

Enterprise Architecture Modelling

ArchiMate 3.0.1 & Archi 4.3.1 & TOGAF 9.2

AUTOCONT

Archi & ArchiMate

- **Archi** is an open source modelling toolkit to create ArchiMate models and sketches. Used by thousands of Enterprise Architects throughout the world.
- **ArchiMate** is an open and independent enterprise architecture (EA) modeling language that provides concepts to support the description, analysis and visualization of relationships within and across different architecture domains.

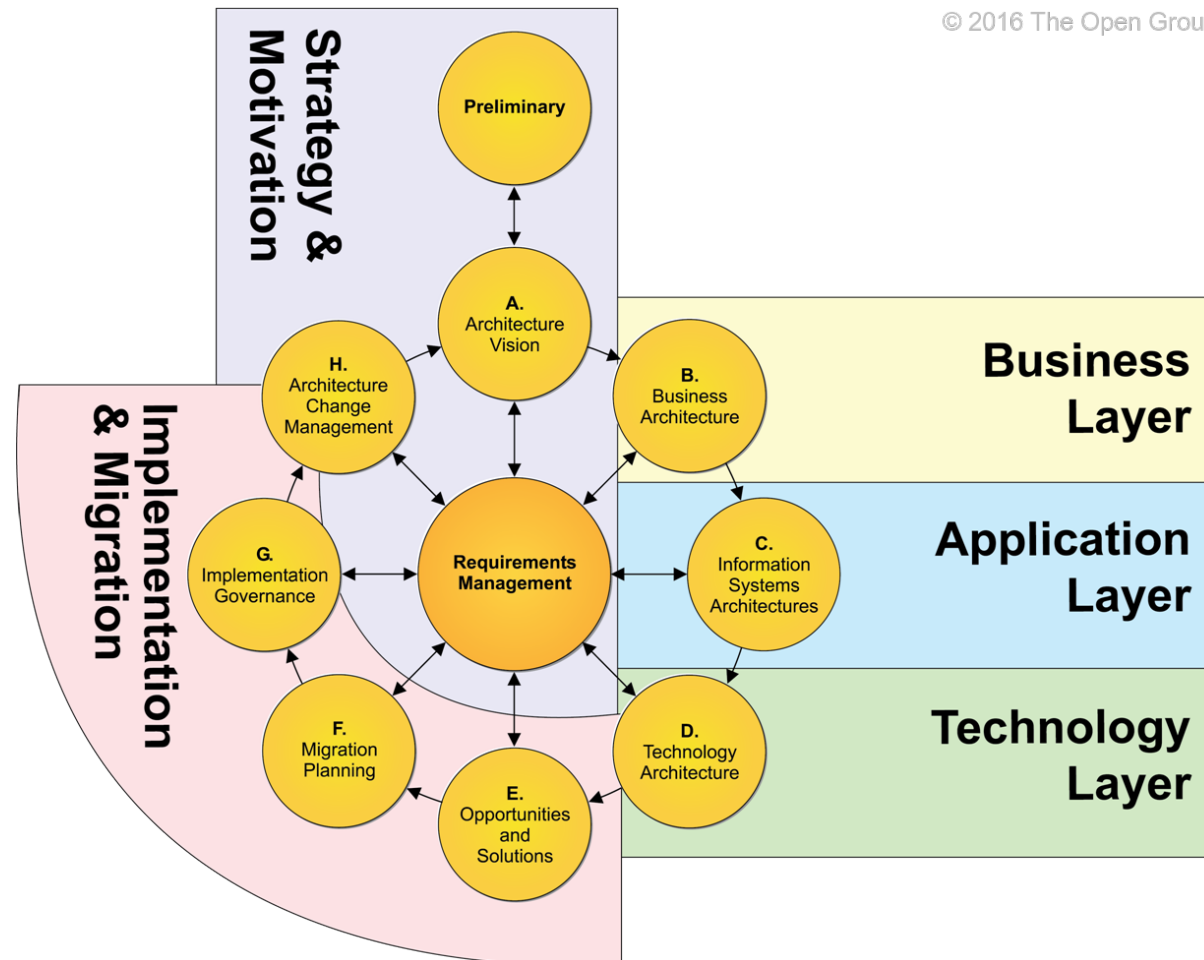
TOGAF

- **The Open Group Architecture Framework (TOGAF)** is a framework for enterprise architecture that provides an approach for designing, planning, implementing, and governing an enterprise information technology architecture. TOGAF is a high level approach to design.
- It is typically modeled at four levels: Business, Application, Data, and Technology.

EA Libraries

- ArchiMate: <http://pubs.opengroup.org/architecture/archimate3-doc/toc.html>
- TOGAF: <http://pubs.opengroup.org/architecture/togaf9-doc/arch/index.html>
- Archi: <https://www.archimatetool.com/>

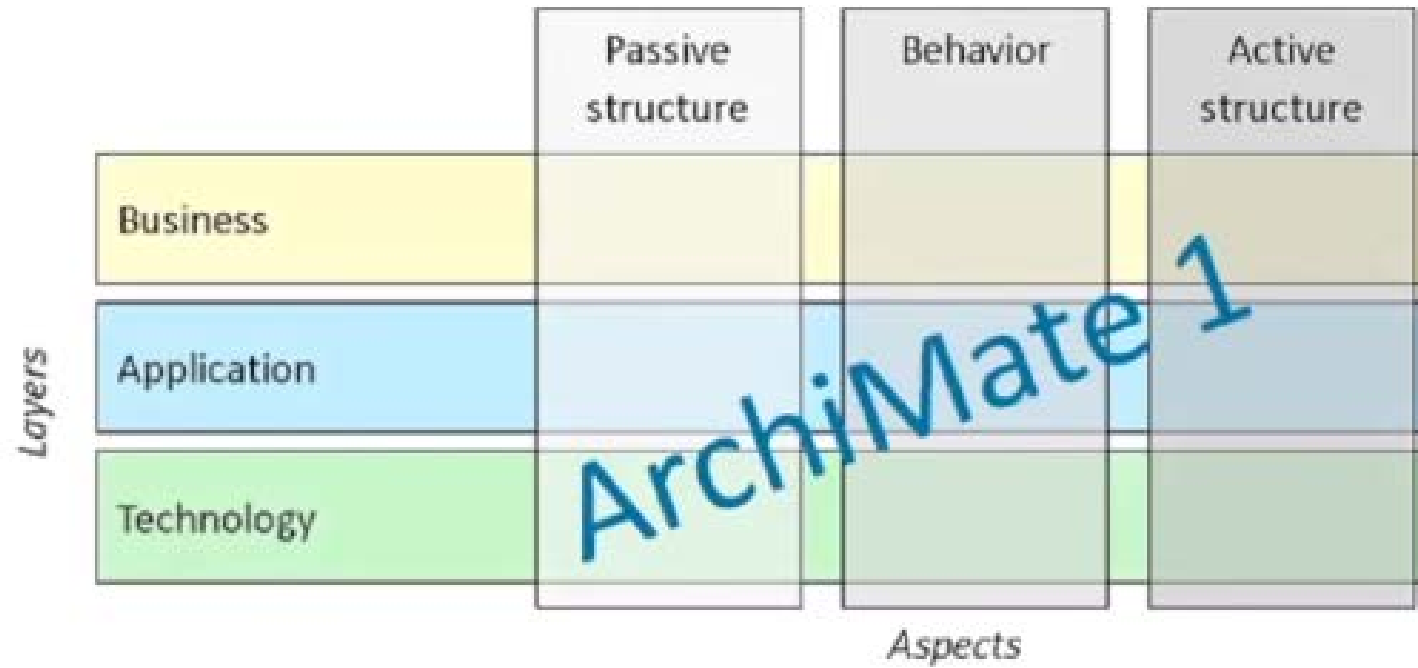
The Relationship between the ArchiMate Language and the TOGAF ADM



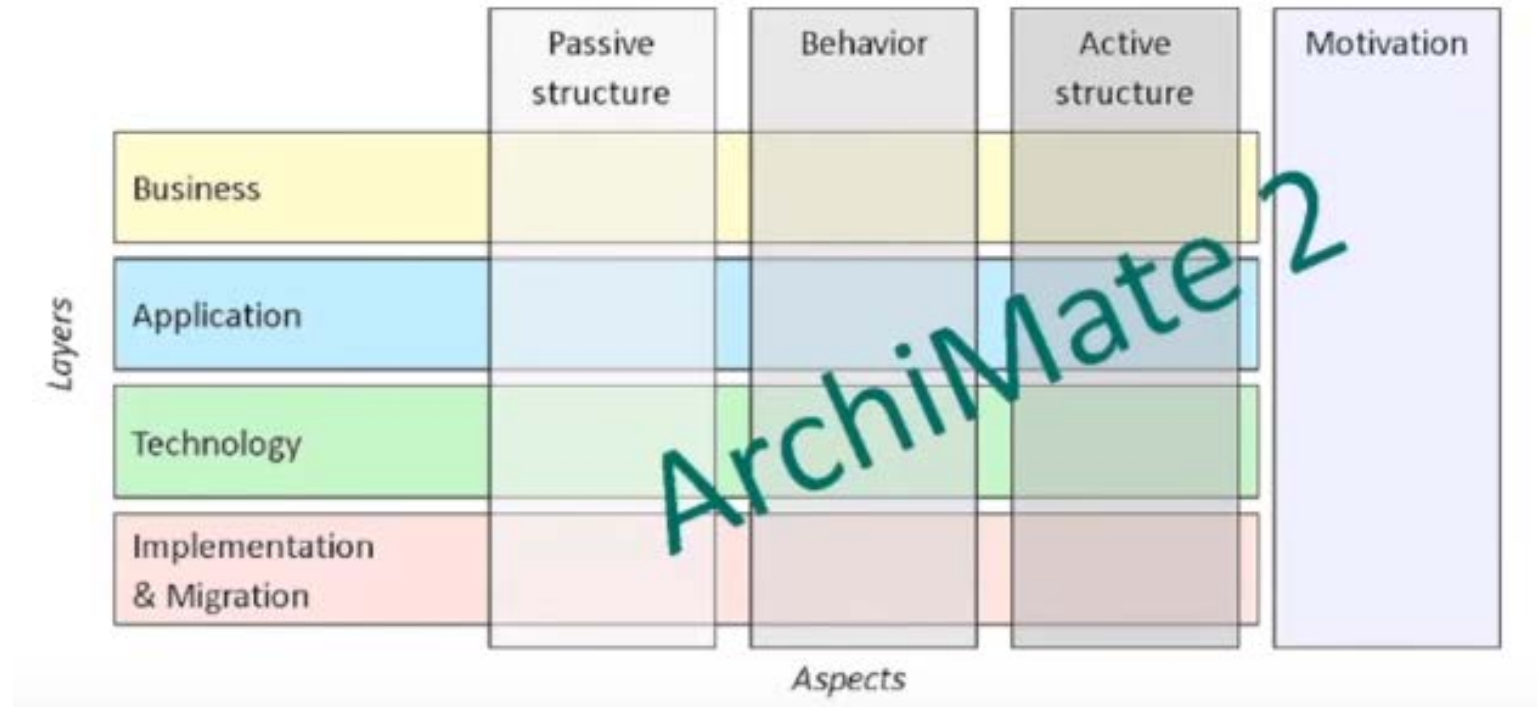
What Does ArchiMate Provide?

- A **language** with concepts to describe architectures
- A **framework** to organize these concepts
- A **graphical notation** for these concepts
- A vision on **visualization** for different stakeholders
- An **open standard** maintained by The Open Group

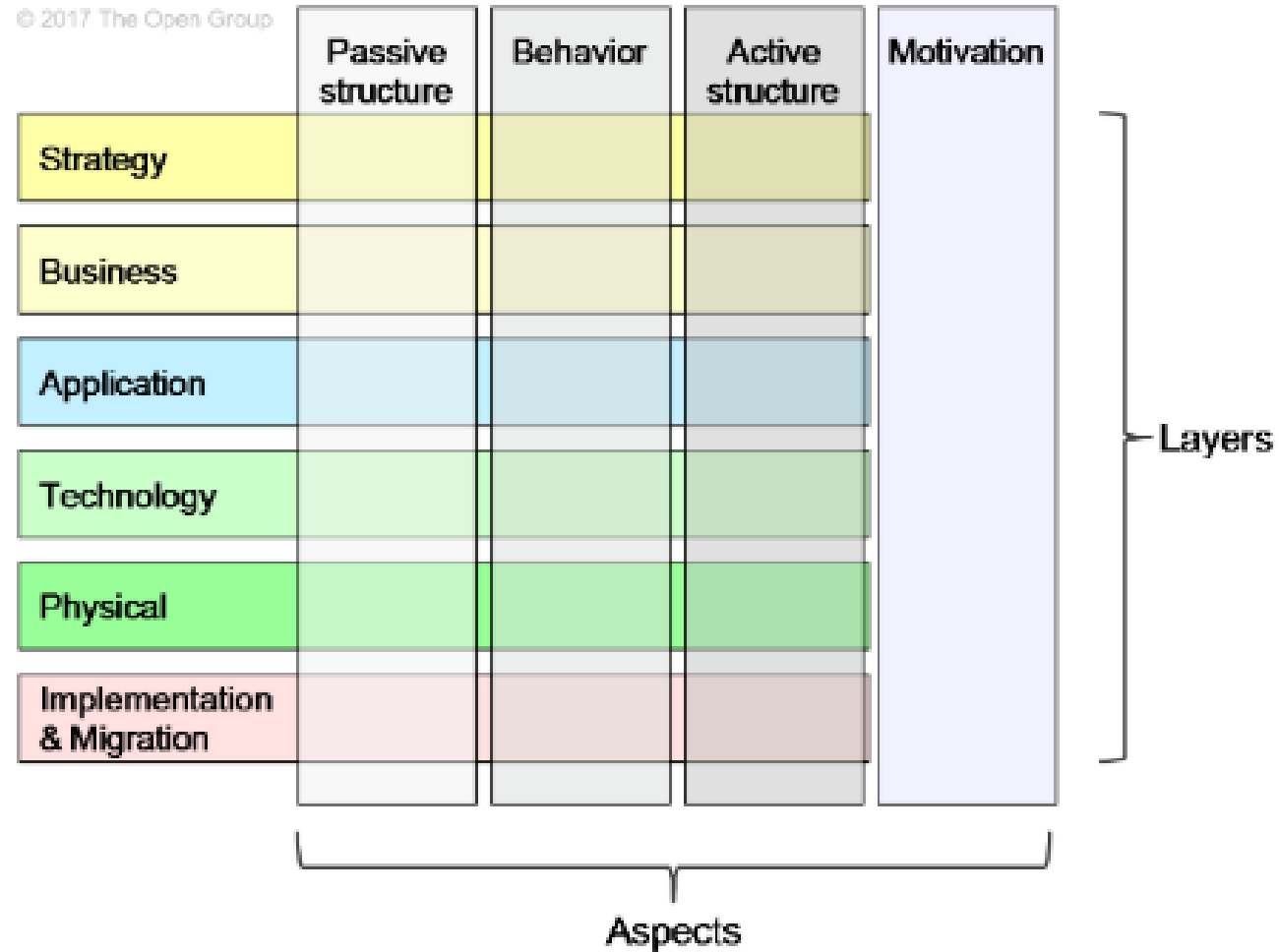
ArchiMate 1



ArchiMate 2

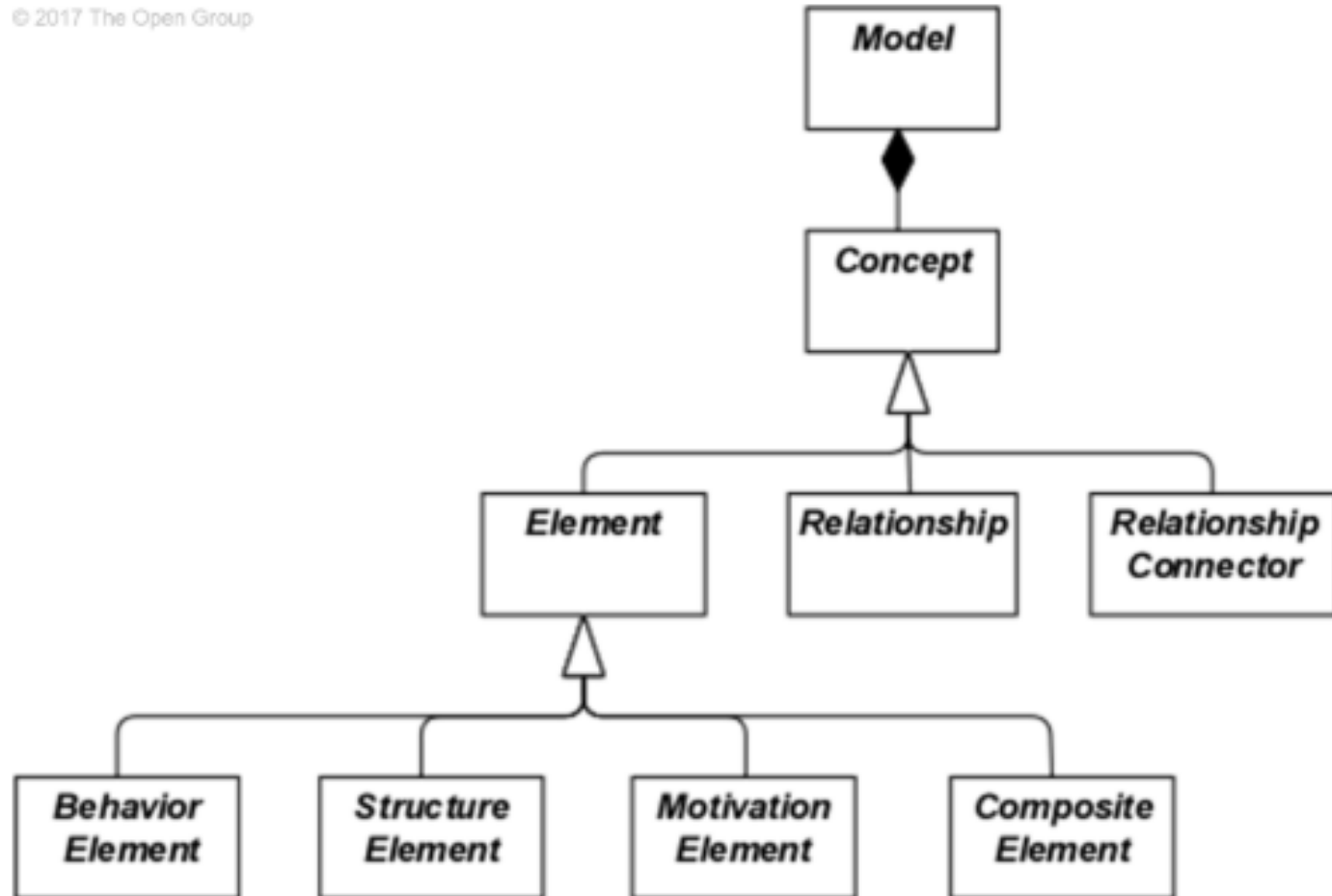


ArchiMate 3



Top-Level Language Structure

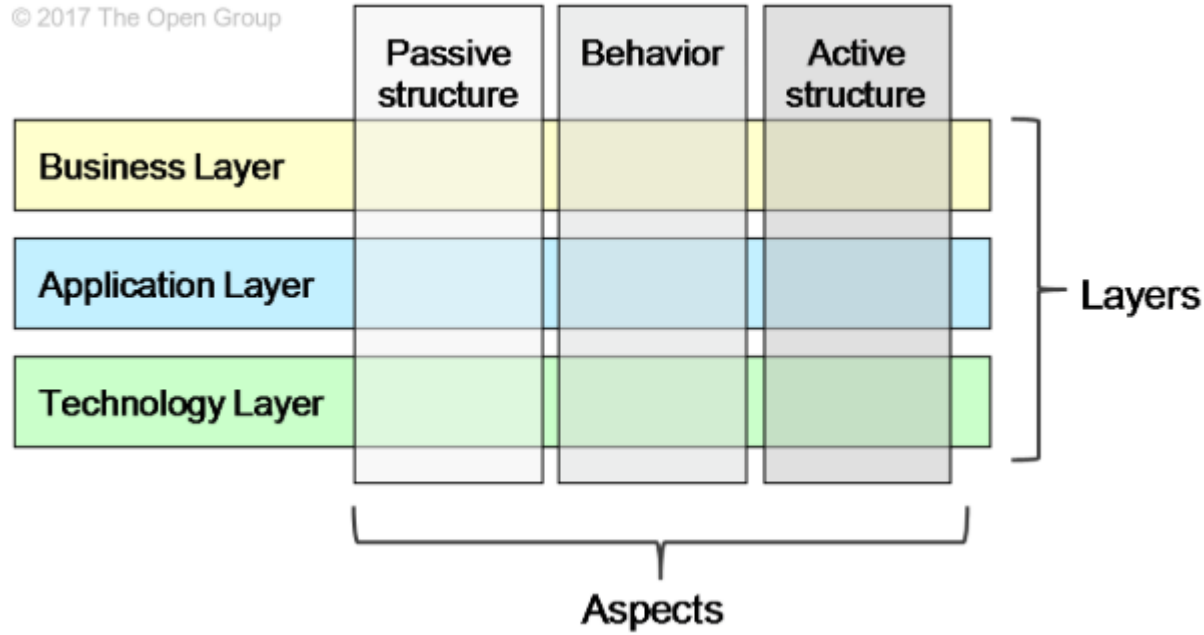
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Layering of the ArchiMate Language

- 1. The Business Layer** depicts business services offered to customers, which are realized in the organization by business processes performed by business actors.
- 2. The Application Layer** depicts application services that support the business, and the applications that realize them.
- 3. The Technology Layer** depicts technology services such as processing, storage, and communication services needed to run the applications, and the computer and communication hardware and system software that realize those services. Physical elements are added for modeling physical equipment, materials, and distribution networks to this layer.

