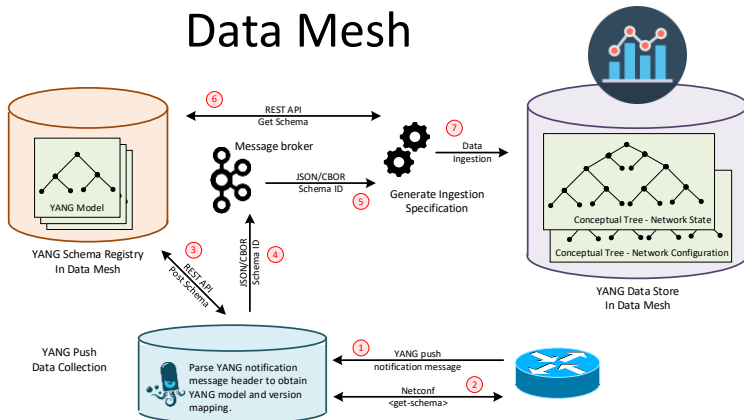


Validate Configured Subscription YANG- Push Publisher Implementations NETCONF & NMOP WG



IETF 122
March 15-16th, 2025
Hackathon

Hackathon – Plan, Software and Website

Test Plan

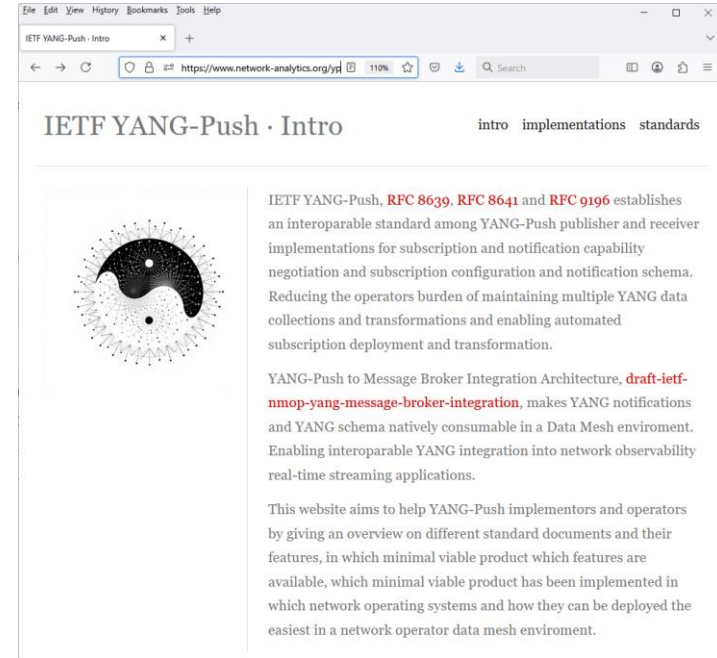
- Validate work in progress vendor YANG-Push publisher implementations.
- Configure RFC 8641 compliant YANG-Push configured subscription.
- Verify output in packet capture before YANG-Push receiver and after transformation.
- Verify YANG Library and YANG-Push systems and notifications capabilities discovery.

Development Plan

- MVP 1 – Basic Requirements (9)
- MVP 2 – Scale and Secure (3)
- MVP 3 – Optimizations (2)

Software

- YANG-Push Publisher - Cisco IOS XR
- YANG-Push Publisher - 6WIND VSR
- YANG-Push Publisher - Huawei NE (Router) and MA (OLT)
- YANG-Push Receiver – Pmacct
- YANG-Push Receiver – Netgauze
- udp-notif dissector - Wireshark



<https://www.network-analytics.org/yp/how-to-deploy.html>

Hackathon – Repository

Test Repository

- <https://github.com/network-analytics/ietf-network-analytics-document-status/tree/main/122/Hackathon>
- Contains
 - Packet capture on the wire
 - Netconf RPCs and YANG-Push JSON and CBOR encoded messages
 - Python script which performed test cases

