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Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities —
Part 13: Integrated planning for assets throughout their life-cycle

ABSTRACT:

This document specifies an ontology and schema for integrated life-cycle asset planning.

KEYWORDS:

industrial data, process plant, oil and gas, life-cycle, integration, asset, planning

COMMENTS TO READER:

The URIs for files that are part of this committee draft are not dereferencable. Instead the files are distributed as a package with this document.
Some classes are only valid for oil and gas facilities, but the standard can be used for other types of process plants. In this case the classes only valid for oil and gas facilities are not used.
This document has been reviewed using the internal review checklist, the project leader checklist and the convener checklist, and has been determined to be ready for this ballot cycle. The resolutions of the issues on the Committee Draft are contained in document N-????.

Project leader:	Lillian Hella	Part editor:	David Leal
	POSC Caesar Association		CAESAR Systems Limited
Mob:	+47 91 24 68 64	Mob:	+44 77 0702 6926
Email:	lillian.hella@posccaesar.org	Email:	david.leal@caesarsystems.co.uk

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electro technical Commission (IEC) on all matters of electro technical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75% of the member bodies casting a vote.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50% of the members of the parent committee casting a vote;

— an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed every three years with a view to deciding whether it can be transformed into an International Standard.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15926-13 was prepared by Technical Committee ISO/TC184, *Automation systems and integration*, Subcommittee SC4, *Industrial data*.

ISO 15926 is organized as a series of parts, each published separately. The structure of this International Standard is described in ISO 15926-1.

ISO 15926 consists of the following parts, under the general title *Industrial automation systems and integration — Integration of life-cycle data for oil and gas production facilities*:

— *Part 1: Overview and fundamental principles;*

— *Part 2: Data model;*

— *Part 3: Reference data for geometry and topology* [Technical Specification];

— *Part 4: Initial reference data* [Technical Specification];

— *Part 6: Methodology for the development and validation of reference data* [Technical Specification];

— *Part 7: Implementation methods for the integration of distributed systems: Template methodology* [Technical Specification];

— *Part 8: Implementation methods for the integration of distributed systems: Web Ontology Language (OWL) implementation* [Technical Specification];

— *Part 11: Methodology for simplified industrial usage of reference data* [Technical Specification];

— *Part 12: Life cycle integration ontology;*

— *Part 13: Integrated planning for assets throughout their life-cycle (ILAP).*

The following parts are under preparation:

— *Part 9: Implementation methods for the integration of distributed systems: Facade implementation;*

— *Part 10: Implementation·methods·for·the·integration·of·distributed·systems: Abstract·test·methods.*

Introduction

ISO 15926 is an International Standard for the representation of process industries facility life-cycle information. This representation is specified by a generic, conceptual ontology that is suitable as the basis for implementation in a shared database or data warehouse. This ontology is defined in ISO 15926-2, and has an OWL representation defined in ISO 15926-12. ISO 15926-2 and ISO 15926-12 are intended to be used as a foundation for domain specific extensions defined in other parts of ISO 15926.

The ontology is designed to be used in conjunction with reference data, i.e. standard instances that represent information common to a number of users, production facilities, or both. The support for a specific life-cycle activity depends on the use of appropriate reference data in conjunction with the ontology.

This part of ISO 15926 specifies an extension to the generic, conceptual ontology to support integrated planning for assets throughout their life-cycle, abbreviated as ILAP. The ontology is represented in OWL.

This part of ISO 15926 is intended to support the integration of planning data from different sources in a company database. This part of ISO 15926 also specifies an XML schema for a machine-readable exchange of integrated planning for assets throughout their life-cycle. Part of the scope relevant to the content maintained in planning and scheduling tools is defined in a view model. That view model has an xml representation for exchange between planning tools.

Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities — Part 13: Integrated life-cycle asset planning

1 Scope

This part of ISO 15926 specifies ontologies for the representation of asset planning data for process plants including oil and gas production facilities, and XML schemas for its exchange.

The following are within the scope of this part of ISO 15926:

— portfolio, programme and project plans and schedules;

— operational modification and ongoing maintenance plans and schedules;

— calendars for plan execution;

— constraints on the temporal relationships between items within plans and schedules, including succession link, lag, free and total float;

— activity breakdown structures;

— locations of activities

— resources required, including material, equipment and human resources, and their costs;

— work orders and operations;

— responsible organizations and people;

— progress tracking and resource usage;

— reference to standard classes of facility, activity and resource.

   EXAMPLE   Standard classes are defined in ISO 19008 "Standard Cost Coding System for oil and gas production and processing facilities".

The following are outside the scope of this part of ISO 15926:

— standard classes of facility, activity and resource;

   NOTE   The ISO 19008 Standard Cost Coding System contains such standard classes.

— plan simulation and optimisation;

— production planning;

— hazard identification and risk analysis;

— manning and training of personnel;

— work order, purchase orders and shipping information that are interfaces to other systems beyond scheduling software;

— budgeting and cost allocation.

2   Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15288, *Systems and software engineering — System life cycle processes.*

ISO 15926-12, *Industrial automation systems and integration — Integration of life-cycle data for oil and gas production facilities — Part 12: Life cycle integration ontology.*

ISO 21500, *Guidance on project management.*

OWL 2 Web Ontology Language Document Overview (Second Edition), W3C Recommendation 2012-12-11, http://www.w3.org/TR/owl2-overview/.

PMI. (2007). *The Practice Standard for Scheduling*. Project Management Institute, Newtown Square, PA.

Terse RDF Triple Language (TURTLE), W3C Recommendation 2014-02-25, http://www.w3.org/TR/turtle/.

Unified Modeling Language™ (UML), OMG Specification, http://www.uml.org/#UML2.0.

XML Schema Part 1: Structures Second Edition, W3C Recommendation 2004-10-28, http://www.w3.org/TR/xmlschema-1/.

3   Terms, definitions, abbreviations and symbols

3.1   Terms and definitions

For the purposes of this document, the following definitions apply.

3.1.1
activity
something happening or changing

[SOURCE: ISO 15926-12, modified from the definition of the class **activity**]

NOTE 1 The ISO 15288:2015 definition of "activity" as "set of cohesive tasks of a process" implies a hierarchy in which processes contain activities, and activities contain tasks. Within this part of ISO 15926, all are activities.

NOTE 2 The PMI definition states that "activity" is an element of work performed during the course of a project. An activity normally has an expected duration, an expected cost, and expected resource requirements. Activities can be subdivided in tasks.

3.1.2
baseline schedule
the approved version of a schedule model that can be changed using formal change control procedures and is used as the basis for comparison to actual results.

[SOURCE: PMI Lexicon of Project Management Terms–Version 3.0]

NOTE 1 A baseline schedule is a specialisation of the ISO 15288:2015 and IEEE Std 828-2012 definition of "baseline" as "formally approved version of a configuration item, regardless of media, formally designated and fixed at a specific time during the configuration item's life cycle".

3.1.3
calendar
pattern of working days and shifts that are available for scheduled activities

3.1.4
current schedule
schedule of the planned activity that is currently specified as the revised and agreed working schedule to avoid adverse schedule impacts

NOTE ISO 21500 emphasizes "to avoid adverse schedule impact", so it does not formally define current schedule.

3.1.5
decision gate
approval activity where continuation beyond the decision gate is contingent on the agreement of the decision-makers

[SOURCE: The SEBOK definition based on ISO/IEC 15288:2015]

NOTE 1 A decision gate is often associated with a review meeting.

NOTE 2 Criteria for continuation of abandonment are established for each decision gate.

3.1.6
early finish
the earliest possible point in time when the uncompleted portions of the activity can finish based on the schedule

[SOURCE: PMI Lexicon of Project Management Terms–Version 3.0]

3.1.7
early start
the earliest possible point in time when the uncompleted portions of the activity can start based on the schedule

[SOURCE: PMI Lexicon of Project Management Terms–Version 3.0]

3.1.8
finish to finish
successor relationship in a plan that is from the finish of one activity to the finish of the next

3.1.9
finish to start
successor relationship in a plan that is from the finish of one activity to the start of the next

3.1.10
free float
period of time into which an activity in a plan can overrun without causing a delay to subsequent activities in the plan

3.1.11
frontline date
the date on which the achieved progress on an activity was scheduled

3.1.12
lag
period in time that is specified for a plan succession link

NOTE   This corresponds to the attributes "lead" and "lag" which are defined in ISO 21500:2012.

3.1.13
late finish
the latest point in time that an activity can finish based on the schedule

3.1.14
late start
the latest point in time that an activity can start based on the schedule

3.1.15
live schedule
schedule that has been revised from the current schedule to mitigate any delays

3.1.16
maintenance programme
managed programme of work that ensures the continued safe and reliable operation of a facility, system or equipment

3.1.17
managed programme of work
activity that contains management and planning for the whole

3.1.18
milestone
significant event in a project, program of work, or portfolio.

[SOURCE: PMI Lexicon of Project Management Terms–Version 3.0]

3.1.19
ontology
formal statement of an understanding of the world

NOTE 1   An ontology can be represented in any language. It need not be represented in a language specifically designed for ontologies, such as OWL. An ontology can have different representations.

NOTE 2   An ontology does not specify what data shall be recorded about the world.

NOTE 3   The ontology defined by this part of ISO 15926 is principally concerned with the world outside a computer system. Other ontologies, "IT ontologies", can be about data.

[ISO 15926-12]

3.1.20
organizational unit
grouping of resources to which an activity can be allocated for execution

3.1.21
plan
specification of how an activity shall be done

NOTE 1   A plan can include the following:
— a breakdown into component activities;
— resources required by component activities;
— durations of component activities;
— required dates for milestones;
— succession relationships and lags between component activities;
— calendars for activities, resources and lags;
— start and end dates for component activities.

NOTE 2   An unscheduled plan does not contain start and end dates for component activities. A schedule does contain standard and end dates for component activities.

NOTE 3   Plan corresponds to the term design (noun) defined in ISO 15288:2015, where the design is for an activity rather than for a system or system element.

NOTE 4   ISO 55000 defines "plan" as "detailed formulation of a programme to achieve an objective". This definition is consistent, but in this part of ISO 15926, a plan can be more or less detailed.

NOTE 5   PMI defines "project management plan" as "the document that describes how the project will be executed, monitored and controlled, and closed."

3.1.22
plan succession link
succession relationship between one activity or milestone and the next in a plan

NOTE   A plan succession link has the attributes "lead" and "lag" which are defined in ISO 21500:2012.

3.1.23
planning
activity that is creating a plan

NOTE   Planning corresponds to the term design (verb) defined in ISO 15288:2015, where it is a plan for an activity, rather than a design for a system or system element, that is created.

3.1.24
portfolio plan
document that specifies how a portfolio will be organized, monitored and controlled.

[SOURCE: PMI Lexicon of Project Management Terms–Version 3.0]

3.1.25
programme plan
document that integrates the program's subsidiary plans and establishes the management controls and overall plan for integrating and managing the programs individual components.

[SOURCE: PMI Lexicon of Project Management Terms–Version 3.0]

3.1.26
project
endeavour with defined start and finish criteria undertaken to create a product or service in accordance with specified resources and requirements

[SOURCE: ISO 15288:2015]

NOTE 1   A continuing operational activity is not a project.

NOTE 2   A project has a beginning and end, and can be constrained by available time, funding and resources.

NOTE 3   In many cases an activity that is planned consists of parts of different projects with different objectives. Therefore the activity is not a project

NOTE 4   Product here is a result of the project activity, not directly related to Product Breakdown Structure.

3.1.27
resource
individual that is used to perform an activity

NOTE   A resource can be material or staff time or equipment.

3.1.28
revised schedule
schedule that has been revised from the current schedule

3.1.29
revision shutdown
shutdown that is in order to make a change to a production activity

3.1.30
schedule
specification of an activity that contains all that is required as a basis for execution, and that specifies start and end dates for component activities

NOTE 1   A schedule is the end product of a planning activity at a point in time. A schedule can be revised as a project progresses.

NOTE 2   A schedule includes calendars, succession relationships, and all other constraints.

3.1.31
start to finish
successor relationship in which a successor activity cannot finish until a predecessor activity has started.

3.1.32
start to start
successor relationship in which a successor activity cannot start until a predecessor activity has started

3.1.33
subject of work
physical object that an activity is carried out upon

3.1.34
target schedule
schedule that is used to measure project progress

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3.1.35
total float
period of time into which an activity in a plan can overrun without causing a delay to the completion of the plan as a whole

3.1.36
unscheduled plan
plan that does not contain start and end dates for component activities

NOTE 1   A plan for activity can include the following:
— a breakdown into component activities;
— resources required by component activities;
— durations of component activities;
— required dates for milestones;
— succession relationships and lags between component activities;
— calendars for activities, resources and lags.

NOTE 2   A schedule does contain start and end dates for component activities.

3.1.37
work order
managed programme of work that contains a request from one party to another for one or more activities to be performed

3.1.38
work breakdown structure dictionary
set of classes of activity that is intended to describe each component in a work breakdown structure

[SOURCE: ISO 21500:2012, modified by replacing "document that describes" with "set of classes of activity that is intended to describe"]

3.1.39
work package
is a collection of activities that is documented as a single whole. The documentation can include timings and resources.

3.2   Abbreviated terms

COR   Code Of Resources

EF   Early Finish

ES   Early Start

FF   Finish to Finish

FS   Finish to Start

LF   Late Finish

LS   Late Start

OMG   Object Management Group, is an international, open membership, not-for-profit technology standards consortium, founded in 1989

OWL   Web Ontology Language

PBS   Physical Breakdown Structure

RDF   Resource Description Framework

RDL   Reference Data Library

SAB   Standard Activity Breakdown

SAWSDL   Semantic Annotations for WSDL and XML Schema

SCCS   Standard Cost Coding System

SF   Start to Finish

SS   Start to Start

TURTLE   Terse RDF Triple Language

UML   Unified Modeling Language

URI   Uniform Resource Identifier

UTC   Coordinated Universal Time

W3C   The World Wide Web Consortium is an international community where Member organizations, a full-time staff, and the public work together to develop Web standards.

XML   eXtensible Mark-up Language

XSD   XML Schema Definition

3.3   Symbols

This part of ISO 15926 contains examples with diagrams which show instantiations of ISO 15926. The concise notation is used for these diagrams as defined in Figure 1.
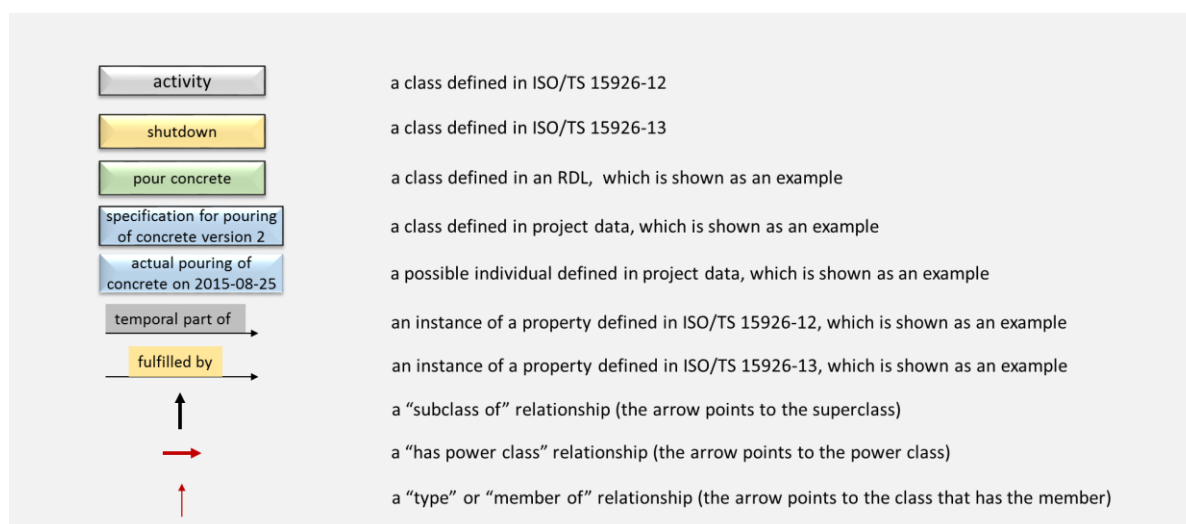
Figure 1: Notation for the ISO 15926 instantiation examples

NOTE 1   ISO 15926-12 implements the ISO 15926-2 entities **composition of individual** and **class of composition of individual** by object properties in OWL. The naming convention for these object properties is shown in Figure 2.
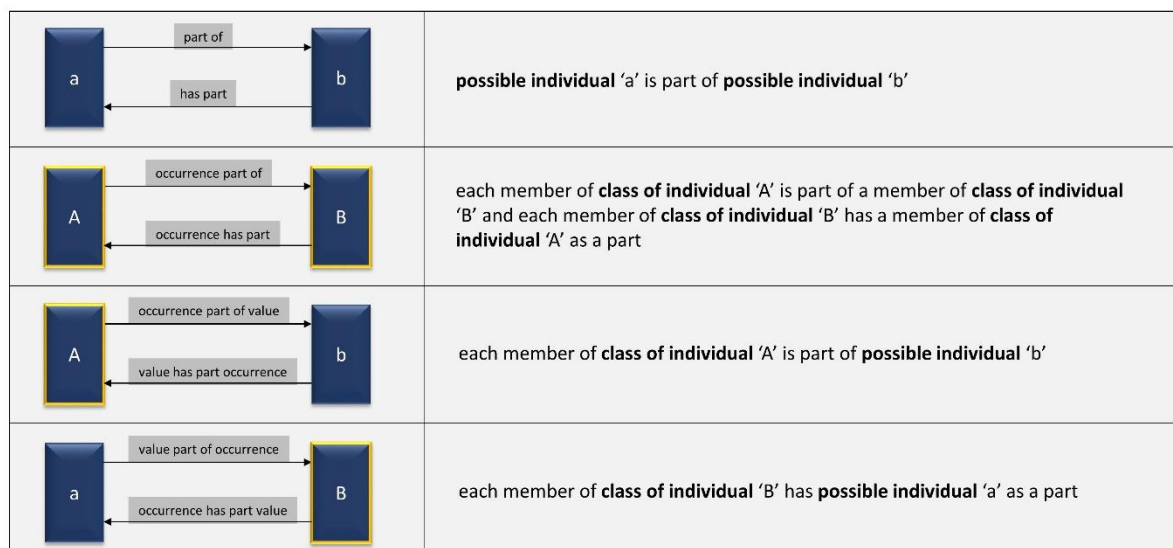
Figure 2: Naming convention for composition and class of composition

The naming convention is used as follows:

— the **activity** 'actual pouring of concrete for the refurbishment of facility F-101' has **part of** relationship with the **activity** 'actual refurbishment of facility F-101'

— the **plan for activity** (a class) 'plan for pouring of concrete for the refurbishment of facility F-101 version 2' has an **occurrence part of** relationship with the **plan for activity** 'plan for the refurbishment of facility F-101 version 2'.

The use of the properties is shown in Figure 3.
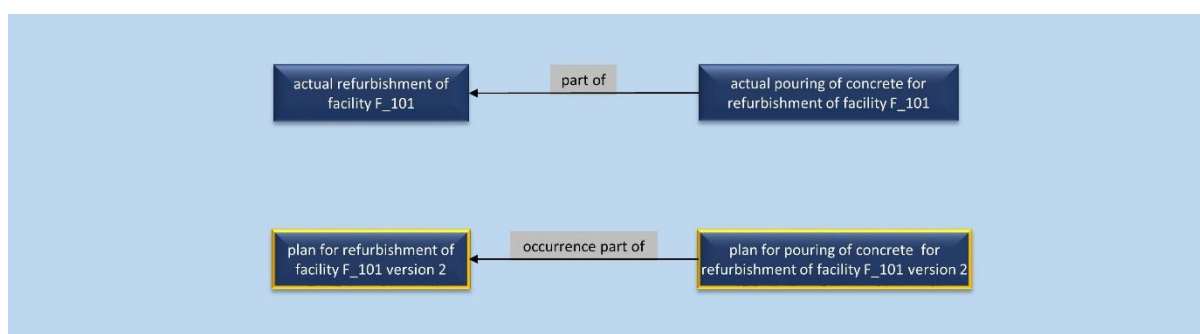
Figure 3: Use of composition properties

NOTE 2   The relationship:

	A	*occurrence part of value*	b

is identical to the relationship:

	A	*occurrence part of*	{b}

Similarly the relationship:

	a	*value part of occurrence*	B

is identical to the relationship:

	{a}	*occurrence part of*	B

Shorthand forms of the relationships between a class and an individual are provided to that it is not necessary to define singleton classes.

4 Layers and extension of integrated lifecycle asset planning data

4.1 Layers for integrated lifecycle asset planning data

The approach to integrated lifecycle asset planning data defined by this part of ISO 15926 has the layers shown in Figure 4.
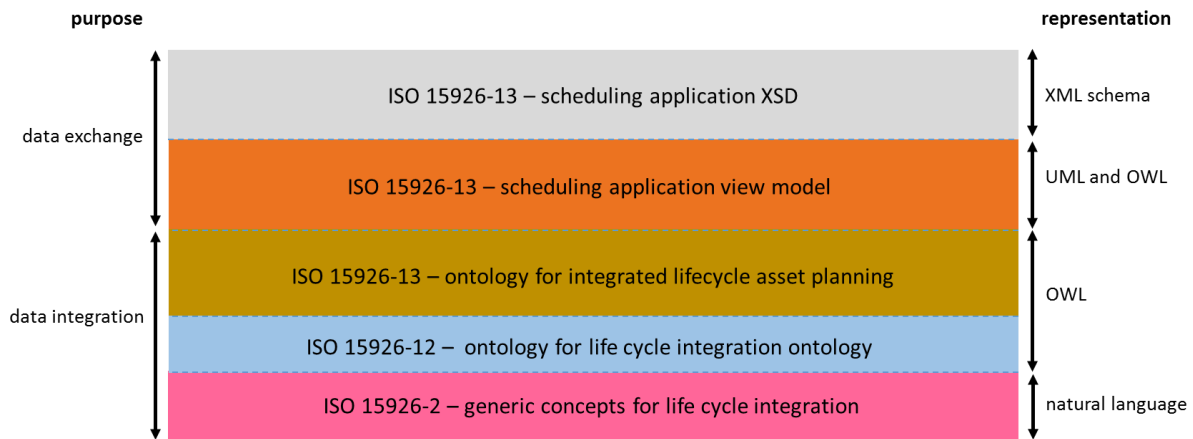
Figure 4: Layers for integrated lifecycle asset planning

These layers are as follow:

— ISO 15926-2 defines the concepts that support the representation of engineering data throughout its lifecycle.

— ISO 15926-12 represents the concepts defined in ISO 15926-2 using OWL.

— The ISO 15926-13 ontology extends ISO 15926-12 with additional concepts required for planning.

This ontology can be used to define a database of planning data.

— The ISO 15926-13 scheduling application view model defines an external view of planning data that is appropriate for scheduling applications. This view model has a limited scope with a defined set of properties.

The view model is expressed as UML diagrams, and in a scheduling application view ontology. This view ontology defines classes with epistemological constraints and template properties that hide objects which are not part of the view.

— The ISO 15926-13 scheduling application XML schema defines a physical file format for exchange between scheduling applications or between a scheduling application and a data base of planning data. The XML schema is derived by algorithm from the OWL representation of the scheduling application view model.

4.2 The documentation of the layers

The documentation of the layers, starting at the bottom of Figure 4, is as follows:

ontology for integrated lifecycle asset planning: The planning ontology is described in clause 5. This clause contains numerous examples. The planning ontology in OWL (serialised in TURTLE) is on the Web with a link in Annex C.

The classes and properties in the ontology are also listed in clause 7 and 8.

scheduling application view model: The scheduling application view is described in clause 6. Although the scope of the ontology within this part of ISO 15926 is greater than that of the view, this clause can serve as an introduction to this part of ISO 15926 as a whole. The data planning diagrams in clause 6.4 are especially useful as an introduction.

The template properties in the scheduling application view are listed in clause 7. The OWL ontology for the scheduling application view is on the Web with a link in Annex C.

scheduling application XML schema: The scheduling application XML schema is derived from the scheduling application view ontology. The scheduling application XML schema is on the Web with a link in Annex D.

4.3   Use of the layers

The layers are used as follows:

exchange of data: Data can be exchanged as a document using the scheduling application XML schema, or as a serialisation of data recorded using the scheduling application view model ontology.

NOTE 1   Possible serialisations formats for data recorded using the ontology include TURTLE and JSON.

sharing of data: Data can be shared by database implementations of the ontology for integrated lifecycle asset planning.

NOTE 2   Data recorded using the ontology can be held in a triple store.

NOTE 3   Usage scenarios are discussed in Annex E.

4.4   Extensions for particular engineering applications

The classes and relationships defined in ISO 15926-2 and this part of ISO 15926 may be extended for particular engineering applications.

NOTE 1   Extensions can be defined in other standard or community ontologies.

EXAMPLE 1   ISO 15926-4 defines "meter" and "pump", which are specialisations of the generic class "physical object" defined in ISO 15926-2. The class "pumping equipment" is an extension, which is defined in the ISO 19008 Standard Cost Coding System.

For an OWL implementation of this part of ISO 15926, an extension for a particular engineering application may be contained in an imported ontology that has been integrated with ISO 15926 in accordance with ISO 15926-6.

NOTE 2   Extensions for the process industry defined in ISO 15926-4 are already integrated with ISO 15926-2. Extensions defined in other standards will need to be integrated with ISO 15926 by the user. Quality requirements for the integration of an ontology that extends ISO 15926 are defined in ISO 15926-6.

EXAMPLE 2   ISO 15926-6 requires that each class is a subclass of a class defined within ISO 15926-2. This give a basic level of quality. An imported ontology for human resources has the classes "stress engineer", "piping

engineer", and "instrumentation engineer". Integration would make these classes subclasses of **person**. This would prevent incorrect use of these classes to classify a member of **activity** or **inanimate physical object**, because these classes are disjoint with **person**.

For an XML implementation of this part of ISO 15926, an extension for a particular engineering application may be referenced as an **externally defined class** or **externally defined property**.

4.5   Simplification for a scheduling application view

The scheduling application view model is a representation of the data at a particular instant in time.

NOTE 1   The view model is a simplification of the full ontology for the integration of lifecycle asset planning, which has been obtained by removing objects that are needed to record how data changes with time.

Two instantiations of the scheduling application view model for different times cannot be merged unless the data is transformed into a representation according to the full ontology for the integration of lifecycle asset planning. This is because the objects that distinguish between the different times are not part of the view model.

The scheduling application view model contains template view properties which:

—   impose epistemological constraints to ensure that the data is complete for a scheduling application;

—   hide objects in the ontology for the integration of lifecycle asset planning that are unnecessary for the scheduling application.

EXAMPLE   A required **activity** has the template view property **activity has actual current percentage complete**. The **activity** "pouring of concrete for refurbishment of facility F_101" has a percentage complete of 50% on 2015-11-05T18:00 and of 80% complete on 2015-11-06T18:00. These two different percentages complete can be recorded in two different instantiations of the scheduling application view model. A single instantiation of the scheduling application view model is shown in Figure 5.
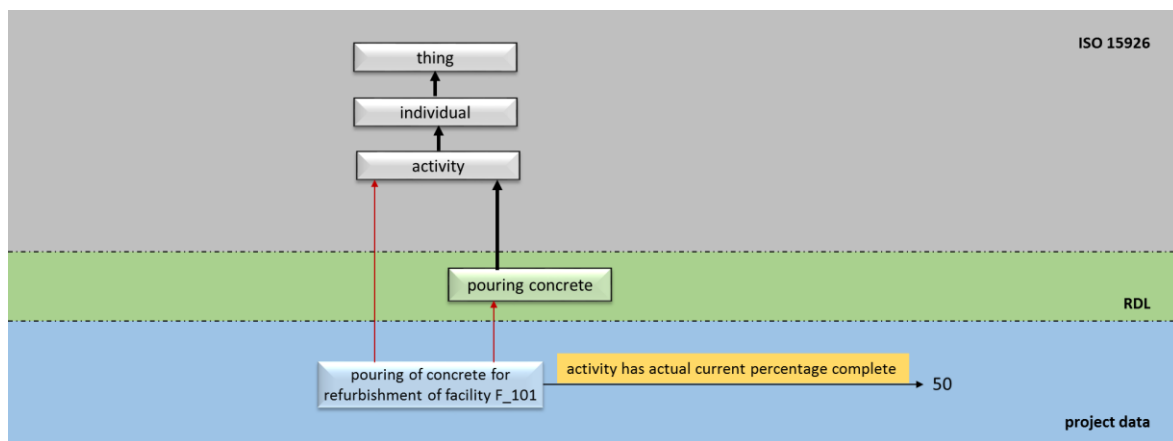
Figure 5: An instantiation of the scheduling application view model

In order to record the two percentages complete within a single database, it is necessary to use the full ontology. The full ontology records that the required **activity** "required pouring of concrete for refurbishment of facility F_101" specified in the **schedule** is realised by an actual **activity** "actual pouring of concrete for refurbishment of facility F_101" which has different temporal parts terminating at 2015-11-05T18:00 and 2015-11-06T18:00 with different percentages complete. This is shown in Figure 6.
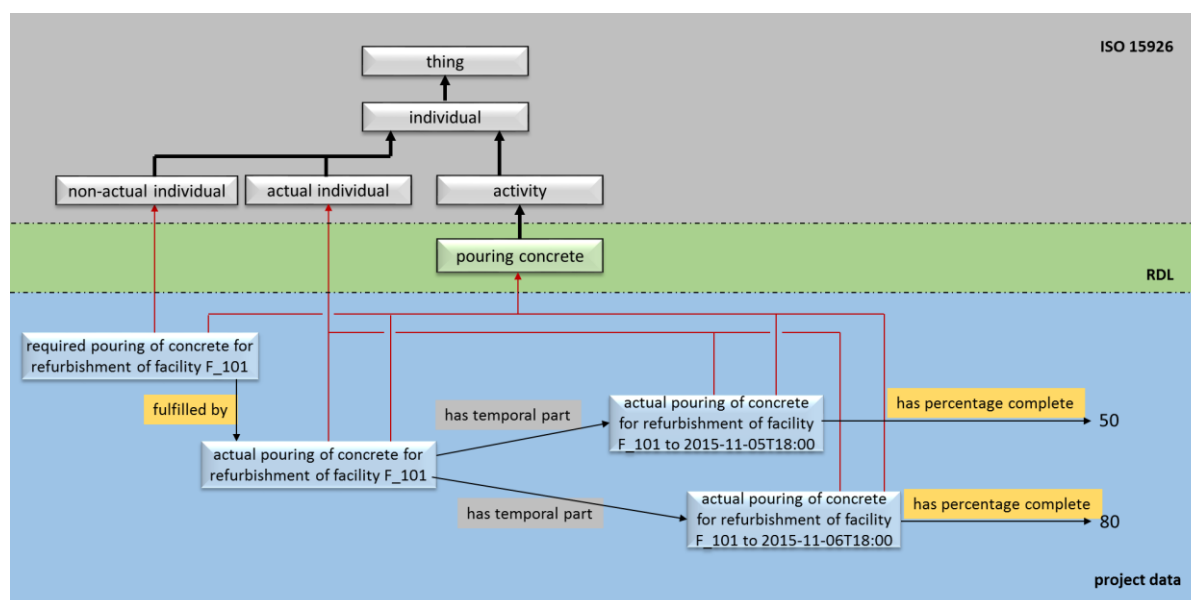
Figure 6: Percentage complete changes with time

5   Representation of planning data

5.1   Basis of the approach

Planning data is about intended **activities** and their **specifications**, and about the recording of progress on the actual **activities** that fulfil the required **activities**.

The **specification** for a required activity has versions. A version of a **specification** is contained within a **schedule**.

The **specification** for a required **activity** specifies its parts, the interrelationships between the parts and the **resources** for the **activities**.

EXAMPLE   The required **activity** "refurbishment of facility F-101" is defined by **specification** "specification for the refurbishment of facility F-101 version 2". This **specification** is contained within the **schedule** "schedule for the refurbishment of facility F-101 version 2.3".

The required **activity** "intended refurbishment of facility F-101" has the required parts "intended construction of foundations for refurbishment of facility F-101" and "required erection of steelwork for refurbishment of facility F-101". These part **activitie**s have **specifications** which are parts of the **specification** of the whole.

The objects and relationship are shown in Figure 7.
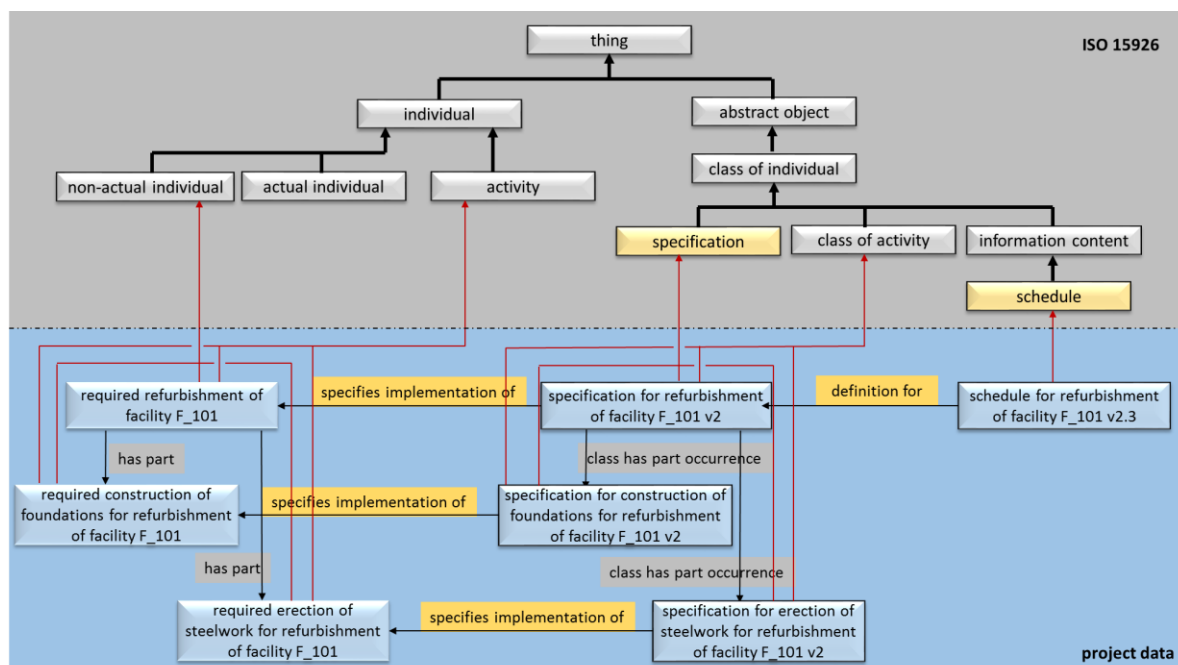
Figure 7: Required activity, specification and parts

In Figure 7, the subclass relationships between the **specifications** and the class **activity** are not shown. The relationship **specifies implementation of** states that a proposed implementation of the requirement is a member of the class. The proposed implementation can be recorded explicitly if required, as shown in Figure 8.
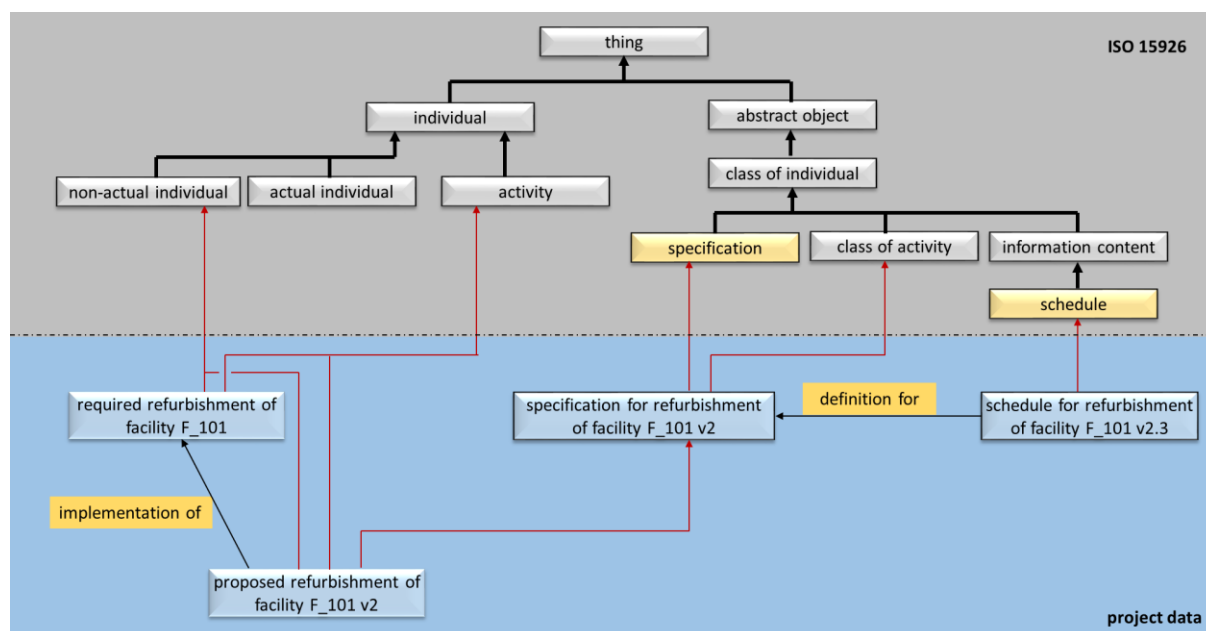
Figure 8: Required activity, proposed implementation and specification

A single required **activity** may have different **specifications** contained in different **schedules**. Specifications may be updated as the actual **activity** that fulfils the requirement progresses.

An actual **activity** may be performed in accordance with a **specification**. This is shown in Figure 9.
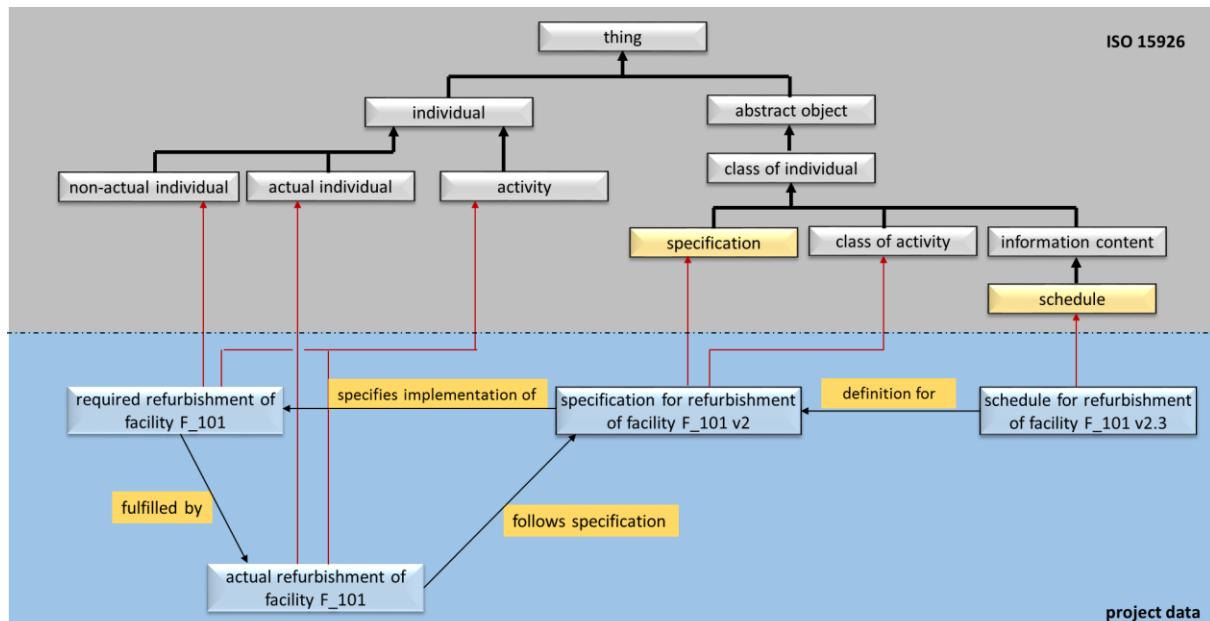
Figure 9: Required activity, actual activity and specification

5.2 Fundamental planning objects

5.2.1 Objective of planning

A **planning** activity begins with a required **individual**. The required **individual** is something that is required to exist in the future. The **planning** is intended to define and control an **activity** that creates it.

NOTE   The required **individual** is usually a **physical object**. It can be a new **physical object** or a new state of an existing **physical object**.

EXAMPLE   UG Oil wishes to upgrade the existing natural gas processing system on platform UGE-1 from a capacity of 100 million ft^3 per day to a capacity of 180 million ft^3 per day.

UGE-1 with the increased capacity is a required future state. There is a required future upgrade activity that is intended to create this state. There is a **planning** activity that has the required future state as its objective.

The objects that record the required future state, the required **activity** to create it, and the **planning** activity are as follows:

— 'UGE-1': a **whole life asset** and **actual individual**;

— 'UGE-1 with increased natural gas capacity': a **state of asset** and a **non-actual individual**;

— 'UGE-1 natural gas capacity upgrade': an **activity**, **whole life individual** and **non-actual individual**;

— 'planning for UGE-1 natural gas capacity upgrade': a **planning** activity, **whole life individual** and **actual individual**.

These objects, with their classifications and relationships, are shown in Figure 10.
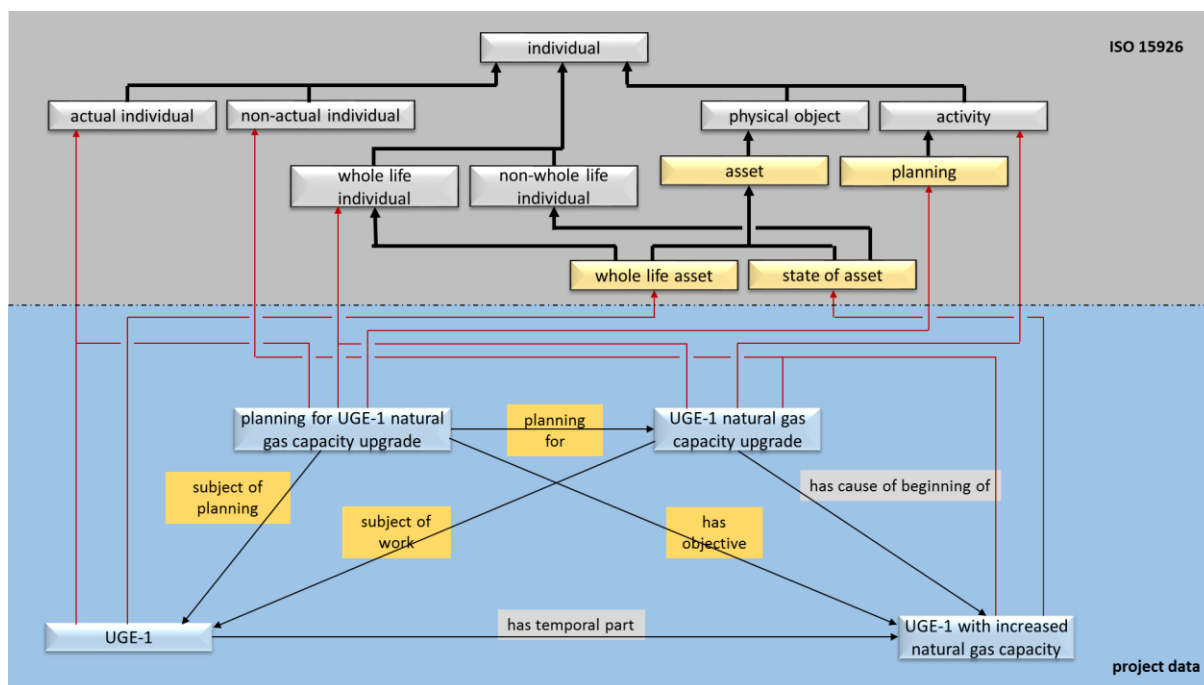
Figure 10: Objective of planning

5.2.2 Required or proposed activity and specification

A required or proposed **activity** is defined by its relationships and classifications.

EXAMPLE 1   UG Oil wishes to upgrade the natural gas processing system on platform UGE-1 from a capacity of 100 million ft^3 per day to a capacity of 180 million ft^3 per day by the end of November 2016.

This statement of requirements can be split into:
— the required **activity**: "UGE-1 natural gas capacity upgrade" is completed before the end of November 2016;
— the required **activity** creates a required **state of asset** that is:
  – a **temporal part of** platform UGE-1';
  – has a natural gas processing capacity of 180 million ft^3 per day.