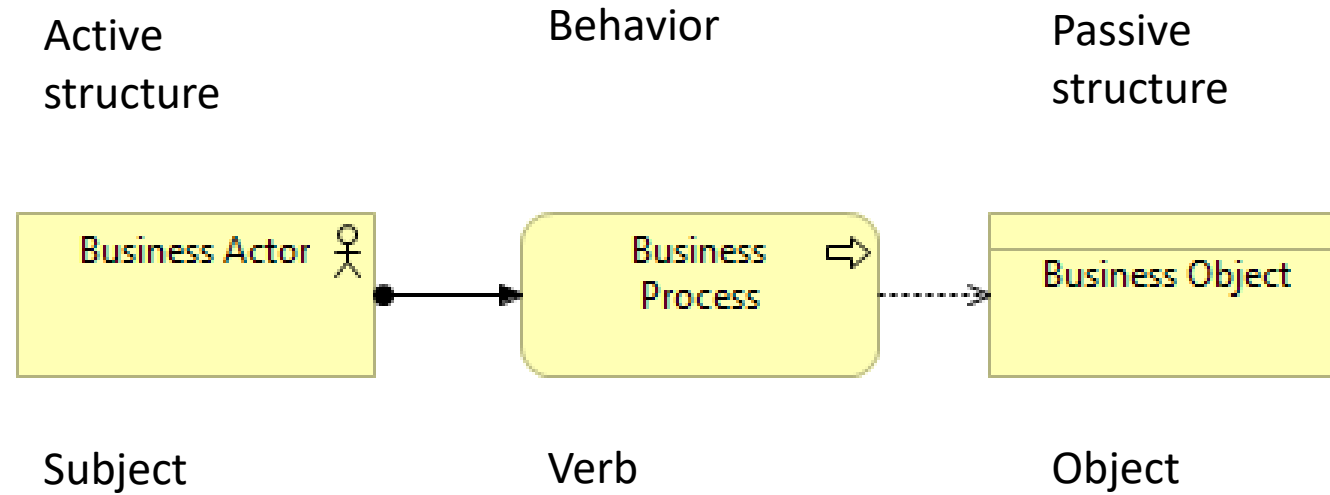
The ArchiMate Core Framework



Aspects

- **The Active Structure Aspect**, which represents the structural elements (the business actors, application components, and devices that display actual behavior; i.e., the “subjects” of activity).
- **The Behavior Aspect**, which represents the behavior (processes, functions, events, and services) performed by the actors. Structural elements are assigned to behavioral elements, to show who or what displays the behavior.
- **The Passive Structure Aspect**, which represents the objects on which behavior is performed. These are usually information objects in the Business Layer and data objects in the Application Layer, but they may also be used to represent physical objects.

Who – How - What



Use of Colors and Notational Cues

In the metamodel pictures within this standard, shades of grey are used to distinguish elements belonging to the different aspects of the ArchiMate framework, as follows:

- White for abstract (i.e., non-instantiable) concepts
- Light grey for passive structures
- Medium grey for behavior
- Dark grey for active structures

Use of Colors and Notational Cues

In ArchiMate models, there are no formal semantics assigned to colors and the use of color is left to the modeler. However, they can be used freely to stress certain aspects in models.

For instance, in many of the example models presented in this standard, colors are used to distinguish between the layers of the ArchiMate Core Framework, as follows:

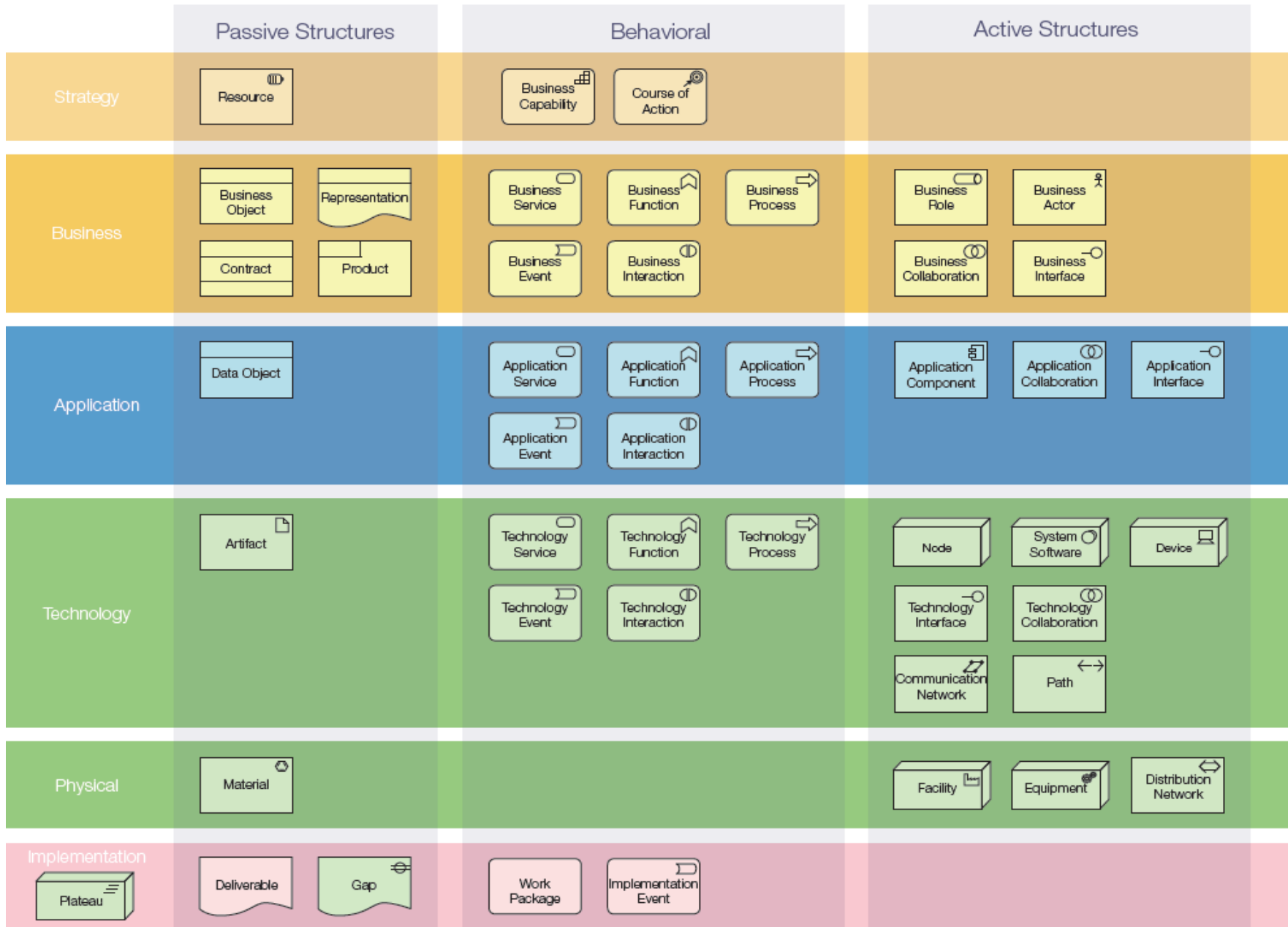
- Yellow for the Business Layer
- Blue for the Application Layer
- Green for the Technology Layer

Use of Colors and Notational Cues

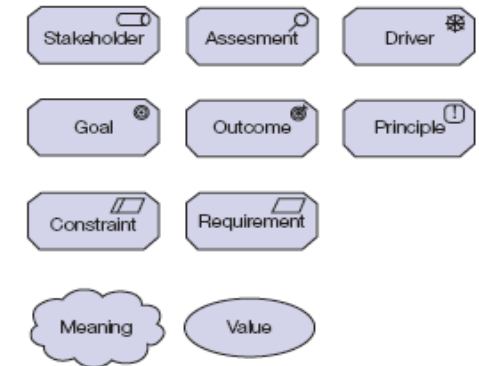
The standard notation also uses a convention with the shape of the corners of its symbols for different element types, as follows:

- Square corners are used to denote structure elements.
- Round corners are used to denote behavior elements.
- Diagonal corners are used to denote motivation elements.

ArchiMate®3.0 Notation Overview



Motivation



Relationships

Structural



Dependency



Dynamic



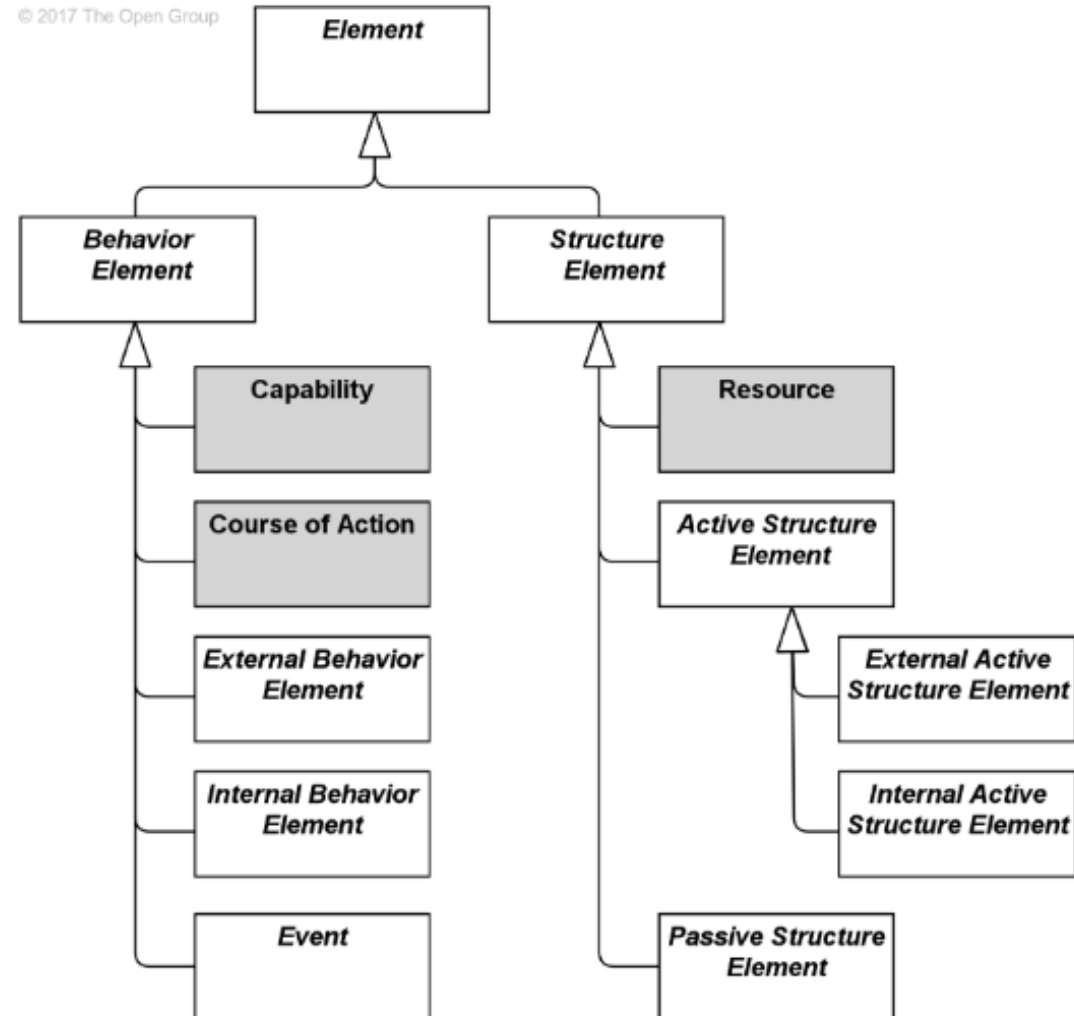
Other



Composite

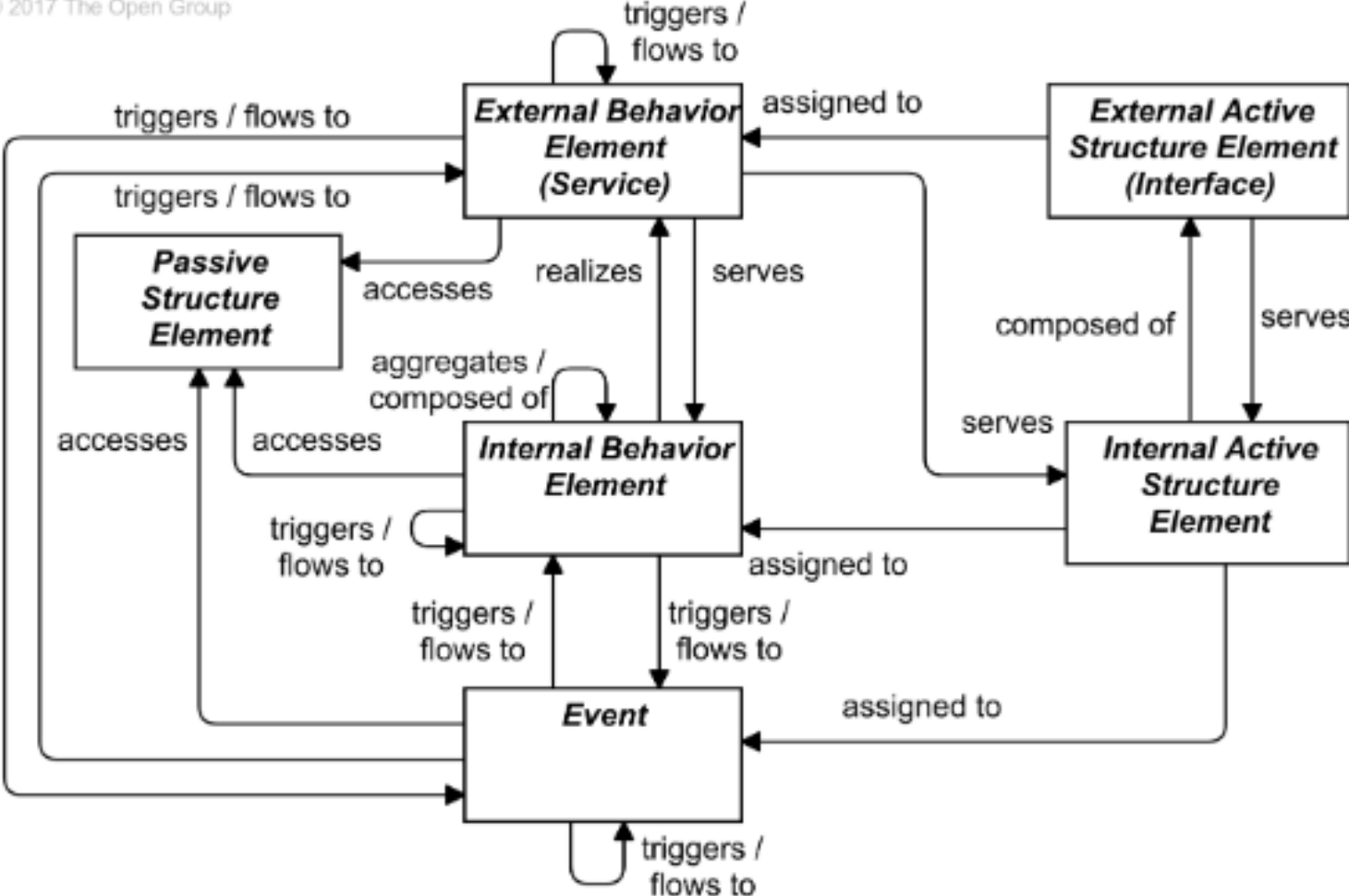


Behavior and Structure Elements



Behavior and Structure Elements

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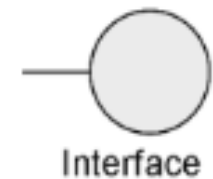
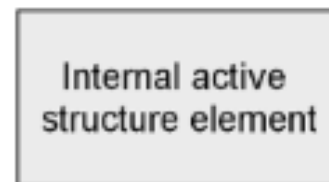


Active Structure Elements

- Active structure elements are the subjects that can perform behavior.
- These can be subdivided into **internal** active structure elements; i.e., the business actors, application components, nodes, etc., that realize this behavior, and **external** active structure elements; i.e., the interfaces that expose this behavior to the environment.
- An interface provides an external view on the service provider and hides its internal structure.

Active Structure Elements

- An **internal active** structure element represents an entity that is capable of performing behavior.
- An **external active** structure element, called an interface, represents a point of access where one or more services are provided to the environment.
- Active structure elements are denoted using boxes with square corners and an icon in the upper-right corner, or by the icon on its own.

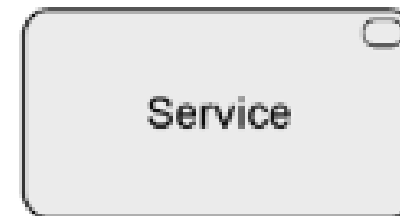
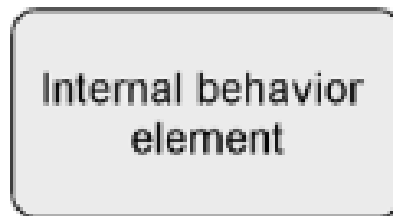


Behavior Elements

- Behavior elements represent the dynamic aspects of the enterprise. Similar to active structure elements, behavior elements can be subdivided into internal behavior elements and external behavior elements; i.e., the services that are exposed to the environment.
- An **internal behavior** element represents a unit of activity performed by one or more active structure elements.
- An **external behavior** element, called a service, represents an explicitly defined exposed behavior.

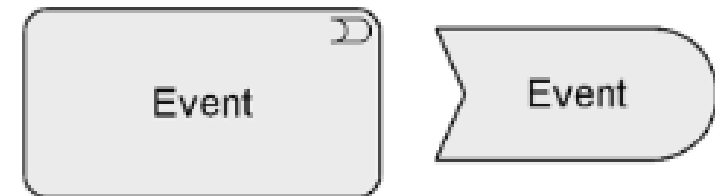
Behavior Elements

- Behavior elements are denoted in the standard iconography using boxes with round corners and an icon in the upper-right corner, or by the icon on its own.



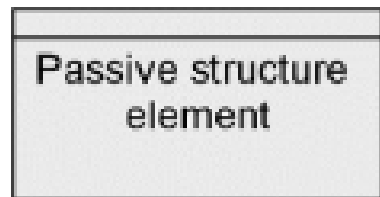
Behavior Elements

- In addition to this, a third type of behavior element is defined to denote an event that can occur; for example, to signal a state change.
- An event is a behavior element that denotes a state change.



Passive Structure Elements

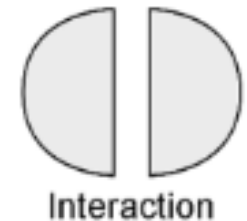
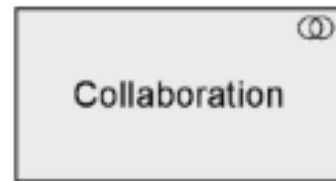
- Passive structure elements can be accessed by behavior elements.
- A passive structure element is a structural element that cannot perform behavior. Active structure elements can perform behavior on passive structure elements.
- Passive structure elements are often information or data objects, but they can also represent physical objects.



Specializations of Structure and Behavior Elements

Generic Collaboration and Interaction Notation

- A **collaboration** is an aggregate of two or more active structure elements, working together to perform some collective behavior.
- An **interaction** is a unit of collective behavior performed by (a collaboration of) two or more active structure elements.



Specializations of Structure and Behavior Elements

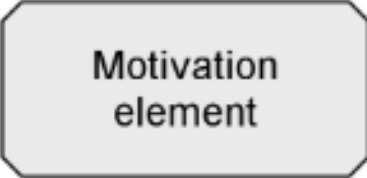
Generic Process and Function Notation

- A **process** represents a sequence of behaviors that achieves a specific outcome.
- A **function** represents a collection of behavior based on specific criteria, such as required resources, competences, or location.



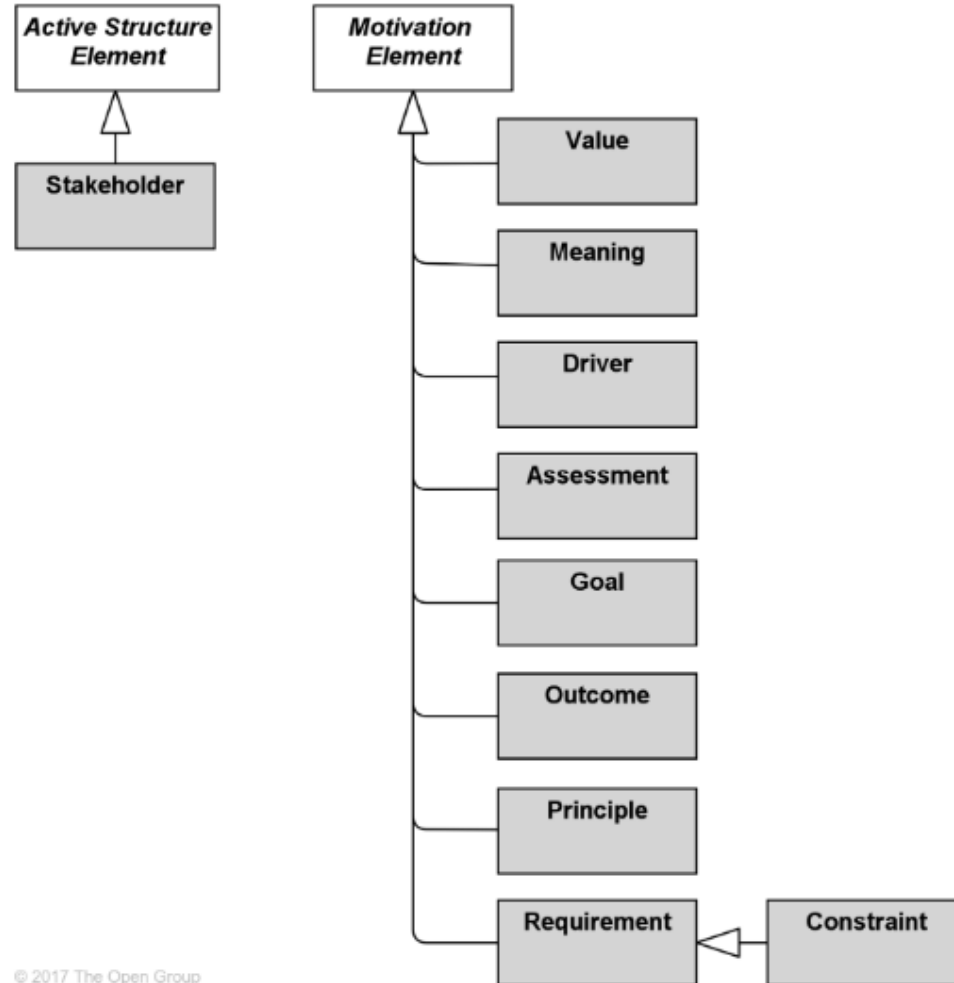
Motivation Elements

- The core elements of the ArchiMate language focus on describing the architecture of systems that support the enterprise.
- They do not cover the elements which, in different ways, drive the design and operation of the enterprise. These motivation aspects correspond to the “Why” column of the Zachman framework.
- A motivation element is an element that provides the context of or reason behind the architecture of an enterprise.



