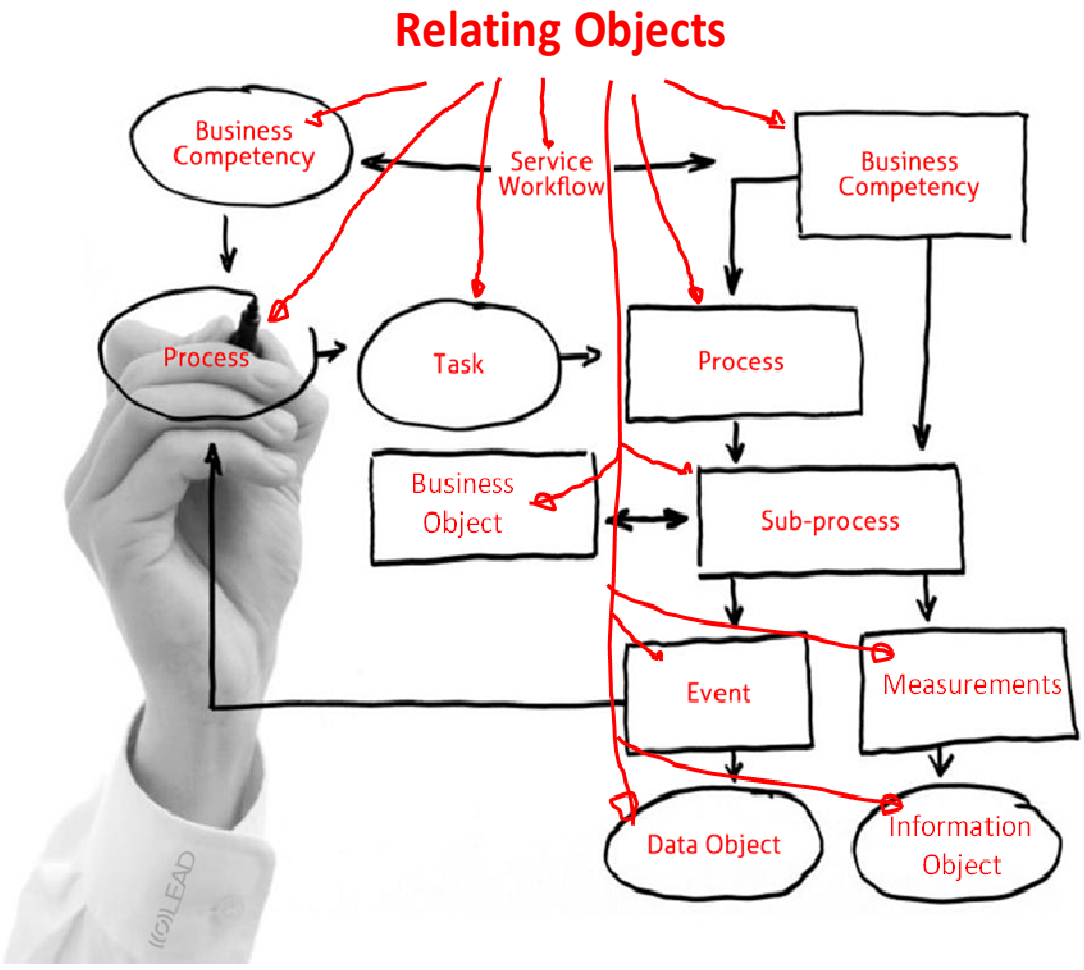
LEADing Practice:

Artifact Description:

Business, Information & Data Object Modelling



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1.1 The Way of Thinking with Objects

In the context of LEAD Meta Modelling principles, an Object can refer to ether a:

1) Business Object - A real-world objects. Examples of such objects include people, employee, products, handheld device or a sales order, customer and revenue. In terms of the way of working with the LEAD Business Objects, they are used to capture the semantics in in for example, business, process or service mapping, and may further be used in describing application implementations where they are used as a semantic layer that shields users from the complexities of information table names and data relationships.

Once the semantic layer has been defined, application users will work in their defined role with familiar real world "business objects" such as product, customer and revenue. Through a request, the user working with the Business Objects pulls information and thereby Information Objects from the system the user is working with.

2) Information Object: These are used to specify information about real-world objects (people, employee, products or a sales order etc.) and therefore it is the digital representation of an existing entity, in an Information System e.g. Oracle ERP, SAP and or IGrafx process modelling. It encompasses both the business information (in the form of functions and methods) and the digital system information (in the form of attributes) of this entity. Information Objects can be found and therefore modelled within business functions, business, service and the process.

Therefore on process and or service models both business and information objects are captured and portrayed. However in the implementation of information systems, the details of the information object types are hidden from the end user, and the information object type itself is accessed through defined functions (Application Programming Interfaces), to achieve business related behaviors or functionalities. Information object are used in business, service, process, application and data workflows to break an information system (e.g., ERP, CRM) down into smaller, disjunctive units. As a result, the system's structure may be fully workflow enabled, improved while its complexity is reduced. Information object types form the point of business object entry to the data objects and the functions of an Information System. At information object type level, non-ERP systems can communicate with an ERP System, and the various ERP business components can communicate with each other.

3) Data Object: A logical cluster of all tables in the data set that have one or more columns containing data related to the same business entity. Whereas from an external perspective , the business object represent the real world objects, when referenced as an implementation component of an application, and an information object reveals only its interface, which consists of a set of clearly defined relations. Applications/systems access the information objects through data objects. To allow users with the business objects, to access the information objects For example, while the name "Data Object" may imply an electronic document, they can be used to represent many different types of objects, both electronic and physical. While data objects could be presented as the specific data aspects e.g. data entities and or data services, these data aspects should rather be related to specific information objects, which represent business objects. In this way, mapping and categorizing data objects, can be achieved faster and easier then attempting to map all columns in a data set.

The work of discovery is more focused and allows the expert or architect to review the discovered mappings in a smaller context, without being overwhelmed by the large number of details otherwise contained in a large mapping that might be required with information objects. If one application table contained business information about employees and orders, this detail would be captured and represented in both data objects. The following diagram illustrates how data objects look in the context of a large application and database schema.

