MOSAICO

Multi-layer Orchestration for Secured and low lAtency applICatiOns

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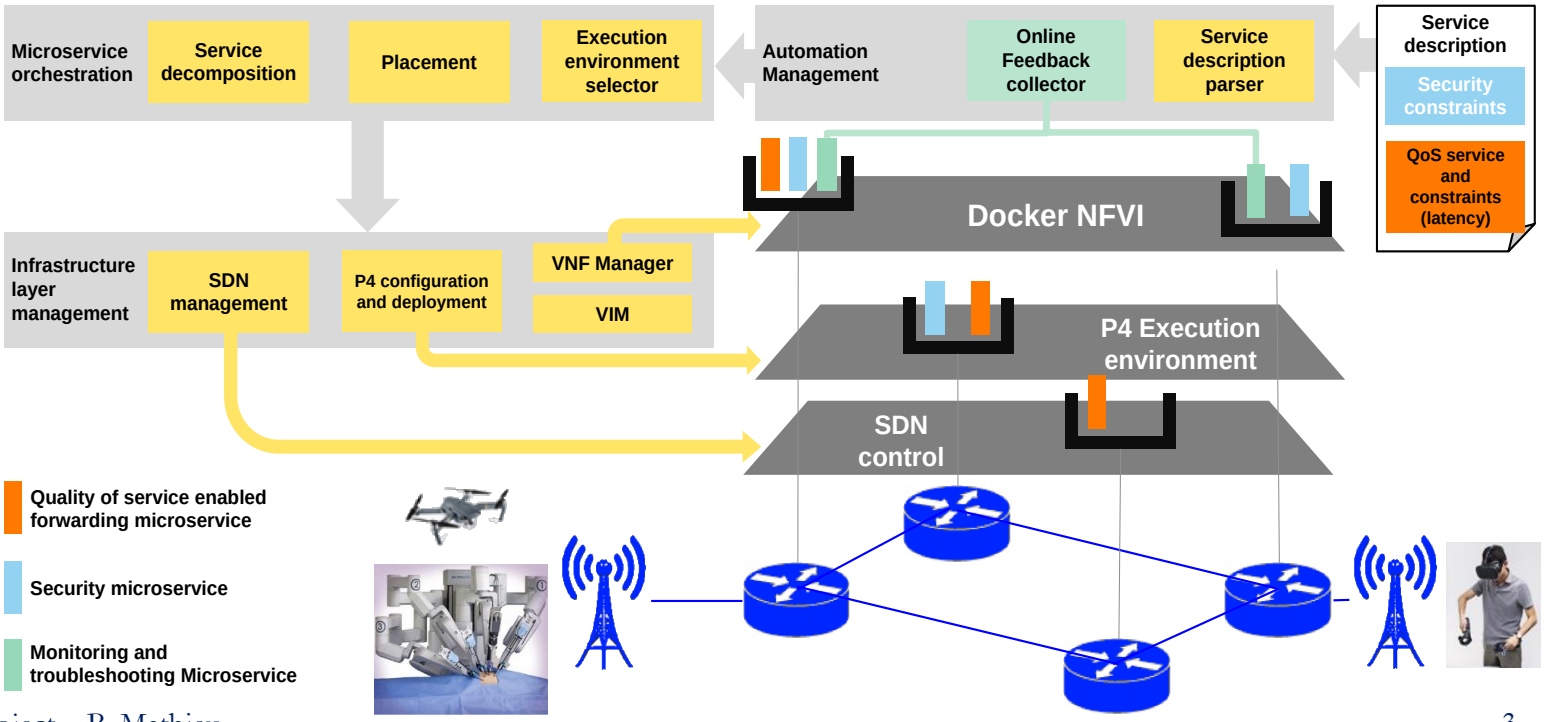
Context and problem statement

- Emergence of services with very strong constraints
  - Latency cannot exceed a few milliseconds
  - End-to-end security should be preserved
- Programmability has become increasingly important in network architectures
  - NFV, OpenFlow, P4
  - Each one exhibits advantages and limitations related its environment : execution time, resource consumption, protocol stack layer, ease of deployment, configuration, migration, etc.
- Networking functions composed of micro-services at control-plane and data-plane

