Composing SDN Controller Enhancements with Mozart

Zhenyu Zhou

Theophilus Benson

Google Runs SDNs @Scale

Global SDN Market Is Business Opportunities and Forecasts 2019 – 2026 | With Key Players Analysis On Cisco Systems,Inc., VMware, Inc., Huawei Technologies Co. Ltd., Ciena Corporation

September 23, 2019 Databridgemarketresearch

Global SDN Market is expected to rise from its initial estimated value of USD 8.92 billion in 2018 to an estimated value of USD 67.98 billion by 2026, registering a CAGR of 28.90% in the forecast period of 2019-2026.

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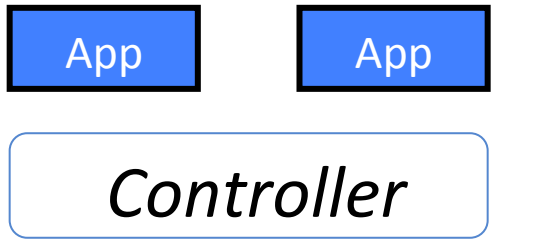
SDNApps' Assumptions

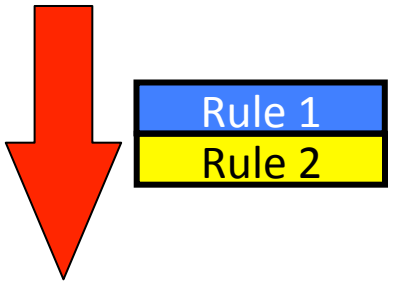
Mozart Design
Abstractions and Interfaces

Evaluation
Performance and Overhead

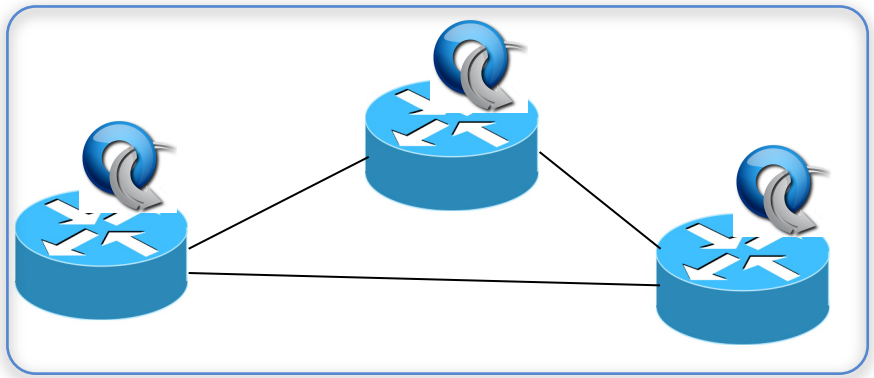
What are SDNs?