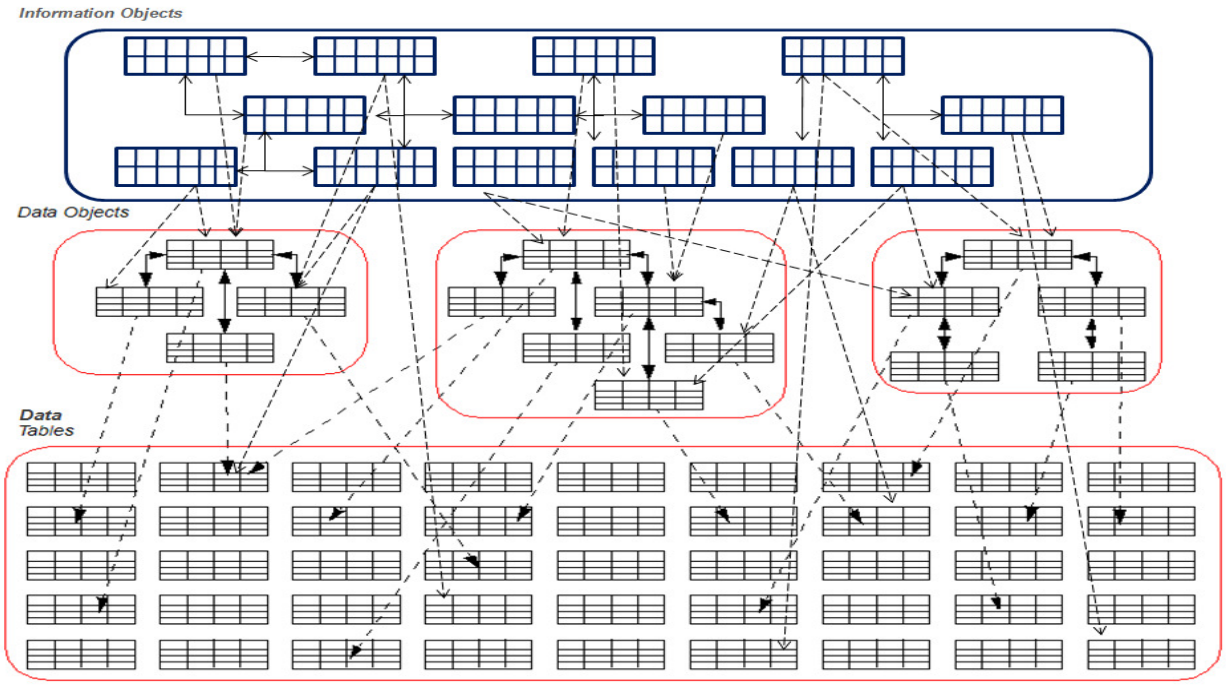


Figure 1. Correlation between Information Objects, Data Objects and Data Tables

1.2 The Way of Working with Objects

Within LEAD, the way of working with objects requires the expert or architect to identify if the item of interest is a business, information and or a data object. Identifying and classifying the different objects e.g. business, information and or data is not always easy, as a process and or service model as well as the execution/realization of them into application software/solution, is quite complex information about the organization, roles, rules, compliance aspects as well as business and information flow. The set of rules and modelling techniques associated with identifying, designing and relating business, information and data object types to fully represents the real object's behavior and representation. Analyzing and understanding this behavior might include 1) analyzing and understanding the business function, roles and its services they deliver, the business process and activities (input and output and the associated flow), information (objects, flow), application (function, task, service and flow) and data (objects, entities, data services and data flow). All information needed in today's process and service models. In figure 2 is an example of such and extended BPMN diagram and the information needed, among others it is organizational information such as roles, business tasks, process steps and activities, services as well as the business, information and data object.

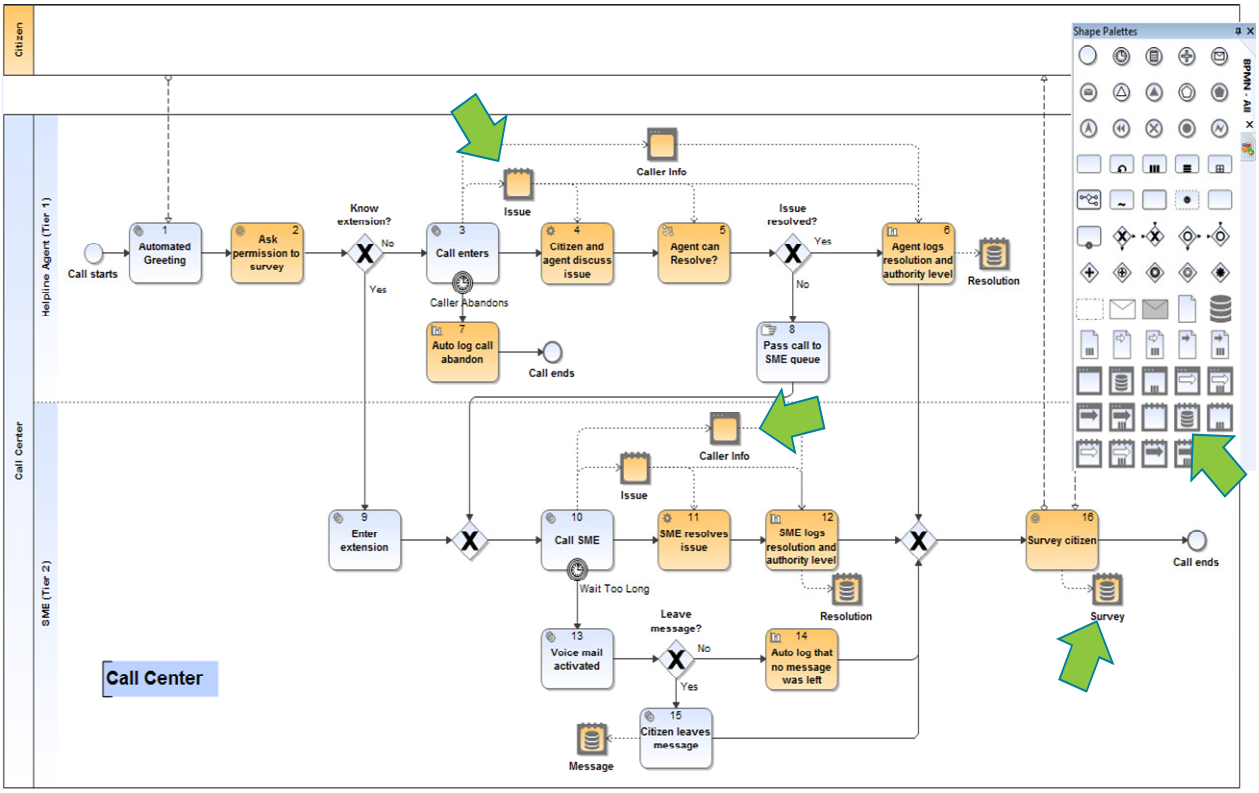


Figure 2. Example of eXtended BPMN with business, information and data object (Used IGrafx 2013 that uses the LEADing Practice X-BPMN modelling principles

