Operations in OpenFlow

James Won-Ki Hong, Jian Li, Seyeon Jeong

Dept. of Computer Science & Engineering

POSTECH

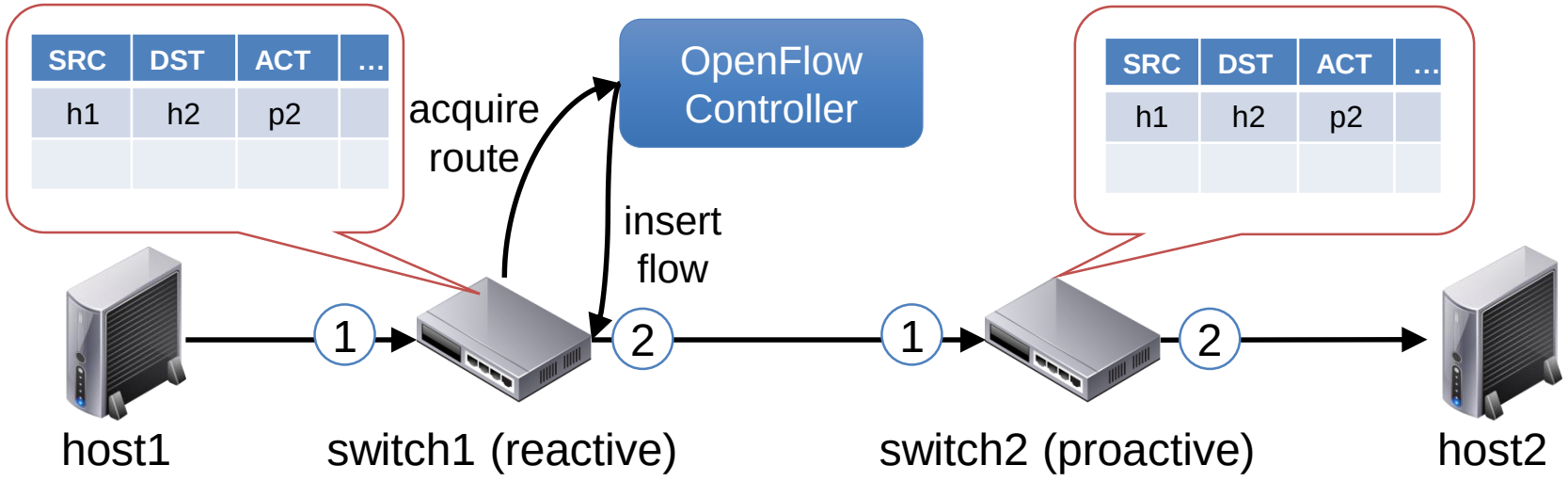
http://dpnm.postech.ac.kr/~jwkhong

jwkhong@postech.ac.kr

Packet Forwarding in OpenFlow

❖ Packet Forwarding

- Reactive flow insertion
  - A non-matched packet reaches to OpenFlow switch, it is sent to the controller, based on the info in packet header, an appropriate flow will be inserted
  - Always need to query the path from controller during packet arrival → slow
  - Can reflect the current traffic status
- Proactive flow insertion
  - Flow can be inserted proactively by the controller to switches before packet arrives
  - No need to communicate during packet arrival → fast packet forwarding
  - Cannot reflect the current traffic status



Topology Discovery in OpenFlow

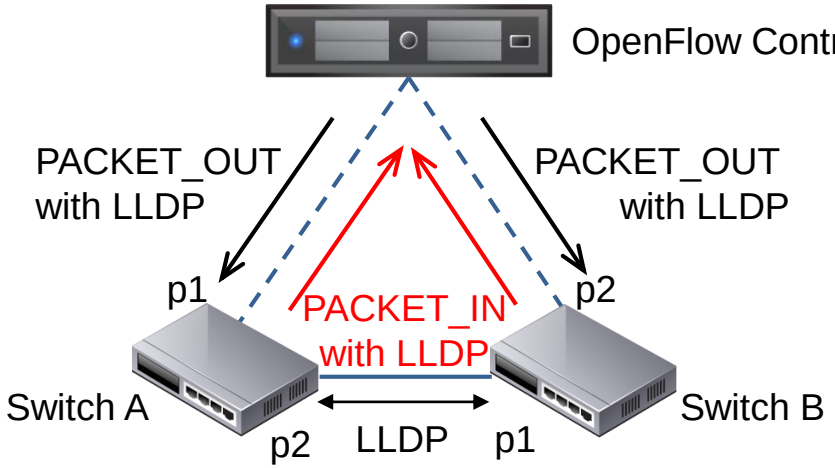
❖ Open Flow Discovery Protocol (OFDP)

