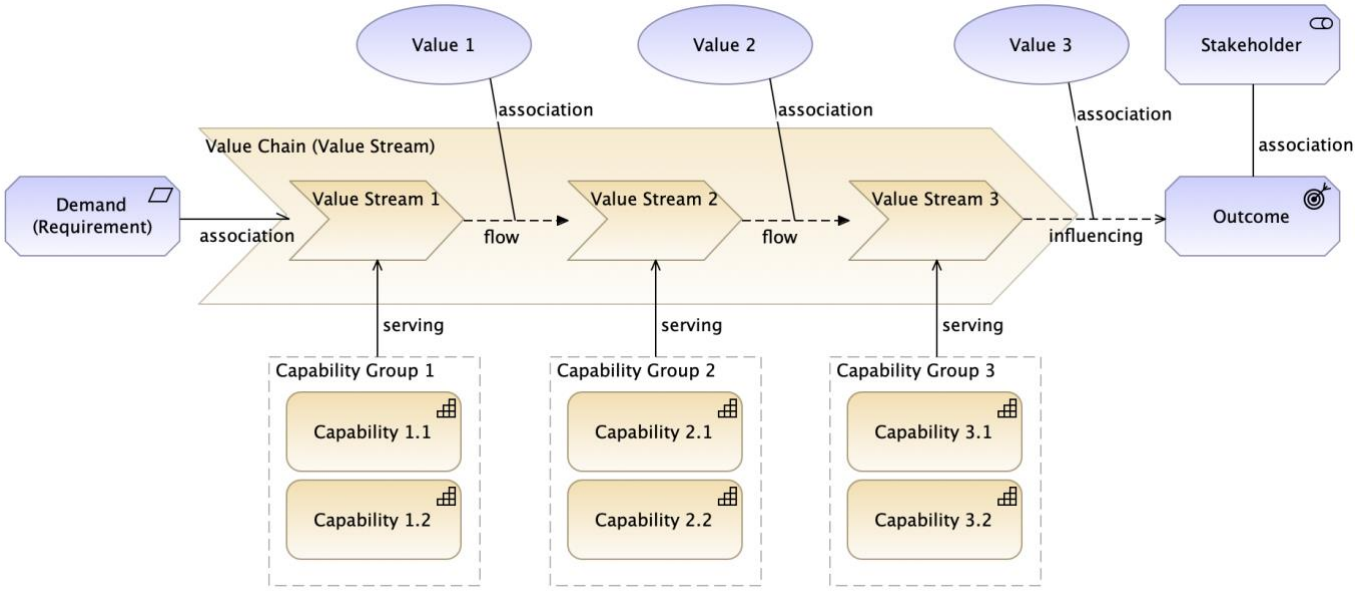


Figure 7: Value Stream - Design Pattern.

A **Value Stream** diagram defines e.g. how value is created for the customers according to the Business Model. In addition, value stream modelling can be used to depict how the business capabilities are connected to the value stream. This makes it visible what is the role and meaning of each capability (and related resources), and what is the actual value-add of each capability in the overall end2end value creation stream (process). As such, the value stream description (with capability connections) visualizes both the beneficial and unproductive capabilities, when measured with pure value-creation factors. How an organization creates value for the customers, and with what

capabilities. A value stream focuses us to “start talking business value instead of architecture”. Architecture, in turn, defines the behavior and structure behind each capability.

This diagram type is modelled with ArchiMate Strategy -elements. (The Value Stream -element is introduced in the ArchiMate 3.1 [1]).

2.2.3.1 Value Stream - Example

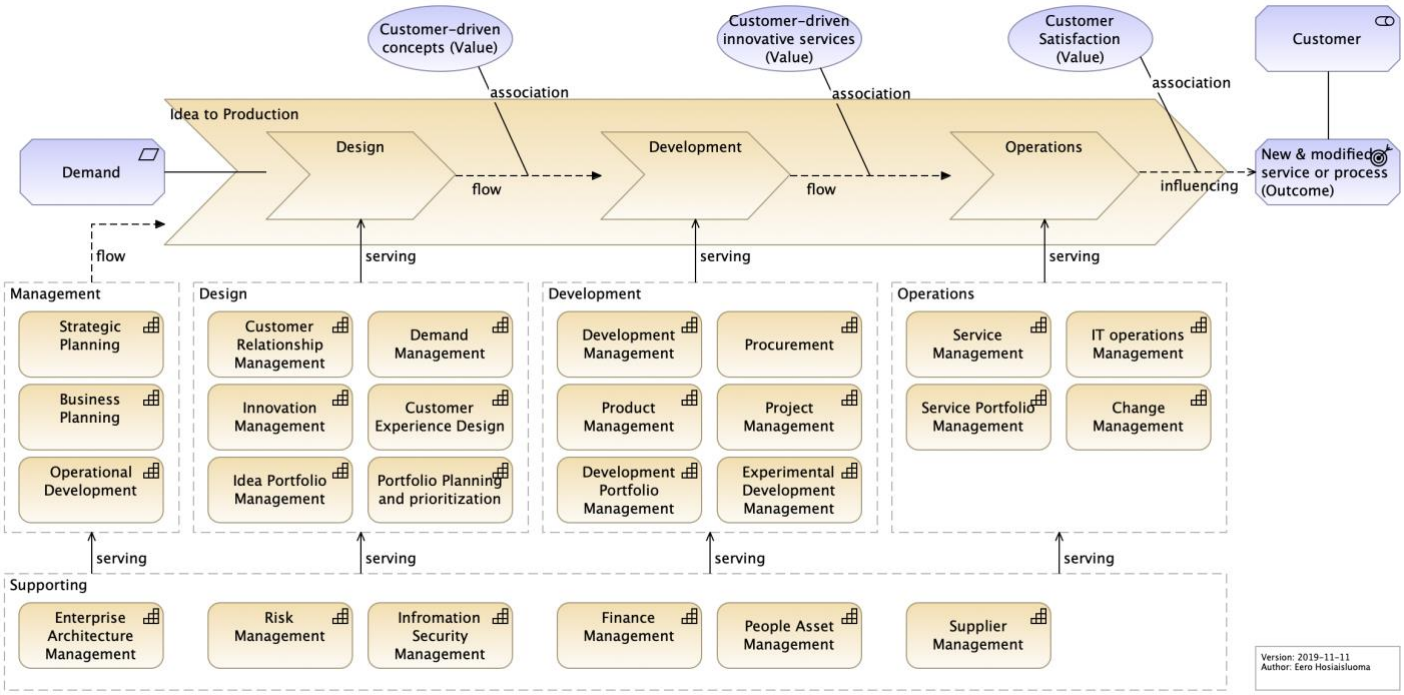


Figure 8: Value Stream - Example.

The Value Stream (figure above) represents the **Business Model** (added with value elements), whereas the Business Process (figure below) represents the **Operating Model** (the implementation of the Value Stream). In that case the value stream and process describe the same “thing”, but in different abstraction levels.

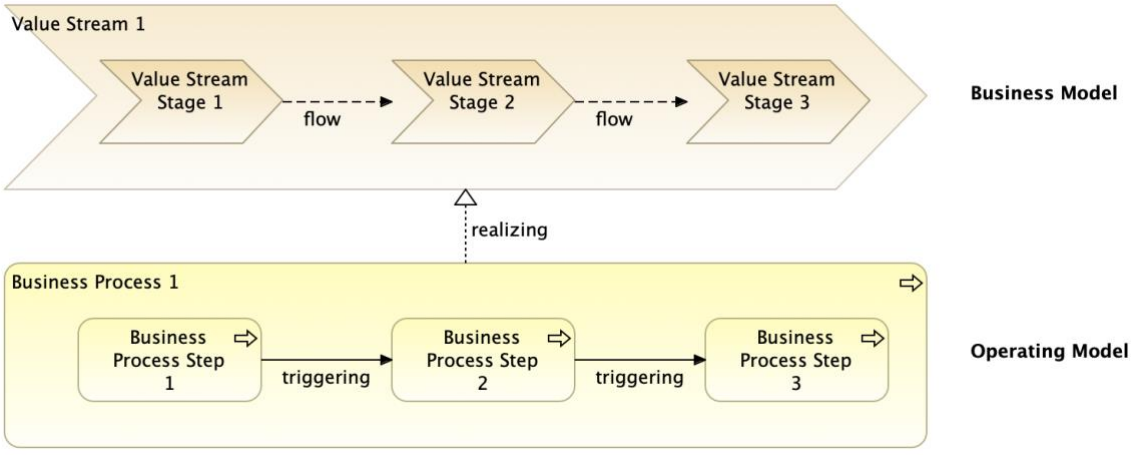


Figure 9: Relation of the Value Stream and the Business Process.

“A **Business Model** should also provide a very high-level view of the key parameters that together combine to produce the value proposition. An **Operating Model** explains the configuration of the enterprise resources considered optimal by the leadership team for the realization of the business model. In other words, how will the business model be realized by some suitable combination of People, Process, and Technology (PPT)”. [Ed Walters, *Modeling the Business Model Canvas with the ArchiMate® Specification*, Document No.: W195, Published by The Open Group, May 2019.]

2.2.4 Strategy & Capability View

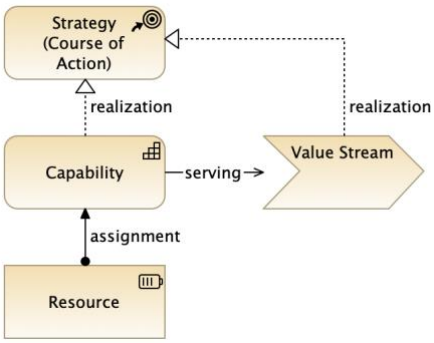


Figure 10: Strategy - Design Pattern.

For the successful and efficient operational development of an organization, it is crucial that the strategy and strategic goals can be connected to the Business Model, to the Capability Model, to the Operating Model, and preferably to all the development targets.

The strategy can be modelled with ArchiMate Strategy -elements: Course of Action, Value Stream, Capability ja Resource. With these elements, the organization can be analyzed and depicted according to *Resource Based View (RBV)* -approach.

A Capability Map View, the **Capability Model**, is valuable to identify the following:

1) the strategic core capabilities, which constitute the fundaments of the existence of the organization (incl. value creation, competitive advantage), and
2) the basic capabilities, which enables the daily operations of the organization.

For capability assessment and identification, the following can be considered:

- a capability defines WHAT the organization does (whereas a resource defines HOW),
- a capability is unambiguous (no overlaps), and relatively stable by its nature,
- a capability can be divided into more detailed, lower-level capabilities,
- a capability can be grouped into a capability group,
- a capability can be:
    a. *organizational* (intangible, related to the existence, strategy or value creation of an organization) or
    b. *operational* (produced by tangible or intangible resources, related to the operating model).

2.2.4.1 Capability Map View

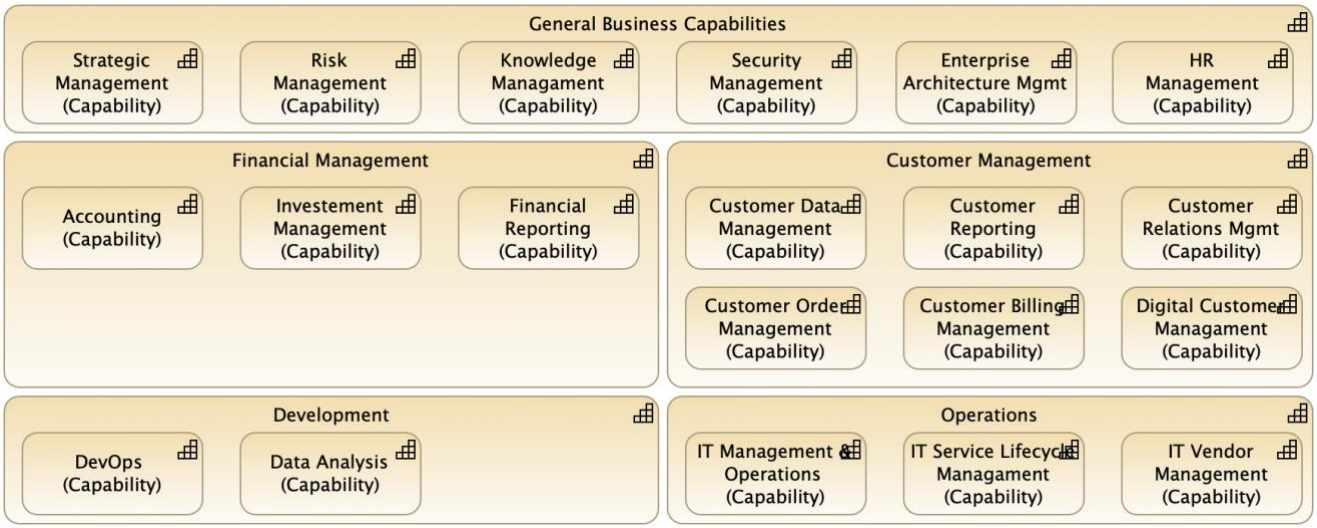


Figure 11: Capability Map View - Example.

A Capability Map View is modelled with ArchiMate Capability -elements. Capability Groups can be modelled with either Capability- or Group-elements.

2.2.4.2 Strategy & Capability Planning View

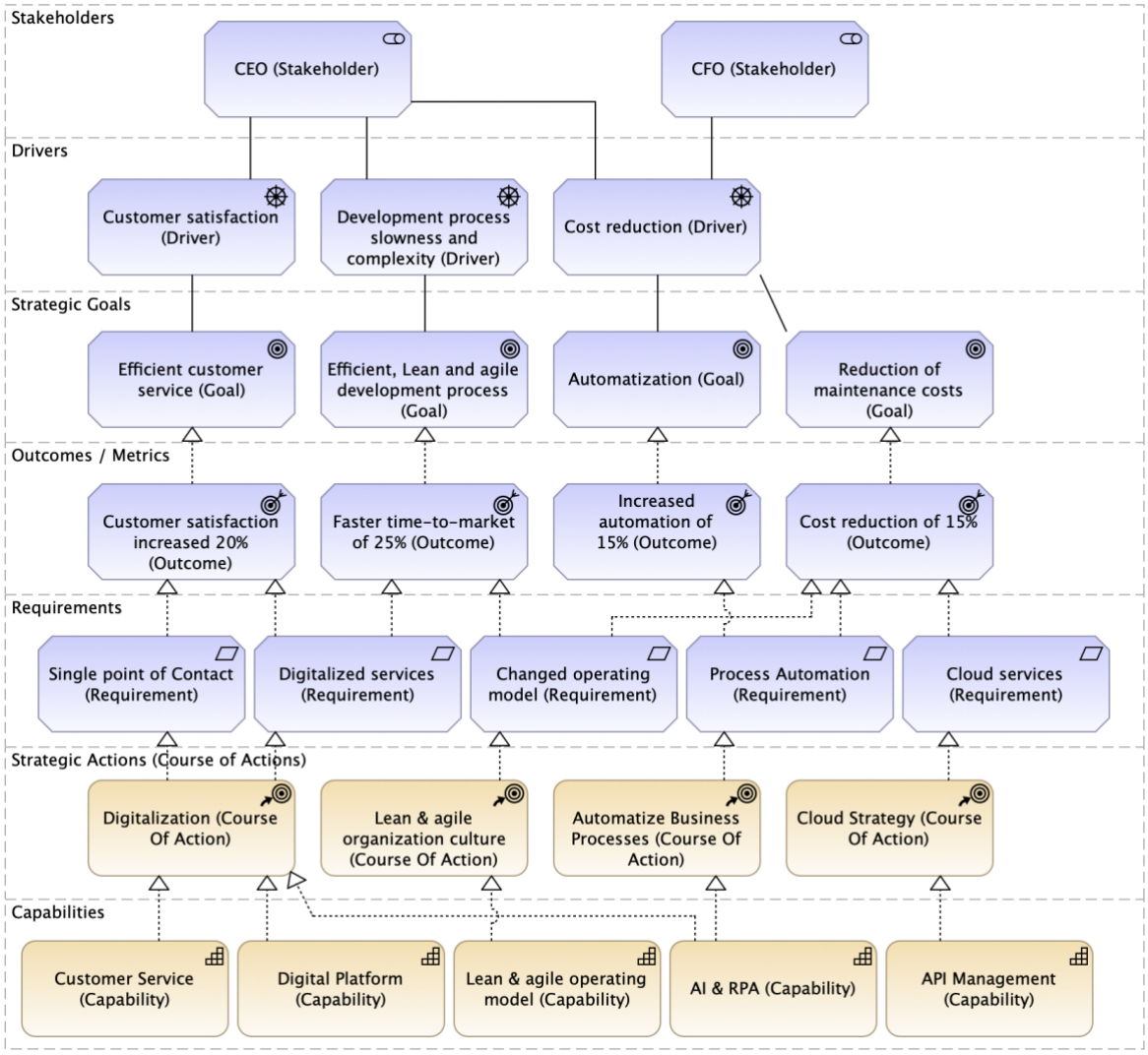


Figure 12: Strategy & Capability Planning View - Example (ref. "Strategy to Capability" Value Stream).

The *Strategy View & Capability Planning View* is modelled with ArchiMate Motivation- and Strategy-elements (figure above). This view and these elements can be used for *Capability-Based Planning (CBP*) purposes.

2.2.4.3 Strategy To Capability View

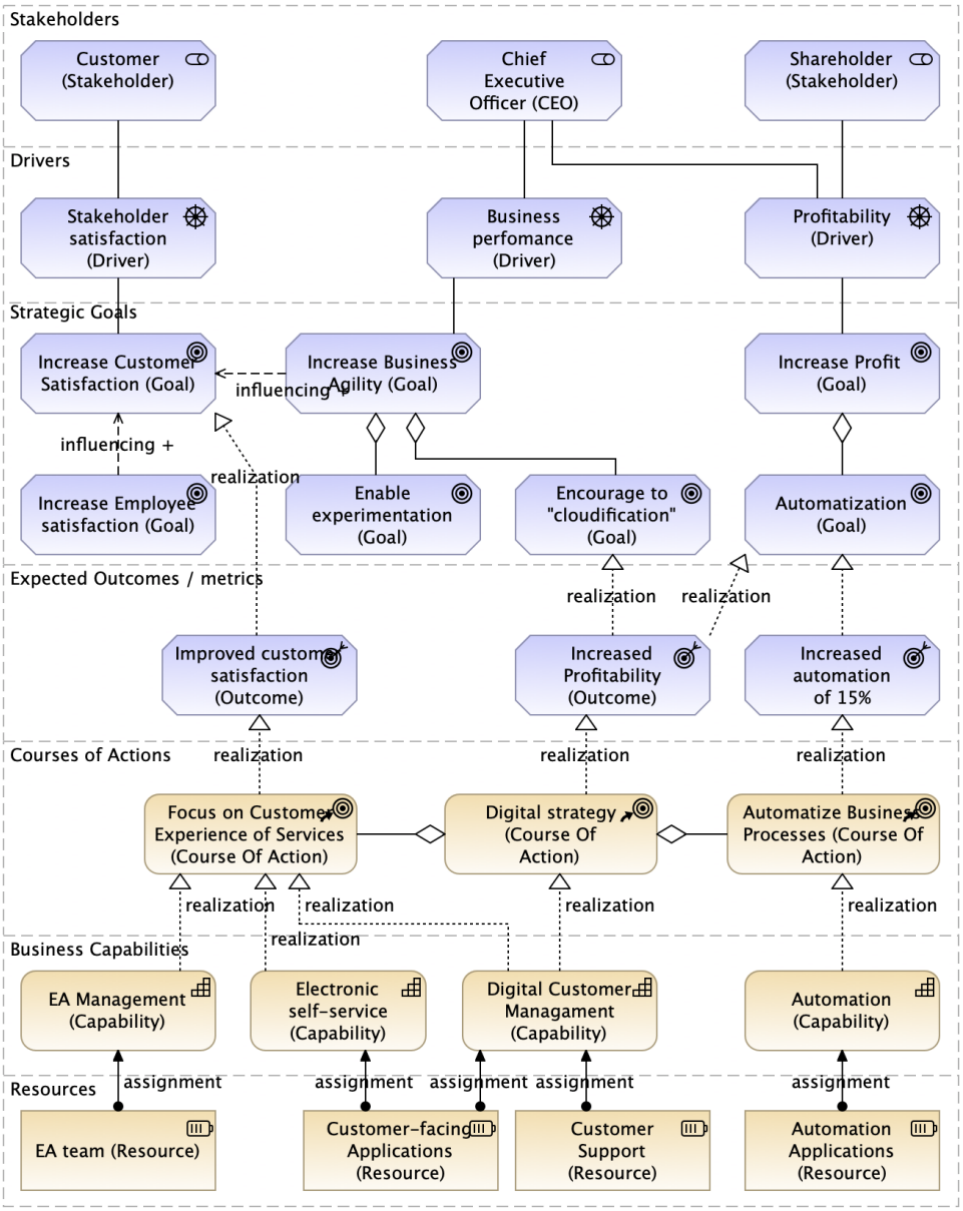


Figure 13: Strategy To Capability View - Example.

Another example of how *Capability-Based Planning (CBP*) can be supported by modelling. Capabilities can be identified based on the strategic course of actions, which can be derived from strategic goals and -outcomes.

For the sake of enabling strategy execution in practice, the strategy statements should be expressed as imperatives, actionable clearly stated clauses. These imperative actions can be modelled with ArchiMate Course of Action -elements. A suggested form is use imperative as follows: “Focus on Customer Experience”, “Automatize Biz Processes”, “Establish Demand Management virtual team” etc.

2.2.4.4 Capability Planning View

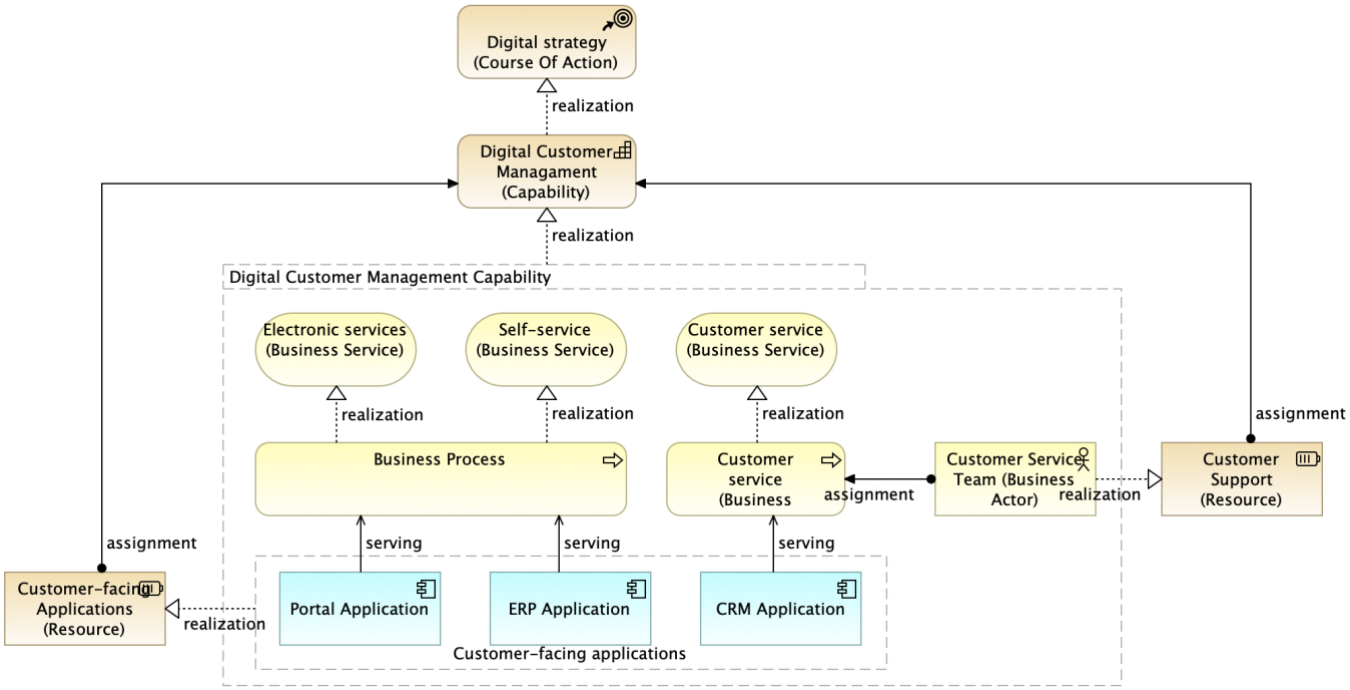


Figure 14: Capability Planning View - Example.