The business, information and data object can then as illustrated in figure 3, be sorted by roles, tasks, services or rules. This does not only enable identification of duplication, but enables modelling of the business and the information/systems

Business Object Flow

Label	Passes Flow	
Call Center KB	From	To
	-nil-	Agent can Resolve?
Caller	From	To
	-nil-	Automated Greeting
Caller Issue	From	To
	Call enters	Agent can Resolve?
	Call enters	Agent logs resolution and authority level
	Call enters	Citizen and agent discuss issue
	Call SME	SME logs resolution and authority level
	Call SME	SME resolves issue
Caller Message	From	To
	Citizen leaves message	-nil-
Caller Survey	From	To
	Survey citizen	-nil-
Call Resolution	From	To
	Agent logs resolution and authority level	-nil-
	SME logs resolution and authority level	-nil-

Information Object Flow

Label	Passes Flow	
Call Center KB Search	From	To
	-nil-	Agent Consults KB
Caller Info	From	To
	Call enters	Agent logs resolution and authority level
	Call SME	SME logs resolution and authority level
Caller Issue Info	From	To
	-nil-	Agent Consults KB

Data Object Flow

Label	Passes Flow	
Call Center KB Answer Data	From	To
	Agent Consults KB	-nil-

Figure 3. Example of sorting of business, information and data objects by roles, tasks, services or rules. This does not only enable identification of duplication, but enables modelling of the business and the information/systems (Used IGrafx 2013 that uses the LEADing Practice X-BPMN modelling principles).

Such extended BPMN modelling information is furthermore needed for most application blueprinting and development. In figure 4 is an example of SAP Solution Manager and the information needed, among others it is organizational information, process steps and activities, application and solution information and documentation as well as object specification in terms of business, information and data and tying this to events, transaction, functions, tasks and services.

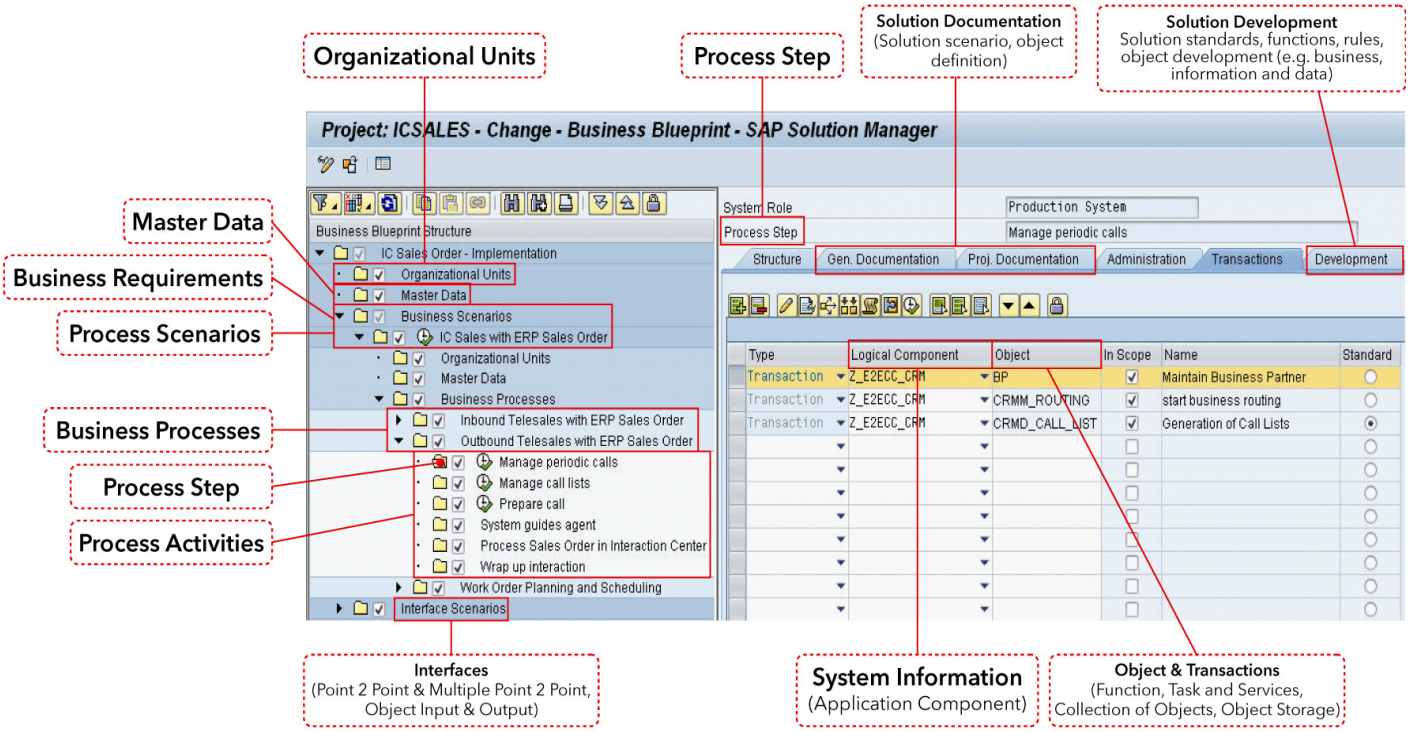


Figure 4. Example of SAP Solution Manager which relates process, objects and application aspects together.