- Objective: construct an entire network view

❖ Method

- Use the Link Layer Discovery Protocol (LLDP) inside Packet-Out

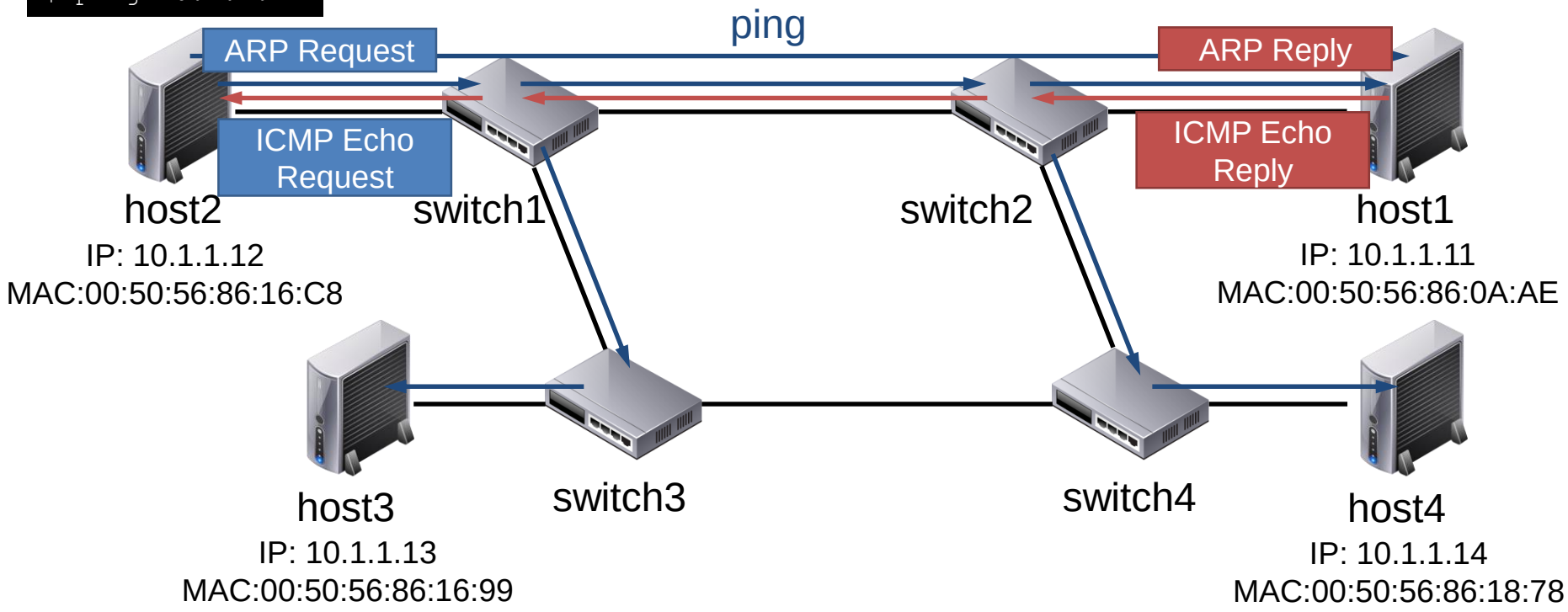
IDX	SRC	DST	SRC PORT	DST PORT
153	sw. A	sw. B	p2	p1
…	…	…	…	…
357	sw. B	sw. A	p1	p2



Communication in Legacy Network

1. host2 tries communication to host1 by sending a ping ICMP packet
2. host2 broadcasts ARP Request packet
3. host1 replies ARP Request with ARP Reply
4. host2 creates entry to ARP Cache Table
5. host2 sends ICMP Echo request packet
6. host1 replies ICMP Echo request with ICMP Echo reply

