Elastic Scaling in an NFV-based Evolved Packet Core

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Outline

1. Motivating scenario

5th Generation mobile networks
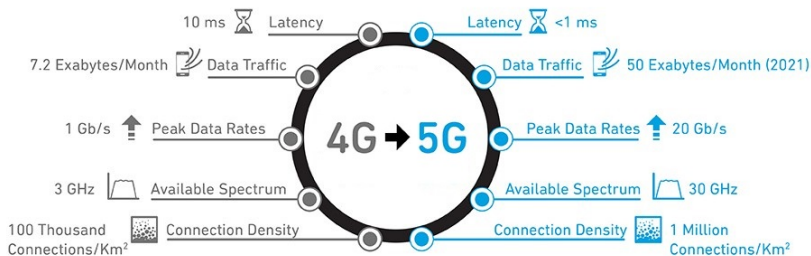

Figure 1: 5G requirements

5th Generation mobile networks
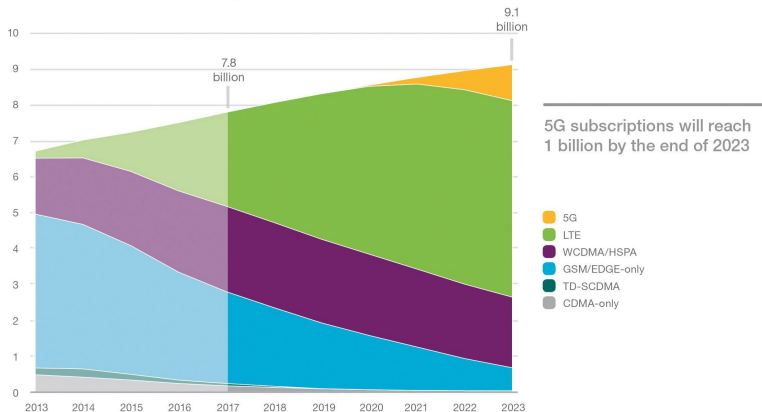

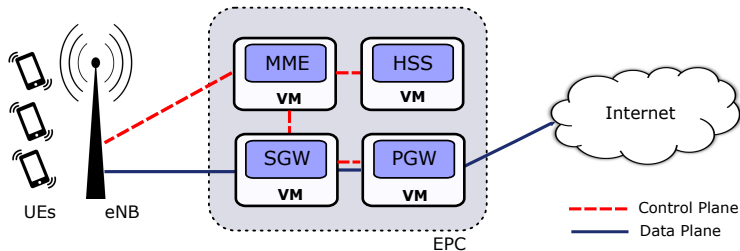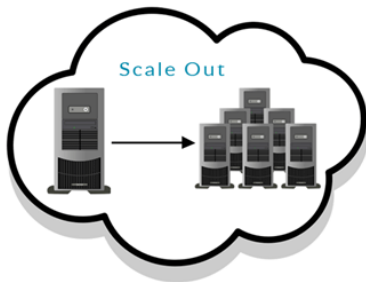Figure 2: 5G subscriptions

Virtual Evolved Packet Core (vEPC)

