

YANG Network Telemetry

Exploring Technologies and Advancements in Standardization

Paolo Lucente
Principal Network Tools Engineer
Global IP Network

24 Oct 2024 | ESN OG 32

Global IP Network | AS2914

Whoami

Paolo Lucente



paololucente



plucente



@Paolo_Lucente



Forewords

Originally based on a presentation delivered at ITNOG7 with the great Salvatore Cuzzilla (Swisscom)
Views in this talk are mine

Circa 2018 (1/2)



Circa 2018 (2/2)

Streaming Telemetry is introduced:

- A commercial term to describe the idea of “*continuously streaming structured data*”
- Continuous, real-time transmission of data from network devices to data collectors
- Data is organized according to a predefined schema, *YANG models*

In retrospective

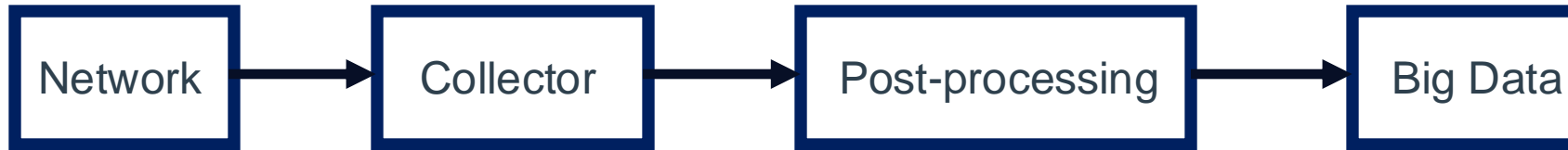
We can say that:

- SNMP certainly reached its horizon but is not dead
- Operators look at Streaming Telemetry for specific use-cases, ie.:
 - A SNMP counter is not available (ie. Different aspects of Segment Routing)
 - Sub 1-minute counters are needed
 - More accurate timestamping

Modeled Data: making order

- **YANG**, Yet Another Next Generation, is a data modelling language
- A database of models supported by a network device
- Configuration Data: to ensure consistent configurations on network devices
- Operational (State) Data: real-time performance and state information of network devices

Modeled Data: collection



- NetFlow / IPFIX / sFlow
- BGP / BMP
- YANG-modeled data streaming

YANG-Modeled data streaming: desiderata

- **Efficiency:** Simple architecture, low latency and high throughput
- **Scalability:** Handling large-scale network environments
- **Security:** Secure communication between exporters and collectors
- **Interoperability:** Easy to integrate and swap in/out data pipeline elements
- **Discoverability:** Discover what capabilities have been implemented
- **Standardization:** Based on open standards

YANG-Modeled data streaming: limits of status quo at network operators

- Telemetry packets are not pushed out directly from line-cards
- Binary encoding comes at the cost of transcoding YANG schemas
- Lack of semantics
- Lack of a standardized dial-out strategy
- Lack of discoverability and feature fragmentation leads to high maintenance efforts

