Lecture Notes

CS 419: Computer Security

Week 1: Part 3

Internet-Enabled Threats

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How the Internet Creates Vulnerabilities

- **Action at a distance**
- **Asymmetric force**
- **Actors can be anonymous**
- **No borders or checkpoints**
- **No distinction**
  - Hard to distinguish valid data from attacks
  - Can’t tell what code will be harmful until it’s executed

Action at a Distance

People can now be beyond our control or visibility.

Asymmetric Force

> Information Technology has “opened up a whole new asymmetry in future warfare”
>
> – *William J. Lynn III, Deputy Defense Secretary, 2010*

- The Pentagon’s 15,000 networks and 7+ million computers are being probed thousands of times daily
- Traditional deterrence models of retaliation do not apply in cyberspace

Asymmetric Force

- Actors can project or harness greater force. Low barriers to entry. Offense can be more effective than defense. A small number of actors can have a large effect.
- E.g., The *Anonymous* hacking group that tries to take down corporations or governments, attackers who send fraud or spam email, or those who send Facebook requests for money.
- Sending millions of messages costs almost nothing.
- Distributed Denial of Service (DDoS) attacks allow rogue actors to overwhelm large companies and nation states
  - Small countries can now inflict damage on countries like the US or China.

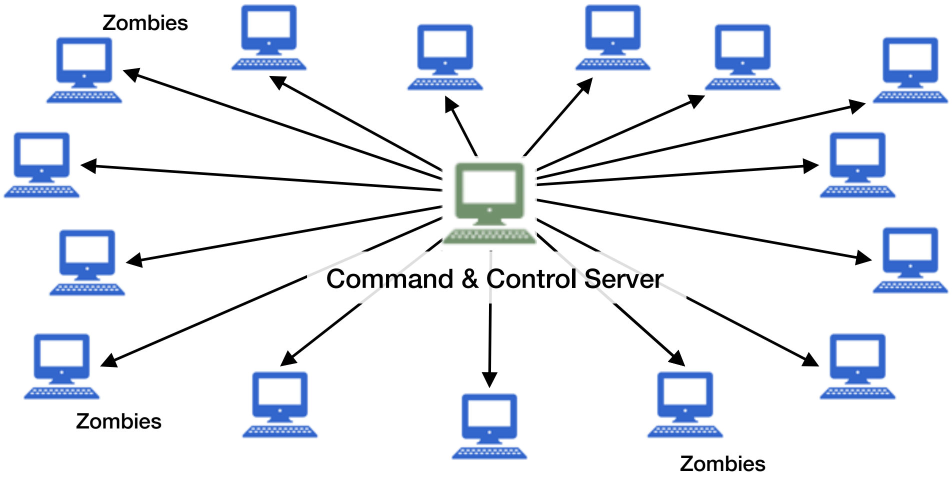
Botnets

Botnet: collection of computers owned by innocent people but infected with malicious software

- Botnet software periodically contacts a command & control server for directions on what additional software to download and what to run and whom to attack

Three common uses are:

1. Distributed Denial of Service (DDoS) attacks
   - One company has only so many servers
   - Send too much traffic to the servers and the server gets overloaded
   - Now nobody can get through – even legitimate traffic
   - Data is not destroyed but service is disrupted
   - Attacks come from the network of zombies
2. Spamming/phishing
   - Send tens of millions of malicious emails or texts
3. Cryptocurrency mining
   - Use the computing power of the zombies



Some large botnets

- **911 S5:**
  - >19 million compromised machines
  - Deployed via malicious VPN software.
  - Sold as ransomware-as-a-service.
  - Taken down by FBI in 2024
- **Srizbi Botnet:**
  - ~450,000 compromised machines
  - Responsible for sending out more than half of all the spam being sent by all the major botnets combined.
  - Crippled in 2008 by Estonian ISP
- **Emotet Botnet:**
  - ~1.6 millioj compromised machines
  - Distributed as an email attachment from infected computers.
  - Eight countries worked to take this down in 2021

Mēris Botnet – 2021 - present

- Exploited a 2018 bug in routers from Latvian vendor MikroTik
  - Winbox, a management component and a Windows GUI application for MikroTik's RouterOS
  - Allowed attackers to write files in the router, reconfiguring it for remote access
  - Only 30% of routers were had a patch applied
- Estimated 250,000 MikroTik routers were hacked
- The Meris botnet broke the record for the largest volumetric DDoS attack twice in 2021
- Attacks
  - Targets 50 different websites every single day with a daily average of 104 unique DDoS attacks
  - Top targets are banking, financial services, and insurance companies
  - 21.8 million RPS (requests per second) attack at a Russian bank hosting infrastructure on Yandex servers
  - 33%+ of attack traffic targeted China-based sites

https://blog.cloudflare.com/meris-botnet

https://cybernews.com/security/weve-seen-just-the-tip-of-the-meris-botnet-iceberg/

