Deploying TeraVM in an OpenStack Environment

TeraVM in OpenStack* is revolutionizing IP testing! Never before has it been as easy or cost effective to scale test traffic to terabits per second levels and beyond. TeraVM in OpenStack provides reliable and repeatable testing to validate the robustness and resiliency of a cloud deployment.

Cloud operating system

OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacenter, all managed through a dashboard that gives administrators control while empowering their users to provision resources through a web interface.

Modularization of the cloud OS

OpenStack has revolutionized cloud computing and has made cloud deployments more accessible to all. OpenStack achieves this by greatly reducing the complexity of deploying clouds and has also simplified the management of the cloud computing space. By modularizing the key aspects of the cloud environment: compute resource (Nova), networking (Neutron), storage (Swift) and providing dedicated management agents such as the virtual machine repository (Glance) and management interface (Horizon), never before has it been easier to deploy a private cloud.

Compute

The OpenStack compute module also known as Nova is used to provision and manage the virtual machines. Nova is deployed into a private cloud using a number of hypervisors, KVM is one of the recommended choices for hypervisor technology. KVM was also VIAVI first choice of hypervisor for deploying its TeraVM in OpenStack.
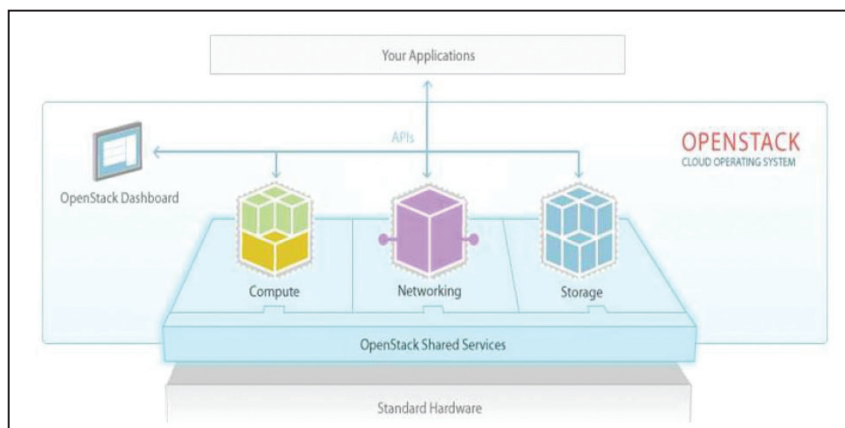

Figure 1: OpenStack Overview [source: http://www.OpenStack.org/software/]

Storage

The OpenStack storage module (Swift) manages the storage needs of the virtual machines running in the private cloud with support for Object Storage and Block Storage with the flexibility to deploy as needed:

- Object Storage: cost effective, scale-out storage
- Block Storage: manages block devices which are used by compute instances for expanded storage

Virtual machine images can be stored as an object-storage system, which are then retrieved using a machine image retrieval and registration tool (Glance). VIAVI uses persistent block level storage for its OpenStack TeraVM compute instances.

Networking

The third pillar of OpenStack is the networking module (Neutron), in which users can create their own networks, control traffic and connect servers and devices to one or more networks. Neutron offers users of a cloud an incredible amount of choice and flexibility:

- Network Functions Virtualization (NFV): use NFV to enable additional network services, such as intrusion detection systems (IDS), load balancing, firewalls and virtual private networks (VPN) to be deployed and managed.
- Software Defined Networking (SDN): use SDN to enable high levels of multi-tenancy and massive scale.

VIAVI utilizes Neutron's switching and routing instances to enable communication with its TeraVM controller compute instance and to enable communication between the controller and test traffic generation compute instances.

Virtual machine image management

OpenStack provides services for discovering, registering, and retrieving virtual machine images (Glance). The ability to make and store images of actual running servers is one of the key reasons why OpenStack cloud OS is used in cloud environments. Users of OpenStack can easily and quickly scale servers and services reliably.

TeraVM is imported into OpenStack as two separate files (controller and test module compute instances) using the RAW format, which is natively supported by KVM.

Administering the virtual environment

OpenStack provides a web based user interface (Horizon) to manage services such as Nova and Swift. Horizon ships with three central dashboards, a "User Dashboard", a "System Dashboard", and a "Settings" dashboard.

