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POLITECNICO MILANO 1863
DIPARTIMENTO DI ELETTRONICA INFORMAZIONE E BIOINGEGNERIA

Modeling of traffic effects in a router for Autonomic networks

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Agenda

- Introduction
- Autonomic Networks
- A model for an autonomic router
- Results
- Conclusion

Introduction

When you have to manage thousands of computing nodes you need a mechanism to let the system to reconfigure itself according to changed traffic and workload condition

For this reasons we work on Autonomic Networks

Autonomic Networks could work in cooperation with SDN (Software Defined Network)

Autonomic Networks

Introduced by IBM

4 main properties:

— Self-configuring
— Self-optimizing
— Self-healing
— Self-protecting

Autonomic Networks

Actual implementation may be partially compliant with these definition

Components cover only some of the 4 properties

These devices that have different and partial degrees of autonomicity will be part of a network

This network need a general strategy and a high-level policy to ensure quality of services and flexibility

Autonomic Networks

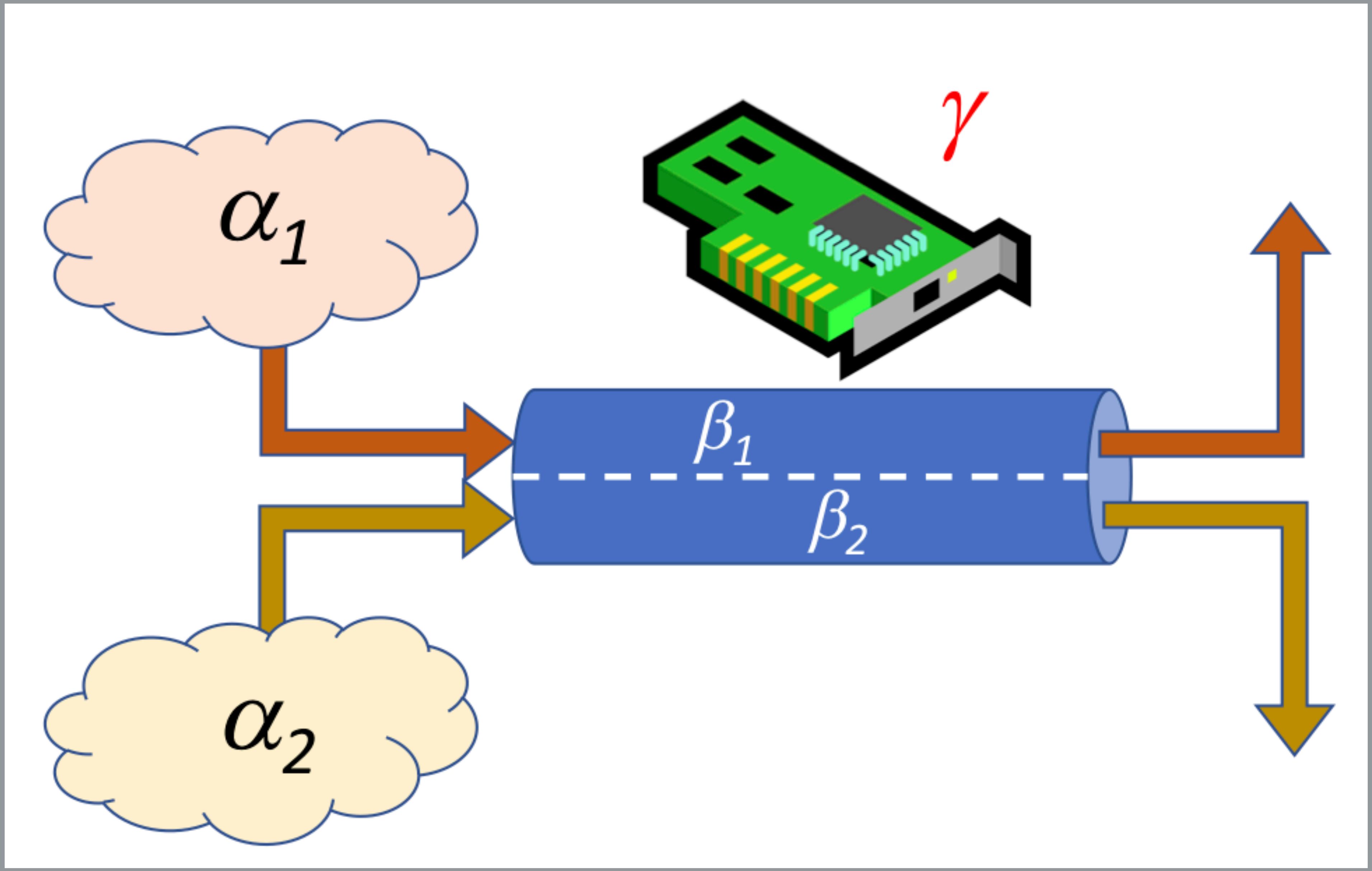
In this presentation we propose a model for autonomic router

