
Computer and
Informatics
Engineering
Projects

SOFTWARE DEFINED NETWORKS MONITORING SYSTEM

universidade de aveiro



deti

departamento de eletrónica, telecomunicações e informática

Afonso Cardoso	88964
David Araújo	93444
Diogo Dias	85085
Guilherme Craveiro	103574
João Machado	89119
Vasco Santos	98391

December 2022

Requirement elicitation



Sources for these requirements came from:

- ✓ Study of similar implementations;
 - ✓ Brainstorming sessions;
 - ✓ Task Analysis;
 - ✓ Domain Analysis;
-

Functional Requirements

Management

- ❑ **Device** - Add and remove network devices.
- ❑ **Network Entities** - subdivisions like vlans or subnets are treated as entities.
- ❑ **Users** - The network can have multiple admins.

Measurements

- ❑ **Configurability** - user can set its own set of metrics.
- ❑ **Sample size** - can be set per device or has an globally measure value.

Atomicity

- ❑ **Network devices** - devices should require little no none initial configuration.
- ❑ **Metrics** - metrics should be device independent.

Non-Functional Requirements

Capacity

- ❑ **Bandwidth** - stable width.
- ❑ **Response** - agent number or environment agnostic.
- ❑ **Size** - usable for a large number of agents

Reliability

- ❑ **Stability** - links do not disconnect.
- ❑ **Solidity** - lost of packs is minimized.

Availability

- ❑ **Access** - user access individuality.
- ❑ **Grouping** - device organization by common qualities.
- ❑ **Device type** - device agnostic.
- ❑ **Topologies** - topology structure agnostic

Non-Functional Requirements

Security

- ❑ **Privacy** - Guarantee data privacy.
- ❑ **Protection** - Ensuring the data is not compromised.

Usability

- ❑ **Customization** - Create a group of rules to simplify common operations.
- ❑ **Multi-Task** - Access multiple networks.
- ❑ **Multi-User** - Network accessible by multiple users.

State of the Art

Monitoring
&
Inband Network Telemetry

“P4-powered” SDN monitoring is mainly academic.

All monitoring solutions with P4 is based on the implementation of INT

Some of the work focus on what type of metrics to collect

What is not seen is the implementation of a proprietary header type.

Expected Use & Results

Deployment on **new** network or **existing ones**.

Use **simultaneously** with other SDN **controllers** or as a **standalone** solution.

Observer role over a network.

