Interworking of NFV/SDN with QoE Monitoring in Mobile Networks

Future Networks
2014

TU Chemnitz
Communication Networks

Marcus Eckert
marcus.eckert@etit.tu-chemnitz.de
Contents

• Introduction - QoE Monitoring
• Motivation for use of SDN and NFV Concepts
• ISAAR Functional Layout
• ISAAR Function Split Options
• Lab Setup to demonstrate SDN Support
• Results
• Summary and Next Steps
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 management 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 – no real splitting but SDN support

DPI Traffic Classification and QoE Estimation (Flow based)
Traffic Flow Manipulation (Policy Enforcement, PCEF)

If GTP/IPSec is "accessible"
ISAAR Function Split Options

- ISAAR function split – SDN + NFV light version

DPI Traffic Classification and QoE Estimation (Flow based)
Traffic Flow Manipulation (Policy Enforcement, PCEF)
• 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

- Video flow
- Background traffic

Diagram showing the setup with Internet, Video Server, OpenvSwitch, Controller, Application Selective Tee-out, Prioritisation & Path selection, Gbit switch, Iperf to generate background traffic, Service Monitoring & QoE Estimation, and Video Client.
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
  
  ![Graph showing video buffer and MOS value over time](image)

- 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 the existing QoE monitoring and enforcement

- ISAAR makes use of SDN to selectively copy out flows as well as to enforce flow manipulation actions

- ISAAR functional block structure (QMON, QRULE, QEN with their 10 functions F1.1-F3.2.3) allows for direct NFV implementation

- Three function split options have been presented:
  - SDN only, SDN + NFV “light” and SDN + NFV “full”

- Test lab has proven a smooth interworking of ISAAR and OpenvSwitch with good QoE results
Next Steps

- Decentralized ISAAR implementation for NFV demonstration
- Feasibility and performance analysis of NFV-ISAAR in field trials (SDN testbed)