OData Version 4.0. Part 3: Common Schema Definition Language (CSDL) Plus Errata 03

OASIS Standard incorporating Draft 01 of Errata 03

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Specification URIs

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This prose specification is one component of a Work Product that also includes:

- *OData Version 4.0 Errata 03*. Edited by Michael Pizzo, Ralf Handl, Martin Zurmuehl, and Hubert Heijkers. 10 March 2016. OASIS Committee Specification Draft 01. http://docs.oasis-open.org/odata/odata/v4.0/errata03/csd01/odata-v4.0-errata03-csd01.html.

- *OData Version 4.0. Part 1: Protocol Plus Errata 03*. Edited by Michael Pizzo, Ralf Handl, and Martin Zurmuehl. 10 March 2016. OASIS Standard incorporating Draft 01 of Errata 03. http://docs.oasis-open.org/odata/odata/v4.0/errata03/csd01/complete/part1-protocol/odata-v4.0-errata03-csd01-part1-protocol-complete.html.
- *OData Version 4.0. Part 2: URL Conventions Plus Errata 03*. Edited by Michael Pizzo, Ralf Handl, and Martin Zurmuehl. 10 March 2016. OASIS Standard incorporating Draft 01 of Errata 03. http://docs.oasis-open.org/odata/odata/v4.0/errata03/csd01/complete/part2-url-conventions/odata-v4.0-errata03-csd01-part2-url-conventions-complete.html.
- *OData Version 4.0. Part 3: Common Schema Definition Language (CSDL) Plus Errata 03* (this document). Edited by Michael Pizzo, Ralf Handl, and Martin Zurmuehl. 10 March 2016. OASIS Standard incorporating Draft 01 of Errata 03. http://docs.oasis-open.org/odata/odata/v4.0/errata03/csd01/complete/part3-csdl/odata-v4.0-errata03-csd01-part3-csdl-complete.html.
- ABNF components: OData ABNF Construction Rules Version 4.0 and OData ABNF Test Cases. http://docs.oasis-open.org/odata/odata/v4.0/errata03/csd01/complete/abnf/.
- Vocabulary components: OData Core Vocabulary, OData Measures Vocabulary and OData Capabilities Vocabulary. http://docs.oasis-open.org/odata/odata/v4.0/errata03/csd01/complete/vocabularies/.
- XML schemas: OData EDMX XML Schema and OData EDM XML Schema. http://docs.oasis-open.org/odata/odata/v4.0/errata03/csd01/complete/schemas/.
- OData Metadata Service Entity Model: http://docs.oasis-open.org/odata/odata/v4.0/errata03/csd01/complete/models/.
- Change-marked (redlined) versions of OData Version 4.0 Part 1, Part 2, and Part 3. OASIS Standard incorporating Draft 01 of Errata 03. http://docs.oasis-open.org/odata/odata/v4.0/errata03/csd01/redlined/.

Related work:

This specification is related to:

- *OData Version 4.0 Part 3: Common Schema Definition Language (CSDL)*. Edited by Michael Pizzo, Ralf Handl, and Martin Zurmuehl. 24 February 2014. OASIS Standard. http://docs.oasis-open.org/odata/odata/v4.0/os/part3-csdl/odata-v4.0-os-part3-csdl.html.
- *OData Atom Format Version 4.0*. Edited by Martin Zurmuehl, Michael Pizzo, and Ralf Handl. Latest version. http://docs.oasis-open.org/odata/odata-atom-format/v4.0/odata-atom-format-v4.0.html.
- *OData JSON Format Version 4.0*. Edited by Ralf Handl, Michael Pizzo, and Mark Biamonte. Latest version. http://docs.oasis-open.org/odata/odata-json-format/v4.0/odata-json-format-v4.0.html.

Declared XML namespaces:

- http://docs.oasis-open.org/odata/ns/edmx
- http://docs.oasis-open.org/odata/ns/edm

Abstract:

OData services are described by an Entity Data Model (EDM). The Common Schema Definition Language (CSDL) defines an XML representation of the entity data model exposed by an OData service.

Status:

This document was last revised or approved by the OASIS Open Data Protocol (OData) TC on the above date. The level of approval is also listed above. Check the “Latest version” location noted above for possible later revisions of this document. Any other numbered Versions and other technical work produced by the Technical Committee (TC) are listed at https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=odata#technical.

TC members should send comments on this specification to the TC’s email list. Others should send comments to the TC’s public comment list, after subscribing to it by following the instructions at the “Send A Comment” button on the TC’s web page at https://www.oasis-open.org/committees/odata/.

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Table of Contents

1 Introduction

OData services are described in terms of an Entity Data Model (EDM). The Common Schema Definition Language (CSDL) defines an XML representation of the entity data model exposed by an OData service. CSDL is articulated in the Extensible Markup Language (XML) 1.1 (Second Edition) **[XML-1.1]** with further building blocks from the W3C XML Schema Definition Language (XSD) 1.1 as described in **[XML-Schema-1]** and **[XML-Schema-2]**.

1.1 Terminology

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

1.2 Normative References

[EPSG] European Petroleum Survey Group (EPSG). http://www.epsg.org/.

[OData-ABNF] *OData ABNF Construction Rules Version 4.0*.
See link in “Additional artifacts” section on cover page.

[OData-Atom] *OData Atom Format Version 4.0*.
See link in “Related work” section on cover page.

[OData-EDM] *OData EDM XML Schema*.
See link in “Additional artifacts” section on cover page.

[OData-EDMX] *OData EDMX XML Schema*.
See link in “Additional artifacts” section on cover page.

[OData-JSON] *OData JSON Format Version 4.0.*
See link in “Related work” section on cover page.

[OData-Meta] *OData Metadata Service Schema.*
See link in “Additional artifacts” section on cover page.

[OData-Protocol] *OData Version 4.0 Part 1: Protocol*.
See link in “Additional artifacts” section on cover page.

[OData-URL] *OData Version 4.0 Part 2: URL Conventions*.
See link in “Additional artifacts” section on cover page.

[OData-VocCore] *OData Core Vocabulary.*
See link in “Additional artifacts” section on cover page.

[RFC2119] Bradner, S., “Key words for use in RFCs to Indicate Requirement Levels”, BCP 14, RFC 2119, March 1997. http://www.ietf.org/rfc/rfc2119.txt.

[RFC6570] Gregorio, J., Fielding, R., Hadley, M., Nottingham, M., and D. Orchard, “URI Template”, RFC 6570, March 2012. http://tools.ietf.org/html/rfc6570.

[XML-1.1] Extensible Markup Language (XML) 1.1 (Second Edition), F. Yergeau, E. Maler, J. Cowan, T. Bray, C. M. Sperberg-McQueen, J. Paoli, Editors, W3C Recommendation, 16 August 2006,
http://www.w3.org/TR/2006/REC-xml11-20060816.
Latest version available at http://www.w3.org/TR/xml11/.

[XML-Base] XML Base (Second Edition), J. Marsh, R. Tobin, Editors, W3C Recommendation, 28 January 2009,
http://www.w3.org/TR/2009/REC-xmlbase-20090128/.
Latest version available at http://www.w3.org/TR/xmlbase/.

[XML-Schema-1] W3C XML Schema Definition Language (XSD) 1.1 Part 1: Structures, D. Beech, M. Maloney, C. M. Sperberg-McQueen, H. S. Thompson, S. Gao, N. Mendelsohn, Editors, W3C Recommendation, 5 April 2012,

http://www.w3.org/TR/2012/REC-xmlschema11-1-20120405/.
Latest version available at http://www.w3.org/TR/xmlschema11-1/.

[XML-Schema-2] W3C XML Schema Definition Language (XSD) 1.1 Part 2: Datatypes, D. Peterson, S. Gao, C. M. Sperberg-McQueen, H. S. Thompson, P. V. Biron, A. Malhotra, Editors, W3C Recommendation, 5 April 2012, http://www.w3.org/TR/2012/REC-xmlschema11-2-20120405/.
Latest version available at http://www.w3.org/TR/xmlschema11-2/.

1.3 Typographical Conventions

Keywords defined by this specification use this `monospaced` font.

```
Normative source code uses this paragraph style.
```

Some sections of this specification are illustrated with non-normative examples.

Example 1: text describing an example uses this paragraph style

```
Non-normative examples use this paragraph style.
```

All examples in this document are non-normative and informative only.

All other text is normative unless otherwise labeled.

2 CSDL Namespaces

In addition to the default XML namespace, the elements and attributes used to describe the entity model of an OData service are defined in one of the following namespaces. An XML document using these namespaces and having an `edmx:Edmx` root element will be called a CSDL document.

2.1 Namespace EDMX

Elements and attributes associated with the top-level wrapper that contains the CSDL used to define the entity model for an OData Service are qualified with the Entity Data Model for Data Services Packaging namespace:

- `http://docs.oasis-open.org/odata/ns/edmx`

Prior versions of OData used the following namespace for EDMX:

- EDMX version 1.0: `http://schemas.microsoft.com/ado/2007/06/edmx`

They are non-normative for this specification.

In this specification the namespace prefix `edmx` is used to represent the Entity Data Model for Data Services Packaging namespace, however the prefix name is not prescriptive.

2.2 Namespace EDM

Elements and attributes that define the entity model exposed by the OData Service are qualified with the Entity Data Model namespace:

- `http://docs.oasis-open.org/odata/ns/edm`

Prior versions of CSDL used the following namespaces for EDM:

- CSDL version 1.0: `http://schemas.microsoft.com/ado/2006/04/edm`
- CSDL version 1.1: `http://schemas.microsoft.com/ado/2007/05/edm`
- CSDL version 1.2: `http://schemas.microsoft.com/ado/2008/01/edm`
- CSDL version 2.0: `http://schemas.microsoft.com/ado/2008/09/edm`
- CSDL version 3.0: `http://schemas.microsoft.com/ado/2009/11/edm`

They are non-normative for this specification.

In this specification the namespace prefix `edm` is used to represent the Entity Data Model namespace, however the prefix name is not prescriptive.

2.3 XML Schema Definitions

This specification contains normative XML schemas for the EDMX and EDM namespaces; see **[OData-EDMX]** and **[OData-EDM]**.

These XML schemas only define the shape of a well-formed CSDL document, but are not descriptive enough to define what a correct CSDL document MUST be in every imaginable use case. This specification document defines additional rules that correct CSDL documents MUST fulfill. In case of doubt on what makes a CSDL document correct the rules defined in this specification document take precedence.

2.4 XML Document Order

Client libraries MUST retain the document order of XML elements for CSDL documents because for some elements the order of child elements is significant. This includes, but is not limited to, members of enumeration types and items within a collection-valued annotation.

OData does not impose any ordering constraints on XML attributes within XML elements.

3 Entity Model Wrapper

An OData service exposes a single entity model. This model may be distributed over several schemas, and these schemas may be distributed over several physical locations. The entity model wrapper provides a single point of access to these parts by including them directly or referencing their physical locations.

A service is defined by a single CSDL document which can be accessed by sending a `GET` request to `<serviceRoot>/$metadata`. This document is called the metadata document. It may reference other CSDL documents.

The metadata document contains a single entity container that defines the resources exposed by this service. This entity container MAY extend an entity container defined in referenced documents.

The *model* of the service consists of all CSDL constructs used in its entity containers.

3.1 Element `edmx:Edmx`

A CSDL document MUST contain a root `edmx:Edmx` element. This element MUST contain a single direct child `edmx:DataServices` element. In addition to the data services element, the `Edmx` element contains zero or more `edmx:Reference` elements.

Example 2:

```
<edmx:Edmx xmlns:edmx="http://docs.oasis-open.org/odata/ns/edmx"
           Version="4.0">
  <edmx:DataServices>
    ...
  </edmx:DataServices>
</edmx:Edmx>
```

3.1.1 Attribute `Version`

The `edmx:Edmx` element MUST provide the value `4.0` for the `Version` attribute. It specifies the version of the EDMX wrapper defined by this version of the specification.

3.2 Element `edmx:DataServices`

The `edmx:DataServices` element MUST contain one or more `edm:Schema` elements which define the schemas exposed by the OData service.

3.3 Element `edmx:Reference`

The `edmx:Reference` element specifies external CSDL documents referenced by the referencing document. The child elements `edmx:Include` and `edmx:IncludeAnnotations` specify which parts of the referenced document are available for use in the referencing document. The `edmx:Reference` element MUST contain at least one `edmx:Include` or `edmx:IncludeAnnotations` child element.

The `edmx:Reference` element contains zero or more `edm:Annotation` elements.

The *scope* of a CSDL document is the document itself and all schemas included from directly referenced documents. All entity types, complex types and other named elements *in scope* (that is, defined in the document itself or a schema of a directly referenced document) can be accessed from a referencing document by their namespace-qualified names.

Referencing another document may alter the model defined by the referencing document. For instance, if a referenced document defines an entity type derived from an entity type in the referencing document, then an entity set of the service defined by the referencing document may return entities of the derived

type. This is identical to the behavior if the derived type had been defined directly in the referencing document.

Note: referencing documents is not recursive. Only named elements defined in directly referenced documents can be used within the schema. However, those elements may in turn include elements defined in schemas referenced by their defining schema.

Example 3: to reference entity models containing definitions of vocabulary terms

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<edmx:Edmx xmlns:edmx="http://docs.oasis-open.org/odata/ns/edmx"
           Version="4.0">
  <edmx:Reference Uri="http://vocabs.odata.org/capabilities/v1">
    <edmx:Include Namespace="Org.OData.Capabilities.V1" />
  </edmx:Reference>
  <edmx:Reference Uri="http://vocabs.odata.org/display/v1">
    <edmx:Include Alias="UI" Namespace="org.example.Display" />
  </edmx:Reference>
  <edmx:DataServices>...</edmx:DataServices>
</edmx:Edmx>
```

3.3.1 Attribute `Uri`

The `edmx:Reference` element MUST specify a `Uri` attribute. The `Uri` attribute uniquely identifies a model, so two references MUST NOT specify the same URI. The value of the `Uri` attribute SHOULD be a URL that locates a CSDL document describing the referenced model. If the URI is not dereferencable it SHOULD identify a well-known schema. The value of the `Uri` attribute MAY be an absolute or relative URI; relative URIs are relative to the `xml:base` attribute, see **[XML-Base]**.

3.4 Element `edmx:Include`

The `edmx:Reference` element contains zero or more `edmx:Include` elements that specify the schemas to include from the target document.

3.4.1 Attribute `Namespace`

The `edmx:Include` element MUST provide a Namespace value for the `Namespace` attribute. The value MUST match the namespace of a schema defined in the referenced CSDL document. The same namespace MUST NOT be included more than once, even if it is declared in more than one referenced document.

3.4.2 Attribute `Alias`

An `edmx:Include` element MAY define a SimpleIdentifier value for the `Alias` attribute. The `Alias` attribute defines an alias for the specified `Namespace` that can be used in qualified names instead of the namespace. It only provides a more convenient notation. Every model element that can be used via an alias-qualified name can alternatively also be used via its full namespace-qualified name. An alias allows a short string to be substituted for a long namespace. For instance, an alias of `display` might be assigned to the namespace `org.example.vocabularies.display`. An alias-qualified name is resolved to a fully qualified name by examining aliases on `edmx:Include` and `edm:Schema` elements within the same document.

Aliases are document-global, so `edmx:Include` and `edm:Schema` elements within a document MUST NOT assign the same alias to different namespaces and MUST NOT specify an alias with the same name as an in-scope namespace.

The `Alias` attribute MUST NOT use the reserved values `Edm`, `odata`, `System`, or `Transient`.

An alias is only valid within the document in which it is declared; a referencing document has to define its own aliases with the `edmx:Include` element.

3.5 Element edmx:IncludeAnnotations

The edmx:Reference element contains zero or more edmx:IncludeAnnotations elements that specify the annotations to include from the target document. If no edmx:IncludeAnnotations element is specified, a client MAY ignore all annotations in the referenced document that are not explicitly used in an edm:Path expression of the referencing document.

Example 4: reference documents that contain annotations

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<edmx:Edmx xmlns:edmx="http://docs.oasis-open.org/odata/ns/edmx"
           Version="4.0">
  <edmx:Reference Uri="http://odata.org/ann/b">
    <edmx:IncludeAnnotations TermNamespace="org.example.validation" />
    <edmx:IncludeAnnotations TermNamespace="org.example.display"
                             Qualifier="Tablet" />
    <edmx:IncludeAnnotations TermNamespace="org.example.hcm"
                             TargetNamespace="com.example.Sales" />
    <edmx:IncludeAnnotations TermNamespace="org.example.hcm"
                             Qualifier="Tablet"
                             TargetNamespace="com.example.Person" />
  </edmx:Reference>
  <edmx:DataServices>...</edmx:DataServices>
</edmx:Edmx>
```

The following annotations from `http://odata.org/ann/b` are included:

- *Annotations that use a term from the `org.example.validation` namespace, and*
- *Annotations that use a term from the `org.example.display` namespace and specify a `Tablet` qualifier and*
- *Annotations that apply a term from the `org.example.hcm` namespace to an element of the `com.example.Sales` namepace and*
- *Annotations that apply a term from the `org.example.hcm` namespace to an element of the `com.example.Person` namepace and specify a `Tablet` qualifier.*

3.5.1 Attribute TermNamespace

An edmx:IncludeAnnotations element MUST provide a Namespace value for the TermNamespace attribute.

The edmx:IncludeAnnotations element will import the set of annotations that apply terms defined in the schema identified by the TermNamespace value. The TermNamespace attribute also provides consumers insight about what namespaces are used in the annotations document. If there are no edmx:IncludeAnnotations elements that have a term namespace of interest to the consumer, the consumer can opt not to download the document.

3.5.2 Attribute Qualifier

An edmx:IncludeAnnotations element MAY specify a SimpleIdentifier for the Qualifier attribute. A qualifier is used to apply an annotation to a subset of consumers. For instance, a service author might want to supply a different set of annotations for various device form factors.

If Qualifier is specified, only those annotations applying terms from the specified TermNamespace with the specified Qualifier (applied to an element of the TargetNamespace, if present) SHOULD be imported. If Qualifier is not specified, all annotations within the referenced document from the specified TermNamespace (taking into account the TargetNamespace, if present) SHOULD be imported.

The `Qualifier` attribute also provides consumers insight about what qualifiers are used in the annotations document. If the consumer is not interested in that particular qualifier, the consumer can opt not to download the document.

3.5.3 Attribute `TargetNamespace`

An `edmx:IncludeAnnotations` element MAY specify a Namespace value for the `TargetNamespace` attribute.

If `TargetNamespace` is specified, only those annotations which apply a term from the specified `TermNamespace` to an element of the `TargetNamespace` (with the specified `Qualifier`, if present) SHOULD be imported. If `TargetNamespace` is not specified, all annotations within the referenced document from the specified `TermNamespace` (taking into account the `Qualifier`, if present) SHOULD be imported.

The `TargetNamespace` attribute also provides consumers insight about what namespaces are used in the annotations document. If there are no target elements that have a namespace of interest to the consumer, the consumer can opt not to download the document.