The screenshot shows the GitHub interface for the repository 'network-analytics / ietf-network-analytics-document-status'. The 'Code' tab is selected. On the left, the 'Files' sidebar shows a directory tree with folders 116 through 122. The main content area shows the path 'ietf-network-analytics-document-status / 122 / Hackathon /'. Below this, a commit by 'graf3net' is displayed with the message 'added website and IOS XR yp-capabilities'. A table lists the files in this commit:

Name	Last commit message
..	
6Wind_VSR	hackathon test results 6wind and huawei ma5800
Huawei_VRP-MA5800	hackathon test results 6wind and huawei ma5800
Huawei_VRP_NE8000	IETF 122 hackathon
ietf-122-hackathon-validate-yang-push-publisher.pdf	added website and IOS XR yp-capabilities
ietf-122-hackathon-validate-yang-push-publisher.pptx	added website and IOS XR yp-capabilities

An Architecture for YANG-Push to Apache Kafka Integration

draft-ietf-nmop-yang-kafka-integration

- Subscription to YANG Notifications
[RFC 8639](#)
- Subscription to YANG Notifications for Datastore Updates
[RFC 8641](#)
- UDP-based Transport for Configured Subscriptions
[draft-ietf-netconf-udp-notif](#)
- Subscription to Distributed Notifications
[draft-ietf-netconf-distributed-notif](#)
- Extensible YANG Model for YANG-Push Notifications
[draft-ietf-netconf-notif-envelope](#)
- Support of Versioning in YANG Notifications Subscription
[draft-ietf-netconf-yang-notifications-versioning](#)
- YANG Modules Describing Capabilities for Systems and Datastore Update Notifications
[RFC 9196](#)
- YANG Notification Transport Capabilities
[draft-ietf-netconf-yp-transport-capabilities](#)
- YANG Library
[RFC 8525](#)
- Augmented-by Addition into the IETF-YANG-Library
[draft-ietf-netconf-yang-library-augmentation](#)
- Encoding of Data Modeled with YANG in the CBOR
[RFC 9254](#)

