YANG-push status overview

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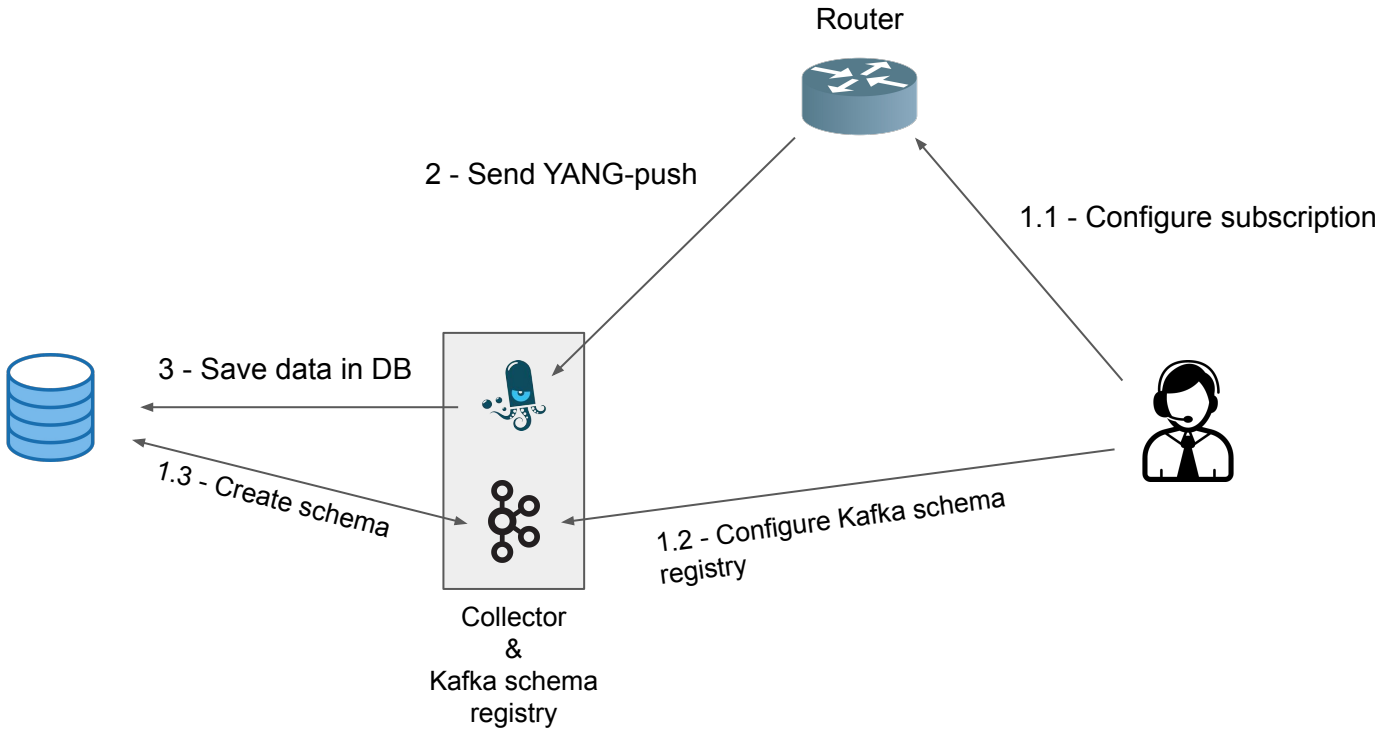
Goals

- Architecture overview
- Describe how to configure YANG Push
  - Management plane: Netconf RPCs
  - Dataplane: YANG Push messages
- Configuration variants
  - Datastore
  - Stream
  - On change vs. periodic updates
- Testing: Features of Scapy emulator
- Discuss possible gaps in the architecture/RFCs/Drafts

Architecture overview

Topology for Configured Subscriptions RFC8639/RFC8641

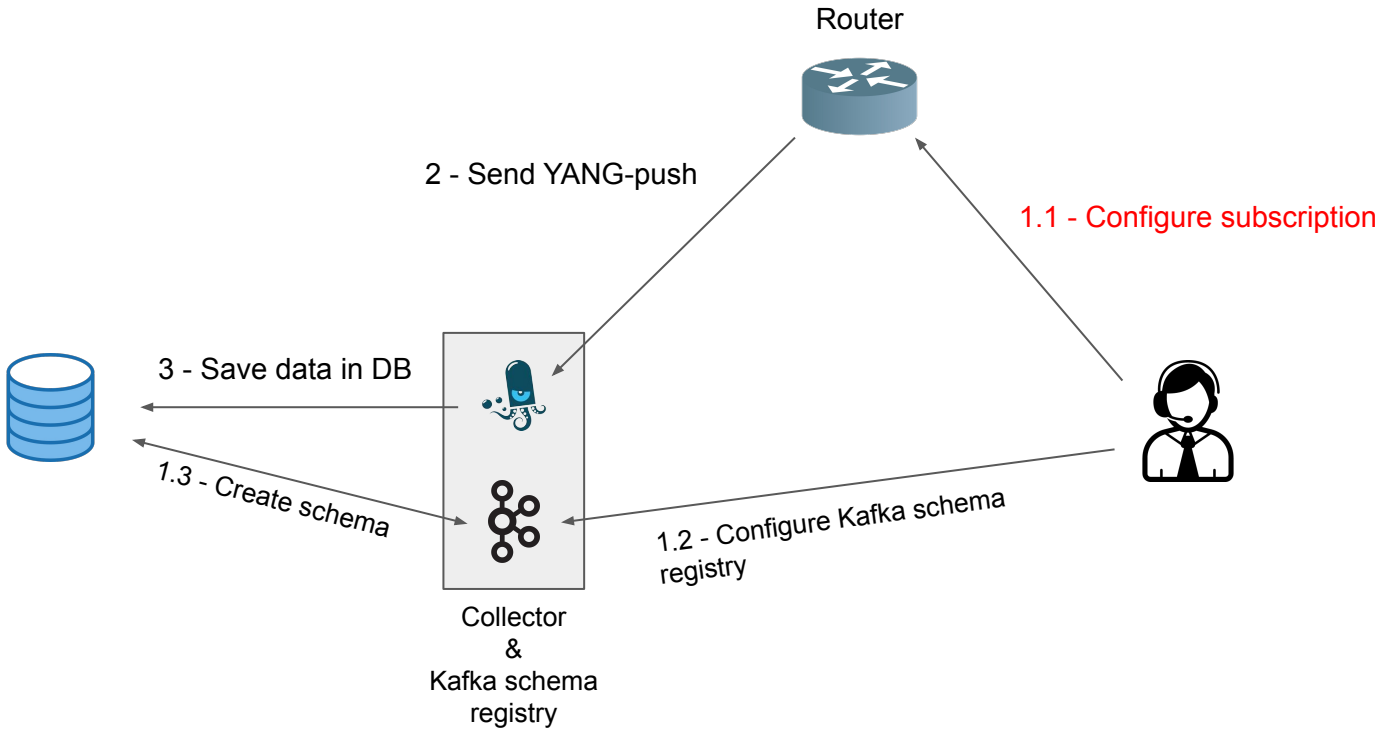


Architecture overview

Configure subscription

YANG Push messages

Topology for Configured Subscriptions RFC8639/RFC8641



Stream and datastore

- [RFC8639] A configuration performed to obtain a flow of events from the publisher