In order to better understand and work with the different objects e.g. business, application and or data the basic LEAD Object associations, correlations and thereby connectivity need to be understood:

- Business competencies create and work with business objects to execute the defined goals
- Business Goals define the reason and purpose of the business object
- Rules are set in place to govern the business, information and data objects
- When business competencies deliver these business services, they have activities (business process), which interact with the business objects as well.
- Business Objects contain Information Objects.
- Applications can automate one or more process's (business process) which interact with the business objects, information object and data object.
- An Application is decomposed in one or more Application Component(s) which host Data Objects
- Data Objects are called upon and used and thereby processed within Information Objects.
- An Application Component is decomposed in one or more Application Module(s), and Application

Function(s), which work through information objects with the business objects

- An Application Function is decomposed in multiple Application Tasks, which create, read, update and delete data and work therefore with data objects.
- The Application task triggers one or more application features, thereby application features work with information objects.
- Application tasks work through the application functions with the information objects and thereby the real world business objects.
- Application users, have roles that use the application functionality that call upon information objects
- In the application the information Objects called upon by the users are processed Data Objects
- All objects use both media and channels

As we can see from the above mentioned LEAD Object associations and correlations, do the different objects e.g. business, information and or data have multiple interaction points. In order to identify and capture all of the objects and their relation correctly is the LEAD way of working with Objects a decomposition of objects into the area they are connected with e.g. competency, process, role, flow, application, media, channel etc. This decomposition and composition principle is applied both for business, information and data objects:

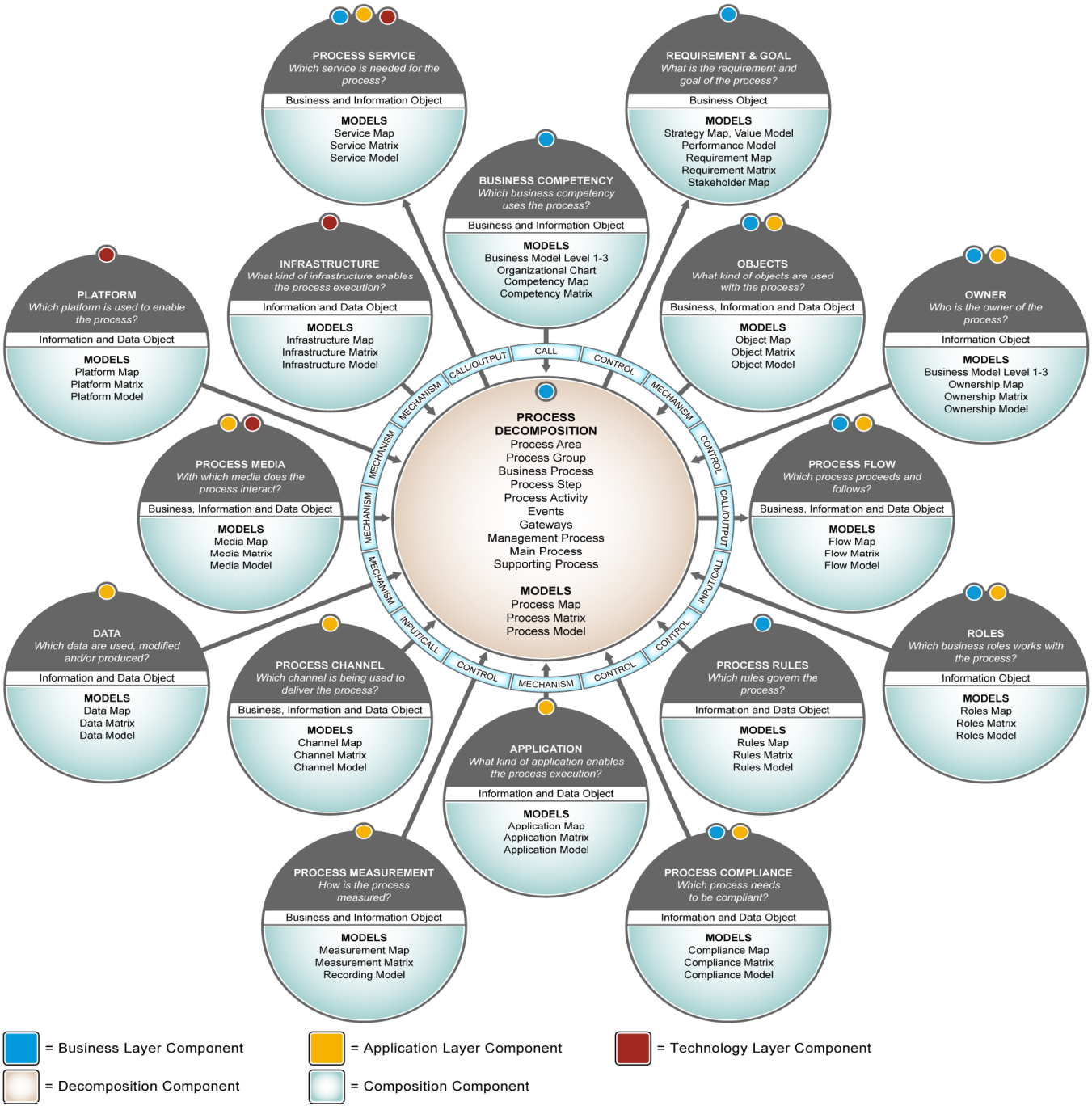


Figure 5) Example of LEAD decomposition and composition with Object associations in all the different process aspects

1.3 The Way of Modelling with Objects

In terms of the way of modelling a business, information and data objects are each considered an artifact and not a flow object (even though it can be in a flow). They are considered an artifact because they do not have any direct effect on the Sequence Flow or Message Flow of the business function, service or process, but they do provide and order and in this way a sequence about what they do. That is, how documents, data, and other objects are used and updated during the progression. In order to identify and collect the needed information the LEAD eXperts and LEAD Enterprise Architects will first use the LEAD Object Model in order to identify and map which business, information and or data objects the organization works. Once the objects have been identified they need to be organized into a matrix and related to their respective business competencies, to relevant business function and to the correct organizational level e.g. strategic, tactical and or operational. An example of this matrix is provided in figure 6.