=> Need for a multi-level and multi-technology orchestration of high-performance micro-services

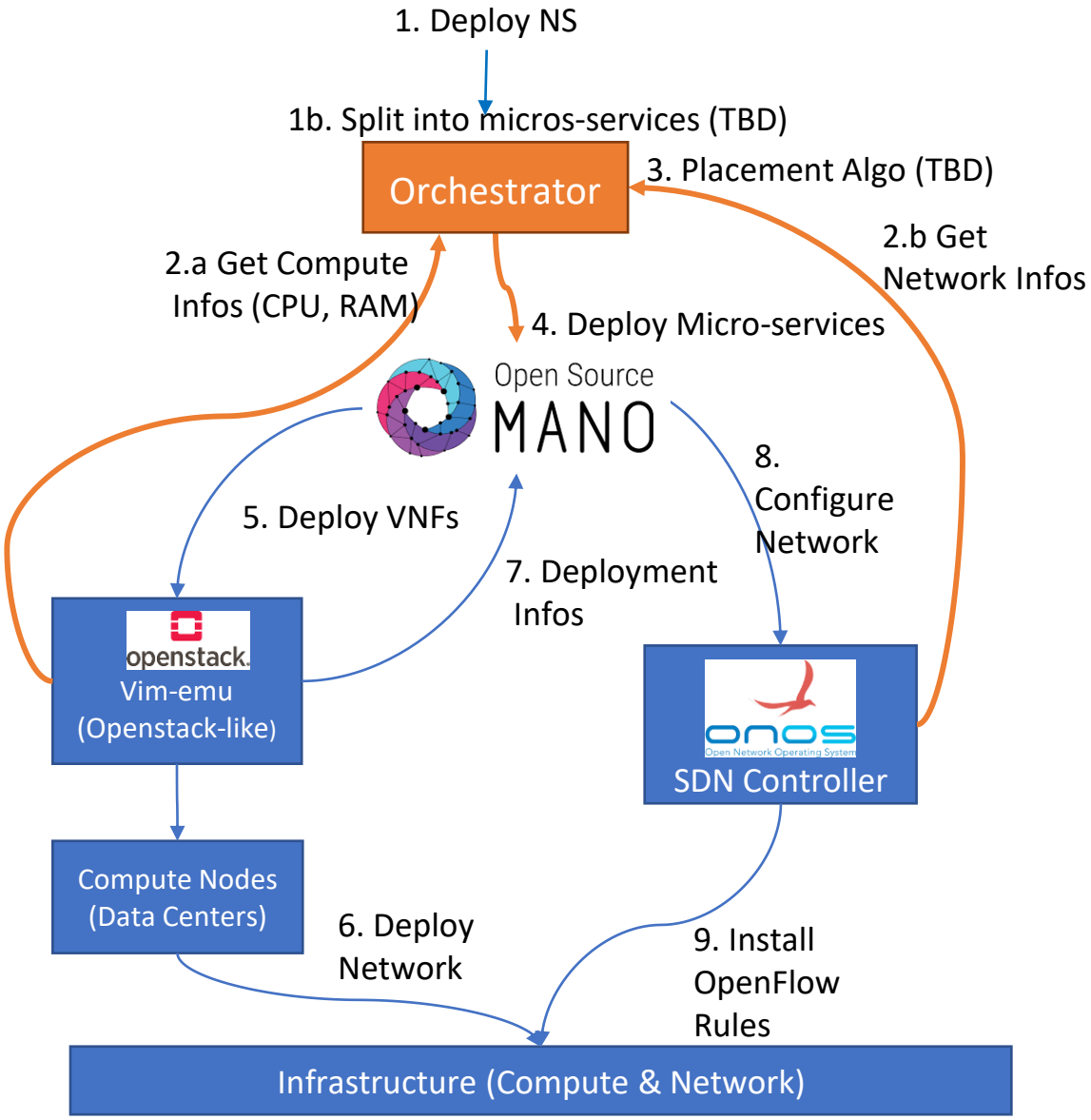
Objectives of MOSAICO

- Identify network functions to convert a monolithic low-latency secure application into micro-services
- Define orchestration solutions enabling the choreography of micro-services, deployed over heterogeneous technologies
- Select the optimal placement of micro-services to guarantee security, performance and troubleshooting objectives.



