

New Balance

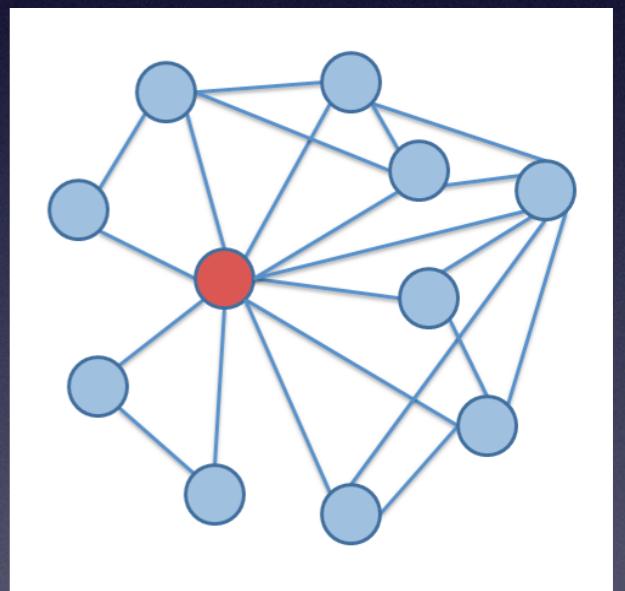
SDN Course, 2017 Fall

Outline

- 1.Background: P4 and Load Balance
- 2.Introduction: What's New Balance?
- 3.Demo Presentation
- 4.Conclusion

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- *1.Background: P4 and Load Balance*
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P4 Language



- P4: Programming Protocol-Independent Packet Processors
- A Network Domain-Specific Language:
 - *Allow programming of packet forwarding planes*
- Design Principles:
 - *Target / Protocol independence, Reconfigurability*

