CE 442/Computer and Network Security

25 Shahrivar, 1396

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What is Security?

- Confidentiality (محرمانگی)
  - Not the same as privacy (حریم خصوصی)
- Integrity (صحت)
- Availability (دسترس پذیری)
  - Turning off a computer provides confidentiality and integrity, but hurts availability. . .

[Bellovin 06]

More Definitions

- **vulnerability (آسیب پذیری):** An error or weakness in the design, implementation, or operation of a system
- **threat (تـهدید):** An adversary that is motivated and capable of exploiting a vulnerability
- **attack (حمله):** A means of exploiting some vulnerability in a system

(Definitions from Trust in Cyberspace)

[Bellovin 06]

Threats (تهدیدات)

- script kiddies
- Hacking for profit
  - The primary motivation for most current attacks is money (i.e. spammers)
- Industrial espionage
  - Professionals are more likely to use non-technical means, too: social engineering, bribery (رشوه), wiretaps, etc.
  - Professionals tend to know what they want

[Bellovin 06]

Threats (تهدیدات)

- Inside jobs
  - insiders know what you have and your weak points
  - Insiders are on the inside of your firewall
- Government backed attackers
  - Governments may want your technology (Boeing vs. Airbus)
  - Well-funded attackers
  - Is cyber-warfare a threat?

[Bellovin 06]

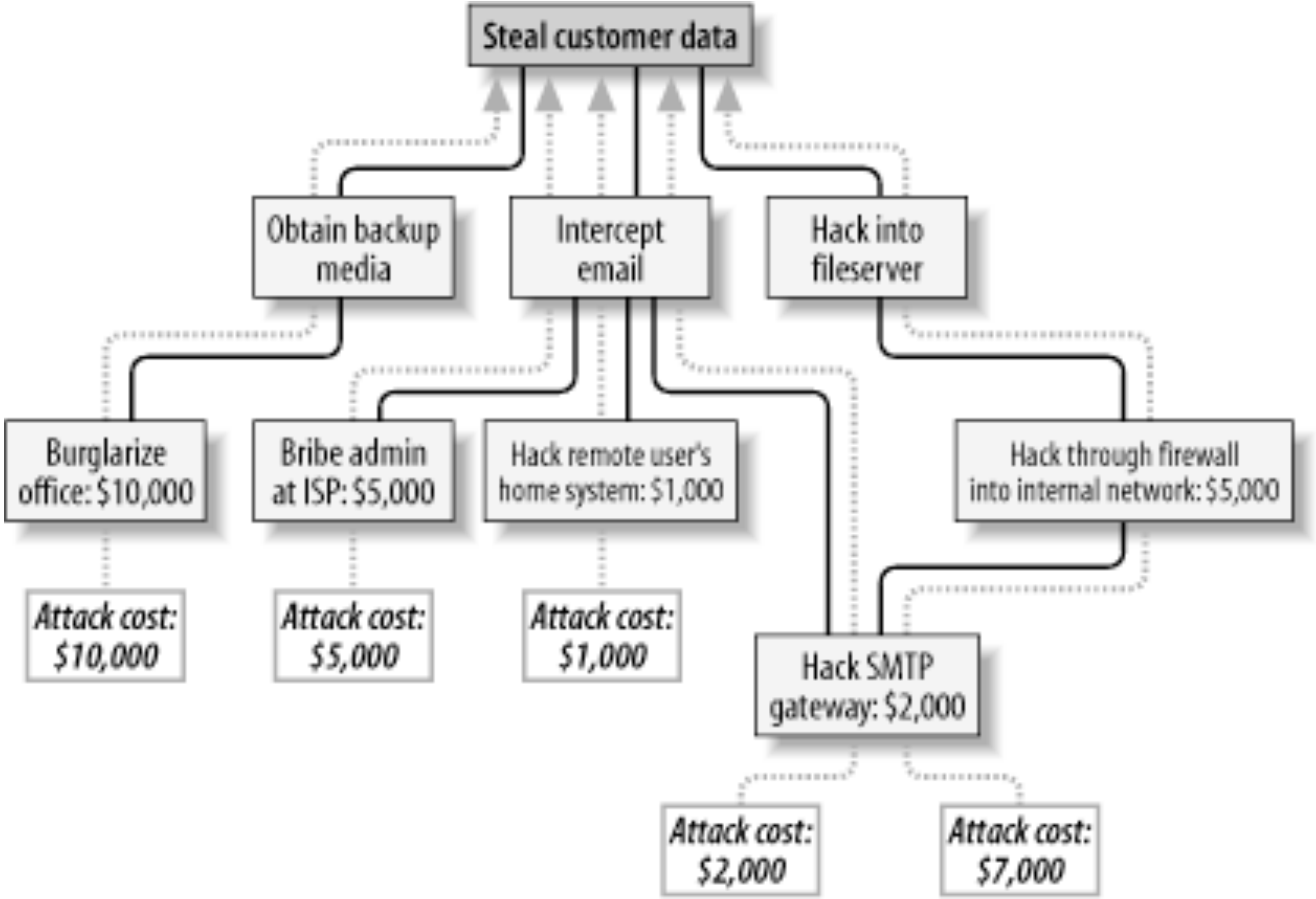
Why Do Threats Matter?

