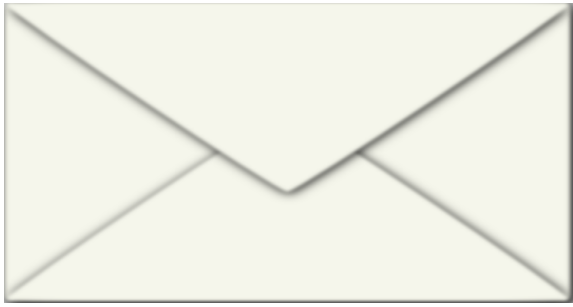
ONRC RESEARCH

How Did We Get Into This Mess? Automated Diagnosis for SDN

Colin Scott, Andreas Wundsam, Sam Whitlock,
Andrew Or, Eugene Huang, Kyriakos Zarifis, Scott Shenker

How many events in a DC network?



- 20,000 servers * 4 VMs / server = 80,000 VMs
- (6 migrations / day / VM) + (2 power up | down / day / VM) * 80,000 VMs = 640,000 VM events / day ~= **450 VM changes / minute** [1]
- **8.5 network error events / minute** [2]
- 1 policy change / tenant / day * 2000 tenants ~= **1 policy change / minute**

How many events in a DC network?

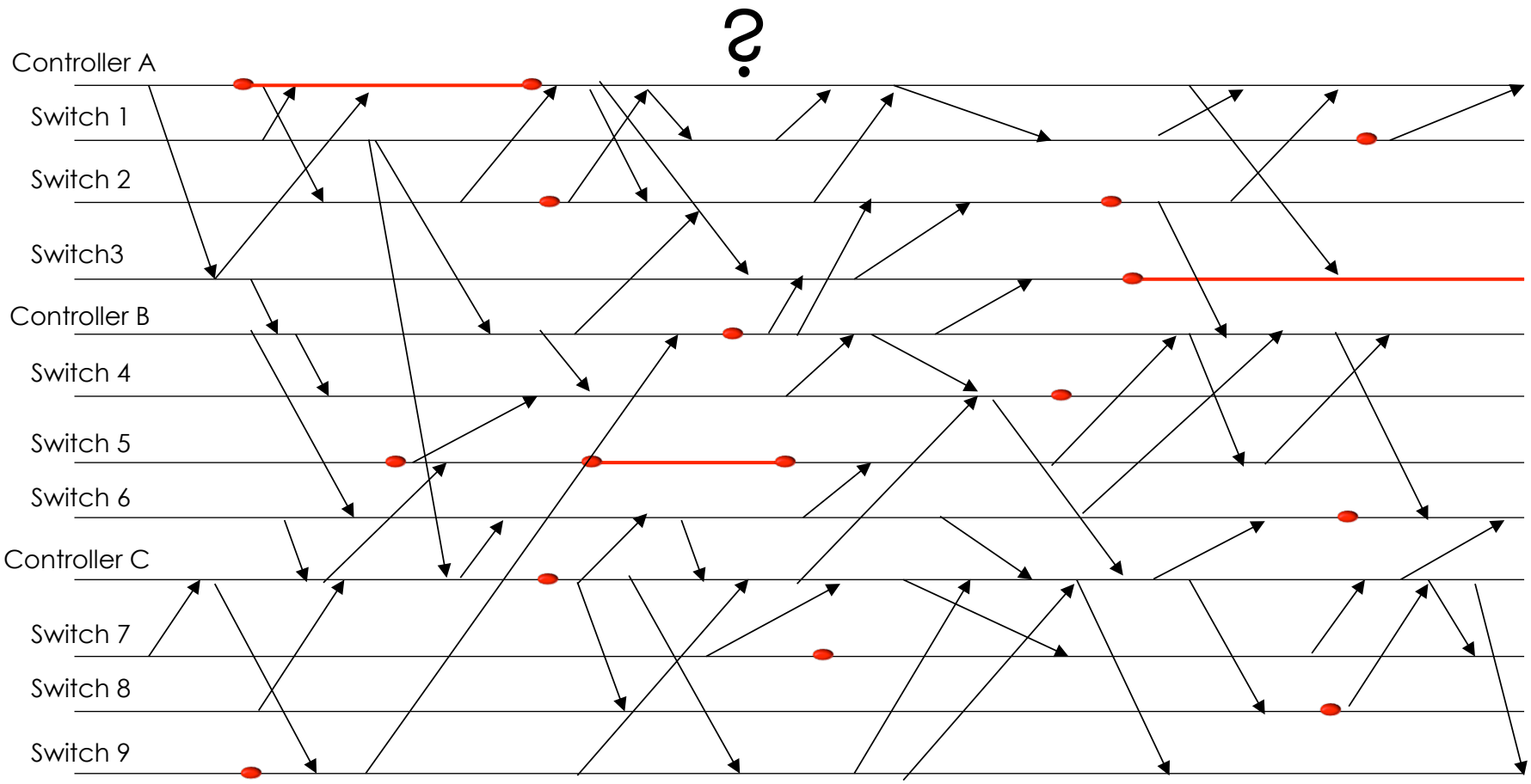
= ~500 events / minute

Something goes wrong!

Best practice: Logs

Manual analysis of log files

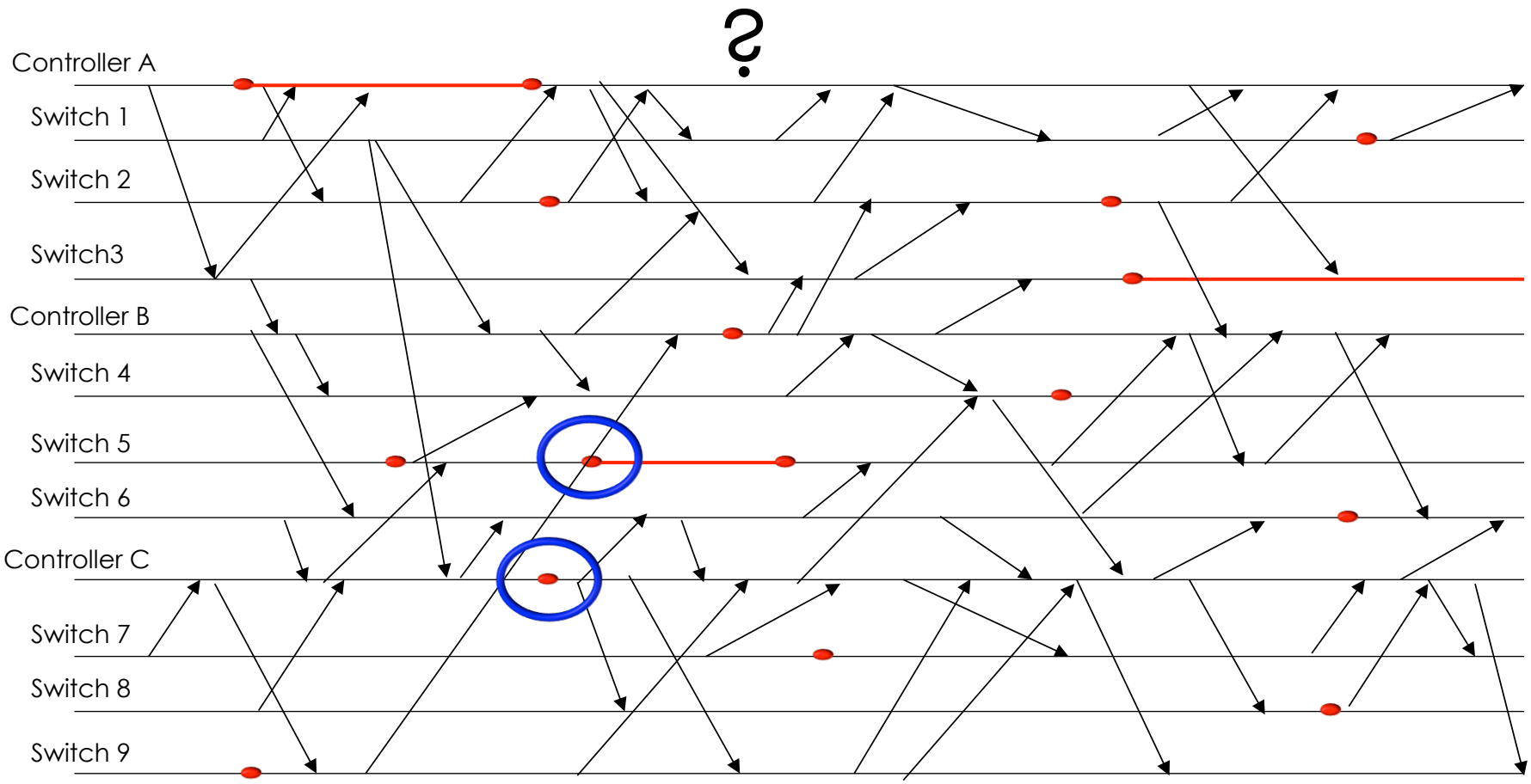
Best practice: Logs



Goal

Identify the **minimal** set of inputs that trigger the bug

Minimal Causal Set



High-Level Approach

Modify history!

