



# PPS (Production Planning and Scheduling) Part 1: Core Elements, Version 1.0

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**Technical Committee:**

[OASIS Production Planning and Scheduling TC](#)

**Chair(s):**

[Yasuyuki Nishioka, PSLX Forum / Hosei University](#)

**Editor(s):**

[Yasuyuki Nishioka, PSLX Forum / Hosei University](#)  
[Koichi Wada, PSLX Forum](#)

**Related work:**

This specification is related to:

- [Universal Business Language 2.0](#)

**Declared XML Namespace(s):**

<http://docs.oasis-open.org/pps/2009>

**Abstract:**

OASIS PPS (Production Planning and Scheduling) specifications deal with problems of decision-making in all manufacturing companies who want to have a sophisticated information system for production planning and scheduling. PPS specifications provide XML schema and communication protocols for information exchange among manufacturing application programs in the web-services environment. Part 1: Core Element especially focuses on information model of core elements which can be used as ontology in the production planning and scheduling domain. Since the elements have been designed without particular contexts in planning and scheduling, they can be used in any specific type of messages as a building block depending on the context of application programs.

**Status:**

This document was last revised or approved by the PPS TC on the above date. The level of approval is also listed above. Check the "Latest Version" or "Latest Approved Version" location noted above for possible later revisions of this document.

Technical Committee members should send comments on this specification to the Technical Committee's email list. Others should send comments to the Technical Committee by using the "Send A Comment" button on the Technical Committee's web page at <http://www.oasis-open.org/committees/pps/>.

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# 1 Introduction

This document prescribes how to describe contents of the XML messages which are used for exchanging the information on Production Planning and Scheduling by some application software programs.

If information is exchanged between production planning and scheduling applications, the enterprise can develop systems comparatively easily at a low cost and make them more competitive for the whole enterprise. To make matters better, the systems will be able to have high extendability in future.

This specification aims at production planning and scheduling for all kinds of products and services provided by manufacturing enterprises. Production scheduling explained in this specification can be divided into scheduling in the whole enterprise including some areas and sites, and detailed scheduling within an individual area and work-centers.

The scope of this specification doesn't include optimization logic for solution, special knowledge of individual enterprises, concrete solution methods for production planning and scheduling, and planning for the total supply chain.

## 1.1 Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

## 1.2 Normative References

- [RFC2119] S. Bradner, *Key words for use in RFCs to Indicate Requirement Levels*, <http://www.ietf.org/rfc/rfc2119.txt>, IETF RFC 2119, March 1997.
- [PPS02] PPS (Production Planning and Scheduling) Part 2: Transaction Messages, Version 1.0, Public Review Draft, <http://www.oasis-open.org/committees/pps/>
- [PPS03] PPS (Production Planning and Scheduling) Part 3: Profile Specifications, Version 1.0, Public Review Draft, <http://www.oasis-open.org/committees/pps/>

## 1.3 Non-Normative References

- [PSLXWP] PSLX Consortium, PSLX White Paper - APS Conceptual definition and implementation, <http://www.pslx.org/>
- [PSLX001] PSLX Technical Standard, Version 2, Part 1: Enterprise Model (in Japanese), Recommendation of PSLX Forum, <http://www.pslx.org/>
- [PSLX002] PSLX Technical Standard, Version 2, Part 2: Activity Model (in Japanese), Recommendation of PSLX Forum, <http://www.pslx.org/>
- [PSLX003] PSLX Technical Standard, Version 2, Part 3: Object Model (in Japanese), Recommendation of PSLX Forum, <http://www.pslx.org/>

## 1.4 Conformance

A document or part of document conforms to OASIS PPS Core Elements if all elements in the artifact are consistent with the normative statements of this part of specifications, and the document can be processed properly with the XML schema that can be downloaded from the following URI.

<http://docs.oasis-open.org/pps/v1.0/pps-schema-1.0.xsd>

## 1.5 Terms and definitions

### Plan

Unit for intensive information of related orders corresponding to a specific period on a discrete time scale, or calculated information based on the schedule under the related orders. This can represent actual results when the related events have been occurred.

### Order

Unit of requirement describing concrete item, resource or operation in a specific place at a specific time. This can also represent the results to the requirement.

### Party

Customer who is a sender of an order and has a demand to make a decision, or supplier who is a receiver in case that a decision-maker sends the demand that can't be handled inside.

### Item

Object to be produced or consumed by production activities. The quantity or the quality of item is changed during the production activity. Examples include product, parts, module, unit, work in process and materials.

### Resource

Object that can provide essential function for production activities. The capacity of function is used during production activity, and is available again after finishing the production. Examples include equipment, machine, device, labor and tool.

### Process

Segment of production activities indicating a certain production line or method. This takes duration from start time to end time, and gives added value to the producing item. One process may have two or more than two processes detailed in the lower levels.

### Lot

Instance of a specific volume of item that exists in a specific place at a specific time. Generally the specific time corresponds to start or end of an operation, and the specific volume is equal to the quantity of item produced or consumed by the operation.

### Task

Unit of necessity to execute a specific operation at a specific time, indicating the volume of used capability provided by the applicable resource. This can represent both capacity value provided by resource at a specific time point, and aggregated total value of capacity provided by resource during specific duration.

