Modular Approach for NFV
- On Separation of Control Plane and Media Plane

Dr. Li Mo
CTO Group, ZTE TX
The Big Picture - Networking 20/20

- Connectivity Service (e.g. VPN)
- Traditional Consumer Service (e.g. VoLTE, IPTV)
- Traditional Enterprise Service (e.g. Centrex)
- Smart Home Applications
- Smart Vehicle Applications
- Health Applications

Application Platform
(Big Data Analytics, Device Management, Development Environment)

Network and Resource Orchestrator

Virtual Network Functions (VNF)
(Mobility Management, Policy, Accounting, Authentication, Resource, etc.)

SDN Controller

Cloud Management

Fixed Access Network

Mobile Access Network

WAN

Physical Data Center

Physical Terminals (Fixed, Mobile, Sensors)

© ZTE Corporation. All rights reserved
Service Development and Deployment in Networking 20/20

Design

Service Development & Test
- Development Environment
- Model library
- Test tools

Policy

Business

Service Authentication & Orchestration
- BSS
- NFV Orchestrator
- NS, VNF Database
- VNF A
- VNF Z

Analytics (Big Data)

O&M

Service Lifecycle Management
- OSS
- VNFM
- Service Instances
- Legacy Equipment
On the Way to Full Automatic Deployment - Promise of SDN and NFV

2013~2015

Decouple
(SW& HW Decomposition)

Challenge
• Performance enhancement
• Reliability enhancement
• Hardware compatibility
• Note: Equipment Virtualization. Proof of Concept phase of NFV

OSS
BSS

Big Data
VNE
VM

2015~2016

Virtualize
(Resource Pooling)

Challenge
• VNF elasticity & lifecycle management
• Emerging of VNF
• More Roles for Big Data
• Distributed NFVI resource pool scheduling
• Note: SDN Controller is part of virtualization layer while driven by VNF/VNE.

VNF
VNE
SDN-C
Virtualization
VIM

2016~2018

Cloudification
(Network Service Opening)

Challenge
• Network Service automatic deployment & elasticity with big data
• Network Service Orchestration with open programmable environment
• Note: Starting to extract “Network Function” from “Equipment”

3rd Party Applications/BSS
Big Data
OSS
NSO
VNF
VNE
VNF
VNF
VNF
VNF

Post 2018

Challenge
• True “Network Function Virtualization supporting business development
• Note: Without standardization, vendor lock-in will be reality. The necessary evil, OSS, shall be history.

3rd Party Applications/ BSS
Business Enabling/Big Data
VIM
VNF
VNF
NSO
VNF
VNF
VNE
SDN-C
Virtualization

© ZTE Corporation. All rights reserved
Deployment Considerations for NFV
COTS in Media Plane and COTS in Control Plane

Servers on the Edge Data Center
- Processing Media
- I/O Intensive
- Limited State Information
- Route optimization, Delay, ...
- Limited Customer Information
- Normally Physically Distributed

Servers on the Center Data Center
- Processing Control
- Computation Intensive
- Massive State Information
- Maintenance Intensive
- Sensitive Information
- Normally Centralized

Server Requirements Are Very Different
Server Technology Evolution

Connectivity - Silicon Photonics

<table>
<thead>
<tr>
<th>Speed</th>
<th>Width</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>x4</td>
<td>100G</td>
</tr>
<tr>
<td>25</td>
<td>x16</td>
<td>400G</td>
</tr>
<tr>
<td>50</td>
<td>x8</td>
<td>400G</td>
</tr>
<tr>
<td>32</td>
<td>x32</td>
<td>1T</td>
</tr>
<tr>
<td>50</td>
<td>x20</td>
<td>1T</td>
</tr>
</tbody>
</table>

