2020

Systems and Network Administration - Introduction

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systems and network adminstration

Week 1 –Sys. & Network admin. introduction

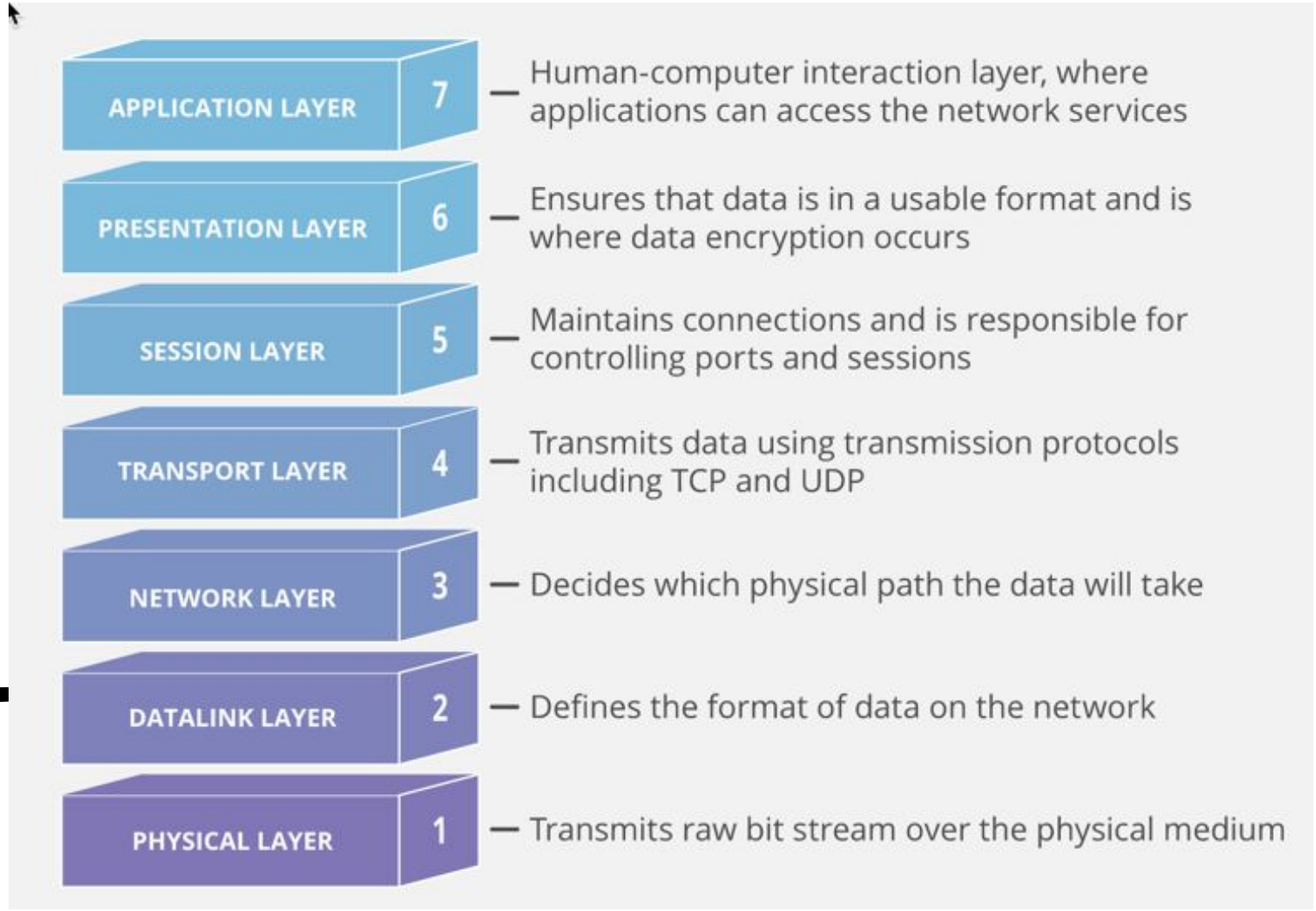
- All class documentation can be found in Blackboard. Please check Blackboard regularly for updates.
- Please have the textbook for start of week 2 class. You can rent it from Amazon, and the seventh edition is MORE than fine (do not spend the extra $ on the eighth edition!)
- Please sign the attendance sheet before you leave.
- Office hours will be held before class, 5:30 – 6:30pm in the same room as class.

