ESPRES: Transparent SDN Update Scheduling

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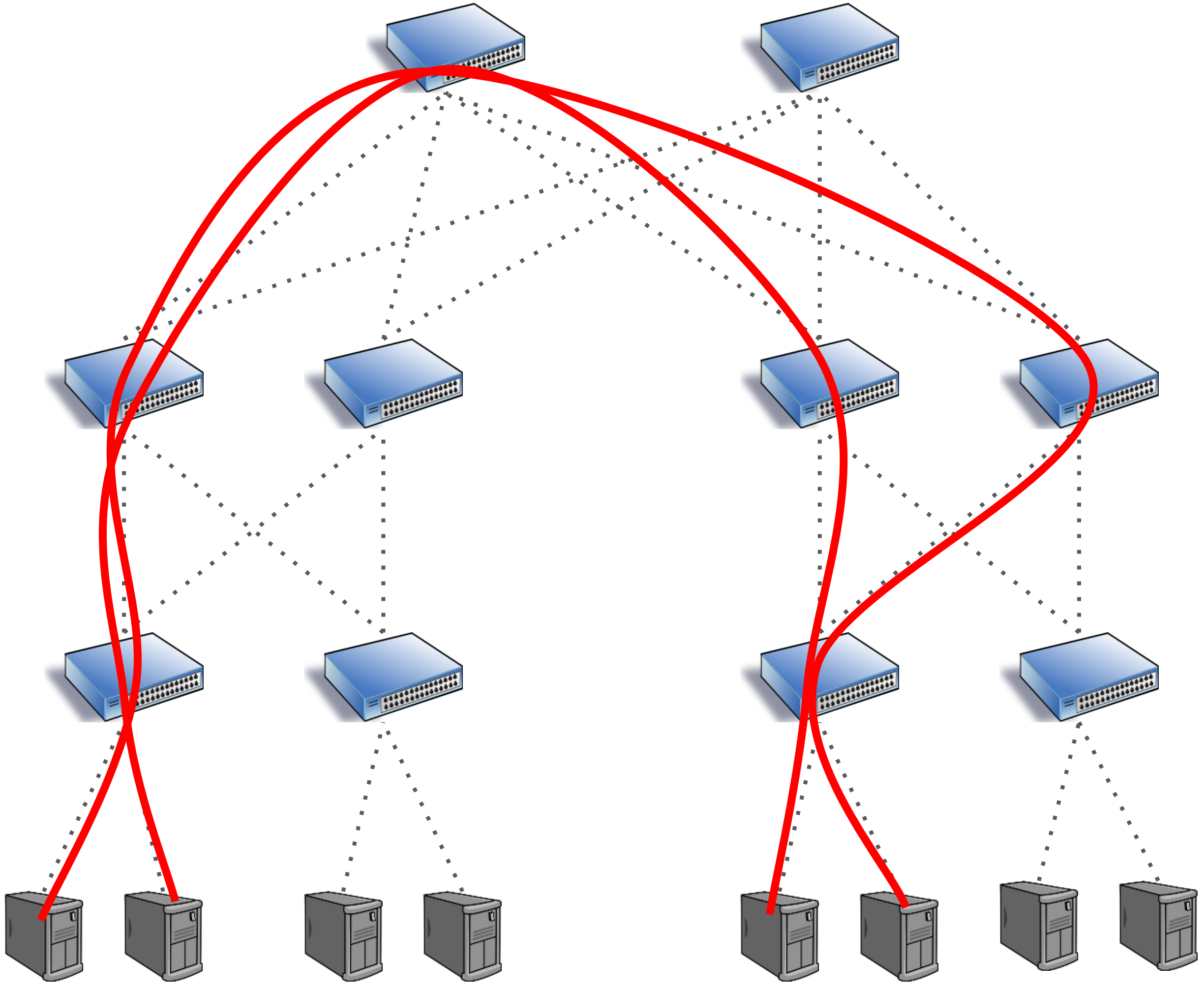
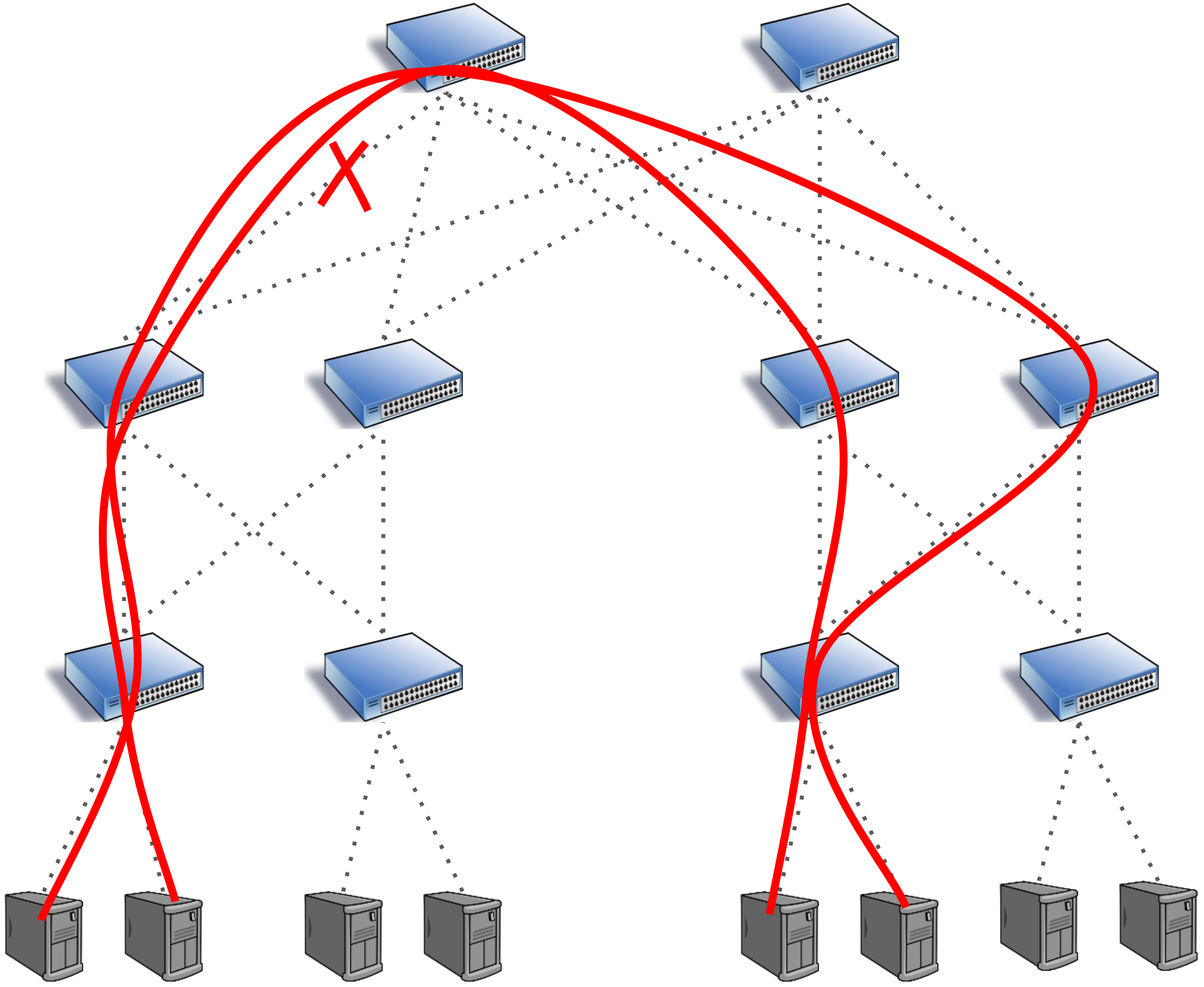
Network events trigger big updates



