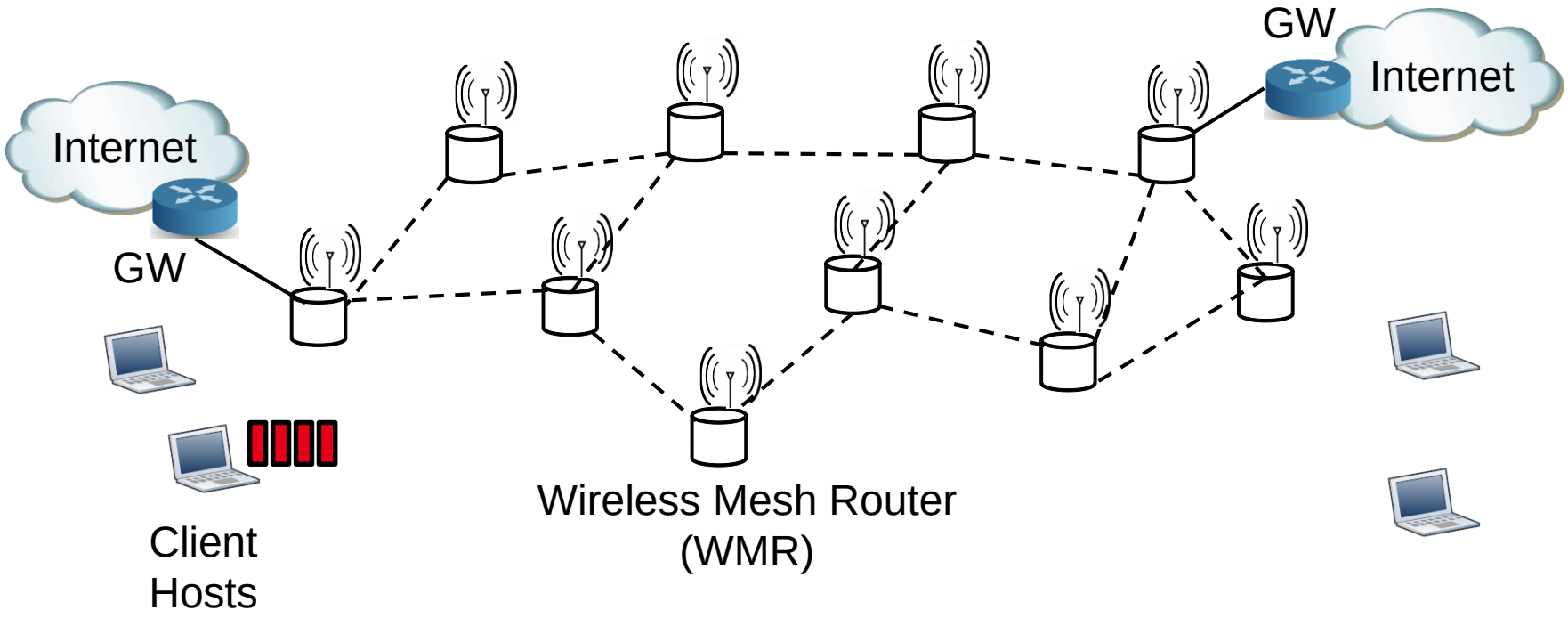
SELF-CONGURATION MECHANISMS FOR SDN DEPLOYMENT IN WMNS

Mohamed LABRAOUI

CEA supervisor: Michael BOC – DIASI/LSC
Thesis supervisor: Anne FLADENMULLER – LIP6/CNRS

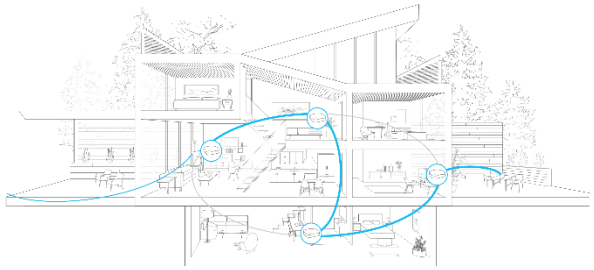
SDN DAY **NOVEMBER 23, 2017**

CONTEXT : WIRELESS MESH NETWORK



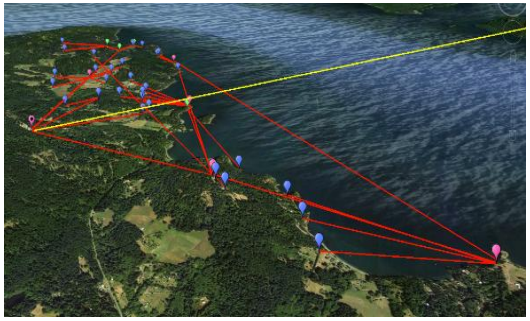
CONTEXT : WIRELESS MESH NETWORK

Home Networks



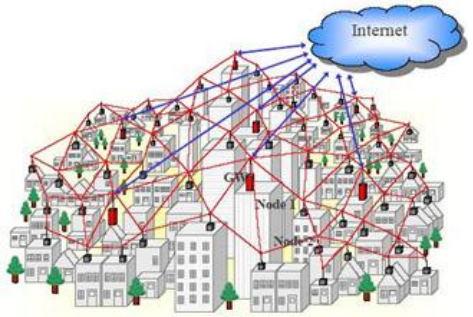
Google eero Plume

META MESH COMMOTION



Remote Areas

City Center

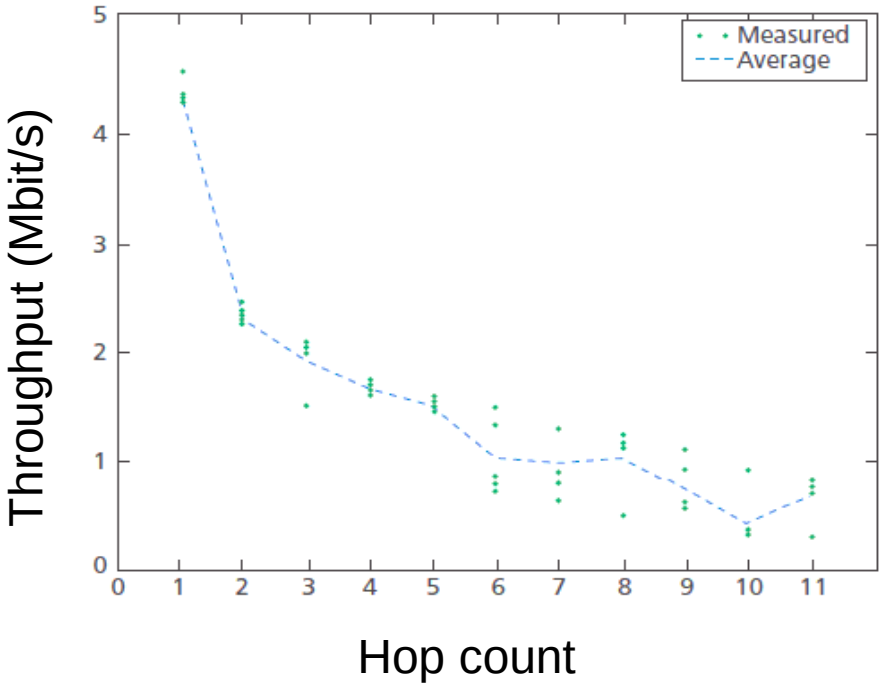


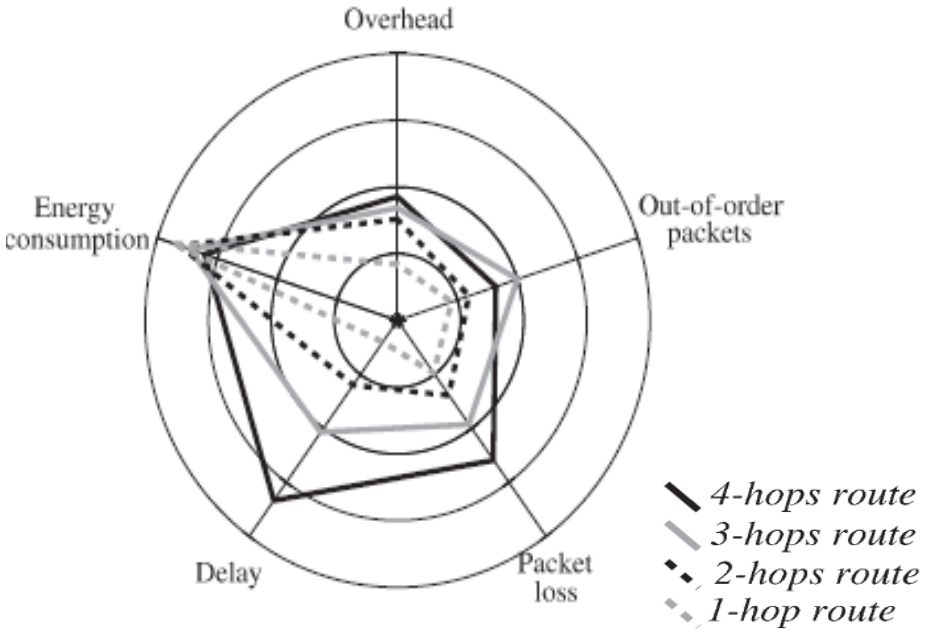
NOKIA MOTOROLA

NEXCOM FILAMENT ERICSSON

Factory Floors

CONTEXT : WIRELESS MESH NETWORK





- Scalability of routing protocols used in wireless mesh networks is a critical issue.
- There is still no routing metric able to capture the overall network state.
- Link failures or congestion often lead to service disruption in such networks .

How to help these routing protocols to gain visibility and reactivity ?

