



IBM Austin Research Lab

# SDN traceroute: Tracing SDN Forwarding without Changing Network Behavior

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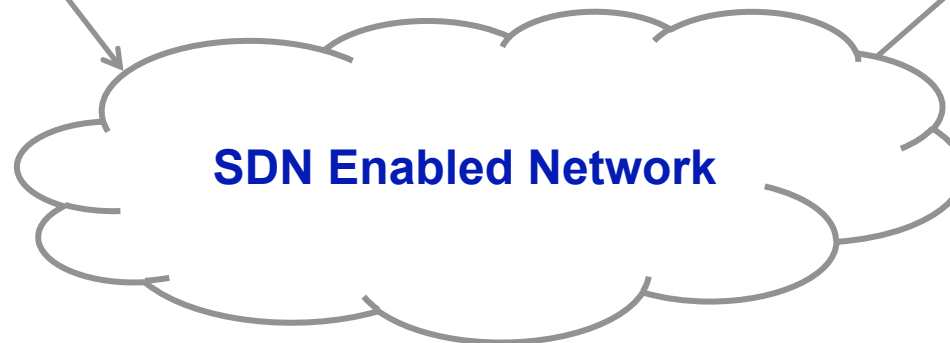
# SDN traceroute Interface

## Input

- Ethernet frame with user-specified packet header fields,
- Injection point: (Switch id, Port)

## Output

- Route taken by the packet
- Ordered list of (Switch id, Port)



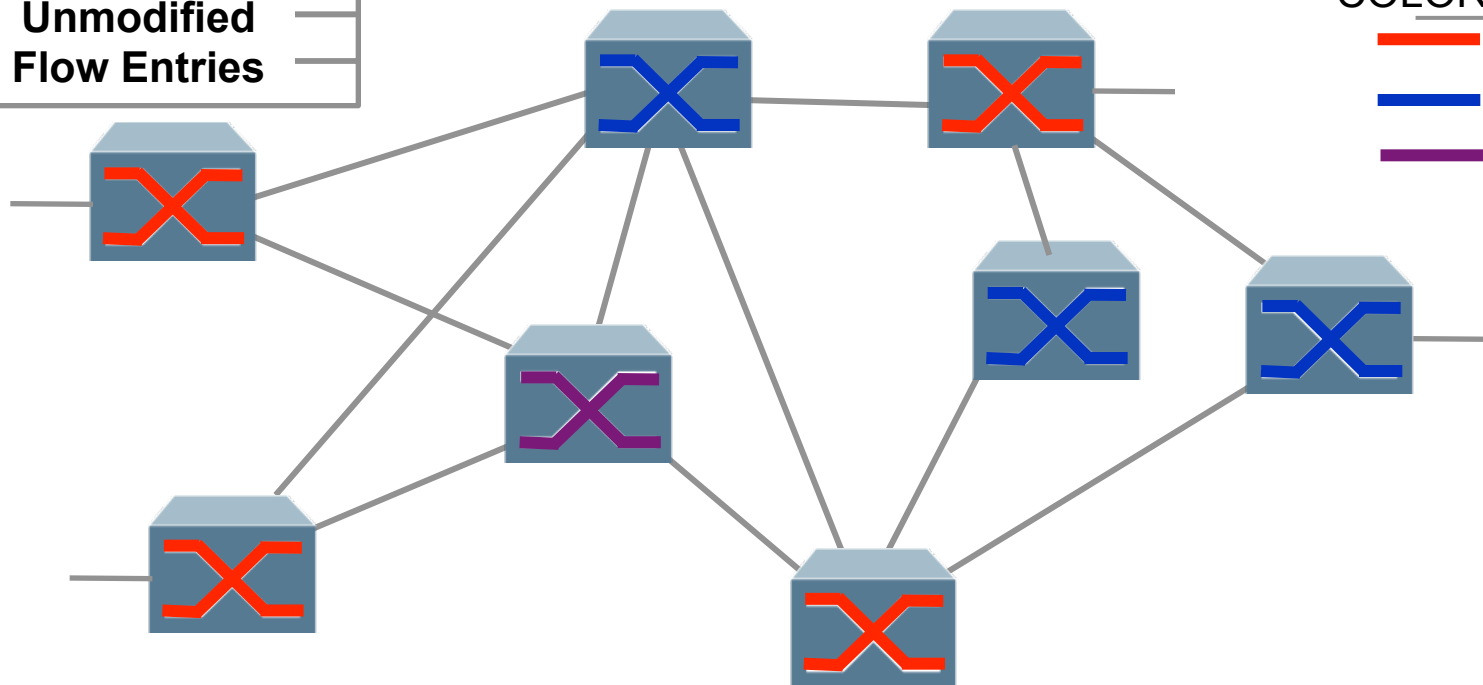
# Network Configuration for traceroute

- Perform vertex coloring of network topology
- Install rules in switches: send to controller if tag == adjacent switch color