This statement of requirements is shown diagrammatically in Figure 11.
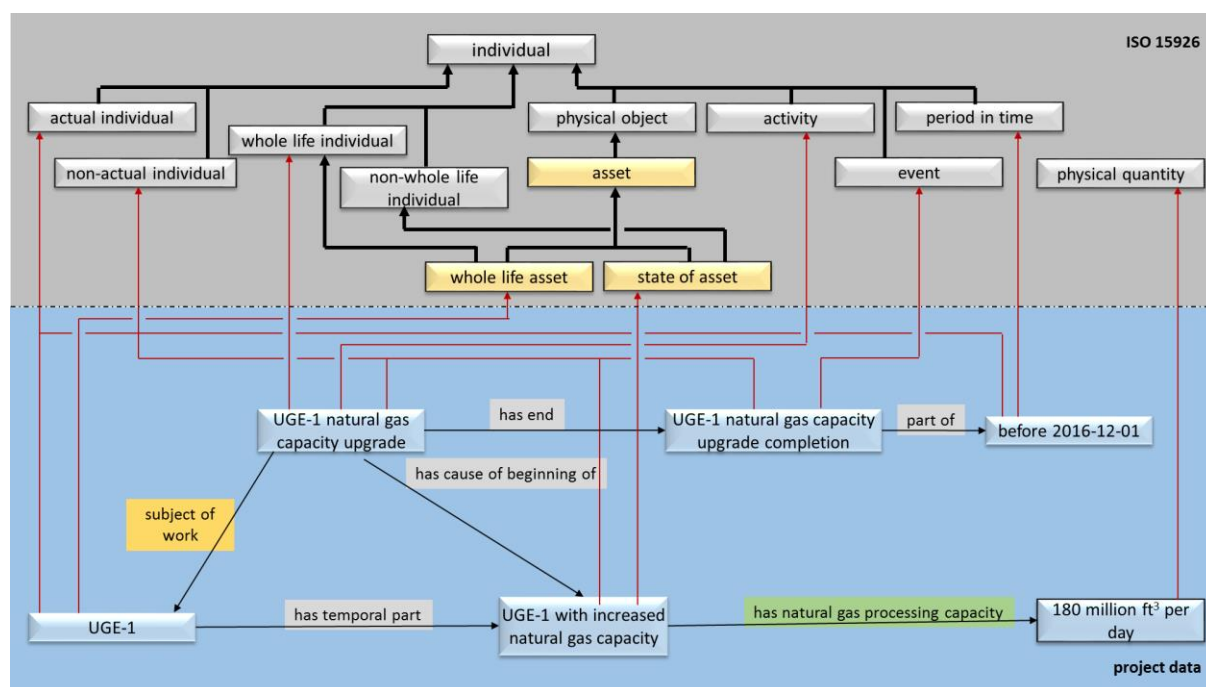
Figure 11: Requirements for an activity

A **specification** expresses the relationships and classifications that define a required or proposed **activity** as a single classification.

NOTE   The expression of the definition of a required or proposed **activity** as a single classification simplifies the representation of multiple versions of a definition.

As planning progresses, proposed **activities** that implement a requirement are defined. A **specification** for a proposed **activity** may contain:

— a breakdown of the overall **activity** into parts;

— a classification of the part **activities** with respect to a **work breakdown structure**;

— **resources** required by the part activities, and their classification with respect to a **resource breakdown structure**;

— succession dependencies between part **activities**;

— proposed start and end times for the part **activities**.

EXAMPLE 2   UG Oil wishes to upgrade the natural gas processing system on platform UGE-1. The initial proposal increases the capacity from 100 million ft^3 per day to a 180 million ft^3 per day by the end of November 2016. Subsequently there is a new proposal to increase the capacity to 200 million ft^3 per day by the end of December 2016.

There are two specifications as follows:

— **specification** version 1 that is the subclass of:
   – activity completed before the end of November 2016;
   – activity that creates a state of UGE-1 with a natural gas capacity of 180 million ft^3 per day.

— **specification** version 2 that is the subclass of:
   – activity completed before the end of December 2016;

– activity that creates a state of UGE-1 with a natural gas capacity of 200 million ft^3 per day.

There is a **has successor** relationship between the two specifications. The objects and their relationships are shown in Figure 12.
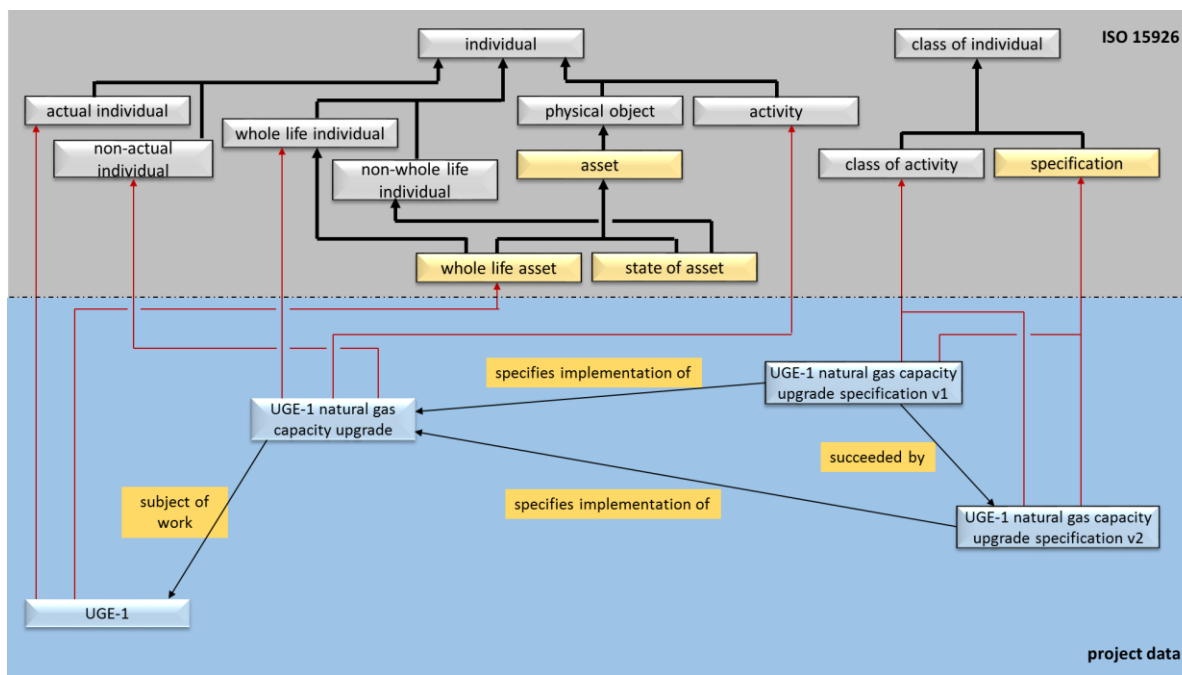
Figure 12: Specifications and versions

5.2.3   Alternative specifications

Alternative proposed **activities** can be defined for a required **activity**. Each proposed **activity** has a **specification**. There is a **has alternative** relationship between two alternative **specifications**.

EXAMPLE   Two alternative **specifications** are produced for the UGE-1 natural gas capacity upgrade to 200 million ft^3 per day by the end of December 2016 – specification version 2a and specification version 2b. Subsequently version 2b is issued as a part of **schedule** version 2.3.

There is a **has alternative** relationship between the two specifications. The objects and their relationships are shown in Figure 13.
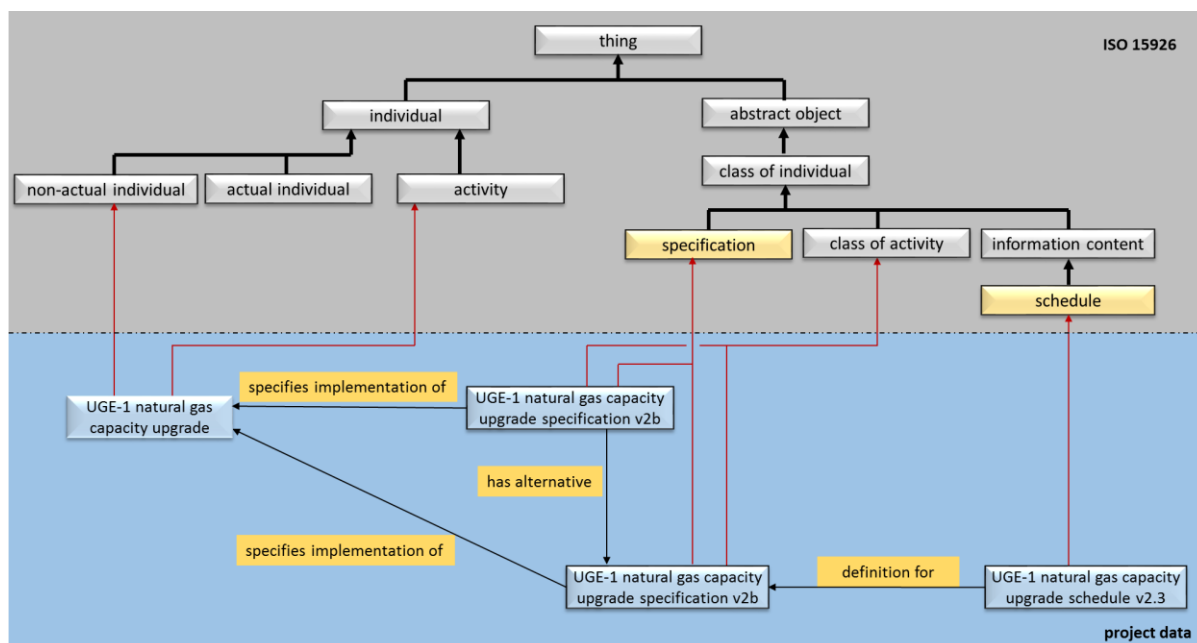
Figure 13: Alternative specifications

5.3 Schedule

5.3.1 Definition of a schedule

A **schedule** is **information content** that is defines the work to be done. A **schedule** defines the **specification** of a proposed **activity**.

NOTE 1   A **schedule** can be part of a contract and can contain other information that is relevant to the performance of the contract.

NOTE 2   A **schedule** can contain person readable documents, structured content such as spreadsheets, and formal content defined by standards such as this part of ISO 15926.

A **schedule** and a **specification** that is defined by it are created by a **planning** activity.

NOTE 3   Within an overall **planning** activity, a **schedule** and a **specification** can be created by different people at different times.

EXAMPLE   The **planning** activity "planning for the UGE-1 natural gas capacity upgrade" creates the **specification** version 2 of the work to be done in June 2016. This **specification** is included within **schedule** version 2.3, which is created in July 2016. The objects and their relationships are shown in Figure 14.
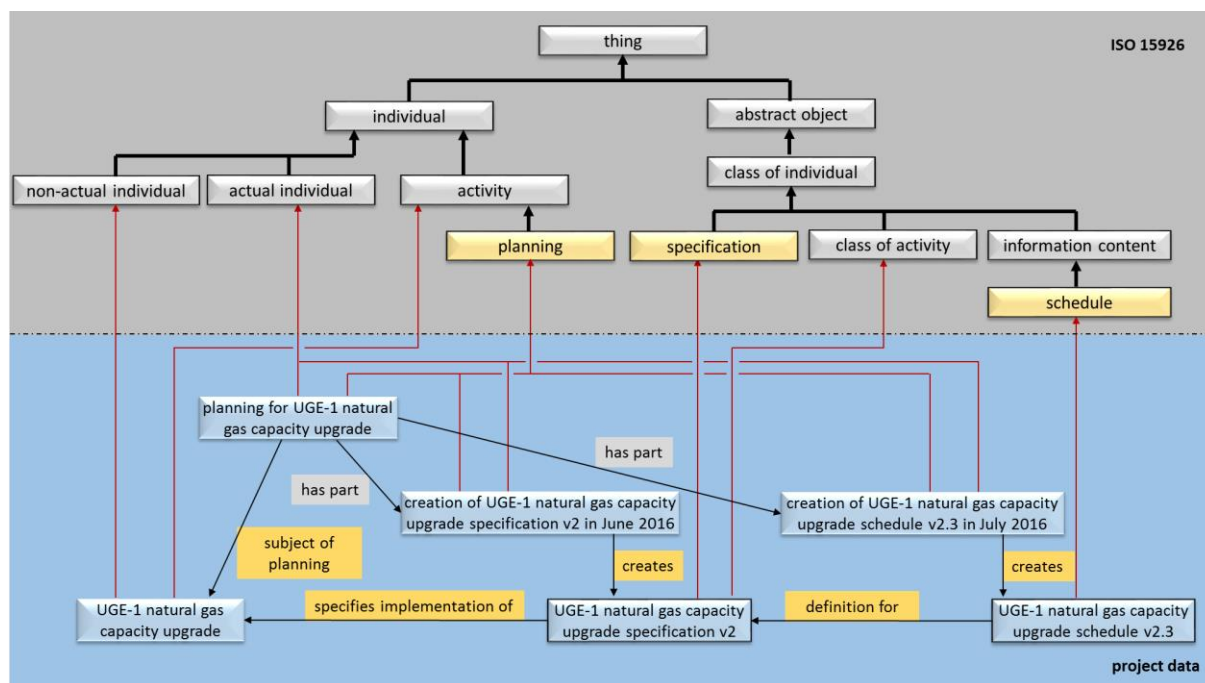
Figure 14: Creation of a specification and schedule

5.3.2 Level of a schedule

A schedule exists at different levels in the planning process, and is classified according to its level.

NOTE   Schedule levels are not standardised in this part of ISO 15926, but can be defined in a Reference Data Library. Common schedule levels and their use are described in Annex **Error! Reference source not f ound.**.

EXAMPLE 1   In EXAMPLE 1 of this clause, the schedule version 2.3 is created in July 2016. This schedule is a level 3 "project coordination schedule". This is shown in Figure 15.
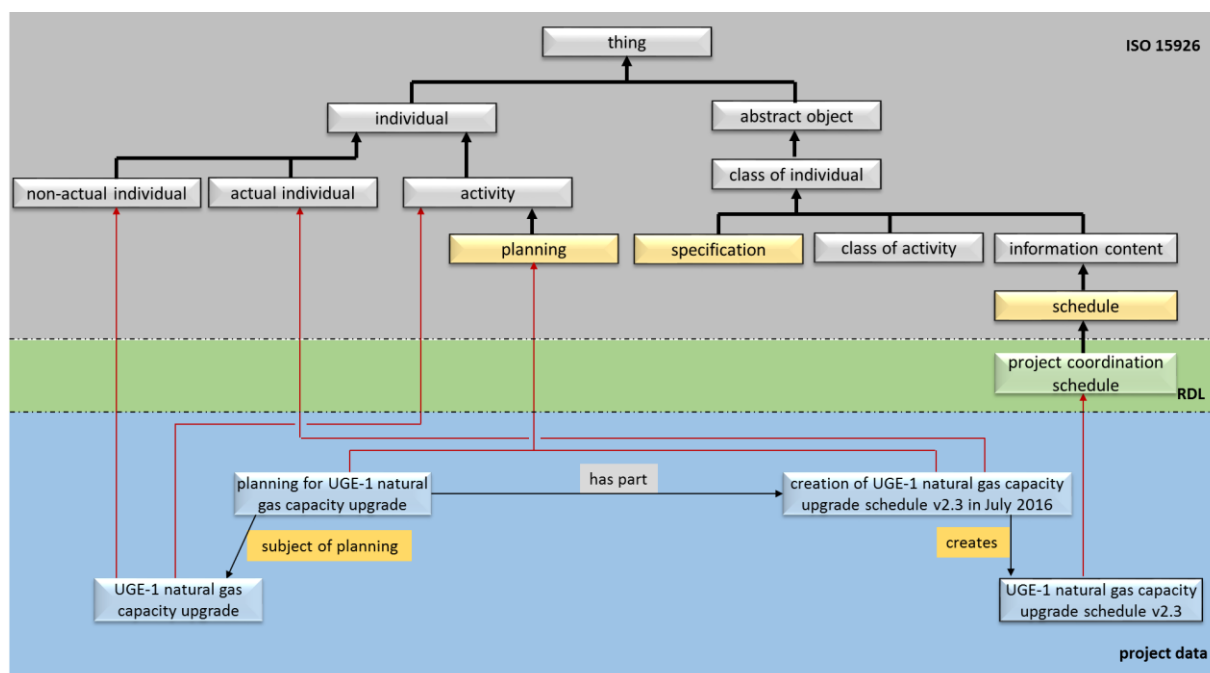
Figure 15: Classification of a schedule by level

Subclasses of schedule according to level, which are defined in a Reference Data Library are classified as members of **schedule level**.

EXAMPLE 2   The subclasses of schedule "project master schedule", "project summary schedule" and "project coordination schedule" are all members of schedule level. This is shown in Figure 16.
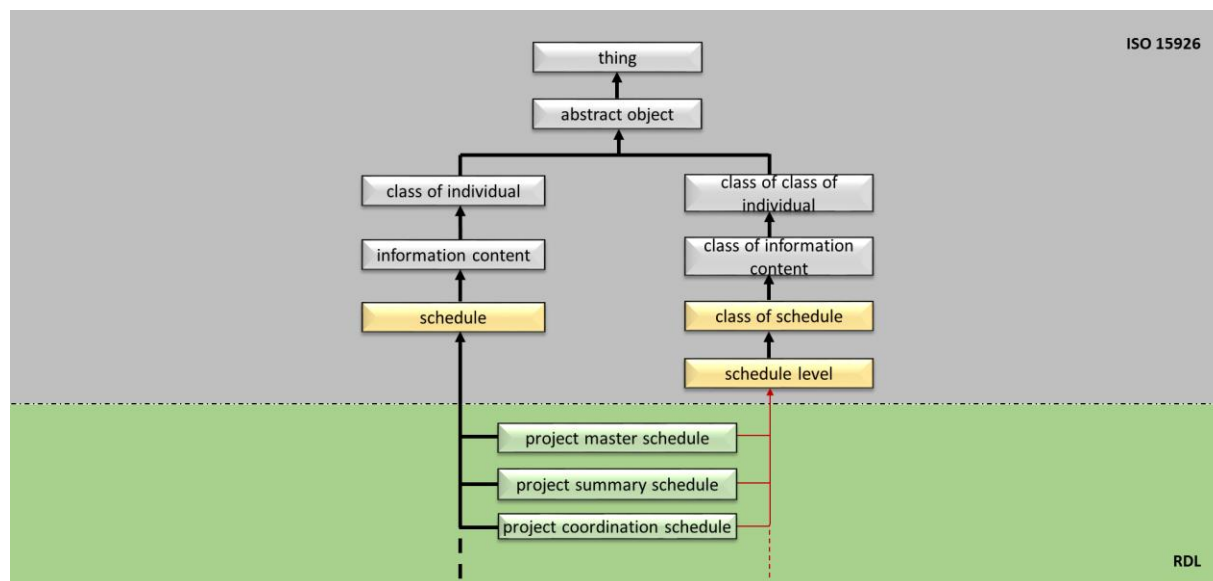
Figure 16: Schedule level

A **schedule** that is specified to a level of detail appropriate for inclusion within a work order is a **schedule for work order**.

5.3.3   Role of a schedule

Different **schedules** have different roles with respect to a **planning** activity. A role is indicted by the relationship between the **planning** activity and the **schedule**. The following roles are defined by this part of ISO 15926:

—— **has baseline schedule**;

—— **has current schedule**.

NOTE 1   Other roles can be defined within a Reference Data Library. Common roles include:

—— has revised schedule;

—— has live schedule.

A **schedule** does not always play the same role. The **schedule** does not change, but instead it is the **planning** activity that changes. Therefore, the role is stated by the relationship with the **planning** activity.

NOTE 2   A relationship, such as **current schedule**, is usually with a temporal part of the overall **planning** activity.

EXAMPLE   The 'UGE-1 natural gas capacity upgrade schedule version 2.3'' is set as the baseline by the planning activity on 1st July 2016 and is initially both current and the baseline. It replaces as the current schedule by version 2.4 on 13th September 2016. Objects are as follows:

— 'planning for UGE-1 natural gas capacity upgrade': a **planning** activity and an **actual individual**;

— 'planning for UGE-1 natural gas capacity upgrade from 1st July 2016': a **planning** activity and an **actual individual**;

— 'planning for UGE-1 natural gas capacity upgrade from 1st July to 13th September': a **planning** activity and an **actual individual**;

— 'planning for UGE-1 natural gas capacity upgrade from 13th September': a **planning** activity and an **actual individual**;

— 'UGE-1 natural gas capacity upgrade schedule version 2.3': a **schedule**;

— 'UGE-1 natural gas capacity upgrade schedule version 2.3': a **schedule**.

These objects, with their classifications and relationships, are shown in Figure 17.
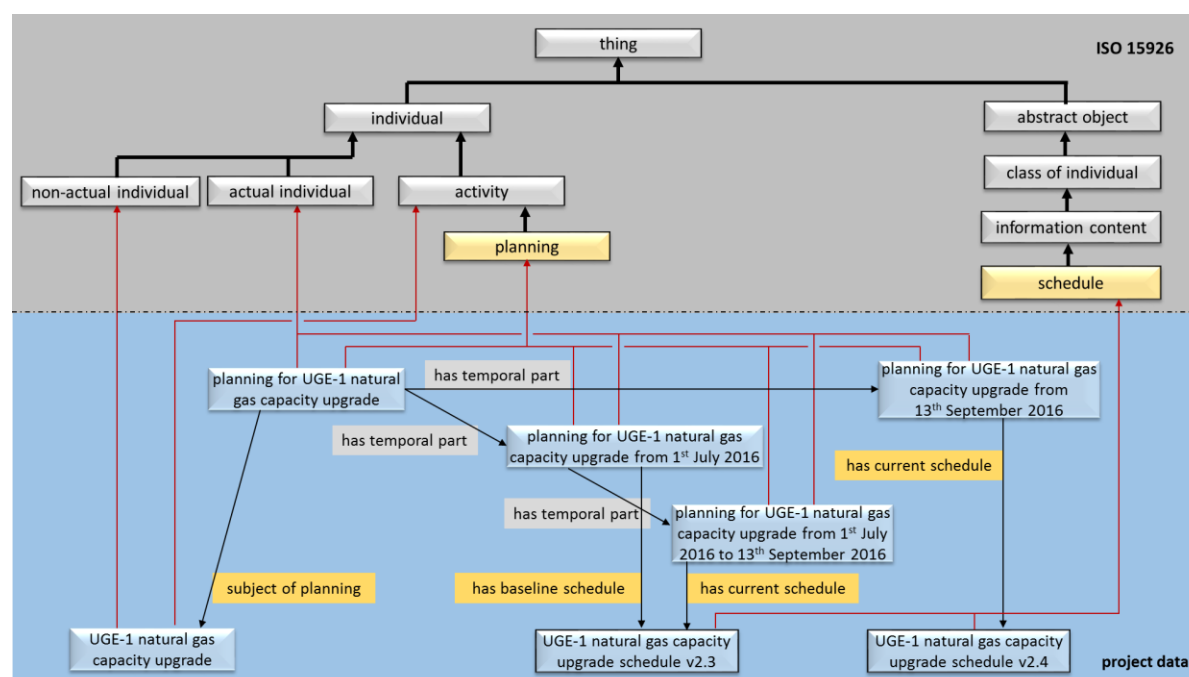
Figure 17: Baseline and current schedules

The periods in time during which a **schedule** is a baseline or current are recorded by the start and end times of the **planning** activities with which they have a **has baseline schedule** or **has current schedule** relationship.

5.4 Planning activity

The way in which the **specifications** and **schedules** for a required **activity** change with time is recorded by their relationships with the **planning** activity.

EXAMPLE 1   This is shown in Figure 17.

The following may be recorded for any **activity**:

— the **period of time** during which it takes place;

— the **person** or **organization** that performs it;

—— the **information objects** that are referenced by it.

EXAMPLE 2   On the 4th November 2016, a "project summary schedule" is created from a "project coordination schedule". . Objects are as follows:

—— 'UGE-1 natural gas capacity upgrade': an **activity** and **non-actual individual**;

—— 'planning for UGE-1 natural gas capacity upgrade': a **planning** activity and an **actual individual**;

—— 'creation of UGE-1 natural gas capacity upgrade project summary schedule on 4th November 2016': a **planning** activity and an **actual individual**;

—— 'UGE-1 natural gas capacity upgrade project coordination schedule v2.3 – 2016-11-04': a **schedule**;

—— 'UGE-1 natural gas capacity upgrade project summary schedule v2.3 – 2016-11-04': a **schedule**.

These objects, with their classifications and relationships, are shown in Figure 18.
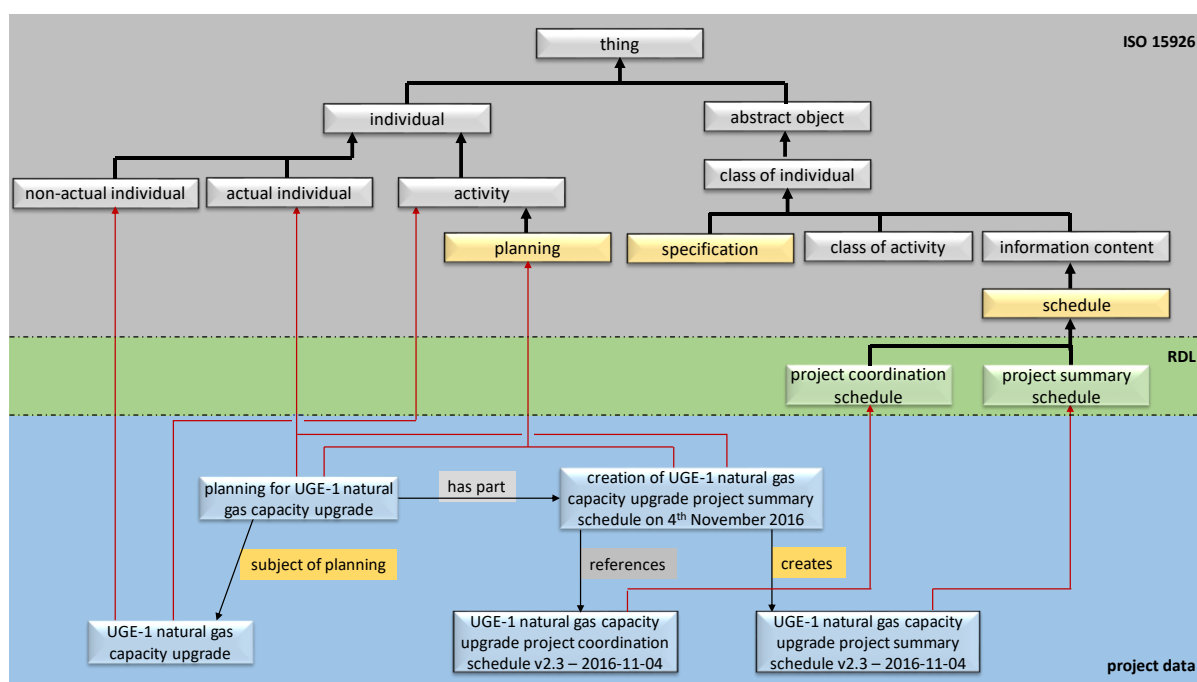
Figure 18: Creation of a Project Summary Schedule

5.5   Actual activity that fulfils a requirement

A **planning** activity creates a **specification** for a proposed implementation of the requirement.

An actual **activity** has a **follows specification** relationship with the **specification**.

NOTE 1   A **follows specification** relationship does not state that the **activity** is a member of the class defined by the **specification**. It merely states that this is what is intended.

An **actual activity** has a **fulfils** relationship with the required **activity**.

NOTE 2   A **fulfils** relationship does not state that the actual **activity** fulfils the requirement. It merely states that this is what was obtained.

As work progresses:

— properties of the actual **activity**, such as percentage complete, resources used, and expenditure, are recorded;

— the **planning** activity revises the specification followed by the actual activity.

The properties of the actual **activity** change with time and are recorded for temporal parts of the actual **activity**.

A **planning** activity has a **monitors** relationship with an actual **activity** that follows the **specification**.

EXAMPLE   The 'actual UGE-1 natural gas capacity upgrade' **fulfils** the required 'UGE-1 natural gas capacity upgrade'. The temporal part 'actual UGE-1 natural gas capacity upgrade to 13th September 2016' **follows specification** 'UGE-1 natural gas capacity upgrade specification version 2' contained in 'UGE-1 natural gas capacity upgrade schedule version 2.3'. On the 13th September 2016, the 'actual UGE-1 natural gas capacity upgrade' is 50% complete.

The objects that record the required **activity**, the actual **activity** and its percentage complete, the **planning** activity; the **specification** and the **schedule** are as follows:

— 'UGE-1 natural gas capacity upgrade': an **activity** and **non-actual individual**;

— 'actual UGE-1 natural gas capacity upgrade': an **activity** and **actual individual**;

— 'actual UGE-1 natural gas capacity upgrade to 13th September 2016': an **actual activity**;

— 'planning for UGE-1 natural gas capacity upgrade': a **planning** activity and an **actual activity**;

— 'UGE-1 natural gas capacity upgrade specification version 2': a **specification**;

— 'UGE-1 natural gas capacity upgrade schedule version 2.3': a **schedule**.

These objects, with their classifications and relationships, are shown in Figure 19.
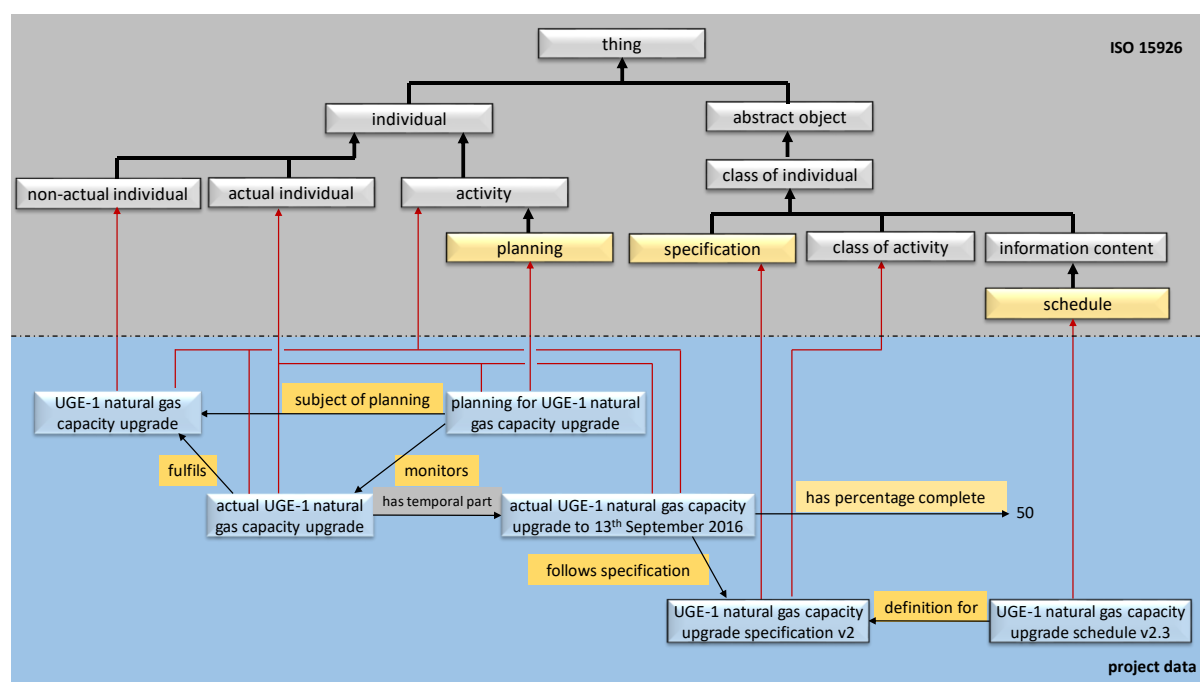
Figure 19: Actual activity to fulfil a requirement

5.6   Decomposition of an activity

5.6.1   Parts of activities and their level

An **activity** has smaller part **activities**. An **activity** is classified according to its size and level.

NOTE 1   Classifications of **activity** according to size and level, such as "project", "project phase", "work package" and "task", are not standardised in this part of ISO 15926, but can be defined in a Reference Data Library. Common **activity** levels and their use are described in Annex **Error! Reference source not found.**.

NOTE 2   Planning software requires an explicit statement of the "top" **activity** and the parts that are to be scheduled. In the "Scheduling Application View" defined in clause 6, the two level structure is made explicit by classifying the "top" **activity** as **project** and the parts that are to be scheduled as **activity in project**.

Whole-part relationships between activities that are not relevant to the scheduling, such as the relationship between an activity in project and a project phase or work package, are recorded in the "Scheduling Application View" by an **activity part of** relationship

EXAMPLE   The required project 'refurbishment of facility F_101' has the work package 'pouring concrete for refurbishment of facility F_101' as a part.

Objects are as follows:

— 'refurbishment of facility F_101': a "project" and **activity**;

— 'pouring concrete for refurbishment of facility F_101': a "work package" and **activity**.

These objects, with their classifications and relationships, are shown in Figure 20.
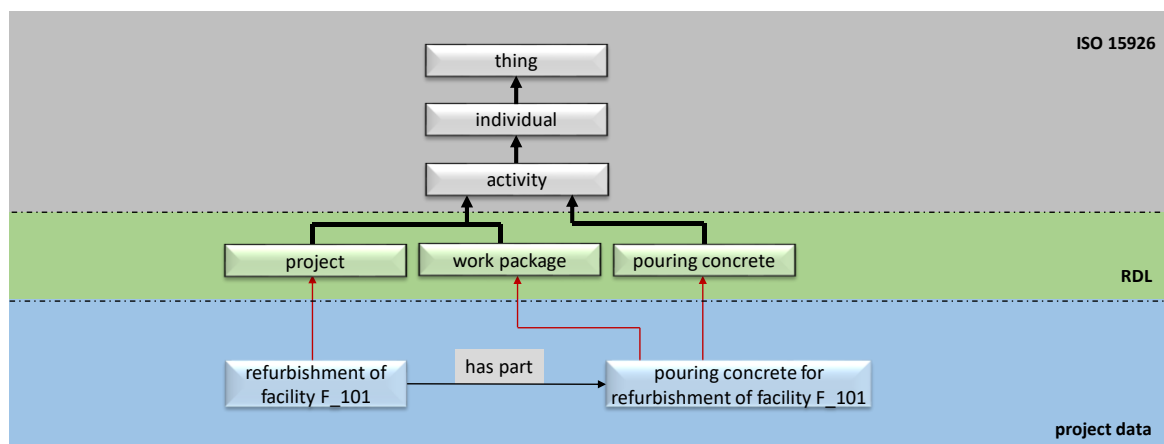
Figure 20: Project and work package

5.6.2   Decomposition of a specification

A **specification** specifies the parts of an **activity**.

EXAMPLE 1   The relationships **class has part occurrence** between **specifications** P and A states that a member of P has a member of A as a part, and that a member of A is a part of a member of P.

NOTE   Whether a decomposition of a required **activity** is recorded by **has part** relationships between **activities**, by **class has part occurrence** relationships between **specifications**, or both is a choice. For the "Scheduling Application View", the choice is defined in clause 6.

EXAMPLE   The **specification** 'refurbishment of facility F_101 specification version 2' specifies that a member of 'pouring concrete for the refurbishment of facility F_101 specification version 2' is a part.

Objects are as follows:

— 'refurbishment of facility F_101': an **activity**;

— 'refurbishment of facility F_101 specification version 2': a **specification** and **class of activity**;

— 'pouring concrete for refurbishment of facility F_101': an **activity**;

— 'pouring concrete for refurbishment of facility F_101 specification version 2': a **specification** and **class of activity**.

These objects, with their classifications and relationships, are shown in Figure 21.
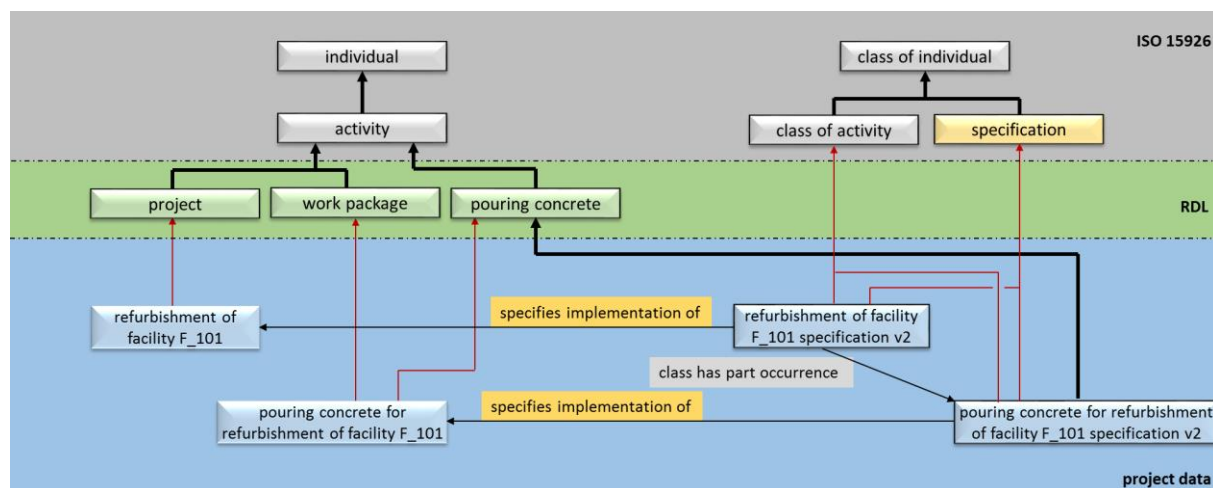
Figure 21: Specification and decomposition

5.7   Classifications of an activity

5.7.1   Activity purpose and activity breakdown

An **activity** may be classified according to its purpose.

NOTE 1   Classes of **activity** according to purpose are not standardized in this part of ISO 15926 but can be defined in a Reference Data Library. Such classes are often domain specific. Classes of activity according to purpose which are of significance to oil and gas exploration and production include:

— drilling;

— well isolating;

— well servicing;

— well transfer;

— production activity revision.

An **activity** that is a part of a whole may be classified by an **activity breakdown class**.

NOTE 2   **Activity breakdown classes** are not standardized in this part of ISO 15926 but can be defined in a Reference Data Library.

NOTE 3   Work breakdown structure is a synonym for activity breakdown structure in the scope of ILAP.

EXAMPLE   **Activity breakdown classes** are defined in ISO 19008 "Standard Cost Coding System".

5.7.2 Activity management objective

An **activity** can be classified according to business objective. Such subclasses of **activity** are members of **class of activity by business objective**.

NOTE   **Classes of activity according to business objective** are not standardized in this part of ISO 15926 but can be defined in a Reference Data Library. Such classes are often domain specific. **Classes of activity according to business objective** which are of significance to oil and gas exploration and production include:

— increase oil and gas recovery;

— maintain business as usual;

— make incremental improvement;

— make radical change;

— recover from disaster;

— manage closedown.

5.7.3 Asset lifecycle phase

An activity that is carried out on a major asset is part of an **asset lifecycle phase** for that asset. Subclasses of **asset lifecycle phase** specify the nature of the phase.

NOTE   Subclasses of **asset lifecycle phase** are not standardized in this part of ISO 15926 but can be defined in a Reference Data Library. Such classes are often domain specific. Subclasses of **asset lifecycle phase** which are of significance to oil and gas exploration and production include:

— oil and gas field exploration: which begins when block or area is assigned to company, and ends with "oil and gas field planning";

— oil and gas field planning: which begins when an oil or gas field is declared commercial, and ends with "oil and gas field development";

— oil and gas field development: which begins when the licensee accepts the development concept, and ends with "oil and gas field operation";

— oil and gas field operation: which begins with regular start-up of production, and ends with "oil and gas field shutdown and decommissioning";

— oil and gas field shutdown and decommissioning: which begins when the operator submits a schedule for the shutdown of wells, and ends with "oil and gas field removal";

— oil and gas field removal: which begins when operator confirms the concept for removal of field installations.

EXAMPLE   The facility UGE-1 is a **resource** for the **asset lifecycle phase** "operate UG - A field". The required **activity** "UGE-1 natural gas capacity upgrade" is part of the **asset lifecycle phase**. This is shown in Figure 22.
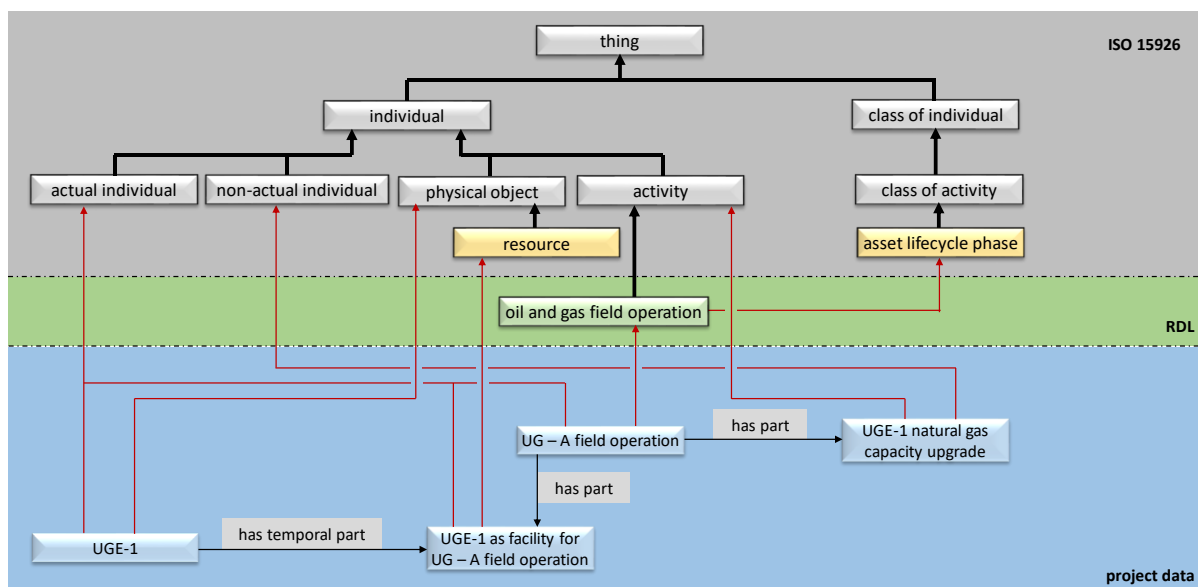
Figure 22: Asset lifecycle phase

5.7.4 Activity risk

An **activity** may be classified according to the nature of a risk. Such a subclass of **activity** is a member of **activity risk factor**.

NOTE **Activity risk factors** are not standardised in this part of ISO 15926, but can be defined in a Reference Data Library. Common risk factors include "height work", "hot work", "lifting operation" and "shallow gas operation".

EXAMPLE The **activity** 'replace the instrumentation of the flare tip of platform UGE-1' is a member of "height work". The specification 'replace the instrumentation of the flare tip of platform UGE-1 specification v3' is a subclass of "height work". These objects are shown in Figure 23.
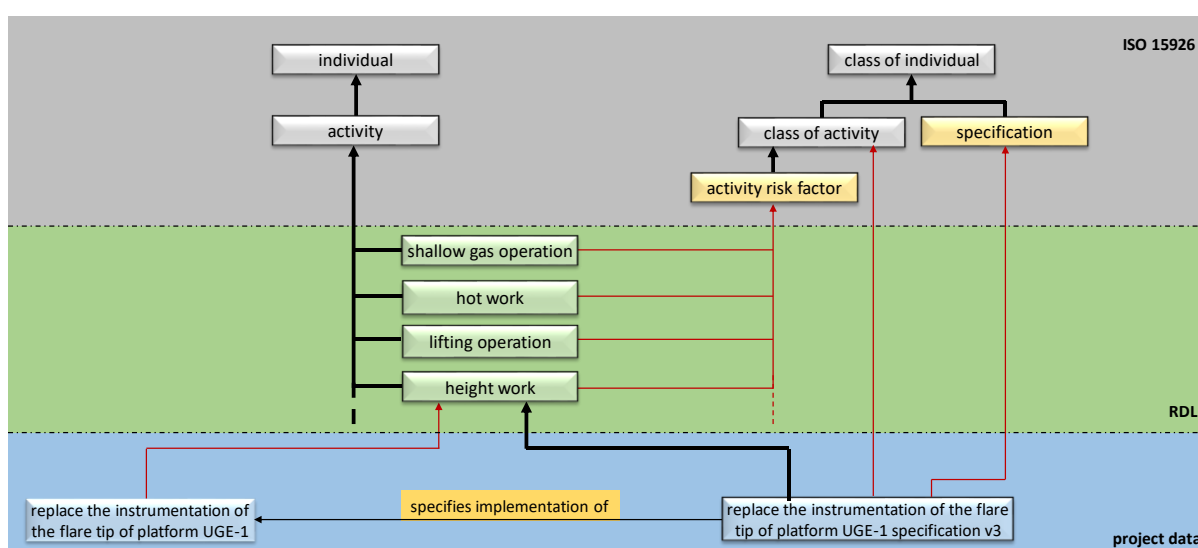
Figure 23: Activity risk factor

In Figure 23, both the required **activity** and the **specification** for its implementation are associated with the **activity risk factor**. In some cases, a required **activity** does not necessarily have an **activity risk factor**. Instead some **specifications** of a possible implementations have the **activity risk factor**, but not others.

5.7.5 Activity criticality

An **activity** may be classified according to its criticality. Such a subclass of **activity** is a member of **activity criticality**.

NOTE   **Activity criticalities** are not standardised in this part of ISO 15926, but can be defined in a Reference Data Library. The criticality can be based upon business, safety or environmental concerns.

