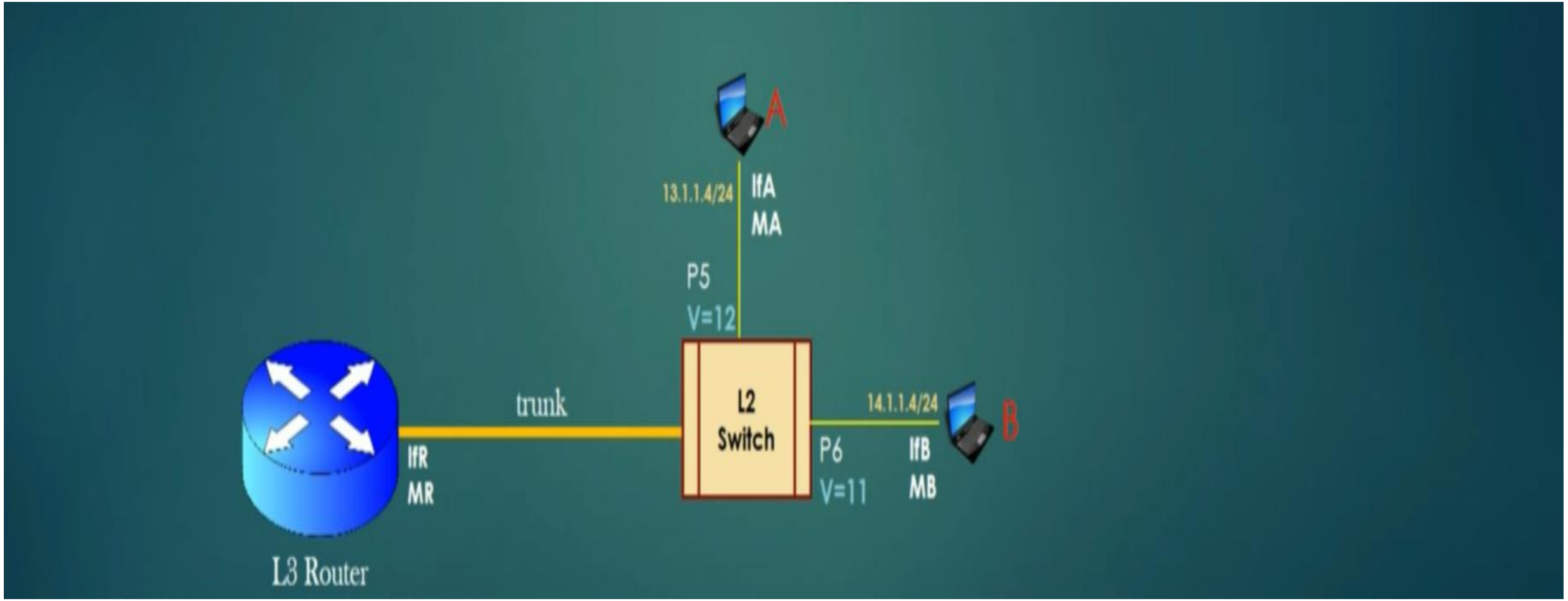
Inter-VLAN Routing

TOPIC COVERED IN THIS LECTURE

- Inter - VLAN Routing: Introduction
- Problem Statement
- Recap of Traditional L3 Routing
- Inter VLAN Routing Basics and Routing methodology,

Inter VLAN Routing

- Problem Statement:
- How Host A will talk to Host B?



Recap of Traditional L3 Routing

If Host A wants to communicate with Host B :

1. First Host A will send Frames to the Gateway Router with Default Entry in its Routing Table

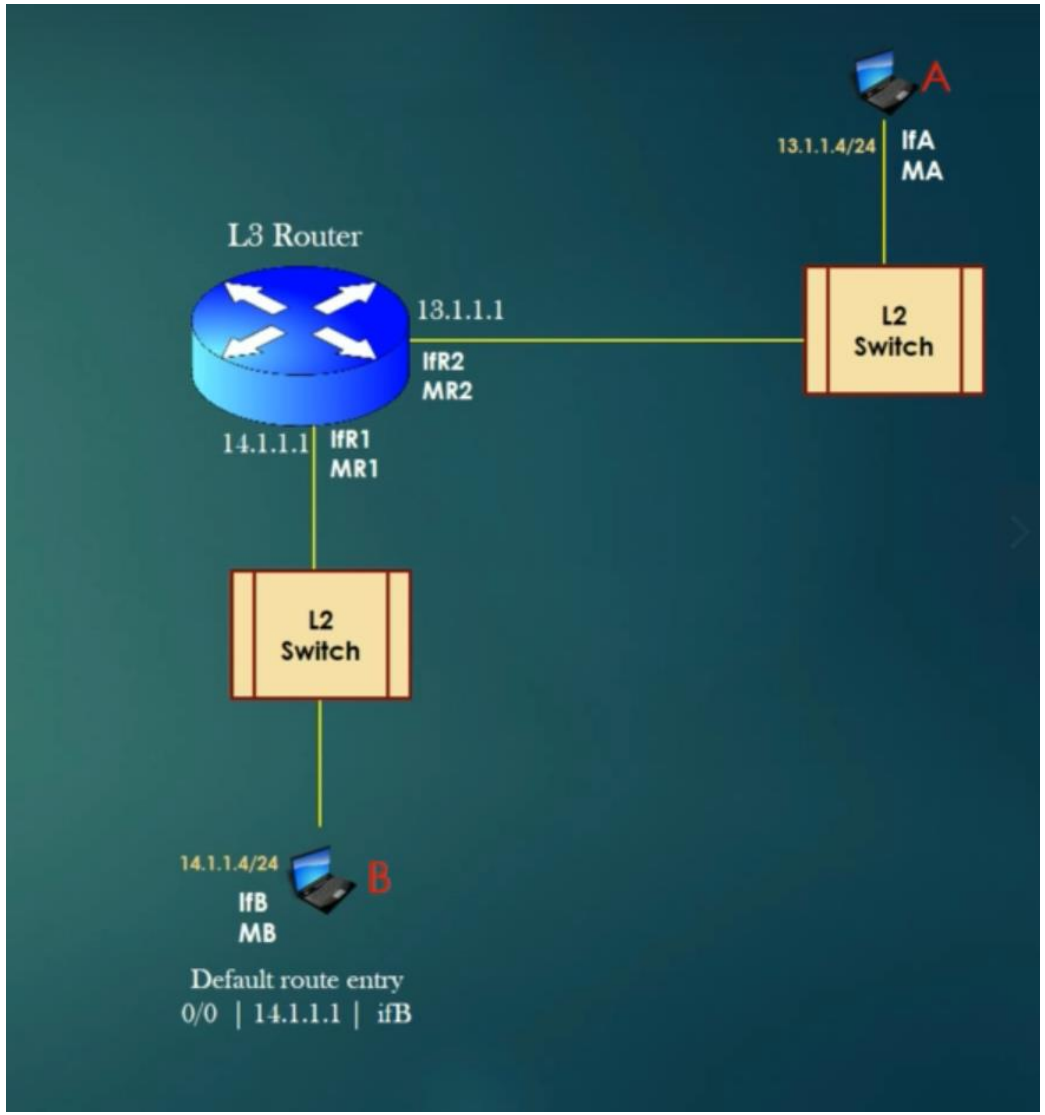
2. To do so A must know the MAC Address of the default Gateway IP.
   ie, A must have ARP entry 13.1.1.1 in its ARP cache, Once A has this ARP mapping, A can send a Frame to L3 gateway router using Dest MAC =MR2 in Ethernet header.

3. If A Doesn't have MAC Address of default gateway in its ARP Cache, then A will have to send the Broadcast message to the L3 Router, then L3 router will reply back with the MAC address of the Corresponding Interface to the HOST A.

