RESQML Technical Reference Guide

For RESQM: v2.1

RESQML Overview	The RESQML standard facilitates data exchange among the many software applications used along the E&P subsurface workflow, which helps promote interoperability and data integrity among these applications and improve workflow efficiency and flexibility.
Version	2.1
Abstract	Listing of all data objects, elements, and definitions generated from the UML model. For an overview of RESQML, including a list of resources, see the *RESQML Technical Usage Guide.*
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1 ResqmlCommon

Package: xsd_schemas
Notes: This package contains data objects that are shared across all classes in RESQML.

1.1 AbstractLocal3dCrs

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/15/2012 *Last modified:* 11/1/2016
Notes: Defines a local 2D+1D coordinate reference system (CRS), by translation and rotation, whose origin is located at the (X,Y,Z) offset from the projected and vertical 2D+1D CRS.
For specific business rules, see the attribute definitions.

The units of measure in XY must be the same as the projected CRS. The units of measure of the third coordinate is determined in the depth or concrete type.

ArealRotation is a plane angle.

Defines a local 3D CRS, which is subject to the following restrictions:

- The projected 2D CRS must have orthogonal axes.
- The vertical 1D CRS must be chosen so that it is orthogonal to the plane defined by the projected 2D CRS.

As a consequence of the definition:

- The local CRS forms a Cartesian system of axes.
- The local areal axes are in the plane of the projected system.
- The local areal axes are orthogonal to each other.

This 3D system is semantically equivalent to a compound CRS composed of a local 2D areal system and a local 1D vertical system.

The labels associated with the axes on this local system are X, Y, Z or X, Y, T.

The relative orientation of the local Y axis with respect to the local X axis is identical to that of the projected axes.

Attributes

Name	Type	Notes
ArealRotation	PlaneAngleMeasure	The rotation of the local Y axis relative to the projected Y axis. A positive value indicates a clockwise rotation from the projected Y axis. A negative value indicates a counter-clockwise rotation form the projected Y axis.
ProjectedAxisOrder	AxisOrder2d	Defines the coordinate system axis order of the global projected CRS when the projected CRS is an unknown CRS, else it must correspond to the axis order of the projected CRS.
ProjectedUom	LengthUomExt	Unit of measure of the associated projected CRS. BUSINESS RULE: When the projected CRS is well known, it must have the same UOM as the UOM defined by the well-known projected CRS. Explanation: A well-known CRS already defines the

Name	Type	Notes
		UOM. When you indicate that you use a CRS EPSG code, e.g., 7500, if you go to the EPSG database, you find the constrained UOM. This approach removes the need to depend on an EPSG database (or other external database), so RESQML copies the UOM of the well-known CRS into the RESQML CRS.
ProjectedUomCustomDict	DataObjectReference	A reference to the dictionary where the projected UOM is defined.
VerticalUom	LengthUomExt	Unit of measure of the associated vertical CRS. BUSINESS RULE: When the vertical CRS is well known, it must have the same UOM defined by the well-known vertical CRS. Explanation: See ProjectedUom.
VerticalUomCustomDict	DataObjectReference	A reference to the dictionary where the vertical UOM is defined.
XOffset	double	The X location of the origin of the local areal axes relative to the projected CRS origin. BUSINESS RULE: The value MUST represent the first axis of the coordinate system. The unit of measure is defined by the unit of measure for the projected 2D CRS.
YOffset	double	The Y offset of the origin of the local areal axes relative to the projected CRS origin. BUSINESS RULE: The value MUST represent the second axis of the coordinate system. The unit of measure is defined by the unit of measure for the projected 2D CRS.
ZIncreasingDownward	boolean	Indicates that Z values correspond to depth values and are increasing downward, as opposite to elevation values increasing upward. BUSINESS RULE: When the vertical CRS is already defined somewhere else (e.g., in a well-known source), it must correspond to the axis orientation of the vertical CRS.
ZOffset	double	The Z offset of the origin of the local vertical axis relative to the vertical CRS origin. According to CRS type (depth or time) it corresponds to the depth or time datum. BUSINESS RULE: The value MUST represent the third axis of the coordinate system. The unit of measure is defined by the unit of measure for the vertical CRS.

Associations

Association		Notes
1..1	**From:** AbstractLocal3dCrs.ProjectedCrs **To:** AbstractProjectedCrs *Association*	
1	**From:** AbstractLocal3dCrs.VerticalCrs **To:** AbstractVerticalCrs *Association*	
	From: AbstractLocal3dCrs.	

Association		Notes
	To: AbstractObject *Generalization*	
0..1	**From:** AbstractProperty.LocalCrs **To:** AbstractLocal3dCrs *Association*	
	From: Seismic3dPostStackRepresentation.LocalCrs **To:** AbstractLocal3dCrs *Association*	
	From: LocalTime3dCrs. **To:** AbstractLocal3dCrs *Generalization*	
	From: Seismic2dPostStackRepresentation.LocalCrs **To:** AbstractLocal3dCrs *Association*	
	From: LocalDepth3dCrs. **To:** AbstractLocal3dCrs *Generalization*	
	From: AbstractGeometry.LocalCrs **To:** AbstractLocal3dCrs *Association*	

1.2 LocalDepth3dCrs

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/15/2012 *Last modified:* 11/1/2016
Notes: Defines a local depth coordinate system. the geometrical origin and location are defined by the elements of the base class AbstractLocal3dCRS. This CRS uses the units of measure of its projected and vertical CRS.

Associations

Association	Notes
From: LocalDepth3dCrs. **To:** AbstractLocal3dCrs *Generalization*	
From: TvdInformation.LocalDepth3dCrs **To:** LocalDepth3dCrs *Association*	

1.3 LocalTime3dCrs

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/15/2012 *Last modified:* 11/1/2016
Notes: Defines a local time coordinate system. The geometrical origin and location are defined by the elements of the base class AbstractLocal3dCRS. This CRS defines the time unit that the time-based geometries that refer to it will use.

Attributes

Name	Type	Notes
CustomUnitDictionary	DataObjectReference	Reference to a custom units dictionary, if one is used.
TimeUom	TimeUomExt	Defines the unit of measure of the third (time) coordinates, for the geometries that refer to it.

Associations

Association	Notes
From: LocalTime3dCrs. **To:** AbstractLocal3dCrs *Generalization*	
From: SeismicWellboreFrameRepresentation.LocalTime3dCrs **To:** LocalTime3dCrs *Association*	

2 Features

Package: xsd_schemas

Notes: This package contains the main classes used to define and exchange data for geologic and technical features in RESQML Other packages in RESQML also define features and may leverage classes in this Feature package; those other packages include:

- Wells
- Seismic
- Streamlines

Features refer to something that has physical existence at some point during the exploration, development, production, or abandonment of a reservoir. For example: It can be a boundary, a rock volume, a basin area, but also extends to a drilled well, a drilling rig, an injected or produced fluid, or a 2D, 3D, or 4D seismic survey.

In RESQML, features are divided into these categories: geologic or technical.

Geologic Feature. Objects that exist a priori, in the natural world, for example: the rock formations and how they are positioned with regard to each other; the fluids that are present before production; or the position of the geological intervals with respect to each. Some of these objects are static—such as geologic intervals---while others are dynamic—such as fluids: their properties, geometries, and quantities may change over time during the course of field production.

This concept of geologic feature is relative to the three following features: BoundaryFeature, RockVolumeFeature and Model feature

Technical Feature. Objects that exist by the action of humans. Examples include: wells and all they may contain, seismic surveys (surface, permanent water bottom), or injected fluid volumes. Because the decision to deploy such equipment is the result of studies or decisions by humans, technical features are usually not subject to the same kind of large changes in interpretation as geologic features. However, they are still subject to measurement error and other sources of uncertainty, and so still can be considered as subject to “interpretation”.

2.1 AbstractFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/22/2012 *Last modified:* 11/1/2016
Notes: Something that has physical existence at some point during the exploration, development, production or abandonment of a reservoir. For example: It can be a boundary, a rock volume, a basin area, but also extends to a drilled well, a drilling rig, an injected or produced fluid, or a 2D, 3D, or 4D seismic survey.
Features are divided into these categories: geologic or technical.

Associations

Association	Notes
From: AbstractFeature. **To:** AbstractObject *Generalization*	
From: AbstractFeatureInterpretation.InterpretedFeature **To:** AbstractFeature *Association*	Indicates the feature that is interpreted by this interpretation.
From: RockVolumeFeature. **To:** AbstractFeature *Generalization*	
From: Model. **To:** AbstractFeature *Generalization*	
From: AbstractTechnicalFeature. **To:** AbstractFeature *Generalization*	
From: BoundaryFeature. **To:** AbstractFeature *Generalization*	

2.2 AbstractTechnicalFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/22/2012 *Last modified:* 11/1/2016
Notes: Objects that exist by the action of humans. Examples include: wells and all they may contain, seismic surveys (surface, permanent water bottom), or injected fluid volumes. Because the decision to deploy such equipment is the result of studies or decisions by humans, technical features are usually not subject to the same kind of large changes in interpretation as geologic features. However, they are still subject to measurement error and other sources of uncertainty, and so still can be considered as subject to "interpretation".

Associations

Association	Notes
From: AbstractTechnicalFeature. **To:** AbstractFeature *Generalization*	
From: FrontierFeature. **To:** AbstractTechnicalFeature *Generalization*	
From: WellboreFeature. **To:** AbstractTechnicalFeature *Generalization*	
From: AbstractSeismicSurveyFeature. **To:** AbstractTechnicalFeature *Generalization*	
From: StreamlinesFeature. **To:** AbstractTechnicalFeature *Generalization*	

2.3 BoundaryFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/22/2012 *Last modified:* 11/1/2016
Notes: An interface between two objects, such as horizons and faults. It is a surface object.
A RockVolumeFeature is a geological feature **(**which is the general concept that refers to the various categories of geological objects that exist in the natural world).

For example: the stratigraphic boundaries, the =geobody boundaries or the fluid boundaries that are present before production. To simplify the hierarchy of concepts, the geological feature is not represented in the RESQML design.

Associations

Association	Notes
From: BoundaryFeature. **To:** AbstractFeature *Generalization*	

2.4 FluidContact

Type: Enumeration *Stereotype:*
Detail: *Created:* 8/22/2012 *Last modified:* 11/1/2016
Notes: Enumerated values used to indicate a specific type of fluid boundary interpretation.

Attributes

Name	Type	Notes
free water contact	External Reference	A surface defined by vanishing capillary pressure between the water and hydrocarbon phases.
gas oil contact	External Reference	A surface defined by vanishing capillary pressure between the gas and oil hydrocarbon phases.
gas water contact	External Reference	A surface defined by vanishing capillary pressure between the water and gas hydrocarbon phases.
seal	External Reference	Identifies a break in the hydrostatic column.
water oil contact	External Reference	A surface defined by vanishing capillary pressure between the water and oil hydrocarbon phases.

Associations

Association	Notes
From: WellboreMarker. **To:** FluidContact *Dependency*	

2.5 FluidMarker

Type: Enumeration *Stereotype:*
Detail: *Created:* 4/30/2014 *Last modified:* 11/1/2016
Notes: The various fluids a well marker can indicate.

Attributes

Name	Type	Notes
gas down to		
gas up to		
oil down to		
oil up to		
water down to		
water up to		

Associations

Association	Notes
From: WellboreMarker. **To:** FluidMarker *Dependency*	

2.6 FrontierFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/7/2012 *Last modified:* 11/1/2016
Notes: Identifies a frontier or boundary in the earth model that is not a geological feature but an arbitrary geographic/geometric surface used to delineate the boundary of the model.

Associations

Association	Notes
From: FrontierFeature. **To:** AbstractTechnicalFeature *Generalization*	

2.7 Model

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/22/2012 *Last modified:* 11/1/2016
Notes: The explicit description of the relationships between geologic features, such as rock features (e.g. stratigraphic units, geobodies, phase unit) and boundary features (e.g., genetic, tectonic, and fluid boundaries). In general, this concept is usually called an “earth model”, but it is not called that in RESQML. In RESQML, model is not to be confused with the concept of earth model organization interpretation.

Associations

Association	Notes
From: Model. **To:** AbstractFeature *Generalization*	

2.8 Phase

Type: Enumeration *Stereotype:*
Detail: *Created:* 8/22/2012 *Last modified:* 11/1/2016
Notes: The enumeration of the possible rock fluid unit phases in a hydrostatic column.
The seal is considered here as a part (the coverage phase) of a hydrostatic column.

Attributes

Name	Type	Notes
aquifer	External Reference	Volume of the hydrostatic column for which only the aqueous phase is mobile. Typically below the Pc (hydrocarbon-water) = 0 free fluid surface.
gas cap	External Reference	Volume of the hydrostatic column for which only the gaseous phase is mobile. Typically above the Pc (gas-oil) = 0 free fluid surface.
oil column	External Reference	Volume of the hydrostatic column for which only the oleic and aqueous phases may be mobile. Typically below the gas-oil Pc = 0 free fluid surface. Pc (gas-oil) = 0 free fluid surface.
seal	External Reference	Impermeable volume that provides the seal for a hydrostatic fluid column.

2.9 RockVolumeFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/22/2012 *Last modified:* 11/1/2016
Notes: A continuous portion of rock material bounded by definite rock boundaries. It is a volume object. Some of these rock volumes are “static”, while others are **“**dynamic”. Reservoir fluids are dynamic because their properties, geometries, and quantities may change over time during the course of field production.

A RockVolume feature is a geological feature--which is the general concept that refers to the various categories of geological objects that exist in the natural world, for example, the rock volume or the fluids that are present before production. The geological feature is not represented in the RESQML design.

Associations

Association	Notes
From: RockVolumeFeature. **To:** AbstractFeature *Generalization*	

3 Interpretations

Package: xsd_schemas

Notes: This package contains the main classes used to define and exchange data for geologic interpretations in RESQML.

RESQML uses the definition of David Gawith, which explains an interpretation as a single consistent description of a feature. An interpretation is subjective and very strongly tied to the intellectual activity of the project team members. The initial curiosity and reasoning of the people on the project team initiates the early pre-screening campaign (remote sensing, surveys). They make hypotheses that consist of as many interpretations as necessary to describe the features (Gawith and Gutteridge 2007).

NOTE: The formal name is actually "feature-interpretation" and many of the class names use this full term. For conciseness of documentation, we use simply "interpretation" where this usage is not confusing.

RESQML now uses the term “interpretation” instead of alternative terms that were used in V1.1, such as “version” or “opinion".

Most of the information contained as attributes or enumerations in individual interpretation or organization interpretation will help users understand how the representations of the geological objects should be built or have been built, if the representation is already associated to the given interpretation.

3.1 AbstractContactInterpretationPart

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: The parent class of an atomic, linear, or surface geologic contact description.

When the contact is between two surface representations (e.g., fault/fault, horizon/fault, horizon/horizon), then the contact is a line.

When the contact is between two volume representations (stratigraphic unit/stratigraphic unit), then the contact is a surface.

A contact interpretation can be associated with other contact interpretations in an organization interpretation.

To define a contact representation, you must first define a contact interpretation.

Associations

Association		Notes
0..1	**From:** AbstractContactInterpretationPart.PartOf **To:** AbstractFeatureInterpretation *Association*	Indicates the interpretation that contains the contact, for example, the horizon or the fault that contains a unit/unit contact.
	From: MultipleContactInterpretationPart. **To:** AbstractContactInterpretationPart *Generalization*	
	From: BinaryContactInterpretationPart. **To:** AbstractContactInterpretationPart *Generalization*	
0..*	**From:** AbstractOrganizationInterpretation.ContactInterpretation **To:** AbstractContactInterpretationPart *Association*	

3.2 AbstractFeatureInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: The main class that contains all of the other feature interpretations included in an interpreted model.

Attributes

Name	Type	Notes
Domain	Domain	An enumeration that specifies in which domain the interpretation of an AbstractFeature has been performed: depth, time, mixed (= depth + time)

Associations

Association	Notes
From: AbstractFeatureInterpretation.HasOccurredDuring 0..1 **To:** AbstractTimeInterval *Association*	Indicates that the interpretation is valid only for a specific time interval. For example, a fault feature can be normal for a certain period and inverse during another period.
From: AbstractFeatureInterpretation.InterpretedFeature **To:** AbstractFeature *Association*	Indicates the feature that is interpreted by this interpretation.
From: AbstractFeatureInterpretation. **To:** AbstractObject *Generalization*	
From: StructuralOrganizationInterpretation.TopFrontier 0..* **To:** AbstractFeatureInterpretation *Association*	
From: BoundaryFeatureInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	
From: GeologicUnitInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	
From: StructuralOrganizationInterpretation.Sides 0..* **To:** AbstractFeatureInterpretation *Association*	
From: WellboreInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	
From: ConnectionInterpretations.FeatureInterpretation 1..* **To:** AbstractFeatureInterpretation *Association*	
From: GenericFeatureInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	
From: StructuralOrganizationInterpretation.BottomFrontier 0..* **To:** AbstractFeatureInterpretation *Association*	
From: EarthModelInterpretation.	

Association		Notes
	To: AbstractFeatureInterpretation *Generalization*	
	From: AbstractOrganizationInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	
0..1	**From:** AbstractContactInterpretationPart.PartOf **To:** AbstractFeatureInterpretation *Association*	Indicates the interpretation that contains the contact, for example, the horizon or the fault that contains a unit/unit contact.
0..1	**From:** AbstractRepresentation.RepresentedInterpretation **To:** AbstractFeatureInterpretation *Association*	
1..*	**From:** FeatureInterpretationSet.FeatureInterpretation **To:** AbstractFeatureInterpretation *Association*	

3.3 AbstractOrganizationInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: The main class used to group features into meaningful units as a step in working towards the goal of building an earth model (the organization of all other organizations in RESQML).
An organization interpretation:

- Is typically comprised of one stack of its contained elements.
- May be built on other organization interpretations.

Typically contains:

- contacts between the elements of this stack among themselves.
- contacts between the stack elements and other organization elements.

Associations

Association	Notes
From: AbstractOrganizationInterpretation.ContactInterpretation 0..* **To:** AbstractContactInterpretationPart *Association*	
From: AbstractOrganizationInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	
From: StructuralOrganizationInterpretation. **To:** AbstractOrganizationInterpretation *Generalization*	
From: AbstractStratigraphicOrganizationInterpretation. **To:** AbstractOrganizationInterpretation *Generalization*	
From: AbstractStratigraphicOrganizationInterpretation. **To:** AbstractOrganizationInterpretation *Generalization*	
From: RockFluidOrganizationInterpretation. **To:** AbstractOrganizationInterpretation *Generalization*	

3.4 AbstractStratigraphicOrganizationInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: The main class that defines the relationships between the stratigraphic units and provides the stratigraphic hierarchy of the Earth.

BUSINESS RULE: A stratigraphic organization must be in a ranked order from a lower rank to an upper rank. For example, it is possible to find previous unit containment relationships between several ranks.

Attributes

Name	Type	Notes
OrderingCriteria	OrderingCriteria	

Associations

Association	Notes
From: AbstractStratigraphicOrganizationInterpretation. **To:** AbstractOrganizationInterpretation *Generalization*	
From: StratigraphicColumnRankInterpretation. **To:** AbstractStratigraphicOrganizationInterpretation *Generalization*	
From: StratigraphicColumnRankInterpretation. **To:** AbstractStratigraphicOrganizationInterpretation *Generalization*	
From: StratigraphicOccurrenceInterpretation. **To:** AbstractStratigraphicOrganizationInterpretation *Generalization*	
From: StratigraphicOccurrenceInterpretation. **To:** AbstractStratigraphicOrganizationInterpretation *Generalization*	
From: IntervalStratigraphicUnits.StratigraphicOrganizationInterpretation **To:** AbstractStratigraphicOrganizationInterpretation *Association*	

3.5 AbstractTimeInterval

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/10/2014 *Last modified:* 11/1/2016
Notes: The abstract superclass for all RESQML time intervals. The super class that contains all types of intervals considered in geolog, including those based on chronostratigraphy, the duration of geological events, and time intervals used in reservoir simulation (e.g., time step).

Associations

Association	Notes
From: GeologicTimeBasedTimeInterval. **To:** AbstractTimeInterval *Generalization*	
From: AbstractFeatureInterpretation.HasOccurredDuring 0..1 **To:** AbstractTimeInterval *Association*	Indicates that the interpretation is valid only for a specific time interval. For example, a fault feature can be normal for a certain period and inverse during another period.
From: GeneticBoundaryBasedTimeInterval. **To:** AbstractTimeInterval *Generalization*	
From: FaultThrow.HasOccurredDuring 0..1 **To:** AbstractTimeInterval *Association*	

3.6 BinaryContactInterpretationPart

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 5/16/2012 *Last modified:* 11/1/2016
Notes: The main class for data describing an opinion of the contact between two geologic feature-interpretations.

- A contact interpretation between two surface geological boundaries is usually a line.
- A contact interpretation between two volumes (rock feature-interpretation) is usually a surface.

This class allows you to build a formal sentence—in the pattern of subject-verb-direct object—which is used to describe the construction of a node, line, or surface contact. It is also possible to attach a primary and a secondary qualifier to the subject and to the direct object.

For more information, see the R*ESQML Technical Usage Guide*.

Attributes

Name	Type	Notes
DirectObject	ContactElementReference	Data-object reference (by UUID link) to a geologic feature-interpretation, which is the direct object of the sentence that defines how the contact was constructed.
Subject	ContactElementReference	Data-object reference (by UUID link) to a geologic feature-interpretation, which is the subject of the sentence that defines how the contact was constructed.
Verb	ContactVerb	

Associations

Association	Notes
From: BinaryContactInterpretationPart. **To:** ContactVerb *Dependency*	
From: BinaryContactInterpretationPart. **To:** AbstractContactInterpretationPart *Generalization*	

3.7 BoundaryFeatureInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/28/2013 *Last modified:* 11/1/2016
Notes: The main class for data describing an opinion of a surface feature between two volumes.

BUSINESS RULE: The data-object reference (of type "interprets") must reference only a boundary feature.

Attributes

Name	Type	Notes
OlderPossibleAge	long	A value in years of the age offset between the DateTime attribute value and the DateTime of a GeologicalEvent occurrence of generation. When it represents a geological event that happened in the past, this value must be POSITIVE.
YoungerPossibleAge	long	A value in years of the age offset between the DateTime attribute value and the DateTime of a GeologicalEvent occurrence of generation. When it represents a geological event that happened in the past, this value must be POSITIVE.

Associations

Association	Notes
From: BoundaryFeatureInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	
0..1 **From:** BoundaryFeatureInterpretation.AbsoluteAge **To:** GeologicTime *Association*	
From: FaultInterpretation. **To:** BoundaryFeatureInterpretation *Generalization*	
From: GeobodyBoundaryInterpretation. **To:** BoundaryFeatureInterpretation *Generalization*	
From: BoundaryFeatureInterpretationPlusItsRank.BoundaryFeatureInterpretation 0..1 **To:** BoundaryFeatureInterpretation *Association*	
From: GeneticBoundaryBasedTimeInterval.ChronoTop **To:** BoundaryFeatureInterpretation *Association*	
From: HorizonInterpretation. **To:** BoundaryFeatureInterpretation *Generalization*	
From: GeneticBoundaryBasedTimeInterval.ChronoBottom **To:** BoundaryFeatureInterpretation *Association*	
From: FluidBoundaryInterpretation.	

Association		Notes
	To: BoundaryFeatureInterpretation *Generalization*	
0..1	**From:** WellboreMarker.Interpretation **To:** BoundaryFeatureInterpretation *Association*	

3.8 BoundaryFeatureInterpretationPlusItsRank

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/28/2013 *Last modified:* 11/1/2016
Notes: Element that lets you index and order feature interpretations which must be boundaries (horizon, faults and frontiers) or boundary sets (fault network). For possible ordering criteria, see OrderingCriteria.

BUSINESS RULE: Only BoundaryFeatureInterpretation and FeatureInterpretationSet having faults as homogeneous type must be used to build a StructuralOrganizationInterpretation.

Attributes

Name	Type	Notes
StratigraphicRank	NonNegativeLong	The first rank on which you find the boundary or the interpretation set of boundaries.

Associations

Association	Notes
From: BoundaryFeatureInterpretationPlusItsRank.FaultCollection 0..1 **To:** FeatureInterpretationSet *Association*	
From: BoundaryFeatureInterpretationPlusItsRank.BoundaryFeatureInterpretation 0..1 **To:** BoundaryFeatureInterpretation *Association*	
From: StructuralOrganizationInterpretation.OrderedBoundaryFeatureInterpretation 0..* **To:** BoundaryFeatureInterpretationPlusItsRank *Association*	

3.9 BoundaryRelation

Type: Enumeration *Stereotype:*
Detail: *Created:* 7/25/2014 *Last modified:* 11/1/2016
Notes: An attribute that characterizes the stratigraphic relationships of a horizon with the stratigraphic units that it bounds.

Attributes

Name	Type	Notes
conformable		If used uniquely, then it means the horizon is conformable above and below. If used with unconformity, then it means partial unconformity.
unconformable below and above		
unconformable above		If used with conformable, then it means partial unconformity.
unconformable below		If used with conformable, then it means partial unconformity.

3.10 ContactElementReference

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 5/16/2012 *Last modified:* 11/1/2016
Notes: A reference to either a geologic feature interpretation or a frontier feature.

BUSINESS RULE: The content type of the corresponding data-object reference must be a geological feature-interpretation or a frontier feature.

Attributes

Name	Type	Notes
Qualifier	ContactSide	
SecondaryQualifier	ContactMode	

Associations

Association	Notes
From: ContactElementReference. **To:** ContactMode *Dependency*	
From: ContactElementReference. **To:** ContactSide *Dependency*	
From: ContactElementReference. **To:** DataObjectReference *Generalization*	

3.11 ContactMode

Type: Enumeration *Stereotype:*
Detail: *Created:* 6/19/2014 *Last modified:* 11/1/2016
Notes: An optional second qualifier that may be used when describing binary contact interpretation parts. (See also BinaryContactInterpretationPart and the *RESQML Technical Usage Guide*.)

Attributes

Name	Type	Notes
conformable		
extended		
unconformable		

Associations

Association	Notes
From: ContactElementReference. **To:** ContactMode *Dependency*	

3.12 ContactSide

Type: Enumeration *Stereotype:*
Detail: *Created:* 4/10/2014 *Last modified:* 11/1/2016
Notes: Enumeration that specifies the location of the contacts, chosen from the attributes listed below. For example, if you specify contact between a horizon and a fault, you can specify if the contact is on the foot wall side or the hanging wall side of the fault, and if the fault is splitting both sides of a horizon or the older side only.

From Wikipedia: http://en.wikipedia.org/wiki/Foot_wall

Attributes

Name	Type	Notes
footwall		The footwall side of the fault. See picture.
hanging wall		
north		For a vertical fault, specification of the north side.
south		For a vertical fault, specification of the south side.
east		For a vertical fault, specification of the east side.
west		For a vertical fault, specification of the west side.
younger		Indicates that a fault splits a genetic boundary on its younger side.
older		Indicates that a fault splits a genetic boundary on its older side.
both		Indicates that a fault splits both sides of a genetic feature.

Associations

Association	Notes
From: ContactElementReference. **To:** ContactSide *Dependency*	

3.13 ContactVerb

Type: Enumeration *Stereotype:*
Detail: *Created:* 11/16/2012 *Last modified:* 11/1/2016
Notes: Enumerations for the verbs that can be used to define the impact on the construction of the model of the geological event that created the binary contact.

Attributes

Name	Type	Notes
stops		
interrupts		Operation on which an “unconformable” genetic boundary interpretation interrupts another genetic boundary interpretation or a stratigraphic unit interpretation.
crosses		Defines if a tectonic boundary interpretation crosses another tectonic boundary interpretation.

Associations

Association	Notes
From: BinaryContactInterpretationPart. **To:** ContactVerb *Dependency*	

3.14 DepositionMode

Type: Enumeration *Stereotype:*
Detail: *Created:* 7/25/2014 *Last modified:* 11/1/2016
Notes: Specifies the position of the stratification of a stratigraphic unit with respect to its top and bottom boundaries.

Attributes

Name	Type	Notes
proportional between top and bottom		
parallel to bottom		
parallel to top		
parallel to another boundary		

3.15 Domain

Type: Enumeration *Stereotype:*
Detail: *Created:* 10/24/2013 *Last modified:* 11/1/2016
Notes: An enumeration that specifies in which domain the interpretation of an AbstractFeature has been performed: depth, time, or mixed (= depth + time).

Attributes

Name	Type	Notes
depth		Position defined by measurements in the depth domain.
time		Position based on geophysical measurements in two-way time (TWT).
mixed		depth + time

3.16 EarthModelInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: An earth model interpretation has the specific role of gathering at most:

- one StratigraphicOrganizationInterpretation
- One or several StructuralOrganizationInterpretations
- One or several RockFluidOrganizationInterpretations

BUSINESS RULE: An earth model Interpretation interprets only a model feature.

Associations

Association		Notes
0..1	**From:** EarthModelInterpretation.StratigraphicColumn **To:** StratigraphicColumn *Association*	
	From: EarthModelInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	
0..*	**From:** EarthModelInterpretation.Structure **To:** StructuralOrganizationInterpretation *Association*	
0..*	**From:** EarthModelInterpretation.StratigraphicOccurrences **To:** StratigraphicOccurrenceInterpretation *Association*	
0..*	**From:** EarthModelInterpretation.Fluid **To:** RockFluidOrganizationInterpretation *Association*	

3.17 FaultInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: A general term for designating a boundary feature intepretation that corresponds to a discontinuity having a tectonic origin, identified at mapping or outcrop scale. Fault may designate true faults but also thrust surfaces. A thrust surface is specified as a FaultInterpretation whose FaultThrow kind is “thrust” and which has the attributes: is Listric = 0, MaximumThrow = 0.