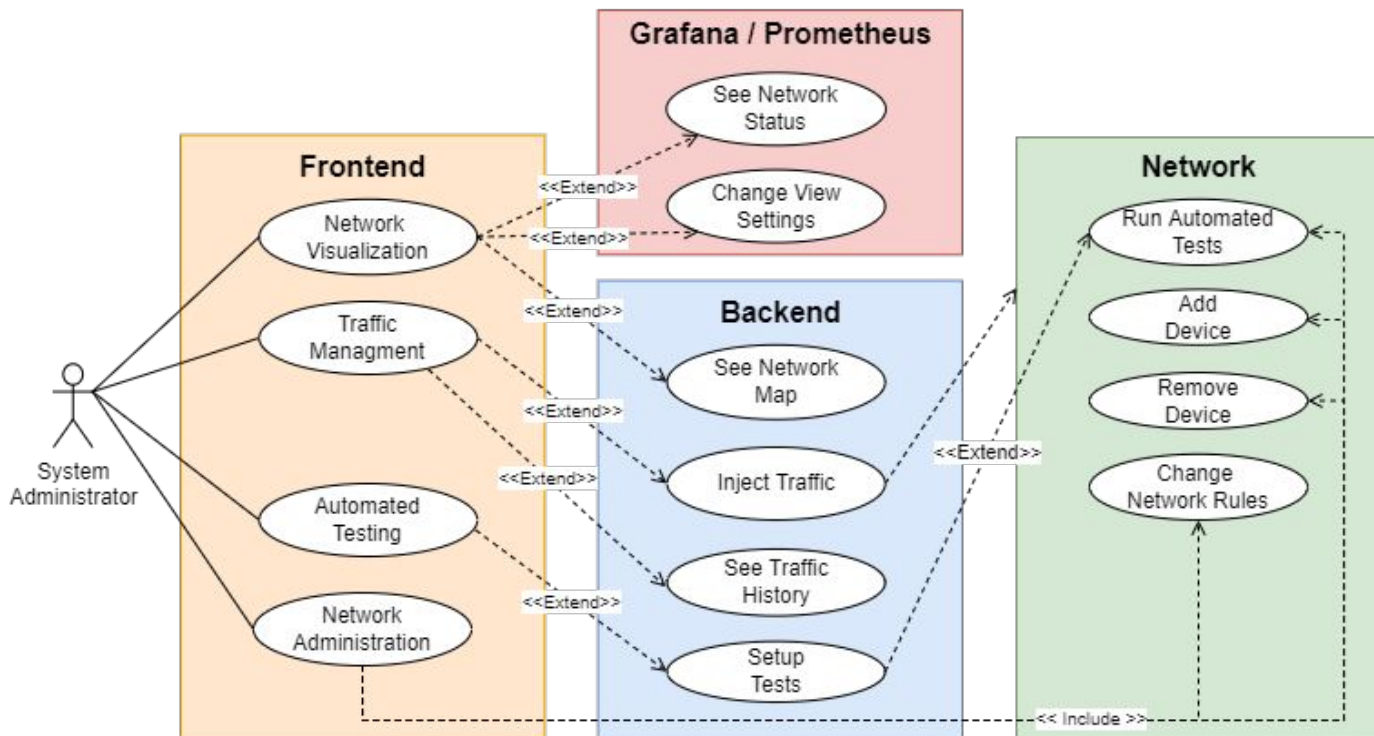
Autonomous **reactive** topology **reconfiguration**.



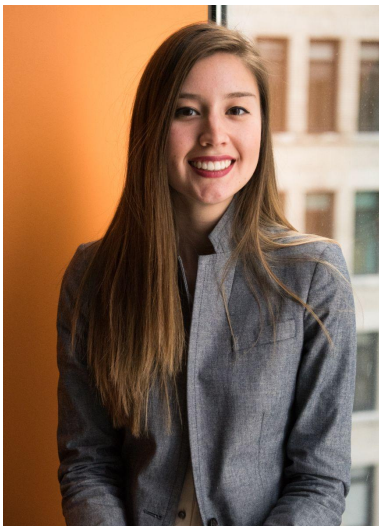
Use Cases

Interaction only has one actor, the **system administrator**, which in production environments can have multiple **roles**.

In production, a network can have **multiple administrators**.



