

# Module 3: Basic Networking and The Internet

IT Exploration Training  
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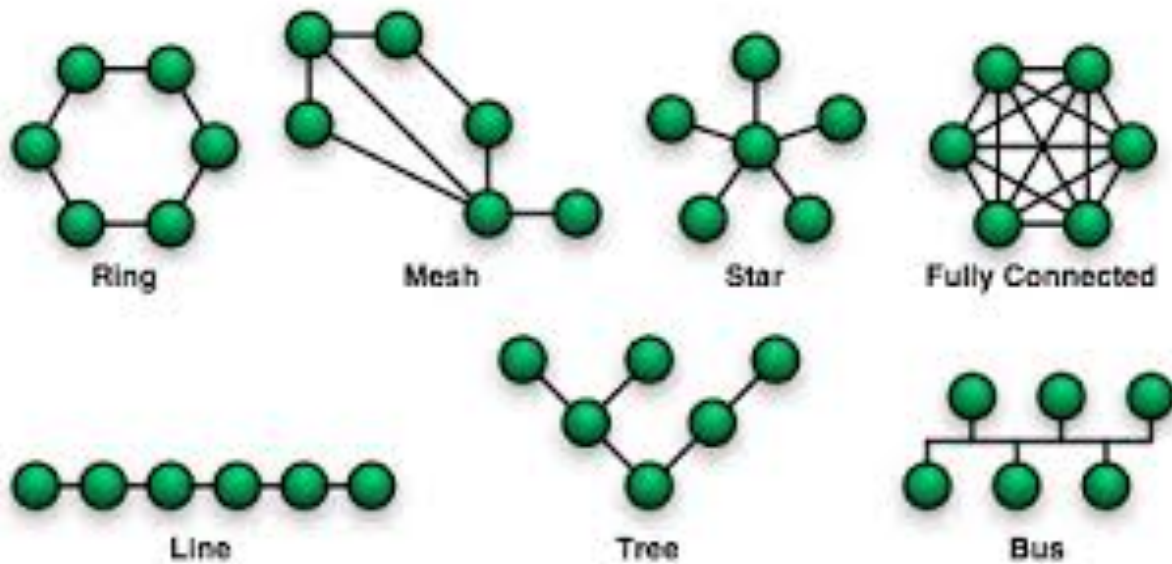
# Activity for Students Joining Today

- Introductions
  - Introduce your self to the rest of the Camp.
  - Describe your background with computers.
  - Give a “horror story” with computers.
- The 16GB USB Flash Drive
  - Contains lots of free software
  - You’ll use it **here** – and leave it in the classroom at the end of each day, until the course is over.
  - Then you can take it home!
- Instructions will be given on downloading folders from GitHub containing each Module's resources.

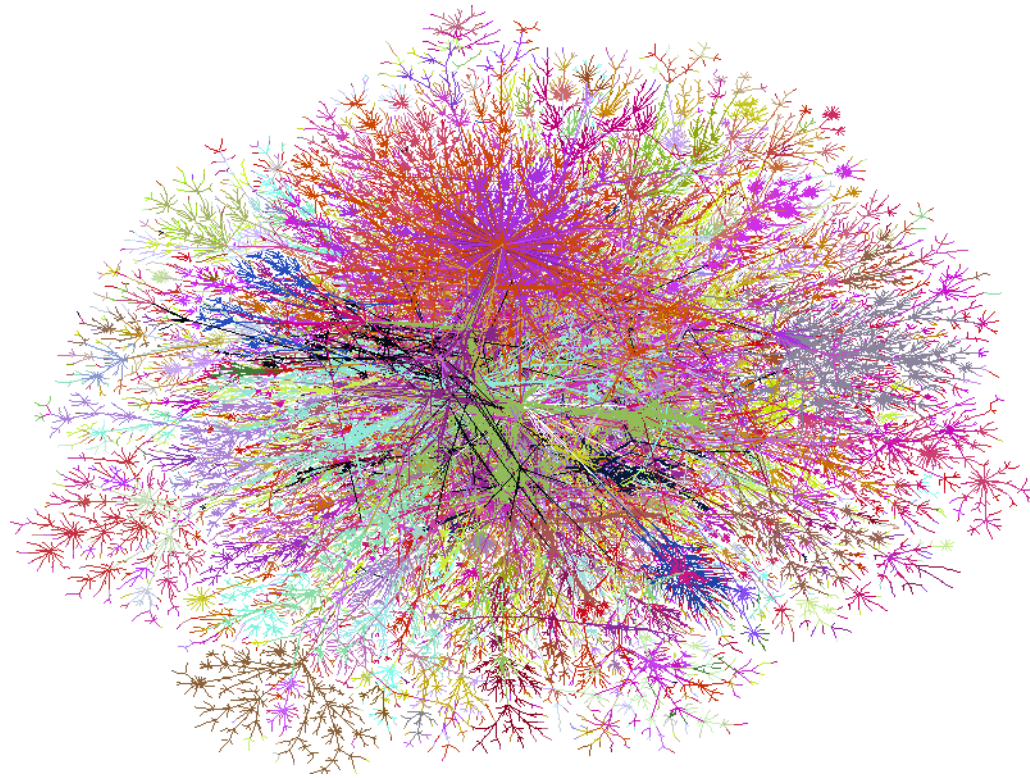
# What's a Computer Network?

- A network is a group of computers and other devices (such as printers), connected by some type of transmission media.
- Each computer is a node on this network, each running software programs.
- Networks have different **topologies**: ways of interconnecting them together.

