

**OCF Jakarta+ – IDD resolution for devices behind a proxy – Core Technology WG  
CR 3365**

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## 1.1 Introspection

### Overview

Introspection is a mechanism to announce the capabilities of Resources hosted on the Device.

The intended usage of the Introspection Device Data (IDD) is to enable dynamic Clients e.g. Clients that can use the IDD) to generate dynamically a UI or dynamically create translations of the hosted Resources to another eco-system. Other usages of Introspection is that the information can be used to generate Client code. The IDD is designed to augment the existing data already on the wire. This means that existing mechanisms need to be used to get a full overview of what is implemented in the Device. For example, the IDD does not convey information about Observability, since that is already conveyed with the "p" Property on the Links in "/oic/res" (see 7.8.2.5.3).

The IDD is recommended to be conveyed as static data. Meaning that the data does not change during the uptime of a Device. However, when the IDD is not static, the Introspection Resource shall be Observable and the url Property Value of "oic.wk.introspection" Resource shall change to indicate that the IDD is changed.

The IDD describes the Resources that make up the Device. For the complete list of included Resources see Table 21. The IDD is described as a OpenAPI 2.0 in JSON format file. The text in the following bulleted list contains OpenAPI 2.0 terms, such as paths, methods etc. The OpenAPI 2.0 file shall contain the description of the Resources:

- The IDD will use the HTTP syntax, e.g., define the CRUDN operation as HTTP methods and use the HTTP status codes.
- The IDD does not have to define all the status codes that indicate an error situation.
- The IDD does not have to define a schema when the status code indicates that there is no payload (see HTTP status code 204 as an example).
- The paths (URLs) of the Resources in the IDD shall be without the OCF Endpoint description, e.g. it shall not be a fully-qualified URL but only the relative path from the OCF Endpoint, aka the "href". The relative path may include a query parameter (e.g. "?if=oic.if.ll"), in such cases the text following (and including) the "?" delimiter shall be removed before equating to the "href" that is conveyed by "/oic/res".
- The following Resources shall be excluded in the IDD:
  - Resource with Resource Type: "oic.wk.res" unless 3rd party defined or optional Properties are implemented.
  - Resource with Resource Type: "oic.wk.introspection".
  - Resources explicitly identified within other specifications working in conjunction with this document (e.g. Resources that handle Wi-Fi Easy Setup, see [2]).
- The following Resources shall be included in the IDD when optional or 3<sup>rd</sup> party defined Properties are implemented:
  - Resources with type: "oic.wk.p" and "oic.wk.d" (e.g. discovery related Resources).
  - Security Virtual Resources from ISO/IEC 30118-2.
- When the Device does not expose instances of Vertical Resource Types, and does not have any 3<sup>rd</sup> party defined Resources (see 7.8.4.4), and does not need to include Resources in the IDD due to other clauses in this clause, then the IDD shall be an empty OpenAPI 2.0 file. An example of an empty OpenAPI 2.0 file can be found in found in Annex **B.2**.

- All other Resources that are individually addressable by a Client (i.e. the "href" can be resolved and at least one operation is supported with a success path response) shall be listed in the IDD.
- Per Resource the IDD shall include:
  - All implemented methods
    - For an OCF defined Resource Type, only the methods that are listed in the OpenAPI 2.0 definition are allowed to exist in the IDD. For an OCF defined Resource Type, methods not listed in the OpenAPI 2.0 definition shall not exist in the IDD. The supported methods contained in the IDD shall comply with the listed OCF Interfaces. For example, if the POST method is listed in the IDD, then an OCF Interface that allows UPDATE will be listed in the IDD.
  - Per supported method:
    - Implemented query parameters per method.
      - This includes the supported OCF Interfaces ("if") as enum values.
    - Schemas of the payload for the request and response bodies of the method.
    - Where the schema provides the representation of a batch request or response ("oic.if.b") the schema shall contain the representations for all Resource Types that may be included within the batch representation. The representations shall be provided within the IDD itself.
    - The schema data shall be conveyed by the OpenAPI 2.0 schema.
    - The OpenAPI 2.0 schema object shall comply with:
      - The schemas shall be fully resolved, e.g. no references shall exist outside the OpenAPI 2.0 file.
      - The schemas shall list which OCF Interfaces are supported on the method.
      - The schemas shall list if a Property is optional or required.
      - The schemas shall include all Property validation keywords. Where an enum is defined the enum shall contain the values supported by the Device. When vendor defined extensions exist to the enum (defined in accordance to 7.8.4.4) these shall be included in the enum.
      - The schemas shall indicate if an Property is read only or read-write.
        - By means of the readOnly schema tag belonging to the Property.
        - Default value of readOnly is false as defined by OpenAPI 2.0.
      - The default value of the "rt" Property shall be used to indicate the supported Resource Types.
      - oneOf and anyOf constructs are allowed to be used as part of a OpenAPI 2.0 schema object. The OpenAPI 2.0 schema with oneOf and anyOf constructs can be found in Annex **B.1**.
- For Atomic Measurements (see clause 7.8.4), the following apply:
  - The "rts" Property Value in the IDD shall include only the Resource Types the instance contains and not the theoretical maximal set allowed by the schema definition.
  - The Resources that are part of an Atomic Measurement, excluding the Atomic Measurement Resource itself, shall not be added to their own individual path in the IDD, as they are not individually addressable; however, the schemas for the composed Resource Types shall be provided in the IDD as part of the batch response definition along with the "href" for the Resource.

