موسسه آموزش عالی غیردولتی غیرانتفاعی بصیر آبیک

NETWORK AND E-COMMERCE SECURITY

Basir University, 2020-2021

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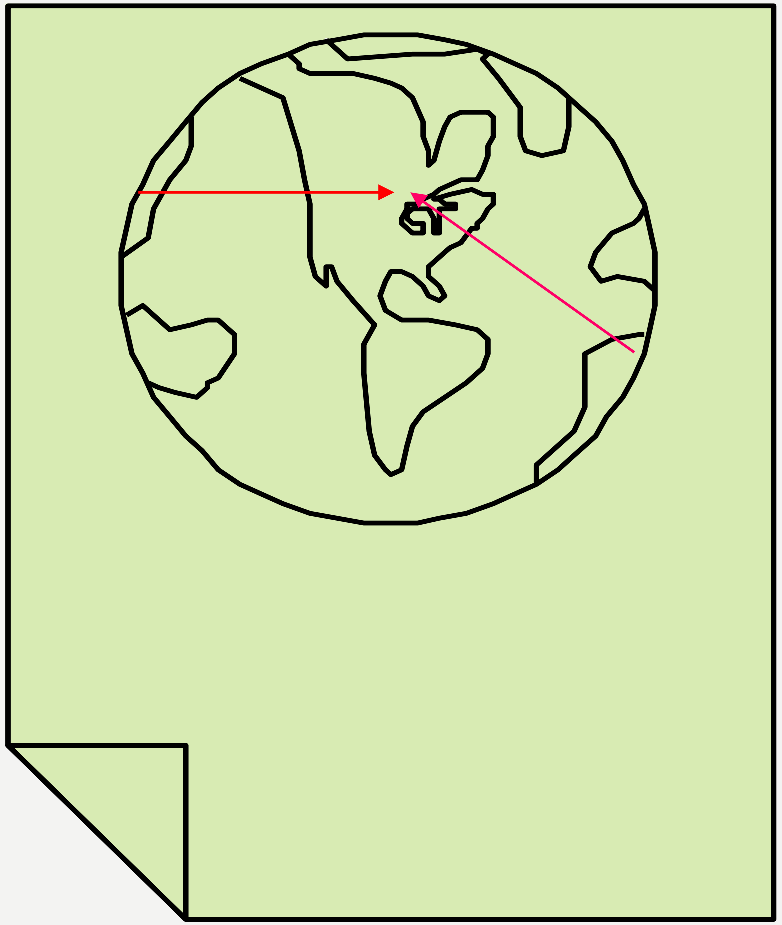
SECURITY

THE PROBLEM OF NETWORK SECURITY

The Internet allows an attacker to attack from anywhere in the world from their home desk.

They just need to find one vulnerability: a security analyst need to close every vulnerability.



PROGRESS OF SECURITY ATTACKS

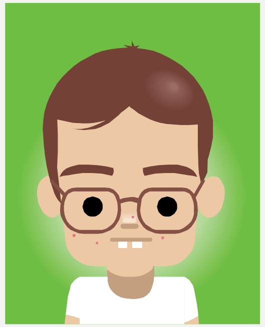
Threat Type	Year: Example Threats
Experiment	1984: Fred Cohen publishes "Computer Viruses: Theory and Experiments"
Vandalism	1988: Jerusalem Virus deletes all executable files on the system, on Friday the 13th. 1991: Michelangelo Virus reformats hard drives on March 6, M's birthday.
Hactivism	2010: Anonymous' Operation Payback hits credit card and communication companies with DDOS after companies refuse to accept payment for Wiki-Leaks.
Cyber-crime	2007: Zeus Trojan becomes 'popular'; turns computers into zbots and spyware steals credit card (CC) numbers. 2008-9: Gonzales re-arrested for implanting spyware on WLANs, affecting 171 M CC. 2013: In July 160 M CC numbers are stolen via SQL Attack. In Dec. 70 M CC numbers are stolen through Target stores. 2016-7: Ransomware charges $522 to decrypt your disk; Petya/NotPetya does not. 2017: Cryptocurrency coin mining
Information Warfare	2007, 2008: Russia launches DDOS attack against Estonia, Georgia news, gov't, banks 2010: Stuxnet worm disables 1000 of Iran's nuclear centrifuges. 2016-7: N Korea Lazarus stole $81 M Bangladesh Centralbank, releases WannaCry ransomware to fund military operations.
Surveillance State	2012: Chinese affiliations attack U.S. businesses to steal intellectual property. 2013: Lavabit closes secure email service rather than divulge corporate private key to NSA without customers' knowledge.

HISTORY OF CYBER-WAR

YEAR	FROM -> TO	ATTACK DESCRIPTION
2007	Russia -> Estonia	DOS attacks on gov't, financial inst., news
2008	Russia -> Georgia	DOS attacks on Internet, gov't websites
2008	US -> US	Malware to top aides of pres. candidates
2009	China->Embassies, foreign ministries	GhostNet malware: Command & Control software
2012	US, Israel -> Iran	Stuxnet Worm disables nuclear facilities
2010	India <->Pakistan	Hacker groups hit gov't websites
2011	China -> Canada	Spyware virus causes shutdown of economic agencies
2012	-> Iran, Middle East	Flame cyber-espionage malware
2013	N. Korea -> S. Korea	Dark Seoul Malware hits TV, banks; makes computers unusable.

CRACKERS

System Administrators
Some scripts are useful to protect networks…
Get info from hacker bulletin boards



