

OCF 2.3 – Location Services – DMWG CR 1781

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Change 1 – Add the following to the T&Ds

1.1 Terms and definitions

1.1.1

Distance Service

set of Resources that provide the distance in metres between a reference entity and a tracked entity

1.1.2

Entity Catalogue

complete set of entities for which Location Services are provided by the Server

1.1.3

Geofence

virtual space defined as a sphere of known radius around a given point

1.1.4

Geofence Service

set of Resources that define a Geofence and indicate whether a tracked entity is inside or outside of the Geofence

1.1.5

Location Services

one or more of the location based services that a Device supports.

Position Service

set of Resources that define the current known position of an entity either as a geolocation or in a known coordinate space

1.1.6

Presence Service

set of Resources that define whether an entity is determined to be present or otherwise

Change 2

1.2 Location Services

1.2.1 Introduction

Location Services present location information about the physical world to applications. Location Services are composed of five services, Presence Service, Position Service, Geofence Service, Distance Service, and Entity Catalogue. A Device that supports a Location Service then exposes an instance of a location Collection ("oic.r.locationcollection") for each of the Location Services that are supported. A Client then interacts with the Resources specific to a Location Service via the appropriate Collection instance.

1.2.2 Entities

Reference [X] defines an entity as "a thing having a distinct existence". For Location Services the definition is further refined to include the location aspect of the thing exposed through Location Services.

Thus an entity is a representation of the thing that is tracked by Location Services; they are defined by specializations of an entity Resource ("oic.r.location.entity"). An entity Resource may be added to a Device to show location information. The tracked physical thing can be Device, a Bluetooth beacon, RFID tag, facial recognition or other technologies. At a minimum, an instance of an entity Resource consists of a globally unique ID, and a description. The format of the globally unique ID is dependent

on the technology of the thing that the entity Resource represents. The description is a human readable string that allows applications to display a context for the entity Resource and allows entity Resources to be grouped for easier searching.

The relationship between the "oic.r.location.entity" and the physical thing it represents is shown in Figure XX

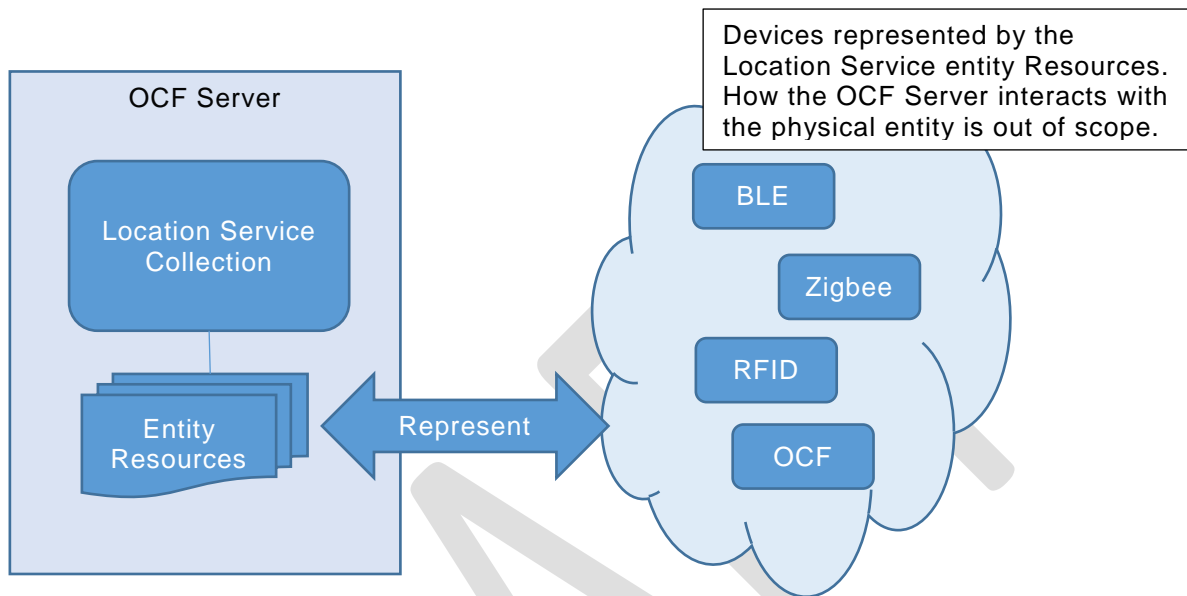


Figure 1 – Entity and relationship to physical thing

Each Location Service as defined in the following clauses provides a service specific specialization of the entity Resource to convey the service specific information. The entity Resources defined herein may be Links within an instance of a location Collection or they may be simply exposed as Links within "/oic/res" by the hosting Device .

1.2.3 Service Definitions

1.2.3.1 Presence Service

The Presence Service announces on the OCF Network whether an entity is present or absent. A Device that supports the Presence Service may expose an instance of "oic.r.locationcollection" with the "supportedlocationservice" Property populated with "presence".