- You can’t design a security system unless you know who the enemy is
- Security is fundamentally a matter of economics
    - Cost vs. Reward
- Defender:
    - How much security can you afford?
    - How much do you need?
- Attacker:
    - How much can you spend?
    - How much do you gain?

- ATM with 50,000 IR or 500,000 IR

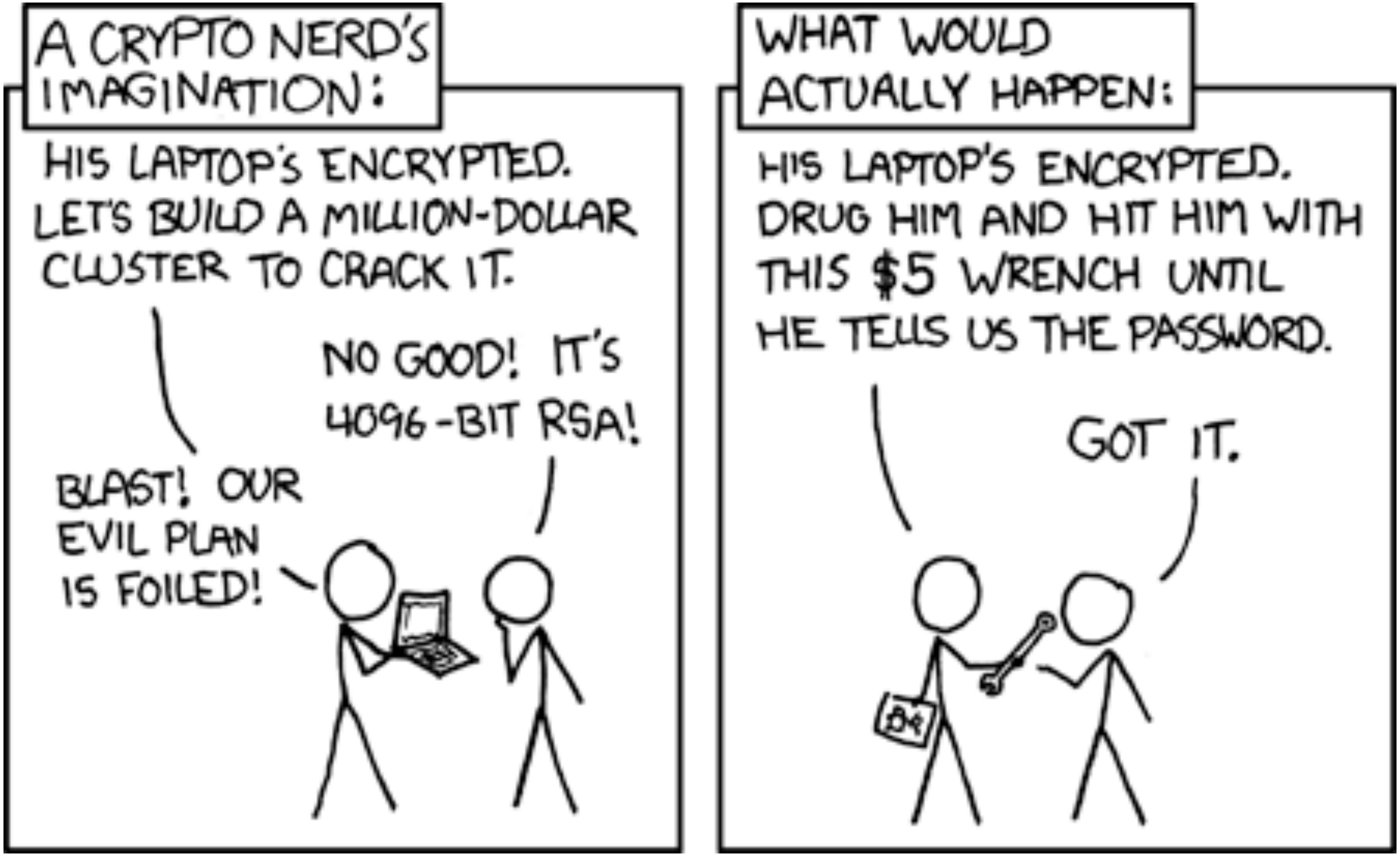
[Bellovin06]

