OPENSTACK NETWORKING PLUGINS: OPTIMIZING PERFORMANCE

PROJECT PROPOSAL

1. Goals and Vision

Software based networking infrastructure is a major component of cloud infrastructure along with cloud compute and storage infrastructure. Workloads such as cryptography, deep packet inspection (DPI) and delay sensitive traffic transmission (such as video and financial data) require high performance networking. OpenStack provides cloud based networking services (layer 3 networking services includes NAT, static routing, etc.). Some OpenStack use cases require highly performant networking services. Therefore, Cisco has provided OpenStack Plugin support to offload networking services to specialized networking hardware. However, using this hardware is often expensive to use. This project will help users to determine the optimum way to router their network traffic through the cloud.

1.1 Primary Goals

- Study various factors like (e.g. latency, throughput) and performance parameters associated with networking in the cloud; develop a set of metrics and provide meaningful quantification for network performance.
- Create Representative Test Profiles based on comparative analysis of the Neutron namespace router and the Cisco® ASR 1000 Series Aggregation Services hardware routers by using the developed metrics.
- Create an API which will take user input and recommend if the user application can be done by a namespace router or it requires specialized hardware.

1.2 Stretch Goals

- Creating a scheduling algorithm on the lines of OpenStack Flavor which will take multiple user jobs and assign them to the namespace router or to the CISCO ASR 1000 hardware

2. Users/Personas of the Project

- Used by external users to determine the optimal networking solution for their network job. For now, this will be limited to the CISCO hardware, but the idea can be extended to determine which hardware or virtual router is most suitable for their application.
- CISCO development teams can also use this to test new hardware to find areas of improvement or fine tune networking strategies for cloud applications.

3.Scope and Features of the Project:

The Scope of this project is to develop metrics, undertake testing to compare the performance of the CISCO router plugin vs OpenStack and automate the Tests.

- Use Horizon and CLI to interact with the CISCO router hardware and analyze common work flows.
- Develop a set of metrics which can be used to quantify network performance.
- Use performance tools, Kloudbuster and vmtp, to test Cisco® ASR 1000 plugin and Neutron activity to create Representative Performance profiles.
- Automate the testing environment and add an API to enable users to test their network jobs to determine if specialized hardware is required.

❖ Minimum acceptance criteria

Minimum acceptance criteria are:

- To develop metrics to quantify networking performance in the cloud
- Test the performance of ASR 1000 plugin vs Neutron based on the developed metrics to create Representative Profiles
- Automation of the tests being run.

4. Solution Concept

The current architecture of Neutron could limit scalability, reliability and performance of the cloud. The project entails gaining an understanding of performance tools in order to determine how the Cisco® ASR 1000 Series Routers can overcome these limitations. Our results will lead to possible recommendations for Cisco to make any adjustments in design and utilization.

Global Architectural Structure of the Project and a walkthrough:
The OpenStack system, the limitations of Neutron and the solution through Cisco's networking plugin and the project goals will be outlined below.

OpenStack is an open source cloud operating system that controls compute, storage, and networking resources throughout a datacenter. Administrators and users manage

it through a dashboard to provision services through a web interface. The core services are Keystone (authentication service), Nova (compute service), Glance (image service), Cinder and Swift (storage) and Neutron (networking service).

Performance and scalability testing are essential to any software application. In order to determine network performance certain measures such as bandwidth (maximum rate that information can be transferred), latency (the delay between the sender and the receiver decoding it) and throughput (the number of messages successfully delivered per unit time) are considered important. Scalability tests are used to determine the user limit for the web application and ensure end user experience, under a high load is not compromised.

Currently, there are limitations of Openstack Neutron, which establishes open networking services for the cloud. Apart from single point failures, one major limitation of Neutron is that it cannot scale, so therefore for test deployments Nova-networking must replace Neutron.

In Neutron, packets are routed through the Neutron hosts demonstrated below in Figure [1]. As the OpenStack cloud gets larger, traffic through the hosts increases causing the network to become a bottleneck. These bottlenecks can occur in several ways, i.e. in establishing current networks. Capacity barriers limit cloud expansion, hence reducing user satisfaction with OpenStack.

