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HARDWARE & NETWORKING ACADEMY (P)Ltd

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AN ISO 9001:2008 CERTIFIED INSTITUTION

CCNP

CCNP (Cisco Certified Network Professional)

- ROUTE (300-101)
  - Implementing Cisco IP Routing

- SWITCH (300-115)
  - Implementing Cisco IP Switched networks

- TSHOOT (300-135)
  - Troubleshooting and maintaining Cisco IP Networks

200 $ * 3 = 600 $

CISCO NETWORK ACADEMY PROGRAM:

✓CCENT : Cisco Certified Entry Networking Technician

✓CCNA : Cisco Certified Network Associate

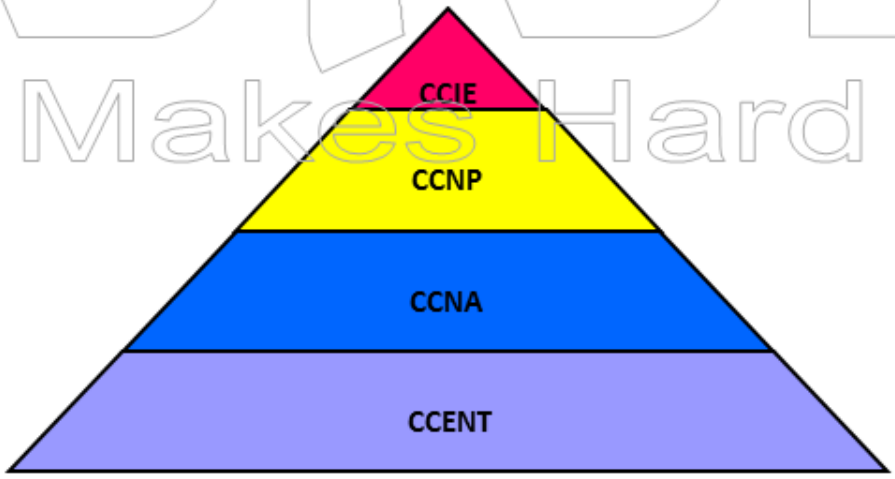
Associate level

✓CCNP : Cisco Certified Network Professional

Professional level

✓CCIE : Cisco Certified Internetwork Expert

Expert level



CISCO:

✓ Leader in network device manufacturing company

✓ started in 1984 by a couple from San Francisco

HUB

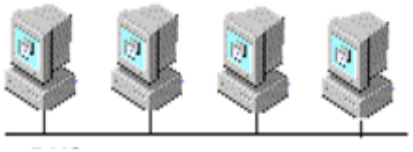
SWITCH

LAYER 3 SWITCH

ROUTER

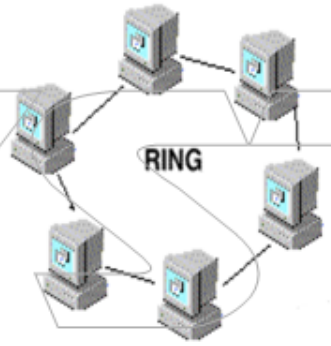
TOPOLOGY TYPES

BUS TOPOLOGY



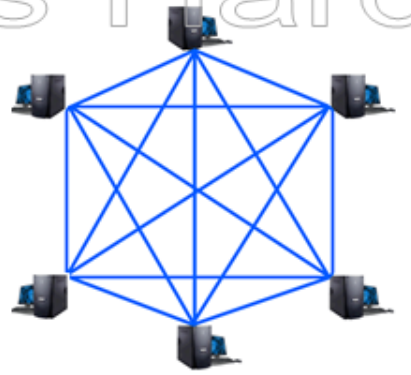
START TOPOLOGY

RING TOPOLOGY



EXTENDED STAR TOPOLOGY

MESH TOPOLOGY



SYSTEM COMMUNICATION

SIMPLEX:

- ✓ Only one device can send data other device can receive data
- ✓ E.g. pager

HALF DUPLEX:

- ✓ Two way communication is possible but not at the same time
- ✓ E.g. hub
- ✓ Collision happens in half duplex

FULL DUPLEX:

- ✓ Two way communication is possible, at same time
- ✓ E.g. switch
- ✓ Collisions do not happen

UNICAST:

- ✓ One device to One device

BROADCAST:

- ✓ One device to All device

MULTICAST:

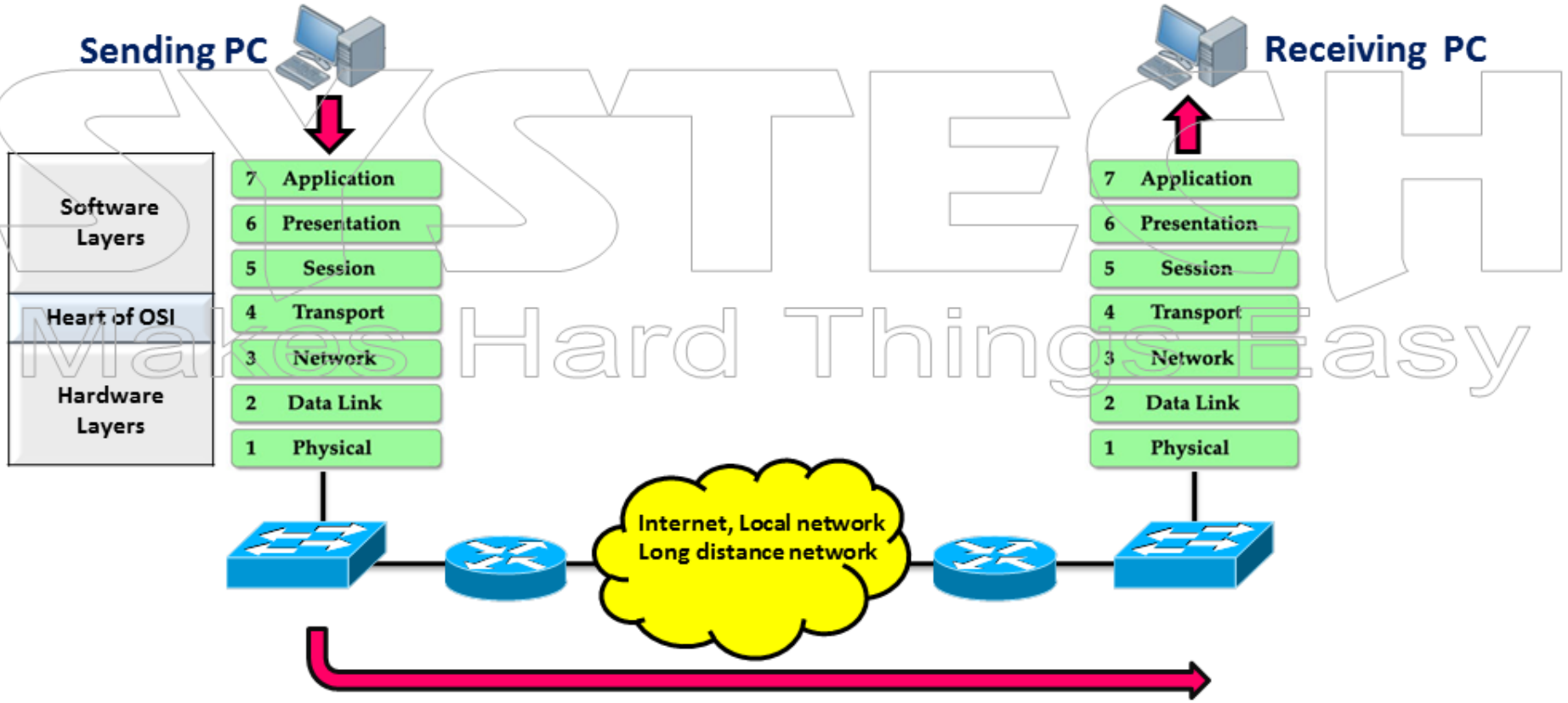
- ✓ One device to group of devices

ANYCAST:

- ✓ One device to nearest device in the group

OSI –MODEL (Open Systems Interconnection)

- ✓ In the beginning each network device manufacturer had their own proprietary solution
- ✓ The bad part was that one vendor's solution was not compatible with another vendor's solution
- ✓ Using an open model which everyone agrees (compatible with each other)
- ✓ This is why OSI-model was created by ISO(International Organization for standardization) & ITU-T (International telecommunication Union-Telecom standard sector) in 1984
- ✓ Hardware vendors would design hardware for the network layer & software vendors for application layer
- ✓ Nowadays hardware from different vendors are compatible



1.Physical :

- ✓ Deals with electrical and mechanical properties
- ✓ Includes voltage levels, physical connectors and so on
- ✓ Everything we can "touch" since it's physical
- ✓ E.g.: Rj-45,Rj-11 connectors, Transceiver, V.35 cables

2.Data Link:

- ✓ Provides physical transmission across the medium.
- ✓ Handles error detection and makes sure data is delivered reliable
- ✓ This is where Ethernet and Ethernet frames lives
- ✓ This layer uses the Media Access Control (MAC) address
- ✓ 14 byte Data link header is added to the packet at the beginning
- ✓ 4 byte Data link Tailor is added to the packet at ending
- ✓ Data link tailor is used for error checking
- ✓ Source and destination computer runs CRC algorithm (cyclic redundancy check) on data before accepting

3.Network:

- ✓ Determines the best way to move data from one place to another
- ✓ Router operates at this layer
- ✓ This is where IPV4 & IPV6 lives
- ✓ E.g.: RIP,IGRP & OSPF

4.Transport:

- ✓ Takes care of transport
- ✓ When we download from internet the file will be sent in segments
- ✓ No of segments = Total size/64KB (1 MB of data is made into 16 segments)
- ✓ TCP (send data in reliable way) UDP (send data unreliable way) ICMP (when we send ping)

5.Session:

- ✓ Takes care of establishing. Managing and termination of sessions between two host
- ✓ When we browse a website there are many users doing the same and so web server must keep track of all different "sessions".