EXAMPLE   The **activity** 'replace the instrumentation of the flare tip of platform UGE-1' is a member of "essential for continued operation". These objects are shown in Figure 24.
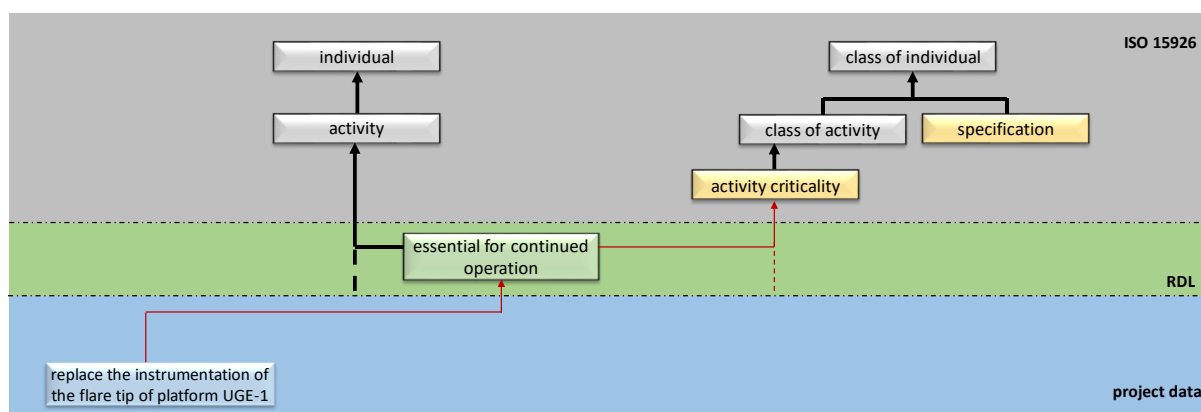
Figure 24: Activity criticality

5.7.6 Activity priority

An **activity** may be classified according to its priority. Such a subclass of **activity** is a member of **activity priority**.

NOTE   **Activity priorities** are not standardised in this part of ISO 15926, but can be defined in a Reference Data Library.

EXAMPLE   The **activity** 'replace the instrumentation of the flare tip of platform UGE-1' is a member of "high priority". These objects are shown in Figure 25.
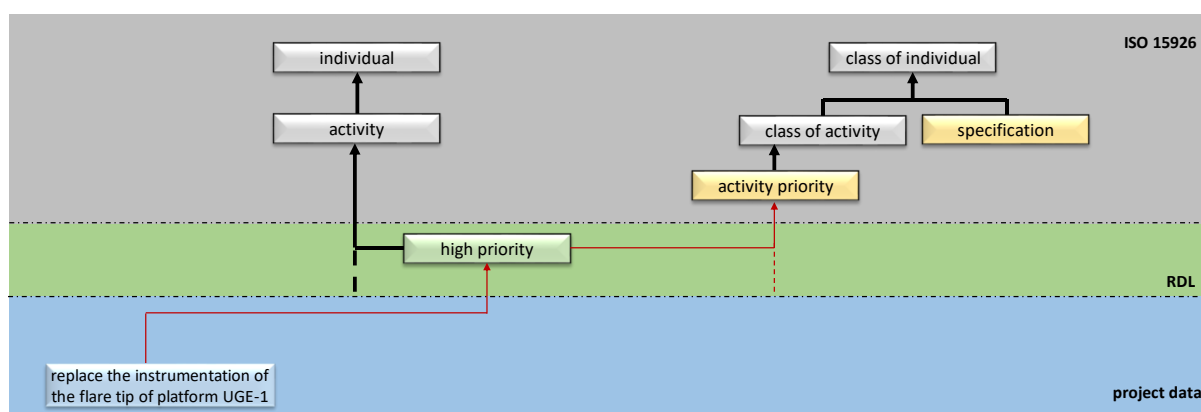
Figure 25: Activity priority

5.7.7 Activity completion status

An **activity** may be classified according its completion status. Such a subclass of **activity** is a member of **activity completion status**. The following **activity completion statuses** are standardised in this part of ISO 15926:

— **active activity**;

— **completed activity**.

NOTE 1   Additional **activity completion statuses** can be defined in a Reference Data Library. Common statuses include "abandoned" and "paused".

NOTE 2   Usually an **activity completion status** is specified for an **actual activity**.

ISO 15926 ontologies, do not have the concept of "now". Instead an **activity completion status** is specified for either:

— a **whole life individual**; or

— a **non-whole life individual** and temporal part, where the end **point in time** is specified.

NOTE 3   The concept of "now" exists within the "scheduling application view" described in clause 6.1.

EXAMPLE   The **activity** and **actual individual** 'actual replacement the instrumentation of the flare tip of platform UGE-1' has the status **active** in April 2015 and is 90% complete. Objects are as follows:

— 'replacement the instrumentation of the flare tip of platform UGE-1': an **activity**, **whole life individual** and **non-actual individual**;

— 'actual replacement the instrumentation of the flare tip of platform UGE-1': an **activity**, **whole life individual** and **actual individual**;

— 'actual replacement the instrumentation of the flare tip of platform UGE-1 to May 2015': an **activity**, **non-whole life individual** and **actual individual**;

These objects, with their classifications and relationships, are shown in Figure 26.
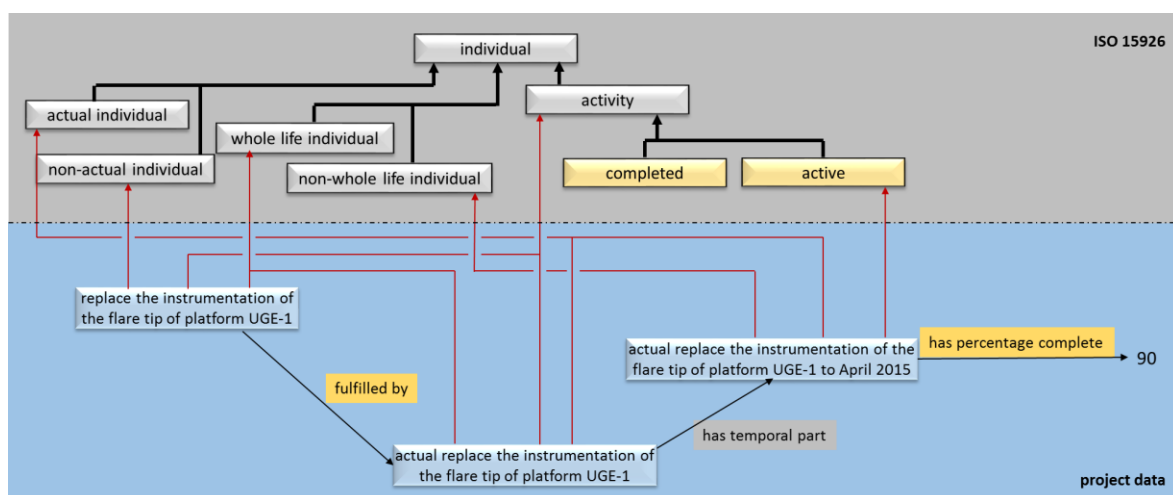
Figure 26: An active activity

The **activity** and **actual individual** 'actual replacement the instrumentation of the flare tip of platform UGE-1' has the status **completed activity** in May 2015. The end point in time for the whole **activity** can be recorded. The final status can also be recorded as shown in Figure 27.
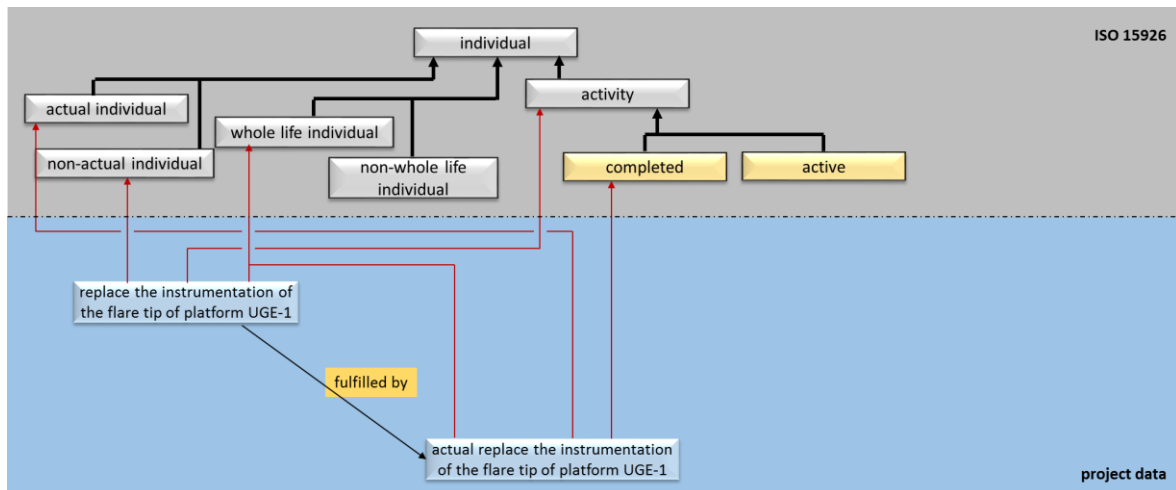
Figure 27: A completed activity

5.7.8 Activity planning status

A **planning** activity gives the activity that it is **planning for** an **activity planning status**. The following are members of **activity planning status**:

— **planning – to be planned;**

— **planning – under planning**;

— **planning – cancelled**;

— **planning – ready for execution**.

These are subclasses of **planning** are according to the status that the **planning** activity gives to the **activity** that it is **planning for**.

NOTE 1   Additional **activity planning statuses** can be defined in a Reference Data Library.

NOTE 2   The status of a required **activity** can change with time. Therefore different temporal parts of a **planning** activity can be members of different **activity planning statuses**.

NOTE 3   Different planning activities can give the same required **activity** different statuses at the same time.

EXAMPLE   The required **activity** "replace the instrumentation of the flare tip of platform UGE-1" is "under planning" in March 2015, and "ready for execution" in April 2015. This is shown in Figure 28.
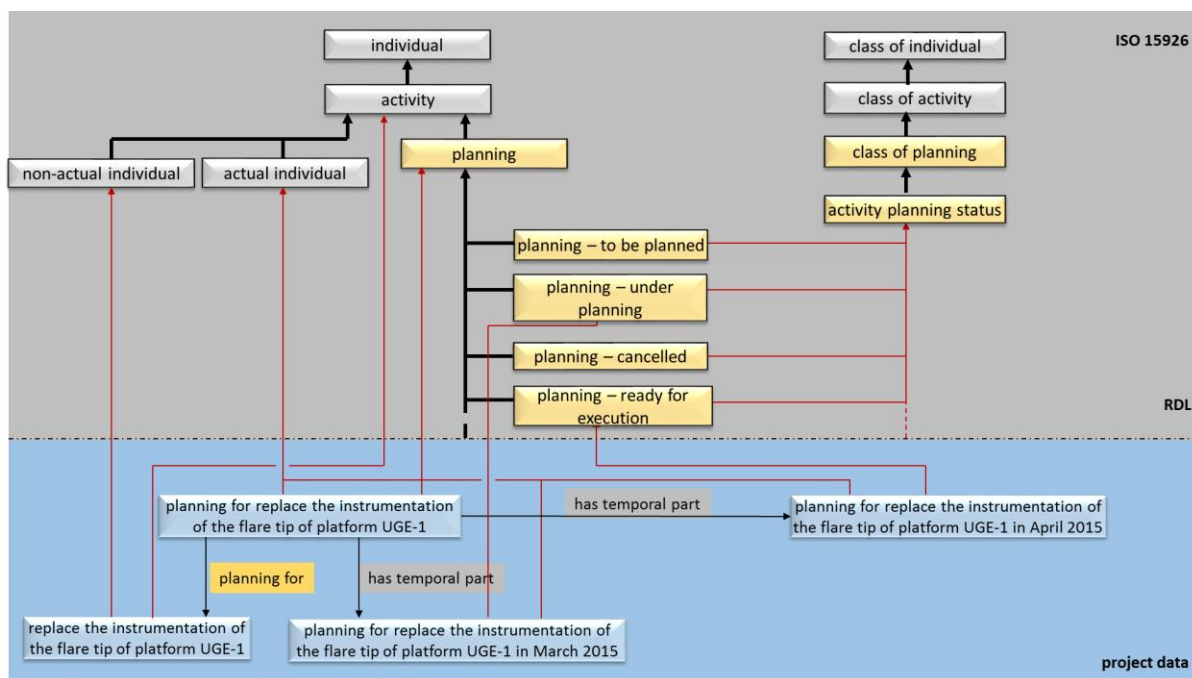
Figure 28: Activity planning status

5.8   Resource for an activity

5.8.1   Specification of a resource

A **physical object** that is used to perform an **activity** is a **resource**.

NOTE 1   A **physical object** usually exists before and after an **activity**, so usually a **resource** is a temporal part of a whole life **physical object**. The source of a **resource** can be recorded by statements about earlier temporal parts of the **physical object**.

NOTE 2   A **resource** corresponds to the element "ProjectResource" in the UN/CEFACT XML schema.

A required or proposed **activity** has required or proposed **resources**. It is fulfilled by an actual **activity** that has actual **resources**.

A **resource** is classified and has a specified magnitude.

EXAMPLE 1   The required refurbishment of facility F_101 has required piping engineering **resource**. Version 2 of the proposal for the refurbishment of facility F_101 specifies 500 hours of piping engineering **resource**. This is shown in Figure 29.
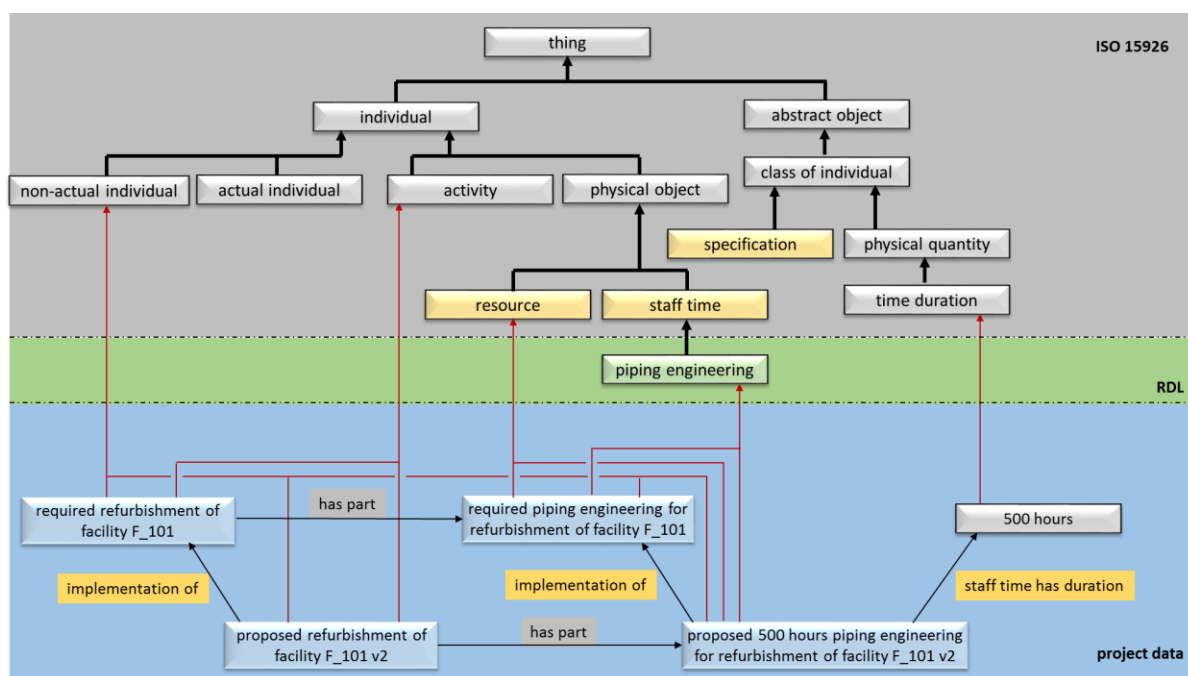
Figure 29: Required and proposed piping engineering resource

The actual refurbishment of facility F_101, which fulfils the requirement, uses 510 hours of piping engineering **resource**. This is shown in Figure 30.
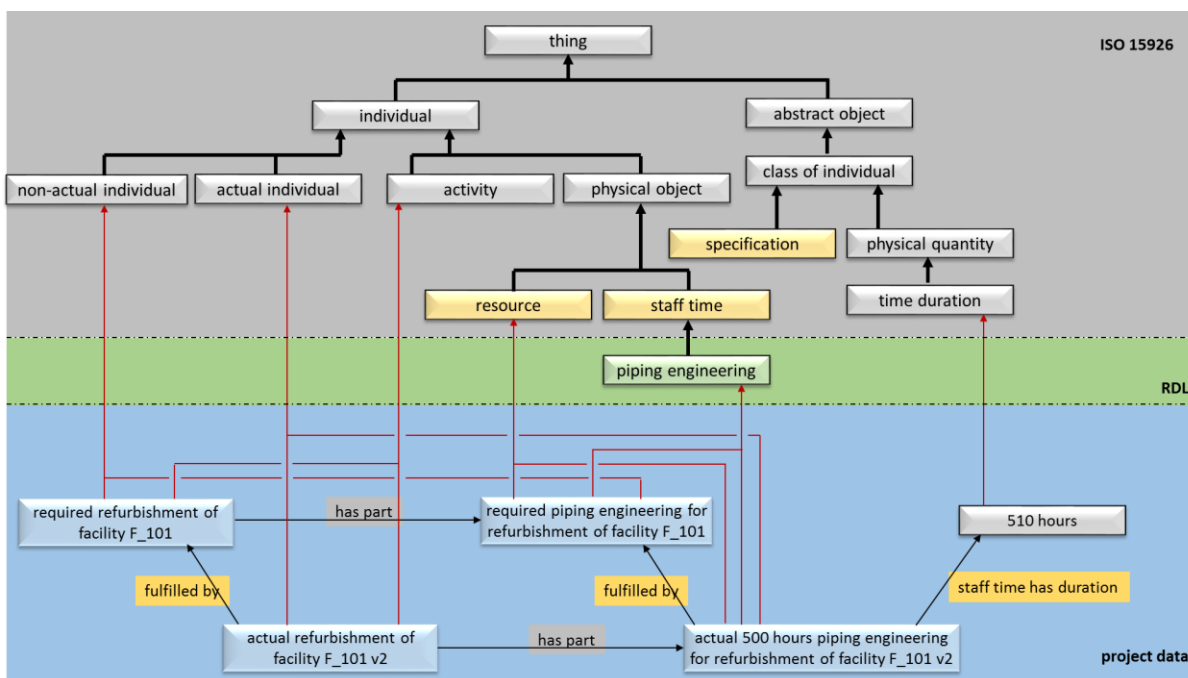
Figure 30: Actual piping engineering resource

The classification and magnitude of a **resource** may be defined by a **specification**.

EXAMPLE 2   The proposed piping engineering **resource** of EXAMPLE 1 is defined by a **specification** as shown in Figure 31.
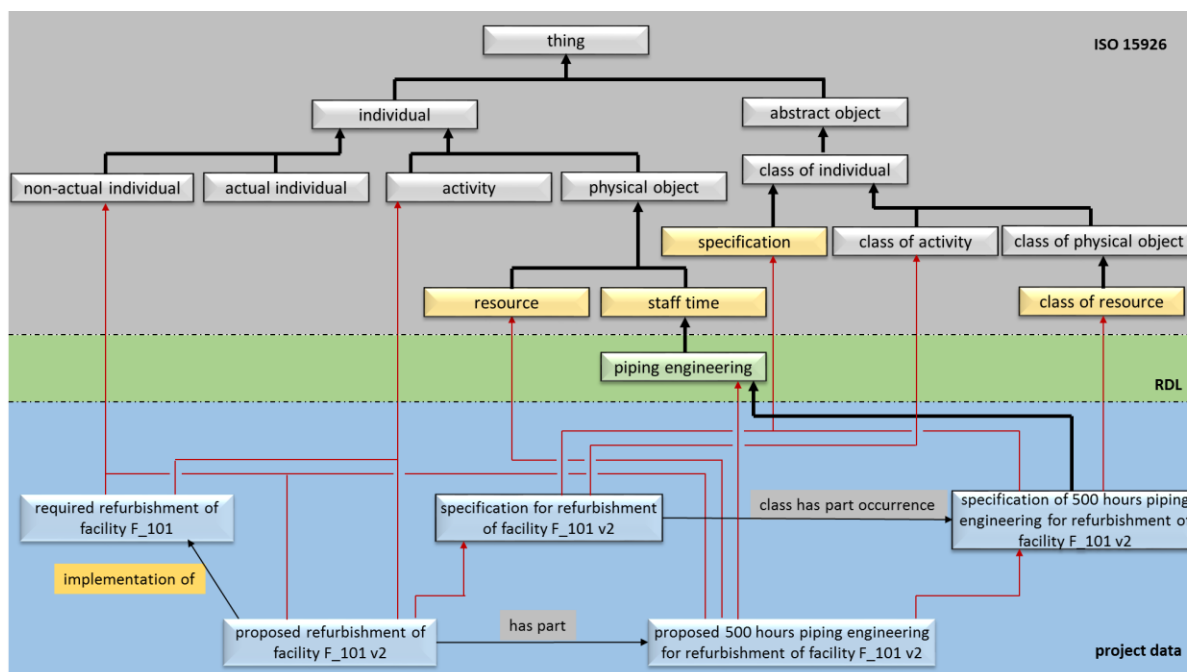
Figure 31: Piping engineering resource specification

The **specification** "specification of 500 hours piping engineering for refurbishment of facility F_101 v2" shown in Figure 31, is made computer processable by the statement that each member of this class has a **duration of staff time** relationship with 500 hours.

The **specification** of the proposed piping engineering **resource** can be associated directly with the resource requirement.   This is shown in Figure 32.
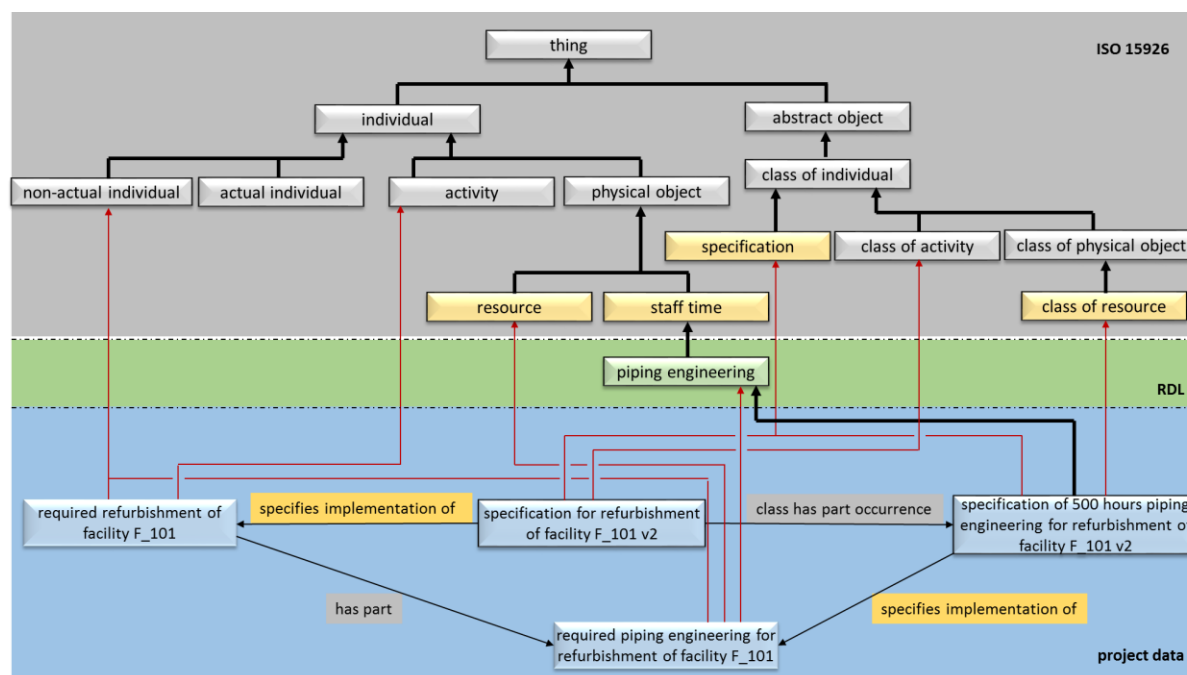
Figure 32: Piping engineering resource requirement and specification

5.8.2   Resource breakdown

A **resource** for an **activity** that is a part of a whole may be classified by a **resource breakdown class**.

NOTE   **Resource breakdown classes** are not standardized in this part of ISO 15926 but can be defined in a Reference Data Library. Resource breakdown classes are often associated with codes, and can be referred to as "Codes of resources".

EXAMPLE   **Resource breakdown classes** are defined in ISO 19008 "Standard Cost Coding Specification".

5.8.3   Available physical object for a resource

A **resource** for a proposed **activity** is a role of **physical object** which may be available for only some **periods of time**.

NOTE   A **physical object** can have a **calendar** of availability. A **physical object** can also be available only for defined **periods of time**.

EXAMPLE   The required refurbishment of facility F_101 has required piping engineering **resource**. Version 2 of the proposal for the refurbishment of facility F_101 specifies 500 hours of piping engineering **resource** supplied by A. D. Vance and Partners.

The A. D. Vance and Partners piping engineering staff time has a 'professional engineering hours' **calendar**. The piping engineering staff time is available from January to June 2015 and in 2016, but not from July to December 2015 when it is already fully committed to another project. The objects with their classifications and relationships are shown in Figure 33.
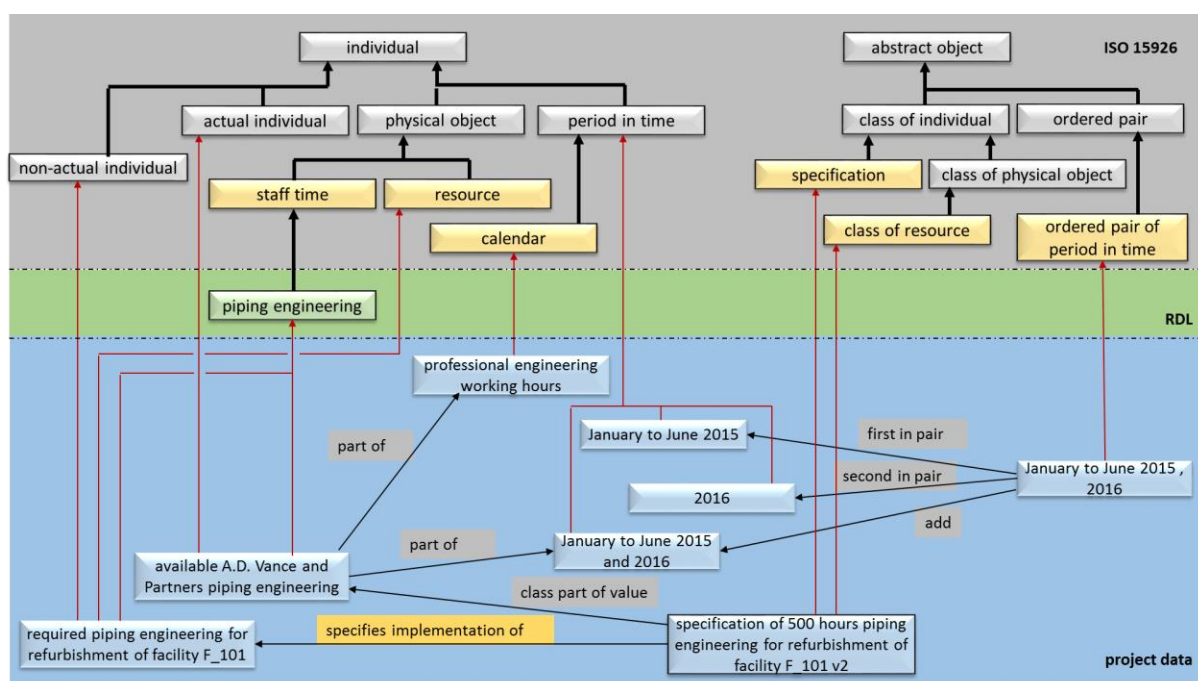
Figure 33: Availability for a resource

5.8.4   Quantity-based and time-based resources

A resource is either:

quantity based: A quantity based **resource** is defined by what it is and how much.

> EXAMPLE 1   The refurbishment of facility F_101 has required quantity-based **resources** as follows:
> — 500 hours of piping engineering;
> — 100 tonnes of steel pipe.

time based: A time based **resource** is defined by what it is and how long it is needed.

EXAMPLE 2   The refurbishment of facility F_101 has required time-based **resources** as follows:
— one stand-by rescue boat for the duration of the project;
— two 10 tonne SWL mobile cranes for 90 hours.

5.8.5   Consumable material and equipment

A **resource** may be classified according to whether it is used up by the activity or whether it is equipment used to perform an activity as follows:

consumable material resource: A **resource** that is consumed during the activity, and that does not have an existence after the activity

EXAMPLE 1   The refurbishment of facility F_101 has a required **consumable material resource** as follows:
— 100 tonnes of steel pipe.

equipment resource: A **resource** is equipment needed to perform an activity.

EXAMPLE 2   The refurbishment of facility F_101 has a required **equipment resource** as follows:
— 400A generator for welding.

5.8.6   Quantity base resource usage

The amount of quantity-based **resource** used by an **activity** gives a measure of progress.

EXAMPLE 1   The **specification** for the pouring of concrete in the refurbishment of facility F_101 version 2 has 200 tonnes of concrete mix as a **resource**. Objects are as follows:

— 'required pouring of concrete in the refurbishment of facility F_101': a **non-actual individual** and **activity**;

— 'pouring of concrete in the refurbishment of facility F_101 specification version 2': a **specification** and **class of activity**;

— 'required concrete mix for the refurbishment of facility F_101': a **non-actual individual** and **resource**;

— 'concrete mix for the refurbishment of facility F_101 specification version 2': a **specification** and **class of resource**;

These objects, with their classifications and relationships, are shown in Figure 34.
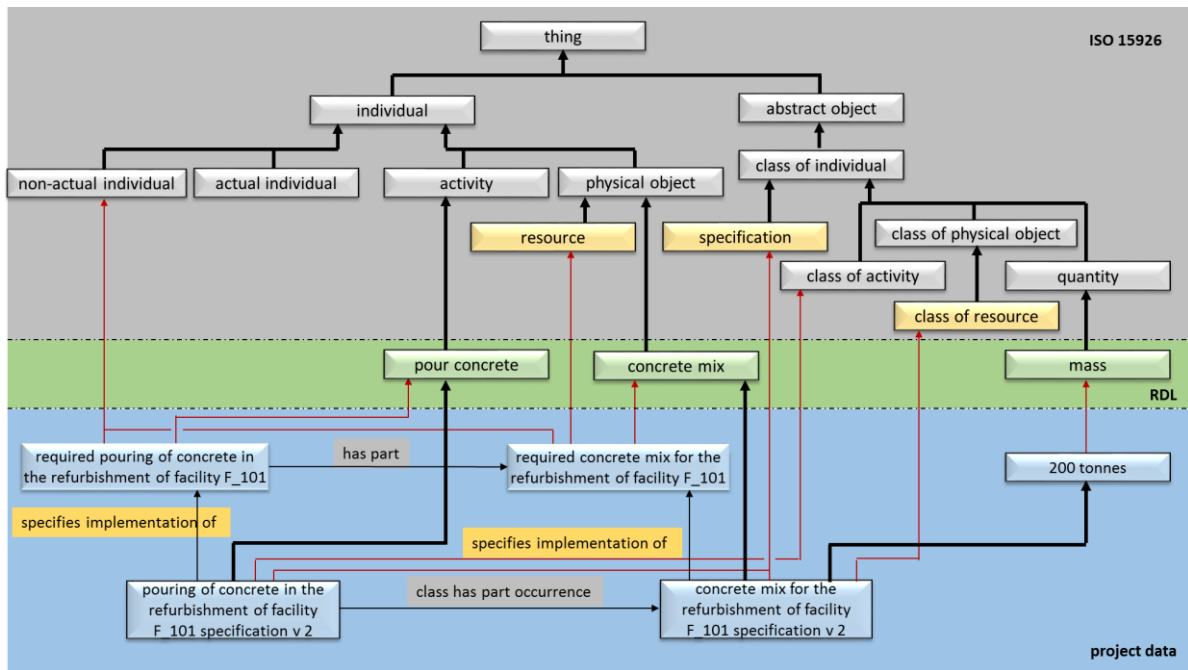
Figure 34: Specified quantity for a resource

A quantity-based **resource** is used progressively as an **activity** progresses. In the period up to 2015-05-04, 50 tonnes of concrete mix are used by the actual pouring of concrete. This is a resource usage of 25%. The additional objects are as follows:

— 'actual pouring of concrete in the refurbishment of facility F_101': an **actual individual** and **activity**;

— 'actual pouring of concrete in the refurbishment of facility F_101 to 2015-05-04': an **actual individual** and **activity**;

— 'actual concrete mix for the refurbishment of facility F_101': an **actual individual** and **resource**;

— 'actual concrete mix for the refurbishment of facility F_101 used to 2015-05-04': an **actual individual** and **resource**.

These objects, with their classifications and relationships, are shown in Figure 35.
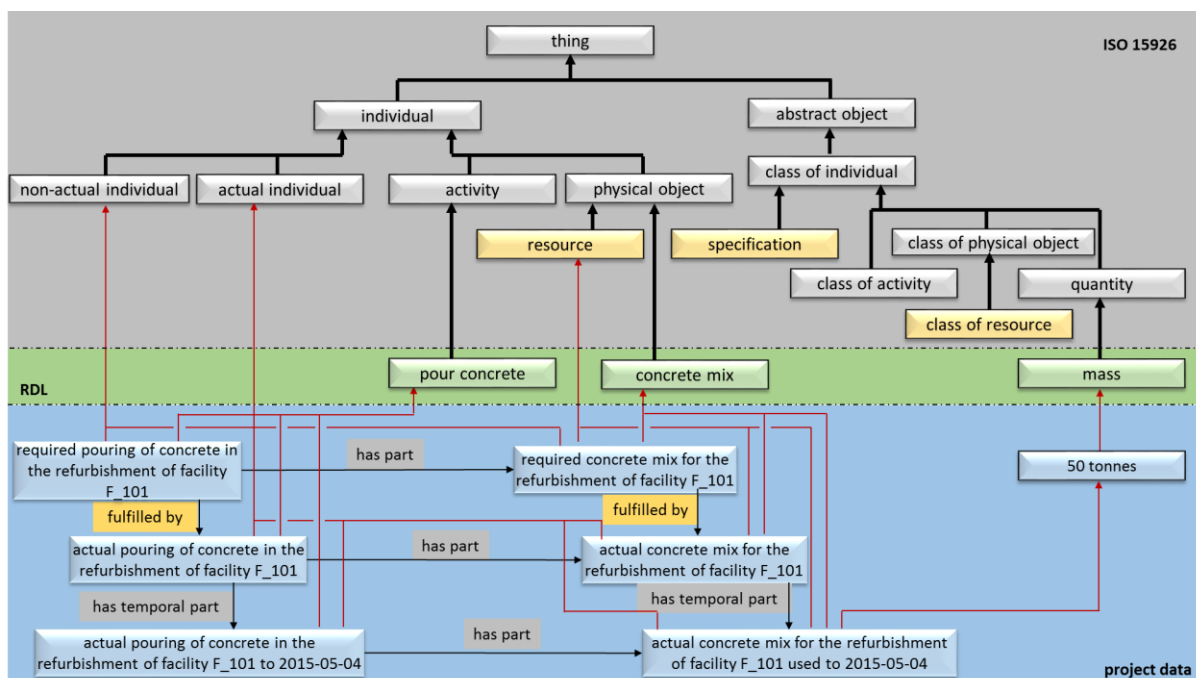
Figure 35: Material quantity used

The ratio of the mass concrete mix used to 2015-05-04 to the mass of concrete mix in the specification gives a measure of progress. This is shown in Figure 36.
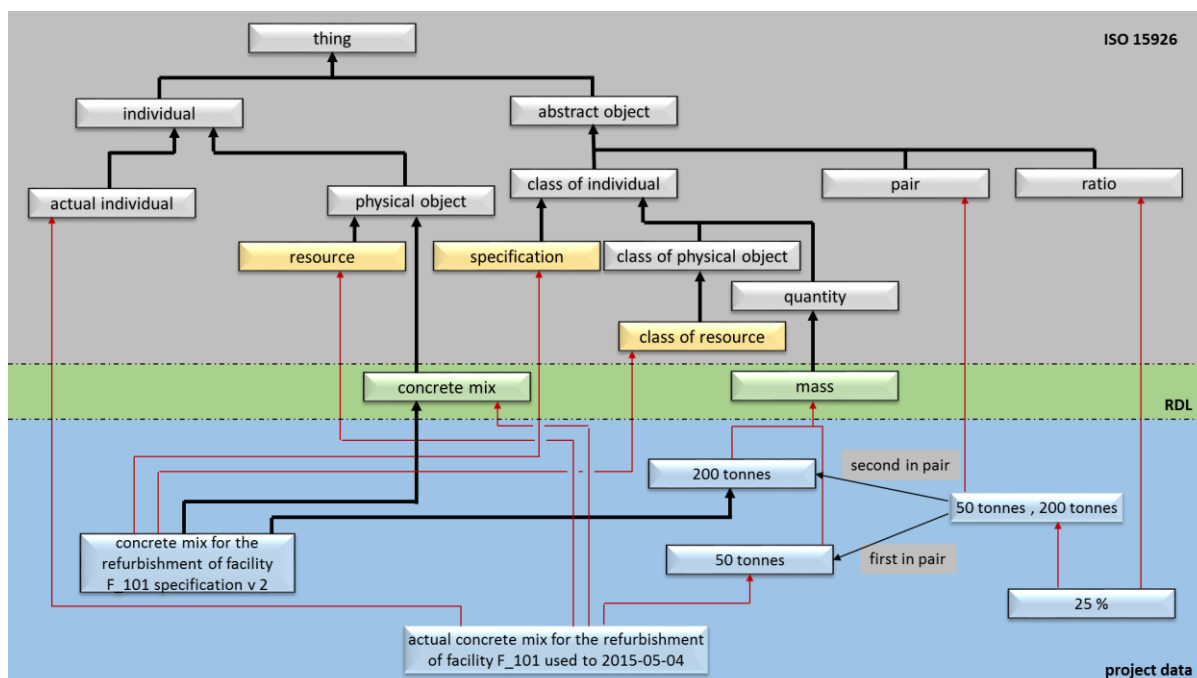
Figure 36: Ratio of material quantity used to quantity in specification

5.8.7 Work centre and organizational level

A **work centre** is a **resource** for the performance of an **activity** that is provided by an **organization**.

NOTE 1   Subclasses of **work centre**, such as "main work centre" or "operational work centre" can be defined within a Reference Data Library.

Subclasses of organization may be defined to specify the size and level of an **organization**.

NOTE 2   Subclasses of **organization** are not standardised in this part of ISO 15926, but can be defined in a Reference Data Library. Common subclasses include "department" and "team".

EXAMPLE   The "Fred Bloggs and Co. on-site team and equipment" is the "operational work centre" for the pouring of concrete in the refurbishment of facility F_101 version 2. This is shown in Figure 37.
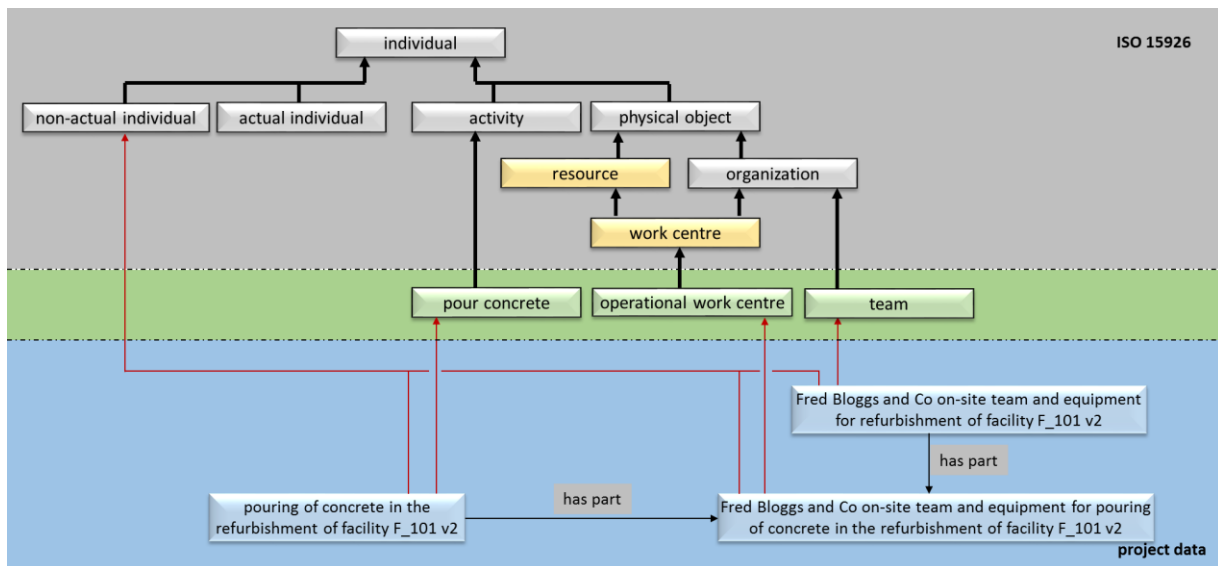
Figure 37: Work centre

5.8.8   Staff time and discipline

The **staff time** is a **physical object** that is a **resource**.

A member of **staff time** has a **staff time has duration** relationship with a **duration**.

NOTE 1   A **duration** can be represented by a unit of measure, such as hours, or identified by a string defined by ISO 8601.

Staff time can be classified according to the engineering skill required. Such classifications are members of **discipline**.

NOTE 1   **Disciplines** are not standardised in this part of ISO 15926, but can be defined in a Reference Data Library.

NOTE 2   Classifications of **staff time** are defined in the ISO 19008 Standard Cost Coding System (SCCS).

EXAMPLE   The "required piping engineering for refurbishment of facility F_101" is of the **discipline** "piping engineering". This is shown in Figure 38.
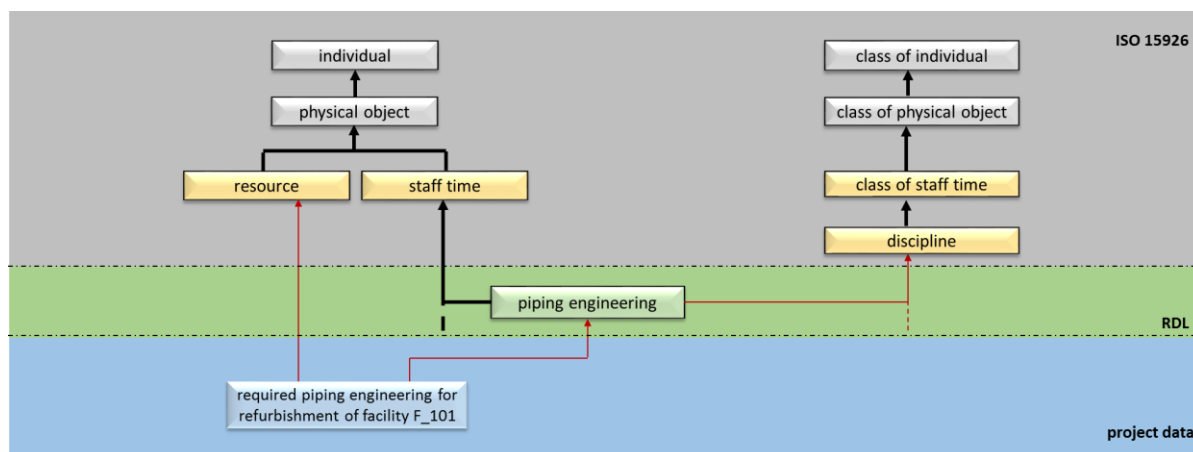
Figure 38: Discipline

5.8.9 Consumption profile

A **consumption profile** is record as a function of how a **resource** is used as an **activity** progresses.

The domain of the function is a percentage of the total time of the **activity**. The range of the function is a percentage of the total amount of the **resource** that is used by that time.

NOTE   A consumption profile necessarily starts at (0, 0) and ends at (100, 100) and increases or remains constant in each period.

EXAMPLE   For proposed the pouring of concrete in the refurbishment of facility F_101 version 2, 75% of the concrete mix is used after 50% of the time. This is recorded by a point (50, 75) in the **consumption profile**. This is shown in Figure 39.
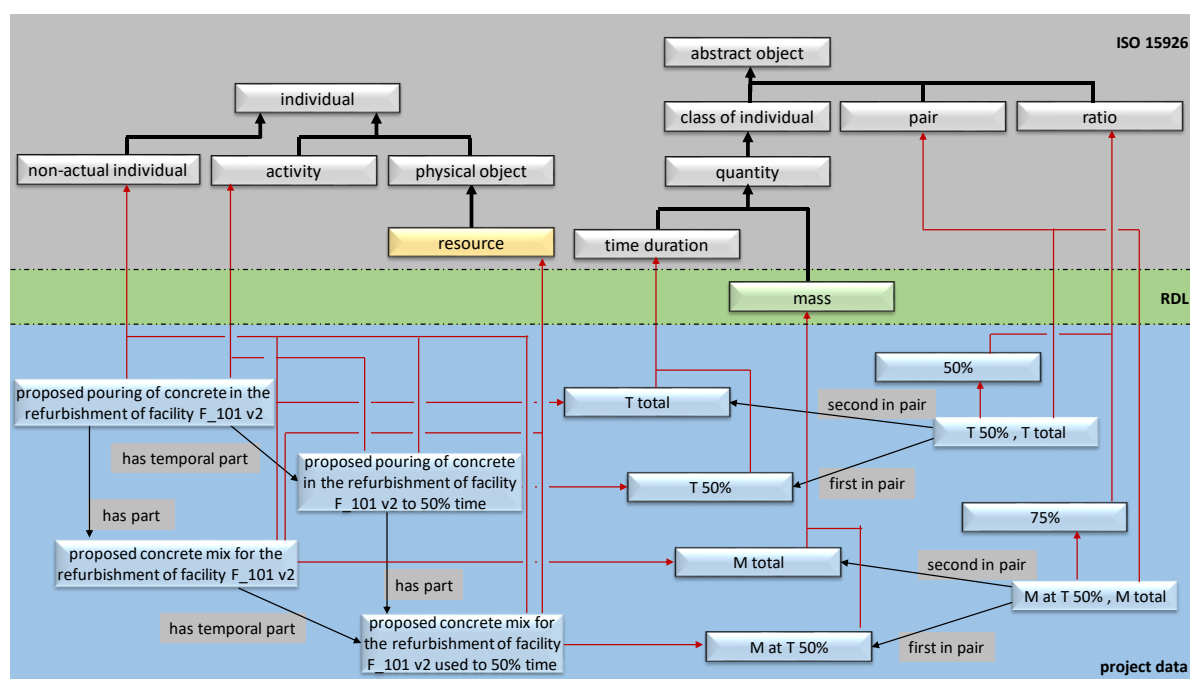
Figure 39: Point in a consumption profile

A concise encoding of a consumption profile, for inclusion within a **specification** for a **resource** is defined for the scheduling application view model.

