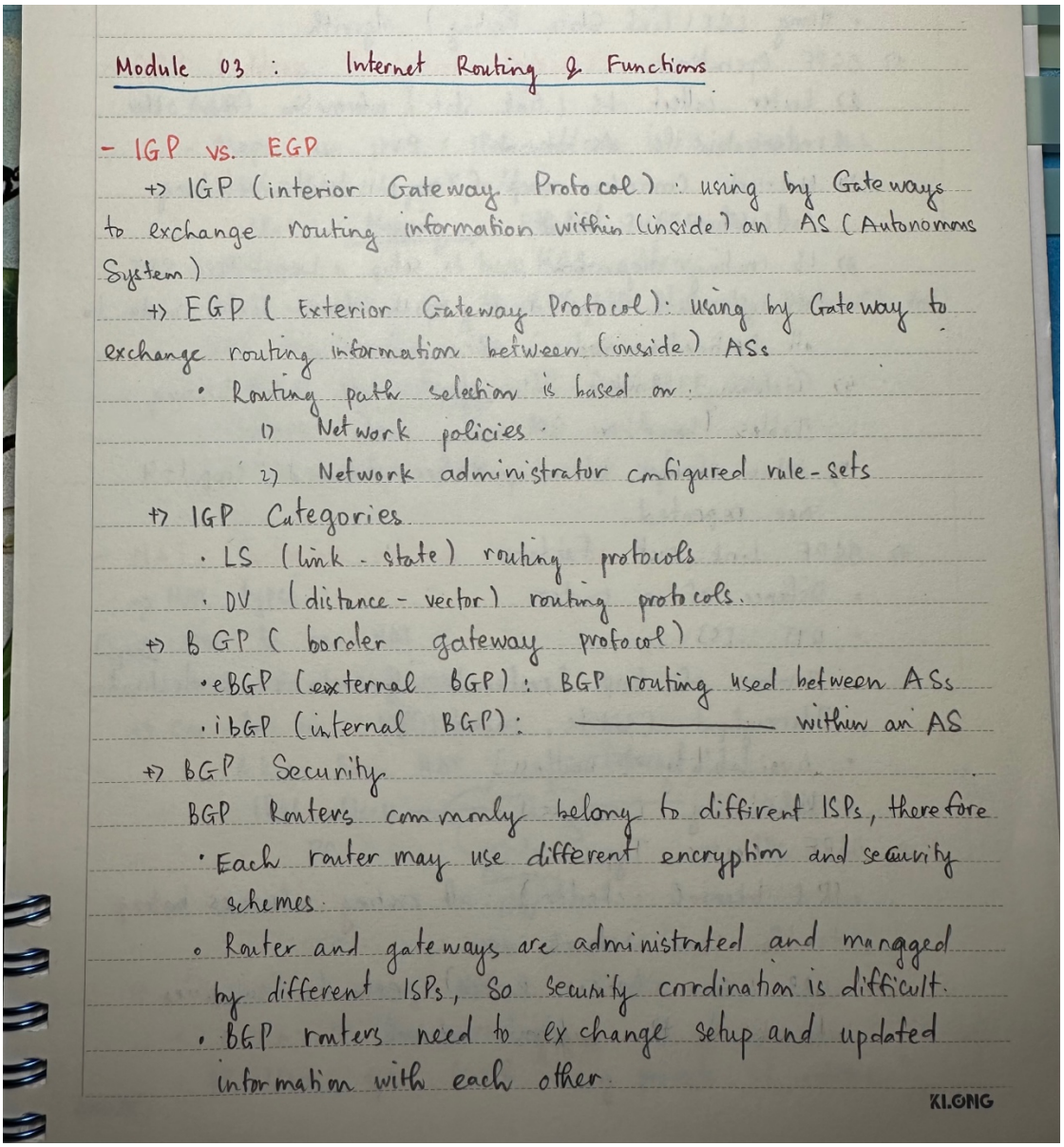
3. Internet Routing & Functions

Note:



Module 03 : Internet Routing & Functions

- IGP vs. EGP

+) IGP (interior Gateway Protocol) : using by Gateways to exchange routing information within (inside) an AS (Autonomous System)

+) EGP (Exterior Gateway Protocol): using by Gateway to exchange routing information between (inside) ASs

- Routing path selection is based on:
  1) Network policies
  2) Network administrator configured rule-sets

+) IGP Categories
- LS (link-state) routing protocols
- DV (distance-vector) routing protocols.

+) BGP (border gateway protocol)
- eBGP (external BGP): BGP routing used between ASs
- iBGP (internal BGP): _____ within an AS

+) BGP Security

BGP Routers commonly belong to different ISPs, therefore
- Each router may use different encryption and security schemes.
- Router and gateways are administrated and mangaged by different ISPs, So security cordination is difficult.
- BGP routers need to exchange setup and updated information with each other.

