

# Introduction to Computer Networks

Network topologies mean the way of connecting the devices together the messaging among them.

WAN = Wide Area Network "under ISP administration 'Internet Service Provider'"

LAN = Local Area Network

NIC = Network Interface Card

Hub use half duplex "Allows collisions"

Switch is considered as one broadcast domain "collision domain".

Routers are devices divide the network into multiple broadcast domains

Access point has One collision domain and use CSMA/CA to avoid collisions

CSMA/CA = Carrier Sense Multiple Access/ Collision Avoidance, by "sending a RTS signal 'Request To Send' then receive a CTS signal 'Clear To Send' then send the data"

Access Point can have more than one SSID "Service Set Identifier" name of the wifi Network

Coaxial used for video transfer and by the TVs.

STP = Shielded Twisted Pair use RJ45

Most usable cables UTP "Unshielded Twisted Pair" use RJ45

GSM = Global System Mobile "Mobile Networks like 3G, 4G"

WiMax (WAN) transmitting signals through large geographic distances "air phone cables"

Wi-Fi (LAN) = Wireless Fidelity

ISM Band = Industrial Scientific Medical Band

IEEE 802.11 standard is a geographical range the LAN cover "A - B - G - N"

The 802.11 standard defines protocols in both the Physical Layer and the Data-Link Layer of the OSI model

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## ISO/OSI Model (7 Layers)

OSI Model = Open Systems Interconnection

7 layers "Physical - Data Link - Network - Transport - Session - Presentation - Application" layer

LLC = Logical Link Control

FCS = Frame Check Sequence

MAC = Media Access Control

Logical Address "like IP" is changeable cause it related to the geographical location "Unique"

Physical Address "like MAC" is constant cause it's related to the Network card type and the brand of the producing company "Unique"

Physical Address is responsible for transmitting data from a device to another step by step.

Data Link Layer use "switches and Network Interface Cards NIC"

Application Layer acts as user interface with lower layers

The Presentation Layer is responsible for presenting data to the application layer in a format that can be understood by the application layer.

The Network Layer is responsible for end-to-end addressing and routing of data between hosts in a network and responsible for logical addressing, or IP addressing.

The Transport Layer is responsible for end-to-end communication between processes running on different hosts and can be either connection-oriented or connectionless-oriented.

The Data-Link Layer is responsible for reliable transmission of data over a single link and responsible of physical addressing, or MAC addressing

the Physical Layer is responsible for the transmission of raw bit streams over a physical medium.

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## TCP/IP Protocol Suite

The length of the port number in TCP/IP is 16 bits

Protocol in computer networks mean group of rules and agreements were set to transmit data in a right and fast way from a sender to a receiver

TCP/IP protocol consist of 4 layers "Application - Transport - Internet - Network Access" Layers

Application Layer consist of "Application - Presentation - Session" Layers and has "HTTP - HTTPS - FTP - STMP - DNS - ..." Protocols

Transport layer still Transport Layer and has "TCP - UDP" Protocols

Network layer become Internet Layer and has "IP" Protocol

Network Access Layer consist of "Data Link - Physical" Layers

1: Application Layer:

- Protocols that provides "web services":
  - HTTP = Hyper Text Transfer Protocol
  - HTTPS = Hyper Text Transfer Protocol Secure
- Protocols that provides "files transmsion sevice":
  - FTP = File Transfer Protocol
- Protocols that provides "email sevice":
  - SMTP = Simple Mail Transfer Protocol "send emails from client to server"
  - POP3 = Post Office Protocol version 3 "recieve emails from server to client"
- Protocols that provides "changing domain names into IP addresses":
  - DNS = Domain Name System Protocol
- Protocols that provides "distributing IP adress, Subnet mask, Gateway, and DNS":
  - DHCP = Dynamic Host Configuration Protocol

2: Transport layer:

- TCP protocol:
  - segments the data then adds sequencing identifier
  - use Connection oriented and reliable communication method
  - data will be sent after confirming there is a connection loop
  - used in emails - file sharing - downloading
- UDP protocol:
  - segments the data
  - use Connectionless oriented and best effort communiction method
  - ne need to make a connection loop

- care about the speed of delivering data and not about well ordered data
- used in voice - video streaming

