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Technical Committee:
OASIS Open Data Protocol (OData) TC

Chairs:
Barbara Hartel (barbara.hartel@sap.com), SAP AG
Ram Jeyaraman (Ram.Jeyaraman@microsoft.com), Microsoft

Editors:
Martin Zurmuehl (martin.zurmuehl@sap.com), SAP AG
Michael Pizzo (mikep@microsoft.com), Microsoft
Ralf Handl (ralf.handl@sap.com), SAP AG

Additional artifacts:
This prose specification is one component of a Work Product that also includes:
  - XML schema:  http://docs.oasis-open.org/odata/odata-atom-format/v4.0/cs01/schemas/
  - OData Atom Vocabulary:  http://docs.oasis-open.org/odata/odata-atom-format/v4.0/cs01/vocabularies/

Related work:
This specification is related to:
  - OData Version 4.0, a multi-part Work Product which includes:
• **OData Version 4.0 Part 3: Common Schema Definition Language (CSDL).** Latest version. [http://docs.oasis-open.org/odata/v4.0/odata-v4.0-part3-csdl.html](http://docs.oasis-open.org/odata/v4.0/odata-v4.0-part3-csdl.html)

• **ABNF components:** *OData ABNF Construction Rules Version 4.0 and OData ABNF Test Cases.* 14 August 2013. [http://docs.oasis-open.org/odata/v4.0/cs01/abnf/](http://docs.oasis-open.org/odata/v4.0/cs01/abnf/)

• **Vocabulary components:** *OData Core Vocabulary, OData Measures Vocabulary and OData Capabilities Vocabulary.* 14 August 2013. [http://docs.oasis-open.org/odata/v4.0/cs01/vocabularies/](http://docs.oasis-open.org/odata/v4.0/cs01/vocabularies/)

• **OData JSON Format Version 4.0.** Latest version. [http://docs.oasis-open.org/odata/odata-json-format/v4.0/odata-json-format-v4.0.html](http://docs.oasis-open.org/odata/odata-json-format/v4.0/odata-json-format-v4.0.html)

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- [http://docs.oasis-open.org/odata/ns/data](http://docs.oasis-open.org/odata/ns/data)
- [http://docs.oasis-open.org/odata/ns/metadata](http://docs.oasis-open.org/odata/ns/metadata)

**Abstract:**
The Open Data Protocol (OData) for representing and interacting with structured content is comprised of a set of specifications. The core specification for the protocol is in OData Version 4.0 Part 1: Protocol; this document extends the former by defining representations for OData requests and responses using an Atom format.

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# 1 Introduction

The OData protocol is comprised of a set of specifications for representing and interacting with structured content. The core specification for the protocol is in [OData-Protocol]. The OData Atom Format specification extends the former by defining representations for OData requests and responses using an Atom format.

An OData payload may represent:

- a service document describing the top-level resources exposed by the service
- a single entity (a structured type with an identity)
- a resource reference
- a collection of entities
- a single primitive or complex type value
- a collection of primitive or complex type values
- a media resource
- a collection of changes
- a single link to a related entity
- a collection of links to related entities
- an error document
- an xml document describing the entity model exposed by the service
- a batch of requests to be executed in a single request
- a set of responses returned from a batch request

For a description of the xml format for describing an entity model, see [OData-CSDL]. For a description of batch requests and responses, see [OData-Protocol].

## 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

This document references the following related documents:

- **[OData-ABNF]** OData ABNF Construction Rules Version 4.0. See link in “Related work” section on cover page.
- **[OData-CSDL]** OData Version 4.0 Part 3: Common Schema Definition Language (CSDL). See link in “Related work” section on cover page.
- **[OData-MetaXML]** OData Metadata XML Schema. See link in “Additional artifacts” section on cover page.
- **[OData-URL]** OData Version 4.0 Part 2: URL Conventions. See link in “Related work” section on cover page.
- **[OData-VocAtom]** OData Atom Vocabulary. See link in “Additional artifacts” section on cover page.
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 Atom Format Design


OData builds on [RFC4287] and [RFC5023] by defining additional conventions and extensions for representing and querying entity data, e.g. OData collections are represented as Atom feeds, with one Atom entry for each entity within a collection.

As specified in [RFC4287] and [RFC5023] processors that encounter foreign markup MUST NOT stop processing and MUST NOT signal an error. This includes additional elements or attributes in any namespace, including elements and attributes in the OData Data and Metadata namespaces, e.g. values for properties not declared in $metadata, and annotation that are not defined in the version of the payload being returned.

2.1 Namespaces

OData defines meaning for elements and attributes defined in the following namespaces.

2.1.1 Atom Syndication

Atom elements and attributes are defined within the Atom namespace, see [RFC4287]: http://www.w3.org/2005/Atom

In this specification the namespace prefix atom is used to represent the Atom Namespace, however the prefix name is not prescriptive.

2.1.2 Atom Publishing Protocol

Atom Publishing Protocol (AtomPub) elements and attributes are defined within the AtomPub namespace, see [RFC5023]: http://www.w3.org/2007/app

In this specification the namespace prefix app is used to represent the AtomPub Namespace, however the prefix name is not prescriptive.

2.1.3 Atom Tombstone

The deleted-entry element is defined within the Atom Tombstone namespace, see [RFC6721]: http://purl.org/atompub/tombstones/1.0

In this specification the namespace prefix atom-tombstone is used to represent the Atom Tombstone Namespace, however the prefix name is not prescriptive.

2.1.4 OData Data

Elements that describe the actual data values for an entity are qualified with the OData Data Namespace: http://docs.oasis-open.org/odata/ns/data

In this specification the namespace prefix data is used to represent the OData Data Namespace, however the prefix name is not prescriptive.
2.1.5 OData Metadata

Attributes and elements that represent metadata (such as type, null usage, and entry-level etags) are defined within the OData Metadata Namespace:

http://docs.oasis-open.org/odata/ns/metadata

Custom elements or attributes MUST NOT use this namespace.

In this specification the namespace prefix `metadata` is used to represent the OData Metadata Namespace, however the prefix name is not prescriptive.

2.2 XML Schema Definition for OData Metadata

This specification contains a normative XML schema for the OData Metadata namespace, see [OData-MetaXML].

It only defines the shape of well-formed OData metadata, but is not descriptive enough to define what correct OData metadata is. This specification document defines additional rules that correct OData metadata MUST fulfill. In case of doubt on what makes OData metadata correct the rules defined in this specification document take precedence.
3 Requesting the Atom Format

The OData Atom format MAY be requested using the $format query option in the request URL with the MIME type application/atom+xml, or the case-insensitive abbreviation atom which MUST NOT be followed by format parameters.

Alternatively, this format MAY be requested using the Accept header with the MIME type application/atom+xml.

If specified, $format overrides any value specified in the Accept header.

The service document MAY additionally be requested with the more specific MIME type application/atomsvc+xml using either $format or Accept.

All resources MAY additionally be requested with the less specific MIME type application/xml using either $format or Accept, or the case-insensitive abbreviation xml using $format.

Services SHOULD advertise the supported MIME types by annotating their entity container with the term Capabilities.SupportedFormats defined in [OData-VocCap].
4 Common Characteristics

4.1 Header Content-Type

The Content-Type header for Atom responses MUST use the most specific MIME type for the requested resource that is indicated as acceptable by the client.

Requests using the $format query option with the abbreviation atom MUST receive the MIME type
- application/atomsvc+xml for the service document,
- application/atom+xml for entities and collections of entities, references, or changes,
- application/xml for all other resources.

Requests using $format or an Accept header with value application/atom+xml MUST receive the MIME type
- application/xml for the service document,
- application/atom+xml for entities and collections of entities, references, or changes,
- application/xml for all other resources.

Requests using $format or an Accept header with value application/xml or $format with the abbreviation xml MUST receive the MIME type application/xml for all resources.

Data modification requests for entities or collections of entities MUST specify a Content-Type header with a value of either application/atom+xml or application/xml. Data modification requests for all other resources MUST specify a Content-Type header with a value of application/xml.

