



Quality of Service Management Module for Software-Defined Networking

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Summary

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

- 1 Introduction
- 2 Related Works
- 3 Objective
- 4 Proposal Architecture
- 5 Module Implementation
- 6 Preliminary Results
- 7 Under development
- 8 Work Schedule

Summary

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

1 Introduction

2 Related Works

3 Objective

4 Proposal Architecture

5 Module Implementation

6 Preliminary Results

7 Under development

8 Work Schedule

Introduction

Related Works

Objective

Proposal Architecture

Module Implementation

Preliminary Results

Under development

Work Schedule

- 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;

Introduction

Related Works

Objective

Proposal Architecture

Module Implementation

Preliminary Results

Under development

Work Schedule

- 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;

Summary

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

1 Introduction

2 **Related Works**

3 Objective

4 Proposal Architecture

5 Module Implementation

6 Preliminary Results

7 Under development

8 Work Schedule

Related Works 1/2

QoS applications

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

- 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;

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

- 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

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

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.

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

- 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;

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

- 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.

Summary

Introduction

Related Works

Objective

**Proposal
Architecture**

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

1 Introduction

2 Related Works

3 Objective

4 Proposal Architecture

5 Module Implementation

6 Preliminary Results

7 Under development

8 Work Schedule

Introduction

Related Works

Objective

**Proposal
Architecture**

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

- 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

Introduction

Related Works

Objective

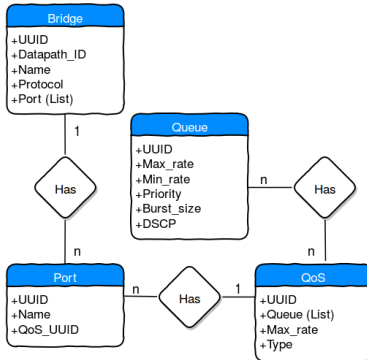
**Proposal
Architecture**

Module
Implementation

Preliminary
Results

Under
development

Work Schedule



An entity–relationship model
showing QoS features
in OVSDb.

- QoS features presented in OVSDb;

Proposal Architecture

Proposal System Architecture

Introduction

Related Works

Objective

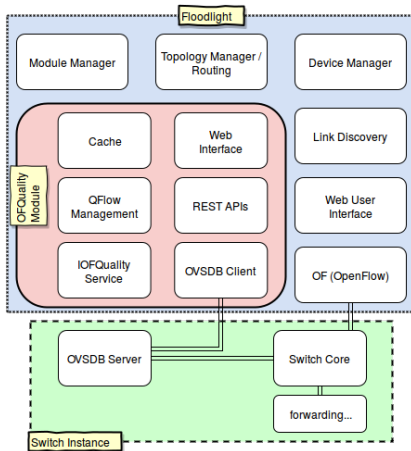
**Proposal
Architecture**

Module
Implementation

Preliminary
Results

Under
development

Work Schedule



Proposal System Architecture.

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

Proposal Architecture

Proposal System Architecture

Introduction

Related Works

Objective

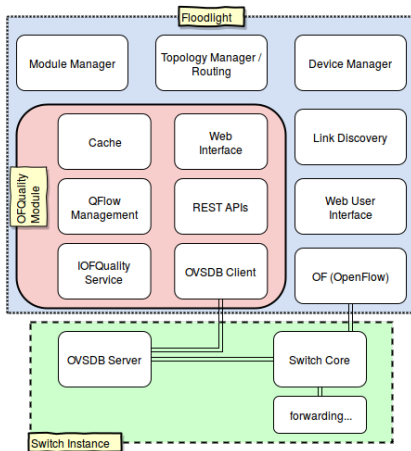
**Proposal
Architecture**

Module
Implementation

Preliminary
Results

Under
development

Work Schedule



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

Proposal System Architecture.

Proposal Architecture

Proposal System Architecture

Introduction

Related Works

Objective

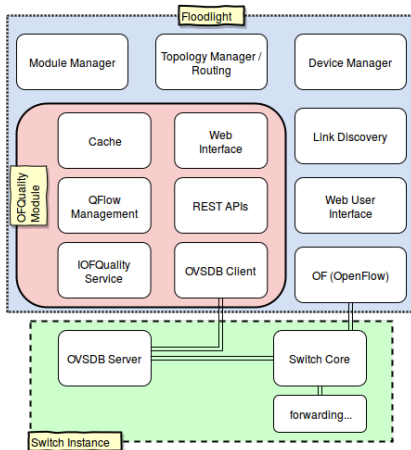
**Proposal
Architecture**

Module
Implementation

Preliminary
Results

Under
development

Work Schedule



- Floodlight modules;
- Switch instances;

Proposal System Architecture.

Summary

Introduction

Related Works

Objective

Proposal
Architecture

**Module
Implementation**

Preliminary
Results

Under
development

Work Schedule

- 1 Introduction
- 2 Related Works
- 3 Objective
- 4 Proposal Architecture
- 5 Module Implementation**
- 6 Preliminary Results
- 7 Under development
- 8 Work Schedule

Differentiated Features 1/3

QFlow Management

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

■ 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	<div>Delete</div> <div>Apply!</div> <div>Stop!</div>

QFlow Management datatable on web interface.

