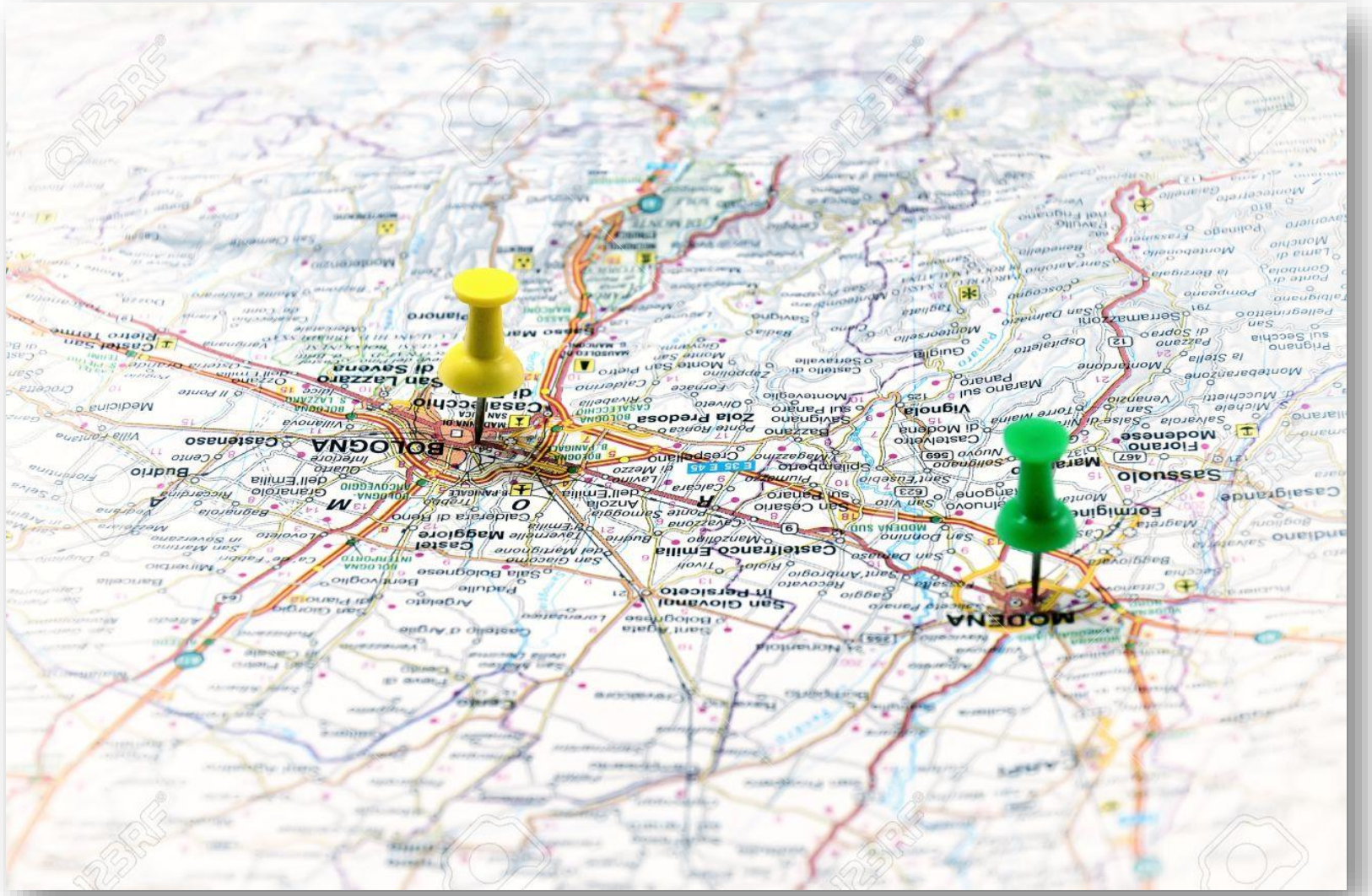
a mini session on

NETWORK ADDRESSING



NETWORK ADDRESSING

Layer	Application/Example		Central Device/ Protocols	
Application (7) Serves as the window for users and application processes to access the network services.	**End User layer** Program that opens what was sent or creates what is to be sent Resource sharing • Remote file access • Remote printer access • Directory services • Network management		**User Applications** SMTP	GATEWAY Can be used on all layers
Presentation (6) Formats the data to be presented to the Application layer. It can be viewed as the "Translator" for the network.	**Syntax layer** encrypt & decrypt (if needed) Character code translation • Data conversion • Data compression • Data encryption • **Character Set Translation**		JPEG/ASCII EBDIC/TIFF/GIF PICT	
Session (5) Allows session establishment between processes running on different stations.	**Synch & send to ports** (logical ports) Session establishment, maintenance and termination • Session support - perform security, name recognition, logging, etc.		**Logical Ports** RPC/SQL/NFS NetBIOS names	
Transport (4) Ensures that messages are delivered error-free, in sequence, and with no losses or duplications.	**TCP** Host to Host, Flow Control Message segmentation • Message acknowledgement • Message traffic control • Session multiplexing	PACKET FILTERING	TCP/SPX/UDP	
Network (3) Controls the operations of the subnet, deciding which physical path the data takes.	**Packets** ("letter", contains IP address) Routing • Subnet traffic control • Frame fragmentation • Logical-physical address mapping • Subnet usage accounting		**Routers** IP/IPX/ICMP	
Data Link (2) Provides error-free transfer of data frames from one node to another over the Physical layer.	**Frames** ("envelopes", contains MAC address) [NIC card — Switch — NIC card] (end to end) Establishes & terminates the logical link between nodes • Frame traffic control • Frame sequencing • Frame acknowledgment • Frame delimiting • Frame error checking • Media access control		**Switch** **Bridge** **WAP** PPP/SLIP	Land Based Layers