YANG Push

The effort of standardizing YANG-modeled data streaming at IETF

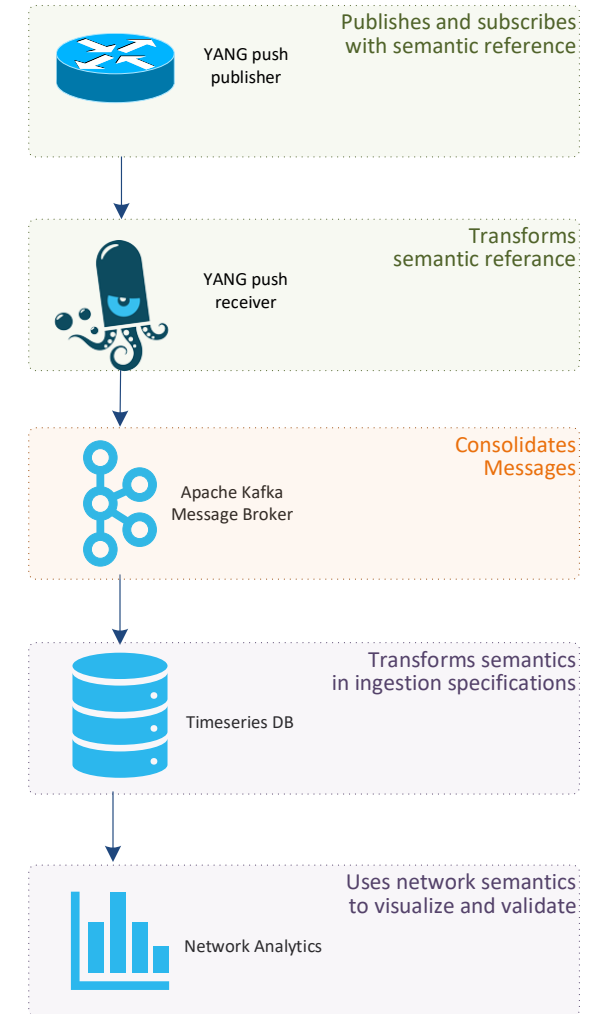
YANG Push: context

A network operator aims for:

- An **automated data processing pipeline** which starts with YANG-Push, consolidates at Data Mesh and ends at Network Analytics.
- Operational metrics where **IETF defines the semantics.**
- Analytical metrics where **network operators gain actionable insights.**

We achieve this by integrating YANG-Push into Data Mesh to:

- Produce metrics from networks **with timestamps when network events were observed.**
- Hostname, publisher ID and sequence numbers help us to understand **from where metrics were exported and measure its delay and loss.**
- Forward **metrics unchanged** from networks
- **Learn semantics** from networks and validate messages.
- **Control semantic** changes end to end.



YANG Push: main coordinates / roadmap

- Massive data scale out
- Model distribution, report model versions
- Accurate timestamping
- Documented cross en/de-coding
- Keep semantic information
- Rich meta-data / pipeline protocol (vs router-collector protocol)
- **STANDARDIZATION**

Evolving YANG Push

Missing puzzle pieces

YANG Push	Today at Network Operators	Today at IETF
Transport Protocol	Many and non-standard	netconf-https-notif and netconf-udp-notif
Encoding	JSON widely adopted. Propriety protobuf in various variants. CBOR not implemented yet.	XML in RFC7950, JSON in RFC7951, CBOR in RFC9254
Subscription	Non-standard, periodical widely adopted. On-change sparse.	RFC8639 and RFC8641
Metadata	Non-standard. Partially among message content.	netconf-yang-notifications-versioning, draft-tgraf-netconf-notif-sequencing, draft-tgraf-yang-push-observation-time, draft-claise-opsawg-collected-data-manifest, draft-claise-netconf-metadata-for-collection
Versioning	Neither covered in subscription nor in publishing.	netmod-yang-module-versioning
YANG module	Non-standard widely adopted. IETF coverage non-existent.	Many RFC's defined