Topology changes

Network events trigger big updates



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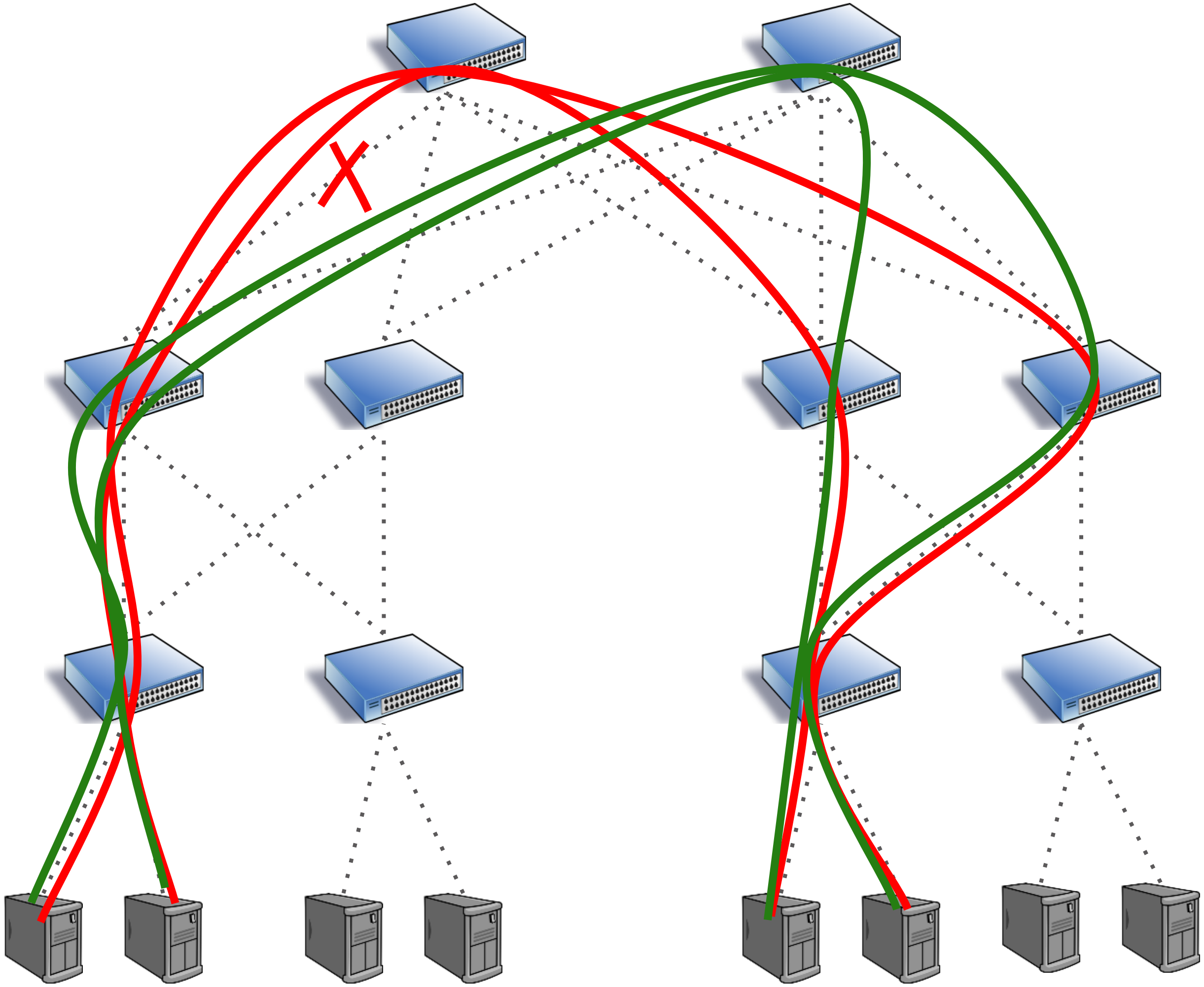

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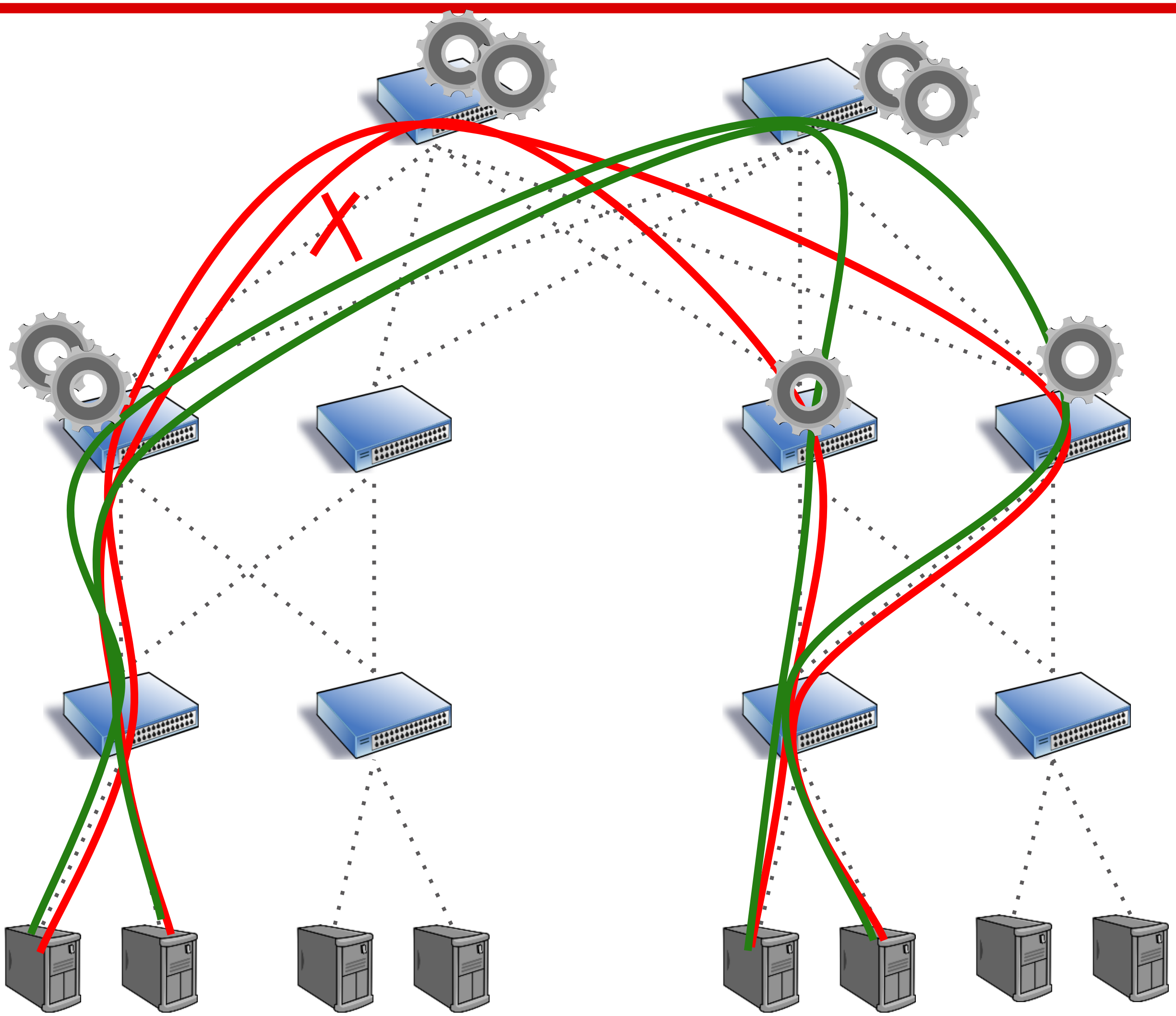

