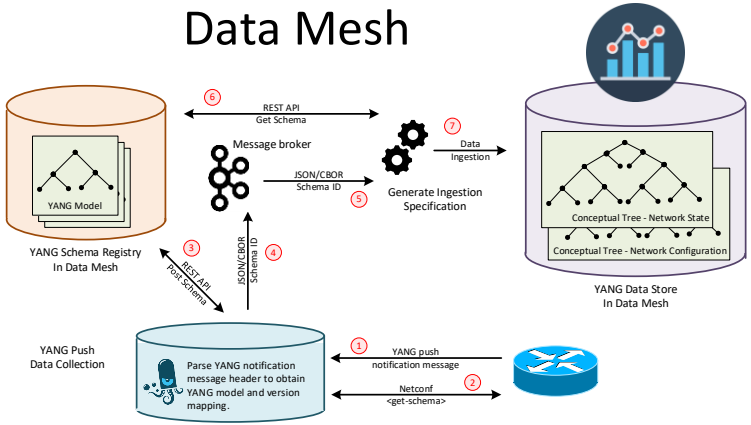
Validate Configured Subscription YANG-Push Publisher Implementations

NETCONF & NMOP WG



IETF 121

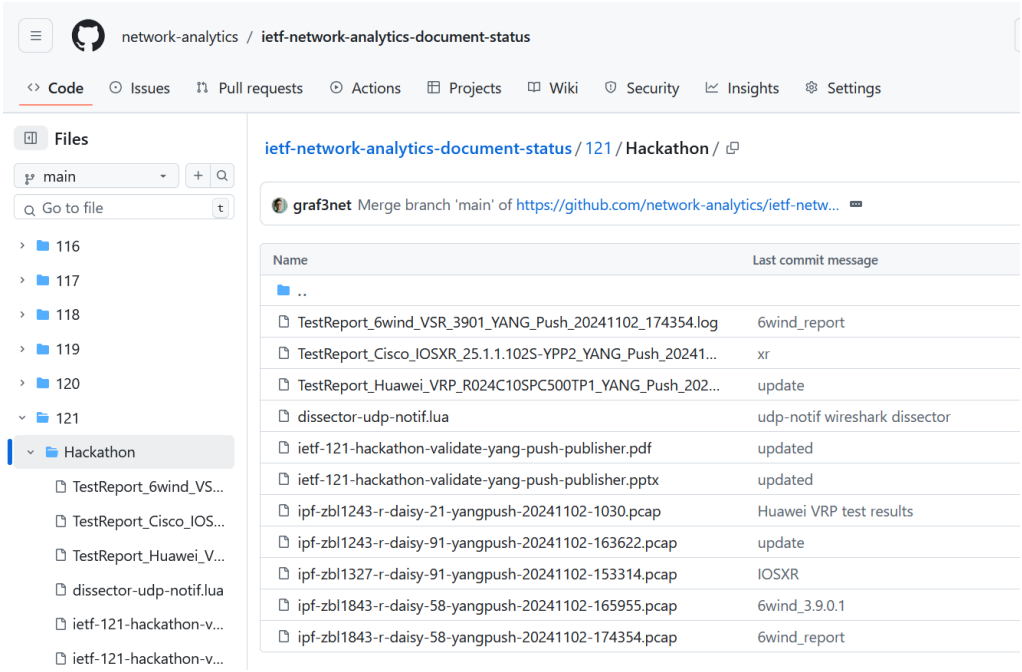
November 2-3rd, 2024

Hackathon

Hackathon – Repository

Test Repository

- https://github.com/network-analytics/ietf-network-analytics-document-status/tree/main/121/Hackathon
- Contains
  - Packet capture on the wire
  - Netconf RPCs and YANG-Push JSON messages
  - Python script which performed test cases



YANG-Push Implementation Status

IETF 121 – MVP 1

	6WIND VSR	Huawei VRP	Cisco IOS XR	Open-Source
RFC 8639 YANG-Push Subscription	✓	P	P	
RFC 8641 YANG-Push Notification	✓	P	✓	
draft-ietf-netconf-udp-notif	✓	✓	✓	✓
draft-ietf-netconf-yang-notifications-versioning	✓	✓	✓	
draft-tgraf-netconf-notif-sequencing	✓	✓	✓	
draft-tgraf-netconf-yang-push-observation-time	✓	✓	✓	
RFC 7895 YANG Library		✓		
RFC 8525 YANG Library (NMDA)	✓		✓	
draft-ietf-netconf-yang-library-augmentation		P		✓
RFC 9196 System and Notification Capabilities				
draft-netana-netconf-notif-envelope				

Green marked describes new capability at IETF 121. "P" to partially implemented.