Cracker:
Computer-savvy programmer creates attack software

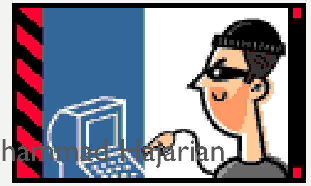
Dark Web

For Sale:
Credit Cards
Medical Insurance
Identification
Malware

Script Kiddies:
Know how to execute programs

Criminals:
Create & sell botnets -> spam
Sell credit card numbers,…

Nation States:
Cyber-warfare, spying, extortion, DDOS



Crimeware or Attack Kit=$1K-2K
1 M Email addresses = $8
10,000 PCs = $1000

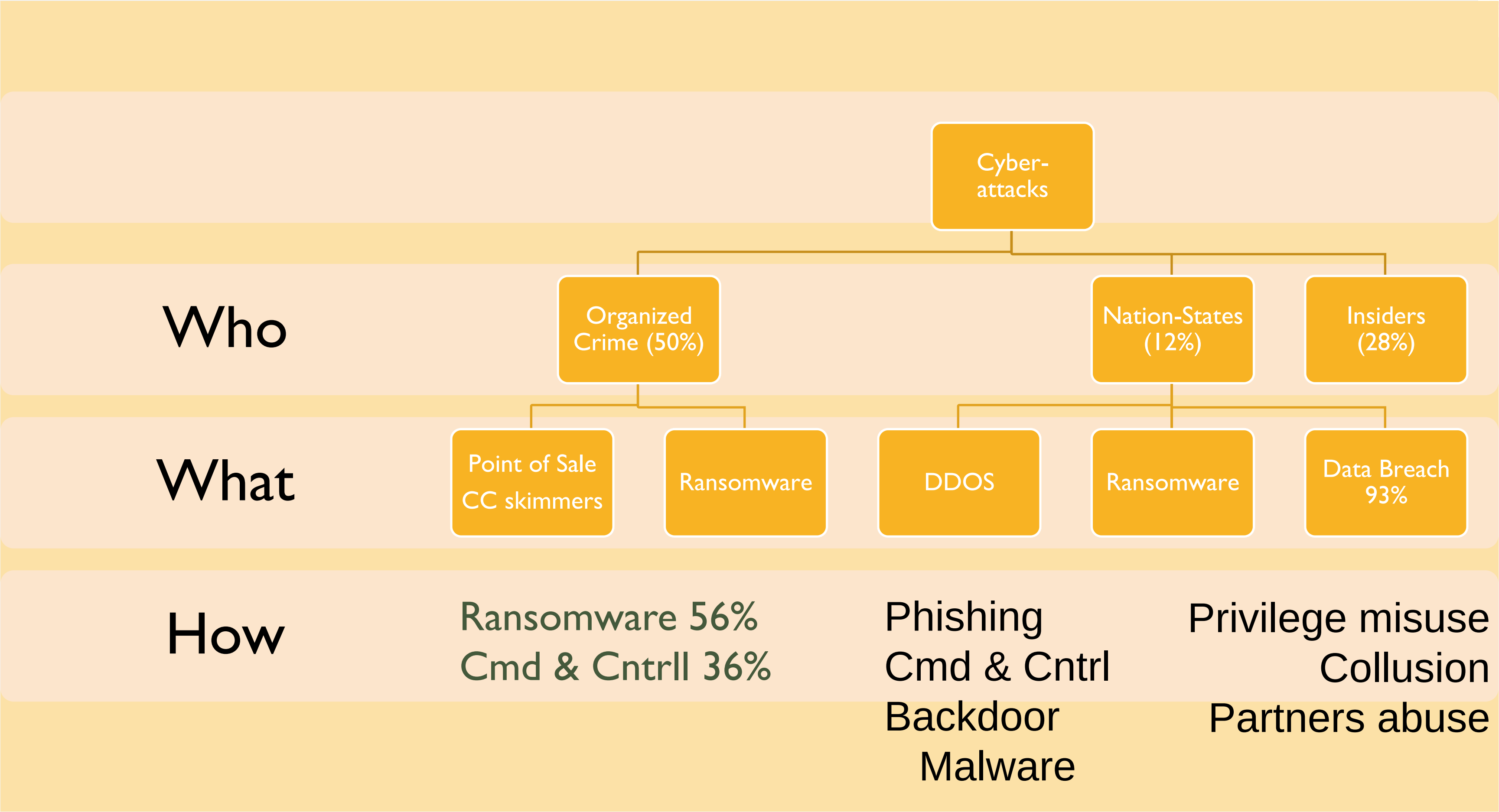
OTHER HACKERS/CRACKERS:

- **Cyberterrorists**
- **Cyberwar**: National governments attack IT
- **Espionage**: Accused: Russia, North Korea, China, France, South Korea, Germany, Israel, India, Pakistan, US.

ADVANCED PERSISTENT THREAT

- Advanced: Combination of custom & common malware
  - Target: Business or Gov’t data/operation
- Persistent: Extended period attack until target is compromised
- Threat: Organized, capable, well-funded attacker
  - Source: Gov’t or criminal enterprise

WHO-WHAT-HOW



Cyber-attacks

Who

Organized Crime (50%)

Nation-States (12%)

Insiders (28%)