### 3: Internet Layer:

- IP protocol:
    - divides data into packets and adds logical address
    - packet has IP for "destination - source" address
    - Router has routing table
  - IP address V.4 "32 Bits or 4 Bytes"
    - each Byte has value range "0:255"
    - IP addresses classified into classes
    - each class range has private IP address related to the internal network
    - Class A:
      - 1.0.0.0 - 126.255.255.255 "Public"
      - 10.0.0.0 - 10.255.255.255 "Private"
      - first Byte indicate the Network location from left
      - the rest Bytes indicate the Host or Device number
    - Class B:
      - 128.0.0.0 - 191.255.255.255 "Public"
      - 172.16.0.0 - 172.31.255.255 "Private"
      - first 2 Bytes indicate the Network location from left
      - the rest Bytes indicate the Host or Device number
    - Class C:
      - 192.0.0.0 - 223.255.255.255 "Public"
      - 192.168.0.0 - 192.168.255.255 "Private"
      - first 3 Bytes indicate the Network location from left
      - the rest Bytes indicate the Host or Device number
    - Example "163.121.12.15":
      - 163.121 > related to Class B and indicate location of the "network"
      - 163.121 > from Egypt
      - 12.15 > indicate location of the device and its number "Host"
  - Routing table:
    - table saved on the router has information about all IP addressed it receives and about their direction
    - created by 2 methods "statically - dynamically"
- TCP/IP Commands for troubleshooting or maintenance for the network:
- IP Config
    - configuration of TCP/IP protocol
    - in CMD type "IPConfig/all"
    - IP address - MAC address - Subnet mask - Gateway for NIC
  - PING
    - testing connectivity with another device
    - like typing "ping www.google.com" OR "ping then the IP address"
    - if i'm connected to it through internet, it will "Reply" if not "Request timed out"
  - ARP
    - ARP = Address Resolution Protocol
    - in CMD type "arp -a"
    - resolution between "IP - MAC" addresses OR "internet - physical" Addressed
  - FTP
    - FTP = File Transfer Protocol
    - used to connect to a file sever exists on internet
    - in CMD type "ftp" to open a file transfer session with a server type "open then name of the File Transfer Server" then it asks for the "user and pass" or your account in the FTP server finally it

- allows you to get files from the server or vice versa
    - o to exit type "bye"
    - o Ex: ftp | open ftp microsoft.com
  - NSLOOKUP
    - o used for getting the IP address of a domain name that I have
    - o EX: nslookup | www.google.com | then you get IP for google "142.250.203.228"
    - o to exit type "quit"
  - ROUTE
    - o Print, add, change, and delete related to this command
    - o used to recognize the components of my device in terms of routing table saved in it
    - o in CMD type "route print"
  - Netstat
    - o in CMD type "netstat -a" to show all connection that my pc makes
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## Recorded Labs "Computer Networks Practical":

Your role As a Computer Network Engineer:

- IP address configuration:
    - o Static configuration
    - o Infrastructure services (DHCP - DNS)
  - Web service:
    - o HTTP "hyper text transfer protocol"
    - o HTTPS "hyper text transfer protocol secure"
  - Email service:
    - o SMTP "simple mail transfer protocol"
    - o POP3 "post office protocol"
    - o IMAP protocol
  - File Transfer protocol:
    - o FTP "File Transfer protocol"
  - Remoter desktop Administration:
    - o RDB "remote desktop protocol"
    - o SSH
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install DHCP server in win server 2012:

- DHCP server configuration
  - o Make static IP address
    - IP address = 192:168:10:15
    - subnet mask = 255:255:255:0
    - Default gateway = 192:168:10:2
    - DNS server = 127:0:0:1
    - Alternate DNS server = 8888
- Install DHCP server
  - Manage > Add Roles and Features
  - Next > Next > Next
  - IN Server Roles select "DHCP server - DNS server"
  - Next > Next > Next
  - install > close
- DHCP configuration manager
  - Right click > DHCP manager
  - IP-V4 > right click > New scope
  - Type "name - description"
  - Start of IP addresses "192:168:10:50" and End of it "192:168:10:100"
  - subnet mask = 255:255:255:0, and lenght "24"
  - 4 Days as a client reservation

- Default gateway = 192:168:10:2
- Parent domain "name of it"
- finish

- ON client\_1 machine we request for IP address
  - in CMD type "ipconfig /renew
  - in CMD type "ipconfig /all"
  - we care about "lease obtained - lease expires"
- ON client\_2 machine we request for IP address
  - in CMD type "ipconfig /renew
- ON DHCP manager we can reserve IP for a client:
  - Right click > DHCP manager > IP-V4 > address leases
  - Right click at client\_1 > add to Reservation