SDNApps



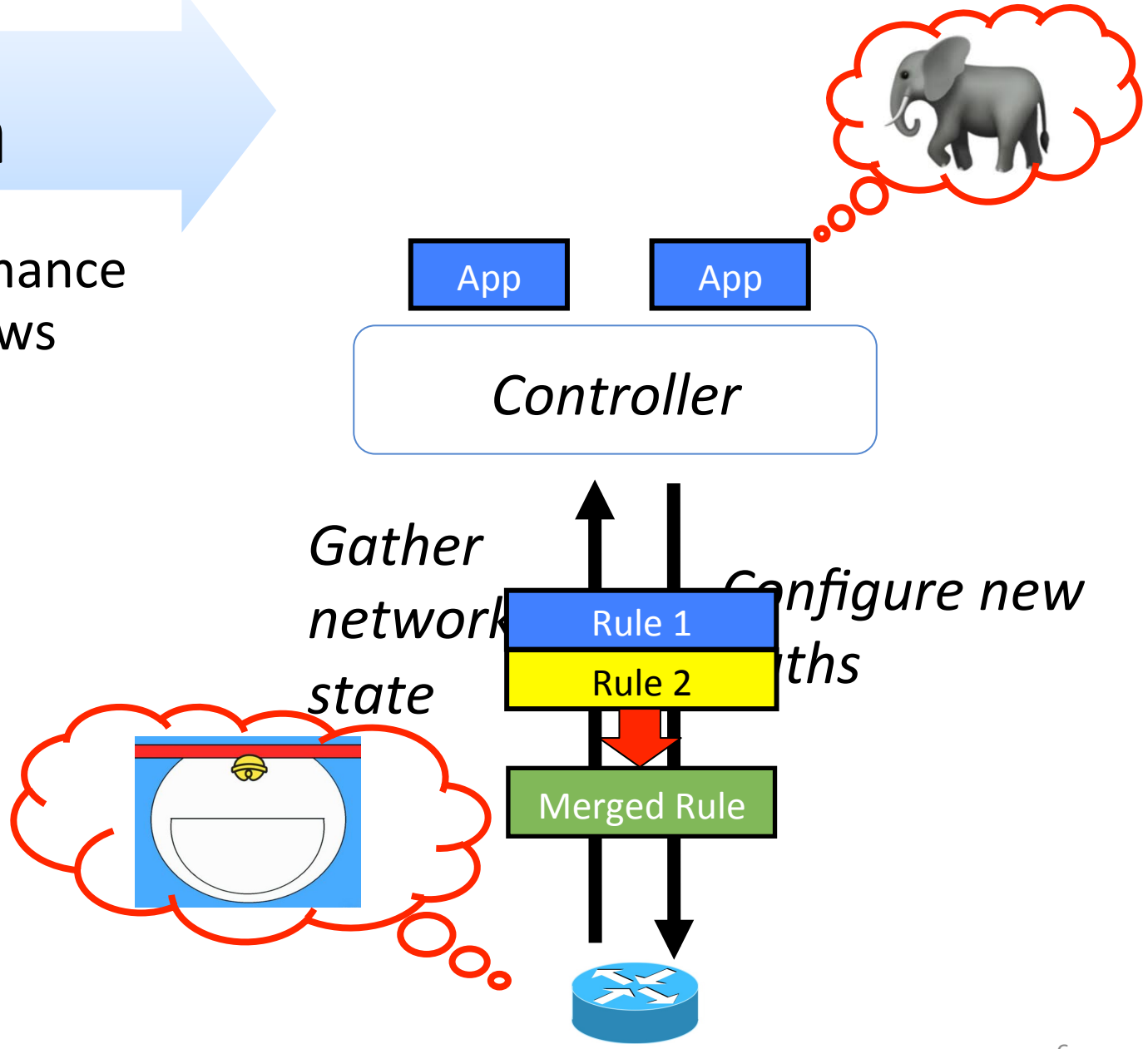


Network

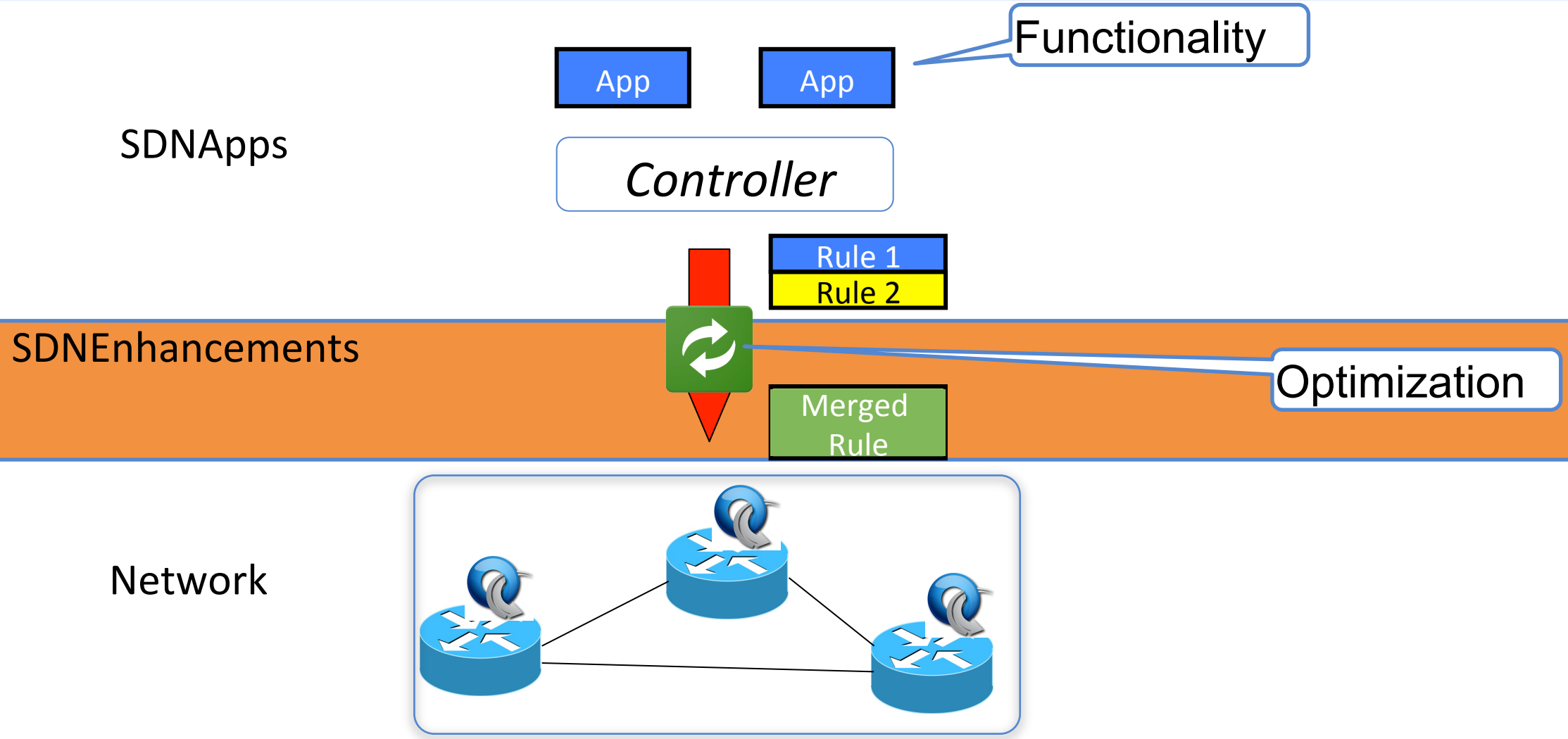


Case Study: Hedera

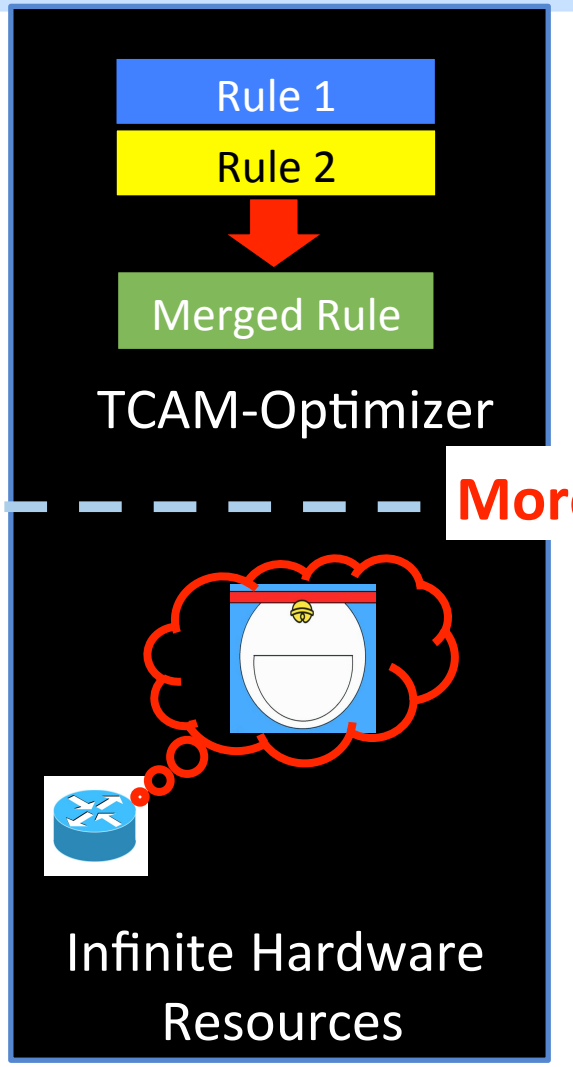
- Improving data center performance by load balancing elephant flows

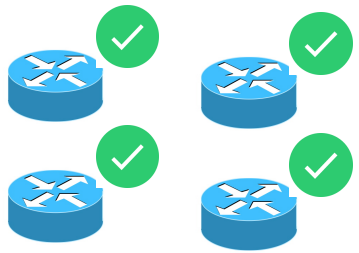


What are SDNs?