Attack Tree



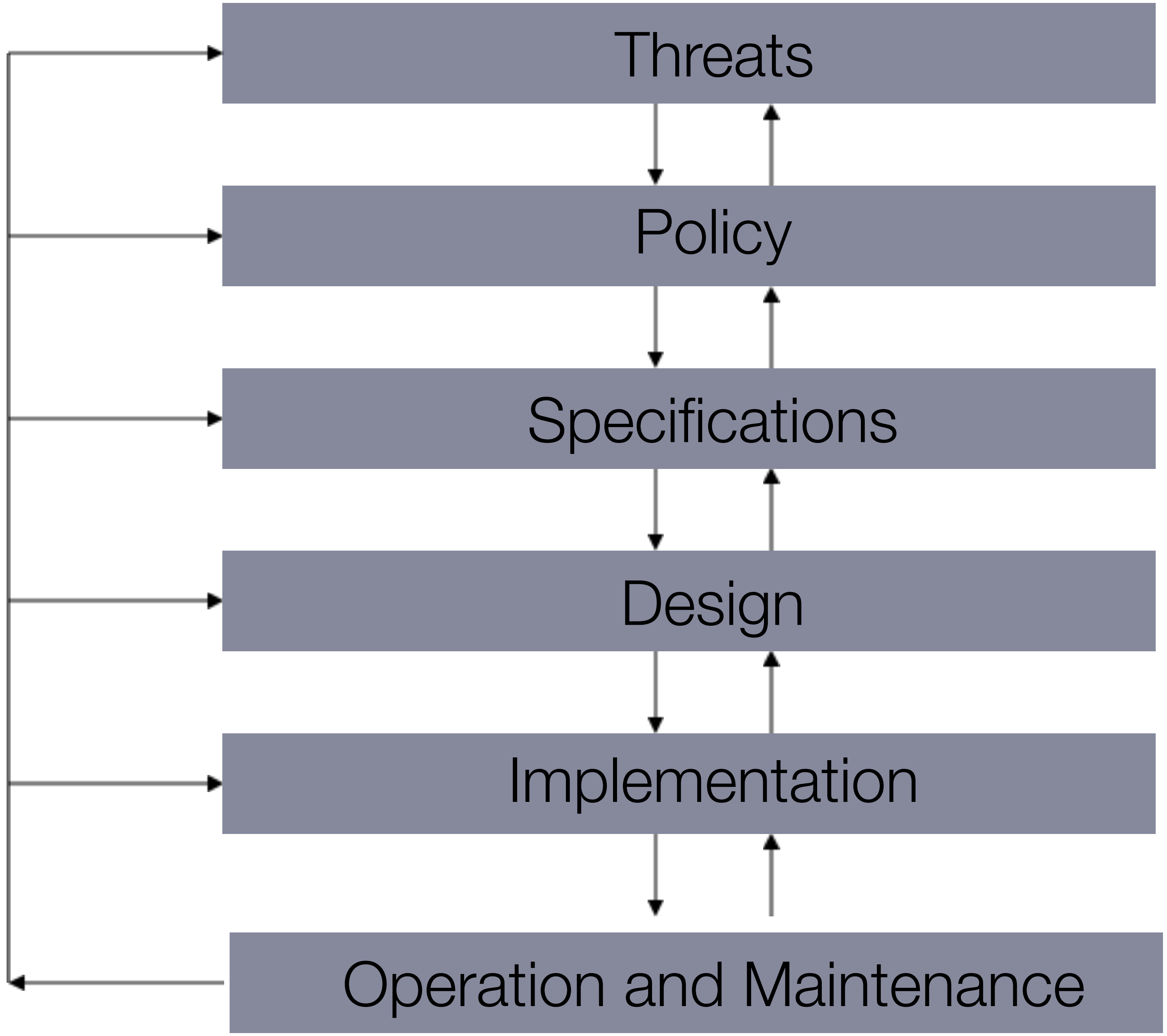
[Cappos06]