4.2 Message Body

Each message body MUST be represented as an XML document with a single root element. This element is either the representation of an entity, an entity reference, a primitive value, a complex type instance, a collection of primitive values, a collection of complex values, a collection of entities, or a collection of entries that represent changes to a previous result.

Client libraries MUST retain the order of XML elements in document order for ATOM and XML responses. OData does not impose any ordering constraints on XML attributes within XML elements.

4.3 Relative URLs

OData payloads MAY use relative references as defined in [RFC3986] by specifying the xml:base attribute to define a base URL for relative references defined within the scope of the element containing the xml:base attribute.

If no xml:base attribute is present in the context of a relative reference or is itself a relative URL, relative URLs in responses are relative to the Content-Location header of the response.

In responses without a Content-Location header, responses with a relative URL in the Content-Location header, and in requests relative URLs are relative to the request URL.
5 Service Document

AtomPub defines the concept of a service document to represent the set of available collections. OData uses the service document to describe the entity sets, singletons, and parameterless function imports published by the service.

Example 2:

```xml
<app:service xmlns:app="http://www.w3.org/2007/app"
            xmlns:atom="http://www.w3.org/2005/Atom"
            xmlns:metadata="http://docs.oasis-open.org/odata/ns/metadata"
            xml:base="http://host/service/"
            metadata:context="$/metadata"
            metadata:metadata-etag="W/"MjAxMy0wNS0xM1QxNDo1NFo="">
  <app:workspace>
    <atom:title type="text">Data</atom:title>
    <app:collection href="Orders">
      <atom:title type="text">Orders</atom:title>
    </app:collection>
    <app:collection href="OrderItems">
      <atom:title type="text">Order Details</atom:title>
    </app:collection>
    <metadata:function-import href="TopProducts">
      <atom:title>Best-Selling Products</atom:title>
    </metadata:function-import>
    <metadata:singleton href="Contoso">
      <atom:title>Contoso Ltd.</atom:title>
    </metadata:singleton>
    <metadata:service-document href="http://host/HR/">
      <atom:title>Human Resources</atom:title>
    </metadata:service-document>
  </app:workspace>
</app:service>
```

5.1 Element app:service

The root of a service document is a single app:service element. The app:service element MUST contain exactly one app:workspace elements.

5.1.1 Attribute metadata:context

An app:workspace element MUST have a metadata:context attribute, defined in the OData Metadata namespace, whose value is the URL that returns the metadata document of the service. For more information on the format of the metadata document, see [OData-CSDL].

5.1.2 Attribute metadata:metadata-etag

An app:workspace element MAY have a metadata:metadata-etag attribute to specify an ETag that can be used to determine the current version of the service's metadata document. For details on how ETags are used, see [OData-Protocol].
5.2 Element `app:workspace`

OData represents the entity container of a service (see [OData-CSDL]) as an `app:workspace` element. An `app:workspace` element contains zero or more `app:collection` elements, one for each entity set published by the container, zero or more `metadata:function-import` elements, one for each function import published by the container, zero or more `metadata:singleton` elements, one for each singleton published by the container, and zero or more `metadata:service-document` elements, one for each related service document.

As defined in [RFC-5023], the `app:workspace` element MUST contain an `atom:title` element containing the human-readable description of the workspace. This value may be different from the name of the entity container.

5.3 Element `app:collection`

OData represents entity sets that are not marked with `IncludeInServiceDocument="false"` (see [OData-CSDL]) as `app:collection` elements contained within the `app:workspace` element.

**Example 3:**

```xml
<app:collection href="OrderItems">
  <atom:title type="text">Order Details</atom:title>
</app:collection>
```

### 5.3.1 Attribute `href`

The `app:collection` element MUST contain an `href` attribute which represents a URL that can be used to retrieve the members of the entity set.

### 5.3.2 Attribute `metadata:name`

The `metadata:name` attribute MUST contain the name of the entity set.

It MAY be omitted if its value is identical to the value of the `href` attribute, which is the case if the service uses relative URLs following the OData URL conventions described in [OData-URL].

### 5.3.3 Element `atom:title`

As defined in [RFC-5023], the `app:collection` element MUST contain an `atom:title` element. The `atom:title` element SHOULD contain a human-readable description of the entity set which MAY be the name of the entity set.

5.4 Element `metadata:function-import`

OData represents function imports that are marked with `IncludeInServiceDocument="true"` (see [OData-CSDL]) as `metadata:function-import` elements contained within the `app:workspace` element.

### 5.4.1 Attribute `href`

The `metadata:function-import` element MUST contain an `href` attribute which represents a URL that can be used to retrieve the function import result.

### 5.4.2 Attribute `metadata:name`

The `metadata:name` attribute MUST contain the name of the function import.

It MAY be omitted if its value is identical to the value of the `href` attribute, which is the case if the service uses relative URLs following the OData URL conventions described in [OData-URL].
5.4.3 Element atom:title

The metadata:function-import element MUST contain an atom:title element. The atom:title element SHOULD contain a human-readable description of the function import which MAY be the name of the function import.

5.5 Element metadata:singleton

OData represents singletons as metadata:singleton elements contained within the app:workspace element.

5.5.1 Attribute href

The metadata:singleton element MUST contain an href attribute which represents a URL that can be used to retrieve the singleton.

5.5.2 Attribute metadata:name

If the href attribute of a metadata:singleton element contains a relative url that follows the conventions described in [OData-URL], the metadata:name attribute can be omitted. Otherwise the metadata:name attribute MUST be specified and MUST contain the name of the singleton.

5.5.3 Element atom:title

The metadata:singleton element MUST contain an atom:title element. The atom:title element SHOULD contain a human-readable description of the singleton which MAY be the name of the singleton.

5.6 Element metadata:service-document

OData represents related service documents as metadata:service-document elements contained within the app:workspace element.

Example 4:

```xml
<metadata:service-document href="http://host/HR/">
  <atom:title>Human Resources</atom:title>
</metadata:service-document>
```

5.6.1 Attribute href

The metadata:service-document element MUST contain an href attribute which represents a URL that can be used to retrieve the related service document.

5.6.2 Element atom:title

6 Entity

Entities, whether individual or within an Atom feed, are represented as atom:entry elements.

Example 5:

```xml
<entry xmlns="http://www.w3.org/2005/Atom"
    xmlns:metadata="http://docs.oasis-open.org/odata/ns/metadata"
    xmlns:data="http://docs.oasis-open.org/odata/ns/data"
    xmlns:base="http://host/service/
    metadata:context="$metadata#Customers/$entity"
    metadata:metadata-etag="W/"MjAxMy0wNS0xM1QxNDo1NFo="">
  <id>http://host/service/$metadata#Customers('ALFKI')</id>
  <title />  
  <updated>2012-03-30T07:11:05Z</updated>
  <author>
    <name />
  </author>
  <link rel="edit" title="Customer" href="Customers('ALFKI')" />
  <link rel="http://docs.oasis-open.org/odata/ns/related/Orders"
      type="application/atom+xml;type=feed"
      title="Orders" href="Customers('ALFKI')/Orders" />
  <link rel="http://docs.oasis-open.org/odata/ns/related/Supplier"
      type="application/atom+xml;type=entry"
      title="Supplier" href="Customers('ALFKI')/Supplier" />
  <category term="ODataDemo.Customer"
    scheme="http://docs.oasis-open.org/odata/ns/scheme" />
  <content type="application/xml">
    <metadata:properties>
      <data:ID>ALFKI</data:ID>
      <data:CompanyName>Alfreds Futterkiste</data:CompanyName>
      <data:ContactName>Maria Anders</data:ContactName>
      <data:ContactTitle>Sales Representative</data:ContactTitle>
      <data:Phone>030-0074321</data:Phone>
      <data:Fax>030-0076545</data:Fax>
      <data:Address>
        <data:Street>Obere Str. 57</data:Street>
        <data:City>Berlin</data:City>
      </data:Address>
      <data:Region metadata:null="true" />
      <data:PostalCode>0-12209</data:PostalCode>
      <link rel="http://docs.oasis-open.org/odata/ns/related/Country"
        type="application/atom+xml;type=entry"
        title="Country of residence"
        href="Customers('ALFKI')/Address/Country" />
    </metadata:properties>
  </content>
</entry>
```

This section defines the elements and attributes within an atom:entry element that are assigned meaning in OData.
6.1 Element **atom:entry**

An **atom:entry** element is used to represent a single OData entity, which is an instance of a structured type with an identity.


