What is a Computer Network?
Early definition: the set of serial lines that attach terminals to mainframe computers from research facilities

Features of Computer Networks
the key feature of computer networks is generality.
also…
networks are built primarily from general purpose programmable hardware
are able to carry different types of data and support a wide and ever growing range of applications
increasingly taking over the functions performed by a single-use network (e.g., phone network, cable network, etc.)

Network Applications
Domain Name Service (DNS);
Address Resolution Protocol (ARP);
Web proxy;
Simple Mail Transport Protocol (SMTP);
Internet Message Access Protocol (IMAP)
…

Example Application 1: WWW (world wide web)
each page has an identifier called Uniform Resource Locator (URL)
By clicking a URL, how many messages will be exchanged over the internet?

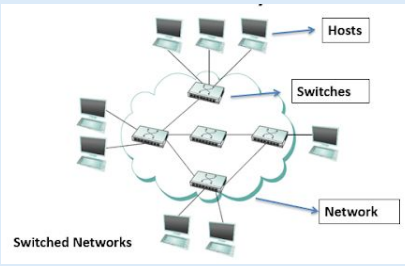
- up to 6 msges to translate server name to its IP (Internet Protocol) address
- 3 msges to set up a Transmission Control Protocol (TCP) between your browser and the server
- 4 msgs for your browser to send HTTP "GET" request and the server to respond with the pages
- 4 msgs to tear down the TCP connection

Example Application 2: Video Conference
How is this different from page download in WWW?

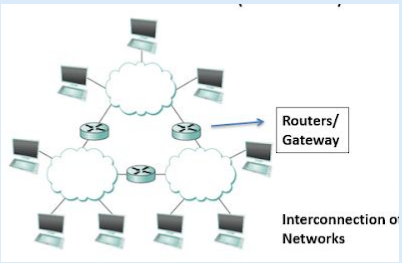
- real-time requirement; video and audio normally consumes more bandwidth than text; make sure audio and video remain in sync

How to build a computer network from the ground up?

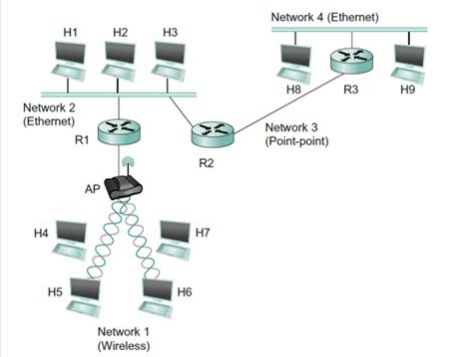
1. What is the most basic function of a computer network should provide?
   Connectivity!
   - Direct Connectivity (2 or more computers are directly connected through a physical medium)
   - Problems with connecting every computer directly? cannot scale
   - Solution: Indirect Connectivity



   - How to further scale the size of networks? Internetworks (internet)



2. Given the generality feature of computer networks, any other key challenges that need to be addressed?
   Heterogeneity: we need to connect all different types of network into the same global internet



3. Having connectivity bw hosts does not mean 2 hosts can talk; so what are some challenges while we enable host-to-host communication through networks?
   Address Definition and Assignment;
   Media Access Contention and Share;
   Routing;
   Congestion Control;
   Error correction;
   Resource Sharing and Efficiency;
   Performance Guarantees;
   Malicious behaviors;
   …