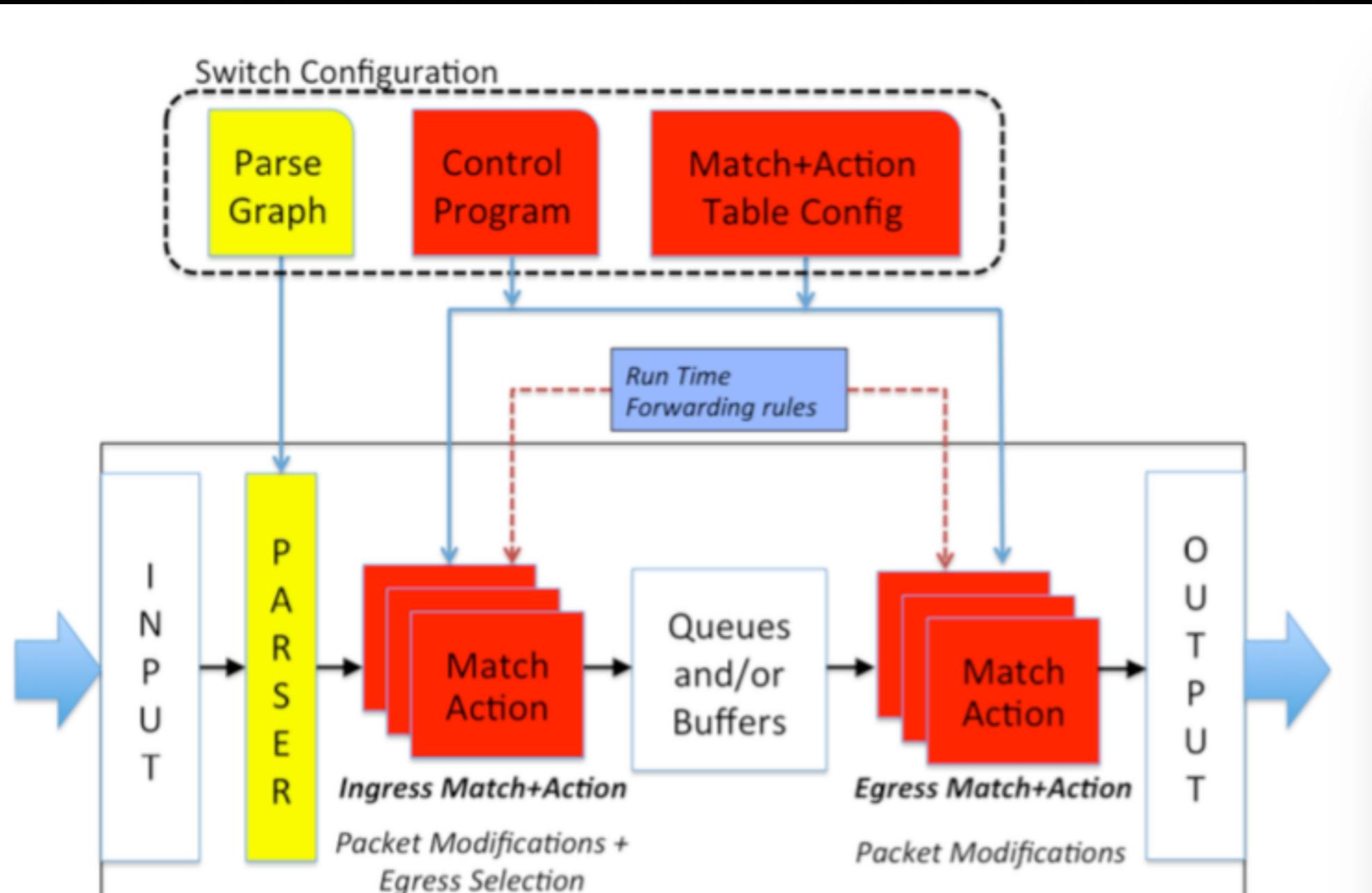


Figure 1: Abstract Forwarding Model

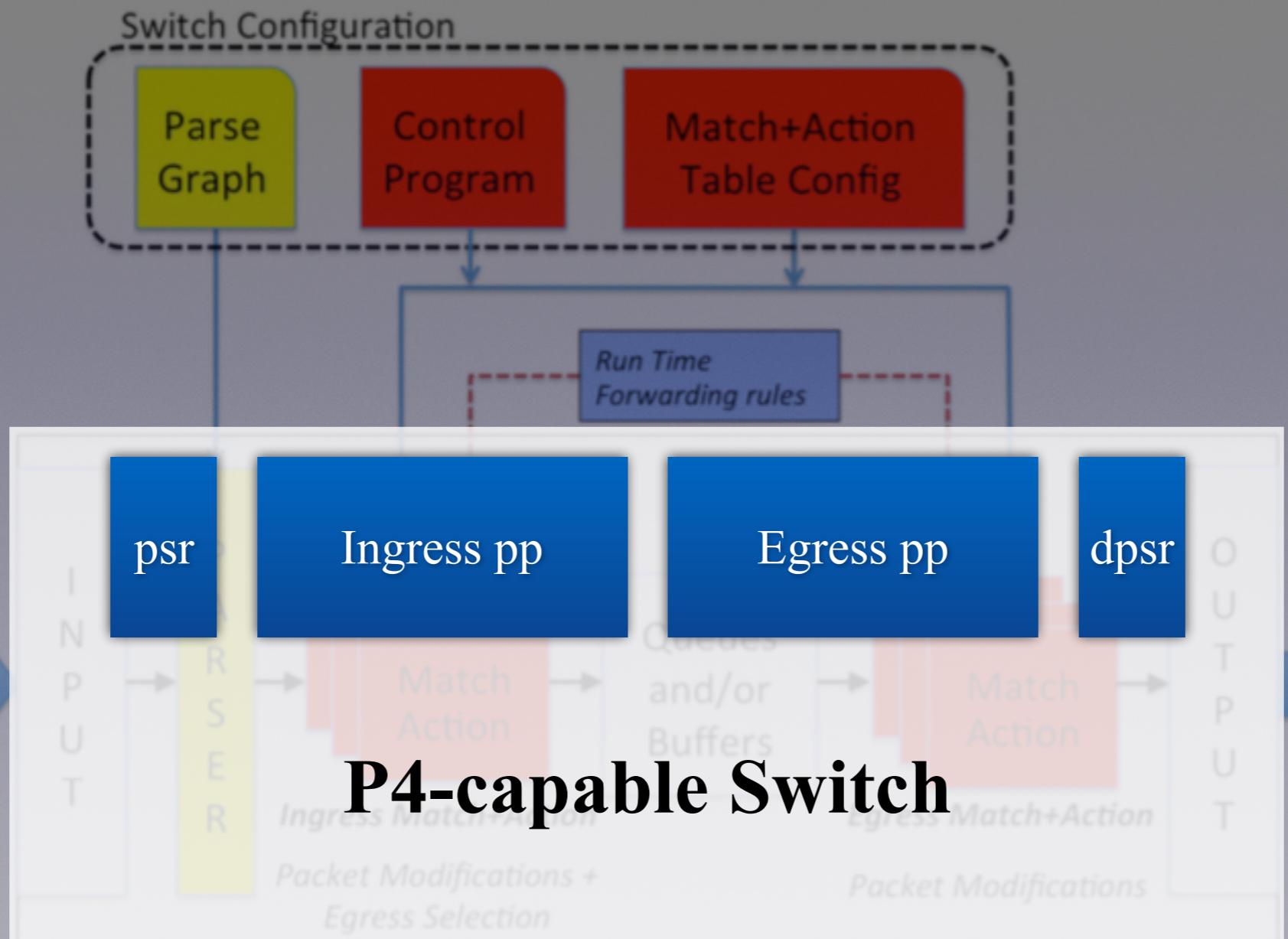


Figure 1: Abstract Forwarding Model

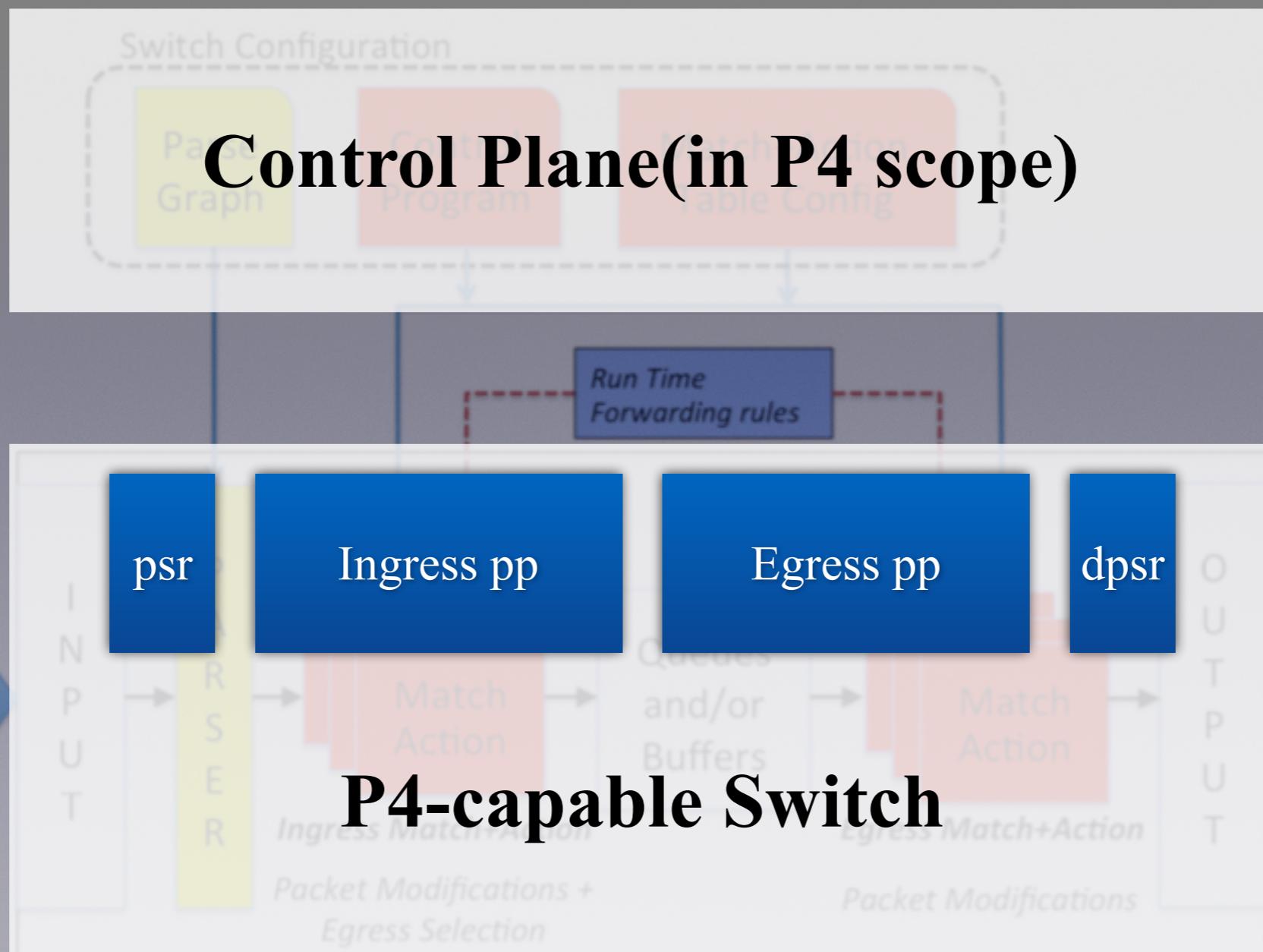


Figure 1: Abstract Forwarding Model

Control Plane(in P4 scope)

psr

Ingress pp

Egress pp

dpsr

P4-capable Switch

```
// Flexible Tables
#define LPM_TABLE_SIZE 16384
#define IPV6_LPM_TABLE_SIZE 4096
#define HOST_TABLE_SIZE 131072
#define IPV6_HOST_TABLE_SIZE 32768
...
header_type routing_metadata_t {
    fields {
        bd : BD_BIT_WIDTH; /* bridge domain */
        vrf : VRF_BIT_WIDTH; /* routing domain */
        v6_vrf : VRF_BIT_WIDTH; /* routing domain */
    ...
}

table bridge_domain {
    reads {
        routing_metadata.bd : exact;
    }
    actions {
        nop; // Not used
        bd_set;
    ...
}
```

Control Plane(in P4 scope)

“The backbone of pipeline is ...”