If a Device includes "presence" within the " supportedlocationservice" Property then that instance of a location Collection shall contain at least one Resource of type "oic.r.location.entity.presence" (a Presence Service entity Resource). The Presence Service entity resource is a specialisation of "oic.r.location.entity" (entity Resource) that additionally has a timestamp of the last measurement and a Boolean value indicating whether or not the presence of the entity has been detected.

See clause 1.2.4.2 for details on the model and the associated Resource definitions.

1.2.3.2 Geofence Service

The Geofence Service announces whether an entity is inside or outside a sphere of known radius around a reference entity. A Device that supports the Geofence Service may expose an instance of "oic.r.locationcollection" with the "supportedlocationservice" Property populated with "geofence".

If a Device includes "geofence" within the "supportedlocationservice" Property then that instance of a location Collection shall contain at least one instance of "oic.r.location.entity.geofence" (Geofence Service entity Resource) and/or an instance of "oic.r.location.entity.geofence.report" (Geofence Service entity report Resource). "oic.r.location.entity.geofence" defines the Geofence by means of a reference entity and a radius around that reference entity (in metres). "oic.r.location.entity.geofence.report" additionally provides the accuracy of the measurement, a timestamp of the last measurement, and a Boolean on whether the tracked entity is inside or outside the Geofence.

See clause 1.2.4.3 for details on the model and the associated Resource definitions.

1.2.3.3 Position Service.

The Position Service announces the position of an entity within a coordinate system. A Device that supports the Position Service may expose an instance of "oic.r.locationcollection" with the "supportedlocationservice" Property populated with "position".

If a Device includes "position" within the "supportedlocationservice" Property then that instance of a location Collection shall contain at least one instance of "oic.r.location.entity.position" (Position Service entity Resource). "oic.r.location.entity.position" supports two coordinate systems, the WGS84 GPS coordinates and an "origin X/Y/Z" coordinate system. The "origin X/Y/Z" coordinates are generally used indoors where the origin is set to an arbitrary position within the building. The Position Service entity Resource contains the coordinate data, and a timestamp of the last measurement.

See clause 1.2.4.4 for details on the model and the associated Resource definitions.

1.2.3.4 Distance Service

The Distance Service exposes an instance of "oic.r.location.entity.distance" (Distance Service entity Resource) that provides the distance between an entity that is being tracked and a reference entity. A Device that supports the Distance Service may expose an instance of "oic.r.locationcollection" with the "supportedlocationservice" Property populated with "distance".

If a Device includes "distance" within the "supportedlocationservice" Property then that instance of a location Collection shall contain at least one instance of "oic.r.location.entity.distance". The Distance Service entity Resource contains a reference entity, the distance between the reference entity and the entity being tracked (in metres) that may be calculated, measured, or estimated, the accuracy of the measurement and a timestamp of the last measurement.

If the position of the entity represented by the distance entity Resource and the entity represented by the reference entity are known, then the distance may be the calculated distance between the two positions.

See clause 1.2.4.5 for details on the model and the associated Resource definitions.

1.2.3.5 Entity Catalogue Service

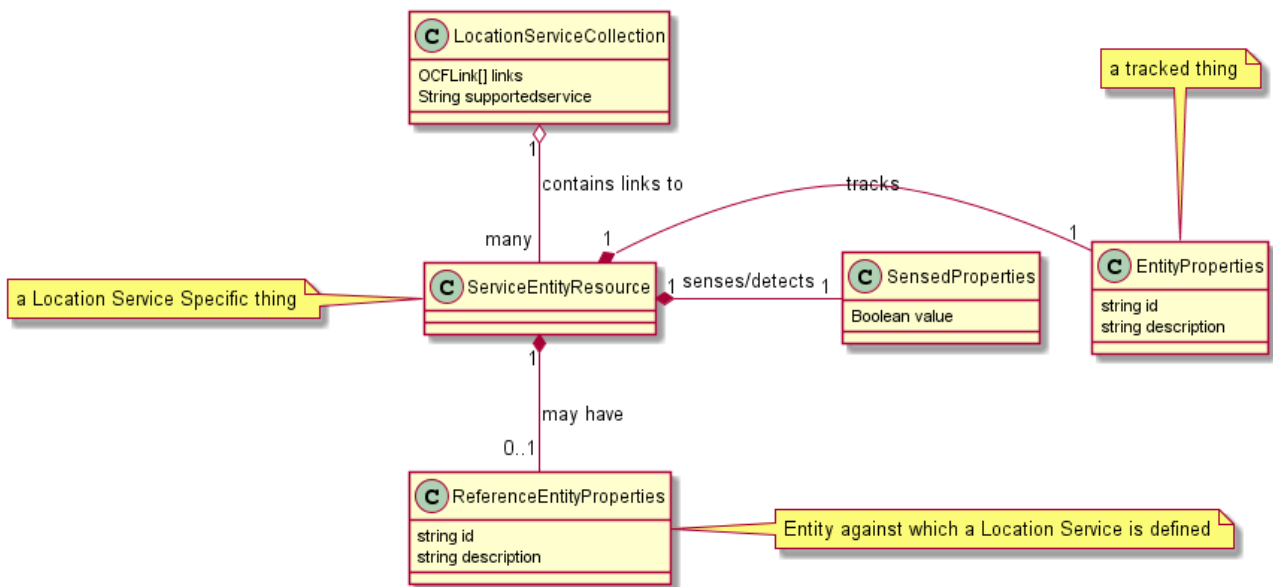
The Entity Catalogue is an instance of a location Collection with the "supportedlocationservice" Property set to "entitycatalog" that contains all entities of which a Device that hosts Location Services has knowledge.