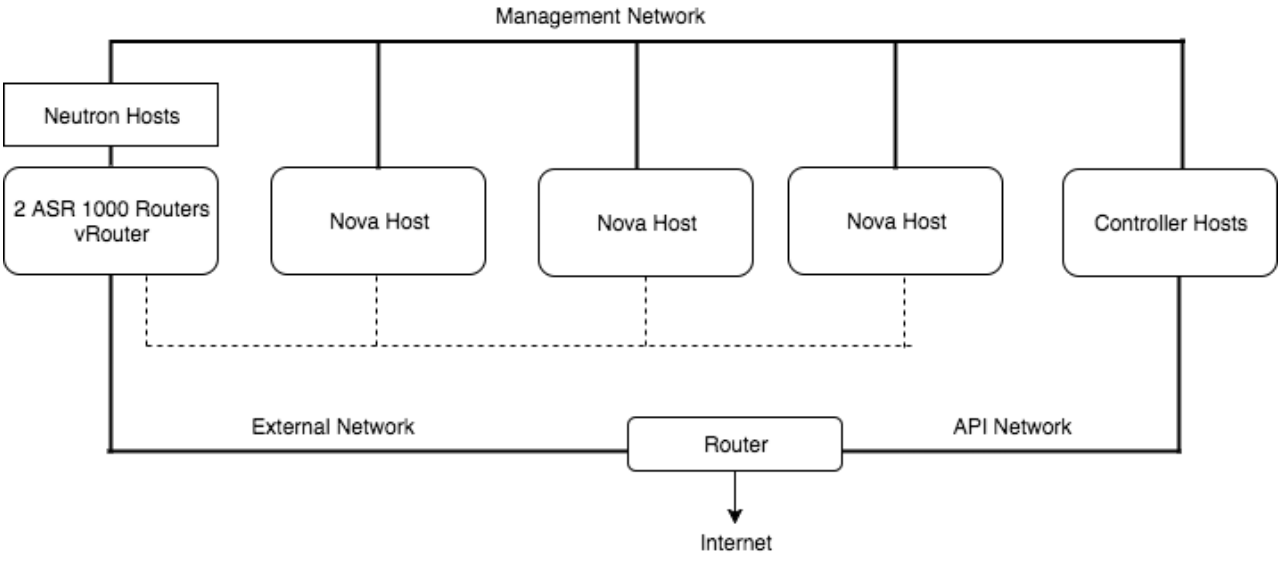

Figure [1]: Diagram of network architecture in OpenStack. Task are filtered to the Cisco® ASR 1000 Series Aggregation Services Routers in an effort to reduce network traffic and increase external network availability.

Cisco solved the issue using a network plugin that moves tasks from network hosts to a pair of ASR 1000 routers. Cisco® ASR 1000 Routers aggregate multiple WAN connections and network services including encryption and traffic management,

and forward them across WAN connections at line speeds from 2.5 to 200 Gbps. With Cisco's solution, it is possible to increase external network connectivity, tenant routing, tenant networks, data throughput, data pad redundancy in OpenStack cloud.

There will be load testing using both the CISCO plugin and the default Neutron plugin for various applications with varying sizes of data. Depending on the outcome of the tests we will create a set of recommendations for the determining which jobs are suitable to be routed through the ASR 1000 hardware via the CISCO plugin and which jobs can be run through Neutron without specialized hardware support.

Cisco has given us the task of developing performance profiles for the network plugin to optimize jobs that would require a namespace router or hardware router. There currently exist instruments that test networking equipment and develop representative traffic profiles. For the internet, commonly used profiles are Internet Mix or IMIX, which tests internet traffic passing through routers, switches and firewalls (IMIX traffic profiles are used by network equipment vendors to simulate real world traffic pattern and packet distributions) and eMIX (Electronic Medical Information Exchange): which is a cloud computing-based technology used to exchange medical imaging data between Information Technology systems that do not "talk to each other".

Using existing metrics such as latency, the speed at which it takes a packet to get from a source to a destination and throughput, the number of actions executed, we will develop similar types of profiles to demonstrate the network's' capabilities and limitations while either hardware or software solution is in use. In order to create these test profiles, we will be using tools such as Kloudbuster, which takes data from Neutron OpenStack cloud instance and allows specification of routers, networks, VM instances to simulate how the cloud will operation under these defined specifications. Vmtp is another performance test tool that measure, latency and throughput behavior. We will be deploying Neutron on Devstack in a multi-node configuration, which will include a controller and a separate compute not on the same server for testing.

5. Release Planning

Trello link:
https://trello.com/b/BxGGeI67/openstack-networking-plugins-optimizing-performance

Release 1 (Sprint 1)
The first sprint will focus on the basis of setting up a basic OpenStack environment by installing Devstack on a virtual machine, exploring common workflows, creating a network and router and working with neutron

Release 2 (Sprint 2)

- Understanding Plugins, Agent and Driver Concepts.
- Creating Virtual Machines, Security Groups.
- Develop performance metrics for networking applications in the cloud.
- Get familiar with testing tools and begin preliminary testing.

Release #3 (Sprint 3):

- Utilize our metrics to test performance of the Cisco Plugin ASR1k against the neutron namespace router using Kloudbuster and vmpt.
- Develop Network Profiles which demonstrate optimal conditions with respect to CPU utilization, latency, throughput and other metrics which will be developed in Sprint 2.

Release #4 (Sprint 4):

- Automate the testing environment
- Create an API to enable users to run the automated tests and determine which of the profiles developed in Sprint 3 is best suited for their application.

Release #5 (Sprint 5):

- Complete any trickle-down work from the previous sprints
- Work on the Stretch Goal of developing a Scheduling algorithm which would enable complete end to end automation for networking jobs in the cloud.