

OCF 2.0 – Constrained Device Support OIC 1.1 – Core Technology WG CR 2413

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7.8.2 Resource Relationships

Resource relationships are expressed as Links. A Link embraces and extends typed web links concept as a means of expressing relationships between Resources. A Link consists of a set of Parameters that define:

- a context URI,
- a target URI,
- a relation from the context URI to the target URI
- elements that provide metadata about the target URI, the relationship or the context of the Link.

The target URI is mandatory and the other items in a Link are optional. Additional items in the Link may be made mandatory based on the use of the links in different contexts (e.g. in collections, in discovery, in bridging etc.). Schema for the Link payload is provided in **Error! Reference source not found.**

An example of a Link is shown in:

```
{"href": "/switch", "rt": ["oic.r.switch.binary"], "if": ["oic.if.a", "oic.if.baseline"],  
"p": {"bm": 3}, "rel": "item"}
```

Two Links are distinct from each other when at least one parameter is different. For example the two Links shown below are distinct and can appear in the same list of Links.

```
{"href": "/switch", "rt": ["oic.r.switch.binary"], "if": ["oic.if.a", "oic.if.baseline"],  
"p": {"bm": 2}, "rel": "item"}
```

```
{"href": "/switch", "rt": ["oic.r.switch.binary"], "if": ["oic.if.a", "oic.if.baseline"],  
"p": {"bm": 2}}
```

The specification may mandate Parameters and Parameter values as required for certain capabilities. For all Links returned in a response to a RETRIEVE on "/oic/res", if a Link does not explicitly include the "rel" Parameter, a value of "rel"="hosts" shall be assumed. The relation value of "hosts" is defined by **Error! Reference source not found.**, the value of "item" by **Error! Reference source not found.**, and the value of "self" by **Error! Reference source not found.** and all are registered in the IANA Registry for Link Relations defined in **Error! Reference source not found.**

As shown in **Error! Reference source not found.** the relation between the context URI and target URI in a Link is specified using the "rel" JSON element and the value of this element specifies the particular relation.

The context URI of the Link shall implicitly be the URI of the Resource (or specifically a Collection) that contains the Link unless the Link specifies the anchor parameter. The anchor parameter is used to change the context URI of a Link – the relationship with the target URI is based off the anchor URI when the anchor is specified. Anchor parameter uses OCF URI defined in Sec 6 for OCF 1.0 Links (e.g. "anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989"). For optional backward compatibility with OIC 1.1, anchor parameter uses transfer protocol URI for OIC 1.1 Link (e.g. "anchor": "coaps://[fe80::b1d6]:44444").

...

10.2.4 Endpoint information in "eps" Parameter

To carry Endpoint information, a new Link Parameter "eps" is defined in **Error! Reference source not found**. "eps" has an array of items as its value and each item represents Endpoint information with two key-value pairs, "ep" and "pri", of which "ep" is mandatory and "pri" is optional.

Endpoint Information in an "eps" Parameter is valid for the target Resource of the Link, i.e., the Resource referred by "href" Parameter. Endpoint information in an "eps" Parameter may be used to access other Resources on the Device, but such access is not guaranteed.

A Link with "eps":

```
{
  "anchor": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9 ",
  "href": "/myLightSwitch",
  "rt": ["oic.r.switch.binary"],
  "if": ["oic.if.a", "oic.if.baseline"],
  "p": {"bm": 3},
  "eps": [{"ep": "coap://[fe80::b1d6]:1111", "pri": 2}, {"ep":
"coaps://[fe80::b1d6]:1122"}]
}
```

In the previous example, "anchor" represents the hosting OCF Device, "href", target Resource and "eps" the two Endpoints for the target Resource.

If the target Resource of a Link requires a secure connection (e.g. CoAPS), "eps" Parameter shall be used to indicate the necessary information (e.g. port number) in OCF 1.0 payload. For optional backward compatibility with OIC 1.1, the "sec" and "port" shall only be used in OIC 1.1 payload.

Annex E
(informative)

OIC 1.1 Resource Type definitions

...

12.2.6 Content-Format policy

All Devices shall support the current Content-Format Option, "application/vnd.ocf+cbor", and OCF-Content-Format-Version "1.0.0".

