                    RESTCONF Extensions to Support the
                 Network Management Datastore Architecture

Abstract

   This document extends the RESTCONF protocol defined in RFC 8040 in
   order to support the Network Management Datastore Architecture (NMDA)
   defined in RFC 8342.

   This document updates RFC 8040 by introducing new datastore
   resources, adding a new query parameter, and requiring the usage of
   the YANG library (described in RFC 8525) by RESTCONF servers
   implementing the NMDA.

Status of This Memo

   This is an Internet Standards Track document.

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   received public review and has been approved for publication by the
   Internet Engineering Steering Group (IESG). Further information on
   Internet Standards is available in Section 2 of RFC 7841.

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   and how to provide feedback on it may be obtained at
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1. Introduction

   This document extends the RESTCONF protocol defined in [RFC8040] in
   order to support the Network Management Datastore Architecture (NMDA)
   defined in [RFC8342].

   This document updates [RFC8040] in order to enable RESTCONF clients
   to discover which datastores are supported by the RESTCONF server,
   determine which modules are supported in each datastore, and interact
   with all the datastores supported by the NMDA. Specifically, the
   update introduces new datastore resources, adds a new query
   parameter, and requires the usage of the YANG library [RFC8525] by
   RESTCONF servers implementing the NMDA.

   The solution presented in this document is backwards compatible with
   [RFC8040]. This is achieved by only adding new resources and leaving
   the semantics of the existing resources unchanged.

1.1. Terminology

   This document uses the terminology defined by the NMDA [RFC8342].

   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 [RFC2119] [RFC8174] when, and only when, they appear in all
   capitals, as shown here.

2. Datastore and YANG Library Requirements

   An NMDA-compliant RESTCONF server MUST support the operational state
   datastore and MUST implement at least revision 2019-01-04 of the
   "ietf-yang-library" module defined in [RFC8525].

   Such a server identifies that it supports the NMDA both by
   implementing the {+restconf}/ds/ietf-datastores:operational resource
   and by implementing at least revision 2019-01-04 of the
   "ietf-yang-library" module.

   A RESTCONF client can test if a server supports the NMDA by using
   either the HEAD or GET methods on {+restconf}/ds/ietf-
   datastores:operational.

   A RESTCONF client can discover which datastores and YANG modules the
   server supports by reading the YANG library information from the
   operational state datastore.

3. RESTCONF Extensions

   This section describes the RESTCONF extensions needed to support the
   NMDA.

3.1. New Datastore Resources

   This document defines a set of new resources representing datastores
   as defined in [RFC8342]. These resources are available using the
   following resource path template:

      {+restconf}/ds/<datastore>

   The <datastore> path component is encoded as an "identityref"
   according to the JSON encoding rules for identities, defined in
   Section 6.8 of [RFC7951]. The namespace-qualified form MUST be used.
   Such an identity MUST be derived from the "datastore" identity
   defined in the "ietf-datastores" YANG module [RFC8342].

   Specifically:

   o The resource {+restconf}/ds/ietf-datastores:operational refers to
      the operational state datastore.

   o The resource {+restconf}/ds/ietf-datastores:running refers to the
      running configuration datastore.

   o The resource {+restconf}/ds/ietf-datastores:intended refers to the
      intended configuration datastore.

   An NMDA-compliant server MUST implement {+restconf}/ds/ietf-
   datastores:operational. Other datastore resources MAY be
   implemented.

   YANG actions can only be invoked in {+restconf}/ds/ietf-
   datastores:operational.

   As an example, if a server implements a datastore called
   "ds-ephemeral", defined in a module called "example-ds-ephemeral",
   then the server would implement the resource {+restconf}/ds/example-
   ds-ephemeral:ds-ephemeral.

