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Telemetry Data Export capability
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Abstract

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

Status of This Memo

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1. Introduction

Notification capability 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 capability 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 pre-configuration for some transport specific parameters (e.g., transport protocol, encoding format, encryption by the client is still inevitable, which may cause unexpected failure and additional message exchange between client and server.

This document proposes a YANG module for telemetry data export capability which augments System Capabilities model and provide additional data export attributes for transport dependent capability negotiation.

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 and session level capabilities and can be provided either at implementation time or reported at 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 transport connection;
- o Specification of encoding selection(e.g., XML or JSON, to binary) of 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 Maximum number of data nodes that can be sent in a group of data node with the same characteristics;

- o Specification of the number of sensors group. A sensor group represents a reusable grouping of multiple paths and exclude filters.
- o Specification of the notification message encapsulation type, either one notification per message or multiple notifications per message.
- o Specification of the type of subscription, e.g., periodic subscription, on-change subscription, bulk subscription, adaptive subscription.
- o Specification of the update trigger type such as 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
      +--ro max-nodes-per-sensor-group?  uint32
      +--ro max-sensor-group-per-update? uint32
    augment /sysc:system-capabilities/inc:subscription-capabilities:
      +--ro data-export-capabilities
      +--ro message-bundling-support?    boolean
      +--ro subscription-mode?           identityref
    augment /sysc:system-capabilities/sysc:datastore-capabilities/sysc:per-node-capabilities:
      +--ro data-export-capabilities
      +--ro timer-event-support?         boolean
      +--ro sampling-interval* []
        | +--ro observable-period        centiseconds
        | +--ro count?                   uint16
        | +--ro anchor-time?             yang:date-and-time
      +--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;
}
import ietf-yang-types {
  prefix yang;
}

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.

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  authors of the code.  All rights reserved.

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  (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 transport protocol.";
}

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

identity grpc {
  base transport-protocol;
  description
    "Identity for grpc 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 gpb {
  base encoding-format;
  description
    "Identity for gpb encoding format.";
}

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

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

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

identity deflate {
  base security-protocol;
  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.";
    container data-export-capabilities {
      description
        "Capabilities related to telemetry data export capability 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.";
    }
    leaf max-nodes-per-sensor-group {
        type uint32 {
            range "1..max";
        }
        description
            "Maximum number of selected data nodes that can be sent
            per sensor group.";
    }
    leaf max-sensor-group-per-update {
        type uint32 {
            range "1..max";
        }
        description
            "Maximum number of sensor groups that can be sent
            in an update.";
    }
}
}
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.";
        }
        leaf subscription-mode {
            type identityref {
                base subscription-mode;
            }
            description
                "Type of subscription mode.";
        }
    }
}
}
augment "/sysc:system-capabilities/sysc:datastore-capabilities/sysc:per-node-ca
pabilities" {
    description
        "Add datastore and node level capability.";
    container data-export-capabilities {
        description
            "Capabilities related to telemetry data export capability negotiation.";
        leaf timer-event-support {
```

```
type boolean;
default "false";
description
  "Set to true if the subscription mode is event based
  subscription mode and timer based trigger is supported.
  Set to false if event based subscription mode is not
  supported.";
}
list sampling-interval {
  description
    "Time-based triggers are used to define the
    Sampling intervals. All packets are selected that arrive
    at the Observation Point within the time intervals defined
    by the start and stop triggers (i.e., arrival time of the
    packet is larger than the start time and smaller than the
    stop time).";
  leaf observable-period {
    type centiseconds;
    mandatory true;
    description
      "Duration of time that should occur between Observation Point
      for periodic push updates, in units of 0.01 seconds.";
  }
  leaf count {
    type uint16;
    description
      "specify the count number of interval that has to pass before
      successive adaptive periodic push update records for the same
      subscription are generated for a receiver.";
  }
  leaf anchor-time {
    type yang:date-and-time;
    description
      "Designates a timestamp before or after which a series
      of periodic push updates are determined. The next
      update will take place at a point in time that is a
      multiple of a period from the 'anchor-time'.
      For example, for an 'anchor-time' that is set for the
      top of a particular minute and a period interval of a
      minute, updates will be sent at the top of every
      minute that this subscription is active.";
  }
}
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 duplicated data objects to be sent during each update interv
al.";
    }
}
}
}
}
<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:

- o /sysc:system-capabilities/dec:transport-protocol
- o /sysc:system-capabilities/dec:encoding-format
- o /sysc:system-capabilities/dec:secure-transport
- o /sysc:system-capabilities/dec:compression-mode
- o /sysc:system-capabilities/dec:max-nodes-per-sensor-group
- o /sysc:system-capabilities/dec:sensor-group-count
- o /sysc:system-capabilities/inc:subscription-capabilities/
dec:message-bundling-support
- o /sysc:system-capabilities/inc:subscription-capabilities/
dec:subscription-mode
- o /sysc:system-capabilities/sysc:datastore-capabilities/sysc:per-
node-capabilities/dec:sampling-interval

6. Contributors

The authors would like to thank Ran Tao for his major contributions to the initial modeling and use cases.

7. References

7.1. Normative References

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- [RFC8340] Bjorklund, M. and L. Berger, Ed., "YANG Tree Diagrams", BCP 215, RFC 8340, DOI 10.17487/RFC8340, March 2018, <<https://www.rfc-editor.org/info/rfc8340>>.

Appendix A. Usage Example of interaction between telemetry data export capabilities and 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 timer-event-support and count-threshold-support are set to true.

```
<CODE BEGINS> file "acme-router-notification-capabilities.xml"
===== NOTE: '\ ' line wrapping per BCP YYY (RFC YYYY) =====
```

```
<?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>
      <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:timer-event-support>true</dec:timer-event-support>
          <dec:sampling-interval>
            <dec:period>5</dec:period>
            <dec:count>6</dec:count>
          </dec:sampling-interval>
          <dec:sampling-interval>
            <dec:period>60</dec:period>
            <dec:count>6</dec:count>
          </dec:sampling-interval>
          <dec:threshold-event-support>false</dec:threshold-event-support>
        </dec:data-export-capabilities>
      </per-node-capabilities>
    </datastore-capabilities>
  </system-capabilities>
</content-data>

```

```
</per-node-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:timer-event-support>false</dec:timer-event-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 up to 30 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 up to 360 seconds. 30 seconds and 360 seconds can be seen as time window. The time window length is 6 period values. Irrespective of period value set for adaptive subscription, 6 event records during the time window should be generated for the same subscription and send to the receivers.


```
<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">
        <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:condition-expression>in-errors < 1000</as:condition-expressioni>
            <as:watermark>1000</as:watermark>
            <as:period>5</as:period>
            <as:count>12</as:count>
          </as:adaptive-period>
          <as:adaptive-period>
            <as:condition-expression>in-errors < 1000</as:condition-expressioni>
            <as:watermark>1000</as:watermark>
            <as:period>60</as:period>
            <as:count>12</as:count>
          </as:adaptive-period>
        </as:adaptive-subscriptions>
      </top>
    </config>
  </edit-config>
</rpc>
```

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