CONTEXT : WIRELESS MESH SOFTWARE DEFINED NETWORK

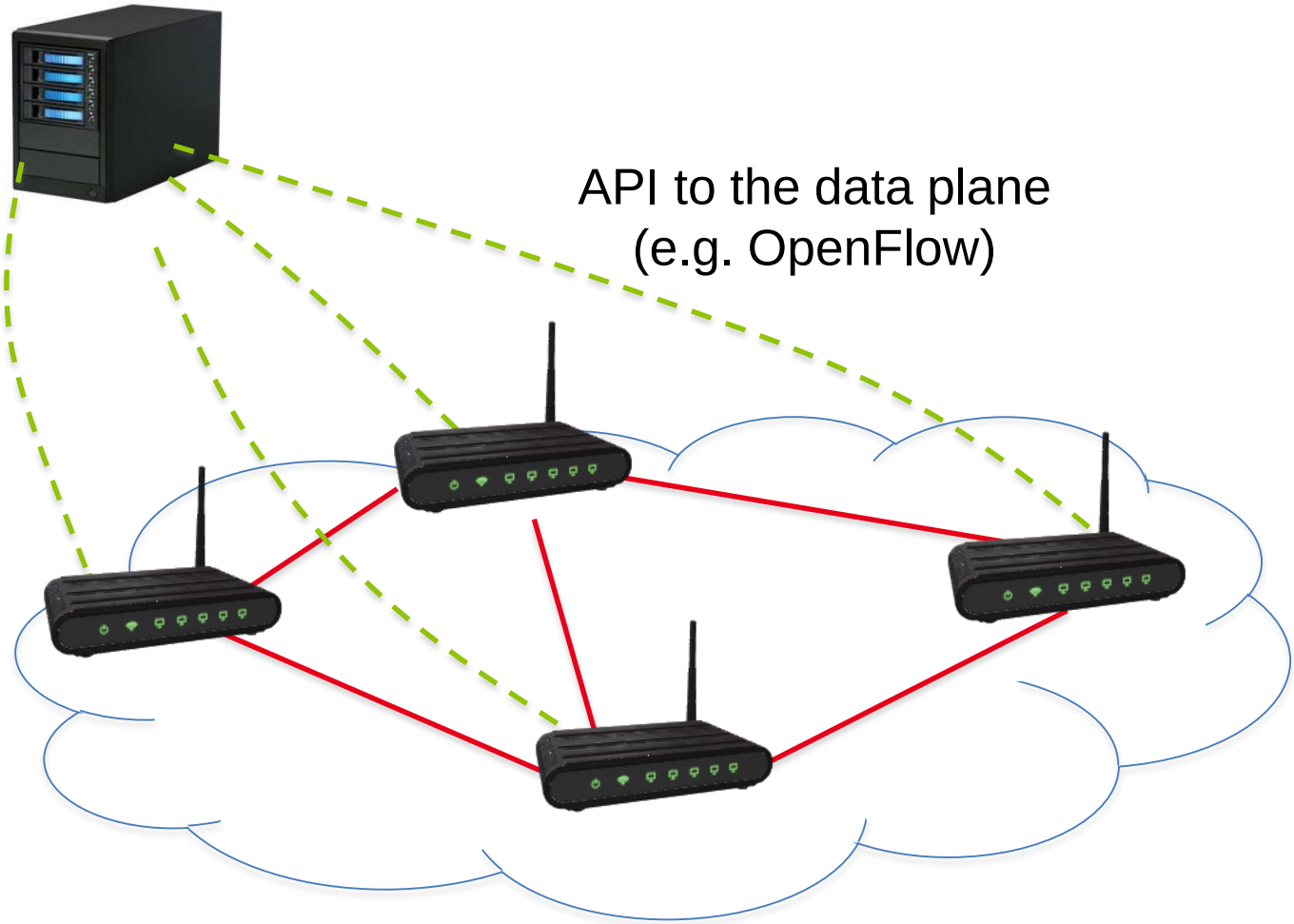
Control Plane

Separated

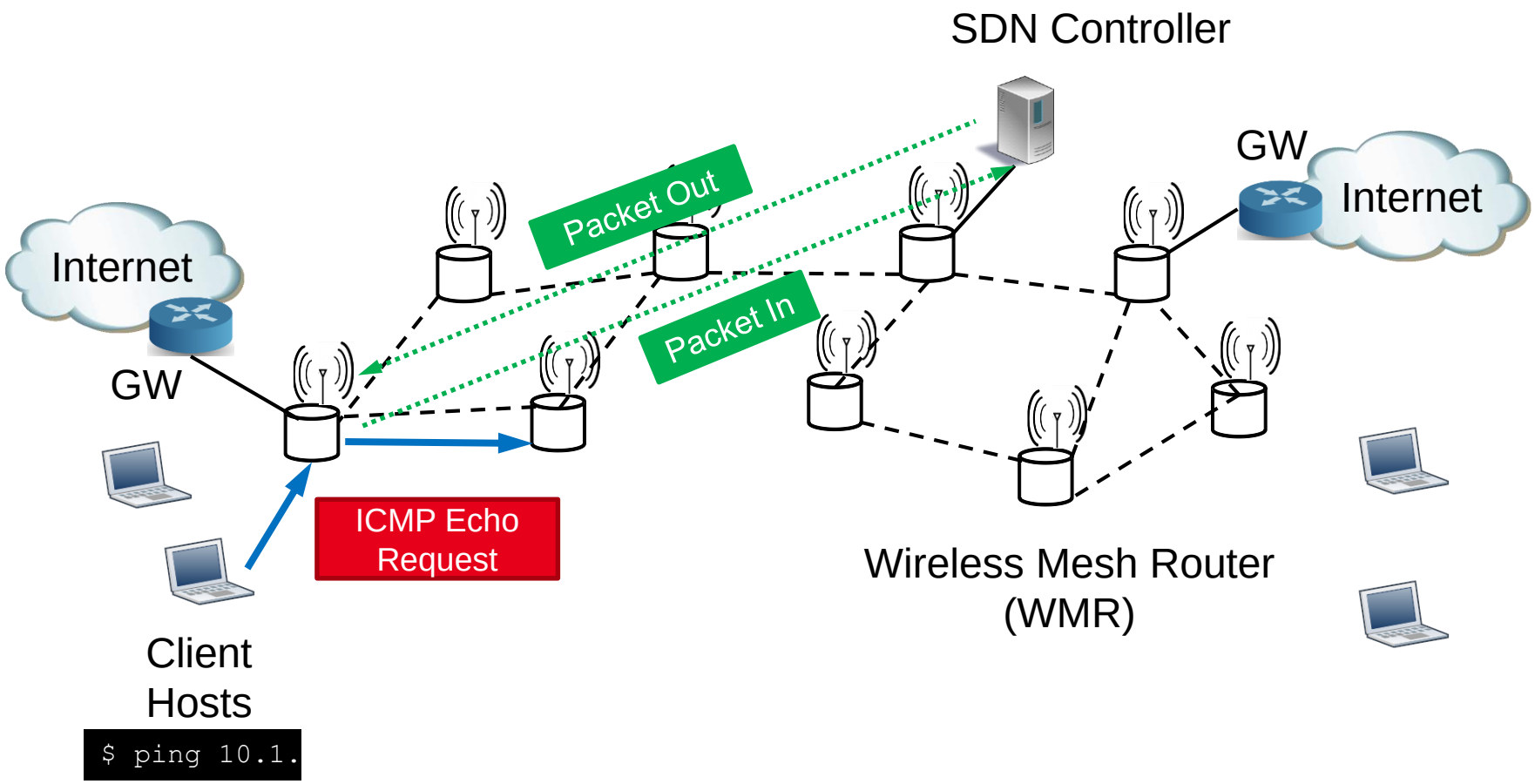
Data Plane

Logically-centralized control

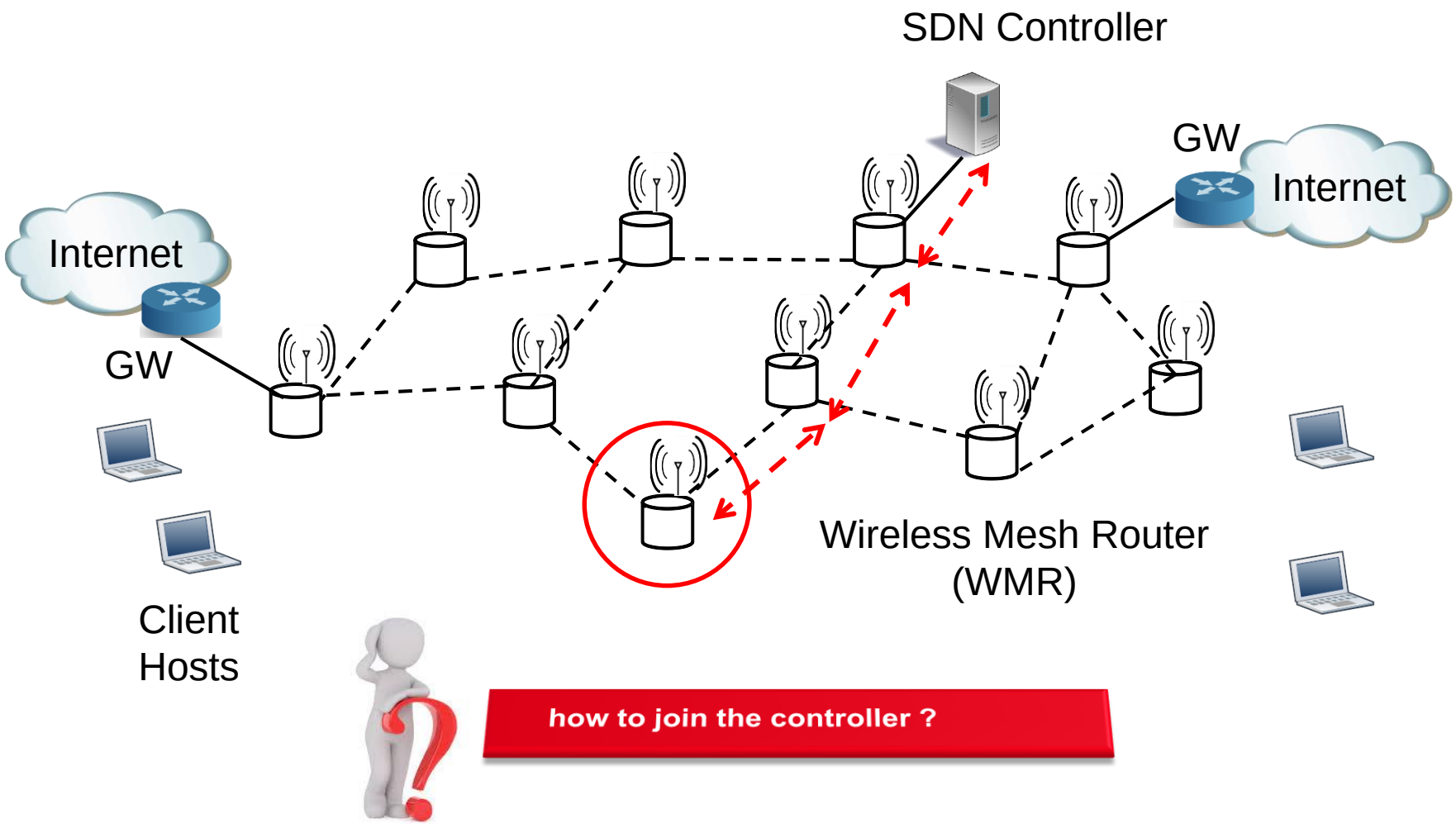
API to the data plane
(e.g. OpenFlow)



