Semester project presentation: Software defined Network assisted Distributed Mobility Management

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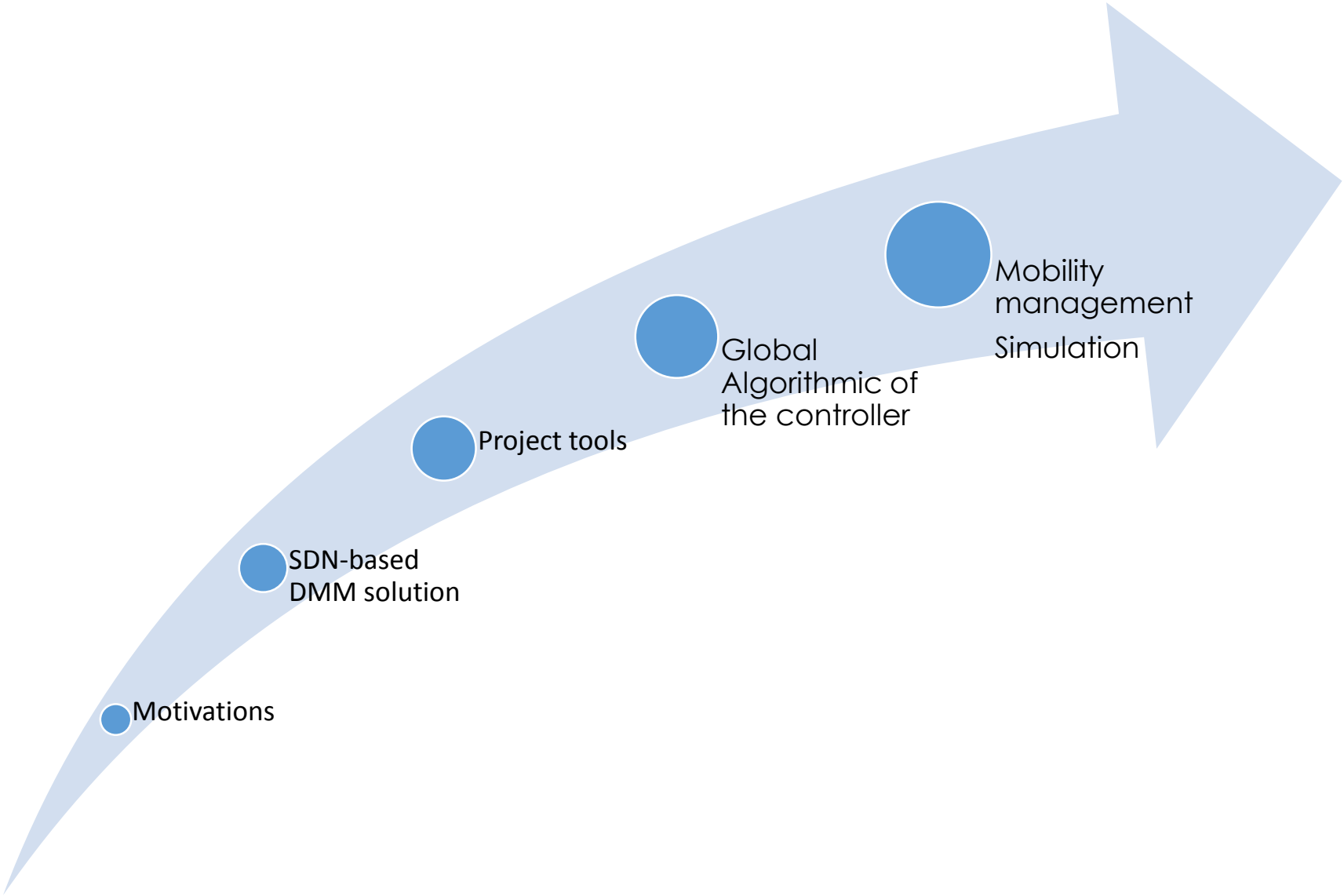
Time Line

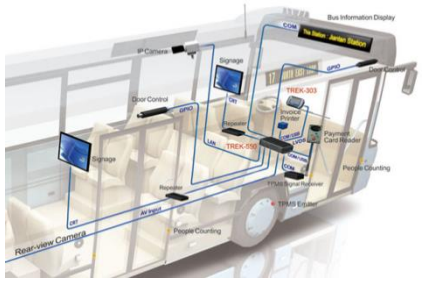

Motivations
SDN-based
DMM solution
Project tools
Global
Algorithmic of
the controller
Mobility
management
Simulation

Motivation(1)

Network challenges

the growing number of Internet-connected users, devices and applications.

Mobility of the user.



The increase of user demand.

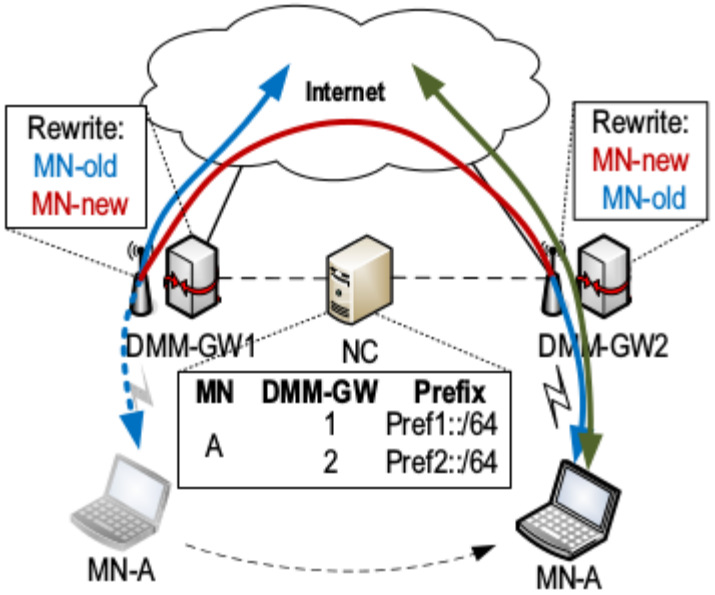
Motivation(2)

Mobile IPv6	Proxy Mobile IPv6
• The user get new IPv6 address when he changes his point of attachment . • Tunnel between mobile node and the home agent . • A lot of signaling messages.	• The IPv6 address is unique per user wherever he goes . • Tunnel between LMA and MAG . • Saves bandwidth .

Limitations of those solutions :

- ❖ Centralized mobility management .
- ❖ Hierarchical architecture of mobile networks.
- ❖ Packet loss, and delay problem.
- ❖ Handover latency problem.

SDN-based DMM solution



Decouple control plane and data plane.

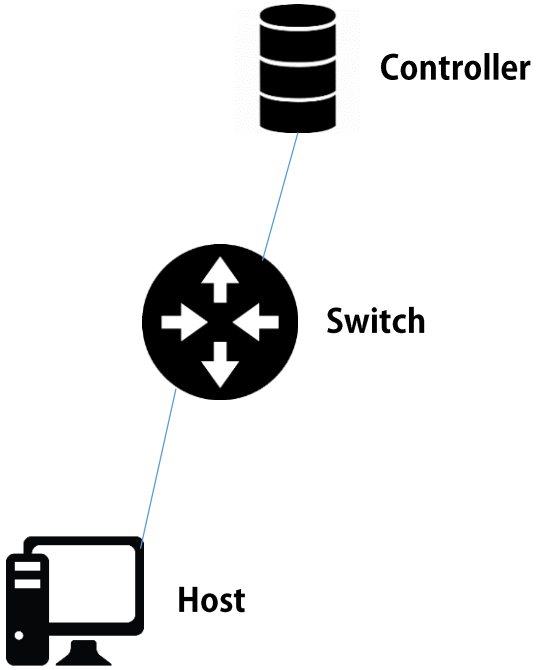
Figure SDN-based DMM solution architecture

SDN-based DMM solution

Advantages of this approach :

- Enhanced access to IP services.
- Quick provisioning and configuration of network connections.
- High system performances.
- Optimal outing policies.
- Perfect exploitation of multiple anchors points .
- Simplified mobile node functions.

Project Tools(1)



Mininet

Advantages

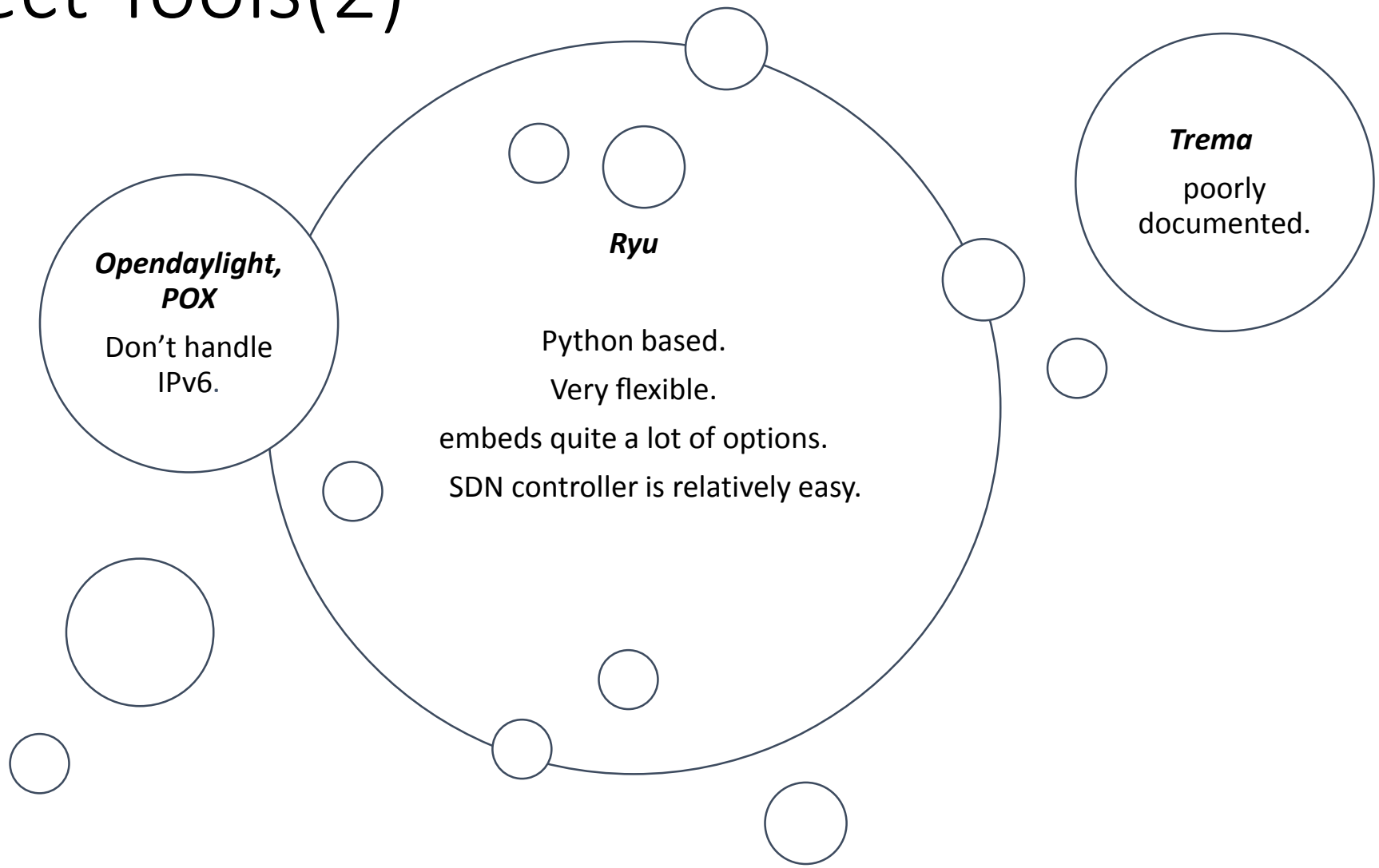
Use of python to create network.

Suits well SDN oriented network.

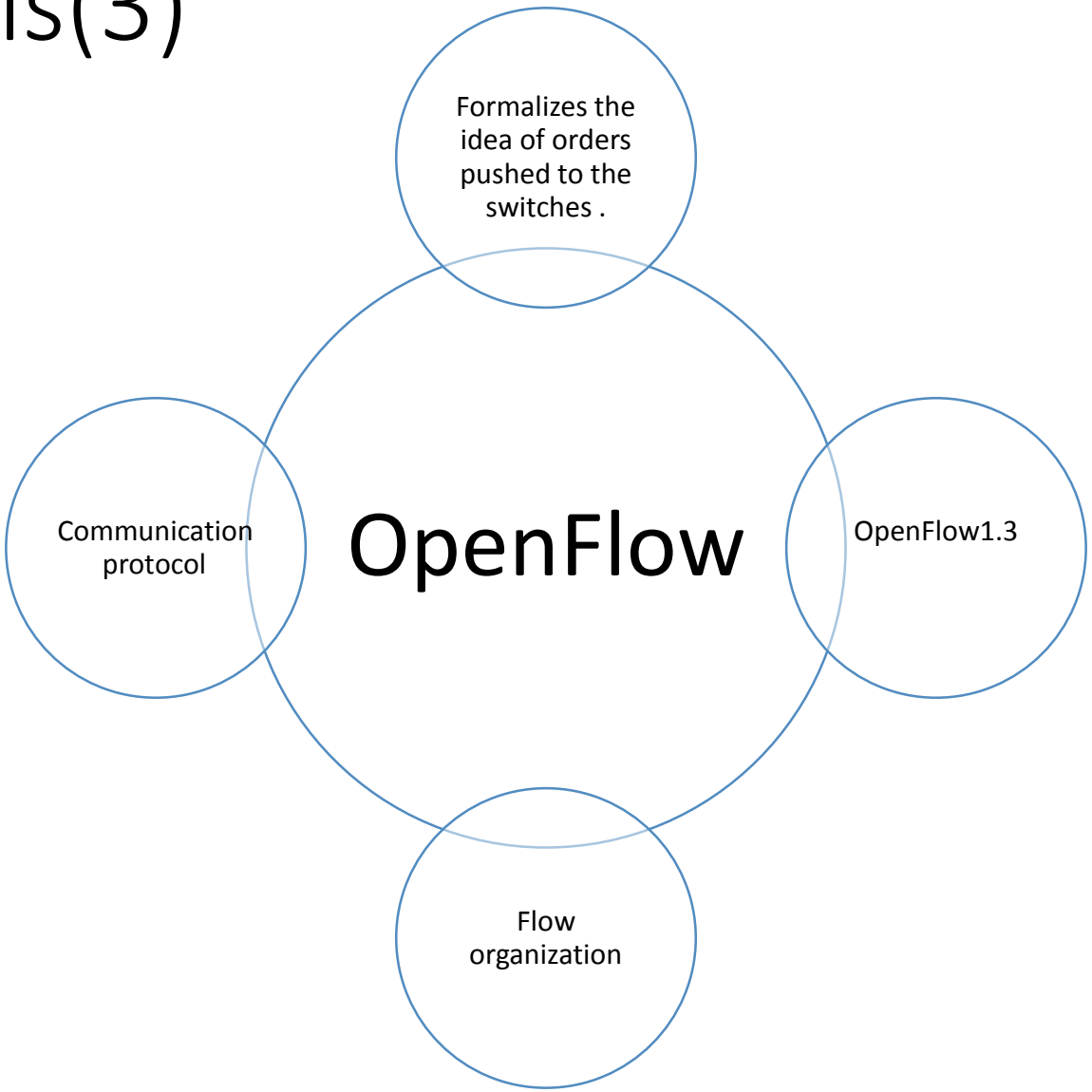
Limitations

complex to make the topology change at run-time through the command line interface.

Project Tools(2)

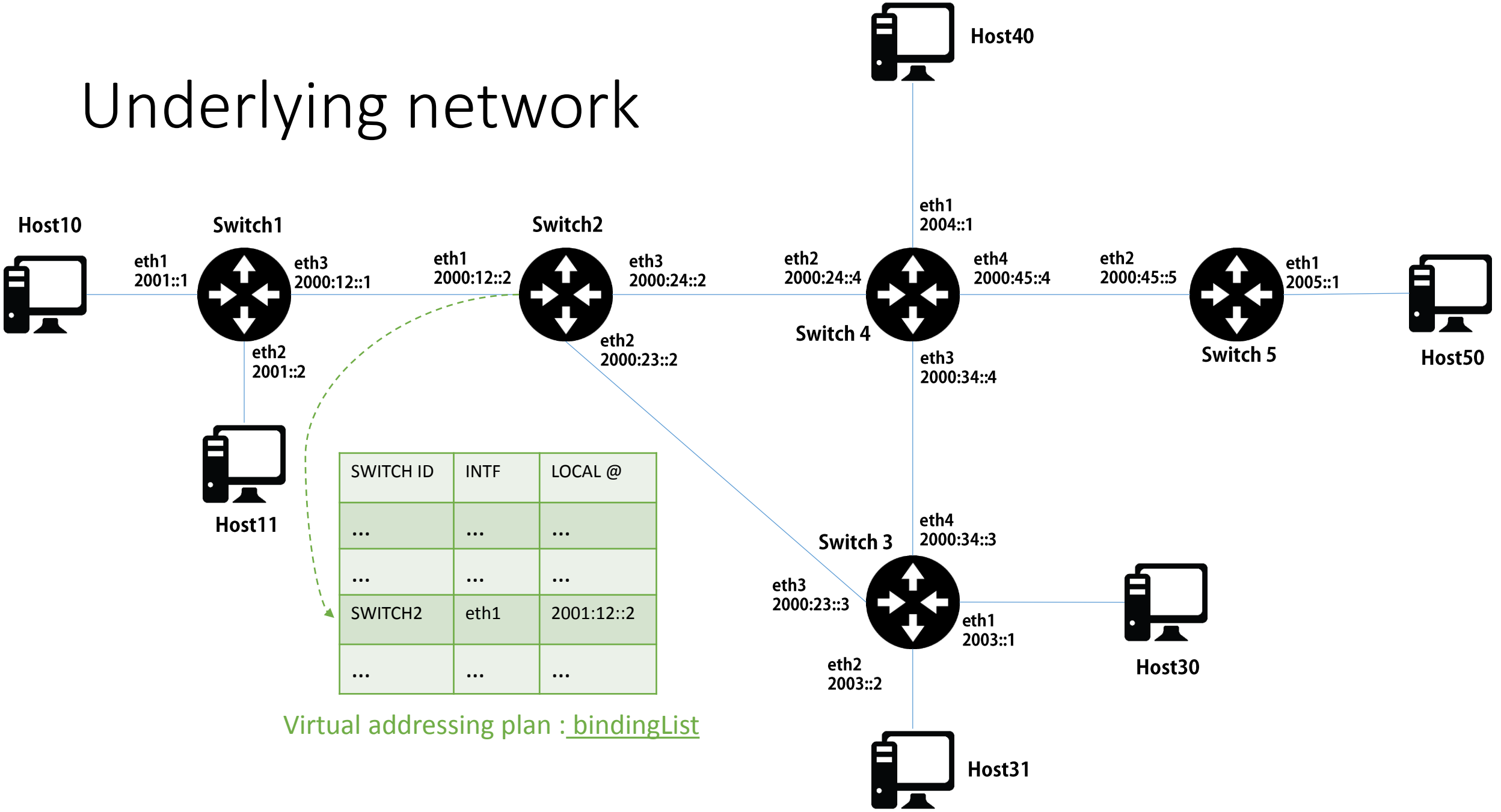


Project Tools(3)