In addition to the web based interface, users of OpenStack can use a command line interface to access the key management services. The TeraVM instances can also be instantiated through the command line, enabling even greater flexibility through automation.
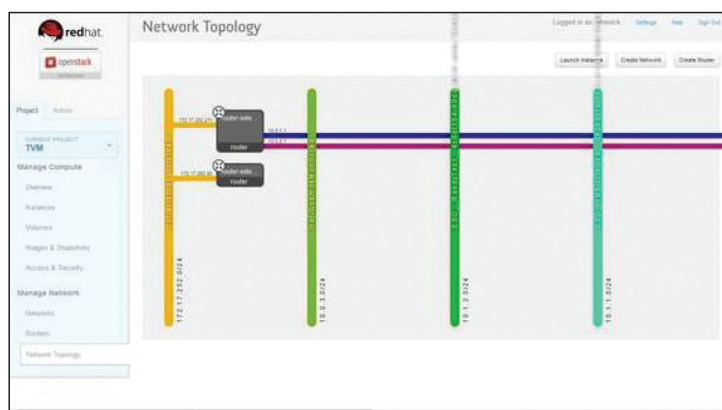

Figure 2: Horizon Dashboard an example view showing a network

Using Horizon, OpenStack users can quickly orchestrate any number of TeraVM compute instances. In the sections that follow, this solution brief will outline how easy it is to orchestrate a scaled virtualized IP test solution in OpenStack with a sample use case of a multi-tenant test.

TeraVM virtualized IP testing

TeraVM is a fully virtualized IP test and measurement solution that can emulate and measure millions of unique application flows. TeraVM provides comprehensive measurement and performance analysis on each and every applications flow with the ability to easily pinpoint and isolate problems flows.

Two key reasons why TeraVM is used in testing OpenStack based clouds is as follows:

• Elastic Test bed: Scale the test bed as needed, for example as the number of tenants grows enable testing on a per tenant basis.

• Portability: Users of TeraVM can efficiently test enterprise and/or private cloud deployment without additional costs, TeraVM license server enables users to re-locate the test resources as needed.

TeraVM architecture

TeraVMs architecture is relatively straight forward, it consists of two key components a controller and a test module(s). The controller is a single compute instance which allows the user to configure and manage tests which will run across a number of compute instances of test modules.
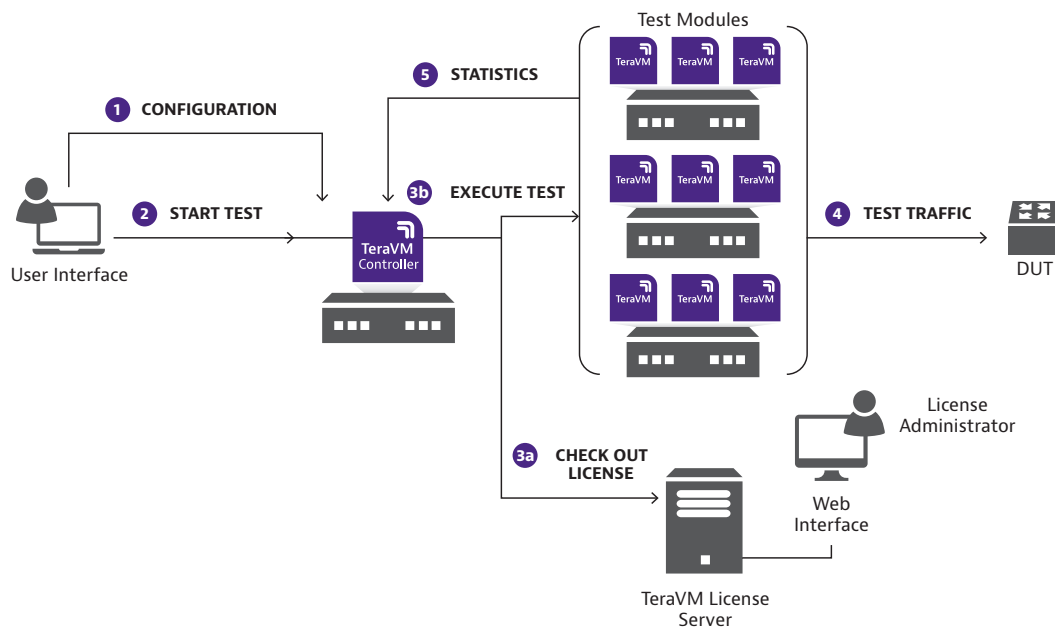

Figure 3: Example TeraVM deployment orchestrated with OpenStack

Step by step guide to using TeraVM

Figure 3 above highlights the steps required to generate test traffic in the direction of the device under test (DUT). The steps are as follows:

• Configure a test via the graphical user interface (GUI) or command line interface (CLI) on the TeraVM controller.

