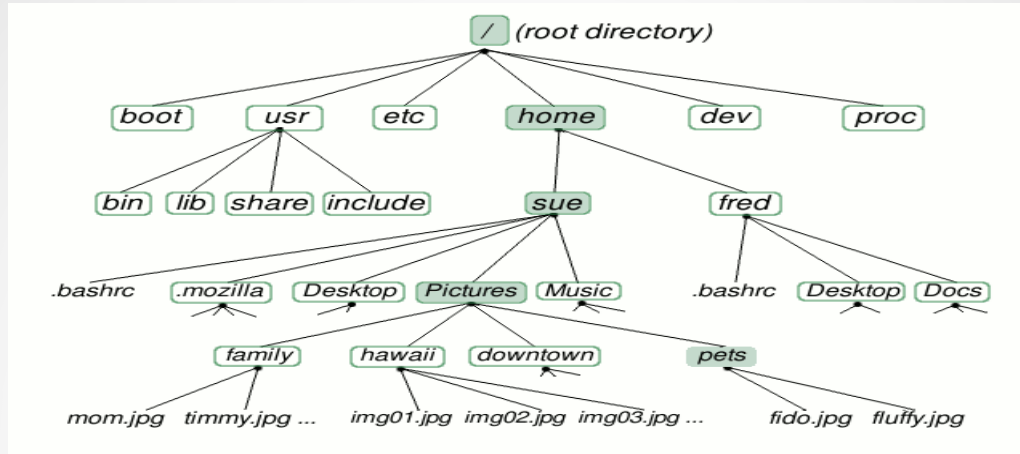


Abstractions in Networking: Software Defined Networks and OpenFlow

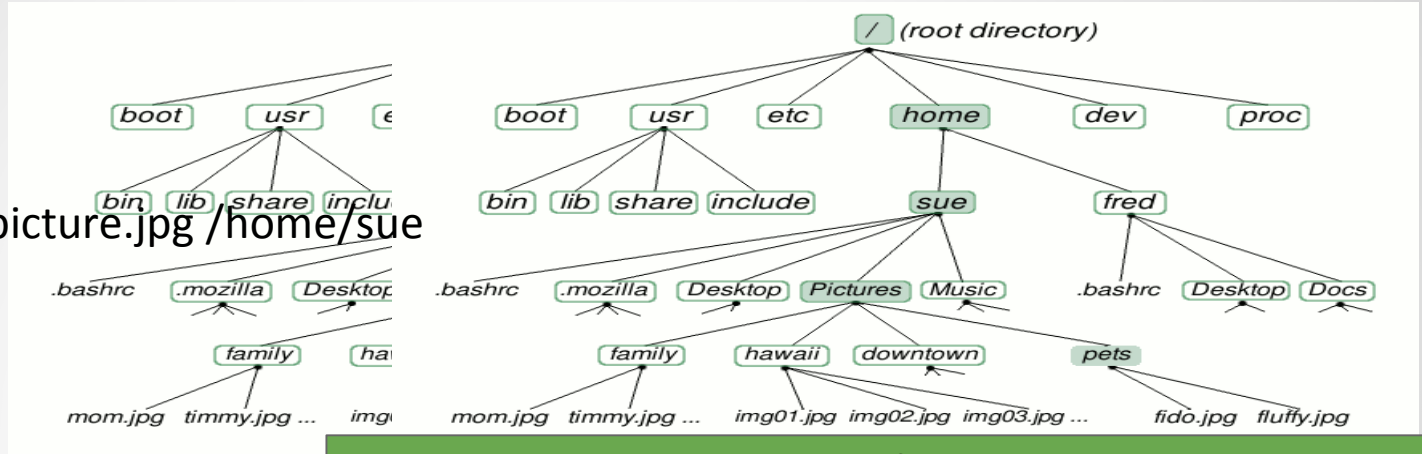


What is an Abstraction?