For backward compatibility with previous OCF-Content-Format-Version Options:

- All Client Devices shall support OCF-Content-Format-Version Option set to "1.0.0" and above.
- All Client Devices shall support OCF-Accept-Content-Format-Version Option set to "1.0.0" and above.
- A Client shall send a discovery request message with its Accept Option set to "application/vnd.ocf+cbor", and its OCF-Accept-Content-Format-Version Option matching its highest supported version.
- A Server shall respond to a Client's discovery request that is higher than its OCF-Content-Format-Version by responding with its Content-Format Option set to "application/vnd.ocf+cbor", and OCF-Content-Format-Version matching its highest supported version. The response representation shall be encoded with the OCF-Content-Format-Version matching the Server's highest supported version.
- A Server may support previous Content-Formats and OCF-Content-Format-Versions to support backward compatibility with previous versions.
- For a Server that supports multiple OCF-Content-Format-Version Options, the Server should attempt to respond with an OCF-Content-Format-Version that matches the OCF-Accept-Content-Format-Version of the request.

For optional backward compatibility with OIC 1.1:

- All Devices that claim backward compatibility to the OIC 1.1 specification shall support the "application/cbor" media type.
- For a Client supporting backward compatibility with OIC 1.1, the Client shall send a discovery request with its Accept Option set to "application/cbor" in response to an error from an OIC 1.1 Server.
- A Server supporting OIC 1.1 compatibility shall handle a Client request containing the Accept Option ="application/cbor" by responding with its Content-Format Option set to "application/cbor" and no OCF-Content-Format-Version Option.
- For more OIC 1.1 information see Annex E

To maintain compatibility between Devices implemented to different versions of this specification, Devices should follow the policy as described in Figure 28, Figure 29 and Figure 30.

The OIC 1.1 Clients and Servers represented below support sending Content-Format Option set to "application/cbor" and Accept Option set to "application/cbor". The OIC 1.1 Clients and Servers do not support OCF-Content-Format-Version Option, nor the OCF-Accept-Content-Format-Version Option. The OCF Clients below support sending Content-Format Option set to "application/vnd.ocf+cbor", Accept Option set to "application/vnd.ocf+cbor", OCF-Content-Format-Version Option set to "1.0.0", and OCF-Accept-Content-Format-Version Option set to "1.0.0" (representing OCF 1.0 and later Clients). The OCF Servers below support sending Content-Format Option set to "application/vnd.ocf+cbor" and OCF-Content-Format-Version Option set to "1.0.0" (representing OCF 1.0 and later Servers).

```

@startuml
hide footbox
skinparam shadowing false
skinparam dpi 300

Participant "OIC 1.1 Client" as Client1.1
Participant "OCF Server" as ServerOCF
Participant "OCF Server with previous\n Content-Format Option support" as ServerOCFCompat

== OCF Server behavior ==
Client1.1 -> ServerOCF: GET /oic/res with Accept="application/cbor"
ServerOCF -> Client1.1: error
== OCF Server supporting optional backward compatibility behavior ==
Client1.1 -> ServerOCFCompat: GET /oic/res with Accept="application/cbor"
ServerOCFCompat -> Client1.1: /oic/res response with Content-Format="application/cbor"
@enduml

