Communication and Protocols

CSC309
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Before we get to **web programming**...

- We should have a basic idea of how the **internet** works
  - And what the **web** is, but we’ll get to that later..

- Nothing too detailed, but enough to give some context to what we’ll be doing
Let’s say we wanted to build a network of computers...

- What do we need at the minimum?
  - Computers
  - A method of communication between those computers
Communicating computers

- Computers have to “talk” to each other
- They need a language (set of rules)
  - Is one enough?
    - Not really..
- We need an efficient multi-step system
## Network 4-Layer Model

<table>
<thead>
<tr>
<th>Layer</th>
<th>Protocols/Protocols</th>
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<tbody>
<tr>
<td><strong>Application Layer</strong></td>
<td>HTTP, FTP, SSH, SMTP, POP3, ...</td>
</tr>
<tr>
<td><strong>Transport Layer</strong></td>
<td>TCP, UDP, ...</td>
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<tr>
<td><strong>Internet Layer</strong></td>
<td>IP</td>
</tr>
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<td><strong>Link Layer</strong></td>
<td>Ethernet, Wifi, ...</td>
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**TCP/IP**: A suite of protocols

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Client-Server

- Client initiates request to server
- Server accepts or rejects connection
- If a connection is established, data can flow until connection terminates

- TCP/IP facilitates connections between **client** and **server** over many networks
  - The internet!
Application Layer

- Provides applications with standardized protocols to exchange data
  - Example: Web browsers need a protocol to get and send data

- Protocols include
  - HTTP, FTP, SSH, SMTP, POP3...
Transport Layer

- Provides **host-to-host** communication services
  - “Connection-oriented”
  - Sends segments of data from the application layer (packets)

- Transport protocol for **TCP/IP** is **TCP**
  - We’ll talk more about it later

- Other transport protocols include **UDP**
Internet Layer

- Provides protocols for sending **packets** across a **network** or through multiple networks

- The **Internet Protocol (IP)** handles this in **TCP/IP**
  - *Routes* data across networks using IP addresses
  - “Connection-less” protocol
  - No prearranged connection required to send data
**Link Layer**

- Protocols of the **physical link** between the nodes of the network
  - Ethernet, WiFi, DSL

- Lowest level
  - TCP/IP can sit on top of any Link layer
# The Internet

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More on TCP
TCP

- Recall: **Connection-oriented**
  - Needs to have a pre-arranged connection before sending data
  - Should be **bi-directional**
  - Both client and server should **acknowledge** when they get data

- How do we start a connection using TCP?
3-way Handshake

Client and Server can now send each other data, and must **acknowledge** to each other when they receive something.

Client

Server

**Hi! Let’s talk**

**Ok, let’s talk.**

**Ok.**

SYN

SYN-ACK

ACK
Acknowledgements

● An important part of TCP because...
  ○ Losing packets is a real problem

● If no acknowledgment that packet was received...
  ○ Packet sent again

● TCP is **reliable**
  ○ But reacts to losing packets by slowing connection
  ○ **UDP** is not reliable, but doesn’t react to packet loss
Keep this in mind as we start

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Next Time...

Application Layer
HTTP, FTP, SSH, SMTP, POP3

Transport Layer
TCP

Internet Layer
IP

Link Layer
Ethernet, Wifi