Uploading P4 program



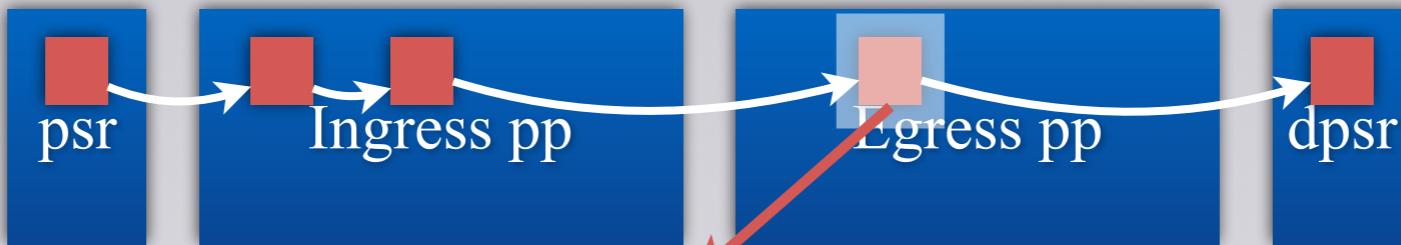
P4-capable Switch
(Offline or Runtime)

Control Plane(in P4 scope)

“table_add l3_forward forward 10.0.0.2/32 => 2”

“That’s how I process the packets”

Populating Control Rules



Forward the packets with dstIP 10.0.0.2/32 to port 2

**P4-capable Switch
(Offline or Runtime)**

Network Load Balancing

- A Classic Network Technology
 - Improving the **utilization rate** of network links
 - Increasing the **total amount of bandwidth available**

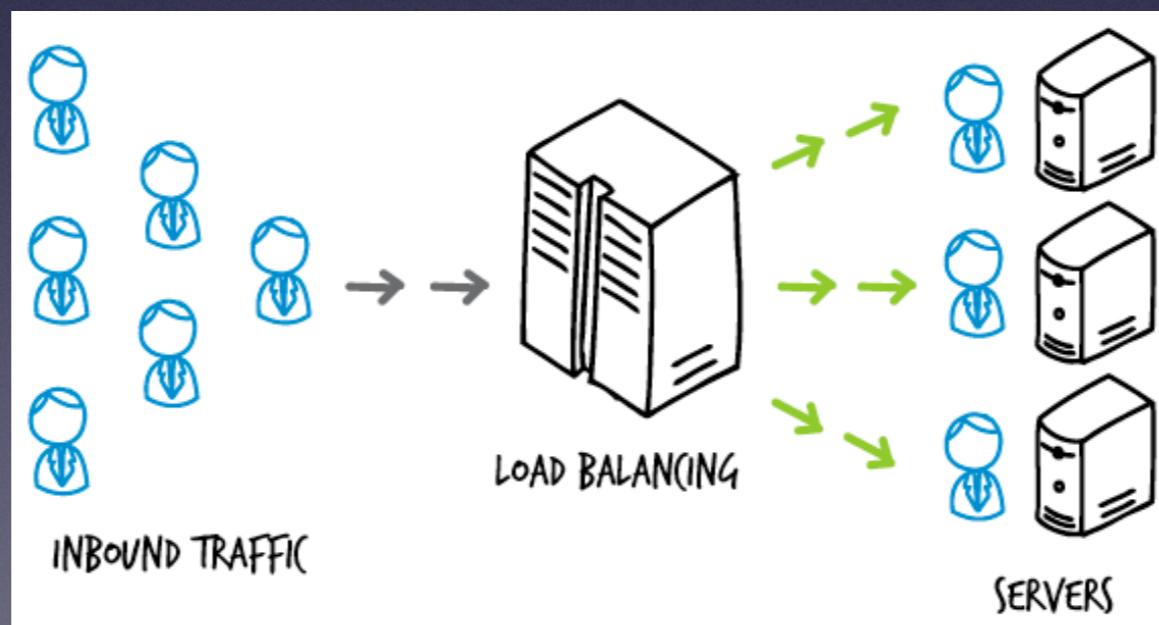


Figure: Network Load Balancing

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New Balance(NewB)

- A P4-based Network Load Balancing Application
- Scheduling traffics to avoid *heavy switch loads*
- Design Principles:
 - Previously record all the possible paths
 - Dynamically choose back-up paths



New Balance(NewB)

- A P4-based Network Load Balancing Application
- The P4 program:
 - *Counters for recording total received packet number*
 - *Match-Action Tables for identifying and forwarding flows*



A blurred screenshot of a computer screen displaying a terminal window with blue text on a dark background, showing code or logs related to the P4 program.

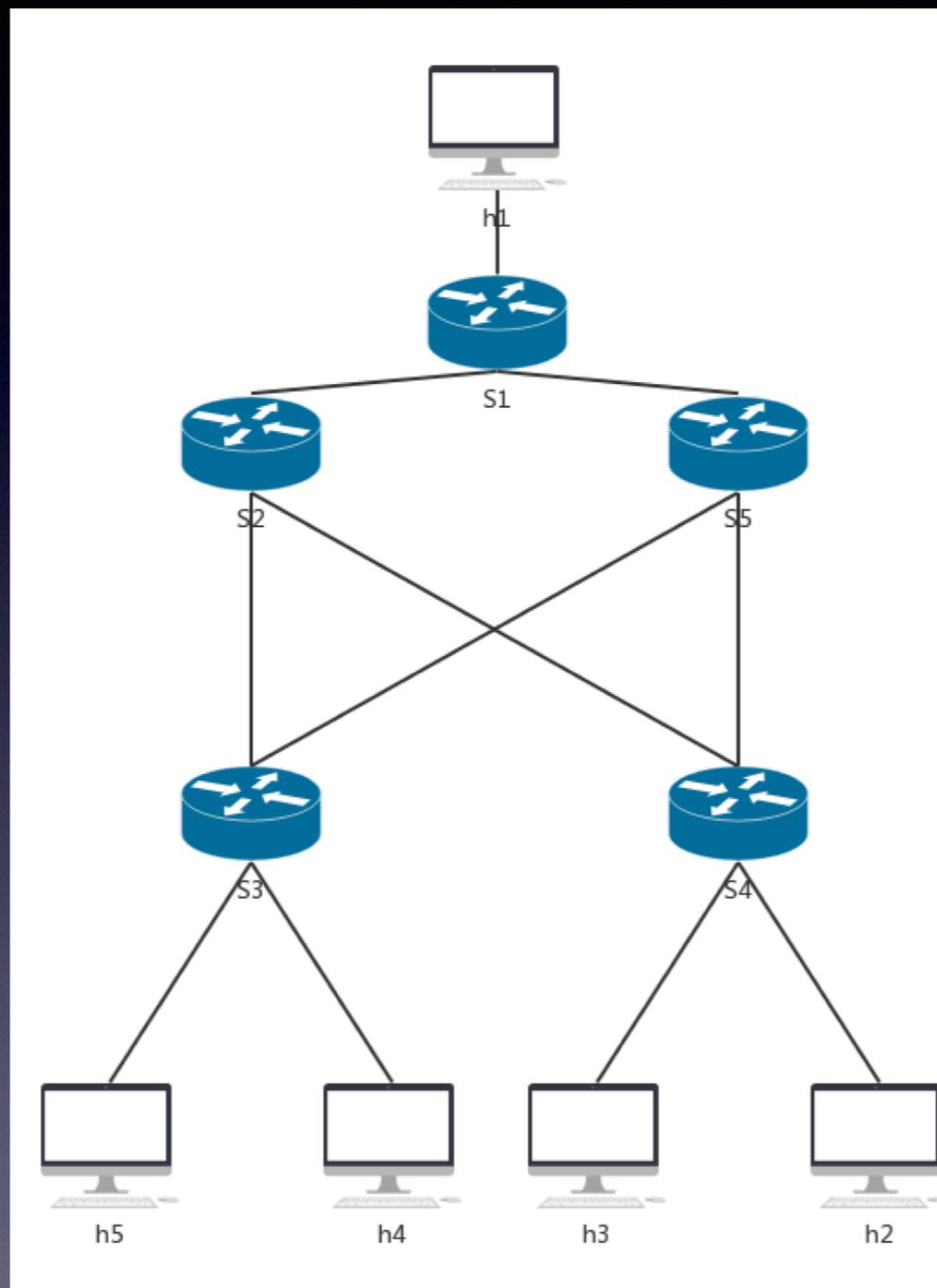
New Balance(NewB)