We try to describe a model affordable for non specialists

The motivation of a model for an autonomic router

- choice of devices
- planning and managment
- cost evaluation and estimation

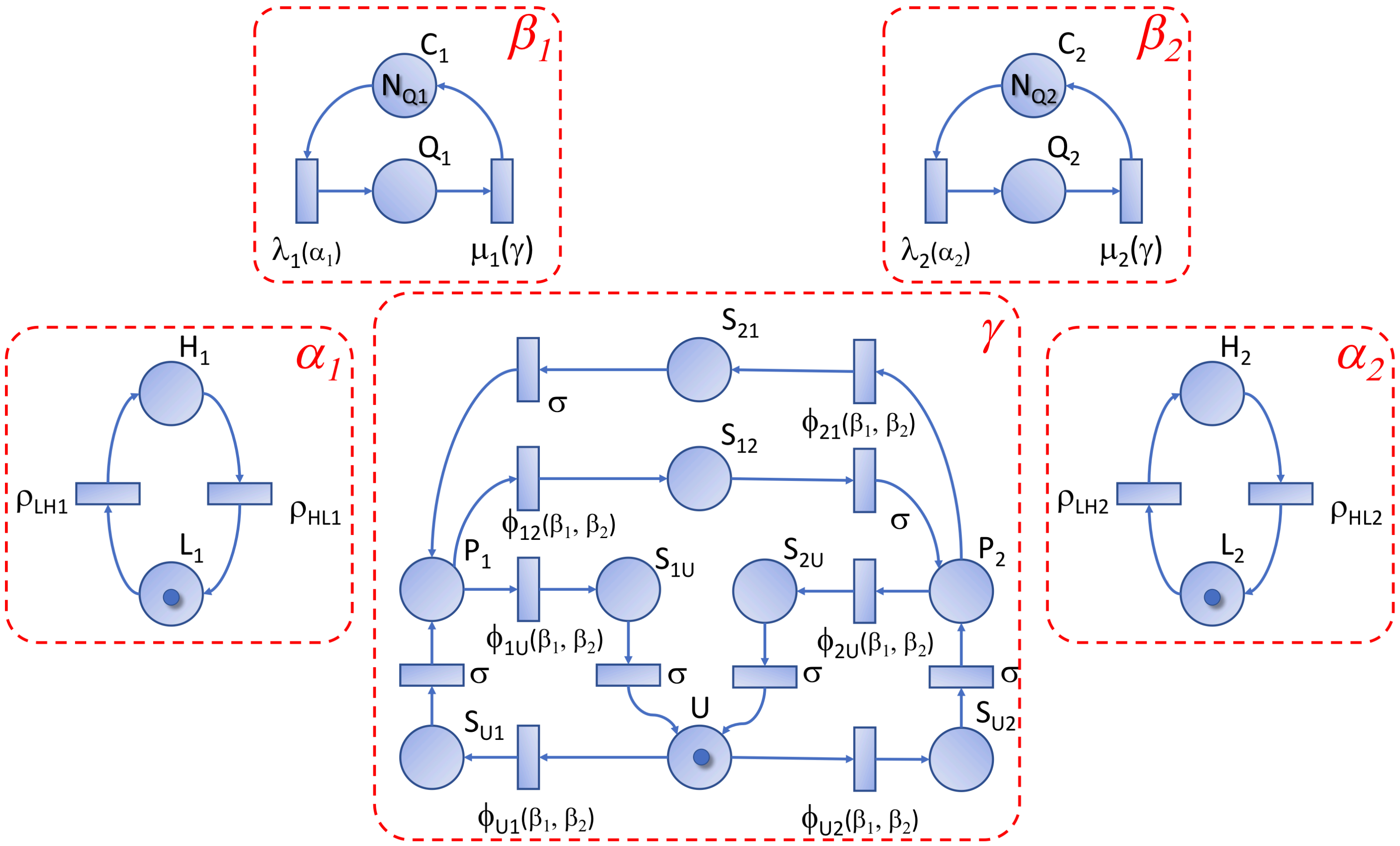
Modeling Approach: A single channel shared by two source



Modeling Approach: Parameters

- γ is the autonomic router
- α_1 and α_2 are sources modelled as MMPPs (Markov Modulated Poisson Processes)
- μ_1 and μ_2 are the traffic rates for α_1 and α_2
- β_1 and β_2 are the buffers and are characterised by capacity N_{Q1} and N_{Q2}

