ClosedFlow: OpenFlow-like Control over Proprietary Devices

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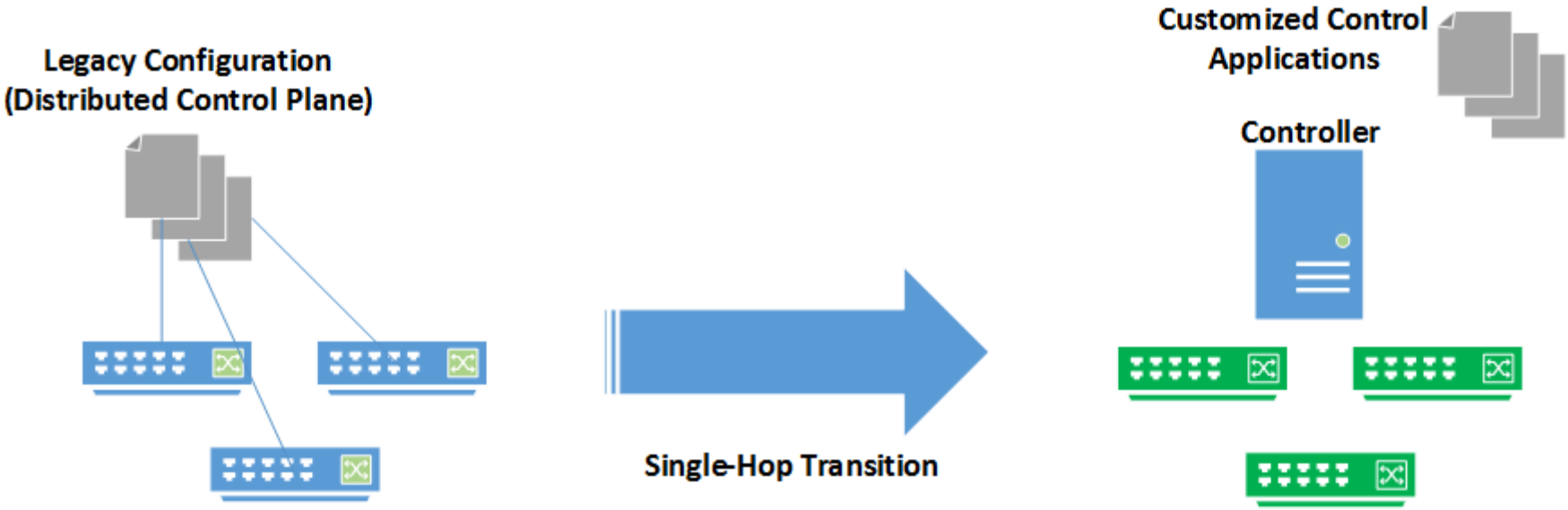
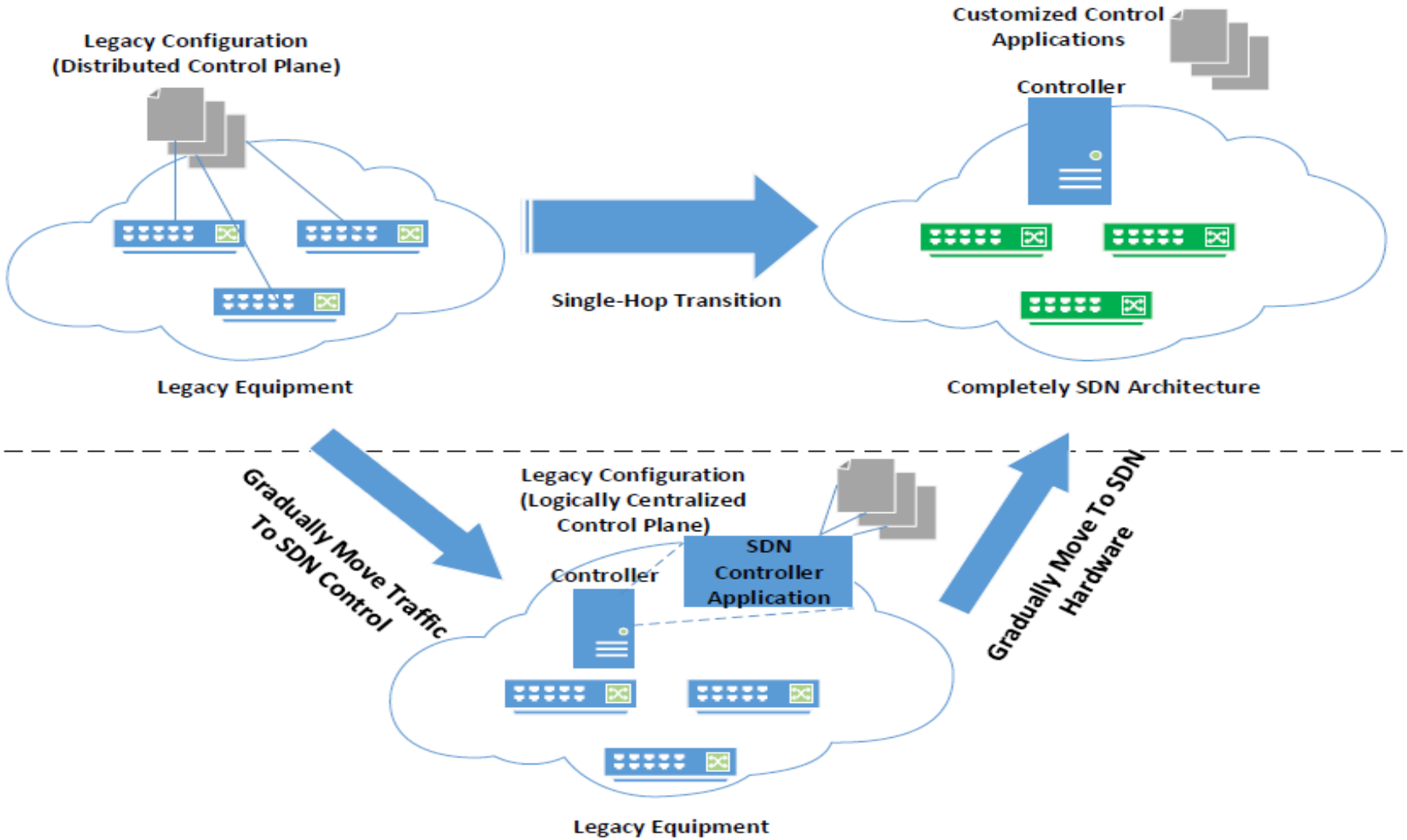
8 / 22 / 2014

