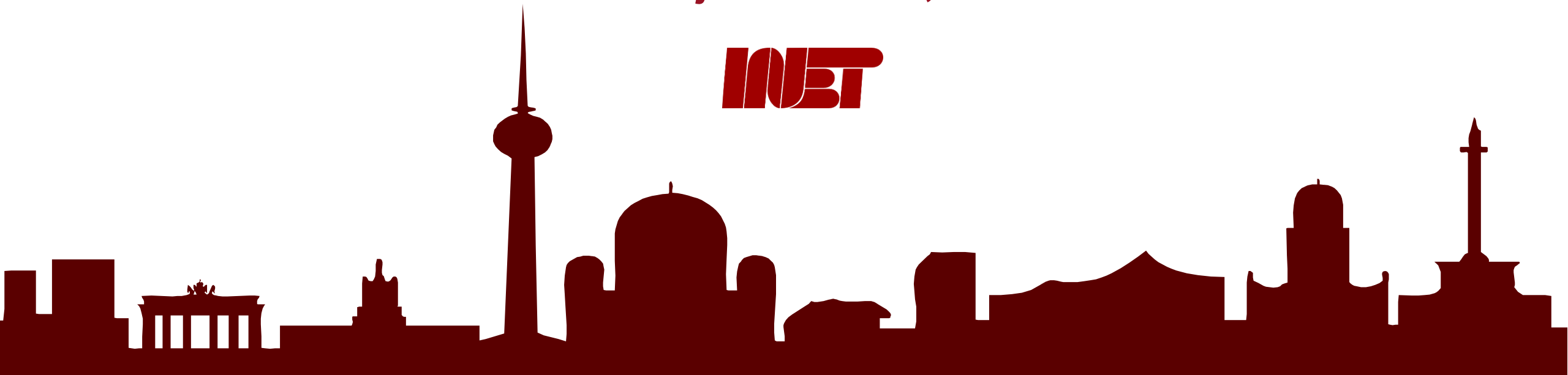


AP 13: Ausnutzung von Software- Defined Networking zur Datenverarbeitung

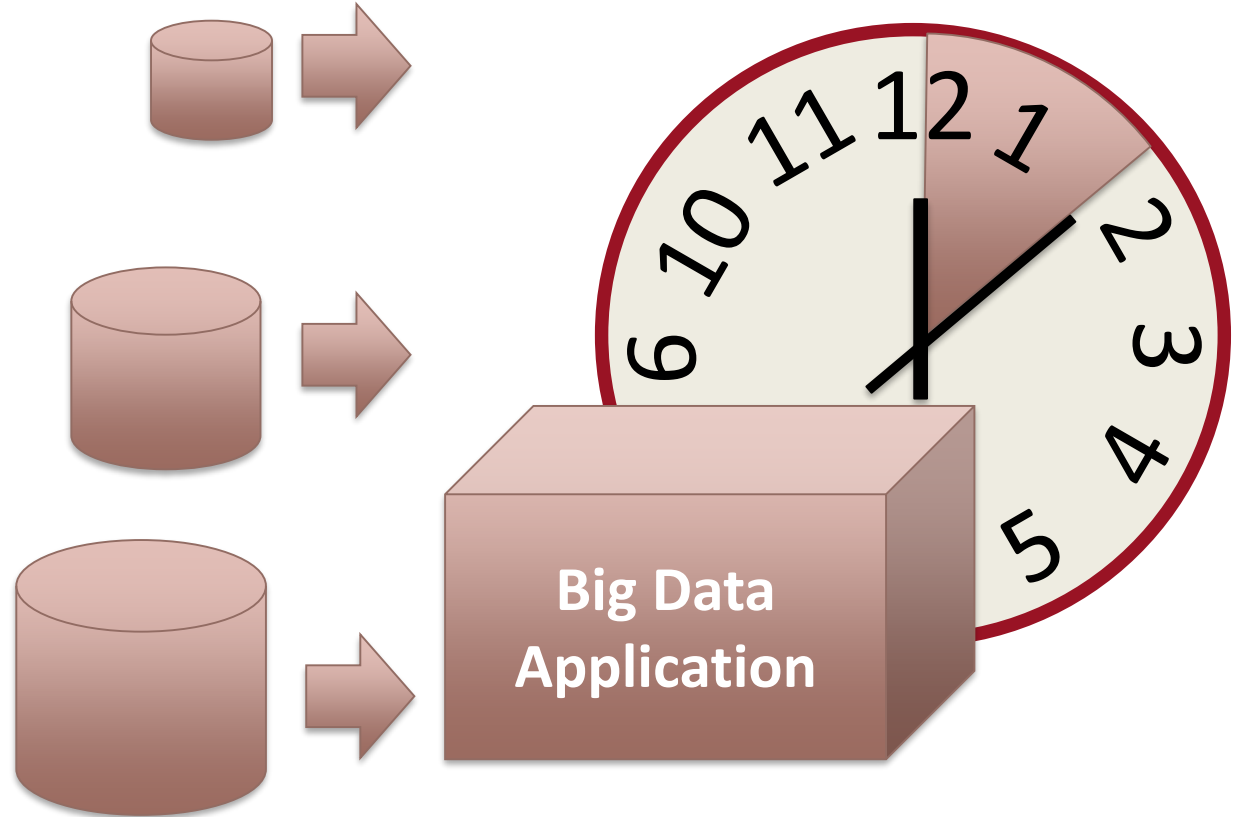
Niklas Semmler, Robert Krösche, Damien Foucard,
Prof. Anja Feldmann, PhD