### Operation

Actual processing element to be executed by a specific task, and to produce or consume a specific lot. It is a concrete instance of particular processes in production activities.

---

## 2 Primitive Elements

### 2.1 Structure of primitive elements

Primitive elements are the minimum series of element that corresponds to the most basic domain objects. The type of this element MUST be represented with the following XML schema.

```
<xsd:complexType name="PrimitiveType">
  <xsd:sequence>
    <xsd:element ref="Compose" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Produce" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Consume" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Assign" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Relation" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Location" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Capacity" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Progress" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Spec" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Start" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="End" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Event" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Price" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Cost" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Priority" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Display" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Description" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Author" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Date" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:string" use="required"/>
  <xsd:attribute name="key" type="xsd:long"/>
  <xsd:attribute name="name" type="xsd:string"/>
  <xsd:attribute name="parent" type="xsd:string"/>
  <xsd:attribute name="type" type="xsd:string"/>
  <xsd:attribute name="status" type="xsd:string"/>
  <xsd:attribute name="party" type="xsd:string"/>
  <xsd:attribute name="plan" type="xsd:string"/>
  <xsd:attribute name="order" type="xsd:string"/>
  <xsd:attribute name="item" type="xsd:string"/>
  <xsd:attribute name="resource" type="xsd:string"/>
  <xsd:attribute name="process" type="xsd:string"/>
  <xsd:attribute name="lot" type="xsd:string"/>
  <xsd:attribute name="task" type="xsd:string"/>
  <xsd:attribute name="operation" type="xsd:string"/>
</xsd:complexType>
```

- id* attribute SHOULD represent an identifier of the domain object.
- key* attribute represents a key used in the local applications.
- name* attribute represents the name of the domain object.
- parent* attribute represents the identifier of the inherited object of the domain object.
- type* attribute represents the modifier of the domain object.
- status* attribute represents the status of the domain object.
- party* attribute represents an identifier of the party associated with the domain object.
- plan* attribute represents the identifier of the plan associated with the domain object.
- order* attribute represents the identifier of the order associated with the domain object.
- item* attribute represents the identifier of the item associated with the domain object.



- *resource* attribute represents the identifier of the resource associated with the domain object.
- *process* attribute represents the identifier of the process associated with the domain object.
- *lot* attribute represents the identifier of the lot associated with the domain object.
- *task* attribute represents the identifier of the task associated with the domain object.
- *operation* attribute represents the identifier of the operation associated with the domain object.
- *Compose* element represents the element corresponding to part of the domain object.
- *Produce* element represents the relation that the domain object produces.
- *Consume* element represents the relation that the domain object consumes.
- *Assign* element represents the relation that the domain object uses.
- *Relation* element represents the relation to other primitive elements.
- *Location* element represents the location where the domain object exists.
- *Capacity* element represents the capacity status of the domain object.
- *Progress* element represents the progress of the domain object.
- *Spec* element represents the specification of the domain object.
- *Start* element represents the start event of the domain object.
- *End* element represents the completion event of the domain object.
- *Event* element represents the optional event under the domain object.
- *Price* element represents the price of the domain object.
- *Cost* element represents the cost of the domain object.
- *Priority* element represents the priority of the domain object.
- *Display* element represents how to display the domain object.
- *Description* element represents the description of the domain object.
- *Author* element represents the author of the domain object information.
- *Date* element represents the date of the domain object information.

## 2.2 List of primitive elements

This specification defines nine primitive elements: *Party*, *Plan*, *Order*, *Item*, *Resource*, *Process*, *Lot*, *Task*, and *Operation*. The type of those elements MUST be represented with the following XML schema.

```
<xsd:element name="Party" type="PrimitiveType"/>
<xsd:element name="Plan" type="PrimitiveType"/>
<xsd:element name="Order" type="PrimitiveType"/>
<xsd:element name="Item" type="PrimitiveType"/>
<xsd:element name="Resource" type="PrimitiveType"/>
<xsd:element name="Process" type="PrimitiveType"/>
<xsd:element name="Lot" type="PrimitiveType"/>
<xsd:element name="Task" type="PrimitiveType"/>
<xsd:element name="Operation" type="PrimitiveType"/>
```

### 2.2.1 Party element

*Party* element represents a customer or a supplier. Customer is an object that requests some products or services to the enterprise. The requests are sent to a person who is in charge of production planning and

scheduling. Supplier is an object providing some products or services to the enterprise. Supplier receives orders from the enterprise, and provides corresponding items, resources or processes for the enterprise.

### 2.2.2 Plan element

*Plan* element represents a value planned for particular products or services. The value shows volume of the products or services required or resulted during certain period of time. Typical cases of planning period include day, week and month.

### 2.2.3 Order element

*Order* element represents an object of information produced to request some products or services. Order is source to create production orders that are finally dispatched to the plant floor. Orders can be divided into inventory order, capacity order and production order according to the type of request.

