

OCF 2.3 (“Cleveland”) – Endpoint with DNS name – CTWG CR2356

Legal Disclaimer

THIS IS A DRAFT SPECIFICATION DOCUMENT ONLY AND HAS NOT BEEN ADOPTED BY THE OPEN CONNECTIVITY FOUNDATION. THIS DRAFT DOCUMENT MAY NOT BE RELIED UPON FOR ANY PURPOSE OTHER THAN REVIEW OF THE CURRENT STATE OF THE DEVELOPMENT OF THIS DRAFT DOCUMENT. THE OPEN CONNECTIVITY FOUNDATION AND ITS MEMBERS RESERVE THE RIGHT WITHOUT NOTICE TO YOU TO CHANGE ANY OR ALL PORTIONS HEREOF, DELETE PORTIONS HEREOF, MAKE ADDITIONS HERETO, DISCARD THIS DRAFT DOCUMENT IN ITS ENTIRETY OR OTHERWISE MODIFY THIS DRAFT DOCUMENT AT ANY TIME. YOU SHOULD NOT AND MAY NOT RELY UPON THIS DRAFT DOCUMENT IN ANY WAY, INCLUDING BUT NOT LIMITED TO THE DEVELOPMENT OF ANY PRODUCTS OR SERVICES. IMPLEMENTATION OF THIS DRAFT DOCUMENT IS DONE AT YOUR OWN RISK AMEND AND IT IS NOT SUBJECT TO ANY LICENSING GRANTS OR COMMITMENTS UNDER THE OPEN CONNECTIVITY FOUNDATION INTELLECTUAL PROPERTY RIGHTS POLICY OR OTHERWISE. IN CONSIDERATION OF THE OPEN CONNECTIVITY FOUNDATION GRANTING YOU ACCESS TO THIS DRAFT DOCUMENT, YOU DO HEREBY WAIVE ANY AND ALL CLAIMS ASSOCIATED HERewith INCLUDING BUT NOT LIMITED TO THOSE CLAIMS DISCUSSED BELOW, AS WELL AS CLAIMS OF DETRIMENTAL RELIANCE.

The OCF logo is a trademark of Open Connectivity Foundation, Inc. in the United States or other countries. *Other names and brands may be claimed as the property of others.

Copyright © 2018 Open Connectivity Foundation, Inc. All rights reserved.

Copying or other form of reproduction and/or distribution of these works are strictly prohibited.

***** Paste the Change Request content here *****

10.1 OCF Endpoint definition

The specific definition of an OCF Endpoint depends on the Transport Protocol Suite being used. For the example of CoAP over UDP over IPv6, the OCF Endpoint is identified by an IPv6 address and UDP port number.

Each OCF Device shall associate with at least one OCF Endpoint with which it can exchange request and response messages. When a message is sent to an OCF Endpoint, it shall be delivered to the OCF Device which is associated with the OCF Endpoint. When a request message is delivered to an OCF Endpoint, path component is enough to locate the target Resource.

OCF Device can be associated with multiple OCF Endpoints. For example, an OCF Device can have several IP addresses or port numbers or support both CoAP and HTTP transfer protocol. Different Resources in an OCF Device may be accessed with the same OCF Endpoint or need different ones. Some Resources may use one OCF Endpoint and others a different one. It depends on an implementation.

On the other hand, an OCF Endpoint can be shared among multiple OCF Devices, only when there is a way to clearly designate the target Resource with request URI. For example, when multiple CoAP servers use uniquely different URI paths for all their hosted Resources, and the CoAP implementation demultiplexes by path, they can share the same CoAP OCF Endpoint. However, this is not possible in this version of the specification, because a pre-determined URI (e.g. "/oic/d") is mandatory for some mandatory Resources (e.g. "oic.wk.d").

10.2 OCF Endpoint information

10.2.1 Introduction

OCF Endpoint is represented by OCF Endpoint information which consists of two items of key-value pair, "ep" and "pri".