INET



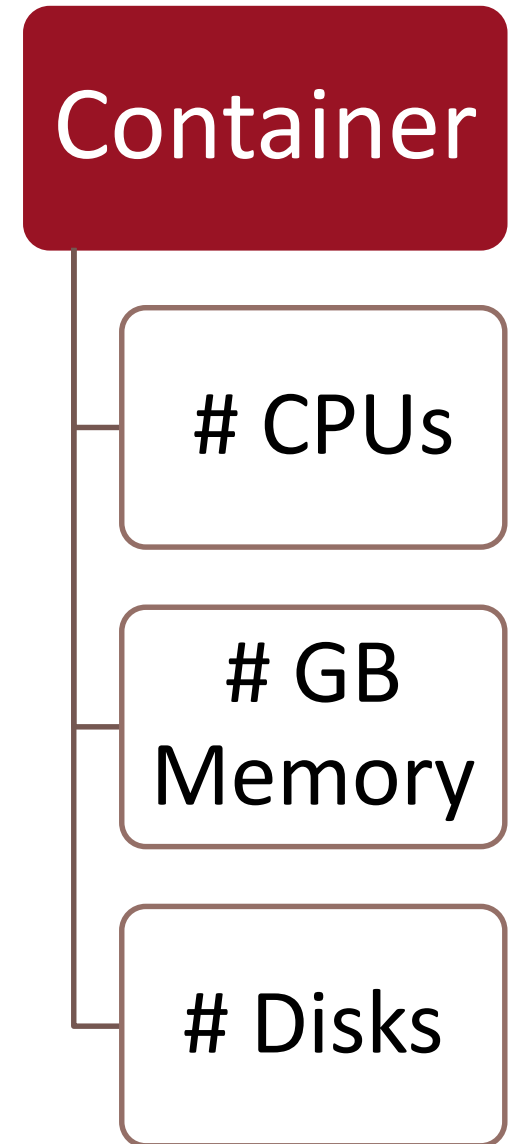
MOTIVATION

Big Data Applications are expected to adhere to static runtimes, independently of the data volume.



