ClosedFlow: OpenFlow-like Control over Proprietary Devices

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Problem: Abrupt Transition to Using SDN

Legacy Configuration (Distributed Control Plane) -> Single-Hop Transition -> Customized Control Applications (Controller)
Goal: Smooth Transition to SDN
User interface, and integrations into, e.g., OpenStack

Configuration interface (Cisco, Juniper, etc.)

Just Remote/Central Configuration?
User interface(s), and APIs to integrate into, e.g., OpenStack

Layers of abstractions, and applications

**Programming interface** (e.g., OpenFlow)
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
OpenFlow Extensions

Extensions to reduce switch-controller interactions

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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