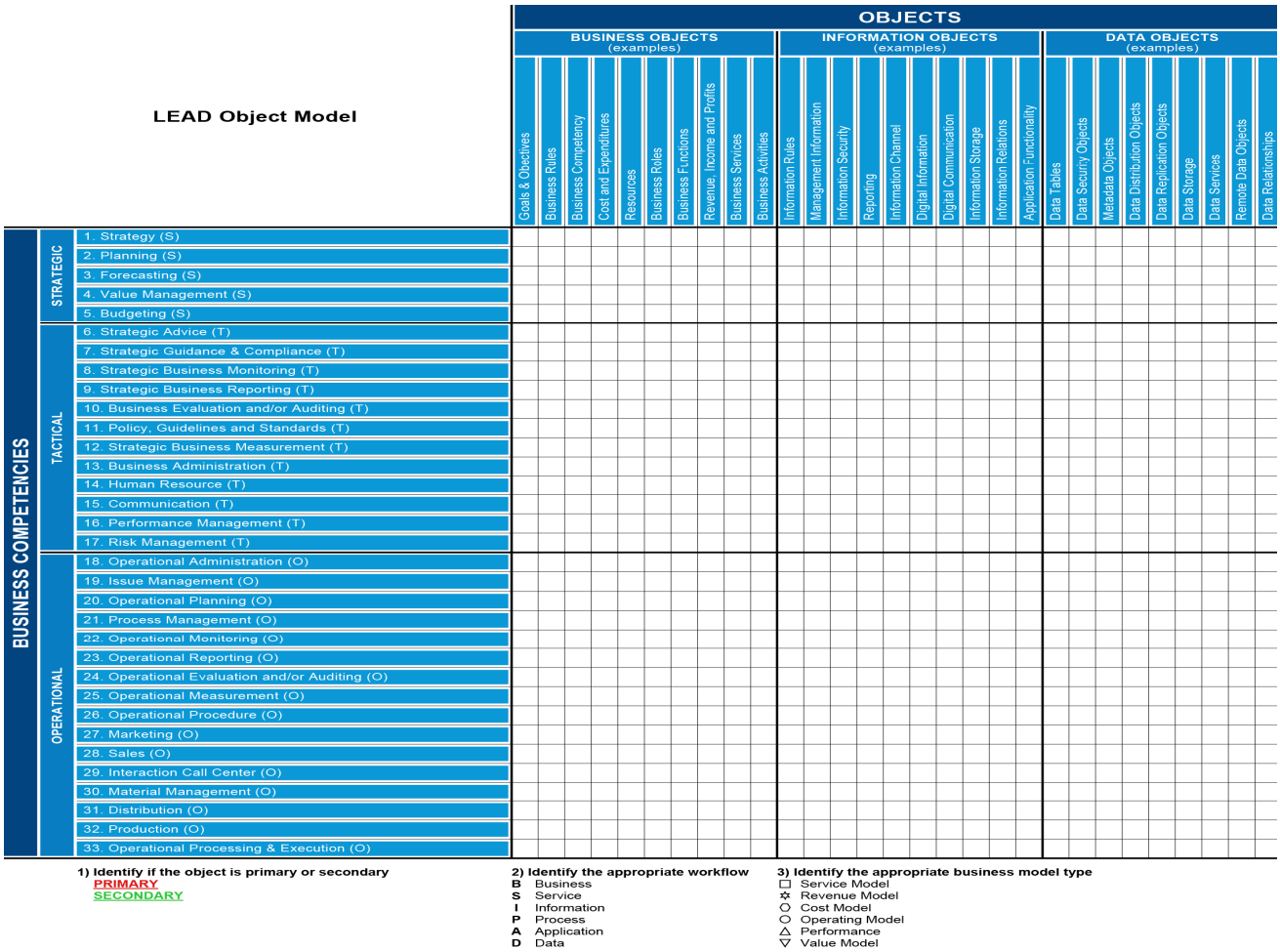


Figure 6) The LEAD Object Model

The steps to develop such an Object Model include

1. Identify at the different levels, which workflow, the objects interact with. As mentioned before is nether the business, information or the data object a flow object, even though it can be in a flow, it is an artifact. They are considered an artifact because they do not have any direct effect on the Sequence Flow or Message Flow of the business function, service or process, but they do provide and order and in this way a sequence about what they do. That is, how documents, data, and other objects are used and updated during the progression. As workflow consists of a sequence of concatenated (connected) steps, objects can be in multiple sequence of connected steps, such as business, information, service, process, application and or data. The most known and modelled today is business workflow, process flow and application flow, however in enterprise architecture the identification and modelling of information, service and data flow is a part of putting context and structure to the entire workflows.

   Despite which workflow it is e.g. business, information, service, process, application and or data, emphasis is on the flow paradigm, where each step follows the precedent without delay or gap and ends just before the subsequent step may begin. This concept is related to non overlapping tasks of single resources. It is a depiction of a sequence of operations, declared as work of a person, a group of persons, an organization of staff, or one or more simple or complex mechanisms like human-to-machine interaction. Workflow may be seen as any abstraction of real work. For control purposes, workflow may be a view on real work under a chosen aspect, thus serving as a virtual representation of actual work. The flow being described may refer to a document or product that is being transferred from one step to another in terms of physical, information and/or data. Therefore workflow concepts are closely related to other concepts used to describe organizational structure, such as silos, functions, teams, projects, policies and hierarchies modelled in BPMN and/or EA. Workflows may be viewed as one primitive building block of organizations. The relationships among these concepts and the different objects they interact with are cross workflows.

   A workflow with the tasks, events, gateways, resources and objects in terms of business, information and/or data it interacts with, can usually be described using formal or informal flow diagramming techniques, showing directed flows between processing steps. Single processing steps or components of a workflow can basically be defined by three basic parameters:

   - input description: the information (information and data objects), material (business object) and energy required to complete the step

- transformation rules, algorithms, which may be carried out by associated human roles, objects or machines, or a combination of all three
- output description: the information (information and data objects), material (business object) and energy produced by the step and provided as input to downstream steps.

Workflow components can only be plugged together if the output of one previous (set of) component(s) is equal to the mandatory input requirements of the following component. Thus, the essential description of a component actually comprises only in- and output that are described fully in terms of information or data types and their meaning (semantics). The algorithms' or individual or flow rules' description need only be included when there are several alternative ways to transform one type of input into one type of output – possibly with different accuracy, speed, etc. When the workflow components are non-local services that are invoked remotely via a computer network, such as Web services calling upon or delivering objects, additional descriptors (such as QoS and availability) also must be considered.