Attributes

Name	Type	Notes
IsListric	boolean	Indicates if the normal fault is listric or not. BUSINESS RULE: Must be present if the fault is normal. Must not be present if the fault is not normal.
MaximumThrow	LengthMeasure	
MeanAzimuth	PlaneAngleMeasure	
MeanDip	PlaneAngleMeasure	

Associations

Association		Notes
	From: FaultInterpretation. **To:** BoundaryFeatureInterpretation *Generalization*	
0..*	**From:** FaultInterpretation.ThrowInterpretation **To:** FaultThrow *Association*	

3.18 FaultThrow

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/7/2013 *Last modified:* 11/1/2016
Notes: Identifies the characteristic of the throw of a fault interpretation.

Attributes

Name	Type	Notes
Throw	ThrowKindExt	

Associations

Association		Notes
0..1	**From:** FaultThrow.HasOccurredDuring **To:** AbstractTimeInterval *Association*	
0..*	**From:** FaultInterpretation.ThrowInterpretation **To:** FaultThrow *Association*	

3.19 FeatureInterpretationSet

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/10/2014 *Last modified:* 11/1/2016
Notes: This class allows feature interpretations to be grouped together, mainly to specify the constituents of a StructuralOrganizationInterpretation.

Attributes

Name	Type	Notes
IsHomogeneous	boolean	Indicates that all of the selected interpretations are of a single kind.

Associations

Association	Notes
From: FeatureInterpretationSet. **To:** AbstractObject *Generalization*	
From: FeatureInterpretationSet.FeatureInterpretation 1..* **To:** AbstractFeatureInterpretation *Association*	
From: StructuralOrganizationInterpretation.UnorderedFaultCollection 0..1 **To:** FeatureInterpretationSet *Association*	
From: BoundaryFeatureInterpretationPlusItsRank.FaultCollection 0..1 **To:** FeatureInterpretationSet *Association*	

3.20 FluidBoundaryInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 1/8/2016 *Last modified:* 11/1/2016
Notes: A boundary (usually a plane or a set of planes) separating two fluid phases, such as a gas-oil contact (GOC), a water-oil contact (WOC), a gas-oil contact (GOC), or others. For types, see FluidContact.

Attributes

Name	Type	Notes
FluidContact	FluidContact	The kind of contact of this boundary.

Associations

Association	Notes
From: FluidBoundaryInterpretation. **To:** BoundaryFeatureInterpretation *Generalization*	

3.21 GenericFeatureInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/21/2013 *Last modified:* 11/1/2016
Notes: An interpretation of a feature that is not specialized. For example, use it when the specialized type of the associated feature is not known.
For example, to set up a StructuralOrganizationInterpretation you must reference the interpretations of each feature you want to include. These features must include FrontierFeatures which have no interpretations because they are technical features. For consistency of design of the StructuralOrganizationInterpretation, create a GenericFeatureInterpretation for each FrontierFeature.

Associations

Association	Notes
From: GenericFeatureInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	

3.22 GeneticBoundaryBasedTimeInterval

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: Geological time during which a geological event (e.g., deposition, erosion, fracturation, faulting, intrusion) occurred.

Associations

Association	Notes
From: GeneticBoundaryBasedTimeInterval. **To:** AbstractTimeInterval *Generalization*	
From: GeneticBoundaryBasedTimeInterval.ChronoTop **To:** BoundaryFeatureInterpretation *Association*	
From: GeneticBoundaryBasedTimeInterval.ChronoBottom **To:** BoundaryFeatureInterpretation *Association*	

3.23 GeobodyBoundaryInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/3/2014 *Last modified:* 11/1/2016
Notes: Contains the data describing an opinion about the characterization of a geobody BoundaryFeature, and it includes the attribute boundary relation.

Attributes

Name	Type	Notes
BoundaryRelation	BoundaryRelation	Characterizes the stratigraphic relationships of a horizon with the stratigraphic units that its bounds.

Associations

Association	Notes
From: GeobodyBoundaryInterpretation. **To:** BoundaryFeatureInterpretation *Generalization*	

3.24 GeobodyInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: A volume of rock that is identified based on some specific attribute, like its mineral content or other physical characteristic. Unlike stratigraphic or phase units, there is no associated time or fluid content semantic.

Associations

Association	Notes
From: GeobodyInterpretation. **To:** GeologicUnitInterpretation *Generalization*	

3.25 GeologicTimeBasedTimeInterval

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/10/2014 *Last modified:* 11/1/2016
Notes: A time interval that is bounded by two geologic times.
Can correspond to a TimeStep in a TimeSeries, such as the International Chronostratigraphic Scale or a regional chronostratigraphic scale.

Associations

Association	Notes
From: GeologicTimeBasedTimeInterval. **To:** AbstractTimeInterval *Generalization*	
From: GeologicTimeBasedTimeInterval.End **To:** GeologicTime *Association*	
From: GeologicTimeBasedTimeInterval.Start **To:** GeologicTime *Association*	

3.26 GeologicUnitInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/28/2013 *Last modified:* 11/1/2016
Notes: The main class for data describing an opinion of an originally continuous rock volume individualized in view of some characteristic property (e.g., physical, chemical, temporal) defined by GeologicUnitComposition and/or GeologicUnitMaterialImplacement, which can have a 3D defined shape. BUSINESS RULE: The data object reference (of type "interprets") must reference only a rock volume feature.
In an earth model, a geological unit interrupted by faults may consist of several disconnected rock volumes.

Attributes

Name	Type	Notes
GeologicUnit3dShape	Shape3dExt	3D shape of the geologic unit.
GeologicUnitComposition	LithologyKindExt	
GeologicUnitMaterialEmplacement	GeologicUnitMaterialEmplacement	Attribute specifying whether the GeologicalUnitIntepretation is intrusive or not.

Associations

Association	Notes
From: GeologicUnitInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	
From: StratigraphicOccurrenceInterpretation.GeologicUnitIndex 0..* **To:** GeologicUnitInterpretation *Association*	
From: RockFluidUnitInterpretation. **To:** GeologicUnitInterpretation *Generalization*	
From: GeobodyInterpretation. **To:** GeologicUnitInterpretation *Generalization*	
From: VolumeRegion.Represents **To:** GeologicUnitInterpretation *Association*	
From: StratigraphicUnitInterpretation. **To:** GeologicUnitInterpretation *Generalization*	
From: RockFluidOrganizationInterpretation.RockFluidUnitIndex 0..* **To:** GeologicUnitInterpretation *Association*	

3.27 GeologicUnitMaterialEmplacement

Type: Enumeration *Stereotype:*
Detail: *Created:* 7/25/2014 *Last modified:* 11/9/2016
Notes: The enumerated attributes of a horizon.

Attributes

Name	Type	Notes
intrusive		
non-intrusive		

3.28 HorizonInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 5/10/2012 *Last modified:* 11/1/2016
Notes: An interpretation of a horizon, which optionally provides stratigraphic information on BoundaryRelation, HorizonStratigraphicRole, SequenceStratigraphysurface.
.

Attributes

Name	Type	Notes
BoundaryRelation	BoundaryRelation	
HorizonStratigraphicRole	HorizonStratigraphicRole	
SequenceStratigraphySurface	SequenceStratigraphySurface	

Associations

Association	Notes
From: HorizonInterpretation. **To:** BoundaryFeatureInterpretation *Generalization*	

3.29 HorizonStratigraphicRole

Type: Enumeration *Stereotype:*
Detail: *Created:* 1/26/2015 *Last modified:* 11/1/2016
Notes: Interpretation of the stratigraphic role of a picked horizon (chrono, litho or bio).
Here the word “role” is a business term which doesn’t correspond to an entity dependent from an external property but simply characterizes a kind of horizon.

Attributes

Name	Type	Notes
chronostratigraphic		
lithostratigraphic		
biostratigraphic		

3.30 MultipleContactInterpretationPart

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 5/16/2012 *Last modified:* 11/1/2016
Notes: Describes multiple interface contacts of geologic feature-interpretations (compared to a binary contact). A composition of several contact interpretations.

Attributes

Name	Type	Notes
With	NonNegativeLong	Indicates a list of binary contacts (by their UUIDs) that participate in this multiple-part contact.

Associations

Association	Notes
From: MultipleContactInterpretationPart. **To:** AbstractContactInterpretationPart *Generalization*	

3.31 OrderingCriteria

Type: Enumeration *Stereotype:*
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: Enumeration used to specify the order of an abstract stratigraphic organization or a structural organization interpretation.

Attributes

Name	Type	Notes
age		From youngest to oldest period (increasing age).
apparent depth		From surface to subsurface.
measured depth		From well head to wellbore bottom/total depth (TD).

3.32 RockFluidOrganizationInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: This class describes the organization of geological reservoir, i.e., of **a**n interconnected network of porous and permeable rock units, containing an accumulation of economic fluids, such as oil and gas.
A reservoir is normally enveloped by rock and fluid barriers and contains a single natural pressure system.

Associations

Association	Notes
From: RockFluidOrganizationInterpretation. **To:** AbstractOrganizationInterpretation *Generalization*	
From: RockFluidOrganizationInterpretation.RockFluidUnitIndex 0..* **To:** GeologicUnitInterpretation *Association*	
From: CellFluidPhaseUnits.RockFluidOrganizationInterpretation **To:** RockFluidOrganizationInterpretation *Association*	
From: EarthModelInterpretation.Fluid 0..* **To:** RockFluidOrganizationInterpretation *Association*	

3.33 RockFluidUnitInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/1/2014 *Last modified:* 11/1/2016
Notes: A type of rock fluid feature-interpretation, this class identifies a rock fluid unit interpretation by its phase.

Attributes

Name	Type	Notes
Phase	Phase	

Associations

Association	Notes
From: RockFluidUnitInterpretation. **To:** GeologicUnitInterpretation *Generalization*	

3.34 SequenceStratigraphySurface

Type: Enumeration *Stereotype:*
Detail: *Created:* 5/10/2012 *Last modified:* 11/1/2016
Notes: The enumerated attributes of a horizon.

Attributes

Name	Type	Notes
flooding		
ravinement		
maximum flooding		
transgressive		

3.35 Shape3d

Type: Enumeration *Stereotype:*
Detail: *Created:* 7/25/2014 *Last modified:* 11/1/2016
Notes: Enumeration characterizing the 3D shape of a geological unit.

Attributes

Name	Type	Notes
sheet		
dyke		
dome		
mushroom		
channel		
delta		
dune		
fan		
reef		
wedge		

Associations

Association	Notes
From: Shape3dExt. **To:** Shape3d *Generalization*	

3.36 Shape3dExt

Type: Class *Stereotype:* «XSDunion»
Detail: *Created:* 1/21/2016 *Last modified:* 11/1/2016
Notes:

Associations

Association	Notes
From: Shape3dExt. **To:** EnumExtensionPattern *Generalization*	
From: Shape3dExt. **To:** Shape3d *Generalization*	

3.37 StratigraphicColumn

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/29/2013 *Last modified:* 11/1/2016
Notes: A global interpretation of the stratigraphy, which can be made up of several ranks of stratigraphic unit interpretations.

BUSINESS RULE: All stratigraphic column rank interpretations that make up a stratigraphic column must be ordered by age.

Associations

Association		Notes
1..*	**From:** StratigraphicColumn.Ranks **To:** StratigraphicColumnRankInterpretation *Association*	
	From: StratigraphicColumn. **To:** AbstractObject *Generalization*	
0..1	**From:** EarthModelInterpretation.StratigraphicColumn **To:** StratigraphicColumn *Association*	

3.38 StratigraphicColumnRankInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/28/2013 *Last modified:* 11/1/2016
Notes: A global hierarchy containing an ordered list of stratigraphic unit interpretations.

Attributes

Name	Type	Notes
RankInStratigraphicColumn	NonNegativeLong	The rank in the stratigraphic column.

Associations

Association	Notes
From: StratigraphicColumnRankInterpretation. **To:** AbstractStratigraphicOrganizationInterpretation *Generalization*	
From: StratigraphicColumnRankInterpretation.StratigraphicUnits 1..* **To:** StratigraphicUnitInterpretation *Association*	
From: StratigraphicColumn.Ranks 1..* **To:** StratigraphicColumnRankInterpretation *Association*	
From: StratigraphicOccurrenceInterpretation.IsOccurrenceOf 0..1 **To:** StratigraphicColumnRankInterpretation *Association*	

3.39 StratigraphicOccurrenceInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/28/2013 *Last modified:* 11/1/2016
Notes: A local Interpretation—it could be along a well, on a 2D map, or on a 2D section or on a part of the global volume of an earth model—of a succession of rock feature elements.
The stratigraphic column rank interpretation composing a stratigraphic occurrence can be ordered by the criteria listed in OrderingCriteria.

Note: When the chosen ordering criterion is not age but measured depth along a well trajectory, the semantics of the name of this class could be inconsistent semantics. In this case:

- When faults are present, the observed succession may show repetition of a stratigraphic succession composed of a series of units each younger than the one below it.
- This succession should not be called a stratigraphic occurrence because it is not stratigraphic (because the adjective 'stratigraphic' applies to a succession of units ordered according to their relative ages).

A more general term for designating a succession of geological units encountered in drilling would be "Geologic Occurrence". So we may consider that the term "stratigraphic cccurrence interpretation" should be understood as "geologic occurrence interpretation".

BUSINESS RULE: A representation of a stratigraphic occurrence interpretation can be a wellbore marker or a wellbore frame.

Associations

Association	Notes
From: StratigraphicOccurrenceInterpretation.GeologicUnitIndex 0..* **To:** GeologicUnitInterpretation *Association*	
From: StratigraphicOccurrenceInterpretation. **To:** AbstractStratigraphicOrganizationInterpretation *Generalization*	
From: StratigraphicOccurrenceInterpretation.IsOccurrenceOf 0..1 **To:** StratigraphicColumnRankInterpretation *Association*	
From: EarthModelInterpretation.StratigraphicOccurrences 0..* **To:** StratigraphicOccurrenceInterpretation *Association*	

3.40 StratigraphicUnitInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: A volume of rock of identifiable origin and relative age range that is defined by the distinctive and dominant, easily mapped and recognizable features that characterize it (petrographic, lithologic, paleontologic, paleomagnetic or chemical features).
Some stratigraphic units (chronostratigraphic units) have a GeneticBoundaryBasedTimeInterval (between its ChronoTop and ChronoBottom) defined by a BoundaryFeatureInterpretation.

A stratigraphic unit has no direct link to its physical top and bottom limits. These physical limits are only defined as contacts between StratigraphicUnitInterpretations defined within a StratigraphicOrganizationInterpretation.

Attributes

Name	Type	Notes
DepositionMode	DepositionMode	BUSINESS RULE: The deposition mode for a geological unit MUST be consistent with the boundary relations of a genetic boundary. If it is not, then the boundary relation declaration is retained.
MaxThickness	LengthMeasure	
MinThickness	LengthMeasure	
StratigraphicUnitKind	StratigraphicUnitKind	

Associations

Association	Notes
From: StratigraphicUnitInterpretation. **To:** GeologicUnitInterpretation *Generalization*	
From: StratigraphicColumnRankInterpretation.StratigraphicUnits 1..* **To:** StratigraphicUnitInterpretation *Association*	

3.41 StratigraphicUnitKind

Type: Enumeration *Stereotype:*
Detail: *Created:* 2/5/2016 *Last modified:* 11/1/2016
Notes: Attribute specifying the criteria that are considered for defining various kinds of stratigraphic units (age, lithology, fossil content).

Attributes

Name	Type	Notes
chronostratigraphic		
lithostratigraphic		
biostratigraphic		

3.42 StructuralOrganizationInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/4/2013 *Last modified:* 11/1/2016
Notes: One of the main types of RESQML organizations, this class gathers boundary interpretations (e.g., horizons, faults and fault networks) plus frontier features and their relationships (contacts interpretations), which when taken together define the structure of a part of the earth.
IMPLEMENTATION RULE: Two use cases are presented:

1. If the relative age or apparent depth between faults and horizons is unknown, the writer must provide all individual faults within the UnorderedFaultCollection FeatureInterpretationSet.

2. Else, the writer must provide individual faults and fault collections within the OrderedBoundaryFeatureInterpretation list.

BUSINESS RULE: Two use cases are processed:

1 - If relative age or apparent depth between faults and horizons is unknown, writer must provides all individual faults within the UnorderedFaultCollection FeatureInterpretationSet.

2 - Else, individual faults and fault collections are provided within the OrderedBoundaryFeatureInterpretation list.

Attributes

Name	Type	Notes
OrderingCriteria	OrderingCriteria	

Associations

Association	Notes
From: StructuralOrganizationInterpretation.TopFrontier 0..* **To:** AbstractFeatureInterpretation *Association*	
From: StructuralOrganizationInterpretation. **To:** AbstractOrganizationInterpretation *Generalization*	
From: StructuralOrganizationInterpretation.UnorderedFaultCollection 0..1 **To:** FeatureInterpretationSet *Association*	
From: StructuralOrganizationInterpretation.Sides 0..* **To:** AbstractFeatureInterpretation *Association*	
From: StructuralOrganizationInterpretation.BottomFrontier 0..* **To:** AbstractFeatureInterpretation *Association*	
From: StructuralOrganizationInterpretation.OrderedBoundaryFeatureInterpretation 0..* **To:** BoundaryFeatureInterpretationPlusItsRank *Association*	
From: EarthModelInterpretation.Structure 0..* **To:** StructuralOrganizationInterpretation *Association*	

3.43 ThrowKind

Type: Enumeration *Stereotype:*
Detail: *Created:* 4/5/2012 *Last modified:* 11/1/2016
Notes: Enumeration that characterizes the type of discontinuity corresponding to a fault.

Attributes

Name	Type	Notes
reverse		
normal		
thrust		
strike and slip		
scissor		
variable		Used when a throw has different behaviors during its lifetime.

Associations

Association	Notes
From: ThrowKindExt. **To:** ThrowKind *Generalization*	

3.44 ThrowKindExt

Type: Class *Stereotype:* «XSDunion»
Detail: *Created:* 1/21/2016 *Last modified:* 11/1/2016
Notes:

Associations

Association	Notes
From: ThrowKindExt. **To:** ThrowKind *Generalization*	
From: ThrowKindExt. **To:** EnumExtensionPattern *Generalization*	

4 Representations

Package: xsd_schemas

Notes: This package contains the main classes used to define and exchange representation data in RESQML. Other packages in RESQML also define representations and may leverage objects in this Representation package; those other packages include:

- Grids
- Structural
- Wells
- Seismic
- Streamlines

A representation refers to a digital description of a feature or interpretation. For example, currently in RESQML, a horizon interpretation may be represented by a point set, a set of triangulated surfaces, or a set of orthogonal grids.

A representation has two distinct and complementary roles in RESQML:

It is an important component of the feature/interpretation/representation/property knowledge hierarchy where it corresponds to a 3D modeling expression of a feature that was initialized at the beginning of a business process. For example, the same horizon feature-interpretation can have a 2D grid representation or a triangulated set representation.

It supports the geometry and properties of data-objects in RESQML. The geometry of a representation is contained within the representation, while properties may be attached to the representation. Each property is “attached” to the indexable elements of a representation, which may be as simple as the nodes on a single triangulated surface or as complex as the cell, nodes, faces, pillars, coordinate lines, columns, etc., for a 3D grid.

4.1 AbstractRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/7/2012 *Last modified:* 11/1/2016
Notes: The parent class of all specialized digital descriptions, which may provide a representation of a feature interpretation or a technical feature. It may be either of these:

- based on a topology and contains the geometry of this digital description.
- based on the topology or the geometry of another representation.

Not all representations require a defined geometry. For example, a defined geometry is not required for block-centered grids or wellbore frames. For representations without geometry, a software writer may provide null (NaN) values in the local 3D CRS, which is mandatory.

TimeIndex is provided to describe time-dependent geometry.

Associations

Association		Notes
	From: AbstractRepresentation.RepresentedInterpretation **To:** AbstractFeatureInterpretation *Association*	
0..1	**From:** AbstractRepresentation. **To:** AbstractObject *Generalization*	
0..1	**From:** PatchBoundaries.OuterRing **To:** AbstractRepresentation *Association*	OuterRing defines the extension of a representation patch. Inside the ring, the patch is defined, outside it is not. The associated representation is used to limit the extension. The patch is limited by the contact between the patch and the associated representation.
	From: WellboreFrameRepresentation. **To:** AbstractRepresentation *Generalization*	
	From: RedefinedGeometryRepresentation. **To:** AbstractRepresentation *Generalization*	
	From: DeviationSurveyRepresentation. **To:** AbstractRepresentation *Generalization*	
1..*	**From:** SubRepresentation.SupportingRepresentation **To:** AbstractRepresentation *Association*	One patch of a sub-representation is defined on one supporting representation. Patches and supporting representations are ordered the same. If patches are on the same supporting representations, they can be repeated.
	From: PointSetRepresentation. **To:** AbstractRepresentation *Generalization*	

Association	Notes
From: Seismic2dPostStackRepresentation. **To:** AbstractRepresentation *Generalization*	
From: StreamlinesRepresentation. **To:** AbstractRepresentation *Generalization*	
From: AbstractProperty.SupportingRepresentation **To:** AbstractRepresentation *Association*	
1..1 **From:** WellboreTrajectoryRepresentation. **To:** AbstractRepresentation *Generalization*	
From: AbstractGridRepresentation. **To:** AbstractRepresentation *Generalization*	
From: GridConnectionSetRepresentation. **To:** AbstractRepresentation *Generalization*	
From: AbstractGridRepresentation. **To:** AbstractRepresentation *Generalization*	
From: ContactRepresentationReference.Representation **To:** AbstractRepresentation *Association*	
From: SubRepresentation. **To:** AbstractRepresentation *Generalization*	
From: RepresentationSetRepresentation. **To:** AbstractRepresentation *Generalization*	
From: ElementIdentity.Representation **To:** AbstractRepresentation *Association*	BUSINESS RULE: Each list of (sub)representation elements must have the same count (ElementCount).
0..* **From:** PatchBoundaries.InnerRing **To:** AbstractRepresentation *Association*	A hole inside a representation patch. Inside the ring, the representation patch is not defined, outside it is. The associated representations are used to define the holes. The holes occur inside the contact between the patch and the associated representations.
From: AbstractSurfaceRepresentation. **To:** AbstractRepresentation *Generalization*	
From: Point3dFromRepresentationLatticeArray.SupportingRepresentation **To:** AbstractRepresentation *Association*	BUSINESS RULE: The target root representation must have nodes as indexable elements.
From: ParametricLineFromRepresentationLatticeArray.SupportingRepresentation	

Association	Notes
To: AbstractRepresentation *Association*	
From: PolylineRepresentation. **To:** AbstractRepresentation *Generalization*	
From: ParametricLineFromRepresentationGeometry.SupportingRepresentation **To:** AbstractRepresentation *Association*	
From: RepresentationSetRepresentation.Representation 1..* **To:** AbstractRepresentation *Association*	
From: RedefinedGeometryRepresentation.SupportingRepresentation **To:** AbstractRepresentation *Association*	
From: AbstractSeismicCoordinates.SeismicSupport **To:** AbstractRepresentation *Association*	BUSINESS RULE: The seismic support must be a representation of a seismic lattice or seismic line.
From: PolylineSetRepresentation. **To:** AbstractRepresentation *Generalization*	

4.2 ElementIdentity

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/13/2014 *Last modified:* 11/1/2016
Notes: Indicates the nature of the relationship between 2 or more representations, specifically if they are partially or totally identical. For possible types of relationships, see IdentityKind.
Commonly used to identify contacts between representations in model descriptions. May also be used to relate the components of a grid (e.g., pillars) to those of a structural framework.

Attributes

Name	Type	Notes
ElementIndices	AbstractIntegerArray	Indicates which elements are identical based on their indices in the (sub)representation. If not given, then the selected indexable elements of each of the selected representations are identical at the element by element level. BUSINESS RULE: The number of identical elements must be equal to identicalElementCount for each representation.
IdentityKind	IdentityKind	
IndexableElement	IndexableElement	

Associations

Association		Notes
0..1	**From:** ElementIdentity.ToTimeIndex **To:** TimeIndex *Association*	
0..1	**From:** ElementIdentity.FromTimeIndex **To:** TimeIndex *Association*	
	From: ElementIdentity.Representation **To:** AbstractRepresentation *Association*	BUSINESS RULE: Each list of (sub)representation elements must have the same count (ElementCount).
2..*	**From:** RepresentationIdentity.ElementIdentity **To:** ElementIdentity *Association*	

4.3 ElementIndices

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/11/2013 *Last modified:* 11/1/2016
Notes: Index into the indexable elements selected.

Attributes

Name	Type	Notes
IndexableElement	IndexableElement	
Indices	AbstractIntegerArray	
SupportingRepresentationIndex	AbstractIntegerArray	

Associations

Association	Notes
From: SubRepresentationPatch.ElementIndices 1..2 **To:** ElementIndices *Association*	

4.4 IdentityKind

Type: Enumeration *Stereotype:*
Detail: *Created:* 8/23/2012 *Last modified:* 11/1/2016
Notes: Enumeration of the identity kinds for the element identities (ElementIdentity).

Attributes

Name	Type	Notes
collocation	External Reference	A set of (sub)representations is collocated if there is bijection between the simple elements of all of the participating (sub)representations. This definition implies there is the same number of simple elements. **NOTE:** The geometric location of each set of simple elements mapped through the bijection is intended to be identical even if the numeric values of the associated geometries differ, i.e., due to loss of spatial resolution.
previous collocation	External Reference	The participating (sub)representations were collocated at some time in the geologic past—but not necessarily in the present day earth model.
equivalence	External Reference	A set of (sub)representations is equivalent if there is a map giving an association between some of the simple topological elements of the participating (sub)representations.
previous equivalence	External Reference	The participating (sub)representations were equivalent at some time in the geologic past—but not necessarily in the present day earth model.

4.5 IndexableElement

Type: Enumeration *Stereotype:*
Detail: *Created:* 8/21/2012 *Last modified:* 11/1/2016
Notes: Indexable elements for the different representations. The indexing of each element depends upon the specific representation.
To order and reference the elements of a representation, RESQML makes extensive use of the concept of indexing. Both one-dimensional and multi-dimensional arrays of elements are used. So that all elements may be referenced in a consistent and uniform fashion, each multi-dimensional index must have a well-defined 1D index.

Attributes below identify the IndexableElements, though not all elements apply to all types of representations.

Indexable elements are used to:

- attach geometry and properties to a representation.
- identify portions of a representation when expressing a representation identity.
- construct a sub-representation from an existing representation.

For the table of indexable elements and the representations to which they apply, see the *RESQML Technical Usage Guide*.

Attributes

Name	Type	Notes
cells	External Reference	
intervals from datum		
column edges	External Reference	
columns	External Reference	
contacts	External Reference	
coordinate lines	External Reference	
edges	External Reference	
edges per column	External Reference	
enumerated elements	External Reference	
faces	External Reference	
faces per cell	External Reference	
interval edges	External Reference	Count = NKL (column-layer grids, only)
intervals	External Reference	
I0	External Reference	Count = NI (IJK grids, only)
I0 edges	External Reference	Count = NIL (IJK grids, only)
J0	External Reference	Count = NJ (IJK grids, only)
J0 edges	External Reference	Count = NJL (IJK grids, only)
layers	External Reference	Count = NK (column-layer grids, only)
lines		Streamlines
nodes	External Reference	

Name	Type	Notes
nodes per cell	External Reference	
nodes per edge	External Reference	
nodes per face	External Reference	
patches	External Reference	
pillars	External Reference	
regions	External Reference	
representation	External Reference	
subnodes	External Reference	
triangles	External Reference	

Associations

Association	Notes
From: AbstractProperty. **To:** IndexableElement *Dependency*	

4.6 Patch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: A Patch is a mechanism in RESQML that provides a clear way of ordering indices to avoid ambiguity. For example, the representation of a horizon consists of 10 triangulated surfaces, to correctly represent the same horizon, the software importing or reading that horizon must know the indices within each of the 10 triangulated surfaces AND how the 10 triangulated surfaces are sequenced.
Representations with unique indexing of their elements DO NOT require Patches. For example, a (lower order) corner-point grid has an indexing scheme that can be defined without using Patches. However, a RESQML general purpose (GP) grid (an unconstrained hybrid of any of the other RESQML grid types) is much more complex and variable, with no "natural" sequence. For a reader to correctly interpret a GP grid, the software that created the GP grid must:

- Explicitly define each Patch (specify the indices) that comprise the grid.
- Designate the correct order of the Patches.

If a representation includes indexable elements both specified within patches and external to patches, then Patch Index = 0 is defined to be the representation itself.

For more information, see the *RESQML Technical Usage Guide*.

Associations

Association	Notes
From: IjkGpGridPatch. **To:** Patch *Generalization*	
From: UnstructuredGpGridPatch. **To:** Patch *Generalization*	
From: Grid2dPatch. **To:** Patch *Generalization*	
From: TruncationCellPatch. **To:** Patch *Generalization*	
From: Patch1d. **To:** Patch *Generalization*	
From: SplitNodePatch. **To:** Patch *Generalization*	
From: UnstructuredColumnLayerGpGridPatch. **To:** Patch *Generalization*	
From: SubnodePatch. **To:** Patch *Generalization*	
From: PolylineSetPatch. **To:** Patch *Generalization*	

4.7 Patch1d

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/11/2013 *Last modified:* 11/1/2016
Notes: A patch with a single 1D index count.

Attributes

Name	Type	Notes
Count	PositiveLong	Number of items in the patch.

Associations

Association	Notes
From: Patch1d. **To:** Patch *Generalization*	
From: ContactPatch. **To:** Patch1d *Generalization*	
From: EdgePatch. **To:** Patch1d *Generalization*	
From: SubRepresentationPatch. **To:** Patch1d *Generalization*	
From: NodePatch. **To:** Patch1d *Generalization*	
From: TrianglePatch. **To:** Patch1d *Generalization*	

4.8 PatchOfGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/13/2014 *Last modified:* 11/1/2016
Notes: Indicates which patch of the representation has a new geometry.