4. Now after getting MAC address of the corresponding interface, Host A will send Data to the L3 Router by L2 Routing.

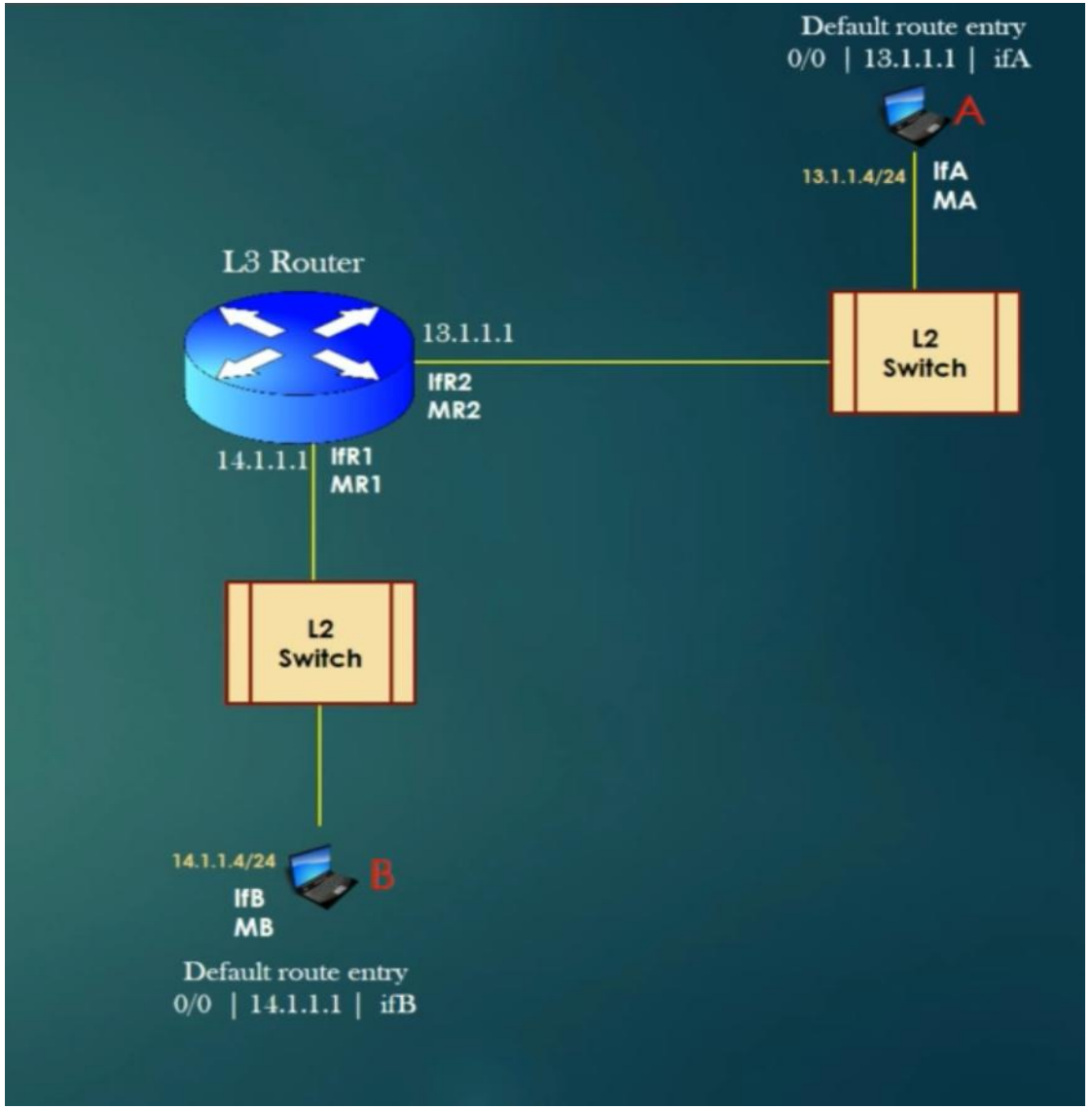
5. Then Router will Extract Destination IP address, and check if its belong to remote Subnet, then it will use L3 Routing to forward the packet, by consulting its routing table.

6. If the destination belong to Local Subnet , the it will use L2 Routing to forward the packet to the destination.



Recap of Traditional L3 Routing

- Whenever a host machine A needs to communicate with host machine B present in a remote subnet, A sends frame to its gateway router using default entry in it's routing table.
  - Eg: if A wants to send a frame destined to 14.1.1.4, A has to send a frame to L3 router
- To do so, host machine A must know the MAC address for default gateway IP
  - or it must have ARP entry 13.1.1.1←→MR2 in its ARP cache. Once A has this ARP mapping, A can send a Frame to L3 gateway router using Dest MAC =MR2 in Ethernet header.

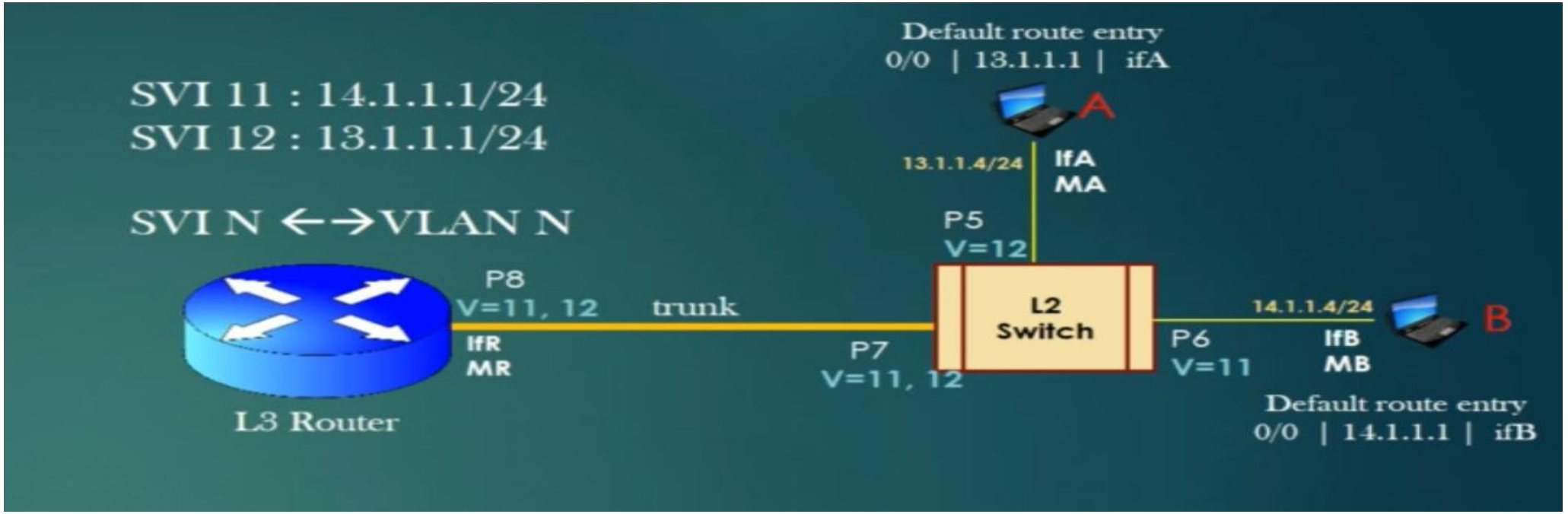


Inter VLAN Routing

Similarly in inter VLAN routing, we need to know two things first:

- Default Route
- ARP Resolution for Default gateway ip

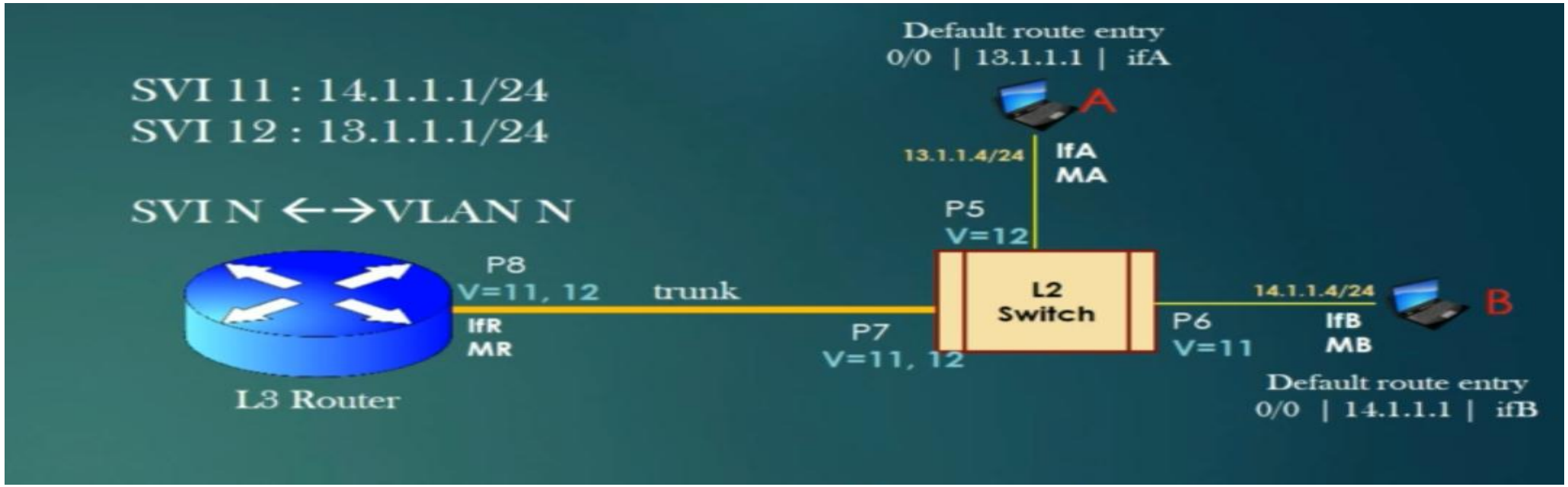
Default Route



- To support inter-vlan routing, every host machine in the network is configured with a default route
- Thus default route of host machine= IP address of SVI interface which is bind to VLAN on which host machine is present.
- Thus A's default route = 13.1.1.1 because A is in VLAN 12, and VLAN 12 binds with SVI 12.
  - B's default route = 14.1.1.1 because B is in VLAN 11, and VLAN 11 binds with SVI 11
  - Default route on host A's routing table is installed as: 0.0.0.0/0 / 13.1.1.1 / ifA
- Whenever the host needs to send a frame to destination machine which is outside its own subnet (vlan), host machine use a default route.

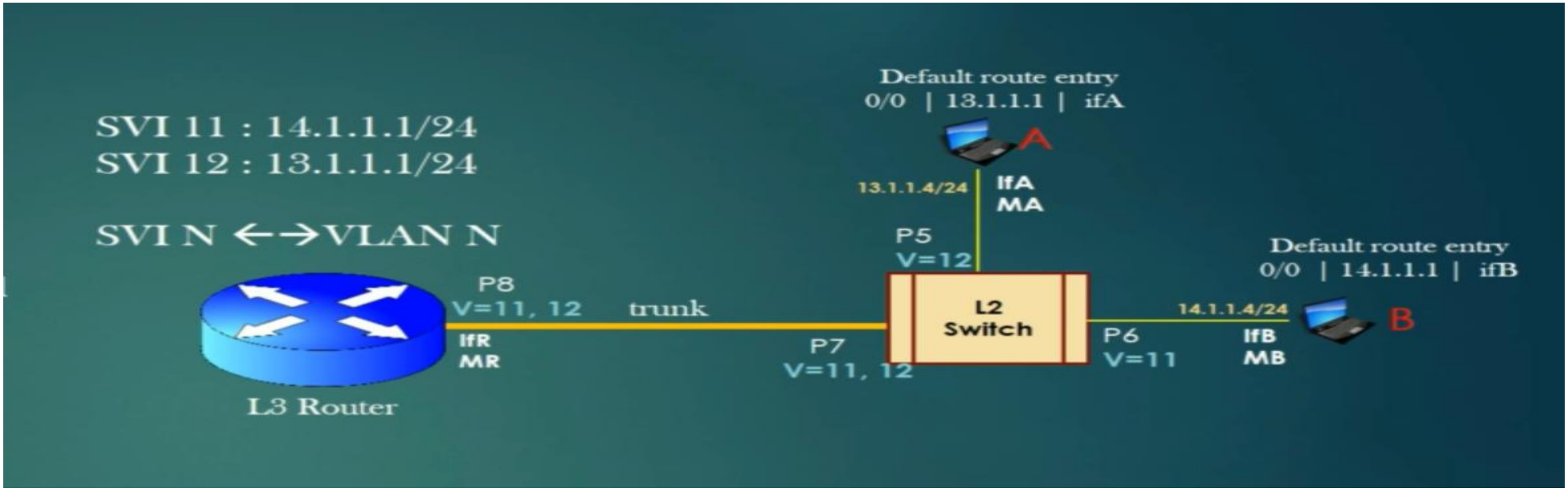
If A want to send data to B,
First B has to send data to A, using default route entry in A routing table

ARP Resolution for Default Routes



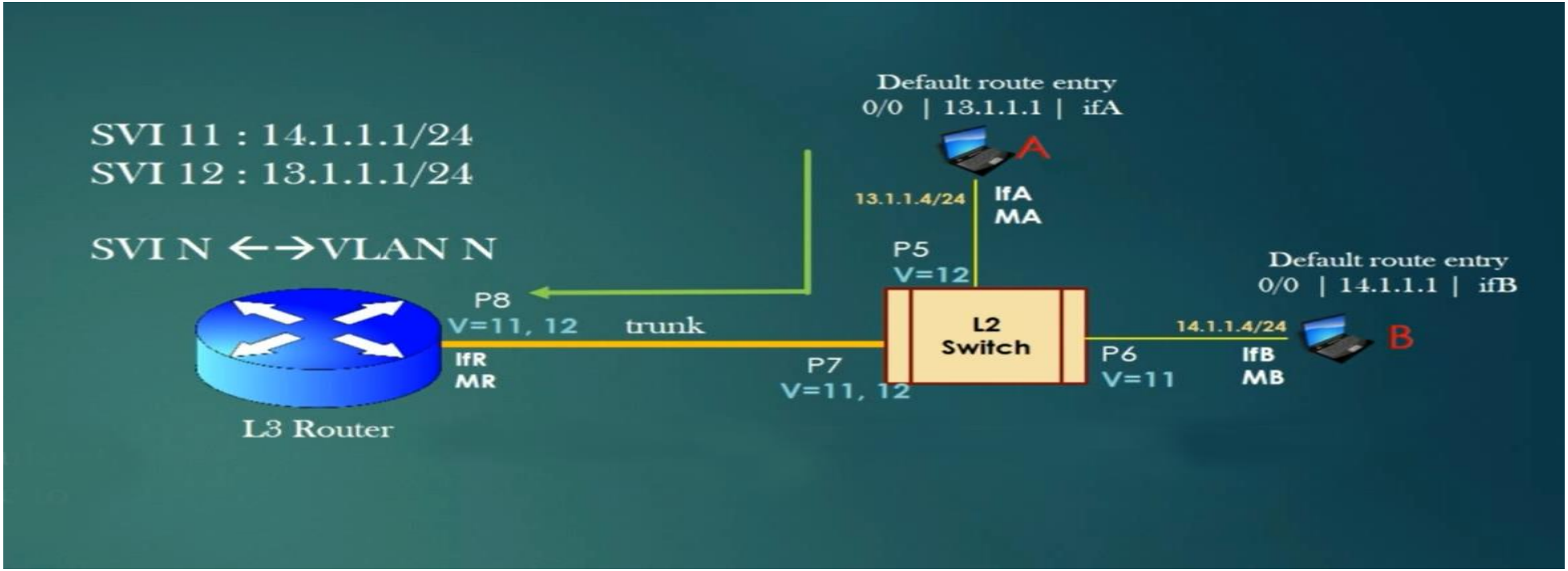
- Whose MAC address L3 router would return if it receives ARP Broadcast message for ARP resolution of IP= IP address of SVI Interface?
- For example, Host Machine A issues ARP Broadcast message to know MAC for default ip=13.1.1.1
- 13.1.1.1 is the IP of SVI 12, but SVI 12 is a logical interface, then whose MAC should L3 router must return in ARP reply?
- ANS: MAC of physical interface on which ARP Broadcast message is received .
- In this case, MAC=MR will be returned in ARP reply.
- Thus L3 router returns MAC=MR in ARP reply for IP address = SVI's ip address (14.1.1.1 or 13.1.1.1) since these are the ip addresses of one of router's local interface (however logical interface) of L3 router.

