Implementing Quality of Service for the Software Defined Networking Enabled Future Internet

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Agenda of our talk

CityFlow

- Motivations
- Our QoS Framework for SDN
- Objective of our experiments
- Experimental Setup and Results
- Conclusions

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Motivation

- Achieving high QoS is a major concern in the current Internet
  - Service Level Agreement between business customers and a Service Provider

- Current QoS mechanisms (IntServ & DiffServ) are practically not possible to implement globally over the Internet

Motivation

- Three tasks are needed to be performed in the current Internet for establishing QoS
  - Determining availability of network resources
    - Difficult to determine because each device runs its own control software
  - Configure network resources if they are available
    - No standard protocol available to configure resources
  - Reconfigure network resources on a failure conditions
    - Resilience protocols need to depend on vendor specific protocol for reconfiguration
- With SDN, all the above tasks are practically possible to implement
  - Centralized control
  - Standard OpenFlow, OF-CONFIG or OVSDB protocol for configuration and reconfiguration.

Our proposed Framework

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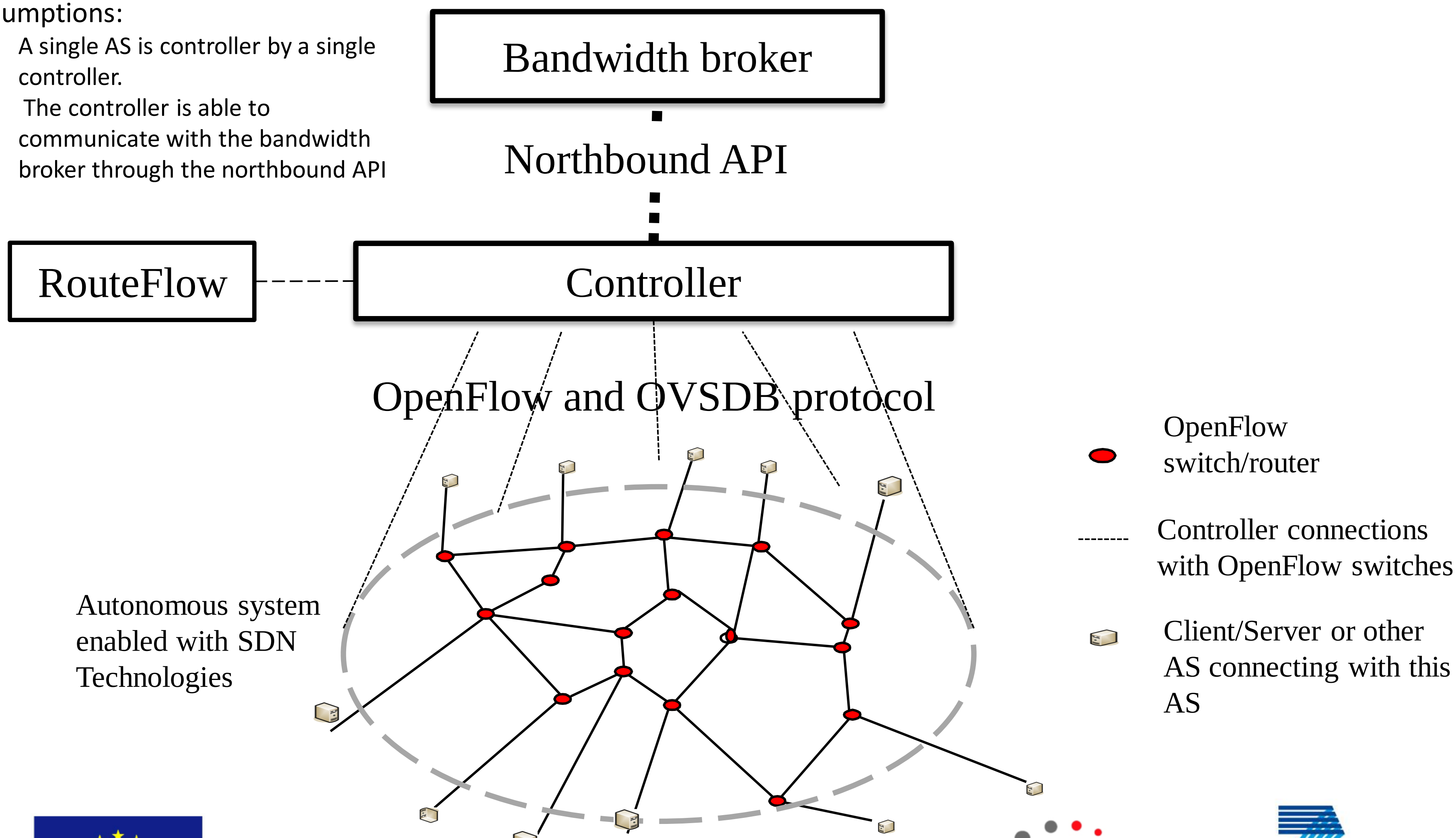
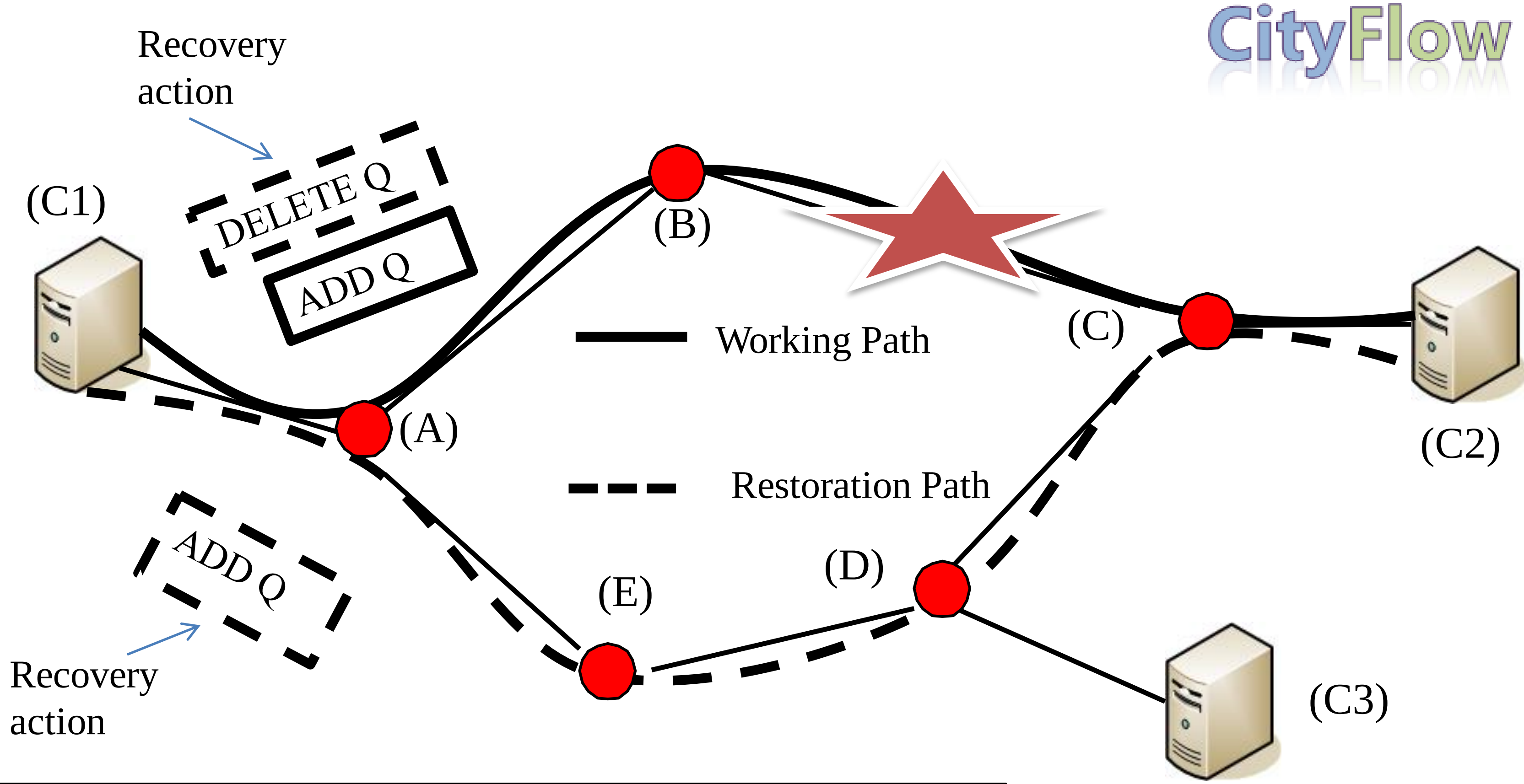
Assumptions:

1. A single AS is controller by a single controller.
2. The controller is able to communicate with the bandwidth broker through the northbound API





By default, three queues are implemented for each port :

•The first queue is for **control traffic**

•The second queue is for **high priority traffic**

•The third queue is for **best effort traffic**

•Q is a **rate limiter queue for high priority traffic at the edge** router (Router A)

Objective of Experiments

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- To evaluate three QoS failure recovery scenarios for SDN networks using our implemented Framework
  - When enough bandwidth in the working and the failure recovery path, neither high-priority nor best-effort traffic should get affected
  - When limited bandwidth, best-effort traffic get affected to fullfill the requirements of high-priority traffic
  - When very low bandwidth, high-priority traffic also gets affected, but there should be no interference from best-effort traffic.

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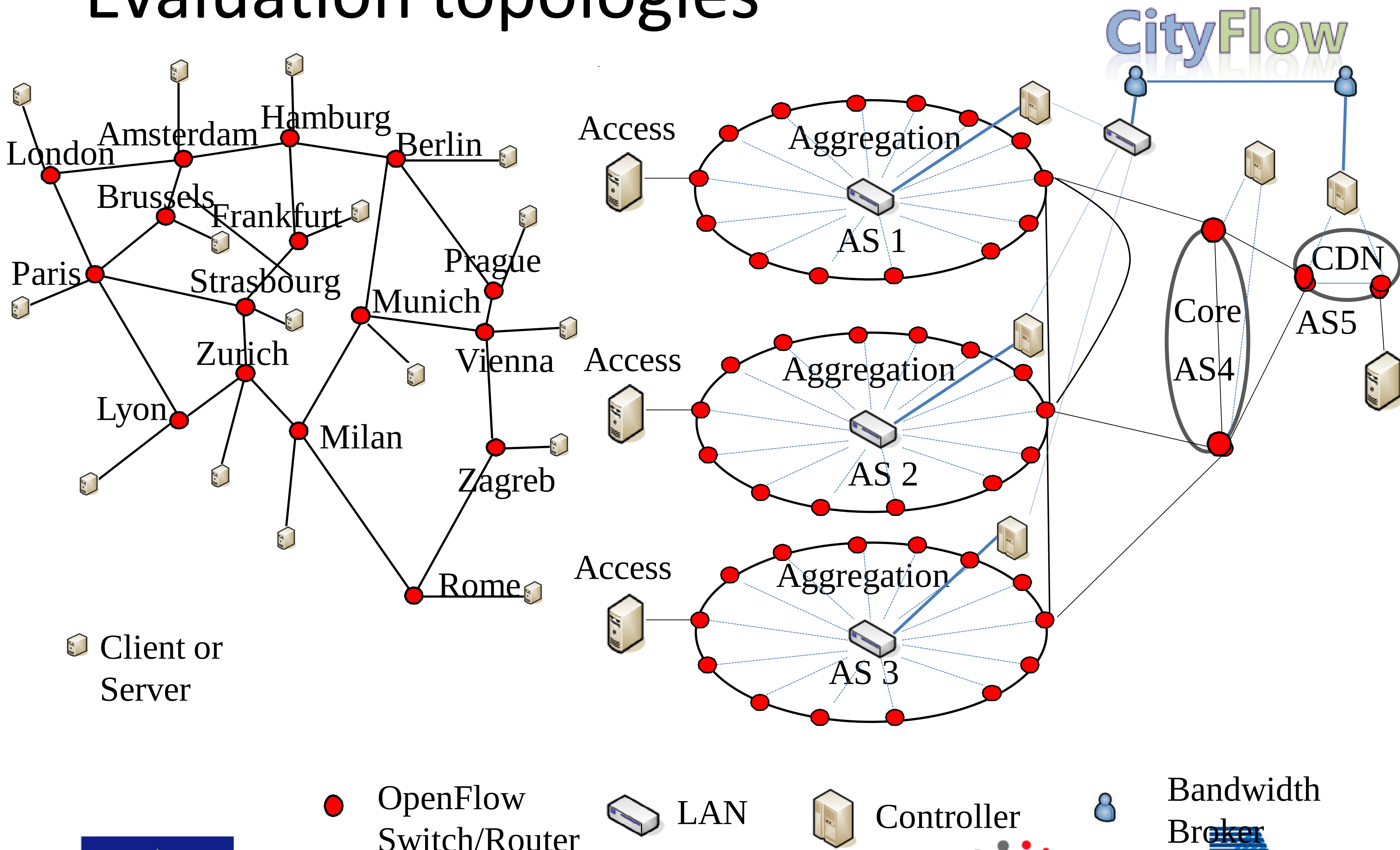
Evaluation topologies



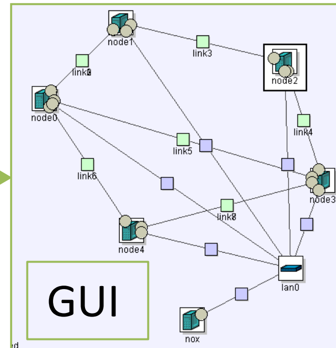
OFELIA island @ iMinds

CityFlow

Creating a CityFlow experiment

CityFlow

OpenFlow Experiment idea



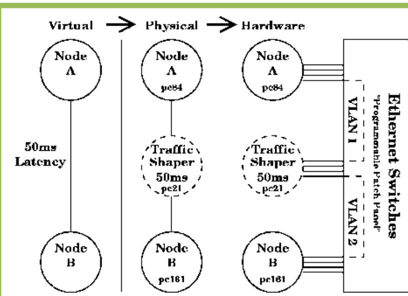
Use Cityflow OF images

```
#generated by Netbuild 1.03
set ns [new Simulator]
source tb_compat.tcl

#set ofclick1 [$ns node]
#tb-set-node-os $ofclick1 UBU1004-STD
#set ofclick2 [$ns node]
#tb-set-node-os $ofclick2 UBU1004-STD
set nox [$ns node]
tb-set-node-os $nox DEB60-STD

#set datachannel1 [$ns duplex-link $ofclick1 $ofclick2 1000Mb 0ms DropTail]
#set controlchannel1 [$ns duplex-link $ofclick1 $nox 1000Mb 0ms DropTail]
#set controlchannel2 [$ns duplex-link $nox $ofclick2 1000Mb 0ms DropTail]

#tb-set-ip-link $ofclick1 $datachannel1 172.16.0.1
#tb-set-ip-link $ofclick2 $datachannel1 172.16.0.2
#tb-set-ip-link $nox $controlchannel1 172.16.1.100
#tb-set-ip-link $ofclick1 $controlchannel1 172.16.1.1
#tb-set-ip-link $nox $controlchannel1 172.16.1.100
#tb-set-ip-link $ofclick2 $controlchannel2 172.16.2.1
#tb-set-ip-link $nox $controlchannel2 172.16.2.100

#$ns rtproto Static
$ns run
#netbuild-generated ns file ends.
```