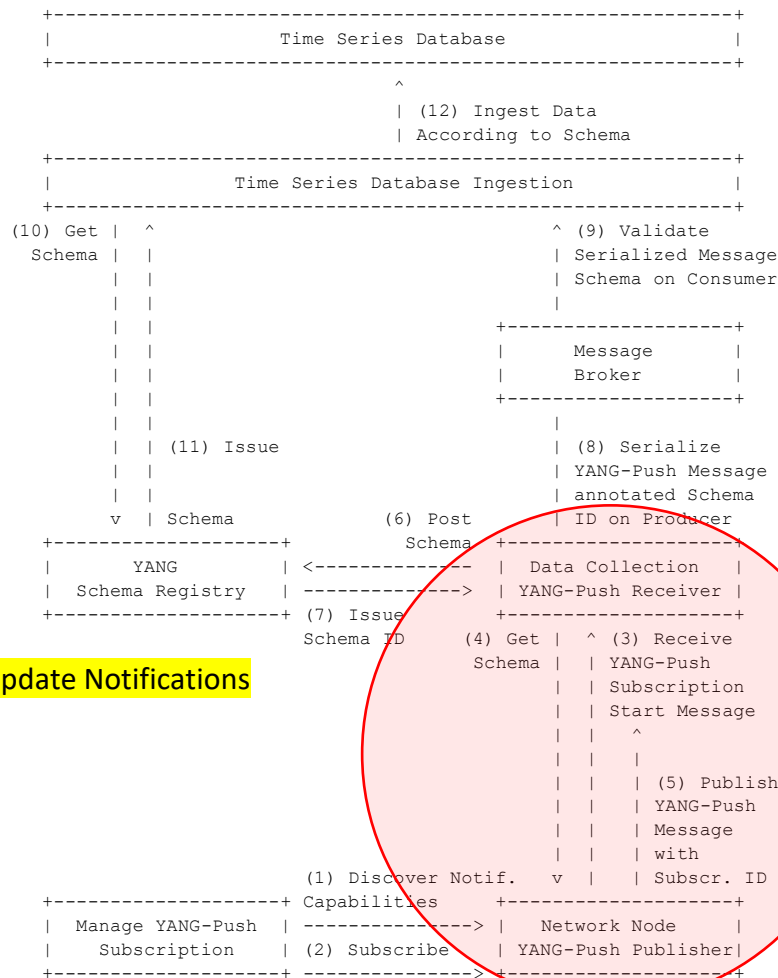


Figure 1: End to End Workflow

Cisco IOS XR – Subscription Notifications

Subscription-Started Notification

```
{
  "ietf-yp-notification:envelope": {
    "event-time": "2025-03-12T11:33:37.918Z",
    "hostname": "ios",
    "sequence-number": 2,
    "contents": {
      "ietf-subscribed-notifications:subscription-started": {
        "id": 0,
        "ietf-yang-push:datastore": "operational",
        "ietf-yang-push:datastore-xpath-filter": "Cisco-IOS-XR-pfi-im-cmd-oper:interfaces",
        "transport": "ietf-udp-notif-transport:udp-notif",
        "ietf-yang-push-revision:module-version": [
          {
            "module-name": "Cisco-IOS-XR-pfi-im-cmd-oper",
            "revision": "2024-02-29"
          }
        ],
        "ietf-yang-push-revision:yang-library-content-id": "6da7f478e60adccd442070e18843ca1318b20ca4",
        "encoding": "encode-json",
        "ietf-yang-push:periodic": {
          "period": 3000
        }
      }
    }
  }
}
```

Cisco IOS XR – YANG-Push Capabilities

Systems and Transport Capabilities

```
<?xml version="1.0"?>
<rpc-reply message-id="101" xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <system-capabilities xmlns="urn:ietf:params:xml:ns:yang:ietf-system-capabilities">
      <subscription-capabilities xmlns="urn:ietf:params:xml:ns:yang:ietf-notification-capabilities">
        <max-nodes-per-update>4294967295</max-nodes-per-update>
        <periodic-notifications-supported>state-changes</periodic-notifications-supported>
        <minimum-update-period>3000</minimum-update-period>
        <on-change-supported>state-changes</on-change-supported>
        <notification-metadata xmlns="urn:ietf:params:xml:ns:yang:ietf-yp-notification">
          <notification-envelope>true</notification-envelope>
          <metadata>
            <hostname-sequence-number>true</hostname-sequence-number>
          </metadata>
        </notification-metadata>
        <transport-capabilities xmlns="urn:ietf:params:xml:ns:yang:ietf-notification-transport-capabilities">
          <transport-capability>
            <transport-protocol xmlns:idx="urn:ietf:params:xml:ns:yang:ietf-udp-notif-transport">idx:udp-notif </transport-protocol>
            <encoding-format xmlns:idx="urn:ietf:params:xml:ns:yang:ietf-subscribed-notifications">idx:encode-json</encoding-format>
          </transport-capability>
        </transport-capabilities>
        <yang-push-observation-supported xmlns="urn:ietf:params:xml:ns:yang:ietf-yp-observation">true</yang-push-observation-supported>
        <yang-push-module-revision-supported xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push-revision">true</yang-push-module-revision-supported>
      </subscription-capabilities>
    </system-capabilities>
  </data>
</rpc-reply>
```

