An Architecture for YANG-Push to Message Broker Integration

draft-ietf-nmop-yang-message-broker-integration-06

Motivation and architecture of a native
YANG-Push notifications and YANG Schema integration
into Message Broker and YANG Schema Registry

thomas.graf@swisscom.com
ahmed.elhassany@swisscom.com
alex.huang-feng@insa-lyon.fr

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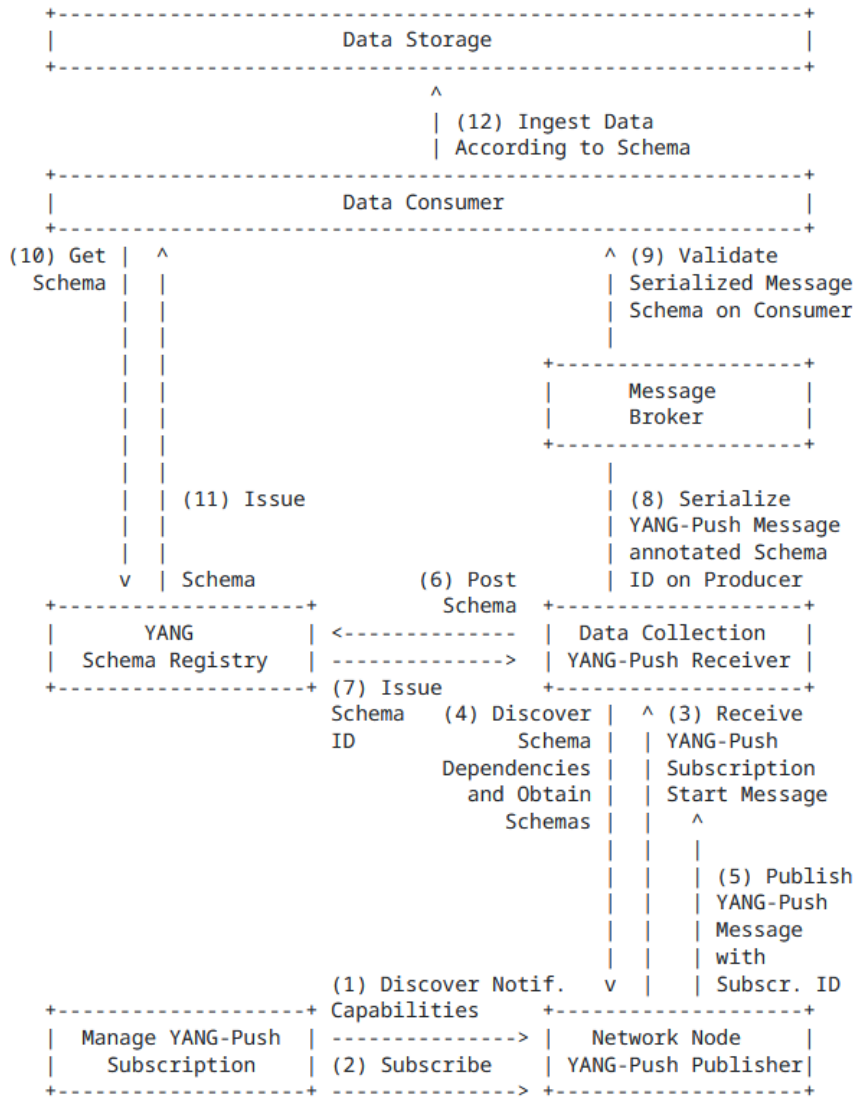
Agenda Items

- Architecture Overview and Document Relationships
- Document Changes in -06 and next steps
- Changes in draft-ietf-netconf-yang-notifications-versioning-07
- IETF 122 hackathon activities
- Related YANG-Push integration and specification gaps status

Elements of the Architecture

Document Relationships



- **4.1. YANG-Push Subscription**
  Thanks to RFC 9196 based YANG modules describing capabilities for systems and notifications, transport (draft-netana-netconf-yp-transport-capabilities), notification extensions (draft-netana-netconf-notif-envelope) and supported xpaths can be discovered.
- **4.2. YANG-Push Publisher**
  For configured subscriptions, udp-notif, distributed-notif and https-notif are the RFC 8639, RFC 8641 based YANG-Push transport protocols. draft-netana-netconf-notif-envelope provides the notification header with hostname, sequence and observation timestamp extensions.
- **4.3. YANG-Push Receiver**
  Discovers subscription state changes by detecting changes in xpath/sub-tree, module name, revision, revision-label and YANG library content-id defined in draft-ietf-netconf-yang-notifications-versioning and discovers YANG schema tree through YANG library with ietf-netconf-yang-library-augmentedby extension.
- **4.6. YANG Message Broker Consumer**
  Validates YANG notifications against schema. Anydata described in Section 7.10 of RFC 7950, validation described in draft-aelhassany-anydata-validation.
- **4.7. YANG Data Consumer**
  Thanks to hostname, sequence-number and event-time from draft-netana-netconf-notif-envelope, loss and serialization delay can be measured.
- **4.8. YANG Data Storage**
  Metrics can be indexed in timeseries database thanks to observation timestamp defined in draft-netana-netconf-notif-envelope.