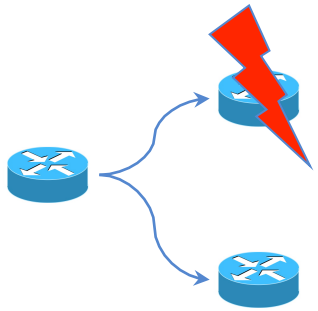


SDNApps' Assumptions & SDNEnhancements





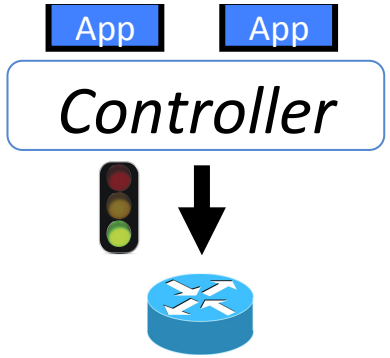
Consistent Update



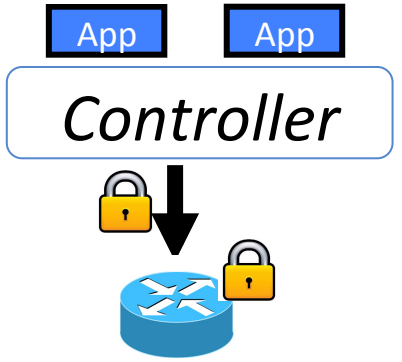
Fault Tolerance Path

SDN-Enhancements

More results can be found in the paper



Instantaneous Updates

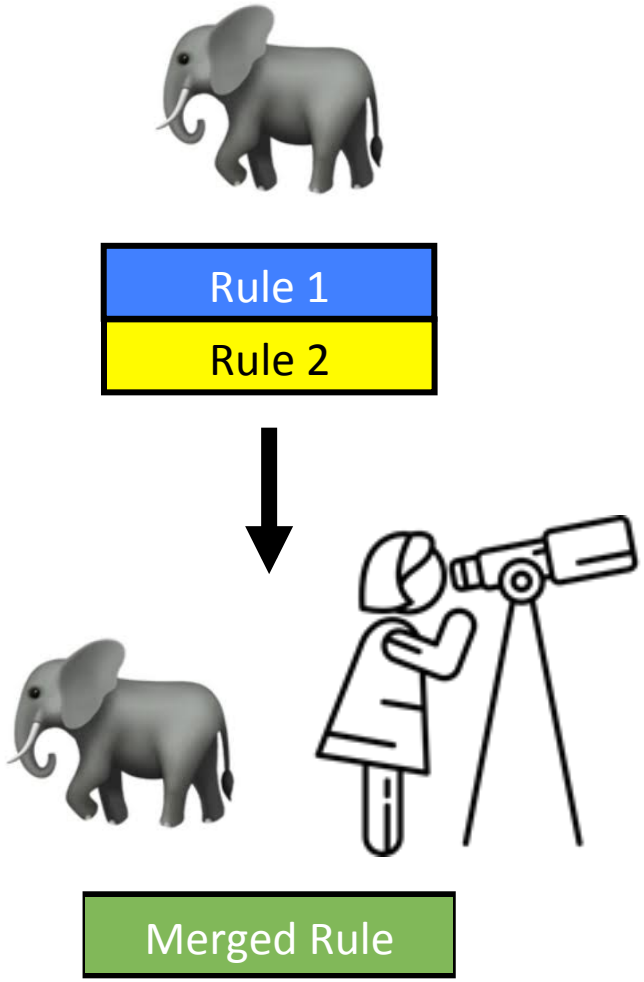


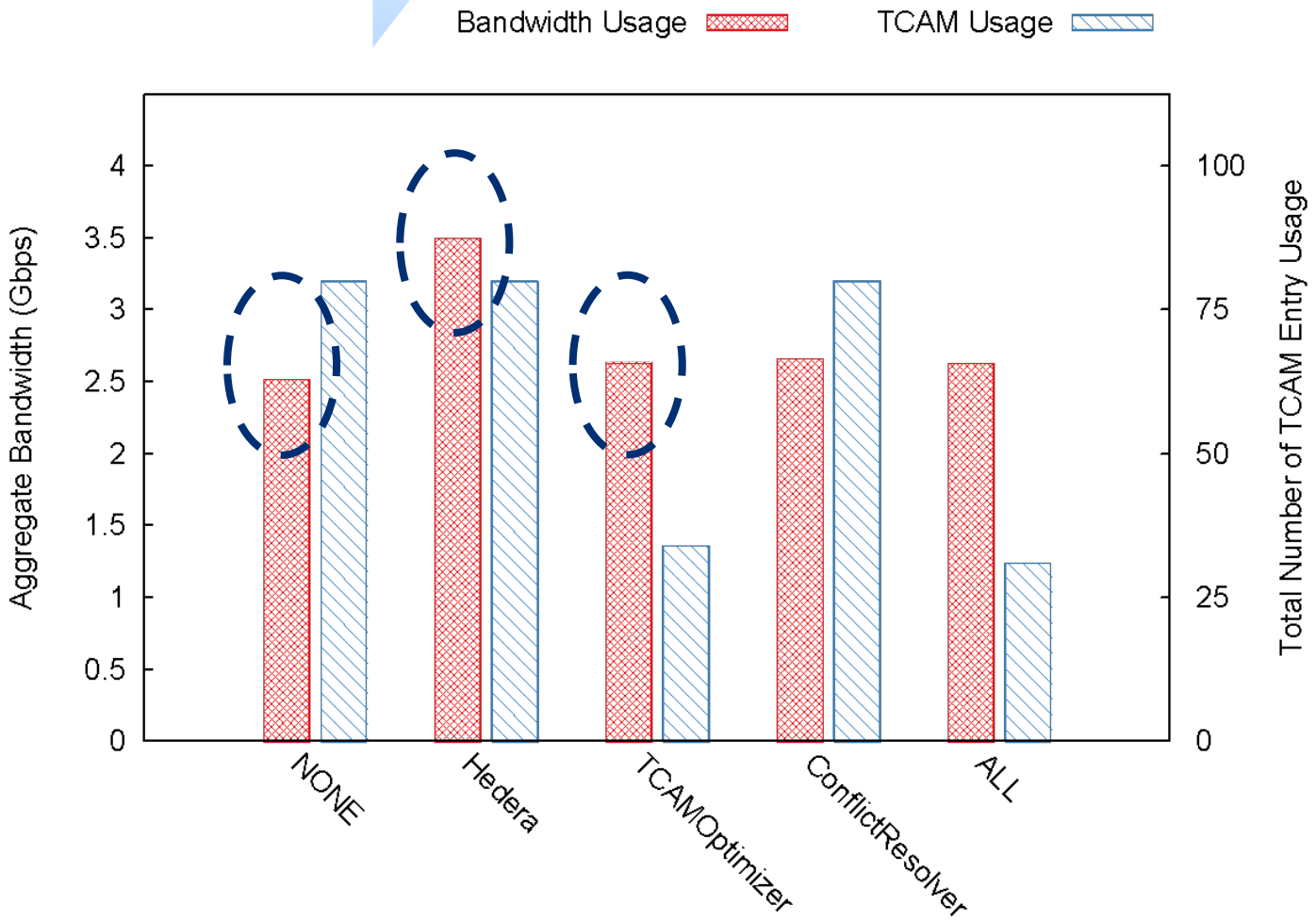
Unmodified Actions

SDNApps' Assumptions

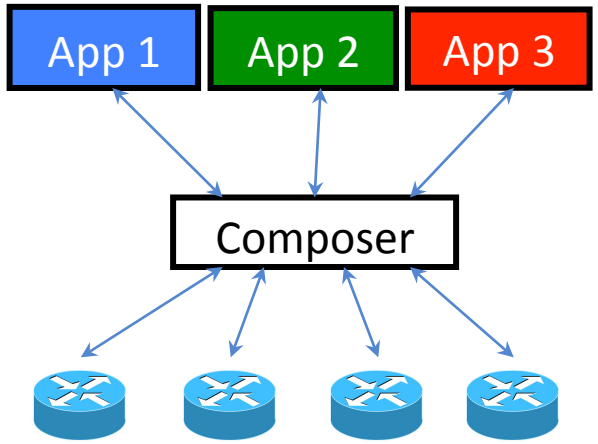
SDNEnhancements
Optimization
Merged
Rule

Case Study: Hedera



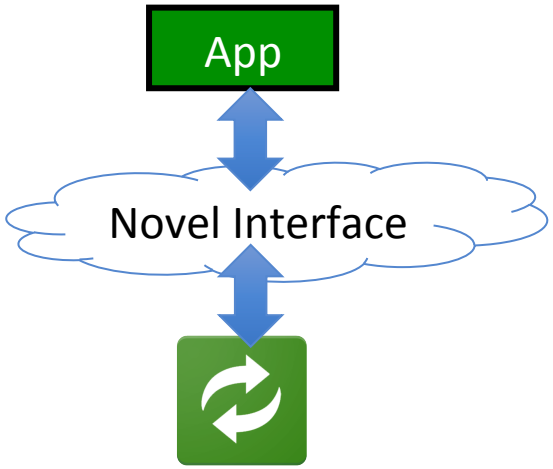


Related Works



Pyretic [NSDI'13]

Ignores SDNEnhancements



Athens [CoNEXT'14] , Chopin [CoNEXT '18]

Requires understanding all SDNEnhancements

What abstractions are required to systematically include SDNEnhancements into the SDN ecosystem?

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Another Story: Compiler Optimization

