SDN Practice and Implementation for Inspur Cloud Platform

Yanjun Li
Outline

» Background

» Inspur SDN Controller Architecture

» Implementation for Core modules

» Open Source Contribution
Internet Application Landscape
Huge Requirements for Network In Cloud Era

**Digital Disruption**
63 million new devices will access Internet per second till 2020 year.

**Complication**
Networking OPEX is 3 times of Networking CAPEX

**Security**
Average security detection period is 6 months

Lack of Business insight & informatization

Inefficient and Frequent failure Networking Operation & Management

Security attack everywhere
## Most Important Value for Networking Technology

**Networking should be complicated.**

For Inspur Not for you.

<table>
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<th>Old way of doing things</th>
<th>New way of doing things</th>
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SDN Requirements for Inspur Cloud Platform

**SDN – OpenStack Network**
- Auto network port bonding
- Failure recovery
- Network scalability
- VPC/Tenant network Mng.

**SDN – OpenStack Network**
- Floating IP bonding/unbinding
- DHCP server elimination
- VLAN auto configuration

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**New**

Full-stack Inspur SDN controller

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**SDN – Networking Control**
- Efficient resource utilization
- IDDM
- South-bound interface
- EIP support

**SDN – Networking Mng.**
- Heterogeneous network Mng.
- SFC support
- Physical infrastructure Mng.
- Hybrid VxLAN support
Outline

- Background
- Inspur SDN Controller Architecture
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Inspur Cloud Networking Controller

- **Cloud Network**
  - VPC (Virtual Private Cloud)

- **Cloud Domain OS**
  - ICD NOS (Inspur Cloud Domain NOS)

- **Cloud Map**
  - IDDM (Inspur Device Discovery & Management)

---

**Infrastructure**

- **Subnet Topology**
- **Subnet Management**
- **Subnet IP**
- **Connection Configuration**
- **Subnet Routing**
- **Metering**

- **VLAN Management**
- **IP Allocation**
- **Networking Resource Pool**
- **IP Utilization Ratio**
- **Traffic Statistics**
- **Traffic Distribution Statistics**

- **Device Discovery**
- **Device Status**
- **Device Connection Topology**
- **System Preinstall**
- **Device Management**
- **Inventory Correlation**

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**Cloud Path (HNI)**

- Heterogeneous Hybrid Net Convergence Compatibility

**Cloud Chain (SFC)**

- Transparence Multi-Chain Cross nodes Multi-Protocol

**Cloud Controller (QoS+TC)**

- Traffic Control ACL QoS Failure Analysis

**Cloud Decision (AI)**

- Intent Auto Heal Visualization Auto Optimization

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**Cloud Network**

- **System Preinstall**
- **Device Management**
- **Inventory Correlation**

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**Cloud Domain OS**

- **Network Path**
- **Cloud Domain NOS**

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**Cloud Map**

- **Device Discovery**
- **Device Status**
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Inspur SDN Controller Architecture

Inspur Cloud Platform Orchestration

North Bound Interface
- OpenStack
- RESTful
- SOAP
- JAVA/OSGI
- Private Interface
- ...

Control Plane

Inspur Application-Based Controller

South Bound Interface
- OpenFlow
- NETCONF
- SNMPv2
- SNMPv3
- C.1
- Private Interface
- ...

Overlay

NFV
- Virtual Firewall
- Virtual Gateway
- Virtual DPI Server

Infrastructure
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HNI Module for VxLAN & VLAN Interconnection
HNI Module Implementation

1. Establish tunnel from br-hni to br-int
2. REST: Mapping data reading
3. Set flow table on br-hni
4. RPC: Notification for updating of VMs and Mapping data

Physical Server

ODL

HNI Proxy

br-hni

BareMetal

VLAN1
SV1

VLAN2
SV2

VLAN3
SV3

Leaf Switch

Trunk Traffic

1. Establish tunnel from br-hni to br-int
2. REST: Mapping data reading
3. Set flow table on br-hni

Simple Network Management Protocol (SNAP)

External Traffic

SNAT Process

Compute Node1
VM4

br-int
br-tun

Networking Node

DHCP Agent
SNAT

br-ex
br-tun

Compute Node2
VM5

br-int
br-tun

VLAN1
SV1

VLAN2
SV2

VLAN3
SV3

Switching Virtual Interface (SVI)

SV1

SV2

SV3

InfiniBand

Physical Server

ICP
SFC (Service Function Chain)

- **host1**
- **Classifier**
- **Classified Packets**
- **SFF1**
- **SF1: Dpi service**
- **SFF2**
- **SF2: Firewall service**
- **SFF3**
- **SF3: Qos service**
- **Host2**