6.1.1 Attribute **metadata:etag**

The **atom:entry** element MAY contain a **metadata:etag** attribute, representing an opaque string value that can be used in a subsequent request to determine if the value of the entity has changed. For details on how ETags are used, see [OData-Protocol].

6.1.2 Attribute **metadata:context**

If the root of the response is an **atom:entry** element, or the entity set cannot be determined from the context URL of the feed, the **atom:entry** element MUST have a **metadata:context** attribute, defined in the OData Metadata namespace, whose value is the context URL that describes the entity represented by the **atom:entry**. This URL MAY be absolute or relative to the context URL of the feed.

For more information on the context URL, see [OData-Protocol].

6.1.3 Attribute **metadata:metadata-etag**

If the root of the response is an **atom:entry** element, it MAY have a **metadata:metadata-etag** attribute to specify an ETag that can be used to determine the current version of the service’s metadata document.

For details on how ETags are used, see [OData-Protocol].

6.2 Element **atom:id**

The **atom:id** element MUST contain the entity-id; see [OData-Protocol]. By convention the entity-id is identical to the canonical URL of the entity, as defined in [OData-URL].

If the entity is transient (i.e. cannot be read or updated), the **atom:id** SHOULD follow the pattern `odata:transient:{some-generated-unique-identifier-to-not-break-atom-parsers}`.

Clients MAY assume that an entity with an **atom:id** that matches the transient pattern cannot be compared to other entities, reread, or updated.

6.3 Element **atom:category**

An OData entry MUST contain a single **atom:category** element with a scheme attribute equal to `http://docs.oasis-open.org/odata/ns/scheme` to identify the entity type of the entry.

An **atom:category** element describing an OData entity type MUST have a `term` attribute whose value is the namespace-qualified or alias-qualified name of the entity type of the entry, in which case the type MUST be defined in the metadata document indicated by the current context URL, otherwise it MUST be a full URL to a metadata document with the namespace-qualified name of the instance’s type appended as a URL fragment.

*Example 6: entity of type Model.VipCustomer defined in the metadata document of the same service*
<category rel="http://docs.oasis-open.org/odata/ns/scheme" term="Model.VipCustomer"/>

Example 7: entity of type Model.VipCustomer defined in the metadata document of a different service


For more information on namespace-qualified and alias-qualified names, see [OData-CSDL].

The entry MAY contain additional atom:category elements with different scheme values; such atom:category elements have no semantic meaning in OData.

### 6.4 Element atom:link

Atom defines two types of links within an entry that represent retrieve or update/delete operations on the entry:

- atom:link elements with a rel attribute of self can be used to retrieve the entity (via the URL specified in the href attribute).
- atom:link elements with a rel attribute of edit can be used to retrieve, update, or delete the entity (via the URL specified in the href attribute).

An atom:entry element representing an OData entity MUST contain an edit link if and only if the entity is updatable. It MUST contain a self link if and only if the entity is read-only or the read link is different from the edit link. Transient entities contain neither a self link nor an edit link.

Clients MAY use the edit link to retrieve the entity if no self link is present. They SHOULD NOT attempt to update an entity that does not contain an edit link.

### 6.5 Element atom:content

The atom:content element contains the properties of the entity as a metadata:properties element unless the entity is a media entity.
7  Structural Property

7.1 Primitive Value

OData Atom and XML payloads represent values of primitive types following the rules of [OData-ABNF]. Geography and Geometry values are represented as defined in [GML]. Values of the other primitive types are represented according to the xxxValue rules, i.e. Edm.Binary as binaryValue etc.

Example 8:

```xml
<metadata:properties>
    <data:NullValue metadata:null="true"/>
    <data:TrueValue metadata:type="Boolean">true</data:TrueValue>
    <data:FalseValue metadata:type="Boolean">false</data:FalseValue>
    <data:IntegerValue metadata:type="SByte">-128</data:IntegerValue>
    <data:DoubleValue metadata:type="Double">3.1415926535897931</data:DoubleValue>
    <data:SingleValue metadata:type="Single">INF</data:SingleValue>
    <data:DecimalValue metadata:type="Decimal">34.95</data:DecimalValue>
    <data:StringValue>
        Say "Hello",
        then go!
    </data:StringValue>
    <data:DateValue metadata:type="Date">2012-12-03</data:DateValue>
    <data:DateTimeOffsetValue metadata:type="DateTimeOffset">2012-12-03T07:16:23Z</data:DateTimeOffsetValue>
    <data:DurationValue metadata:type="Duration">P12DT23H59M59.999999999999S</data:DurationValue>
    <data:TimeOfDayValue metadata:type="TimeOfDay">07:59:59.999</data:TimeOfDayValue>
    <data:GuidValue metadata:type="Guid">
        01234567-89ab-cdef-0123-456789abcdef
    </data:GuidValue>
    <data:Int64Value metadata:type="Int64">0</data:Int64Value>
    <data:ColorEnumValue metadata:type="#org.example.Pattern">Yellow</data:ColorEnumValue>
    <data:GeographyPoint metadata:type="GeographyPoint">
        <gml:Point>
            <gml:pos>64.1 142.1</gml:pos>
        </gml:Point>
    </data:GeographyPoint>
</metadata:properties>
```

Note that the line break in the body of StringValue is intentional, it represents a line break.

7.2 Element metadata:properties

The metadata:properties element represents property values for an entity.

7.3 Element data: [PropertyName]

Within the metadata:properties element, individual entity properties are represented as elements where the name of the element is the name of the entity property within the OData Data Namespace. The data: [PropertyName] element MAY include a metadata:type attribute to specify the type of the primitive- or complex-typed instance.

Example 9:

```xml
<data:Rating metadata:type="Int32">4</data:Rating>
```
The `data:[PropertyName]` element MAY include a `metadata:null` attribute to specify that the primitive- or complex-typed instance has the null value.

Example 10:

```xml
<data:Rating metadata:null="true"/>
```

### 7.3.1 Attribute `metadata:type`

If the type of the property is anything other than `Edm.String`, the property representation MUST contain a `metadata:type` attribute to specify the URI that identifies the type of the property.

For built-in primitive types the value is the unqualified name of the primitive type. For all other types, the URI may be absolute or relative to the URI of the containing type. The root `metadata:type` may be absolute or relative to the root context URL.

For non-built-in primitive types, the URI contains the namespace-qualified or alias-qualified type, specified as a URI fragment. For properties that represent a collection of values, the fragment is the namespace-qualified or alias-qualified element type prefixed with `Collection` and enclosed in parentheses.

Example 11:

```xml
<data:Age metadata:type="Int32">25</data:Age>
```

### 7.3.2 Attribute `metadata:null`

Null-valued properties are represented as empty elements with the `metadata:null="true"` attribute.

The `metadata:null` attribute distinguishes null values from other empty content (such as an empty string).

Example 12:

```xml
<data:Apartment metadata:null="true"/>
```

The absence of the `metadata:null` attribute is equivalent to specifying `metadata:null="false"`.

### 7.4 Primitive and Enumeration Property

For primitive properties, the content of the `data:[PropertyName]` element represents the value of the property following the syntax for primitive values.

Example 13: string value

```xml
<data:Title>CEO</data:Title>
```

Example 14: enumeration value

```xml
<data:Pattern metadata:type="#org.example.Pattern">Solid,Yellow</data:Pattern>
```

### 7.5 Complex Property

For complex properties, the content of the `data:[PropertyName]` element consists of nested `data:[PropertyName]` elements describing the properties of the complex type.