CONTROLLER IMPLEMENTATION

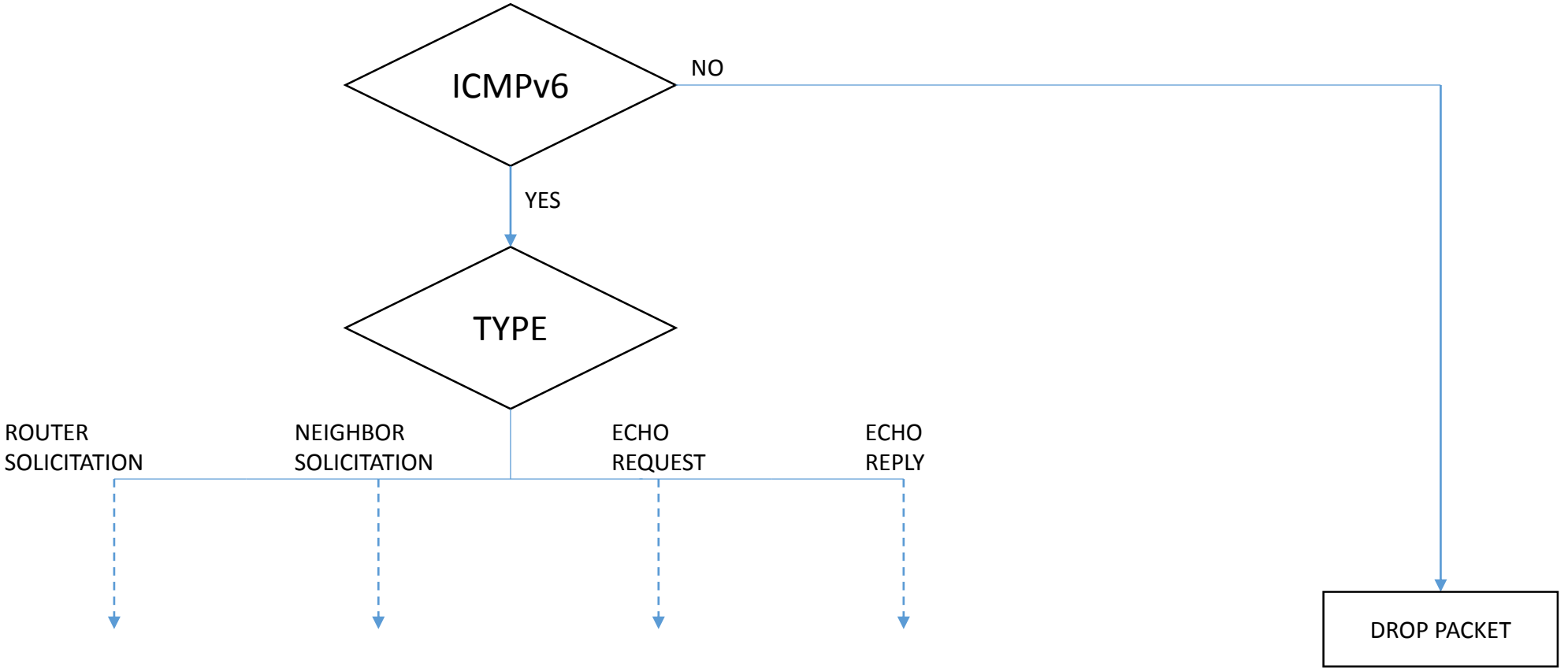
Underlying network



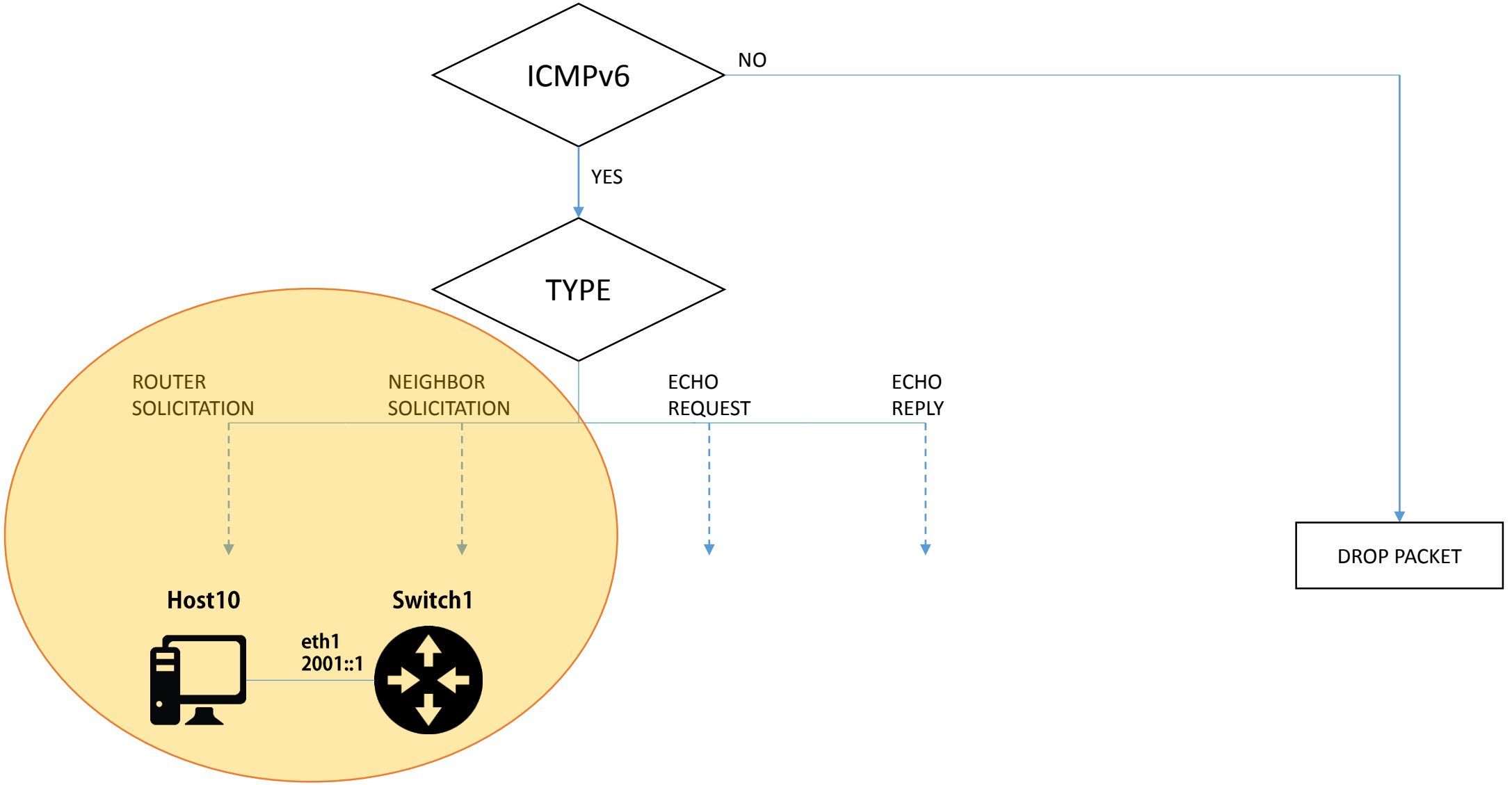
SWITCH ID	INTF	LOCAL @
…	…	…
…	…	…
SWITCH2	eth1	2001:12::2
…	…	…

Virtual addressing plan : bindingList

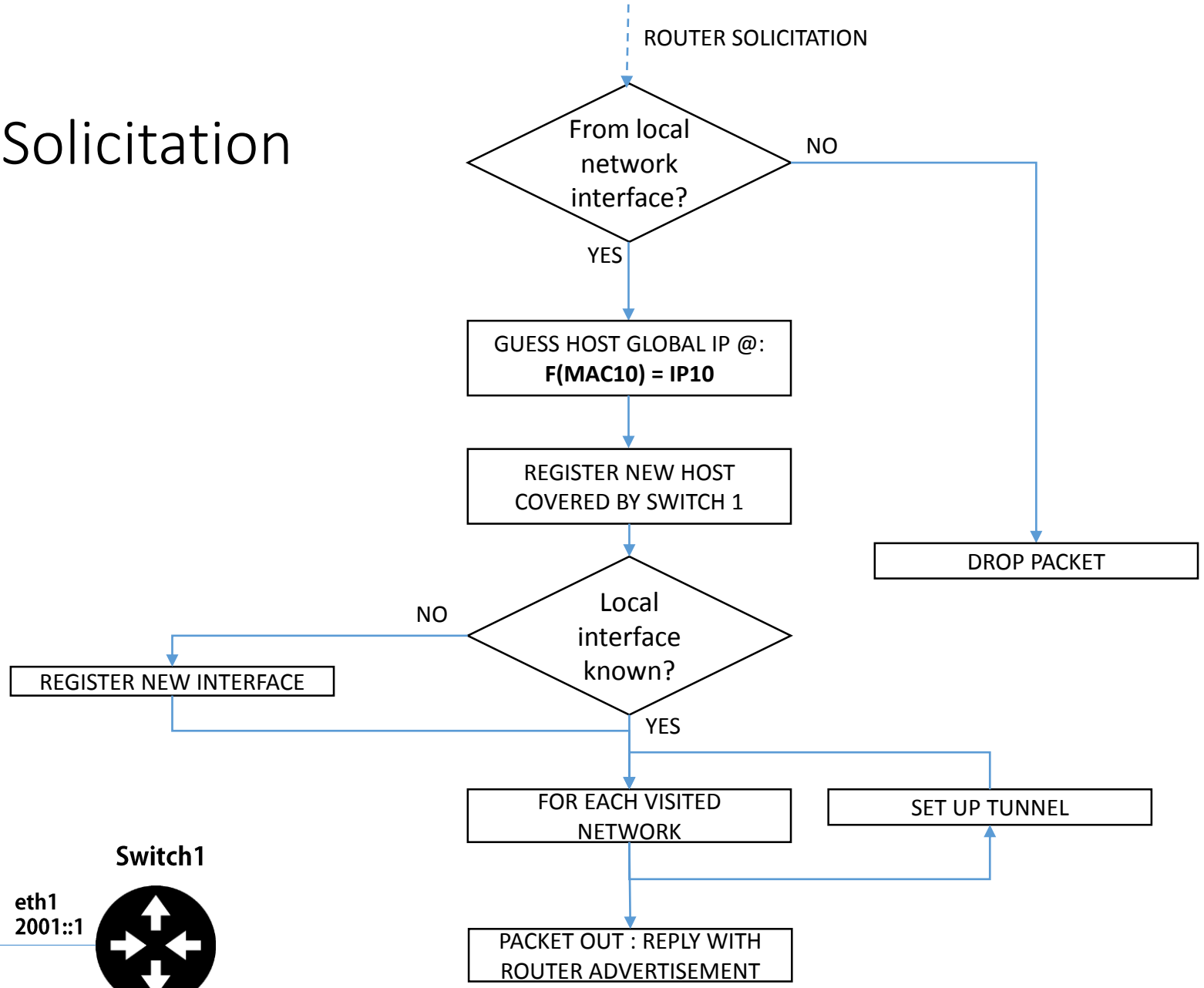
Global Algorithmic of the controller

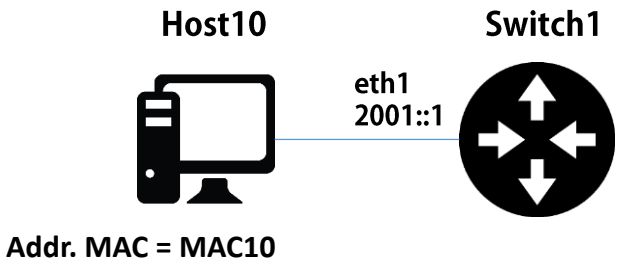


1_ Hosts Configuration & Registration:

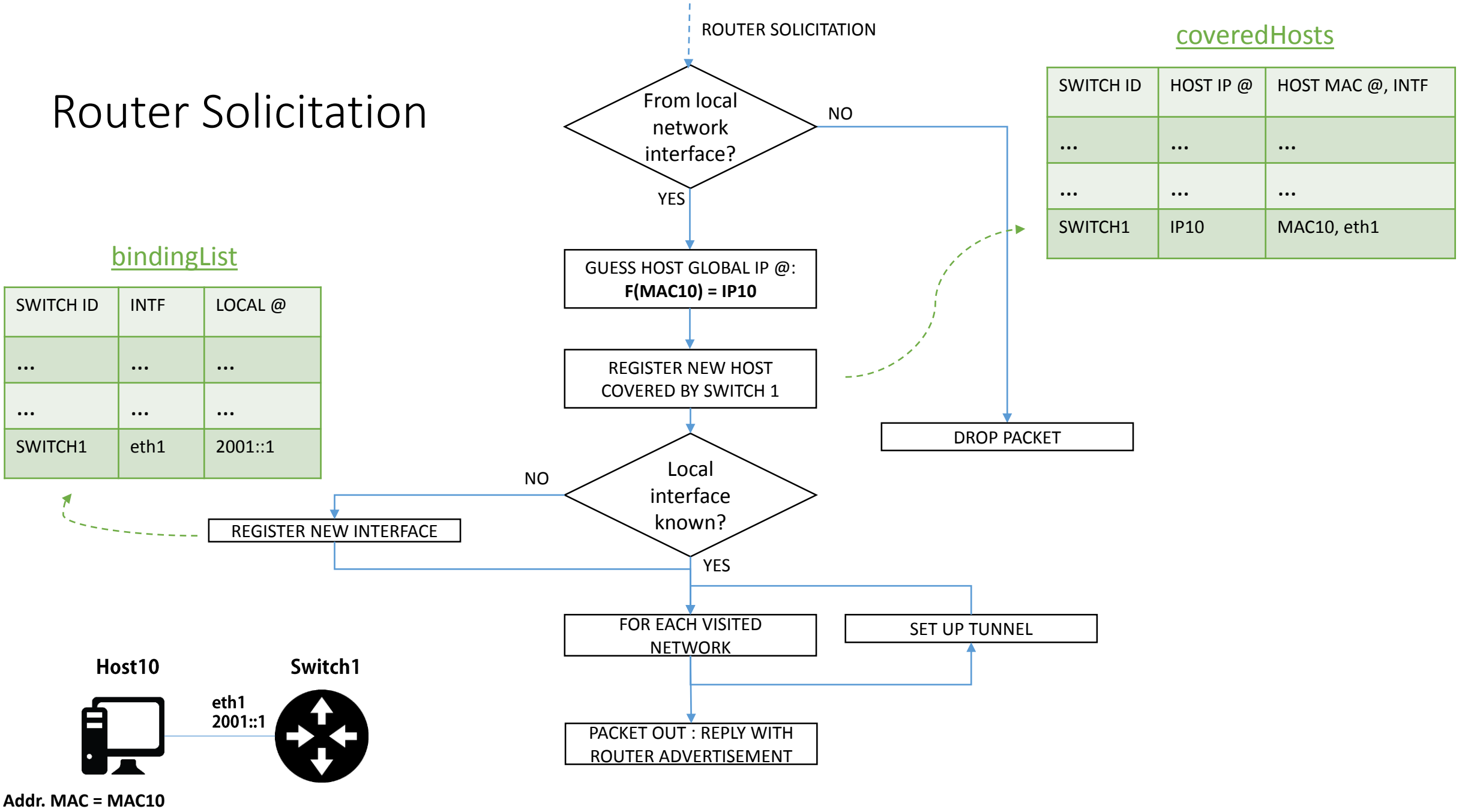


Router Solicitation





Router Solicitation



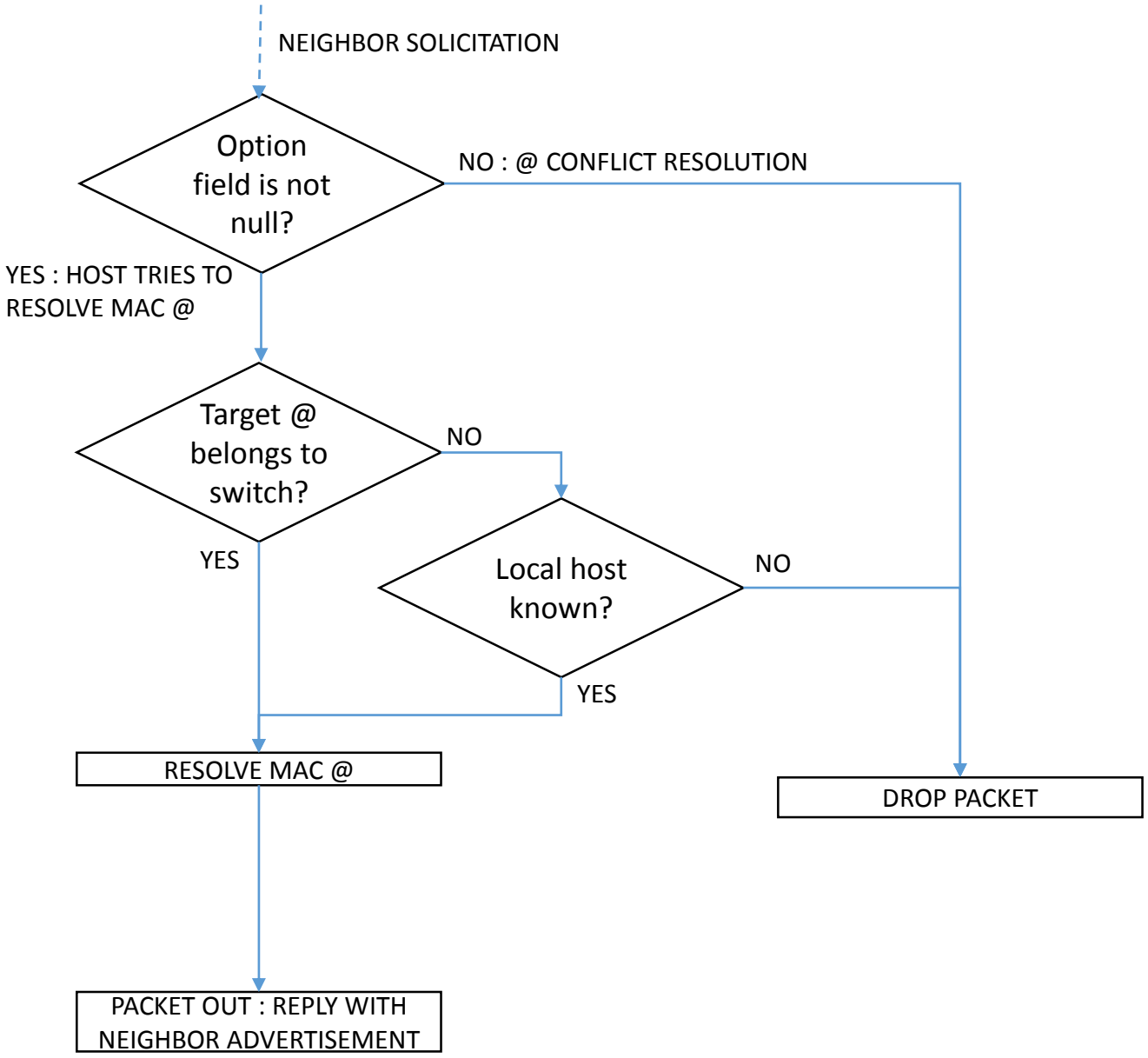
bindingList

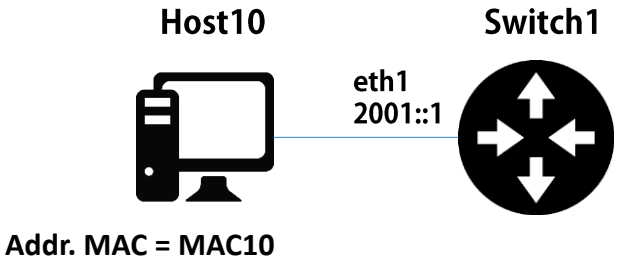
SWITCH ID	INTF	LOCAL @
…	…	…
…	…	…
SWITCH1	eth1	2001::1

