Forwarding and Routing with Packet Subscriptions

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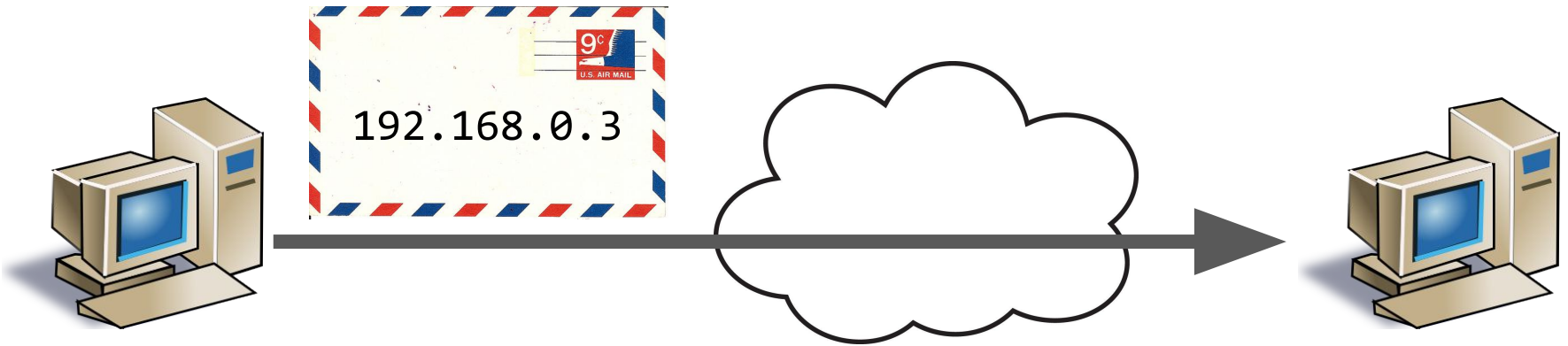
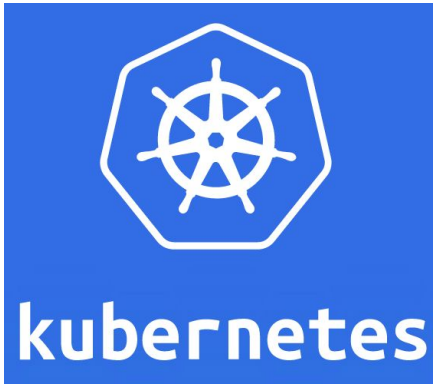
Status quo: location-based addressing



How do applications communicate?