YANG-Push Implementation Status

IETF 121 – MVP 2

	6WIND VSR	Huawei VRP	Cisco IOS XR	Open-Source
draft-ietf-netconf-distributed-notif	✓	✓		
RFC 9254 CBOR				
RFC 6347/RFC 9147 DTLS				

Green marked describes new capability at IETF 121. "P" to partially implemented

YANG-Push Implementation Status

IETF 121 – MVP 3

	6WIND VSR	Huawei VRP	Cisco IOS XR	Open-Source
RFC 8641 on-change subscriptions	✓	✓	P	
draft-netana-netconf-yp-transport-capabilities				

Green marked describes new capability at IETF 121. "P" to partially implemented

YANG-Push Standardization Progress at IETF 121

Suggest to Review

Relevant Presentations at Hackathon

- slides-121-hackathon-sessd-validate-configured-subscription-yang-push-publisher-implementations-00.pdf
- slides-121-hackathon-sessd-implement-find-relationship-solution-with-augmented-by-list-in-ietf-yang-library-00

Relevant Presentations at NMOP

- slides-121-nmop-ietf-yang-push-implementations-and-next-steps-01
- slides-121-nmop-an-architecture-for-yang-push-to-message-broker-integration-00.pdf

Relevant Presentations at NETCONF

- slides-121-netconf-draft-ietf-netconf-udp-client-server-03-00.pdf
- slides-121-netconf-draft-ietf-netconf-udp-notif-distributed-notif-00.pdf
- slides-121-netconf-draft-ietf-netconf-yang-library-augmentedby-01-00.pdf
- slides-121-netconf-draft-netana-netconf-notif-envelope-00-00.pdf
- slides-121-netconf-yang-push-operational-data-observability-enhancements-00.pdf

Address YANG Specification and Integration Gaps

Aiming for an automated data processing pipeline

YANG Specifications Gaps:

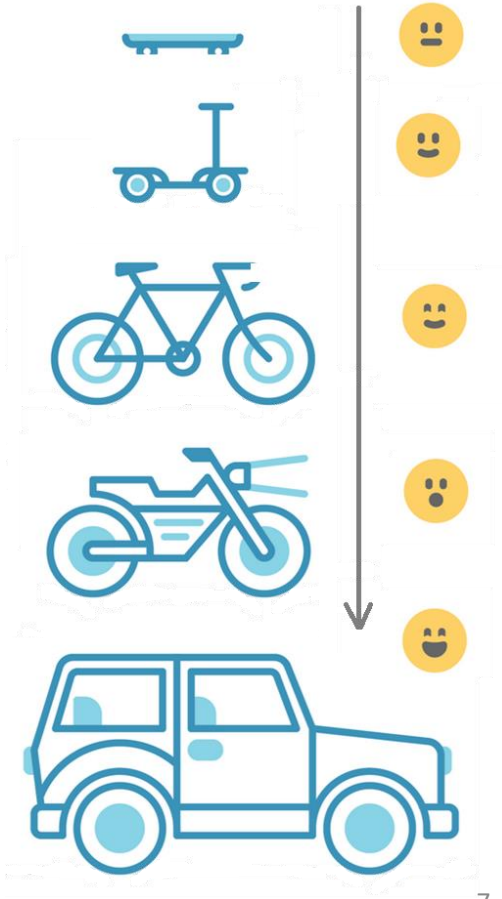
- Extensible YANG model for YANG-Push Notifications
  draft-netana-netconf-notif-envelope
- YANG Notification Transport Capabilities
  draft-netana-netconf-yp-transport-capabilities
- Validating anydata in YANG Library context
  draft-aelhassany-anydata-validation

