Aruba Network Analytics Engine: Troubleshooting with Intelligent Network Insights in HPE Aruba's Switch OS-CX

Anu Mercian, David Rodrigues, Charles F Clark

HPE Aruba

{anu.mercian, david.pinheiro, c.clark }@hpe.com

Abstract

The explosion in internet usage over the past several years has indicated an increasing demand for network connectivity as a medium of communication. With the adoption of IoT, the dependence is extending further to all things around us. While this improves the intelligence at the edge-network, it is essential to improve the intelligence at the core-network. In this paper, we introduce the core feature of the ***Network Analytics Engine (NAE)*** *in the latest* ***HPE Aruba's Core-Aggregation Switch 8400x series*** *which enables our customers to troubleshoot switch resources and leverage machine-learning algorithms to make intelligent decisions in their core network.*

Introduction

For decades, network administrators have spent significant time provisioning and maintaining networks manually. With the surge in Software Defined Networking (SDN), automating network provisioning has become possible, but there is still a large gap in the Networking Industry to address intelligent troubleshooting mechanisms that simplify the life of network admins and to enable Enterprises to reduce their network maintenance CAPEX and OPEX. In a Core-Distribution layer as shown in Fig 1(a), troubleshooting and automation is an essential part of the network as it manages a large topography and is responsible for seamless network connectivity for multiple edge-devices. The path to Intelligence evolves from Data collection to Machine-learning as shown in Fig 1(b).

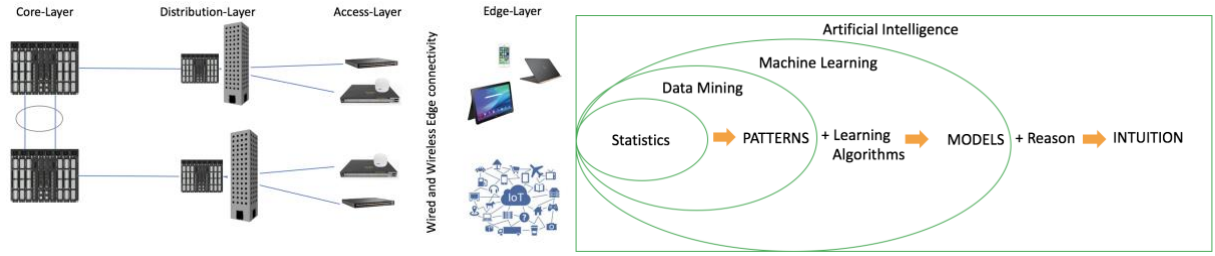

Fig 1: (a) HPE Aruba 8400x utilized in the core and distribution layers connected to Aruba wireless edge switches that provide connectivity to various devices giving way for IoT, (b) The evolution of Artificial Intelligence from statistics of data to intuition using reasoning which is the core concept of NAE feature in 8400x

Design

In this demonstration, we will be show-casing Network Analytics Engine (NAE), which is one of Industry's first showcases of troubleshooting the switch by uploading python scripts that identify switch resources that need to be monitored, enabling conditions on them so that the network administrator can be notified of important alerts and also enable performing pre-defined desired callback actions. An illustration of a scenario is when interfaces go down or when the CPU usage is very high, the administrator is notified of these changes and the admin can define to collect queue depth logs, currently running processes and/or the top processes running at that time which would be useful for debugging. As shown in the general public YouTube video (NAE Demo, n.d.), the customer can also generate a root cause analysis graph. We will be demonstrating the following capabilities of the Analytics Engine:

1. **Secure Python scripting:** Coding on a switch is generally considered as a security threat owning to the fact that if the admin power is compromised the entire network is at stake. We demonstrate

how we use our novel technique to execute the python script securely that it does not affect the switch.

2. **Monitoring time-series**: We will showcase how various switch resources can be monitored and also the nested aggregation of resources, such as Sum of rate of Queue depths can be monitored and how historical data is persisted across reboots, system failures etc.
3. **Conditional Query Language**: We devise a conditional query language from scratch to enable customers to perform **aggregation queries** such as mathematical or logical operability, for example, average over time of traffic packet bytes, the count of VLAN ids, ratio of sum of packets across various interfaces, etc., as well as **transitional queries** to identify states of enumerated resources, for example, if a specific or all interfaces are UP or DOWN or ERROR.
4. **Callback Action Execution**: The ultimate goal of identifying issues is to take appropriate actions which would either alleviate the repercussions of an issue and generate a root-cause analysis when a problem occurred. For example, if the network is under stress and the L2 switching is being overloaded, then the appropriate action would be to secure the network and generate a analysis report to help the admin solve the issue faster. This way the effects of security attacks, for instance, can be minimized and the network would be back online in no time.
5. **Intelligent-Baselining**: Machine learning is the key to intelligent network automation. We demonstrate how we use machine learning to help simplify switch resource monitoring. It is hard to identify what is the threshold for each switch resource that is considered an issue, threat or problem. For example we help customer identify what maximum or minimum temperature of the switch is considered to be an issue with the hardware. Similarly when can we decide that a specific traffic flow is a threat to the underlying network.

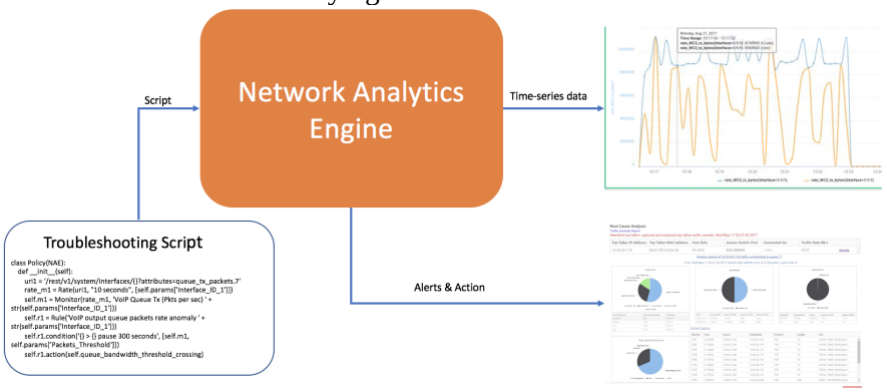

Fig 2: (a) The engine accepts a python script and the engine extracts the resource and exhibits the time-series data on the Web UI chart and when the condition in the script is met, the desired action is performed.

Conclusion

Automation and intuition in the network have been introduced in literature as an area of study called "Intent-Based Networking", embraced by many open source communities and industry leaders recently. There are feature projects such as Network Intent Composition, Congress, etc., that enable the network to make decisions. NAE is novel in the aspect of time-series data collection, querying based on the user's analytical priority and the flexibility to perform multiple desired actions, such as configure switch via CLI and REST, and generation of personalized root cause analysis report, thereby providing a innovative demonstration of intelligence in the Core-Aggregation Network.

References

8400x. (n.d.). Retrieved from HPE Aruba's Core-Aggregation Switch 8400x series: https://www.youtube.com/watch?v=9U3htv2lec0

NAE Demo. (n.d.). Retrieved from Network Analytics Engine (NAE) Marketing Demo : https://www.youtube.com/watch?v=8QwvxlWIdUE