Paper Review: Applying NFV and SDN to LTE Mobile Core Gateways; The Functions Placement Problem

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Problems in NFV and SDN implementation

- *Increase in network load*  
  - traffic needs to be offloaded to a datacenter

- *Increase in data-plane delay*  
  - Virtualization adds to delay
Goals

- VNF placement while minimizing network load (also SDN control overhead)

- The constraints:
  - Data-plane delay
  - Number of potential data centers
Virtualized (V) or Decomposed (D) VNFs

- LTE mobile core functions which involve both control and data-plane functions:
  - SGW – Serving Gateway
  - PGW – Packet Gateway

- Control-plane functions (LTE signaling/resource allocation)

- Data-plane functions (GTP Tunneling in PGW)
Figure 1: Mobile core gateways re-design
# Mean Packet Processing Delay

<table>
<thead>
<tr>
<th>no. of Tunnels</th>
<th>10</th>
<th>100</th>
<th>1 K</th>
<th>10 K</th>
</tr>
</thead>
<tbody>
<tr>
<td>bits/sec</td>
<td>1 M</td>
<td>10 M</td>
<td>100 M</td>
<td>1 G</td>
</tr>
<tr>
<td>packets/sec</td>
<td>83</td>
<td>830</td>
<td>8.3 K</td>
<td>83 K</td>
</tr>
<tr>
<td>Virtualized GW $T_{proc}$</td>
<td>62 $\mu$s</td>
<td>83 $\mu$s</td>
<td>109 $\mu$s</td>
<td>132 $\mu$s</td>
</tr>
<tr>
<td>Decomposed GW $T_{proc}$</td>
<td>15 $\mu$s</td>
<td>15 $\mu$s</td>
<td>15 $\mu$s</td>
<td>15 $\mu$s</td>
</tr>
</tbody>
</table>
Figure 2: Alternative paths for data-plane demand between SGW and PGW, demand volume = T
Presumed Core Gateways (Topology)

Figure 3: Presumed core gateways topology based on LTE coverage map in [15]
Results

Figure 4: Datacenters location at K = 4, 3, 2, 1
Continued...

Figure 5: Functions placement at 3 datacenters with SDN control of 10% under 5.3 ms delay budget
Delay Budget – 5.3 ms
Delay Budget – 10 ms