ns script

Add script lines for automated datapath configuration

- Specify links to script
- Auto -> available NICs



Hardware Mapping and swap in

Emulab runs the additional scripts from ns file

Emulation environment

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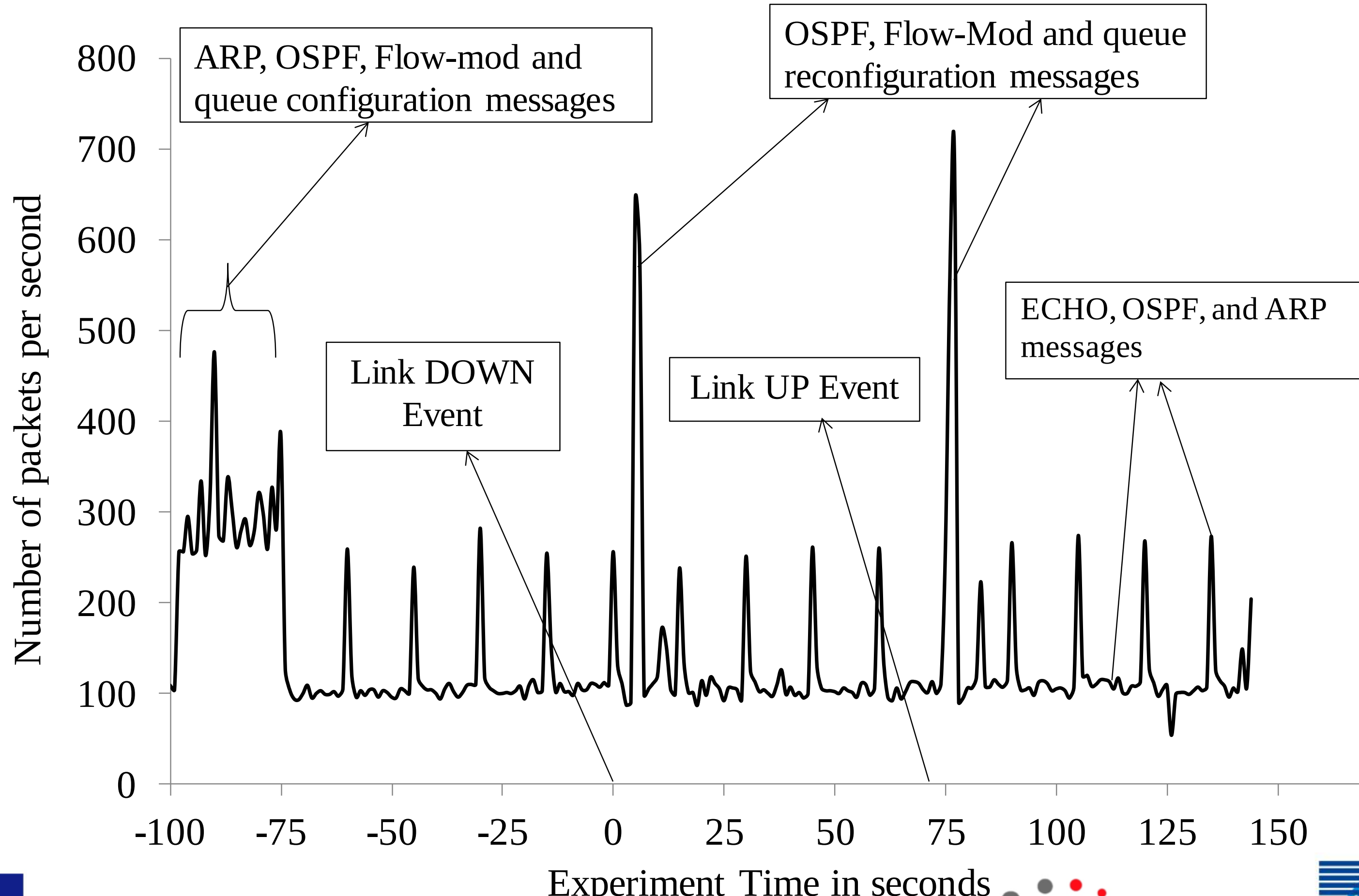
Traffic between the controller and switches



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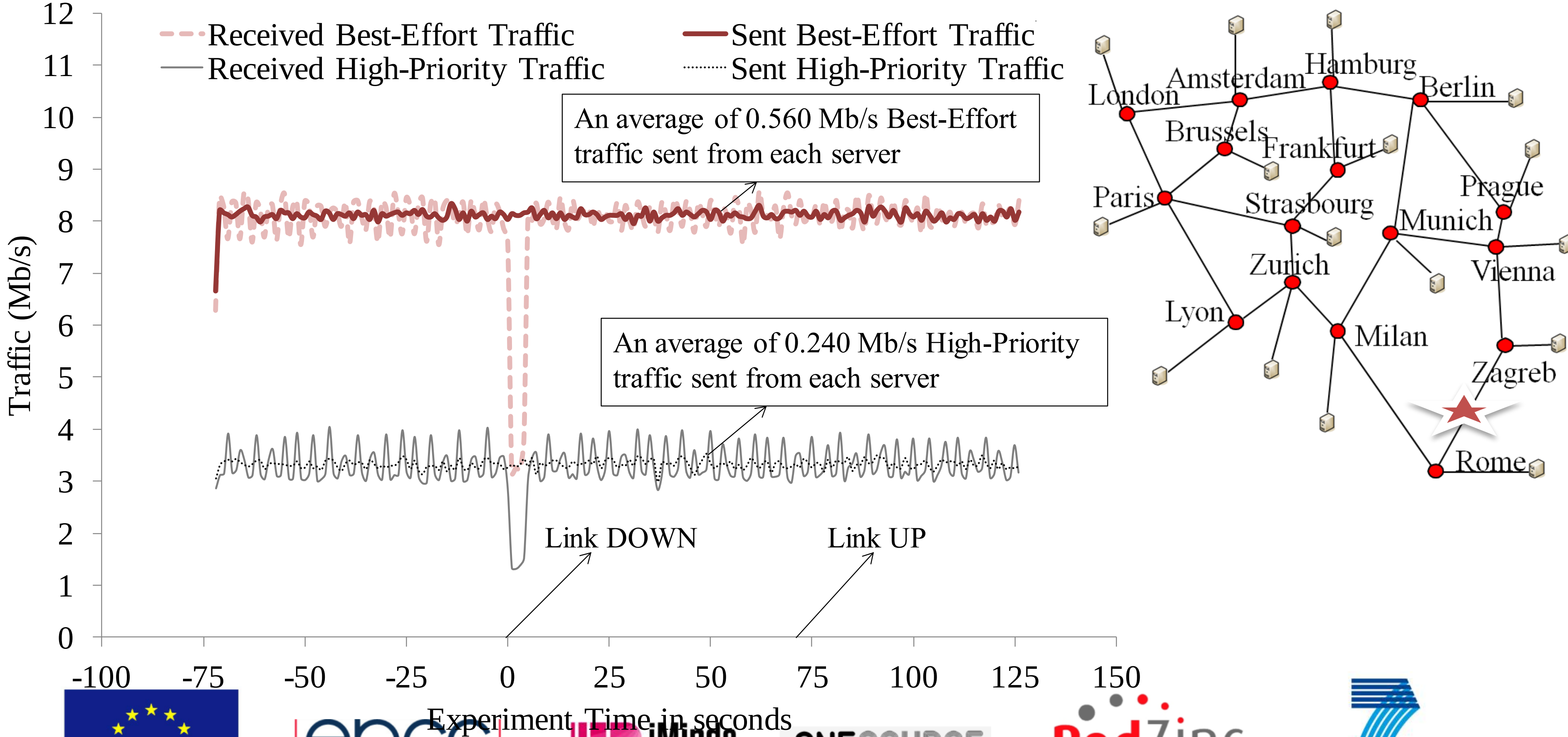
Traffic for the client connecting Zagreb