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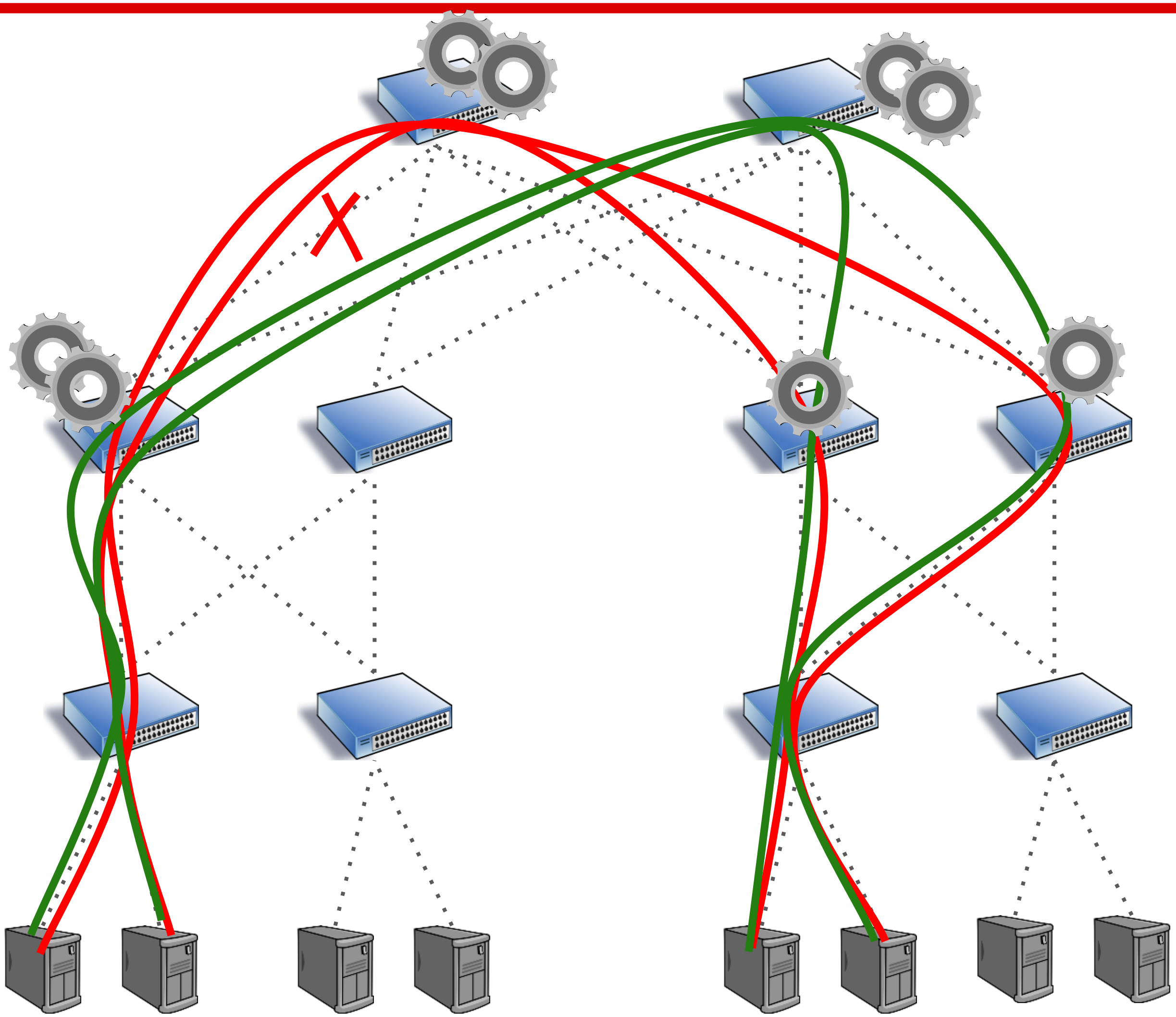
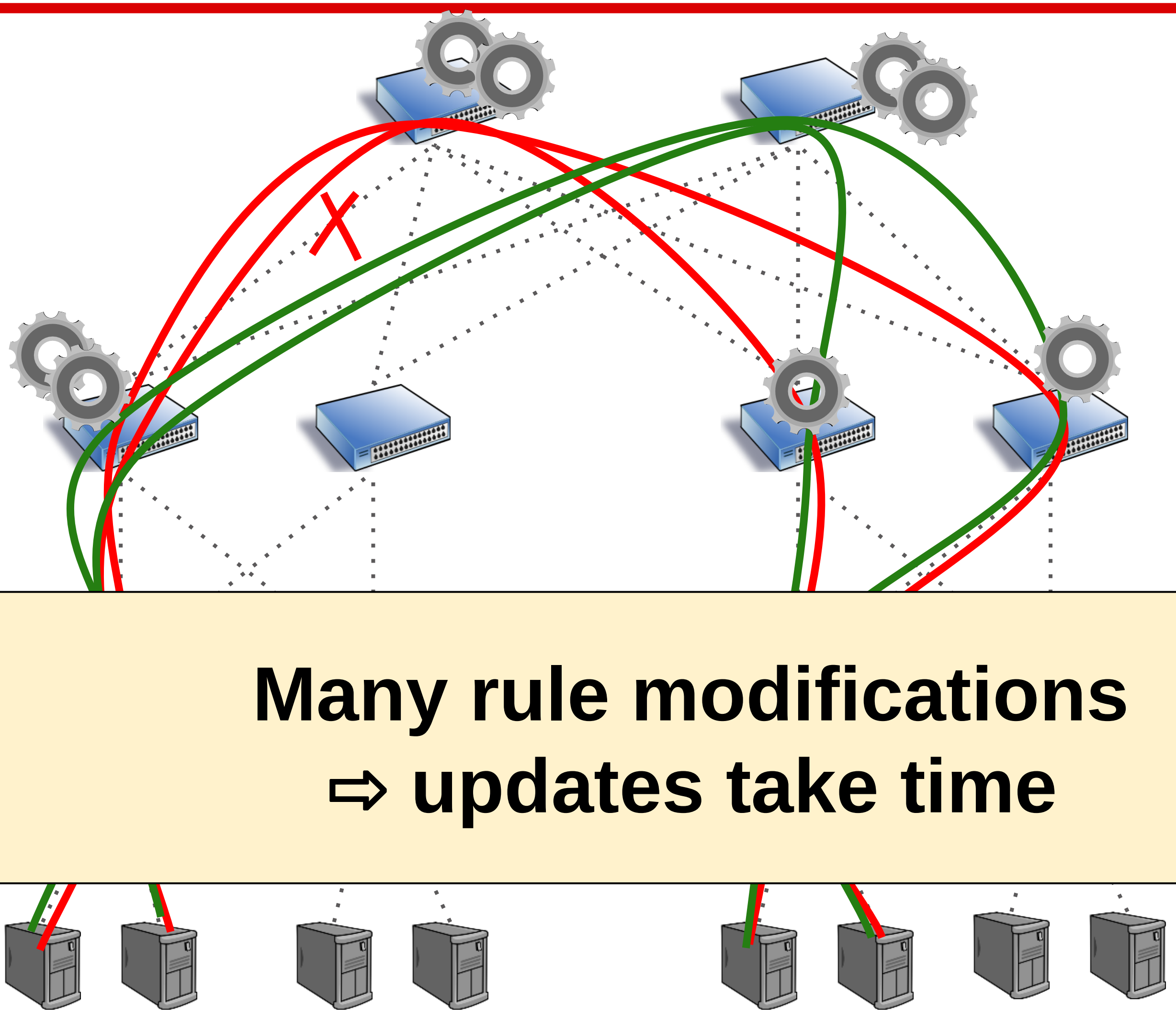