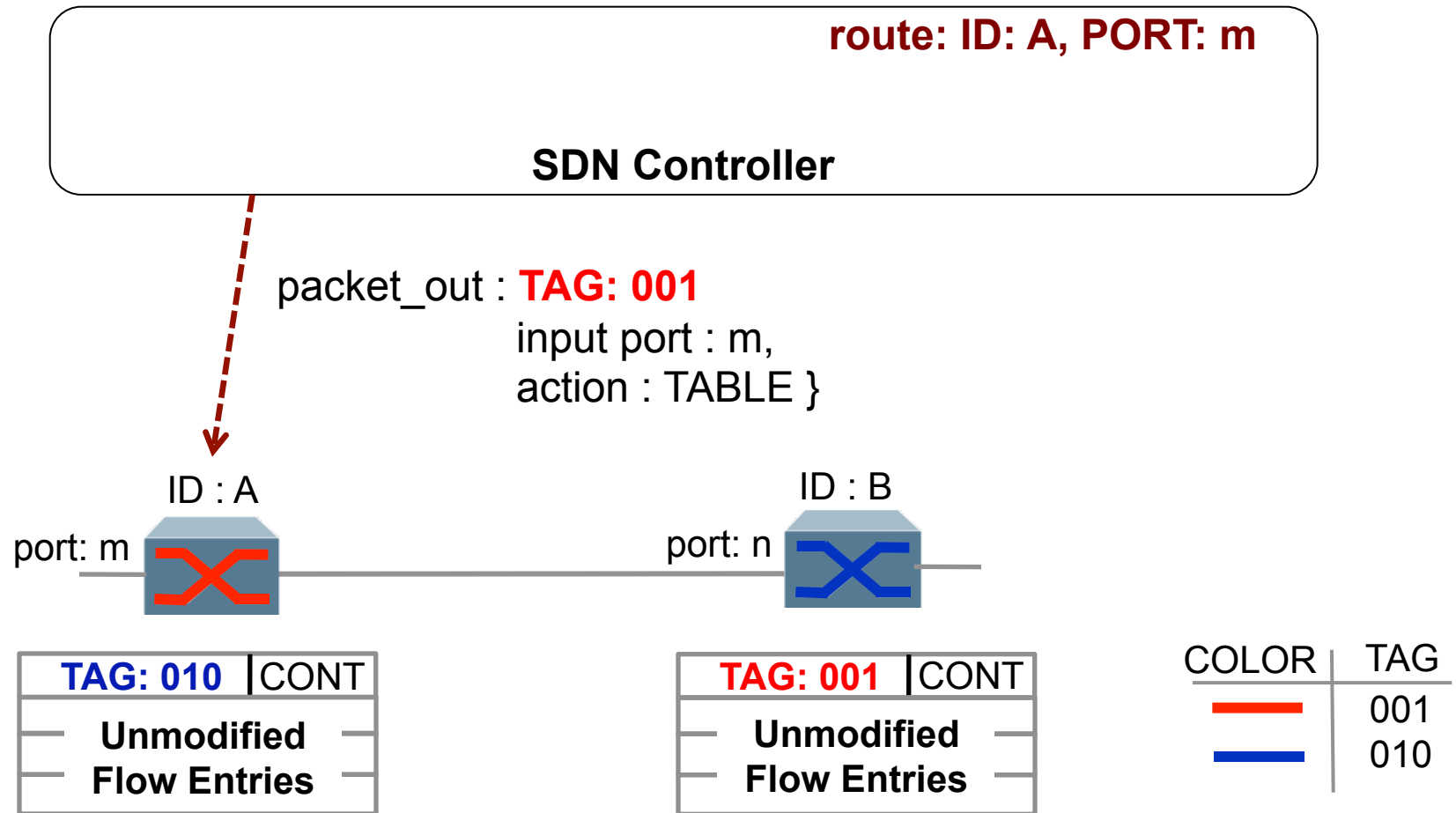
MATCH	ACTION
TAG: 010	CONT
TAG: 011	CONT
Unmodified Flow Entries	