Inter VLAN Routing Steps



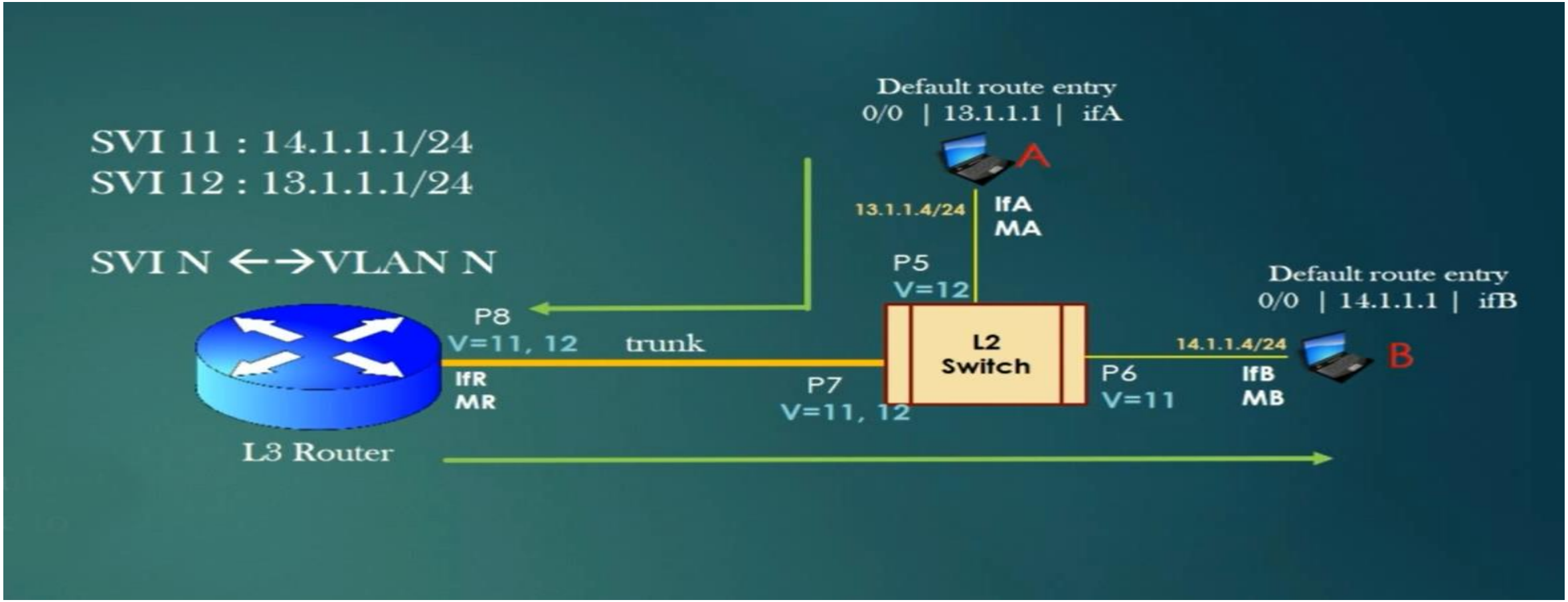
- Now you have all the knowledge to do inter vlan routing
- Suppose host machine A wants to send data to host machine B whose ip address is 14.1.1.4

Inter VLAN Routing Steps



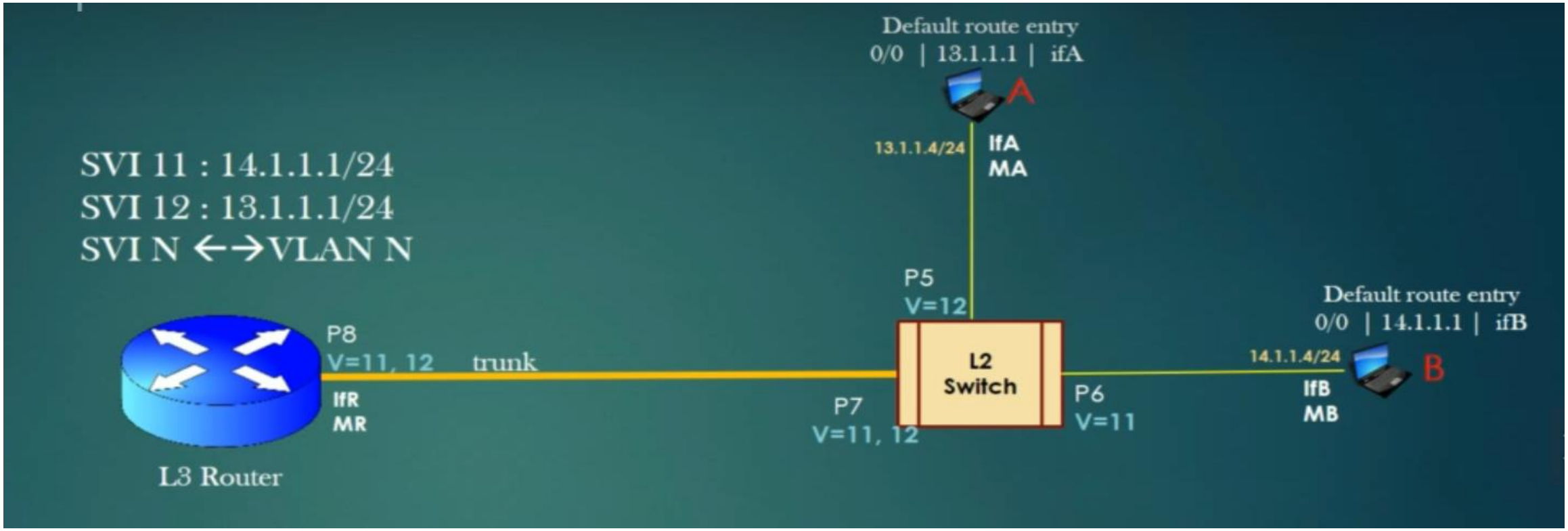
- Since, the data needs to go to remote subnet, there host A (src) needs to send frame to gateway router first.

