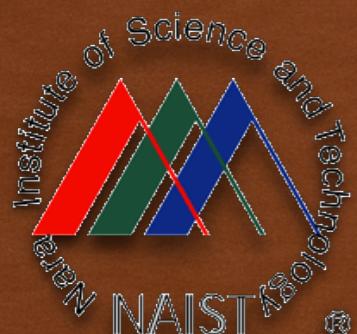


AN IMPLEMENTATION OF OPENFLOW NETWORK MONITORING AND VISUALIZATION TOOL



Wassapon Watanakeesuntorn
(Boom)

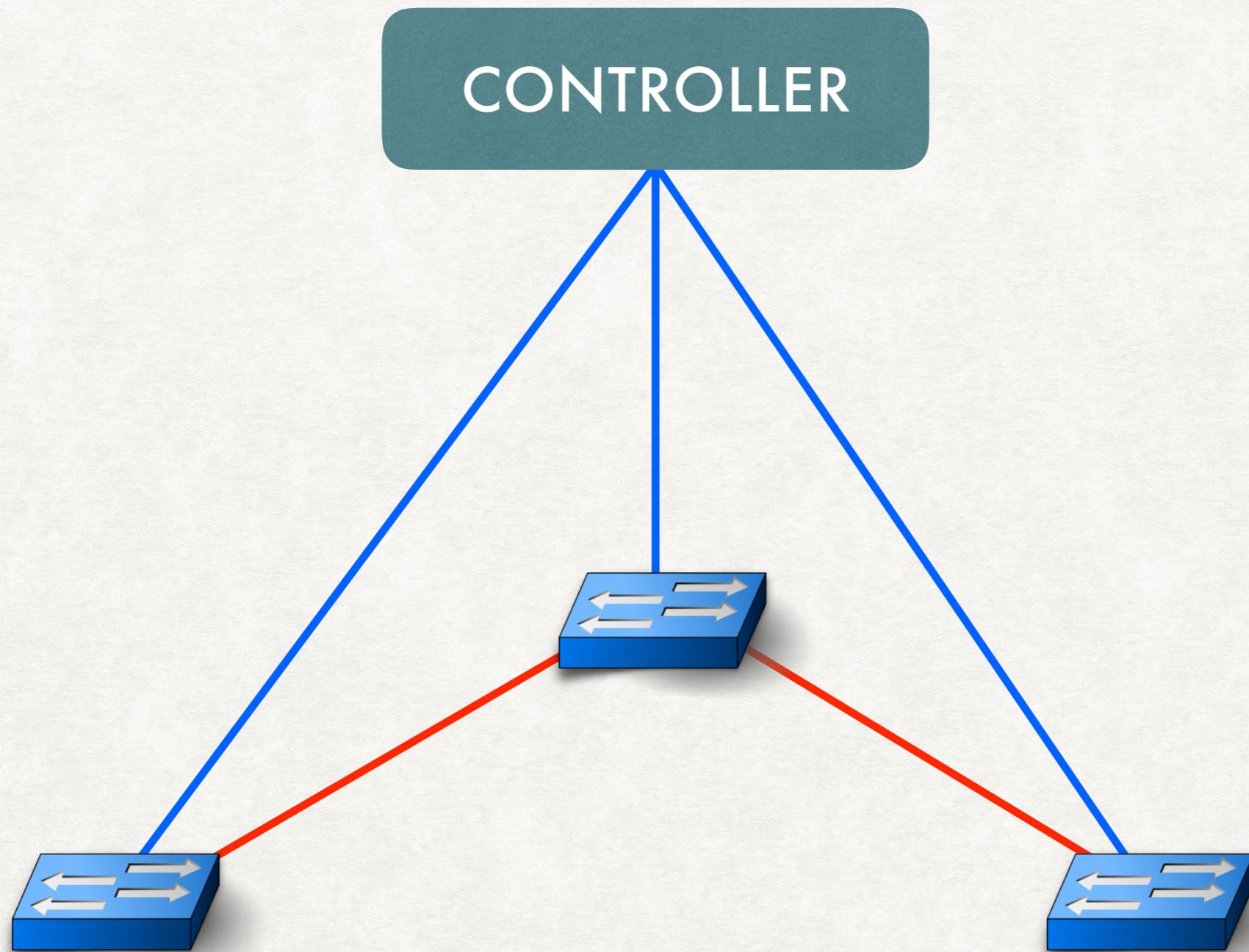


Software Design and Analysis Laboratory
Nara Institute of Science and Technology

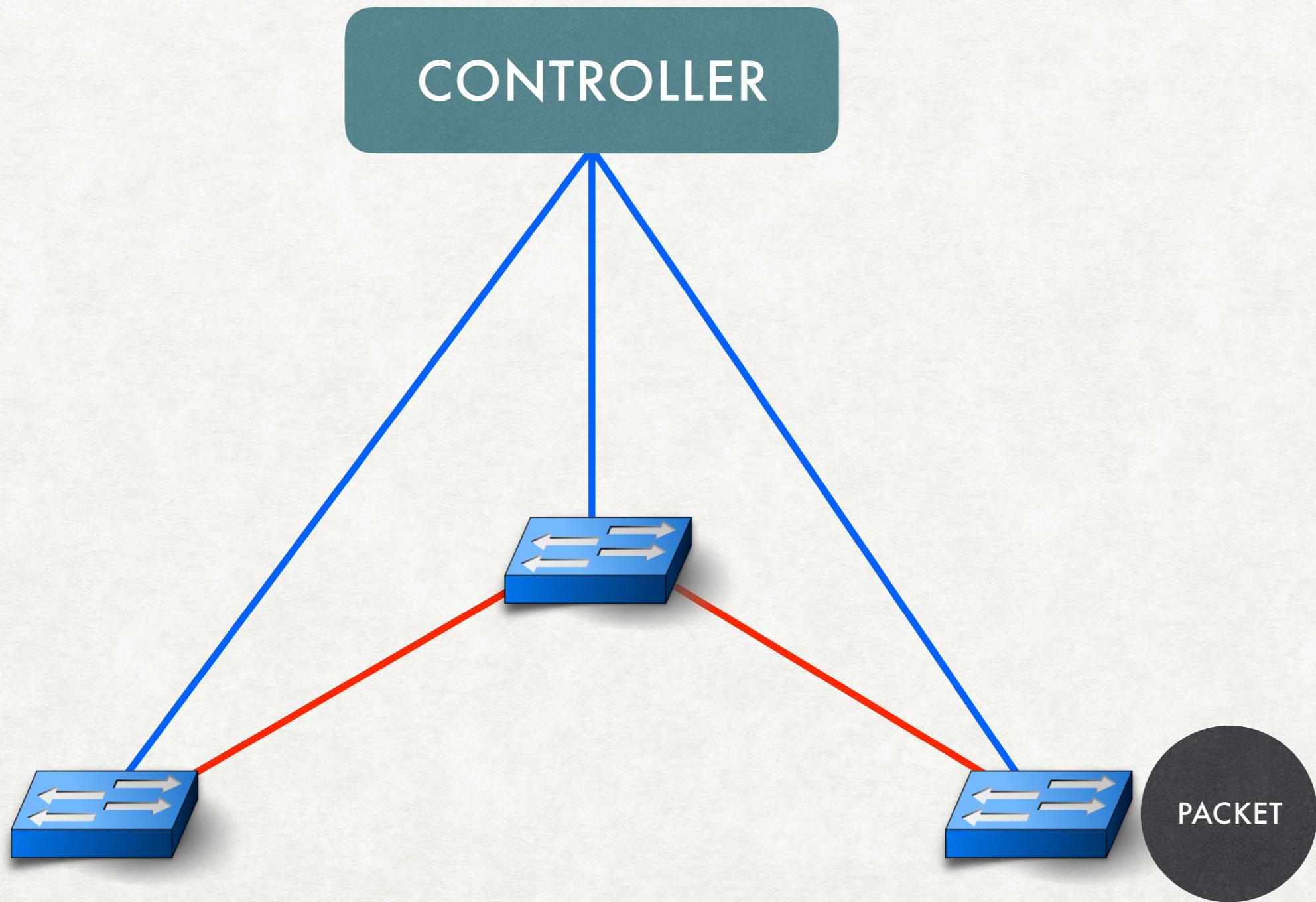


High Performance Computing and Networking Center
Kasetsart University

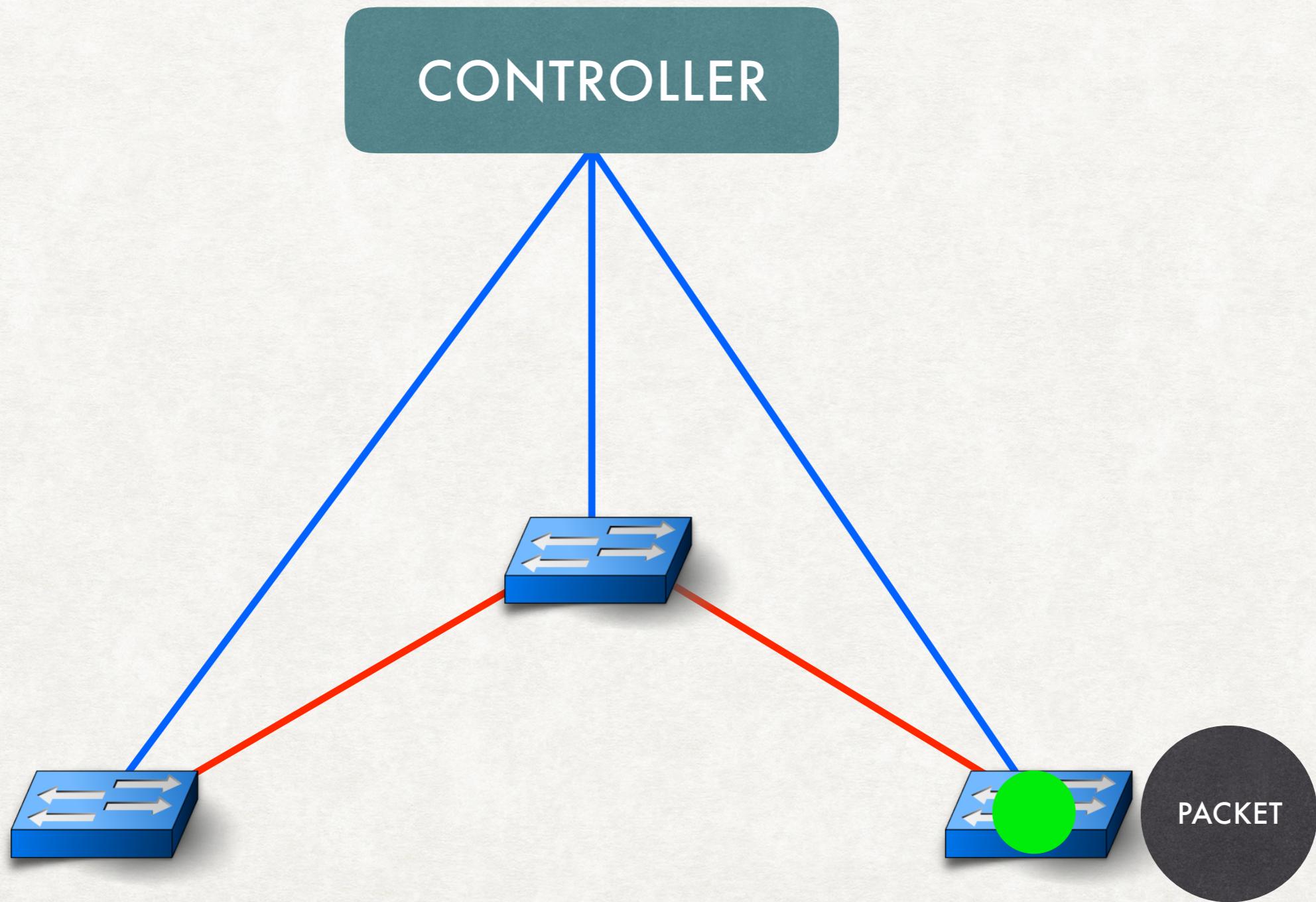
OPENFLOW NETWORK



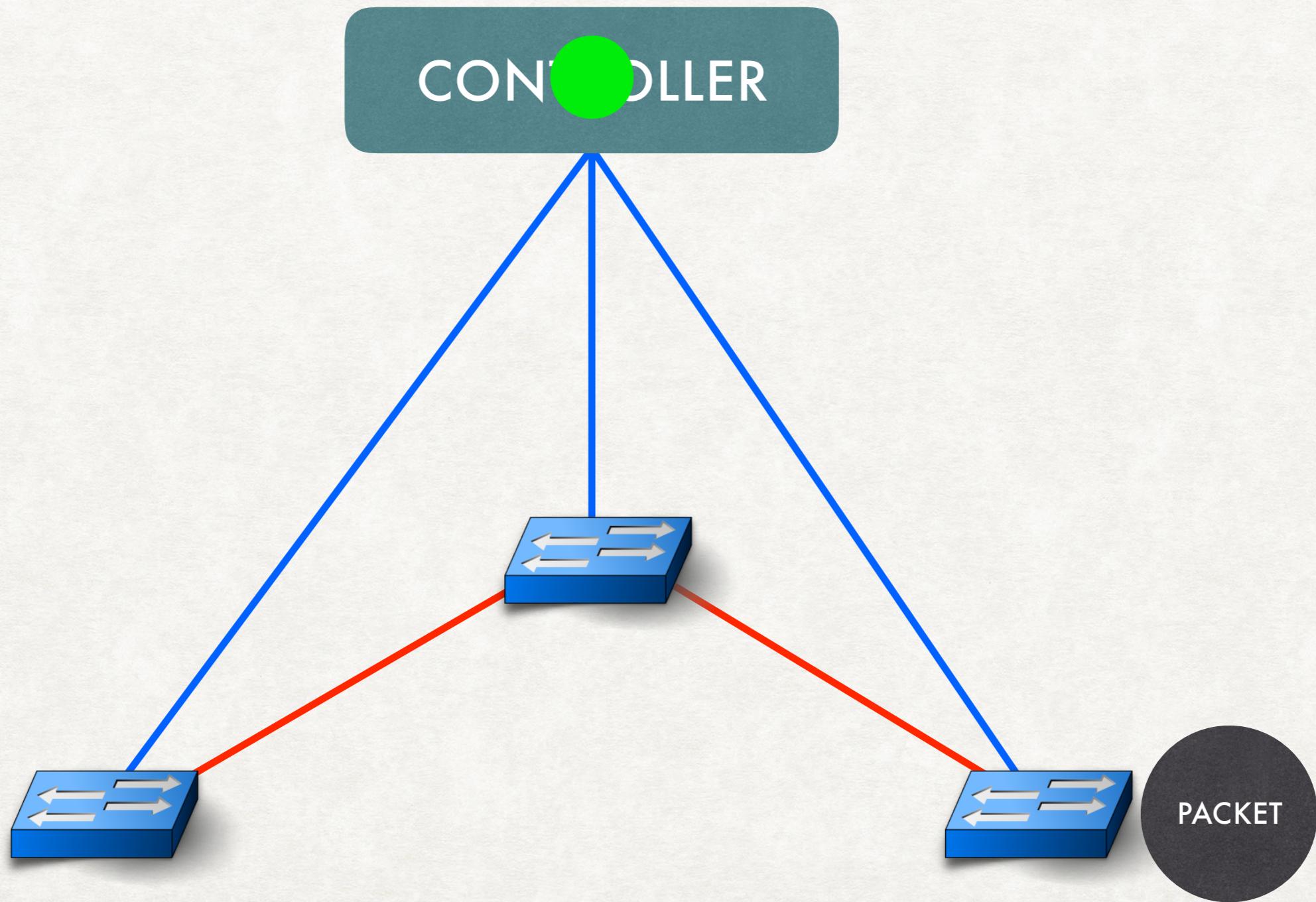
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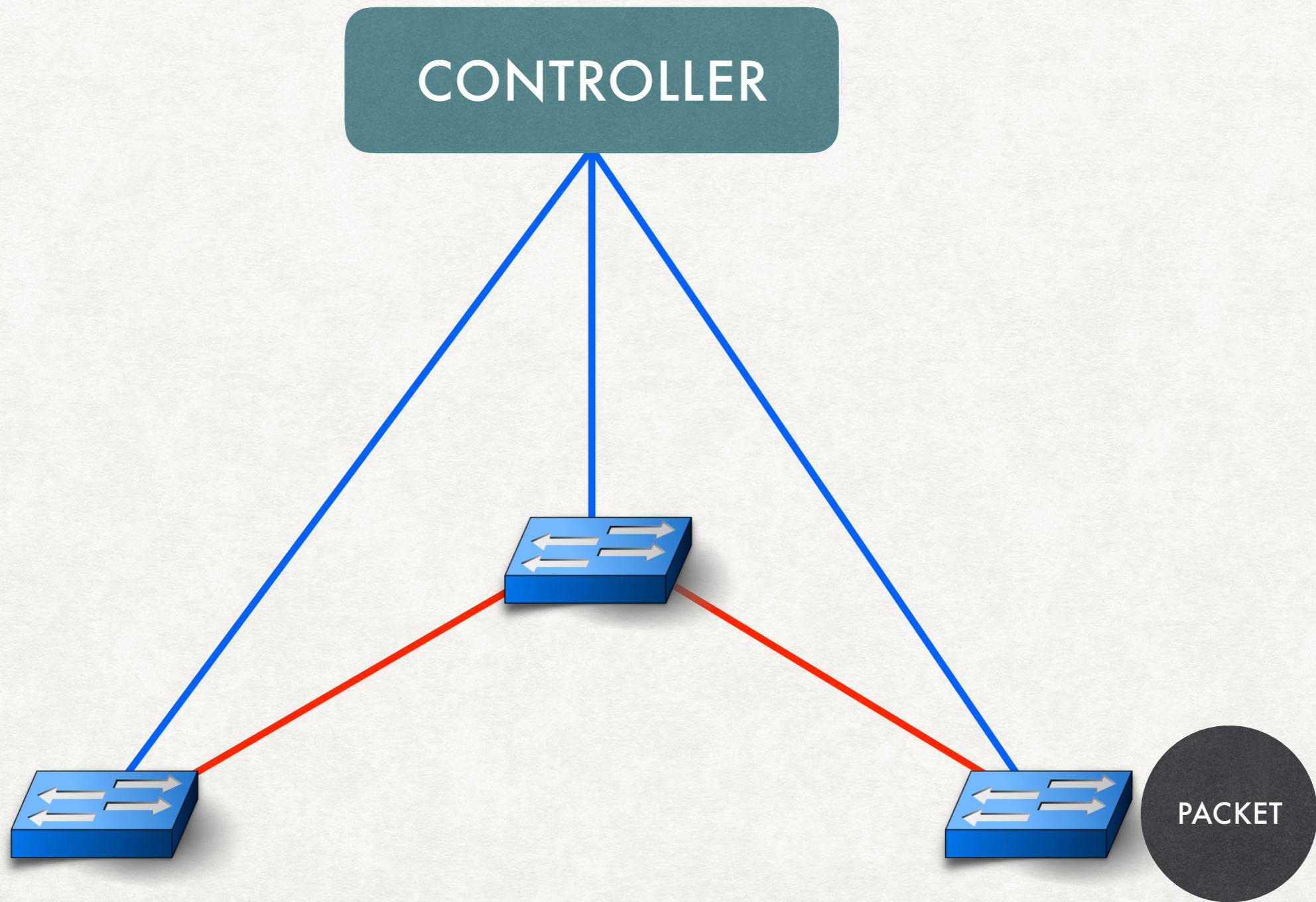
