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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 with various different period intervals to report updates.
   Applying these elements allows servers automatically adjust the
   volume of telemetry traffic and rate of traffic sent from publisher
   to the receivers.

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   This Internet-Draft is submitted in full conformance with the
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   material or to cite them other than as "work in progress."

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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 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 large scale deployments (e.g., wireless network
performance monitoring) where an increased data collection rate is
being used, it becomes more likely that a burst of streamed data may
temporarily overwhelm a receiver and consume expensive network
resource (e.g., radio resource). If the rate at which we can collect
a stream of data is set too low or getting low priority telemetry
data dropped, these telemetry data are not sufficient to detect and
diagnose problems and verify correct network behavior. There is 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., 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.

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 servers to automatically
adjust the volume of telemetry traffic and rate of 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.

The following terms are defined in [RFC5277] [RFC7950] [RFC3198]
[RFC8342] [RFC8639] and are not redefined here:

o Event

o Client

o Configuration

o Configured subscription

o Configuration datastore

   o Notification message

   o Publisher

   o Receiver

   o Subscriber

   o Subscription

   o On-change subscription

   o Periodic subscription

2. Model Overview

   This document defines a YANG module "ietf-adaptive-subscription",
   which augments the "update-trigger" choice defined in the "ietf-yang-
   push" module [RFC8641] with subscription configuration parameters
   that are specific to adaptive subscription.

   In addition to Subscription state notifications defined in [RFC8639]
   and Notifications for Subscribed Content defined in [RFC8641], "ietf-
   adaptive-subscription" YANG module also defines "adaptive-period-
   update" notification to report update interval change.

