                   Notification Message Headers and Bundles
                  draft-voit-netconf-notification-messages-01

Abstract

   This document specifies transport independent capabilities for
   messages transporting event notifications and YANG datastore update
   records. Included are:

   o a set of transport agnostic message header objects, and

   o how to associate a subset of these header objects with one or more
      events, YANG datastore updates, and/or alarms.

Status of This Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

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   Task Force (IETF). Note that other groups may also distribute
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   and may be updated, replaced, or obsoleted by other documents at any
   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on January 3, 2018.

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[1](#). Introduction

   Mechanisms to support subscription to event notifications and yang
   datastore push are being defined in [[subscribe](#)] and [[yang-push](#)].
   Work on those documents have shown that existing YANG notifications
   described in [[RFC7950] section 7.16](#) do not expose some useful
   transport independent capabilities that application developers are
   requesting. Communicating information on the following objects
   should not require knowledge of the underlying transport:

   o the kind of information encapsulated (event, data objects, alarm?)

   o the time information was generated

   o the time the information was sent

   o a signature to verify authenticity

o   the process generating the information

   o   an originating request correlation

   o   an ability to bundle information records together in a message

   o   the ability to check for message loss/reordering

   The document describes information elements needed for the functions
   above. It also provides YANG Notifications for sending messages
   containing bone or more events and/or update records to a receiver.

2. Terminology

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
   document are to be interpreted as described in RFC 2119 [RFC2119].

   Definitions of Notification, Event, Event Notification, Receiver, and
   Subscription are defined in [subscribe].

3. Header Objects

   There are a number of transport independent headers which should have
   common definition across applications. These include:

   o   record-type: defines the kind of information assembled as a unit.
       (E.g., is it a YANG datastore update, an alarm, an event, etc.)

   o   subscription-id: provides a reference into the reason the
       originator believed the receiver wishes to be notified of this
       specific information.

   o   record-time: the time an event, datastore update, or other item it
       itself is recognized in the originating system.

   o   record-id: identifies an event notification on an originator.

   o   observation-domain-id: identifies the originator process which
       discovered and recorded the event notification. (note: look to

reuse the domains set up with IPFIX.)

     o notification-time: the time the message was packaged sent to the
        transport layer for delivery to the receiver.

     o signature: allows an application to sign a message so that a
        receiver can verify the authenticity of the message.

     o dscp: network qos encoding which an application suggests should be
        applied to the message.

     o notification-id: for a specific message generator, this identifies
        a message which includes one or more event records.

     o previous-notification-id: the notification-id of the message
        preceding the current one intended for the same receiver. When
        used in conjunction with the current notification-id, this allows
        loss/duplication across previous messages to be discovered. If
        there was no previous message from a message generator, the
        reserved id "0" must be sent.

     o message-generator-id: identifier for the process which created the
        message notification. This allows disambiguation of an
        information source, such as the identification of different line
        cards sending the notification messages. Used in conjunction with
        previous-notification-id, this can help find drops and
        duplications when notifications are coming from multiple sources
        on a device. If there is a message-generator-id in the header,
        then the previous-notification-id should be the notification-id
        from the last time that message-generator-id was sent.

4. Transport independent headers for notifications

   Many objects may be placed within a notification. However only a
   certain subset these objects are of potential use to networking
   layers prior the notification being interpreted by some receiving
   application layer process. By exposing this object information as
   part of a header, and by using standardized object names, it becomes
   possible for this object information to be leveraged in transit.

The objects defined in the previous section effectively become well-
known objects where, if in the header, may act as supplemental
information in communications between two devices. These well-known
header fields are encapsulated within a dedicated subtree which leads
off the notification message. This allows header objects to be
easily be decoupled, stripped, and processed separately.

Typically sequence of information in YANG models is irrelevant. But
as part of a transported notification, It is useful to sequence these
header objects so that processing is as efficient as possible. This
allows the handling or discarding of uninteresting notifications
quickly.