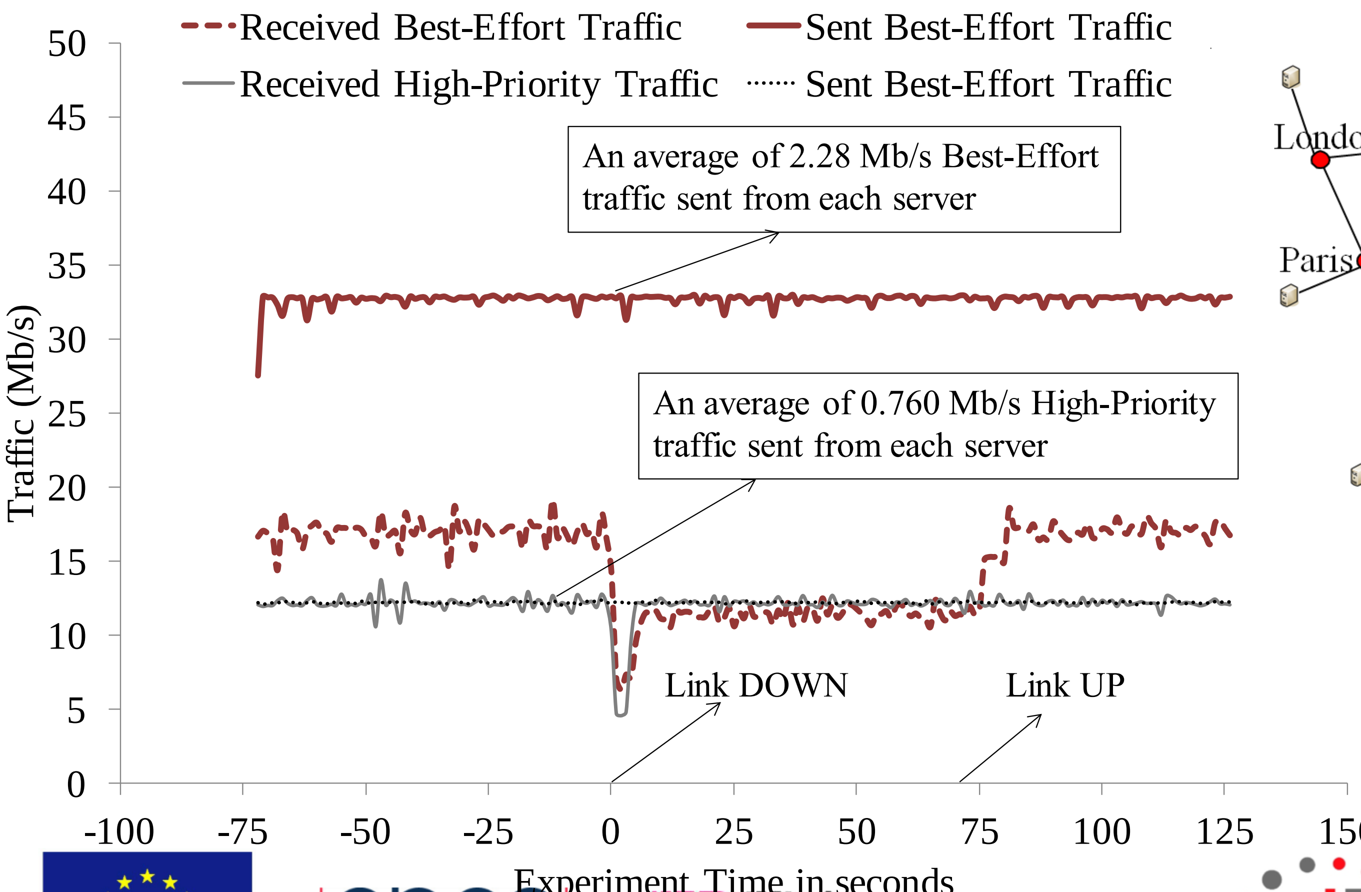
Best-Effort Traffic 0.560 Mb/s and High priority Traffic 0.240 Mb/s from each server