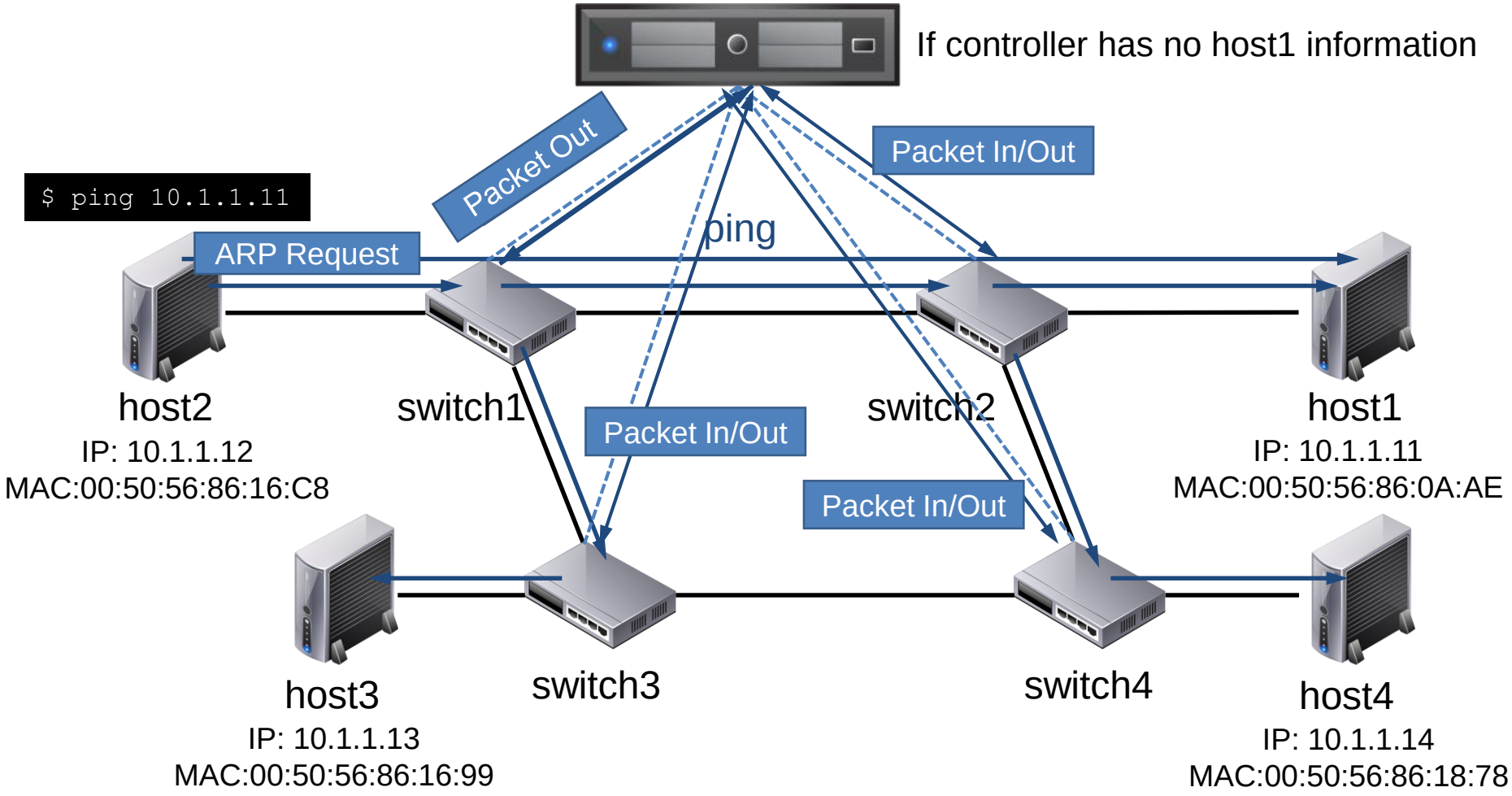
```
$ ping 10.1.1.11
```



ARP Cache Table of Host2

Internet Address	Physical Address	Type
10.1.1.254	00-00-0C-E7-58-CD	Dynamic
10.1.1.11	00-50-56-86-0A-AE	Dynamic

