



CS 348

Computer Networks

Lec 11

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Disclaimer: These slides are based on the content in “Computer Networking: A Top-down Approach by Kurose & Ross, 7th ed” and some specific topics are referenced from Wikipedia.

Questions

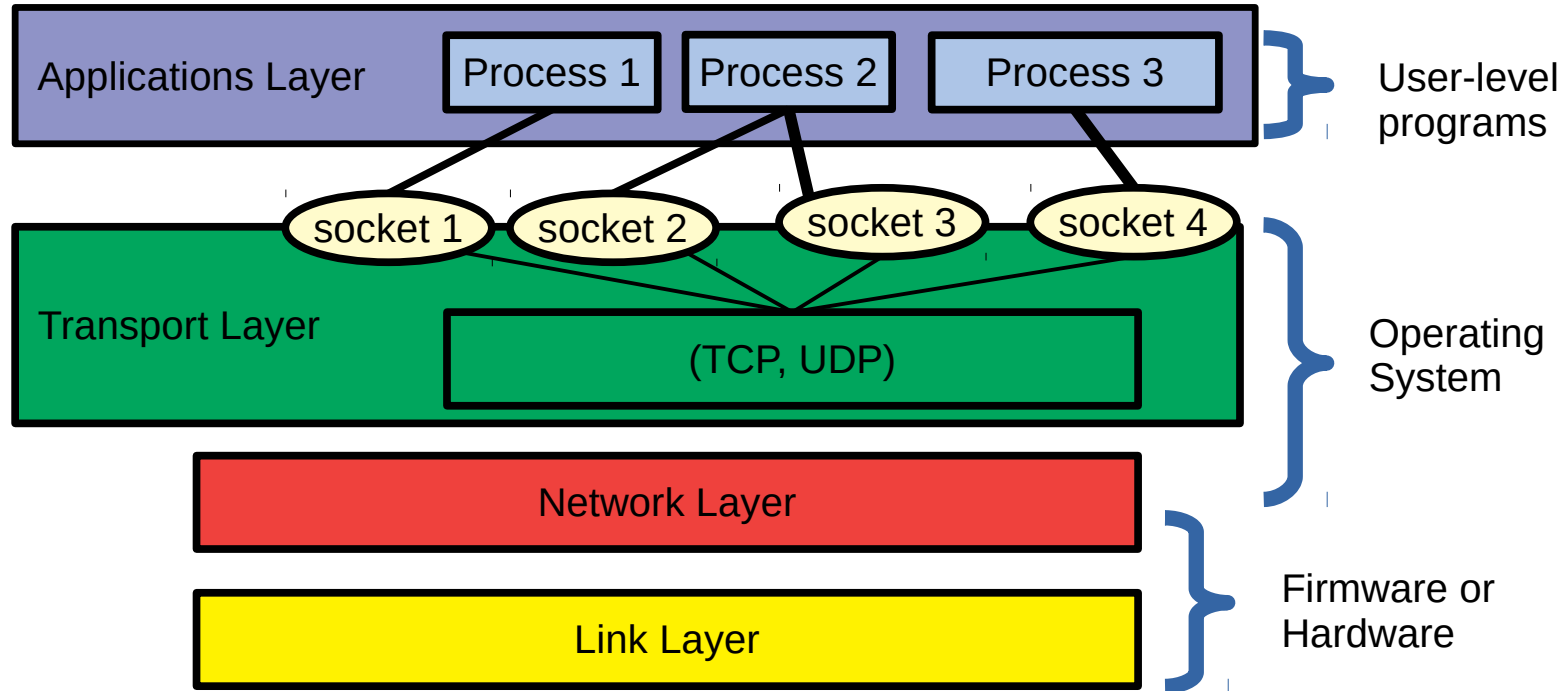


APPLICATIONS LAYER

- What is the “Interface” between applications and the Internet? How can applications use services of the layers below? **The Sockets API**
- Some popular applications, how they work, protocols they use:
 - **The Web** and HTTP, Email, Peer-to-peer applications
- How can “names” be translated to IP addresses? **DNS**

Recap: Sockets

- Sockets serve as an Interface between Applications and the Transport layer



Recap: Types of Sockets

- **SOCK_STREAM** (Uses **TCP**)

- Reliable, in-order delivery
- **Connection-oriented**
- Congestion-controlled

A destination socket on the receiving host is uniquely identified by:

<dest Port, Src IP, Src Port>

- **SOCK_DGRAM** (Uses **UDP**)

- Best-effort (unreliable, not guaranteed to be in-order)
- **Connection-less**
- No congestion control

A destination socket on the receiving host is uniquely identified by:

<dest Port>

- **Using the Sockets interface and the services provided by the layers below, how can we design/re-create some popular Internet Applications?**

- A Chat Room
- Remote Login
- Email
- Peer-to-Peer File Sharing
- **The Web**
- Multiplayer online games
-

What is an Application-Layer Protocol?