The SPN Model



Model explaination

The γ autonomic route alternates three states

- U state: traffic equally shared between the source
- P_1 state: source α_1 got more bandwidth
- P_2 state: source α_2 got more bandwidth

Model explaination

if α_1 and α_2 are in normal traffic then γ goes in U state

if α_1 is in high traffic then γ goes in P_1 state

if α_2 is in high traffic then γ goes in P_2 state

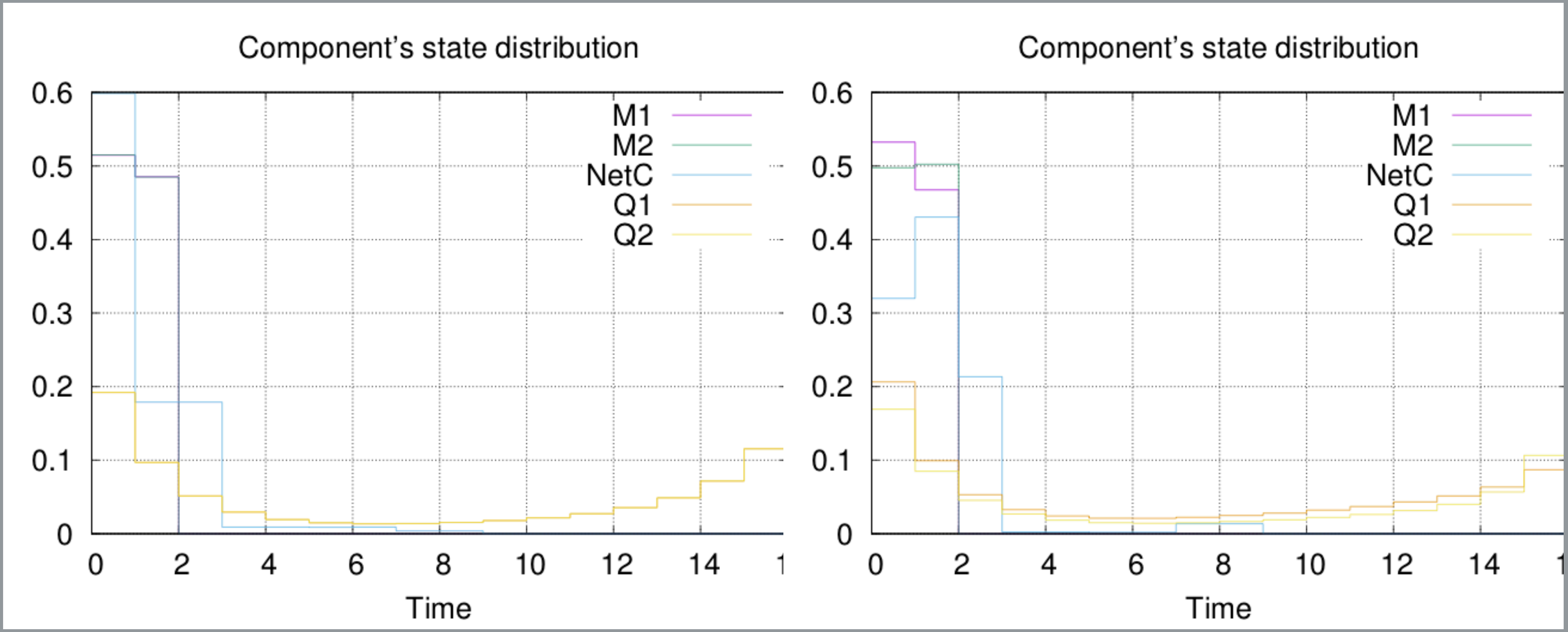
if α_1 and α_2 are both in high traffic then γ goes in U state