Attributes

Name	Type	Notes
RepresentationPatchIndex	NonNegativeLong	Patch index for the geometry attachment, if required.

Associations

Association	Notes
From: PatchOfGeometry.Geometry **To:** AbstractGeometry *Association*	
From: RedefinedGeometryRepresentation.PatchOfGeometry 1..* **To:** PatchOfGeometry *Association*	

4.9 PolylineSetPatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/12/2013 *Last modified:* 11/1/2016
Notes: A Patch containing a set of polylines.
For performance reasons, the geometry of each Patch is described in only one 1D array of 3D points, which aggregates the nodes of all the polylines together.

To be able to separate the polyline descriptions, additional information is added about the type of each polyline (closed or not) and the number of 3D points (node count) of each polyline.

This additional information is contained in two arrays, which are associated with each polyline set patch. The dimension of these arrays is the number of polylines gathered in one polyline set patch.

- The first array contains a Boolean for each polyline (closed or not closed).
- The second array contains the count of nodes for each polyline.

Attributes

Name	Type	Notes
ClosedPolylines	AbstractBooleanArray	Indicates whether a polyline is closed. If closed, then the interval count for that polyline is equal to the node count. If open, then the interval count for that polyline is one less than the node count.
IntervalCount	NonNegativeLong	Total number of intervals. BUSINESS RULE: Should be equal to the sum of the count of intervals per polyline.
NodeCount	PositiveLong	Total number of nodes. BUSINESS RULE: Should be equal to the sum of the number of nodes per polyline.
NodeCountPerPolyline	AbstractIntegerArray	The first number in the list defines the node count for the first polyline in the polyline set patch. The second number in the list defines the node count for the second polyline in the polyline set patch. etc.

Associations

Association		Notes
0..1	**From:** PolylineSetPatch.IntervalGridCells **To:** IntervalGridCells *Association*	
	From: PolylineSetPatch.Geometry **To:** PointGeometry *Association*	
	From: PolylineSetPatch. **To:** Patch *Generalization*	
	From: PolylineSetRepresentation.LinePatch	

Association		Notes
1..*	**To:** PolylineSetPatch *Association*	
0..1	**From:** StreamlinesRepresentation.Geometry **To:** PolylineSetPatch *Association*	

4.10 PolylineSetRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/14/2013 *Last modified:* 11/1/2016
Notes: A representation made up of a set of polylines or a set of polygonal chains (for more information, see PolylineRepresentation).
For compactness, it is organized by line patch as a unique polyline set patch.

If allPolylineClosed = True, all the polylines are connected between the first and the last point.

Its geometry is a 1D array of points, corresponding to the concatenation of the points of all polyline points.

Attributes

Name	Type	Notes
LineRole	LineRole	

Associations

Association		Notes
1..*	**From:** PolylineSetRepresentation.LinePatch **To:** PolylineSetPatch *Association*	
	From: PolylineSetRepresentation. **To:** AbstractRepresentation *Generalization*	

4.11 RedefinedGeometryRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/14/2013 *Last modified:* 11/1/2016
Notes: A representation derived from an existing representation by redefining its geometry. Example use cases include deformation of the geometry of an object, change of coordinate system, and change of time <=> depth.

Associations

Association	Notes
From: RedefinedGeometryRepresentation. **To:** AbstractRepresentation *Generalization*	
From: RedefinedGeometryRepresentation.PatchOfGeometry 1..* **To:** PatchOfGeometry *Association*	
From: RedefinedGeometryRepresentation.SupportingRepresentation **To:** AbstractRepresentation *Association*	

4.12 RepresentationIdentity

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/21/2012 *Last modified:* 11/1/2016
Notes: Indicates the nature of the relationship between 2 or more representations, specifically if they are partially or totally identical. For possible types of relationships, see IdentityKind.

Attributes

Name	Type	Notes
IdenticalElementCount	PositiveLong	Number of elements within each representation for which a representation identity is specified.

Associations

Association		Notes
0..1	**From:** RepresentationIdentity.AdditionalGridTopology **To:** AdditionalGridTopology *Association*	
2..*	**From:** RepresentationIdentity.ElementIdentity **To:** ElementIdentity *Association*	
1..*	**From:** RepresentationIdentitySet.RepresentationIdentity **To:** RepresentationIdentity *Association*	

4.13 RepresentationIdentitySet

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/22/2014 *Last modified:* 11/1/2016
Notes: A collection of representation identities.

Associations

Association		Notes
	From: RepresentationIdentitySet. **To:** AbstractObject *Generalization*	
1..*	**From:** RepresentationIdentitySet.RepresentationIdentity **To:** RepresentationIdentity *Association*	

4.14 RepresentationSetRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/22/2012 *Last modified:* 11/1/2016
Notes: The parent class of the framework representations. It is used to group together individual representations to represent a “bag” of representations. If the individual representations are all of the same, then you can indicate that the set is homogenous.
These “bags” do not imply any geologic consistency. For example, you can define a set of wellbore frames, a set of wellbore trajectories, a set of blocked wellbores.

Because the framework representations inherit from this class, they inherit the capability to gather individual representations into sealed and non-sealed surface framework representations, or sealed volume framework representations.

For more information, see the *RESQML Technical Usage Guide*.

Attributes

Name	Type	Notes
IsHomogeneous	boolean	Indicates that all of the selected representations are of a single kind.

Associations

Association	Notes
From: RepresentationSetRepresentation. **To:** AbstractRepresentation *Generalization*	
From: RepresentationSetRepresentation.Representation 1..* **To:** AbstractRepresentation *Association*	
From: SealedVolumeFrameworkRepresentation. **To:** RepresentationSetRepresentation *Generalization*	
From: AbstractSurfaceFrameworkRepresentation. **To:** RepresentationSetRepresentation *Generalization*	

4.15 SubRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/21/2012 *Last modified:* 11/1/2016
Notes: An ordered list of indexable elements and/or indexable element pairs of an existing representation.
Because the representation concepts of topology, geometry, and property values are separate in RESQML, it is now possible to select a range of nodes, edges, faces, or volumes (cell) indices from the topological support of an existing representation to define a sub-representation.

A sub-representation may describe a different feature interpretation using the same geometry or property as the "parent" representation. In this case, the only information exchanged is a set of potentially non-consecutive indices of the topological support of the representation.

Optional additional grid topology is available for grid representations.

Associations

Association		Notes
0..1	**From:** SubRepresentation.AdditionalGridTopology **To:** AdditionalGridTopology *Association*	
1..*	**From:** SubRepresentation.SupportingRepresentation **To:** AbstractRepresentation *Association*	One patch of a sub-representation is defined on one supporting representation. Patches and supporting representations are ordered the same. If patches are on the same supporting representations, they can be repeated.
	From: SubRepresentation. **To:** AbstractRepresentation *Generalization*	
1..*	**From:** SubRepresentation.SubRepresentationPatch **To:** SubRepresentationPatch *Association*	

4.16 SubRepresentationPatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/2/2013 *Last modified:* 11/1/2016
Notes: Each sub-representation patch has its own list of representation indices, drawn from the supporting representation.
If a list of pairwise elements is required, use two ElementIndices. The count of elements (or pair of elements) is defined in SubRepresentationPatch.

Associations

Association		Notes
	From: SubRepresentationPatch. **To:** Patch1d *Generalization*	
1..2	**From:** SubRepresentationPatch.ElementIndices **To:** ElementIndices *Association*	
1..*	**From:** SubRepresentation.SubRepresentationPatch **To:** SubRepresentationPatch *Association*	

5 Properties

Package: xsd_schemas

Notes: This package contains classes used to define and exchange property data in RESQML. Individual property values are attached to a single type of element in the representation, either its topological elements, such as nodes or cells, or larger elements such as the entire representation or large parts of it, through patches and sub-representations.

Each property value is also associated with a single property type, which provides global semantics about the meaning of these values. Property values can also be associated with facets, which provide additional context for the values.

It is very common in subsurface/earth modeling workflows to follow the evolution of some property values through time or to consider them together as a group of property values attached to the same or different representations and property types. To capture this information, RESQML provides the notion of time series and a property group.

When spatial locations (geometry) need to be stored for specific elements in a representation, then property points are used.

5.1 AbstractProperty

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/5/2012 *Last modified:* 11/1/2016
Notes: Base class for storing all property values on representations, except current geometry location. Values attached to a given element can be either a scalar or a vector. The size of the vector is constant on all elements, and it is assumed that all elements of the vector have identical property types and share the same unit of measure.

Attributes

Name	Type	Notes
IndexableElement	IndexableElement	
RealizationIndices	AbstractIntegerArray	Provide the list of indices corresponding to realizations number. For example, if a user wants to send the realization corresponding to p10, p20, ... he would write the array 10, 20, ... If not provided, then the realization count (which could be 1) does not introduce a dimension to the multi-dimensional array storage.
ValueCountPerIndexableElement	PositiveLong	Number of elements in a 1D list of properties of the same property kind. When used in a two-dimensional array, count is always the fastest. If not provided, then the value count does not introduce a dimension to the multi-dimensional array storage.

Associations

Association		Notes
1	**From:** AbstractProperty.PropertyKind **To:** PropertyKind *Association*	
0..1	**From:** AbstractProperty.LocalCrs **To:** AbstractLocal3dCrs *Association*	
	From: AbstractProperty.SupportingRepresentation **To:** AbstractRepresentation *Association*	
0..1	**From:** AbstractProperty.TimeIndices **To:** TimeIndices *Association*	
	From: AbstractProperty. **To:** IndexableElement *Dependency*	
	From: AbstractProperty. **To:** AbstractObject *Generalization*	
0..*	**From:** PropertySet.Properties **To:** AbstractProperty *Association*	
	From: AbstractValuesProperty. **To:** AbstractProperty	

Association	Notes
Generalization	
From: PointsProperty. **To:** AbstractProperty *Generalization*	

5.2 AbstractPropertyLookup

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/6/2012 *Last modified:* 11/1/2016
Notes: Generic representation of a property lookup table. Each derived element provides specific lookup methods for different data types.

Associations

Association	Notes
From: AbstractPropertyLookup. **To:** AbstractObject *Generalization*	
From: CategoricalProperty.Lookup **To:** AbstractPropertyLookup *Association*	
From: StringTableLookup. **To:** AbstractPropertyLookup *Generalization*	
From: DoubleTableLookup. **To:** AbstractPropertyLookup *Generalization*	

5.3 AbstractValuesProperty

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/31/2013 *Last modified:* 11/1/2016
Notes: Base class for property values. Each derived element provides specific property values, including point property in support of geometries.

Associations

Association		Notes
0..*	**From:** AbstractValuesProperty.Facet **To:** PropertyKindFacet *Association*	BUSINESS RULE : Don't use several facets of the same kind for the same property.
	From: AbstractValuesProperty. **To:** AbstractProperty *Generalization*	
1..*	**From:** AbstractValuesProperty.PatchOfValues **To:** PatchOfValues *Association*	
	From: CommentProperty. **To:** AbstractValuesProperty *Generalization*	
	From: BooleanProperty. **To:** AbstractValuesProperty *Generalization*	
	From: ContinuousProperty. **To:** AbstractValuesProperty *Generalization*	
	From: CategoricalProperty. **To:** AbstractValuesProperty *Generalization*	
	From: DiscreteProperty. **To:** AbstractValuesProperty *Generalization*	

5.4 BooleanArrayFromDiscretePropertyArray

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/29/2013 *Last modified:* 11/1/2016
Notes: An array of Boolean values that is explicitly defined by indicating which indices in the array are either true or false. This class is used to represent very sparse true or false data, based on a discrete property.

Attributes

Name	Type	Notes
Value	long	Integer to match for the value to be considered true

Associations

Association	Notes
From: BooleanArrayFromDiscretePropertyArray. **To:** AbstractBooleanArray *Generalization*	
From: BooleanArrayFromDiscretePropertyArray.Property **To:** DiscreteProperty *Association*	

5.5 BooleanProperty

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 1/26/2016 *Last modified:* 11/1/2016
Notes: Information specific to one Boolean property.
Used to capture a choice between 2 and only 2 possible values/states for each indexable element of a data object, for example, identifying active cells of a grid.

Associations

Association	Notes
From: BooleanProperty. **To:** AbstractValuesProperty *Generalization*	

5.6 CategoricalProperty

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/6/2012 *Last modified:* 11/1/2016
Notes: Information specific to one categorical property. Contains discrete integer. This type of property is associated either as:

- an internally stored index to a string through a lookup mapping.
- an internally stored double to another double value through an explicitly provided table.

Associations

Association	Notes
From: CategoricalProperty.Lookup **To:** AbstractPropertyLookup *Association*	
From: CategoricalProperty. **To:** AbstractValuesProperty *Generalization*	

5.7 CommentProperty

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/19/2013 *Last modified:* 11/1/2016
Notes: Information specific to one comment property.
Used to capture comments or annotations associated with a given element type in a data-object, for example, associating comments on the specific location of a well path.

Attributes

Name	Type	Notes
Language	String64	Identify the language (e.g., US English or French) of the string. It is recommended that language names conform to ISO 639.

Associations

Association	Notes
From: CommentProperty. **To:** AbstractValuesProperty *Generalization*	

5.8 ContinuousProperty

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/6/2012 *Last modified:* 11/1/2016
Notes: Most common type of property used for storing rock or fluid attributes; all are represented as doubles.
So that the value range can be known before accessing all values, the min and max values of the range are also stored.

BUSINESS RULE: It also contains a unit of measure, which can be different from the unit of measure of its property type, but it must be convertible into this unit.

Attributes

Name	Type	Notes
CustomUnitDictionary	DataObjectReference	
MaximumValue	double	The maximum of the associated property values. BUSINESS RULE: There can be only one value per number of elements.
MinimumValue	double	The minimum of the associated property values. BUSINESS RULE: There can be only one value per number of elements.
Uom	UnitOfMeasureExt	Unit of measure for the property.

Associations

Association	Notes
From: ContinuousProperty. **To:** AbstractValuesProperty *Generalization*	
From: SingleGridPropertyParameter.NetToGrossMultiplier 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.Pressure 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.OilSaturation 0..1 **To:** ContinuousProperty *Association*	
From: MultipliedPerm.Multiplier 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.NetToGross 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.WaterSaturation 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.PoreVolume 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.Porosity	

Association	Notes
0..1 **To:** ContinuousProperty *Association*	
From: MultipliedPerm.Property **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.PorosityMultiplier 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.GasSaturation 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.PoreVolumeMultiplier 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.TransmissibilityMultiplier 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.MinimumPoreVolume 0..1 **To:** ContinuousProperty *Association*	
From: SingleGridPropertyParameter.CellActivity 0..1 **To:** ContinuousProperty *Association*	

5.9 DiscreteProperty

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/6/2012 *Last modified:* 11/1/2016
Notes: Contains discrete integer values; typically used to store any type of index.
So that the value range can be known before accessing all values, it also stores the minimum and maximum value in the range.

Attributes

Name	Type	Notes
MaximumValue	long	The maximum of the associated property values. BUSINESS RULE: There can only be one value per number of elements.
MinimumValue	long	The minimum of the associated property values. BUSINESS RULE: There can only be one value per number of elements.

Associations

Association	Notes
From: DiscreteProperty. **To:** AbstractValuesProperty *Generalization*	
From: BooleanArrayFromDiscretePropertyArray.Property **To:** DiscreteProperty *Association*	

5.10 DoubleLookup

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/31/2013 *Last modified:* 11/1/2016
Notes: (key,value) pairs for a lookup table.

Attributes

Name	Type	Notes
Key	double	Input to a table lookup.
Value	double	Output from a table lookup.

Associations

Association	Notes
1..* **From:** DoubleTableLookup.Value **To:** DoubleLookup *Association*	

5.11 DoubleTableLookup

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/6/2012 *Last modified:* 11/1/2016
Notes: Defines a function for table lookups. For example, used for linear interpolation, such as PVT. Used for categorical property, which also may use StringTableLookup.

Associations

Association		Notes
1..*	**From:** DoubleTableLookup.Value **To:** DoubleLookup *Association*	
	From: DoubleTableLookup. **To:** AbstractPropertyLookup *Generalization*	

5.12 Facet

Type: Enumeration *Stereotype:*
Detail: *Created:* 2/22/2016 *Last modified:* 11/1/2016
Notes:
In addition to property kinds to define semantics, a facet is a mechanism that give some context about the nature of the property. Each property kind can be associated with as many property kind facets as needed.

NOTE: Recommended best practice is to you use facets instead of creating a specialized local property kind.

Attributes

Name	Type	Notes
I		Applies to direction facet kind. With respect to the first local grid (lateral) direction. Used for full tensor permeability.
J		Applies to direction facet kind. With respect to the second local grid (lateral) direction. Used for full tensor permeability.
K		Applies to direction facet kind. With respect to the third local grid (vertical) direction. Used for full tensor permeability.
X		Applies to direction facet kind. With respect to the first coordinate system (laterall) direction. Used for full tensor permeability.
Y		Applies to direction facet kind. With respect to the second coordinate system (lateral) direction. Used for full tensor permeability.
Z		Applies to direction facet kind. With respect to the third coordinate system (vertical) direction. Used for full tensor permeability.
I+		Applies to direction facet kind. With respect to the first local grid (lateral) increasing direction. Used for full tensor permeability.
J+		Applies to direction facet kind. With respect to the second local grid (lateral) increasing direction. Used for full tensor permeability.
K+		Applies to direction facet kind. With respect to the third local grid (vertical) increasing direction. Used for full tensor permeability.
X+		Applies to direction facet kind. With respect to the first coordinate system (laterall) increasing direction. Used for full tensor permeability.
Y+		Applies to direction facet kind. With respect to the second coordinate system (lateral) increasing direction. Used for full tensor permeability.
Z+		Applies to direction facet kind. With respect to the third coordinate system (vertical) increasing direction. Used for full tensor permeability.
I-		Applies to direction facet kind. With respect to the first local grid (lateral) decreasing direction. Used for full tensor permeability.

Name	Type	Notes
J-		Applies to direction facet kind. With respect to the second local grid (lateral) decreasing direction. Used for full tensor permeability.
K-		Applies to direction facet kind. With respect to the third local grid (vertical) decreasing direction. Used for full tensor permeability.
X-		Applies to direction facet kind. With respect to the first coordinate system (laterall) decreasing direction. Used for full tensor permeability.
Y-		Applies to direction facet kind. With respect to the second coordinate system (lateral) decreasing direction. Used for full tensor permeability.
Z-		Applies to direction facet kind. With respect to the third coordinate system (vertical) decreasing direction. Used for full tensor permeability.
net		Applies to netgross facet kind.
gross		Applies to netgross facet kind.
plus		
minus		
average		Applies to statistics facet kind.
maximum		Applies to statistics facet kind.
minimum		Applies to statistics facet kind.
maximum threshold		Applies to qualifier facet kind.
minimum threshold		Applies to qualifier facet kind.
surface condition		Applies to conditions facet kind.
reservoir condition		Applies to conditions facet kind.
oil		Applies to what facet kind.
water		Applies to what facet kind.
gas		Applies to what facet kind.
condensate		Applies to what facet kind.
cumulative		Applies to statistics facet kind.

Associations

Association	Notes
From: FacetExt. **To:** Facet *Generalization*	

5.13 FacetExt

Type: Class *Stereotype:* «XSDunion»
Detail: *Created:* 2/22/2016 *Last modified:* 11/1/2016
Notes: The extensible enumeration of facets.

Associations

Association	Notes
From: FacetExt. **To:** Facet *Generalization*	
From: FacetExt. **To:** EnumExtensionPattern *Generalization*	
From: PropertyKindFacet. **To:** FacetExt *Dependency*	

5.14 FacetKind

Type: Enumeration *Stereotype:*
Detail: *Created:* 11/30/2012 *Last modified:* 11/1/2016
Notes: Enumerations of the type of qualifier that applies to a property type to provide additional context about the nature of the property. For example, may include conditions, direction, qualifiers, or statistics. Facets are used in RESQML to provide qualifiers to existing property types, which minimizes the need to create specialized property types.

Attributes

Name	Type	Notes
conditions		Indicates condition of how the property was acquired, e.g., distinguishing surface condition of a fluid compared to reservoir conditions.
side		Indicates on which side of a surface the property applies, for example, it can indicate plus or minus.
direction		Indicates that the property is directional. Common values are X, Y, or Z for vectors; I, J, or K for properties on a grid; or tensorial coordinates, e.g., XX or IJ. For example, vertical permeability vs. horizontal permeability.
netgross		Indicates that the property is of kind net or gross, i.e., indicates that the spatial support of a property is averaged only over the net rock or all of the rock. rock or all of the rock.
qualifier		Used to capture any other context not covered by the other facet types listed here.
statistics		Indicates values such as minimum, maximum, average, etc.
what		Indicates the element that is measured, for example, the concentration of a mineral.

Associations

Association	Notes
From: PropertyKindFacet. **To:** FacetKind *Dependency*	

5.15 PatchOfPoints

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/9/2013 *Last modified:* 11/1/2016
Notes: A patch of points. In RESQML, a patch is a set or range of one kind of topological elements used to define part of a data-object, such as grids or structural data-objects.

Attributes

Name	Type	Notes
Points	AbstractPoint3dArray	Geometric points (or vectors) to be attached to the specified indexable elements.
RepresentationPatchIndex	NonNegativeLong	Optional patch index used to attach properties to a specific patch of the indexable elements.

Associations

Association		Notes
1..*	**From:** PointsProperty.PatchOfPoints **To:** PatchOfPoints *Association*	

5.16 PatchOfValues

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/9/2013 *Last modified:* 11/1/2016
Notes: A patch of values. See also Patch.

Attributes

Name	Type	Notes
RepresentationPatchIndex	NonNegativeLong	Patch index used to attach properties to a specific patch of the indexable elements.
Values	AbstractValueArray	Values to be attached to the indexable elements.

Associations

Association	Notes
From: AbstractValuesProperty.PatchOfValues 1..* **To:** PatchOfValues *Association*	

5.17 PointsProperty

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/13/2012 *Last modified:* 11/1/2016
Notes: Represents the geometric information that should *not* be used as representation geometry, but should be used in another context where the location or geometrical vectorial distances are needed.

Associations

Association		Notes
1..*	**From:** PointsProperty.PatchOfPoints **To:** PatchOfPoints *Association*	
	From: PointsProperty. **To:** AbstractProperty *Generalization*	

5.18 PropertyKindFacet

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/30/2012 *Last modified:* 11/1/2016
Notes: Qualifiers for property values, which allow users to semantically specialize a property without creating a new property kind.
For the list of enumerations, see FacetKind.

Attributes

Name	Type	Notes
Facet	FacetExt	A facet allows you to better define a property in the context of its property kind. The technical advantage of using a facet vs. a specialized property kind is to limit the number of property kinds.
Kind	FacetKind	Facet kind of the property kind (see the enumeration)

Associations

Association		Notes
	From: PropertyKindFacet. **To:** FacetExt *Dependency*	
	From: PropertyKindFacet. **To:** FacetKind *Dependency*	
0..*	**From:** AbstractValuesProperty.Facet **To:** PropertyKindFacet *Association*	BUSINESS RULE : Don't use several facets of the same kind for the same property.

5.19 PropertySet

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/6/2012 *Last modified:* 11/1/2016
Notes: A set of properties collected together for a specific purpose. For example, a property set can be used to collect all the properties corresponding to the simulation output at a single time, or all the values of a single property type for all times.

Attributes

Name	Type	Notes
HasMultipleRealizations	boolean	If true, indicates that the collection contains properties with defined realization indices.
HasSinglePropertyKind	boolean	If true, indicates that the collection contains only property values associated with a single property kind.
TimeSetKind	TimeSetKind	

Associations

Association		Notes
	From: PropertySet. **To:** AbstractObject *Generalization*	
0..*	**From:** PropertySet.Properties **To:** AbstractProperty *Association*	
0..*	**From:** PropertySet.ParentSet **To:** PropertySet *Association*	
0..*	**From:** PropertySet.ParentSet **To:** PropertySet *Association*	

5.20 ResqmlPropertyKind

Type: Enumeration *Stereotype:*
Detail: *Created:* 5/17/2012 *Last modified:* 11/1/2016
Notes: Enumeration of the standard set of RESQML property kinds.

Attributes

Name	Type	Notes
absorbed dose	TypeEnum	The amount of energy absorbed per mass.
acceleration linear	TypeEnum	
active	TypeEnum	
activity (of radioactivity)	TypeEnum	A measure of the radiation being emitted.
amount of substance	TypeEnum	Molar amount of a substance.
amplitude	TypeEnum	Amplitude of the acoustic signal recorded. It is not a physical property, only a value.
angle per length	TypeEnum	
angle per time	TypeEnum	The angular velocity. The rate of change of an angle.
angle per volume	TypeEnum	
angular acceleration	TypeEnum	
area	TypeEnum	
attenuation	TypeEnum	A logarithmic, fractional change of some measure, generally power or amplitude, over a standard range. This is generally used for frequency attenuation over an octave.
area per area	TypeEnum	A dimensionless quantity where the basis of the ratio is area.
attenuation per length	TypeEnum	
area per volume	TypeEnum	
azimuth	TypeEnum	Angle between the North and the projection of the normal to the horizon surface estimated on a local area of the interface.
bubble point pressure	TypeEnum	The pressure at which the first gas bubble appears while decreasing pressure on a fluid sample.
bulk modulus	TypeEnum	Bulk modulus, K
capacitance	TypeEnum	
categorical	TypeEnum	The abstract supertype of all enumerated string properties.
cell length	TypeEnum	Distance from cell face center to cell face center in the specified direction, DI, DJ, DK.
code	TypeEnum	A discrete code.
charge density	TypeEnum	
compressibility	TypeEnum	
chemical potential	TypeEnum	
concentration of B	TypeEnum	Molar concentration of a substance.