Huawei MA – Push Notifications

Subscription Started Notification

```
{
  "ietf-notification:notification": {
    "eventTime": "2025-03-06T13:31:00.520+01:00",
    "ietf-notification-sequencing:sysName": "ipd-zbl1535-s-fh-79",
    "ietf-notification-sequencing:sequenceNumber": 0,
    "ietf-subscribed-notifications:subscription-started": {
      "id": 1,
      "ietf-yang-push:datastore": "ietf-datastores:running",
      "ietf-yang-push:datastore-xpath-filter": "/ietf-
interfaces:interfaces-state/interface[type='iana-if-
type:ethernetCsmacd']/statistics",
      "dscp": 0,
      "transport": "ietf-udp-notif-transport:udp-notif",
      "encoding": "ietf-subscribed-notifications:encode-json",
      "ietf-yang-push:periodic": {
        "period": 500
      }
    }
  }
}
```

Push-Update Notification of initial on-change sync-on-start

```
{
  "ietf-notification:notification": {
    "eventTime": "2025-03-06T13:31:00.970+01:00",
    "ietf-notification-sequencing:sysName": "ipd-zbl1535-s-fh-79",
    "ietf-notification-sequencing:sequenceNumber": 1,
    "ietf-yang-push:push-update": {
      "id": 20,
      "ietf-yp-observation:timestamp": "2025-03-06T13:31:00.970+01:00",
      "ietf-yp-observation:point-in-time": "initial-state",
      "ietf-distributed-notif:message-publisher-id": 3021116856,
      "datastore-contents": {
        "ietf-interfaces:interfaces-state": {
          "interface": [
            {
              "name": "ethernetCsmacd.0.9.0",
              "oper-status": "up"
            },
            {
              "name": "ethernetCsmacd.0.9.1",
              "oper-status": "down"
            },
            {
              "name": "ethernetCsmacd.0.9.2",
              "oper-status": "down"
            }
          ]
        }
      }
    }
  }
}
```

Huawei MA – YANG-Push Capabilities

System Capabilities

```
<?xml version="1.0" encoding="utf-8"?>
<rpc-reply message-id="1739882832263"
  xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <data>
    <system-capabilities
      xmlns="urn:ietf:params:xml:ns:yang:ietf-system-capabilities">
      <datastore-capabilities
        xmlns="urn:ietf:params:xml:ns:yang:ietf-system-capabilities">
        <datastore
          xmlns:ds="urn:ietf:params:xml:ns:yang:ietf-
datastores">ds:running
        </datastore>
        <per-node-capabilities>
          <node-selector
            xmlns:if="urn:ietf:params:xml:ns:yang:ietf-interfaces"
            xmlns:ianaift="urn:ietf:params:xml:ns:yang:iana-if-
type">/if:interfaces-
state/if:interface[if:type='ianaift:ethernetCsmacd']
          </node-selector>
          <subscription-capabilities
            xmlns="urn:ietf:params:xml:ns:yang:ietf-notification-
capabilities">
            <max-nodes-per-update>2</max-nodes-per-update>
            <on-change-supported>state-changes</on-change-supported>
            <minimum-dampening-period>500</minimum-dampening-period>
            <supported-excluded-change-type>none</supported-excluded-
change-type>
          </subscription-capabilities>
          </per-node-capabilities>
        </datastore-capabilities>
      </system-capabilities>
    </data>
  </rpc-reply>
```

Subscription Capabilities

```
<subscription-capabilities
  xmlns="urn:ietf:params:xml:ns:yang:ietf-notification-capabilities">
  <max-nodes-per-update
    xmlns="urn:ietf:params:xml:ns:yang:ietf-notification-capabilities">2
  </max-nodes-per-update>
  <periodic-notifications-supported
    xmlns="urn:ietf:params:xml:ns:yang:ietf-notification-
capabilities">config-changes state-changes
  </periodic-notifications-supported>
  <minimum-update-period
    xmlns="urn:ietf:params:xml:ns:yang:ietf-notification-
capabilities">6000
  </minimum-update-period>
  <on-change-supported
    xmlns="urn:ietf:params:xml:ns:yang:ietf-notification-
capabilities">state-changes
  </on-change-supported>
  <minimum-dampening-period
    xmlns="urn:ietf:params:xml:ns:yang:ietf-notification-
capabilities">1000
  </minimum-dampening-period>
  <supported-excluded-change-type
    xmlns="urn:ietf:params:xml:ns:yang:ietf-notification-
capabilities">none
  </supported-excluded-change-type>
</subscription-capabilities>
</system-capabilities>
</data></rpc-reply>
```


