Interworking of NFV/SDN with QoE Monitoring in Mobile Networks

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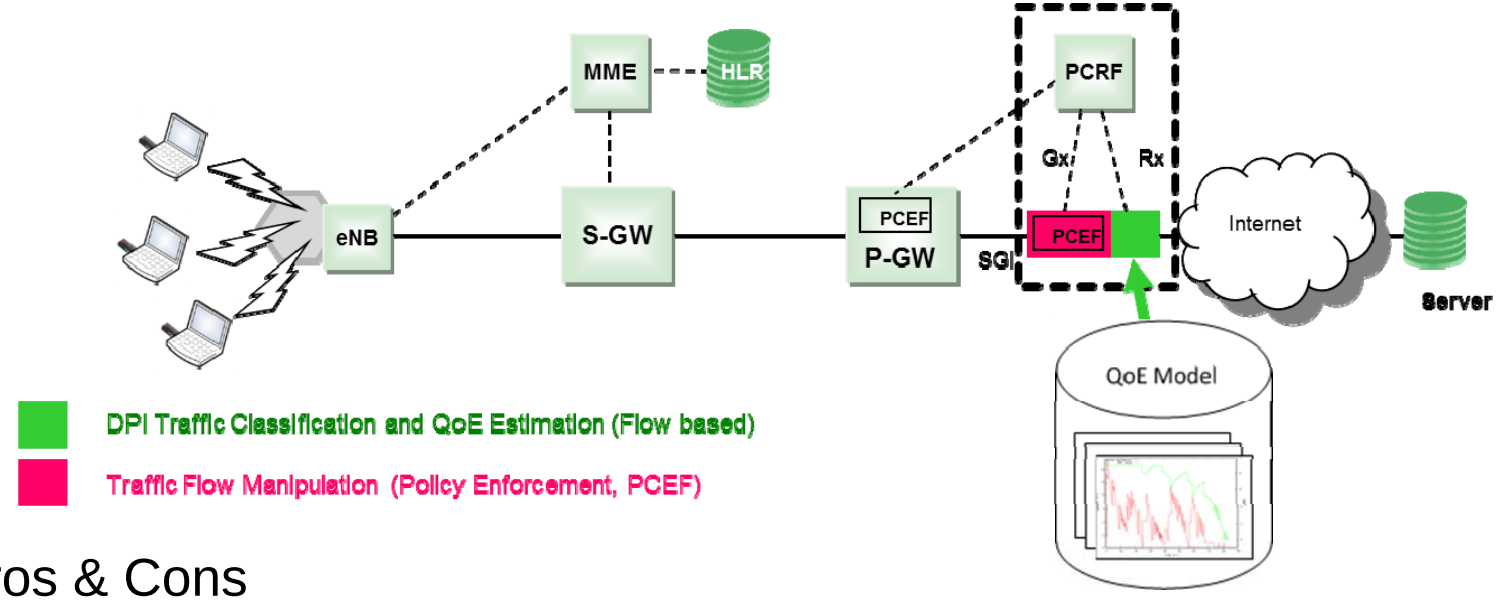
Introduction - QoE Monitoring

- Current solution:



- Pros & Cons
  - (+) centralized solution with full coverage of traffic flows in monitoring
  - (+) simple administration in central location
  - (-) interface speed and traffic volume to be monitored -> does not scale
  - (-) enforcement limited, if only possible at core site

Motivation for use of SDN and NFV Concepts

- How can SDN support QoE monitoring and enforcement?
  - Flow detection by means of matching rules
  - Flow selective copying for traffic monitoring
  - Enforcement function (prioritisation, traffic engineering)
- How can NFV support QoE monitoring and enforcement?
  - Distribute the monitoring and enforcement function into functional blocks, which are freely and smoothly instantiated and relocated
- Cost reduction and flexibility gained by software realization