1.2.4 Resource Model

1.2.4.1 Conceptual Model

1.2.4.1.1 Conceptual Model Introduction

Figure 2 describes the overall conceptual Resource model for all Location Services. The "LocationServiceCollection" is an instance of a location Collection ("oic.r.locationcollection") specific to one of the Location Services defined herein.


Figure 2 – Generalised Location Service Model

Whereby "LocationServiceCollection" is an instance of an "oic.r.locationcollection" that supports one of the defined Location Services. The Collection contains Links to instances of an entity Resource ("oic.r.location.entity") specialized for the specific Location Service. The entity Resources have Properties that provide a representation of at least one entity, any sensed or detected information appropriate to the Location Service, and optionally one reference entity depending on the definition of the Location Service.

1.2.4.1.2 Conceptual Model Resource Definitions

Table 1 lists the Resource Types that define a Location Service. Table 2 lists the Properties for the "oic.r.locationcollection" Resource, Table 3 lists the Properties for the "oic.r.location.entity" Resource.

Table 1. Location Service Resources

Example URI	Resource Type Title	Resource Type ID ("rt" value)	Interfaces	Description	Related Functional Interaction
"example/locationcollectionURI"	Location Collection	"oic.r.locationcollection"	"oic.if.ll" "oic.if.baseline"	This Resource is a Collection of Location Service specific entities. The Properties exposed by Resource Type "oic.r.locationcollection" are listed in Table 2.	Location Services
"example/locationentityURL"	Entity	"oic.r.location.entity"	"oic.if.rw", "oic.if.baseline"	This Resource defines the entity that is tracked or that is defined as a reference against which an entity is tracked. The Properties exposed by Resource Type "oic.r.location.entity" are listed in Table 3	Location Services

Table 2. "oic.r.locationcollection" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Links	links	Array	See OCF Core Specification Table 9		R	yes	See OCF Core Specification Table 9
Resource	rt	array	["oic.r.locationcollection"]		R	yes	See OCF Core Specification Table 4.
Resource Types	rts	array	Any of the defined Location Service entity Resources		R	yes	See OCF Core Specification Table 9
Supported Location Service	supportedlocationsservice	string	Enum		R	yes	Location Service supported by this instance of a location collection

The "rts" Property contents within an instance of "oic.r.locationcollection" depend upon the Location Service that is supported. Table 3 describes the contents of "rts" that shall be supported by a Server per Location Service. A Server shall not include in "rts" nor the Collection itself any Resource Types not explicitly listed in Table 3.

Table 3. "rts" population per supported Location Service

Location Service	Supported Location Service Property Value	"rts" population
Distance Service	distance	["oic.r.location.entity.distance"]
Entity Catalog	entitycatalog	["oic.r.location.entity"]
Geofence Service	geofence	["oic.r.location.entity.geofence", "oic.r.location.entity.geofence.report"]
Position Service	position	["oic.r.location.entity.position"]
Presence Service	presence	["oic.r.location.entity.presence"]

Table 4. "oic.r.location.entity" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Entity ID	entityid	string	Max length 128		RW	yes	Locally unique identifier for the entity
Entity Description	entitydescription	string	Max length 128		RW	yes	Human readable description of the entity (e.g. "Mom")

1.2.4.2 Presence Service Model

1.2.4.2.1 Presence Service Model Introduction

Figure 3 describes an example Resource model for an instance of the Presence Service:

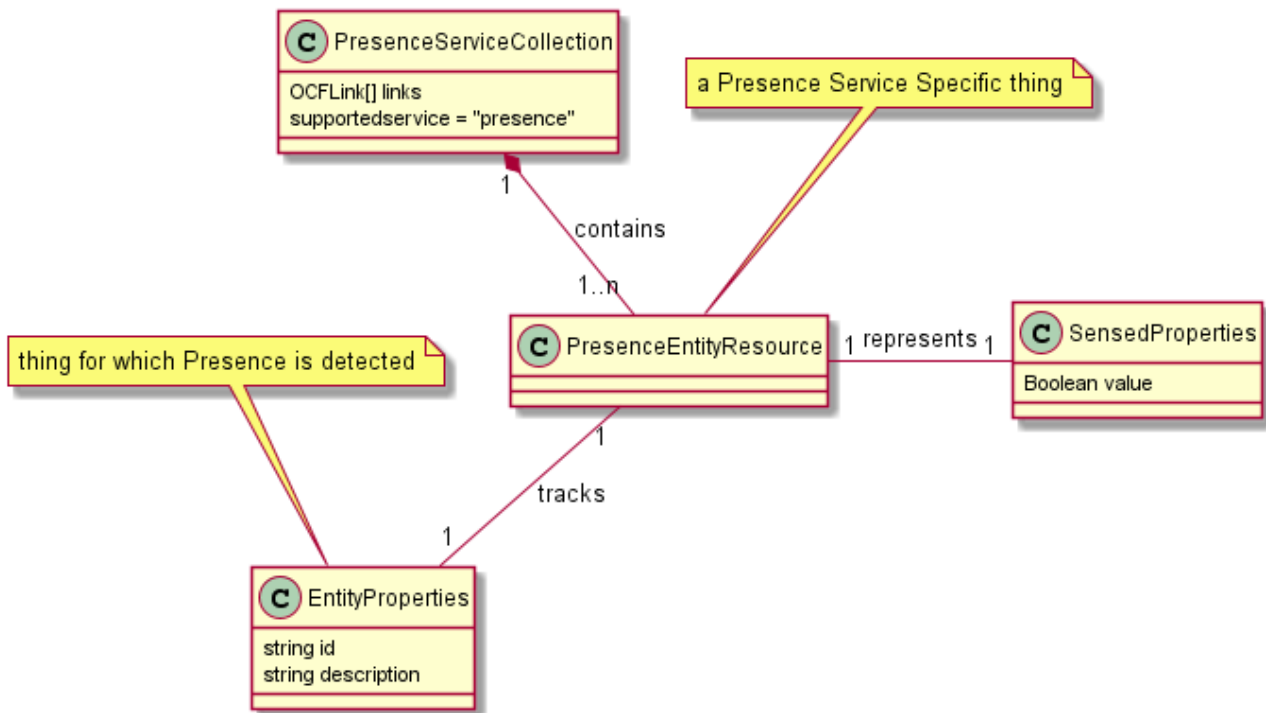


Figure 3 – Presence Service Model

Whereby "PresenceService" is an instance of "oic.r.locationcollection" that supports the Presence Service. The Collection contains Links to Presence Service entity Resources ("oic.r.location.entity.presence").

A Presence Service entity Resource contains Properties that represent the thing whose presence is being detected (i.e. an entity) and a Boolean that provides the indication of whether or not the presence of the entity is detected.

1.2.4.2.2 Presence Service Resource Definitions

Table 4 lists the Resources that are exposed by the Presence Service. Table 5 lists the Properties for the "oic.r.location.entity.presence" Resource Type.

Table 5. Presence Service Resources

Example URI	Resource Type Title	Resource Type ID ("rt" value)	Interfaces	Description	Related Functional Interaction
"example/location/entity/presenceURI"	Presence Service Entity	"oic.r.location.entity.presence"	"oic.if.rw", "oic.if.baseline"	This Resource is a specialisation of the entity Resource for the Presence Service. The Properties exposed by Resource Type "oic.r.location.entity.presence" are listed in Table 5.	Location Services

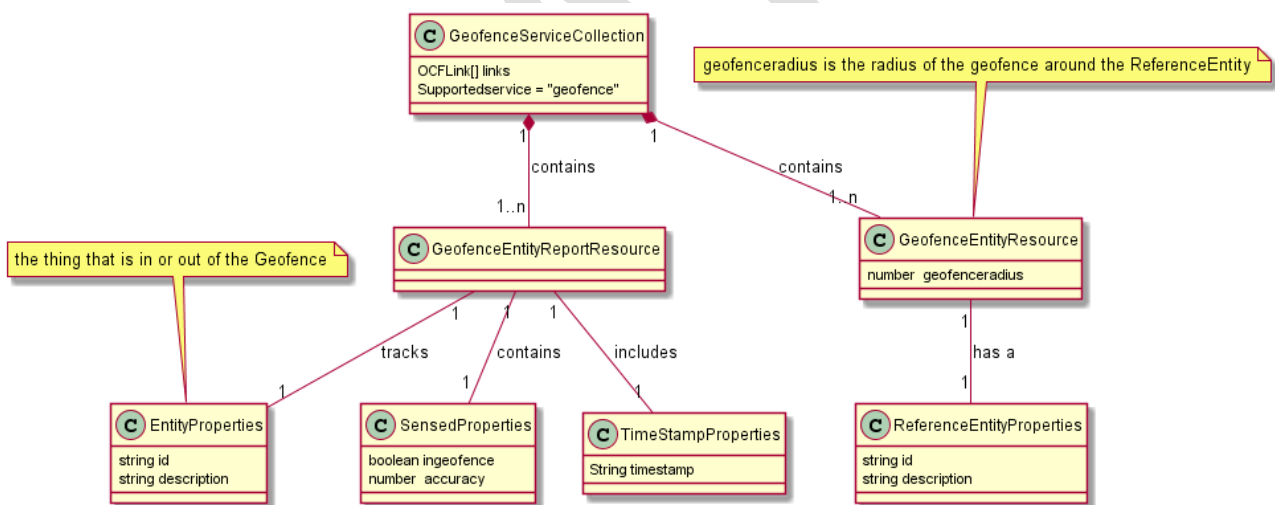
Table 6. "oic.r.location.entity.presence" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Entity ID	entityid	string	See Table XX		RW	yes	See Table XX
Entity Description	entitydescription	string	See Table XX		RW	yes	See Table YY
Value	value	Boolean	See clause XXX ("oic.r.sensor.presence")		R	yes	See clause XXX ("oic.r.sensor.presence")
Timestamp	timestamp	string	See clause XYZ ("oic.r.time.stamp")		R	yes	See clause XZZ ("oic.r.time.stamp")