- NIC temperatures
- Netconf events [RFC8639]

```
module: ietf-subscribed-notifications
  +--ro streams
  |  +--ro stream* [name]
  |     +--ro name                          string
  |     +--ro description?                  string
  |     +--ro replay-support?               empty {replay}?
  |     +--ro replay-log-creation-time      ietf-yang-types:date-and-time {replay}?
  |     +--ro replay-log-aged-time?         ietf-yang-types:date-and-time {replay}?
```

```
|  +--:(stream)
|  |  +--rw (stream-filter)?
|  |  |  +--:(by-reference)
|  |  |  |  +--rw stream-filter-name                stream-filter-ref
|  |  |  +--:(within-subscription)
|  |  |     +--rw (filter-spec)?
|  |  |        +--:(stream-subtree-filter)
|  |  |        |  +--rw stream-subtree-filter?       <anydata> {subtree}?
|  |  |        +--:(stream-xpath-filter)
|  |  |           +--rw stream-xpath-filter?         ietf-yang-types:xpath1.0 {xpath}?
|  |  +--rw stream                                   stream-ref
|  |  +--ro replay-start-time?                       ietf-yang-types:date-and-time {replay}?
|  |  +--rw configured-replay?                       empty {configured,replay}?
```

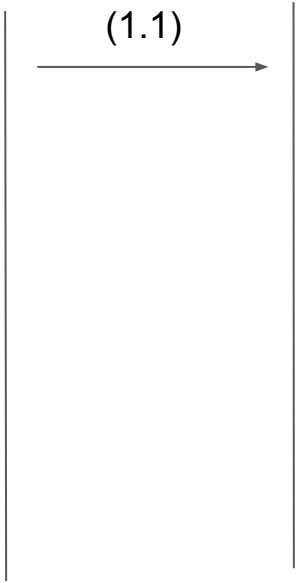
- [RFC8641] A configuration performed to obtain a flow of updates happening on a datastore [RFC8342] of the publisher

- An update to a config <startup>; <candidate>; <running>; <operational>; <intended>

```
|  +--:(ietf-yang-push:datastore)
|     +--rw ietf-yang-push:datastore                  identityref
|     +--rw (ietf-yang-push:selection-filter)?
|        +--:(ietf-yang-push:by-reference)
|        |  +--rw ietf-yang-push:selection-filter-ref   selection-filter-ref
|        +--:(ietf-yang-push:within-subscription)
|           +--rw (ietf-yang-push:filter-spec)?
|              +--:(ietf-yang-push:datastore-subtree-filter)
|              |  +--rw ietf-yang-push:datastore-subtree-filter?   <anydata> {sn:subtree}?
|              +--:(ietf-yang-push:datastore-xpath-filter)
|                 +--rw ietf-yang-push:datastore-xpath-filter?   ietf-yang-types:xpath1.0 {sn:xpath}?
```

Configure Subscription with RFC8639: Stream

config tree are wrapped in <edit-config> rpc




```
<?xml version='1.0' encoding='UTF-8'?>
<config xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <subscriptions xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">
    <subscription>
      <id>6666</id>
      <stream-subtree-filter>some-subtree-filter</stream-subtree-filter>
      <stream>some-stream</stream>
      <transport xmlns:unt="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">unt:udp-notif</transport>
      <encoding>encode-json</encoding>
      <receivers>
        <receiver>
          <name>subscription-specific-receiver-def</name>
          <receiver-instance-ref xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">global-udp-notif-receiver-def</receiver-instance-ref>
        </receiver>
      </receivers>
    </subscription>
    <receiver-instances xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">
      <receiver-instance>
        <name>global-udp-notif-receiver-def</name>
        <udp-notif-receiver xmlns="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">
          <address>192.0.5.1</address>
          <port>12345</port>
          <enable-segmentation>false</enable-segmentation>
          <max-segment-size/>
        </udp-notif-receiver>
      </receiver-instance>
    </receiver-instances>
  </subscriptions>
</config>
```

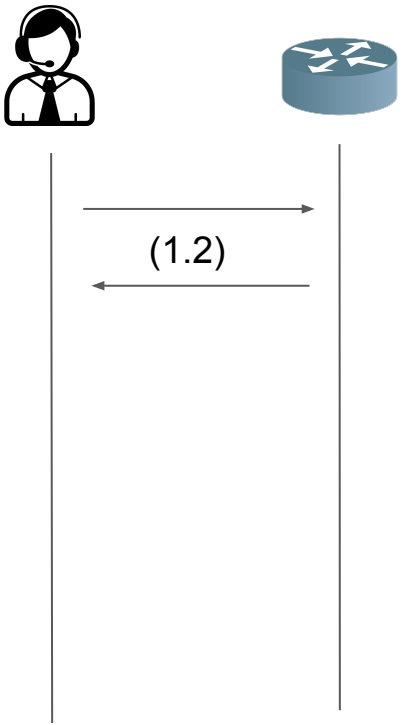
Configure Subscription with RFC8641: Datastore

config tree are wrapped in <edit-config> rpc

(1-bis.1)

```
<?xml version='1.0' encoding='UTF-8'?>
<config xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <subscriptions xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">
    <subscription>
      <id>6666</id>
      <datastore xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">ds:operational</datastore>
      <datastore-xpath-filter xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">/some/path</datastore-xpath-filter>
      <transport xmlns:unt="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">unt:udp-notif</transport>
      <encoding>encode-json</encoding>
      <receivers>
        <receiver>
          <name>subscription-specific-receiver-def</name>
          <receiver-instance-ref xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">global-udp-notif-receiver-def</receiver-instance-ref>
        </receiver>
      </receivers>
    </subscription>
    <receiver-instances xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">
      <receiver-instance>
        <name>global-udp-notif-receiver-def</name>
        <udp-notif-receiver xmlns="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">
          <address>192.0.5.1</address>
          <port>12345</port>
          <enable-segmentation>false</enable-segmentation>
          <max-segment-size/>
        </udp-notif-receiver>
      </receiver-instance>
    </receiver-instances>
  </subscriptions>
</config>
```

Configure Subscription RFC8639/RFC8641: RPC reply




```
<rpc-reply message-id="101"
    xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
    <ok/>
</rpc-reply>
```

After 1.2, there is still no reference to the YANG module name

QUESTION

- *Name of the stream == YANG module name?*
- *The datastore name is associated to a YANG module name by default? How can we find this relation?*

ANSWER

Thomas: *we get the YANG module from the XPath*

Getting the YANG module from XPath

- From RFC8641 Section 3.6

*A subscription **must** specify both the selection filters and the datastore[...].*
[...]
*A publisher MUST support **at least one** type of selection filter.*

- YANG Types
  - subtree: anydata
  - xpath: yang:xpath1.0

3.6. Defining the Selection with a Datastore

A subscription must specify both the selection filters and the datastore against which these selection filters will be applied. This information is used to choose and subsequently push data from the publisher's datastore to the receivers.

Only a single selection filter can be applied to a subscription at a time. An RPC request proposing a new selection filter replaces any existing filter. The following selection filter types are included in the YANG-Push data model and may be applied against a datastore:

o subtree: A subtree selection filter identifies one or more datastore subtrees. When specified, update records will only come from the datastore nodes of selected datastore subtree(s). The syntax and semantics correspond to those specified in [RFC6241], Section 6.

o xpath: An "xpath" selection filter is an XPath expression that returns a node set. (XPath is a query language for selecting nodes in an XML document; see [XPATH] for details.) When specified, updates will only come from the selected datastore nodes.

These filters are intended to be used as selectors that define which objects are within the scope of a subscription. A publisher MUST support at least one type of selection filter.

We need to assume that the namespace/YANG module name is specified in the Xpath.

