CSE 548 Course Intro

Spring 2024
Advanced Computer Network Security
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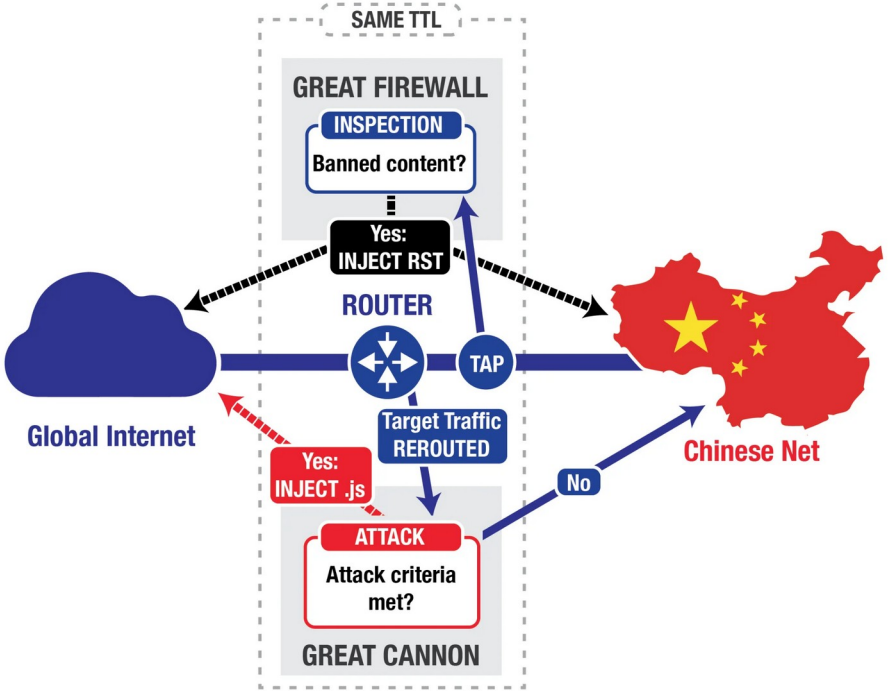
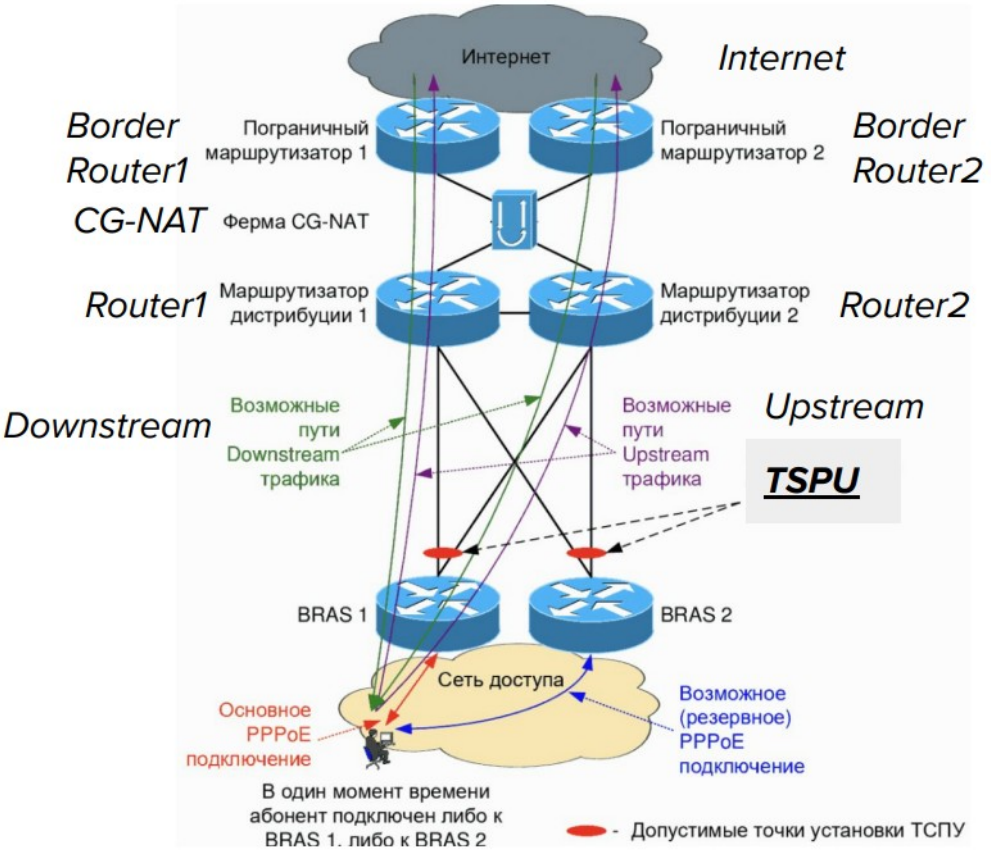
Where are you from? In what ways are encryption and protocols restricted here, there, or in other places that matter to you?

