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Telemetry Data Export capability
draft-tao-netconf-data-export-capabilities-03

Abstract

This document proposes a YANG module for telemetry data export capabilities which augments system Capabilities model and provides additional telemetry data export attributes associated with system capabilities for transport dependent capability advertisement.

Status of This Memo

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1. Introduction

Notification capabilities model defined in [I-D.netconf-notification-capabilities] allows a client to discover a set of capabilities supported by the server (e.g., basic system capabilities and YANG-Push related capabilities) both at implementation-time and run-time. These capabilities permit the client to adjust its behavior to take advantage of the features exposed by the device.

However the client and the server may still support various different transport specific parameters (e.g., transport protocol, encoding format, encryption). As described in section 3.1 of [RFC8641], a simple negotiation (i.e., inserting hints into error responses to a failed RPC request) between subscribers and publishers for subscription parameters increases the likelihood of success for subsequent RPC requests, but not guaranteed, which may cause unexpected failure or additional message exchange between client and server.

This document defines a corresponding solution that is built on top of [I-D.netconf-notification-capabilities]. Supplementing that work are YANG data model augmentations for transport dependent capability advertisement.

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 BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2. Data Export capability

The YANG module ietf-notification-capabilities defined in [I-D.netconf-notification-capabilities] specify the following server capabilities related to YANG Push:

- o A set of capabilities related to the amount of notifications the server can send out

- o Specification of which data nodes support on-change notifications.

- o Capability values can be specified on server level, datastore level or on specific data nodes (and their contained sub-tree) of a specific datastore. Capability values on a smaller, more specific part of the server's data always override more generic values.

- o On-change capability is not specified on a server level as different datastores usually have different on-change capabilities. On a datastore level on-change capability for configuration and state data can be specified separately.

These server capabilities are transport independent, session level capabilities. They can be provided either at the implementation time or reported at the run time.

This document augments system Capabilities model and provides additional data export attributes associated with system capabilities:

- o Specification of transport protocol the client can use to establish a transport connection;

- o Specification of the encoding selection used (e.g., XML or JSON, Binary) for Data Modeled with YANG;

- o Specification of secure transport mechanisms that are needed by the client to communicate with the server;

- o Specification of the type of data compression algorithm (e.g., lossless data compression) the client can use for file compression and decompression

- o Specification of the notification message encapsulation type, either one notification per message or multiple notifications per message.

- o Specification of the update trigger type such as adaptive interval trigger, timer event based trigger, count threshold trigger, redundant suppression.

2.1. Tree Diagram

The following tree diagram [RFC8340] provides an overview of the data model.

```
module: ietf-data-export-capabilities
  augment /sysc:system-capabilities:
    +--ro data-export-capabilities* []
       +--ro transport-protocol?            identityref
       +--ro encoding-format?               identityref
       +--ro security-protocol?             identityref
       +--ro compression-mode?              identityref
  augment /sysc:system-capabilities/inc:subscription-capabilities:
    +--ro data-export-capabilities
       +--ro message-bundling-support?   boolean
  augment /sysc:system-capabilities/sysc:datastore-capabilities/sysc:per-node-
capabilities:
    +--ro data-export-capabilities
       +--ro adaptive-interval-support    boolean
       +--ro timer-event-support?         boolean
       +--ro counter-threshold-support?   boolean
       +--ro suppress-redundant?          boolean
```

