Real World Scenario & Lesson Companion

LAB : PACKET TRACER

Real World Scenario

Network Addressing

Read the scenario. Then, use this guide as you work through the lesson. Answer the questions to help you connect your learning to the scenario.

Scenario:

Conflicting Connections

You are working for a telecommunications company called NetPulse that is rolling out a new fiber-optic network in a large city. As part of this project, **you have been tasked with assigning IP addresses to all of the devices t**hat will be connected. **Your goal is to resolve these issues and ensure that all devices are properly configured with the appropriate IP addresses and network settings.** You must also create a plan for ongoing monitoring and management of the network, including regular audits to ensure that all devices are in compliance with network policies and protocols. The network will consist of a variety of devices, including smartphones, computers, tablets, and smart home devices, such as security cameras and thermostats. In addition to assigning IP addresses, **you must also ensure that the network is configured for both IPv4 and IPv6,** and that both **static and dynamic addressing are used** as needed. Your goal is to ensure that the network is efficient and secure, while also allowing for future expansion and growth.

As you work on this project, **you discover that some devices have conflicting IP addresses and that others are not configured for IPv6. In addition, some devices are using static addressing even though they should be using dynamic addressing and vice versa**. You also realize that some devices are using MAC addresses that are not registered with the network, which could pose a security risk.

Task 1: Define the Dependencies

What are the key factors that influence the scenario? How many devices are in network, what the future plans are, to setup future proofing.

What are the prerequisites required to understand the scenario?
Can you handle IOT in the future? Do we need to or are we going to be required to use IPV6. Future proofing and demands on the data in the future. Ensure the network is able to handle more devices in terms of addressing
What devices have ipv4 vs ipv6 – what kind of devices –

What are the main assumptions underlying the scenario?monitoring, auditing, compliance

What external factors can affect the outcome of the scenario? The security you want to implement based on what's actually being done on the network is this sensitive? How much of the network is going to be net facing.

Task 2: Assess the Needs

What is the purpose of the scenario and what needs does it aim to address?
What skills or knowledge are needed to successfully address the needs of the scenario?
What resources are required to address the needs of the scenario and how can they be acquired?

Task 3: Create an Implementation Plan

What are the main steps required to implement the solution to the scenario?
What ethical considerations must be taken into account when implementing the solution?
How can the implementation plan be evaluated to determine whether the solution was effective in addressing the scenario?

Lesson Companion

Network Addressing

Use this lesson companion to help you retain and synthesize the information that is integral to your progress. As you engage with the lesson material alongside your instructor, take note of key points and extract pertinent details.

IPv4

What does IP stand for? Internet Protocol
What is an IP address? A group of 32 bits divided into 8 octets
How many regional internet registries (RIRs) are there?
What are RIRs responsible for?
How many bit numbers make up an IP address identifier? 32
How many octets is an IPv4 address divided into? 8
Define each of the two parts that make up an IPv4 address. NETWORK HOST
What is subnetting? Logical way of grouping IPs
What are the three main types of networks?A 1.0.0.0 B 1.1.0.0 C 1.1.1.1
What is a subnet mask? Similar IPs that can belong to different networks depending on the mask
What is a classful network? Started in 1981 divides into 5 classes
Describe three communication types. Unicast (1-1) - Multicast (1 - many) - Broadcast (1 to all) DHCP ARP
What are link-local addresses? 169.254.0.0/16 APIPA usually not internet connected
What is a loopback address? Address referring back to your machine localhost
What is the difference between public and private IP addresses? Private IPs are used internally, inside networks – not publicly routable Public are used externally connected to the internet reserved for public use (8.8.8.8)

Real World Scenario Connection

How can the use of IPv4 addresses impact the ability to connect all devices on a network? There can be limited IP space availability Limited Scalability Lack of Security Efficient allocation of addresses (classes applied properly)

What strategies can be implemented to conserve IPv4 addresses and ensure that all devices are able to connect to a network? Using IPV6 or sharing of IPs among different entities
Subnetting your networks and further break them down.

IPv6

Leading zeros : first rule allows to discard leading zeros
Consecutive Zeros : if two or more contain consec. Zeros they’re omitted and replaced by ::
Zero Block : if there is a block that consists of four zeros without a consec. zero filled block it can be replaced by a single 0

```
Ipv6 unicast-routing
Ipv6 address
show ipv6 or ipv4
```

Why was there a need to create IPv6? IPV4 space depleted, the amount of devices that were able to connect became smaller and smaller.
List and describe three rules that exist to omit specific numbers to simplify addresses.
Describe the three device communication types.NAT
Describe the three IPv6 unicast types. Global-Unicast Link-Local Unique-Local
What are three protocols and tools created by IEFT that are used for IPv4 and IPv6 to coexist? Dual-Stack Tunneling Translation

Real World Scenario Connection

NetPulse has tasked you with ensuring that the network is configured for both IPv4 and IPv6. What is the difference between these two versions of IP addressing and why is it important to support both on the network?
NetPulse has some devices that are not configured for IPv6, which could lead to issues with address space exhaustion. Explain how IPv6 addresses are structured differently from IPv4 addresses and how this will allow Netpulse to use a larger pool of available addresses? IPV6 simply has an enormous amount of address'
One of NetPulse's goals is to ensure that the network is efficient and secure while also allowing for future expansion and growth. How does the use of IPv6 addressing support this goal? What benefits does it offer compared to IPv4?