4 Common Characteristics of Entity Models

4.1 Nominal Types

A nominal type has a name that MUST be a SimpleIdentifier. Nominal types are referenced using their QualifiedName. The qualified type name MUST be unique within a model as it facilitates references to the element from other parts of the model.

When referring to nominal types, the reference MUST use one of the following:

- Namespace-qualified name
- Alias-qualified name

Example 5:

```
<Schema xmlns="http://docs.oasis-open.org/odata/ns/edm"
        Namespace="org.example"
        Alias="sales">
  <ComplexType Name="Address">...</ComplexType>
</Schema>
```

The two ways of referring to the nominal type `Address` are:

- *the fully qualified name `org.example.Address` can be used in any namespace*
- *an alias could be specified in any namespace and used in an alias-qualified name, e.g. `sales.Address`*

4.2 Structured Types

Structured types are composed of other model elements. Structured types are common in entity models as the means of representing entities and structured properties in an OData service. Entity types and complex types are both structured types.

4.3 Structural Properties

A structural property is a property (of a structural type) that has one of the following types:

- Primitive type
- Complex type
- Enumeration type
- A collection of one of the above

4.4 Primitive Types

Structured types are composed of other structured types and primitive types. OData defines the following primitive types:

Type	Meaning
`Edm.Binary`	Binary data
`Edm.Boolean`	Binary-valued logic
`Edm.Byte`	Unsigned 8-bit integer
`Edm.Date`	Date without a time-zone offset

Type	Meaning
Edm.DateTimeOffset	Date and time with a time-zone offset, no leap seconds
Edm.Decimal	Numeric values with fixed precision and scale
Edm.Double	IEEE 754 binary64 floating-point number (15-17 decimal digits)
Edm.Duration	Signed duration in days, hours, minutes, and (sub)seconds
Edm.Guid	16-byte (128-bit) unique identifier
Edm.Int16	Signed 16-bit integer
Edm.Int32	Signed 32-bit integer
Edm.Int64	Signed 64-bit integer
Edm.SByte	Signed 8-bit integer
Edm.Single	IEEE 754 binary32 floating-point number (6-9 decimal digits)
Edm.Stream	Binary data stream
Edm.String	Sequence of UTF-8 characters
Edm.TimeOfDay	Clock time 00:00-23:59:59.999999999999
Edm.Geography	Abstract base type for all Geography types
Edm.GeographyPoint	A point in a round-earth coordinate system
Edm.GeographyLineString	Line string in a round-earth coordinate system
Edm.GeographyPolygon	Polygon in a round-earth coordinate system
Edm.GeographyMultiPoint	Collection of points in a round-earth coordinate system
Edm.GeographyMultiLineString	Collection of line strings in a round-earth coordinate system
Edm.GeographyMultiPolygon	Collection of polygons in a round-earth coordinate system
Edm.GeographyCollection	Collection of arbitrary Geography values
Edm.Geometry	Abstract base type for all Geometry types
Edm.GeometryPoint	Point in a flat-earth coordinate system
Edm.GeometryLineString	Line string in a flat-earth coordinate system
Edm.GeometryPolygon	Polygon in a flat-earth coordinate system
Edm.GeometryMultiPoint	Collection of points in a flat-earth coordinate system
Edm.GeometryMultiLineString	Collection of line strings in a flat-earth coordinate system
Edm.GeometryMultiPolygon	Collection of polygons in a flat-earth coordinate system
Edm.GeometryCollection	Collection of arbitrary Geometry values

`Edm.Date` and `Edm.DateTimeOffset` follow **[XML-Schema-2]** and use the proleptic Gregorian calendar, allowing the year `0000` and negative years.

`Edm.Stream` is a primitive type that can be used as a property of an entity type or complex type, the underlying type for a type definition, or the binding parameter or return type of a function or action.

`Edm.Stream`, or a type definition whose underlying type is `Edm.Stream`, cannot be used in collections or for non-binding parameters to functions or actions.

Some of these types allow facet attributes, defined in section 6.2.

See rule `primitiveLiteral` in **[OData-ABNF]** for the representation of primitive type values in URLs, and **[OData-Atom]** and **[OData-JSON]** for the representation in requests and responses.

4.5 Built-In Abstract Types

The following built-in abstract types can be used within a model:

- `Edm.PrimitiveType`
- `Edm.ComplexType`
- `Edm.EntityType`

Conceptually, these are the abstract base types for primitive types (including type definitions and enumeration types), complex types, and entity types, respectively, and can be used anywhere a corresponding concrete type can be used, except:

- `Edm.EntityType`
  - cannot be used as the type of a singleton in an entity container because it doesn't define a structure, which defeats the purpose of a singleton.
  - cannot be used as the type of an entity set because all entities in an entity set must have the same key fields to uniquely identify them within the set.
  - cannot be the base type of an entity type or complex type.
- `Edm.ComplexType`
  - cannot be the base type of an entity type or complex type.
- `Edm.PrimitiveType`
  - cannot be used as the type of a key property of an entity type.
  - cannot be used as the underlying type of a type definition or enumeration type.
- `Collection(Edm.PrimitiveType)` and `Collection(Edm.ComplexType)`
  - cannot be used as the type of a property.
  - cannot be used as the return type of a function.

Vocabulary terms can, in addition, use

- `Edm.AnnotationPath`
- `Edm.PropertyPath`
- `Edm.NavigationPropertyPath`

as the type of a primitive term, or the type of a property of a complex type that is exclusively used as the type of a term.

4.6 Annotations

Many parts of the model can be annotated with additional information using the `edm:Annotation` element.

A model element MUST NOT specify more than one annotation for a given combination of `Term` and `Qualifier` attributes.

Vocabulary annotations can be specified as a child of the model element being annotated or as a child of an `edm:Annotations` element that targets the model element.

Refer to Vocabulary Annotations for details on which model elements support vocabulary annotations.

5 Schema

One or more schemas describe the entity model exposed by an OData service. The schema acts as a namespace for elements of the entity model such as entity types, complex types, enumerations and terms.

5.1 Element edm:Schema

The edm:Schema element contains one or more of the following elements:

- edm:Action
- edm:Annotations
- edm:Annotation
- edm:ComplexType
- edm:EntityContainer
- edm:EntityType
- edm:EnumType
- edm:Function
- edm:Term
- edm:TypeDefinition

Values of the Name attribute MUST be unique across all direct child elements of a schema, with the sole exception of overloads for an action and overloads for a function. The names are local to the schema; they need not be unique within a document.

5.1.1 Attribute Namespace

A schema is identified by a namespace. All edm:Schema elements MUST have a namespace defined through a Namespace attribute which MUST be unique within the document, and SHOULD be globally unique. A schema cannot span more than one document.

The schema's namespace is combined with the name of elements in the entity model to create unique qualified names, so identifiers that are used to name types MUST be unique within a namespace to prevent ambiguity. See Nominal Types for more detail.

The Namespace attribute MUST NOT use the reserved values Edm, odata, System, or Transient.

5.1.2 Attribute Alias

A schema MAY define an alias by providing a SimpleIdentifier value for the Alias attribute. An alias allows nominal types to be qualified with a short string rather than a long namespace.

Aliases are document-global, so all edmx:Include and edm:Schema elements within a document MUST specify different values for the Alias attribute. Aliases defined by an edm:Schema element can be used throughout the containing document and are not restricted to the schema that defines them.

The Alias attribute MUST NOT use the reserved values Edm, odata, System, or Transient.

6 Structural Property

Structured Types are composed of zero or more structural properties (represented as `edm:Property` elements) and navigation properties (represented as `edm:NavigationProperty` elements).

Example 6: complex type with two properties

```
<ComplexType Name="Measurement">
  <Property Name="Dimension" Type="Edm.String" Nullable="false" MaxLength="50"
            DefaultValue="Unspecified" />
  <Property Name="Length" Type="Edm.Decimal" Nullable="false" Precision="18"
            Scale="2" />
</ComplexType>
```

Open entity types and open complex types allow properties to be added dynamically to instances of the open type.

6.1 Element `edm:Property`

The `edm:Property` element defines a structural property.

Example 7: property that can have zero or more strings as its value

```
<Property Name="Units" Type="Collection(Edm.String)" />
```

A property MUST specify a unique name as well as a type and zero or more facets. Facets are attributes that modify or constrain the acceptable values for a property value.

6.1.1 Attribute `Name`

The `edm:Property` element MUST include a `Name` attribute whose value is a SimpleIdentifier used when referencing, serializing or deserializing the property.

The name of the structural property MUST be unique within the set of structural and navigation properties of the containing structured type and any of its base types.

6.1.2 Attribute `Type`

The `edm:Property` element MUST include a `Type` attribute. The value of the `Type` attribute MUST be the QualifiedName of a primitive type, complex type, or enumeration type in scope, or a collection of one of these types.

6.2 Property Facets

Property facets allow a model to provide additional constraints or data about the value of structural properties. Facets are expressed as attributes on the property element.

Facets apply to the type referenced in the element where the facet attribute is declared. If the type is a collection, the facets apply to the type of elements in the collection.

Example 8: `Precision` facet applied to the `DateTimeOffset` type

```
<Property Name="SuggestedTimes" Type="Collection(Edm.DateTimeOffset)"
          Precision="6" />
```

6.2.1 Attribute `Nullable`

The `edm:Property` element MAY contain the `Nullable` attribute whose Boolean value specifies whether a value is required for the property.

If no value is specified for a property whose `Type` attribute does not specify a collection, the `Nullable` attribute defaults to `true`. If no value is specified for a property whose `Type` attribute specifies a collection, the client cannot assume any default value.

If the `edm:Property` element contains a `Type` attribute that specifies a collection, the property MUST always exist, but the collection MAY be empty. In this case, the `Nullable` attribute applies to members of the collection and specifies whether the collection can contain null values. A `Nullable` value of `true` means that the collection MAY contain null values (although attempting to insert a null value may still fail for a variety of reasons). A `Nullable` value of `false` means that the collection cannot contain null values. The absence of the `Nullable` attribute means it is unknown whether the collection can contain null values.

6.2.2 Attribute `MaxLength`

A binary, stream or string property MAY define a positive integer value for the `MaxLength` facet attribute. The value of this attribute specifies the maximum length of the value of the property on a type instance. For binary or stream properties this is the octet length of the binary data, for string property it is the character length of the string value. Instead of an integer value the constant `max` MAY be specified as a shorthand for the maximum length supported for the type by the service.

If no value is specified, the property has unspecified length.

6.2.3 Attribute `Precision`

A datetime-with-offset, decimal, duration, or time-of-day property MAY define a value for the `Precision` attribute.

For a decimal property the value of this attribute specifies the maximum number of significant decimal digits of the property's value; it MUST be a positive integer. If no value is specified, the decimal property has unspecified precision.

For a temporal property the value of this attribute specifies the number of decimal places allowed in the seconds portion of the property's value; it MUST be a non-negative integer between zero and twelve. If no value is specified, the temporal property has a precision of zero.

Note: service designers SHOULD be aware that some clients are unable to support a precision greater than 28 for decimal properties and 7 for temporal properties. Client developers MUST be aware of the potential for data loss when round-tripping values of greater precision. Updating via `PATCH` and exclusively specifying modified properties will reduce the risk for unintended data loss.

6.2.4 Attribute `Scale`

A decimal property MAY define a non-negative integer value or `variable` for the `Scale` attribute.

This attribute specifies the maximum number of digits allowed to the right of the decimal point.

The value `variable` means that the number of digits to the right of the decimal point may vary from zero to the value of the `Precision` attribute.

An integer value means that the number of digits to the right of the decimal point may vary from zero to the value of the `Scale` attribute, and the number of digits to the left of the decimal point may vary from one to the value of the `Precision` attribute minus the value of the `Scale` attribute. If `Precision` is equal to `Scale`, a single zero has to precede the decimal point.

The value of the `Scale` attribute MUST be less than or equal to the value of the `Precision` attribute. If no value is specified, the Scale facet defaults to zero.

Note: if the underlying data store allows negative scale, services may use a `Precision` attribute with the absolute value of the negative scale added to the actual number of significant decimal digits, and client-provided values may have to be rounded before being stored.

Example 9: `Precision` and `Scale` facets applied to the `Decimal` type.
Allowed values: 1.23, 0.23, 3.14 and 0.7, not allowed values: 123, 12.3.


```
<Property Name="Amount" Type="Edm.Decimal" Precision="3" Scale="2" />
```

Example 10: `Precision` equals `Scale`.
Allowed values: 0.23, 0,7, not allowed values: 1.23, 1.2.

```
<Property Name="Amount" Type="Edm.Decimal" Precision="2" Scale="2" />
```

Example 11: `Precision` and a variable `Scale` applied to the `Decimal` type.
Allowed values: 0.123, 1.23, 0.23, 0.7, 123 and 12.3, not allowed would be: 12.34, 1234 and 123.4 due to the limited precision.

```
<Property Name="Amount" Type="Edm.Decimal" Precision="3" Scale="variable" />
```

6.2.5 Attribute `Unicode`

A string property MAY define a Boolean value for the `Unicode` attribute.

The value `true` indicates that the property might contain and accept string values with Unicode characters beyond the ASCII character set. The value `false` indicates that the property will only contain and accept string values with characters limited to the ASCII character set.

If no value is specified, the `Unicode` facet defaults to `true`.

6.2.6 Attribute `SRID`

A geometry or geography property MAY define a value for the `SRID` attribute. The value of this attribute identifies which spatial reference system is applied to values of the property on type instances.

The value of the `SRID` attribute MUST be a non-negative integer or the special value `variable`. If no value is specified, the attribute defaults to `0` for `Geometry` types or `4326` for `Geography` types.

The valid values of the `SRID` attribute and their meanings are as defined by the European Petroleum Survey Group **[EPSG]**.

6.2.7 Attribute `DefaultValue`

A primitive or enumeration property MAY define a value for the `DefaultValue` attribute. The value of this attribute determines the value of the property if the property is not explicitly represented in an annotation or the body of a `POST` or `PUT` request.

Default values of type `Edm.String` MUST be represented according to the XML escaping rules for character data in attribute values. Values of other primitive types MUST be represented according to the appropriate alternative in the `primitiveValue` rule defined in **[OData-ABNF]**, i.e. `Edm.Binary` as `binaryValue`, `Edm.Boolean` as `booleanValue` etc.

If no value is specified, the client SHOULD NOT assume a default value.

7 Navigation Property

7.1 Element edm:NavigationProperty

A navigation property allows navigation to related entities.

Example 12: the Product entity type has a navigation property to a Category, which has a navigation link back to one or more products

```
<EntityType Name="Product">
  ...
  <NavigationProperty Name="Category" Type="Self.Category" Nullable="false"
                      Partner="Products" />
  <NavigationProperty Name="Supplier" Type="Self.Supplier" />
</EntityType>

<EntityType Name="Category">
  ...
  <NavigationProperty Name="Products" Type="Collection(Self.Product)"
                      Partner="Category" />
</EntityType>
```

7.1.1 Attribute Name

The `edm:NavigationProperty` element MUST include a `Name` attribute whose value is a SimpleIdentifier that is used when navigating from the structured type that declares the navigation property to the related entity type.

The name of the navigation property MUST be unique within the set of structural and navigation properties of the containing structured type and any of its base types.

7.1.2 Attribute Type

The `edm:NavigationProperty` element MUST include a `Type` attribute. The value of the type attribute MUST resolve to an entity type or a collection of an entity type declared in the same document or a document referenced with an `edmx:Reference` element, or the abstract type `Edm.EntityType`.

If the value is an entity type name, there can be at most one related entity. If it is a collection, an arbitrary number of entities can be related.

The related entities MUST be of the specified entity type or one of its subtypes.

7.1.3 Attribute Nullable

The `edm:NavigationProperty` element MAY contain the `Nullable` attribute whose Boolean value specifies whether a navigation target is required for the navigation property.

If no value is specified for a navigation property whose `Type` attribute does not specify a collection, the `Nullable` attribute defaults to `true`. The value `true` (or the absence of the `Nullable` attribute) indicates that no navigation target is required. The value `false` indicates that a navigation target is required for the navigation property on instances of the containing type.

A navigation property whose `Type` attribute specifies a collection MUST NOT specify a value for the `Nullable` attribute as the collection always exists, it may just be empty.

7.1.4 Attribute `Partner`

A navigation property of an entity type MAY specify a navigation property path value for the `Partner` attribute.

This attribute MUST NOT be specified for navigation properties of complex types.

If specified, the value of this attribute MUST be a path from the entity type specified in the `Type` attribute to a navigation property defined on that type or a derived type. The path may traverse complex types, including derived complex types, but MUST NOT traverse any navigation properties. The type of the partner navigation property MUST be the containing entity type of the current navigation property or one of its parent entity types.

If the `Partner` attribute identifies a single-valued navigation property, the partner navigation property MUST lead back to the source entity from all related entities. If the `Partner` attribute identifies a multi-valued navigation property, the source entity MUST be part of that collection.

If no partner navigation property is specified, no assumptions can be made as to whether one of the navigation properties on the target type will lead back to the source entity.

If a partner navigation property is specified, this partner navigation property MUST either specify the current navigation property as its partner to define a bi-directional relationship or it MUST NOT specify a partner attribute. The latter can occur if the partner navigation property is defined on a complex type or the current navigation property is defined on a type derived from the type of the partner navigation property.

7.1.5 Attribute `ContainsTarget`

A navigation property MAY assign a Boolean value to the `ContainsTarget` attribute. If no value is assigned to the `ContainsTarget` attribute, the attribute defaults to `false`. If the value of the `ContainsTarget` attribute is `true`, the navigation property is called a *containment navigation property*.

Containment navigation properties define an implicit entity set for each instance of its declaring entity type. This implicit entity set is identified by the read URL of the navigation property for that entity.

Entities of the entity type that declares the navigation property, either directly or indirectly via a property of complex type, contain the entities referenced by the containment navigation property. The canonical URL for contained entities is the canonical URL of the containing entity, followed by the path segment of the navigation property and the key of the contained entity, see **[OData-URL]**.

As items in a collection of complex types do not have a canonical URL, complex types declaring a containment navigation property, either directly or indirectly via a property of complex type, MUST NOT be used as the type of a collection-valued property.

An entity cannot be referenced by more than one containment relationship, and cannot both belong to an entity set declared within the entity container and be referenced by a containment relationship.

Containment navigation properties MUST NOT be specified as the last path segment in the `Path` attribute of a navigation property binding. When a containment navigation property navigates between entity types in the same inheritance hierarchy, the containment is called *recursive*.

Containment navigation properties MAY specify a `Partner` attribute. If the containment is recursive, the partner navigation property MUST be nullable and specify a single entity type. If the containment is not recursive, the partner navigation property MUST NOT be nullable.

An entity type hierarchy MUST NOT contain more than one navigation property with a `Partner` attribute referencing a containment relationship.

Note: without a partner attribute, there is no reliable way for a client to determine which entity contains a given contained entity. This may lead to problems for clients if the contained entity can also be reached via a non-containment navigation path.

