The BPM ontology

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INTRODUCTION

Many business process management (BPM) and/or process frameworks, methods, or approaches (e.g., Lean, Six Sigma, Business Process Reengineering (BPR), Total Quality Management (TQM), Zero Defect, Business Process Modeling Notation (BPMN), Business Process Execution Language (BPEL) have their own vocabulary. Each of these vocabularies has its own definition of terms, such as business process, process step, process activity, events, process role, process owner, process measure, and process rule. This chapter introduces a BPM ontology that can be applied within the area of process modeling, process engineering, and process architecture. It provides fundamental process concepts that can be used to document corporate knowledge and structure process knowledge by defining relation process concepts (e.g., the order of process steps). The BPM ontology is presented as a shared vocabulary (i.e., folksonomy) that structures knowledge in two ways. First, it allows practitioners to structure their business knowledge by adding meaningful relationships between the vocabulary terms. Second, it organizes concepts in hierarchic "is-a" relationships that allow a polymorphic inheritance of properties.

The BPM ontology presented in this chapter should help to remedy the inconsistent use of these terms by providing benchmark terms and definitions and mapping those terms and definitions to the terms in the vocabularies of other existing frameworks. As these mappings demonstrate the shared use of terms in the BPM ontology and several business standards and reference frameworks, we could argue that the BPM ontology documents (i.e., externalizes) a tacit business folksonomy that was mainly shared through socialization before.[1] Part of the BPM ontology presented here is an explicit business folksonomy that is supported by a wide community of practitioners and academics.[2]

This explicit business folksonomy is presented in the next section of this chapter. The BPM Ontology as a Thesaurus: Structuring Process Knowledge by Defining Relations then presents the BPM ontology as a thesaurus, focusing on the meaningful relationships that exist between the concepts of this business folksonomy. The BPM Ontology as a Frame: The Ontological Structure of the LEADing Practice Process Meta Model demonstrates how this thesaurus can be formalized as a frame, using conceptual graphs (CGs). The BPM ontology is discussed in Discussion of the BPM Ontology, and its advantages are summarized in the final section.

THE BPM ONTOLOGY AS A FOLKSONOMY: SHARING FUNDAMENTAL PROCESS CONCEPTS

All ontologies have a controlled vocabulary as a foundation. Because the BPM ontology is an extensive ontology that has the ambition to cover all aspects of

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business (as opposed to academic ontologies), its terms are organized in a top-level domain and multiple intersecting subdomains. The top-level ontology is kept relatively simple, consisting of four main terms: object, meta-object, object group, and object meta-model. *Objects* refer to something that is within the grasp of the senses and that which a subject relates to. They represent a piece of reality in a model or a document. *Meta-objects* create, describe, or equip objects. A meta-object defines an object's type, relation attributes, functions, control structures, etc. *Object groups* serve to group objects with a common purpose, goal, aim, target, objective, and sets. In the BPM ontology, object groups collect meta-objects related to a subdomain. *Object meta-models* are precise definitions of meta-objects, the semantics[3] of the relationships they are involved in, and the rules that apply to them.[4]

BPM ontology terms are assembled into two groups: composition and decomposition (meta-objects). The decomposition meta-objects are presented in Table 7.1 and allow modelers to structure processes. Categorizations assemble

Table 7.1 ***Decomposed Process Meta-Objects***

Process Object	Description
Process area (categorization)	The highest level of an abstract categorization of processes.
Process group (categorization)	A categorization and collection of processes into common groups.
Business process	A set of structured activities or tasks with logical behaviors that produce a specific service or product.
Process step	A conceptual set of behaviors bound by the scope of a process that, each time it is executed, leads to a single change of inputs (form or state) into a single specified output. Each process step is a unit of work normally performed within the constraints of a set of rules by one or more actors in a role, which are engaged in changing the state of one or more resources or enterprise objects to create a single desired output.
Process activity	A part of the actual physical work system that specifies how to complete the change in the form or state of an input, oversee, or even achieve the completion of an interaction with others actors and which results in the making of a complex decision based on knowledge, judgment, experience, and instinct.
Event	A state change that recognizes the triggering or termination of processing.
Gateway	Determines the forking and merging of paths, depending on the conditions expressed.
Process rule	A statement that defines or constrains some aspect of work and always resolves to either true or false.
Process measurement (process performance indicator)	The basis by which the enterprise evaluates or estimates the nature, quality, ability, and extent as to whether a process or activity is performing as desired.

Table 7.1 ***Decomposed Process Meta-Objects—cont'd***

Process Object	Description
Process owner	A role performed by an actor with the fitting rights, competencies, and capabilities to take decisions to ensure work is performed.
Process flow (including input/output)	A stream, sequence, course, succession, series, or progression, all based on the process input/output states, where each process input/output defines the process flow that together executes a behavior.
Process role	A specific and prescribed set of expected behavior and rights (authority to act) that is meant to enable its holder to successfully carry out his or her responsibilities in the performance of work. Each role represents a set of allowable actions within the organization in terms of the rights that are required for the enterprise to operate.

heterogeneous groups, whereas classifications assemble objects into order (e.g., through the use of strict part-whole or sequencing semantics). For example, a process area can cluster otherwise independent processes; process steps need to follow each other.

The decomposed process meta-objects listed in Table 7.1 can be used in process architecture and process engineering, as they allow for process decomposition. These fundamental concepts can be combined with auxiliary concepts to produce the semantic richness needed by practitioners. These auxiliary concepts are called process composition meta-objects and represent various process aspects such as strategy, goals, critical success factors, performance indicators, reporting, services, applications, and/or data. Together, process composition and decomposition meta-objects provide a structuring mechanism that facilitates the developments of corporate ontologies (e.g., combining the decomposition meta-object process step with the decomposition meta-object risk invites practitioners to think about the risks of each process step they identify). The composition meta-objects, which are shown in Table 7.2, intersect with several subdomains of business (e.g., process, strategy). Consequently, they can be reused for the elicitation of risks, costs, and other aspects of business in several subdomains of business next to processes.

In addition to the decomposed process meta-objects, other meta-objects relate to the concept of process modeling. The related meta-objects are called composed process meta-objects and are considered an essential part for any practitioner working with and around innovation and transformation across various relevant subjects (vs siloed process modeling, engineering and architecture view). The additional related meta-objects fundamental to the various process concepts shown in Table 7.2.