Example 15:

```xml
<data:ShipTo metadata:type="#Model.Address">
  <data:Street>Obere Str. 57</data:Street>
  <data:City>Berlin</data:City>
  <data:Region metadata:null="true"/>
  <data:PostalCode>D-12209</data:PostalCode>
</data:ShipTo>
```
7.6 Primitive and Enumeration Property Collection

For properties that represent a collection of primitive or enumeration values, the URI fragment specified in the metadata:type attribute is the namespace-qualified or alias-qualified element type prefixed with Collection and enclosed in parenthesis.

7.6.1 Element metadata:element

Each item in the collection is represented as a metadata:element element in the OData Metadata namespace.

The value of each metadata:element in the collection follows the syntax for primitive values.

A metadata:element element MUST NOT contain the metadata:null="true" attribute value.

Example 16:

```xml
<data:EmailAddresses metadata:type="#Collection(String)"
  <metadata:element>Julie@Swansworth.com</metadata:element>
  <metadata:element>Julie.Swansworth@work.com</metadata:element>
</data:EmailAddresses>
```

7.7 Complex Property Collection

For properties that represent a collection of complex types, the URI fragment specified in the metadata:type attribute is the namespace-qualified or alias-qualified element type prefixed with "Collection" and enclosed in parenthesis.

7.7.1 Element metadata:element

Each item in the collection is represented as a metadata:element element in the OData Metadata namespace.

The value of each complex-typed metadata:element follows the syntax for complex-typed properties.

A metadata:element elements MUST NOT be empty and MUST NOT contain the metadata:null="true" attribute.

7.7.1.1 Attribute metadata:type

A metadata:element element MAY include a metadata:type attribute to specify the complex type of the represented instance. It MUST include a metadata:type attribute if the instance is of a type derived from the declared type of the property.

Example 17:

```xml
<data:PhoneNumbers metadata:type="#Collection(Model.PhoneNumber)"
  <metadata:element>
    <data:Number>425-555-1212</data:Number>
    <data:Type>Home</data:Type>
  </metadata:element>
  <metadata:element>
    <data:Number>425-555-0178</data:Number>
    <data:Type>Cell</data:Type>
    <data:Carrier>Sprint</data:Carrier>
  </metadata:element>
</data:PhoneNumbers>
```
8 Navigation Property

A navigation property is a reference to zero or more related entities. It is represented as a navigation link that MAY be immediately preceded by an association link.

8.1 Navigation Link

The navigation link is a URL that allows retrieving the related entity or collection of entities. It is represented as an atom:link element.

Example 18: products related to a category

```xml
<atom:link
   rel="http://docs.oasis-open.org/odata/ns/related/Products"
   href="Categories(0)/Products"
   type="application/atom+xml;type=feed"
   title="Products"/>
```

The related data for the relationship MAY be included in the entity using a single child metadata:inline element.

8.1.1 Element atom:link

In the case where the atom:link element describes a navigation link the attributes rel, href, type, metadata:context, and title MUST be used as described in the following subsections.

8.1.1.1 Attribute rel

The rel attribute MUST be present and MUST contain the string

http://docs.oasis-open.org/odata/ns/related/

followed by the name of the navigation property on the entity.

Note that the full name must be used; the use of relative URLs in the rel attribute is not allowed.

8.1.1.2 Attribute href

The href attribute MUST be present and specifies the URL that can be used to retrieve the related entities. This URL may be relative or absolute.

For navigation properties declared by an entity type the URL should be the canonical URL for the navigation property, i.e. the canonical URL of the source entity followed by a forward slash and the name of the navigation property, see Example 18.

For navigation properties declared by a complex type that is used as a single value in an entity type, the URL should be the canonical URL of the source entity, followed by a forward slash and the path to the navigation property, see second atom:link in Example 5.

For navigation properties declared by a complex type that is used in a collection of complex type values, the URL should be the canonical URL of the target entity.

Example 19: country related to an address within a collection
8.1.1.3 Attribute type

The type attribute MUST be present and determines whether the cardinality of the related end is a single entity or a collection of entities. The value "application/atom+xml;type=entry" represents a single entity and the value "application/atom+xml;type=feed" an collection of entities.

8.1.1.4 Attribute metadata:context

The metadata:context Attribute MUST be present if the navigation property is not defined in metadata. The value of the metadata:context attribute, defined in the OData Metadata namespace, specifies the context URL that describes the type of the related entity or entities.

For details on the context URL, see [OData-Protocol].

8.1.1.5 Attribute title

The title attribute SHOULD be present and equal to the name of the navigation property, and provides human-readable, possibly language-dependent, and not necessarily unique information about the link.

8.2 Association Link

The association link is a URL that allows retrieving the reference or collection of references to the related entity or entities. It is represented as an atom:link element. If the URL follows conventions, i.e. is the navigation link with /$ref appended, the association link MAY be omitted.

Example 20: products related to a category

```
<atom:link
  rel="http://docs.oasis-open.org/odata/ns/relatedlinks/Products"
  href="Categories(0)/Products/$ref"
  type="application/xml"
  title="Products"/>
```

8.2.1 Element atom:link

A collection of relationship links is represented by an atom:link element. The attributes rel, href, type, metadata:context, and title MUST be used as described in the following subsections.

8.2.1.1 Attribute rel

The rel attribute MUST be present. The value MUST contain the string

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

followed by the name of the navigation property of the entity.

Note that the full name must be used; the use of relative URLs in the rel attribute is not allowed.
8.2.1.2 Attribute href

The `href` attribute MUST be present and MUST specify the URL that represents the collection of relationship links. This URL may be relative or absolute.

8.2.1.3 Attribute type

The `type` attribute MUST be present with the string "application/xml" as value.

8.2.1.4 Attribute title

The `title` attribute SHOULD be present and be set to the name of the navigation property. The `title` attribute provides human-readable, possibly language-dependent, and not necessarily unique information about the link.

8.3 Expanded Navigation Property

An expanded navigation property MUST be represented as a single `metadata:inline` child element of the `atom:link` element representing the navigation link. The value of the `metadata:inline` element MUST be the correct representation of the related entity or collection of entities.

It is valid to include the `metadata:inline` element in only a subset of the entries within a feed.

If at most one entity can be related, the value is the representation of the related entity, or the `metadata:inline` element is empty if no entity is currently related.

If a collection of entities can be related, it MUST be represented as an `atom:feed`. An empty collection of entities (one that contains no entity type instances) MUST be represented as an empty `atom:feed`. Each entity MUST be represented as an `atom:entry` element or as an entity reference.

Example 21:

```xml
<atom:link
  rel="http://docs.oasis-open.org/odata/ns/related/Products"
  href="Categories(0)/Products"
  type="application/atom+xml;type=feed"
  title="Products">
  <metadata:inline>
    <atom:feed>
      ...
    </atom:feed>
  </metadata:inline>
</atom:link>
```

8.4 Deep Insert

When inserting a new entity with a POST request, related new entities MAY be specified using the same representation as for an expanded navigation property.

Deep inserts are not allowed in update operations using PUT or PATCH requests.

Example 22: inserting a new order for a new customer with order items related to existing products

```xml
<entry ...>
  ...
  <link rel="http://docs.oasis-open.org/odata/ns/related/Customer"
    type="application/atom+xml;type=entry"
    title="Customer" href="Orders(11643)/Customer">
    <metadata:inline>
      <entry>
      ...
    </metadata:inline>
</entry>
```
8.5 Bind Operation

When inserting or updating an entity, relationships of navigation properties MAY be inserted or updated via bind operations.

If at most one entity can be related, the bind operation MUST be represented as a navigation link whose href attribute MUST contain the id of the entity to be related.

For update operations a bind operation on a collection navigation property MUST be represented as a navigation link with an inlined collection of entity references. The referenced entities are added as additional related entities, and existing relationships are not updated or deleted.

For insert operations collection navigation property bind operations and deep insert operations MAY be combined by inlining an atom:feed that contains atom:entry elements and metadata:ref elements.
Example 23: assign a product to an existing category

```xml
<atom:link
    rel="http://docs.oasis-open.org/odata/ns/related/Category"
    href="http://host/service/Categories(6)"
    type="application/atom+xml;type=entry"
    title="Category"
/>
```
9  Stream Property

9.1 Element atom:link

An entity or complex type instance MAY have one or more stream properties (for example, a photo property of an employee entity). Properties that represent streams have a type of Edm.Stream.

