**??**

**OSI Model**

**What is the OSI Model?**

* Open Systems Interconnection, it is the standard model that all electronic communication technologies must abide by in order to communicate with one another. Has 7 layers,
  1. Layer 1, Physical Layer (IPs)
  2. Layer 2, Data Link Layer (Switches)
  3. Layer 3, Network Layer (Routers and Routing Protocols)
  4. Layer 4, Transport Layer (TCP, UDP) (TCP=more secure do to acknowledgments, while UDP= not as secure because it doesn’t use acknowledgement)
  5. Layer 5, Session Layer
  6. Layer 6, Presentation Layer
  7. Layer 7, Application Layer
* Please Do Not Touch Sally’s Private Area (a saying used to for remembering the 7 layers) (PDNTSPA)

**Routing**

**What is an IP?**

* Internet Protocol= an address that is used to route from one point of a destination to another, used to find a destination throughout the internet, every electronic device has one in order to find each other, IP resides in the Layer 1 of the OSI model

**What is a Router?**

* Router is a device that knows how to route IPs to their destinations, routers reside in the Layer 3 of the OSI model

**What is a LAN?**

* Local Area Network, usually defines the connections between your internal/private network, things like Ethernet cables are physical example of LAN

**What is WAN?**

* Wide Area Network, usually defines the external connections that is external to you private/internal network, things like your internet connection, T1 cable is a physical example of WAN

**Routing Protocols Study**

**What is RIP?**

* Routing Information Protocol, one of the oldest routing protocols, no longer or hardly used anymore, reason is because it’s too slow, takes approximately 30 secs, used for LAN connections
* A.D.= 120, Administrative Distance is the preferrability of the route
* Metric= Uses hop counts, 15 is max, 16 is unreachable
* Distance Vector Routing Protocol= route by rumor
* 2 versions, RIPv1 and RIPv2 (no auto-summarization), version 2 is backwards compatible with version 1

**What is EIGRP?**

* Enhanced Interior Gateway Routing Protocol, used for LAN connections
* A.D.= 90 (internal) (same AS), 170 (external) (different AS)
* Metric= 5k values
* Distance Vector Routing Protocol= route by neighbor, also acts like a Link State Routing Protocol, sometimes called a hybrid Routing Protocol
* DUAL= Diffusing Update Algorithm, used by EIGRP to find the shortest path and maintain freedom from loops
* Autonomous Systems (A.S.)= routing domains, EX: EIGRP 100 is in the domain of 100

**What is OSPF?**

* Open Shortest Path First, used for LAN connections
* A.D.= 110
* Metric= 10^8/Bandwidth
* Link State Routing Protocol= can see all links in its domain
* LSAs (Link State Advertisements) which contains all info on links
* Area 0= Backbone Area, all Areas must have a connection back to Area 0
* Areas= Uses the concept of Areas, common routers under same administration

**What is BGP?**

* Border Gateway Protocol, used for WAN connections
* A.D.= iBGP(interior BGP) 200, eBGP(exterior BGP) 20
* Distance Vector Routing Protocol= route by rumor
* Metric= no metric, but uses a 10 commandment process
  1. Highest administrative weight
  2. Highest local preference
  3. Locally originated routes
  4. Shortest A.S. path length
  5. Most favorable origin code (IGP>EGP>Incomplete)
  6. Lowest M.E.D
  7. (eBGP>eBGP Confederate>iBGP)
  8. Lowest IGP metric
  9. Load balance using equal paths if available
  10. Lowest BGP router I.D.
* Autonomous Systems= common devices under the same domain
* iBGP= peers in the same A.S.
* eBGP= peers in different A.S.
* Public A.S. (1-64511)- means don’t belong to us/has to be assigned
* Private A.S. (64512-65535)- means anyone can use it
* Most company has only 1 to 2 A.S.
* **What is NAT?**
* Network Address Translation, used to translate private IPs into public IPs (vice versa), this is how you talk to the internet even though your network is private
* Private IPs EX: 192.168.0.0, 172.16.0.0, 10.0.0.0 (used for private/internal/testing)
* Public IPs EX: 67.0.0.0, etc.

**Switching**

**What is a Switch?**

* A switch is a device used to connect multiple electronic devices together. Switches forwards information/packets to their destinations via IP addresses.
* Resides by default in Layer 2 of the OSI model, some comes in Layer 3

**What is a VLAN?**

* Virtual Local Area Network, a virtually created domain or a virtually created group that multiple devices are assigned to. Also called a broadcast domain.