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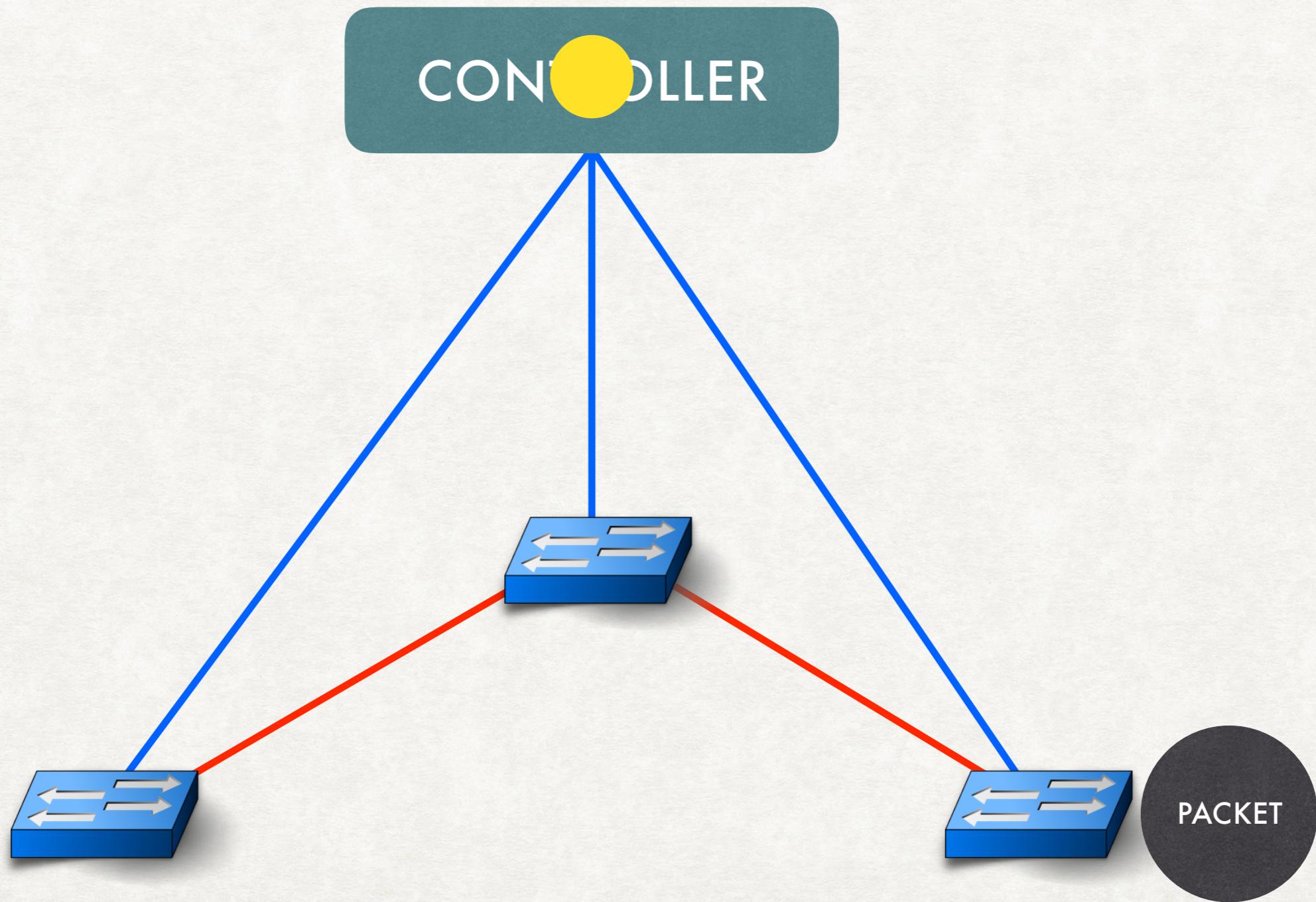
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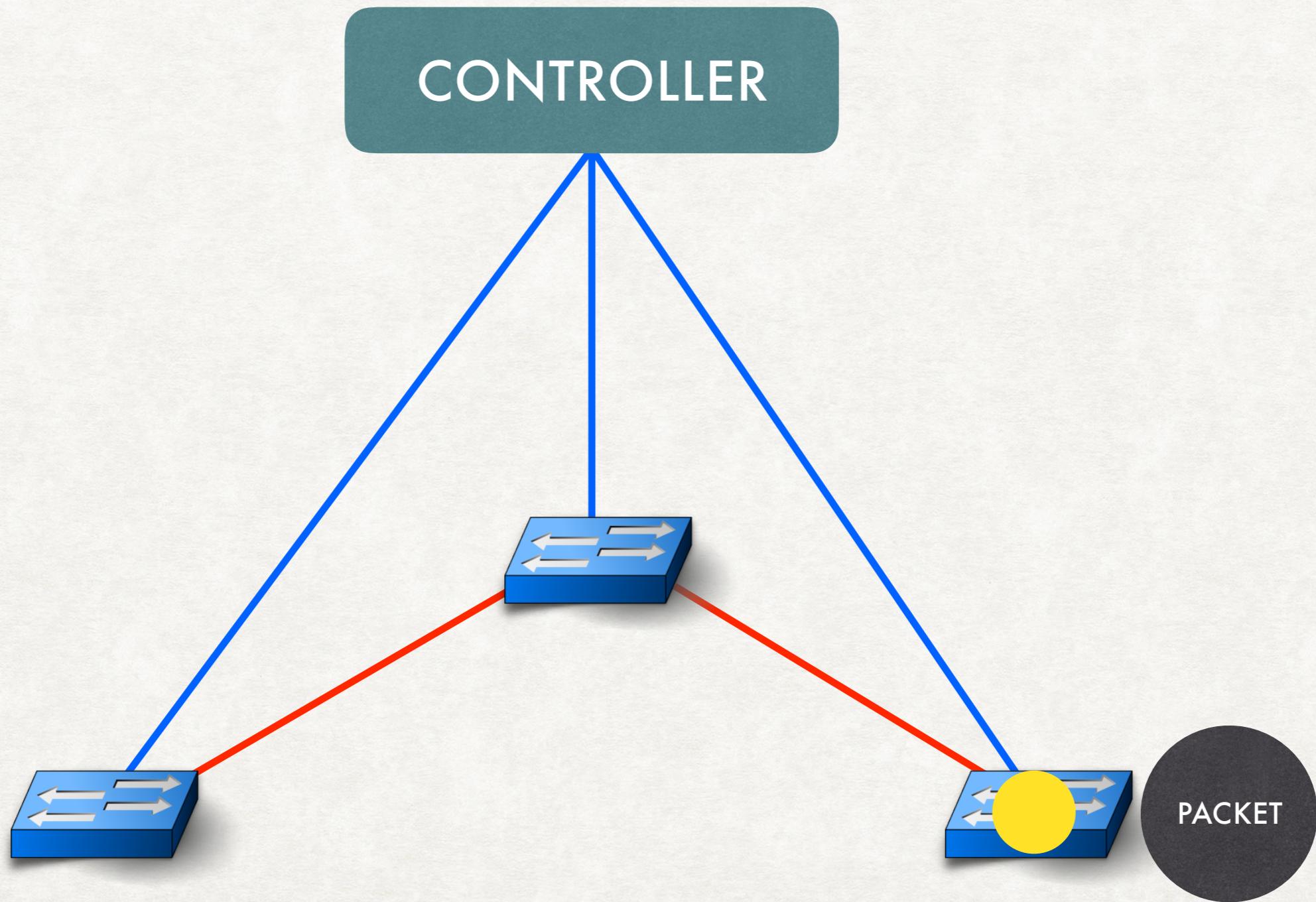
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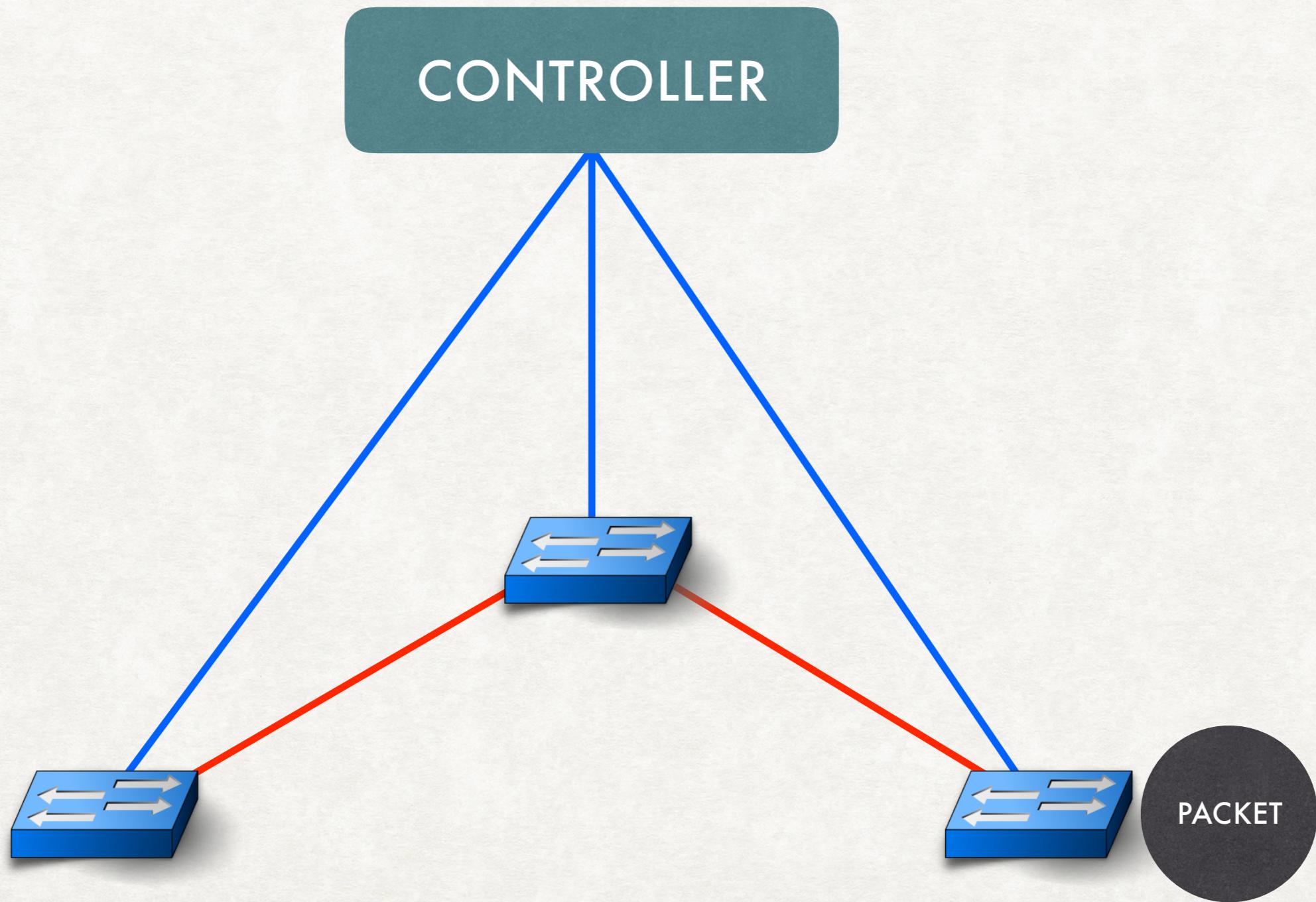
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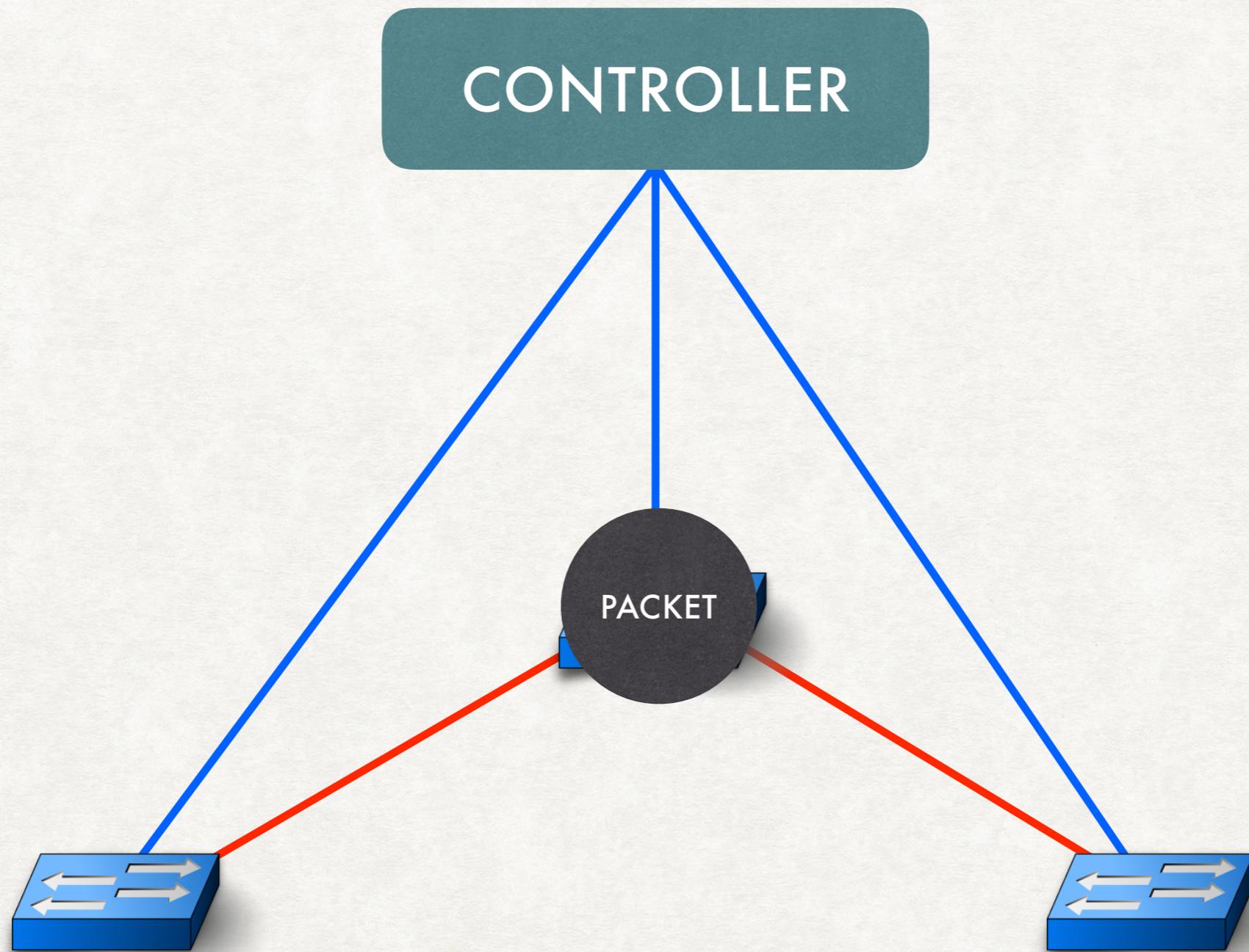
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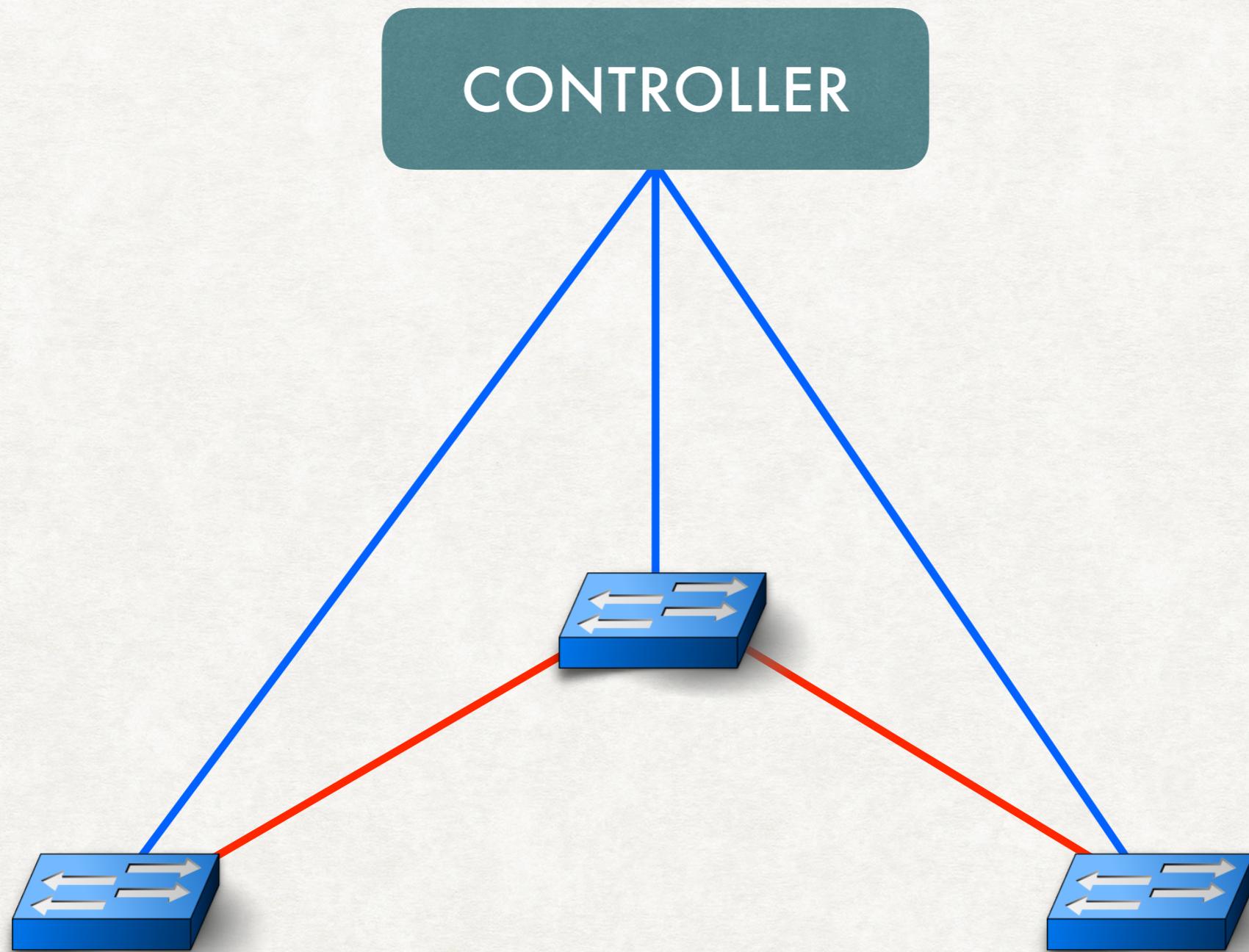
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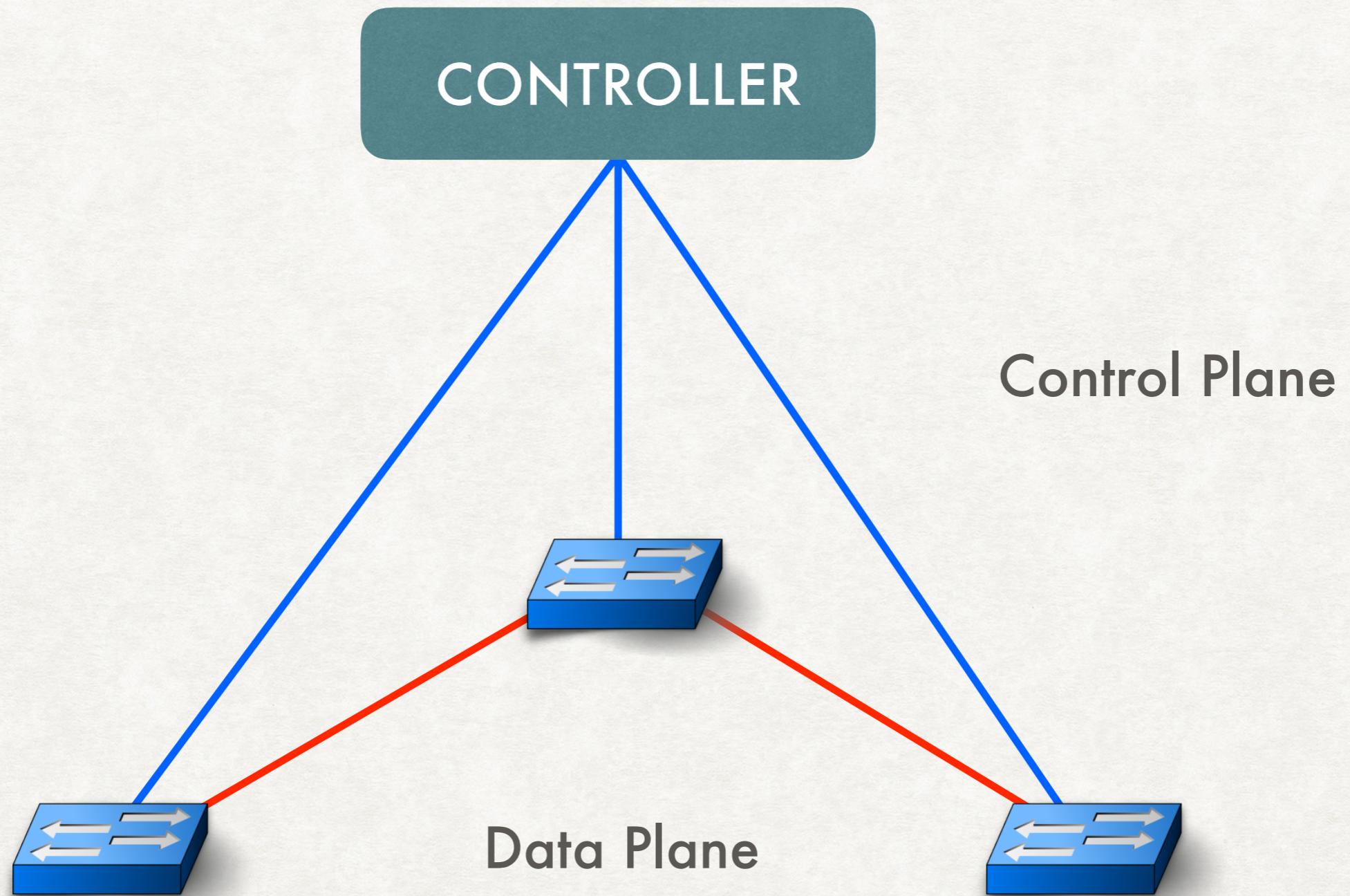
OPENFLOW NETWORK