XPath in XML

- /example:root
- /example:root/actors
- /example:root/foo:singers

```
<root xmlns:yp="urn:ietf-yang-push" xmlns="urn:example">
        <actors>
                <actor id="1">Christian Bale</actor>
                <actor id="2">Liam Neeson</actor>
                <actor id="3">Michael Caine</actor>
        </actors>
        <foo:singers>
                <foo:singer id="4">Tom Waits</foo:singer>
                <foo:singer id="5">B.B. King</foo:singer>
                <foo:singer id="6">Ray Charles</foo:singer>
        </foo:singers>
</root>
```

“example” is the YANG module name bound to the namespace “urn:example”

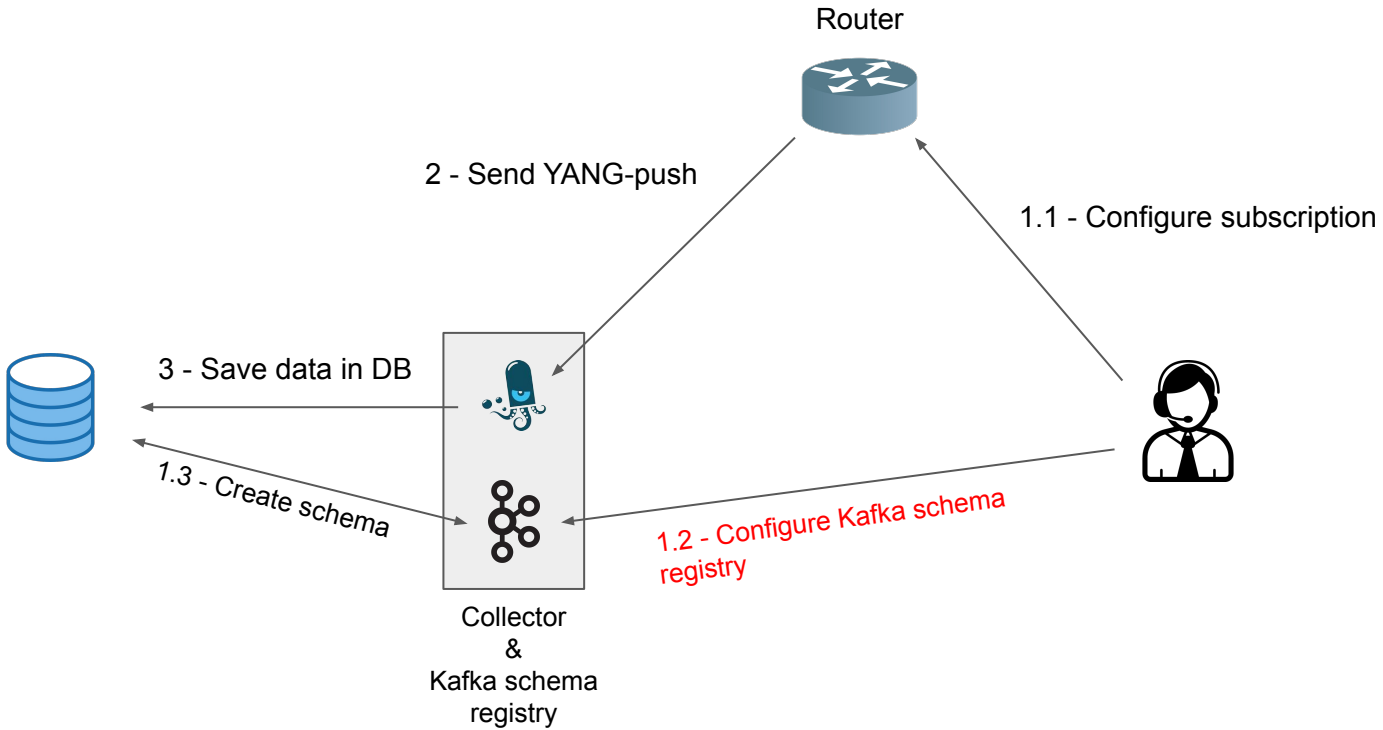
Unwritten rule:

- ***An XPath has always the root yang module name***

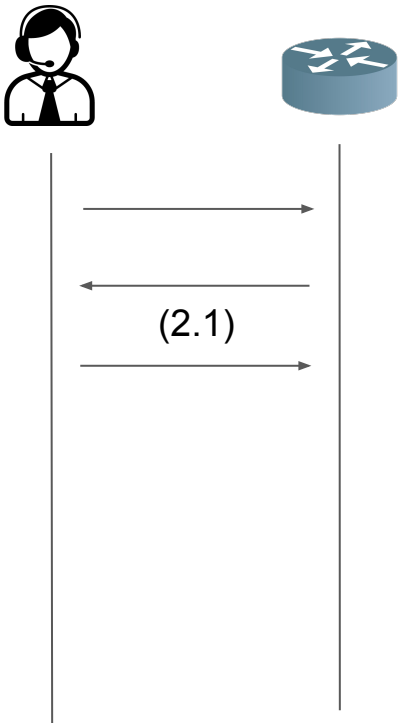
Current drafts

- draft-tgraf-netconf-yang-notifications-versioning
  - Adds “revision” and “revision-label” to the subscription
- draft-tgraf-netconf-notif-sequencing
  - Adds “sysName” and “sequenceNumber”
- draft-tgraf-yang-push-observation-time
  - Adds “start-observation-time” to push-update
  - Adds “changed-observation-time” to push-change-update

Topology for Configured Subscriptions RFC8639/RFC8641



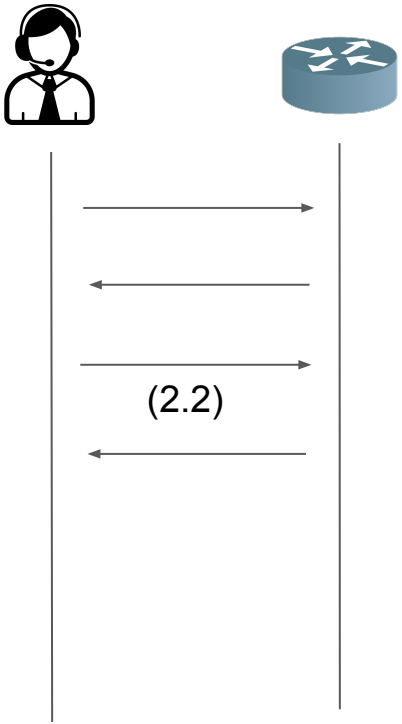
Configure Subscription RFC8639/RFC8641 - Obtaining available schemas



Discovering available YANGs

```
<rpc message-id="101"
    xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
    <get>
        <filter type="subtree">
            <netconf-state xmlns="urn:ietf:params:xml:ns:yang:ietf-netconf-monitoring">
                <schemas/>
            </netconf-state>
        </filter>
    </get>
</rpc>
```

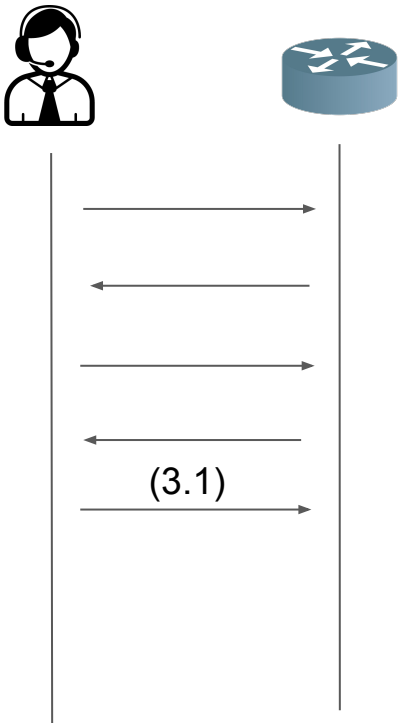
Configure Subscription RFC8639/RFC8641 - Obtaining available schemas