Highest priority

COLOR	TAG
Red	001
Blue	010
Purple	011



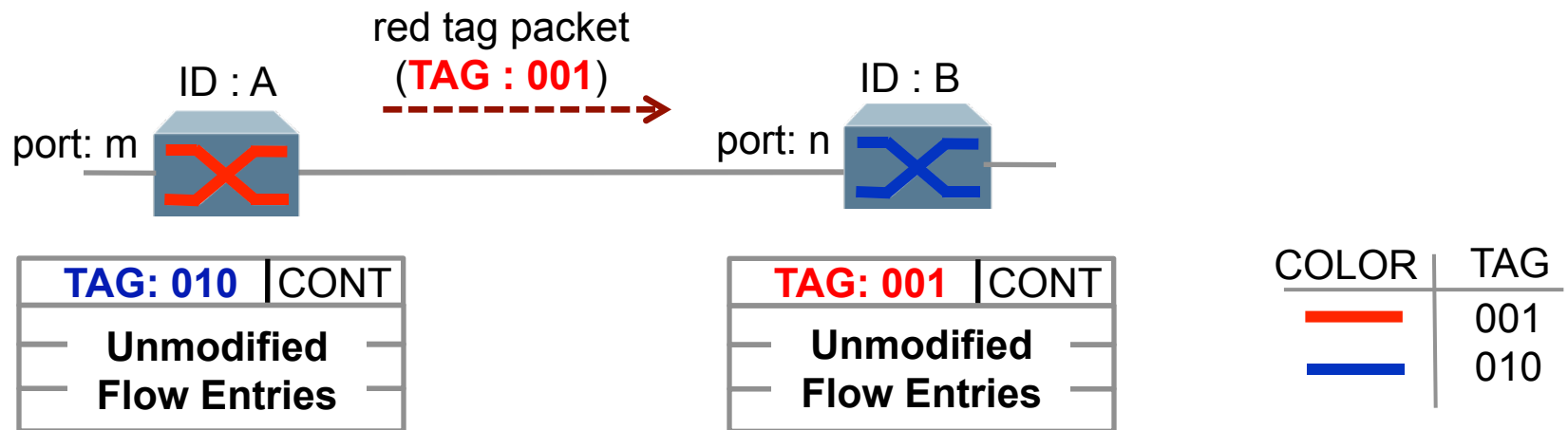
# Conducting traceroute: Insert Probe Packet in Network