**What is STP?**

* Spanning Tree Protocol, the protocol a switch uses to stay loop free
* Both are modes that a port on a switch is in. Access Ports have 1 VLAN and Trunk Ports have multiple VLANs.0,
* M-stp(multi-spanning tree protocol), pv-stp(per vlan-stp, r-stp (rapid-stp)

**Others**

**What is a static route?**

* A manually configured route to a destination.

**What is DHCP?**

* Dynamic Host Configuration Protocol, used for handing out a range of IPs to devices. EX: is like a ticketing system that assigns a range of numbers to people waiting in line, but instead, assigns IPs

**What is a LoopBack?**

* A loopback is a virtual interface that will never go down. Basically is created for testing purposes, so that there is an interface that will always be reachable.

**What is a Subnet Mask?**

* A 32 bit number that defines a range of IPs that an IP address falls into. EX: /24, /25, /26

**What is Putty?**

* An application used for console, telnet, or SSH into network devices.

**What is Teamviewer?**

* An application that allows for remote control of a user’s desktop, as if you are physically present to control the desktop.

**What is Ping?**

Ping is used for testing connectivity of a destination.

**What is traceroute?**

* Traceroute is used for tracing the path in which a packet travels to a destination.

**Experience and Scenarios Study (prepare things to talk about showing that you’ve utilized your skills)**

**What kind of networking things have you’ve done?**

* I configured EIGRP on routers for the internal network. As for the external network and connections, I used BGP.
  + Config t
    - Router EIGRP 100
    - Network 10.30.1.0 0.0.0.255
    - End
    - Wr
  + Config t
    - Router BGP 6500
* I configured a default gateway on a router by configuring a static route.
  + EX: ip route 0.0.0.0 0.0.0.0 67.20.1.43
  + Ip route (broadcast ip) (network) (destination)
  + Ex: ip route 10.10.10.0 255.255.255.0 10.10.10.1
* I also configured a switch with different types of VLANS for different devices, such as putting printers in VLAN 100, and PCs in VLAN 101.
* I also configured DHCP on a router so that it can automatically hand out IP addresses to multiple devices.

**Extra: DON’T NEED TO STUDY BUT IS GOOD TO KINDA KNOW/FAMILIARIZE A LITTLE BIT ABOUT**

**MPLS**

**Layer 2.5**

**MPLS** --Multiprotocol Label Switching. An industry standard on which label switching is based.

**MPLS troubleshoot commands**

**Show ip cef**

**Show ip cef interface**

: to verify CEF status. If CEF has not been enabled, nothing appears:

**Show ip cef summary**

:to display specific entries in the Forwarding Information Base (FIB) with IP address information as a basis

**Show mpls interfaces**

:to ensure that MPLS is globally enabled. This command also verifies that a Label Distribution Protocol (LDP) runs on the requested interfaces:

**What is CEF? (cisco express forwarding)**

The reason CEF is required for MPLS on Cisco devices is because it allows for the correct forwarding data structures required for MPLS (label imposition/disposition).

**How to configure MPLS?**

1. enable

2. configure terminal

3. ip cef distributed

1. enable

2. configure terminal

3. interface type slot/subslot /port [. subinterface]

4. mpls ip

5. end

**LDP** --Label Distribution Protocol. The protocol that supports MPLS hop-by-hop forwarding by distributing bindings between labels and network prefixes.

**LSR** --label switching router. A Layer 3 router that forwards a packet based on the value of an identifier encapsulated in the packet.

**LFIB** --Label Forwarding Information Base. A data structure in which destinations and incoming labels are associated with outgoing interfaces and labels.

**FIB** --Forwarding Information Base. A table that contains a copy of the forwarding information in the IP routing table.

PE- Provider Edge Router

CE- Customer Edge Router

<https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mp_basic/configuration/xe-3s/mp-basic-xe-3s-book/mp-mpls-cisco-rtrs.html>

<https://community.cisco.com/t5/routing/why-cef-needed-in-mpls-network/td-p/1699091>