6WIND VSR – Subscription Notifications

Subscription-Started Notification

```
{
  "ietf-yp-notification:envelope": {
    "event-time": "2025-03-04T07:31:36.806021107+00:00",
    "hostname": "daisy-ietf-ipf-zbl1843-r-daisy-58",
    "sequence-number": 48,
    "notification-contents": {
      "ietf-subscribed-notifications:subscription-started": {
        "id": 12345678,
        "ietf-yang-push:datastore": "ietf-datastores:operational",
        "ietf-yang-push:datastore-xpath-filter": "/state/vrf/l3vrf/interface/loopback/enabled",
        "transport": "ietf-udp-notif-transport:udp-notif",
        "encoding": "encode-json",
        "purpose": "send notifications",
        "ietf-distributed-notif:message-publisher-ids": [
          0
        ],
        "ietf-yang-push:on-change": {
          "sync-on-start": true
        },
        "ietf-yang-push-revision:module-version": [
          {
            "module-name": "vrrouter-loopback",
            "revision": "2024-04-22"
          }
        ],
        "ietf-yang-push-revision:yang-library-content-id": "3625735881"
      }
    }
  }
}
```

6WIND VSR – Push Notifications

Push-Update Notification

```
{
  "ietf-yp-notification:envelope": {
    "event-time": "2025-03-04T07:37:40.725023242+00:00",
    "hostname": "daisy-ietf-ipf-zb11843-r-daisy-58",
    "sequence-number": 58,
    "notification-contents": {
      "ietf-yang-push:push-update": {
        "id": 4,
        "datastore-contents": {
          "vrouters:state": {
            "vrf": [
              {
                "name": "main",
                "vrouters-interface:interface": {
                  "physical": [
                    {
                      "name": "ens192",
                      "counters": {
                        "in-octets": "189227",
                        "in-unicast-pkts": "736",
                        "in-discards": "271",
                        "in-errors": "0",
                        "out-octets": "759448",
                        "out-unicast-pkts": "5548",
                        "out-discards": "0",
                        "out-errors": "0"
                      }
                    }
                  ]
                }
              }
            ]
          }
        }
      }
    }
  }
}
```

Push-Change-Update Notification

```
{
  "ietf-yp-notification:envelope": {
    "event-time": "2025-03-04T07:32:37.561586599+00:00",
    "hostname": "daisy-ietf-ipf-zb11843-r-daisy-58",
    "sequence-number": 50,
    "notification-contents": {
      "ietf-yang-push:push-change-update": {
        "id": 3,
        "datastore-changes": {
          "yang-patch": {
            "patch-id": "patch-1",
            "edit": [
              {
                "edit-id": "edit-1",
                "operation": "replace",
                "target": "/vrouters:state/vrf[name='main']/l3vrf[name='A9']/vrouters-interface:interface/vrouters-loopback:loopback[name='Loopback-A9']/enabled",
                "value": {
                  "vrouters-loopback:enabled": "false"
                }
              }
            ]
          }
        },
        "ietf-distributed-notif:message-publisher-id": 0,
        "ietf-yp-observation:timestamp": "2025-03-04T07:32:37.561829359+00:00",
        "ietf-yp-observation:point-in-time": "state-changed"
      }
    }
  }
}
```

