Can Virtual CPE Be Cost-Effective for Enterprise Customers?

Charlie Ashton, Wind River
Topics

- Introduction to Wind River in telecom
- Business drivers for virtual CPE
- Four key challenges for cost-effective vCPE
  - Service reliability
  - Service agility
  - Virtualization overhead
  - Server footprint
- Summary
Introduction to Wind River in NFV

- Founded in 1981 as embedded tools and Operating System company
  - Acquired by Intel in 2009

- Our software has been deployed in over two billion devices
  - Where failure is not an option

- Telecom customers include all the top 20 TEMs worldwide

- Solving critical challenges for network virtualization
  - **Titanium Server**: only commercial NFV cloud that delivers the Carrier Grade reliability required for telecom networks
  - Supported by **Titanium Cloud** ecosystem of industry-leading partners
An Open Solution for NFV Infrastructure

- 100% compatible with open standards: no vendor lock-in
- Full Carrier Grade reliability for virtualized services
- Maximum VM density drives OPEX savings
Titanium Cloud Ecosystem Partners
Addressing Multiple Virtual CPE Deployment Options

Supporting three deployment models planned by service providers

- Customer Premise
- Service Provider Data Center
- Service Provider Point-of-Presence (PoP) or Central Office (CO)

VNF partnerships supporting all three deployment models

- Only two nodes
- 99.9999% uptime
- VNF acceleration
- Service agility
Why Virtual CPE for Enterprises?

Revenue growth plus cost savings for service providers

USD 1.4 billion new revenue

- NPV = USD 1.1 billion
- ROI = 156%
- Payback period = 3.1 years
- 47% cost savings per site
Revenue Growth from Agile, On-Demand Services

- Managed network services for enterprises is already a lucrative market for service providers
  - ~$135B worldwide in 2016
  - MPLS, Ethernet, VPN, WAN Optimization, Security

- vCPE presents significant growth opportunity for first movers
  - Scalable, automated deployment of existing and new services
  - Self-provisioning by customers accelerates adoption cycle
  - ~5% annual revenue growth per site
New Revenue from Upsell and Cross-Sell of Services

- **Managed network services enabled by virtualization**
  - Dynamic VPN configuration
  - Dynamic WAN configuration
  - Self-service bandwidth-on-demand
  - Data center interconnect services
  - Security as a service (firewall, DDoS etc.)
  - WAN optimization
  - Web acceleration

- **On-demand provisioning is key**
  - Expectations set by portals from cloud service providers (Amazon, Google etc.)
  - Automated, scalable platforms
  - User-friendly dashboards
  - On-demand instantiation of CPE VNFs
40-50% Cost Savings from Migration to vCPE

- Replace expensive, dedicated physical appliances with standard servers
  - 42% savings in equipment CAPEX and OPEX

- Remove inefficiencies in manual equipment installation and service provisioning
  - 72% savings in “Order to Cash” (O2C)

- Eliminate most truck rolls and accelerate remote resolution of failures
  - 61% reduction in “Trouble to Resolve” (T2R) costs
SDN and NFV are Key Enablers for Cost Savings

- **Equipment CAPEX and OPEX savings driven by low-cost standard servers**
  - Efficient resource utilization thanks to virtualization
  - No stranded assets
  - Aggressive VNF pricing driven by competition

- **SDN and NFV drive efficiency in Order-to-Cash**
  - Accelerated, self-service provisioning of new services

- **CPE virtualization minimizes support costs**
  - Customer site repairs mostly eliminated
So.... vCPE is Top NFV Use Case for 2015-2016

<table>
<thead>
<tr>
<th>Rank</th>
<th>Use Case</th>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Business vE-CPE</td>
<td>91%</td>
<td>Tops for 2015–2016 and later; COLT, OBS, Telstra, AT&amp;T, BT, Telefónica</td>
</tr>
<tr>
<td>2</td>
<td>Service chaining</td>
<td>82%</td>
<td>Horizontal function supporting many use cases</td>
</tr>
<tr>
<td>3</td>
<td>vNPaaS</td>
<td>77%</td>
<td>Gives full control of a slice of network to customer</td>
</tr>
<tr>
<td>4</td>
<td>vPE</td>
<td>77%</td>
<td>vPE is provider edge software router</td>
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</tbody>
</table>

Source: IHS Infonetics, NFV Strategies: Global Service Provider Survey, March 2015; Respondents control 43% of global telecom capex
Four Challenges to Cost-Effective Business CPE

- Service reliability
- Service agility
- Virtualization overhead
- Server footprint
vBCPE Challenge #1: Service Reliability

- Enterprise customers expect high reliability from managed services
  - Whether provided by traditional appliances or delivered by virtual CPE software
  - Typical requirement is five-nines uptime (99.999%)

- Service downtime impacts service provider revenues
  - Service Level Agreement (SLA) penalties
  - plus operational expenses
  - plus customer churn

Virtualized CPE services need to maintain reliability of traditional physical implementations
IT Cloud Platforms Don’t Deliver Telco Reliability