Personas

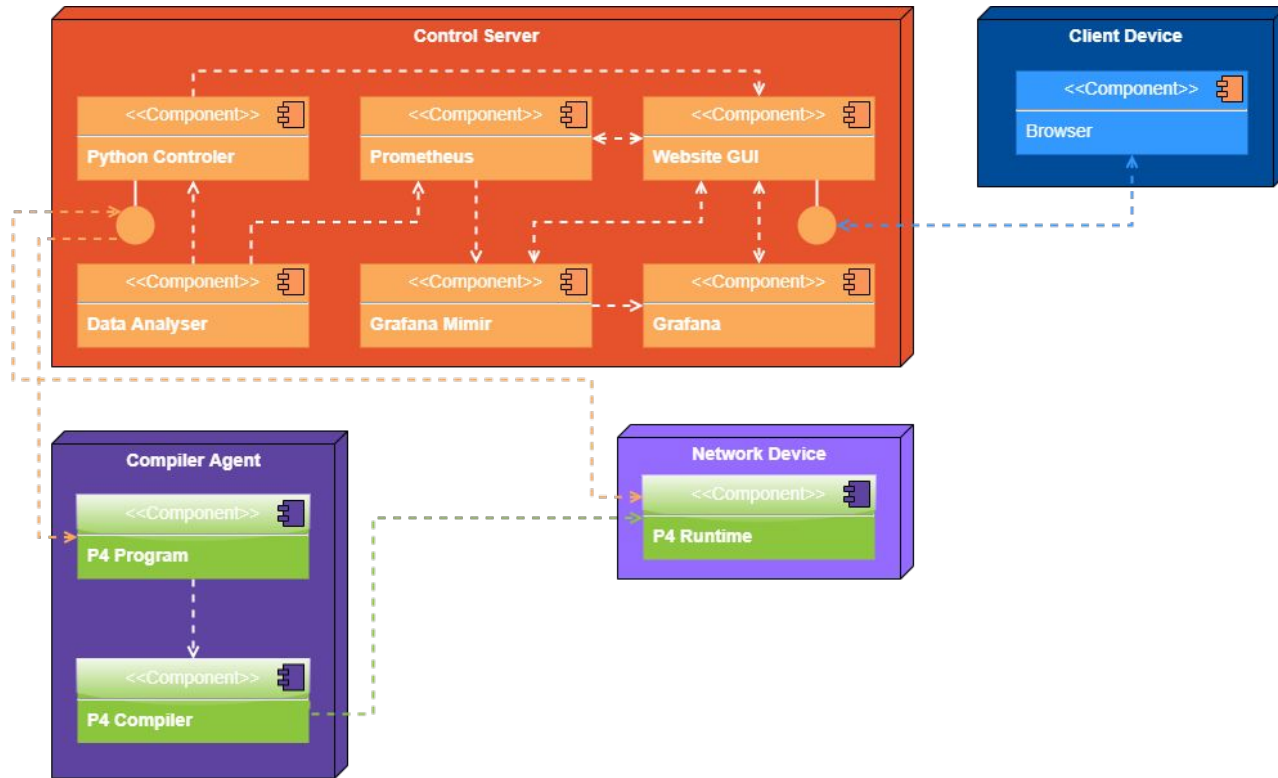


Name	Diana Silva	Age	27
Job	Network Engineer	Location	Braga
Context Challenges &	The company where she currently works deals with a variety of projects at a given time. It wants to begin transitioning to virtualized services, but doing so “in-house”, so they tasked Diana with developing a network structure for the upcoming virtualized environment.		
Goals	Diana need to keep a close eye on the network of services, but not only that, she needs a solution that actively alerts her to whatever parameter she defines and that she can define to react to certain events.		

Personas



Name	Diogo Ferreira	Age	34
Job	SOC Analyst	Location	Aveiro
Context Challenges &	Diogo works as part of a “blue team” for the security division of his company, one of his task is to monitor the impact of different types of traffic, the time periods during the day with large bandwidth demands , detect and act upon attacks like <i>DDOS</i> or even perform some vulnerability isolation .		
Goals	Diogo needs a solution that enables him to automate some of this tasks in his company’s virtual networks. He needs a system that not only detects but also is capable of reconfigure routes (or even vlans) when certain types of traffic are detected .		



System Architecture

MySQL

User	
PK	<u>user_id int NOT NULL</u>
username char(20) NOT NULL	
password char(40) NOT NULL	

Network	
PK	<u>network_id int NOT NULL</u>
FK1	user_id int NOT NULL
Devices	

Device	
PK	<u>Device_id int NOT NULL</u>
FK1	network_id int NOT NULL
	device_type char(10) NOT NULL
FK2	device_type_id int NOT NULL

Mimir

Metric	
PK	<u>metric_id int NOT NULL</u>
FK1	network_id int NOT NULL
DATA (Unstructured Data)	