2015ish *vs.* 2025ish



https://citizenlab.ca/2015/04/chinas-great-cannon/



https://diwenx.com/assets/files/TSPU_IMC-slides.pdf

2003ish vs. 2023ish

- 6MB = 

- 40,960.00 GFlop/s for about $486 million (NEC EARTH-SIMULATOR)

- 476MB = 

- 1,685.65 PFlop/s for $600 million (FRONTIER)
  - 1.6 billion Gflop/s
  - **39000X as much**

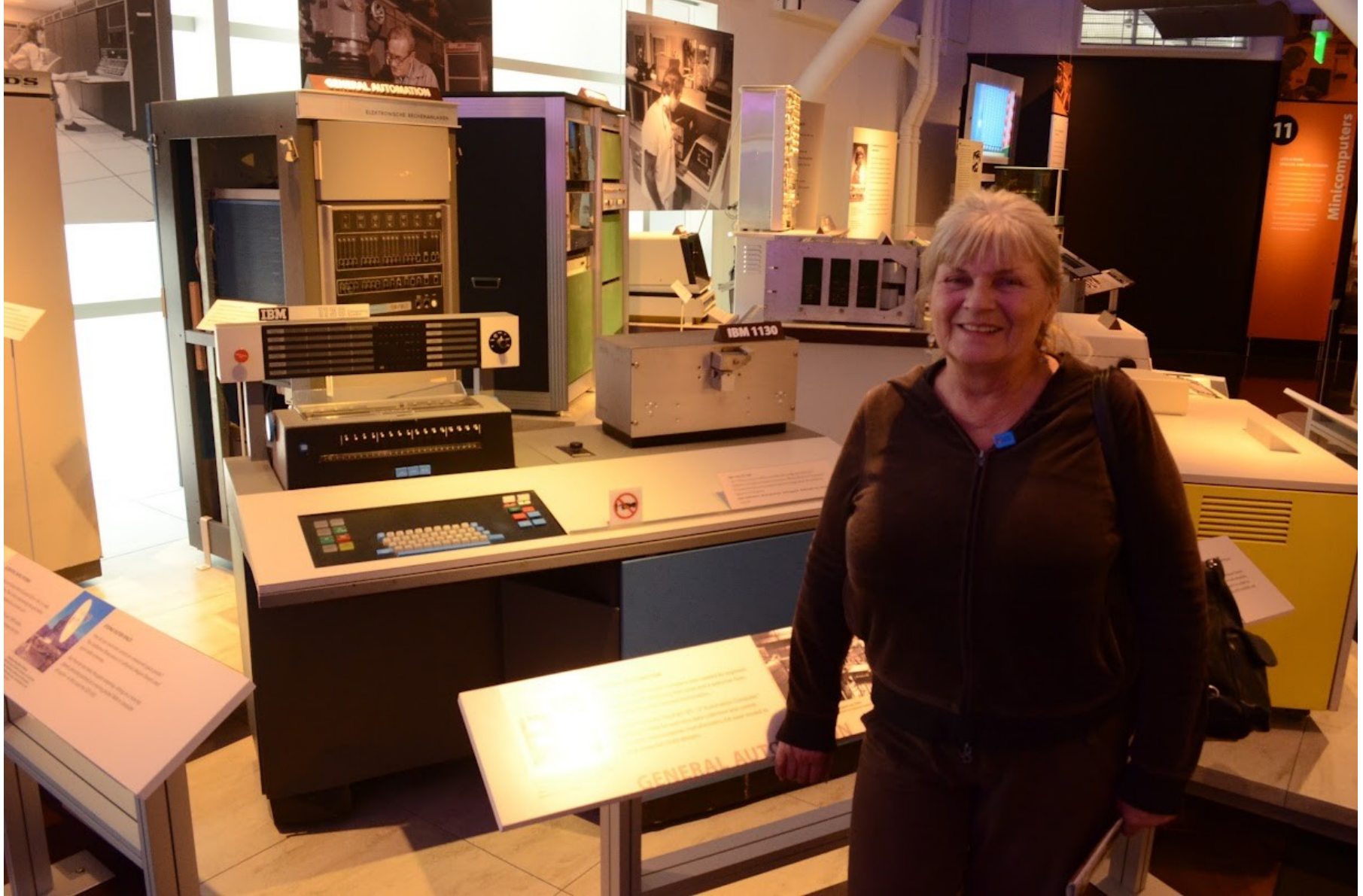
https://jcmit.net/memoryprice.htm
https://www.top500.org/

