OData Version 4.0 Part 3: Common Schema Definition Language (CSDL)

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Additional artifacts:
This prose specification is one component of a Work Product that also includes:
- OData Version 4.0 Part 3: Common Schema Definition Language (CSDL) (this document). http://docs.oasis-open.org/odata/odata/v4.0/csprd02/part3-csdl/odata-v4.0-csprd02-part3-csdl.html
• ABNF components: OData ABNF Construction Rules Version 4.0 and OData ABNF Test Cases. http://docs.oasis-open.org/odata/odata/v4.0/csprd02/abnf/
• Vocabulary components: OData Core Vocabulary, OData Measures Vocabulary and OData Capabilities Vocabulary. http://docs.oasis-open.org/odata/odata/v4.0/csprd02/vocabularies/
• OData Metadata Service Entity Model: http://docs.oasis-open.org/odata/odata/v4.0/csprd02/models/MetadataService.edmx

Related work:
This specification is related to:

Declared XML namespaces:
• http://docs.oasis-open.org/odata/ns/edmx
• http://docs.oasis-open.org/odata/ns/edm

Abstract:
The Open Data Protocol (OData) enables the creation of REST-based data services, which allow resources, identified using Uniform Resource Identifiers (URIs) and defined in an Entity Data Model (EDM), to be published and edited by Web clients using simple HTTP messages. OData version 4.0 defines the core semantics and facilities of the protocol, a set of recommended (but not required) rules for constructing URLs to identify the data and metadata exposed by an OData service as well as a set of reserved URL query string operators, an Entity Data Model (EDM), and an XML representation of the entity data model exposed by an OData service. OData Atom Format version 4.0 extends the former by defining representations for OData requests and responses using an Atom format.

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.

Technical Committee members should send comments on this specification to the Technical Committee’s email list. Others should send comments to the Technical Committee by using the “Send A Comment” button on the Technical Committee’s web page at http://www.oasis-open.org/committees/odata/.

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When referencing this specification the following citation format should be used:

[OData-Part3]
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Appendix A. Acknowledgments

Appendix B. Revision History
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

See link in “Additional artifacts” section on cover page.
See link in “Related work” section on cover page.
See link in “Additional artifacts” section on cover page.
See link in “Additional artifacts” section on cover page.
[OData-JS] OData JSON Format Version 4.0.
See link in “Related work” section on cover page.
See link in “Additional artifacts” section on cover page.
See link in “Additional artifacts” section on cover page.
See link in “Additional artifacts” section on cover page.
[OData-VocCore] OData Core Vocabulary.
See link in “Additional artifacts” section on cover page.
Latest version available at http://www.w3.org/TR/xml11/.
Latest version available at http://www.w3.org/TR/xmlbase/.
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 `edm: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`

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 edm:Edmx

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

Example 2:

```xml
<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 edm: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 edm:DataServices

The edm:DataServices element MUST contain at least one edm:Schema element which define the schema(s) exposed by the OData service.

3.3 Element edm:Reference

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

The edm: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 accessed; elements that are defined in documents that are only referenced by referenced documents cannot be accessed.

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

```xml
<?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 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 edm: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 `edmx:Schema` elements within the same document.

Aliases are document-global, so `edmx:Include` and `edmx:Schema` elements within a document MUST NOT assign the same alias to different namespaces.

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
<?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.contoso.Sales" Qualifier="Tablet" TargetNamespace="com.contoso.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.contoso.Sales` **namespace and**
- **Annotations that apply a term from the** `org.example.hcm` **namespace to an element of the** `com.contoso.Person` **namespace and specify a Tablet qualifier.**

