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**Data Export Notification Capability**

## Abstract

This document proposes a YANG module for data export notification capabilities which augments System-Capabilities model defined in [I-D.netconf-notification-capabilities] and provides additional data export attributes associated with system capabilities for transport specific Notification. This YANG module can be used by the client to learn capability information from the server at run-time or implementation-time, per the YANG Instance Data File Format.

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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 allow the client to adjust its behavior to take advantage of the features exposed by the server.

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 specific notification. The module can be used by the client to discover

capability information from the server at run-time or implementation-time, per the YANG Instance Data File Format.

### 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:

- \*Supported (reporting) periods for "periodic" subscriptions
- \*Maximum number of objects that can be sent in an update
- \*The set of datastores or data nodes for which "periodic" or "on-change" notification is supported
- \*Supported dampening periods for "on-change" subscriptions

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:

- \*Specification of transport protocol the client can use to establish a transport connection;
- \*Specification of the encoding selection used (e.g., XML or JSON, Binary) for Data modeled with YANG;
- \*Specification of secure transport mechanisms that are needed by the client to communicate with the server;
- \*Specification of the notification message encapsulation type, either one notification per message or multiple notifications per message [I-D. ietf-netconf-notification-messages].

## 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 data-export-capability* []
      +--ro transport-protocol?      identityref
      +--ro encoding-format*         identityref
      +--ro security-protocol?       identityref
      +--ro message-bundling-support? empty
```

### 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>
    Editor:    Qiufang Ma <mailto:maqiufang1@huawei.com>
    Editor:    Peng Liu <mailto:liupengyjy@chinamobile.com>
    Editor:    Wei Wang <mailto:wangw36@chinatelecom.cn>";
  description
    "This module defines an extension to System Capability and YANG Push
    Notification Capabilities model and provides additional data export
    attributes for transport specific notification.

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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 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 dtls {
    base security-protocol;
    description
        "Identity for dtls 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 cbor {
    base binary;
    description
        "Identity for cbor encoding format.";
}

augment "/sysc:system-capabilities" {
    description
        "Add system level capability.";
    container data-export-capabilities {
        description
            "Capabilities related to data export notification capabilities negotiation.";
        list data-export-capability {
            description
                "Capability list related to data export notification capabilities negotiation.";
            leaf transport-protocol {
                type identityref {
                    base transport-protocol;
                }
                description

```

```

        "Type of transport protocol.";
    }
    leaf-list 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 message-bundling-support {
        type empty;
        description
            "Enables message bundling support.";
    }
}
}
}
}
}

```

<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.

All protocol-accessible data nodes are read-only and cannot be modified. The data in these modules is not security sensitive. Access control may be configured, to avoid exposing the read-only data.

When this data is in file format, data should be protected against modification or unauthorized access using normal file handling mechanisms.

## 6. Contributors

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- [RFC7950] Bjorklund, M., Ed., "The YANG 1.1 Data Modeling Language", RFC 7950, DOI 10.17487/RFC7950, August 2016, <<https://www.rfc-editor.org/info/rfc7950>>.
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**[RFC8174]**

Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.

**[RFC8341]**

Bierman, A. and M. Bjorklund, "Network Configuration Access Control Model", STD 91, RFC 8341, DOI 10.17487/RFC8341, March 2018, <<https://www.rfc-editor.org/info/rfc8341>>.

**[RFC8342]**

Bjorklund, M., Schoenwaelder, J., Shafer, P., Watsen, K., and R. Wilton, "Network Management Datastore Architecture (NMDA)", RFC 8342, DOI 10.17487/RFC8342, March 2018, <<https://www.rfc-editor.org/info/rfc8342>>.

**[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>>.

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HTTPS-based Transport for YANG Notifications", Work in Progress, Internet-Draft, draft-ietf-netconf-https-notif-08, 22 February 2021, <<https://www.ietf.org/archive/id/draft-ietf-netconf-https-notif-08.txt>>.

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Voit, E., Jenkins, T., Birkholz, H., Bierman, A., and A. Clemm, "Notification Message Headers and Bundles", Work in Progress, Internet-Draft, draft-ietf-netconf-notification-messages-08, 17 November 2019, <<https://>

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**[RFC6020]** Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", RFC 6020, DOI 10.17487/RFC6020, October 2010, <<https://www.rfc-editor.org/info/rfc6020>>.