coveredHosts

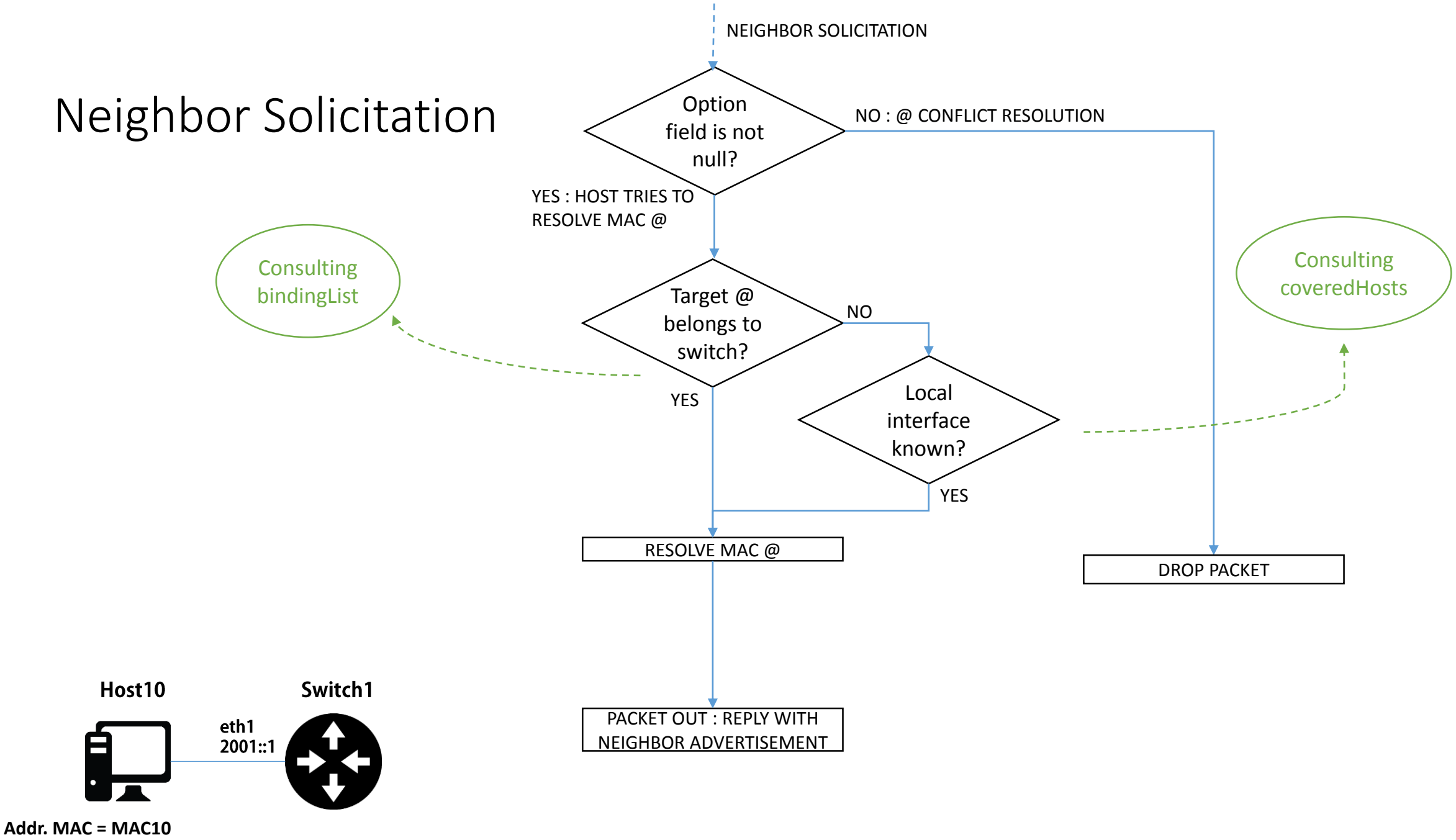
SWITCH ID	HOST IP @	HOST MAC @, INTF
…	…	…
…	…	…
SWITCH1	IP10	MAC10, eth1

Neighbor Solicitation

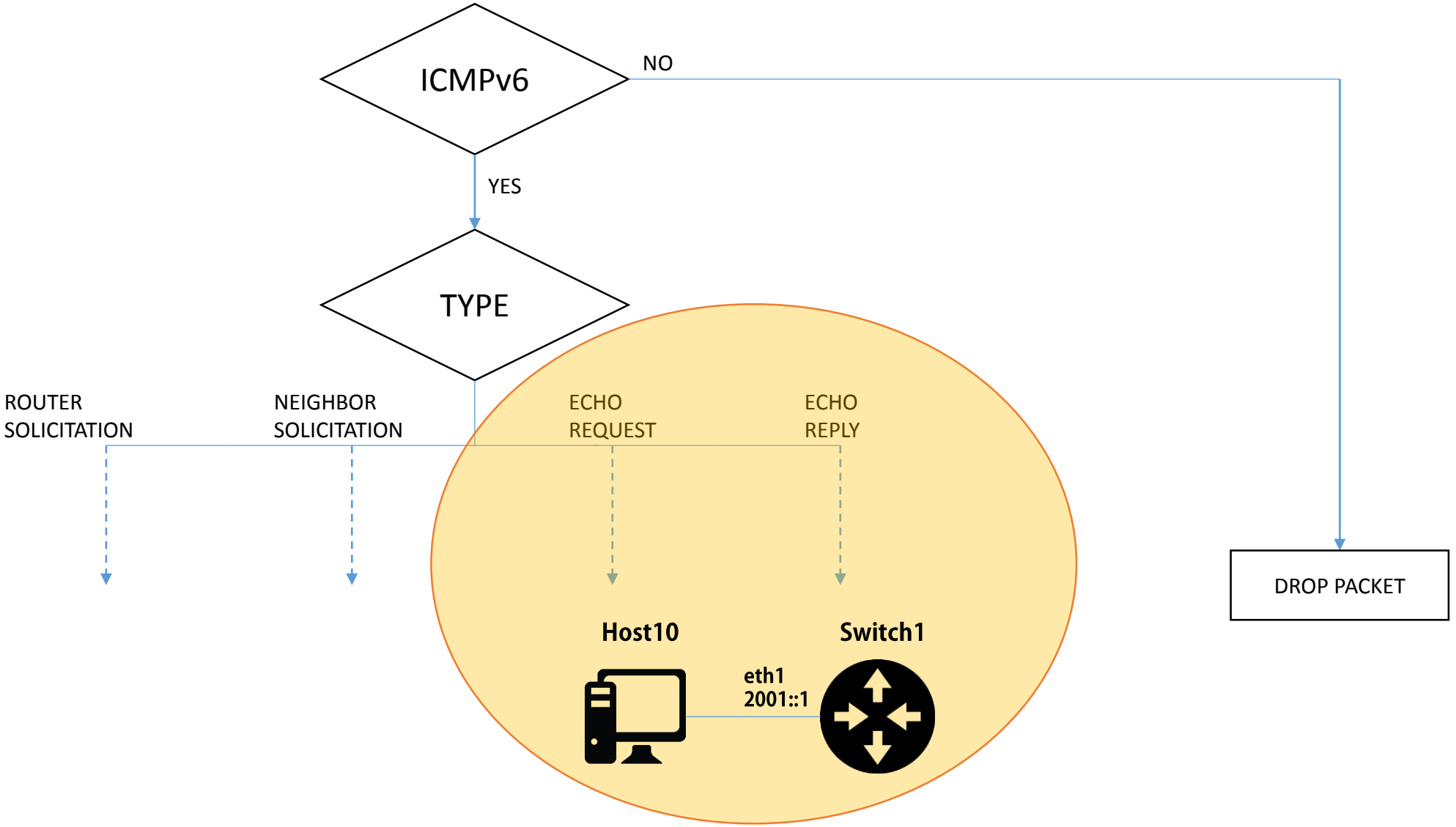




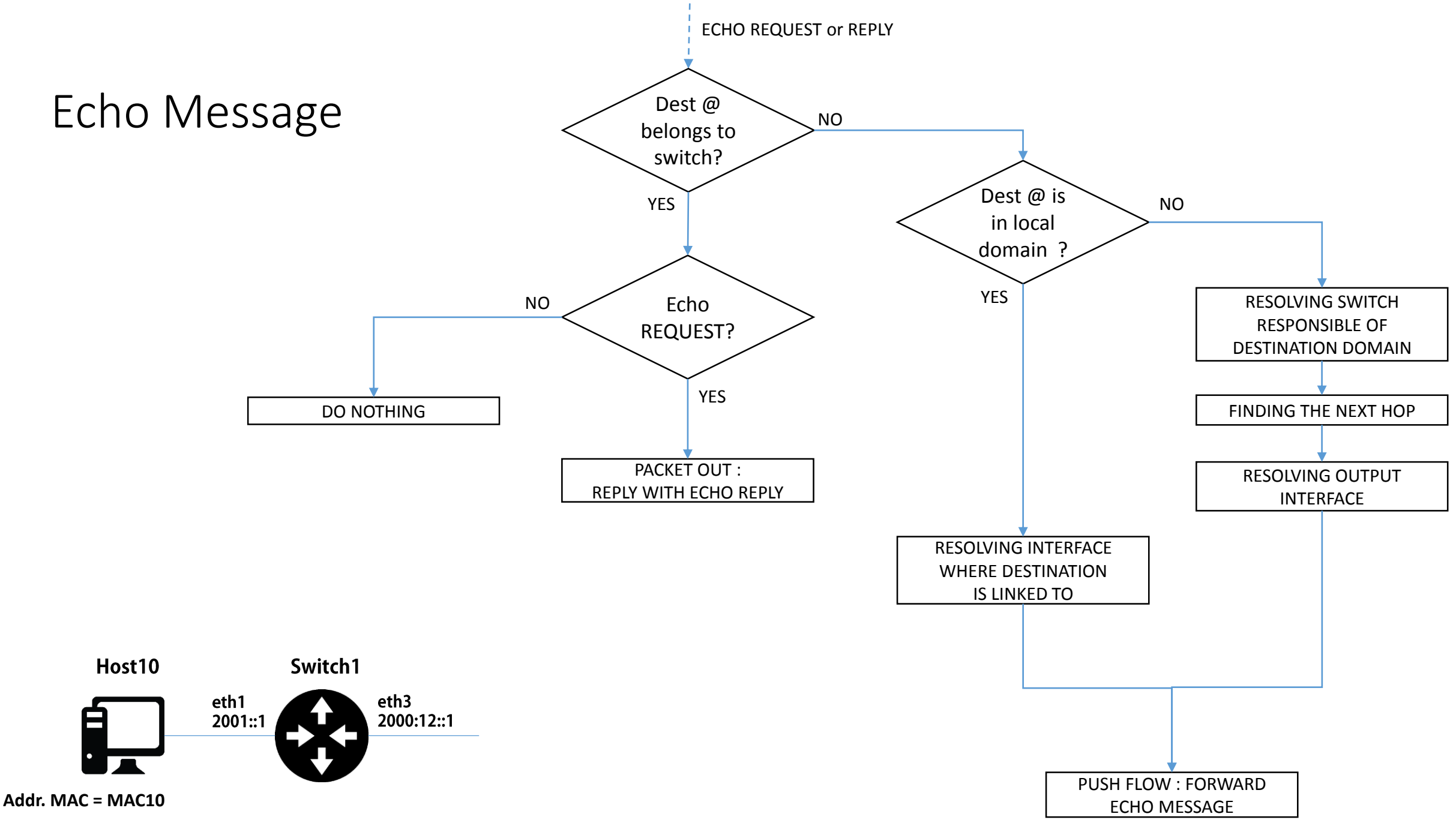
Neighbor Solicitation



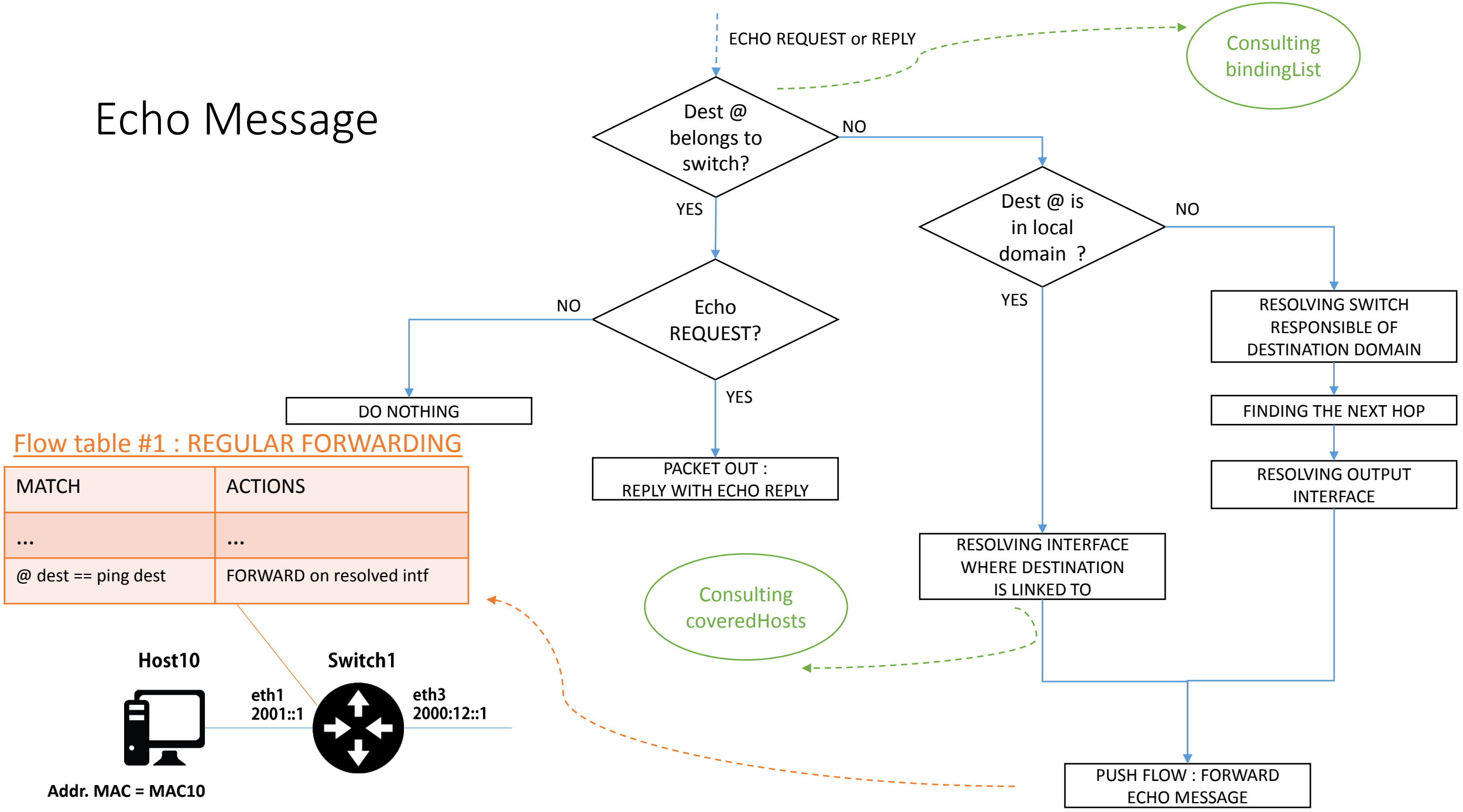
2_ Answering & Forwarding Echo messages:



Echo Message



Echo Message

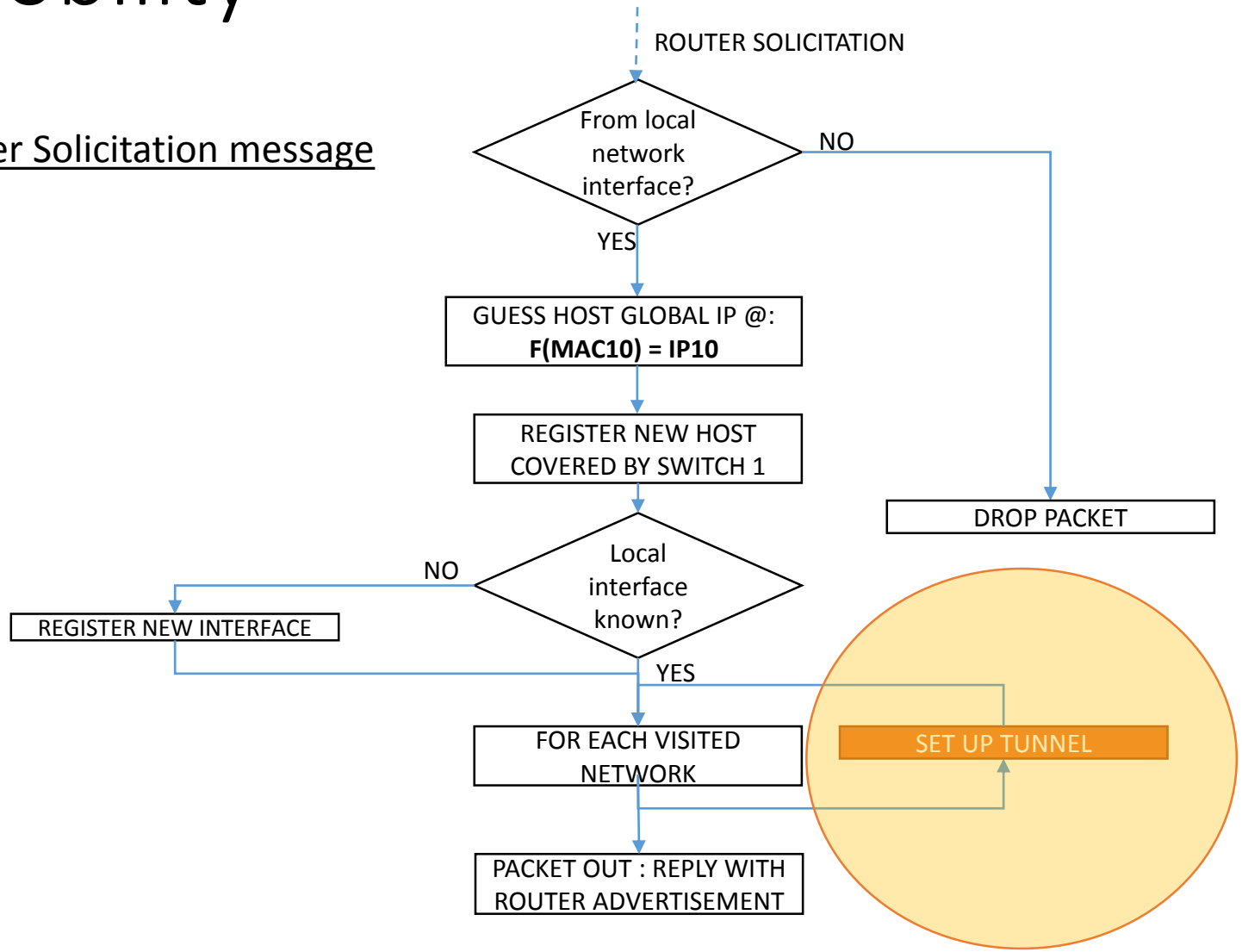


Flow table #1 : REGULAR FORWARDING

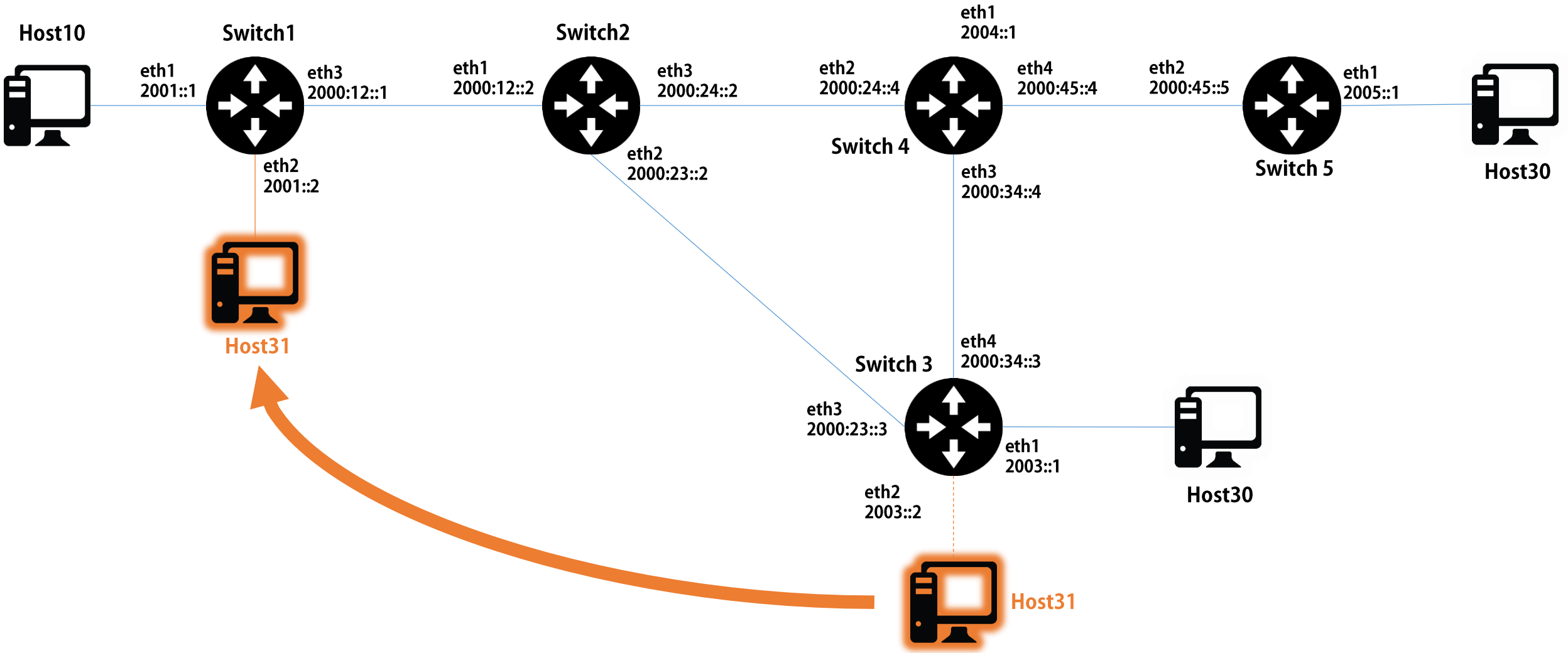
MATCH	ACTIONS
...	...
@ dest == ping dest	FORWARD on resolved intf

3_ Handling Mobility

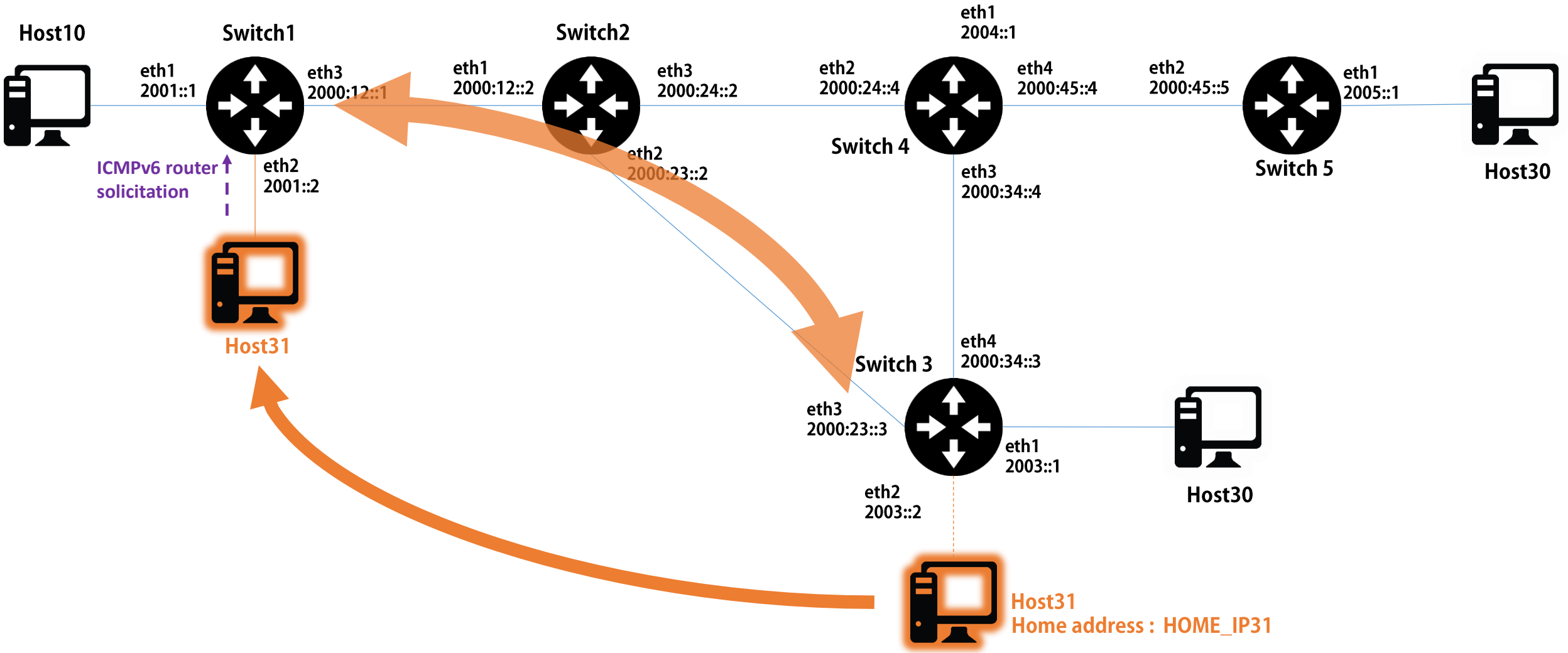
Reminder : reception of a Router Solicitation message



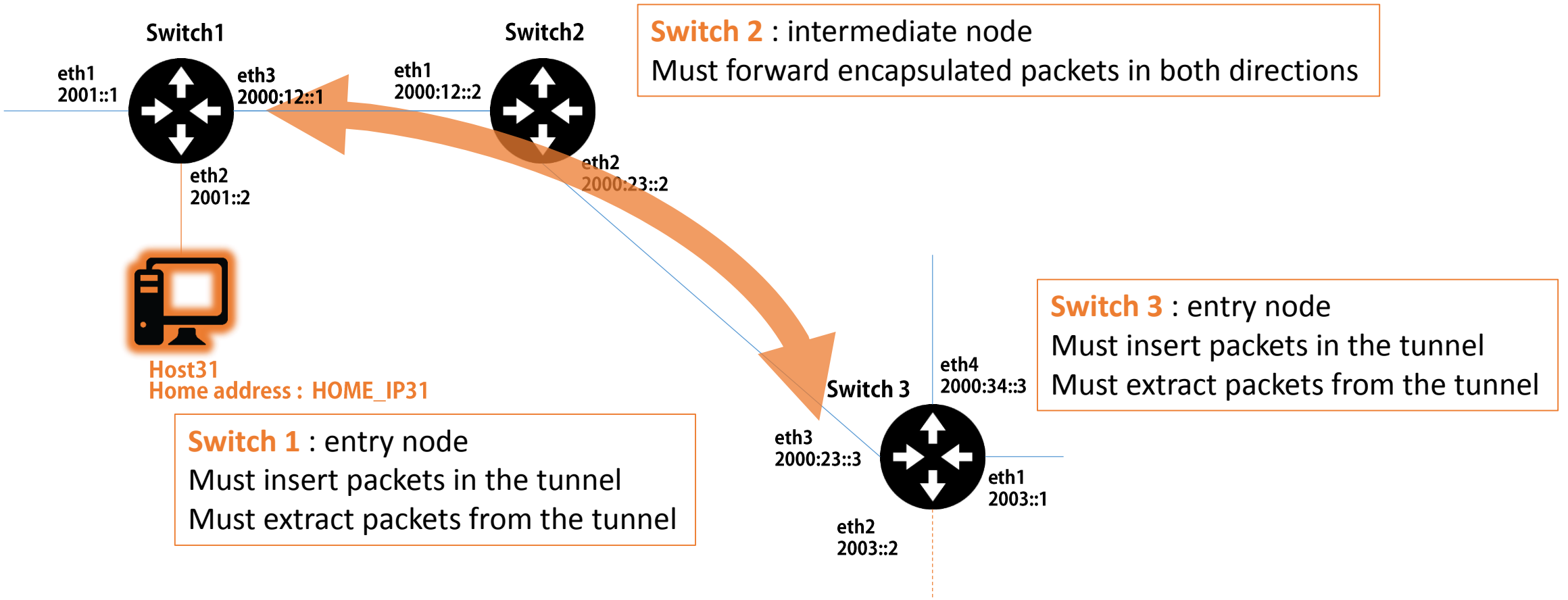
3_ Handling Mobility



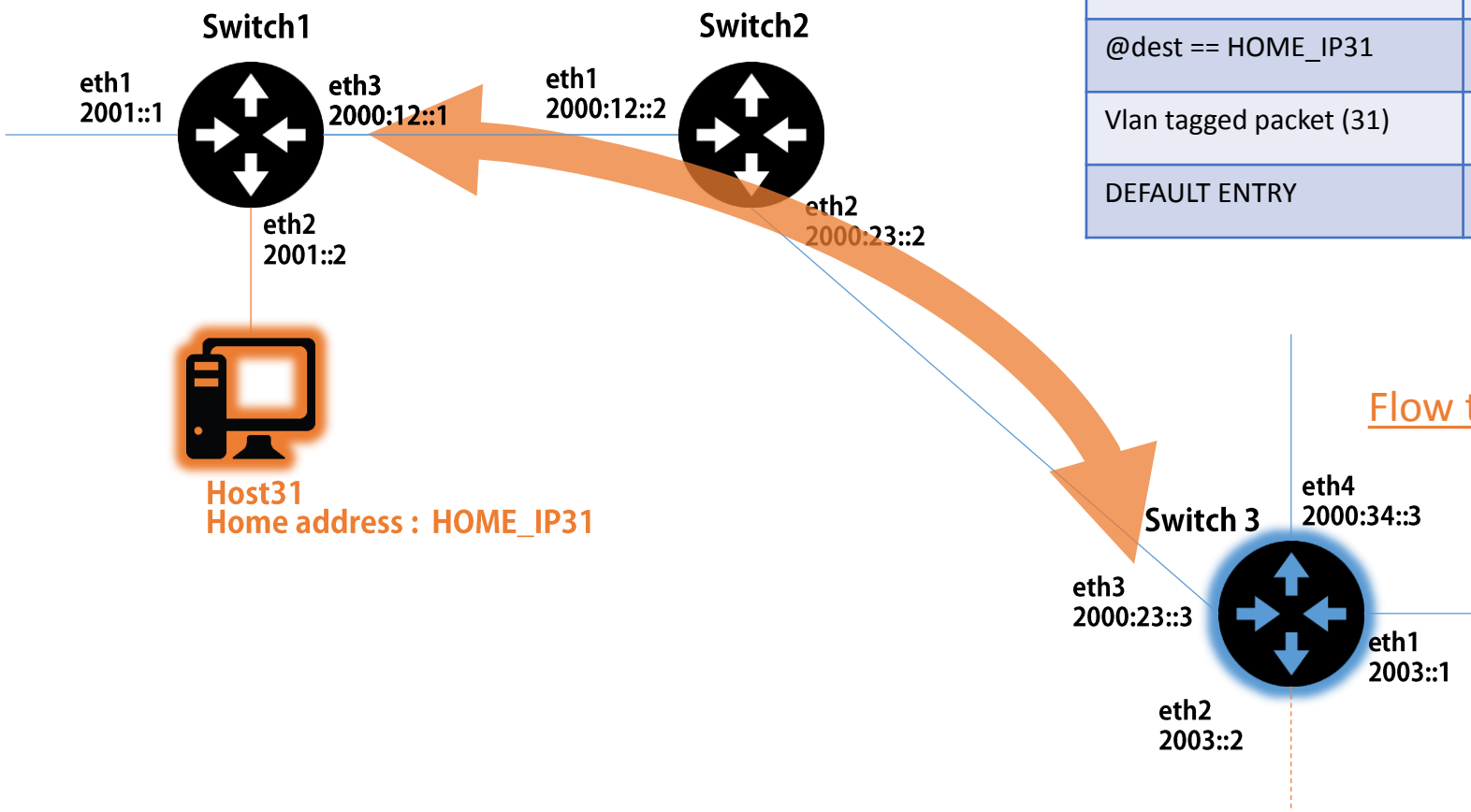
Set up tunnel



Entry & Intermediate nodes of a tunnel



Corresponding Flows : Switch3



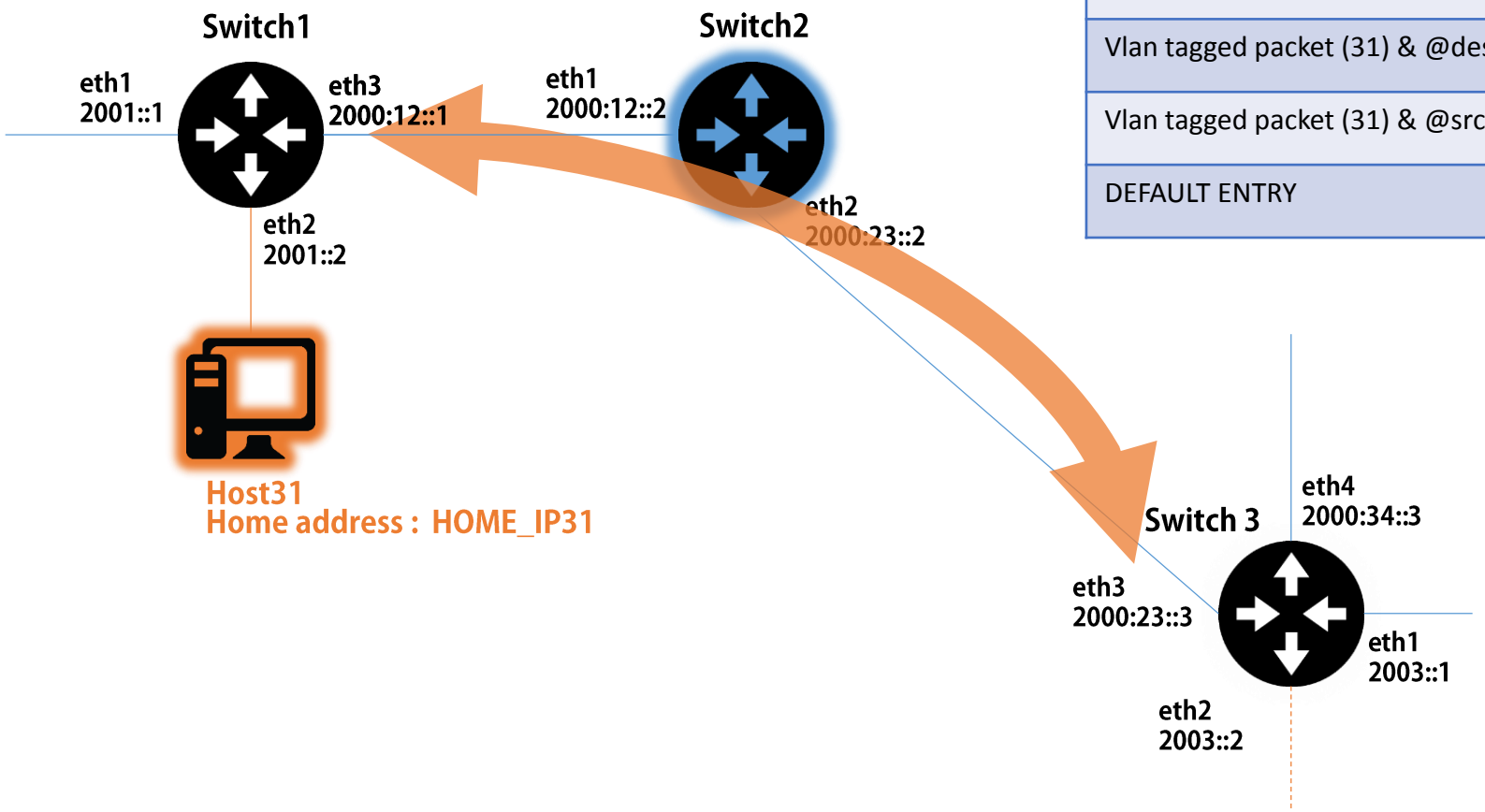
Flow table #0 : TUNNELED FORWARDING

MATCH	ACTION
@dest == HOME_IP31	Set Vlan TAG (31) & FORWARD on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward to table #1
DEFAULT ENTRY	FORWARD TO TABLE #1