This view can be used for designing the actual architectural building blocks to realize a capability. The Grouping -element can be used for aggregating the elements into a logical entity.

2.2.5 Implementation Roadmap View

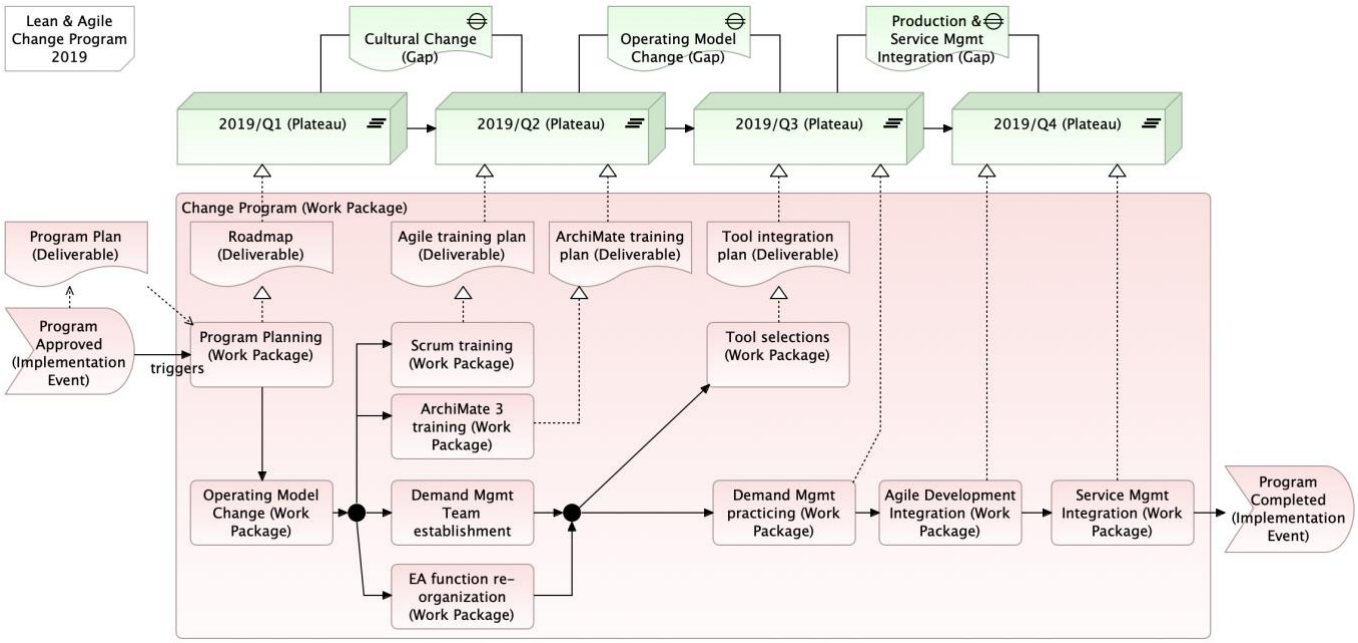


Figure 15: Implementation Roadmap View - Example.

This view can be used for modelling the implementation plan of a strategy or capability etc.

An implementation roadmap can be added with the core enterprise architecture elements (such as application services) that are to be implemented in certain phases as illustrated in the figure below.

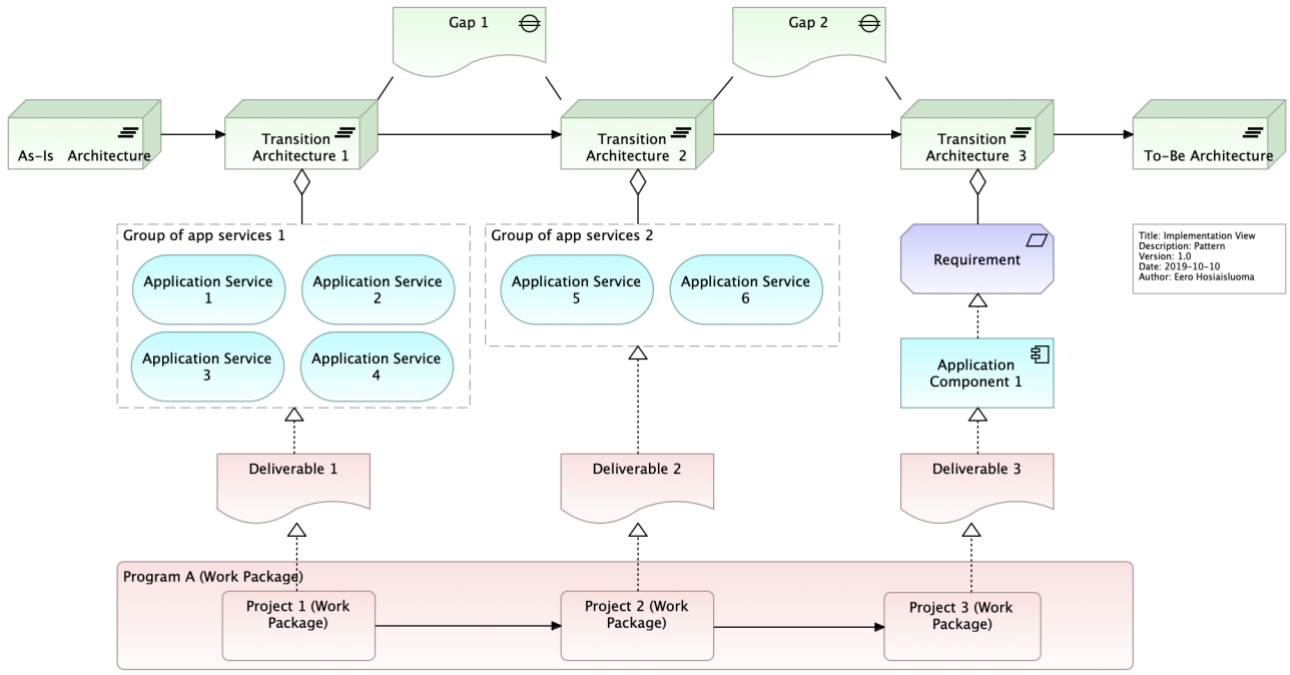


Figure 16: Implementation Roadmap View - Example 2.

This version (figure above) can be used for grouping the changes into the implementation phases.

2.3 Layered View

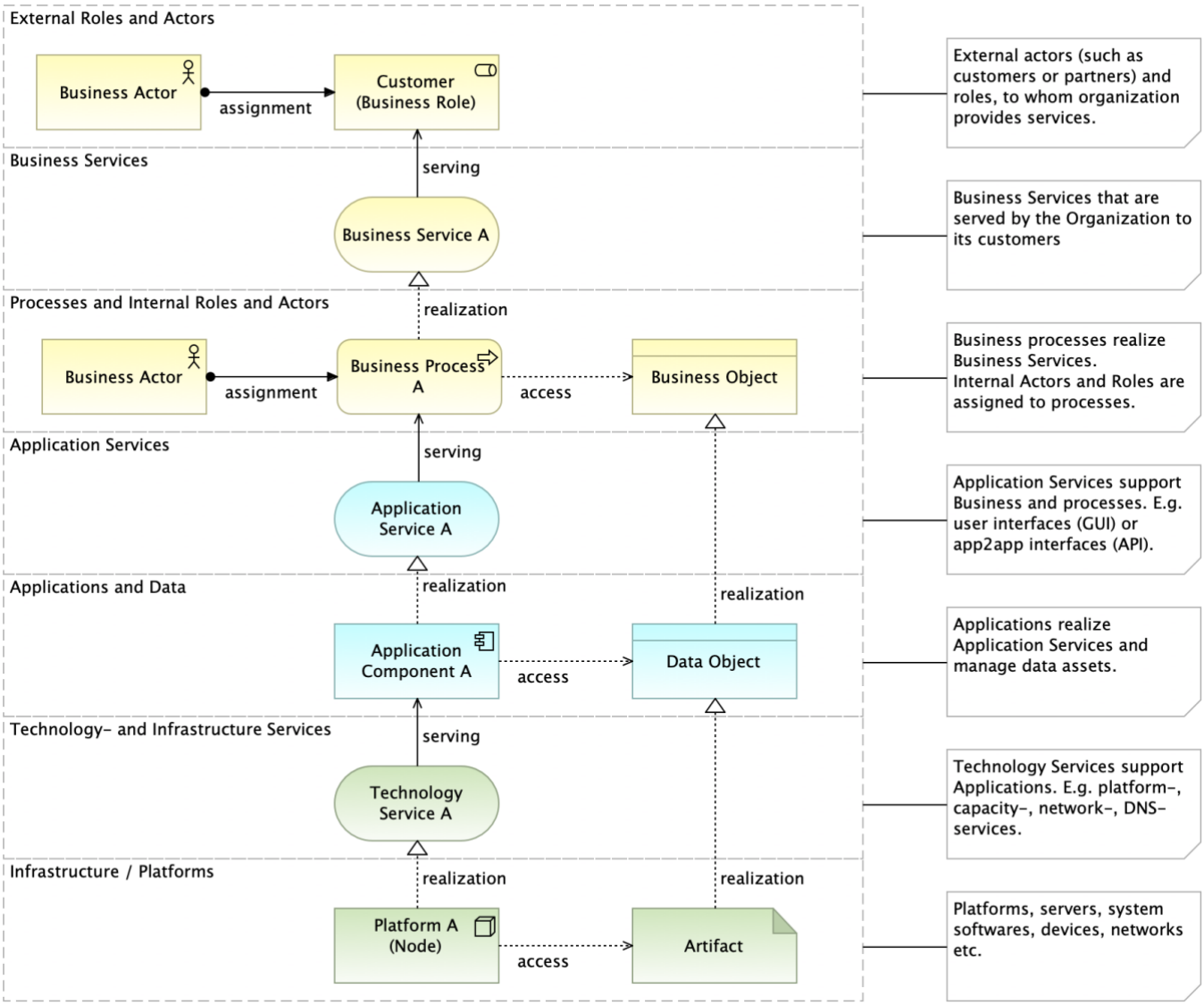


Figure 17: Layered View (Overview) - Basic Design Pattern.

The *Layered View* combines ArchiMate-elements from different ArchiMate-layers as follows: Business-, Application- and Technology Layers.

The *Layered View* enables the development target to be analyzed and depicted as a layered “stack” as follows: first the business aspects on the top, then application aspects in the next layer, and finally the technology aspects on the bottom. This approach makes the overall big picture visible with all the necessary relationships between all the behavioral and structural elements, which are meaningful in the context of the development target in hand.

The layers are connected with the services (of different kinds), so in that sense the *Layered View* is enabling the *Service-Driven Approach (SDA)* to analyze and depict a development target. This diagram type is one of the most useful and informative, because that makes it possible to visualize all the important relationships from bottom-up and top-down between all the necessary elements on each layer (biz, app, tech).

This diagram type can be modelled with any elements of the ArchiMate layers.

2.3.1 Layered View - Business- and Application Layers Example

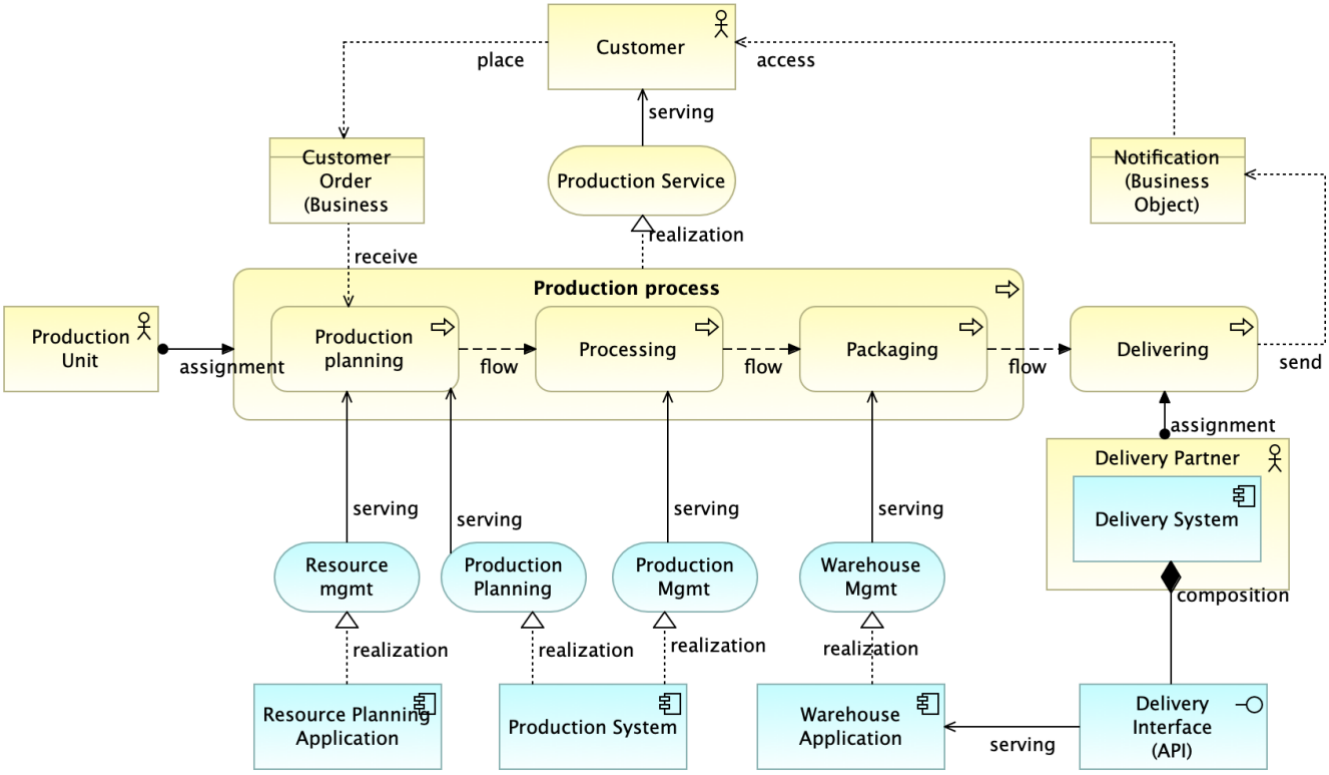


Figure 18: Layered View Example - business and application layers.

This example diagram of the *Layered View* connects business and application layers via the application services.

2.3.2 Layered View - Business Layer

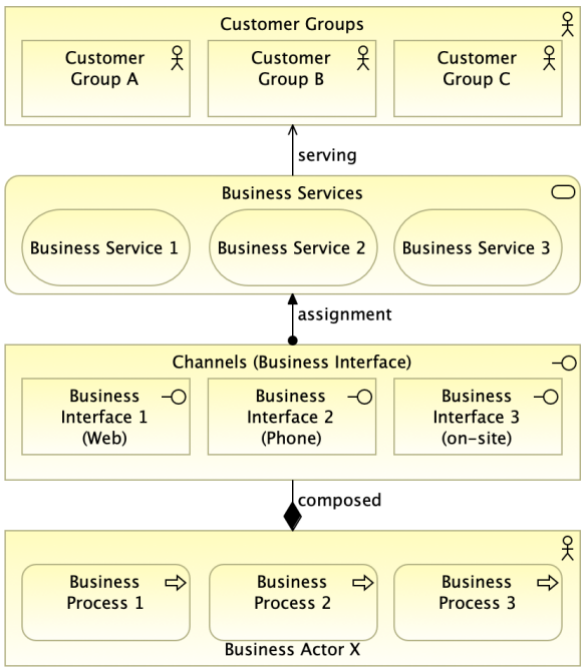


Figure 19: Layered View, Business Layer - Design Pattern. Note: business interfaces as “channels”.

Note! Business Interfaces 1-3 are nested into higher level business interface “Channels” with relation type Composition. Accordingly, Business Services 1-3 are nested into higher level business service.

The *Layered View* can be applied to what is appropriate for the purpose. For example, layers can be left out and depict the development target from the certain viewpoint, e.g. from the business point of view like in the figure above. However, the layered approach is always based on the top-down order of the elements: customers on the top, then the business services and so on.

2.3.3 Layered View - Customer Service Journey

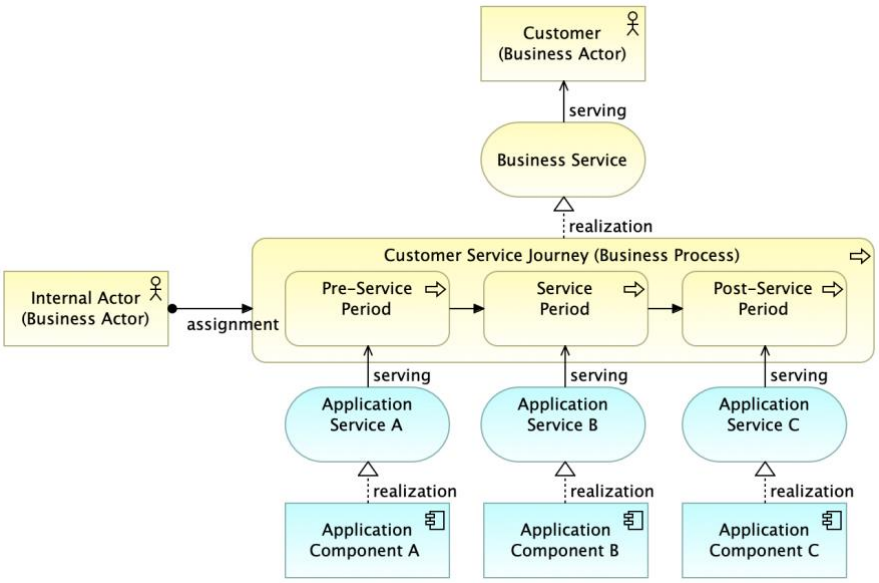


Figure 20: Customer Service Journey - Design Pattern.

The *Layered View* can also be taken from the customer viewpoint. Customer centric diagrams can be modelled as *Customer Service Journey* or *Service Blueprint* diagrams. These diagram types combine the customer- and organization viewpoints together. These are the “outside-in” and “inside-out” approaches.

2.3.3.1 Layered View - Customer Journey View - Example

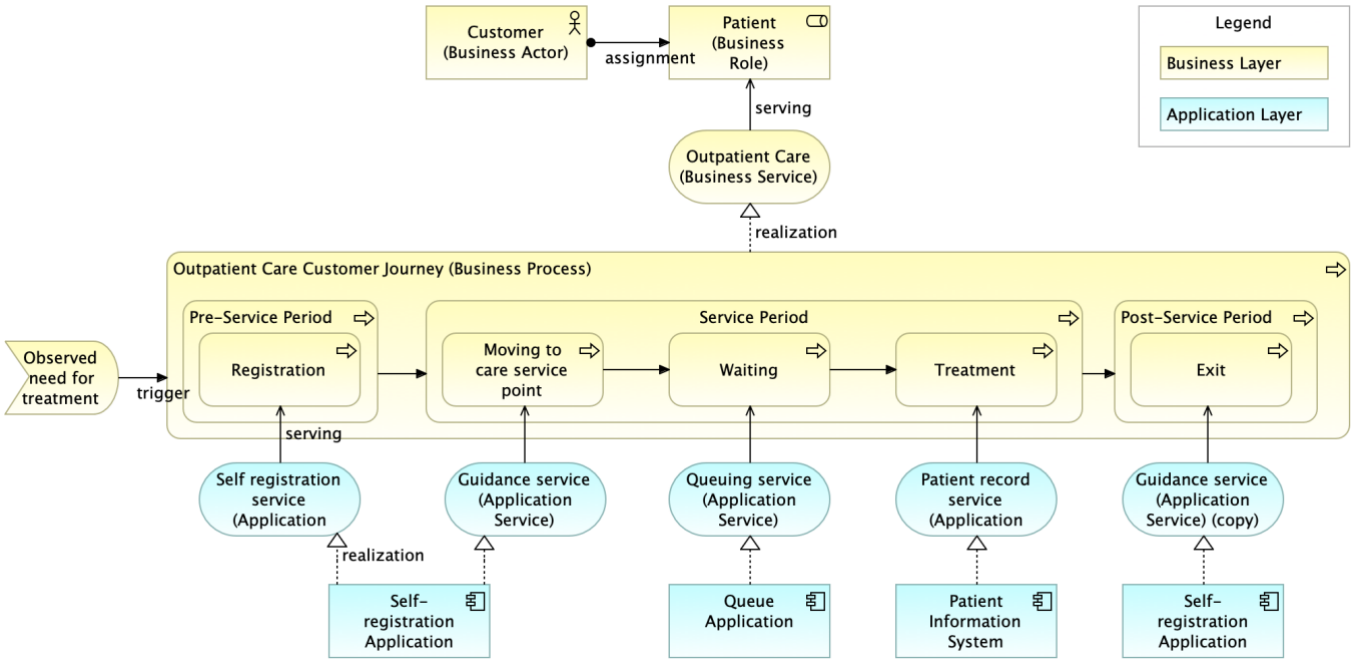


Figure 21: Customer Service Journey - Example.

The *Customer Service Journey* is a specialization of the *Layered View*, which combines business- and application layer elements.