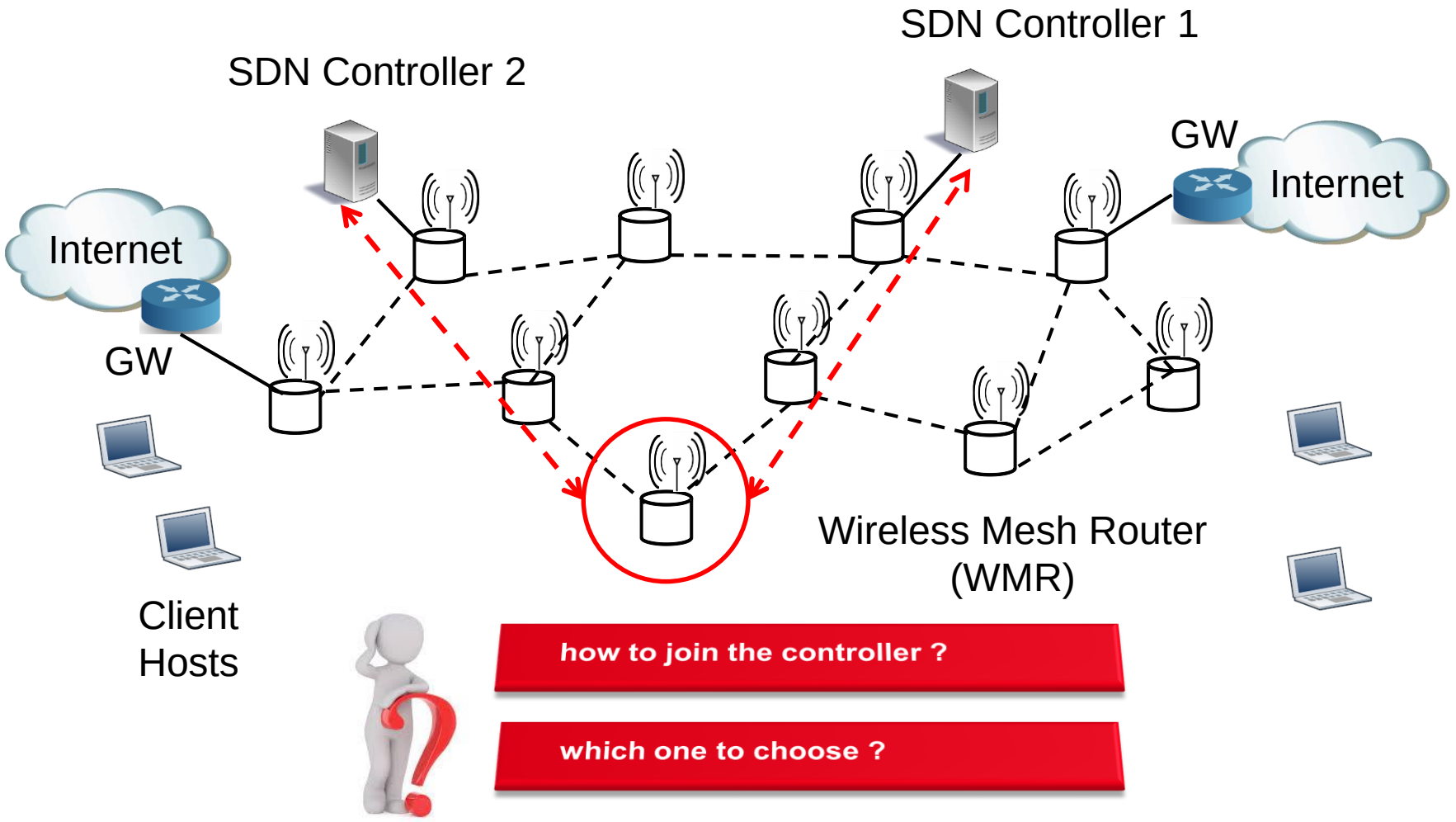
CONTEXT : WIRELESS MESH SOFTWARE DEFINED NETWORK



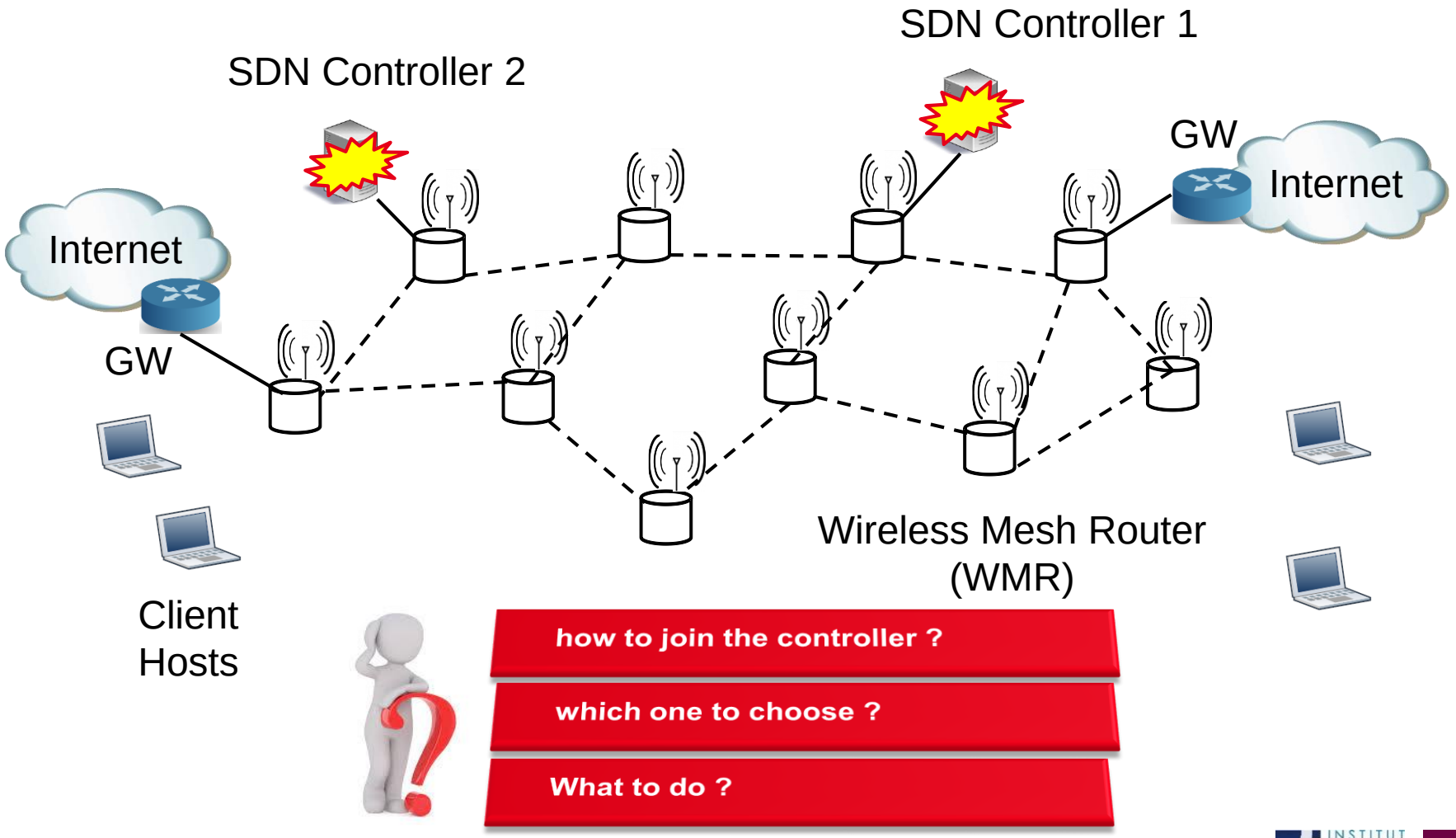
CONTEXT : WIRELESS MESH SOFTWARE DEFINED NETWORK



CONTEXT : WIRELESS MESH SOFTWARE DEFINED NETWORK

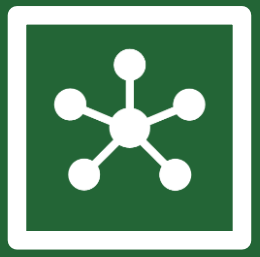


CONTEXT : WIRELESS MESH SOFTWARE DEFINED NETWORK



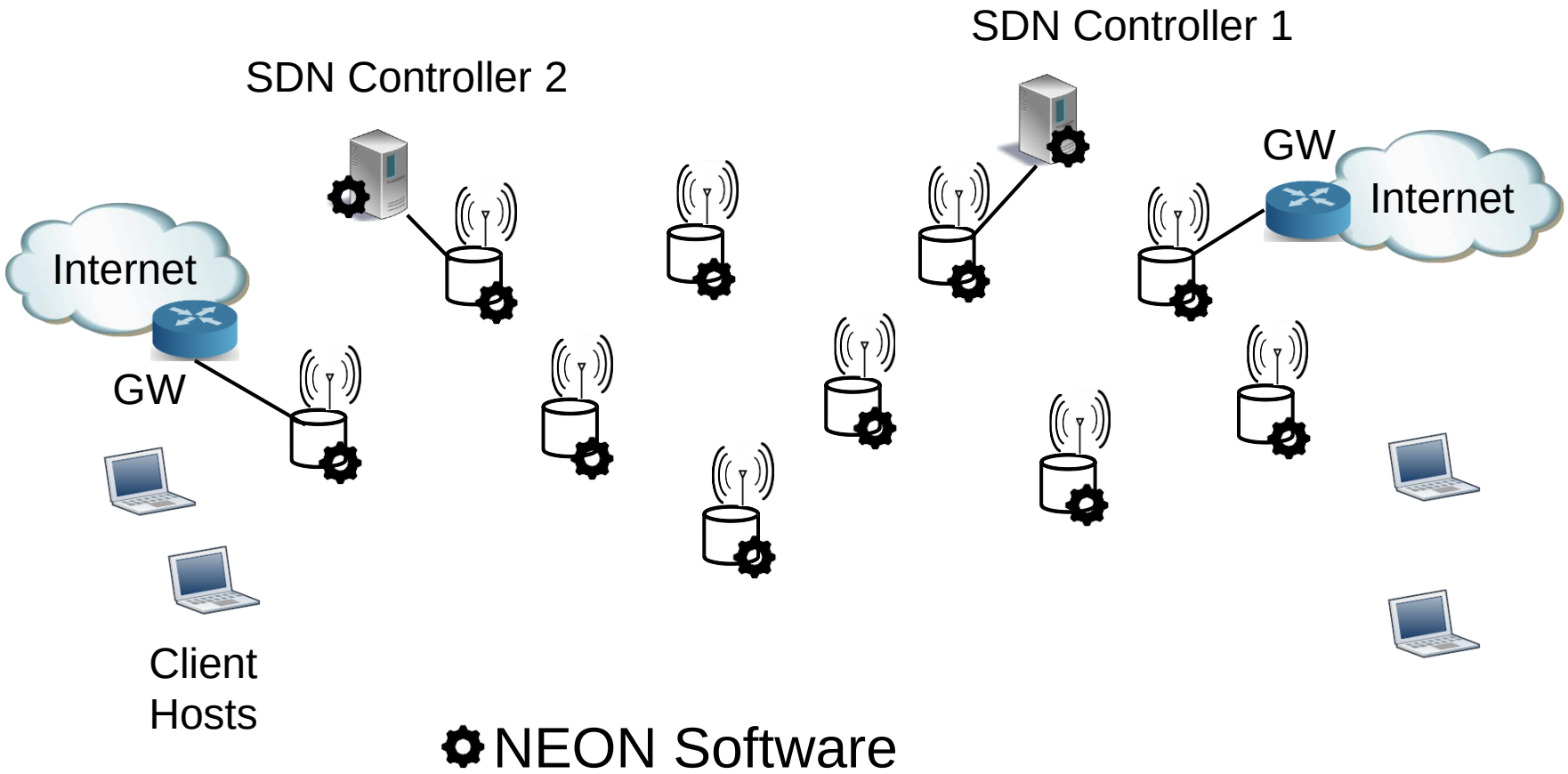
OBJECTIVES

- A mechanism to allow WMRs (Wireless Mesh Routers) to discover SDN controllers present in the network.
- A solution to elect the master controller in a scenario with multiple concurrent SDN controllers.
- A mechanism to set up an SDN controller on the fly among the WMRs when necessary (in case of controllers unavailability).