Inter VLAN Routing Steps



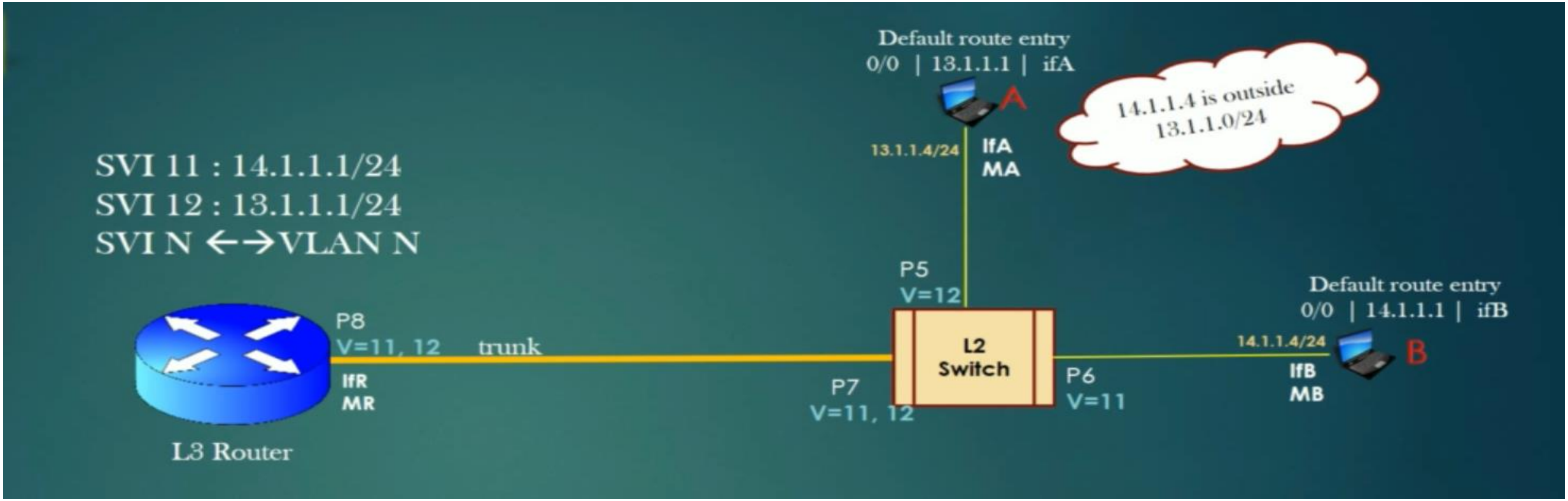
- Gateway router then re-routes the frame to destination subnet.

Inter VLAN Routing Steps



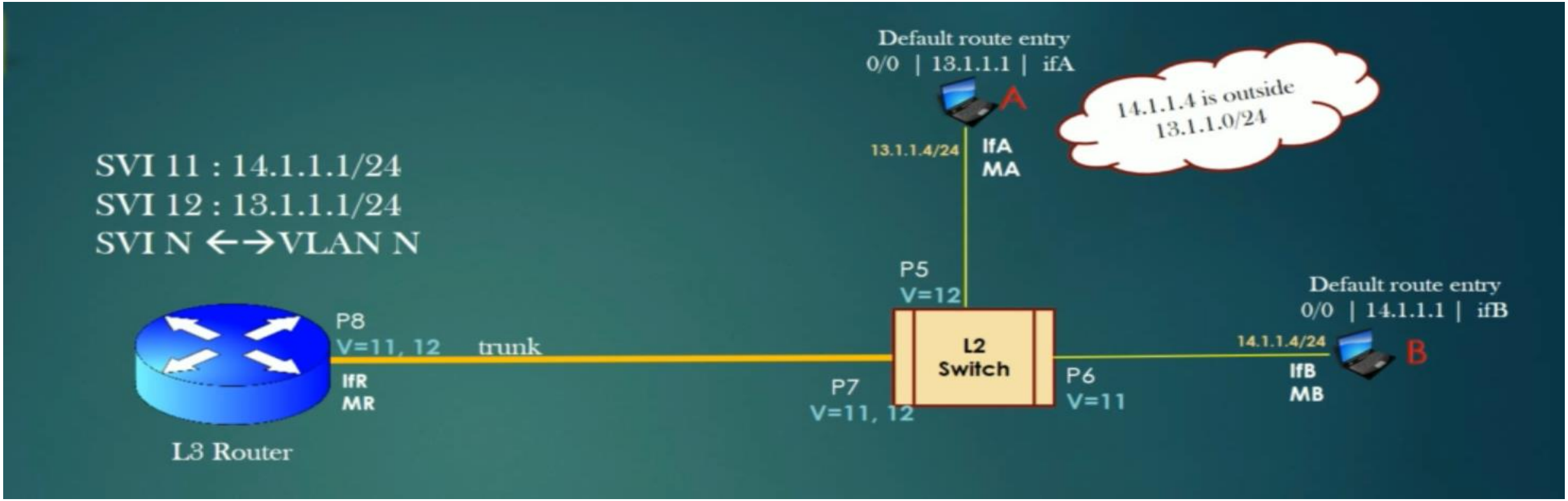
- Steps: from source host machine A to L3 gateway router:

Inter VLAN Routing Steps



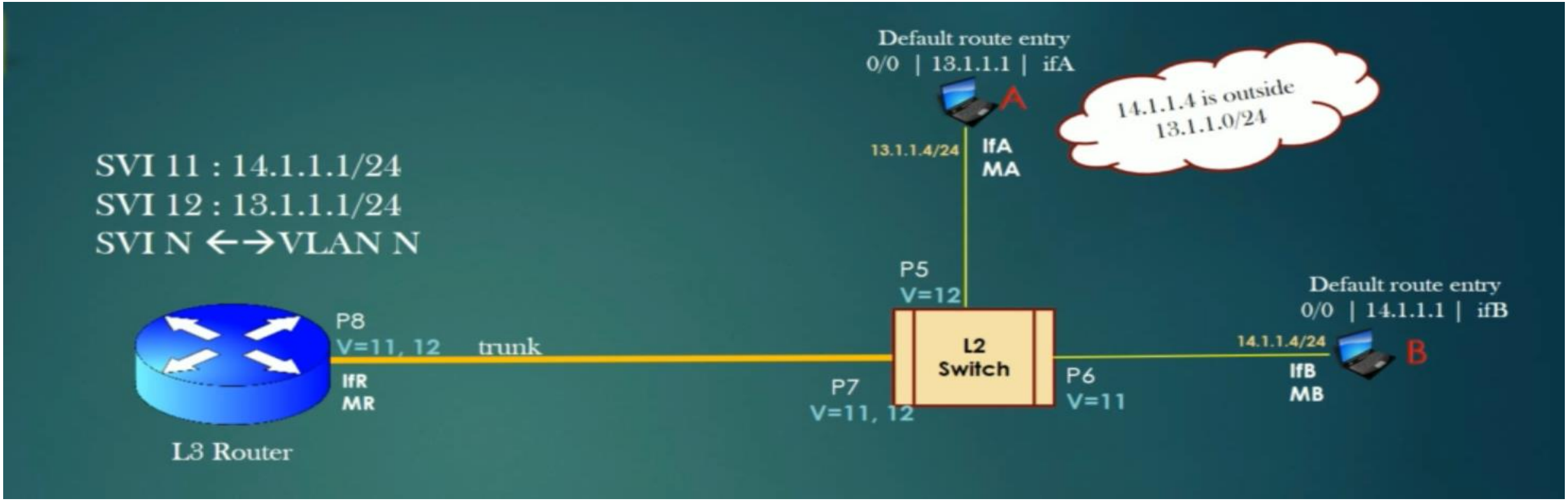
- Steps: from source host machine A to L3 gateway router
  1. A finds the B's ip=14.1.1.4 belongs to remote subnet.