KI.ONG

- OSPF (open shortest Path First)

+) OSPF
- Most widely used IGP (interior Gateway Protocol) routing protocol in the internet
- Routing protocol for IPv4, IPv6, and CIDR addresses
- Using by Internet Gateway & Router
- Using LSR (Link State Routing) algorith

+) OSPF Operations
1) Router collect LS (link State) information from other routers in the AS network.
2) Network Connection map (Tree) is made including Cost values of links
3) LS routing algorithm : used to setup a Loop-Tree SPT (shortest Path Tree) routing path from source node to all Destination nodes in the network.
4) Gateway / Routers will setup / update their Routing Tables (based on SPT routing paths)
5) When changes in network are detected, step 1-4 are repeated

+) OSPF Link cost Factors
- Distance of a router
- RTT [s]
- Number of hops (routers / switches to reach destination [hops]
- Throughput [bit/s, packet/s]
- Availability [unitless]
- Reliability [unitless]

+) OSPF Router Types.
- IR (Internal Router) : all routing interfaces belong to the same network area
- ABR (Area border Router): Connects subarea networks to the backbone network

- BR (Backbone Router) : connects to the backbone network
- ASBR (Autonomous System Boundary Router) : connects between ASs using multiple routing protocols.

↳ MOSPF (Multicast Open Shortest Path First)

Alternative multicasting schemes include.

OSPF + PIM (protocol independent multicast)

- ARP (address Resolution Protocol)

↳ ARP

- Maps an IPV4 / IPv6 address to a device's DLL (Data Link Layer) address

IPv4 Address ⟷ (Mapping) Ethernet (IEEE 802.3) MAC address

- IPv6 networks use NDP (Neighbor discovery protocol) for ARP functionality.

IPv6 Address ⟷ (Mapping) Wi-fi (IEEE 802.1) Mac address.

- IANA manages ARP parameter values.

- NAT (network address translation)

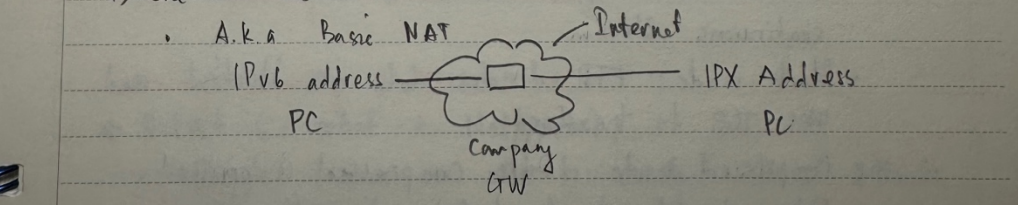
↳ NAT types :

one-to-one NAT

one-to-many NAT

↳ One-to-one NAT

- A.k.a Basic NAT



↳ One-to-many NAT

- A.k.a IP Masqueroding
- IP address space (with many private IP address)

KI.ONG

hidden under a single public IP address.

- Pros
  Provides enhanced security
  Made to save public IPv4 addresses ($2^{32} = 4.3$)

- RPC (Remote Procedure Call)
  => RPC request & response procedures
  - Client initiates RPC by sending a request message to a remote Server
  - Server replies with a Response to the client.

- FTP (File Transfer Protocol)
  => FTP
  - used to transfer files from a server to a client computer. (Server → client)
  - FTP over TCP/IP is defined in RFC 959.
  - FTP sign-in protocol commonly requires username and password.
  - FTP with TLS protection (FTPS) is commonly used
  => FTP Modes
  - Active Mode
  - Passive Mode.
  => FTP data transfer modes.
  - Stream mode: TCP is used to send data in a continuous stream.
  - Block mode: FTP divides data into blocks and uses TCP to transfer
  - Compressed mode: Data compression is applied
  - Enhanced data transfer techniques exist.

— E-mail

↦ POP3 vs. IMAP

- Both are e-mail retrieval applications that use TCP/IP
- POP3 (post office protocol v3) specs in RFC 1939.
- IMAP (internet messager access protocol) v4 rev. 1 specs in RFC 3501
- Encryption through TLS, STARTTLS or SSL

↦ POP3

- POP3 has a very simple operation
- POP3 moves emails from the server onto your device
- POP3 can be set to leave emails on the server after being retrieved

↦ IMAP

- IMAP enable complete management of a user e-mail box from multiple e-mail devices
- IMAP is more popular due to multiple device support
- IMAP use more complex queries in communicating with the server due to multiple device support
- IMAP leaves e-mails on the server after retrieval