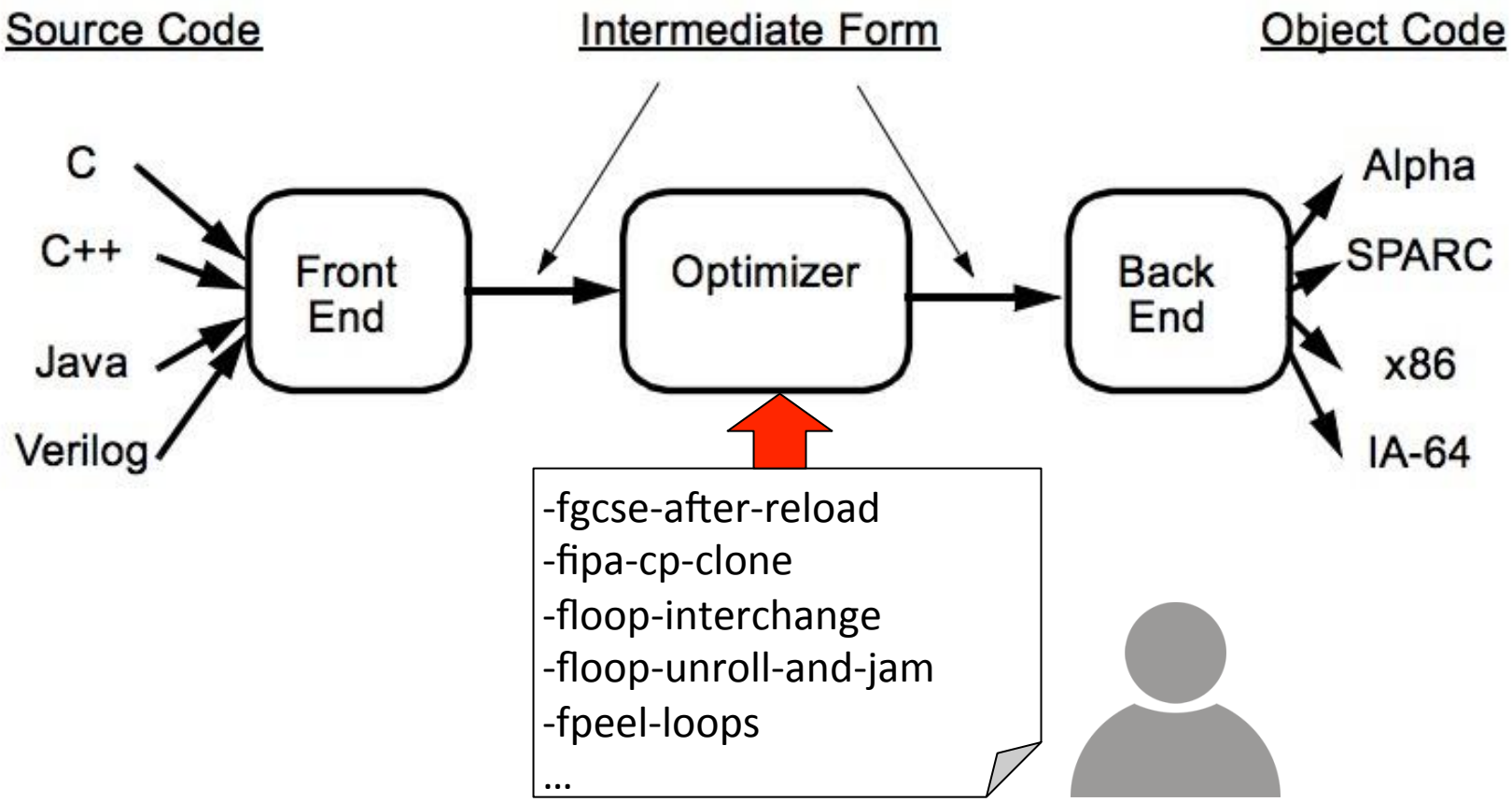
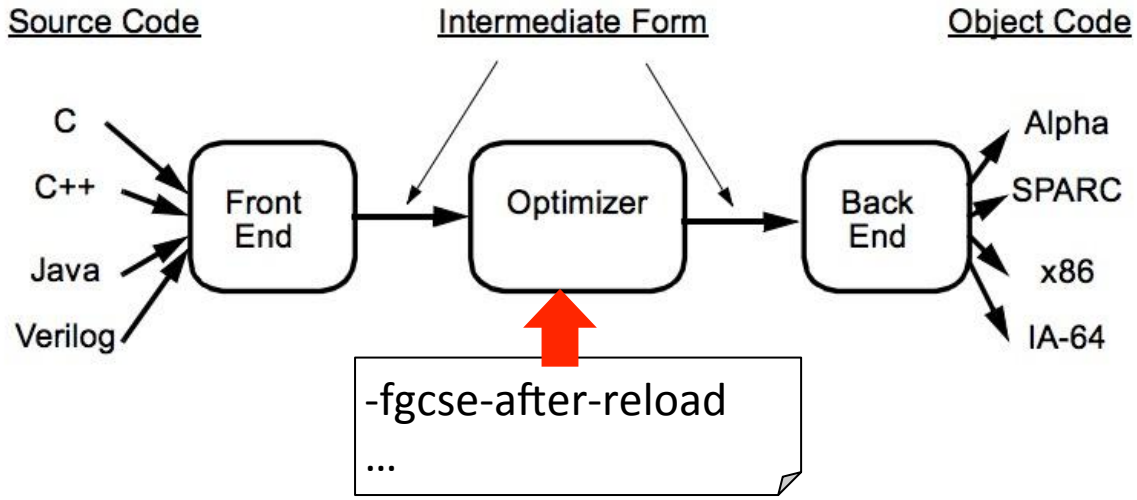


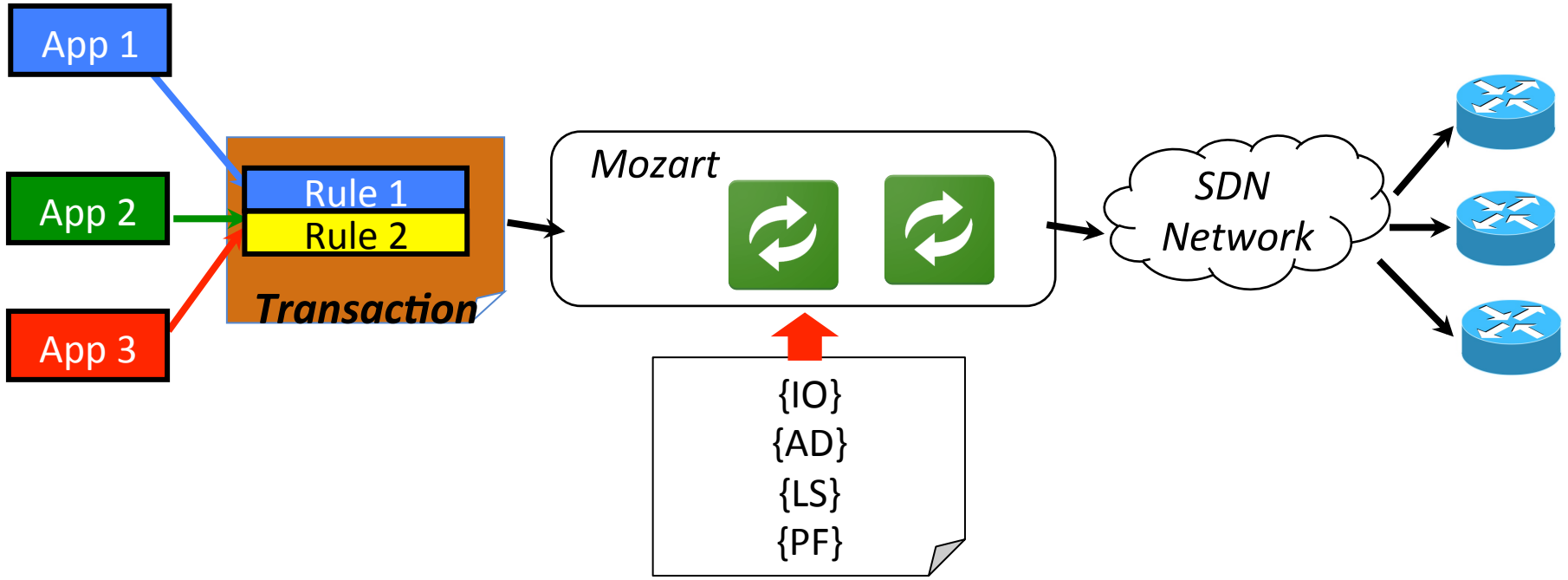
Image referenced from: https://www.cs.cmu.edu/afs/cs/academic/class/15745-s02/www/lectures/lect1.pdf