What

Point of Sale CC skimmers

Ransomware

DDOS

Ransomware

Data Breach 93%

How

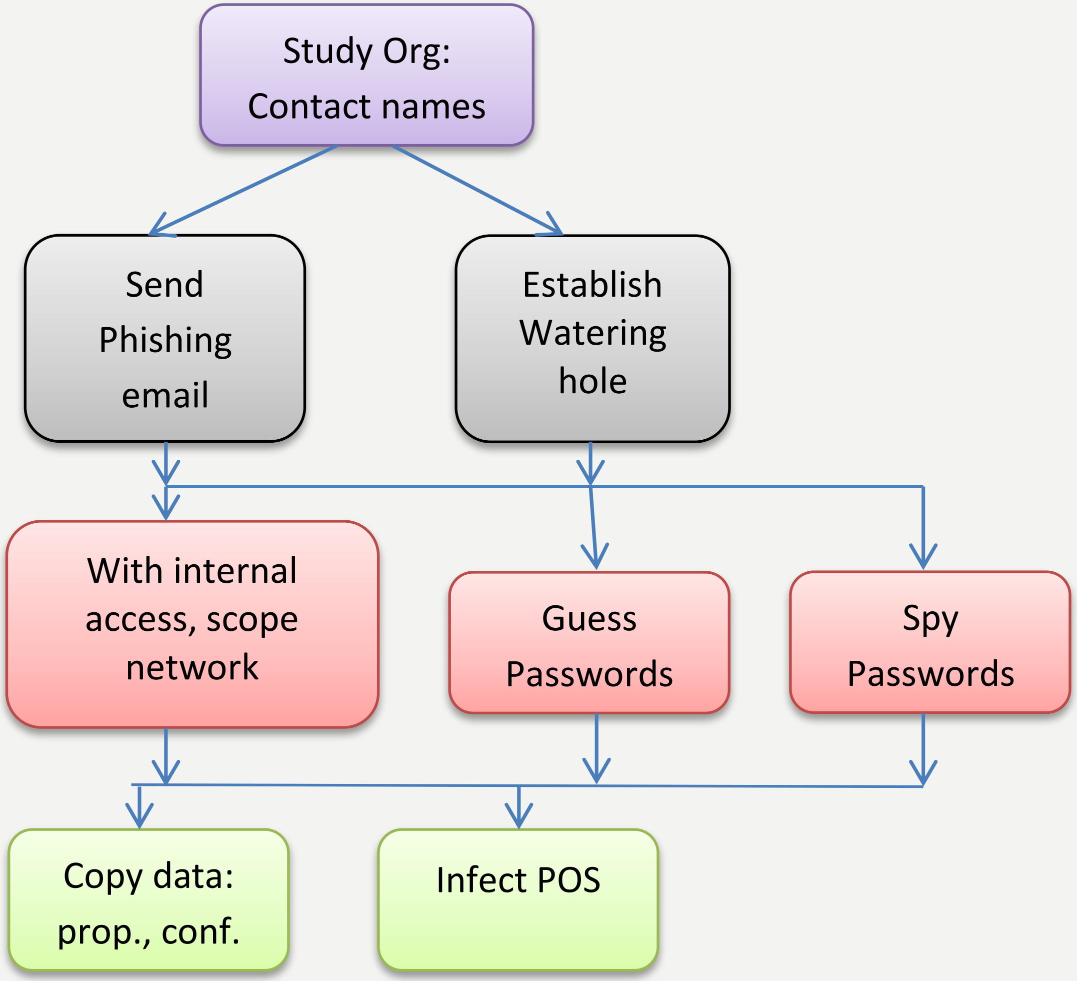
Ransomware 56%
Cmd & Cntrll 36%

Phishing
Cmd & Cntrl
Backdoor
Malware

Privilege misuse
Collusion
Partners abuse

Verizon 2018 Data Breach Investigations Report

A COMMON MEANS OF ATTACK



Study Org: Contact names

Send Phishing email

Establish Watering hole

With internal access, scope network

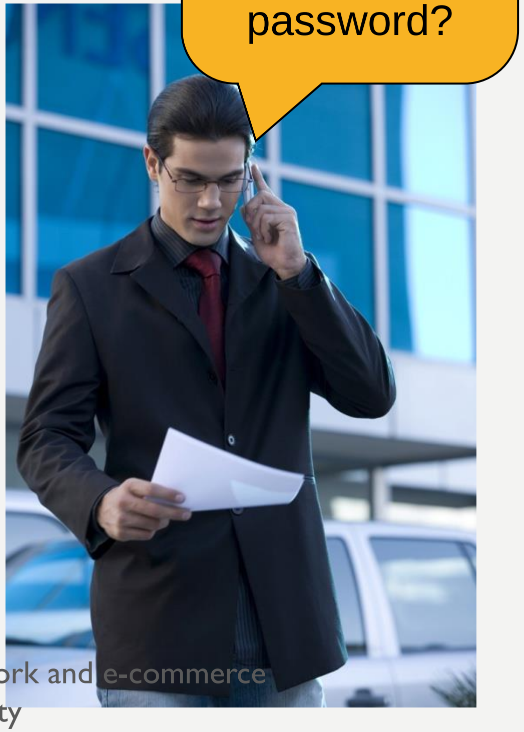
Guess Passwords

Spy Passwords

Copy data: prop., conf.

Infect POS

SOCIAL ENGINEERING



This is John, the System Admin. What is your password?

Email:
ABC Bank has noticed a problem with your account…

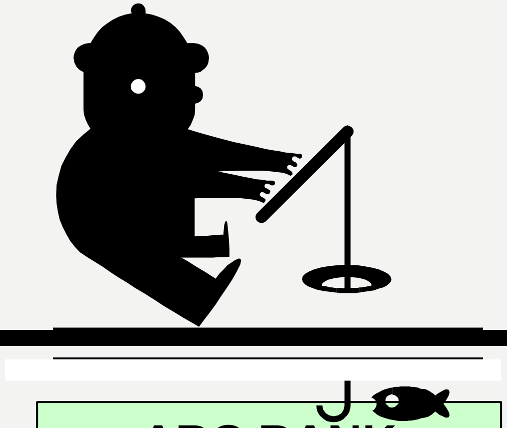
What ethnicity are you? Your mother's maiden name?

I need a password reset. What is the passwd set to?

I have come to repair your machine…

and have some software patches

PHISHING = FAKE EMAIL



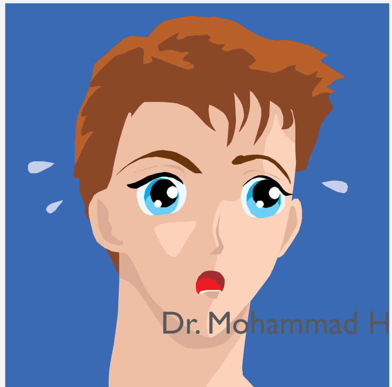
ABC BANK

Your bank account password is about to expire.
Please login…

Spearfishing

John:
Could you send Automated Services $1200?
Joe (CEO)

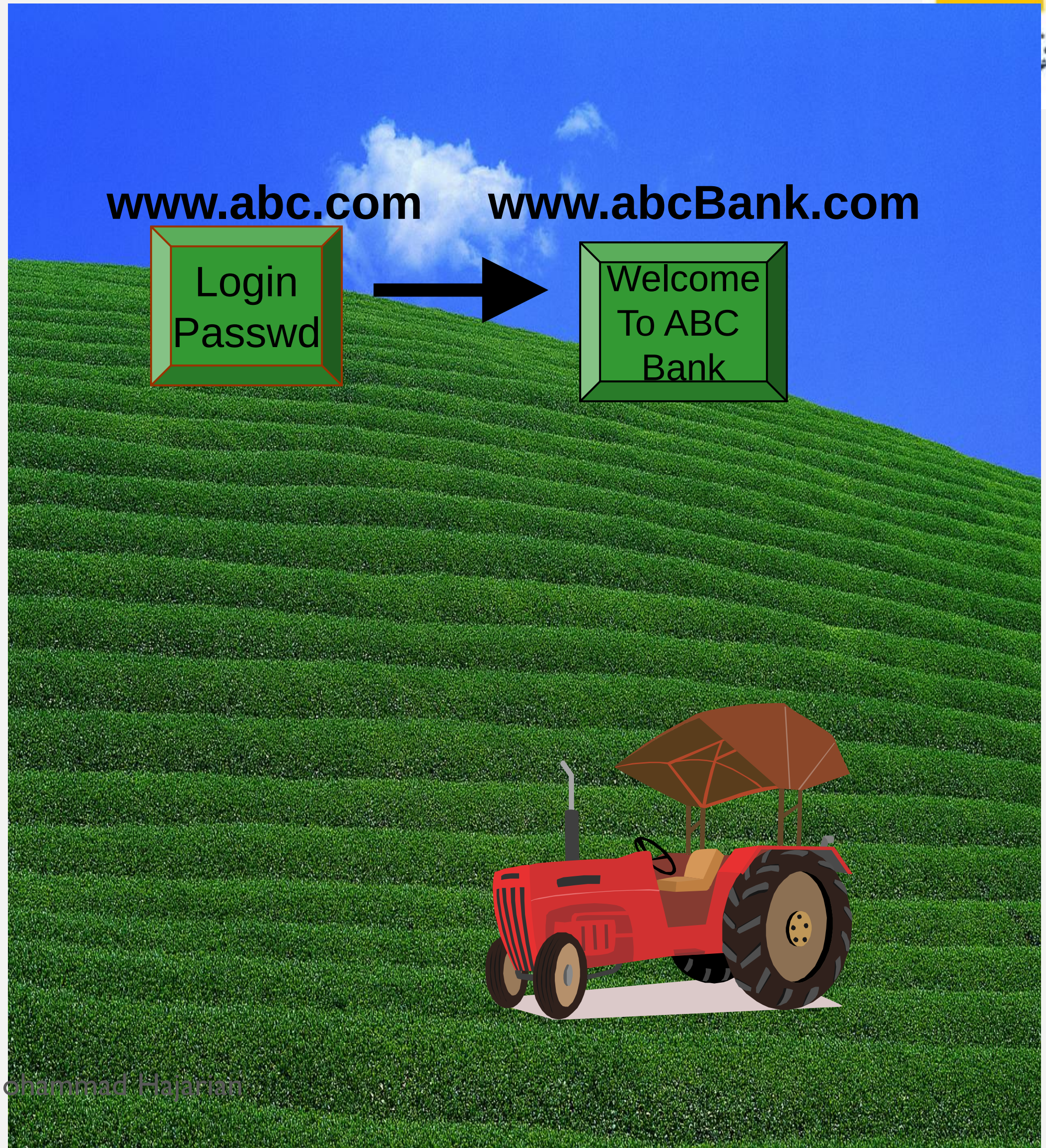
The bank has found problems with your account.
Please contact …”