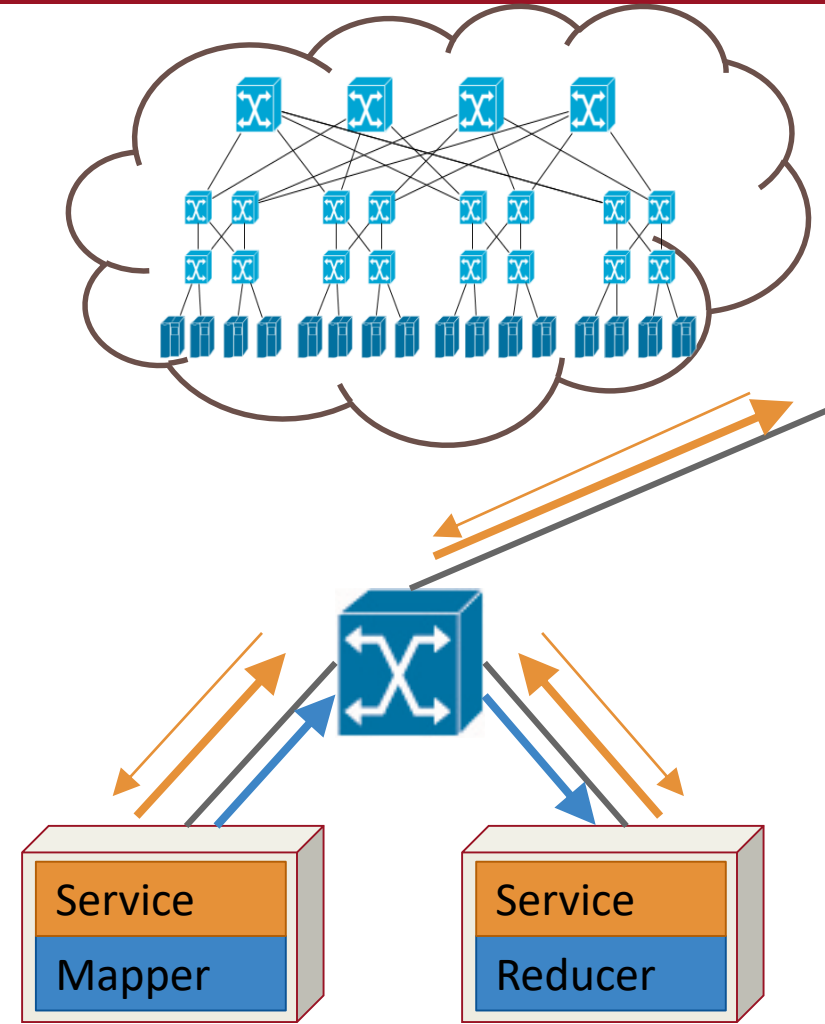
MOTIVATION

The Cloud offers flexible allocation of computing units in the form of containers.



PROBLEM

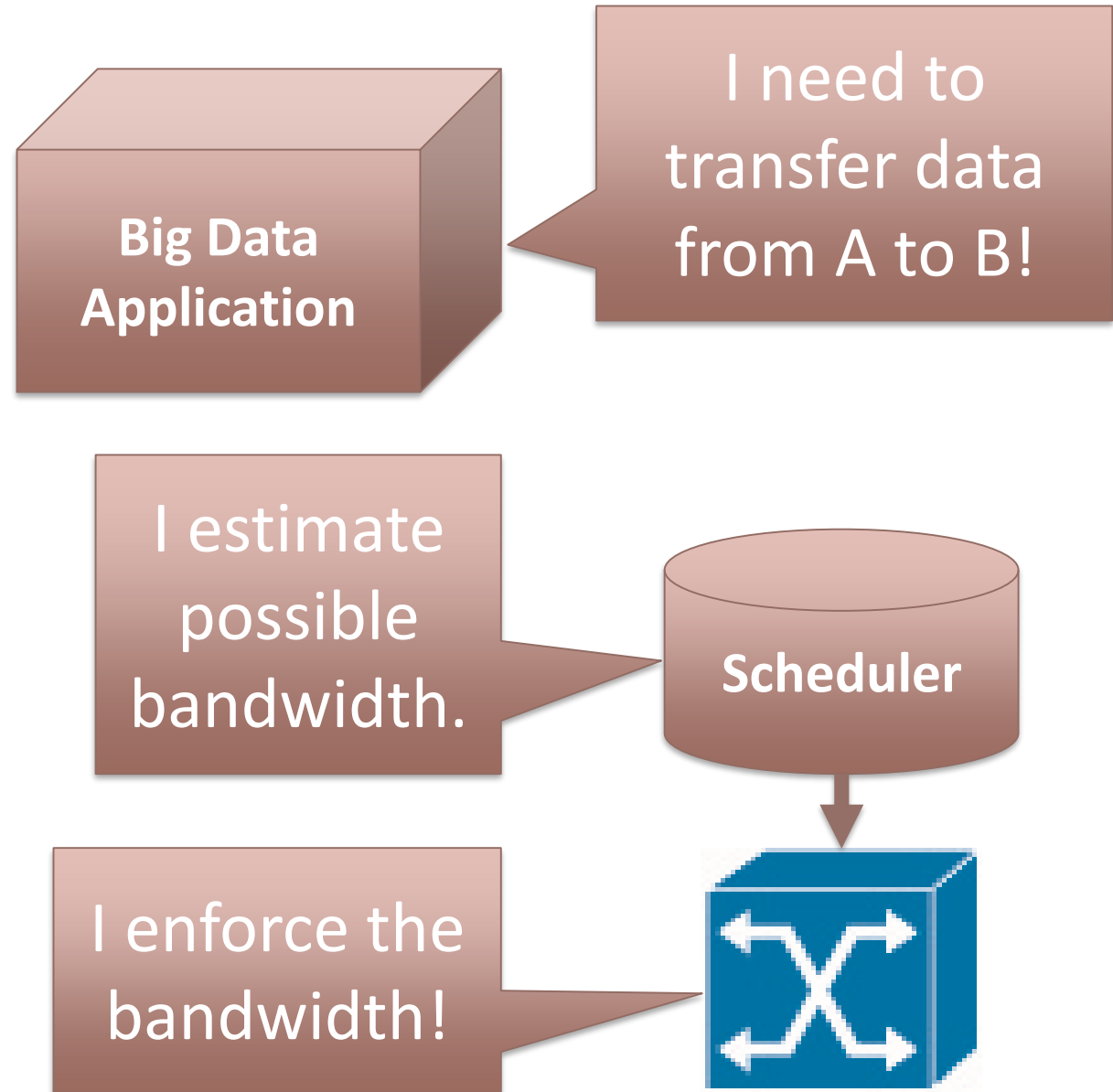
- Network is shared by all clients
- Location of containers is decided by Cloud operator
- Different applications might run on the same machine



Available Bandwidth is unpredictable!

