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Exercise: Representing Process Knowledge in an Ontology

In this exercise an ontology about process knowledge is created in Protégé using the method Ontology Developmetn 101 (Noy & McGuinness, 2001).

Determine Domain and Scope

The objective of the knowledge base is to support the process manager in designing the process flow and assigning tasks to actors. Therefore, knowledge about process flows and responsibilities for tasks shall be represented in the ontology.

Competency Questions

To determine the scope of the ontology, the following competency questions were defined:

- Who executes task X?
- Which task is executed after task X?
- When can task X start?

Reusing existing ontologies

Thee are no ontologies, which were imported. However, one can use concepts from modeling languages as basis to identify relevant terms. In case of business processes, the concepts of the BPMN standard can be used as reference
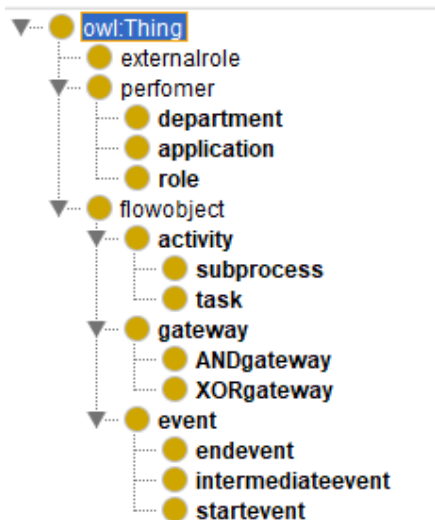
Enumerate important terms

BPMN was used to identify important terms. As the focus is on process flow and responsibilities, important terms are: process, task, role, event, sequence, gateway, department, application, and execute,

Define classes and class hierarchy

The identified terms ask, role, event, sequence, gateway, department, application are represented as classes. A bottom-up approach was chosen to structure them in a hierarchy. The hierarchy is shown in the following figure:

```
▼ owl:Thing
   │── externalrole
   ▼ perfomer
   │   │── department
   │   │── application
   │   └── role
   ▼ flowobject
   │   ▼ activity
   │   │   │── subprocess
   │   │   └── task
   │   ▼ gateway
   │   │   │── ANDgateway
   │   │   └── XORgateway
   │   ▼ event
   │       │── endevent
   │       │── intermediateevent
   │       └── startevent
```

Define data properties and object properties

The object properties represent relations between elements. The following object properties were represented:

```
▼ owl:topObjectProperty
   │── triggers
   │── executes
   │── isexecutedby
   └── sequenceflow
```
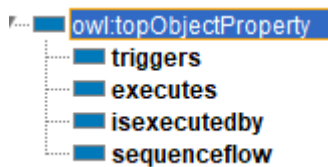
Sequenceflow is a relation between two flow object, i.e. between tasks, events and gateways. The relations represents the order, which tasks are executed. It corresponds to the sequenceflow relation in BPMN.

The relation executes connects a performer and a task. The inverser relation between a task and a performer is called isexecutedby.

Trigger is a relation between an event and a task. As soon as an event occurs, it triggers the execution of a task.

The data properties are shown in the following figure:

```
▼ owl:topDataProperty
   │── condition
   │── question
   └── hasname
```
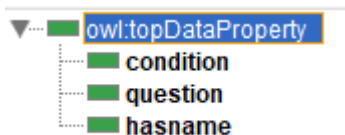
A performer and a task can have a name, a gateways has a question and a sequence flow can have a condition.

Create instances

Instances were created to represent the following process:

The waiter serves the beverages. Then the waiter serves the food. When the guests are finished, the waiter presents the bill.

There are three tasks:
- presentbill
- servebeverages
- servefood

one performer:
- waiter

one event:
- guestsfinished

The following figure shows the properies of the task serververages:

The task is executed by the waiter and has a sequenceflow to servefood, representing that servefood is executed after servebeverages.

The following figure shows that the event guestsfinished triggers the task presentbill:

Querying the knowledge base

The following queries show that the with the knowledge base the competency questions can be answered

Query 1: Who performs task "Serve food"

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX po: <http://www.semanticweb.org/knut.hinkelmann/ProcessOntology#>
SELECT ?performer
        WHERE { ?performer po:executes  po:servefood }
```

Answer: waiter

Query 2: Which task es executed after task "serve beverages"?

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX po: <http://www.semanticweb.org/knut.hinkelmann/ProcessOntology#>
SELECT ?task
        WHERE { po:servebeverages po:sequenceflow  ?task }
```

Answer: servefood

Query 3: When can task "Present Bill" start?

The query is equivalent to: What is the trigger for task "Present Bill"?

```
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX po: <http://www.semanticweb.org/knut.hinkelmann/ProcessOntology#>
SELECT ?event
      WHERE { ?event po:triggers  po:presentbill}
```

Answer: guestsfinished