Example: Item "A" products are requested.

```
<Order id="Z01" item="A">
  <Spec type="quantity"><Qty value="10"/></Spec>
</Order>
```

Example: Three labors in "group B" are requested.

```
<Order id="Z02" resource="groupB">
  <Spec type="quantity"><Qty value="3"/></Spec>
</Order>
```

Example: Switching operation is requested two times.

```
<Order id="Z03" process="change01">
  <Spec type="quantity"><Qty value="2"/></Spec>
</Order>
```

Example: Order which consist of 10 of "A" and 5 of "B" is totally 3,000 yen.

```
<Order id="Z00">
  <Compose order="Z01"/>
  <Compose order="Z02"/>
  <Price value="3000" unit="yen"/>
</Order>
<Order id="Z01" item="A">
  <Spec type="quantity"><Qty value="10"/></Spec>
</Order>
<Order id="Z02" item="B">
  <Spec type="quantity"><Qty value="5"/></Spec>
</Order>
```

### 2.2.4 Item element

*Item* element represents a product, component, parts, work in process (WIP), raw material and other items. Item is produced by any processes, and after that, it is consumed by another processes.

### 2.2.5 Resource element

*Resource* element represents a resource, which is an object enabling production, transportation, storage, inspection and other various services. As resource can produce tasks to execute operations, it is assigned to an operation by considering its volume of capacity.

216 **2.2.6 Process element**

217 *Process* element represents a process that has a function to produce value. Process can be defined as a  
218 segment of activities in production process. It produces and consumes production items by being  
219 executed during certain period of time.

220 **2.2.7 Lot element**

221 *Lot* element represents a production lot. Production lot is an object corresponding to a concrete item that  
222 actually exists in a specific place at a specific date and time. Lot is produced by an operation and finally  
223 consumed by another operation or discarded.

224 **2.2.8 Task element**

225 *Task* element represents a task, which is an object showing the usage of a specific resource capability for  
226 a specific period of time. Schedule may request a certain volume of task for each resource assigned to  
227 execute the appropriate operations.

228  
229 Example: Task corresponding to the volume that 3 labors work load is required for 2 days

```
230 <Task id="T01">  
231 <Capacity type="human"><Qty value="3"/></Capacity>  
232 <Capacity type="duration"><Qty value="2" unit="day" /></Capacity>  
233 </Task>
```

235 **2.2.9 Operation element**

236 *Operation* element represents a segment of activities that is actually dispatched to plant floor. Operation  
237 identifies an executable function at a specific place on a plant floor for a specific time. Operation is  
238 associated with a specific lot and task by executing those activities.

---

## 3 Relational Elements

### 3.1 Structure of relational elements

*Relational* elements represent any relations between domain objects. A relational element can have properties. The type of this element **MUST** be represented with the following XML schema.

```
<xsd:complexType name="RelationalType">
  <xsd:sequence>
    <xsd:element ref="Location" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Capacity" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Progress" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Spec" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Start" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="End" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Event" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Price" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Cost" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Priority" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Display" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Description" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Author" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Date" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Qty" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Char" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Time" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:string"/>
  <xsd:attribute name="key" type="xsd:long"/>
  <xsd:attribute name="name" type="xsd:string"/>
  <xsd:attribute name="type" type="xsd:string"/>
  <xsd:attribute name="status" type="xsd:string"/>
  <xsd:attribute name="apply" type="xsd:string"/>
  <xsd:attribute name="party" type="xsd:string"/>
  <xsd:attribute name="plan" type="xsd:string"/>
  <xsd:attribute name="order" type="xsd:string"/>
  <xsd:attribute name="item" type="xsd:string"/>
  <xsd:attribute name="resource" type="xsd:string"/>
  <xsd:attribute name="process" type="xsd:string"/>
  <xsd:attribute name="lot" type="xsd:string"/>
  <xsd:attribute name="task" type="xsd:string"/>
  <xsd:attribute name="operation" type="xsd:string"/>
</xsd:complexType>
```

- *id* attribute SHOULD represent an identifier of the relation.
- *key* attribute represents a key used in the local applications.
- *name* attribute represents the name of the relation.
- *type* attribute represents the modifier of the relation.
- *status* attribute represents the status of the relation.
- *apply* attribute represents application type of the relation. This element is a disjunctive (OR) content under the parent object, if the attribute value is "*disjunctive*".
- *party* attribute represents an identifier of the party associated with the relation.
- *plan* attribute represents the identifier of the plan associated with the relation.
- *order* attribute represents the identifier of the order associated with the relation.
- *item* attribute represents the identifier of the item associated with the relation.

- *resource* attribute represents the identifier of the resource associated with the relation.
- *process* attribute represents the identifier of the process associated with the relation.
- *lot* attribute represents the identifier of the lot associated with the relation.
- *task* attribute represents the identifier of the task associated with the relation.
- *operation* attribute represents the identifier of the operation associated with the relation.
- *Location* element represents the location associated with the relation.
- *Capacity* element represents the capacity status of the relation.
- *Progress* element represents the progress of the relation.
- *Spec* element represents the specification of the relation.
- *Start* element represents the start event of the relation.
- *End* element represents the completion event of the relation.
- *Event* element represents the optional event under the relation.
- *Price* element represents the price of the relation.
- *Cost* element represents the cost of the relation.
- *Priority* element represents the priority of the relation.
- *Display* element represents how to display the relation.
- *Description* element represents the description of the relation.
- *Author* element represents the author of the relation information.
- *Date* element represents the date of the relation information.
- *Qty* element represents the quantity of the relation.
- *Char* element represents the qualitative value of the relation.
- *Time* element represents the time of the relation.