Mozart

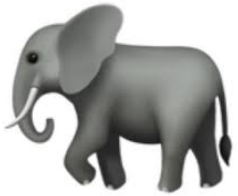


Compiler

SDN



SDN-Flags



Rule 1

Rule 2

Merged Rule

App

Transaction

Optimization

{IO}

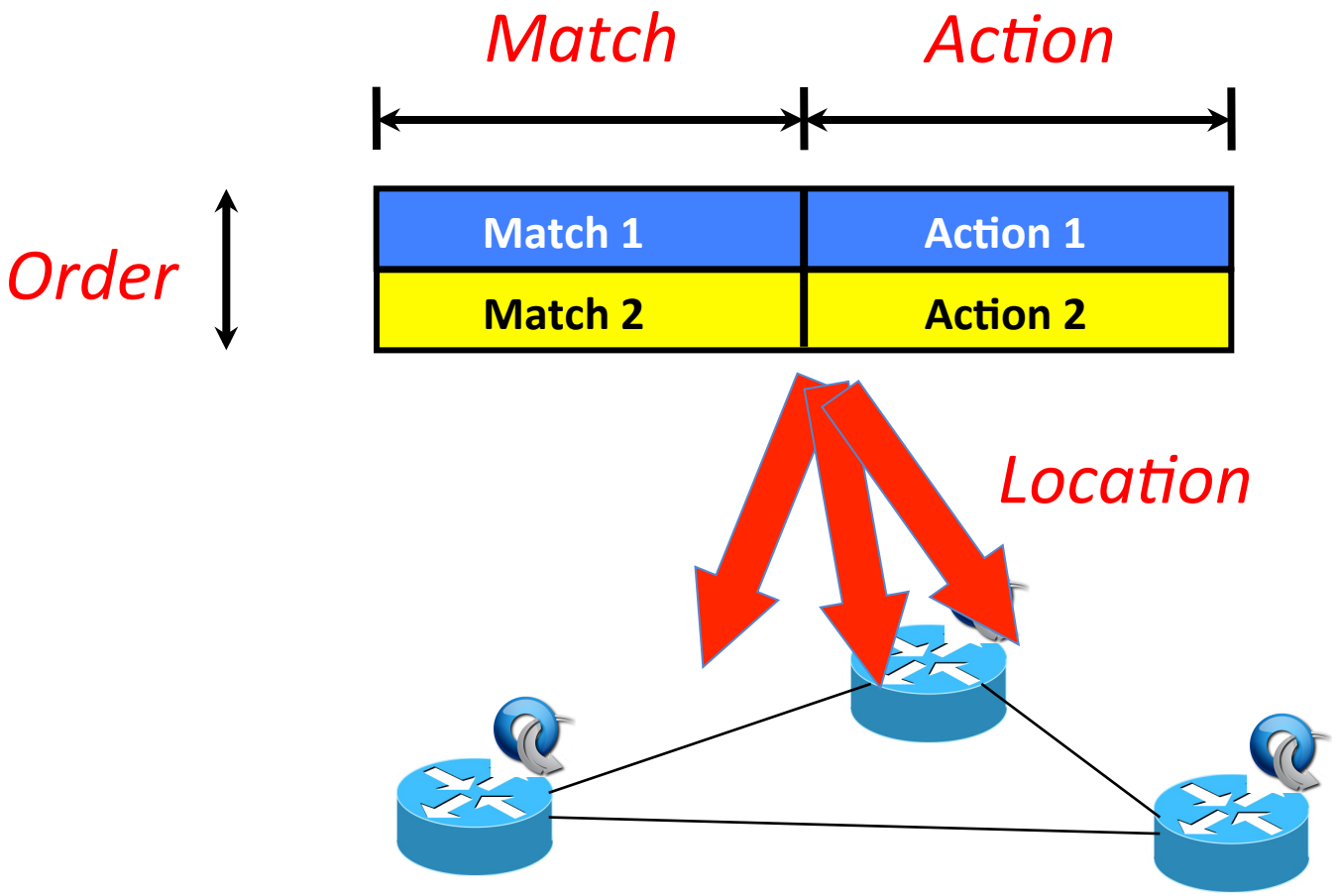
Message 1	Flag 1
Message 2	Flag 2
…	…

Global Flag

Transaction

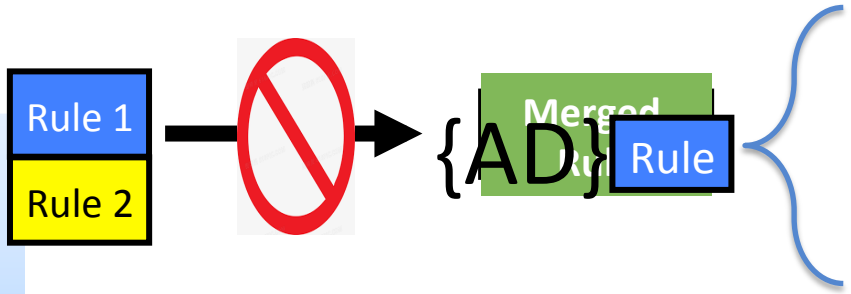
Checker

SDN-Flags

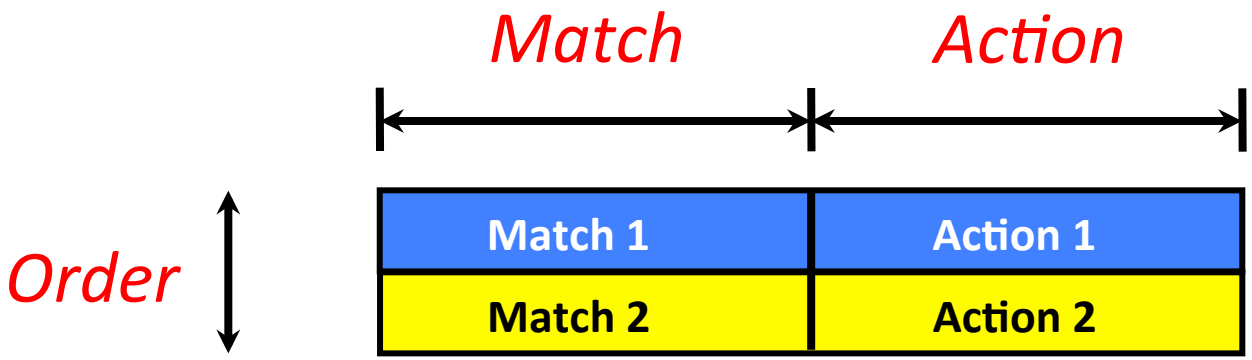

Match
Action
Order
Match 1
Action 1
Match 2
Action 2
Location

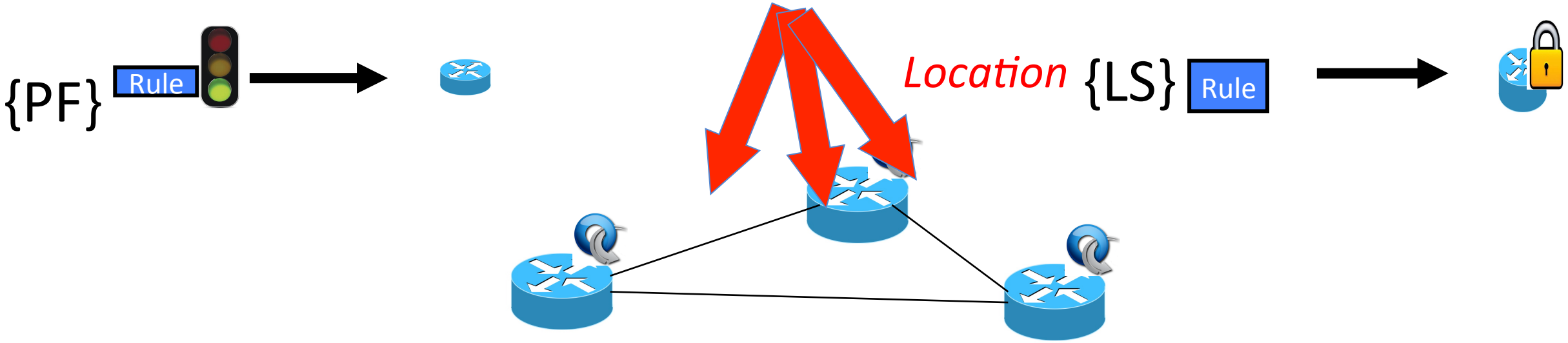
SDN-Flags

{IO}



Match 1	Action 1
Match 2	Action 2