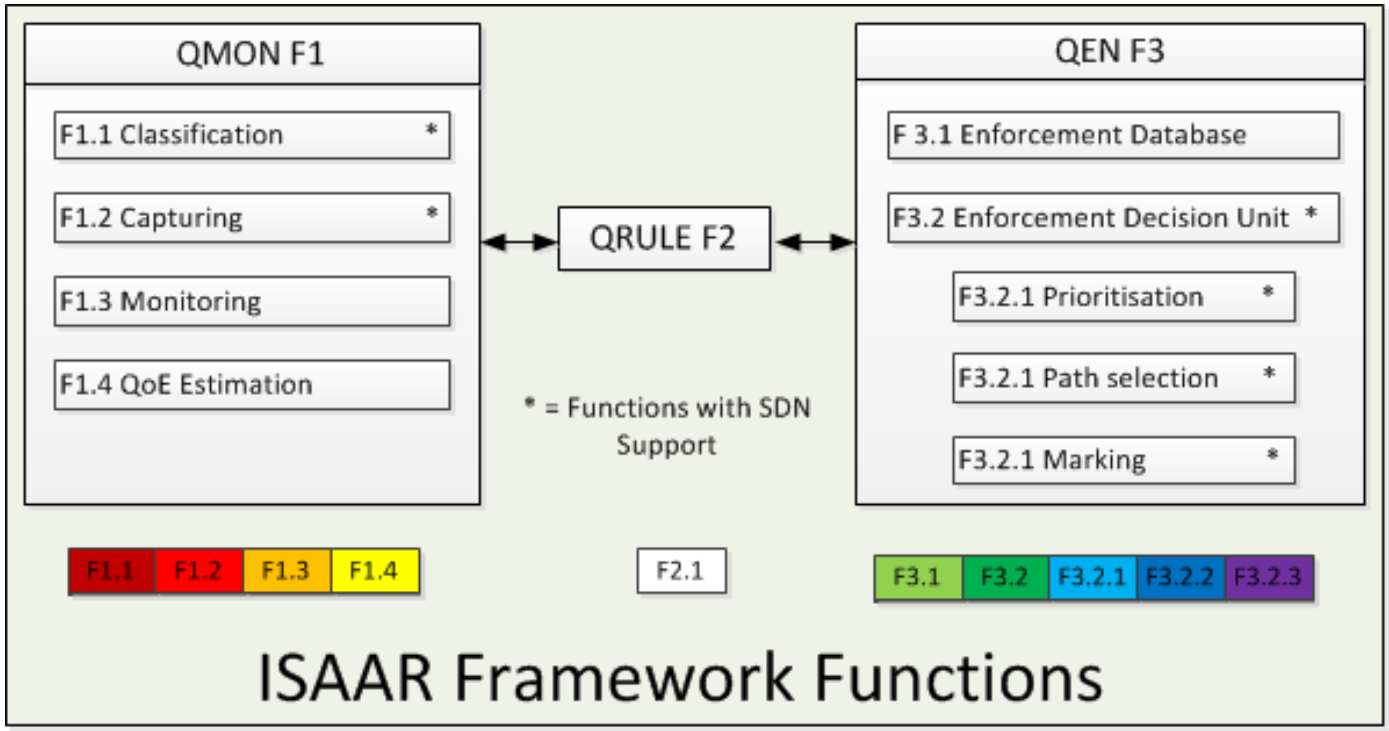
Proposal:

SDN/NFV based solution for QoE monitoring in mobile networks

"ISAAR (Internet Service quality Assessment and Automatic Reaction) Framework"