Flow table #1 : REGULAR FORWARDING

MATCH	ACTION
…	…
@dest == 2005::1	Forward on eth1
@dest == HOME_IP31	Forward on eth2
DEFAULT ENTRY	ASK CONTROLLER

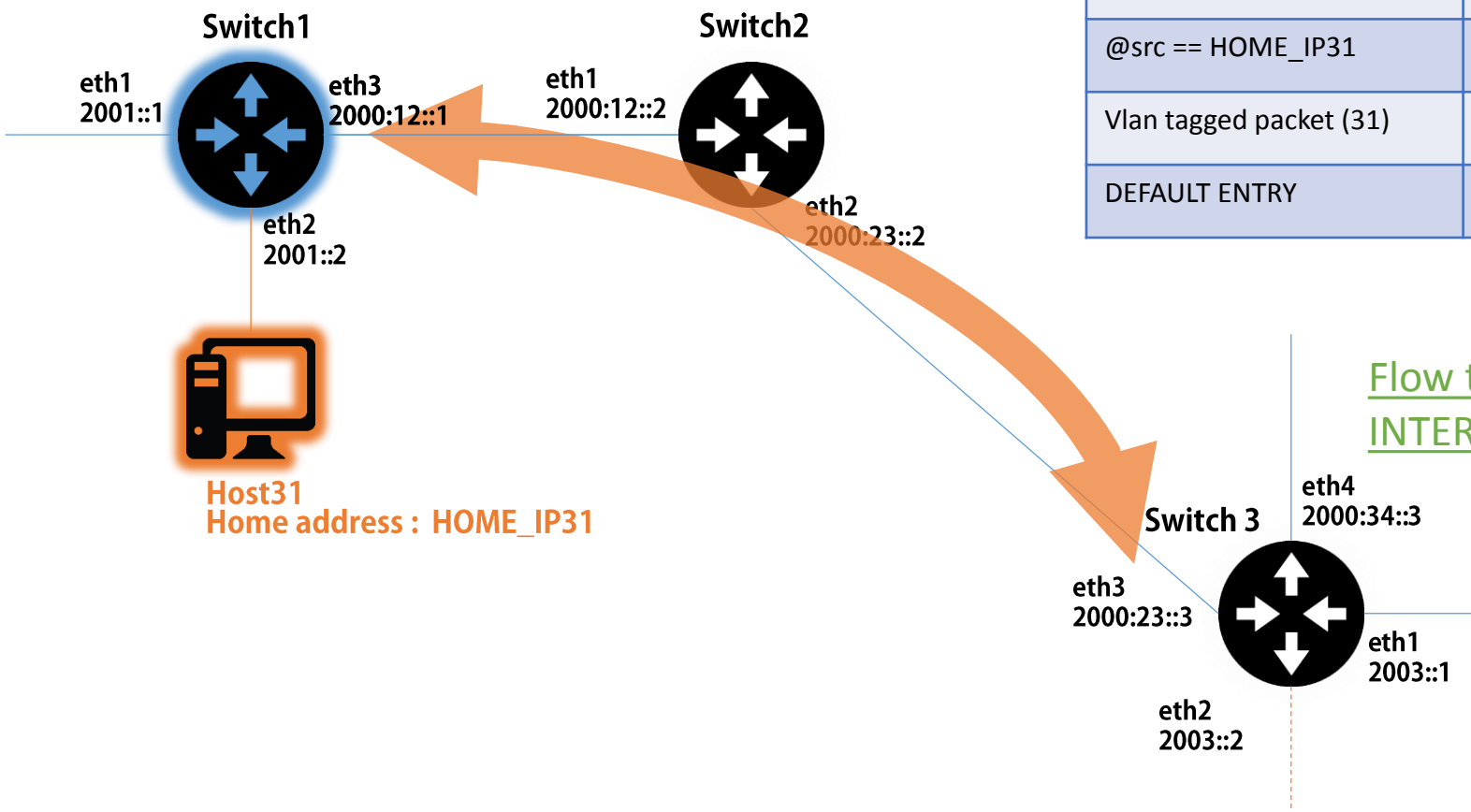
Corresponding Flows : Switch2



Flow table #0 : TUNNELED FORWARDING

MATCH	ACTION
Vlan tagged packet (31) & @dest == HOME_IP31	Forward on eth1
Vlan tagged packet (31) & @src == HOME_IP31	Forward on eth3
DEFAULT ENTRY	FORWARD TO TABLE #1

Corresponding Flows : Switch1



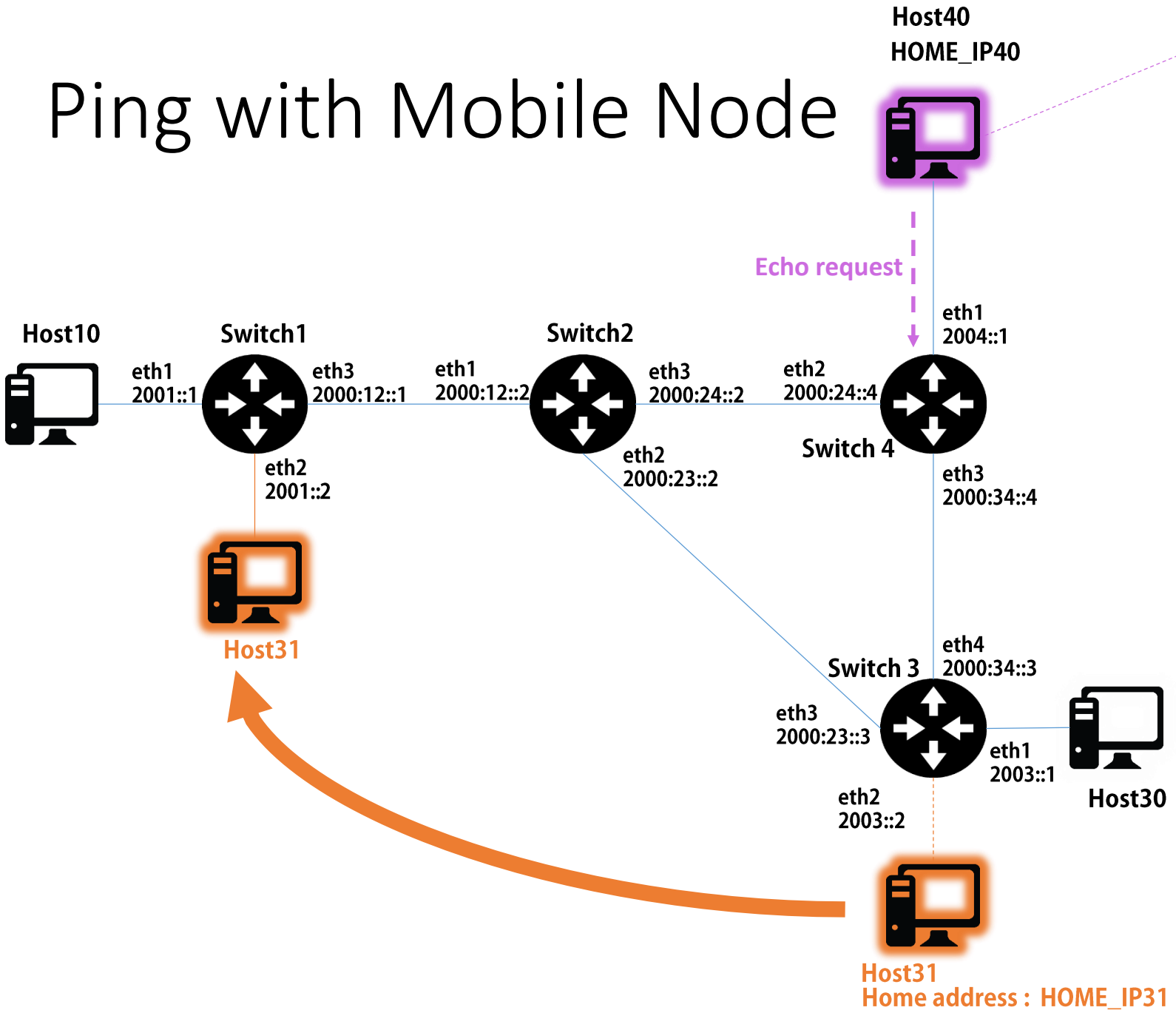
Flow table #0 : TUNNELED FORWARDING

MATCH	ACTION
@src == HOME_IP31	Set Vlan TAG (31) & Forward on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward toward table #2
DEFAULT ENTRY	FORWARD TO TABLE #1

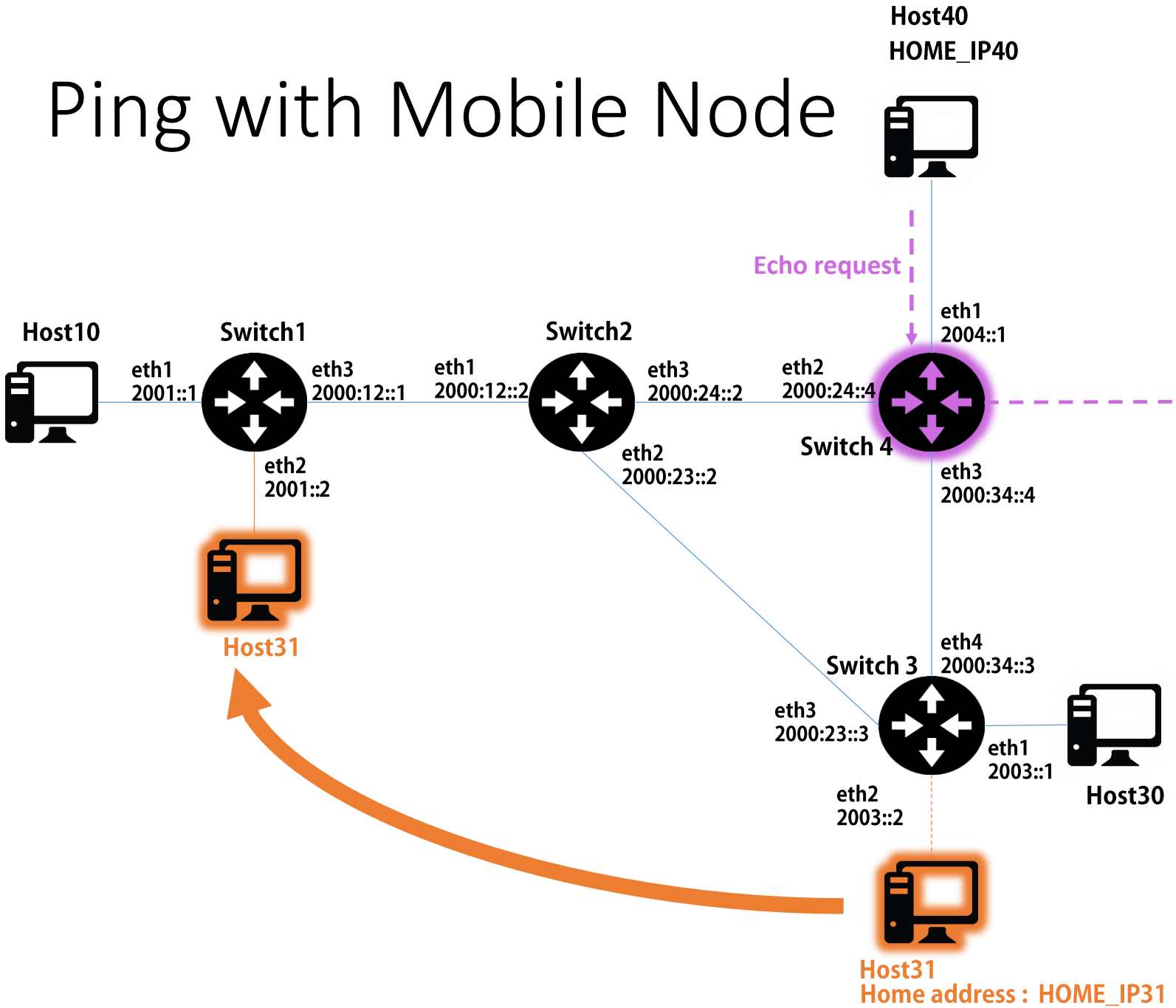
Flow table #2 : FOREIGNER HOSTS INTERFACE RESOLUTION

MATCH	**ACTION**
@dest = HOME_IP31	Forward on eth2
DEFAULT ENTRY	DROP

Ping with Mobile Node



Ping with Mobile Node



Flow table #0

MATCH	ACTION
DEFAULT ENTRY	FORWARD TO TABLE #1

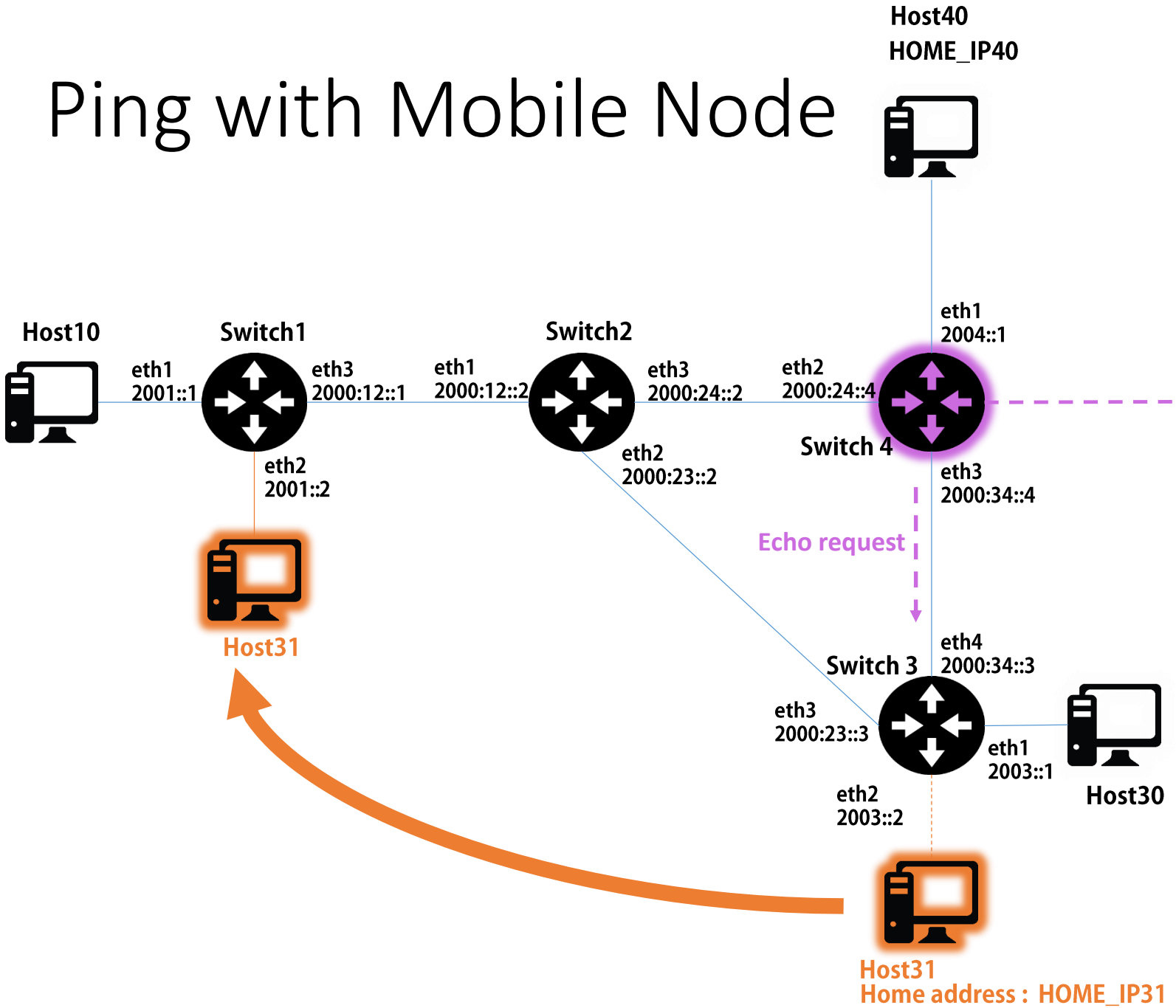
Flow table #1

MATCH	ACTION
…	…
@dest == HOME_IP31	Forward on eth3
…	…
DEFAULT ENTRY	ASK CONTROLLER

Flow table #2

MATCH	ACTION
DEFAULT ENTRY	DROP

Ping with Mobile Node



Flow table #0

MATCH	ACTION
DEFAULT ENTRY	FORWARD TO TABLE #1

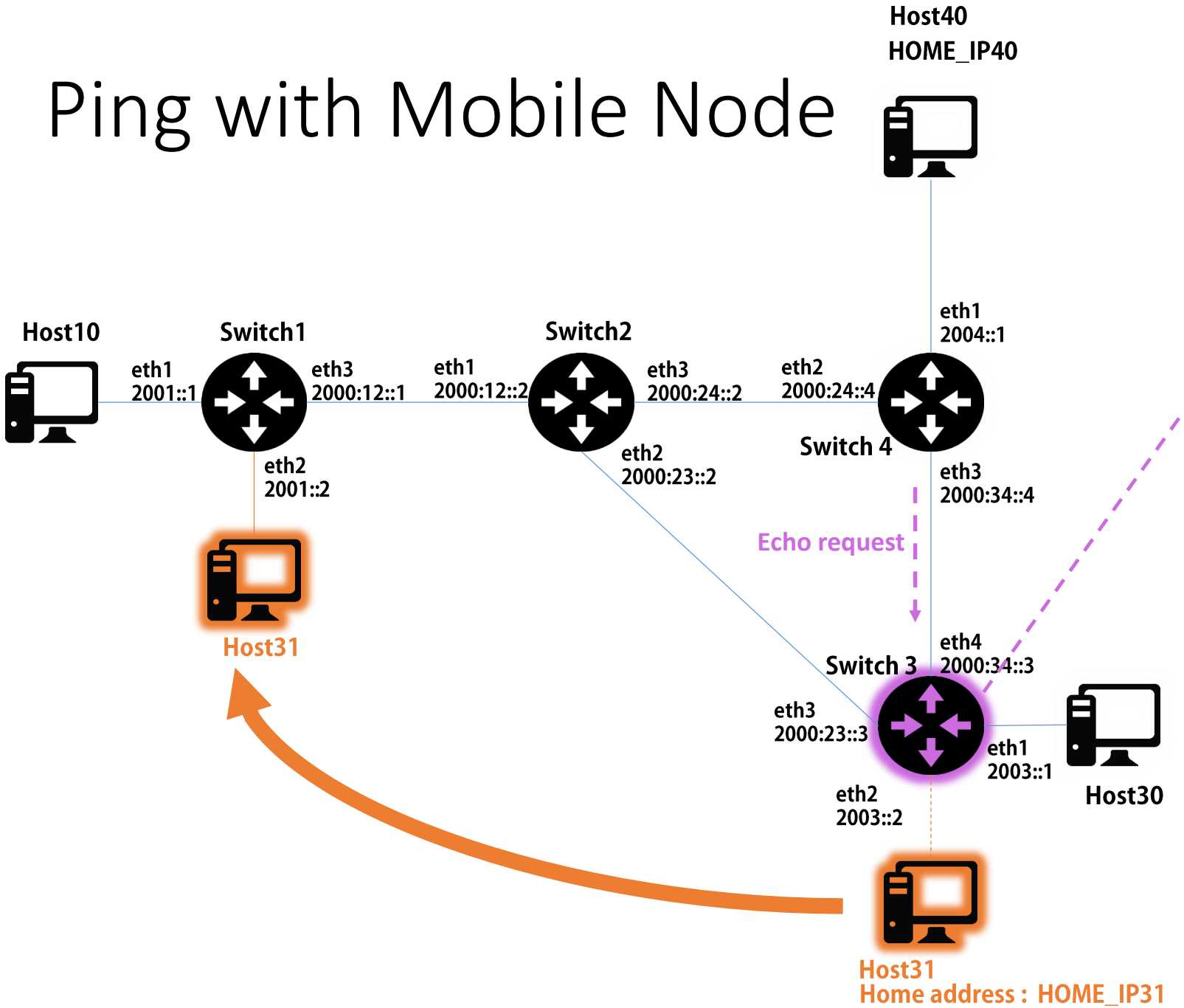
Flow table #1

MATCH	ACTION
…	…
@dest == HOME_IP31	Forward on eth3
…	…
DEFAULT ENTRY	ASK CONTROLLER