2.3.4 Layered View - Swimline Process View

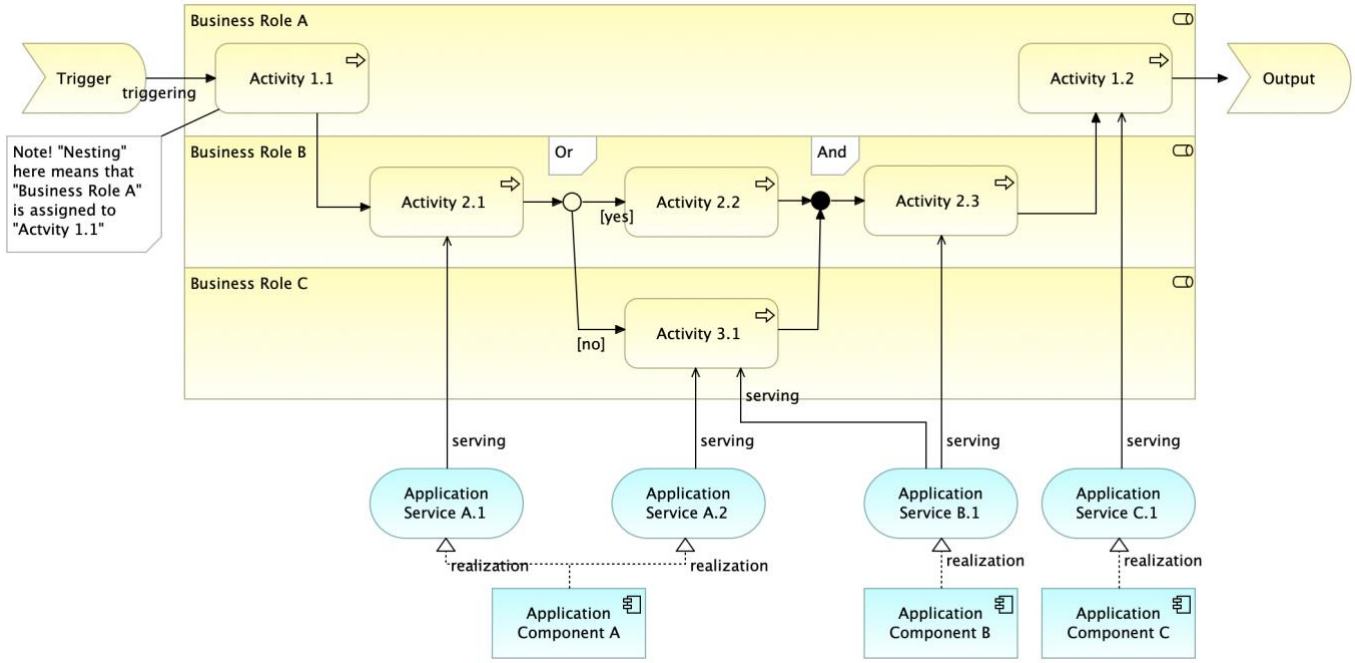


Figure 22: Swimline Process View - Design Pattern.

This version of the *Layered View* combines business layer elements and application layer elements. This cross-layer view can be used for modelling high-level process flow, in which application services and/or applications are linked to. With this view, a business process can be illustrated at high-level with ArchiMate – without need for BPMN modelling. In addition, this view enables connecting process steps to actual application services used.

In this example above Business process steps are performed by distinct business roles. Practically, business roles A, B and C are assigned to business process elements with ArchiMate Assignment-relationship type. Business role -elements are visualized as large objects that represent the “swimlanes”, and then the business process -elements are “nested” into those business roles.

2.3.5 Layered View - Service Design View

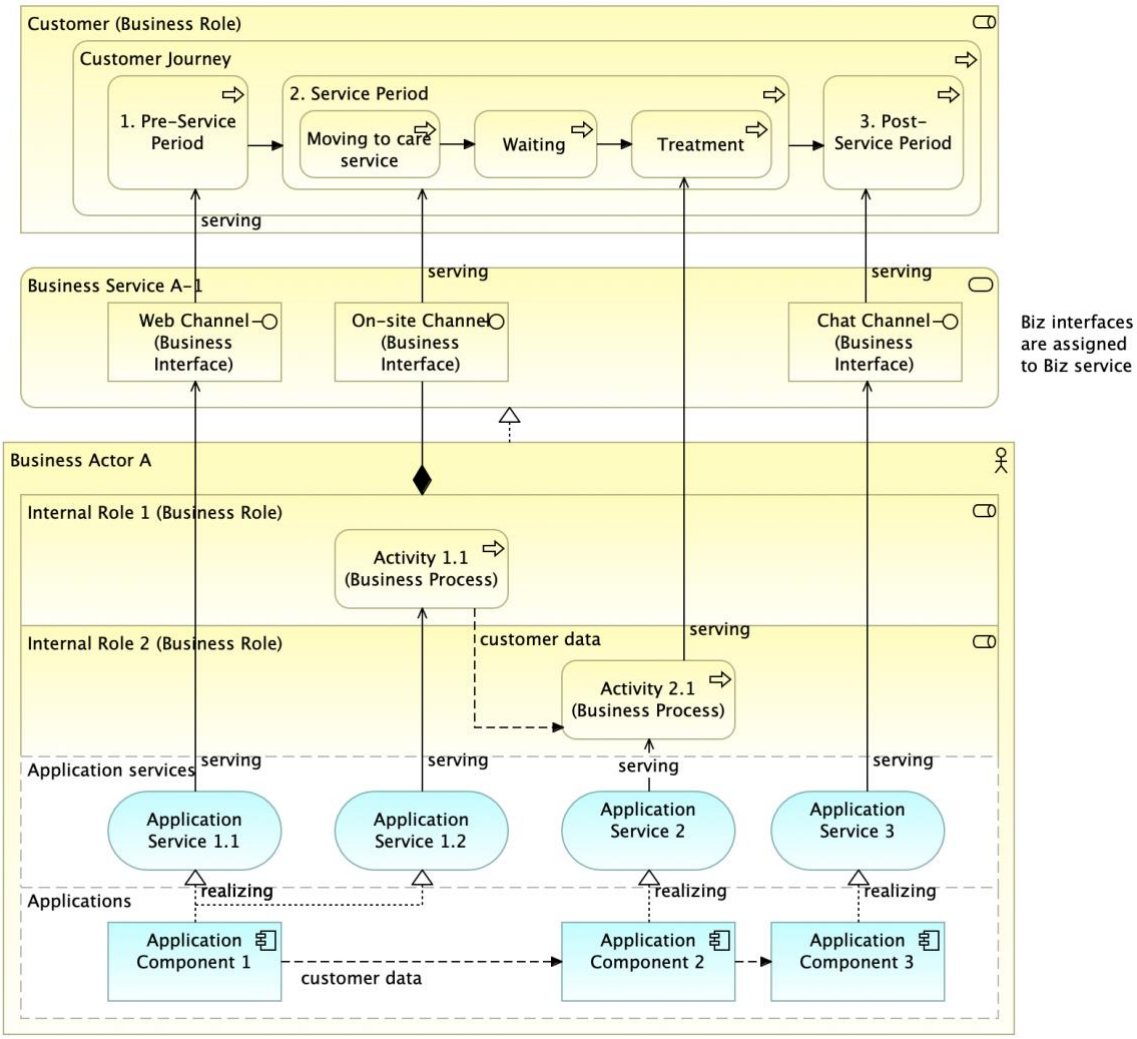


Figure 23: Service Design View - Design Pattern.

This version of the *Layered View* using “swimline style”, is focused on customer role. This view can be used for service design purposes, for integrating “outside-in” and “inside-out” approaches into a one view. The customer journey with phases (Pre-service period, Service period and Post-service period) is added into the customer role, and channels added in between customer and personnel roles.

Business Process -elements are nested into Business Role -elements, which means that Business Roles are assigned to Business Processes (in the model repository). In addition, Business Roles are nested into the Business Actor, so the roles are assigned to the actor. Hence, there are relations between these elements, even though they are not visible. This layout of the element saves space in the diagram. The value of this view is that we can use ArchiMate and its relations when visualizing a “swimlines of roles with connected application services and applications”.

The service layer is can be divided into distinct business services, if that is the case. Whether there is a certain specific business service that is to be designed, or there are several business services with specific channels that are serving the customer role. However, the focus is on the customer service path – on the customer journey, the customer perspective. As such, this approach is focusing on the outside-in approach, by linking the inside-out behavior and structure to customer facing process steps.

2.3.6 Layered View - Service Blueprint

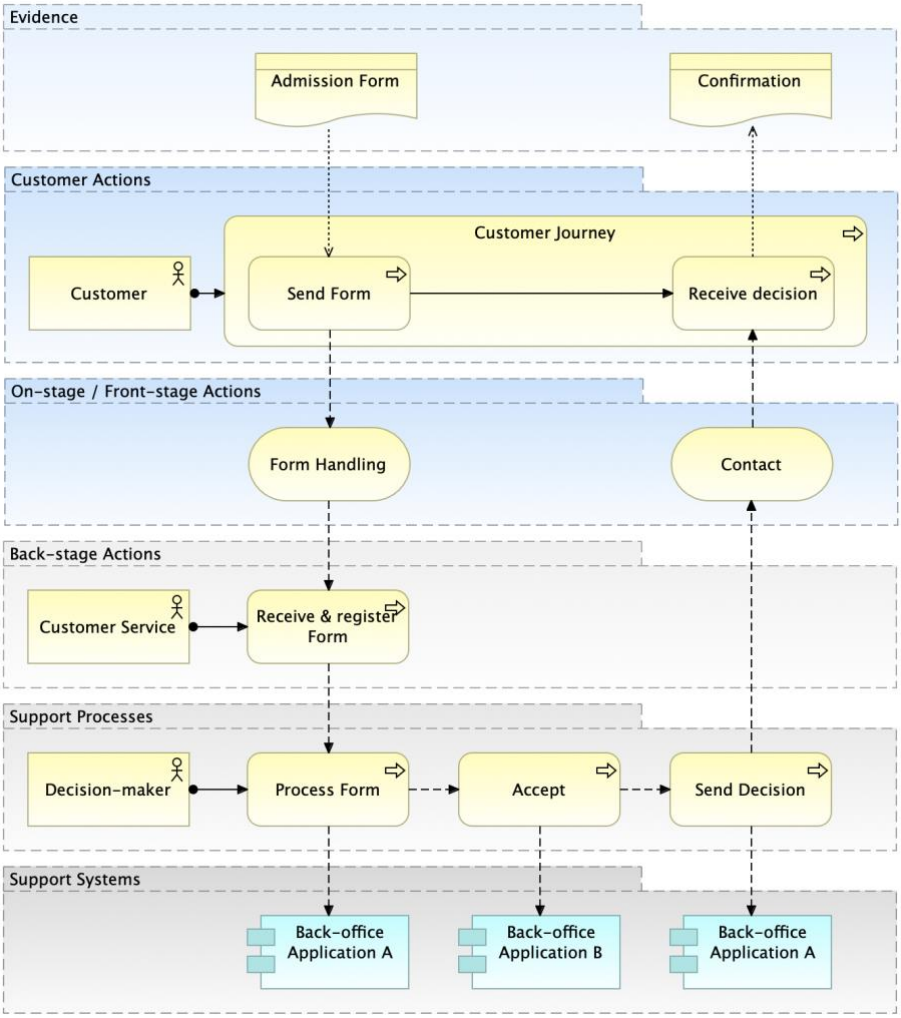


Figure 24: Service Blueprint - Example.

2.4 Interaction View (Co-operation View)

There are three variants of the *Interaction View* diagram type as follows:

1) Actor Interaction View,
2) Process Interaction View and
3) Application Interaction View.

The *Interaction View* (also known as *Co-operation View* or *Integration View*) can be used for modelling relationships between the actors, processes or applications. The main advantage of this diagram type is to visualize the direction of switching information, and to illustrate the amount of the interacting elements. This diagram type has been found very informative and the easiest way to visualize the complexity of the development target.

This diagram type is to be used for modelling WHAT information flows in WHICH direction, from WHERE to WHERE. This diagram type is not applied for modelling the “dynamics” of the information switching: which element starts the interaction or what interfaces are used.

The ArchiMate Flow-relationship type is used here to model the information flow between the elements. The “information” can also be modelled as ArchiMate Business Objects or Data Objects.

2.4.1 Actor Interaction (Co-operation) View

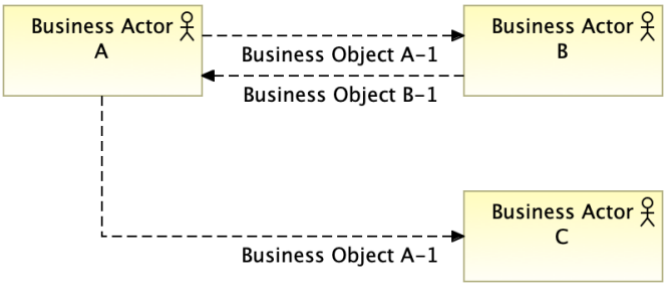


Figure 25: Actor Interaction (Co-operation) View - Design Pattern.

2.4.2 Process Interaction (Co-operation) View

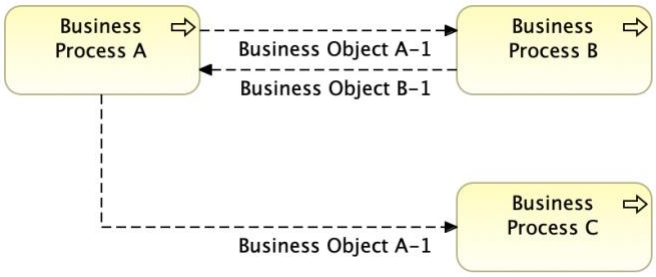


Figure 26: Process Interaction (Co-operation) View - Design Pattern.

2.4.3 Application Interaction (Co-operation) View

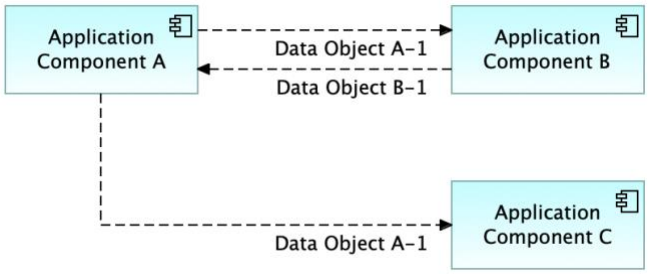


Figure 27: Application Interaction (Co-operation) View - Design Pattern.

This version of this diagram type is used for modelling application integrations at high level: what data flows from which application to which application, in which direction. For more detailed level integration modelling, these diagrams can be added with e.g. application interfaces or -services, and Trigger-relationships (see chapter 2.9.7).

2.5 Process View

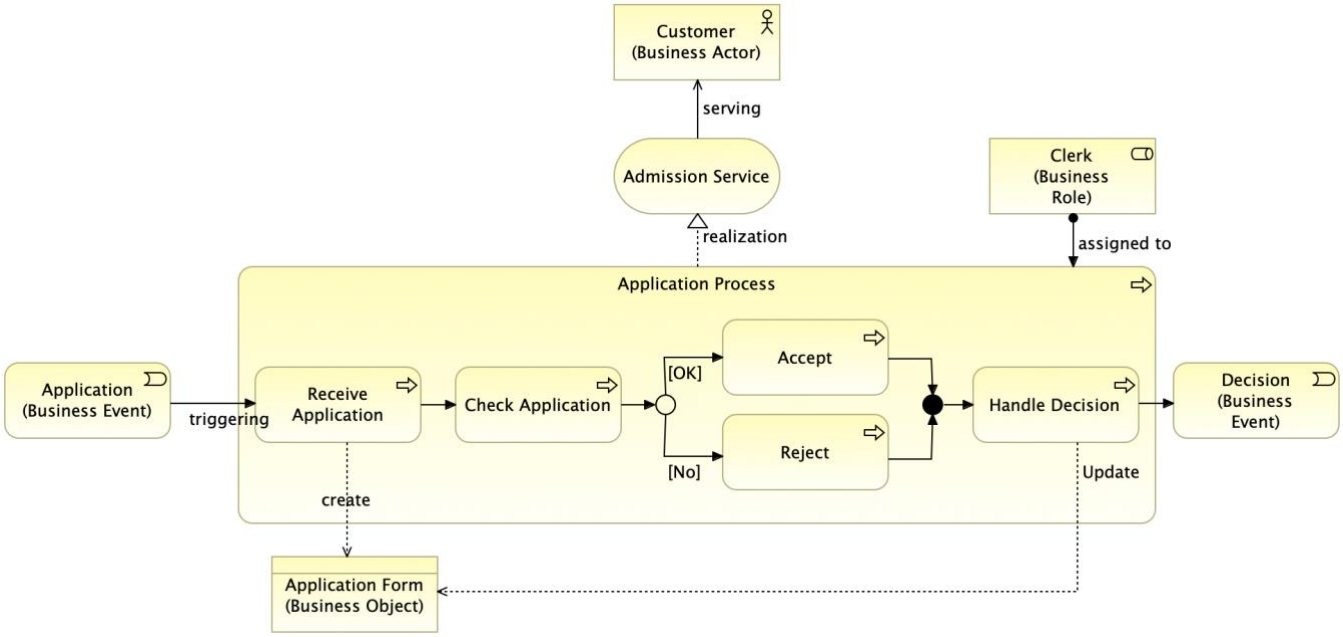


Figure 28: Process View - Example.

Process View is modelled with ArchiMate Business Layer -elements as follows: Business Process), Business Actor), Business Role, Business Object and Business Event. Relationship types are Trigger and Access.

2.6 Conceptual Data Model View

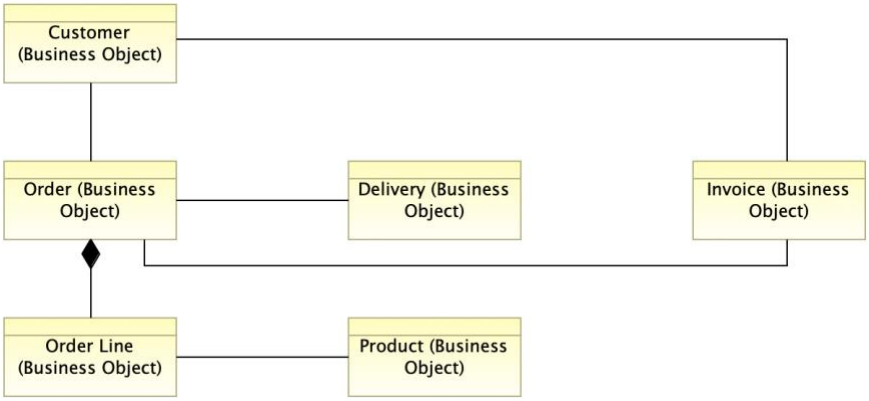


Figure 29: Conceptual Data Model View - Example.

The *Conceptual Data Model View* can be used for modelling the concepts and their relations of the development target.

This diagram type is modelled with ArchiMate Business Object -element, and Association, Composition, Aggregation and Specialization relationship types. Some tools allow cardinality indicators (such as “one”, “many”, “0..n”) to be modelled on both ends of the association relations between the elements.

2.7 Data Model View

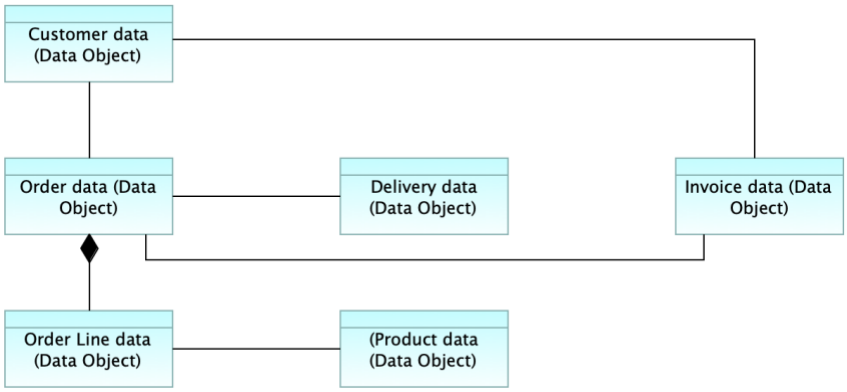


Figure 30: Data Model View - Example.

The *Data Model View* can be used for modelling the detailed, logical application level information and their relations of the development target.

This diagram type is modelled with ArchiMate Data Object -element and Association, Composition, Aggregation and Specialization relationship types. Some tools allow cardinality indicators (such as “one”, “many”, “0..n”) to be modelled on both ends of the association relations between the elements.

2.8 Technology Platform View (Infrastructure View)

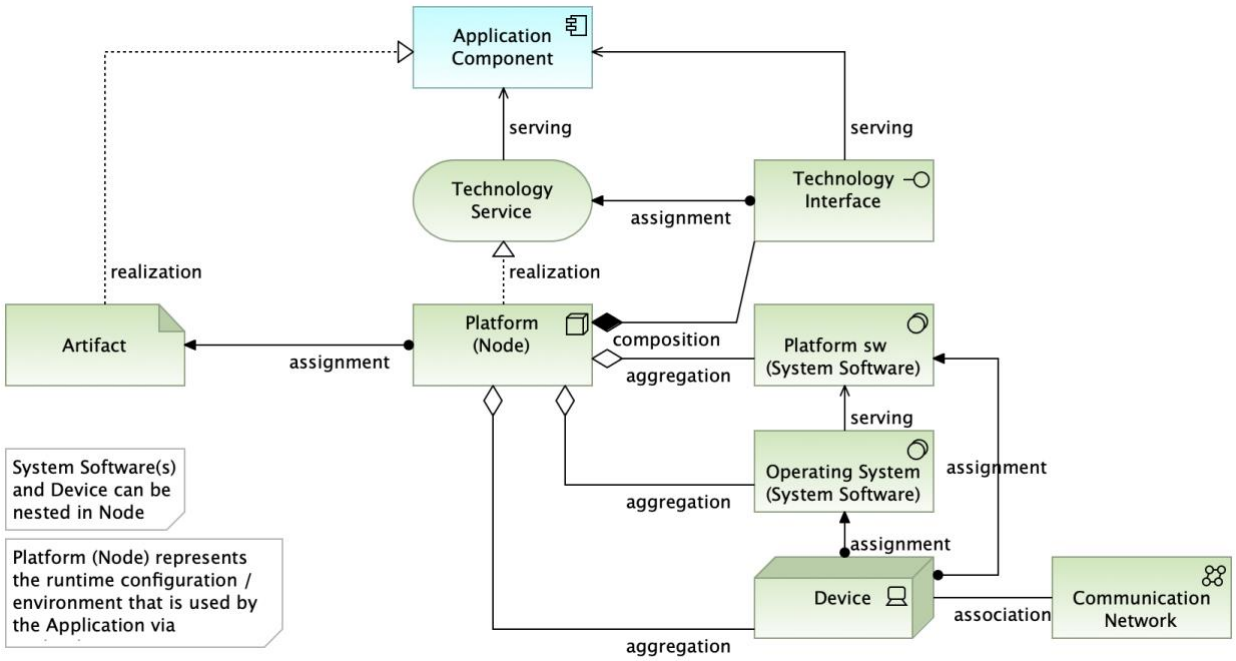


Figure 31: Technology Platform View - Design Pattern.

The *Technology Platform View* (Infrastructure View) can be used e.g. for modelling the underlying infrastructure and deployment of an application (softwares, servers, clustering, communication networks, load balancing etc.).

This diagram type is modelled with ArchiMate Technology layer elements such as Node, Technology Service, Artifact, Device, System Software, Technology Interface and Communication Network.

