

# **CSCI 15: AN INTRODUCTION TO THE MODERN INTERNET**

Lecture 4: Net Neutrality extras

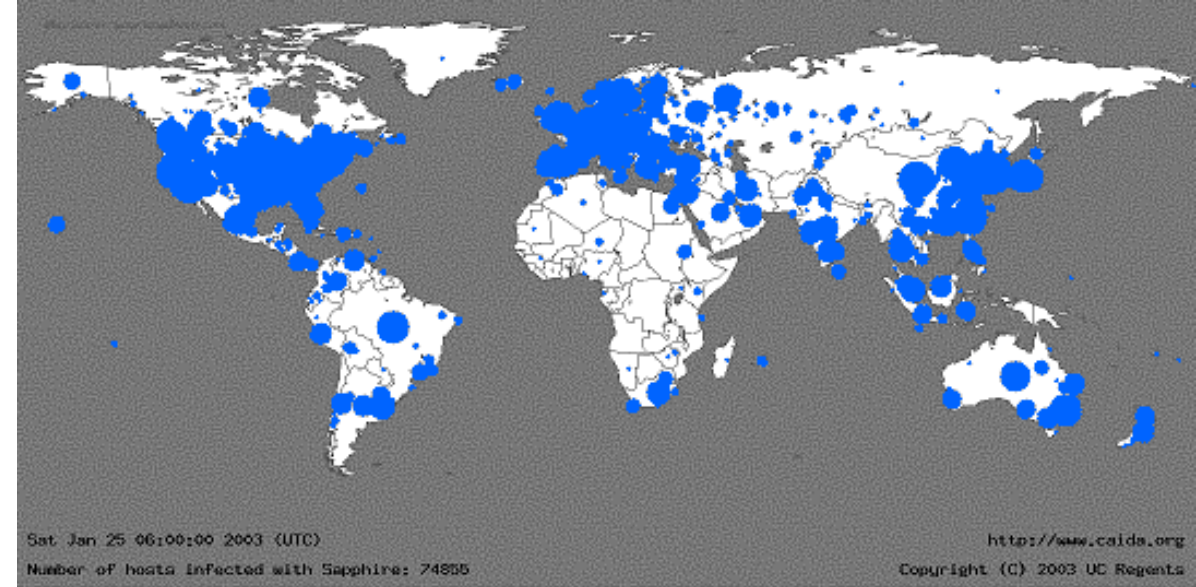
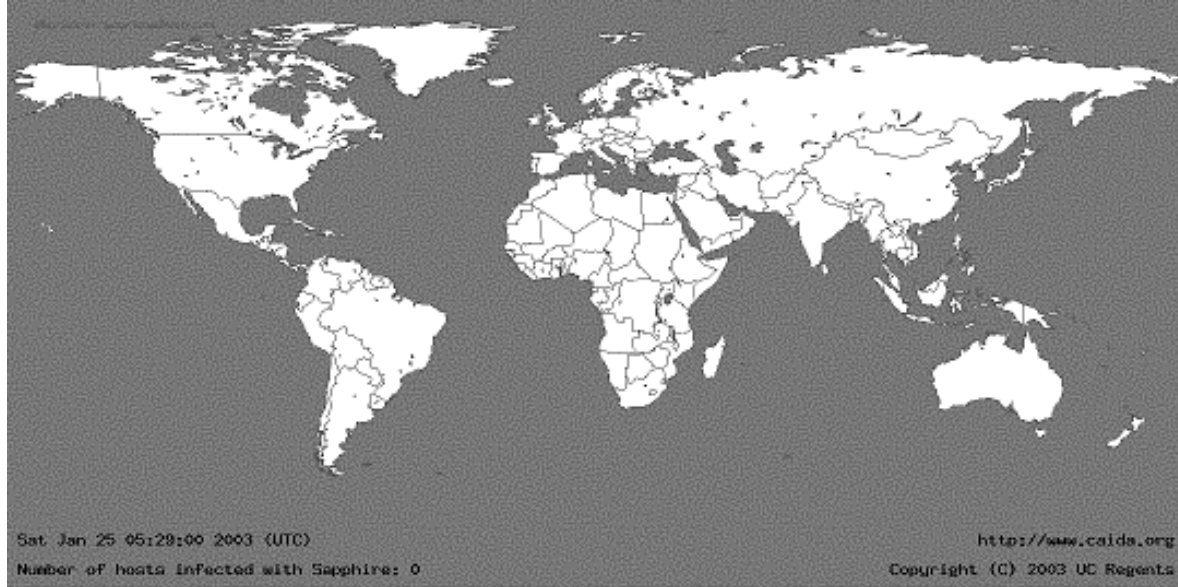
# ANNOUNCEMENTS

- Schedule updated
- No class next Monday (MLK day)
- Final paper suggestions posted tomorrow
- Website is no longer on the dark web!
  - (Linked to from my website; should make it easier to find)
- Question: can you find the website with Google? Why not? When will you be able to?