1.2.4.3 Geofence Service Model

1.2.4.3.1 Geofence Service Model Introduction

Figure 4 describes an example Resource model for an instance of the Geofence Service. Note that a Server that exposes a Geofence Service or associated entities may also additionally provide geolocation information.


Figure 4 – Geofence Service Model

Whereby "GeofenceService" is an instance of "oic.r.locationcollection" that supports the Geofence Service. The Collection contains Links to Geofence Service entity Resources ("oic.r.location.entity.geofence") and Geofence Service entity report Resources ("oic.r.location.entity.geofence.report"). An example of a baseline response for a RETRIEVE on such a Collection is given in Figure XX


```

    {
      "rt": ["oic.r.locationcollection"],
      "id": "unique_example_id",
      "rts":
    ["oic.r.location.entity.geofence","oic.r.location.entity.geofence.report"],
      "supportedlocationservice": ["geofence"],
      "links": [
        {"href": "/entity1", "rt": ["oic.r.location.entity.geofence"], "if":
    ["oic.if.rw","oic.if.baseline"]},
        {"href": "/entity2", "rt": ["oic.r.location.entity.geofence"], "if":
    ["oic.if.rw","oic.if.baseline"]},
        {"href": "/entity3", "rt": ["oic.r.location.entity.geofence"], "if":
    ["oic.if.rw","oic.if.baseline"]},
        {"href": "/entity4", "rt": ["oic.r.location.entity.geofence"], "if":
    ["oic.if.r","oic.if.baseline"]},
        {"href": "/entity5", "rt": ["oic.r.location.entity.geofence.report"], "if":
    ["oic.if.r","oic.if.baseline"]},
        {"href": "/entity6", "rt": ["oic.r.location.entity.geofence.report"], "if":
    ["oic.if.r","oic.if.baseline"]}
      ]
    }
  
```

Figure 5 – Example Location Collection for Geofence Service

A Geofence Service entity Resource contains Properties that represent the reference entity around which the Geofence is defined and the radius of the Geofence itself. That is, it defines a specific Geofence.

A Geofence Service entity report Resource represents the tracking of entities within the defined Geofences. It contains Properties that represent the Geofence itself, the entity whose presence inside or outside of a Geofence is being detected, a Boolean that provides the actual indication of whether or not the entity is inside of the defined Geofence, and a timestamp of when the report was generated.

There exists in the instance of "oic.r.locationcollection" for a Geofence Service an instance of a Geofence Service entity Resource per Geofence that is known, and an instance of Geofence Service entity report Resource for each tracked entity that may or may not be within a Geofence. The Geofence Service entity report Resource contains a timestamp that is updated each time an update is made to the determination of whether or not the tracked entity is within the Geofence.

1.2.4.3.2 Geofence Service Model Resource Definitions

Table 7 lists the Resources Types that are exposed by the Geofence Service. Table 8 lists the Properties for the "oic.r.location.entity.geofence" Resource Type, Table 9 lists the Properties for the "oic.r.location.entity.geofence.report" Resource Type, Table 10 lists the Properties for the "oic.r.sensor.geofence" Resource Type.

Table 7. Geofence Service Resources

Example URI	Resource Type Title	Resource Type ID ("rt" value)	Interfaces	Description	Related Functional Interaction
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"example/locationentitygeofenceURL"	Geofence Entity	"oic.r.location.entity.geofence"	"oic.if.rw" "oic.if.baseline"	This Resource is a specialisation of a location entity for Geofence Service entities. The Properties exposed by Resource Type "oic.r.location.entity.geofence" are listed in Table 8.	Location Services
"example/locationentitygeofence.reportURI"	Geofence Entity Report	"oic.r.location.entity.geofence.report"	"oic.if.r" "oic.if.baseline"	This Resource provides a reporting layer for a Geofence entity. The Properties exposed by Resource Type "oic.r.location.entity.geofence.report" are listed in Table 9.	Location Services

Table 8. "oic.r.location.entity.geofence" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Reference Entity	referenceentity	object	See Table 3		RW	Yes	Instance of "oic.r.location.entity"
Geofence Radius	geofenceradius	number		Metres	RW	Yes	Radius of the Geofence around the reference entity

Table 9. "oic.r.location.entity.geofence.report" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Entity	entity	object	See Table 3		R	yes	Instance of "oic.r.location.entity"
Reference Entity	referenceentity	object	See Table 3		R	yes	Instance of "oic.r.location.entity"
Geofence Radius	geofenceradius	number	See Table 8		R	yes	See Table 8
Inside Geofence	ingeofence	boolean			R	yes	Indicates whether or not an entity is inside this geofence
Accuracy	accuracy	number		metres	R	No	68% confidence measure for entities detected within the Geofence.
Measurement Method	measurementmethod	string			R	No	Descriptive indicator of the method used to determine that the entity is inside the Geofence
Timestamp	timestamp	string	See clause 6.86 ("oic.r.time.stamp")		R	yes	See clause 6.86 ("oic.r.time.stamp")

1.2.4.4 Position Service Model

1.2.4.4.1 Position Service Model Introduction

Figure 5 describes an example Resource model for an instance of the Position Service.