Figure 3: vEPC

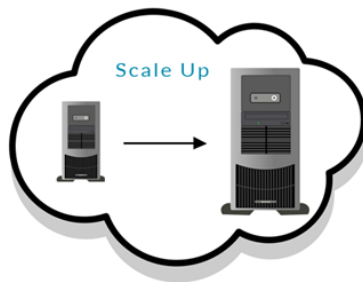**Elastic scalability**

Horizontal scaling   Vertical scaling

Figure 4: Scale out and scale up

Elastic scaling mechanism
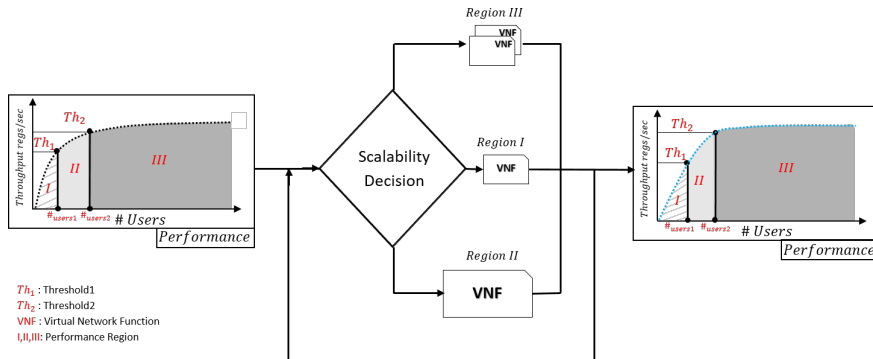

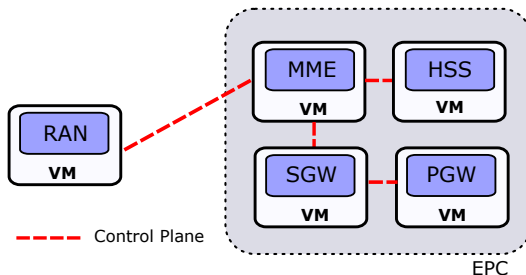Figure 5: Elastic scaling mechanism

Baseline vEPC architecture

Figure 6: Baseline architecture

3. Our solution

Baseline vEPC specification

ENTITY	HARDWARE RESOURCES		
	RAM	**CPUs**	**STORAGE**
RAN	4 GB	4	10 GB
MME	1 GB	1	10 GB
HSS	2 GB	1	10 GB
SGW	1 GB	1	10 GB
PGW	1 GB	1	10 GB

Table 1: Individual component specification
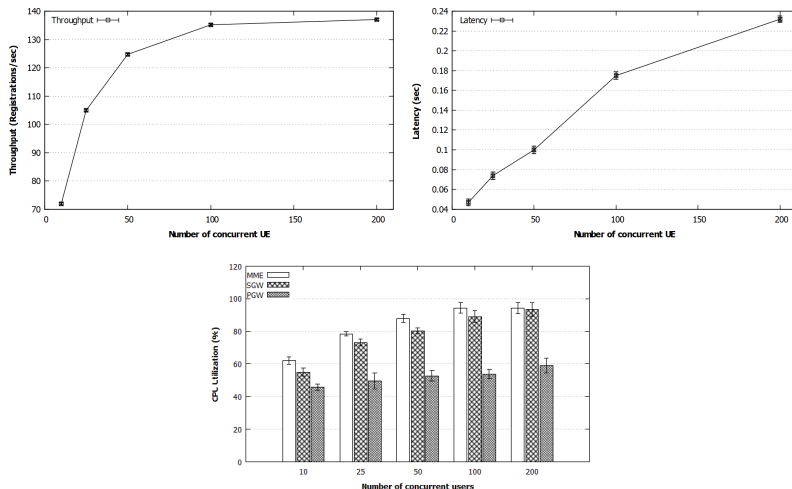
Figure 7: Baseline evaluation

Vertical scaling

ENTITY	configuration 1		configuration 2		configuration 3		configuration 4	
	RAM	CPU	RAM	CPU	RAM	CPU	RAM	CPU
MME	1	2	1	1	1	2	1	3
SGW	1	1	1	2	1	2	1	3
PGW	1	1	1	1	1	1	1	1

Table 2: Individual component specification
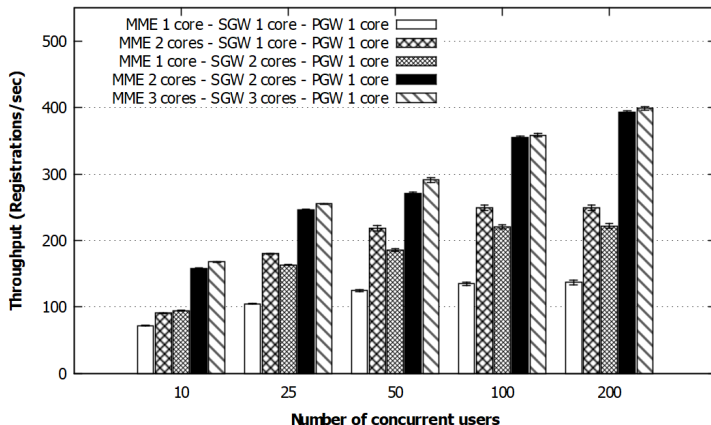
Vertical scaling
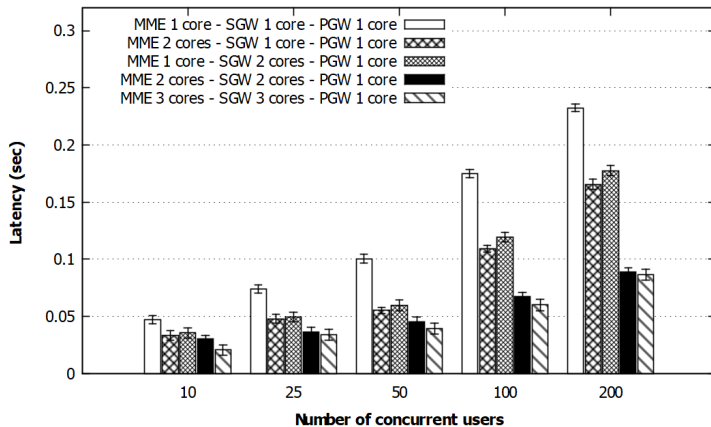
Vertical scaling