PHARMING = FAKE WEB PAGES

Pharming:

- A fake web page may lead to a real web page
- The fake web page looks like the real thing
  - Extracts account information



DRIVE-BY DOWNLOAD

- A web site exploits a vulnerability in the visitor’s browser when the site is viewed

SOCIAL ENGINEERING

Phishing

- Gain Foothold
- Techniques:
  - Malware>67%
- Goals:
  - Financial 59%
  - Spying 41%

Pretexting

- Dialogue
- Obtain info, influence
- Technique:
  - CEO impersonation
  - Human resources: W2 info->fraudulent tax returns
  - Finance: transfer $
  - Malware 10%
- Goals:
  - Financial: 95%

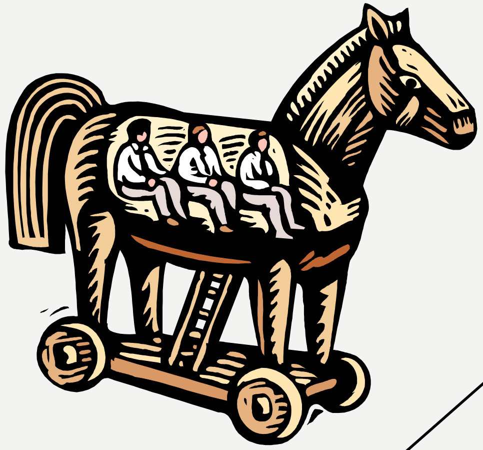
- 93% of Breaches
- Prominent technique: email 96%
  - Malicious attachment
  - Link to pharming website
- 78% do not click a single phish all year;
- 4% phish acceptance rate

Verizon 2018 Data Breach Investigations Report

ATTACK KIT - CRIMEWARE

- **Attack kit = Crimeware**: Tools which generate malware automatically
  - with varied propagation and payload mechanisms
- **Auto-rooter**: Breaks into new machines remotely
- **Downloader:** Original attack opens the door, then downloads the full attack software
- **Spammer program:** Generates large volumes of unwanted email

EXPLOIT/MAINTAIN ACCESS



Backdoor

Abnormal way to enter system, provided by Programmer or Vulnerability

Trojan Horse

Useful utility also performs malicious function

User-Level Rootkit

Replaces system executables: e.g. Login, ls, du to hide itself

Kernel-Level Rootkit

Replaces OS kernel: e.g. process or file control to hide

Bots

Slave forwards/performs commands; spreads, list email addrs, DOS attacks

Spyware/Adware

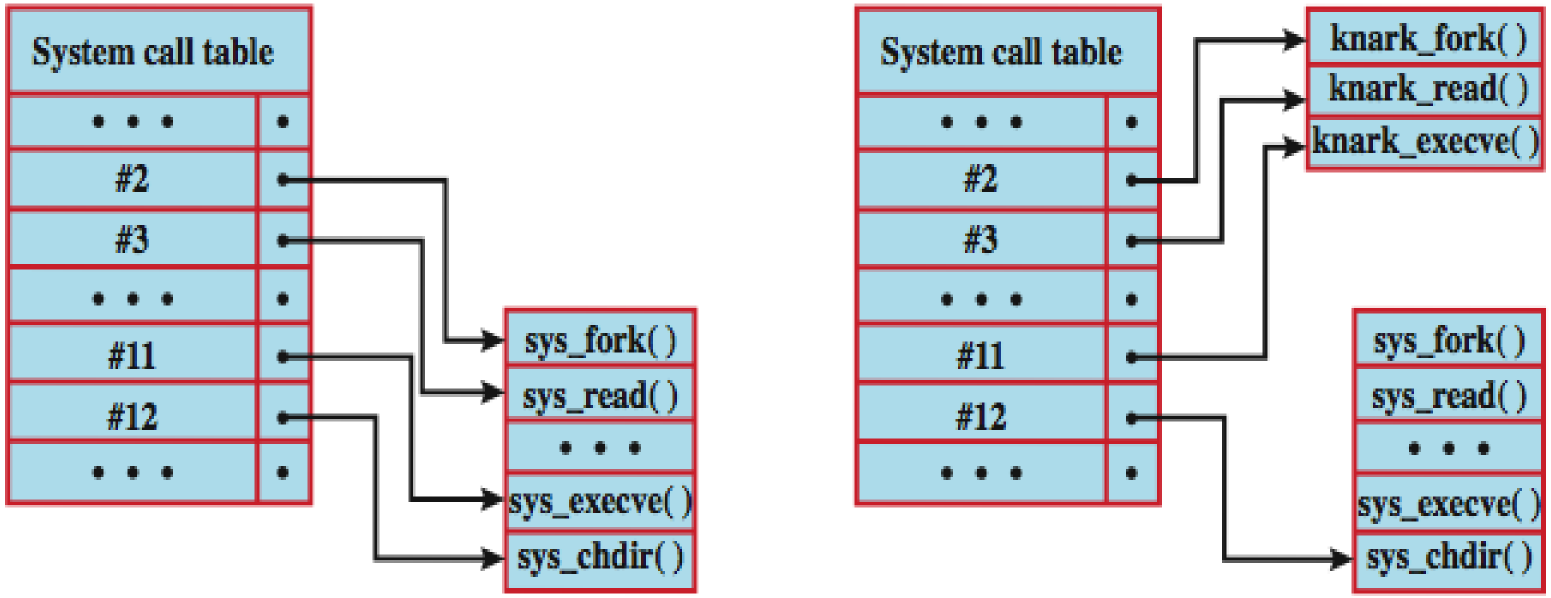
Spyware collects info: keystroke logger, collect credit card #s, **Adware**: insert ads, filter search results

ROOT KIT

Root Kit

- Upon penetrating a computer, a hacker installs a root kit
- May enable:
  - Easy entrance for the hacker (and others)
  - Keystroke logger
- Eliminates evidence of break-in
- Modifies the operating system
- Requires new OS install, when detected

ROOTKIT SYSTEM TABLE MODS



(a) Normal kernel memory layout

(b) After nkark install

OTHER MALWARE

Logic Bomb: Functional software has a built-in malicious attack or failure mechanism

- E.g., Software will malfunction if maintenance fee is not paid

Ransomware: E.g., Pay fee to decrypt software (or just pay fee)

Trojan Horse: E.g., Social Engineering: "Try this game…it is so cool"

  – Game also emails password file.