Be Realistic About Modeling Threats...


A CRYPTO NERD'S IMAGINATION:
HIS LAPTOP'S ENCRYPTED. LET'S BUILD A MILLION-DOLLAR CLUSTER TO CRACK IT.
NO GOOD! IT'S 4096-BIT RSA!
BLAST! OUR EVIL PLAN IS FOILED!
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.

[*] comic from xkcd

Security Life Cycle



[Cappos06]

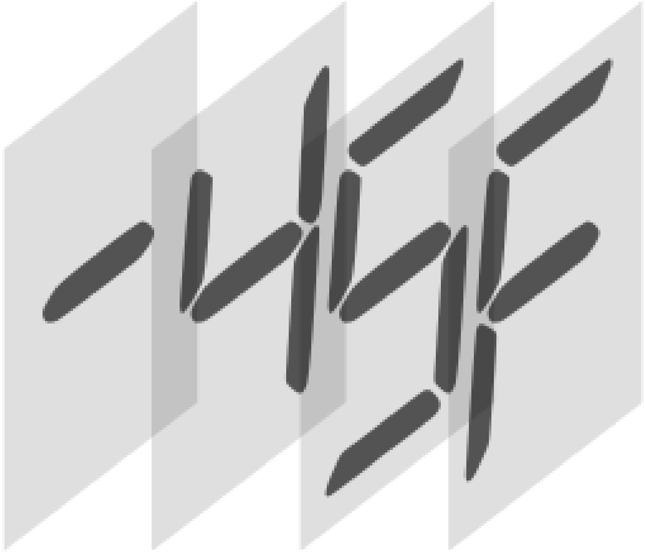
Attacks

Eavesdropping (شنود)

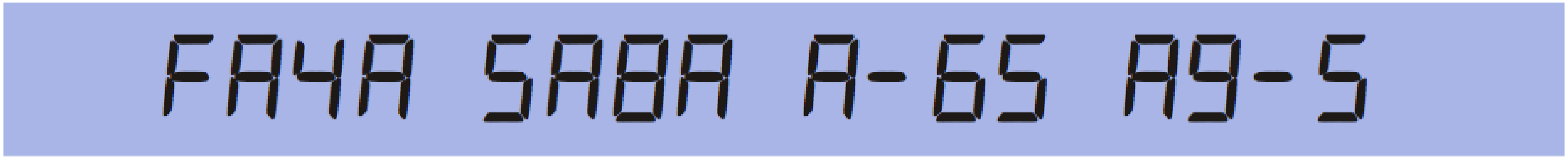
- Attack on confidentiality
- Cryptography is a defense
- What about traffic analysis?
  - Pentagon Pizza deliveries
  - Language identification in encrypted VoIP traffic
- Some times you want to avoid encryption
  - Steganography
    - Prisoner problem
  - Covert channels
    - CPU usage

Creative attacks!