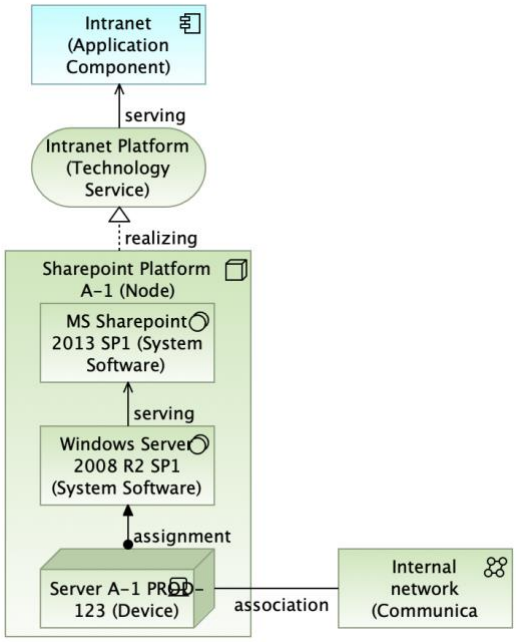


Figure 32: Technology Platform - Example.

2.9 Application Structure View (Solution Architecture View)

The Solution Architecture defines the behavior and structure of a single solution, which is a part of the Enterprise Architecture (EA). A solution is a logically and physically independent, autonomous building block of the organization wide EA. In the EA, a solution is a “black box”: its interfaces and services are interesting, but its internal structure is irrelevant. As such, a solution is the smallest meaningful unit of EA. EA is composed of solutions. A solution can also be comprised as a “system”, whereas EA is a “system of systems”. Systemic thinking takes the holistic view by identifying and considering all the aspects of business, application and technology.

Solution Architecture, instead, covers the application as a “white box”: its internal structure and interfaces with adjacent applications are interesting. The solution architecture comprehends the internal structure of an application: the modularization (sub-components and their services/interfaces and dependencies). In addition, the solution architecture typically takes the technology aspect into account - in the form of “technology platform”.

2.9.1 Application Design Pattern (Basic Model)

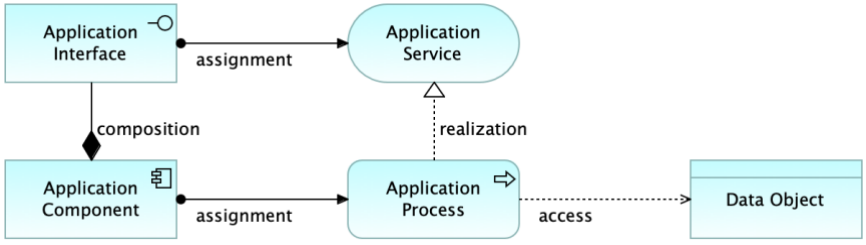


Figure 33: Application View - Design Pattern (Basic Model).

Solution Architecture modelling can be done with the elements of ArchiMate Business, Application and Technology layers. The logical view of the structure of a solution is modelled with ArchiMate Application layer elements such as Application Component, Application Service, Application Interface, Application Process and Application Function.

The logical structure of a solution is modelled with ArchiMate Application Component -elements. The internal behavior of an application is modelled with the Application Process and Application Function -elements. Provided services and interfaces (to adjacent solutions) are modelled with Application Service and Application Interface -elements. The Application Interface -element is used for modelling the user interfaces (GUIs) and app2app interfaces (APIs).

According to ArchiMate derivation rules (introduced in the ArchiMate specification), the basic application design pattern can be depicted as shown below.

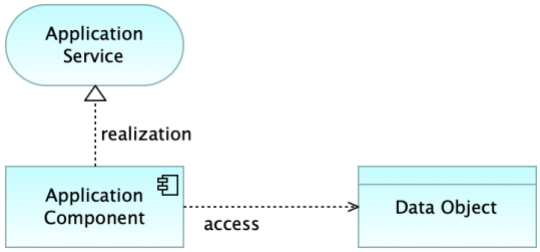


Figure 34: Application View - Design Pattern (Simplification of the Basic Model).

Note! Application services and application interfaces are the “different sides of the same coin”: a) *behavioral* services and b) *structural* interfaces. Both can be used for modelling the behavior of an application that is exposed for external use (interactions). Which one to use depends on the case. Application services can be used for modelling functional dependencies and interactions. Application interfaces instead, can be used for modelling concrete user interfaces (GUIs) or app2app interfaces (APIs) with operations. As such, application interfaces can be used for modelling actual dynamics between applications, or between users and applications. Access -relationship can be bi-directional (in case of read & write accessibility).

If an application interface is to be modelled instead of an application service, then the application interface is connected with the application component with a Composition -relation type (figure below).

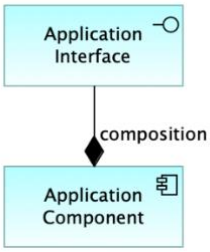


Figure 35: Application Component and (provided) Application Interface.

> **GUI** = Graphical User Interface, **API** = Application Programming Interface, both interfaces of an application. The former provides application services to the users, whereas the latter provides application services to other applications. According to ArchiMate specification: “An application interface represents a point of access where application services are made available to a user, another application component, or a node” [1].

2.9.2 Application Logical Structure View (Application Structure / Internal Structure)

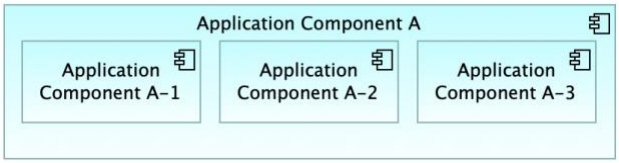


Figure 36: Application Logical Structure (functional decomposition into sub-components /modularization).

This view is useful in designing or understanding the main structure of an application and its sub-components and the associated data. This diagram can be used e.g. to break down the structure of the application system under construction, to illustrate modularization /decomposition: what are the sub-systems / sub-components what are the application services (or application interfaces) they provide. The sub-components are nested into the main component (Aggregation relationship).

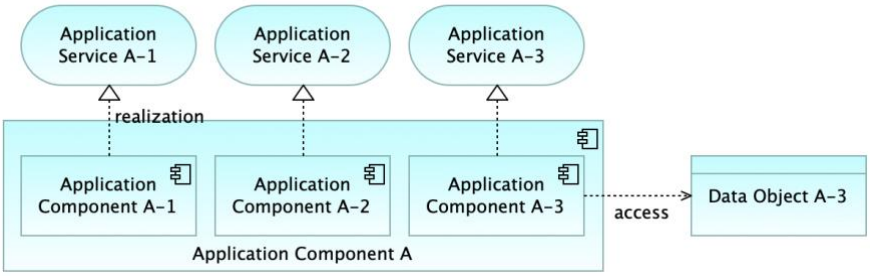


Figure 37: Application Logical Structure: sub-components and application services.

This view is useful in designing or understanding the main structure of an application, its sub-components and their functions. This diagram can be used e.g. to break down the structure of the application system under construction, to illustrate modularization (functional decomposition): what are the sub-systems / sub-components, what are the functions and application services (or application interfaces) they provide.

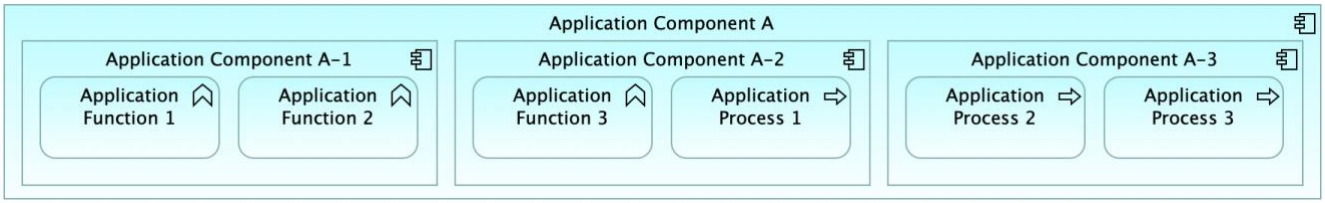


Figure 38: Application Logical Structure: Application Functions assigned to modules of an application (A).

Note! The behavior (functions) of an application can be modelled with either ArchiMate Application Function or Application Process -elements. The latter can also be used for modelling e.g. Robotic Process Automation (RPA) or (scheduled) batch-processing behavior.

2.9.3 Component Model (CM)

Application Component Model 0-n (CM 0-n) is an application architecture modelling approach, which consists of diagrams of different abstraction levels as follows:

- At Component Model 0 (**CM-0**) -level the diagram describes how the application interacts with its environment, what are the boundaries and interactions with adjacent applications and users. The target application is depicted as a *black-box*.
- At Component Model 1 (**CM-1**) -level the diagram describes how the target application is decomposed into modules (main components), their responsibilities, and what application services (or application interfaces) those modules provide and require. Logical decomposition of an application is based on the functional aspects, which typically relates to physical decomposition too. The target application is depicted as a *white-box*.
- At Component Model 2 (**CM-2**) -level, the diagrams describe how the main modules are decomposed into sub-components, and what are their responsibilities, services or interfaces.

The Application Component Model (CM) diagrams below consist of application components and application services. Alternatively, application interfaces can be used instead of application services depending on the case. As always, it is important to utilize such a modelling style what is appropriate for the purpose, and model only those elements that are relevant in the context, to fit for purpose. (Note! *Application* in this context is analogous to *solution* or *system*.)

2.9.3.1 Component Model - 0 (CM-0)

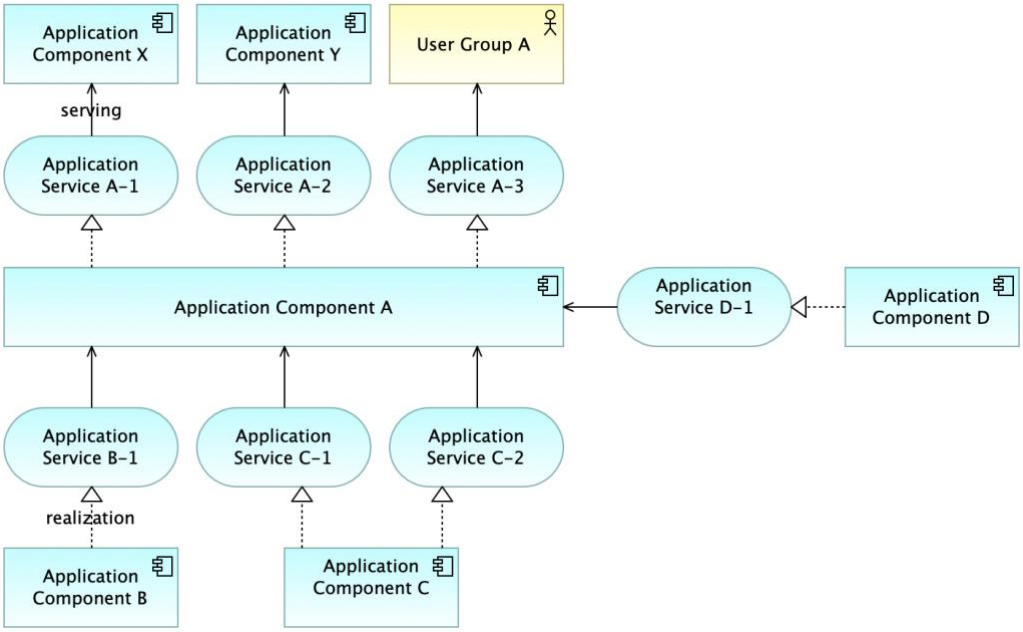


Figure 39: Component Model - 0 (CM-0).

The target application ”A” introduced in the middle of the diagram as a “black-box”, with all the application services it provides, and with all the required services, realized by adjacent applications. This is the Enterprise Architecture (EA) level view of the application: its internal structure is not relevant, but its services are.

2.9.3.2 Component Model - 1 (CM-1)

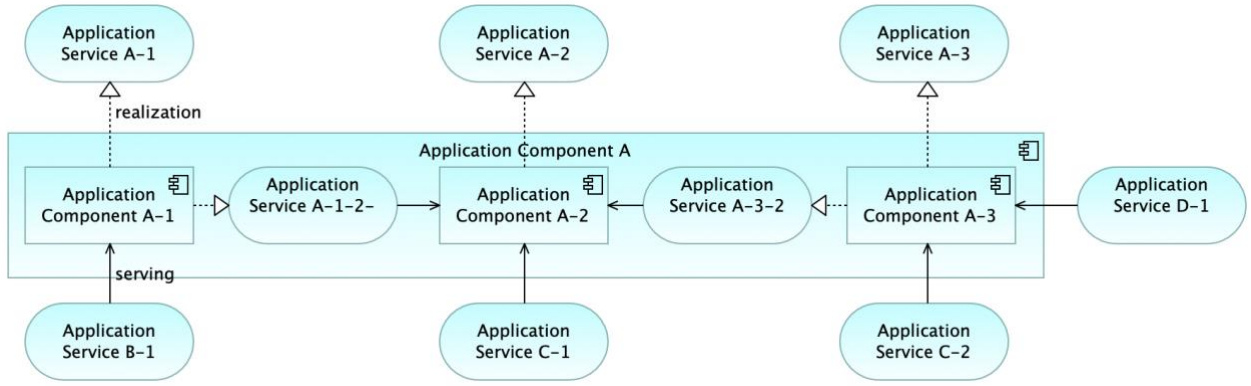


Figure 40: Component Model - 1 (CM-1).

The target application ”A” opened as a “white-box”, with all its internal sub-components (modules) shown with the services they provide and require. This is the Solution Architecture (SA) level view of the application: its internal behavior and structure is interesting (incl. e.g. internal application components, application processes, application functions, and application services or application interfaces they provide and require).

2.9.3.3 Component Model - 2 (CM-2)

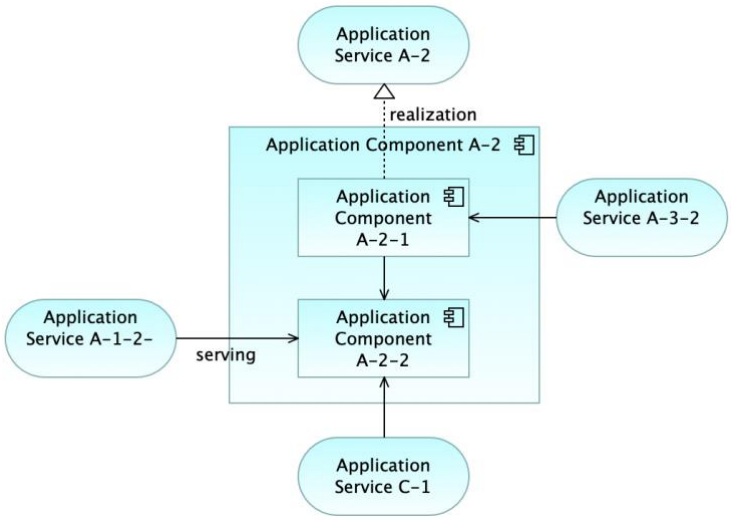


Figure 41: Component Model - 2 (CM-2).

One of the main components (“A-2”) of the application “A” opened in a more detailed diagram.

2.9.4 Database

A *database* is a meaningful unit in the overall enterprise architecture of an organization. E.g. “Client database” or “Customer database”, “Product database” etc. A *logical database* is a composition of all the tables of an application (e.g. “Customer table”, “Orders table”, “Invoices table” etc.), which altogether build up a *database*.

A logical database can be modelled on the application layer with a) Data Object- or b) Application Component-element. Which element to use, depends on what kind of database is in question: a) a passive structure or b) an active structure. Data Object is suitable for modelling the passive data itself: what is the data, how it is structured or composed (or aggregated) from other data objects, and what are the associations between these data objects. Application Component is suitable for modelling an active data structure that is capable of data management behavior such as data processing and/or data storing.

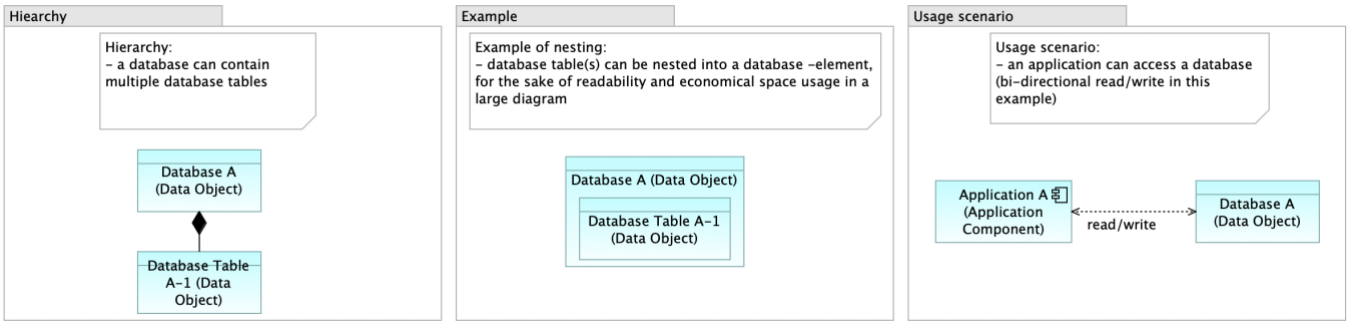


Figure 42: Modelling a logical database with ArchiMate.

A Data Object can be used for modelling for example a logical database, a database table, message structure (switched between applications) etc.

A Data Model View consists of database tables as shown below. (See also chapter 2.7).

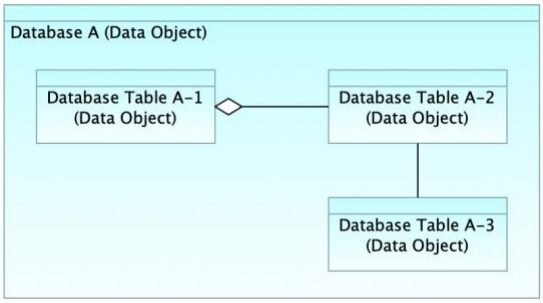


Figure 43: Data Model View.

A logical database can be modelled also with the Application Component, given that the database is capable of performing data processing or data storing. In such a case, a database is part of an application: a logical component of an application. (Other modular parts/components of an application can be for example “the front-end application” and “the business logic application”).

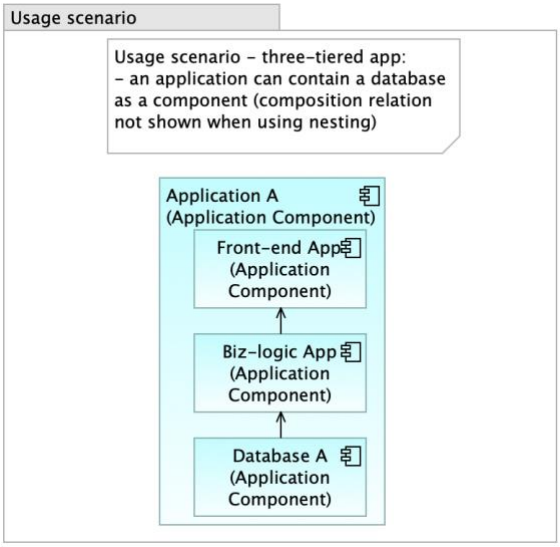


Figure 44: Database as a component of an application system.

In addition, a database can be modelled with technology layer elements such as Node, Artifact or System Software. All in all, there are several ways to model a database, depending on the abstraction level, as shown in the figure below. It depends on the case, from which viewpoint a database is to be modelled, e.g. from the application viewpoint as a logical entity, from technology viewpoint as a physical construct etc.

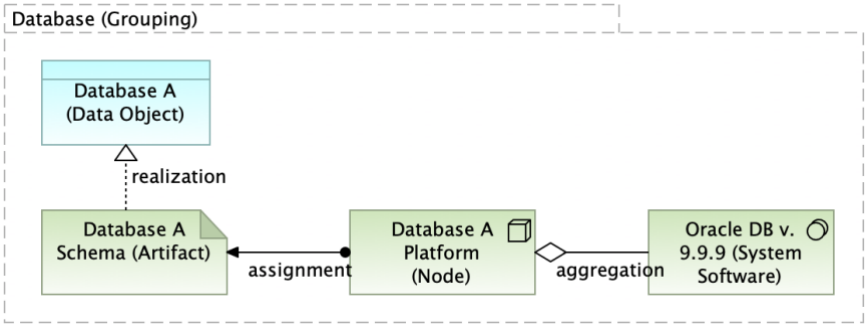


Figure 45: Database modelling in different abstraction levels.

2.9.5 Application Integrations

2.9.5.1 Application Interface and Synchronic Request-Reply Design Pattern

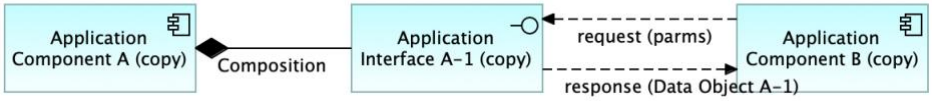


Figure 46: Application Interface and Synchronic Request-Reply Design Pattern.

This pattern illustrates the following system case:

> The application “A” provides the application interface “A-1”, which is used by application “B”. The application “B” calls the interface “A-1” and transfers parameters within the request message, and gets the response back within the message structure “Data Object A-1”. The application “B” is the active party that initiates the interaction (information switching).

This view is modelled with dynamic relations of ArchiMate: Trigger and Flow.

For more detailed Application Integration Patterns, see Appendix 2 (2.9.7).

2.9.5.2 ETL-Process

Figure 47: ETL-process - Design Pattern.

This ETL-process (Extract, Transform, Load) pattern view is modelled with Application Process and Data Object -elements. An ETL-process reads from the source table(s), performs some processing, and then writes to the target table(s) (figure above). The ETL-process can be assigned to the Application Component with Assignment-relationship (figure below). Note! Behavior (such as process or function) is always performed by an active structure element (e.g. an application component)!

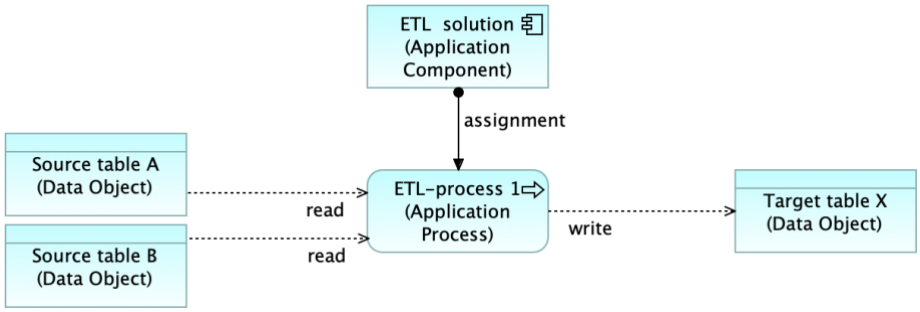


Figure 48: ETL-process, tables and assigned application.

2.9.6 Sequence Diagrams

2.9.6.1 Application Component Sequence Diagram View

Sequence diagrams are not exactly in scope of the ArchiMate (or EA), but instead, those are in scope of the UML (and SA). However, we can use ArchiMate for modelling sequences of actions taken by e.g. Application Components as shown below.

