WIT 2016 ITA Module

Architecture Modeling
Lecture Group #2 - Part 3

Lecture Group #2 - Part 3
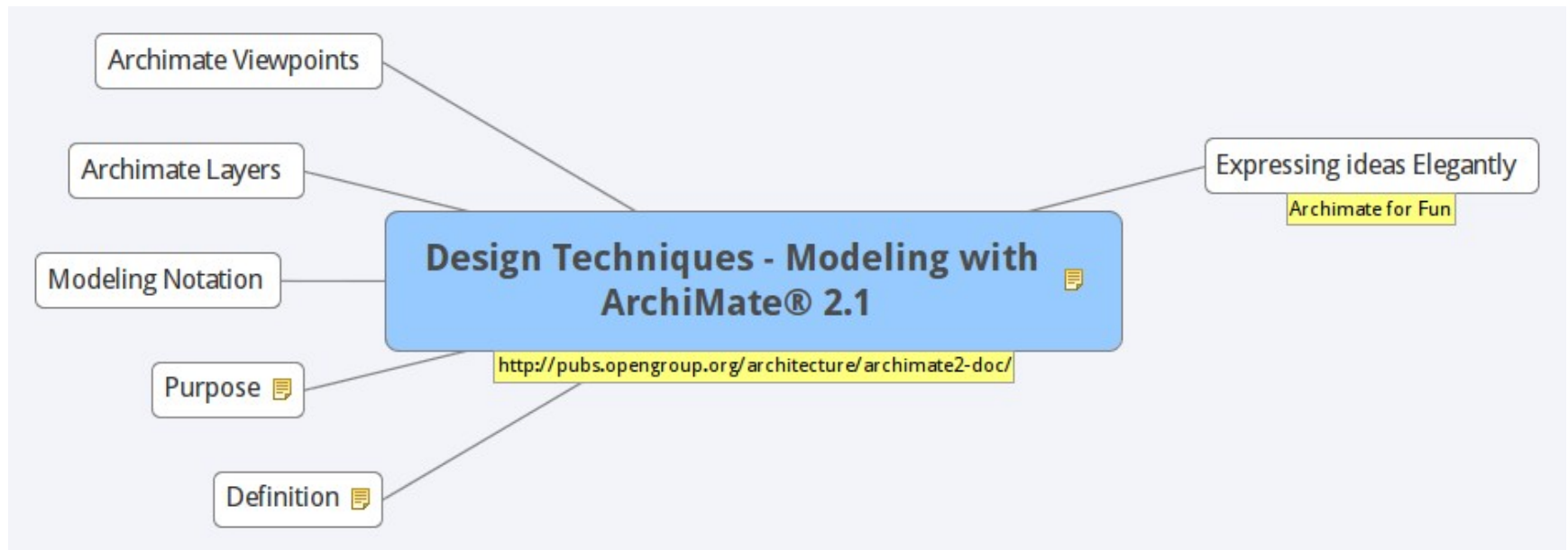# Architecture Modeling

WIT 2016 ITA Module
Lecture Group #2 - Part 3
Architecture Modeling

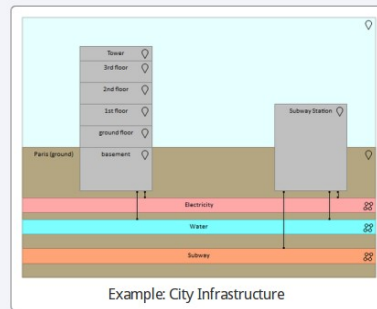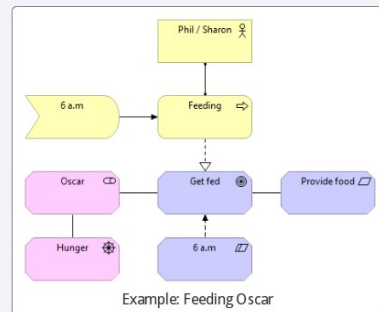Design Techniques - Modeling with ArchiMate® 2.1

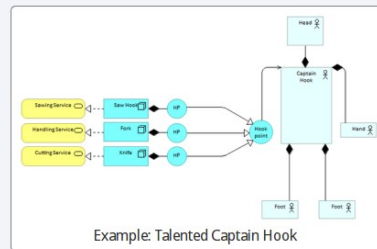http://pubs.opengroup.org/architecture/archimate2-doc/

Design Techniques
Modeling with ArchiMate® 2.1

http://pubs.opengroup.org/architecture/archimate2-doc/

About "Expressiveness"
...and modeling ideas elegantly
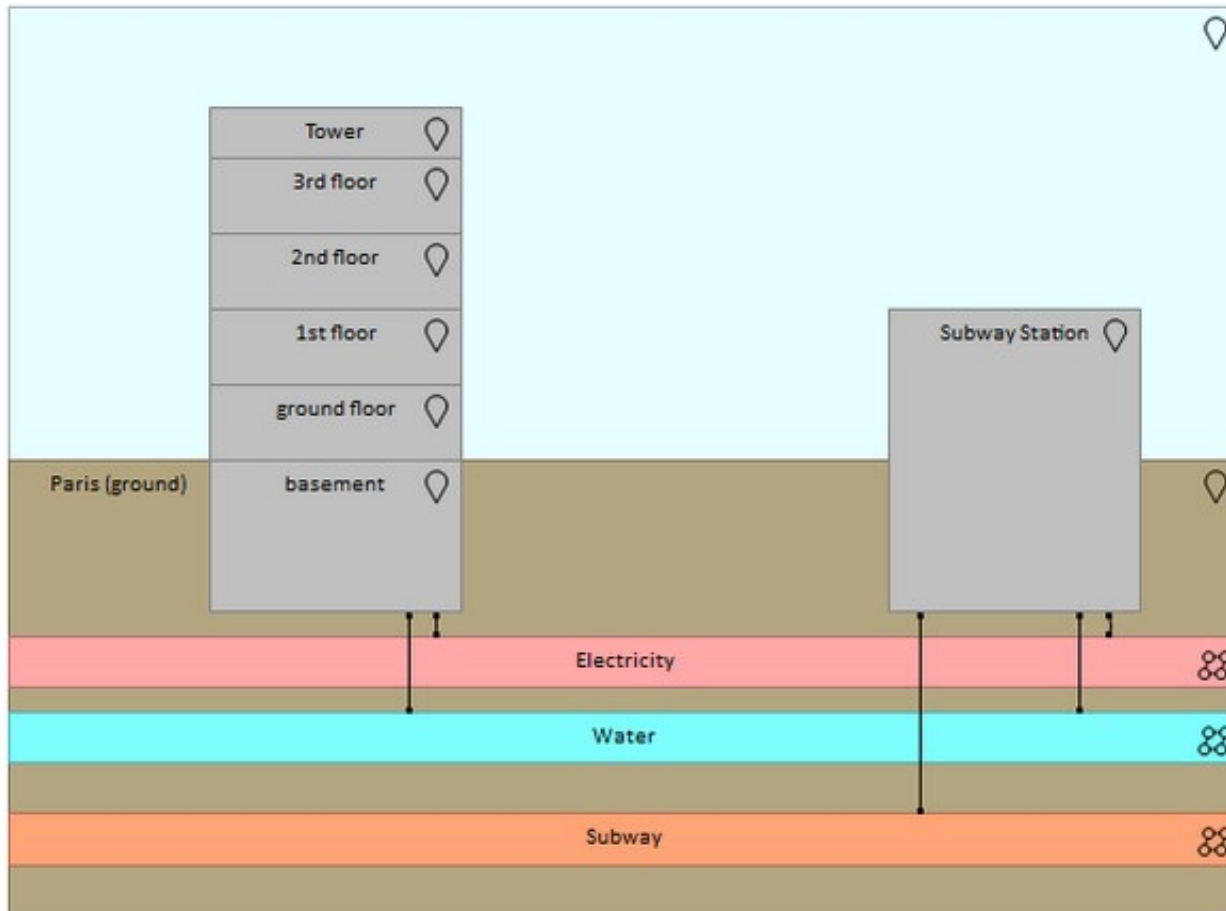

Example: Talented Captain Hook
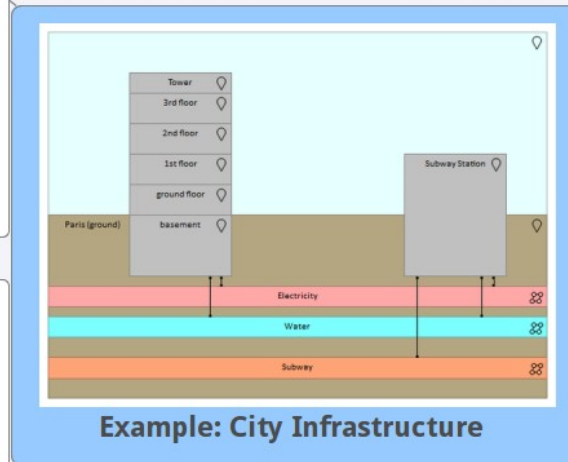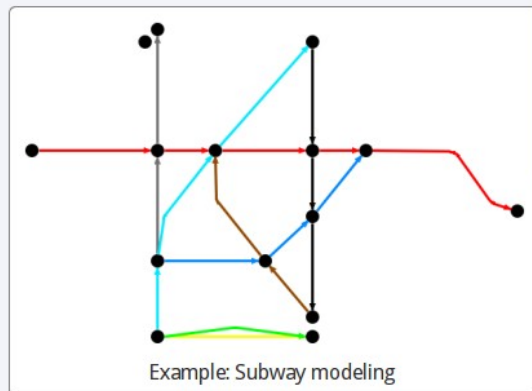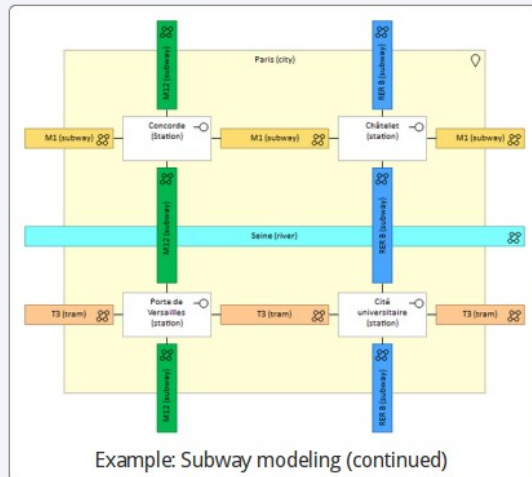
Example: Feeding Oscar

Expressing ideas Elegantly
Archimate for Fun
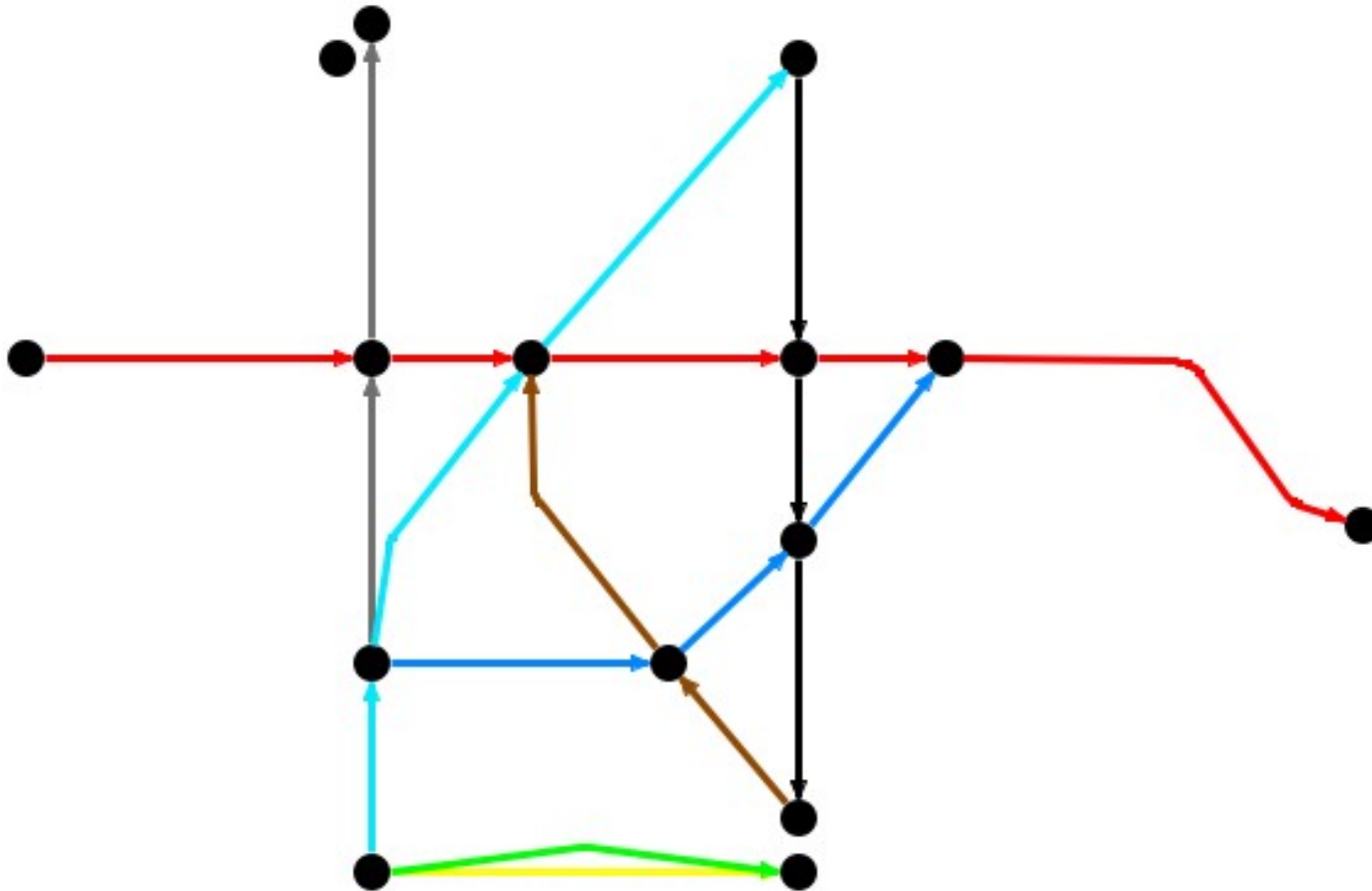
Example: City Infrastructure

Example: City Infrastructure

Example: City Infrastructure

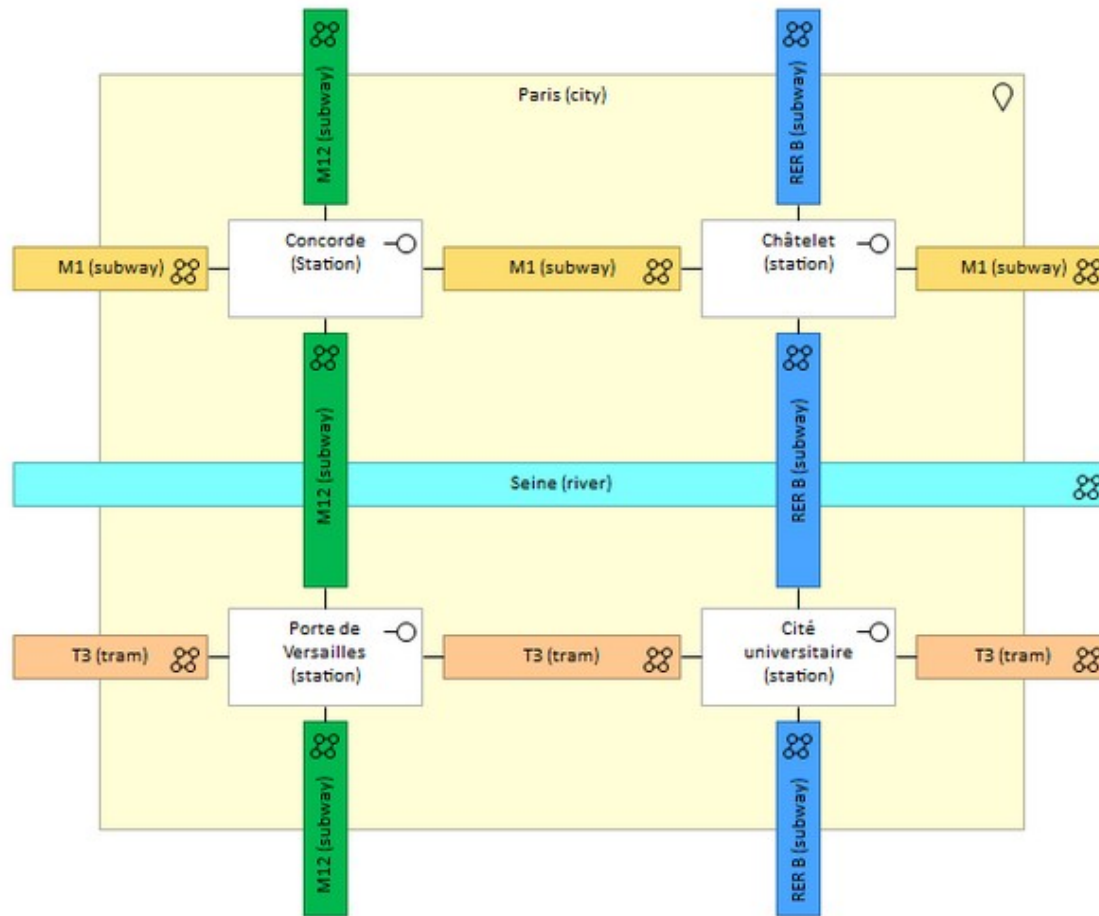Example: Subway modeling (continued)