Discovering available YANGs

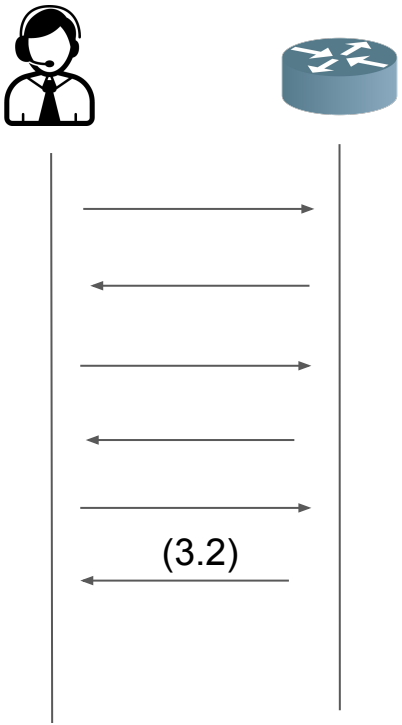
```
<rpc-reply message-id="101"
  xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <netconf-state xmlns="urn:ietf:params:xml:ns:yang:ietf-netconf-monitoring">
      <schemas>
        <schema>
          <identifier>foo</identifier>
          <version>2020-10-10</version>
          <format>yang</format>
          <namespace>http://example.com/foo</namespace>
          <location>
            http://example.com/schema/foo@2020-10-10.yang
          </location>
          <location>NETCONF</location>
        </schema>
        <schema>
          <identifier>bar-types</identifier>
          <version>2008-06-01</version>
          <format>yang</format>
          <namespace>http://example.com/bar</namespace>
          <location>
            http://example.com/schema/bar-types@2008-06-01.yang
          </location>
          <location>NETCONF</location>
        </schema>
      </schemas>
    </netconf-state>
  </data>
</rpc-reply>
```

Configure Subscription RFC8639/RFC8641 - Get schema




```
<rpc message-id="101"
    xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
    <get-schema xmlns="urn:ietf:params:xml:ns:yang:ietf-netconf-monitoring">
        <identifier>foo</identifier>
        <version>1.0</version>
        <format>yang</format>
    </get-schema>
</rpc>
```

Configure Subscription RFC8639/RFC8641
Using the schema




```
<rpc-reply message-id="101"
    xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
    <data xmlns="urn:ietf:params:xml:ns:yang:ietf-netconf-monitoring">
        module foo {
        //default format (yang) returned
        //bar version 2020-10-10 yang module
        //contents here ...
        }
    </data>
</rpc-reply>
```

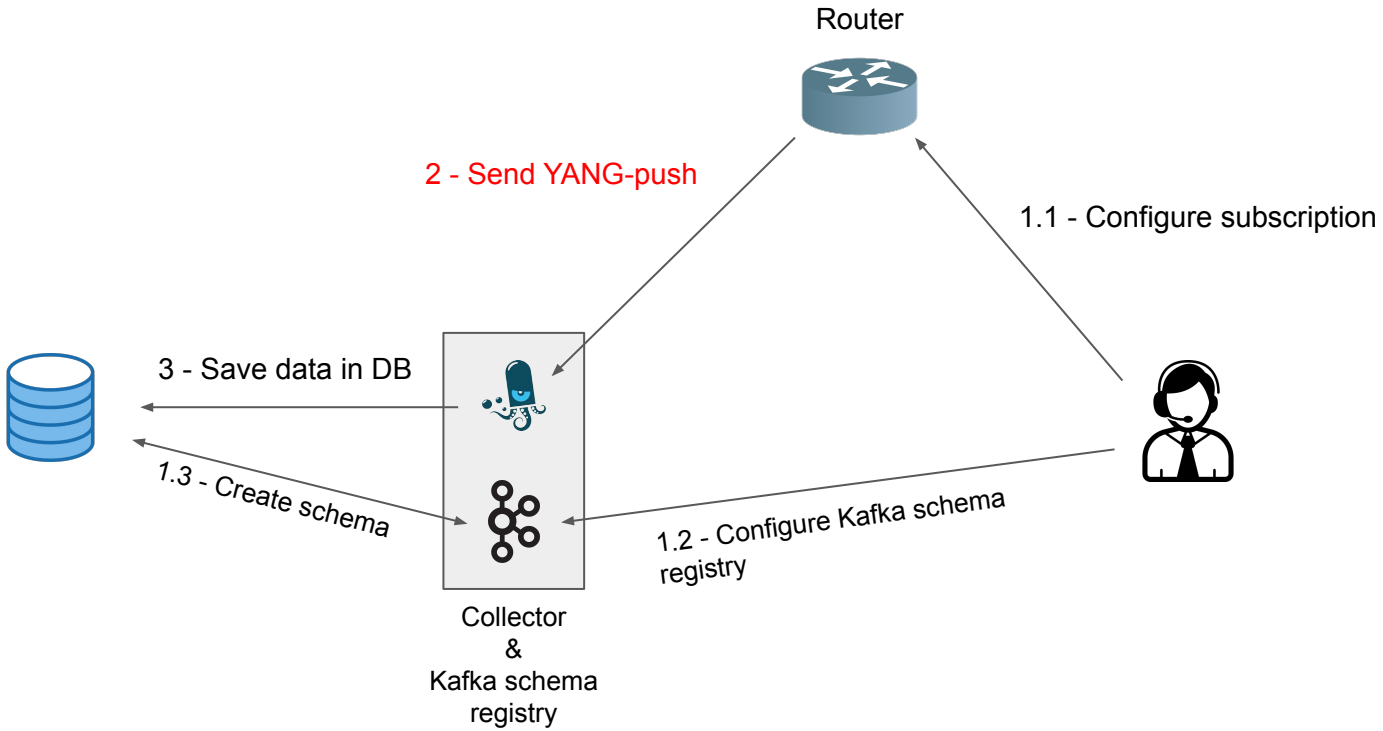
Once got the YANG module and the Xpath
→ Configure Schema registry for Kafka ingestion