- A P4-based Network Load Balancing Application
- The NewB Controller:
 - *Acquire the counter value of switches per second*
 - *Calculate the processing rate of switch*
 - *Runtime traffic scheduling*

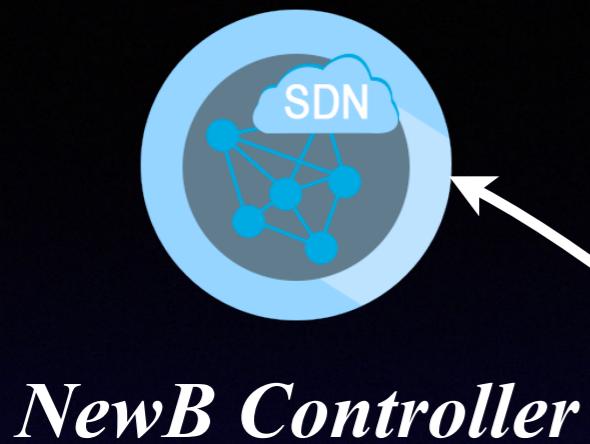


BMv2:
OvS-based P4
Software Switch

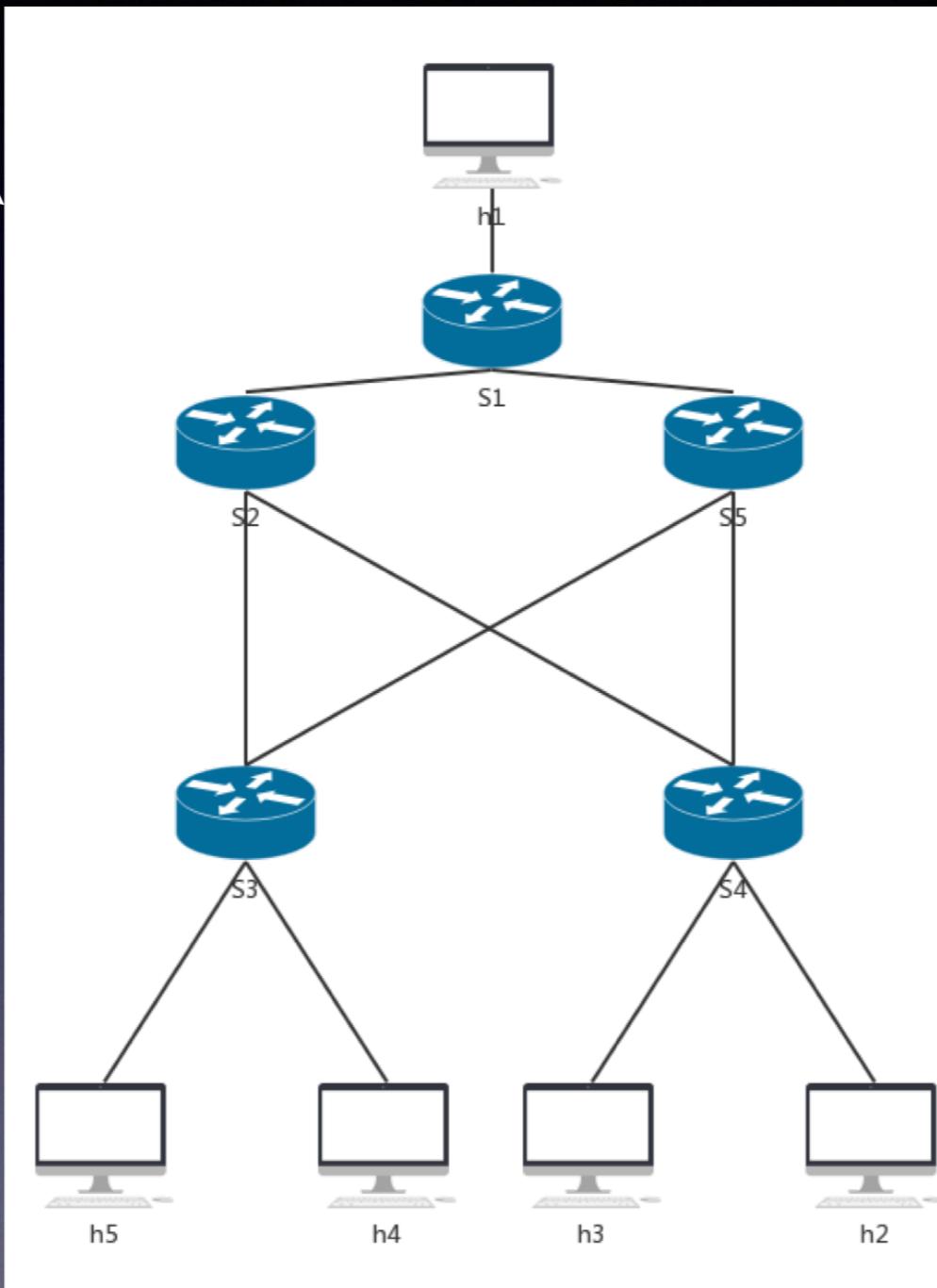
Simulated in Mininet



5x BMv2 Switches and 5x Hosts



NewB Controller



BMv2:
OvS-based P4
Software Switch

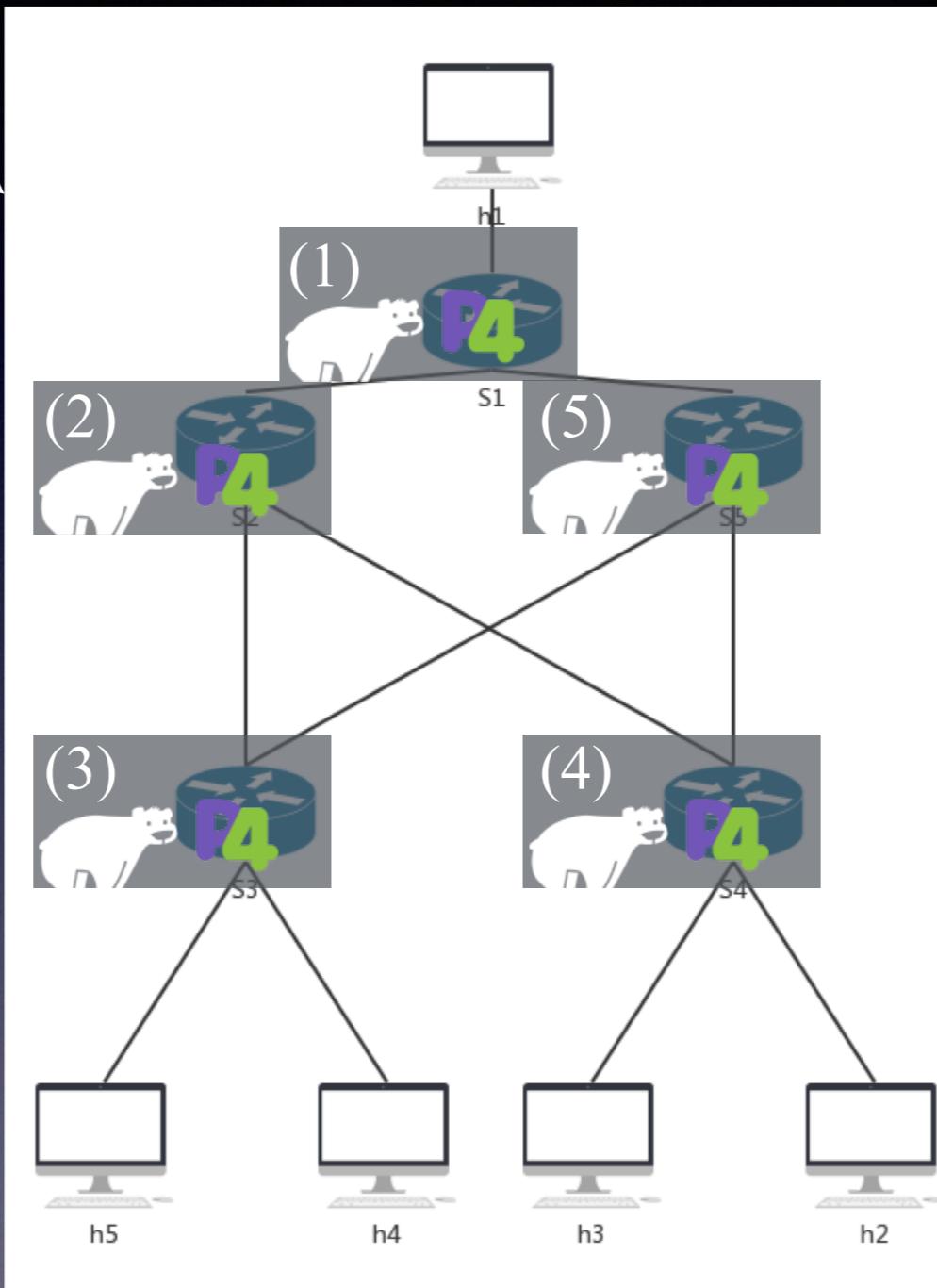
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5x BMv2 Switches and 5x Hosts



NewB Controller

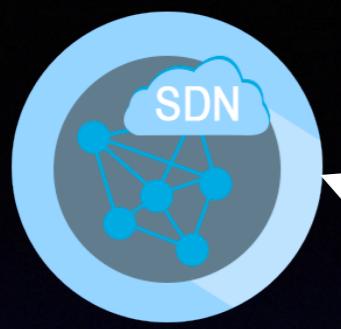
(1) Loading P4 program



BMv2:
OvS-based P4
Software Switch

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5x BMv2 Switches and 5x Hosts