Below is are record objects contents would include the objects
presented in the section above. The proper way this message would be
generated would be to look for the well known object names and place
them in the header. All other would be placed in the notification
record contents. (Note: are there any of these we should rather
duplicate than move?)

```
    +---n notification-message
       +--ro notification-message-header
       |  +--ro record-time                    yang:date-and-time
       |  +--ro record-type?                   notification-record-format
       |  +--ro subscription-id*               uint32
       |  +--ro record-id?                     uint32
       |  +--ro observation-domain-id?         string
       |  +--ro notification-id?               uint32
       |  +--ro notification-time?             yang:date-and-time
       |  +--ro previous-notification-id?      uint32
       |  +--ro dscp?                          inet:dscp
       |  +--ro message-generator-id?          string
       |  +--ro signature?                     string
       +--ro receiver-record-contents?
```

An actual instance of a notification might look like:

```
  <notification
    xmlns="urn:ietf:params:xml:ns:netmod:notification:2.0">
    <notification-message-header>
       <record-time>
            2017-02-14T00:00:02Z
```

```
            </record-time>
            <record-type>
                yang-patch
            </record-type>
            <subscription-identifier>
                823472
            </subscription-identifier>
            <notification-time>
                2017-02-14T00:00:05Z
            </notification-time>
            <notification-identifier>
                456
            </notification-identifier>
            <previous-notification-identifier>
                567
            </previous-notification-identifier>
            <signature>
                lKIo8s03fd23.....
            </signature>
        </notification-message-header>
        <datastore-changes>
            ...(yang patch here)...
        </datastore-changes>
    </notification>
```

5. Bundled Notifications

   In many implementations, it may be inefficient to transport every
   notification independently. Instead, scale and processing speed can
   be improved by placing multiple notifications into one transportable
   bundle.

   When this is done, one additional header field becomes valuable.
   This is the "record-count" which would tally the quantity of records
   which make up the contents of the bundle.

   The format of a bundle would look as below. When compared to the
   unbundled notification, note that the headers have been split so that
   one set of headers associated with the notification occur once at the
   beginning of the message, and additional record specific headers

which occur before individual records.

```
+---n bundled-notification-message
   +--ro bundled-notification-message-header
   |  +--ro notification-id?             uint32
   |  +--ro notification-time            yang:date-and-time
   |  +--ro previous-notification-id?    uint32
   |  +--ro dscp?                        inet:dscp
   |  +--ro message-generator-id?        string
   |  +--ro signature?                   string
   |  +--ro record-count?                uint16
   +--ro notification-records*
      +--ro notification-record-header
      |  +--ro record-time              yang:date-and-time
      |  +--ro record-type?             notification-record-format
      |  +--ro subscription-id*         uint32
      |  +--ro record-id?               uint32
      |  +--ro observation-domain-id?   string
      +--ro receiver-record-contents?
```

An actual instance of a bundled notification might look like:

```
<notification
  xmlns="urn:ietf:params:xml:ns:netmod:notification:2.0">
  <bundled-notification-message-header>
     <notification-time>
        2017-02-14T00:00:05Z
     </notification-time>
     <notification-identifier>
        456
```

```
            </notification-identifier>
            <previous-notification-identifier>
                567
            </previous-notification-identifier>
            <signature>
                lKIo8s03fd23...
            </signature>
            <record-count>
                2
            </record-count>
        </bundled-notification-message-header>
        <notification-record>
            <notification-record-header>
                <record-time>
                    2017-02-14T00:00:02Z
                </record-time>
                <record-type>
                    yang-patch
                </record-type>
                <subscription-identifier>
                    823472
                </subscription-identifier>
            </notification-record-header>
            <notification
               xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
                <datastore-changes>
                  ...(yang patch here)...
                </datastore-changes>
            </notification>
        </notification-record>
        <notification-record>
                ...(record #2)...
        </notification-record>
     </notification>
```