Server - RSA Architecture

Physical

Networking

Sharing FANs

On Rack IO/Networking

Sharing Processing and Storage

Processing Elements

Storage

FPGA

OMNI Path

Si-Ph

NVMe SSD

CPU

AEP

SAS/SATA

Distributed Storage

PCIe

IP SAN

Physical Decoupling

Networking

System Decoupling

50 Gbps

100 Gbps

400 Gbps

1.6 Tbps

Silicon Photonics

Physical Networking

System Decoupling

On Rack IO/Networking

Sharing FANs

AEP Sharing FANs

On Rack IO/Networking

Sharing Processing and Storage

CPU

AEP

SAS/SATA

Distributed Storage

PCIe

IP SAN

Processing Elements

Storage
Architectural Considerations

Management
- FCAPS
- Network Service Orchestration
- VNFM
- Components Deployment
- Fault Correlation
- Hardware Monitoring

Specific Network Service Logic (Control or Media Plane)
- Mobility Management
- SDN Controller
- xCSCF Service

Common Network Service Logic (Control or Media Plane)
- Load Balance
- Signaling Processing
- Interface Logic

Databases (Control Plane)
- Subscription Database
- Service Database
- Resource Database
- Link State Database

Persistent Data

Stateless
Advantage of the Architecture - Easy Elasticity

**New Elasticity**

**Traditional Elasticity**

- Centralized Data Base (Persistent Data)
- New VM in the same or different Data Center

- Common or Service Specific Processing Logic
- New VM in the same or different Data Center
- Common or Service Specific Processing Logic
- Common or Service Specific Processing Logic
- Common or Service Specific Processing Logic

- Common or Service Specific Processing Logic
- Common or Service Specific Processing Logic
- New VM in the same or different Data Center

© ZTE Corporation. All rights reserved
Advantage of the Architecture - Easy Redundancy

**Traditional 1+1**

- Active Server (Service Logic and Data)
- Standby Server (Service Logic and Data)

Data Sync

**New 1+1**

- Active Centralized Data Base
- Standby Centralized Data Base

Active Server (Service Logic)

Standby Server (Service Logic, Idle)
Advantage of the Architecture - Easy Service Deployment

Media Plane
- pGW
- vEPC+GI LAN
- vEPC Base
- Edge DC

Control Plane
- SDN
- Session Control
- Authentication
- Central DC

Management & Orchestration

Fixed Access
- xhaul

Internet

Edge DC

Media Plane
- sGW
- IoT vEPC
- vEPC Base
- Edge DC

Central DC

Internet

© ZTE Corporation. All rights reserved
Application Examples - China Unicom

Multi-vendor NFV environment
- NFVO: ZTE (vManager), HP(NFV Director);
- VNFM: ZTE (vManager);
- VNFs: ZTE (vEPC & vIMS);
- EMS: ZTE (NetNumen U31)
- VIM: ZTE (TECS), HP(Helion);
- HW: HP (BL460c Gen9), ZTE (ZXCLOUD E9000).

PoC
- E2E VoLTE service verification: LTE service, Voice service, billing
- NS&VNF life cycle management: registration, deployment, expansion, hot migration, upgrade;
- Elastic scalability: manual and automatic Scale-in & Scale-out;
- User plane acceleration technology: DPDK, SR-IOV;
- vGW based iSDN: separate control plane and user plane;
Application Examples – China Mobile

ZTE Cloud Works

- **Cloud Works: Carrier-class open ecosystem**
  - Convenient for the operator to quickly launch new services for enterprise customers
  - Open API to partners, diversified services

<table>
<thead>
<tr>
<th>Dev Tool</th>
<th>Basic API set</th>
<th>Service API capability set</th>
<th>Operation API capability set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Message</td>
<td>Signaling</td>
<td>Big data analysis</td>
</tr>
<tr>
<td>Develop</td>
<td>Database</td>
<td>Packet control</td>
<td>Session level control</td>
</tr>
<tr>
<td>Compile</td>
<td></td>
<td></td>
<td>Charging</td>
</tr>
<tr>
<td>Test</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Ops Framework**
  - Automatic deploy
  - Lifecycle management
  - Elastic scale-in/out
  - Load control
  - HA/DR
  - ...