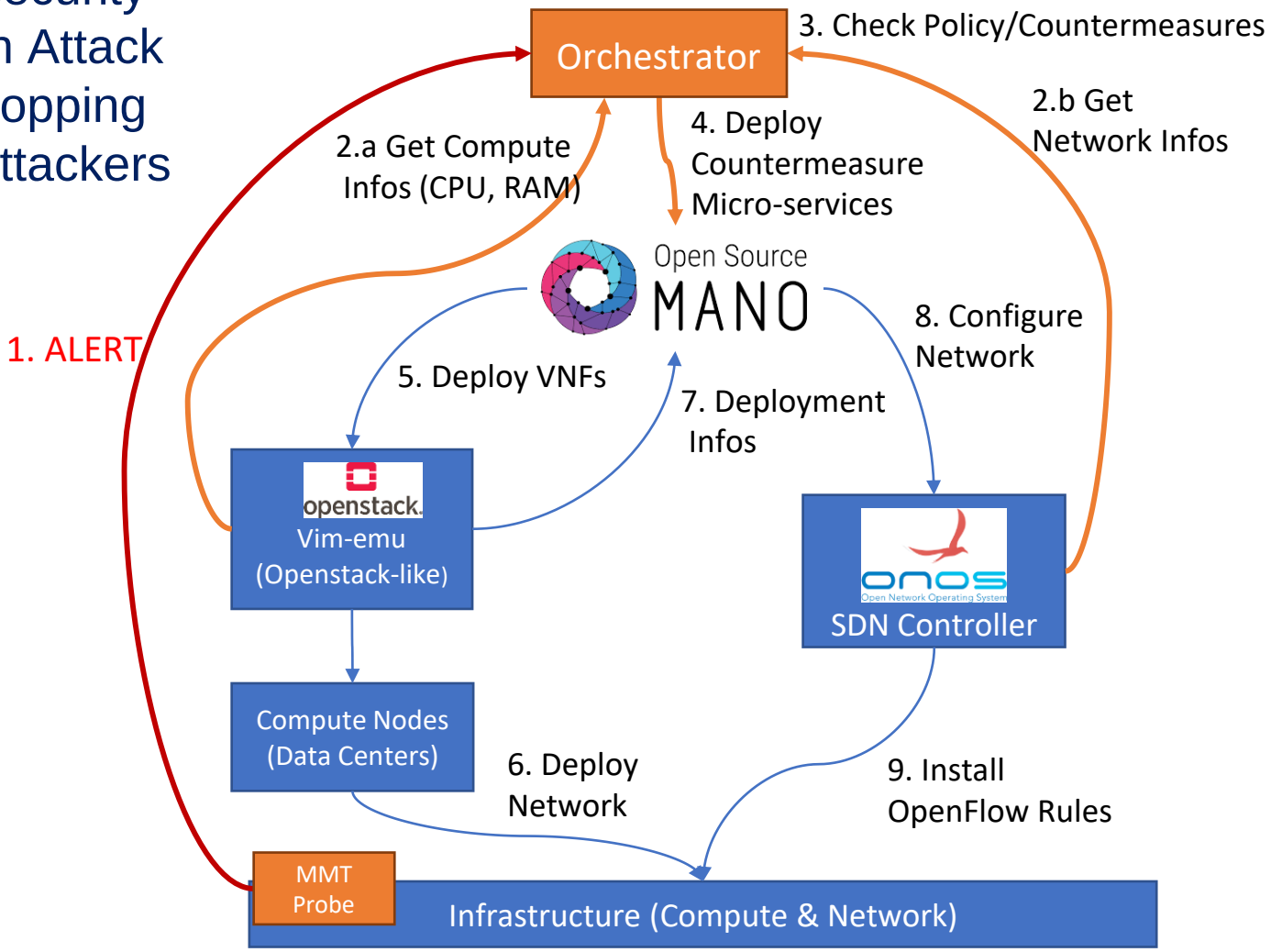
Preliminary version of Orchestrator (1/2)