Name	Type	Notes
conductivity	TypeEnum	
continuous	TypeEnum	The abstract supertype of all floating point properties.
cross section absorption	TypeEnum	
current density	TypeEnum	
Darcy flow coefficient	TypeEnum	
data transmission speed	TypeEnum	Used primarily for computer transmission rates.
delta temperature	TypeEnum	Refers to temperature differences. For non-zero offset temperature scales, Fahrenheit and Celsius, the conversion formulas are different than for absolute temperatures.
density	TypeEnum	
depth	TypeEnum	The perpendicular measurement downward from a surface. Also, the direct linear measurement from the point of viewing usually from front to back.
diffusion coefficient	TypeEnum	
digital storage	TypeEnum	
dimensionless	TypeEnum	A dimensionless quantity is the ratio of two dimensional quantities. The quantity types are not apparent from the basic dimensionless class, but may be apparent in variations--such as area per area, volume per volume, or mass per mass.
dip	TypeEnum	In the azimuth direction, the angle between a horizon plane and an estimated plane on a local area of the interface.
discrete	TypeEnum	The abstract supertype of all integer properties.
dose equivalent	TypeEnum	
dose equivalent rate	TypeEnum	
dynamic viscosity	TypeEnum	
electric charge	TypeEnum	
electric conductance	TypeEnum	
electric current	TypeEnum	
electric dipole moment	TypeEnum	
electric field strength	TypeEnum	
electric polarization	TypeEnum	
electric potential	TypeEnum	
electrical resistivity	TypeEnum	
electrochemical equivalent	TypeEnum	An electrochemical equivalent differs from molarity in that the valence (oxidation reduction potential) of the element is also considered.
electromagnetic moment	TypeEnum	
energy length per area	TypeEnum	
energy length per time area temperature	TypeEnum	
energy per area	TypeEnum	

Name	Type	Notes
energy per length	TypeEnum	
equivalent per mass	TypeEnum	
equivalent per volume	TypeEnum	
exposure (radioactivity)	TypeEnum	
fault block	TypeEnum	
fluid volume	TypeEnum	Volume of fluid.
force	TypeEnum	
force area	TypeEnum	
force length per length	TypeEnum	
force per force	TypeEnum	A dimensionless quantity where the basis of the ratio is force.
force per length	TypeEnum	
force per volume	TypeEnum	
formation volume factor	TypeEnum	Ratio of volumes at subsurface and surface conditions.
frequency	TypeEnum	
frequency interval	TypeEnum	An octave is a doubling of a frequency.
gamma ray API unit	TypeEnum	This class is defined by the API and is used for units of gamma ray log response.
geologic k	TypeEnum	
heat capacity	TypeEnum	
heat flow rate	TypeEnum	
heat transfer coefficient	TypeEnum	Pressure per velocity area.
illuminance	TypeEnum	
index	TypeEnum	Serial ordering.
irradiance	TypeEnum	
isothermal compressibility	TypeEnum	
kinematic viscosity	TypeEnum	
Lambda Rho	TypeEnum	Product of Lame constant and density, LR.
Lame constant	TypeEnum	Lame constant, Lambda.
length	TypeEnum	
length per length	TypeEnum	A dimensionless quantity where the basis of the ratio is length.
length per temperature	TypeEnum	
length per volume	TypeEnum	
level of power intensity	TypeEnum	
light exposure	TypeEnum	
linear thermal expansion	TypeEnum	
luminance	TypeEnum	
luminous efficacy	TypeEnum	
luminous flux	TypeEnum	

Name	Type	Notes
luminous intensity	TypeEnum	
magnetic dipole moment	TypeEnum	
magnetic field strength	TypeEnum	
magnetic flux	TypeEnum	
magnetic induction	TypeEnum	
magnetic permeability	TypeEnum	
magnetic vector potential	TypeEnum	
mass	TypeEnum	M/L2T
mass attenuation coefficient	TypeEnum	
mass concentration	TypeEnum	A dimensionless quantity where the basis of the ratio is mass.
mass flow rate	TypeEnum	
mass length	TypeEnum	
mass per energy	TypeEnum	
mass per length	TypeEnum	M/L4T
mass per time per area	TypeEnum	
mass per time per length	TypeEnum	
mass per volume per length	TypeEnum	
mobility	TypeEnum	
modulus of compression	TypeEnum	
molar concentration	TypeEnum	The molar concentration of a substance.
molar heat capacity	TypeEnum	
molar volume	TypeEnum	
mole per area	TypeEnum	
mole per time	TypeEnum	
mole per time per area	TypeEnum	
moment of force	TypeEnum	
moment of inertia	TypeEnum	
moment of section	TypeEnum	
momentum	TypeEnum	
Mu Rho	TypeEnum	Product of Shear modulus and density, MR.
net to gross ratio	TypeEnum	Ratio of net rock volume to gross rock volume, NTG.
neutron API unit	TypeEnum	
nonDarcy flow coefficient	TypeEnum	
operations per time	TypeEnum	
parachor	TypeEnum	
per area	TypeEnum	
per electric potential	TypeEnum	

Name	Type	Notes
per force	TypeEnum	
per length	TypeEnum	
per mass	TypeEnum	
per volume	TypeEnum	
permeability length	TypeEnum	
permeability rock	TypeEnum	
permeability thickness	TypeEnum	Product of permeability and thickness.
permeance	TypeEnum	
permittivity	TypeEnum	
pH	TypeEnum	A class that measures the hydrogen ion concentration (acidity).
plane angle	TypeEnum	
Poisson ratio	TypeEnum	Poisson's ratio, Sigma
pore volume	TypeEnum	Volume of the pore space of the rock.
porosity	TypeEnum	Porosity.
potential difference per power drop	TypeEnum	
power	TypeEnum	
power per volume	TypeEnum	
pressure	TypeEnum	
pressure per time	TypeEnum	
pressure squared	TypeEnum	
pressure squared per force time per area	TypeEnum	
pressure time per volume	TypeEnum	
productivity index	TypeEnum	
property multiplier	TypeEnum	Unitless multiplier to apply to any property.
quantity	TypeEnum	The abstract supertype of all floating point properties with a unit of measure.
quantity of light	TypeEnum	
radiance	TypeEnum	
radiant intensity	TypeEnum	
region initialization	TypeEnum	
relative permeability	TypeEnum	Ratio of phase permeability, which is a function of saturation, to the rock permeability.
relative power	TypeEnum	A dimensionless quantity where the basis of the ratio is power.
relative time	TypeEnum	A dimensionless quantity where the basis of the ratio is time.
reluctance	TypeEnum	
resistance	TypeEnum	
resistivity per length	TypeEnum	

Name	Type	Notes
RESQML root property	TypeEnum	The abstract supertype of all properties. This property does not have a parent.
Rock Impedance	TypeEnum	Acoustic impedance, Ip, Is.
rock permeability	TypeEnum	See "permeability rock".
rock volume	TypeEnum	Rock volume.
saturation	TypeEnum	Ratio of phase fluid volume to pore volume
second moment of area	TypeEnum	
shear modulus	TypeEnum	Shear modulus, Mu.
solid angle	TypeEnum	
solution gas-oil ratio	TypeEnum	Ratio of solution gas volume to oil volume at reservoir conditions.
specific activity (of radioactivity)	TypeEnum	
specific energy	TypeEnum	
specific heat capacity	TypeEnum	
specific productivity index	TypeEnum	
specific volume	TypeEnum	
surface density	TypeEnum	
temperature per length	TypeEnum	
temperature per time	TypeEnum	
thermal conductance	TypeEnum	
thermal conductivity	TypeEnum	
thermal diffusivity	TypeEnum	
thermal insulance	TypeEnum	
thermal resistance	TypeEnum	
thermodynamic temperature	TypeEnum	
thickness	TypeEnum	Distance measured in a volume between two surfaces (e.g., geological top boundary and geological bottom boundary of a geological unit).
time	TypeEnum	
time per length	TypeEnum	
time per volume	TypeEnum	
transmissibility	TypeEnum	Volumetric flux per unit area per unit pressure drop for unit viscosity fluid.
unit productivity index	TypeEnum	
unitless	TypeEnum	The abstract supertype of all floating point properties with NO unit of measure. To allow the unit information to be required for all continuous properties, the special unit of measure of "NONE" has been assigned to all children of this class. In addition, the special dimensional class of "0" has been assigned to all children of this class.
vapor oil-gas ratio	TypeEnum	Ratio of oil vapor volume to gas volume at reservoir conditions.

Name	Type	Notes
velocity	TypeEnum	
volume	TypeEnum	
volume flow rate	TypeEnum	
volume length per time	TypeEnum	
volume per area	TypeEnum	
volume per length	TypeEnum	
volume per time per area	TypeEnum	
volume per time per length	TypeEnum	
volume per time per time	TypeEnum	
volume per time per volume	TypeEnum	
volume per volume	TypeEnum	A dimensionless quantity where the basis of the ratio is volume.
volumetric heat transfer coefficient	TypeEnum	
volumetric thermal expansion	TypeEnum	
work	TypeEnum	
Young modulus	TypeEnum	Young's modulus, E.

5.21 StringLookup

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/6/2012 *Last modified:* 11/1/2016
Notes: Defines an element inside a string-to-integer lookup table.

Attributes

Name	Type	Notes
Key	long	The corresponding integer value. This value is used in HDF5 instead of the string value. The value of null integer value must be reserved for NULL. The size of this value is constrained by the size of the format used in HDF5.
Value	String2000	A string value. Output from the lookup table.

Associations

Association		Notes
1..*	**From:** StringTableLookup.Value **To:** StringLookup *Association*	

5.22 StringTableLookup

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/6/2012 *Last modified:* 11/1/2016
Notes: Defines an integer-to-string lookup table, for example, stores facies properties, where a facies index is associated with a facies name. Used for categorical properties, which also may use a double table lookup.

Associations

Association		Notes
1..*	**From:** StringTableLookup.Value **To:** StringLookup *Association*	
	From: StringTableLookup. **To:** AbstractPropertyLookup *Generalization*	

5.23 TimeSetKind

Type: Enumeration *Stereotype:*
Detail: *Created:* 4/3/2014 *Last modified:* 11/1/2016
Notes: Indicates that the collection of properties shares this time relationship, if any.

Attributes

Name	Type	Notes
single time		Indicates that the collection contains only property values associated with a single time index, i.e., time identity can be ascertained from the time index itself, without knowledge of the time.
single time series		Indicates that the collection contains only property values associated with a single time series, so that time identity can be ascertained from the time index itself, without knowledge of the time.
equivalent times		Indicates that the collection of properties is at equivalent times, e.g., a 4D seismic data set and a reservoir simulation model at comparable times. For a more specific relationship, select single time.
not a time set		Indicates that the property collection is not related by time.

6 Geometry

Package: xsd_schemas

Notes: This package contains the classes used to define and exchanged geometry data in RESQML. In general, geometry is attached to a representation with either a finite extent or planes, which are infinite. However, when spatial locations need to be stored for specific elements in a representation, then this information is stored similarly to properties using property points.

6.1 AbstractGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/21/2013 *Last modified:* 11/1/2016
Notes: The base class for all geometric values, which is always associated with a representation.

Associations

Association		Notes
0..1	**From:** AbstractGeometry.TimeIndex **To:** TimeIndex *Association*	
	From: AbstractGeometry.LocalCrs **To:** AbstractLocal3dCrs *Association*	
	From: SinglePointGeometry. **To:** AbstractGeometry *Generalization*	
	From: PatchOfGeometry.Geometry **To:** AbstractGeometry *Association*	
	From: AbstractParametricLineGeometry. **To:** AbstractGeometry *Generalization*	
0..1	**From:** NonSealedContactRepresentationPart.Geometry **To:** AbstractGeometry *Association*	
	From: PointGeometry. **To:** AbstractGeometry *Generalization*	
	From: AbstractPlaneGeometry. **To:** AbstractGeometry *Generalization*	

6.2 AbstractParametricLineArray

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/30/2012 *Last modified:* 11/1/2016
Notes: Defines an array of parametric lines.
The array size is obtained from context. In the current schema, this may be as simple as a 1D array (#Lines=count) or a 2D array #Lines = NIL x NJL for an IJK grid representation.

Associations

Association	Notes
From: Point3dParametricArray.ParametricLines **To:** AbstractParametricLineArray *Association*	
From: ParametricLineFromRepresentationLatticeArray. **To:** AbstractParametricLineArray *Generalization*	
From: ParametricLineArray. **To:** AbstractParametricLineArray *Generalization*	

6.3 AbstractParametricLineGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/27/2013 *Last modified:* 11/1/2016
Notes: The abstract class for defining a single parametric line.

Associations

Association		Notes
	From: AbstractParametricLineGeometry. **To:** AbstractGeometry *Generalization*	
0..1	**From:** WellboreTrajectoryRepresentation.Geometry **To:** AbstractParametricLineGeometry *Association*	
	From: ParametricLineGeometry. **To:** AbstractParametricLineGeometry *Generalization*	
	From: ParametricLineFromRepresentationGeometry. **To:** AbstractParametricLineGeometry *Generalization*	

6.4 AbstractPlaneGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/13/2013 *Last modified:* 11/1/2016
Notes: The abstract class for all geometric values defined by planes.

Associations

Association		Notes
	From: AbstractPlaneGeometry. **To:** AbstractGeometry *Generalization*	
	From: HorizontalPlaneGeometry. **To:** AbstractPlaneGeometry *Generalization*	
1..*	**From:** PlaneSetRepresentation.Planes **To:** AbstractPlaneGeometry *Association*	
	From: TiltedPlaneGeometry. **To:** AbstractPlaneGeometry *Generalization*	

6.5 AbstractPoint3dArray

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/30/2012 *Last modified:* 11/1/2016
Notes: The abstract class of 3D points implemented in a single fashion for the schema. Abstraction allows a variety of instantiations for efficiency or to implicitly provide additional geometric information about a data-object. For example, parametric points can be used to implicitly define a wellbore trajectory using an underlying parametric line, by the specification of the control points along the parametric line.
The dimensionality of the array of 3D points is based on context within an instance.

Associations

Association	Notes
From: Point3dZValueArray. **To:** AbstractPoint3dArray *Generalization*	
From: Point2dHdf5Array. **To:** AbstractPoint3dArray *Generalization*	
From: Point3dFromRepresentationLatticeArray. **To:** AbstractPoint3dArray *Generalization*	
From: Point3dLatticeArray. **To:** AbstractPoint3dArray *Generalization*	
From: Point3dHdf5Array. **To:** AbstractPoint3dArray *Generalization*	
From: Point3dParametricArray. **To:** AbstractPoint3dArray *Generalization*	

6.6 HorizontalPlaneGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/3/2013 *Last modified:* 11/1/2016
Notes: Defines the infinite geometry of a horizontal plane provided by giving its unique Z value.

Attributes

Name	Type	Notes
Coordinate	double	

Associations

Association	Notes
From: HorizontalPlaneGeometry. **To:** AbstractPlaneGeometry *Generalization*	

6.7 ParametricLineArray

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/30/2014 *Last modified:* 11/1/2016
Notes: Defines an array of parametric lines of multiple kinds.
For more information, see the R*ESQML Technical Usage Guide*.

These are the documented parametric line kinds; see additional information below:

0 = vertical

1 = linear spline (piecewise linear)

2 = natural cubic spline

3 = tangential cubic spline

4 = Z linear cubic spline

5 = minimum-curvature spline

null value = no line

In general, a parametric line is unbounded so the interpolant in the first or last interval is used as an extrapolating function.

Special Cases:

(1) Natural cubic splines with only two control points reduce to linear interpolation.

(2) If required but not defined, tangent vectors at a spline knot are calculated from the control point data using a quadratic fit to the control point and the two adjacent control points (if internal) or, if at an edge, by a vanishing second derivative. This calculation reduces locally to a natural spline.

(3) If not expected but provided, then extraneous information is to be ignored, e.g., tangent vectors for linear splines.

Vertical:

(1) Control points are (X,Y,-).

(2) Parameter values are interpreted as depth => (X,Y,Z), where the depth to Z conversion depends on the vertical CRS direction.

Piecewise Linear:

(1) Control points are (P,X,Y,Z).

(2) Piecewise interpolation in (X,Y,Z) as a linear function of P.

Natural Cubic:

(1) Control points are (P,X,Y,Z).

(2) First and second derivatives at each knot are inferred from a quadratic fit to the two adjacent control points, if internal, or, if external knots, by specifying a vanishing second derivative.

Tangential Cubic and Minimum-Curvature.

(1) Control points are (P,X,Y,Z).

(2) Tangent vectors are (P,TX,TY,TZ). Tangent vectors are defined as the derivative of position with respect to the parameter. If the parameter is arc-length, then the tangent vectors are unit vectors, but not otherwise.

(3) Interpolating minimum-curvature basis functions obtained by a circular arc construction. This differs from the "drilling" algorithm in which the parameter must be arc length.

Z Linear Cubic:

(1) (X,Y) follow a natural cubic spline and Z follows a linear spline.

(2) Parametric values cannot be freely chosen but are instead defined to take on the values of 0,,,.N for a line with N intervals, N+1 control points.

(3) On export, to go from Z to P, the RESQML "software writer" first needs to determine the interval and then uses linearity in Z to determine P. For the control points, the P values are 0...N and for values of Z, other than the control points, non-integral values of P arise.

(4) On import, a RESQML "software reader" converts from P to Z using piecewise linear interpolation, and from P to X and Y using natural cubic spline interpolation. Other than the differing treatment of Z from X and Y, these are completely generic interpolation algorithms.

(5) The use of P instead of Z for interpolation allows support for over-turned reservoir structures and removes any apparent discontinuities in parametric derivatives at the spline knots.

Attributes

Name	Type	Notes
ControlPointParameters	AbstractFloatingPointArray	An optional array of explicit control point parameters for all of the control points on each of the parametric lines. Used only if control point parameters are present. The number of explicit control point parameters per line is given by the count of non-null parameters on each line. Described as a 1D array, the control point parameter array is divided into segments of length count, with null (NaN) values added to each segment to fill it up. Size = count x #Lines, e.g., 2D or 3D BUSINESS RULE: This count should be zero for vertical and Z linear cubic parametric lines. For all other parametric line kinds, there should be one control point parameter for each control point. NOTES: (1) Vertical parametric lines do not require control point parameters (2) Z linear cubic splines have implicitly defined parameters. For a line with N intervals (N+1 control points), the parametric values are P=0,...,N. BUSINESS RULE: The parametric values must be strictly monotonically increasing on each parametric line.

Name	Type	Notes
ControlPoints	AbstractPoint3dArray	An array of 3D points for all of the control points on each of the parametric lines. The number of control points per line is given by the KnotCount. Described as a 1D array, the control point array is divided into segments of length KnotCount, with null (NaN) values added to each segment to fill it up. Size = KnotCount x #Lines, e.g., 2D or 3D
KnotCount	PositiveLong	The first dimension of the control point, control point parameter, and tangent vector arrays for the parametric splines. The Knot Count is typically chosen to be the maximum number of control points, parameters or tangent vectors on any parametric line in the array of parametric lines.
LineKindIndices	AbstractIntegerArray	An array of integers indicating the parametric line kind. 0 = vertical 1 = linear spline 2 = natural cubic spline 3 = tangential cubic spline 4 = Z linear cubic spline 5 = minimum-curvature spline null value: no line Size = #Lines, e.g., (1D or 2D)
TangentVectors	AbstractPoint3dArray	An optional array of tangent vectors for all of the control points on each of the tangential cubic and minimum-curvature parametric lines. Used only if tangent vectors are present. The number of tangent vectors per line is given by the KnotCount for these spline types. Described as a 1D array, the tangent vector array is divided into segments of length Knot Count, with null (NaN) values added to each segment to fill it up. Size = Knot Count x #Lines, e.g., 2D or 3D BUSINESS RULE: For all lines other than the cubic and minimum-curvature parametric lines, this array should not appear. For these line kinds, there should be one tangent vector for each control point. If a tangent vector is missing, then it is computed in the same fashion as for a natural cubic spline. Specifically, to obtain the tangent at internal knots, the control points are fit by a quadratic function with the two adjacent control points. At edge knots, the second derivative vanishes.

Associations

Association		Notes
0..1	**From:** ParametricLineArray.ParametricLineIntersections **To:** ParametricLineIntersections *Association*	
	From: ParametricLineArray. **To:** AbstractParametricLineArray *Generalization*	

6.8 ParametricLineFromRepresentationGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 5/16/2014 *Last modified:* 11/1/2016
Notes: The parametric line extracted from an existing representation.

BUSINESS RULE: The supporting representation must have pillars or lines as indexable elements.

Attributes

Name	Type	Notes
LineIndexOnSupportingRepresentation	NonNegativeLong	The line index of the selected line in the supporting representation. For a column-layer grid, the parametric lines follow the indexing of the pillars.

Associations

Association	Notes
From: ParametricLineFromRepresentationGeometry. **To:** AbstractParametricLineGeometry *Generalization*	
From: ParametricLineFromRepresentationGeometry.SupportingRepresentation **To:** AbstractRepresentation *Association*	

6.9 ParametricLineFromRepresentationLatticeArray

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 4/29/2014 *Last modified:* 11/1/2016
Notes: The lattice array of parametric lines extracted from an existing representation.
BUSINESS RULE: The supporting representation must have pillars or lines as indexable elements.

Attributes

Name	Type	Notes
LineIndicesOnSupportingRepresentation	IntegerLatticeArray	The line indices of the selected lines in the supporting representation. The index selection is regularly incremented from one node to the next node. BUSINESS RULE: The dimensions of the integer lattice array must be consistent with the dimensions of the supporting representation. For a column-layer grid, the parametric lines follow the indexing of the pillars. BUSINESS RULE: The start value of the integer lattice array must be the linearized index of the starting line. Example: iStart + ni * jStart in case of a supporting 2D grid.

Associations

Association	Notes
From: ParametricLineFromRepresentationLatticeArray. **To:** AbstractParametricLineArray *Generalization*	
From: ParametricLineFromRepresentationLatticeArray.SupportingRepresentation **To:** AbstractRepresentation *Association*	

6.10 ParametricLineGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 5/16/2014 *Last modified:* 11/1/2016
Notes: Defines a parametric line of any kind.
For more information on the supported parametric lines, see ParametricLineArray.

Attributes

Name	Type	Notes
ControlPointParameters	AbstractFloatingPointArray	An optional array of explicit control point parameters for the control points on the parametric line. Used only if control point parameters are present. NOTES: (1) Vertical parametric lines do not require control point parameters. (2) Z linear cubic splines have implicitly defined parameters. For a line with N intervals (N+1 control points), the parametric values are P=0,...,N. BUSINESS RULE: If present, the size must match the number of control points. BUSINESS RULE: For vertical and Z linear cubic parametric lines, this count must be zero. For all other parametric line kinds, each control point must have one control point parameter. BUSINESS RULE: The parametric values must be strictly monotonically increasing on each parametric line. This is an optional array which should only be used if control point parameters are present. BUSINESS RULE: If present, the size must match the number of control points. BUSINESS RULE: This count should be zero for vertical and Z linear cubic parametric lines. For all other parametric line kinds there should be one control point parameter for each control point. Notes: (1) Vertical parametric lines do not require control point parameters (2) Z linear cubic splines have implicitly defined parameters. For a line with N intervals (N+1 control points), the parametric values are P=0,...,N. BUSINESS RULE: The parametric values must be strictly monotonically increasing on each parametric line.

Name	Type	Notes
ControlPoints	AbstractPoint3dArray	An array of 3D points for the control points on the parametric line.
KnotCount	PositiveLong	Number of spline knots in the parametric line.
LineKindIndex	long	Integer indicating the parametric line kind 0 for vertical 1 for linear spline 2 for natural cubic spline 3 for cubic spline 4 for z linear cubic spline 5 for minimum-curvature spline (-1) for null: no line
TangentVectors	AbstractPoint3dArray	An optional array of tangent vectors for each control point on the cubic and minimum-curvature parametric lines. Used only if tangent vectors are present. If a tangent vector is missing, then it is computed in the same fashion as for a natural cubic spline. Specifically, to obtain the tangent at internal knots, the control points are fit by a quadratic function with the two adjacent control points. At edge knots, the second derivative vanishes.

Associations

Association	Notes
From: ParametricLineGeometry. **To:** AbstractParametricLineGeometry *Generalization*	

6.11 ParametricLineIntersections

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/30/2012 *Last modified:* 11/1/2016
Notes: Used to specify the intersections between parametric lines. This information is purely geometric and is not required for the evaluation of the parametric point locations on these lines. The information required for that purpose is stored in the parametric points array.

Attributes

Name	Type	Notes
Count	PositiveLong	Number of parametric line intersections. Must be positive.
IntersectionLinePairs	AbstractIntegerArray	Intersected line index pair for (line 1, line 2). Size = 2 x count
ParameterValuePairs	AbstractValueArray	Intersected line parameter value pairs for (line 1, line 2). Size = 2 x count

Associations

Association		Notes
0..1	**From:** ParametricLineArray.ParametricLineIntersections **To:** ParametricLineIntersections *Association*	

6.12 Point2dHdf5Array

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/25/2014 *Last modified:* 11/1/2016
Notes: An array of explicit XY points stored as two coordinates in an HDF5 dataset. If needed, the implied Z coordinate is uniformly 0.

Attributes

Name	Type	Notes
Coordinates	ExternalDataset	Reference to an HDF5 2D dataset of XY points. The 2 coordinates are stored sequentially in HDF5, i.e., a multi-dimensional array of points is stored as a 2 x ... HDF5 array.

Associations

Association	Notes
From: Point2dHdf5Array. **To:** AbstractPoint3dArray *Generalization*	

6.13 Point3d

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 5/17/2012 *Last modified:* 11/1/2016
Notes: Defines a point using coordinates in 3D space.

Attributes

Name	Type	Notes
Coordinate1	double	X coordinate
Coordinate2	double	Y coordinate
Coordinate3	double	Either Z or T coordinate

6.14 Point3dFromRepresentationLatticeArray

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/4/2013 *Last modified:* 11/1/2016
Notes: A lattice array of points extracted from an existing representation.
BUSINESS RULE: The supporting representation must have nodes as indexable elements.

Attributes

Name	Type	Notes
NodeIndicesOnSupportingRepresentation	IntegerLatticeArray	The node indices of the selected nodes in the supporting representation. The index selection is regularly incremented from one node to the next node. BUSINESS RULE: The node indices must be consistent with the size of supporting representation.

Associations

Association	Notes
From: Point3dFromRepresentationLatticeArray. **To:** AbstractPoint3dArray *Generalization*	
From: Point3dFromRepresentationLatticeArray.SupportingRepresentation **To:** AbstractRepresentation *Association*	BUSINESS RULE: The target root representation must have nodes as indexable elements.

6.15 Point3dHdf5Array

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/30/2012 *Last modified:* 11/1/2016
Notes: An array of explicit XYZ points stored as three coordinates in an HDF5 dataset.

Attributes

Name	Type	Notes
Coordinates	ExternalDataset	Reference to an HDF5 3D dataset of XYZ points. The 3 coordinates are stored sequentially in HDF5, i.e., a multi-dimensional array of points is stored as a 3 x ... HDF5 array.

Associations

Association	Notes
From: Point3dHdf5Array. **To:** AbstractPoint3dArray *Generalization*	

6.16 Point3dLatticeArray

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/5/2013 *Last modified:* 11/1/2016
Notes: Describes a lattice array of points obtained by sampling from along a multi-dimensional lattice. Each dimension of the lattice can be uniformly or irregularly spaced.

Attributes

Name	Type	Notes
AllDimensionsAreOrthogonal	boolean	The optional element that indicates that the offset vectors for each direction are mutually orthogonal to each other. This meta-information is useful to remove any doubt of orthogonality in case of numerical precision issues. BUSINESS RULE: If you don't know it or if only one lattice dimension is given, do not provide this element.
Origin	Point3d	The origin location of the lattice given as XYZ coordinates.

Associations

Association		Notes
1..*	**From:** Point3dLatticeArray.Offset **To:** Point3dOffset *Association*	Defines one axis of the lattice. The first given axis corresponds to the first dimension/axis of the lattice which is the slowest dimension in I/O operation context, the second given axis corresponds to the second dimension/axis of the lattice which is quicker than the previous dimension, etc.
	From: Point3dLatticeArray. **To:** AbstractPoint3dArray *Generalization*	

6.17 Point3dOffset

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/28/2013 *Last modified:* 11/1/2016
Notes: Defines the size and sampling in each dimension (direction) of the point 3D lattice array. Sampling can be uniform or irregular.

Attributes

Name	Type	Notes
Offset	Point3d	The direction of the axis of this lattice dimension. This is a relative offset vector instead of an absolute 3D point.
Spacing	AbstractFloatingPointArray	A lattice of N offset points is described by a spacing array of size N-1. The offset between points is given by the spacing value multiplied by the offset vector. For example, the first offset is 0. The second offset is the first spacing * offset. The second offset is (first spacing + second spacing) * offset, etc.

Associations

Association	Notes
From: Point3dLatticeArray.Offset 1..* **To:** Point3dOffset *Association*	Defines one axis of the lattice. The first given axis corresponds to the first dimension/axis of the lattice which is the slowest dimension in I/O operation context, the second given axis corresponds to the second dimension/axis of the lattice which is quicker than the previous dimension, etc.

6.18 Point3dParametricArray

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/30/2012 *Last modified:* 11/1/2016
Notes: A parametric specification of an array of XYZ points.

Attributes

Name	Type	Notes
Parameters	AbstractValueArray	A multi-dimensional array of parametric values that implicitly specifies an array of XYZ points. The parametric values provided in this data-object must be consistent with the parametric values specified in the referenced parametric line array. When constructing a column-layer grid geometry using parametric points, the array indexing follows the dimensionality of the coordinate lines x NKL, which is either a 2D or 3D array.
ParametricLineIndices	AbstractIntegerArray	An optional array of indices that map from the array index to the index of the corresponding parametric line. If this information is known from context, then this array is not needed. For example, in either of these cases: (1) If the mapping from array index to parametric line is 1:1. (2) If the mapping has already been specified, as with the pillar Index from the column-layer geometry of a grid. For example, when constructing a column-layer grid geometry using parametric lines, the array indexing follows the dimensionality of the coordinate lines.
TruncatedLineIndices	AbstractIntegerArray	A 2D array of line indices for use with intersecting parametric lines. Each record consists of a single line index, which indicates the array line that uses this truncation information, followed by the parametric line indices for each of the points on that line. For a non-truncated line, the equivalent record repeats the array line index NKL+1 times. Size = (NKL+1) x truncatedLineCount

Associations

Association	Notes
From: Point3dParametricArray. **To:** AbstractPoint3dArray *Generalization*	

Association	Notes
From: Point3dParametricArray.ParametricLines **To:** AbstractParametricLineArray *Association*	

6.19 Point3dZValueArray

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/4/2013 *Last modified:* 11/1/2016
Notes: An array of points defined by applying a Z value on top of an existing array of points, XYZ, where Z is ignored. Used in these cases:

- in 2D for defining geometry of one patch of a 2D grid representation.
- for extracting nodal geometry from one grid representation for use in another.

Attributes

Name	Type	Notes
SupportingGeometry	AbstractPoint3dArray	Geometry defining the X and Y coordinates.
ZValues	AbstractFloatingPointArray	The values for Z coordinates

Associations

Association	Notes
From: Point3dZValueArray. **To:** AbstractPoint3dArray *Generalization*	

6.20 PointGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/5/2012 *Last modified:* 11/1/2016
Notes: The geometry of a set of points defined by their location in the local CRS, with optional seismic coordinates.

Attributes

Name	Type	Notes
Points	AbstractPoint3dArray	

Associations

Association		Notes
0..1	**From:** PointGeometry.SeismicCoordinates **To:** AbstractSeismicCoordinates *Association*	
	From: PointGeometry. **To:** AbstractGeometry *Generalization*	
	From: NodePatch.Geometry **To:** PointGeometry *Association*	
	From: TrianglePatch.Geometry **To:** PointGeometry *Association*	
	From: AbstractGridGeometry. **To:** PointGeometry *Generalization*	
	From: PolylineSetPatch.Geometry **To:** PointGeometry *Association*	
	From: Grid2dPatch.Geometry **To:** PointGeometry *Association*	

6.21 SinglePointGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/9/2014 *Last modified:* 11/1/2016
Notes: The geometry of a single point defined by its location in the local CRS.

Attributes

Name	Type	Notes
Point3d	Point3d	

Associations

Association	Notes
From: SinglePointGeometry. **To:** AbstractGeometry *Generalization*	

6.22 ThreePoint3d

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/6/2013 *Last modified:* 11/1/2016
Notes: List of three 3D points.

Attributes

Name	Type	Notes
Point3d	Point3d	

Associations

Association	Notes
From: TiltedPlaneGeometry.Plane 1..* **To:** ThreePoint3d *Association*	One list of 3 points per tilted plane patch. Because there is no corresponding topology patch on a horizontal plane, the order of the points does not matter.

6.23 TiltedPlaneGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/5/2012 *Last modified:* 11/1/2016
Notes: Describes the geometry of a tilted (or potentially not tilted) plane from three points.

Associations

Association	Notes
From: TiltedPlaneGeometry. **To:** AbstractPlaneGeometry *Generalization*	
1..* **From:** TiltedPlaneGeometry.Plane **To:** ThreePoint3d *Association*	One list of 3 points per tilted plane patch. Because there is no corresponding topology patch on a horizontal plane, the order of the points does not matter.

7 Grids

Package: xsd_schemas

Notes: This package contains classes used to define and exchange grid representations in RESQML.

A grid is a RESQML representation that provides a cellular discretization of space. A grid shares three important characteristics with all other RESQML representations:

A description of the topology (indexing) and geometry of the grid representation.

A grid, or a subrepresentation of a grid, may provide a representation of an interpretation of a RESQML geologic feature, most often an earth model or a structural organization.

Properties may be attached to a grid representation, i.e., a grid supplies the topological support for properties.

