# **ISP Network Architecture**

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#### Layers

- OSI Model Layers
- Network Layers







#### **OSI Model Layers**





- Human-computer interaction layer, where applications can access the network services
- Ensures that data is in a usable format and is where data encryption occurs
- Maintains connections and is responsible for controlling ports and sessions
- Transmits data using transmission protocols including TCP and UDP
- Decides which physical path the data will take
- Defines the format of data on the network
- Transmits raw bit stream over the physical medium

### 1. Physical Layer

- Physical Equipment
- Copper Cables
- Fibre Cables
- Wireless





### 2. Data link Layer

- Facilitates data transfer between two devices on the same network
- called frames
- Ethernet operates at this layer
- Sometimes referred to as the MAC layer
- Broadcasts happen at this layer



# Takes packets from the network layer and breaks them into smaller pieces



## 3. The Network Layer

- Facilitating data transfer between two different networks
- Breaks up segments from the transport layer into smaller units, called packets
- Network layer protocols include IP, ICMP, IGMP and IPsec
- Layer3 is routing 0



## 4. The Transport Layer

- Responsible for end-to-end communication between the two devices
- Takes data from the session layer and breaking it up into chunks called segments before sending it to layer 3
- Responsible for flow control and error control
- Transport layer protocols include TCP and UDP





#### **ISP Network Layers Depends on type of network**

- Transport
- Datacentre Leaf and Spine
- Campus Core, Distribution, Access
- Core big routers in middle of network. Connects different parts together
- Aggregation Aggregate services from the edge to the core
- Edge Specific functions, User access, Peering, Transit  $\bullet$
- Access network Wireless, FTTH may resemble the above





# Create a network from building blocks





# High Level network design







#### Example of IP address allocation Private IP addressing

- 172.16.255.x/24 Loopbacks /32 x=site
- 172.16.0.0 /23 Core point to point links /30
- 172.16.128.0/24 Device IPs /24 per site or LAN
- 10.1.x.0/16 Customers per site /24



#### Device Roles

- Core routers
- Peering routers / Transit routers
- BNGs / PPPoE servers
- Hosting routers / access routers
- Customer routers (CPE)
- Firewalls
- Switches
- Layer2 devices vs routing devices





### **Network Systems**

- Network Monitoring System Alerts, historical performance data, logging, netflow
  - LibreNMS, Cacti, Nagios, Smokeping
- User subscriber management system controls user access to services on the network, may including billing and self access portal. May in
- Access Control systems TACACS
- Provisioning systems Deploy and backup configs
- IPAM Documentation eg Wiki Circuit information, Inventory management Netbox
- DNS servers resolvers and authoritative
- Mail / Web servers
- NTP Time Servers