Physical (1) Concerned with the transmission and reception of the unstructured raw bit stream over the physical medium.	**Physical structure** Cables, hubs, etc. Data Encoding • Physical medium attachment • Transmission technique - Baseband or Broadband • Physical medium transmission Bits & Volts		**Hub**	

Media Access Control (MAC) Address

- MAC address of a device is a unique identifier assigned to a network interface controller (NIC) for communication
- Hexadecimal : eg FA-2B-37-68-01-01
- 48 bits : 2^{48}, approx. 281 trillion addresses
- Hardcoded and unique

Network Switch

- Maintains a list of MAC addresses of the devices in the network
- Initialisation : get all the MAC addresses
- Updating : update list by ‘forgetting’ inactive MAC addresses

Internet Protocol (IP) Address

- IP address is a numerical label assigned to each device connected to a computer network that uses the Internet Protocol for communication.
- IP address identifies a host or a network interface and provide its with a location addressing
- IPv4 (since 1983) : 32 bits, from 0.0.0.0 to 255.255.255.255
- 2^{32} , approx. 4 billion IP addresses
- But we have 6 billion people, so insufficient to have a unique IP address for each person or device.

Public IP Address

- Internet Assigned Number Authority (IANA) www.iana.org
- Each Internet Service Provider (ISP) is given one Public IP address

Domain Name Server, DNS

- https://ipinfo.info/html/ip_checker.php
- singtel.com.sg (203.126.100.199)
- yishunjc.moe.edu.sg (107.154.114.116)
- google.com.sg (172.217.18.163)

Private IP Address

- If a Local Area Network (LAN) can use from 172.16.0.0 to 172.31.255.255, then there are 16 x 2^{16} , which is about 1 million addresses.
- And within the LAN, there is a smaller network which uses from 172.16.0.0 to 172.16.255.255, then there can be 2^{16} , which is 65,536 addresses.

Advantages of hierarchical addressing

- Hierarchical (same subnet for Hosts under the same switch)
- IP vs MAC - address

Why "255"?

- in a 8-bit system, 255 = 1111 1111

xxxx xxxx 0001 0000 0000 0000 0000 0000 = ... 16.0.0

xxxx xxxx 0001 1111 1111 1111 1111 1111 = ... 31.255.255

Router

- Recognises IP addresses
- Uses Dynamic Host Configuration Protocol, DHCP

- assign a local IP for a "leased time"
- DHCP vs Static IP address

Since 1983 : IPv4 (32bit)

Mid 2000 : IPv6 (128bit)

www.ping.eu/nslookup

-> Ping

-> Trace route

-> DNS lookup