Inter VLAN Routing Steps



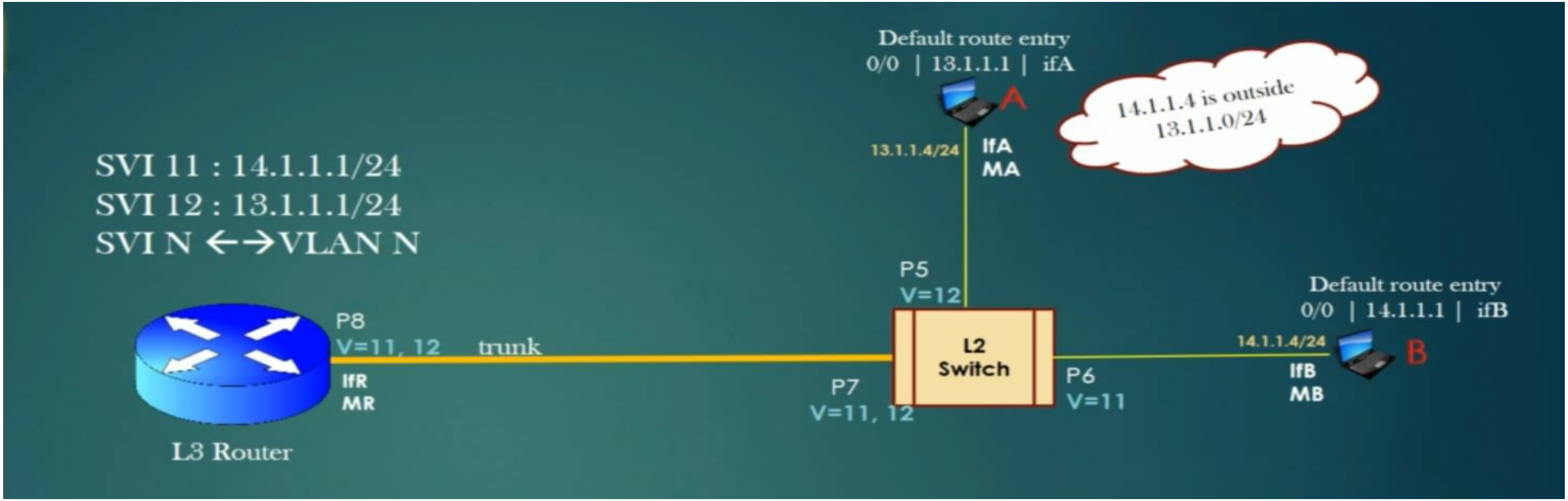
- Steps: from source host machine A to L3 gateway router
  1. A finds the B's ip=14.1.1.4 belongs to remote subnet.
  2. A decides to send data using default route which states that gateway ip is 13.1.1.1, outgoing interface is ifA.

Inter VLAN Routing Steps



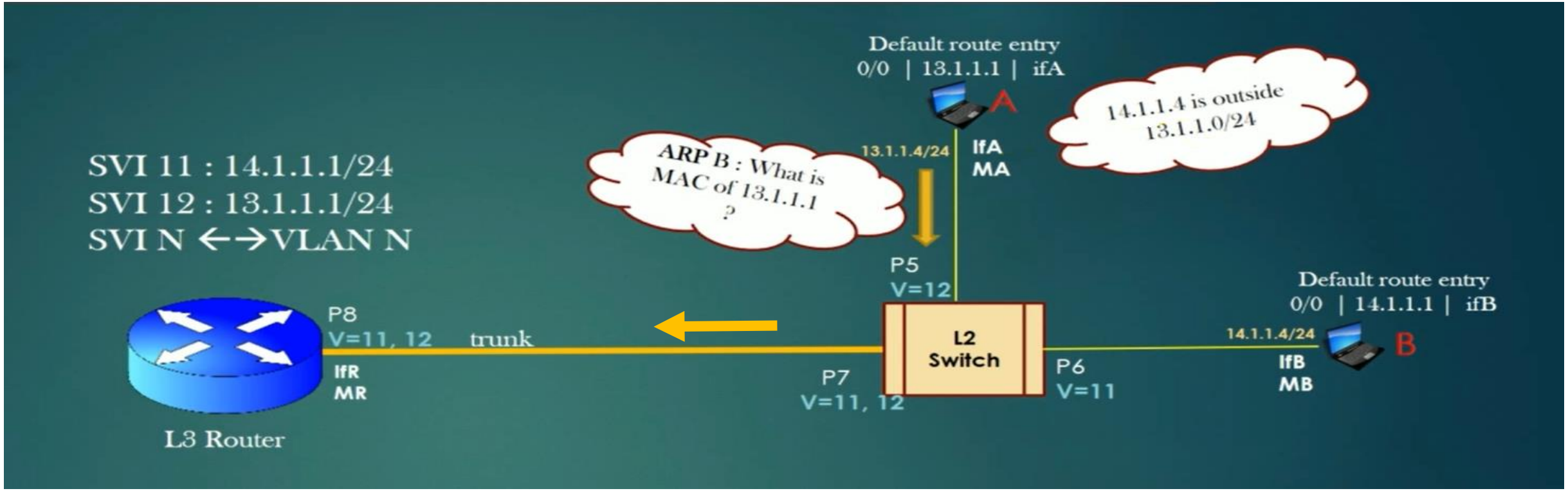
- Steps: from source host machine A to L3 gateway router
  1. A finds the B's ip=14.1.1.4 belongs to remote subnet.
  2. A decides to send data using default route which states that gateway ip is 13.1.1.1, outgoing interface is ifA.
  3. To send data to gateway router, A needs MAC address of gateway router having IP 13.1.1.1

Inter VLAN Routing Steps



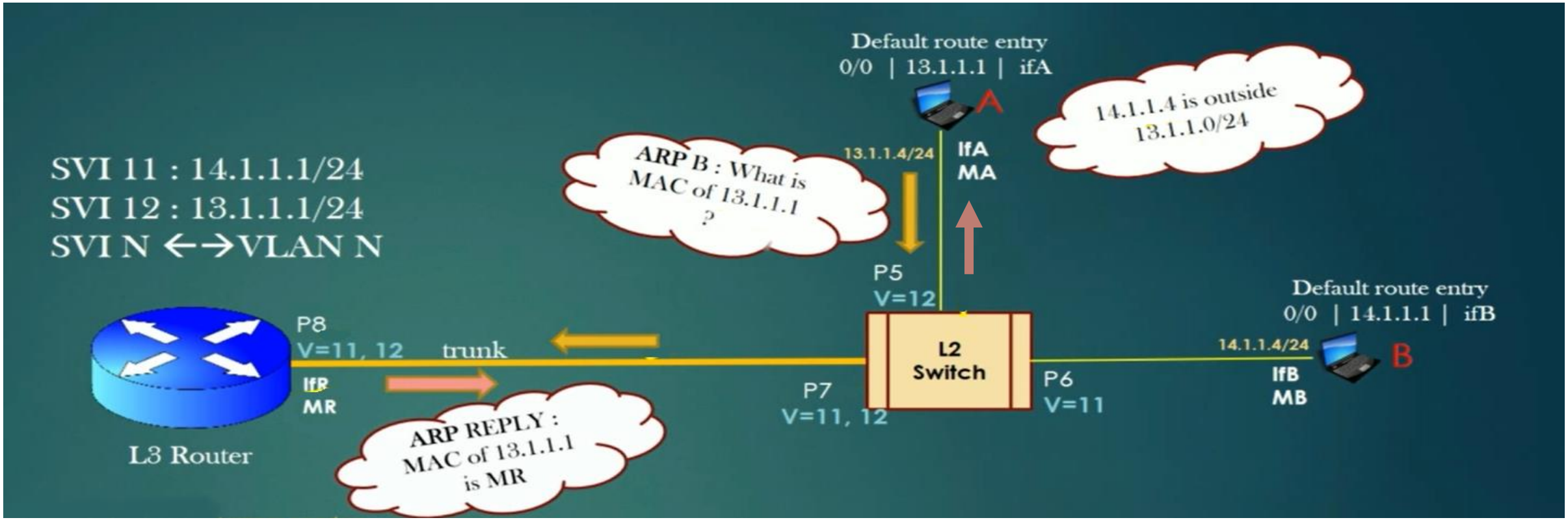
- Steps: from source host machine A to L3 gateway router
  1. A finds the B's ip=14.1.1.4 belongs to remote subnet.
  2. A decides to send data using default route which states that gateway ip is 13.1.1.1, outgoing interface is ifA.
  3. To send data to gateway router, A needs MAC address of gateway router having IP 13.1.1.1
  4. A checks its ARP cache to resolve ARP for default gateway ip 13.1.1.1