2. Identify if the object in the competency is a primary or secondary.
   Primary objects are those that are being used or created in ether the core differentiating competencies or core competitive competencies.
   Secondary objects are the objects that are being used or created in the supporting competencies, non revenue generating and or no value generating competencies.

   There is a link between the categorization of primary or secondary objects and the automation in terms of technology. From a technology standpoint, activities typically require people (resources) and capabilities to work with business objects in discern patterns and trends from rich, multidimensional information, usually stored in a data warehouse. Systems at the strategic level are not designed for speed of data entry, but rather for ease, breadth, and depth of analysis. Real-time interfaces are not needed, because data is often months old and processed in batches. To drive as much revenue, value creation, and realization as possible from business model competency development, only core competitive and core differentiated competencies across the firm are aggregated. It is an organization's primary and thereby core critical competencies (CCC) that enable an organization to outperform its rivals. These competencies and the interaction of business objects and information objects should, when automated and supported with an IT system, be treated as own practice. Far too

often such competencies and the business and information objects are automated with the IT Vendors Best Practices, and therefore their uniqueness and differentiation is most likely being destroyed. Whereas the IT vendor Best Practices are vital to cut costs, for example, fast implementation, fewer mistakes, standardization, and less risk, because it is proven to work, this can't be applied in the area of primary competencies that enable core competitive and core differentiated competencies. However, even if a firm offers the right customer value to the right market segments and does so better than its rivals, it is still possible that the firm might not be profitable. That is, superior relative customer value offered to the right customer segments, although necessary, is not always a sufficient condition for profitability. Therefore, the cost of making money is a vital ingredient for succeeding. Offering the right value to the right customer segments and being positioned advantageously vis-à-vis suppliers, customers, rivals, potential new entrants, and substitute products may still not be enough for a firm to capture the revenues that its positions suggest it should. To keep the cost low a company should standardize its secondary also called non-core competencies (NNCs) and thereby apply Best Practices to all NNCs and the attached main and supporting processes.

3. Once the primary and secondary competencies as well as the workflow that the objects interact with is identified, the next step in the Object Modelling include allocating it to the right Business Model Domain. Since "business model describes the logic of a business system for creating value that lies behind the actual processes" (Petrovic 2001) and today, the understanding that "Business Model" is interlinked with strategy, as a base approach for competitive advantage and differentiation[1], it is vital to identify the specific business model domains and the objects it interacts with. As both in theory and practice, the success of organizations like Amazon, eBay, Dell, Google, IBM, Wal Mart, Skype and Apple Inc is attributed, not only to their industry or to their firm-specific competencies, but also to their business models and their unique ability to successfully adapt it to the changes in the business environment, linking business model domains to the right objects e.g. business, information and data would give the possibility to model the organization in new ways. And among executives, "transformation and innovation in products, services, and business models" is the single factor contributing the most to the accelerating pace of change in the global business environment, outranking other factors related to information and the Internet, talent, trade barriers, greater access to

[1] The Execution Premium: Linking Strategy to Operations for Competitive Advantage by Robert S. Kaplan and David P. Norton, Harvard Business School Press, 2004

cheaper labor and capital.[2] While it becomes clear that business model matters and that most executives understand this and have it on their agenda. Historically business model has evolved to be considered as a single phenomena with certain components like customer relationships, customer segmentations, value proposition, key partners, key resources, key activities, revenue stream and cost structure. This however, only captures parts of what a company does and partly how they do it, but it does not really consider the full dimensions of what a business model should consider.
Business Models are not one single phenomenon, but rather an occurrence of multiple disciplines that play together. A business model consists of six business model domains, namely: service model, revenue model, cost model, operating model, value model and performance model. organizations take advantage of emerging opportunities in a changing economic environment in different ways:

- Many organizations revisit their business model during a downturn to improve their **performance model** through new collaboration and partnership initiatives while reconfiguring the **operating model**.
- Industry leaders with strong financial resources take advantage of the unprecedented service transformation by introducing alternative **value models** and disrupting their competitors with new **service models**.
- Many also rethink their **revenue model** and **cost model** to respond to a different set of customer behaviors and market requirements.

Therefore once the primary and secondary competencies as well as the workflow that the objects interact with is identified, the next step in the Object Modelling include allocating it to the right Business Model Domain. This is done through linking business model domains to the right objects e.g. business, information and data. This gives the modeler new strategic possibilities to map the organization in a new ways.