YANG Integration Gaps:

- Support of Network Observation Timestamping in YANG Notifications
  draft-tgraf-netconf-yang-push-observation-time
- Support of Versioning in YANG Notifications Subscription
  draft-ietf-netconf-yang-notifications-versioning
- Augmented-by Addition into the IETF-YANG-Library
  draft-ietf-netconf-yang-library-augmentation

YANG Simplification:

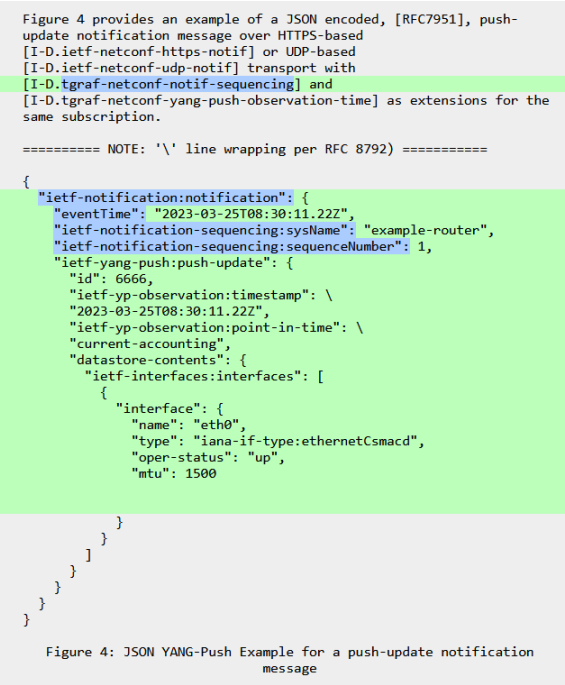
- YANG-Push Operational Data Observability Enhancements
  draft-wilton-netconf-yp-observability



YANG-Push Specification changes at IETF 121

To be addressed in running code by IETF 122

- **Three new documents**
  - draft-netana-netconf-notif-envelope
  - draft-netana-netconf-yp-transport-capabilities
  - draft-wilton-netconf-yp-observability
- draft-netana-netconf-notif-envelope replaces draft-ahuang-netconf-notif-yang and draft-tgraf-netconf-notif-sequencing. Changes YANG module namespace and names for notification, sysName and sequencenumber.



```
Figure 4 provides an example of a JSON encoded, [RFC7951], push-
update notification message over HTTPS-based
[I-D.ietf-netconf-https-notif] or UDP-based
[I-D.ietf-netconf-udp-notif] transport with
[I-D.tgraf-netconf-notif-sequencing] and
[I-D.tgraf-netconf-yang-push-observation-time] as extensions for the
same subscription.

========== NOTE: '\' line wrapping per RFC 8792) ===========

{
  "ietf-notification:notification": {
    "eventTime": "2023-03-25T08:30:11.22Z",
    "ietf-notification-sequencing:sysName": "example-router",
    "ietf-notification-sequencing:sequenceNumber": 1,
    "ietf-yang-push:push-update": {
      "id": 6666,
      "ietf-yp-observation:timestamp": \
      "2023-03-25T08:30:11.22Z",
      "ietf-yp-observation:point-in-time": \
      "current-accounting",
      "datastore-contents": {
        "ietf-interfaces:interfaces": [
          {
            "interface": {
              "name": "eth0",
              "type": "iana-if-type:ethernetCsmacd",
              "oper-status": "up",
              "mtu": 1500
            }
          }
        ]
      }
    }
  }
}
```