Flow table #2

MATCH	ACTION
DEFAULT ENTRY	DROP

Ping with Mobile Node



Flow table #0

MATCH	ACTION
@dest == HOME_IP31	Set Vlan TAG (31) & FORWARD on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward to table #1
DEFAULT ENTRY	FORWARD TO TABLE #1

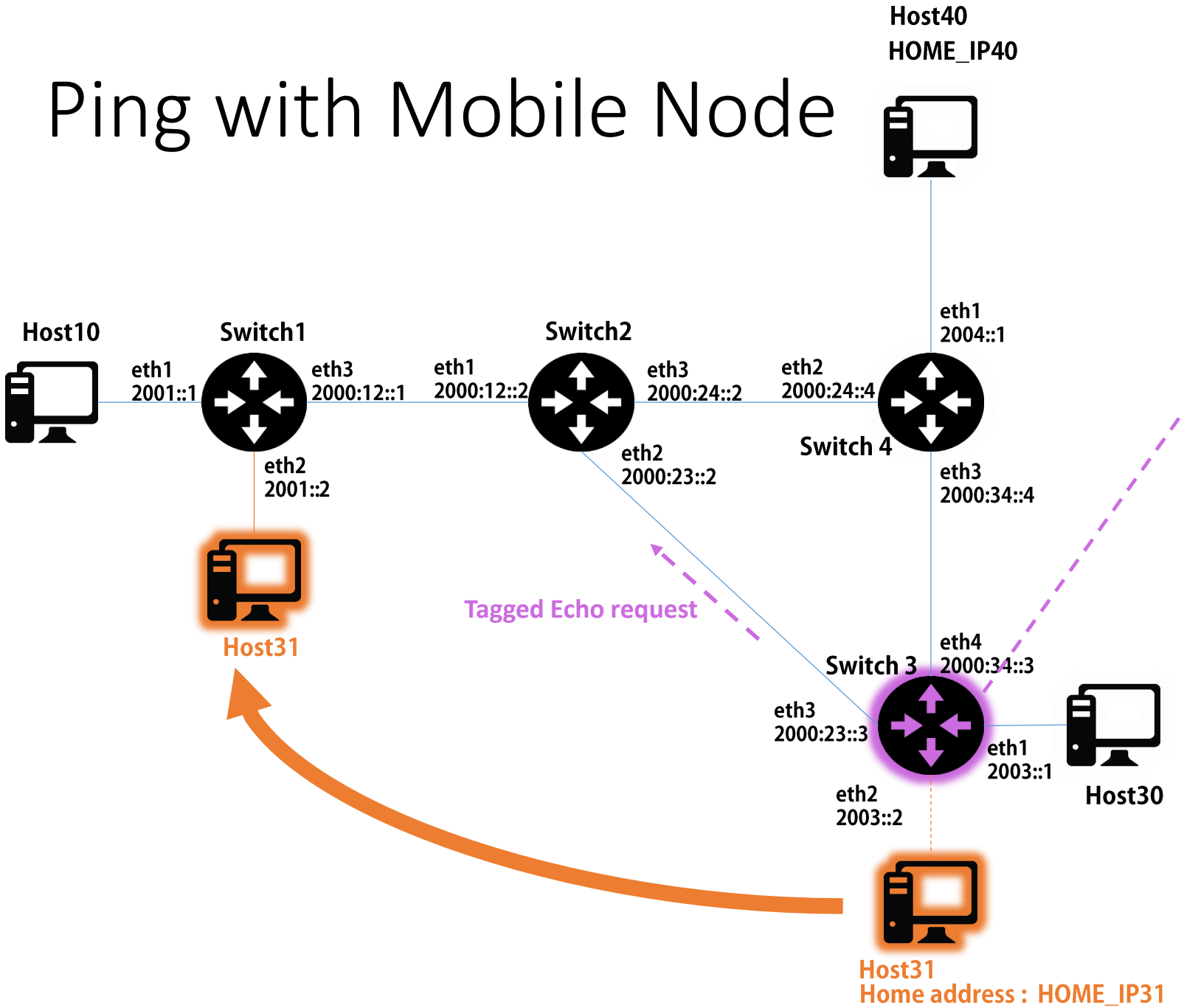
Flow table #1

MATCH	ACTION
…	…
DEFAULT ENTRY	ASK CONTROLLER

Flow table #2

MATCH	ACTION
DEFAULT ENTRY	DROP

Ping with Mobile Node



Flow table #0

MATCH	ACTION
@dest == HOME_IP31	Set Vlan TAG (31) & FORWARD on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward to table #1
DEFAULT ENTRY	FORWARD TO TABLE #1

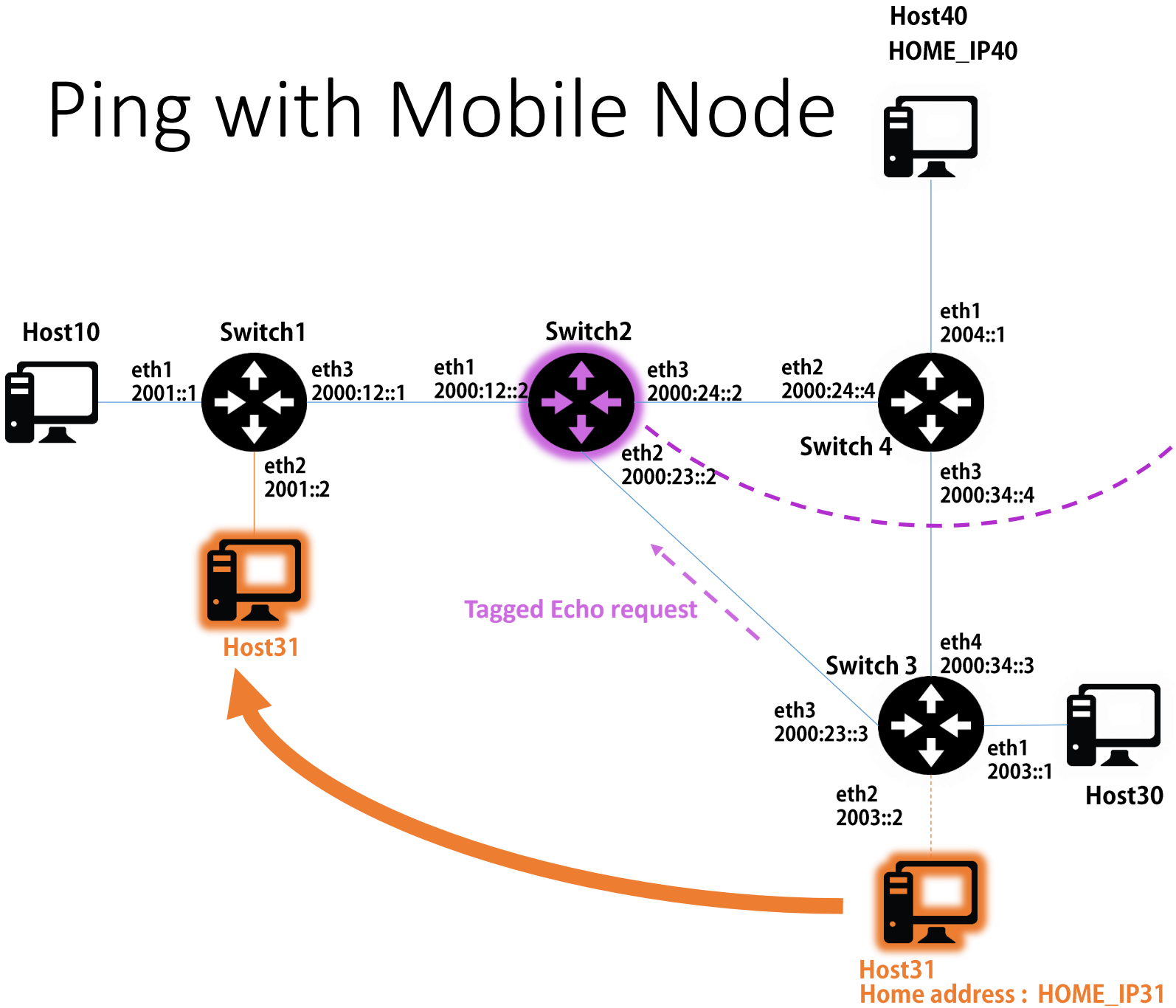
Flow table #1

MATCH	ACTION
…	…
DEFAULT ENTRY	ASK CONTROLLER

Flow table #2

MATCH	ACTION
DEFAULT ENTRY	DROP

Ping with Mobile Node



Flow table #0

MATCH	ACTION
Vlan tagged packet (31) & @dest == HOME_IP31	Forward on eth1
Vlan tagged packet (31) & @src == HOME_IP31	Forward on eth3
DEFAULT ENTRY	FORWARD TO TABLE #1

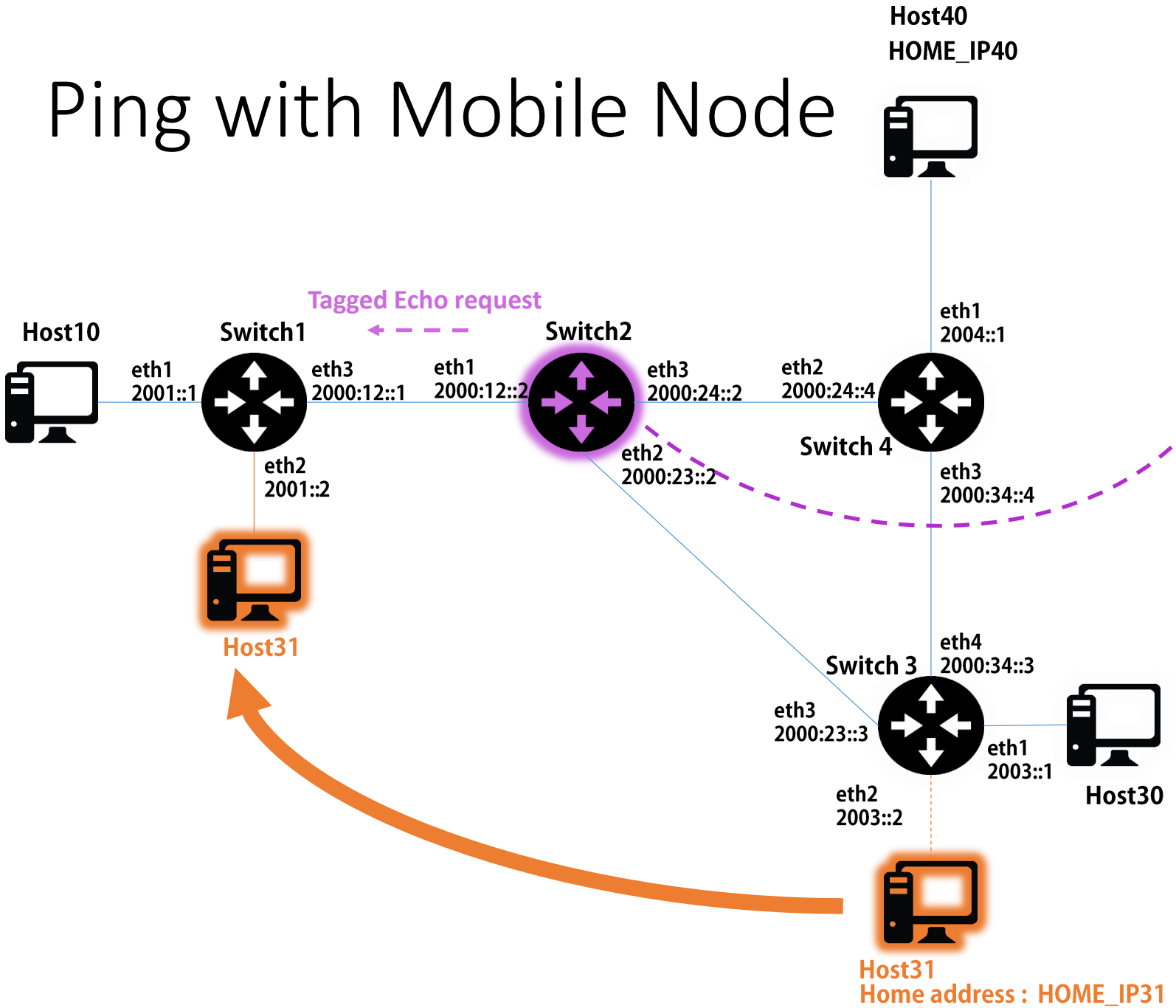
Flow table #1

MATCH	ACTION
…	…
DEFAULT ENTRY	ASK CONTROLLER

Flow table #2

MATCH	ACTION
DEFAULT ENTRY	DROP

Ping with Mobile Node



Flow table #0

MATCH	ACTION
Vlan tagged packet (31) & @dest == HOME_IP31	Forward on eth1
Vlan tagged packet (31) & @src == HOME_IP31	Forward on eth3
DEFAULT ENTRY	FORWARD TO TABLE #1

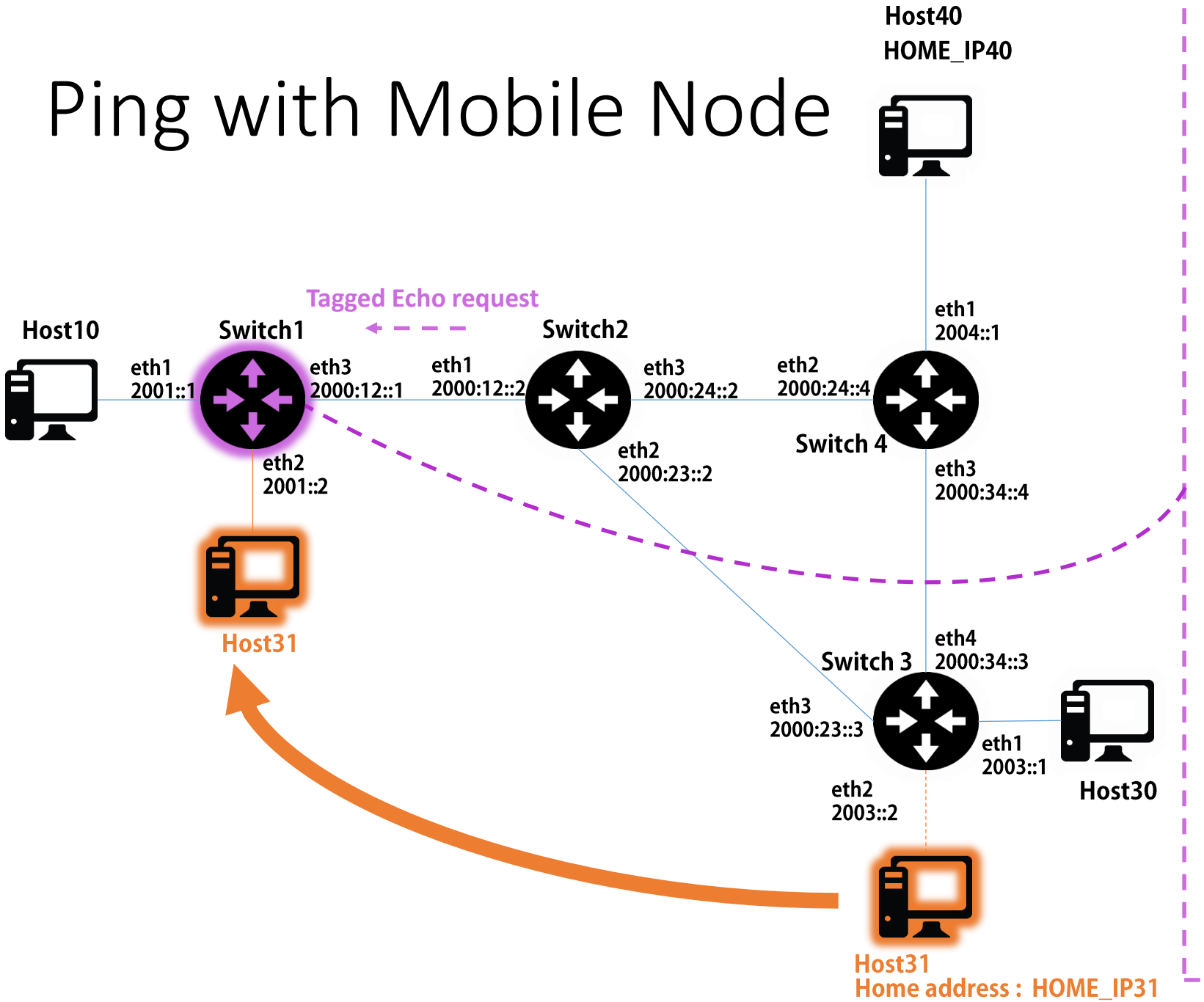
Flow table #1

MATCH	ACTION
…	…
DEFAULT ENTRY	ASK CONTROLLER

Flow table #2

MATCH	ACTION
DEFAULT ENTRY	DROP

Ping with Mobile Node



Flow table #0

MATCH	ACTION
@src == HOME_IP31	Set Vlan TAG (31) & Forward on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward toward table #2
DEFAULT ENTRY	FORWARD TO TABLE #1