DENIAL OF SERVICE

- Single-Message DoS Attacks: Crash or disable system by attacking vulnerability
- Flooder DoS Attack: Flood victim with requests
    - **SYN Flooding**: Flood victim host with TCP SYNs (which initiate session).
    - **Smurf Attack**: Broadcast Pings to third parties with source address of victim host
    - **Amplification Attack:** Uses Broadcast address (common in 2017)
    - **Rabbit or Bacteria:** Reproduces exponentially, using up system resources
    - **Coin Mining**: Your web browser mines cryptocurrencies (e.g., Monero) for money for attacker

COVERT CHANNEL

- Exfiltrate information outside the organization
- E.g.: manipulate bits in a jpeg or mpeg
- E.g.: carry out info in a Lady GaGa CD
- E.g.: set bytes in an Excel spreadsheet

MOBILE MALWARE

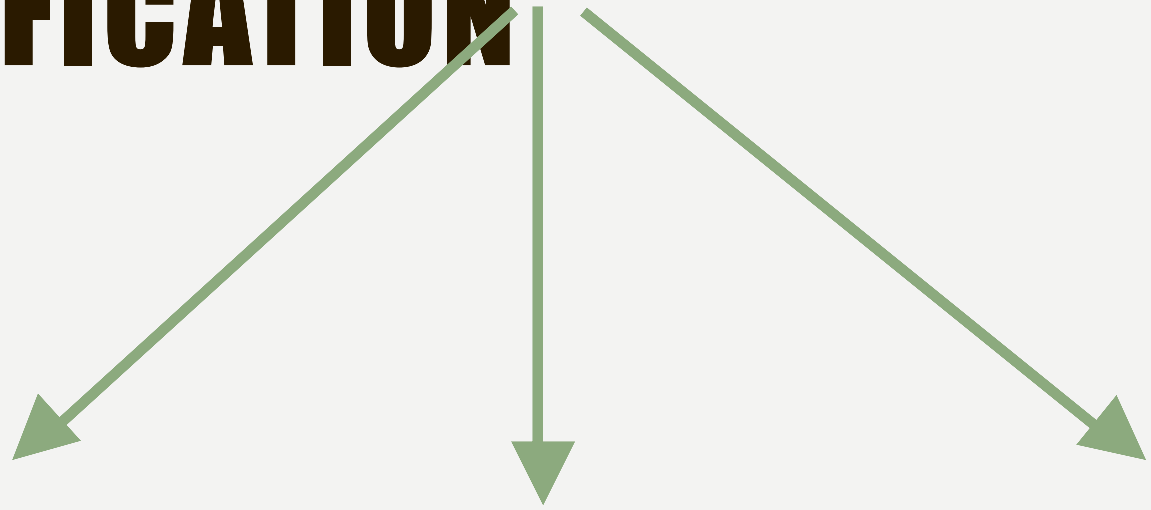
Mobile apps can be:

- Adware: Displays advertisements on other apps
- Chargeware: Charges for services without explicit notification
- Riskware: Reduces device security
- Spyware: Gathers information for another party
- Trojans: Features useful and unadvertised malicious intent

MALICIOUS SOFTWARE

- programs exploiting system vulnerabilities
- known as malicious software or malware
  - program fragments that need a host program
    - e.g. viruses, logic bombs, and backdoors
  - independent self-contained programs
    - e.g. worms, bots
  - replicating or not
- sophisticated threat to computer systems

MALWARE PROPAGATION CLASSIFICATION

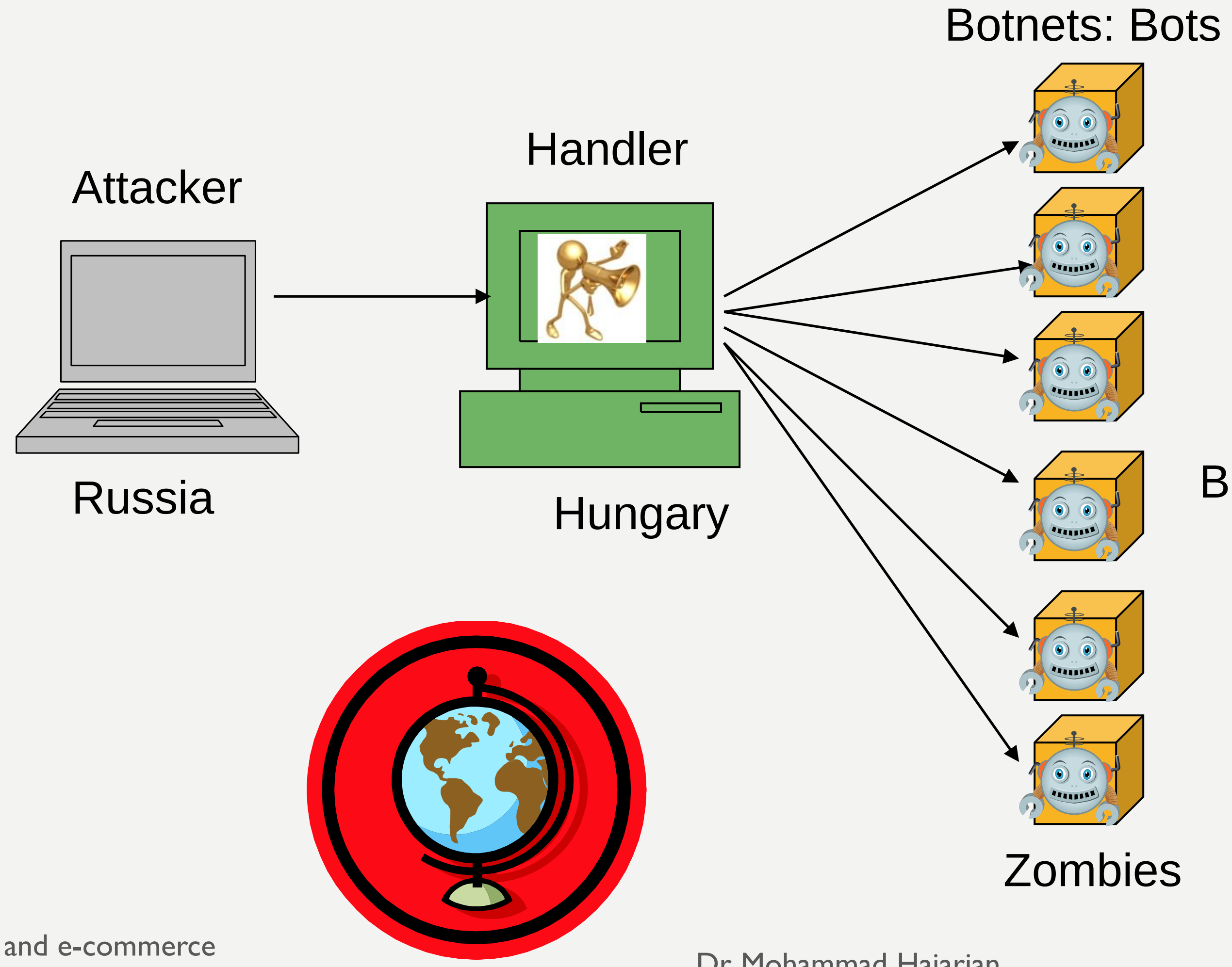


Infection
Of Executable
(e.g., Virus)