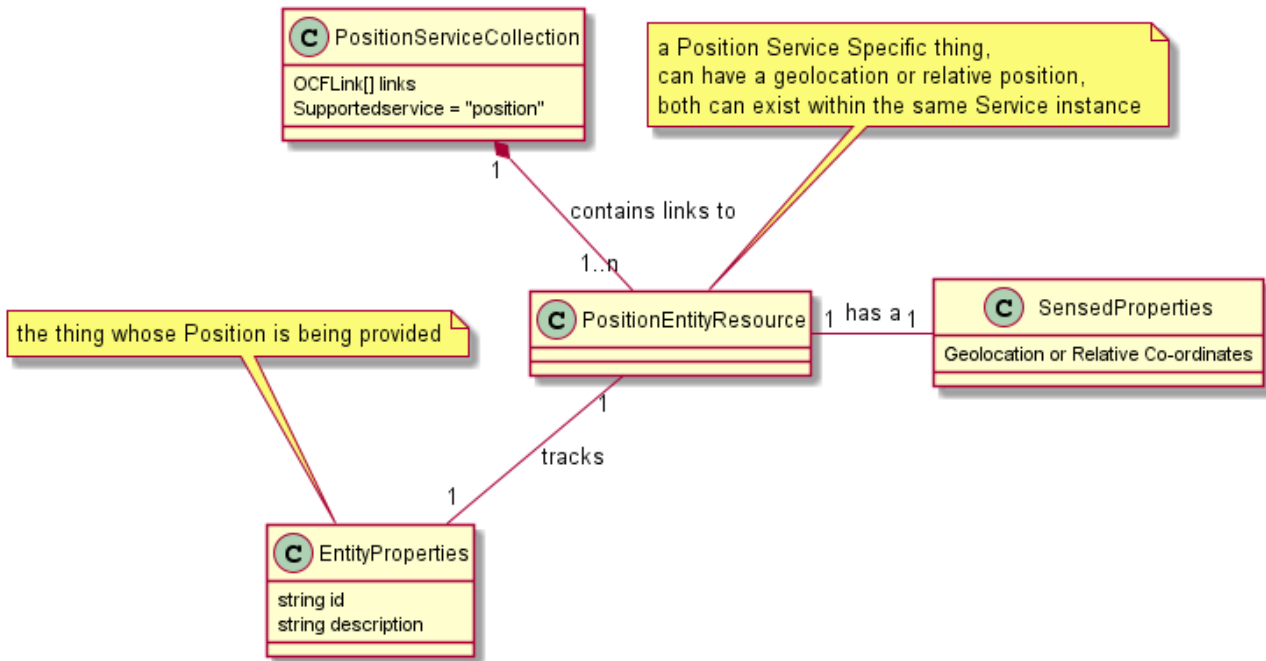


Figure 6 – Position Service Model

Whereby "PositionService" is an instance of "oic.r.locationcollection" that supports the Position Service. The Collection contains Links to Position Service entity Resources ("oic.r.location.entity.position").

A Position Service entity Resource contains Properties that represent the entity whose position is being provided, and the position of the entity using either the entity's determined geolocation (i.e. latitude, longitude, altitude) or using the entity's determined position within some other co-ordinate system (i.e. relative to some known point, typically used for indoor applications).

1.2.4.4.2 Position Service Resource Definitions

Table 11 lists the Resource Types that are exposed by the Position Service. Table 12 lists the Properties for the "oic.r.location.entity.position" Resource Type, Table 13 lists the Properties for the "oic.r.sensor.position" Resource Type.

Table 10. Position Service Resources

Example URI	Resource Type Title	Resource Type ID ("rt" value)	Interfaces	Description	Related Functional Interaction
"example/location/entity/positionURI"	Position Entity	"oic.r.location.entity.position"	"oic.if.rw" "oic.if.baseline"	This Resource is a specialisation of a location entity for Position Service entities. The Properties exposed by Resource Type "oic.r.location.entity.position" are listed in Table 12.	Location Services