Dynamic Resources (e.g. Resources that can be created on a request by a Client) shall have a URL definition which contains a URL identifier (e.g. using the {} syntax). A URL with {} identifies that the Resource definition applies to the whole group of Resources that may be created. The actual path may contain the Collection node that links to the Resource.

Example of a URL with identifiers:

```
/SceneListResURI/{SceneCollectionResURI}/{SceneMemberResURI}:
```

When different Resource Types are allowed to be created in a Collection, then the different schemas for the CREATE method shall define all possible Resource Types that may be created. The schema construct `oneOf` allows the definition of a schema with selectable Resources. The `oneOf` construct allows the integration of all schemas and that only one existing sub schema shall be used to indicate the definition of the Resource that may be created.

Example usage of `oneOf` JSON schema construct is shown in Figure 13:

```
{
  "oneOf": [
    { <<subschema 1 definition>> },
    { << sub schema 2 definition >> }
  ]
}
```

**Figure 1 – Example usage of oneOf JSON schema**

A Client using the IDD of a Device should check the version of the supported IDD of the Device. The OpenAPI 2.0 version is indicated in each file with the tag "swagger". Example of the 2.0 supported version of the tag is: "swagger": "2.0". Later versions of this document may reference newer versions of the OpenAPI specification, for example 3.0.

A Device shall support one Resource with a Resource Type of "oic.wk.introspection" as defined in Table 27. The Resource with a Resource Type of "oic.wk.introspection" shall be included in the Resource "/oic/res".

An empty IDD file, e.g. no URLs are exposed, shall still have the mandatory OpenAPI 2.0 fields. See OpenAPI specification. An example of an empty OpenAPI 2.0 file can be found in found in Annex B.2.

**Table 1 – Introspection Resource**

Pre-defined URI	Resource Type Title	Resource Type ID ("rt" value)	OCF Interfaces	Description	Related Functional Interaction
none	Introspection	"oic.wk.introspection"	"oic.if.r"	The Resource that announces the URL of the Introspection file.	Introspection

Table 28 defines "oic.wk.introspection" Resource Type.

**Table 2 – "oic.wk.introspection" Resource Type definition**

Property title	Property name	Value type	Value rule	Unit	Access mode	Mandatory	Description
urlInfo	"urlInfo"	"array"	N/A	N/A	R	Yes	array of objects
url	"url"	"string"	"uri"	N/A	R	Yes	URL to the hosted payload

<b>protocol</b>	"protocol"	"string"	"enum"	N/A	R	Yes	Protocol definition to retrieve the Introspection Device Data from the url.
<b>content-type</b>	"content-type"	"string"	"enum"	N/A	R	No	content type of the url.
<b>version</b>	"version"	"integer"	"enum"	N/A	R	No	Version of the Introspection protocol, indicates which rules are applied on the Introspection Device Data regarding the content of the OpenAPI 2.0 file. Current value is 1.

If the IDD is hosted on the local Device, then an additional "url" specified as an OCF URI should be listed.

