OMNeT ++ Summit 2020

Computational Evaluation of the Effects of OpenFlow and OSPF Routing on QoS metrics in a Large Simulated Mobile Core Internet Protocol Network

Nicholas Odhiambo, Titus Muhambe, Cyprian Ratemo

School of Computing and Informatics, Maseno University, Kenya

nicholas.j.omumbo@gmail.com

6th October 2020

1.Background information

- Globally the demand for mobile IP access services has been on the upward growth in the last decade *(Worldbank, 2011; ITU, 2017; Liu, Ding, & Tarkoma, 2013).*
- QoS values are key perfomance indicators that determine how best a network is operating *(CAK,2014) (Szigeti et al., 2013).*
- Routing is an important element in communication between different networks and its impacted by the size of the network *(Odom, 2017; Li et al., 2016*).
- QoS metrics discussed in this research were *Jitter, Delay, Throughput and PDR.*

2. Statement of the Problem

- Multiple studies showed that classical routing is not able to address effectively (QoS) values desired of a large mobile IP provider network (Feamster et al., 2004; Li et al., 2016; Liu et al., 2013; Tanenbaum, 2013).
- Studies show that most mobile provider companies still use classical routing approaches in the core (Feamster et al., 2004; Li et al., 2016; Liu et al., 2013; Tanenbaum, 2013).
- Quality of Service values is impacted with the increase of mobile IP device subscribers. In the light of these findings there was urgent need to evaluate OpenFlow as possible alternative to routing in large mobile core network.
- OpenFlow strengths; centrality and programmability against distributed nature of classical routing approaches.

3. Objectives of the study)

Specific objectives were

- To evaluate the effects of *jitter* on OSPF and OpenFlow routing in large simulated mobile internet protocol core network
- To evaluate the effects of on *packet data ratio* on OSPF and OpenFlow large simulated mobile IP core network.
- To evaluate the effects of *throughput* on OSPF and OpenFlow routing on a simulated large mobile IP core network.
- To evaluate the effects of *delay* on OSPF and OpenFlow routing on a simulated large mobile IP core network.

4. Justification of the study

- Mobile IP network service is among the key drivers of most nation's economy around the world economy (*Chepken et al., 2012; Hudson, 1991; ITU, 2009; Wachira, 2012*) hence there need to understand how OpenFlow can improve routing in core network.
- Studies by *(Araniti et al, 2014)* studied performance of OpenFlow and OSPF in limited wireless network. This therefore was an opportunity to extend the research and contribute to try new knowledge by examining a different network domain.

5.Summary of Literature review

- Routing is important part of any network because it allows remote IP networks to communicate *(Odom, 2017; Tanebaum,2013*).
- Jitter, Throughput, Delay and PDR collectively known as (QoS) are some of the important metrics that affect the quality of routing in mobile phone network (*CAK, 2014; Balasubramanian, 2013; Nick Feamster et., al 2012).*
- Many approaches used to improve routing have deficiencies such bundling of (CP) and (DP) in one box, lack of openness and favor complex configuration instead of programmability*(Araniti et al., 2014; Feamster et al., 2004, 2013*).
- ...approaches ; M2M, MPLS,NBAR, Vrf...some industry techniques. proprietary.
- OpenFlow routing improves performance in small wireless and wired networks *(Araniti et.,al)*
- This justified the need for this research to test exhaustively how OpenFlow would perform in large simulated mobile IP network.

6.0 Research Design and Tools

- This study was conducted using OMNeTT++5.5.1 with add on simuLTE 0.9.1 and INET 3.3.6
- OpenFlow as built for OMNeT++.
- Mesh and star topology (hybrid)
- This study adopted Exploratory approach
- Scenario manager, ues, enodeB,