RESQML also provides a closely related “grid connection set” representation, which is based on “cell-face-pairs”, for the purpose of describing the connections between grid cells, and a “blocked wellbore” representation to describe wellbore trajectories discretized on a grid.

Although it may seem reasonable to organize grids by the geometry of their cells, industry applications more naturally segregate grids by their topology, i.e., the dimensionality of the indexing of the cells. RESQML follows this approach and supports six distinct grid classes:

Three grid classes are fundamental and will be recognizable to most practitioners.

Three grid classes are combinations of these fundamental classes, and provide support for advanced variations in unstructured grids.

All grids support various extensions, such as higher order cell geometry, although some extensions may only exist for particular classes. For example, only IJK grids support radial grid cell interpolation. The corner point grid supported by many applications is a specific example of an IJK grid, although without all of the extensions now supported in RESQML

For more information, see the Grid chapter in the *RESQML Technical Usage Guide*.

7.1 AbstractColumnLayerGridGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Description of the geometry of a column layer grid, e.g., parity and pinch, together with its supporting topology.

- Column layer grid cell geometry is based upon nodes on coordinate lines.
- Geometry is contained within the representation of a grid.
- Point Geometry is that of the column layer coordinate line nodes. Coordinate line nodes for all of the coordinate lines, with NKL nodes per line.
- The numbering of these lines follow the pillar numbering if no split coordinate lines are present.
- The unsplit coordinate lines share an indexing with the pillars. The numbering of the remaining lines are defined in the columnsPerSplitCoordinateLine list-of-lists if split coordinate lines are present.
- Pillar numbering is either 1D or 2D, so for unfaulted grids, the node dimensions may follow either a 2D or 3D array. Otherwise the nodes will be 2D.
- In HDF5 nodes are stored as separate X, Y, Z, values, so add another dimension (size=3) which is fastest in HDF5.

Attributes

Name	Type	Notes
CellGeometryIsDefined	AbstractBooleanArray	Indicator that a cell has a defined geometry. This attribute is grid metadata. If the indicator shows that the cell geometry is NOT defined, then this attribute overrides any other node geometry specification. Array index is 2D/3D.
KDirection	KDirection	
NodeIsColocatedInKDirection	AbstractBooleanArray	Optional indicator that two adjacent nodes on a coordinate line are colocated. This is considered grid metadata, and is intended to over-ride any geometric comparison of node locations. Array index follows #CoordinateLines x (NKL-1).
NodeIsColocatedOnKEdge	AbstractBooleanArray	Optional indicator that two adjacent nodes on the KEDGE of a cell are colocated. This is considered grid metadata, and is intended to over-ride any geometric comparison of node locations. Array index follows #EdgesPerColumn x NKL for unstructured column layer grids and 4 x NI x NJ x NKL for IJK grids.
PillarGeometryIsDefined	AbstractBooleanArray	Indicator that a pillar has at least one node with a defined cell geometry. This is considered grid metadata. If the indicator does not indicate that the pillar geometry is defined, then this over-rides any other node geometry specification.

Name	Type	Notes
		Array index follows #Pillars and so may be either 2D or 1D.
PillarShape	PillarShape	

Associations

Association	Notes
From: AbstractColumnLayerGridGeometry.ColumnLayerSubnodeTopology 0..1 **To:** ColumnLayerSubnodeTopology *Association*	
From: AbstractColumnLayerGridGeometry.SplitNodePatch 0..1 **To:** SplitNodePatch *Association*	
From: AbstractColumnLayerGridGeometry. **To:** AbstractGridGeometry *Generalization*	
From: AbstractColumnLayerGridGeometry.SplitColumnEdges 0..1 **To:** SplitColumnEdges *Association*	
From: AbstractColumnLayerGridGeometry.ColumnLayerSplitCoordinateLines 0..1 **To:** ColumnLayerSplitCoordinateLines *Association*	
From: UnstructuredColumnLayerGridGeometry. **To:** AbstractColumnLayerGridGeometry *Generalization*	
From: IjkGridGeometry. **To:** AbstractColumnLayerGridGeometry *Generalization*	

7.2 AbstractColumnLayerGridRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/5/2013 *Last modified:* 11/1/2016
Notes: Abstract class that includes IJK grids and unstructured column layer grids. All column layer grids have a layer index K=1,...,NK or K0=0,...,NK-1.
Cell geometry is characterized by nodes on coordinate lines.

Attributes

Name	Type	Notes
Nk	PositiveLong	Number of layers in the grid. Must be positive.

Associations

Association	Notes
From: AbstractColumnLayerGridRepresentation. **To:** AbstractGridRepresentation *Generalization*	
From: UnstructuredColumnLayerGridRepresentation. **To:** AbstractColumnLayerGridRepresentation *Generalization*	
From: ColumnLayerParentWindow.ParentColumnLayerGridRepresentation **To:** AbstractColumnLayerGridRepresentation *Association*	
From: IjkGridRepresentation. **To:** AbstractColumnLayerGridRepresentation *Generalization*	

7.3 AbstractGridGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/23/2014 *Last modified:* 11/1/2016
Notes: Grid geometry described by means of points attached to nodes and additional optional points which may be attached to other indexable elements of the grid representation.

Associations

Association		Notes
0..*	**From:** AbstractGridGeometry.AdditionalGridPoints **To:** AdditionalGridPoints *Association*	
	From: AbstractGridGeometry. **To:** PointGeometry *Generalization*	
	From: AbstractColumnLayerGridGeometry. **To:** AbstractGridGeometry *Generalization*	
	From: UnstructuredGridGeometry. **To:** AbstractGridGeometry *Generalization*	

7.4 AbstractGridRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/31/2013 *Last modified:* 11/1/2016
Notes: Abstract class for all grid representations.

Associations

Association	Notes
From: AbstractGridRepresentation.IntervalStratigraphicUnits 0..1 **To:** IntervalStratigraphicUnits *Association*	
From: AbstractGridRepresentation.CellFluidPhaseUnits 0..1 **To:** CellFluidPhaseUnits *Association*	
From: AbstractGridRepresentation.ParentWindow 0..1 **To:** AbstractParentWindow *Association*	
From: AbstractGridRepresentation. **To:** AbstractRepresentation *Generalization*	
From: <anonymous>. **To:** AbstractGridRepresentation *NoteLink*	
From: LocalGridSet.ChildGrid 1..* **To:** AbstractGridRepresentation *Association*	
From: Seismic3dPostStackRepresentation. **To:** AbstractGridRepresentation *Generalization*	
From: UnstructuredGridRepresentation. **To:** AbstractGridRepresentation *Generalization*	
From: AlternateCellIndex.OriginalGrids 1..* **To:** AbstractGridRepresentation *Association*	
From: IntervalGridCells.Grid 1..* **To:** AbstractGridRepresentation *Association*	
From: AbstractTruncatedColumnLayerGridRepresentation. **To:** AbstractGridRepresentation *Generalization*	
From: GridConnectionSetRepresentation.Grid 1..* **To:** AbstractGridRepresentation *Association*	
From: AbstractColumnLayerGridRepresentation. **To:** AbstractGridRepresentation *Generalization*	
From: GpGridRepresentation. **To:** AbstractGridRepresentation *Generalization*	

Association	Notes
From: CellParentWindow.ParentGridRepresentation **To:** AbstractGridRepresentation *Association*	

7.5 AbstractParentWindow

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/21/2013 *Last modified:* 11/1/2016
Notes: Parent window specification, organized according to the topology of the parent grid. In addition to a window specification, for grids with I, J, and/or K coordinates, the parentage construction includes a regridding description that covers grid refinement, coarsening, or any combination of the two.

Associations

Association		Notes
0..1	**From:** AbstractParentWindow.CellOverlap **To:** CellOverlap *Association*	
	From: IjkParentWindow. **To:** AbstractParentWindow *Generalization*	
0..1	**From:** AbstractGridRepresentation.ParentWindow **To:** AbstractParentWindow *Association*	
	From: ColumnLayerParentWindow. **To:** AbstractParentWindow *Generalization*	
	From: CellParentWindow. **To:** AbstractParentWindow *Generalization*	

7.6 AbstractTruncatedColumnLayerGridRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/12/2013 *Last modified:* 11/1/2016
Notes: Abstract class for truncated IJK grids and truncated unstructured column layer grids. Each column layer grid class must have a defined geometry in which cells are truncated and additional split cells are defined.

Attributes

Name	Type	Notes
Nk	PositiveLong	Number of layers in the grid. Must be positive.

Associations

Association	Notes
From: AbstractTruncatedColumnLayerGridRepresentation.TruncationCellPatch **To:** TruncationCellPatch *Association*	
From: AbstractTruncatedColumnLayerGridRepresentation. **To:** AbstractGridRepresentation *Generalization*	
From: TruncatedUnstructuredColumnLayerGridRepresentation. **To:** AbstractTruncatedColumnLayerGridRepresentation *Generalization*	
From: TruncatedIjkGridRepresentation. **To:** AbstractTruncatedColumnLayerGridRepresentation *Generalization*	

7.7 Activation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/11/2014 *Last modified:* 11/1/2016
Notes: Used to activate and deactivate the referencing object at the times indicated.

- If the activation object is not present, then the referencing object is always active.
- If the activation object is present, then the referencing object is not active until activated.

- *Attributes*

Name	Type	Notes
ActivationToggleIndices	AbstractIntegerArray	The index in the time series at which the state of the referencing object is changed. Toggle changes state from inactive to active, or toggle changes state from active to inactive.

Associations

Association		Notes
	From: Activation.TimeSeries **To:** TimeSeries *Association*	
0..1	**From:** LocalGridSet.Activation **To:** Activation *Association*	

7.8 AdditionalGridPoints

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/30/2013 *Last modified:* 11/1/2016
Notes: Geometry given by means of points attached to additional elements of a grid.

Attributes

Name	Type	Notes
Attachment	GridGeometryAttachment	
Points	AbstractPoint3dArray	
RepresentationPatchIndex	NonNegativeLong	Used to remove ambiguity in geometry attachment, if the attachment element is not sufficient. Usually required for subnodes and for the general purpose grid, but not otherwise.

Associations

Association		Notes
0..*	**From:** AbstractGridGeometry.AdditionalGridPoints **To:** AdditionalGridPoints *Association*	

7.9 AdditionalGridTopology

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/2/2013 *Last modified:* 11/1/2016
Notes: Additional grid topology and/or patches, if required, for indexable elements that otherwise do not have their topology defined within the grid representation. For example, column edges need to be defined if you want to have an enumeration for the faces of a column layer grid, but not otherwise.

Associations

Association	Notes
0..1 **From:** AdditionalGridTopology.SplitNodePatch **To:** SplitNodePatch *Association*	
0..1 **From:** AdditionalGridTopology.SplitEdges **To:** SplitEdges *Association*	
0..1 **From:** AdditionalGridTopology.SplitColumnEdges **To:** SplitColumnEdges *Association*	
0..1 **From:** AdditionalGridTopology.UnstructuredColumnEdges **To:** UnstructuredColumnEdges *Association*	
0..1 **From:** AdditionalGridTopology.ColumnLayerSubnodeTopology **To:** ColumnLayerSubnodeTopology *Association*	
0..1 **From:** AdditionalGridTopology.SplitFaces **To:** SplitFaces *Association*	
0..1 **From:** AdditionalGridTopology.UnstructuredSubnodeTopology **To:** UnstructuredSubnodeTopology *Association*	
0..1 **From:** RepresentationIdentity.AdditionalGridTopology **To:** AdditionalGridTopology *Association*	
0..1 **From:** SubRepresentation.AdditionalGridTopology **To:** AdditionalGridTopology *Association*	

7.10 AlternateCellIndex

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/29/2016 *Last modified:* 11/1/2016
Notes: Allows definition of an alternate cell indexing for a representation. If defined, this alternate cell indexing is the only one to rely on when referencing the representation cells. The alternate cell indices must come from existing grid representations. Because this alternate indexing requires a lot of extra work for software readers to process, use only when no other solution is acceptable.

Attributes

Name	Type	Notes
CellIndex	AbstractIntegerArray	Defines each alternate cell index for each representation cell. BUSINESS RULE :CellIndex.Count = GridIndex.Count = Representation.Cell.Count
GridIndex	AbstractIntegerArray	Defines which grid each alternate cell index comes from. The grids are defined by means of an index of the OriginalGrids set. BUSINESS RULE : GridIndex.Count = CellIndex.Count = Representation.Cell.Count

Associations

Association	Notes
From: AlternateCellIndex.OriginalGrids 1..* **To:** AbstractGridRepresentation *Association*	
From: UnstructuredGridRepresentation.OriginalCellIndex 0..1 **To:** AlternateCellIndex *Association*	

7.11 CellFluidPhaseUnits

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/13/2014 *Last modified:* 11/1/2016
Notes: A mapping from cells to fluid phase unit interpretation to describe the initial hydrostatic fluid column.

Attributes

Name	Type	Notes
PhaseUnitIndices	JaggedArray	Index of the phase unit kind within a given fluid phase organization for each cell. Follows the indexing defined by the PhaseUnit enumeration. When applied to the wellbore frame representation, the indexing is identical to the number of intervals. Since a single cell or interval may corresponds to several units, the mapping is done using a jagged array. Use null value if no fluid phase is present, e.g., within the seal. BUSINESS RULE: Array length is equal to the number of cells in the representation (grid, wellbore frame or blocked well).

Associations

Association	Notes
From: CellFluidPhaseUnits.RockFluidOrganizationInterpretation **To:** RockFluidOrganizationInterpretation *Association*	
From: WellboreFrameRepresentation.CellFluidPhaseUnits 0..1 **To:** CellFluidPhaseUnits *Association*	
From: AbstractGridRepresentation.CellFluidPhaseUnits 0..1 **To:** CellFluidPhaseUnits *Association*	

7.12 CellOverlap

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/4/2013 *Last modified:* 11/1/2016
Notes: Optional cell volume overlap information between the current grid (the child) and the parent grid. Use this data-object when the child grid has an explicitly defined geometry, and these relationships cannot be inferred from the regrid descriptions.

Attributes

Name	Type	Notes
Count	PositiveLong	Number of parent-child cell overlaps. Must be positive.
ParentChildCellPairs	AbstractIntegerArray	(Parent cell index, child cell index) pair for each overlap. BUSINESS RULE: Length of array must equal 2 x overlapCount.

Associations

Association		Notes
0..1	**From:** CellOverlap.OverlapVolume **To:** OverlapVolume *Association*	
0..1	**From:** AbstractParentWindow.CellOverlap **To:** CellOverlap *Association*	

7.13 CellParentWindow

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Parent window for ANY grid indexed as if it were an unstructured cell grid, i.e., using a 1D index.

Attributes

Name	Type	Notes
CellIndices	AbstractIntegerArray	Cell indices that list the cells in the parent window. BUSINESS RULE: Number of cells must be consistent with the child grid cell count.

Associations

Association	Notes
From: CellParentWindow. **To:** AbstractParentWindow *Generalization*	
From: CellParentWindow.ParentGridRepresentation **To:** AbstractGridRepresentation *Association*	

7.14 CellShape

Type: Enumeration *Stereotype:*
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Used to indicate that all cells are of a uniform topology, i.e., have the same number of nodes per cell. This information is supplied by the RESQML writer to indicate the complexity of the grid geometry, as an aide to the RESQML reader.
If a specific cell shape is not appropriate, then use polyhedral.

BUSINESS RULE: Should be consistent with the actual geometry of the grid.

Attributes

Name	Type	Notes
tetrahedral	External Reference	All grid cells are constrained to have only 4 nodes/cell with 4 faces/cell, 3 nodes/face, 4 nodes/cell for all cells (degeneracy allowed).
pyramidal	External Reference	All grid cells are constrained to have only 5 nodes/cell with 5 faces/cell, with 1 quadrilateral face and 4 triangular faces.
prism	External Reference	All grid cells are constrained to have 6 nodes/cell with 5 faces/cell, with 3 quadrilateral faces and 2 non-adjacent triangular faces, as in a column layer grid with triangular columns.
hexahedral	External Reference	All grid cells are constrained to have 8 nodes/cell with 6 faces/cell, 4 nodes/face, 8 nodes/cell for all cells (degeneracy allowed). Equivalent to IJK grid cells.
polyhedral	External Reference	If the cell geometry is not of a more specific kind, use polyhedral.

7.15 ColumnLayerGpGrid

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/3/2013 *Last modified:* 11/1/2016
Notes: Used to construct a column layer grid patch based upon multiple unstructured column-layer and IJK grids that share a layering scheme.
Multiple patches are supported.

Attributes

Name	Type	Notes
Nk	NonNegativeLong	Number of layers. Degenerate case (nk=0) is allowed for GPGrid.

Associations

Association		Notes
0..*	**From:** ColumnLayerGpGrid.IjkGpGridPatch **To:** IjkGpGridPatch *Association*	
0..1	**From:** ColumnLayerGpGrid.KGaps **To:** KGaps *Association*	
0..*	**From:** ColumnLayerGpGrid.UnstructuredColumnLayerGpGridPatch **To:** UnstructuredColumnLayerGpGridPatch *Association*	
0..*	**From:** GpGridRepresentation.ColumnLayerGpGrid **To:** ColumnLayerGpGrid *Association*	

7.16 ColumnLayerParentWindow

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Parent window for any column-layer grid indexed as if it were an unstructured column layer grid, i.e., IJ columns are replaced by a column index.

Attributes

Name	Type	Notes
ColumnIndices	AbstractIntegerArray	Column indices that list the columns in the parent window. BUSINESS RULE: Number of columns must be consistent with the child grid column count.
OmitParentCells	AbstractIntegerArray	List of parent cells that are to be retained at their original resolution and are not to be included within a local grid. The "omit" allows non-rectangular local grids to be specified. 0-based indexing follows #Columns x #Layers relative to the parent window cell count, not to the parent grid.

Associations

Association	Notes
From: ColumnLayerParentWindow.ParentColumnLayerGridRepresentation **To:** AbstractColumnLayerGridRepresentation *Association*	
From: ColumnLayerParentWindow.KRegrid **To:** Regrid *Association*	
From: ColumnLayerParentWindow. **To:** AbstractParentWindow *Generalization*	

7.17 ColumnLayerSplitCoordinateLines

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Definition of the indexing for the split coordinate lines. When present, this indexing contributes to the coordinate line nodes.

Attributes

Name	Type	Notes
ColumnsPerSplitCoordinateLine	JaggedArray	Column indices for each of the split coordinate lines. Used to implicitly define column and cell geometry. List-of-lists construction used to support shared coordinate lines.
Count	PositiveLong	Number of split coordinate lines. The count must be positive.
PillarIndices	AbstractIntegerArray	Pillar index for each split coordinate line. Length of this array is equal to the number of split coordinate lines. For the first pillarCount lines, the index of the coordinate line equals the index of the corresponding pillar. This array provides the pillar indices for the additional (split) coordinate lines. Used to implicitly define column and cell geometry.

Associations

Association	Notes
From: AbstractColumnLayerGridGeometry.ColumnLayerSplitCoordinateLines 0..1 **To:** ColumnLayerSplitCoordinateLines *Association*	

7.18 ColumnLayerSubnodeTopology

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/22/2013 *Last modified:* 11/1/2016
Notes: This data-object consists of the unstructured cell finite elements subnode topology plus the column subnodes.

Associations

Association	Notes
From: ColumnLayerSubnodeTopology. **To:** SubnodeTopology *Generalization*	
From: ColumnLayerSubnodeTopology.ColumnSubnodePatch 0..* **To:** ColumnSubnodePatch *Association*	
From: AbstractColumnLayerGridGeometry.ColumnLayerSubnodeTopology 0..1 **To:** ColumnLayerSubnodeTopology *Association*	
From: AdditionalGridTopology.ColumnLayerSubnodeTopology 0..1 **To:** ColumnLayerSubnodeTopology *Association*	

7.19 ColumnShape

Type: Enumeration *Stereotype:*
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Used to indicate that all columns are of a uniform topology, i.e., have the same number of faces per column. This information is supplied by the RESQML writer to indicate the complexity of the grid geometry, as an aide to the RESQML reader.
If a specific column shape is not appropriate, then use polygonal.

BUSINESS RULE: Should be consistent with the actual geometry of the grid.

Attributes

Name	Type	Notes
triangular	External Reference	All grid columns have 3 sides.
quadrilateral	External Reference	All grid columns have 4 sides. Includes tartan and corner point grids.
polygonal	External Reference	At least one grid column is a polygon, N>4.

7.20 ColumnSubnodePatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/14/2013 *Last modified:* 11/1/2016
Notes: Use this subnode construction if the number of subnodes per object varies from column to column, but does not vary from layer to layer.

Attributes

Name	Type	Notes
SubnodeCountPerObject	AbstractIntegerArray	Number of subnodes per object, with a different number in each column of the grid.

Associations

Association	Notes
From: ColumnSubnodePatch. **To:** SubnodePatch *Generalization*	
From: ColumnLayerSubnodeTopology.ColumnSubnodePatch 0..* **To:** ColumnSubnodePatch *Association*	

7.21 ConnectionInterpretations

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 7/24/2014 *Last modified:* 11/1/2016
Notes: For each connection in the grid connection set representation, zero, one or more feature-interpretations. The use of a jagged array allows multiple interpretations for each connection, e.g., to represent multiple faults discretized onto a single connection. Note: Feature-interpretations are not restricted to faults, so that a connection may also represent a horizon or geobody boundary, for example.

Attributes

Name	Type	Notes
InterpretationIndices	JaggedArray	Indices for the interpretations for each connection, if any. The use of a RESQML jagged array allows zero or more than one interpretation to be associated with a single connection.

Associations

Association		Notes
1..*	**From:** ConnectionInterpretations.FeatureInterpretation **To:** AbstractFeatureInterpretation *Association*	
0..1	**From:** GridConnectionSetRepresentation.ConnectionInterpretations **To:** ConnectionInterpretations *Association*	

7.22 Edges

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/11/2013 *Last modified:* 11/1/2016
Notes: Unstructured cell grids require the definition of edges if the subnode attachment is of kind edges. Use Case: Finite elements, especially for higher order geometry.

BUSINESS RULE: Edges must be defined for unstructured cell grids if subnode nodes of kind edges are used.

Attributes

Name	Type	Notes
Count	PositiveLong	Number of edges. Must be positive.
NodesPerEdge	AbstractIntegerArray	Defines a list of 2 nodes per edge. Count = 2 x EdgeCount

Associations

Association		Notes
0..1	**From:** UnstructuredSubnodeTopology.Edges **To:** Edges *Association*	

7.23 GpGridRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/5/2013 *Last modified:* 11/1/2016
Notes: General purpose (GP) grid representation, which includes and/or extends the features from all other grid representations. This general purpose representation is included in the schema for research and/or advanced modeling purposes, but is not expected to be used for routine data transfer.

Associations

Association		Notes
0..*	**From:** GpGridRepresentation.ColumnLayerGpGrid **To:** ColumnLayerGpGrid *Association*	
	From: GpGridRepresentation. **To:** AbstractGridRepresentation *Generalization*	
0..*	**From:** GpGridRepresentation.UnstructuredGpGridPatch **To:** UnstructuredGpGridPatch *Association*	

7.24 GridConnectionSetRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/18/2013 *Last modified:* 11/1/2016
Notes: Representation that consists of a list of connections between grid cells, potentially on different grids.
Connections are in the form of (Grid,Cell,Face)1<=>(Grid,Cell,Face)2 and are stored as three integer pair arrays corresponding to these six elements.

Grid connection sets are the preferred means of representing faults on a grid. The use of cell-face-pairs is more complete than single cell-faces, which are missing a corresponding cell face entry, and only provide an incomplete representation of the topology of a fault.

Unlike what is sometimes the case in reservoir simulation software, RESQML does not distinguish between standard and non-standard connections.

Within RESQML, if a grid connection corresponds to a "nearest neighbor" as defined by the cell indices, then it is never additive to the implicit nearest neighbor connection.

BUSINESS RULE: A single cell-face-pair should not appear within more than a single grid connection set. This rule is designed to simplify the interpretation of properties assigned to multiple grid connection sets, which might otherwise have the same property defined more than once on a single connection, with no clear means of resolving the multiple values.

Attributes

Name	Type	Notes
CellIndexPairs	AbstractIntegerArray	2 x #Connections array of cell indices for (Cell1,Cell2) for each connection.
Count	PositiveLong	count of connections. Must be positive.
GridIndexPairs	AbstractIntegerArray	2 x #Connections array of grid indices for (Cell1,Cell2) for each connection. The grid indices are obtained from the grid index pairs. If only a single grid is referenced from the grid index, then this array need not be used. BUSINESS RULE: If more than one grid index pair is referenced, then this array should appear.
LocalFacePerCellIndexPairs	AbstractIntegerArray	Optional 2 x #Connections array of local face-per-cell indices for (Cell1,Cell2) for each connection. Local face-per-cell indices are used because global face indices need not have been defined. If no face-per-cell definition occurs as part of the grid representation, e.g., for a block-centered grid, then this array need not appear.

Associations

Association	Notes
From: GridConnectionSetRepresentation.ConnectionInterpretations 0..1 **To:** ConnectionInterpretations *Association*	

Association		Notes
	From: GridConnectionSetRepresentation. **To:** AbstractRepresentation *Generalization*	
1..*	**From:** GridConnectionSetRepresentation.Grid **To:** AbstractGridRepresentation *Association*	

7.25 GridGeometryAttachment

Type: Enumeration *Stereotype:*
Detail: *Created:* 11/19/2013 *Last modified:* 11/1/2016
Notes: Indexable grid elements to which point geometry may be attached to describe additional grid geometry.

Attributes

Name	Type	Notes
cells	External Reference	Geometry may be attached to cells to distort the geometry of that specific cell, only (finite element grid).
edges	External Reference	Geometry may be attached to edges to distort the geometry of all cells that refer to that edge (finite element grid). BUSINESS RULE: The edges indexing must be known or defined in the grid representation if geometry is attached to the edges.
faces	External Reference	Geometry may be attached to faces to distort the geometry of all cells that refer to that face (finite element grid). BUSINESS RULE: The faces indexing must be known or defined in the grid representation if geometry is attached to the faces.
hinge node faces	External Reference	For column layer grids, these are the K faces. For unstructured grids these faces are enumerated as the hinge node faces.
nodes	External Reference	Additional grid geometry may be attached to split or truncated node patches for column layer grids. All other node geometry attachment should be done through the Points array of the AbstractGridGeometry, not through the additional grid geometry.
radial origin polyline	External Reference	NKL points must be attached to the radial origin polyline for a grid with radial interpolation. BUSINESS RULE: The optional radialGridIsComplete element must be defined in the grid representation if geometry is attached to the radial origin polyline.
subnodes	External Reference	Geometry may be attached to subnodes to distort the geometry of all cells that refer to that subnode (finite element grid). BUSINESS RULE: An optional subnode patch object must be defined in the grid representation if geometry is attached to the subnodes.

7.26 IjGaps

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Optional object used to indicate that adjacent columns of the model are split from each other, which is modeled by introducing additional (split) pillars.
Use the ColumnLayerSplitColumnEdges object to specify the numbering of the additional column edges generated by the IJ Gaps.

Attributes

Name	Type	Notes
ColumnsPerSplitPillar	JaggedArray	List of columns for each of the split pillars. This information is used to infer the grid cell geometry. BUSINESS RULE: The length of the first list-of-lists array must match the splitPillarCount.
ParentPillarIndices	AbstractIntegerArray	Parent pillar index for each of the split pillars. This information is used to infer the grid cell geometry. BUSINESS RULE: Array length must match splitPillarCount.
SplitPillarCount	PositiveLong	Number of split pillars in the model. Count must be positive.

Associations

Association		Notes
0..1	**From:** IjkGridGeometry.IjGaps **To:** IjGaps *Association*	

7.27 IjkGpGridPatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/3/2013 *Last modified:* 11/1/2016
Notes: Used to specify IJK grid patch(es) within a general purpose grid. Multiple patches are supported.

Attributes

Name	Type	Notes
Ni	NonNegativeLong	Count of I indices. Degenerate case (ni=0) is allowed for GPGrid representations.
Nj	NonNegativeLong	Count of J indices. Degenerate case (nj=0) is allowed for GPGrid representations.
RadialGridIsComplete	boolean	TRUE if the grid is periodic in J, i.e., has the topology of a complete 360 degree circle. If TRUE, then NJL=NJ. Otherwise, NJL=NJ+1

Associations

Association		Notes
	From: IjkGpGridPatch. **To:** Patch *Generalization*	
0..1	**From:** IjkGpGridPatch.TruncationCellPatch **To:** TruncationCellPatch *Association*	
0..1	**From:** IjkGpGridPatch.Geometry **To:** IjkGridGeometry *Association*	
0..*	**From:** ColumnLayerGpGrid.IjkGpGridPatch **To:** IjkGpGridPatch *Association*	

7.28 IjkGridGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/18/2013 *Last modified:* 11/1/2016
Notes: Explicit geometry definition for the cells of the IJK grid. Grid options are also defined through this data-object.

Attributes

Name	Type	Notes
GridIsRighthanded	boolean	Indicates that the IJK grid is right handed, as determined by the triple product of tangent vectors in the I, J, and K directions.

Associations

Association		Notes
0..1	**From:** IjkGridGeometry.IjGaps **To:** IjGaps *Association*	
	From: IjkGridGeometry. **To:** AbstractColumnLayerGridGeometry *Generalization*	
	From: TruncatedIjkGridRepresentation.Geometry **To:** IjkGridGeometry *Association*	
0..1	**From:** IjkGridRepresentation.Geometry **To:** IjkGridGeometry *Association*	
0..1	**From:** IjkGpGridPatch.Geometry **To:** IjkGridGeometry *Association*	

7.29 IjkGridRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/5/2013 *Last modified:* 11/1/2016
Notes: Grid whose topology is characterized by structured column indices (I,J) and a layer index, K.

Cell geometry is characterized by nodes on coordinate lines, where each column of the model has 4 sides. Geometric degeneracy is permitted.