   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:
    +--rw (adaptive-subscription)?
       +--:(adaptive-subscriptions)
          +--rw adaptive-subscriptions
             +--rw adaptive-period* [name]
                +--rw name                    string
                +--rw xpath-external-eval     string
                +--rw watermark?              uint32
                +--rw period                  centiseconds
                +--rw anchor-time?            yang:date-and-time
  augment /sn:establish-subscription/sn:input/yp:update-trigger:
    +-- (adaptive-subscription)?
       +--:(adaptive-subscriptions)
          +--rw adaptive-subscriptions
             +--rw adaptive-period* [name]
                +--rw name                    string
                +--rw xpath-external-eval     string
                +--rw watermark?              uint32
                +--rw period                  centiseconds
                +--rw anchor-time?            yang:date-and-time
  notifications:
    +---n adaptive-period-update
       +--ro id?                              sn:subscription-id
       +--ro period                           centiseconds
       +--ro anchor-time?                     yang:date-and-time
       +--ro (selection-filter)?
          +--:(by-reference)
          |  +--ro selection-filter-ref       selection-filter-ref
          +--:(within-subscription)
             +--ro (filter-spec)?
                +--:(datastore-subtree-filter)
                |  +--ro datastore-subtree-filter?   <anydata> {sn:subtree}?
                +--:(datastore-xpath-filter)
                   +--ro datastore-xpath-filter?     yang:xpath1.0 {sn:xpath}?
```

2.1. Subscription Configuration

   For adaptive subscriptions, triggered updates will occur at the
   boundaries of specified time intervals when a trigger condition is
   satisfied. These boundaries can be calculated from the adaptive
   periodic parameters:

   o   a "period" that defines the new duration between push updates, the
       period can be changed based on trigger condition.

   o   an "anchor-time" update intervals fall on the points in time that
       are a multiple of a "period" from an "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.

o a "watermark" that defines the threshold value of the targeted
data object, e.g., it can be lower boundary or upper boundary of
targeted data object.

o a "xpath-external-eval" represents an Evaluation criteria that may
be applied against event records in an event stream, which is used
to trigger update interval switch in the server. It contains
comparisons of datastore node with its value to the specific
threshold (i.e., watermark) and associated logical operation in
the XPath format. Different from stream-xpath-filter defined in
[RFC8639], it doesn't influence the event records output
generation from a publisher.

2.2. YANG RPC

2.2.1. "establish-subscription" RPC

The augmentation of YANG module ietf-yang-push made to RPCs specified
in YANG module ietf-subscribed-notifications [RFC8639] is introduced.
This augmentation concerns the "establish- subscription" RPC, which
is augmented with parameters that are needed to specify adaptive
subscriptions. These parameters are same as one defined in
Section 2.1.

2.3. Notifications for Adaptive Subscribed Content

The adaptive update notification is similar to Subscription state
change notifications defined in [RFC8639]. It is inserted into the
sequence of notification messages sent to a particular receiver. The
adaptive update notification cannot be dropped or filtered out, it
cannot be stored in replay buffers, and it is delivered only to
impacted receivers of a subscription. The identification of adaptive
update notification is easy to separate from other notification
messages through the use of the YANG extension "subscription-state-
notif". This extension tags a notification as a subscription state
change notification.

The objects in the 'adpative-update' notification include:

o a "period" that defines the duration between push updates, the
period can be changed based on trigger condition.

o an "anchor-time"; update intervals fall on the points in time that
are a multiple of a "period" from an "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.

   o A selection filter identifying YANG nodes of interest in a
      datastore. Filter contents are specified via a reference to an
      existing filter or via an in-line definition for only that
      subscription. Referenced filters allow an implementation to avoid
      evaluating filter acceptability during a dynamic subscription
      request. The "case" statement differentiates the options. Note
      that filter contents are not affected by "xpath-external-eval"
      parameter and "watermark" parameter defined by update trigger.

3. Adaptive 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.
     Copyright (c) 2020 IETF Trust and the persons identified as
     the document authors.  All rights reserved.

     Redistribution and use in source and binary forms, with or
     without modification, is permitted pursuant to, and subject
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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 seconds {
     type uint32;
     description
       "A period of time, measured in units of 1 seconds.";
   }

   grouping adaptive-subscription-modifiable {
     description
       "This grouping describes the datastore-specific adaptive subscription
        conditions that can be changed during the lifetime of the
        subscription.";
     choice adaptive-subscription {
       description
         "Defines necessary conditions for sending an event record to
                 the subscriber.";
       container adaptive-subscriptions {
         list adaptive-period {
           key "name";
           description
             "Defines necessary conditions to switch update interval for
             sending an event record to the subscriber. The event record output
             generation will not be influeced these conditions.";
           leaf name {
             type string {
           length "1..64";
            }
         description
           "The name of the condition to be matched.  A device MAY further
            restrict the length of this name; space and special
            characters are not allowed.";
          }
           leaf xpath-external-eval {
             type string;
             description
               "A XPath string, representing a logical expression,
```

```
                   which can contain comparisons of datastore values
                   and logical operations in the XPath format.";
             }
             leaf watermark {
               type uint32;
               description
                 "The watermark for targeted data object. The high
                  watermark, lowe watermark can be specified for the
                  targeted data object.";
             }
             leaf period {
               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'.
                  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.";
             }
           }
         }
         description
           "Container for adaptive subscription.";
       }
     }
   }

   augment "/sn:subscriptions/sn:subscription/yp:update-trigger" {
     description
       "This augmentation adds additional subscription parameters
        that apply specifically to adaptive subscription.";
     uses adaptive-subscription-modifiable;
   }
   augment "/sn:establish-subscription/sn:input/yp:update-trigger" {
     description
       "This augmentation adds additional subscription parameters
          that apply specifically to datastore updates to RPC input.";
     uses adaptive-subscription-modifiable;
   }
```

```
notification adaptive-period-update {
  sn:subscription-state-notification;
  description
    "This notification contains a push update that in turn contains
     data subscribed to via a subscription.  In the case of a
     periodic subscription, this notification is sent for periodic
     updates.  It can also be used for synchronization updates of
     an on-change subscription.  This notification shall only be
     sent to receivers of a subscription.  It does not constitute
     a general-purpose notification that would be subscribable as
     part of the NETCONF event stream by any receiver.";
  leaf id {
    type sn:subscription-id;
    description
      "This references the subscription that drove the
       notification to be sent.";
  }
  leaf period {
    type centiseconds;
    mandatory true;
    description
      "New 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'.
       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.";
  }
  uses yp:datastore-criteria {
    refine "selection-filter/within-subscription" {
      description
        "Specifies the selection filter and where it originated
         from.  If the 'selection-filter-ref' is populated, the
         filter in the subscription came from the 'filters'
         container.  Otherwise, it is populated in-line as part
         of the subscription itself.";
    }
  }
}
}
```

<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/as:adaptive-
   subscriptions/as:adaptive-period/as:watermark

o /sn:subscriptions/sn:subscription/yp:update-trigger/as:adaptive-
   subscriptions/as:adaptive-period/as:period

o /sn:subscriptions/sn:subscription/yp:update-trigger/as:adaptive-
   subscriptions/as:adaptive-period/as:anchor-time

o /sn:establish-subscription/sn:input/yp:update-trigger/as:adaptive-
   subscriptions/as:adaptive-period/as:watermark

o /sn:establish-subscription/sn:input/yp:update-trigger/as:adaptive-
   subscriptions/as:adaptive-period/as:period

o /sn:establish-subscription/sn:input/yp:update-trigger/as:adaptive-
   subscriptions/as:adaptive-period/as:anchor-time

6. Contributors

Michale Wang, Liang Geng for his major contributions to the initial
modeling and use cases.

