

Distributed Overlay Virtual Ethernet (DOVE) integration with Openstack

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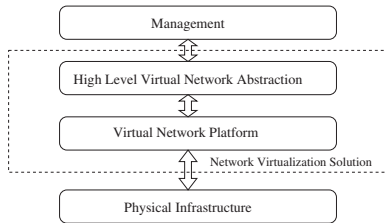


Fig. 1. Network Virtualization Reference Architecture.

Abstract—In this demo we present IBM comprehensive SDN based network virtualization solution - DOVE (Distributed Overlay Virtual Ethernet network), providing multi tenant NaaS, and its integration with the cloud computing platform Openstack. The demo is based on the work “An Intent-based Approach for Network Virtualization” presented in IFIP/IEEE IM 2013 [1].

We present research prototype of DOVE (Distributed Overlay Virtual Ethernet network) and demonstrate its management integration with the open source computing platform.

DOVE is IBM’s SDN-based network virtualization solution providing a scalable, flexible, multi-tenant Network as a Service (NaaS) for data centers and clouds. DOVE architecture, described in details in [1], is built around the concept of centrally controlled, platform terminated overlays and allows creation of multiple, totally isolated, and dynamic virtual networks over the shared physical infrastructure. To the network service consumers, DOVE virtualization solution provides novel intent based network service abstraction, capturing the functionality of the network. Figure 1 shows the high level architecture of the comprehensive network virtualization solution that DOVE represents.

To demonstrate the concepts presented in [1], we show the working prototype of DOVE solution for open systems, managed with OpenStack— an open source cloud computing platform, aiming to deliver scalable solutions for all types of clouds. OpenStack consists of a series of interrelated services, delivering various cloud management aspects. Quantum is an Openstack project for network management. Quantum exposes an extensible set of APIs for creating and managing virtual networks interconnecting virtual machine interfaces created and managed by the Openstack compute service, Nova. In addition, Quantum defines the Quantum plug-in APIs whereby each vendor/provider can implement its own network virtualization technology.

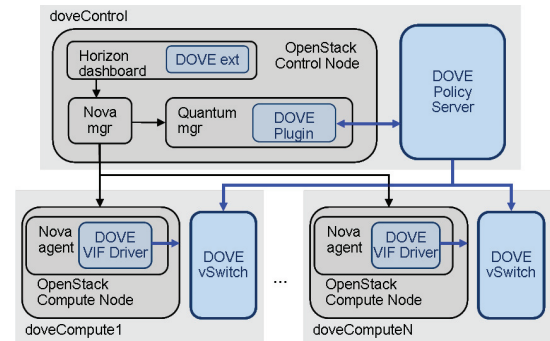


Fig. 2. DOVE virtual network environment prototype integrated into the OpenStack cloud management software.

Integrated with the OpenStack cloud management software, DOVE achieves a fully functional management plane, allowing cloud tenants to specify abstract network blueprints for their workloads and to subsequently deploy workload components into these blueprints. This way, a tenant achieves the desired communication behaviors between the service components. In addition, tenant can specify the advanced network services that traffic must be submitted to, e.g. security policing, inspection, compression, acceleration, etc, and the system ensures that the specified policies are applied by selectively redirecting the traffic through network appliances, either physical or virtual.

The prototype setup is presented in Figure 2 and comprises the *doveControl* box and several *doveCompute* boxes, each running as a bare-metal application on a separate virtualization-enabled x86 computer. All the computers are running Ubuntu 12 and have OpenStack components deployed and configured: the *doveControl* box runs the OpenStack control services and each *doveCompute* box runs an instance of the OpenStack compute node. The OpenStack components are extended to accommodate DOVE integration, as shown in blue in Figure 2.