2023 China/Russia access U.S. govt emails/networks

China

- Chinese-backed hackers accessed email of U.S. State Department officials and Commerce Secretary Gina Raimondo
- Exploited a vulnerability in Microsoft email systems
- Microsoft investigators identified the infiltrators as Storm-0558, a group that targets government agencies in Western Europe

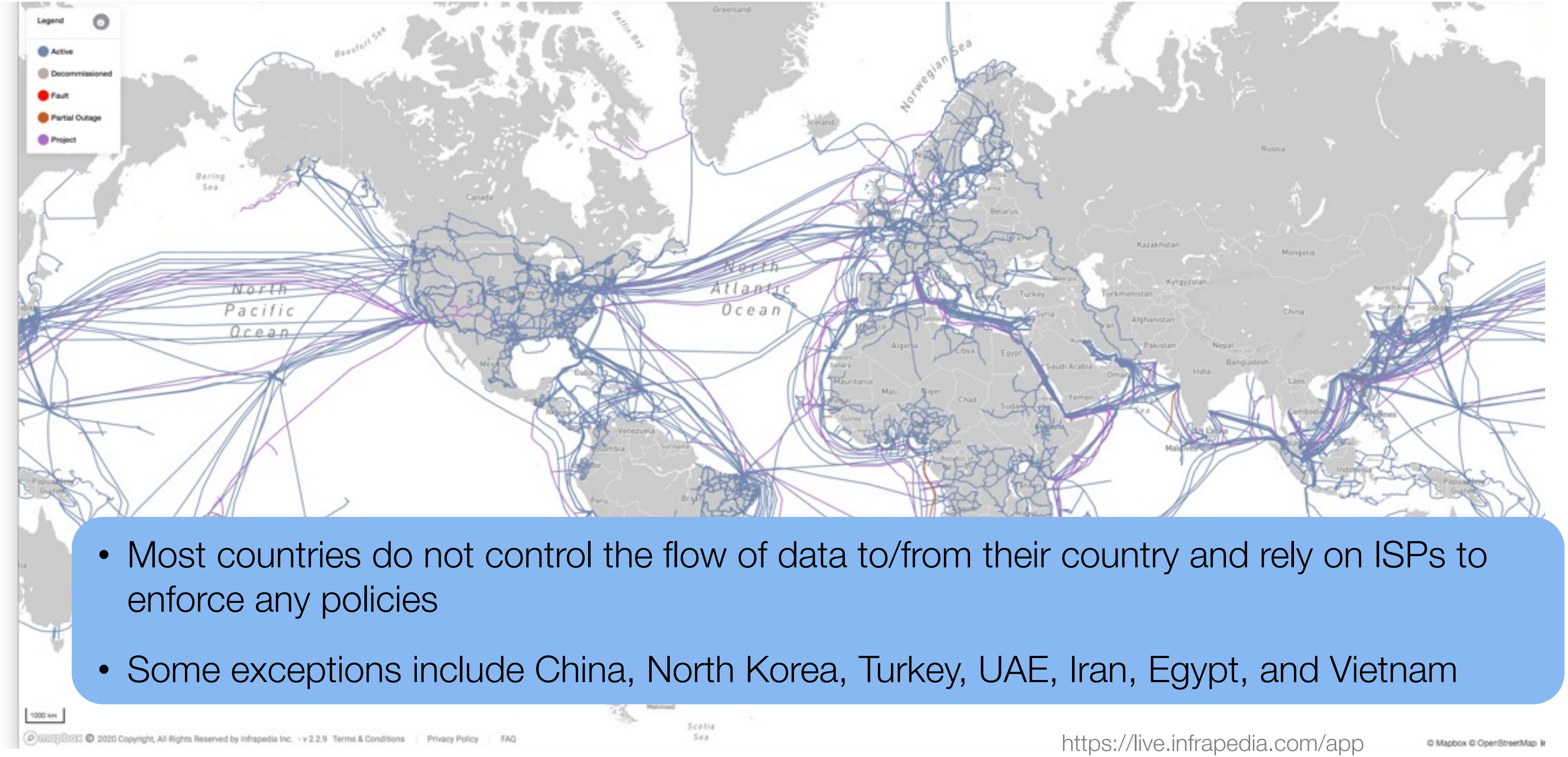
- **Russia**
  - Russia-linked cybercriminal group CLoP breached networks at various U.S. agencies
  - Exploited a vulnerability in the MOVEit file transfer program
  - CLoP began stealing files Sept 2022 and gave agencies to June 2023 to respond to its ransom demands

https://www.politico.com/news/2023/07/12/chinese-hackers-government-emails-microsoft-breach-00105879
https://www.politico.com/news/2023/06/15/multiple-federal-agencies-hit-by-hack-00102229