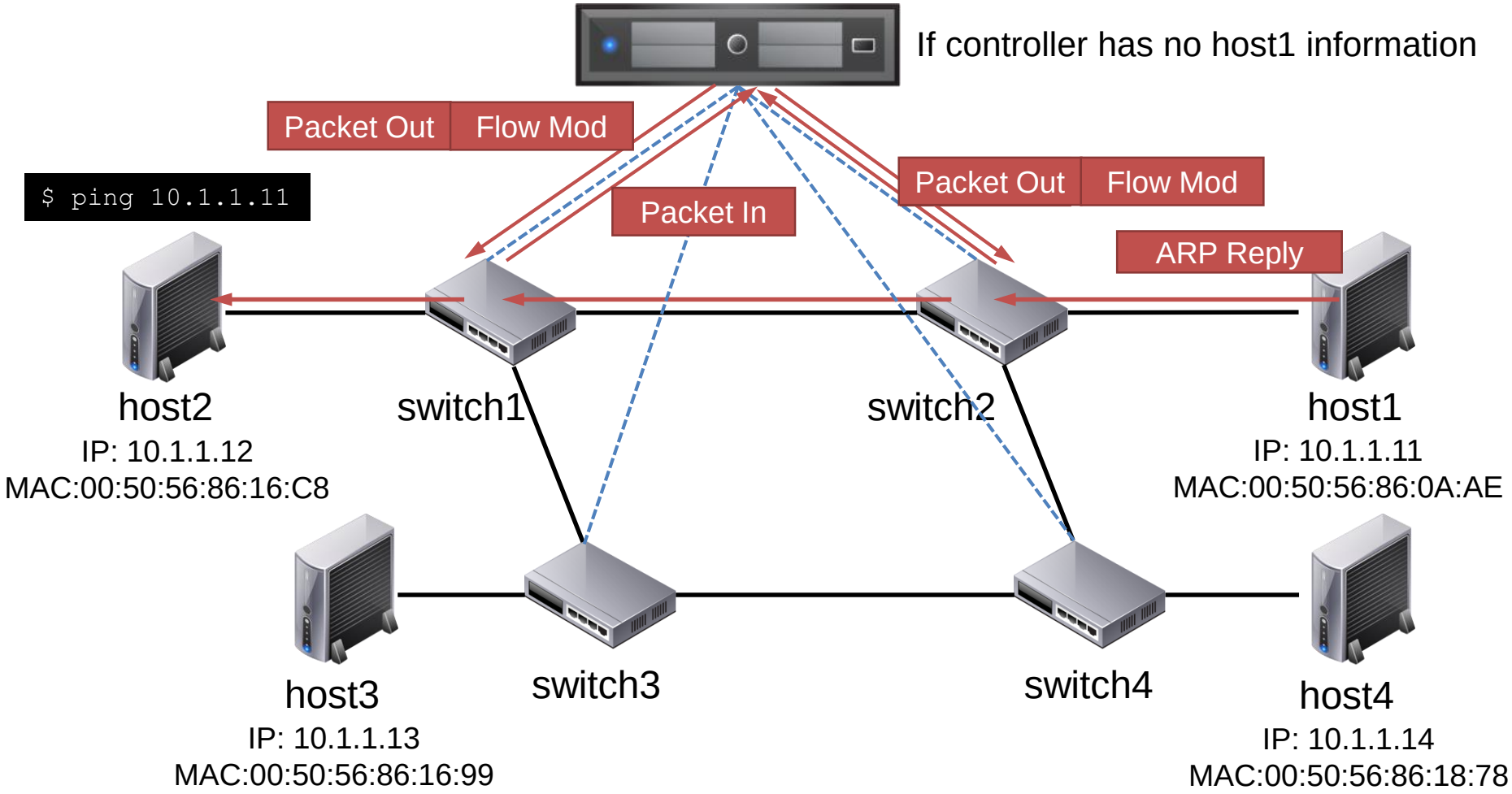
Communication in OpenFlow



ARP Cache Table of Host2

```
Internet Address          Physical Address          Type
10.1.1.254                00-00-0C-E7-58-CD         Dynamic
```

