Open Source Networking Technology in Inspur Cloud

Yanjun Li
Outline

• Background
  • Inspur Cloud Native Network
  • Inspur Container Network
• Summary
<table>
<thead>
<tr>
<th>Data Center Technology Tendency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legacy DC</strong></td>
</tr>
<tr>
<td>System on bare metal HW w/o virtualization.</td>
</tr>
<tr>
<td>No Virtualization</td>
</tr>
<tr>
<td>No Orchestration</td>
</tr>
<tr>
<td>Clearly Defined Silos</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Utilization</th>
<th>High TCO</th>
<th>Provision in Months</th>
<th>Utilization</th>
<th>30% TCO reduction</th>
<th>Provision in Days/Hours</th>
<th>Utilization</th>
<th>80% TCO reduction</th>
<th>Provision in Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>~30%</td>
<td>High</td>
<td>Provision in Months</td>
<td>~60%</td>
<td>30% TCO reduction</td>
<td>Provision in Days/Hours</td>
<td>70~80%</td>
<td>80% TCO reduction</td>
<td>Provision in Minutes</td>
</tr>
</tbody>
</table>
Cloud Network Architecture

Product Service Layer

- VPC
- EIP
- SLB
- Cloud Connection
- DNS
- VPC Connection
- IPv4/v6 Service
- NAT Gateway
- Network Monitor
- Networking Resource Pool
- IPSec/SSL VPN
- Traffic Monitor
- vWAF
- Anti-DDoS

Control Layer

- Virtual Network
- Hybrid Interconnection
- Policy Route
- DCI
- VPC
- Traffic Control
- SFC
- Multi-SFC
- Cross node
- Multi-Protocol
- QoS
- Traffic Limited
- ACL
- QoS Guarantee
- Exception Analysis
- AI Analysis
- Intent
- Self-healing
- Network Visualization
- Optimization

Infrastructure

- Bare Metal
- Host
- Switch
- Route
- Monitor
- VPN
- FW&WAF

Compute

Network

Security
ISP SDN Solution in China

AERO: SDN controller developed by China Mobile based on OpenDayLight

Unified Ctrl and Mgmt for Cloud and WAN by China Telecom based on OpenDayLight
http://www.georgezhao.org/blog/major-chinese-carriers-shared-their-experience-of-leveraging-opendaylight

OpenDayLight is a popular solution for ISP in China

Requirement analysis and best practices based on OpenDayLight by China Unicom
http://www.georgezhao.org/blog/major-chinese-carriers-shared-their-experience-of-leveraging-opendaylight

Unified Ctrl and Mgmt for Cloud and WAN by China Telecom based on OpenDayLight
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OpenDayLight is a popular solution for ISP in China
### Data Plane Technology Comparison

<table>
<thead>
<tr>
<th></th>
<th>OVS (ODL)</th>
<th>vRouter (OpenContrail)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Popularity (in China)</td>
<td>★★★★★</td>
<td>★</td>
</tr>
<tr>
<td>Richness of network function</td>
<td>★★★★★</td>
<td>★★</td>
</tr>
<tr>
<td>Working layer inside of TCP/IP stack</td>
<td>L2-L4</td>
<td>L3</td>
</tr>
<tr>
<td>Segmentation of virtualized networks</td>
<td>VLAN or Overlaid TUNNEL(GRE, VXLAN, etc)</td>
<td>Overlaid TUNNEL(MPLS over GRE, MPLS over UDP, VXLAN, etc)</td>
</tr>
<tr>
<td>Performance of virtualized network</td>
<td>High (in VLAN mode segmentation), Medium (in overlay mode segmentation)</td>
<td>Medium (in overlay mode segmentation)</td>
</tr>
<tr>
<td>Lines of code</td>
<td>300K</td>
<td>50K</td>
</tr>
<tr>
<td>OpenFlow protocol</td>
<td>Support</td>
<td>Not support</td>
</tr>
<tr>
<td>License</td>
<td>Apache v2.0</td>
<td>GPL</td>
</tr>
<tr>
<td>Open source community</td>
<td>Majority, Active</td>
<td>Minority, inactive</td>
</tr>
<tr>
<td>Interoperability with open source SDN controller</td>
<td>★★★★★★</td>
<td>★</td>
</tr>
<tr>
<td>Recruiting corresponding staff</td>
<td>Easy</td>
<td>Hard</td>
</tr>
</tbody>
</table>
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• **Inspur Cloud Native Network**
• **Inspur Container Network**
• Summary
Infrastructure of Inspur Cloud

Proxy VLAN
PXE VLAN
Storage control plane
Storage data plane
Storage replication VLAN

Virtualized Control Plane
Physical servers with KVM
Compute nodes

Datacenter network
Public network
Cloud gateway router (OpenContrail) / network node (Neutron OVS)
Network Model in Inspur Cloud
Inspur Open Source Networking Scheme

- Support large scale out network
- Support rich networking products
  - SLB
  - VPC
  - EIP/SBW
  - IPv6
  - NAT
  - VPC Connection
  - VPN
- Enhanced Neutron Dev.
  - ACL
  - VPC Service
  - Policy Route
  - EIP Cluster

**Enhanced Neutron Interface**

- POST ~/v2.0/acl
- POST ~/v2.0/VPC service
- POST ~/v2.0/policy route
- POST ~/v2.0/eip

**Inspur Cloud Platform**

- POST ~/v2.0/ports

**Neutron REST API**

- Core API
  - Network CRUD
  - Subnet CRUD
  - Port CRUD
- Service API
  - LBaaS
  - FWaaS
  - ACL
  - VPNaaS
  - VPC Service
  - Policy Route
  - EIP+QoS