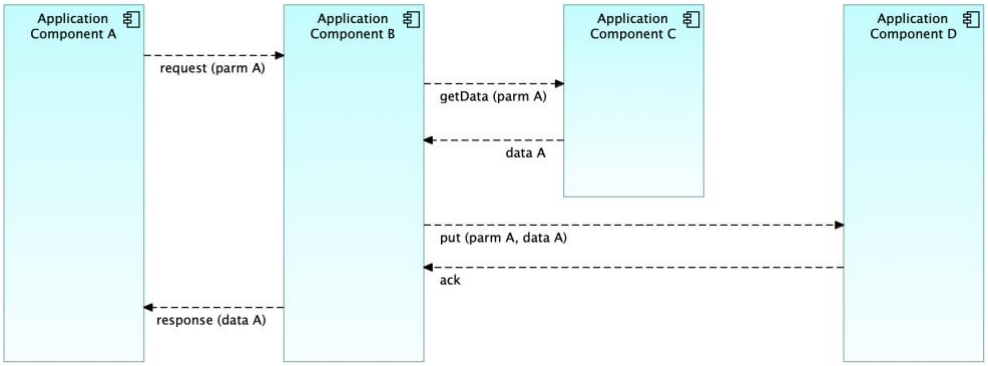


Figure 49: Application Sequence View.

Dynamic relations “Trigger” and “Flow” can be used for modelling dynamics between application components. The layout of this view can be positioned analogously to the UML sequence diagram.

2.9.6.2 Application Component Sequence Diagram View 2

This version (diagram below) illustrates how ArchiMate can be used for modelling sequences of actions taken by internal parts of Application Components. The internal parts are such as a) behavioral processes or functions and b) structural sub-components. These are modelled with Application Process-, Application Function- and Application Component -elements. Those are shown here just as alternatives.

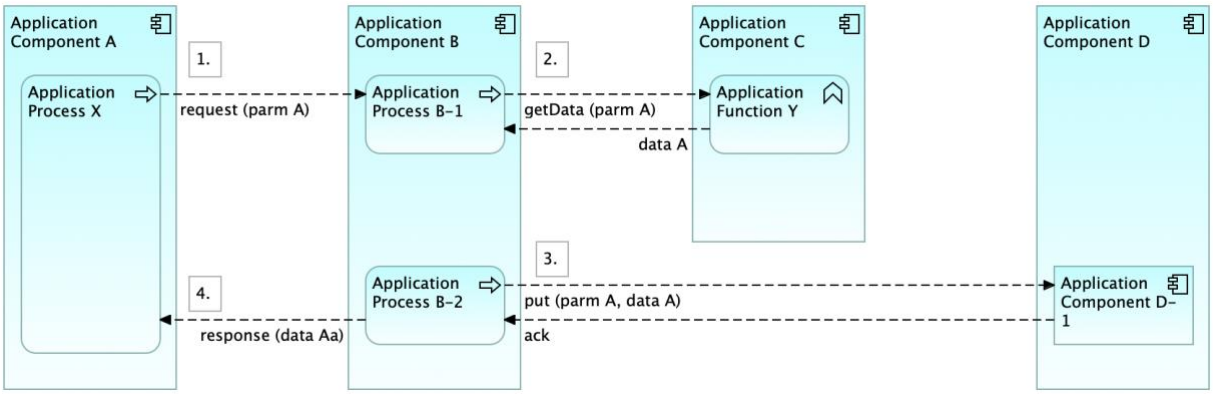


Figure 50: Application Sequence View (2).

The flow of actions in this sequence diagram (above):

1. The Application Component A’s sub-process X sends a request message with parameter A to the Application B.
2. The Application Component B’s sub-process B-1 receives the incoming request, and then calls (synchronously) Application Component C, in which Application Function Y receives the request, performs some actions and responds back.
3. The Application Component B’s other sub-process B-2 sends a message with parameters to the Application Component D, and then receives an acknowledgment. The Application Component D contains a sub-component that executes the processing.
4. The Application Component A receives the response message from the Application Component B.

As shown here, we can model quite complex integration mechanisms with a combination of these elements (Application Component, Application Process and Application Function and relations (Trigger, Flow). UML sequence diagram has its own specialized purpose in software design, but ArchiMate can be utilized in quite a many modelling purposes - also in application design.

Application integration is one of the most important parts of the enterprise architecture. That is why it is advantageous if we can model more detailed how applications switch data, and what are the interaction mechanisms used. A good source to dive into integration patterns, see “Enterprise Integration Patterns” -book, here is the link: https://www.enterpriseintegrationpatterns.com/ .

2.9.7 Application Integration Patterns

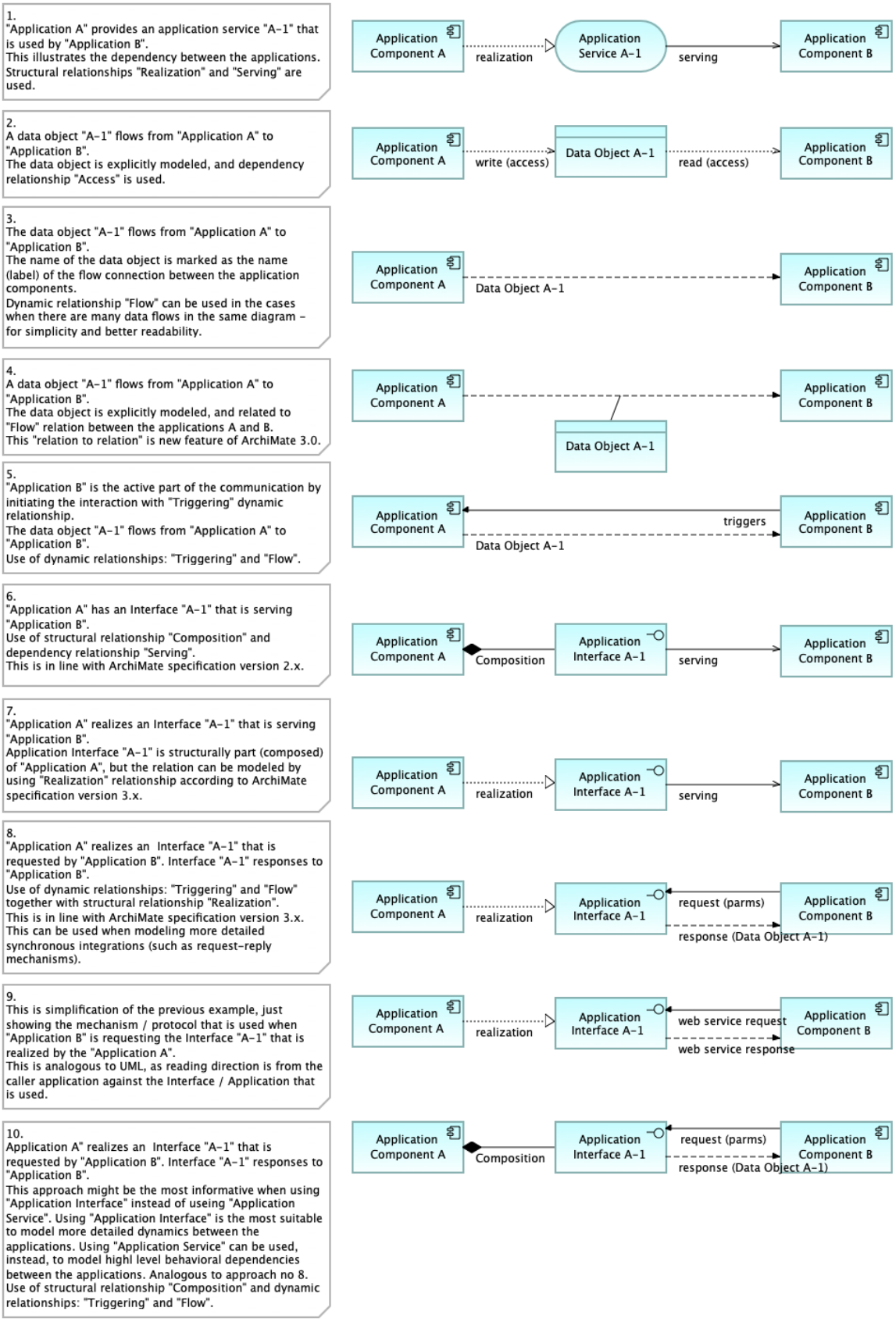


Figure 51: Application Integration Patterns.

2.9.8 Use Case View

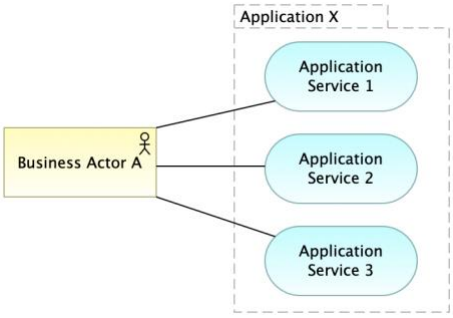


Figure 52: Use Case View - Design Pattern.

ArchiMate can be used for modelling the use case diagrams. A business actor can be associated with the application services, which represent the use cases of the target application. These application services are the functionalities of the target application, and they can be used in other diagrams (such as Layered View).

The intrinsic value of this approach: we can use ArchiMate throughout the design cycle. From the business requirements gathering phase to the further detailed design phase. The same language, the same tool. No need for switching between UML and ArchiMate, or from one tool to another[1]. Application services can be used when we initially define what the application should do, and how the user roles use the application, and then finally, these already identified application services can be used in later design phases within diverse diagram types.

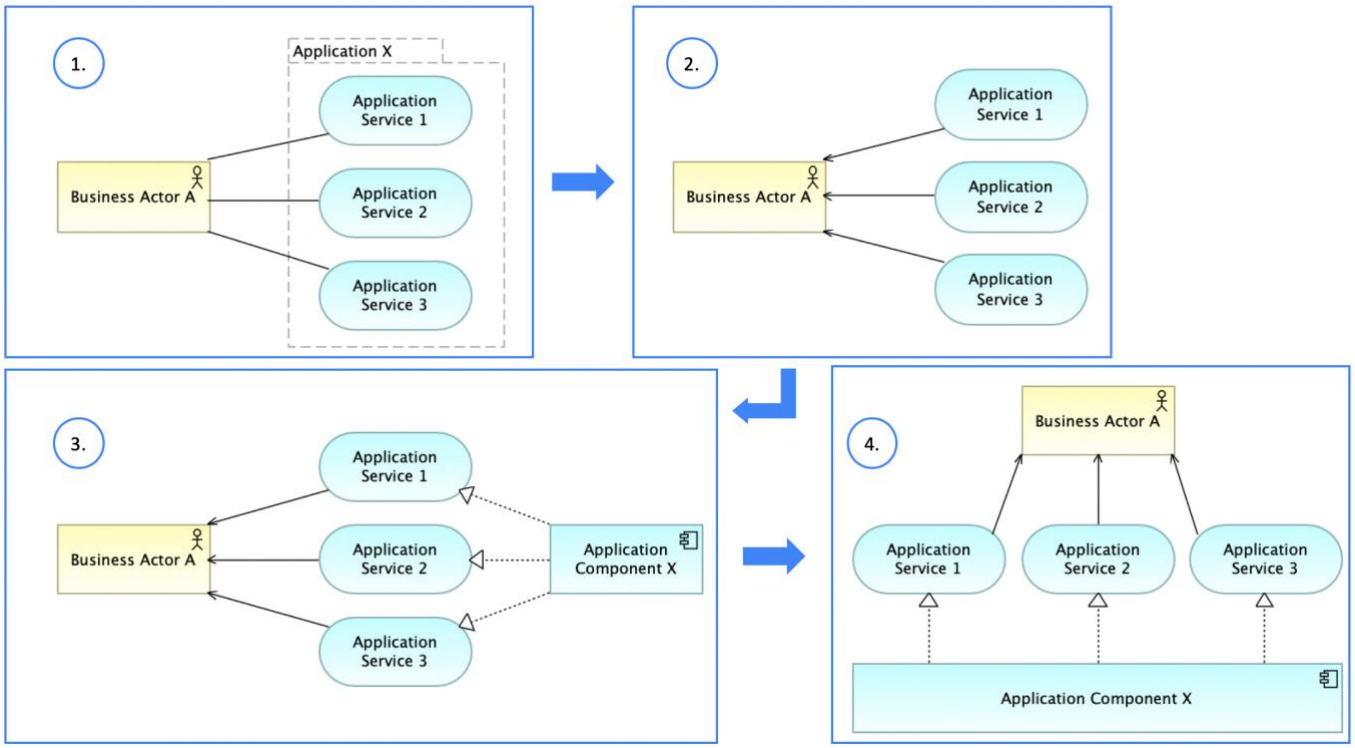


Figure 53: Use Case Analysis Views.

Use Case analysis can be performed by the following steps:

1. Use Cases are identified by using application services (analogous to UML Use Case Diagram)
2. Relation types are changed from *Association* to *Serving* (optional step)
3. Application is added to realize the application services (optional step)
4. Elements are positioned on the Layered View layout.

[1] Some tools support many notations such as ArchiMate, BPMN and UML, like Sparx EA for example.

The diagrams 1-4 above are just mentioned here for information. Diagrams 1 and 4 can be kept as part of the documentation of the target application (here: Application Component X).

2.9.8.1 Use Case View - Example

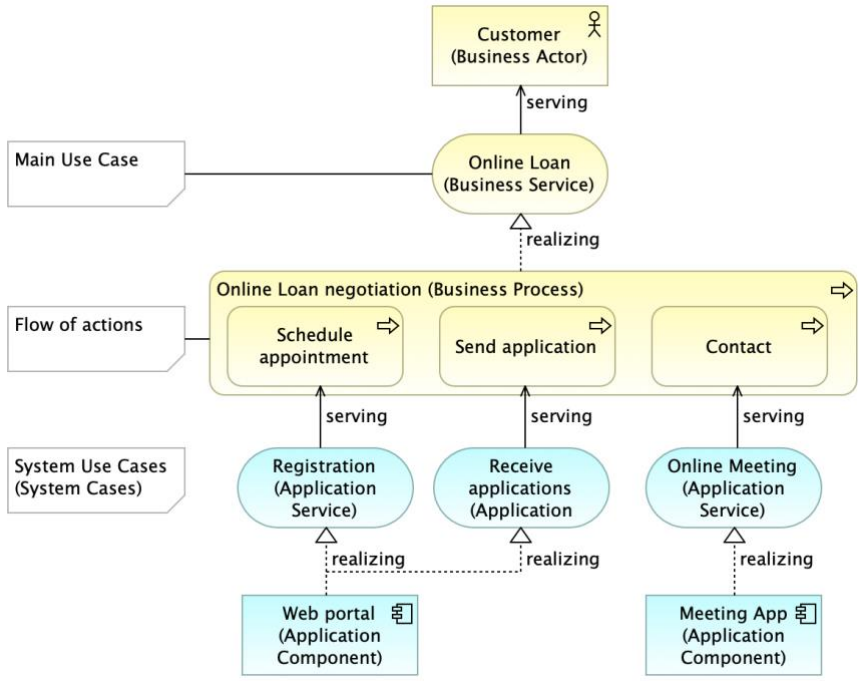


Figure 54: Use Case View - Example.

A use case can be depicted with a layered view (figure above). The main use case can be modelled as a Business Service, the flow of actions can be modelled with Business Process -elements, and the related system-level use cases (a.k.a. System Cases) can be modelled with Application Service -elements.

The diagram below just illustrates how we can use add-on visual elements to point which elements are identified as new or modified parts of the development target area (the problem domain).

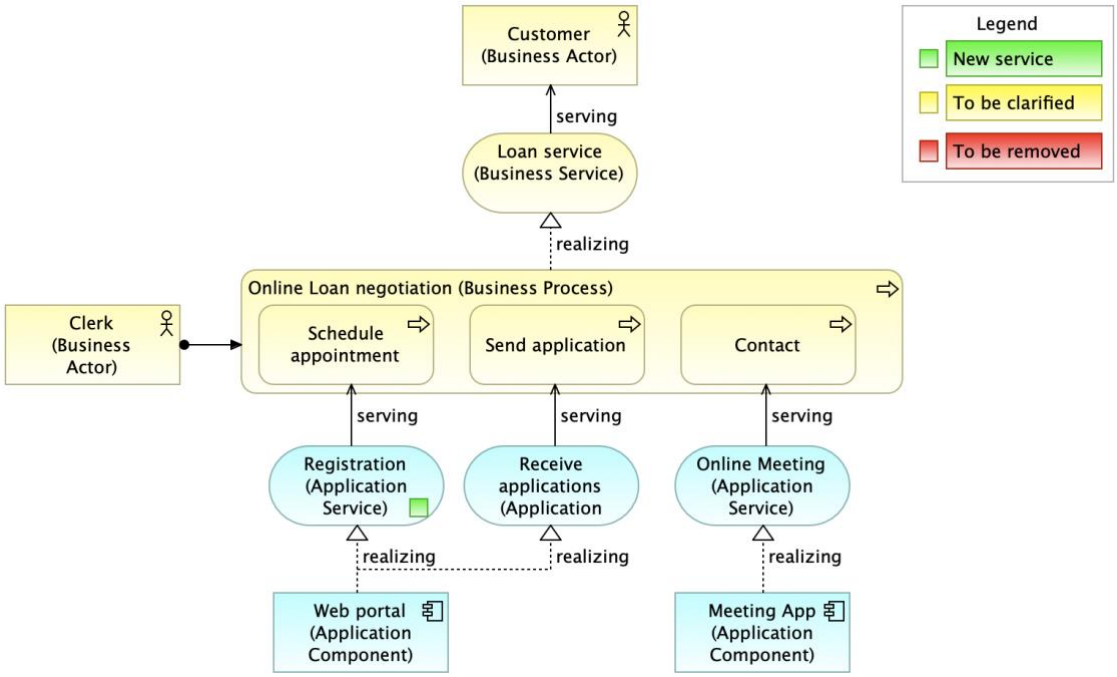


Figure 55: Use Case View - Example 2.

Once again we can see how the layered view can be applied to diverse modelling needs (=“use cases”).

3. ArchiMate-Elements (subset)

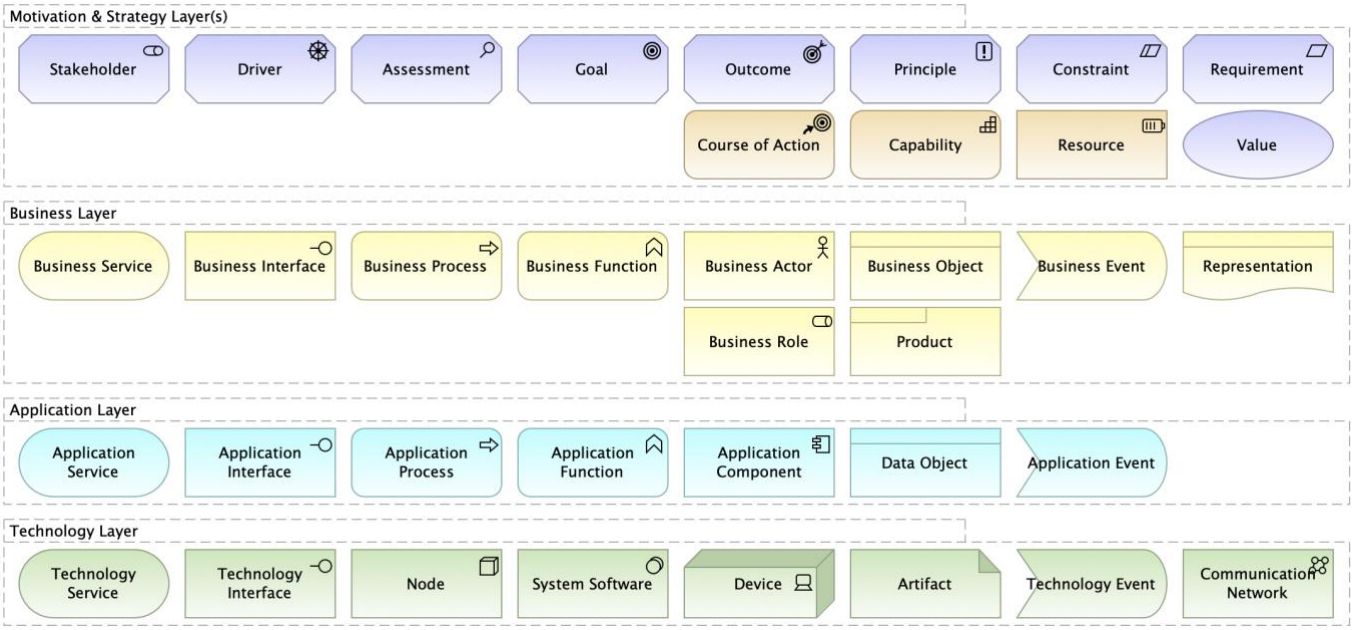


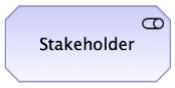
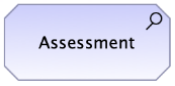
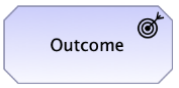
Figure 56: Subset of ArchiMate-elements.

These ArchiMate-elements covers the most cases (80% of diagrams can be modelled with these elements).

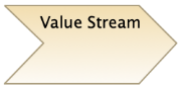
The subset of ArchiMate -elements are introduced in the following tables (based on ArchiMate specification [1]). ArchiMate-elements are grouped into following categories: active structure, behavior and passive structure. In addition, there are certain composite elements as follows: Grouping, Location and Product.

Active structure element can be regarded as a “subject”, behavior element as a “predicate” (verb”), and passive structure element as an “object”.

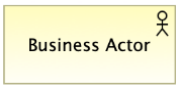
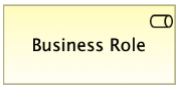
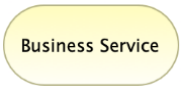
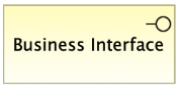
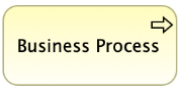
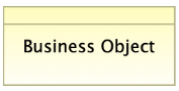
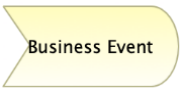
3.1 ArchiMate Motivation -Elements

ArchiMate Motivation- Elements (Motivation View) - Motivation Aspect		
Name	**Description**	**Symbol**
Stakeholder	The role of an individual, team, or organization that represents their interests in the outcome of the architecture (development target).	
Driver	An external or internal condition that motivates an organization to define its goals and implement the changes necessary to achieve them. Defines the WHY a change is important.	
Assesment	The result of an analysis of the state of affairs of the enterprise with respect to some driver. Can be used e.g. in SWOT-analysis.	
Goal	A high-level statement of intent, direction, or desired end state for an organization and its stakeholders.	
Outcome	An end-result that has been achieved. High-level, business-oriented results produced by capabilities, tangible, possibly quantitative.	
Principle	A qualitative statement of intent that should be met by the architecture.	
Requirement	A statement of need that must be met by the architecture.	
Constraint	A factor that prevents or obstructs the realization of goals.	
Value	The relative worth, utility, or importance of a core element or an outcome.	