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Status, Summary and Next steps

Changes in -06

- draft-netana-netconf-notif-envelope-02, draft-netana-netconf-yp-transport-capabilities-01 and draft-ietf-netconf-yang-notifications-versioning-07 (details on slide 5) changes are incorporated.
- Terminology section has been updated with data product terms from Data Mesh.
- YANG-Push Receiver section describes now how YANG-Push schema changes are being detected by incorporating xpath, sub-tree filter module name, revision, revision-label or YANG Library content-id.

  A change in xpath or sub-tree filter or module name in the subscription state change notifications indicates that the subscribed path has changed. A change in revision indicates that the version of the YANG module of the subscribed path has changed, where revision-label indicates wherever the revision was backward compatible or not. YANG Libary content-id changes indicates that there were potential semantic changes in the augmented or imported yang modules of the subscribed xpath or sub-tree. If no change to previous subscription state is observed, step 4 can be omitted.

- YANG Data Consumer section describes how notification message loss and reordering is being detected and how it contributes to Data Mesh data product excellence.

  By tracking the YANG-Push notification sequence-number for a given hostname as defined in Section 3.4 of [I-D.netana-netconf-notif-envelope] loss can be recognized across the YANG data processing chain. By taking the event-time in the YANG-Push notification header and the time the YANG-Push notification messages was consumed into account, the serialization delay between YANG-Push publisher and YANG Data Consumer can be measured. The loss rate and delay for a given hostname can be used as a Service Level Indicator for the YANG data product in the Data Mesh [Deh22].

Next Steps

- **Looking forward for review and comments.**
- **Message Broker message schema document will be published before IETF 122.**

Support of Versioning in YANG Notifications Subscription

For subscription state change notification messages

```
module: ietf-yang-push-revision
  augment /sn:establish-subscription/sn:input:
    +---w module-version-config* [module-name]
       +---w module-name       yang:yang-identifier
       +---w revision?         rev:revision-date-or-label
       +---w revision-label?   ysver:version

 augment /sn:subscription-started:
    +--ro module-version* [module-name]
    |       {yang-push-revision-supported}?
    |  +--ro module-name       yang:yang-identifier
    |  +--ro revision          rev:revision-date
    |  +--ro revision-label?   ysver:version
    +--ro yang-library-content-id?       -> /yanglib:yang-library/content-id
            {yang-push-revision-supported}?
 {
     "ietf-notification:notification": {
       "eventTime": "2023-03-25T08:30:11.22Z",
       "ietf-notification-sequencing:sysName": "example-router",
       "ietf-notification-sequencing:sequenceNumber": 1,
       "ietf-subscribed-notification:subscription-started": {
         "id": 6666,
         "ietf-yang-push:datastore": "ietf-datastores:operational",
         "ietf-yang-push:datastore-xpath-filter": "/if:interfaces",
         "ietf-yang-push-revision:revision": "2014-05-08",
         "ietf-yang-push-revision:module-name": "ietf-interfaces",
         "ietf-yang-push-revision:revision-label": "",,
         "ietf-yang-push-revision:yang-library-content-id": "1",
         "ietf-distributed-notif:message-observation-domain-id": [1,2],
         "transport": "ietf-udp-notif-transport:udp-notif",
         "encoding": "encode-json",
         "ietf-yang-push:periodic": {
           "ietf-yang-push:period": 100
         }
       }
     }
   }
```

- **Network operators need to control semantics in its data processing pipeline. That includes YANG-Push.**
- This is today only possible during YANG-Push subscription but not when nodes are being upgraded or when messages are being published for configured subscription.
- draft-ietf-netconf-yang-notifications-versioning extends the YANG push subscription and publishing mechanism defined in RFC 8641:
  - **By adding the ability to subscribe to a specific revision** or latest-compatible-semversion of one or more yang modules.
  - **By extending the YANG push Subscription State Change Notifications Message** so that the YANG push receiver learns beside the xpath and the sub-tree filter also the yang module name, revision, revision-label and the yang-library-content-id.