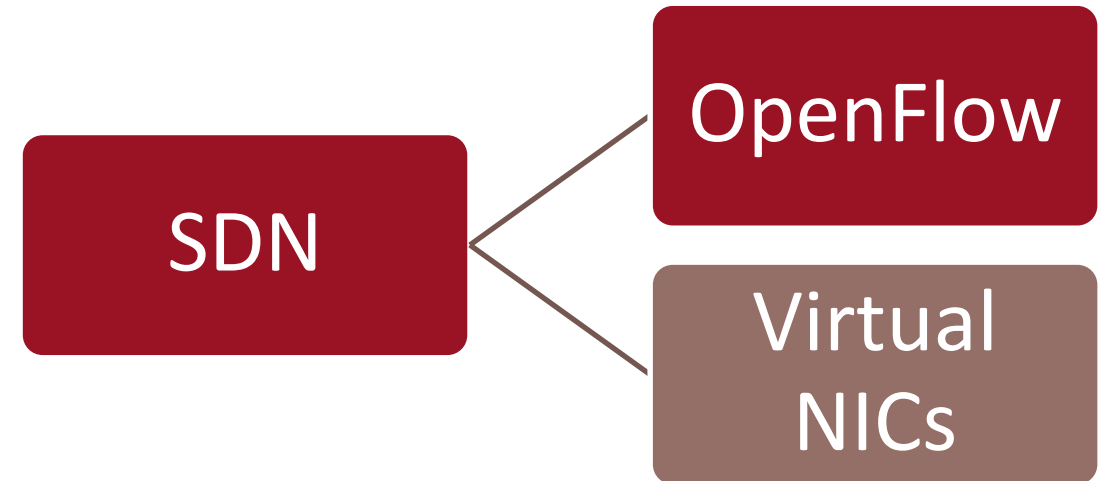
SOLUTION

Reserve bandwidth for high-priority applications.

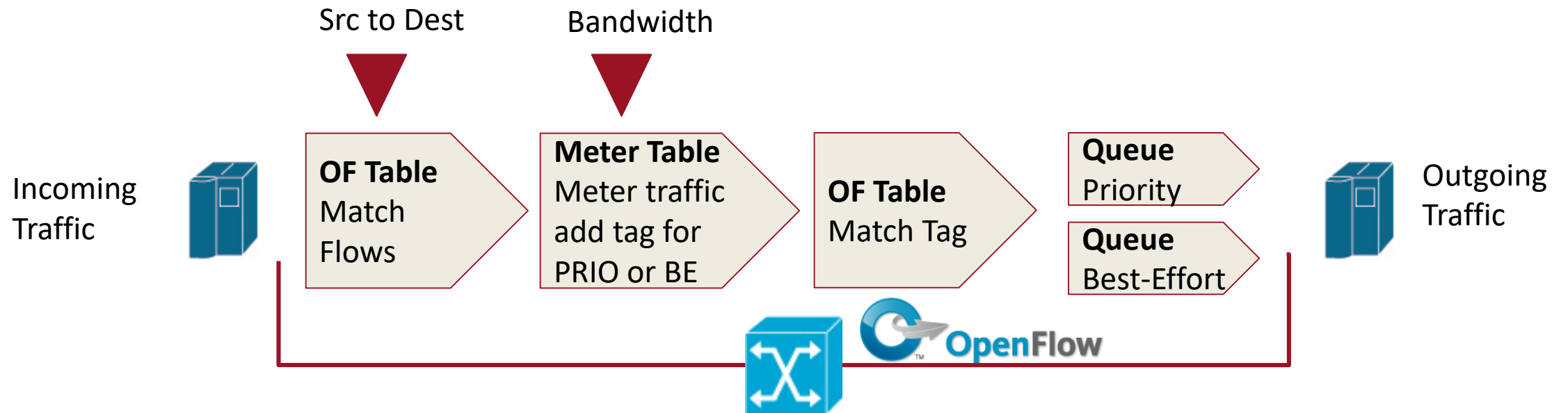


SOLUTION

We implemented bandwidth guarantees using software-defined networking.