IPV6 is newer, more security and supports more newer devices than the older IPV4. Represented by 16 bit groups, for a total of 128 bits.

MAC Address

Define MAC (Media Access Control) address. Hardware Address unique 48bit embedded to network interface card, doesn't matter what kind of NIC card it may be it has a mac assigned.
What is the structure of a MAC address? 12-digit hexadecimal number. First six digits mac id the manufacturer IEEE registration authority assigns these unique. The right 6 digits per individual chip
List four main characteristics of a MAC address. First three groups represent OUI last three represent NIC specific values

Real World Scenario Connection

How does the use of MAC addresses relate to the process of assigning IP addresses in the NetPulse network? IPs are assigned to MACs
What steps can be taken to ensure that all MAC addresses used in NetPulse's network are registered and authorized? Using specific commands you can look @ those mac address' and see if the manufacturers & devices match those that should be there.

Address Resolution Protocol

What has to happen if a device wants to communicate with another device on the same LAN? Host sends arp request to all hosts on network. 2. Switch forwards arp request to all ports 3.host B recognizes th.e IP and replies with its mac and iP 4. Host receives reply and responds with a corresponding packet with mac & ip
When is Address Resolution Protocol used and which layer of the OSI model does it operate on? Layer 2 and Layer 3
List and describe the steps of the ARP process.Host sends arp request to all hosts on network. 2. Switch forwards arp request to all ports 3.host B recognizes th.e IP and replies with its mac and iP 4. Host receives reply and responds with a corresponding packet with mac & ip
Where is the ARP table or cache stored? On the host PC
List four ARP commands.

```
arp -a
arp -g
show arp #cisco devices#
arp -d #delete#
arp -s #static entry#
arp inet_addr #defines specifcic IP#
arp eth_addr #defines a specific mac#
```

Real World Scenario Connection

One of the smartphones connected to the fiber-optic network is unable to communicate with other devices on the network. After troubleshooting, you determine that the smartphone is not able to resolve the MAC address of the devices it is trying to communicate with. How can ARP be used to resolve this issue? Clear the ARP table arp -d

A new security camera is added to the fiber-optic network and you need to assign it a static IP address. How can ARP be used to ensure that the camera's IP address is associated with its MAC address? arp -a it and see what the address' are then set a specific IP or MAC

You discover that some smart home devices, such as thermostats and security cameras, are using MAC addresses that are not registered with the network. This poses a security risk. How can you mitigate this risk using ARP? Setting static entries for them.

Introduction to Wireshark

What is Wireshark and what does it do? Intercepts and analyzes network traffic

What is Wireshark commonly used for? Analyzing the network traffic

Captured data can be exported into which file types? .cap .pcap .png

What are the three sections of the Wireshark main view? Packet List, Packet Details, Packet Bytes

Real World Scenario Connection

How can Wireshark be utilized to identify and resolve IP address conflicts in the new fiber-optic network? Intercepting the traffic moving and then analyzing how the conflicts are happening and why then addressing them.

In the given scenario, how can Wireshark assist in detecting and rectifying devices that are using unregistered MAC addresses, thereby mitigating potential security risks? By using wireshark to identify manufacturing and device info then mitigating things that should not be there.

What does the ping command include? Request and Reply

Why does the ICMP only have four fields?

What will appear in the data packet of a DNS traffic search tree?

What is HTTP and how is it used?

Why can HTTP be sniffed? It is communicated unencrypted.

Which filter can be applied to view packets more efficiently when dealing with thousands of packets?

Which Wireshark filter finds packets that match both specified port numbers in TCP?

What is a stream? Streams are collections of packets from the same conversation

How does encrypted traffic appear? It won't be human readable (non-meaningful characters)

Real World Scenario Connection

How can you utilize ICMP traffic analysis using Ping or Wireshark to troubleshoot and resolve issues related to conflicting IP addresses in the fiber-optic network? Explain the steps you would take and the information you would gather from ICMP packets to identify and resolve the conflicts. Use ping to gather the IP and or Mac address' and then use wireshark to filter that traffic and analyze it

Some devices in the network are not configured for IPv6. How can you use DNS traffic analysis to identify and rectify this issue? Describe the steps you would take to analyze DNS requests and responses using tools like Wireshark to ensure that all devices in the network are properly configured for both IPv4 and IPv6 addressing.