### 3.5.1 Attribute `TermNamespace`

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

The include element will import the set of annotations that apply terms defined in the schema identified by the namespace in the value. The term namespace 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:**

```xml
<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:

<table>
<thead>
<tr>
<th>Type</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edm.Binary</td>
<td>Fixed-length or variable-length binary data</td>
</tr>
<tr>
<td>Edm.Boolean</td>
<td>Binary-valued logic</td>
</tr>
<tr>
<td>Edm.Byte</td>
<td>Unsigned 8-bit integer</td>
</tr>
<tr>
<td>Edm.Date</td>
<td>Date without a time-zone offset</td>
</tr>
<tr>
<td>Type</td>
<td>Meaning</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Edm.DateTimeOffset</td>
<td>Date and time with a time-zone offset, no leap seconds</td>
</tr>
<tr>
<td>Edm.Decimal</td>
<td>Numeric values with fixed precision and scale</td>
</tr>
<tr>
<td>Edm.Double</td>
<td>Floating-point number with 15 digits precision</td>
</tr>
<tr>
<td>Edm.Duration</td>
<td>Signed duration in days, hours, minutes, and (sub)seconds</td>
</tr>
<tr>
<td>Edm.Guid</td>
<td>16-byte (128-bit) unique identifier</td>
</tr>
<tr>
<td>Edm.Int16</td>
<td>Signed 16-bit integer</td>
</tr>
<tr>
<td>Edm.Int32</td>
<td>Signed 32-bit integer</td>
</tr>
<tr>
<td>Edm.Int64</td>
<td>Signed 64-bit integer</td>
</tr>
<tr>
<td>Edm.SByte</td>
<td>Signed 8-bit integer</td>
</tr>
<tr>
<td>Edm.Single</td>
<td>Floating-point number with 7 digits precision</td>
</tr>
<tr>
<td>Edm.Stream</td>
<td>Fixed-length or variable-length data stream</td>
</tr>
<tr>
<td>Edm.String</td>
<td>Fixed-length or variable-length sequence of UTF-8 characters</td>
</tr>
<tr>
<td>Edm.TimeOfDay</td>
<td>Clock time 0-23:59:59.99999999999999</td>
</tr>
<tr>
<td>Edm.Geography</td>
<td>Abstract base type for all Geography types</td>
</tr>
<tr>
<td>Edm.GeographyPoint</td>
<td>A point in a round-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeographyLineString</td>
<td>Line string in a round-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeographyPolygon</td>
<td>Polygon in a round-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeographyMultiPoint</td>
<td>Collection of points in a round-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeographyMultiLineString</td>
<td>Collection of line strings in a round-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeographyMultiPolygon</td>
<td>Collection of polygons in a round-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeographyCollection</td>
<td>Collection of arbitrary Geography values</td>
</tr>
<tr>
<td>Edm.Geometry</td>
<td>Abstract base type for all Geometry types</td>
</tr>
<tr>
<td>Edm.GeometryPoint</td>
<td>Point in a flat-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeometryLineString</td>
<td>Line string in a flat-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeometryPolygon</td>
<td>Polygon in a flat-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeometryMultiPoint</td>
<td>Collection of points in a flat-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeometryMultiLineString</td>
<td>Collection of line strings in a flat-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeometryMultiPolygon</td>
<td>Collection of polygons in a flat-earth coordinate system</td>
</tr>
<tr>
<td>Edm.GeometryCollection</td>
<td>Collection of arbitrary Geometry values</td>
</tr>
</tbody>
</table>

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

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

```xml
<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

```xml
<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 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

```xml
<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`.

A 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.

### 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. 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 datetimeoffset, 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 digits allowed in 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 29 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.

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.

### 6.2.5 Attribute Unicode

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

A `true` value assigned to this attribute indicates that the value of the property is encoded with Unicode. A `false` value assigned to this attribute indicates that the value of the property is encoded with ASCII.

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, the body of a POST or PUT request, or the URL of a function invocation.

Default values MUST be represented according to the xxxValue rule defined in [OData-ABNF] that is appropriate for the type of the property.

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

7.1 Element edm:NavigationProperty

A navigation property allows navigation to related entities.

Example 9: the Product entity type has a navigation property to a Category, which has a navigation link back to one or more products

```xml
<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:Property` element MAY contain the `Nullable` attribute whose a 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 type 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 it 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 (i.e. have a multiplicity of 0..1). If the containment is not recursive, the partner navigation property MUST NOT be nullable (i.e. have a multiplicity of 1).

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 navigation property 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 a referential constraint. A referential constraint asserts that if the navigation property is not null, the property of the dependent entity (the source of the navigation) listed in the referential constraint MUST have the same value as the referenced property of the principal entity (the target of the navigation).

Example 10: 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

```xml
<EntityType Name="Product">
  ...
  <NavigationProperty Name="Category" Type="Self.Category" Nullable="false">
    <ReferentialConstraint Property="CategoryID" ReferencedProperty="ID" />
    <OnDelete Action="Cascade" />
  </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 an edm:OnDelete element. It describes the action the service will take on related entities when the source entity is deleted.