Exploit of
Software
Vulnerability
(SQL Attack,
Worm)

Social Engineering
(E.g., Phishing,
Pretexting
Watering hole,
Trojans)

BOTNETS: COMMAND AND CONTROL



Botnets: Bots

Attacker

Russia

Handler

Hungary

Zombies

Bots: Host illegal movies, music, pornography, criminal web sites, …

Forward Spam for financial gain

Sniffing traffic or Keylogging

DDOS, spread bots

Manipulate voting games

Generate clicks for ads

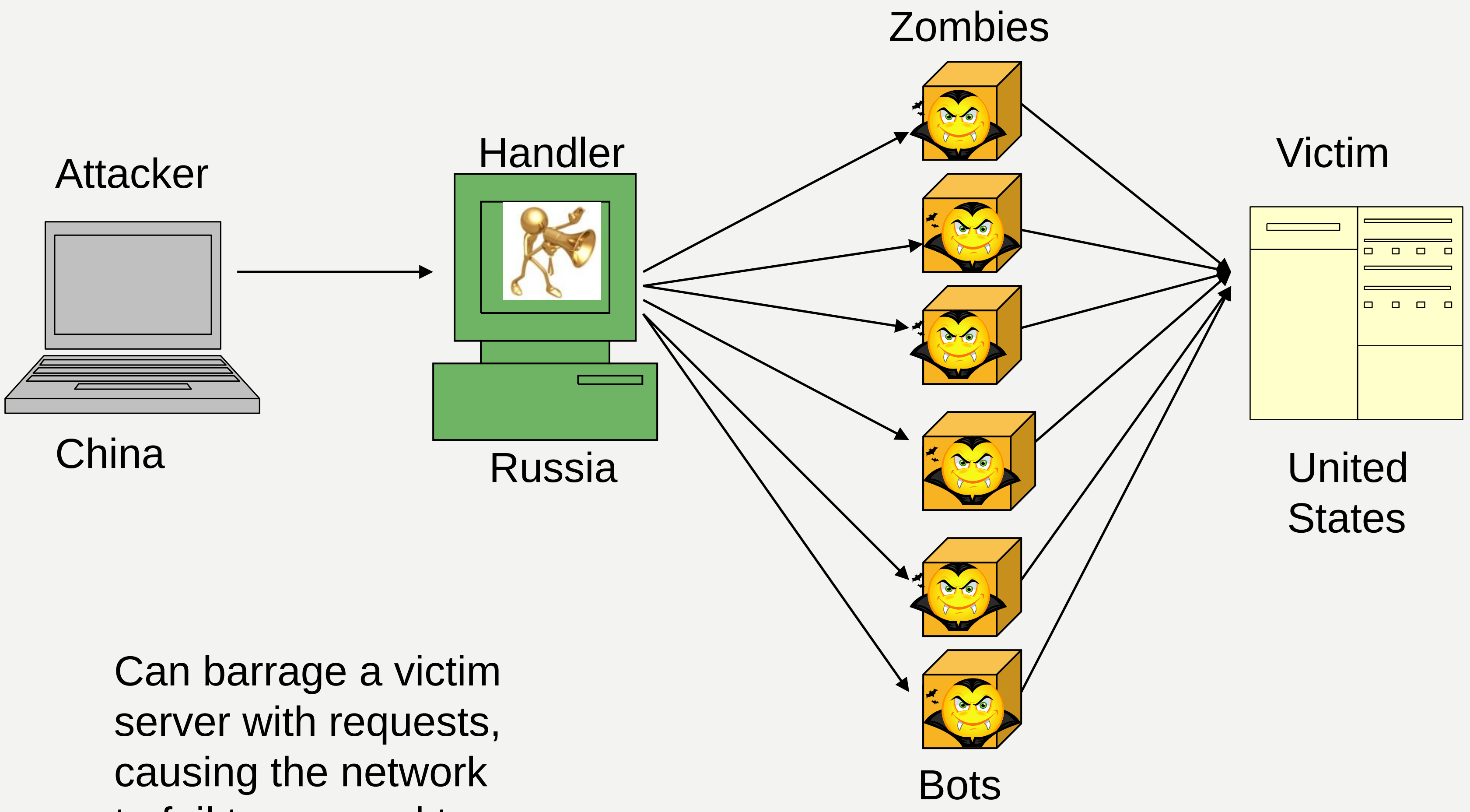
BOTS: COMMAND & CONTROL

- program taking over other computers
- hard to trace attacks
- if coordinated form a botnet
- characteristics:
  - remote control facility
    - via IRC/HTTP etc
  - spreading mechanism
    - attack software, vulnerability, scanning strategy
- various counter-measures applicable

BOT USES

- DDOS attacks
  - E.g., Internet Relay Chat overload
- Spamming
- Spying
  - Sniffing traffic
  - Keylogging
- Malware abuse
  - Spread malware
  - Install advertisement add-ons: pay-for-clicks
  - Manipulating online games

DISTRIBUTED DENIAL OF SERVICE

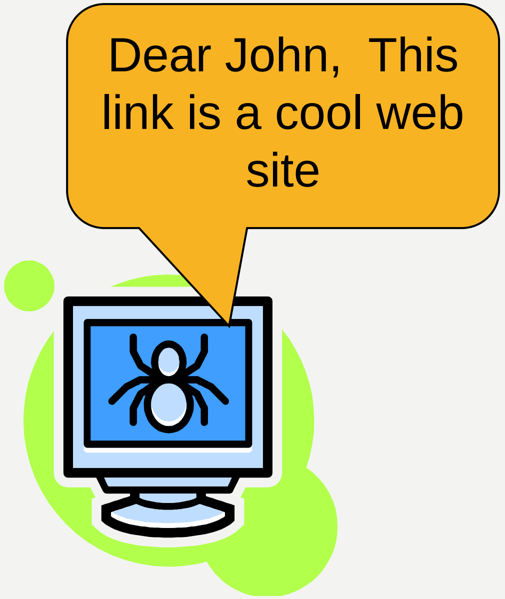


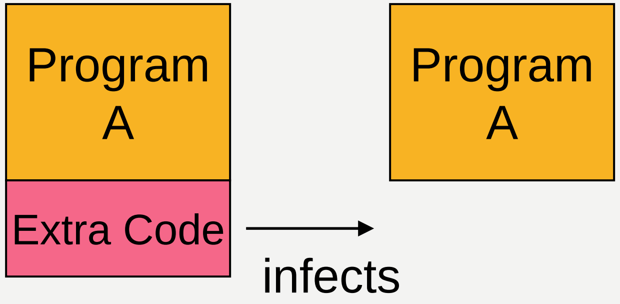
Can barrage a victim server with requests, causing the network to fail to respond to anyone