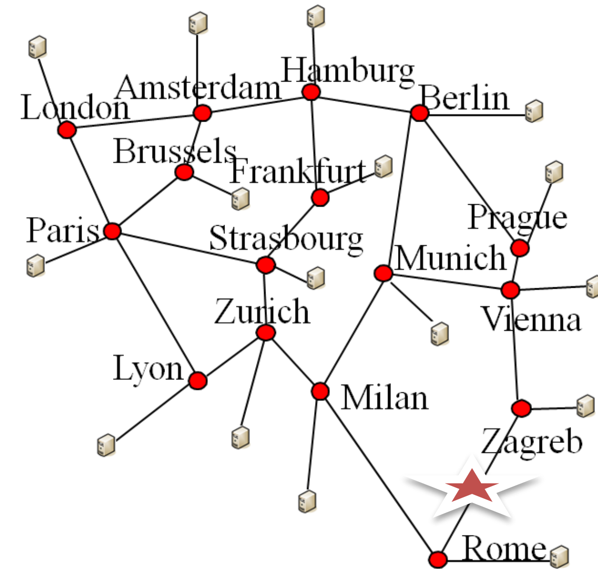


Traffic for the client connecting Zagreb

CityFlow

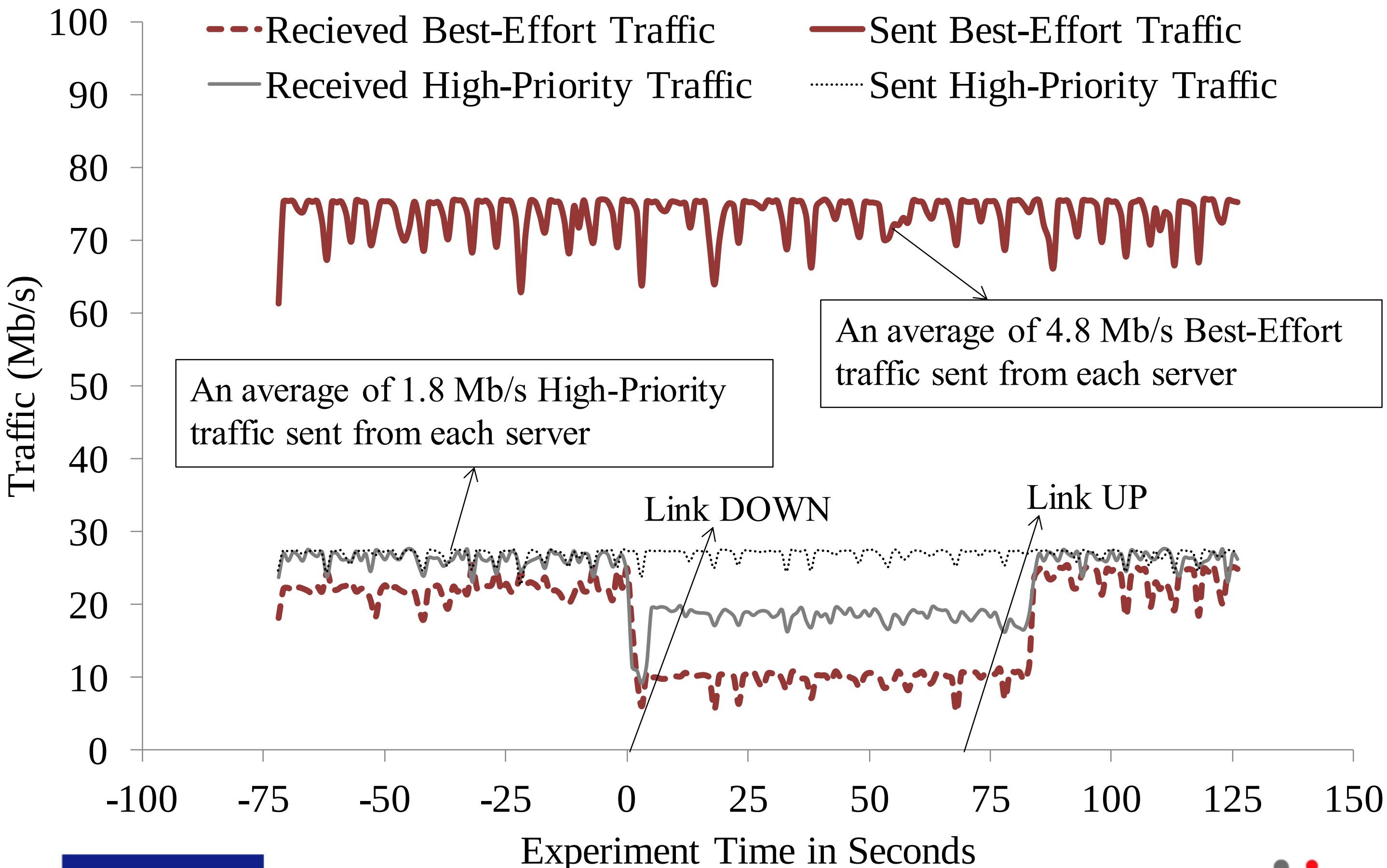
Best-Effort Traffic 2.28 Mb/s and High priority Traffic 0.760 Mb/s from each server