# SQL SLAMMER

- 2003 computer worm
  - What is a worm?
  - Self-replicating application (viruses require other applications)
- **Very very small!**
  - 376 bytes
  - Fit into single packet

# SQL SLAMMER: 30 MINUTES OF SPREAD



# SQL SLAMMER

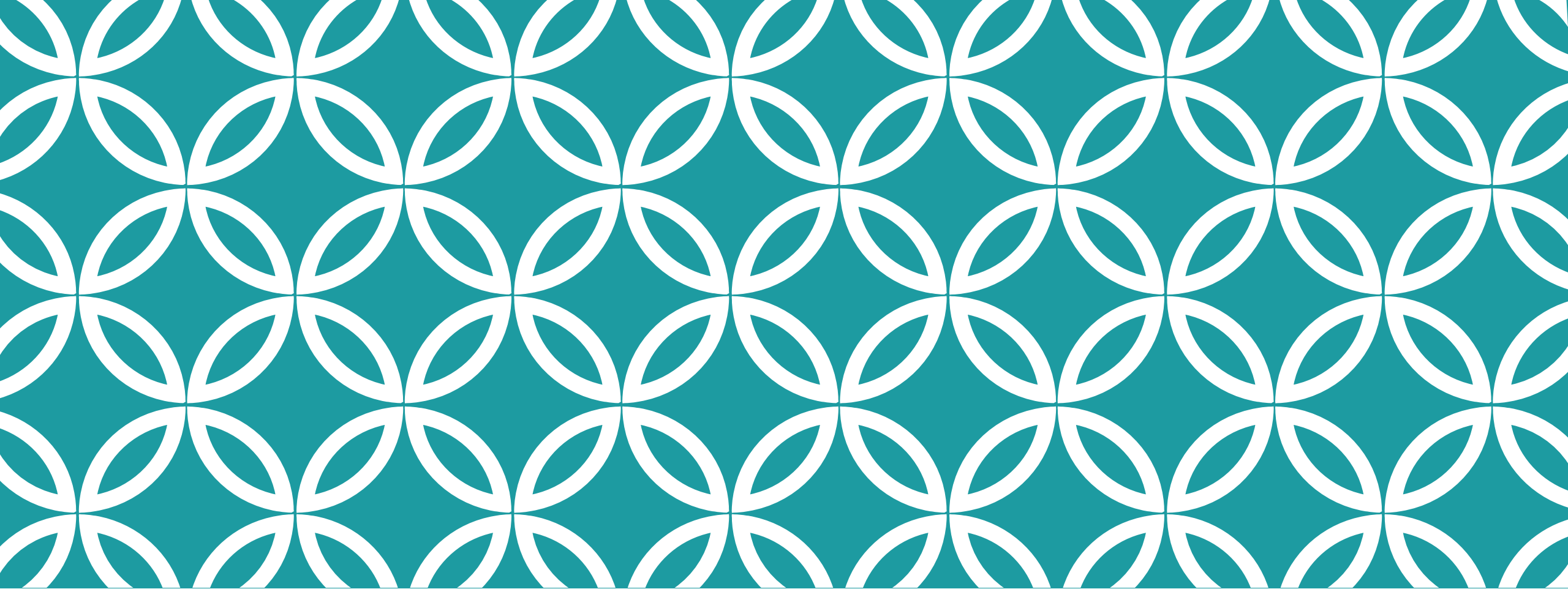
- Doubled in size every 8.5 seconds
- South Korea lost internet
- All Bank of America ATMs knocked offline
  
- Why?

# SQL SLAMMER

- Worm constantly spread itself to other computers
- Gunned up internet infrastructure
- But, it could get through when nothing else could!
  - Fit inside single packet

# SQL SLAMMER: TAKEAWAYS

- Update your software!
- Limiting internet traffic can be important



# PACKETS AND PROTOCOLS





# HOW IS INFORMATION TRANSMITTED?

- Step 1: break into “packets”
  - ~576 bytes
- Each packet is transmitted individually
  - Sent one-by-one (same route?)
  - Recovered one-by-one
  - Verified one-by-one

# PROTOCOLS FOR PACKETS

- Several protocols used simultaneously, such as:
- Internet Protocol
- TCP
- HTTP

# INTERNET PROTOCOL

- Gets packet from point A to point B
- Information/guarantees?
  - Keeps track of what “point A” and “point B” are
  - Forwards to next hop
  - Time to live
  - Packet size/formatting issues? - fragmentation

# INTERNET PROTOCOL: WHAT'S MISSING?

- Stitching packets back together
  - Can packets arrive out of order?
- Did all the packets make it?
- Quality of service guarantee

# IP: TWO VERSIONS

- IPv4 and IPv6
- Why?
  - Ran out of IP addresses in 2011
- Both in use now
- Major differences:
  - Addresses: 192.168.0.1 vs 2001:0db8:0000:0000:0000:8a2e:0370:7334
  - Multicasting

# TCP/UDP

- Stitch packets together (*in-order* sending)
- Reliability guarantee
- Quality of Service guarantee
- Handles “ports”
  - Helps computer forward packet to application
  - Incoming Web traffic is handled differently than email

# TCP (TRANSMISSION CONTROL PROTOCOL)

- TCP guarantees accurate delivery, but does not guarantee timely delivery
- How?
- “Acknowledgements”
- Timer for resending
- TCP can wait a long time
- “Connect” to a server

# UDP (USER DATAGRAM PROTOCOL)

- Guarantees timely delivery, but may drop some packets, does not guarantee ordering
- Still handles ports, but very lightweight
- Why would you want this?



# HTTP (HYPERTEXT TRANSFER PROTOCOL)

- Protocol used on Web
- Documents with URLs
  - What is a URL?
- Good for information retrieval
- HTTPS: Secure version
  - We'll talk about this in a couple classes

# HOW ARE THESE USED TOGETHER?



# HOW ARE THESE USED TOGETHER?

- “Layers”
- Outer layer: IP (gets it where it needs to go)
- Within IP: TCP
  - Machine “unwraps” the packet, gets TCP information
- Within TCP: HTTP
  - Machine “unwraps” TCP packet, gets HTTP information