Block Device

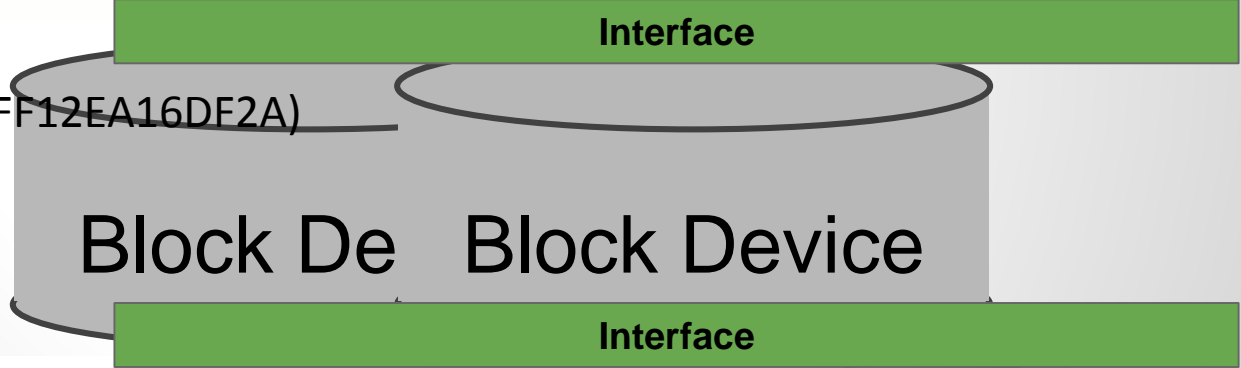


Why is this useful?



```
mv /home/fred/my_picture.jpg /home/sue
```

```
blk = allocate(4096KB, @0xFFFFFFFF12EA16DF2A)  
write(*blk, data)
```



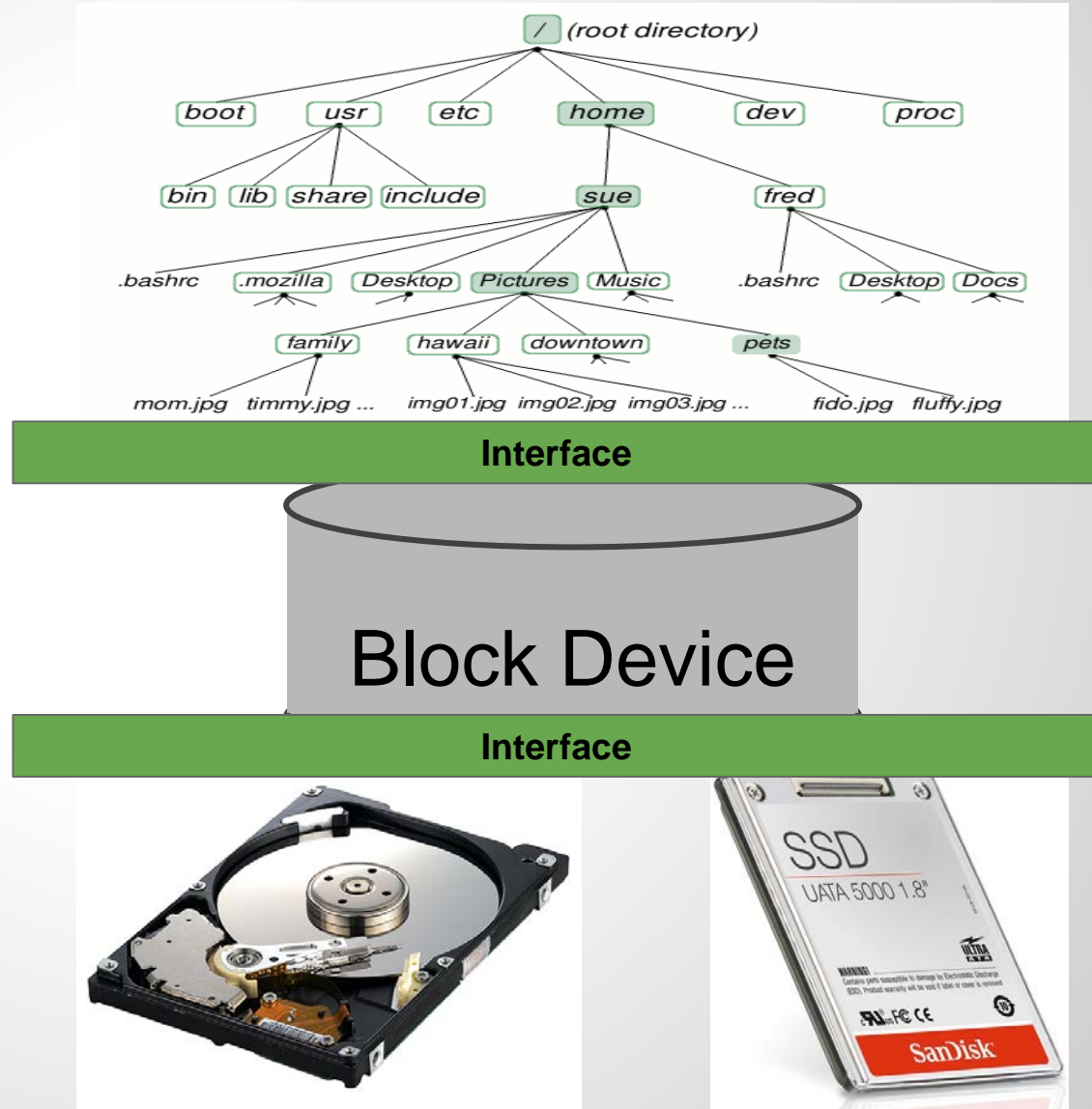
move_head to sector 5
rotate spindle to 7200RPM
magnetize the platter
....