- Can I find out what links you have visited?
  - Use javascript to get the color of the links on the page
    - Can find out if you have visited a specific link (This was fixed)!
  - Set the background color to that of the visited link color, and employ Captchas



4+5 = 9; 4+F = A; 5 + F = 6; 4 + 5 + F = 8



Phishing

- Attack on integrity
- Which site is authentic?

http://www.tejaratbank.ir/en/

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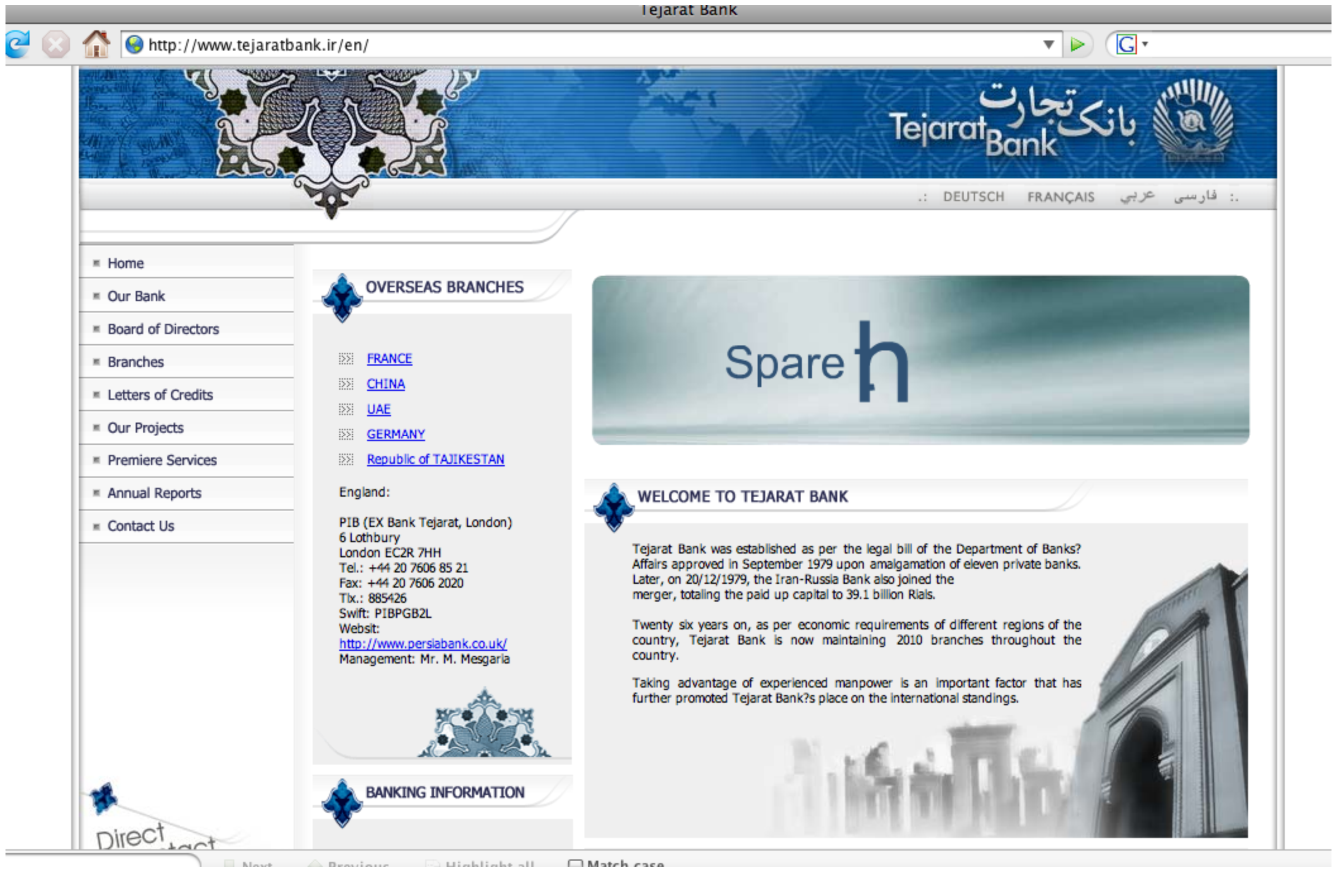


