

## In CLASS Quick Notes week 9

# Networking Fundamentals: IP Addresses & Topologies

### Action Items

- Review the eight quiz questions mentioned and confirm they contain no unauthorized content.
- Verify the “robot” checks on homework items as discussed.
- Listen to Clara’s feedback on the recent assignment.
- Prepare group homework outlines before the next class (due early November).
- Bring any lingering questions about IP addressing or NAT to the next session.

### Key Topics Covered

- Recap of previous class: networking basics, cable types, transmission methods.
- Introduction to IP addressing (IPv4 vs IPv6) and address structure.
- Differences between local (private) and global (public) IP addresses.
- NAT (Network Address Translation) and masquerading explained.
- Static vs dynamic IP addressing, use-cases and cost considerations.
- DNS purpose, domain names vs IP addresses, and basic DNS lookup.
- Common service ports (HTTP 80, HTTPS 443, FTP, SMTP, etc.).
- Network topologies: bus, star, ring, mesh, their pros/cons.
- Internet connection types: DSL (ADSL, symmetric/asymmetric), cable modem, satellite.

### IP Addressing

- IPv4: four octets, each 0-255; total ~4 billion addresses.
- Reserved address blocks (e.g., 10.x.x.x) not routable on the public Internet.
- IPv6: 128-bit, vastly larger address space, still coexists with IPv4.
- Local (private) IPs used inside homes/offices; not visible externally.
- Global (public) IPs assigned by ISPs, unique worldwide.

### NAT & Masquerading

- NAT translates private IPs to a single public IP for outbound traffic.
- Masquerading is a form of NAT that hides internal device addresses.

- Enables local devices to communicate with external servers without exposing internal topology.

## Static vs Dynamic IP

- **Static IP**: fixed address, useful for servers, IP cameras, VPN endpoints; higher cost, requires manual configuration.
- **Dynamic IP**: assigned by DHCP, changes over time, suitable for typical client devices; lower cost, no manual upkeep.
- Choice depends on service needs, budget, and whether consistent addressability is required.

## DNS & Domain Names

- DNS maps human-readable domain names (e.g., google.com) to IP addresses.
- Provides hierarchical naming (root, TLD, second-level, subdomains).
- Without DNS, users would need to remember numeric IPs for every site.
- DNS also supports load balancing and redundancy.

## Common Service Ports

- 80 → HTTP (unencrypted web)
- 443 → HTTPS (secure web)
- 21 → FTP (file transfer)
- 25 → SMTP (email sending)
- 110 → POP3 (email retrieval)
- 22 → SSH (secure remote login)

## Network Topologies

- **Bus**: single cable, failure of one node can bring down whole network.
- **Star**: central hub/switch; hub failure isolates entire network.
- **Ring**: each node connects to two neighbors; a break disrupts the loop.
- **Mesh**: multiple redundant paths; high reliability, higher cost.

## Connectivity Options

- **DSL**: uses telephone lines; ADSL (asymmetric) favors download speed, SDSL (symmetric) offers equal upload/download.
- **Cable Modem**: leverages coaxial TV lines, higher bandwidth than DSL.
- **Satellite**: for remote locations, higher latency.

- Filters/splitters needed to separate voice and data on DSL lines.

## Homework & Projects

- Group assignments due soon; focus on organizing tasks to avoid last-minute rush.
- Projects will involve configuring IP addressing, NAT, and basic routing.
- Instructor and teaching assistants will review submissions manually.

## Miscellaneous

- Emphasis on understanding concepts rather than memorizing definitions.
- Encouragement to ask questions if any material feels unclear.
- Reminder that the course will continue building from basics to more advanced networking topics.