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PoC Demonstration of TAPI Based Performance Data Streaming in Open Optical Networks

Contribution from AI-NET PROTECT to OOPT MUST Subgroup

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Authors

Vignesh Karunakaran

Engineer, Adtran Networks SE.

vignesh.karunakaran@adtran.com

Behnam Shariati

Deputy Head of Data Analytics and Signal Processing Group, Fraunhofer HHI.

behnam.shariati@hhi.fraunhofer.de

Contributors

Renzo Díaz
Network Architect, Telia Company.
renzo.z.diaz@teliacompany.com

Achim Autenrieth
Director Advanced Technology, Adtran Networks SE.
achim.autenrieth@adtran.com

Anders Lindgren
Network Architect, Telia Company.
anders.x.lindgren@teliacompany.com

Stefan Melin
Network Architect, Telia Company.
stefan.melin@teliacompany.com

Aydin Jafari
Research Associate, Fraunhofer HHI.
aydin.jafari@hhi.fraunhofer.de

Stephan Neidlinger
Vice President Global Business Development – NMS, SDN, Alliances, Adtran Networks SE.
stephan.neidlinger@adtran.com

Johannes Karl Fischer
Head of Data Analytics and Signal Processing Group, Fraunhofer HHI.
johannes.fischer@hhi.fraunhofer.de

1. PoC Demonstration of TAPI Based Performance Data Streaming in Open Optical Networks

Performance data streaming in the network plays a vital part for many applications like monitoring, network management, closed loop automation, and much more. This is getting complex when it comes to optical transport network, where streaming of performance data from multiple domains is required to manage the end to end optical service.

Therefore, a systematic approach is required for telemetry data streaming from optical domain controllers to facilitate its utilization to northbound applications. The ONF TAPI v2.5 is proposed with a telemetry streaming improvements and recommended respective YANG models and protocols to effectively support streaming of performance data from multiple domains.

Following the TAPI v2.5 performance data streaming, it allows different data consumers to access the data from multiple domains with a unified data format. This systematic approach of telemetry data collection from multiple domains allows the orchestrator / service provider to have a common software platform to listen performance data and automate the network.

Before TAPI v2.5, TAPI streaming was existing but with limited data streaming capabilities focusing alarm, fault, and configuration data to monitor the state of the network. The data exchange takes place over RESTCONF with JSON data encoding format, where the same strategy is also applied for performance data. However, the performance data in the network must be continuously monitored and anomalies in the data should be addressed promptly. This requires continuous streaming of performance metrics in an efficient manner as this adds huge load to network traffic.

So, TAPI v2.5 addressed the difficulties in streaming the performance data in section 6.1.1 to 6.1.11 [1]. The key consideration includes volume of data, data source, efficient streaming functionality, measurement time, etc. In addition, a solution for streaming performance data using gNMI/GRPC is also recommended in section 6.2 in [1]. The solution recommends the use of GNMI connection protocol, PROTOBUF encoding format, and truncated log-storage strategy.