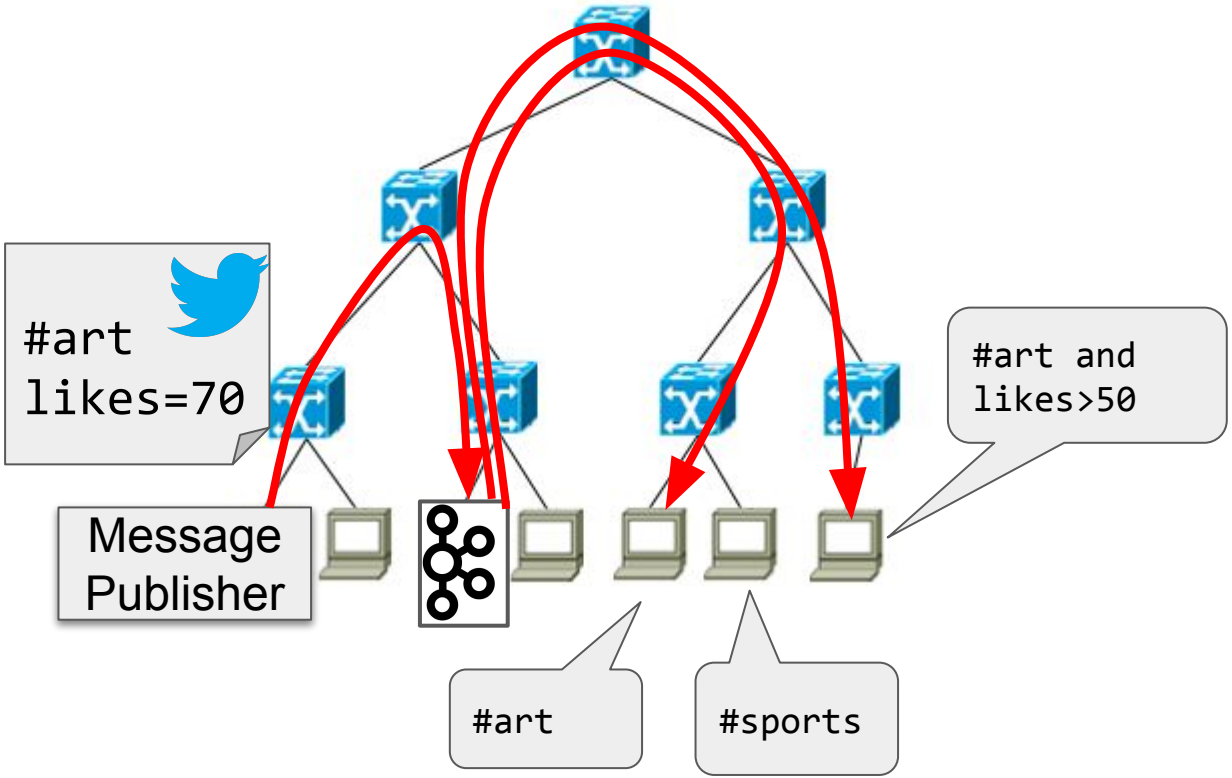
Microservices:
service ID



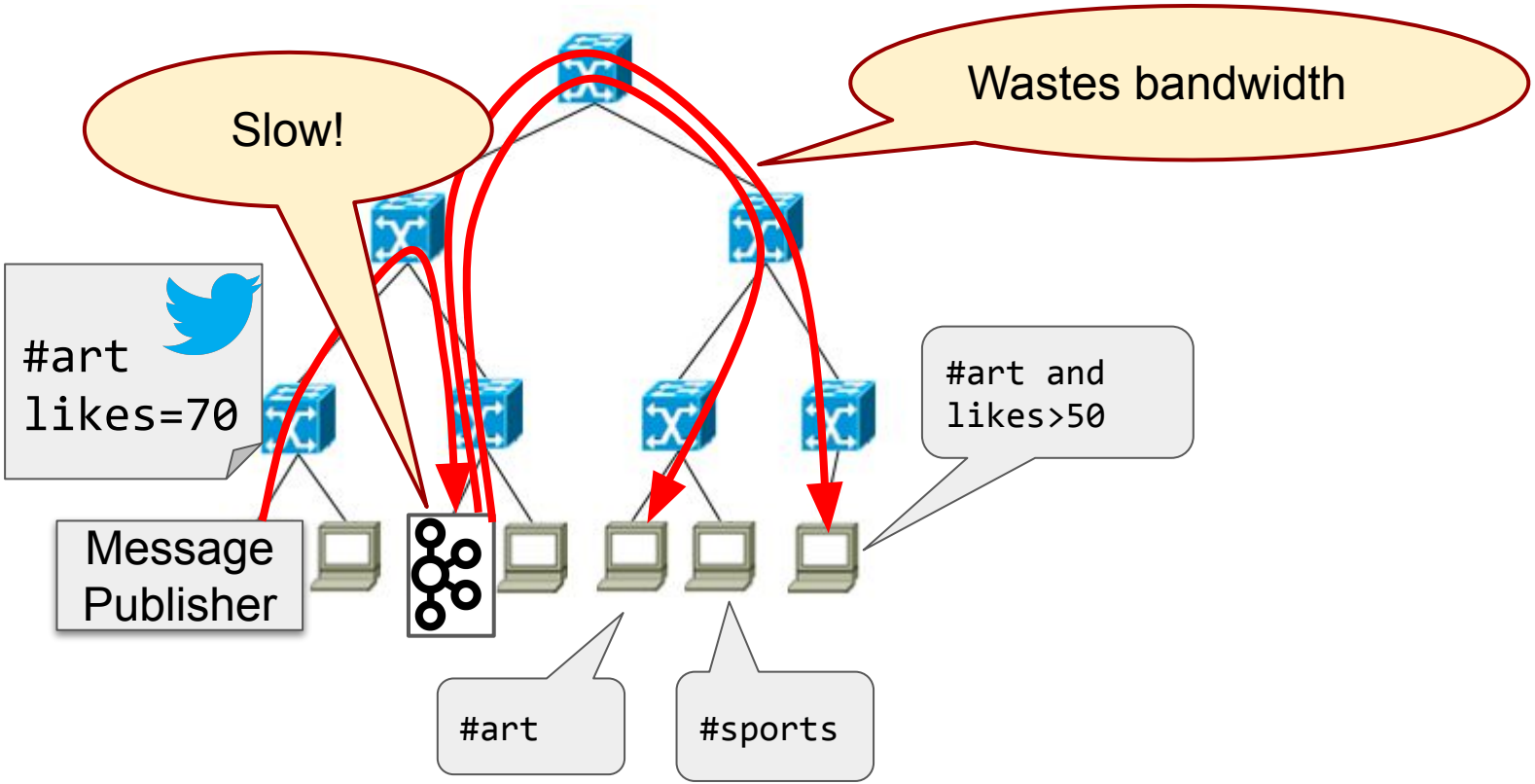
Load balancers:
lowest load

Pub/sub:
topic

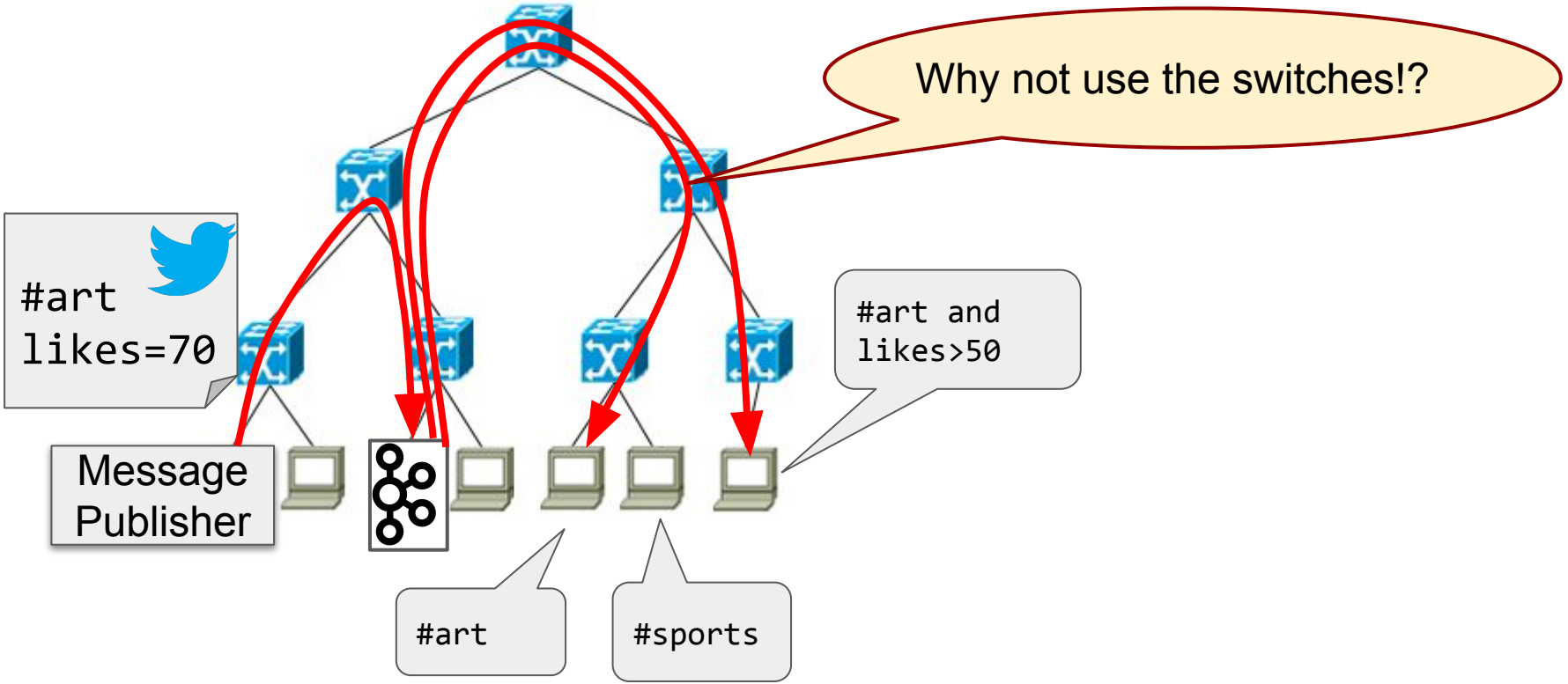
Forwarding with software middleware



Forwarding with software middleware



Forwarding with software middleware




We now have fast, programmable networks.