## 3.2 List of relational elements

This part of specifications defines five relational elements: *Compose*, *Produce*, *Consume*, *Assign*, and *Relation*. Relational element defines relationship between the parent element and those that characterize the element. The type of this element MUST be represented with the following XML schema.

```
<xsd:element name="Compose" type="RelationalType"/>
<xsd:element name="Produce" type="RelationalType"/>
<xsd:element name="Consume" type="RelationalType"/>
<xsd:element name="Assign" type="RelationalType"/>
<xsd:element name="Relation" type="RelationalType"/>
```

### 3.2.1 Compose element

*Compose* element defines a hierarchical relation between the parent element and another same primitive element that addresses one level upper or lower than the target element. This element can represent that the object referred to in this element composes or be composed by the parent element.

Example: Product "A" family includes product "A1" and product "A2".

```
<Item id="A">
```

```
334 <Compose type="child" item="A1"/>
335 <Compose type="child" item="A2"/>
336 </Item>
```

337 Example: Product "B" is assembled with 2 of parts "C1" and 3 of parts "C2".

```
338 <Item id="B">
339 <Compose type="child" item="C1"><Qty value="2"/></Compose>
340 <Compose type="child" item="C2"><Qty value="3"/></Compose>
341 </Item>
```

342 Example: 2 of parts "C1" are used for product "B1", and 5 of parts "C1" are used for product "B2".

```
343 <Item id="C1">
344 <Compose type="parent" item="B1"><Qty value="2"/></Compose>
345 <Compose type="parent" item="B2"><Qty value="5"/></Compose>
346 </Item>
```

347

### 348 3.2.2 Produce element

349 *Produce* element defines a relation between processes and items, or a relation between operations and  
350 lots. This element can show the quantity of the item or lot produced by the process or operation  
351 respectively, or how many items or lots are produced by the process or the operation respectively.

### 352 3.2.3 Consume element

353 *Consume* element defines a relation between processes and items, or a relation between operations and  
354 lots. This element can show the quantity of the item or lot consumed by the process or operation  
355 respectively, or how many items or lots are consumed by the process or operation respectively.

### 356 3.2.4 Assign element

357 *Assign* element defines a relation between processes and resources, or a relation between operations  
358 and tasks. This element can show the volume of capacity provided by the resource or task assigned for  
359 the process or operation respectively, or how many resources or tasks are used.

### 360 3.2.5 Relation element

361 *Relation* element can show that the parent element has a specific relation to other primitive elements.  
362 This element can additionally define relational classes between primitive elements. Examples include  
363 precedence relations and pegging relations.

---

## 4 Specific Elements

### 4.1 Structure of specific element

Specific elements are defined to represent any properties of the primitive element. This element MAY be described more than once on the same parent element if the value is historical. Those multiple properties have time stamp. The type of this element MUST be represented with the following XML schema.

```
<xsd:complexType name="SpecificType">
  <xsd:sequence>
    <xsd:element ref="Start" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="End" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Event" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Price" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Cost" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Priority" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Display" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Description" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Author" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Date" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Qty" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Char" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Time" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:string"/>
  <xsd:attribute name="key" type="xsd:long"/>
  <xsd:attribute name="name" type="xsd:string"/>
  <xsd:attribute name="type" type="xsd:string"/>
  <xsd:attribute name="status" type="xsd:string"/>
  <xsd:attribute name="apply" type="xsd:string"/>
</xsd:complexType>
```

- *id* attribute SHOULD represent an identifier of the property.
- *key* attribute represents a key used in the local applications.
- *name* attribute represents the name of the property.
- *type* attribute represents the modifier of the property.
- *status* attribute represents the status of the property.
- *apply* attribute represents application type of the property. The value of the element is relative, if the value is "*relative*".
- *Start* element represents the start event of the property.
- *End* element represents the completion event of the property.
- *Event* element represents the optional event under the property.
- *Price* element represents the price of the property.
- *Cost* element represents the cost of the property.
- *Priority* element represents the priority of the property.
- *Display* element represents how to display the property.
- *Description* element represents the description of the property.
- *Author* element represents the author of the property information.
- *Date* element represents the date of the property information.

- *Qty* element represents the quantity of the property.
- *Char* element represents the qualitative value of the property.
- *Time* element represents the time of the property.

## 4.2 List of specific elements

For specific elements, this part of specifications has four elements: *Location*, *Capacity*, *Progress*, and *Spec*. The type of this element MUST be represented with the following XML schema.

```
<xsd:element name="Location" type="SpecificType"/>
<xsd:element name="Capacity" type="SpecificType"/>
<xsd:element name="Progress" type="SpecificType"/>
<xsd:element name="Spec" type="SpecificType"/>
```

### 4.2.1 Location element

*Location* element represents a location. When the expression of location has structure, multiple values can be set by describing different names of the data. Change of the location depending on time can also be represented by multiple values.