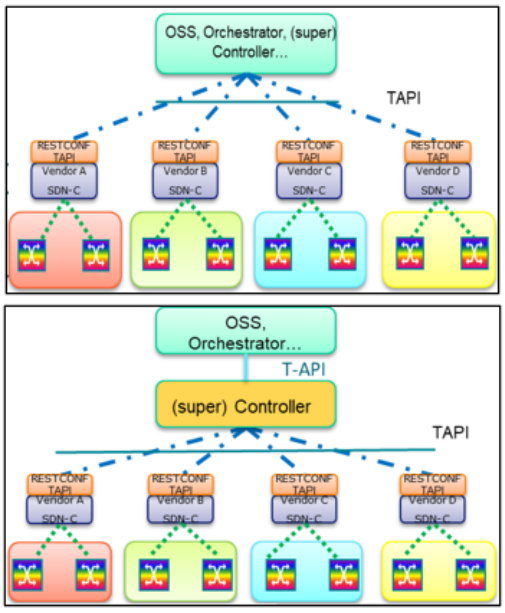

Fig 1:Reference Target Architecture proposed in TAPI v2.5

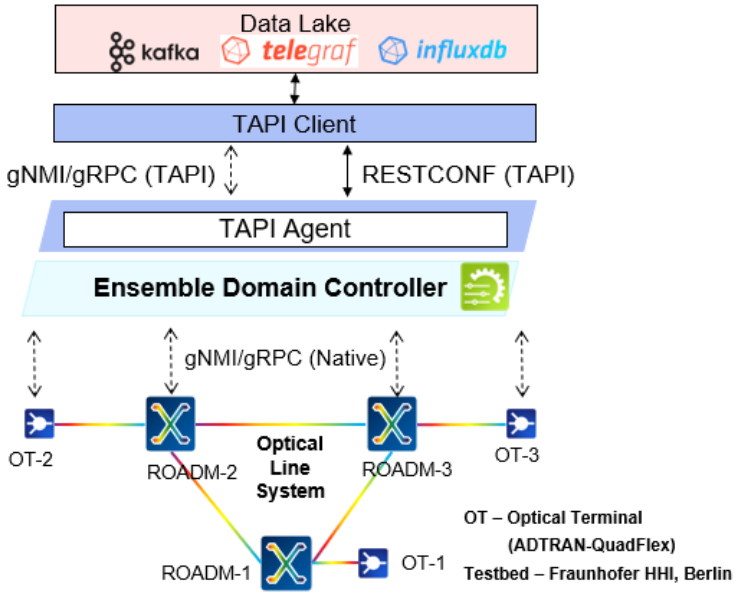

Fig 2: Overview of Proposed Architecture

In TAPI v2.5, the YANG data model and the respective Protobuf file is defined. The YANG data model is defined in such a way, that a unified data structure to support streaming of data from multiple domains. This enables the operator to subscribe for the PM data without complexity and can able to monitor the E2E service spanning across multiple domains.

As seen in figure 1, referenced from section 1.2 in TAPI v2.5 reference implementation agreement [2], the controllers are equipped with a TAPI component such that performance data of each domain is retrieved using a common data model for the OSS. In our implementation as in figure 2, a similar TAPI proxy agent is attached which gets all the PM data from the network, and streams it to northbound using a unified TAPI model. The Transport Layer Security (TLS) v1.3 is used to establish communication between gNMI/gRPC server and client. In this Proof of Concept, the gNMI/gRPC based streaming is evaluated with REST best approach. So, the same data model is tested using REST by implementing the REST server and client. The throughput of both approaches are compared as seen in figure 3.

We have demonstrated our implementation on the networking testbed hosted by Fraunhofer HHI (see [3] for details) and performed a set of experiments to compare the performance of gNMI/gRPC with REST. For our experiments, the subscribed data in the northbound is pushed to the HHI's Network Observability Platform (NOBS) [4], which itself

complies with telemetry system of ETSI ISG F5G [5]. The gNMI/gRPC based streaming offers various advantages over REST based telemetry retrieval. The gNMI/gRPC offers a lightweight payload with 2.3 times smaller than REST in subscription responses (downlink). The throughput of gNMI/gRPC in subscription request (uplink) is 10x smaller than REST. Also, the gRPC uses protocol buffer definitions and uses binary data transfer which is significantly faster than REST. The demonstrated solution is quite beneficial for the realization of various network automation use-cases for which real-time telemetry streaming across layers and domains is a must, such as the one presented in [6].