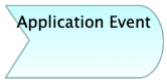
3.2 ArchiMate Strategy -Elements

ArchiMate Strategy Layer -Elements - Strategy Layer		
Name	**Description**	**Symbol**
Course of Action [behavior]	An approach or plan for configuring some capabilities and resources of the enterprise, undertaken to achieve a goal. Can be categorized as strategies and tactics	
Capability [behavior]	An ability that an active structure element, such as an organization, person, or system, possesses.	
Resource [structure]	An asset owned or controlled by an individual or organization. Can be classified into tangible assets – financial assets (e.g., cash, securities, borrowing capacity), physical assets (e.g., plant, equipment), intangible assets (technology; e.g., patents, copyrights, trade secrets; reputation; e.g., brand, relationships; culture), and human assets (skills/know-how, capacity for communication and collaboration, motivation).	
Value Stream [behavior]	Represents a sequence of value-adding activities that achieve a specific result that is of value to a stakeholder. to a stakeholder. (ArchiMate 3.1 -version).	

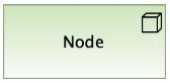
3.3 ArchiMate Business Layer -Elements

ArchiMate Business Layer -Elements - Business Layer		
Name	**Description**	**Symbol**
Business Actor [active structure]	A business entity that is capable of performing behavior.	
Business Role [active structure]	The responsibility for performing specific behavior, to which an actor can be assigned, or the part that an actor plays.	
Business Service [behavior]	An explicitly defined exposed business behavior.	
Business Interface [active structure]	A point of access where a business service is made available to the environment. Often referred to as a *channel* (telephone, Internet, local office, etc.). The same business service may be exposed through different interfaces.	
Business Process [behavior]	A sequence of business behaviors that achieves a specific outcome such as a defined set of products or business services.	
Business Function [behavior]	A collection of business behavior based on a chosen set of criteria (typically required business resources and/or competencies), closely aligned to an organization, but not necessarily explicitly governed by the organization.	
Business Object [passive structure]	A concept used within a particular business domain.	
Business Event [behavior]	A business behavior element that denotes an organizational state change. It may originate from and be resolved inside or outside the organization.	

3.4 ArchiMate Application Layer -Elements

ArchiMate Application Layer -Elements - Application Layer		
Name	**Description**	**Symbol**
Application Service [behavior]	An explicitly defined exposed application behavior.	
Application Interface [active structure]	A point of access where application services are made available to a user, another application component, or a node.	
Application Component [active structure]	An encapsulation of application functionality aligned to implementation structure, which is modular and replaceable. It encapsulates its behavior and data, exposes services, and makes them available through interfaces.	
Data Object [passive structure]	Data structured for automated processing. A “Data entity”. Represents e.g. database, database table, message etc.	
Application Process [behavior]	A sequence of application behaviors that achieves a specific outcome.	
Application Function [behavior]	Automated behavior that can be performed by an application component.	
Application Event [behavior]	An application behavior element that denotes a state change.	

3.5 ArchiMate Technology Layer -Elements

ArchiMate Technology Layer -Elements - Technology Layer		
Name	**Description**	**Symbol**
Technology Service [behavioral]	An explicitly defined exposed technology behavior.	
Node [active structural]	A computational or physical resource that hosts, manipulates, or interacts with other computational or physical resources. Active structure elements that perform technology behavior and execute, store, and process technology objects such as artifacts. For instance, nodes are used to model application platforms, defined by the TOGAF framework as: “a collection of technology components of hardware and software that provide the services used to support applications”.	
System Software	Software that provides or contributes to an environment for storing, executing, and using software or data deployed within it.	
Device	A physical IT resource upon which system software and artifacts may be stored or deployed for execution.	
Communication Network	A set of structures that connects computer systems or other electronic devices for transmission, routing, and reception of data or data-based communications such as voice and video.	
Artifact	A piece of data that is used or produced in a software development process, or by deployment and operation of an IT system. It is typically used to model (software) products such as source files, executables, scripts, database tables, messages, documents, specifications, and model files.	

4. ArchiMate Relationships

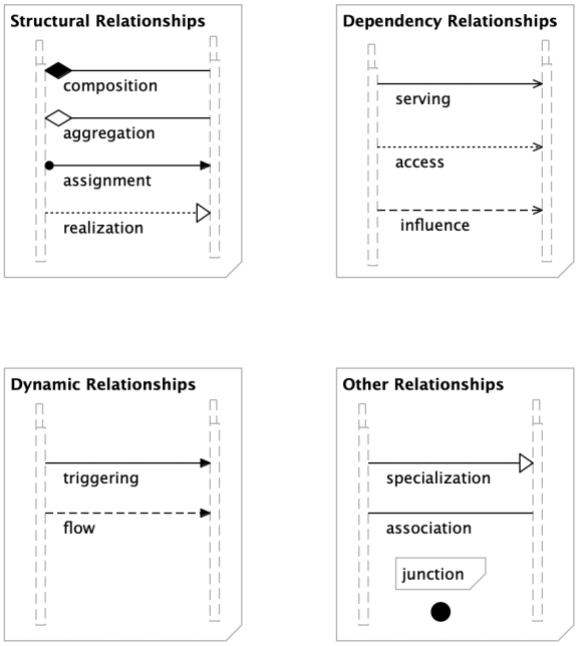
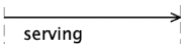
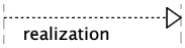
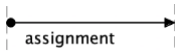
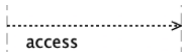
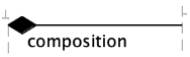
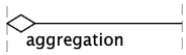
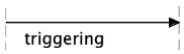
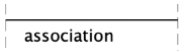


Figure 57: ArchiMate -Relationships.

ArchiMate relationship types are used for modelling a) structural- b) dependency c) dynamic and d) other relations between the elements ([1]). Relations are introduced in the following table.

ArchiMate Relationships		
Name	**Description**	**Symbol**
Serving [dependency]	Dependency relation between the elements: an element provides its functionality to another element.	
Realization [structural]	Structural relation between the elements: an element realizes another, more abstract element.	
Assignment [structural]	Structural relation between the elements: an active structural element is allocated as “doer” to another element.	
Access [dependency]	Dependency relation between the elements: the ability of *behavior* and *active structure* elements to observe or act upon *passive structure* elements.	
Composition [structural]	Structural relation between the elements: an element consists of one or more other elements.	
Aggregation [structural]	Structural relation between the elements: an element groups a number of other elements.	
Flow [dynamic]	Dynamic relation between the elements: represents transfer from one element to another.	
Trigger [dynamic]	Dynamic relation between the elements: a temporal or causal relationship between elements.	
Association	An unspecified relationship, or one that is not represented by another ArchiMate relationship - always allowed between two elements.	

5. Metamodel

5.1 Metamodel - Core

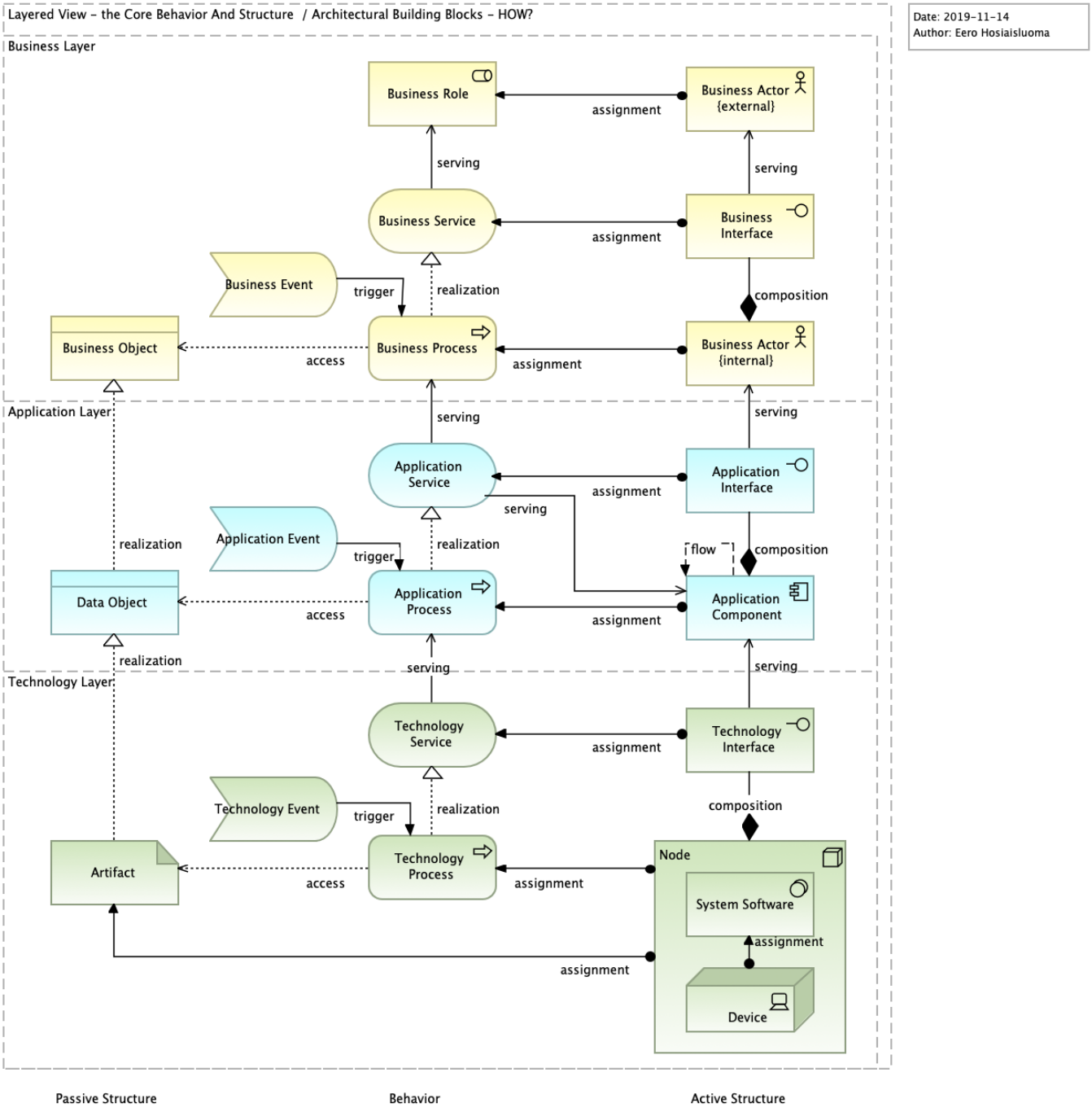


Figure 58: Metamodel - Compact (with subset of ArchiMate core elements).

Note! The behavior of a structure element (such as Business Actor, Application Component or Node) can be modelled with Process or Function -elements on each layer. For the sake of simplicity, this figure introduces Process -elements on each layer, namely: Business Process, Application Process and Technology Process. Thus, Business Function, Application Function or Technology Function can be used when appropriate, accordingly.

This applies both to the core metamodel (figure above) and also to the full metamodel (figure below).

5.2 Metamodel - Full

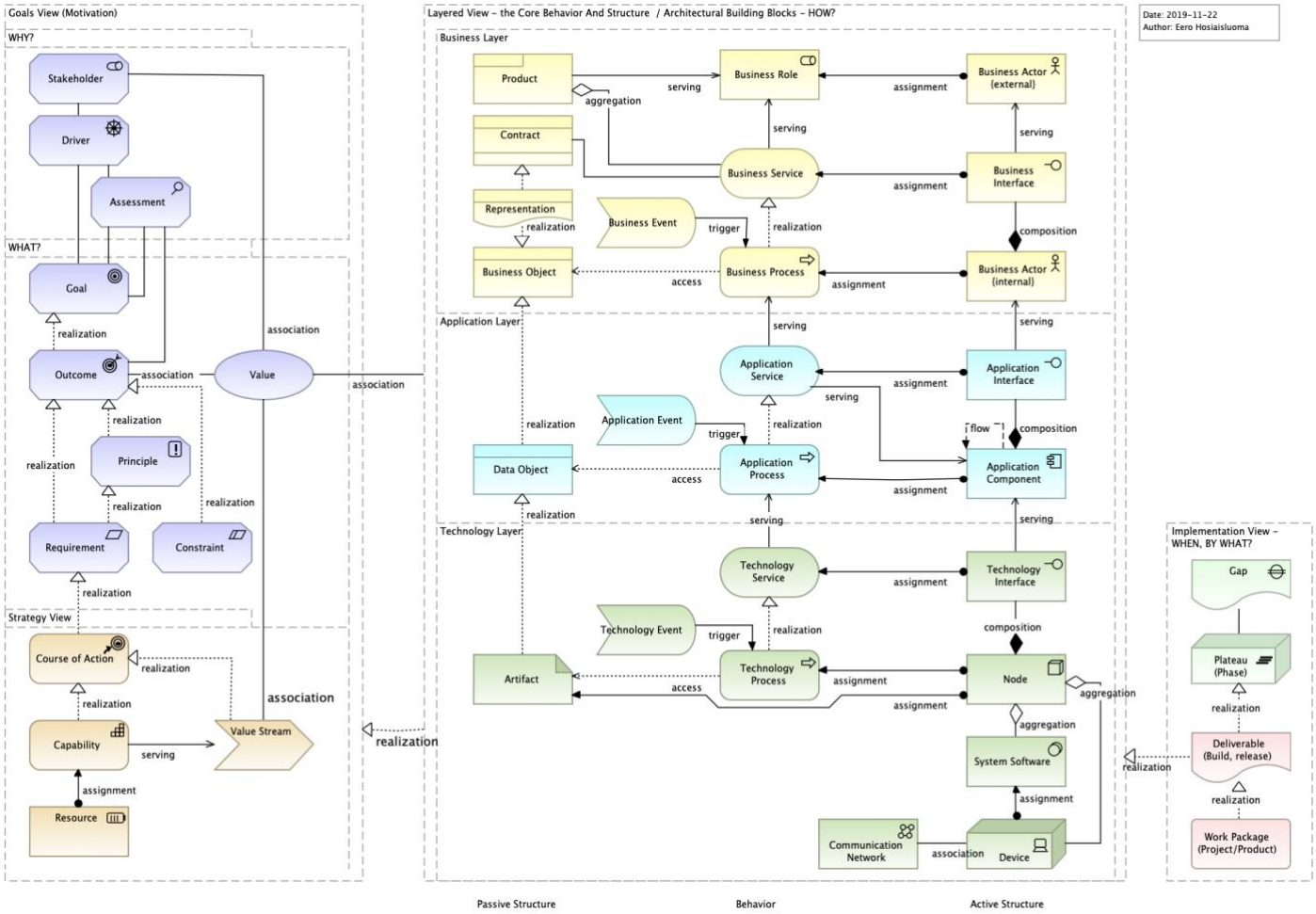


Figure 59: Metamodel - Extended.

6. Diagram Types

The most essential diagram types that tackle most (80%) of the modelling requirements are as follows:

A. The most useful diagrams:

1. Motivation View (Goals View) [2.1]
2. Layered View [2.3]
3. Interaction View (Co-operation diagram) [2.4]
    a. Actor Interaction View (Actor Co-operation diagram) [2.4.1]
    b. Process Interaction View (Process Co-operation diagram) [2.4.2]
    c. Application Interaction View (Application Co-operation diagram) [2.4.3]
4. Conceptual Data Model View [2.6]

B. Also valuable diagrams:

5. Data Model View [2.7]
6. Technology Platform View (Infrastructure View) [2.8]

C. Additional diagrams:

7. Application Structure View [2.9]
8. Process View [2.5]
9. Business Model Canvas (BMC) [2.2.1]
10. Service Blueprint [2.3.6]
11. SIPOC [7.7]

These diagram types are introduced in this document.

6.1 Basic Views

Basic Views (Diagram Types)		
#	**Name**	**Description**
1	Motivation View	Analysis view of the concept incl. drivers, goals, outcomes etc.
2	Layered View	An overview (the context) of the concept.
3	Conceptual Data Model View	Conceptual model of business objects and their relations at high-level.
4	Actor Interaction View	Information flows between business actors (such as organizations).
5	Process Interaction View	Information flows between processes (the *operating model*).
6	Application Interaction View	Data flows between applications at high-level: the business view.
7	Application Integration View	Data flows between applications at detailed level with the application interfaces, protocols etc. The Solution Architecture (SA) version of the Application Interaction View.
8	Application Structure View	Internal logical structure of an application, the Solution Architecture (SA). Incl. e.g. Component Model (CM) 0-n diagrams.
9	Technology Platform View	Technology platform of an application.

6.2 Business Model Views

Business Model Views (Diagram Types)		
#	**Name**	**Description**
1	Business Model Canvas (BMC)	Template for developing new or documenting existing business models at one page.
2	SIPOC	Suppliers, Inputs, Process, Outputs, Customers -diagram can be used for defining elements common to all processes. This is an easy tool for analyzing the business case: what is the value the customer gets and how.

6.3 Customer Views

Customer Views (Diagram Types)		
#	**Name**	**Description**
1	Customer Journey	A view for defining the customer path through certain business service(s).
2	Service Blueprint	A layered template for analyzing elements that are related to a service path: intra-organizational business services and -processes, applications etc.

6.4 Maps

Maps (Diagram Types)		
#	**Name**	**Description**
1	Strategic Goals	Map of strategic goals of an organization or an organization unit / domain.
2	Principles	Map of development principles of an organization or an organization unit / domain.
3	Value Streams Map	Map of value streams of an organization or an organization unit / domain.
4	Capability Map	Map of business capabilities of an organization or an organization unit / domain.
5	Resources	Map of resources of an organization or an organization unit / domain.
6	Business Actor Map	Map of business actors, internal and external to an organization or an organization unit / domain.
7	Business Service Map	Map of business services of an organization or an organization unit / domain.
8	Business Process Map	Map of business processes of an organization or an organization unit / domain.
9	Business Function Map	Map of business functions of an organization or an organization unit / domain.
10	Business Concept Map	Map of business concepts of an organization or an organization unit / domain.
11	Application Map	Map of applications of an organization or an organization unit / domain, grouped by certain business relevant criteria such as business service area.
12	Application Service Map	Map of application services of an organization or an organization unit / domain.
13	Data Object Map	Map of data objects of an organization or an organization unit / domain.
14	Technology Map	Map of technologies of an organization or an organization unit / domain.

6.5 Solution Architecture Views

Solution Architecture Views (Diagram Types)		
#	**Name**	**Description**
1	Component Model	Decomposition of a solution into sub-components (modules, sub-systems).
2	Sequence Diagram	Information switching (method/procedure calls) between the components.
3	State Diagram	State machine: state transitions of a data object (e.g. class).

Some of the Solution Architecture (SA) level diagrams are exactly the same as on the EA level. However, these diagrams mentioned in the table above are typical to the solution level. The diagrams 1 and 2 can be modelled with the Application Components.

7. Frameworks, Methods & Tools

7.1 Lean EA Framework (LEAF)

The ***Lean Enterprise Architecture Framework (LEAF)*** can be used for visualization of overall aspects from ideas to production. The idea behind this LEAF is to manage end to end value delivery chains of any kind of development targets, such as services. The LEAF consists of three layers as follows: 1) Management, 2) Value Delivery Chain and 3) Operational Development - Architecture Landscape.

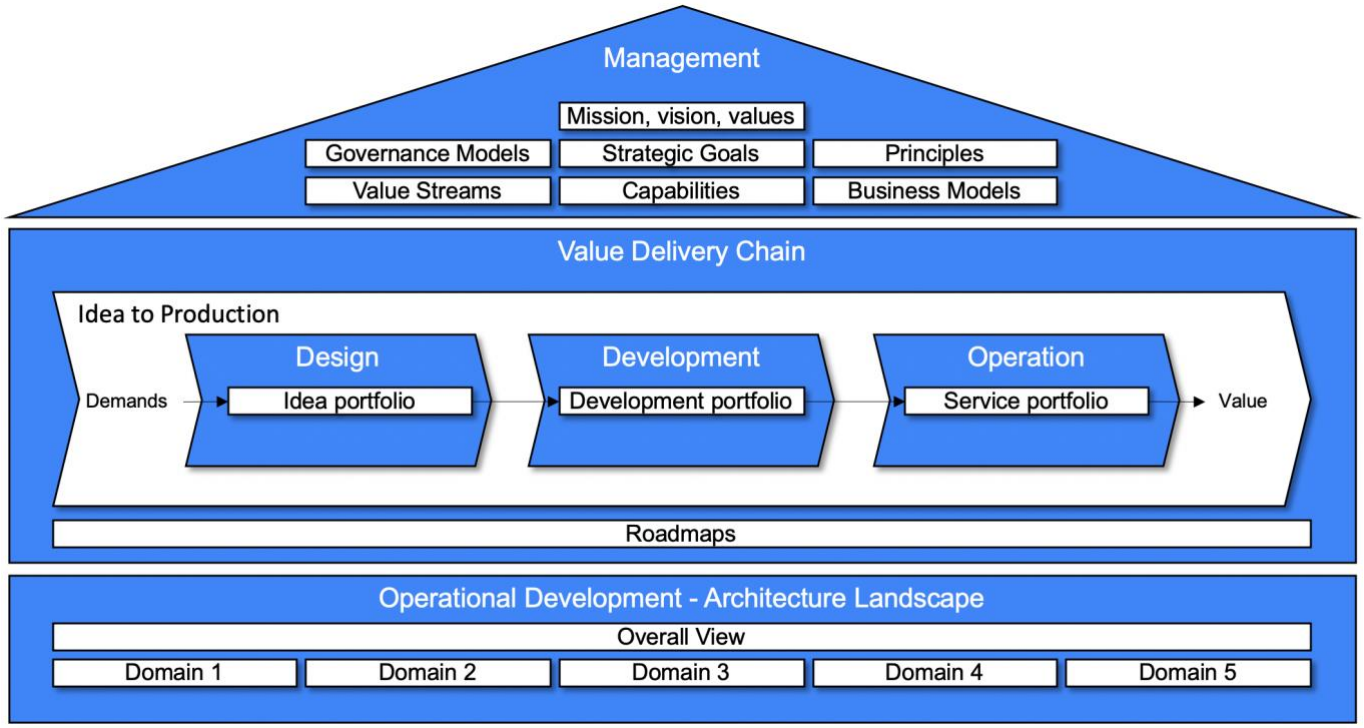


Figure 60: LEAF - Level-1 (the business view).

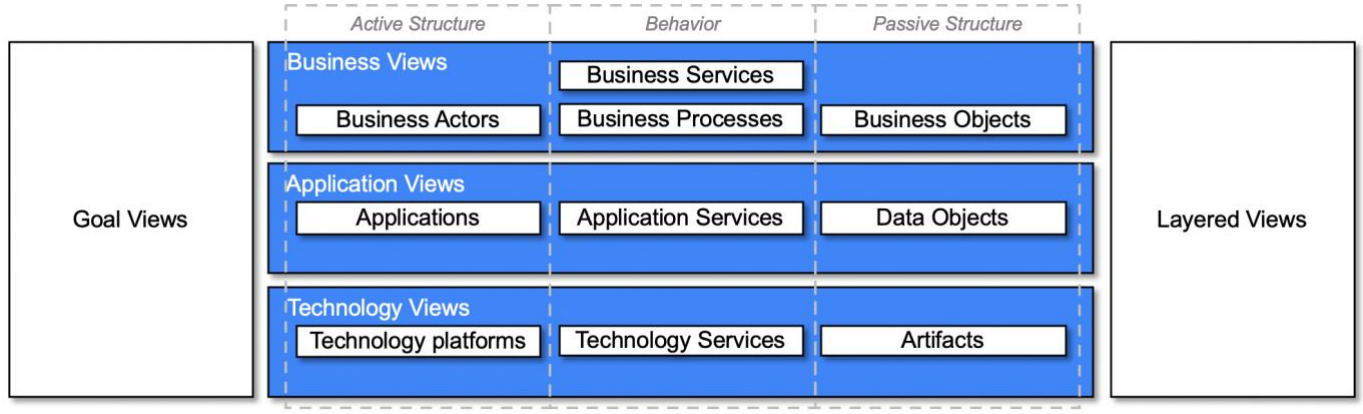


Figure 61: LEAF - Level-2 (the EA content view).

