

Abstração da Camada de Gerenciamento de Dispositivos com Ênfase em QoS e Suporte a OpenFlow

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- Complexity of computer networks configurations keep growing;
 - Management and maintenance of current networks are a hard task;
 - Control and data planes of network devices are individualized and routing decisions are made independently;
- Software Defined Networking (SDN)
 - Control and data layers are decoupled;
 - OpenFlow perform only per-flow operations;

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- Management Protocols;
 - Open vSwitch Database (OVSDB) Management Protocol
 - OpenFlow Management and Configuration Protocol (OF-CONFIG)
- Configuration of Quality Of Service (QoS) on legacy networks has always been a challenge [5]:
 - Heterogeneity and consequent complexity of proposed third party QoS solutions;
 - Largely manual per-device configuration;

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Related Works 1/2

QoS applications

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- Adami et al. [1] proposed a SDN controller (SDNC) that enable QoS control and routing in SDN;
- Assuiti et al. [2] proposed a QoS configuration for an eHealth application inside a Hospital environment;
- Da Silva et al. [4] described a study about network resources adaptation in accordance with the user experience;

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- Palma et al. [7] proposed a module with the intention of providing an interface to the SDNC, in order to ease the process of queue creation within the OF enabled switches;
- Caba et al. [3] developed an API for QoS configuration adding granularity;
- Seddiki et al. [8] described a system whose purpose was to facilitate the QoS setting in a home environment;

Main goal

Main goal

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Objective

Propose an implementation of a SDN controller (SDNC) module, in order to enable QoS configuration using management, control and data planes, besides providing mechanisms to test and facilitate the user's own configuration.

Objectives

Specific objectives

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- Specific objectives 1/2:
 - Define and implement a basic version of the management protocol for network devices;
 - Define useful QoS parameters;
 - Provide services for internal/external applications use;

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■ Specific objectives 2/2:

- Develop a web interface allowing that network administrators could interact with the module in an easier way;
- Provide a tool for users so that they can test their own QoS configurations;
- Make the module available to the open-source community.

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- Floodlight SDNC;
 - Java;
 - OpenFlow (OF);
 - Experience through our previous works;
- OVSDB Management Protocol;
 - Open vSwitch (OVS);
 - OpenFlow (OF);
- Mininet emulation environment;
 - *"A network in a laptop: rapid prototyping for Software-Defined Networks" [6]*

Proposal Architecture

QoS in OVSDb

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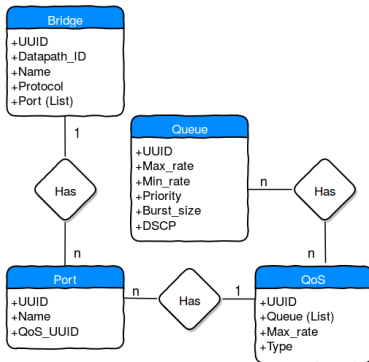
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An entity–relationship model
showing QoS features
in OVSDb.

- QoS features presented in OVSDb;

Proposal Architecture

Proposal System Architecture

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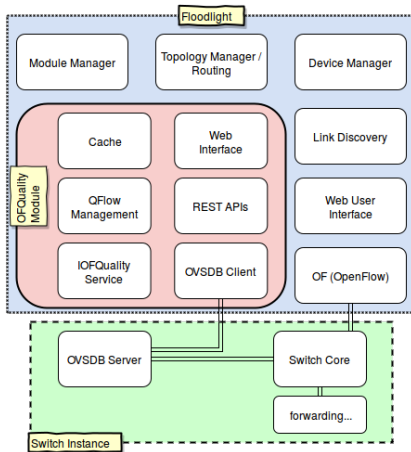
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Proposal System Architecture.

- Cache;
- Northbound and the Southbound REST APIs;
- IOFQuality Service

Proposal Architecture

Proposal System Architecture

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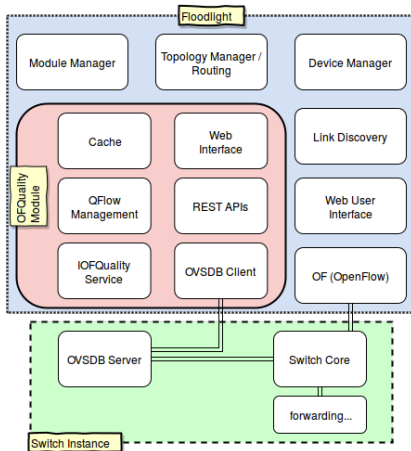
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Proposal System Architecture.

