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K. Lynn
Verizon Labs
P. van der Stok
consultant
M. Koster
SmartThings
C. Amsuess, Ed.
Energy Harvesting Solutions

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CoRE Resource Directory: DNS-SD mapping
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Abstract

TBD

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1. Introduction

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1.1. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119]. The term "byte" is used in its now customary sense as a synonym for "octet".

This specification requires readers to be familiar with all the terms and concepts that are discussed in [RFC5988] and [RFC6690]. Readers should also be familiar with the terms and concepts discussed in [RFC7252]. To describe the REST interfaces defined in this specification, the URI Template format is used [RFC6570].

This specification makes use of the terminology of [I-D.ietf-core-resource-directory].

This specification makes use of the following additional terminology:

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2. New Link-Format Attributes

When using the CoRE Link Format to describe resources being discovered by or posted to a resource directory service, additional information about those resources is useful. This specification defines the following new attributes for use in the CoRE Link Format [RFC6690]:

```
link-extension    = ( "ins" "=" (ptoken | quoted-string) )
                     ; The token or string is max 63 bytes
link-extension    = ( "exp" )
```

2.1. Resource Instance attribute 'ins'

The Resource Instance "ins" attribute is an identifier for this resource, which makes it possible to distinguish it from other similar resources. This attribute is similar in use to the <Instance> portion of a DNS-SD record (see Section 3.1, and SHOULD be unique across resources with the same Resource Type attribute in the domain it is used. A Resource Instance might be a descriptive string like "Ceiling Light, Room 3", a short ID like "AF39" or a unique UUID or iNumber. This attribute is used by a Resource Directory to distinguish between multiple instances of the same resource type within the directory.

This attribute MUST be no more than 63 bytes in length. The resource identifier attribute MUST NOT appear more than once in a link description. This attribute MAY be used as a query parameter in the RD Lookup Function Set defined in Section 7.

2.2. Export attribute 'exp'

The Export "exp" attribute is used as a flag to indicate that a link description MAY be exported by a resource directory to external directories.

The CoRE Link Format is used for many purposes between CoAP endpoints. Some are useful mainly locally, for example checking the observability of a resource before accessing it, determining the size of a resource, or traversing dynamic resource structures. However, other links are very useful to be exported to other directories, for example the entry point resource to a functional service. This attribute MAY be used as a query parameter in the RD Lookup Function Set defined in Section 7.

3. DNS-SD Mapping

CoRE Resource Discovery is intended to support fine-grained discovery of hosted resources, their attributes, and possibly other resource relations [RFC6690]. In contrast, service discovery generally refers to a coarse-grained resolution of an endpoint’s IP address, port number, and protocol.

Resource and service discovery are complementary in the case of large networks, where the latter can facilitate scaling. This document defines a mapping between CoRE Link Format attributes and DNS-Based Service Discovery [RFC6763] fields that permits discovery of CoAP services by either method.

3.1. DNS-based Service discovery

DNS-Based Service Discovery (DNS-SD) defines a conventional method of configuring DNS PTR, SRV, and TXT resource records to facilitate discovery of services (such as CoAP servers in a subdomain) using the existing DNS infrastructure. This section gives a brief overview of DNS-SD; see [RFC6763] for a detailed specification.

DNS-SD service names are limited to 255 octets and are of the form:

Service Name = <Instance>.<ServiceType>.<Domain>.

The service name is the label of SRV/TXT resource records. The SRV RR specifies the host and the port of the endpoint. The TXT RR provides additional information in the form of key/value pairs.

The <Domain> part of the service name is identical to the global (DNS subdomain) part of the authority in URIs that identify servers or groups of servers.

The <ServiceType> part is composed of at least two labels. The first label of the pair is the application protocol name [RFC6335] preceded by an underscore character. The second label indicates the transport and is always "_udp" for UDP-based CoAP services. In cases where narrowing the scope of the search may be useful, these labels may be optionally preceded by a subtype name followed by the "_sub" label. An example of this more specific <ServiceType> is "light._sub._dali._udp".

A default <Instance> part of the service name may be set at the factory or during the commissioning process. It SHOULD uniquely identify an instance of <ServiceType> within a <Domain>. Taken together, these three elements comprise a unique name for an SRV/ TXT record pair within the DNS subdomain.

The granularity of a service name MAY be that of a host or group, or it could represent a particular resource within a CoAP server. The SRV record contains the host name (AAAA record name) and port of the service while protocol is part of the service name. In the case where a service name identifies a particular resource, the path part of the URI must be carried in a corresponding TXT record.

A DNS TXT record is in practice limited to a few hundred octets in length, which is indicated in the resource record header in the DNS response message. The data consists of one or more strings comprising a key=value pair. By convention, the first pair is txtver=<number> (to support different versions of a service description).

3.2. mapping ins to <Instance>

The Resource Instance "ins" attribute maps to the <Instance> part of a DNS-SD service name. It is stored directly in the DNS as a single DNS label of canonical precomposed UTF-8 [RFC3629] "Net-Unicode" (Unicode Normalization Form C) [RFC5198] text. However, to the extent that the "ins" attribute may be chosen to match the DNS host name of a service, it SHOULD use the syntax defined in Section 3.5 of [RFC1034] and Section 2.1 of [RFC1123].

The <Instance> part of the name of a service being offered on the network SHOULD be configurable by the user setting up the service, so that he or she may give it an informative name. However, the device or service SHOULD NOT require the user to configure a name before it can be used. A sensible choice of default name can allow the device or service to be accessed in many cases without any manual configuration at all. The default name should be short and descriptive, and MAY include a collision-resistant substring such as the lower bits of the device’s MAC address, serial number, fingerprint, or other identifier in an attempt to make the name relatively unique.