Topology changes

Traffic Engineering

Policy changes

Network events trigger big updates



Topology changes

Traffic Engineering

Policy changes

Many rule modifications
⇨ updates take time

What if we reorder installations...

Update touching two (independent) flows

- blue - 3 changes on a switch
- red - 2 changes on a switch

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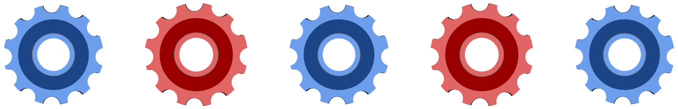

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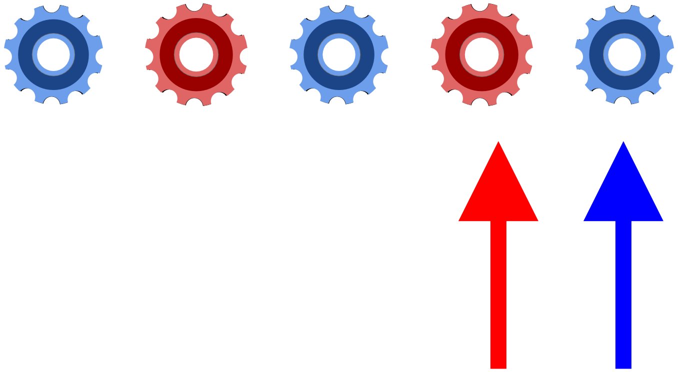

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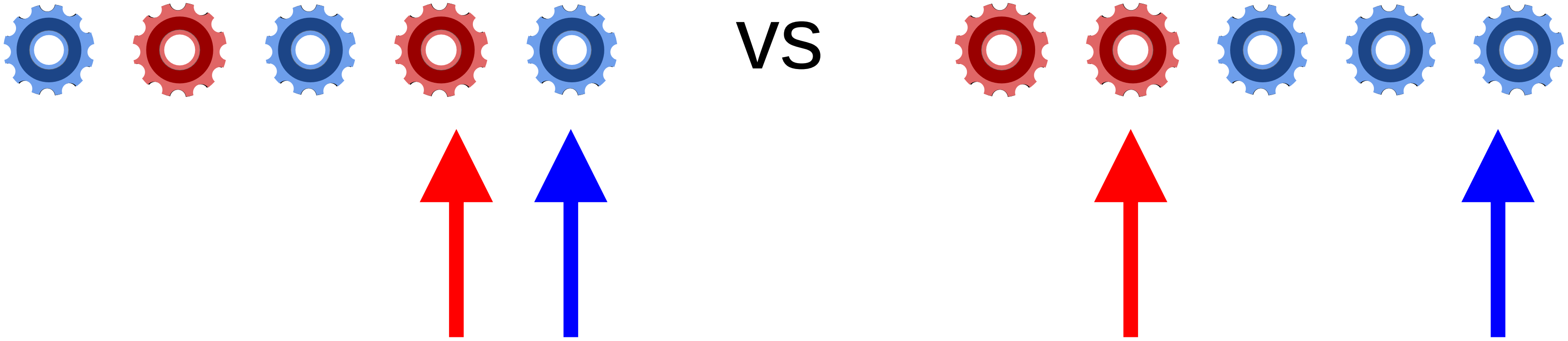


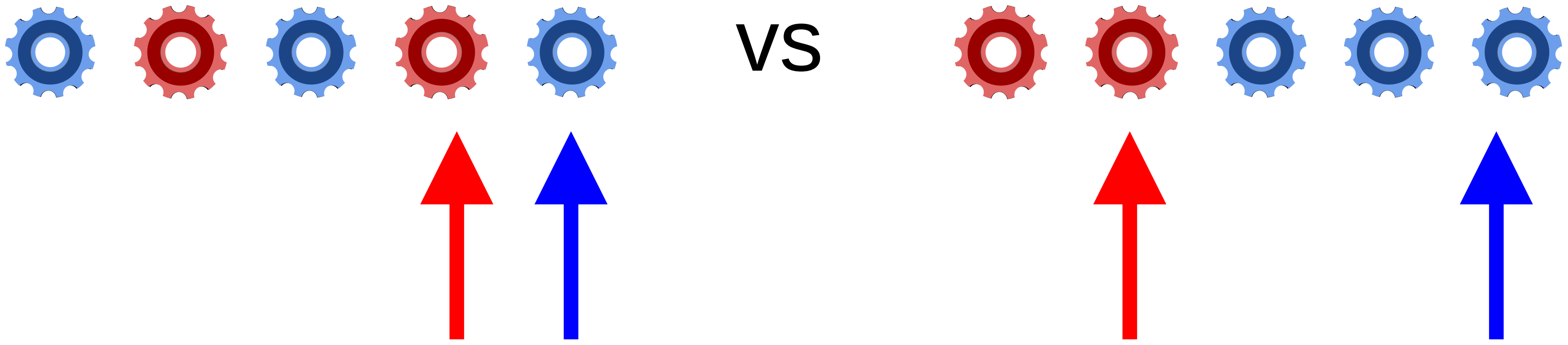
What if we reorder installations...