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understanding on the concept and ideas. Thanks Michael for providing
CHIP/Matter WIFI statistics reference.

8. References

8.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
           Requirement Levels", BCP 14, RFC 2119,
           DOI 10.17487/RFC2119, March 1997,
           <https://www.rfc-editor.org/info/rfc2119>.

[RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed.,
           and A. Bierman, Ed., "Network Configuration Protocol
           (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011,
           <https://www.rfc-editor.org/info/rfc6241>.

[RFC6242] Wasserman, M., "Using the NETCONF Protocol over Secure
           Shell (SSH)", RFC 6242, DOI 10.17487/RFC6242, June 2011,
           <https://www.rfc-editor.org/info/rfc6242>.

[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>.

[RFC8040] Bierman, A., Bjorklund, M., and K. Watsen, "RESTCONF
           Protocol", RFC 8040, DOI 10.17487/RFC8040, January 2017,
           <https://www.rfc-editor.org/info/rfc8040>.

[RFC8126] Cotton, M., Leiba, B., and T. Narten, "Guidelines for
           Writing an IANA Considerations Section in RFCs", BCP 26,
           RFC 8126, DOI 10.17487/RFC8126, June 2017,
           <https://www.rfc-editor.org/info/rfc8126>.

[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>.

[RFC8641]   Clemm, A. and E. Voit, "Subscription to YANG Notifications
            for Datastore Updates", RFC 8641, DOI 10.17487/RFC8641,
            September 2019, <https://www.rfc-editor.org/info/rfc8641>.

8.2. Informative References

[CHIP]   Matter, "Connected Home over IP Specification", April
            2021.

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

[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. Example YANG Module

The example YANG module used in this document represents a Wi-Fi
Network Diagnostics data specified in [CHIP] which can be used by a
Node to assist a user or Administrative Node in diagnosing potential
problems.

YANG tree diagram for the "example-wifi-mac" module:

```
module: example-wifi-network-diagnostic
  +--rw server
  |  +--rw bssid?                      yang:mac-address
  |  +--rw security-type?             enumeration
  |  +--rw wifi-version?              enumeration
  |  +--rw channel-num?               int8
  |  +--rw rssi?                      int8
  |  +--rw beacon-lost-count?         int8
  |  +--rw beacon-rx-count?           int8
  |  +--rw packet-multicast-rx-count? int8
  |  +--rw packet-multicast-tx-count? int8
  |  +--rw packet-unicast-rx-count?   int8
  |  +--rw packet-unicast-tx-count?   int8
  |  +--rw current-max-rate?          int8
  |  +--rw overrun-count?             int8
  +--rw events
     +--rw event* [name]
        +--rw name                    string
        +--rw disconnection?          enumeration
        +--rw association-failure?    enumeration
        +--rw Connection-status?      enumeration
```

