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  ✓ **DO** clearly identify the positive purpose of each project and follow it
  ✓ **DO** consult with legal in areas where you are unsure
  ✗ **DON’T** enter into agreements that restrict other parties’ actions or creates barriers to market entry
  ✗ **DON’T** discuss or exchange information on pricing, business plans, or any other confidential or commercially sensitive data
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Common NFVI Telco Taskforce

RM Core Deep Dive
Mark Shostak, Kelvin Edmison
January 16, 2020
RM Core Deep Dive Topics

- CNTT Target Workloads
- Non-Conforming Technology Proposal
- VNF Profile Generations and Evolution
- H/W Profiles and Performance
- H/W Selection Guidelines
CNTT Target Workloads

› Target workload classes for CNTT NFVI
› Priority of workload classes
› Relevance to & alignment with Public Cloud
Non-Conforming Technology Proposal (Petar Torre)
Decoupling applications from Infrastructure and PaaS, other application components, and application management/control

Telco (on-prem) Cloud:

<table>
<thead>
<tr>
<th>App control</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>App resilient decomposed functionality</td>
<td>3</td>
</tr>
<tr>
<td>SW Platform</td>
<td>2</td>
</tr>
<tr>
<td>HW</td>
<td>1</td>
</tr>
</tbody>
</table>

Service agility and easier operations will depend on levels of Decoupling between application and:
1. Infrastructure
2. Platform as a Service
3. Application Resiliency
4. Other app functionality (decomposition, manageability)
Non-Conforming Framework

Handling technology that pierces the virtualization abstraction (e.g. SR-IOV, GPUs, FPGAs, SmartNICs), s/w and other areas

- Decouple offending component from aggregate feature. Ex.:
  - Feature: SR-IOV
  - Dependent on: PCI-PassThrough/Direct Assignment
  - Issue: Requires h/w-specific code in workloads
  - Issue impact: Violates CNTT principle; Requires VNF customization; Restricts portability

Policy identifies

- Steps to mitigate/resolve, timeline to resolve, treatment by RC, etc.
- Template format to ensure consistency across policies
VNF Profile Generations

› Drivers:
  › Generations in host hardware
    › Micro-architecture as ABI
    › ABI changes in new micro-architectures trigger need for specification of a per profile generation that can trace changes in ABI
  › Technology exceptions
    › NFVI need to simultaneously support VNFs that have migrated away from technology exceptions, and those that have not yet done so
VNF Profile Generations: Technology Deprecation straw-man

› Scenario: Profile B1 contains a permitted exception

› RM 3.0 puts a usage note on the technology.
› RM 4.0 introduces the alternative technology and marks the use of B1 with a stronger deprecation warning.
› RM 5.0 removes support for that profile, and VNFs will fail validation if they use it.
### VNF Profile Generations: Profile template straw-man proposal

#### Profile Attributes

<table>
<thead>
<tr>
<th>Profile Name</th>
<th>B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile Family</td>
<td>Basic</td>
</tr>
<tr>
<td>CPU Micro-architecture</td>
<td>Haswell/Broadwell</td>
</tr>
<tr>
<td>CPU Speed</td>
<td>2.2/2.1 GHz</td>
</tr>
<tr>
<td>Overbooked</td>
<td>N</td>
</tr>
</tbody>
</table>

#### Profile Name

<table>
<thead>
<tr>
<th>Profile Name</th>
<th>vCPUs</th>
<th>RAM</th>
<th>Disk</th>
</tr>
</thead>
<tbody>
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<tr>
<td>B1.small</td>
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<td>20</td>
</tr>
<tr>
<td>B1.medium</td>
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<td>4</td>
<td>40</td>
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<tr>
<td>B1.large</td>
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<td>80</td>
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<tr>
<td>B1.2xlarge</td>
<td>8</td>
<td>16</td>
<td>160</td>
</tr>
<tr>
<td>B1.4xlarge</td>
<td>16</td>
<td>32</td>
<td>320</td>
</tr>
</tbody>
</table>

#### Permitted Exceptions

| SR-IOV |

Note: Actual values are not being proposed; only examples of how attributes relate with subsequent generation of profile.
## VNF Profile Generations: Profile template straw-man proposal

### Profile Attributes

<table>
<thead>
<tr>
<th>Profile Name</th>
<th>vCPUs</th>
<th>RAM</th>
<th>Disk</th>
</tr>
</thead>
<tbody>
<tr>
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<td>B2.small</td>
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<td>20</td>
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<td>320</td>
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</tbody>
</table>

### Profile Attributes

<table>
<thead>
<tr>
<th>Profile Attributes</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile Name</td>
<td>B2</td>
</tr>
<tr>
<td>Profile Family</td>
<td>Basic</td>
</tr>
<tr>
<td>CPU Micro-architecture</td>
<td>Cascade Lake</td>
</tr>
<tr>
<td>CPU Speed</td>
<td>2.1 GHz</td>
</tr>
<tr>
<td>Overbooked</td>
<td>N</td>
</tr>
</tbody>
</table>

### Permitted Exceptions

<table>
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</thead>
</table>

Note: Actual values are not being proposed; only examples of how attributes relate with previous generation of profile.
H/W Profiles and Performance

Problem Statement:

*Need to be able to assure reasonable level of deterministic performance*

- Question: To what level of granularity should CNTT specify h/w
- Objectives and drivers for specifying h/w config
- Question: Can you combine normalized performance coefficients w/ high-level h/w specification to address problem?
H/W Profiles and Performance

 › CNTT documents strive for abstraction of hardware from VNF workloads

 › However…CPU microarchitectures periodically add new instructions & features that are not supported on previous versions
   › Correctness impact as well as performance impact
   › How to balance this with CNTT abstraction goals?
H/W Profiles and Performance: comparing architectures

› Following slide is from Intel’s forecast on Goldmont Plus & Tremont performance comparison
› Both are x86 Low Power processor (think Atom)
  › Comparison is informative only
  › Wide range of performance gain based on test type
Some tests show ~10% lift, and some show ~80% lift.

H/W Profiles and Performance: calls for way forward

› Can you combine normalized performance coefficients w/ high-level h/w specification to address problem?
› Is anyone aware of a better way?
Guidelines in host hardware selection: Straw-man proposal

› Intent is to create expectation that VNF workload on profile generation n-1 will work correctly, and perform with similar or better speed, on the next generation.

› Guidelines for selecting computes to match flavours
  › Select desired micro-architecture (e.g. Haswell), + system features (e.g. SmartNICs)
  › Select memory based on optimal memory controller performance
  › Select CPU model based on
    › desired # of cores to RAM ratio
    › Clockspeed + IPC gain equivalent to, or better than, previous generation
  › If present, select local disk options to provide sufficient storage for cores-to-disk ratio
  › For indivisible units (e.g GPUs, smartNICs, determine how many per host can be supported, and assign per flavour?)
Why introduce memory into the selection so early?

› Lenovo paper on memory fill rules [https://lenovopress.com/lp0742.pdf](https://lenovopress.com/lp0742.pdf)
  › Measures performance when under-filling or unbalancing DIMM slots
  › Sample findings for 2P system (12 DIMM slots)
    › Using just 8 slots in balanced mode results in 68% memory throughput
    › Using just 8 slots in unbalanced mode results in 34% memory throughput

› Potential for memory-induced performance problems, or over-provisioning on memory, if memory is not considered early in cpu/memory specification