Table 11. "oic.r.location.entity.position" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Entity ID	entityid	string	See Table 3		RW	yes	See Table 3
Entity Description	entitydescription	string	See Table 3		RW	yes	See Table 3
Either the Properties of "oic.r.sensor.position" defined in clause 6.xx or the Properties of "oic.r.sensor.geolocation" defined in clause 6.62 as illustrated below							
Properties as defined in "oic.r.sensor.position"							
Origin	origin	String	See clause 6.xx ("oic.r.sensor.position")		R	no	See clause 6.xx ("oic.r.sensor.position")
X Co-ordinate	x	number	See clause 6.xx ("oic.r.sensor.position")		R	yes	See clause 6.xx ("oic.r.sensor.position")
Y Co-ordinate	y	number	See clause 6.xx ("oic.r.sensor.position")		R	yes	See clause 6.xx ("oic.r.sensor.position")
Z Co-ordinate	z	number	See clause 6.xx ("oic.r.sensor.position")		R	yes	See clause 6.xx ("oic.r.sensor.position")
Accuracy	accuracy	number	See clause 6.xx ("oic.r.sensor.position")		R	no	See clause 6.xx ("oic.r.sensor.position")
Altitude Accuracy	altitudeaccuracy	number	See clause 6.xx ("oic.r.sensor.position")		R	no	See clause 6.xx ("oic.r.sensor.position")
Measurement Method	measurementmethod	String	See clause 6.xx ("oic.r.sensor.position")		R	no	See clause 6.xx ("oic.r.sensor.position")
Timestamp	timestamp	String	See clause 6.86		R	yes	See clause 6.86 ("oic.r.time.stamp")
Properties as defined in "oic.r.sensor.geolocation"							
Latitude	latitude	number	See clause 6.62 ("oic.r.geolocation")		R	yes	See clause 6.62 ("oic.r.geolocation")
Longitude	longitude	number	See clause 6.62 ("oic.r.geolocation")		R	yes	See clause 6.62 ("oic.r.geolocation")
Altitude	alt	number	See clause 6.60 ("oic.r.altimeter")		R	yes	See clause 6.60 ("oic.r.altimeter")

Accuracy	accuracy	number	See clause 6.62 ("oic.r.geolocation")		R	no	See clause 6.62 ("oic.r.geolocation")
Altitude Accuracy	altitudeaccuracy	number	See clause 6.62 ("oic.r.geolocation")		R	no	See clause 6.62 ("oic.r.geolocation")
Heading	heading	number	See clause 6.62 ("oic.r.geolocation")		R	no	See clause 6.62 ("oic.r.geolocation")
Speed	speed	number	See clause 6.62 ("oic.r.geolocation")		R	no	See clause 6.62 ("oic.r.geolocation")
Measurement Method	measurementmethod	string	See clause 6.62 ("oic.r.geolocation")		R	no	See clause 6.62 ("oic.r.geolocation")
Timestamp	timestamp	string	See clause 6.86		R	yes	See clause 6.86 ("oic.r.time.stamp")

1.2.4.5 Distance Service Model

1.2.4.5.1 Distance Service Model Introduction

Figure 6 describes an example Resource model for an instance of the Distance Service

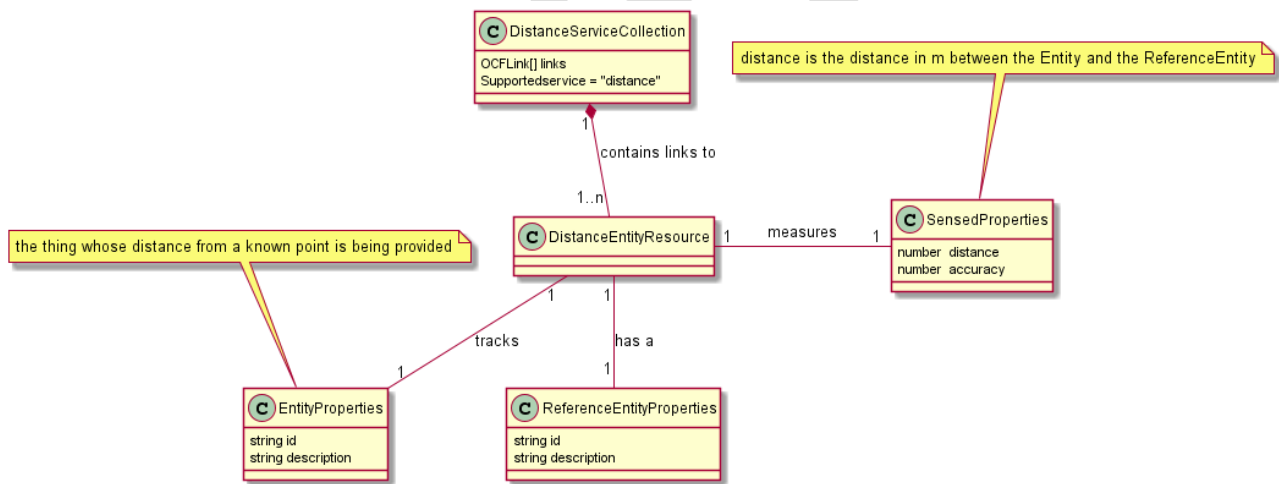


Figure 7 – Distance Service Model

Whereby "DistanceService" is an instance of "oic.r.locationcollection" that supports the Distance Service. The Collection contains Links to Distance Service entity Resources ("oic.r.location.entity.distance").