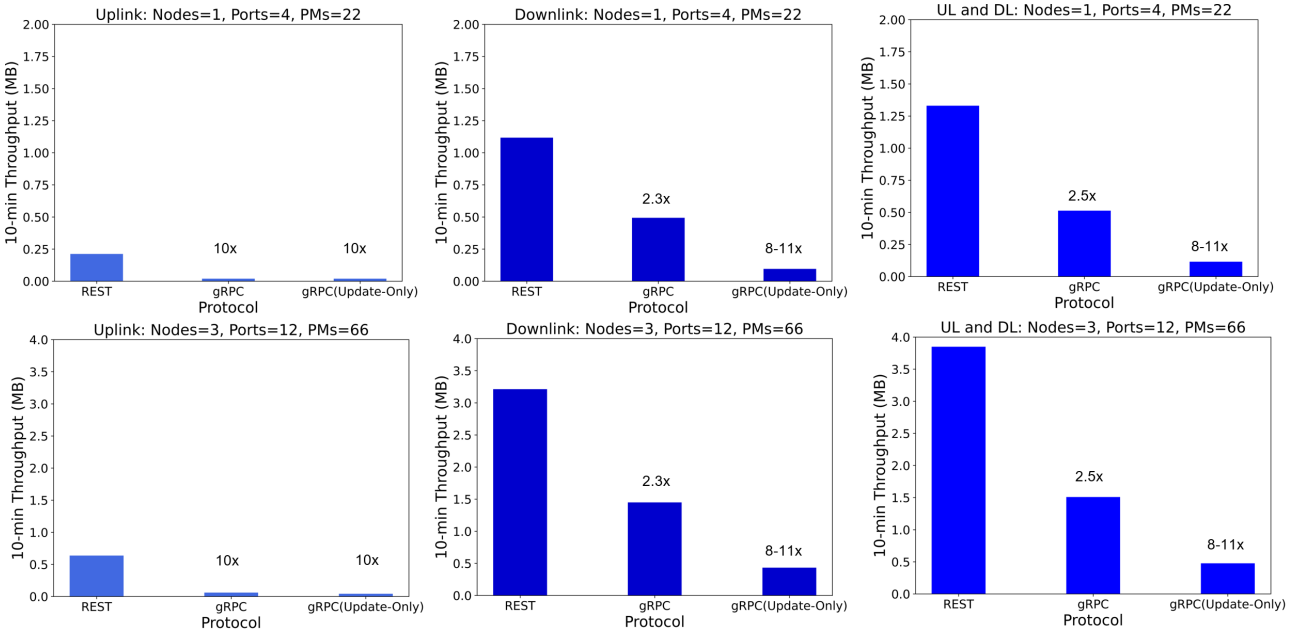

Fig 3: Comparison of Throughputs between REST, gRPC, and gRPC(update-only) for Uplink (Left), Downlink(Middle), and Total (Right)

Contributors:

Telia: Telia is a Nordic and Baltic telecommunications leader and Nordic media house, serving consumers, businesses and public sector customers with essential digital infrastructure, ICT services and entertainment. Our 19,000 talented colleagues serve millions of customers with services that are fundamental enablers of the digital societies we live in, including more than 25 million mobile, broadband and TV subscriptions. The Telia contribution to this PoC are the description and requirements of the operator target environment that is based on the Telecom Infra Project optical collaboration in OOPT, Open Optical Packet Transport, project group.

Adtran Networks SE: ADTRAN, creating a new tomorrow, by leading in optical network innovation, automation, and cybersecurity. Our Advanced Technology group, dedicated to cutting-edge research and innovation, has significantly contributed to this research activity by developing a PoC in collaboration with Telia and Fraunhofer HHI. Key contributions include conducting research on ONF-TAPI gNMI streaming activities and developing a prototype to compare and evaluate ONF-TAPI (gNMI/gRPC) and REST-based telemetry data exchange.

Fraunhofer HHI: Fraunhofer HHI is a world leader in the development for mobile and optical communication networks and systems as well as processing and coding of video signals. This PoC was led by Dr. Behnam Shariati, the Deputy Head of Data Analytics and Signal Processing Group within the department of Photonic Networks and Systems. The contributions of HHI include: 1) the extension of their data-sovereign telemetry framework [4] to receive the telemetry data and consume it for further processing and visualization, 2) the implementation of the demonstration over their SDN-controlled partially disaggregated networking testbed.

References

[1] TAPI v2.5.0 Reference Implementation Agreement, TR-548, TAPI Streaming. Version 3.1

[2] TAPI v2.5.0 Reference Implementation Agreement, TR-547. Version 3.1 (October 2023).

[3] B. Shariati, et al., "Demonstration of Latency-aware 5G Network Slicing on Optical Metro Networks." JOCN, vol. 14, no. 1, Jan 2022.

[4] B. Shariati, et al., "Telemetry Framework with Data Sovereignty Features," in Proc. OFC, San Diego, CA, Mar 2023, Paper M3G.2.

[5] ETSI GS F5G 011, "Telemetry Framework and Requirements for Access Networks," v1.1.1 (2022-11).

[6] M. Balanici, et al., "Live Demonstration of Autonomous Link-Capacity Adjustment in Optical Metro-Aggregation Networks," in Proc. OFC, San Diego, CA, Mar 2024, Paper M3Z.3.

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