Figure 4: JSON YANG-Push Example for a push-update notification message

```
Figure 4 provides an example of a JSON encoded, [RFC7951], push-
update notification message over HTTPS-based
[I-D.ietf-netconf-https-notif] or UDP-based
[I-D.ietf-netconf-udp-notif] transport with
[I-D.netana-netconf-notif-envelope] and
[I-D.tgraf-netconf-yang-push-observation-time] as extensions for the
same subscription.

========== NOTE: '\' line wrapping per RFC 8792) ===========

{
  "ietf-yp-notification:envelope": {
    "event-time": "2023-03-25T08:30:11.22Z",
    "hostname": "example-router",
    "sequence-number": 1,
    "notification-contents": {
      "ietf-yang-push:push-update": {
        "id": 6666,
        "ietf-yp-observation:timestamp": \
        "2023-03-25T08:30:11.22Z",
        "ietf-yp-observation:point-in-time": \
        "current-accounting",
        "datastore-contents": {
          "ietf-interfaces:interfaces": [
            {
              "interface": {
                "name": "eth0",
                "type": "iana-if-type:ethernetCsmacd",
                "oper-status": "up",
                "mtu": 1500
              }
            }
          ]
        }
      }
    }
  }
}
```

Figure 4: JSON YANG-Push Example for a push-update notification message

https://author-tools.ietf.org/iddiff?url1=draft-ietf-nmop-yang-message-broker-integration-04&url2=draft-ietf-nmop-yang-message-broker-integration-05&difftype=--html

YANG-Push Standardization Progress at IETF 121

Planned activities by IETF 122

The following documents are going to be NETCONF working group last called

- draft-ietf-netconf-udp-notif
- draft-ietf-netconf-distributed-notif
- draft-ietf-netconf-udp-client-server

The following document is going to be NETCONF working group adopt called

- draft-netana-netconf-notif-envelope

The following document is going to be scoped, refined and discussed within a group of implementors and operators (Huawei xxx, Cisco Rob Wilton, Juniper Ebben Aries, Nokia James Cummings, Swisscom Thomas Graf, Bell Canada Daniel Voyer, Deutsche Telekom Holger Keller, NTT Paolo Lucente)

- draft-wilton-netconf-yp-observability

The following documents are discussed on the NETCONF mailing list

- draft-netana-netconf-yp-transport-capabilities
- draft-tgraf-netconf-yang-push-observation-time
- draft-ietf-netconf-yang-notifications-versioning
- draft-ietf-netconf-yang-library-augmentation

YANG Notification Transport Capabilities

Extending System Capabilities for YANG-Push Configured Subscription Transport

```
module: ietf-notification-transport-capabilities

  augment /sysc:system-capabilities/notc:subscription-capabilities:
    +--ro transport-capabilities
       +--ro transport-capability* [transport-protocol]
          +--ro transport-protocol    identityref
          +--ro security-protocol?    identityref
          +--ro encoding-format*      identityref
```

```
augment "/sysc:system-capabilities/notc:subscription-capabilities" {
    description "Add system level capability.";
    container transport-capabilities {
      description "Capabilities related to YANG-Push transports.";
      list transport-capability {
        key "transport-protocol";
        description "Capability list related to notification transport
capabilities.";
        leaf transport-protocol {
          type identityref {
            base sn:transport;
          }
          description "Supported transport protocol for YANG-Push.";
        }
        leaf security-protocol {
          type identityref {
            base security-protocol;
          }
          description "Type of secure transport.";
        }
        leaf-list encoding-format {
          type identityref {
            base sn:encoding;
          }
          description "Supported encoding formats.";
        }
      }
    }
```

- draft-netana-netconf-yp-transport-capabilities augments System Capabilities model and provides additional transport related attributes associated with system capabilities:
  - Specification of transport protocols the client can request to establish a draft-ietf-netconf-udp-notif or draft-ietf-netconf-https-notif configured transport connection;
  - Specification of transport encoding, such as JSON or XML as defined in RFC 8040 or CBOR as defined in RFC 9254 the client can request to encode YANG notifications;
  - Specification of secure transport mechanisms that are needed by the client to communicate with the server such as DTLS as defined in RFC 9147 TLS as defined in RFC 8446 or SSH as defined in RFC 4254;

