CN-Lecture 1

Dev M.

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Chapter 1

Course struct

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1.1.1 Grading

- 10 % → Quizzes (n-1, 3)
- 15 % → Midsem
- 35 % → Endsem
- 40 % → Assignments (n, 4)

1.1.2 Schedule

Monday to Wednesday → 9:00 to 11 (lect)
Prof Office hours → 12:00 to 13:00 (mon)
Head TA → Gopi

1.1.3 Textbook

- J.F. Kurose and K.W. Ross, Computer Networking: A Top-Down Approach, 6th Edition, Pearson, 2012.
- `https://gaia.cs.umass.edu/kurose_ross/ppt.htm`
- L L Peterson and B S Davie, Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann, 2011.
- A. S. Tanenbaum and D. J. Wetherall, Computer Networks, 5th Edition, Pearson, 2011.

Chapter 2

Intro to Network

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2.1 Common Terminology

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2.1.1 Router

- A device that connects two or more networks.
- A device that forwards data packets between computer networks.
- Helps to determine the best path for the data packets to reach the destination.

2.1.2 IP Address

- A unique number assigned to each host.
- Generally written in dotted decimal notation.
- Helps in specifying each unique user on the network/internet.
- Global Identifier for a device.
- In IPv4, 32 bits are divided into 4 octets.
  Example: 127.123.123.123
- In IPv6, 128 bits are divided into 8 octets.
- There are two types of IP addresses:
  - Public IP Address: Assigned by ISP (Internet Service Provider) and visible to each device connected to the internet.
  - Private IP Address: Assigned by the router and visible only to the devices connected to the router.

  For proof you can match your local IP Address (Using Ipconfig) with the IP Address shown on `https://whatismyipaddress.com/`

2.1.3 Port

- A 16-bit number assigned to each process.
- Port has nothing to do with process ID (PID), it is just a number assigned to each process using the network.
- Helps in specifying each unique process on the network/internet.
- No two processes can have the same port number.
- There are two types of ports:
  - Well-known ports: 0 to 1023
  - Registered ports/User-Defined ports: 1024 to 49151

  - Dynamic ports: 49152 to 65535

- Well known ports are assigned to processes by the IANA (Internet Assigned Numbers Authority).
- These ports are used by system processes that provide widely used types of network services.
- Examples are: FTP (21), SSH (22), Telnet (23), SMTP (25), HTTP (80), HTTPS (443), etc.
- Rest of the ports are used by user-defined processes like Chrome, Firefox, etc.

2.1.4 MAC Address

- A unique number assigned to each network interface.
- Local Identifier for a device.
- Generally 48 bits long. Written in hexadecimal notation.

2.1.5 DNS

- Domain Name System.
- A system that maps and fetches domain names/URLs to IP Addresses.
- DNS IP is preconfigured/hardcoded in the router and is fetched from the ISP.

2.1.6 NAT

- Network Address Translation.
- A system that maps and fetches private IP Addresses to public IP Addresses.
- NAT IP is preconfigured/hardcoded in the router and is fetched from the ISP.

2.1.7 Connection

- Connection is a 4-tuple of (source IP, source port, destination IP, destination port).
- Connection is uniquely identified by the 4-tuple and is created upon a successful handshake between the client and the server.

2.2 High Level View

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2.2.1 Connect to a website

- The process:
  - User types the URL in the browser.
  - Browser fetches the IP Address of the URL from the DNS.
  - Browser sends a request o the IP Address on port 80 (HTTP) or 443 (HTTPS).
  - Request is sent to your ISP's router.
  - Router maps the private IP Address to a public IP Address using NAT.
  - Router forwards the request to the public IP Address.
  - Server responds to the request.
  - Router maps the public IP Address to a private IP Address using NAT.
  - Router forwards the response to the private IP Address.
  - Use the specifed port, if any, to forward the request and response.
  - Browser renders the response.
- This process is repeated for each request and response and is called a connection.
- The Endpoints are:
  - Client's Global IP Address and Port.
  - Server's Global IP Address and HTTP/HTTPS/Well-known port.

  Both these Endpoints are known as socket addresses.