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 11: a simple entity type

```xml
<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 12: a derived entity type based on the previous example

```xml
<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 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, the value of the HasStream attribute is set to false.

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
Example 13: entity type with a simple key

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

Example 14: entity type with a simple key referencing a property of a complex type

```xml
<EntityType Name="Category">
  <Key>
    <PropertyRef Name="Info/ID" Alias="EntityInfoID" />
  </Key>
  <Property Name="Name" Type="Edm.String" />
  <ComplexType Name="EntityInfo">
    <Property Name="ID" Type="Edm.Int32" Nullable="false" />
    <Property Name="Created" Type="Edm.DateTimeOffset" />
  </ComplexType>
</EntityType>
```

Example 15: entity type with a composite key

```xml
<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

The `edm:PropertyRef` element MAY define a `SimpleIdentifier` value for the Alias attribute.

The Alias attribute defines an alias for the property identified by the Name attribute. The alias MUST be unique within the set of aliases, structural and navigation properties of the containing entity type and any of its base types.

An alias MUST be defined if the key property is a member of a complex type.

If an alias is defined, it 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 16 (based on example 14): requests to an entity set Categories of type Category must use the alias
http://host/service/Categories(EntityInfoID=1)

Example 17 (based on example 14): 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 18: a complex type used by two entity types

```xml
<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 scalar 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 19: 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.

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.

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

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 20: 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.

*Example 21: `FirstClass` has a value of 0, `TwoDay` a value of 1, and `Overnight` a value of 2.*

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

*Example 22: pattern values can be combined, and some combined values have explicit names*

```xml
<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. Applying the same annotation to a property whose type definition already defines that annotation is an error.

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 23:

```
<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 are not composable.

The action MAY specify a return type using the edm:ReturnType element. The return type must be a scalar, entity or complex type, or a collection of scalar, 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. An action MAY have overloads, that is multiple edm:Action elements in a schema MAY specify the same value for the Name attribute.

For bound overloads, the combination of the action name and the binding parameter type MUST be unique within its namespace. For unbound overloads, the name MUST be unique within its namespace and MAY be identical to the name of a bound overload.

12.1.2 Attribute ReturnType

The return type of the function may be specified through the ReturnType attribute on the edm:Action element or through a child edm:ReturnType element.

If specified through the ReturnType attribute, the value of the attribute is the TypeName of the return type and the edm:Action element MUST NOT contain an edm:ReturnType element.

12.1.3 Attribute IsBound

An action element MAY specify a Boolean value for the IsBound attribute. If no value is specified for the IsBound attribute, the value defaults to false.

If the value of the IsBound attribute is set to true, the action element MUST contain at least one edm:Parameter element, and the first parameter is the binding parameter. It MAY be of any type, and it MAY be nullable.

12.1.4 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 either the *Return Type* attribute or the *edm:ReturnType* element. The return type must be a scalar, entity or complex type, or a collection of scalar, 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*. A function MAY have overloads, that is multiple *edm:Function* elements in a schema MAY specify the same value for the *Name* attribute.

For unbound overloads the combination of the function name and unordered set of parameter names MUST identify a particular function overload.

All unbound overloads MUST have the same return type.

For bound overloads the combination of the function name, the binding parameter type, and the unordered set of names of the non-binding parameters MUST identify a particular function overload.

All bound overloads with a given binding parameter type MUST have the same return type.

12.2.2 Attribute **ReturnType**

The return type of the function may be specified through the *ReturnType* attribute on the *edm:Action* element or through a child *edm:ReturnType* element.

If specified through the *ReturnType* attribute, the value of the attribute is the *TypeName* of the return type and the *edm:Action* element MUST NOT contain an *edm:ReturnType* element.