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install DNS server in win server 2012:

- DNS server configuration
- Make a Forward lookup Zone
  - Server Manager > DNS
  - Right click > DNS Manager
  - Right click > New Zone "like logs"
  - Primary zone "for local"
  - forward lookup zone "translates DNS into IP addresses"
  - type zone\_name > next
  - Don't allow dynamic updates
  - Finish
- Make a Reverse lookup Zone
  - Server Manager > DNS
  - Right click on "Reverse lookup Zones" folder > New Zone "like logs"
  - Primary zone "for local"
  - IP-V4 reverse lookup Zone
  - Network ID = 192:168:10: > next
  - Don't allow dynamic updates
  - Finish
- Create New Records
  - ON Forward lookup Zones > Zone\_name
  - Right click > New Host
  - Client\_name > its IP
  - ON Reverse lookup zones > zone\_name
  - we find the Reverse DNS of created records

Test the DNS on Client Machines:

- ON client\_1 machine
- On CMD type "nslookup client\_2"
- now you have the IP of the client\_2
- you can ping with it
- type "ping client\_2"

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Remote desktop services "RDB protocol":

- used to make Remote administration on specific machine
- Remote configuration on specific machine
- Using RDB protocol on port 3389 TCP
- 1: Enable remote desktop connection
  - On client machine > Right click on windows sign
  - System > Remote Settings
  - Check Allow remote connection
  - Remove check from network level authentication > apply

- 2: Create user account
  - On client machine > Right click on windows sign
  - Computer Managements > Local Users and Groups > Users
  - Right click > New User
  - give Name and Pass
  - Remove check User change Pass > create
- 3: Configuration of service
  - Right click on the Created account > properties
  - Member of > Local users and groups > Add
  - Advanced > Find Now > choose the Remote Group
  - OK > OK > Apply
- 4: Assign user account to group
  - On other client machine > search > Remote Desktop Connection
  - Machine\_name to log into it
  - type User and Pass

#### File Transfer Protocol configuration:

- Create 2 accounts as before
- Download FTP on client\_2 machine to act as server
- FTP listen to port 21 TCP
- To Access FTP service:
  - Command line "CMD"
  - Web interface
  - Third party program like FileZilla

#### Email server:

- MTA "Mail Transfer Agent"
  - Protocol SMTP on port 25 TCP
  - To send mails
- MDA "Mail Delivery Agent"
  - Protocol IMAP on port 143 TCP
  - Protocol POP3 on port 110 TCP
  - To send mails
- MUA "Mail User Agent"
  - To access mail by user interface or third party program

We use Email Architect Server app on Client\_2

- to act as email server and send mails by MTA

The biggest attraction towards wireless networks is the feature of ...

- Mobility

Which of the following is a typical LAN technology?

- Ethernet

The most convenient topology allowing for redundancy in the computer network is the ... topology

- Mesh

Class B IP addresses range starts from ...

- 128.x.x.x

The RJ45 connector is used with ....

- Twisted Pair Cables

Which of the following devices divides the network into multiple broadcast domains?

- Router

The length of the IPv4 address is ... bits

- 32

Print, add, change, and delete are all switches for the ... command

- ROUTE

The network topology dependent on a central connecting device (Hub/Switch) is the ... topology

- Star

The ISO/OSI model is a ... model for internetworking

- Conceptual

TCP/IP model compacted the 7 layers of the ISO/OSI model into ... layers

- 4

The 1G, 2G, 3G, 4G, and 5G generations are all belonging to the ... wireless technology

- GSM

UDP is characterized to be a ... protocol

- Best-effort delivery

Which of the following layers acts as user interface with lower layers?

- Application Layer

Which of the following layers is responsible of end-to-end addressing and routing?

- Network Layer

Which of the following layers is responsible of physical addressing?

- Data-Link Layer

The .... cables are the most convenient for submarine communications

- Fiber Optic

TCP/IP compacted the upper ... layers of the ISO/OSI into one application layer

- 3

The length of the port number in TCP/IP is ... bits

- 16

Layer 3 in the ISO/OSI model is called the ... layer

- Network

Which of the following layers in can be either connection or connectionless oriented?

- Transport Layer

The 802.11 standard defines protocols in both of the following layers

- Physical, Data-Link

Which of the following layers must be adapted to the transmission media type?

- Physical Layer

Port number 80 is dedicated to the ... protocol communication in TCP/IP

- HTTP