• Manage the test run by starting and/or stopping the test as needed.

• Test is executed by the controller:
   - The controller checks out a run-time license
   - The test configuration is loaded and started on the TeraVM test modules

• Test traffic is emulated in the direction of the DUT

• Live performance analysis of all emulated traffic is available in the TeraVM controller

TeraVM virtual machine instances

A basic TeraVM deployment consists of two distinct virtual machine types; controller and test module(s). VIAVI provides these as raw image formats. However, the TeraVM test modules come in a number of distinct flavors.

To enable TeraVM in OpenStack, the administrator simply loads the various TeraVM images into the repository. To make TeraVM available for use by all users of the cloud immediately, they simply select the public setting during the import.
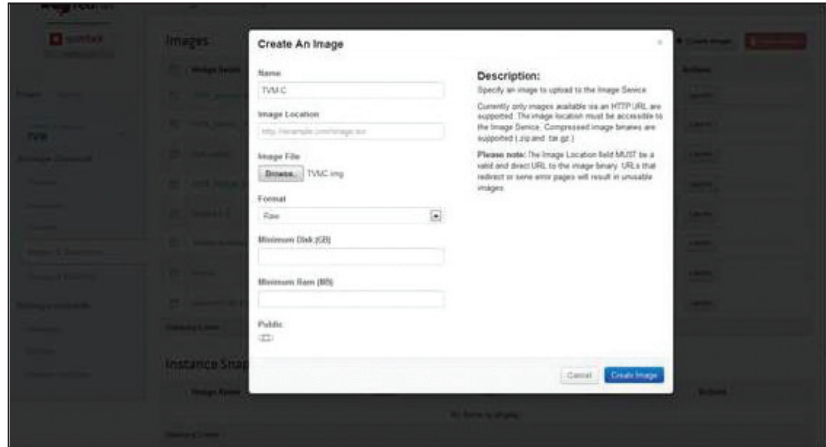

Figure 4: TeraVM image being imported to the Glance repository

Instantiating TeraVM in OpenStack

Once the machine images are available in the Glance repository, the OpenStack user can instantiate as many TeraVM test modules as they wish. TeraVM will appear in the Nova service as a compute instance. As a pre-requisite to deploying the TeraVM test module, the only requirements is that the user know, to which virtual network interface the test module will connect through to generate traffic load.

Enabling an elastic test bed in OpenStack

OpenStack has greatly simplified the effort to instantiate compute nodes, so much so that if you get the configuration wrong it's just as easy to simply delete the environment and start over again. Just imagine the consequences of an incorrectly configured physical test bed, there is no comparison it's a day's work as compared to just minutes to recover.

Using the Horizon web interface a user can quickly select a flavor of TeraVM test module, based on the scale of the test requirement (e.g. 100Gbps) and set the instance count for the number of required test modules (e.g. 10).
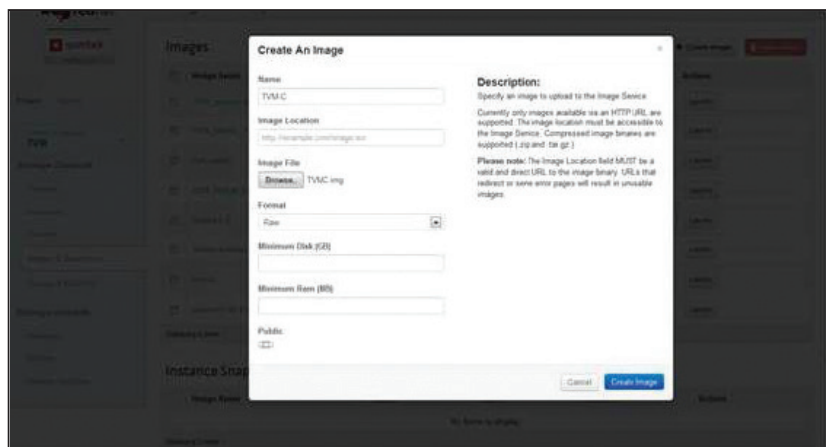

Figure 5: Instantiating a scaled test in a matter of minutes

Performance analysis from within the cloud

As soon as the TeraVM test resource is available, users can begin to configure or even edit existing test cases to utilize the newly scaled test bed. Users of TeraVM have the option to use a graphical user interface or command line.