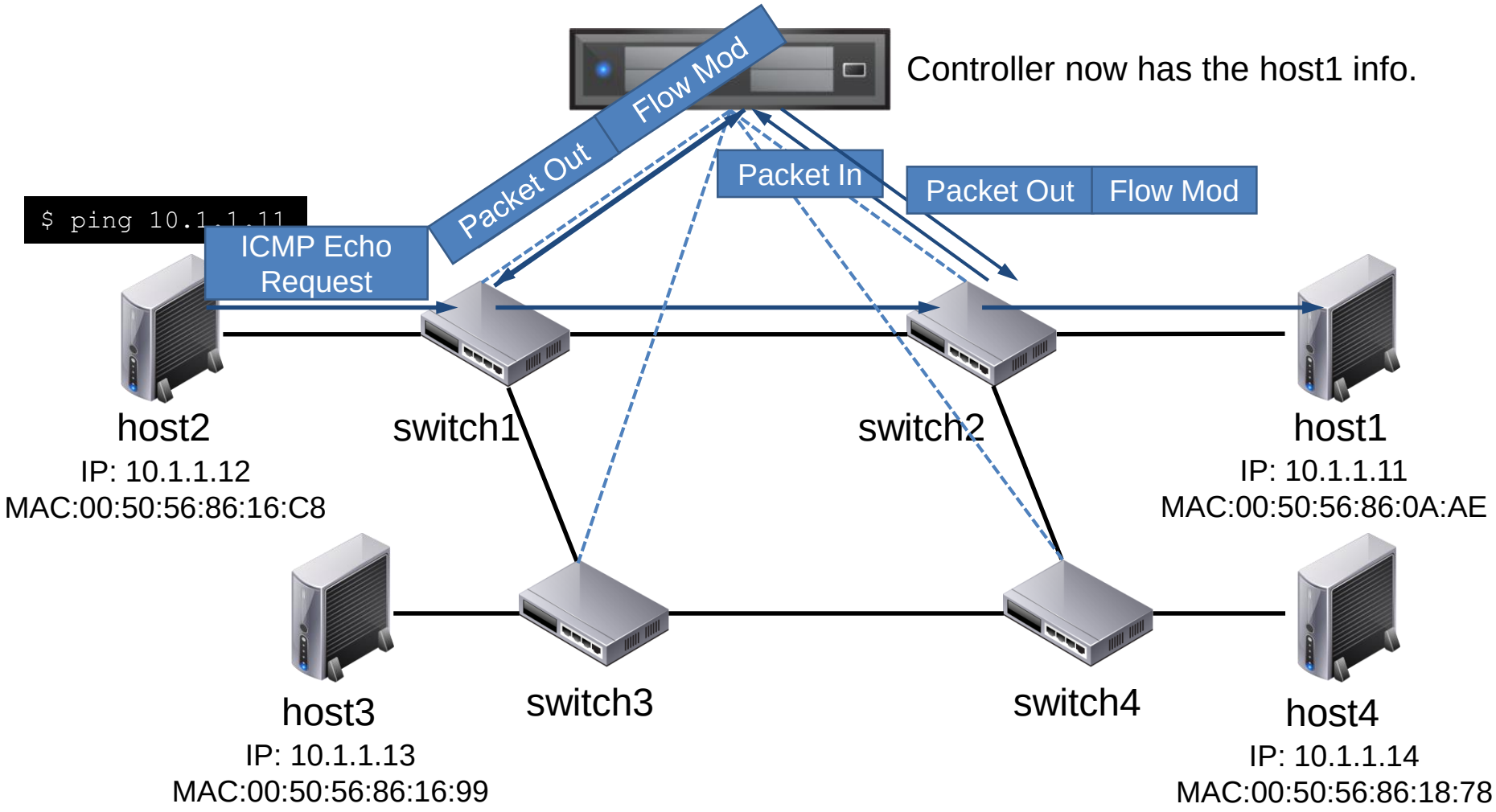
Communication in OpenFlow



ARP Cache Table of Host2

Internet Address	Physical Address	Type
10.1.1.254	00-00-0C-E7-58-CD	Dynamic
10.1.1.11	00-50-56-86-0A-AE	Dynamic