Credits to: T. Graf (Swisscom) @ IETF 116

YANG Push: implementation status

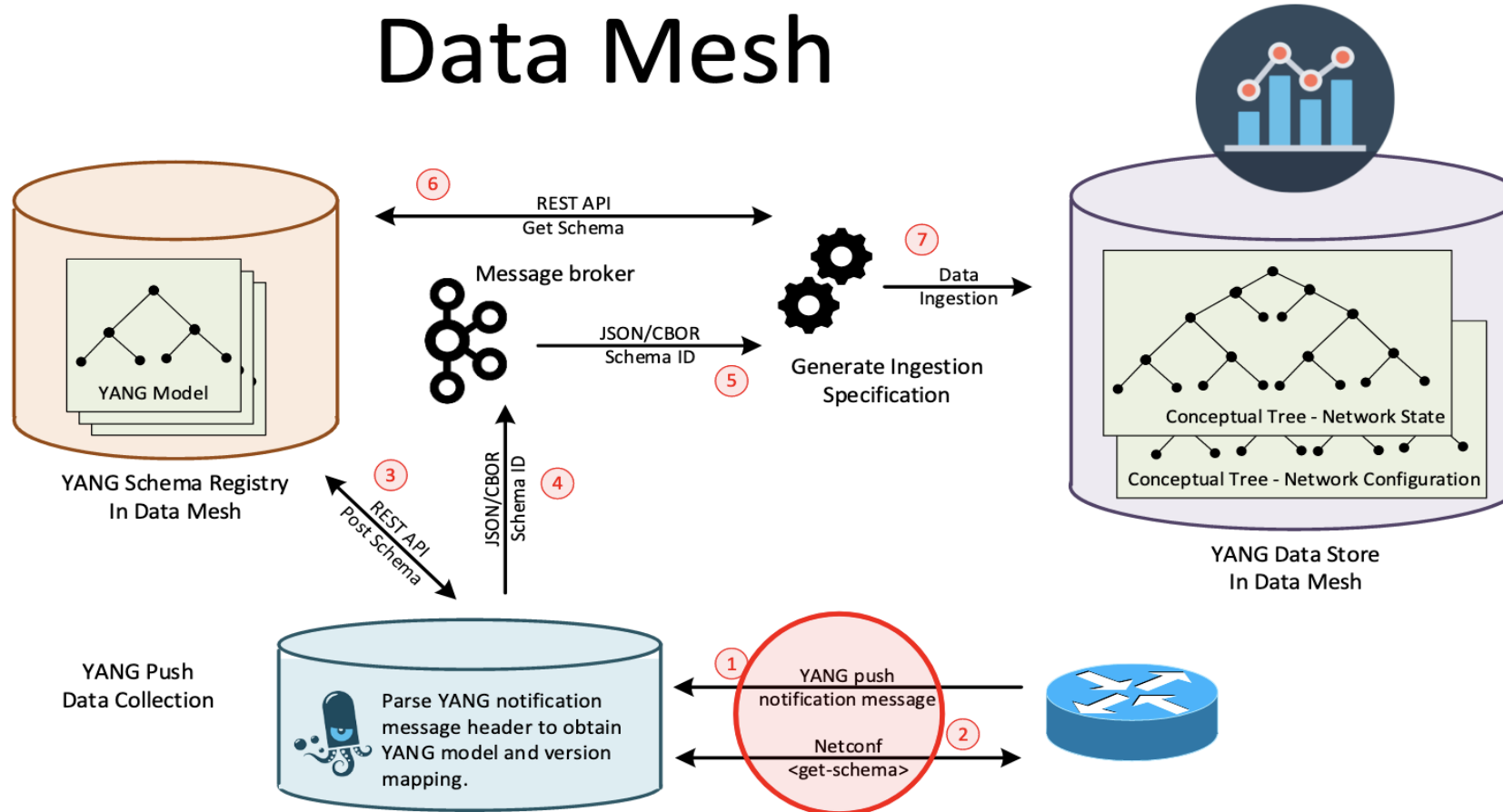
	6WIND VSR	Huawei VRP	Cisco IOS XR	Open- Source
RFC 8639 YANG-Push Subscription	X	X		
RFC 8641 YANG-Push Notification	X	X	X	
draft-ietf-netconf-udp-notif	X	X		X
draft-ietf-netconf-distributed-notif	X	X		
draft-ietf-netconf-yang-notifications-versioning	X	X		
draft-tgraf-netconf-notif-sequencing	X			
draft-tgraf-netconf-yang-push-observation-time	X			
RFC 7895 YANG Module Library		X		
RFC 8525 YANG Library	X		X	
draft-linclanetconf-yang-library-augmentation				X