TeraVM's graphical user interface enables the user to quickly generate scaled tests which automatically load all of the available test resources. An additional benefit of using TeraVM in testing on the OpenStack cloud is the integrated analysis window, showing in real time the actual performance of real traffic.
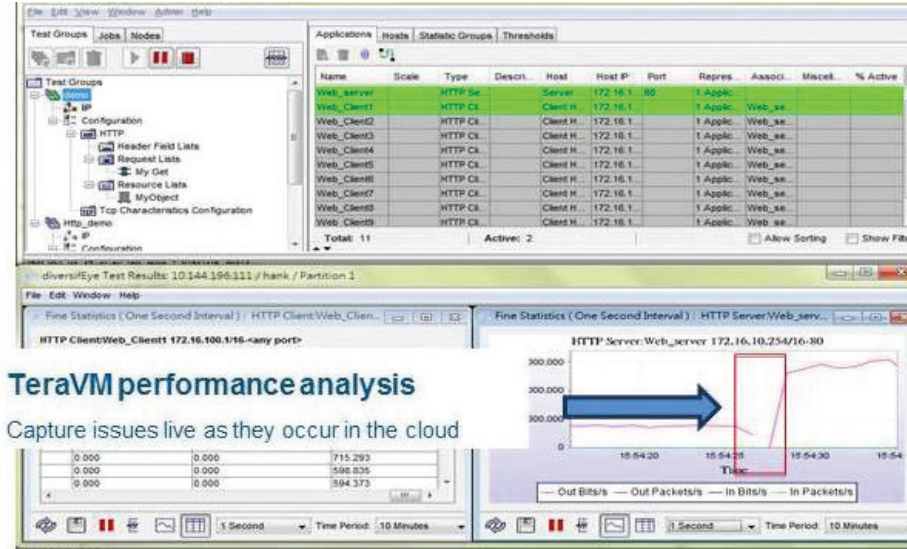

Figure 6: TeraVM's integrated emulation and performance analysis

Use case: Performance testing hybrid cloud deployments

OpenStack offers enterprises a cost effective means to quickly scale and make available compute resources on demand. A key benefit for the security conscious enterprise is the ability within OpenStack to make available department or tenant style hosting similar to commercially available cloud deployments. As with all tenant type systems, performance testing is required to ensure the resource configuration of storage, network and compute are available and that the security which prevents data leaks between tenants is correctly configured.
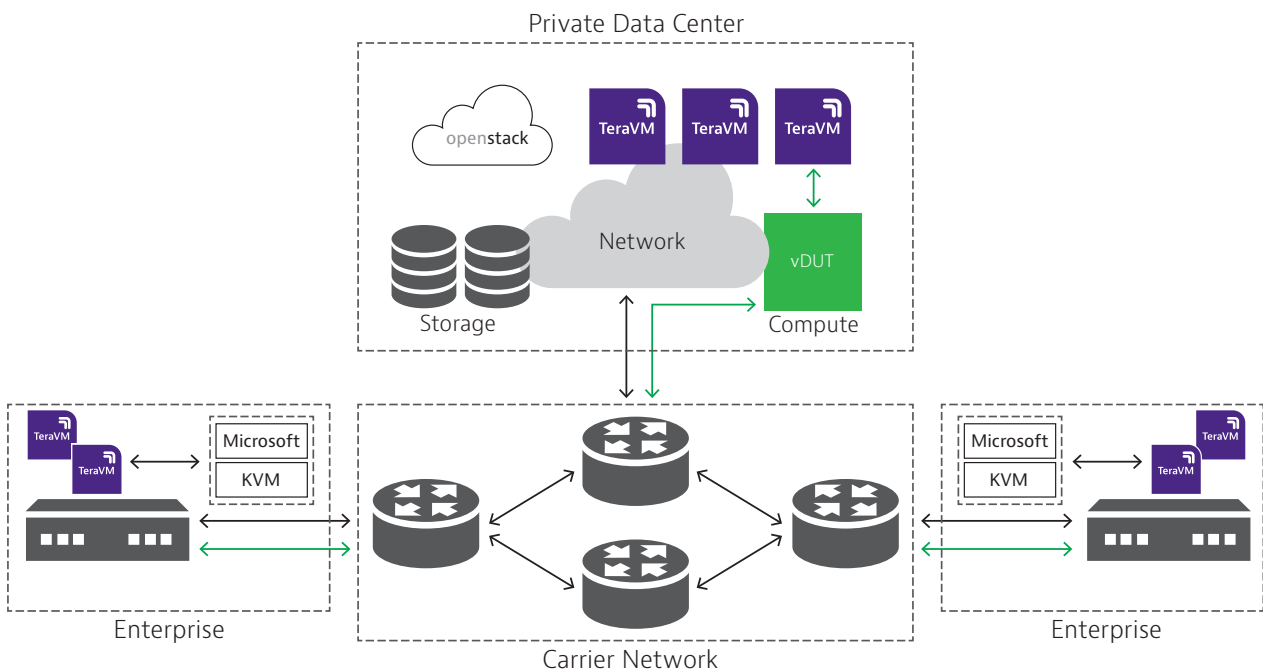