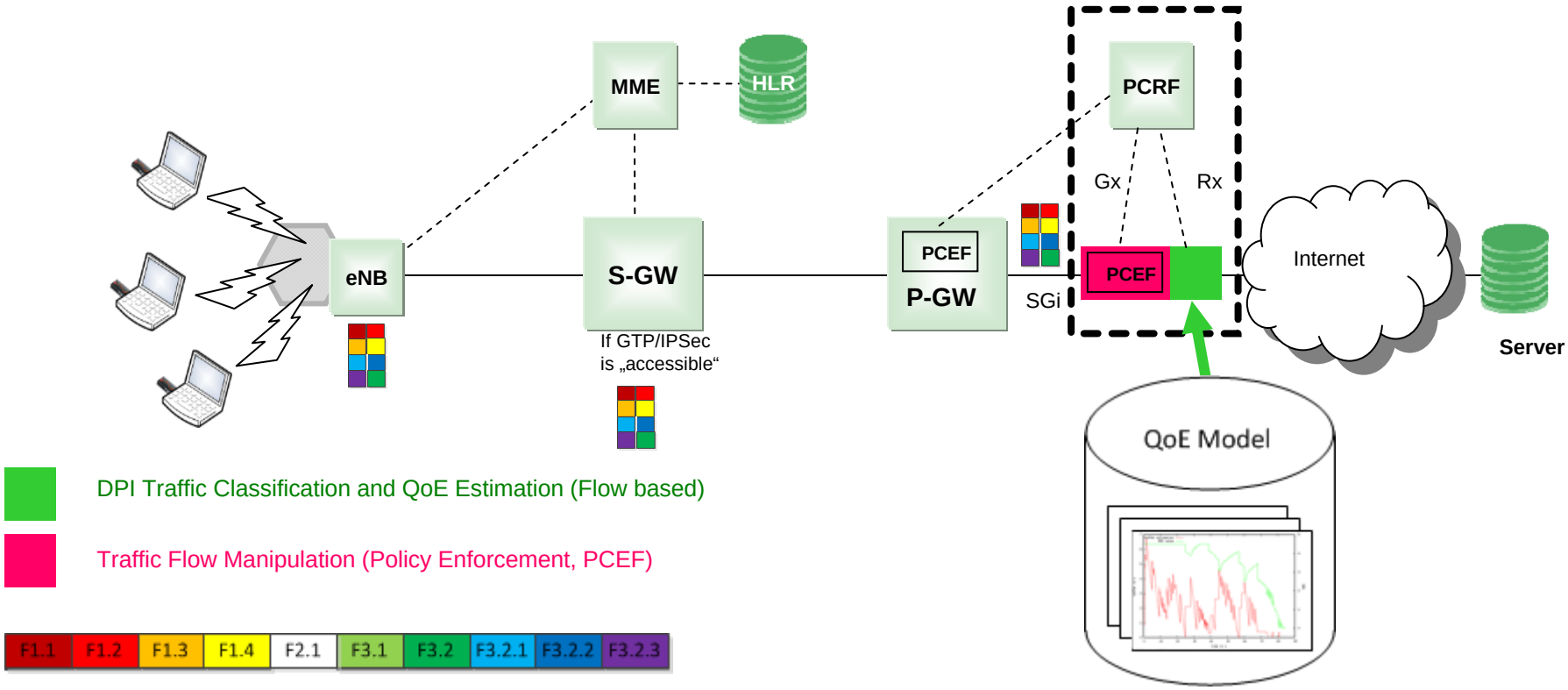
ISAAR Functional Layout

- 3 functional components:
  - QoE Monitoring (QMON) – flow detection and assessment,
  - QoE Rules (QRULE) – policy rules and permission checking and
  - QoE Enforcement (QEN) – respective flow manipulation