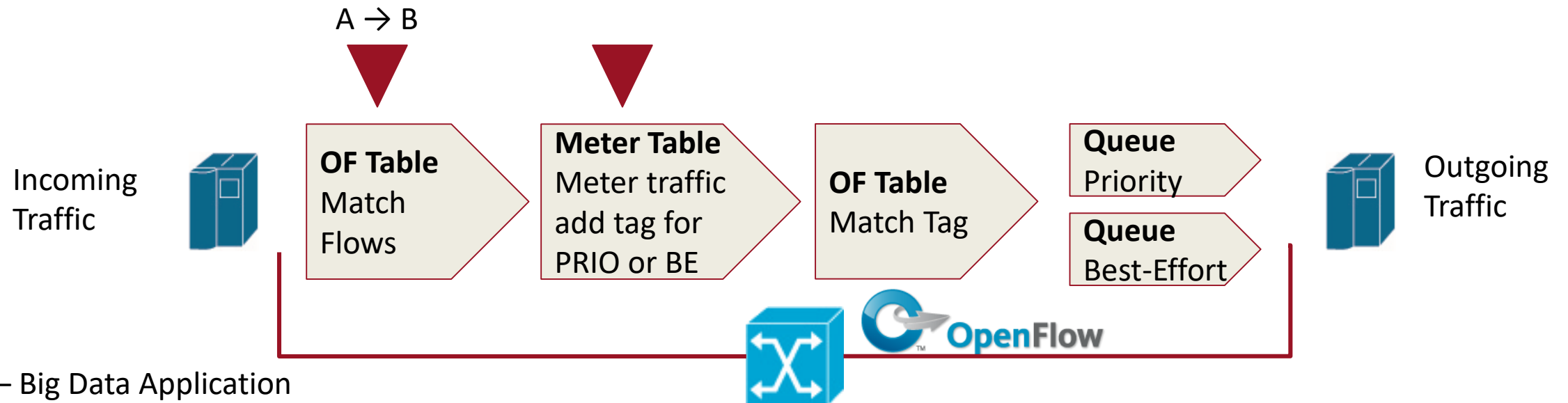
BANDWIDTH GUARANTEES



BANDWIDTH GUARANTEES

BDA Flow, A → B
7 Mbit/s

CT Flow1, C → B
9.5 Mbit/s



BDA – Big Data Application
CT – Cross Traffic

BANDWIDTH GUARANTEES

BDA Flow, A → B
7 Mbit/s

CT Flow1, C → B
9.5 Mbit/s

PRIO
BDA Flow, A → B
PRIO, 6 Mbit/s

BE
BDA Flow, A → B
1 Mbit/s

BE
CT Flow1, C → B
9.5 Mbit/s

A → B
▼

6 Mbit/s
▼

Incoming Traffic