12.2.3 Attribute **IsBound**

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

If the value of the *IsBound* attribute is set to *true*, the function element MUST contain at least one *edm:Parameter* element, and the first parameter is the binding parameter. It may be of any type, and it MAY be nullable.

12.2.4 Attribute **IsComposable**

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

12.2.5 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`

If an `edm:Action` or `edm:Function` element does not include the `ReturnType` attribute, it MUST contain a single `edm:ReturnType` element.

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 corresponds to the `ReturnType` attribute of the function or action.

#### 12.3.2 Attribute Nullable

A return type 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 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.

A return type whose `Type` attribute specifies a collection MUST NOT specify a value for the `Nullable` attribute as the returned collection cannot be `null`, it may just be empty.

### 12.4 Element `edm:Parameter`

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

**Example 24:** 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" ReturnType="Collection(Model.Product)">
  <Parameter Name="Year" Type="Edm.Decimal" Precision="4" Scale="0" />
</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 25: 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 26: 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.

Note: although a model may expose multiple entity sets of the same type, an entity can be a member of at most one entity set, see [OData-Protocol].

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

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

Example 28: 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> |
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.

Example 29: 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

```xml
<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 or singleton’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 entity type, 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.

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 names the entity set that contains the related instances targeted by the navigation property specified in the Path attribute, or the name of a singleton. If a SimpleIdentifier is specified, it MUST resolve to an entity set or singleton defined in the same entity container as the enclosing element. If a TargetPath is specified, it MUST resolve to an entity set or singleton in scope.

Example 30: for an entity set in the same container as the enclosing entity set
```
<EntitySet Name="Categories" EntityType="Self.Category">
  <NavigationPropertyBinding Path="Products" Target="SomeSet" />
</EntitySet>
```

Example 31: 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 SimpleIdentifier 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.

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 SimpleIdentifier 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.

Example 32: 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.

```xml
<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">
    <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>
  </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 DefaultValue

A edm:Term element of 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 MUST be represented according to the xxxValue rule defined in [OData-ABNF] that is appropriate for the type of the term.

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

14.1.4 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 can be applied to. If no value is supplied, the term is not restricted in its application.

Example 33: the IsURI 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])

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

14.1.5 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 `TargetPath` 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:ActionImport`
- `edm:ComplexType`
- `edm:EntityContainer`
- `edm:EntitySet`
- `edm:EntityType`
- `edm:EnumType`
- `edm:Member`
- `edm:NavigationProperty`
- `edm:Property`
- `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. Most of the not uniquely identifiable EDM elements can still be annotated using a nested `edm:Annotation` element.

The allowed path expressions are:

- QualifiedName of schema child
- QualifiedName of schema child followed by a forward slash and name of child element

Example 34: Target expressions

```
Schema.Type
Schema.EntityType/Property
Schema.ComplexType/NavigationProperty
Schema.EnumType/Member
Schema.EntityContainer
Schema.EntityContainer/EntitySet
```

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 35: 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`
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 annotation element MAY contain a constant expression or dynamic expression in either attribute or element notation. If no expression is specified, the default value of the term definition is used.

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` definition 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 36:** annotation should only be applied to tablet devices

```xml
<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 37:** two annotations intended as user interface hints

```xml
<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">Supplier Directory</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 of type xs:hexBinary, see [XML-Schema-2], section 3.2.15. The binary expression MAY be provided using element notation or attribute notation.

Example 38:

```xml
<Annotation Term="org.example.display.Thumbnail" Binary="3f3c6d78206c" />
<Annotation Term="org.example.display.Thumbnail">
  <Binary>3f3c6d78206c</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 39:

```xml
<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 NOT contain a time-zone offset. The date expression MAY be provided using element notation or attribute notation.