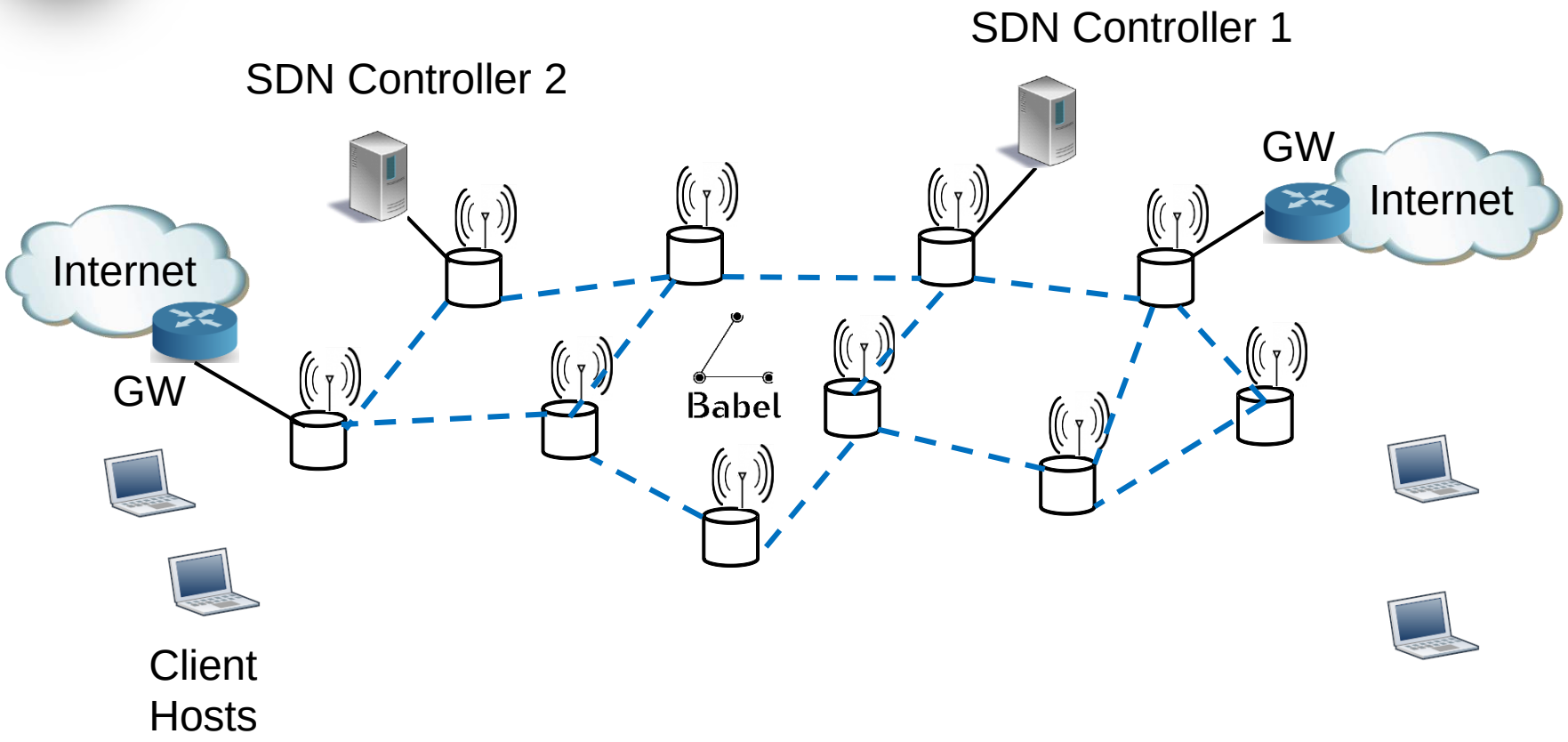


SDN DEPLOYMENT

NETWORK ARCHITECTURE SCENARIO

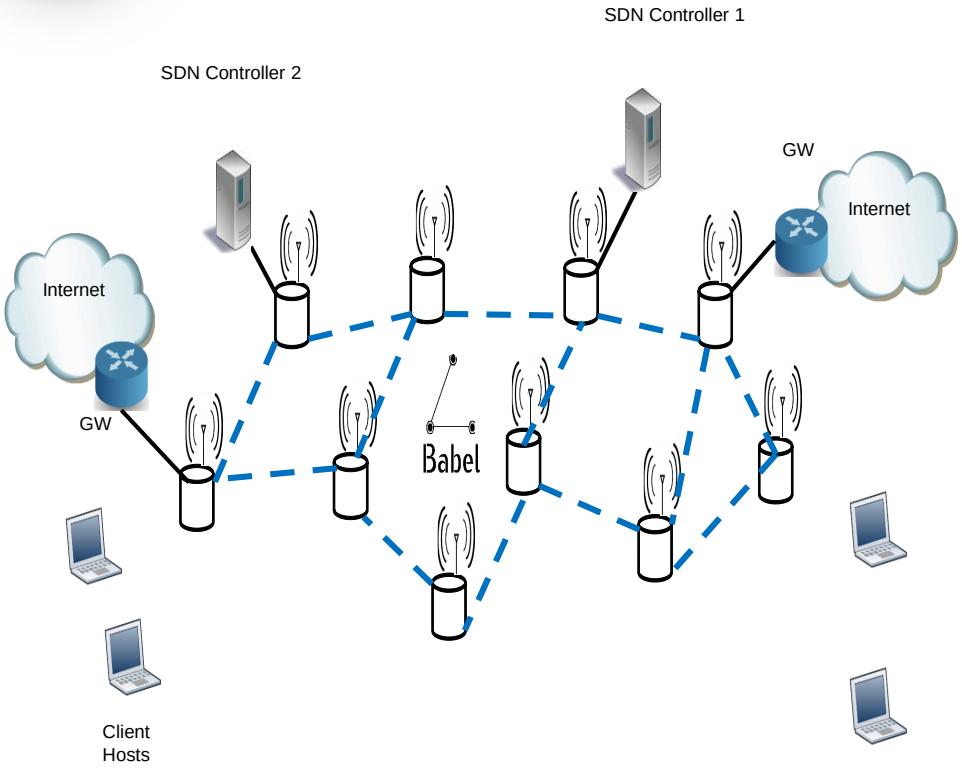


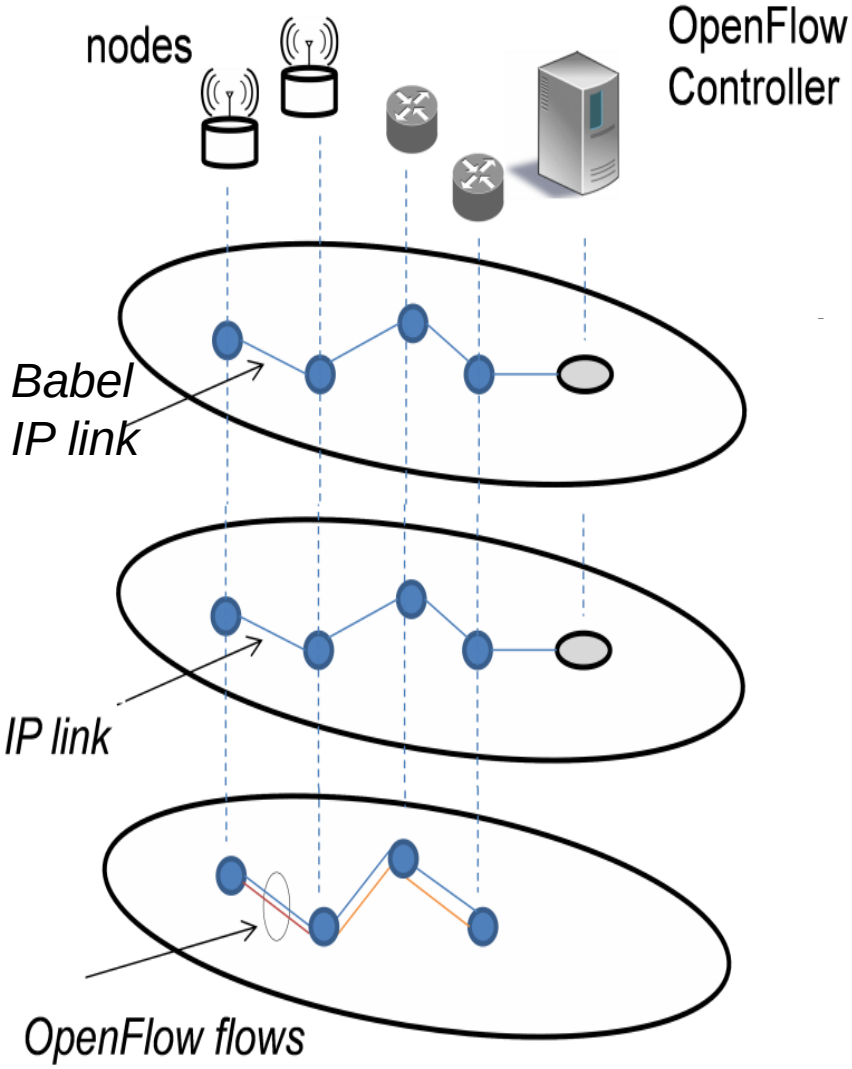
01 Mesh networking



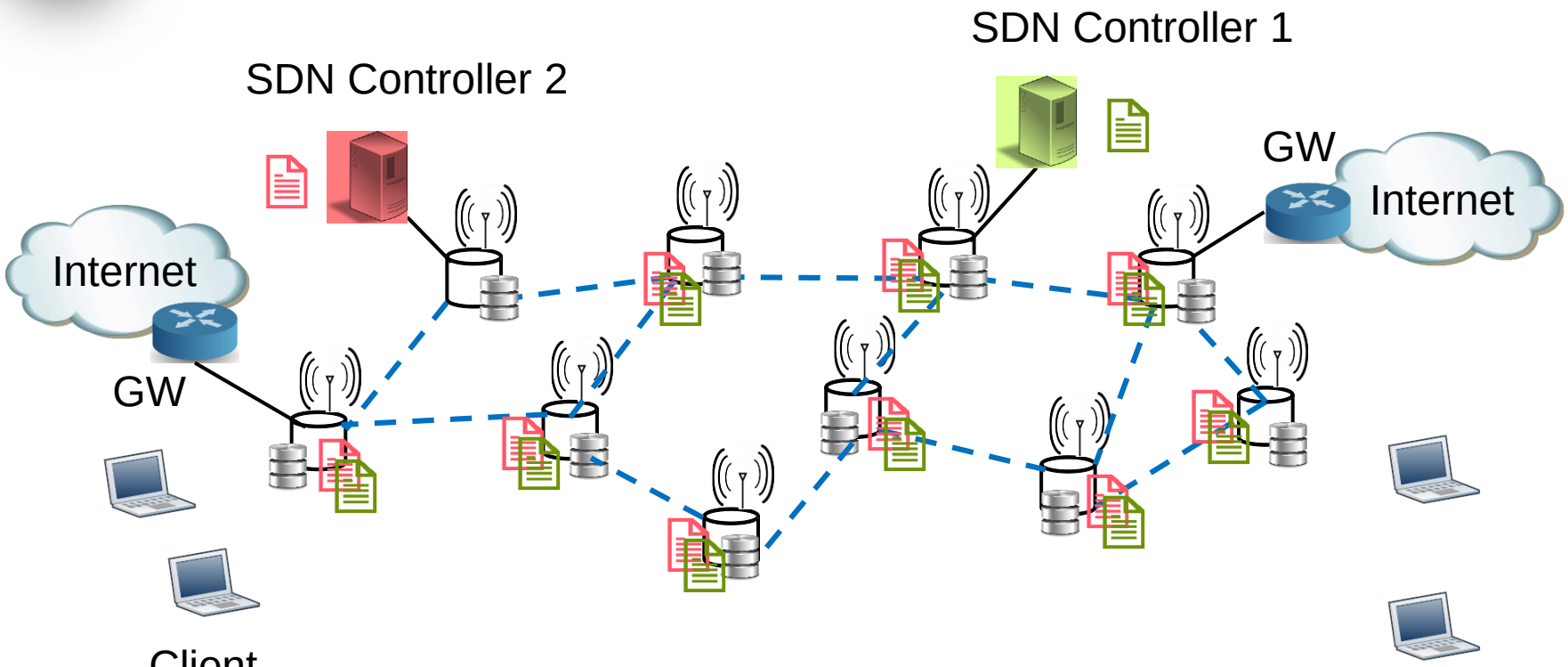
SDN DEPLOYMENT

01 Mesh networking

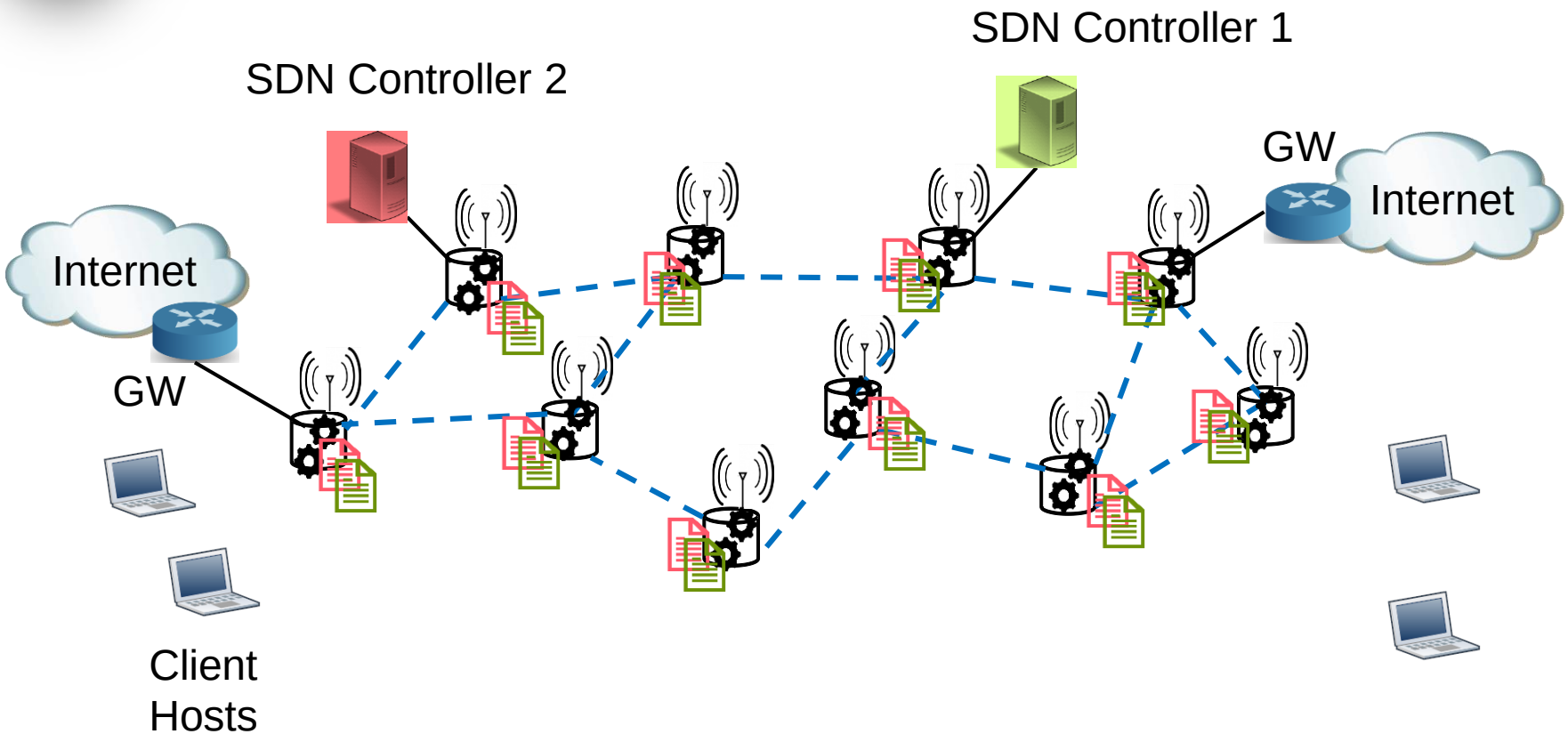




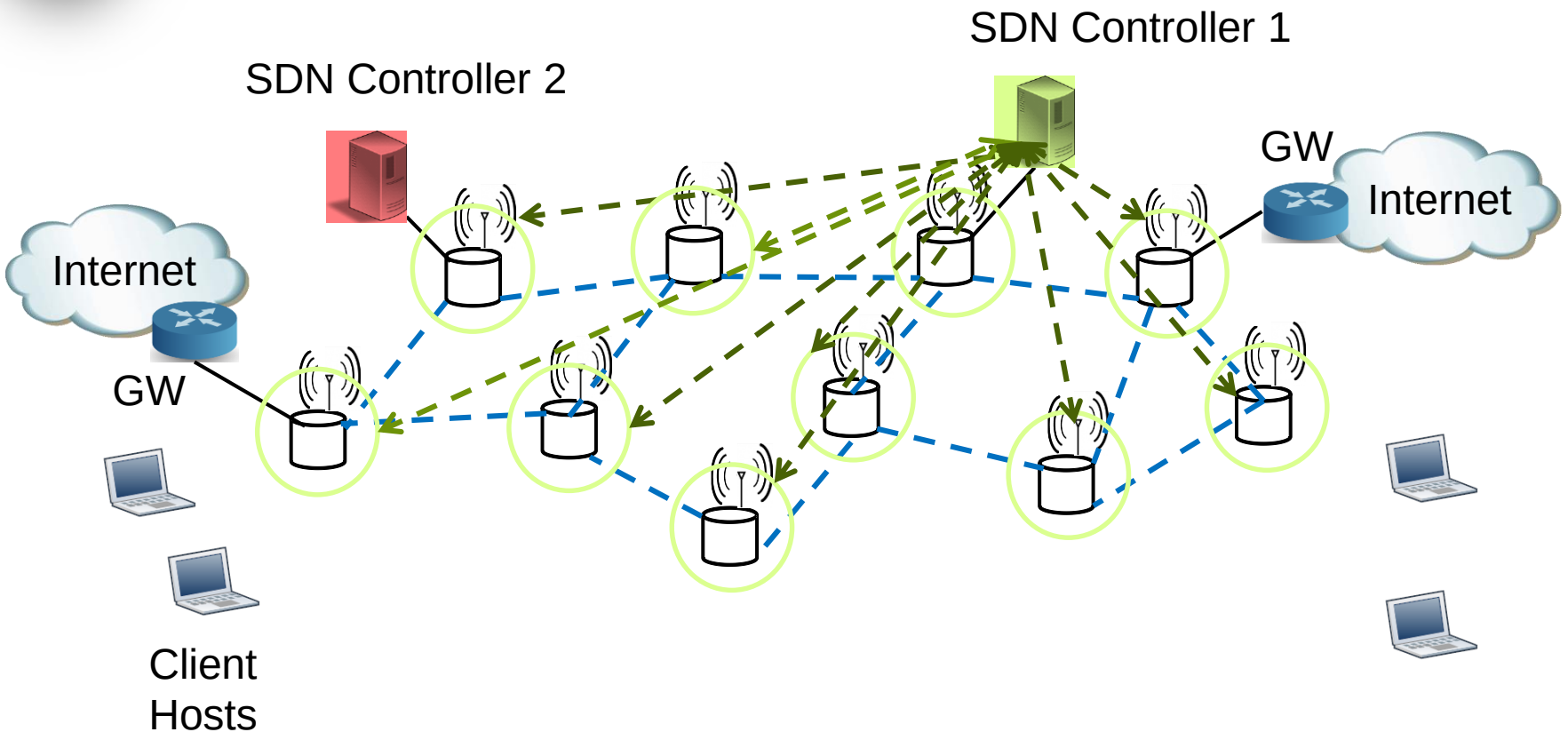
02 Broadcasting



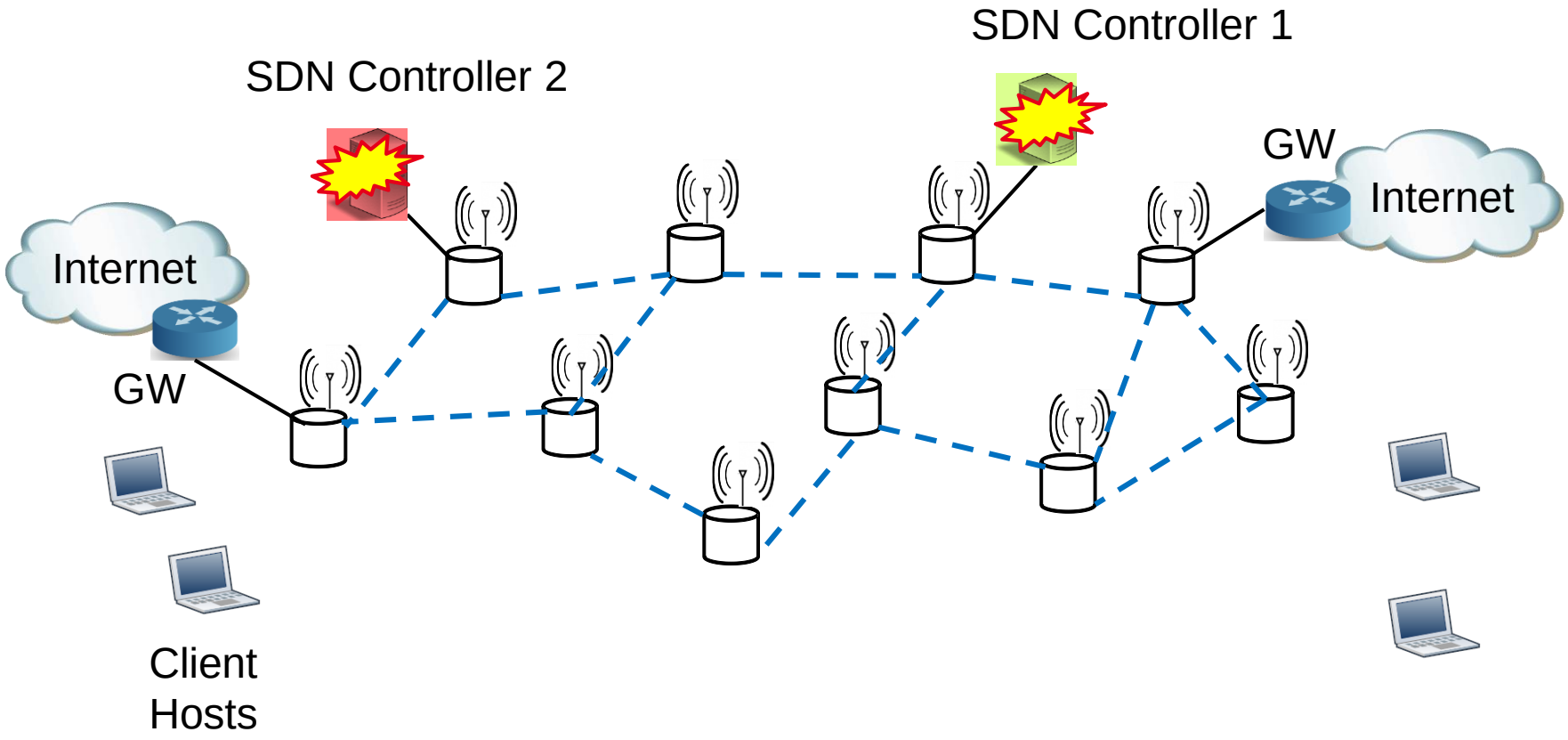
03 Controller election



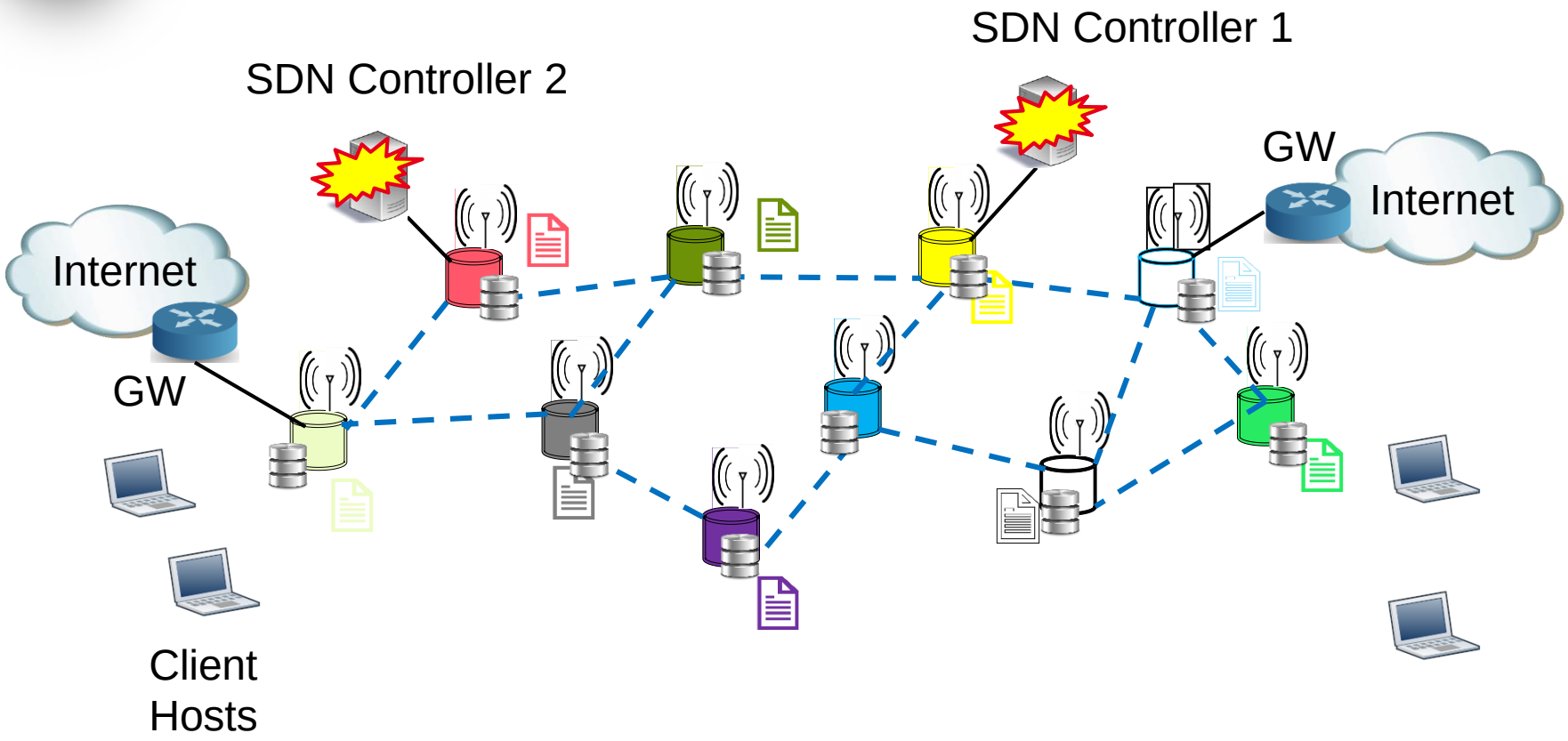
04 Connection



No SDN controllers

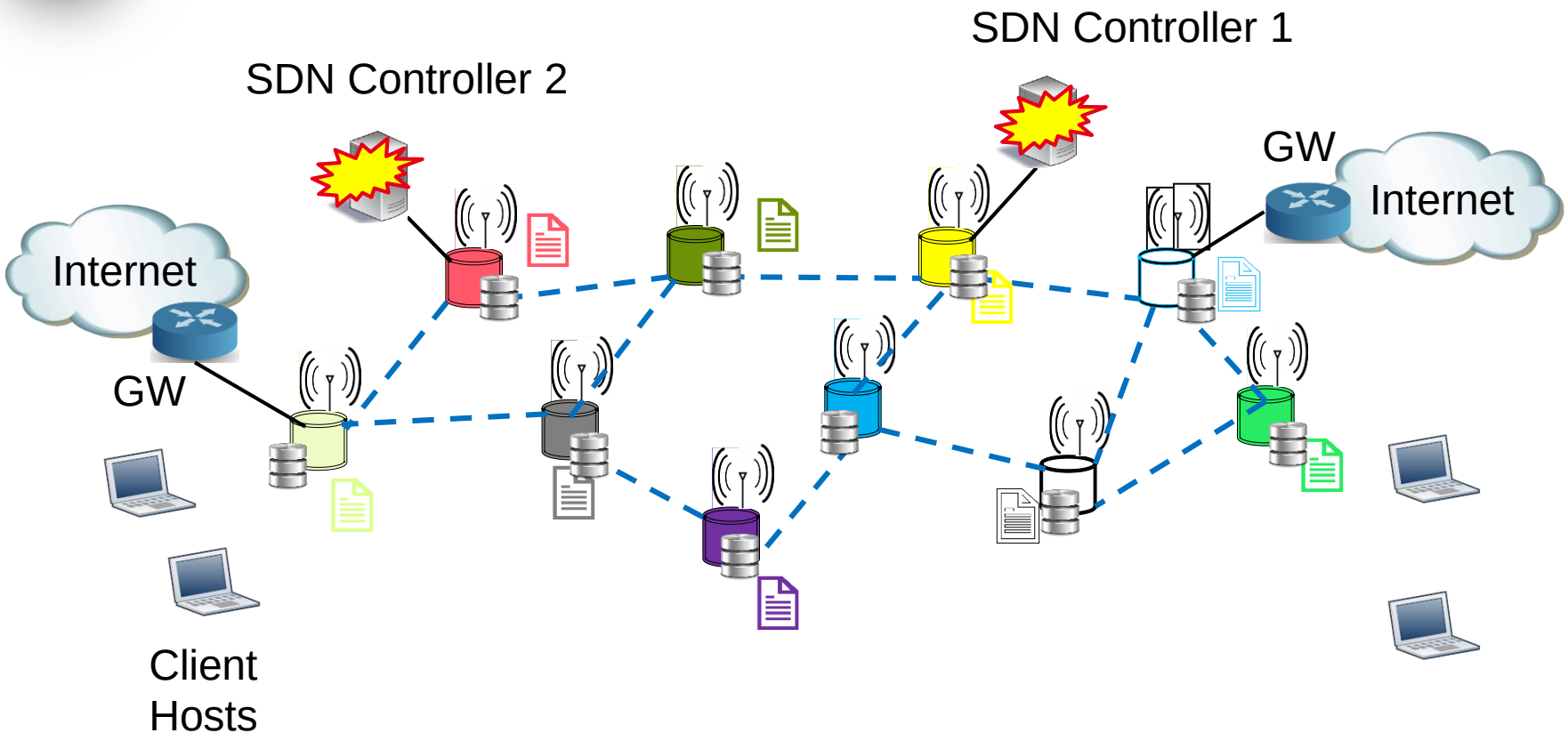


01 Routers performance evaluation

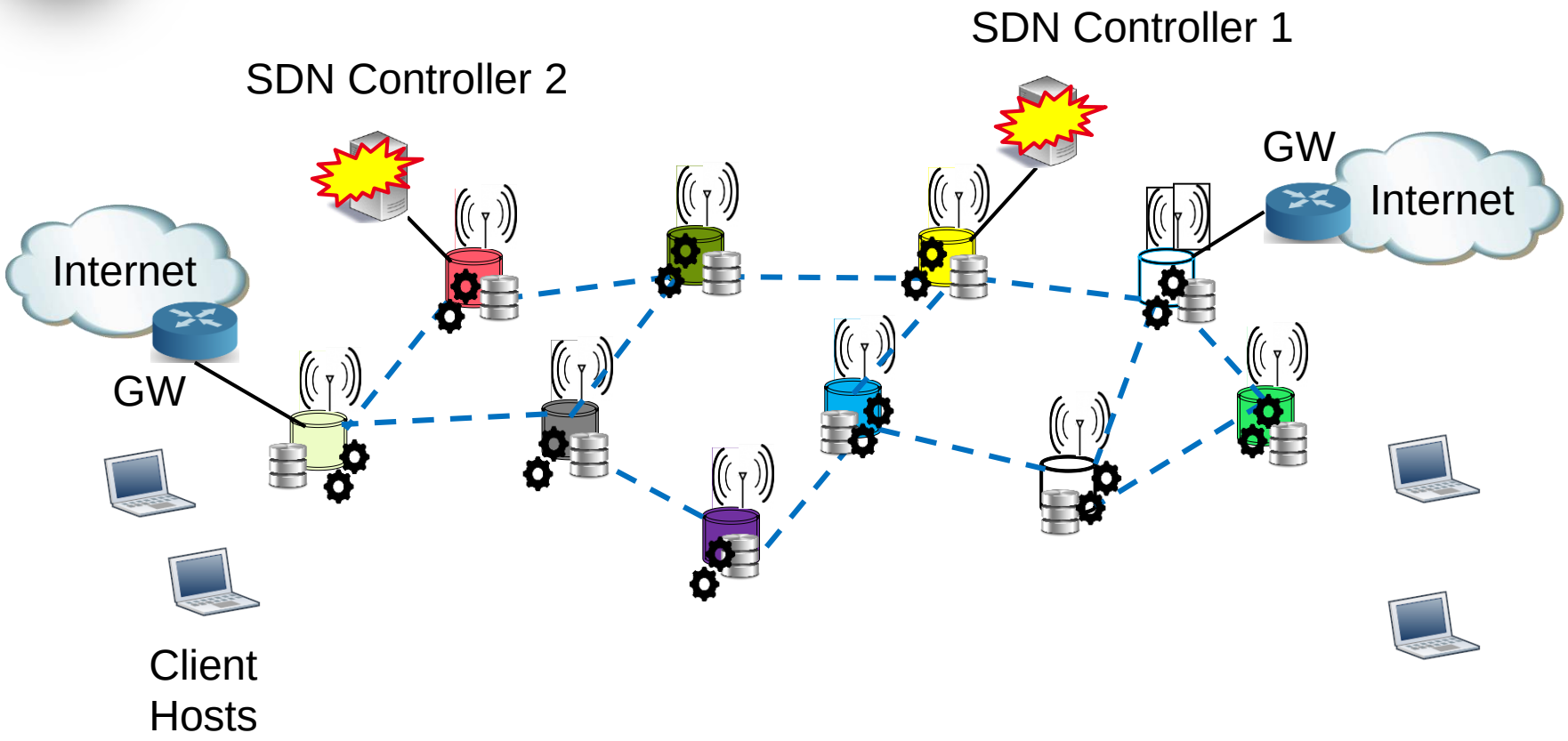