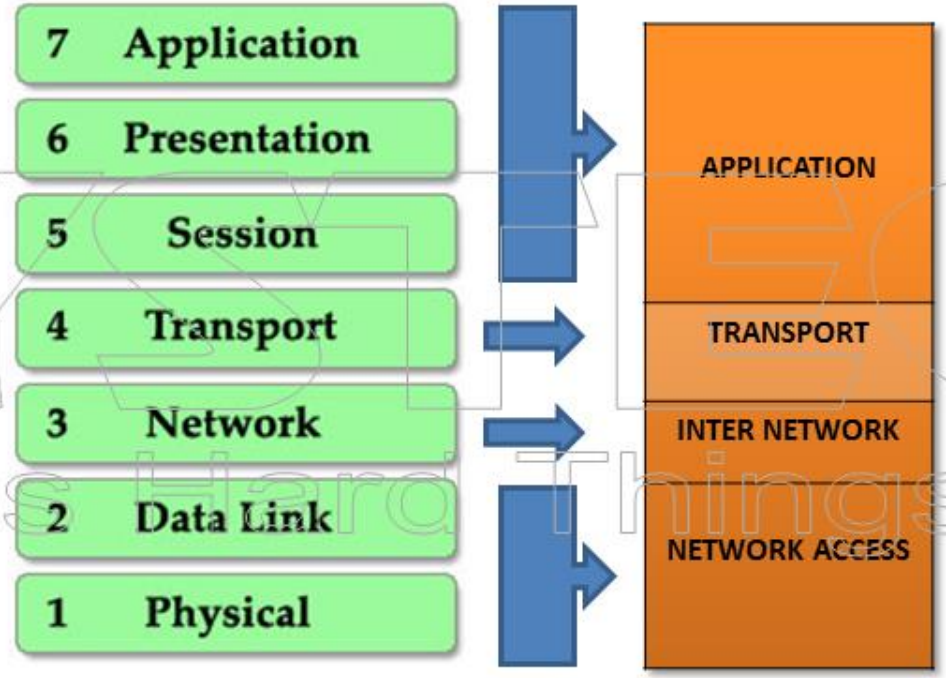
6.Presentation:

- ✓ It converts data from standard format to machine format
- ✓ Most computers use the ASCII(American Standard Code for Information Interchange) table for characters and some may use EBCDIC(Extended Binary Coded Decimal Interchange Code)
- ✓ This layer will reformat the data so the both computers agree the same characters

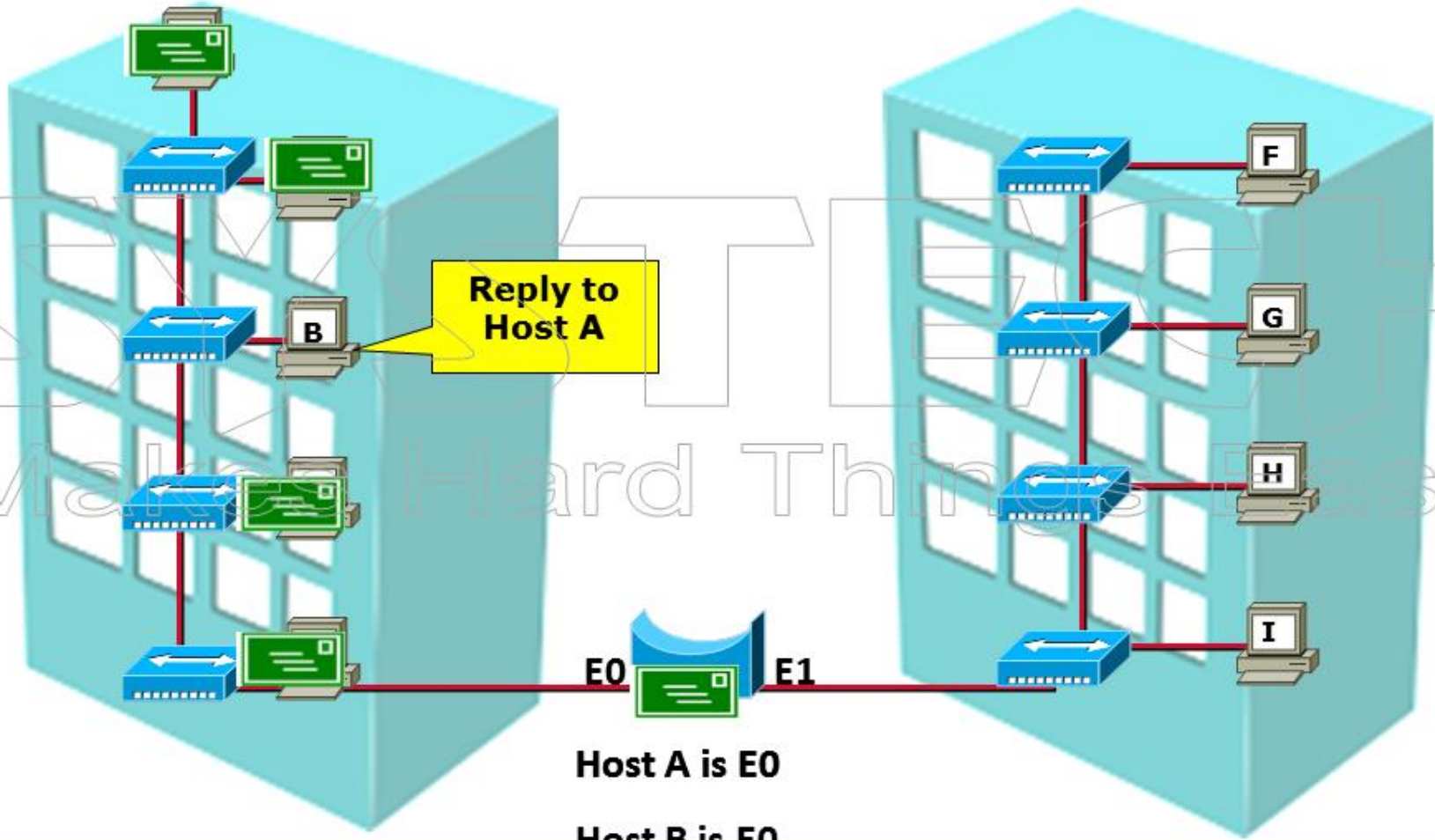
7.Application:

- ✓ Provides network services to user applications like Email, Browser and chat.

OSI REFERENCE MODEL | TCP/IP REFERENCE MODEL



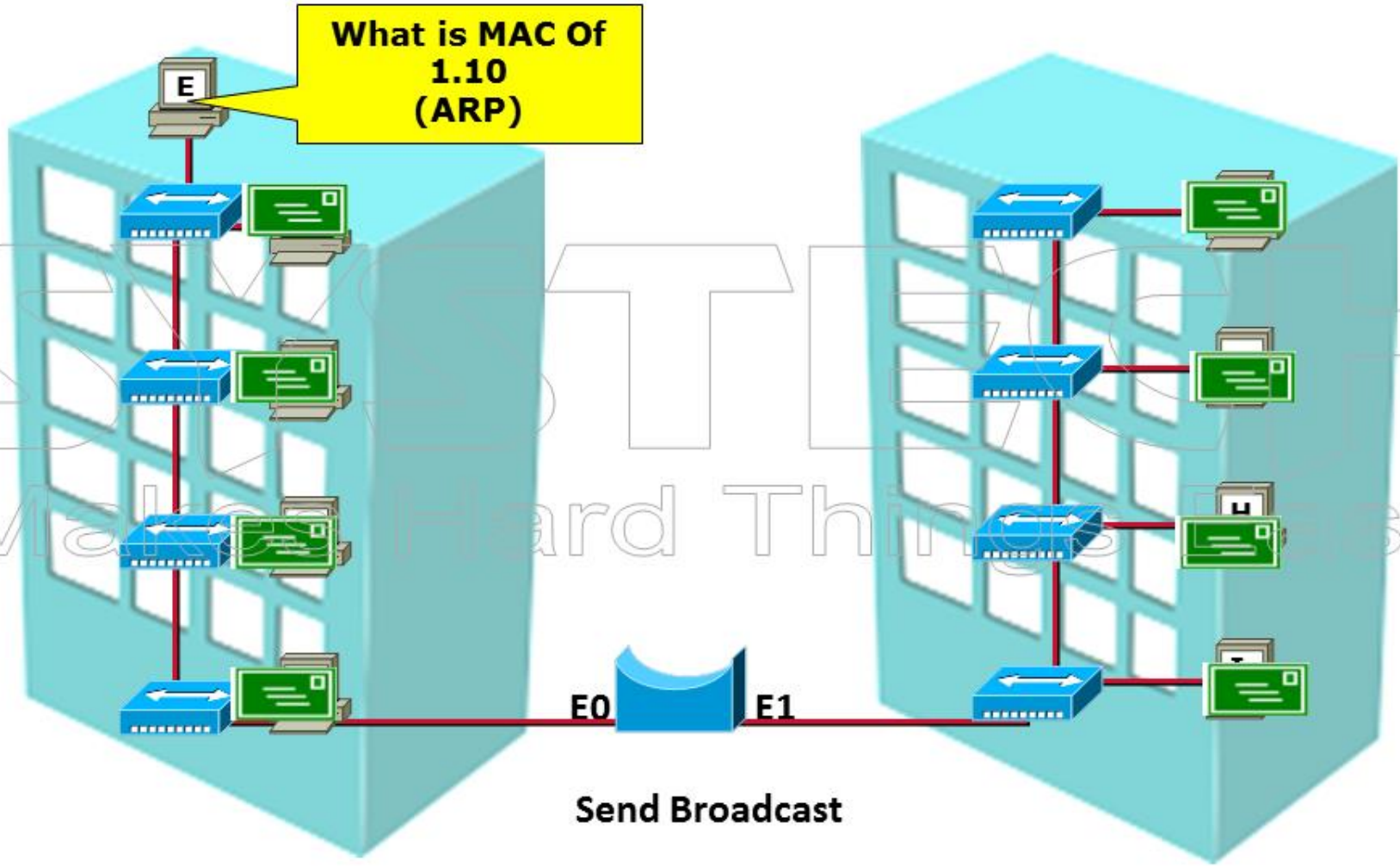
SHARED NETWORK