**ODL**
**SFC Module Implementation**

East-west service function chains:
- Client -> SF -> server

North-south service function chains:
- Client -> SF -> network node -> external network

- Write sfc flow tables, make flows from
  - proxy -> sf -> proxy -> server
  - Or proxy -> sf -> proxy -> network node

- Write flow tables, make flows access the external network

- Configure sfc

**Openstack**

- Add the proxy for the nsh-unaware sf
- Write the sfc flow tables, make flow from client -> proxy

**SDN**

- East-West SFC (improved)
- North-South SFC (Newly added)
- Proxy for SF (Newly added)
- Netvirt (improved)
  - Add the function of listening interface change for classifier.
  - Fix bugs.

- Dashboard
  - Add the function of north-south SFC

- External network
Distributed QoS Mechanism
QoS Module Implementation

- QoS Rate limiter
  - Depend on Inspur Controller
  - Support North-south and West-east traffic rate limit
  - Support dynamic QoS configuration
  - Recognize different traffic according to destination IP address matching
Cluster Implementation

Northbound Interface

Southbound LB
Underlay Management and Configuration

Unified Intent Based API
- RESTful API
- Topology Explore
- Inventory Management
- Configuration DS OpenConfig
- Operational DS OpenConfig
- Node/Mountpt Manager
- Device Translation Unit
- Transaction
- Comparator
- Connection
- Direct Access Translation Unit

Rich Service Sets
- L2
- L3
- QoS
- Security
- Batch Configuration
- Power On Provisioning

Uniform Internal Data Store
- Unified Intent Based API
- Rich Service Sets
- Uniform Internal Data Store

Different Network Devices
- NETCONF
- NX-API
- SNMP
- BGP
- SSH/CLI
Feature Summary

» HNI module
  » Provide L2 interconnection between VxLAN and VLAN
  » VM migration support and seamless scalability

» SFC feature
  » Fix Netvirt module’s bugs related to SFC
  » Enhanced North-South service traffic control
  » Enable multiple traffic control mode

» QoS module
  » Distributed and dynamic QoS mechanism
  » Fine-granularity QoS guarantee

» Cluster support

» Underlay auto-management and auto-configuration
SDN Kernel Module Testbed

- Openstack Node
  - ODL Controller Node 1
  - ODL Controller Node 2
  - ODL Controller Node 3

- HA Network
- Management Network

- Service Networking Switch

- Service Network
Network Traffic Model

External Traffic

Management Traffic (eth0/eth1)

Data Traffic (eth6/eth7)

Service Traffic (Trunk)

Data Replication Traffic (eth4/eth5)

Data Traffic (eth5/eth6, eth2/eth3)

L2/L3 Switch Fabric

Control Traffic (eth2/eth3)

MySQL

Control Network

Data Network

Service Network

Public Network

Data Replication Network
Performance Results

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Execution Summary

Distribution

- neutron_create_network: 55%
- neutron_delete_network: 45%

Histogram: Duration (seconds)
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Embrace Convergence and Open Source

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

Series of Inspur Server

Inspur Server Products

Multi-Layer virtualization and Convergent Architecture
Inspur Contributions for Open Source Solution on SDN

Inspur Cloud Platform/3rd Part Cloud Orchestrators

OpenStack

Networking ODL Mechanism Driver

Disaster Recovery

Newly added Features

Improved Features

OpenDayLight

- HNI (Heterogeneous Network Interconnection for VxLAN & VLAN)
- Netvirt
- Port Mapping (one-to-many)
- SFC (North-South)
- ACL

- EIP (one-to-one)
- QoS (East-West)
- QoS (North-South)
- SFC (East-West)

Cloud Infrastructure Layer
Recent Delivery to OpenDayLight Community

- Committed 5 bugs on Netvirt to OpenDayLight Community (Done)
- Fixed 3 bugs on Netvirt / SFC module (Done)
- Contribute codes to existing projects (Doing)
  - Patch1: add the function of north-south SFC
  - Patch2: add the proxy for nsh-unaware service function
- New projects proposal (Doing)
  - EIP + QoS
  - HNI
  - Infrastructure Management
  - Cluster
Inspur SDDC in Cloud Era

Offering optimal SDI for various workload:
- SLA guaranteed
- No over-provisioning
- Cost-efficient

Achieving auto-scale operation efficiencies:
- Lower operation barriers by intelligent automation
- Self-healing by leveraging domain knowledge
- Proactive rather than reactive

Managing heterogeneous commodity hardware:
- Fully tuned & optimized
- HA by software (instead of hardware)
- Auto-scaling (across DC)