SC22 Network Research Exhibition: Demonstration Preliminary Abstract

[Federated Machine Learning Controller Framework for optimizing Service Function Chains]

Gauravdeep Shami, Marc Lyonnais, Ciena, gshami,mlyonnai@ciena.com

Abdullah Bittar, Ziqiang Wang, Carleton University, AbdullahBittar,ZiqiangWang @cmail.carleton.ca

Abstract

It has already been demonstrated that cloud-native technology brings high flexibility and efficiency to the field of large-scale network service deployment compared to the traditional VNF with Virtual Machines (VMs). However, more work is needed to provide a flexible and reliable Service Function Chaining (SFC) development solution in a cloud-native environment. One of these network management challenges is collecting and analyzing network measurement data and further predicting and diagnosing the performance of SFCs. Deep Learning (DL) has emerged as a suitable solution for network modelling of the self-driven network because it is light-weighted and more accurate. Data is acquired from various traffic invasive and non-invasive sources which is used by an analytics model to predict SFC user experience. Accordingly, network or Kubernetes resources are adjusted pre-emptively to adjust to avoid service degradation.

Goals

The system will include four components: Data Acquisition server, SDN controller, container orchestrator, and deep learning model with the following high level objectives.

1. The SDN controller is in charge of managing SDN switches. In the SFC monitor and management environment, the SDN controller manages flow control and controls telemetry instructions based on the programmable data plane technique. For example, by defining rules for specific VLAN ID and flow ID, the data traffic of a particular SFC can be monitored by inserting INT telemetry information on specific SDN switches. The SDN controller communicates with the other three entities through East-West interfaces.

2. The DAQ server performs two tasks. The first task is to define telemetry instructions (such as telemetry frequency, flow ID, sFlow etc.) and sends this information to the SDN controller to inform switches to perform the telemetry. The second task it collects and analyzes telemetry data from switches/servers.

3. The container orchestrator will manage container deployment and interconnection between them. It will also pass information to the DAQ server to map each SFC to a specific telemetry job.

4. Deep learning model will be composed of a central model and multiple agents spread across the network switches/routers. The agents will use local data for training and send the results to a centralized model for prediction.

Resources

The solution will be demonstrated using 100Gbps links on the Ciena Environment for Network Innovation CENI Testbed between Ottawa, Chicago and Hanover. There is no request from SCinet at the moment.

Involved Parties

Solution involves Ciena Corporation and Carleton University, Ottawa Canada.

- Gauravdeep Shami, Marc Lyonnais, Rodney Wilson, Scott Kohlert, Ciena, gshami,mlyonnai,rwilson,skohlert@ciena.com
- Abdullah Bittar, Ziqiang Wang, Carleton University, AbdullahBittar,ZiqiangWang@cmail.carleton.ca