Table 7.2 ***Process Composition Meta-Objects***

Composed Process Meta-Object Descriptions	
Goal (e.g., business, application, technology)	A desired result considered a part of the organizational direction, aims, targets, and aspirations.
Objective (critical success factor)	Time-bounded milestones to measure and gauge the progress towards a strategy or goal.
Value indicator (critical success factor)	Any of a series of metrics used by an enterprise, to indicate its overall ability to achieve its mission.
Performance indicator	Any of a series of metrics used by an enterprise, to indicate its overall success or the success of a particular area in which it is engaged.
Performance expectation	The manner in which, or the efficiency with which, something reacts or fulfills its intended purpose as anticipated by a specific stakeholder.
Performance driver	Those variables that are critical to develop the means and overall performance of an enterprise.
Quality	A state of excellence or worth, specifying the essential and distinguishing individual nature and the attributes based on the intended use.
Risk	The combined impact of any condition or events, including those cause by uncertainty, change, hazards, or other factors that can affect the potential for achieving these objectives.
Security	The objects or tools that secure, make safe, and protect through measures that prevent exposure to danger or risk.
Business measure	Any type of measurement used to gauge some quantifiable component of an enterprise's performance.
Report	The exposure, description, and portrayal of information, about the status, direction, or execution of work within the functions, services, processes, and resources of the enterprise.
Timing	A plan, schedule, or arrangement when something should happen or be done or to take place.
Business area	The highest level meaningful grouping of the activities of the enterprise.
Business group	An aggregation within an enterprise, which is within an enterprise area.
Business competency	An integrated and holistic set of related knowledge, skills, and abilities, related to a specific set of resources (including persons and organizations) that combined enable the enterprise to act in a particular situation.
Business resource/actor	A specific person, system, or organization that initiates or interacts with the defined functions and activities. Actors may be internal or external to an organization.
Business role	A part that someone or something has in a particular defined function, activity, or situation. A resource/actor may have a number of roles.
Business function	A cluster of tasks creating a specific class of jobs.

Table 7.2 *Process Composition Meta-Objects—cont'd*

Composed Process Meta-Object Descriptions	
Business owner	A role performed by an actor with the rights, rules, competencies, and capabilities to take decisions for the part of enterprise for which stewardship responsibilities have been assigned.
Cost	An amount that has to be paid or given up to obtain the use or access to something.
Revenue	The realized income of an enterprise or part thereof.
Object (business and information)	A real-world thing of use by or which exists within the enterprise and information objects reveal only their interface, which consists of a set of clearly defined relations. In the context of the business competency, the relevant objects are only those which relate to the enterprise's means to act.
Product	A result and output generated by the enterprise. It has a combination of tangible and intangible attributes (features, functions, usage).
Contract	An agreement between two or more parties that establishes conditions for interaction.
Business rule	A statement that defines or constrains some aspect of behavior within the enterprise and always resolves to either true or false.
Business compliance	The process or tools for verifying adherence to rules and decisions.
Location	A facility, place, or geographic position.
Business channel	A means of access or otherwise interacting within an enterprise or between an enterprise and its external partners (customers, vendors, suppliers, etc.).
Business workflow	A stream, sequence, course, succession, series, and progression as well as order for the movement of information or material from one enterprise function, enterprise service, or enterprise activity (worksite) to another.
Business service	The externally visible ("logical") deed or effort performed to satisfy a need or to fulfill a demand, meaningful to the environment.
Service flow (including output/input)	A set of one or more service input output states, where each service state defines a step in the service flow that, when entered, executes a behavior.
Service measurement (Service Performance Indicator (SPI) and Service Level Agreement (SLA))	The basis by which the enterprise evaluates or estimates the nature, quality, ability, or extent of the services. The commitments of a business service are assessed.
Logical application component	An encapsulation of application functionality that is independent of a particular implementation.
Physical application component	A deployable part of a software product, providing identifiable functions and existing within a specific version of the product.
Application function	The specification of a significant aspect of the internal behavior of the application, which acts as a broader description of a set of application features.
Application task	The automated behavior of a process activity performed by an application.

Continued

Table 7.2 ***Process Composition Meta-Objects—cont'd***

Composed Process Meta-Object Descriptions	
Application service	An externally visible unit of functionality, provided by one or more components, exposed through well-defined interfaces, and meaningful to the environment.
Application/system flow	The specification of the sequence in which two application tasks processes (or an application task and an application event or gateway) are executed, one of which provides an output, which is an input to the other.
System measurement	Measures that are defined and implementable within an application.
Application/system report	Reports that are defined and implementable or implemented within or by an application.
Application roles	A role performed by an actor with the rights, competencies, and capabilities to take decisions about an application, its behavior, and properties.
Application rule	A business rule implemented within and able to be executed by an application.
Data object	A logical cluster of all sets of related data representing an object view of a business object.
Data table	A physical specification of the means of arranging data in rows and columns while being stored in physically persistence structures.
Data flow	The specification of the sequence in which data moves from one state to another.
Data owner	A role performed by an actor with the rights, competencies, and capabilities to take decisions about the aspects of data for which stewardship responsibilities have been assigned.
Data rule	Criteria used in the process of determining or verifying values of data or generalizing certain features of data.
Platform device	A set of platform components configured to act as a modular part of a platform.

THE BPM ONTOLOGY AS A THESAURUS: STRUCTURING PROCESS KNOWLEDGE BY DEFINING RELATIONS

The process objects that have been defined through a search for process composition and decomposition meta-object instances in an organization require additional structure.

Structuring the process knowledge includes identifying the existing classes and groups of process objects and the relations between them and the characteristics that unite or differentiate them. The following criteria facilitate grouping:

- *Identity*: allows users to distinguish an object from any other object and distinguishes objects from meta-objects, which have no identity.
- *State*: is the aggregate of an object's properties, including its relations with other object, meta-objects, classes, etc.
- *Behavior*: distinguishes between legal and illegal state changes.