Model explaination

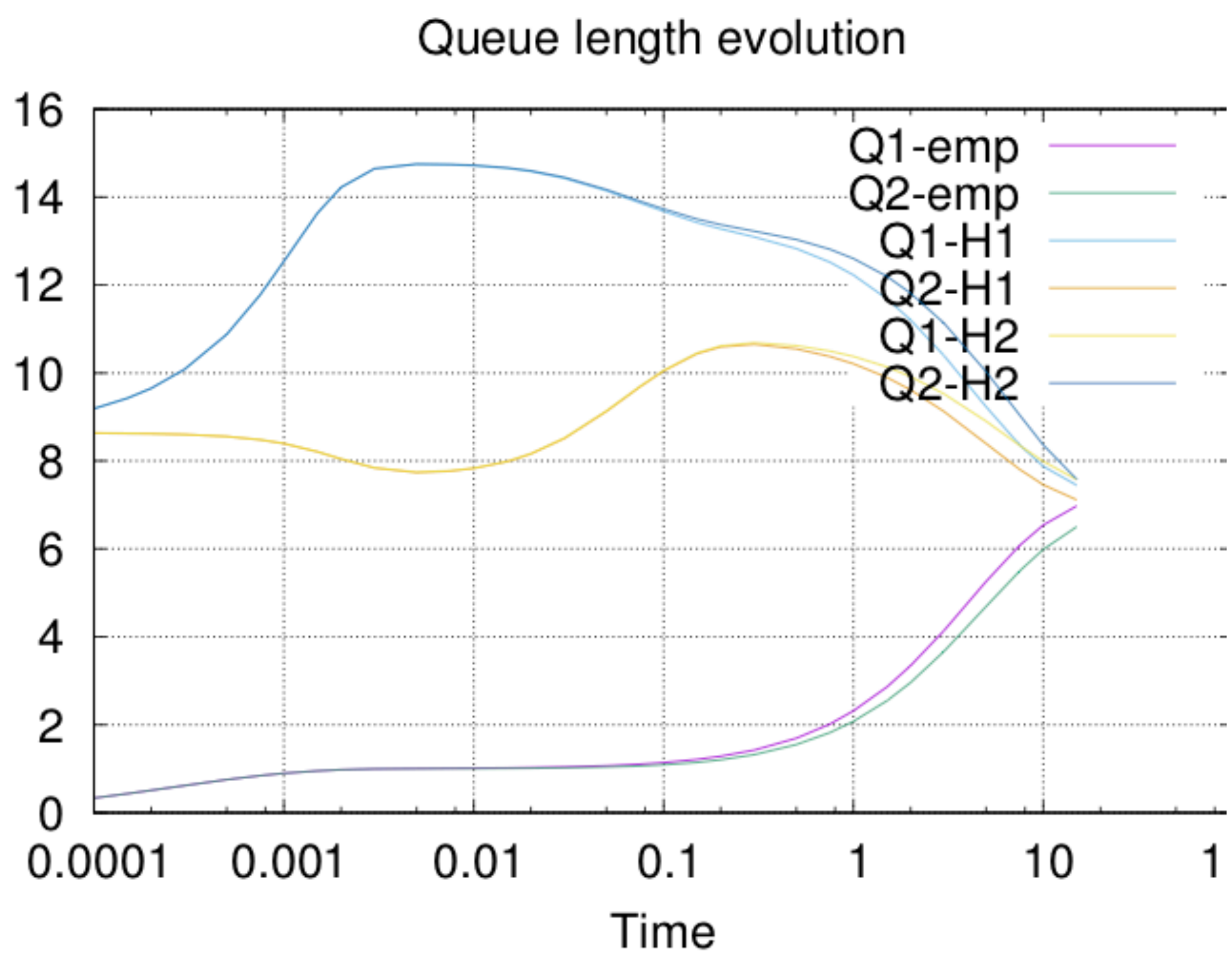
Detection of traffic conditions are performed by checking the occupation of the two buffers β_1 and β_2