Example: Subway modeling
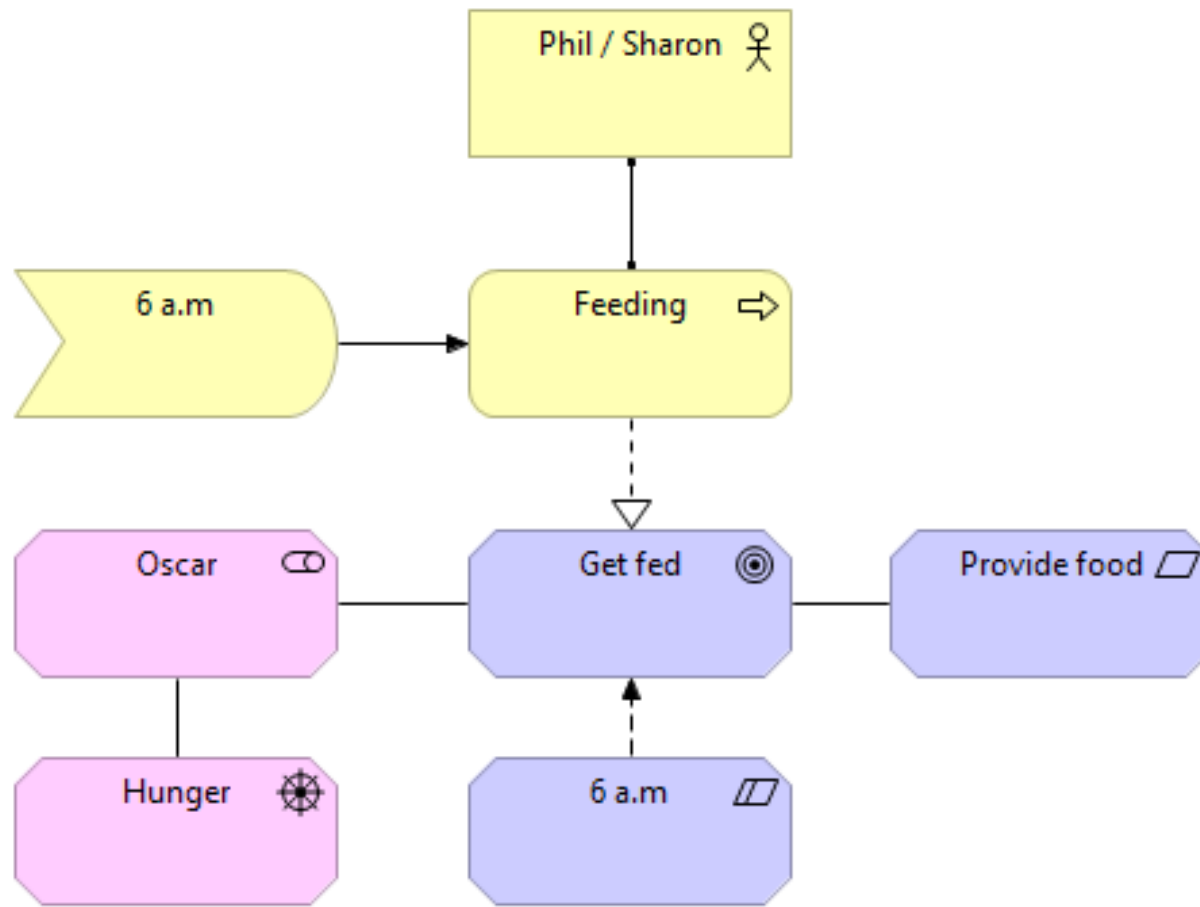
Example: City Infrastructure
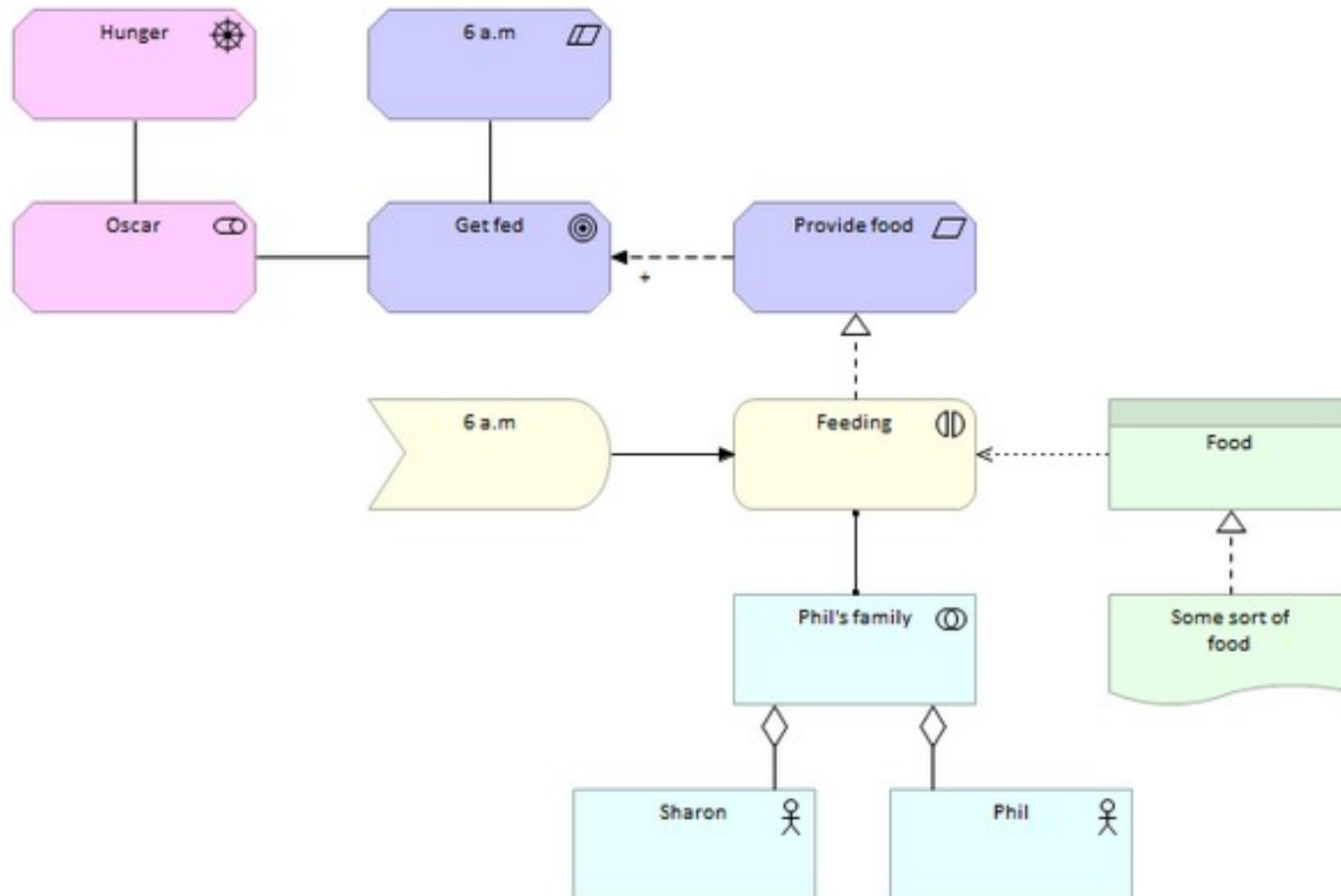
Subway modeling?
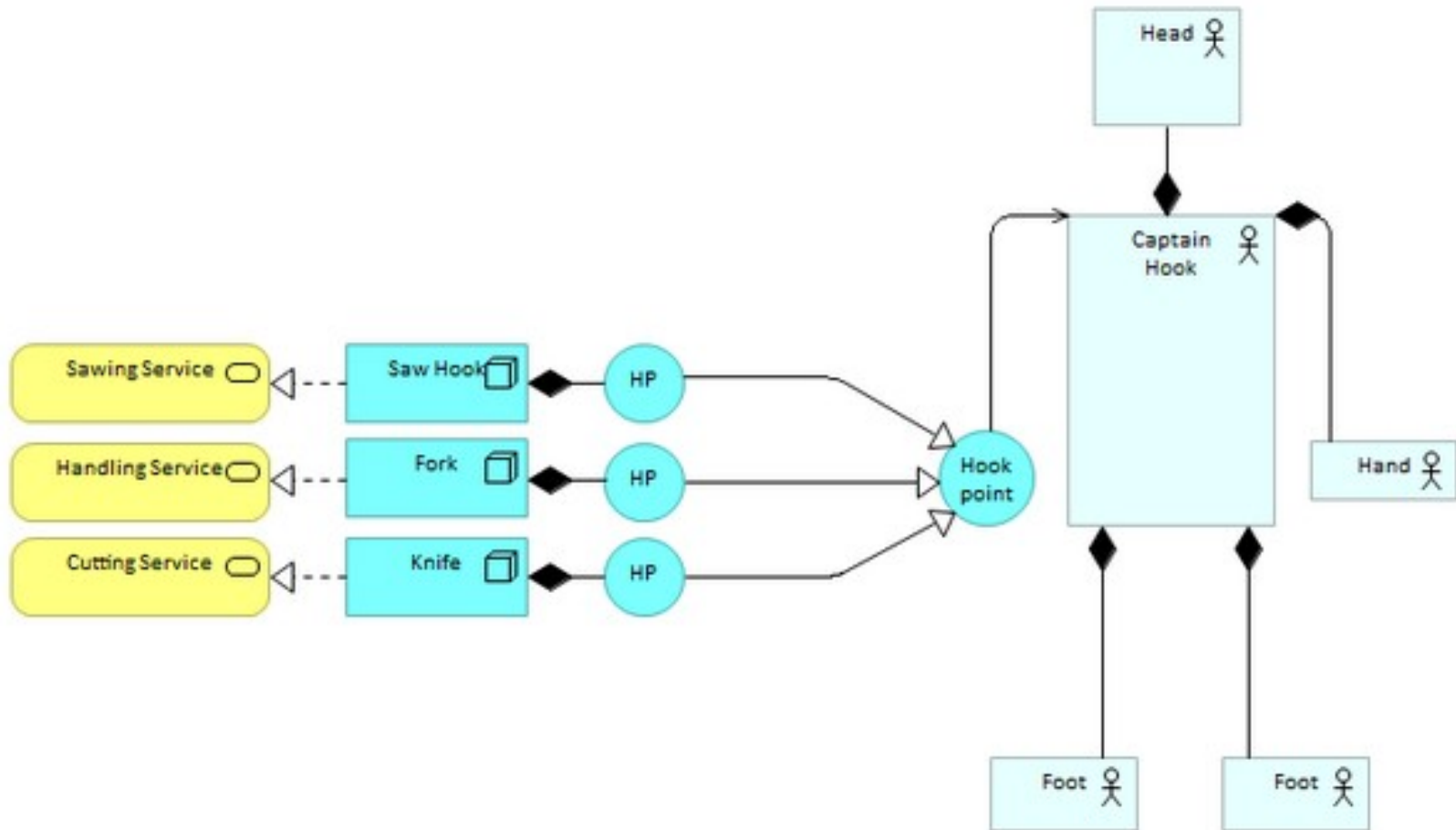
Example: Subway modeling (continued)

Story telling Example: Feeding Oscar

Example: Feeding Oscar (continued)

Example: Talented Captain Hook

Definition

A modeling standard published by The Open Group in 2009 (v1.0)/2012 (v2.1). A design technique for describing architectures.

Presents a clear set of concepts within architecture domains, offers a uniform structure for describing the contents of each domain.

...each domain is specified by a meta-model, constraining the diagrams that can be created, and allowing consistency of notation and re-use of concept elements between Views.

Presents a clear set of concepts to establish RELATIONSHIPS (.e. MAP) between domains.

...allows the connection of models belonging to different layers (i.e. Business/Application/Data/Technology), hence helping an Architect to document View consistency.
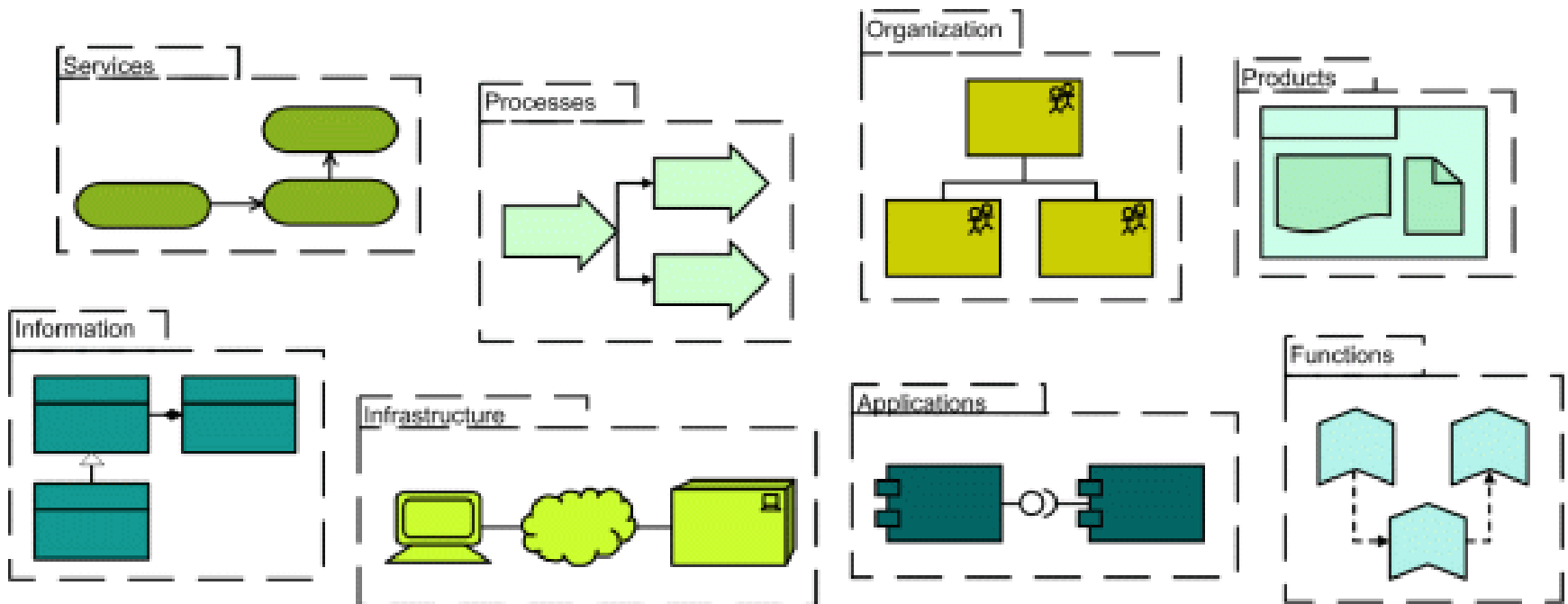
Purpose

The purpose of ArchiMate® 2.1 is to:

- be semantically precise so to help analysing and visualising relationships among problem/solution domains in an unambiguous way,

- be read by all stakeholders, and convey one same meaning,

- be intuitive to understand, with little or no training to understand the models.

To transcend Diagramming/Notational Silos

About UML Extensions

The Object Management Group Unified Modeling Language (UML) can be extended to support Enterprise Architecture modeling.

The Enterprise Architecture EXTENSION Profile (UML EAP) proposes to combine:

- the Unified Modeling Language (OMG UML [[http://www.omg.org/spec/UML/]]),

- the Business Processing Langauge (OMG BPMN [http://www.omg.org/spec/BPMN/]),

- however it does not include the Object Management Group Business Motivation Modeling (OMG BMM [http://www.omg.org/spec/BMM/]).
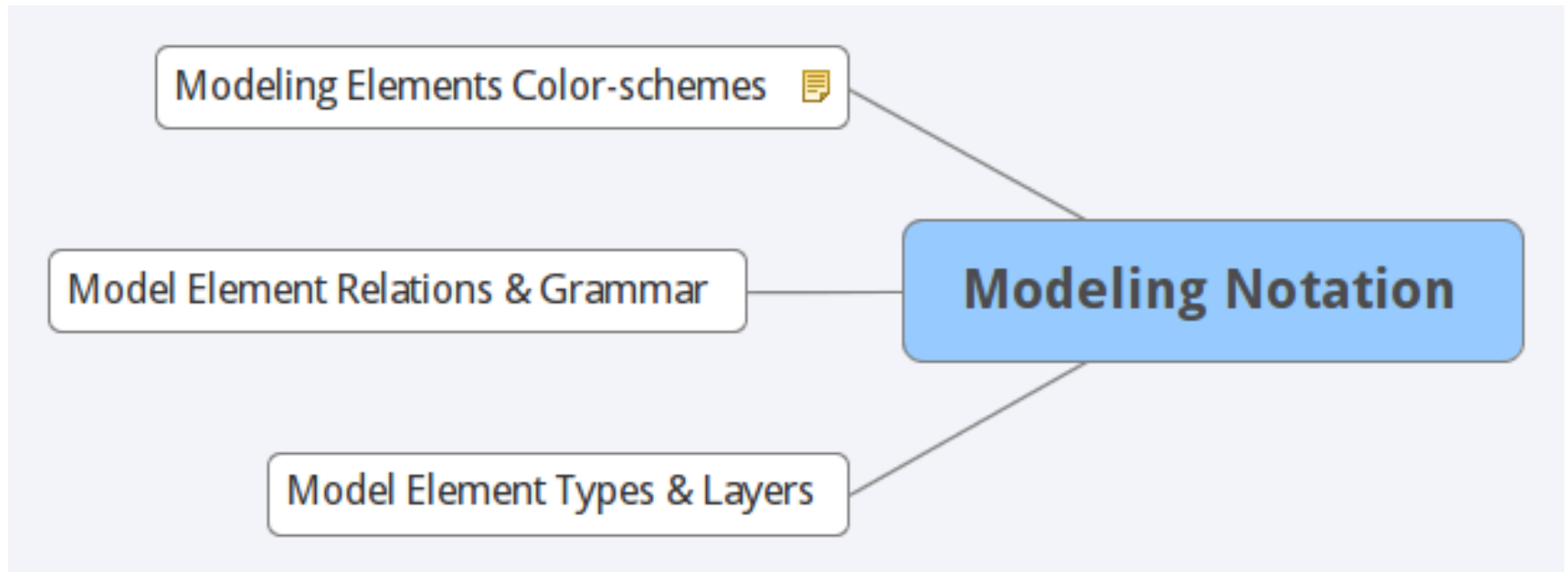
About Archimate Extensions

Model Extensions introduced in 2012:

- Motivation Extension

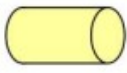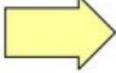- Implementation / Migration Extension (to picture current/target state increments, for program planning)
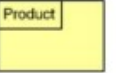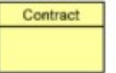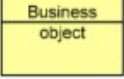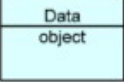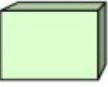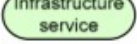
Archimate Version 3.0 being finalized in 2016.

Modeling Notation

Core Elements Classification by Layer

Core Semantics (Who, Acts, on What, How)

Core Semantics (Who, Acts, on What, How)

The language consists of 3 main TYPES of core elements:

- ACTIVE structure elements are entities capable of performing behavior (business actors, application components, devices, etc.)

- BEHAVIOR elements are units of activity performed by one or several active structure elements (processes, interactions, use cases, etc.)

- PASSIVE structure elements are objects on which behavior is performed, such as data (business entities, data objects, etc.)

Note: External View model elements EXPOSE model elements from Internal View.

ACTIVE Model Elements

An Entity of your design capable of performing behavior (i.e. Subject).

A permanent or temporary grouping (or aggregation) of two or more structure elements, working together to perform some collective behavior (i.e. Collaboration).

BEHAVIORAL Elements

A unit of activity performed by one or more active structural elements (i.e. Verb).

A unit of behavior performed by a collaboration of two or more structure elements (i.e. Interaction).

PASSIVE Elements

An object on which behavior is performed, usually information or data objects.

Symbols & Relationships

© The Open Group

© The Open Group

Symbols & Relationships

Symbols & Relationships

Additional Relationships

Behavioral Relationships
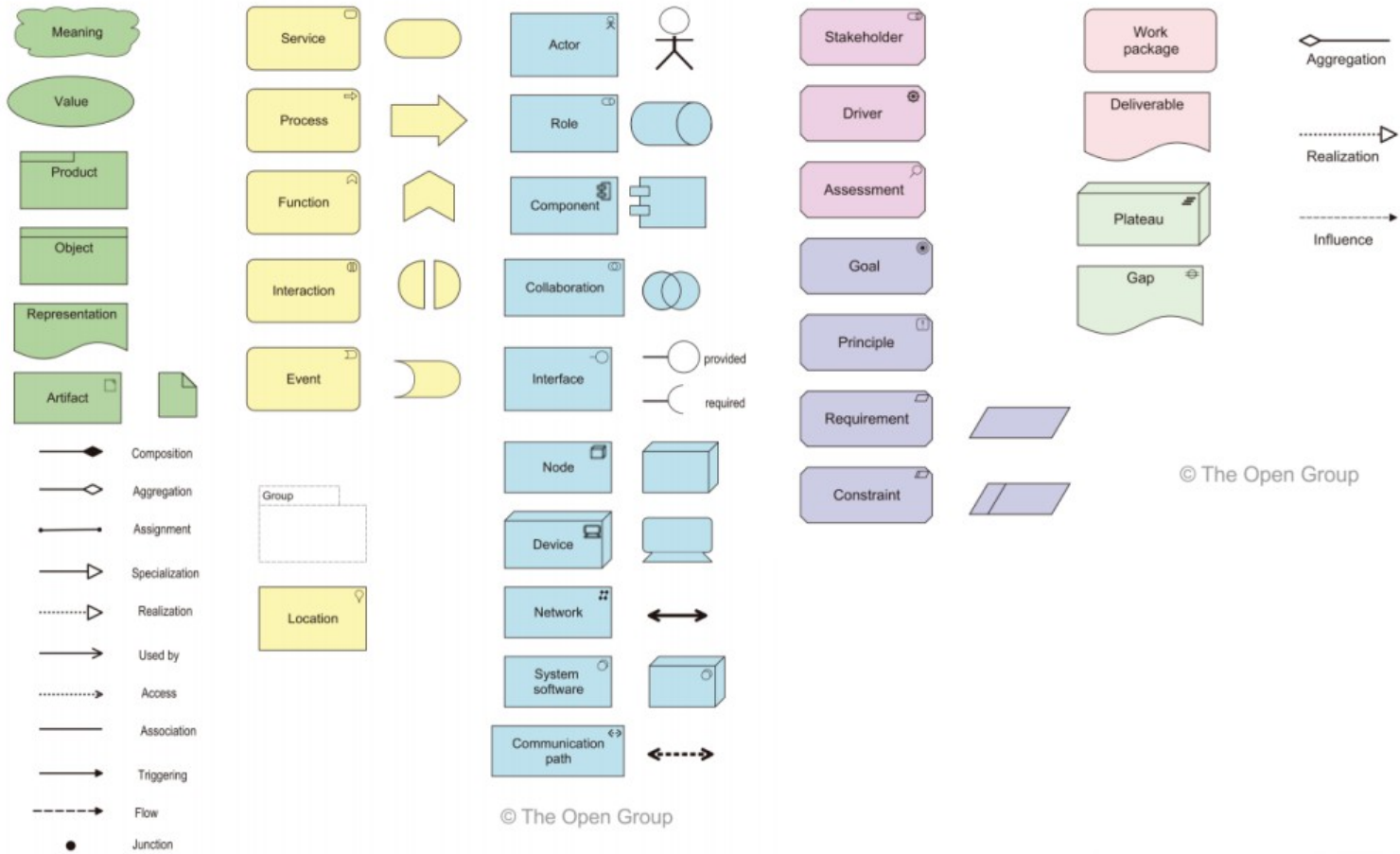
Structural Relationships
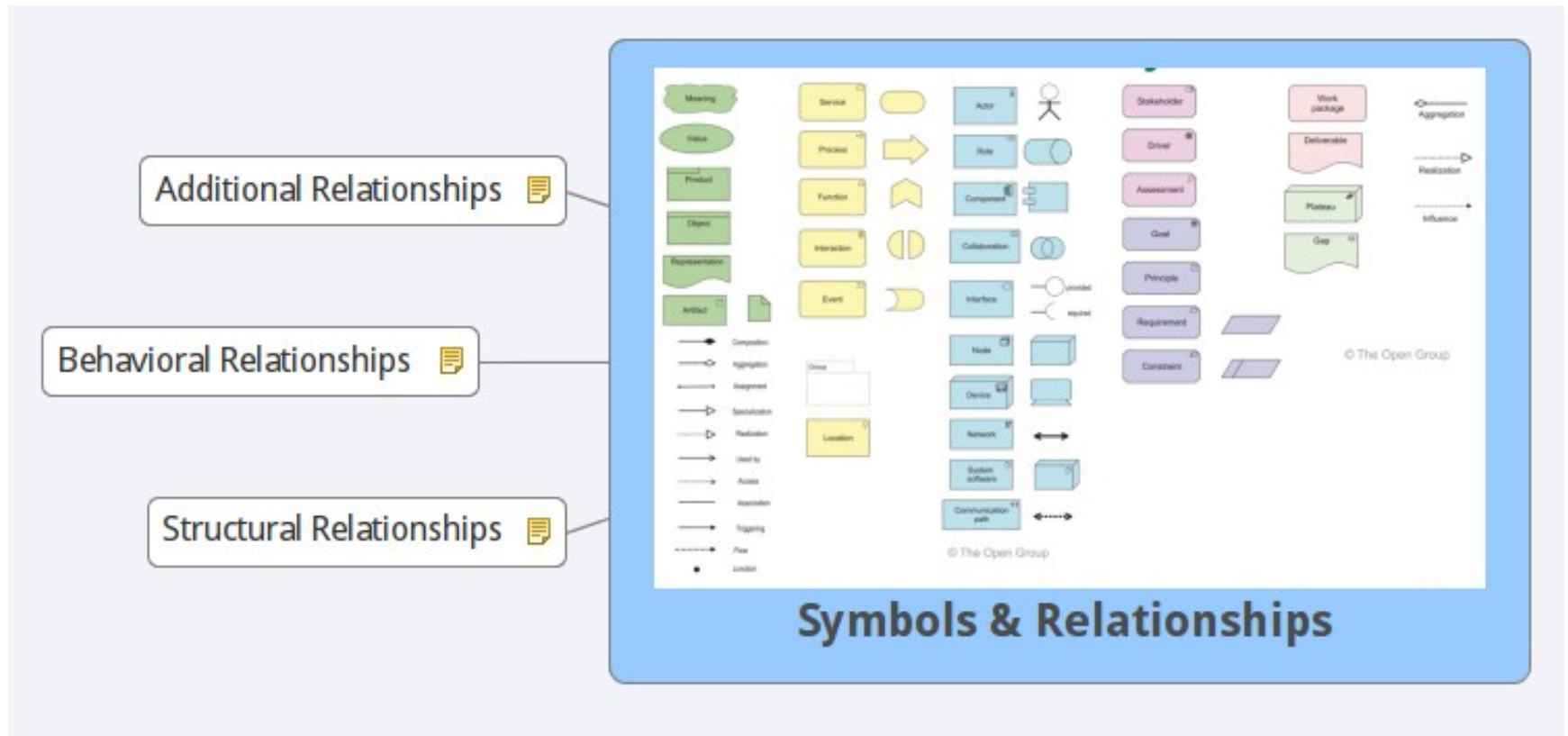
Structural Relationships

Structural relationships model the STRUCTURAL COHERENCE of concepts of same (or different) model element types.