3. YANG Module

```
<CODE BEGINS> file "ietf-data-export-capabilities.yang"
module ietf-data-export-capabilities {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-data-export-capabilities";
  prefix dec;

  import ietf-system-capabilities {
    prefix sysc;
  }
  import ietf-notification-capabilities {
    prefix inc;
  }
```

```
  organization
    "IETF NETCONF (Network Configuration) Working Group";
  contact
    "WG Web:   <https://tools.ietf.org/wg/netconf/>
     WG List:  <mailto:netconf@ietf.org>
     Editor:   Qin Wu
               <mailto:bill.wu@huawei.com";
  description
    "This module defines an extension to System Capability and YANG Push
     Notification Capabilities model and provides additional data export
     attributes for transport dependent capability negotiation.

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

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     set forth in Section 4.c of the IETF Trust's Legal Provisions
     Relating to IETF Documents
     (http://trustee.ietf.org/license-info).

     This version of this YANG module is part of RFC XXXX;
     see the RFC itself for full legal notices.";

  revision 2020-07-03 {
    description
      "Initial revision.";
    reference
      "RFC XXXX: Telemetry Data Export capability";
  }

  identity transport-protocol {
    description
      "Base identity for transport protocol type.";
  }

  identity tcp {
    base transport-protocol;
    description
      "Identity for tcp as transport protocol.";
  }

  identity udp-notif {
    base transport-protocol;
    description
      "Identity for udp notif as transport protocol.";
    reference
```

```
      "draft-ietf-netconf-udp-notif:UDP-based Transport
       for Configured Subscriptions";
  }

  identity http-notif {
    base transport-protocol;
    description
      "Identity for http notif as transport protocol.";
    reference
      "draft-ietf-netconf-https-notif: An HTTPS-based
       Transport for Configured Subscriptions";
  }

  identity grpc {
    base transport-protocol;
    description
      "Identity for grpc as transport protocol.";
  }

  identity security-protocol {
    description
      "Base identity for security protocol type.";
  }

  identity tls {
    base security-protocol;
    description
      "Identity for tls security protocol.";
  }

  identity ssh {
    base security-protocol;
    description
      "Identity for ssh transport protocol.";
  }

  identity encoding-format {
    description
      "Base identity for encoding format type.";
  }

  identity xml {
    base encoding-format;
    description
      "Identity for xml encoding format.";
  }

  identity json {
```

```
    base encoding-format;
    description
      "Identity for json encoding format.";
  }

  identity binary {
    base encoding-format;
    description
      "Identity for binary encoding format.";
  }

  identity gpb {
    base binary;
    description
      "Identity for gpb encoding format.";
  }

  identity cbor {
    base binary;
    description
      "Identity for cbor encoding format.";
  }

  identity compression-mode {
    description
      "Base identity for compression mode.";
  }

  identity gzip {
    base compression-mode;
    description
      "Identity for gzip compression mode.";
  }

  identity deflate {
    base compression-mode;
    description
      "Identity for deflate compression mode.";
  }

  identity subscription-mode {
    description
      "Base identity for subscription mode.";
  }

  identity periodic {
    base subscription-mode;
    description
```

```
      "Identity for periodic subscription mode.";
  }

  identity on-change {
    base subscription-mode;
    description
      "Identity for on change subscription mode.";
  }

  identity event {
    base subscription-mode;
    description
      "Identity for event based subscription mode.";
  }

  typedef centiseconds {
    type uint32;
    description
      "A period of time, measured in units of 0.01 seconds.";
  }

  augment "/sysc:system-capabilities" {
    description
      "Add system level capability.";
    list data-export-capabilities {
      description
        "Capabilities related to telemetry data export capabilities
negotiation.";
      leaf transport-protocol {
        type identityref {
          base transport-protocol;
        }
        description
          "Type of transport protocol.";
      }
      leaf encoding-format {
        type identityref {
          base encoding-format;
        }
        description
          "Type of encoding format.";
      }
      leaf security-protocol {
        type identityref {
          base security-protocol;
        }
        description
          "Type of secure transport.";
```

```
}
```

```
      leaf compression-mode {
        type identityref {
          base compression-mode;
        }
        description
          "Type of compression mode.";
      }
    }
  }
  augment "/sysc:system-capabilities/inc:subscription-capabilities" {
    description
      "Add subscription level capability.";
    container data-export-capabilities {
      description
        "Capabilities related to telemetry data export capability
negotiation.";
      leaf message-bundling-support {
        type boolean;
        default "false";
        description
          "Enables message bundling support.";
      }
    }
  }
  augment "/sysc:system-capabilities/sysc:datastore-capabilities/sysc:per-node-
capabilities" {
    description
      "Add datastore and node level capability.";
    container data-export-capabilities {
      description
        "Capabilities related to telemetry data export capability
negotiation.";
      leaf adaptive-interval-support {
        type boolean;
        default "false";
        description
          "Set to true if one event stream supports multiple period intervals
and
           allows period interval switching. Set to false if the event stream
doesn't
           support period interval switching.";
      }
      leaf timer-event-support {
        type boolean;
        default "false";
        description
          "Set to true if timer event is supported, i.e.,, schedule a specific
event
```

```
           periodically with specified start time, duration, repeat option,
repeat
           interval.";
      }
      leaf counter-threshold-support {
        type boolean;
        default "false";
```

```
        description
          "Set to true if the subscription mode is event based
           subscription mode and counter based trigger is support
           (i.e., named counter crosses a specified threshold).
           Set to false if event based subscription mode is not
           supported.";
      }
      leaf suppress-redundant {
        type boolean;
        default "false";
        description
          "Suppress dupplicated data objects to be sent during each update
interval.";
      }
    }
  }
}
<CODE ENDS>
```

4. IANA Considerations

4.1. Updates to the IETF XML Registry

This document registers a URI in the "IETF XML Registry" [RFC3688]. Following the format in [RFC3688], the following registration has been made:

```
URI:
   urn:ietf:params:xml:ns:yang:ietf-data-export-capabilities
Registrant Contact:
   The IESG.
XML:
   N/A; the requested URI is an XML namespace.
```

4.2. Updates to the YANG Module Names Registry

This document registers one YANG module in the "YANG Module Names" registry [RFC6020]. Following the format in [RFC6020], the following registration has been made:

```
name:
   ietf-data-export-capabilities
namespace:
   urn:ietf:params:xml:ns:yang:ietf-data-export-capabilities
prefix:
   dec
reference:
   RFC XXXX (RFC Ed.: replace XXX with actual RFC number and remove
```

this note.)