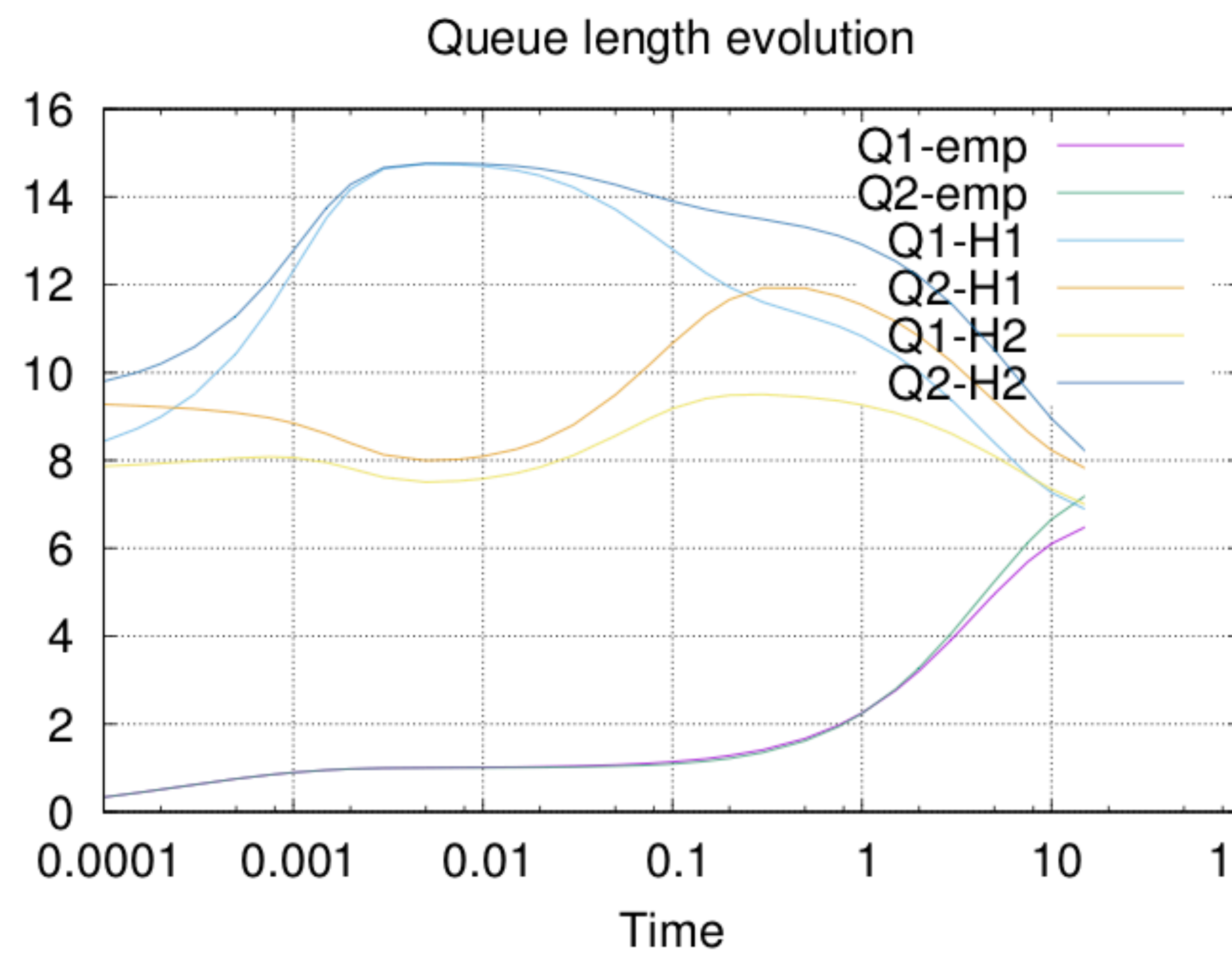
During the reconfiguration time needed for a change of state, the autonomic router γ works only at a fraction of its max capacity

Results



Component's state distribution
M1
M2
NetC
Q1
Q2
Time
Component's state distribution
M1
M2
NetC
Q1
Q2
Time


