Protocols and Techniques for Data Networks

By example...

Goal: browse to http://www.depaul.edu
What things happen first?

• What happens when you hit enter or click the link?
• What does the browser do?
URL interpretation

- Parses request URI
- It is an HTTP GET
- For www.depaul.edu
- What is www.depaul.edu?
Domain name look up

• Does the browser have the name cached?
• Let us assume the answer is no
• Browser issues a gethostbyname() or equivalent
• We embark on a resolution sub-process...
What is involved in resolving?

- Does hosts(.txt) have www.depaul.edu in it
- Are we a stub, forwarder or full resolver?
- Assume we're a stub, who do we talk to?
  - And how did we get that information?
  - That was probably derived from boot strap
- OK, let's format an A query. What about AAAA?
  - Maybe do both?
- Getting pretty complicated isn't it?
OK, let's send the query!?!?

• Not so fast!
• Put the DNS message in... UDP? Ya should work
• OK, IP datagram, sending to DNS resolver, easy
• From... my IP address? Uhm, am I connected?
• OK, send it on the wire?!?!
Finish your IP encap bub

- Fits in MTU, checksum, set TTL, etc... OK go, go!
- Wait, what L2 destination? Is it a local host?
- Oh, gotta talk to a router... OK lets do that.
  - How do I know who that is? Argh...
  - That was probably part of boot strap
- OK, got it, get this into Ethernet and off we go...
- Done yet? Not even close
Here ya go router!

- OK, Ethernet daddr is to the router.
  - Wha...? is that right
- Yep, unless your mask is broken
  - What the @?!# is a mask?
- Presume it's non-local, router gets it, now what?
- Router has a decision to make.
- Forwarding/policy decision, re-encap, ARP, etc...
- At least no DNS... I think
Skip ahead, DNS server has query!

We haven't even gotten to HTTP request yet!
DNS server processing

• Process query
  • Can we?
  • Do I know about this name? Cache or auth?
  • How do I go about finding out?
• If not auth and not cached, how many more steps?
• Quite a few maybe
• ...skip ahead ...skip ahead ...skip ahead
Time warp...

- Sending TCP packet
  - UDP for DNS, now TCP? What gives?
- Gotta setup a connection, the 3-way handshake
  - Connection? Isn't IP connectionless?!?!
- Exchange options, sequence numbers
- Timers, congestion control, sliding window, oh my!
- Is it time for HTTP now?
This isn't a cake walk

- It's hard to learn how this all works even after years of experience, never mind a short networks course.
- But we'll try our best...
- I left out a whole bunch of stuff. This slide deck could have been hundreds of pages long, easily! ..and that's without pictures.
- Someone else's version of a related idea:  
  https://github.com/alex/what-happens-when