7.2 Element edm:ReferentialConstraint

A navigation property whose Type attribute specifies a single entity type MAY define one or more referential constraints. A referential constraint asserts that the *dependent property* (the property defined on the *dependent entity* containing the navigation property) MUST have the same value as the *principal property* (the referenced property defined on the *principal entity* that is the target of the navigation).

The type of the dependent property MUST match the type of the principal property. If the navigation property on which the referential constraint is defined or the principal property is nullable, then the dependent property MUST be nullable. If both the navigation property and the principal property are not nullable, then the dependent property MUST be marked with the Nullable="false" attribute value.

Example 13: the category must exist for a product in that category to exist, and the CategoryID of the product is identical to the ID of the category

```
<EntityType Name="Product">
  ...
  <Property Name="CategoryID" Type="Edm.String" Nullable="false"/>
  <NavigationProperty Name="Category" Type="Self.Category" Nullable="false">
    <ReferentialConstraint Property="CategoryID" ReferencedProperty="ID" />
  </NavigationProperty>
</EntityType>
```

7.2.1 Attribute Property

A referential constraint MUST specify a value for the Property attribute. The Property attribute specifies the property that takes part in the referential constraint on the dependent entity type. Its value MUST be a path expression resolving to a primitive property of the dependent entity type itself or to a primitive property of a complex property (recursively) of the dependent entity type. The names of the properties in the path are joined together by forward slashes.

7.2.2 Attribute ReferencedProperty

A referential constraint MUST specify a value for the ReferencedProperty attribute. The ReferencedProperty attribute specifies the corresponding property of the principal entity type. Its value MUST be a path expression resolving to a primitive property of the principal entity type itself or to a primitive property of a complex property (recursively) of the principal entity type that MUST have the same data type as the property of the dependent entity type.

7.3 Element edm:OnDelete

A navigation property MAY define one edm:OnDelete element. It describes the action the service will take on related entities when the entity on which the navigation property is defined is deleted.

Example 14: deletion of a category implies deletion of the related products in that category

```
<EntityType Name="Category">
  ...
  <NavigationProperty Name="Products" Type="Collection(Self.Product)">
    <OnDelete Action="Cascade" />
  </NavigationProperty>
</EntityType>
```

7.3.1 Attribute Action

The edm:OnDelete element MUST include the Action attribute with one of the following values:

- Cascade, meaning the related entities will be deleted if the source entity is deleted,
- None, meaning a DELETE request on a source entity with related entities will fail,

- `SetNull`, meaning all properties of related entities that are tied to properties of the source entity via a referential constraint and that do not participate in other referential constraints will be set to null,
- `SetDefault`, meaning all properties of related entities that are tied to properties of the source entity via a referential constraint and that do not participate in other referential constraints will be set to their default value.

If no `edm:OnDelete` element is present, the action taken by the service is not predictable by the client and could vary per entity.

8 Entity Type

Entity types are nominal structured types with a key that consists of one or more references to structural properties. An entity type is the template for an entity: any uniquely identifiable record such as a customer or order.

An `edm.Key` child element MAY be specified if the entity type does not specify a base type that already has a key declared. The key consists of one or more references to structural properties of the entity type.

An entity type can define two types of properties. A structural property is a named reference to a primitive, complex, or enumeration type, or a collection of primitive, complex, or enumeration types. A navigation property is a named reference to another entity type or collection of entity types.

All properties MUST have a unique name within an entity type. Properties MUST NOT have the same name as the declaring entity type. They MAY have the same name as one of the direct or indirect base types or derived types.

An open entity type allows properties to be dynamically added to instances of the type.

Example 15: a simple entity type

```
<EntityType Name="Employee">
  <Key>
    <PropertyRef Name="ID" />
  </Key>
  <Property Name="ID" Type="Edm.String" Nullable="false" />
  <Property Name="FirstName" Type="Edm.String" Nullable="false" />
  <Property Name="LastName" Type="Edm.String" Nullable="false" />
  <NavigationProperty Name="Manager" Type="Model.Manager" />
</EntityType>
```

Example 16: a derived entity type based on the previous example

```
<EntityType Name="Manager" BaseType="Model.Employee">
  <Property Name="AnnualBudget" Type="Edm.Decimal" />
  <NavigationProperty Name="Employees" Type="Collection(Model.Employee)" />
</EntityType>
```

Note: the derived type has the same name as one of the properties of its base type.

8.1 Element `edm:EntityType`

The `edm:EntityType` element represents an entity type in the entity model. It contains zero or more `edm:Property` and `edm:NavigationProperty` elements describing the properties if the entity type.

It MAY contain one `edm:Key` element.

8.1.1 Attribute `Name`

The `edm:EntityType` element MUST include a `Name` attribute whose value is a SimpleIdentifier. The name MUST be unique within its namespace.

8.1.2 Attribute `BaseType`

An entity type can inherit from another entity type by specifying the QualifiedName of the base entity type as the value for the `BaseType` attribute.

An entity type inherits the key as well as structural and navigation properties declared on the entity type's base type.

An entity type MUST NOT introduce an inheritance cycle via the base type attribute.

8.1.3 Attribute Abstract

An entity type MAY indicate that it cannot be instantiated by providing a Boolean value of `true` to the `Abstract` attribute. If not specified, the `Abstract` attribute defaults to `false`.

If `Abstract` is `false`, the entity type MUST define a key or derive from a base type with a defined key.

An abstract entity type MUST NOT inherit from a non-abstract entity type.

8.1.4 Attribute OpenType

An entity type MAY indicate that it is open by providing a value of `true` for the `OpenType` attribute. An open type allows clients to add properties dynamically to instances of the type by specifying uniquely named values in the payload used to insert or update an instance of the type.

If not specified, the value of the `OpenType` attribute defaults to `false`.

An entity type derived from an open entity type MUST NOT provide a value of `false` for the `OpenType` attribute.

Note: structural and navigation properties MAY be returned by the service on instances of any structured type, whether or not the type is marked as open. Clients MUST always be prepared to deal with additional properties on instances of any structured type, see **[OData-Protocol]**.

8.1.5 Attribute HasStream

An entity type that does not specify a `BaseType` attribute MAY specify a Boolean value for the `HasStream` attribute.

A value of `true` specifies that the entity type is a media entity. *Media entities* are entities that represent a media stream, such as a photo. For more information on media entities see **[OData-Protocol]**.

If no value is provided for the `HasStream` attribute, and no `BaseType` attribute is specified, the value of the `HasStream` attribute is set to `false`.

The value of the the `HasStream` attribute is inherited by all derived types.

Entity types that specify `HasStream="true"` MAY specify a list of acceptable media types using an annotation with term `Core.AcceptableMediaTypes`, see **[OData-VocCore]**.

8.2 Element edm:Key

An entity is uniquely identified within an entity set by its key. An entity type that is not abstract MUST either contain exactly one `edm:Key` element or inherit its key from its base type. An abstract entity type MAY define a key if it doesn't inherit one.

An entity type's key refers to the set of properties that uniquely identify an instance of the entity type within an entity set.

The `edm:Key` element MUST contain at least one `edm:PropertyRef` element. An `edm:PropertyRef` element references an `edm:Property`. The properties that compose the key MUST be non-nullable and typed with an enumeration type, one of the following primitive types, or a type definition based on one of these primitive types:

- `Edm.Boolean`
- `Edm.Byte`
- `Edm.Date`
- `Edm.DateTimeOffset`
- `Edm.Decimal`
- `Edm.Duration`
- `Edm.Guid`

- Edm.Int16
- Edm.Int32
- Edm.Int64
- Edm.SByte
- Edm.String
- Edm.TimeOfDay

The properties that make up a primary key MAY be language-dependent, but their values MUST be unique across all languages and the entity ids (defined in **[OData-Protocol]**) MUST be language independent.

Example 17: entity type with a simple key

```
<EntityType Name="Category">
  <Key>
    <PropertyRef Name="ID" />
  </Key>
  <Property Name="ID" Type="Edm.Int32" Nullable="false" />
  <Property Name="Name" Type="Edm.String" />
</EntityType>
```

Example 18: entity type with a simple key referencing a property of a complex type

```
<EntityType Name="Category">
  <Key>
    <PropertyRef Name="Info/ID" Alias="EntityInfoID" />
  </Key>
  <Property Name="Info" Type="Sales.EntityInfo" Nullable="false" />
  <Property Name="Name" Type="Edm.String" />
</EntityType>

<ComplexType Name="EntityInfo">
  <Property Name="ID" Type="Edm.Int32" Nullable="false" />
  <Property Name="Created" Type="Edm.DateTimeOffset" />
</ComplexType>
```

Example 19: entity type with a composite key

```
<EntityType Name="OrderLine">
  <Key>
    <PropertyRef Name="OrderID" />
    <PropertyRef Name="LineNumber" />
  </Key>
  <Property Name="OrderID" Type="Edm.Int32" Nullable="false" />
  <Property Name="LineNumber" Type="Edm.Int32" Nullable="false" />
</EntityType>
```

8.3 Element edm:PropertyRef

The edm:PropertyRef element provides an edm:Key with a reference to a property.

8.3.1 Attribute Name

The edm:PropertyRef element MUST specify a value for the Name attribute which MUST be a path expression resolving to a primitive property of the entity type itself or to a primitive property of a complex property (recursively) of the entity type. The names of the properties in the path are joined together by forward slashes.

8.3.2 Attribute `Alias`

If the property identified by the `Name` attribute is a member of a complex type, the `edm:PropertyRef` element MUST specify the `Alias` attribute.

The value of the `Alias` attribute MUST be a SimpleIdentifier and MUST be unique within the set of aliases, structural and navigation properties of the containing entity type and any of its base types.

The `Alias` attribute MUST NOT be defined if the key property is not a member of a complex type.

For keys that are members of complex types, the alias MUST be used in the key predicate of URLs instead of the value assigned to the `Name` attribute. The alias MUST NOT be used in the query part.

Example 20 (based on example 18): requests to an entity set `Categories` of type `Category` must use the alias

```
http://host/service/Categories(EntityInfoID=1)
```

Example 21 (based on example 18): in a query part the value assigned to the name attribute must be used

```
http://example.org/OData.svc/Categories?$filter=Info/ID le 100
```


9 Complex Type

Complex types are keyless nominal structured types. The lack of a key means that complex types cannot be referenced, created, updated or deleted independently of an entity type. Complex types allow entity models to group properties into common structures.

A complex type can define two types of properties. A structural property is a named reference to a primitive, complex, or enumeration type, or a collection of primitive, complex, or enumeration types. A navigation property is a named reference to an entity type or a collection of entity types.

All properties MUST have a unique name within a complex type. Properties MUST NOT have the same name as the declaring complex type. They MAY have the same name as one of the direct or indirect base types or derived types.

An open complex type allows properties to be dynamically added to instances of the type.

Example 22: a complex type used by two entity types

```
<ComplexType Name="Dimensions">
  <Property Name="Height" Nullable="false" Type="Edm.Decimal" />
  <Property Name="Weight" Nullable="false" Type="Edm.Decimal" />
  <Property Name="Length" Nullable="false" Type="Edm.Decimal" />
</ComplexType>

<EntityType Name="Product">
  ...
  <Property Name="ProductDimensions" Type="Self.Dimensions" />
  <Property Name="ShippingDimensions" Type="Self.Dimensions" />
</EntityType>

<EntityType Name="ShipmentBox">
  ...
  <Property Name="Dimensions" Type="Self.Dimensions" />
</EntityType>
```

9.1 Element `edm:ComplexType`

The `edm:ComplexType` element represents a complex type in an entity model. It contains zero or more `edm:Property` and `edm:NavigationProperty` elements describing properties of the complex type.

9.1.1 Attribute `Name`

The `edm:ComplexType` element MUST include a `Name` attribute whose value is a SimpleIdentifier. The value identifies the complex type and MUST be unique within its namespace.

9.1.2 Attribute `BaseType`

A complex type can inherit from another complex type by specifying the QualifiedName of the base complex type as the value for the `BaseType` attribute.

A complex type inherits the properties declared on the complex type's base type.

A complex type MUST NOT introduce an inheritance cycle via the base type attribute.

9.1.3 Attribute `Abstract`

A complex type MAY indicate that it cannot be instantiated by providing a Boolean value of `true` to the `Abstract` attribute.

If not specified, the `Abstract` attribute defaults to `false`.

9.1.4 Attribute `OpenType`

A complex type MAY indicate that it is open by providing a value of `true` for the `OpenType` attribute. An open type allows clients to add properties dynamically to instances of the type by specifying uniquely named values in the payload used to insert or update an instance of the type.

If not specified, the `OpenType` attribute defaults to `false`.

A complex type derived from an open complex type MUST NOT provide a value of `false` for the `OpenType` attribute.

Note: structural and navigation properties MAY be returned by the service on instances of any structured type, whether or not the type is marked as open. Clients MUST always be prepared to deal with additional properties on instances of any structured type, see **[OData-Protocol]**.

10 Enumeration Type

Enumeration types are nominal types that represent a series of related values. Enumeration types expose these related values as members of the enumeration.

The `IsFlags` attribute indicates that more than one member may be selected at a time.

Example 23: a simple flags-enabled enumeration

```
<EnumType Name="FileAccess" UnderlyingType="Edm.Int32" IsFlags="true">
  <Member Name="Read"   Value="1" />
  <Member Name="Write"  Value="2" />
  <Member Name="Create" Value="4" />
  <Member Name="Delete" Value="8" />
</EnumType>
```

10.1 Element `edm:EnumType`

The `edm:EnumType` element represents an enumeration type in an entity model.

The enumeration type element contains one or more child `edm:Member` elements defining the members of the enumeration type.

10.1.1 Attribute `Name`

The `edm:EnumType` element MUST include a `Name` attribute whose value is a SimpleIdentifier. The value identifies the enumeration type and MUST be unique within its namespace.

10.1.2 Attribute `UnderlyingType`

An enumeration type MAY include an `UnderlyingType` attribute to specify an underlying type whose value MUST be one of `Edm.Byte`, `Edm.SByte`, `Edm.Int16`, `Edm.Int32`, or `Edm.Int64`. If the `UnderlyingType` attribute is not specified, `Edm.Int32` is used as the underlying type.

10.1.3 Attribute `IsFlags`

An enumeration type MAY specify a Boolean value for the `IsFlags` attribute. A value of `true` indicates that the enumeration type allows multiple members to be selected simultaneously.

If no value is specified for this attribute, its value defaults to `false`.

10.2 Element `edm:Member`

The `edm:Member` element defines the discrete options for the enumeration type .

Example 24: an enumeration type with three discrete members

```
<EnumType Name="ShippingMethod">
  <Member Name="FirstClass" />
  <Member Name="TwoDay" />
  <Member Name="Overnight" />
</EnumType>
```

10.2.1 Attribute `Name`

Each `edm:Member` element MUST include a `Name` attribute whose value is a SimpleIdentifier. The enumeration type MUST NOT declare two members with the same name.

10.2.2 Attribute `Value`

The value of an enumeration member allows instances to be sorted by a property that has an enumeration member for its value.

If the `IsFlags` attribute has a value of `false`, either all members MUST specify an integer value for the `Value` attribute, or all members MUST NOT specify a value for the `Value` attribute. If no values are specified, the members are assigned consecutive integer values in the order of their appearance, starting with zero for the first member. Client libraries MUST preserve elements in document order.

If the `IsFlags` attribute has a value of `true`, a non-negative integer value MUST be specified for the `Value` attribute. A combined value is equivalent to the bitwise OR of the discrete values.

The value MUST be a valid value for the `UnderlyingType` of the enumeration type.

Enumeration types can have multiple members with the same value. Members with the same value compare as equal, and members with the same value can be used interchangeably.

Example 25: `FirstClass` has a value of `0`, `TwoDay` a value of 1, and `Overnight` a value of 2.

```
<EnumType Name="ShippingMethod">
  <Member Name="FirstClass" />
  <Member Name="TwoDay" />
  <Member Name="Overnight" />
</EnumType>
```

Example 26: pattern values can be combined, and some combined values have explicit names

```
<EnumType Name="Pattern" UnderlyingType="Edm.Int32" IsFlags="true">
  <Member Name="Plain"             Value="0" />
  <Member Name="Red"               Value="1" />
  <Member Name="Blue"              Value="2" />
  <Member Name="Yellow"            Value="4" />
  <Member Name="Solid"             Value="8" />
  <Member Name="Striped"           Value="16" />
  <Member Name="SolidRed"          Value="9" />
  <Member Name="SolidBlue"         Value="10" />
  <Member Name="SolidYellow"       Value="12" />
  <Member Name="RedBlueStriped"    Value="19" />
  <Member Name="RedYellowStriped"  Value="21" />
  <Member Name="BlueYellowStriped" Value="22" />
</EnumType>
```


11 Type Definition

11.1 Element edm:TypeDefinition

A type definition defines a specialization of one of the primitive types.

Type definitions can be used wherever a primitive type is used (other than as the underlying type in a new type definition), and are type-comparable with their underlying types and any type definitions defined using the same underlying type.

11.1.1 Attribute Name

The edm:TypeDefinition element MUST include a Name attribute whose value is a SimpleIdentifier. The name identifies the type definition and MUST be unique within its namespace.

11.1.2 Attribute UnderlyingType

The edm:TypeDefinition element MUST provide the QualifiedName of a primitive type as the value of the UnderlyingType attribute. This type MUST NOT be another type definition.

11.1.3 Type Definition Facets

The edm:TypeDefinition element MAY specify facets applicable to the underlying type: MaxLength, Unicode, Precision, Scale, or SRID.

Additional facets appropriate for the underlying type MAY be specified when the type definition is used but the facets specified in the type definition MUST NOT be re-specified.

Annotations MAY be applied to a type definition, and are considered applied wherever the type definition is used. The use of a type definition MUST NOT specify an annotation specified in the type definition.

Where type definitions are used, the type definition is returned in place of the primitive type wherever the type is specified in a response.

Example 27:

```
<TypeDefinition Name="Length" UnderlyingType="Edm.Int32">
  <Annotation Term="Org.OData.Measurements.V1.Unit"
              String="Centimeters" />
</TypeDefinition>

<TypeDefinition Name="Weight" UnderlyingType="Edm.Int32">
  <Annotation Term="Org.OData.Measurements.V1.Unit"
              String="Kilograms" />
</TypeDefinition>

<ComplexType Name="Size">
  <Property Name="Height" Type="Self.Length" />
  <Property Name="Weight" Type="Self.Weight" />
</ComplexType>
```


12 Action and Function

12.1 Element edm:Action

The edm:Action element represents an action in an entity model.

Actions MAY have observable side effects and MAY return a single instance or a collection of instances of any type. Actions cannot be composed with additional path segments.

The action MAY specify a return type using the edm:ReturnType element. The return type must be a primitive, entity or complex type, or a collection of primitive, entity or complex types.

The action may also define zero or more edm:Parameter elements to be used during the execution of the action.

12.1.1 Attribute Name

The edm:Action element MUST include a Name attribute whose value is a SimpleIdentifier.