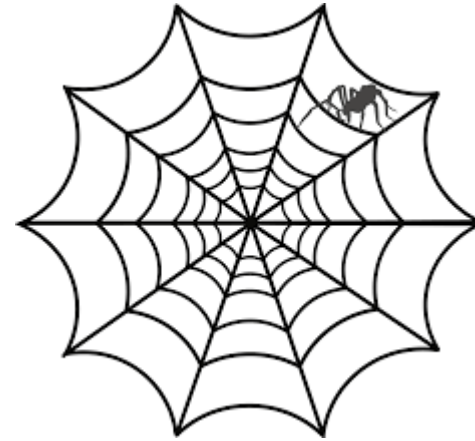
- **Format** of messages exchanged by communicating processes
- **Sequence/Order** of messages expected
- **Interpretation/Meaning** of each message

A Protocol spans all of the above

Stateful and Stateless Protocols

- **Stateless Protocol**
 - The receiver (typically Server) maintains no information about the State of the sender (Client).
 - Every packet received can be understood in isolation
- **Stateful Protocol**
 - The server maintains information about the client's state
 - Need to allocate storage for each communication session in progress and clean-up after the session ends
- **Q: Is TCP Stateful? What about UDP? IP? HTTP? DNS?**

The Web and HTTP



The World Wide Web (WWW) also known as **The Web**

- Is an **Information-sharing** application that uses the Internet

How is Knowledge/Information structured?

- As a graph or “web”. One topic connects/links to others.
- The Web has a **Client-server architecture**:
 - A Client process (web browser) requests web-pages from a Server and displays them to the user.

History of the Web

- Invented by **Sir Tim Berners-Lee** in **1989** at **CERN**
- **1990**: Berners-Lee wrote the first web browser and server program

Interesting Ref:

<https://webfoundation.org/about/vision/history-of-the-web/>

The World Wide Web Consortium
(**W3C**) maintains open standards
related to the Web



Components of The Web

- **Documents** (and other resources such as Images/videos)
- **Links** between these documents/objects
- **An addressing scheme:**
 - For uniquely identifying each document/object

Components of The Web

- **Documents** (and other resources such as Images/videos): **Web Resources**
- **Links** between these documents/objects: **Hyperlinks**
- **An addressing scheme: Uniform Resource Locator (URL)**
 - For uniquely identifying each document/object

Components of The Web

- **Documents** (and other resources such as Images/videos): **Web Resources**
- **Links** between these documents/objects: **Hyperlinks**
- **An addressing scheme: Uniform Resource Locator (URL)**
 - For uniquely identifying each document/object
- **The sending/receiving programs: Web Browser and Web Server**
- **A Protocol** for communicating between the sending/receiving programs:
 - **Hyper Text Transfer Protocol (HTTP)**
- **A standard for formatting/displaying the Information:**
 - **Hyper Text Markup Language (HTML)**

The Web

- **Web Page:** A single document
- **Website:** Multiple web resources with a common theme, a common domain name, or both, make up a website.
- **Web Server:** Websites are stored in computers that run a program called a web server that responds to requests made over the Internet from web browsers running on client computers.

HTML

- **Need some way of expressing how to display/format the information**
- **Hypertext Markup Language (HTML)**
 - Allows creators to express formatting info such as:
 - Bold/italic text, font size, style and color, images, image position ... and much more.
- **How to Create Webpages? HTML/CSS Tutorials:**
<https://www.w3schools.com/html/default.asp>
- **Demo: view template files index.html and page2.html in a text editor**
Also hosted (temporarily) at: <https://www.iitgoa.ac.in/~nehak/example.html>

References and Reading Assignment

- **Kurose and Ross 6th ed**
 - **Section 2.2: The Web and HTTP**
- Wikipedia entry about the WWW:
https://en.wikipedia.org/wiki/World_Wide_Web
- [Cold Fusion] A Brief History of the Internet:
<https://www.youtube.com/watch?v=8sTy8466MoE>