OData uses the atom:link element to represent a stream property.

Example 24: read link of stream property Thumbnail

```xml
<atom:link rel="http://docs.oasis-open.org/odata/ns/mediaresource/Thumbnail"
    type="image/jpeg" title="Photo" href="Products(0)/Thumbnail" />
```

Example 25: edit link of stream property Thumbnail

```xml
<atom:link
    rel="http://docs.oasis-open.org/odata/ns/edit-media/Thumbnail"
    type="image/jpeg" title="Photo" href="Products(0)/Thumbnail" />
```

The attributes rel, href, type, metadata:etag, and title are to be used as described in the following subsections.

9.1.1 Attribute rel

The rel attribute MUST be present and MUST be made up of the string http://docs.oasis-open.org/odata/ns/mediaresource/, followed by the name of the stream property on the entity.

The rel attribute for an atom:link element that can be used to change a stream property value is made up of the string http://docs.oasis-open.org/odata/ns/edit-media/, followed by the name of the stream property on the entity.

In both cases the full name must be used; the use of relative URLs in the rel attribute is not allowed.

9.1.2 Attribute href

The href attribute MUST be present and MUST contain the URL that can be used to read, or write, the stream, according to the rel attribute. This URL may be relative or absolute.

9.1.3 Attribute type

The type attribute MAY be present and specifies the MIME-type of the stream.

9.1.4 Attribute metadata:etag

The metadata:etag attribute MAY be present and specifies an etag value that can be used in an if-match header to conditionally write to the stream property as described in [OData-Protocol].

9.1.5 Attribute title

The title attribute MAY be present and provides human-readable, possibly language-dependent, and not necessarily unique information about the link.
10 Media Entity

Media entities (in AtomPub: media link entries, see [RFC5023]) are entities that describe and link to a media resource.

Example 26:

```xml
<entry ...>
  <id>http://host/service/Employees(6)</id>
  ...
  <link rel="edit-media" title="Employee" href="Employees(6)/$value"/>
  <content type="image/jpeg" src="Employees(6)/$value"/>
  <metadata:properties>
    <data:ID metadata:type="Int32">6</data:ID>
    ...
  </metadata:properties>
</entry>
```

10.1 Element atom:link

A media entity MAY contain an atom:link element with a rel attribute of "edit-media" to specify a URL that can be used to write to the BLOB associated with the entity. The attributes rel and href MUST be used as described in the following subsections.

10.1.1 Attribute rel

The rel attribute MUST be present and MUST have the string "edit-media" as value.

10.1.2 Attribute href

The href MUST be present and its value MUST specify the URL that can be used to write the stream. This URL may be relative or absolute.

10.2 Element atom:content

For media entities the atom:content element MUST be empty. Properties of the media entity are represented by the metadata:properties element as a sibling to, rather than a child of, the atom:content element.

10.2.1 Attribute src

The atom:content element MUST contain a src attribute and the value of the src attribute MUST be a URL that can be used to retrieve the content of the media resource.

10.2.2 Attribute type

The atom:content element MUST specify a type attribute that SHOULD contain the MIME type of the media resource.
11 Individual Property

A valid OData payload may consist of a single primitive or complex value, or of a collection of these. A single-valued property that has the null value does not have a representation, see [OData-Protocol].

11.1 Single Scalar Value

Example 27: string value

```
<value xmlns="http://docs.oasis-open.org/odata/ns/metadata"
       context="http://host/service/$metadata#Edm.String">CEO</value>
```

Example 28: primitive null value:

```
<metadata:value xmlns="http://docs.oasis-open.org/odata/ns/metadata"
                metadata:context="http://host/service/$metadata#Edm.Date"
                metadata:null="true" />
```

Example 29: complex value

```
<metadata:value metadata:type="#Model.Address"
                 metadata:context="http://host/service/$metadata#Model.Address"
                 xmlns:metadata="http://docs.oasis-open.org/odata/ns/metadata"
                 xmlns="http://docs.oasis-open.org/odata/ns/data">
    <Street>Obere Str. 57</Street>
    <City>Berlin</City>
    <Region metadata:null="true"/>
    <PostalCode>D-12209</PostalCode>
</metadata:value>
```

11.1.1 Element metadata:value

Single scalar values are represented as a metadata:value root element that contains the representation of the scalar value. The attributes metadata:type and metadata:null MUST be used as described in the following subsections.

11.1.1.1 Attribute metadata:context

The metadata:value element MUST have a metadata:context attribute, defined in the OData Metadata namespace, whose value is the context URL that describes the element.

For more information on the context URL, see [OData-Protocol].

11.1.1.2 Attribute metadata:metadata-etag

The metadata:value element MAY have a metadata:metadata-etag attribute to specify an ETag for the service’s metadata document. It can be used to determine whether the client’s cached copy of the metadata document is outdated.

For details on how ETags are used, see [OData-Protocol].

11.1.1.3 Attribute metadata:type

If the type of the scalar value being specified is anything other than Edm.String the metadata:type attribute MUST be present and specify the namespace - or alias - qualified type of the value.
11.1.1.4 Attribute metadata:null

The metadata:null attribute distinguishes null values from other empty content (such as an empty string). Null-values are represented as an empty metadata:value element with a metadata:null="true" attribute.

11.2 Collection of Scalar Values

A valid OData payload MAY consist of a collection of primitive or complex properties.

Example 30: collection of strings

```xml
<metadata:value
  metadata:context="http://host/service/$metadata#Collection(Edm.String)"
  xmlns:metadata="http://docs.oasis-open.org/odata/ns/metadata"
>
  <metadata:element>(203) 555-1718</metadata:element>
  <metadata:element>(203) 555-1719</metadata:element>
</metadata:value>
```

Example 31: collection of complex values

```xml
<metadata:value xmlns:metadata="http://docs.oasis-open.org/odata/ns/metadata"
  metadata:context="http://host/service/$metadata#Collection(Model.Address)"
  xmlns="http://docs.oasis-open.org/odata/ns/data"
  metadata:type="#Model.BaseAddress"
>
  <metadata:element>
    <Street>Obere Str. 57</Street>
    <City>Berlin</City>
    <PostalCode>D-12209</PostalCode>
  </metadata:element>
  <metadata:element metadata:type="#Model.Address">
    <Street>12345 Grant Street</Street>
    <City>Taft</City>
    <Region>Ohio</Region>
    <PostalCode>OH 98052</PostalCode>
  </metadata:element>
</metadata:value>
```

11.2.1 Element metadata:value

A collection of scalar values is represented as a metadata:value root element that contains a metadata:element child element for each item of the collection whose content is an individual primitive or complex value as defined above.

The metadata:value element MUST NOT contain a metadata:null attribute. The attribute metadata:type MUST be used as described in the following subsection.

11.2.1.1 Attribute metadata:context

The metadata:value element MUST have a metadata:context attribute, defined in the OData Metadata namespace, whose value is the context URL that describes the element.

For more information on the context URL, see [OData-Protocol].
11.2.1.2 Attribute `metadata:metadata-etag`

The `metadata:value` element MAY have a `metadata:metadata-etag` attribute to specify an ETag for the service's metadata document. It can be used to determine whether the client's cached copy of the metadata document is outdated.

For details on how ETags are used, see [OData-Protocol].

11.2.1.3 Attribute `metadata:type`

The attribute `metadata:type` MUST be present and specify the collection type according to the rules described in section 7.3.1.

For collections of complex scalar values this attribute specifies a collection type for the base type of the collection. Individual elements of a derived type MUST specify their derived type with a `metadata:type` attribute on the `metadata:element` element.
12 Collection of Entities

Collections of entities are represented in Atom as an `atom:feed` element.

12.1 Element `atom:feed`

Collections of entities are represented using an `atom:feed` Element, where each entity is represented as an `atom:entry` or `metadata:ref` element.