Architecture overview

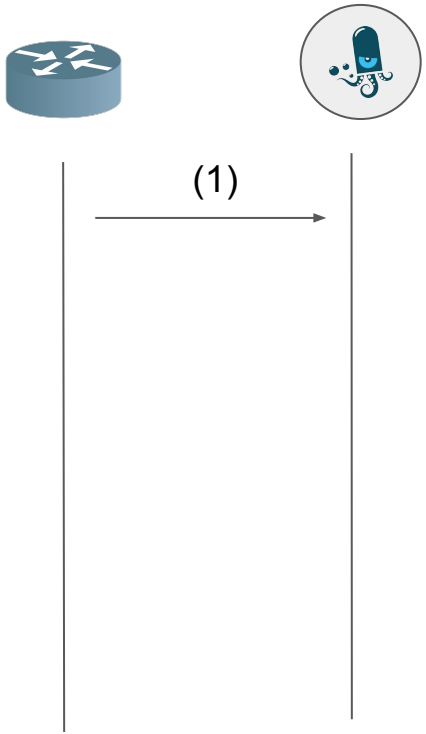
Configure subscription

YANG Push messages

Topology for Configured Subscriptions RFC8639/RFC8641

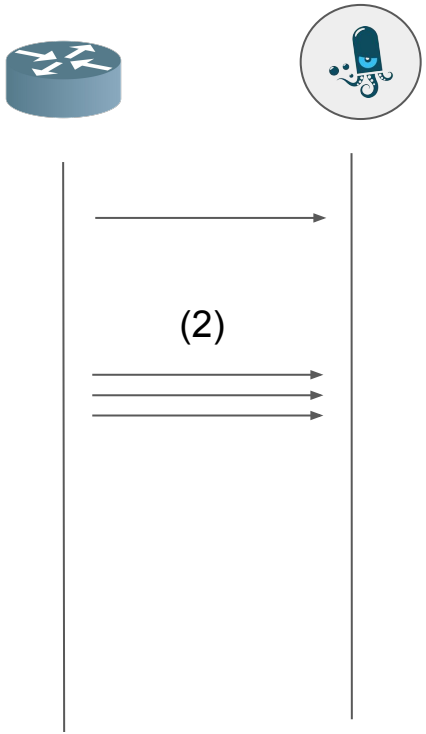


Sending YANG-push to the collector: Subscription started



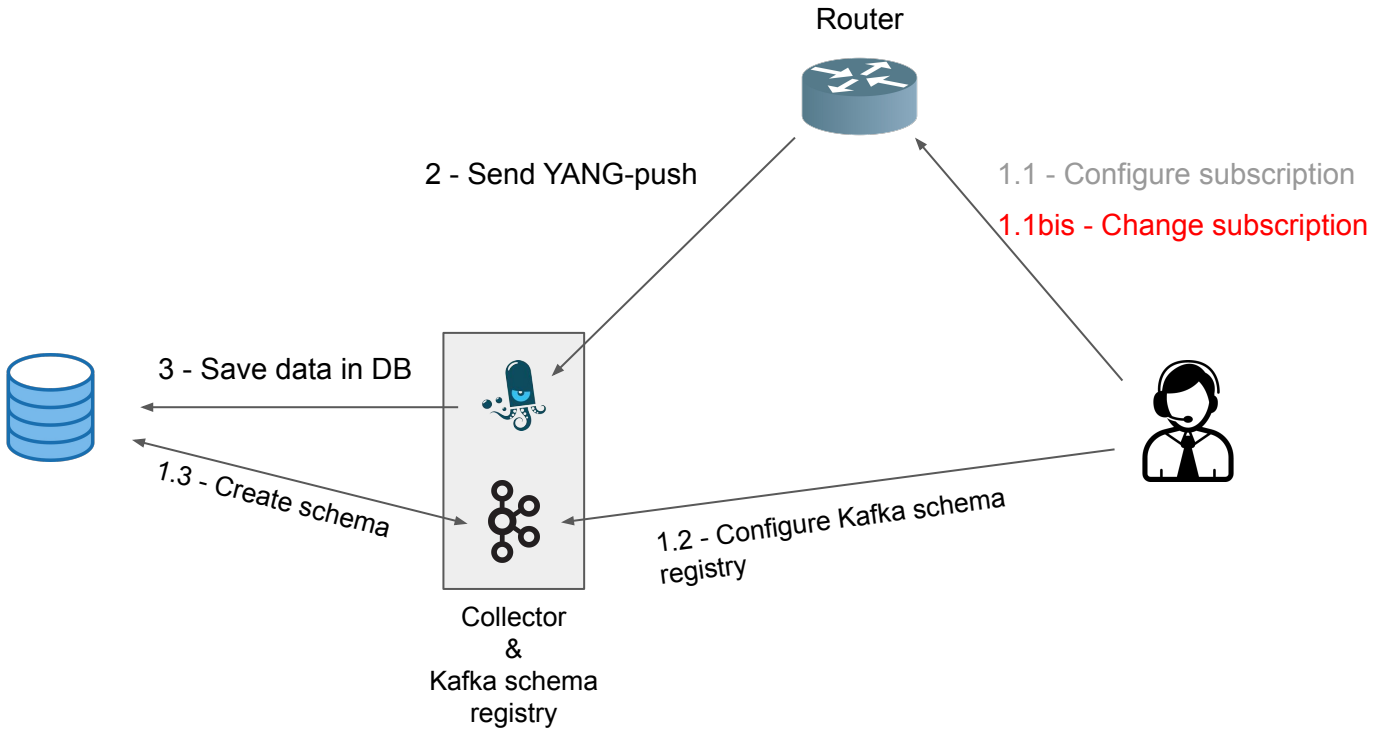

```
{
  "ietf-notification:notification": {
    "eventTime": "2023-03-25T08:30:11.22Z",
    "ietf-subscribed-notification:subscription-started": {
      "id": 1011,
      "target": {
        "ietf-yang-push:datastore": "ds:operational"
      },
      "transport": "ietf-udp-notif-transport:udp-notif",
      "encoding": "encode-json",
      "ietf-yang-push:periodic": {
        "ietf-yang-push:period": 100
      }
    }
  }
}
```

2 - Sending YANG-push to the collector: Updates




```
{
  "ietf-notification:notification": {
    "eventTime": "2023-03-25T08:30:11.22Z",
    "ietf-yang-push:push-update": {
      "id": 6666,
      "datastore-contents": {
        "ietf-interfaces:interfaces": [
          {
            "interface": {
              "name": "eth0",
              "oper-status": "up"
            }
          }
        ]
      }
    }
  }
}
```

Topology for Configured Subscriptions RFC8639/RFC8641



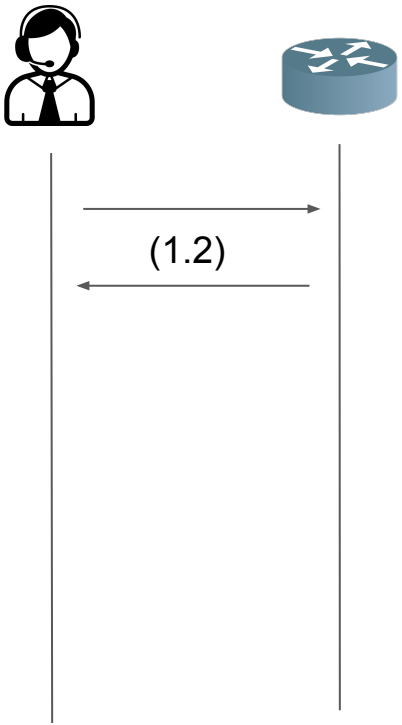
Change Subscription RFC8639/RFC8641 - Router

(1-bis.1)

Example: Change encoding

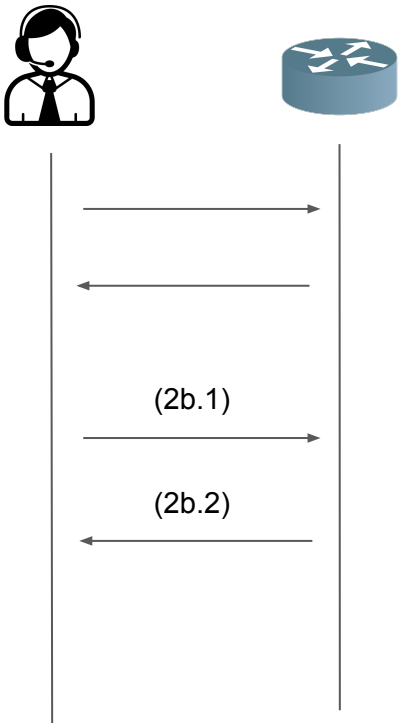
```
<?xml version='1.0' encoding='UTF-8'?>
<config xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <subscriptions xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">
    <subscription>
      <id>6666</id>
      <datastore xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">ds:operational</datastore>
      <datastore-xpath-filter xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">/some/path</datastore-xpath-filter>
      <transport xmlns:unt="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">unt:udp-notif</transport>
      <encoding>encode-xml</encoding>
      <receivers>
        <receiver>
          <name>subscription-specific-receiver-def</name>
          <receiver-instance-ref xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">global-udp-notif-receiver-def</receiver-instance-ref>
        </receiver>
      </receivers>
    </subscription>
    <receiver-instances xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">
      <receiver-instance>
        <name>global-udp-notif-receiver-def</name>
        <udp-notif-receiver xmlns="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">
          <address>192.0.5.1</address>
          <port>12345</port>
          <enable-segmentation>false</enable-segmentation>
          <max-segment-size/>
        </udp-notif-receiver>
      </receiver-instance>
    </receiver-instances>
  </subscriptions>
</config>
```

Change Subscription RFC8639/RFC8641 - Router




```
<rpc-reply message-id="101"
    xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
    <ok/>
</rpc-reply>
```