Figure 9: Latency

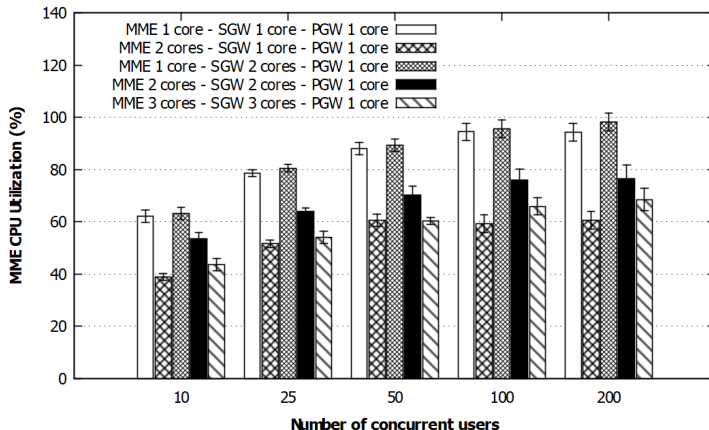
3. Our solution

Vertical scaling

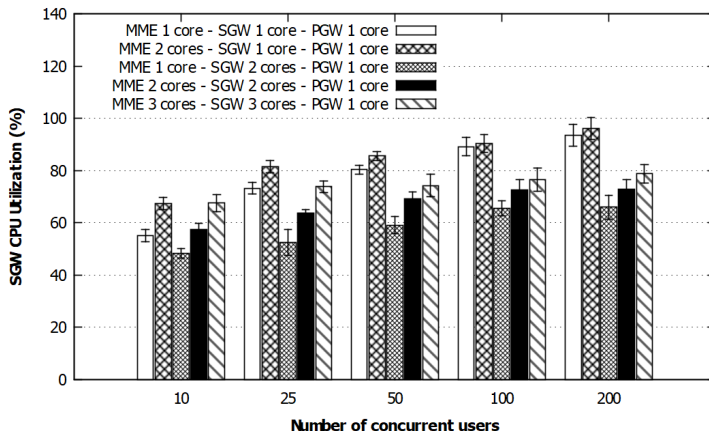
Figure 10: MME CPU utilization

Vertical scaling

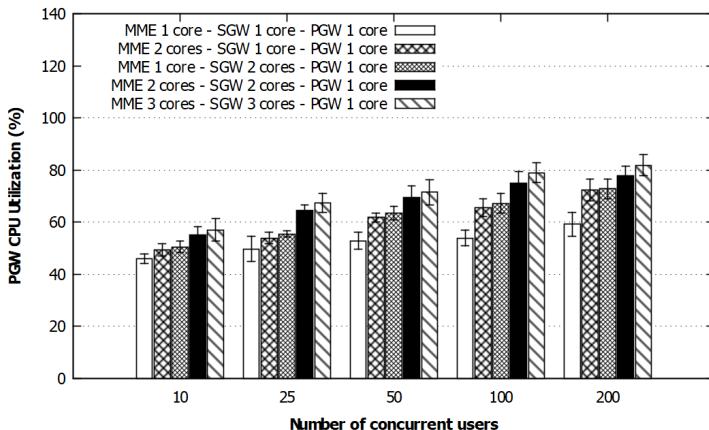Figure 11: SGW CPU utilization

3. Our solution

Vertical scaling
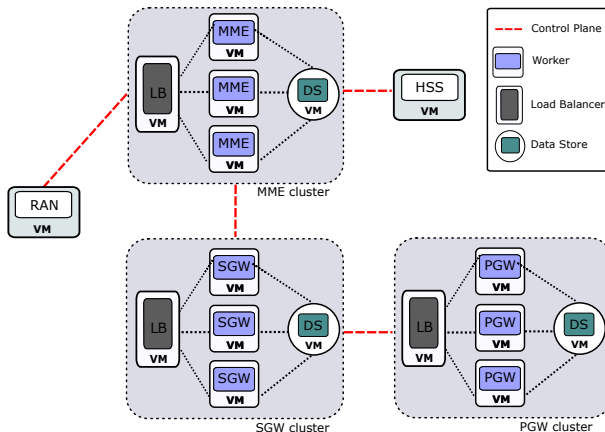

Figure 12: PGW CPU utilization

Horizontal scaling

Figure 13: Horizontal scaling architecture

Horizontal scaling

ENTITY	HARDWARE RESOURCES		
	RAM	CPUs	STORAGE
RAN	4 GB	4	10 GB
MME	1 GB	1	10 GB
HSS	2 GB	1	10 GB
SGW	1 GB	1	10 GB
PGW	1 GB	1	10 GB
LOAD BALANCER	2 GB	1	10 GB
DATA STORE	2 GB	2	15 GB

