# Handout #3 — CS 471

Jared Dyreson
California State University, Fullerton

September 22, 2021

## Contents

# 1 Questions

1. Under what conditions are packet delays and losses likely to occur?

   - High volume usage (packet queue is full, therefore cannot accept incoming packets). This results in packet loss.
   - Packets cannot be processed fast enough (packet delay, nothing is lost).

2. Assume a circuit switched network based on time division multiplexing. The speed of the link is 1,000 BPS and the size of the single frame is 1 second. The network contains 10 users. All users share the link fairly. How long does it take for a user to transmit a 100,000,000,000 bit file?

   - The link for an individual user would be: $\frac{\text{1000 bits per second}}{\text{10 users}} = 100$ bps
   - The size of the file is $100,000,000,000$ bits, therefore one user sending this packet would take: $\frac{\text{100,000,000,000}}{100} = 1,000,000,000$ seconds

3. Assume a network of 100 users. The speed of the shared link is 1,000,000 BPS. Each user is active 5% of the time. When a user is active, he transmits at a rate of 1,000 BPS.

   - Circuit switching: $\frac{\text{1,000,000 bps}}{\text{1,000 bps}} = 1,000$ simultaneous users
   - Packet switching: $\frac{\text{1,000,000 bps}}{0.05 \times \text{1000 bps}} = 20,000$ users

4. Explain the structure of the contemporary Internet. Be sure to explain the roles of the residential access networks, regional ISPS, tier-1 ISPS, IXPS, peer links and content provider networks.

   - The internet now consists of multiple interconnected large networks.
   - Residential access networks: connects people to the Internet
   - Regional ISPs: an ISP that has subscribers within the franchise area
   - Tier-1 ISPs: Act like global ISPs. These are the networks that are the backbone of the Internet
   - IXPs (Internet Exchange Points): a physical location through which the Internet infrastructure companies such as ISPs and CDNs connect with each other.

- Peer links: voluntary interconnection of administratively separate Internet networks for the purpose of exchanging traffic between the "down-stream" users of each network.

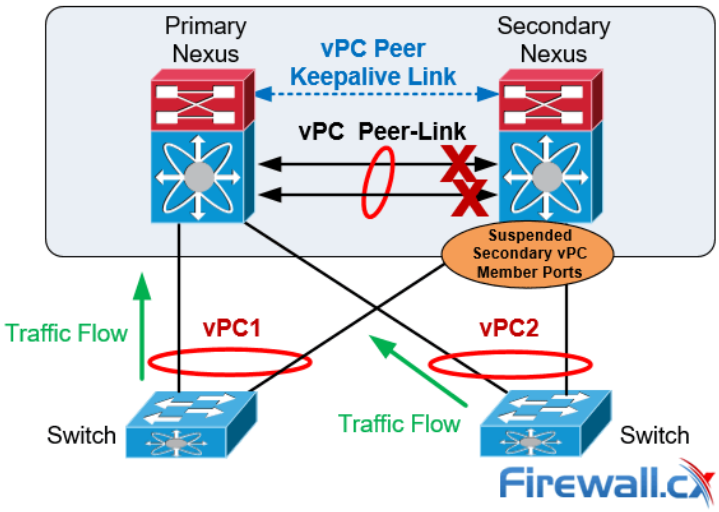


Figure 1: Peer Linking

- Content Provider Networks: all companies that operate an Internet Service but do not sell transit within the Peering Ecosystem.