Queue length evolution
Q1-emp
Q2-emp
Q1-H1
Q2-H1
Q1-H2
Q2-H2
16
14
12
10
8
6
4
2
0
0.0001
0.001
0.01
0.1
1
10
1
Time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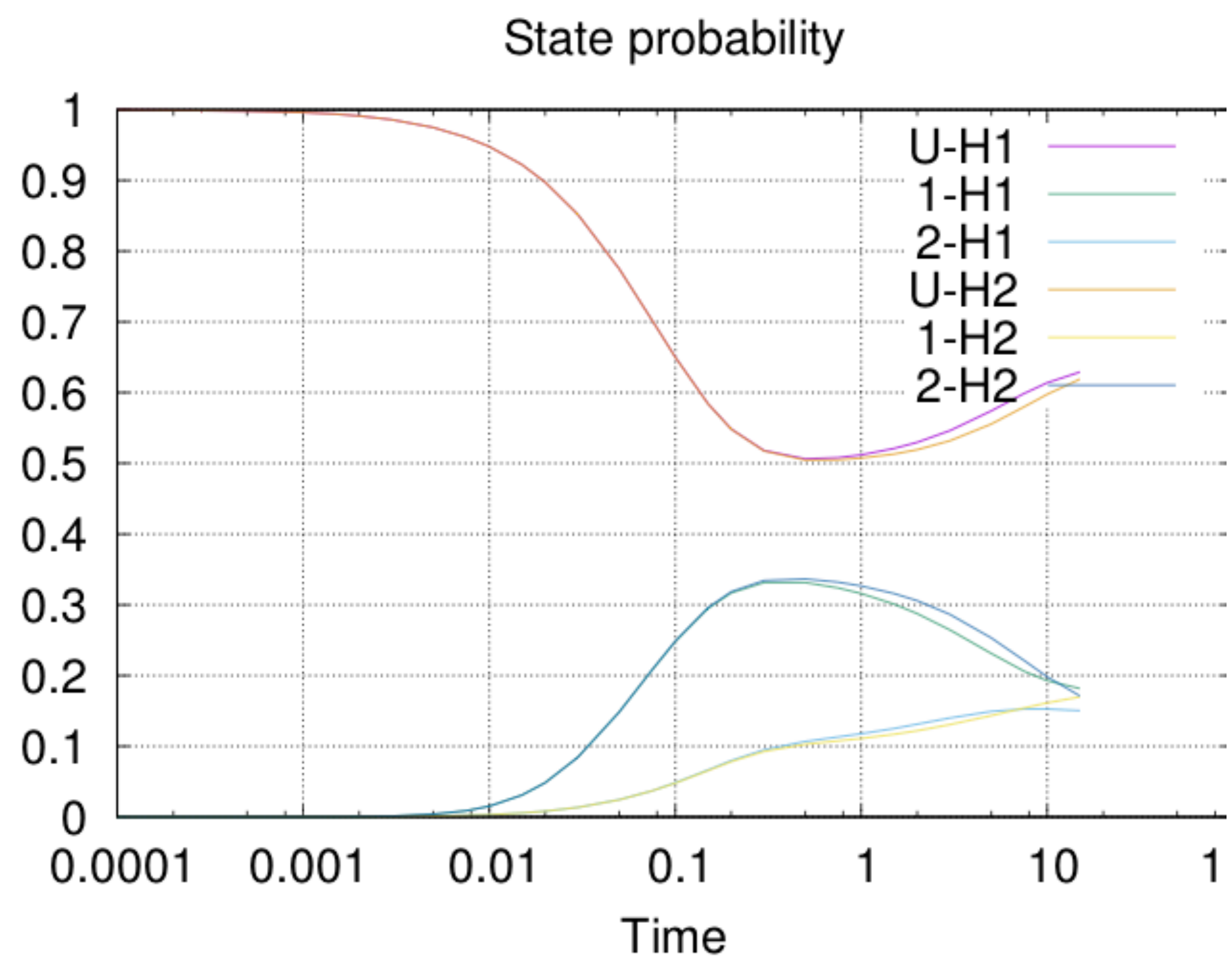
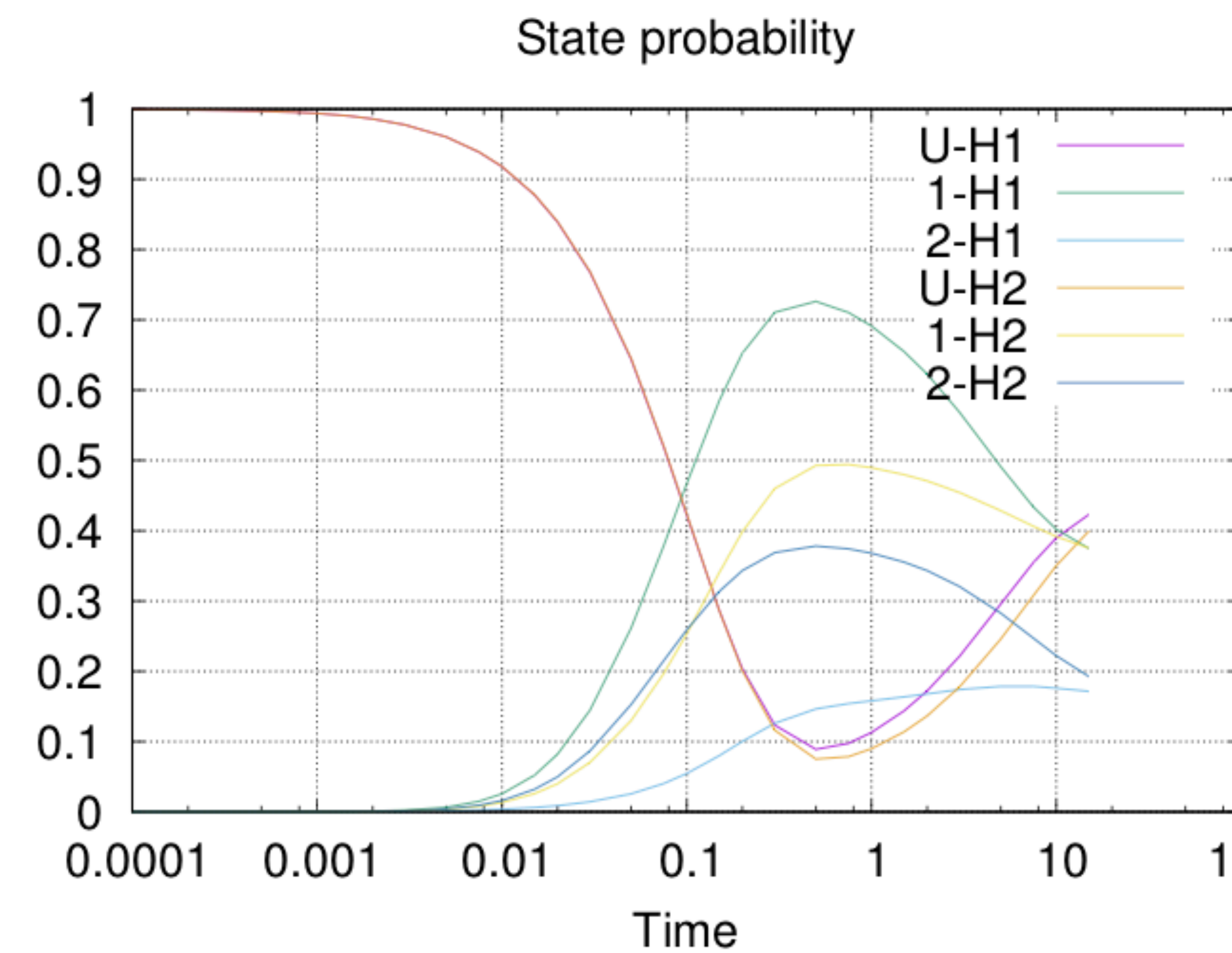