10.2.2 "ep"

"ep" represents Transport Protocol Suite and OCF Endpoint Locator specified as follows:

- **Transport Protocol Suite** - a combination of protocols (e.g. CoAP + UDP + IPv6) with which request and response messages can be exchanged for RESTful transaction (i.e. CRUDN). A Transport Protocol Suite shall be indicated by a URI scheme name. All scheme names supported by this specification are IANA registered, these are listed in Table 17. A vendor may also make use of a non-IANA registered scheme name for their own use (e.g. "com.example.foo"), this shall follow the syntax for such scheme names defined by IETF RFC 7595. The behaviour of a vendor-defined scheme name is undefined by this specification. All OCF defined Resource Types when exposing OCF Endpoint Information in an "eps" (see section 10.2.4) shall include at least one "ep" with a Transport Protocol Suite as defined in Table 17.
- **OCF Endpoint Locator** – an address (e.g. IPv6 address + Port number) or an indirect identifier (e.g., DNS name)resolvable to an IP address, through which a message can be sent to the OCF Endpoint and in turn associated OCF Device. The OCF Endpoint Locator for "coap" and "coaps" shall be specified as "IP address: port number". The OCF Endpoint Locator for "coap+tcp" or "coaps+tcp" shall be specified "IP address: port number" or "DNS name: port number" or "DNS name" such that DNS name shall be resolved to a valid IP address for the target Resource with a name resolution service (i.e., DNS). Also, for the 3rd case, when the port number is omitted, then the default port 5683 (and 5684) shall be assumed for coap+tcp (and coaps+tcp) scheme respectively as in (IETF RFC 8323). Temporary addresses should not be used because OCF Endpoint Locators are for the purpose of accepting incoming sessions, whereas temporary

addresses are for initiating outgoing sessions (IETF RFC 4941). Moreover, its inclusion in "/oic/res" can cause a privacy concern (IETF RFC 7721).

"ep" shall have as its value a URI (as specified in IETF RFC 3986) with the scheme component indicating Transport Protocol Suite and the authority component indicating the OCF Endpoint Locator.

The "ep" example for "coap" and "coaps" is as below

```
"ep": "coap://[fe80::b1d6]:1111"
```

and the "ep" example for "coap+tcp" and "coaps+tcp" is as below.

```
"ep": "coap+tcp://[2001:db8:a::123]:2222"
"ep": "coap+tcp://foo.bar.com:2222"
"ep": "coap+tcp://foo.bar.com"
```

The current list of "ep" with corresponding Transport Protocol Suite is shown in Table 17:

Table 1. "ep" value for Transport Protocol Suite

Transport Protocol Suite	scheme	Endpoint Locator	"ep" Value example
coap + udp + ip	coap	IP address + port number	coap://[fe80::b1d6]:1111
coaps + udp + ip	coaps	IP address + port number	coaps://[fe80::b1d6]:1122
coap + tcp + ip	coap+tcp	IP address + port number DNS name : port number DNS name	coap+tcp://[2001:db8:a::123]:2222 coap+tcp://foo.bar.com:2222 coap+tcp://foo.bar.com
coaps + tcp + ip	coaps+tcp	IP address + port number DNS name : port number DNS name	coaps+tcp://[2001:db8:a::123]:2233 coaps+tcp://foo.bar.com:2233 coap+tcp://foo.bar.com

10.2.3 "pri"

When there are multiple OCF Endpoints, "pri" indicates the priority among them.

"pri" shall be represented as a positive integer (e.g. "pri": 1) and the lower the value, the higher the priority.

The default "pri" value is 1, i.e. when "pri" is not present, it shall be equivalent to "pri": 1.

10.2.4 OCF Endpoint information in "eps" Parameter

To carry OCF Endpoint information, a new Link Parameter "eps" is defined in 7.8.2.1.5. "eps" has an array of items as its value and each item represents OCF Endpoint information with two key-value pairs, "ep" and "pri", of which "ep" is mandatory and "pri" is optional.

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

A Client may resolve "ep" value to an IP address for the target Resource, i.e., the address to access the Device which hosts the target Resource. A valid (transfer protocol) URI for the target Resource can be constructed with the "scheme", "host" and "port" components from "ep" value and "path" component from "href" value.

