Toward a Network Telemetry Framework

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What’s new

• New co-authors: Giuseppe Fioccola (Telecom Italia), Zhenqiang Li (China Mobile), Pedro Martinez-Julia (NICT), Laurent Ciavaglia (Nokia) and Aijun Wang (China Telecom)

• Clearer definition and characteristics summary of network telemetry
  • Clear distinction between conventional OAM and telemetry

• New module for the framework: External data and event telemetry

• New content for Control Plane Telemetry: identify the requirements and challenges in details. BMP extensions are identified as NMP (Network monitoring Protocol)

• New content for Data Plane Telemetry:
  • Technique Classification: Active and Passive, In-Band and Out-of-Band, E2E and In-Network, Flow-Path-Node
  • New technology: IPFPM alternately mark for point-to-point and multipoint-to-multipoint
Challenges of Today’s Networks

- Networks become more and more complex
  - Cloud, 5G, IoT, overlay, underlay, VPN, slicing, ...
- Applications are sensitive to network performance
  - Bandwidth, latency, jitter, packet drop, network churn, ...
- Network visibility is important for
  - Network OAM
  - Network Provision
  - Network Planning
  - Network Security
  - Network Troubleshooting
- Yet our old tools for network visibilities are outdated
  - Lack of application level visibility
  - Lack of automation tools
Challenges of the Future Networks

• Network management and service evolve to become intent-driven and automatic
  • Reduce human labor
  • Improve agility and performance
  • Optimize resource efficiency

• Network visibility through telemetry is pivotal to realize intent-driven autonomous networks
  • Telemetry can provide rich, reliable and real-time data, and build a close-loop network service management system.
  • Telemetry should be promoted as a first class citizen in network technologies and protocols
  • Telemetry work should be better unified, consolidated, and integrated to support the future networks
Current Solution: Network OAM

• Conventional OAM is inefficient and insufficient to sustain future autonomous networks
  • SNMP is based on low frequent polling and CLI
  • Lack of coverage, timeliness, and accuracy

• Existing OAM mechanisms are disaggregated
  • Piecemeal vertical solutions are hard to be composed into a cohesive one
  • Repetitive and redundant work, lack of collaboration and consolidation
  • Designed as afterthought patches and on a case-by-case basis, lack of holistic and systematic view

• A new brood of technologies is expected
  • A framework is needed to normalize the concepts, terms, and technology/standard developments
  • Telemetry to replace OAM as the standard term to achieve network visibility
Conventional Network OAM vs. Network Telemetry

- Poll based vs. Push based
- Conventional Network Oriented vs. SDN-based
- Data Elements vs. Streaming Data
- Small Data vs. Big Data
- Human consumer vs. Machine Consumer
- Manual vs. Automated
- CLI vs. Programming
- Reactive vs. Proactive
- Trouble Shooting vs. Prediction
- Independent Tools vs. Unified and correlated

Technologies:
- NETCONF
- IPFPM
- RESTCONF
- YANG
- IOAM
- sFLOW
- gRPC
Network Telemetry Framework (NTF)

- Control Plane Telemetry
- Data Plane Telemetry
- Management Plane Telemetry
- External Data and Event Telemetry

E2E Solution to Facilitate Machine Learning and Big Data Analytics

- Data Source
  - YANG Data store
  - Control Protocol, Network State
  - Flow/Packet Statistics & States

- Data Subscription
  - gRPC, YANG PUSH
  - NETCONF/YANG, BGP
  - NETCONF/YANG FSM

- Data Generation & Processing
  - Dynamic network probe (DNP)
  - Soft DNP
  - INT/IOAM, IPFPM Hard DNP

- Data Export
  - gRPC, YANG Push UDP
  - BMP
  - IPFIX UDP

Other Huawei Tools

- ONAP
- Open day
- OpenStack
- Kafka
- logstash
- Spark
- Hadoop
Telemetry Use Cases

• Intent and Policy Verification
• SLA Compliance Verification
• Root Cause Analysis
• Traffic Engineering and Network Planning
• Event Tracking and Prediction
Challenges of Network Telemetry

• Dynamics
  • Continuous, real-time, and interactive

• Multiple sources
  • In device, in network, and out of network
  • Passive, active, and hybrid

• Performance impact
  • Bandwidth and latency
  • Data retention
  • Observer effect
Recap & Conclusion

• Promote the significance of telemetry work in IETF
  • Keep the big picture in mind (Intent-Driven Autonomous Network)
  • Make IETF the leading SDO in this area

• Formalize the telemetry-related terms and technology classification in IETF
  • Network measurement, troubleshooting, and monitoring are all data oriented and serve for the network visibility
  • Consolidate existing work
  • Guide future work

• Call for collaboration from operators and vendors