              Discovery Of Restconf Metadata for Source-specific multicast
                      draft-jholland-mboned-dorms-00

Abstract

   This document defines DORMS (Discovery Of Restconf Metadata for
   Source-specific multicast), a method to discover and retrieve
   extensible metadata about source-specific multicast channels using
   RESTCONF. The reverse IP DNS zone for a multicast sender's IP
   address is configured to use SRV resource records to advertise the
   hostname of a RESTCONF server that publishes metadata according to a
   new YANG module with support for extensions. A new service name and
   the new YANG module are defined.

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1. Introduction

   This document defines DORMS (Discovery Of Restconf Metadata for
   Source-specific multicast).

   A DORMS service is a RESTCONF [RFC8040] service that provides read
   access to data in the "ietf-dorms" YANG [RFC7950] model defined in
   Section 4. This model, along with optional extensions defined in
   other documents, provide an extensible set of information about
   multicast data streams.

This document defines the "dorms" service name for use with the SRV
DNS Resource Record (RR) type [RFC2782]. A sender offering a DORMS
service to publish metadata SHOULD configure at least one SRV RR for
the "_dorms._tcp" subdomain in the reverse IP DNS zone for the source
IP of its multicast channel to advertise a hostname for a DORMS
server that can provide metadata for the sender's source-specific
multicast traffic. Doing so enables receivers and middleboxes to
discover and query a DORMS server as described in Section 2.

The goal is to provide an extensible framework for attaching
information necessary for the correct processing of multicast data
channels, both for middle boxes forwarding the traffic, and for
receivers subscribing to traffic (hereafter called "clients").

1.1. Background

The reader is assumed to be familiar with the basic DNS concepts
described in [RFC1034], [RFC1035], and the subsequent documents that
update them, as well as the use of the SRV Resource Record type as
described in [RFC2782].

The reader is also assumed to be familiar with the concepts and
terminology regarding source-specific multicast as described in
[RFC4607] and the use of IGMPv3 [RFC3376] and MLDv2 [RFC3810] for
group management of source-specific multicast channels, as described
in [RFC4604].

The reader is also assumed to be familiar with the concepts and
terminology for RESTCONF [RFC8040] and YANG [RFC7950].

1.2. Terminology

```
+--------+------------------------------------------------------------+
|   Term | Definition                                                 |
+--------+------------------------------------------------------------+
|  (S,G) | A source-specific multicast channel, as described in       |
|        | [RFC4607]. A pair of IP addresses with a source host IP    |
|        | and destination group IP.                                  |
|        |                                                            |
|     RR | A DNS Resource Record, as described in [RFC1034]           |
|        |                                                            |
| RRType | A DNS Resource Record Type, as described in [RFC1034]      |
|        |                                                            |
|    SSM | Source-specific multicast, as described in [RFC4607]       |
+--------+------------------------------------------------------------+
```

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] and [RFC8174] when, and only when, they appear in all
capitals, as shown here.

2. Discovery and Metdata Retrieval

A client that needs metadata about a (S,G) MAY attempt to discover
metadata for the (S,G) using the mechanisms defined here, and MAY use
the metadata received to manage the forwarding or processing of the
packets in the channel.

2.1. DNS Bootstrap

The DNS Bootstrap step is how a client discovers an appropriate
RESTCONF server, given the source address of an (S,G). Use of the
DNS Bootstrap is OPTIONAL for clients with an alternate method of
obtaining a RESTCONF hostname for a DORMS server with metadata for an
(S,G).

This mechanism only works for source-specific multicast (SSM)
channels. The source address of the (S,G) is reversed and used as an
index into one of the reverse mapping trees (in-addr.arpa for IPv4,
as described in Section 3.5 of [RFC1035], or ip6.arpa for IPv6, as
described in Section 2.5 of [RFC3596]).

When a receiver or middle box needs metadata for an (S,G), for
example when handling a new join for that (S,G) and looking up
authentication methods available, a receiver or middlebox can issue a
DNS query for a SRV RR using the "dorms" service name with the domain
from the reverse mapping tree, combining them as described in
[RFC2782].

For example, while handling a join for (203.0.113.15, 232.1.1.1), a
receiver would perform a DNS query for the SRV RRType for the domain:

    _dorms._tcp.15.113.0.203.in-addr.arpa.

The DNS response for this domain might return a record such as:

    SRV 0 1 443 dorms-restconf.example.com.

This response informs the receiver that a DORMS server SHOULD be
reachable at dorms-restconf.example.com on port 443. Multiple SRV
records are handled as described by [RFC2782].