5. Security Considerations

The YANG module specified in this document defines a schema for data that is designed to be accessed via network management protocols such as NETCONF [RFC6241] or RESTCONF [RFC8040]. The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [RFC6242]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS [RFC8446].

The NETCONF Configuration Access Control Model (NACM) [RFC8341] provides the means to restrict access for particular NETCONF or RESTCONF users to a preconfigured subset of all available NETCONF or RESTCONF protocol operations and content.

There are a number of data nodes defined in this YANG module that are writable/creatable/deletable (i.e., config true, which is the default). These data nodes may be considered sensitive in some network environments. Write operations (e.g., edit-config) to these data nodes without proper protection can have a negative effect on network operations. These are the subtrees and data nodes and their sensitivity/vulnerability:

- /sysc:system-capabilities/dec:transport-protocol

- /sysc:system-capabilities/dec:encoding-format

- /sysc:system-capabilities/dec:security-protocol

- /sysc:system-capabilities/dec:compression-mode

- /sysc:system-capabilities/inc:subscription-capabilities/dec:message-bundling-support

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[RFC8407] Bierman, A., "Guidelines for Authors and Reviewers of Documents Containing YANG Data Models", BCP 216, RFC 8407, DOI 10.17487/RFC8407, October 2018, <https://www.rfc-editor.org/info/rfc8407>.

[RFC8446] Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.3", RFC 8446, DOI 10.17487/RFC8446, August 2018, <https://www.rfc-editor.org/info/rfc8446>.

7.2. Informative References

[I-D.ietf-netconf-https-notif]
Jethanandani, M. and K. Watsen, "An HTTPS-based Transport for Configured Subscriptions", draft-ietf-netconf-https-notif-06 (work in progress), November 2020.

[I-D.ietf-netconf-udp-notif]
Zheng, G., Zhou, T., Graf, T., Francois, P., and P. Lucente, "UDP-based Transport for Configured Subscriptions", draft-ietf-netconf-udp-notif-01 (work in progress), November 2020.

[RFC3688] Mealling, M., "The IETF XML Registry", BCP 81, RFC 3688, DOI 10.17487/RFC3688, January 2004, <https://www.rfc-editor.org/info/rfc3688>.

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Appendix A. Usage Example of interaction with Adaptive Subscription

The following instance-data example describes the notification capabilities of a hypothetical "acme-router". The router implements the running, and operational datastores. Every change can be reported on-change from running, but only config=true nodes and some config=false data from operational. Interface statistics are reported only when both adaptive-interval-support and count-threshold-support are set to true.

```
<?xml version="1.0" encoding="UTF-8"?>
<instance-data-set xmlns=
    "urn:ietf:params:xml:ns:yang:ietf-yang-instance-data">
  <name>acme-router-notification-capabilities</name>
  <content-schema>
    <module>ietf-system-capabilities@2020-03-23</module>
    <module>ietf-notification-capabilities@2020-03-23</module>
    <module>ietf-data-export-capabilities@2020-03-23</module>
  </content-schema>
  <!-- revision date, contact, etc. -->
  <description>Defines the notification capabilities of an acme-router.
    The router only has running, and operational datastores.
    Every change can be reported on-change from running, but
    only config=true nodes and some config=false data from operational.
    Statistics are not reported based on timer based trigger and counter
    threshold based trigger.
  </description>
  <content-data>
    <system-capabilities
      xmlns="urn:ietf:params:xml:ns:yang:ietf-system-capabilities"
      xmlns:inc=
        "urn:ietf:params:xml:ns:yang:ietf-notification-capabilities"
      xmlns:ds="urn:ietf:params:xml:ns:yang:ietf-datastores">
      <datastore-capabilities
      xmlns:dec="urn:ietf:params:xml:ns:yang:ietf-data-export-capabilities">
        <datastore>ds:operational</datastore>
        <per-node-capabilities>
          <node-selector>
              /if:interfaces/if:interface/if:statistics
```

```
          </node-selector>
          <inc:subscription-capabilities>
            <inc:minimum-dampening-period>5
              </inc:minimum-dampening-period>
            <inc:on-change-supported>
              state-changes
            </inc:on-change-supported>
          </inc:subscription-capabilities>
        </per-node-capabilities>
        <per-node-capabilities>
          <node-selector>
              /if:interfaces/if:interface/if:statistics/if:out-octets
          </node-selector>
          <dec:data-export-capabilities>
            <dec:adaptive-interval-support>false</dec:adaptive-interval-
support>
              <dec:threshold-event-support>false</dec:threshold-event-support>
          </dec:data-export-capabilities>
        </per-node-capabilities>
        <per-node-capabilities>
          <node-selector>
              /if:interfaces/if:interface/if:statistics/if:in-errors
          </node-selector>
          <dec:data-export-capabilities>
            <dec:adaptive-interval-support>true</dec:adaptive-interval-support>
            <dec:threshold-event-support>true</dec:threshold-event-support>
          </dec:data-export-capabilities>
        </per-node-capabilities>
      </datastore-capabilities>
    </system-capabilities>
  </content-data>
</instance-data-set>
```