**VPN (Virtual Private Network)**

**How to configure?**

1. **Configure the tunnel**
   1. **GRE tunnel** 
      1. **interface tunnel 0**
      2. **ip address 172.17.3.x 255.255.255.0**
      3. **tunnel source 172.17.2.x 255.255.255.0**
      4. **tunnel destination 172.24.2.x 255.255.255.0**
      5. **tunnel mode gre ip**
      6. **interface tunnel 0**
      7. **no shut**
      8. **exit**
      9. **ip route 10.1.x.0 255.255.255.0 tunnel 0**
   2. **IPSEC tunnel**
      1. **crypto ipsec transform-set proposal4 ah-sha-hmac esp-des**
      2. **mode tunnel**
      3. **exit**
2. **Configure NAT**
   1. **Inside and outside interfaces**
3. **Configure Encryption** 
   1. **IKE**
      1. **Crypto isakmp policy 1**
      2. **Crypto isakmp keepalive 12 2**
      3. **Encryption des**
      4. **Hash sha**
      5. **Authentication pre-share**
      6. **Group 1**
      7. **Lifetime 86400**
      8. **Exit**
      9. **PRE-SHARED KEYS**
      10. **Crypto isakmp identity address**
      11. **crypto isakmp key test12345 address 172.24.2.5**
      12. **crypto isakmp identity address**
      13. **(Router 2) crypto isakmp key test12345 address 172.24.2.4**
      14. **(Router 2) crypto isakmp identity address**
      15. **Access lists**
   2. **IPSEC**
      1. **crypto ipsec transform-set proposal4 ah-sha-hmac esp-des**
      2. **mode tunnel**
      3. **exit**
      4. **CONFIGURE CRYPTO MAPS**
      5. **crypto map s4second local-address serial x/0**
      6. **crypto map s4second 2 ipsec-isakmp**
      7. **match address 111**
      8. **set peer 172.23.2.x**
      9. **set transform-set**
      10. **proposal4**
      11. **exit**
      12. **APPLY CRYPTO MAPS TO INTERFACE**
      13. **interface serial 2/0**
      14. **crypto map s4second**
      15. **exit**
      16. **clear crypto sa**
4. **Configure QOS**
5. **Configure Firewall**

**Extra:**

**SONET**

**Synchronous Optical Network, the communication protocol used for transmitting large amounts of data over long distances using fiber optics**

**POS interface (packet over sonnet)**

1. **Default setting**
   1. **Keepalive 10 secs**
   2. **5 sec PPP encap, 3 sec HDLC encap**
   3. **HDLC**
   4. **4474**
   5. **32**

**Troubleshooting SONET**

* **Interface pos x/1**
  + **Pos report ?**
    - **Pos report slos**
    - **Pos report lais**
    - **Pos report all**
    - **Pos report plop**
* **Show controllers pos x/0**
  + **Displays how many times an alarm is declared and what alarms is active on the interface**
* **Check the fiber connections**
* **Check if there is any breaks or defects**
* **Create an internal loopback** 
  + **Interface pos x/0**
  + **Loop internal**
  + **Test with ping**
* **Create a line loopback**
  + **Interface pos x/0**
  + **Loop line**
  + **Test with ping**

**Other commands**

* **Interface pos x/0**
* **pos delay triggers ?**
* **(line or path)**

**Types of problems**

* A PRDI alarm usually indicates a problem two sites away (check neighboring sites)
* LAIS (Line Alarm Indication Signal). This is a minor warning, and no action needs (monitor the far end. If the alarms are persistent, verify the interface configurations on both ends)
* RDI (remote defect indicator)-Line problems arise from the remote interface. (Check the remote site for alarm conditions.)
* LOF (loss of frame)- check damages and configuration consistency of framing format of interface and line (**[no] pos framing-sdh)**
* LOS (loss of signal)- check fiber cable and initiate loopback internal for testing, or hard loopback

**How to configure SONET?**

1. **Prerequisites for Configuring SONET**
   1. **You must select the MediaType controller to configure and enter the controller configuration mode.**
   2. **You must configure the controller as a SONET port.**
2. **Configuring MediaType Controller**
   1. **To configure MediaType Controller, use the following commands:**
      1. enable
      2. configure terminal
      3. controller MediaType 0/0/16
      4. mode sonet
      5. end
3. **Configuring SONET Ports**
   1. **To configure SONET ports, use the following commands:**
      1. enable
      2. configure terminal
      3. controller MediaType 0/0/16
      4. mode sonet
      5. controller sonet 0/0/16
      6. rate OC12
      7. end
   2. **The above example shows how to configure SONET ports in OC-12 mode**

<https://www.cisco.com/c/en/us/support/docs/optical/synchronous-optical-network-sonet/16154-sonetalarms-16154.html>

<https://www.cisco.com/c/en/us/td/docs/routers/asr9000/software/asr9k_r4-2/interfaces/configuration/guide/hc42asr9kbook/hc42pos.pdf>