OPENFLOW NETWORK



OPENFLOW NETWORK



PROBLEM

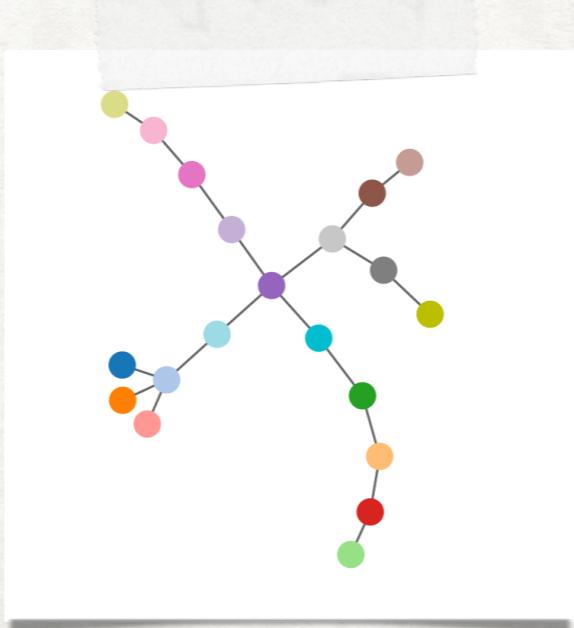
- Hard to follow dynamic behaviour of OpenFlow Network
- Information is distributed over switches in the network

PROPOSAL

- Hard to follow dynamic behaviour of OpenFlow Network
- Information are distributed over switches in the network

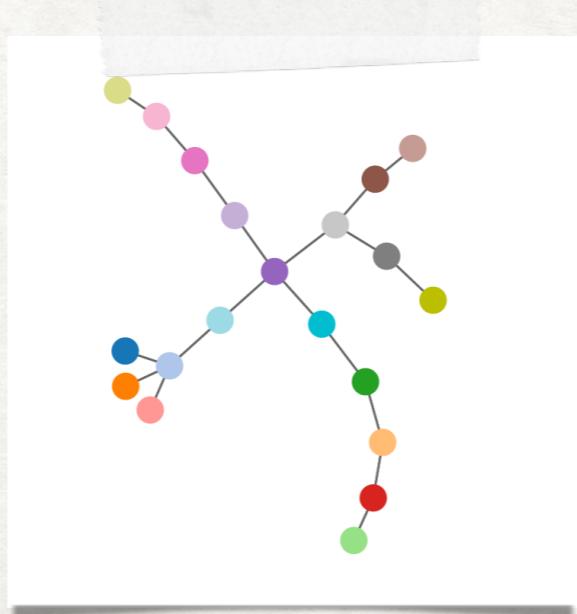
PROPOSAL

- Visualize real-time network status
 - Show graph of current network topology and flow table
 - Centralize tool
 - Visually appealing presentation



PROPOSAL

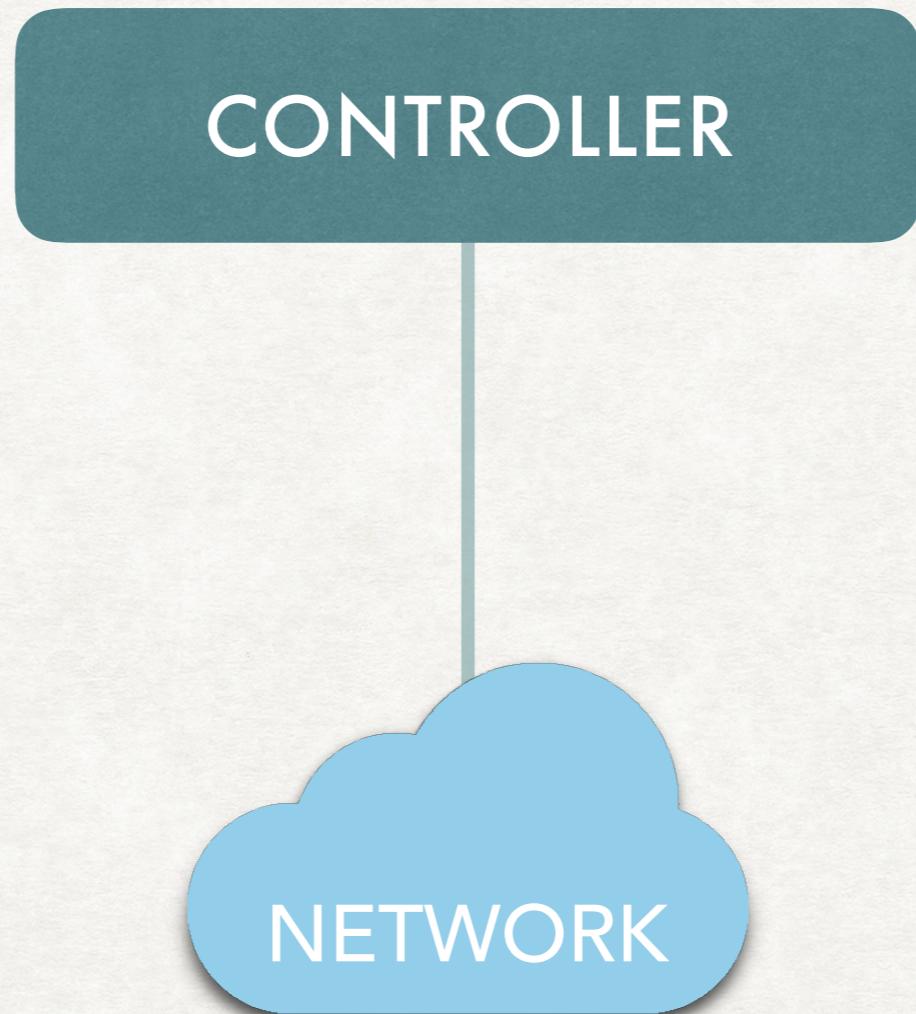
- Visualize real-time network status
 - Show graph of current network topology and flow table
 - Centralize tool
 - Visually appealing presentation
- OpenFlow monitoring tool for control and data plane