5.8.10 Material resource availability checking and ordering

Whether or not an **activity** requires a material **resource** is a classification of the **activity** according to an **activity material resource status**, as follows:

— **activity without material resource**;

— **activity with material resource**.

An overall **planning** activity may contain a **check material availability** activity. There are two sub-classes of a **check material availability** activity according to the outcome of the check, as follows:

— **check material availability – available**;

— **check material availability – not available**.

A **check material availability** activity has an **availability checked for** relationship with a required **physical object**.

The ordering of the material for a resource is recorded by an **order material** activity. An **order material** activity has an **order placed for** relationship with a required **physical object**.

EXAMPLE   The proposed **activity** 'plan for install piping for dehydration train B on UGE-1 version 2' is an **activity with material component**. The planning activity checks material availability and places an order. The objects are as follows:

— 'planning for UGE-1 natural gas capacity upgrade': an **actual individual** and a **planning** activity;

— 'installation of piping for dehydration train B on UGE-1 version 2': a **non-actual individual** and an **activity with material component**;

— 'piping material for dehydration train B on UGE-1 version 2': a **non-actual individual** and a **physical object**;

— 'piping material for dehydration train B on UGE-1 version 2 as resource': a **non-actual individual**, a **resource** and a **physical object**;

— 'check availability of piping material for dehydration train B on UGE-1': an **actual individual** and a **check material availability - available**;

— 'order piping material for dehydration train B on UGE-1': an **actual individual** and an **order material** activity.

These objects, with their classifications and relationships, are shown in Figure 40.
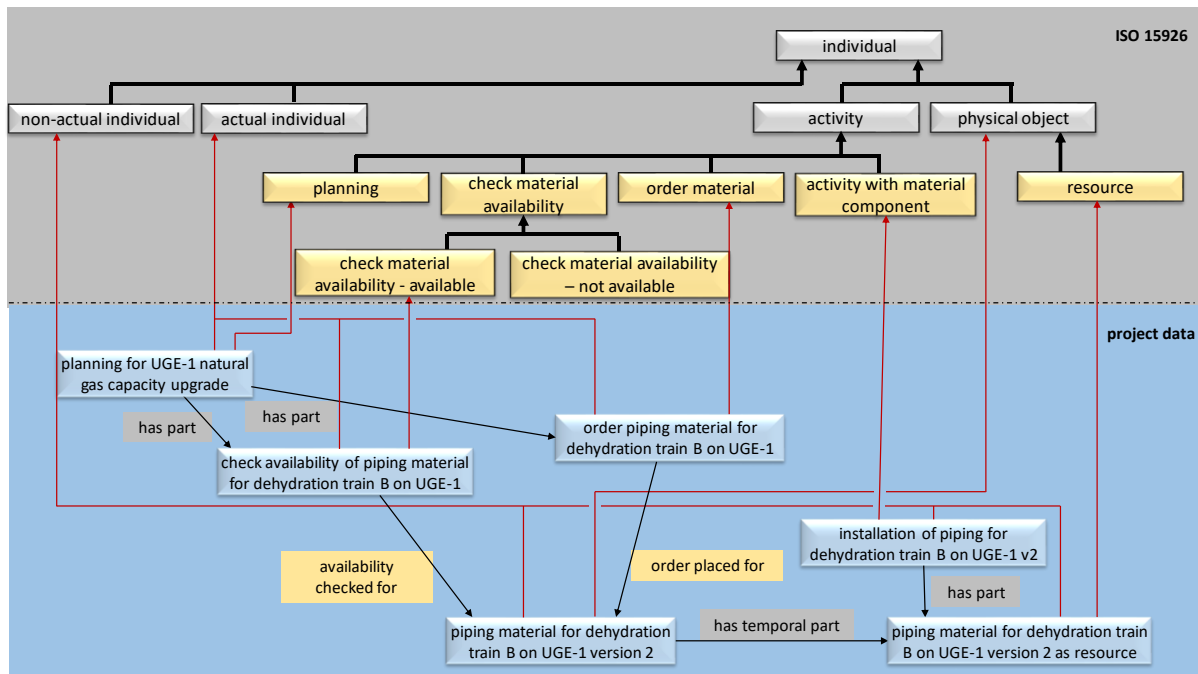
Figure 40: Check availability and order material.

The times and the people involved can be recorded for the **check material availability** and **order material** activities.

5.8.11 Material resource delivery

A **physical object** is delivered by a **deliver material** activity. The progress of the delivery can be recorded by a classification of the delivery activity according to a **material delivery progress status**, as follows:

— **deliver material – on time**;

— **deliver material – delayed**.

The temporal part of a **physical object** being delivered is part of the **deliver material** activity and classified as **material in delivery**.

The location of a **physical object** is recorded by a classification according to a **material delivery location status**, as follows:

— **material delivered to base**;

— **material delivered off-shore**;

— **material delivered on-shore**.

EXAMPLE   Following an **order material** activity in the example in clause 5.8.10, there is actual **physical object**. This **physical object** is delivered on time, and is delivered to base. The objects are as follows:

— 'installation of piping for dehydration train B on UGE-1 version 2': a **non-actual individual** and an **activity with material component**;

— 'piping material for dehydration train B on UGE-1 version 2': a **non-actual individual** and a **physical object**;

— 'piping material for dehydration train B on UGE-1 version 2 as resource': a **non-actual individual**, a **resource** and a **physical object**;

— 'actual piping material for dehydration train B on UGE-1': an **actual individual** and a **physical object**;

— 'deliver piping material for dehydration train B on UGE-1': an **actual individual** and a **deliver material – on time** activity;

— 'actual piping material for dehydration train B on UGE-1 during delivery': an **actual individual** and a **material in delivery**;

— 'actual piping material for dehydration train B on UGE-1 at base': an **actual individual** and a **material delivered to base**.

These objects, with their classifications and relationships, are shown in Figure 41.
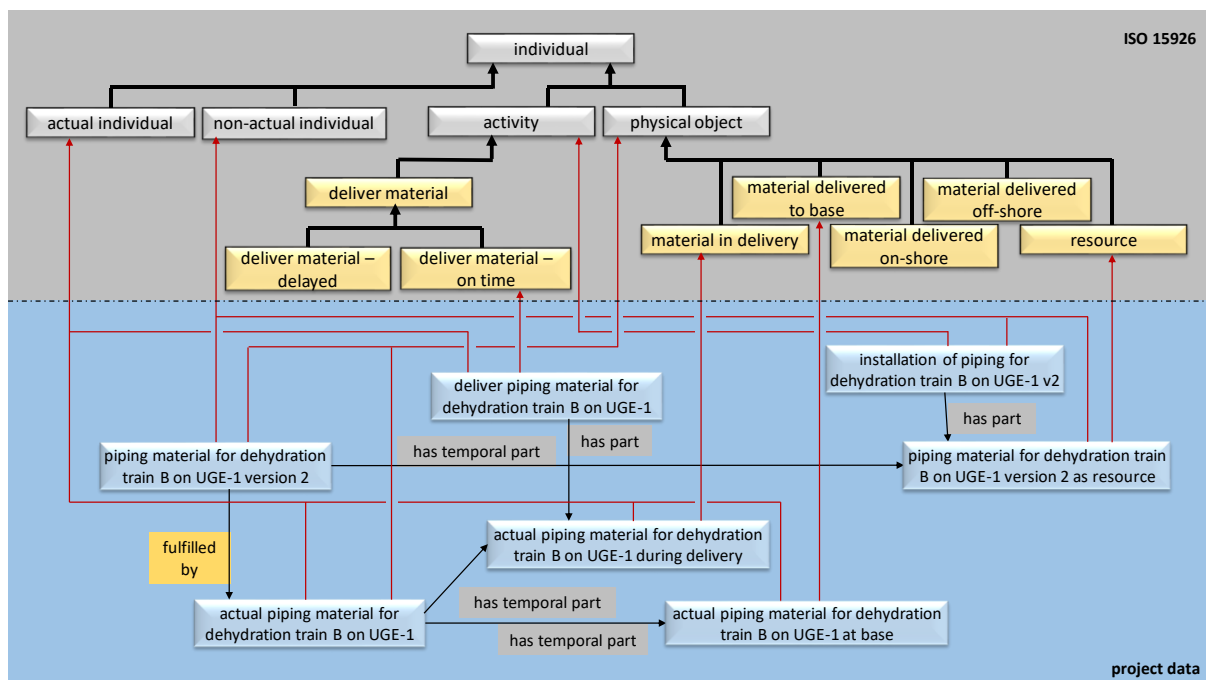
Figure 41: Deliver material

The time and organization involved can be recorded for the **deliver material** activity. The start and end times can be recorded for temporal part of the **physical object** that is **material delivered to base**.

5.9 Participants in an activity

5.9.1 Subject of work

An **activity** is carried out on a **physical object** that is the **subject of work**.

A **physical object** exists before and after the **activity**, so a **physical object** is a **subject of work** for only part of its life.

NOTE   The subject of work for an activity can be specified in general by reference to a whole facility, or in detail by reference to a particular system or equipment item.

EXAMPLE 1   Part of UGE-1 is **subject of work** for the proposed natural gas capacity upgrade **activity**. For a period of time, all of the TEG dehydration system is **subject of work** for the proposed natural gas capacity upgrade **activity**.

The relationships between facility UGE-1, its TEG dehydration system and the proposed natural gas capacity upgrade **activity** are shown as a space-time diagram in Figure 42.
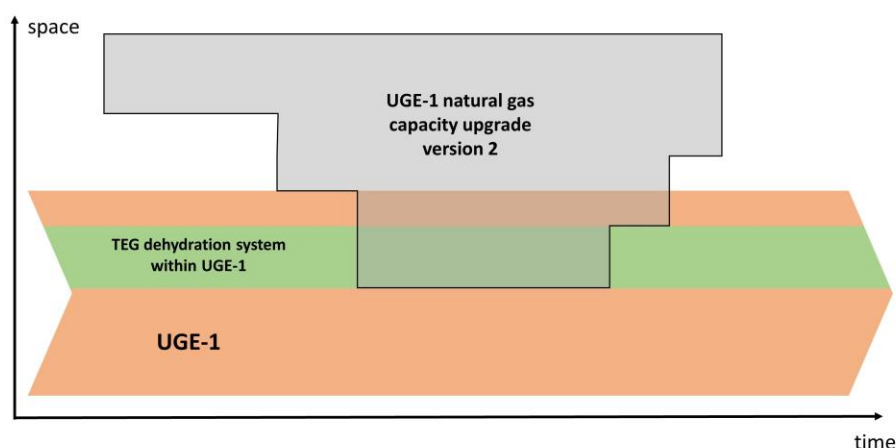
Figure 42: Subject of work space-time diagram

Objects are as follows:

— UGE-1: an **actual individual** and **physical object**;

— UGE-1 TEG dehydration system: an **actual individual** and **physical object**;

— 'UGE-1 natural gas capacity upgrade version 2': a **non-actual individual** and **activity**;

— 'part of UGE-1 participating in natural gas capacity upgrade version 2': a **non-actual individual** and **subject of work**;

— 'temporal part of UGE-1 TEG dehydration system participating in natural gas capacity upgrade version 2': a **non-actual individual** and **subject of work**.

These objects, with their classifications and relationships, are shown in Figure 43.
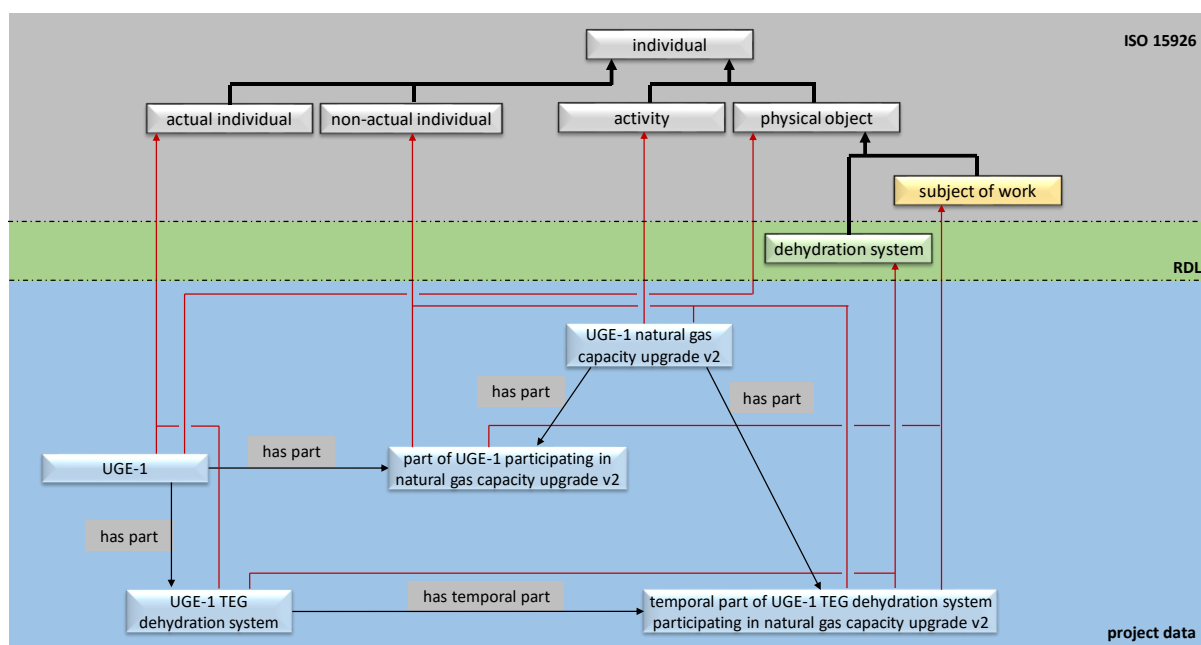
Figure 43: Subject of work

A record of a physical object that is the **subject of work** of an **activity** may be omitted if a **subject of work** relationships is used.

EXAMPLE 2   A simplification of EXAMPLE 1 by the use of a subject of work relationship is shown in Figure 44.
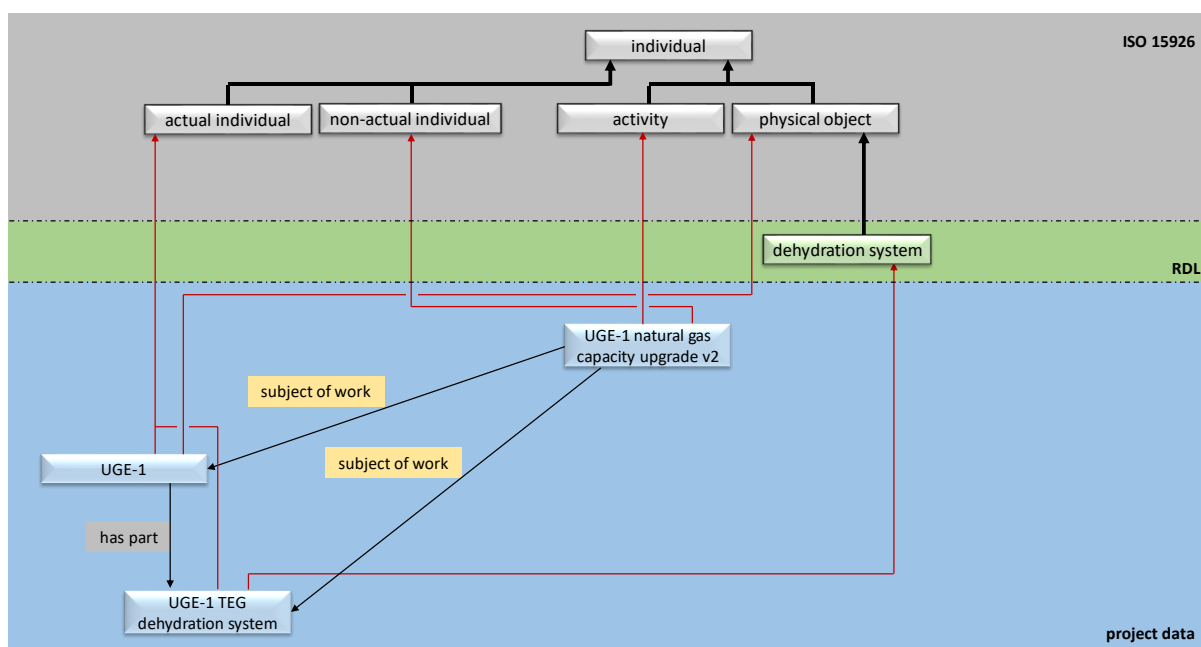
Figure 44: Subject of work relationship

5.9.2   Subject of work and physical breakdown

A **physical object** that is a **subject of work** may be classified according to its function.

NOTE 1   Classes of **physical object** according to function are not standardized in this part of ISO 15926 but can be defined in a Reference Data Library. Such classes are usually domain specific.

The **subject of work** of an **activity** that is a part of a whole may be classified by a **physical breakdown class**.

NOTE 2   **Physical breakdown classes** are not standardized in this part of ISO 15926 but can be defined in a Reference Data Library.

EXAMPLE   **Physical breakdown classes** are defined in ISO 19008 "Standard Cost Coding System".

5.9.3   Role of a person or organization

An **organization** may participate in an **activity** as:

— **operator**;

— **main-contractor**;

— **sub-contractor**.

A **person** or **organization** may participate in an **activity** as:

— **project leader**.

NOTE   Other roles for an **organization** or **person** in an **activity** can be defined within a Reference Data Library. Common roles includes "regulator", "project sponsor", "project director", "construction manager", "engineering manager", and "team leader".

EXAMPLE   The **person** Fred Bloggs is the proposed "chief engineer" for the proposed **activity** "UGE-1 natural gas capacity upgrade v2". This is shown in Figure 45.
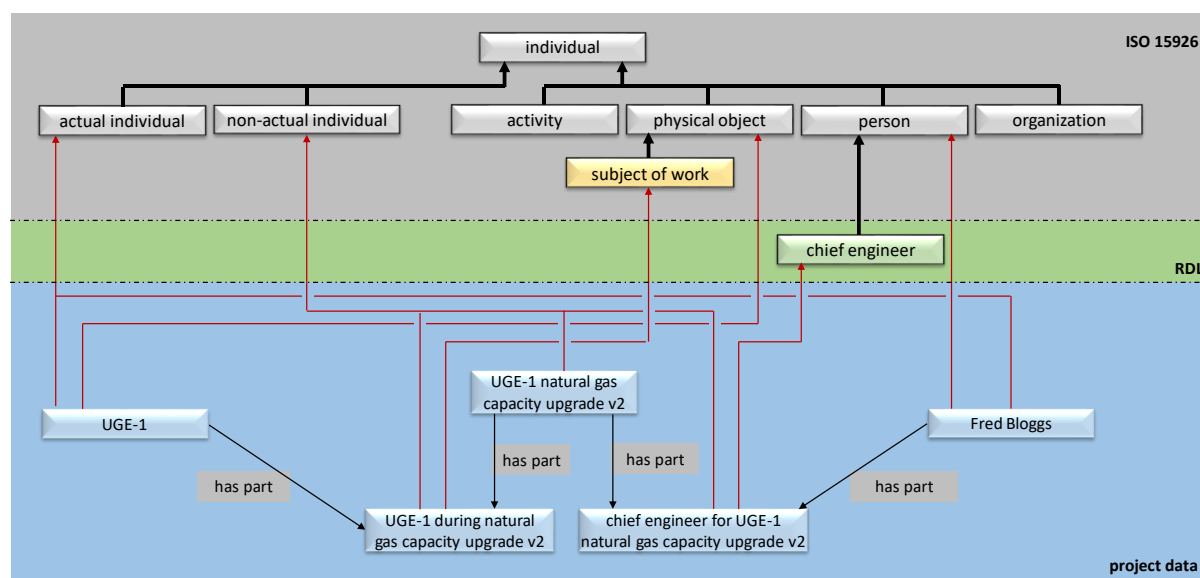
Figure 45: Role of a person in an activity

Figure 45 assumes that Fred Bloggs is the proposed chief engineer throughout the project. It is were proposed that the chief engineer changed during the project, then:

— the **functional physical object** "chief engineer for UGE-1 natural gas capacity upgrade v2" would have a temporal part "Fred Bloggs as chief engineer for UGE-1 natural gas capacity upgrade v2" with beginning and end dates;

— only the temporal part "Fred Bloggs as chief engineer for UGE-1 natural gas capacity upgrade v2" would be a part of the person "Fred Bloggs".

5.9.4 Planning software

A **planning** activity may be carried out using **installed planning software**.

Installed planning software is a subclass of **physical object**. Subclasses of **installed planning software** may be according to the type and version of the software.

NOTE   Subclasses of **installed planning software** are not defined in this part of ISO 15926, but can be defined within a Reference Data Library. A common subclass is "Microsoft Project" Different versions of Microsoft Project are subclasses of this.

5.10 Shutdown

5.10.1 Shutdown phase

An **activity** that has a **shutdown** as a part is divided into **shutdown phases** as follows:

— **activity before running down**;

— **running down**;

— **activity between running down and starting up**;

— **starting up**;

— **activity after starting up**.

EXAMPLE   The proposed **activity** 'scheduled maintenance of platform UGE-1 in May 2015 version 2' has a **shutdown** as a part. This **activity** has the phase 'scheduled maintenance of platform UGE-1 in May 2015 whilst shutdown version 2' which is a member of **activity between running down and starting up**.

5.10.2 Necessary shutdown for an activity

An **activity** is classified according whether or not it is necessarily part of an **activity between shutdown and start-up**. The following are members of **class of activity by shutdown requirement**:

— **activity independent of shutdown**;

— **activity requiring shutdown**.

EXAMPLE   The proposed **activity** 'required replacement of the instrumentation of the flare tip of platform UGE-1 version 2' is part of the scheduled maintenance of platform UGE-1 in May 2015, and is an **activity requiring shutdown**. Therefore this **activity** is part of the **activity between shutdown and start-up** 'scheduled maintenance of platform UGE-1 in May 2015 whilst shutdown version 2'.

A **class of activity** can be classified according whether or not its members are necessarily part of an **activity whilst shutdown**. The following are members of **class of class of activity by shutdown requirement**:

— **class of activity independent of shutdown**;

— **class of activity requiring shutdown**;

— **class of activity possibly requiring shutdown**.

NOTE   A **specification** and a **class of activity** can be classified according whether or not its members are necessarily part of an **activity whilst shutdown**.

5.10.3 Shutdown scope

A **shutdown** activity has a temporal part of a **physical object** as its **subject of work**. The classification of the **physical object** may place requirements on the nature of the shutdown.

NOTE 1   Subclasses of **physical object** relevant to the nature of a **shutdown** are not standardized in this part of ISO 15926 but can be defined in a Reference Data Library. Such classes are usually domain specific. Subclasses of **physical object** that are of significance to an oil and gas exploration and production shutdown include:

— system;

— system train;

— equipment;

— field;

— living quarters;

— plant.

A **shutdown** activity can cause the end of another **activity**. The classification of the **activity** that is ended may place requirements on the nature of the **shutdown**.

NOTE 2   Subclasses of **activity** relevant to the nature of a **shutdown** are not standardized in this part of ISO 15926 but can be defined in a Reference Data Library. Such classes are usually domain specific. Subclasses of **activity** that are of significance to an oil and gas exploration and production shutdown include:

— drilling;

— gas export;

— gas injection;

— oil and gas production;

— water injection;

— water production.

5.10.4 Shutdown reason

A **shutdown** is classified according to reason. The following subclasses of **shutdown** are members of **class of shutdown by reason**:

— **emergency shutdown**;

— **safety test shutdown**;

— **mini shutdown**;

— **revision shutdown**.

NOTE   Additional members of **class of shutdown by reason**, such as "cycle ending turnaround" and "non-cycle ending turnaround" can be defined in a Reference Data Library.

A **shutdown** can be classified according to whether or not it has been planned. The following sub-classes of **shutdown** are members of **class of shutdown by prior intent**:

— **unplanned shutdown**;

— **planned shutdown**.

EXAMPLE   The proposed **activity** 'scheduled maintenance of UGE-1 in May 2015 version 2' has the **shutdown** 'production shutdown of UGE-1 in May 2015 version 2'as a part. This **shutdown** is a **planned shutdown** and a **mini shutdown**. This shutdown causes an end to the **activity** 'production on UGE-1in May 2015'. Objects are as follows:

— 'production on UGE-1 in May 2015': an **activity** and **actual individual**;

— 'scheduled maintenance on UGE-1 in May 2015 version 2': an **activity** and **non-actual individual**;

— 'production shutdown on UGE-1 in May 2015 version 2': a **scheduled shutdown**, a **mini shutdown** and a **non-actual individual**;

— 'end of production on UGE-1 in May 2015 version 2': an **event** and **non-actual individual**;

— 'scheduled maintenance on UGE-1 in May 2015 whilst shutdown version 2': an **activity between shutdown and start-up** and **non-actual individual**;

— 'replacement of the instrumentation of the flare tip of UGE-1 version 2': an **activity** and **non-actual individual**.

These objects, with their classifications and relationships, are shown in Figure 46.
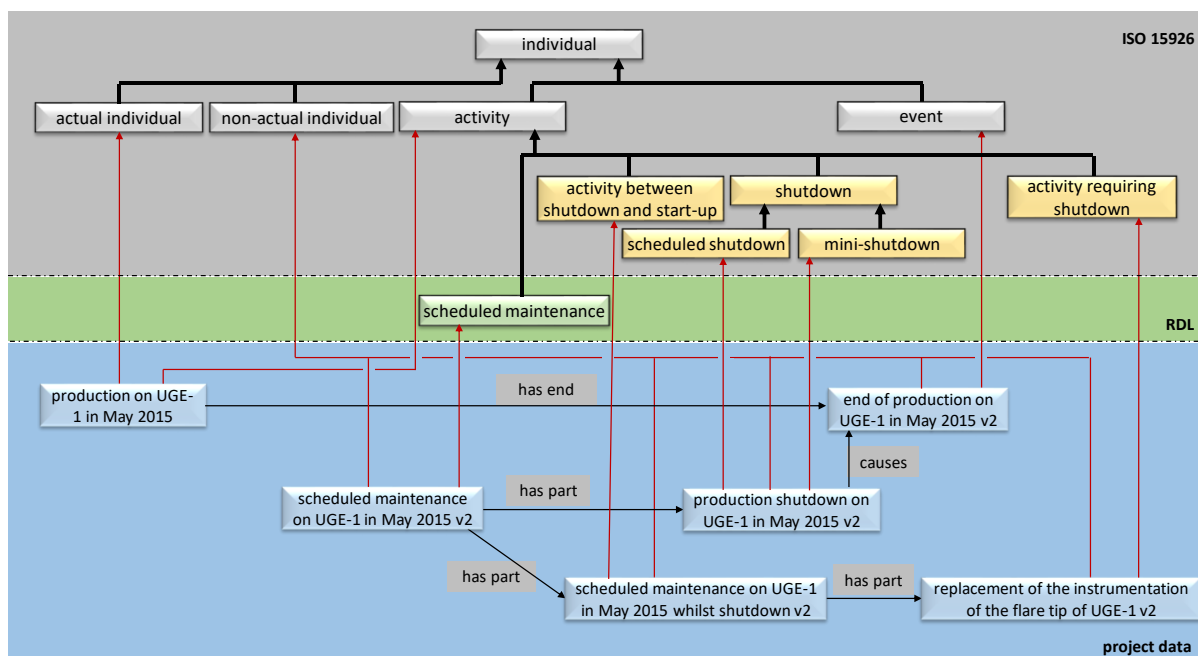
Figure 46: Activity shutdown type

5.11 Dates and times for an activity

5.11.1 Beginning and end events for an activity

An **activity** has beginning and end **events**. The **point in time** of an **event**, or a **period in time** that contains an **event** may be recorded.

NOTE 1   A **point in time** can be identified by an **iso 8601 identification of point in time**. The property **iso 8601 identification of point in time** is defined in ISO 15926-12.

NOTE 2   A **period in time** can be described by an **iso 8601 identification of period in time**. A **period in time** can also be defined by a beginning and end **point in time**. The property **iso 8601 identification of period in time** is defined in ISO 15926-12.

A **period in time** may have both a beginning and an end, or have no beginning or no end. The following subclasses of **period in time** are defined:

— **period of time with definite beginning and end**;

— **period of time with indefinite beginning**;

— **period of time with indefinite end**.

5.11.2 Required beginnings and ends

A required **activity** has required beginning and end **events**. The **periods in time** that contain these **events** may be specified.

NOTE   Dates that are commonly specified for a required **activity** are shown in Table 1, along with their commonly used initializations.

Table 1: Dates specified for a required activity

initialization	name	representation
MSO	must start on date	beginning **event** is part of a **period of time** that is the specified **calendar day**
MFO	must finish on date	end **event** is part of a **period of time** that is the specified **calendar day**
SNET	start no earlier than date	beginning **event** is part of a **period of time** that begins at the beginning of the specified **calendar day**
SNLT	start no later than date	beginning **event** is part of a **period of time** that ends at the end of the specified **calendar day**
FNET	finish no earlier than date	end **event** is part of a **period of time** that begins at the beginning of the specified **calendar day**
FNLT	finish no later than date	end **event** is part of a **period of time** that ends at the end of the specified **calendar day**

EXAMPLE   The required **activity** 'UGE-1 natural gas capacity upgrade' is required to start no later than the 30th June 2016. Object are as follows:

—— 'UGE-1 natural gas capacity upgrade': an **activity** and **non-actual individual**;

—— 'UGE-1 natural gas capacity upgrade beginning': an **event** and an **non-actual individual**;

—— 'before 1st June 2016': a **period in time with indefinite beginning**;

—— '2016-06-01T00:00Z': a **point in time**.

These objects, with their classifications and relationships, are shown in Figure 47.
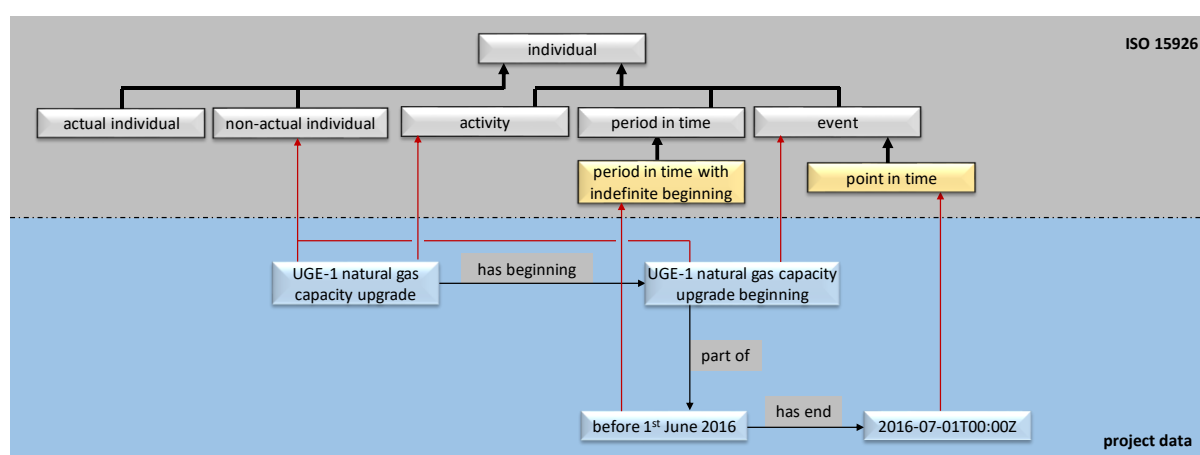
Figure 47: Required beginning

5.11.3 Required as early or as late as possible

A planning **activity** may require a beginning or end **event** to be as early or as late as possible.

The following relationships are defined between a planning activity and an event:

— **required as early as possible**;

— **required as late as possible**.

EXAMPLE   Planning for **activity** 'UGE-1 natural gas capacity upgrade' requires that it ends as early as possible. Objects are as follows:

— 'planning for UGE-1 natural gas capacity upgrade': a **planning** activity and an **actual individual**;

— 'UGE-1 natural gas capacity upgrade': an **activity** and a **non-actual individual**;

— 'UGE-1 natural gas capacity upgrade end': an **event** and a **non-actual individual**.

These objects, with their classifications and relationships, are shown in Figure 48.
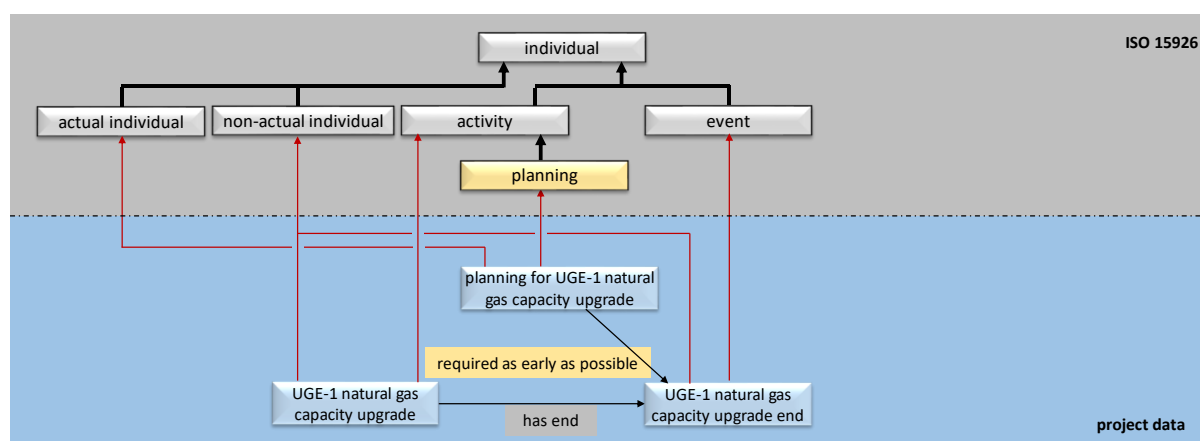
Figure 48: Required as early as possible

5.11.4 Proposed beginnings and ends

A proposed **activity** has proposed beginning and end **events**. The **periods in time** that contain these **events** may be specified.

NOTE 1   The information about the beginning and end **events** of a proposed **activity** can be contained in a **schedule**.

NOTE 2   The dates and times of proposed beginning and end **events** are usually calculated by planning software.

NOTE 3   Dates that are commonly specified for a proposed **activity** are shown in Table 2 along with their commonly used initializations.

Table 2: Plan for activity dates

initialization	name	representation
ES	early start date	beginning **event** is part of a **period of time** that begins at the beginning of the specified **calendar day**
LS	late start date	beginning **event** is part of a **period of time** that ends at the end of the specified **calendar day**

EF	early finish date	end **event** is part of a **period of time** that begins at the beginning of the specified **calendar day**
LF	late finish date	end **event** is part of a **period of time** that ends at the end of the specified **calendar day**

EXAMPLE   The proposed **activity** 'UGE-1 natural gas capacity upgrade version 2' specifies a beginning between the 10th and 22nd June 2016. Objects are as follows:

— 'UGE-1 natural gas capacity upgrade version 2': an **activity** and **non-actual individual**;

— 'UGE-1 natural gas capacity upgrade beginning version 2': an **event** and **non-actual individual**;

— '10th to 22nd June 2016': a **period in time with definite beginning and end**;

— '2016-06-10T00:00Z': a **point in time**;

— '2016-06-22T24:00Z': a **point in time**.

These objects, with their classifications and relationships, are shown in Figure 49.
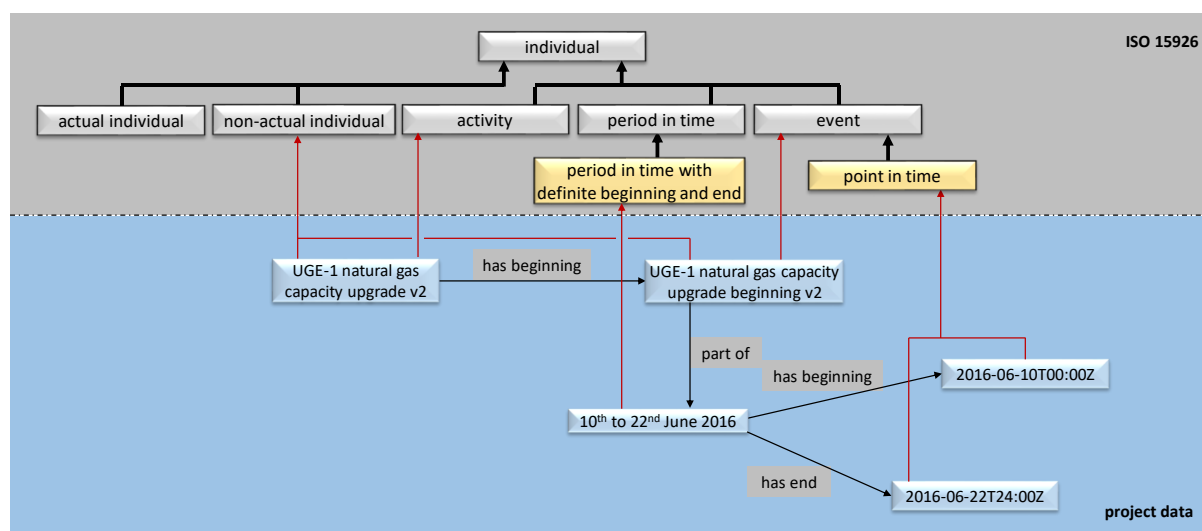
Figure 49: Proposed beginning

5.11.5 Actual beginnings and ends

An **actual activity** has an actual beginning **event** and an actual end **event**.

A **period of time** that contains an actual beginning or end **event** can be recorded.

EXAMPLE   The actual **activity** 'actual UGE-1 natural gas capacity upgrade' starts on 15th June 2015. Objects that record this are as follows:

— 'actual UGE-1 natural gas capacity upgrade': an **actual activity**;

— 'actual UGE-1 natural gas capacity upgrade beginning': an **event** and an **actual individual**;

— '15th June 2015': a **period in time** and a **calendar day**.

These objects, with their classifications and relationships, are shown in Figure 50.
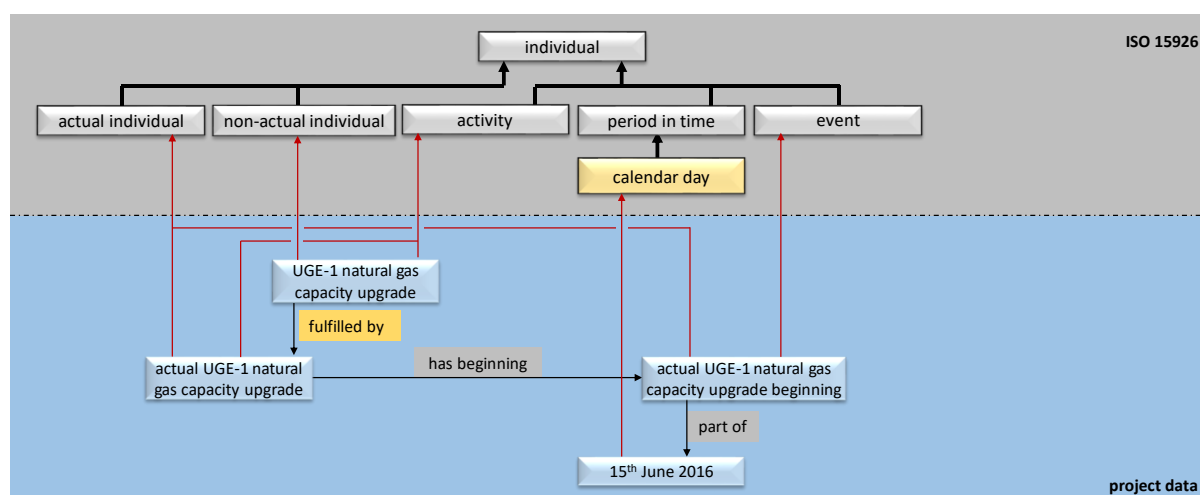
Figure 50: Actual beginning

5.12 Duration of an activity

The duration of an **activity** is the total amount of time during which the **activity** continues. This is recorded by a **has duration** relationship with a **time duration**.

If an **activity** has a calendar of working times, then the duration is the sum of the working times within the calendar during which the **activity** continues.

EXAMPLE 1   The activity 'pour concrete for the refurbishment of facility F_101' has a calendar. This activity is divided into four parts 'A', 'B', 'C' and 'D', which are separated by non-working times. The duration of the activity is the sum of the durations of the parts A, B, C and D, as shown in Figure 51. Space dimension illustrates amount of poured concrete during the activity.
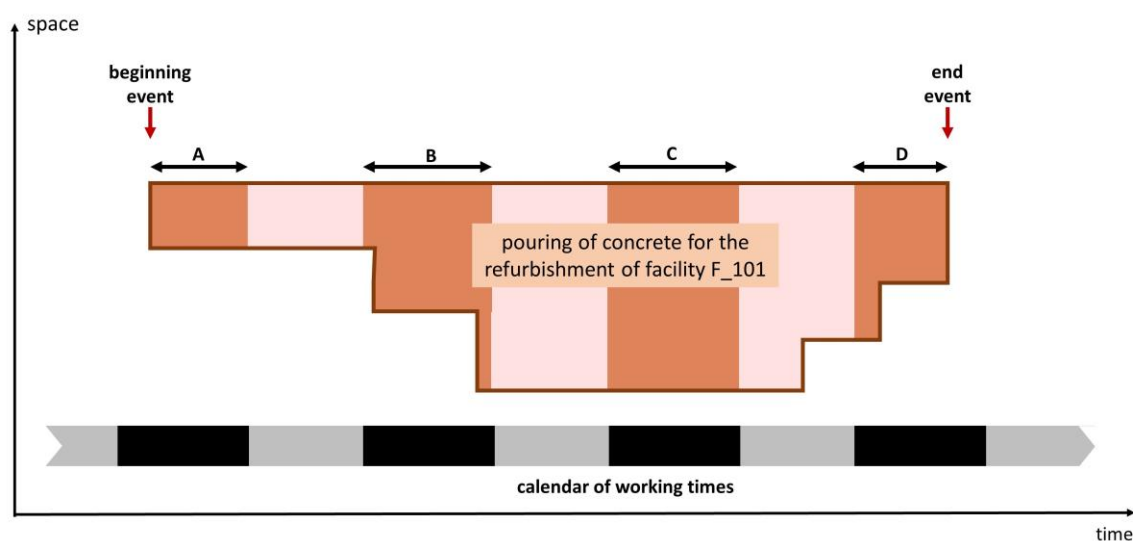
Figure 51: Duration of an activity with a calendar

The proposed pouring of concrete activity has duration of 50 hours. The actual pouring of concrete activity has a duration of 51 hours. Objects are as follows:

— 'pouring concrete for refurbishment of facility F_101 version 2': an **activity**;

— 'actual pouring concrete for refurbishment of facility F_101': an **actual activity**;

— '50 hours': a **time duration**;

— '51 hours': a **time duration**.