State probability
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.0001
0.001
0.01
0.1
1
10
1
Time
U-H1
1-H1
2-H1
U-H2
1-H2
2-H2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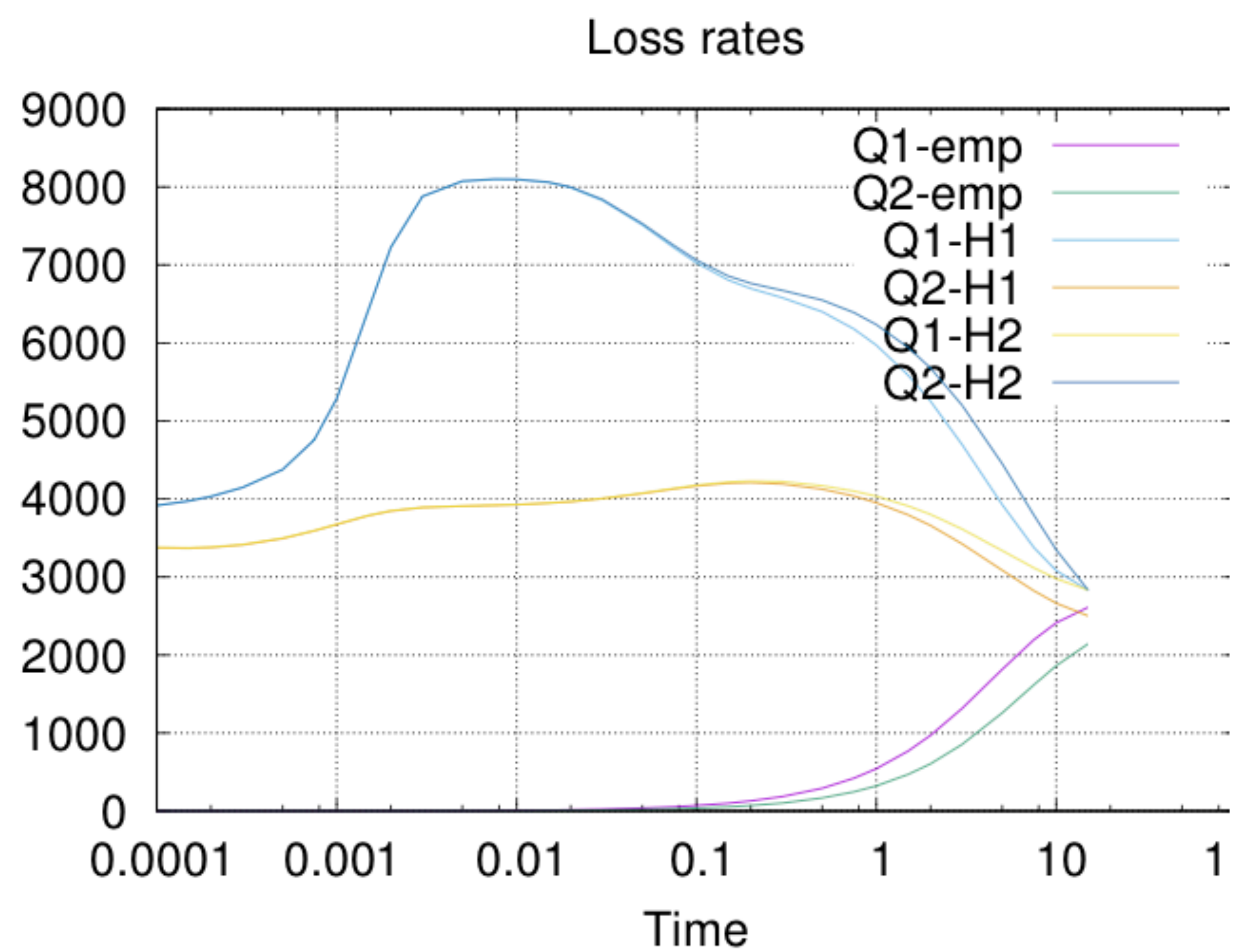
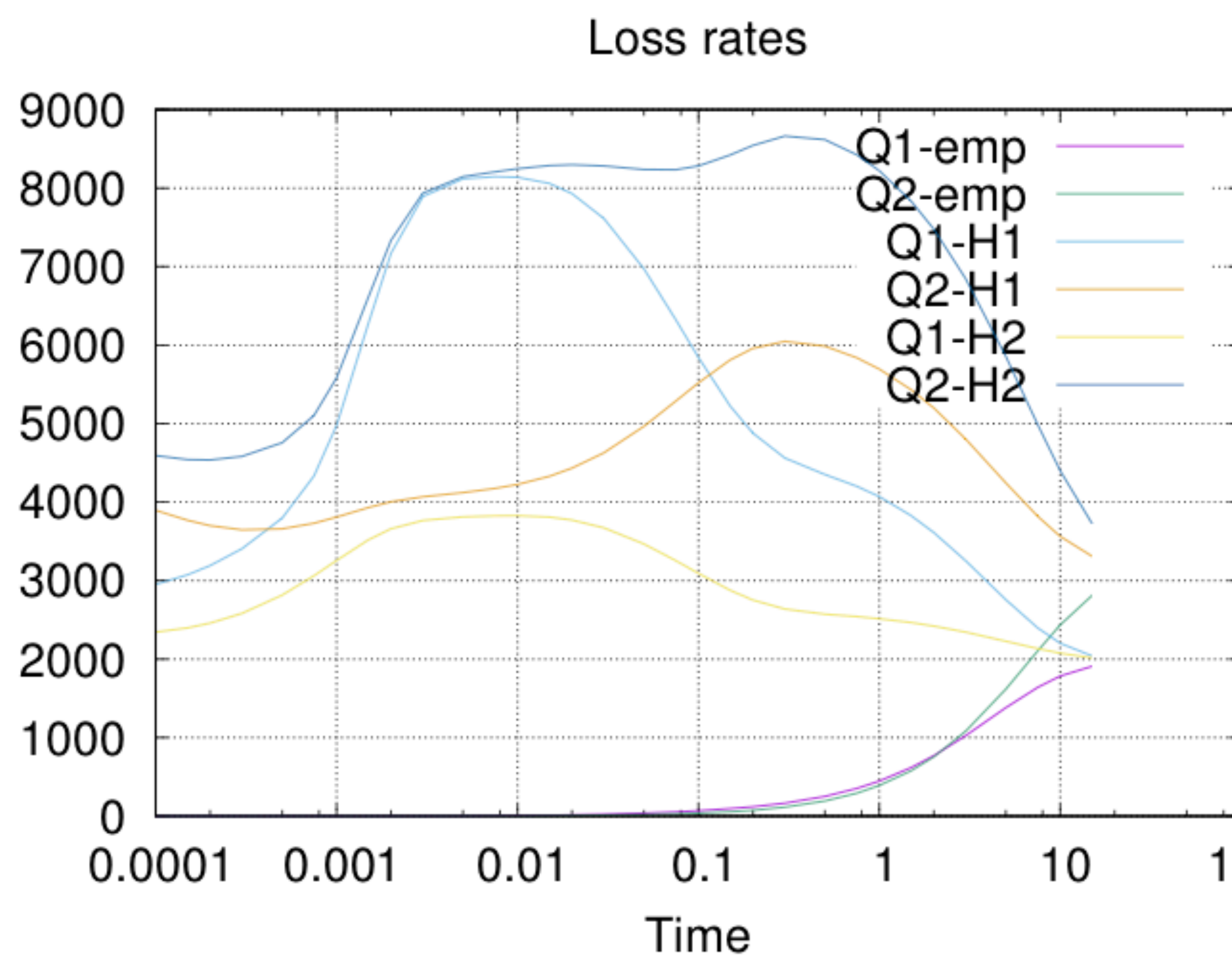
1
10
1
Time
U-H1
1-H1
2-H1
U-H2
1-H2
2-H2


Loss rates
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0.0001
0.001
0.01
0.1
1
10
1
Time
Q1-emp
Q2-emp
Q1-H1
Q2-H1
Q1-H2
Q2-H2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Time
Q1-emp
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Q1-H1
Q2-H1
Q1-H2
Q2-H2

Conclusion

We presented a simple evaluation model for performance of autonomic routers.

Future works:

- **extension to more complex routers**
- **addition of a validation frameworks**