

# Computer and Network Security: Motivation

Kameswari Chebrolu

All the figures used as part of the slides are either self created or from the public domain with either 'creative commons' or 'public domain dedication' licensing. The public sites from which some of the figures have been picked include: <http://commons.wikimedia.org> (Wikipedia, Wikimedia and Workbooks); <http://www.sxc.hu> and <http://www.pixabay.com>

# Outline

- What is Computer and network security?
- Why is security important?
- Why is security hard?
- What does all this mean to “you”?

# What is Computer Security?

*“**Computer Security** is the process of preventing and detecting unauthorized use of your computer. It involves the process of safeguarding against intruders from using your computer resources for malicious intents or for their own gains ”*

*(From [www.cert.org](http://www.cert.org))*

# What is Network Security?

***“Network security consists of the policies adopted to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. ”***

*(From wikipedia.org)*

# Terms from Definition

- Resource
- Un-authorized use
- Intruders/Attackers
- Safeguard/Defense

# Resources

- Computer could be replaced by laptops, desktops, cellphones, medical devices, ATMs, cars etc
- Resources(**Digital assets**) have value
  - CPU
  - Disk Space
  - Network Connection
  - Data: Passwords, Contact List, Credit Card #s, Secret Files, Trade/Military secrets
  - Entire System or Network

# Unauthorized Use

- Steal Identity/Information
  - Credit card, social security numbers, Intellectual property
- Cause Inconvenience
  - Reboots, pop-ups, corrupt files
- Disruption of service
  - Launch denial-of-service (DOS) attacks; deface website
- Warfare (spying, sabotage)

# Terms from Definition

- ~~Resource~~
- ~~Un-authorized use~~
- Intruders/Attackers
- Safeguard/Defense



# Intruder/Attacker Profile

- Can be anyone: insider, outsider, vendor, service-provider etc
- Assumed very powerful
  - Has access to large computational power
  - Can intercept and modify messages
  - Can buy people off
  - Knows implementation details

# Incentives for Attacks

- Glory/Bragging Rights
- Malice
- Competition
- **Money (e.g. bug bounty)**
- Political/ Private Activism (e.g. stuxnet worm , Anonymous Group,)

Upto \$20k per bug



# Underground Economy

Service	Price
Hack a normal website	\$9.99
Hack a high profile site	\$9.99 +
Govt. Database of Names, addresses, Phone etc	\$20 per 1KB
Fresh emails for spam	\$10 per 1MB
<a href="http://xxx.yyy.mil">http://xxx.yyy.mil</a> full site admin control	\$499
<a href="http://www.xxx.edu">http://www.xxx.edu</a> full site admin control	\$88
Zero day against iOS	\$500,000
50,000 botnets for rent for two weeks	\$4000
DDOS for one week/hour	\$150/\$10

- Several companies specialize in finding and selling exploits
  - ReVuln, Vupen, Netragard, Exodus Intelligence
  - The average flaw sells for \$35 - 160K
- Nation/State buyers
  - Israel, Britain, Russia, India and Brazil are some of the biggest spenders

# Terms from Definition

- ~~Resource~~
- ~~Un-authorized use~~
- ~~Intruders/Attackers~~
- Safeguard/Defense

# Safeguards/Defense

- Individually, Organization level
  - Latter is very complex
- Whole course is about attacks and how to “defend” them!
  - a brief intro coming up later

# Outline

- ~~What is Computer and network security?~~
- Why is security important?
- Why is security hard?
- What does all this mean to me?

# Why is Security Important?

- At a personal level:
  - Preserve privacy (e.g. what I browse)
  - Prevent access to confidential information (passwords, bank/property details)
  - Misuse of your resources for illegal activities
  - Avoid inconvenience (reboots, pop-ups, corruption of files due to virus)



- At business level:

“There are only **two types of companies**: those that have been hacked, and those that will be.”

-- Robert Mueller, **FBI Director**, 2012

- At business level:
  - Prevent access to confidential data like credit/debit card, passwords, DOB etc (ebay, 2014, 145 million records stolen)
  - Avoid financial loss (Morris worm, 1988, estimated damage \$100,000–10,000,000)
  - Prevent access to intellectual property (many companies, operation Aurora, 2009)
- Nation level: Cyber warfare
  - Protection from enemies/terrorist groups; (Stuxnet worm, 2010, Iran's nuclear enrichment facility)

# Statistics

- <http://www.informationisbeautiful.net/visualizations/worlds-biggest-data-breaches-hacks/>

# Why is Security Hard?

- **Complex System:** Hardware, Software, Storage, Network, Data, Peripheral devices, People
  - Only as Strong as the Weakest Link in the Chain
  - “If you think technology can solve your security problems, then you don’t understand the problems and you don’t understand the technology.” -- *Bruce Schneier*

A CRYPTO NERD'S  
IMAGINATION:

HIS LAPTOP'S ENCRYPTED.  
LET'S BUILD A MILLION-DOLLAR  
CLUSTER TO CRACK IT.

BLAST! OUR  
EVIL PLAN  
IS FOILED!

NO GOOD! IT'S  
4096-BIT RSA!



WHAT WOULD  
ACTUALLY HAPPEN:

HIS LAPTOP'S ENCRYPTED.  
DRUG HIM AND HIT HIM WITH  
THIS \$5 WRENCH UNTIL  
HE TELLS US THE PASSWORD.

GOT IT.



- Tough environment:

- Defender: Find/Eliminate all vulnerabilities
- Attacker: Find only one vulnerability
- “A good attack is one that the engineers never thought of.” -- *Bruce Schneier*

- Ease of attacks
  - Cheap
  - Distributed, automated
  - Anonymous
  - Insider threats
- Usability vs Security
  - More focus on usability and performance; Security often an after thought
  - Security mechanisms often viewed as nuisance

# Takeaway

*“The only truly secure system is one that is powered off, cast in a block of concrete and sealed in a lead-lined room with armed guards - and even then I have my doubts.” -- Gene Spafford*

- Perfect Security is impossible
- Tradeoff security with other goals (Usability/Cost)
- High level goal: Risk management not complete protection



# Outline

- ~~What is Computer and network security?~~
- ~~Why is security important?~~
- ~~Why is security hard?~~
- What does all this mean to me?

# What does all this mean to me?

- Can protect yourself
  - Install anti-virus, understand risks of downloads, sharing info in websites etc
- Ethical hacking (help the community)
- Research
- Jobs

**You will *not* be a security expert after this class**

# Goals of the Course

1. Understand the basic building blocks that help defend against attacks
  - Support Confidentiality and Integrity
2. Understand common exploits and how to defend/avoid them
3. In the process, explore/familiarize with a few popular standards/protocols and also Appreciate the challenges posed by security
4. Implement/experiment some of the ideas (in the form of labs)
5. Get a high level overview of ongoing research/hot topics in this space (?)

# Summary

- Definition of computer/network security
- Why security is hard/important?
- What will you get out of this course