SDN DEPLOYMENT

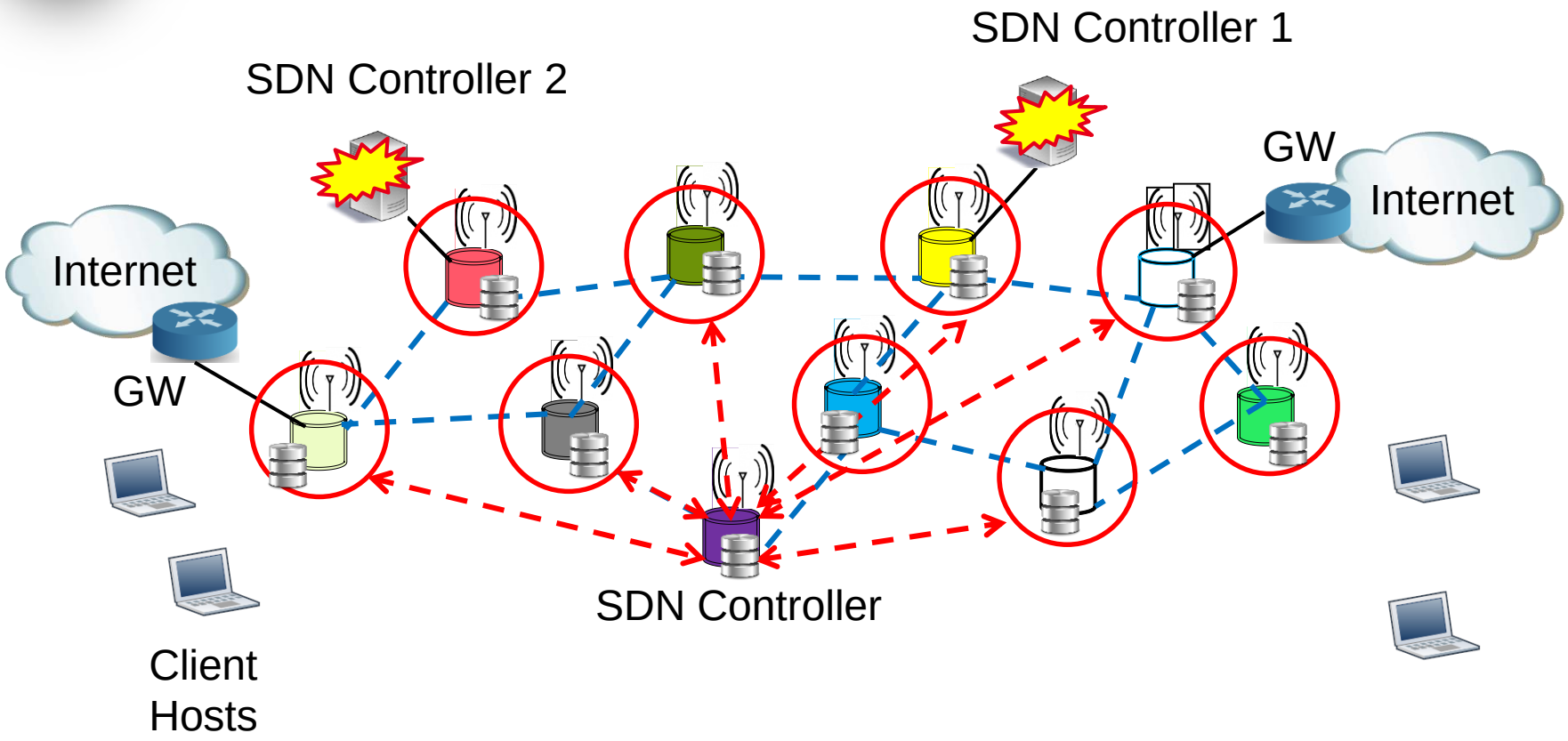
02 Broadcasting



03 Router election



04 Connection



CONTROLLER ELECTION

SELECTION METRICS

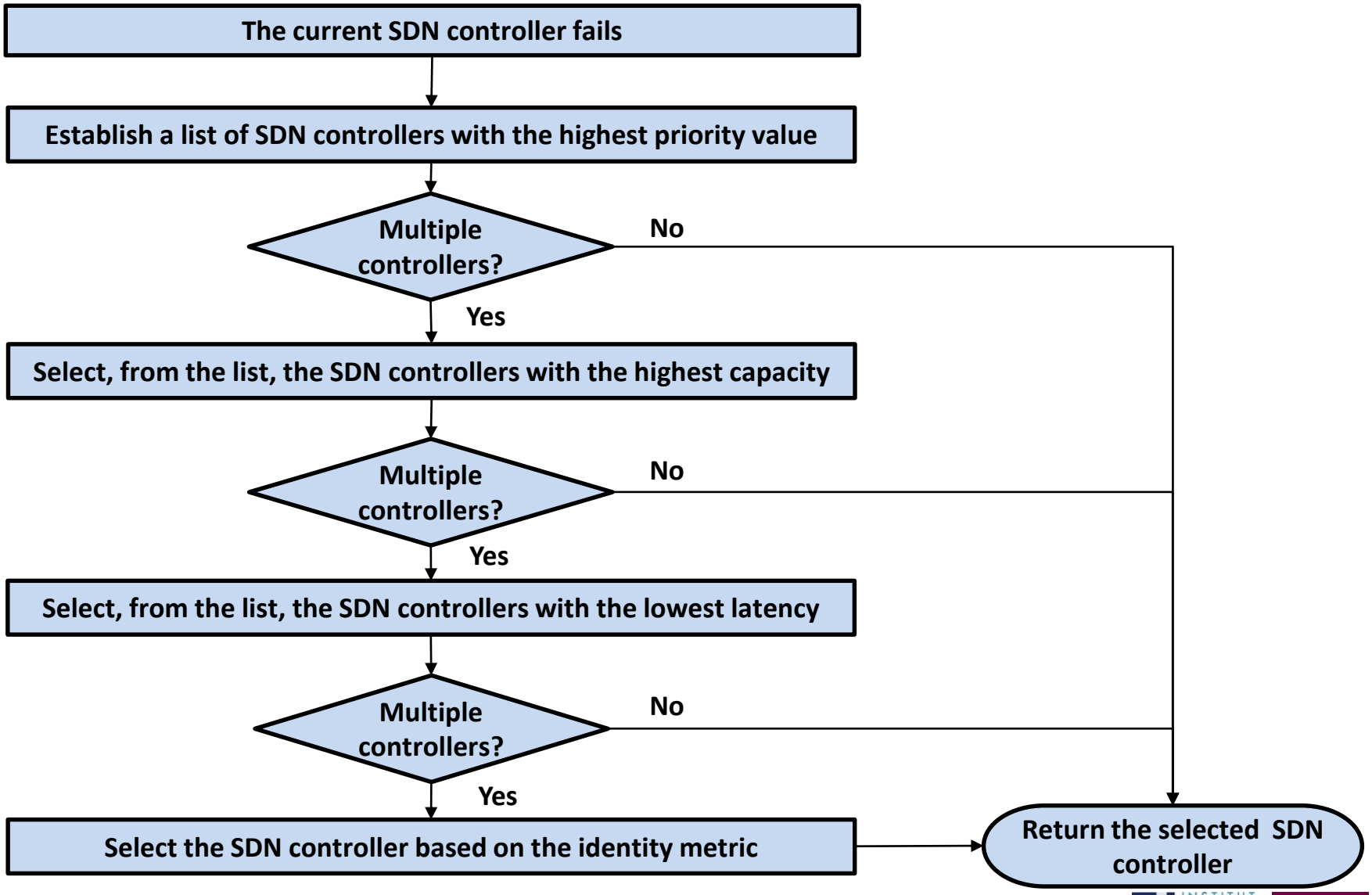
- Controller priority: it is set by the network operator to force the SDN controller selection algorithm to choose a specific controller.

- Controller capacity: it represents the SDN controller computational performance (i.e. maximum number of new flows that the SDN controller can process).

- Controller location: it represents the SDN controller distance from the impacted SDN nodes (i.e. the average propagation latency of the controller from the impacted SDN nodes).