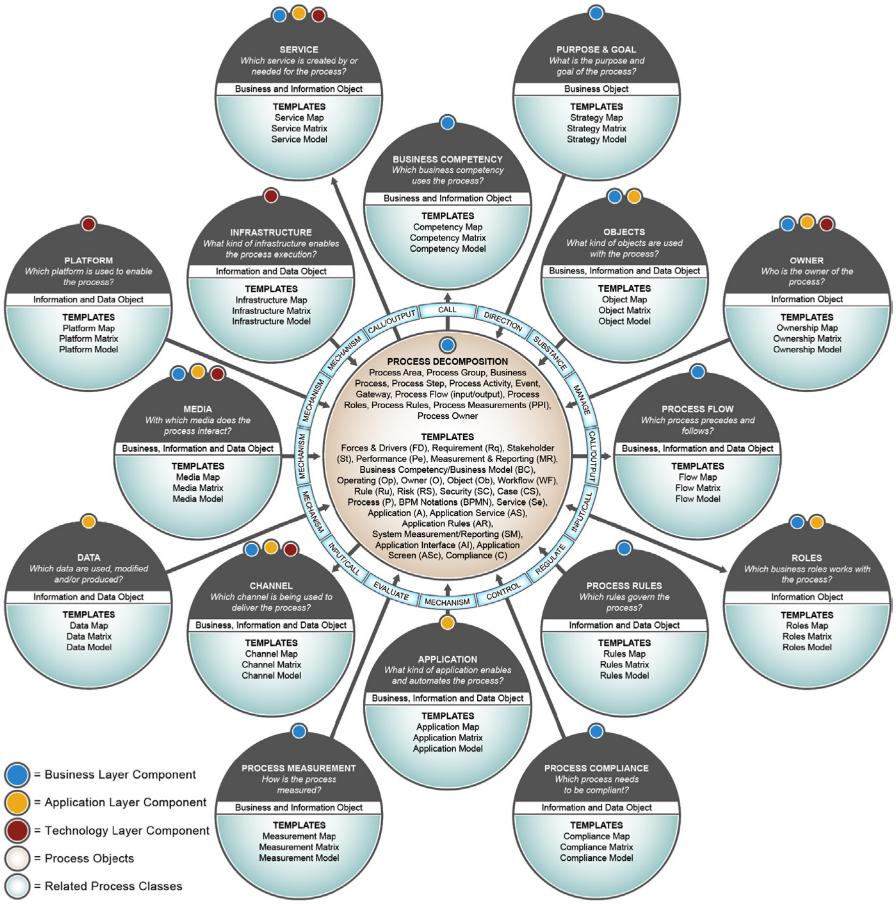

FIGURE 7.1

The 16 basic process classes and groups.[5]

Although relations are mainly defined that the level of meta-objects (e.g., in corporate ontologies), the BPM ontology contains a set of archetypal relations that have been observed to apply to almost any process. These relations have been defined at the level of meta-object groups, which means that they apply to object groups in corporate ontologies, elicited using these meta-objects. Sixteen meta-object groups can be identified. Although these groups contain meta-objects, they are not meta-objects. Their relations with the process meta-object group are summarized in Figure 7.1, which is an overview of these 16 classes and how they relate to the process objects. These 16 groups assemble composition meta-objects, which can be observed several areas of business other than processes. Consequently, this template can be reused to represent the relations between these 16 groups and other aspects of business.[6]

Next to the meta-object relations visualized in Figure 7.1, process composition meta-objects do not only have relationships to the central concept of a business process, but also with multiple other areas. These relations provide an important tool to assess the details of a corporate business ontology, as each object that belongs to one of these 16 meta-object groups is expected to be related to any business process object in order to obtain a complete business process specification. Consequently, a process specification that is missing one or more of these essential objects in its relationships will be considered to be malformed and incomplete. This approach is expected to provide a powerful tool to assist in the identification and capture of all relevant process aspects.

The following process meta-objects and relations are expected to exist within most organizations:

1. The *business competency meta-object group* relates to the following meta-objects: organizational construct, business capability, business resource/actor, business function, product, location, report, timing, revenue, and cost. They intersect with the process meta-object groups as a business calls upon its *business competencies*, or organizational skills and knowledge, which are part of its business model and thereby the organizational structure, to create value within the organization and for its customers via its processes, events, and decisions, or gateways, which are decomposed process meta-objects.

   The relations between business competency and process meta-objects include descriptions of relations between cost and the process objects, of which some examples are given below:
   - **a.** Cost occurs when executing a task within a business process, cost can therefore be related to a business process.
   - **b.** Cost accrued at an event can be associated and tracked.
   - **c.** Cost measures can be specialized within a process measurement (process performance indicator).
   - **d.** Cost control is, among others, the responsibility of a process owner.
   - **e.** Cost compliance can be ensured through process rules.
   - **f.** Cost flow can be found in various process flows.
2. The *purpose and goal meta-object group* contains the following meta-objects: driver (value/performance), strategy, goal, objective, value indicator, value expectation, value proposition, performance indicator, performance expectation, quality, risk, and security. They intersect with the meta-objects of the purpose and goal meta-object groups as business strategies will dictate the *purpose and goals (value)* that provide directions for the process objects. This includes business process objectives, performance expectations, and performance indicators, which can be measured and linked back to the strategy through process performance indicators (PPIs).

   Below is an example of the semantic relations between performance drivers, which belong to the purpose and goal meta-object group and the process objects:
   - **a.** Performance driver influences choices of process owner.
   - **b.** The categorization of process areas and groups can be influenced by performance drivers.
   - **c.** Performance drivers influence the design of business processes.

   d. Events realize the various performance drivers.
   e. Performance driver sets criteria for the direction of the gateways.
   f. Performance driver set criteria for the execution of the process flow (including input/output).
   g. Performance drivers set presentation criteria for the process role.
   h. Process rules are set based on various performance drivers.
   i. Process measurements (PPI) can be tracked and reported against the performance drivers.
3. The *object meta-object group* has the following members: business objects, information objects, and data objects. They need to be considered because (parts of) business, information, and data objects give *substance* to business process tasks and services. A business process uses, modifies, and/or produces business information and data objects on several hierarchical levels; data objects with data components, business processes with information objects, and business process tasks with data services.