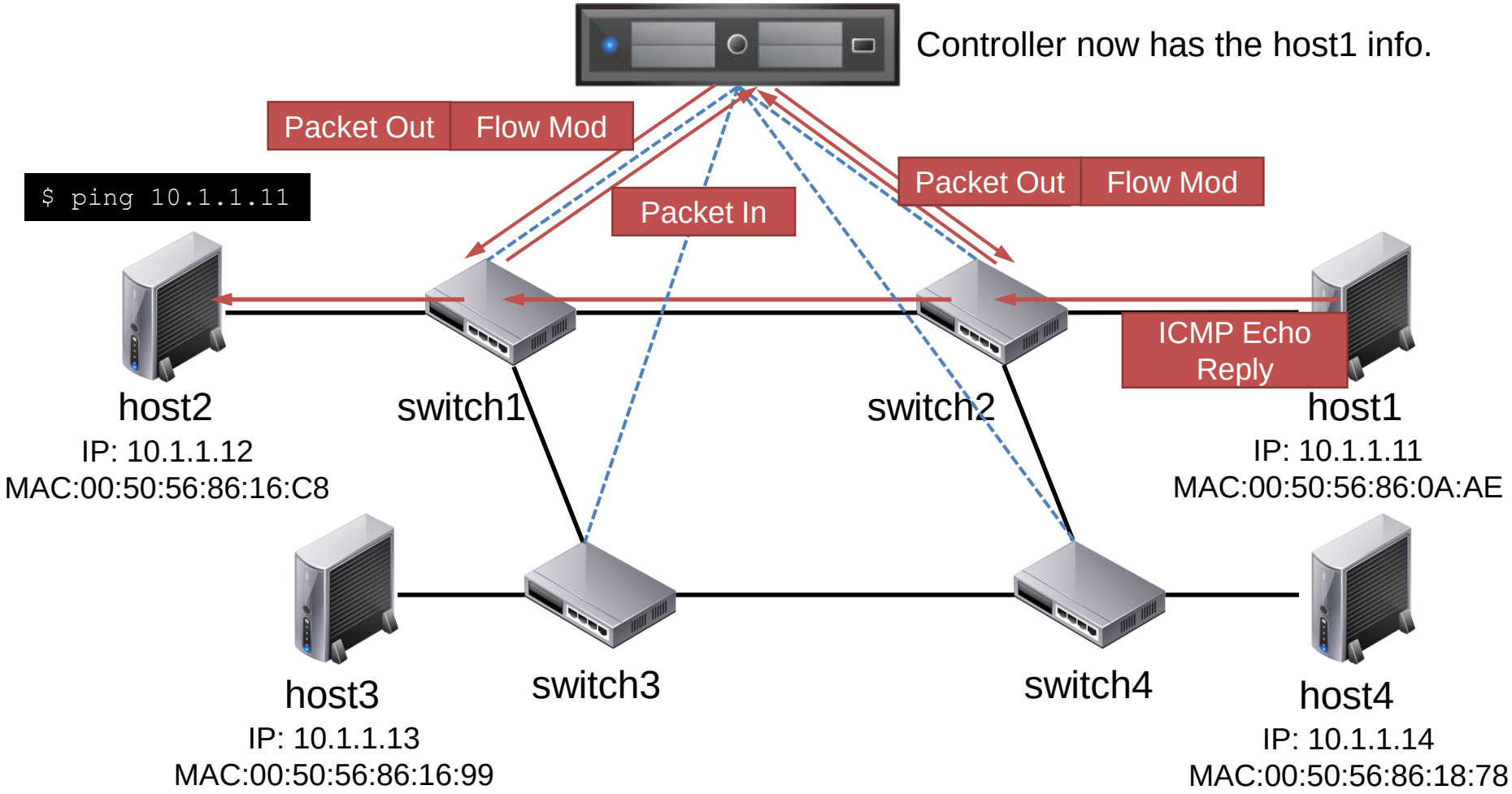
Communication in OpenFlow



ARP Cache Table of Host2

Internet Address	Physical Address	Type
10.1.1.254	00-00-0C-E7-58-CD	Dynamic
10.1.1.11	00-50-56-86-0A-AE	Dynamic

Communication in OpenFlow



ARP Cache Table of Host2

```
Internet Address      Physical Address      Type
10.1.1.254            00-00-0C-E7-58-CD     Dynamic
10.1.1.11             00-50-56-86-0A-AE     Dynamic
```