**Plugins (Drivers)**

- Vender1
  - Core plugin
  - Ext. plugin
- Vender2
  - Core plugin
  - Ext. plugin
- Vender3
  - Core plugin
  - Ext. plugin
- OVS driver
  - Core plugin
  - ACL ext. plugin
  - VPC service ext. plugin
  - Policy route ext. plugin
  - EIP+QoS ext. plugin

**Agents**

- ML2
- L2
- L3
- OpenFlow
- ACL service ext. agent
- VPC service ext. agent
- Policy route ext. agent
- EIP+QoS ext. agent

**External Services**

- OpenDaylight
- NSX

**Enhanced Neutron Dev.**

- High availability
- Portability
- Scalability
- Compatibility
- Performance
- Security
ACL Module Implementation

Neutron Core API

Core Plugin

Neutron Plugin

Service Plugin

ACL

L2 ACL

Neutron L2 Agent Extension

Neutron Agent

Neutron L3 Agent Extension

L3 ACL
VPC Connection is to solve communication among VMs in different VPC:

- Add VPC connection
- Add static route table
- Scale out and high availability
Module Feature
• Leverage Hardware SW to access Bare Metal machine, and connect Hardware SW with OVS vTEP in Virtual node through enhanced Neutron module to import related flow table to realize reachable tunnel between VM and Bare Metal in cloud platform
• Uniform tunnel management
• Uniform address management
• Auto configuration and OVS flow table management
Hybrid Container & VM network

- Kubernetes Master Node
  - Kube Network Mgr
- Inspur Cloud Platform
- Openstack Network Node
  - Neutron
- OssAggr
- Physical Network
  - ContMgmt (Contiv)
  - VM Mgmt (ODL)

Container Cluster:
- OVS
  - Container Node

Virtual Machine Cluster:
- OVS
  - VM
  - Compute

Inspur Cloud Platform

Openstack Network Node

L3 underlay leads to complicated route table configuration for north-south bound traffic under DVR network model

- Create external VxLAN network, and set it as default external path
- Develop external VxLAN resource pool to realize encapsulation/de-capsulation for north-south bound traffic
Inspur Cloud Platform

North Bound Interface

OpenStack
RESTful
JAVA/OSGI
Private Interface

Inspur ODL-based Controller

South Bound Interface

OpenFlow
NETCONF
SNMPv2
SNMPv3
CLI
Private Interface

Overlay

VM
Virtual Switch
VM
VM

NFV

Virtual Firewall
Virtual Gateway
Virtual DPI Server

Infrastructure

- DCI
- Traffic Tracy
- SFC
- Networking High Availability
- Large Scale Network (10000+)
- Failure Recovery based on AI
- Uniform container & VM network

Inspur Network (Long-term)

DCI
Traffic Tracy
SFC
Networking High Availability
Large Scale Network (10000+)
Failure Recovery based on AI
Uniform container & VM network
Migration to ODL smoothly:

- Reserve compatibility on Rest API and Data structure layer
- Develop new Plugin and Agent to support incremental features based on Neutron
- Replace neutron with stable ODL controller to manage North-bound interface and South-bound interface later
- SLA Guarantee
- Large Scale-out migration support
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Inspur Container Network Architecture

- Multi-cluster management: Realize the functions of purchasing, expanding, shrinking, deleting, binding/unbinding eip, renewing, closing/soft deleting of overdue fees, upgrading, etc.
- Functions:
  - External access, mount inspur cloud disk/object storage, monitoring, log collection and other self-developed core functions.
  - IaaS resource management: Terraform manages IaaS resources.
  - Image management:
    - Self-research inspur image warehouse management cluster images.

Cluster management:
- create
- scaleup/down
- delete
- renew
- shutdown
- upgrade

Application management:
- release
- gateway
- config
- upgrade
- registry
- manage

Terraform
- Kubelet
- Kube-api
- Incloud-disk
- Incloud-oss

Kubernetes
- Scheduler
- Fluentd
- Prometheus
- Controller

Image service

Docker

Calico

IaaS
Container Engine consist of two networks: management and business.

The management network is used for cluster management applications and cluster communication.

Business networks are used for intra-cluster pod communication.
Inspur Cloud Custom Service Network Topology Based on Containers

- External network users access custom container-based services through eip.
- Custom services access the Inspur cloud console cluster through the management network.
- Custom service accesses the services of the different tenants via floatingip.
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Cloud Computing

Opening Technical Architecture

Participate Many Standard organizations, OpenStack Gold Member, Patents & Standards related to Cloud Computing Rank First in China

ICP for Future Cloud DC

Multi-Layer virtualization and Convergent Architecture

Series of Inspur Server

Inspur Server
Inspur Blade
Inspur Rack

Inspur Server Products
Open Source Culture

- Open Source Program Office
- Open Source Interest Group
- Happy employees mean bigger profits
- ...
Inspur Potential Contributions to Neutron

Inspur Cloud Platform/3rd Part Cloud Orchestrators

Neutron Plugins
- Network ACL
- Interconnection of Baremetal and ECS
- VPC Peer Connection
- EIP (one-to-one)
- NAT Gateway (one-to-many)
- QoS (North-South)
- …...

Neutron L2 Agent Extensions
- Interconnection of Baremetal and ECS
- Network ACL

Neutron L3 Agent Extensions
- Network ACL
- VPC Peer Connection

Newly Added Agents
- EIP (one-to-one)
- NAT Gateway (one-to-many)
- QoS (North-South)
Thanks for Your Listening