- Controller identity: it is used to uniquely identify each SDN controller. It is used as a tie-breaker in the controller selection algorithm.

RESILIENCY IMPROVEMENT

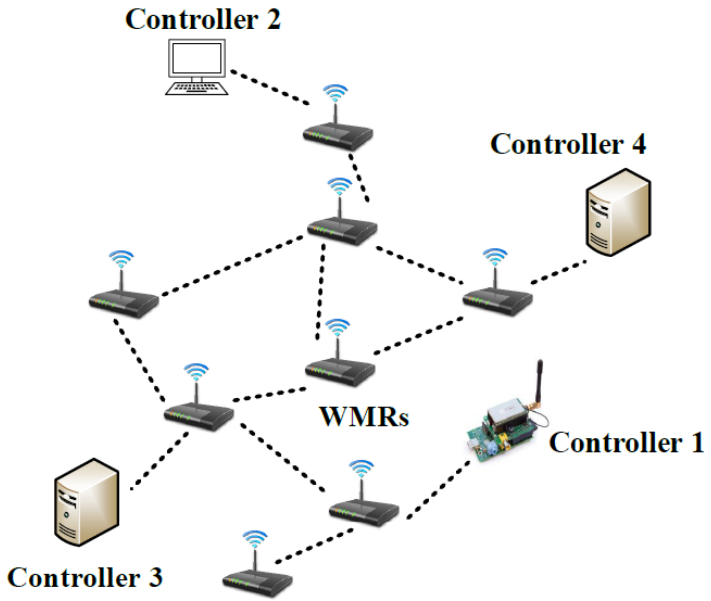


VALIDATION

BENCHMARKING - SETTING

- Common Open Research Emulator (CORE)
- 8 Wireless Mesh Routers (SDN nodes) using CORE
- SDN node run NEON software (i.e. CEA in-house SDN software)
- 4 SDN controllers running on different hardware platforms (C1=Rasberry Pi, C2=laptop, C3=server, C4=server)

Controllers	C1	C2	C3	C4
Hardware Characteristics				
CPU frequency (MHz)	900	933	3312	3312
Number of CPU Cores	4	4	14	23