- Example of Deployment scenario
- For deploying VNFs (later P4 programs to be added)
- Currently relying on OpenMano, OpenStack, Onos



Preliminary version of Orchestrator (2/2)

- Example of a security VNF: Mitigation Attack scenario, by dropping packets from attackers



P4 micro-services : Example of a QoS module

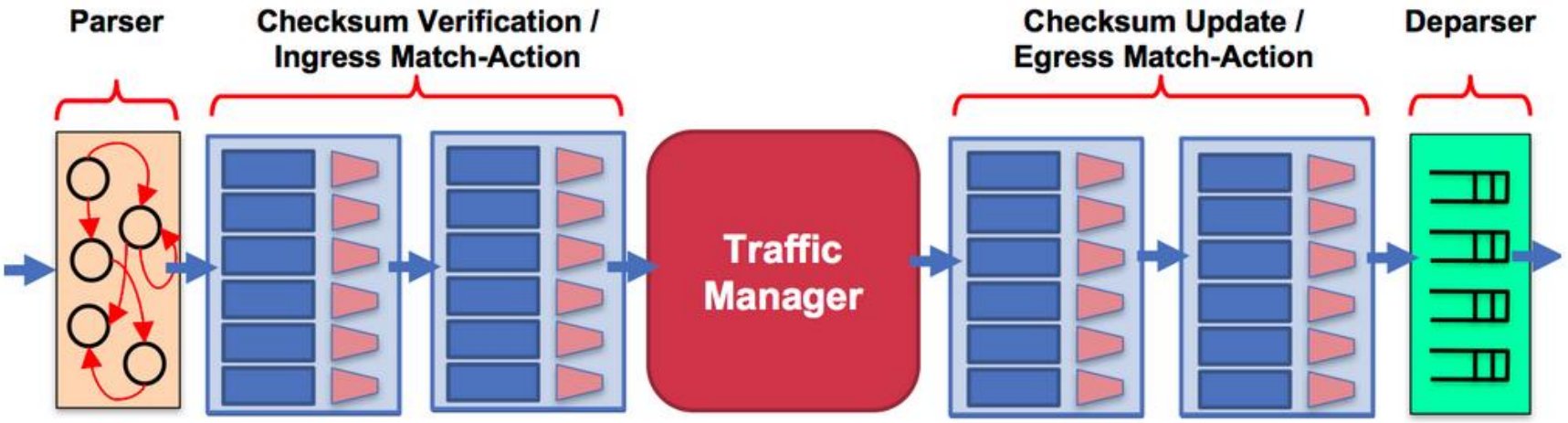
- End-to-end latency can be addressed at different locations: endpoints (soft & hard), network physical capacity, network equipment

- We propose a queueing and forwarding system :
  - deployed in network equipment
  - for transmitting LL packets in a short time, as expected by the services
  - while not starving other traffic
  - following IETF L4S (Low Latency, Low Loss, Scalable Throughput Internet Service) proposal

- We propose to rely on a programmable network approach :
  - the P4 framework to deploy and dynamically configure the network equipment for packet processing