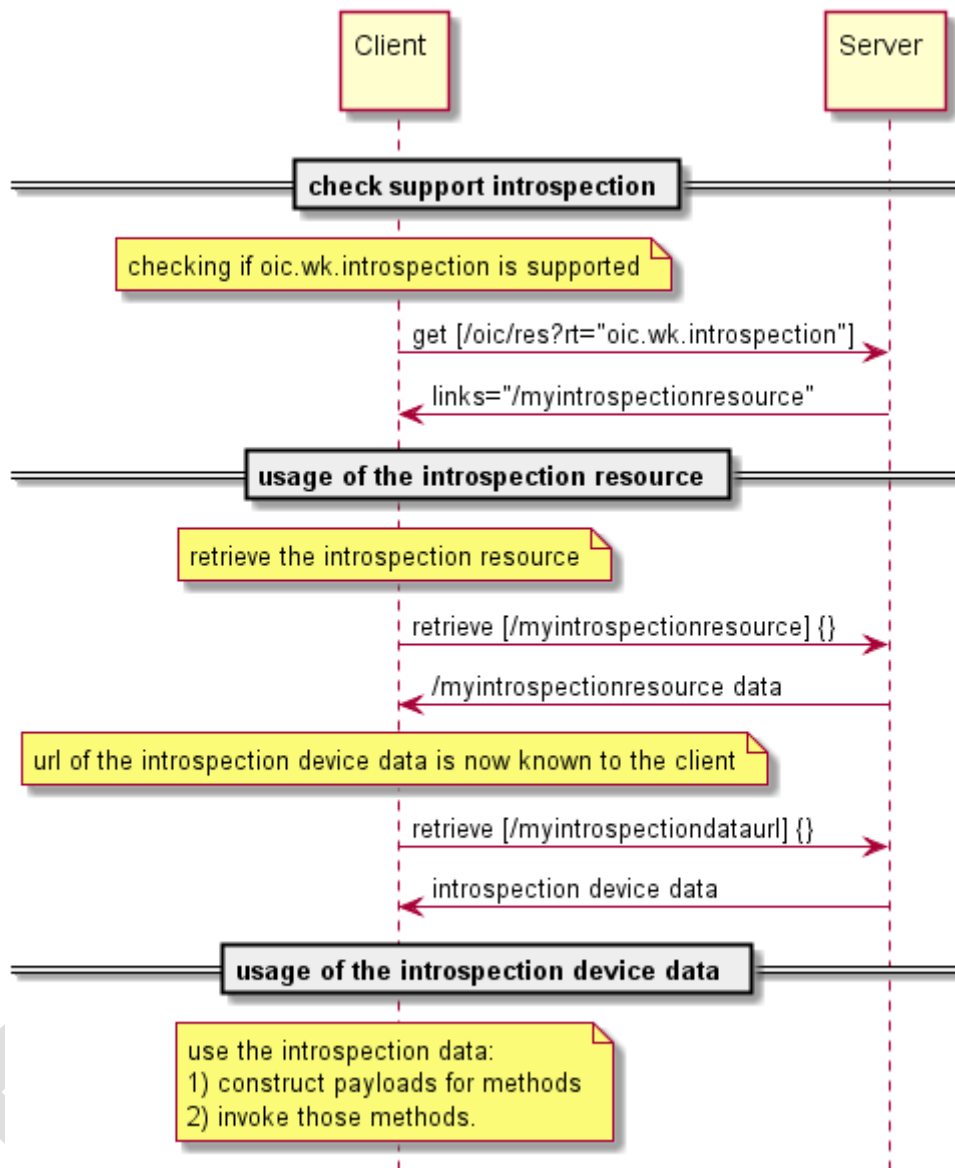
Example payload with an entry using a scheme of "coap" and an entry with an OCF URI:

```
{
  "rt": ["oic.wk.introspection"],
  "urlInfo": [
    {
      "content-type": "application/cbor",
      "protocol": "coap",
      "url": "coap://[fe80::1]:1234/IntrospectionExampleURI"
    },
    {
      "content-type": "application/cbor",
      "protocol": "coap",
      "url": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9/IntrospectionExampleURI"
    }
  ]
}
```

### Usage of Introspection

The Introspection Device Data is retrieved in the following steps and as depicted in Figure 14:

- Check if the Introspection Resource is supported and retrieve the URL of the Resource.
- Retrieve the contents of the Introspection Resource
- Download the Introspection Device Data from the URL specified the Introspection Resource.
- Usage of the Introspection Device Data by the Client



**Figure 2 – Interactions to check Introspection support and download the Introspection Device Data.**