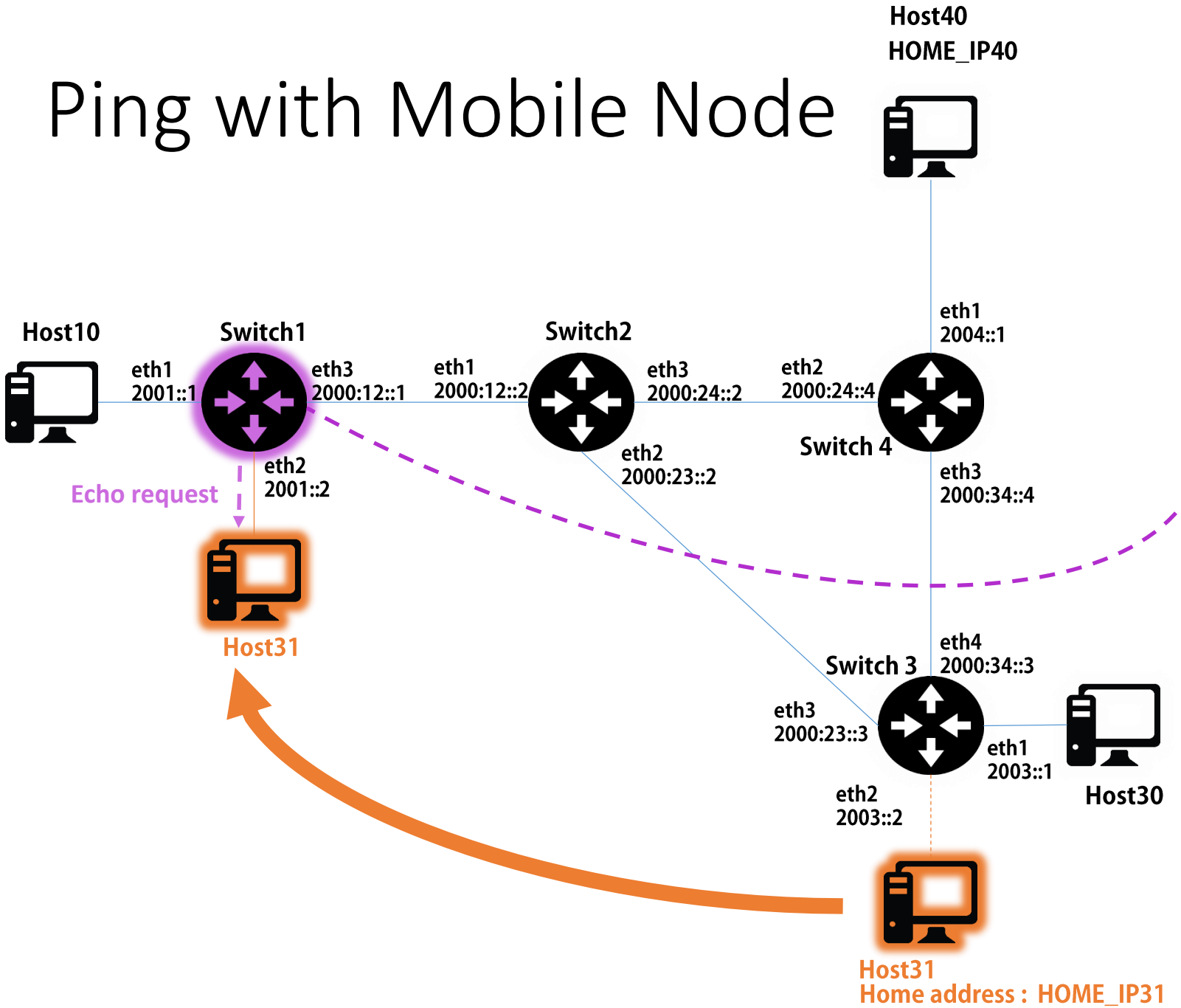
Flow table #1

MATCH	ACTION
…	…
DEFAULT ENTRY	ASK CONTROLLER

Flow table #2

MATCH	ACTION
@dest = HOME_IP31	Forward on eth2
DEFAULT ENTRY	DROP

Ping with Mobile Node



Flow table #0

MATCH	ACTION
@src == HOME_IP31	Set Vlan TAG (31) & Forward on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward toward table #2
DEFAULT ENTRY	FORWARD TO TABLE #1

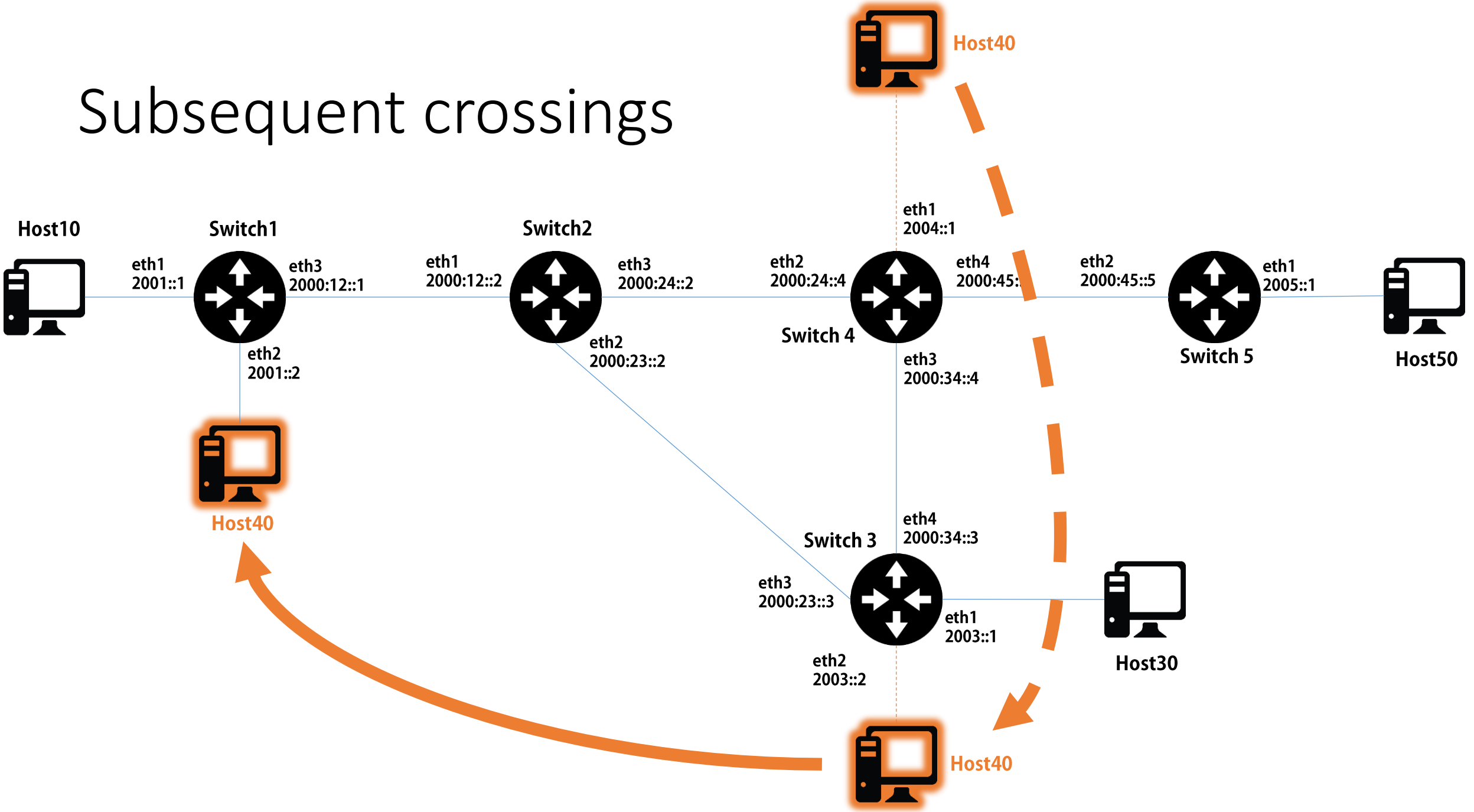
Flow table #1

MATCH	ACTION
…	…
DEFAULT ENTRY	ASK CONTROLLER

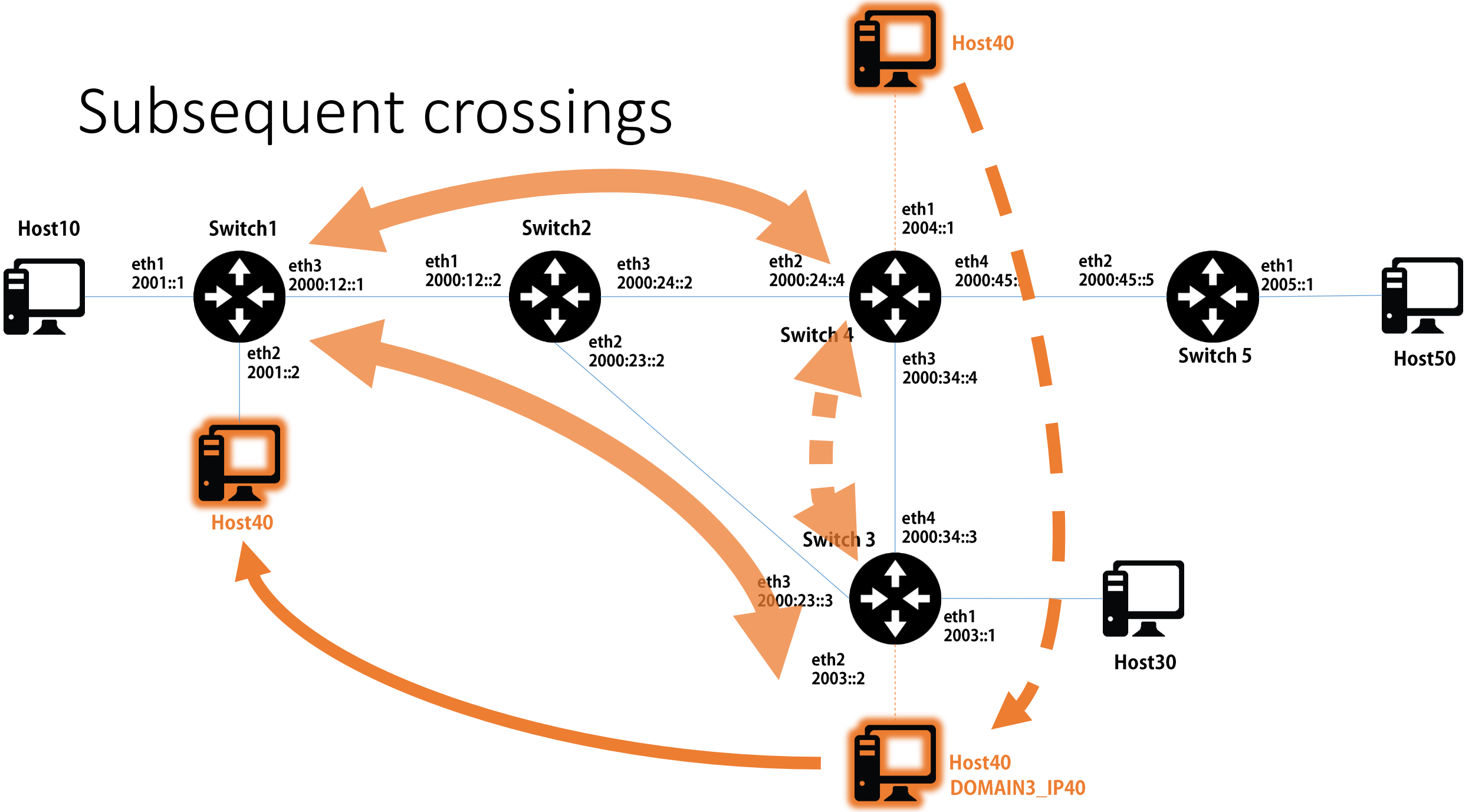
Flow table #2

MATCH	ACTION
@dest = HOME_IP31	Forward on eth2
DEFAULT ENTRY	DROP

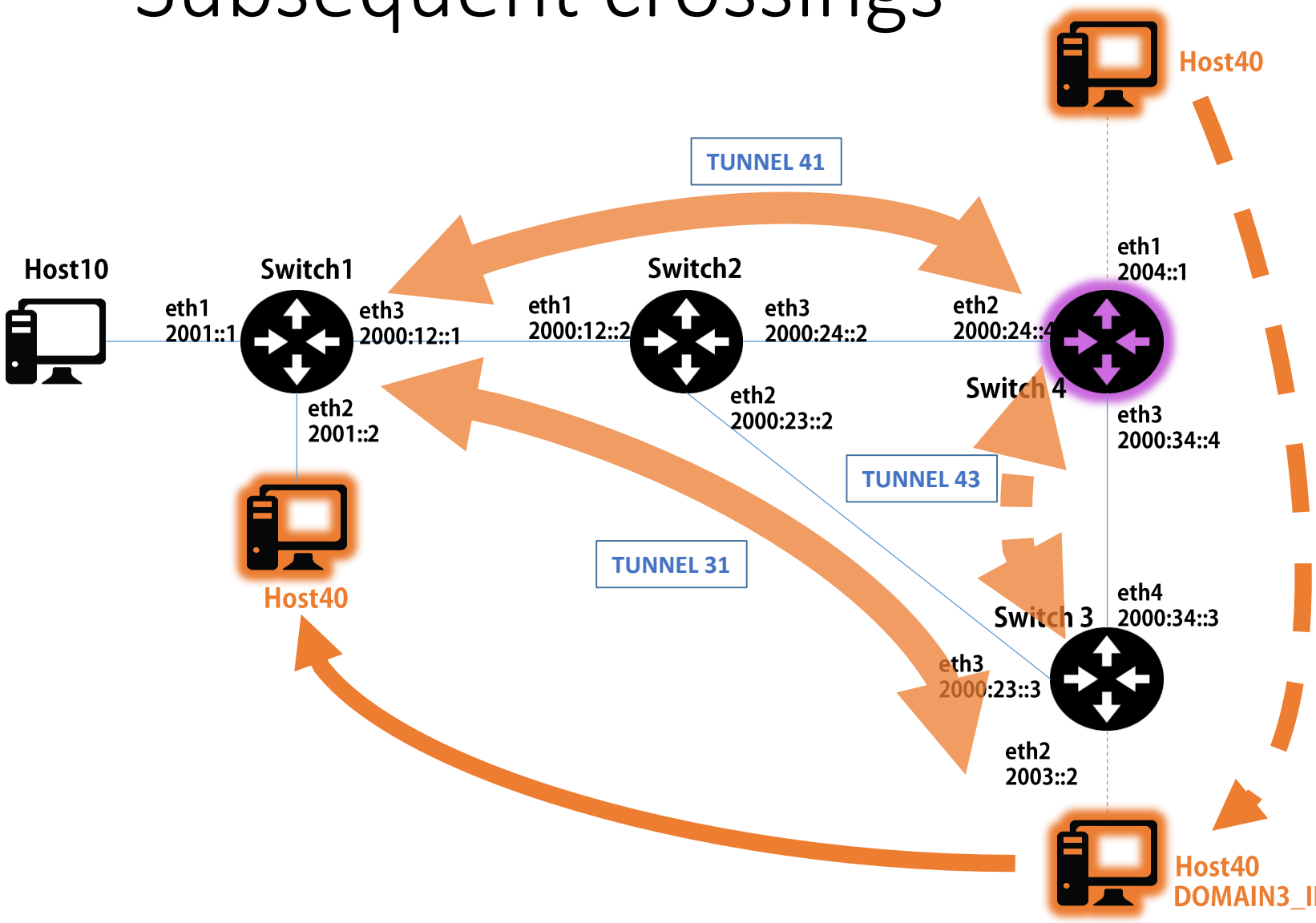
Subsequent crossings



Subsequent crossings



Subsequent crossings



Flow table #0

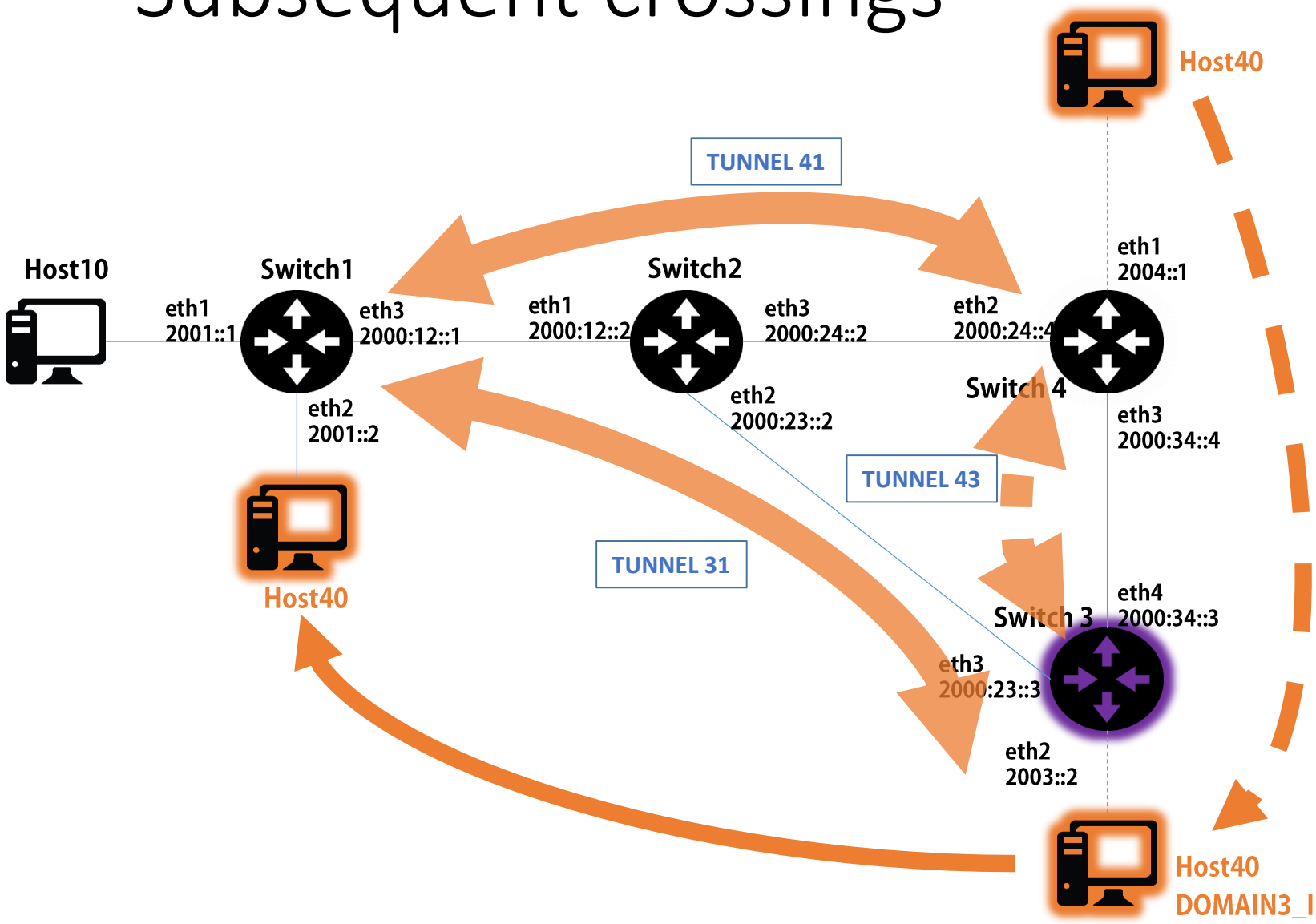
MATCH	ACTION
@dest == HOME_IP40	Set Vlan TAG (43) & FORWARD on eth3
Vlan tagged packet (43)	Strip Vlan tag & forward to table #1
DEFAULT ENTRY	FORWARD TO TABLE #1