Links 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"}]
}

{
  "anchor": "ocf:// dc70373c-1e8d-4fb3-962e-017eaa863989",
  "href": "/myTemperature",
  "rt": ["oic.r.temperature"],
  "if": ["oic.if.a", "oic.if.baseline"],
  "p": {"bm": 3},
  "eps": [{"ep": "coap+tcp://foo.bar.com", "pri": 2}, {"ep":
"coaps+tcp://foo.bar.com:1122"}]
}
```

In the previous example, "anchor" represents the hosting OCF Device, "href", target Resource and "eps" the two OCF Endpoints for the target Resource. The (fully-qualified) URIs for the target Resource are

```
coap://[fe80::b1d6]:1111/myLightSwitch
coaps://[fe80::b1d6]:1122/myLightSwitch
coap+tcp://foo.bar.com:5683/myTemperature
coaps+tcp://foo.bar.com:1122/myTemperature
```

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, because "sec" and "port" shall be used only in OIC 1.1 payload.

10.3 OCF Endpoint discovery

10.3.1 Introduction

OCF Endpoint discovery is defined as the process for a Client to acquire the OCF Endpoint information for OCF Device or Resource.

10.3.2 Implicit discovery

If a Device is the source of a CoAP message (e.g. "/oic/res" response), the source IP address and port number may be combined to form the OCF Endpoint Locator for the Device. Along with a "coap" scheme and default "pri" value, OCF Endpoint information for the Device may be constructed.

In other words, an "/oic/res" response message with CoAP may implicitly carry the OCF Endpoint information of the responding Device and in turn all the hosted Resources, which may be accessed with the same transfer protocol of CoAP. In the absence of "eps" Parameter, a Client shall be able to utilize implicit discovery to access the target Resource.

10.3.3 Explicit discovery with "/oic/res" response

OCF Endpoint information may be explicitly indicated with the "eps" Parameter of the Links in "/oic/res".

As in 10.3.2, an "/oic/res" response may implicitly indicate the OCF Endpoint information for some Resources hosted by the responding Device. However implicit discovery, i.e., inference of OCF Endpoint information from CoAP response message, may not work for some Resources on the same Device. For example, some Resources may allow only secure access via CoAPS which requires the "eps" Parameter to indicate the port number. Moreover "/oic/res" may expose a target Resource which belongs to another Device.

When the OCF Endpoint for a target Resource of a Link cannot be implicitly inferred, the "eps" Parameter shall be included to provide explicit OCF Endpoint information with which a Client can access the target Resource. In the presence of "eps" Parameter, a Client shall be able to utilize it to access the target Resource. For "coap" and "coaps", a Client may use the IP address in "ep" value in "eps" Parameter to access the target Resource. For "coap+tcp", "coaps+tcp", a Client may use the IP address in "eps" Parameter or resolve the DNS name in "eps" Parameter to acquire a valid IP address for the target Resource. If "eps" Parameter omits port number, then the default port 5683 (and 5684) shall be assumed for coap+tcp (and coaps+tcp) scheme as in (IETF RFC 8323). To access the target Resource of a Link, a Client may use the "eps" Parameter in the Link, if it is present and fall back on implicit discovery if not.

This applies to the case of "/oic/res" for a Resource Directory or Bridge Device which usually carries the Links for Resources which another Device hosts.

An "/oic/res" response from a Bridge Device with two Bridged Devices, having the "eps" Parameter in Links:

```
[  
{  
  "anchor": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9",
```

```
"href": "/oic/res",
"rel": "self",
"rt": ["oic.wk.res"],
"if": ["oic.if.ll", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:55555"},
        {"ep": "coaps://[2001:db8:a::b1d4]:11111"}]
},
{
"anchor": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9",
"href": "/oic/d",
"rt": ["oic.wk.d", "oic.d.bridge"],
"if": ["oic.if.r", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:55555"},
        {"ep": "coaps://[2001:db8:a::b1d4]:11111"}]
},
{
"anchor": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9",
"href": "/oic/p",
"rt": ["oic.wk.p"],
"if": ["oic.if.r", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:55555"},
        {"ep": "coaps://[2001:db8:a::b1d4]:11111"}]
},
{
"anchor": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9",
"href": "/mySecureMode",
"rt": ["oic.r.securemode"],
"if": ["oic.if.rw", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:11111"}]
},
{
```