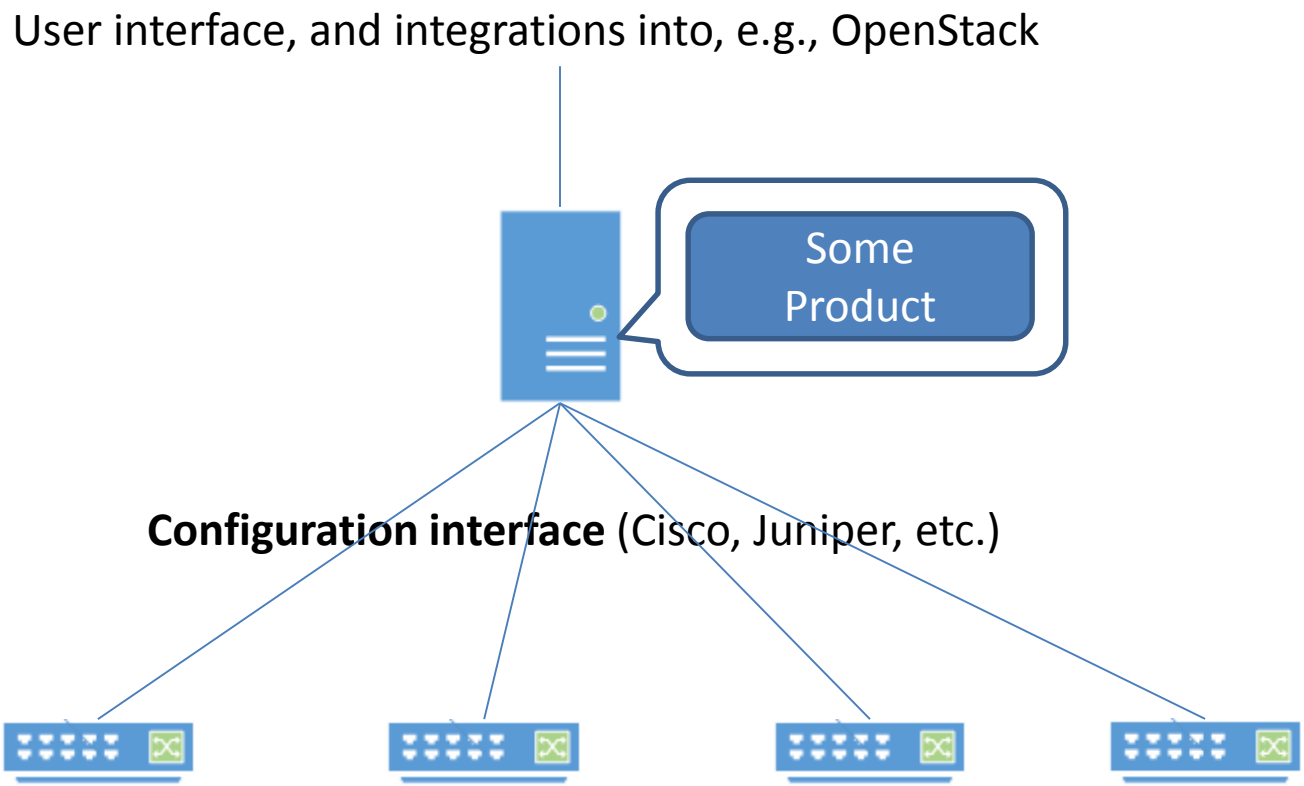
Problem: Abrupt Transition to Using SDN



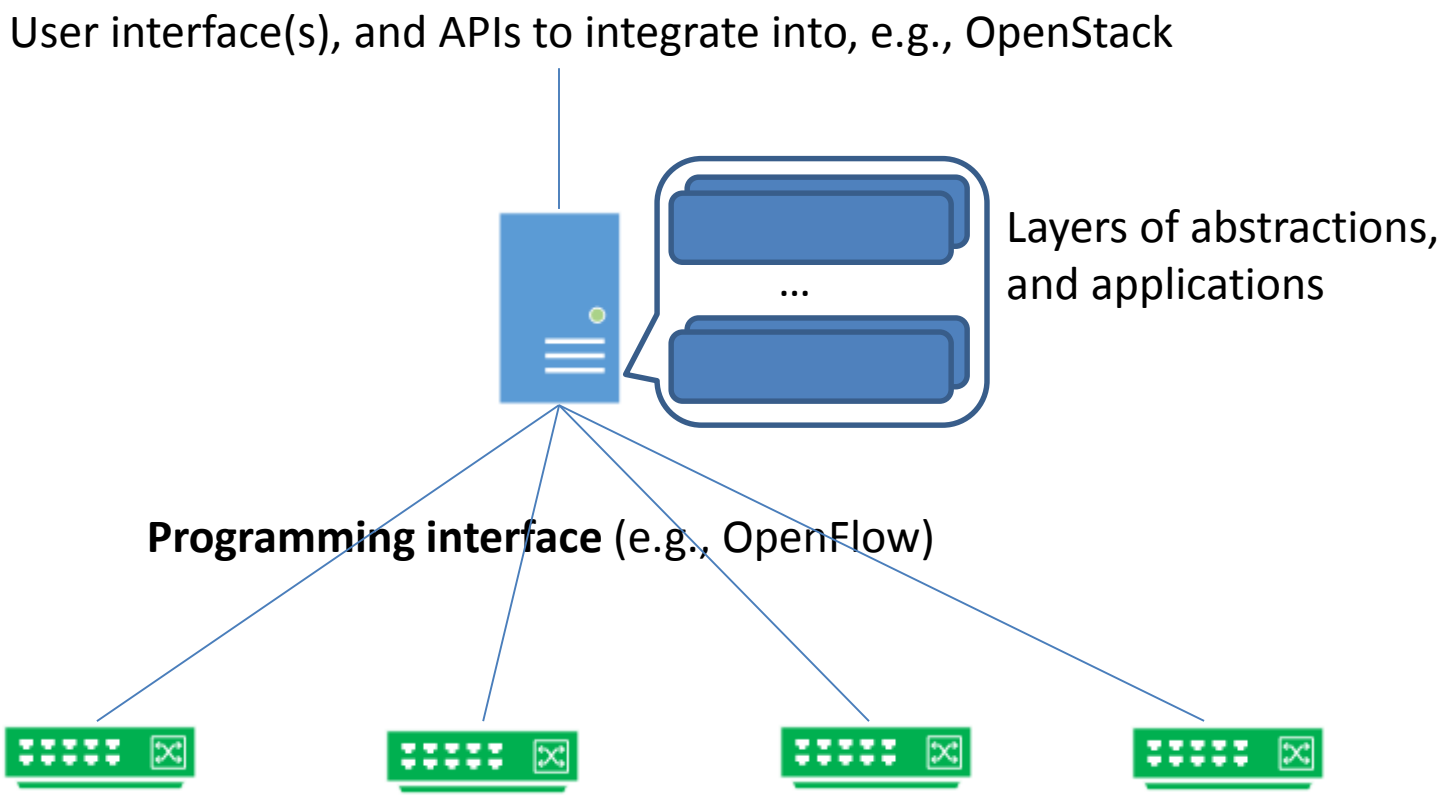
Goal: Smooth Transition to SDN



Just Remote/Central Configuration?



Or Switch Programming Interfaces?