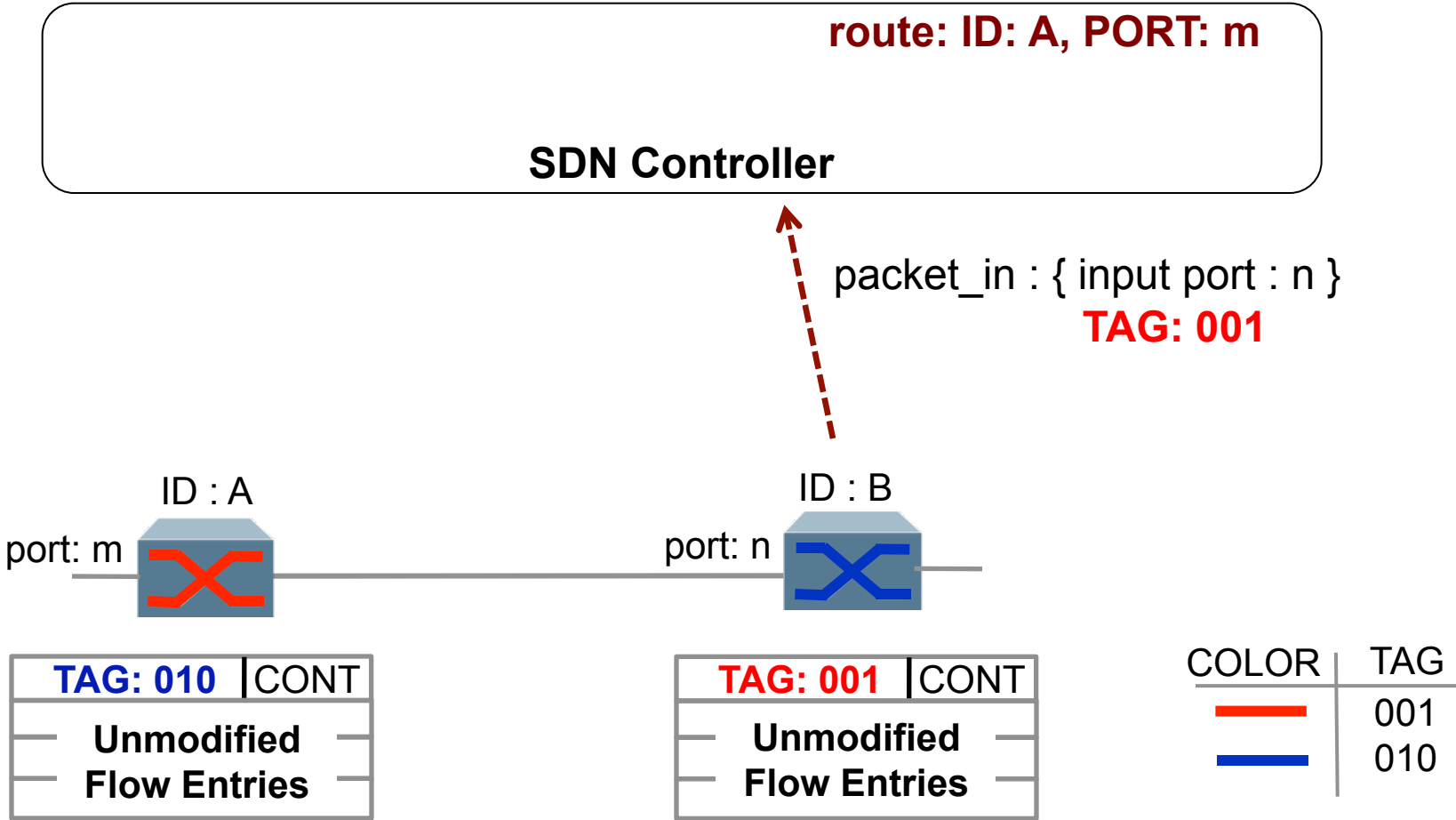
# traceroute: Packet Sent to Next Hop

route: ID: A, PORT: m

**SDN Controller**



# traceroute: Packet Sent to Controller



# traceroute: Packet Returned by Controller

route: ID: A, PORT: m  
ID: B, PORT: n

**SDN Controller**

packet\_out : {input port : n  
**TAG : 010**  
action : TABLE }



<b>TAG: 010</b>	CONT
Unmodified	
Flow Entries	

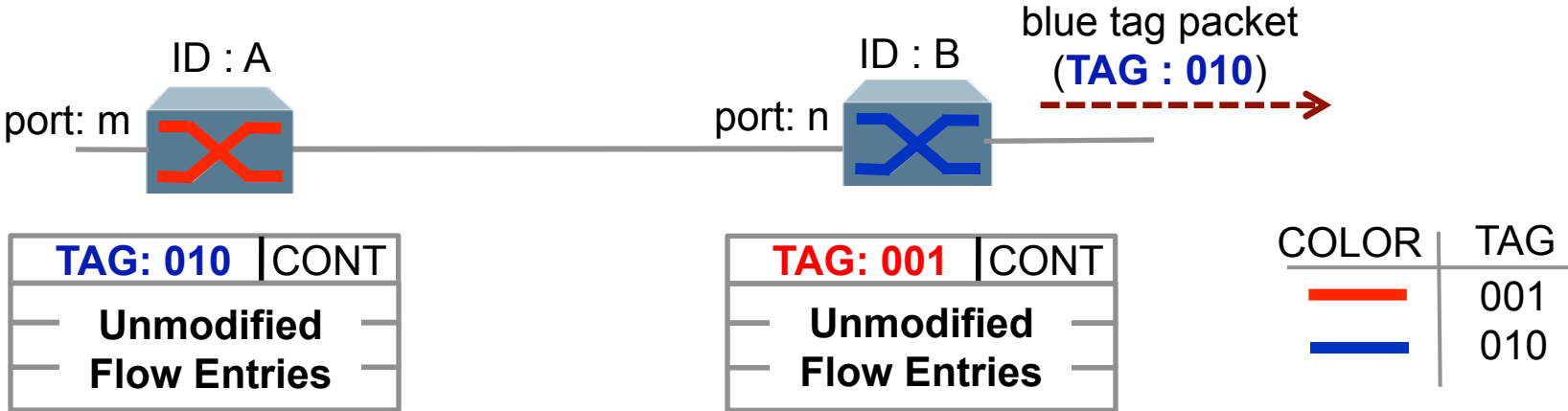
<b>TAG: 001</b>	CONT
Unmodified	
Flow Entries	

COLOR	TAG
—	001
—	010

# traceroute: Packet Sent to Next Hop

route: ID: A, PORT: m  
ID: B, PORT: n

**SDN Controller**





## Key Characteristics

- **Non invasive** : requires **no modification** in production rules
- **Low overhead** : requires **very few (1-2)** TCAM rules per switch
- **Generic**: can trace **arbitrary** Ethernet packets
- **Practical**: **compatible** with existing SDN switches and protocols
  
- **Limitations** :
  - **Reserves a header bit field** for carrying color tags
  - **Reserves highest priority rules** for color tag matching