We can use them for more expressive routing.

Packet Subscriptions

- Identify packet and indicate action
- Relational and logical operators
- Multicast

```
topic = art: fwd(1)
```

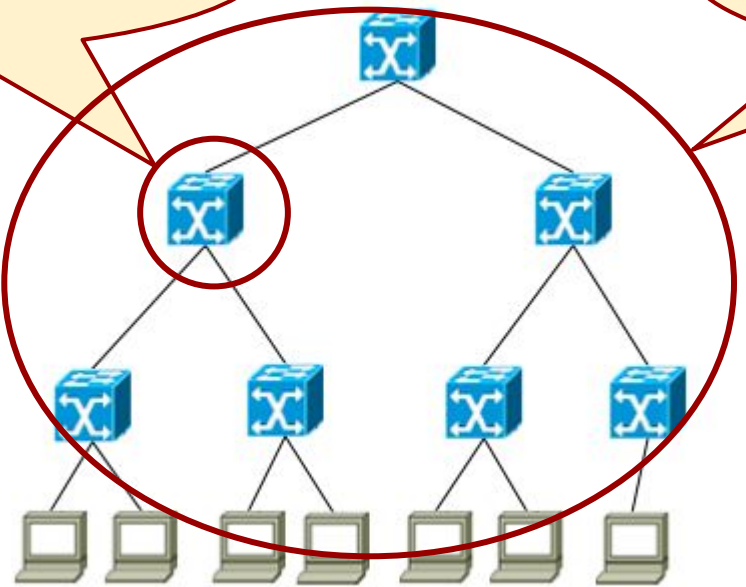
```
topic = art ∧ likes > 70: fwd(1)
```

```
likes > 70: fwd(1, 2, 3)
```

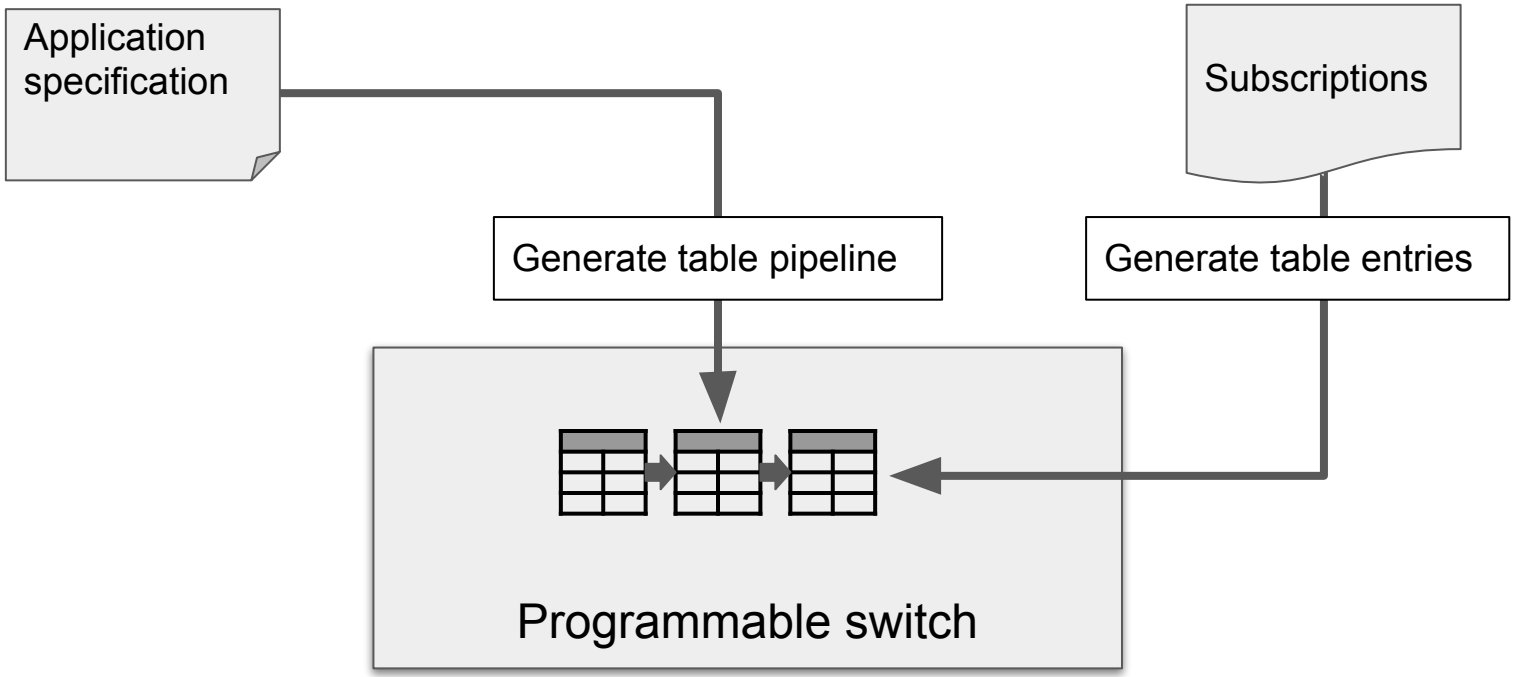
Packet Subscriptions challenges

How to evaluate rules?