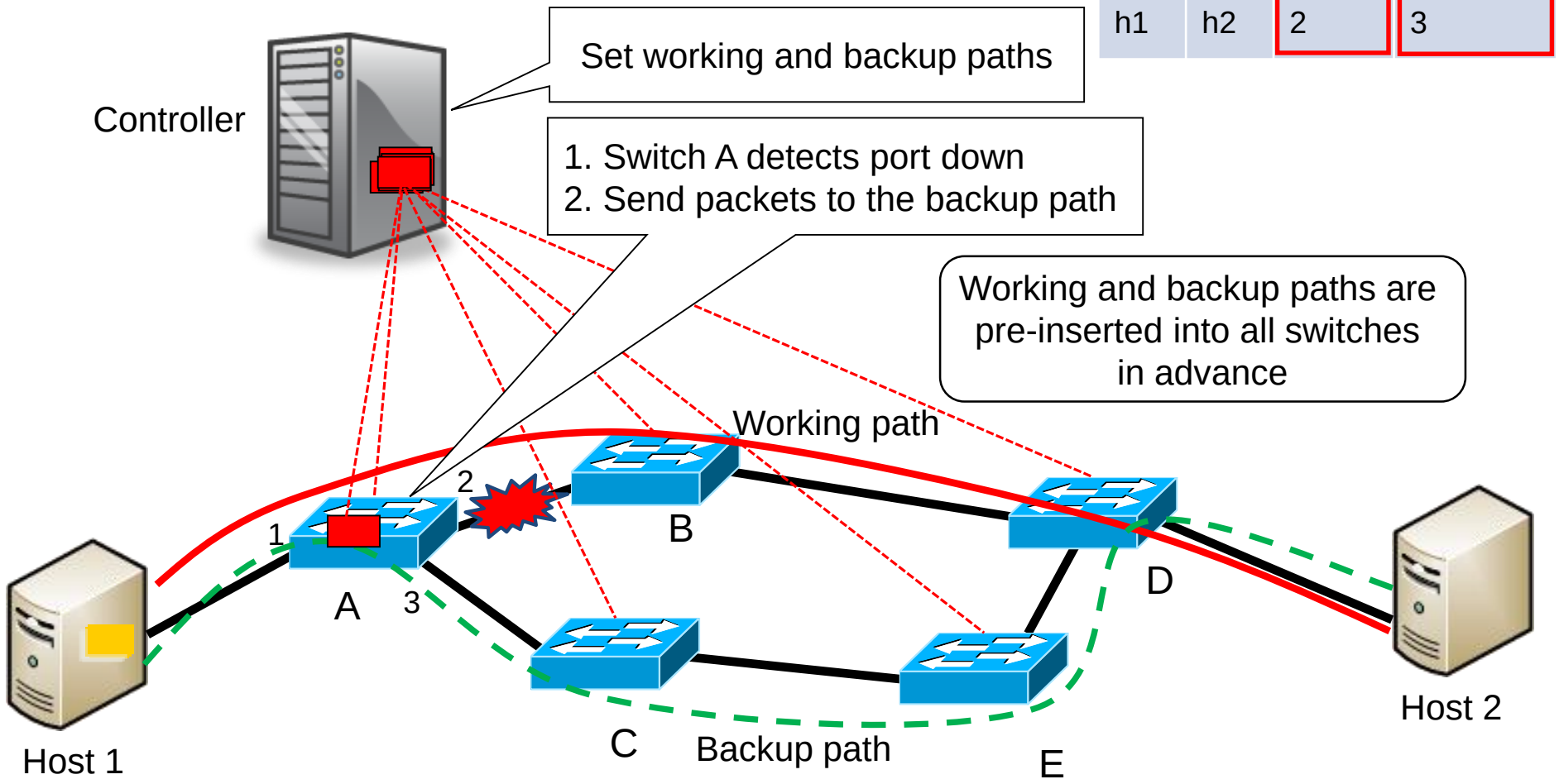
OpenFlow Failover

❖ OpenFlow Failover

- Protection

Flow table of Switch A (group table combined)