Example: Customer's address

```
<Party id="ABC Inc.">
  <Location type="address"><Char value="123 ABC street"/></Location>
  <Location type="city"><Char value="Cambridge"/></Location>
  <Location type="state"><Char value="MA"/></Location>
  <Location type="code"><Char value="02139"/></Location>
  <Location type="country"><Char value="USA"/></Location>
</Party>
```

### 4.2.2 Capacity element

*Capacity* element represents volume of capability provided by resources, items or processes. In the case of resource capability, it may show available amount of corresponding tasks. In the case of Items, it shows the available amount of Lots. And for Processes, it shows maximum ratio of production. All of this information is represented in a time horizon.

Example: Inventory level of "material01"

```
<Item id="material01">
  <Capacity><Qty value="150"/></Capacity>
</Item>
```

Example: Temporal change of the material

```
<Item id="material01">
  <Capacity><Qty value="150"><Time value="2005-04-10T00:00:00"/></Capacity>
  <Capacity><Qty value="200"><Time value="2005-04-17T00:00:00"/></Capacity>
</Item>
```

Example: Material location information: Stock of "material01" is 150 located at "storage01"

```
<Item id="material01">
  <Location value="storage01"/>
  <Capacity><Qty value="150"/></Capacity>
```



458 </Item>

### 4.2.3 Progress element

*Progress* element represents progress of order and operation, or status of lot and task. This element shows the latest data, status or progress at a specific time point. This element MAY represent a change of time-dependent values.

### 4.2.4 Spec element

*Spec* element represents various specifications for primitive elements. The content can be represented with a pair of a spec name and a value. This element can also represent time-dependent change of the value. The value of the specification is represented with one data type of a numerical value, characters and date time.

---

## 5 Eventual Elements

### 5.1 Structure of eventual element

Eventual elements represent any properties that occur at one time point. Any type of events can be specified by using this element. The type of this element **MUST** be represented with the following XML schema.

```
<xsd:complexType name="EventualType">
  <xsd:sequence>
    <xsd:element ref="Priority" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Display" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Description" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Author" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Date" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Qty" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Char" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Time" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:string"/>
  <xsd:attribute name="key" type="xsd:long"/>
  <xsd:attribute name="name" type="xsd:string"/>
  <xsd:attribute name="type" type="xsd:string"/>
  <xsd:attribute name="status" type="xsd:string"/>
  <xsd:attribute name="apply" type="xsd:string"/>
  <xsd:attribute name="condition" type="xsd:string"/>
  <xsd:attribute name="value" type="xsd:string"/>
</xsd:complexType>
```

- *id* attribute SHOULD represent an identifier of the property.
- *key* attribute represents a key used in the local applications.
- *name* attribute represents the name of the property.
- *type* attribute represents the modifier of the property.
- *status* attribute represents the status of the property.
- *apply* attribute represents application type of the property. The value of this element is exclusive, if the value is “exclusive”.
- *condition* attribute represents the condition of the property.
- *value* attribute represents the qualitative value of the property.
- *Priority* element represents the priority of the property.
- *Display* element represents how to display the property.
- *Description* element represents the description of the property.
- *Author* element represents the author of the property information.
- *Date* element represents the date of the property information.
- *Qty* element represents the quantity of the property.
- *Char* element represents the qualitative value of the property.
- *Time* element represents the time of the property.

## 5.2 List of eventual elements

This part of specifications defines three eventual elements: *Start*, *End*, and *Event*. The *Start* and *End* are special cases of *Event* element. The type of this element MUST be represented with the following XML schema.

```
<xsd:element name="Start" type="EventualType"/>
<xsd:element name="End" type="EventualType"/>
<xsd:element name="Event" type="EventualType"/>
```

### 5.2.1 Start element

*Start* element represents a start event of orders, processes or operations. In case of order, this element represents an event at the earliest start time of corresponding operations.

### 5.2.2 End element

*End* element represents an end event of orders, processes or operations. In case of order, this element represents an event at the latest end time of corresponding operations.

### 5.2.3 Event element

*Event* element represents an event associated with a customer, supplier, item, resource, process or operation. Event brings any action or any status change at a specific time point. In general, the status value of item or resource changes discontinuously before the event.

---

## 6 Accounting Elements

### 6.1 Structure of Accounting element

Accounting element represents any accounting information such as profit revenue and cost spending. Price and cost associated with goods and services are the target of the elements. The type of this element MUST be represented with the following XML schema.

```
<xsd:complexType name="AccountingType">
  <xsd:sequence>
    <xsd:element ref="Priority" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Display" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Description" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Author" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Date" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Qty" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Char" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Time" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="id" type="xsd:string"/>
  <xsd:attribute name="key" type="xsd:long"/>
  <xsd:attribute name="name" type="xsd:string"/>
  <xsd:attribute name="type" type="xsd:string"/>
  <xsd:attribute name="status" type="xsd:string"/>
  <xsd:attribute name="value" type="xsd:string"/>
  <xsd:attribute name="condition" type="xsd:string"/>
  <xsd:attribute name="apply" type="xsd:string"/>
</xsd:complexType>
```

- *id* attribute SHOULD represent an identifier of the property.
- *key* attribute represents a key used in the local applications.
- *name* attribute represents the name of the property.
- *type* attribute represents the modifier of the property.
- *status* attribute represents the status of the property.
- *apply* attribute represents application type of the property. The value of this element is exclusive, if the value is “exclusive”.
- *condition* attribute represents the condition of the property.
- *value* attribute represents the qualitative value of the property.
- *Priority* element represents the priority of the property.
- *Display* element represents how to display the property.
- *Description* element represents the description of the property.
- *Author* element represents the author of the property information.
- *Date* element represents the date of the property information.
- *Qty* element represents the quantitative value of the property.
- *Char* element represents the qualitative value of the property.
- *Time* element represents the temporal value of the property.