Syllabus in a nutshell

- Attendance not recorded
- *Might* record lectures
  - Only me, the class, and the TA will have access
- Three exams and final are in-person
- Check both Canvas and the course website

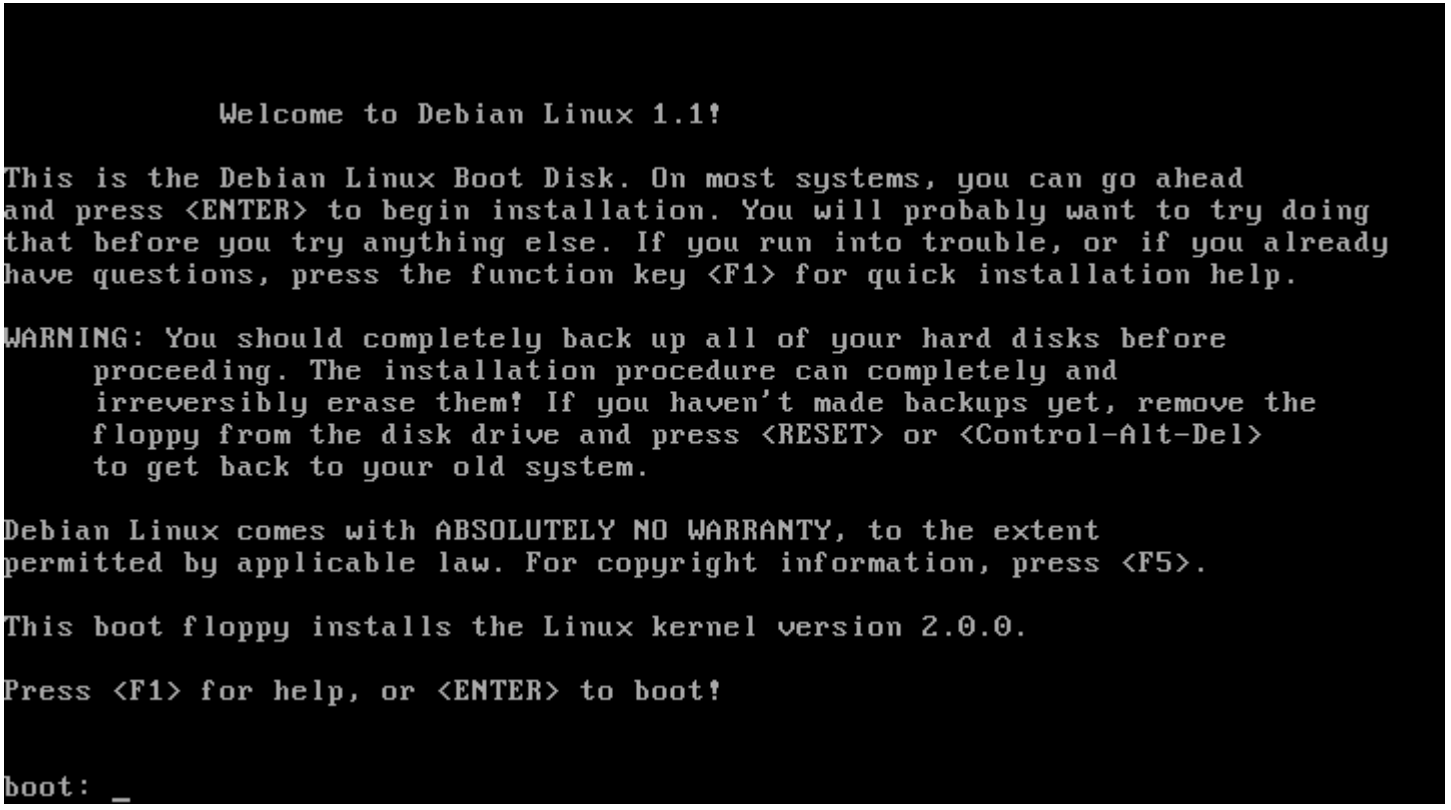
A bit about me…

- Associate Professor, SCAI *and* Biodesign Center for Biocomputation, Security, and Society
- Research is about Internet Freedom, including:
  - Internet censorship (measurement and evasion)
  - Machine-in-the-middle attacks, adversarial networking, VPNs
  - Privacy, forensics, and a few other things