How to route with rules?

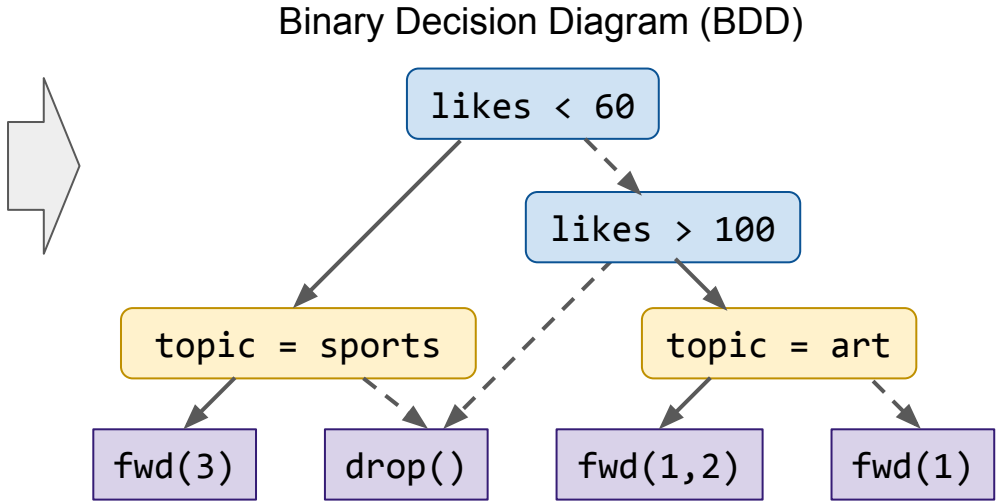


Compilation overview



Compiling subscription rules

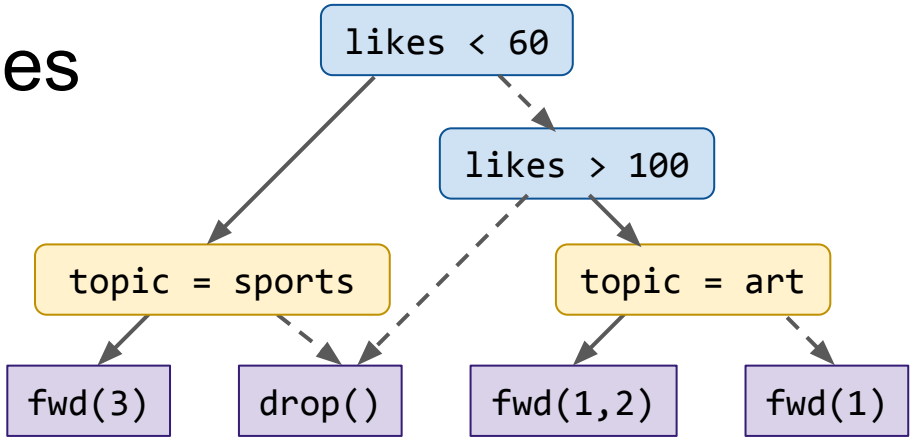
```
likes > 100: fwd(1)
likes > 100 ∧ topic = art: fwd(2)
likes < 60 ∧ topic = sports: fwd(3)
```



Compiling subscription rules

BDD

P4 table entries



Match	Action
likes	
< 60	state←1
> 100	state←2
*	state←6

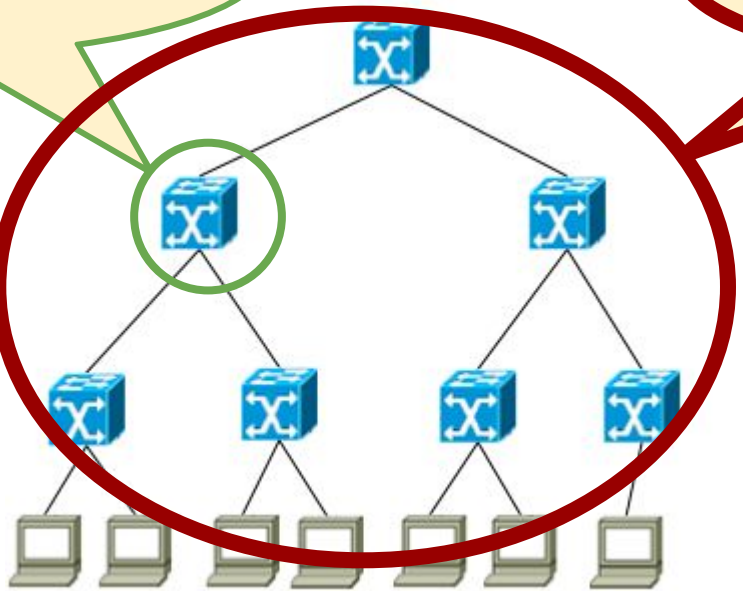
Match		Action
state	topic	
1	sports	state←3
1	*	state←6
2	art	state←4
2	*	state←5

Match	Action
state	
3	fwd(3)
4	fwd(1,2)
5	fwd(1)
6	drop()