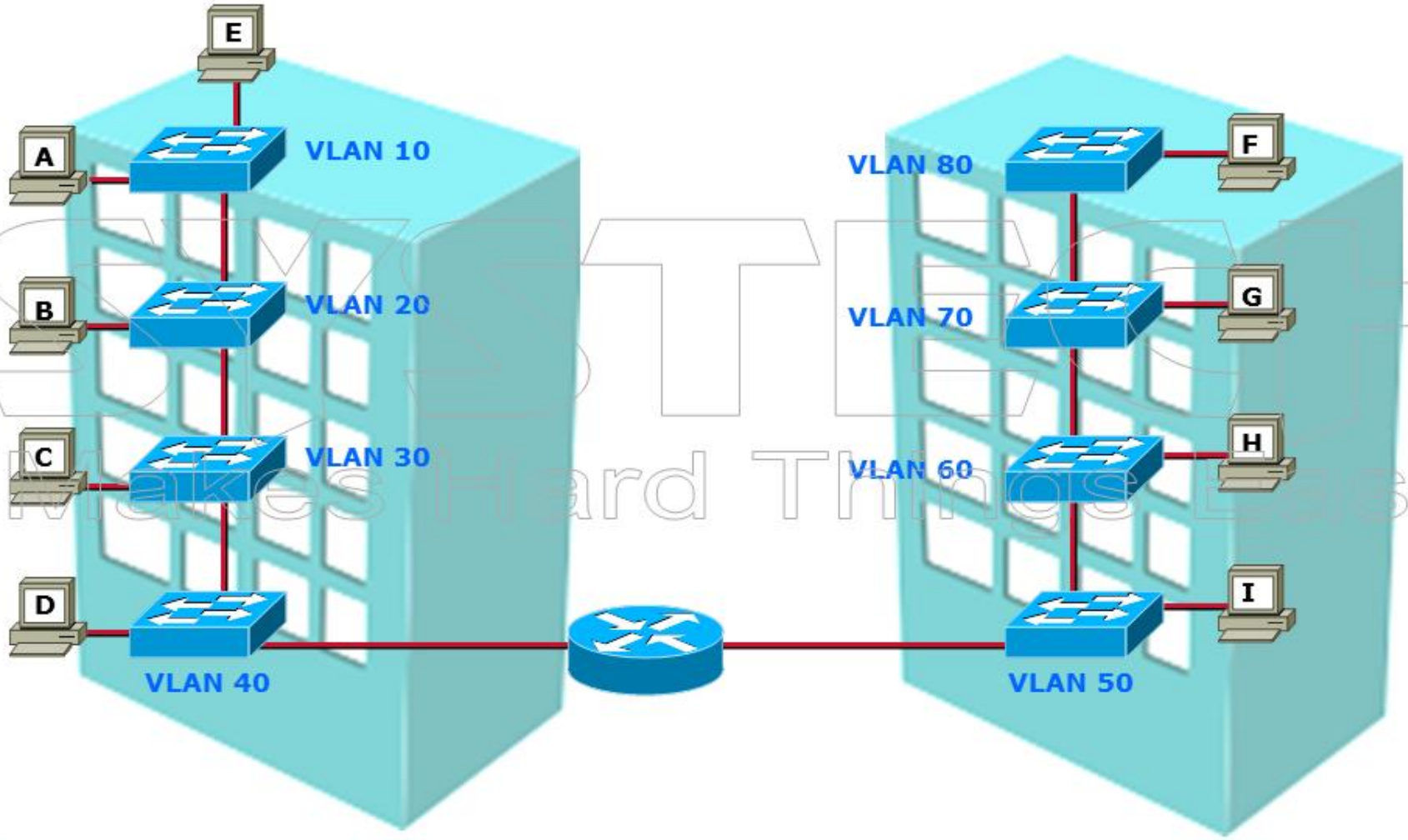
Host A is E0

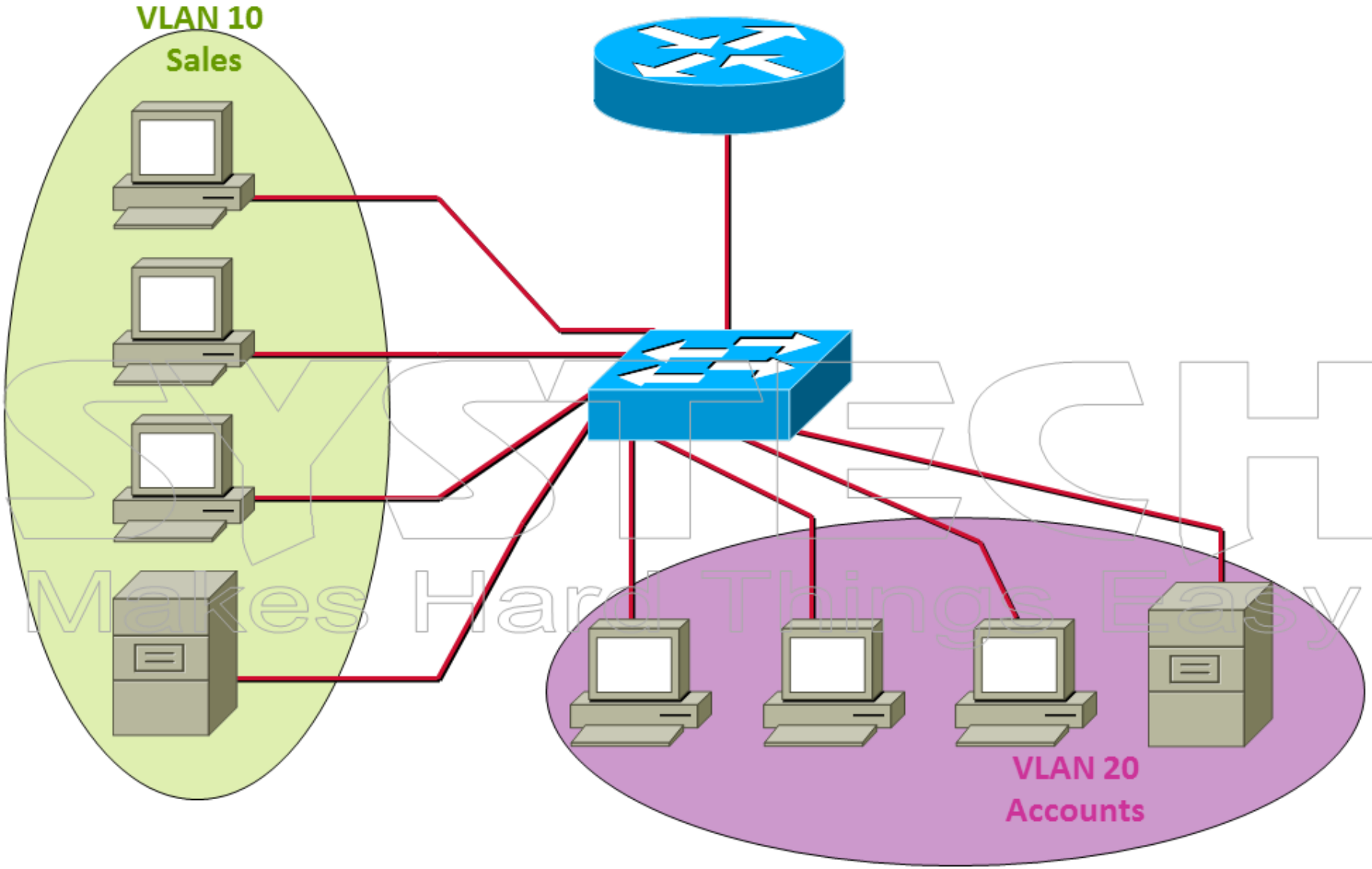
Host B is E0

SHARED NETWORK



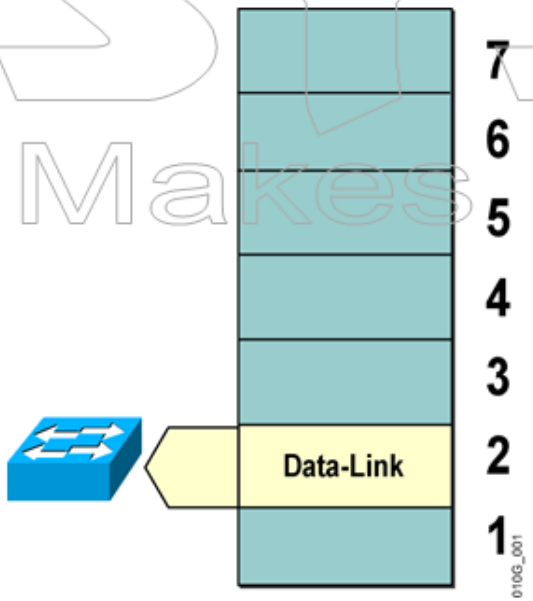
LAN Segmentation