Extensible YANG model for YANG-Push Notifications

For XML, JSON or CBOR encoded messages with hostname and sequence-number

```
notifications:
  +---n envelope
     +--ro event-time                    yang:date-and-
time
     +--ro hostname?                     inet:host
     |       {notification-hostname-sequence-number}?
     +--ro sequence-number?              yang:counter32
     |       {notification-hostname-sequence-number}?
     +--ro notification-contents?        <anydata>
```

```
{
    "ietf-yp-notification:envelope": {
     "event-time": "2023-03-25T08:30:11.22Z",
     "hostname": "example-router",
     "sequence-number": 1,
     "notification-contents": {
       "ietf-yang-push:push-update": {
         "id": 6666,
         "datastore-contents": {
           "ietf-interfaces:interfaces": [
             {
               "interface": {
                 "name": "eth0",
                 "type": "iana-if-type:ethernetCsmacd",
                 "oper-status": "up",
                 "mtu": 1500
               }
             }
           ]
         }
       }
     }
   }
}
```

- draft-netana-netconf-notif-envelope defines new extensible notification structure, defined in YANG, for use in YANG-Push Notification messages enabling any YANG compatible encodings such as XML RFC 7950, JSON RFC 7951 or CBOR RFC 9264.
- New notification envelope can be enabled in "ietf-subscribed-notification" RFC 8639.
- Capability can be discovered through 'ietf-notification-capabilities' RFC 9196.
- Supports the following notification metadata extensions
  - **hostname:** Describes the node's hostname according to the 'sysName' object definition in RFC 1213 from where the message was published from. This value is usually configured on the node by the administrator to uniquely identify the node in the network.
  - **sequence-number:** Generates a unique sequence number for each published message by the publisher process. The number counts up at every published notification message as described in RFC 9187.

YANG-Push Operational Data Observability Enhancements

Simplifies by combining periodic and on-change subscription

```
module: ietf-yp-ext

  augment /sn:subscription-started/yp:update-trigger:
    +--:(periodic-and-on-change) {yp:on-change}?
       +-- periodic-and-on-change!
          +-- period               yp:centiseconds
          +-- anchor-time?         yang:date-and-time
          +-- dampening-period?    yp:centiseconds
          +-- sync-on-start?       boolean
          +-- excluded-change*     yp:change-type
  augment /sn:subscription-started:
    +--ro common-notification-format?   boolean
  augment /sn:subscription-modified/yp:update-trigger:
    +--:(periodic-and-on-change) {yp:on-change}?
       +-- periodic-and-on-change!
          +-- period               yp:centiseconds
          +-- anchor-time?         yang:date-and-time
          +-- dampening-period?    yp:centiseconds
          +-- sync-on-start?       boolean
          +-- excluded-change*     yp:change-type
  augment /sn:subscription-modified:
    +--ro common-notification-format?   boolean
  augment /sn:subscriptions/sn:subscription/yp:update-
trigger:
    +--:(periodic-and-on-change) {yp:on-change}?
       +--rw periodic-and-on-change!
          +--rw period               yp:centiseconds
          +--rw anchor-time?         yang:date-and-time
          +--rw dampening-period?    yp:centiseconds
          +--rw sync-on-start?       boolean
          +--rw excluded-change*     yp:change-type
  augment /sn:subscriptions/sn:subscription:
    +--rw common-notification-format?   boolean
```

- To reduce complexities in modelling the operational state, the following two YANG-Push enhancements are proposed:
  - A new YANG-Push encoding format that can be used for both on-change and periodic subscriptions that reports the data from the subscription filter point.
  - A combined periodic and on-change subscription that reports events on a periodical cadence and also if changes to the data have occurred.

```
notifications:
  +---n update
     +--ro id?                    sn:subscription-id
     +--ro subscription-path?     yang:xpath1.0
     +--ro target-path?           string
     +--ro snapshot-type?         enumeration
     +--ro observation-time?      yang:date-and-time
     +--ro datastore-snapshot?    <anydata>
     +--ro incomplete?            empty
```

- This removes the YANG Patch format RFC 8072 dependency and eases the message broker integration.
- Allows the YANG-Push publisher to split a subscription into smaller child subscriptions for more efficient independent and concurrent processing. Reuses the ideas from draft-ietf-netconf-distributed-notif. Child subscriptions remain encoded from the same subscription point.

Thanks to…

- Rob Wilton – Cisco
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- Zhuoyao Lin - Huawei
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- Thomas Graf – Swisscom
- Ahmed Elhassany – Swisscom (remote)
- Uwe Storbeck – Swisscom (remote)