12.1.1.1 Action Overload Rules

Bound actions support overloading (multiple actions having the same name within the same namespace) by binding parameter type. The combination of action name and the binding parameter type MUST be unique within a namespace.

Unbound actions do not support overloads. The names of all unbound actions MUST be unique within a namespace.

An unbound action MAY have the same name as a bound action.

12.1.2 Attribute IsBound

An action element MAY specify a Boolean value for the IsBound attribute.

Actions whose IsBound attribute is false or not specified are considered *unbound*. Unbound actions are invoked through an action import.

Actions whose IsBound attribute is true are considered *bound*. Bound actions are invoked by appending a segment containing the qualified action name to a segment of the appropriate binding parameter type within the resource path. Bound actions MUST contain at least one edm:Parameter element, and the first parameter is the binding parameter. The binding parameter can be of any type, and it MAY be nullable.

12.1.3 Attribute EntitySetPath

Bound actions that return an entity or a collection of entities MAY specify a value for the EntitySetPath attribute if determination of the entity set for the return type is contingent on the binding parameter.

The value for the EntitySetPath attribute consists of a series of segments joined together with forward slashes.

The first segment of the entity set path MUST be the name of the binding parameter. The remaining segments of the entity set path MUST represent navigation segments or type casts.

A navigation segment names the SimpleIdentifier of the navigation property to be traversed. A type cast segment names the QualifiedName of the entity type that should be returned from the type cast.

12.2 Element edm:Function

The edm:Function element represents a function in an entity model.

Functions MUST NOT have observable side effects and MUST return a single instance or a collection of instances of any type. Functions MAY be composable.

The function MUST specify a return type using the edm:ReturnType element. The return type must be a primitive, entity or complex type, or a collection of primitive, entity or complex types.

The function may also define zero or more edm:Parameter elements to be used during the execution of the function.

12.2.1 Attribute Name

The edm:Function element MUST include a Name attribute whose value is a SimpleIdentifier.

12.2.1.1 Function Overload Rules

Bound functions support overloading (multiple functions having the same name within the same namespace) subject to the following rules:

- The combination of function name, binding parameter type, and unordered set of non-binding parameter names MUST be unique within a namespace.
- The combination of function name, binding parameter type, and ordered set of parameter types MUST be unique within a namespace.
- All bound functions with the same function name and binding parameter type within a namespace MUST specify the same return type.

Unbound functions support overloading subject to the following rules:

- The combination of function name and unordered set of parameter names MUST be unique within a namespace.
- The combination of function name and ordered set of parameter types MUST be unique within a namespace.
- All unbound functions with the same function name within a namespace MUST specify the same return type.

An unbound function MAY have the same name as a bound function.

Note that type definitions can be used to disambiguate overloads for both bound and unbound functions, even if they specify the same underlying type.

12.2.2 Attribute IsBound

A function element MAY specify a Boolean value for the IsBound attribute.

Functions whose IsBound attribute is false or not specified are considered *unbound*. Unbound functions are invoked as static functions within a filter or orderby expression, or from the entity container through a function import.

Functions whose IsBound attribute is true are considered *bound*. Bound functions are invoked by appending a segment containing the qualified function name to a segment of the appropriate binding parameter type within a resource path, filter, or orderby expression. Bound functions MUST contain at least one edm:Parameter element, and the first parameter is the binding parameter. The binding parameter can be of any type, and it MAY be nullable.

12.2.3 Attribute IsComposable

A function element MAY specify a Boolean value for the IsComposable attribute. If no value is specified for the IsComposable attribute, the value defaults to false.

Functions whose `IsComposable` attribute is `true` are considered *composable*. A composable function can be invoked with additional path segments or key predicates appended to the path that identifies the composable function, and with system query options as appropriate for the type returned by the composable function.

12.2.4 Attribute `EntitySetPath`

Bound functions that return an entity or a collection of entities MAY specify a value for the `EntitySetPath` attribute if determination of the entity set for the return type is contingent on the binding parameter.

The value for the `EntitySetPath` attribute consists of a series of segments joined together with forward slashes.

The first segment of the entity set path MUST be the name of the binding parameter. The remaining segments of the entity set path MUST represent navigation segments or type casts.

A navigation segment names the SimpleIdentifier of the navigation property to be traversed. A type cast segment names the QualifiedName of the entity type that should be returned from the type cast.

12.3 Element `edm:ReturnType`

The attributes `MaxLength`, `Precision`, `Scale`, and `SRID` can be used to specify the facets of the return type, as appropriate. If the facet attributes are not specified, their values are considered unspecified.

12.3.1 Attribute `Type`

The `Type` attribute specifies the type of the result returned by the function or action.

12.3.2 Attribute `Nullable`

A return type MAY specify a Boolean value for the `Nullable` attribute. If not specified, the `Nullable` attribute defaults to `true`.

If the return type has a `Type` attribute that does not specify a collection, the value of `true` means that the action or function may return a single `null` value. A value of `false` means that the action or function will never return a `null` value and instead fail with an error response if it cannot compute a result.

If the return type has a `Type` attribute that specifies a collection, the result will always exist, but the collection MAY be empty. In this case, the `Nullable` attribute applies to members of the collection and specifies whether the collection can contain null values.

12.4 Element `edm:Parameter`

The `edm:Parameter` element allows one or more parameters to be passed to a function or action.

Example 28: a function returning the top-selling products for a given year. In this case the year must be specified as a parameter of the function with the `edm:Parameter` element.

```
<Function Name="TopSellingProducts">
  <Parameter Name="Year" Type="Edm.Decimal" Precision="4" Scale="0" />
  <ReturnType Type="Collection(Model.Product)" />
</Function>
```

12.4.1 Attribute `Name`

The `edm:Parameter` element MUST include a `Name` attribute whose value is a SimpleIdentifier. The parameter name MUST be unique within its parent element.

12.4.2 Attribute Type

The edm:Parameter element MUST include the Type attribute whose value is a TypeName indicating the type of value that can be passed to the parameter.

12.4.3 Attribute Nullable

A parameter whose Type attribute does not specify a collection MAY specify a Boolean value for the Nullable attribute. If not specified, the Nullable attribute defaults to true.

The value of true means that the parameter accepts a null value.

12.4.4 Parameter Facets

An edm:Parameter element MAY specify values for the MaxLength, Precision, Scale, or SRID attributes. The descriptions of these facets and their implications are covered in section 6.2.

13 Entity Container

Each metadata document used to describe an OData service MUST define exactly one entity container. Entity containers define the entity sets, singletons, function and action imports exposed by the service.

An *entity set* allows access to entity type instances. Simple entity models frequently have one entity set per entity type.

Example 29: one entity set per entity type

```
<EntitySet Name="Products"   EntityType="Self.Product" />
<EntitySet Name="Categories" EntityType="Self.Category" />
```

Other entity models may expose multiple entity sets per type.

Example 30: three entity sets referring to the two entity types

```
<EntitySet Name="StandardCustomers" EntityType="Self.Customer">
  <NavigationPropertyBinding Path="Orders" Target="Orders" />
</EntitySet>
<EntitySet Name="PreferredCustomers" EntityType="Self.Customer">
  <NavigationPropertyBinding Path="Orders" Target="Orders" />
</EntitySet>
<EntitySet Name="Orders" EntityType="Self.Order" />
```

There are separate entity sets for standard customers and preferred customers, but only one entity set for orders. The entity sets for standard customers and preferred customers both have navigation property bindings to the orders entity set, but the orders entity set does not have a navigation property binding for the Customer navigation property, since it could lead to either set of customers.

An entity set can expose instances of the specified entity type as well as any entity type inherited from the specified entity type.

A *singleton* allows addressing a single entity directly from the entity container without having to know its key, and without requiring an entity set.

A *function import* or an *action import* is used to expose a function or action defined in an entity model as a top level resource.

Example 31: function import returning the top ten revenue-generating products for a given fiscal year

```
<FunctionImport Name="TopSellingProducts"
                Function="Model.TopSellingProducts"
                EntitySet="Products" />
```

Example 32: An entity container aggregates entity sets, singletons, action imports, and function imports.

```
<EntityContainer Name="DemoService">
  <EntitySet Name="Products" EntityType="Self.Product">
    <NavigationPropertyBinding Path="Category"
                               Target="Self.DemoService.Categories" />
    <NavigationPropertyBinding Path="Supplier"
                               Target="Self.DemoService.Suppliers" />
  </EntitySet>
  <EntitySet Name="Categories" EntityType="Self.Category">
    <NavigationPropertyBinding Path="Products"
                               Target="Self.DemoService.Products" />
  </EntitySet>
  <EntitySet Name="Suppliers" EntityType="Self.Supplier">
    <NavigationPropertyBinding Path="Products"
                               Target="Self.DemoService.Products" />
  </EntitySet>
  <Singleton Name="MainSupplier" Type="Self.Supplier" />
```



```
  <ActionImport Name="LeaveRequestApproval" Action="Self.Approval" />
  <FunctionImport Name="ProductsByRating" Function="Self.ProductsByRating"
                  EntitySet="Products" />
</EntityContainer>
```

13.1 Element edm:EntityContainer

The edm:EntityContainer element represents an entity container in an entity model. It corresponds to a virtual or physical data store and contains one or more edm:EntitySet, edm:Singleton, edm:ActionImport, or edm:FunctionImport elements. Entity set, singleton, action import, and function import names MUST be unique within an entity container.

13.1.1 Attribute Name

The edm:EntityContainer element MUST provide a unique SimpleIdentifier value for the Name attribute.

13.1.2 Attribute Extends

The edm:EntityContainer element MAY include an Extends attribute whose value is the QualifiedName of an entity container in scope. All children of the “base” entity container specified in the Extends attribute are added to the “extending” entity container that has the Extends attribute.

Note: services should not introduce cycles with Extends. Clients should be prepared to process cycles introduced with Extends.

Example 33: the entity container Extending will contain all child elements that it defines itself, plus all child elements of the Base entity container located in SomeOtherSchema

```
<EntityContainer Name="Extending" Extends="SomeOtherSchema.Base">
   ...
</EntityContainer>
```

13.2 Element edm:EntitySet

The edm:EntitySet element represents an entity set in an entity model.

13.2.1 Attribute Name

The edm:EntitySet element MUST include a Name attribute whose value is a SimpleIdentifier.

13.2.2 Attribute EntityType

The edm:EntitySet element MUST include an EntityType attribute whose value is the QualifiedName of an entity type in scope. Each entity type in the model may have zero or more entity sets that reference the entity type.

An entity set MUST contain only instances of the entity type specified by the EntityType attribute or its subtypes. The entity type named by the EntityType attribute MAY be abstract but MUST have a key defined.

13.2.3 Attribute IncludeInServiceDocument

The edm:EntitySet element MAY include the IncludeInServiceDocument attribute whose Boolean value indicates whether the entity set is advertised in the service document.

If no value is specified for this attribute, its value defaults to true.

Entity sets that cannot be queried without specifying additional query options SHOULD specify the value `false` for this attribute.

13.3 Element `edm:Singleton`

The `edm:Singleton` element represents a single entity in an entity model, called a *singleton.*

13.3.1 Attribute `Name`

The `edm:Singleton` element MUST include a `Name` attribute whose value is a SimpleIdentifier.

13.3.2 Attribute `Type`

The `edm:Singleton` element MUST include a `Type` attribute whose value is the QualifiedName of an entity type in scope. Each entity type in the model may be used in zero or more `edm:Singleton` elements.

A singleton MUST reference an instance of the entity type specified by the `Type` attribute.

13.4 Element `edm:NavigationPropertyBinding`

An entity set or a singleton SHOULD contain an `edm:NavigationPropertyBinding` element for each navigation property of its entity type, including navigation properties defined on complex typed properties.

If omitted, clients MUST assume that the target entity set or singleton can vary per related entity.

13.4.1 Attribute `Path`

A navigation property binding MUST name a navigation property of the entity set's, singleton's, or containment navigation property's entity type or one of its subtypes in the `Path` attribute. If the navigation property is defined on a subtype, the path attribute MUST contain the QualifiedName of the subtype, followed by a forward slash, followed by the navigation property name. If the navigation property is defined on a complex type used in the definition of the entity set's entity type, the path attribute MUST contain a forward-slash separated list of complex property names and qualified type names that describe the path leading to the navigation property.

The path can traverse one or more containment navigation properties but the last segment MUST be a non-containment navigation property and there MUST NOT be any non-containment navigation properties prior to the final segment.

A navigation property MUST NOT be named in more than one navigation property binding; navigation property bindings are only used when all related entities are known to come from a single entity set.

13.4.2 Attribute `Target`

A navigation property binding MUST specify a SimpleIdentifier or TargetPath value for the `Target` attribute that specifies the entity set, singleton, or containment navigation property that contains the related instance(s) targeted by the navigation property specified in the `Path` attribute.

If the value of the `Target` attribute is a SimpleIdentifier, it MUST resolve to an entity set or singleton defined in the same entity container as the enclosing element.

If the value of the `Target` attribute is a TargetPath, it MUST resolve to an entity set, singleton, or containment navigation property in scope. The path can traverse containment navigation properties or complex properties before ending in a containment navigation property, but there MUST not be any non-containment navigation properties prior to the final segment.

Example 34: for an entity set in the same container as the enclosing entity set `Categories`

```
<EntitySet Name="Categories" EntityType="Self.Category">
  <NavigationPropertyBinding Path="Products"
```



```
                              Target="SomeSet" />
</EntitySet>
```

Example 35: for an entity set in any container in scope

```
<EntitySet Name="Categories" EntityType="Self.Category">
  <NavigationPropertyBinding Path="Products"
                             Target="SomeModel.SomeContainer/SomeSet" />
</EntitySet>
```

13.5 Element edm:ActionImport

The edm:ActionImport element allows exposing an unbound action as a top-level element in an entity container. Action imports are never advertised in the service document.

13.5.1 Attribute Name

The edm:ActionImport element MUST include a Name attribute whose value is a SimpleIdentifier. It MAY be identical to the last segment of the QualifiedName used to specify the Action attribute value.

13.5.2 Attribute Action

The edm:ActionImport element MUST include a QualifiedName value for the Action attribute which MUST resolve to the name of an unbound edm:Action element in scope.

13.5.3 Attribute EntitySet

If the return type of the action specified in the Action attribute is an entity or a collection of entities, a SimpleIdentifier or TargetPath value MAY be specified for the EntitySet attribute that names the entity set to which the returned entities belong. If a SimpleIdentifier is specified, it MUST resolve to an entity set defined in the same entity container. If a TargetPath is specified, it MUST resolve to an entity set in scope.

If the return type is not an entity or a collection of entities, a value MUST NOT be defined for the EntitySet attribute.

13.6 Element edm:FunctionImport

The edm:FunctionImport element allows exposing an unbound function as a top-level element in an entity container. All unbound overloads of an imported function can be invoked from the entity container.

13.6.1 Attribute Name

The edm:FunctionImport element MUST include a Name attribute whose value is a SimpleIdentifier. It MAY be identical to the last segment of the QualifiedName used to specify the Function attribute value.

13.6.2 Attribute Function

The edm:FunctionImport element MUST include the Function attribute whose value MUST be a QualifiedName that resolves to the name of an unbound edm:Function element in scope.

13.6.3 Attribute EntitySet

If the return type of the function specified in the Function attribute is an entity or a collection of entities, a SimpleIdentifier or TargetPath value MAY be defined for the EntitySet attribute that names the entity set to which the returned entities belong. If a SimpleIdentifier is specified, it MUST resolve to an entity set

defined in the same entity container. If a TargetPath is specified, it MUST resolve to an entity set in scope.

If the return type is not an entity or a collection of entities, a value MUST NOT be defined for the `EntitySet` attribute.

13.6.4 Attribute `IncludeInServiceDocument`

The `edm:FunctionImport` for a parameterless function MAY include the `IncludeInServiceDocument` attribute whose Boolean value indicates whether the function import is advertised in the service document.

If no value is specified for this attribute, its value defaults to `false`.

14 Vocabulary and Annotation

Vocabularies and annotations provide the ability to annotate metadata as well as instance data, and define a powerful extensibility point for OData. An *annotation* applies a *term* to a model element and defines how to calculate a value for the applied term.

Metadata annotations can be used to define additional characteristics or capabilities of a metadata element, such as a service, entity type, property, function, action, or parameter. For example, a metadata annotation may define ranges of valid values for a particular property. Metadata annotations are applied in CSDL documents describing or referencing an entity model.

Instance annotations can be used to define additional information associated with a particular result, entity, property, or error; for example, whether a property is read-only for a particular instance. Where the same annotation is defined at both the metadata and instance level, the instance-level annotation overrides the annotation specified at the metadata level. Instance annotations appear in the actual payload as described in **[OData-Atom]** and **[OData-JSON]**. Annotations that apply across instances should be specified as metadata annotations.

A *vocabulary* is a namespace containing a set of terms where each term is a named metadata extension. Anyone can define a vocabulary (a set of terms) that is scenario-specific or company-specific; more commonly used terms can be published as shared vocabularies such as the OData Core vocabulary **[OData-VocCore]**.

A term can be used:

- To extend model elements and type instances with additional information.
- To map instances of annotated structured types to an interface defined by the term type; i.e. annotations allow viewing instances of a structured type as instances of a differently structured type specified by the applied term.

A service SHOULD NOT require a client to interpret annotations. Clients SHOULD ignore unknown terms and silently treat unexpected or invalid values (including invalid type, invalid literal expression, etc.) as an unknown value for the term.

Example 36: the `Product` entity type is extended with a `DisplayName` by a metadata annotation that binds the term `DisplayName` to the value of the property `Name`. The `Product` entity type also includes an annotation that allows its instances to be viewed as instances of the type specified by the term `SearchResult`

```
<EntityType Name="Product">
  <Key>
    <PropertyRef Name="ID" />
  </Key>
  <Property Name="ID" Nullable="false" Type="Edm.Int32" />
  <Property Name="Name" Type="Edm.String" />
  <Property Name="Description" Type="Edm.String" />
  ...
  <Annotation Term="UI.DisplayName" Path="Name" />
  <Annotation Term="SearchVocabulary.SearchResult">
    <Record>
      <PropertyValue Property="Title" Path="Name" />
      <PropertyValue Property="Abstract" Path="Description" />
      <PropertyValue Property="Url">
        <Apply Function="odata.concat">
          <String>Products(</String>
          <Path>ID</Path>
          <String>)</String>
        </Apply>
      </PropertyValue>
    </Record>
  </Annotation>
</EntityType>
```


14.1 Element edm:Term

The edm:Term element defines a term in a vocabulary.

A term allows annotating a CSDL element or OData resource representation with additional data.

14.1.1 Attribute Name

The edm:Term element MUST include a Name attribute whose value is a SimpleIdentifier.

14.1.2 Attribute Type

The edm:Term element MUST include a Type attribute whose value is a TypeName. It indicates what type of value must be returned by the expression contained in an annotation using the term.

14.1.3 Attribute BaseTerm

The edm:Term element MAY provide a QualifiedName value for the BaseTerm attribute. The value of the BaseTerm attribute MUST be the name of a term in scope. When applying a term with a base term, the base term MUST also be applied with the same qualifier, and so on until a term without a base term is reached.