When Host40 moves
To Switch1 domain

New flow table #0

MATCH	ACTION
Vlan tagged packet (41)	Strip Vlan tag & forward to table #1
@dest == HOME_IP40	Set Vlan TAG (41) & FORWARD on eth2
Vlan tagged packet (43)	Strip Vlan tag & forward to table #1
DEFAULT ENTRY	FORWARD TO TABLE #1

Subsequent crossings



Flow table #0

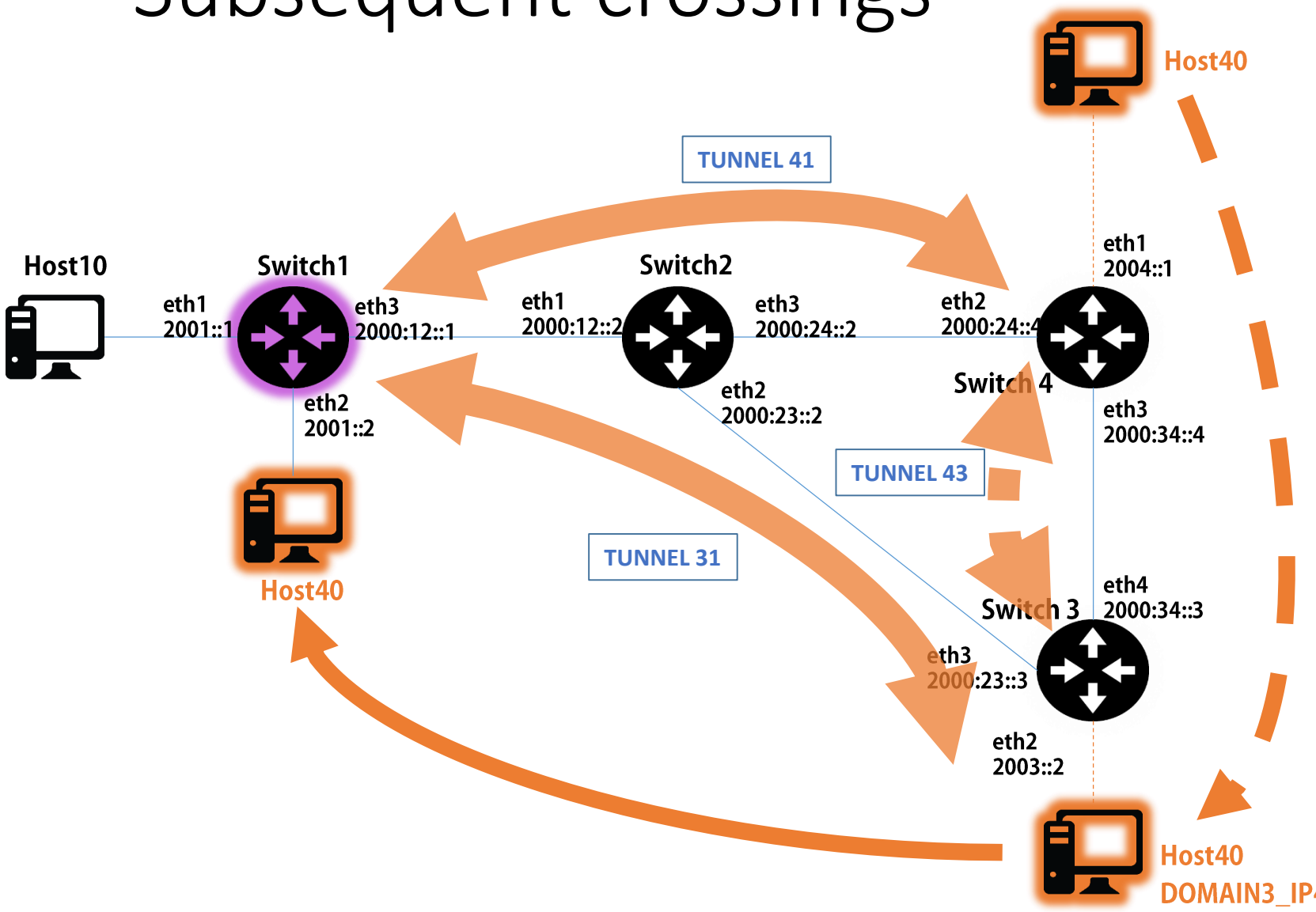
MATCH	ACTION
@src == HOME_IP40	Set Vlan TAG (43) & Forward on eth4
Vlan tagged packet (43)	Strip Vlan tag & forward toward table #2
DEFAULT ENTRY	FORWARD TO TABLE #1

When Host40 moves
To Switch1 domain

New flow table #0

MATCH	ACTION
@dest == DOMAIN3_IP40	Set Vlan TAG (31) & FORWARD on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward to table #1
@src == HOME_IP40	Set Vlan TAG (43) & Forward on eth4
Vlan tagged packet (43)	Strip Vlan tag & forward toward table #2
DEFAULT ENTRY	FORWARD TO TABLE #1

Subsequent crossings



Flow table #0

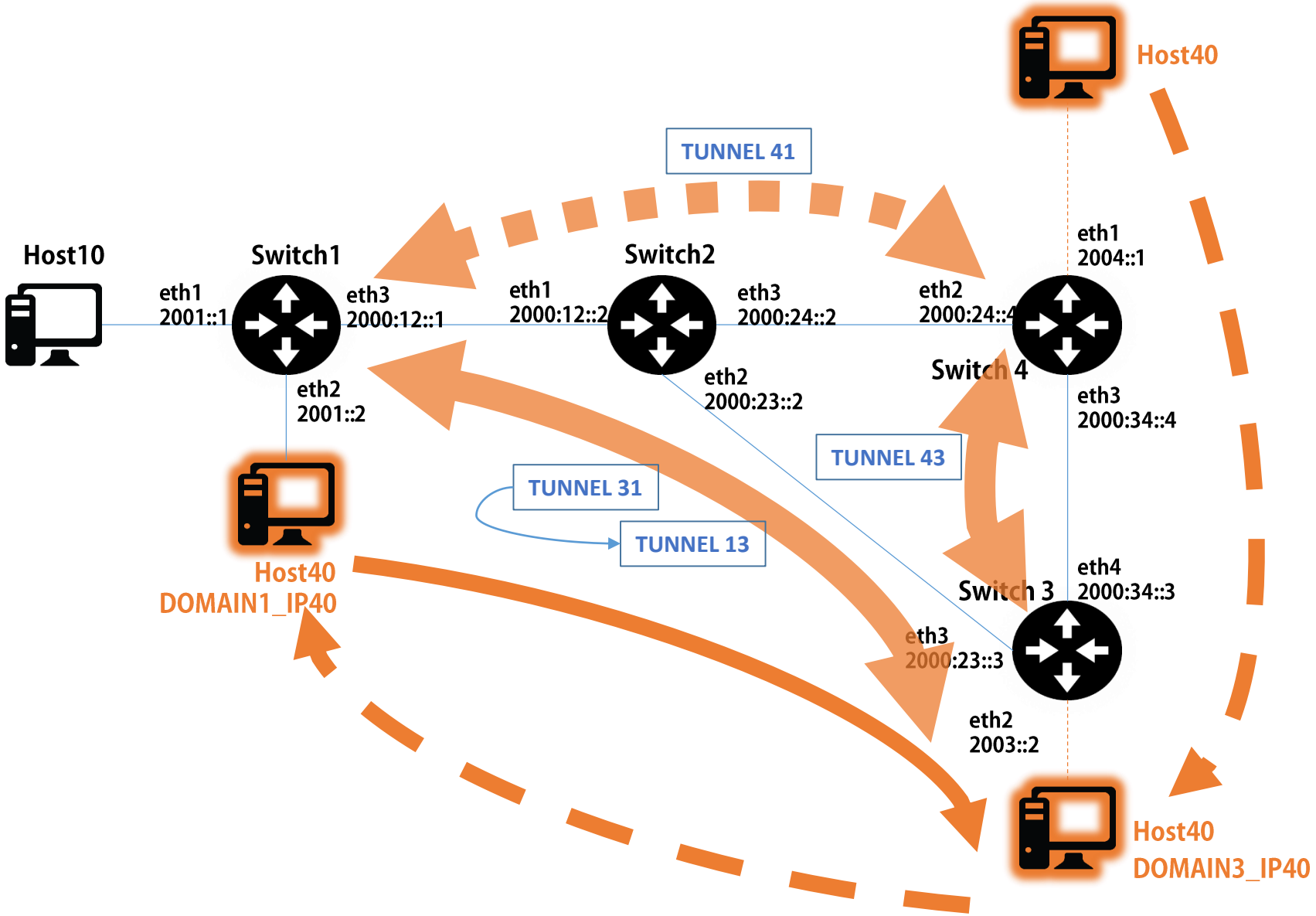
MATCH	ACTION
DEFAULT ENTRY	FORWARD TO TABLE #1

When Host40 moves
To Switch1 domain

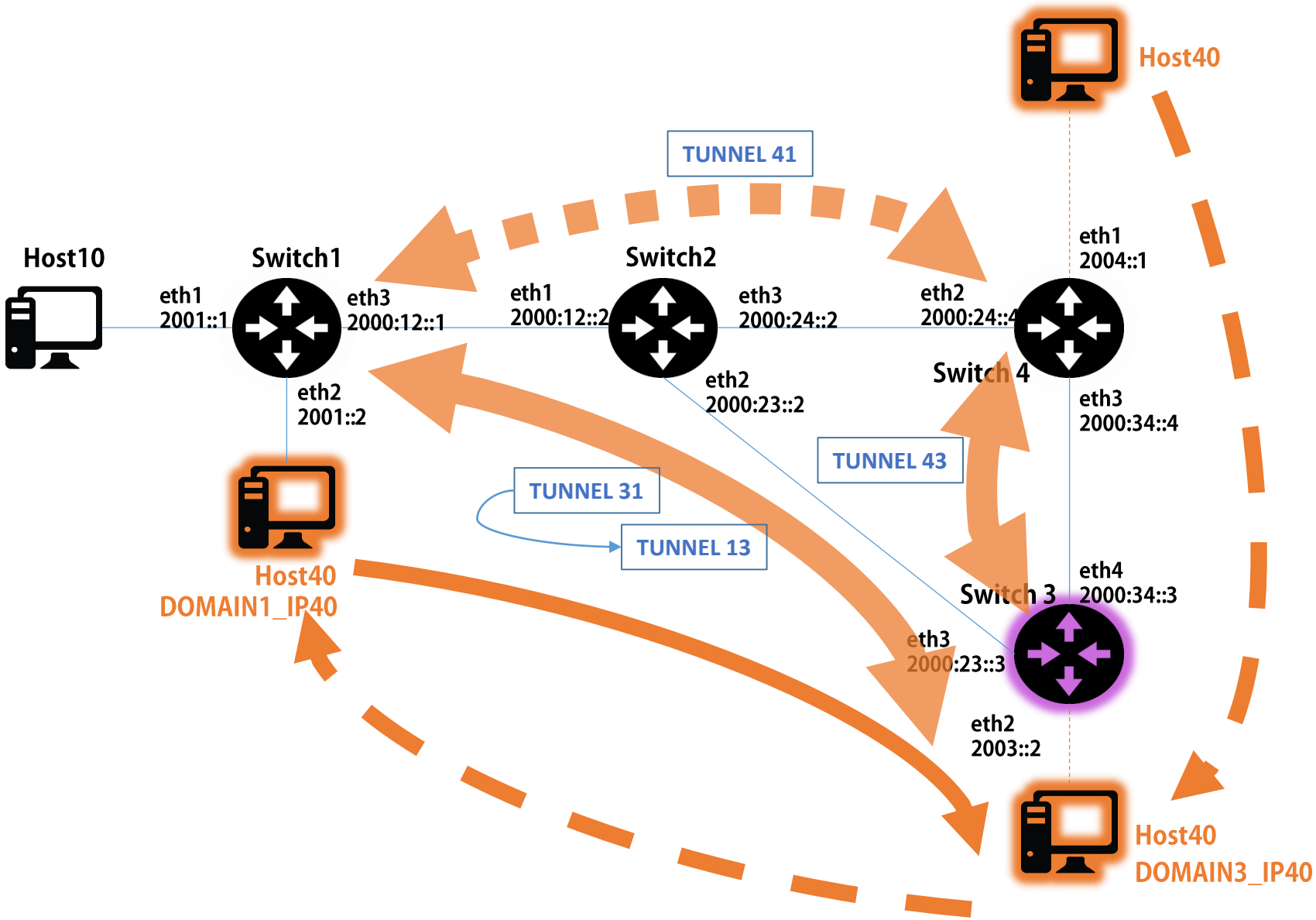
New flow table #0

MATCH	ACTION
@src == HOME_IP40	Set Vlan TAG (41) & Forward on eth3
Vlan tagged packet (41)	Strip Vlan tag & forward toward table #2
@src == DOMAIN3_IP40	Set Vlan TAG (31) & Forward on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward toward table #2
DEFAULT ENTRY	FORWARD TO TABLE #1

Subsequent crossings : moving back



Subsequent crossings : moving back

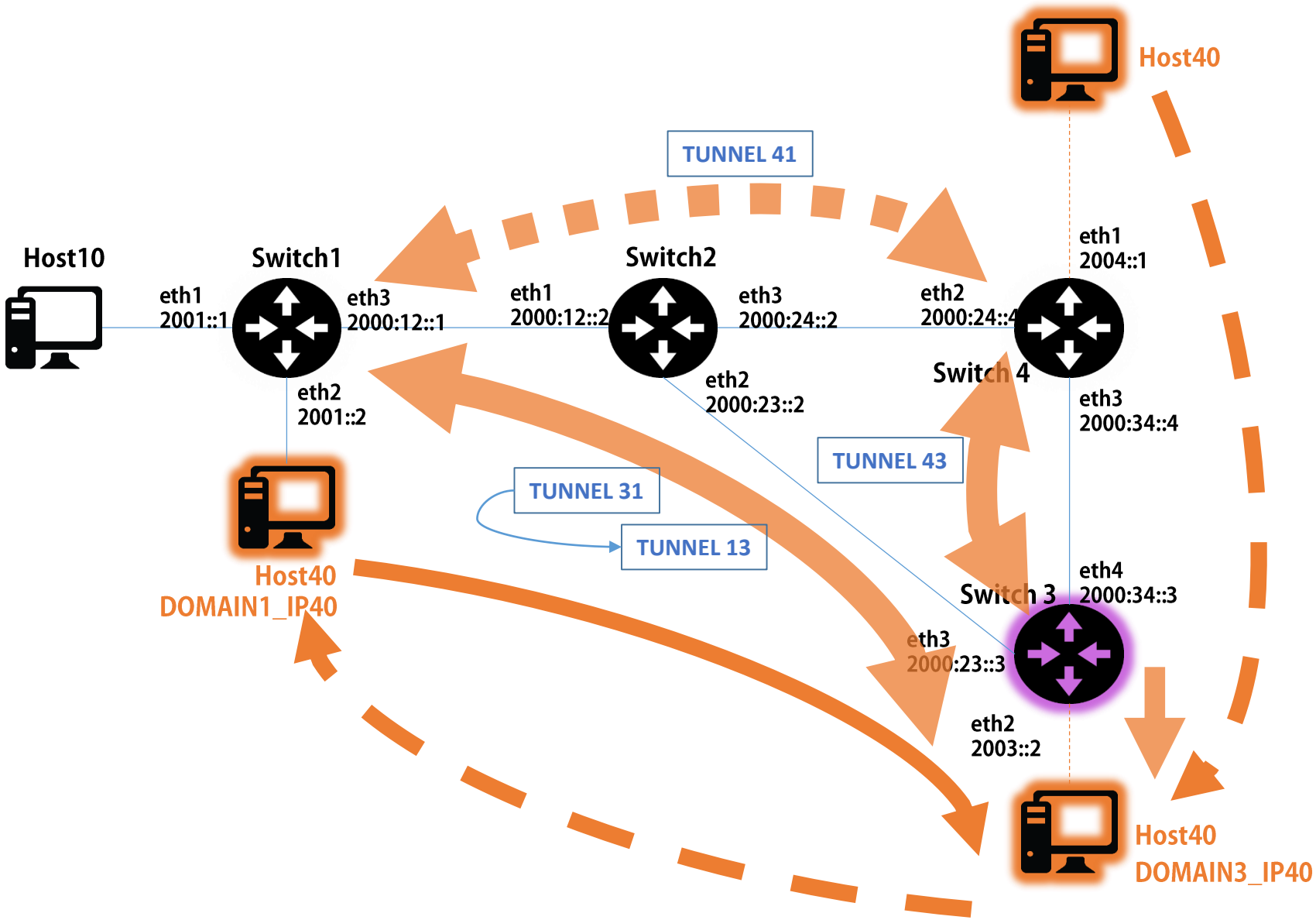


MATCH	ACTION
@dest == DOMAIN3_IP40	Set Vlan TAG (31) & FORWARD on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward to table #1
@src == HOME_IP40	Set Vlan TAG (43) & Forward on eth4
Vlan tagged packet (43)	Strip Vlan tag & forward toward table #2
DEFAULT ENTRY	FORWARD TO TABLE #1

When Host40 moves
To Switch3 domain again

MATCH	ACTION
[redacted]	
@src == DOMAIN1_IP40	Set Vlan TAG (13) & Forward on eth3
Vlan tagged packet (13)	Strip Vlan tag & forward to table #2
@dest == DOMAIN3_IP40	**Set Vlan TAG (31) & FORWARD on eth3**
Vlan tagged packet (31)	Strip Vlan tag & forward to table #1
@src == HOME_IP40	Set Vlan TAG (43) & Forward on eth4
Vlan tagged packet (43)	Strip Vlan tag & forward toward table #2
DEFAULT ENTRY	FORWARD TO TABLE #1

Subsequent crossings : moving back



MATCH	ACTION
@dest == DOMAIN3_IP40	Set Vlan TAG (31) & FORWARD on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward to table #1
@src == HOME_IP40	Set Vlan TAG (43) & Forward on eth4
Vlan tagged packet (43)	Strip Vlan tag & forward toward table #2
DEFAULT ENTRY	FORWARD TO TABLE #1

When Host40 moves
To Switch3 domain again

MATCH	ACTION
@dest == DOMAIN3_IP40	Forward to table #1
@src == DOMAIN1_IP40	Set Vlan TAG (13) & Forward on eth3
Vlan tagged packet (13)	Strip Vlan tag & forward to table #2
@dest == DOMAIN3_IP40	Set Vlan TAG (31) & FORWARD on eth3
Vlan tagged packet (31)	Strip Vlan tag & forward to table #1
@src == HOME_IP40	Set Vlan TAG (43) & Forward on eth4
Vlan tagged packet (43)	Strip Vlan tag & forward toward table #2
DEFAULT ENTRY	FORWARD TO TABLE #1

Conclusion : evaluation of the controller

Controller independent of the underlying topology

Proper way of handling tunnel (spatial complexity)

Vlan oriented tunnels

Organization of packet forwarding (Table)

Packet replay on the same interface impossible

Packet loss during flow establishment

Only handling ICMPv6 packets

Host address conflicts not considered