Inter VLAN Routing Steps



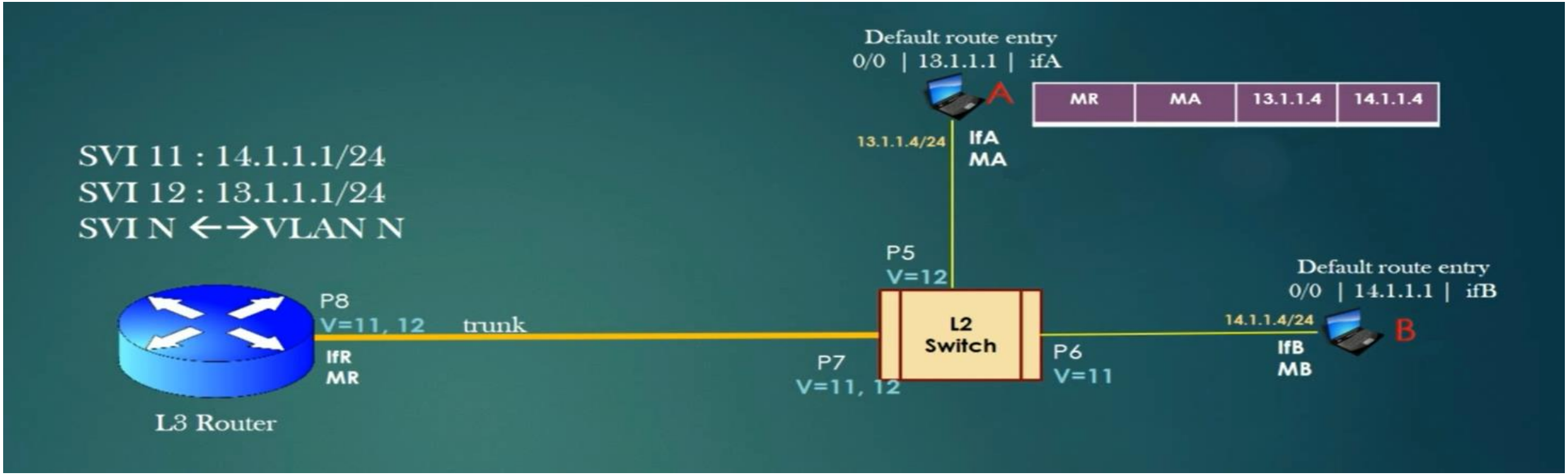
- Steps: from source host machine A to L3 gateway router
  1. A finds the B's ip=14.1.1.4 belongs to remote subnet.
  2. A decides to send data using default route which states that gateway ip is 13.1.1.1, outgoing interface is ifA.
  3. To send data to gateway router, A needs MAC address of gateway router having IP 13.1.1.1
  4. A checks its ARP cache to resolve ARP for default gateway ip 13.1.1.1
  5. A's ARP cache is empty, A launches ARP B message out of ifA to know MAC for 13.1.1.1

Inter VLAN Routing Steps



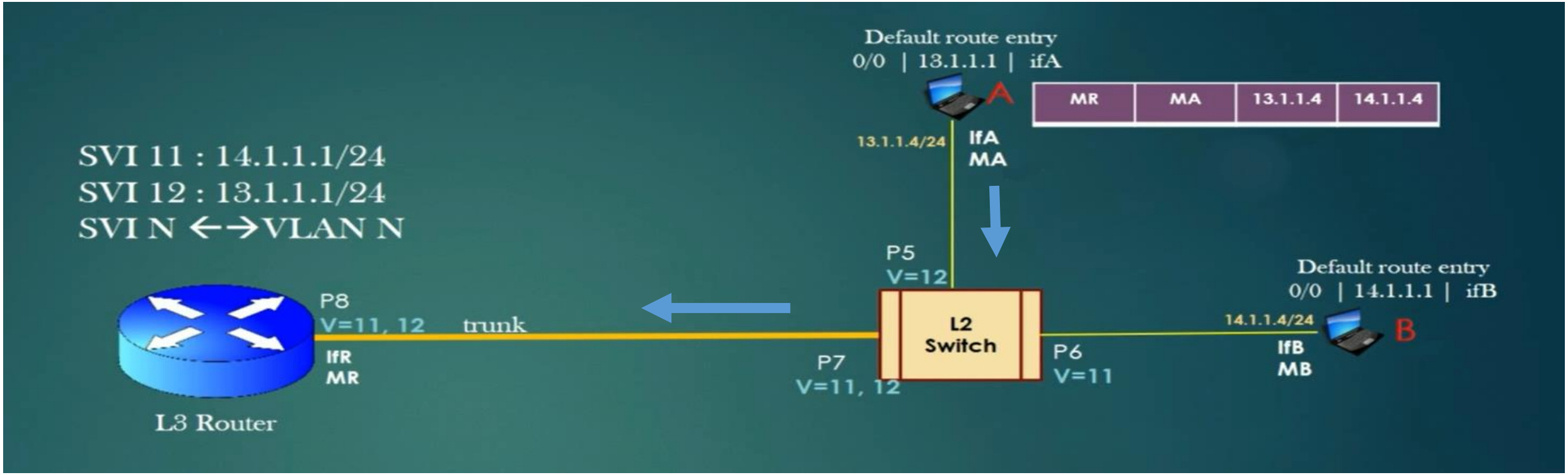
- Steps: from source host machine A to L3 gateway router
  1. A finds the B's ip=14.1.1.4 belongs to remote subnet.
  2. A decides to send data using default route which states that gateway ip is 13.1.1.1, outgoing interface is ifA.
  3. To send data to gateway router, A needs MAC address of gateway router having IP 13.1.1.1
  4. A checks its ARP cache to resolve ARP for default gateway ip 13.1.1.1
  5. A's ARP cache is empty, A launches ARP B message out of ifA to know MAC for 13.1.1.1
  6. L3 router returns MAC MR in ARP reply to A.

Inter VLAN Routing Steps



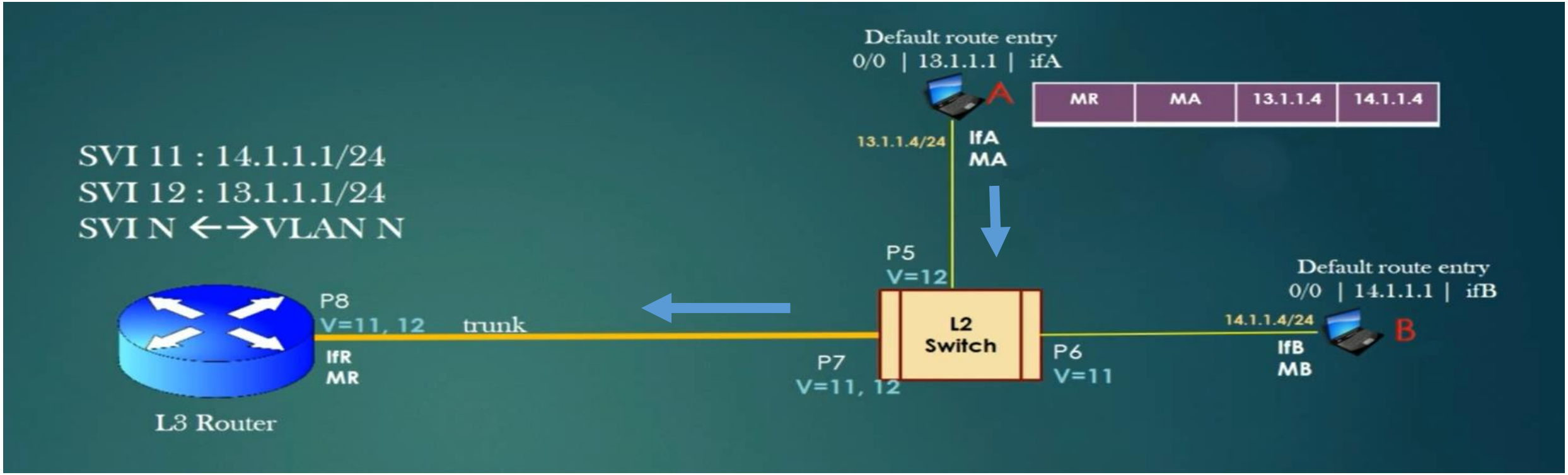
- Steps: from source host machine A to L3 gateway router
  7. A prepares the Frame: Dst MAC: MR, Src MAC: MA, Src IP: 13.1.1.4, Dst IP: 14.1.1.4