```
"anchor": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9",
"href": "/oic/sec/doxm",
"rt": ["oic.r.doxm"],
"if": ["oic.if.baseline"],
"p": {"bm": 1},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:5555"},
        {"ep": "coaps://[2001:db8:a::b1d4]:11111"}]
},
{
"anchor": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9",
"href": "/oic/sec/pstat",
"rt": ["oic.r.pstat"],
"if": ["oic.if.baseline"],
"p": {"bm": 1},
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:11111"}]
},
{
"anchor": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9",
"href": "/oic/sec/cred",
"rt": ["oic.r.cred"],
"if": ["oic.if.baseline"],
"p": {"bm": 1},
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:11111"}]
},
{
"anchor": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9",
"href": "/oic/sec/acl2",
"rt": ["oic.r.acl2"],
"if": ["oic.if.baseline"],
"p": {"bm": 1},
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:11111"}]
},
{
"anchor": "ocf://e61c3e6b-9c54-4b81-8ce5-f9039c1d04d9",
"href": "/myIntrospection",
```

```
"rt": ["oic.wk.introspection"],
"if": ["oic.if.r", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:11111"}]
},
{
"anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
"href": "/oic/res",
"rt": ["oic.wk.res"],
"if": ["oic.if.ll", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:66666"},
{"ep": "coaps://[2001:db8:a::b1d4]:22222"}]
},
{
"anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
"href": "/oic/d",
"rt": ["oic.wk.d", "oic.d.light", "oic.d.virtual"],
"if": ["oic.if.r", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:66666"},
{"ep": "coaps://[2001:db8:a::b1d4]:22222"}]
},
{
"anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
"href": "/oic/p",
"rt": ["oic.wk.p"],
"if": ["oic.if.r", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:66666"},
{"ep": "coaps://[2001:db8:a::b1d4]:22222"}]
},
{
"anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
```

```
"href": "/myLight",
"rt": ["oic.r.switch.binary"],
"if": ["oic.if.a", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:2222"}]
},
{
"anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
"href": "/oic/sec/doxm",
"rt": ["oic.r.doxm"],
"if": ["oic.if.baseline"],
"p": {"bm": 1},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:66666"},
{"ep": "coaps://[2001:db8:a::b1d4]:2222"}]
},
{
"anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
"href": "/oic/sec/pstat",
"rt": ["oic.r.pstat"],
"if": ["oic.if.baseline"],
"p": {"bm": 1},
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:2222"}]
}, {
"anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
"href": "/oic/sec/cred",
"rt": ["oic.r.cred"],
"if": ["oic.if.baseline"],
"p": {"bm": 1},
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:2222"}]
},
{
"anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
"href": "/oic/sec/acl2",
"rt": ["oic.r.acl2"],
"if": ["oic.if.baseline"],
```

```
"p": {"bm": 1},
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:22222"}]
},
{
"anchor": "ocf://dc70373c-1e8d-4fb3-962e-017eaa863989",
"href": "/myLightIntrospection",
"rt": ["oic.wk.introspection"],
"if": ["oic.if.r", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:22222"}]
},
{
"anchor": "ocf://88b7c7f0-4b51-4e0a-9faa-cfb439fd7f49",
"href": "/oic/res",
"rt": ["oic.wk.res"],
"if": ["oic.if.ll", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:77777"},
{"ep": "coaps://[2001:db8:a::b1d4]:33333"}]
},
{
"anchor": "ocf://88b7c7f0-4b51-4e0a-9faa-cfb439fd7f49",
"href": "/oic/d",
"rt": ["oic.wk.d", "oic.d.fan", "oic.d.virtual"],
"if": ["oic.if.r", "oic.if.baseline"],
"p": {"bm": 3},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:77777"},
{"ep": "coaps://[2001:db8:a::b1d4]:33333"}]
},
{
"anchor": "ocf://88b7c7f0-4b51-4e0a-9faa-cfb439fd7f49",
"href": "/oic/p",
"rt": ["oic.wk.p"],
"if": ["oic.if.r", "oic.if.baseline"],
```