   Below is an example of the semantic relations between the information objects and the process objects:
   a. Business process areas and groups consume and develop information objects relevant for decision making.
   b. Business processes use, produce, and store information objects.
   c. Information objects change the state of an event.
   d. Gateways produce and consume information objects.
   e. Information objects are produced and consumed by process roles.
   f. Process rules regulate the compliance of specific information objects.
   g. Information objects are a part of any process measurement (PPI).
   h. Process owners have the responsibility for the information objects involved in the process.
4. The *owner meta-object group* contains the following: Business owner, process owner, service owner, application owner, data owner, platform owner, and infrastructure owner. They are important because multiple owners can have the authority to steward or *manage* business processes. All owners have specific responsibilities that result in different desires, demands, and various performance and value expectations. In the context of business processes, the business process owners have the responsibilities connected to business tasks, process flow, service, creating value, achieving performance goals set by the strategy adhere to security, and maintaining compliance standards within the "work system."

   Below is an example of the semantic relations between the business owner and the process objects:
   a. Business owners define through the business goals the direction of the business process.
   b. Business owners set performance criteria for the business process.
   c. Business owners create and specify the performance indicators within the process measurements (PPI).

   d. Process owners work with business owners.
   e. Business owners govern the process flow.
   f. Business owners are involved in the verification and conformance of the process rules.
5. The *flow meta-object group* consist of the following: business workflow, process flow, service flow, information flow, data flow, and application/system flow. They should be considered because business processes *call and provide output* to the business process flow, which interacts with several different flows within the business. These flows include the business workflow, information flow, data flow, etc., all interacting with the process flow.

   Below is an example of the semantic relations between the information objects and the process objects:
   a. Business processes are found within the information flow.
   b. Events sequence the information flow.
   c. Information flows have gateways.
   d. information flow crosses the process flow (including input/output).
   e. Process measurements (PPI) are a part of the information flow.
   f. Process owners are involved with the creation of certain information flows.
   g. Information flows and their rules can be derived from process rules.
6. The *roles meta-object group* has the following members: business role, process role, service role, and application role. It is important to consider them because the enacted business process roles *input and call* the processes through the process steps and activities so as to be supported by the roles of the respective business functions and tasks.

   Below is an example of the semantic relations between the business roles and the process objects:
   a. The process group categorizes business roles into its groups.
   b. Business roles execute the tasks in the business process and activities.
   c. The process role is a form of the business role.
   d. Process owners interact with various business roles.
   e. Business roles participate within the process flow.
   f. Business roles abide by the process rules.
7. The *rules meta-object group* contains the following: business rule, process rule, service rule, application rule, data rule, platform rule, and infrastructure rule. Business process rules *regulate* the processes, which are then instantiated in services and implemented within applications that enable these processes, data that they consume or produce, and security behavior. This must also both be adhered to and embedded within the different parts of the planning, creation, realization, and governance processes of the business processes.

   Below is an example of the semantic relations between the business rules and the process objects:
   a. Business rules regulate business process tasks.
   b. Business rules ensure the correctness of process flow (including input/output).

c. Business rules apply to gateways.
d. Business rules relate to process roles.
e. Business rules are contained within process rules.
f. Business rules are measured by process performance indicators (PPIs).
g. Business rules are also a part of the responsibility of process owners.

8. The *compliance meta-object group* contains the following: business compliance, application compliance, data compliance, platform compliance, and infrastructure compliance. When designing, building, implementing, updating, working with, or terminating business process tasks, events, and services, it is essential to demonstrate the level of *control* necessary to demonstrate process compliance with respect to applicable policies, guidelines, standards, and regulations through the use of governance controls, risk management, audits, evaluation, security, and monitoring.

   Below is an example of the semantic relations between business compliance and the process objects:
   a. Business compliance verifies execution of business processes.
   b. Business compliance verifies execution of the gateway.
   c. Process flow (including input/output) conforms to business compliance.
   d. Business compliance assesses the performance process role.
   e. Business compliance verifies conformance to the design of the process rule.
   f. Business compliance evaluates process measurements (PPIs).
   g. Business compliance assesses the performance of process owners.

9. The *application meta-object group* contains the following: logical application component, physical application component, application module, application feature, application function, application task, application/system report, and application/system. An *application* is a *mechanism* used to automate a business process, and/or its steps, activities, events, and flows. Applications are also used to automate process reporting through the use of system measurements and system reporting.

   Below is an example of the semantic relations between the application tasks and the process objects:
   a. The application task partially or fully automates the business process and process activities.
   b. Gateways are automated by application tasks.
   c. The application task partially or fully automates process flow (including input/output).
   d. Process rules are partially or fully automated by application tasks.
   e. Process owners desire application task automation.

10. The *measurement meta-object group* contains the following: business measure, service measure, process measure, and system measure. The measurement indicators are the basis by which we *evaluate* the business processes; their outputs and results can all be measured. Process measurements or their automated equivalent, the system measurements, are linked to business reporting (at the strategic, tactical, and operational levels) through scorecards, dashboards, and cockpits, which aid in this assessment.

Below is an example of the semantic relations between the business measurements and the process objects:

- **a.** Business process performance is tracked by business measures.
- **b.** Events can be tracked against business measures.
- **c.** Business measures are found within the process flow (including input/output).
- **d.** Process roles are evaluated against business measures.
- **e.** Process rules are tracked and reported by business measures.
- **f.** Process owners report part of the business measures.

11. The *channel meta-object group* contains the following: business channel, service channel, application channel, data channel, platform channel, and infrastructure channel. The value delivery to those that benefit from the output of a process occurs through business and technology *channels*. The business channel stages can range from marketing, sales, distribution, business service, and so on.

Below is an example of the semantic relations between the business channel and the process objects:

- **a.** Business Channels require execution of business processes and process activities.
- **b.** Business channels require execution of gateways.
- **c.** Business channels involved within the process are the responsibility of process owners.
- **d.** Business process flow participates in the business channel.
- **e.** Process rules regulate the business channel.

12. The *data meta-object group* contains the following: data component, data entity, data objects, and data table. Process execution is the mechanism by which *data* are created, used, or consumed.

Below is an example of the semantic relations between the data objects and the process objects:

- **a.** Data objects are related to business processes and activities.
- **b.** Data objects change state at an event.
- **c.** Data objects abide by process rules.
- **d.** Data objects are within process measurements (PPIs).

13. The *media meta-object group* contains the following: business media, application media, data media, platform media, and infrastructure media. *Media* is the mechanism that is part of any process by which inputs or outputs of a process are held. There are many kinds of media involved within a process, such as paper, visual, or auditory for manual processes; screens, memory, or disks may act as media for automated processes.