14.1.4 Attribute DefaultValue

A edm:Term element whose Type attribute specifies a primitive or enumeration type MAY define a value for the DefaultValue attribute. The value of this attribute determines the value of the term when applied in an edm:Annotation without providing an expression.

Default values of type Edm.String MUST be represented according to the XML escaping rules for character data in attribute values. Values of other primitive types MUST be represented according to the appropriate alternative in the primitiveValue rule defined in **[OData-ABNF]**, i.e. Edm.Binary as binaryValue, Edm.Boolean as booleanValue etc.

If no value is specified, the DefaultValue attribute defaults to null.

14.1.5 Attribute AppliesTo

The edm:Term element MAY define a value for the AppliesTo attribute. The value of this attribute is a whitespace-separated list of CSDL element names that this term is intended to be applied to. If no value is supplied, the term is not intended to be restricted in its application. As the intended usage may evolve over time, clients SHOULD be prepared for any annotation to be applied to any element.

*Example 37: the IsURL term can be applied to properties and terms that are of type Edm.String (the Core.Tag type and the two Core terms are defined in **[OData-VocCore]**)*

```
<Term Name="IsURL" Type="Core.Tag" DefaultValue="true"
      AppliesTo="Property Term">
  <Annotation Term="Core.Description">
    <String>
      Properties and terms annotated with this term MUST contain a valid URL
    </String>
  </Annotation>
  <Annotation Term="Core.RequiresType" String="Edm.String" />
</Term>
```

14.1.6 Term Facets

The edm:Term element MAY specify values for the Nullable, DefaultValue, MaxLength, Precision, Scale, or SRID attributes. These facets and their implications are described in section 6.2.

14.2 Element edm:Annotations

The edm:Annotations element is used to apply a group of annotations to a single model element. It MUST contain at least one edm:Annotation element.

14.2.1 Attribute Target

The edm:Annotations element MUST include a Target attribute whose value is a path expression that MUST resolve to a model element in the entity model.

External targeting is only possible for EDM elements that are uniquely identified within their parent, and all their ancestor elements are uniquely identified within their parent:

- edm:Action (applies to all overloads)
- edm:ActionImport
- edm:ComplexType
- edm:EntityContainer
- edm:EntitySet
- edm:EntityType
- edm:EnumType
- edm:Function (applies to all overloads)
- edm:FunctionImport
- edm:Member
- edm:NavigationProperty (via type, entity set, or singleton)
- edm:Parameter (applies to all overloads defining the parameter)
- edm:Property (via type, entity set, or singleton)
- edm:Singleton
- edm:Term
- edm:TypeDefinition

These are the direct children of a schema with a unique name (i.e. except actions and functions whose overloads to not possess a natural identifier), and all direct children of an entity container. The edm:Schema element and most of the not uniquely identifiable EDM elements can still be annotated using an inline edm:Annotation element.

External targeting is possible for actions, functions, and their parameters, in which case the annotation applies to all overloads of the action or function or all parameters of that name across all overloads. External targeting of individual action or function overloads is not possible.

External targeting is also possible for properties and navigation properties of singletons or entities in a particular entity set. These annotations override annotations on the properties or navigation properties targeted via the declaring structured type.

The allowed path expressions are:

- QualifiedName of schema child
- QualifiedName of schema child followed by a forward slash and name of child element
- QualifiedName of structured type followed by zero or more property, navigation property, or type cast segments, each segment starting with a forward slash
- QualifiedName of an entity container followed by a segment containing a singleton or entity set name and zero or more property, navigation property, or type cast segments

Example 38: Target expressions

```
MySchema.MyEntityType
MySchema.MyEntityType/MyProperty
MySchema.MyEntityType/MyNavigationProperty
MySchema.MyComplexType
MySchema.MyComplexType/MyProperty
MySchema.MyComplexType/MyNavigationProperty
MySchema.MyEnumType
MySchema.MyEnumType/MyMember
MySchema.MyTypeDefinition
MySchema.MyTerm
```



```
MySchema.MyEntityContainer
MySchema.MyEntityContainer/MyEntitySet
MySchema.MyEntityContainer/MySingleton
MySchema.MyEntityContainer/MyActionImport
MySchema.MyEntityContainer/MyFunctionImport
MySchema.MyAction
MySchema.MyFunction
MySchema.MyFunction/MyParameter
MySchema.MyEntityContainer/MyEntitySet/MyProperty
MySchema.MyEntityContainer/MyEntitySet/MyNavigationProperty
MySchema.MyEntityContainer/MyEntitySet/MySchema.MyEntityType/MyProperty
MySchema.MyEntityContainer/MyEntitySet/MySchema.MyEntityType/MyNavProperty
MySchema.MyEntityContainer/MyEntitySet/MyComplexProperty/MyProperty
MySchema.MyEntityContainer/MyEntitySet/MyComplexProperty/MyNavigationProperty
MySchema.MyEntityContainer/MySingleton/MyComplexProperty/MyNavigationProperty
```

14.2.2 Attribute `Qualifier`

An `edm:Annotations` element MAY provide a SimpleIdentifier value for the `Qualifier` attribute.

The `Qualifier` attribute allows annotation authors a means of conditionally applying an annotation.

Example 39: annotations should only be applied to tablet devices

```
<Annotations Target="Self.Person" Qualifier="Tablet">
  ...
</Annotations>
```

14.3 Element `edm:Annotation`

The `edm:Annotation` element represents a single annotation. An annotation applies a term to a model element and defines how to calculate a value for the term application. The following model elements MAY be annotated with a term:

- `edm:Action`
- `edm:ActionImport`
- `edm:Annotation`
- `edm:Apply`
- `edm:Cast`
- `edm:ComplexType`
- `edm:EntityContainer`
- `edm:EntitySet`
- `edm:EntityType`
- `edm:EnumType`
- `edm:Function`
- `edm:FunctionImport`
- `edm:If`
- `edm:IsOf`
- `edm:LabeledElement`
- `edm:Member`
- `edm:NavigationProperty`
- `edm:Null`
- `edm:OnDelete`
- `edm:Parameter`
- `edm:Property`
- `edm:PropertyValue`
- `edm:Record`
- `edm:ReferentialConstraint`
- `edm:ReturnType`
- `edm:Schema`
- `edm:Singleton`
- `edm:Term`
- `edm:TypeDefinition`
- `edm:UrlRef`
- `edmx:Reference`
- all Comparison and Logical Operators

An `edm:Annotation` element can be used as a child of the model element it annotates, or as the child of an `edm:Annotations` element that targets the model element to be annotated.

An edm:Annotation element MAY contain a constant expression or dynamic expression in either attribute or element notation. If no expression is specified for a term with a primitive type, the annotation evaluates to the default value of the term definition. If no expression is specified for a term with a complex type, the annotation evaluates to a complex instance with default values for all properties is used. If no expression is specified for a collection-valued term, the annotation evaluates to an empty collection.

If an entity type or complex type is annotated with a term that itself has a structured type, an instance of the annotated type may be viewed as an “instance” of the term, and the qualified term name may be used as a term-cast segment in path expressions.

14.3.1 Attribute Term

An annotation element MUST provide a QualifiedName value for the Term attribute. The value of the Term attribute MUST be the name of a term in scope. The target of the annotation MUST comply with any AppliesTo constraint.

14.3.2 Attribute Qualifier

An annotation element MAY provide a SimpleIdentifier value for the Qualifier attribute.

The qualifier attribute allows annotation authors a means of conditionally applying an annotation.

Example 40: annotation should only be applied to tablet devices

```
<Annotation Term="org.example.display.DisplayName" Path="FirstName"
            Qualifier="Tablet" />
```

Annotation elements that are children of an edm:Annotations element MUST NOT provide a value for the qualifier attribute if the parent edm:Annotations element provides a value for the qualifier attribute.

14.4 Constant Expressions

Constant expressions allow assigning a constant value to an applied term. The constant expressions support element and attribute notation.

Example 41: two annotations intended as user interface hints

```
<EntitySet Name="Products" EntityType="Self.Product">
  <Annotation Term="org.example.display.DisplayName"
              String="Product Catalog" />
</EntitySet>

<EntitySet Name="Suppliers" EntityType="Self.Supplier">
  <Annotation Term="org.example.display.DisplayName">
    <String>Supplier Directory</String>
  </Annotation>
</EntitySet>
```

14.4.1 Expression edm:Binary

The edm:Binary expression evaluates to a primitive binary value. A binary expression MUST be assigned a value conforming to the rule binaryValue in **[OData-ABNF]**.

The binary expression MAY be provided using element notation or attribute notation.

Example 42: base64url-encoded binary value (OData)

```
<Annotation Term="org.example.display.Thumbnail" Binary="T0RhdGE" />

<Annotation Term="org.example.display.Thumbnail">
  <Binary>T0RhdGE</Binary>
</Annotation>
```


14.4.2 Expression edm:Bool

The edm:Bool expression evaluates to a primitive Boolean value. A Boolean expression MUST be assigned a Boolean value.

The Boolean expression MAY be provided using element notation or attribute notation.

Example 43:

```
<Annotation Term="org.example.display.ReadOnly" Bool="true" />

<Annotation Term="org.example.display.ReadOnly">
  <Bool>true</Bool>
</Annotation>
```

14.4.3 Expression edm:Date

The edm:Date expression evaluates to a primitive date value. A date expression MUST be assigned a value of type xs:date, see **[XML-Schema-2]**, section 3.3.9. The value MUST also conform to rule dateValue in **[OData-ABNF]**, i.e. it MUST NOT contain a time-zone offset.

The date expression MAY be provided using element notation or attribute notation.

Example 44:

```
<Annotation Term="org.example.vCard.birthDay" Date="2000-01-01" />

<Annotation Term="org.example.vCard.birthDay">
  <Date>2000-01-01</Date>
</Annotation>
```

14.4.4 Expression edm:DateTimeOffset

The edm:DateTimeOffset expression evaluates to a primitive date/time value with a time-zone offset. A date/time expression MUST be assigned a value of type xs:dateTimeStamp, see **[XML-Schema-2]**, section 3.4.28. The value MUST also conform to rule dateTimeOffsetValue in **[OData-ABNF]**, i.e. it MUST NOT contain an end-of-day fragment (24:00:00).

The date/time expression MAY be provided using element notation or attribute notation.

Example 45:

```
<Annotation Term="org.example.display.LastUpdated"
            DateTimeOffset="2000-01-01T16:00:00.000Z" />

<Annotation Term="org.example.display.LastUpdated">
  <DateTimeOffset>2000-01-01T16:00:00.000-09:00</DateTimeOffset>
</Annotation>
```

14.4.5 Expression edm:Decimal

The edm:Decimal expression evaluates to a primitive decimal value. A decimal expression MUST be assigned a value conforming to the rule decimalValue in **[OData-ABNF]**.

The decimal expression MAY be provided using element notation or attribute notation.

Example 46:

```
<Annotation Term="org.example.display.Width" Decimal="3.14" />

<Annotation Term="org.example.display.Width">
  <Decimal>3.14</Decimal>
</Annotation>
```


14.4.6 Expression edm:Duration

The edm:Duration expression evaluates to a primitive duration value. A duration expression MUST be assigned a value of type xs:dayTimeDuration, see **[XML-Schema-2]**, section 3.4.27.

The duration expression MAY be provided using element notation or attribute notation.

Example 47:

```
<Annotation Term="org.example.task.duration" Duration="P7D" />

<Annotation Term="org.example.task.duration">
  <Duration>P11DT23H59M59.999999999999S</Duration>
</Annotation>
```

14.4.7 Expression edm:EnumMember

The edm:EnumMember expression references a member of an enumeration type. An enumeration member expression MUST be assigned a value that consists of the qualified name of the enumeration type, followed by a forward slash and the name of the enumeration member. If the enumeration type specifies an IsFlags attribute with value true, the expression MAY also be assigned a whitespace-separated list of values. Each of these values MUST resolve to the name of a member of the enumeration type of the specified term.

The enumeration member expression MAY be provided using element notation or attribute notation.

Example 48: single value

```
<Annotation Term="org.example.HasPattern"
             EnumMember="org.example.Pattern/Red" />

<Annotation Term="org.example.HasPattern">
  <EnumMember>org.example.Pattern/Red</EnumMember>
</Annotation>
```

Example 49: combined value for IsFlags enumeration type

```
<Annotation Term="org.example.HasPattern"
           EnumMember="org.example.Pattern/Red org.example.Pattern/Striped" />

<Annotation Term="org.example.HasPattern">
  <EnumMember>org.example.Pattern/Red org.example.Pattern/Striped</EnumMember>
</Annotation>
```

14.4.8 Expression edm:Float

The edm:Float expression evaluates to a primitive floating point (or double) value. A float expression MUST be assigned a value conforming to the rule doubleValue in **[OData-ABNF]**.

The float expression MAY be provided using element notation or attribute notation.

Example 50:

```
<Annotation Term="org.example.display.Width" Float="3.14" />

<Annotation Term="org.example.display.Width">
  <Float>3.14</Float>
</Annotation>
```

14.4.9 Expression edm:Guid

The edm:Guid expression evaluates to a primitive 32-character string value. A guid expression MUST be assigned a value conforming to the rule guidValue in **[OData-ABNF]**.

The guid expression MAY be provided using element notation or attribute notation.

Example 51:

```
<Annotation Term="org.example.display.Id"
            Guid="21EC2020-3AEA-1069-A2DD-08002B30309D" />

<Annotation Term="org.example.display.Id">
  <Guid>21EC2020-3AEA-1069-A2DD-08002B30309D</Guid>
</Annotation>
```

14.4.10 Expression edm:Int

The `edm:Int` expression evaluates to a primitive integer value. An integer MUST be assigned a value conforming to the rule `int64Value` in **[OData-ABNF]**.

The integer expression MAY be provided using element notation or attribute notation.

Example 52:

```
<Annotation Term="org.example.display.Width" Int="42" />

<Annotation Term="org.example.display.Width">
  <Int>42</Int>
</Annotation>
```

14.4.11 Expression edm:String

The `edm:String` expression evaluates to a primitive string value. A string expression MUST be assigned a value of the type `xs:string`, see **[XML-Schema-2]**, section 3.3.1.

The string expression MAY be provided using element notation or attribute notation.

Example 53:

```
<Annotation Term="org.example.display.DisplayName" String="Product Catalog" />

<Annotation Term="org.example.display.DisplayName">
  <String>Product Catalog</String>
</Annotation>
```

14.4.12 Expression edm:TimeOfDay

The `edm:TimeOfDay` expression evaluates to a primitive time value. A time-of-day expression MUST be assigned a value conforming to the rule `timeOfDayValue` in **[OData-ABNF]**.

The time-of-day expression MAY be provided using element notation or attribute notation.

Example 54:

```
<Annotation Term="org.example.display.EndTime" TimeOfDay="21:45:00" />

<Annotation Term="org.example.display.EndTime">
  <TimeOfDay>21:45:00</TimeOfDay>
</Annotation>
```

14.5 Dynamic Expressions

Dynamic expressions allow assigning a calculated value to an applied term. The dynamic expressions `edm:AnnotationPath`, `edm:NavigationPropertyPath`, `edm:Path`, `edm:PropertyPath`, and `edm:UrlRef` expressions support element and attribute notation, all other dynamic expressions only support element notation.

14.5.1 Comparison and Logical Operators

The following EDM elements allow service authors to supply a dynamic conditional expression which evaluates to a value of type `Edm.Boolean`. They MAY be combined and they MAY be used anywhere instead of an `edm:Bool` expression.

Element	Description	Example
Logical Operators		
`edm:And`	Logical and	`<And><Path>IsMale</Path><Path>IsMarried</Path></And>`
`edm:Or`	Logical or	`<Or><Path>IsMale</Path><Path>IsMarried</Path></Or>`
`edm:Not`	Logical negation	`<Not><Path>IsMale</Path></Not>`
Comparison Operators		
`edm:Eq`	Equal	`<Eq><Null/><Path>IsMale</Path></Eq>`
`edm:Ne`	Not equal	`<Ne><Null/><Path>IsMale</Path></Ne>`
`edm:Gt`	Greater than	`<Gt><Path>Price</Path><Int>20</Int></Gt>`
`edm:Ge`	Greater than or equal	`<Ge><Path>Price</Path><Int>10</Int></Ge>`
`edm:Lt`	Less than	`<Lt><Path>Price</Path><Int>20</Int></Lt>`
`edm:Le`	Less than or equal	`<Le><Path>Price</Path><Int>100</Int></Le>`

The `edm:And` and `edm:Or` elements require two child expressions that evaluate to Boolean values. The `edm:Not` elements requires a single child expression that evaluates to a Boolean value. For details on null handling for comparison operators see **[OData-URL]**.

The other elements representing the comparison operators require two child expressions that evaluate to comparable values.

14.5.2 Expression `edm:AnnotationPath`

The `edm:AnnotationPath` expression provides a value for terms or term properties that specify the built-in abstract type `Edm.AnnotationPath`. It uses the same syntax and rules as the `edm:Path` expression, with the following exceptions:

- The `AnnotationPath` expression may traverse multiple collection-valued structural or navigation properties.
- The last path segment MUST be a term cast with optional qualifier in the context of the preceding path part.

In contrast to the `edm:Path` expression the value of the `edm:AnnotationPath` expression is the path itself, not the value of the annotation identified by the path. This is useful for terms that reuse or refer to other terms.

The `edm:AnnotationPath` expression MAY be provided using element notation or attribute notation.

Example 55:

```
<Annotation Term="UI.ReferenceFacet"
            AnnotationPath="Product/Supplier/@UI.LineItem" />

<Annotation Term="UI.CollectionFacet" Qualifier="Contacts">
  <Collection>
    <AnnotationPath>Supplier/@Communication.Contact</AnnotationPath>
    <AnnotationPath>Customer/@Communication.Contact</AnnotationPath>
  </Collection>
```



```
</Annotation>
```

14.5.3 Expression edm:Apply

The edm:Apply expression enables a value to be obtained by applying a client-side function. The Apply expression MUST contain at least one expression. The expressions contained within the Apply expression are used as parameters to the function. The edm:Apply expression MUST be written with element notation.

14.5.3.1 Attribute Function

The edm:Apply expression MUST include a Function attribute whose value is a QualifiedName specifying the name of the client-side function to apply.

OData defines the following canonical functions. Services MAY support additional functions that MUST be qualified with a namespace or alias other than odata. Function names qualified with odata are reserved for this specification and its future versions.

14.5.3.1.1 Function odata.concat

The odata.concat standard client-side function takes two or more expressions as arguments. Each argument MUST evaluate to a primitive or enumeration type. It returns a value of type Edm.String that is the concatenation of the literal representations of the results of the argument expressions. Values of primitive types other than Edm.String are represented according to the appropriate alternative in the primitiveValue rule of **[OData-ABNF]**, i.e. Edm.Binary as binaryValue, Edm.Boolean as booleanValue etc.