```
"p": {"bm": 3},
"eps": [{"ep": "coap://[2001:db8:a::b1d4]:7777"},
        {"ep": "coaps://[2001:db8:a::b1d4]:33333"}]
},
{
  "anchor": "ocf://88b7c7f0-4b51-4e0a-9faa-cfb439fd7f49",
  "href": "/myFan",
  "rt": ["oic.r.switch.binary"],
  "if": ["oic.if.a", "oic.if.baseline"],
  "p": {"bm": 3},
  "eps": [{"ep": "coaps://[2001:db8:a::b1d4]:33333"}]
},
{
  "anchor": "ocf://88b7c7f0-4b51-4e0a-9faa-cfb439fd7f49",
  "href": "/oic/sec/doxm",
  "rt": ["oic.r.doxm"],
  "if": ["oic.if.baseline"],
  "p": {"bm": 1},
  "eps": [{"ep": "coap://[2001:db8:a::b1d4]:7777"},
        {"ep": "coaps://[2001:db8:a::b1d4]:33333"}]
},
{
  "anchor": "ocf://88b7c7f0-4b51-4e0a-9faa-cfb439fd7f49",
  "href": "/oic/sec/pstat",
  "rt": ["oic.r.pstat"],
  "if": ["oic.if.baseline"],
  "p": {"bm": 1},
  "eps": [{"ep": "coaps://[2001:db8:a::b1d4]:33333"}]
},
{
  "anchor": "ocf://88b7c7f0-4b51-4e0a-9faa-cfb439fd7f49",
  "href": "/oic/sec/cred",
  "rt": ["oic.r.cred"],
  "if": ["oic.if.baseline"],
  "p": {"bm": 1},
```

```
"eps": [{"ep": "coaps://[2001:db8:a::b1d4]:33333"}]
},
{
  "anchor": "ocf://88b7c7f0-4b51-4e0a-9faa-cfb439fd7f49",
  "href": "/oic/sec/acl2",
  "rt": ["oic.r.acl2"],
  "if": ["oic.if.baseline"],
  "p": {"bm": 1},
  "eps": [{"ep": "coaps://[2001:db8:a::b1d4]:33333"}]
},
{
  "anchor": "ocf://88b7c7f0-4b51-4e0a-9faa-cfb439fd7f49",
  "href": "/myFanIntrospection",
  "rt": ["oic.wk.introspection"],
  "if": ["oic.if.r", "oic.if.baseline"],
  "p": {"bm": 3},
  "eps": [{"ep": "coaps://[2001:db8:a::b1d4]:33333"}]
}
]
```

The exact format of the “/oic/res” response and a way for a Client to acquire a “/oic/res” response message is specified in D.9 and 11.3.5 respectively.

10.4 CoAP based OCF Endpoint discovery

The following describes CoAP based OCF Endpoint discovery:

- a) Devices shall join the ‘All OCF Nodes’ multicast groups (as defined in [IANA IPv6 Multicast Address Space Registry]) with scopes 2, 3, and 5 (i.e., ff02::158, ff03::158 and ff05::158) and shall listen on the port 5683. For compliance to IETF RFC 7252 a Device may additionally join the ‘All CoAP Nodes’ multicast groups.
- b) Clients intending to discover resources shall join the multicast groups as defined in a).
- c) Devices shall expose “/oic/res” via an unsecured OCF Endpoint.
- d) Clients shall send discovery requests (GET request) to the ‘All OCF Nodes’ multicast group address with scope 2 (ff02::158) at port 5683. The requested URI shall be “/oic/res”. For compliance to IETF RFC 7252 a Client may additionally send to the ‘All CoAP Nodes’ multicast groups.

- e) If the discovery request is intended for a specific Resource Type, the Query parameter "rt" shall be included in the request (section 6.2.1) with its value set to the desired Resource Type. Only Devices hosting the Resource Type shall respond to the discovery request.
- f) When the "rt" Query parameter is omitted, all Devices shall respond to the discovery request.
- g) Handling of multicast requests shall be as described in section 8 of IETF RFC 7252 and section 4.1 in IETF RFC 6690.
- h) Devices which receive the request shall respond using CBOR payload encoding. A Device shall indicate support for CBOR payload encoding for multicast discovery as described in section 12.4.

DRAFT