The client configure adaptive subscription parameters on the server. The adaptive subscription configuration parameters require the server to scan all interface of specific type every 5 seconds if the value of interface in-errors is greater than 1000; If the interface in-errors value is less than 1000, switch to 60 seconds period value, and then scan all client every 60 seconds.

```
<rpc message-id="101"
     xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <edit-config>
    <target>
      <running/>
    </target>
    <config xmlns:xc="urn:ietf:params:xml:ns:netconf:base:1.0">
      <top xmlns="http://example.com/schema/1.2/config"
      xmlns:yp="urn:ietf:params:xml:ns:yang:ietf-yang-push"
      >
      <yp:datastore
        xmlns:ds="urn:ietf:params:xml:ns:yang:ietf-datastores">
        ds:running
      </yp:datastore>
     <yp:datastore-xpath-filter
       xmlns:ex="https://example.com/sample-data/1.0">
       /if:ietf-interfaces
    </yp:datastore-xpath-filter>
  <as:adaptive-subscriptions
 xmlns:as="urn:ietf:params:xml:ns:yang:ietf-adaptive-subscription">
   <as:data-path>/if:interfaces/if:interface/if:statistics</as:data-path>
   <as:target>in-errors</as:target>
  <as:adaptive-period>
   <as:xpath-external-eval>in-errors &gt; 1000</as:xpath-external-eval>
   <as:watermark>1000</as:watermark>
   <as:period>5</as:period>
  </as:adaptive-period>
  <as:adaptive-period>
   <as:xpath-external-eval>in-errors &lt; 1000</as:xpath-external-eval>
   <as:watermark>1000</as:watermark>
   <as:period>60</as:period>
  </as:adaptive-period>
 </as:adaptive-subscriptions>
      </top>
    </config>
  </edit-config>
</rpc>
```

Appendix B. Usage Example of interaction with UDP based Transport for Configured Subscription

```
<?xml version="1.0" encoding="UTF-8"?>
<instance-data-set xmlns=
    "urn:ietf:params:xml:ns:yang:ietf-yang-instance-data">
  <name>acme-router-notification-capabilities</name>
  <content-schema>
    <module>ietf-system-capabilities@2020-03-23</module>
    <module>ietf-notification-capabilities@2020-03-23</module>
    <module>ietf-data-export-capabilities@2020-03-23</module>
  </content-schema>
  <!-- revision date, contact, etc. -->
  <description>Defines the notification capabilities of an acme-router.
    The router only has running, and operational datastores.
    Every change can be reported on-change from running, but
    only config=true nodes and some config=false data from operational.
    Statistics are not reported based on timer based trigger and counter
    threshold based trigger.
  </description>
  <content-data>
    <system-capabilities
      xmlns="urn:ietf:params:xml:ns:yang:ietf-system-capabilities"
      xmlns:inc="urn:ietf:params:xml:ns:yang:ietf-notification-capabilities"
      xmlns:ds="urn:ietf:params:xml:ns:yang:ietf-datastores">
    <data-export-capabilities>
      <transport-protocol>udp</transport-protocol>
      <encoding-format>binary</encoding-format>
    </data-export-capabilities>
    </system-capabilities>
  </content-data>
</instance-data-set>
```


Appendix C. Changes between Revisions

v02 - v03

- o Change 'data-export-capabilities' into list type to support multiple transport protocol, encoding on the server.

- o Add Usage Example of interaction with UDP based Transport for Configured Subscription.

- o Add Thomas Graf as a contributor;

- o Update motivation in the introduction to clarify why this work is needed.

- o Support udp notif and http notif as two optional transport in the YANG data model.

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