**CISC3001 Homework 1 (DC026157 Wong Kai Yuan)**

1) Key components including:

- Billions of connected computing devices (End Systems like Hosts and Servers, running apps that generate data)

- Communication Links (physical and wireless connections)

- Packet Switches (Routers and Switches)

- Internet Service Providers (ISPs, IXP, Peering)

- Protocols and Standards (TCP, IP, HTTP etc…)

- Access Network

- Network Core

2) 3 types of access network including:

- Home (Residential) Network

- Mobile Network

- Institutional Network

3)

A. Difference between Tier 1 & Tier 2 ISPs

|  |  |  |
| --- | --- | --- |
|  | Tier 1 | Tier 2 |
| Internet Coverage | National Level, with a presence in multiple regions or countries. | Regional Level, within a specific geographic area or country. |
| Network Independence | No | Yes, need to use Tier 1 ISP to reach global access |
| Peering Agreements | Peer with another Tier 1 ISP | Can be peered with another Tier 2 ISP |
| Examples | Sprint, AT&T, China Telecom | China Unicom, CTM Macau |

B. 2 different Tier 1 ISPs exchange data via peering link that they have. They are connected with each other via IXP (Internet exchange point) to exchange data. This direct exchange of traffic between Tier-I ISPs helps improve the efficiency of data transfer and reduce cost.

4)

A. Difference between circuit switching & packet switching.

|  |  |  |
| --- | --- | --- |
|  | Circuit Switching | Packet Switching |
| Resource (Bandwidth) Reservation | Yes | No (on demand manner) |
| Call Setup and Tear up | Yes | No (very simple) |
| Number of served users | Limited due to limited capacity | Multiplexing gain, can serve more users |
| Performance | Guarantee Performance | Packet delay, loss, and network congestion |
| Application | Telephone Network | Internet, and computer networks |

B. Advantages & Disadvantages of Circuit Switching

|  |  |
| --- | --- |
| Advantages | Disadvantages |
| Dedicated connection -> Reliable Performance (latency, quality) of delivering data from source to destination | Resource is idle even not using -> low efficient utilisation of network resources |
| Suitable for Realtime traffic | Complicated Management (Call setup & tear up) |
|  | Limited Scalability |

C. Advantages & Disadvantages of Packet Switching

|  |  |
| --- | --- |
| Advantages | Disadvantages |
| Given the number of users, save the bandwidth | Packet Delay, Loss |
| Given the bandwidth capacity, more users can be served | Network Congestion |
| Scalability | Limited Quality Guarantee |
| Cost-Effective |  |

5) 1MB/s link, each host need 100kb/s when active, active probability is 0.2

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E. Yes, when each host's active probability is reduced to 0.1, the statistical multiplexing gain becomes more significant because hosts are active less frequently, leading to reduced contention for bandwidth and a higher likelihood of hosts obtaining their required bandwidth when active.

6) Overall Latency (only consider transmission delay) to receive all 3 packets is **4 L/R**

- During the 1st L/R, packet 1 is sent from the source host to the router.

- During the 2nd L/R, packet 1 is sent from the router to the destination host, and packet 2 is sent from the source host to the router.

- During the 3rd L/R, packet 1 has reached the destination, packet 2 is sent from the router to the destination host, and packet 3 is sent from the source host to the router.

- During the 4th L/R, packets 1 and 2 are at the destination, and packet 3 is sent from the router to the destination host.