Design for the RAS challenges of NFV

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NFV now is the mainstream in Telecom

Members from CT and IT are working together:

- **Carriers:**
  AT&T, Verizon, BT, FT, DT, Vodafone, Telefonica, TI, Century Link ……

- **CT Vendors:**
  Huawei, Ericsson, Alcatel-Lucent, NSN, NEC ……

- **IT Vendors:**
  HP, Intel, IBM, CISCO, Juniper ……

Decoupled HW/SW, COTS hardware, Virtualization, Openness, Portability / Interoperability, Elasticity / Scalability, Orchestration, Automation ……
Huawei is Working together with Industry to enable NFV

- Reliability & Availability working group is still a dedicated WG for phase 2
- Huawei actively engaged in and make key contributions.

Phase 1 ----2014 WGs

- Technical Steering Committee
  - Expert Group Performance & Portability
    - Francisco Javier Ramón Selguera (BT)
  - Expert Group Security
    - Bob Brassor (BT)

Phase 2 ----2015 WGs

- Re-organized

ETO ISG NFV
WG Structure and leadership as of 2015.02.26

- Chairman: Steven WRIGHT, AT&T
- Vice Chair: Bruno CHATRAS, Orange
- Vice Chair: Michael BRENNER, Clearpath
- Vice Chair: Maria-Pascale ODINI, NO
NFV Challenges for example......Far more about Function

1. Virtualization layer decouples HW/SW and breaks the traditional telecom HA design.

2. Less reliable COTS

3. New fault modes by the new virtualization layer.

4. Open Source: Bazaar vs. Cathedral, tough way to be carrier grade

5. Integration of HW/SW Components from different providers make fault localization more challengeable (Cross-layers/Nodes)

6. Some HA mechanisms might need to be re-architected because of the virtualization.
Challenges are Real!

- “715 hours of downtime across 51 major events in 2014” CloudEndure, 1/14/2015
- “Verizon upgrade triggers 40-hours cloud service outage” Fierce Telecom, 1/12/2015
- “Google Compute Engine, AOL Mail Suffer Early Morning Outages”, DataCenterKnowledge, 2/19/2015
- “Google suffers new cloud outage, promises to be “better prepared”” SiliconANGLE, 3/9/2015
- “£17m: Cost of Apple 12-hour cloud outage”, CloudHUB, 3/12/2015
- “JetBlue Computer Outage Causes Major Check-In Delays” NBC News, 3/30/2015

Data center outage: overall average cost of $505,502 per incident, more than $5,000 per minute, 2/1/2011, Ponemon Institute

Top ten cloud outages of 2013 accounted for a whopping revenue loss more than $31Million

The number of Cloud outages rise quickly with the growth of cloud services, CSA, 2013

<table>
<thead>
<tr>
<th>Provider</th>
<th>2014 Downtime(hrs/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon Web Service</td>
<td>2.41</td>
</tr>
<tr>
<td>Joyent</td>
<td>2.6</td>
</tr>
<tr>
<td>Google Cloud Platform</td>
<td>4.46</td>
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<tr>
<td>Rackspace Cloud</td>
<td>7.52</td>
</tr>
<tr>
<td>Microsoft Azure</td>
<td>39.77</td>
</tr>
</tbody>
</table>

Source: CloudHarmony

Ready for Mission Critical?

99.9%?

99.999%?
Build HA by Software?

40% because of software bugs, compared to 15% during 2012

Detail causes for mobile telephony (%)

- **System failures are the most common root cause:** Most major incidents were caused by "System failures" (61% of the incidents).
  - Looking more in detail at this root cause category, the most common detailed causes were "software bugs" and "hardware failures".
  - The assets most often affected were switches (e.g. mobile switching and routers) and base stations and controllers.
- **System failures affect the most user connections:** Incidents categorized with the root cause system failure, affected around **1.5 million user connections on average per incident**.
  - Looking more in detail, the detailed causes affecting most user connections were "software misconfiguration", "software bugs", and "power surges".
  - Software bugs were the cause affecting most user connections (more than 2.4 million connections on average per incident) followed by power surges and bad maintenance with 2 million and 1.2 million affected connections respectively.

Source: 《Annual Incident Reports 2013》，ENISA，2014.09
Our Practice for new RAS challenges

Some of our Design Practice for the new challenges:

- **FC-DFR** ----- Feature Centered DFR
- **DMFA** --------- Data Mining Failure Analysis
- **SDA** --------- Software Defined Availability
- **DFD** --------- Design for Durability, from Availability to Durability

……
New Way for New Challenges——DMFA

Predictive/Proactive-----Silent Failure / Missed Probes, Degradation Failure, False Alarm
New Way for New Challenges——SDA

- **Service Differentiation** does exist
- **Customer Req. differentiation** does exist
- **Resource Differentiation** does exist  （HW 10X better than AVG.）
- **Network condition** dynamically changes and NFV makes it more frequently

[Req.4.2.8] NFV frameworks shall ensure that not all services need to be "built to the peak", but Service Level Agreements (SLAs) can be defined and applied according to given resiliency classes.

Service Availability will be defined on a service basis, but a single service may have different levels of Service Availability (different sets of parameter thresholds). For example, in a large-scale disaster situation, the network operator may decide to prioritize the voice call service over on-line gaming by shifting all the resources available to the voice call service, in which case, the Service Availability for the on-line gaming will be different than that in the normal situation.

Source:  ETSI GS NFV REL001
New Way for New Challenges——DFD

- Data Loss could be a more serious issue -------- Data Durability!
- 0.07% of the volumes lost permanently during one Amazon outage in 2011.
- My Case

Source: EMC Globe data protection index, 2014.12
All-IP drives the telecom industry in past 10 years and take years for IP’s from IT to Telecom.

To meet with carrier grade, fault detection and Failover technologies should be improved for Telecom application:

- **BFD**，enhance OAM, etc.: faster fault detecting, less than 50ms (Vs. seconds before)
- **E-VRRP**，IGP FC, MPLS FRR etc.: faster failover, in hundreds microseconds (Vs. seconds before)

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- NFV is irresistible, and Carrier-Grade is Must-have but Harder
- Learn from lessons and make it happen ASAP!

All-IP from IT to Telecom
Virtualization/cloud from IT to Telecom

Huawei’s Best Practice of Telecom RAS Design + Lessons from history and IT → Carrier Grade NFV ASAP!
Thank you

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