Below is an example of the semantic relations between the business media and the process objects:

- **a.** Business media are supplied or consumed by business processes and process activities.
- **b.** Gateways use business media.
- **c.** Business media are produced at events.
- **d.** Process owners have the responsibility for the business media.

14. The *platform meta-object group* consists of the following: physical platform component, and platform device. A *platform* is a mechanism used to enable process automation; for example, a platform component enables an application component, and a platform service enables an application service and thereby a business service. Platforms such as laptops, smart phones, or tablets are used to access processes.

    Below is an example of the semantic relations between the platform devices and the process objects:
    a. Platform devices generate and participate in a business process.
    b. Platform devices are used by process roles.
    c. Platform devices participate within the process flow.
    d. Platform devices change the state of events.
15. The *infrastructure meta-object group* contains the following: physical infrastructure component and infrastructure device. From a process architecture perspective, processes are automated with dedicated technology, which use a mechanism to draw on *infrastructure* for their ability to execute. For example, a process rule engine resides on infrastructure components, and infrastructure services support the platform services.

    Below is an example of the semantic relations between the infrastructure and the process objects:
    a. Automated business processes reside on physical infrastructure components.
    b. Physical infrastructure components host business process engines (rules, measures, etc.).
16. The *service meta-object group* contains the following: business service, application service, data service, platform services, and infrastructure services. Business services are what actually deliver value within the organization and to its customers. They do this when they call upon and provide output to the processes necessary to instantiate them. This is because value creation is subject to the relationships between business processes and their resources, tasks, events, and the services they deliver. Although there is a distinction between manual and automated services, the division is captured within the process notations, which relate the automated service to the relevant web services, application services, data services, platform services, and infrastructure services and the business services to their manual counterparts.

    Below is an example of the semantic relations between the business compliance and the process objects:
    a. Business services are realized by business processes.
    b. Business services resolve events.
    c. Business services are provided to process roles.
    d. Business services are regulated by process rules.
    e. Business services are measured by process measures.
    f. Business services are governed by process owners.

THE BPM ONTOLOGY AS A FRAME: THE ONTOLOGICAL STRUCTURE OF THE LEADING PRACTICE PROCESS META MODEL

The business process ontology that is embedded in the LEADing Practice narratives, models, tables, and diagrams can be explicated and interrelated by bringing them together in a universal conceptual structure, such as conceptual graphs (CGs).[7–9] CGs provide a graphical interface for first-order logic that enables the visualized objects and relations in the ontology to be articulated as a (class) hierarchy and, by linking (meta)objects to each other through their object relations, the direct and indirect interrelationships in business processes can be discovered. It is the vehicle by which LEADing Practice's ontology and semantics foundation can be applied to enterprises wishing to understand and improve their own processes.[10]

Figures 7.2 and 7.3 show an extract from the meta-object ontology of the business layer and application layer, respectively, taken from LEADing Practice's *Process Architecture Reference Content*.[11] The objects are shown as a CG type hierarchy, linking subtypes (subobjects) to their supertypes (superobjects). Thus, in Figure 7.2

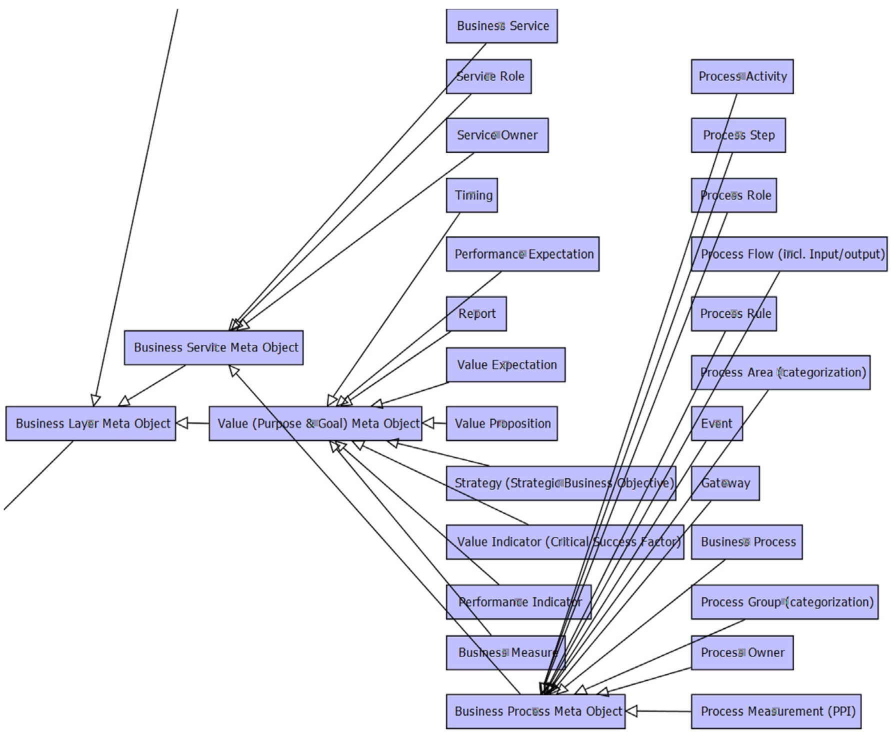

FIGURE 7.2

Extract from the business layer meta-object ontology.

for example, the subtype to supertype path is Process Owner < Business Process Meta-Object < Business Service Meta-Object < Business Layer Meta-Object < Top (not shown). Another is Product < Business Competency Meta-Object < Business Layer Meta-Object < Top. In Figure 7.3, an example is Data Service < Data Meta-Object < Application Layer Meta-Object < Top. Another is Application Module < Application Meta-Object < Application Layer Meta-Object < Top. The "<" symbol can be read as "is a"; for example, product is a business competency meta-object. It is also transitive; thus, for example, process owner < (is a) business layer meta-object. Furthermore, it is polymorphic; properties affecting a superobject will cascade to *all* of its subobjects. Thus, if we make an assertion about the business layer meta-object, for example, then that assertion will also apply to all its subobjects; in this case, all the objects shown in Figure 7.2. Note that it does not apply the other way; thus, for example, an assentation made about the product will only affect that object. Otherwise, it would wrongly affect everything that comes under Business