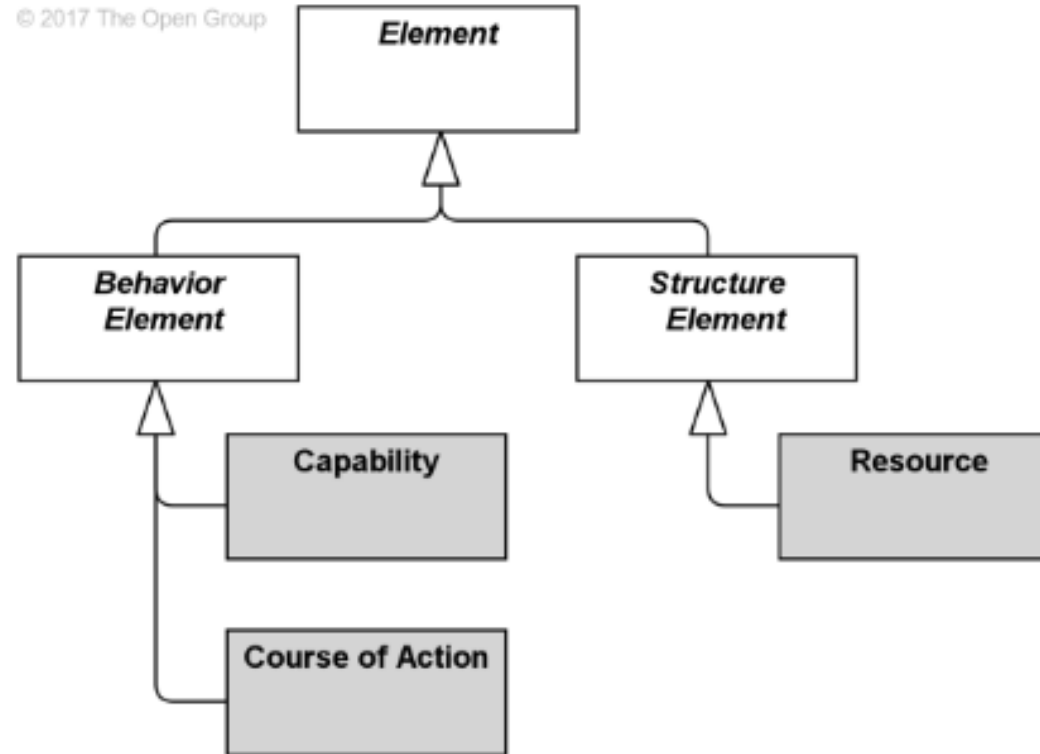
Motivation
element

Overview of Motivation Elements



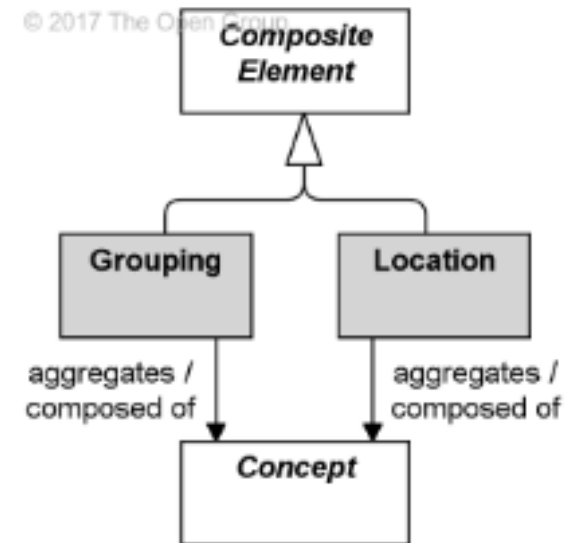
Strategy Elements

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Composite Elements

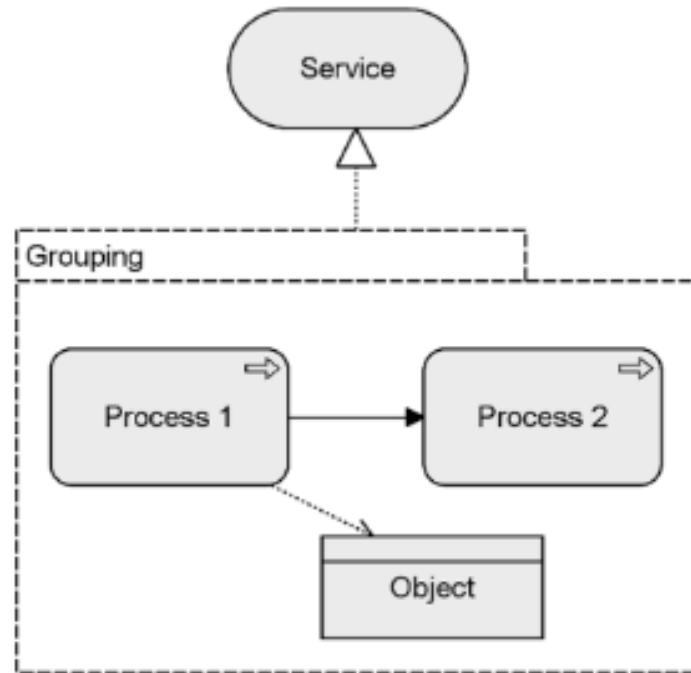
- Composite elements consist of other concepts, possibly from multiple aspects or layers of the language.
- Grouping and location are generic composite elements. Composite elements can themselves aggregate or compose other composite elements.



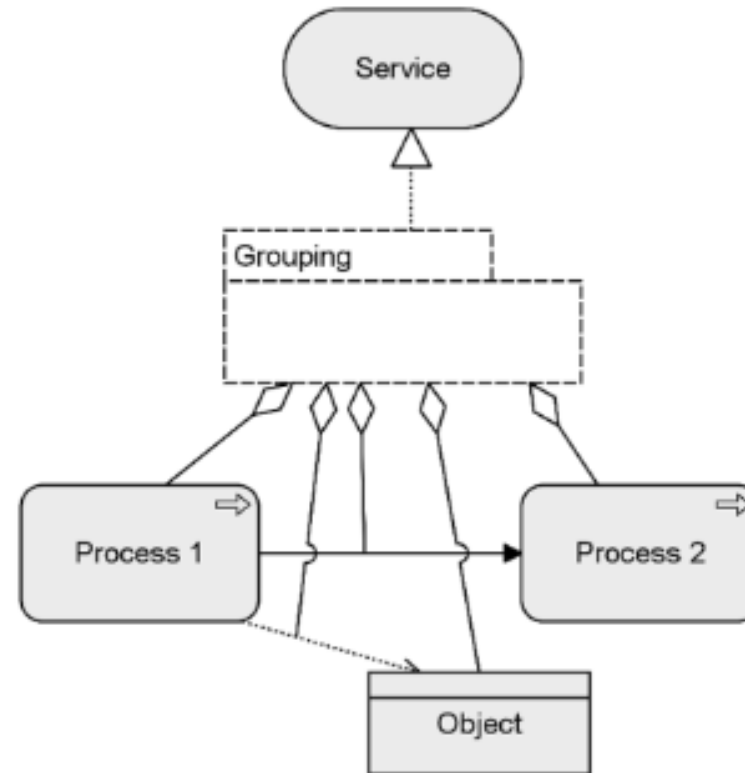
Grouping

- The grouping element aggregates or composes concepts that belong together based on some common characteristic.
- The grouping element is used to aggregate or compose an arbitrary group of concepts, which can be elements and/or relationships of the same or of different types.
- An aggregation or composition relationship is used to link the grouping element to the grouped concepts.

Example: Grouping



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Location

- A location is a place or position where structure elements can be located or behavior can be performed.
- The location element is used to model the places where (active and passive) structure elements such as business actors, application components, and devices are located. This is modeled by means of an aggregation relationship from a location to structure element.
- A location can also aggregate a behavior element, to indicate where the behavior is performed. This element corresponds to the “Where” column of the Zachman framework

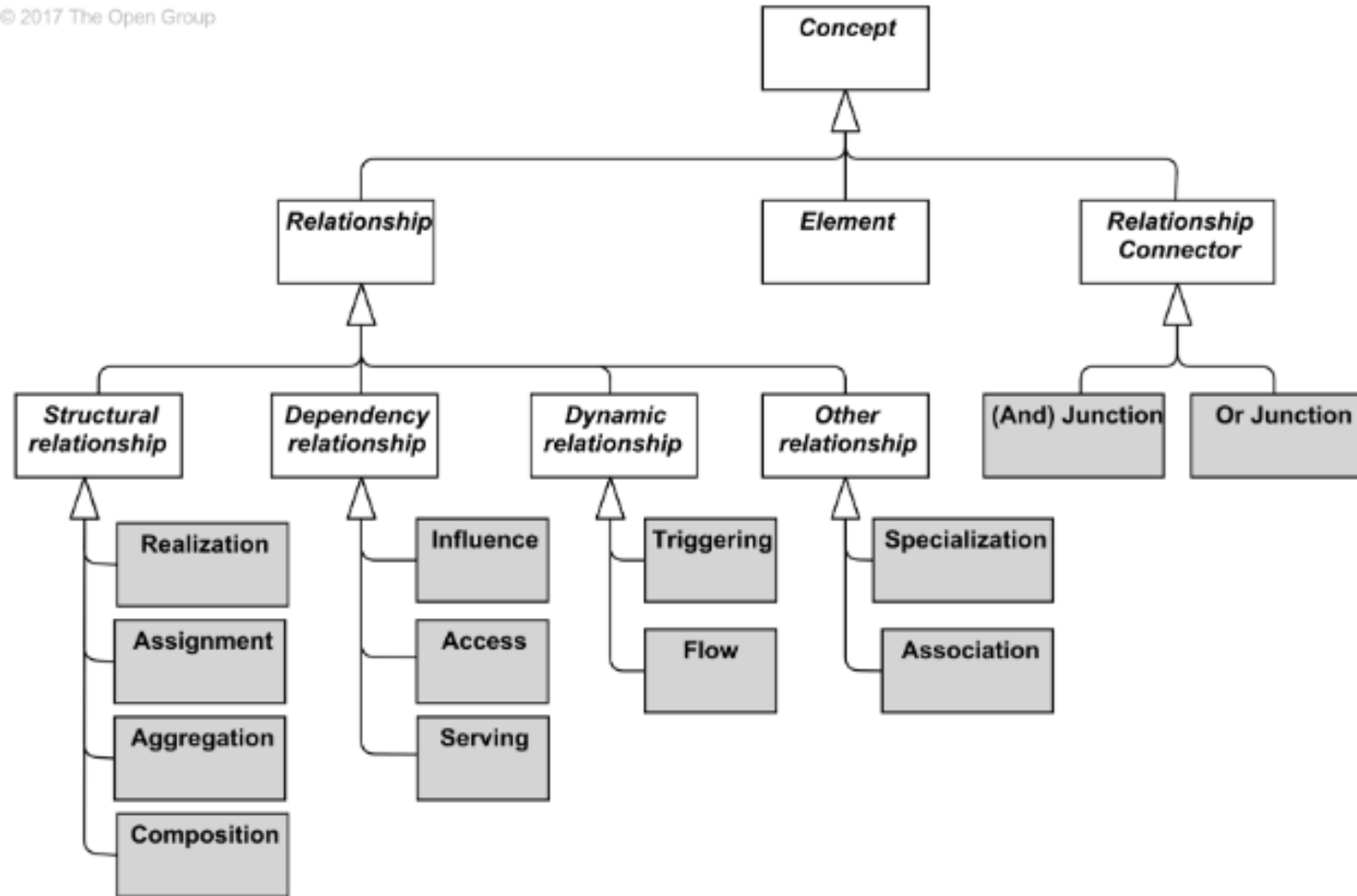


Relationships

- **Structural** relationships, which model the static construction or composition of concepts of the same or different types.
- **Dependency** relationships, which model how elements are used to support other elements.
- **Dynamic** relationships, which are used to model behavioral dependencies between elements.
- **Other** relationships, which do not fall into one of the above categories.

Overview of Relationships

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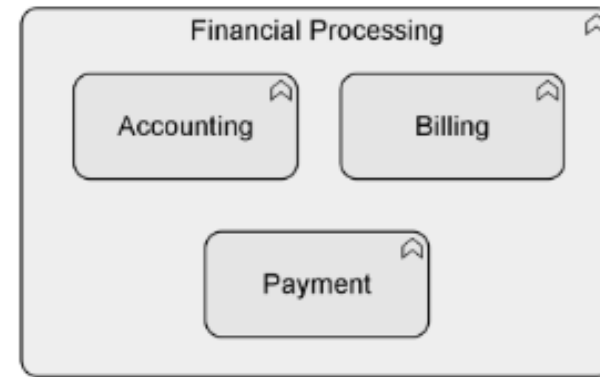
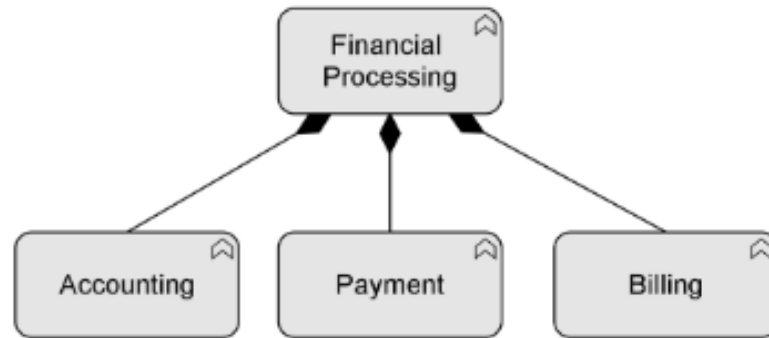
Structural Relationships

Composition



- Indicates that an element consists of one or more other concepts.

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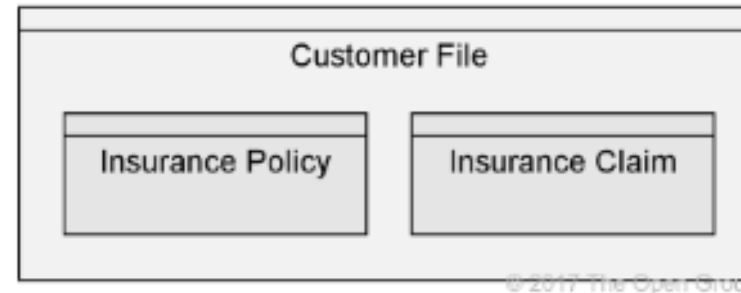
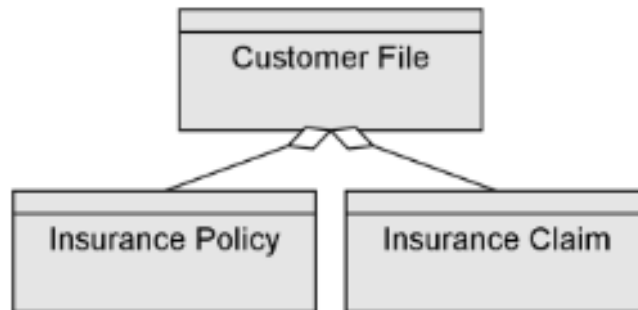


Structural Relationships

Aggregation



- Indicates that an element groups a number of other concepts.

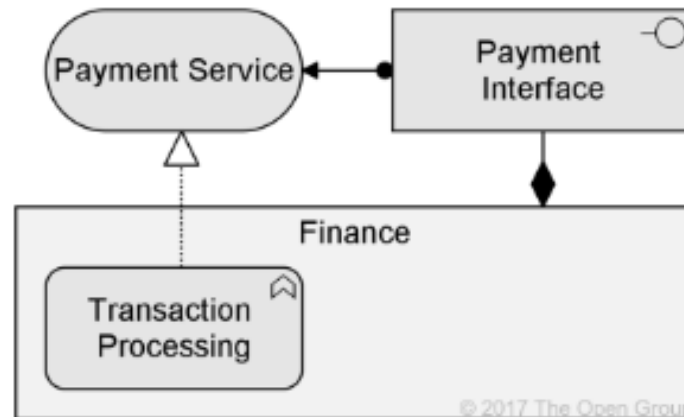


Structural Relationships

Assignment



- Expresses the allocation of responsibility, performance of behavior, or execution.

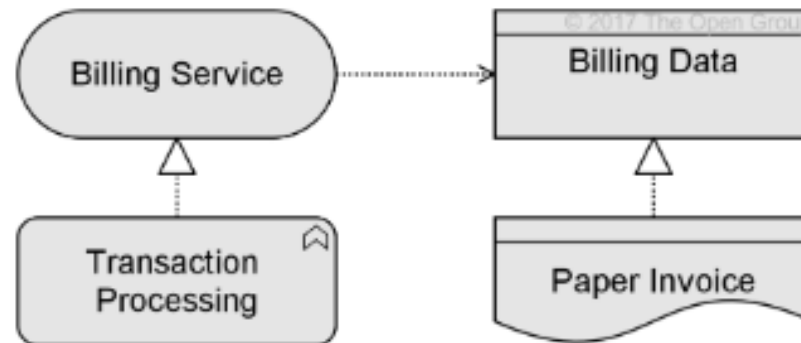


Structural Relationships

Realization



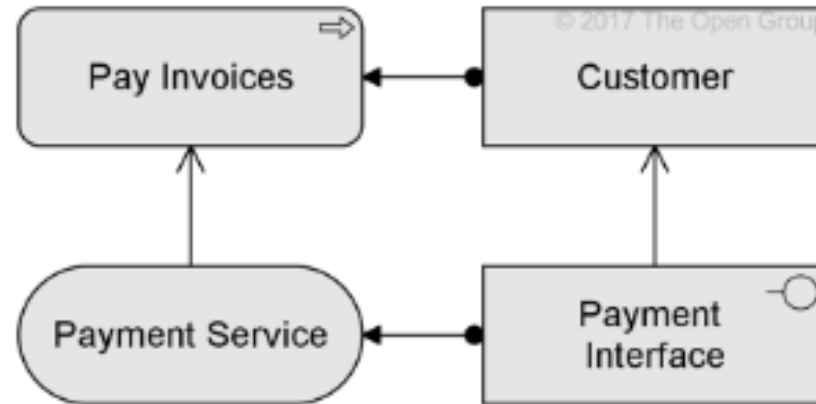
- Indicates that an entity plays a critical role in the creation, achievement, sustenance, or operation of a more abstract entity.



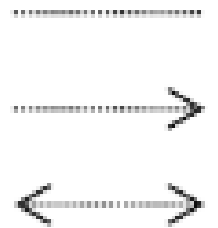
Dependency Relationships

Serving →

- Models that an element provides its functionality to another element.

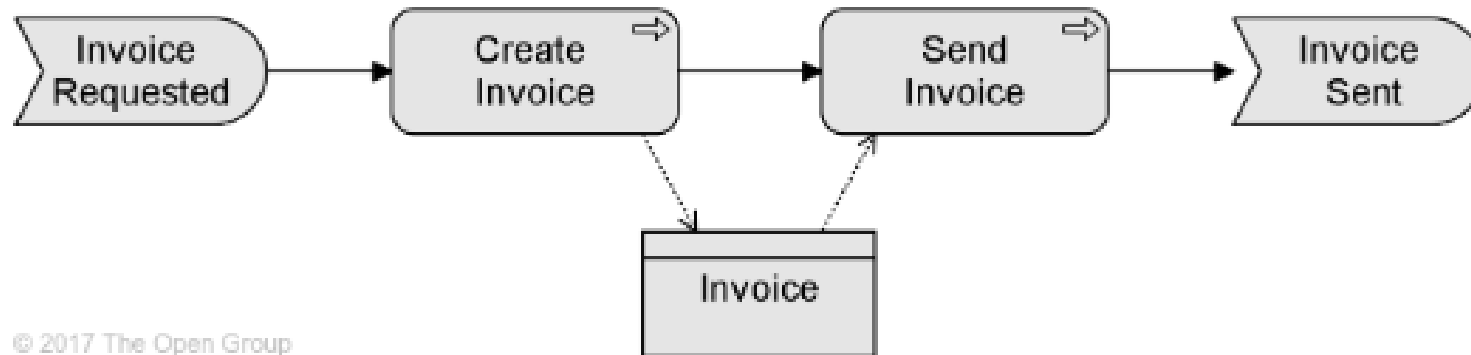


Dependency Relationships



Access

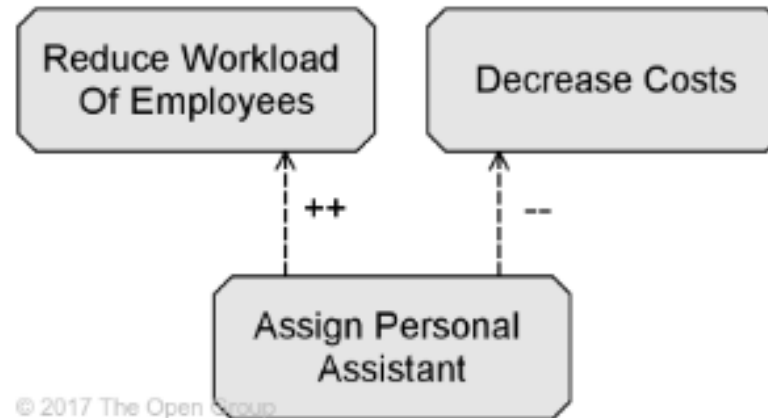
- Models the ability of behavior and active structure elements to observe or act upon passive structure elements



Dependency Relationships

Influence $\text{---} \overset{+/-}{\text{---}} \rightarrow$

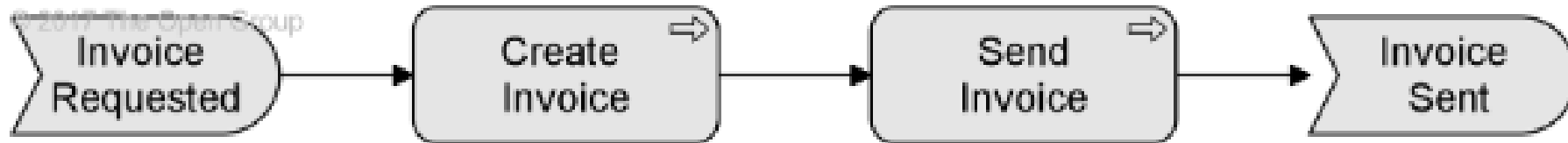
- Models that an element affects the implementation or achievement of some motivation element.