6WIND VSR – CBOR Named Identifiers

6wind-vsr-yang-push-20250305-1133-receiver-cbor.pcap

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help

Apply a display filter ... <Ctrl-/>

No.	Time	Source IP	Destination IP	Protocol	Length	Info
7	2025-03-05 17:34:22.630703	203.0.113.58	100.105.33.20	UDPPUBCHANNEL	672	59279 → 10003 Len=62
8	2025-03-05 17:34:52.893654	203.0.113.58	100.105.33.20	UDPPUBCHANNEL	672	59279 → 10003 Len=62
9	2025-03-05 17:35:23.160913	203.0.113.58	100.105.33.20	UDPPUBCHANNEL	672	59279 → 10003 Len=62

> Frame 8: 672 bytes on wire (5376 bits), 672 bytes captured (5376 bits)
> Linux cooked capture v1
> Internet Protocol Version 4, Src: 203.0.113.58, Dst: 100.105.33.20
> User Datagram Protocol, Src Port: 59279, Dst Port: 10003
▼ UDP-Notif Protocol, Publisher: 0, Msg ID: 3
 001. = Header Version: 1
 ...0 = Media Type Space: standard media types (0)
 0011 = Media Type: application/yang-data+cbor (3)
 Header Length: 12
 Message Length: 628
 Publisher ID: 0
 Message ID: 3
▼ Concise Binary Object Representation
 ▼ Map: (indefinite length)
 101. = Major Type: Map (5)
 ...1 1111 = Size: Indefinite Length (31)
 ▼ Text String: ietf-yp-notification:envelope
 011. = Major Type: Text String (3)
 ...1 1000 = Size: 1 byte (24)
 Length: 29
 Text String: ietf-yp-notification:envelope
 ▼ Map: (indefinite length)
 101. = Major Type: Map (5)
 ...1 1111 = Size: Indefinite Length (31)
 ▼ Text String: event-time
 011. = Major Type: Text String (3)
 ...0 1010 = Length: 10
 Text String: event-time
 ▼ Text String: 2025-03-05T10:34:53.606715118+00:00
 011. = Major Type: Text String (3)
 ...1 1000 = Size: 1 byte (24)
 Length: 35
 Text String: 2025-03-05T10:34:53.606715118+00:00