```

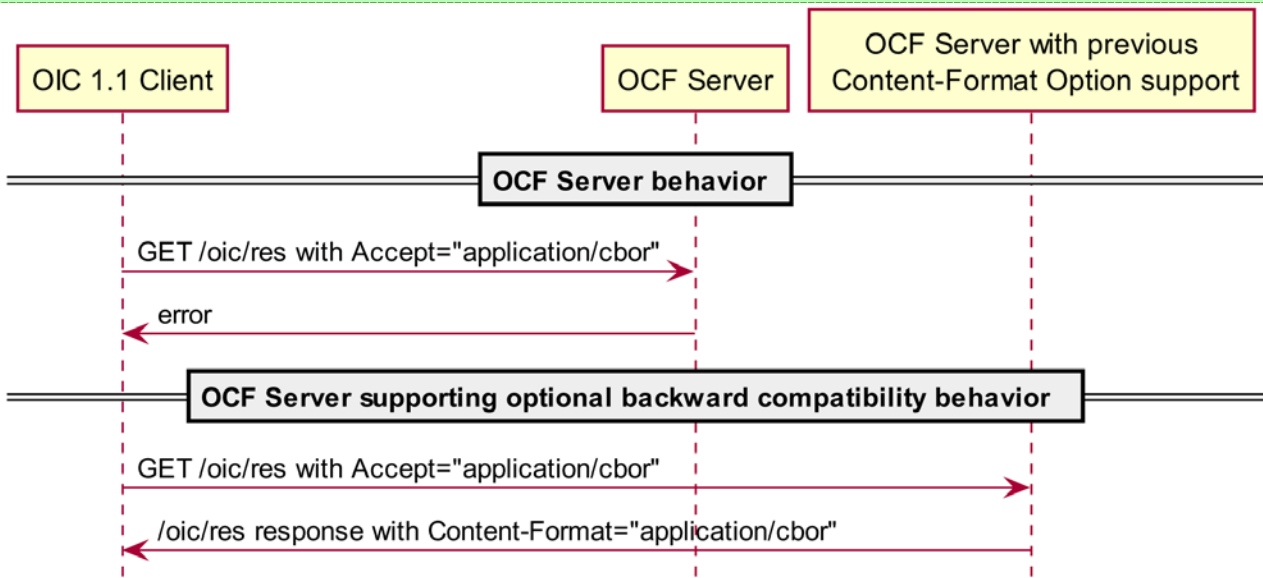


Figure 1 Content-Format Policy for OCF Servers supporting error responses and backward compatibility responses

```

@startuml
hide footbox
skinparam shadowing false
skinparam dpi 300

Participant "OCF Client" as ClientOCF
Participant "OCF Client with previous\n Content-Format Option support" as ClientOCFCompat
Participant "OIC 1.1 Server" as Server1.1

== OIC 1.1 Server behavior ==
ClientOCF -> Server1.1: GET /oic/res with Accept="application/vnd.ocf+cbor" and OCF-Accept-Content-Format-Version="1.0.0"
Server1.1 -> ClientOCF: error
ClientOCFCompat -> Server1.1: GET /oic/res with Accept="application/vnd.ocf+cbor" and OCF-Accept-Content-Format-Version="1.0.0"

```

```
Server1.1 -> ClientOCFCompat: error
ClientOCFCompat -> Server1.1: GET /oic/res with Accept="application/cbor"
Server1.1 -> ClientOCFCompat: /oic/res response with Content-Format="application/cbor"
```

@enduml

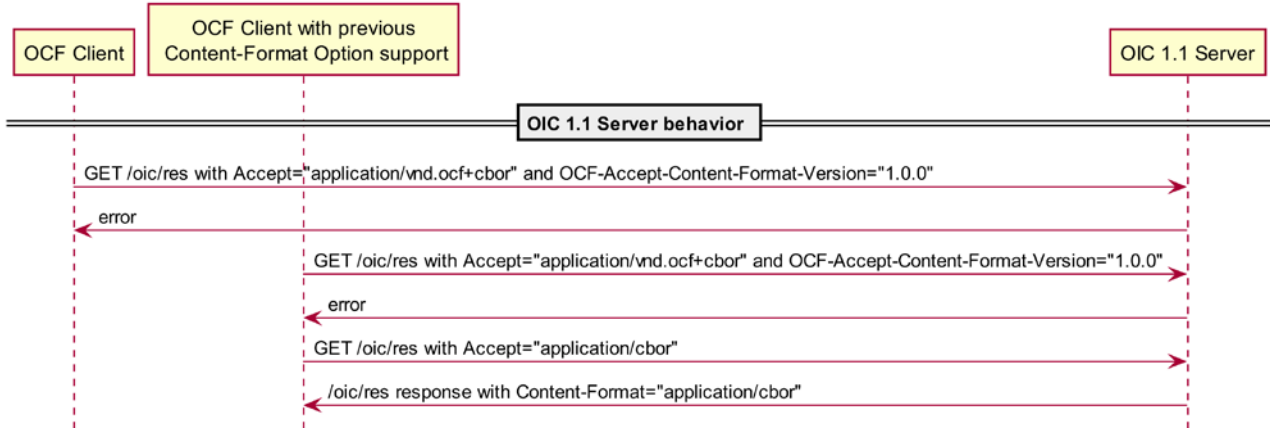


Figure 2 Content-Format Policy for OCF Clients supporting error responses and backward compatibility responses

```
@startuml
hide footbox
skinparam shadowing false
skinparam dpi 300

Participant "OCF Client with newer\n OCF-Content-Format-Version\n (supports <U+0022>1.0.0<U+0022> for compatibility)" as ClientFuture
Participant "OCF Server\n (only supports <U+0022>1.0.0<U+0022>)" as ServerOCF

==OCF Server behavior ==
ClientFuture -> ServerOCF: GET /oic/res with Accept="application/vnd.ocf+cbor" and OCF-Accept-Content-Format-Version="7.5.2"
ServerOCF -> ClientFuture: /oic/res response with Content-Format="application/vnd.ocf+cbor" and OCF-Content-Format-Version="1.0.0"
```