Change Subscription RFC8639/RFC8641 - Router

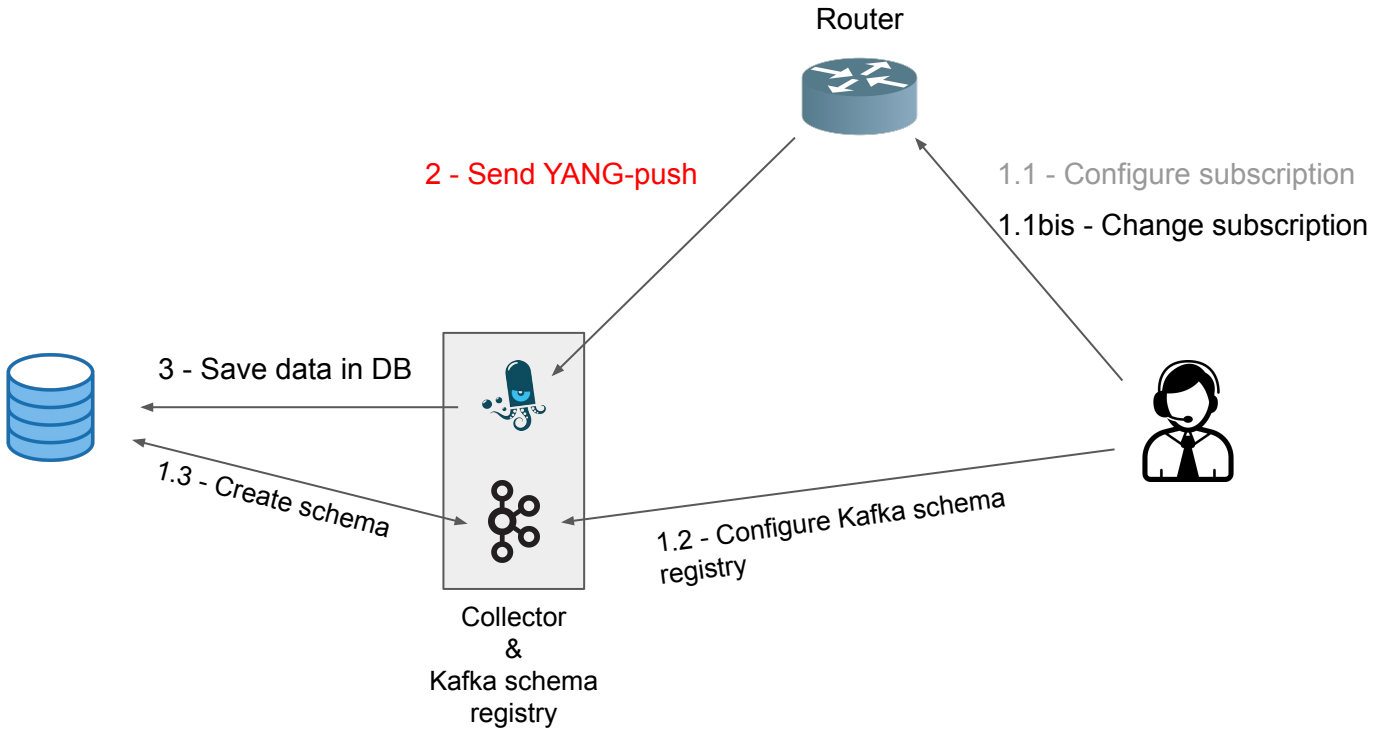



```
<rpc message-id="101"
    xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
    <get-schema xmlns="urn:ietf:params:xml:ns:yang:ietf-netconf-monitoring">
        <identifier>foo</identifier>
        <version>1.0</version>
        <format>yang</format>
    </get-schema>
</rpc>
```

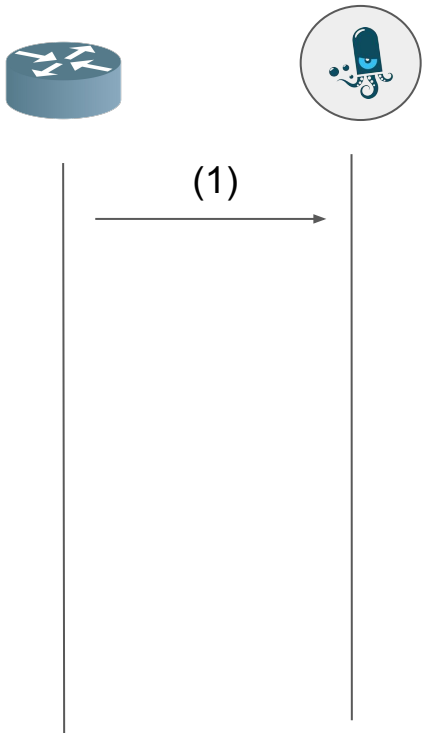
```
<rpc-reply message-id="101"
    xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
    <data xmlns="urn:ietf:params:xml:ns:yang:ietf-netconf-monitoring">
        module foo {
        //default format (yang) returned
        //bar version 2020-10-10 yang module
        //contents here ...
        }
    </data>
</rpc-reply>
```

Pushing new YANG module to Schema registry

Topology for Configured Subscriptions RFC8639/RFC8641



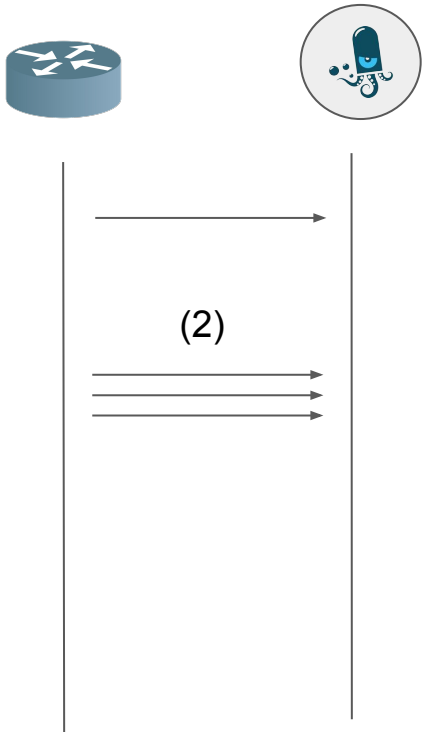
2b - Sending YANG-push to collector




```
{
    "ietf-notification:notification": {
        "eventTime": "2023-03-25T08:30:11.22Z",
        "ietf-subscribed-notification:subscription-modified": {
            "id": 6666,
            "target": {
                "ietf-yang-push:datastore": "ds:operational"
            },
            "transport": "ietf-udp-notif-transport:udp-notif",
            "encoding": "encode-json",
            "ietf-yang-push:periodic": {
                "ietf-yang-push:period": 100
            }
        }
    }
}
```

This first message is in json or in xml?

2 - Sending YANG-push to collector




```
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
    <eventTime>2022-09-02T10:59:55.32Z</eventTime>
    <push-update xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">
        <id>6666</id>
        <datastore-contents>
            <interfaces xmlns="urn:ietf:params:xml:ns:yang:ietf-interfaces">
                <interface>
                    <name>eth0</name>
                    <oper-status>up</oper-status>
                </interface>
            </interfaces>
        </datastore-contents>
    </push-update>
</notification>
```