- OVSDb Client;
- Web user interface;
- QFlow Management;

Proposal Architecture

Proposal System Architecture

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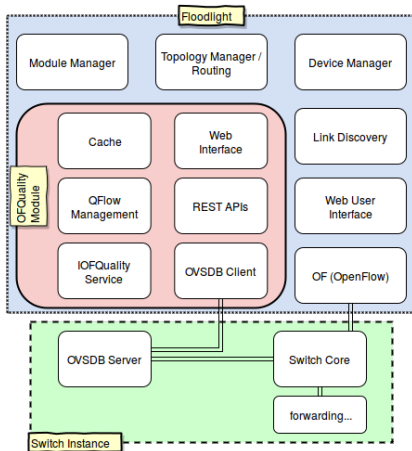
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- Floodlight modules;
- Switch instances;

Proposal System Architecture.

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Differentiated Features 1/3

QFlow Management

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■ QFlow Management Feature;

Add Flow Import .CSV Delete All Flows

QFlows						
ID	IP Source	IP Dest.	Protocol	Port	Queue	Options
1	10.0.0.1	10.0.0.3	0x6	80	0	Delete Apply! Stop!

QFlow Management datatable on web interface.

Differentiated Features 2/3

Web user interface

■ Web user interface;

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Create QoS ×

Switch/OVS IP Address:

(IP Address or "all" for all connected devices)

Select Queues (Hold CTRL for more than one)

QUEUE c94ff4 MAX 6000000 MIN 4000000

QUEUE 374e4c MAX 5000000 MIN 5000000

QUEUE 0b97cc MAX 6000000 MIN 4000000

Maximum Rate Shared between Queues (Bits)

(e.g. 8000000 = 8 megabits)

Set QoS type
☐ Linux HTB
☒ Linux HFSC

Creating a QoS configuration on web interface.

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■ Web user interface

Apply QoS on switch port



Select Ports (Hold CTRL for more than one)

s2

s2-eth1

s2-eth2

s2-eth3

s3

Select a QoS Config.

QOS f81485 MAX 666666

Cancel

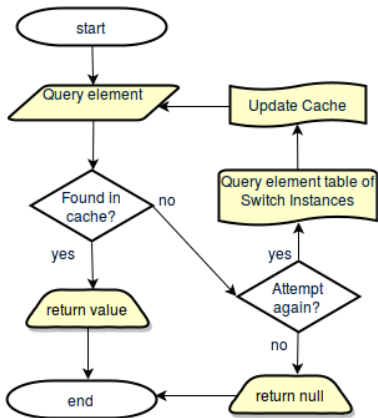
Apply!

Applying QoS in a switch port.

Differentiated Features 3/3

Cache

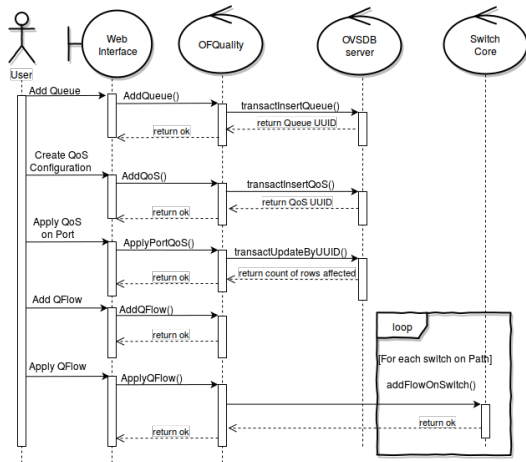
■ Cache feature;



Enabling the management of multiple switch instances.

Interactions between OFQuality Components

Sequence diagram illustrating module features.



Sequence diagram of module features.

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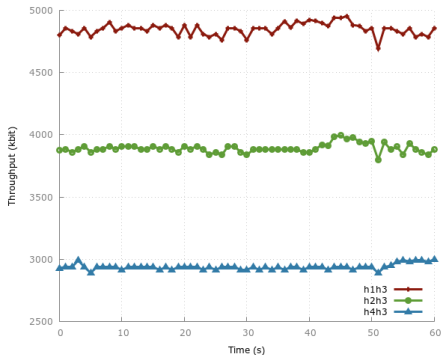
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- 3 queues with respective 5/5 4/4 3/3 Mbps maximum and minimum rates and 12 Mbps shared;



Scenario 1: Testing queues maximum and minimum rates.