Red marked describes new capability at IETF 120

YANG Push: envisioned pipeline

Data Mesh



Credits to: T. Graf (Swisscom) @ IETF 116

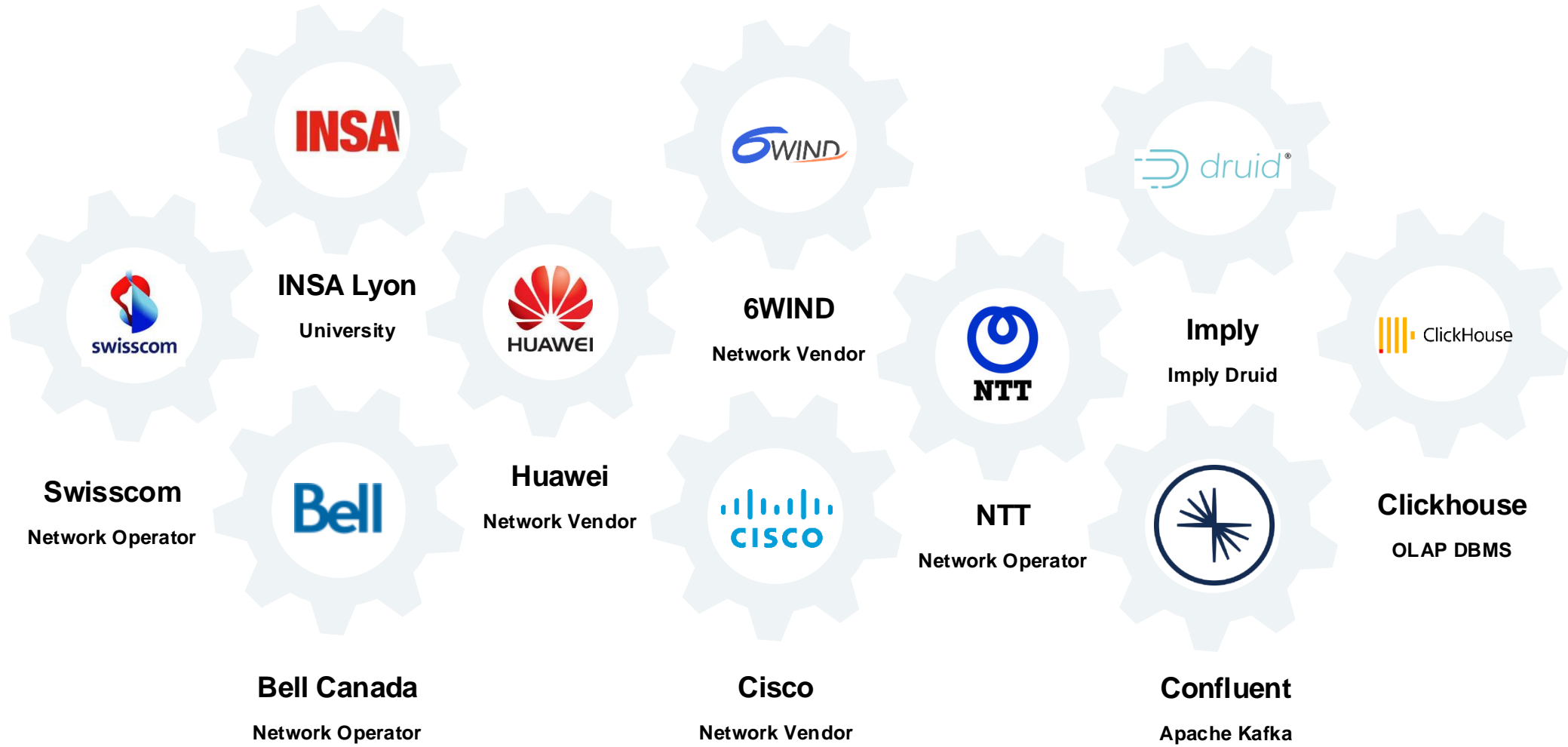
YANG Push: work to do

(subtitle: “*Developers - developers – developers*”)

- Build ecosystem:
 - Tools
 - Libraries
 - APIs
- Keep pushing 🤔
 - Standardization
 - Traction among operators
 - Adoption among vendors



YANG Push: Industry Collaboration (1/2)



YANG Push: Industry Collaboration (2/2)

You too?

<https://datatracker.ietf.org/doc/draft-ietf-nmop-yang-message-broker-integration/>

Thank you!

Paolo Lucente

Principal Network Tools Engineer
Global IP Network
NTT DATA

paolo.lucente@global.ntt
www.gin.ntt.net