OF Table
Match Flows

Meter Table
Meter traffic
add tag for
PRIO or BE

OF Table
Match Tag

Queue
Priority

Queue
Best-Effort

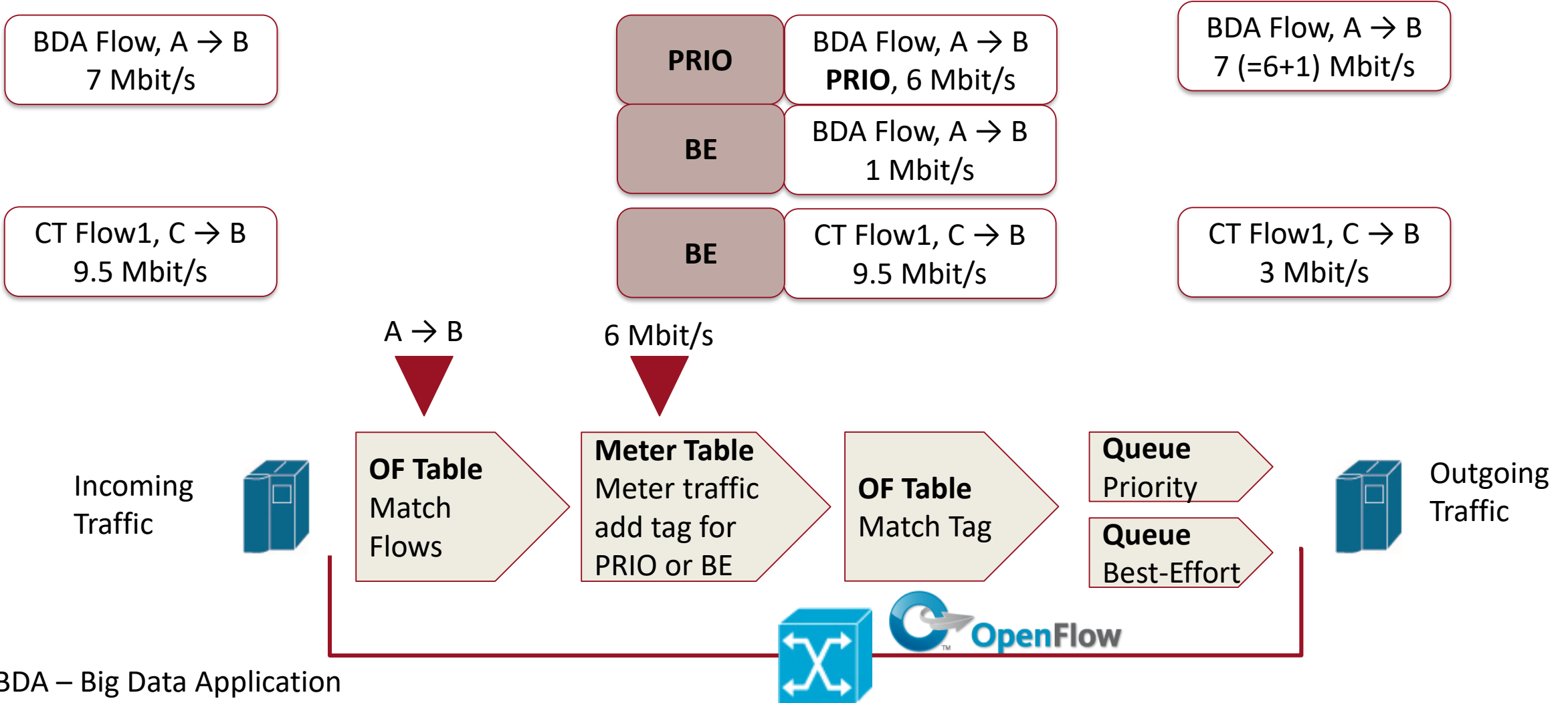


Outgoing Traffic

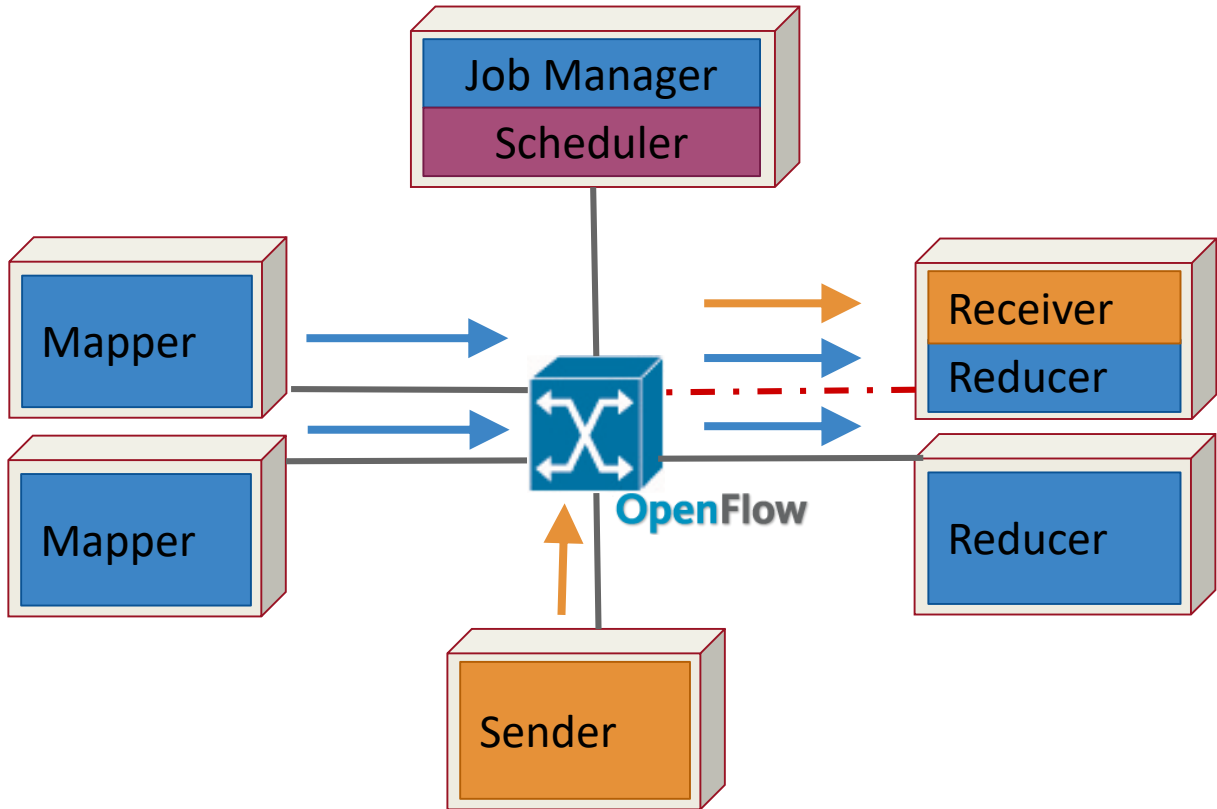


BDA – Big Data Application
CT – Cross Traffic

BANDWIDTH GUARANTEES



NETWORK SETUP



EXPERIMENT SETUP

Testbed

- Mininet Virtual Machine

Switch