Scapy emulation

Implementation status

Planned updates

Scapy: Status

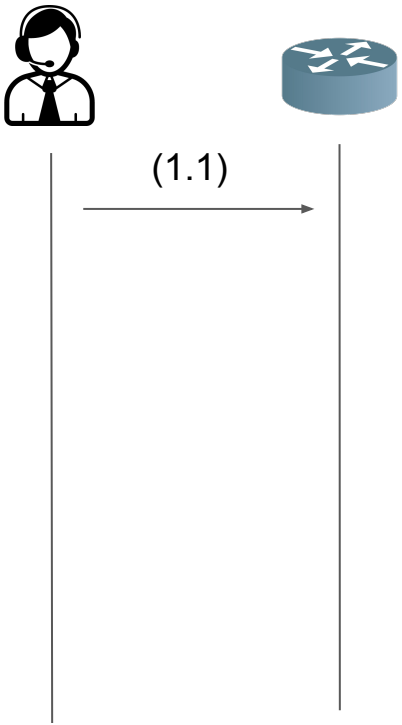
- Classic flow
  - Subscription started
  - PUSH Updates
  - Subscription terminated
- Transport:
  - UDP-notif (-08): https://datatracker.ietf.org/doc/html/draft-ietf-netconf-udp-notif-08
  - UDP pub channel (-05): https://datatracker.ietf.org/doc/html/draft-ietf-netconf-udp-pub-channel-05
- Encoding
  - JSON and XML supported
  - CBOR on the radar

Scapy: Planned

- A subscription is changed to a new (backward compatible) YANG module
  - Subscription started
  - PUSH Updates
  - Subscription modified
  - PUSH Updates
  - Subscription terminated
- Support new drafts in YANG-push notifications:
  - draft-ahuang-netconf-notif-yang
  - draft-tgraf-netconf-notif-sequencing
  - draft-tgraf-yang-push-observation-time
  - draft-tgraf-netconf-yang-notifications-versioning
- Transport:
  - UDP-notif (-09): will be published soon
  - UDP pub channel (-05): https://datatracker.ietf.org/doc/html/draft-ietf-netconf-udp-pub-channel-05
- Issue:
  - **How to know from the configuration to which YANG module we are subscribing to?**

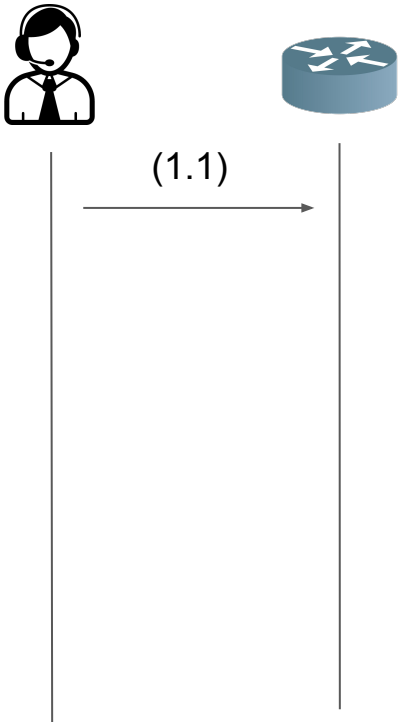
How to track a YANG module

Using a periodic subscription to <subscriptions> container



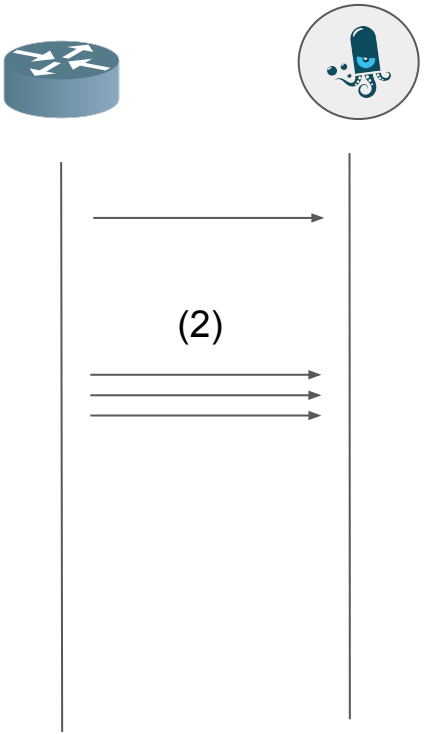

```
<rpc message-id="101"
  xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <subscriptions xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">
        <subscription>
          <id>2222</id>
          <datastore xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">ds:operational</datastore>
          <datastore-xpath-filter xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push"
            xmlns:sn="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">/sn:subscriptions</datastore-xpath-filter>
          <transport xmlns:unt="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">unt:udp-notif</transport>
          <encoding>encode-xml</encoding>
          <receivers>
            <receiver>
              <name>subscription-specific-receiver-def</name>
              <receiver-instance-ref xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">global-udp-notif-receiver-def</receiver-instance-ref>
            </receiver>
          </receivers>
          <periodic xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">
            <period>30000</period>
          </periodic>
        </subscription>
        <subscription>
          <id>6666</id>
          <datastore xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">ds:operational</datastore>
          <datastore-xpath-filter xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push"
            xmlns:if="urn:ietf:params:xml:ns:yang:ietf-interfaces">/if:interfaces</datastore-xpath-filter>
          <transport xmlns:unt="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">unt:udp-notif</transport>
          <encoding>encode-json</encoding>
          <receivers>
            <receiver>
              <name>subscription-specific-receiver-def</name>
              <receiver-instance-ref xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">global-udp-notif-receiver-def</receiver-instance-ref>
            </receiver>
          </receivers>
          <periodic xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">
            <period>6000</period>
          </periodic>
        </subscription>
        <receiver-instances xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">
          <receiver-instance>
            <name>global-udp-notif-receiver-def</name>
            <udp-notif-receiver xmlns="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">
              <address>192.0.5.1</address>
              <port>12345</port>
              <enable-segmentation>false</enable-segmentation>
              <max-segment-size/>
            </udp-notif-receiver>
          </receiver-instance>
        </receiver-instances>
      </subscriptions>
    </config>
  </edit-config>
</rpc>
```

Using a on-change subscription to <subscriptions> container



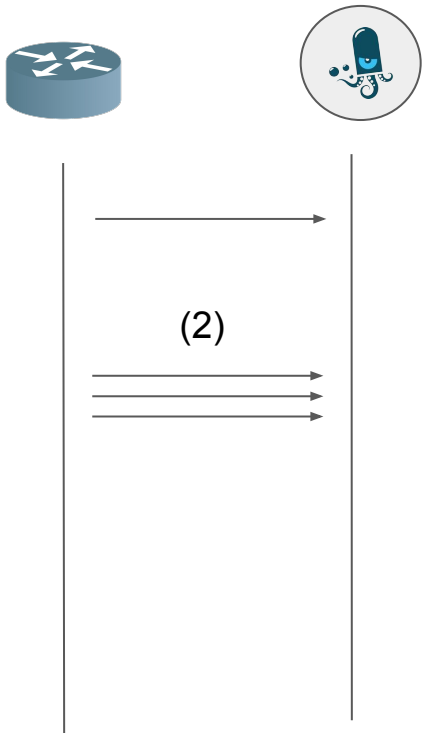

```
<rpc message-id="101"
  xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <edit-config>
    <target>
      <running/>
    </target>
    <config>
      <subscriptions xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">
        <subscription>
          <id>2222</id>
          <datastore xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">ds:operational</datastore>
          <datastore-xpath-filter xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push"
            xmlns:sn="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">/sn:subscriptions</datastore-xpath-filter>
          <transport xmlns:unt="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">unt:udp-notif</transport>
          <encoding>encode-xml</encoding>
          <receivers>
            <receiver>
              <name>subscription-specific-receiver-def</name>
              <receiver-instance-ref xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">global-udp-notif-receiver-def</receiver-instance-ref>
            </receiver>
          </receivers>
          <on-change xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">
            <dampening-period>0</dampening-period>
            <sync-on-start>true</sync-on-start>
            <excluded-change>
              <!-- # entries: 0.. -->
            </excluded-change>
          </on-change>
        </subscription>
        <subscription>
          <id>6666</id>
          <datastore xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">ds:operational</datastore>
          <datastore-xpath-filter xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push"
            xmlns:if="urn:ietf:params:xml:ns:yang:ietf-interfaces">/if:interfaces</datastore-xpath-filter>
          <transport xmlns:unt="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">unt:udp-notif</transport>
          <encoding>encode-json</encoding>
          <receivers>
            <receiver>
              <name>subscription-specific-receiver-def</name>
              <receiver-instance-ref xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">global-udp-notif-receiver-def</receiver-instance-ref>
            </receiver>
          </receivers>
          <periodic xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">
            <period>6000</period>
          </periodic>
        </subscription>
        <receiver-instances xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">
          <receiver-instance>
            <name>global-udp-notif-receiver-def</name>
            <udp-notif-receiver xmlns="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">
              <address>192.0.5.1</address>
              <port>12345</port>
              <enable-segmentation>false</enable-segmentation>
              <max-segment-size/>
            </udp-notif-receiver>
          </receiver-instance>
        </receiver-instances>
      </subscriptions>
    </config>
  </edit-config>
</rpc>
```