Less Complexity
Less Control

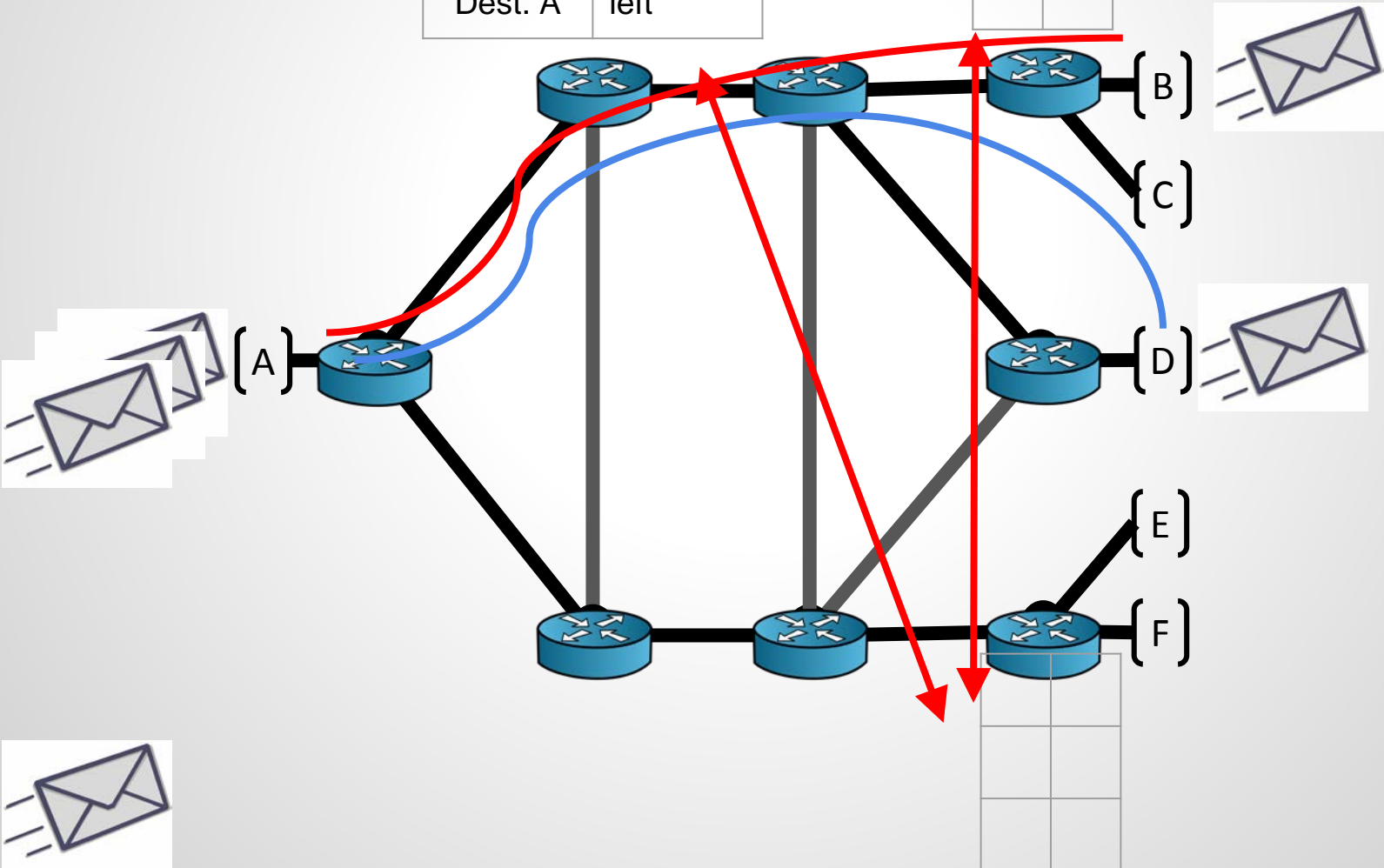


More Complexity
More Control