OVERSEAS BRANCHES

FRANCE
CHINA
UAE
GERMANY
Republic of TAJIKESTAN

England:

PIB (EX Bank Tejarat, London)
6 Lothbury
London EC2R 7HH
Tel.: +44 20 7606 85 21
Fax: +44 20 7606 2020
Tlx.: 885426
Swift: PIBPGB2L
Websit:
http://www.persiabank.co.uk/
Management: Mr. M. Mesgaria

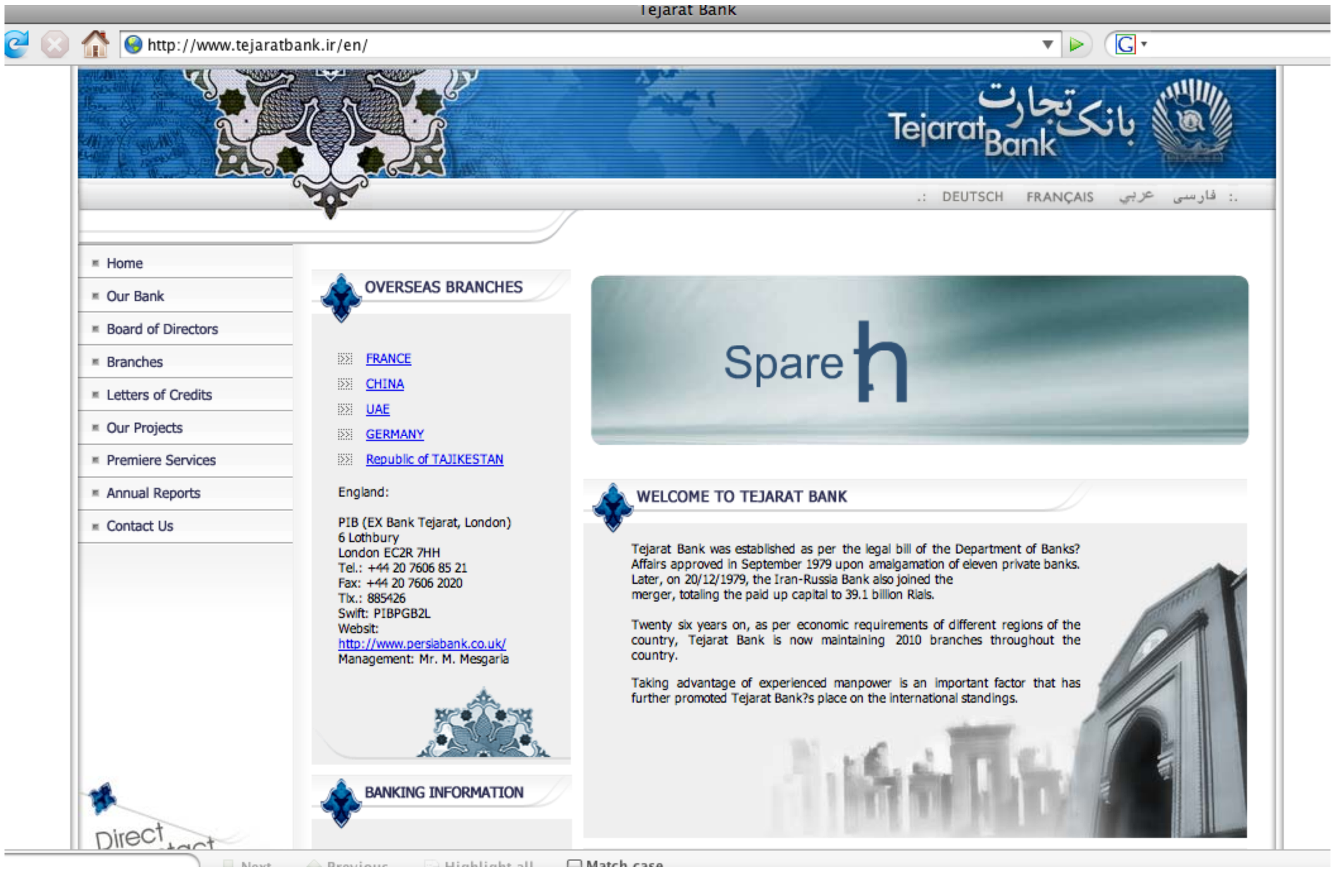
BANKING INFORMATION

WELCOME TO TEJARAT BANK

Tejarat Bank was established as per the legal bill of the Department of Banks? Affairs approved in September 1979 upon amalgamation of eleven private banks. Later, on 20/12/1979, the Iran-Russia Bank also joined the merger, totaling the paid up capital to 39.1 billion Rials.

Twenty six years on, as per economic requirements of different regions of the country, Tejarat Bank is now maintaining 2010 branches throughout the country.

Taking advantage of experienced manpower is an important factor that has further promoted Tejarat Bank?s place on the international standings.



OVERSEAS BRANCHES

FRANCE
CHINA
UAE
GERMANY
Republic of TAJIKESTAN

England:

PIB (EX Bank Tejarat, London)
6 Lothbury
London EC2R 7HH
Tel.: +44 20 7606 85 21
Fax: +44 20 7606 2020
Tlx.: 885426
Swift: PIBPGB2L
Websit:
http://www.persiabank.co.uk/
Management: Mr. M. Mesgaria