These objects, with their classifications and relationships, are shown in Figure 52.
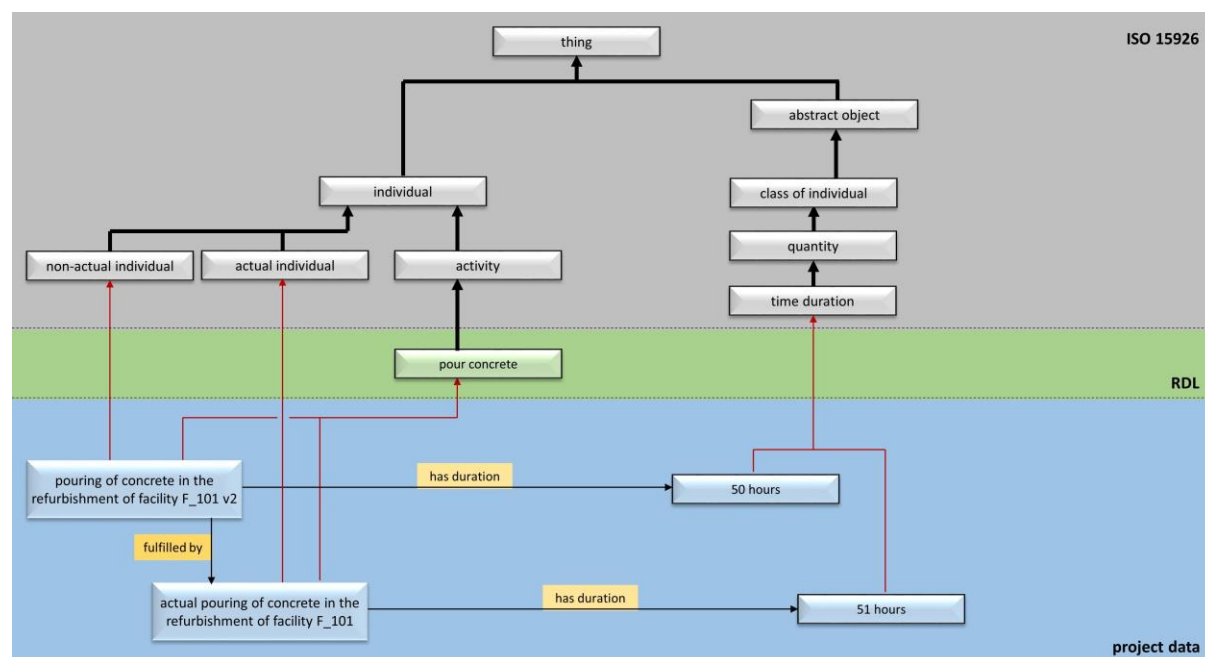
Figure 52: Duration of activity

The duration of a temporal part of the **actual activity** can be recorded.

EXAMPLE 2   Up to 2015-02-04, the duration of the 'actual pouring concrete for refurbishment of facility F_101' activity, defined in EXAMPLE 1, is 12.5 hours. This is 25% of the planned duration. The additional objects to record this information are as follows:

— 'actual pouring concrete for refurbishment of facility F_101 to 2015-02-04': an **actual activity** and a member of 'pouring concrete';

— '12.5 hours': a **time duration**.

These objects, with their classifications and relationships, are shown in Figure 53.
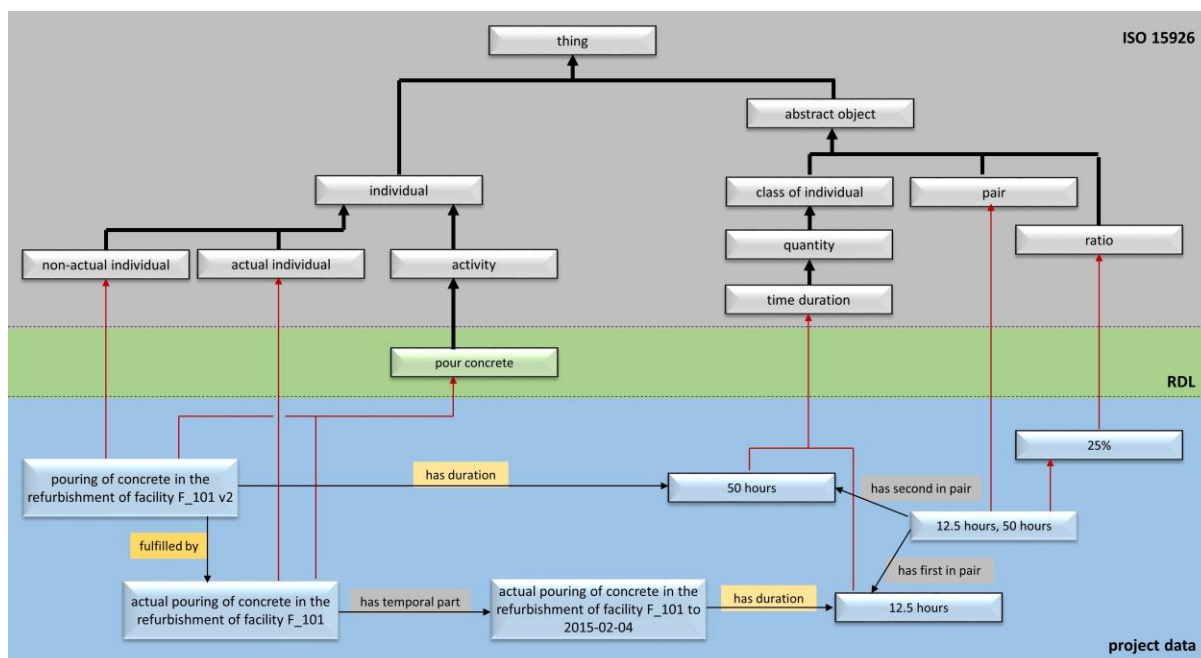
Figure 53: Duration of activity to date

5.13 Measure of progress

5.13.1 Frontline date

The "frontline date" for a proposed **activity** is the date upon which achieved progress was scheduled.

An actual **activity** has measure of progress. A proposed **activity** can be partitioned into the part that corresponds to the progress of the actual **activity** according to the measure, and to the part that remains to be done.

The frontline date is the date of the end of the part of the proposed **activity** that corresponds to the progress of the actual **activity**. If the frontline date is before the date to which the progress of the actual **activity** is reported, then the **activity** is behind schedule.

EXAMPLE   The pouring of concrete for the refurbishment of facility F_101 is reported to 2015-02-04. The measure of progress is the amount of concrete mix used. According to the proposal version 2, this amount of concrete mix should have been used by 2015-02-03. Hence the frontline date for the **activity** is 2015-02-03, whilst the actual date is 2015-02-04.

The objects in proposal version 2 are as follows:

— 'pouring concrete for refurbishment of facility F_101 version 2': an **activity** and **non-actual individual**;

— 'pouring concrete for refurbishment of facility F_101 version 2 to 2015-02-03': an **activity** and **non-actual individual**;

— 'concrete mix resource for use to 2015-02-03 in version 2': a **resource** and **non-actual individual**.

The actual objects are as follows:

— 'actual pouring concrete for refurbishment of facility F_101': an **activity** and **actual individual**;

— 'actual pouring concrete for refurbishment of facility F_101 to 2015-02-04': an **activity** and **actual individual**;

— 'actual concrete mix resource used to 2015-02-04': a **resource** and **actual individual**.

The objects, with their classifications and relationships, are shown in Figure 54.
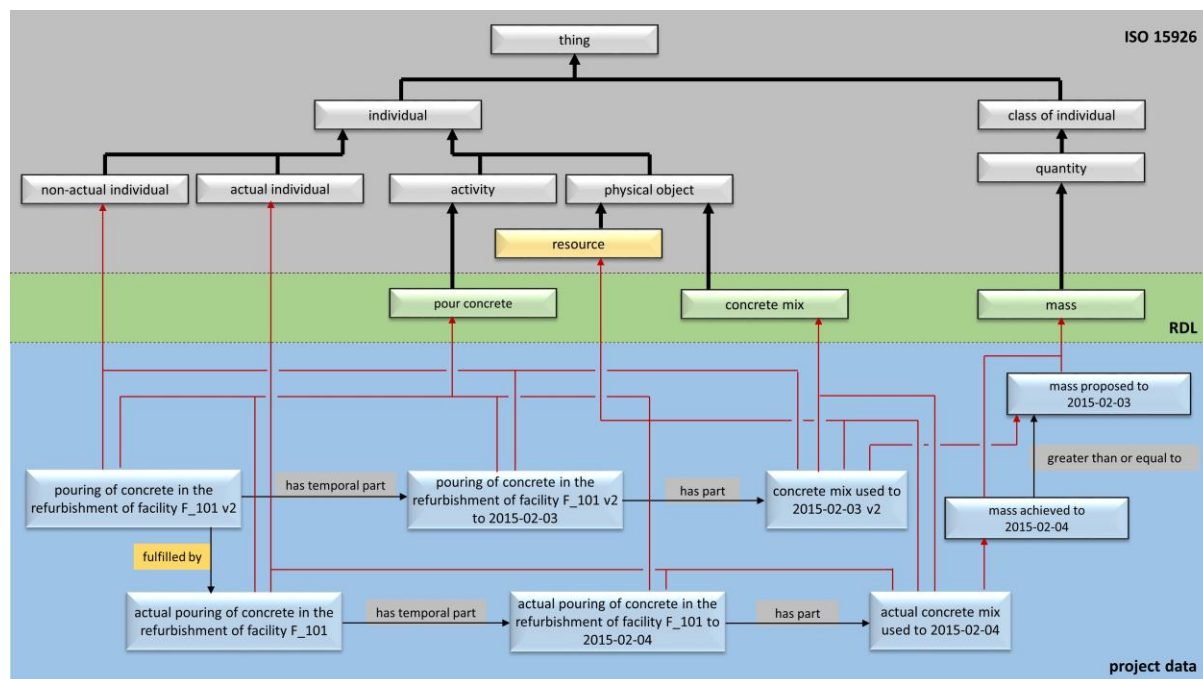
Figure 54: Frontline date

5.13.2 Performance measurement

A **performance evaluating** activity contains **earned value calculating** activities that calculate measures of progress for an actual **activity**. Each **earned value calculating** activity may be classified according to the **earned value method** that is used.

The following is an **earned value method**:

— **always on schedule**: the percentage complete is always according to the proposed timing for the **activity**.

> NOTE 1   An **always on schedule** method is usually used for activities such as providing safety cover that do not have milestones or specific deliverables.

NOTE 2   Other **earned value methods** can be defined within a Reference Data Library. Common methods include:

— earned value 0/100: 100% is earned when an **activity** is completed, but nothing is earned before.

— earned value 20/80: 20% is earned when an **activity** begins, and the remain 80% is eared when an **activity** is completed.

A **performance evaluating** activity has a **uses method** relationship with an **earned value method**.

EXAMPLE   The **planning** activity for the refurbishment of facility F-101 contains a **performance evaluating** activity for the pouring of concrete which uses the "earned value 20/80" method. This is shown in Figure 55.
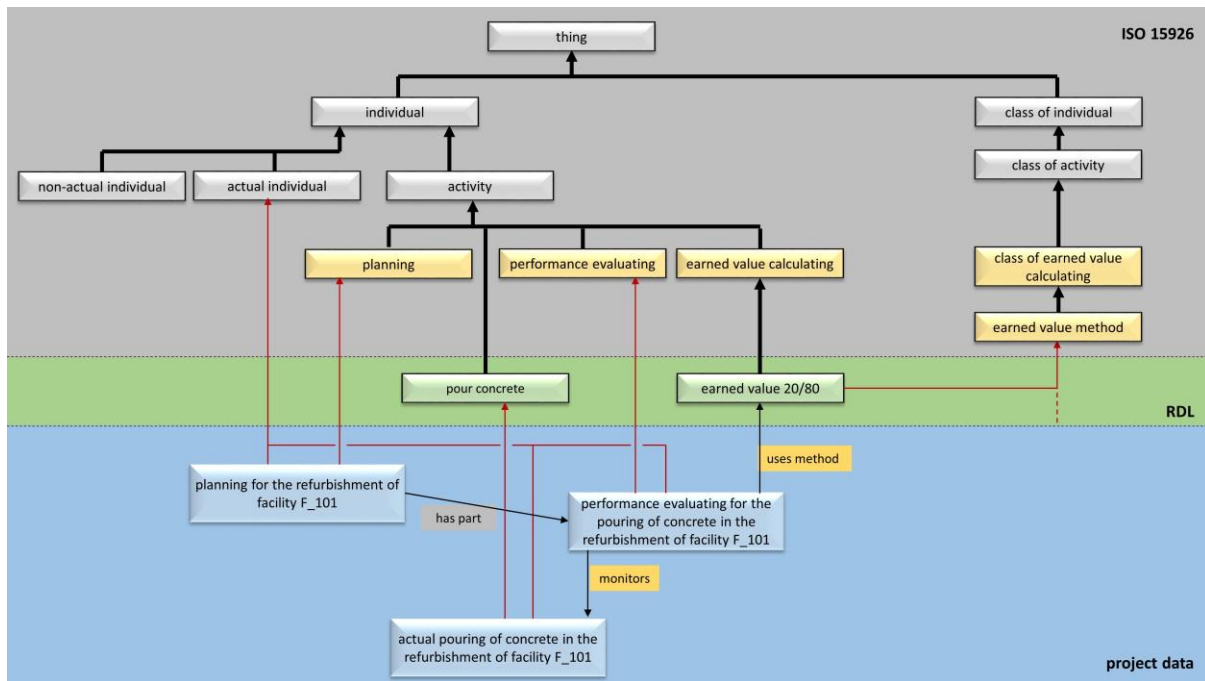
Figure 55: Performance measurement

5.14 Event and milestone

An **event** may be:

⸺ the beginning or end of an **activity**;

⸺ at a stage within an **activity** defined by a metric such as activity duration, staff time, expenditure or material use;

⸺ separated by a **period in time** from another **event**;

⸺ the earliest or latest of a set of **events**.

An **event** may be a "milestone" for a **planning** activity. A **has milestone** relationship specified that a **planning** activity regards an **event** as a milestone.

An **event** may be a milestone for a **decision gate** activity.

EXAMPLE 1   The **planning** activity 'planning for UGE-1 natural gas capacity upgrade' has 'completion of installation of piping for dehydration train B on UGE-1' as a milestone. The objects are as follows:

⸺ 'planning for UGE-1 natural gas capacity upgrade': a **planning** activity and an **actual individual**;

⸺ 'UGE-1 natural gas capacity upgrade': an **activity** and a **non-actual individual**;

⸺ 'installation of piping for dehydration train B on UGE-1': an **activity** and a **non-actual individual**;

⸺ 'completion of installation of piping for dehydration train B on UGE-1': an **event** and a **non-actual individual**.

⸺ These objects, with their classifications and relationships, are shown in Figure 56.
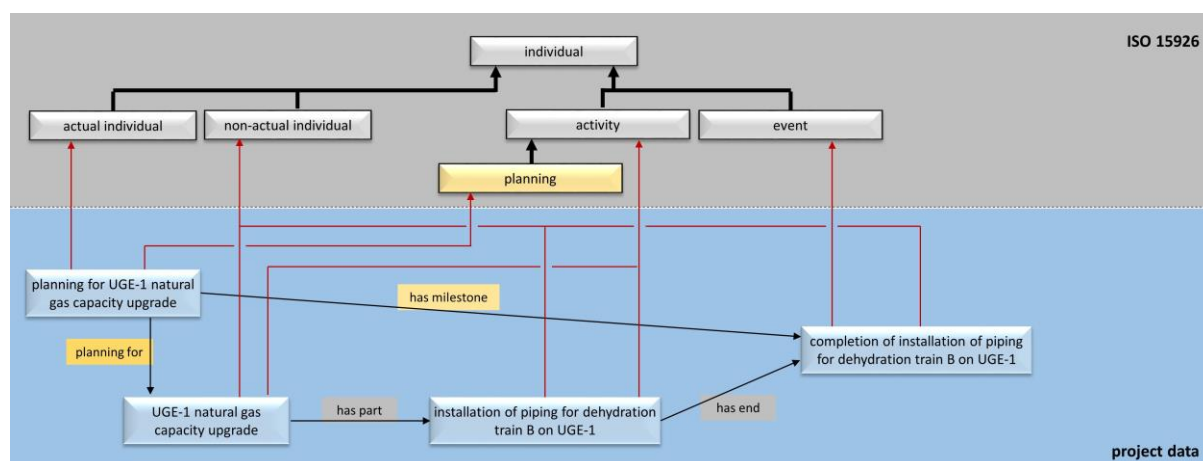
Figure 56: Activity and milestone

EXAMPLE 2   The **specification** for a **point in time** 'specification for 28 days after the completion of pour-
ing concrete for refurbishment of facility F_101 version 2' is 28 days after the **event** 'completion of pouring
concrete for refurbishment of facility F_101 version 2'. Objects are as follows:

— 'pouring concrete for refurbishment of facility F_101 version 2': an **activity** and a **non-actual individual**;

— 'completion of pouring concrete for refurbishment of facility F_101 version 2': an **event** and a **non-actual
individual** (which has **specification** 'specification for completion of pouring concrete for refurbishment of
facility F_101 version 2' at **specification** for **point in time** T_1);

— 'specification for 28 day period beginning with the completion of pouring concrete for refurbishment of fa-
cility F_101 version 2': a **specification** and **class of period in time**;

— 'specification for 28 days after completion of pouring concrete for refurbishment of facility F_101 version
2': **specification** and **class of point in time**.

These objects, with their classifications and relationships, are shown in Figure 57.
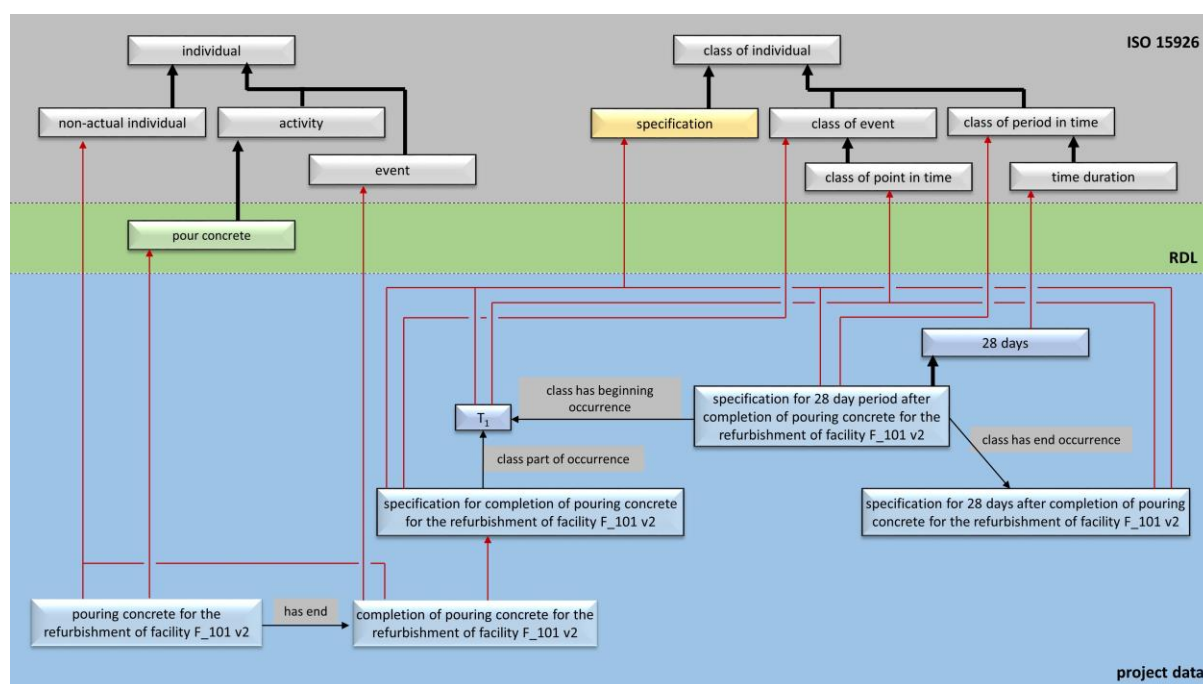
Figure 57: End of a period in time after an event

5.15 Temporal relationships between activities and events

5.15.1 Succession relationship

There may be succession relationships between **events**.

NOTE 1   In many cases, an **event** is the beginning or end of an **activity**, so that there are "succession relationships" between **activities** as shown in Table 3:

Table 3: Plan succession links between activities

initialization	name	representation
SS	start to start	beginning **event** of one **activity** has a temporal relationship with the beginning **event** of another
SF	start to finish	beginning **event** of one **activity** has a temporal relationship with the end **event** of another
FS	finish to start	end **event** of one **activity** has a temporal relationship with the beginning **event** of another
FF	finish to finish	end **event** of one **activity** has a temporal relationship with the end **event** of another

A succession relationship defines a **class of period in time** that separates **specifications** for **points in time** that contain the **events**. If no minimum duration is specified for this **class of period of time**, then it may be very short and defines only a sequence for the **events**.

NOTE 2   A **plan succession link** corresponds to the element "ProjectScheduleTaskRelationship" in the UN/CEFACT XML schema.

EXAMPLE   The **event** 'start of pouring of concrete for the refurbishment of facility F_101 version 2' is constrained to follow the **event** 'completion of erection of shuttering for the refurbishment of facility F_101 version 2'. This is a "Finish to Start" (FS) constraint.

The objects that define the times of the beginning and ends of the **activities** are as follows:

— 'erection of shuttering for refurbishment of facility F_101 version 2': an **activity** and **non-actual individual**;

— 'completion of erection of shuttering for refurbishment of facility F_101 version 2': an **event** and **non-actual individual** (which has **specification** 'specification for completion of erection of shuttering for refurbishment of facility F_101 version 2' at **specification** and **class of point in time** T_1);

— 'pouring concrete for refurbishment of facility F_101 version 2': an **activity** and **non-actual individual**;

— 'start of pouring concrete for refurbishment of facility F_101 version 2': an **event** and **non-actual individual** (which has **specification** 'specification for start of pouring of concrete for refurbishment of facility F_101 version 2' at **specification** and **class of point in time** T_2);

— 'specification for period of time between completion of erection of shuttering and start of pouring of concrete for refurbishment of facility F_101 v2': a **specification** and **class of period in time**.

The objects with their classifications and relationships are shown in Figure 58.
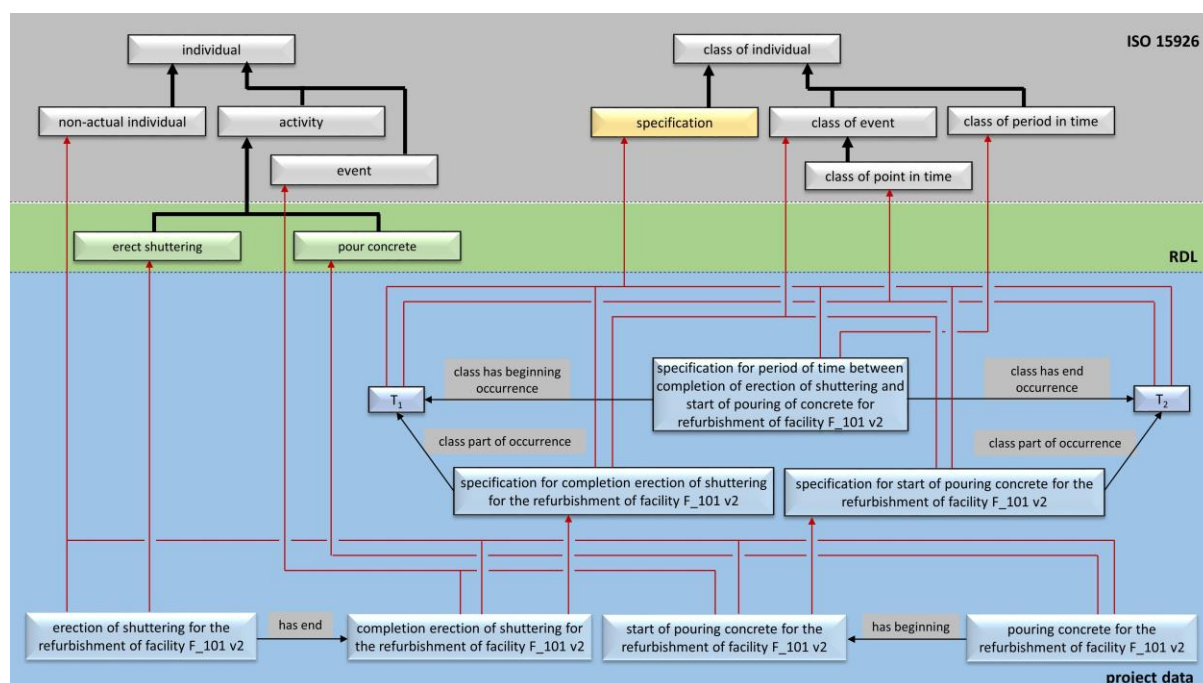
Figure 58: Finish to start succession relationship

5.15.2 Specified lag for a succession relationship

A **period of time** that separates **events** may be constrained to be within **duration range**. This **duration range** is called a "lag".

A **duration range** can be defined by a **duration** that is its **upper bound** and a **duration** that is its **lower bound**.

NOTE   A **duration** can be specified in terms of a duration scale such as **hour** or an ISO 8601 duration description.

EXAMPLE   The **event** 'start of striking shuttering for the refurbishment of facility F_101 version 2' is constrained to be at least 72 hours after the **event** 'completion of pouring concrete for the refurbishment of facility F_101 version 2'. This is a "Finish to Start" (FS) constraint, with a lag of 72 hours or more.

Subsequently the removal of the shuttering from site is constrained to be within 7 working days of the finish of pouring concrete. This is a "Finish to Finish" (FF) constraint with a lag of 7 working days or less. The relationships between the activities of pouring concrete, striking shuttering and removing shuttering from site are shown in Figure 59.
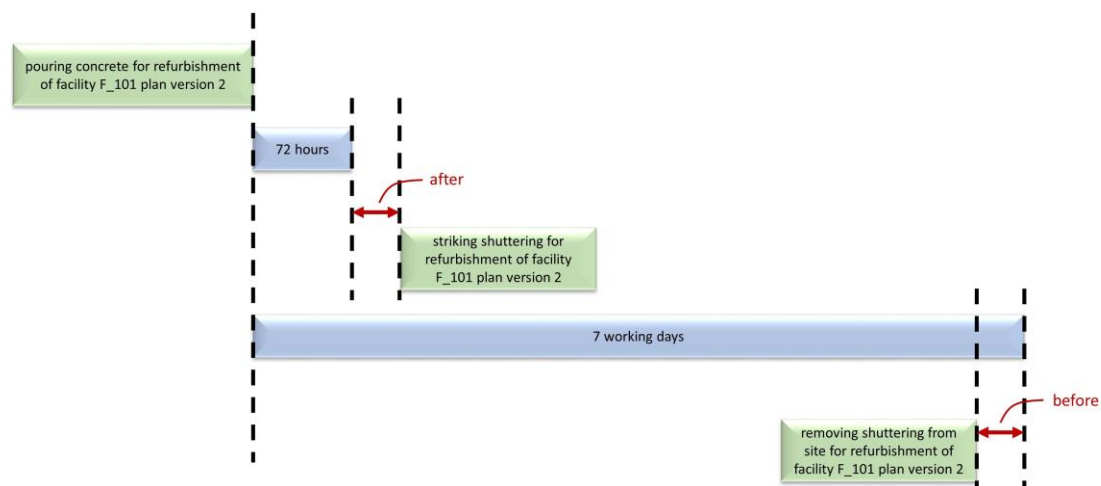
Figure 59: Sequence of activities

The relationship between the end time of the pouring concrete and the beginning time of striking shuttering activities is defined in terms of their specifications as follows:

— 'specification for completion of pouring concrete for refurbishment of facility F_101 version 2': a **specification** and **class of event** (at **specification** and **class of point in time** T_1);

— 'specification for beginning of striking shuttering for refurbishment of facility F_101 version 2': a **specification** and **class of event** (at **specification** and **class of point in time** T_2).

The separation between T_1 and T_2 is

— 'specification for period between time of completion of pouring of concrete and time of start of striking of shuttering version 2': a **specification** and **class of period of time**.

These objects with their classifications and relationships, are shown in Figure 60.
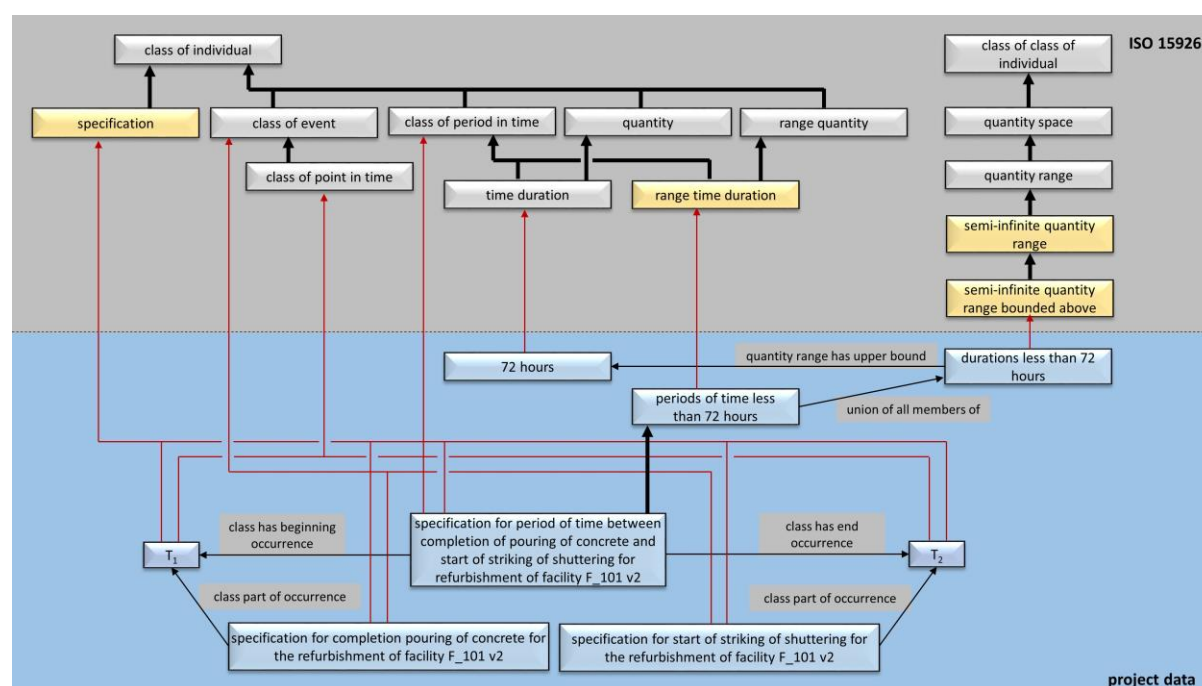
Figure 60: Finish to start succession relationship with lag

5.15.3 Specified lag with calendar for a succession relationship

A **period of time** that separates **events** may be constrained to be within a **calendar** of working times.

If a **period of time** is within a **calendar**, then its **duration** is the sum of the working times within the calendar.

If a **period of time** is within a **calendar**, then its **duration** may be specified in terms of working days, as follows:

— if a **period in time** begins and ends within the same working day it is a member of **period in time within a working day**;

— if a **period in time** ends within a subsequent working day it is has a **number of working days** relationship with an integer, where 1 indicates the next working day.

EXAMPLE   The **event** 'completion of removing shuttering from site for the refurbishment of facility F_101 version 2' is constrained to be within 7 working days of the **event** 'completion of pouring concrete for the refurbishment of facility F_101 version 2'. This is a "Finish to Finish" (FF) constraint, with a lag of 7 working days or less. The working days are defined by the 'civil engineering works calendar'.

Following the approach of the EXAMPLE in clause 5.15.2, the lag is expressed as:

— 'specification for period between time of completion of pouring of concrete and time of completion of removal of shuttering from site for refurbishment of facility F_101 version 2': a **specification** and **class of period of time**.

The lag is defined by:

— 'civil engineering works calendar': a **calendar**;

— 'period in time less than 7 working days in civil engineering works calendar': a **class of period in time**.

The objects that define the **calendar** and **range time duration** for the lag are shown in Figure 61.
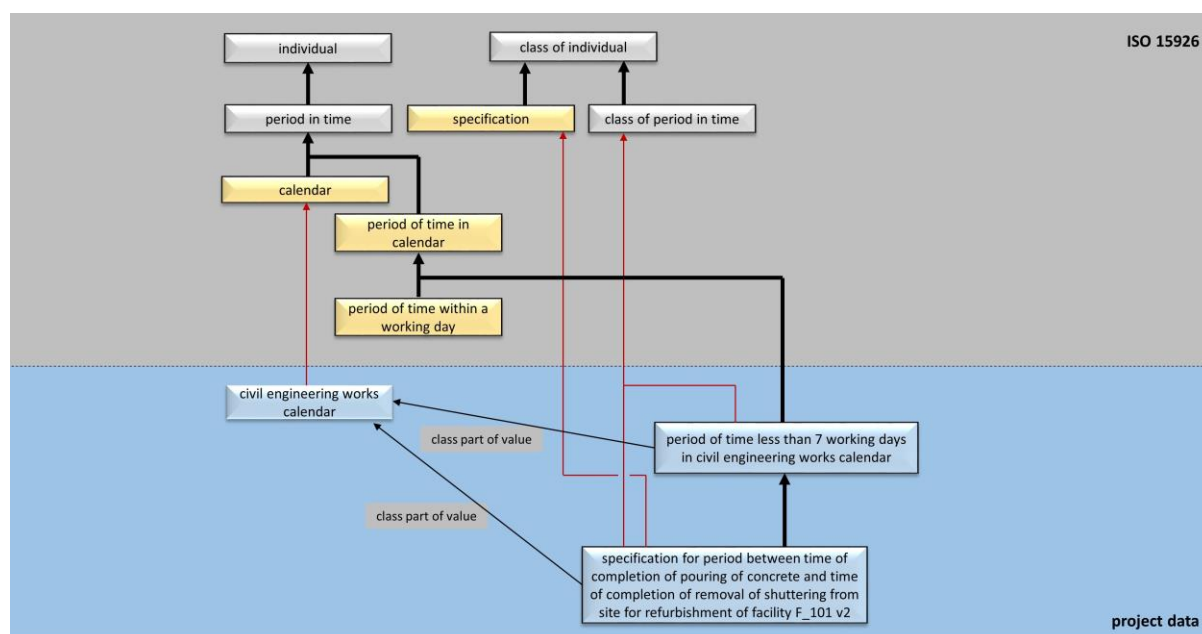
Figure 61: Finish to finish succession relationship with lag defined by working days

5.15.4 Free float and total float for an activity in project

The **free float** for a part **activity** is the extension that would not cause a delay to any subsequent **activities** within the whole.

The **total float** for a part **activity** is the extension that would not cause a delay to the completion of the whole.

The **event** at the end of an **activity** is at the beginning of its **free float** and **total float**.

Activities can be nested, so it may be ambiguous as to which whole a float is relevant. A **free float** or **total float** can have **float for** relationship with a whole **activity** to remove this ambiguity.

A **free float** or **total float** can have a calendar. The **duration** of a **free float** or **total float** is specified in the same way as the **duration** of a lag for a succession relationship.

EXAMPLE   The proposed **activity** 'pouring of concrete for the refurbishment of facility F_101 version 2' has a **free float** within the proposed whole **activity** 'refurbishment of facility F_101 version 2' of 3 working days. The working days are defined by the 'civil engineering works calendar.

The objects that define the **free float**, with their classifications and relationships, are shown in Figure 62.
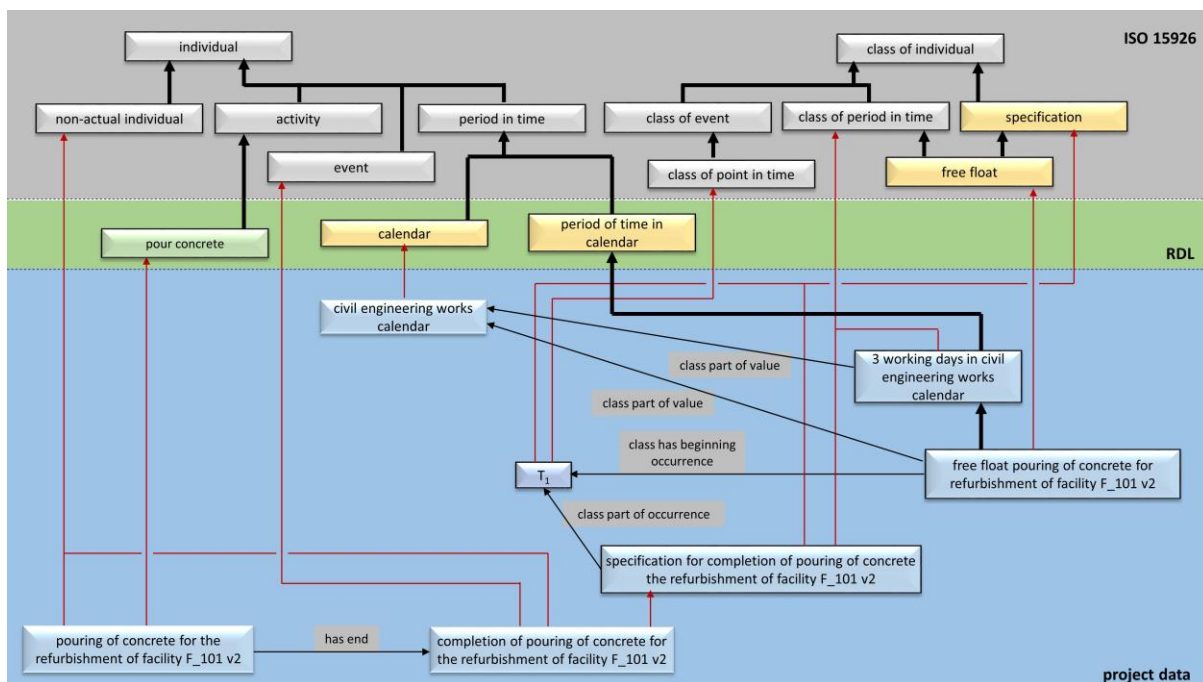
Figure 62: Free float defined by working days

5.15.5 Dependency relationship

A dependency relationship between **activities** is less precise than a temporal succession relationship.

The statement that activity A is **dependent on** activity B, means that something is created by activity B that is required by activity A.

NOTE   A **dependent on** relationship is often used where the relationships between **activities** are not within the scope of planning software. Such a relationship may be between an installation activity and a procurement activity.

5.16 Calendar

5.16.1 Working days

A **calendar** is a **period in time** with a pattern corresponding to working days. Within the overall duration of a **calendar**:

— a **period in time** that is part of a **calendar** is working time;

— a **period in time** that is not part of a **calendar** is non-working time.

NOTE 1   A **calendar** is usually specified as a pattern of daily or weekly repeated working times, but with exceptions if necessary.

A **period in time** that is part of a **calendar** is a **period in time in calendar**. A period in time in calendar may be:

— a **period in time within a working day**;

— have a duration recorded as a **number of working days**.

NOTE 2   A **calendar** can be defined by union, intersection, subtraction and complement operations on **periods in time**.

The following may be part of a calendar:

— **activity**: the **activity** takes place only during working time;

— **resource**: the **resource** is available only during working time;

— **period of time** that is a lag for a succession relationship: only working time is part of the lag;

— **event** that is a milestone: the milestone can be reached only during working time.

EXAMPLE   The proposed **activity** 'pouring concrete for refurbishment of facility F_101 version 2' takes place during the **calendar** 'civil engineering works calendar'.

The **calendar** 'civil engineering works calendar' is defined by a subtracting the **period in time** 'public holidays' from the **calendar** and **weekly repeating period in time** 'civil engineering working hours'.

Objects are as follows:

— 'pouring concrete for refurbishment of facility F_101 plan version 2': a **activity**;

— 'civil engineering works calendar': a **calendar**;

— 'civil engineering working hours': a **calendar** and **weekly repeating period in time**;

— 'public holidays': a **period in time**.

These objects, with their classifications and relationships, are shown in Figure 63.
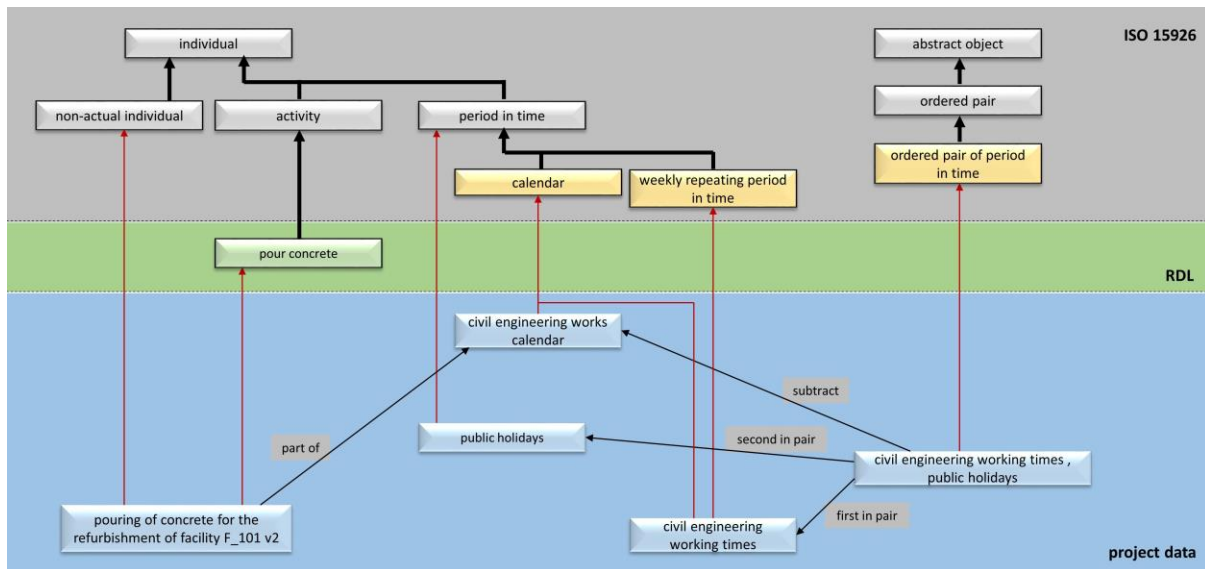
Figure 63: Calendar for an activity

5.16.2 A repeating period in time

A **repeating period in time** can be a **weekly repeating period in time** (repeating every 7 days) or a **daily repeating period in time** (repeating every 24 hours).

EXAMPLE   The weekly **repeating period in time** 'civil engineering working hours' is defined as 8 a.m. to 12 noon and then 1 p.m. to 4.30 p.m. each day except Saturdays and Sundays. This is defined by a **subtract** of the **weekly repeating period in time** 'Saturdays and Sunday' from the **daily repeating period in time** 'daily working hours'.

Objects are as follows:

— 'civil engineering working hours': a **weekly repeating period in time**;

— 'daily working hours': a **daily repeating period in time**;

— 'Saturdays and Sundays': a **weekly repeating period in time**;

—   'Saturdays': a **weekly repeating period in time**;

— 'Sundays': a **weekly repeating period in time**;

— '8 a.m. to 12 a.m.': a **daily repeating period in time**;

— '1 p.m. to 4.30 p.m.': a **daily repeating period in time**;

— '8 a.m. to 12 a.m. and 1 p.m. to 4.30 p.m.: a **daily repeating period in time**.

These objects, with their classifications and relationships, are shown in Figure 64 and Figure 65.
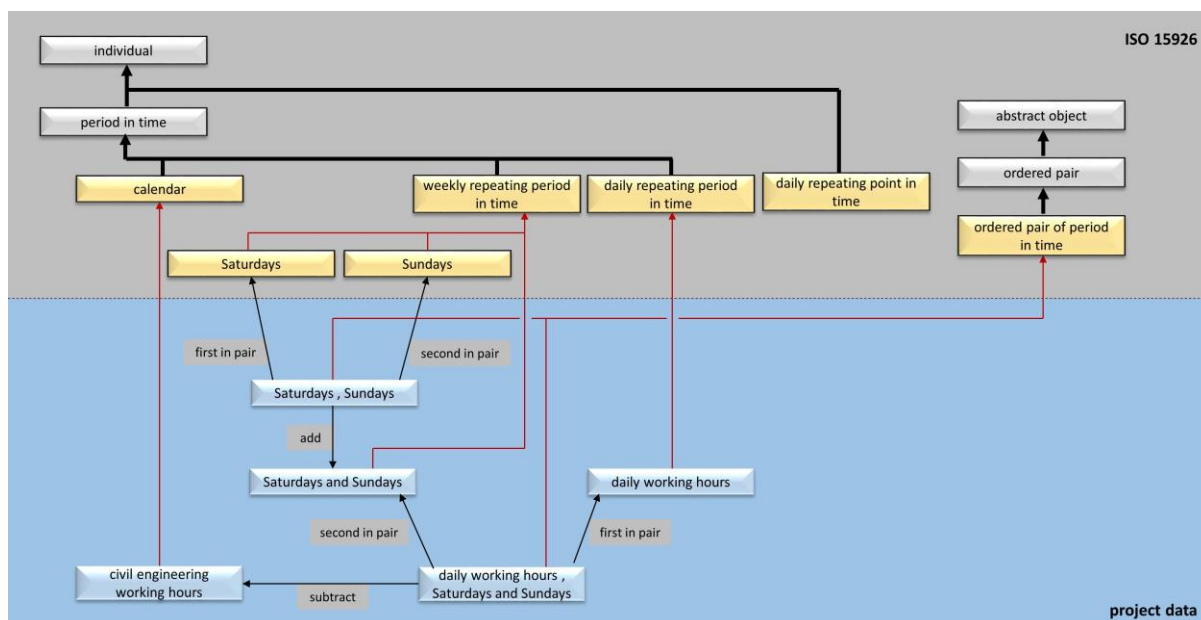
Figure 64: Weekly repeating period in time
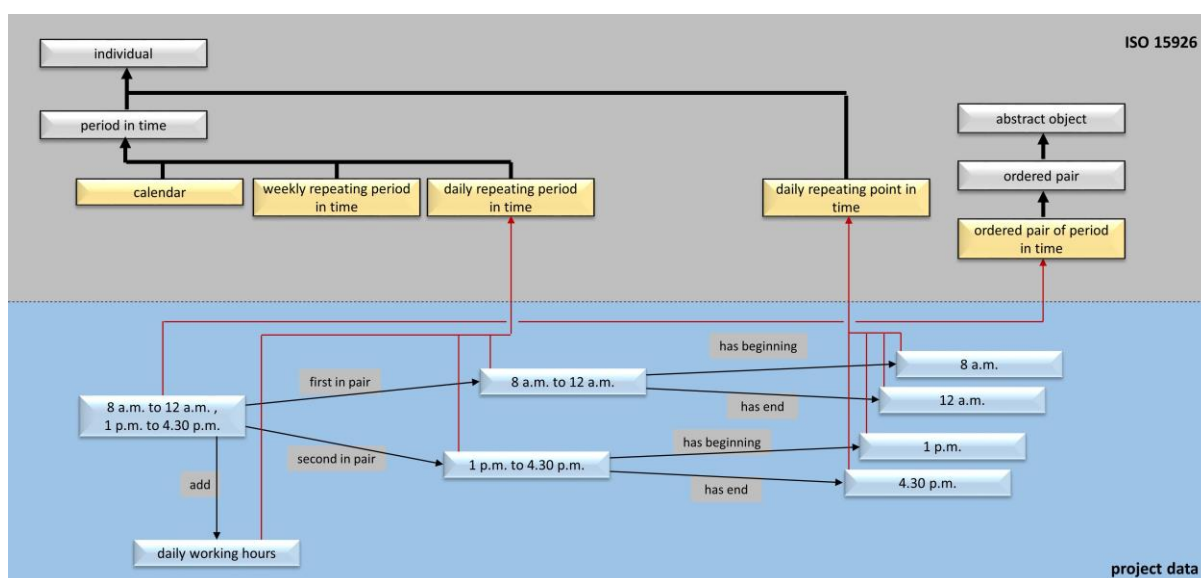
Figure 65: Daily repeating period in time

5.16.3 A repeating point in time

A **repeating point in time** can be can be a **weekly repeating point in time** (repeating every 7 days) or a **daily repeating point in time** (repeating every 24 hours).

