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Adaptive Subscription to YANG Notification
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Abstract

This document defines a YANG data model and associated mechanism enabling subscriber's adaptive subscriptions to a publisher's event streams. Applying these elements allows a subscriber to automatically adjust the volume of telemetry traffic sent from publisher to the receivers.

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1. Introduction

YANG-Push subscriptions [[RFC8641](#)] allow client applications to subscribe to continuous datastore updates without needing to poll. It defines a mechanism (i.e., update trigger) to determine when an update record needs to be generated. Two type of subscriptions are introduced in [[RFC8641](#)], distinguished by how updates are triggered: periodic and on-change.

- o Periodic subscription allows subscribed data to be streamed to the destination at a configured fixed periodic interval
- o On-change subscription allows update to be triggered when whenever a change in the subscribed information is detected. The periodic interval is set to zero value in the on-change subscription case.

However in some cases (e.g., wireless channel contention and interference causes the WLAN throughput and per-packet delays to vary over time), both collectors and publishers are configured with multiple periodic intervals and the subscribed data set can be streamed out to the destination at adaptive sampling or export rate, e.g., when wireless signal strength drops below a certain threshold, more data should be collected at high frequency.

This document defines a YANG data model and associated mechanism enabling subscriber's adaptive subscriptions to a publisher's event streams. Applying these elements allows a subscriber to

automatically adjust the volume of telemetry traffic sent from publisher to the receivers.

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.

This document uses the following terms:

Event: Something that happens which may be of interest or trigger the invocation of the rule. A fault, an alarm, a change in network state, network security threat, hardware malfunction, buffer utilization crossing a threshold, network connection setup, an external input to the system, for example [[RFC3877](#)].

Client: Defined in [[RFC8342](#)].

Configuration: Defined in [[RFC8342](#)].

Configured subscription: Defined in [[RFC8639](#)]

Configuration datastore: Defined in [[RFC8342](#)].

Notification message: Information intended for a receiver indicating that one or more events have occurred [[RFC8639](#)].

Publisher: An entity responsible for streaming notification messages per the terms of a subscription [[RFC8639](#)].

Receiver: A target to which a publisher pushes subscribed event records. For dynamic subscriptions, the receiver and subscriber are the same entity [[RFC8639](#)].

Subscriber: A client able to request and negotiate a contract for the generation and push of event records from a publisher. For dynamic subscriptions, the receiver and subscriber are the same entity [[RFC8639](#)].

Subscription: A contract with a publisher, stipulating the information that one or more receivers wish to have pushed from the publisher without the need for further solicitation [[RFC8639](#)].

On-change subscription: A datastore subscription with updates that are triggered when changes in subscribed datastore nodes are detected.

Periodic subscription: A datastore subscription with updates that are triggered periodically according to some time interval.

2. Model Overview

The YANG data model for the "Adaptive Subscription to YANG Notification" augments the "update-trigger" in the YANG Push model to add a "adaptive-period" case. Under the "adaptive-period" case, a "adaptive-period" list is defined. The "adaptive-period" list uses the key "id" for indexing. Within the "adaptive-period" list, an "interval" leaf and the corresponding trigger conditions are defined. When the trigger condition is satisfied, e.g., "op-field" exceeds the "op-value" and the change of "op-field" is monotonically increasing, the update interval will be changed into the value of "interval" leaf and the objects being filtered will be exported every interval specified by the value of "interval" leaf. The "anchor-time" is used to indicate at which points in time periodic updates need to be assembled and sent.

The following tree diagrams [[RFC8340](#)] provide an overview of the data model for "ietf-adaptive-subscription.yang" module.

```

module: ietf-adaptive-subscription
  augment /sn:subscriptions/sn:subscription/yp:update-trigger:
    +--:(adaptive-subscription)
      +--rw adaptive-subscriptions
        +--rw adaptive-period* [id]
          |   +--rw id          string
          |   +--rw op-field?   yang:xpath1.0
          |   +--rw op-value?   string
          |   +--rw operator?   operator
          |   +--rw interval    centiseconds
          |   +--rw anchor-time yang:date-time
  
```

3. Bulk Subscription YANG Module

```

<CODE BEGINS> file "ietf-adaptive-subscription@2020-02-14.yang"
module ietf-adaptive-subscription {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-adaptive-subscription";
  prefix as;
  import ietf-subscribed-notifications {
    prefix sn;
  }
}
  