DNS labels are currently limited to 63 octets in length and the entire service name may not exceed 255 octets.

3.3. Mapping rt to <ServiceType>

The resource type "rt" attribute is mapped into the <ServiceType> part of a DNS-SD service name and SHOULD conform to the reg-rel-type production of the Link Format defined in Section 2 of [RFC6690]. The "rt" attribute MUST be composed of at least a single Net-Unicode text string, without underscore '_' or period '.' and limited to 15 octets in length, which represents the application protocol name. This string is mapped to the DNS-SD <ServiceType> by prepending an underscore and appending a period followed by the "_udp" label. For example, rt="dali" is mapped into "_dali._udp".

The application protocol name may be optionally followed by a period and a service subtype name consisting of a Net-Unicode text string, without underscore or period and limited to 63 octets. This string is mapped to the DNS-SD <ServiceType> by appending a period followed by the "_sub" label and then appending a period followed by the service type label pair derived as in the previous paragraph. For example, rt="dali.light" is mapped into "light._sub._dali._udp".

The resulting string is used to form labels for DNS-SD records which are stored directly in the DNS.

3.4. Domain mapping

DNS domains may be derived from the "d" attribute. The domain attribute may be suffixed with the zone name of the authoritative DNS server to generate the domain name. The "ep" attribute is prefixed to the domain name to generate the FQDN to be stored into DNS with an AAAA RR.

3.5. TXT Record key=value strings

A number of [RFC6763] key/value pairs are derived from link-format information, to be exported in the DNS-SD as key=value strings in a TXT record ([RFC6763], Section 6.3).

The resource <URI> is exported as key/value pair "path=<URI>".

The Interface Description "if" attribute is exported as key/value pair "if=<Interface Description>".

The DNS TXT record can be further populated by importing any other resource description attributes as they share the same key=value format specified in Section 6 of [RFC6763].

3.6. Importing resource links into DNS-SD

Assuming the ability to query a Resource Directory or multicast a GET (?exp) over the local link, CoAP resource discovery may be used to populate the DNS-SD database in an automated fashion. CoAP resource descriptions (links) can be exported to DNS-SD for exposure to service discovery by using the Resource Instance attribute as the basis for a unique service name, composed with the Resource Type as the <ServiceType>, and registered in the correct <Domain>. The agent responsible for exporting records to the DNS zone file SHOULD be authenticated to the DNS server. The following example, using the example lookup location /rd-lookup, shows an agent discovering a resource to be exported:

```
Req: GET /rd-lookup/res?exp

Res: 2.05 Content
<coap://[FDFD::1234]:5683/light/1>;
  exp;rt="dali.light";ins="Spot";
            d="office";ep="node1"
```

The agent subsequently registers the following DNS-SD RRs, assuming a zone name "example.com" prefixed with "office":

```
node1.office.example.com.          IN AAAA        FDFD::1234
_dali._udp.office.example.com      IN PTR
                          Spot._dali._udp.office.example.com
light._sub._dali._udp.example.com  IN PTR
                          Spot._dali._udp.office.example.com
Spot._dali._udp.office.example.com IN SRV  0 0 5683
                          node1.office.example.com.
Spot._dali._udp.office.example.com IN TXT
                          txtver=1;path=/light/1
```

In the above figure the Service Name is chosen as Spot._dali._udp.office.example.com without the light._sub service prefix. An alternative Service Name would be: Spot.light._sub._dali._udp.office.example.com.

4. Examples

4.1. DNS entries

It may be profitable to discover the light groups for applications, which are unaware ot the existence of the RD. An agent needs to query the RD to return all groups which are exported to be inserted into DNS.

```
      Req: GET /rd-lookup/gp?exp

      Res: 2.05 Content
      <coap://[FF05::1]/>;exp;gp="grp_R2-4-015;ins="grp1234";
   ep="lm_R2-4-015_wndw";
   ep="lm_R2-4-015_door
```

The group with FQDN grp_R2-4-015.bc.example.com can be entered into the DNS by the agent. The accompanying instance name is grp1234. The <ServiceType> is chosen to be _group._udp. The agent enters the following RRs into the DNS.

```
   grp_R2-4-015.bc.example.com.        IN AAAA            FF05::1
   _group._udp.bc.example.com          IN PTR
                                  grp1234._group._udp.bc.example.com
   grp1234._group._udp.bc.example.com  IN SRV  0 0 5683
                                   grp_R2-4-015_door.bc.example.com.
   grp1234._group._udp.bc.example.com  IN TXT
                                           txtver=1;path=/light/grp1
```

From then on applications, not familiar with the existence of the RD, can use DNS to access the lighting group.

5. IANA considerations

TBD

6. Security considerations

TBD

7. References

7.1. Normative References

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Authors' Addresses

Kerry Lynn
Verizon Labs
50 Sylvan Rd
Waltham, MA 02451
USA

Phone: +1 781 296 9722
Email: kerlyn@ieee.org

Peter van der Stok
consultant

Phone: +31-492474673 (Netherlands), +33-966015248 (France)
Email: consultancy@vanderstok.org
URI: www.vanderstok.org

Michael Koster
SmartThings
665 Clyde Avenue
Mountain View 94043
USA

Phone: +1-707-502-5136
Email: Michael.Koster@smartthings.com

Christian Amsuess (editor)
Energy Harvesting Solutions
Hollandstr. 12/4
1020
Austria

Phone: +43-664-9790639
Email: c.amsuess@energyharvesting.at