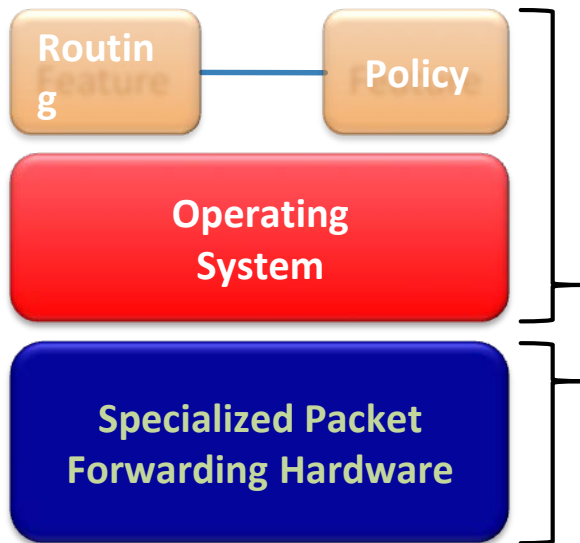


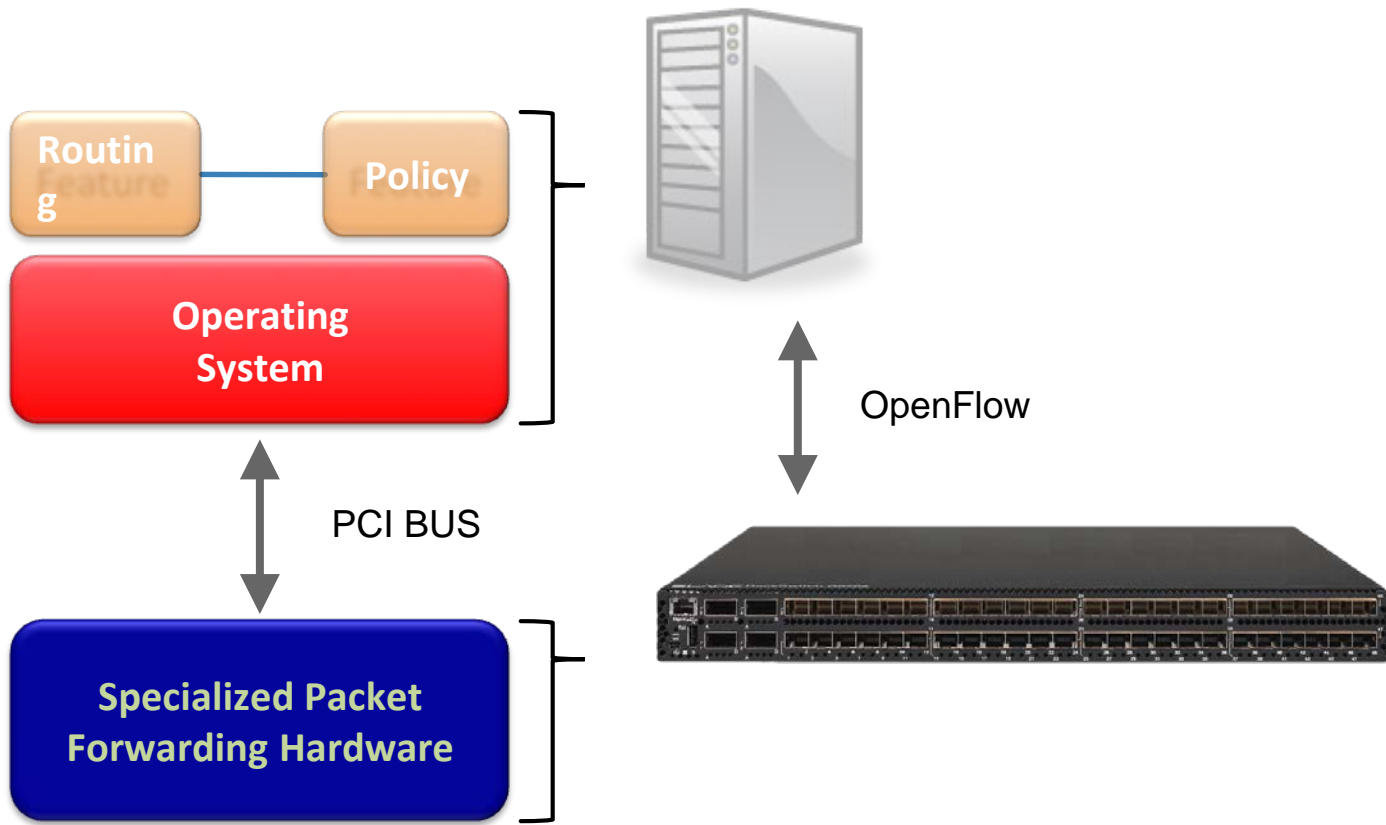
What are the important
abstractions in for networks?