A sender providing DORMS discovery SHOULD publish at least one SRV
record in the reverse DNS zone for each source address of the
multicast channels it is sending, in order to advertise the hostname

of the DORMS server to receivers and middle boxes. The DORMS servers
advertised SHOULD be configured with metadata for all the groups sent
from the same source IP address that have metadata published with
DORMS.

2.2. RESTCONF Bootstrap

Once a DORMS host has been chosen (whether via an SRV RR from a DNS
response or via some other method), RESTCONF provides all the
information necessary to determine the versions and url paths for
metadata from the server. A walkthrough is provided here for a
sequence of example requests and responses from a receiver connecting
to a new DORMS server.

2.2.1. Root Resource Discovery

As described in Section 3.1 of [RFC8040] and [RFC6415], the RESTCONF
server provides the link to the RESTCONF api entry point via the
"/.well-known/host-meta" or "/.well-known/host-meta.json" resource.

Example:

The receiver might send:

```
GET /.well-known/host-meta.json HTTP/1.1
Host: dorms-restconf.example.com
Accept: application/json
```

The server might respond as follows:

```
HTTP/1.1 200 OK
Date: Tue, 27 Aug 2019 20:56:00 GMT
Server: example-server
Cache-Control: no-cache
Content-Type: application/json

{
  "links":[
    {
      "rel":"restconf",
      "href":"/top/restconf"
    }
  ]
}
```

2.2.2. **Yang Library Version**

   As described in Section 3.3.3 of [RFC8040], the yang-library-version
   leaf is required by RESTCONF, and can be used to determine the schema
   of the ietf-yang-library module:

   Example:

   The receiver might send:

```
    GET /top/restconf/yang-library-version HTTP/1.1
    Host: dorms-restconf.example.com
    Accept: application/yang-data+json
```

   The server might respond as follows:

```
    HTTP/1.1 200 OK
    Date: Tue, 27 Aug 2019 20:56:01 GMT
    Server: example-server
    Cache-Control: no-cache
    Content-Type: application/yang-data+json

    {
        "ietf-restconf:yang-library-version": "2016-06-21"
    }
```

   TBD: We might need a method for learning a specific restconf server
   or resource path that supports a version the client knows how to use,
   in the case the client is older than the server after a new yang-
   library version is released... Can this be just retry with a hold-
   down on specific hostnames, so that you can find a lower priority
   older server from the SRV records, or is signaling that can find or
   negotiate an explicit version as part of the lookup going to be
   necessary? -jake 2019-08-26

2.2.3. **Yang Library Contents**

   After checking that the version of the yang-library module will be
   understood by the receiver, the client can check that the desired
   metadata module is available on the DORMS server by fetching the
   module-state resource from the ietf-yang-library module.

   Example:

   The receiver might send:

```
    GET /top/restconf/data/ietf-yang-library:modules-state/\
        module=ietf-dorms,2016-08-15
    Host: dorms-restconf.example.com
    Accept: application/yang-data+json
```

The server might respond as follows:

```
    HTTP/1.1 200 OK
    Date: Tue, 27 Aug 2019 20:56:02 GMT
    Server: example-server
    Cache-Control: no-cache
    Content-Type: application/yang-data+json

    {
      "ietf-yang-library:module": [
        {
          "conformance-type": "implement",
          "name": "ietf-dorms",
          "namespace": "urn:ietf:params:xml:ns:yang:ietf-dorms",
          "revision": "2019-08-25",
          "schema":
              "https://example.com/yang/ietf-dorms@2019-08-25.yang"
        }
      ]
    }
```

Other modules required or desired by the client also can be checked
in a similar way, or the full set of available modules can be
retrieved by not providing a key for the "module" list.

2.2.4. Metadata Retrieval

Once the expected DORMS version is confirmed, the client can retrieve
the metadata specific to the desired (S,G).

Example:

The receiver might send:

```
    GET /top/restconf/data/ietf-dorms:metadata/\
        sender=203.0.113.15/group=232.1.1.1
    Host: dorms-restconf.example.com
    Accept: application/yang-data+json
```

The server might respond as follows:

```
      HTTP/1.1 200 OK
      Date: Tue, 27 Aug 2019 20:56:02 GMT
      Server: example-server
      Cache-Control: no-cache
      Content-Type: application/yang-data+json

      {
        "ietf-dorms:group": [
          {
            "group-address":"232.1.1.1",
            "udp-stream":[
              {
                "port":"5001"
              }
            ]
          }
        ]
      }
```

   Note that when other modules are installed on the DORMS server that
   extend the ietf-dorms module, other fields MAY appear inside the
   response. This is the primary mechanism for providing extensible
   metadata for an (S,G), so clients SHOULD ignore fields they do not
   understand.