Packet Subscriptions challenges

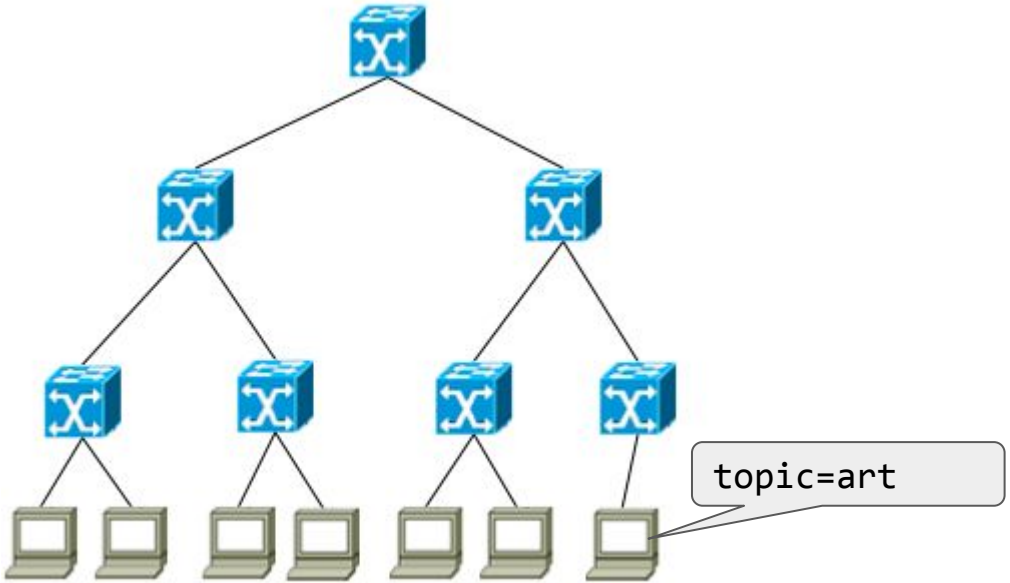
How to evaluate rules?

How to route with rules?



Routing with Packet Subscriptions

Where to place rule?



Routing with Packet Subscriptions

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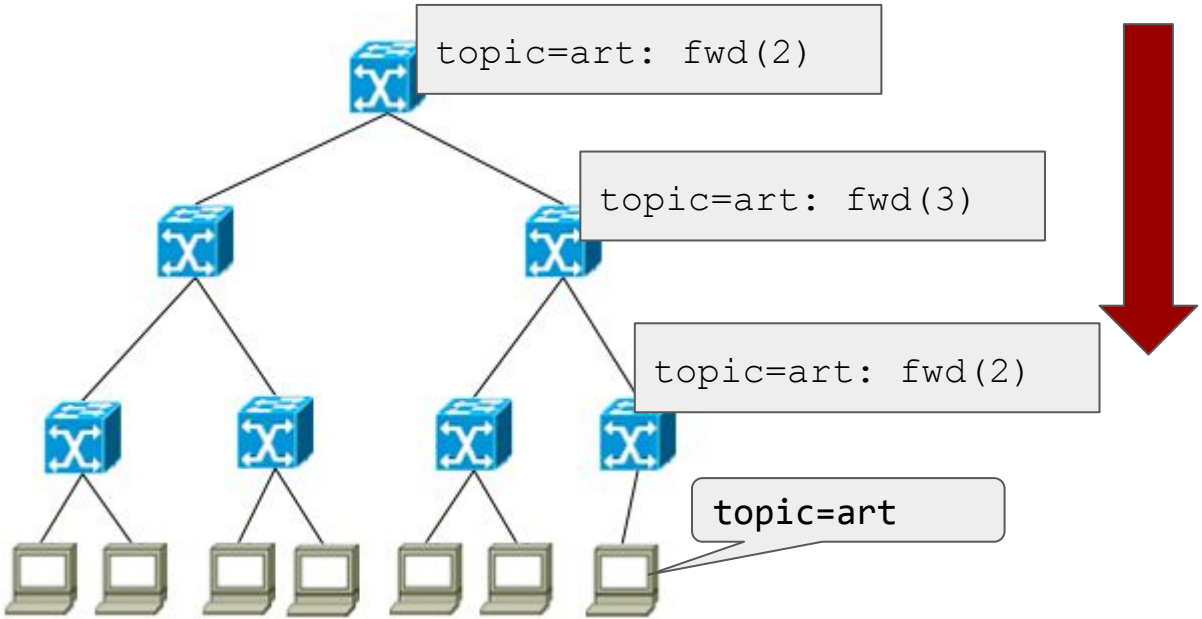
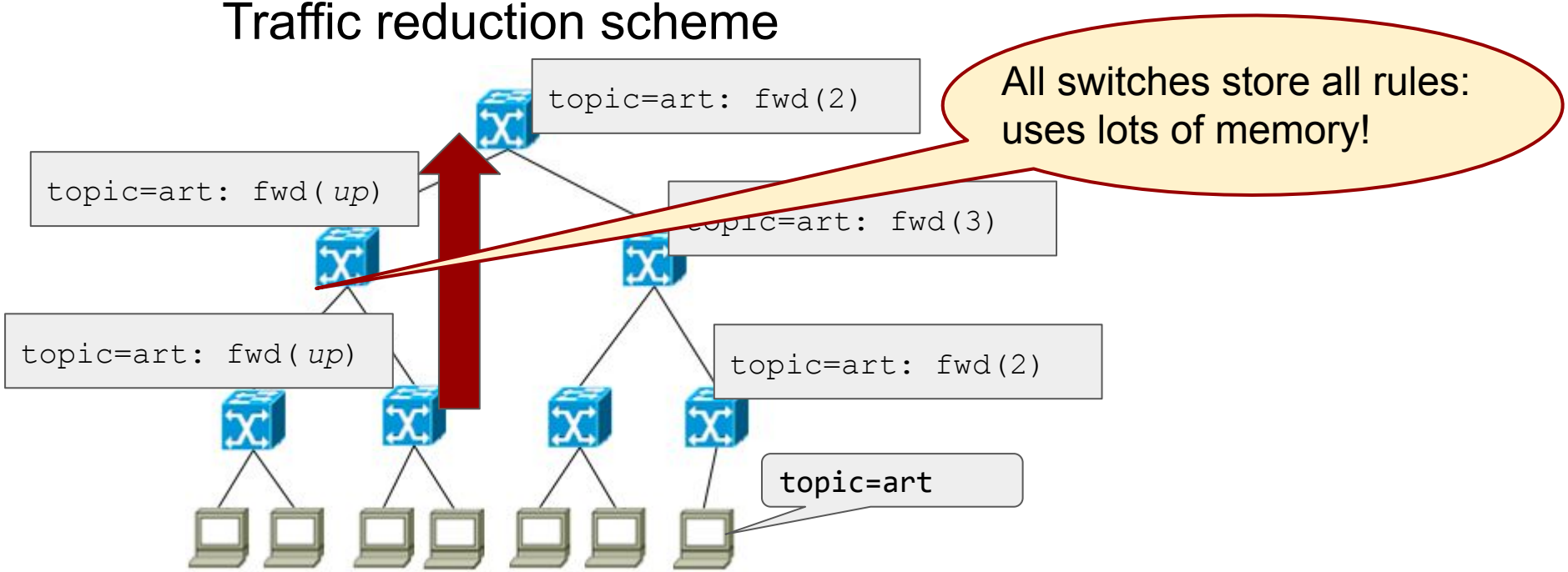