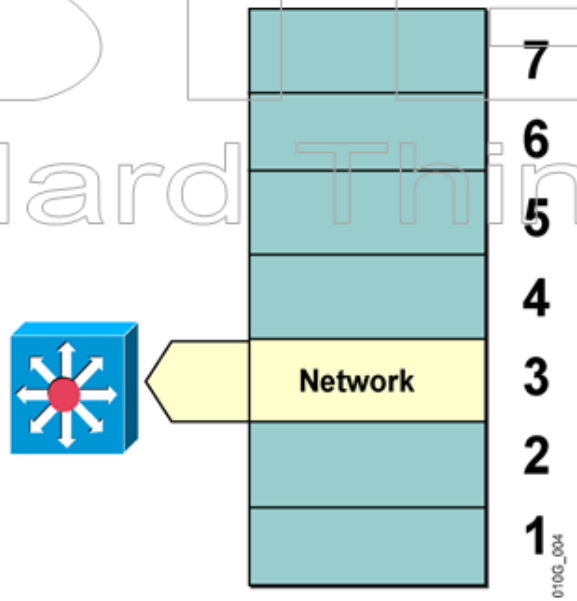
Layer 2 Switching

- ✓ Hardware-based bridging
- ✓ Wire-speed performance
- ✓ High-speed scalability
- ✓ Low latency
- ✓ MAC address