12.1.1 Attribute `metadata:context`

The `atom:feed` element MUST have a `metadata:context` attribute, defined in the OData Metadata namespace, whose value is the context URL that describes the entity set represented by the feed.

For more information on the context URL, see [OData-Protocol].

12.1.2 Attribute `metadata:metadataetag`

The `metadata:metadataetag` attribute MAY appear in an `atom:feed` in order to specify an ETag that can be used to determine the current version of the service's metadata document.

For details on how ETags are used, see [OData-Protocol].

12.2 Element `atom:id`

The `atom:id` element MUST uniquely identify the collection from which the feed was generated.

12.3 Element `metadata:count`

The `atom:feed` element MAY contain a `metadata:count` element to specify the total count of entities in the result to the request. This MAY be greater than the number of entries in the feed, if server-side paging has been applied, in which case the feed MUST include a next results link.

Example 32:

```xml
<feed xmlns="http://www.w3.org/2005/Atom"
      xmlns:metadata="http://docs.oasis-open.org/odata/ns/metadata"
      metadata:context="http://host/service/$metadata#Customers">
  <metadata:count>42</metadata:count>
  ...
  <atom:link rel="next"
            href="http://host/service/Customers?$skiptoken=1237"/>
</feed>
```

12.4 Element `atom:link`

The `atom:feed` element MAY contain a self link to allow reread the feed.

The `atom:feed` element MAY contain a next link to indicate the presence of additional entities that belong to the collection.

The `atom:feed` element representing the final page of results MAY contain a delta link that can be used to fetch subsequent changes (deltas) to the result.

All three cases are distinguished from another by the value of the rel attribute as described in the following subsection.
In a valid OData Atom response Payload the `atom:link` element representing a `next link` or a `delta link` MAY be positioned after the last `atom:entry` or `metadata:ref` element. This defines an exception to the Atom Specification [RFC4287].

12.4.1 Attribute `rel`

A self link is represented as an `atom:link` with a `rel="self"` attribute. The `href` attribute MUST contain the request URL that produced this collection.

A next link is represented as an `atom:link` with a `rel="next"` attribute and an `href` attribute containing a URL that can be used to retrieve the next set of results.

Example 33: `next link`

```
<atom:link rel="next"
  href="http://host/service/Custome
rs?$skiptoken=1237"/>
```

The contents of the `href` attribute SHOULD be treated as an opaque URL that can be used to fetch the next set of results.

A delta link is represented as an `atom:link` element with a `rel` attribute of "http://docs.oasis-open.org/odata/ns/delta" and an `href` attribute containing a URL that can be used to retrieve subsequent changes.

Example 34: `delta link`

```
<atom:link rel=" http://docs.oasis-open.org/odata/ns/delta"
  href="http://host/service/Custome
rs?$deltatoken=1234"/>
```

The contents of the `href` should be treated as an opaque URL that can be used to fetch subsequent changes.

The delta link MUST only appear on the last page of results. A page of results MUST NOT have both a delta link and a next link.
13 Entity Reference

An entity reference (see [OData-Protocol]) MAY take the place of an entity in an Atom payload, based on the client request. The id may be absolute or relative.

Example 35: entity reference to order 10643

```xml
```

Example 36: collection of entity references

```xml
<feed xmlns="http://www.w3.org/2005/Atom"
      xmlns:m="http://docs.oasis-open.org/odata/ns/metadata"
      metadata:context="http://host/service/$metadata#Collection($ref)"
>
  <metadata:ref id="http://host/service/Orders(10643)" />
  <metadata:ref id="http://host/service/Orders(10759)" />
</feed>
```

13.1 Element metadata:ref

A reference to an entity or one of its properties is represented in Atom using a metadata:ref element.

13.1.1 Attribute metadata:context

If the metadata:ref element is the root element of a response, it MUST have a metadata:context attribute, defined in the OData Metadata namespace, whose value is the context URL that describes the reference. If it is part of an Atom feed, the attribute is optional.

For more information on the context URL, see [OData-Protocol].

13.1.2 Attribute id

The id attribute MUST be present. For entities the id attribute MUST be the atom:id of the referenced entity. It may be relative or absolute.
14Delta Response

The non-format specific aspects of the delta handling are described in the section “Requesting Changes” in [OData-Protocol].

Responses from a delta request are returned as an atom:feed. The feed MUST contain all added, changed, or deleted entities, as well as added or deleted links between entities, and MAY contain additional, unchanged entities.

All added, changed, or deleted entities and links, including related entities, are returned as direct children of the atom:feed element.

Entities that are not part of the entity set specified by the metadata:context attribute in the atom:feed element MUST include a metadata:context attribute in the atom:entry element to specify the entity set of the related entity.

If the delta response contains a partial list of changes, it MUST include a next link for the client to retrieve the next set of changes.

The last page of a delta response SHOULD contain a delta link for retrieving subsequent changes once the current set of changes has been applied to the initial set.

If the response from the delta link contains a metadata:count element, the returned number MUST include all added, changed, or deleted entities, as well as added or deleted links.

Example 37: delta response with five changes, in order of occurrence

- ContactName for customer 'BOTTM' was changed to "Susan Halvenstern"
- Order 10643 was removed from customer 'ALFKI'
- Order 10645 was added to customer 'BOTTM'
- The shipping information for order 10643 was updated
- Customer 'ANTON' was deleted

```xml
<feed xml:base="http://host/service/
 xmlns:odata="http://docs.oasis-open.org/odata/ns/data"
 xmlns:metadata="http://docs.oasis-open.org/odata/ns/metadata"
 xmlns="http://www.w3.org/2005/Atom"
 xmlns:at="http://purl.org/atompub/tombstones/1.0"
 metadata:context="$metadata#Customers/$delta">
  <title type="text">Customers</title>
  <id>http://host/service/Customer</id>
  <updated>2012-11-27T15:38:22Z</updated>
  <metadata:count>5</metadata:count>
  <entry>
    <id>http://host/service/Customer('BOTTM')</id>
    <title type="text"/>
    <updated>2012-11-17T15:38:22Z</updated>
    <author><name /></author>
    <link rel="edit" title="Customer" href="http://host/service/Customer('BOTTM')"/>
    <category term="Model.Customer"
             scheme="http://docs.oasis-open.org/odata/ns/scheme"/>
    <content type="application/xml">
      <metadata:properties>
        <data:ContactName>Susan Halvenstern</data:ContactName>
      </metadata:properties>
    </content>
  </entry>
</feed>
```
14.1 Added/Changed Entity

Added or changed entities within a delta response are represented as `atom:entry` elements.

Added or changed entities MUST NOT include inline content.

Added entities MUST include all selected properties and MAY include additional, unselected properties. Collection-valued properties are treated as atomic values; any collection-valued properties returned from a delta request MUST contain all current values for that collection.

Added entities MUST include navigation links.

Changed entities MUST include all selected properties that have changed and MAY include additional properties.

Entities whose set cannot be determined from the context URL of the feed MUST include the `metadata:context` attribute in the `atom:entry` element to specify the set that the entity belongs to. This context URL MAY be absolute or relative to the context URL of the feed.
14.2 Deleted Entity

14.2.1 Element atom-tombstone:deleted-entry

A deleted entity within a delta response is represented as an atom-tombstone:deleted-entry element, defined within the Atom Tombstone namespace, as defined in [RFC6721].

The ref and a when attribute MUST be present, the metadata:reason attribute MAY be present. All attributes have to be used as described in the following subsection.

14.2.1.1 Attribute ref

As defined in [RFC6721], the ref attribute MUST be present. The value of the ref attribute MUST specify the atom:id of the deleted entry. It may be relative or absolute.

14.2.1.2 Attribute when

As defined in [RFC6721], the when attribute MUST be present to specify the time at which the entity was deleted. This attribute is not used in OData and MAY be set to the time the delta response was generated if the service does not track when deletions occur. OData clients MUST NOT assume any semantics around this value.

14.2.1.3 Attribute metadata:reason

The metadata:reason attribute MAY be present. The value of the metadata:reason attribute MUST specify the string value "deleted", if the entity was deleted (destroyed), or "changed" if the entity was removed from membership in the result (i.e., due to a data change).