Dynamic Relationships

Triggering →

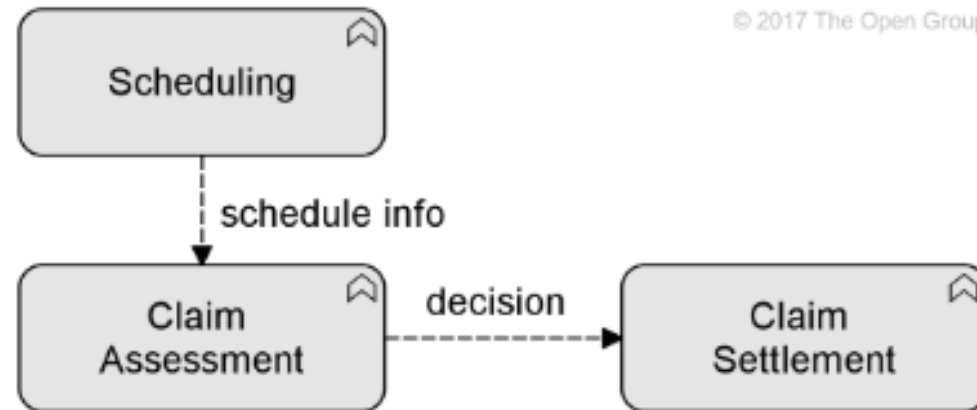
- Describes a temporal or causal relationship between elements.



Dynamic Relationships

Flow 

- Transfer from one element to another.

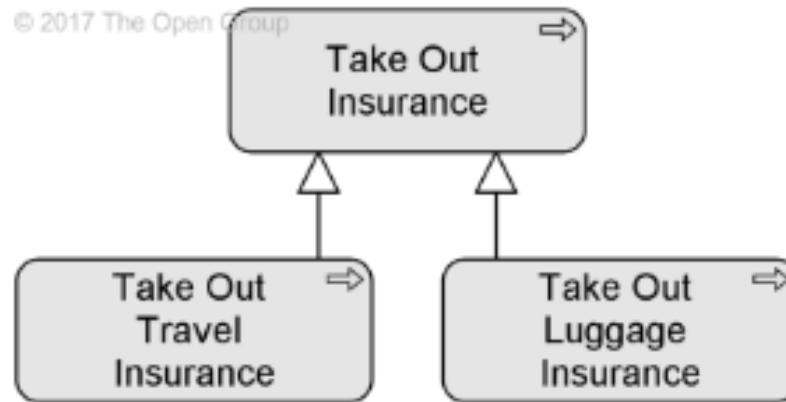


Other Relationships

Specialization



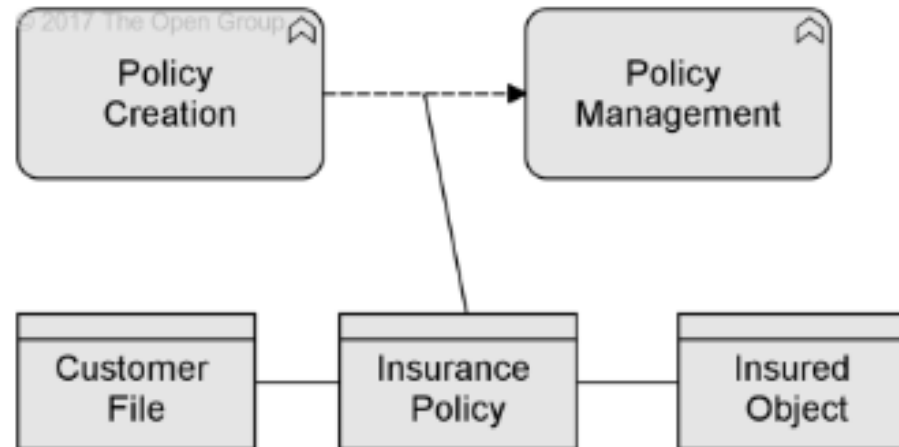
- Indicates that an element is a particular kind of another element.



Other Relationships

Association

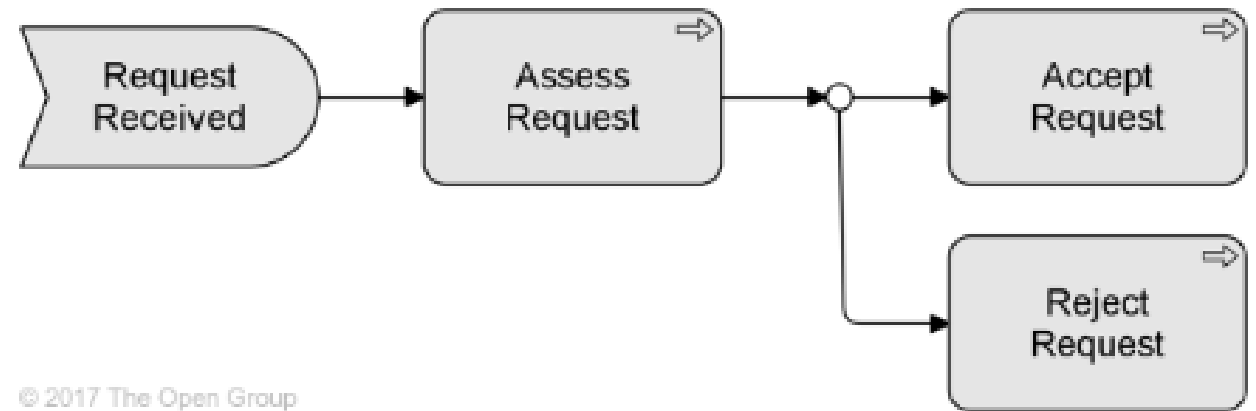
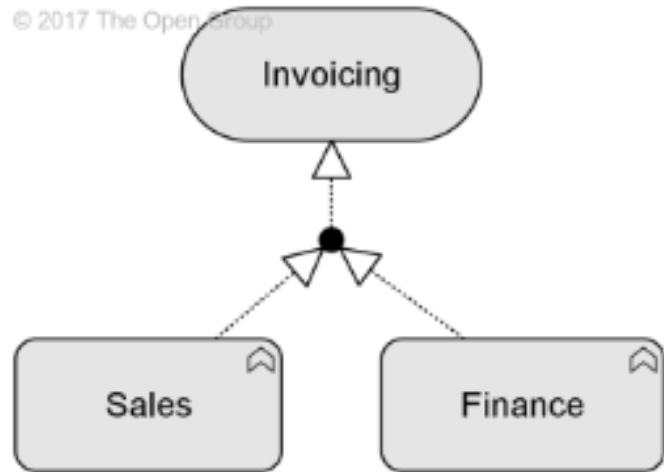
- Models an unspecified relationship, or one that is not represented by another ArchiMate relationship.



Other Relationships

Junction ● (And) Junction ○ Or Junction

- Used to connect relationships of the same type.

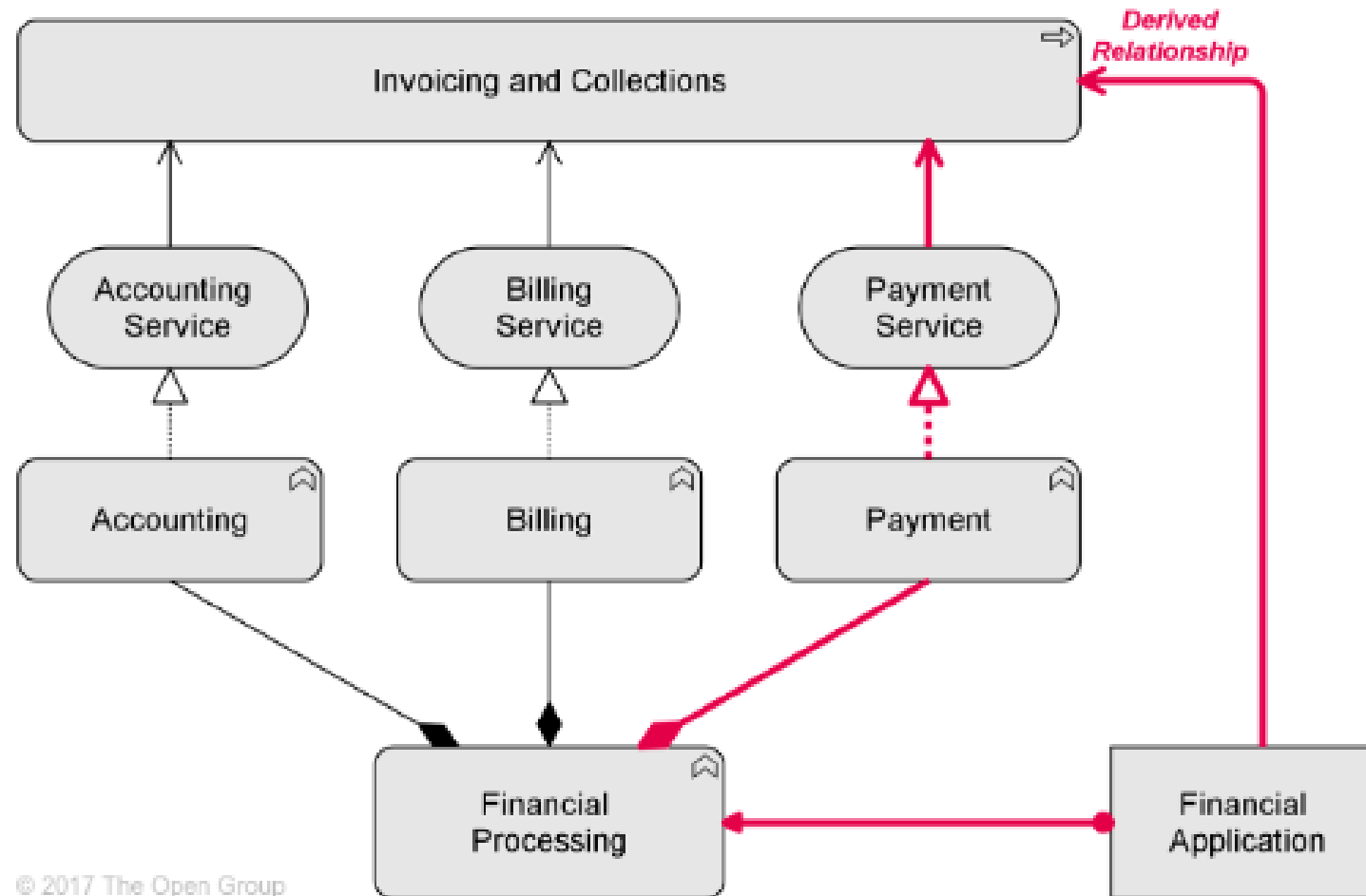


Derivation Rule for Structural and Dependency Relationships

The structural and dependency relationships can be ordered by 'strength'. Structural relationships are 'stronger' than dependency relationships, and the relationships within these categories can also be ordered by strength:

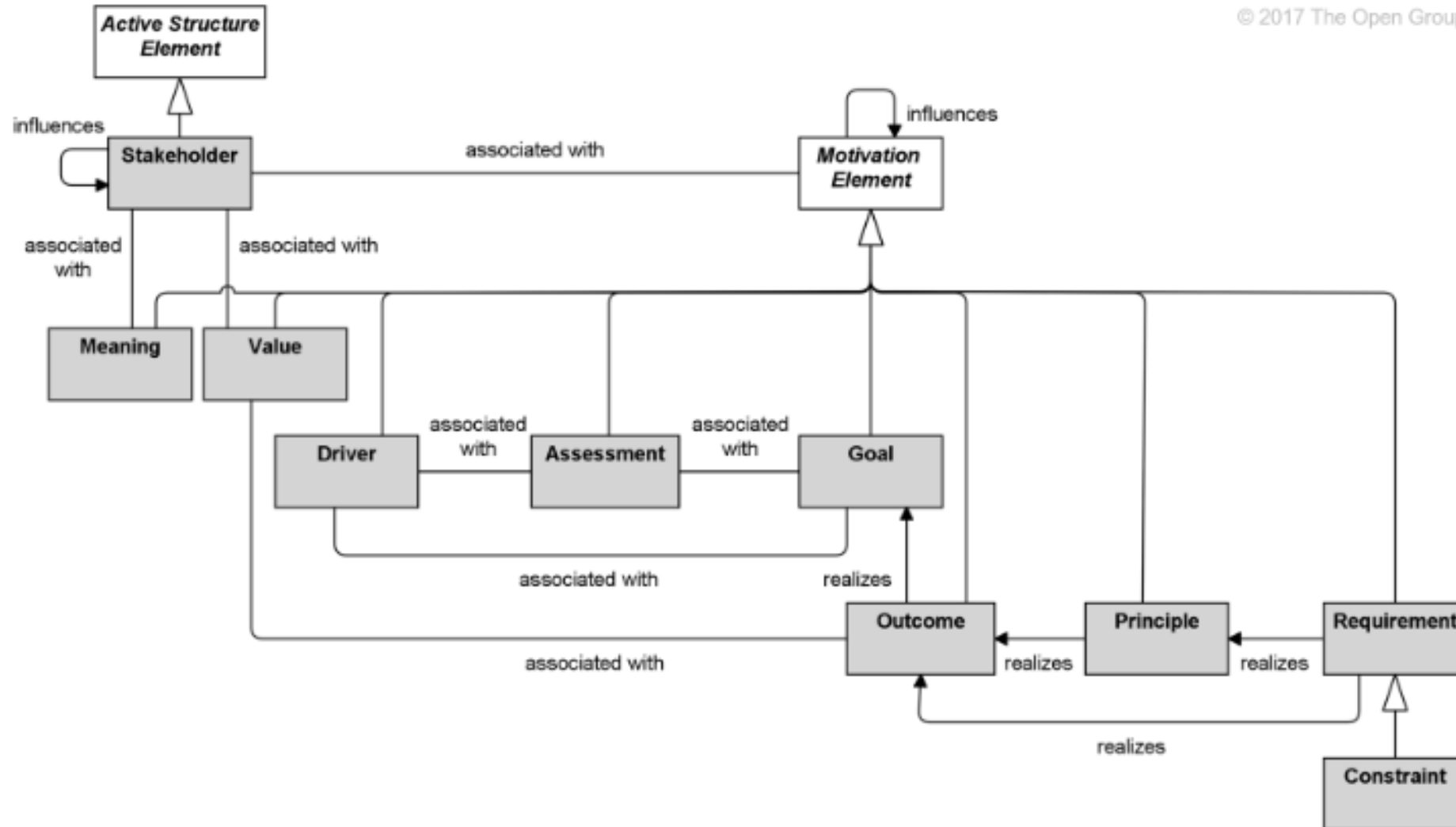
- Influence (weakest)
- Access
- Serving
- Realization
- Assignment
- Aggregation
- Composition (strongest)

Derived Structural and Dependency Relationship



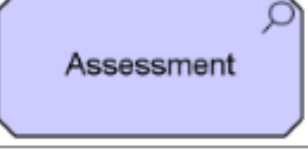

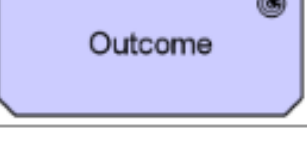


Motivation Elements Metamodel

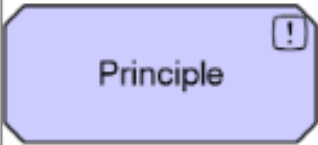






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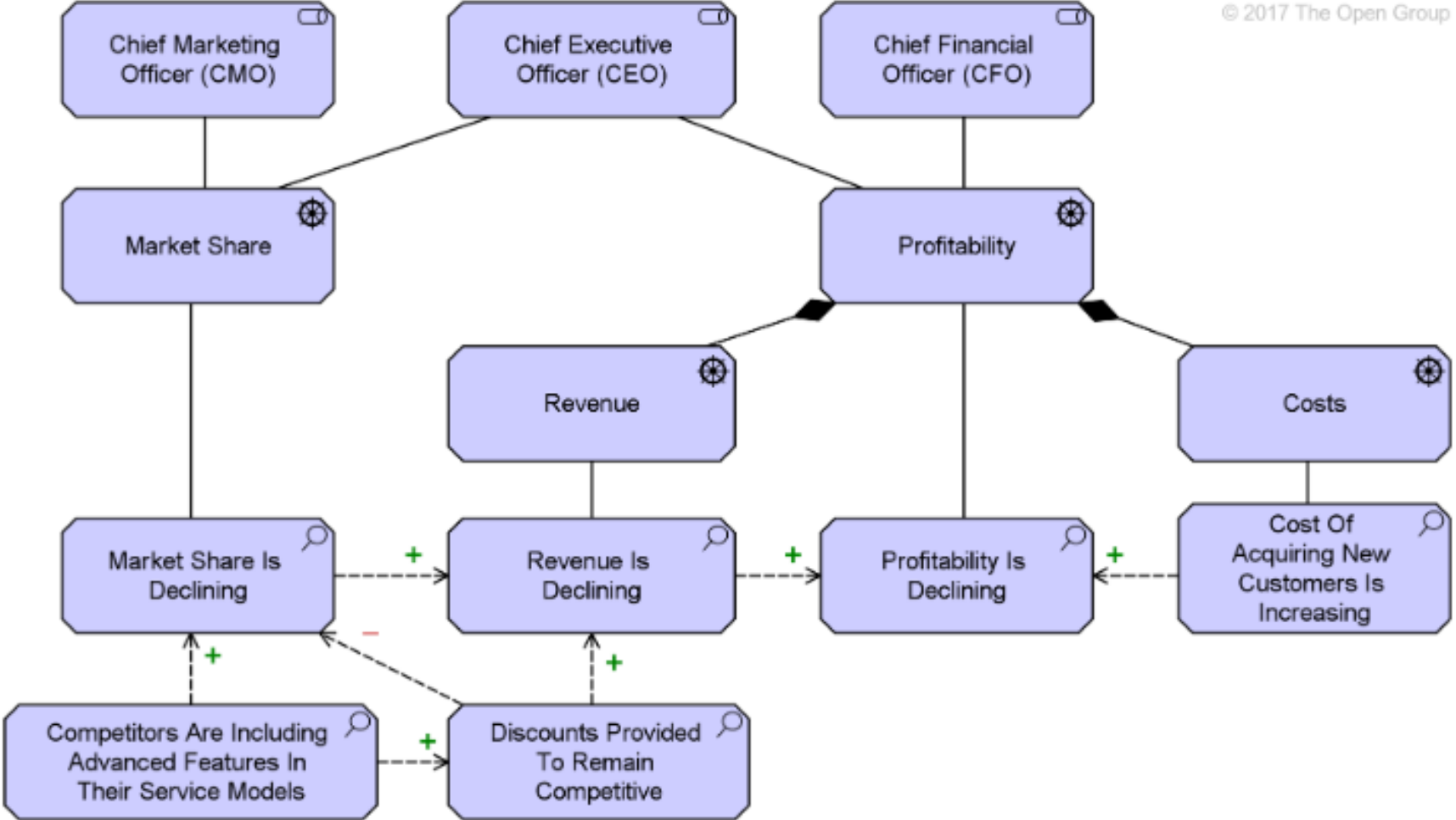
Element, Definition, Notation

Stakeholder	The role of an individual, team, or organization (or classes thereof) that represents their interests in the outcome of the architecture.	
Driver	An external or internal condition that motivates an organization to define its goals and implement the changes necessary to achieve them.	
Assessment	The result of an analysis of the state of affairs of the enterprise with respect to some driver.	
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.	

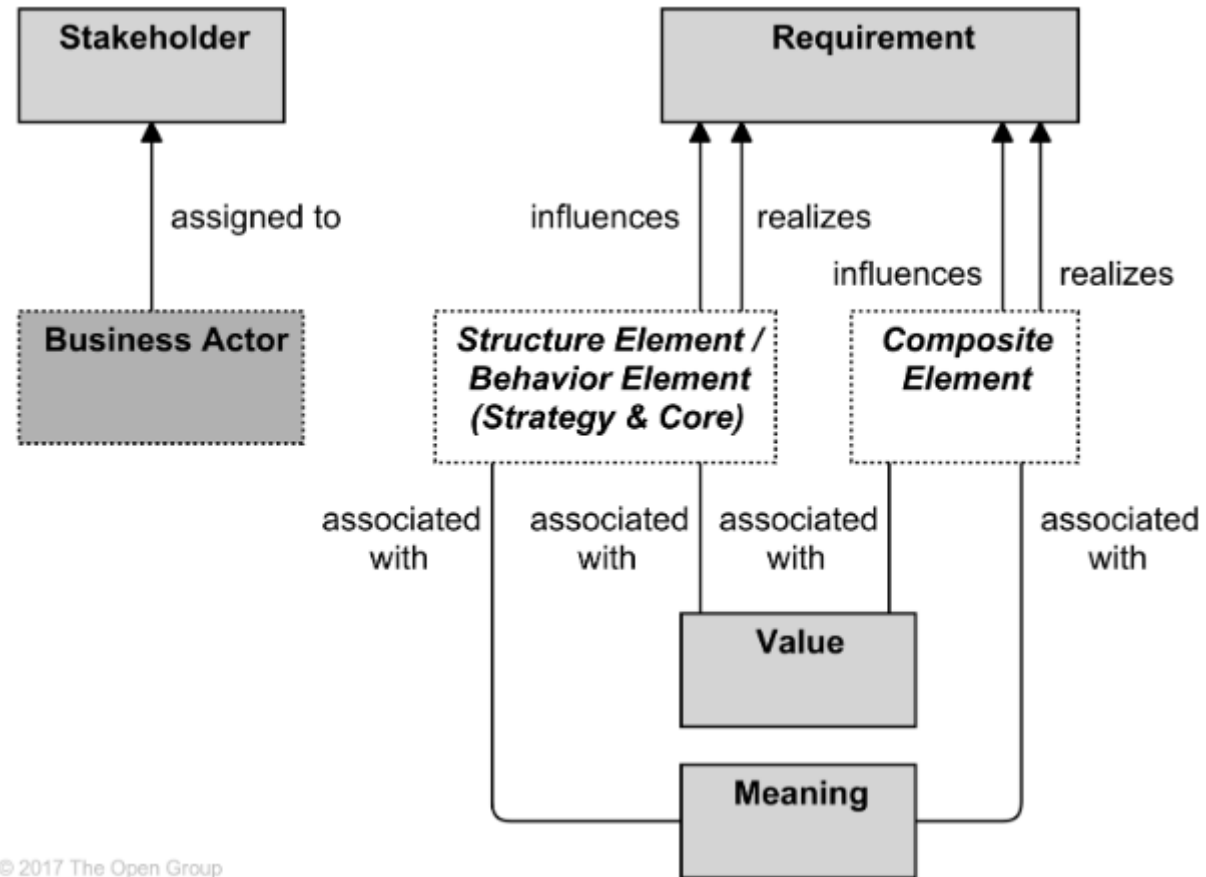
Element, Definition, Notation

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.	 
Meaning	The knowledge or expertise present in, or the interpretation given to, a core element in a particular context.	
Value	The relative worth, utility, or importance of a core element or an outcome.	