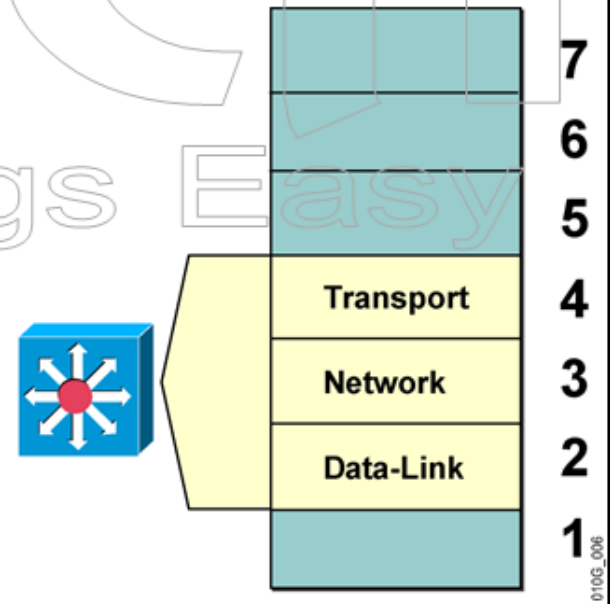
Layer 3 Switching

- ✓ Hardware-based packet Forwarding
- ✓ High-performance packet switching
- ✓ Flow accounting
- ✓ Layer 3 security
- ✓ Policy deployment



Multilayer Switching

- ✓ Combines functionality of:
- ✓ Layer 2 switching
- ✓ Layer 3 switching
- ✓ Layer 4 switching
- ✓ High-speed scalability
- ✓ Low latency



MAC vs IP

MAC -PHYSICAL ADDRESS	IP-LOGICAL ADDRESS
Media Access Control	Internet Protocol
Layer 2 address	Layer 3 address
Permanent	Logical
48 bit	32 bit
Hexadecimal notation	Dotted decimal notation
Example:01-05-C0-D9-6B-03-2E First 24 bit is called OUI (Organizationally Unique Identifier)	Example: 192.168.6.1

HUB:

- ✓ Layer 1 device
- ✓ Does not read MAC address
- ✓ No memory
- ✓ Always broadcasts the data
- ✓ It gets data from one port, regenerates the data and sends the data to all ports
- ✓ All system receive the data, but only one system accepts it
- ✓ It cannot read L2 header (MAC), L3 header (IP), Layer4 Header(PORT)

collision:

- ✓ Multiple ports may sense the free carrier and try to send the data exactly at same time
- ✓ If two ports want to send the data at same time the voltage levels from one port mix up with other ports
- ✓ Situation where data from one port collide with the data from other ports

CSMA/CD

- ✓ Carrier sense multiple access-collision detection

CSMA/CA

- ✓ Carrier sense multiple access-collision avoid

SWITCH:

- ✓ Layer 2 device
- ✓ Has RAM to handle MAC information
- ✓ Unicast data to particular port
- ✓ If there is no outgoing port info then it broadcasts to all
- ✓ Switch has dedicated circuits between ports
- ✓ Every port has dedicated bandwidh
- ✓ It cannot read L3 header (IP), Layer4 Header(PORT)

ASICS

- ✓ Application Specific Integrated Circuits
- ✓ ASICS is specialized hardware designed for faster switching
- ✓ Multiple port can communicate at same time
- ✓ This hardware design is called micro segmentation

Device	Collision Domain	Broadcast Domain
Hub	1	1
Switch	No of ports	1 (no of vlans)
Router	No of ports	No of ports

HUB VS SWITCH

- ✓In a hub, a frame is passed along or "broadcast" to every one of its ports
- ✓ It doesn't matter that the frame is only sent for one port
- ✓The hub has no way of distinguishing which port a frame should be sent to
- ✓ Passing frame to all the port ensures that it will reach its planned destination
- ✓This places a lot of traffic on the network and can lead to poor network response times
- ✓ Additionally, a 10/100Mbps hub must share its bandwidth with each and every one of its ports
- ✓when only one PC is broadcasting, it will have access to the maximum available bandwidth
- ✓ If multiple PCs are broadcasting, then bandwidth will need to be divided and degrade performance
- ✓Switch keeps a record of the MAC addresses of all the devices connected to it
- ✓With this information, a switch can identify which system is sitting on which port
- ✓So when a frame is received, it knows exactly which port to send it to, without increasing network response times
- ✓Switch will allocate a full 10/100Mbps to each of its ports
- ✓ when more number of PCs transmitting, users will always have access to the maximum amount of bandwidth so switch is considered to be a much better choice then a hub

Router:

- ✓ Communicates between different networks
- ✓ It provides WAN connectivity
- ✓ Selects best path
- ✓ Works at layer 3
- ✓ It can read IP header
- ✓ It maintains IP routing table which contains best path destination networks

MANUFACTURES:

- ✓ CISCO
- ✓ DAX
- ✓ JUNIPER
- ✓ LINKSYS
- ✓ NOKIA
- ✓ D-LINK
- ✓ ZYXEL
- ✓ 3COM

INTERNET STRUCTURE:

LOCAL ISP-REGIONAL ISP-NATIONAL ISP-GLOBAL ISP

ROUTER CATEGORIES

- ✓ Access layer (1600,1700,2500 series routers)
- ✓ Distribution Layer (2600,2800,3600 series routers)
- ✓ Core layer 6000,7000,10000,12000 series routers

ROUTING TABLE:

- ✓ The list of networks that router knows
- ✓ Router can reach only those networks
- ✓ Contains only best path to reach networks

NETWORK DESIGN RULES

- ✓ All connected interfaces must be different networks
- ✓ All the LANs must be in different network
- ✓ LAN and default gateway must be in same network
- ✓ Two directly connected interfaces must be same network

DCE-DTE

- ✓ In real time modem generates clock rate to synchronize the data between WAN ports
- ✓ DCE cable is used generate clock rate

What is Routing?