Example 56:

```
<Annotation Term="org.example.display.DisplayName">
  <Apply Function="odata.concat">
    <String>Product: </String>
    <Path>ProductName</Path>
    <String> (</String>
    <Path>Available/Quantity</Path>
    <String> </String>
    <Path>Available/Unit</Path>
    <String> available)</String>
  </Apply>
</Annotation>
```

ProductName is of type String, Quantity in complex type Available is of type Decimal, and Unit in Available is of type enumeration, so the result of the Path expression is represented as the member name of the enumeration value.

14.5.3.1.2 Function odata.fillUriTemplate

The odata.fillUriTemplate standard client-side function takes two or more expressions as arguments and returns a value of type Edm.String.

The first argument MUST be of type Edm.String and specifies a URI template according to **[RFC6570]**, the other arguments MUST be edm:LabeledElement expressions. Each edm:LabeledElement expression specifies the template parameter name in its Name attribute and evaluates to the template parameter value.

[RFC6570] defines three kinds of template parameters: simple values, lists of values, and key-value maps.

Simple values are represented as edm:LabeledElement expressions that evaluate to a single primitive value. The literal representation of this value according to **[OData-ABNF]** is used to fill the corresponding template parameter.

Lists of values are represented as `edm:LabeledElement` expressions that evaluate to a collection of primitive values.

Key-value maps are represented as `edm:LabeledElement` expressions that evaluate to a collection of complex types with two properties that are used in lexicographic order. The first property is used as key, the second property as value.

Example 57: assuming there are no special characters in values of the `Name` property of the `Actor` entity

```
<Apply Function="odata.fillUriTemplate">
  <String>http://host/someAPI/Actors/{actorName}/CV</String>
  <LabeledElement Name="actorName" Path="Actor/Name" />
</Apply>
```

14.5.3.1.3 Function `odata.uriEncode`

The `odata.uriEncode` standard client-side function takes one argument of primitive type and returns the URL-encoded OData literal that can be used as a key value in OData URLs or in the query part of OData URLs. Note: string literals are surrounded by single quotes.

Example 58:

```
<Apply Function="odata.fillUriTemplate">
  <String>http://host/service/Genres({genreName})</String>
  <LabeledElement Name="genreName">
    <Apply Function="odata.uriEncode" >
      <Path>NameOfMovieGenre</Path>
    </Apply>
  </LabeledElement>
</Apply>
```

14.5.4 Expression `edm:Cast`

The `edm:Cast` expression casts the value obtained from its single child expression to the specified type. The cast expression follows the same rules as the `cast` canonical function defined in **[OData-URL]**.

The cast expression MUST specify a `Type` attribute and contain exactly one expression.

The cast expression MUST be written with element notation.

Example 59:

```
<Annotation Term="org.example.display.Threshold">
  <Cast Type="Edm.Decimal">
    <Path>Average</Path>
  </Cast>
</Annotation>
```

14.5.4.1 Attribute `Type`

The `edm:Cast` expression MUST specify a `Type` attribute whose value is a TypeName in scope.

If the specified type is a primitive type, the facet attributes `MaxLength`, `Precision`, `Scale`, and `SRID` MAY be specified if applicable to the specified primitive type. If the facet attributes are not specified, their values are considered unspecified.

14.5.5 Expression `edm:Collection`

The `edm:Collection` expression enables a value to be obtained from zero or more child expressions. The value calculated by the collection expression is the collection of the values calculated by each of the child expressions.

The collection expression contains zero or more child expressions. The values of the child expressions MUST all be type compatible.

The collection expression MUST be written with element notation.

Example 60:

```
<Annotation Term="org.example.seo.SeoTerms">
  <Collection>
    <String>Product</String>
    <String>Supplier</String>
    <String>Customer</String>
  </Collection>
</Annotation>
```

14.5.6 Expression `edm:If`

The `edm:If` expression enables a value to be obtained by evaluating a *conditional expression*. It MUST contain exactly three child elements with dynamic or static expressions. There is one exception to this rule: if and only if the `edm:If` expression is a direct child of `edm:Collection` element the third child element MAY be omitted (this can be used to conditionally add an element to a collection).

The first child element is the conditional expression and MUST evaluate to a Boolean result, e.g. the comparison and logical operators can be used.

The second and third child elements are the expressions, which are evaluated conditionally. The result MUST be type compatible with the type expected by the surrounding element or expression.

If the first expression evaluates to `true`, the second child element MUST be evaluated and its value MUST be returned as the result of the `edm:If` expression. If the conditional expression evaluates to `false` and a third child element is present, it MUST be evaluated and its value MUST be returned as the result of the `edm:If` expression. If no third child element is present, nothing is added to the collection.

The `edm:If` expression MUST be written with element notation, as shown in the following example.

Example 61:

```
<Annotation Term="org.example.person.Gender">
  <If>
    <Path>IsFemale</Path>
    <String>Female</String>
    <String>Male</String>
  </If>
</Annotation>
```

14.5.7 Expression `edm:IsOf`

The `edm:IsOf` expression evaluates a child expression and returns a Boolean value indicating whether the child expression returns the specified type.

An `edm:IsOf` expression MUST specify a `Type` attribute and contain exactly one child expression. The `edm:IsOf` expression MUST return `true` if the child expression returns a type that is compatible with the type named in the `Type` attribute. The `edm:IsOf` expression MUST return `false` if the child expression returns a type that is not compatible with the type named in the `Type` attribute.

The `edm:IsOf` expression MUST be written with element notation.

Example 62:

```
<Annotation Term="Self.IsPreferredCustomer">
  <IsOf Type="Self.PreferredCustomer">
    <Path>Customer</Path>
  </IsOf>
</Annotation>
```


14.5.7.1 Attribute `Type`

The `edm:IsOf` expression MUST specify a `Type` attribute whose value is a TypeName in scope.

If the specified type is a primitive type, the facet attributes `MaxLength`, `Precision`, `Scale`, and `SRID` MAY be specified if applicable to the specified primitive type. If the facet attributes are not specified, their values are considered unspecified.

14.5.8 Expression `edm:LabeledElement`

The `edm:LabeledElement` expression assigns a name to a child expression. The value of the child expression can then be reused elsewhere with an `edm:LabeledElementReference` expression.

A labeled-element expression MUST contain exactly one child expression written either in attribute notation or element notation. The value of the child expression is passed through the labeled-element expression.

A labeled-element expression MUST be written with element notation.

Example 63:

```
<Annotation Term="org.example.display.DisplayName">
  <LabeledElement Name="CustomerFirstName" Path="FirstName" />
</Annotation>

<Annotation Term="org.example.display.DisplayName">
  <LabeledElement Name="CustomerFirstName">
    <Path>FirstName</Path>
  </LabeledElement>
</Annotation>
```

14.5.8.1 Attribute `Name`

An `edm:LabeledElement` expression MUST provide a SimpleIdentifier value for the `Name` attribute that is unique within the schema containing the expression.

14.5.9 Expression `edm:LabeledElementReference`

The `edm:LabeledElementReference` expression returns the value of an `edm:LabeledElement` expression.

The labeled-element reference expression MUST contain the QualifiedName name of a labeled element expression in scope.

The labeled-element reference expression MUST be written with element notation.

Example 64:

```
<Annotation Term="org.example.display.DisplayName">
  <LabeledElementReference>Model.CustomerFirstName</LabeledElementReference>
</Annotation>
```

14.5.10 Expression `edm:Null`

The `edm:Null` expression returns an untyped null value. The only allowed child elements of the null expression are `edm:Annotation` elements.

The null expression MUST be written with element notation.

Example 65:

```
<Annotation Term="org.example.display.DisplayName">
  <Null/>
</Annotation>
```


14.5.11 Expression edm:NavigationPropertyPath

The edm:NavigationPropertyPath expression provides a value for terms or term properties that specify the built-in abstract type Edm.NavigationPropertyPath. It uses the same syntax and rules as the edm:Path expression with the following exceptions:

- The NavigationPropertyPath expression may traverse multiple collection-valued structural or navigation properties.
- The last path segment MUST resolve to a navigation property in the context of the preceding path part, or to a term cast where the term MUST be of type Edm.EntityType, a concrete entity type or a collection of Edm.EntityType or concrete entity type.

In contrast to the edm:Path expression, the value of the edm:NavigationPropertyPath expression is the path itself, not the instance(s) identified by the path.

The edm:NavigationPropertyPath expression MAY be provided using element notation or attribute notation.

Example 66:

```
<Annotation Term="UI.HyperLink" NavigationPropertyPath="Supplier" />

<Annotation Term="Capabilities.UpdateRestrictions">
  <Record>
    <PropertyValue Property="NonUpdatableNavigationProperties">
      <Collection>
        <NavigationPropertyPath>Supplier</NavigationPropertyPath>
        <NavigationPropertyPath>Category</NavigationPropertyPath>
      </Collection>
    </PropertyValue>
  </Record>
</Annotation>
```

14.5.12 Expression edm:Path

The edm:Path expression enables a value to be obtained by traversing an object graph. It can be used in annotations that target entity containers, entity sets, entity types, complex types, navigation properties of structured types, and properties of structured types.

The value assigned to the path expression MUST be composed of zero or more path segments joined together by forward slashes (/).

If a path segment is a QualifiedName, it represents a *type cast*, and the segment MUST be the name of a type in scope. If the instance identified by the preceding path part cannot be cast to the specified type, the path expression evaluates to the null value.

If a path segment starts with an at (@) character, it represents a *term cast*. The at (@) character MUST be followed by a QualifiedName that MAY be followed by a hash (#) character and a SimpleIdentifier. The QualifiedName preceding the hash character MUST resolve to a term that is in scope, the SimpleIdentifier following the hash sign is interpreted as a Qualifier for the term. If the instance identified by the preceding path part has been annotated with that term (and if present, with that qualifier), the term cast evaluates to the value of that annotation, otherwise it evaluates to the null value. Three special terms are implicitly "annotated" for media entities and stream properties:

- odata.mediaEditLink
- odata.mediaReadLink
- odata.mediaContentType

If a path segment is a SimpleIdentifier, it MUST be the name of a structural property or a navigation property of the instance identified by the preceding path part.

When used within an `edm:Path` expression, a path may contain at most one segment representing a multi-valued structural or navigation property. The result of the expression is the collection of instances resulting from applying the remaining path to each instance in the multi-valued property.

A path may terminate in a `$count` segment if the previous segment is multi-valued, in which case the path evaluates to the number of elements identified by the preceding segment.

If a path segment starts with a navigation property followed by an at (`@`) character, then the at (`@`) character MUST be followed by a QualifiedName that MAY be followed by a hash (`#`) character and a SimpleIdentifier. The QualifiedName preceding the hash character MUST resolve to a term that is in scope, the SimpleIdentifier following the hash sign is interpreted as a Qualifier for the term. If the navigation property has been annotated with that term (and if present, with that qualifier), the path segment evaluates to the value of that annotation, otherwise it evaluates to the null value.

Annotations MAY be embedded within their target, or embedded within an `edm:Annotations` element that specifies the annotation target with a path expression in its `Target` attribute. The latter situation is referred to as *targeting* in the remainder of this section.

For annotations embedded within or targeting an entity container, the path expression is evaluated starting at the entity container, i.e. an empty path resolves to the entity container, and non-empty path values MUST start with the name of a container child (entity set, function import, action import, or singleton). The subsequent segments follow the rules for path expressions targeting the corresponding child element.

For annotations embedded within or targeting an entity set or a singleton, the path expression is evaluated starting at the entity set, i.e. an empty path resolves to the entity set, and non-empty paths MUST follow the rules for annotations targeting the declared entity type of the entity set or singleton.

For annotations embedded within or targeting an entity type or complex type, the path expression is evaluated starting at the type, i.e. an empty path resolves to the type, and the first segment of a non-empty path MUST be a property or navigation property of the type, a type cast, or a term cast.

For annotations embedded within a property of an entity type or complex type, the path expression is evaluated starting at the directly enclosing type. This allows e.g. specifying the value of an annotation on one property to be calculated from values of other properties of the same type. An empty path resolves to the enclosing type, and non-empty paths MUST follow the rules for annotations targeting the directly enclosing type.

For annotations targeting a property of an entity type or complex type, the path expression is evaluated starting at the *outermost* entity type or complex type named in the `Target` of the enclosing `edm:Annotations` element, i.e. an empty path resolves to the outermost type, and the first segment of a non-empty path MUST be a property or navigation property of the outermost type, a type cast, or a term cast.

A path expression MAY be provided using element notation or attribute notation.

Example 67:

```
<Annotation Term="org.example.display.DisplayName" Path="FirstName" />

<Annotation Term="org.example.display.DisplayName">
  <Path>@vCard.Address#work/FullName</Path>
</Annotation>
```

14.5.13 Expression `edm:PropertyPath`

The `edm:PropertyPath` expression provides a value for terms or term properties that specify the built-in abstract type `Edm.PropertyPath`. It uses the same syntax and rules as the `edm:Path` expression, with the following exceptions:

- The `PropertyPath` expression may traverse multiple collection-valued structural or navigation properties

- The last path segment MUST resolve either to a structural property in the context of the preceding path part, or to a term cast where the term MUST be of type `Edm.ComplexType`, `Edm.PrimitiveType`, a complex type, an enumeration type, a concrete primitive type, a type definition, or a collection of one of these types.

In contrast to the `edm:Path` expression, the value of the `edm:PropertyPath` expression is the path itself, not the value of the property or the value of the term cast identified by the path.

The `edm:PropertyPath` MAY be provided using either element notation or attribute notation.

Example 68:

```
<Annotation Term="UI.RefreshOnChangeOf" PropertyPath="ChangedAt" />

<Annotation Term="Capabilities.UpdateRestrictions">
  <Record>
    <PropertyValue Property="NonUpdatableProperties">
      <Collection>
        <PropertyPath>CreatedAt</PropertyPath>
        <PropertyPath>ChangedAt</PropertyPath>
      </Collection>
    </PropertyValue>
  </Record>
</Annotation>
```

14.5.14 Expression `edm:Record`

The `edm:Record` expression enables a new entity type or complex type instance to be constructed.

A record expression contains zero or more `edm:PropertyValue` elements. For each single-valued structural or navigation property of the record construct's type that is neither nullable nor specifies a default value an `edm:PropertyValue` child element MUST be provided. The only exception is if the record expression is the direct child of an `edm:Annotation` element for a term that has a base term whose type is structured and directly or indirectly inherits from the type of its base term. In this case, property values that already have been specified in the annotation for the base term or its base term etc. need not be specified again.

For collection-valued properties the absence of an `edm:PropertyValue` child element is equivalent to specifying a child element with an empty collection as its value.

A record expression MUST be written with element notation, as shown in the following example.

Example 69: record with two structural and two navigation properties

```
<Annotation Term="org.example.person.Employee">
  <Record>
    <PropertyValue Property="GivenName" Path="FirstName" />
    <PropertyValue Property="Surname" Path="LastName" />
    <PropertyValue Property="Manager" Path="DirectSupervisor" />
    <PropertyValue Property="CostCenter">
      <UrlRef>
        <Apply Function="odata.fillUriTemplate">
          <String>http://host/anotherservice/CostCenters('{ccid}')</String>
          <LabeledElement Name="ccid" Path="CostCenterID" />
        </Apply>
      </UrlRef>
    </PropertyValue>
  </Record>
</Annotation>
```


14.5.14.1 Attribute `Type`

A record expression MAY specify a QualifiedName value for the `Type` attribute that MUST resolve to an entity type or complex type in scope. If no value is specified for the type attribute, the type is derived from the expression's context.

14.5.14.2 Element `edm:PropertyValue`

The `edm:PropertyValue` element supplies a value to a property on the type instantiated by an `edm:Record` expression. The value is obtained by evaluating an expression.

The `PropertyValue` element MUST contain exactly one expression. The `edm:PropertyValue` expression MAY be provided using element notation or attribute notation.

14.5.14.2.1 Attribute `Property`

The `PropertyValue` element MUST assign a SimpleIdentifier value to the `Property` attribute. The value of the property attribute MUST resolve to a property of the type of the enclosing `edm:Record` expression.

14.5.15 Expression `edm:UrlRef`

The `edm:UrlRef` expression enables a value to be obtained by sending a `GET` request to the value of the `UrlRef` expression.

The `edm:UrlRef` element MUST contain exactly one expression of type `Edm.String`. The `edm:UrlRef` expression MAY be provided using element notation or attribute notation.

The URL may be relative or absolute; relative URIs are relative to the `xml:base` attribute, see **[XML-Base]**.

The response body of the `GET` request MUST be returned as the result of the `edm:UrlRef` expression. The result of the `edm:UrlRef` expression MUST be type compatible with the type expected by the surrounding element or expression.

Example 70:

```
<Annotation Term="Vocab.Supplier">
  <UrlRef>
    <Apply Function="odata.fillUriTemplate">
      <String>http://host/service/Suppliers({suppID})</String>
      <LabeledElement Name="suppID">
      <Apply Function="odata.uriEncode">
        <Path>SupplierId</Path>
      </Apply>
      </LabeledElement>
     </Apply>
  </UrlRef>
</Annotation>

<Annotation Term="Core.LongDescription">
  <UrlRef><String>http://host/wiki/HowToUse</String></UrlRef>
</Annotation>

<Annotation Term="Core.LongDescription" UrlRef="http://host/wiki/HowToUse" />
```


15 Metadata Service Schema

The Metadata Service is a representation of the entity model of an OData service as an OData service with a fixed (meta) data model. The Metadata Service provides convenient access to the entity model of a service, i.e. all CSDL constructs used in its entity containers.

With `~/` as an abbreviation for the service root URL, the Metadata Service root URL is `~/$metadata/`, i.e. the canonical URL of the metadata document of the underlying service with a forward slash appended, and a `GET` request to `~/$metadata/$metadata` returns the CSDL document of the Metadata Service itself, defined in **[OData-Meta]**.

The following sections describe the schema of the Metadata Service.

Example 71: service document of Metadata Service

```
GET ~/$metadata/
```

would return

```
{
  "@odata.context":"~/$metadata/$metadata",
  "value":[
    { "name":"References"                ,"url":"References" },
    { "name":"Schemata"                  ,"url":"Schemata" },
    { "name":"Types"                     ,"url":"Types" },
    { "name":"Properties"                ,"url":"Properties" },
    { "name":"NavigationProperties"      ,"url":"NavigationProperties" },
    { "name":"EnumTypeMembers"           ,"url":"EnumTypeMembers" },
    { "name":"Actions"                   ,"url":"Actions" },
    { "name":"Functions"                 ,"url":"Functions" },
    { "name":"Terms"                     ,"url":"Terms" },
    { "name":"Annotations"               ,"url":"Annotations" },
    { "name":"EntityContainer"           ,"url":"EntityContainer",
                                          "kind":"Singleton" },
    { "name":"EntitySets"                ,"url":"EntitySets" },
    { "name":"Singletons"                ,"url":"Singletons" },
    { "name":"NavigationPropertyBindings","url":"NavigationPropertyBindings"},
    { "name":"ActionImports"             ,"url":"ActionImports" },
    { "name":"FunctionImports"           ,"url":"FunctionImports" }
  ]
}
```

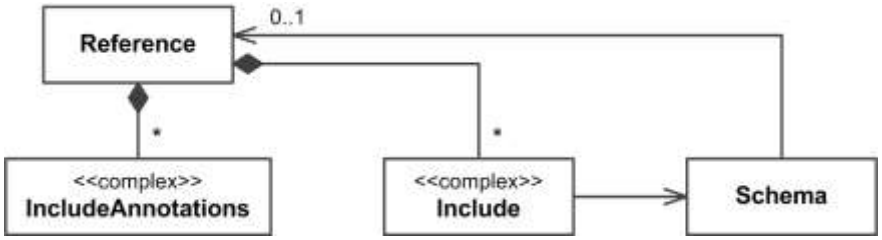
Note: all examples in this chapter use `~/` as an abbreviation for the service root URL.