On *doveControl* node, most of the changes are to the UI Dashboard—HORIZON, and to the network management service—Quantum, as well as some small supporting changes to the main OpenStack service—Nova. Horizon dashboard is extended to expose the available virtual network blueprints in a context of VM deployment, to allow the DOVE network policy management, and to harness the DOVE quantum extension. DOVE Quantum plugin is created to communicate

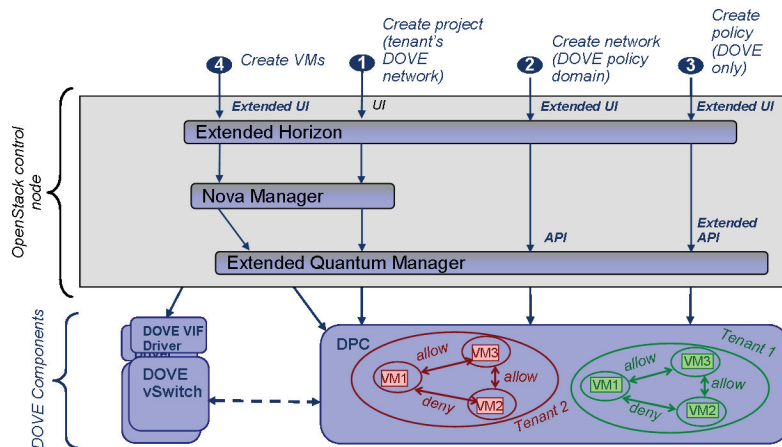


Fig. 3. Example cloud management flow enabled by the DOVE integrated with the Openstack.

management information to the DOVE Policy Service (DPC). Moreover DOVE extension for Quantum API is implemented to expose DOVE specific network operations like policy management and external connectivity.

On *doveCompute* nodes, KVM virtualization platform is activated and the default Linux bridge is replaced with the DOVE Switch (dSwitch), the DOVE dataplane component. As described in the paper, dSwitches intercept guest VM's traffic and forward them over the DOVE encapsulation protocol between them. Following the SDN paradigm, dSwitches do not learn and do not make forwarding decisions but are controlled by the DOVE control plane service—DOVE Policy Controller (DPC). In addition to running dSwitch, *doveCompute* nodes contain the DOVE virtual interface driver (VIF) for the Nova compute agent whereby network management information is delivered from the *doveControl* node to the local dSwitch.

DOVE Policy Controller (DPC) is implemented as a clustered Linux user space application that receives the configuration data from the controller running as part of DOVE Quantum plugin and distributes the forwarding rules among the dSwitches on demand. In this simplified demo setup, all the participating computers can host a DPC node, so that multiple DPC nodes are deployed in the DOVE environment. Each DPC node stores all the required logical network information in a set of in-memory hash tables and is capable of controlling multiple dSwitches in a small scale OpenStack environment where clients are running simple isolated LAMP applications. DOVE control protocol, running between the DPC and the dSwitches, can not be trivially replaced by the OpenFlow (OF) protocol because it incorporates more than just forwarding control in overlay endpoints. DOVE control protocol is designed to support the intent-based network management and to specify advanced network services.

Figure 3 shows the example of the cloud management flow enabled by DOVE integrated with the OpenStack. We are going to demonstrate establishing several tenants networks using DOVE capabilities externalized in the OpenStack UI,

modifying the networks and their policies, and deploying VMs to be interconnected by the DOVE networks. Demo viewer will be able to see that connectivity established between the deployed VMs is according to the policies defined beforehand, including accessibility from outside the DOVE environment, e.g. for management of for accessing the cloud hosted services by their external clients. In addition, isolation between the virtual networks of different tenants, including overlapping IP address spaces assignment, will be verified.

REFERENCES

- [1] Cohen Rami, Barabash Katherine, Rochwerger Benny, Schour Liran, Crisan Daniel, Birke Robert, Minkenberg Cyriel, Gusat Mitchell, Jain Vinit, and Recio Renato. An intent-based approach for network virtualization. In *IM 2013*. IEEE, 2013.