   As mentioned in Section 3.2, most clients SHOULD use data resource
   identifiers in the request URI as in the above example, in order to
   retrieve metadata for only the targeted (S,G)s.

3. Scalability Considerations

3.1. Provisioning

   In contrast to many common RESTCONF deployments that are intended to
   provide configuration management for a service to a narrow set of
   authenticated administrators, DORMS servers often provide read-only
   metadata for public access, or for a very large set of end receivers,
   since it provides metadata in support of multicast data streams and
   multicast can scale to very large audiences.

   Operators are advised to provision the DORMS service in a way that
   will scale appropriately to the size of the expected audience.
   Specific advice on such scaling is out of scope for this document,
   but some of the mechanisms outlined in [RFC3040] or other online
   resources might be useful, depending on the expected number of
   receivers.

3.2. Data Scoping

In the absence of contextual information, clients SHOULD issue
narrowed requests for DORMS resources by following the format from
Section 3.5.3 of [RFC8040] to encode data resource identifiers in the
request URI. This avoids downloading excessive data, since the DORMS
server may provide metadata for many (S,G)s, possibly from many
different senders.

However, clients MAY use heuristics or out of band information about
the service to issue requests for (S,G) metadata narrowed only by the
source-address, or not narrowed at all. Depending on the request
patterns and the contents of the data store, this may result in fewer
round trips or less overhead, and can therefore be helpful behavior
for scaling purposes. Servers MAY restrict or throttle client access
based on the client certificate presented (if any), or based on
heuristics that take note of client request patterns.

A complete description of the heuristics for clients and servers to
meet their scalability goals is out of scope for this document.

4. YANG Model

The primary purpose of the YANG model defined here is to serve as a
scaffold for the more useful metadata that will extend it. Currently
known use cases include providing authentication information and bit-
rate information for use by receivers and middle boxes, but more use
cases are anticipated.

4.1. Yang Tree

```
module: ietf-dorms
  +--rw metadata
     +--rw sender* [source-address]
        +--rw source-address     inet:ip-address
        +--rw group* [group-address]
           +--rw group-address     rt-types:ip-multicast-group-address
           +--rw udp-stream* [port]
              +--rw port     inet:port-number
```

DORMS Tree Diagram

4.2. Yang Module

```
<CODE BEGINS> file ietf-dorms@2019-08-28.yang
module ietf-dorms {
    yang-version 1.1;
```

```
      namespace "urn:ietf:params:xml:ns:yang:ietf-dorms";
      prefix "dorms";

      import ietf-inet-types {
          prefix "inet";
          reference "RFC 6991 Section 4";
      }

      import ietf-routing-types {
          prefix "rt-types";
          reference "RFC 8294";
      }

      organization "IETF";

      contact
          "Author:   Jake Holland
                     <mailto:jholland@akamai.com>
          ";

      description
      "Copyright (c) 2019 IETF Trust and the persons identified as
       authors of the code.  All rights reserved.

       Redistribution and use in source and binary forms, with or
       without modification, is permitted pursuant to, and subject to
       the license terms contained in, the Simplified BSD License set
       forth in Section 4.c of the IETF Trust's Legal Provisions
       Relating to IETF Documents
       (https://trustee.ietf.org/license-info).

       This version of this YANG module is part of RFC XXXX
       (https://www.rfc-editor.org/info/rfcXXXX); see the RFC itself
       for full legal notices.

       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 BCP 14 (RFC 2119) (RFC 8174) when, and only when,
       they appear in all capitals, as shown here.

       This module contains the definition for the DORMS data type.
       It provides out of band metadata about SSM channels.";

      revision 2019-08-25 {
          description "Initial revision.";
          reference
              "";
```

```
             // "I-D.draft-jholland-mboned-dorms";
     }

     container metadata {
         description "Metadata scaffold for source-specific multicast
             channels.";
         list sender {
             key source-address;
             description "Sender for DORMS";

             leaf source-address {
                 type inet:ip-address;
                 mandatory true;
                 description
                     "The source IP address of a multicast sender.";
             }

             list group {
                 key group-address;
                 description "Metadata for a DORMS (S,G).";

                 leaf group-address {
                     type rt-types:ip-multicast-group-address;
                     mandatory true;
                     description "The group IP address for an (S,G).";
                 }

                 list udp-stream {
                   key "port";
                   description
                       "Metadata for UDP traffic on a specific port.";
                   leaf port {
                       type inet:port-number;
                       mandatory true;
                       description
                           "The UDP port of a data stream in an (S,G).";
                   }
                 }
             }
         }
     }
}
<CODE ENDS>
```

5. Privacy Considerations

   In the typical case, the mechanisms defined in this document provide
   a standardized way to discover information that is already available
   in other ways.