## 6.2 List of accounting elements

For accounting elements, *Price* element and *Cost* element are defined in this specification. The type of this element MUST be represented with the following XML schema.

```
<xsd:element name="Price" type="AccountingType"/>  
<xsd:element name="Cost" type="AccountingType"/>
```

### 6.2.1 Price element

*Price* element represents a price. This element can be used to represent price information of primitive element and some properties.

### 6.2.2 Cost element

*Cost* element represents a cost. This element can be used to represent cost information of primitive element and some properties.

---

## 7 Administrative Elements

### 7.1 Structure of Administrative Elements

Administrative elements represent any administrative information, which is not the main body of the problem domain but the information how to deal with the domain information. The type of this element MUST be represented with the following XML schema.

```
<xsd:complexType name="AdministrativeType">
  <xsd:sequence>
    <xsd:element ref="Qty" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Char" minOccurs="0" maxOccurs="unbounded"/>
    <xsd:element ref="Time" minOccurs="0" maxOccurs="unbounded"/>
  </xsd:sequence>
  <xsd:attribute name="name" type="xsd:string"/>
  <xsd:attribute name="type" type="xsd:string"/>
  <xsd:attribute name="status" type="xsd:string"/>
  <xsd:attribute name="apply" type="xsd:string"/>
  <xsd:attribute name="condition" type="xsd:string"/>
  <xsd:attribute name="value" type="xsd:string"/>
</xsd:complexType>
```

- *name* attribute represents the name of the property.
- *type* attribute represents the modifier of the property.
- *status* attribute represents the status of the property.
- *apply* attribute represents application type of the property. The value of this element is exclusive, if the value is “exclusive”.
- *condition* attribute represents the condition of the property.
- *value* attribute represents the qualitative value of the property.
- *Qty* element represents the quantitative value of the property.
- *Char* element represents the qualitative value of the property.
- *Time* element represents the temporal value of the property.

### 7.2 List of Administrative Elements

For administrative elements, *Priority*, *Display*, *Description*, *Author* and *Date* elements are defined in this specification. The type of this element MUST be represented with the following XML schema.

```
<xsd:element name="Priority" type="AdministrativeType"/>
<xsd:element name="Display" type="AdministrativeType"/>
<xsd:element name="Description" type="AdministrativeType"/>
<xsd:element name="Author" type="AdministrativeType"/>
<xsd:element name="Date" type="AdministrativeType"/>
```

### 637 **7.2.1 Priority element**

638 *Priority* element represents the priority of the primitive element or the parent element. This information is  
639 used to make a decision for planning or scheduling.

### 640 **7.2.2 Display element**

641 *Display* element is an element to set how to display the parent element. This element can specify colors  
642 or display locations on the screen.

### 643 **7.2.3 Description element**

644 *Description* element is an element to set an optional comment of the parent element. The comment data  
645 type is a character string.

### 646 **7.2.4 Author element**

647 *Author* element represents the author and its related information such as the authoring date. This  
648 information is not about the target domain model, but information processing model.

### 649 **7.2.5 Date element**

650 *Date* element is an element that shows the creation date, expire date, revising date, and so forth. This  
651 information is for administrative use of the domain model.

---

## 8 Data Elements

### 8.1 Qty element

*Qty* element SHOULD represent quantitative information. This element can be used to represent the quantitative numerical data by decimal type data format. Unit of the value can be set in this element, and representation of fraction is available. The type of this element MUST be represented with the following XML schema.

```
<xsd:element name="Qty">
  <xsd:complexType>
    <xsd:attribute name="name" type="xsd:string"/>
    <xsd:attribute name="type" type="xsd:string"/>
    <xsd:attribute name="status" type="xsd:string"/>
    <xsd:attribute name="apply" type="xsd:string"/>
    <xsd:attribute name="condition" type="xsd:string"/>
    <xsd:attribute name="value" type="xsd:decimal"/>
    <xsd:attribute name="count" type="xsd:long"/>
    <xsd:attribute name="unit" type="xsd:string"/>
    <xsd:attribute name="base" type="xsd:decimal"/>
  </xsd:complexType>
</xsd:element>
```

- *name* attribute represents the name of the data.
- *type* attribute represents the modifier of the data.
- *status* attribute represents the status of the data.
- *apply* attribute represents application type of the data. The value of this element is exclusive, if the value is “exclusive”.
- *condition* attribute represents the condition of the data.
- *value* attribute represents the content corresponding to the qty element.
- *count* attribute represents the countable value of the data.
- *unit* attribute represents the type of unit of the data.
- *base* attribute represents the base data of the data. The value of the “value” attribute is divided with this value.