EXAMPLE   The **point in time** is defined as each Monday at 8 a.m is a **weekly repeating point in time**.

Exemplary objects, with their classifications and relationships, are shown in Figure 66.
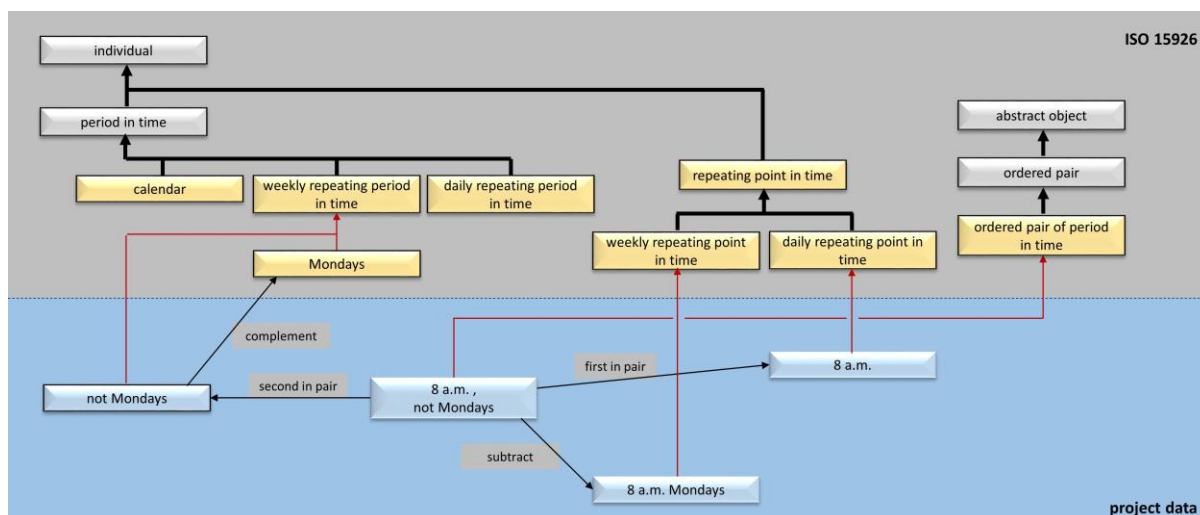
Figure 66: Weekly repeating point in time

5.17 Identification of objects

Objects may be assigned different identifiers by different **organizations**.

NOTE 1   An **operator** and a **main contractor** can use different identifiers for the same **activity** or **class of resource**.

Objects may also have different identifiers with different roles. Identification roles defined in this part of ISO 15926 are:

code: a concise identifier that is not intended to be person interpretable**;**

label: an identifier that is intended to be person interpretable;

local system id: an identifier that is intended for use by a single system and that is unique only within that system;

global system id: an identifier that is intended for use by collaborating systems and that is globally unique

    NOTE 2   A **global system id** can be an IRI.

The **organization** and the **installed software** that assigns an identifier may be recorded, and the time of assignment.

EXAMPLE   The organization 'UGE Oil' assigns labels to the activities in the breakdown of 'UGE-1 natural gas capacity upgrade'. The activity 'installation of piping for dehydration train B' is assigned the label 'dehyd B piping". This is shown in Figure 67.
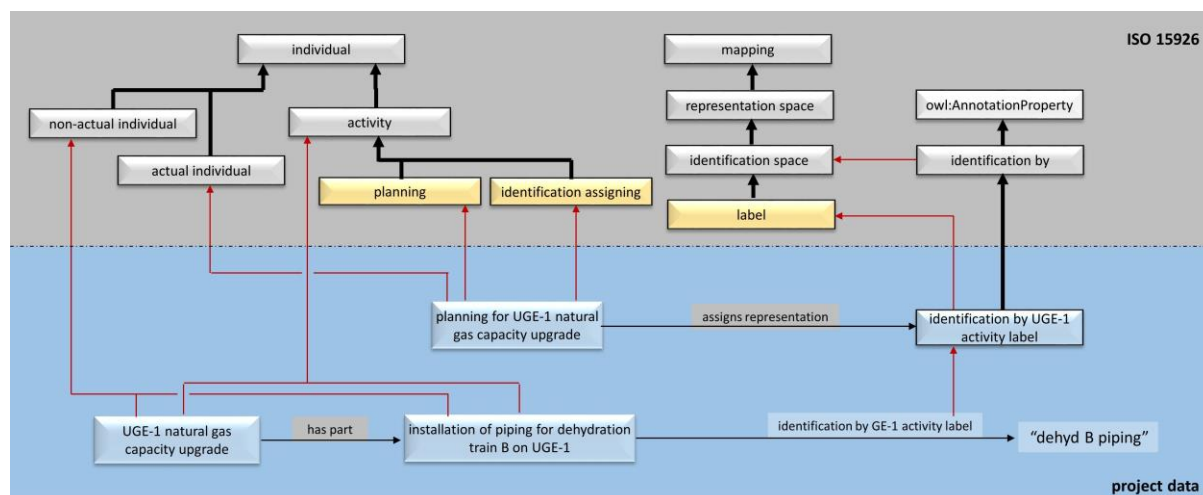
Figure 67: Assigning identifiers

In Figure 67, the role of the organization UGE-1 as **performer** of the activity 'planning for UGE-1 natural gas capacity upgrade' is not shown.

5.18 Work order

A **work order** is an **activity** that includes:

— the issuing of a request to an **organization** to perform an **activity**;

— the performance of that **activity**.

The description of a **work order** defines a **specification** of the **activity** to be performed. A **work order** has the actual **activity** that is a **realisation of** the **specification** is a part of the **work order**.

5.19 Area of facility and site

An **area of facility** is a **physical object** that is all that is within a **region of space**. The **region of space** that defines an **area of facility** can change over time. An **activity** can take place within an **area of facility**.

NOTE 1   An **area of facility** can be an FPSO module.

A **site** is a **physical object** that is all that is on, above or below a part of the surface of the earth. The part of the surface of the earth that defines a **site** can change over time. A **site** can be on land or sea. An **activity** can take place within a **site**.

A **site** can be classified according to the environment. The following subclasses of **site** are members of **class of site by environment**:

— **green field site**;

— **brown field site**.

6 Scheduling application view

6.1 Use of the scheduling application view model

This clause describes the scheduling application view model and its relationship to the planning ontology. The scheduling application view model is represented as UML diagrams and as an ontology represented in OWL.

The classes in the view ontology are formally subclasses of classes in the planning ontology, but they are created in order to specify constraints on the data that can be recorded using the view.

The properties in the view model are templates which hide objects in the ISO 15926 planning ontology. A statement made using the properties in the view model can be "lifted" to one or more statements using the full ISO 15926 planning ontology.

Lifting may require the creation of the missing objects. The definition of these object may rely upon context information that is not stated explicitly within the view.

6.2 Simplification of the ISO 15926 ontology

For every **activity** there is a network of objects as shown in Figure 68.
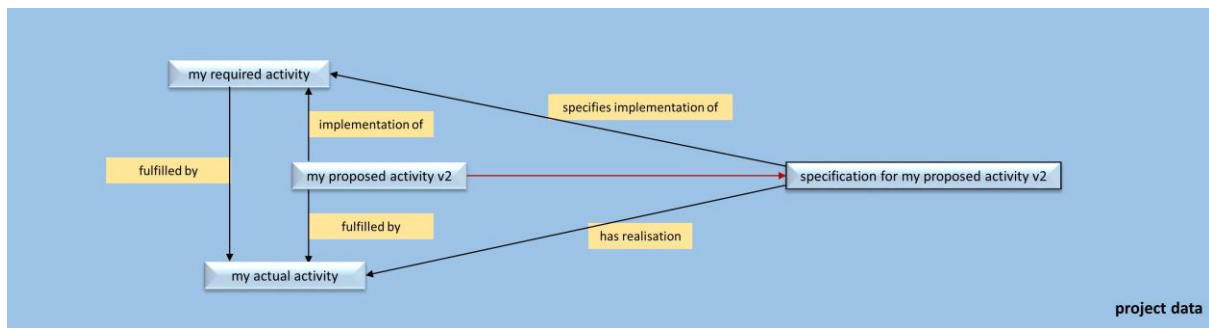
Figure 68: Objects at a level of decomposition

NOTE 1   A **schedule** is **information content** that contains a **specification**.

An **activity** can be decomposed into parts. There is a parallel decomposition for each of these objects.

In the scheduling application view model:

— only the required **activity** and the **specification** for its implementation are shown;

— the top activity is a **project**, and there is a single level of decomposition where each part is an **activity in project**;

— the whole-part relationships that are relevant to scheduling software are recorded between the **specification** for the **project** and the **specifications** for the **activities in project**.

The relationship between a project and an activity in project is shown in Figure 69.
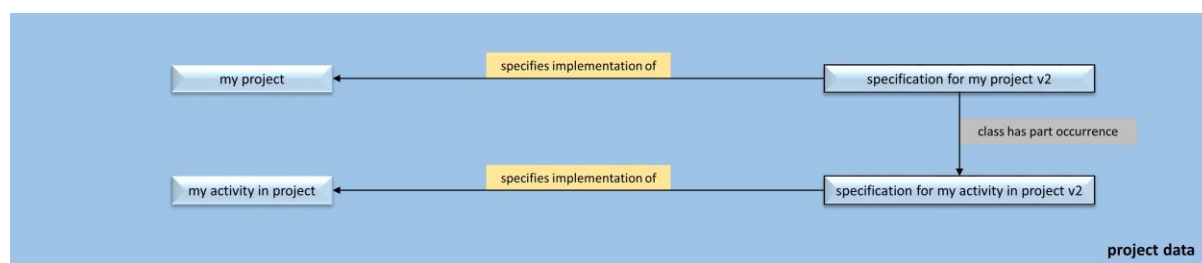
Figure 69: Project and activity in project

NOTE 1   An **activity in project** corresponds to the term "activity" in ISO 21500, which is defined as "identified component of work within a schedule that is required to be undertaken to complete a project".

NOTE 2   An **activity in project** corresponds to the element "ProjectScheduleTask" in the UN/CEFACT XML schema, which is defined as "A cohesive activity, collection of activities, or milestone with a definite duration or date which is required to create a deliverable within a project." Within this part of ISO 15926, activities and events, which can be milestones within a plan, are distinguished.

6.3   An actual activity in the scheduling application view model

In the scheduling application view model, statements about an actual **project** or **activity in project** are recorded as follows:

— as properties of the required **project** or **activity in project**, where they are independent of **specification**,

NOTE 1   The class **project** has the property **project has actual current expenditure**.

— as properties of the **specification** for the **project** or **activity in project**, where they depend upon the **specification**,

NOTE 2   The class **specification for activity in project** has the property **activity frontline date**.

The date for which the properties are valid is specified for the **project** or **activity in project** by the properties:

— **project has date of reported data**;

— **activity has date of reported data**.

Properties relevant to the specification at the date of the reported data are recorded for the specification.

NOTE 3   The class **specification for activity in project** has the property **activity has planned current activity expenditure**.

EXAMPLE   In the scheduling application view model, the **specification for project** 'UGE-1 natural gas capacity upgrade plan version 2' has the properties **project has date of reported data** with the value '2015-07-11' and **project has actual current percentage complete** with the value '57'.

In the lifting of the data represented in the scheduling application view model to the ISO 15926 planning ontology, **has percentage complete** is the property of the temporal part of the **actual activity** 'actual UGE-1 natural gas capacity upgrade' that ends on 2015-07-11.

The representation using the scheduling application view model and the ISO 15926 planning ontology are shown in Figure 70 and Figure 71.
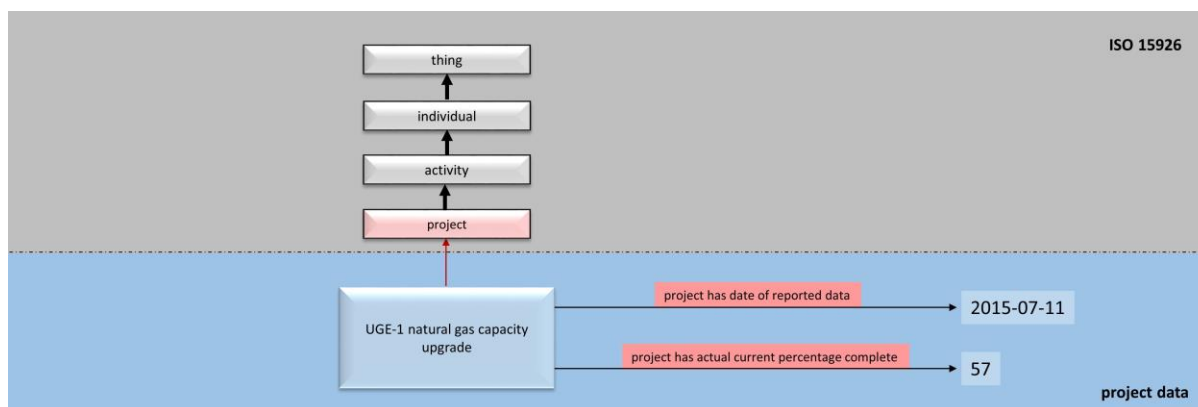
Figure 70: Percentage complete in the scheduling application view model
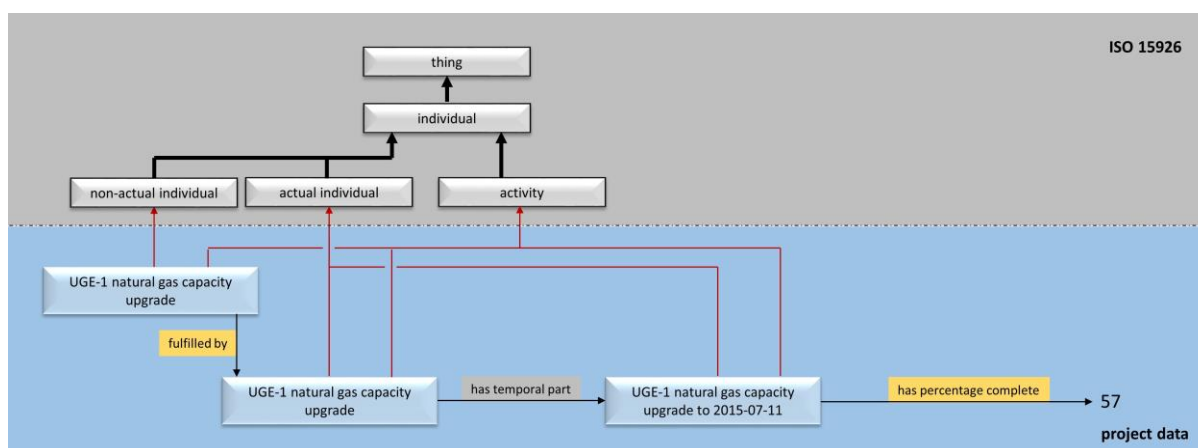
Figure 71: Percentage complete in the ISO 15926 planning ontology

In an exchange scenario, a sequence of exchange files will have different dates of reported data and different actual percentage complete values for the same **project** or **activity in project**. When "lifted" to the ISO 15926 planning ontology, the dates of reporting data define the ends of different actual temporal parts which have different percentage complete values. A software application could produce a graph of percentage complete against time for the temporal parts. The actual temporal parts may have other properties, such as the expended monetary amount.

6.4   Data planning for the scheduling application view

The organization of the data for the scheduling application interface is shown in the UML diagrams in this clause. The classes in the UML diagrams correspond to classes in the planning ontology. However, not all classes in the planning ontology are used in the scheduling application interface.

The relationships in the UML diagrams correspond to the template properties, which have an expansion into classes in the planning ontology.

NOTE   The UML diagrams do not show every aspect of the XML schema that is the scheduling application interface. This is documented in full in Annex D.

The relationships between a project and its schedules are shown in Figure 72.
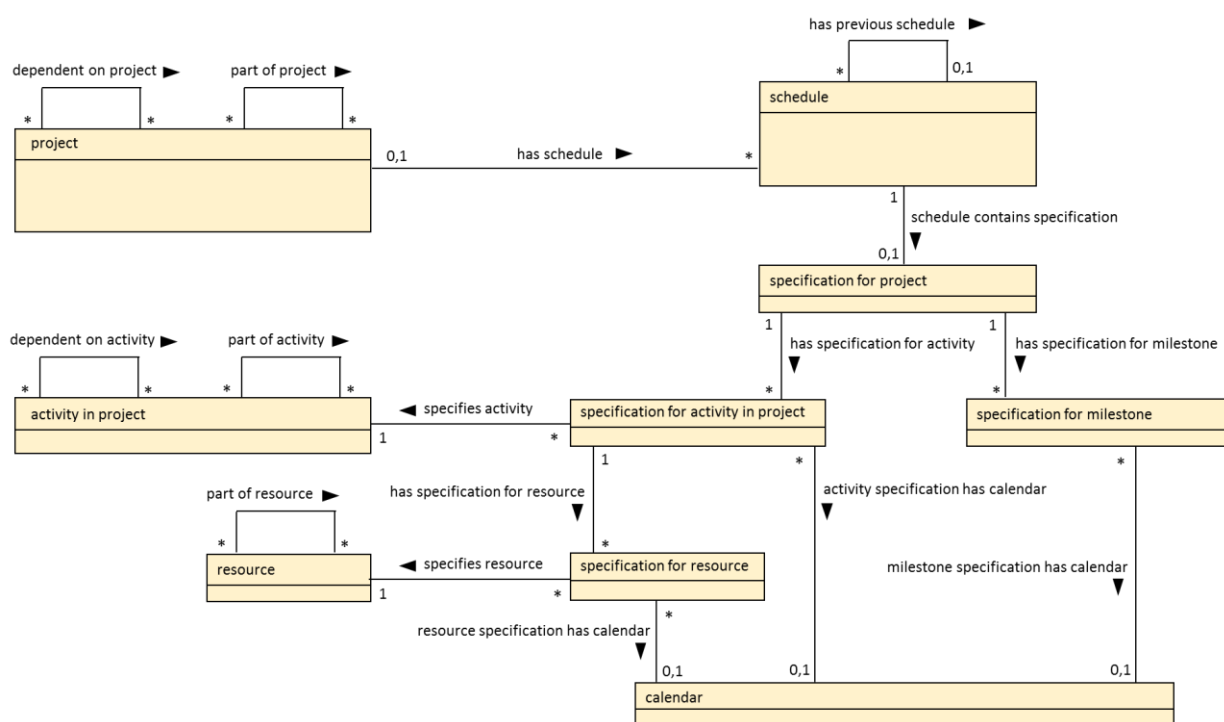
Figure 72: Data on project and schedule

The attributes for a project and schedule are shown in Figure 73. The attributes are colour coded, so that:

- attributes with a brown background can change only when there is a new object with a new ID;

- attributes with a green background change with the passage of time and do not require a new object with a new ID.
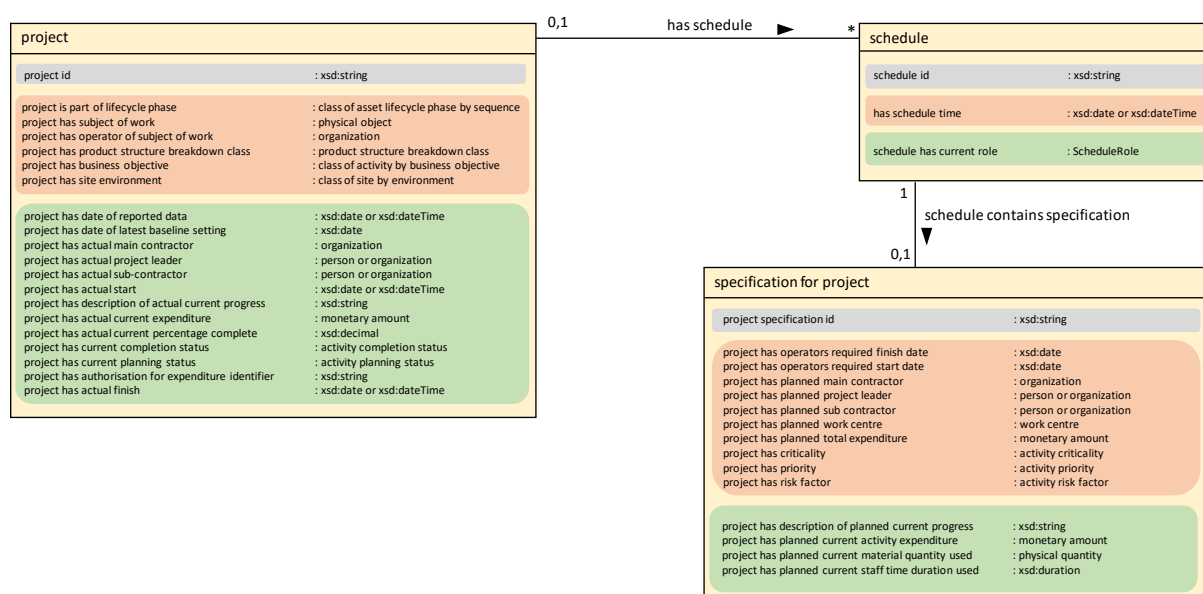
Figure 73: Data planning attributes for project and schedule

The attributes for an activity are shown in Figure 74.
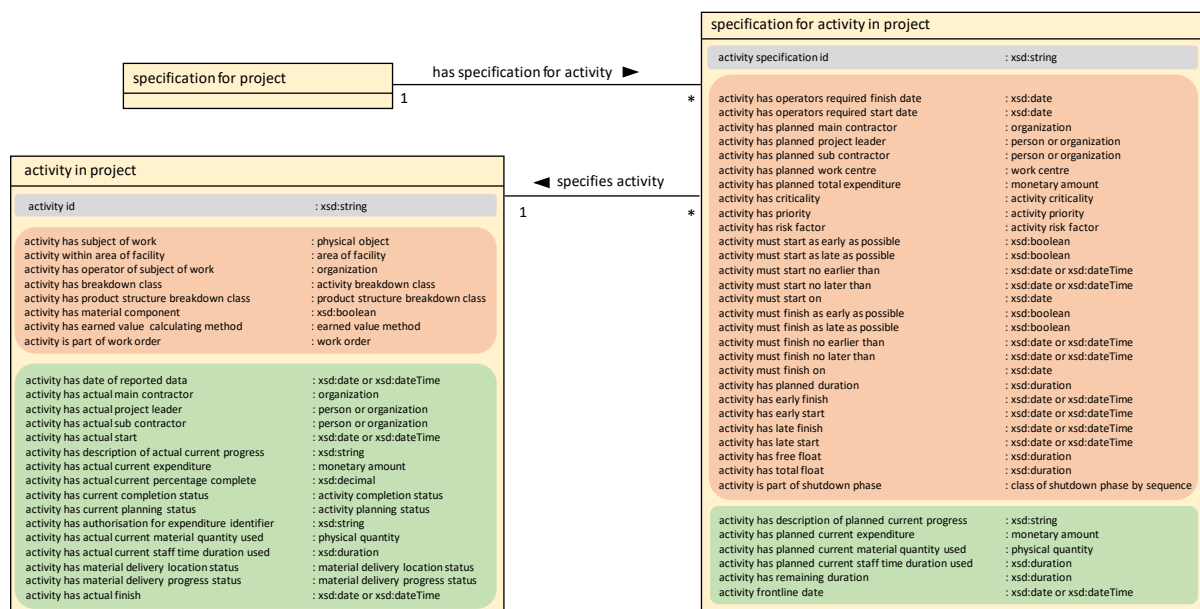
Figure 74: Data scheduling attributes for activities

The relationships between milestone and specification for milestone, and their attributes, are shown in Figure 75.
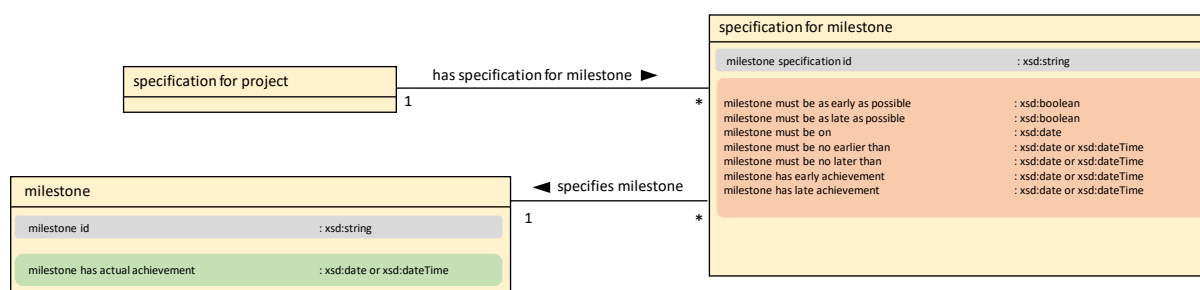
Figure 75: Data planning for milestone and project

The relationships between resource and specification for resource, and their attributes, are shown in Figure 76.
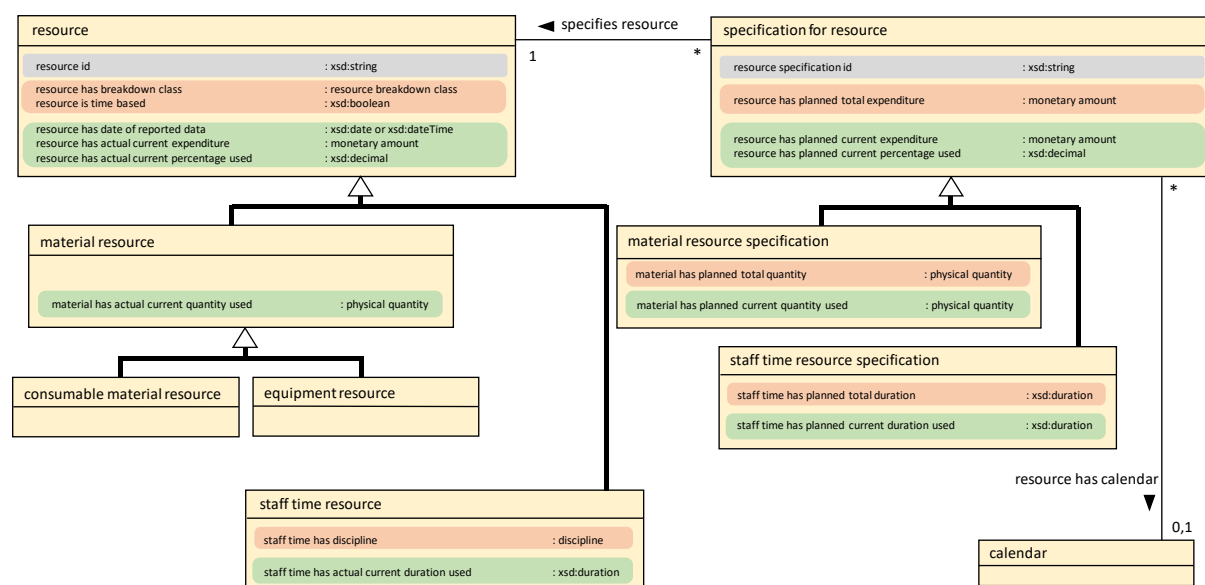
Figure 76: Data planning for resource in plan and available resource

The relationships between succession link, specifications for activity and milestone, are shown in Figure 77.
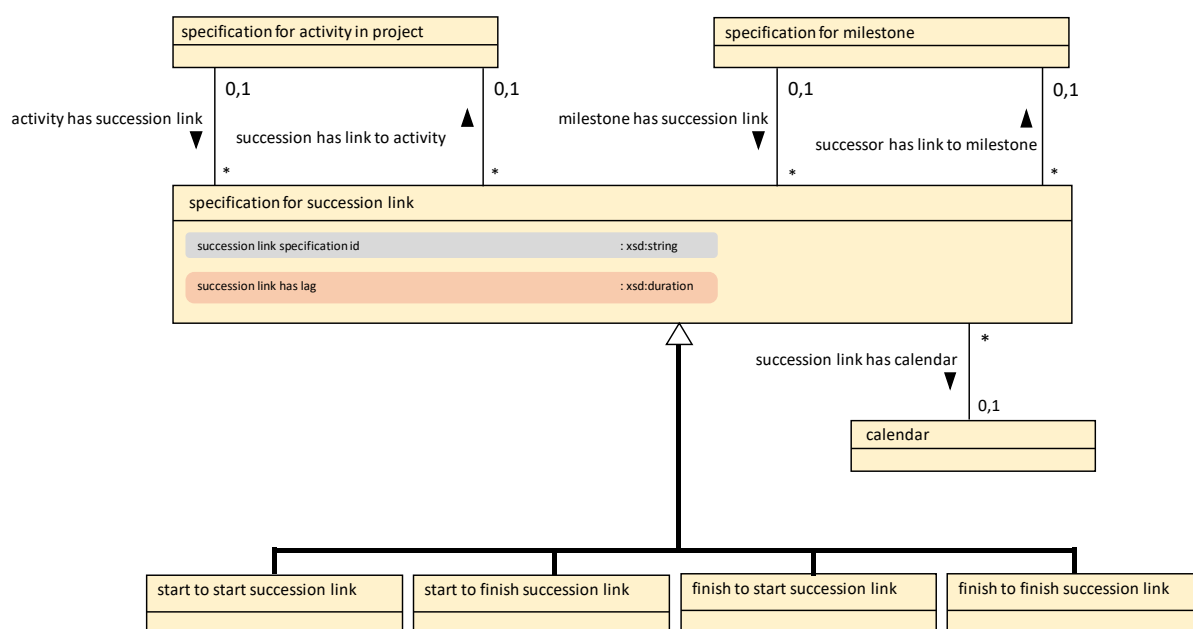
Figure 77: Data planning for plan succession link

The relationship between an activity and shutdown is shown in Figure 78
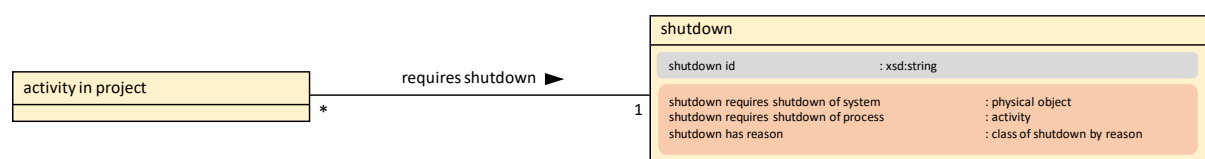
Figure 78: Scheduling data for activity and shutdown

The relationships between calendar, its repeating periods, and calendar operation, and their attributes are shown in Figure 79 and Figure 80.
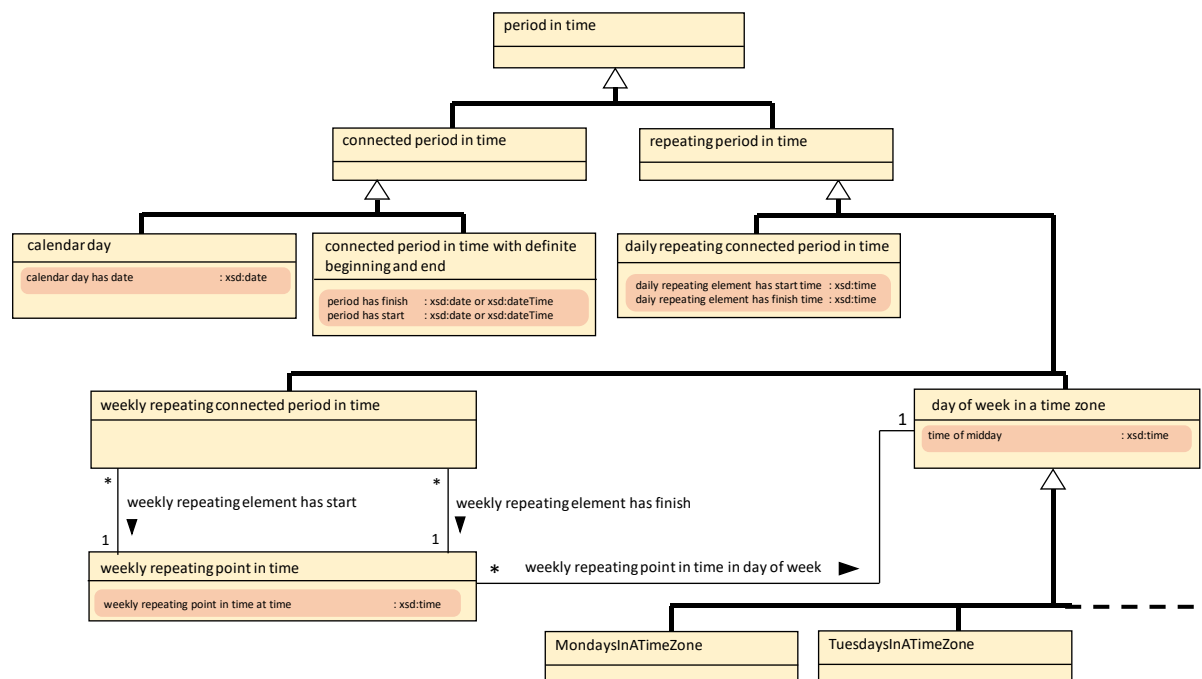
Figure 79: Calendar and repeating timing
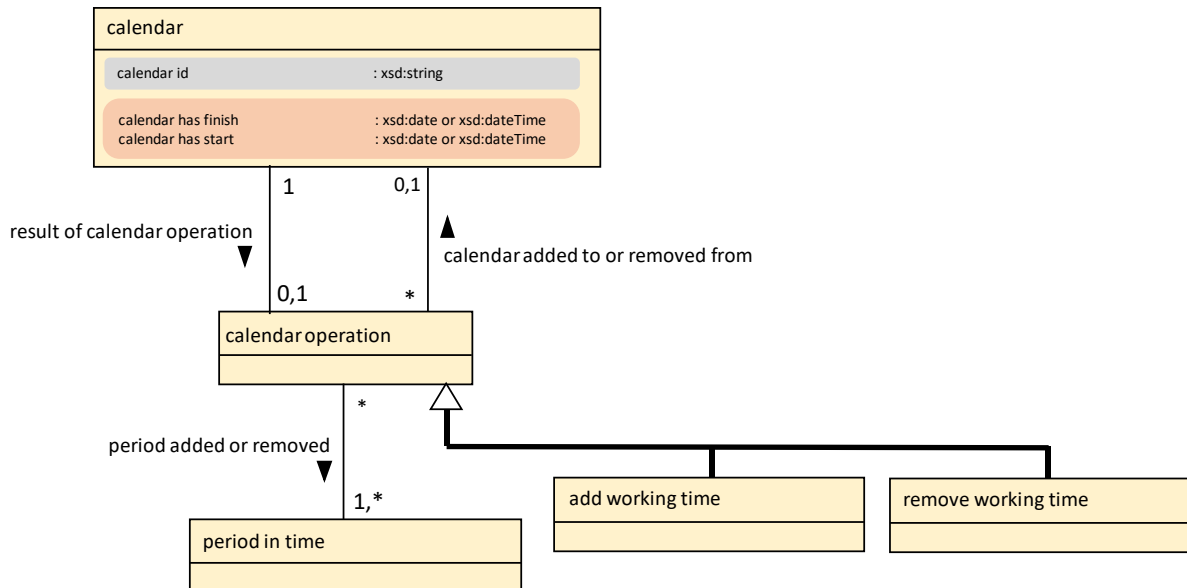
Figure 80: Scheduling data for calendar and calendar operation

Object identification is shown in Figure 81.
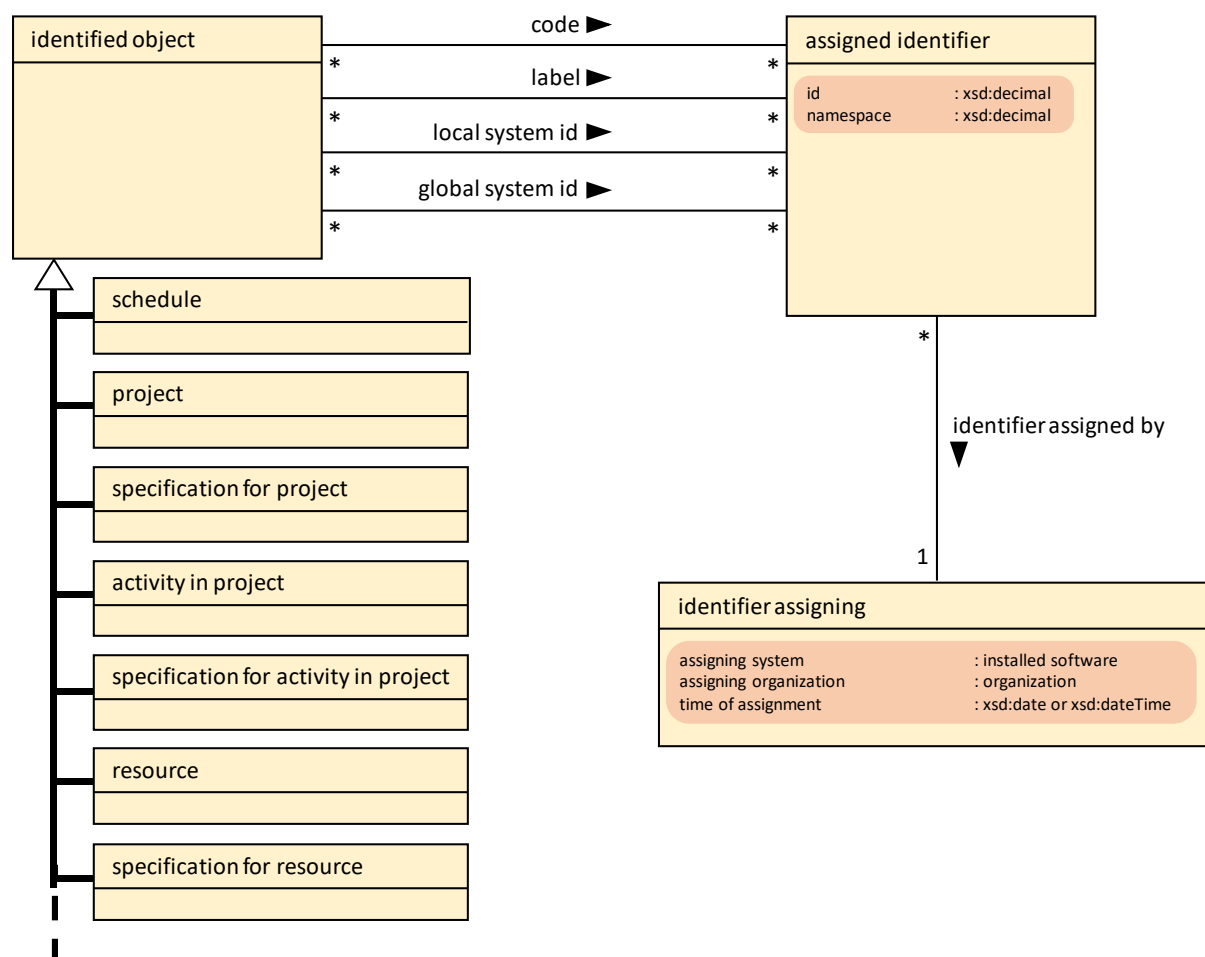
Figure 81: Object identification

Figure 82 shows consumption profile and attributes.
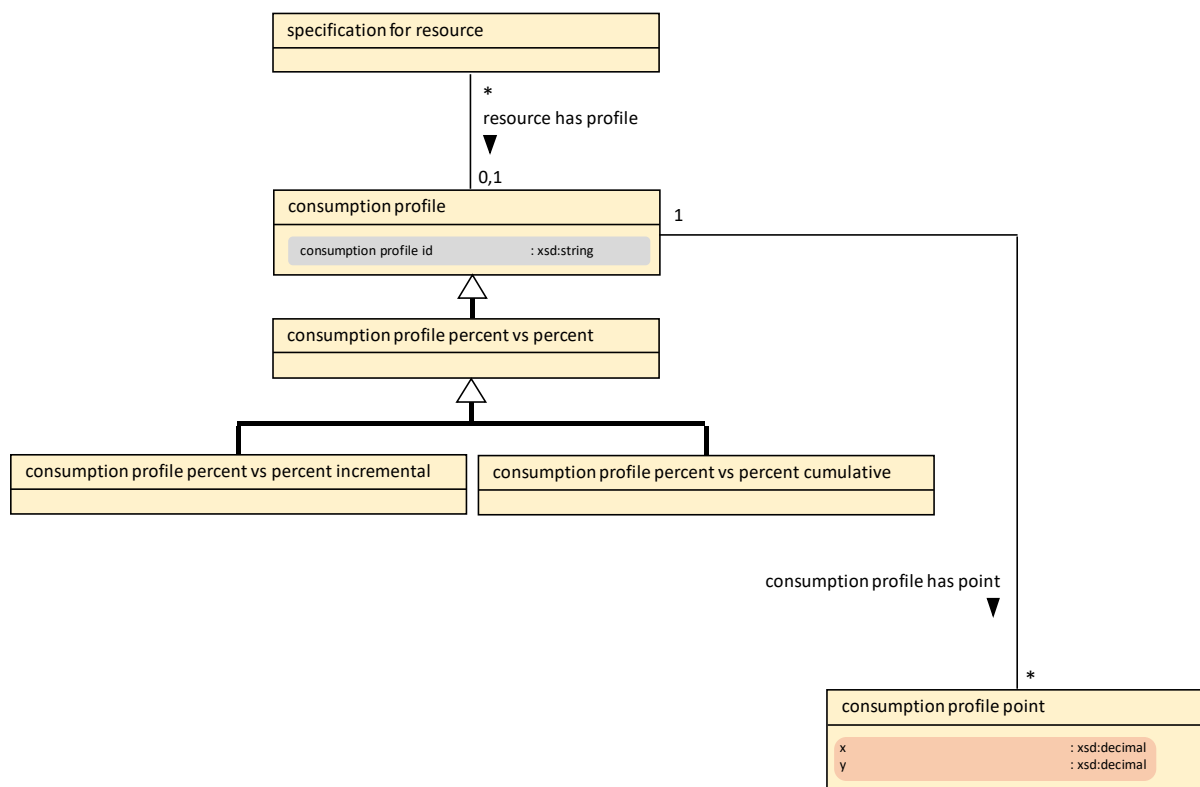
Figure 82: Consumption profile

Standard way to define a property as a user defined field is shown Figure 84:
— the domain is a class within the application view ontology**;**
— a value in the range is:
- a literal, such as a text string, date, number or Boolean;
- a quantity, represented by a number a unit of measure;
- an identified object;
— Property name is specified by a property type.