…	…





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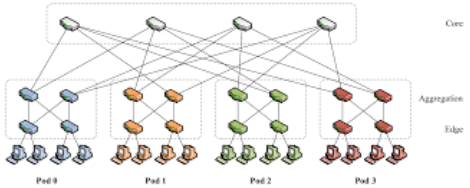
Evaluation

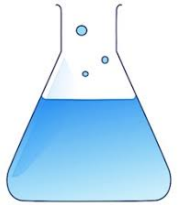
- Data-Plane
- Control-Plane
- Workloads

Mininet



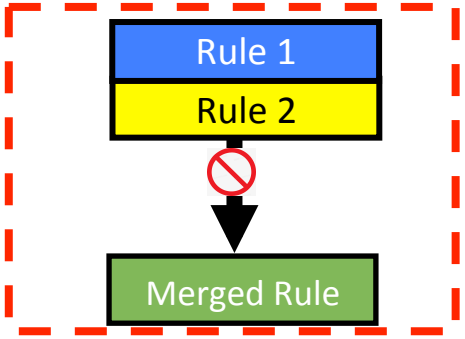
Fat Tree

Realistic DCN

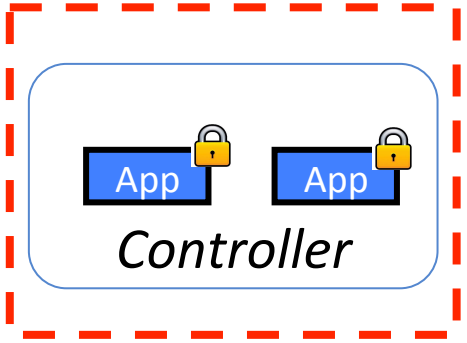


Synthetic
Best - Random
Worst - Stride

Evaluation

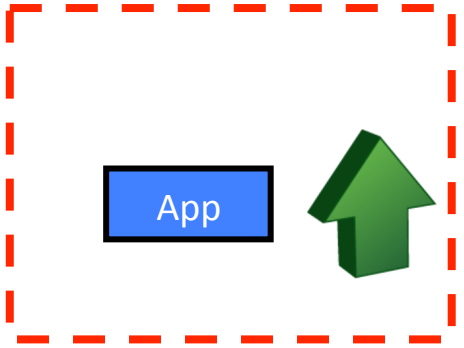


Can Mozart improve performance?



What's Mozart's benefit for backward compatibility?