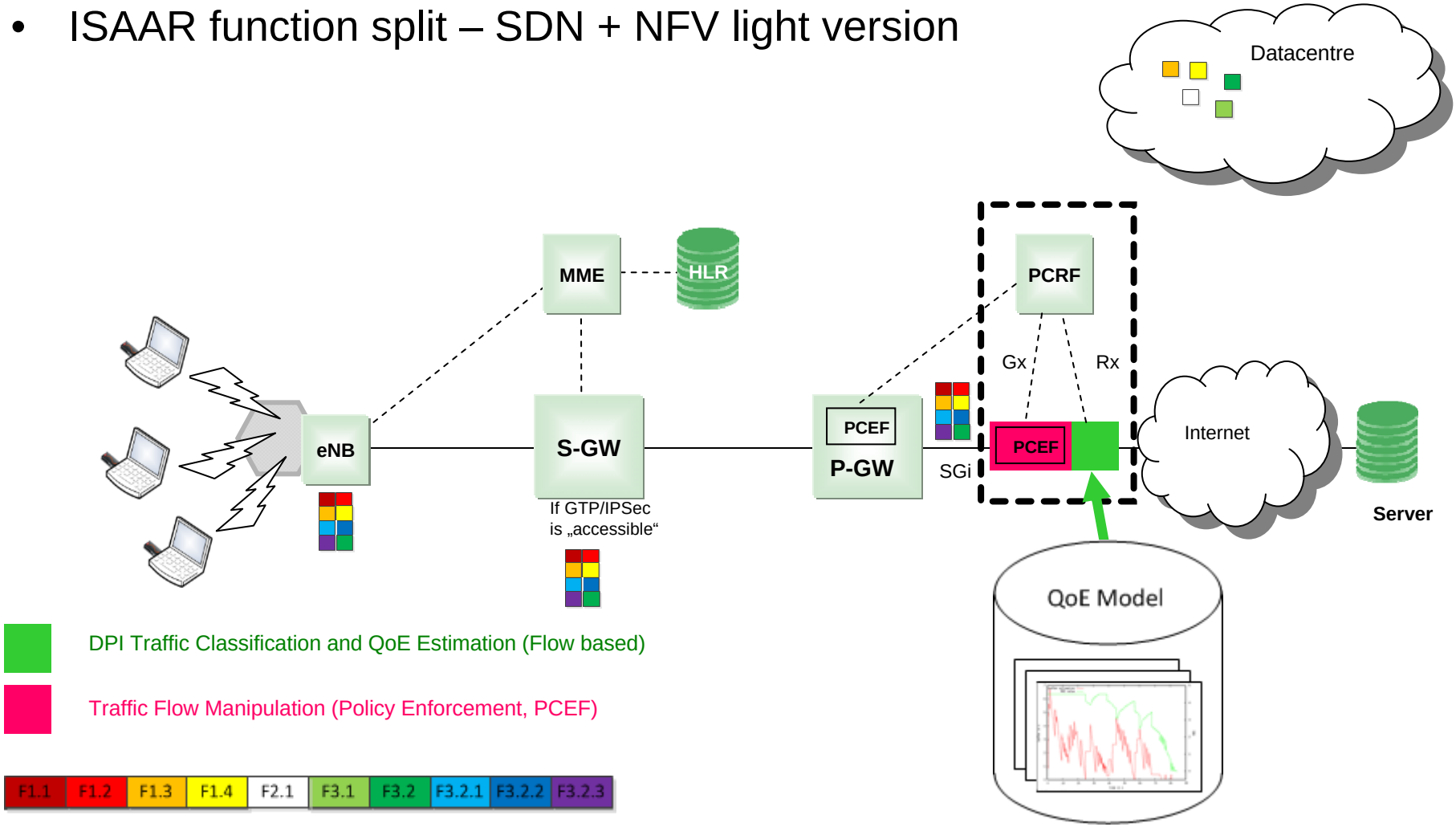
ISAAR Function Split Options

- ISAAR function split – SDN only



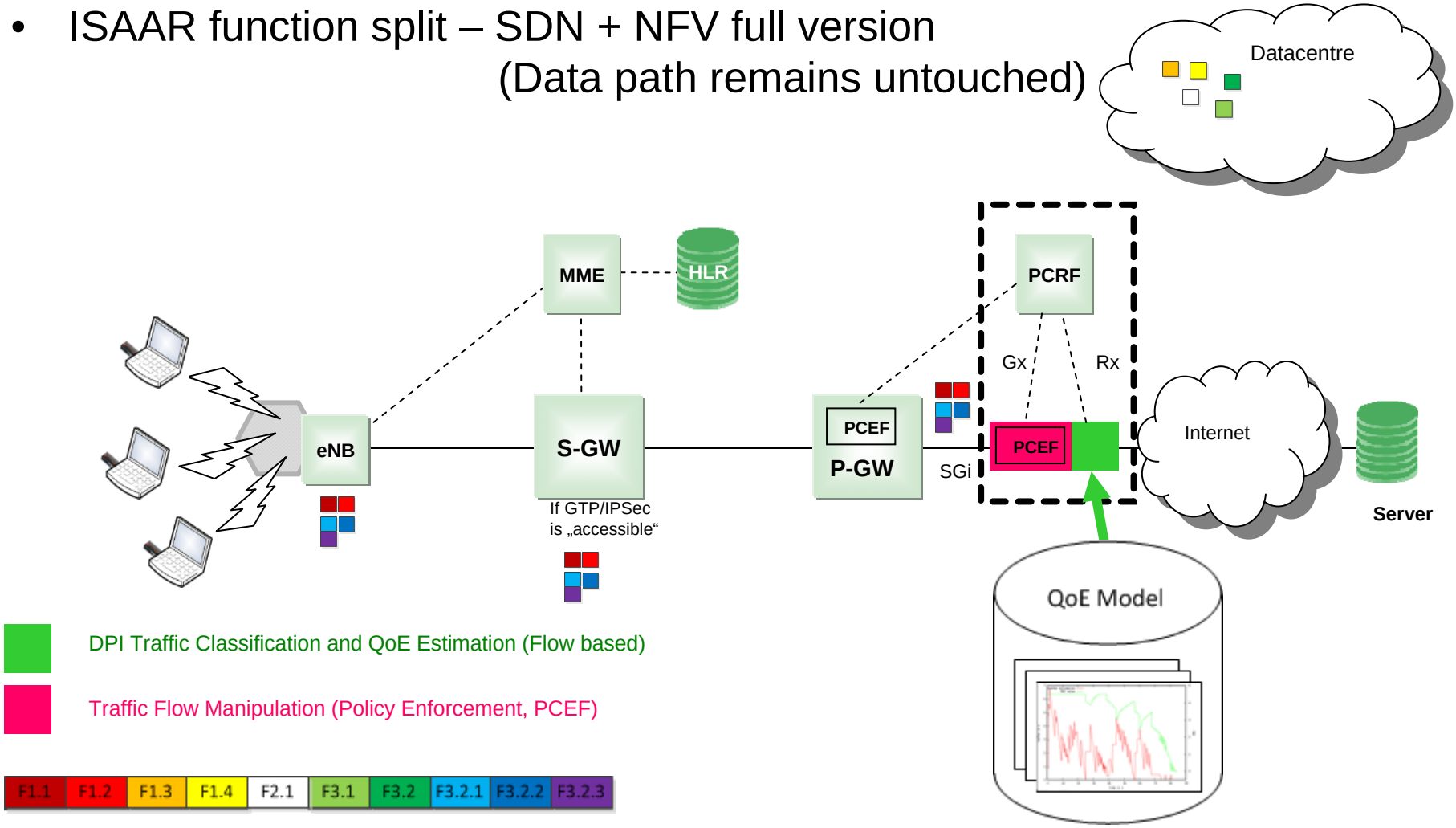
ISAAR Function Split Options

- ISAAR function split – SDN + NFV light version



ISAAR Function Split Options

- ISAAR function split – SDN + NFV full version
  (Data path remains untouched)