- **Composition**: any object is composed of 1 or more other objects,

- **Aggregation**: groups a number of other objects,

- **Assignment**: links active elements with units of behavior that are performed by them, links business actors with business roles that're fulfilled by them,

- **Realization**: links logical entity with a more concrete entity that realizes it,

- **Used by**: models use of service by {processes|functions|interactions}, access to interfaces by {roles|components|collaborations},

- **Access**: models access of behavioral concepts to {business|data} objects (directional if arrowhead),

- **Association**: models other relationships between objects.

Behavioral Relationships

Behavioral relationships model DYNAMIC DEPENDENCIES between behavioral concepts.

Triggering:

- describes temporal or causal relationships between processes, functions, interactions and events

- no distinction between active triggering or passive causal relationship

Flow:

- describes exchange/transfer of information/value between processes, functions, interactions, events

- does not imply temporal or causal relationship

Additional Relationships

Grouping: objects belong together based on some common characteristics,

Junction: used to connect dynamic relationships of the same type,

Specialization: indicates that an object is a specialization of another object,

Derived relationships: two relationships that join at an intermediate element can be combined & replaced by the weaker of the two.
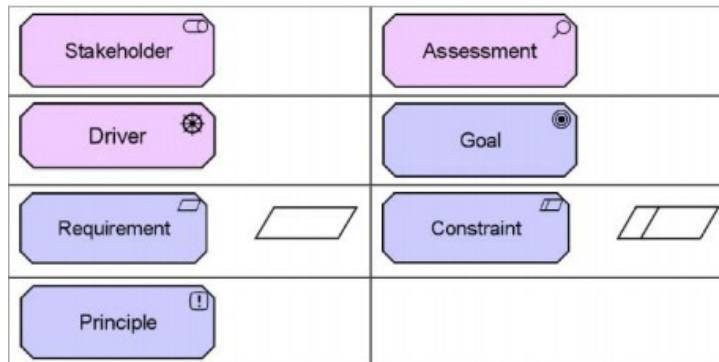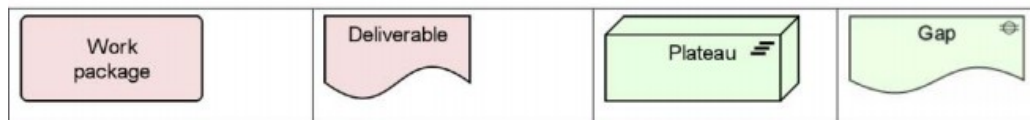
Notations introduced in v2.0

The **Motivation Extension** adds concepts such as goal, principle, and requirement. It addresses the way the enterprise architecture is aligned to its context, as described by motivational elements.

The **Implementation and Migration Extension** adds concepts to support the later ADM phases, related to the implementation and migration of architectures.

Motivation Extension

Stakeholder	Assessment
Driver	Goal
Requirement	Constraint
Principle	

Implementation and Migration Extension

Work package	Deliverable	Plateau	Gap

Modeling Elements Color-schemes

Either of two: (1.) Layered coloring, or (2.) Grammar coloring.

1. "**Layered**" color-scheme (default in modeling tools):
- Yellow-for-Business layer
- Blue-for-Application layer
- Green-for-Infrastructure layer

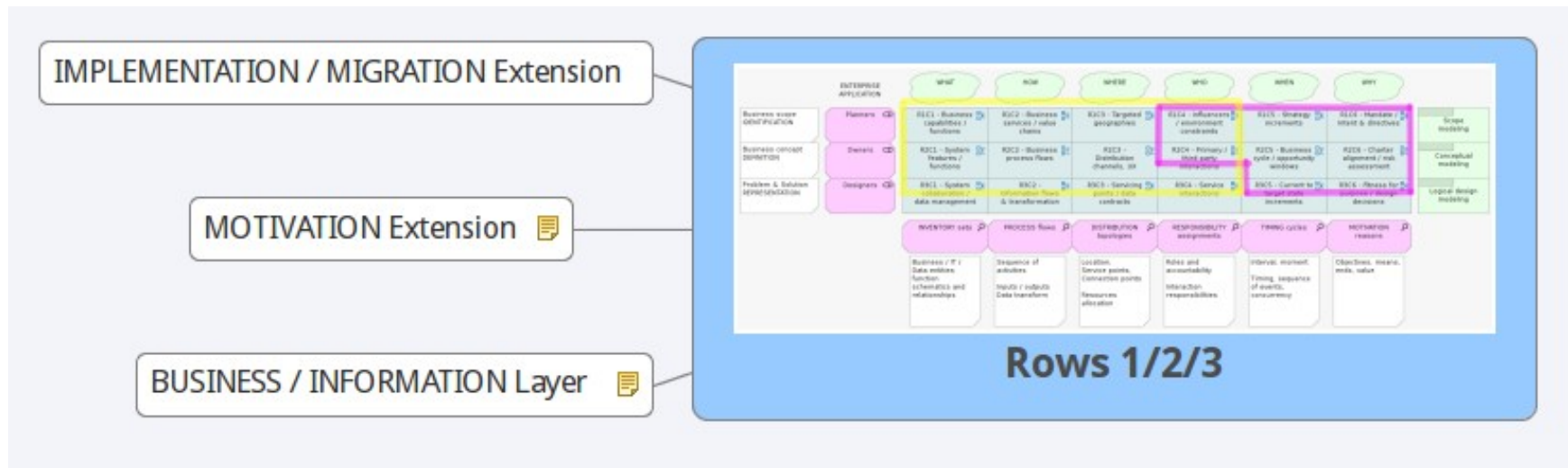2. "**Grammar**" color-scheme (best practice of archimate modeling):
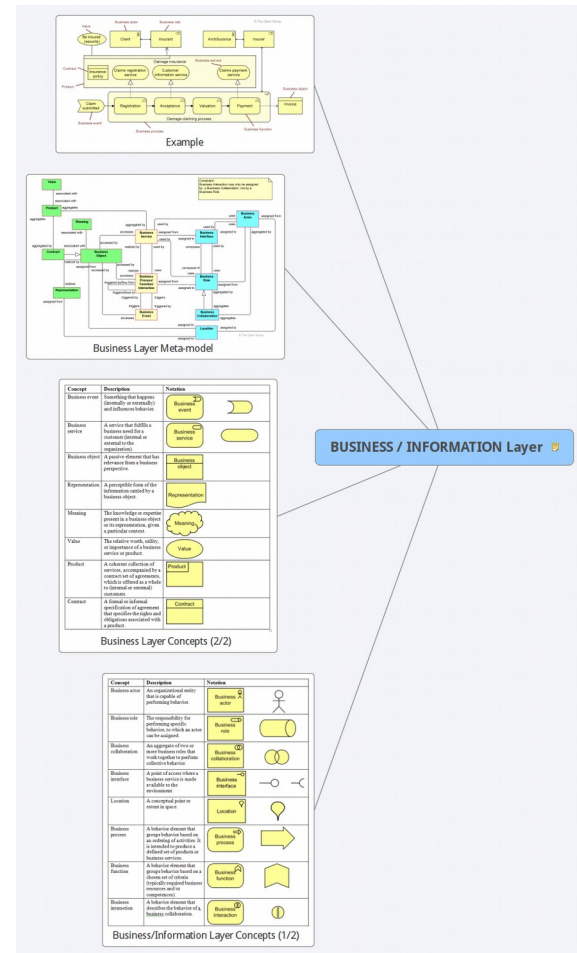- Blue-for-actors
- Yellow-for-behavior
- Green-for-acted-upon

Archimate Layers
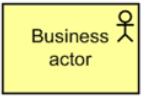
Mapping Archimate to Rows 1/2/3

IMPLEMENTATION / MIGRATION Extension
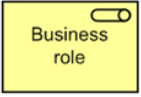
MOTIVATION Extension
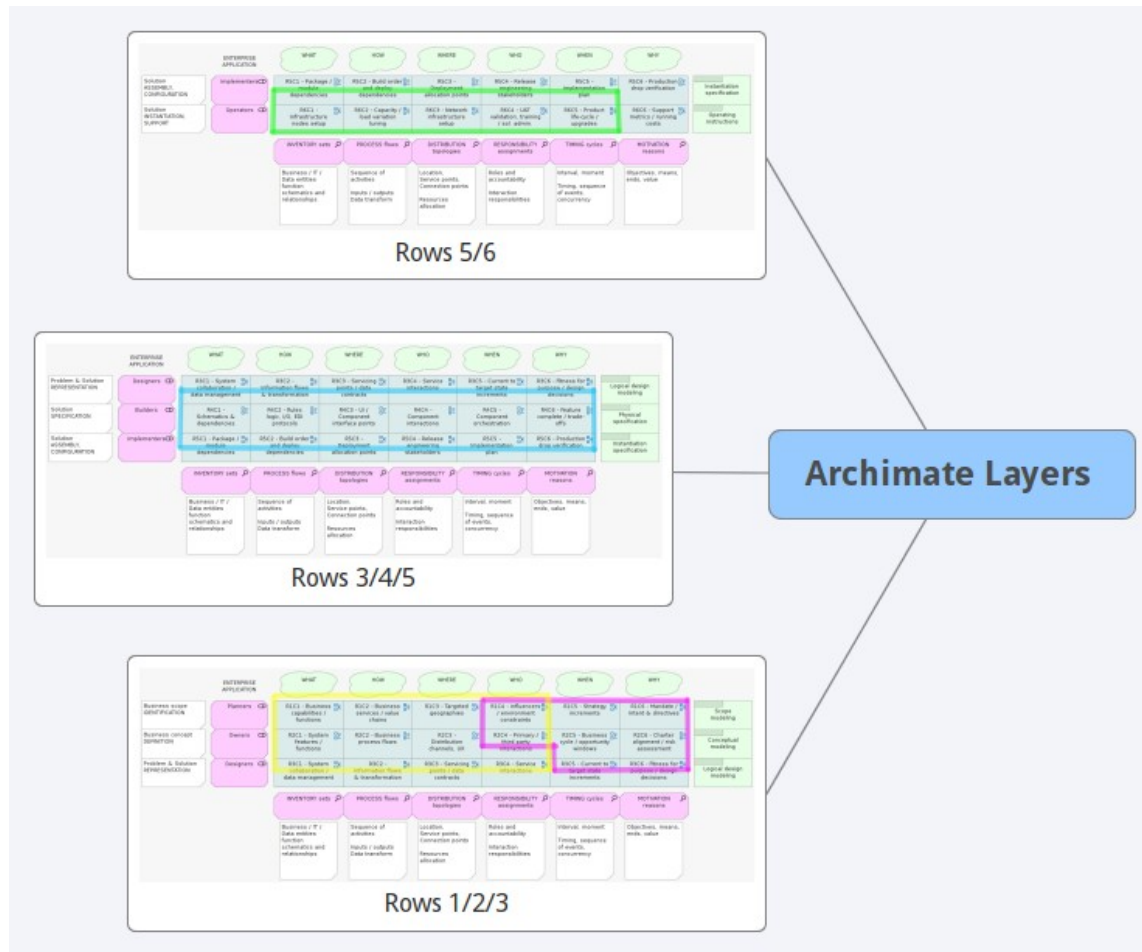
BUSINESS / INFORMATION Layer

Rows 1/2/3
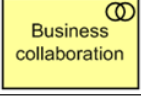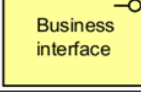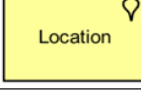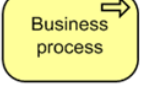
BUSINESS / INFORMATION Layer

The Business layer offers products and services to external customers, which are realised in the organisation by business processes performed by business actors.
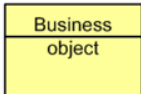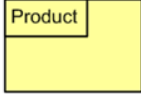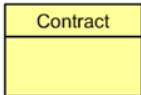
In the Business Layer, data is represented as information (i.e. data in context).

Example

Business Layer Meta-model

Business Layer Concepts (2/2)

BUSINESS / INFORMATION Layer

Business/Information Layer Concepts (1/2)

Business/Information Layer Concepts (1/2)

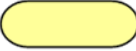| Concept	Description	Notation
Business actor	An organizational entity that is capable of performing behavior.	Business actor
Business role	The responsibility for performing specific behavior, to which an actor can be assigned.	Business role
Business collaboration	An aggregate of two or more business roles that work together to perform collective behavior.	Business collaboration
Business interface	A point of access where a business service is made available to the environment.	Business interface
Location	A conceptual point or extent in space.	Location
Business process	A behavior element that groups behavior based on an ordering of activities. It is intended to produce a defined set of products or business services.	Business process
Business function	A behavior element that groups behavior based on a chosen set of criteria (typically required business resources and/or competences).	Business function
Business interaction	A behavior element that describes the behavior of a business collaboration.	Business interaction

Business Layer Concepts (2/2)

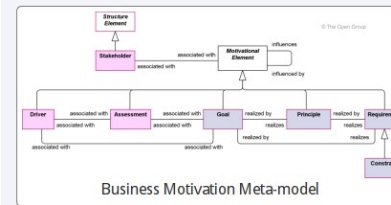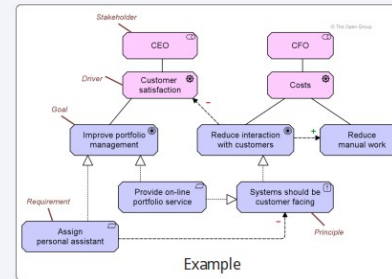| Concept	Description	Notation
Business event	Something that happens (internally or externally) and influences behavior.	Business event
Business service	A service that fulfills a business need for a customer (internal or external to the organization).	Business service
Business object	A passive element that has relevance from a business perspective.	Business object
Representation	A perceptible form of the information carried by a business object.	Representation
Meaning	The knowledge or expertise present in a business object or its representation, given a particular context.	Meaning
Value	The relative worth, utility, or importance of a business service or product.	Value
Product	A coherent collection of services, accompanied by a contract/set of agreements, which is offered as a whole to (internal or external) customers.	Product
Contract	A formal or informal specification of agreement that specifies the rights and obligations associated with a product.	Contract

Business Layer Meta-model
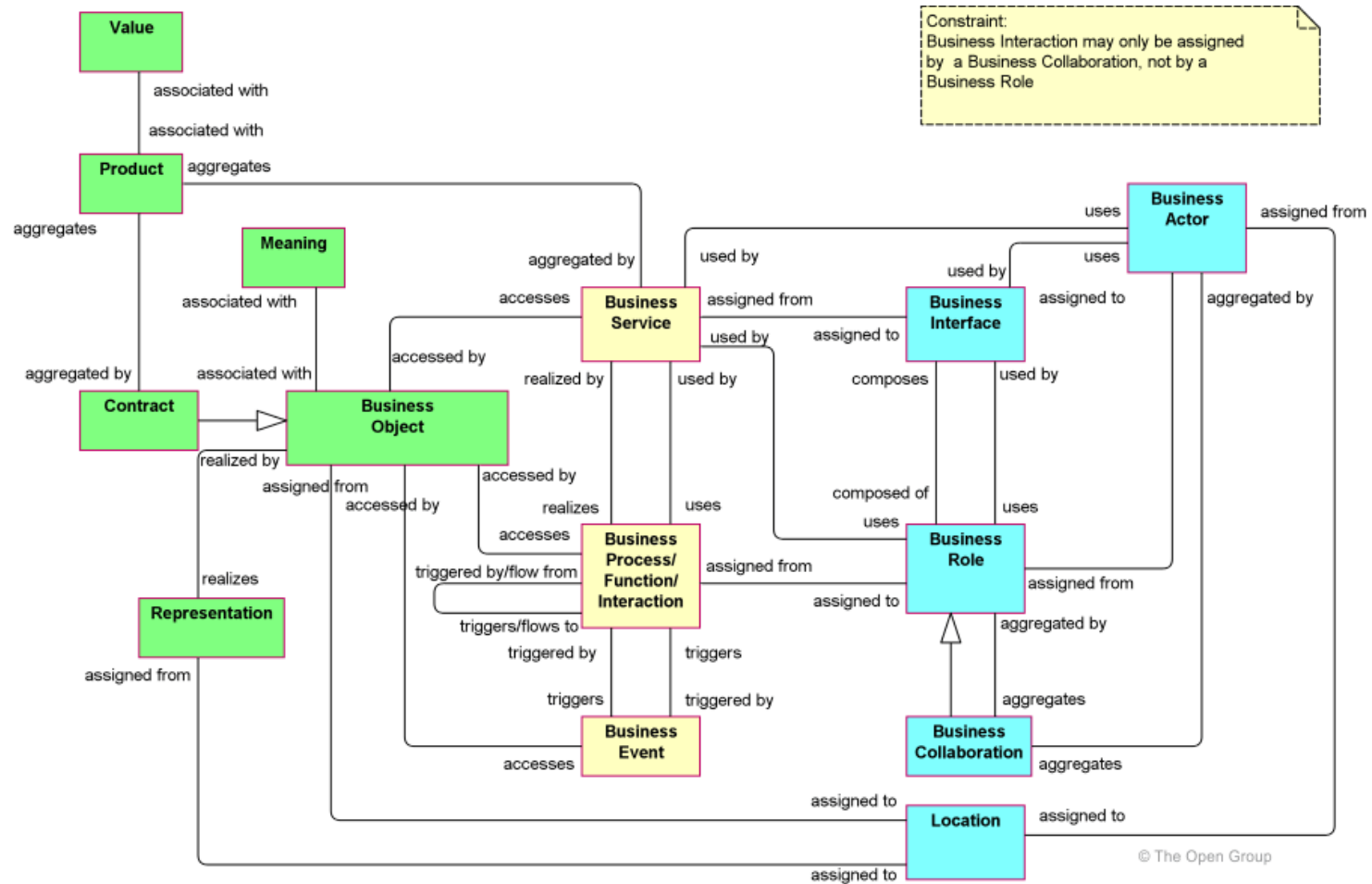
Example
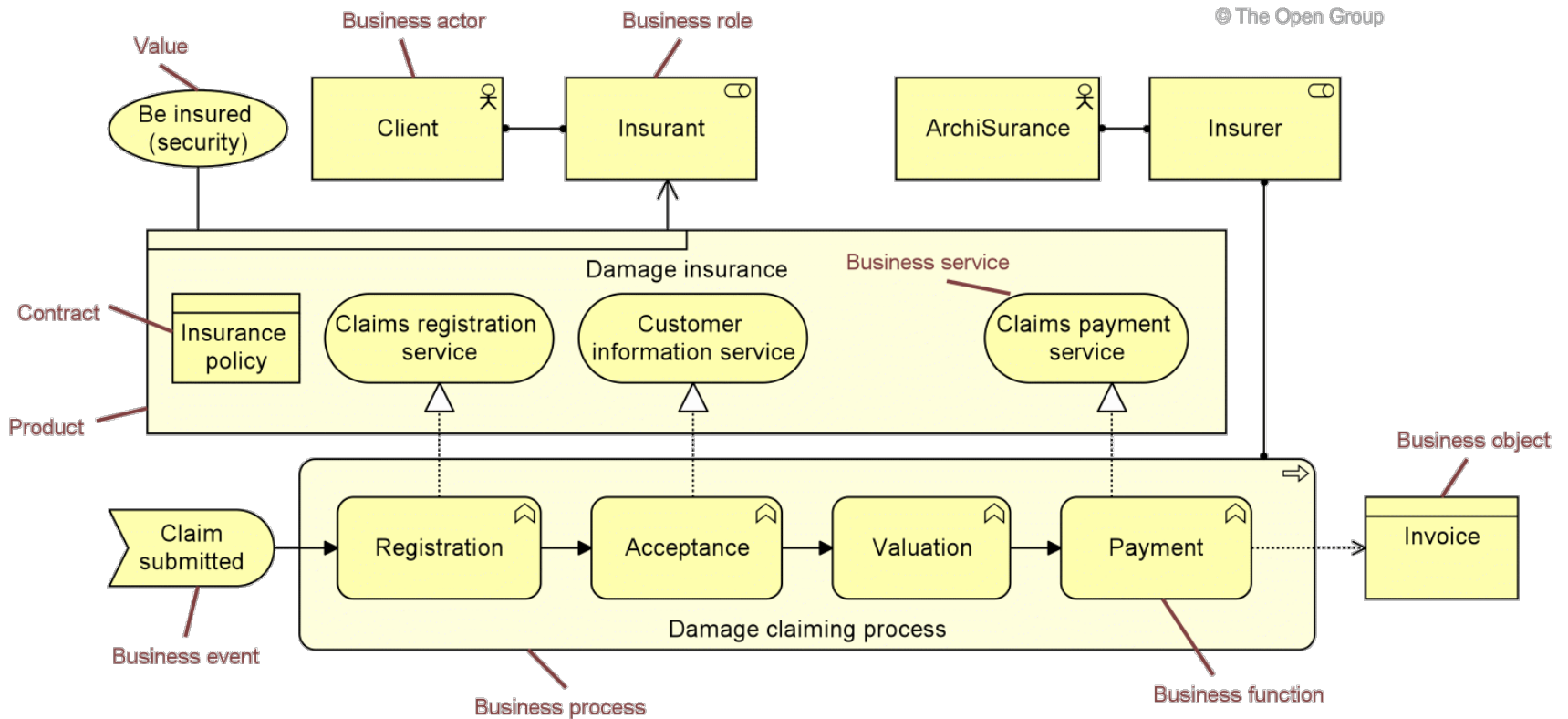
MOTIVATION Extension