Week 1 –Sys. & Network admin. introduction

- Computer networks consist of interconnected hardware.
- Switches, routers, wireless access points, ethernet cables, firewalls form the basis of a network.
- A network can be a LAN, WAN, or a private service such as MPLS (private cloud).
- In recent years, there has been a shift away from on-premise datacenters to the cloud.
- The major cloud providers are Google (Google Cloud Product), Microsoft (Azure), and Amazon (AWS).

OSI Model

The OSI model can be seen as a universal language for computer networking. It's based on the concept of splitting up a communication system into seven abstract layers, each one stacked upon the last.



MAC Addresses

- **Media Access Control (MAC) address** - This is the *physical* address of any device -- such as the NIC in a computer -- on the network. The MAC address, which is made up of two equal parts, is 6 bytes long. The first 3 bytes identify the company that made the NIC. The second 3 bytes are the serial number of the NIC itself.
- MAC addresses operate at Layer 2 of the OSI model. They operate in the same broadcast domain, meaning all devices receive all notifications.
- A layer 2 switch will pass along any broadcast packets they receive to all the other segments in the broadcast domain, but a router will not. Think about a 4-way intersection: all traffic is passed through the intersection no matter where it was going. Now imagine that this intersection is at an international border. To pass through the intersection, you must provide the border guard with the specific address that you are going to. If you don't

Switches and routers

- Switches act at layer 2. There are layer 3 switches, which include routing capabilities (but let's not overcomplicate things for now).
- Switches can only make forwarding decisions based on layer 2 (MAC addresses). They don't know what an IP is!
- That's where routing comes in…
- Routers are layer 3 devices. They are able to use ARP to translate MAC addresses to IP addresses, and thus, make intelligent routing decisions. Otherwise, your data would never be able to leave your local network (and never get to the Internet!)

Switches and Routers

- So why use a layer 2 switch?
- On that note, why use a router then, if you can just use a layer 3 switch?
- While most switches operate at the **Data layer** (Layer 2) of the OSI Reference Model, some incorporate features of a router and operate at the **Network layer** (Layer 3) as well. In fact, a Layer 3 switch is incredibly similar to a router.
- When a router receives a packet, it looks at the Layer 3 source and destination addresses to determine the path the packet should take. A standard switch relies on the MAC addresses to determine the source and destination of a packet, which is Layer 2 (Data) networking.
- The fundamental difference between a router and a Layer 3 switch is that Layer 3 switches have optimized hardware to pass data as fast as Layer 2 switches, yet they make decisions on how to transmit traffic at Layer 3, just like a router. Within the LAN environment, a Layer 3 switch is usually faster than a router because it is built on switching hardware. In fact, many of Cisco's Layer 3 switches are actually routers that operate faster because they are built on "switching" hardware with customized chips inside the box.
- The pattern matching and caching on Layer 3 switches is similar to the pattern matching and caching on a router. Both use a routing protocol and routing table to determine the best path. However, a Layer 3 switch has the ability to **reprogram** the hardware dynamically with the current Layer 3 routing information. This is what allows for faster packet processing.

IP addresses and subnetting

- There are public IP blocks, and private IP blocks.
- Public IP blocks are routable, meaning they can traverse routers and reach external networks across the Internet.
- Private IP blocks never never reach the Internet, though, they are routed internally by a layer 3 device (such as a layer 3 switch or router).
- Private IP subnets: 192.168.0.0/16, 10.0.0.0/8, 172.16.0.0/16
- /huh?

IP addressing

- All computers need IP addresses in order to communicate on a network.
- Remember, layer 2 swatches (the data link layer of the OSI model) only know about MAC addresses, not IP addresses.
- Routers provide the capabilities necessary to direct traffic across different networks (outside of the local IP subnet).
- Switches break up collision domains, routers break up broadcast domains.
- ARP: Each network card has a unique identifier called a **Media Access Control (MAC)** address. This address is used in LANs for communication between devices on the same network segment.