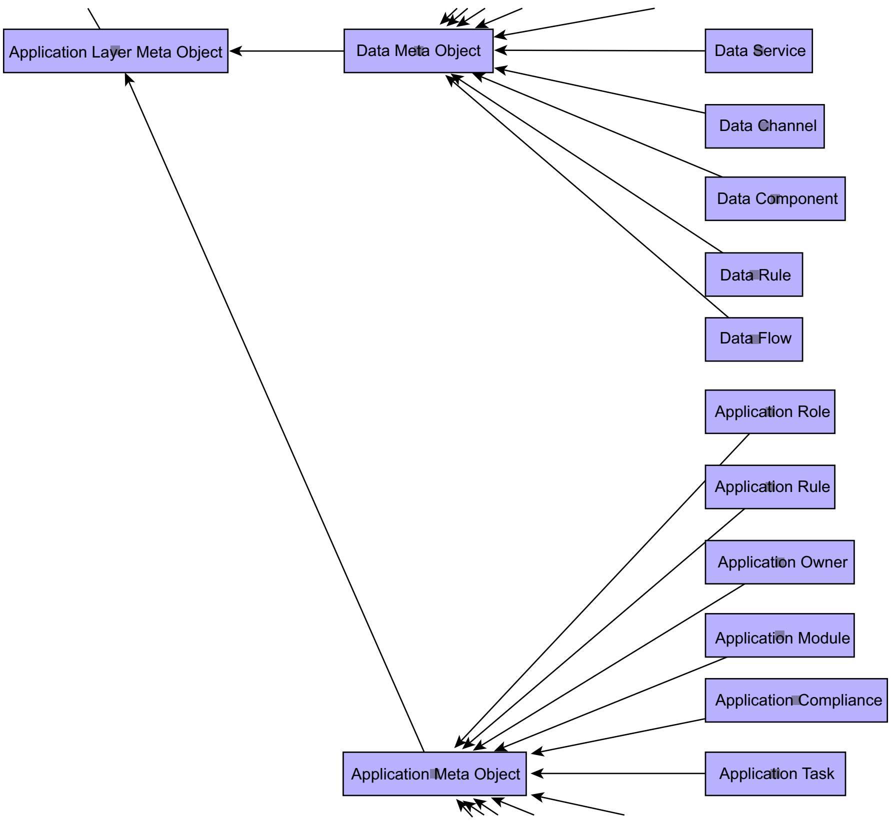

FIGURE 7.3

Extract from the application layer meta-object ontology.

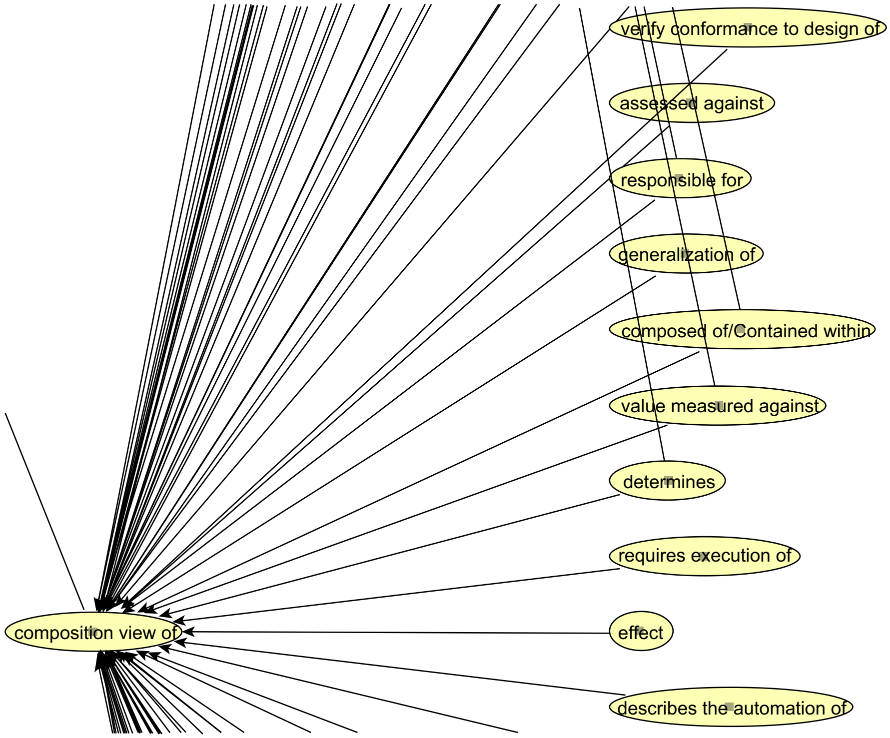

FIGURE 7.4

Extract from the composition relation ontology.

Competency Meta-Object < Business Layer Meta-Object < Top. Consequently, we have the ability to apply reasoning at multiple levels of the ontology.

Figures 7.4 and 7.5 similarly describe extracts of the object relations of the ontology as a CG relation hierarchy. The relations are structured to capture the composition-decomposition views in LEADing Practice's process architecture reference content.[12] The "<" (is a) rules also apply to object relations, such as requires execution of < decomposition view < link (not shown), in Figure 7.4. An example from Figure 7.5 would be participates in < decomposition view < link. Although not shown in these figures, some of the relations are subrelations of both the composition view and decomposition view. These are indicated by relations in the figures that have two lines going from them, one of which goes off the figure to the other view as its superrelation. One such example in Figure 7.4 is "participates in." That relation also has composition view as its superrelation. The "based on" relation in Figure 7.4 only has the decomposition view as its superrelation. Examples of both sorts of relations also appear in Figure 7.3.