A.1. "example-wifi-mac" YANG Module

```
module example-wifi-network-diagnostic {
  yang-version 1;
  namespace "http://example.com/yang/wifi-network-diagnostic";
  prefix wnd;

  import ietf-yang-types {
    prefix yang;
  }

  container server {
    description
      "Configuration of the WiFi Server logical entity.";
    leaf bssid {
      type yang:mac-address;
      description
        "The MAC address of a wireless access point.";
    }
    leaf security-type {
      type enumeration {
        enum unspecified {
          value 0;
        }
        enum none {
          value 1;
```

```
              }
              enum wep {
                value 2;
              }
              enum wpa {
                value 3;
              }
              enum wpa2 {
                value 4;
              }
              enum wpa3 {
                value 5;
              }
            }
            description
              "The type of Wi-Fi security used. A value of 0
               indicate that the interface is not currently
               configured or operational.";
          }
          leaf wifi-version {
            type enumeration {
              enum 80211a {
                value 0;
              }
              enum 80211b {
                value 1;
              }
              enum 80211g {
                value 2;
              }
              enum 80211n {
                value 3;
              }
              enum 80211ac {
                value 4;
              }
              enum 80211ax {
                value 5;
              }
            }
            description
              "The highest 802.11 standard version usable
               by the Node.";
          }
          leaf channel-num {
            type int8;
            description
              "The channel that Wi-Fi communication is currently
```

```
          operating on. A value of 0indicates that the interface
          is not currently configured or operational.";
      }
      leaf rssi {
        type int8;
        description
          "The RSSI of the Node's Wi-Fi radio in dBm.";
      }
      leaf beacon-lost-count {
        type int8;
        description
          "The count of the number of missed beacons the
           Node has detected.";
      }
      leaf beacon-rx-count {
        type int8;
        description
          "The count of the number of received beacons. The
           total number of expected beacons that could have been
           received during the interval since association SHOULD
           match the sum of BeaconRxCount and BeaconLostCount. ";
      }
      leaf packet-multicast-rx-count {
        type int8;
        description
          "The number of multicast packets received by
           the Node.";
      }
      leaf packet-multicast-tx-count {
        type int8;
        description
          "The number of multicast packets transmitted by
           the Node.";
      }
      leaf packet-unicast-rx-count {
        type int8;
        description
          "The number of multicast packets received by
           the Node.";
      }
      leaf packet-unicast-tx-count {
        type int8;
        description
          "The number of multicast packets transmitted by
           the Node.";
      }
      leaf current-max-rate {
        type int8;
```

```
      description
        "The current maximum PHY rate of transfer of
         data in bytes-per-second.";
    }
    leaf overrun-count {
      type int8;
      description
        "The number of packets dropped either at ingress or
         egress, due to lack of buffer memory to retain all
         packets on the ethernet network interface. The
         OverrunCount attribute SHALL be reset to 0 upon a
         reboot of the Node..";
    }
  }
  container events {
    description
      "Configuration of WIFI Network Diagnostic events.";
    list event {
      key "name";
      description
        "The list of event sources configured on the
         server.";
      leaf name {
        type string;
        description
          "The unique name of an event source.";
      }
      leaf disconnection {
        type enumeration {
          enum de-authenticated {
            value 1;
          }
          enum dis-association {
            value 2;
          }
        }
        description
          "A Node's Wi-Fi connection has been disconnected as a
           result of de-authenticated or dis-association and
           indicates the reason.";
      }
      leaf association-failure {
        type enumeration {
          enum unknown {
            value 0;
          }
          enum association-failed {
            value 1;
```

```
        }
        enum authentication-failed {
          value 2;
        }
        enum ssid-not-found {
          value 3;
        }
      }
      description
        "A Node has attempted to connect, or reconnect, to
         a Wi-Fi access point, but is unable to successfully
         associate or authenticate, after exhausting all
         internal retries of its supplicant.";
    }
    leaf Connection-status {
      type enumeration {
        enum connected {
          value 1;
        }
        enum notconnected {
          value 2;
        }
      }
      description
        "A Node's connection status to a Wi-Fi network has
         changed. Connected, in this context, SHALL mean that
         a Node acting as a Wi-Fi station is successfully
         associated to a Wi-Fi Access Point..";
    }
  }
 }
}
```

Appendix B. Adaptive Subscription and Notification Example

   The examples within this document use the normative YANG module
   "ietf-adaptive-subscription" as defined in Section 3 and the non-
   normative example YANG module "example-wifi-network-diagnostic" as
   defined in Appendix A.1.

   This section shows some typical adaptive subscription and
   notification message exchanges.

B.1. "edit-config" Example

   The client configures adaptive subscription policy parameters on the
   server. The adaptive subscription configuration parameters require
   the server to support two update intervals (i.e., 5 seconds, 60

seconds) and scan all clients every 60 seconds in the sampling window
if the rssi value of client is greater than or equal to -65dB in the
sampling window; If the rssi value of client is less than -65dB,
switch to 5 seconds period value, and then scan all clients 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:wnd="https://example.com/sample-data/1.0">
            /wnd:example-wifi-network-diagnostic
    </yp:datastore-xpath-filter>
    <as:adaptive-subscriptions
     xmlns:as="urn:ietf:params:xml:ns:yang:ietf-adaptive-subscription">
     <as:adaptive-period>
      <as:xpath-external-eval>
           /wnd:server[rssi &lt; -65]
     </as:xpath-external-eval>
     <as:watermark>-65</as:watermark>
      <as:period>5</as:period>
     </as:adaptive-period>
     <as:adaptive-period>
      <as:xpath-external-eval>
           /wnd:server[rssi &ge; -65]
        </as:xpath-external-eval>
     <as:watermark>-65</as:watermark>
      <as:period>60</as:period>
     </as:adaptive-period>
    </as:adaptive-subscriptions>
   </top>
  </config>
 </edit-config>
</rpc>
```

B.2. Create Adaptive Subscription Example

   The subscriber sends an "establish-subscription" RPC with the
   parameters listed in to request the creation of a adaptive
   subscription. The adaptive subscription configuration parameters
   require the server to scan all clients every 5 seconds if the rssi
   value of client is less than -65dB; If the rssi value of client is
   great than or equal to -65dB, switch to 60 seconds period value, and
   then report all clients every 60 seconds or scan every 5 seconds,
   collect 12 measurement values but report the last measurement value
   or average value of 12 measurement values. (Section 2)