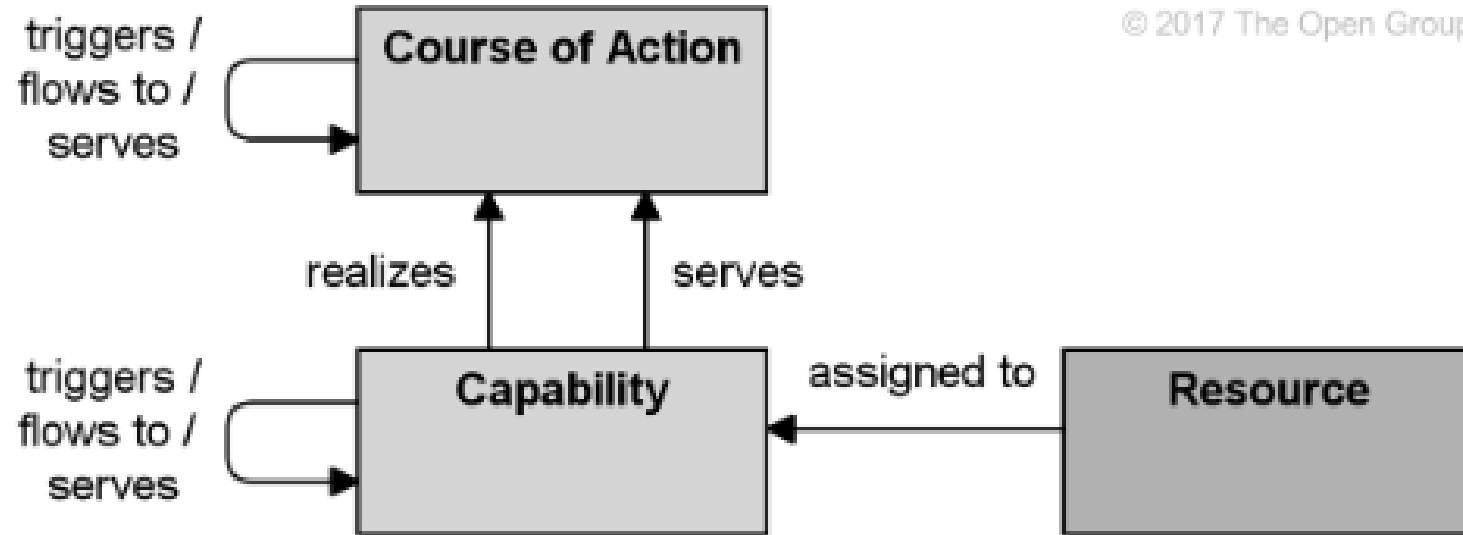
Example: Stakeholder, Driver, and Assessment




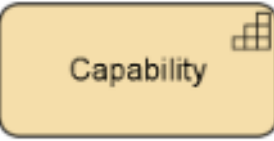

Relationships between Motivation Elements and Core Elements



Strategy Elements Metamodel

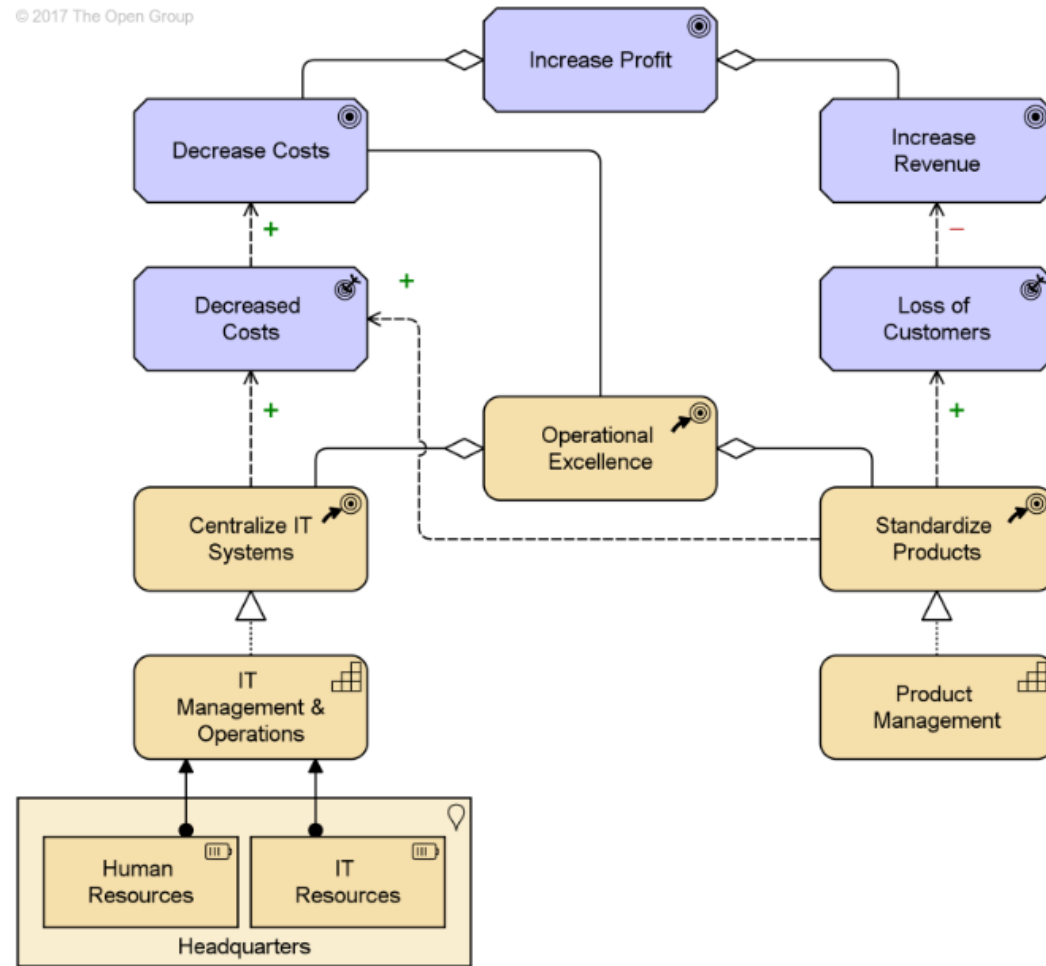


Element, Definition, Notation

Resource	An asset owned or controlled by an individual or organization.	
Capability	An ability that an active structure element, such as an organization, person, or system, possesses.	
Course of action	An approach or plan for configuring some capabilities and resources of the enterprise, undertaken to achieve a goal.	

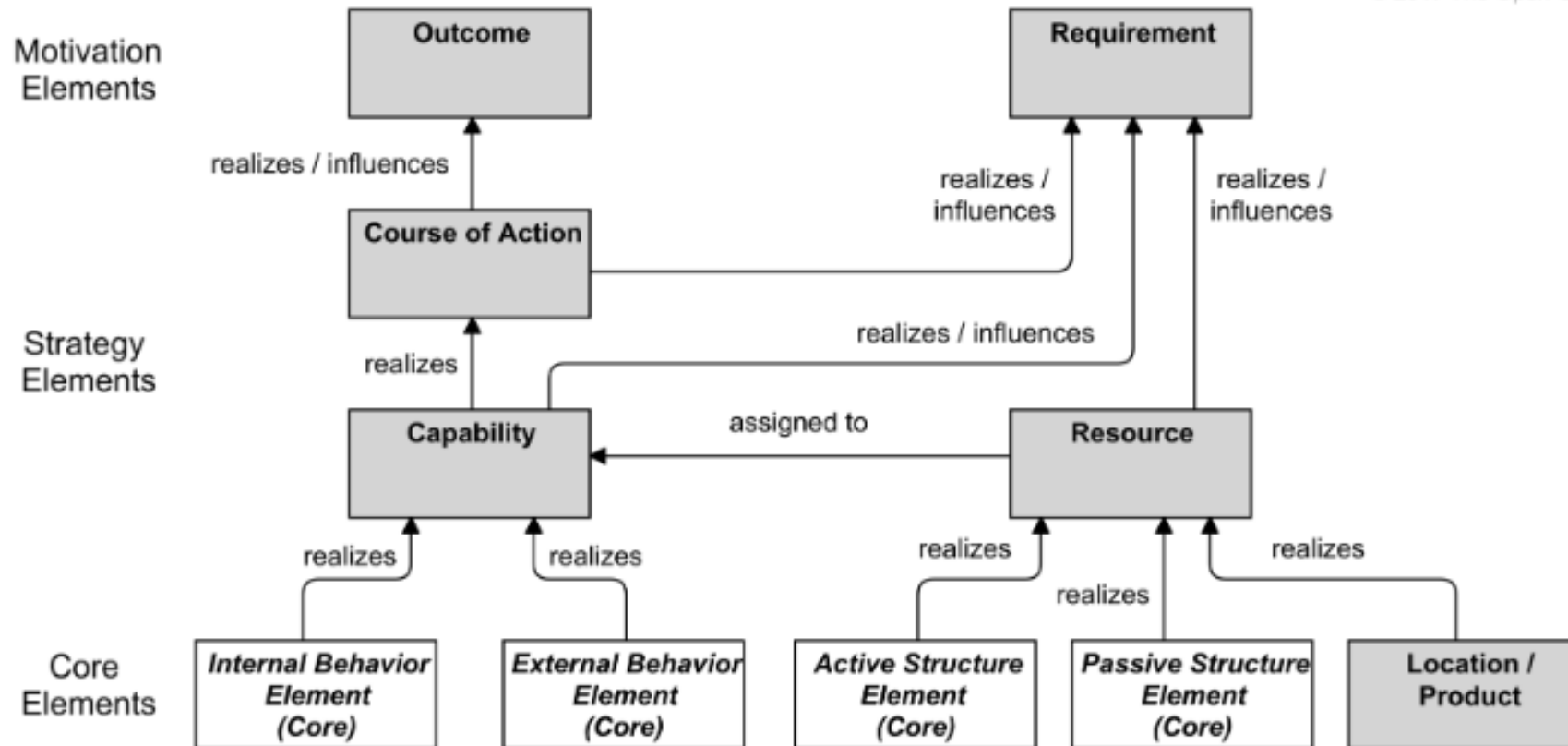
Example: Strategy Elements

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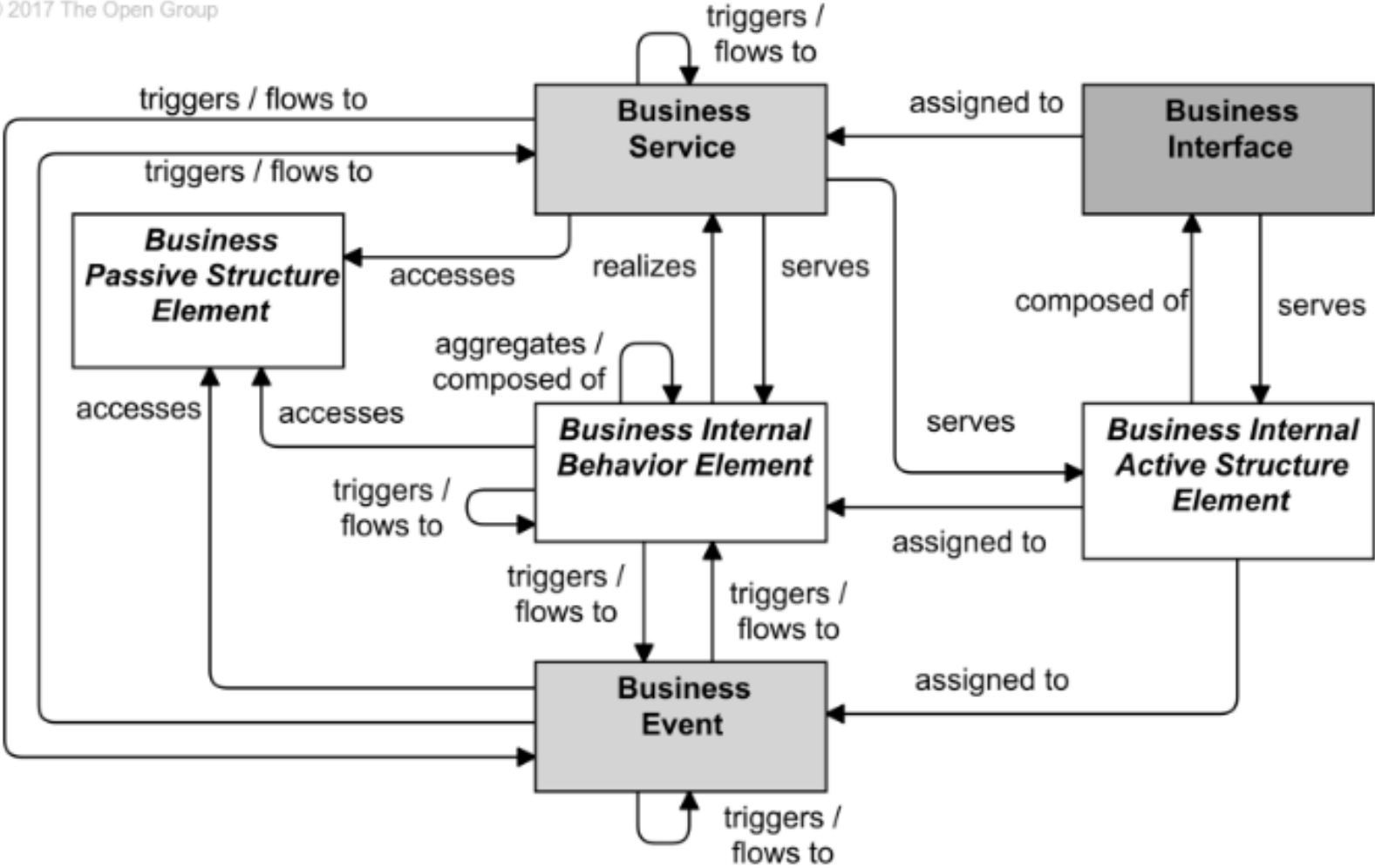
Relationships with Motivation and Core Elements

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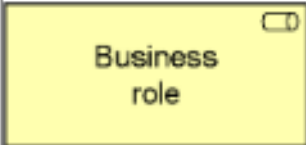

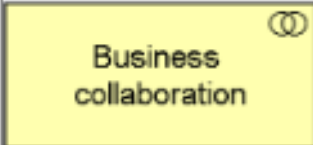
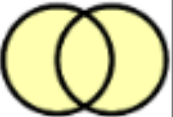



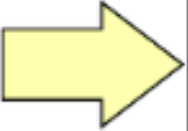


Business Layer Metamodel






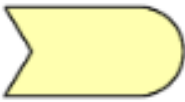

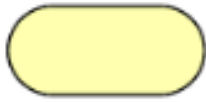
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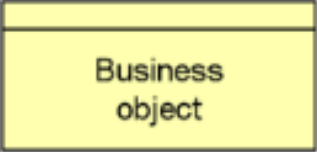
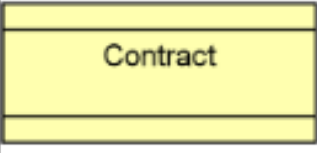

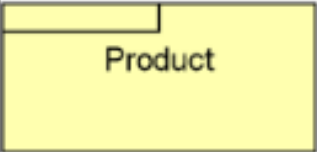
Element, Definition, Notation

Business actor	A business entity that is capable of performing behavior.		
Business role	The responsibility for performing specific behavior, to which an actor can be assigned, or the part an actor plays in a particular action or event.		
Business collaboration	An aggregate of two or more business internal active structure elements that work together to perform collective behavior.		
Business interface	A point of access where a business service is made available to the environment.		
Business process	A sequence of business behaviors that achieves a specific outcome such as a defined set of products or business services.		

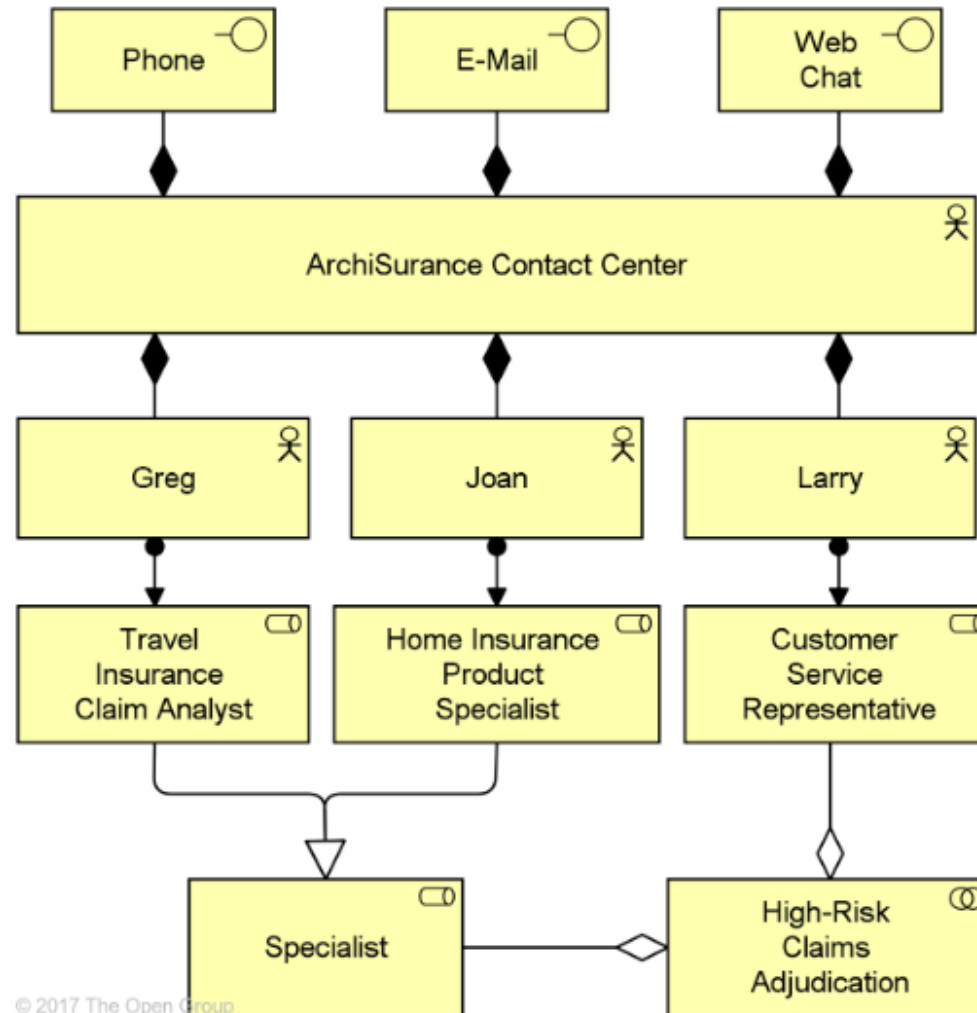
Element, Definition, Notation

Business function	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 interaction	A unit of collective business behavior performed by (a collaboration of) two or more business roles.		
Business event	A business behavior element that denotes an organizational state change. It may originate from and be resolved inside or outside the organization.		
Business service	An explicitly defined exposed business behavior.		

Element, Definition, Notation

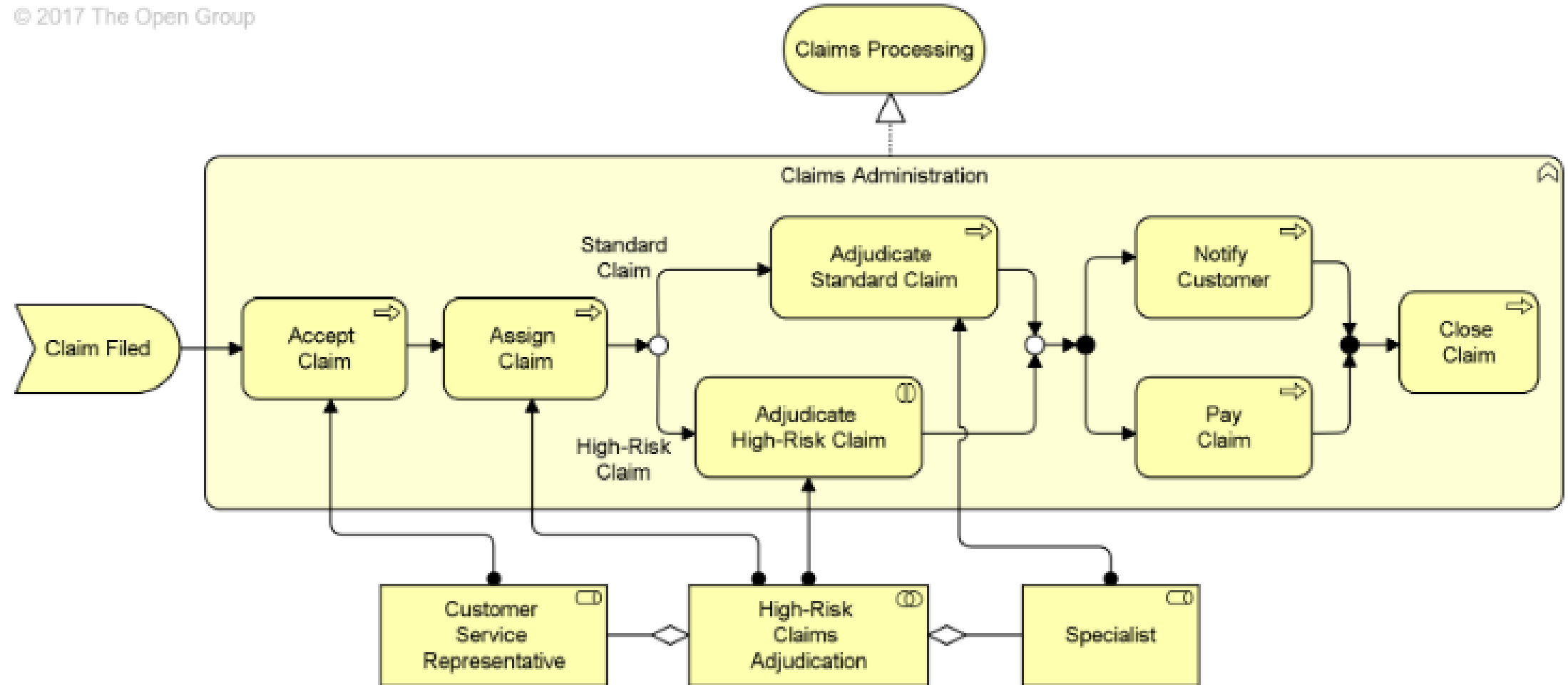
Business object	A concept used within a particular business domain.	
Contract	A formal or informal specification of an agreement between a provider and a consumer that specifies the rights and obligations associated with a product and establishes functional and non-functional parameters for interaction.	
Representation	A perceptible form of the information carried by a business object.	
Product	A coherent collection of services and/or passive structure elements, accompanied by a contract/set of agreements, which is offered as a whole to (internal or external) customers.	