Inter VLAN Routing Steps



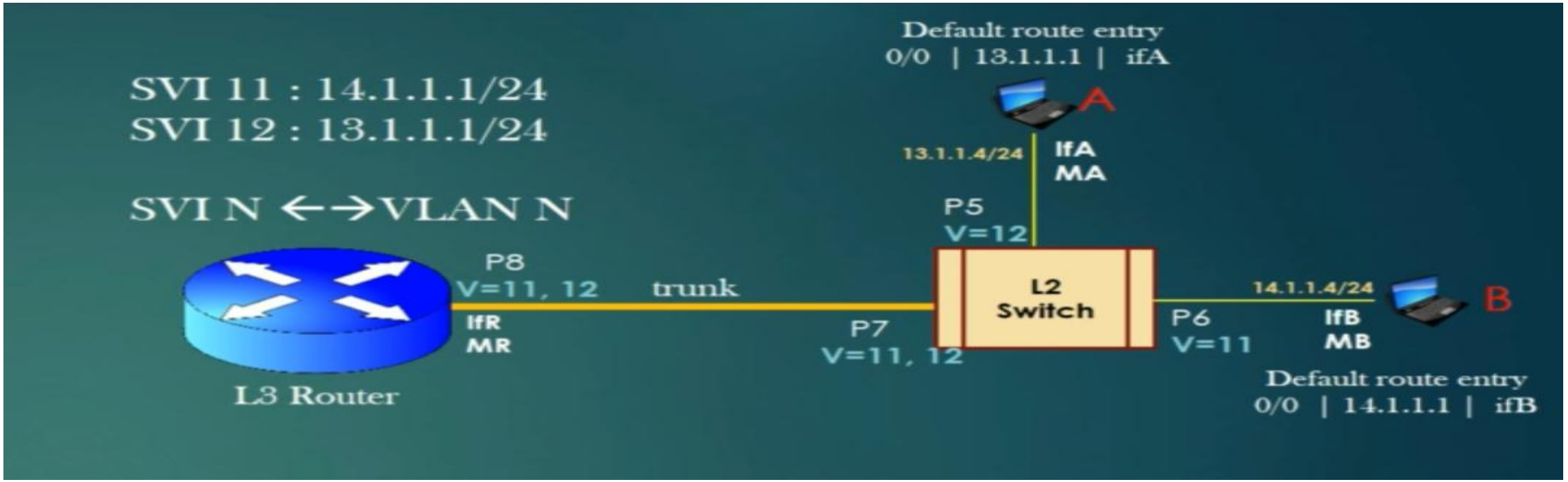
- Steps: from source host machine A to L3 gateway router
  7. A prepares the Frame: Dst MAC: MR, Src MAC: MA, Src IP: 13.1.1.4, Dst IP: 14.1.1.4
  8. This frame is received by L3 router only, and now L3 router needs to forward the frame to host machine whose IP is 14.1.1.4

Inter VLAN Routing Steps



- Steps: from source host machine A to L3 gateway router
  7. A prepares the Frame: Dst MAC: MR, Src MAC: MA, Src IP: 13.1.1.4, Dst IP: 14.1.1.4
  8. This frame is received by L3 router only, and now L3 router needs to forward the frame to host machine whose IP is 14.1.1.4
  9. Now rest of the steps are same as that of L3 router-VLAN routing which we learnt in previous Module.

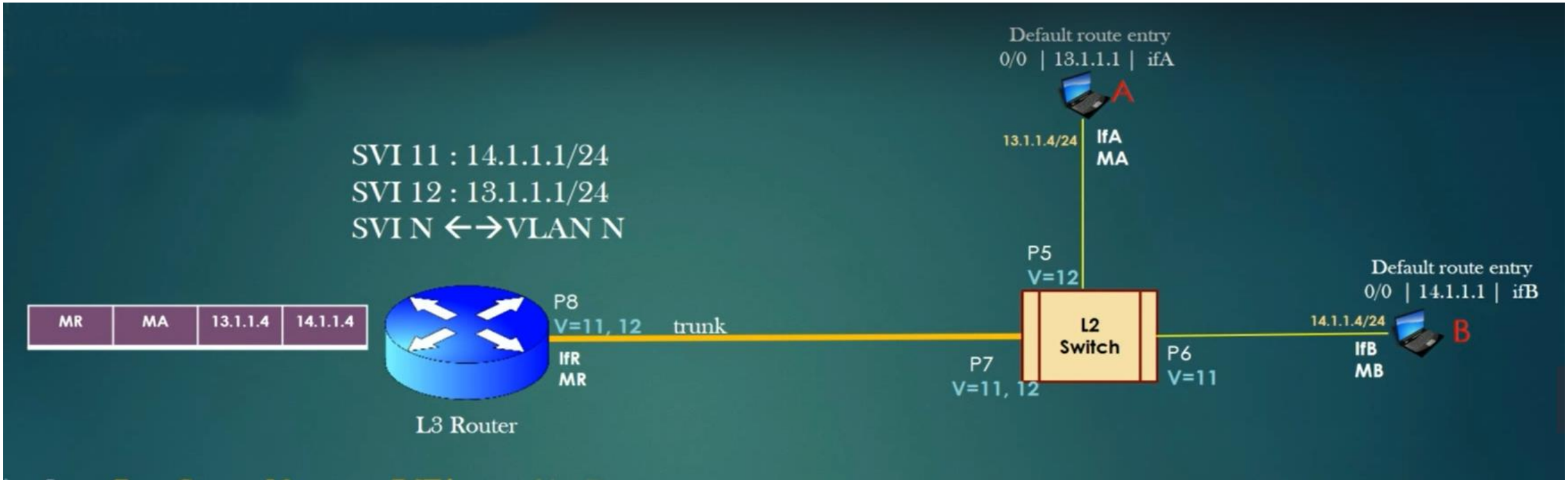
Inter VLAN Routing Steps



Steps : from gateway L3 router to destination host B.

10. The frame received by L3 router is tagged with VLAN 12.
11. Router checks the dst ip 14.1.1.4 address in frame belongs to SVI 11's network id
12. Router finds the VLAN bound to SVI 11 –in this case VLAN 11
13. The router interfaces operating in VLAN 11 is P8 (ifR)

Inter VLAN Routing Steps



Steps : from gateway L3 router to destination host B.

14. Router prepares the frame: Dst MAC: MB, Src MAC: MR, Src IP: 13.1.1.4, Dst IP: 14.1.1.4

    If router do not know the Dst MAC MB then it launches ARP broadcast message for Dst ip=14.1.1.4 on all interfaces operating in VLAN 11.

15. Router retags the frame from VLAN 12 to VLAN 11
16. Router sends out frame on interface P8
17. Host B receives the untagged frame.

Thank You