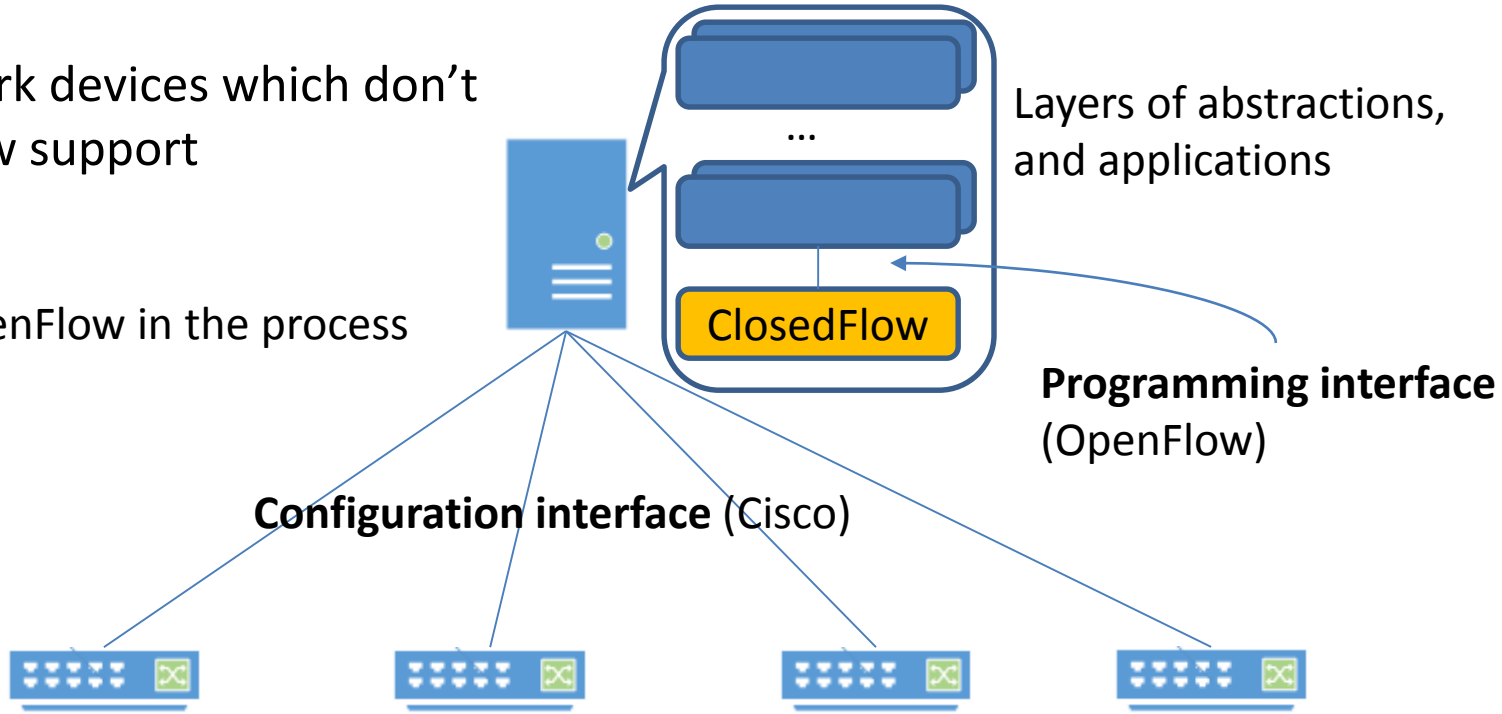


ClosedFlow

Allow layers on top of OpenFlow

But use network devices which don't have OpenFlow support

Learn about OpenFlow in the process



Four Basic Parts of OpenFlow

- Controller to switch channel
- Topology discovery
- Flow abstraction (matching / actions)
- Packet In

(1, 2) Channel and Topology

- Controller to Switch channel

➔Bootstrap path with OSPF, use SSH

- Topology

➔Switch log adjacencies to controller, or controller participate in OSPF

(3) Flow abstraction

Match: src_ip=1.2.3.4, dest_ip=2.3.4.5, action:OUT_PORT_2

```
Switch1#show access-lists
Extended IP access-list 101
    10 permit ip host 1.2.3.4 host 2.3.4.5

Switch1#show route-map
route-map SW1_OUTBOUND, permit, sequence 10
  Match clauses:
    ip address (access-lists): 101
  Set clauses:
    ip next-hop 2.0.0.1

Switch1#show run interface vlan 1
  interface Vlan1
    ip address 1.2.3.1 255.255.255.0
    ip policy route-map SW1_OUTBOUND
```