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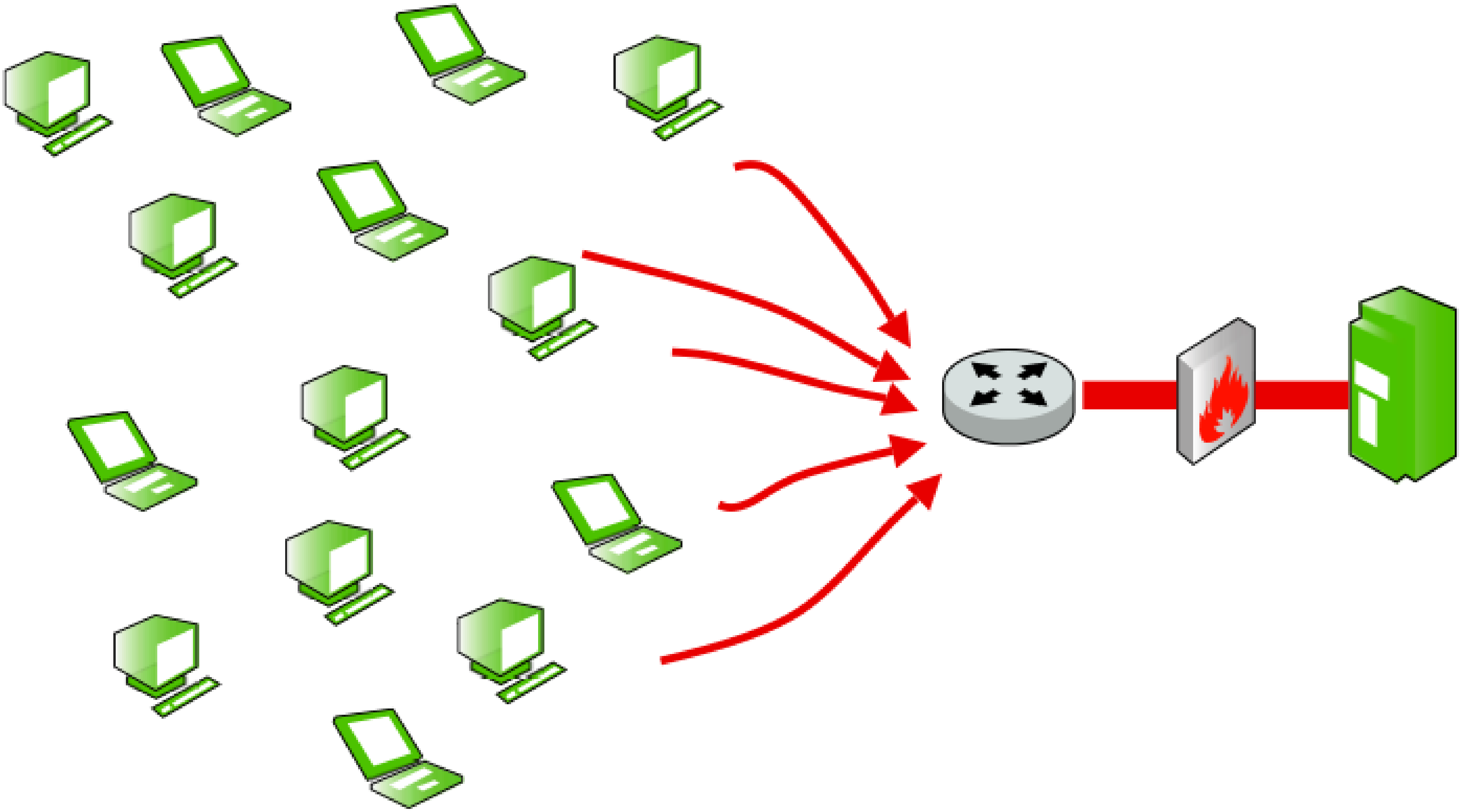
(DDoS) Distributed Denial of Service

- Attack on availability
- Overload the victim with traffic
- Most current attacks use “bots”
  - “bots” are machines under control of the attacker
  - major usage: spamming, DDoS
  - How?
    - Use “come and get it” with infected “free” software
    - Use exploits to penetrate machines, possibly via worms
    - Buy or rent them
    - Steal them!

DDoS Example



[Nazario08]

DDoS (con’t)

- Largest DDoS recorded —> 1tbps
  - using insecure IoT devices

Details on the Course

Administrivia

- Website:
  - sharif.edu/~kharrazi/courses/40442-961/ (will be up soon)
  - You are expected to check the website regularly
- Prerequisites: 40-443 Computer Networks and 40-424 Operating Systems

Administrivia

- TAs
  - Solmaz Salimi (Head TA)
- Grading (tentative)
  - 10% quiz
  - 40% homework
  - 20% midterm
  - 30% final

Policies

- Late Homework
  - One day late will cost you 25%, two days 50%, and three days 75%.
  - No homework will be accepted after the third day.
- Cell phones
  - Please turn them off before entering class.
- Cheating and Copying
  - First time you are caught you will get a zero for the task at hand.
  - Second time you are caught you will fail the course.
  - Providing your assignment to someone else is considered cheating on your behalf.

Acknowledgments/References

- Acknowledgments: Some of the slides are fully or partially obtained from other sources. Reference is noted on the bottom of each slide, when the content is fully obtained from another source. Otherwise a full list of references is provided on the last slide.

- [Nazario08] Jose Nazario, Arbor Network, USENIX Security, 2008.
- [Cappos06] CS3923 / 6813: Computer Security, New York University, Fall 2016.
- [Bellovin06] COMS W4180 — Network Security Class Columbia University, Steven Bellovin, 2006.
- [Schneier] Attack Trees, Bruce Schneier, Dr. Dobb’s journal.