A Distance Service entity Resource contains Properties that represent the entity whose distance from some known point is being calculated, the reference entity (i.e. the known point), and the determined distance between the entity and the reference entity in metres.

1.2.4.5.2 Distance Service Resource Description

Table 14 lists the Resource Types that are exposed by the Distance Service. Table 15 lists the Properties for the "oic.r.location.entity.distance" Resource Type, Table 16 lists the Properties for the "oic.r.sensor.distance" Resource Type.

Table 12. Distance Service Resources

Example URI	Resource Type Title	Resource Type ID ("rt" value)	Interfaces	Description	Related Functional Interaction
"example/locationentitydistanceURI"	Distance Entity	"oic.r.location.entity.distance"	"oic.if.rw" "oic.if.baseline"	This Resource is a specialisation of a location entity for Distance Service entities. The Properties exposed by Resource Type "oic.r.location.entity.distance" are listed in Table 15.	Location Services

Table 13. "oic.r.location.entity.distance" Resource Type definition

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
Reference Entity	referenceentity	object	See Table 3		R	yes	Instance of "oic.r.location.entity"
Entity	entity	object	See Table 3		R	yes	Instance of "oic.r.location.entity"
Timestamp	timestamp	string	See clause 6.86 ("oic.r.time.stamp")		R	yes	See clause 6.86 ("oic.r.time.stamp")
Distance	distance	number		metres	R	yes	Distance between the entity and a reference entity
Measurement Method	measurementmethod	string			R	No	Descriptive indicator of the method used to determine the distance
Accuracy	accuracy	number		metres	R	no	68% confidence distance

1.2.5 Security Considerations

Please refer to the OCF Security Specification.

1.2.6 Example Sequence Diagram

Figure 7 is an illustrative example sequence showing how a Client interacts with a Server that supports Location Services.

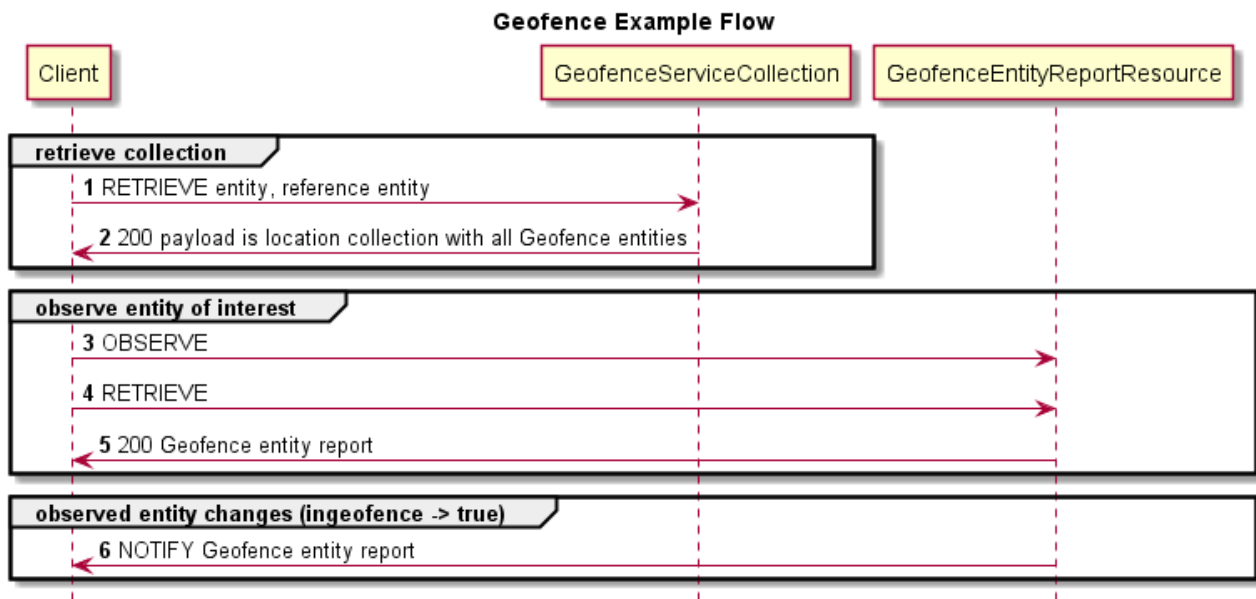


Figure 8 – Example Interaction with an instance of a Geofence Service

In this example, the Client retrieves all the matching entities by passing the "entity", "referenceentity", and "geofenceradius" Properties as query parameters. Any missing Property is treated as a wildcard and matches all entities. To get all known Geofence Service entity Resources, a RETRIEVE with no parameters can be issued.

The Server responds with the Geofence Service entity Resources that match the requested parameters.

Further, if the Client is interested in state changes with respect to the entities being tracked then the Client sends an Observe request to the entity Resources and entity report Resources in which it is interested. Note that there is a single instance of a Geofence entity report Resource per tracked entity. The Resource is updated (and thus a NOTIFY is sent to any registered observers) whenever a status change takes place with respect to the tracked entity entering or leaving the Geofence.