2 - Sending Telemetry YANG-push to collector



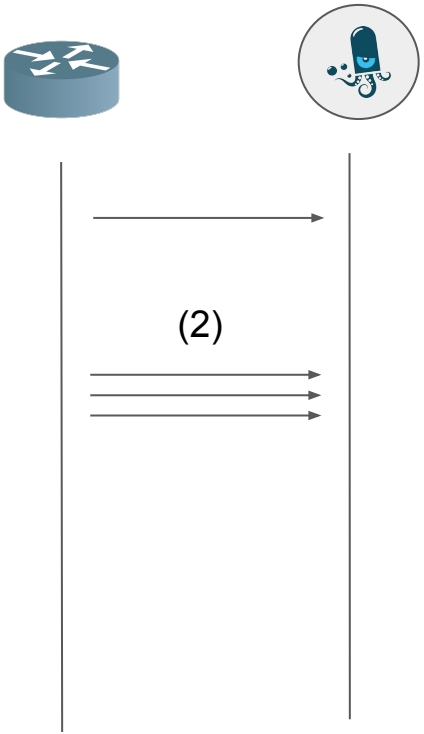

```
{
  "ietf-notification:notification": {
    "eventTime": "2023-03-25T08:30:11.22Z",
    "ietf-yang-push:push-update": {
      "id": 6666,
      "datastore-contents": {
        "ietf-interfaces:interfaces": [
          {
            "interface": {
              "name": "eth0",
              "oper-status": "up"
            }
          }
        ]
      }
    }
  }
}
```

2 - Sending Subscription change periodically




```
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2022-09-02T10:59:55.32Z</eventTime>
  <push-update xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">
    <id>2222</id>
    <datastore-contents>
      <subscriptions xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">
        <subscription>
          <id>2222</id>
          <datastore xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">ds:operational</datastore>
          <datastore-xpath-filter xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push"
            xmlns:sn="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">/sn:subscriptions</datastore-xpath-filter>
          <transport xmlns:unt="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">unt:udp-notif</transport>
          <encoding>encode-xml</encoding>
          <receivers>
            <receiver>
              <name>subscription-specific-receiver-def</name>
              <receiver-instance-ref xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">global-udp-notif-receiver-def</receiver-instance-ref>
            </receiver>
          </receivers>
          <periodic xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">
            <period>30000</period>
          </periodic>
        </subscription>
        <subscription>
          <id>6666</id>
          <datastore xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">ds:operational</datastore>
          <datastore-xpath-filter xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push"
            xmlns:if="urn:ietf:params:xml:ns:yang:ietf-interfaces">/if:interfaces</datastore-xpath-filter>
          <transport xmlns:unt="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">unt:udp-notif</transport>
          <encoding>encode-json</encoding>
          <receivers>
            <receiver>
              <name>subscription-specific-receiver-def</name>
              <receiver-instance-ref xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">global-udp-notif-receiver-def</receiver-instance-ref>
            </receiver>
          </receivers>
          <periodic xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">
            <period>6000</period>
          </periodic>
        </subscription>
        <receiver-instances xmlns="urn:ietf:params:xml:ns:yang:ietf-subscribed-notif-receivers">
          <receiver-instance>
            <name>global-udp-notif-receiver-def</name>
            <udp-notif-receiver xmlns="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">
              <address>192.0.5.1</address>
              <port>12345</port>
              <enable-segmentation>false</enable-segmentation>
              <max-segment-size/>
            </udp-notif-receiver>
          </receiver-instance>
        </receiver-instances>
      </subscriptions>
    </datastore-contents>
  </push-update>
</notification>
```

2 - Sending Subscription change on-change




```
<notification xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2022-09-02T10:59:55.32Z</eventTime>
  <push-change-update xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">
    <id>2222</id>
    <datastore-changes>
      <yang-patch>
        <patch-id>patch_54</patch-id>
        <comment>Changing encoding to JSON and increasing the period to 10 minutes</comment>
        <edit>
          <edit-id>id_change_1</edit-id>
          <operation>merge</operation>
          <target xmlns:sn="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">/sn:subscriptions/subscription[id=2222]</target>
          <value>
            <encoding>encode-json</encoding>
            <periodic xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push">
              <period>60000</period>
            </periodic>
          </value>
        </edit>
      </yang-patch>
    </datastore-changes>
  </push-change-update>
</notification>
```

What messages to implement in Scapy (periodic)?

1. <subscription-started> for monitored YANG module (ietf-interfaces.yang)
2. <subscription-started> for monitored YANG-push subscription
3. N messages <push-update> of “ietf-interfaces.yang” messages
4. M messages <push-update> of YANG-push subscription

(simulating here the ietf-interfaces.yang version change)

5. <subscription-modified> for monitored YANG module (ietf-interfaces.yang)
6. N messages <push-update> of new “ietf-interfaces.yang” messages

Assuming we know a reference to the YANG module during the subscription

What messages to implement in Scapy (on-change)?

1. <subscription-started> for monitored YANG module (ietf-interfaces.yang)
2. <subscription-started> for monitored YANG-push subscription
3. N messages <push-update> of “ietf-interfaces.yang” messages

(simulating here the ietf-interfaces.yang version change)

4. <push-change-update> for YANG-push subscription
5. <subscription-modified> for monitored YANG module (ietf-interfaces.yang)
6. N messages <push-update> of new “ietf-interfaces.yang” messages

Assuming we know a reference to the YANG module during the subscription

Gaps

Something to be done?

References

- YANG-push
  - RFC8639: Subscription to YANG Notifications
  - RFC8641: Subscription to YANG Notifications for Datastore Updates
- Definition of a Datastore:
  - RFC 8342: Network Management Datastore Architecture (NMDA)
- Encoding:
  - RFC7950: The YANG 1.1 Data Modeling Language (for XML)
  - RFC7951: JSON Encoding of Data Modeled with YANG
  - RFC9254: Encoding of Data Modeled with YANG in CBOR
- YANG-push RPCs and notifications in XML:
  - https://github.com/network-analytics/udp-notif-scapy/tree/feature/add-yang-push/src/resources/xml (will be merged)
- YANG-push notification in JSON:
  - https://github.com/network-analytics/udp-notif-scapy/tree/feature/add-yang-push/src/resources/json/notifications (will be merged)

Issues raised

- Architecture: 1.2 configure kafka schema registry is between the router and kafka instead of the operator.
- <get-schema> is recursive getting all the dependent YANG modules
  - Represent also that we need to create a yang module from it having the notification headers
- Can we have a subscription subscribed to multiple xpath?
- Ask Netconf WG about the xml namespace, how in YANG module name is encoded in the xpath
- <subscription-modified>: Thomas says this message is not in the same flow as <push-update>; if it is, the subscription in the subscription container should send the notifications first in a modification in a subscription

Remarks

- One stream is a set of datastore changes
- If we want to change a subscription, it is better to terminate the subscription and create a new one
- No opinion in “on-change” subscription yet
- Scapy implementation: think about not only changing the version, but changing the xpath we are subscribed to