Applied Networks & Security

Introduction

http://condor.depaul.edu/~jkrustof/it263/

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Science, humanities or a trade?

- Various disciplines may appear in this course
  - Physics
  - Mathematics
  - Engineering
  - Skilled labor
  - Philosophy
  - Art
  - History
What do we mean by network?

• Actually there are different classes of networks
  • Telephone network
  • Road system
  • Postal service
  • Neural network
  • Computer network
• We care about so-called computer networks
• We examine some communications technologies that allow computers to talk to each other
Typical peer communication

• <a> Hello?
• <b> Hi.
• <a> yadda yadda yadda
• <b> blah blah blah
No answer

• <a> Hello?
• <a> Hello??
• <a> Are you there?!?
• <a> Cat got your tongue? Can you hear me?!?!
• <a> *sigh* Oh forget it, I give up
Unwelcome

- <a> Hello?
- <b> Not interested, good day.
Impersonation

• <a>Hello, is that you?</a>
• <b>Uhm, yeah, it's me *snicker*</b>
Warriors of the Net

• http://www.warriorsofthe.net

• It is a neat video, but misleading in some details
What is a protocol?

- Usually an agreed upon language and formats
- Computer networks use various sets of protocols
- Some in the set are complimentary
- Some may tend to compete
  - e.g. Token Ring versus Ethernet
  - e.g. TCP/IP versus IPX/SPX
  - e.g. AIM versus Yahoo! IM
- Why are there so many standards?!?!
Are protocols immutable?

• Hindsight is 20/20 – tech advances, market changes
• Protocol definitions are sometimes vague
• Implementors may interpret documents differently
• Implementors may make mistakes
• Implementors may disagree with the standards
• Sometimes conventional wisdom, which is not always written down in an easy to find location, “fix” protocols as needed
Obligatory OSI Reference Model
A more practical model
Protocol layers and layering

• We tend to talk/think about protocols in layers
• Implementation however may not be so modular
• To really understand a protocol, be an implementor
Encapsulation visual

- Protocols are sometimes encapsulated within others
- If you're just looking at these slides outside of class with no video, well, you should have been here
An aside on terms

- Frames, packets, datagrams, messages, cells, PDU
- Headers, trailers, payload, data
- “What's your IP address?” (not “What's your IP?”)
- Host, workstation, PC, node, terminal
- Bandwidth versus capacity
- Pronouncing router (ROOT-er or ROUT-er?)
- Kludge, hack and a PoS
- BFR
Addresses, names and identities

• There is much confusion on what these are
• We'll punt and just discuss some of the issues
• Fixed size versus variable length
• Centralized or distribution assignment/allocation
• Problems when coupling locator and identifier?
• What about using a search (e.g. Google)
• Mapping issues? (e.g. domain name to IP address)
Forwarding and routing

• Source-based versus network-based
• Distance-vector versus link-state
• Policy controls and knobs
• Route advertisement authorization
Flow control

• How to go fast, but not saturate a bottleneck?
• Implicit versus explicit
• Windowing
• End-to-end control
• Network-based control, admission and enforcement
• Timers and retransmissions
Error control

• Detection
• Correction and recovery
• Performance considerations
• What are the causes of errors?
• Link-based or end-to-end controls?
Wireshark

• If you can, download and install this
• http://www.wireshark.org
• Now let's take a look at some traces
Fragmentation

- Maximum transmission unit (MTU) discovery
- Where does fragmentation occur?
- Any interoperability or performance impacts?
Network management

• Simplicity versus complexity
• In-band versus out-of-band
• Class-of-Service / Quality-of-Service
• Billing
• Automated configuration and type checking
Security

- Placement of security services
- Defense-in-depth
- Belt-and-suspenders
- Obscurity
- Walled gardens
- Risk assessment
- We will have much more to say about security later
TELNET packet, one bit per inch

• What would a TELNET packet look like on the wire?
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• *note: this visual exercise lifted from Rich Seifert