Possible failure causes

Set up first hypothesis

Test first hypothesis

Second hypothesis

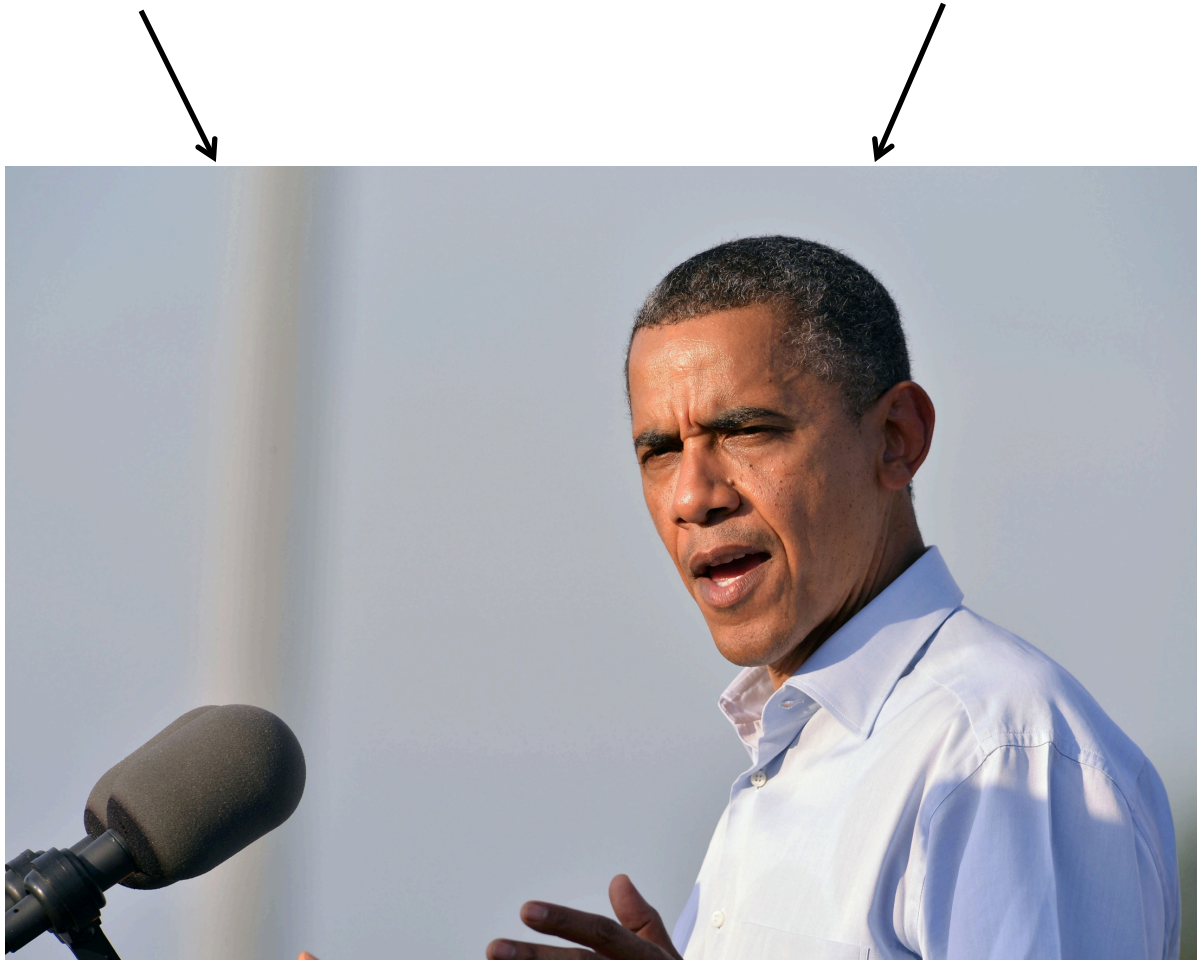
Third hypothesis

Fourth hypothesis...

Analogy

Analogy

Analogy



Need to Reason About Equivalence!