Example 40:

```xml
<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 NOT contain an end-of-day fragment (24:00:00). The date/time expression MAY be provided using element notation or attribute notation.

Example 41:

```xml
<Annotation Term="org.example.display.LastUpdated"/>
```
14.4.5 Expression edm:Decimal

The edm:Decimal expression evaluates to a primitive decimal value. A decimal expression MUST be assigned a value of the type xs:decimal, see [XML-Schema-2], section 3.2.3.

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

Example 42:

```xml
<Annotation Term="org.example.display.Width" Decimal="3.14" />
<Annotation Term="org.example.display.Width">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 43:

```xml
<Annotation Term="org.example.task.duration" Duration="P7D" />
<Annotation Term="org.example.task.duration">P11D23H59M59.999999999999S</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 44: single value

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

Example 45: combined value for IsFlags enumeration type
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 of the type xs:double, see [XML-Schema-2], section 3.2.5. The float expression MAY be provided using element notation or attribute notation.
Example 46:

```xml
<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 guid in [OData-ABNF]. The guid expression MAY be provided using element notation or attribute notation.
Example 47:

```xml
<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 of the type xs:integer, see [XML-Schema-2], section 3.3.13. The integer expression MAY be provided using element notation or attribute notation.
Example 48:

```xml
<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 3.2.1. The string expression MAY be provided using element notation or attribute notation.
Example 49:
### 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 of the type `xs:time` see [XML-Schema-2], section 3.3.8. The value MUST NOT contain an end-of-day fragment (24:00:00) or a time-zone offset. The time-of-day expression MAY be provided using element notation or attribute notation.

**Example 50:**

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

### 14.5 Dynamic Expressions

Dynamic expressions allow assigning a calculated value to an applied term. The dynamic expressions `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.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Logical Operators</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>edm:And</code></td>
<td>Logical and</td>
<td><code>&lt;And&gt;&lt;Path&gt;IsMale&lt;/Path&gt;&lt;Path&gt;IsMarried&lt;/Path&gt;&lt;/And&gt;</code></td>
</tr>
<tr>
<td><code>edm:Or</code></td>
<td>Logical or</td>
<td><code>&lt;Or&gt;&lt;Path&gt;IsMale&lt;/Path&gt;&lt;Path&gt;IsMarried&lt;/Path&gt;&lt;/Or&gt;</code></td>
</tr>
<tr>
<td><code>edm:Not</code></td>
<td>Logical negation</td>
<td><code>&lt;Not&gt;&lt;Path&gt;IsMale&lt;/Path&gt;&lt;/Not&gt;</code></td>
</tr>
<tr>
<td><strong>Comparison Operators</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><code>edm:Eq</code></td>
<td>Equal</td>
<td><code>&lt;Eq&gt;&lt;Null/&gt;&lt;/Path&gt;IsMale&lt;/Path&gt;&lt;/Eq&gt;</code></td>
</tr>
<tr>
<td><code>edm:Ne</code></td>
<td>Not equal</td>
<td><code>&lt;Ne&gt;&lt;Null/&gt;&lt;/Path&gt;IsMale&lt;/Path&gt;&lt;/Ne&gt;</code></td>
</tr>
<tr>
<td><code>edm:Gt</code></td>
<td>Greater than</td>
<td><code>&lt;Gt&gt;&lt;Path&gt;Price&lt;/Path&gt;&lt;Int&gt;20&lt;/Int&gt;&lt;/Gt&gt;</code></td>
</tr>
<tr>
<td><code>edm:Ge</code></td>
<td>Greater than or equal</td>
<td><code>&lt;Ge&gt;&lt;Path&gt;Price&lt;/Path&gt;&lt;Int&gt;10&lt;/Int&gt;&lt;/Ge&gt;</code></td>
</tr>
<tr>
<td><code>edm:Lt</code></td>
<td>Less than</td>
<td><code>&lt;Lt&gt;&lt;Path&gt;Price&lt;/Path&gt;&lt;Int&gt;20&lt;/Int&gt;&lt;/Lt&gt;</code></td>
</tr>
<tr>
<td><code>edm:Le</code></td>
<td>Less than or equal</td>
<td><code>&lt;Le&gt;&lt;Path&gt;Price&lt;/Path&gt;&lt;Int&gt;100&lt;/Int&gt;&lt;/Le&gt;</code></td>
</tr>
</tbody>
</table>