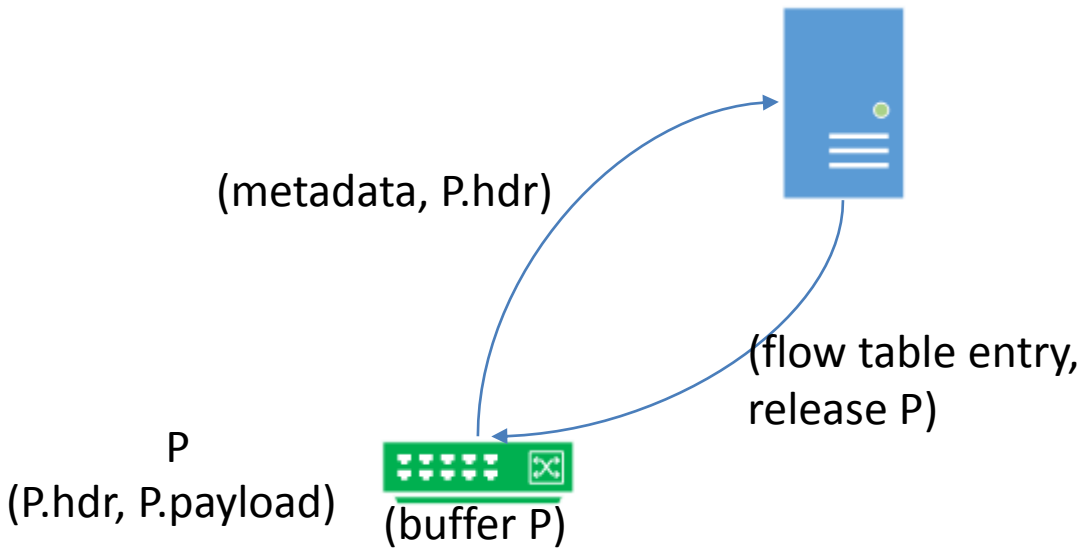
Specifies:
matches
permit/deny

Specifies:
ACLs to apply
Forwarding behavior

Specifies:
Inbound interface to apply Route maps
(VLAN used for mult)