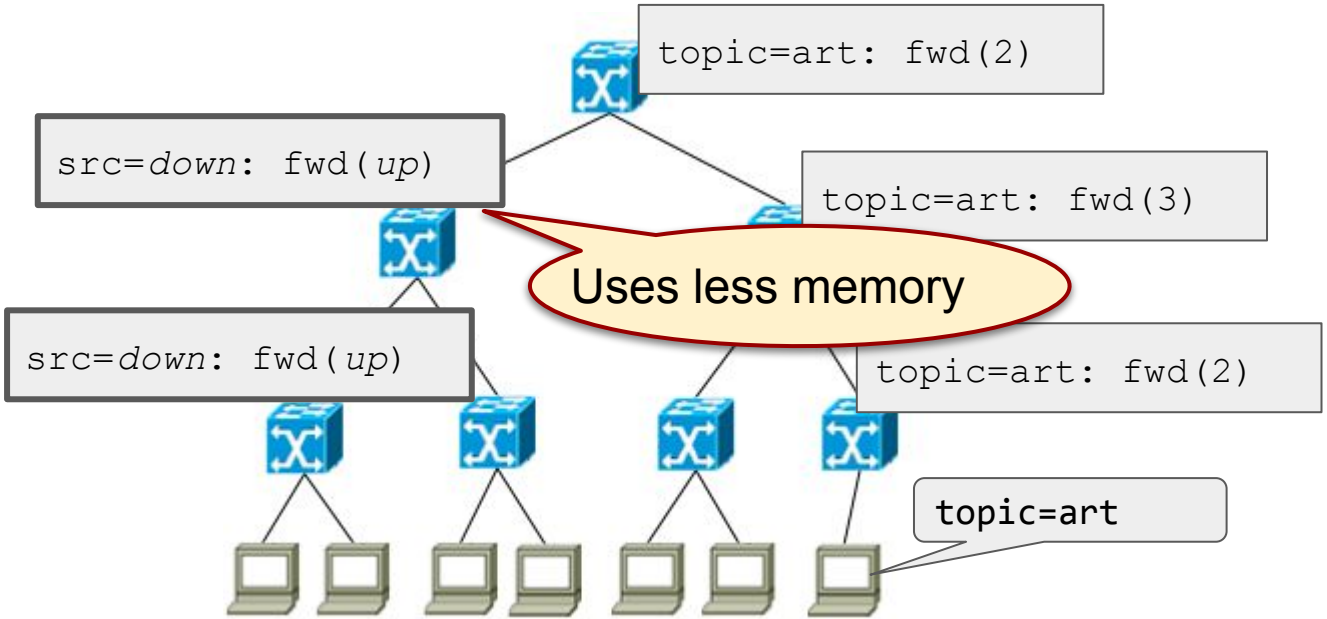
Routing with Packet Subscriptions

Traffic reduction scheme



Routing with Packet Subscriptions

Memory reduction scheme



Evaluation

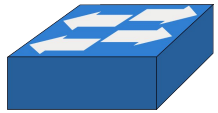
Are Packet Subscriptions useful to applications?

