IPv4 Exhaustion:

- The Ipv4 addresses where originally administered by the IANA (internet assigned number authority) but as internet grew IANA decided to hand out the job **to Regional internet registers (RIR)**
- There are only around 4.2 billion IPv4 ip addresses. Around 2011 the IPv4 addressing space was nearly completely allocated so IANA couldn't provide more blocks to regional internet registers
- Some organisations are now returning unused IPv4 addresses, allowing the Regional interest registers to reallocate them

- To combat exhaustion
    - we move to Classless Inter-domain routing (CIDR)
    - Network address translation
    - IPV6

- **Network Address Translation (NAT):**
    - In the past, each device would need a public Ip address in order to be routed over the internet
    - Network address Translation: Allows for multiple devices (With private Ip addresses) to use a single public Ip address. So allow each household to only require a single public IP address therefore slows down IP address running out

- **Network Address Translation Operation: (Every router)**
    - Contains a network address translation table
        - Stores the mappings between the private Ip address + port number combination to → public Ip address + port number combination
        - Mappings are created when devices tries to communicate outside of the local network

Nat disadvantages:

- User Identification (related to carrier nats):
    - Nat also makes it difficult to identify individual user on network
    - So if a user behind a Nat does something bad then investigation would point to all users on the nat not just the specific user
    - Therefore, if we block the Ip address it would ban all the users (in your house. Think if my IP is banned on Warcraft 3 all the devices are banned)
- Application connectivity:
    - So basically nat mappings are created on demand where bare (so as soon a device wants to send packet outside local network)
    - If an external host want's to send traffic back to our device it can't because network address translation breaks end to end nature
        - Use static nat (port forwarding to solve)

IPv6:

- Is 128 bits that is divided into 16 bits (8)
- Better Integrated of Ip security
- Subnet Mask: Always in slash notation Called **Prefix LINK**
    - **Routing Prefix:** 48 bit or more (Network portion)
    - **Subnet ID:**
    - **Interface Identifier:** 64 bits (Host portion)

Condensing IPv6: Steps

- Line through leading 0 or starting (anything starting with 0)
- Add only TWO IN TOTAL :: between largest leading 0
    - If 4x 0's then leave 1 zero value

IPV6 Transmissions:

- **Multicast :** a packet is delivered to a group of host
- **Any cast:** Packets is delivered to one member of the any cast group. The member closest to sender will be the responder

Approaches to transitioning IPV4 → IPV6

- Government initiatives: Japan or countries setting deadlines for adoption
- Industry driven initiatives: ISP adopting IPv6