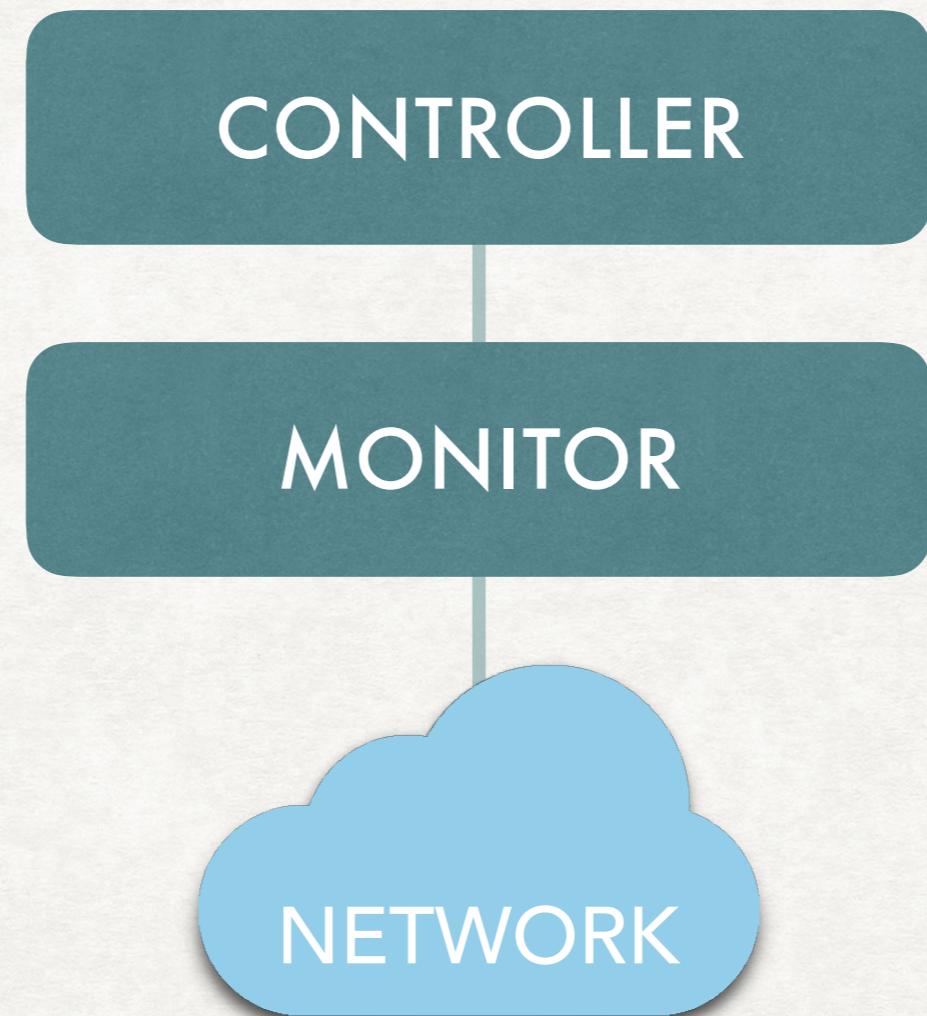
BACKGROUND

- Monitor tools for ordinary network are monitor in data plane only

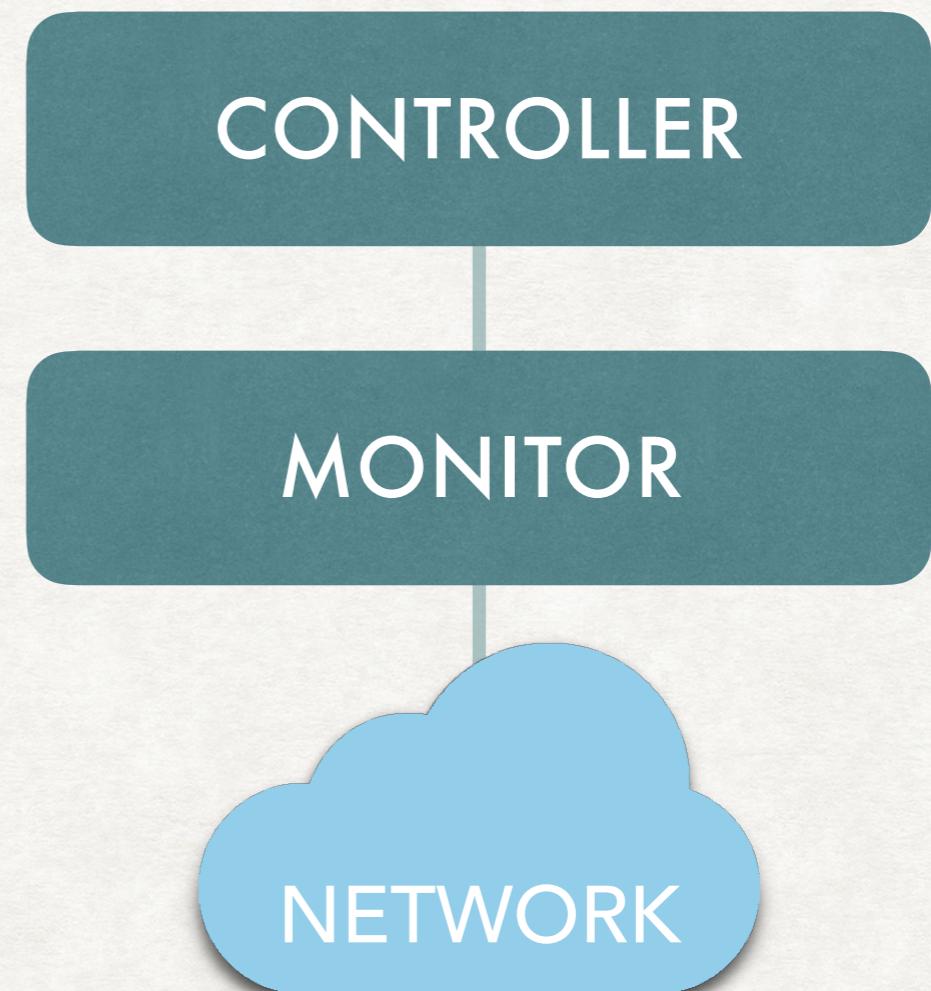
ARCHITECTURE



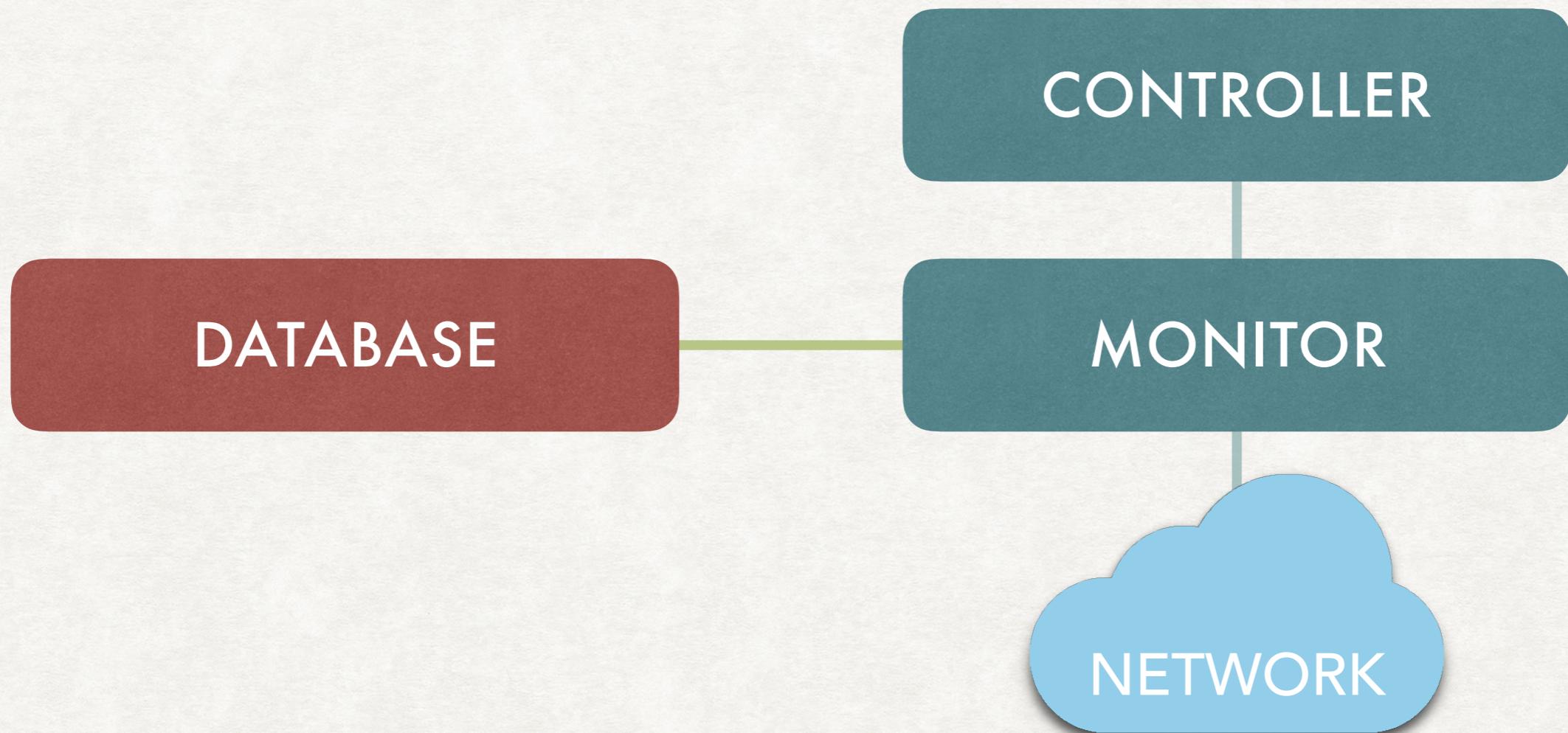
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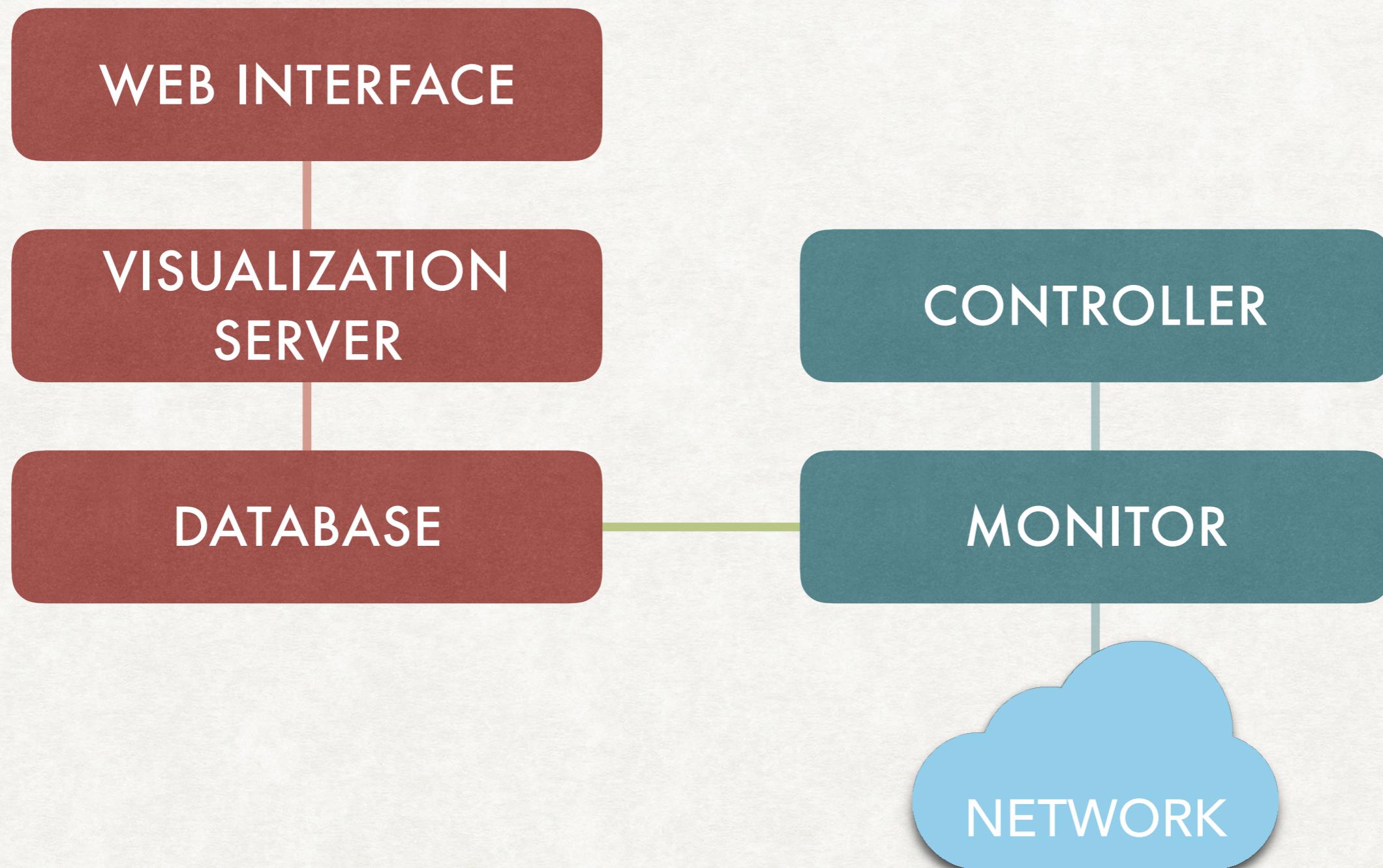
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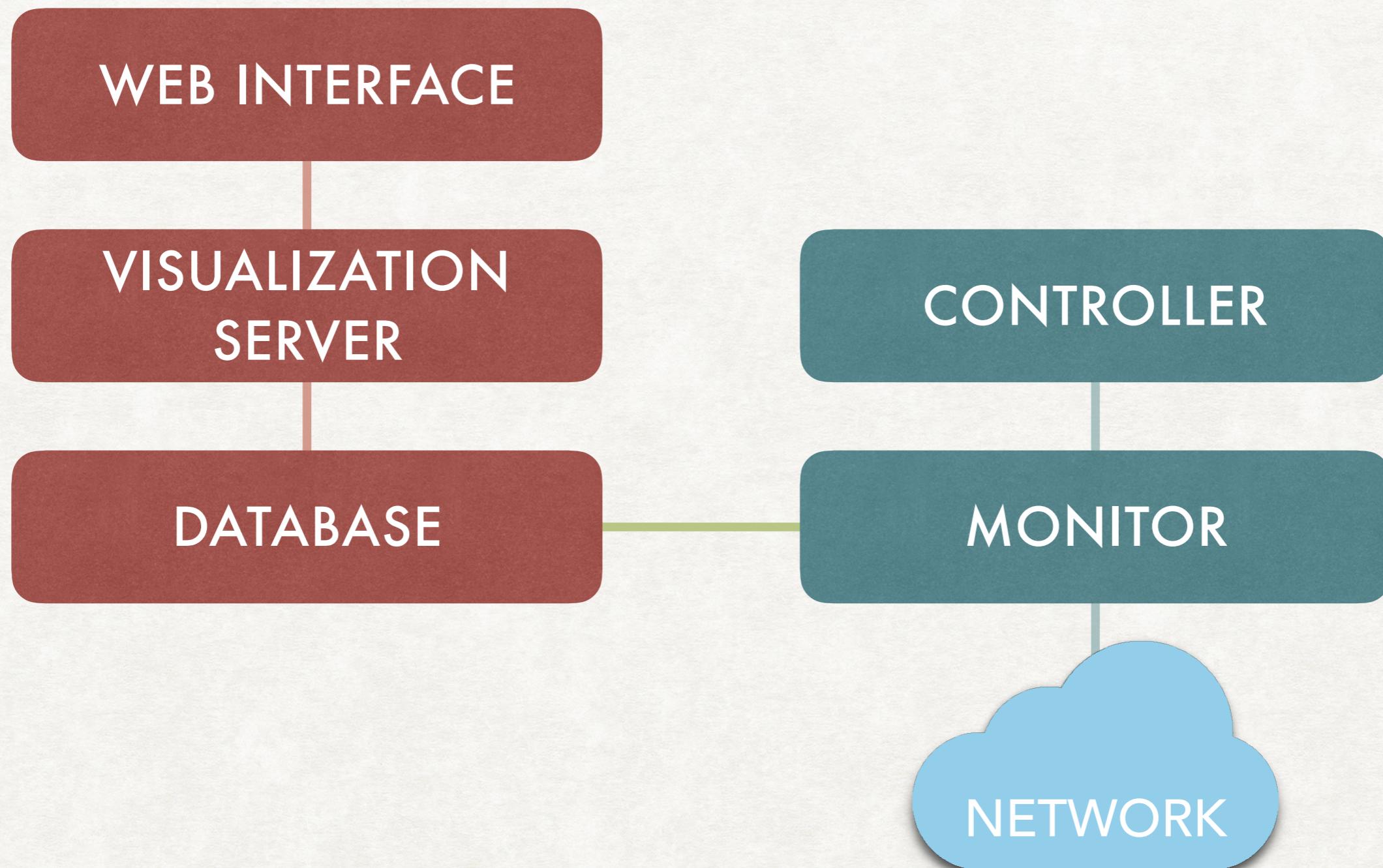
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ARCHITECTURE



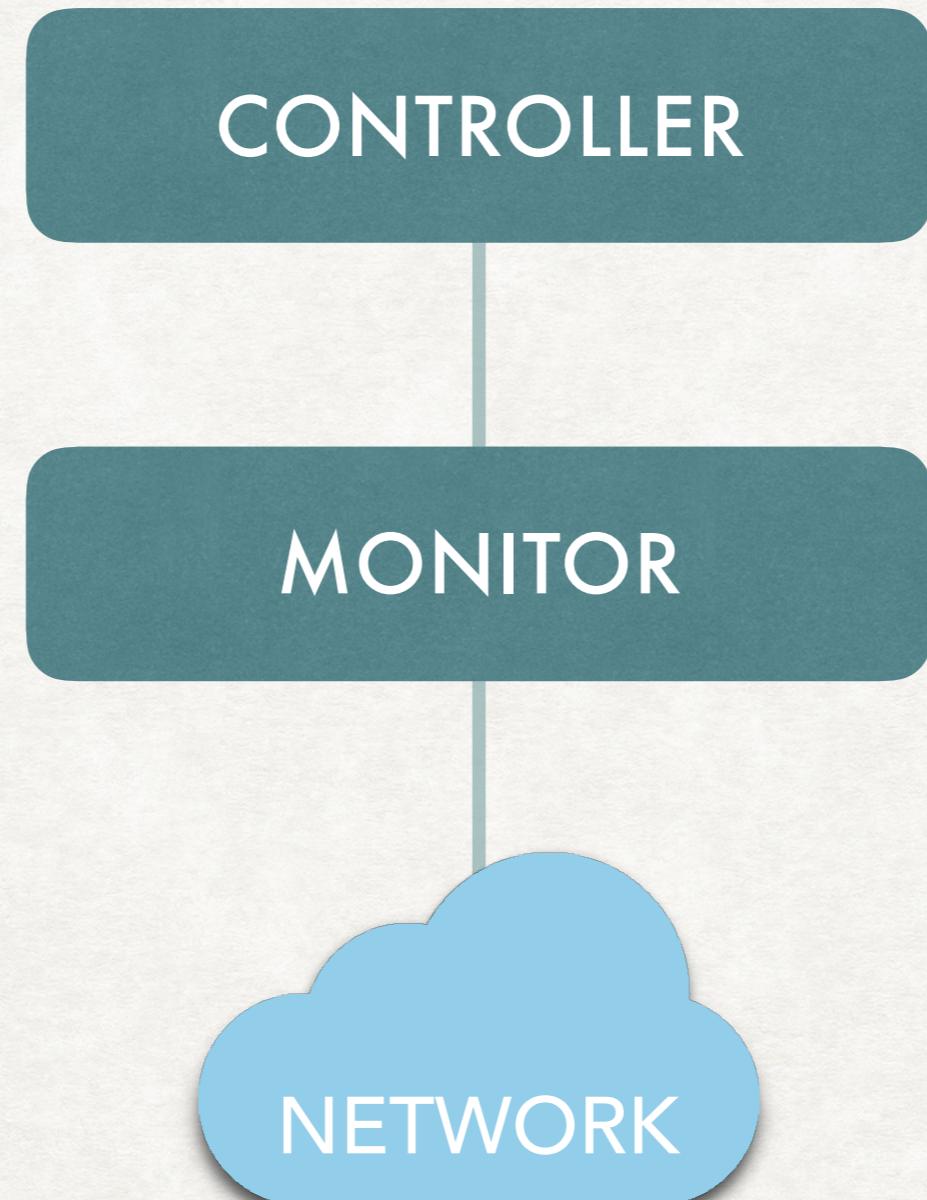
ARCHITECTURE



Visualization Part

Monitoring Part

MONITORING PART



MONITORING PROCESS

- Monitor all communications between switches and controller
- Parse and collect some communication information

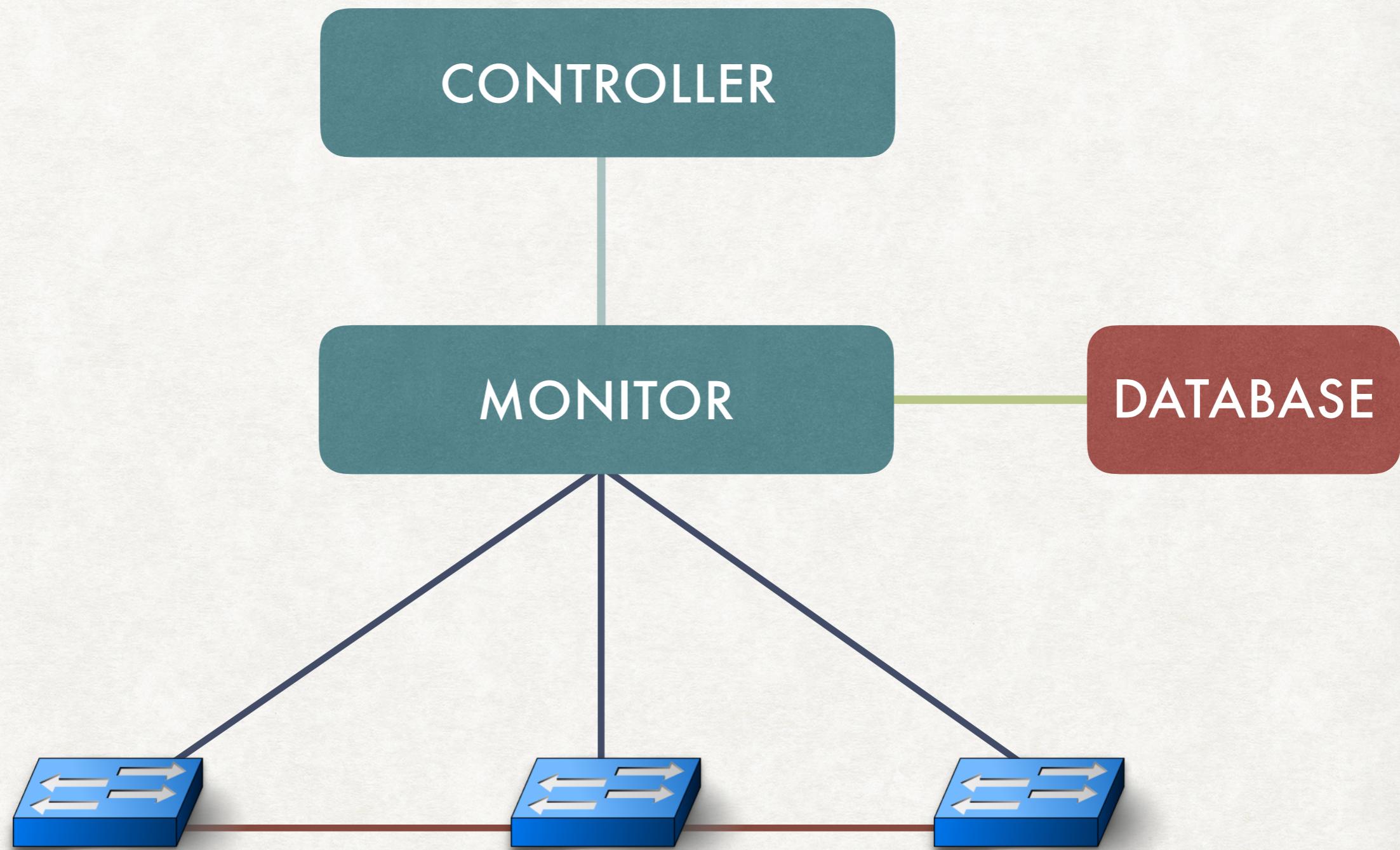
MONITORING PROCESS

- Monitor all communications between switches and controller
- Parse and collect some communication information
 - Flow table on each switch