Dest. B	right
Dest. C	right
Dest. A	left



What is in a switch/router?





OpenFlow Basics

Plumbing Primitives

<Match, Action>

Match arbitrary bits in headers:



Match: 1000x01xx0101001x

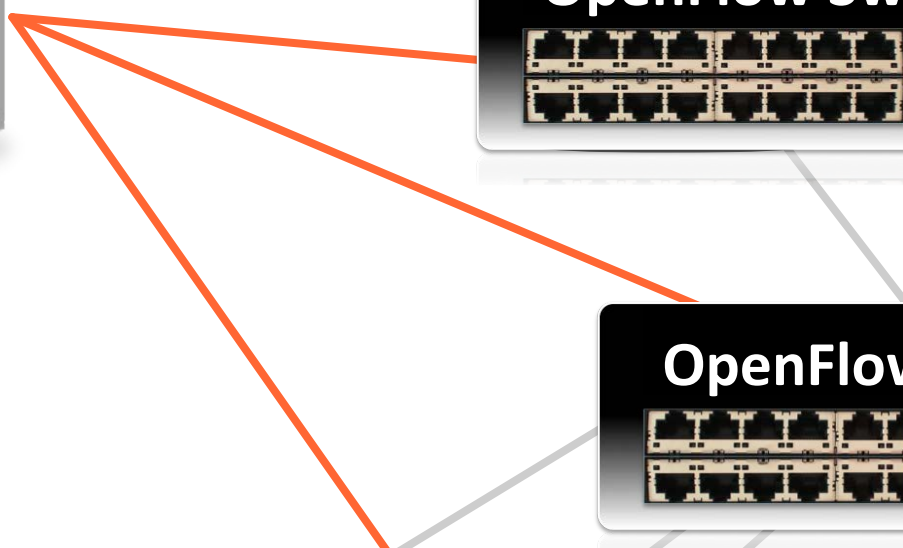
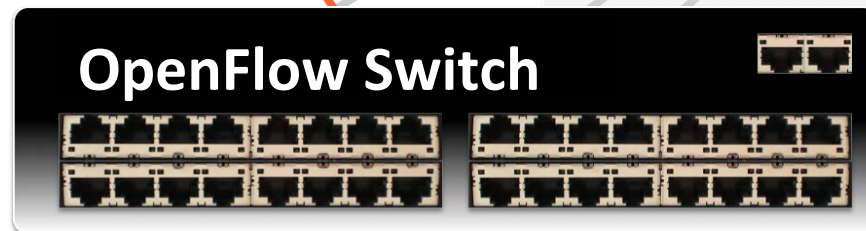
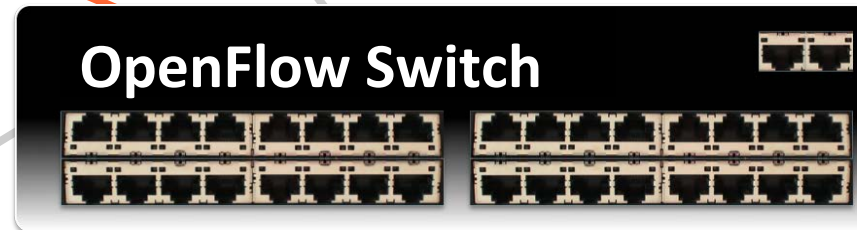
- Match on any header (not only destination)
- Header Patterns define “Flows”