RAM (Mbytes)	862.40	3720	18930	35580



BENCHMARKING - VALIDATION RESULTS

- 4 controllers with the same priority value
- Each controller integrate the cbench tool:
  - run a testing phase at boot time to estimate the average flow setup throughput
  - Run the SDN controller selection algorithm ➔ SDN controller C4 is selected

Controllers	C1	C2	C3	C4
Average flow setup throughput (flows/s)	42495	55265	94439.67	128539.3
Relative Standard Deviation (%)	6.5	1.8	2.33	4.84

- To validate the cbench results:
  - Configure each SDN node (WMR) to send the maximum flow setup request to each controller ➔ validate cbench estimations

Controllers	C1	C2	C3	C4
Average flow setup throughput (flows/s)	39123	45933	80042.21	100399.62

CONCLUSION

This paper proposes mechanisms permitting to deploy an SDN-based WMN architecture automatically.

To address this challenge we extended NEON, a light-weight SDN software for dynamic networks developed by CEA lab.

Our solution would need further performance evaluations to be validated as a final solution before deployment.

Thank you for your attention

Questions

mohamed.labraoui@cea.fr

Commissariat à l'énergie atomique et aux énergies alternatives
Institut List | CEA SACLAY NANO-INNOV | BAT. 861 – PC142
91191 Gif-sur-Yvette Cedex - FRANCE
www-list.cea.fr