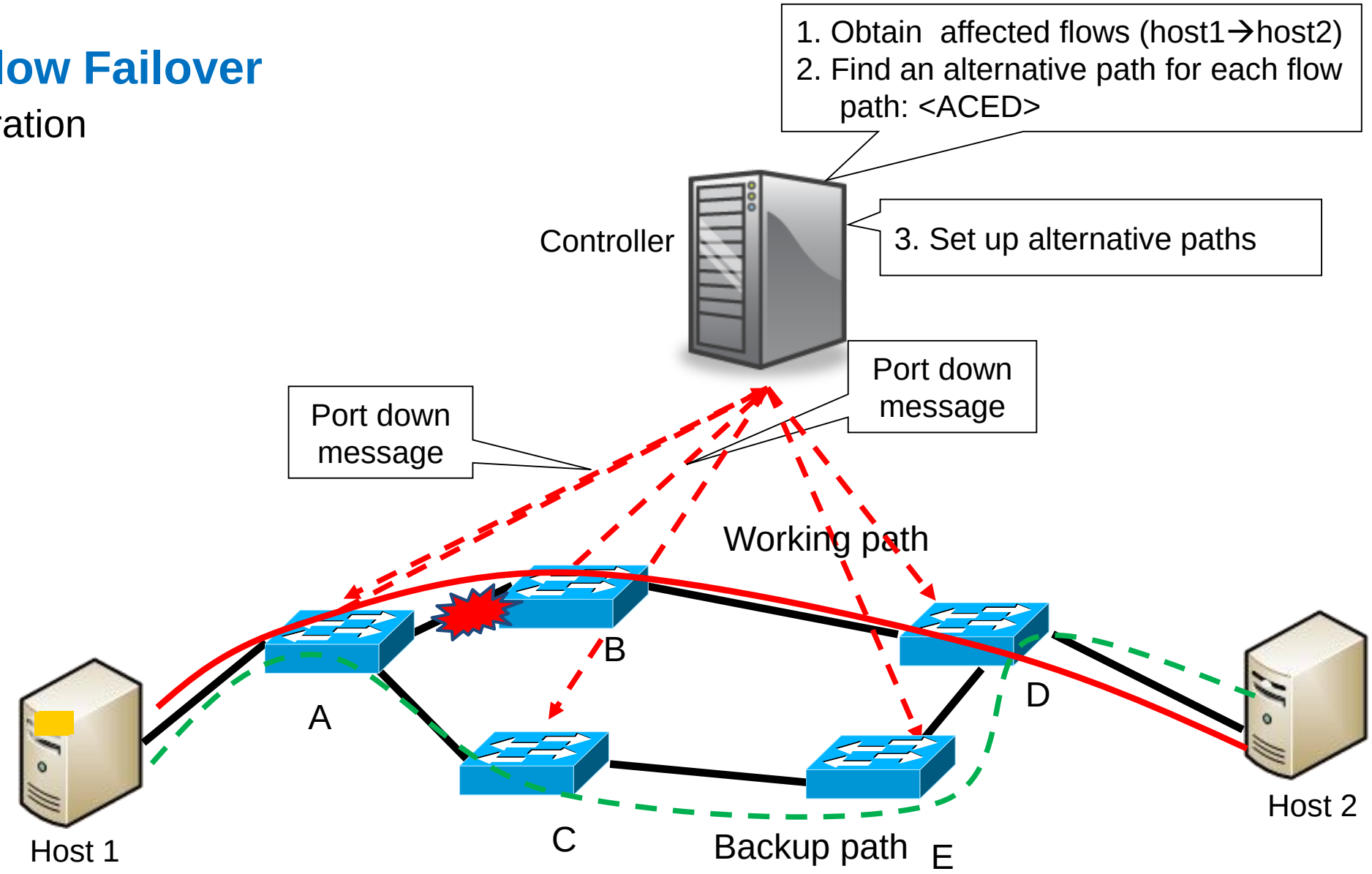
src	dst	Out port	Failover port
h1	h2	2	3



OpenFlow Failover

❖ OpenFlow Failover

- Restoration



References

1. OpenvSwitch: http://openvswitch.org/
2. OpenFlow: https://www.opennetworking.org
3. ONOS: http://onosproject.org/
4. ODL: https://www.opendaylight.org/
5. NOX: https://github.com/noxrepo/nox
6. POX: https://github.com/noxrepo/pox
7. Ryu: https://osrg.github.io/ryu/
8. Talks from Nick McKeown: http://yuba.stanford.edu/~nickm/talks.html
9. Ethane: Taking Control of the Enterprise (SIGCOMM 2007): http://yuba.stanford.edu/~casado/ethane-sigcomm07.pdf

Packet Processing Flowchart in OF Switch