3.2. Protocol Operations

   The protocol operations available for the new datastore resources
   (see Section 3.1) are the same as the protocol operations defined in
   [RFC8040] for the {+restconf}/data resource with the following
   exceptions:

   o Dynamic configuration datastores are excluded, as each dynamic
      configuration datastore definition needs to be reviewed for what
      protocol operations it supports.

   o Some datastores are read-only by nature (e.g., <intended>); hence,
      any attempt to modify these datastores will fail. A server MUST
      return a response with a "405 Method Not Allowed" status-line and
      an error-tag value of "operation-not-supported".

   o The semantics of the "with-defaults" query parameter
      (Section 4.8.9 of [RFC8040]) differ when interacting with the
      operational state datastore. The semantics are described in
      Section 3.2.1.

   o [RFC8040], Section 3.5.4, paragraph 3 does not apply when
      interacting with any resource under {+restconf}/ds.

3.2.1. The "with-defaults" Query Parameter on the Operational State
        Datastore

   Support for the "with-defaults" query parameter (Section 4.8.9 of
   [RFC8040]) is OPTIONAL when interacting with {+restconf}/ds/ietf-
   datastores:operational. The associated capability to indicate a
   server's support is identified with the URI:

     urn:ietf:params:restconf:capability:with-operational-defaults:1.0

   For servers that support it, the behavior of the "with-defaults"
   query parameter on the operational state datastore is defined as
   follows:

   o If no "with-defaults" query parameter is specified, or if it is
      set to "explicit", "report-all", or "report-all-tagged", then the
      "in use" values, as defined in Section 5.3 of [RFC8342], are
      returned from the operational state datastore, even if a node
      happens to have a default statement in the YANG module and this
      default value is being used by the server. If the "with-defaults"
      parameter is set to "report-all-tagged", any values that match the
      schema default are tagged with additional metadata, as described
      in Section 4.8.9 of [RFC8040].

   o If the "with-defaults" query parameter is set to "trim", all "in
      use" values are returned, except that the output is filtered to
      exclude any values that match the default defined in the YANG
      schema.

   Servers are not required to support all values in the "with-defaults"
   query parameter on the operational state datastore. If a request is
   made using a value that is not supported, then the error handling
   behavior is as described in Section 4.8.9 of [RFC8040].

3.2.2. New "with-origin" Query Parameter

   A new query parameter named "with-origin" is added to the GET
   operation. If present, it requests that the server includes "origin"
   metadata annotations in its response, as detailed in the NMDA. This
   parameter is only valid when querying {+restconf}/ds/ietf-
   datastores:operational or any datastores with identities derived from
   the "operational" identity. Otherwise, if an invalid datastore is
   specified, then the server MUST return a response with a "400 Bad
   Request" status-line, using an error-tag value of "invalid-value".
   "origin" metadata annotations are not included unless a client
   explicitly requests them.

   Data in the operational state datatstore can come from multiple
   sources. The server should return the "origin" metadata annotation
   value that most accurately indicates the source of the operational
   value, as specified in Section 5.3.4 of [RFC8342].

   When encoding the "origin" metadata annotation for a hierarchy of
   returned nodes, the annotation can be omitted for a child node when
   the value matches that of the parent node, as described in the
   "ietf-origin" YANG module [RFC8342].

   Support for the "with-origin" query parameter is OPTIONAL. It is
   identified with the URI:

     urn:ietf:params:restconf:capability:with-origin:1.0

4. IANA Considerations

   This document defines two capability identifier URNs in the "RESTCONF
   Capability URNs" registry defined in [RFC8040]:

      Index
      Capability Identifier

      :with-origin
      urn:ietf:params:restconf:capability:with-origin:1.0

      :with-operational-defaults
      urn:ietf:params:restconf:capability:with-operational-defaults:1.0

5. Security Considerations

   This document extends the RESTCONF protocol by introducing new
   datastore resources. The lowest RESTCONF layer is HTTPS, and the
   mandatory-to-implement secure transport is TLS [RFC8446]. The
   RESTCONF protocol uses the network configuration access control model
   [RFC8341], which provides the means to restrict access for particular
   RESTCONF users to a preconfigured subset of all available RESTCONF
   protocol operations and content.

   The security constraints for the base RESTCONF protocol (see
   Section 12 of [RFC8040]) apply to the new RESTCONF datastore
   resources defined in this document.

6. Normative References

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