EXAMPLE 1   The following **properties** are within the ISO 15926-13 model. If they were not, they could be specified as user defined fields as follows:

— **activity in project** "A101" has the **property** of type "has actual start" with the value "2015-11-12";

— **activity in project** "A101" has the **property** of type "has authorisation for expenditure identifier" with the value "AX-98/1234";

EXAMPLE 2   The following **property** is not within the ISO 15926-13 model. It can be specified as a user defined field as follows:

— **activity in project** "A101" has the **property** of type "days behind schedule" with the value "10".
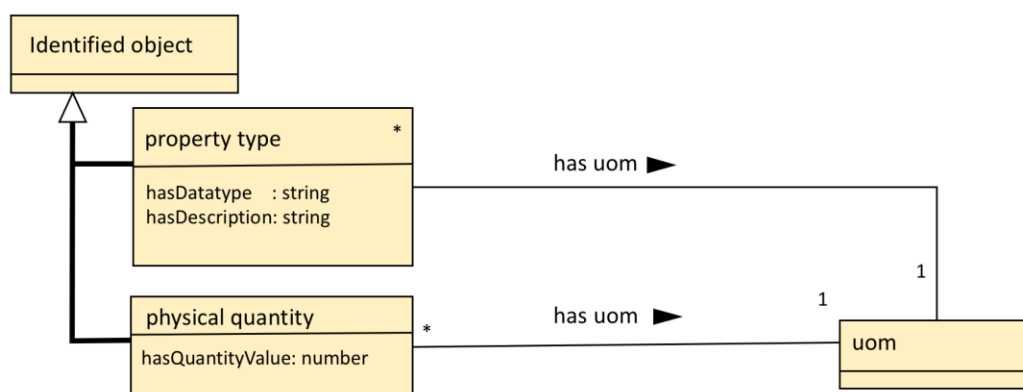
Figure 83 User defined property and unit of measure
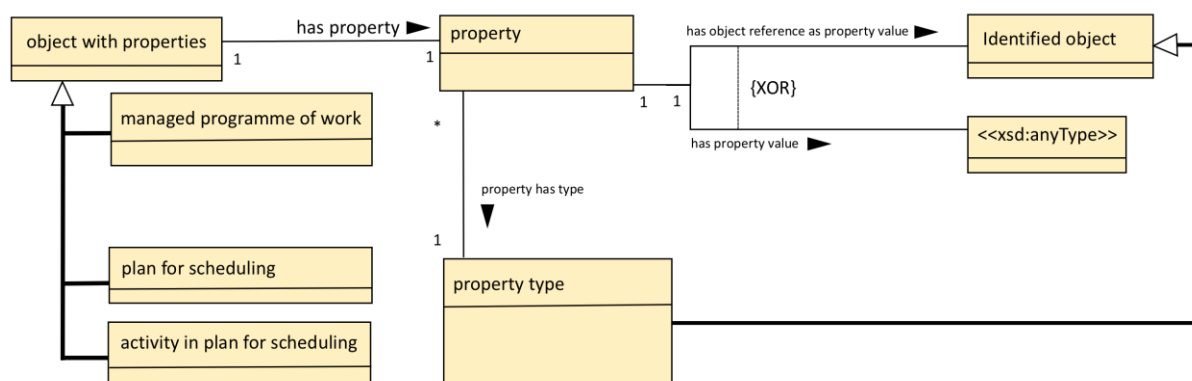
Figure 84: Use of user defined property

7   Template properties in the scheduling application view model

7.1   Template property notation

The templates properties in the scheduling application view model are binary relationships which provide an application view of the underlying ISO 15926 representation of planning information.

NOTE   These binary relationships can be represented as object or datatype properties in OWL.

A property p with domain A and range B can be represented as:

$$A \rightarrow p \rightarrow B$$

A template property has an expansion in the underlying ISO 15926 representation. The expansion of a template property p can be defined using the notation in

Table 4.

Table 4: Notation for template expansion

type of expansion	representation	description
explicit constraint on range	$A \rightarrow q \rightarrow B$	The relationship p is the population of the relationship q, where the range is restricted to members of B.
constraint on range **(defined by a relationship with a member of a class)**	$A \rightarrow q \rightarrow B\ [\rightarrow r \rightarrow X]$	The relationship p is the population of the relationship q, where the range is restricted to members of B with a relationship r to a member of X. The template property says nothing about the member of X, but there may be other views on the underlying ISO 15926 representation that are concerned with it.
constraint on range **(defined by a relationship with a specified object)**	$A \rightarrow q \rightarrow B\ [\rightarrow r \rightarrow \mathbf{x}]$	The relationship p is the population of the relationship q, where the range is restricted to members of B with a relationship r to **x**.
hidden object	$A \rightarrow q \rightarrow X \rightarrow r \rightarrow B$	The relationship p implies the existence of a member of X, and the relationships q and r. The template property says nothing about the member of X, but there may be other views on the underlying ISO 15926 representation that are concerned with it.
hidden object with a constraint **(defined by a relationship with a member of a class)**	$A \rightarrow q \rightarrow X\ [\rightarrow s \rightarrow Y] \rightarrow r \rightarrow B$	The relationship p implies the existence of a member of X and of Y and the relationships q, r and s. The template property says nothing about the members of X and Y, but there may be other views on the underlying ISO 15926 representation that are concerned with them.
hidden object with a constraint **(defined by a relationship with a specified object)**	$A \rightarrow q \rightarrow X\ [\rightarrow s \rightarrow \mathbf{y}] \rightarrow r \rightarrow B$	The relationship p implies the existence of a member of X and the relationships q, r and s. The template property says nothing about the member of X, but there may be other views on the underlying ISO 15926 representation that are concerned with them.

EXAMPLE 1   The **specification for activity in project** 'plan to replace the instrumentation of the flare tip of platform UGE-1 version 2' has the risk factor **height work**.

This is represented using the template property **activity has risk factor**, which is as follows:

specification for activity in project $\rightarrow$ *activity has risk factor* $\rightarrow$ activity risk factor

Using the template property, the risk factor for 'replace the instrumentation of the flare tip of platform UGE-1 specification version 3' is represented as shown in Figure 85.
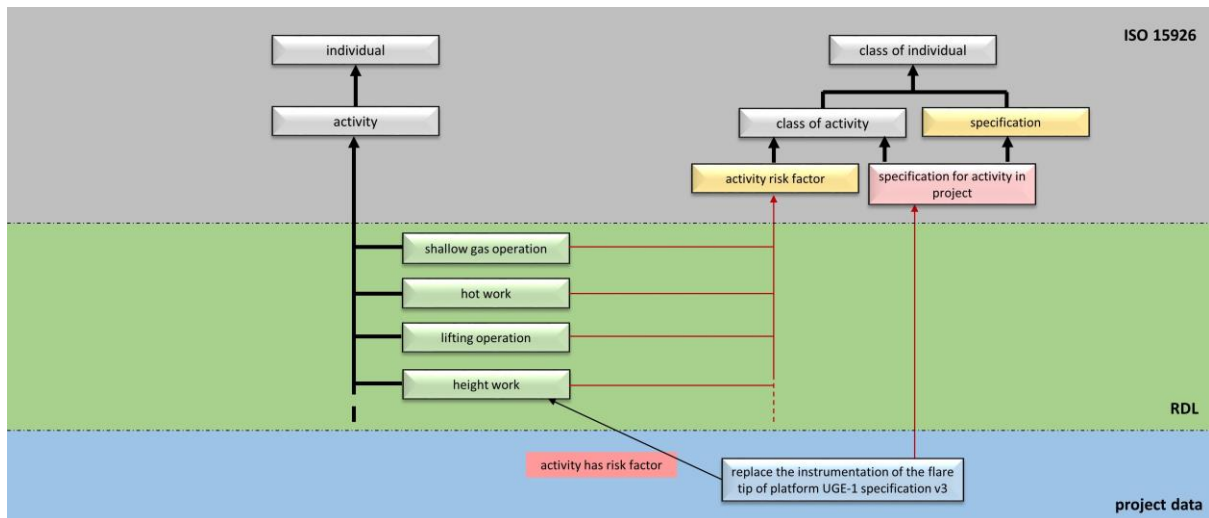
Figure 85: Risk factor represented using a template property

The template property **activity has risk factor** is a population of **subclass of**. Hence the template expansion is as follows:

specification ∩ class of activity → subclass of → activity risk factor

The full ISO 15926 representation of **has risk factor** in Figure 86.
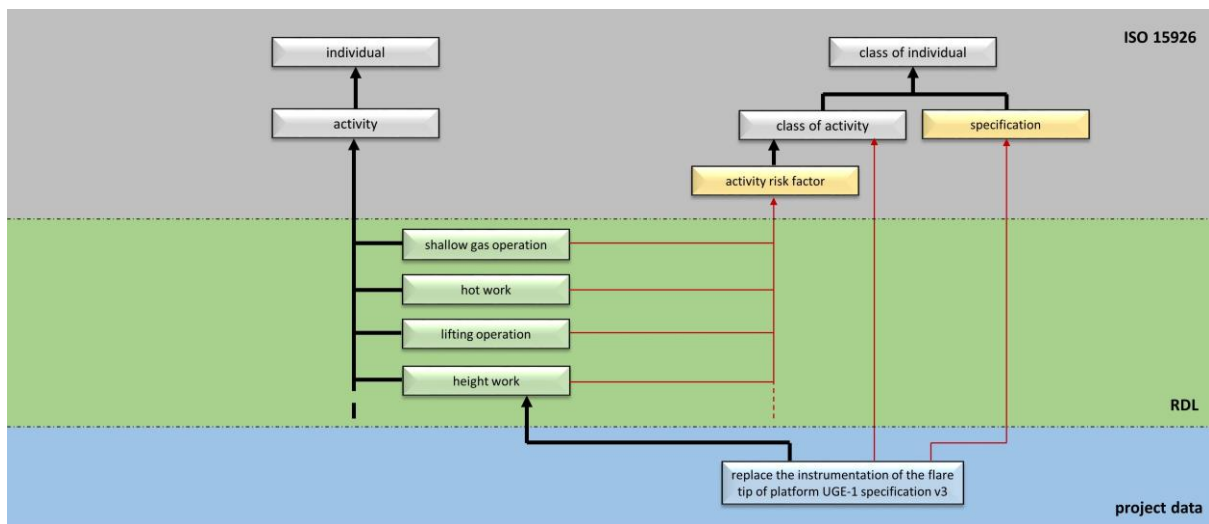
Figure 86: Full representation of risk factor

7.2 Property template relationships in the scheduling application view model

7.2.1 Relationships from project

— **has schedule**
   a **schedule** for the **project**

   template expansion:
   project ← *specifies implementation of* ← specification ∩ class of activity ← *definition for* ← schedule
   [← *has baseline schedule* ← planning]

— **part of project**

a **project** that the **project** is part of

template expansion:
project → *part of* → project

— **dependent on project**
a **project** that the **project** is dependent on

template expansion:
project → *dependent on* → project

7.2.2 Relationships from schedule

— **schedule contains specification**
the **specification for project** that is contained in the **schedule**

template expansion:
schedule → *definition for* → specification for project

— **has previous schedule**
the **schedule** that is the previous **schedule**

template expansion:
schedule ← *succeeded by* ← schedule

7.2.3 Relationships from specification for project

— **has specification for activity**
a **specification for activity in project** that is a part of the **specification for project**

template expansion:
specification for project → *class has part occurrence* → specification for activity in project

— **has specification for milestone**
a **specification for milestone** that is part of the **specification for project**

template expansion:
specification for project → *class has part occurrence* → specification for milestone

7.2.4 Relationships from specification for activity in project

— **specifies activity**
the **activity in project** that is specified by the **specification for activity in project**

template expansion:
specification for activity in project → *specifies implementation of* → activity in project

— **has specification for resource**
a **specification for resource** for the **specification for activity in project**

template expansion:
specification for activity in project → *class has part occurrence* → specification for resource

— **activity specification has calendar**
the **calendar** for the **specification for activity in project**

template expansion:
> specification for activity in project → *class part of value* → calendar

—— **activity has succession link**
a **specification for succession link** that follows the **specification for activity in project**

template expansion:
> activity in project → *class has beginning occurrence/class has end occurrence* → class of event → *class part of occurrence* → class of point in time→ *class has beginning occurrence/class has end occurrence* → specification for succession link

7.2.5   Relationships from activity in project

—— **part of activity**
an **activity in project** that the **activity in project** is part of

template expansion:
> activity in project → *part of* → activity in project

—— **dependent on activity**
an **activity in project** that the **activity in project** is dependent on

template expansion:
> activity in project → *dependent on* → activity in project

—— **requires shutdown**
a **shutdown** that the **activity in project** is dependent on

template expansion:
> activity in project → *dependent on* → shutdown

7.2.6   Relationships from specification for milestone

—— **milestone specification has calendar**
the **calendar** for the **specification for milestone**

template expansion:
> specification for milestone → *class part of value* → calendar

—— **milestone has succession link**
a **specification for succession link** that follows the **specification for milestone**

template expansion:
> specification for milestone → *class part of occurrence* → class of point in time→ *class has beginning occurrence/class has end occurrence* → specification for succession link

7.2.7   Relationships from specification for resource

—— **specifies resource**
the **resource** that is specified by the **specification for resource**

template expansion:
> specification for resource → *specifies implementation of* → resource

—— **resource specification has calendar**
the **calendar** during which the **specification for resource** exists

template expansion:
>   specification for resource → *class part of value* → calendar

— **has available resource**
a **physical object** that is available for the **specification for resource**

template expansion:
>   resource → *part of* → physical object

7.2.8   Relationships from resource

— **part of resource**
a **resource** that the **resource** is part of

template expansion:
>   resource → *part of* → resource

7.2.9   Relationships from available resource

— **available resource has period**
a temporal part of an **available resource**

template expansion:
>   available resource → *has temporal part* → period of available resource

7.2.10   Relationships from period of available resource

— **available resource for activity**
an **activity in project** for which the **period of available resource** is available

template expansion:
>   period of available resource → *value has part occurrence* → specification for resource ← *type* ← physical object ∩ resource → *part of* → activity in project

— **available resource for project**
a **project** for which the **period of available resource** is available

template expansion:
>   period of available resource → *value has part occurrence* → specification for resource ← *type* ← physical object ∩ resource → *part of* → project

— **available resource has calendar**
the **calendar** for the **available resource**

template expansion:
>   period of available resource → *part of* → calendar

— **has available period**
the **connected period in time with definite beginning and end** during which the **available resource** is available

template expansion:
>   period of available resource → *part of* → connected period in time with definite beginning and end

The **available resource** is part of the union of all specified connected periods in time.

7.2.11 Relationships from specification for succession link

— **succession link has calendar**
the **calendar** that has the **plan succession link** as a part

template expansion:
specification for succession link → *class part of occurrence value* → calendar

— **succession has link to activity**
the **activity in project** that follows the **specification for succession link**

template expansion:
specification for succession link → *class has end occurrence* → class of point in time → *class has part occurrence* → class of event → *occurrence begins/occurrence ends* → activity in project

— **succession has link to milestone**
the **milestone** that follows the **plan succession link**

template expansion:
specification for succession link → *class has end occurrence* → class of point in time → *class has part occurrence* → milestone

7.2.12 Relationships from calendar

— **result of calendar operation**
the **calendar operation** that has the **calendar** as the result

template expansion:
calendar → *add/ subtract* → ordered pair of period in time

7.2.13 Relationships from calendar operation

— **calendar added to or removed from**
the **calendar** to which a **period in time** is added, or from which a **period in time** is removed by the **calendar operation**

template expansion:
ordered pair of period in time → *has first in pair* → period in time

— **period added or removed**
the **period in time** that added or removed by the **calendar operation**

template expansion:
ordered pair of period in time → *has second in pair* → period in time

7.2.14 Relationships from weekly repeating connected period in time

— **weekly repeating element has start**
the **weekly repeating point in time** that is the start of each element in a **weekly repeating connected period in time**

template expansion:
weekly repeating connected period in time → *has beginning* → weekly repeating point in time

— **weekly repeating element has finish**

the **weekly repeating point in time** that is the finish of each element in a **weekly repeating connected period in time**

template expansion:
weekly repeating connected period in time → *has end* → weekly repeating point in time

7.2.15 Relationships from weekly repeating point in time

— **weekly repeating point in time in day of week**
the **day of week in a time zone** that contains each a **weekly repeating point in time**

template expansion:
weekly repeating point in time → *part of* → day of week in a time zone

7.3 Property template attributes of the scheduling application view model

7.3.1 Properties of project

— **project is part of lifecycle phase**
the lifecycle phase of the **project**

template expansion:
project → *part of* → activity → *type*→ class of lifecycle phase by sequence

— **project has subject of work**
the physical object that is a subject of work for the **project**

template expansion:
project → *has part* → subject of work → *temporal part of* → physical object ∩ whole life individual

— **project has operator of subject of work**
the operator of the facility that is the subject of work for the **project**

template expansion:
project → *has part* → subject of work → *operated by* → operator → *temporal part of* → organization ∩ whole life individual

— **project has product structure breakdown class**
the **project structure breakdown class** of the **subject of work** for the **project**

template expansion:
project → *has part* → subject of work → *subclass* of → project structure breakdown class

— **project has business objective**
the business objective of the **project**

template expansion:
project → *type* → class of activity by business objective

— **project has site environment**
the site environment of the **project**

template expansion:
project → *part of* → site → *type* → class of site by environment

— **project has date of reported data**

the date on which the data about the actual **project** was reported

template expansion:
> project → *has reporting* → reporting ∩ actual individual[to date of reported data] → *has end* → event→ *part of* → point in time → *iso 8601 identification of point in time*

— **project has date of latest baseline setting**
the date on which the latest baseline schedule for the **project** was set at date of reported data

template expansion:
> project → *has planning* → planning ∩ actual individual[at date of reported data] → *has baseline schedule* → schedule → information content *created by* → planning ∩ actual individual → *has end* → event→ *part of* → point in time → *iso 8601 identification of point in time*

— **project has actual main contractor**
the organization that is the actual main contractor for the **project**

template expansion:
> project → *fulfilled by* → activity ∩ actual individual → *has part* → main contractor → *temporal part of* → organization ∩ whole life individual

— **project has actual project leader**
the person or organization that is the actual project leader for the **project**

template expansion:
> project → *fulfilled by* → activity ∩ actual individual → *has part* → project leader → *temporal part of* → person/organization ∩ whole life individual

— **project has actual sub-contractor**
a person or organization that is an actual sub-contractor for the **project**

template expansion:
> project → *fulfilled by* → activity ∩ actual individual → *has part* → sub-contractor → *temporal part of* → person/organization ∩ whole life individual

— **project has actual start**
the date or date-time that the actual **project** starts on

template expansion:
> project → *fulfilled by* → activity ∩ actual individual → *has beginning* → event → *part of* → point in time → *iso 8601 identification of point in time*

— **project has description of actual current progress**
a description of the **project** up to the time of the reported data

template expansion:
> project → *fulfilled by* → activity ∩ actual individual[to date of reported data] → *described by literal*

— **project has actual current expenditure**
the actual expenditure on the **project** up to the time of the reported data

template expansion:
> project → *fulfilled by* → activity ∩ actual individual[to date of reported data] → *type* → monetary amount

— **project has actual current percentage complete**

the percentage complete of the **project** at the time of the reported data

template expansion:

project → *fulfilled by* → activity ∩ actual individual[to date of reported data] → *has percentage complete*

— **project has current completion status**
the completion status for the **project** at the time of the reported data

template expansion:
project → *fulfilled by* → activity ∩ actual individual [to date of reported data] → *type* → activity completion status

— **project has current planning status**
the **activity planning status** for the **project** at the time of the reported data

template expansion:
project ← *planning for* ← planning ∩ actual individual [to date of reported data] → *type* → activity planning status

— **project has authorisation for expenditure identifier**
the authorisation for expenditure identifier of the **project**

template expansion:
project → *has planning* → planning ∩ actual activity → *has part* → authorisation for expenditure – authorised ∩ actual activity → *identified by literal*

— **project has actual finish**
the date or date-time that the actual completed **project** finishes on

template expansion:
project → *fulfilled by* → activity ∩ completed activity ∩ actual individual → *has end* → event → *part of* → point in time → *iso 8601 identification of point in time*

7.3.2 Properties of specification for project

— **project has operators required start date**
the date on which the **project** according to the **specification for project** is required to start

template expansion:
specification for project → *specifies implementation of* → activity ∩ non-actual individual → *type* → activity requirement specification → *class has beginning occurrence*→ class of event → *class part of occurrence value* → calendar day → *iso 8601 identification of period in time*

— **project has operators required finish date**
the date on which the **project** according to the **specification for project** is required to finish

template expansion:
specification for project → *specifies implementation of* → activity ∩ non-actual individual → *type* → activity requirement specification → *class has end occurrence* → class of event → *class part of occurrence value* → calendar day → *iso 8601 identification of period in time*

— **project has planned main contractor**
the **organization** that is the planned main contractor in the **specification for project**

template expansion:

specification for project → *class has part occurrence* → main contractor → *temporal part* → organization ∩ whole life individual

— **project has planned project leader**
the **organization** that is the planned project leader in the **specification for project**

template expansion:
specification for project → *class has part occurrence* → project leader → *temporal part* → person/organization ∩ whole life individual

— **project has planned sub-contractor**
the **organization** that is a planned sub-contractor in the **specification for project**

template expansion:
specification for project → *class has part occurrence* → sub-contractor → *temporal part* → person/organization ∩ whole life individual

— **project has planned total expenditure**
the planned expenditure according to the **specification for project**

template expansion:
specification for project → *subclass of* → monetary amount

— **project has criticality**
the criticality according to the **specification for project**

template expansion:
specification for project → *subclass of* → activity criticality

— **project has priority**
the priority according to the **specification for project**

template expansion:
specification for project → *subclass of* → activity priority

— **project has risk factor**
a risk factor according to the **specification for project**

template expansion:
specification for project → *subclass of* → activity risk factor

— **project has description of planned current progress**
a description of the planned **project** up to the time of the reported data

template expansion:
specification for project ← *type* ← activity ∩ non-actual individual → *has temporal part* → activity ∩ non-actual individual[to date of reported data] → *described by literal*

— **project has planned current expenditure**
the planned expenditure on the planned **project** up to the time of the reported data

template expansion:
specification for project ← *type* ← activity ∩ non-actual individual → *has temporal part* → activity ∩ non-actual individual[to date of reported data] → *type* → monetary amount

— **project has planned current material quantity used**

the planned material quantity used by the planned **project** up to the time of the reported data

template expansion:
> specification for project ← *type* ← activity ∩ non-actual individual → *has temporal part* → activity ∩ non-actual individual[to date of reported data] → *has part* → material resource → *type* → quantity

— **project has planned current staff time duration used**
the planned staff time duration used by the planned **project** up to the time of the reported data

template expansion:
> specification for project ← *type* ← activity ∩ non-actual individual → *has temporal part* → activity ∩ non-actual individual[to date of reported data] → *has part* → staff time resource → *staff time has duration* → time duration

7.3.3   Properties of schedule

— **has schedule time**
the date or date-time on which the **schedule** was issued

template expansion:
> schedule → *information content created by* → planning ∩ actual individual → *has end* → event→ *part of* → point in time → *iso 8601 identification of point in time*

— **schedule has current role**
the role of the **schedule** at the time of the reported data for the project

template expansion:
> schedule → *role of schedule* → planning ∩ actual individual [to date of reported data]

7.3.4   Properties of activity in project

— **activity has subject of work**
the physical object that is a subject of work for the **activity in project**

template expansion:
> activity in project → *has part* → subject of work → *temporal part of* → physical object ∩ whole life individual

— **activity within area of facility**
the **area of facility** that the **activity in project** is within

template expansion:
> activity in project → *part of* → area of facility ∩ whole life individual

— **activity has operator of subject of work**
the **operator** of the facility that is the **subject of work** for the **activity in project**

template expansion:
> activity in project → *has part* → subject of work → *operated by* → operator → *temporal part of* → organization ∩ whole life individual

— **activity has breakdown class**
the **activity breakdown class** of the **activity in project**

template expansion:
> activity in project → *type* → activity breakdown class

— **activity has project structure breakdown class**
the **project structure breakdown class** of the **subject of work** for the **activity in project**

template expansion:
activity in project → *has part* → subject of work → *type* → project structure breakdown class

— **activity has material component**
the Boolean that is true if the **activity in project** has a material component, and false otherwise

template expansion:
∃ [activity in project → *subclass of* → activity with material component]

— **activity has earned value calculating method**
the **calculating method** that is used for the **activity in project**

template expansion:
activity in project → *monitored by* → performance evaluating → *performance evaluating uses earned value method* → earned value method

— **activity is part of work order**
the **work order** that has the **activity in project** as a part

template expansion:
activity in project → *part of* → work order

— **activity has date of reported data**
the date on which the data about the actual **activity in project** was reported

template expansion:
activity in project → *has reporting* → reporting ∩ actual individual[to date of reported data] → *has end* → event→ *part of* → point in time → *iso 8601 identification of point in time*

— **activity has actual main contractor**
the **organization** that is the actual **main contractor** for the **activity in project**

template expansion:
activity in project → *fulfilled by* → activity ∩ actual individual → *has part* → main contractor → *temporal part of* → organization ∩ whole life individual

— **activity has actual project leader**
the **person** or **organization** that is the actual **project leader** for the **activity in project**

template expansion:
activity in project → *fulfilled by* → activity ∩ actual individual → *has part* → project leader → *temporal part of* → person/organization ∩ whole life individual

— **activity has actual sub-contractor**
a **person** or **organization** that is an actual **sub-contractor** for the **activity in project**

template expansion:
activity in project → *fulfilled by* → activity ∩ actual individual → *has part* → sub-contractor → *temporal part of* → person/organization ∩ whole life individual

— **activity has actual start**
the date or date-time that the actual **activity in project** starts on

template expansion:
> activity in project → *fulfilled by* → activity ∩ actual individual → *has beginning* → event → *part of* → point in time → *iso 8601 identification of point in time*

— **activity has description of actual current progress**
a description of the **activity in project** up to the time of the reported data

template expansion:
> activity in project → *fulfilled by* → activity ∩ actual individual[to date of reported data] → *described by literal*

— **activity has actual current expenditure**
the actual expenditure on the **activity in project** up to the time of the reported data

template expansion:
> activity in project → *fulfilled by* → activity ∩ actual individual[to date of reported data] → *type* → monetary amount

— **activity has actual current percentage complete**
the percentage complete of the **activity in project** at the time of the reported data

template expansion:
> activity in project → *fulfilled by* → activity ∩ actual individual[to date of reported data] → *has percentage complete*

— **activity has current completion status**
the completion status for the **activity in project** at the time of the reported data

template expansion:
> activity in project → *fulfilled by* → activity ∩ actual individual [to date of reported data] → *type* → activity completion status

— **activity has current planning status**
the **activity planning status** for the **activity in project** at the time of the reported data

template expansion:
> activity in project ← *planning for* ← planning ∩ actual individual [to date of reported data] → *type* → activity planning status

— **activity has authorisation for expenditure identifier**
the authorisation for expenditure identifier of the **project**

template expansion:
> activity in project → *has planning* → planning ∩ actual activity → *has part* → authorisation for expenditure – authorised ∩ actual activity → *identified by literal*

— **activity has actual current material quantity used**
the quantity of **material resource** that the **activity in project** has used to the time of the reported data

template expansion:
> activity in project → *fulfilled by* → activity ∩ actual individual [to date of reported data] → *has part* → material resource ∩ actual individual → *type* → quantity

— **activity has actual current staff time duration used**

the duration of **staff time resource** that the **activity in project** has used to the time of the reported data

template expansion:
activity in project → *fulfilled by* → activity ∩ actual individual [to date of reported data] → *has part* → staff time resource ∩ actual individual → *staff time has duration* → time duration

— **activity has material delivery location status**
the actual **material delivery location status** of a **material resource** for the **activity in project** at the time of the reported data

template expansion:
activity in project → *has part* → material resource ∩ non-actual individual → *temporal part of* → physical object ∩ actual individual → *has temporal part* → physical object ∩ actual individual[to date of reported data] → *type* → material delivery location status

— **has material delivery progress status**
the actual **material delivery progress status** of a **material resource** for **activity in project** at the time of the reported data

template expansion:
activity in project → *has part* → material resource ∩ non-actual individual → *temporal part of* → physical object ∩ actual individual → *has temporal part* → material in delivery ∩ actual individual[to date of reported data] → *part of* → delivering material ∩ actual activity[to date of reported data] → *type* → material delivery progress status

— **activity has actual finish**
the date or date-time that the actual completed **activity in project** finishes on

template expansion:
activity in project → *fulfilled by* → activity ∩ completed activity ∩ actual individual → *has end* → event → *part of* → point in time → *iso 8601 identification of point in time*

7.3.5   Properties of specification for activity in project

— **activity has operators required start date**
the date on which the **activity in project** according to the **specification for activity in project** is required to start

template expansion:
specification for activity in roject → *specifies implementation of* → activity ∩ non-actual individual → *type* → activity requirement specification → *class has beginning occurrence* → class of event → *class part of occurrence value* → calendar day → *iso 8601 identification of period in time*

— **activity has operators required finish date**
the date on which the **activity in project** according to the **specification for activity in project** is required to finish

template expansion:
specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *type* → activity requirement specification → *class has end occurrence* → class of event → *class part of occurrence value* → calendar day → *iso 8601 identification of period in time*

— **activity has planned main contractor**
the **organization** that is the planned **main contractor** in the **specification for activity in project**

template expansion:
> specification for activity in project → *class has part occurrence* → main contractor → *temporal part* → organization ∩ whole life individual

— **activity has planned project leader**
the **organization** that is the planned **project leader** in the **specification for activity in project**

template expansion:
> specification for activity in project → *class has part occurrence* → project leader → *temporal part* → person/organization ∩ whole life individual

— **activity has planned sub-contractor**
the **organization** that is a planned **sub-contractor** in the **specification for activity in project**

template expansion:
> specification for activity in project → *class has part occurrence* → sub-contractor → *temporal part* → person/organization ∩ whole life individual

— **activity has planned total expenditure**
the planned expenditure according to the **specification for activity in project**

template expansion:
> specification for activity in project → *subclass of* → monetary amount

— **activity has criticality**
the criticality according to the **specification for activity in project**

template expansion:
> specification for activity in project → *subclass of* → activity criticality

— **activity has priority**
the priority according to the **specification for activity in project**

template expansion:
> specification for activity in project → *subclass of* → activity priority

— **activity has risk factor**
a risk factor according to the **specification for activity in project**

template expansion:
> specification for activity in project → *subclass of* → activity risk factor

— **activity must start as early as possible**
Boolean that is true if the **activity in project** according to the **specification for activity in project** is required to start as early as possible, and false otherwise

template expansion:
> ∃ [specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *has beginning* → event ← *required as early as possible* ← planning ∩ actual individual]

— **activity must start as late as possible**
Boolean that is true if the **activity in project** according to the **specification for activity in project** is required to start as late as possible, and false otherwise

template expansion:

∃ [specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *has beginning* → event ← *required as late as possible* ← planning ∩ actual individual]

— **activity must start no earlier than**
the date or date-time that the **activity in project** according to the **specification for activity in project** is required to start no earlier than

template expansion:
specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *has beginning* → event → *part of* → connected period in time with indefinite end → *has beginning* → point in time → *iso 8601 identification of point in time*

— **activity must start no later than**
the date or date-time that the **activity in project** according to the **specification for activity in project** is required to start no later than

template expansion:
specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *has beginning* → event → *part of* → connected period in time with indefinite beginning → *has end* → point in time → *iso 8601 identification of point in time*

— **activity must start on**
the date or date-time that the **activity in project** according to the **specification for activity in project** is required to start on

template expansion:
specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *has beginning* → event → *part of* → point in time → *iso 8601 identification of point in time*

— **activity must finish as early as possible**
Boolean that is true if the **activity in project** according to the **specification for activity in project** is required to finish as early as possible, and false otherwise

template expansion:
∃ [specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *has end* → event ← *required as early as possible* ← planning ∩ actual individual]

— **activity must finish as late as possible**
Boolean that is true if the **activity in project** according to the **specification for activity in project** is required to finish as late as possible, and false otherwise

template expansion:
∃ [specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *has end* → event ← *required as late as possible* ← planning ∩ actual individual]

— **activity must finish no earlier than**
the date or date-time that the **activity in project** according to the **specification for activity in project** is required to finish no earlier than

template expansion:
specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *has end* → event → *part of* → connected period in time with indefinite end → *has beginning* → point in time → *iso 8601 identification of point in time*

— **activity must finish no later than**

the date or date-time that the **activity in project** according to the **specification for activity in project** is required to finish no later than

template expansion:
> specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *has end* → event → *part of* → connected period in time with indefinite beginning → *has end* → point in time → *iso 8601 identification of point in time*

— **activity must finish on**
the date or date-time that the **activity in project** according to the **specification for activity in project** is required to finish on

template expansion:
> specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *has end* → event → *part of* → point in time → *iso 8601 identification of point in time*

— **has duration**
the duration of the **activity in project** according to the **specification for activity in project**

template expansion:
> specification for activity in project → *subclass of* → time duration

— **has early finish**
the date or date-time that is the earliest the **activity in project** according to the **specification for activity in project** can finish

template expansion:
> specification for activity in project → *class has end occurrence* → class of event → *class part of occurrence value* → period in time → *has beginning* → point in time → *iso 8601 identification of point in time*

— **has early start**
the date or date-time that is the earliest the **activity in project** according to the **specification for activity in project** can start

template expansion:
> specification for activity in project → *class has beginning occurrence* → class of event → *class part of occurrence value* → period in time → *has beginning* → point in time → *iso 8601 identification of point in time*

— **has late finish**
the date or date-time that is the latest the **activity in project** according to the **specification for activity in project** can finish

template expansion:
> specification for activity in project → *class has end occurrence* → class of event → *class part of occurrence value* → period in time → *has end* → point in time → *iso 8601 identification of point in time*

— **has early finish**
the date or date-time that is the earliest the **activity in project** according to the **specification for activity in project** can finish

template expansion:
> specification for activity in project → *class has end occurrence* → class of event → *class part of occurrence value* → period in time → *has beginning* → point in time → *iso 8601 identification of point in time*

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— **has free float**
the duration of the period of time into which the **activity in project** according to the **specification for activity in project** can overrun without causing a delay to any subsequent activities within the whole

template expansion:
specification for activity in project → *class has end occurrence* → class of event → *class part of occurrence* → class of point in time → *class begins occurrence* → free float → *subclass of* → time duration

— **has total float**
the duration of the period of time into which the **activity in project** according to the **specification for activity in project** can overrun without causing a delay to the completion of the whole

template expansion:
specification for activity in project → *class has end occurrence* → class of event → *class part of occurrence* → class of point in time → *class begins occurrence* → total float → *subclass of* → time duration

— **is part of shutdown phase**
the shutdown phase that the **activity in project** according to the **specification for activity in project** is part of

template expansion:
specification for activity in project → *class part of occurrence* → shutdown phase

— **activity has description of planned current progress**
a description of the planned **activity in project** up to the time of the reported data

template expansion:
specification for activity in project ← *type* ← activity ∩ non-actual individual → *has temporal part* → activity ∩ non-actual individual[to date of reported data] → *described by literal*

— **activity has planned current expenditure**
the planned expenditure on the planned **activity in project** up to the time of the reported data

template expansion:
specification for activity in project ← *type* ← activity ∩ non-actual individual → *has temporal part* → activity ∩ non-actual individual[to date of reported data] → *type* → monetary amount

— **activity has planned current material quantity used**
the planned material quantity used by the planned **activity in project** up to the time of the reported data

template expansion:
specification for activity in project ← *type* ← activity ∩ non-actual individual → *has temporal part* → activity ∩ non-actual individual[to date of reported data] → *has part* → material resource → *type* → quantity

— **activity has planned current staff time duration used**
the planned staff time duration used by the planned **activity in project** up to the time of the reported data

template expansion:
specification for activity in project ← *type* ← activity ∩ non-actual individual → *has temporal part* → activity ∩ non-actual individual[to date of reported data] → *has part* → staff time resource → *staff time has duration* → time duration

— **has remaining duration**
the remaining duration that the **activity in project** according to the **specification for activity in project** should have at the time of the reported data

template expansion:
  specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *fulfilled by* → activity ∩ actual individual [to date of reported data] → *type* → time duration[to date of]

  specification for activity in project → *subclass of* → time duration[total]

  (time duration[total] – time duration[to date of reported data]) → *iso 8601 identification of duration*

— **has frontline date**
the date or date-time at which the actual progress for the **activity in project** according to the **specification for activity in project** should have occurred

template expansion:
  specification for activity in project → *specifies implementation of* → activity ∩ non-actual individual → *fulfilled by* → activity ∩ actual individual [to date of reported data] → *has part* → resource ∩ actual individual[to date of reported progress] → *type* → quantity[to date of reported progress]

  specification for activity in project ← *type* ← activity ∩ non-actual individual→ *has temporal part* → activity ∩ non-actual individual [to frontline] → *has part* → material resource[to frontline] → *type* → quantity[to date or reported progress]

  specification for activity in project ← *type* ← activity ∩ non-actual individual→ *has temporal part* → activity ∩ non-actual individual [to frontline] → *has end* → event → *has part* → point in time → *iso 8601 identification of point in time*

  NOTE   The **frontline date** is based upon a measure of progress, but the template property does not specify what this is. The template expansion chooses the usage of a **material resource** as a measure of progress.

7.3.6   Properties of shutdown

— **shutdown requires shutdown of process**
a process that must be shutdown

template expansion:
  shutdown → *occurrence cause of end of* → activity

— **shutdown requires shutdown of system**
a system that must be shutdown

template expansion:
  shutdown → *has part* → subject of work → *temporal part of* → physical object ∩ whole life individual

— **shutdown has reason**
a system that must be shutdown

template expansion:
  shutdown → *has part* → subject of work → *temporal part of* → physical object ∩ whole life individual

7.3.7   Properties of milestone

— **milestone has actual achievement**
the date or date-time that the **milestone** was actually achieved

template expansion:
milestone → *fulfilled by* → event ∩ actual individual → *part of* → point in time → *iso 8601 identification of point in time*

7.3.8 Properties of specification for milestone

— **milestone must be as early as possible**
Boolean that is true if the **event** according to the **specification for milestone** is required as early as possible, and false otherwise

template expansion:
∃ [specification for milestone → *specifies implementation of* → event ∩ non-actual individual ← *required as early as possible* ← planning ∩ actual individual]

— **milestone must be as late as possible**
Boolean that is true if the **event** according to the **specification for milestone** is required as late as possible, and false otherwise

template expansion:
∃ [specification for milestone → *specifies implementation of* → event ∩ non-actual individual ← *required as late as possible* ← planning ∩ actual individual]

— **milestone must be no earlier than**
the date or date-time that the **event** according to the **specification for milestone** is required to be no earlier than

template expansion:
specification for milestone → *specifies implementation of* → event ∩ non-actual individual → *part of* → connected period in time with indefinite end → *has beginning* → point in time → *iso 8601 identification of point in time*

— **milestone must be no later than**
the date or date-time that the **event** according to the **specification for milestone** is required to be no later than

template expansion:
specification for milestone → *specifies implementation of* → event ∩ non-actual individual → *part of* → connected period in time with indefinite beginning → *has end* → point in time → *iso 8601 identification of point in time*

— **milestone must be on**
the date or date-time that the **activity in project** according to the **specification for activity in project** is required to start on

template expansion:
specification for milestone → *specifies implementation of* → event ∩ non-actual individual → *part of* → point in time → *iso 8601 identification of point in time*

— **milestone has early achievment**
the date or date-time that is the earliest the **event** according to the **specification for milestone** can be achieved

template expansion:
specification for milestone → *class part of occurrence value* → period in time → *has beginning* → point in time → *iso 8601 identification of point in time*

— **milestone has late achievment**
  the date or date-time that is the latest the **event** according to the **specification for milestone** can be achieved

  template expansion:
    specification for milestone → *class part of occurrence value* → period in time → *has end* → point in time → *iso 8601 identification of point in time*

7.3.9 Properties of resource

— **resource has breakdown class**
  the breakdown class of the **resource**

  template expansion:
    resource → *type* → resource breakdown class

— **resource is time based**
  whether the **resource** is **time base** or **quantity based**

  template expansion:
    ∃ [resource → *type* → time based resource]

— **resource has date of reported data**
  the date on which the data about the actual **resource** was reported

  template expansion:
    resource → *part of* → activity in project → *has reporting* → reporting ∩ actual individual[to date of reported data] → *has end* → event→ *part of* → point in time → *iso 8601 identification of point in time*

— **resource has actual current expenditure**
  the **monetary amount** for the expenditure on the **resource** to date of reported data

  template expansion:
    resource → *part of* → activity∩ non-actual individual → *fulfilled by* → activity ∩ actual individual [to date of reported data] → *has part* → resource ∩ actual individual [to date of reported data] → *type* → monetary amount

— **resource has actual current percentage used**
  the percentage value for the usage of the **resource** by the **activity** to date of reported data according to the total defined by the **specification for activity in project**

  template expansion:
    resource → *part of* → activity∩ non-actual individual → *fulfilled by* → activity ∩ actual individual [to date of reported data] → *has part* → resource ∩ actual individual [to date of reported data] → *type* → quantity [to date of reported data]

    resource ← *specifies implementation of* ← specification for resource → *subclass of* → quantity[total]

    (quantity[to date] / quantity[total])*100

7.3.10 Properties of specification for resource

— **resource has planned total expenditure**
  the cost of the **resource** according to the **specification for resource**

  template expansion:

specification for resource → *subclass of* → monetary amount

— **resource has planned current expenditure**
the expenditure on the **resource** to the date of reported data according to the **specification for resource**

template expansion:
specification for resource ← *type* ← resource ∩ non-actual individual → *has temporal part* → resource ∩ non-actual individual[to date of reported data] → *type* → monetary amoun

— **resource has planned current percentage used**
the percentage value for the expenditure on the **resource** to the date of reported data according to the **schedule**

template expansion:
specification for resource ← *type* ← resource ∩ non-actual individual → *has temporal part* → resource ∩ non-actual individual[to date of reported data] → *type* → quantity[to date of reported data]

specification for resource → *subclass of* → quantity[total]

(quantity[to date of reported data] / quantity[total])*100

7.3.11 Properties of staff time resource

— **staff time has discipline**
the discipline for the **staff time resource**

template expansion:
resource → *type* → discipline

— **staff time has actual current duration used**
the duration of the **staff time resource** used to the date of reported data

template expansion:
staff time resource → *fulfilled by* → staff time resource ∩ actual individual[to date of reported data] → *staff time has duration* → time duration

7.3.12 Properties of staff time resource specification

— **staff time has planned total duration**
the total duration of the **staff time resource** according to the **staff time resource specification**

template expansion:
staff time resource specification ← *type* ← staff time resource non-actual individual → *staff time has duration* → time duration

— **staff time has planned current duration used**
duration of the **staff time resource** to the date of reported data according to the **staff time resource specification**

template expansion:
staff time resource specification ← *type* ← staff time resource ∩ non-actual individual → *has temporal part* → staff time resource ∩ non-actual individual[to date of reported data] → *staff time has duration* → time duration

7.3.13 Properties of material resource

— **material has actual current quantity used**
the quantity of the **material resource** used to the date of reported data

template expansion:
material resource → *fulfilled by* → material resource ∩ actual individual[to date of reported data] → *staff time has duration* → time duration

7.3.14 Properties of material resource specification

— **material has planned total quantity**
the total quantity of the **material resource** according to the **material resource specification**

template expansion:
material resource specification → *subclass of* → quantity

— **material has planned current quantity used**
quantity of the **material resource** used to the date of reported data according to the **material resource specification**

template expansion:
material resource specification ← *type* ← material resource ∩ non-actual individual → *has temporal part* → material resource ∩ non-actual individual[to date of reported data] → *type* → quantity

7.3.15 Properties of available resource

— **available resource has breakdown class**
the breakdown class of the **physical object** available to be a **resource**

template expansion:
available resource → *type* → resource breakdown class

— **available resource has available rate**
the rate at which the physical object is available to be a **resource**

template expansion:
available resource → *has maximum rate of use* → quantity rate

— **available resource has available amount**
amount of the physical object available to be a **resource**

template expansion:
available resource → *type* → quantity

7.3.16 Properties of specification for succession link

— **succession link has lag**
the duration of lag specified by a **specification for succession link**

template expansion:
specification for succession link → *subclass of* → time duration → *iso 8601 identification of duration*

7.3.17 Properties of calendar

— **calendar has finish**

the date or date-time of the end of the **calendar**

template expansion:
> calendar → *has end*→ point in time → *iso 8601 identification of point in time*

— **calendar has start**
the date or date-time of the **calendar**

template expansion:
> calendar → *has beginning*→ point in time → *iso 8601 identification of point in time*

7.3.18 Properties of connected period in time with definite beginning and end

— **period has finish**
the date or date-time of the end of the **connected period in time with definite beginning and end**

template expansion:
> connected period in time with definite beginning and end → *has end*→ point in time → *iso 8601 identification of point in time*

— **period has start**
the date or date-time of the beginning of the **connected period in time with definite beginning and end**

template expansion:
> connected period in time with definite beginning and end → *has beginning*→ point in time → *iso 8601 identification of point in time*

7.3.19 Properties of daily repeating connected period in time

— **daily repeating element has finish time**
time of the end of an element of the daily repeating **connected period in time**

template expansion:
> daily repeating connected period in time → *has end* → daily repeating point in time → *iso 8601 identification of point in time*

— **daily repeating element has start time**
time of the beginning of an element of the daily repeating **connected period in time**

template expansion:
> daily repeating connected period in time → *has beginning* → daily repeating point in time → *iso 8601 identification of point in time*

Annex A
(normative)

Information object registration

To provide for unambiguous identification of an information object in an open system, the object identifier

```
{iso standard 15926 part{13} version {1}}
```

is assigned to this part of ISO 15926. The meaning of this value is defined in ISO/IEC 8824-1, and is described in ISO 10303-1.

Annex B
(normative)

Document URN

To provide for unambiguous identification of an information object on the Internet, the object identifier:

```
urn:iso:std:iso:ts:15926:-13:ed-1
```

is assigned to this part of ISO 15926. The meaning of this value is defined in document "A Uniform Resource Name (URN) Namespace for the International Organization for Standardization (ISO)"

Annex C
(normative)

Ontology for integrated lifecycle asset planning

C.1   Layers in the ontology

This part of ISO 15926 defines an ontology with two layers as follows:

planning ontology: an extension to the Life Cycle Integration ontology defined in ISO 15926-12 to support planning data;

scheduling application view ontology: an extension to the planning ontology to support a view that is restricted to the exchange of planning data between scheduling software applications;

This ontology has classes that define the data that shall be exchanged, and template properties that hide the details of the full planning ontology.