Motivation Modeling provides the context or reason lying behind the architecture of a solution design.
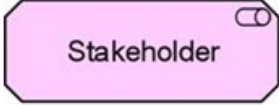
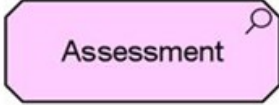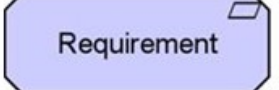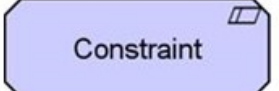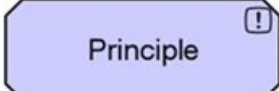# Business Motivation Concepts

Concept	Definition	Notation
Stakeholder	The role of an individual, team, or organization (or classes thereof) that represents their interests in, or concerns relative to, the outcome of the architecture.	Stakeholder
Driver	Something that creates, motivates, and fuels the change in an organization.	Driver
Assessment	The outcome of some analysis of some driver.	Assessment
Goal	An end state that a stakeholder intends to achieve.	Goal
Requirement	A statement of need that must be realized by a system.	Requirement
Constraint	A restriction on the way in which a system is realized.	Constraint
Principle	A normative property of all systems in a given context, or the way in which they are realized.	Principle

Business Motivation Meta-model
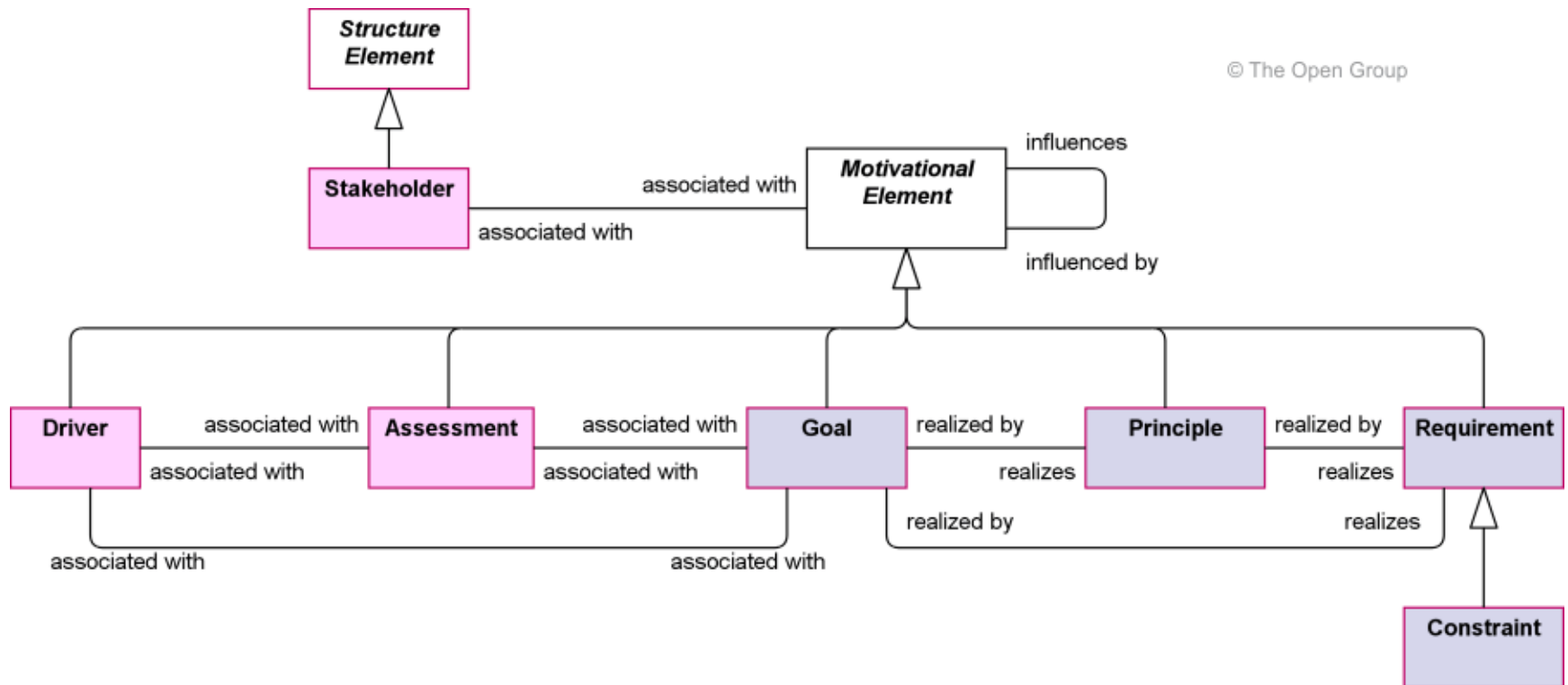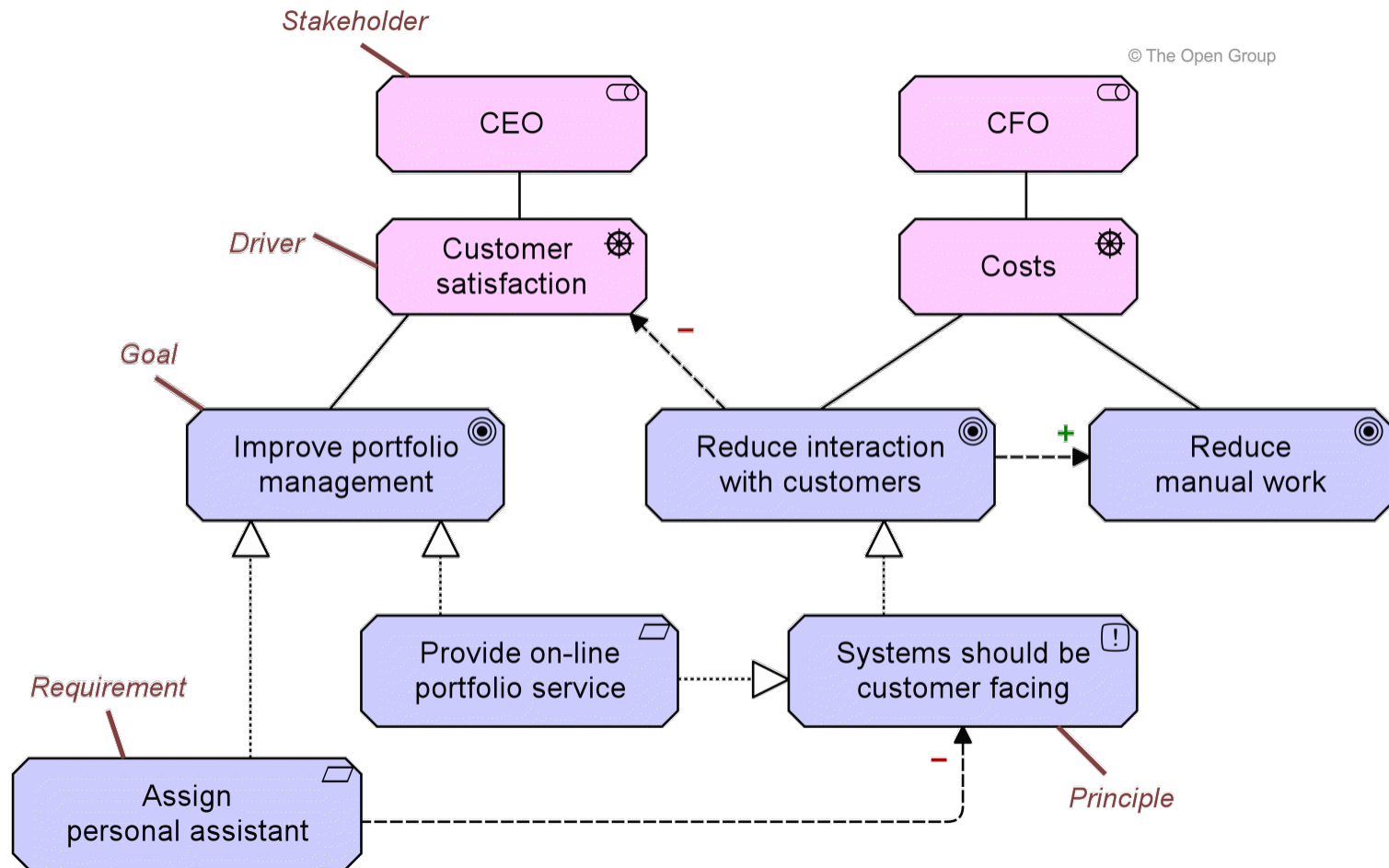

© The Open Group

Example

© The Open Group

MSc in ESS (EA) BY-NC-SA

IMPLEMENTATION / MIGRATION Extension

Example

Implementation/Integration Meta-model
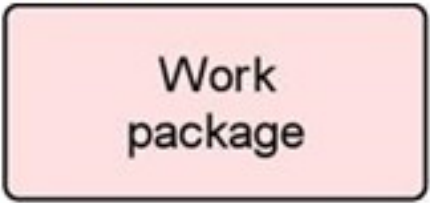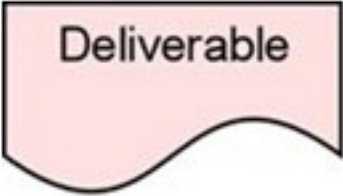
Concept	Definition	Notation
Work Package	A series of actions designed to accomplish a unique goal within a specified time.	Work package
Deliverable	A precisely-defined outcome of a work package.	Deliverable
Plateau	A relatively stable state of the architecture that exists during a limited period of time.	Plateau
Gap	An outcome of a gap analysis between two plateaus.	Gap

Proposed Concepts

IMPLEMENTATION / MIGRATION Extension

Proposed Concepts

Concept	Definition	Notation
Work Package	A series of actions designed to accomplish a unique goal within a specified time.	Work package
Deliverable	A precisely-defined outcome of a work package.	Deliverable
Plateau	A relatively stable state of the architecture that exists during a limited period of time.	Plateau
Gap	An outcome of a gap analysis between two plateaus.	Gap

Implementation/Integration Meta-model

Example

© The Open Group

Mapping Archimate to Rows 3/4/5

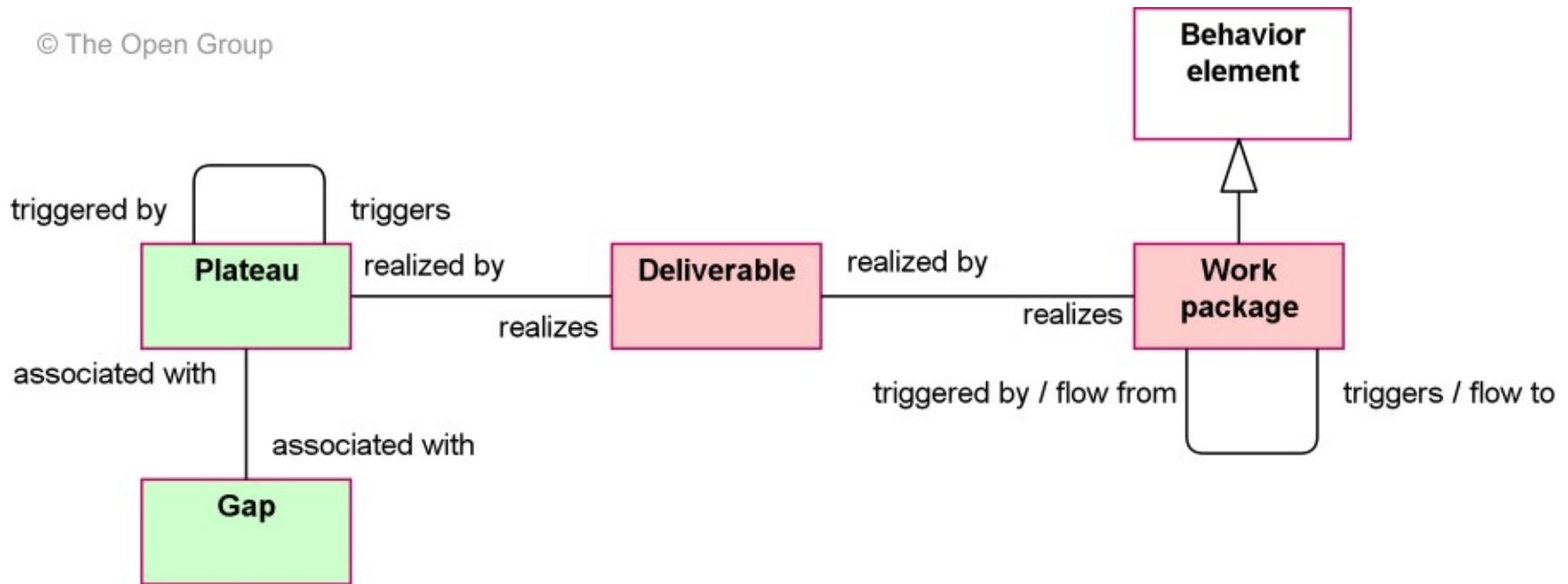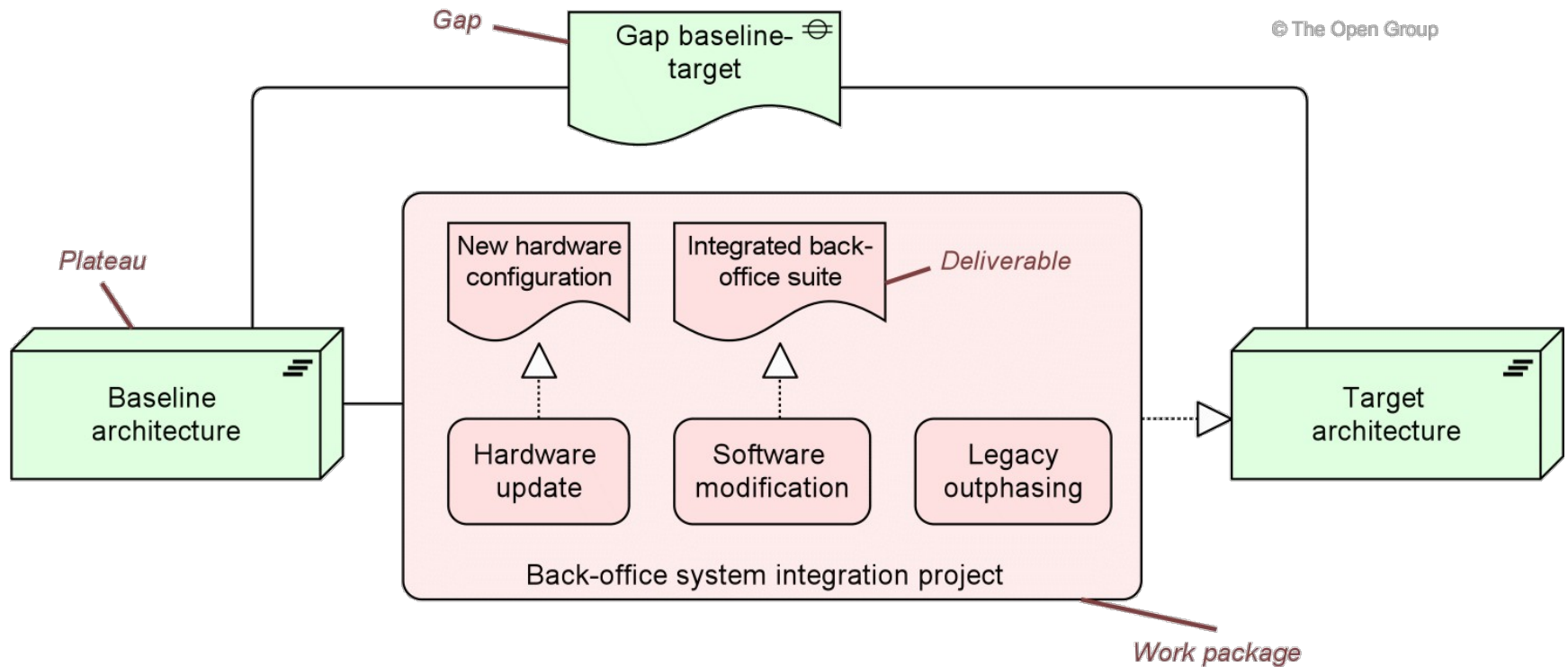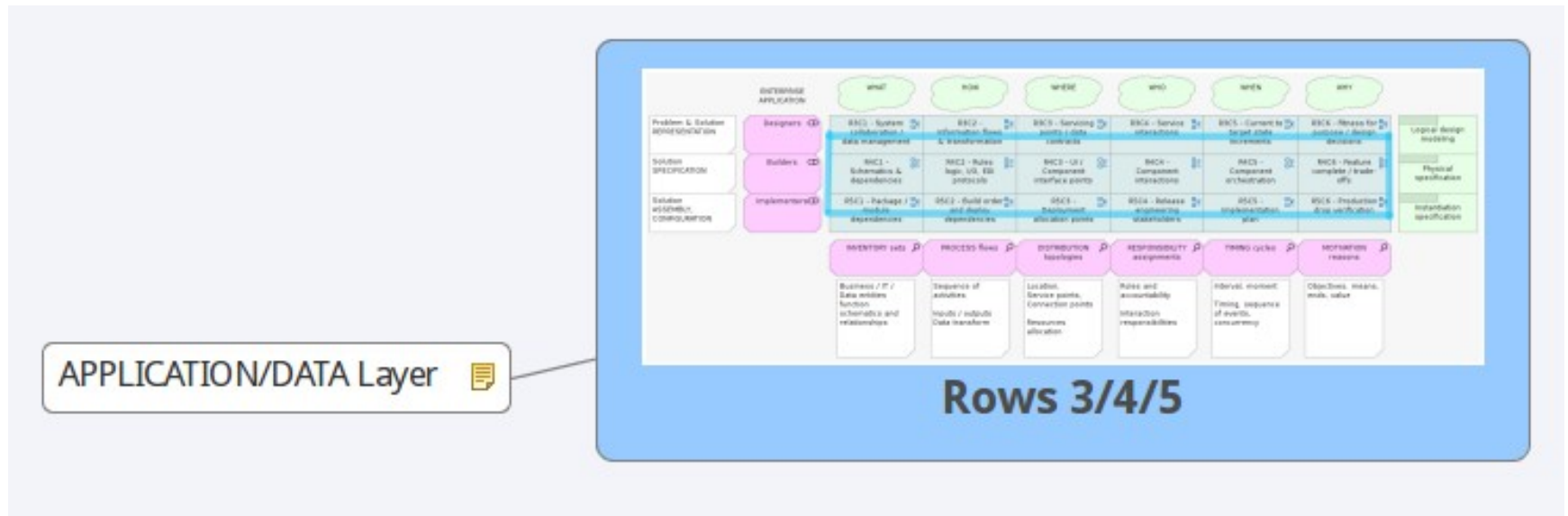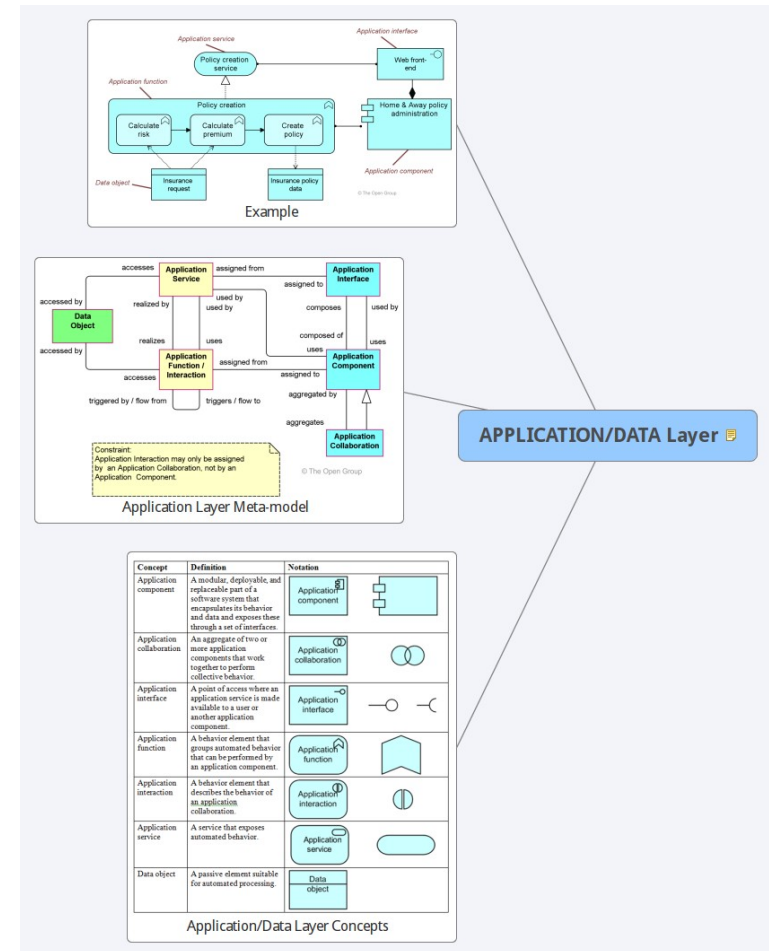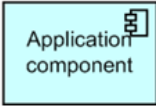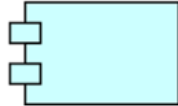APPLICATION/DATA Layer

Rows 3/4/5

APPLICATION/DATA Layer

The Application layer supports the business layer with application services which are realised by (software) applications.

Example

Application Layer Meta-model

APPLICATION/DATA Layer

Application/Data Layer Concepts

Application/Data Layer Concepts

Concept	Definition	Notation
Application component	A modular, deployable, and replaceable part of a software system that encapsulates its behavior and data and exposes these through a set of interfaces.	
Application collaboration	An aggregate of two or more application components that work together to perform collective behavior.	
Application interface	A point of access where an application service is made available to a user or another application component.	
Application function	A behavior element that groups automated behavior that can be performed by an application component.	
Application interaction	A behavior element that describes the behavior of an application collaboration.	
Application service	A service that exposes automated behavior.	
Data object	A passive element suitable for automated processing.	