```



```
import ietf-yang-push {
  prefix yp;
}
import ietf-yang-types {
  prefix yang;
}
organization
  "IETF NETCONF (Network Configuration) Working Group";
contact
  "";
description
  "NETCONF Protocol Data Types and Protocol Operations.
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  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 2019-12-15 {
  description
    "Initial revision";
  reference
    "RFCxxx Adaptive subscription to YANG notification.";
}

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

typedef operator {
  type enumeration {
    enum unequal {
      description
        "Indicates that the comparision type is unequal to.";
    }
    enum equal {
      description
        "Indicates that the comparision type is equal to.";
    }
    enum less {
```



```
    description
      "Indicates that the comparision type is less than.";
  }
  enum less-or-equal {
    description
      "Indicates that the comparision type is less than
      or equal to.";
  }
  enum greater {
    description
      "Indicates that the comparision type is greater than.";
  }
  enum greater-or-equal {
    description
      "Indicates that the comparision type is greater than
      or equal to.";
  }
}
description
  "definition of the operator";
}
augment "/sn:subscriptions/sn:subscription/yp:update-trigger" {
  description
    "This augmentation adds additional subscription parameters
    that apply specifically to adaptive subscription.";
  case adaptive-period {
    container adaptive-periods {
      list adaptive-period {
        key "id";
        leaf id {
          type string;
          description
            "identifier";
        }
        leaf op-field {
          type yang:xpath1.0;
          description
            "targeted objects";
        }
        leaf op-value {
          type string;
          description
            "Compartion value which is static threshold value.";
        }
        leaf operator {
          type operator;
          description
            "Comparison type.";
        }
      }
    }
  }
}
```



```
    }
    leaf interval {
      type centiseconds;
      mandatory true;
      description
        "Duration of time that should occur between periodic
        push updates, in units of 0.01 seconds.";
    }
    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'.
        If an anchor-time is not provided, then the anchor-time
        MUST be set with the creation time of the initial
        update record. ";
    }
  description
    "List for adaptive periods";
}
description
  "Container for adaptive periods.";
}
}
}
}
}
<CODE ENDS>
```

4. IANA Considerations

4.1. Updates to the IETF XML Registry

This document registers two URIs in the IETF XML registry [[RFC3688](#)]. Following the format in [[RFC3688](#)], the following registrations are requested to be made:

```
-----
URI: urn:ietf:params:xml:ns:yang:ietf-adaptive-subscription
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 two YANG modules in the YANG Module Names registry [RFC7950]. . Following the format in [RFC6020], the following registration has been made:

```
-----  
Name:          ietf-adaptive-subscription  
Namespace:     urn:ietf:params:xml:ns:yang:ietf-adaptive-subscription  
Prefix:        as  
Reference:     RFC xxxx  
-----
```

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 /sn:subscriptions/sn:subscription/yp:update-trigger/adaptive-periods/adaptive-period/id
- o /sn:subscriptions/sn:subscription/yp:update-trigger/adaptive-periods/adaptive-period/interval

6. References

6.1. Normative References

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[6.2.](#) Informative References

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[Appendix A.](#) Adaptive Subscription Example

The example YANG module used in this document represents performance data telemetry on a simple optical device. The collector can control the rate of telemetry data to be streamed to the destination by switching to different time interval for the update to be sent.

YANG tree diagram for the "example-opticalbox-telemetry" module:


```
module example-opticalbox-telemetry {
  namespace "tag:ietf:example:opticalbox";
  prefix "optibox";
  container opticalstat {
    leaf transmit-power {
      description "Transmit optical power reading";
      type int;
      config false;
    }
    leaf receiving-power {
      description "Receiving optical power reading";
      type int;
      config false;
    }
    leaf power-threshold {
      description "Optical Power Threshold";
      type int;
    }
    leaf high-voltage {
      description "High voltage threshold";
      type int;
    }
    leaf low-voltage {
      description "Low voltage threshold";
      type int;
    }
    leaf voltage {
      description "current voltage reading";
      type int;
      config false;
    }
    leaf current-temperature {
      description "Current temperature reading";
      type int;
      config false;
    }
    leaf cup-usage {
      type uint32;
      config false;
    }
  }
}
```

The adaptive subscription model can be used to keep track of performance data change such as temperature, voltage, power, cup usage. In addition, it can adjust update period based on performance data change, e.g., when the current receiving power is higher than the pre-configured threshold, the notification for the optical

performance data from publisher can be sent at a low frequency. When the current receiving power is lower than the pre-configured threshold, the notification for the optical performance data can be sent at a high frequency.

```
<netconf:rpc message-id="101"
  xmlns:netconf="urn:ietf:params:xml:ns:netconf:base:1.0">
  <establish-subscription
    xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications"
    xmlns:yp="urn:ietf:params:xml:ns:yang:ietf-yang-push">
    <yp:datastore
      xmlns:ds="urn:ietf:params:xml:ns:yang:ietf-datastores">
      ds:operational
    </yp:datastore>
    <yp:datastore-xpath-filter
      xmlns:ex="https://example.com/sample-data/1.0">
      /ex:foo
    </yp:datastore-xpath-filter>
    <as:adaptive-periods>
      <as:adaptive-period>
        <as:id>01</as:id>
        <as:op-field>/opticalstat/current-voltage</as:op-field>
        <as:op-value>60</as:op-value>
        <as:operator>greater</as:operator>
        <as:period>500</as:period>
      </as:adaptive-period>
      <as:adaptive-period>
        <as:id>02</as:id>
        <as:op-field>/opticalstat/current-voltage</as:op-field>
        <as:op-value>60</as:op-value>
        <as:operator>less-or-equal</as:operator>
        <as:period>100</as:period>
      </as:adaptive-period>
    </yp:adaptive-periods>
  </establish-subscription>
</netconf:rpc>
```

In another example, when the time interval for update to be sent is set to 5 seconds and specific performance data, e.g., 5 receiving power values (0.48dBm; 0.57dBm; 0.61dBm; 0.69dBm; 0.70dBm) can be sampled per second and collected during this time interval changes. When power changes exceed the preconfigured threshold (e.g., 0.20dBm), all these 5 receiving power values falling within detection time window or update time interval should be published to the destinations for data analysis.

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