


Understanding Networks

IT4GIS
Keith T. Weber, GISP
GIS Director



Why is Networking Important?

- GIS has always been cursed with the need to use large files
- GIS'ers have always acted as a community
- Sharing is normal



How to Facilitate Sharing...

- Floppy disks
- Bernouli disks
- Zip disks
- Jazz disks

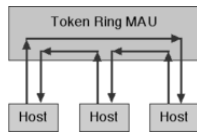
In the beginning...

- There were floppy disks
- And the "Sneaker Net"



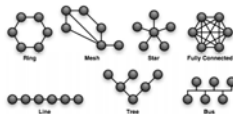
Then along came...

- Networks
 - Cabling that allowed computers to connect to one another
 - Token ring
 - Developed by IBM
 - Using coaxial cable
 - And then...

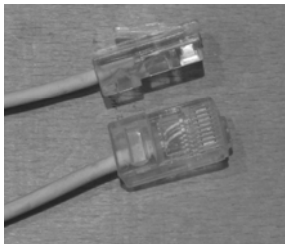


Ethernet

- Developed by Xerox
- Uses Star-topology
- And twisted pair cabling



Cabling



- Twisted pair cabling can be either unshielded (UTP) or,
- Shielded
- IT4GIS will focus on UTP

Capabilities

- Ethernet is described by its data rate and range
- For instance:
- 10Base-2
 - 10 (data rate, 10Mb/s)
 - Base (base band)
 - 2 (range, 200 meter runs)

Ethernet and GIS

- Data rates are 10, 100, and 1000
 - 10 = 10 Mb/s
 - Uses Cat 3 cabling
 - 100 = 100 Mb/s, called Fast Ethernet
 - Uses Cat 5
 - **1000 = 1 Gb/s**
 - Uses Cat 5E



Gigabit Ethernet

- Data rates of 1, 10, or 100 Gb/s
- **1 Gb/s is supported by Cat5E cabling**
 - A good GIS workstation option
 - Gigabit to the desktop
- 10 Gb/s requires copper cabling
- 100 Gb/s requires fiber optic cabling

Ethernet and GIS

- Ranges are 2, 5, T
 - 2 = ~ 200 m
 - 5 = ~ 500 m
 - T = well...
 - It stands for twisted pair. Cable testing tools will determine how long a run can be and still pass "characteristics" test (based on standards)
 - Runs as long as 150 m can be used.

What's Next...

- Wi-Fi (wireless-fidelity)
- Developed by Cisco, 3Com, Lucent, Nokia, and others
- Specs are described under the IEEE 802.11 group.



Advantages and Limitations of Wi-Fi for GIS

- Brain-storm
- Advantages
 - No cabling
 - Fairly inexpensive
- Disadvantages
 - Security
 - Traffic can congest at the 2.4 Ghz frequency
 - Size of transmission (bandwidth)

A Look at 802.11

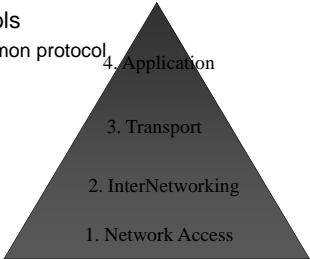
- B=6.5 Mb/s (1999)
- G=24.0 Mb/s (2003)
- N=200 Mb/s (2007)
 - Operates at the 2.4Ghz or 5Ghz freq.
- How do these compare for GIS???

Getting Data from Here to There

- Recap...
 - We know something about the history of networks
 - We know about current Ethernet, Fast Ethernet, and Gigabit Ethernet technologies
 - We know about Wi-Fi capabilities
- These are the *Data Link* and *Physical* Layers, referred to as the *Network Access Layer*.
- But, how does the GIS Data get from here to there on the network...regardless of the type of network


Good Question!

- Packets and Protocols
 - TCP-IP is most common protocol.



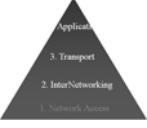
InterNetworking Layer

- Internet Protocol addressing
 - Currently IP v4 is in use. This is a 32bit system allowing 4.2B addresses.
 - IP v 6 is new, 128-bit addressing. Allowing 2^{128} addresses.






Transport Layer

- TCP
 - Transmission Control Protocol
 - Phases of operation
 - Establish connection
 - Transfer data
 - Terminate connection



Application Layer

- You know these well...
 - HTTP
 - SMTP
 - FTP



Where's the Network

- Recap
 - We have now learned how the data moves in packets from our computer through the layers of the TCP-IP model onto the Internet
- But, where's the Internet

The Internet Highway

- From your workstation
- LAN
- Backbone at the Point of Presence
 - AKA...ISP
 - AKA...PoP

Various Backbones

- Reduncy through

- ARPANet
- NSFNet
- Abilene (I2)
- National LambaRail



We could go on forever...

- For IT4GIS, we have gone far enough...
- But today's discussion of networks would not be complete without mention of the second-generation Internet, Web2.0

Web2

- Is not Internet2
- Is not hardware
- Is not software
- Is...a whole new way that the Internet is used.
 - Participatory
 - Users are now "prosumers" instead of "consumers"

Questions...