P4 : Brief concepts

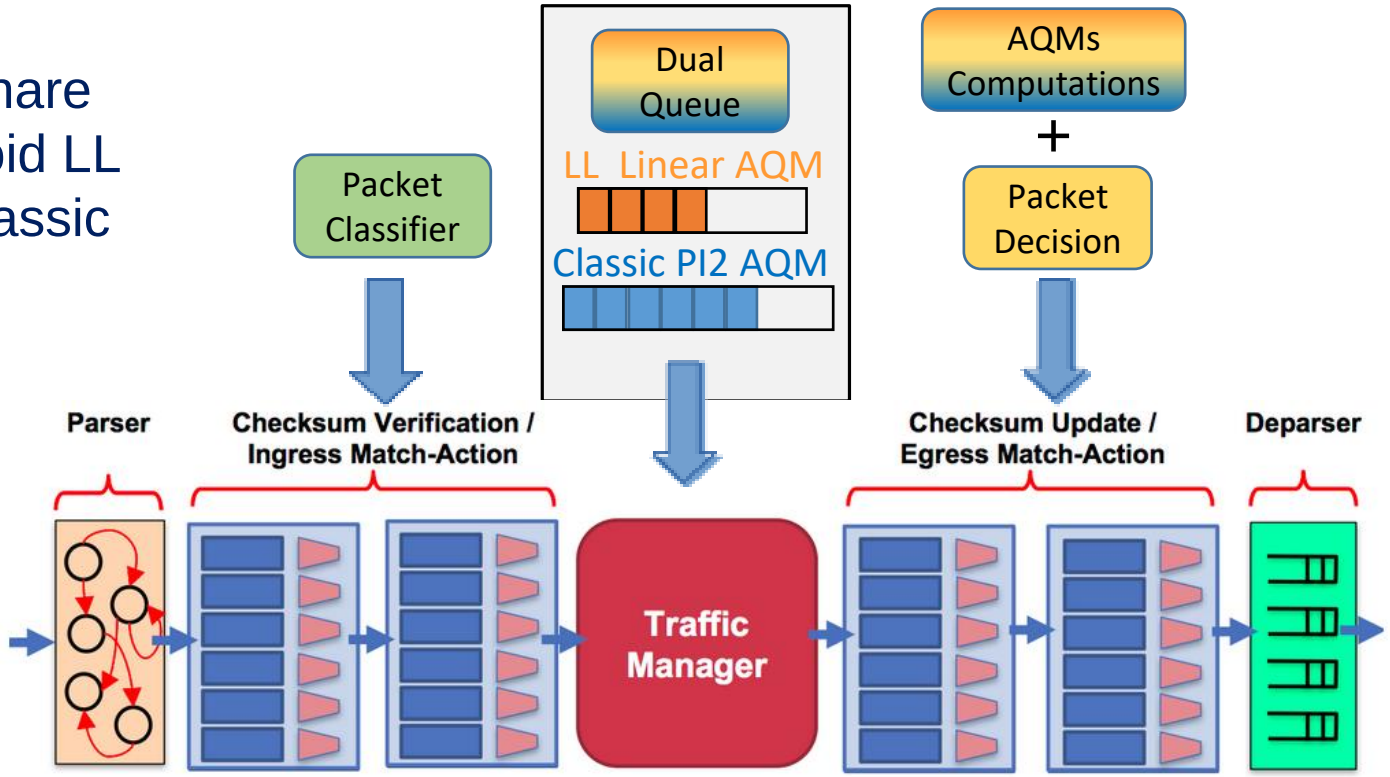
- Open-source Consortium (p4.org)
- Data Plane Programmability
- Based on match-action tables, configurable by interfaces (controllers)
- Parsing of packet information
- A basic software switch provided by P4 (BMv2)