Example: 1/3 meters

```
<Qty value="1" unit="m" base="3"/>
```

Example: 3 weeks (discrete time scale)

```
<Qty count="3" unit="week" />
```

### 8.2 Char element

*Char* element SHOULD represent character data. This element can be used to represent a qualitative value of specification or a value of location. The type of this element MUST be represented with the following XML schema.



```

<xsd:element name="Char">
  <xsd:complexType>
    <xsd:attribute name="name" type="xsd:string"/>
    <xsd:attribute name="type" type="xsd:string"/>
    <xsd:attribute name="status" type="xsd:string"/>
    <xsd:attribute name="apply" type="xsd:string"/>
    <xsd:attribute name="condition" type="xsd:string"/>
    <xsd:attribute name="value" type="xsd:string"/>
    <xsd:attribute name="count" type="xsd:long"/>
    <xsd:attribute name="unit" type="xsd:string"/>
    <xsd:attribute name="base" type="xsd:string"/>
  </xsd:complexType>
</xsd:element>

```

- *name* attribute represents the name of the data.
- *type* attribute represents the modifier of the data.
- *status* attribute represents the status of the data.
- *apply* attribute represents application type of the data. The value of this element is exclusive, if the value is “exclusive”.
- *condition* attribute represents the condition of the data.
- *value* attribute represents the content corresponding to the data.
- *count* attribute represents the countable value of the data.
- *unit* attribute represents the type of unit of the data.
- *base* attribute represents the base data of the data. The value of the “value” attribute is divided with this value.

### 8.3 Time element

*Time* element SHOULD represent a specific time. Time is represented by a continuous time scale, or a specific discrete time scale. The type of this element MUST be represented with the following XML schema.

```

<xsd:element name="Time">
  <xsd:complexType>
    <xsd:attribute name="name" type="xsd:string"/>
    <xsd:attribute name="type" type="xsd:string"/>
    <xsd:attribute name="status" type="xsd:string"/>
    <xsd:attribute name="apply" type="xsd:string"/>
    <xsd:attribute name="condition" type="xsd:string"/>
    <xsd:attribute name="value" type="xsd:dateTime"/>
    <xsd:attribute name="count" type="xsd:long"/>
    <xsd:attribute name="unit" type="xsd:string"/>
    <xsd:attribute name="base" type="xsd:dateTime"/>
  </xsd:complexType>
</xsd:element>

```

- *name* attribute represents the name of the data.
- *type* attribute represents the modifier of the data.
- *status* attribute represents the status of the data.
- *apply* attribute represents application type of the data. The value of this element is exclusive, if the value is “exclusive”.
- *condition* attribute represents the condition of the data.

- 746 • *value* attribute represents the content corresponding to the data.
- 747 • *count* attribute represents the countable value of the data.
- 748 • *unit* attribute represents the type of unit of the data.
- 749 • *base* attribute represents the base data of the data. The value of the “value” attribute is divided with
- 750 this value.

751

752 Example: noon on May 13th, 2005

753 `<Time value="2005-05-13T12:00:00"/>`

754 Example: 2 months later since the present month (May, 2005) (discrete time scale)

755 `<Time count="2" unit="month" base="2005-05-01T00:00:00"/>`

756

## A. Object Class diagram

Figure A-1 shows the structure of primitive objects in this specification with a UML class diagram. Each object corresponds to each XML element. In this figure, arrows represent relative information between the source and destination objects. When an arrow has role names, it corresponds to an independent XML element in the specification. This figure doesn't include all the information of XML schema but the partial information of the primitive elements.