IBM
IBM 1130
11
Minicomputers

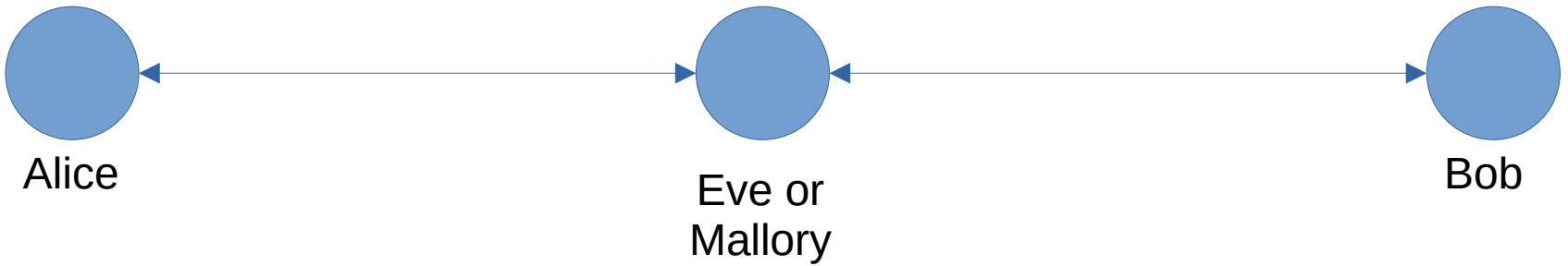

IBM
1130
IBM
GENERAL AUTOMATION
Not every minicomputer company was created by engineers
jumping ship. A marketing executive and a sales
Honeywell founded General A

https://commons.wikimedia.org/wiki/File:Apple_II_typical_configuration_1977.png



https://archive.org/details/debian_1.1

Why are you taking an advanced network security class?


Alice
Eve or
Mallory
Bob

What to expect this semester

- You should be able to look at any PCAP and critically analyze it *w.r.t.* network security and privacy
  - So, we need to study crypto and physics (and build a quantum computer)
  - We need to understand the ways in which our tools (*e.g.*, Wirseshark) can be wrong
    - *E.g.*, overlapping IP fragments
  - We need to think critically about what can make a bit pattern “malicious”

[Cypherpunks want] “a guarantee -- with physics and mathematics, not with laws -- that we can give ourselves real privacy of personal communications.”

“We are literally in a race between our ability to build and deploy technology, and their ability to build and deploy laws and treaties. Neither side is likely to back down or wise up until it has definitively lost the race.”

--John Gilmore

Grading/houses summary

- Divided into four houses (assigned, not chosen)
  - 2/3rds of exams/labs don’t affect your individual grade, 1/3rd do
  - House with the most points at the end of the semester gets 100/100 on the final

Part 1: Crypto

- Three exams (no notes, book, calculator, *etc.*)
  - 1st is 100 points (25% of grade) individual effort, first half of RSA and Diffie-Hellman
  - 2nd not graded but for house points, second half of signature and key exchange
  - 3rd is not graded but for house points, attack crypto

Part 2: Network Intrusion Detection Systems (NIDS)

- Each student will individually create a Scapy script to obfuscate a TCP data transfer
  - 100 points, 25% of your grade
- Messages uploaded to a server that is keeping PCAPs for points
- Houses will be provided with the raw PCAPs
  - Take some points away for your own house if you can recover the raw message transferred

Part 3: Malware

- Each student will submit (100 points, 25% of your grade) a tar ball that compiles a “warrior”
  - Each student knows some secret about the build environment
  - Tar balls shared with entire class
- First round of house *vs.* house, randomly chosen warriors in Core Wars
- Each student gets to submit one more warrior for round 2

Calendar (Part 1 of 2)

- 1/15 – House assignments announced, read Diffie-Hellman paper carefully
- 1/20 – Read RSA paper carefully
- 1/22 – Read/skim Mini AES spec, LDC tutorial, and KRACK attacks and/or watch relevant YouTube videos
  - House names and number of bits for prime numbers due
- 1/27 – Read/skim MD5 collisions paper and WeChat Citizen Lab report
- 1/29 – Read OTR paper and watch CITIZEN FOUR

Calendar (Part 2 of 2)

- 2/3 – Read “Quantum Algorithms Revisited”
- 2/5 – In-person exam, individually graded
  - First half of RSA and Diffie-Hellman
- 2/10 – In-person exam for house points
  - Second half
- 2/12 – In-person exam for house points
  - Attack the Diffie-Hellman scheme of others

Do you *really* want to take this class?

- Your classmates will be depending on you
  - Not just the ones in your house
- 115/115 seats are full
- Instructor is unapologetically a cypherpunk and an academic