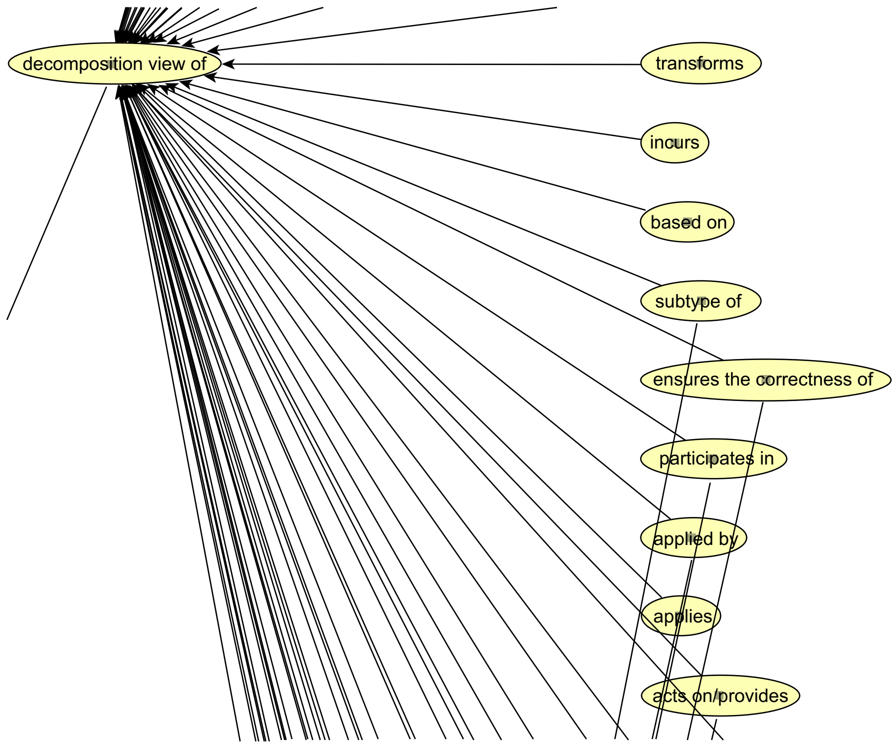

FIGURE 7.5

Extract from the decomposition relation ontology.

Figures 7.6 and 7.7 show extracts of the objects linked by their relations for the business process composition and decomposition attribute taxonomy, respectively, based on the object and relation ontology of the earlier figures. Semantics is thereby added to these taxonomies, as each object is described by its relation to other objects through the ontological structure defined in the CGs of Figures 7.2–7.5. Accordingly, for example, business process is delivered by business service. Business Service < Business Service Meta-Object; thus, properties (assertions) applied to this meta-object would cascade to business service (but not vice versa as explained earlier). Business process is not on this hierarchical path, so it would be unaffected. Of course, any properties applied to the business layer meta-object would affect them both. The same pattern applies to the object relations. Overall, we can see how this multilevel behavior affects the context of each object in relation to its others. Properties applied to the superobject and relations are thereby reused at their sublevels. Such relationship models also acts as the test that properties are not applied at too high a level, as that would highlight oversimplification through overgeneralization. Conversely, when common properties are discovered at a common sublevel, they can be generalized and reused over those objects. This generalization and specialization can be updated in

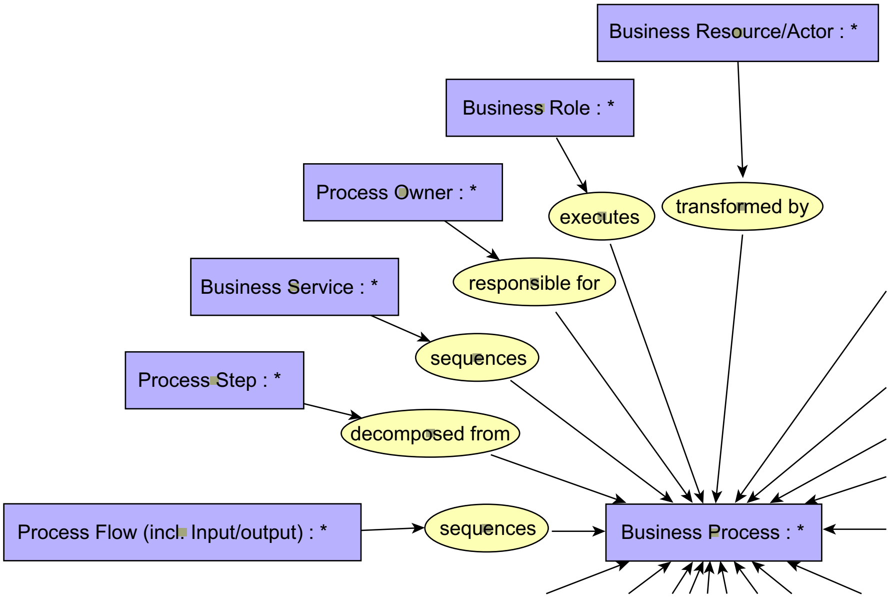

FIGURE 7.6

Extract from the business process composition attribute taxonomy.

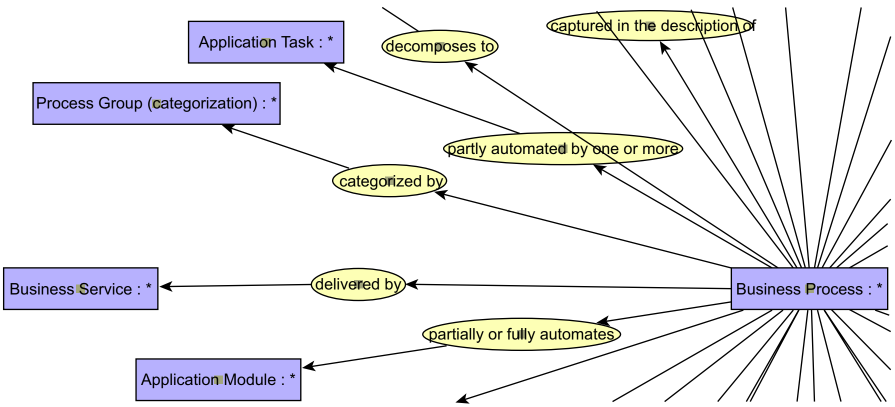

FIGURE 7.7

Extract from the business process decomposition attribute taxonomy.

the light of new best practices; notably, those best practices are being applied through CG logic rather than loosely on less formal foundations. Understanding is assisted by how objects are linked to other objects (directly and indirectly) through their relations, thus adding context to how the generalizations may be applied.