Business Active Structure Elements



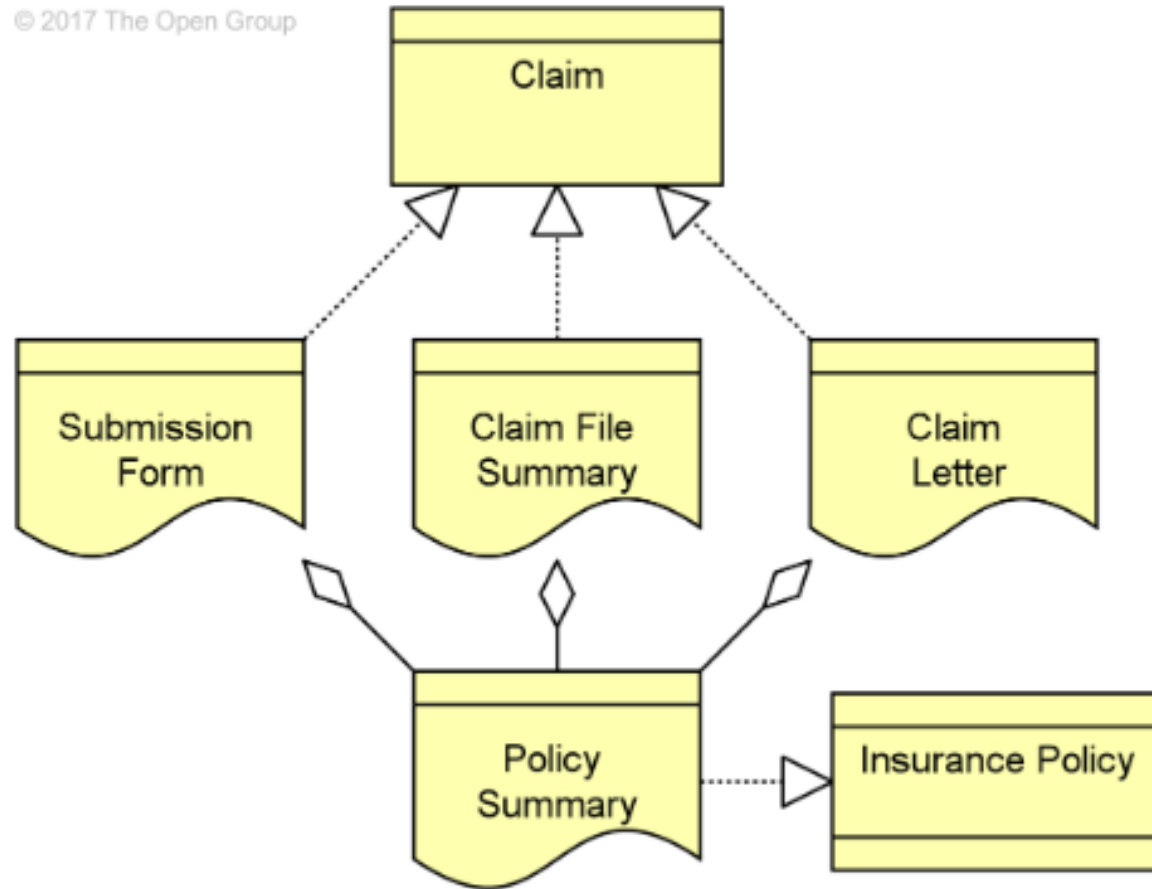
Business Behavior Elements

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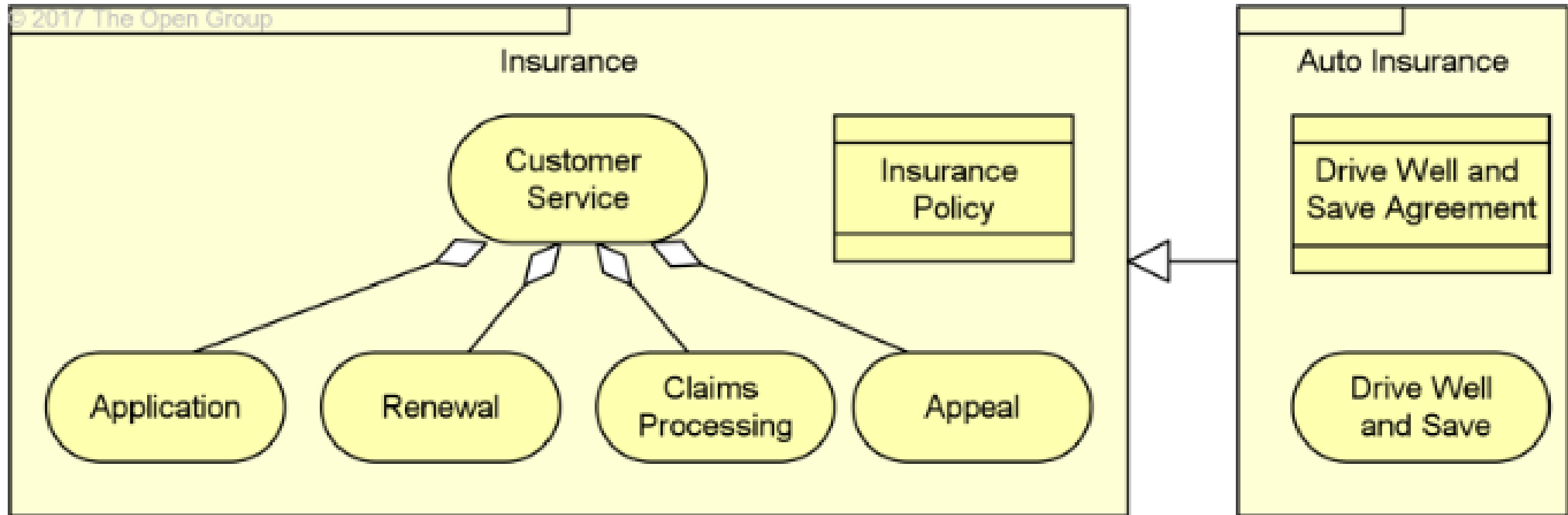


Business Passive Structure Elements

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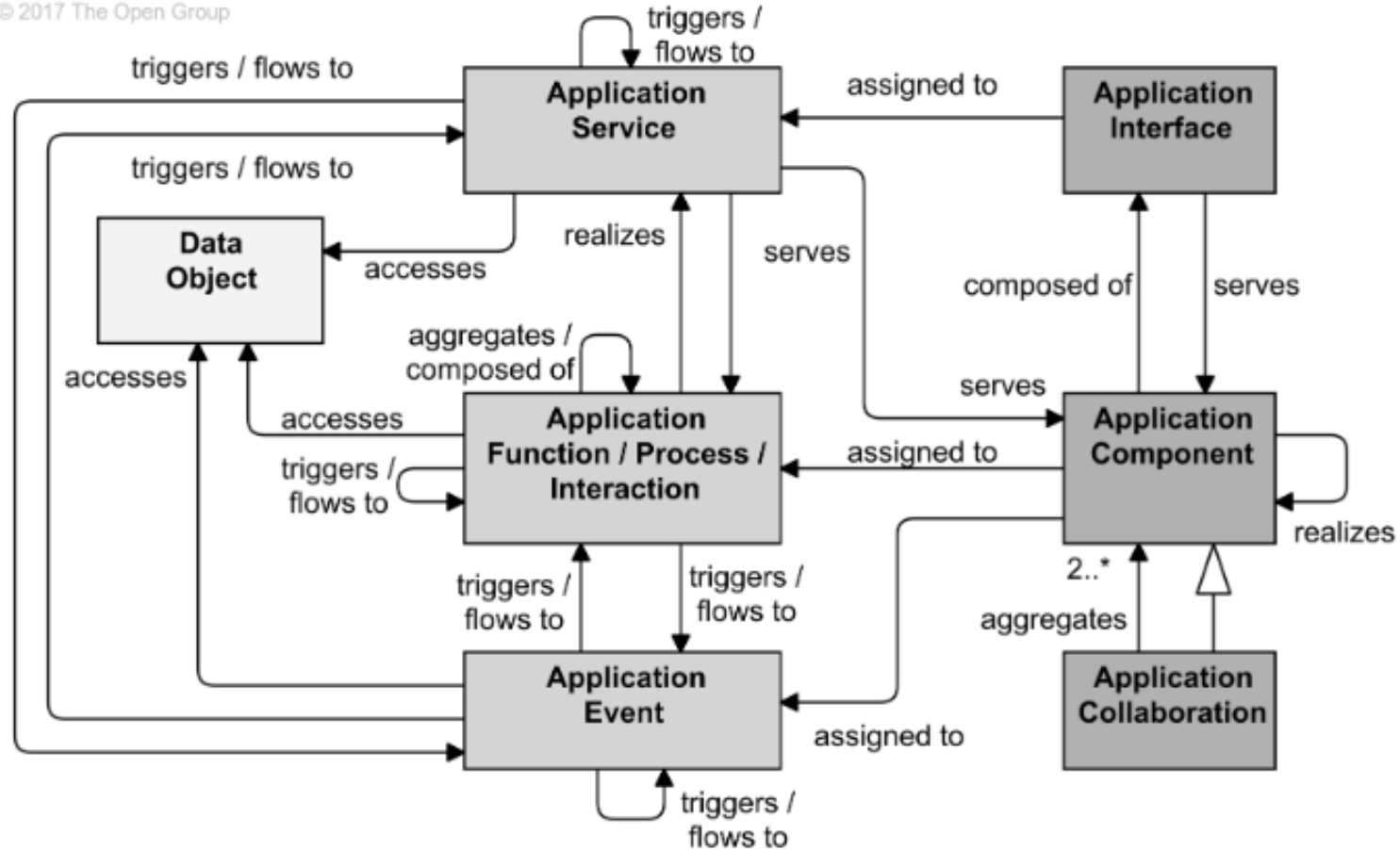


Business Composite Element: Product

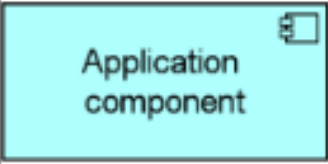


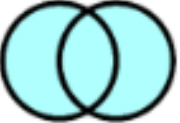






Application Layer Metamodel


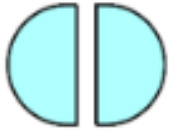

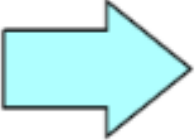




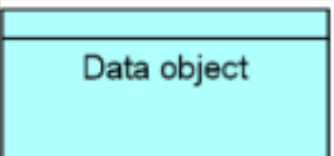
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Element, Definition, Notation

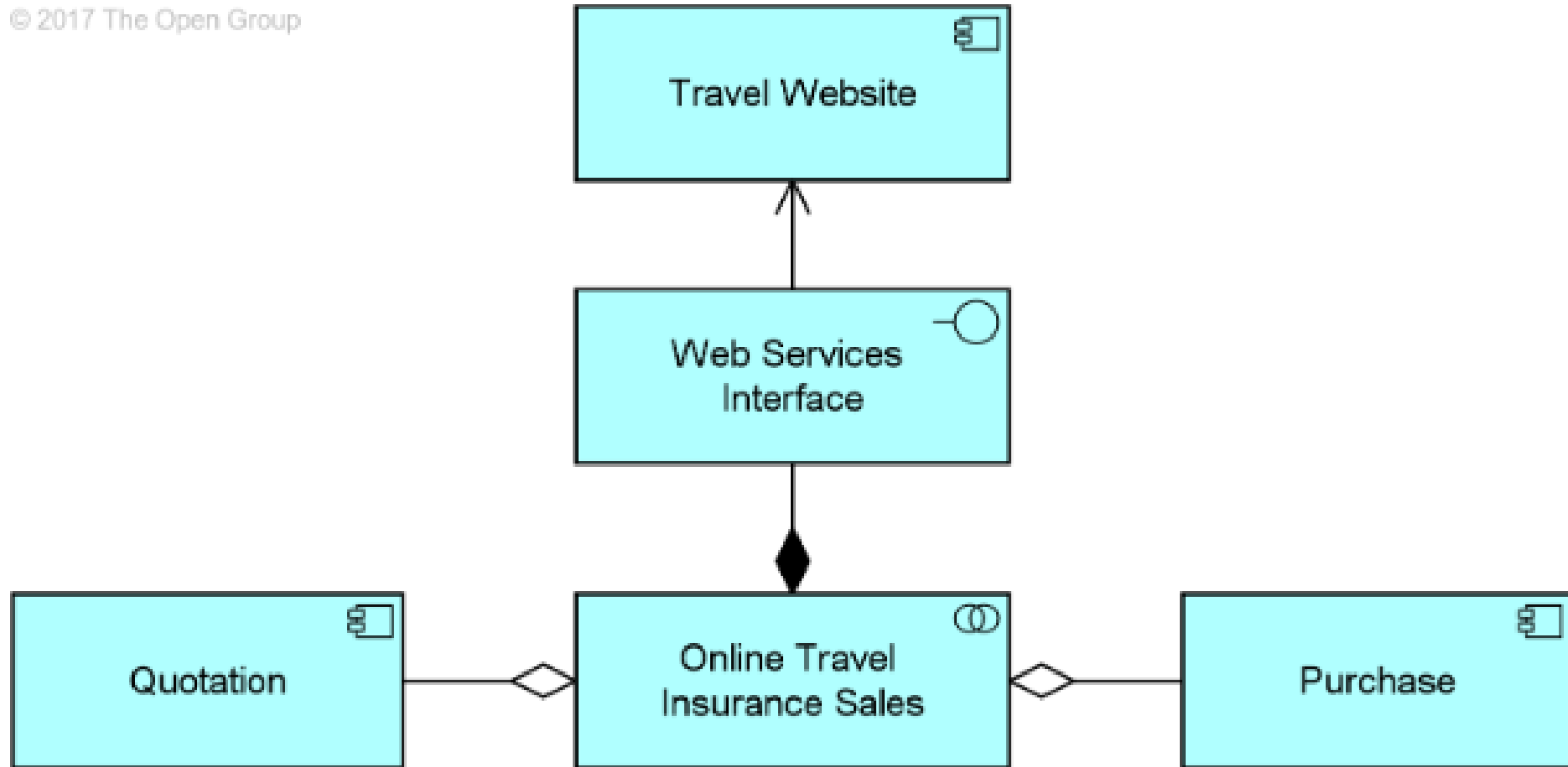
Application component	An encapsulation of application functionality aligned to implementation structure, which is modular and replaceable. It encapsulates its behavior and data, exposes services, and makes them available through interfaces.		
Application collaboration	An aggregate of two or more application components that work together to perform collective application behavior.		
Application interface	A point of access where application services are made available to a user, another application component, or a node.		
Application function	Automated behavior that can be performed by an application component.		

Element, Definition, Notation

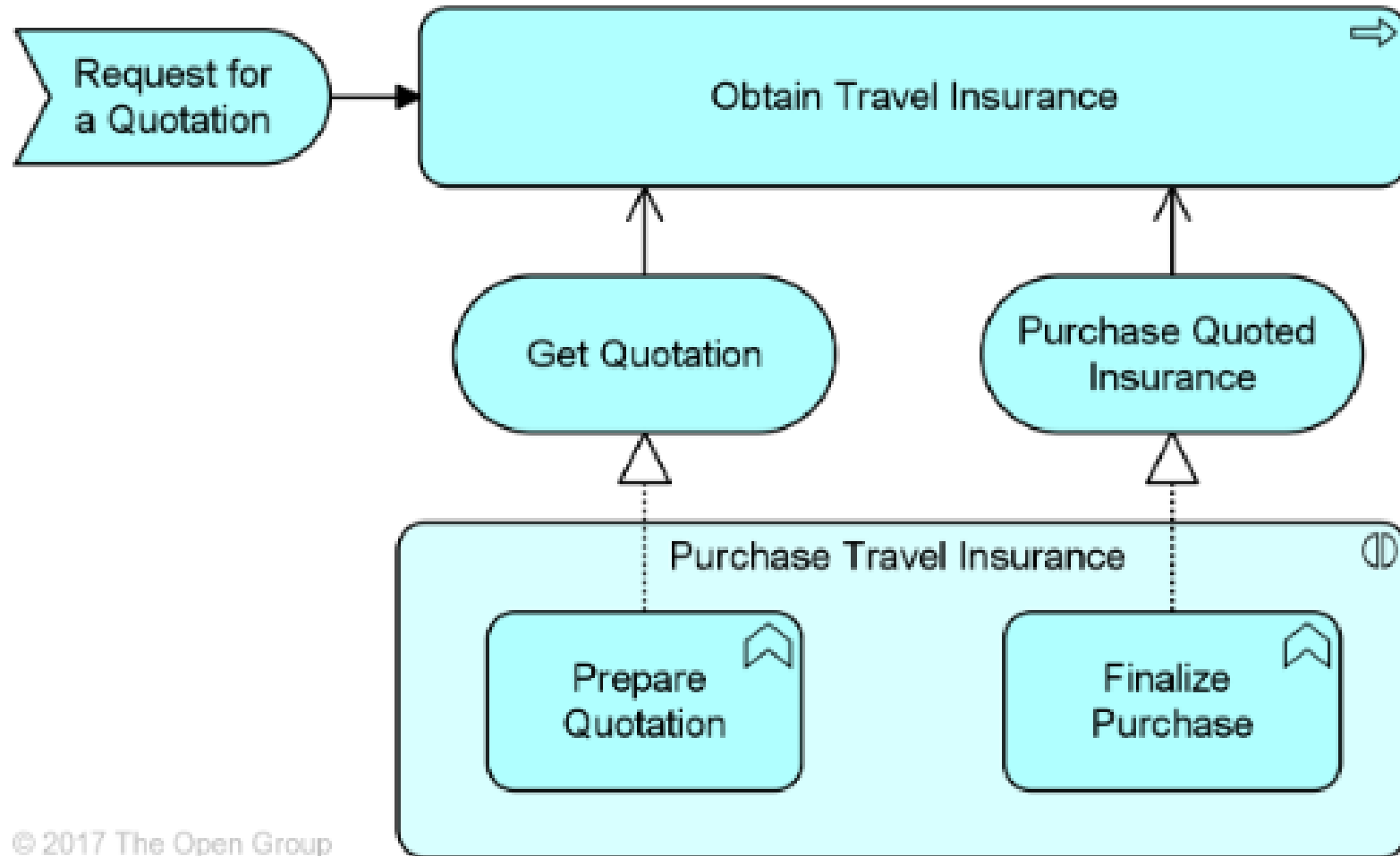
Application interaction	A unit of collective application behavior performed by (a collaboration of) two or more application components.		
Application process	A sequence of application behaviors that achieves a specific outcome.		
Application event	An application behavior element that denotes a state change.		
Application service	An explicitly defined exposed application behavior.		
Data object	Data structured for automated processing.		