The `edm:And` and `edm:Or` elements require two child expressions that evaluate to Boolean values. The `edm:Not` element requires a single child expression that evaluates to a Boolean value.
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 added restriction that 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 51:**

```xml
<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; see `xxxValue` rules [OData-ABNF].

**Example 52:**

```xml
"abc" + "def" = "abcdef"
```
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.

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 53: assuming there are no special characters in values of the NameOfMovieGenre property

```xml
<Apply Function="odata.fillUriTemplate">
  <String>http://host/service/Genres('{genreName}')</String>
  <LabeledElement Name="genreName" Path="NameOfMovieGenre" />
</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 54:

```xml
<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 55:

```xml
<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 56:

```xml
<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. They 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 57:**

```xml
<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 58:**

```xml
<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 59:**

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

```xml
<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.

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 `SimpleIdentifier` name of a labeled element expression in scope.

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

Example 60:

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

14.5.10 Expression `edm:Null`

The `edm:Null` expression returns an untyped null value. The null expression MUST NOT contain any other elements or expressions.

The null expression MUST be written with element notation.

Example 61:

```xml
<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 added restriction that the last path segment MUST resolve to a navigation property in the context of the preceding path part.

In contrast to the `edm:Path` expression the value of the `edm:NavigationPropertyPath` expression is the path itself, not the target instance(s) of the navigation property identified by the path. This is useful for terms that describe the semantics of a group of navigation properties and thus cannot be applied to a single navigation property.

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

Example 62:

```xml
<Annotation Term="UI.HyperLink" NavigationPropertyPath="Supplier" />
<Annotation Term="Capabilities.UpdateRestrictions">
  <PropertyValue Property="NonUpdatableNavigationProperties">
    <Collection>
      <NavigationPropertyPath>Supplier</NavigationPropertyPath>
      <NavigationPropertyPath>Category</NavigationPropertyPath>
    </Collection>
  </PropertyValue>
</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 the 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 the path segment start 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 annotations are implicitly “annotated” for media entities and stream properties:

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

If the 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.

If a path segment is the name of a navigation property that has a cardinality of many, the path MUST NOT have any subsequent segments other than type casts, term casts, or a $count segment. If the last segment is a $count segment, the path evaluates to the number of related entities.

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 63:

```xml
<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 added restriction that the last path segment MUST resolve to a property in the context of the preceding path part. It MUST NOT resolve to a navigation property.

In contrast to the edm:Path expression the value of the edm:PropertyPath expression is the path itself, not the value of the property identified by the path. This is useful for terms that describe the semantics of a group of properties and thus cannot be applied to a single property.

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

Example 64:

```xml
<Annotation Term="UI.RefreshOnChangeOf" PropertyPath="ChangedAt" />
<Annotation Term="Capabilities.UpdateRestrictions">
  <Property Value Property="NonUpdatableProperties">
    <Collection>
      <PropertyPath>CreatedAt</PropertyPath>
      <PropertyPath>ChangedAt</PropertyPath>
    </Collection>
  </PropertyValue>
</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 property of the record construct's type that is neither nullable nor specifies a default value an edm:PropertyValue child element MUST be provided. For derived types this rule applies only to properties directly defined by the derived type. 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 65:

```xml
<Annotation Term="org.example.person.Employee">
  <Record>
    <PropertyValue Property="GivenName" Path="FirstName" />
    <PropertyValue Property="Surname" Path="LastName" />
  </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 Url 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 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 66:

```xml
<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>
```
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 67: 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 containers. 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 multiplicity 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 68: 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 containers. Each model construct is defined in a schema:

![Schema Diagram]

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 69: for the Products and Categories example the request**

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

would return

```json
{
  "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 70: redirecting from alias to schema**

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

would return

```json
{
  "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.

Example 71: single type by name, and all entity types

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

Example 72: all types

GET ~/metadata/Types

would return

```json
{
  "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": "ODataDemo.OptimisticConcurrencyControl",
    "Name": "OptimisticConcurrencyControl",
```

```json
```
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 73: single property or navigation property by name**

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

**Example 74: 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":[]  
    },  
    {  
      "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":[]  
    }  
  ]}
Example 75: all navigation properties with type and partner

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

would return