- OpenFlow 1.3 Software Switch
- Links have 10 Mbit/s Bandwidth

Cross-Traffic

- 9.5 Mb/s UDP static traffic (iperf)

Condition

- 6 Mbit/s Guarantee or None

EXPERIMENT SETUP

Workloads

1. wordcount: Compute word frequency



2. k-Means: Estimate cluster centers for points

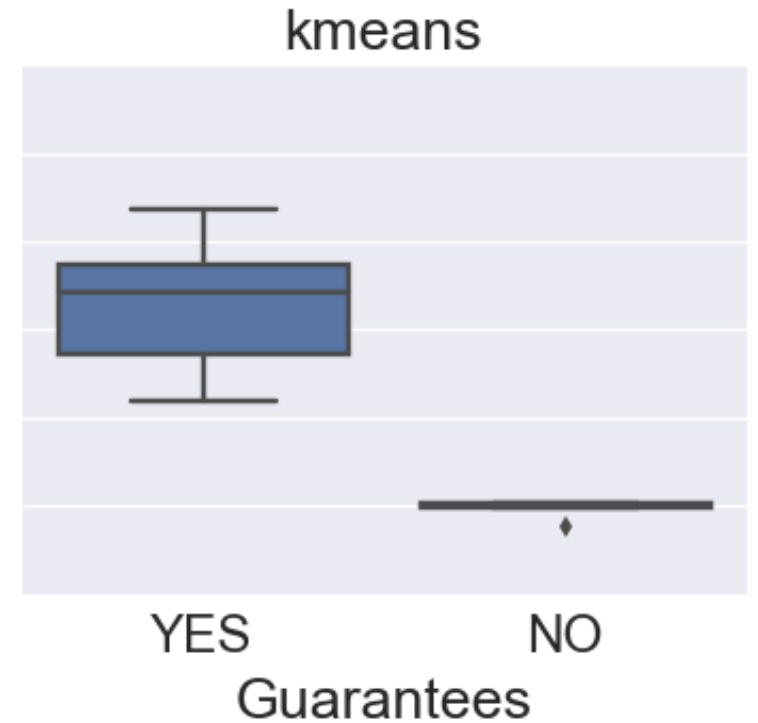
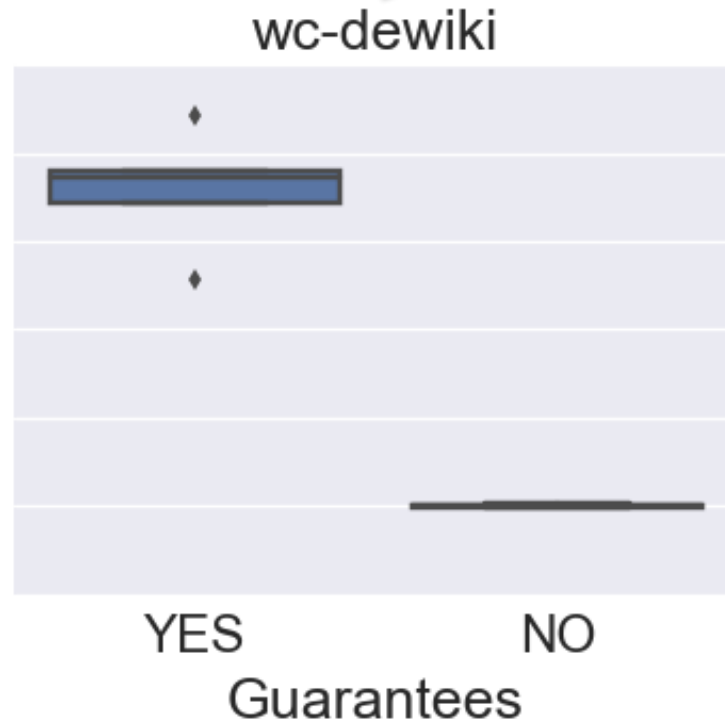
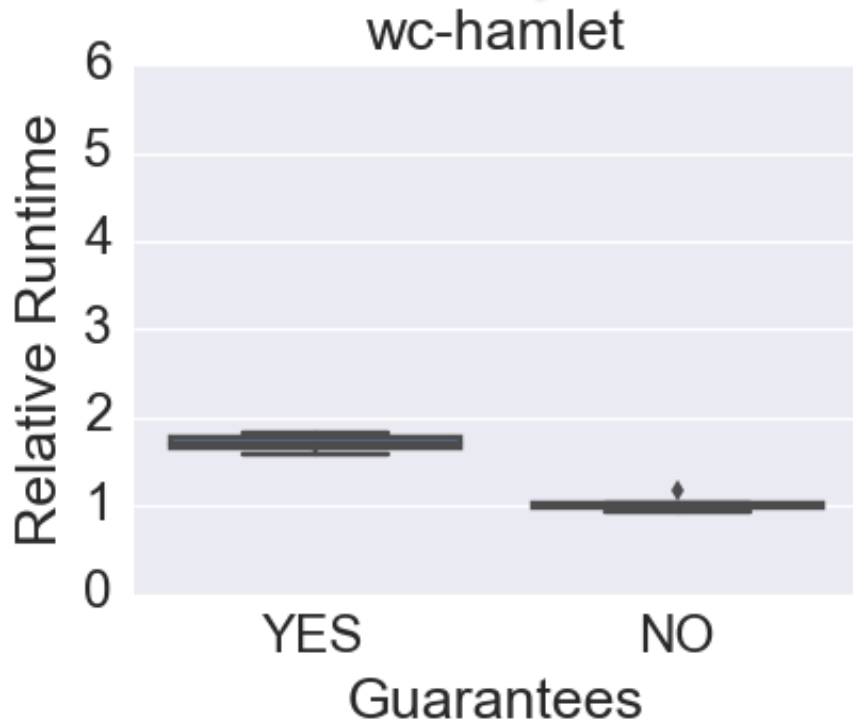