Note: `~/$metadata/$metadata` is not a typo, it is the metadata URL of the Metadata Service for the service with root URL `~/`.

15.1 Entity Model Wrapper

The Metadata Service provides convenient access to the entity model of a service, i.e. all CSDL constructs used in its entity container. This model may be distributed over several schemas, and these schemas may be distributed over several physical locations, bound together via the entity model wrapper.

This document structure is represented in the metadata service as an entity type `Reference` and two complex types `Include` and `IncludeAnnotations`.



Legend: boxes without a stereotype represent entity types; boxes with stereotype «`complex`» represent complex types. Compositions represent complex properties; associations represent navigation properties. Arrows indicate navigation properties without a partner; associations without arrows are bidirectional. No cardinality means 1.

A reference is identified by its `Uri` property, which is the absolute value of the `Uri` attribute after resolving a relative value against the `xml:base` attribute.

Example 72: for the Products and Categories example the request

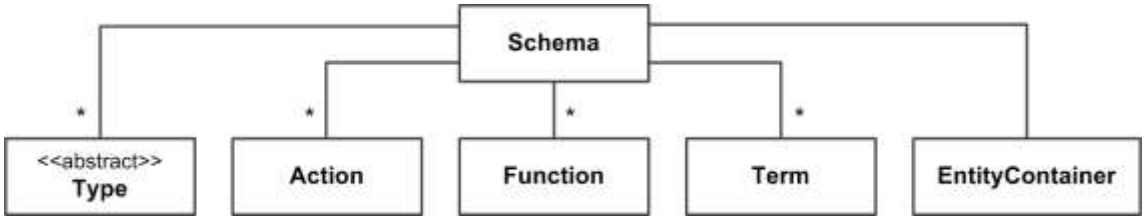
```
GET ~/$metadata/References?$expand=Include/Schema($select=Namespace)
```

would return

```
{
  "@odata.context":
              "~/$metadata/$metadata#References(.,Include/Schema(Namespace))",
  "value":[
    {
      "Uri":"http://tinyurl.com/Org-OData-Core",
      "Include":[
        { "Alias":"Core", "Schema":{ "Namespace":"Org.OData.Core.V1" } }
      ],
      "IncludeAnnotations":[]
    },{
      "Uri":"http://tinyurl.com/Org-OData-Measures-V1",
      "Include":[
        { "Alias":"UoM", "Schema":{ "Namespace":"Org.OData.Measures.V1" } }
      ],
      "IncludeAnnotations":[]
    }
  ]
}
```


15.2 Schema

The *model* of the service consists of all CSDL constructs used in its entity container. Each model construct is defined in a schema:



A schema is identified by its `Namespace` property. If it defines an alias, direct key access using the alias instead of the namespace redirects to the schema with this alias.

Example 73: for the Products and Categories example the request

```
GET ~/$metadata/Schemata
```

would return

```
{
  "@odata.context":"~/$metadata#Schemata",
"value":[
  {
      "Namespace":"ODataDemo", "Alias":null
    },{
      "Namespace":"Org.OData.Core.V1", "Alias":"Core"
    },{
      "Namespace":"Org.OData.Measures.V1", "Alias":"UoM"
    },{
      "Namespace":"Edm", "Alias":null
    }
  ]
}
```

Example 74: redirecting from alias to schema

```
GET ~/$metadata/Schemata('Core')
```

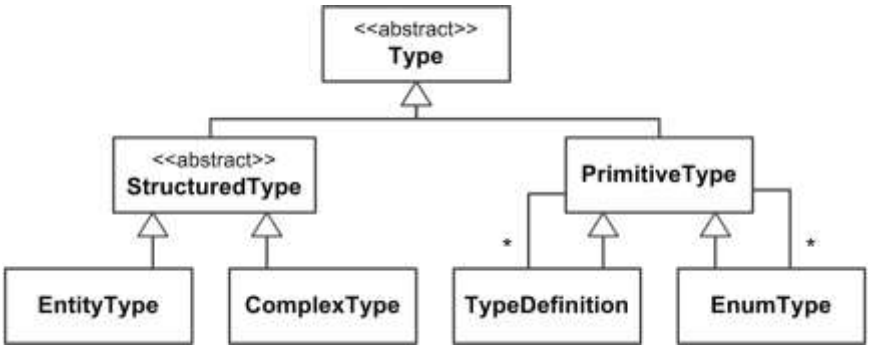
would return

```
{
  "@odata.context":"~/$metadata#Schemata/@entity",
"Namespace":"Org.OData.Core.V1",
"Alias":"Core"
}
```

All schemata used in the model are listed in this entity set, independently of whether they are defined directly in the metadata document or included via a reference.

15.3 Types

Types form an inheritance hierarchy



A type is identified by its `QualifiedName` property, which is the `Namespace` of the defining schema, followed by a dot (`.`) and the `Name` of the type. There is only one entity set `Types` for all types. Type cast segments can be used to access specialized types.

Only those built-in primitive types that are actually used in the model appear in the `Types` entity set.

Enumeration type members are identified by their `Fullname` property, which is the `QualifiedName` of the enumeration type, followed by a forward slash (`/`) and the `Name` of the member.

Example 75: single type by name, and all entity types

```
GET ~/$metadata/Types('ODataDemo.Product')
GET ~/$metadata/Types/Meta.EntityType
```

Example 76: all types

```
GET ~/$metadata/Types
```

would return

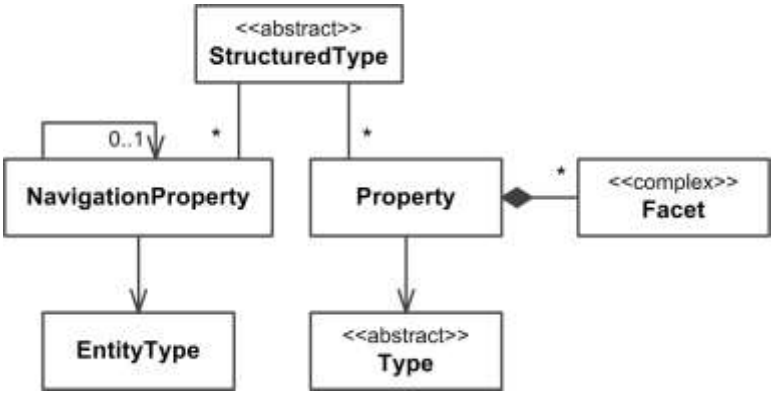
```
{
  "@odata.context":"~/$metadata/$metadata#Types",
  "value":[ {
      "@odata.type":"Meta.EntityType",
      "QualifiedName":"ODataDemo.Product", "Name":"Product",
      "Key":[{"PropertyPath":"ID","Alias":null}],
      "Abstract":false, "OpenType":false, "HasStream":true
    },{
      "@odata.type":"Meta.EntityType",
      "QualifiedName":"ODataDemo.Category", "Name":"Category",
      "Key":[{"PropertyPath":"ID","Alias":null}],
      "Abstract":false, "OpenType":false, "HasStream":false
    },{
      "@odata.type":"Meta.EntityType",
      "QualifiedName":"ODataDemo.Supplier", "Name":"Supplier",
      "Key":[{"PropertyPath":"ID","Alias":null}],
      "Abstract":false, "OpenType":false, "HasStream":false
    },{
      "@odata.type":"Meta.EntityType",
      "QualifiedName":"ODataDemo.Country", "Name":"Country",
      "Key":[{"PropertyPath":"Code","Alias":null}],
      "Abstract":false, "OpenType":false, "HasStream":false
    },{
      "@odata.type":"Meta.ComplexType",
      "QualifiedName":"ODataDemo.Address", "Name":"Address",
      "Abstract":false, "OpenType":false
    },{
```



```
      "@odata.type":"Meta.ComplexType",
      "QualifiedName":"Core.OptimisticConcurrency",
      "Name":"OptimisticConcurrency",
      "Abstract":false, "OpenType":false
    },{
      "@odata.type":"Meta.PrimitiveType",
      "QualifiedName":"Edm.Date", "Name":"Date"
    },{
      "@odata.type":"Meta.PrimitiveType",
      "QualifiedName":"Edm.Decimal", "Name":"Decimal"
    },{
      "@odata.type":"Meta.PrimitiveType",
      "QualifiedName":"Edm.Int32", "Name":"Int32"
    },{
      "@odata.type":"Meta.PrimitiveType",
      "QualifiedName":"Edm.String", "Name":"String"
    },{
      "@odata.type":"Meta.PrimitiveType",
      "QualifiedName":"Edm.PropertyPath", "Name":"PropertyPath"
    },{
      "@odata.type":"Meta.EntityType",
      "QualifiedName":"Edm.EntityType", "Name":"EntityType", "Key":[],
      "Abstract":true, "OpenType":false, "HasStream":false    }
  ]
}
```

15.4 Properties

Structural properties and navigation properties are represented as



This model is intentionally simplified. It closely resembles the XML schema and makes querying easy as it e.g. allows expanding the `Type` for all structural properties. A structured type is only related to properties it directly declares, not to properties it inherits from ancestor types. All inherited and directly declared properties or navigation properties can be requested with the bound functions `Meta.AllProperties` and `Meta.AllNavigationProperties`.

Structural properties and navigation properties are identified by their `Fullname` property, which is the `QualifiedName` of the containing entity type or complex type, followed by a forward slash (`/`) and the `Name` of the property or navigation property.

Example 77: single property or navigation property by name

```
GET ~/$metadata/Properties('ODataDemo.Product%2FID')
GET ~/$metadata/NavigationProperties('ODataDemo.Category%2FProducts')
```

Example 78: all properties with type


```
GET ~/$metadata/Properties?$expand=Type($select=QualifiedName)
```

would return

```
{
  "@odata.context":"~/$metadata/$metadata#Properties(*,Type(QualifiedName))",
  "value":[
    {
      "Fullname":"ODataDemo.Product/ID", "Name":"ID",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Product/Description", "Name":"Description",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Product/ReleaseDate", "Name":"ReleaseDate",
      "Nullable":true, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.Date"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Product/DiscontinuedDate",
      "Name":"DiscontinuedDate",
      "Nullable":true, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.Date"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Product/Rating", "Name":"Rating",
      "Nullable":true, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.Int32"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Product/Currency", "Name":"Currency",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[{"Name":"MaxLength","Value":"3"}]
    },{
      "Fullname":"ODataDemo.Category/ID", "Name":"ID",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.Int32"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Category/Name", "Name":"Name",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Supplier/ID", "Name":"ID",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Supplier/Name", "Name":"Name",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Supplier/Address", "Name":"Address",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"ODataDemo.Address"},
      "Facets":[]
    },{
```



```
      "@odata.type":"Meta.PrimitiveProperty",
      "Fullname":"ODataDemo.Supplier/Concurrency", "Name":"Concurrency",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.Int32"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Country/Code", "Name":"Code",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[{"Name":"MaxLength","Value":"2"}]
    },{
      "Fullname":"ODataDemo.Country/Name", "Name":"Name",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Address/Street", "Name":"Street",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Address/City", "Name":"City",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Address/State", "Name":"State",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Address/ZipCode", "Name":"ZipCode",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"ODataDemo.Address/CountryName", "Name":"CountryName",
      "Nullable":false, "IsCollection":false,
      "Type":{"QualifiedName":"Edm.String"},
      "Facets":[]
    },{
      "Fullname":"Core.OptimisticConcurrency/ETagDependsOn",
      "Name":"ETagDependsOn",
      "Nullable":false, "IsCollection":true,
      "Type":{"QualifiedName":"Edm.PropertyPath"},
      "Facets":[]
    }
  ]
}
```

Example 79: all navigation properties with type and partner

```
GET ~/$metadata/NavigationProperties?
                    $expand=Type($select=QualifiedName),Partner($select=Name)
```

would return

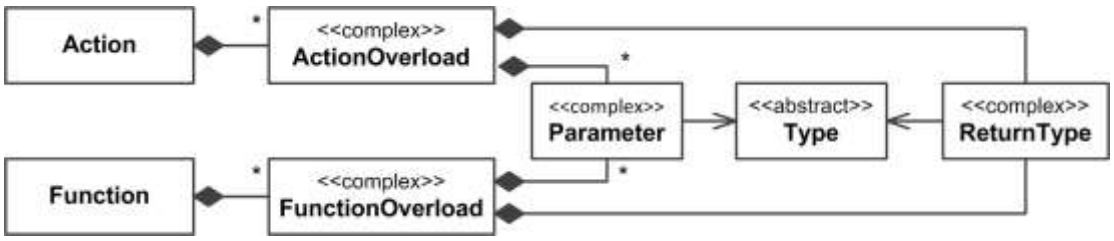
```
{
"@odata.context":"~/$metadata/$metadata#NavigationProperties(Type(QualifiedNam
e),Partner(Name))",
    {
      "Fullname":"ODataDemo.Product/Category", "Name":"Category",
      "Nullable":false, "ContainsTarget":false,
      "OnDelete":null,
```



```
      "ReferentialConstraints":[],
      "IsCollection":false,
      "Type":{ "QualifiedName":"ODataDemo.Category" },
      "Partner":{ "Name":"Product" }
    },{
      "Fullname":"ODataDemo.Product/Supplier", "Name":"Supplier",
      "Nullable":false, "ContainsTarget":false,
      "OnDelete":null,
      "ReferentialConstraints":[],
      "IsCollection":false,
      "Type":{ "QualifiedName":"ODataDemo.Supplier" },
      "Partner":{ "Name":"Products" }
    },{
      "Fullname":"ODataDemo.Category/Products", "Name":"Products",
      "Nullable":false, "ContainsTarget":false,
      "OnDelete":{ "Action":"Cascade", "Annotations":[] },
      "ReferentialConstraints":[],
      "IsCollection":true,
      "Type":{ "QualifiedName":"ODataDemo.Product" },
      "Partner":{ "Name":"Category" }
    },{
      "Fullname":"ODataDemo.Supplier/Products", "Name":"Products",
      "Nullable":false, "ContainsTarget":false,
      "OnDelete":null,
      "ReferentialConstraints":[],
      "IsCollection":true,
      "Type":{ "QualifiedName":"ODataDemo.Product" },
      "Partner":{ "Name":"Supplier" }
    },{
      "Fullname":"ODataDemo.Address/Country", "Name":"Country",
      "Nullable":false, "ContainsTarget":false,
      "OnDelete":null,
      "ReferentialConstraints":[
        {
          "Property":"CountryName", "ReferencedProperty":"Name",
          "Annotations":[]
        }
      ],
      "IsCollection":false,
      "Type":{ "QualifiedName":"ODataDemo.Product" },
      "Partner":{ "Name":"Supplier" }
    }
  ]
}
```

15.5 Actions and Functions

Actions and functions are represented as



Actions and functions are identified by their `QualifiedName` property, which is the `Namespace` of the containing schema, followed by a dot (`.`) and the `Name` of the action or function.

Example 80:


```
GET ~/$metadata/Actions('SampleModel.Approval')
GET ~/$metadata/Functions('ODataDemo.ProductsByRating')
```

Example 81: all functions

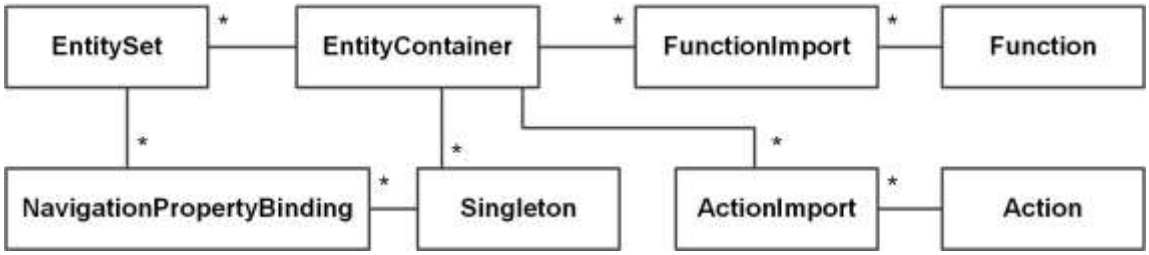
```
GET ~/$metadata/Functions?
                      $expand=Overloads/Parameters/Type($select=QualifiedName)
```

would return

```
{
  "@odata.context":
"~/$metadata/$metadata#Functions(*,Overloads/Parameters/Type(QualifiedName))",
  "value":[
    {
      "QualifiedName":"ODataDemo.ProductsByRating",
      "Name":"ProductsByRating",
      "Overloads":[
        {
          "IsBound":false, "IsComposable":false,
          "ReturnType":{
            "IsCollection":true, "Nullable":false, "Facets":[],
            "Type":{"QualifiedName":"ODataDemo.Product"}
          },
          "Parameters":[
            {
              "Name":"Rating", "IsBinding":false,
              "Nullable":true,
              "IsCollection":false, "Facets":[],
              "Type":{"QualifiedName":"Edm.Int32"}
            }
          ]
        }
      ]
    }
  ]
}
```

15.6 Entity Container

Entity container constructs are represented as



An entity container is identified by its `QualifiedName` property, which is the `Namespace` of the containing schema, followed by a dot (`.`) and the `Name` of the entity container. As there is exactly one entity container per service, it is a singleton.

Example 82:

```
GET ~/$metadata/EntityContainer
```


Direct children of an entity container are identified by their `Fullname` property, which is the `QualifiedName` of the entity container, followed by a forward slash (`/`) and the `Name` of the child.

Example 83:

```
GET ~/$metadata/EntitySets('ODataDemo.DemoService%2FCategories')
```

A navigation property binding is identified by its `Fullname` property, which is the `Fullname` of the source entity set or singleton, followed by a forward slash (`/`) and the `Path` of the navigation property binding.