Differentiated Features 2/3

Web user interface

■ Web user interface;

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

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.

Differentiated Features 2/3

Web user interface

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

■ 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

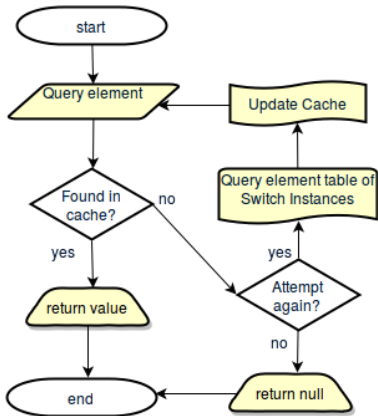
Apply!

Applying QoS in a switch port.

Differentiated Features 3/3

Cache

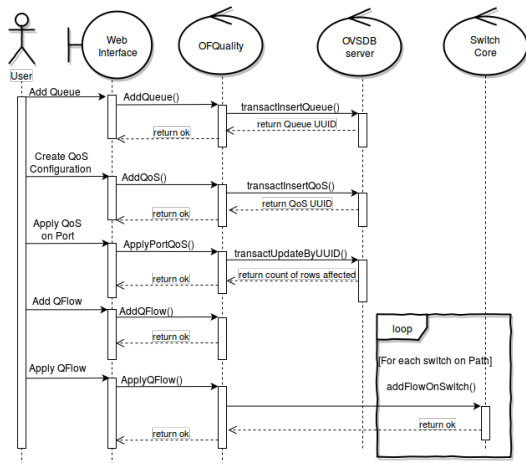
■ Cache feature;



Enabling the management of multiple switch instances.

Interactions between OFQuality Components

Sequence diagram illustrating module features.



Sequence diagram of module features.

Summary

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

**Preliminary
Results**

Under
development

Work Schedule

1 Introduction

2 Related Works

3 Objective

4 Proposal Architecture

5 Module Implementation

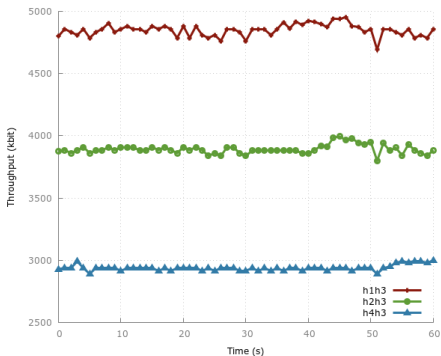
6 Preliminary Results

7 Under development

8 Work Schedule

Preliminary Results 1/3

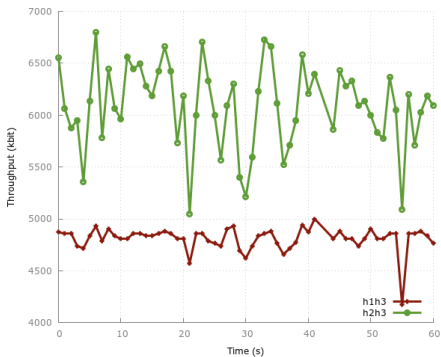
- 3 queues with respective 5/5 4/4 3/3 Mbps maximum and minimum rates and 12 Mbps shared;



Scenario 1: Testing queues maximum and minimum rates.

Preliminary Results 2/3

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

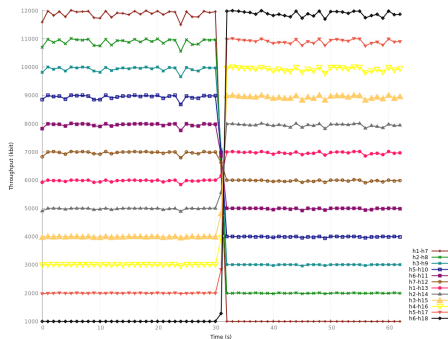


Scenario 2: Testing queues priority feature.

Preliminary Results 3/3

Introduction
Related Works
Objective
Proposal
Architecture
Module
Implementation
**Preliminary
Results**
Under
development
Work Schedule

■ Changing max and min parameters from 12 queues;



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

Summary

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

**Under
development**

Work Schedule

1 Introduction

2 Related Works

3 Objective

4 Proposal Architecture

5 Module Implementation

6 Preliminary Results

7 Under development

8 Work Schedule

Under development

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

**Under
development**

Work Schedule

- 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;

Summary

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

- 1 Introduction
- 2 Related Works
- 3 Objective
- 4 Proposal Architecture
- 5 Module Implementation
- 6 Preliminary Results
- 7 Under development
- 8 Work Schedule**

Work Schedule

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule

	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

References I

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule



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References II

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule



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References III

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule



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References IV

Introduction

Related Works

Objective

Proposal
Architecture

Module
Implementation

Preliminary
Results

Under
development

Work Schedule



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