14.3 Added Link

14.3.1 Element metadata:link

A link within a delta response is represented by a metadata:link element.

A delta response MUST contain a metadata:link for each added link that corresponds to a $expand path in the initial request.

The source, relationship, and target attribute MUST be present. All attributes have to be used as described in the following subsection.

14.3.1.1 Attribute source

The source attribute MUST be present and specify the atom:id of the entity from which the link originates. It may be relative or absolute.

14.3.1.2 Attribute relationship

The relationship MUST be present and specify the name of the navigation property on the source entity for which the link exists.

14.3.1.3 Attribute target

The target attribute MUST be present and specify the atom:id of the related entity. It may be relative or absolute.
14.4 Deleted Link

14.4.1 Element metadata:deleted-link

A deleted link within a delta response is represented as a metadata:deleted-link element. Delta responses MUST contain a metadata:deleted-link for each deleted link that corresponds to a $expand path in the initial request, unless either of the following is true:

- The source or target entity has been deleted.
- The maximum cardinality of the related entity is one and there is a subsequent metadata:link that specifies the same source and relationship.

The service MAY return a metadata:deleted-link where one of the entities has also been deleted, or where there is a subsequent metadata:link with the same source and relationship and a maximum cardinality of one for the related end.

The source, relationship and target attribute MUST be present. All attributes have to be used as described in the following subsection.

14.4.1.1 Attribute source

The source attribute MUST be present and specify the atom:id of the entity from which the link originates. It may be relative or absolute.

14.4.1.2 Attribute relationship

The relationship attribute MUST be present and specify the name of the navigation property on the source entity for which the link is deleted.

14.4.1.3 Attribute target

The target attribute MUST be present and specify the atom:id of the related entity. It may be relative or absolute.
15 Bound Function

Zero or more functions MAY be bound to a collection of entities or an entity.
The functions associated with a particular collection of entities or an entity MAY be described using metadata:function elements that are direct children of the feed or entry to which the functions can be bound.

Example 38: a function bound to an entry:

```xml
<atom:entry>
  ...
  <metadata:function
    metadata="#Model.RemainingVacation"
    target="http://host/service/Employees(2)/RemainingVacation"
    title="Remaining Vacation"
  />
  ...
</atom:entry>
```

Example 39: a function bound to a feed:

```xml
<atom:feed>
  ...
  <metadata:function
    metadata="#Model.RemainingVacation"
    target="http://host/service/Managers(22)/Employees/RemainingVacation"
    title="Remaining Vacation"
  />
  ...
</atom:feed>
```

15.1 Element metadata:function

Each function is represented as a metadata:function element that MUST be a child of the atom:feed or atom:entry element representing the collection of entities or the entity on which the function exists.

15.1.1 Attribute metadata

The metadata attribute MUST be present and specify the namespace-qualified or alias-qualified name of the function, preceded by a #.

A function may have multiple overloads with different parameters. If the URL in the target attribute of the metadata:function element cannot be used to invoke all overloads for the function, then it MUST further be distinguished by appending the parentheses-enclosed, comma-separated list of non-binding parameter names, see rule qualifiedFunctionName in [OData-ABNF].

Example 40:

```xml
<metadata:function
  metadata="#Model.RemainingVacation(Year)"
  target="http://host/service/Employees(2)/RemainingVacation(Year=@Year)"
  title="Remaining vacation from year..."
/>
```
15.1.2 Attribute target
The target attribute MUST be present and specify the URL to GET from in order to invoke the function. The first parameter of the function MUST be a binding parameter that is bound to the feed or entity on which the function is specified, and MUST NOT be provided as a separate parameter by the client when invoking the function.

15.1.3 Attribute title
The title attribute MUST be present and contain a human-readable, possibly language-dependent, and not necessarily unique name for the function, commonly used by clients to describe the function to a user.
16 Bound Action

Zero or more actions MAY be bound to a collection of entities or an entity. The actions associated with a particular collection of entities or an entity MAY be described using `metadata:action` elements that are direct children of the feed or entry to which the actions can be bound.

Example 41: action bound to an entity

```
<atom:entry>
  ...
  <metadata:action
    metadata="#Model.Approval"
    target="http://host/service/LeaveRequests(2)/Approval"
    title="Approve Leave Request"
  />
  ...
</atom:entry>
```

Example 42: action bound to a feed

```
<atom:feed>
  ...
  <metadata:action
    metadata="#Model.Approval"
    target="http://host/service/Managers(22)/Inbox/Approval"
    title="Approve All Leave Requests"
  />
  ...
</atom:feed>
```

16.1 Element `metadata:action`

Each action is represented as a `metadata:action` element that MUST be a direct child of the `atom:feed` or `atom:entry` element representing the collection of entities or the entity on which the action exists.

16.1.1 Attribute `metadata`

The `metadata` attribute MUST be present and specify the namespace-qualified or alias-qualified name of the action element describing the action, preceded by a `#`.

16.1.2 Attribute `target`

The `target` attribute MUST be present and specify the URL to POST to in order to invoke the action. The first parameter of the action MUST be a binding parameter that is bound to the feed or entity on which the action is specified, and MUST NOT be provided as a separate parameter by the client when invoking the action.

16.1.3 Attribute `title`

The `title` attribute MUST be present and contain a human-readable, possibly language-dependent, and not necessarily unique name for the action, commonly used by clients to describe the action to a user.
17 Action Invocation

Action parameter values in the request body MUST be encoded as an individual complex scalar value with the name parameters and no metadata: type attribute for the parameters element.

Each non-binding parameter value specified MUST be encoded as an individual primitive or complex scalar value. The name of the scalar value is the name of the parameter. The value is the parameter value in the XML representation appropriate for its type.

Any parameter values not specified in the request body MUST be assumed to have the null value.

Example 43:

```
<parameters>
  <param1>42</param1>
  <param2 metadata:type="#Model.Address">
    <Street>One Microsoft Way</Street>
    <Zip>98052</Zip>
  </param2>
  <param3>
    <element>1</element>
    <element>42</element>
    <element>99</element>
  </param3>
  <param4 metadata:null="true"/>
  <!-- <param5/> not specified, has null value -->
</parameters>
```
18 Instance Annotations

Annotations MAY be applied to an instance of a feed, entry, entity reference, complex scalar value, property, navigation property, function, action, added link, deleted link, or error within an Atom payload.

18.1 Element metadata:annotation

An instance annotation in Atom is represented as an XML element with the name Annotation in the metadata namespace.

The value of the annotation is specified according to the Annotation Value, described below.

18.1.1 Attribute target

The target attribute MAY be used to specify the annotation target. If the target attribute is not specified the target of the annotation is the element represented by the direct parent of the metadata:annotation element.

18.1.2 Attribute term

The metadata:annotation element MUST have a term attribute that specifies the namespace-qualified or alias-qualified name of the term being applied.

18.1.3 Attribute metadata:type

If the type of the annotation value being specified is anything other than Edm.String the metadata:annotation element MUST contain a metadata:type attribute to specify the appropriate type of the annotation value.

18.1.4 Attribute metadata:null

Null-valued annotations are represented as empty metadata:annotation elements with the metadata:null="true" attribute.

The metadata:null attribute distinguishes null values from other empty content (such as an empty string).

The absence of the metadata:null attribute is equivalent to specifying metadata:null="false".

18.2 Annotation Value

An instance annotation value may be specified as a primitive value, collection value, or structured value.

18.2.1 Primitive Value

When specified in the content of an annotation element representing a primitive value, the content MUST be formatted as per Primitive Types in Atom. If the type of the annotation value is anything other than Edm.String, then the annotation element MUST contain the metadata:type attribute specifying the appropriate primitive type.

Example 44:
18.2.2 Collection Value

The content of an element representing a collection-valued annotation MUST be the individual elements of that collection formatted as direct child elements of the `metadata:annotation` element as described in Collections of Primitive or Collection of Complex Scalar Values.

For collection-valued annotations, the annotation element MUST contain the `metadata:type` attribute specifying the appropriate collection type.