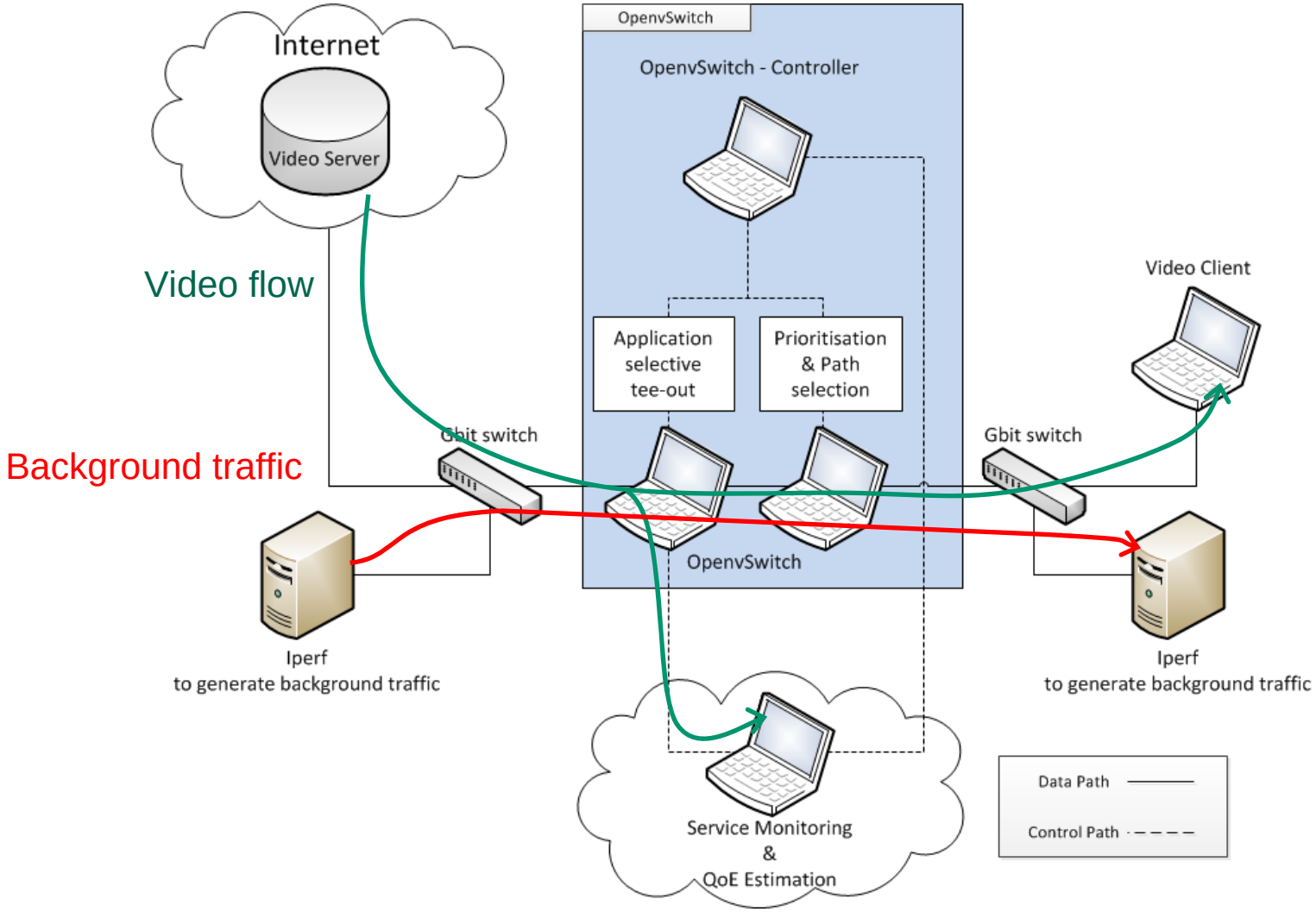
Lab Setup to demonstrate SDN Support

- Lab setup to demonstrate SDN support for QoE monitoring and enforcement
- Setup consists of 2 laptops implementing OpenFlow switches and one laptop as OpenFlow controller

Task 1: OpenFlow support to selectively copy out video flows from the traffic mix (match rule for flow detection + action set to implement the copy function)

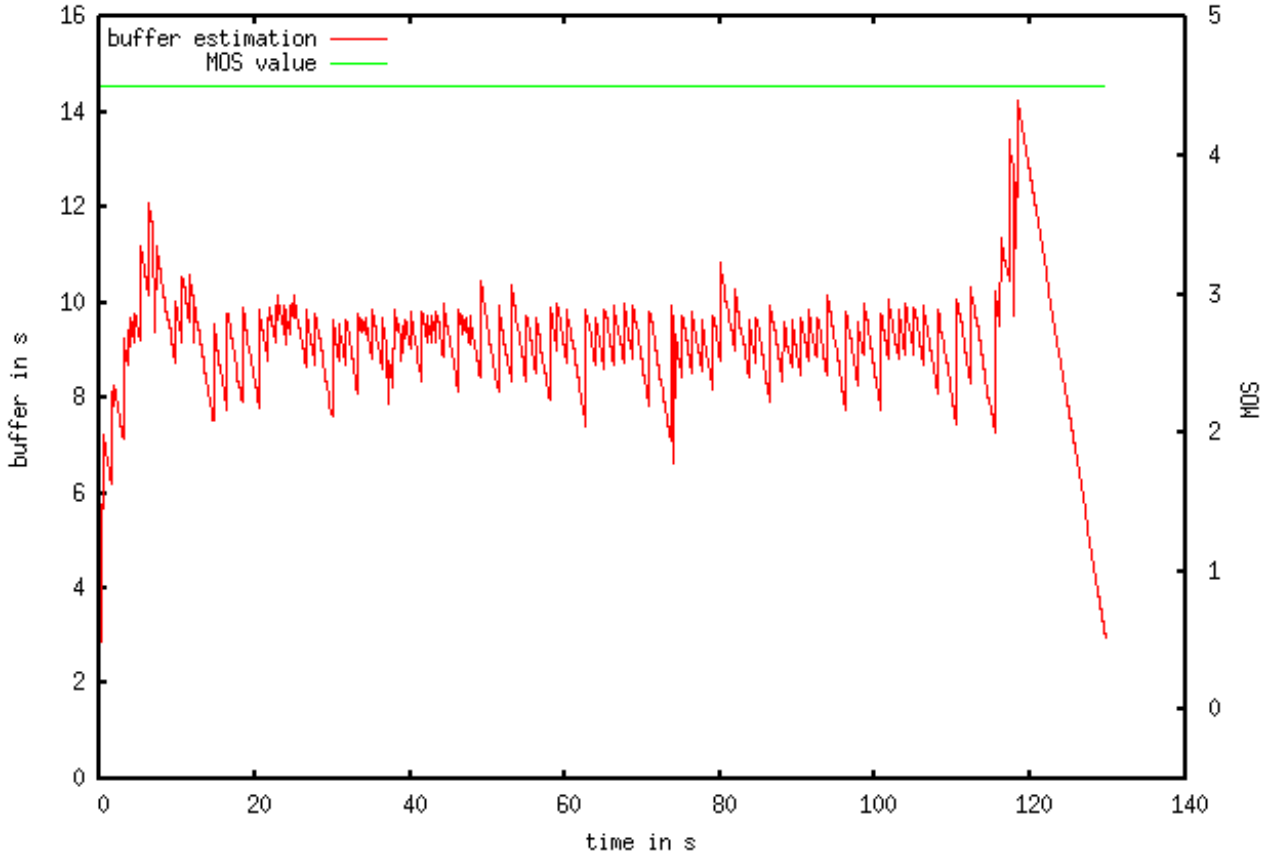
Task 2: OpenFlow support to enforce traffic priority (OpenvSwitch action set to use different queues for the flows)