6. Data Model

```
 <CODE BEGINS> file "ietf-notification-messages.yang"
 module ietf-notification-messages {
   yang-version 1.1;
```

```
   namespace "urn:ietf:params:xml:ns:yang:ietf-notification-messages";
```

```
      prefix nm;

      import ietf-yang-types {
        prefix yang;
      }
      import ietf-inet-types {
        prefix inet;
      }


      organization "IETF";
      contact
        "WG Web:   <http://tools.ietf.org/wg/netconf/>
         WG List:  <mailto:netconf@ietf.org>

         WG Chair: Mahesh Jethanandani
                   <mailto:mjethanandani@gmail.com>

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         Editor:   Tim Jenkins
                   <mailto:timjenki@cisco.com>

         Editor:   Andy Bierman
                   <mailto:andy@yumaworks.com>";


      description
        "This module contains conceptual YANG specifications for
        notification messages with well known header objects.";

      revision 2017-04-25 {
        description
          "This module includes definitions for two new yang
          notification message objects:
          (a) a message format including the definitions for common header
              information prior to notification payload.
          (b) a message format allowing the bundling of multiple
              notifications within it";

        reference
```

```
        "draft-voit-netconf-notification-messages-01";
   }

   /*
    * IDENTITIES
    */

    /* Identities for notification record types */

    identity notification-record-format {
     description
       "Base identity to represent a different formats for notification
       records.";
   }

   identity system-event {
     base notification-record-format;
     description
       "System XML event";
   }

   identity yang-datastore {
     base notification-record-format;
     description
       "yang data node / tree extract";
   }

   identity yang-patch {
     base notification-record-format;
     description
       "yang patch record";
   }

   identity syslog-entry {
     base notification-record-format;
     description
       "Unstructured syslog entry.";
   }

   identity alarm {
     base notification-record-format;
     description
       "Alarm (perhaps link draft-sharma-netmod-fault-model-01 for more
       info)";
   }
```

```
   /*
    * TYPEDEFs
```

```
    */


   typedef notification-record-format {
     type identityref {
       base notification-record-format;
     }
     description
       "Type of notification record";
   }

   /*
    * GROUPINGS
    */

   grouping notification-message-header {
     description
       "Header information included with a notification.";
     leaf notification-id {
       type uint32;
       description
         "unique id for a notification which may go to one or many
         receivers.";
     }
     leaf notification-time {
       type yang:date-and-time;
       description
         "time the notification was generated prior to being sent to
         transport.";
     }
     leaf previous-notification-id {
       type uint32;
       description
         "Notification id previously sent by publisher to a specific
         receiver (allows detection of loss/duplication).";
     }
     leaf dscp {
       type inet:dscp;
       default "0";
```

```
      description
        "The push update's IP packet transport priority. This is made
        visible across network hops to receiver. The transport
        priority is shared for all receivers of a given
        subscription.";
    }
    leaf message-generator-id {
      type string;
      description
```

```
          "Software entity which created the notification message (e.g.,
          linecard 1).";
      }
      leaf signature {
        type string;
        description
          "Any originator signing of the contents of a notification
          message.  This can be useful for originating applications to
          verify record contents even when shipping over unsecure
          transport.";
      }
    }

    grouping notification-record-header {
      description
        "Common informational objects which might help a receiver
        interpret the meaning, details, and importance of an event
        notification.";
      leaf record-time {
        type yang:date-and-time;
        mandatory true;
        description
          "Time the system recognized the occurrence of an event.";
      }
      leaf record-type {
        type notification-record-format;
        description
          "Describes the type of payload included.  This is turn allow
          the interpretation of the record contents.";
      }
      leaf-list subscription-id {
        type uint32;
```

```
          description
            "Id of the subscription which led to the notification being
            generated.";
        }
        leaf record-id {
          type uint32;
          description
            "Identifier for the notification record.";
        }
        leaf observation-domain-id {
          type string;
          description
            "Software entity which created the notification record (e.g.,
            process id).";
        }
      }
```

```
      /*
       * NOTIFICATIONS
       */

      notification notification-message {
        description
          "Notification message to a receiver containing only one event.";
        container notification-message-header {
          description
            "delineates header info from notification messages for easy
            parsing.";
          uses notification-record-header;
          uses notification-message-header;
        }
        anydata receiver-record-contents {
          description
            "Non-header info of what actually got sent to receiver after
            security filter.  (Note: Possible to have extra process
            encryption.)";
        }
      }

      notification bundled-notification-message {
        description
          "Notification message to a receiver containing many events,
```

```
           possibly relating to independent subscriptions.";
        container bundled-notification-message-header {
           description
               "Delineates header info from notification messages for easy
               parsing.";
           uses notification-message-header {
             refine notification-time {
               mandatory true;
             }
           }
           leaf record-count {
               type uint16;
               description
                   "Quantity of events in a bundled-notification-message
                   for a specific receiver.  This value is per receiver in
                   case an entire notification record is filtered out.";
           }
        }
        list notification-records {
           description
             "Set of messages within a notification to a receiver.";
           container notification-record-header {
             description
```

```
               "delineates header info from notification messages for easy
               parsing.";
           uses notification-record-header;
         }
         anydata receiver-record-contents {
           description
             "Non-header info of what actually got sent to receiver after
             security filter.  (Note: Possible to have extra process
             encryption.)";

         }
       }
     }
   }
 }
 <CODE ENDS>
```