IJK grids support the following specific extensions:

- IJK radial grids
- K-Layer gaps
- IJ-Column gaps

•

Attributes

Name	Type	Notes
Ni	PositiveLong	Count of cells in the I-direction in the grid. Must be positive. I=1,...,NI, I0=0,...,NI-1.
Nj	PositiveLong	Count of cells in the J-direction in the grid. Must be positive. J=1,...,NJ, J0=0,...,NJ-1.
RadialGridIsComplete	boolean	TRUE if the grid is periodic in J, i.e., has the topology of a complete 360 degree circle. If TRUE, then NJL=NJ. Otherwise, NJL=NJ+1 May be used to change the grid topology for either a Cartesian or a radial grid, although radial grid usage is by far the more common.

Associations

Association	Notes
0..1 **From:** IjkGridRepresentation.KGaps **To:** KGaps *Association*	
0..1 **From:** IjkGridRepresentation.Geometry **To:** IjkGridGeometry *Association*	
From: IjkGridRepresentation. **To:** AbstractColumnLayerGridRepresentation *Generalization*	
From: IjkParentWindow.ParentIjkGridRepresentation **To:** IjkGridRepresentation *Association*	

7.30 IjkIndexableElements

Type: Enumeration *Stereotype:*
Detail: *Created:* 9/22/2013 *Last modified:* 11/1/2016
Notes: Indexable elements for IJK grids and patches.

Attributes

Name	Type	Notes
cells	External Reference	Count = NI x NJ x NK
column edges	External Reference	Count = NIL*NJ + NI*NJL + #SplitColumnEdges
columns	External Reference	Count = NI x NJ = #Columns = columnCount
coordinate lines	External Reference	Count = #CoordinateLines = #Pillars + #SplitCoordinateLines
edges	External Reference	Count = #Edges = edgeCount
edges per column	External Reference	Ordered list of edges, specified (local) to a column = 0...3
faces	External Reference	Count = #Faces = #KFaces + #ColumnEdges x NK + #SplitFaces
faces per cell	External Reference	Ordered list of faces, specified (local) to a cell = 0...5
hinge node faces	External Reference	Count = NI x NJ x NKL (K faces)
interval edges	External Reference	Count = NKL = NK + gapCount + 1
intervals	External Reference	Count = NK + gapCount
I0	External Reference	Count = NI
I0 edges	External Reference	Count = NIL = NI+1
J0	External Reference	Count = NJ
J0 edges	External Reference	Count = NJL = NJ or NJ+1
layers	External Reference	Count = NK
nodes	External Reference	Count = #Nodes = #CoordinateLines x NKL
nodes per cell	External Reference	Ordered list of nodes, specified (local) to a cell = 0...7
nodes per edge	External Reference	Ordered list of nodes, specified (local) to an edge, 2 x edgeCount
nodes per face	External Reference	Ordered list of nodes, specified (local) to a face = 0...3
pillars	External Reference	Count = #Pillars = NIL x NJL + #SplitPillars
radial origin polyline	External Reference	Count = NKL
subnodes	External Reference	Count specified per subnode patch

7.31 IjkParentWindow

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Parent window for any IJK grid.

Attributes

Name	Type	Notes
OmitParentCells	AbstractIntegerArray	List of parent cells that are to be retained at their original resolution and are not to be included within a local grid. The "omit" allows non-rectangular local grids to be specified. 0-based indexing follows NI x NJ x NK relative to the parent window cell count—not to the parent grid.

Associations

Association	Notes
From: IjkParentWindow.ParentIjkGridRepresentation **To:** IjkGridRepresentation *Association*	
From: IjkParentWindow. **To:** AbstractParentWindow *Generalization*	
From: IjkParentWindow.KRegrid **To:** Regrid *Association*	
From: IjkParentWindow.IRegrid **To:** Regrid *Association*	
From: IjkParentWindow.JRegrid **To:** Regrid *Association*	

7.32 IntervalGridCells

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/12/2014 *Last modified:* 11/1/2016
Notes: Specifies the (Grid,Cell) intersection of each interval of the representation, if any.
The information allows you to locate, on one or several grids, the intersection of volume (cells) and surface (faces) elements with a wellbore trajectory (existing or planned), streamline trajectories, or any polyline set.

Attributes

Name	Type	Notes
CellCount	PositiveLong	The number of non-null entries in the grid indices array.
CellIndices	AbstractIntegerArray	The cell index for each interval of a representation. The grid index is specified by grid index array, to give the (Grid,Cell) index pair. BUSINESS RULE: Array length must equal cell count.
GridIndices	AbstractIntegerArray	Size of array = IntervalCount. Null values signify that interval is not within a grid. BUSINESS RULE: The cell count must equal the number of non-null entries in this array.
LocalFacePairPerCellIndices	AbstractIntegerArray	For each cell, these are the entry and exit intersection faces of the trajectory in the cell. Use null for missing intersections, e.g., when a trajectory originates or terminates within a cell. The local face-per-cell index is used because a global face index need not have been defined on the grid. BUSINESS RULE: The array dimensions must equal 2 x CellCount.

Associations

Association	Notes
1..* **From:** IntervalGridCells.Grid **To:** AbstractGridRepresentation *Association*	
From: BlockedWellboreRepresentation.IntervalGridCells **To:** IntervalGridCells *Association*	Reference to the intersected grid.
0..1 **From:** PolylineSetPatch.IntervalGridCells **To:** IntervalGridCells *Association*	

7.33 Intervals

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 5/21/2014 *Last modified:* 11/1/2016
Notes: Refinement and/or coarsening per interval.
If there is a 1:1 correspondence between the parent and child cells, then this object is not needed.

Attributes

Name	Type	Notes
ChildCellWeights	AbstractFloatingPointArray	Weights that are proportional to the relative sizes of child cells within each interval. The weights need not be normalized.
ChildCountPerInterval	AbstractIntegerArray	The number of child cells in each interval. If the child grid type is not commensurate with the parent type, then this attribute is ignored by a reader and its value should be set to null value. For example, for a parent IJK grid with a child unstructured column-layer grid, then the child count is non-null for a K regrid, but null for an I or J regrid. BUSINESS RULES: 1.) The array length must be equal to intervalCount. 2.) If the child grid type is commensurate with the parent grid, then the sum of values over all intervals must be equal to the corresponding child grid dimension.
IntervalCount	PositiveLong	The number of intervals in the regrid description. Must be positive.
ParentCountPerInterval	AbstractIntegerArray	The number of parent cells in each interval. BUSINESS RULES: 1.) The array length must be equal to intervalCount. 2.) For the given parentIndex, the total count of parent cells should not extend beyond the boundary of the parent grid.

Associations

Association	Notes
From: Regrid.Intervals 0..1 **To:** Intervals *Association*	

7.34 IntervalStratigraphicUnits

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/13/2014 *Last modified:* 11/1/2016
Notes: A mapping from intervals to stratigraphic units for representations (grids or wellbore frames). Since a single interval may corresponds to several units, the mapping is done using a jagged array.

Attributes

Name	Type	Notes

UnitIndices	JaggedArray	Index of the stratigraphic unit per interval, of a given stratigraphic column.
		
		Notes:
		1.) For grids:
		if it does not exist a property kind "geologic k" attached to the grid then
		intervals = layers + K gaps
		else
		intervals = values property of property kind "geologic k"
		2.) If there is no stratigraphic column, e.g., within salt, use null value
		
		BUSINESS RULE: Array length must equal the number of intervals.

Associations

Association	Notes
From: IntervalStratigraphicUnits.StratigraphicOrganizationInterpretation **To:** AbstractStratigraphicOrganizationInterpretation *Association*	
From: AbstractGridRepresentation.IntervalStratigraphicUnits 0..1 **To:** IntervalStratigraphicUnits *Association*	
From: WellboreFrameRepresentation.IntervalStratigraphiUnits 0..* **To:** IntervalStratigraphicUnits *Association*	

7.35 KDirection

Type: Enumeration *Stereotype:*
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Enumeration used to specify if the direction of the coordinate lines is uniquely defined for a grid. If not uniquely defined, e.g., for over-turned reservoirs, then indicate that the K direction is not monotonic.

Attributes

Name	Type	Notes
down	External Reference	K is increasing with depth, dot(tangent,gradDepth)>0.
up	External Reference	K is increasing with elevation, dot(tangent,gradDepth)<0.
not monotonic	External Reference	K is not monotonic with elevation, e.g., for over-turned structures.

7.36 KGaps

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Optional data-object used to indicate that there are global gaps between layers in the grid. With K gaps, the bottom of one layer need not be continuous with the top of the next layer, so the resulting number of intervals is greater than the number of layers.

Attributes

Name	Type	Notes
Count	PositiveLong	Number of gaps between layers. Must be positive. Number of intervals = gapCount + NK.
GapAfterLayer	AbstractBooleanArray	Boolean array of length NK-1. TRUE if there is a gap after the corresponding layer. NKL = NK + gapCount + 1 BUSINESS RULE: gapCount must be consistent with the number of gaps specified by the gapAfterLayer array.

Associations

Association		Notes
0..1	**From:** ColumnLayerGpGrid.KGaps **To:** KGaps *Association*	
0..1	**From:** IjkGridRepresentation.KGaps **To:** KGaps *Association*	

7.37 LocalGridSet

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Used to activate and/or deactivate the specified children grids as local grids on their parents. Once activated, this object indicates that a child grid replaces local portions of the corresponding parent grid. Specifically, properties and/or geometry in the region of a parent window will be stored on both the parent and child grids, usually with differing spatial resolutions. The choice of whether non-null properties are stored on both grids, or only the child grid, is application specific. Parentage is inferred from the child grid construction. Without a grid set activation, the local grids are always active. Otherwise, the grid set activation is used to activate and/or deactivate the local grids in the set at specific times.

Associations

Association		Notes
1..*	**From:** LocalGridSet.ChildGrid **To:** AbstractGridRepresentation *Association*	
	From: LocalGridSet. **To:** AbstractObject *Generalization*	
0..1	**From:** LocalGridSet.Activation **To:** Activation *Association*	

7.38 OverlapVolume

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/16/2013 *Last modified:* 11/1/2016
Notes: Optional parent-child cell overlap volume information. If not present, then the CellOverlap data-object lists the overlaps, but with no additional information.

Attributes

Name	Type	Notes
OverlapVolumes	AbstractFloatingPointArray	Parent-child cell volume overlap. BUSINESS RULE: Length of array must equal the cell overlap count.
VolumeUom	VolumeUom	Units of measure for the overlapVolume.

Associations

Association	Notes
From: CellOverlap.OverlapVolume 0..1 **To:** OverlapVolume *Association*	

7.39 PillarShape

Type: Enumeration *Stereotype:*
Detail: *Created:* 9/21/2013 *Last modified:* 11/1/2016
Notes: Used to indicate that all pillars are of a uniform kind, i.e., may be represented using the same number of nodes per pillar. This information is supplied by the RESQML writer to indicate the complexity of the grid geometry, as an aide to the RESQML reader.

If a combination of vertical and straight, then use straight.

If a specific pillar shape is not appropriate, then use curved.

BUSINESS RULE: Should be consistent with the actual geometry of the grid.

Attributes

Name	Type	Notes
vertical	External Reference	If represented by a parametric line, requires only a single control point per line.
straight	External Reference	If represented by a parametric line, requires 2 control points per line.
curved	External Reference	If represented by a parametric line, requires 3 or more control points per line.

7.40 Regrid

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: One-dimensional I, J, or K refinement and coarsening regrid specification.
The regrid description is organized using intervals. Within each interval, the number of parent and child cells is specified. Parent and child grid cell faces are aligned at interval boundaries. By default, child cells are uniformly sized within an interval unless weights are used to modify their size.

If the child grid is a root grid with an independent geometry, then there will usually be only a single interval for a regrid, because internal cell faces are not necessarily aligned.

Attributes

Name	Type	Notes
InitialIndexOnParentGrid	NonNegativeLong	0-based index for the placement of the window on the parent grid.

Associations

Association		Notes
0..1	**From:** Regrid.Intervals **To:** Intervals *Association*	
	From: ColumnLayerParentWindow.KRegrid **To:** Regrid *Association*	
	From: IjkParentWindow.KRegrid **To:** Regrid *Association*	
	From: IjkParentWindow.IRegrid **To:** Regrid *Association*	
	From: IjkParentWindow.JRegrid **To:** Regrid *Association*	

7.41 SplitColumnEdges

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Column edges are needed to construct the indices for the cell faces for column-layer grids. For split column-layer grids, the column edge indices must be defined explicitly. Column edges are not required to describe the lowest order grid geometry, but may be required for higher order geometries or properties.

Attributes

Name	Type	Notes
ColumnPerSplitColumnEdge	AbstractIntegerArray	Column index for each of the split column edges. Used to implicitly define column and cell faces. List-of-lists construction not required because each split column edge must be in a single column.
Count	PositiveLong	Number of split column edges in this grid. Must be positive.
ParentColumnEdgeIndices	AbstractIntegerArray	Parent unsplit column edge index for each of the split column edges. Used to implicitly define split face indexing.

Associations

Association	Notes
From: AdditionalGridTopology.SplitColumnEdges 0..1 **To:** SplitColumnEdges *Association*	
From: AbstractColumnLayerGridGeometry.SplitColumnEdges 0..1 **To:** SplitColumnEdges *Association*	

7.42 SplitEdges

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/20/2014 *Last modified:* 11/1/2016
Notes: If split nodes are used in the construction of a column-layer grid and indexable elements of kind edges are referenced, then the grid edges need to be re-defined.
Use Case: finite elements, especially for higher order geometry.

Attributes

Name	Type	Notes
Count	PositiveLong	Number of edges. Must be positive.
FacesPerSplitEdge	JaggedArray	Association of faces with the split edges, used to infer continuity of property, geometry, or interpretation with an attachment kind of edges.
ParentEdgeIndices	AbstractIntegerArray	Parent unsplit edge index for each of the additional split edges.

Associations

Association		Notes
0..1	**From:** AdditionalGridTopology.SplitEdges **To:** SplitEdges *Association*	
0..1	**From:** SplitFaces.SplitEdges **To:** SplitEdges *Association*	

7.43 SplitFaces

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 1/12/2014 *Last modified:* 11/1/2016
Notes: Optional construction used to introduce additional faces created by split nodes. Used to represent complex geometries, e.g., for stair-step grids and reverse faults.

Attributes

Name	Type	Notes
CellPerSplitFace	AbstractIntegerArray	Cell index for each split face. Used to implicitly define cell geometry.
Count	PositiveLong	Number of additional split faces. Count must be positive.
ParentFaceIndices	AbstractIntegerArray	Parent unsplit face index for each of the additional split faces.

Associations

Association		Notes
0..1	**From:** SplitFaces.SplitEdges **To:** SplitEdges *Association*	
0..1	**From:** SplitNodePatch.SplitFaces **To:** SplitFaces *Association*	
0..1	**From:** AdditionalGridTopology.SplitFaces **To:** SplitFaces *Association*	

7.44 SplitNodePatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Optional construction used to introduce additional nodes on coordinate lines. Used to represent complex geometries, e.g., for stair-step grids and reverse faults.
BUSINESS RULE: Patch index must be positive because a patch index of 0 refers to the fundamental column-layer coordinate line nodes.

Attributes

Name	Type	Notes
CellsPerSplitNode	JaggedArray	Cell indices for each of the split nodes. Used to implicitly define cell geometry. List-of-lists construction used to support split nodes shared between multiple cells.
Count	PositiveLong	Number of additional split nodes. Count must be positive.
ParentNodeIndices	AbstractIntegerArray	Parent coordinate line node index for each of the split nodes. Used to implicitly define cell geometry.

Associations

Association	Notes
From: SplitNodePatch.SplitFaces 0..1 **To:** SplitFaces *Association*	
From: SplitNodePatch. **To:** Patch *Generalization*	
From: AdditionalGridTopology.SplitNodePatch 0..1 **To:** SplitNodePatch *Association*	
From: AbstractColumnLayerGridGeometry.SplitNodePatch 0..1 **To:** SplitNodePatch *Association*	

7.45 SubnodeNodeObject

Type: Enumeration *Stereotype:*
Detail: *Created:* 9/16/2013 *Last modified:* 11/1/2016
Notes: SubnodeNodeObject is used to specify the node object that supports the subnodes. This determines the number of nodes per subnode and the continuity of the associated geometry or property. For instance, for hexahedral cells, cell indicates a fixed value of 8, while for an unstructured column layer grid, cell indicates that this count varies from column to column.

Attributes

Name	Type	Notes
cell	External Reference	If geometry or properties are discontinuous from cell to cell (i.e., their spatial support is cell), then attach them to cell subnodes. BUSINESS RULE: If this object kind is selected, then an ordered list of nodes per cell must be specified or otherwise known.
face	External Reference	If geometry or properties are continuous between cells that share the same face (i.e., their spatial support is the face), then attach them to face subnodes. BUSINESS RULE: If this object kind is selected, then an ordered list of nodes per face must be specified or otherwise known.
edge	External Reference	If geometry and properties are continuous between cells that share the same edge of a face (i.e. their spatial support is the edge), then attach them to edge subnodes. BUSINESS RULE: If this object kind is selected, then an ordered list of nodes per edge must be specified or otherwise known.

7.46 SubnodePatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/11/2013 *Last modified:* 11/1/2016
Notes: Each patch of subnodes is defined independently of the others. Number of nodes per object is determined by the subnode kind.

Attributes

Name	Type	Notes
NodeWeightsPerSubnode	AbstractValueArray	Node weights for each subnode. Count of nodes per subnode is known for each specific subnode construction. Data order consists of all the nodes for each subnode in turn. For example, if uniform and stored as a multi-dimensional array, the node index cycles first. BUSINESS RULE: Weights must be non-negative. BUSINESS RULE: Length of array must be consistent with the sum of nodeCount x subnodeCount per object, e.g., for 3 subnodes per edge (uniform), there are 6 weights.
SubnodeNodeObject	SubnodeNodeObject	

Associations

Association	Notes
From: SubnodePatch. **To:** Patch *Generalization*	
From: UniformSubnodePatch. **To:** SubnodePatch *Generalization*	
From: ColumnSubnodePatch. **To:** SubnodePatch *Generalization*	
From: VariableSubnodePatch. **To:** SubnodePatch *Generalization*	

7.47 SubnodeTopology

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/22/2013 *Last modified:* 11/1/2016
Notes: Finite element subnode topology for an unstructured cell can be either variable or uniform, but not columnar.

Associations

Association		Notes
0..*	**From:** SubnodeTopology.UniformSubnodePatch **To:** UniformSubnodePatch *Association*	
0..*	**From:** SubnodeTopology.VariableSubnodePatch **To:** VariableSubnodePatch *Association*	
	From: UnstructuredSubnodeTopology. **To:** SubnodeTopology *Generalization*	
	From: ColumnLayerSubnodeTopology. **To:** SubnodeTopology *Generalization*	

7.48 TruncatedIjkGridRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/12/2013 *Last modified:* 11/1/2016
Notes: Grid class with an underlying IJK topology, together with a 1D split-cell list. The truncated IJK cells have more than the usual 6 faces. The split cells are arbitrary polyhedra, identical to those of an unstructured cell grid.

Attributes

Name	Type	Notes
Ni	PositiveLong	Count of I-indices in the grid. Must be positive.
Nj	PositiveLong	Count of J-indices in the grid. Must be positive.

Associations

Association	Notes
From: TruncatedIjkGridRepresentation.Geometry **To:** IjkGridGeometry *Association*	
From: TruncatedIjkGridRepresentation. **To:** AbstractTruncatedColumnLayerGridRepresentation *Generalization*	

7.49 TruncatedUnstructuredColumnLayerGridRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/12/2013 *Last modified:* 11/1/2016
Notes: Grid class with an underlying unstructured column-layer topology, together with a 1D split-cell list. The truncated cells have more than the usual number of faces within each column. The split cells are arbitrary polyhedra, identical to those of an unstructured cell grid.

Attributes

Name	Type	Notes
ColumnCount	PositiveLong	Number of unstructured columns in the grid. Must be positive.

Associations

Association	Notes
From: TruncatedUnstructuredColumnLayerGridRepresentation. **To:** AbstractTruncatedColumnLayerGridRepresentation *Generalization*	
From: TruncatedUnstructuredColumnLayerGridRepresentation.Geometry **To:** UnstructuredColumnLayerGridGeometry *Association*	

7.50 TruncationCellPatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/3/2013 *Last modified:* 11/1/2016
Notes: Truncation definitions for the truncated and split cells.
BUSINESS RULE: Patch Index must be positive because a patch index of 0 refers to the fundamental column-layer coordinate line nodes and cells.

Attributes

Name	Type	Notes
LocalFacesPerCell	JaggedArray	Local cell face index for those faces that are retained from the parent cell in the definition of the truncation cell. The use of a local cell-face index, e.g., 0...5 for an IJK cell, can be used even if the face indices have not been defined.
NodesPerTruncationFace	JaggedArray	Definition of the truncation faces is in terms of an ordered list of nodes. Node indexing is EXTENDED, i.e., is based on the list of untruncated grid nodes (always first) plus the split nodes (if any) and the truncation face nodes. Relative order of split nodes and truncation face nodes is set by the pillar indices.
ParentCellIndices	AbstractIntegerArray	Parent cell index for each of the truncation cells. BUSINESS RULE: Size must match truncationCellCount
TruncationCellCount	PositiveLong	Number of polyhedral cells created by truncation. Must be positive. Note: Parent cells are replaced.
TruncationCellFaceIsRightHanded	AbstractBooleanArray	Boolean mask used to indicate which truncation cell faces have an outwardly directed normal, following a right hand rule. Data size and order follows the truncationFacesPerCell list-of-lists.
TruncationFaceCount	PositiveLong	Number of additional faces required for the split and truncation construction. The construction does not modify existing face definitions, but instead uses these new faces to redefine the truncated cell geometry. Must be positive. These faces are added to the enumeration of faces for the grid
TruncationFacesPerCell	JaggedArray	Truncation face index for the additional cell faces that are required to complete the definition of the truncation cell. The resulting local cell face index follows the local faces-per-cell list, followed by the truncation faces in the order within the list-of-lists constructions.

Name	Type	Notes
TruncationNodeCount	PositiveLong	Number of additional nodes required for the truncation construction. Must be positive. Uses a separate enumeration and does not increase the number of nodes, except as noted below.

Associations

Association	Notes
From: TruncationCellPatch. **To:** Patch *Generalization*	
0..1 **From:** IjkGpGridPatch.TruncationCellPatch **To:** TruncationCellPatch *Association*	
0..1 **From:** UnstructuredColumnLayerGpGridPatch.TruncationCellPatch **To:** TruncationCellPatch *Association*	
From: AbstractTruncatedColumnLayerGridRepresentation.TruncationCellPatch **To:** TruncationCellPatch *Association*	

7.51 UniformSubnodePatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/14/2013 *Last modified:* 11/1/2016
Notes: Use this subnode construction if the number of subnodes is the same for every object, e.g., 3 subnodes per edge for all edges.

Attributes

Name	Type	Notes
SubnodeCountPerObject	PositiveLong	Number of subnodes per object, with the same number for each of this data-object kind in the grid.

Associations

Association	Notes
From: UniformSubnodePatch. **To:** SubnodePatch *Generalization*	
0..* **From:** SubnodeTopology.UniformSubnodePatch **To:** UniformSubnodePatch *Association*	

7.52 UnstructuredCellIndexableElements

Type: Enumeration *Stereotype:*
Detail: *Created:* 9/22/2013 *Last modified:* 11/1/2016
Notes: Indexable elements for unstructured cell grids and patches.

Attributes

Name	Type	Notes
cells	External Reference	Count = #Cells = cellCount
edges	External Reference	Count = #Edges = edgeCount
faces	External Reference	Count = #Faces = faceCount
faces per cell	External Reference	Ordered list of faces, specified (local) to a cell
hinge node faces	External Reference	Count = #HingeNodeFaces
nodes	External Reference	Count = #Nodes = nodeCount
nodes per cell	External Reference	Ordered list of nodes, specified (local) to a cell
nodes per edge	External Reference	Ordered list of nodes, specified (local) to an edge, 2 x edgeCount
nodes per face	External Reference	Ordered list of nodes, specified (local) to a face
subnodes	External Reference	Count specified per subnode patch

7.53 UnstructuredColumnEdges

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Column edges are used to construct the index for faces. For unstructured column-layer grids, the column edge indices must be defined explicitly. Column edges are not required to describe lowest order grid geometry, but may be needed for higher order geometries or properties.

Attributes

Name	Type	Notes
Count	PositiveLong	Number of unstructured column edges in this grid. Must be positive.
PillarsPerColumnEdge	JaggedArray	Definition of the column edges in terms of the pillars-per-column edge. Pillar count per edge is usually 2, but the list-of-lists construction is used to allow column edges to be defined by more than 2 pillars.

Associations

Association	Notes
From: UnstructuredColumnLayerGridGeometry.UnstructuredColumnEdges 0..1 **To:** UnstructuredColumnEdges *Association*	
From: AdditionalGridTopology.UnstructuredColumnEdges 0..1 **To:** UnstructuredColumnEdges *Association*	

7.54 UnstructuredColumnLayerGpGridPatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/3/2013 *Last modified:* 11/1/2016
Notes: Used to specify unstructured column-layer grid patch(es) within a general purpose grid. Multiple patches are supported.

Attributes

Name	Type	Notes
UnstructuredColumnCount	NonNegativeLong	Number of unstructured columns. Degenerate case (count=0) is allowed for GPGrid.

Associations

Association	Notes
From: UnstructuredColumnLayerGpGridPatch.TruncationCellPatch 0..1 **To:** TruncationCellPatch *Association*	
From: UnstructuredColumnLayerGpGridPatch.Geometry 0..1 **To:** UnstructuredColumnLayerGridGeometry *Association*	
From: UnstructuredColumnLayerGpGridPatch. **To:** Patch *Generalization*	
From: ColumnLayerGpGrid.UnstructuredColumnLayerGpGridPatch 0..* **To:** UnstructuredColumnLayerGpGridPatch *Association*	

7.55 UnstructuredColumnLayerGridGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Description of the geometry of an unstructured column-layer grid, e.g., parity and pinch, together with its supporting topology.
Unstructured column-layer cell geometry is derived from column-layer cell geometry and hence is based upon nodes on coordinate lines.

Geometry is contained within the representation of a grid.

Attributes

Name	Type	Notes
ColumnIsRightHanded	AbstractBooleanArray	List of columns that are right handed. Right handedness is evaluated following the pillar order and the K-direction tangent vector for each column.
ColumnShape	ColumnShape	
PillarCount	PositiveLong	Number of pillars in the grid. Must be positive. Pillars are used to describe the shape of the columns in the grid.
PillarsPerColumn	JaggedArray	List of pillars for each column. The pillars define the corners of each column. The number of pillars per column can be obtained from the offsets in the first list-of-lists array. BUSINESS RULE: The length of the first array in the list -of-lists construction must equal the columnCount.

Associations

Association	Notes
From: UnstructuredColumnLayerGridGeometry.UnstructuredColumnEdges 0..1 **To:** UnstructuredColumnEdges *Association*	
From: UnstructuredColumnLayerGridGeometry. **To:** AbstractColumnLayerGridGeometry *Generalization*	
From: TruncatedUnstructuredColumnLayerGridRepresentation.Geometry **To:** UnstructuredColumnLayerGridGeometry *Association*	
From: UnstructuredColumnLayerGpGridPatch.Geometry 0..1 **To:** UnstructuredColumnLayerGridGeometry *Association*	
From: UnstructuredColumnLayerGridRepresentation.Geometry 0..1 **To:** UnstructuredColumnLayerGridGeometry	

Association	Notes
Association	

7.56 UnstructuredColumnLayerGridRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/5/2013 *Last modified:* 11/1/2016
Notes: Grid whose topology is characterized by an unstructured column index and a layer index, K. Cell geometry is characterized by nodes on coordinate lines, where each column of the model may have an arbitrary number of sides.

Attributes

Name	Type	Notes
ColumnCount	PositiveLong	Number of unstructured columns in the grid. Must be positive.

Associations

Association	Notes
From: UnstructuredColumnLayerGridRepresentation. **To:** AbstractColumnLayerGridRepresentation *Generalization*	
From: UnstructuredColumnLayerGridRepresentation.Geometry 0..1 **To:** UnstructuredColumnLayerGridGeometry *Association*	

7.57 UnstructuredColumnLayerIndexableElements

Type: Enumeration *Stereotype:*
Detail: *Created:* 9/22/2013 *Last modified:* 11/1/2016
Notes: Indexable elements for unstructured column layer grids and patches.

Attributes

Name	Type	Notes
cells	External Reference	Count = #Columns x NK
column edges	External Reference	Count = #UnstructuredColumnEdges + #SplitColumnEdges
columns	External Reference	Count = #Columns = columnCount
coordinate lines	External Reference	Count = #Pillars + #SplitCoordinateLines
edges	External Reference	Count = #Edges = edgeCount
edges per column	External Reference	Ordered list of edges, specified (local) to a column
faces	External Reference	Count = #KFaces + #ColumnEdges x NK
faces per cell	External Reference	Ordered list of faces, specified (local) to a cell
hinge node faces	External Reference	Count = #Columns x NKL (K faces)
interval edges	External Reference	Count = NKL = NK + gapCount + 1
intervals	External Reference	Count = NK + gapCount Only needed if the Unstructured Column Layer indices are a component of GPGrid.
layers	External Reference	Count = NK
nodes	External Reference	Count = #CoordinateLines x NKL
nodes per cell	External Reference	Ordered list of nodes, specified (local) to a cell
nodes per edge	External Reference	Ordered list of nodes, specified (local) to an edge, 2 x edgeCount
nodes per face	External Reference	Ordered list of nodes, specified (local) to a face
pillars	External Reference	Count = #Pillars = pillarCount
subnodes	External Reference	Count specified per subnode patch

7.58 UnstructuredGpGridPatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/3/2013 *Last modified:* 11/1/2016
Notes: Used to specify unstructured cell grid patch(es) within a general purpose grid. Multiple patches are supported.