Table 3: Individual component specification

Horizontal scaling

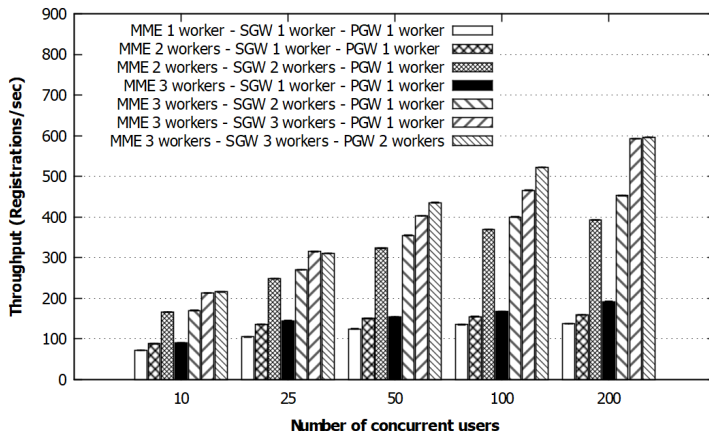Figure 14: Throughput

Horizontal scaling
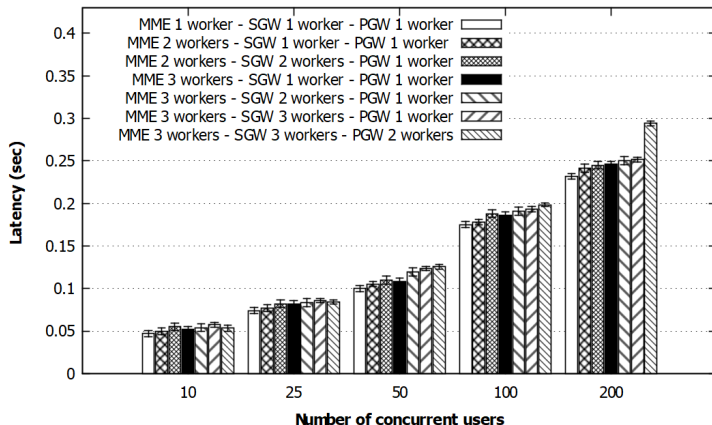
Figure 15: Latency

3. Our solution

Elastic scaling mechanism

Type of scaling	Number of concurrent users		
	50 users	100 users	150 users
Baseline	90.47%	98.54%	99.82%
Vertical	68.85%	90.30 %	96.17%
Horizontal	68.25%	78.5%	87.99%

Table 4: Elastic scaling mechanism

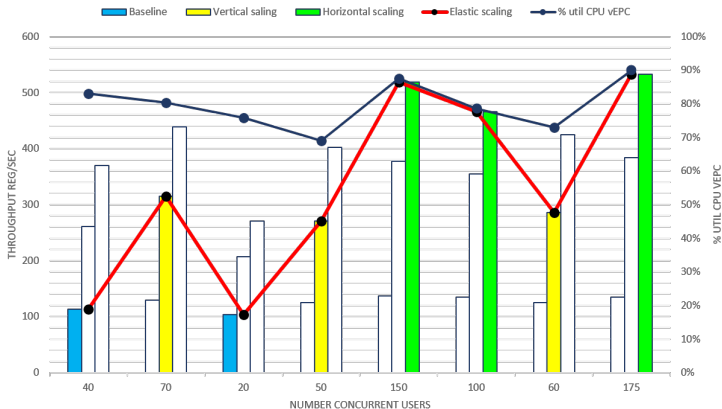**Elastic scaling mechanism**

Figure 16: Elastic scaling mechanism

4. Conclusions

- Analyzing the behavior of individual vEPC entities allowed us to make proper use of resources by scaling only those entities that need to be scaled

- The analysis of vEPC performance for control traffic should not focus only on MME

- Performing an elastic scaling mechanism requires an performance analysis of the baseline, the types of scaling (*i.e.,* horizontal and vertical) and when it is required

- Ensuring a high vEPC performance through an elastic scalability mechanism requires the definition of decision parameters based on target performance metrics

Thank You