6.1Research design and Tools

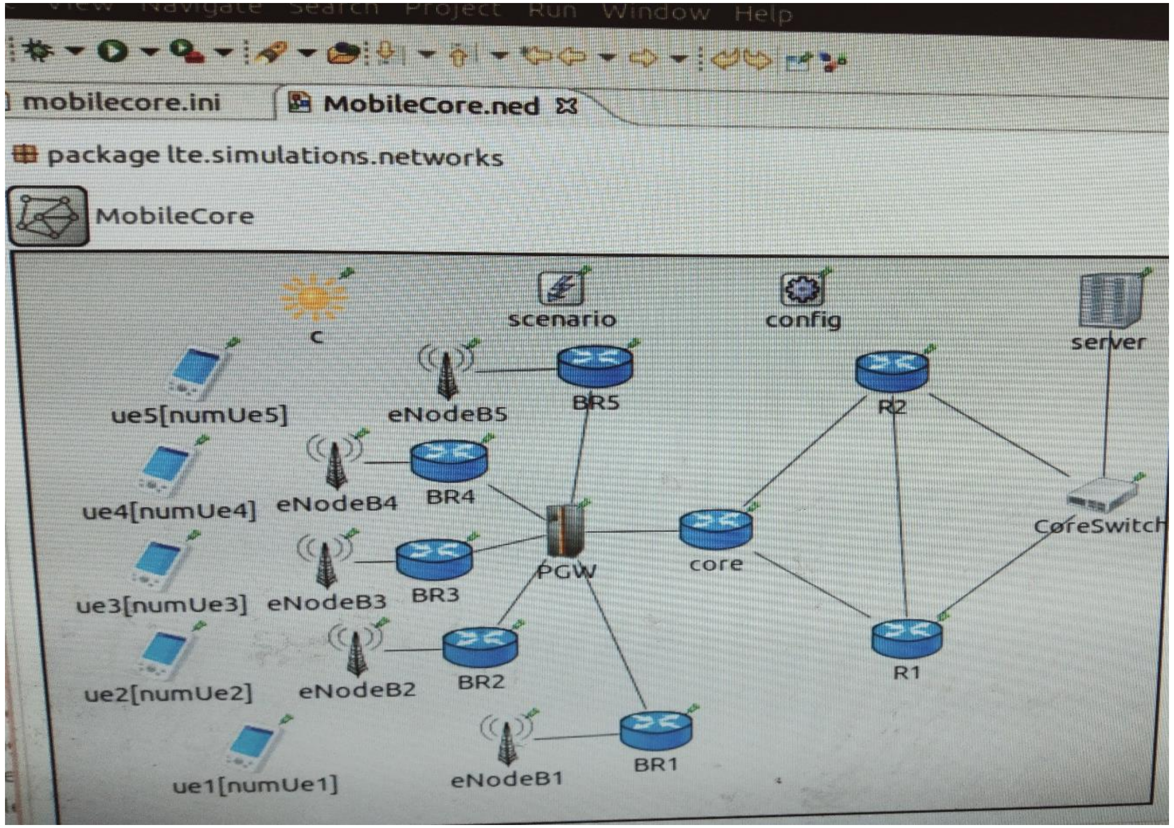
Summary of simulation testing parameters

Parameter	Technology and UEs
Wireless standard	LTE
Frequency Channel	LTE channel control
Application 1	Interactive gaming
Application 2	VoiP
Application 3	Streaming Audio
Application 4	IPTV
Simulation run time in minutes	20,40,60,80,100
Number of UEs	200,400,600,800,1000
Number of Routers/OpenFlow	10,40,60,80