Update touching two (independent) flows

total time same

but

different **ordering** of rule installation **matters**



Some challenges

Scheduling sounds easy but

- multiple switches affected
  - and switch-speeds are different over time
- rule dependencies
  - e.g. update ingress only after core installed
- control channel is FIFO
  - no reordering

ESPRES overview

(See paper for more details)

- Keep backlog of rule installations in ESPRES
    - enables re-ordering on control channel
- Schedule rules to be installed next
    - react on-the-fly to current switch conditions
    - needs to be fast
    - support flexible goals

Possible scheduling goals

Already illustrated:

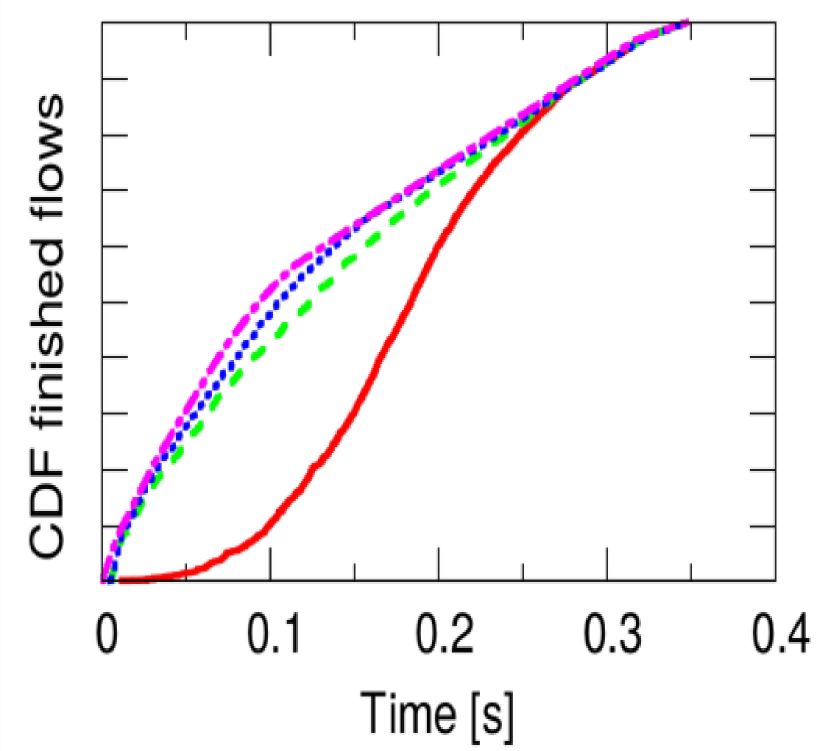
- install majority of flows sooner

See paper:

- decrease mid-update rule overhead
- decrease transient instabilities

A taste of results

1000 new flows; 18 switches



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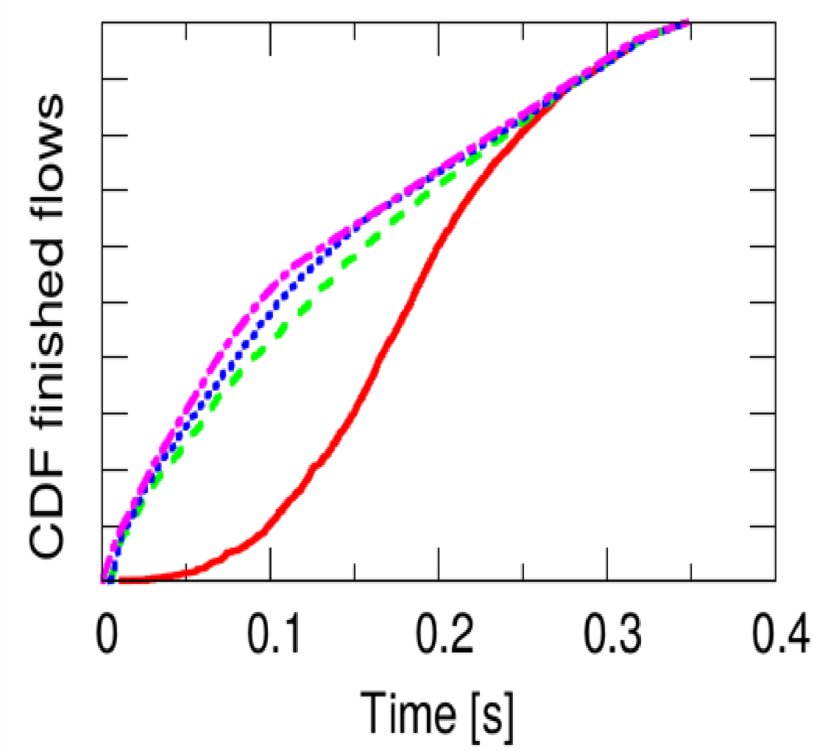