Application Layer Meta-model

Example

Application service

Application interface

Policy creation service

Web front-end

Application function

Policy creation

Calculate risk → Calculate premium → Create policy

Home & Away policy administration

Application component

Data object

Insurance request

Insurance policy data
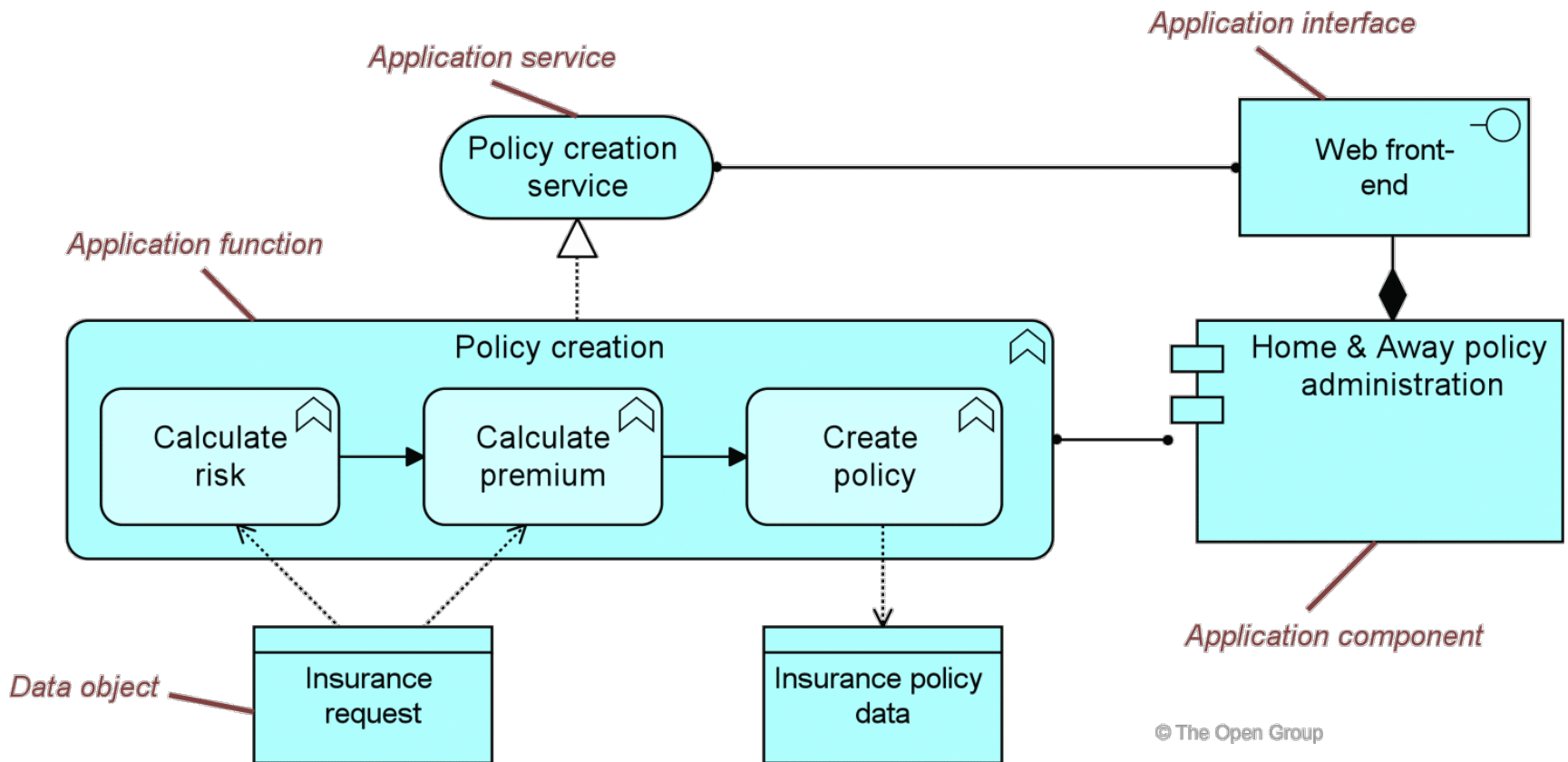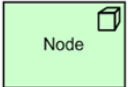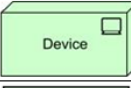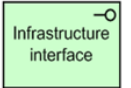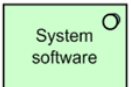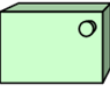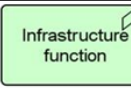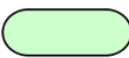
© The Open Group

Mapping Archimate to Rows 5/6

TECHNOLOGY/INFRASTRUCTURE Layer

Rows 5/6

TECHNOLOGY/INFRASTRUCTURE Layer

The Technology layer offers infrastructure services (e.g., processing, storage and communication services) needed to run applications,

realised by computer and communication hardware and system software.

Example

Example

TECHNOLOGY/INFRASTRUCTURE Layer

Technology Layer Meta-model

Technology/Infrastructure Layer Concepts

Technology/Infrastructure Layer Concepts

Concept	Definition	Notation
Node	A computational resource upon which artifacts may be stored or deployed for execution.	Node
Device	A hardware resource upon which artifacts may be stored or deployed for execution.	Device
Network	A communication medium between two or more devices.	Network
Communication path	A link between two or more nodes, through which these nodes can exchange data.	Communication path
Infrastructure interface	A point of access where infrastructure services offered by a node can be accessed by other nodes and application components.	Infrastructure interface
System software	A software environment for specific types of components and objects that are deployed on it in the form of artifacts.	System software
Infrastructure function	A behavior element that groups infrastructural behavior that can be performed by a node.	Infrastructure function
Infrastructure service	An externally visible unit of functionality, provided by one or more nodes, exposed through well-defined interfaces, and meaningful to the environment.	Infrastructure service
Artifact	A physical piece of data that is used or produced in a software development process, or by deployment and operation of a system.	Artifact

Technology Layer Meta-model

Example

© The Open Group

Archimate Viewpoints
...i.e. Formalized, Verifiable

Extended Viewpoints

Archimate Viewpoints

Review of a few Viewpoints

Review of a few Viewpoints

Review of a few Viewpoints

ArchiMate® 2.1

THE **Open** GROUP

ArchiMate Standard Viewpoints

Viewpoint	Description
Introductory	This viewpoint uses a simplified notation to explain the essence of an architecture model to non-architects that require a simpler, more intuitive notation.
Organization	This viewpoint focuses on the (internal) organization of a company, a department, a network of companies, or of another organizational entity.
Actor Co-operation	This viewpoint focuses on the relationships of actors with each other and their environment.
Business Function	This viewpoint shows the main business functions of an organization and their relationships in terms of the flows of information, value, or goods between them.
Business Process	This viewpoint shows the high-level structure and composition of one or more business processes.
Business Process Co-operation	This viewpoint shows the relationships of one or more business processes with each other and/or with their environment.
Product	This viewpoint describes the value that one or more products offer to the customers or other external parties involved and shows the composition of one or more products in terms of the constituting (business or application) services, and the associated contract(s) or other agreements.
Application Behavior	This viewpoint describes the internal behavior of an application; e.g., as it realizes one or more application services.
Application Co-operation	This viewpoint describes the relationships between applications components in terms of the information flows between them, or in terms of the services they offer and use.
Application Structure	This viewpoint shows the structure of one or more applications or components.
Application Usage	This viewpoint describes how applications are used to support one or more business processes, and how they are used by other applications.
Infrastructure	This viewpoint describes the software and hardware infrastructure elements supporting the application layer, such as physical devices, networks, or system software (e.g., operating systems, databases, and middleware).
Infrastructure Usage	This viewpoint shows how applications are supported by the software and hardware infrastructure: the infrastructure services are delivered by the devices; system software and networks are provided to the applications.
Implementation and Deployment	This viewpoint shows how one or more applications are realized on the infrastructure.
Information Structure	This viewpoint shows the structure of the information used in the enterprise or in a specific business process or application, in terms of data types or (object-oriented) class structures.
Service Realization	This viewpoint shows how one or more business services are realized by the underlying processes (and sometimes by application components).
Layered	This viewpoint shows several layers and aspects of an enterprise architecture in a single diagram.
Landscape Map	This viewpoint uses a matrix to represent a three-dimensional co-ordinate system describing architectural relationships.

N132 Reference Card: ArchiMate® 2.1 Viewpoints

Review of a few Viewpoints

For the compete list / description of Archimate Viewpoints, refer to the Archimate 2.1 Specification included in Moodle,

or review it online at [http://pubs.opengroup.org/architecture/archimate2-doc/].
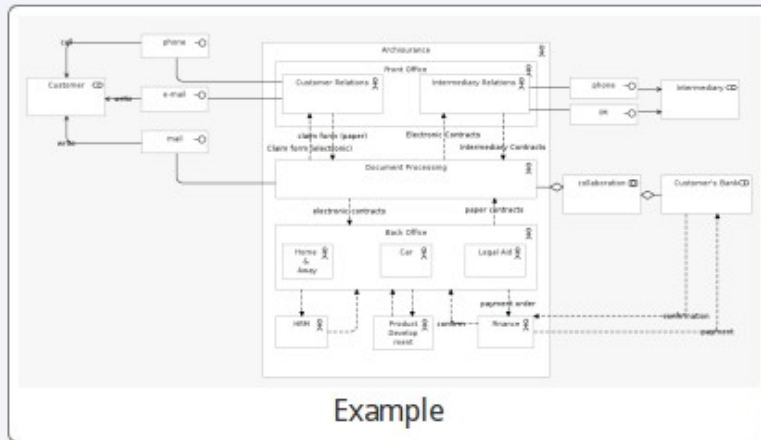
Example: Actor Co-operation Viewpoint

Example

Meta-model

Example: Actor Co-operation Viewpoint

Example: Application Behavior Viewpoint

Example

Meta-model
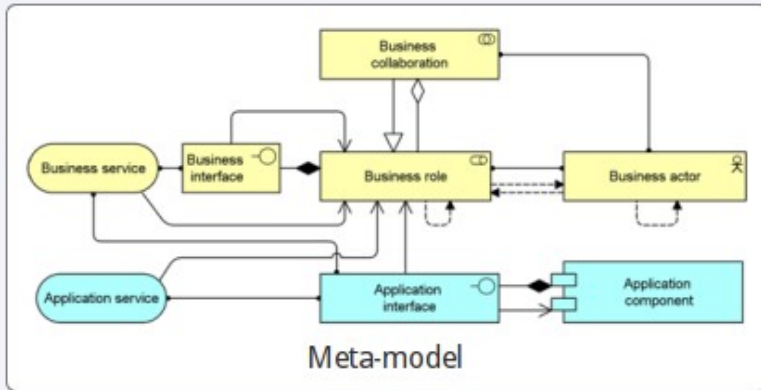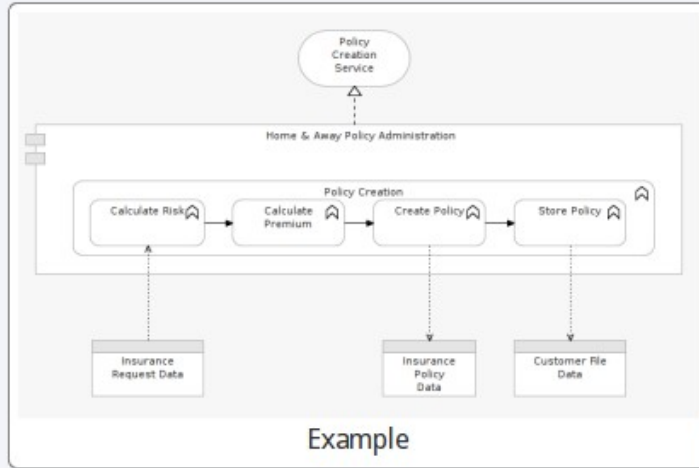
Example: Application Behavior Viewpoint
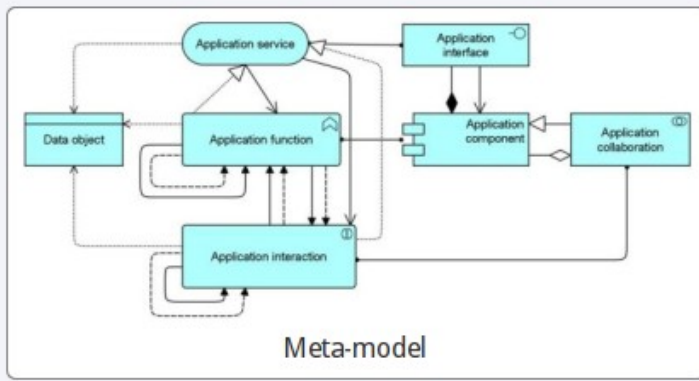
Example: Application Behavior Viewpoint

To describe the internal behaviour of an application; e.g., as it realizes one or more application services.

To design the main behaviour of applications.

...helpful in identifying functional overlap between different applications (i.e. cross cutting concern, impact analysis)

.. or identifying functional coverage gaps within or between applications.

Linked Model-type(s): Behavioral, Data Flow diagram.

Meta-model
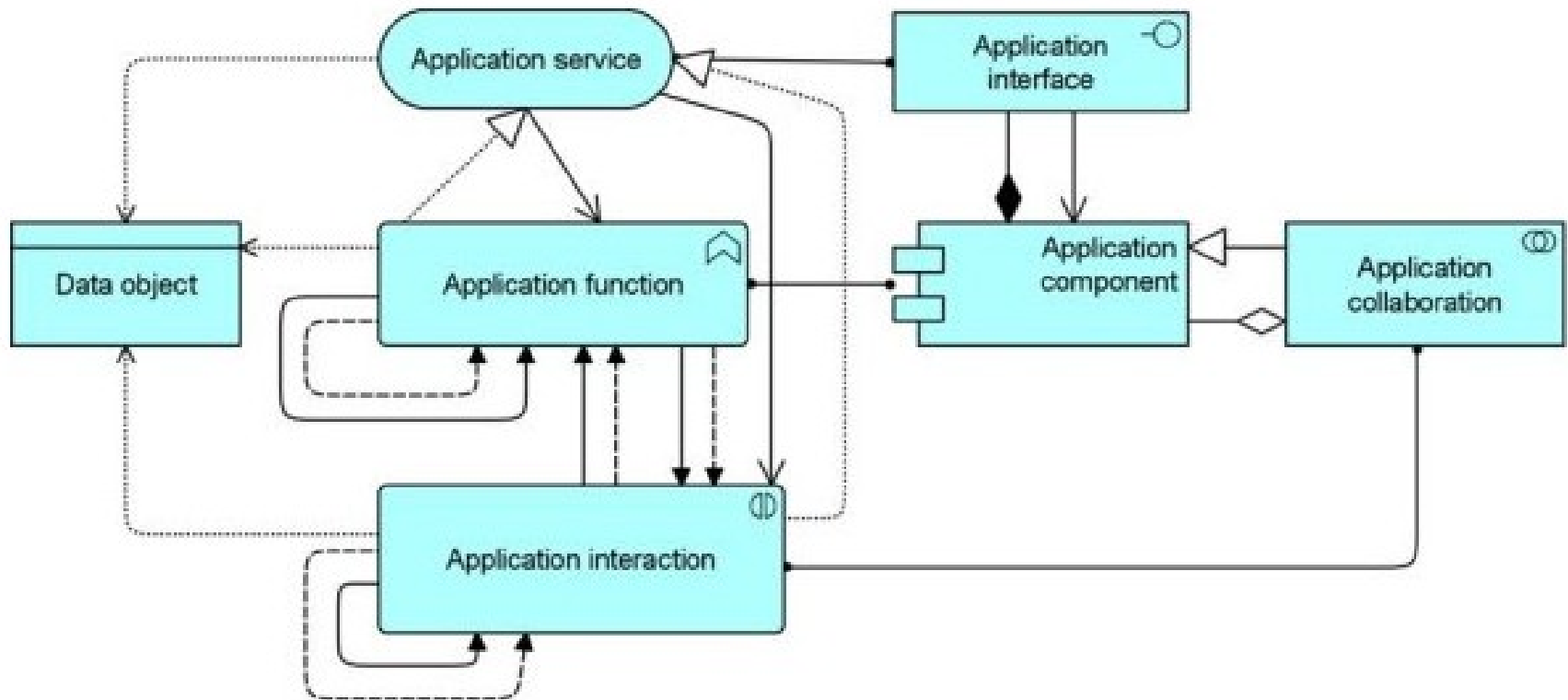
Example: Application Co-operation Viewpoint
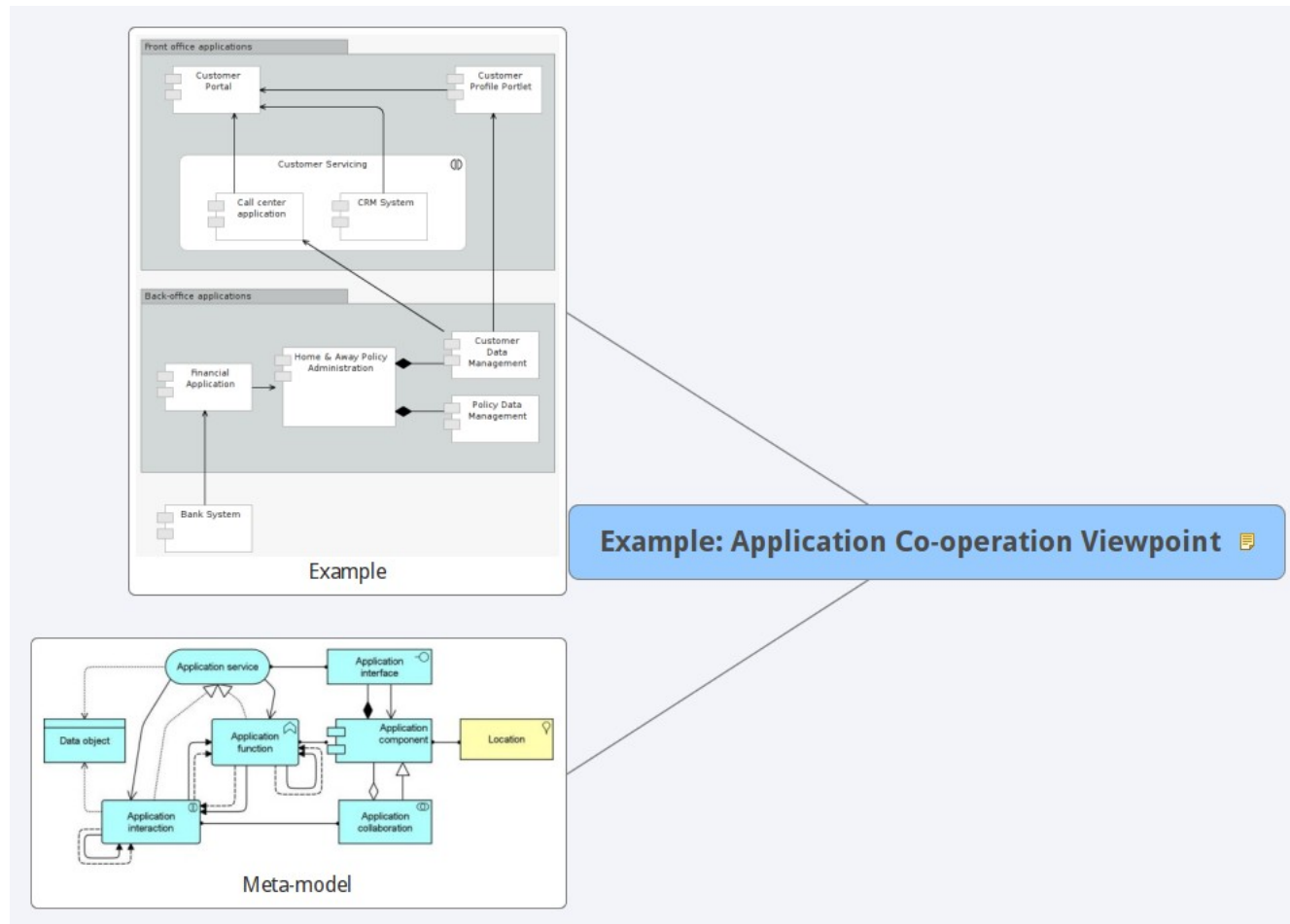
Example: Application Co-operation Viewpoint

To express the (internal) orchestration of application services that together support the execution of a business process.

To describe information flowing between application components.

To enumerate the services application components offer or/and use.

Can be used to create a high-level overview of the application landscape of an organization.

Linked Model-type(s): Behavioral, Data Flow or Component collaboration diagrams.