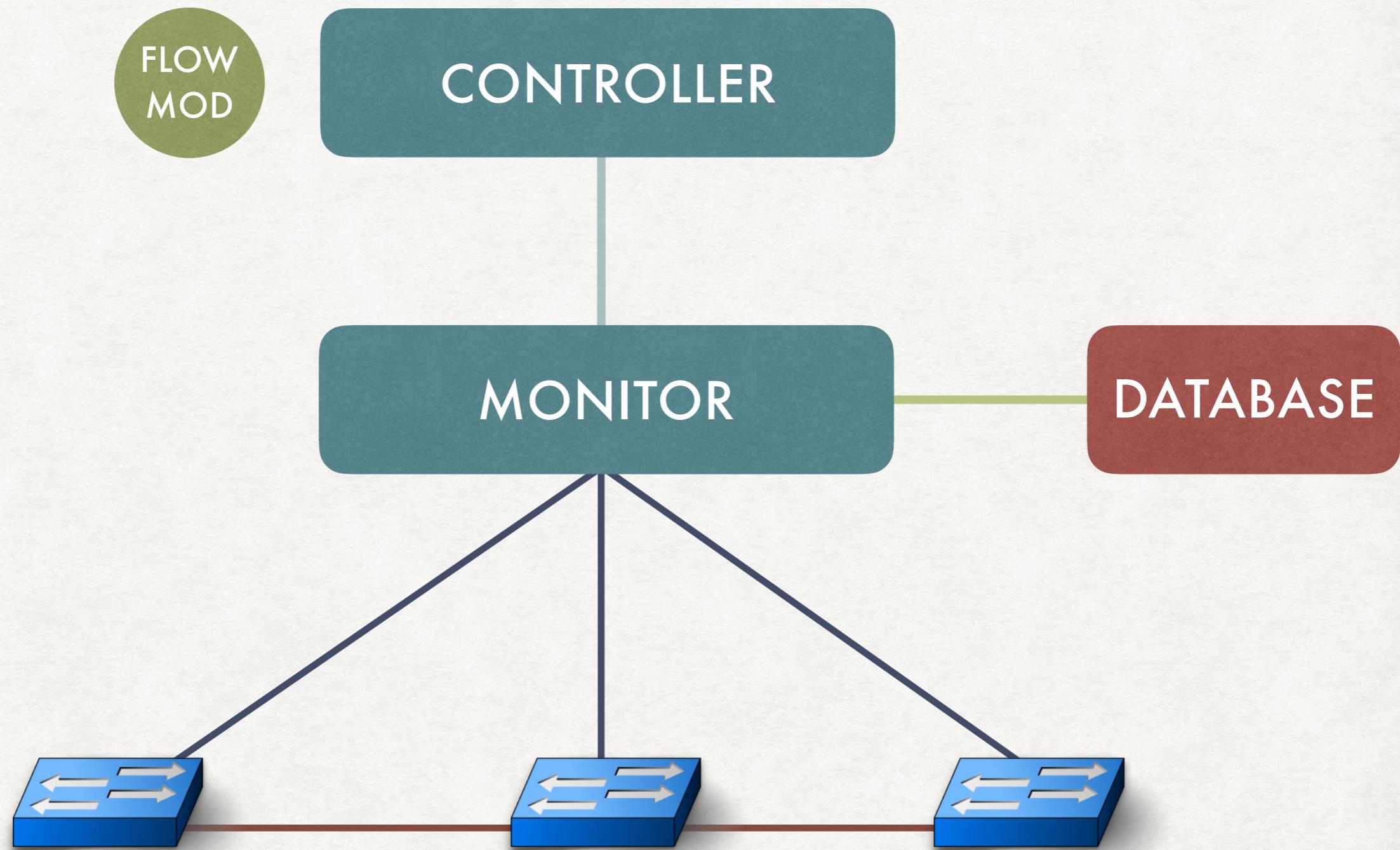
MONITORING PROCESS

- Monitor all communications between switches and controller
- Parse and collect some communication information
 - Flow table on each switch
 - FlowMod message : Match / Action

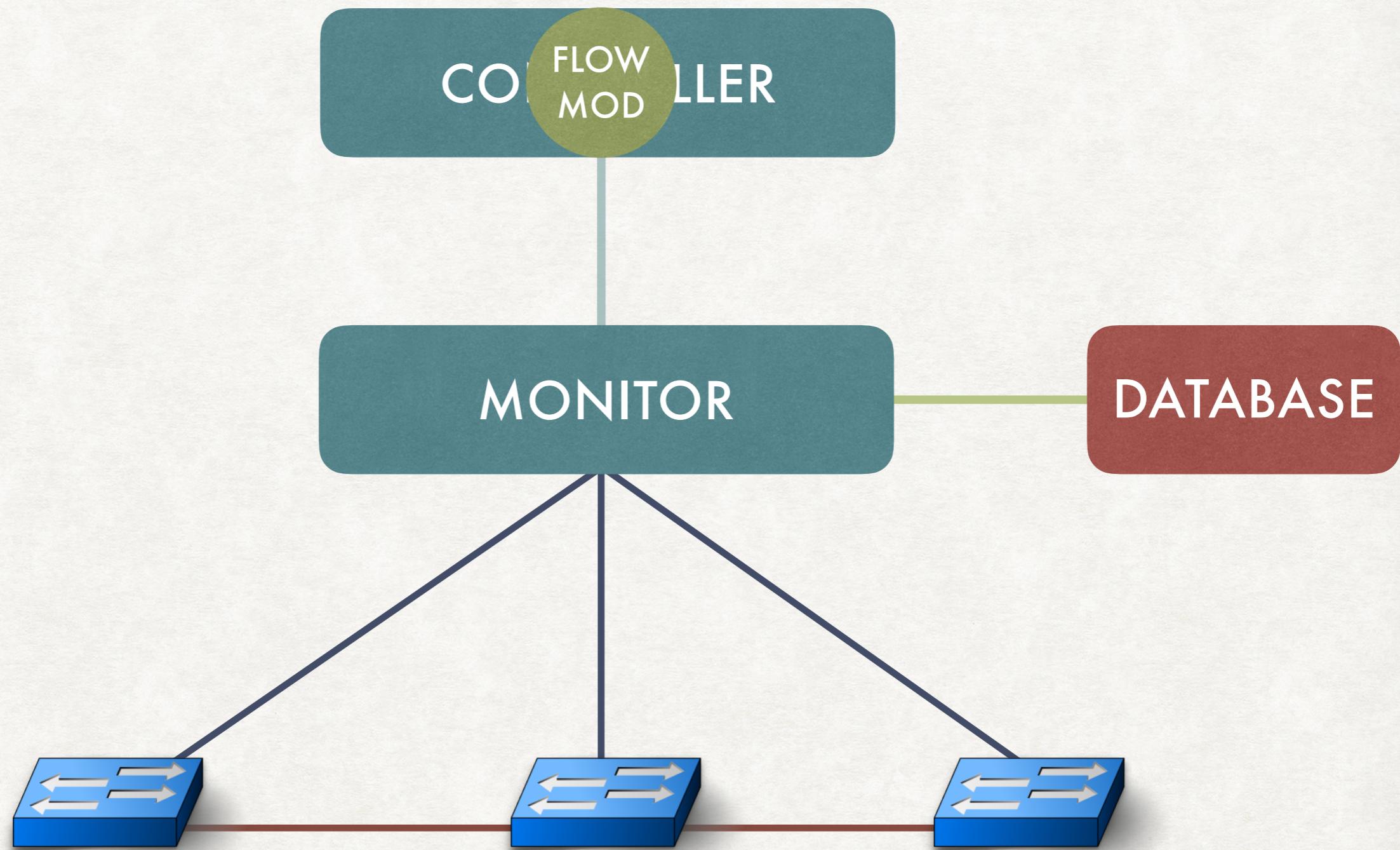
MONITOR



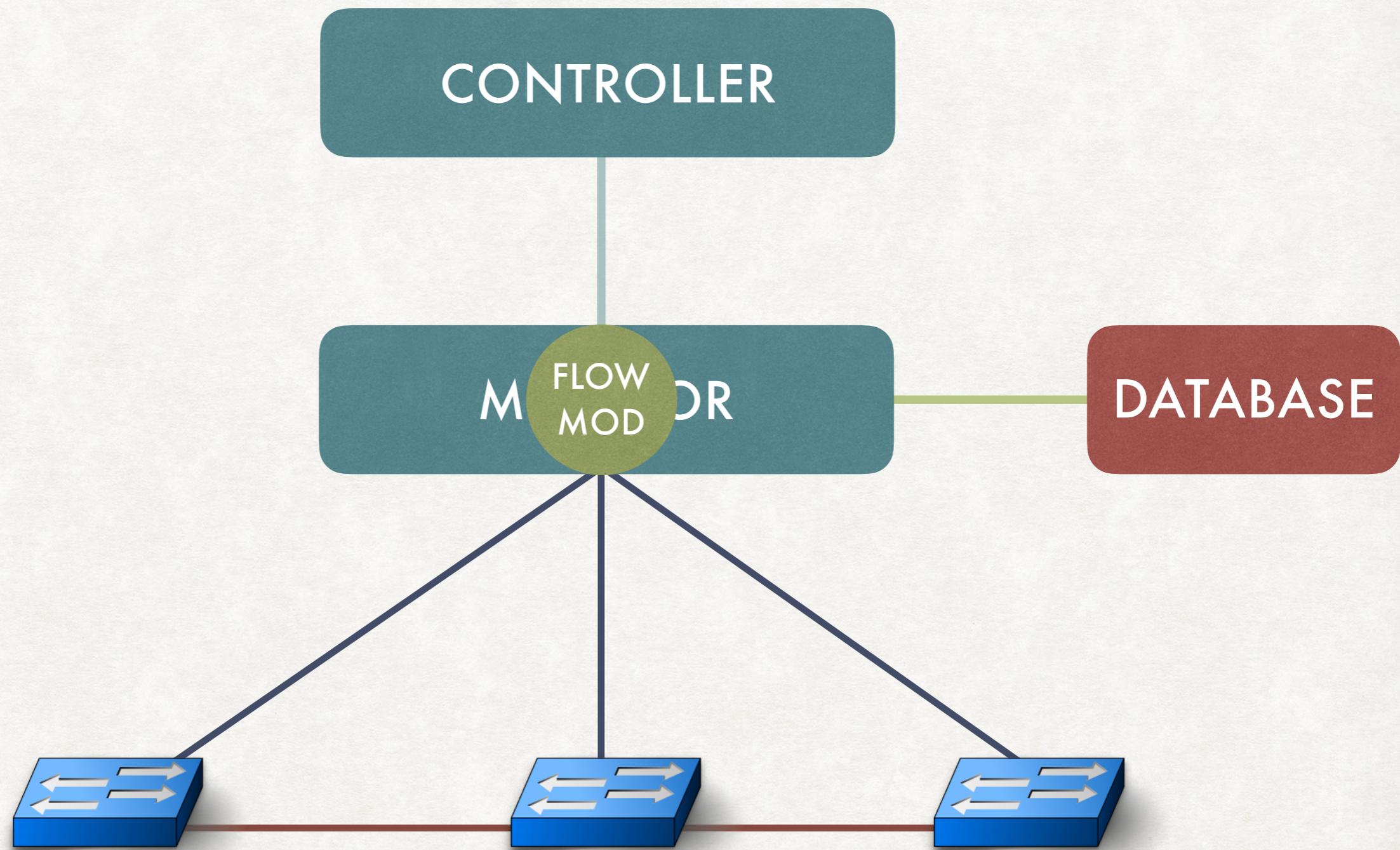
MONITOR



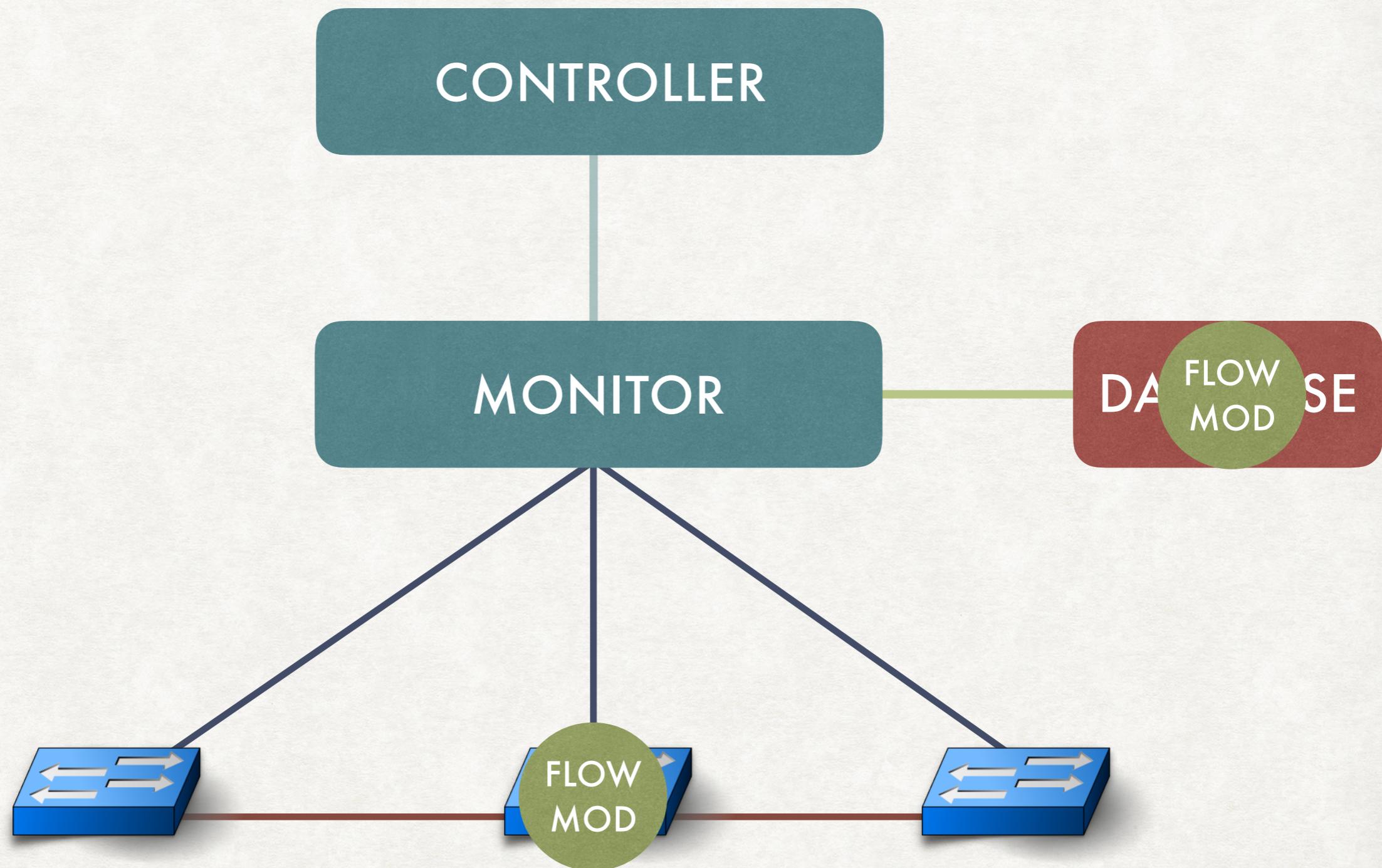
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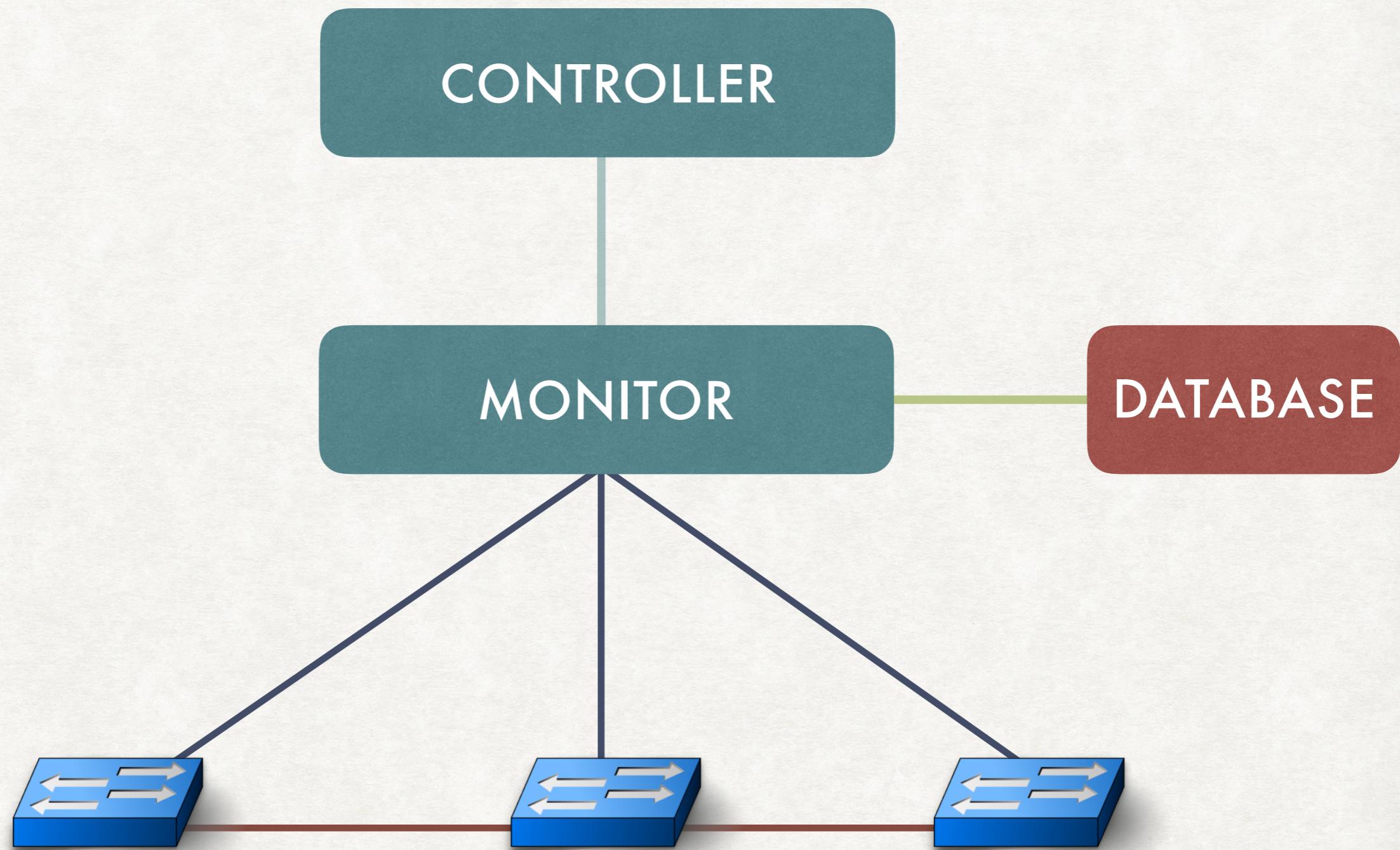
MONITOR



