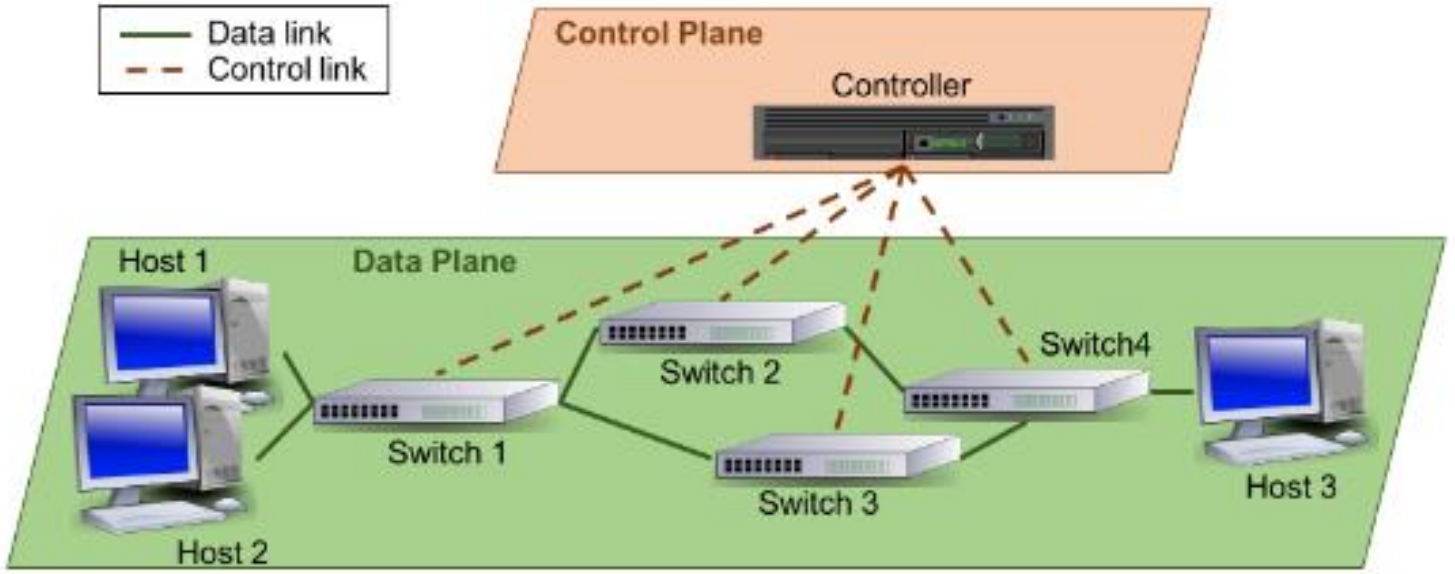
ALLOY 6

CHALLENGE

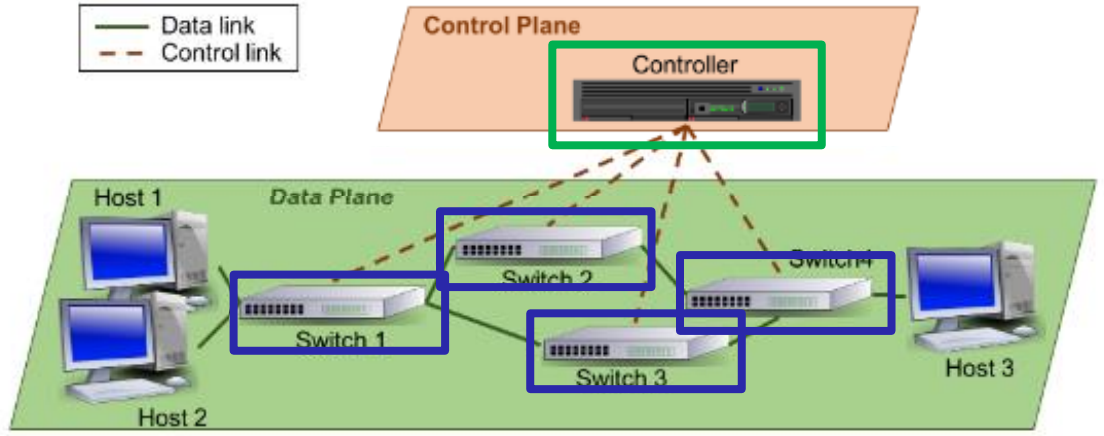
Authors:
Luca Padalino
Francesca Pia Panaccione
Francesco Santambrogio

Software-Defined Network (SDN): A is a modern networking paradigm that explicitly separates the data and control planes to include intelligence in the network.