# Different Network Topologies



# Map of WWW Connections (1998)



# Why Use Networks?

- Sharing resources

- Hardware
- Software
- Data

- Communicating

- Email
- Web sites
- Texting/tweeting

# Complex Networks are Hard to Understand

- We humans have a **limited** ability to understand complexity.
- "The Magic Number  $7 \pm 2$ "
- Complex networks have:
  - Multiple computers and other devices
  - Running different software
  - Scattered over multiple distributed sites
  - Interconnected in different ways
- Management problems:
  - Performance
  - Reliability
  - Security
  - Ease of use

# What is the Internet?

- “Little i” internet => “network of networks”
- “Big I” Internet => “network of networks” all sharing the same schemes or **protocols** for network communications.
- Think of the Internet as the PLUMBING which the World Wide Web uses for its communication.
- Vincent Cerf @ Code.org explains:
  - <https://youtu.be/Dxcc6ycZ73M>



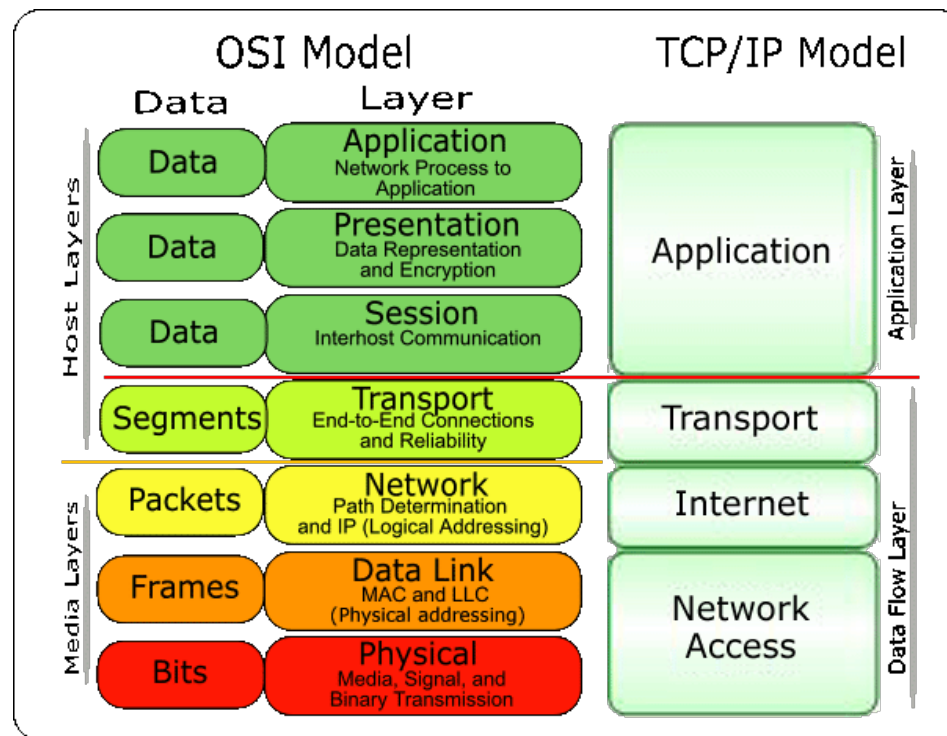
# How to Organize Network Communications?

- Starting in 1960's, people thought deeply about how to connect together computers into networks.
- Over the next 20 years, much of the world standardized on a collection of conventions and rules for how computers talk among themselves on this giant network: The **Internet**, based on the TCP/IP Protocol Suite.
  - Protocol? Suite? TCP/IP? Details later...
- The Internet allowed any kind of data to be sent – but early communication tended towards text and not multi-media.
  - No Instagram! No Spotify! No YouTube!

# Networks are Layered

- The Internet is a “Network of Networks”.
- Local area networks (LANs) are those like our classroom computer setup.
- Each such LAN can be connected to the outside world by routers and other connectivity devices.

# TCP/IP Protocol "Suite"



# How Networking Works

- Three videos from Code.org help explain...
- **The Internet: Wiring, Cables, and WiFi**

<https://youtu.be/ZhEf7e4kopM>

# Addresses on the Internet

- **The Internet: IP Addresses and DNS**

<https://youtu.be/5o8CwafCxnU>

- **Activity**: use the **ifconfig** command in the Windows Command Prompt to find your computer's IP address.
- **Activity**: use the **ping** command to send a message to a remote IP address.
  - Usage: **ping** <ip-address>

# Packet Routing

- The Internet's TCP/IP Protocol Suite (collection of protocols) allows packets to get sent from node to node.
- These techniques allow packets of data to be routed from network device to device, so they eventually arrive at the correct destination.
- **The Internet: Packets, Routing and Reliability**

<https://youtu.be/AYdF7b3nMto>

- **Activity**: see the paths taken by packets using **tracert** **<ip-address>**

<https://stefansundin.github.io/traceroute-mapper/>

# The Internet is Layered Communications

- Slides and animations explain (browse in Firefox):

[https://infonet.siemens.es/Apli\\_Industry/formacion/RedEthernet/swf/kap\\_03\\_1.swf](https://infonet.siemens.es/Apli_Industry/formacion/RedEthernet/swf/kap_03_1.swf)

- A network simulation site:

<https://ea25f758-a-62cb3a1a-sites.googlegroups.com/site/tcpipanimation/download/Animace17.swf>

# Why Organize This Way?

- It hides the complicated stuff:
  - Upper layers are less complicated, since they rely on services provided by layer below WITHOUT having to know how they're provided.
- It's extensible and scalable:
  - May add new layers on top (later) that were unknown (or infeasible) earlier. (Think Web. Think Smartphones. Think...)
- It works!
  - Usually....



# Wigle.net: A National Wireless Map

- A national map showing wireless access points:

<https://wisle.net>