P4-based L4S instanciation

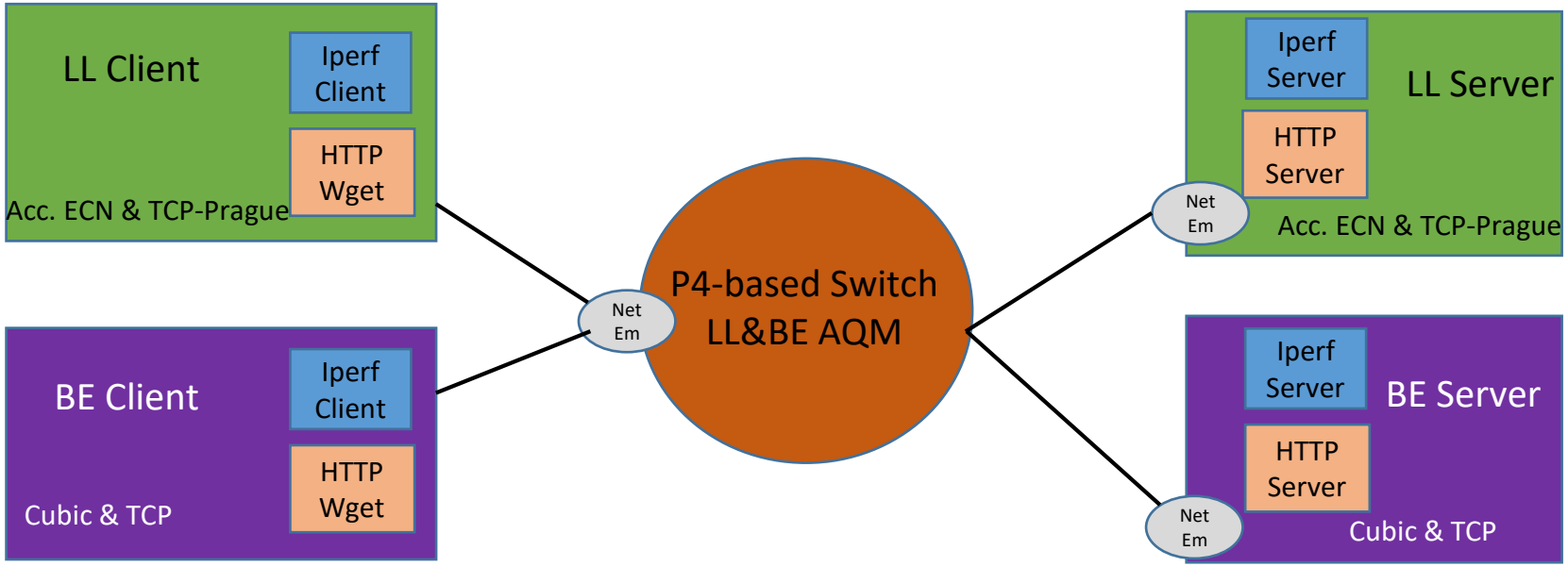
- Traffic separation (Low Latency, Classic) based on ECN bits in the Ingress
- A dual-coupled AQM in the Traffic Manager : for LL (linear AQM), for Classic (PI2 AQM), with 2 latency targets
- AQM computations (probability to forward/mark/drop packet) & Decision in the Egress