```json
{
   "odata.context":"~/metadata/$metadata#NavigationProperties(Type(QualifiedName),Partner(Name))",
   {
      "Fullname":"ODataDemo.Product/Category", "Name":"Category",
      "Nullable":false, "ContainsTarget":false,
      "OnDelete":null,
      "ReferentialConstraints":[]
   }
}```
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 76:

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

Example 77: all functions
GET ~/metadata/Functions?
$expand=Overloads/Parameters/Type($select=QualifiedName)

would return

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

15.6 Entity Container

Entity container constructs are represented as

```
EntitySet * EntityContainer * FunctionImport * Action

* NavigationPropertyBinding * Singleton * ActionImport * Function
```

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 78:

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 79:

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 80:**

```plaintext
GET ~/$_metadata/NavigationPropertyBindings(
    "ODataDemo.DemoService%2FCategories%2FProducts")
```

**Example 81: all containers with direct children**

```plaintext
GET ~/$_metadata/EntityContainer?$expand=* would return
```

```plaintext
{
    "odata.context":"~/$_metadata/$metadata#EntityContainer",
    "value":[
        {
            "QualifiedName":"ODataDemo.DemoService",
            "Name":"DemoService",
            "EntitySets":[
                {
                    "Fullname":"ODataDemo.DemoService/Products",   "Name":"Products"
                },
                {
                    "Fullname":"ODataDemo.DemoService/Suppliers",  "Name":"Suppliers"
                },
                {
                    "Fullname":"ODataDemo.DemoService/Categories", "Name":"Categories"
                },
                {
                    "Fullname":"ODataDemo.DemoService/Countries",  "Name":"Countries"
                }
            ],
            "Singletons":[
                {
                    "QualifiedName":"ODataDemo.DemoService/Contoso", "Name":"Contoso"
                }
            ],
            "ActionImports":{},
            "FunctionImports":{
                "QualifiedName":"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 82:**

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

would return

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

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 84 would reference the CSDL document in Example 85, all its annotations would also be members of the Annotations entity set of the Metadata Service for Example 84.

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 83:**

```sql
GET ~/metadata/Annotations
```

would return

```json
{
  "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.OptimisticConcurrencyControl",
"Qualifier": null,
"Value": {
"odata.type": "Meta.Record",
"Annotations": [],
"PropertyValues": [
{
"Annotations": [],
"Property": "ETagDependsOn",
"Value": {
"odata.type": "Meta.Collection",
"Annotations": [],
"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 84:

```xml
<edmx:Edmx xmlns:edmx="http://docs.oasis-open.org/odata/ns/edmx"
    Version="4.0">
  <edmx:Reference Uri="http://tinyurl.com/Org-OData-Measures-V1">
    <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 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"/>
        <NavigationProperty Name="Products" Partner="Category"
            Type="Collection(ODataDemo.Product)"
            OnDelete Action="Cascade" />
      </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)" />
    </Schema>
  </edmx:DataServices>
</edmx:Edmx>
```
16.2 Annotations for Products and Categories Example

Example 85:
<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="Self.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]:

```xml
<x:simpleType name="TSimpleIdentifier">
  <xs:restriction base="xs:string">
    <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 a schema child
- The QualifiedName of a schema child followed by a forward slash and name of a child element
- The TargetPath of a complex property of a structured type, followed by a forward slash and the name of a property of the complex property

Example 86: Target expressions

| Schema.Type |
17.6 Boolean

One of the literals true and 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

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Editor</th>
<th>Changes Made</th>
</tr>
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<tbody>
<tr>
<td>Working Draft 01</td>
<td>2012-08-22</td>
<td>Michael Pizzo</td>
<td>Translated Contribution to OASIS format/template</td>
</tr>
<tr>
<td>Committee Specification Draft 01</td>
<td>2013-04-26</td>
<td>Michael Pizzo, Ralf Handl, Martin Zurmuehl</td>
<td>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</td>
</tr>
<tr>
<td>Committee Specification Draft 02</td>
<td>2013-07-01</td>
<td>Michael Pizzo, Ralf Handl, Martin Zurmuehl</td>
<td>Restricted services to exactly one entity container Simplified function and action overloads Rounded off annotations 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</td>
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