Application Active Structure Elements

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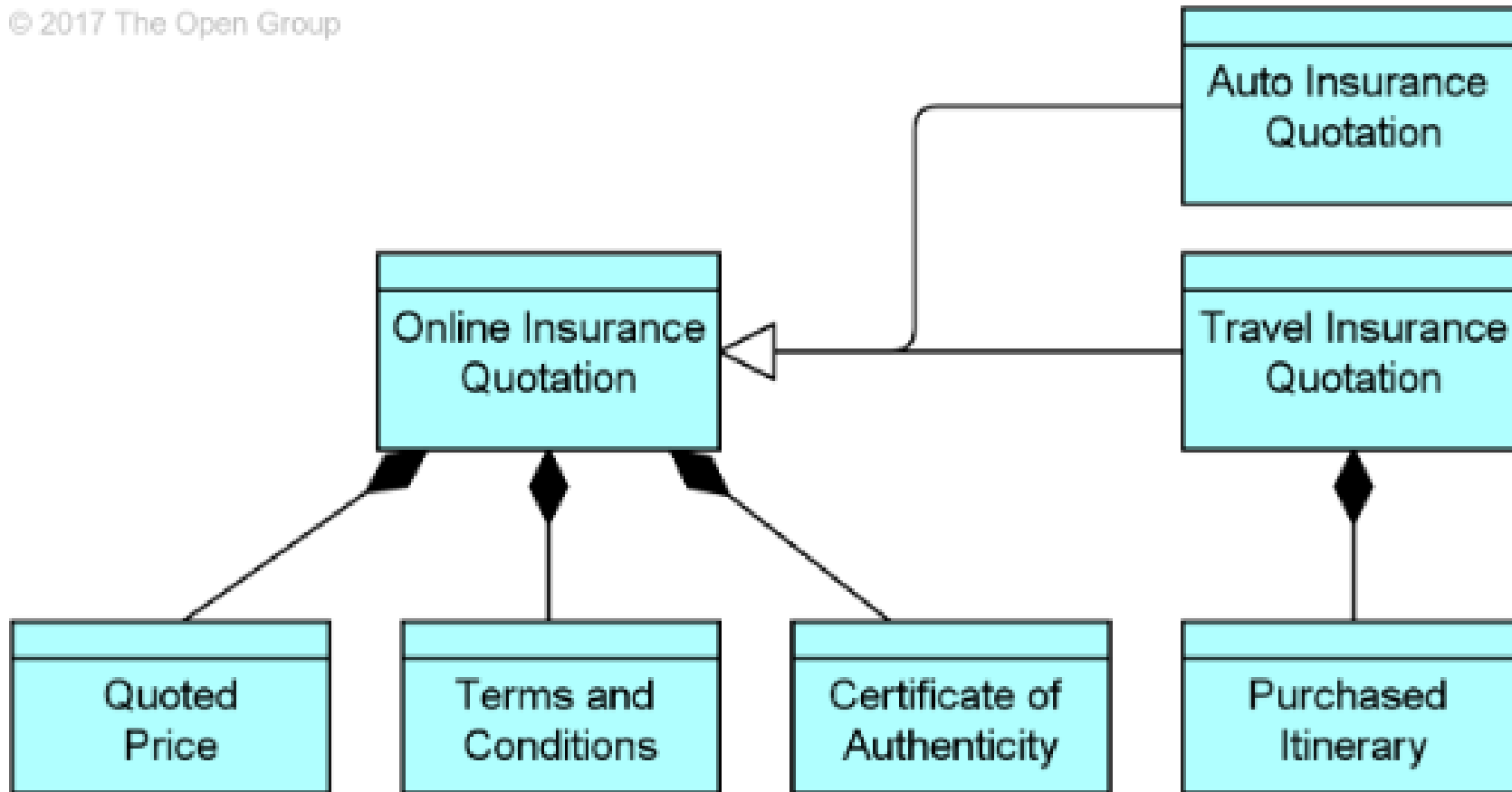


Application Behavior Elements



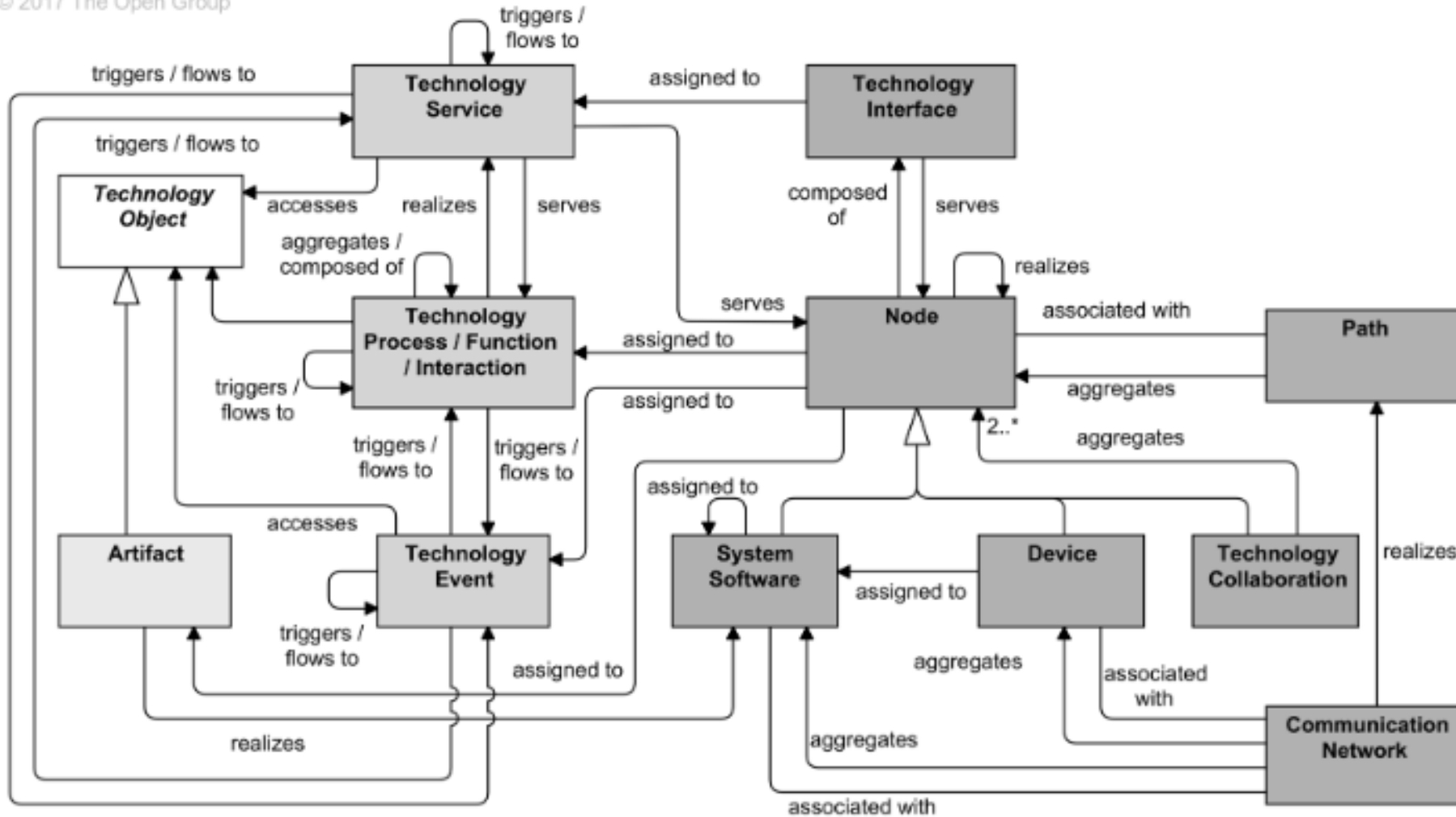
Application Passive Structure Elements

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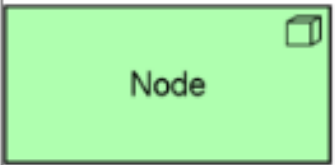
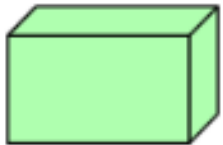
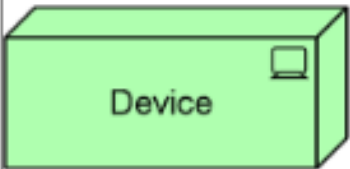
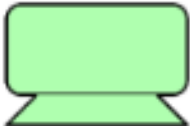
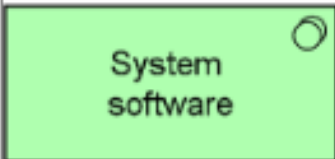
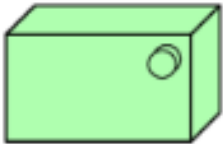
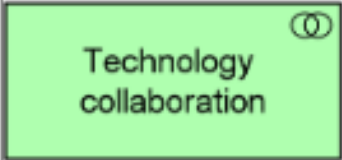





Technology Layer Metamodel

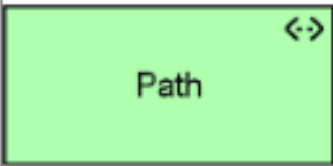



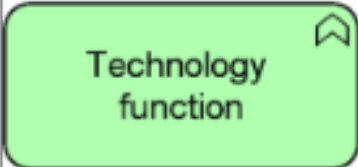


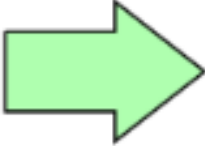
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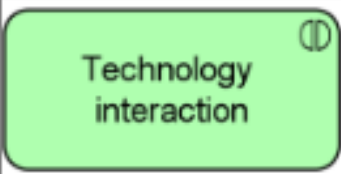




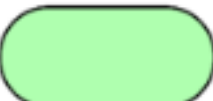


Element, Definition, Notation

Node	A computational or physical resource that hosts, manipulates, or interacts with other computational or physical resources.		
Device	A physical IT resource upon which system software and artifacts may be stored or deployed for execution.		
System software	Software that provides or contributes to an environment for storing, executing, and using software or data deployed within it.		
Technology collaboration	An aggregate of two or more nodes that work together to perform collective technology behavior.		
Technology interface	A point of access where technology services offered by a node can be accessed.		

Element, Definition, Notation

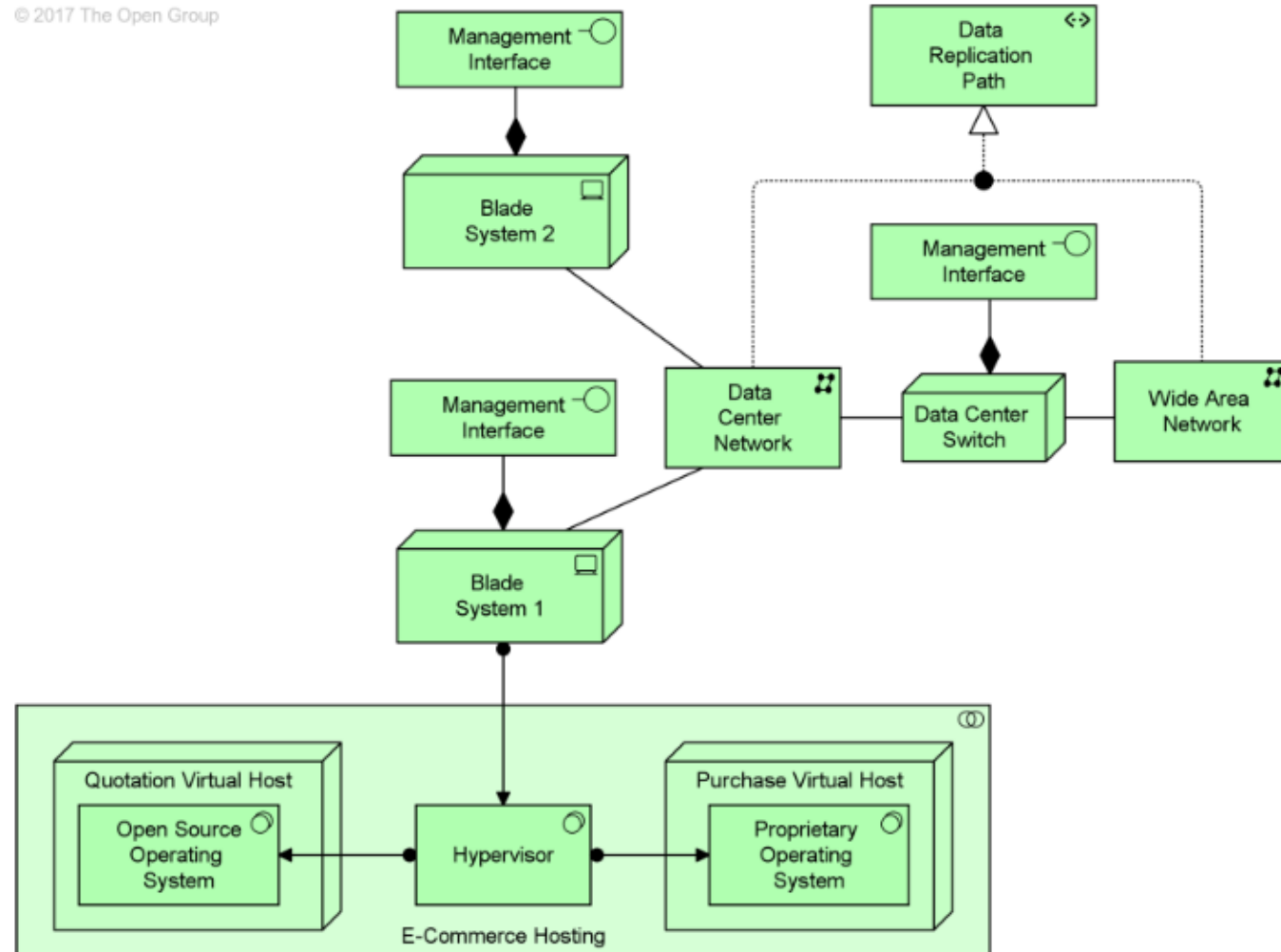
Path	A link between two or more nodes, through which these nodes can exchange data or material.		
Communication network	A set of structures that connects computer systems or other electronic devices for transmission, routing, and reception of data or data-based communications such as voice and video.		
Technology function	A collection of technology behavior that can be performed by a node.		
Technology process	A sequence of technology behaviors that achieves a specific outcome.		

Element, Definition, Notation

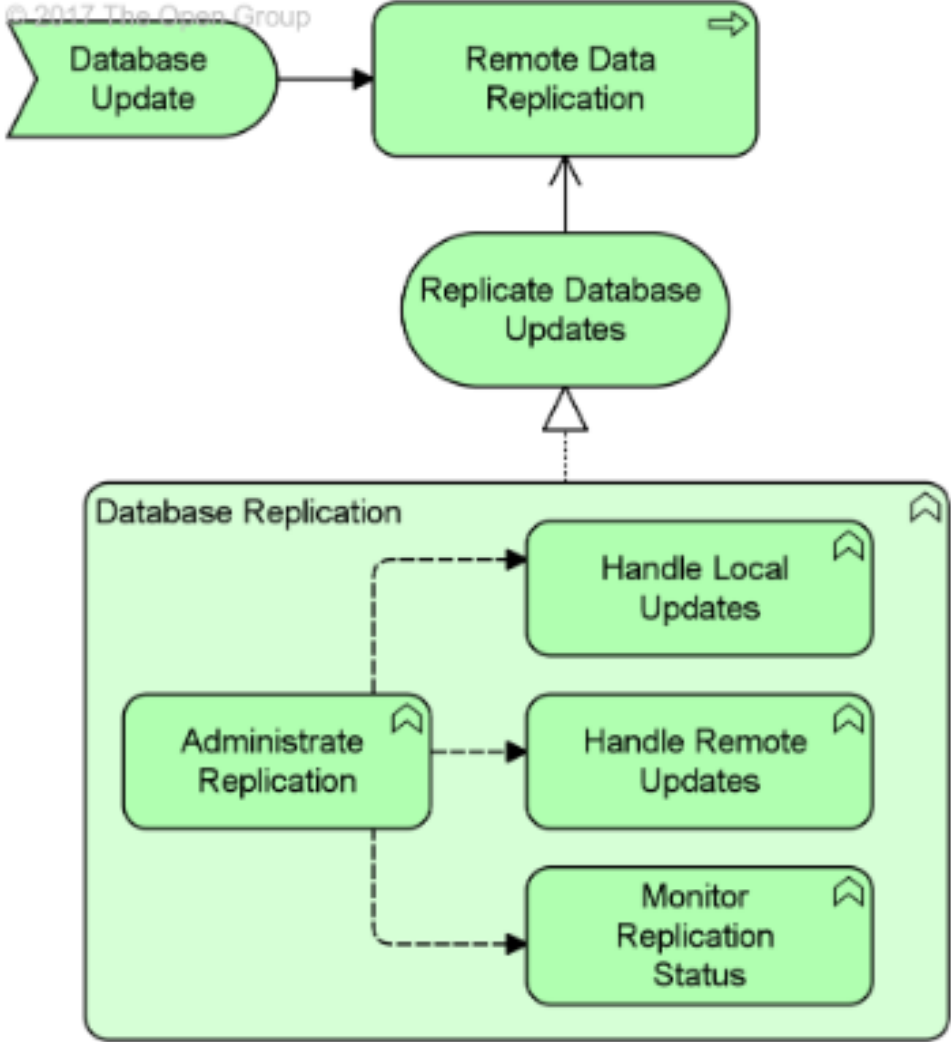
Technology interaction	A unit of collective technology behavior performed by (a collaboration of) two or more nodes.		
Technology event	A technology behavior element that denotes a state change.		
Technology service	An explicitly defined exposed technology behavior.		
Artifact	A piece of data that is used or produced in a software development process, or by deployment and operation of a system.		

Technology Active Structure Elements

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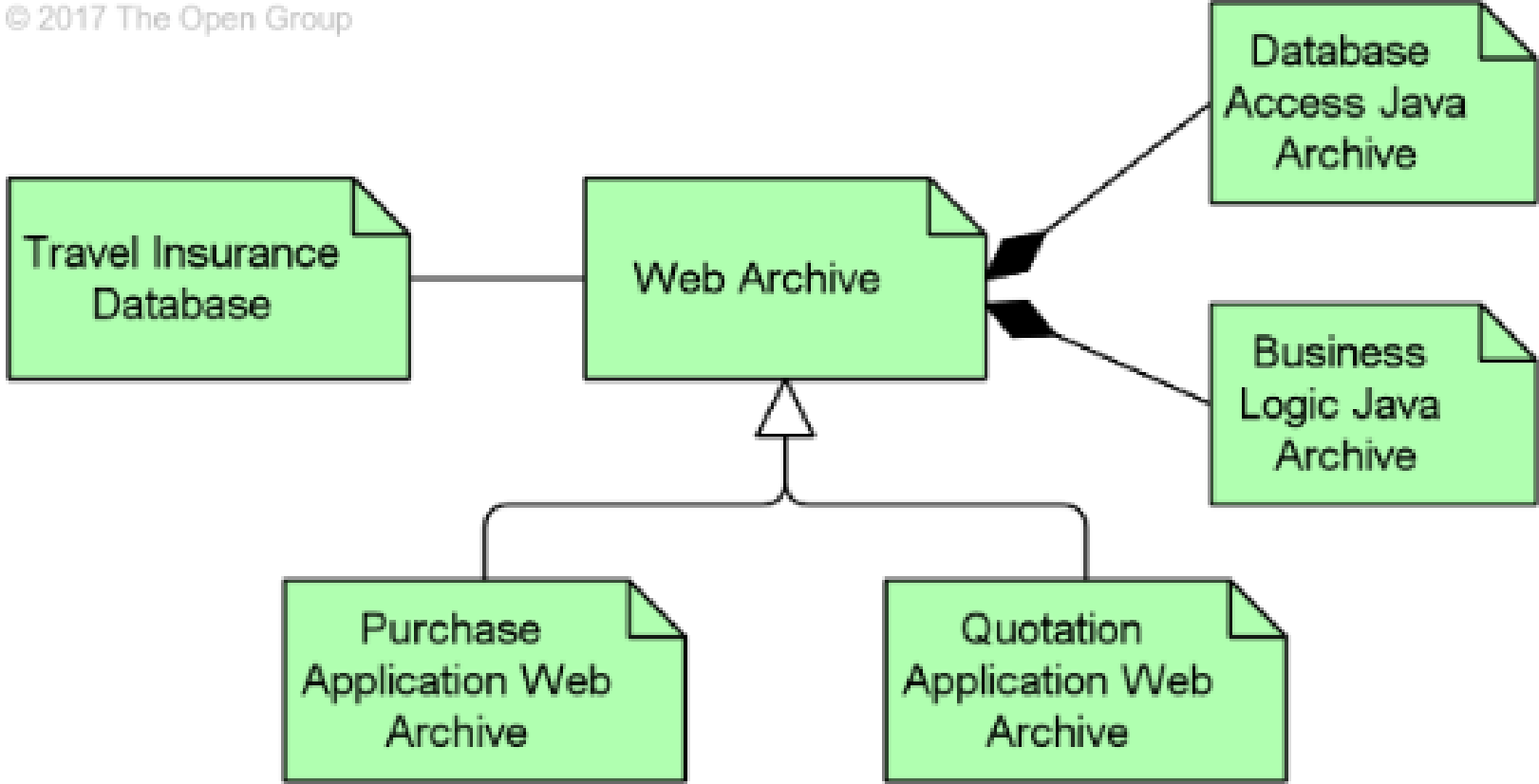


Technology Behavior Elements

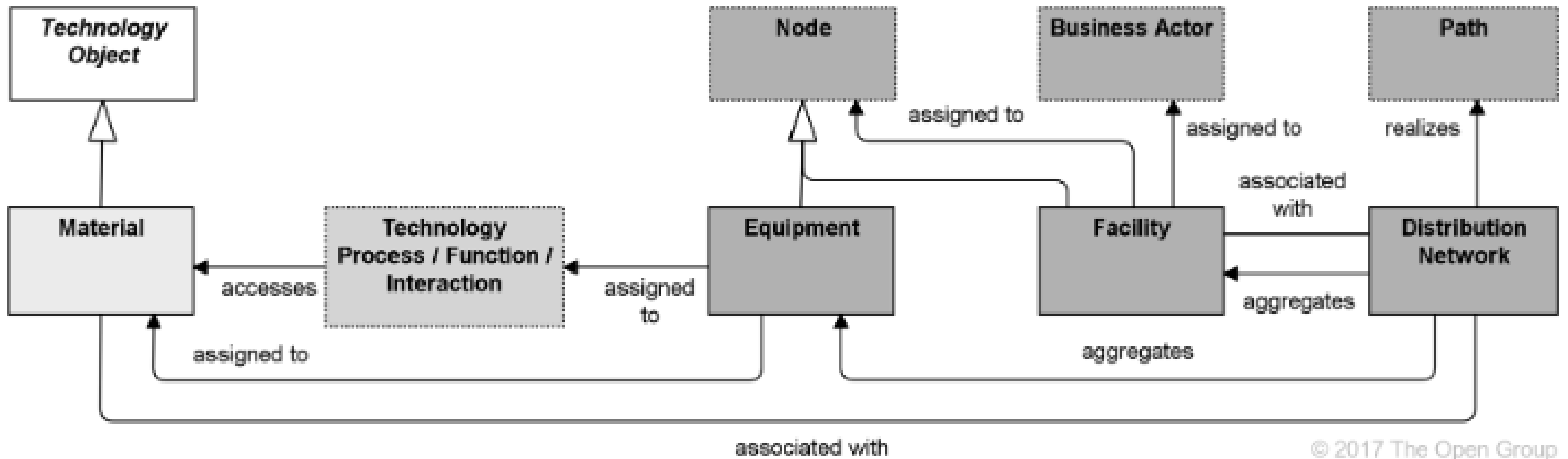


Technology Passive Structure Element: Artifact

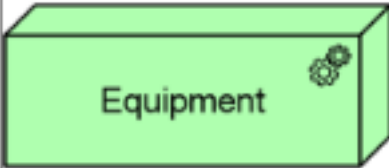
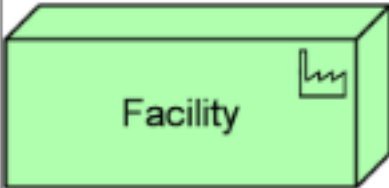
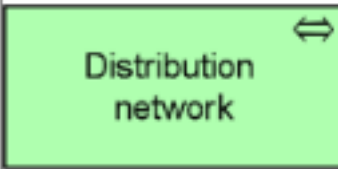