RESULTS

807 MB
Copies of
Hamlet

16 GB
German
Wikipedia

13 MB
Points



Median improvement

1.7

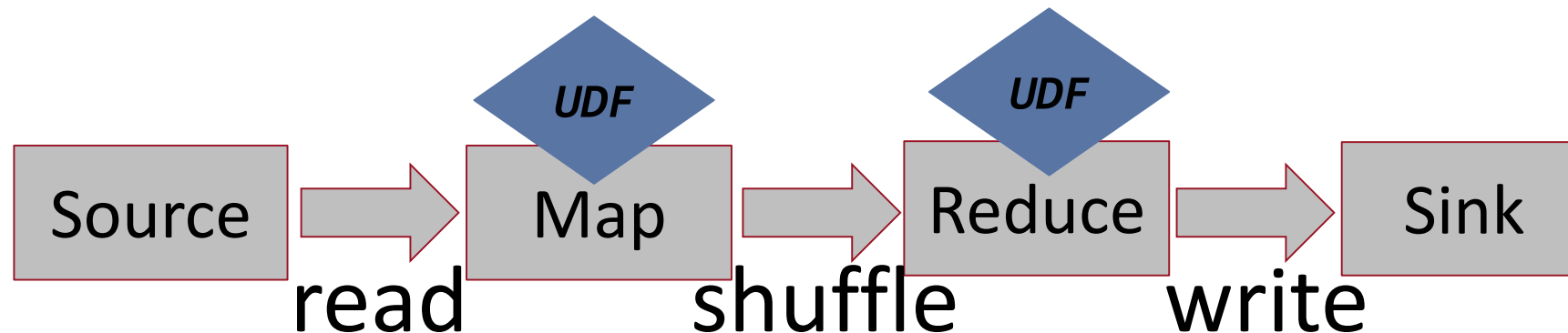
4.7

3.5

Discussion

Improvement through guarantees depends on

- Output-to-input ratio of Operators
 - k-means: The same points are used in the iterations → ratio equal to 1
 - wordcount: Words are grouped. Ratio depends on data redundancy.
 - Hamlet: Multiple versions of the same piece → high redundancy, lower ratio
 - Wikipedia: XML File with tags → low redundancy, ratio closer to 1
- CPU-heaviness
 - k-means requires more computation than wordcount



CONCLUSIONS & FUTURE WORK

Mechanism for Guarantees work.

How can the scheduling be extended to larger networks (more switches) and more applications?

What happens when the network is spread out over more than a single data center?