The CGs shown in each figure were drawn in the CoGui[13] software. As well as a CG editor, CoGui enables the first-order logic reasoning of CGs, as was outlined

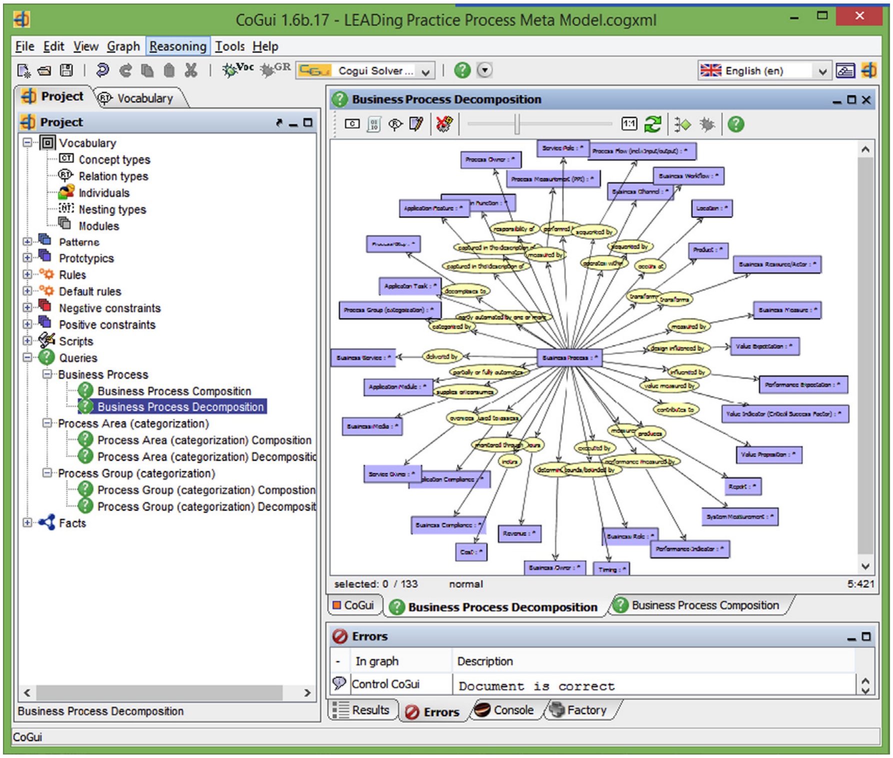

FIGURE 7.8

Example of querying the process meta-model.

earlier. Consequently, as Figure 7.8 indicates, the business process decomposition (and composition) meta-model can be used to query the models of a given enterprise. This enables the enterprise to test the conformity of their business models against the rich body of knowledge underpinned by LEADing Practice's ontology and semantics, identifying where the enterprise's own business processes might require further maturity.

DISCUSSION OF THE BPM ONTOLOGY

The BPM ontology is an empiric ontology, meaning that its roots lie in practice, as it was developed by practitioners documenting their practical knowledge of the field rather than having originated from theory and academics specialized in a restricted area of business. Consequently, it is one of the few ontologies that has the ambition to cover all aspects of business. To attain the desired level of completeness, the ontology is complemented with elicitation support, such as the guiding principles for creating, interpreting, analyzing, and using process objects within a particular domain and/or layers of an enterprise or an organization. The BPM ontology also offers a set of principles, views, artefacts, and templates that have detailed meta-object relations and rules that apply to them, such as how and where can the process objects be related (and where not). Because the BPM ontology has the ambition to support a large community, it is open-source within the community and vendor neutral or agnostic, so it can be used with most existing frameworks, methods and or approaches that have any of the meta-objects mentioned in this document. The mapping can be found online.[14]

By sharing knowledge within the community, practitioners have found and documented repeatable patterns[15] for process-related objects, structures, and artefacts. This has led to the identification of 16 cross-domain meta-object groups that provide additional structure to the ontology, and it may lead to the development of 16 orthogonal task ontologies (e.g., describing costs or risks) that intersect with domain ontologies (e.g., business processes). However, further research is needed to determine whether or not such a decomposition is feasible and desirable.

The ontology is also complemented by a framework that helps practitioners transform their (ontological) knowledge of a process into process models and (new) working methods. To be able to cope with the complexity of the real world, the framework allows practitioners to (temporarily) simplify their (mental) models by taking partial views on their knowledge. These viewpoints are especially useful in the context of process engineering, process modeling, and process architecture.

SUMMARY

The BPM ontology's primary purpose is to provide a shared vocabulary for practitioners and academics in the business domain. This purpose was achieved by selecting terms from other business process ontologies embedded in existing frameworks, standards, and approaches and mapping them to their equivalent, which is often the exact same term, in the BPM ontology. Because practitioners need more than just a glossary to describe the aspects of business, this folksonomy is enriched with relationships between meta-objects to build a business thesaurus. This frame has been complemented with rules and a framework that should help practitioners to transform their process knowledge in competitive advantage. This will help practitioners to achieve the following:

- Identify the relevant process objects
- Decompose the process objects into the smallest parts that can, should, and need to be modeled, and then compose the process objects entities before building them (through mapping, simulation, and scenarios)
- Visualize and clarify process object relationships with the process artefacts by using maps, matrices, and models (alternative representation of information)
- Reduce and/or enhance the complexity of process modeling, process engineering, and process architecture principles by applying the process decomposition and composition standard (see decomposition and composition reference content) [16]
- Model the relevant process objects through the architectural layers
- Adding process requirements (see requirement reference content)

- Provide a structured process blueprinting and implementation (see blueprint and implementation reference content).

This chapter also demonstrated how parts of this thesaurus (i.e., the BPM ontology) have been determined and how the entire thesaurus will be formalized as a frame, which allows for polymorphic property inheritance.

In the next chapters, the BPM ontology's meta-objects, groups, categorizations, strict specialization–generalization relations, and rules will be elaborated in detail, with examples. For further information on semantic process relations, process decomposition and composition, layered modeling, process engineering, and process architecture or how the BPM Ontology content can be used, we refer the reader to to the *Business Process Reference Content*.[17]

End Notes

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10. PDF of Diagram on www.leadingpractice.com Homepage, (2014). LEADing Practice. Retrieved from: http://www.leadingpractice.com/wp-content/uploads/2014/02/LEAD-Frameworks-Enterprise-Engineering-Enterprise-Modelling-Enterprise-Architecture.pdf.
11. Process Architecture Reference Content, (2014). Retrieved from: http://www.leadingpractice.com/enterprise-standards/enterprise-architecture/process-architecture/.
12. See note 11 above.
13. CoGui: A Conceptual Graph Editor, (2014). LIRMM. Retrieved from: http://www.lirmm.fr/cogui/.
14. See note 1 above.
15. The definition of a pattern used here is the description of the repeatable and mostly used/generic specifications and relations of a topic, not all theoretically possible specifications or relations.
16. LEADing Practice decomposition and composition reference content, LEADing Practice, 2012 content.
17. See note 6 above.