Nasdaq

Market Feed Filtering

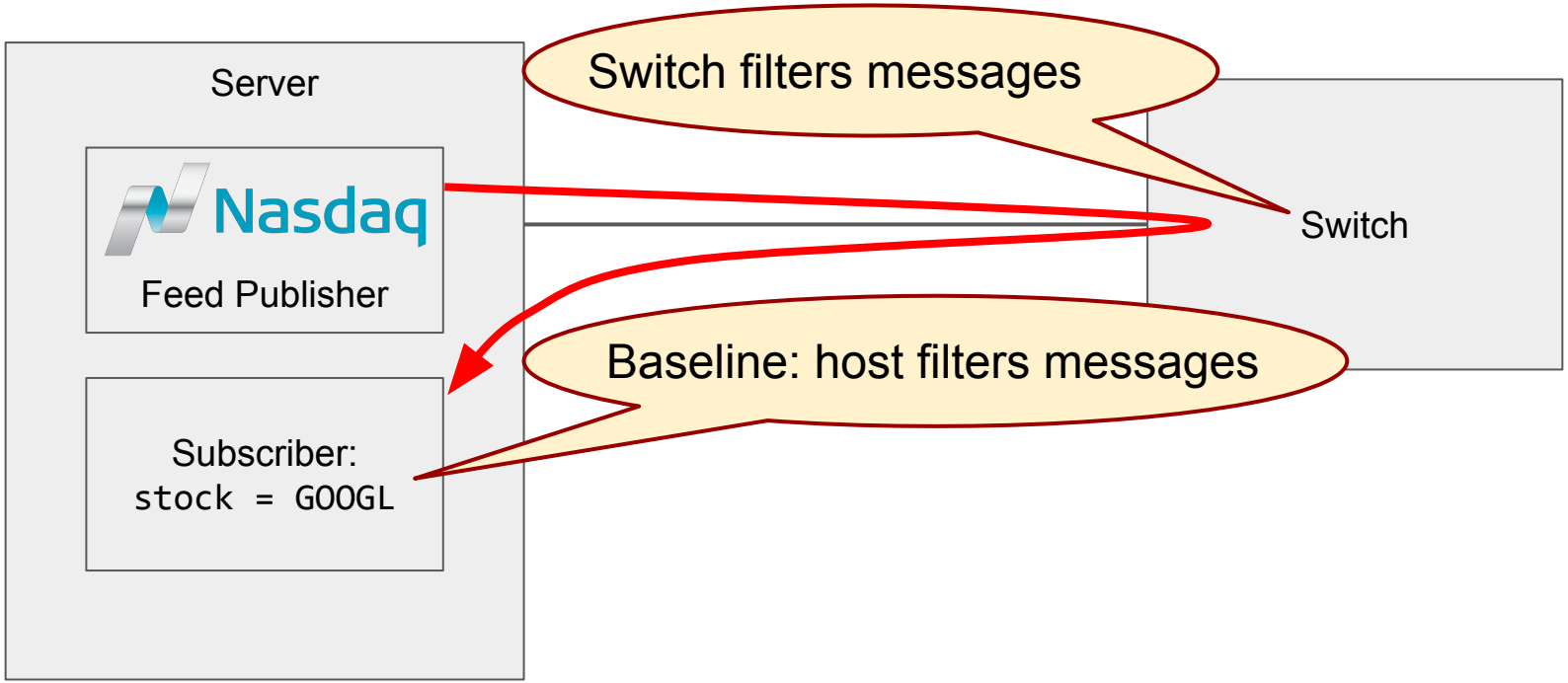
.io hICN

Video Streaming

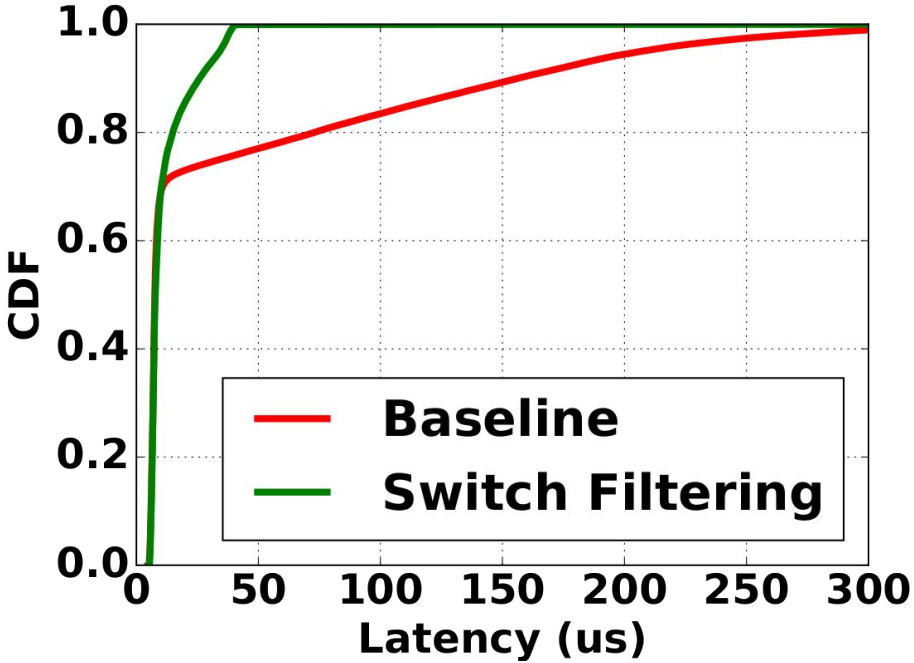


In-Band Network Telemetry

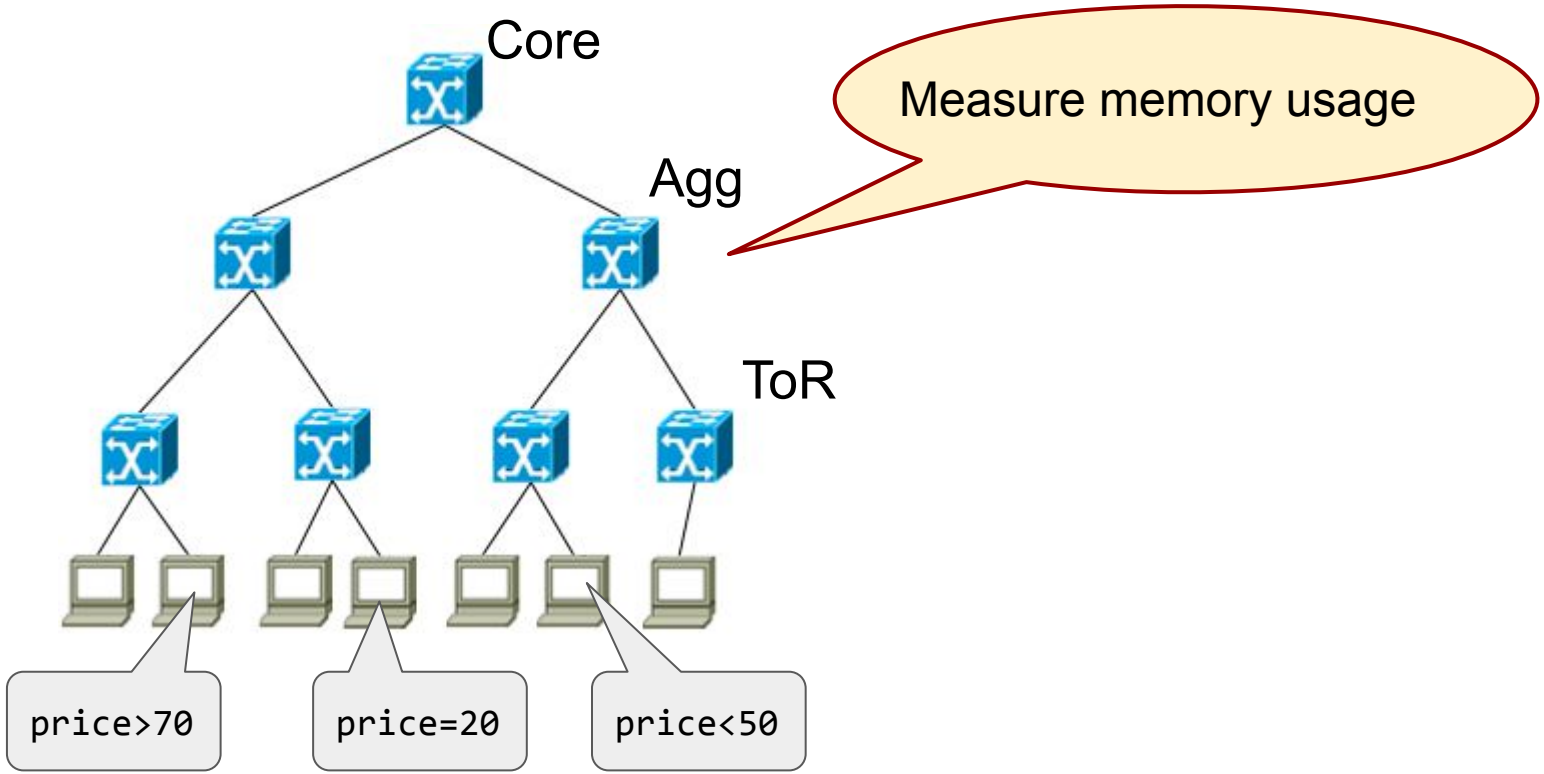
Is forwarding efficient, in terms of performance?



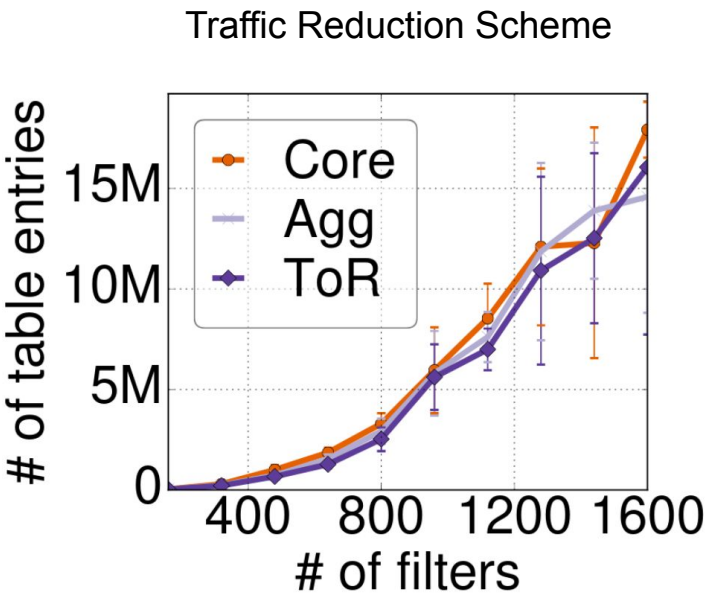
In-network filtering reduces tail latency



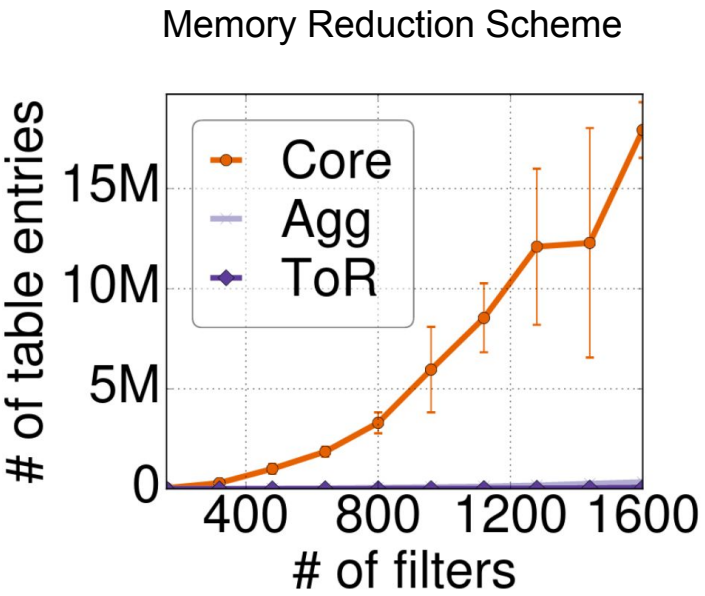
Is routing efficient, in terms of FIB memory?



Compiler uses memory efficiently



Compiler uses memory efficiently



In conclusion, Packet Subscriptions...

- Provide the network abstraction used by applications
- Improve performance by using network resources efficiently
- Scale to large network topologies

Try it out!
https://github.com/usi-systems/camus-compiler
https://github.com/usi-systems/packet-subscriptions-demo