- Goal to equally share bandwidth, to avoid LL traffic to starve classic traffic



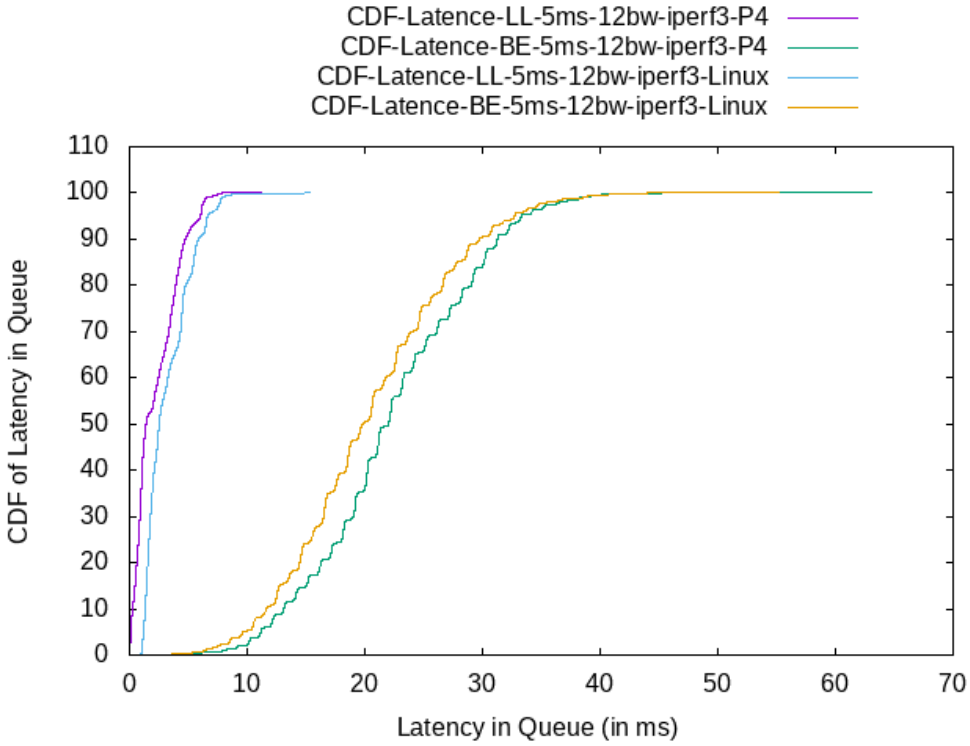
Evaluation : Testbed

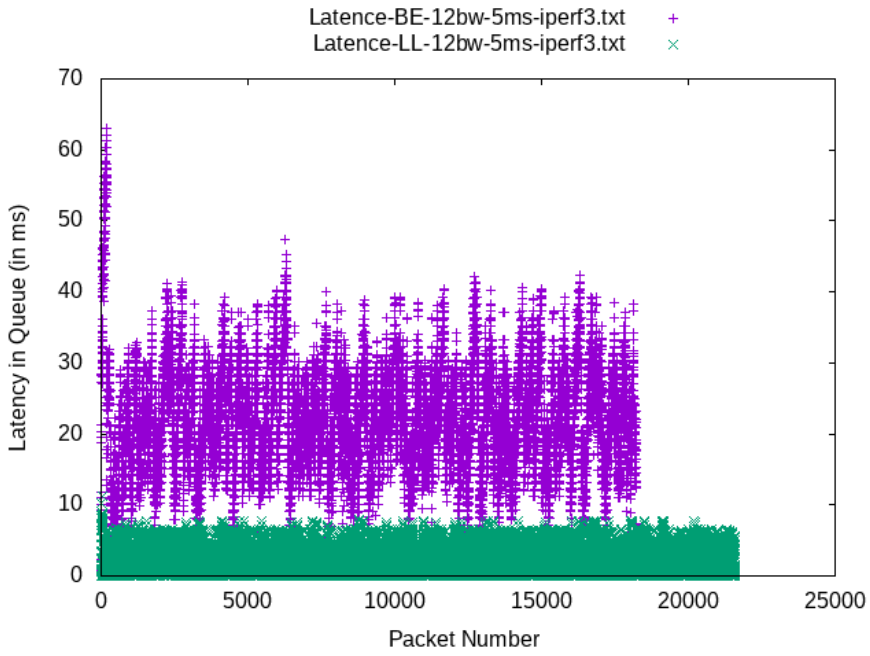
- Virtual machines (KVM/QEMU) for clients/servers
- Linux-based BMv2 modified P4 L4S Switch
- 1 “classic” connection, 1 LL TCP-Prague connection (with Accurate ECN) NetEm to introduce link delay
- 2 types of traffic : web (HTTP) or simulated traffic (Iperf)
- 5 measured information : queue delay, queue occupancy, number of marked/dropped packets, throughput



Evaluation : Results (1/2)

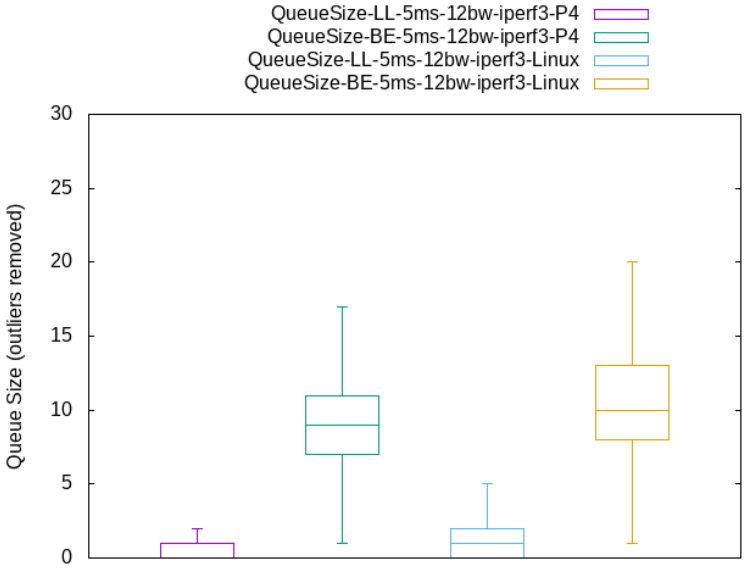
- LL (Accurate ECN) packets in L4S queue spent short time (as expected) and quite stable.
- Classic packets in Classic queue spent more time, more variable along time