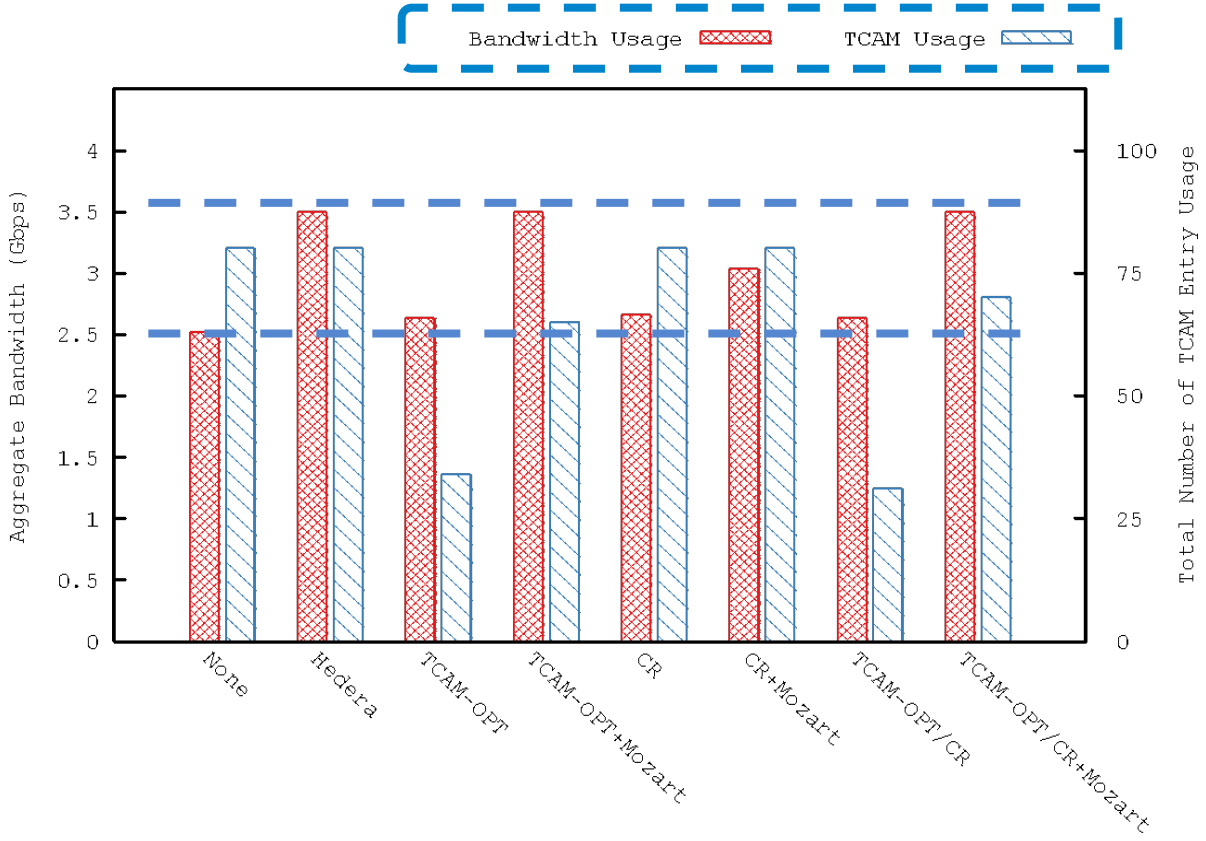
What's the overhead of Mozart?



How much work does Mozart introduce for SDNApp updates?

More results can be found in the paper

Evaluation

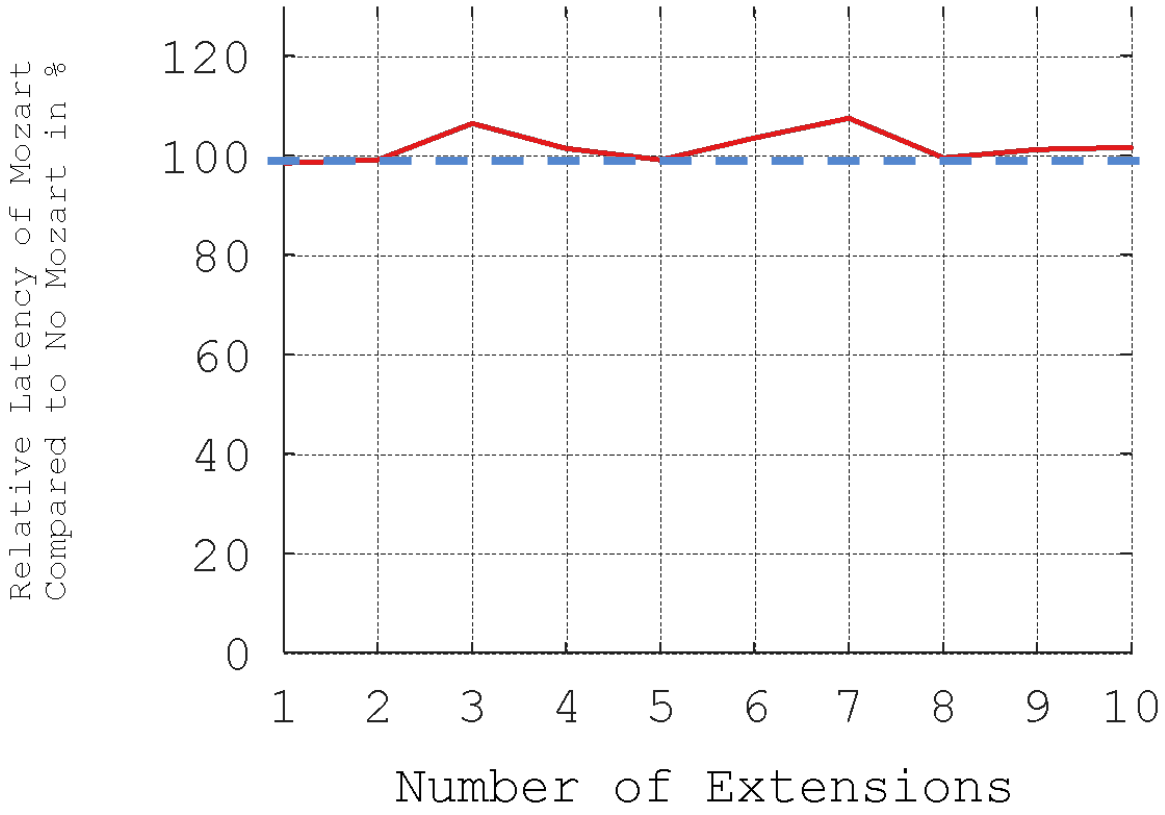


Proactive SDNApp (Hedera)

- Saves **24.8%** reduction in aggregate bandwidth introduced by TCAMOptimizer.

More results can be found in the paper

Evaluation



Mozart Overhead

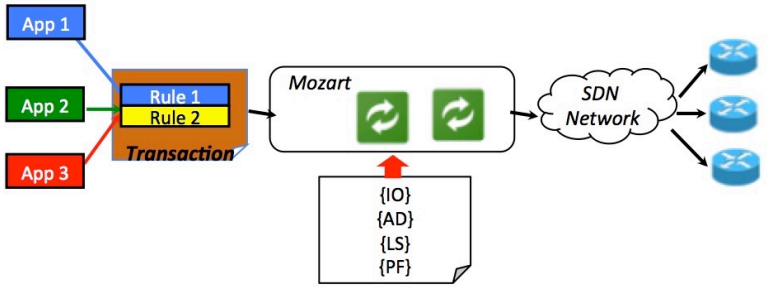
- Sublinear
- **1.58%** to latency

More results can be found in the paper

Conclusion

- SDN controllers are ill-equipped with poor primitives for supporting SDNApps and abstractions for enabling SDNEnhancements.

- Mozart interface allows for a systematic and principled inclusion of SDNEnhancements into the SDN ecosystem.



Thanks for your attentions!