Flooder

VIRUS

- A virus attaches itself to a program, file, or disk
- When the program is executed, the virus too is executed
- When the program is given away (floppy/email) the virus spreads
- The virus may be benign or malignant but executes its load pay at some point (often upon contact)





Program A

Extra Code

infects

Program A

VIRUSES

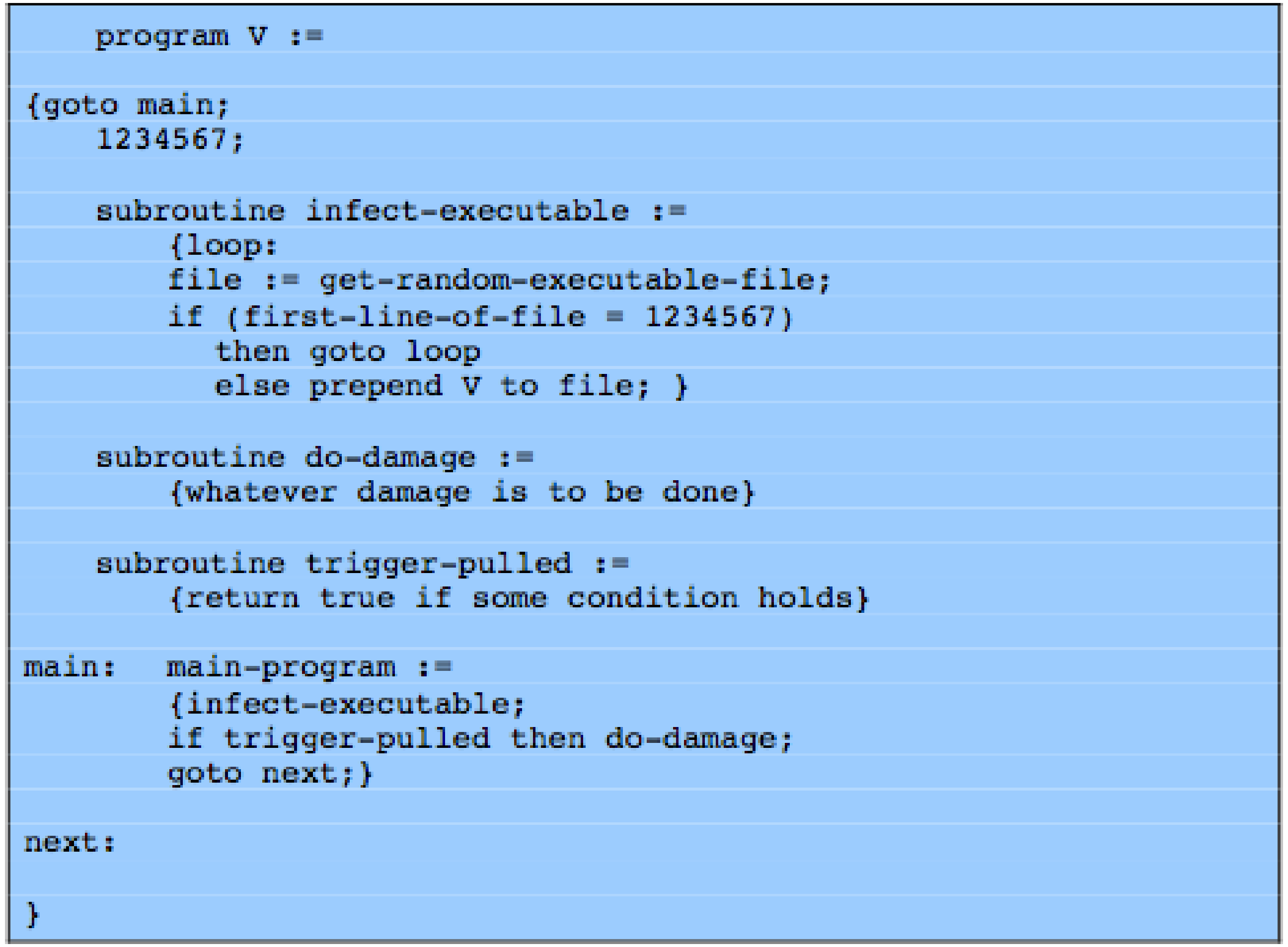
- piece of software that infects programs
  - modifying them to include a copy of the virus
  - so it executes secretly when host program is run

- a typical virus goes through phases of:
  1. Dormant: Wait for file presence, date, event,…
  2. Propagation: Spreading technique
  3. Triggering: Complete full intention
  4. Execution: Harmless or harmful