- ✓ Communication between two different networks
- ✓ It will communicate with those networks presented in its Routing Table
- ✓ If there is no information in the routing table about destination than router drops all the packets for that destination

ROUTER TYPES:

- ✓ Fixed Routers (fixed interfaces)
- ✓ Modular Routers (interfaces can be increased)

STATIC ROUTING:

- ✓ Manual Routing
- ✓ Administrative work is more
- ✓ Suitable for small and fixed networks
- ✓ Single change will effect all routers configuration
- ✓ Manually configured
- ✓ Administrative distance is 1
- ✓ Destination network should be known
- ✓ Secure and fast

DYNAMIC ROUTING:

- ✓ Routing done by dynamically (auto) by using routing protocols
- ✓ Administrative work is less
- ✓ Suitable for large network
- ✓ Single change will not effect the remaining routers configuration

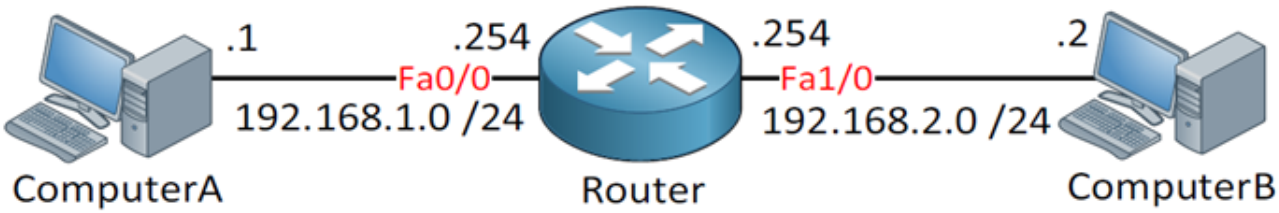
STATIC DEFAULT ROUTING:

- ✓ used for unknown destination e.g.: internet
- ✓ Used on stub router
- ✓ It is last preferred route in routing table

 # ip route 0.0.0.0 0.0.0.0 serial 0

or

 # ip route 0.0.0.0 0.0.0.0 20.0.0.2

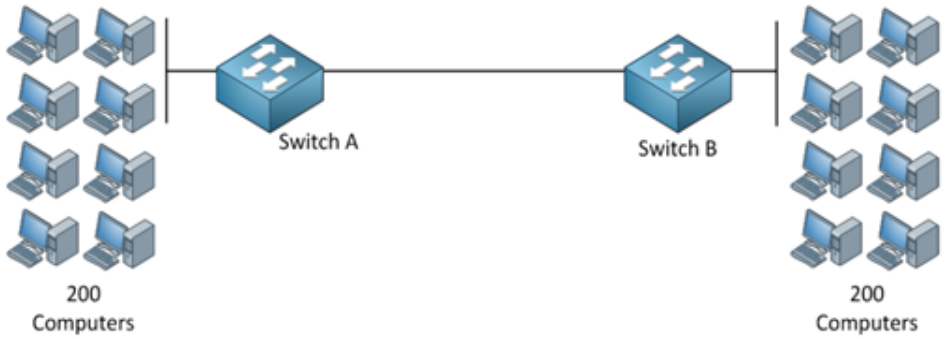


Routing Table	
192.168.1.0 /24	Fa0/0
192.168.2.0 /24	Fa1/0

- ✓ Computer A has IP 192.168.1.1 gateway 192.168.1.254
- ✓ Computer B has IP 192.168.2.2 gateway 192.168.2.254
- ✓ Router Fa0/0 IP 192.168.1.254 , Fa0/1 192.168.2.254
- ✓ When computer A sends IP packets with destination IP address 192.168.2.2
- ✓ Computer A checks its own IP address and subnet mask and concludes that 192.168.2.2 is in another subnet. As a result it will forward the IP packet to its default gateway
- ✓ The router receives IP packet, checks the destination IP address and scans the routing table. IP address 192.168.2.2 matches the 192.168.2.0/24 entry & router will forward the IP packets out if its Fast Ethernet 1/0
- ✓ Computer B receives the IP packet .

SWITCH:

- ✓ Switch "switches" and router "routes"
- ✓ Switch based on MAC
- ✓ Switch work is to know when an Ethernet frame enters one of its interfaces where it should send this Ethernet frame by looking at destination MAC address
- ✓ Switches make decisions based on data link layer information(layer 2)



- ✓ If 400 computers want to communicate each switch must learn all 400 MAC address
- ✓ Its not possible for large network for example INTERNET
- ✓ Its hard to have millions of entry in MAC –address table

IP ROUTING:

- ✓ Routers have similar task but will look at IP packets (layer 3)
- ✓ Router looks at destination IP address in an IP packet and send it out the correct interface

- ✓ RA only has to know that network 192.168.2.0/24 is behind RB & vice-versa
- ✓ Switches use MAC address table to forward Ethernet frames & router use routing table to learn where to forward IP packets .