Lab Setup to demonstrate SDN Support



Results: Video QoE Reference + SDN QMON

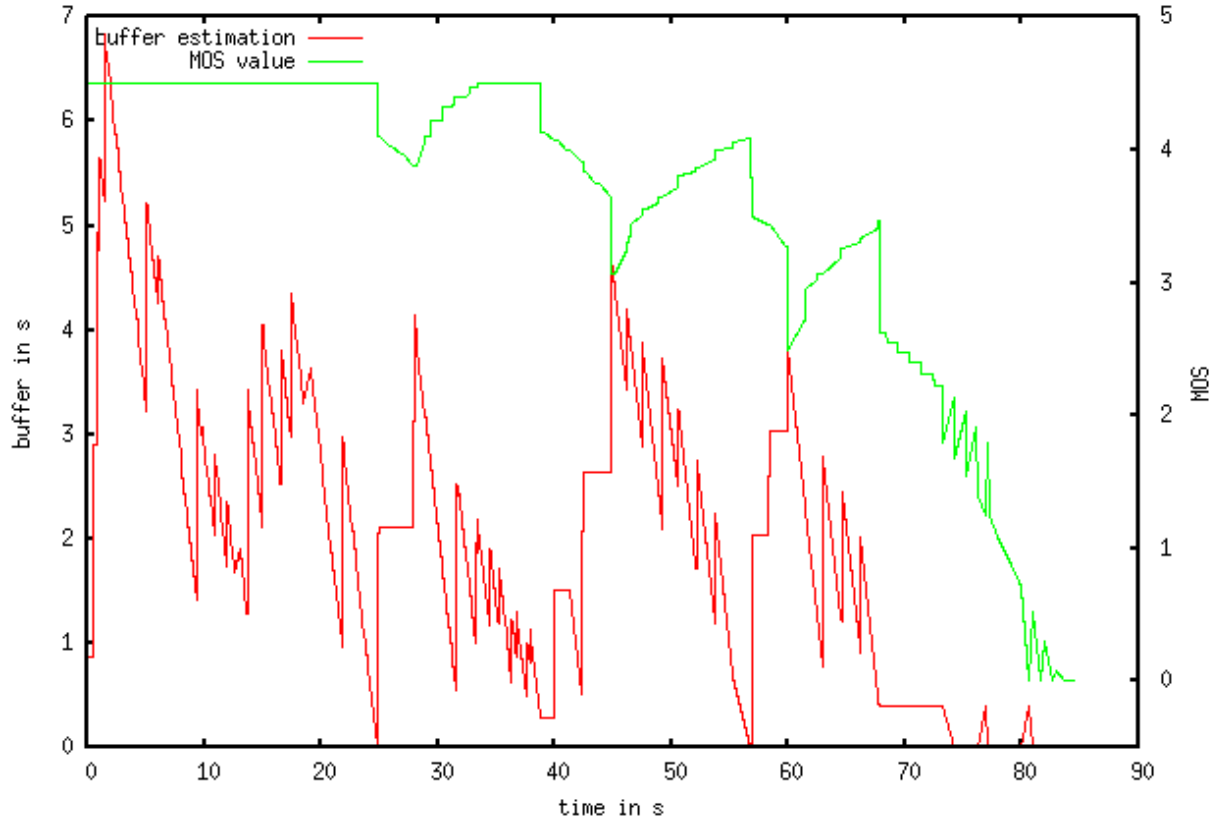
- Reference setup = video flow transport across SDN platform without background traffic and without any flow manipulation