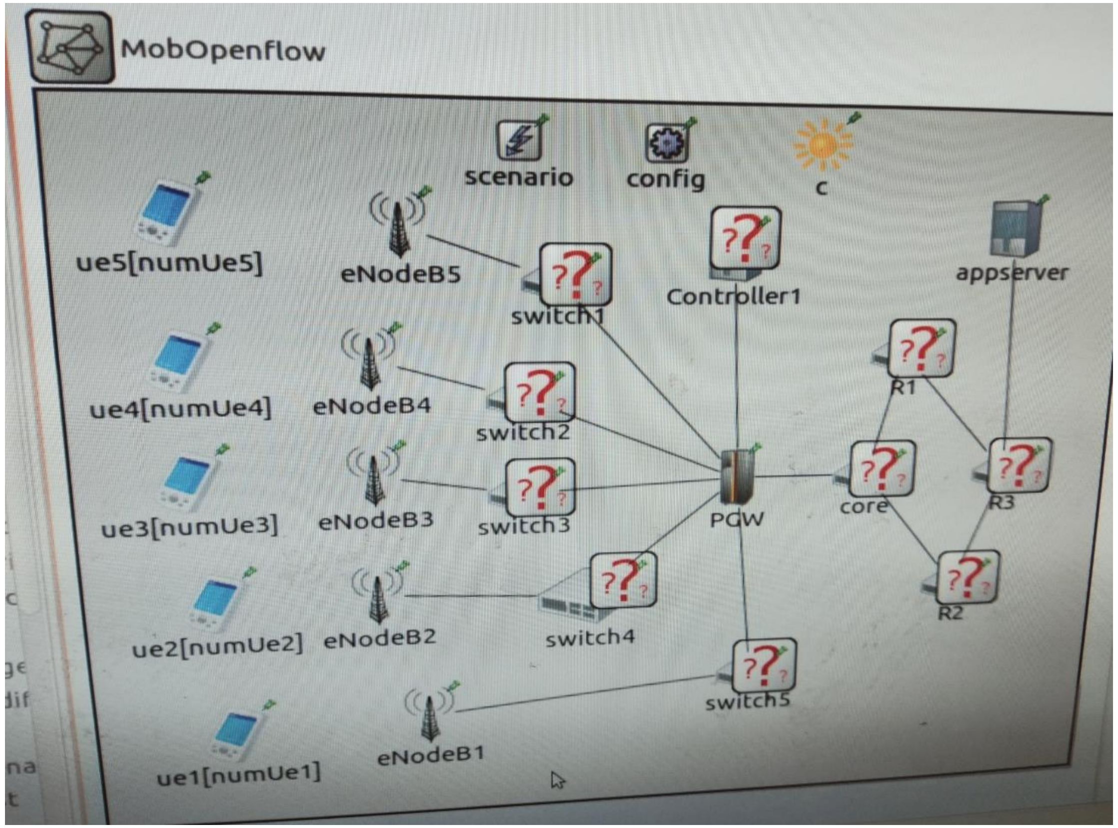
6.2 Research Design and Tools

Topological design

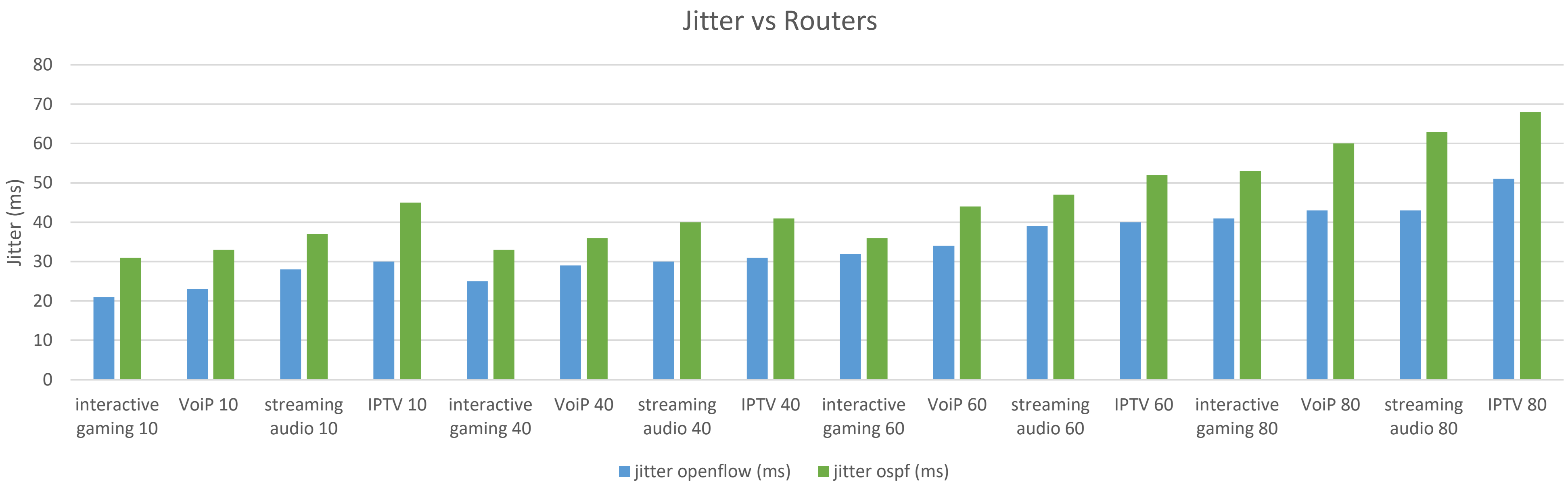
OSPF mobile core network



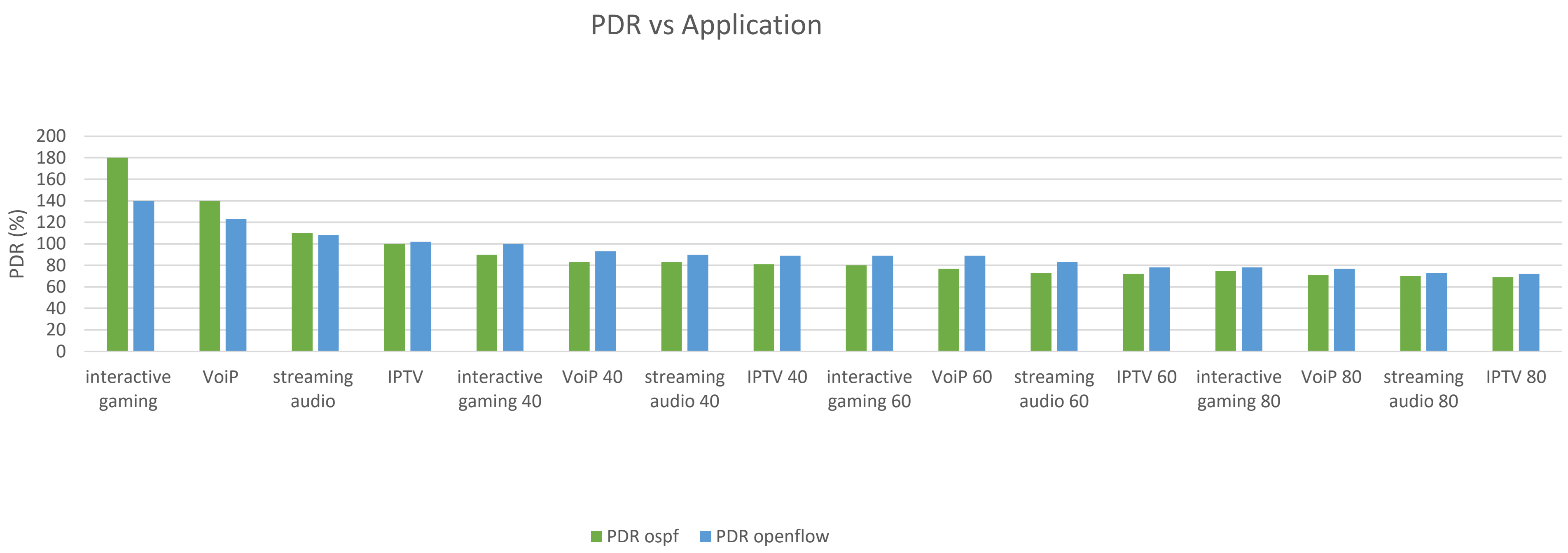
OpenFlow with single controller and several switches



7.0 Results


Jitter vs Routers
Jitter (ms)
80
70
60
50
40
30
20
10
0
interactive gaming 10
VoiP 10
streaming audio 10
IPTV 10
interactive gaming 40
VoiP 40
streaming audio 40
IPTV 40
interactive gaming 60
VoiP 60
streaming audio 60
IPTV 60
interactive gaming 80
VoiP 80
streaming audio 80
IPTV 80
jitter openflow (ms)
jitter ospf (ms)

7.1 Results


PDR vs Application
PDR (%)
200
180
160
140
120
100
80
60
40
20
0
interactive gaming
VoiP
streaming audio
IPTV
interactive gaming 40
VoiP 40
streaming audio 40
IPTV 40
interactive gaming 60
VoiP 60
streaming audio 60
IPTV 60
interactive gaming 80
VoiP 80
streaming audio 80
IPTV 80
PDR ospf
PDR openflow

8.0 Conclusion and Recommendations

- Across the four metrics investigated jitter, throughput, PDR and end to end delay in this simulated scenario OpenFlow seems to have better performance compared to OSPF.
- Further test can be done in real network.

###

- Multi-page paper with more details and revamped core data center.
- Test to be validated in real network as agreed by mobile provider company to test SDN technologies.
- Challenges: self training results in longer curve to deliver results.

9.0 End

- Thank you.
- Question and Answers