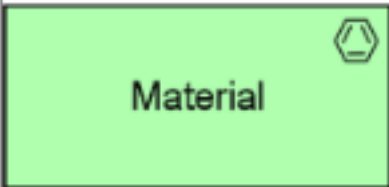
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Physical Elements Metamodel

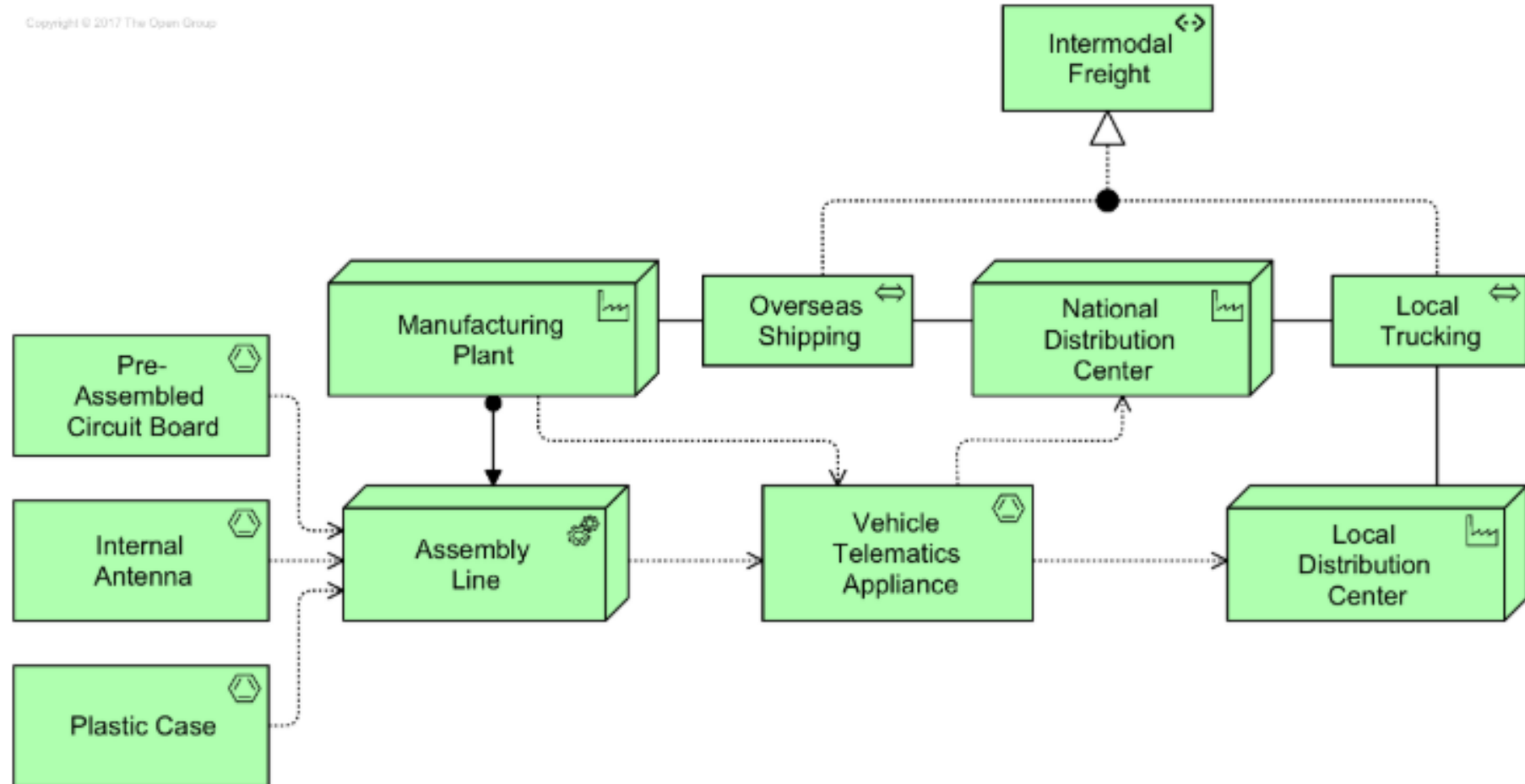


Element, Definition, Notation

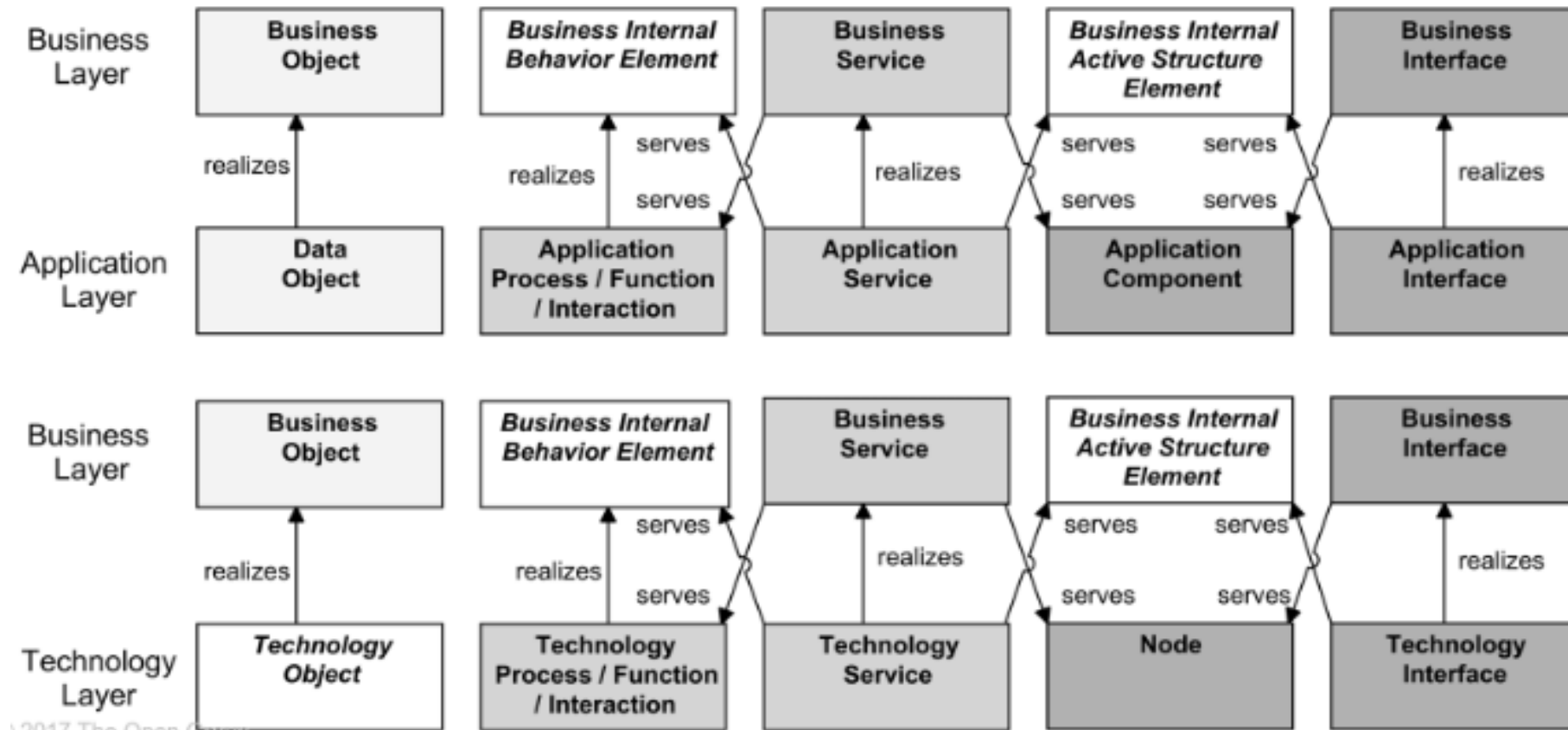
Equipment	One or more physical machines, tools, or instruments that can create, use, store, move, or transform materials.		
Facility	A physical structure or environment.		
Distribution network	A physical network used to transport materials or energy.		
Material	Tangible physical matter or physical elements.		

Physical Elements

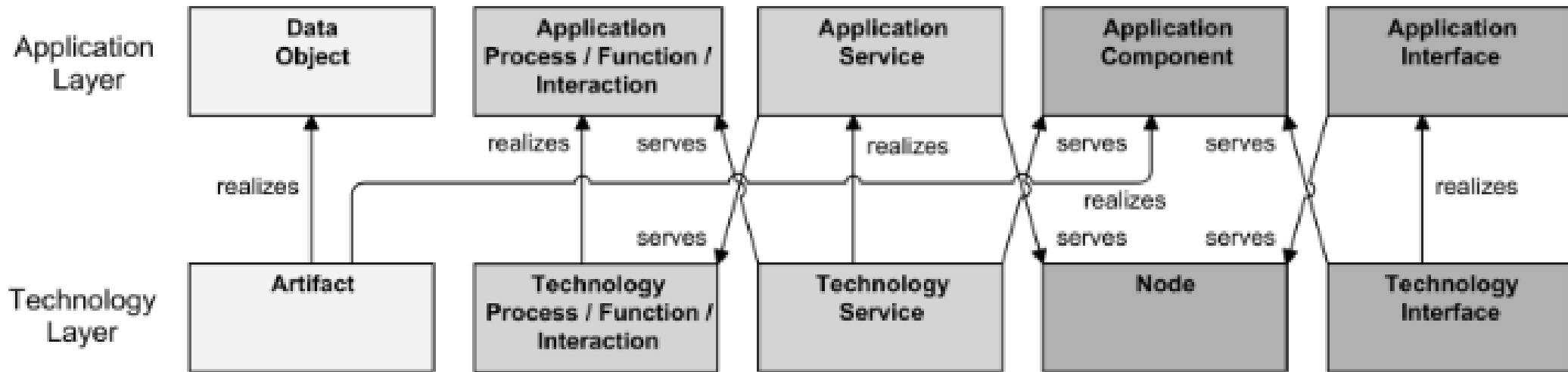
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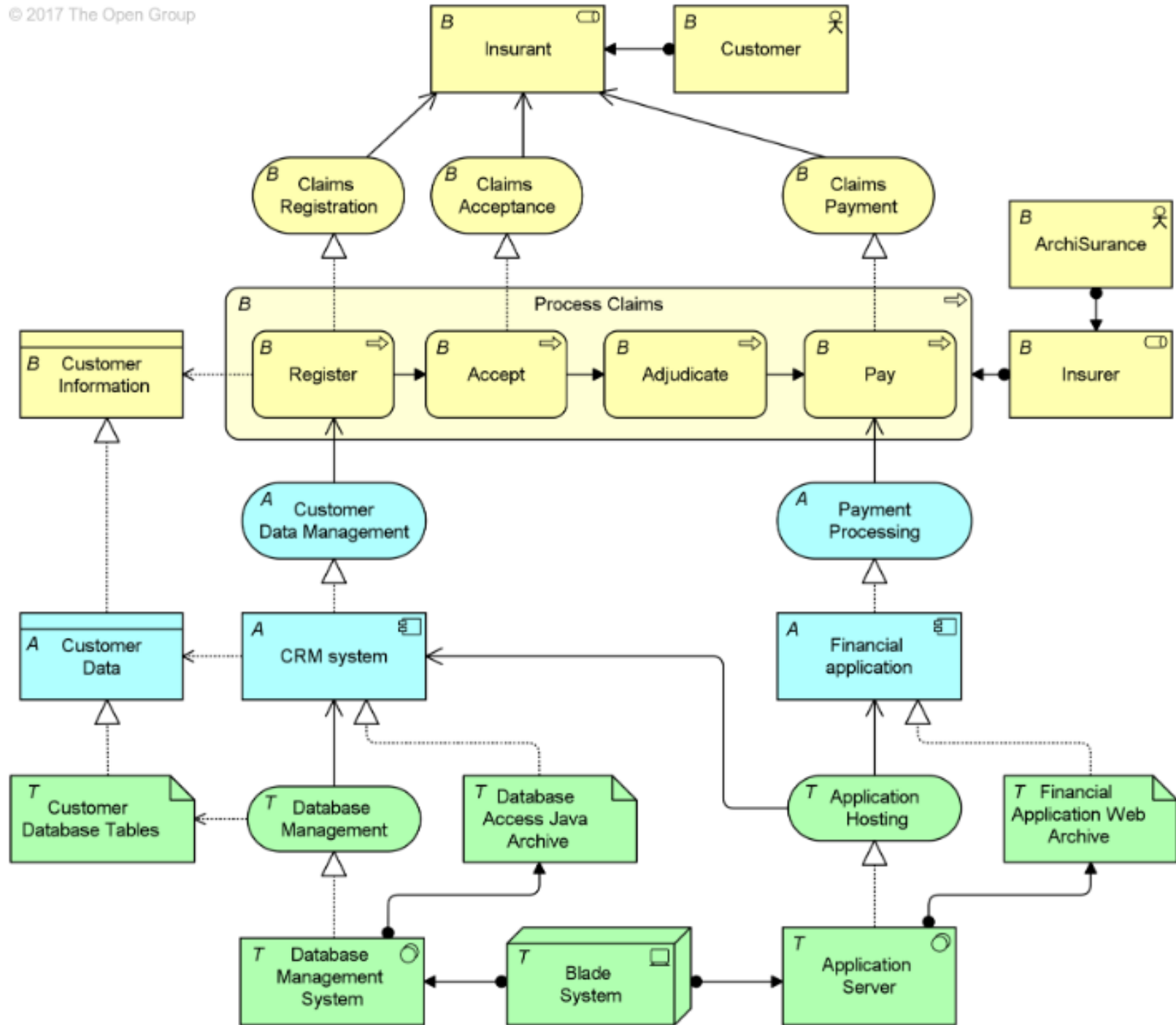


Relationships between Business Layer and Application and Technology Layer Elements

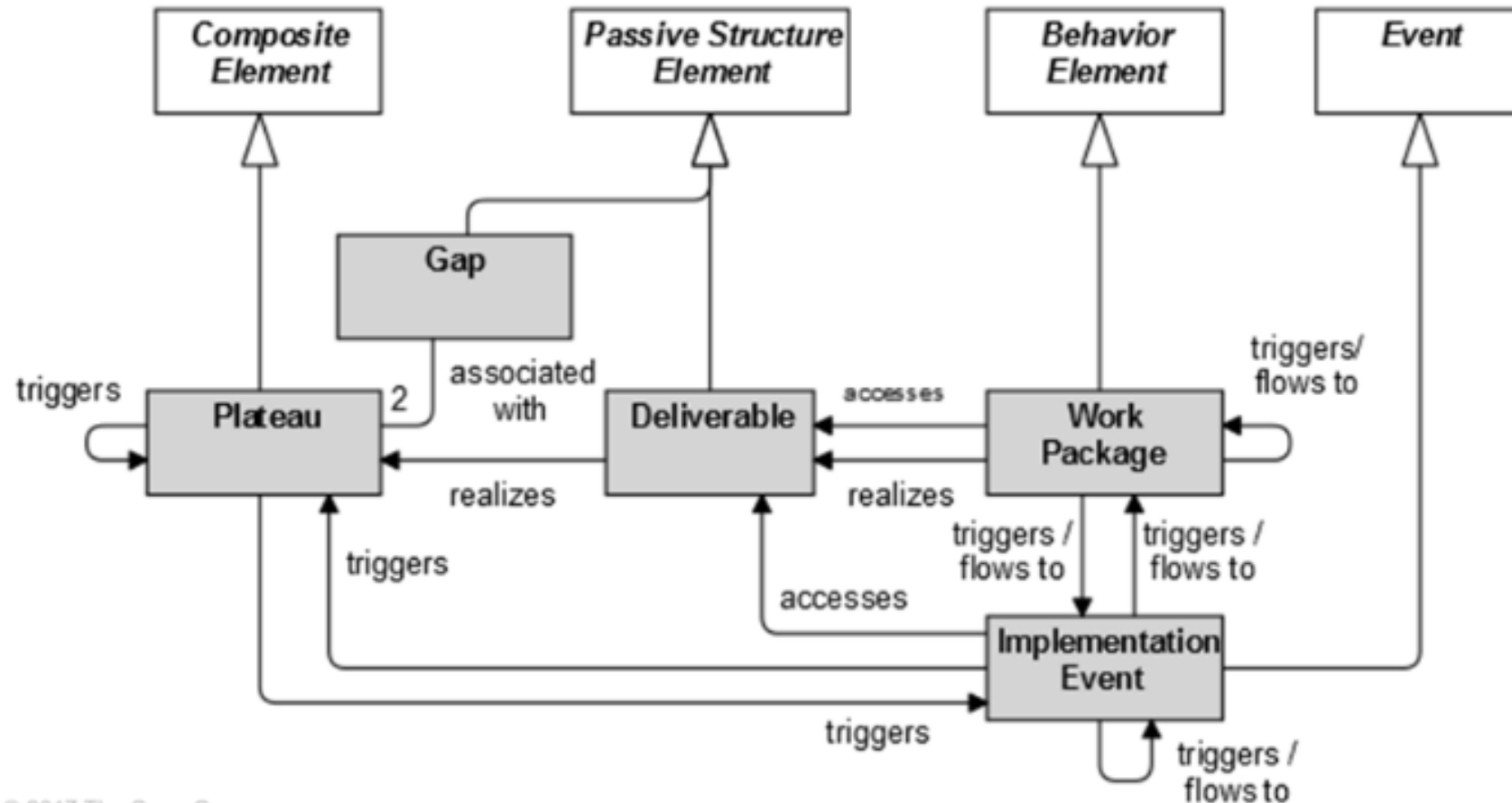


Relationships between Application Layer and Technology Layer Elements

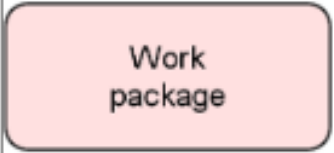









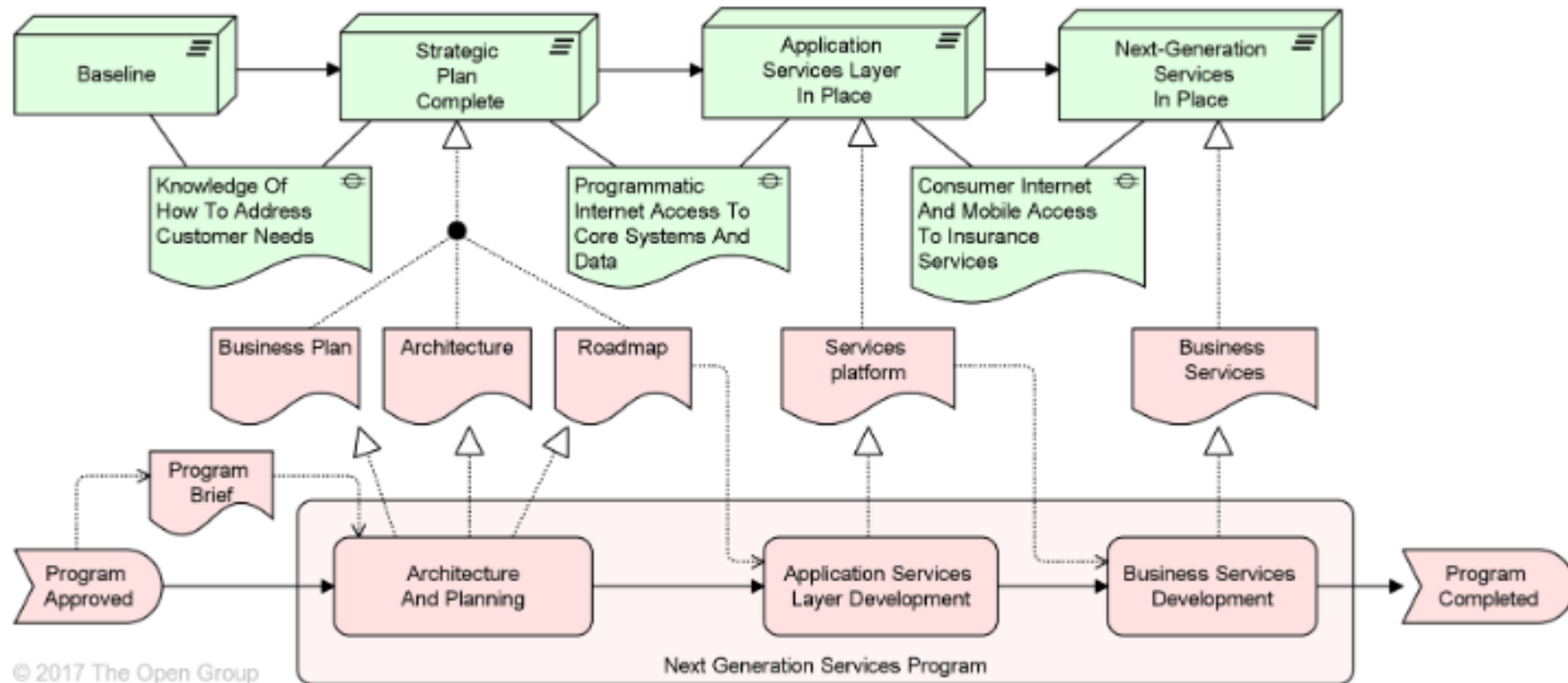
Implementation and Migration Elements Metamodel



Element, Definition, Notation

Work package	A series of actions identified and designed to achieve specific results within specified time and resource constraints.	
Deliverable	A precisely-defined outcome of a work package.	
Implementation event	A behavior element that denotes a state change related to implementation or migration.	 
Plateau	A relatively stable state of the architecture that exists during a limited period of time.	
Gap	A statement of difference between two plateaus.	

Example: Implementation and Migration Elements



Cross-Aspect Dependencies

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