NewB Controller

- (1) Loading P4 program
- (2) Inspect paths

path1: 1-2-3-h5

path2: 1-2-3-h4

path3: 1-2-4-h3

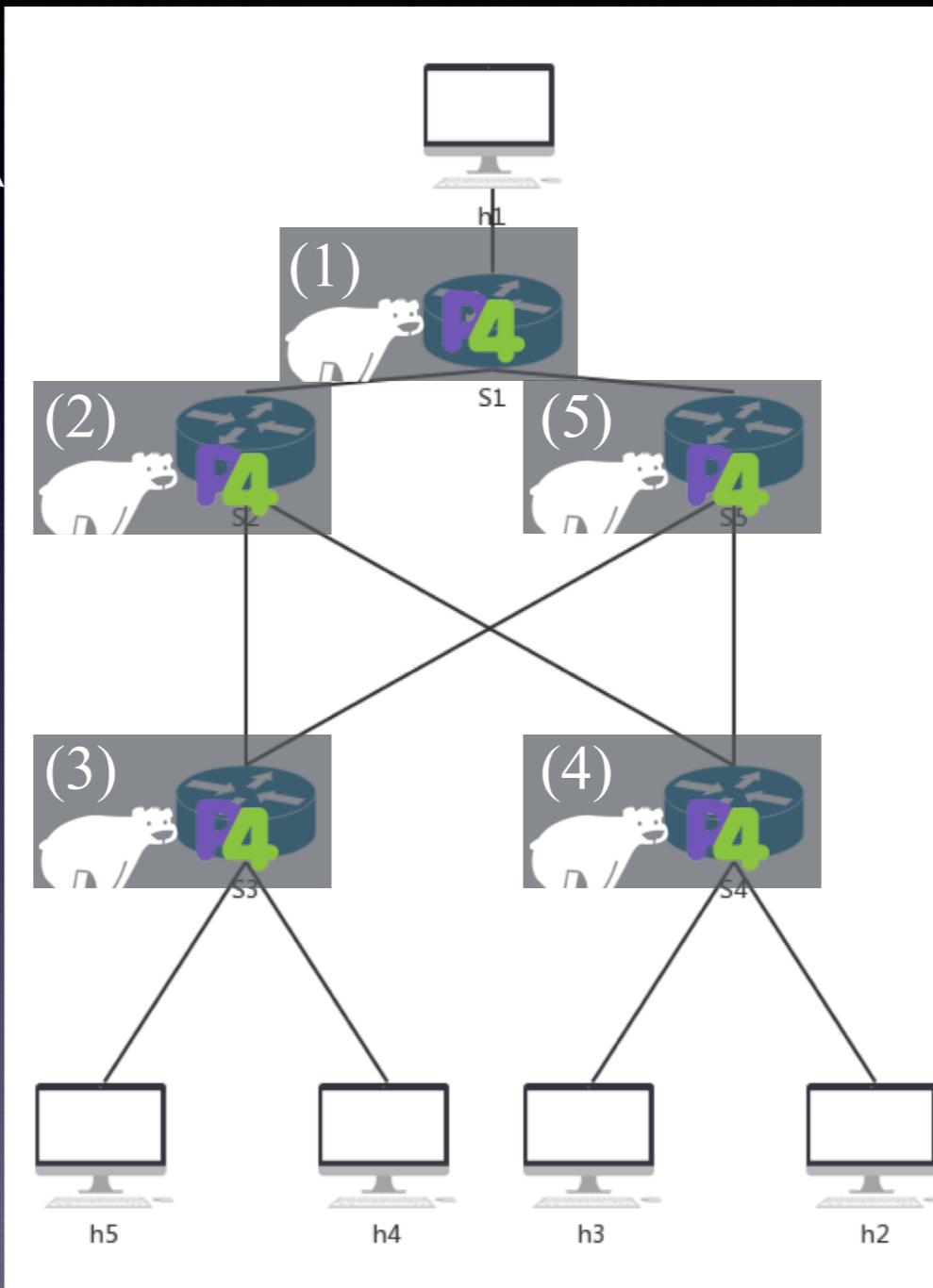
path4: 1-2-4-h2

path5: 1-5-3-h5

path6: 1-5-3-h4

path7: 1-5-4-h3

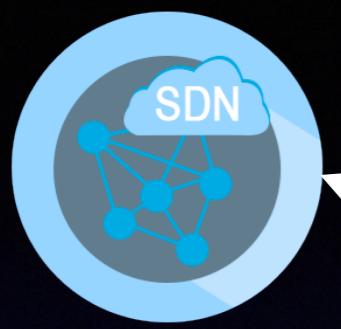
path8: 1-5-4-h2



BMv2:
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5x BMv2 Switches and 5x Hosts



NewB Controller

- (1) Loading P4 program
- (2) Inspect paths
- (3) Read Counter per sec

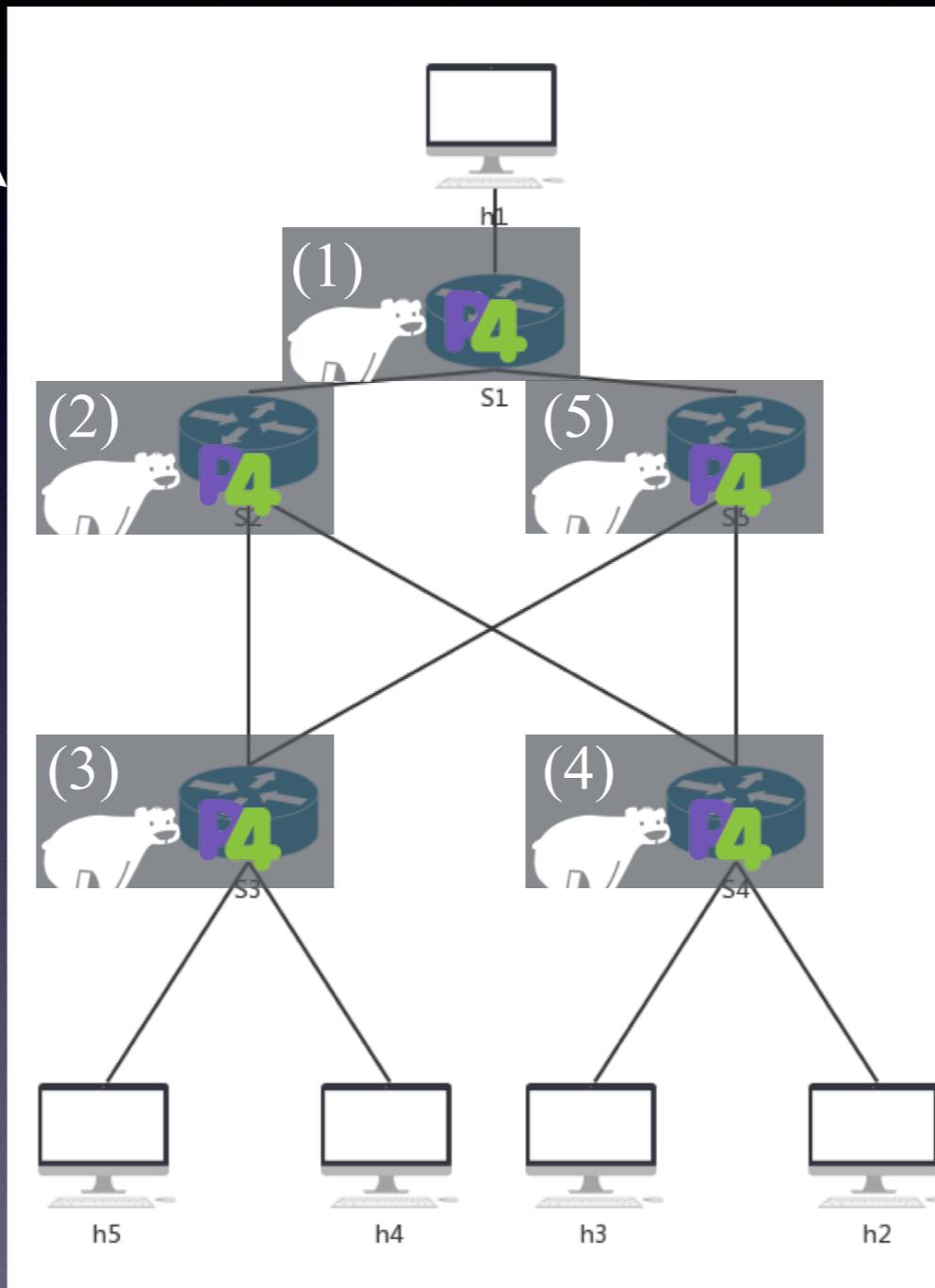
cnt1: 20

cnt2: **50** → warning!

cnt3: 20

cnt4: 0

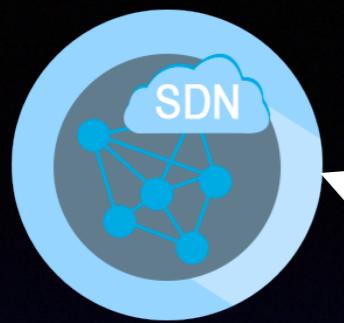
...



