

Network Overview

What is the question you concern about networks?

- “Faster” networks
 - Higher transmission **rate**
 - bitrate (bits/second, bps)
 - kbps (10^3), Mbps (10^6), Gbps (10^9), Tbps (10^{12})
 - Lower **latency**
 - quick response for a request
 - Lower **error rate** (bit error rate, packet loss probability)
 - error checking, error detection, error correction
 - Higher **availability** (reliability)
 - the network is less likely to be down
 - **Ubiquity**
 - the service can be provided everywhere
 - Lower monetary **cost**
 - can access fast and reliable networks everywhere with low cost
 - Improved **user experience** (low complexity)
 - easy to use
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Categories of Networks

- Wide Area Network (WAN)
 - A computer network spanning a large geographical distance (regions, countries, world)
- Local Area Network (LAN)
 - A computer network that extends over a limited area, such as a residence, school, laboratory, university campus, or office building.
 - Its network equipments and interconnections are locally managed.
- Access Network
 - The network that physically connects an end system to the first router on a path from the end system to any other distant end system (aka, connect the subscribers to the service providers)
 - End system = host: desktop, PC, smartphone, tablet, TV, watch, eye glasses, ...
- Core Network
 - backbone, provide services to customers interconnected by access network
- Cellular Data Networks
 - extending the Internet to cellular subscribers
 - smartphones are able to connected to Internet

- cellular technology generation
 - 1G: designed exclusively for voice-only communication (extinct now)
 - 2G: designed for voice
 - 2.5G: extension of 2G, support data and voice (e.g. Internet), not success
 - 3G: support voice and data, with an emphasis on data capabilities and higher-speed radio access links ($> 1\text{Mbps}$)
 - 4G: system deployed today based on LTE (Long-Term Evolution) technology, voice and data are all packed in IP datagrams, higher speed ($> 10\text{Mbps}$), wider area access
 - 5G: faster, 20 Gbps download speed. Why is 5G so important if it's just faster than 4G? Why does speed matter?

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* We didn't have time to talk about the following networks in class.
* Don't hesitate to contact me if you want to talk about any of
* them. :)

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- Datacenter Networks
 - Data Center
 - Internet companies, like Google, Microsoft, Facebook, and Amazon have their own data center.
 - 10's to 100's of thousands of hosts, concurrently supporting many distinct cloud applications (e.g., search, e-mail, social networking, e-business)
 - Those companies have their own datacenter network that interconnects its hosts with each other and interconnects the data center with the Internet.
- Personal Area Networks (PAN)
 - A network used for data transmission among devices over a short range.
 - Bluetooth
 - A network operates over a short range, at low power, and at low cost.
 - Typically less than 10 m (WiFi typical 100 m), transmission rate over 1 Mbps
 - It is essentially for interconnecting a computer with its wireless keyboard, mouse or other peripheral devices; cellular phones, speakers, headphones, and many other devices.
 - Zigbee
 - Lower-powered, lower transmission rate than Bluetooth (10/20/40/100/250 Kbps)
 - E.g., Home temperature and light sensors, security devices. Applications that do not need faster transmission rate and the consequent rate.
- ...

Disclaimer: Notes adapted from the textbook and online resources.