MONITOR



MONITOR



MONITORING PROCESS

- Monitor all communications between switches and controller
- Parse and collect some communication information
 - Flow table on each switch
 - FlowMod message : Match / Action

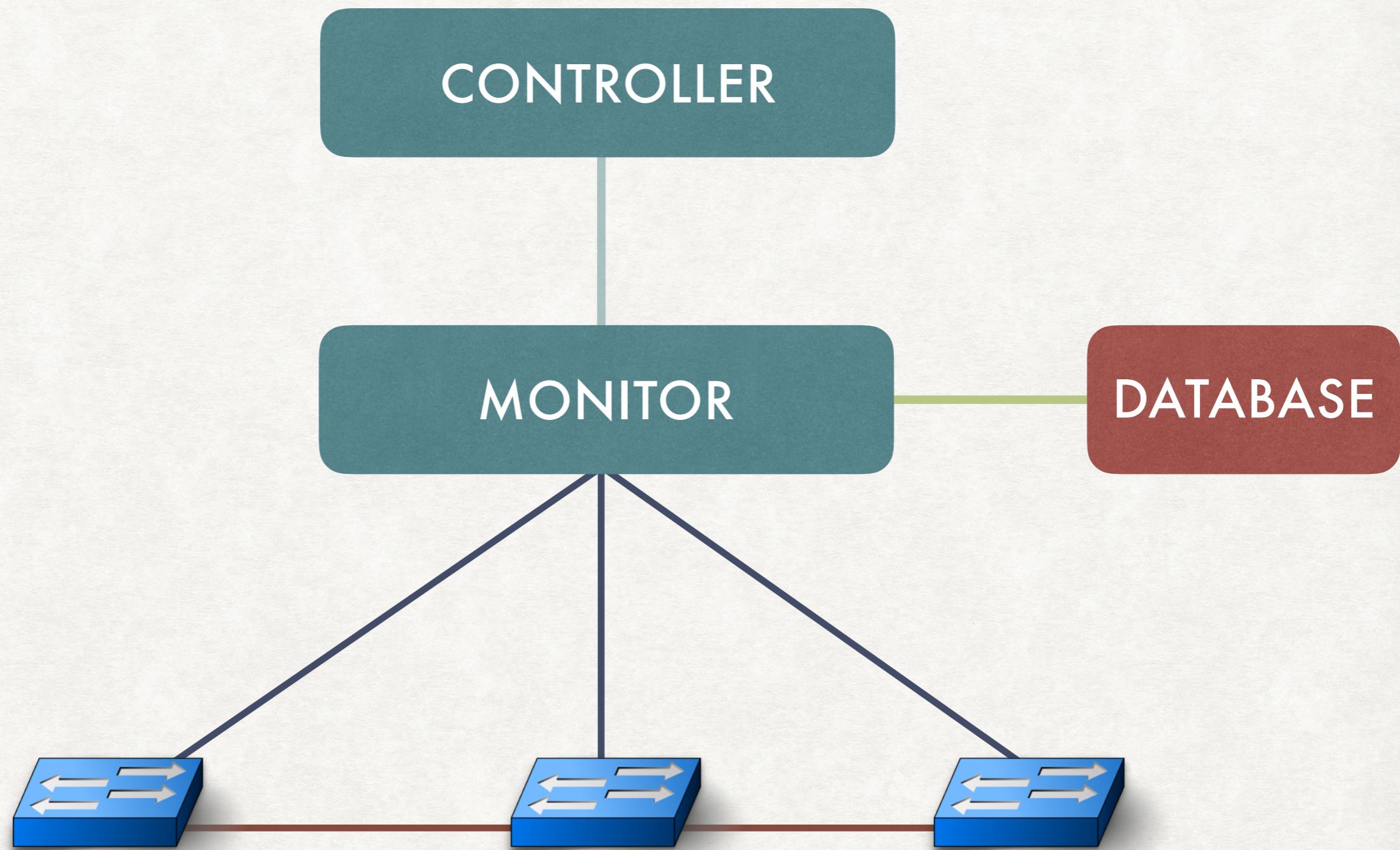
MONITORING PROCESS

- Monitor all communications between switches and controller
- Parse and collect some communication information
 - Flow table on each switch
 - FlowMod message : Match / Action
 - Network graph topology

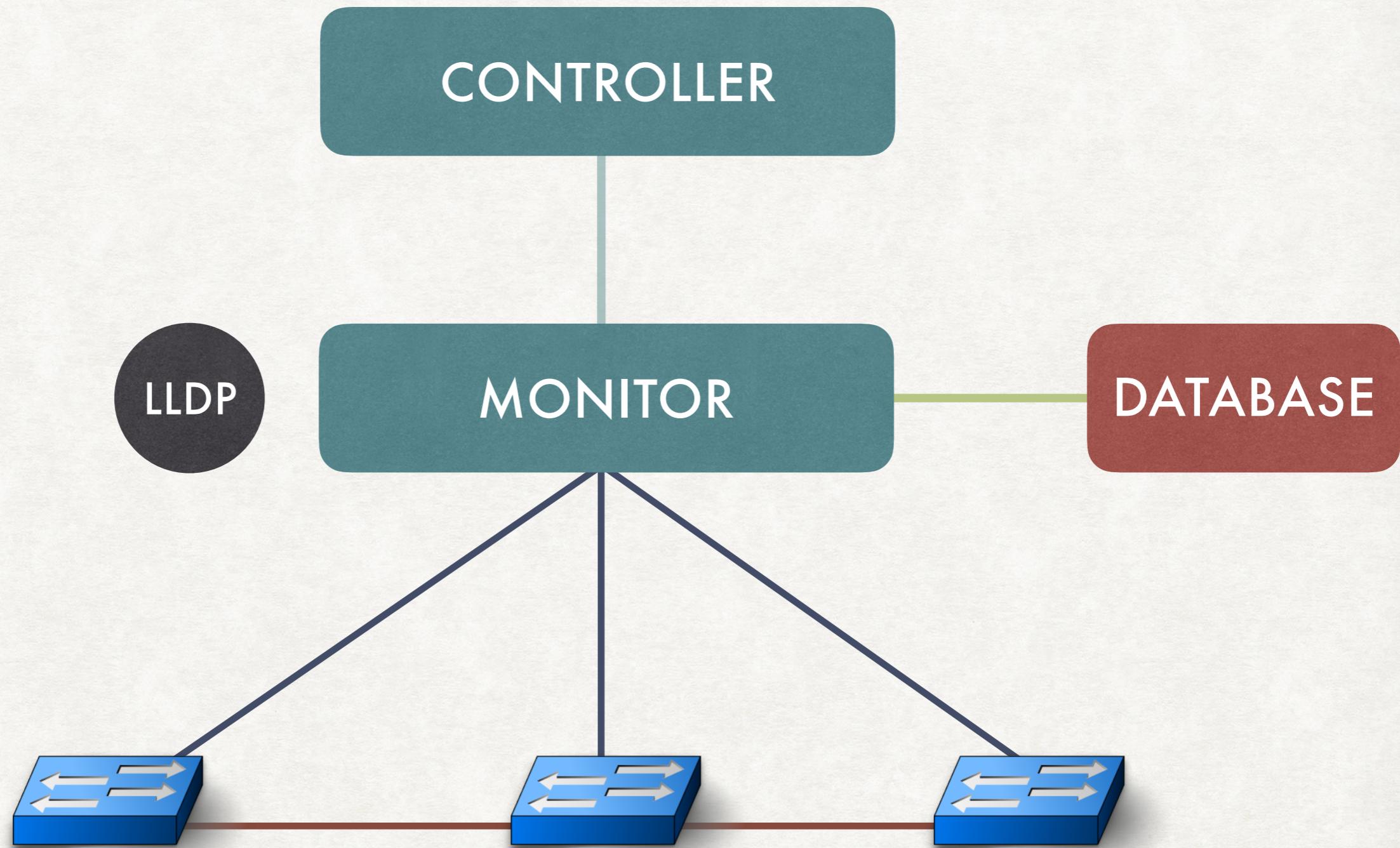
MONITORING PROCESS

- Monitor all communications between switches and controller
- Parse and collect some communication information
 - Flow table on each switch
 - FlowMod message : Match / Action
 - Network graph topology
 - LLDP packet : Switch ID / Port