BMv2:
OvS-based P4
Software Switch

Simulated in Mininet

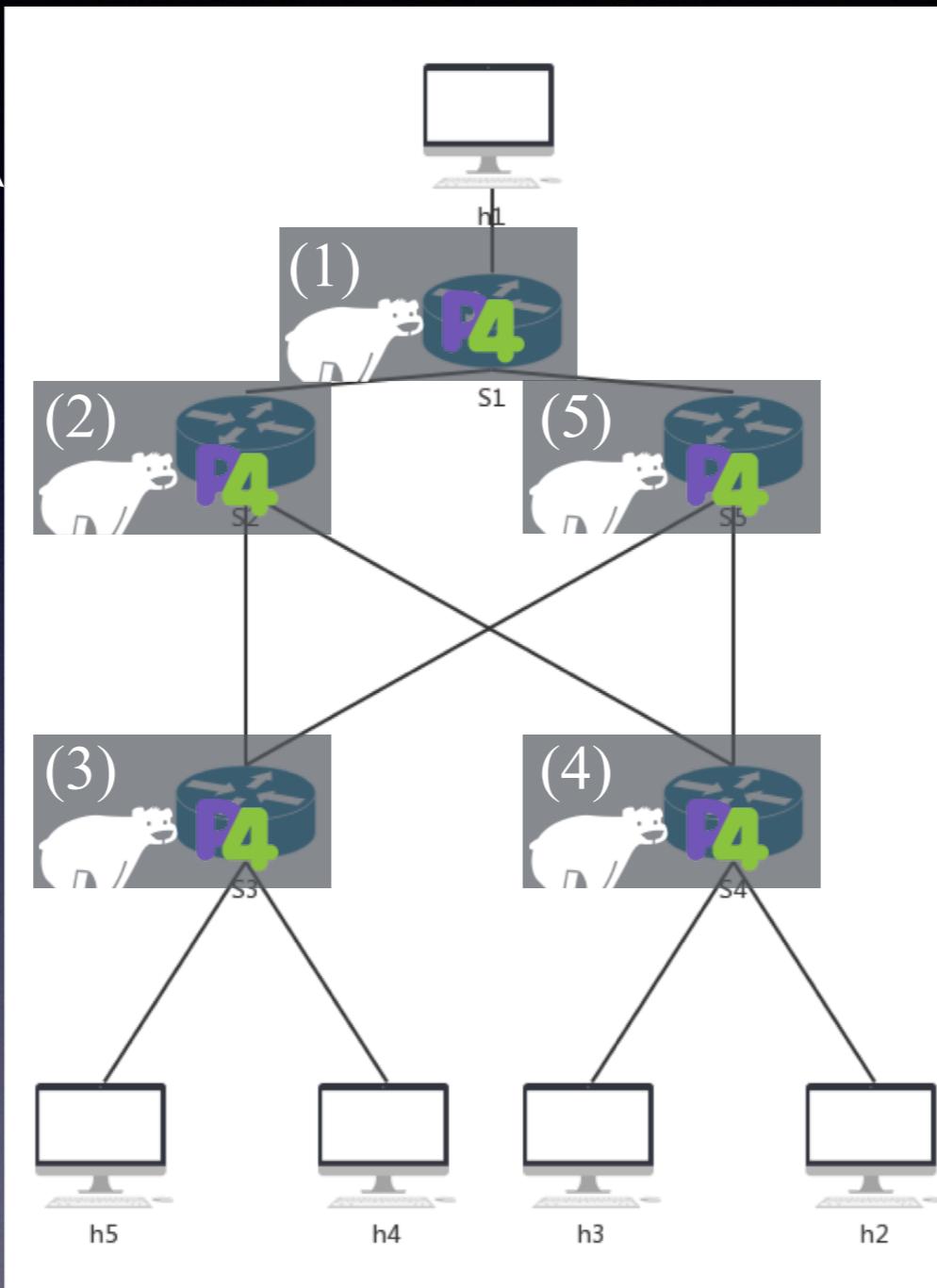
5x BMv2 Switches and 5x Hosts



NewB Controller

- (1) Loading P4 program
- (2) Inspect paths
- (3) Read Counter per sec
- (4) Calculate new path

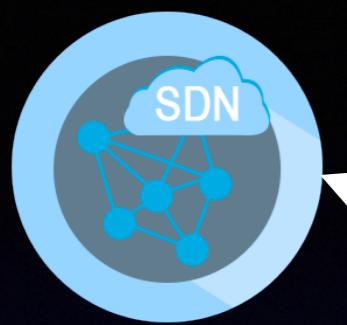
path1: 1-2-3-h5



5x BMv2 Switches and 5x Hosts

BMv2:
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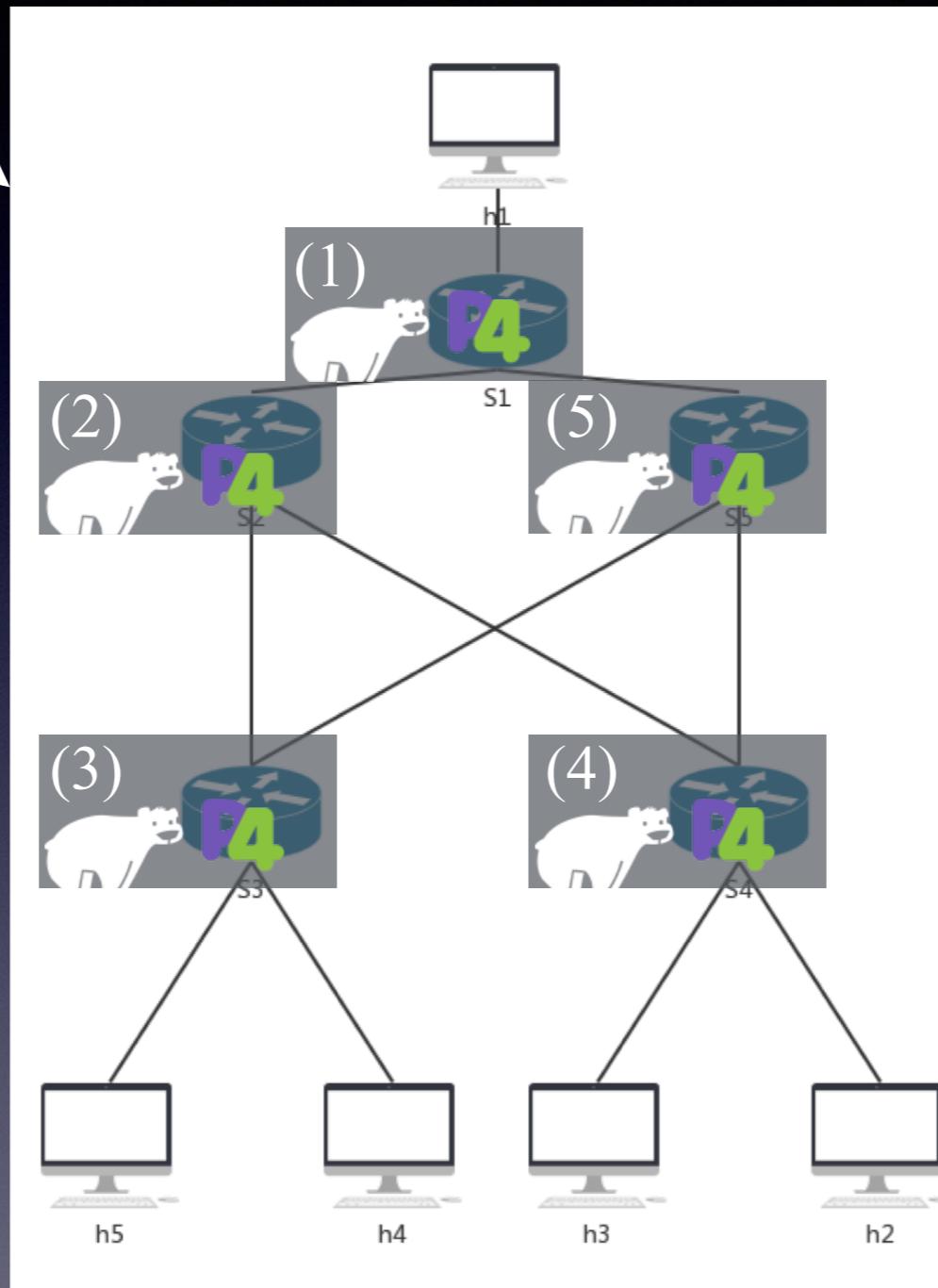
NewB Controller