Action

- Forward to port(s), drop, send to controller
- Overwrite header, push or pop a new header

Step 1: Separate Control from Datapath

OpenFlow Controller



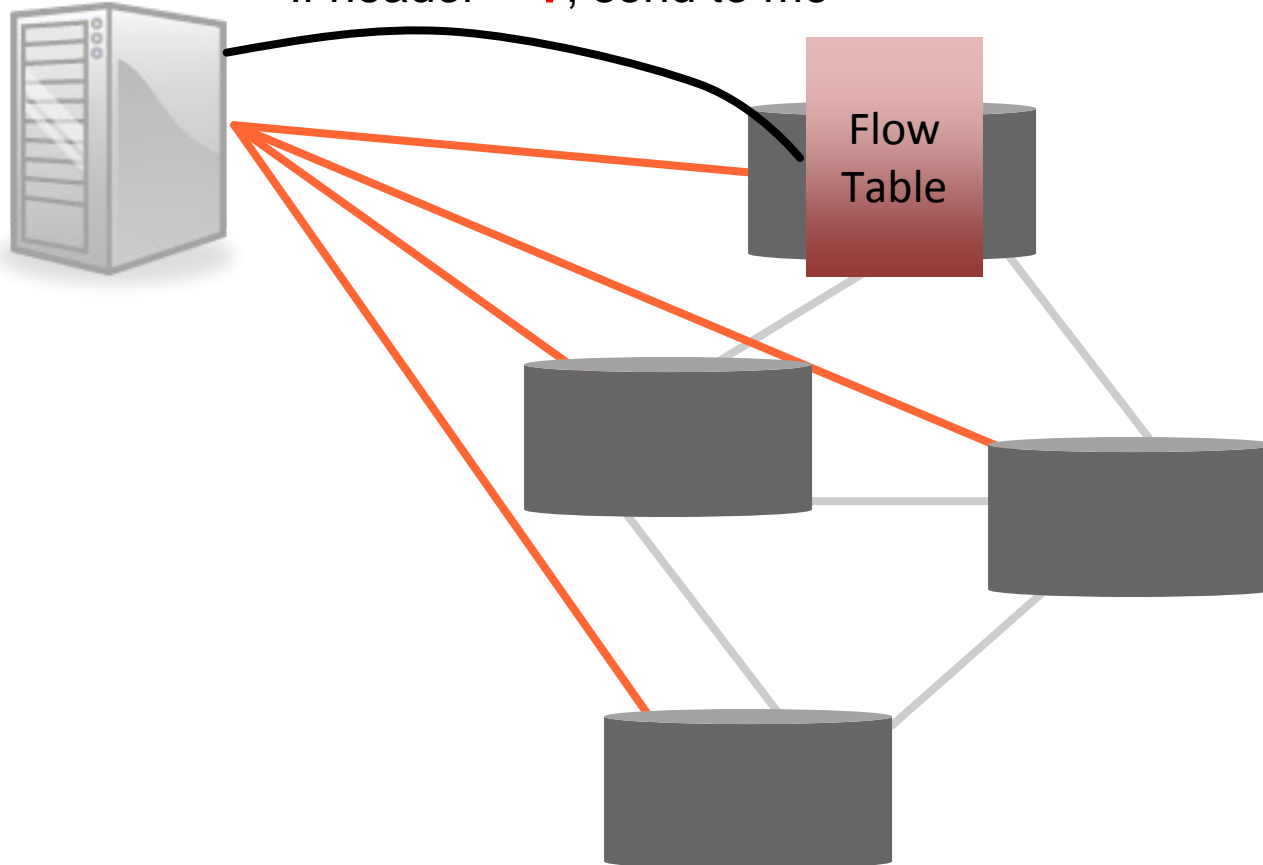
Step 2:

Cache flow decisions in datapath

“If header = **x**, send to port 4”

“If header = **y**, overwrite header with **z**, send to ports 5,6”

“If header = **?**, send to me”



Abstraction 1 in review:

**Hardware is decoupled from
the software**

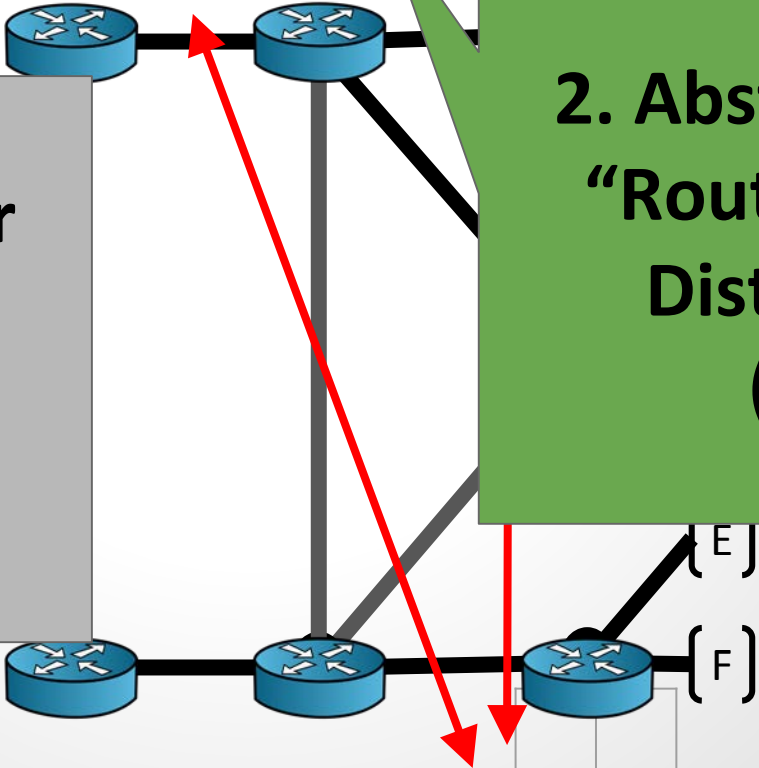
and

**Most functionality is pushed to
Software**

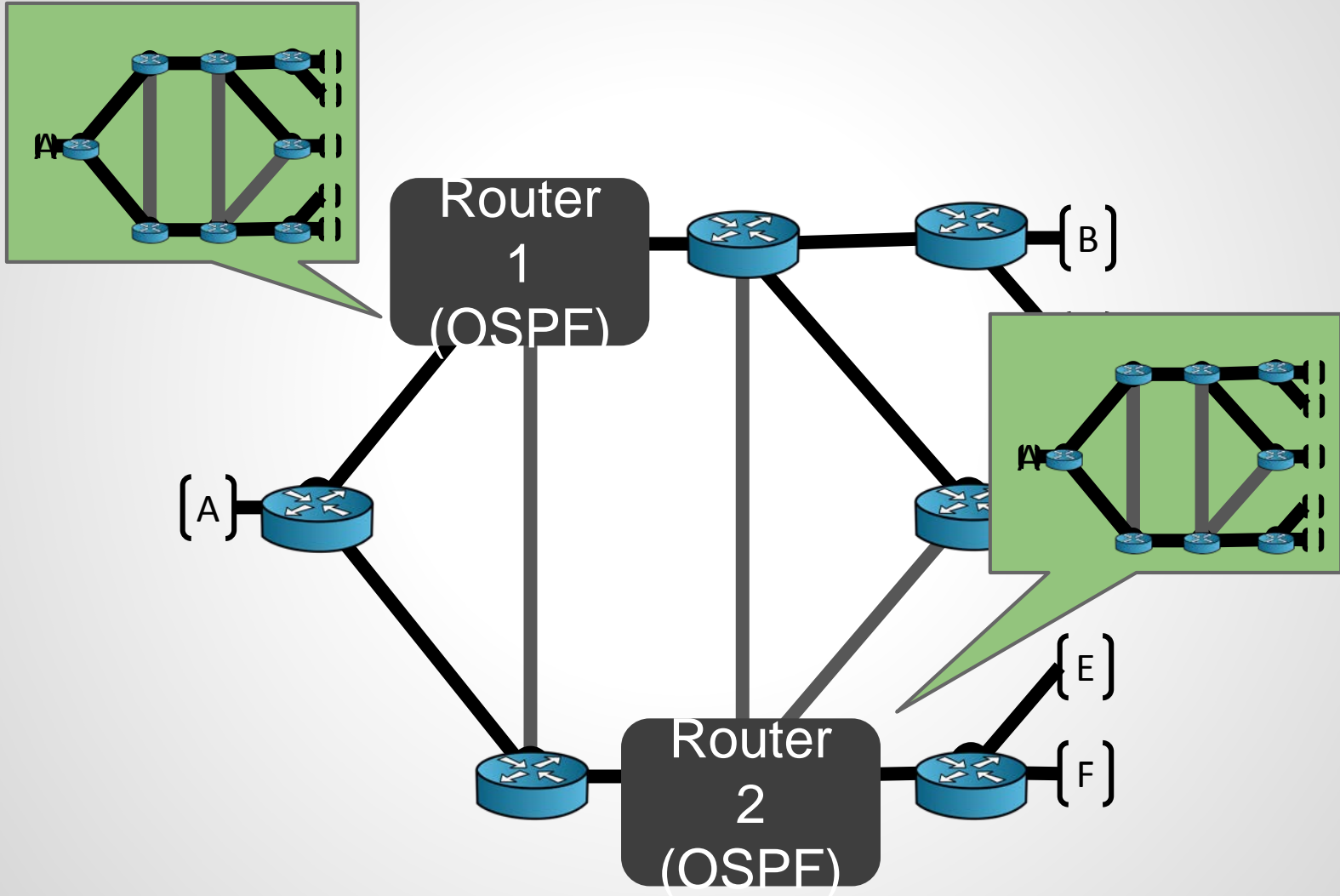
Dest. B	right
Dest. C	right
Dest. A	left

