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CC615x

Cloud Infrastructure

Week 4: Cloud Infrastructure Network Part 1

Objectives

In this week's lesson, you will learn:

Review of Networking Basics	Virtual Local Area Networks (VLANs)	Virtual Network Security and Separation
• OSI Model • IP Addresses • Private IP Addresses • CIDR Notation	• What is a VLAN? • Public, Dynamic, Static, Private, IP Addresses	• Firewalls • VPN • Network Separation, Security Groups

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Review of Networking Basics

OSI Model

- Computer networks connect different computer components together. These components have their network interfaces connected by wire, fiber optic, radio, and satellite. Hubs, switches, and routers direct and manage the network traffic.
- All of these networked devices implement stacks of hardware and software protocols following the OSI networking model.
- Click on the link to view the OSI model description video: Understanding the OSI Reference Model: Cisco Router Training 101
- A popular OSI stack is the Internet Protocol, also called TCP/IP suite. It splits communication content into packets. The IP protocol is responsible for delivery of packets and network addressing. TCP is responsible for secure and reliable splitting and reassembly of packets. On top of TCP/IP, higher level protocols such as HTTP (Hypertext Transfer Protocol – the communication language of Worldwide-Web) are defined.

IP Addresses

- Servers (also called network hosts, not the same as hosts for virtual servers) are addressed by using IP addresses. IP addresses exist in two forms:
  - IP version 4 (IPv4). This is older and running out of address space
  - Version 6 (IPv6). This is the new version
- Even though IPv4 is older, it is still used in many applications in the cloud. IPv4 addresses are 32-bit entities. They are often split into 4 bytes and written down as 4 decimal numbers in the 0-255 range (numeric capacity of a byte) separated by dots; for example: 10.11.30.252.
- The IPv4 format allows for over 4 billion unique IP address. While this was more than enough to handle demand during the 1990s and 2000s, it is not nearly enough to keep up with demand today and in the future. To solve this problem, IPv6 has been introduced, extending IPv4 from 32-bits to 128-bits. Cloud vendors are getting ready for IPv6, and most allow for specifying IP protocol version (IPv4 vs. IPv6) when provisioning servers.

Private IP Addresses

- In order for IPv4 addresses to be used efficiently, three blocks of IP addresses were separated and reserved as private IP addresses. Local, smaller networks access the Internet through a router which can have a unique public IP address, and it can take care of internal addressing within the network using private addresses which don't have to be globally unique. This is similar to a company having a main phone number which is unique, and internal extension numbers for its many internal phones, which the main number switch handles and which don't have to be globally unique.
- The three private address block ranges are:
  - 10.0.0.0 to 10.255.255.255 (class A private addresses- over 16 million addresses)
  - 172.16.0.0 to 172.31.255.255 (class B - over 1 million addresses)
  - 192.168.0.0 to 192.168.255.255 (class C – over 16 thousand addresses)

Private IP Addresses, Cont.

- The first and last address in each range are reserved. Your home Internet router has a unique global IP address and likely uses class C private addresses for your home network devices. See https://en.wikipedia.org/wiki/IP_address for more information about IP addresses.

- In addition to IP addresses, TCP/IP communications also use port numbers – communication endpoints on a server assigned to various higher level communication protocols or applications. For example, port 80 is a default port reserved for HTTP communications.

CIDR Notation

- The CIDR (Classless Inter-Domain Routing) is used for defining blocks of IP addresses. It specifies how many bits in a 32-bit IPv4 address are intended for the “network” (global) address. Remaining bits can be used for “host” (internal - inside network) addresses. For example, 20.30.40.0/24 defines a network address of 20.30.40.0 (leftmost 24 bits, plus 0) and leaves 8 bits for 256 host addresses within the block. The bitmap of the network part, specified as an IP address (255.255.255.0 in the example above) is also called the network mask.
- CIDR notation allows for the specification of subnets sub-blocks of IP addresses within larger blocks. You will need to understand the CIDR notation because cloud providers use it for specifying details of networks and subnets used when provisioning servers.
- See **https://en.wikipedia.org/wiki/Classless_Inter-Domain_Routing** for more information about CIDR notation.

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Continue to Part 2 of the Video Lecture