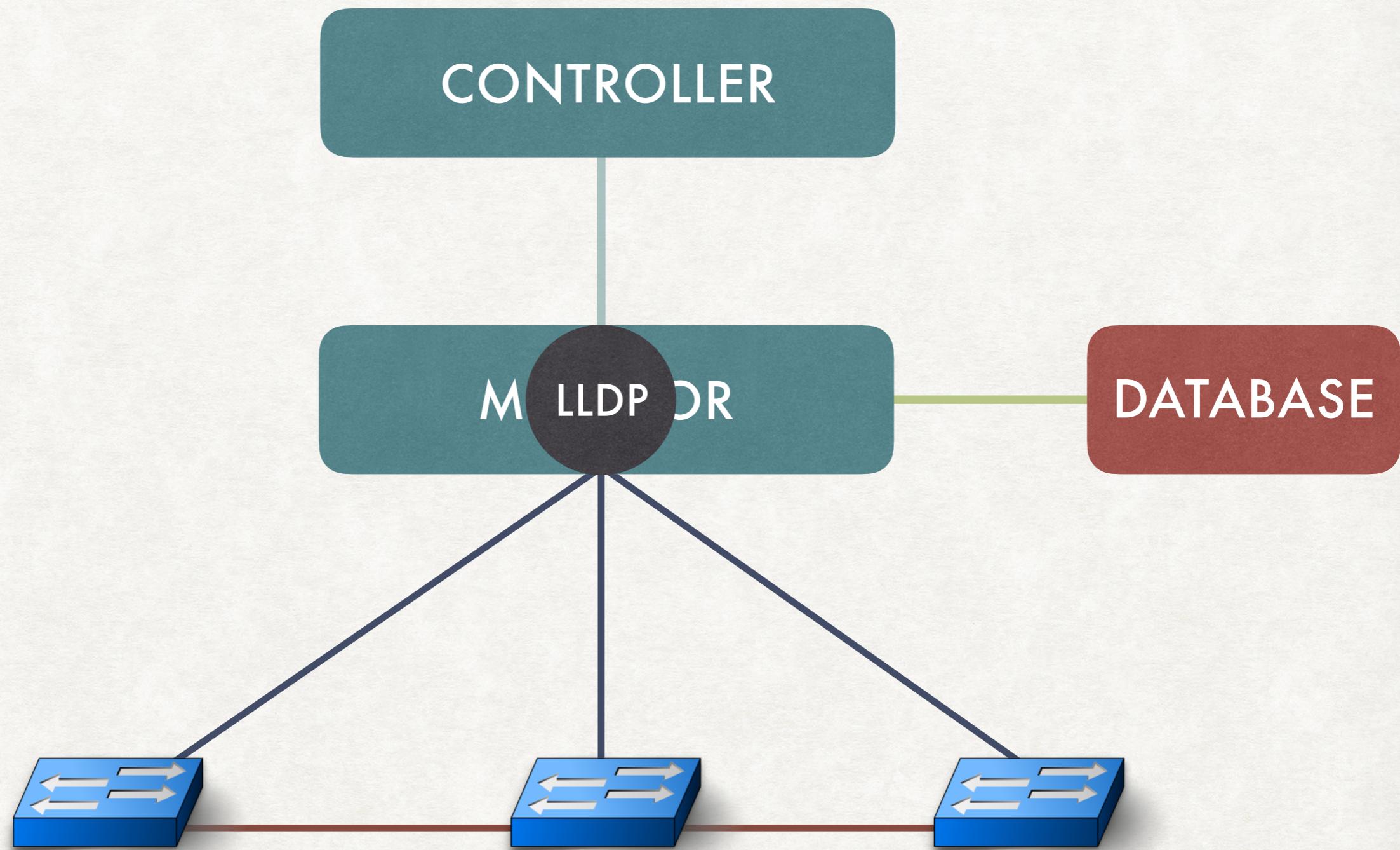
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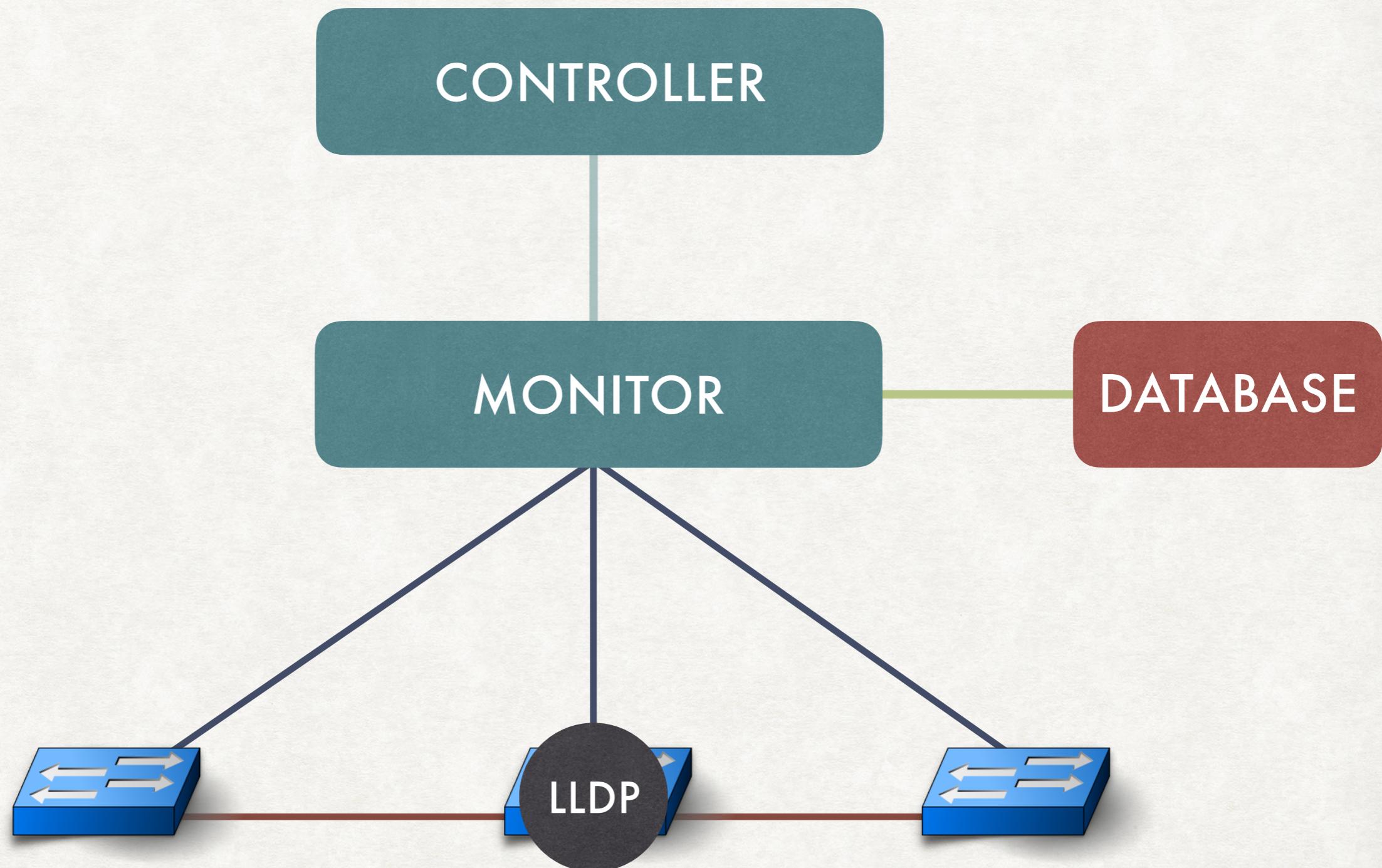
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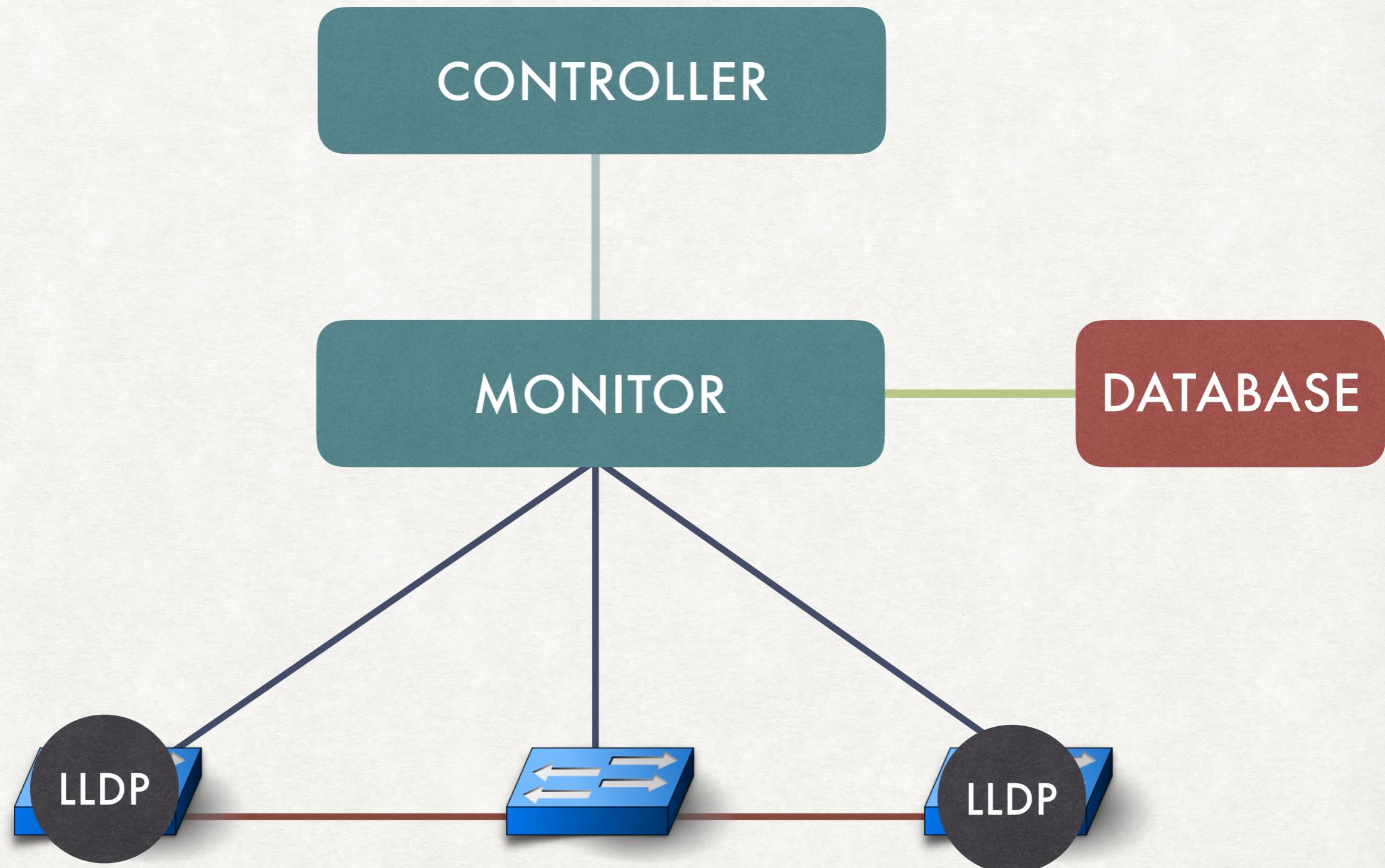
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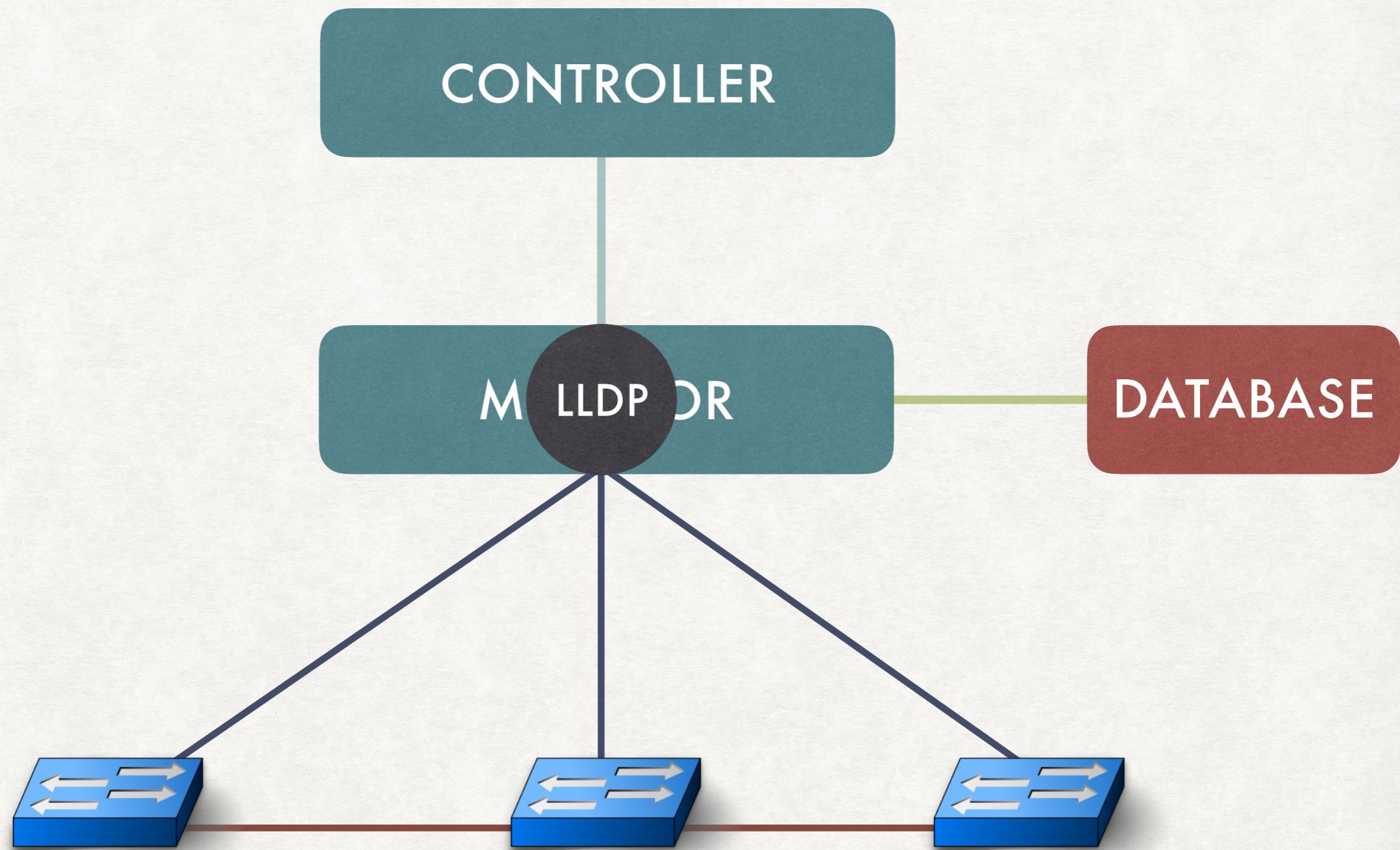
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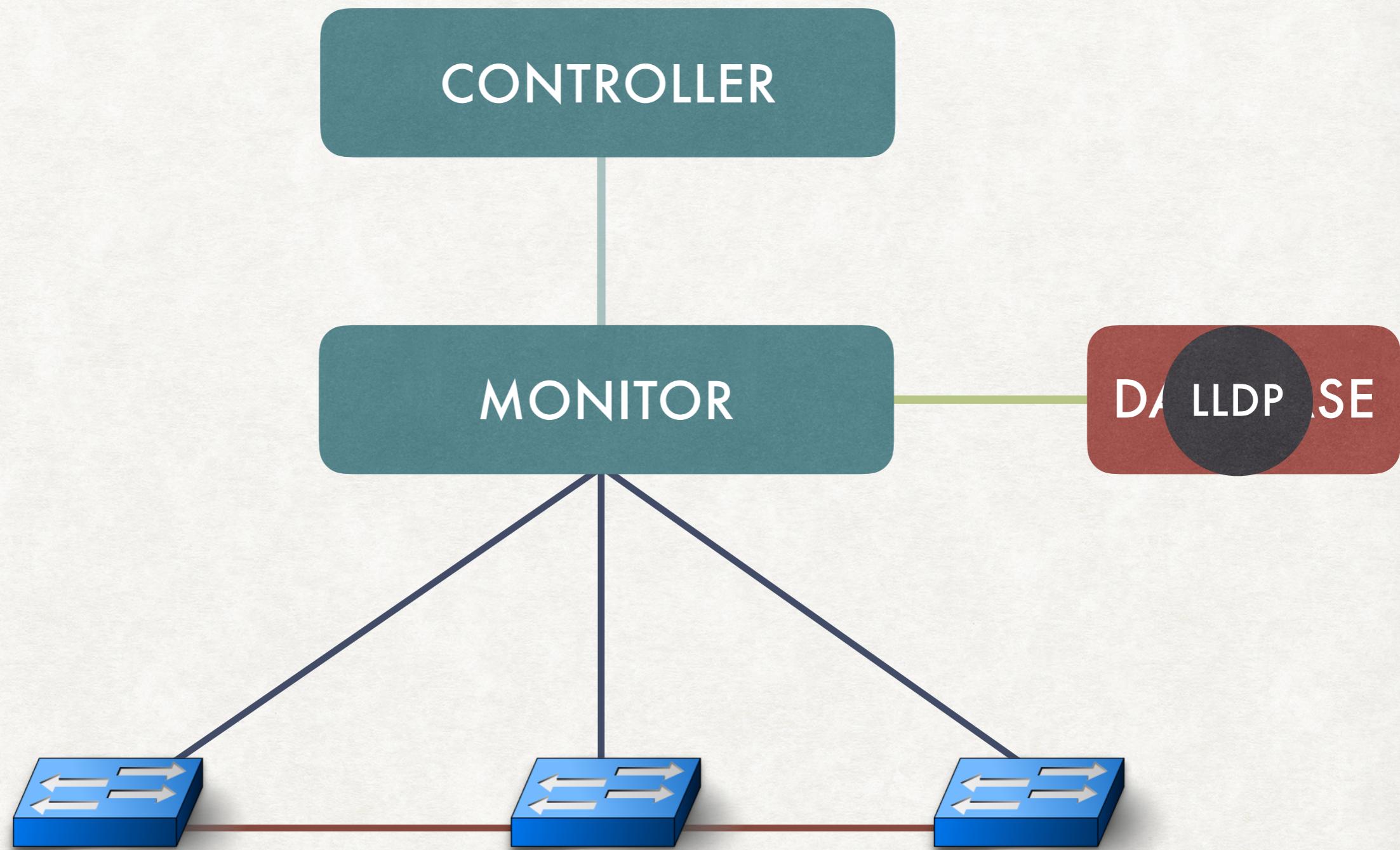
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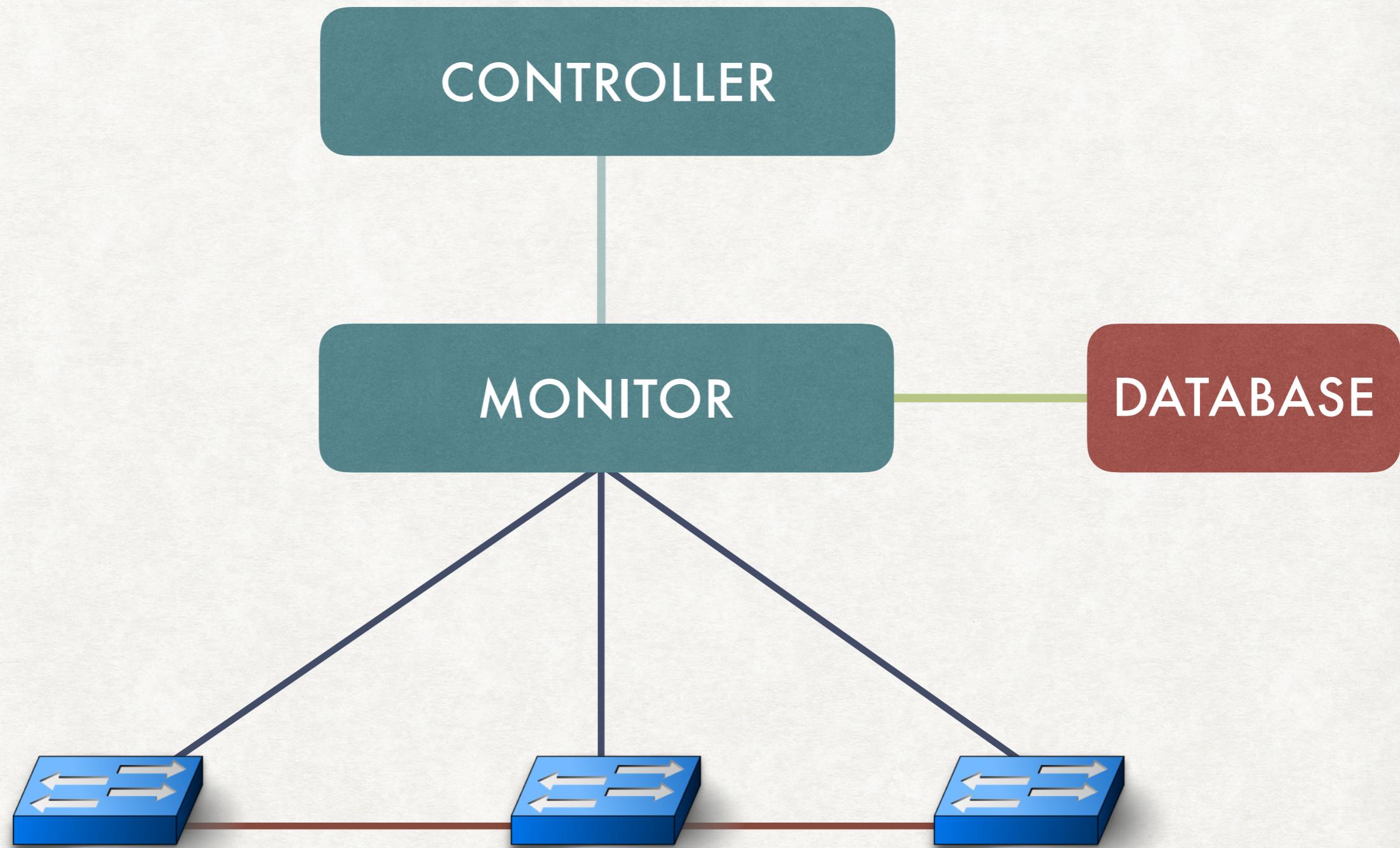
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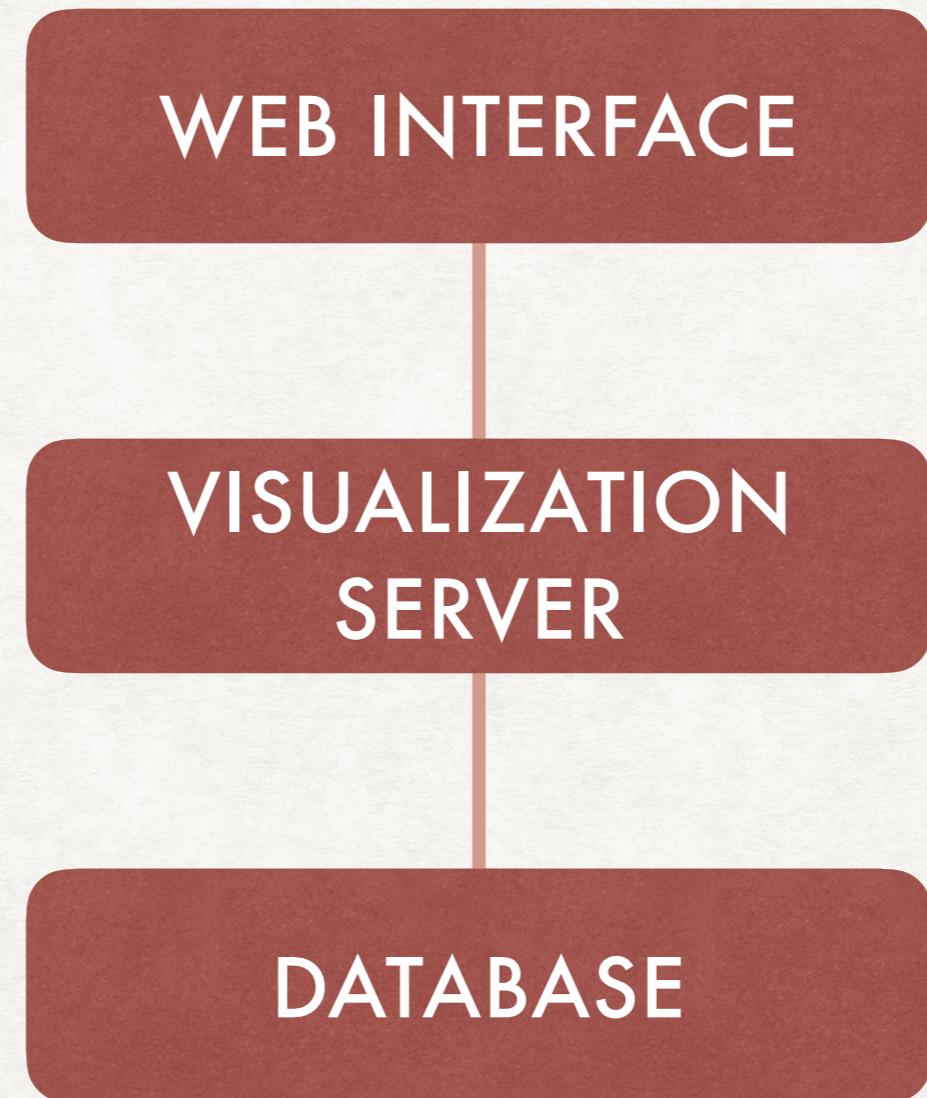
MONITOR