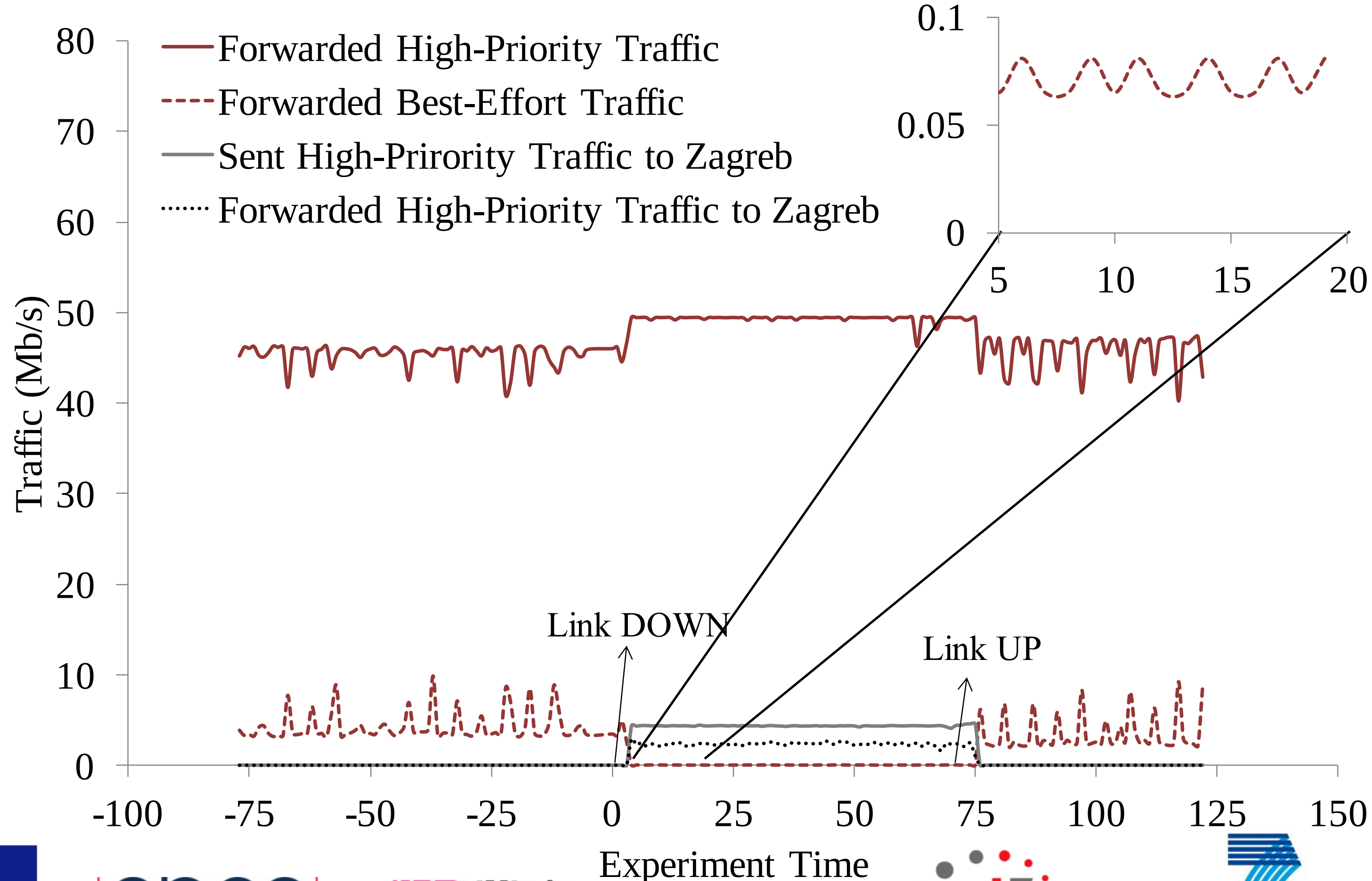


Traffic for the client connecting Zagreb

Best-Effort Traffic 4.8 Mb/s and High priority Traffic 1.8 Mb/s from each server

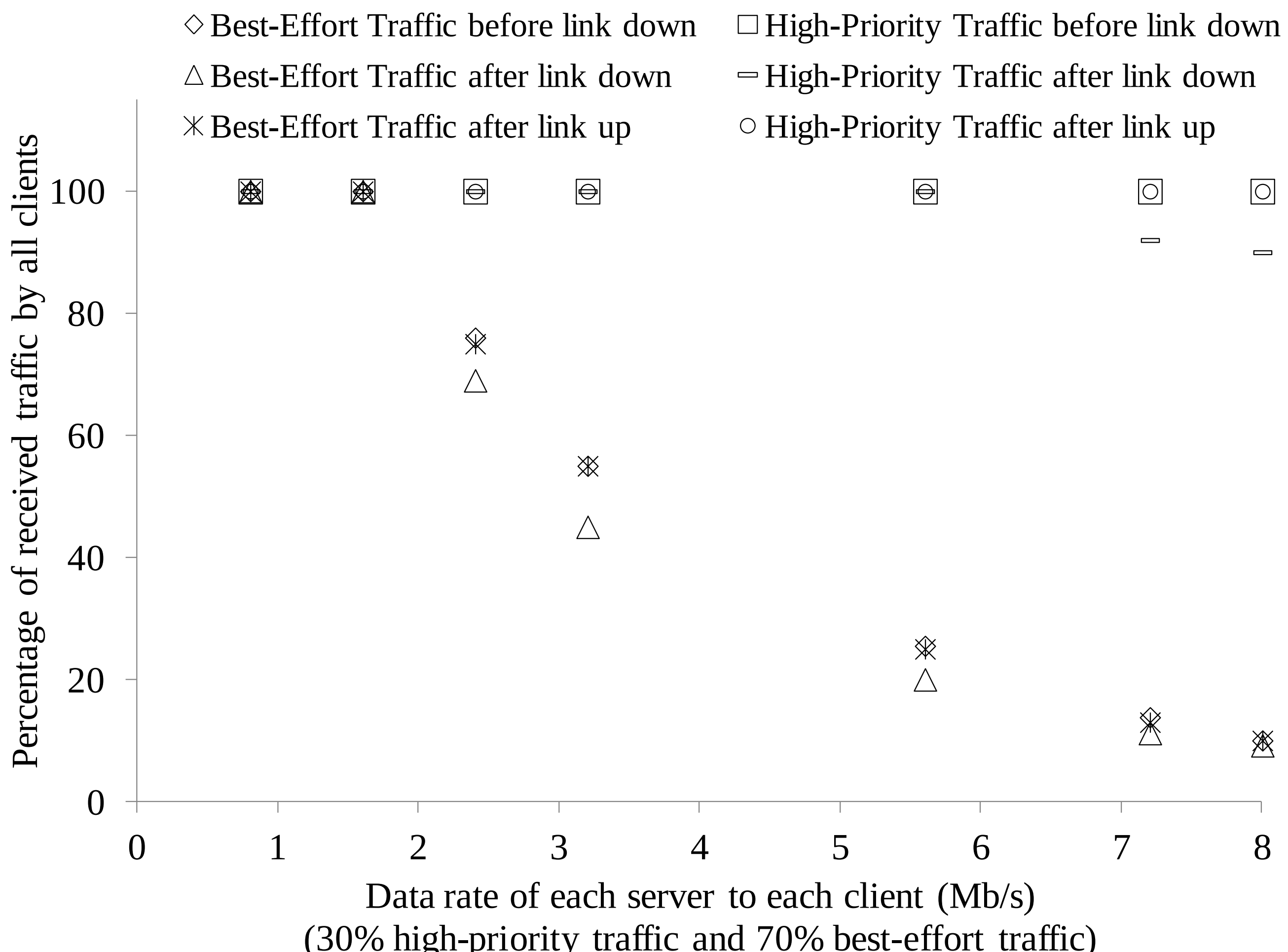


Traffic on link Milan-Munich (no interference link)



Total traffic received by all clients

CityFlow



Multiple AS experiment

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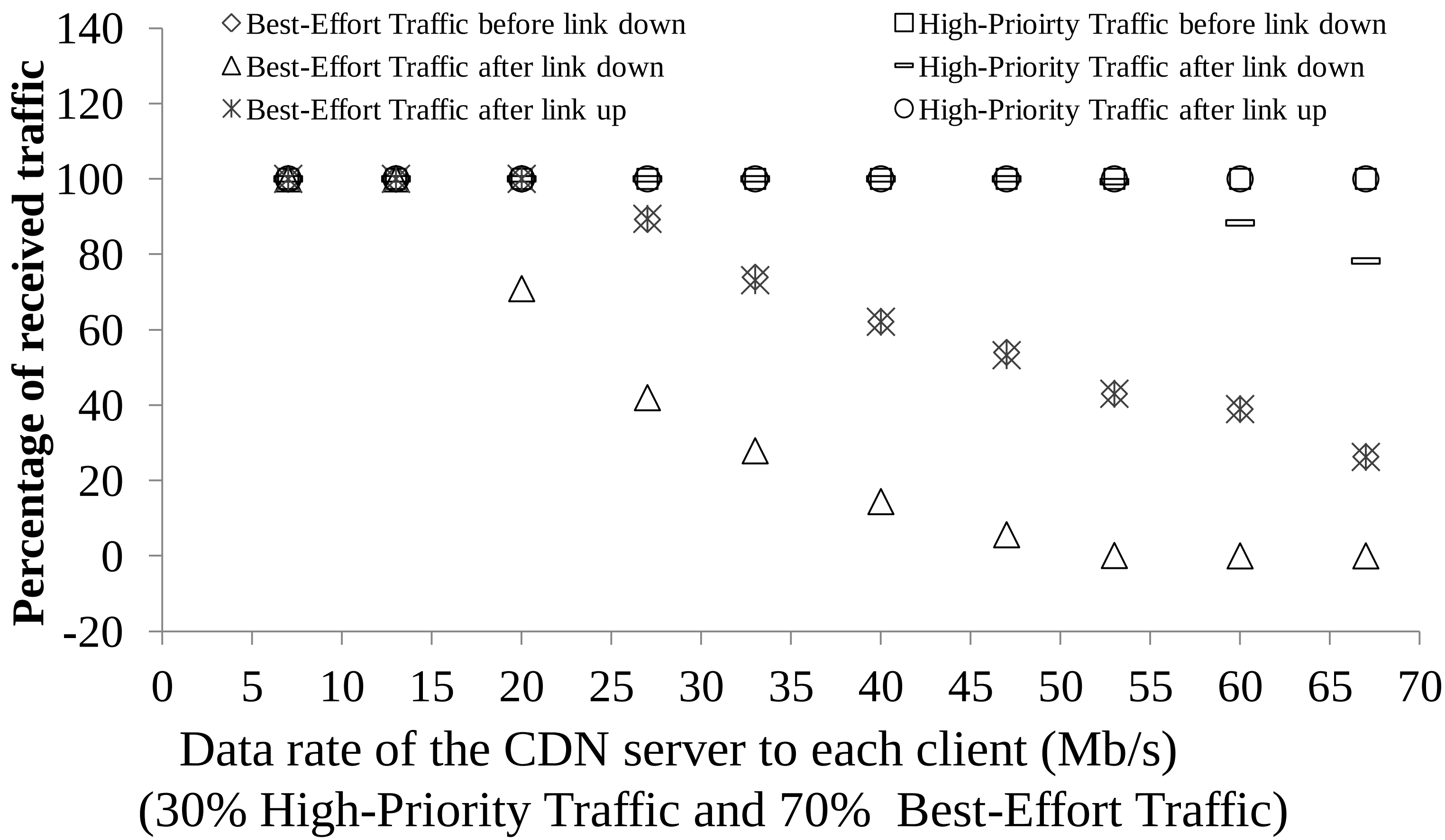
Total traffic received by all clients in access networks



Conclusions

- Designed a framework for Diffserv-like operation in OpenFlow
- Implemented QoS-aware failure recovery using VPS technology
- Experimentally validated the approach in single and multi-AS scenario’s

Questions?

CityFlow

- Sachin.Sharma@intec.ugent.be
- www.cityflow.eu (Project website for more detail)

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