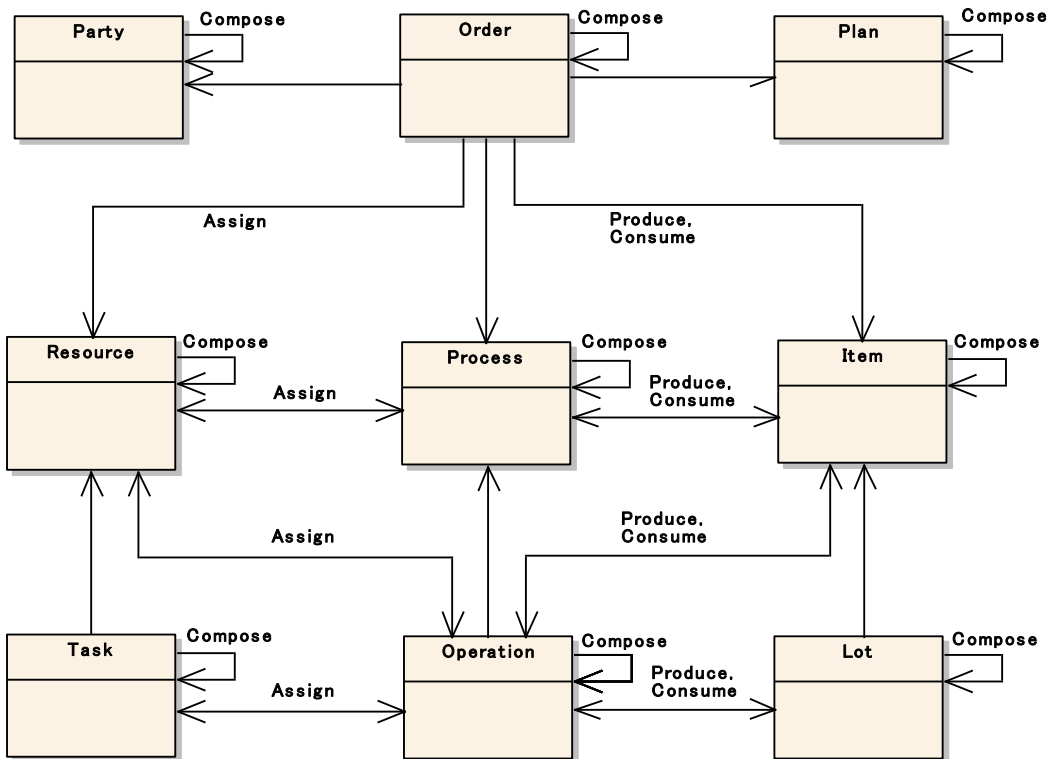


Figure A-1: Primitive objects for representing planning and scheduling problems

## B. Cross reference of elements

Table B-1 shows the relations between elements. The row headers represent parent elements and the column headers represent child elements. Symbol \* in the table means 0 or more than 0 element can be described.

Table B-1 Element and sub-element relations

	Compose	Produce	Consume	Assign	Relation	Location	Capacity	Progress	Spec	Start	End	Event	Price	Cost	Priority	Display	Description	Author	Date	Qty	Char	Time
Party	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Plan	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Order	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Item	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Resource	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Process	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Lot	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Task	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Operation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*			
Compose						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Produce						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Consume						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Assign						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Relation						*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Location										*	*	*	*	*	*	*	*	*	*	*	*	*
Capacity										*	*	*	*	*	*	*	*	*	*	*	*	*
Progress										*	*	*	*	*	*	*	*	*	*	*	*	*
Spec										*	*	*	*	*	*	*	*	*	*	*	*	*
Start															*	*	*	*	*	*	*	*
End															*	*	*	*	*	*	*	*
Event															*	*	*	*	*	*	*	*
Price															*	*	*	*	*	*	*	*
Cost															*	*	*	*	*	*	*	*
Priority																				*	*	*
Display																				*	*	*
Description																				*	*	*
Author																				*	*	*
Date																				*	*	*
Qty																						
Char																						
Time																						

The following table B-2 shows the correspondence between elements and attributes. The row headers show the element name, and the column headers show attribute the name. The characters in the table represent data types. The character in the table are used as follows: “U” denotes identification character of element, “P” denotes an identification character of referencing elements, “S” denotes the character string, “D” denotes a decimal number, “N” denotes an integer number and “T” for date time. Boldface means required information.

Table B-2 Element and attribute relations

	id	key	name	parent	type	status	apply	condition	value	count	unit	base	party	plan	order	item	resource	process	lot	task	operation
Party	U	N	S	P	S	S							P	P	P	P	P	P	P	P	P
Plan	U	N	S	P	S	S							P	P	P	P	P	P	P	P	P
Order	U	N	S	P	S	S							P	P	P	P	P	P	P	P	P
Item	U	N	S	P	S	S							P	P	P	P	P	P	P	P	P
Resource	U	N	S	P	S	S							P	P	P	P	P	P	P	P	P
Process	U	N	S	P	S	S							P	P	P	P	P	P	P	P	P
Lot	U	N	S	P	S	S							P	P	P	P	P	P	P	P	P
Task	U	N	S	P	S	S							P	P	P	P	P	P	P	P	P
Operation	U	N	S	P	S	S							P	P	P	P	P	P	P	P	P
Compose	U	N	S		S	S	S						P	P	P	P	P	P	P	P	P
Produce	U	N	S		S	S	S						P	P	P	P	P	P	P	P	P
Consume	U	N	S		S	S	S						P	P	P	P	P	P	P	P	P
Assign	U	N	S		S	S	S						P	P	P	P	P	P	P	P	P
Relation	U	N	S		S	S	S						P	P	P	P	P	P	P	P	P
Location	U	N	S		S	S	S														
Capacity	U	N	S		S	S	S														
Progress	U	N	S		S	S	S														
Spec	U	N	S		S	S	S														
Start	U	N	S		S	S	S	S	S												
End	U	N	S		S	S	S	S	S												
Event	U	N	S		S	S	S	S	S												
Price	U	N	S		S	S	S	S	S												
Cost	U	N	S		S	S	S	S	S												
Priority			S		S	S	S	S	S												
Display			S		S	S	S	S	S												
Description			S		S	S	S	S	S												
Author			S		S	S	S	S	S												
Date			S		S	S	S	S	S												
Qty			S		S	S	S	S	S	D		N	S	D							
Char			S		S	S	S	S	S			N	S	S							
Time			S		S	S	S	S	T			N	S	T							

---

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Yukio Hamaguchi, Hitachi  
Tomoichi Sato, Individual  
Hiroaki Sasaki, Individual  
Tomoichi Sato, Individual  
Junzo Kato, PSLX Forum  
Hiroaki Machida, PSLX Forum

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## D. Revision History

Revision	Date	Editor	Changes Made
01		Y.Nishioka	