MONITOR



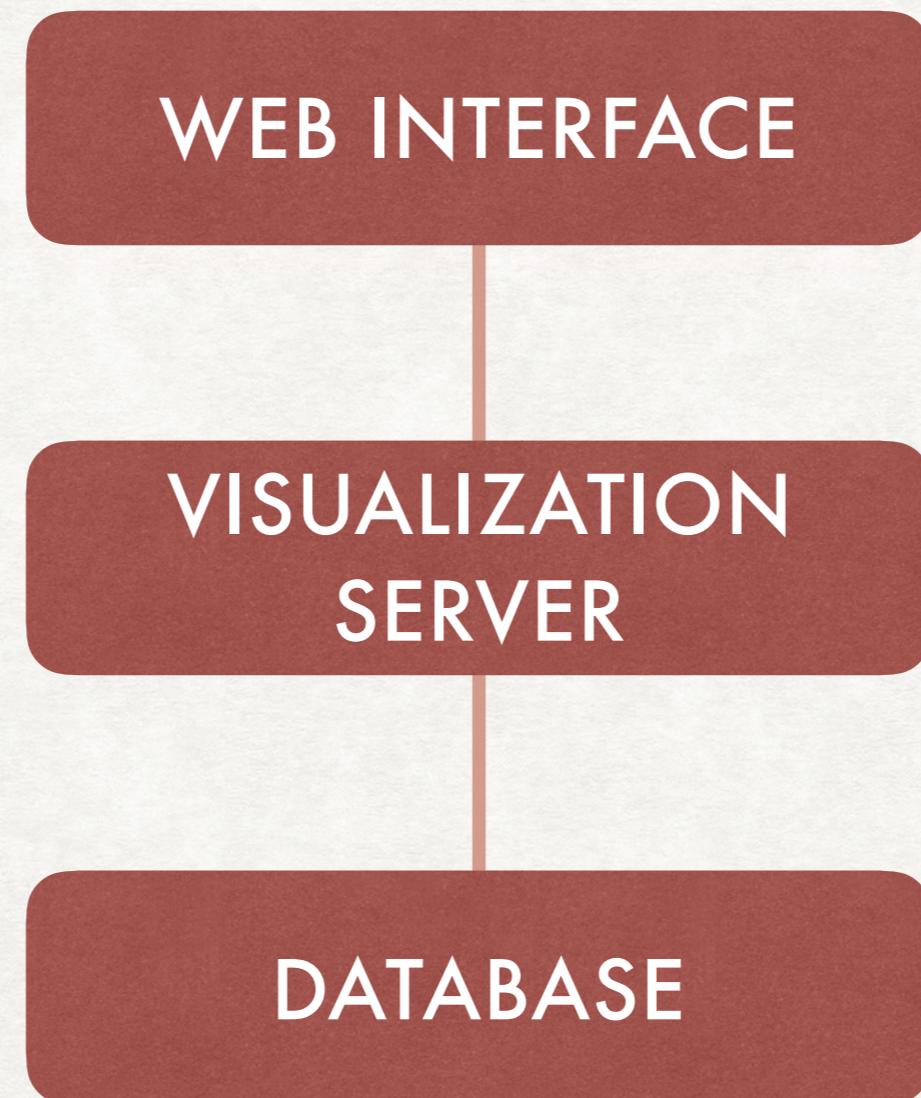
VISUALIZATION PART



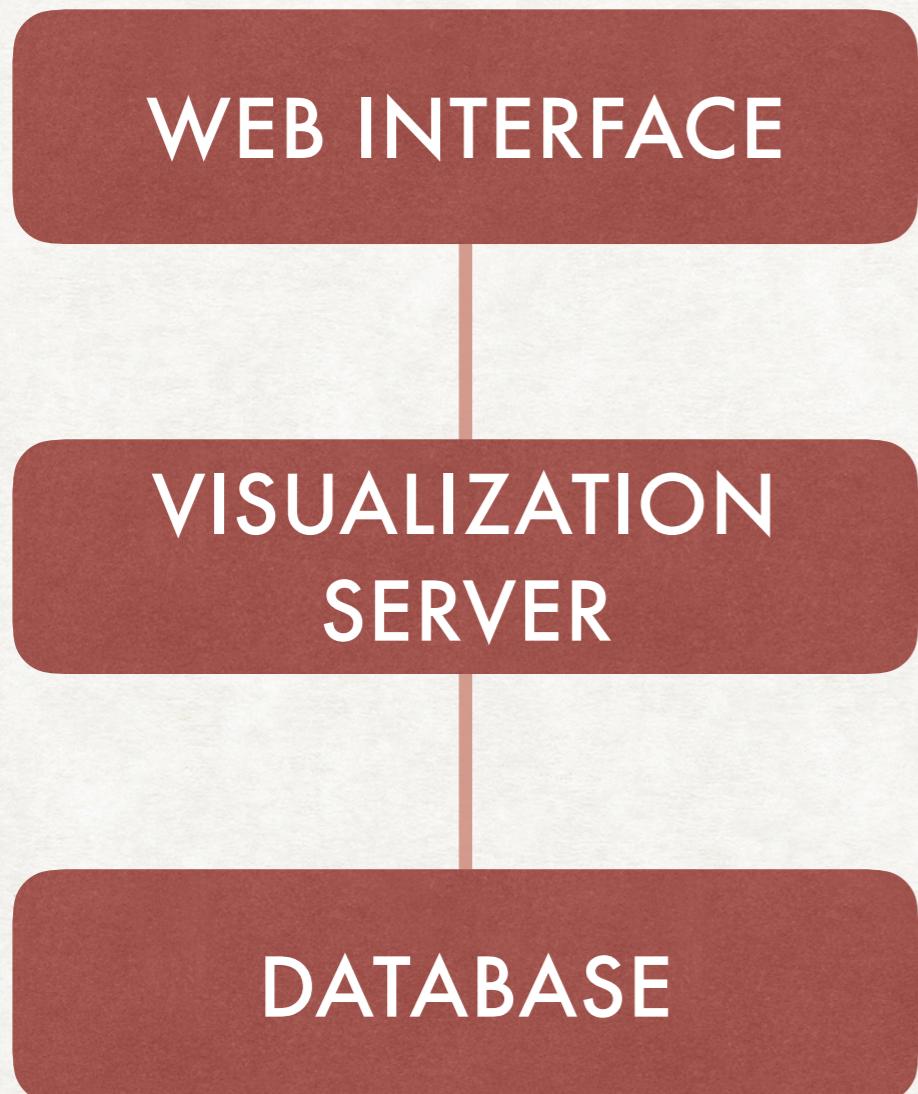
VISUALIZATION PROCESS

- Database collect the monitoring information
- Visualize Server transform the data into visualization ready format
- Web Interface draw topology and table from the data

VISUALIZE



VISUALIZE



VISUALIZE

WEB INTERFACE

VISUALIZATION SERVER

DATABASE

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VISUALIZE

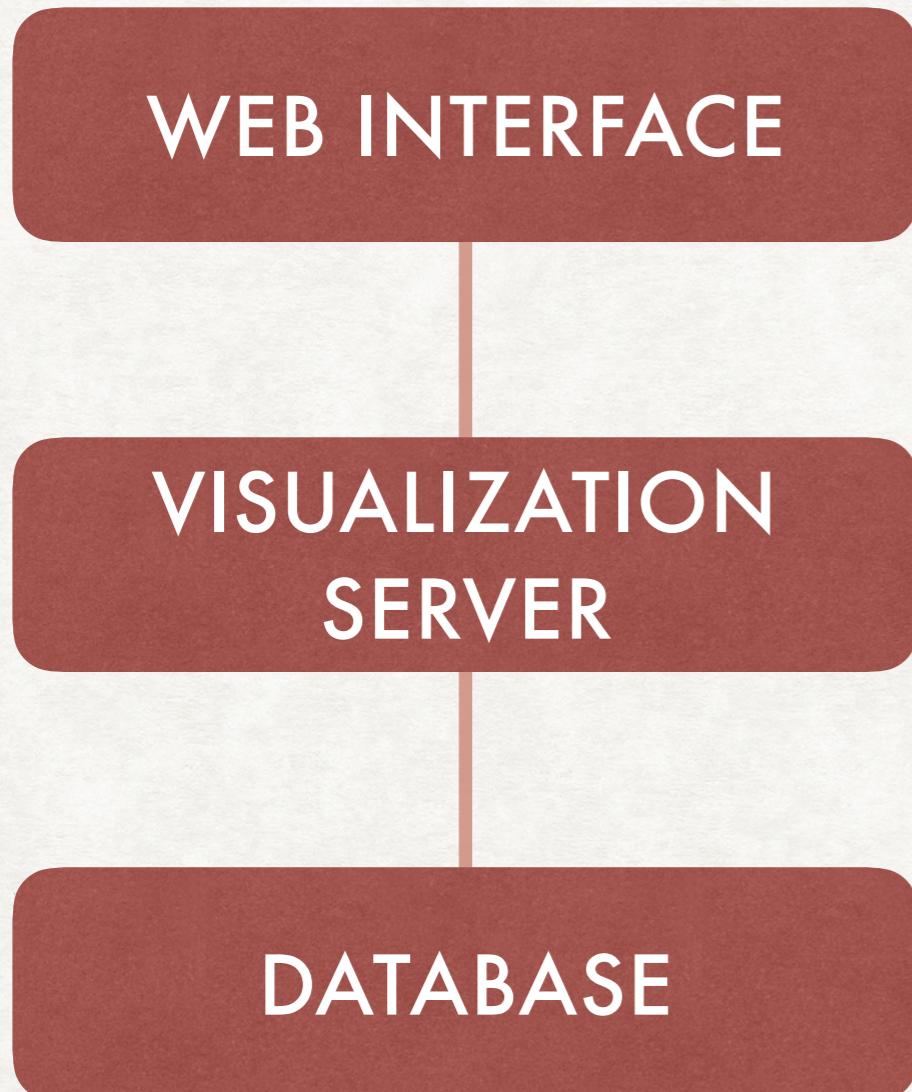
WEB INTERFACE

VISUALIZATION
SERVER

DATABASE

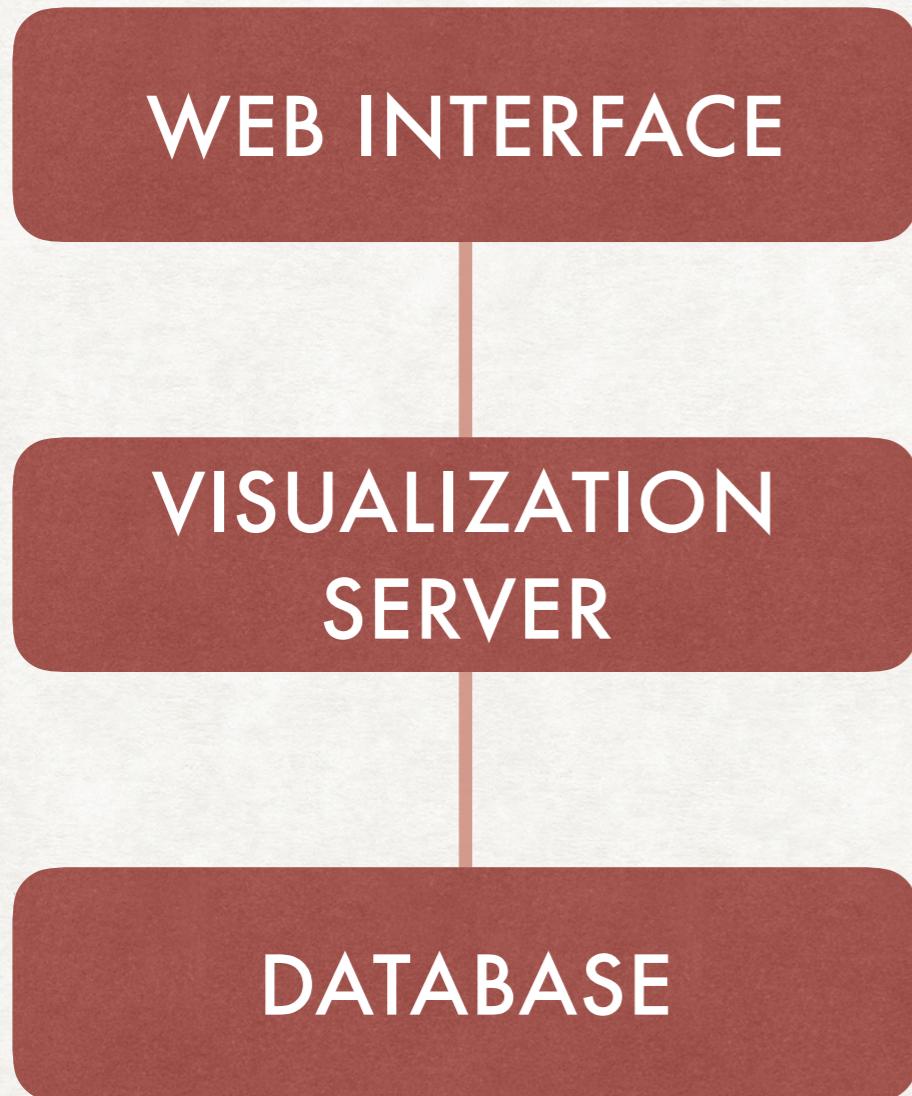
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VISUALIZE



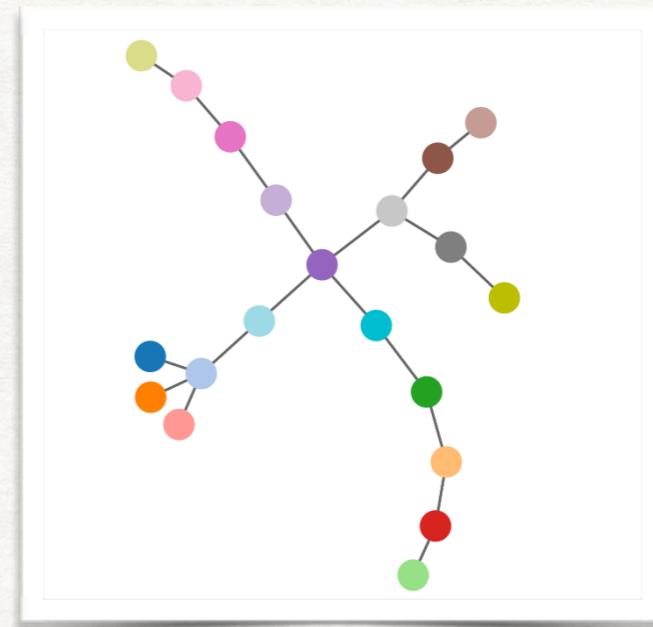
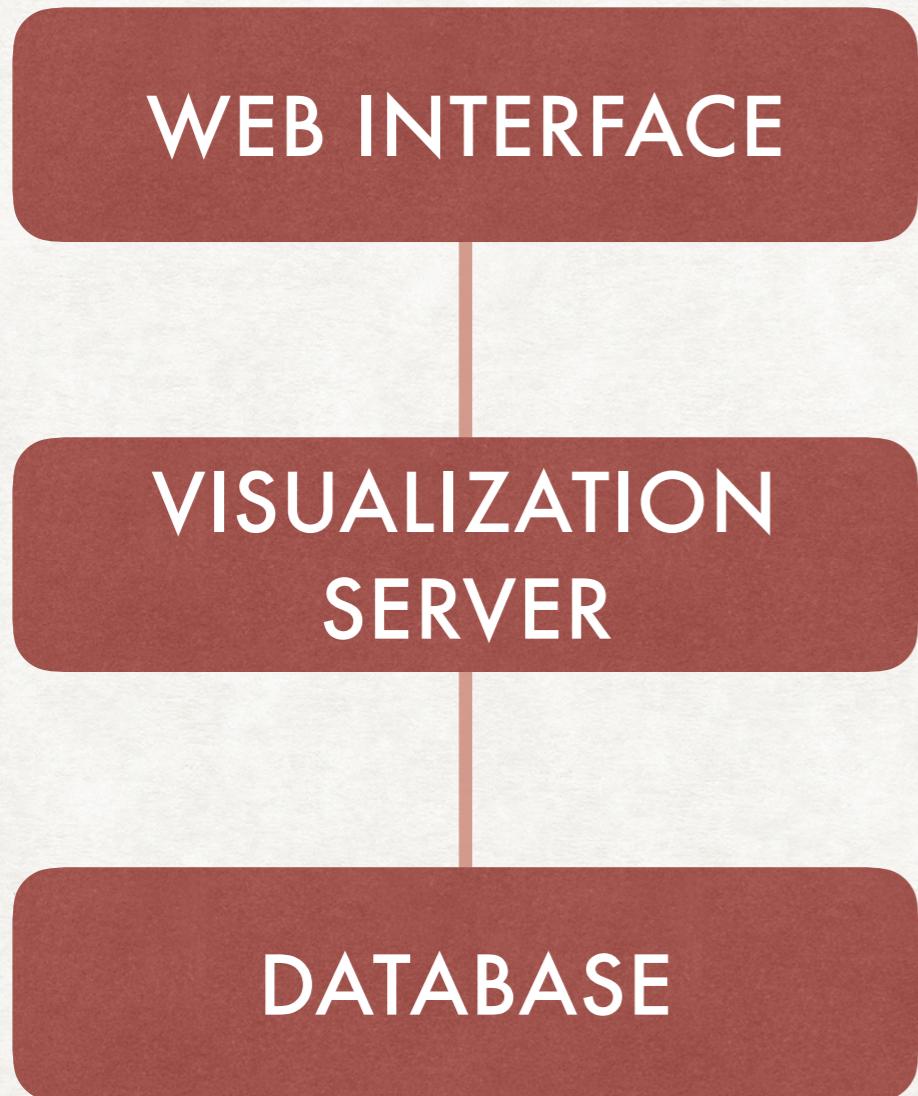
Source	Port	Destination	Port
A	2	B	4
A	1	C	3

VISUALIZE



Source	Port	Destination	Port
A	2	B	4
A	1	C	3

VISUALIZE



CONFIGURATIONS

- Monitoring Tools
 - Address and port of OpenFlow Network
 - Address and port of Controller
 - Require Ryu Library
- Visualization Server
 - Port of web interface
 - Require Node.js
- Require MongoDB as Database

LIVE DEMO

LIVE DEMO

sd-lemon.naist.jp:3000

Wassapon

OpenFlow Monitor

Switch ID : 0x1018c1900e (NAIST (sd-lemon))

Switch Detail

Port	MAC Address
2	00:10:18:c1:90:0e
25	fe:54:00:29:15:2c
26	5a:d7:9f:52:41:8f
27	8e:52:0f:83:20:42
28	fe:54:00:09:fb:95
29	52:36:7c:c9:73:af
33	5e:b7:85:99:ce:cd
34	6a:bc:da:f9:d5:51
65534	00:10:18:c1:90:0e

Flow Table

Time : Wed Jul 27 2016 15:17:32 GMT+0900 (JST)

Match	Actions
<ul style="list-style-type: none"> Wildcard : 3145954 Switch Input Port : 26 Source MAC Address : 8a:4a:58:e1:2b:4f Destination MAC Address : 52:36:7c:c9:73:af Ethernet Frame Type : 2048 Source IP Address : 10.99.2.2 Destination IP Address : 10.99.1.1 Idle Timeout : 62 Hard Timeout : 0 	<ul style="list-style-type: none"> Type : 0 (OFPActionOutput) Switch Output Port : 29 Max Length : 65535
<ul style="list-style-type: none"> Wildcard : 3145954 Switch Input Port : 29 Source MAC Address : 52:36:7c:c9:73:af Destination MAC Address : 8a:4a:58:e1:2b:4f Ethernet Frame Type : 2048 Source IP Address : 10.99.1.1 Destination IP Address : 10.99.2.2 Idle Timeout : 61 Hard Timeout : 0 	<ul style="list-style-type: none"> Type : 0 (OFPActionOutput) Switch Output Port : 26 Max Length : 65535

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CONCLUSION

- Developed OpenFlow monitoring and visualization tool
- Display network information (topology and flow table) in real-time

CONCLUSION

- Developed OpenFlow monitoring and visualization tool
- Display network information (topology and flow table) in real-time
- Future Works
 - Support newer version of OpenFlow
 - API for other application to get data from the system
 - Export current network topology in mininet format
 - Improve User Interface on Dashboard

THANK YOU