The LEAF supports the ***BizDevOps*** -approach, in which business- and customer-driven demand- and requirements management is supported by architecture in the Design -phase. The Development and Operations -phases are aligned with the *DevOps* -approach. The Level-1 of the LEAF-framework consists of management framework, business development framework, development framework and the EA content framework, which is grouped based on the organization-specific domain-structure (e.g. business units, business service areas or operational value streams). For more information see blog posts: https://www.hosiaisluoma.fi/blog/lean-ea-framework/ and https://www.hosiaisluoma.fi/blog/sparx-ea/ (a Sparx EA reference implementation).

7.2 Lean EA Development (LEAD)

The ***Lean Enterprise Architecture Development (LEAD)*** method is an integrated development operating model. The LEAD consists of following aspects: 1) Value chain based Operating Model with revised EA practice and 2) Visualization tool supported Lean EA Framework, LEAF. Architecture function is participating in the work of the Demand Management team. This co-operation produces an architecture concept, which is then either accepted or rejected for further development (build or buy).

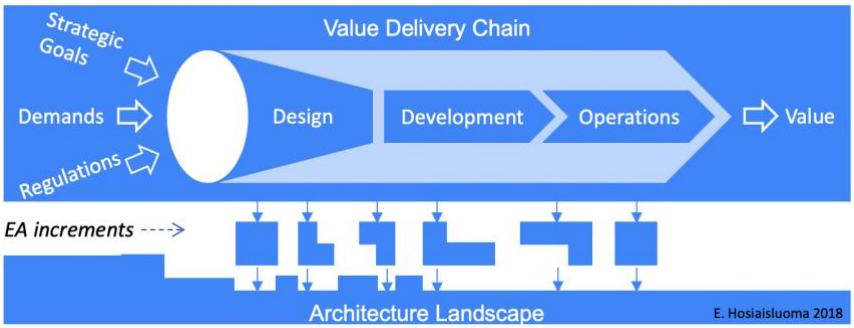


Figure 62: Value Chain based operating model with integrated EA discipline.

Within the LEAD, architecture is done "**just enough**". Architecture artifacts (deliverables) are created on demand basis, "**just in time**", not "just in case". All the architecture diagrams are published continuously on the EA portal for all the concerned stakeholders of the organization. Architecture is involved in all the development cases right from the beginning, there is no need for board committee reviews afterwards. Architects provide the Architecture Landscape, against which all the development targets are evaluated before the development phase (build or buy). As the "idea to production" process (figure below) performs daily basis (e.g. in two-week sprints), new architectural content is continuously added into the Architecture Landscape, which is managed within the EA tool's repository.

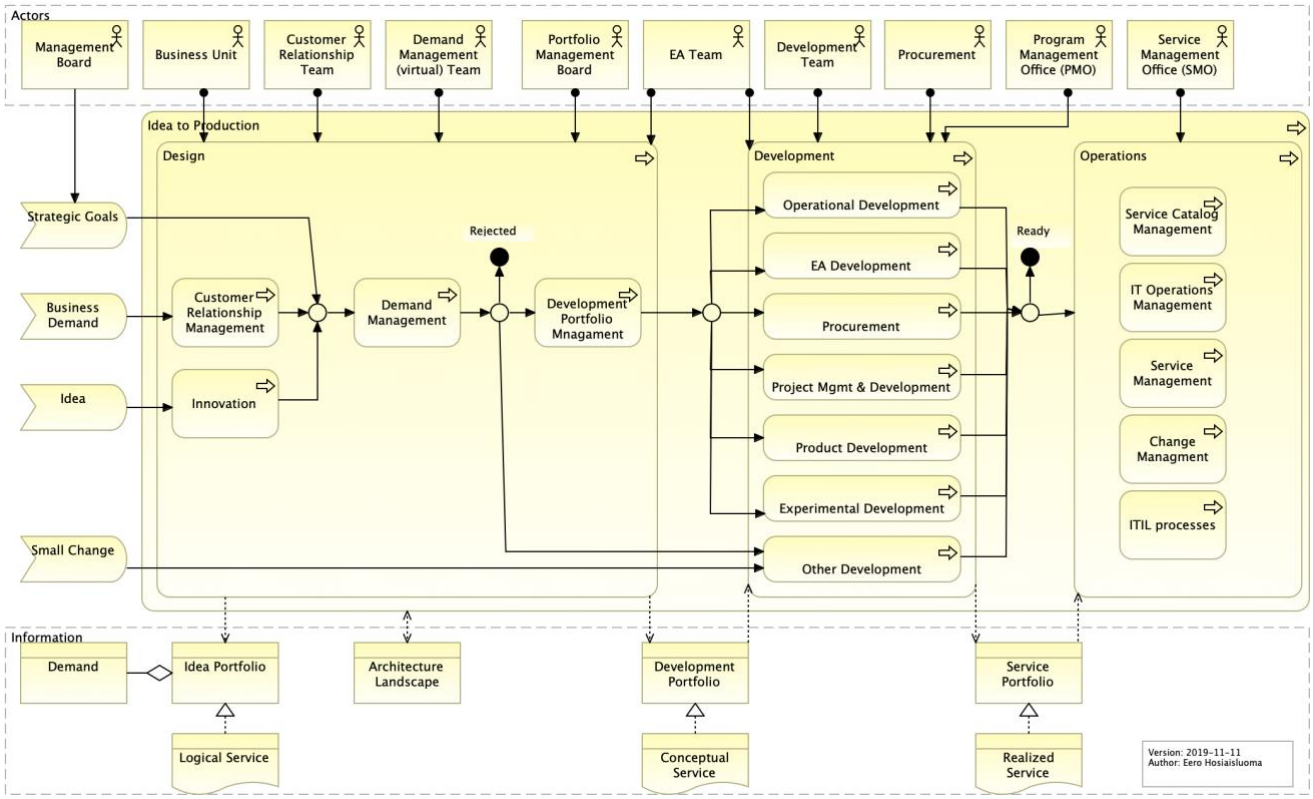


Figure 63: The LEAD process (implementation of the "*Idea To Production*" Value Stream).

Note! The development phase consists of several "development paths", some of which are introduced in the diagram above.

For more information of the LEAD see this blog post: https://www.hosiaisluoma.fi/blog/lean-enterprise-architecture-method-for-value-chain-based-development-in-public-sector/.

The LEAD and the LEAF are introduced more detailed in the design science research article [4] (*Lean Enterprise Architecture Method for Value Chain Based Development in Public Sector, Hosiaisluoma et al*., *2018*.), which can be retrieved from the Research Gate via this link: https://www.researchgate.net/publication/328560027_Lean_Enterprise_Architecture_Method_for_Value_Chain_Based_Development_in_Public_Sector .

7.3 Goal-Driven Approach (GDA)

Goal-Driven Approach (GDA) supports all kinds of development, by focusing on the WHY first of all (according to Simon Sinek's "start with why" -concept). For every demand, it is always important to define the goals first, before any further actions are to be taken. It is crucial to analyze "to whom", "why" and "what" and compose a clear one-pager of goals - for the sake of simplicity. If precise statements cannot be defined for defining drivers, goals and outcomes, then this implies that this demand is not clear enough, and that demand doesn't deserve to be proceeded to detailed design or development phases.

The Goal-Driven Approach (GDA) is simple approach to start with goals. This can be done by utilizing the *Motivation View* -diagram type (introduced in this document). When the goals are clearly defined, then the demand can move forward in the value chain of the operational development operating model.

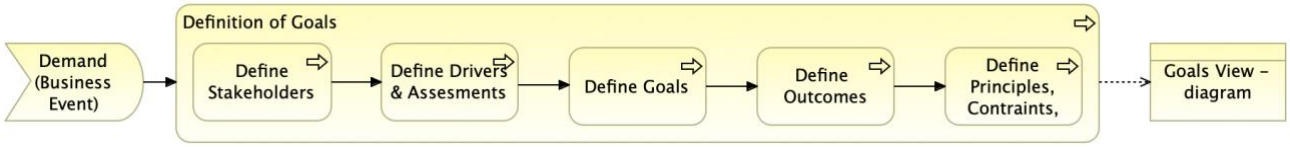


Figure 64: Goal-Driven Approach - start always with defining the goals (the WHY) first.

7.4 Service-Driven Approach (SDA)

Holistic enterprise development can be supported by the *Service-Driven Approach (SDA)*, which focuses on services (instead of projects) as primary units of value creation, design, development and operations. The SDA combines both customer oriented ("outside-in") and organization internal behavior and structure oriented ("inside-out") approaches. By focusing on services, enterprise development (or an IT function) can be organized as a "production line" that produces services. The *service* concept is crucial, everything can be provided and consumed as a service according to idea where "**everything as a service**".

The Service-Driven Approach (SDA) is based on layered approach, in which layers (business, application, technology) are connected with specific kind of services as follows: 1) business services, 2) application services and 3) technology services. All the development targets (demands) are analyzed and visualized with the services they provide and/or require. These layers and services are based on ArchiMate framework (figure below), which can be used for analyzing the behavior and structure of each development target – whether it is a single service or wider area such as a business unit.

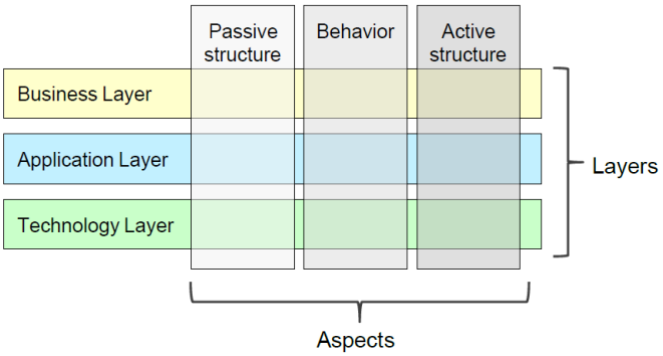


Figure 65: ArchiMate Core Framework separates the elements of each layer in behavioral and structural aspects.

A simplified service-driven pattern is illustrated in the diagram below. These are the basic elements of Service-Driven Approach (SDA).

Figure 66: The core elements of Service-Driven Approach (SDA).

The Service-Driven Approach (SDA) method starts from identifying the goals of the development target (the WHY) first. Then the concerning business service is analyzed e.g. as follows: WHAT are the customer groups and processes HOW the service is produced. In addition, WHAT are the application services, applications and technologies that are used (figure below).

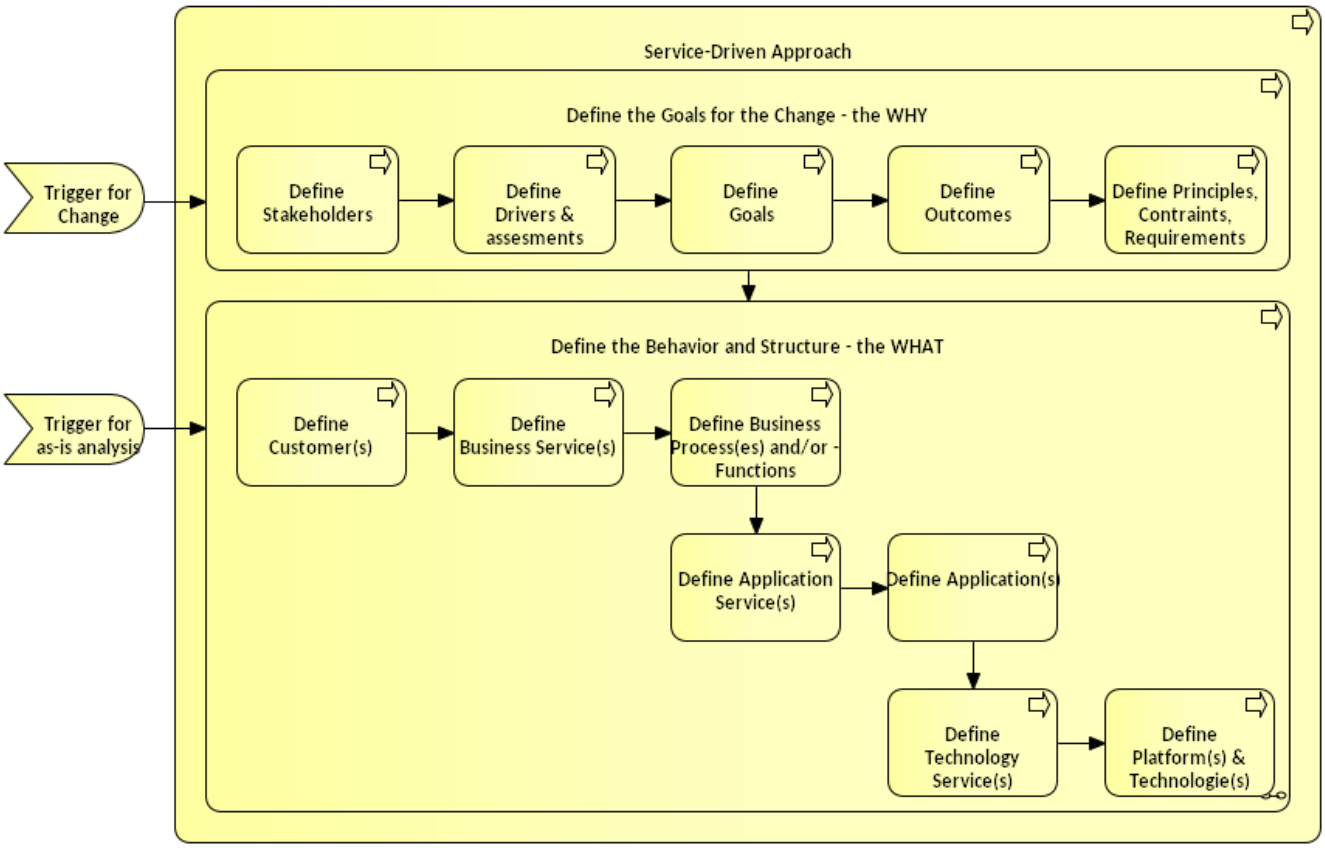


Figure 67: Service-Driven Approach (SDA) method as a process.

The Service-Driven Approach (SDA) covers all the relevant aspects for analyzing and visualizing a business service. The method goes as follows:

1. Identify Stakeholders, goals, outcomes, principles and requirements,
2. Define Customers,
3. Define Business service(s), to serve the customers
4. Define Business process(es) & functions and related business actors, to realize the business service(s),
5. Define Application services, to serve the processes & functions,
6. Define Applications, to realize the app. services,
7. Define Technology services (when appropriate), to serve the applications and
8. Define Technology platforms (system softwares, servers, comm. networks etc.), to realize tech. services.

All of these elements can all be analyzed and visualized with the following diagram types (introduced in this document): Motivation View-, Business Model Canvas-, Layered View- and Interaction View diagrams - depending on the case, and what is appropriate to fit for the purpose.

7.5 ArchiMate 1-2-3

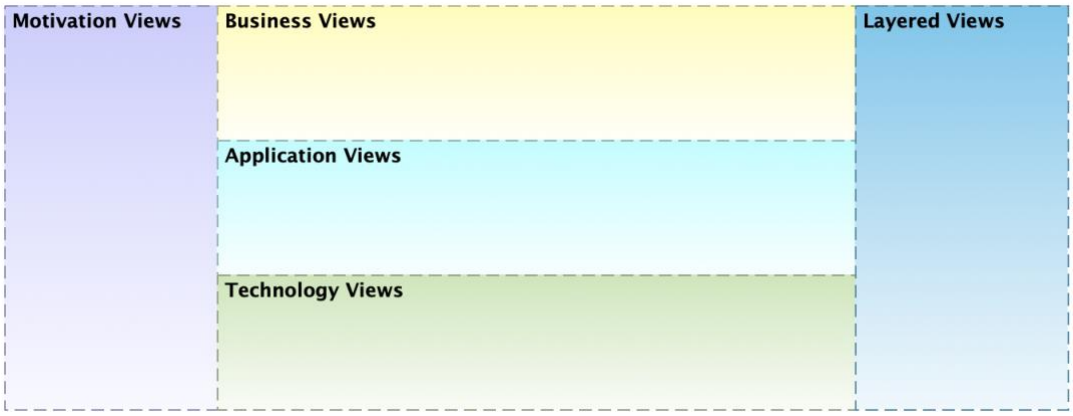


Figure 68: ArchiMate 1-2-3.

ArchiMate 1-2-3 is a simple approach to utilize modelling within the architecture work. This approach is based on smallest possible set of ArchiMate elements (figure below).

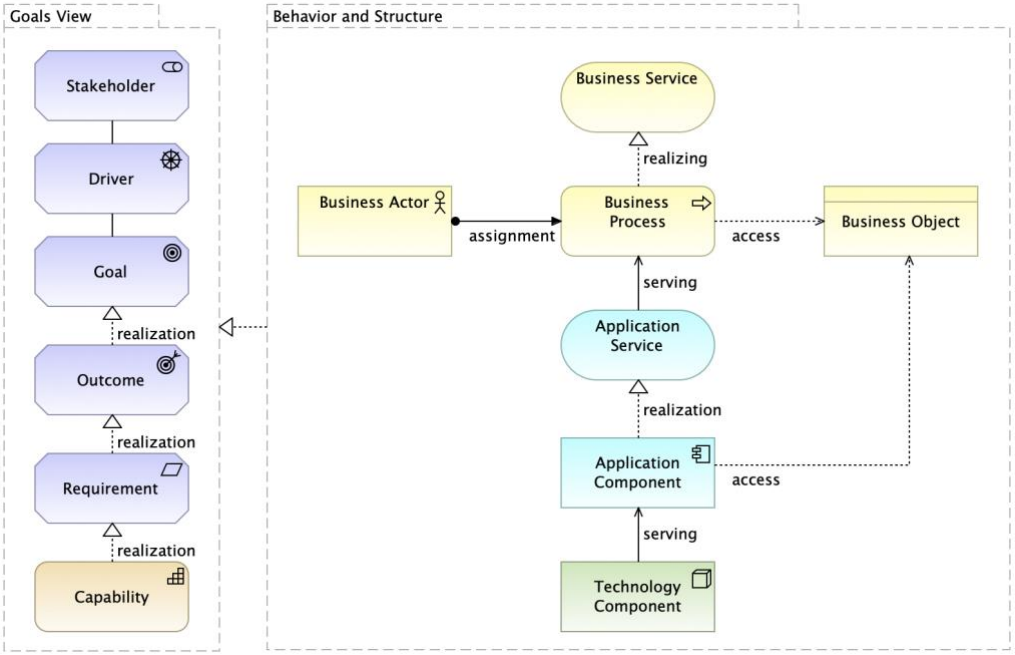


Figure 69: ArchiMate 1-2-3 metamodel. The WHY and WHAT on the left, the HOW on the right.

The naming “ArchiMate 1-2-3” stands for “one holistic wholeness, two aspects (behavior and structure), three layers (business, application, technology)”. It is analogous to and compatible with *Goal-Driven Approach (GDA)* and *Service-Driven Approach (SDA)*, as they all are based on ArchiMate Framework’s layers and aspects.

The ArchiMate 1-2-3 is an easy as A-B-C, fast track for start using modelling for visualization in all the development cases in an organization. By starting small and keeping things simple, and then learning by doing, this approach can be extended smoothly with other ArchiMate elements. Modelling can be used as a supporting method for overall development. Architecture artifacts can be created with an appropriate modelling tool, and all the concerning documents can be produced from the tool - according to *Model-Based System Engineering, MBSE* (as introduced in the SAFe). It is good practice to start small and simple, and then extend the way of working - as the architecture- and modelling maturity evolves. ArchiMate 1-2-3 is based on the same diagram types as introduced in this document.

7.6 EA Content Frameworks

There are three variations how the EA content can be organized in the LEAF level-2 (introduced above) as follows: 1) Layered Framework, 2) Aspect-Oriented Framework or 3) Views & Maps Framework. These alternative approaches are based on the ArchiMate Core Framework, which consists of layers and aspects (figures 1 and 65).

7.6.1 Layered Framework

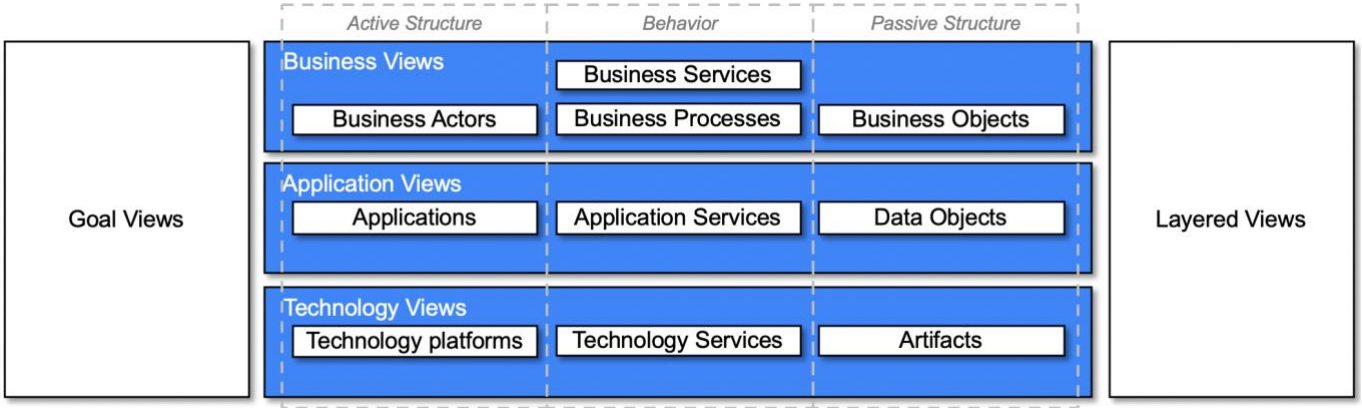


Figure 70: Layered Framework.

This is the conventional approach to manage the EA content within a layered view (according to ArchiMate Core Framework). Elements on the layers are positioned according to ArchiMate aspects as verticals. Note! These content placeholders (white boxes) can be named according to what is appropriate.

7.6.2 Aspect-Oriented Framework

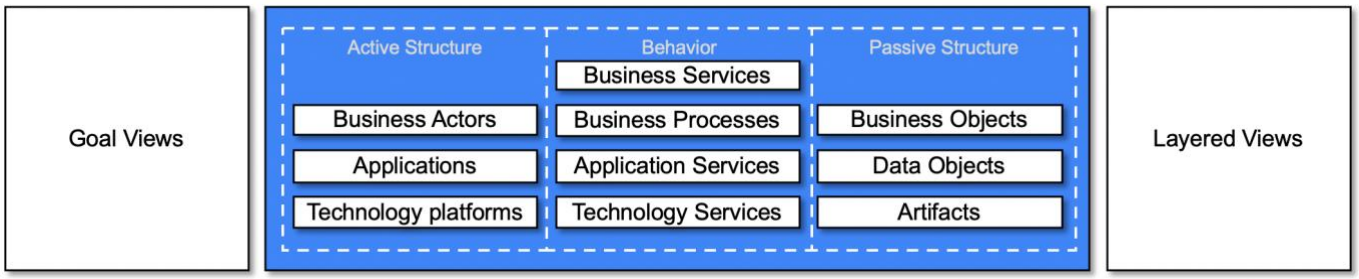


Figure 71: Aspect-Oriented Framework.