    With YANG Library content-id a YANG-Push receiver is now able to detect changes in the YANG library. This includes also the imported YANG modules of the subscribed xpath.

- Extends RFC 9196 defined subscription-capabilities with a **yang-push-module-revision-supported** leaf.

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IETF 122 Hackathon

Validate Configured Subscription YANG-Push Publisher Implementations

- **Champion(s)**
  Thomas Graf (thomas.graf @ swisscom.com)
  Yannick Buchs (yannick.buchs @ swisscom.com)
  Daniel Voyer (danvoyerwork @ gmail.com)
  Holger Keller (holger.keller @ telekom.de)
  Rob Wilton (rwilton @ cisco.com)
  Benoit Claise (benoit.claise@huawei.com)
  Qiufang Ma (maqiufang1 @ huawei.com)
  Jérémie Leska (jeremie.leska @ 6wind.com)
  Samuel Gauthier (samuel.gauthier @ 6wind.com)
- **Draft Specifications**
  https://datatracker.ietf.org/doc/html/rfc8639
  https://datatracker.ietf.org/doc/html/rfc8641
  https://datatracker.ietf.org/doc/html/rfc9196
  https://datatracker.ietf.org/doc/html/draft-netana-netconf-notif-envelope
  https://datatracker.ietf.org/doc/html/draft-ietf-netconf-yang-notifications-versioning
  https://datatracker.ietf.org/doc/html/draft-ietf-netconf-udp-notif
  https://datatracker.ietf.org/doc/html/draft-ietf-netconf-distributed-notif
  https://datatracker.ietf.org/doc/html/draft-netana-netconf-yp-transport-capabilities
- **Project Info**
  Validates and verify 3 YANG-Push vendor implementations in the area of:
- *Subscription automation*
  Discover YANG-Push systems and notifications capabilities and configure periodical and on-change subscriptions with netconf.
- *Notification integration*
  Validate subscription state change and push-update and push-change-update notifications for draft-ietf-nmop-yang-message-broker-integration integration.
- *Configured subscription transport integration*
  Validate draft-ietf-netconf-udp-notif and draft-ietf-netconf-distributed-notif packet format on the wire.
- **Repository**
  https://github.com/network-analytics/ietf-network-analytics-document-status/tree/main/122/Hackathon

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.

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Address YANG Specification and Integration Gaps

Aiming for an automated data processing pipeline

YANG Specifications Gaps:

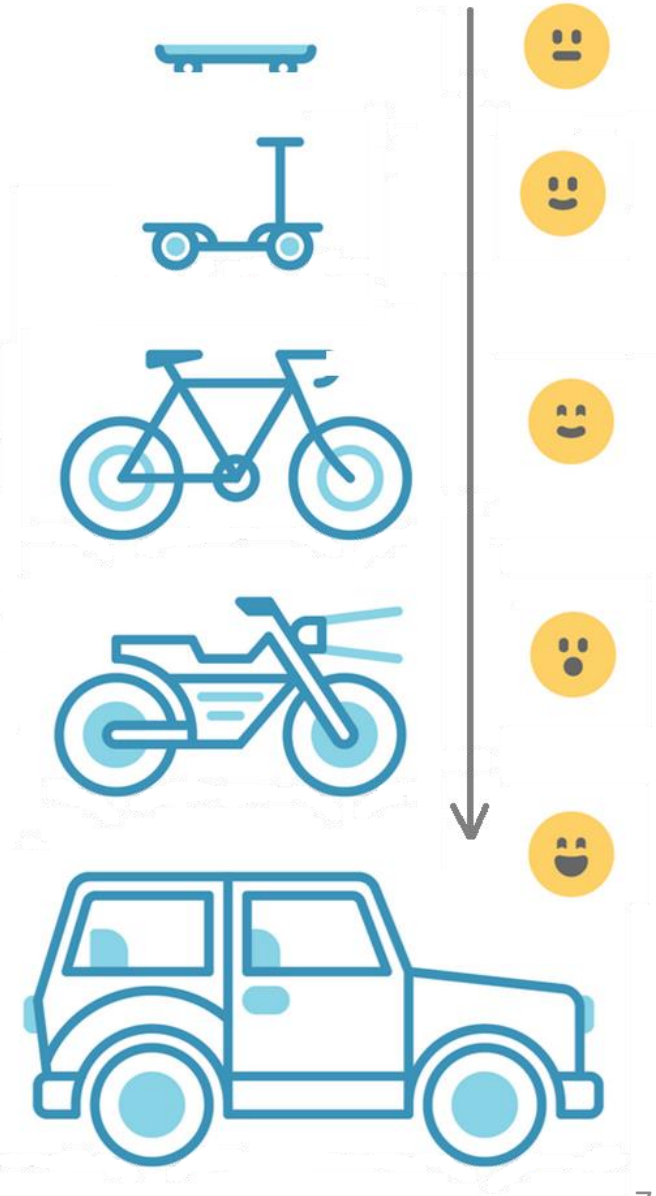
- Extensible YANG model for YANG-Push Notifications
  draft-netana-netconf-notif-envelope
- YANG Notification Transport Capabilities
  draft-netana-netconf-yp-transport-capabilities
- Validating anydata in YANG Library context
  draft-aelhassany-anydata-validation

