Bite of Science Baltimore

**Agenda**

1. A little about me and where I work
2. A demonstration on some of how the Internet works
3. IEEE
What I do

- **Office of the CTO of Ciena Corporation**
  - Ciena is a manufacturer of telecommunications equipment
  - Ciena’s equipment powers the bandwidth of the Internet

- **I am an Network Engineer by training**
  - I completed an Electrical Engineering curriculum
  - I’ve helped build large Internet backbones

- **I consider myself a “technologist”**
  - Most technologies fascinate me
  - IEEE supports this (more on IEEE later)
About Me: Early STEM Influences

- Early introduction to computers
  - Dialing into Gallaudet with dad
  - BASIC and BBS’s (10-12 yrs old)
  - Digital Divide?
- 8th Grade science class
  - I remember this is when I found science intriguing
- High School
  - Summer internships at NBS (now NIST)
    - I found out what I didn’t want to do
  - Heavy STEM curriculum: Physics, Chemistry, Calculus
About Me: Education and Focus on Telecommunications

- **Undergraduate degree at Duke**
  - Electrical Engineering and Computer Science.
  - Taught how to solve problems.
  - First international experience: semester abroad in Australia at the University of New South Wales.
    - Assisted by having AP credits
  - More internships
    - I found out I *didn’t* want to go work right away

- **Graduate degree at Duke and ENST**
  - Unique opportunity to earn a French Diplôme d’Ingénieur from École Nationale Supérieure des Télécommunications.
  - This experience helped shaped how I communicate and interact with other people.
About Me: After Graduation, Continued Telecommunications

 Networks and the Internet
  - Master’s thesis was on ATM network queuing
  - Building the Internet for MCI
  - Building the Internet for Level 3 Communications
  - Building IP networks for federal government
  - I consider myself an IP/MPLS network engineer
  - Now at Ciena
Ciena Corporation (www.ciena.com)

- Headquartered in Hanover, MD.
- Ciena is a telecommunications equipment manufacturer.
- Initial focus in 1992 was Dense Wave Division Multiplexing (DWDM).
  - First company to commercialize this technology.
  - It’s a technique to put multiple wavelengths of light down a single fiber optic cable pair, greatly increasing the capacity of the fiber.
  - Steve Alexander, CTO, was at MIT Lincoln Laboratory working on optical communication technologies prior to Ciena.
- Like many telecommunications companies, Ciena was affected by the bubble burst in the early 2000’s.
- Through acquisition and growth, Ciena added Carrier Ethernet and strengthened optical transport networking.
- Now, Ciena refers to itself as “the Network Specialist” and uses what we call the “OPn architecture” to characterize networks.
Let’s Try a Demonstration: Some of How the Internet Works

Here’s your problem. The connection to the network is broken.

Uh-oh. It’s a “token ring” LAN. That means the token fell out and it’s in this room someplace.

You are the wind beneath my wings.

I’ll wait a week then tell him the token must be in the “Ethernet.”
Let’s Try a Demonstration: Some of How the Internet Works

- How the Internet works can be explained with a postal service analogy
- You want to send a book to a friend
  - But all you have are letter sized envelopes, one for each page

Network Models:
Let’s Try a Demonstration: TCP/IP & a Postal Service

- Each person is a router
  - You have a routing and a forwarding table
- The envelopes are the IP packets (datagrams)
- Send and forgot: User Datagram Protocol (UDP)
- Add handshake and sequence numbers (session): Transmission Control Protocol (TCP)
  - 3-way handshake: SYN, SYN/ACK, ACK
  - TCP helps ensure the correct order
- Domain Name System (DNS): Internet directory system, numbers to names
  - IP address: 98.139.183.24
  - What you type: www.yahoo.com
- Quality of Service (QoS): Treating packet differently
  - VoIP packet preferred over email
- Denial of Service (DoS)
  - Overload the resources of a router to prevent it from doing its job
The Lazy Grey Dog...

Message in the packets was “The quick brown fox jumped over the lazy grey dog.”
Institute of Electrical and Electronics Engineers (IEEE)

→ World’s largest professional organization advancing innovation and technology

→ Resources for pre-university students & teachers:
  
  https://transmitter.ieee.org/tag/stem/

• Teacher In-Service Program (TISP)
• TryEngineering.org
• Find an accredited engineering degree program
• Lesson plans
• Career preparation
• IEEE Spark
• TryComputing.org

• Outreach programs
• Engineering Projects in Community Service (EPICS) in IEEE
• Presidents' Scholarship
• TryNano.org
• E-Scientia
• Pre-university resources
Some Thoughts for Students

➔ **Openness**
  ➔ Be open to new ideas and new people

➔ **Passion**
  ➔ Find something to pour yourself into

➔ **Communication**
  ➔ Getting people to understand what you’re doing is as important as the work itself

➔ **Continuous Learning**
  ➔ Don’t be afraid not to know something
Thank You