[2] A Historic View of Business Models, von Rosing - The Open Roundtable, 2002

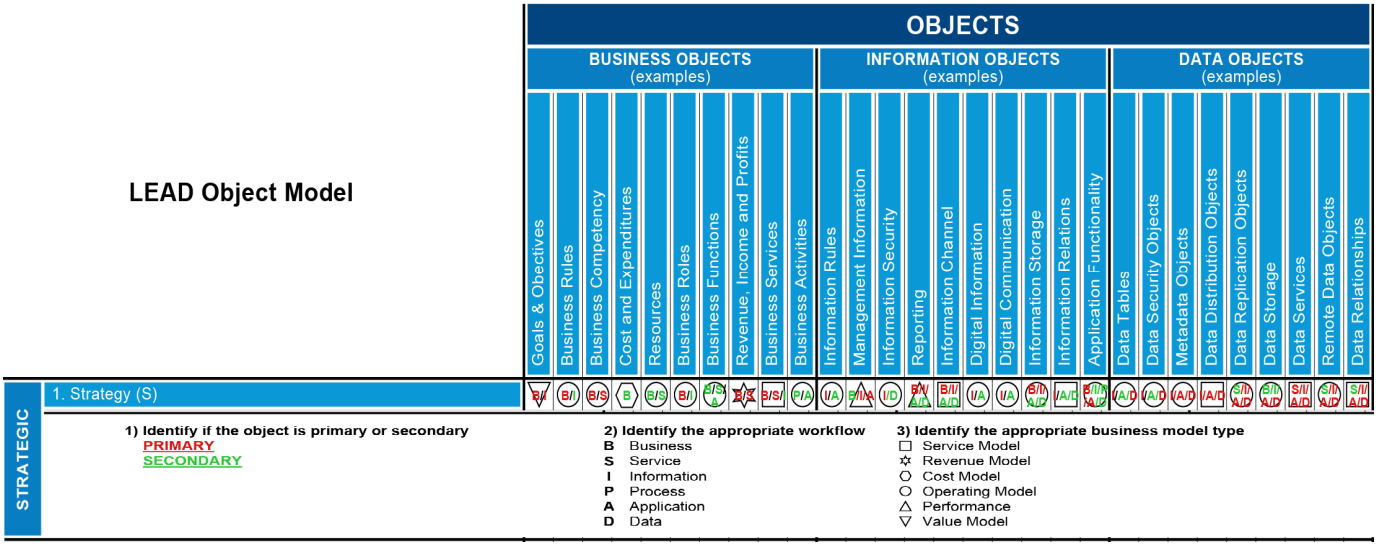


Figure 7) Example of how to fill out the LEAD Object Model

Objects within Business Process Modelling Notations (BPMN)

Business Process Modelling Notations also called Business Process Model and Notation (BPMN) is a graphical representation for specifying business processes in a business process model. Business Process Model and Notation (BPMN) is a standard for business process modelling that provides a graphical notation for specifying business processes in a Business Process Diagram (BPD), based on a flowcharting technique very similar to activity diagrams from Unified Modeling Language (UML). The objective of BPMN is to support business process management, for both technical users and business users, by providing a notation that is intuitive to business users, yet able to represent complex process semantics. It is however vital to consider that BPMN 2.0 is partly constrained to support only the concepts of modelling applicable to business processes. Other types of modelling done by organizations for non-process purposes are out of scope for BPMN. Examples of modelling excluded from BPMN are:

- Business Models and with that Organizational structures, functional breakdowns
- Value Model (not value mapping that is something different)
- Enterprise Architecture Models
  - Service Model and Service Architecture
  - Reporting Model and Measurements
  - Rules Model
  - Information Model
  - Data Model

However when connecting the LEAD Framework and its modelling approach with BPMN 2.0 all of the above mentioned restrictions are possible in what we call the BPMN eXtended[3].

Notification	Mapping	Reporting	Manual Service	Automated Service	Decision Table
					
Rule Flow	**Rule Script**	**Rule**	**Ruleset**	**Flow Ruleset**	
					

Figure 8) New Task Types in BPMN eXtended

Business Object	Business Store	Business Object Collection	Business Input	Business Input Collection	Business Output	Business Output Collection
						

Figure 9) New Business Object Types in BPMN eXtended

Information Object	Information Store	Information Object Collection	Information Input	Information Input Collection	Information Output	Information Output Collection
						

Figure 10) New Information Object Types in BPMN eXtended

Below will be a description how to work with what we call the BPMN eXtended version in terms of business objects, information objects and data objects.

Defining, mapping and model the business, information and data object mostly includes analyzing and understanding: business function/tasks, resources/roles, business process and activities (activity input and output, flow), Information (object, flow), Application (task, service, flow) and Data (object, entity,

[3] See LEAD Artifact Description: LEAD BPMN eXtended

service, flow). In order to identify and capture all of the objects and their relation correctly do we have specific views for where there is a collection of objects, a object input, a object output and where there is a object store/storage. This categorization principle is applied both for business, information and data objects:

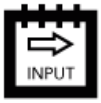
Basic graphical view of Business Objects

Below we see a graphical view of Business Objects used in business modelling, process mapping or service mapping as well as in application and architectural mapping e.g. business architecture, application architecture and solution architecture:

- **Business Object -** Represents real-world objects like people, employee, products or a sales order, customer and revenue.
- **Collection of Business Objects -** Represents a collection of real-world objects, e.g. a employee roles.
- **Business Input -** Is an external input for the real-world objects. A kind of input parameter.
- **Business Output -** Is the real-world result of the entire process and or service flow. A kind of output parameter.
- **Business Store -** Is a place where the real-world objects is stored.

Business ObjectCollection of Business Objects

Business Store Business Input Business Output



Basic graphical view of Information Objects

Below we see a graphical view of Information Objects used in business modelling, process mapping, service mapping as well as in application and architectural mapping e.g. business architecture, information architecture, application architecture and solution architecture:

- **Information Object -** Represents a container of information within the flow of the process and or service, such as business documents, e-mails, or letters.
- **Collection of Information Objects -** Represents a collection of information, e.g. a list of order items.

- **Information Input -** Is an external information input for the entire process. A kind of input parameter.
- **Information Output -** Is the information output/result of the entire process. A kind of output parameter.
- **Information Store -** Is a place where the information can be read or written, e.g. knowledge management or a filing cabinet. It persists beyond the lifetime of the process instance.

Information Object Collection of Information Objects


Information Store Information Input Information Output


Basic graphical view of Data Objects

Below we see a graphical view of Data Objects used in process mapping, service mapping as well as in application and architectural mapping e.g. information architecture, application architecture, solution architecture and data architecture:

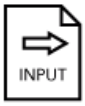
- **Data Object -** Represents a container/logical cluster of all tables in the data set that have one or more columns containing data related to the same data entity, such as business documents, e-mails, or letters.
- **Collection of Data Objects -** Represents a collection of data tables/columns containing data related to the same data entity, e.g. a list of order items.
- **Data Input -** Is an external data input for the entire process. A kind of input parameter.
- **Data Output -** Is the data result of the entire process. A kind of output parameter.
- **Data Store -** Is a place where the process can read or write data, e.g. a database or a filing cabinet. It persists beyond the lifetime of the process instance.

Data Object Collection of Data Objects

Data Store

Data Input

Data Output



The primary goal of capturing all objects in terms of both business, information and data into BPMN is to provide a standard notation readily understandable by all stakeholders, both within business, as well as them working with information and data. These obviously should include the LEAD Process eXpert and the business analysts who create and refine the processes, the technical developers responsible for implementing them, and the business managers who monitor and manage them. With fully mapping all objects, consequently, BPMN eXtended serves as a common language, bridging the communication gap that frequently occurs between business, process design and technology implementation.