Attributes

Name	Type	Notes
UnstructuredCellCount	NonNegativeLong	Number of unstructured cells. Degenerate case (count=0) is allowed for GPGrid.

Associations

Association		Notes
	From: UnstructuredGpGridPatch. **To:** Patch *Generalization*	
0..1	**From:** UnstructuredGpGridPatch.Geometry **To:** UnstructuredGridGeometry *Association*	
0..*	**From:** GpGridRepresentation.UnstructuredGpGridPatch **To:** UnstructuredGpGridPatch *Association*	

7.59 UnstructuredGridGeometry

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Description of the geometry of an unstructured cell grid, which includes geometric characteristics, e.g., cell face parity, and supporting topology.
Each grid cell is defined by a (signed) list of cell faces. Each cell face is defined by a list of nodes.

Attributes

Name	Type	Notes
CellFaceIsRightHanded	AbstractBooleanArray	Boolean mask used to indicate which cell faces have an outwardly directed normal following a right hand rule. Array length is the sum of the cell face count per cell, and the data follows the order of the faces per cell RESQMLlist-of-lists.
CellShape	CellShape	
FaceCount	PositiveLong	Total number of faces in the grid. Must be positive.
FacesPerCell	JaggedArray	List of faces per cell. Face count per cell can be obtained from the offsets in the first list-of-lists array. BUSINESS RULE: CellCount must match the length of the first list-of-lists array.
NodeCount	PositiveLong	Total number of nodes in the grid. Must be positive.
NodesPerFace	JaggedArray	List of nodes per face. Node count per face can be obtained from the offsets in the first list-of-lists array. BUSINESS RULE: FaceCount must match the length of the first list- of-lists array.

Associations

Association	Notes
From: UnstructuredGridGeometry.UnstructuredSubnodeTopology 0..1 **To:** UnstructuredSubnodeTopology *Association*	
From: UnstructuredGridGeometry.UnstructuredGridHingeNodeFaces 0..1 **To:** UnstructuredGridHingeNodeFaces *Association*	
From: UnstructuredGridGeometry. **To:** AbstractGridGeometry *Generalization*	
From: UnstructuredGridRepresentation.Geometry 0..1 **To:** UnstructuredGridGeometry *Association*	
From: UnstructuredGpGridPatch.Geometry 0..1 **To:** UnstructuredGridGeometry *Association*	

7.60 UnstructuredGridHingeNodeFaces

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/9/2013 *Last modified:* 11/1/2016
Notes: Hinge nodes define a triangulated interpolation on a cell face. In practice, they arise on the K faces of column layer cells and are used to add additional geometric resolution to the shape of the cell. The specification of triangulated interpolation also uniquely defines the interpolation schema on the cell face, and hence the cell volume.
For an unstructured cell grid, the hinge node faces need to be defined explicitly.

This hinge node faces data-object is optional and is only expected to be used if the hinge node faces higher order grid point attachment arises. Hinge node faces are not supported for property attachment. Instead use a subrepresentation or an attachment kind of faces or faces per cell.

BUSINESS RULE: Each cell must have either 0 or 2 hinge node faces, so that the two hinge nodes for the cell may be used to define a cell center line and a cell thickness.

Attributes

Name	Type	Notes
Count	PositiveLong	Number of K faces. This count must be positive.
FaceIndices	AbstractIntegerArray	List of faces to be identified as K faces for hinge node geometry attachment. BUSINESS RULE: Array length equals K face count.

Associations

Association	Notes
From: UnstructuredGridGeometry.UnstructuredGridHingeNodeFaces 0..1 **To:** UnstructuredGridHingeNodeFaces *Association*	

7.61 UnstructuredGridRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/5/2013 *Last modified:* 11/1/2016
Notes: Unstructured grid representation characterized by a cell count, and potentially nothing else. Both the oldest and newest simulation formats are based on this format.

Attributes

Name	Type	Notes
CellCount	PositiveLong	Number of cells in the grid. Must be positive.

Associations

Association	Notes
From: UnstructuredGridRepresentation.OriginalCellIndex 0..1 **To:** AlternateCellIndex *Association*	
From: UnstructuredGridRepresentation. **To:** AbstractGridRepresentation *Generalization*	
From: UnstructuredGridRepresentation.Geometry 0..1 **To:** UnstructuredGridGeometry *Association*	

7.62 UnstructuredSubnodeTopology

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/11/2013 *Last modified:* 11/1/2016
Notes: If edge subnodes are used, then edges must be defined. If cell subnodes are used, nodes per cell must be defined.

Attributes

Name	Type	Notes
NodesPerCell	JaggedArray	

Associations

Association	Notes
From: UnstructuredSubnodeTopology. **To:** SubnodeTopology *Generalization*	
From: UnstructuredSubnodeTopology.Edges 0..1 **To:** Edges *Association*	
From: UnstructuredGridGeometry.UnstructuredSubnodeTopology 0..1 **To:** UnstructuredSubnodeTopology *Association*	
From: AdditionalGridTopology.UnstructuredSubnodeTopology 0..1 **To:** UnstructuredSubnodeTopology *Association*	

7.63 VariableSubnodePatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 9/11/2013 *Last modified:* 11/1/2016
Notes: If the number of subnodes per data-object are variable for each data-object, use this subnode construction.

Attributes

Name	Type	Notes
ObjectIndices	AbstractIntegerArray	Indices of the selected data-objects
SubnodeCountPerSelectedObject	AbstractIntegerArray	Number of subnodes per selected data-object.

Associations

Association		Notes
	From: VariableSubnodePatch. **To:** SubnodePatch *Generalization*	
0..*	**From:** SubnodeTopology.VariableSubnodePatch **To:** VariableSubnodePatch *Association*	

8 Seismic

Package: xsd_schemas

Notes: This package contains classes for features, interpretations, representations and related objects used to define and exchange seismic survey data in RESQML.
A RESQML seismic survey representation makes use of previously defined representations, with the addition of seismic coordinates to their geometry.

A seismic survey is an organization of seismic lines. For the context of RESQML, a seismic survey does not refer to any vertical dimension information, but only areally at shot point locations or common midpoint gathers. The seismic traces, if needed by reservoir models, are transferred in an industry standard format such as SEGY. The SEGY format contains information about the number of samples in the seismic traces and whether the vertical domain is in time or depth. This section only discusses the areal aspects of seismic surveys.

RESQML supports two basic kinds of seismic surveys:

- seismic lattice (organization of the traces for the 3D acquisition and processing phases).
- seismic line (organization of the traces for the 2D acquisition and processing phases).

Additionally, to transport several seismic surveys together:

- Seismic lattices can be aggregated into a seismic lattice set.
- Seismic lines can be aggregated into a seismic line set.

Thus there are four groupings of seismic surveys, which are represented in RESQML as follows:

- A seismic lattice is generally represented using a 2D grid representation.
- A seismic lattice set is represented using a set of 2D grid representations.
- A seismic line is generally represented using a polyline representation.
- The seismic line set is then represented by a set of polyline representations.

In RESQML seismic surveys are technical features that do not have multiple interpretations. Although it is possible to re-interpret a seismic survey for improved physical properties or for positioning, these types of relationships are not included within the RESQML knowledge hierarchy.

8.1 AbstractSeismicCoordinates

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/4/2013 *Last modified:* 11/1/2016
Notes: Parent class that is used to associate horizon and fault representations to seismic 2D and seismic 3D technical features. It stores a 1-to-1 mapping between geometry coordinates (usually X, Y, Z) and trace or inter-trace positions on a seismic survey.

Associations

Association		Notes
	From: AbstractSeismicCoordinates.SeismicSupport **To:** AbstractRepresentation *Association*	BUSINESS RULE: The seismic support must be a representation of a seismic lattice or seismic line.
0..1	**From:** PointGeometry.SeismicCoordinates **To:** AbstractSeismicCoordinates *Association*	
	From: Seismic3dCoordinates. **To:** AbstractSeismicCoordinates *Generalization*	
	From: Seismic2dCoordinates. **To:** AbstractSeismicCoordinates *Generalization*	

8.2 AbstractSeismicLineFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/26/2013 *Last modified:* 11/1/2016
Notes: Location of the line used in a 2D seismic acquisition.
Defined by one lateral dimension: trace (lateral).

To specify its location, the seismic feature can be associated with the seismic coordinates of the points of a representation.

Represented by a PolylineRepresentation.

Associations

Association		Notes
0..1	**From:** AbstractSeismicLineFeature.TraceLabels **To:** StringExternalArray *Association*	The labels (as they would be found in SEGY trace headers for example) of the traces of the 2D seismic survey. BUSINESS RULE : count of this array must be the same as the count of nodes in the associated polyline representations.
	From: AbstractSeismicLineFeature. **To:** AbstractSeismicSurveyFeature *Generalization*	
0..1	**From:** AbstractSeismicLineFeature.IsPartOf **To:** SeismicLineSetFeature *Association*	
	From: CmpLineFeature. **To:** AbstractSeismicLineFeature *Generalization*	
	From: ShotPointLineFeature. **To:** AbstractSeismicLineFeature *Generalization*	

8.3 AbstractSeismicSurveyFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/7/2012 *Last modified:* 11/1/2016
Notes: An organization of seismic lines. For the context of RESQML, a seismic survey does not refer to any vertical dimension information, but only areally at shot point locations or common midpoint gathers. The seismic traces, if needed by reservoir models, are transferred in an industry standard format such as SEGY.
RESQML supports these basic types of seismic surveys:

- seismic lattice (organization of the traces for the 3D acquisition and processing phases).
- seismic line (organization of the traces for the 2D acquisition and processing phases).

Additionally, these seismic lattices and seismic lines can be aggregated into sets.

Associations

Association	Notes
From: AbstractSeismicSurveyFeature. **To:** AbstractTechnicalFeature *Generalization*	
From: SeismicLatticeFeature. **To:** AbstractSeismicSurveyFeature *Generalization*	
From: AbstractSeismicLineFeature. **To:** AbstractSeismicSurveyFeature *Generalization*	
From: SeismicLatticeSetFeature. **To:** AbstractSeismicSurveyFeature *Generalization*	
From: SeismicLineSetFeature. **To:** AbstractSeismicSurveyFeature *Generalization*	

8.4 CmpLineFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/19/2015 *Last modified:* 11/1/2016
Notes: Location of a single line of common mid-points (CMP) resulting from a 2D seismic acquisition

Associations

Association		Notes
	From: CmpLineFeature.NearestShotPointIndices **To:** AbstractIntegerArray *Association*	Index of closest shot point (inside the associated CmpPointLineFeature) for each cmp.
0..1	**From:** CmpLineFeature.ShotPointLineFeature **To:** ShotPointLineFeature *Association*	Line of shots used to generate the current common midpoints.
	From: CmpLineFeature. **To:** AbstractSeismicLineFeature *Generalization*	

8.5 Seismic2dCoordinates

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/4/2013 *Last modified:* 11/1/2016
Notes: A group of 2D seismic coordinates that stores the 1-to-1 mapping between geometry patch coordinates (usually X, Y, Z) and trace or inter-trace positions on a seismic line.
BUSINESS RULE: This patch must reference a geometry patch by its UUID.

Attributes

Name	Type	Notes
LineAbscissa	AbstractFloatingPointArray	The sequence of trace or inter-trace positions that correspond to the geometry coordinates. BUSINESS RULE: Both sequences must be in the same order.
VerticalCoordinates	AbstractFloatingPointArray	The sequence of vertical sample or inter-sample positions that corresponds to the geometry coordinates. BUSINESS RULE: Sequence must be in the same order as the previous one.

Associations

Association	Notes
From: Seismic2dCoordinates. **To:** AbstractSeismicCoordinates *Generalization*	

8.6 Seismic2dPostStackRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 7/2/2015 *Last modified:* 11/1/2016
Notes: The feature of this representation should be the same survey feature as the associated PolylineRepresentation represents..
The indexing convention (mainly for associated properties) is :

- Trace sample goes fastest
- Then polyline node slowest

The indexing convention only applies to HDF datasets (not SEGY file).

A whole SEGY file can be referenced in properties of this representation, but not partial files.

Attributes

Name	Type	Notes
SeismicLineSubSampling	IntegerLatticeArray	This array must be one dimension and count must be the node count in the associated seismic line i.e., polylineRepresentation. The index is based on array indexing, not on index labeling of traces. The values of the integer lattice array are the increments between 2 consecutive subsampled nodes.
TraceSampling	FloatingPointLatticeArray	Defines the sampling in the vertical dimension of the representation. This array must be one dimension. The values are given with respect to the associated local CRS.

Associations

Association	Notes
From: Seismic2dPostStackRepresentation.SeismicLineRepresentation **To:** PolylineRepresentation *Association*	
From: Seismic2dPostStackRepresentation. **To:** AbstractRepresentation *Generalization*	
From: Seismic2dPostStackRepresentation.LocalCrs **To:** AbstractLocal3dCrs *Association*	

8.7 Seismic3dCoordinates

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/4/2013 *Last modified:* 11/1/2016
Notes: The 1-to-1 mapping between geometry coordinates (usually X, Y, Z or X, Y, TWT) and trace or inter-trace positions on a seismic lattice.

Attributes

Name	Type	Notes
CrosslineCoordinates	AbstractFloatingPointArray	The sequence of trace or inter-trace crossline positions that correspond to the geometry coordinates. BUSINESS RULE: Both sequences must be in the same order.
InlineCoordinates	AbstractFloatingPointArray	The sequence of trace or inter-trace inline positions that correspond to the geometry coordinates. BUSINESS RULE: Both sequences must be in the same order.
VerticalCoordinates	AbstractFloatingPointArray	The sequence of vertical sample or inter-sample positions that corresponds to the geometry coordinates. BUSINESS RULE: Sequence must be in the same order as the two previous ones.

Associations

Association	Notes
From: Seismic3dCoordinates. **To:** AbstractSeismicCoordinates *Generalization*	

8.8 Seismic3dPostStackRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 7/1/2015 *Last modified:* 11/1/2016
Notes: The feature of this representation should be the same survey feature as the associated Grid2Representation represents.
The indexing convention (mainly for associated properties) is:

- Trace sample goes fastest
- Then inline
- And crossline goes slowest

The indexing convention only applies to HDF datasets (not SEGY file).

A whole SEGY file can be referenced in properties of this representation, but not partial files.

Attributes

Name	Type	Notes
SeismicLatticeSubSampling	IntegerLatticeArray	This array must be two dimensions: - Fastest Axis is inline. - Slowest Axis is crossline. The index is based on array indexing, not on index labeling of inlines/crosslines. The values of the integer lattice array are the increments between 2 consecutive subsampled nodes.
TraceSampling	FloatingPointLatticeArray	Defines the sampling in the vertical dimension of the representation. This array must be one dimension. The values are given with respect to the associated Local Crs.

Associations

Association	Notes
From: Seismic3dPostStackRepresentation. **To:** AbstractGridRepresentation *Generalization*	
From: Seismic3dPostStackRepresentation.LocalCrs **To:** AbstractLocal3dCrs *Association*	
From: Seismic3dPostStackRepresentation.SeismicLatticeRepresentation **To:** Grid2dRepresentation *Association*	

8.9 SeismicLatticeFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/26/2013 *Last modified:* 11/1/2016
Notes: Defined by two lateral ordered dimensions: inline (lateral), crossline (lateral and orthogonal to the inline dimension), which are fixed.
To specify its location, a seismic feature can be associated with the seismic coordinates of the points of a representation.

Represented by a 2D grid representation.

Associations

Association		Notes
0..1	**From:** SeismicLatticeFeature.CrosslineLabels **To:** IntegerLatticeArray *Association*	The labels (as they would be found in SEGY trace headers for example) of the crosslines of the 3D seismic survey. BUSINESS RULE: Count of this array must be the same as the count of nodes in the slowest axis of the associated grid 2D representations.
	From: SeismicLatticeFeature. **To:** AbstractSeismicSurveyFeature *Generalization*	
0..1	**From:** SeismicLatticeFeature.IsPartOf **To:** SeismicLatticeSetFeature *Association*	
	From: SeismicLatticeFeature.InlineLabels **To:** IntegerLatticeArray *Association*	The labels (as they would be found in SEGY trace headers for example) of the inlines of the 3D seismic survey. BUSINESS RULE: Count of this array must be the same as the count of nodes in the fastest axis of the associated grid 2D representations.

8.10 SeismicLatticeSetFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/6/2013 *Last modified:* 11/1/2016
Notes: An unordered set of several seismic lattices. Generally, it has no direct interpretation or representation.

Associations

Association		Notes
	From: SeismicLatticeSetFeature. **To:** AbstractSeismicSurveyFeature *Generalization*	
0..1	**From:** SeismicLatticeFeature.IsPartOf **To:** SeismicLatticeSetFeature *Association*	

8.11 SeismicLineSetFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/26/2013 *Last modified:* 11/1/2016
Notes: An unordered set of several seismic lines. Generally, it has no direct interpretation or representation.

Associations

Association		Notes
	From: SeismicLineSetFeature. **To:** AbstractSeismicSurveyFeature *Generalization*	
0..1	**From:** AbstractSeismicLineFeature.IsPartOf **To:** SeismicLineSetFeature *Association*	

8.12 ShotPointLineFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/19/2015 *Last modified:* 11/1/2016
Notes: Location of a single line of shot points in a 2D seismic acquisition.

Associations

Association		Notes
	From: ShotPointLineFeature. **To:** AbstractSeismicLineFeature *Generalization*	
0..1	**From:** CmpLineFeature.ShotPointLineFeature **To:** ShotPointLineFeature *Association*	Line of shots used to generate the current common midpoints.

9 Streamlines

Package: xsd_schemas

Notes: This package contains classes for features, interpretations, representations and related objects used to define and exchange seismic survey data in RESQML.
Streamlines are used in a reservoir engineering context to visualize the directions of fluid flow within a reservoir. Streamlines are static geometric trajectories in space that are based upon fluid velocities at a specified time. The velocities may be obtained from the flow of a fluid phase, e.g., water, oil, gas, or the sum of phases, or the flow of components, e.g., CO2 or CH4, or they may describe the flow of another attribute, e.g., temperature and thermal flux. Streamlines differ from the "streaklines" that describe the physical trajectories of particles in a time-varying velocity field.

9.1 StreamlineFlux

Type: Enumeration *Stereotype:*
Detail: *Created:* 12/11/2014 *Last modified:* 11/1/2016
Notes: Enumeration of the usual streamline fluxes

Attributes

Name	Type	Notes
oil		Oil Phase flux
gas		Gas Phase flux
water		Water Phase flux
total		Sum of (Water + Oil + Gas) Phase fluxes
other		Used to indicate that another flux is being traced. BUSINESS RULE: OtherFlux should appear if this value is specified.

9.2 StreamlinesFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/12/2014 *Last modified:* 11/1/2016
Notes: Specification of the vector field upon which the streamlines are based. Streamlines are commonly used to trace the flow of phases (water / oil / gas / total) based upon their flux at a specified time. They may also be used for trace components for compositional simulation, e.g., CO2, or temperatures for thermal simulation.
The flux enumeration provides support for the most usual cases with provision for extensions to other fluxes.

Attributes

Name	Type	Notes
Flux	StreamlineFlux	Specification of the streamline flux, drawn from the enumeration.
OtherFlux	String64	Optional specification of the streamline flux, if an extension is required beyond the enumeration. BUSINESS RULE: OtherFlux should appear if Flux has the value of other.

Associations

Association	Notes
From: StreamlinesFeature.TimeIndex **To:** TimeIndex *Association*	
From: StreamlinesFeature. **To:** AbstractTechnicalFeature *Generalization*	

9.3 StreamlinesRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/11/2014 *Last modified:* 11/1/2016
Notes: Representation of streamlines associated with a streamline feature and interpretation. Use StreamlinesFeature to define the vector field that supports the streamlines, i.e., describes what flux is being traced.

Use Interpretation to distinguish between shared and differing interpretations.

Usage Note: When defining streamline geometry, the PatchIndex is not referenced and may be set to a value of 0.

Attributes

Name	Type	Notes
LineCount	PositiveLong	Number of streamlines.

Associations

Association		Notes
	From: StreamlinesRepresentation. **To:** AbstractRepresentation *Generalization*	
0..1	**From:** StreamlinesRepresentation.Geometry **To:** PolylineSetPatch *Association*	
0..1	**From:** StreamlinesRepresentation.StreamlineWellbores **To:** StreamlineWellbores *Association*	

9.4 StreamlineWellbores

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/11/2014 *Last modified:* 11/1/2016
Notes: Used to specify the wellbores on which streamlines may originate or terminate. Additional properties, e.g., MD, or cell index may be used to specify locations along a wellbore. The 0-based wellbore index is defined by the order of the wellbore in the list of WellboreTrajectoryRepresentation references.

Attributes

Name	Type	Notes
InjectorPerLine	AbstractIntegerArray	Size of array = LineCount. Null values signify that that line does not initiate at an injector, e.g., it may come from fluid expansion or an aquifer.
ProducerPerLine	AbstractIntegerArray	Size of array = LineCount Null values signify that that line does not terminate at a producer, e.g., it may approach a stagnation area. BUSINESS RULE: The cell count must equal the number of non-null entries in this array.

Associations

Association	Notes
From: StreamlineWellbores.WellboreTrajectoryRepresentation 1..* **To:** WellboreTrajectoryRepresentation *Association*	
From: StreamlinesRepresentation.StreamlineWellbores 0..1 **To:** StreamlineWellbores *Association*	

10 Structural

Package: xsd_schemas

Notes: This package contains classes for features, interpretations, representations and related objects used to define and exchange seismic survey data in RESQML. Representations are the digital descriptions of a feature interpretation or a technical feature. This representation is based on a topology and contains the geometry of the digital description or is based on the topology or the geometry of another representation. Structural has two types of representations:

- **Representation of Individual Representations**. Each Individual representation is specialized by dimension (point, polyline, surface, volume) and represents only one individual geological interpretation (such as, horizons, faults, geological bodies, geological units, and fluids units).
- **Representation of Organization Representations**. Each organization representations is a consistent assembly of different representations of interpretations of organizations (such as, earth model, structural organization, stratigraphic organizations, stratigraphic columns, and fluid organizations).

10.1 AbstractContactRepresentationPart

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/26/2014 *Last modified:* 11/1/2016
Notes: Parent class of the sealed and non-sealed contact elements.

Attributes

Name	Type	Notes
Index	NonNegativeLong	The index of the contact. Indicates identity of the contact in the surface framework context. It is used for contact identities and to find the interpretation of this particular contact.

Associations

Association	Notes
From: ContactRepresentationReference. **To:** AbstractContactRepresentationPart *Generalization*	
From: NonSealedContactRepresentationPart. **To:** AbstractContactRepresentationPart *Generalization*	
From: SealedContactRepresentationPart. **To:** AbstractContactRepresentationPart *Generalization*	
From: NonSealedSurfaceFrameworkRepresentation.NonSealedContact Representation 0..* **To:** AbstractContactRepresentationPart *Association*	Can contain sealed or non-sealed contact representations, in the case of the surface framework during the sealing process.

10.2 AbstractSurfaceFrameworkRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/24/2014 *Last modified:* 11/1/2016
Notes: Parent class for a sealed or non-sealed surface framework representation. Each one instantiates a representation set representation.
The difference between the sealed and non-sealed frameworks is that, in the non-sealed case, we do not have all of the contact representations, or we have all of the contacts but they are not all sealed.

Associations

Association	Notes
From: AbstractSurfaceFrameworkRepresentation.ContactIdentity 0..* **To:** ContactIdentity *Association*	
From: AbstractSurfaceFrameworkRepresentation. **To:** RepresentationSetRepresentation *Generalization*	
From: SealedSurfaceFrameworkRepresentation. **To:** AbstractSurfaceFrameworkRepresentation *Generalization*	
From: NonSealedSurfaceFrameworkRepresentation. **To:** AbstractSurfaceFrameworkRepresentation *Generalization*	

10.3 AbstractSurfaceRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 12/2/2013 *Last modified:* 11/1/2016
Notes: Parent class of structural surface representations, which can be bounded by an outer ring and has inner rings. These surfaces may consist of one or more patches.

Attributes

Name	Type	Notes
SurfaceRole	SurfaceRole	

Associations

Association		Notes
0..*	**From:** AbstractSurfaceRepresentation.Boundaries **To:** PatchBoundaries *Association*	
	From: AbstractSurfaceRepresentation. **To:** AbstractRepresentation *Generalization*	
	From: TriangulatedSetRepresentation. **To:** AbstractSurfaceRepresentation *Generalization*	
	From: PlaneSetRepresentation. **To:** AbstractSurfaceRepresentation *Generalization*	
	From: Grid2dRepresentation. **To:** AbstractSurfaceRepresentation *Generalization*	
	From: Grid2dSetRepresentation. **To:** AbstractSurfaceRepresentation *Generalization*	

10.4 ContactIdentity

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/12/2014 *Last modified:* 11/1/2016
Notes: Indicates identity between two (or more) contacts. For possible types of identities, see IdentityKind.

Attributes

Name	Type	Notes
IdentityKind	IdentityKind	The kind of contact identity.
ListOfContactRepresentations	AbstractIntegerArray	The contact representations that share common identity as specified by their indices.
ListOfIdenticalNodes	AbstractIntegerArray	Indicates which nodes (identified by their common index in all contact representations) of the contact representations are identical. If this list is not present, then it indicates that all nodes in each representation are identical, on an element by element level.

Associations

Association	Notes
From: AbstractSurfaceFrameworkRepresentation.ContactIdentity 0..* **To:** ContactIdentity *Association*	

10.5 ContactPatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/21/2012 *Last modified:* 11/1/2016
Notes: A subset of topological elements of an existing contact representation part (sealed or non-sealed contact).

Attributes

Name	Type	Notes
RepresentationIndex	NonNegativeLong	Identifies a representation by its index, in the list of representations contained in the organization.
SupportingRepresentationNodes	AbstractIntegerArray	The ordered list of nodes (identified by their global index) in the supporting representation, which constitutes the contact patch.

Associations

Association		Notes
	From: ContactPatch. **To:** Patch1d *Generalization*	
2..*	**From:** SealedContactRepresentationPart.Contact **To:** ContactPatch *Association*	
0..*	**From:** NonSealedContactRepresentationPart.Contact **To:** ContactPatch *Association*	

10.6 ContactRepresentationReference

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/14/2014 *Last modified:* 11/1/2016
Notes: Used when the contact already exists as a top-level element representation.

Associations

Association	Notes
From: ContactRepresentationReference. **To:** AbstractContactRepresentationPart *Generalization*	
From: ContactRepresentationReference.Representation **To:** AbstractRepresentation *Association*	

10.7 EdgePatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/1/2013 *Last modified:* 11/1/2016
Notes: Describes edges that are not linked to any other edge. Because edges do not have indices, a consecutive pair of nodes is used to identify each edge.
The split edges dataset is a set of nodes (2 nodes per edge). Each patch has a set of 2 nodes.

Attributes

Name	Type	Notes
SplitEdges	AbstractIntegerArray	An array of split edges to define patches. It points to an HDF5 dataset, which must be a 2D array of non-negative integers with dimensions 2 x numSplitEdges.

Associations

Association	Notes
From: EdgePatch. **To:** Patch1d *Generalization*	
0..* **From:** TrianglePatch.SplitEdgePatch **To:** EdgePatch *Association*	

10.8 GeologicBoundaryKind

Type: Enumeration *Stereotype:*
Detail: *Created:* 4/25/2013 *Last modified:* 11/1/2016
Notes: The various geologic boundaries a well marker can indicate.

Attributes

Name	Type	Notes
fault		
geobody		
horizon		

Associations

Association	Notes
From: WellboreMarker. **To:** GeologicBoundaryKind *Dependency*	

10.9 Grid2dPatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/20/2013 *Last modified:* 11/1/2016
Notes: Patch representing a single 2D grid and its geometry.
The FastestAxisCount and the SlowestAxisCount determine the indexing of this grid 2D patch, by defining a 1D index for the 2D grid as follows:

Index = FastestIndex + FastestAxisCount * SlowestIndex

When stored in HDF5, this indexing order IS the data order, in which case, in HDF5 it would be a 2D array of the SlowestAxisCount*FastestAxisCount.

I is the fastest axis; J is the slowest.

Inline is the fastest axis; crossline is the slowest axis.

Attributes

Name	Type	Notes
FastestAxisCount	PositiveLong	The number of nodes in the fastest direction.
SlowestAxisCount	PositiveLong	The number of nodes in the slowest direction.

Associations

Association		Notes
	From: Grid2dPatch. **To:** Patch *Generalization*	
	From: Grid2dPatch.Geometry **To:** PointGeometry *Association*	
2..*	**From:** Grid2dSetRepresentation.Grid2dPatch **To:** Grid2dPatch *Association*	
	From: Grid2dRepresentation.Grid2dPatch **To:** Grid2dPatch *Association*	

10.10 Grid2dRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/14/2013 *Last modified:* 11/1/2016
Notes: Representation based on a 2D grid. For definitions of slowest and fastest axes of the array, see Grid2dPatch.

Associations

Association	Notes
From: Grid2dRepresentation.Grid2dPatch **To:** Grid2dPatch *Association*	
From: Grid2dRepresentation. **To:** AbstractSurfaceRepresentation *Generalization*	
From: Seismic3dPostStackRepresentation.SeismicLatticeRepresentation **To:** Grid2dRepresentation *Association*	

10.11 Grid2dSetRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/14/2013 *Last modified:* 11/1/2016
Notes: Set of representations based on a 2D grid. Each 2D grid representation corresponds to one patch of the set.

Associations

Association		Notes
2..*	**From:** Grid2dSetRepresentation.Grid2dPatch **To:** Grid2dPatch *Association*	
	From: Grid2dSetRepresentation. **To:** AbstractSurfaceRepresentation *Generalization*	

10.12 LineRole

Type: Enumeration *Stereotype:*
Detail: *Created:* 5/17/2012 *Last modified:* 11/1/2016
Notes: Indicates the various roles that a polyline topology can have in a representation.