@enduml

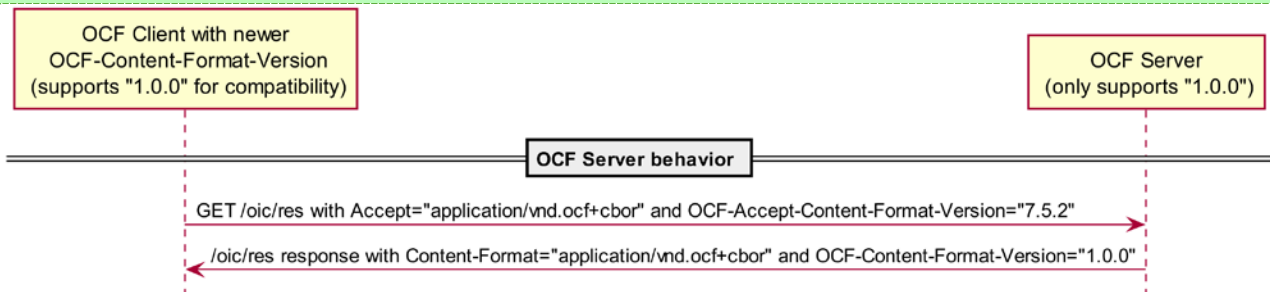


Figure 3 Content-Format Policy for backward compatible OCF Clients negotiating lower OCF-Content-Format-Version

7.8.2.1.3 “type” or Media Type Parameter

The “type” Parameter may be used to specify the various media types that are supported by a specific target Resource. The default type of "application/vnd.ocf+cbor" shall be used when the “type” element is omitted. Once a Client discovers this information for each Resource, it may use one of the available representations in the appropriate header field of the Request or Response.

7.8.2.1.4 “di” or Device ID parameter

The “di” Parameter specifies the device ID of the Device that hosts the target Resource defined in the in the “href” Parameter.

The device ID may be used to qualify a relative reference used in the “href” or to lookup OCF Endpoint information for the relative reference.

7.8.2.1.5 “eps” Parameter

The "eps" Parameter indicates the OCF Endpoint information of the target Resource.

"eps" shall have as its value an array of items and each item represents OCF Endpoint information with "ep" and "pri" as specified in 10.2. "ep" is mandatory but "pri" is optional.

Example of "eps" with multiple OCF Endpoints:

```
"eps": [  
  { "ep": "coap://[fe80::b1d6]:1111", "pri": 2 },  
  { "ep": "coaps://[fe80::b1d6]:1122" },  
  { "ep": "coap+tcp://[2001:db8:a::123]:2222", "pri": 3 }  
]
```

When "eps" is present in a link, the OCF Endpoint information in "eps" can be used to access the target Resource referred by the "href" Parameter.

Note that the type of OCF Endpoint – Secure or Unsecure – that a Resource exposes merely determines the connection type(s) guaranteed to be available for sending requests to the Resource. For example, if a Resource only exposes a single CoAP “ep”, it does not guarantee that the Resource cannot also be accessed via a Secure Endpoint (e.g. via a CoAPS “ep” from another Resource’s “eps” information). Nor does exposing a given type of OCF Endpoint ensure that access to the Resource will be granted using the “ep” information. Whether requests to the Resource are granted or denied by the Access Control layer is separate from the “eps” information, and is determined by the configuration of the /acl2 Resource (see OCF Security specification section 13.4.2 for details).

When present, max-age information (e.g. Max-Age option for CoAP defined in IETF RFC 7252) determines the maximum time "eps" values may be cached before they are considered stale.

7.8.2.2 Formatting

When formatting in JSON, the list of Links shall be an array.

7.8.2.3 List of Links in a Collection

A Resource that exposes one or more Properties that are defined to be an array of Links where each Link can be discretely accessed is a Collection. The Property Name “links” is recommended for such an array of Links.

A Resource with a list of Links:

```
/Room1
{
  "rt": ["my.room"],
  "if": ["oic.if.ll", "oic.if.baseline" ],
  "color": "blue",
  "links":
  [
    {
      "href": "/oic/d",
      "rt": ["oic.d.light", "oic.wk.d"],
      "if": [ "oic.if.r", "oic.if.baseline" ],
      "p": {"bm": 1}
    },
    {
      "href": "/oic/p",
      "rt": ["oic.wk.p"],
      "if": [ "oic.if.r", "oic.if.baseline" ],
      "p": {"bm": 1}
    },
    {
      "href": "/switch",
      "rt": ["oic.r.switch.binary"],
      "if": [ "oic.if.a", "oic.if.baseline" ],
      "p": {"bm": 3},
      "mt": [ "application/vnd.ocf+cbor", "application/exi+xml" ]
    },
    {
      "href": "/brightness",
      "rt": ["oic.r.light.brightness"],
      "if": [ "oic.if.a", "oic.if.baseline" ],
      "p": {"bm": 3}
    }
  ]
}
```