Preliminary Results 2/3

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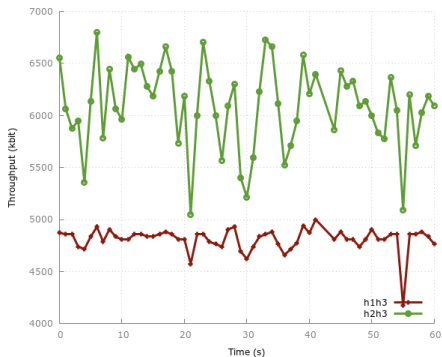
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- 2 queues configured with 7/5 Mbps rates and 12 Mbps shared.

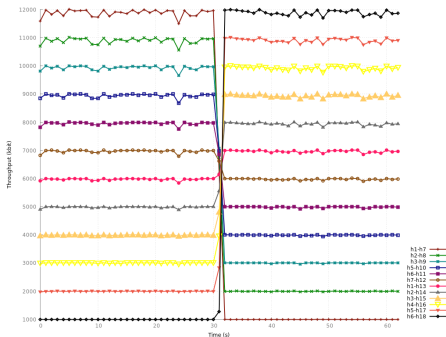


Scenario 2: Testing queues priority feature.

Preliminary Results 3/3

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■ Changing max and min parameters from 12 queues;



Scenario 3: Evaluating transition time for changes on queue rates.

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- Enhancement of QFlow management features, adding a DNS query service;
- Implement QFlow Management as a service (not only for web interface usage);
- Increase of the web user interface usability;
- Perform more experiments adding more features. Evaluate in a different hardware;
- Review of related works;

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	Work months November/2016 to June/2017										
	09	10	11	12	01	02	03	04	05	06	
Activities											
Survey and analysis of the state of the art	X	X	X	X	X	X	X	X	X	X	
Qualifying			X								
Development of a network device management Protocol	X	X									
Development of the web user interface	X	X	X								
Development of REST APIs	X	X	X								
Development of programming interfaces and services	X	X	X								
Development of testing features	X	X	X								
Experiments and results		X	X	X							
Thesis write					X	X	X	X	X		
Write of papers	X	X	X	X	X						
Papers submission			X	X	X						
Thesis defense										X	

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Davide Adami, Lisa Donatini, Stefano Giordano, and Michele Pagano.

A network control application enabling software-defined quality of service.

In 2015 IEEE International Conference on Communications (ICC), pages 6074–6079. IEEE, 2015.



Marcus Assuiti, Felipe Volpato, Madalena Pereira da Silva, and Mario Antônio Ribeiro Dantas.

A software-defined network configuration providing differentiated qos to an ehealth environment.

In Proceedings of the International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA), page 237, 2016.

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Cosmin Caba and José Soler.

Apis for qos configuration in software defined networks.
In Network Softwarization (NetSoft), 2015 1st IEEE Conference on, pages 1–5. IEEE, 2015.



Madalena P da Silva, Mario AR Dantas, Alexandre L Gonçalves, and Alex R Pinto.

A managing qoe approach for provisioning user experience aware services using sdn.

In Proceedings of the 11th ACM Symposium on QoS and Security for Wireless and Mobile Networks, pages 51–58. ACM, 2015.

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Wonho Kim, Puneet Sharma, Jeongkeun Lee, Sujata Banerjee, Jean Tourrilhes, Sung-Ju Lee, and Praveen Yalagandula.

Automated and scalable qos control for network convergence.

INM/WREN, 10:1–1, 2008.



Bob Lantz, Brandon Heller, and Nick McKeown.

A network in a laptop: rapid prototyping for software-defined networks.

In Proceedings of the 9th ACM SIGCOMM Workshop on Hot Topics in Networks, page 19. ACM, 2010.

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D. Palma, J. Gonçalves, B. Sousa, L. Cordeiro, P. Simoes, S. Sharma, and D. Staessens.

The queuepusher: Enabling queue management in openflow.

In 2014 Third European Workshop on Software Defined Networks, pages 125–126, Sept 2014.



M. Said Seddiki, Muhammad Shahbaz, Sean Donovan, Sarthak Grover, Miseon Park, Nick Feamster, and Ye-Qiong Song.

Flowqos: Qos for the rest of us.

In Proceedings of the Third Workshop on Hot Topics in Software Defined Networking, HotSDN '14, pages 207–208, New York, NY, USA, 2014. ACM.