≈

Summary

- Goal: automatically diagnose network correctness violations
- Approach: iteratively alter history
- Check us out:

ucb-sts.github.com/sts/

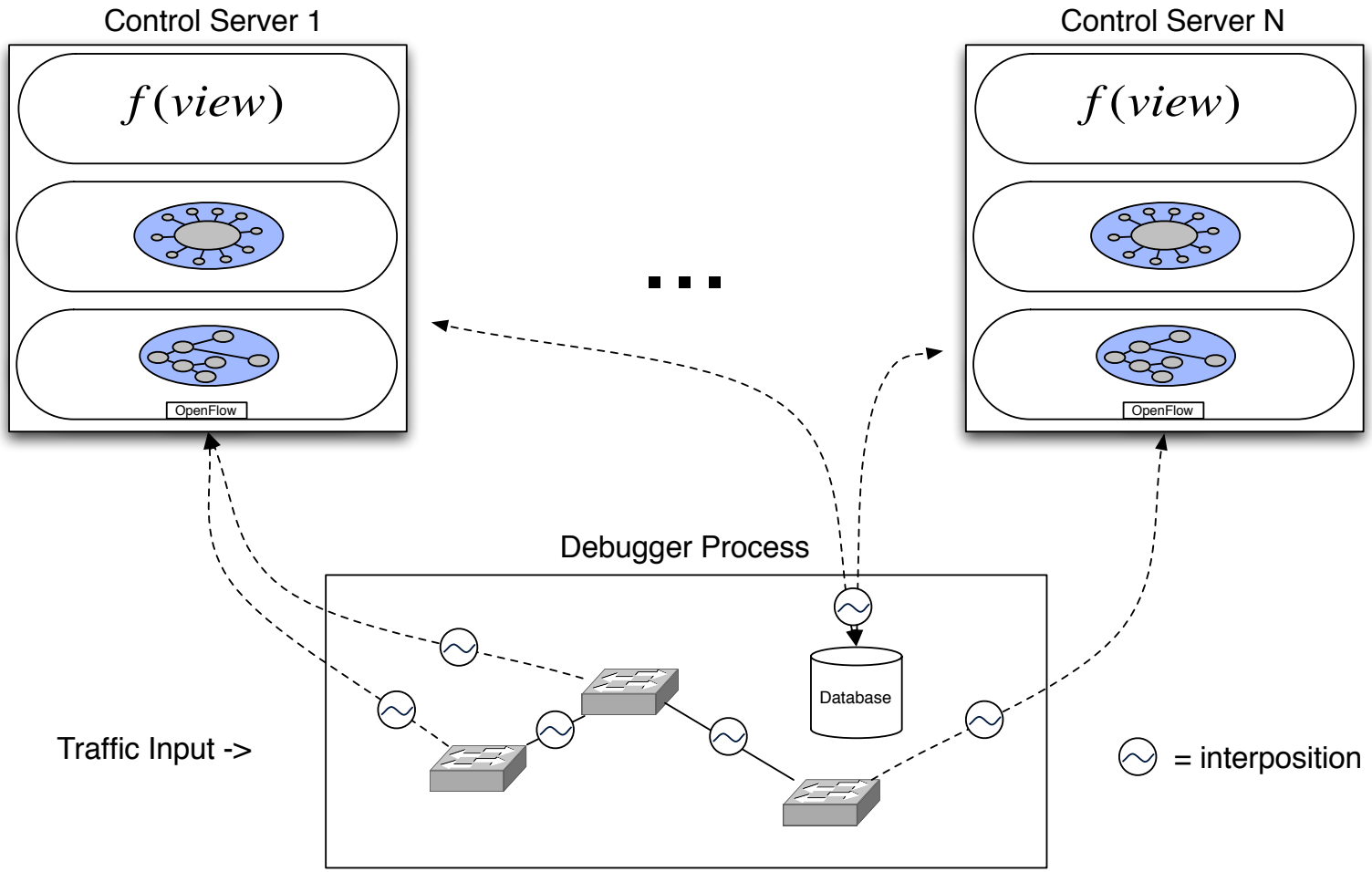
Backup

References

- [1] V. Soundararajan and K. Govil. Challenges in building scalable virtualized datacenter management. SIGOPS Operating Systems Review '10.

- [2] A. Greenberg, J. R. Hamilton, N. Jain, S. Kandula, C. Kim, P. Lahiri, D. A. Maltz, P. Patel, and S. Sengupta. VL2: a scalable and flexible data center network, Sec. 3.4. SIGCOMM '09.

Simulator


Control Server 1
f(view)
OpenFlow
Control Server N
f(view)
OpenFlow
Debugger Process
Database
Traffic Input ->
= interposition