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



BACKUP

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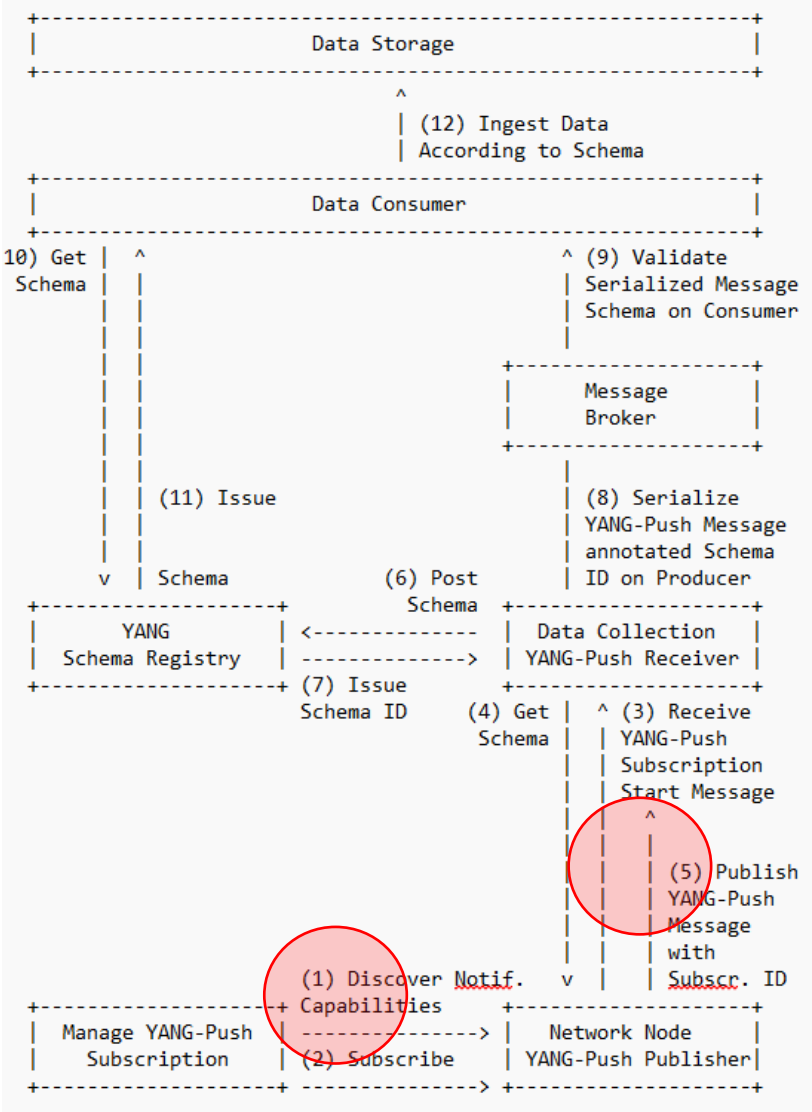
Status, Summary and Next steps

Changes in -05

- Section 4.1 covers now
  - draft-netana-netconf-yp-transport-capabilities which helps the NETCONF, RESTCONF client performing YANG-Push subscription to discover the YANG-Push transport, encoding and security capabilities of the YANG-Push publisher.
  - draft-netana-netconf-notif-envelope defines a new extensible notification structure, defined in YANG, for use in YANG-Push Notification messages enabling any YANG compatible encodings such as XML, JSON or CBOR. Replaces and consolidates draft-ahuang-netconf-notif-yang and draft-tgraf-netconf-notif-sequencing based on the outcome of the last NETCONF interim.
- Milestones for IETF 121 and 122 have been added.
- Open Points and YANG-Push notification examples have been updated reflecting the changes from draft-netana-netconf-yp-transport-capabilities and draft-netana-netconf-notif-envelope.

Next Steps

➢ **Looking forward for review and comments.**



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Implementation Status