Attributes

Name	Type	Notes
fault center line	External Reference	Usually used to represent fault lineaments on horizons. These lines can represent nonsealed contact interpretation parts defined by a horizon/fault intersection.
pick	External Reference	Used to represent all types of nonsealed contact interpretation parts defined by a horizon/fault intersection.
inner ring		Closed polyline that delineates a hole in a surface patch.
outer ring		Closed polyline that delineates the extension of a surface patch.
trajectory		Polyline that is used to represent a well trajectory representation.
interpretation line		Line corresponding to a digitalization along an earth model section.
contact		Used to represent nonsealed contact interpretation parts defined by a horizon/fault intersection.
depositional line		Used to represent nonsealed contact interpretation parts defined by a horizon/horizon intersection.
erosion line		Used to represent nonsealed contact interpretation parts defined by a horizon/horizon intersection.
contouring		Used to obtain sets of 3D x, y, z points to represent any boundary interpretation.
pillar		Used to represent the pillars of a column-layer volumic grid.

10.13 NodePatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/1/2013 *Last modified:* 11/1/2016
Notes: Patch representing a list of nodes to which geometry may be attached.

Associations

Association		Notes
	From: NodePatch.Geometry **To:** PointGeometry *Association*	
	From: NodePatch. **To:** Patch1d *Generalization*	
1..*	**From:** PointSetRepresentation.NodePatch **To:** NodePatch *Association*	
1	**From:** PolylineRepresentation.NodePatch **To:** NodePatch *Association*	

10.14 NonSealedContactRepresentationPart

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/24/2014 *Last modified:* 11/1/2016
Notes: Defines a non-sealed contact representation, meaning that this contact representation is defined by a geometry.

Associations

Association		Notes
	From: NonSealedContactRepresentationPart. **To:** AbstractContactRepresentationPart *Generalization*	
0..1	**From:** NonSealedContactRepresentationPart.Geometry **To:** AbstractGeometry *Association*	
0..*	**From:** NonSealedContactRepresentationPart.Contact **To:** ContactPatch *Association*	

10.15 NonSealedSurfaceFrameworkRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/24/2014 *Last modified:* 11/1/2016
Notes: A collection of contact representations parts, which are a list of contact patches with no identity. This collection of contact representations is completed by a set of representations gathered at the representation set representation level.

Associations

Association	Notes
From: NonSealedSurfaceFrameworkRepresentation. **To:** AbstractSurfaceFrameworkRepresentation *Generalization*	
From: NonSealedSurfaceFrameworkRepresentation.NonSealedContact Representation 0..* **To:** AbstractContactRepresentationPart *Association*	Can contain sealed or non-sealed contact representations, in the case of the surface framework during the sealing process.

10.16 OrientedMacroFace

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/27/2013 *Last modified:* 11/1/2016
Notes: An element of a volume shell that is defined by a set of oriented faces belonging to boundable patches.
A macroface may describe a contact between:

- two structural, stratigraphic, or fluid units.
- one boundary feature (fault or frontier) and a unit.

A face is a bounded open subset of a plane or a curved surface in 3D, delimited by an outer contour and zero, one, or more inner contours describing holes.

Attributes

Name	Type	Notes
PatchIndexOfRepresentation	NonNegativeLong	Creates the triangulation and 2D grid representation for which the patches match the macrofaces.
RepresentationIndex	NonNegativeLong	Identifies the representation by its index, in the list of representations contained in the organization.
SideIsPlus	boolean	Because a user must represent the two sides of a macro face that correspond to the same patch (identified by a PatchIndexOfRepresentation) of a Representation (identified by a RepresentationIndex), then he must define each side by its orientation. Each macro face has two orientations: A positive one and a negative one. The positive one is declared by setting SideIsPlus = True; the negative one is declared by setting SideIsPlus = False. This attribute allows us to define different property distributions on the different macro face sides.

Associations

Association		Notes
1..*	**From:** VolumeShell.MacroFaces **To:** OrientedMacroFace *Association*	

10.17 PatchBoundaries

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/5/2013 *Last modified:* 11/1/2016
Notes: Defines the boundaries of an indexed patch. These boundaries are outer and inner rings.

Attributes

Name	Type	Notes
ReferencedPatch	NonNegativeLong	The XML index of the referenced patch inside this representation.

Associations

Association		Notes
0..1	**From:** PatchBoundaries.OuterRing **To:** AbstractRepresentation *Association*	OuterRing defines the extension of a representation patch. Inside the ring, the patch is defined, outside it is not. The associated representation is used to limit the extension. The patch is limited by the contact between the patch and the associated representation.
0..*	**From:** PatchBoundaries.InnerRing **To:** AbstractRepresentation *Association*	A hole inside a representation patch. Inside the ring, the representation patch is not defined, outside it is. The associated representations are used to define the holes. The holes occur inside the contact between the patch and the associated representations.
0..*	**From:** AbstractSurfaceRepresentation.Boundaries **To:** PatchBoundaries *Association*	

10.18 PlaneSetRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/14/2013 *Last modified:* 11/1/2016
Notes: Defines a plane representation, which can be made up of multiple patches. Commonly represented features are fluid contacts or frontiers. Common geometries of this representation are titled or horizontal planes.
BUSINESS RULE: If the plane representation is made up of multiple patches, then you must specify the outer rings for each plane patch.

Associations

Association		Notes
	From: PlaneSetRepresentation. **To:** AbstractSurfaceRepresentation *Generalization*	
1..*	**From:** PlaneSetRepresentation.Planes **To:** AbstractPlaneGeometry *Association*	

10.19 PointSetRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/14/2013 *Last modified:* 11/1/2016
Notes: A representation that consists of one or more node patches. Each node patch is an array of XYZ coordinates for the 3D points. There is no implied linkage between the multiple patches.

Associations

Association		Notes
1..*	**From:** PointSetRepresentation.NodePatch **To:** NodePatch *Association*	
	From: PointSetRepresentation. **To:** AbstractRepresentation *Generalization*	

10.20 PolylineRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/14/2013 *Last modified:* 11/1/2016
Notes: A representation made up of a single polyline or "polygonal chain", which may be closed or not.

Definition from Wikipedia (http://en.wikipedia.org/wiki/Piecewise_linear_curve):

A polygonal chain, polygonal curve, polygonal path, or piecewise linear curve, is a connected series of line segments. More formally, a polygonal chain *P* is a curve specified by a sequence of points \scriptstyle(A_1, A_2, \dots, A_n) called its vertices so that the curve consists of the line segments connecting the consecutive vertices.

In computer graphics a polygonal chain is called a polyline and is often used to approximate curved paths.

BUSINESS RULE: To record a polyline the writer software must give the values of the geometry of each node in an order corresponding to the logical series of segments (edges). The geometry of a polyline must be a 1D array of points.

A simple polygonal chain is one in which only consecutive (or the first and the last) segments intersect and only at their endpoints.

A closed polygonal chain (isClosed=True) is one in which the first vertex coincides with the last one, or the first and the last vertices are connected by a line segment.

Attributes

Name	Type	Notes
IsClosed	boolean	
LineRole	LineRole	

Associations

Association		Notes
1	**From:** PolylineRepresentation.NodePatch **To:** NodePatch *Association*	
	From: PolylineRepresentation. **To:** AbstractRepresentation *Generalization*	
	From: Seismic2dPostStackRepresentation.SeismicLineRepresentation **To:** PolylineRepresentation *Association*	

10.21 SealedContactRepresentationPart

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/21/2012 *Last modified:* 11/1/2016
Notes: Sealed contact elements that indicate that 2 or more contact patches are partially or totally colocated or equivalent. For possible types of identity, see IdentityKind.

Attributes

Name	Type	Notes
IdenticalNodeIndices	AbstractIntegerArray	Indicates which nodes (identified by their common index in all contact patches) of the contact patches are identical. If this list is not present, then it indicates that all nodes in each representation are identical, on an element-by-element level.
IdentityKind	IdentityKind	

Associations

Association	Notes
From: SealedContactRepresentationPart.Contact 2..* **To:** ContactPatch *Association*	
From: SealedContactRepresentationPart. **To:** AbstractContactRepresentationPart *Generalization*	
From: SealedSurfaceFrameworkRepresentation.SealedContactRepresentation 0..* **To:** SealedContactRepresentationPart *Association*	

10.22 SealedSurfaceFrameworkRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/27/2013 *Last modified:* 11/1/2016
Notes: A collection of contact representations parts, which are a list of contact patches and their identities. This collection of contact representations is completed by a set of representations gathered at the representation set representation level.

Associations

Association	Notes
From: SealedSurfaceFrameworkRepresentation. **To:** AbstractSurfaceFrameworkRepresentation *Generalization*	
From: SealedSurfaceFrameworkRepresentation.SealedContactRepresentation 0..* **To:** SealedContactRepresentationPart *Association*	
From: SealedVolumeFrameworkRepresentation.BasedOn **To:** SealedSurfaceFrameworkRepresentation *Association*	Identifies the sealed structural framework, which must integrate all the necessary line contacts for the sealed volume framework.

10.23 SealedVolumeFrameworkRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/27/2013 *Last modified:* 11/1/2016
Notes: A strict boundary representation (BREP), which represents the volume region by assembling together shells.
BUSINESS RULE: The sealed structural framework must be part of the same earth model as this sealed volume framework.

Associations

Association	Notes
From: SealedVolumeFrameworkRepresentation. **To:** RepresentationSetRepresentation *Generalization*	
From: SealedVolumeFrameworkRepresentation.BasedOn **To:** SealedSurfaceFrameworkRepresentation *Association*	Identifies the sealed structural framework, which must integrate all the necessary line contacts for the sealed volume framework.
From: SealedVolumeFrameworkRepresentation.Regions 1..* **To:** VolumeRegion *Association*	

10.24 SurfaceRole

Type: Enumeration *Stereotype:*
Detail: *Created:* 5/17/2012 *Last modified:* 11/1/2016
Notes: Indicates the various roles that a surface topology can have.

Attributes

Name	Type	Notes
map		Representation support for properties.
pick		Representation support for 3D points picked in 2D or 3D.

10.25 TrianglePatch

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/1/2013 *Last modified:* 11/1/2016
Notes: Patch made of triangles, where the number of triangles is given by the patch count.
BUSINESS RULE: Within a patch, all the triangles must be contiguous.

The patch contains:

- Number of nodes within the triangulation and their locations.
- 2D array describing the topology of the triangles.

Two triangles that are connected may be in different patches.

Attributes

Name	Type	Notes
NodeCount	NonNegativeLong	
Triangles	AbstractIntegerArray	The triangles are a 2D array of non-negative integers with the dimensions 3 x numTriangles.

Associations

Association		Notes
	From: TrianglePatch.Geometry **To:** PointGeometry *Association*	
0..*	**From:** TrianglePatch.SplitEdgePatch **To:** EdgePatch *Association*	
	From: TrianglePatch. **To:** Patch1d *Generalization*	
1..*	**From:** TriangulatedSetRepresentation.TrianglePatch **To:** TrianglePatch *Association*	

10.26 TriangulatedSetRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/14/2013 *Last modified:* 11/1/2016
Notes: A representation based on set of triangulated mesh patches, which gets its geometry from a 1D array of points.

BUSINESS RULE: The orientation of all the triangles of this representation must be consistent.

Associations

Association		Notes
	From: TriangulatedSetRepresentation. **To:** AbstractSurfaceRepresentation *Generalization*	
1..*	**From:** TriangulatedSetRepresentation.TrianglePatch **To:** TrianglePatch *Association*	

10.27 VolumeRegion

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/27/2013 *Last modified:* 11/1/2016
Notes: The volume within a shell or envelope.

Known issue (2.0): This object should be considered a volume region patch. Specifically the indexable element kind = patch, despite not inheriting from a patch, with the patch index given by the contained element.

The volume region must be considered as a patch in version 2.0 (even if now, this volume region is not literally inheriting from the patch class).

Attributes

Name	Type	Notes
PatchIndex	NonNegativeLong	This patch index is used to enumerate the volume regions. Known issue (2.0): Patch Index should inherit from patch, instead of being listed as a volume region element. Volume regions must be considered as a patch in version 2.0 (even if now, this volume region is not literally inheriting from the patch class).

Associations

Association	Notes
From: VolumeRegion.ExternalShell **To:** VolumeShell *Association*	
From: VolumeRegion.Represents **To:** GeologicUnitInterpretation *Association*	
From: VolumeRegion.InternalShells 0..* **To:** VolumeShell *Association*	
From: SealedVolumeFrameworkRepresentation.Regions 1..* **To:** VolumeRegion *Association*	

10.28 VolumeShell

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/27/2013 *Last modified:* 11/1/2016
Notes: The shell or envelope of a structural, stratigraphic, or fluid unit.

Attributes

Name	Type	Notes
ShellUid	String64	

Associations

Association		Notes
1..*	**From:** VolumeShell.MacroFaces **To:** OrientedMacroFace *Association*	
	From: VolumeRegion.ExternalShell **To:** VolumeShell *Association*	
0..*	**From:** VolumeRegion.InternalShells **To:** VolumeShell *Association*	

11 Wells

Package: xsd_schemas

Notes: This package contains classes for features, interpretations, representations and related objects used to define and exchange well data in RESQML.
The RESQML description of a well uses a wellbore trajectory representation to describe the geometry of a wellbore, and a wellbore frame to provide the topological support for properties. Wellbore marker frames and blocked wellbores are derived from the wellbore frame.

11.1 BlockedWellboreRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/7/2013 *Last modified:* 11/1/2016
Notes: The information that allows you to locate, on one or several grids (existing or planned), the intersection of volume (cells) and surface (faces) elements with a wellbore trajectory (existing or planned).

Associations

Association	Notes
From: BlockedWellboreRepresentation. **To:** WellboreFrameRepresentation *Generalization*	
From: BlockedWellboreRepresentation.IntervalGridCells **To:** IntervalGridCells *Association*	Reference to the intersected grid.

11.2 CorrectionInformation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 7/1/2015 *Last modified:* 11/1/2016
Notes: Occurs only if a correction has been applied on the survey wellbore.

Attributes

Name	Type	Notes
CorrectionAverageVelocity	double	The UOM is composed by: UOM of the LocalDepth3dCrs of the associated wellbore frame trajectory / UOM of the associated LocalTime3dCrs. If not used, enter zero.
CorrectionTimeShift	double	The UOM is the one specified in the LocalTime3dCrs. If not used, enter zero.

Associations

Association	Notes
From: SeismicWellboreFrameRepresentation.CorrectionInformation 0..1 **To:** CorrectionInformation *Association*	

11.3 DeviationSurveyRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 10/30/2012 *Last modified:* 11/1/2016
Notes: Specifies the station data from a deviation survey.
The deviation survey does not provide a complete specification of the geometry of a wellbore trajectory. Although a minimum-curvature algorithm is used in most cases, the implementation varies sufficiently that no single algorithmic specification is available as a data transfer standard.

Instead, the geometry of a RESQML wellbore trajectory is represented by a parametric line, parameterized by the MD.

CRS and units of measure do not need to be consistent with the CRS and units of measure for wellbore trajectory representation.

Attributes

Name	Type	Notes
AngleUom	PlaneAngleUomExt	Defines the units of measure for the azimuth and inclination.
AngleUomCustomDict	DataObjectReference	
Azimuths	AbstractFloatingPointArray	An array of azimuth angles, one for each survey station. The rotation is relative to the projected CRS north with a positive value indicating a clockwise rotation as seen from above. If the local CRS--whether in time or depth--is rotated relative to the projected CRS, then the azimuths remain relative to the projected CRS, not the local CRS. Note that the projection's north is not the same as true north or magnetic north. A good definition of the different kinds of "north" can be found in the OGP Surveying & Positioning Guidance Note 1 http://www.ogp.org.uk/pubs/373-01.pdf (the "True, Grid and Magnetic North bearings" paragraph). BUSINESS RULE: Array length equals station count.
FirstStationLocation	SinglePointGeometry	XYZ location of the first station of the deviation survey.
Inclinations	AbstractFloatingPointArray	Dip (or inclination) angle for each station. BUSINESS RULE: Array length equals station count.
IsFinal	boolean	Used to indicate that this is a final version of the deviation survey, as distinct from the interim interpretations.
Mds	AbstractFloatingPointArray	MD values for the position of the stations. BUSINESS RULE: Array length equals station count.

Name	Type	Notes
MdUom	LengthUomExt	Units of measure of the measured depths along this deviation survey.
MdUomCustomDict	DataObjectReference	
StationCount	PositiveLong	Number of stations.
WitsmlDeviationSurveyReference	DataObjectReference	A reference to an existing WITSML deviation survey.

Associations

Association	Notes
From: DeviationSurveyRepresentation.MdDatum **To:** MdDatum *Association*	
From: DeviationSurveyRepresentation. **To:** AbstractRepresentation *Generalization*	
From: WellboreTrajectoryRepresentation.DeviationSurvey 0..1 **To:** DeviationSurveyRepresentation *Association*	

11.4 MdDatum

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/1/2013 *Last modified:* 11/1/2016
Notes: Specifies the location of the measured depth = 0 reference point.
The location of this reference point is defined with respect to a CRS, which need not be the same as the CRS of a wellbore trajectory representation, which may reference this location.

Attributes

Name	Type	Notes
Location	SinglePointGeometry	The location of the MD reference point relative to a local CRS.
MdReference	WellboreDatumReference	

Associations

Association	Notes
From: MdDatum. **To:** AbstractObject *Generalization*	
From: MdDatum. **To:** WellboreDatumReference *Dependency*	
From: DeviationSurveyRepresentation.MdDatum **To:** MdDatum *Association*	
From: WellboreTrajectoryRepresentation.MdDatum **To:** MdDatum *Association*	

11.5 MdDomain

Type: Enumeration *Stereotype:*
Detail: *Created:* 4/25/2013 *Last modified:* 11/1/2016
Notes: Different types of measured depths.

Attributes

Name	Type	Notes
driller		The original depths recorded while drilling a well or LWD or MWD.
logger		Depths recorded when logging a well, which are in general considered to be more accurate than driller's depth.

Associations

Association	Notes
From: WellboreTrajectoryRepresentation. **To:** MdDomain *Dependency*	

11.6 SeismicWellboreFrameRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 7/1/2015 *Last modified:* 11/1/2016
Notes: The interpretation of this representation must be a WellboreInterpretation.
The acquisition information such as the time kind (e.g., TWT vs OWT for example) or survey acquisition type (e.g., checkshot vs VSP) should be captured by the associated acquisition activity.

Attributes

Name	Type	Notes
NodeTimeValues	AbstractFloatingPointArray	BUSINESS RULE: Count must be equal to the inherited NodeCount. The direction of the supporting axis is given by the LocalTime3dCrs itself. It is necessary to get this information to know what means positive or negative values. The values are given with respect to the SeismicReferenceDatum. The UOM is the one specified in the LocalTime3dCrs.
SeismicReferenceDatum	double	This is the Z value where the seismic time is equal to zero for this survey wellbore frame. The direction of the supporting axis is given by the LocalTime3dCrs of the associated wellbore trajectory. It is necessary to get the information to know what means a positive or a negative value. The value is given with respect to the ZOffset of the LocalDepth3dCrs of the associated wellbore trajectory. The UOM is the one specified in the LocalDepth3dCrs of the associated wellbore trajectory.
WeatheringVelocity	double	The UOM is composed by: UOM of the LocalDepth3dCrs of the associated wellbore frame trajectory / UOM of the associated LocalTime3dCrs Sometimes also called seismic velocity replacement.

Associations

Association	Notes
From: SeismicWellboreFrameRepresentation.TvdInformation 0..1 **To:** TvdInformation *Association*	
From: SeismicWellboreFrameRepresentation.CorrectionInformation 0..1 **To:** CorrectionInformation *Association*	
From: SeismicWellboreFrameRepresentation. **To:** WellboreFrameRepresentation *Generalization*	
From: SeismicWellboreFrameRepresentation.LocalTime3dCrs **To:** LocalTime3dCrs *Association*	

11.7 TvdInformation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 7/1/2015 *Last modified:* 11/1/2016
Notes:

Attributes

Name	Type	Notes
NodeTvdValues	AbstractFloatingPointArray	Count must be equal to count of nodes of the associated wellbore frame. The direction of the supporting axis is given by the LocalDepth3dCrs itself. It is necessary to get the information to know what are positive or negative values. The values are given with respect to the TvdDatum, not with respect to the ZOffest of the LocalDepth3dCrs The UOM is the one specified in the LocalDepth3dCrs.
TvdDatum	double	The direction of the supporting axis is given by the LocalDepth3dCrs itself. It is necessary to get the information to know what is a positive or a negative value. The value is given with respect to the ZOffset of the LocalDepth3dCrs. The UOM is the one specified in the LocalDepth3dCrs.
TvdReference	WellboreDatumReference	

Associations

Association	Notes
From: TvdInformation.LocalDepth3dCrs **To:** LocalDepth3dCrs *Association*	
From: TvdInformation. **To:** WellboreDatumReference *Dependency*	
From: SeismicWellboreFrameRepresentation.TvdInformation 0..1 **To:** TvdInformation *Association*	

11.8 WellboreFeature

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 11/28/2012 *Last modified:* 11/1/2016
Notes: May refer to one of these:
wellbore. A unique, oriented path from the bottom of a drilled borehole to the surface of the earth. The path must not overlap or cross itself.

borehole. A hole excavated in the earth as a result of drilling or boring operations. The borehole may represent the hole of an entire wellbore (when no sidetracks are present), or a sidetrack extension. A borehole extends from an originating point (the surface location for the initial borehole or kickoff point for sidetracks) to a terminating (bottomhole) point.

sidetrack. A borehole that originates in another borehole as opposed to originating at the surface.

Associations

Association		Notes
0..1	**From:** WellboreFeature.WitsmlWellbore **To:** WitsmlWellboreReference *Association*	Indicates which WITSML wellbore this borehole belongs to.
	From: WellboreFeature. **To:** AbstractTechnicalFeature *Generalization*	

11.9 WellboreFrameIndexableElements

Type: Enumeration *Stereotype:*
Detail: *Created:* 11/20/2013 *Last modified:* 11/1/2016
Notes: The elements on a wellbore frame that may be indexed. NOTE: This class is not actually used. It is intended for documentation purposes only to indicate the set of indexable elements that is appropriate for a wellbore frame.

Attributes

Name	Type	Notes
intervals		Count = WellboreFrameRepresentation.NodeCount-1 The propertyValue[n] is applied to the MD interval defined by MD values WellboreFrameRepresentation.NodeMd[n] and WellboreFrameRepresentation.NodeMd[n+1]
nodes		Count = WellboreFrameRepresentation.NodeCount
cells		Count = Number of intervals that intersect grids in the blocked wellbore. When applied to the wellbore frame representation, this is identical to the number of intervals.
intervals from datum		

11.10 WellboreFrameRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/7/2012 *Last modified:* 11/1/2016
Notes: Representation of a wellbore that is organized along a wellbore trajectory by its MD values. RESQML uses MD values to associate properties on points and to organize association of properties on intervals between MD points.

Attributes

Name	Type	Notes
NodeCount	PositiveLong	Number of nodes. Must be positive.
NodeMd	AbstractFloatingPointArray	MD values for each node. BUSINESS RULE: MD values and UOM must be consistent with the trajectory representation.
WitsmlLogReference	DataObjectReference	The reference to the equivalent WITSML well log.

Associations

Association	Notes
From: WellboreFrameRepresentation. **To:** AbstractRepresentation *Generalization*	
From: WellboreFrameRepresentation.CellFluidPhaseUnits 0..1 **To:** CellFluidPhaseUnits *Association*	
From: WellboreFrameRepresentation.IntervalStratigraphiUnits 0..* **To:** IntervalStratigraphicUnits *Association*	
From: WellboreFrameRepresentation.Trajectory **To:** WellboreTrajectoryRepresentation *Association*	
From: BlockedWellboreRepresentation. **To:** WellboreFrameRepresentation *Generalization*	
From: WellboreMarkerFrameRepresentation. **To:** WellboreFrameRepresentation *Generalization*	
From: SeismicWellboreFrameRepresentation. **To:** WellboreFrameRepresentation *Generalization*	

11.11 WellboreInterpretation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 3/21/2013 *Last modified:* 11/1/2016
Notes: Contains the data describing an opinion of a borehole. This interpretation is relative to one particular well trajectory.

Attributes

Name	Type	Notes
IsDrilled	boolean	Used to indicate that this wellbore has been, or is being, drilled, as opposed to planned wells. One wellbore feature may have multiple wellbore interpretations. For updated drilled trajectories, use IsDrilled=TRUE. For planned trajectories, use IsDrilled=FALSE used.

Associations

Association	Notes
From: WellboreInterpretation. **To:** AbstractFeatureInterpretation *Generalization*	

11.12 WellboreMarker

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/7/2013 *Last modified:* 11/1/2016
Notes: Representation of a wellbore marker that is located along a wellbore trajectory, one for each MD value in the wellbore frame.
BUSINESS RULE: Ordering of the wellbore markers must match the ordering of the nodes in the wellbore marker frame representation.

Attributes

Name	Type	Notes
FluidContact	FluidContact	
FluidMarker	FluidMarker	
GeologicBoundaryKind	GeologicBoundaryKind	
WitsmlFormationMarker	DataObjectReference	Optional WITSML wellbore reference of the well marker frame.

Associations

Association	Notes
From: WellboreMarker. **To:** FluidMarker *Dependency*	
From: WellboreMarker. **To:** GeologicBoundaryKind *Dependency*	
From: WellboreMarker. **To:** AbstractObject *Generalization*	
0..1 **From:** WellboreMarker.Interpretation **To:** BoundaryFeatureInterpretation *Association*	
From: WellboreMarker. **To:** FluidContact *Dependency*	
From: WellboreMarkerFrameRepresentation.WellboreMarker 1..* **To:** WellboreMarker *Association*	

11.13 WellboreMarkerFrameRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/7/2013 *Last modified:* 11/1/2016
Notes: A well log frame where each entry represents a well marker

Associations

Association	Notes
From: WellboreMarkerFrameRepresentation.WellboreMarker 1..* **To:** WellboreMarker *Association*	
From: WellboreMarkerFrameRepresentation. **To:** WellboreFrameRepresentation *Generalization*	

11.14 WellboreTrajectoryParentIntersection

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 8/2/2013 *Last modified:* 11/1/2016
Notes: For a wellbore trajectory in a multi-lateral well, indicates the MD of the kickoff point where the trajectory begins and the corresponding MD of the parent trajectory.

Attributes

Name	Type	Notes
KickoffMd	double	KickoffMd is the measured depth for the start of the child trajectory, as defined within the child.
ParentMd	double	If the kickoff MD in the child (KickoffMd) is different from the kickoff MD in the parent (ParentMd), then specify the ParentMD here. If not specified, then these two MD's are implied to be identical.

Associations

Association	Notes
From: WellboreTrajectoryParentIntersection.ParentTrajectory **To:** WellboreTrajectoryRepresentation *Association*	Indicates the parent trajectory of the wellbore trajectory.
From: WellboreTrajectoryRepresentation.ParentIntersection 0..1 **To:** WellboreTrajectoryParentIntersection *Association*	

11.15 WellboreTrajectoryRepresentation

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 6/7/2012 *Last modified:* 11/1/2016
Notes: Representation of a wellbore trajectory.

Attributes

Name	Type	Notes
CustomUnitDictionary	DataObjectReference	
FinishMd	double	Specifies the ending measured depth of the range for the wellbore trajectory. Range may often be from kickoff to TD, but this is not required. BUSINESS RULE: Start MD is always less than the Finish MD.
MdDomain	MdDomain	Indicates if the MD is either in “driller” domain or “logger” domain.
MdUom	LengthUomExt	Units of measure of the measured depths along this trajectory.
StartMd	double	Specifies the measured depth for the start of the wellbore trajectory. Range may often be from kickoff to TD, but this is not required. BUSINESS RULE: Start MD is always less than the Finish MD.
WitsmlTrajectoryReference	DataObjectReference	Pointer to the WITSML trajectory that is contained in the referenced wellbore. (For information about WITSML well and wellbore references, see the definition for RESQML technical feature, WellboreFeature).

Associations

Association	Notes
From: WellboreTrajectoryRepresentation.Geometry 0..1 **To:** AbstractParametricLineGeometry *Association*	
From: WellboreTrajectoryRepresentation. 1..1 **To:** AbstractRepresentation *Generalization*	
From: WellboreTrajectoryRepresentation.DeviationSurvey 0..1 **To:** DeviationSurveyRepresentation *Association*	
From: WellboreTrajectoryRepresentation.ParentIntersection 0..1 **To:** WellboreTrajectoryParentIntersection *Association*	
From: WellboreTrajectoryRepresentation.	

Association	Notes
To: MdDomain *Dependency*	
From: WellboreTrajectoryRepresentation.MdDatum **To:** MdDatum *Association*	
From: WellboreTrajectoryParentIntersection.ParentTrajectory **To:** WellboreTrajectoryRepresentation *Association*	Indicates the parent trajectory of the wellbore trajectory.
From: StreamlineWellbores.WellboreTrajectoryRepresentation 1..* **To:** WellboreTrajectoryRepresentation *Association*	
From: WellboreFrameRepresentation.Trajectory **To:** WellboreTrajectoryRepresentation *Association*	

11.16 WitsmlWellboreReference

Type: Class *Stereotype:* «XSDcomplexType»
Detail: *Created:* 2/7/2013 *Last modified:* 11/1/2016
Notes: Reference to the WITSML wellbore that this wellbore feature is based on.

Attributes

Name	Type	Notes
WitsmlWell	DataObjectReference	
WitsmlWellbore	DataObjectReference	

Associations

Association		Notes
0..1	**From:** WellboreFeature.WitsmlWellbore **To:** WitsmlWellboreReference *Association*	Indicates which WITSML wellbore this borehole belongs to.