Meta-model
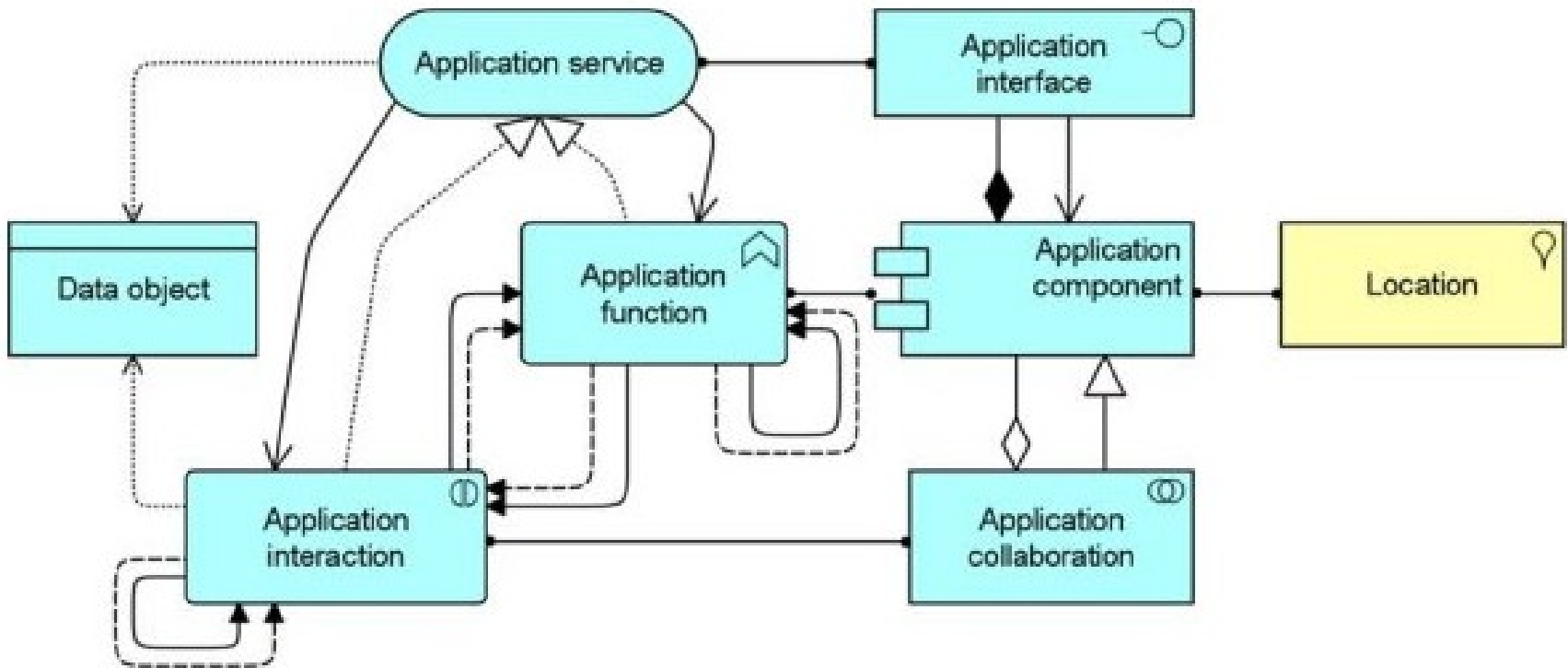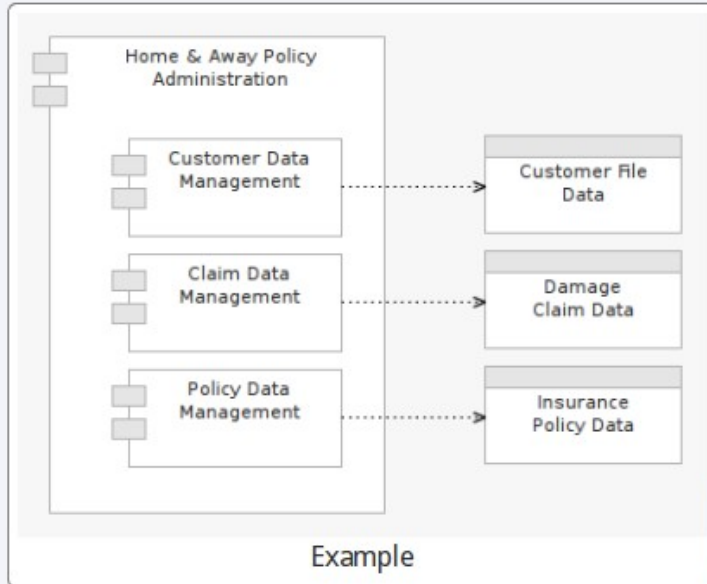
Example: Application Structure Viewpoint
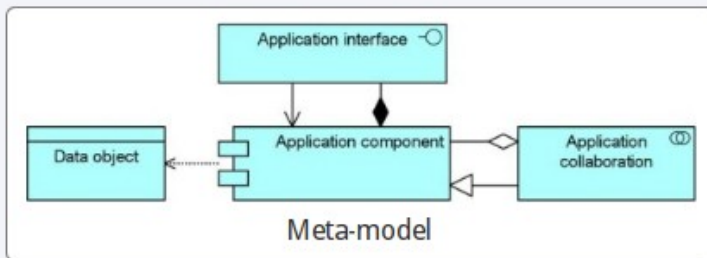
Example: Application Structure Viewpoint

To outline the structure of one or more applications or components.

To associate components and data entities.

Linked Model-type(s): Functional, Component/Application diagrams.

Meta-model
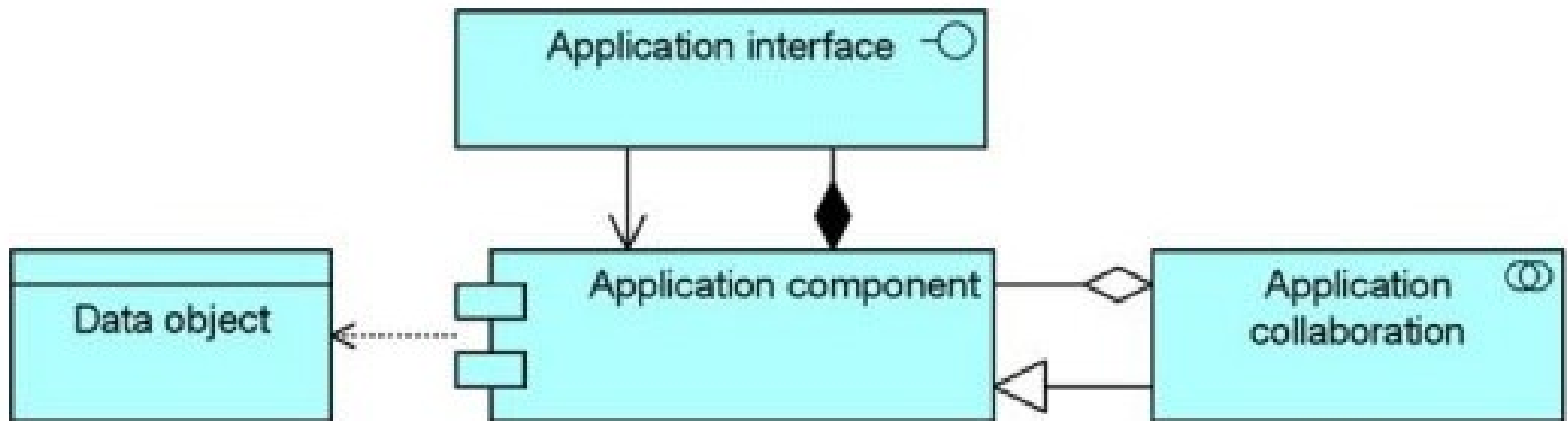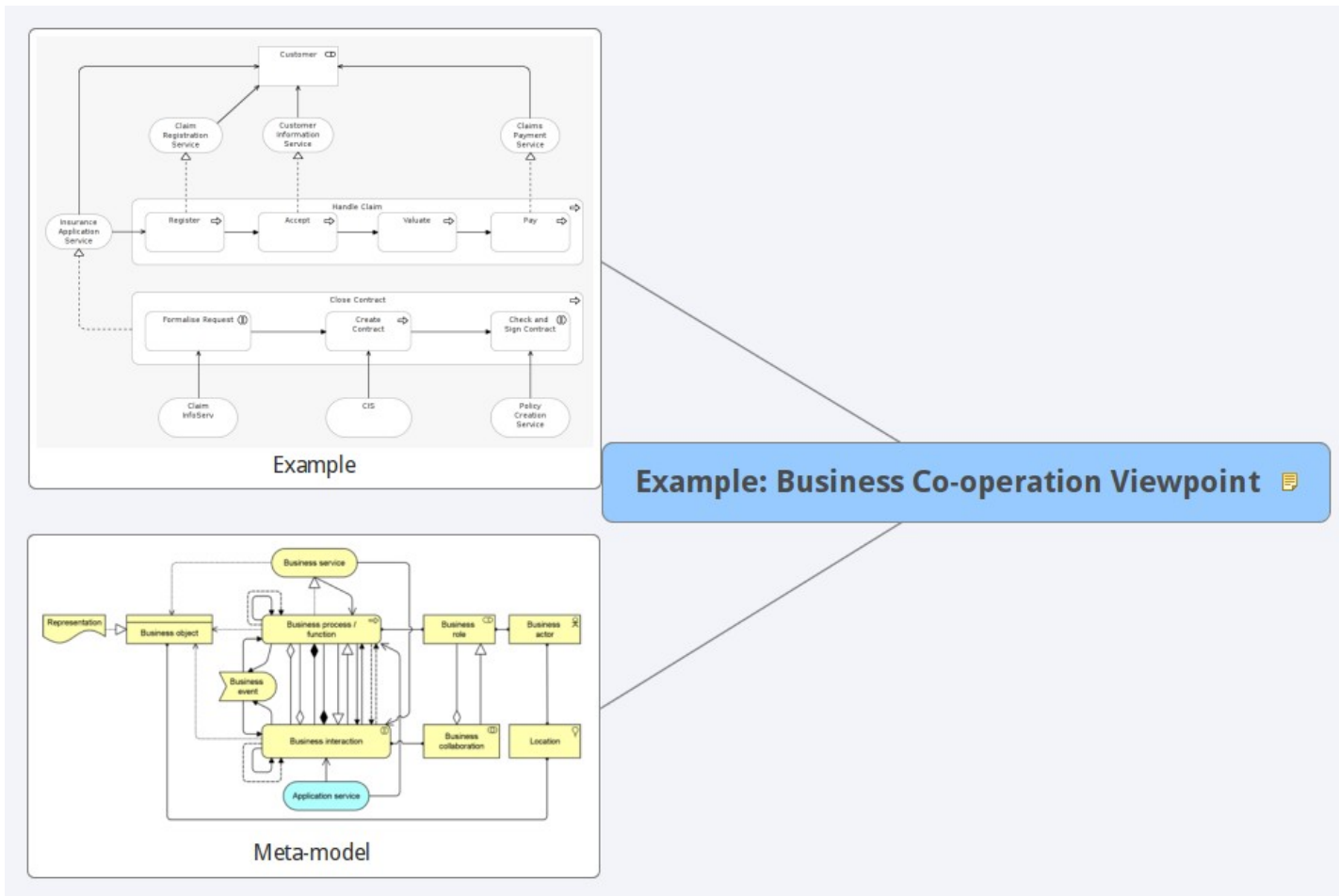
Example: Business Co-operation Viewpoint

Example: Business Co-operation Viewpoint

To outline causal relations of business processes with each other and/or with their environment.

To outline business process dependencies within their temporal context.

To show how what business process realize what Business services.

To outline cross-cutting uses of shared data.

To show actors accountable for / interacting with process steps.

Model-kind: Behavioral, Process Flow diagrams.

Meta-model
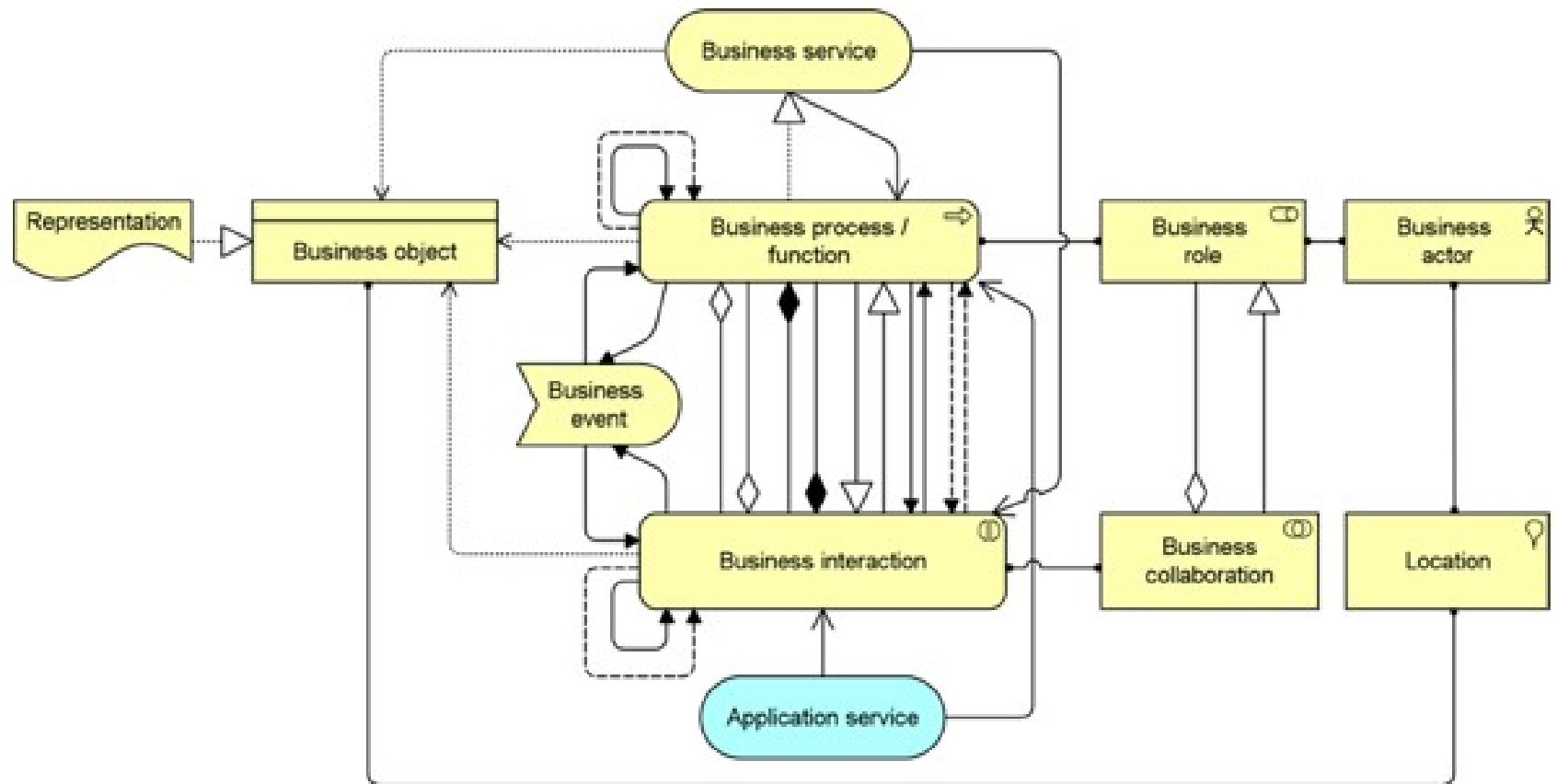
Example: Business Function Viewpoint
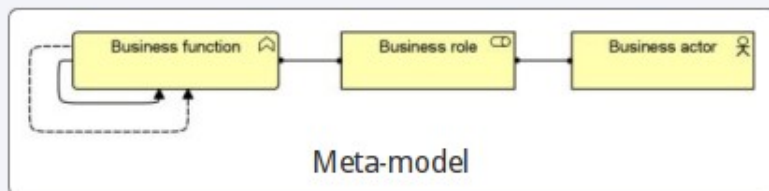
Meta-model
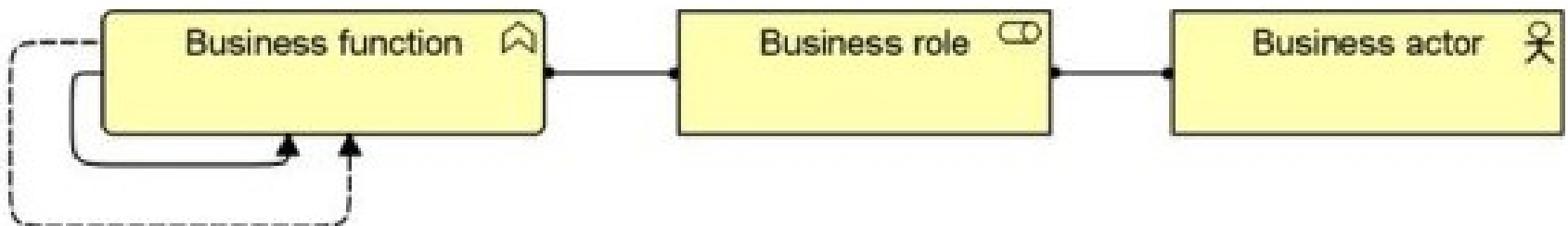
Example: Business Process Viewpoint
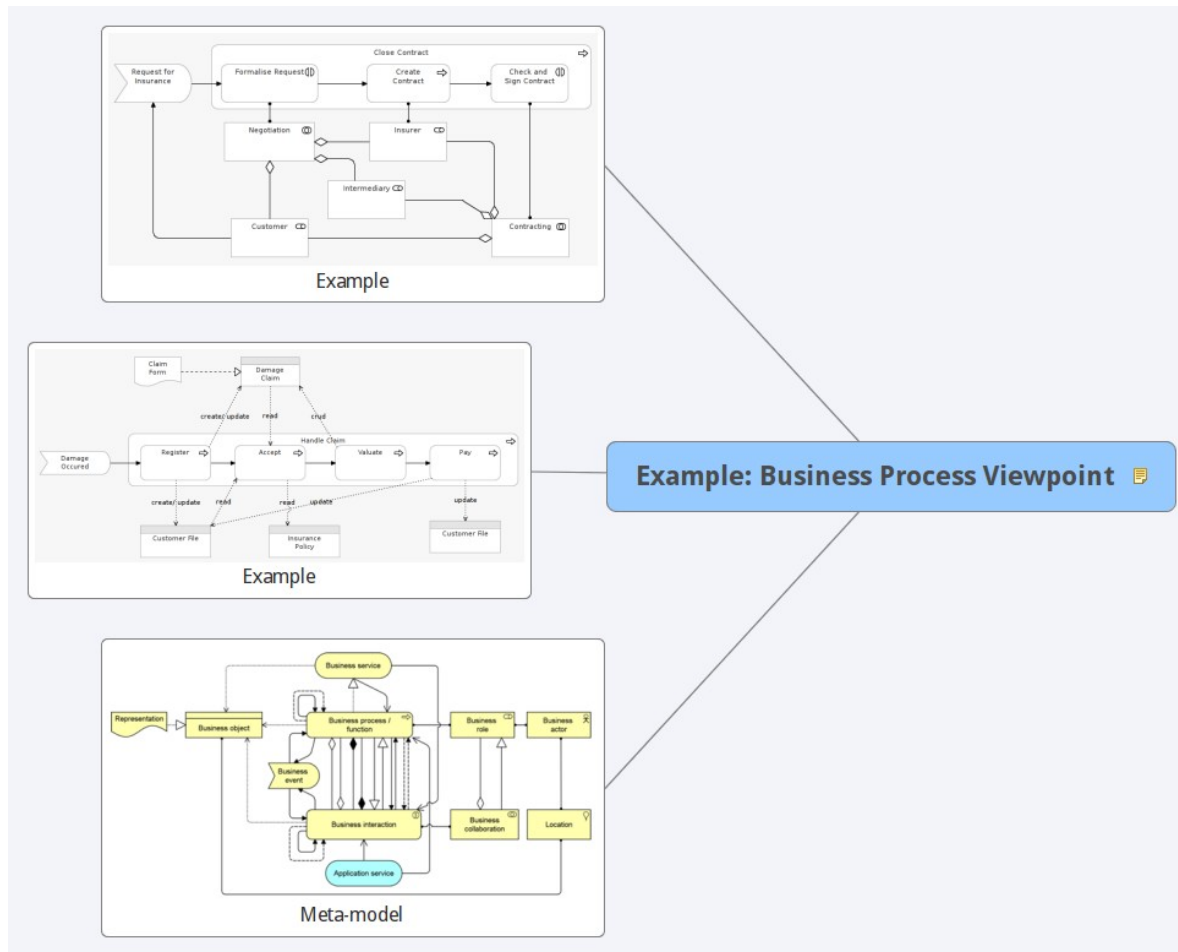
Example: Business Process Viewpoint

To show the high-level structure of one or more business processes.

To show information types required/used for each process steps.

To show actors interacting with each process step and define accountability.

To realize service offered / exposed.

To compose/relate processes with other processes.