- (1) Loading P4 program
- (2) Inspect paths
- (3) Read Counter per sec
- (4) Calculate new path

path1: 1-2-3-h5



path5: 1-5-3-h5



BMv2:
OvS-based P4
Software Switch

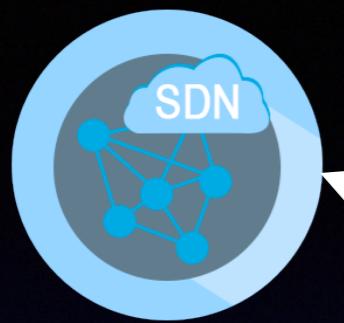
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5x BMv2 Switches and 5x Hosts

Validation

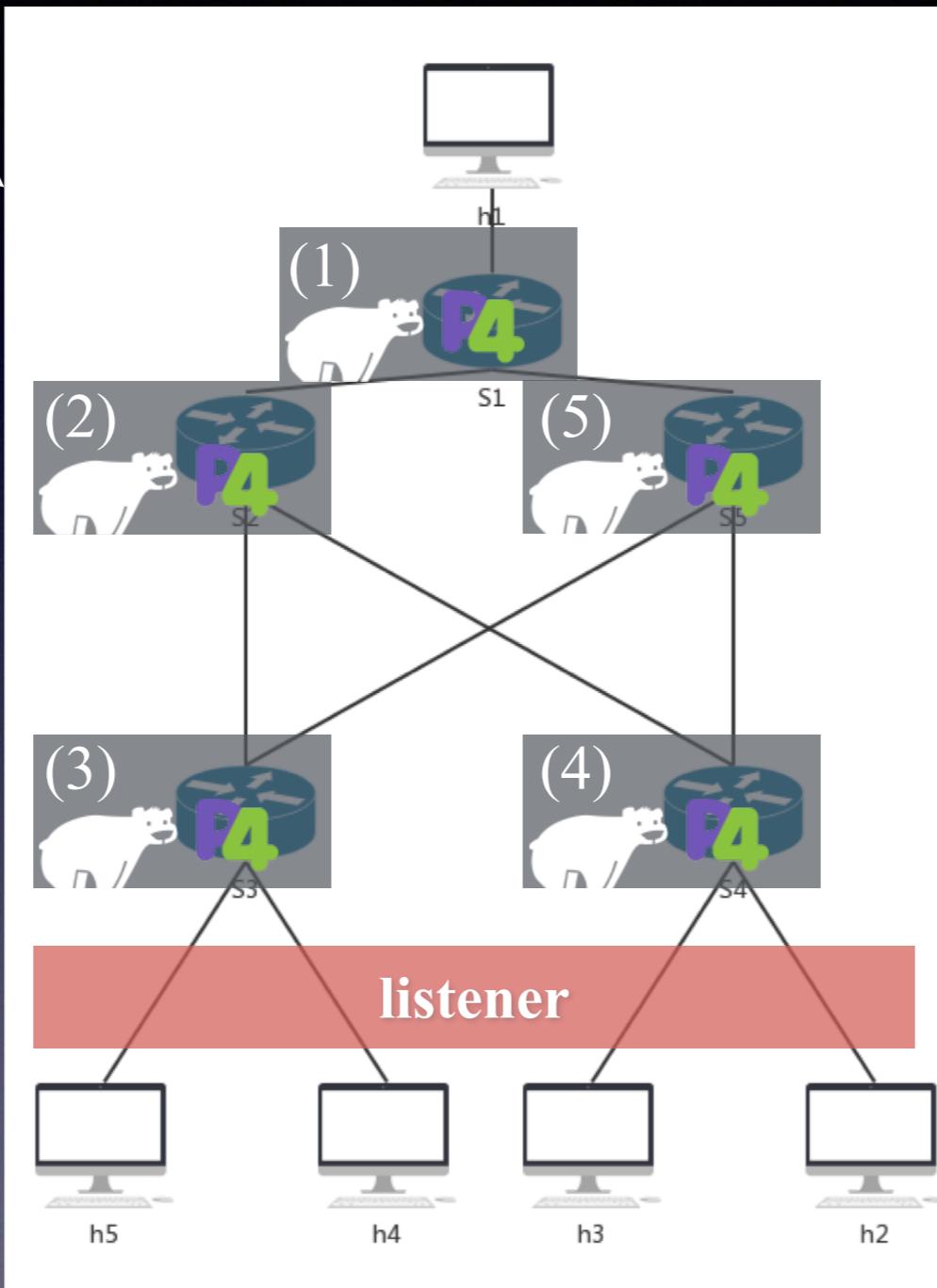
- Listener:
 - *Listen to all the possible server ports*
 - *Report packet number per second, in order to validate the behavior at runtime.*





NewB Controller

- (1) Loading P4 program
- (2) Inspect paths
- (3) Read Counter per sec
- (4) Calculate new path



BMv2:
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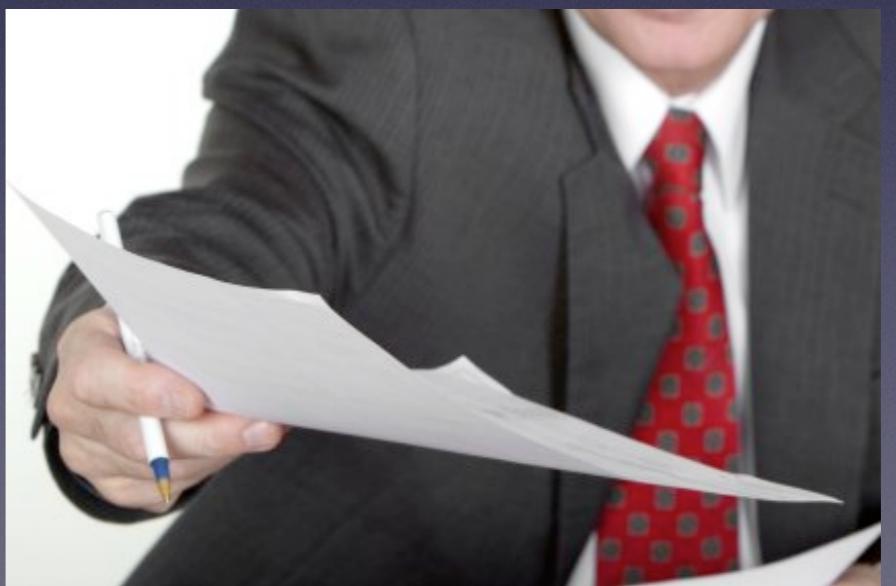


This demo is available at Github:

https://github.com/Wasdns/new_balance

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Conclusion

- Introducing P4 and Load Balance
- Presenting the mechanism of implementing NewB
- Illustrating how NewB works through demonstration



Thank you!

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