The following copyright statement applies to each of the ontologies, and is included within the representations of each of the ontologies.

The import graph for the ontology files is shown in Figure 87.
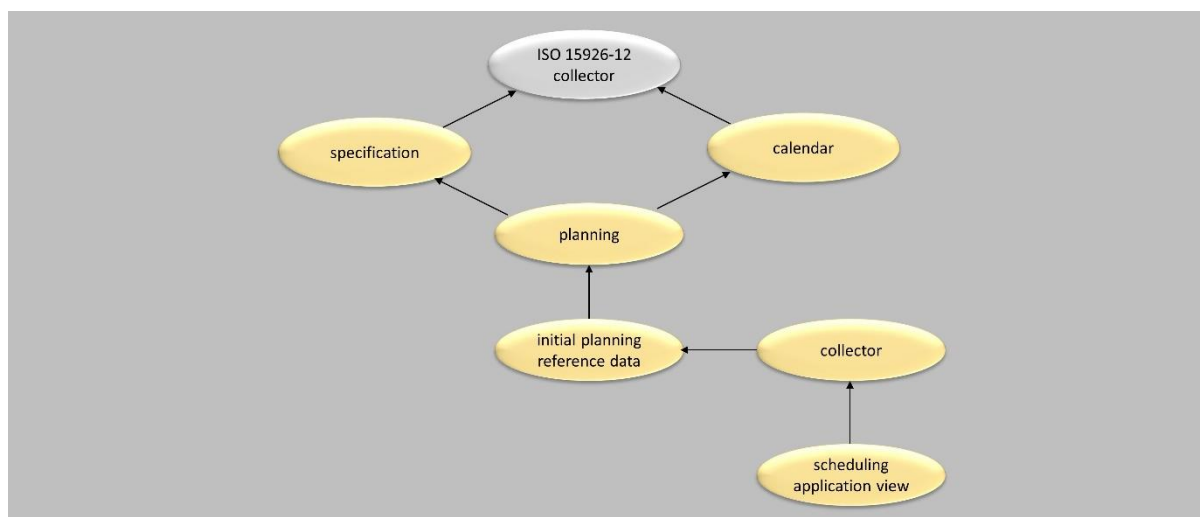
Figure 87: Import hierarchy

The annotation can be added to the collectors as shown in Figure 88.
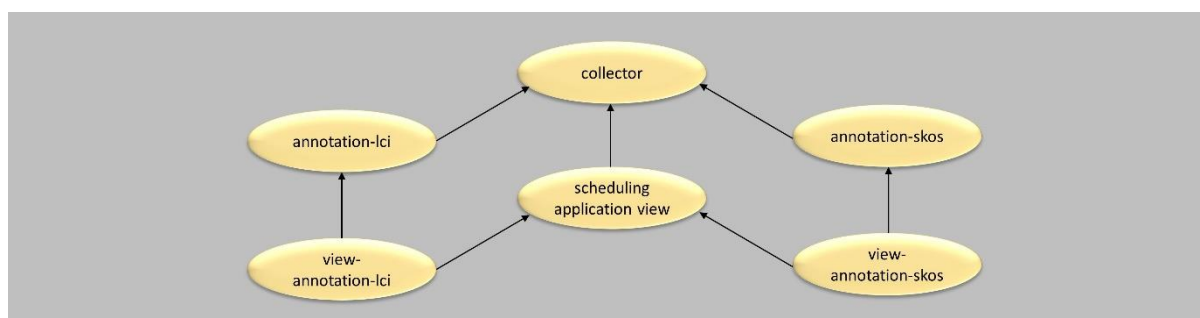
Figure 88: Import for annotation

C.2   Planning ontology

The planning ontology defined by part of ISO 15926, and by its subsequent editions and amendments, has the IRI:

http://standards.iso.org/iso/15926/-13/tech/ontology

The version of the ontology that is defined by this edition of this part of ISO 15926 has the IRI:

http://standards.iso.org/iso/15926/-13/tech/ontology/v-0-1

The version of the ontology that is defined by this edition of this part of ISO 15926 is represented by the TURTLE files listed in Table 5. The files can be obtained by dereferencing the IRIs with the prefix:

http://standards.iso.org/iso/15926/-13/tech/ontology/<file>.ttl

Table 5: Representation of the planning ontology

file	file content
calendar-v-0-1	ontology for **calendars** or working and non-working time
specification-v-0-1	ontology for **specifications** for required or proposed **individuals**

planning-v-0-1	ontology for **planning**, which imports the ontologies for **calendar** and **specification**
initial-planning-reference-data-v-0-1	subclasses of classes in the ontology for **planning**, that may be extended by classes in a reference data library outside this part of ISO 15926
collector-lci-v-0-1	collector of all the planning ontologies
annotation-lci-v-0-1	annotation of the ontology using annotation properties defined in ISO 15926-12
annotation-skos-v-0-1	annotation of the ontology using annotation properties defined in SKOS

The annotation of the planning ontology is also available as HTML in the file:

http://standards.iso.org/iso/15926/-13/tech/ontology/definitions-v-0-1.htm

This file has hypertext links between:

— the classes and properties within the planning ontology of this part of ISO 15926;

— the classes and properties within the Life Cycle Integration ontology of ISO 15926-12".

C.3   Scheduling application view ontology

The scheduling application view ontology defined by part of ISO 15926, and by its subsequent editions and amendments, has the IRI:

http://standards.iso.org/iso/15926/-13/tech/ontology/view

The version of the ontology that is defined by this edition of this part of ISO 15926 has the IRI:

http://standards.iso.org/iso/15926/-13/tech/ontology/view/v-1

The version of the ontology that is defined by this edition of this part of ISO 15926 is represented by the TURTLE files listed in Table 6. The files can be obtained by dereferencing the IRI with the prefix:

http://standards.iso.org/iso/15926/-13/tech/ontology/view/<file>.ttl

Table 6: Representation of the scheduling application view ontology

file	file content
view-v-0-1	ontology for the scheduling application view
annotation-lci-v-0-1	annotation of the ontology using annotation properties defined in ISO 15926-12
annotation-skos-v-0-1	annotation of the ontology using annotation properties defined in SKOS

The annotation of the scheduling application view ontology is also available as HTML in the file:

http://standards.iso.org/iso/15926/-13/tech/ontology/view/definitions-v-0-1.htm

This file has hypertext links between:

— the classes and properties within the planning ontology of this part of ISO 15926;

— the classes and properties within the scheduling application view ontology of this part of ISO 15926;

— the classes and properties within the Life Cycle Integration ontology of ISO 15926-12.

C.4 Scheduling application view ontology

The scheduling application view ontology defined by part of ISO 15926, and by its subsequent editions and amendments, has the IRI:

<div align="center">http://standards.iso.org/iso/15926/-13/tech/ontology/view</div>

The version of the ontology that is defined by this edition of this part of ISO 15926 has the IRI:

<div align="center">http://standards.iso.org/iso/15926/-13/tech/ontology/view/v-1</div>

The version of the ontology that is defined by this edition of this part of ISO 15926 is represented by the TURTLE files listed in Table 6. The files can be obtained by dereferencing the IRI with the prefix:

<div align="center">http://standards.iso.org/iso/15926/-13/tech/ontology/view/<file>.ttl</div>

<div align="center">**Table 7: Representation of the scheduling application view ontology**</div>

file	file content
view-v-0-1	ontology for the scheduling application view
annotation-lci-v-0-1	annotation of the ontology using annotation properties defined in ISO 15926-12
annotation-skos-v-0-1	annotation of the ontology using annotation properties defined in SKOS

The annotation of the scheduling application view ontology is also available as HTML in the file:

<div align="center">http://standards.iso.org/iso/15926/-13/tech/ontology/view/definitions-v-0-1.htm</div>

This file has hypertext links between:

— the classes and properties within the planning ontology of this part of ISO 15926;

— the classes and properties within the scheduling application view ontology of this part of ISO 15926;

— the classes and properties within the Life Cycle Integration ontology of ISO 15926-12.

Annex D
(normative)

XML schema for exchange between scheduling applications

This part of ISO 15926 defines an XML schema for the exchange of data between scheduling applications. The XML schema is semantically annotated using W3C SAWSDL. The XML schema is a valid exchange method.

The following copyright statement applies to the schema, and is included within the representation of the schema.

The XML schema that is defined by part of ISO 15926, and by its subsequent editions and amendments, has the IRI:

http://standards.iso.org/iso/15926/-13/tech/xml-schema

The version of the schema that is defined by this edition of this part of ISO 15926 has the IRI:

http://standards.iso.org/iso/15926/-13/tech/xml-schema/v-0-1

The version of the schema that is defined by this edition of this part of ISO 15926 can be obtained by dereferencing the IRI:

http://standards.iso.org/iso/15926/-13/tech/xml-schema/v-0-1.xsd

Annex E
(informative)

Relationship between the planning ontology and the scheduling application interface

This part of ISO 15926 defines levels, as follows:

external level: this is the ontology view for scheduling applications described in Clause 6, with the XSD implementation defined in Annex D;

    This level corresponds to the ANSI SPARC external level with user views.

community level: this is the planning ontology described in Clause 4, with the OWL representation defined in Annex C.

    This level corresponds to the ANSI SPARC conceptual level.

The relationship between the levels and the generic, conceptual ontology defined in ISO 15926-2 is shown in Figure 89.
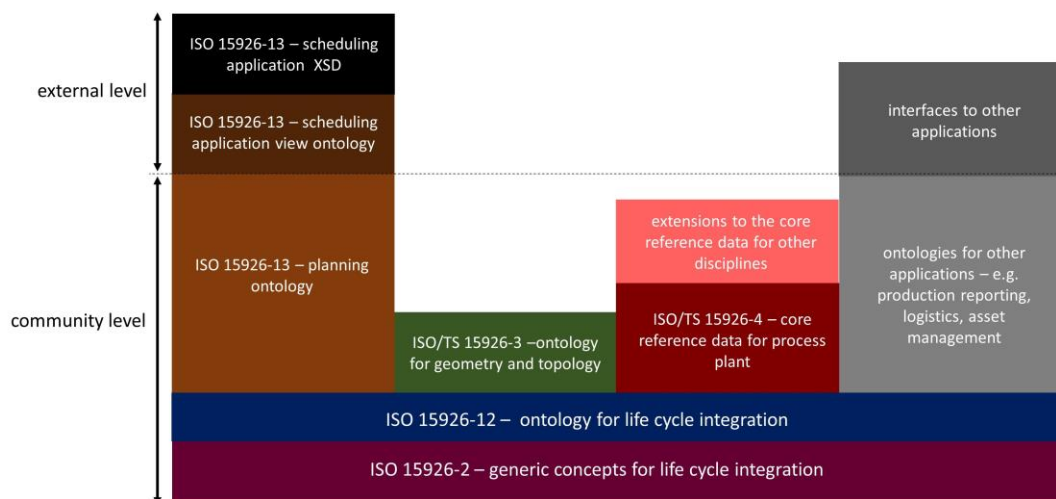
Figure 89: Implementation levels and the ISO 15926 generic, conceptual ontology

Figure 89 shows that:

— the generic, conceptual ontology in ISO 15926-2 can have extensions for different applications;

— the reference data that supports these applications is also an extension of the ISO/TS 15926-4 reference data library.

The use of the ISO 15926-2 ontology as the basis for the community level, makes it possible to define views on multiple applications.

Annex F
(informative)

Schedule and activity level

F.1 Schedule level

The classification of a **schedule** according to a "level" is common practice within the process industry, and terms such as "level 1", "level 2", etc. are widely used. However, the definitions of these terms are not the same within all sectors of the process industry.

Within this part of ISO 15926, the class **schedule level** is defined, but subclasses of **schedule** that are members of **schedule level** are not. Instead, subclasses of **schedule** that are members of **schedule level** can be standardised in a Reference Data Library.

Subclasses of **schedule** according to level that are commonly used in EPC projects are as follows:

Level 1 – Project Master Schedule (PMS): This can also be called the "Major Milestone Schedule" or "Executive Summary". This schedule is created by the commissioning company for the stakeholders. It is often a document no longer than one page. Informally, this level can be called "the big picture".

A **project master schedule** can specify the type of the facility, and the estimated time to design, procure goods and services, construct, and commission. It specifies the timings of major milestones and key deliverables. Usually the timings are no more precise than months. It can be used to help the business decision making process, and will probably have been developed as a result of an initial feasibility study. A **project master schedule** is usually concerned only with facilities as a whole, and does not contain a product or work breakdown structure. It usually contains a milestone chart or simple bar charts spanning the project from start to finish.

A **project master schedule** can be the starting point for the development of further contractual content, and can be included in a bid specification. An EPC contractor making a bid would have to show evidence of an ability to conform to it.

Level 2 – Summary Master Schedule (SMS): This can also be called the "Project Summary Schedule", "Management Summary Schedule" or "Summary Master Schedule". This schedule is created by a contractor from a level 3 **project coordination schedule** in order to report progress to general managers, project managers, and sometimes project sponsors.

A **summary master schedule** contains all the information in the **project master schedule**, but with additionally a product and work breakdown structure against which the progress towards the deliverables defined in the **project master schedule** is recorded.

Level 3 – Project Coordination Schedule (PCS): This can also be called "Project Phase Summary Schedule", "Progress Schedule" or "Publication Schedule". This schedule contains product, work and other breakdown structures.

A **project coordination schedule** is often initial developed by the main contractor to form part of the technical proposal for its bid. It is used by project managers and commissioning company representatives. The Critical Path Method can be applied to this schedule.

During project execution, a **project coordination schedule** is maintained by the EPC contractor as a monthly summary of the **execution schedule**. It covering all major milestones of design, engineering, procurement, construction, pre-commissioning, commissioning, taking over, start-up and may be extended to cover operation and maintenance.

A **project coordination schedule** is usually part of the contract between a commissioning company and an EPC contractor. Conformance to this schedule is monitored during execution, and payments can be linked to progress on deliverables defined by this schedule.

Many EPC projects are carried out by an alliance of EPC contractors, sub-contractors, manufactures, and suppliers. The main EPC contractor usually sends an initial **project coordination schedule** to the members of the alliance. Each member of the alliance develops its own portion of the schedule. The main EPC contractor puts together contributions from the members of the alliance to produce an integrated **project coordination schedule**.

Level 4 – Execution Schedule: This is also called "Project Working Level Schedule" or "Working Schedule". An **execution schedule** is created by combining a full work breakdown structure with an integrated **project coordination schedule**. The main users of an **execution schedule** are project managers and team leaders to monitor and control their tasks.

The Critical Path Method can be applied to this schedule to produce the start and finish dates, durations, and required resources.

Level 5 – Detail Schedule: This is also called a "look ahead schedule". A detail schedule is a schedule for a few weeks that is generated from an execution schedule as a temporary schedule document. It is used by team leaders and crew leaders to coordinate day to day tasks in an area of a facility. A **detail schedule** is often represented as a Gantt chart.

The five levels are described in the Guide to the Forensic Scheduling Body of Knowledge (FSBOK) Part 1.

F.2 Activity level

An **activity** can be classified according to its size and complexity in the same way that a **schedule** is classified according to level. Terms such as "project", "workpackage", "activity (in project)", and "task" are widely used in the process industry. As for the level of a schedule, the definitions of these terms are not the same within all sectors.

The class **activity** is defined within ISO 15926-2 to be anything that happens independent of size and complexity. Within the process industry, the term "activity" is often used to mean something that is smaller than a project, but bigger than a task. To avoid confusion with **activity** as defined in ISO 15926-2, the term "activity in project" is used here.

Subclasses of **activity** according to size and complexity are not defined within this part of ISO 15926. Instead, subclasses of **activity** according to size and complexity can be standardised in a Reference Data Library.

Subclasses of **activity** according to size and complexity that are commonly used in EPC projects are as follows:

project: This is a large and complicated **activity** which often has a level 1 **project master schedule**.

work package: This is a part of a **project** defined by a work breakdown structure. It is usually a collection of tasks to be performed at a location within a time frame. The manager of a **work**

package can deploy resources to perform the tasks, and can monitor and control progress and expenditure. A work package is often defined in a level 3 **project coordination schedule**.

During the planning stage, costs of the individual **work packages** are aggregated to give the authorized cost baseline or authorized budget for the **project**. The performance of a **work package** is usually measured by the Earned Value method.

activity in project: This is an umbrella term for either a **work package** or a **task** within a **work package**. The Critical Path Method is applied to a **project** and to its component **activities in project**.

task: This is a part of a **work package** that is often defined in a level 4 **execution schedule**.

Annex G
(informative)

Interface to reference data libraries

The ontology defined in this part of ISO 15926 is intended to be used with reference data that defines specialisations of classes or mappings within the ontology. The specialisations are often specific to a particular branch of industry or even to a particular company.

In some cases, specialisations with a broad application are standardised in this part of ISO 15926, whilst other specialisations are left to reference data outside this part of ISO 15926. For instance, subclasses of activity according to size and complexity are defined in as reference data. These levels could include "program", "project", "workpackage", and "task".

The interfaces to reference data in this part of ISO 15926 are shown in Table 8.

The columns in Table 8 are as follows:

class: the class in this part of ISO 15926 the reference data items are a member of

standardized items: members of the class that are standardized in this part of ISO 15926

example items: example members of the class that could be defined in reference data libraries outside this part of ISO 15926

Table 8: Interfaces to reference data

class	standardized items	example items
schedule level		Level 1 – Project Master Schedule Level 2 – Summary Master Schedule (SMS) Level 3 – Project Coordination Schedule (PCS) Level 4 – Execution Schedule Level 5 – Detail Schedule
role of a schedule	baseline schedule current schedule	revised schedule live schedule
class of activity according to size or scope		project work package task
class of activity according to purpose		classes relevant to oil and gas production and processing facilities include: drilling well isolating well servicing well transfer production activity revision
activity breakdown class		classes relevant to oil and gas production and processing facilities are defined in ISO 19008
class of activity by business objective		classes relevant to oil and gas production and processing facilities include: increase oil and gas recovery maintain business as usual make incremental improvement make radical change

		recover from disaster manage closedown
class of asset lifecycle phase		classes relevant to oil and gas production and processing facilities include: oil and gas field exploration oil and gas field planning oil and gas field development oil and gas field operation oil and gas field shutdown and decommissioning oil and gas field removal
activity risk factor		classes relevant to oil and gas production and processing facilities include: height work hot work lifting operation shallow gas operation
activity criticality		All members are probably company specific
activity priority		All members are probably company specific
activity completion status	active activity completed activity	
activity planning status	planning – to be planned planning – under planning planning – cancelled planning – ready for execution	
resource breakdown class		classes relevant to oil and gas production and processing facilities are defined in ISO 19008
class of work centre		main work centre operational work centre
class of organization according to size and scope		department team
discipline		classes relevant to oil and gas production and processing facilities are defined in ISO 19008
physical breakdown class		classes relevant to oil and gas production and processing facilities are defined in ISO 19008
role of agent	operator project leader contractor main contractor sub-contractor	regulator chief engineer responsible person team leader
class of installed planning software		Microsoft Project
class of physical object (classifying the shutdown system)		system system train equipment field living quarters plant
class of activity (classifying the shutdown process)		drilling gas export gas injection

		oil and gas production water injection water production
class of shutdown by reason		emergency shutdown safety test shutdown mini-shutdown revision shutdown cycle ending turnaround non-cycle ending turnaround
performance measurement algorithm	always on schedule	earned value 0/100 earned value 20/80

Annex H
(informative)

Usage scenarios

The standard is developed for exchange of schedule data and has no impact on internal planning and scheduling activities for any company adopting it. It does fit to planning processes as defined by major standardization bodies and their standards for project management, such as ISO 21500, PMI and PRINCE2. Typically, project management is conducted in project phases displayed in Figure 90.

Figure 90: Project management phases

One of which is planning that is decomposed to activities, including scheduling, Figure 91.
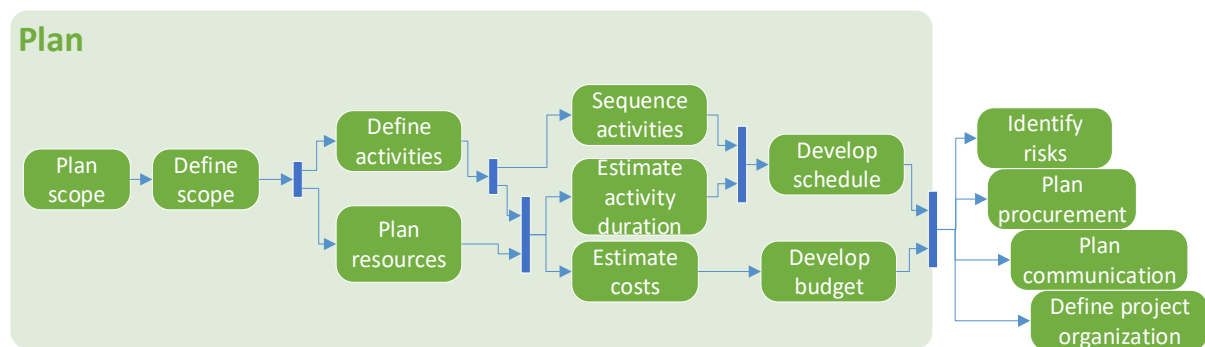
Figure 91: Planning activities

The above sketch of the planning activities corresponds to planning steps defined in PRINCE2: designing the plan, defining and analysing products, identifying activities and dependencies, preparing estimates, preparing the schedule, analysing risks, and documenting the plan. Basically, these planning methods are well suited for stable and controlled project environments with limited amount of schedule revision and exchange.

All projects, but especially ones that involve many activities (e.g., engineering, maintenance, modification projects) or are weather dependent, often require to adjust schedules for opportunity windows (weather permitting operations, or equipment being delivered earlier) or align with other actors involved. Changes in the schedules need to be communicated fast. Use of different scheduling software tools requires tedious and time consuming manual data quality control and, sometimes, re-entry. Therefore, ISO 15926-13 is addressing these settings by a standard for plan data integration and exchange as depicted in Figure 92.
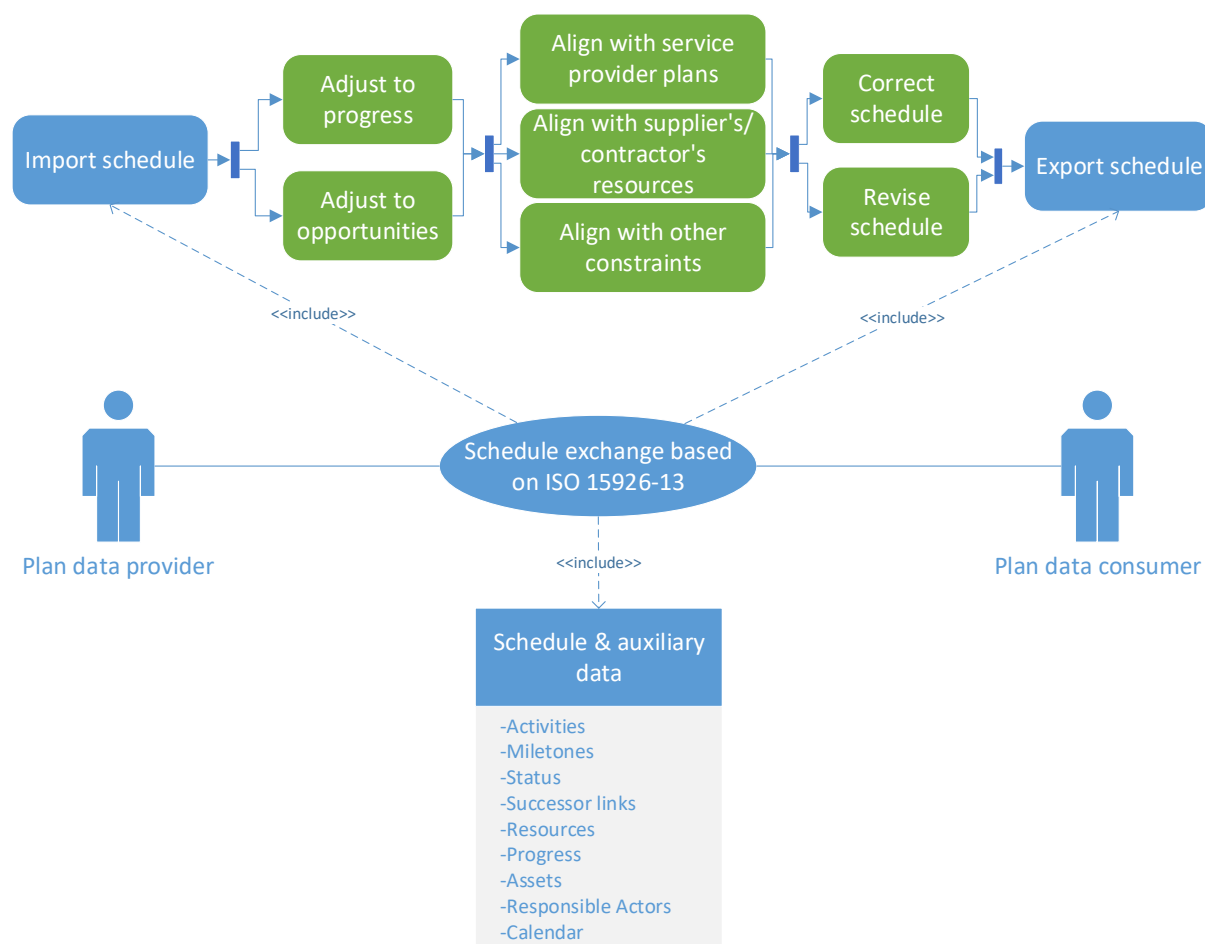
Figure 92: ILAP usage scenario for data exchange

Plan Data Provider

Plan data provider is an actor that is responsible for doing the work or aggregating the project data for an end client. The plan data providers are: suppliers, contractors, program or project managers.

Plan Data Consumer

The plan data consumer is an actor that is responsible for managing a project and/or have the authority to obligate funds to a contractor or supplier to perform work. They are responsible for collecting the project status and performance data for analysis on a periodic basis. These plan data consumers are: government agency, contractor, program or project manager, internal management.

In ILAP, actors assuming above described roles change them. An operator provides its schedule as a master schedule for use by a contractor. Later the contractor provides its detailed schedule for the operator for review, control or integration. A revised schedule often is sent back to the contractor.

Another important usage scenario is archiving in a neutral representation that makes historical schedules available for future analysis independently from currently used scheduling software.

Note, that cost estimating software and cost performance control are out of scope of the ISO 15926-13 ILAP standard. Parts of the data elements in these peripheral to scheduling software can be mapped to the ILAP model and successfully exchanged, however this standard covers only schedule related data, such as costs related to activities and resources. For more details, see Annex I, where ILAP and UN/CEFACT are compared.

Annex I
(informative)

Relationship to UN/CEFACT

There is a significant overlap between ISO 15926-13 (ILAP) and UN/CEFACT Project Schedule and Cost Performance Management. UN/CEFACT XML schema is used for reporting project schedule and cost performance, likewise in ILAP.

The objective of UN/CEFACT is solely on one-direction transfer for project control purposes. A project performance data is transferred from a scheduling software to a project analysis/management software. A significant focus is on reporting, differently from ILAP: variances in costs, reporting thresholds, funding and contract data.

The objective of ILAP is both project control and integration of schedules (collaboration) by transferring schedules both ways with a scheduling software at each end. Schedules are revised by a plan data consumer as well as a plan data provider. Scheduling software calculates earned value and other variance measures. Another objective of the ILAP is to integrate asset planning with the rest of ISO 15926 family of standards for life cycle data management by creating planning philosophy ontology according to ISO 15926-12.

The UN/CEFACT standards are snapshot standards, and do not define the formal ontology that would support the integration of multiple snapshots within a repository. The UN/CEFACT standards were developed without reference to Semantic Web technologies. Therefore, they do not make references to activity classifications, such as defined by ISO 19008, which can be available as reference data.

Other parts of UN/CEFACT and ILAP are overlapping and can be mapped. Data such as, schedule level, free float, total float, milestone, total duration, lag time, resources are used in both.

References to relevant parts of UN/CEFACT is made in the text where it is relevant. Mappings between UN/CEFACT and ILAP fields are shown in the table below.

Table 9: Plan succession links between

Dictionary Entry Name	ILAP name
Calendar. Details	Calendar
Calendar. Identification. Identifier	calendarId
Calendar. Name. Text	label
Calendar. Description. Text	hasDescription
Calendar. Start. Date	hasStart
Calendar. End. Date	hasFinish
Calendar. Holiday. Date	ConnectedPeriodInTimeWithDefiniteBeginningAndEnd
Calendar. Specified. Period	DisconnectedPeriodInTime ConnectedPeriodInTimeWithDefiniteBeginningAndEnd
Calendar. Associated. Work Shift	AvailablePeriod
Contract Change. Details	n/a
Contract Change. Identification. Identifier	n/a
Contract Change. Name. Text	n/a

Dictionary Entry Name	ILAP name
Contract Change. Description. Text	n/a
Contract Change. Estimated Cost Difference. Amount	n/a
Contract Change. Actual Cost Difference. Amount	n/a
Contract Change. Status. Code	n/a
Contract Change. Effective. Date	n/a
Contract Change. Identified. Party	n/a
Contract. Fee. Percent	n/a
Contract. End. Date	n/a
Contract. Cost. Amount	n/a
Contract. Funding Year. Identifier	n/a
Contract. Last Item Delivery. Date	n/a
Contract. Over Target Baseline. Date	n/a
Contract. Modification. Contract Change	n/a
Contract. Associated. Cost	n/a
Contract. Principal. Programme	n/a
Contract. Contained. Project Portfolio	n/a
Contract. Incentive. Performance Measurement	n/a
Contract. Contained. Project	n/a
Contract. Specified. Contract Line Item	n/a
Contract Line Item. Details	n/a
Contract Line Item. Identification. Identifier	n/a
Contract Line Item. Name. Text	n/a
Contract Line Item. Description. Text	n/a
Contract Line Item. Total. Quantity	n/a
Cost. Details	n/a
Cost. Identification. Identifier	activityHasAuthorisationForExpenditureIdentifier
Cost. Name. Text	n/a
Cost. Description. Text	hasDescription
Cost. Type. Code	n/a
Cost. Component. Amount	n/a
Cost. Effective. Date	n/a
Cost. Component. Quantity	resourceHasPlannedTotalExpenditure
Cost. Component Name. Text	n/a
Cost. Included. Resource	Resource.Id
Cost. Reporting. Period	n/a
Data Node. Details	n/a
Data Node. Identification. Identifier	id
Data Node. Name. Text	label
Data Node. Description. Text	hasDescription

Dictionary Entry Name	ILAP name
Data Node. Hierarchical Level. Numeric	n/a
Data Node. Calculation Method. Code	EarnedValueMethod
Data Node. Summary Exclusion. Indicator	n/a
Data Node. Sequence. Numeric	n/a
Data Node. Subordinate. Data Node	n/a
Hierarchical Structure. Details	ActivityBreakdownClass PhysicalBreakdownClass ResourceBreakdownClass
Hierarchical Structure. Identification. Identifier	id
Hierarchical Structure. Name. Text	label
Hierarchical Structure. Description. Text	hasDescription
Hierarchical Structure. Type. Code	code
Hierarchical Structure. Component. Data Node	n/a
Hierarchical Structure. Used. Project	n/a
Hierarchical Structure. Associated. Cost	n/a
Note. Details	n/a
Note. Subject. Code	code
Note. Content. Text	hasDescription
Note. Content. Code	code
Note. Identification. Identifier	id
Note. Name. Text	label
Note. Creation. Date Time	hasDateOfReportedData
Performance Measurement. Details	n/a
Performance Measurement. Calculation. Percent	EarnedValueMethod
Performance Measurement. Basis. Amount	n/a
Performance Measurement. Actual. Amount	hasActualCurrentQuantityUsed hasActualCurrentPercentageUsed hasActualCurrentDurationUsed
Performance Measurement. Calculated. Amount	n/a
Period. Name. Text	n/a
Period. Sequence. Numeric	n/a
Programme. Details	n/a
Programme. Identification. Identifier	id
Programme. Name. Text	label
Programme. Type. Code	code
Programme. Description. Text	hasDescription
Programme. Sponsor Name. Text	n/a
Project Portfolio. Details	partOfProject
Project Portfolio. Identification. Identifier	id

Dictionary Entry Name	ILAP name
Project Portfolio. Name. Text	label
Project Portfolio. Description. Text	hasDescription
Project Portfolio. Category. Text	n/a
Project Portfolio. Component. Project	partOfProject
Project Portfolio. Management Reserve. Cost	n/a
Project. Contract. Identifier	n/a
Project. Project Portfolio. Identifier	partOfProject
Project. Baseline. Calendar	projectHasDateOfLatestBaselineSetting
Project. Managed. Cost	n/a
Project. Management Reserve. Cost	n/a
Project. Undistributed Budget. Cost	n/a
Project. Overhead. Cost	n/a
Project. Funds Borrowed. Cost	n/a
Reporting Threshold. Details	n/a
Reporting Threshold. Identification. Identifier	n/a
Reporting Threshold. Name. Text	n/a
Reporting Threshold. Description. Text	n/a
Reporting Threshold. Trigger Type. Code	n/a
Reporting Threshold. Cost Reporting. Code	n/a
Reporting Threshold. Minimum Variance. Amount	n/a
Reporting Threshold. Minimum Variance. Percent	n/a
Reporting Threshold. Applied. Data Node	n/a
Resource. Details	Resource
Resource. Identification. Identifier	id
Resource. Name. Text	label
Resource. Description. Text	hasDescription
Resource. Type. Code	hasBreakdownClass
Resource. Availability. Quantity	Quantity
Resource. Unit Cost. Amount	hasValue
Resource. Unit Cost Measure. Code	Currency
Resource. Category. Code	StaffTimeResource MaterialResource: ConsumableResource EquipmentResource
Resource. Availability. Period	AvailablePeriod
Resource. Schedule. Calendar	availableResourceHasCalendar
Resource Assignment. Details	
Resource Assignment. Identification. Identifier	id
Resource Assignment. Name. Text	label

Dictionary Entry Name	ILAP name
Resource Assignment. Cost Management. Code	resourceHasBreakdownClass availableResourceHasBreakdownClass
Resource Assignment. Resource. Amount	resourceHasPlannedTotalExpenditure
Resource Assignment. Duration Based. Indicator	staffTimeHasDuration
Resource Assignment. Resource. Quantity	materialHasActualCurrentQuantityUsed materialHasPlannedCurrentQuantityUsed materialHasPlannedTotalQuantity
Resource Assignment. Allocated. Period	resourceSpecificationHasCalendar
Resource Assignment. Allocated. Resource	availableResourceForActivity
Resource Assignment. Schedule. Calendar	resourceHasCalendar
Schedule Task. Details	activityInProject
Schedule Task. Identification. Identifier	id
Schedule Task. Name. Text	label
Schedule Task. Description. Text	hasDescription
Schedule Task. Completion. Percent	activityHasActualCurrentPercentageComplete
Schedule Task. Priority Ranking. Numeric	activityHasPriority
Schedule Task. Method. Code	activityHasEarnedValueCalculatingMethod
Schedule Task. Schedule Level. Numeric	ScheduleLevel
Schedule Task. Float Duration. Measure	activityHasFreeFloat activityHasTotalFloat
Schedule Task. Milestone Weight. Numeric	n/a
Schedule Task. Type. Code	activityHasBreakdownClass
Schedule Task. Duration. Measure	activityHasPlannedDuration activityHasRemainingDuration activityHasDuration
Schedule Task. Critical Path. Indicator	n/a
Schedule Task. Reserve. Indicator	n/a
Schedule Task. Completion. Date Time	n/a
Schedule Task. Lag Time. Measure	successionLinkHasLag
Schedule Task. Schedule. Calendar	activitySpecificationHasCalendar
Schedule Task. Scheduled. Period	n/a
Schedule Task. Reporting. Period	n/a
Schedule Task. Required. Resource Assignment	availableResourceForActivity
Schedule Task. Details	SpecificationForActivityInProject
Schedule Task Relationship. Details	activityHasSuccessionLink
Schedule Task Relationship. Identification. Identifier	SpecificationForSuccessionLink
Schedule Task Relationship. Name. Text	n/a
Schedule Task Relationship. Description. Text	n/a
Schedule Task Relationship. Type. Code	FF-successionLink FS-successionLink SS-successionLink SF-successionLink

Dictionary Entry Name	ILAP name
Schedule Task Relationship. Lag Time. Measure	successionLinkHasLag
Schedule Task Relationship. Specified. Schedule Task	successionHasLinkToActivity
Work Shift. Details	n/a
Work Shift. Identification. Identifier	n/a
Work Shift. Day. Code	n/a
Work Shift. Name. Text	n/a
Work Shift. Effective. Period	n/a

Annex J
(informative)

Industry validation report

This annex presents the ILAP Adapter that is currently under development for Safran and SAP. The industry validation report is illustrated by screenshots of the ILAP adapter and main steps showing how it is used, see Figure 93.
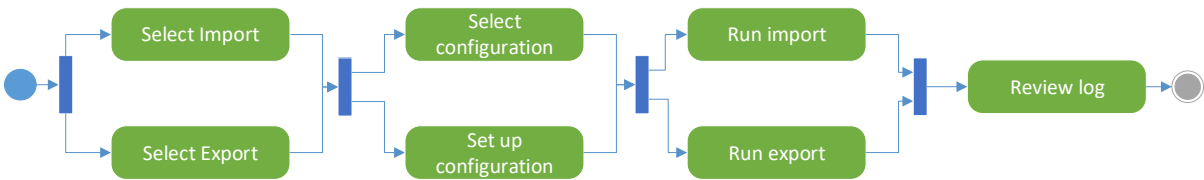
Figure 93: Basic steps to run the ILAP Adapter

The Adapter is started as in Windows OS as executable file. Normal use would be to select a last used configuration. Though configuration can be changed or created, see Figure 94 illustrating graphical user interface for mapping (the rest of configuration forms is skipped for brevity).
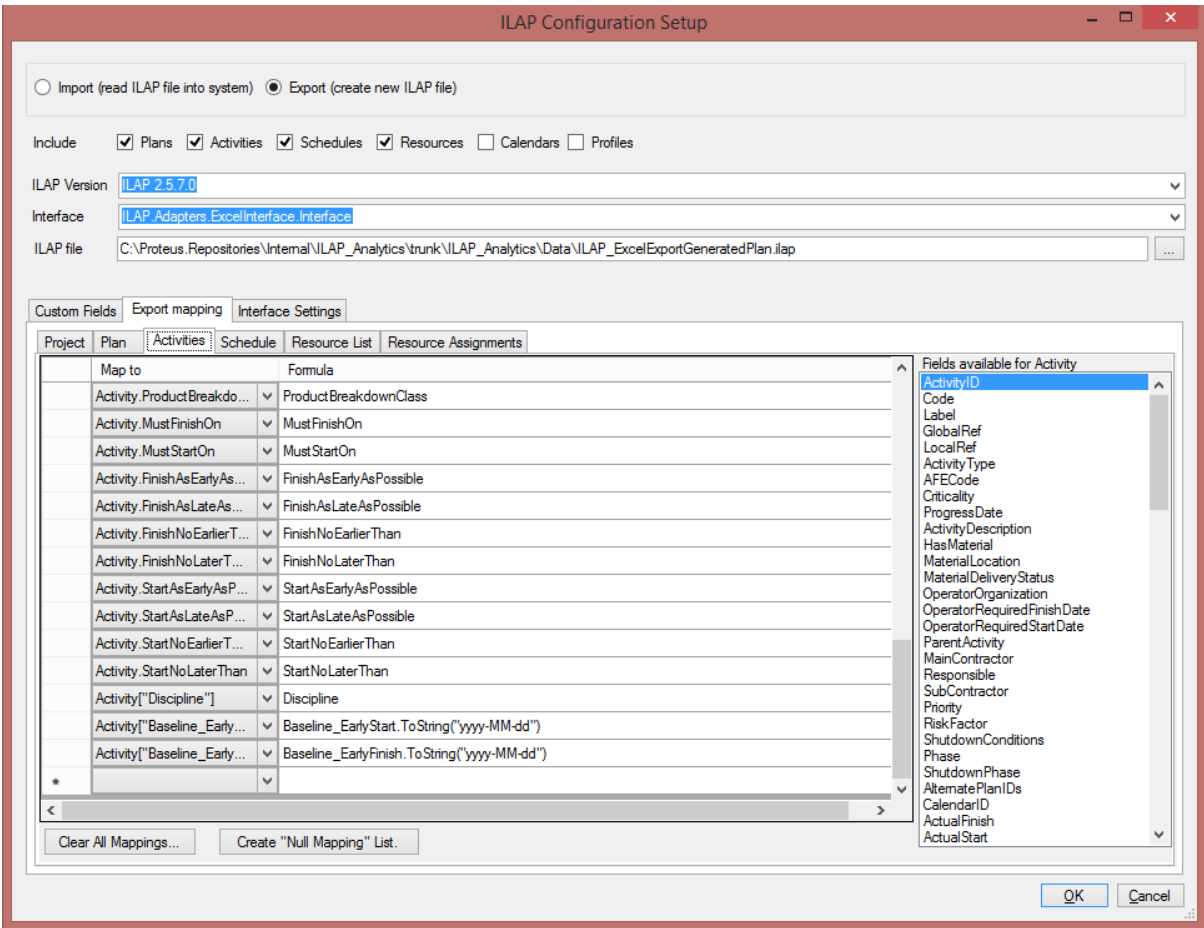
Figure 94: Configuration form for the ILAP adapter

In the figure above, the second line of tabs represents the structure of the ILAP XSD. Here "Activity" is shown. A new configuration will be empty in a column "Map to" and "Formula". The fields listed

under "Activity" represent fields that are defined in the ILAP XSD. The fields not prefixed with "Activity" are not defined in ILAP, typically user defined properties or other fields that available in the host application but not defined in ILAP. Reason for transferring such fields are to exchange a more complete dataset to a receiving host that can make use of that data.

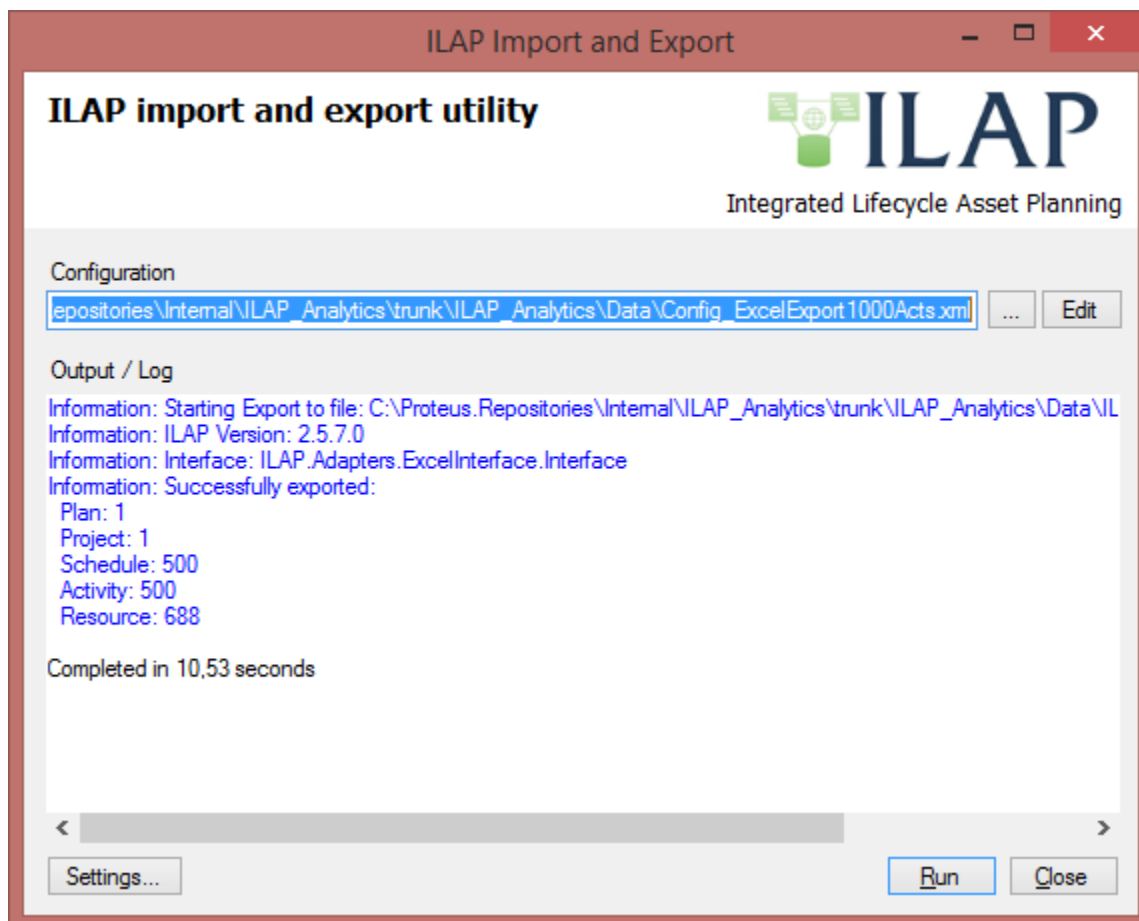Finally, a log is displayed for user, see Figure 95.

Figure 95: Display of log in the ILAP adapter

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