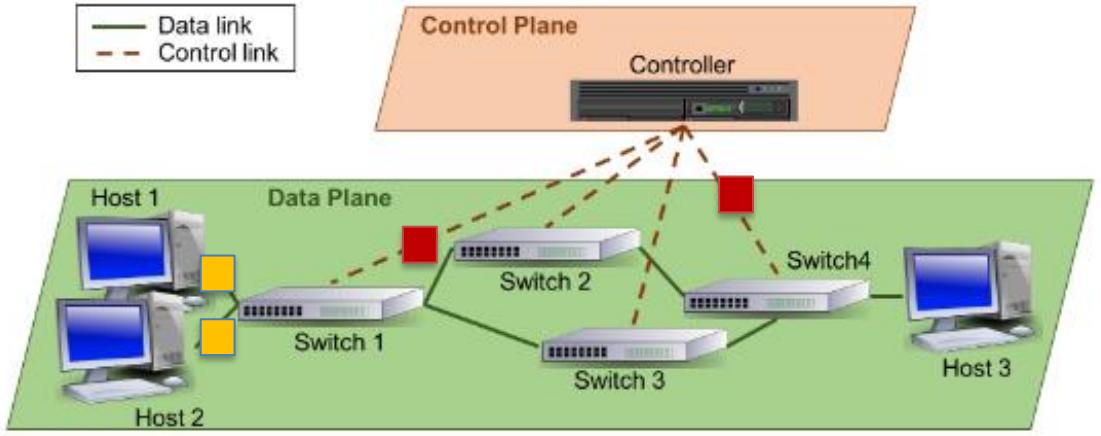
It is composed by these elements:

- **Controller**: core entity of the SDN control plane. The network intelligence is logically centralized in the controller, which is able to dynamically configure the forwarding devices of the data plane in order to achieve a specific goal;
- **Switches**: data plane components in charge of forwarding the **data packets** from its source to the destination. In SDNs, each switch has a **routing table** that contains a set of **rules** defining how the different incoming packets must be processed (forwarded, discarded, etc.). Each switch has also always a specific **link** (and thus a **port**) that connects it with the **controller**. This connection is mainly used to configure the switches. The data transmitted between nodes are called **packets**.



Packets that can be of two types:

- **control packets** include control plane information, such as new rules that must be installed in an specific switch, or a request to know how to process a data packet;
- **data packets** encapsulate information that must be transmitted from one host to another. In this case, the relevant information are the source and destination hosts, the type of data packets, and the current position in the network.



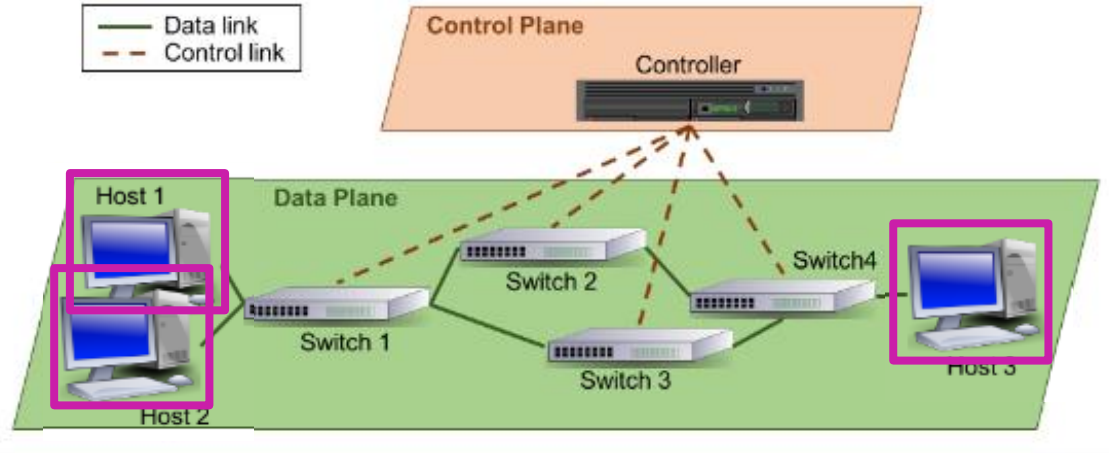
Switches contain **tables** with **rules** that specify how to route **data packets**. Simplifying, a **rule** is a structure with a field denoting the *type of* ***data packet*** *(e.g. HTTP or FTP)* and the **input** and **output ports**. The meaning of the rule is as follows:

- If a data packet of a particular type arrives at port *PortI*, it must be forwarded through port *PortO*;
- It is also possible to define rules that discard incoming data packets;
- When a switch has no rule to deal with a data packet, it sends a request to the controller in order to know how to process the packet;

Finally, the controller can also send new rules to switches to update the routing tables.

packetType	action	iPort	oPort
…	…	…	…
…	…	…	…

Hosts are the endpoints of the network, they are the source and destination of the data plane traffic. Although hosts are not specific elements of the SDN architecture, in our case study they are part of the model.



- Identify the main **signatures** of the system
- Design some **static facts** defining:
  - how connections between nodes (switches, hosts, controllers) should be defined
  - how nodes should behave according to their type
  - how many packets should be accommodated in their port at the same time
  - what should travel within the various links (pay attention to the type of link and thus the type of packet)

- Design some **dynamic facts** defining:
  - how packet position changes to reach the destination host

(A received packet must be handled by the node by applying the rules it contains, which may vary over time)

- Then:
  - define **predicates** related to sending and receiving requests, then packets.
  - define **predicates** that handle forwarding, accepting, rejecting, and sending packets and simulate some scenarios by preparing an initial topology and observing how it changes over time.
  - define **two assertions:** one that proves that the controller does not receive requests, the other that a packet arrives at a node.

Based on the directions in the slides above, construct your .als file and submit it by dd/mm/yyyy to this form. Your model will be corrected and if it is correct you will be given N additional point on the exam.

https://forms.office.com/e/WyxBQTYwCd