Objects within Layered Enterprise Architecture Development (LEAD)

Layered Architecture is build on the concept that the different layers have a high degree of coupling and thereby enterprise architecture domains e.g. business architecture, process architecture etc are in revertible interlinked and coupled together and should not be modelled separately. As the domains have a high degree of coupling, the LEAD eXpert or LEAD Enterprise Architect should in many cases not work within one domain and thereby layer, but inside and throughout the different layers. Unfortunately, people applying domain architecture modelling principles can often run into a scenario where they introduce an unnecessary amount of coupling between the different layers of their domains (e.g. business, application, data, platform and/or infrastructure). Such a domain approach can therefore lead to a high degree of complexity, which is one of the factors that can lead to complex and fragile architectures that are difficult to change or extend.

The main principle behind layered enterprise architecture is that of "integrating and thereby interlinking the different modelling principles". Each layer has different models and modelling principles appropriate for handling an artifact like for example objects, e.g.:
The three main modelling properties characterizing and modelling an object:

1) Identity: describe the property of the object and possibly what distinguishes it from other objects

2) State: describe the data/information stored in the business object

3) Relationship: describes the way and means in which the object's has relationships to other object e.g. collection of objects

4) Behavior: describes the and possible interfaces to other objects (input and outputs) throughout the layers (e.g. business, application, data, platform and/or infrastructure). For the way of modelling with business, information as well as data objects within the layers it is vital to consider it in the whole connection of tasks, activities, events and gateways throughout all the layers of Layered Architecture (business, application, data and technology). :

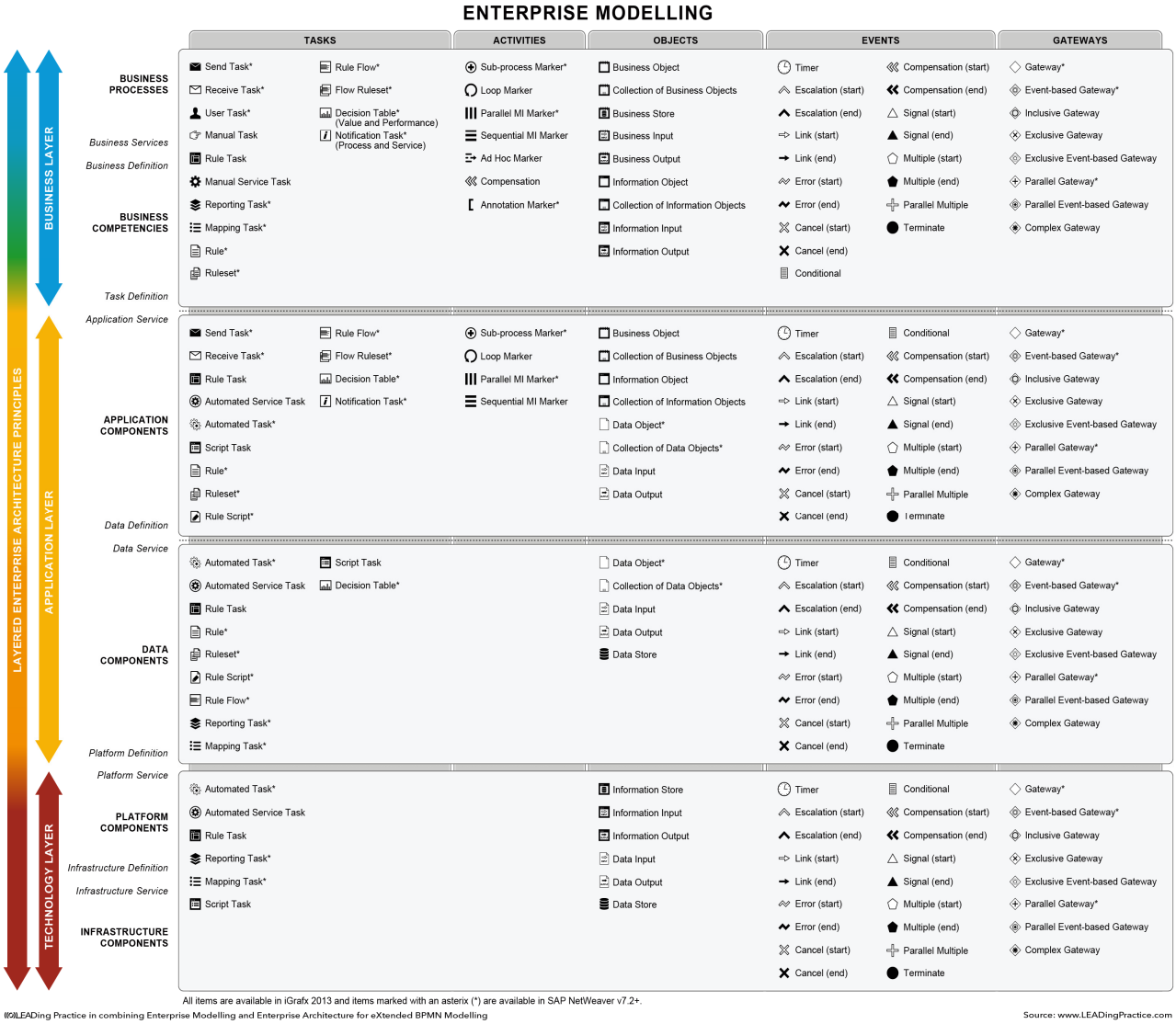


Figure 11) How to use BPMN eXtended in Layered Architecture

Each objects function within the layer's is defined by its protocol called "nth layer protocol" (1st layer, 2nd layer, etc.). The objects purpose and thereby function that a layer provides to another layers object, can be seen as the layer's services since a layer provides a set of object output and thereby services to its upper layer. In turn, the upper layer uses the lower layer's services (object) to achieve its own functions (services). A higher layer can therefore be seen as a service user since it uses the objects provided by its lower layer. A lower layer with its objects that has relationships and correlations with the upper layer, can therefore in the layered architecture approach be seen as a service provider. Using BPMN eXtended modelling principles to model not only ones processes, but to model ones enterprise architecture enables an organization to structure, integrate, standardize and relate aspects which are vital for performance (e.g. efficiency and effectiveness) cost cutting, value creation and service improvement.