   However, depending on the metadata provided by the server, observers
   may be able to more easily associate traffic from an (S,G) with the
   content contained within the (S,G). At the subscriber edge of a
   multicast-capable network, where the network operator has the
   capability to localize a IGMP [RFC3376] or MLD [RFC3810] channel
   subscription to a specific user or location by MAC address or source
   IP address, the structured publishing of metadata may make it easier
   to automate collection of data about the content a receiver is
   consuming.

   RESTCONF communication will expose to the controller of the RESTCONF
   server information about the consumers of content that is not
   otherwise available from multicast subscription to a channel, such as
   the remote IP address and timing information.

6. IANA Considerations

6.1. The YANG Module Names Registry

   This document adds one YANG module to the "YANG Module Names"
   registry maintained at <https://www.iana.org/assignments/yang-
   parameters>. The following registrations are made, per the format in
   Section 14 of [RFC6020]:

        name: ietf-dorms
        namespace: urn:ietf:params:xml:ns:yang:ietf-dorms
        prefix: dorms
        reference: I-D.draft-jholland-mboned-dorms

6.2. The Service Name and Transport Protocol Port Number Registry

   This document adds one service name to the "Service Name and
   Transport Protocol Port Number Registry" maintained at
   <https://www.iana.org/assignments/service-names-port-numbers>. The
   following registrations are made, per the format in Section 8.1.1 of
   [RFC6335]:

```
      Service Name:             dorms
      Transport Protocol(s):    TCP
      Assignee:                 IESG <iesg@ietf.org>
      Contact:                  IETF Chair <chair@ietf.org>
      Description:              This service name is used to construct the
                                SRV service label "_dorms" for discovering
                                DORMS servers.
      Reference:                I-D.draft-jholland-mboned-dorms
      Port Number:              N/A
      Service Code:             N/A
      Known Unauthorized Uses: N/A
      Assignment Notes:         This protocol uses HTTPS as a substrate.
```

7. Security Considerations

7.1. Secure Communications

   It is intended that security related metadata about the SSM channels
   will be delivered over the RESTCONF connection, and that information
   available from this connection can be used as a trust anchor.

   The provisions of Section 2 of [RFC8040] provide secure communication
   requirements that are already required of DORMS servers, since they
   are RESTCONF servers. All RESTCONF requirements and security
   considerations remain in force for DORMS servers.

7.2. Exposure of Metadata

   Although some DORMS servers MAY restrict access based on client
   identity, as described in Section 2.5 of [RFC8040], many DORMS
   servers will use the ietf-dorms YANG model to publish information
   without restriction, and even DORMS servers requiring client
   authentication will inherently, because of the purpose of DORMS, be
   providing the DORMS metadata to potentially many receivers.

   Accordingly, future YANG modules that augment data paths under "ietf-
   dorms:metadata" MUST NOT include any sensitive data unsuitable for
   public dissemination in those data paths. Because of the possibility
   that scalable read-only access might be necessary to fulfill the
   scalability goals for a DORMS server, data under these paths MAY be
   cached or replicated by numerous external entities, so owners of such
   data SHOULD NOT assume it can be kept secret when provided by DORMS
   servers anywhere under the "ietf-dorms:metadata" path, even if they
   are authenticating clients.

7.3. DNS Bootstrapping

The DNS bootstrap phase relies on DNS for the reverse IP tree. When
using DNS to discover a DORMS server's domain name, there must be a
trust relationship between the end consumer of this resource record
and the DNS server. This relationship may be end-to-end DNSSEC
validation, a TSIG [RFC2845] or SIG(0) [RFC2931] channel to another
secure source, a secure local channel on the host, DNS over TLS
[RFC7858] or HTTPS [RFC8484], or some other secure mechanism.

If the SRV Resource Record cannot be authenticated, it may be
possible for an attacker who can spoof the resource record to perform
a denial of service for the receiver by providing wrong or missing
authentication metadata. An attacker who can also inject traffic for
(S,G)s, would also be able to provide false content in the data
stream, so an attacker who can perform both could provide
authenticated false content by authenticating with a trust anchor
from an attacker-controlled DORMS server.

Clients MAY use other secure methods to explicitly associate an (S,G)
with a set of DORMS server hostnames, such as a configured mapping or
an alternative trusted lookup service.

TBD: do we need CORS [whatwg-fetch] on the DORMS server? Perhaps in
a new URI path, or maybe on /.well-known/host-meta? (Suppose evil
Javascript joins someone else's stream, providing a correct DORMS
hostname-should DORMS get an Origin header and have the option to
block?)

8. Acknowledgements

Thanks to Christian Mortensen for some very helpful comments and
review.

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