1. Abstraction for the Forwarding Table (OpenFlow)

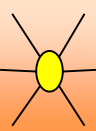
2. Abstraction for "Routing" State Distribution (SDN)




Network Routing

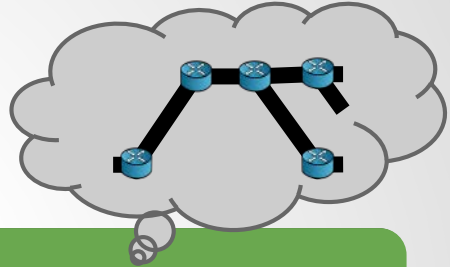


**SDN
Interface**

Control Programs 

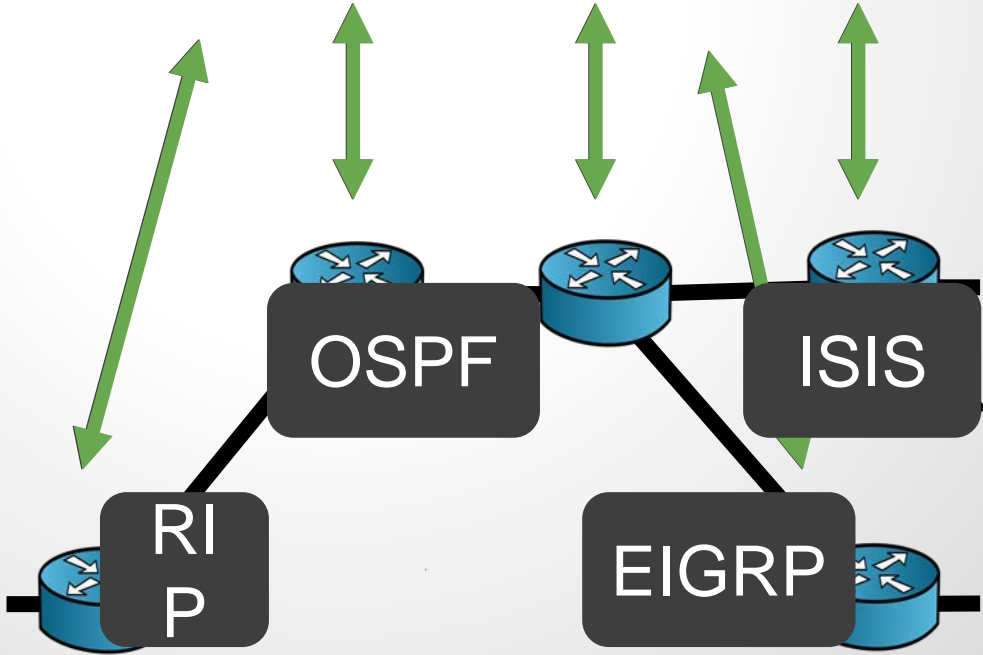
Control Programs 

Control Programs 



Controller Platform

Software Defined Networking



Why SDN Matters

- Decoupling Software from Hardware allows for better network control abstractions.
- Good Network control abstractions can help realize faster, more efficient, more reliable networks.
- New opportunities for Network Management Automation, Troubleshooting, Verification