Model-type: Behavioral

Meta-model
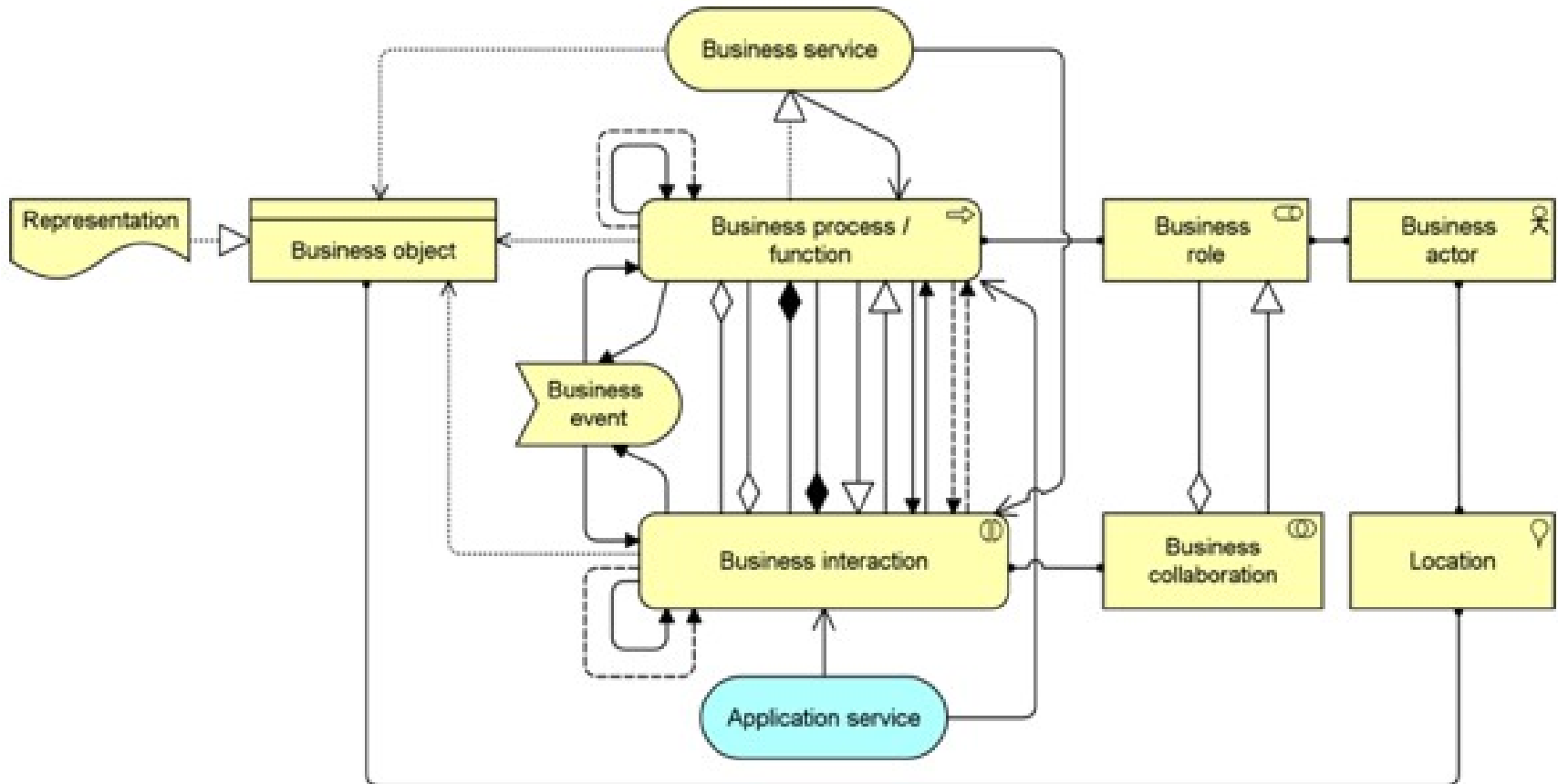
Example: Business Product Viewpoint
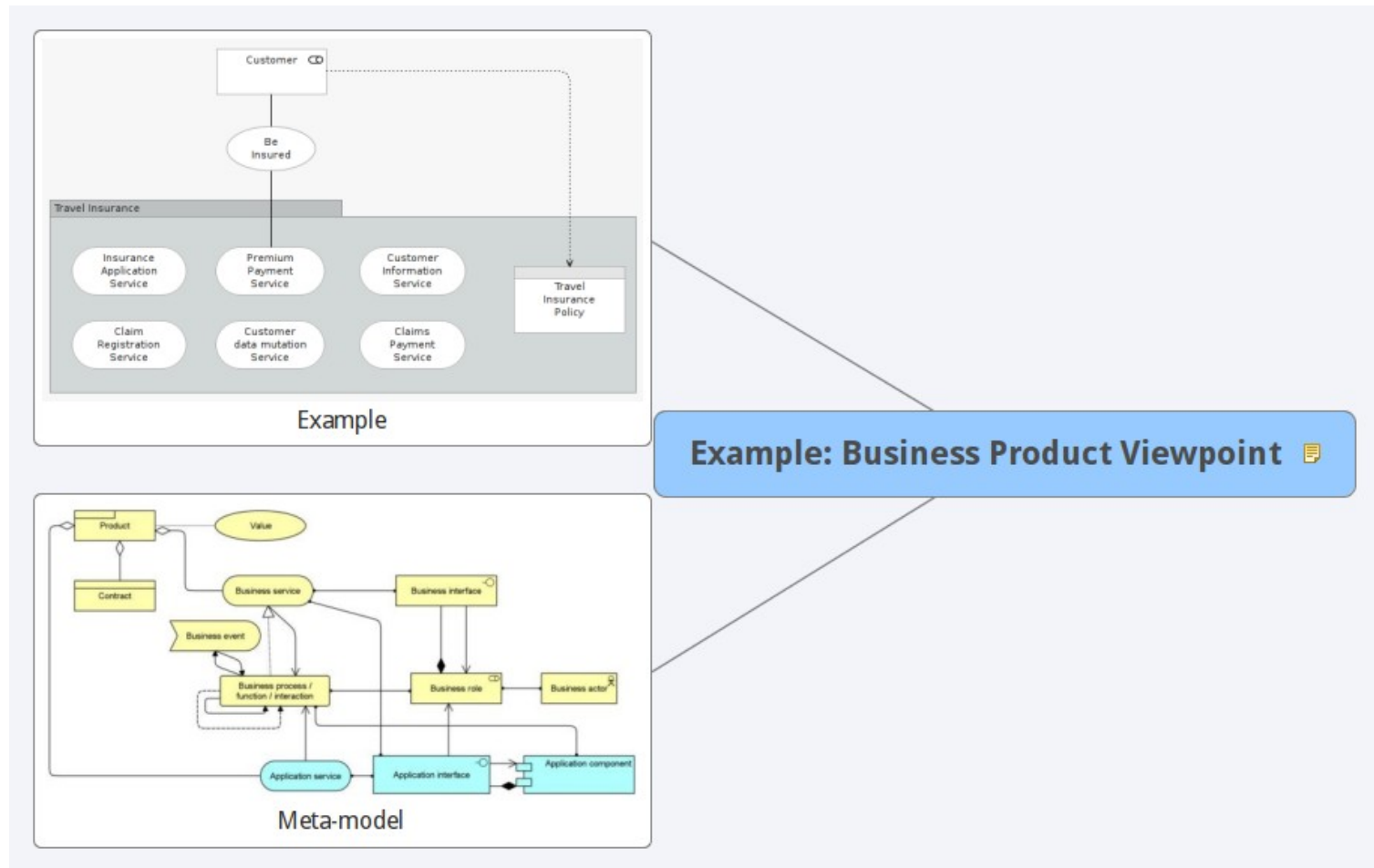
Example: Business Product Viewpoint

To depict the value products offer to external parties (intermediaries, customers,..)

To shows the composition of one or more products in terms of the constituting (business or application) services, and the associated contract(s) or other agreements.

To show the interfaces (channels) through which this product is offered, and the events associated with the product.

To identify which services can be re-used, or must be created created for a product, given the value a customer expects from it.

Product are realized by processes.

Model-type: Structural, Service Map

Meta-model
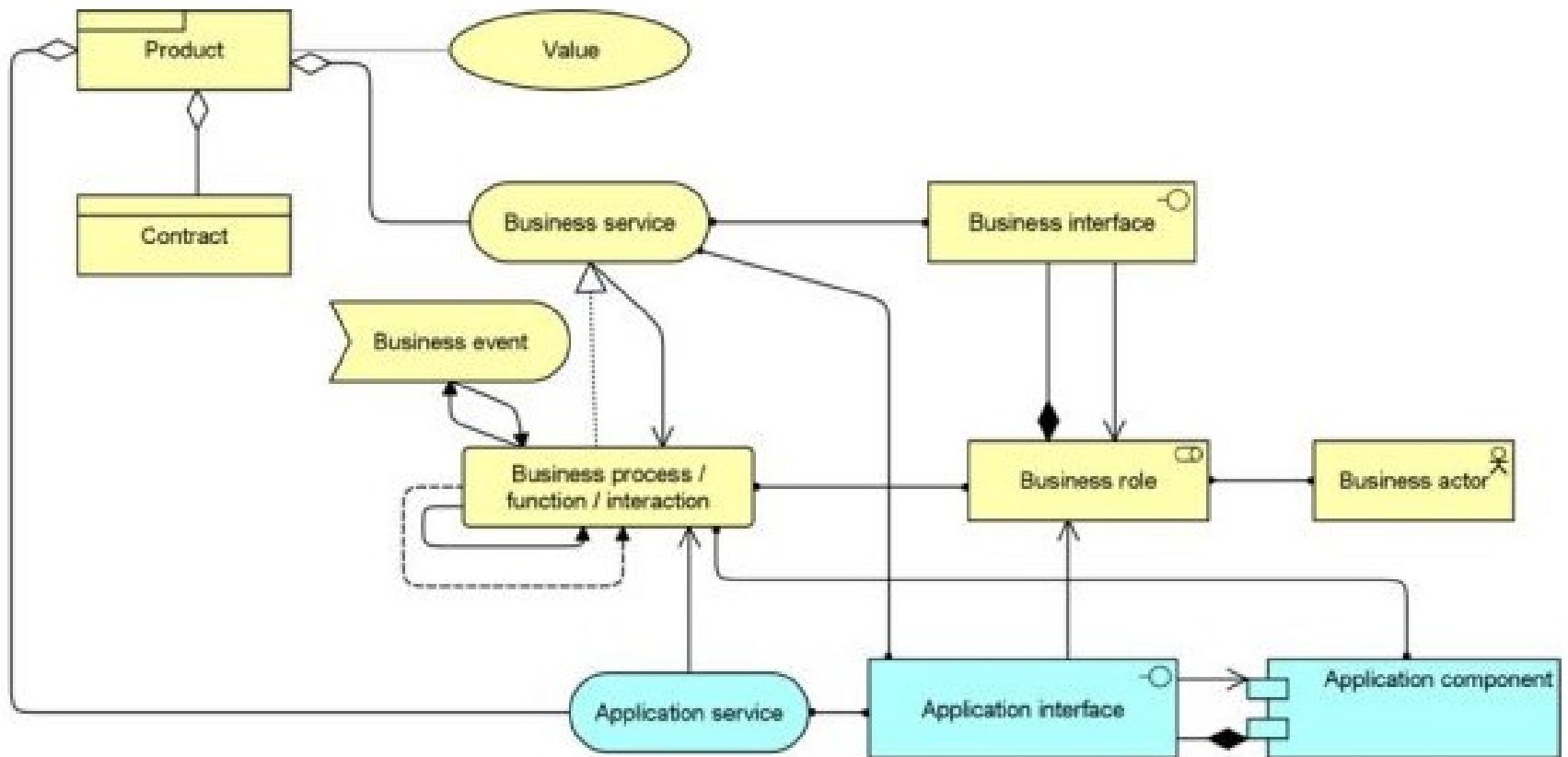
Example: Information Structure Viewpoint
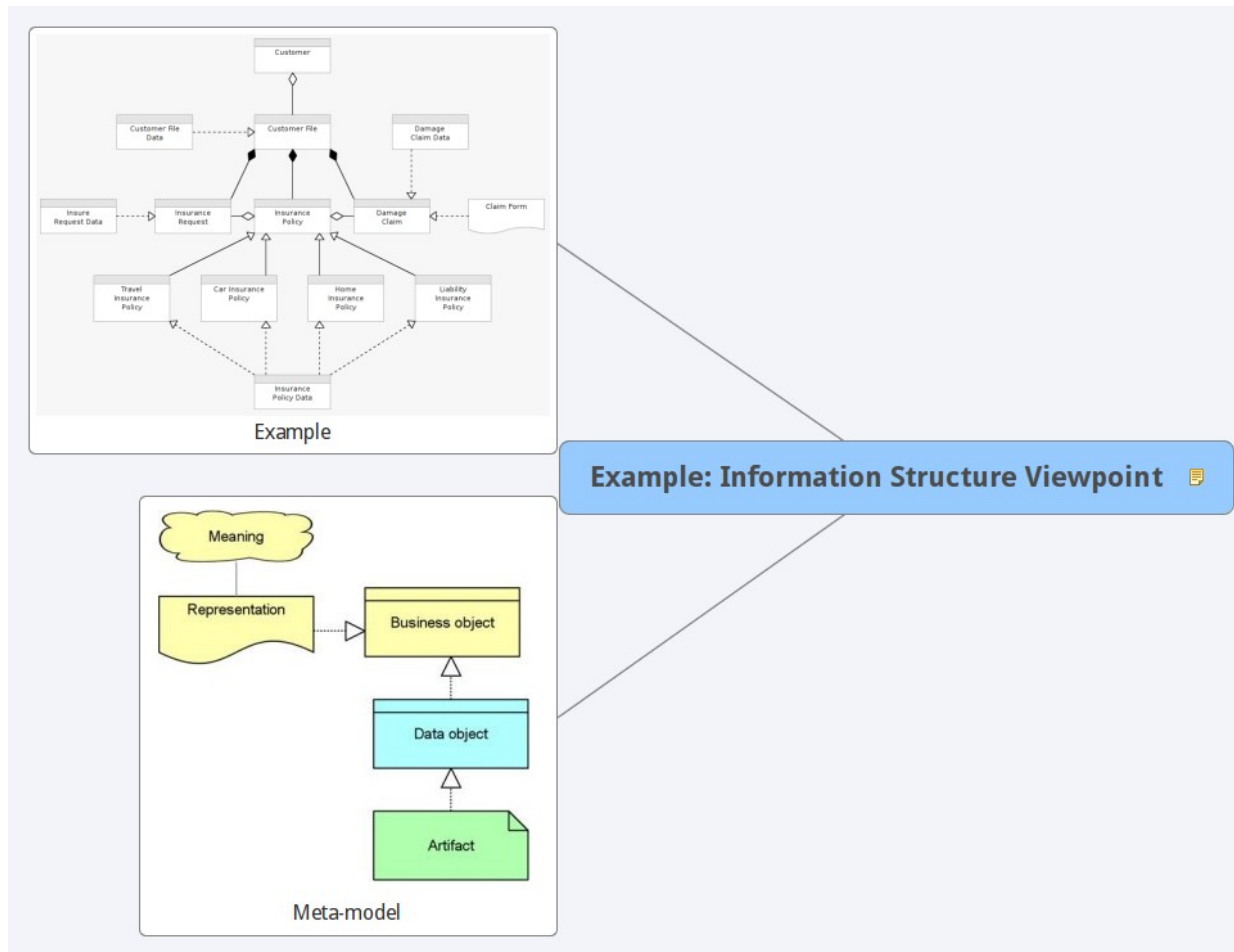
Example: Information Structure Viewpoint

To show the structure of the information used in the solution.

To map data to business processes or application function/services, in terms of data types/messages or data contract structures.

To realize business information concepts with data structures used.

To allocate data assets to underlying infrastructure; e.g., by means of a database schema.

Model-kind: Data Structure

Meta-model
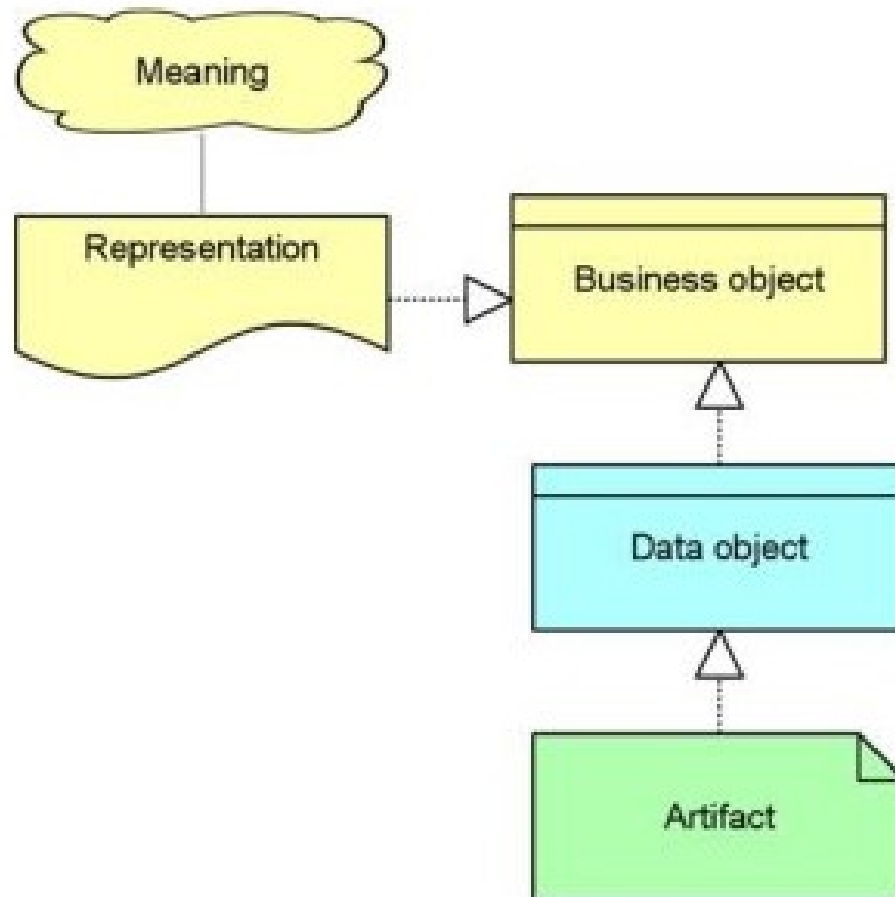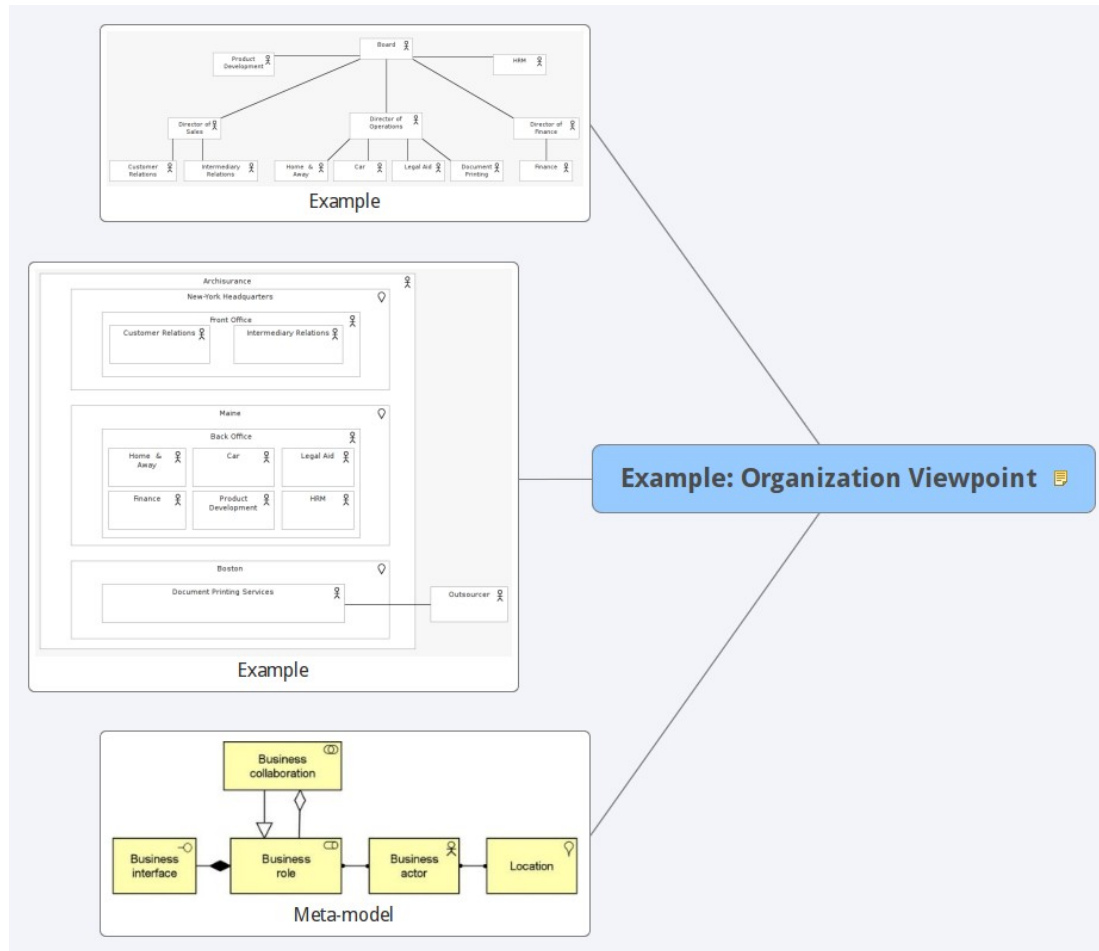
Example: Organization Viewpoint

Example: Organization Viewpoint

To model the (internal) organisation of a company, a department, a network of companies, or of another organisational entity.

To identifying geographies, and map competencies, activities.

Model-kind: Organizational Chart, Nested-block diagrams.

Meta-model
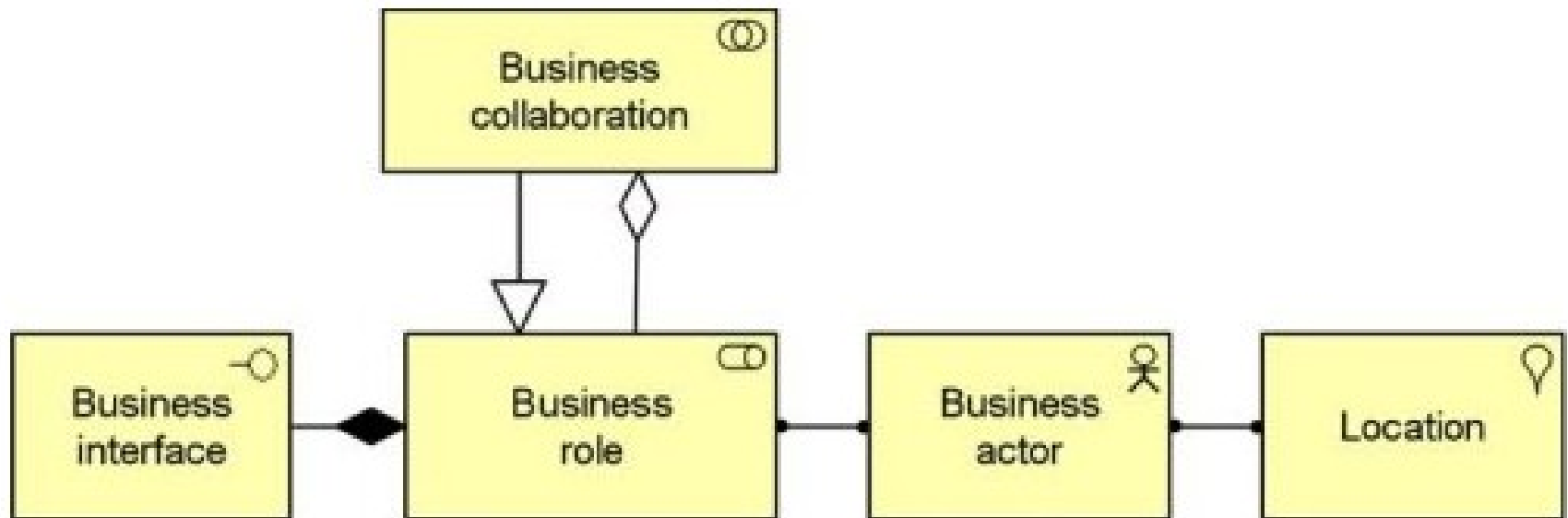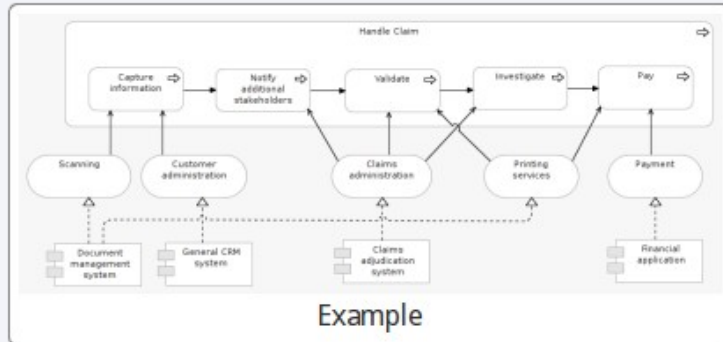
Example: Service Realization Viewpoint
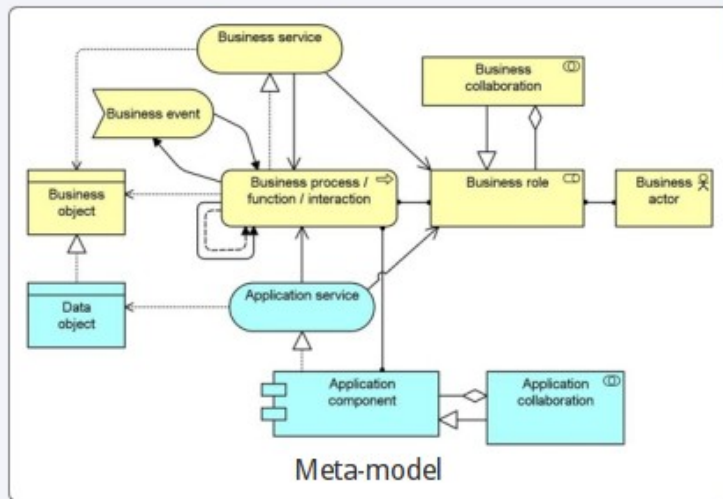
Example: Service Realization Viewpoint

To show how one or more business services are realized by the underlying processes (and sometimes by application components).