**[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 with UDP Notif and HTTP Notif for Configured Subscription**

The following instance-data example describes the Data Export Notification capabilities of a hypothetical "acme-router".

```

<?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>Server Capability Discovery</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-capabilit
      xmlns:ds="urn:ietf:params:xml:ns:yang:ietf-datastores">
      <data-export-capabilities>
        <data-export-capability>
          <transport-protocol>http-notif</transport-protocol>
          <encoding-format>json</encoding-format>
          <encoding-format>xml</encoding-format>
        </data-export-capability>
        <data-export-capability>
          <transport-protocol>udp-notif</transport-protocol>
          <encoding-format>binary</encoding-format>
        </data-export-capability>
      </data-export-capabilities>
    </system-capabilities>
  </content-data>
</instance-data-set>

```

In addition, the client could also query data export capability from the server. For example, the client sends <get> request message to the the server to query data export capability from the server.

```

<rpc message-id="101" xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <get>
    <filter type="subtree">
      <system-capabilities xmlns="urn:ietf:params:xml:ns:yang:ietf-system
        <data-export-capabilities/>
      </system-capabilities>
    </filter>
  </get>
</rpc>

```

The server returns server data export capability using <rpc-reply> as follows:

```

<rpc-reply message-id="101" xmlns="urn:ietf:params:xml:ns:netconf:base:1
  <data>
    <system-capabilities xmlns="urn:ietf:params:xml:ns:yang:ietf-system-ca
      <data-export-capabilities>
        <data-export-capability>
          <transport-protocol>http-notif</transport-protocol>
          <encoding-format>json</encoding-format>
        </data-export-capability>
        <data-export-capability>
          <transport-protocol>udp-notif</transport-protocol>
          <encoding-format>binary</encoding-format>
        </data-export-capability>
      </data-export-capabilities>
    </system-capabilities>
  </data>
</rpc-reply>

```

## Appendix B. Other Per-node Notification-related Capabilities

Since there may be a need for a service to configure both clients and servers with multiple different period intervals and corresponding subscription policy which allows servers/publishers automatically switch to different period intervals according to resource usage change without the interaction with the remote client. E.g., in a wireless network performance monitoring scenario when the wireless signal strength falls below a configured low watermark, the subscribed data can be streamed at a higher rate while when the wireless signal strength crosses a configured high watermark, the subscribed data can be streamed at lower rate.

Some per-node capability parameters may be useful in this scenario, which augments system capabilities model(e.g., /sysc:system-capabilities/sysc:datastore-capabilities /sysc:per-node-capabilities) to indicate if the server supports to multiple period intervals switching and counter threshold evaluation. These parameters could be:

- \*adaptive-interval-support, which is used to indicate if one event stream supports multiple period intervals and allows period interval switching;
- \*counter-threshold-support, which is used to indicate if the subscription mode supports counter-based trigger (i.e., named counter crosses a specified threshold).

The "adaptive-interval-support" parameter can be used to report if a server supports to switch to different period intervals automatically when a trigger condition is satisfied. And the counter threshold evaluation could be used for a specific integer built-in

type data node when the "counter-threshold-support" parameter is true or present as an empty type.

## **Appendix C. Changes between Revisions**

### **v05-v06**

- \*Revise abstract and introduction sessions so that the scope of this draft is not limited to telemetry but other notification.
- \*Revise the description of module ietf-system-capabilities to align with the latest version of draft-ietf-netconf-notification-capabilities.
- \*Remove compression-mode, timer-event-support and suppress-redundant parameters in the model.
- \*Move per-node related capability parameters to appendix section.
- \*Add a container to wrap data export capabilities to cleanly separate different groups of capabilities.

### **v04 - v05**

- \*Change per-node-capabilities related parameters into empty type.
- \*Revise abstract and introduction section to only focus on capability fetching mechanism from the client to the server.
- \*Update Usage Example of interaction with HTTP-Notif and UDP-Notif for Configured Subscription.

### **v03 - v04**

- \*Add interface namespace in the Adaptive Subscription usage example.
- \*subtrees and data nodes changes in the security section.
- \*Two compression mode related identities change.
- \*Move message-bundling-support parameter to system capabilities level.
- \*Add an example to discuss report receiver capability from the client per yang instance file format.
- \*Change encoding format from leaf to leaf-list and support multiple encoding formats for the same transport specific notif.

v02 - v03

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

\*Add Usage Example of interaction with UDP based Transport for Configured Subscription.

\*Add Thomas Graf as a contributor;

\*Update motivation in the introduction to clarify why this work is needed.

\*Support udp notif and http notif as two optional transport in the YANG data model.

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