This is the aspect-oriented approach to manage the EA content within a view with no layers (according to ArchiMate Core Framework).

7.6.3 Views & Maps Framework

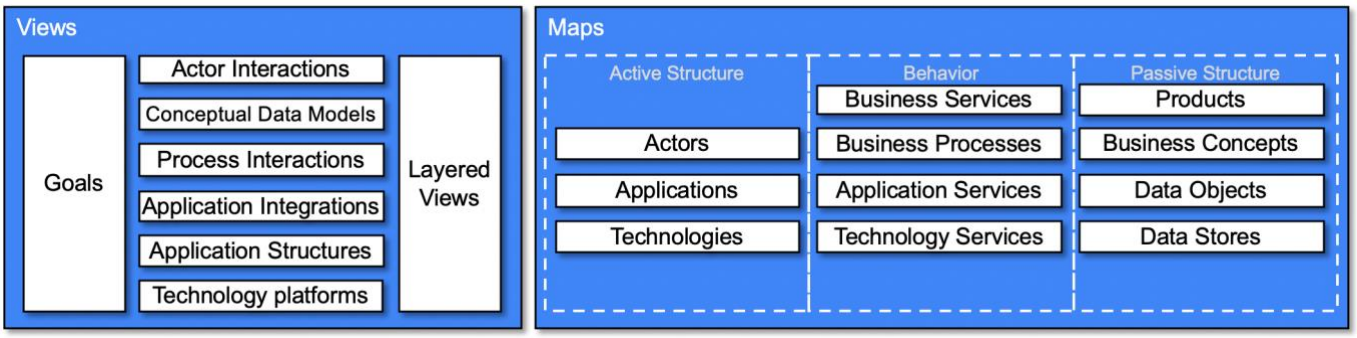


Figure 72: Views & Maps Framework.

This is a “use case oriented” view to manage the EA content. This is a combination of a) typical diagrams grouped into the Views, and b) collection of maps of fundamental EA structural and behavioral elements. The maps are positioned according to ArchiMate aspects (active structure, behavior and passive structure).

Note! These frameworks are examples, all the content placeholders (white boxes) can be identified and named to what is appropriate; content placeholders can be added, modified, removed or replaced to according to what is essential in the organization. It is important to notice that these maps are collections (catalogs) of relevant elements in the enterprise architecture of an organization.

When customizing these content frameworks introduced here, the rule of thumb is to keep it simple. Good practice is to apply the Lean EA principles: use only the relevant content placeholders (“just enough”); create content placeholders only if needed (“just in time”) – not to create them “just in case”. However, content placeholders can act like reminders of what should be investigated and modeled. (A specific step-by-step method is to be introduced here.)

7.7 SIPOC (Suppliers, Inputs, Process, Outputs, Customers)

Six Sigma tool called SIPOC (Suppliers, Inputs, Process, Outputs, Customers) can be used for defining elements common to all processes. This is an easy tool for analyzing the business case: what is the value the customer gets and how.

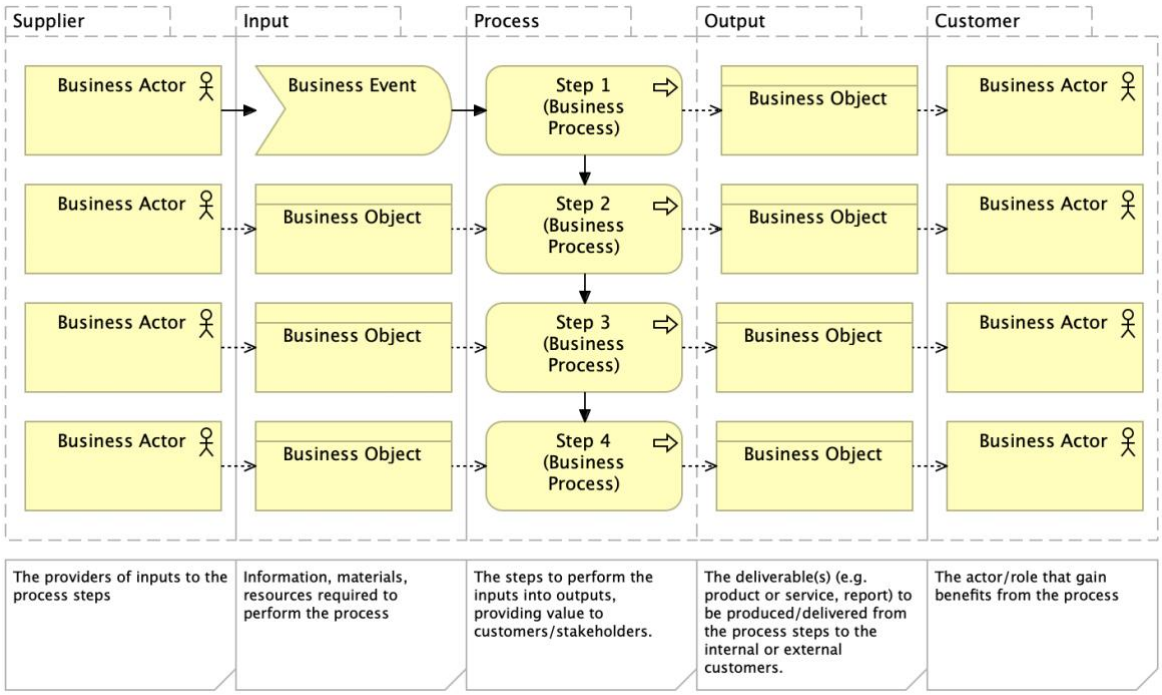


Figure 73: SIPOC diagram.

8. Appendixes

8.1 Appendix 1: Cloud Service Models

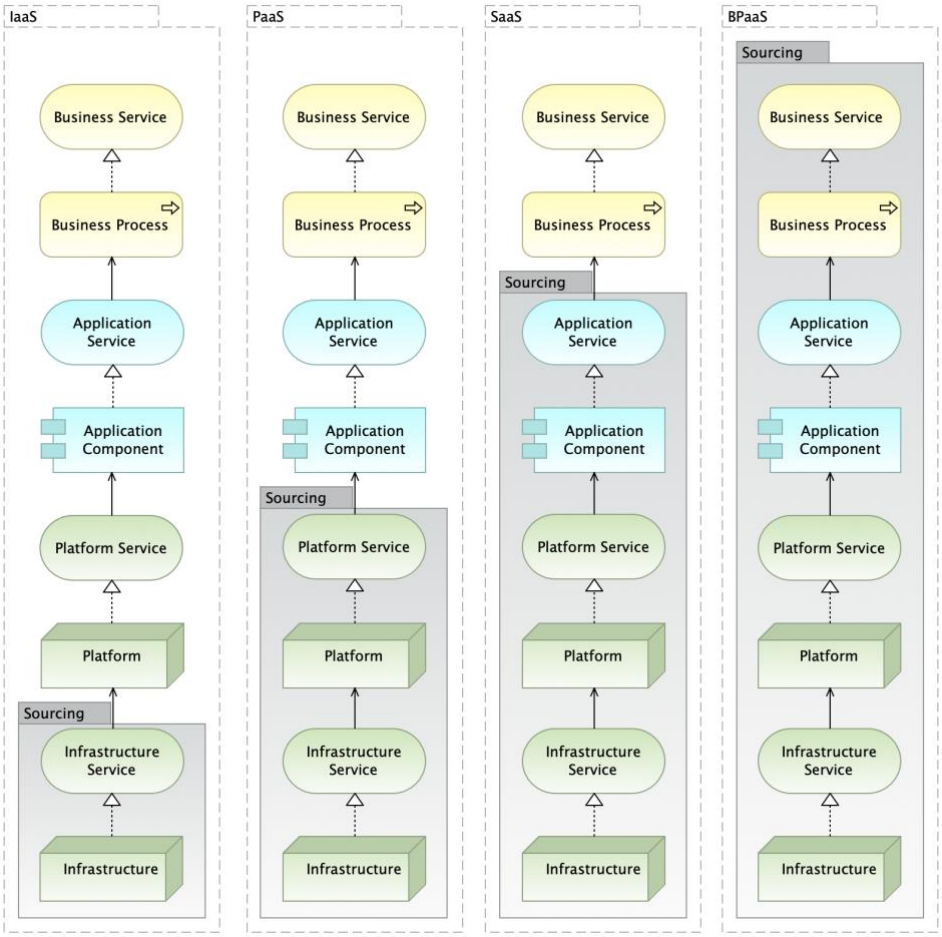


Figure 74: Cloud Service Models.

8.2 Appendix 2: Modelling Tips & Tricks + Extra Patterns

Some miscellaneous tips and tricks for fine-tuning diagrams.

8.2.1 Line Width And Color

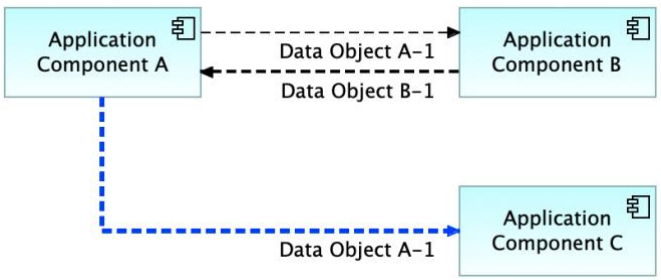


Figure 75: Line width and color.

It is possible to add extra information (meaning, semantics) to relationship types such as Flow. For example, line width can implicate e.g. volume of the integration. Line color can implicate e.g. importance, or interaction type such as automatic, semi-automatic, manual integration, or integration mechanism such as FTP-transfer, batch, messaging, service call (Remote Procedure Call, RPC), synchronous/asynchronous etc.

8.2.2 Legend

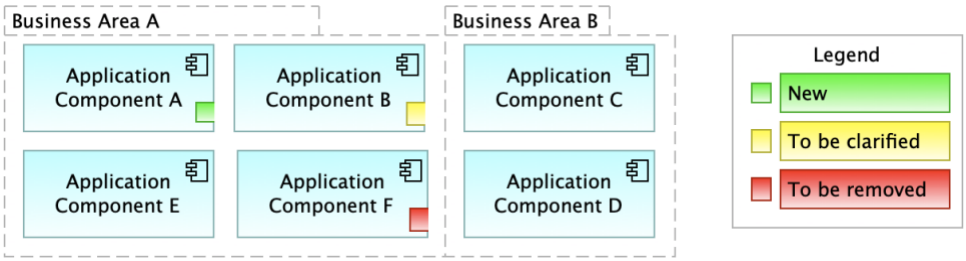


Figure 76: Legend for extra information.

Using descriptions for add-on information in the form of a *legend* in diagrams, it is possible to add any kind of extra meaning into diagram elements. For example, to illustrate life-cycle indicators.

It is worth noticing, that there are established practices for using colors with ArchiMate as follows: a) yellow for the business layer, b) light blue (turquoise) for the application layer and c) light green for the technology layer. Hence it is not suggested to use custom colors with elements, even though modelling tools allow this, as colors have these "built-in" meanings already.

8.2.3 Grouping

The Grouping -element can be used for modelling logical groups of elements that can be handled as an entity. E.g. application group such as financial applications, external applications, legacy applications etc. In addition, the grouping can be used for abstracting a group of elements. For example, if we don't know yet enough details, or we are not interested in the details of a specific area, we can model such a target area as a group. For example, we just like to handle external organization's applications as a group, or certain applications as a group (see figure below).

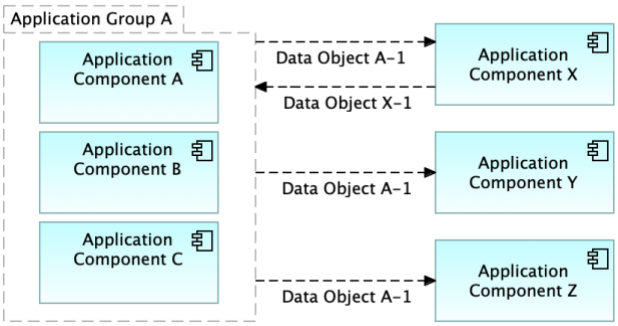


Figure 77: Grouping -element used for abstracting.

The value of using grouping is that we can use relationships with the group. E.g. information flow can be modelled against the group instead of distinct applications (figure above), if the integrations are similar.

According to ArchiMate -specification:

- "The grouping element aggregates or composes concepts that belong together based on some common characteristic."
- "One useful way of employing grouping is for modeling Architecture and Solution Building Blocks (ABBs and SBBs), as described in the TOGAF framework."
- "Another useful application of grouping is for modeling domains."

8.2.4 Abstracting Elements

ArchiMate has an elegant built-in abstraction mechanism, which enables to utilize certain concept for diverse abstraction levels (and levels of details). Hence, e.g. the Data Object can be used for modelling for example a logical database, a database table, message structure (switched between applications) etc. In addition, the Application Component can be used for modelling a single application, its sub-components (modules), or whole

group of applications e.g. of an organization unit. A class of applications can be modelled as an abstract application (e.g. named according to following notation: << Application >>), which represents e.g. an application that is not known, cannot be identified by name etc. These abstractions can be made visible with specialization.

An abstraction represents:

- a "class" of objects / elements
  - there can be several instances of this class
  - none of the individual instances, but them all as a whole is relevant and meaningful
  - all the instances inherit similar behavior (relative to the context in hand)
  - Instance naming (according to UML): “Instance name : Class”
- a "role" which certain objects can play
  - models an element of a specific kind, that is identified, but not necessary to be known by the name
  - only the behavior of an object is known or important to be known
  - e.g. a business actor is meaningful to be specified, but its application is not, only the behavior it plays
- a collection of objects of the same type
  - models a set of objects as a whole, group of elements
  - e.g. << Financial applications >>, << Front-end applications >> (Note! Naming: plural)
- generalization / specialization
  - models the generic element (stereo)type, not any specific element
  - there can be specializations of this generalization
  - e.g. << Financial application >> and “Purchasing Application” (Note! Naming: singular)
  - elements can be typed with the specialization prefix, e.g. “<< IT-service >> Name”
  - Module or sub-system e.g. “Module Name [Application Name]”

Notation:

- naming as follows: abstraction << Application(s) >> (with or without “<<” and “>> prefix and suffix)
- *italic* font can be used in naming, indicating that the concerning element is an “abstraction”

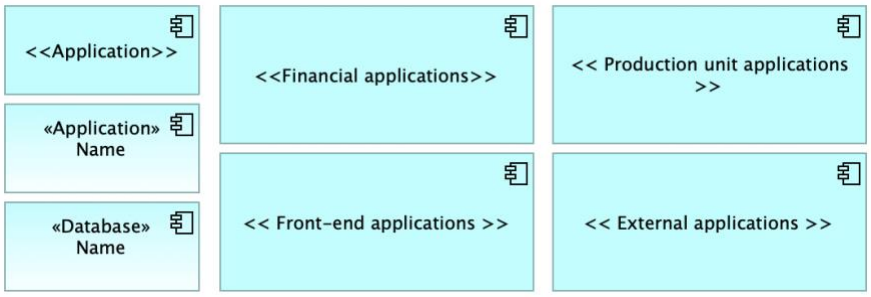


Figure 78: Abstracting applications.

All in all, the most typical usage scenario is to abstract active structure elements into a collection of the same type. E.g.

- *Business Actor* “Customers” for representing all the categories of customers, not specifying them individually by name
- *Application Component* “Financial applications” for representing all the applications relating to cash flow

8.2.5 Enterprise Application Integration (EAI) patterns

These patterns apply to modelling enterprise application integration (EAI) solutions that implement various EAI patterns.

8.2.5.1 Enterprise Service Bus (ESB)

An ESB platform can be modelled as shown in the figure below. An ESB provides a pattern (platform) for switching data between applications.

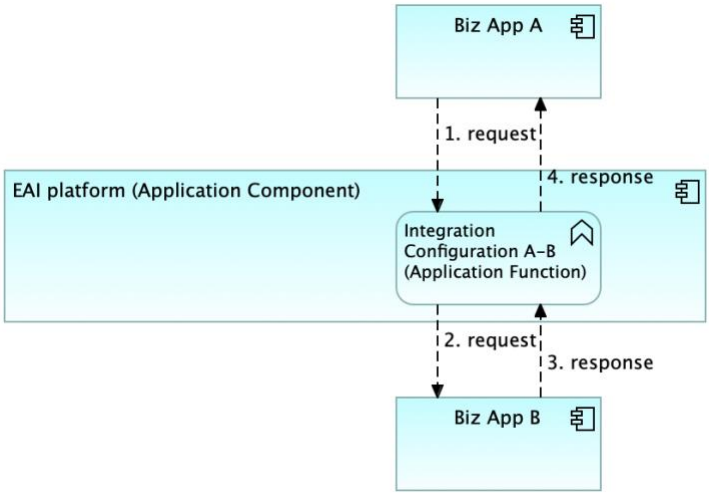


Figure 79: ESB pattern (this example uses the Application Function to represent the integration configuration).

An ESB contains configurations per each integration. These configurations can be modelled e.g. as 1) Application Components, 2) Application Functions or 3) Application Processes. An Application Component represents a deployable, independent execution entity, whereas an Application Function and an Application Process represent the behavior, that can be performed by a) EAI platform itself or b) a sub-component of an EAI platform. Anyhow, the integration configuration shall be specifically modelled, so that the whole end2end flow of an individual integration can be handled as a single unit (of work): logically and physically independent and coherent encapsulation of functionality.

8.2.6 Information Resource

An information/data resource can be e.g. a database, databank, data store, register/registry, information/data pool etc., which is logically meaningful entity in the enterprise architecture of an organization. Such an information resource is a structural element, which can be either a) active structure or b) passive structure. The former is an active doer (“actor”), which can provide (application) services via the (application) interfaces and can be involved in data switching between other active structure elements, and can perform behavior such as data processing (extracting, enriching etc.). The latter is a passive element that represents only data in different abstraction levels (e.g. database, data structure, message etc.).

There are few alternative ways to model an information resource that contain data, and may or may not include data processing behavior. The options are as follows:

1. **Grouping** composite element can be used for modelling databases (or any kinds of data storages) into a logical group, which can be handled as a single entity in the enterprise architecture
2. **Data Object** -element can be used for modelling an entity that is composed of data only. This is a passive structure element, which is not associated with behavior – only data
3. **Application Component** -element represents an active structure that can contain data, behavior (such as data processing) and it can expose services (via interfaces) to external applications etc. An application component can contain sub-components, each of which can contain the behavior of its own. As such the application component is a very multipurpose element, which can be used for abstracting many kinds of concepts and entities of the enterprise architecture of an organization. Note! The type of the component can be expressed with the specialization mechanism of ArchiMate, e.g. introducing the specialization type such as “<<Data store>>” in the label of the component as shown in the diagram below (option 3).

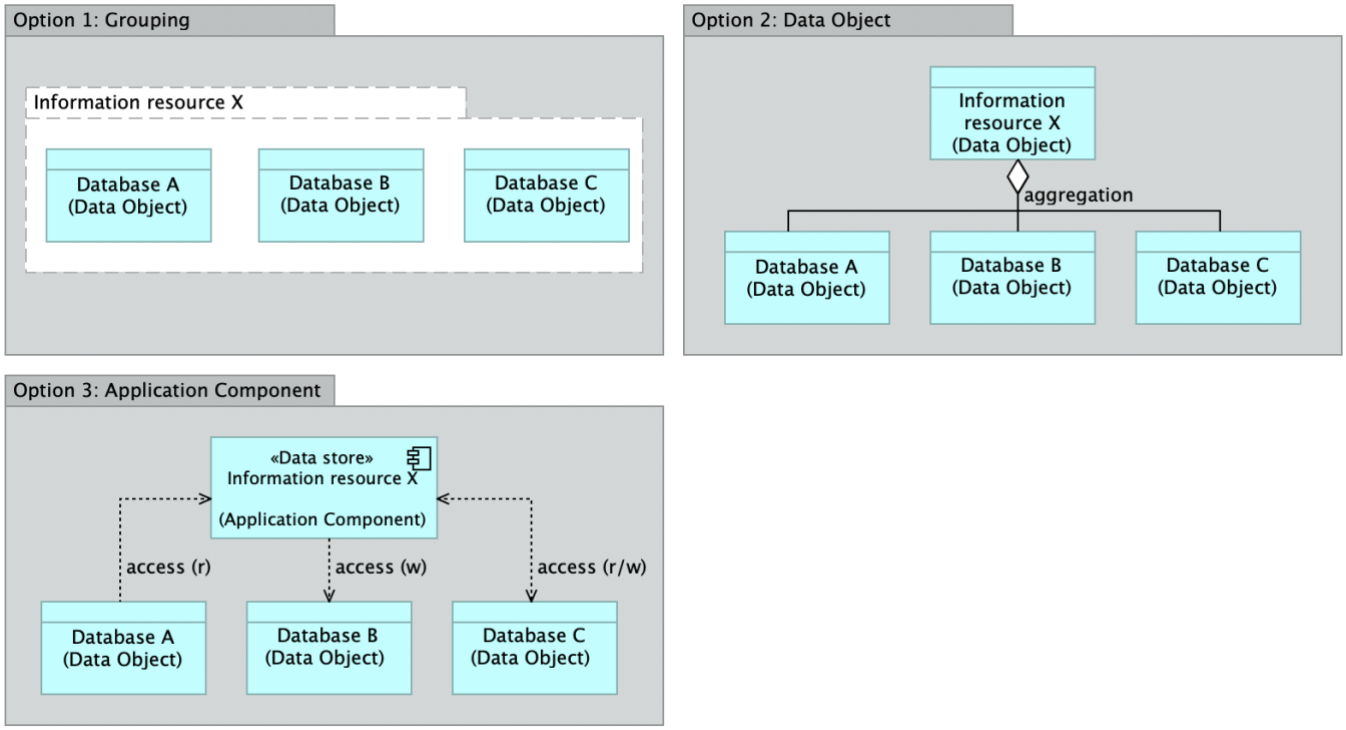


Figure 80: Information resource options.

8.2.7 API (Application Programming Interface)

Organization may have number of APIs available, that are exposed and made available with a specialized platform (such as an API Gateway). An individual API can be modelled with the Application Interface -element, as the API represents an “externally exposed behavior of an application”.

The API can be introduced by using the ArchiMate specialization mechanisms, e.g. by using a stereotype as an extra information associated with the API. The API is an application interface by nature, but the <<stereotype>> makes the specialized purpose visible as shown below. The <<stereotype>> indicates what is type of an application interface: e.g. <<API>> or <<GUI>>.

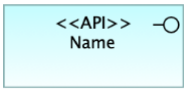


Figure 81: API modelled with the Application Interface -element, by using a <<stereotype>>.