- WebM http video stream; Video player buffer: 10s ; Video bitrate: avg. 800Kbit/s

Results: Video QoE with Background Traffic + SDN QMON

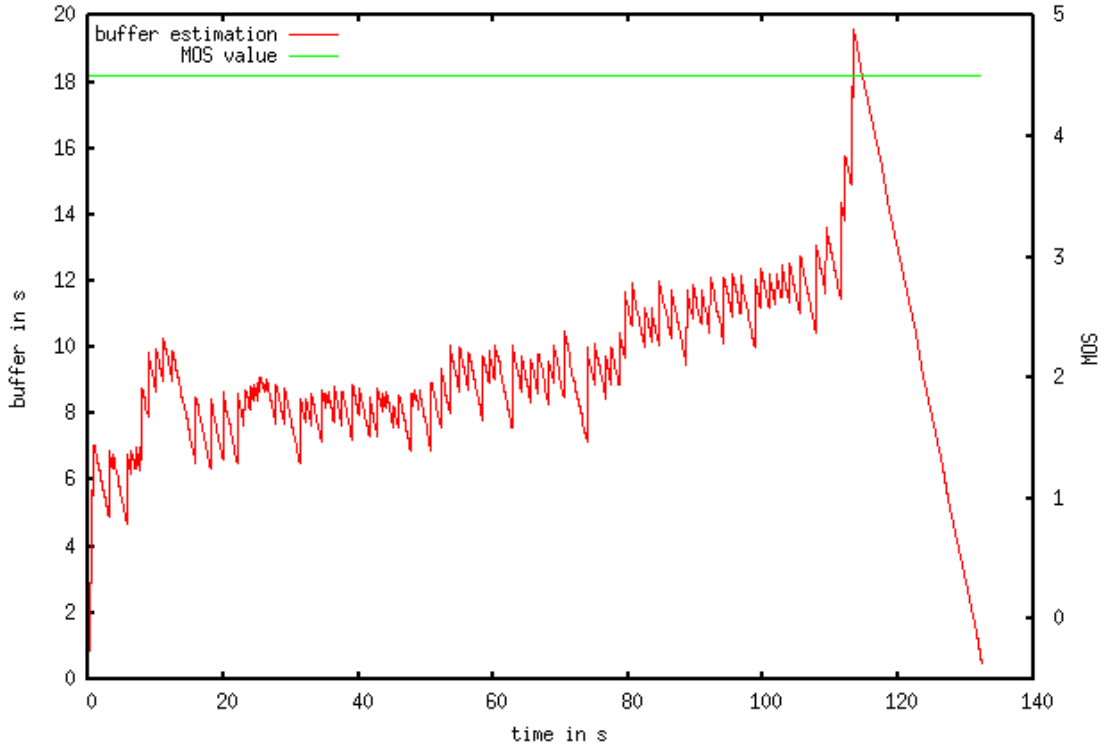
- Video flow transport across SDN platform with background traffic but without any flow manipulation



- WebM http video stream; Video player buffer: 10s ; Video bitrate: avg. 800Kbit/s
- Emulated 2Mbps line speed + 1,4 Mbps background traffic

Results: Video QoE w. Backgr. Traffic + SDN QMON & QEN

- Video flow transport across SDN platform with background traffic and OpenvSwitch based flow manipulation



- WebM http video stream; Video player buffer: 10s ; Video bitrate: avg. 800Kbit/s
- Emulated 2Mbps line speed + 2 traffic classes (1Mbps reservation for video & background)
- SDN prioritization by means of separate queues (video queue with 800kbps reservation)

Summary

- SDN/NFV augments QoE monitoring and enforcement
- ISAAR makes use of SDN to selectively copy out flows as well as to enforce flow manipulation actions
- The ISAAR functional block structure (QMON, QRULE, QEN with 10 functions F1.1 - F3.2.3) allows for direct NFV implementation
- Different function split options:
  - SDN only, SDN + NFV “light” and SDN + NFV “full”
- In a test lab setup a smooth interworking of ISAAR and OpenvSwitch with good QoE results has been proved

Next Steps

- Improved interworking of ISAAR with SDN (OpenFlow 1.0 … 1.3) in terms of performance and OpenFlow capability usage
- Decentralized ISAAR implementation for NFV demonstration
- Feasibility and performance analysis of NFV-ISAAR in field trials (SDN testbed)