<table>
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<tr>
<th>IT Platform Capability</th>
<th>Enterprise vCPE Requirements</th>
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<tr>
<td>Detection of failed VM</td>
<td>&gt; 1 minute</td>
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<tr>
<td>Detection of failed compute node</td>
<td>&gt; 1 minute</td>
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<tr>
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<td>Network link failure detection</td>
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<td>Live migration for DPDK-based VMs</td>
<td>No support</td>
</tr>
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Service Reliability Requirements Are Complex

VM lifecycle management, software updates, security and performance

- Enterprise vCPE requirements
  - Minimum, deterministic latency
  - High-performance switching
  - Carrier Grade storage
  - VM scale-up and scale-down
  - Telco-grade AAA security
  - Advanced software management
  - Live VM migration
  - Automatic failure detection and recovery

Advanced software management
One Solution that Meets All the Requirements

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<th>Enterprise vCPE Requirements</th>
<th>Titanium Server</th>
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<td>&lt; 1s</td>
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<td>Detection of failed compute node</td>
<td>&gt; 1 minute</td>
<td>~ 1s</td>
</tr>
<tr>
<td>Recovery from control node failure</td>
<td>No support</td>
<td>&lt; 25s</td>
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<tr>
<td>vSwitch performance</td>
<td>1-2 Gbps</td>
<td>Line rate with minimum core utilization</td>
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<tr>
<td>Network link failure detection</td>
<td>Depends on Linux distribution</td>
<td>50ms</td>
</tr>
<tr>
<td>Live migration for DPDK-based VMs</td>
<td>No support</td>
<td>Full support</td>
</tr>
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vBCPE Challenge #2: Service Agility

- OpenStack has no primitives to reconnect the firewall interface from the router to the WAN accelerator

- Only options are:
  - Either delete the firewall interface and reconnect, which may lead to ambiguity because firewall rules tied to specific virtual NIC
  - Or provision new service chain from scratch which causes outage of at least five minutes

Need a solution for reconfiguring service chains with minimal service downtime
Two Solutions for Service Chain Reconfiguration

Option 1:
- Orchestrate service chain update using OpenStack
- Accelerated by use of HEAT stack for each service

Option 2:
- Reconfigure vSwitch flows using SDN

Add a new service in seconds
- vs. weeks or months today
vBCPE Challenge #3: Virtualization Overhead

- **Multiple elements contribute to bottom-line cost-per-user**
  - Needs to be favorable vs. physical appliances
  - Goal is lower costs *plus* increased revenues

- **Virtualization overhead is a major factor**
  - Off-the-shelf virtual switches have very low performance vs. physical switches
  - Limits VNF performance
  - Causes inefficient resource utilization

Need to ensure that virtualization overhead is minimized

*CAPEX, OPEX, Order-to-Cash, Trouble-to-Resolve etc.*
High Performance vSwitching Drives OPEX Savings

- Example: Accelerated vSwitch integrated in Titanium Server
  - 40x performance of Open vSwitch (OVS)
  - Fully compatible with Open vSwitch: standard APIs

- Increased switching performance = greater VM density
  - Fewer cores required to run vSwitch
  - More cores available for VMs

Greater VM density ➔ reduced OPEX
- More users per server

Virtualization overhead is minimized

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Example use case: virtualized media gateway

System configuration:
- 28-core platform (dual socket) with one VM per core
- Bandwidth required: 3.5 Gbps per core (6.8 Mpps per core)

Most efficient implementation using Open vSwitch
- 23 cores required for switching, 1 core running VM, 4 unused

Most efficient implementation using Titanium Server
- 10 cores required for switching, 17 cores running VMs, 1 unused

17x improvement in VM density
vBCPE Challenge #4: Server Footprint

Especially critical issue for customer premise deployments

- **Need to deploy vBCPE on low-cost servers**
  - Customers won’t pay more for servers than for physical appliances
  - Solution price has to include VNFs and virtualization platform

- **Must ensure service reliability required by enterprises**
  - Minimum two servers for redundancy on hardware failures

- **Server utilization must be optimized**
  - Only compute nodes run the services that generate revenue
  - Control and storage nodes represent overhead costs
One Small-Footprint Solution: Titanium Server CPE

Complete, high-reliability vBCPE on just two servers

- **Compute, control and storage nodes instantiated on each server**
  - Only one processor core required for control and one for storage
  - Maximizes cores available for accelerated vSwitch and VMs: **revenue**

- **Ensures service uptime required by enterprises**
  - Six-nines infrastructure reliability enables five-nines services

- **Accelerated vSwitching maximizes number of users per server**

- **Validated, pre-integrated VNFs for complete vCPE solution**
Summary

Key challenges to cost-effective enterprise virtual CPE are all solvable

- Service reliability ✔
- Service agility ✔
- Virtualization overhead ✔
- Server footprint ✔

Business upside opportunity for service providers is significant and achievable
Please Come and See Our Complete vCPE Demo