```
<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:running
  </yp:datastore>
  <yp:datastore-xpath-filter
   xmlns:wnd="https://example.com/sample-data/1.0">
       /wnd:example-wifi-network-diagnostic
  </yp:datastore-xpath-filter>
  <as:adaptive-subscriptions
   xmlns:as="urn:ietf:params:xml:ns:yang:ietf-adaptive-subscription">
   <as:adaptive-period>
   <as:xpath-external-eval>wnd:server[rssi &lt; -65]
        </as:xpath-external-eval>
    <as:watermark>-65</as:watermark>
    <as:period>5</as:period>
   </as:adaptive-period>
   <as:adaptive-period>
    <as:xpath-external-eval>wnd:server[rssi &ge; -65]
    </as:xpath-external-eval>
    <as:watermark>-65</as:watermark>
    <as:period>60</as:period>
   </as:adaptive-period>
  </as:adaptive-subscriptions>
 </establish-subscription>
</netconf:rpc>
```

   In another example, the adaptive subscription configuration
   parameters could also require the server to scan all clients every 5
   seconds and report if the difference between maximum value of client
   rssi and minimum value of client rssi is greater than 0.20 dB in the
   sampling window; If the difference between maximum value of client

rssi and minimum value of client rssi is less than 0.20 dB, switch to
60 seconds period value and then scan all clients every 60 seconds
and report the last measurement value. If the difference between
maximum value of client rssi and minimum value of client rssi is
greater than or equal to 0.20 dB in two consecutive sampling windows,
then in the second sampling window, only report the measurement value
not reported by the previous sampling window.

```
<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:running
  </yp:datastore>
  <yp:datastore-xpath-filter
   xmlns:wnd="https://example.com/sample-data/1.0">
       /wnd:example-wifi-network-dianostic
  </yp:datastore-xpath-filter>
  <as:adaptive-subscriptions
   xmlns:as="urn:ietf:params:xml:ns:yang:ietf-adaptive-subscription">
   <as:adaptive-period>
    <as:xpath-external-eval>
        wnd:server[max(rssi)-min(rssi) &ge; 20]
         </as:xpath-external-eval>
    <as:watermark>20</as:watermark>
    <as:period>5</as:period>
   </as:adaptive-period>
   <as:adaptive-period>
    <as:xpath-external-eval>
        wnd:server[max(rssi)-min(rssi) &lt; 20]
    </as:xpath-external-eval>
    <as:watermark>20</as:watermark>
    <as:period>60</as:period>
   </as:adaptive-period>
  </as:adaptive-subscriptions>
 </establish-subscription>
</netconf:rpc>
```

B.3. "adaptive-update" notification example

Upon the server switches to from the update interval 5 seconds to the
new update interval 60 seconds, Before sending event records to
receivers, the "adaptive-update" notification should be generated and
sent to the receivers to inform the receivers that the update
interval value is switched to the new value.

```
   <notification
    xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0"
    xmlns:yp="urn:ietf:params:xml:ns:yang:ietf-yang-push">
    <eventTime>2016-11-21T13:51:00Z</eventTime>
    <adaptive-update
     xmlns="http://example.com/ietf-adaptive-subscription">
     <id>0</id>
     <period>60</period>
     <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">
          /ex:example-wifi-network-diagnostic
     </yp:datastore-xpath-filter>
    </adaptive-update>
   </notification>
```

[B.4](#). Changes between Revisions

   v05 -v06

   o Replace example-wifi-mac module with example-wifi-network-
      diagnostic using WIFI statistics specified in CHIP specification.

   o Update adaptive subscription Example to align with WIFI example
      module change.

   o Add one more reference to CHIP Specification.

   v04 -v05

   o Remove "modify-subscption" RPC usage.

   o Module update to fix the nits.

   o Update adaptive subscription Example.

   o Other Editorial changes.

   v03 - v04

   o Add missing subtrees and data nodes in the security section;

   o Change "adaptive-update" notification into "adaptive-period-
      update" notification;

   o Other Editorial changes.

   v02 - v03

   o Clarify the difference between low priority telemetry data
      dropping and collection rate switching in the introduction
      section;

   o Update the abstract and introduction section to focus on
      collection rate switching in the server without interaction with
      the remote client;

   o Format usage example and change ssid into rssi in the appendix;

   o Use boilerplate and reuse the terms in the terminology section.

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