VIRUS STRUCTURE

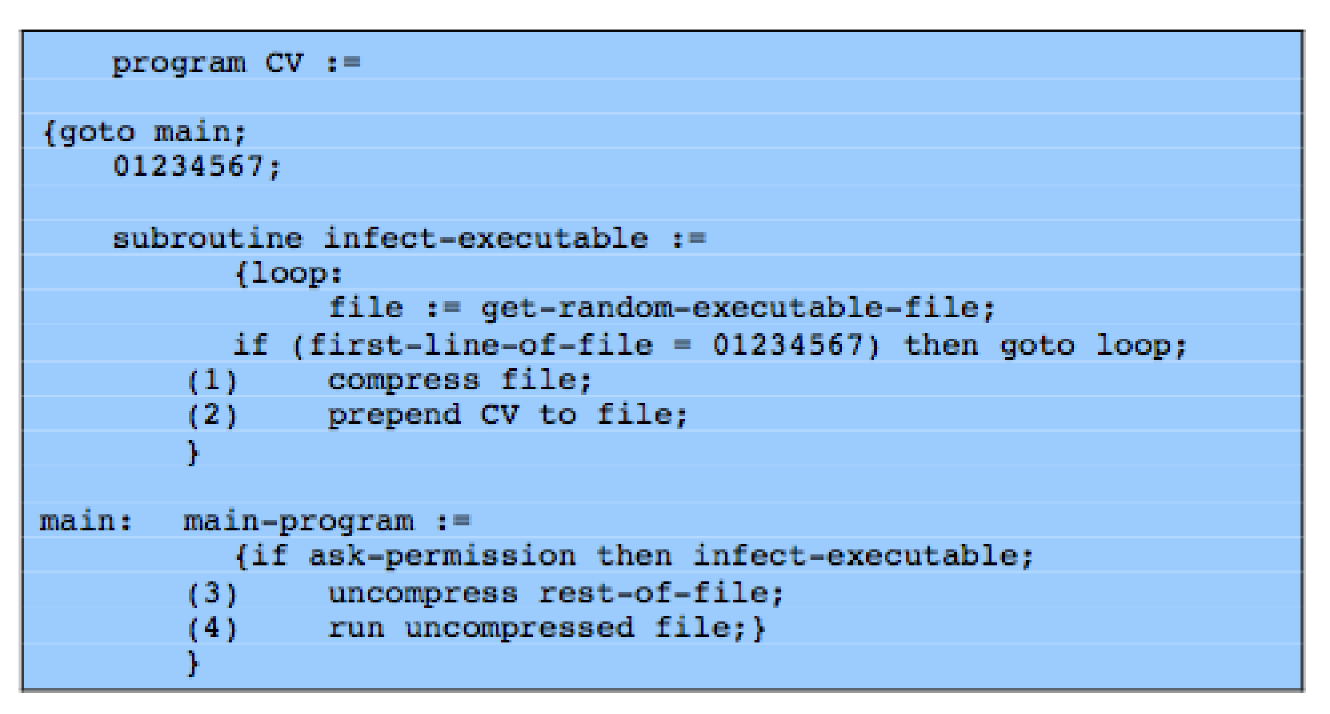
- components:
  - infection mechanism - enables replication
  - trigger - event that makes payload activate
  - payload - what it does, malicious or benign
- prepended / postpended / embedded
- when infected program invoked, executes virus code then original program code
- can block initial infection (difficult)
- or propogation (with access controls)

VIRUS STRUCTURE

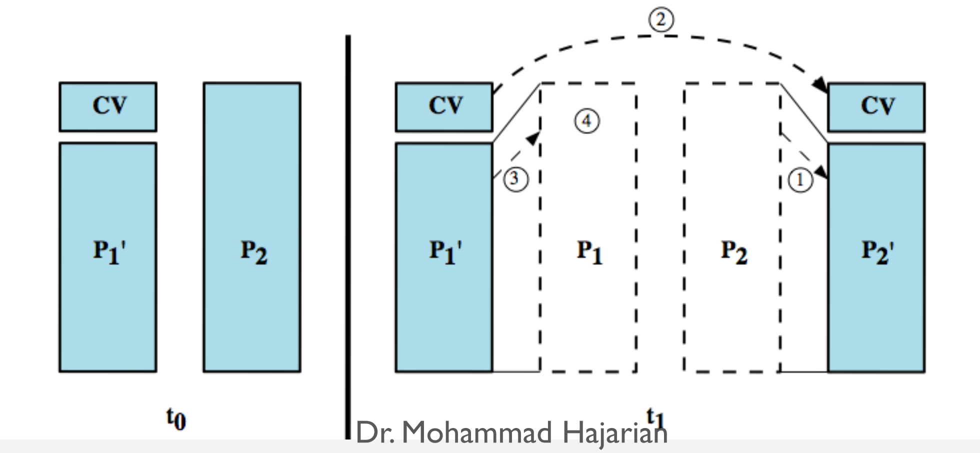


```
    program V :=

{goto main;
    1234567;

    subroutine infect-executable :=
        {loop:
        file := get-random-executable-file;
        if (first-line-of-file = 1234567)
          then goto loop
          else prepend V to file; }

    subroutine do-damage :=
        {whatever damage is to be done}

    subroutine trigger-pulled :=
        {return true if some condition holds}

main:   main-program :=
        {infect-executable;
        if trigger-pulled then do-damage;
        goto next;}

next:

}
```

COMPRESSION VIRUS



```
    program CV :=

{goto main;
    01234567;

    subroutine infect-executable :=
          {loop:
               file := get-random-executable-file;
          if (first-line-of-file = 01234567) then goto loop;
        (1)    compress file;
        (2)    prepend CV to file;
        }

main:   main-program :=
          {if ask-permission then infect-executable;
        (3)    uncompress rest-of-file;
        (4)    run uncompressed file;}
        }
```



VIRUS TARGET CLASSIFICATION

- **boot sector:** Spreads when system is booted from disk containing virus
- **macro virus**: Inserted in application file as script (e.g., MS Word doc.)
- **file infector**: Infects executable in OS or shell
- **multipartite**: Infects multiple ways/files
  - Difficult to clean, eradicate

VIRUS CONCEALMENT STRATEGIES

- **encrypted virus:** Uses a random key to encrypt virus, and stores key with virus
- **stealth virus**: Hides via encryption, file sizing, virus location, rootkit
- **polymorphic virus**: Mutates new virus with each infection
- **metamorphic virus:** Changes itself with each iteration; also polymorphic

MACRO VIRUS

- became very common in mid-1990s since
  - platform independent
  - infect documents
  - easily spread
- exploit macro capability of office apps
  - executable program embedded in MS Office doc
  - often a form of Basic
- more recent releases include protection
- recognized by many anti-virus programs

E-MAIL VIRUSES

- more recent development
- e.g. Melissa
  - exploits MS Word macro in attached doc
  - if attachment opened, macro activates
  - sends email to all on users address list
  - does local damage
  - had no Dormant phase -> faster propagation
    - 100k computers in 3 days

BRAIN VIRUS

- Lodges in upper memory then sets upper memory bound below itself
- Replaces interrupt vector for disk reads to screen disk read calls. Calls interrupt handler after screening.
- Places itself in the boot sector and six other sectors on disk
- Marks sectors as ‘bad’ so they will not get overwritten.
- Variants erase disks or destroy file allocation table

VIRUS COUNTERMEASURES

- prevention - ideal solution but difficult
- realistically need:
  - detection
  - identification
  - removal
- if detect but can’t identify or remove, must discard and replace infected program
- But what has cracker done in the mean time?

ANTI-VIRUS EVOLUTION

- virus & antivirus tech have both evolved
- early viruses simple code, easily removed
- more complex viruses -> more complex countermeasures
- 4 generations:
  - first - signature scanners
  - second – heuristics
    - Integrity checking & fragment recognition
  - third - identify actions (e.g., decompression)
  - fourth - combination packages
    - Limit access control to system & files

Antivirus, Antispyware

ANTIVIRUS

- Scheduled scans
- Antivirus updates
- Real-time file access protection
- E-mail protection
- Popular: Norton, McAfee,Panda, Fprot, AVG

ANTISPYWARE

- Real-time protection
- Scheduled scans
- Browser hijack protection
- Auto updates
- Popular: Spybot, Ad-aware, MS Windows Defender

All-in-one also includes

- URL Filter
- Content inspection: packet content

Q/A

- End of Session 1

THANK YOU!