Example 45:

```
<entry>
  <id>Customers('ALFKI')</id>
  <link rel="http://docs.oasis-open.org/odata/ns/related/Orders" href="Customers('ALFKI')/Orders" type="application/atom+xml;type=feed" title="List of Orders">
    <metadata:annotation term="com.contoso.PersonalInfo.PhoneNumbers" type="Collection(String)">
      <element>(203) 555-1718</element>
      <element>(203) 555-1719</element>
    </metadata:annotation>
  </link>
</entry>
```

18.2.3 Structured Value

The content of an element representing a structured annotation MUST be a single child element for each property of the annotation type being specified, formatted as per properties within an entity type.

For structural-valued annotations, the annotation element MUST contain the `metadata:type` attribute specifying the appropriate structural type.

Example 46:

```
<entry>
  <id>Customers('ALFKI')</id>
  <metadata:annotation term="com.contoso.display.style" metadata:type="#com.contoso.display.styleType">
    <data:order metadata:type="Int32">2</data:order>
  </metadata:annotation>
</entry>
```
18.3 Instance Annotation Target

Instance annotations MAY target model elements represented by a feed, entry, complex scalar value, property, navigation property, function, action, or error within an Atom payload.

18.3.1 Feed

When annotating a feed, annotation elements MUST be direct children of the atom:feed element, and they MUST appear in a group at the beginning of the feed or (another) group at the end of the feed, depending on whether they are needed beforehand to understand the feed content, or can only be computed after serializing the feed content.

18.3.2 Entry

When annotating an entity, the annotation element MUST be a direct child of the atom:entry element representing the entity.

18.3.3 Entity Reference

When annotating an entity reference, the annotation element MUST be a direct child of the metadata:ref element.

18.3.4 Complex Type

When annotating an instance of a complex type, the annotation element MUST be a direct child of the metadata:value element representing the complex-typed value.

18.3.5 Property

When annotating a property, the annotation element MUST be a direct child of the metadata:properties element, or a direct child of the element representing a complex type in the case of annotating the property of a complex type. The value of the target attribute MUST specify the name of the property being annotated. The annotation elements MUST immediately precede the target property element.

Instance annotations are not supported when serializing single primitive properties in XML as described in Individual Primitive or Complex Scalar Values.

18.3.6 Navigation Property

When annotating a navigation property, stream property, or other element represented by an atom:link element, the annotation element must be a direct child of the atom:link element.
18.3.7 Function or Action
When annotating a function or action, the annotation element must be a direct child of the metadata:function or metadata:action element.

18.3.8 Added Link or Deleted Link
When annotating an added or deleted link in a delta response, the annotation element must be a direct child of the metadata:link or metadata:deleted-link element.

18.3.9 Error
When annotating an error, the metadata:annotation element MUST be a direct child of the metadata:error element. The annotation element MAY have a target attribute value of "code", "message", or "innererror". If the target attribute is not specified, then the annotation is applied to the error itself. The annotation elements MUST follow the other child elements of the error element.
19 Error Response

In the case of an error being generated in response to a request specifying an Accept header of application/xml or application/atom+xml, or that does not specify an Accept header, the service MUST respond with an error formatted as XML.

When formatting error responses as XML, services SHOULD include a Content-Type response header with the value "application/xml".

19.1 Element metadata: error

Errors formatted as XML MUST have a root metadata: error element. The metadata: error element MUST have at least two child elements: metadata: code and metadata: message.

In addition, errors may be annotated using custom annotations.

Example 47:

```xml
<error xmlns="http://docs.oasis-open.org/odata/ns/metadata">
  <code>501</code>
  <message>Unsupported functionality</message>
  <target>query</target>
  <details>
    <detail>
      <code>301</code>
      <message>$search query option not supported</message>
      <target>$search</target>
    </detail>
  </details>
</error>
```

19.2 Element metadata: code

The metadata: error element MUST contain one metadata: code element specifying a service-defined string. This value MAY be used to provide a more specific substatus to the returned HTTP response code.

19.3 Element metadata: message

The metadata: error element MUST contain a metadata: message element specifying a human readable, language-dependent message describing the error. The Content-Language header MUST contain the language code from [RFC5646] corresponding to the language in which the value for message is written.

19.4 Element metadata: target

The metadata: error element MAY contain a metadata: target element to specify the target of the error (for example, the name of the property in error).

19.5 Element metadata: details

The metadata: error element MAY contain a metadata: details element containing one or more metadata: detail elements specifying detail about the error.
19.5.1 Element metadata:detail

The metadata:detail element specifies information about an individual error detail.

19.5.2 Element metadata:code

The metadata:detail element MUST contain one metadata:code element specifying a service-defined string. This value MAY be used to provide a more specific substatus to the returned HTTP response code.

19.5.3 Element metadata:message

The metadata:detail element MUST contain a metadata:message element specifying a human readable, language-dependent message describing the error.

19.5.4 Element metadata:target

The metadata:detail element MAY contain a metadata:target element to specify the target of the error.

19.6 Element metadata:innererror

The metadata:innererror element MAY contain a metadata:innererror element containing service specific debugging information that might assist a service implementer in determining the cause of an error.

The metadata:innererror element SHOULD only be used in development environments in order to guard against potential security concerns around information disclosure.
20 Extensibility

Implementations MAY add custom content anywhere allowed by [RFC4287], Section 6, “Extending Atom”, and [RFC5023], Section 6.2 “Document Extensibility”. However, custom elements and attributes MUST NOT be defined in the OData Data Namespace nor the OData Metadata Namespace, and SHOULD not be required to be understood by the receiving party in order to correctly interpret the rest of the payload as the receiving party MUST ignore unknown foreign markup according to [RFC4287].
21 Security Considerations

This specification raises no security issues.

This section is provided as a service to the application developers, information providers, and users of OData version 4.0 giving some references to starting points for securing OData services as specified. OData is a REST-full multi-format service that depends on other services and thus inherits both sides of the coin, security enhancements and concerns alike from the latter.

For ATOM-relevant security implications please cf. the relevant sections of [RFC4287] (8. Security Considerations), [RFC5023] (15. Security Considerations) and for the deleted-entry element: see [RFC6721] (7. Security Considerations) as starting points.
Conformance

Conforming clients MUST be prepared to consume a service that uses any or all of the constructs defined in this specification. The exception to this are the constructs defined in Delta Response, which are only required for clients that request changes.

In order to be a conforming consumer of the OData ATOM format, a client or service:

1. MUST be prepared to receive all data types (section 7.1)
   a. defined in this specification (client)
   b. exposed by the service (service)
2. MUST be prepared to receive custom annotations (section 18)
3. MUST be prepared to receive additional constructs not defined in this version of the specification (section 20)

In addition, in order to conform to the OData Atom format, a service:

4. MUST comply with one of the conformance levels defined in [OData-Protocol]
5. MUST support the application/atom+xml, application/xml and application/atomsvc+xml media types in the Accept header (section 3)
6. MUST include the next link in feeds containing partial results (section 12.4)
7. MUST return service documents as Atom service documents (section 5)
8. MUST return XML responses in well formed XML according to this OData Atom specification
9. MUST return well-formed Atom payloads with the exceptions for the next link and the delta link (section 12.4)
10. MUST support entity instances with external metadata (section 6.1.2)
11. MUST support properties with externally defined data types (section 11.1.1.3)
12. MUST NOT violate any other aspects of this OData Atom specification
13. SHOULD support the $format system query option (section 3)
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>
</thead>
<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>Martin Zurmuehl Ralf Handl Michael Pizzo</td>
<td>Expanded error information Added enumerations 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>Martin Zurmuehl Ralf Handl Michael Pizzo</td>
<td>Improved metadata:type Improved entity references Simplified delta responses GML for Geo types Improved description of primitive value representation Improved examples, aligned with JSON format specification Aligned terms across specifications</td>
</tr>
<tr>
<td>Committee Specification 01</td>
<td>2013-07-30</td>
<td>Martin Zurmuehl Ralf Handl Michael Pizzo</td>
<td>Non-Material Changes</td>
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