MongoDB

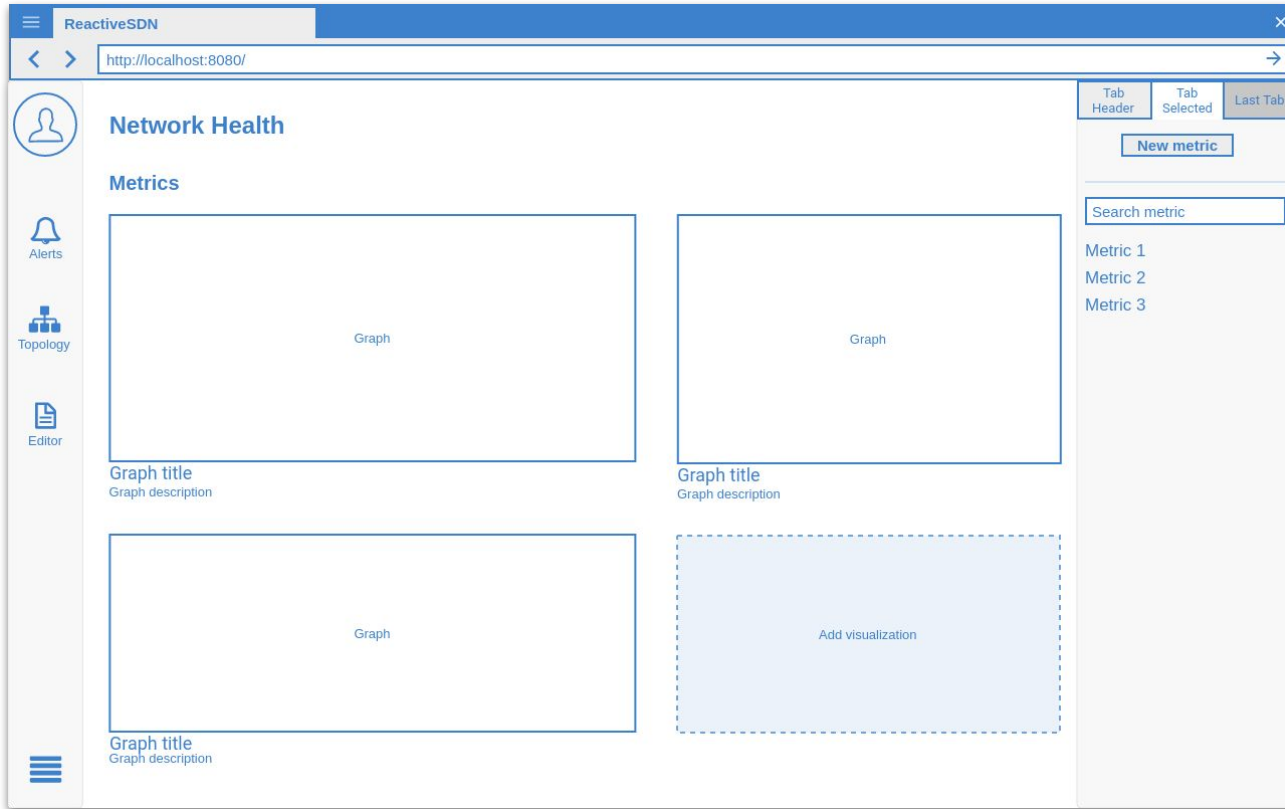
DeviceSettings	
PK	<u>device_type_id int NOT NULL</u>
FK1	device_id int NOT NULL
FK2	device_type char(10) NOT NULL
SETTINGS (Unstructured Data)	

Topology	
PK	<u>topology_id int NOT NULL</u>
FK1	network_id int NOT NULL
SETTINGS (Unstructured Data)	

Entity Diagram

System Mockup

Metric visualization & Device management



Overview of the network

The screenshot shows the ReactiveSDN web interface in a browser window. The address bar displays `http://localhost:8080/`. The interface has a blue header with the title "ReactiveSDN" and a hamburger menu icon. A left sidebar contains icons for a user profile, Alerts, Topology, and Editor. The main content area is titled "Topology" and "Devices". Under "Devices", there are tabs for "Routers", "L3 Switches", and "+ New Category". Below these tabs is a "+ New Device" button. A table lists network devices:

Marketing		Configure
Name	Marketing	
Addresses	20.56.89.124 14:2d:27:e4:36:0f	Subnet Seniors
Hosts	8 List all	
Secretary		Configure

Topology and network devices listing