7. Security Considerations

More needs to be thought through here, as this adds additional
information onto notifications, the security implications shouldn't
be singificantly beyond those from [subscribe] other than ensuring
that data plane devices can accomplish the necessary content
filtering despite the potential of a new level of header being
applied.

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,
              <http://www.rfc-editor.org/info/rfc2119>.

   [subscribe]
              Voit, E., Clemm, A., Gonzalez Prieto, A., Prasad Tripathy,
              A., and E. Nilsen-Nygaard, "Custom Subscription to Event
              Notifications", April 2017,
              <https://datatracker.ietf.org/doc/draft-ietf-netconf-
              subscribed-notifications/>.

8.2. Informative References

   [initial-version]
              Voit, E., Bierman, A., Clemm, A., and T. Jenkins, "Custom
              Subscription to Event Notifications", February 2017,
              <https://tools.ietf.org/html/draft-voit-netmod-yang-
              notifications2-00>.

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

   [yang-push]
              Clemm, A., Voit, E., Gonzalez Prieto, A., Prasad Tripathy,
              A., and E. Nilsen-Nygaard, "Subscribing to YANG datastore
              push updates", April 2017,
              <https://datatracker.ietf.org/doc/draft-ietf-netconf-yang-
              push/>.

Appendix A. Issues being worked

   (To be removed by RFC editor prior to publication)

   We need to define the ways to invoke and configure the capability
   within an originating device. This includes defining what header
   types are selected. This also includes knowning the header types
   which can be supported by a receiver.

   We need to do a lot more to discuss transport efficiency
   implications.

   Relationship with DTN protocols.

Appendix B. Querying an Object Model

   (This appendix was in a previous iteration of this draft. It has
   been removed as unlikely to be seen in an implementation. It is
   being kept in for discussion purposes.)

   It is also possible that that external entities might want to query
   message information after it has been sent. And therefore it is
   possible that an administrator would like to examine the contents of
   notifications via random access using a YANG model rather that
   Syslog. There could be several values in such random access. These
   include:

   o ability for applications to determine what message bundles were
      used to transport specific records.

   o ability for applications to check which receivers have been sent
      an event notification.

   o ability for applications to determine the time delta between event
      identification and transport.

   o ability to reconstruct message passing during troubleshooting.

   o ability to extract messages and records to evaluate whether the
      security filters have been properly applied.

   o ability to compare the payloads of the same notification message

sent to different receivers (again to evaluate the impact of the security filtering).

If such random access is needed, it is possible to extend the YANG model data model document to enable random access to the information. A cut at what this might look like can be seen in [initial-version]

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