Figure 7: Hybrid cloud testing with TeraVM

Why test OpenStack hybrid clouds with TeraVM?

TeraVM is the only IP test and measurement solution available today which can be deployed in OpenStack. In addition, TeraVM's flexible licensing scheme enables scalability, elasticity of scale and portability of test resources facilitating the hybrid cloud administrator to deploy test resources between the physical network and the private cloud.

An even more important aspect of testing OpenStack with TeraVM is the ability to test the security configurations between cloud tenants (i.e. traffic for one tenant is not visible by another).

Sample test cases for OpenStack's networking configuration

TeraVM's emulated stateful flows are used to provide detailed performance analysis from the networking layer to the application layer (L4-7). TeraVM is used extensively to determine if latency sensitive applications are impeded by a move to a remote site or indeed if the addition of new tenants in the virtual cloud space impacts existing services.

In addition, TeraVM can be used to:

- Determine the reliability and performance limitations of the Neutron networking elements which includes switch and router network configurations.
- Robustness testing of essentials services such as DHCP enabled address assignments. TeraVM

facilitates this via scalability testing with a large volume of virtual machine instances and interfaces.

Summary

TeraVM is the only emulation and performance measurement solution available today which can be deployed using the open source cloud operating system OpenStack. TeraVM can be fully instantiated into a cloud environment using the OpenStack modules of Glance, Nova and Neutron.

Once instantiated with OpenStack, TeraVM is used to test network traffic in the cloud itself and to test traffic across a hybrid deployment of physical and cloud networks. On the OpenStack platform, TeraVM can be used to test the performance limitations of local services, network configurations and other compute instances.

OpenStack's powerful orchestration capability is playing a fundamental role in enabling the next generation of networking products which are evolving out of software defined networks (SDN) and network function virtualization (NFV). TeraVM as a stateful application traffic emulator is also playing a key part by ensuring that these new virtual appliance and functions such as vSwitch, vLoadbalancer, vFirewall, vDPI, etc. are reliable and robust for cloud deployments.

TeraVM's flexible license model means that the TeraVM test resources are highly scalable, this alongside OpenStack's orchestration results in a truly elastic test bed, in which a test bed can be instantiated to enable terabits per second of traffic emulation or simply deleted all within minutes. In addition, TeraVM offers portability, enabling the TeraVM resource to be deployed outside the OpenStack cloud. This ability to provision in the cloud and reside outside on a local network enables application performance testing on an end-to-end basis from the enterprise LAN to the public cloud.

*The OpenStack modules highlighted in this solution brief are as referenced in the OpenStack Havana release: [https://wiki.openstack.org/wiki/ReleaseNotes/ Havana#OpenStack_2013.2_.28Havana.29_Release_Notes]

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