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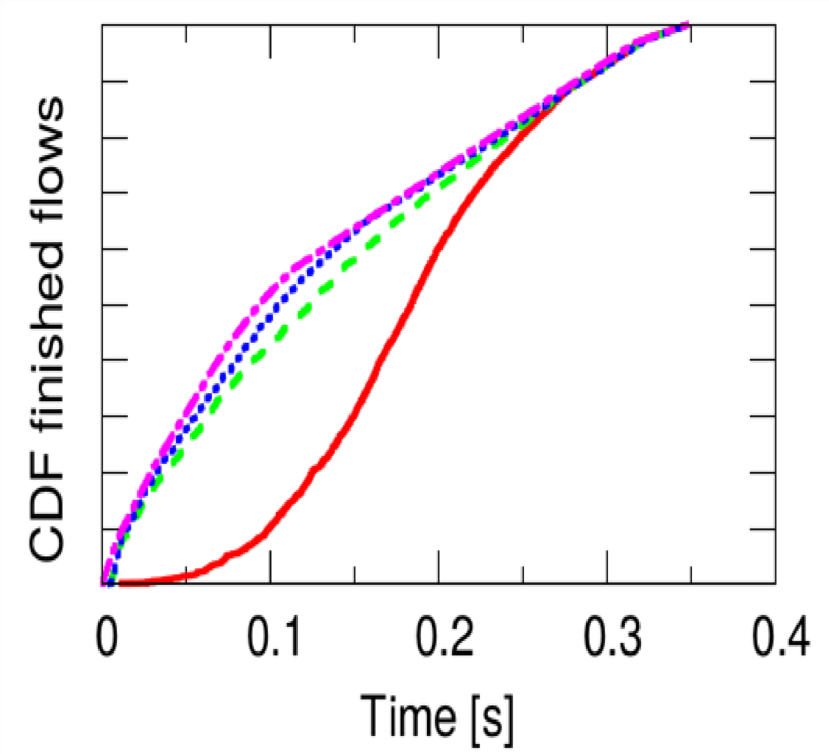

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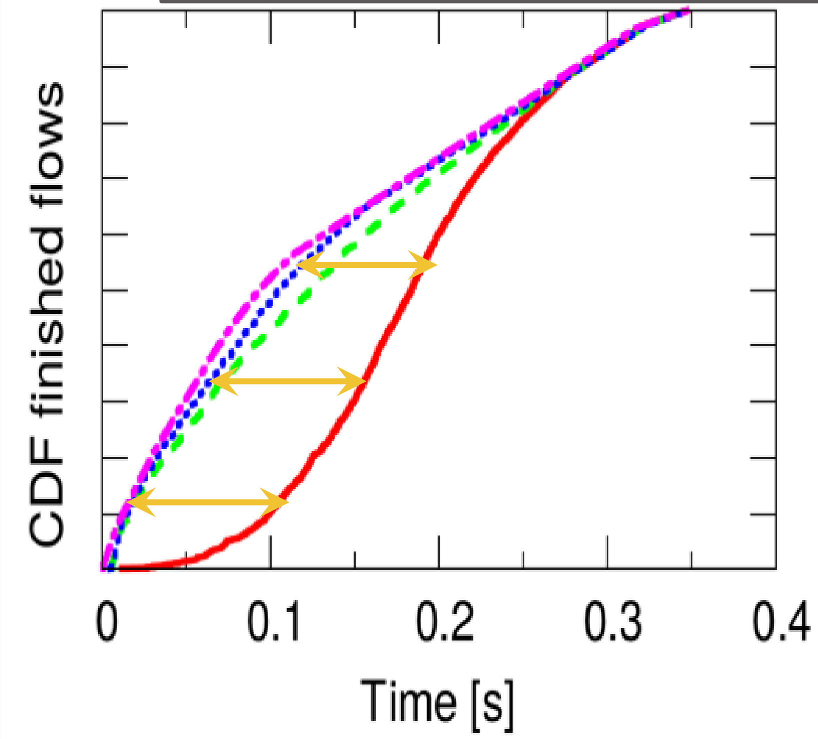
- Espres A
- Espres B
- Optimal (Offline)

A taste of results

1000 n

We reduce completion time by ≥40% for half of flows



- ➢ No scheduling (send rule when dependencies are met)
- ➢ Espres A
- ➢ Espres B
- ➢ Optimal (Offline)

Summary

- Updates touch many flows
- Changing rule installation order helps achieve different goals

ESPRES

- ➢ Maintain backlog of rule installations at the controller
- ➢ Schedule their order on-the-fly