To realize business process flows with application services.

Model-kind: Function <-> Behavioral Mappings

Meta-model
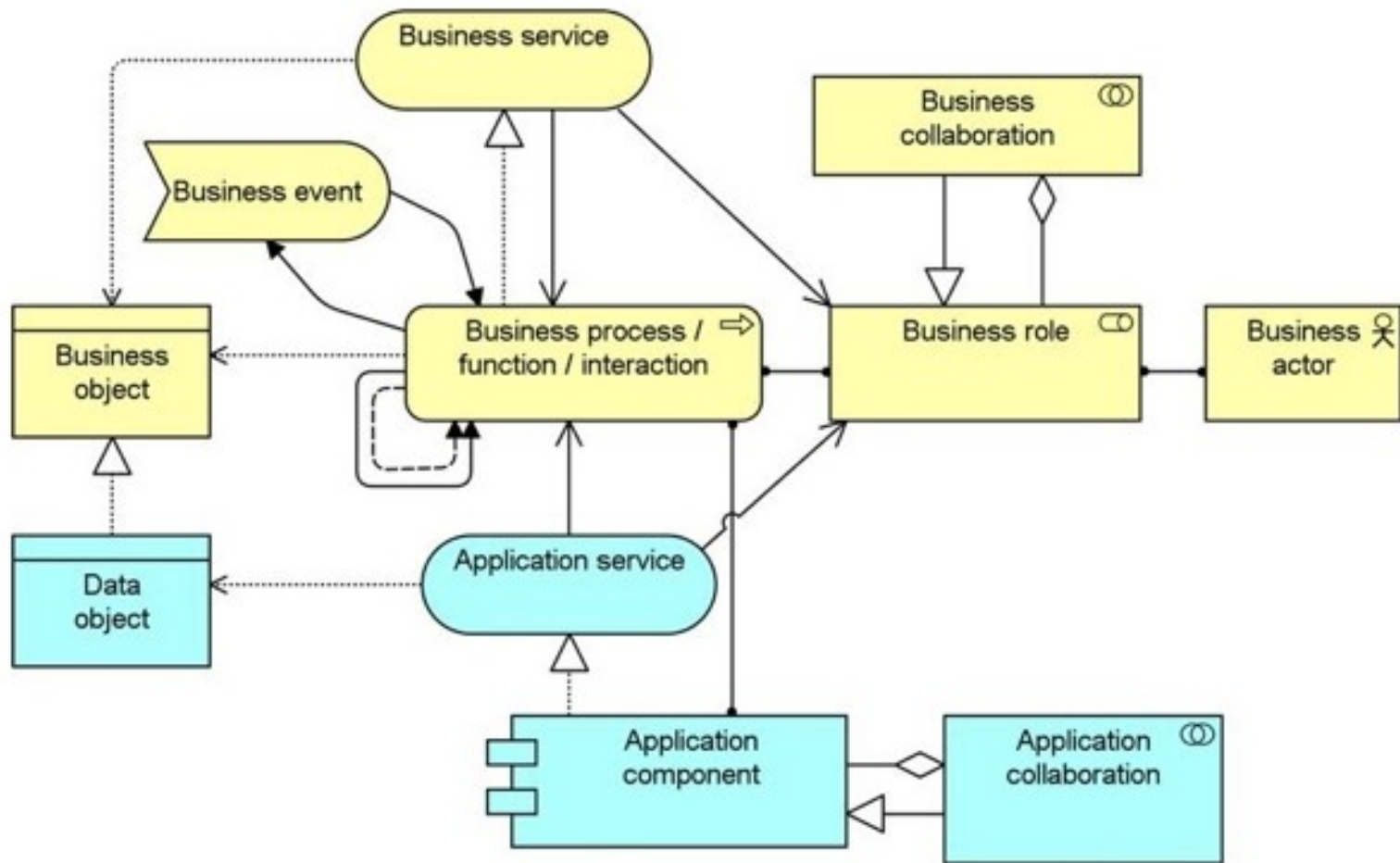
Example: Infrastructure Viewpoint
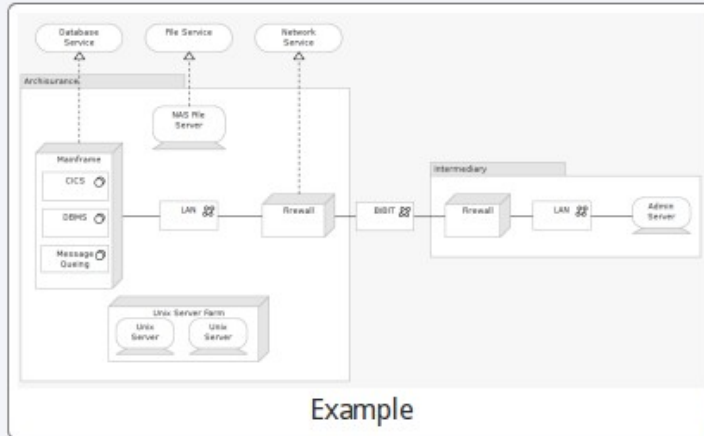
Example

Meta-model

Example: Infrastructure Viewpoint
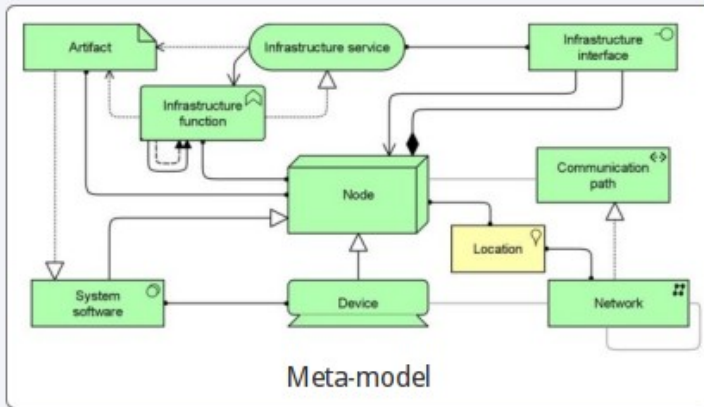
Example: Infrastructure Viewpoint

The Infrastructure viewpoint contains the software and hardware infrastructure elements supporting the application layer, such as physical devices, networks, or system software (e.g., operating systems, databases, and middleware).

Meta-model

Example: Layered Viewpoint

Example

Extended Viewpoints

ArchiMate® 2.1

ArchiMate Extension Viewpoints

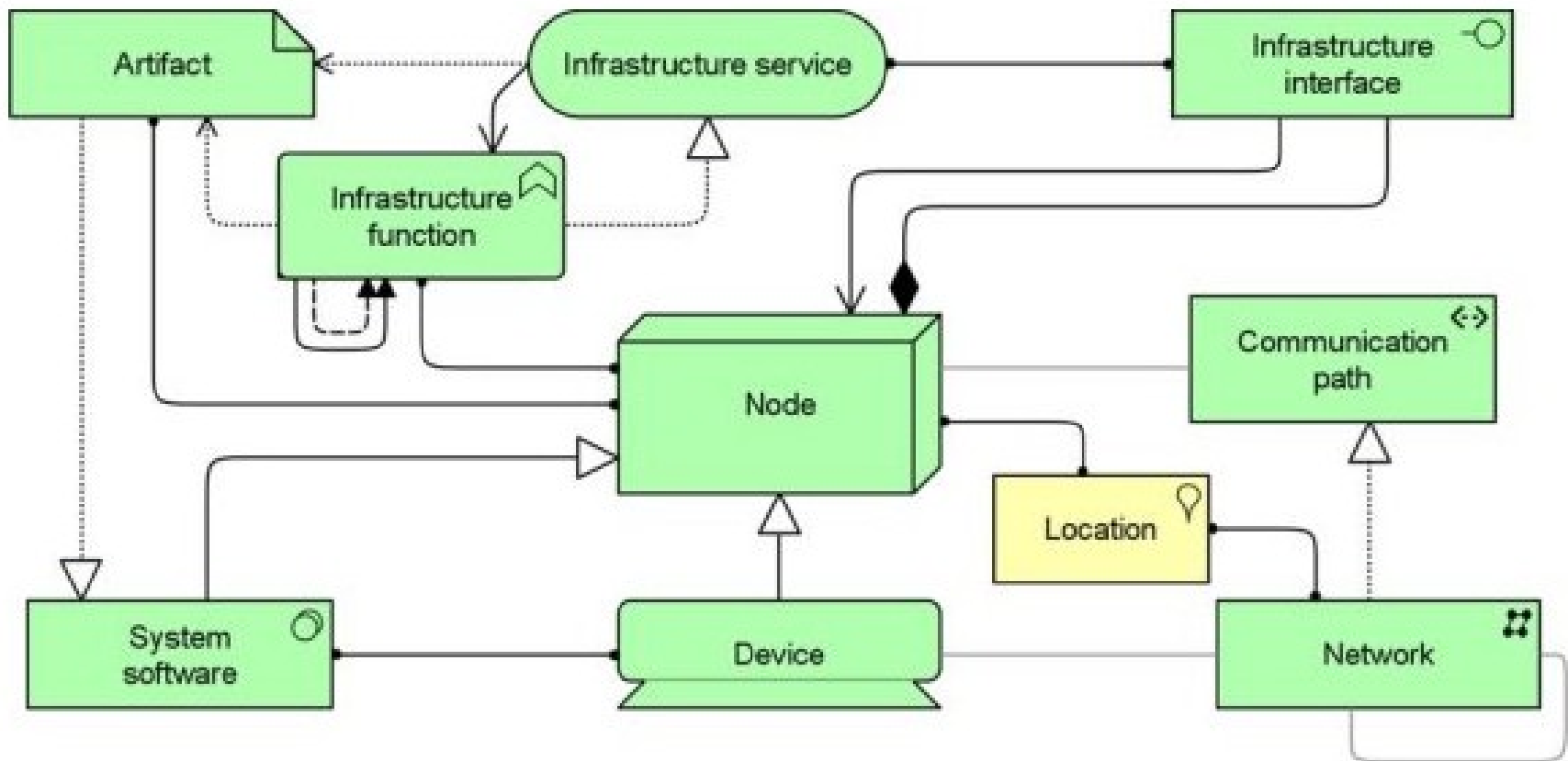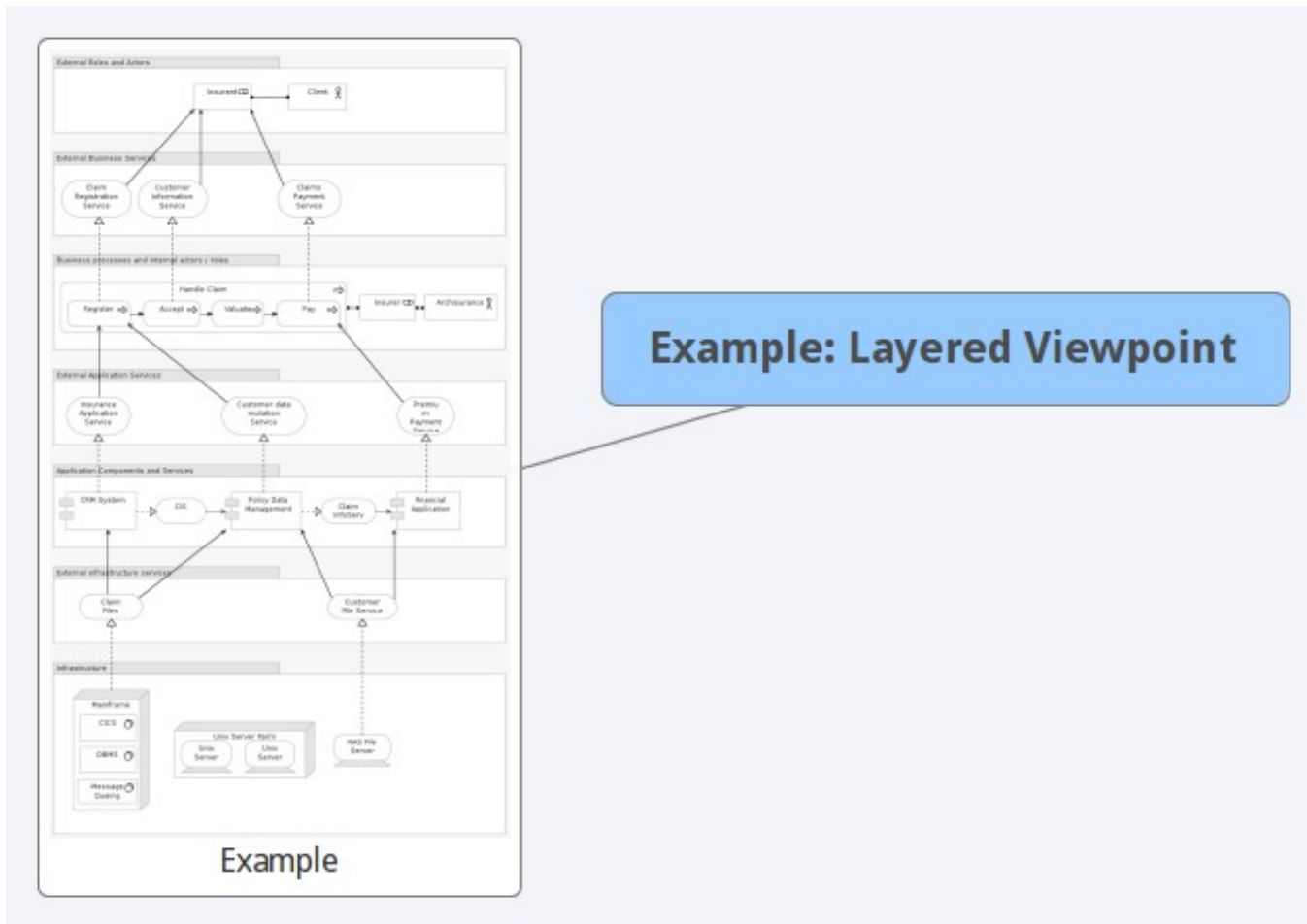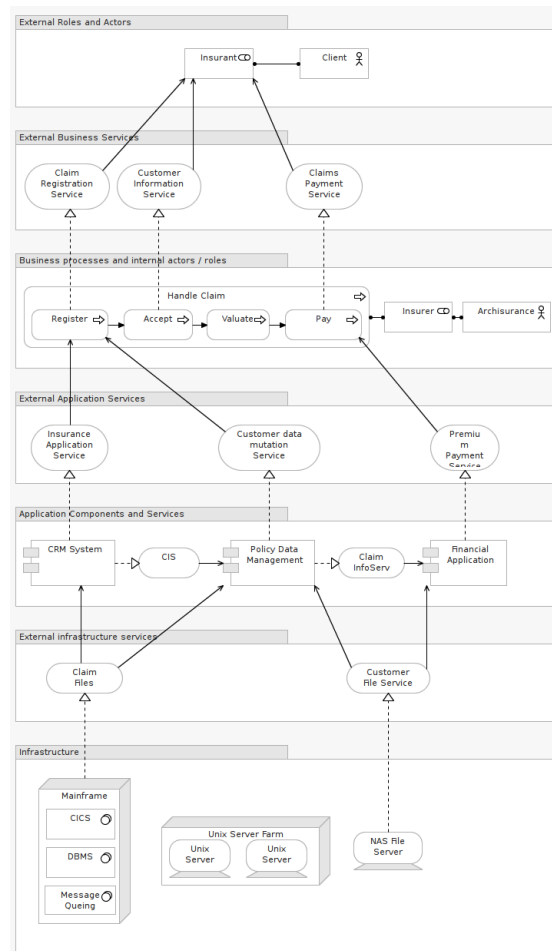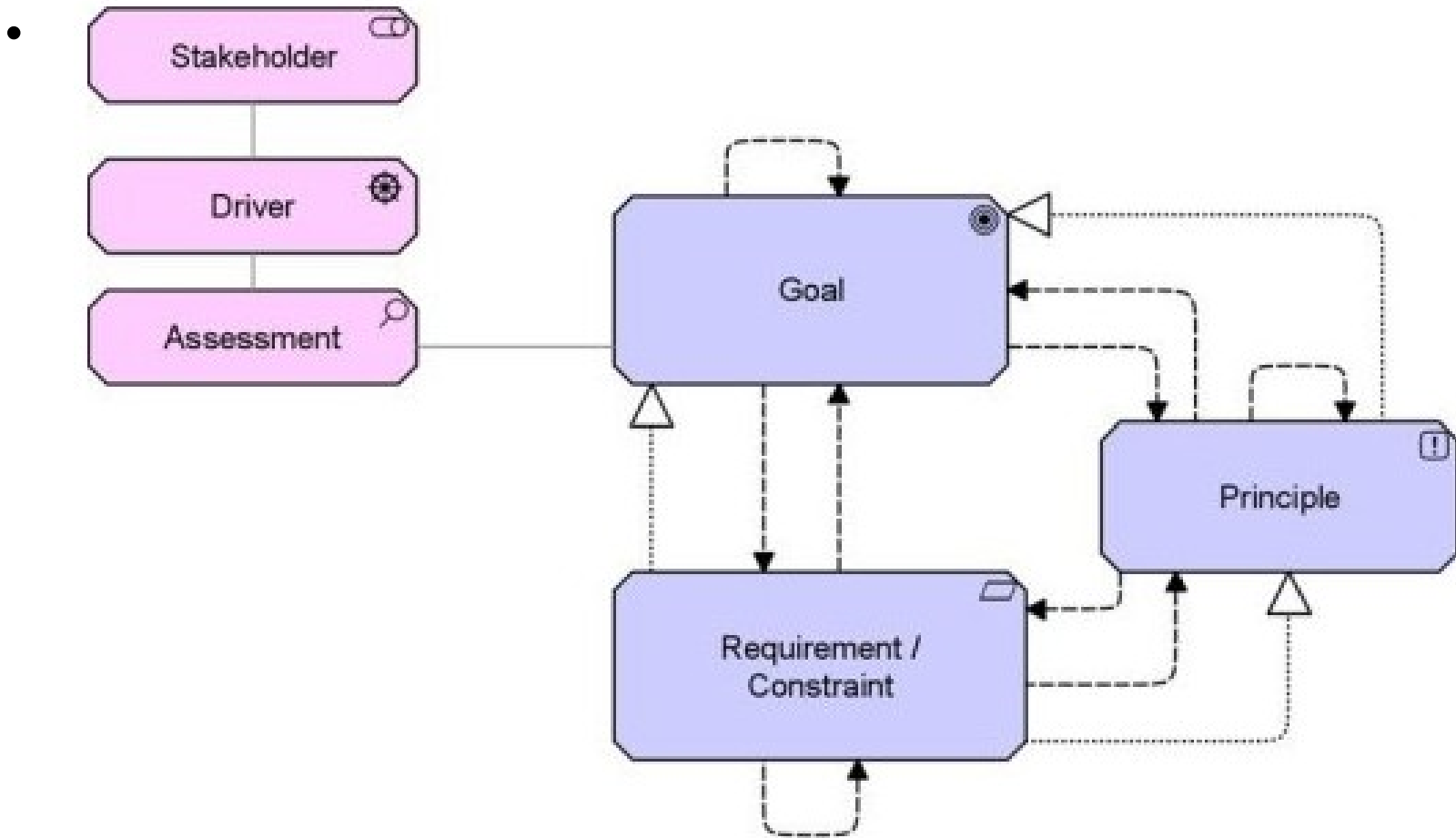| Viewpoint	Type	Description
Stakeholder	Motivation Extension	This viewpoint allows the analyst to model the stakeholders, the internal and external drivers for change, and the assessments (in terms of strengths, weaknesses, opportunities, and threats) of these drivers.
Goal Realization	Motivation Extension	This viewpoint allows a designer to model the refinement of (high-level) goals into more concrete goals, and the refinement of concrete goals into requirements or constraints that describe the properties that are needed to realize the goals.
Goal Contribution	Motivation Extension	This viewpoint allows a designer or analyst to model the influence relationships between goals and requirements.
Principles	Motivation Extension	This viewpoint allows the analyst or designer to model the principles that are relevant to the design problem at hand, including the goals that motivate these principles.
Requirements Realization	Motivation Extension	This viewpoint allows the designer to model the realization of requirements by the core elements, such as business actors, business services, business processes, application services, application components, etc.
Motivation	Motivation Extension	This viewpoint allows the designer or analyst to model the motivation aspect, without focusing on certain elements within this aspect.
Project	Implementation & Migration Extension	This viewpoint is used to model the management of architecture change.
Migration	Implementation & Migration Extension	This viewpoint contains models and concepts that describe the transition from an existing architecture to a desired architecture.
Implementation & Migration	Implementation & Migration Extension	This viewpoint is used to relate programs and projects to the parts of the architecture that they implement.

N132 Reference Card: ArchiMate® 2.1 Viewpoints

Meta-model

Example