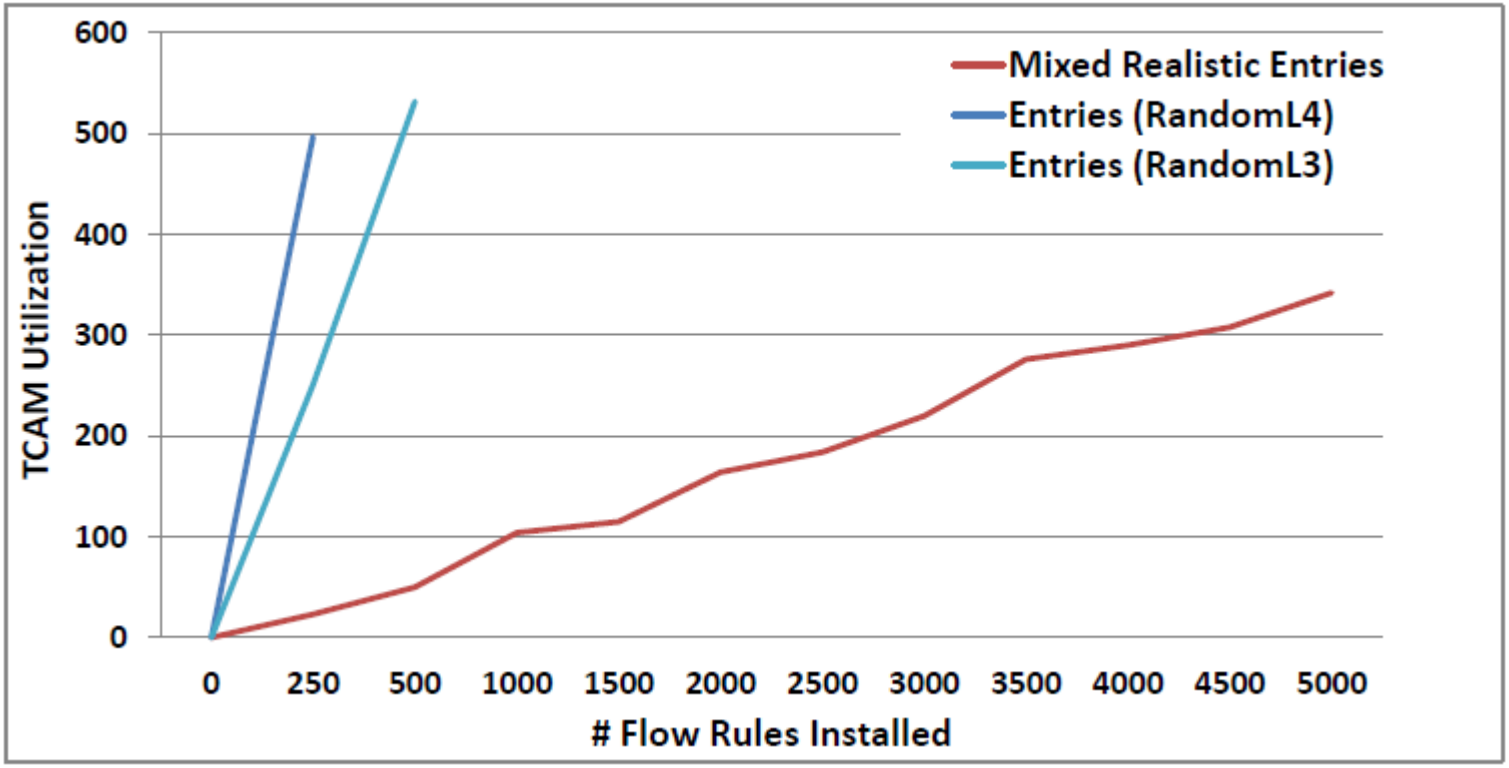
Challenge: (4) Packet In

- Can forward packets out specific ports, or (remote) Log headers and drop packets
- Can't buffer packets and remote log header



Challenge: Table Transparency

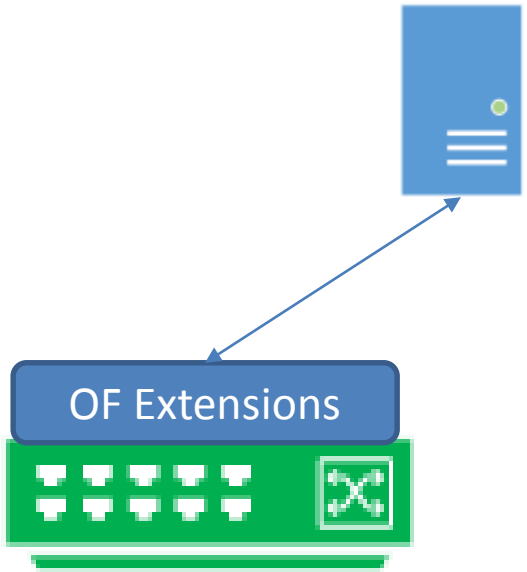
- Rule compression – overlapping rules get combined into less TCAM entries



OpenFlow Extensions

Extensions to reduce switch-controller interactions

- AvantGuard – security
- DevoFlow – monitoring



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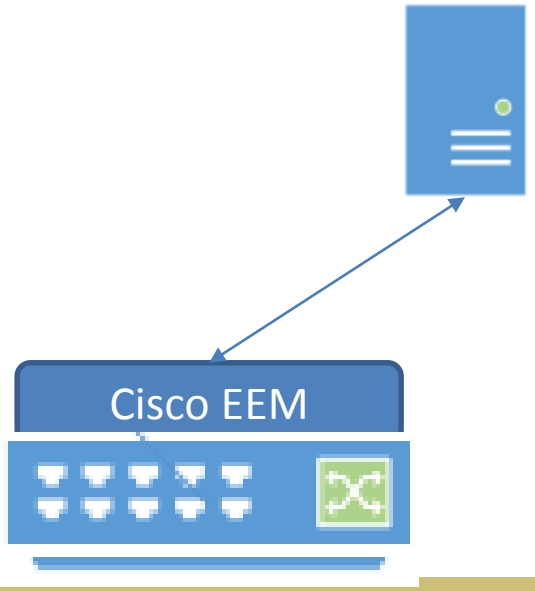

Embedded Event Manager

- Several event detectors,
- Add TCL scripts for actions

=> Could seemingly implement intent of AvantGuard and DevoFlow

Conclusions

- ClosedFlow is layer providing OpenFlow like programmability to legacy network configs.
  - Giving some insight into commonalities/differences
- A point in the “Transition to SDN” space
  - Panopticon (partial deploy), Fabric (edge), others.

Questions?

Challenge: Table Transparency (2)

- Overflowing table – uses slow memory, or SW