0000 00 00 00 01 00 06 00 50 56 82 48 25 00 00 08 00P V-HX....
0010 45 00 02 90 a3 87 40 00 3d 11 d6 1d cb 00 71 3a E.....@ =.....q:
0020 64 69 21 14 e7 8f 27 13 02 7c 4f 81 23 0c 02 74 di!.....' .|0 #.t
0030 00 00 00 00 00 00 00 03 bf 78 1d 69 65 74 66 2dx ietf-
0040 79 70 2d 6e 6f 74 69 66 69 63 61 74 69 6f 6e 3a yp-notif ication:
0050 65 6e 76 65 6c 6f 70 65 bf 6a 65 76 65 6e 74 2d envelope .jevent-
0060 74 69 6d 65 78 23 32 30 32 35 2d 30 33 2d 30 35 timex#20 25-03-05
0070 54 31 30 3a 33 34 3a 35 33 2e 36 30 36 37 31 35 T10:34:5 3.606715
0080 31 31 38 2b 30 30 3a 30 30 68 68 6f 73 74 6e 61 118+00:0 0hostname
0090 6d 65 78 21 64 61 69 73 79 2d 69 65 74 66 2d 69 mexidals y-ietf-i
00a0 70 66 2d 7a 62 6c 31 38 34 33 2d 72 2d 64 61 69 pf-zbl18 43-r-dai
00b0 73 79 2d 35 38 6f 73 65 71 75 65 6e 63 65 2d 6e sy-S8ose quence-n
00c0 75 6d 62 65 72 03 75 6e 6f 74 69 66 69 63 61 74 umber-un otificat
00d0 69 6f 6e 2d 63 6f 6e 74 65 6e 74 73 bf 78 1a 69 ion-cont ents-x-i
00e0 65 74 66 2d 79 61 6e 67 2d 70 75 73 68 3a 70 75 etf-updat -push:pu
00f0 73 68 2d 75 70 64 61 74 65 bf 62 69 64 01 72 64 sh-updat e-bid-rd
0100 61 74 61 73 74 6f 72 65 2d 63 6f 6e 74 65 6e 74 atastore -content
0110 73 bf 6d 76 72 6f 75 74 65 72 3a 73 74 61 74 65 s-mvrout er:state
0120 bf 63 76 72 66 9f bf 64 6e 61 6d 65 64 6d 61 69 -cvrf-d namedmai
0130 6e 78 1b 76 72 6f 75 74 65 72 2d 69 6e 74 65 72 nx-vrout er-inter
0140 66 61 63 65 3a 69 6e 74 65 72 66 61 63 65 bf 68 face:int erface-h
0150 70 68 79 73 69 63 61 6c 9f bf 64 6e 61 6d 65 66 physical -dnamef
0160 65 6e 73 31 39 32 68 63 6f 75 6e 74 65 72 73 bf ens192hc ounters-
0170 69 69 6e 2d 6f 63 74 65 74 73 1a 00 3f 81 43 6f iin-octe ts-? .Co
0180 69 6e 2d 75 6e 69 63 61 73 74 2d 70 6b 74 73 19 in-unica st-pkts-
0190 3e 1c 6b 69 6e 2d 64 69 73 63 61 72 64 73 19 16 > .kin-di scards-
01a0 cf 69 69 6e 2d 65 72 72 6f 72 73 00 6a 6f 75 74 -iin-err ors-jout
01b0 2d 6f 63 74 65 74 73 1a 02 de 3c f5 70 6f 75 74 -octets. -< .pout
01c0 2d 75 6e 69 63 61 73 74 2d 70 6b 74 73 1a 00 02 -unicast -pkts-
01d0 4e c7 6c 6f 75 74 2d 64 69 73 63 61 72 64 73 00 N-lout-d iscards-
01e0 6a 6f 75 74 2d 65 72 72 6f 72 73 00 ff ff ff ff jout-err ors-
01f0 ff ff ff ff 78 2b 69 65 74 66 2d 64 69 73 74 72 -> .x-ief distr
0200 69 62 75 74 65 64 2d 6e 6f 74 69 66 3a 6d 65 73 ibuted-n otif:mes
0210 73 61 6f 65 2d 70 75 62 6c 69 73 68 65 72 2d 69 sage-pub lisher-i
0220 64 00 78 1d 69 65 74 66 2d 79 70 2d 6f 62 73 65 d-x-ietf -yp-obsr
0230 72 76 61 74 69 6f 6e 3a 74 69 6d 65 73 74 61 6d rvation: timestam
0240 70 78 23 32 30 32 35 2d 30 33 2d 30 35 54 31 30 px#2025- 03-05T10
0250 3a 23 3a 3a 3c 33 7a 2c 30 37 31 33 3c 33 37 30 :34:53 6 0715370

YANG-Push Implementation Status

IETF 122 – MVP 1

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



Green marked describes new capability at IETF 122. "P" to partially implemented.

YANG-Push Implementation Status

IETF 122 – MVP 2

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



Green marked describes new capability at IETF 122. "P" to partially implemented

YANG-Push Implementation Status

IETF 122 – MVP 3

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



Green marked describes new capability at IETF 122. "P" to partially implemented

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- Benoit Claise – Huawei
- Zhuoyao Lin – Huawei (remote)
- Jiale Li – Huawei (remote)
- Jian Ping– Huawei (remote)
- Xiao Chen– Huawei (remote)
- Paolo Lucente – Pmacct
- Holger Keller – DT
- Nils Warnke - DT
- Alex Huang-Feng – INSA Lyon
- Yannick Buchs – Swisscom (remote)
- Thomas Graf – Swisscom