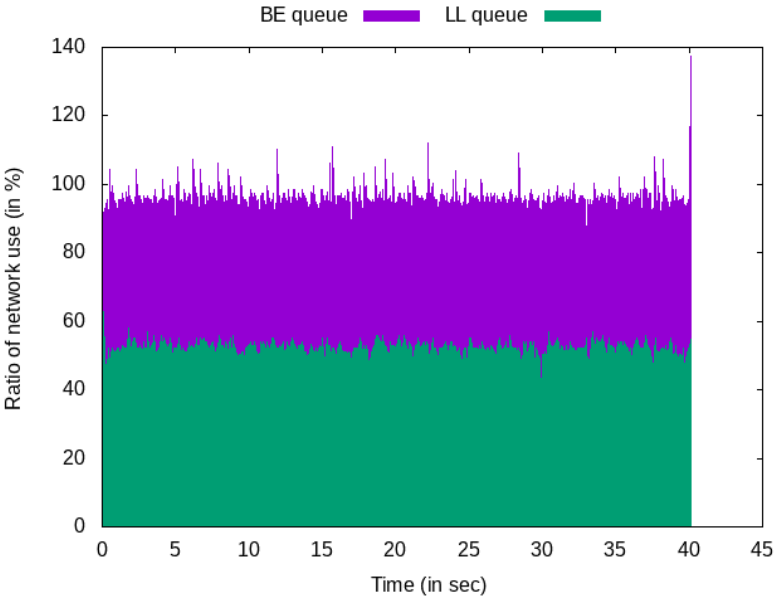


Evaluation : Results (2/2)

- Queue size in LL queue very small and stable (in this config, LL delay 5ms, BW : 12 Mbit => 1 or 2 packets max)
- Higher queue size in Classic queue (less constrained delay) and more variable.

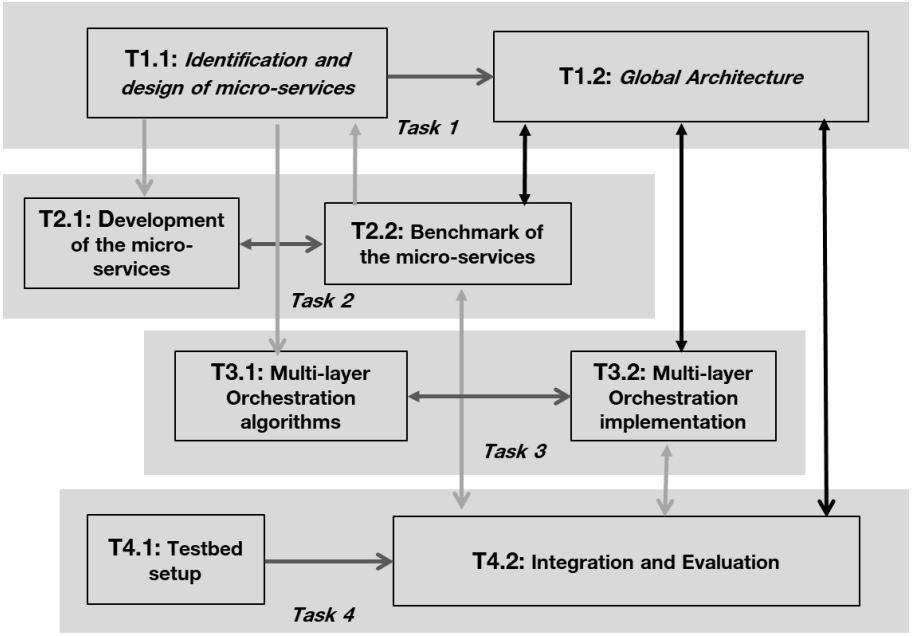


- Outgoing throughput almost equally shared when 2 traffic to be forwarded



Conclusion

- Ongoing works of the MOSAICO project
- First version of a global orchestrator, integrating existing open sources solution (OpenMano, Onos, etc.)
- First VNF for security attack mitigation
- First implemented P4 module for QoS



- Future work to include P4 deployment into the global orchestrator
- Define a common interface for deploying VNFs and P4 programs

- MOSAICO Website : www.mosaico-project.org

Questions

Q & A