Example 84:

```
GET ~/$metadata/NavigationPropertyBindings(
                              'ODataDemo.DemoService%2FCategories%2FProducts')
```

Example 85: all containers with direct children

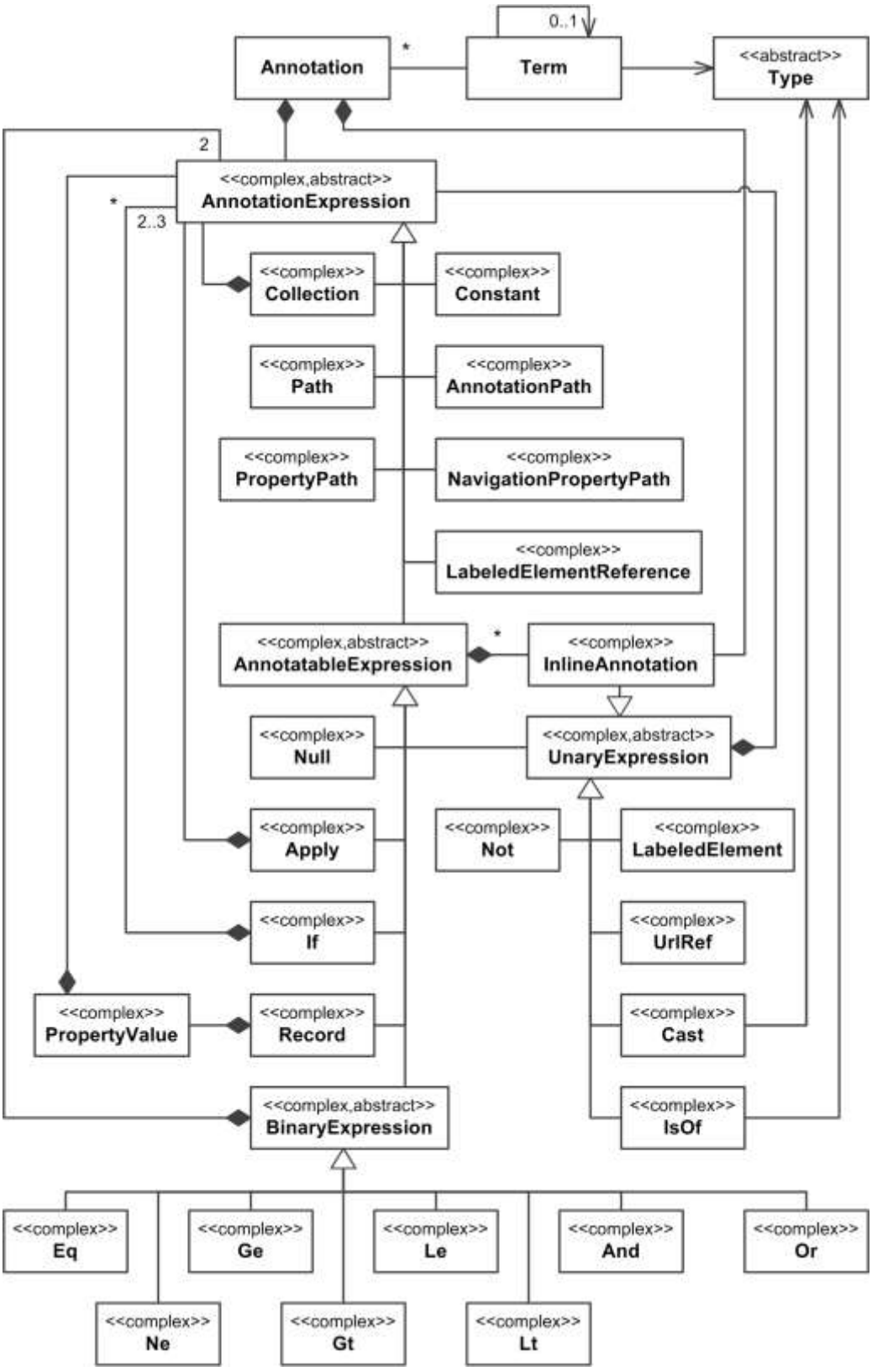
```
GET ~/$metadata/EntityContainer?$expand=*
```

would return

```
{
  "@odata.context":"~/$metadata/$metadata#EntityContainer",
  "QualifiedName":"ODataDemo.DemoService",
  "Name":"DemoService",
  "EntitySets":[
    {
      "Fullname":"ODataDemo.DemoService/Products",   "Name":"Products",
      "IncludeInServiceDocument":true
    },{
      "Fullname":"ODataDemo.DemoService/Suppliers",  "Name":"Suppliers",
      "IncludeInServiceDocument":true
    },{
      "Fullname":"ODataDemo.DemoService/Categories", "Name":"Categories",
      "IncludeInServiceDocument":true
    },{
      "Fullname":"ODataDemo.DemoService/Countries",  "Name":"Countries",
      "IncludeInServiceDocument":true
    }
  ],
  "Singletons":[
    {
      "Fullname":"ODataDemo.DemoService/MainSupplier",
      "Name":"MainSupplier"
    }],
  "ActionImports":[],
  "FunctionImports":[
    {
      "Fullname":"ODataDemo.DemoService/ProductsByRating",
      "Name":"ProductsByRating",
      "IncludeInServiceDocument":false
    }
  ]
}
```


15.7 Terms and Annotations

Terms and annotations based on these terms are represented as



A term is identified by its `QualifiedName` property, which is the `Namespace` of the containing schema, followed by a dot (`.`) and the `Name` of the term.

Example 86:

```
GET ~/$metadata/Terms?$expand=Type($select=QualifiedName)
```

would return

```
{
  "@odata.context":"~/$metadata/$metadata#Terms(Type(QualifiedName))",
  "value":[
    {
      "QualifiedName":"Core.Description", "Name":"Description",
      "DefaultValue":null, "IsCollection":false,
      "Type":{ "QualifiedName":"Edm.String" }
    },{
      "QualifiedName":"Core.OptimisticConcurrency",
      "Name":"OptimisticConcurrency",
      "DefaultValue":null, "IsCollection":true,
      "Type":{ "QualifiedName":"Edm.PropertyPath" }
    }
  ]
}
```

Annotations can be stated in CSDL in two ways: *inline* as child elements of the annotated element, or *externally* as children of an `edm:Annotations` element that targets the model element to be annotated. The external form is only possible for model elements that can be uniquely identified by a target path expression, and these model elements are represented in the Metadata Service as entity types, while all model elements that cannot be targeted are represented as complex types.

Consequently annotations that can only be stated with the inline form are represented with the complex type `Edm.Metadata.InlineAnnotation`, while annotations that can be stated externally are represented with the entity type `Edm.Metadata.Annotation`, whether they are stated inline or externally in the metadata document or referenced CSDL documents. If the example metadata document in Example 88 would reference the CSDL document in Example 89, all its annotations would also be members of the Annotations entity set of the Metadata Service for Example 88.

These annotations are identified by the combination of their target, term, and qualifier. The `Fullname` of an annotation is the `Fullname` of the target, followed by an at (`@`) sign and the `QualifiedName` of the term, and for non-empty qualifiers followed by a hash (`#`) sign and the qualifier.

Example 87:

```
GET ~/$metadata/Annotations
```

would return

```
{
  "@odata.context":"~/$metadata/$metadata#Annotations",
  "value":[
    {
      "Fullname":"ODataDemo.Product/Description@Core.IsLanguageDependent",
      "Qualifier":null,
      "Value":{ "@odata.type":"Meta.ConstantExpression","Value":true }
    },
    {
      "Fullname":"ODataDemo.Product/Price@UoM.ISOCurrency",
      "Qualifier":null,
      "Value":{ "@odata.type":"Meta.Path","Value":"Currency" }
    },
    {
      "Fullname":"ODataDemo.Category/Name@Core.IsLanguageDependent",
      "Qualifier":null,
```



```
      "Value":{ "@odata.type":"Meta.Constant","Value":true }
    },
    {
      "Fullname":"ODataDemo.DemoService/Suppliers@Core.OptimisticConcurrency",
      "Qualifier":null,
      "Value":{
        "@odata.type":"Meta.Collection",
        "Items":[
          {
            "@odata.type":"Meta.PropertyPath",
            "Value":"Concurrency"
          }
        ]
      }
    }
  ]
}
```


16 CSDL Examples

Following are two basic examples of valid EDM models as represented in CSDL. These examples demonstrate many of the topics covered above.

16.1 Products and Categories Example

Example 88:

```
<edmx:Edmx xmlns:edmx="http://docs.oasis-open.org/odata/ns/edmx"
           Version="4.0">
  <edmx:Reference Uri="http://docs.oasis-
open.org/odata/odata/v4.0/os/vocabularies/Org.OData.Core.V1.xml">
    <edmx:Include Namespace="Org.OData.Core.V1" Alias="Core" />
  </edmx:Reference>
  <edmx:Reference Uri="http://docs.oasis-
open.org/odata/odata/v4.0/os/vocabularies/Org.OData.Measures.V1.xml">
    <edmx:Include Alias="UoM" Namespace="Org.OData.Measures.V1" />
  </edmx:Reference>
  <edmx:DataServices>
    <Schema xmlns="http://docs.oasis-open.org/odata/ns/edm"
            Namespace="ODataDemo">
      <EntityType Name="Product" HasStream="true">
        <Key>
          <PropertyRef Name="ID" />
        </Key>
        <Property Name="ID" Type="Edm.Int32" Nullable="false" />
        <Property Name="Description" Type="Edm.String" >
          <Annotation Term="Core.IsLanguageDependent" />
        </Property>
        <Property Name="ReleaseDate" Type="Edm.Date" />
        <Property Name="DiscontinuedDate" Type="Edm.Date" />
        <Property Name="Rating" Type="Edm.Int32" />
        <Property Name="Price" Type="Edm.Decimal">
          <Annotation Term="UoM.ISOCurrency" Path="Currency" />
        </Property>
        <Property Name="Currency" Type="Edm.String" MaxLength="3" />
        <NavigationProperty Name="Category" Type="ODataDemo.Category"
                            Nullable="false" Partner="Products" />
        <NavigationProperty Name="Supplier" Type="ODataDemo.Supplier"
                            Partner="Products" />
      </EntityType>
      <EntityType Name="Category">
        <Key>
         <PropertyRef Name="ID" />
        </Key>
        <Property Name="ID" Type="Edm.Int32" Nullable="false" />
        <Property Name="Name" Type="Edm.String">
          <Annotation Term="Core.IsLanguageDependent" />
        </Property>
        <NavigationProperty Name="Products" Partner="Category"
                            Type="Collection(ODataDemo.Product)">
          <OnDelete Action="Cascade" />
```



```
      </NavigationProperty>
    </EntityType>
    <EntityType Name="Supplier">
      <Key>
        <PropertyRef Name="ID" />
      </Key>
      <Property Name="ID" Type="Edm.String" Nullable="false" />
      <Property Name="Name" Type="Edm.String" />
      <Property Name="Address" Type="ODataDemo.Address" Nullable="false" />
      <Property Name="Concurrency" Type="Edm.Int32" Nullable="false" />
      <NavigationProperty Name="Products" Partner="Supplier"
                          Type="Collection(ODataDemo.Product)" />
    </EntityType>
    <EntityType Name="Country">
      <Key>
        <PropertyRef Name="Code" />
      </Key>
      <Property Name="Code" Type="Edm.String" MaxLength="2"
                            Nullable="false" />
      <Property Name="Name" Type="Edm.String" />
    </EntityType>
    <ComplexType Name="Address">
      <Property Name="Street" Type="Edm.String" />
      <Property Name="City" Type="Edm.String" />
      <Property Name="State" Type="Edm.String" />
      <Property Name="ZipCode" Type="Edm.String" />
      <Property Name="CountryName" Type="Edm.String" />
      <NavigationProperty Name="Country" Type="ODataDemo.Country">
        <ReferentialConstraint Property="CountryName"
                               ReferencedProperty="Name" />
      </NavigationProperty>
    </ComplexType>
    <Function Name="ProductsByRating">
      <Parameter Name="Rating" Type="Edm.Int32" />
      <ReturnType Type="Collection(ODataDemo.Product)" />
    </Function>
    <EntityContainer Name="DemoService">
      <EntitySet Name="Products" EntityType="ODataDemo.Product">
        <NavigationPropertyBinding Path="Category" Target="Categories" />
      </EntitySet>
      <EntitySet Name="Categories" EntityType="ODataDemo.Category">
        <NavigationPropertyBinding Path="Products" Target="Products" />
      </EntitySet>
      <EntitySet Name="Suppliers" EntityType="ODataDemo.Supplier">
        <NavigationPropertyBinding Path="Products" Target="Products" />
        <NavigationPropertyBinding Path="Address/Country"
                                   Target="Countries" />
        <Annotation Term="Core.OptimisticConcurrency">
          <Collection>
            <PropertyPath>Concurrency</PropertyPath>
          </Collection>
        </Annotation>
      </EntitySet>
      <Singleton Name="MainSupplier" Type="Self.Supplier">
        <NavigationPropertyBinding Path="Products" Target="Products" />
      </Singleton>
      <EntitySet Name="Countries" EntityType="ODataDemo.Country" />
      <FunctionImport Name="ProductsByRating" EntitySet="Products"
                      Function="ODataDemo.ProductsByRating" />
    </EntityContainer>
  </Schema>
 </edmx:DataServices>
</edmx:Edmx>
```


16.2 Annotations for Products and Categories Example

Example 89:

```
<edmx:Edmx xmlns:edmx="http://docs.oasis-open.org/odata/ns/edmx"
           Version="4.0">
  <edmx:Reference Uri="http://host/service/$metadata">
    <edmx:Include Namespace="ODataDemo" />
  </edmx:Reference>
  <edmx:Reference Uri="http://somewhere/Vocabulary/V1">
    <edmx:Include Alias="Vocabulary1" Namespace="Some.Vocabulary.V1" />
  </edmx:Reference>
  <edmx:DataServices>
    <Schema xmlns="http://docs.oasis-open.org/odata/ns/edm"
            Namespace="Annotations">
      <Annotations Target="ODataDemo.Supplier">
        <Annotation Term="Vocabulary1.EMail">
          <Null />
        </Annotation>
        <Annotation Term="Vocabulary1.AccountID" Path="ID" />
        <Annotation Term="Vocabulary1.Title" String="Supplier Info" />
        <Annotation Term="Vocabulary1.DisplayName">
        <Apply Function="odata.concat">
            <Path>Name</Path>
            <String> in </String>
            <Path>Address/CountryName</Path>
          </Apply>
        </Annotation>
      </Annotations>
      <Annotations Target="ODataDemo.Product">
        <Annotation Term="Vocabulary1.Tags">
          <Collection>
            <String>MasterData</String>
          </Collection>
        </Annotation>
      </Annotations>
  </Schema>
  </edmx:DataServices>
</edmx:Edmx>
```


17 Attribute Values

17.1 Namespace

A Namespace is a character sequence of type `edm:TNamespaceName`, see **[OData-EDM]**.

Non-normatively speaking it is a dot-separated sequence of SimpleIdentifiers with a maximum length of 511 Unicode characters.

17.2 SimpleIdentifier

A SimpleIdentifier is a character sequence of type `edm:TSimpleIdentifier`, see **[OData-EDM]**:

```
<xs:simpleType name="TSimpleIdentifier">
  <xs:restriction base="xs:NCName">
    <xs:maxLength value="128" />
    <xs:pattern
     value="[\p{L}\p{Nl}_][\p{L}\p{Nl}\p{Nd}\p{Mn}\p{Mc}\p{Pc}\p{Cf}]{0,}"
    />
  </xs:restriction>
</xs:simpleType>
```

Non-normatively speaking it starts with a letter or underscore, followed by at most 127 letters, underscores or digits.

17.3 QualifiedName

For model elements that are direct children of a schema: the namespace or alias of the schema that defines the model element, followed by a dot and the name of the model element, see rule `qualifiedTypeName` in **[OData-ABNF]**.

For built-in primitive types: the name of the type, prefixed with `Edm` followed by a dot.

17.4 TypeName

The QualifiedName of a built-in primitive or abstract type, a type definition, complex type, enumeration type, or entity type, or a collection of one of these types, see rule `qualifiedTypeName` in **[OData-ABNF]**.

The type must be in scope, i.e. the type MUST be defined in the `Edm` namespace or it MUST be defined in the schema identified by the namespace or alias portion of the qualified name, and the identified schema MUST be defined in the same CSDL document or included from a directly referenced document.

17.5 TargetPath

Target paths are used in attributes of CSDL elements to refer to other CSDL elements or their nested child elements.

The allowed path expressions are:

- The QualifiedName of an entity container, followed by a forward slash and the name of a container child element
- The target path of a container child followed by a forward slash and one or more forward-slash separated property, navigation property, or type cast segments

Example 90: Target expressions

```
MySchema.MyEntityContainer/MyEntitySet
```



```
MySchema.MyEntityContainer/MySingleton
MySchema.MyEntityContainer/MyEntitySet/MyContainmentNavigationProperty
MySchema.MyEntityContainer/MyEntitySet/My.EntityType/MyContainmentNavProperty
MySchema.MyEntityContainer/MySingleton/MyComplexProperty/MyContainmentNavProp
```

17.6 Boolean

One of the literals `true` or `false`.

18 Conformance

Conforming services MUST follow all rules of this specification document for the types, sets, functions, actions, containers and annotations they expose.

Conforming clients MUST be prepared to consume a model that uses any or all of the constructs defined in this specification, including custom annotations, and MUST ignore any elements or attributes not defined in this version of the specification.

Appendix A. Acknowledgments

The contributions of the OASIS OData Technical Committee members, enumerated in **[OData-Protocol]**, are gratefully acknowledged.

Appendix B. Revision History

Revision	Date	Editor	Changes Made
Working Draft 01	2012-08-22	Michael Pizzo	Translated Contribution to OASIS format/template
Committee Specification Draft 01	2013-04-26	Michael Pizzo, Ralf Handl, Martin Zurmuehl	Simplified annotations, relationships, added containment, singletons Added Type Definitions, Edm.Date, Edm.TimeOfDay, Edm.Duration datatypes. Retired Edm.DateTime, Edm.Time. Enhanced ComplexType support Expanded Service Document Fleshed out descriptions and examples and addressed numerous editorial and technical issues processed through the TC Added Conformance section
Committee Specification Draft 02	2013-07-01	Michael Pizzo, Ralf Handl, Martin Zurmuehl	Restricted services to exactly one entity container Simplified function and action overloads Rounded off annotaitons Fleshed out containment Simplified rules for implicit enum member values Clarified intention of Partner and NavigationPropertyBinding Simplified and completed CSDL for Metadata Service, added description of behavior
Committee Specification 01	2013-07-30	Michael Pizzo, Ralf Handl, Martin Zurmuehl	Non-Material Changes
Committee Specification Draft 03	2013-10-03	Michael Pizzo, Ralf Handl, Martin Zurmuehl	Changed function overload resolution rules Improved path expressions for annotations
Committee Specification 02	2013-11-04	Michael Pizzo, Ralf Handl, Martin Zurmuehl	Non-Material Changes
OASIS Specification	2014-02-24	Michael Pizzo, Ralf Handl, Martin Zurmuehl	Non-Material Changes
Errata 01	2014-07-24	Michael Pizzo, Ralf Handl, Martin Zurmuehl	Minor changes and improvements

Errata 02	2014-10-29	Michael Pizzo, Ralf Handl, Martin Zurmuehl	Repaired mechanical error in the editable source
Errata 03	2016-03-03	Michael Pizzo, Ralf Handl, Martin Zurmuehl	Minor changes and clarifications