Anonymity

- **Internet protocols don't require identification**
- **We often can't identify the attacker**
  - Nobody knows who ran some of the biggest botnets or cyber-attacks
  - Identifying a source can be difficult
  - *Attack with impunity. We won't know who fired the missile.*
- **Make guesses**
  - Reverse engineer the code, compare to other known malware and attacks
  - Identify the location of the command & control server & who is accessing it
  - Trace packets & propagation paths
- **Sometimes we will never know**
- **Trust becomes a challenge**
  - How do you know you are really communicating with your bank? How does the bank know it's you?

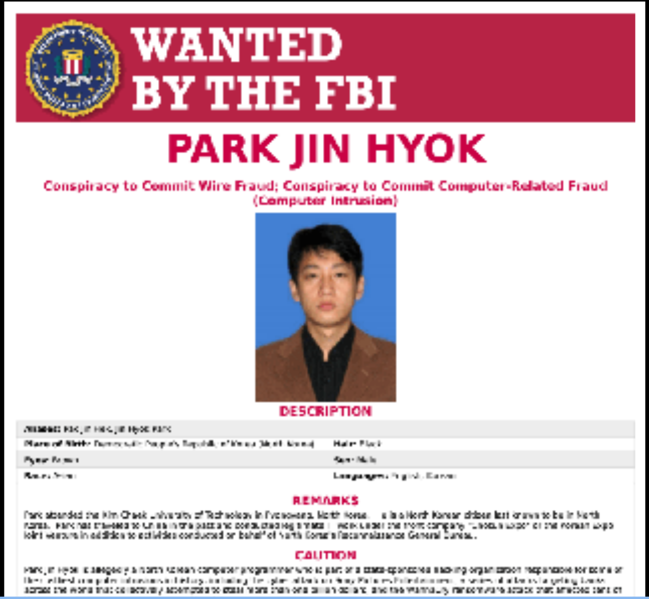
Lack of Borders & Checkpoints



- Most countries do not control the flow of data to/from their country and rely on ISPs to enforce any policies
- Some exceptions include China, North Korea, Turkey, UAE, Iran, Egypt, and Vietnam

https://live.infrapedia.com/app

We expect you to show up in court…



WANTED BY THE FBI

PARK JIN HYOK

Conspiracy to Commit Wire Fraud; Conspiracy to Commit Computer-Related Fraud (Computer Intrusion)

DESCRIPTION

Aliases: Pak Jin Hek, Jin Hyok Park	
Place of Birth: Democratic People's Republic of Korea (North Korea)	Hair: Black
Eyes: Brown	Sex: Male
Race: Asian	Languages: English, Korean

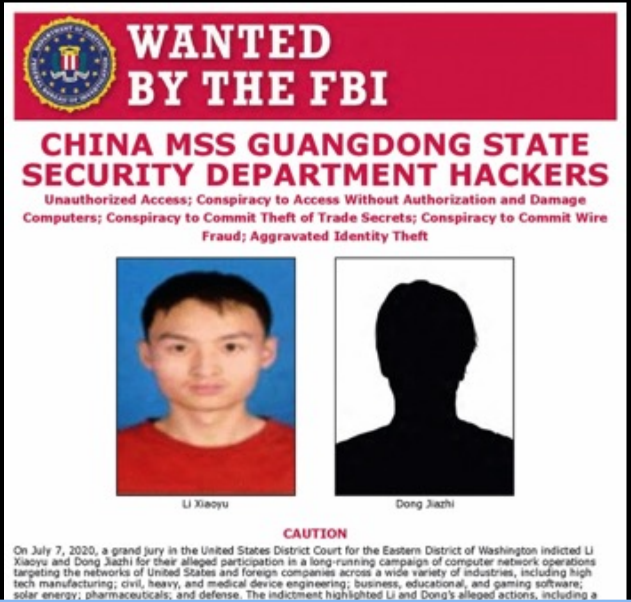
REMARKS

Park attended the Kim Chaek University of Technology in Pyongyang, North Korea. [illegible] is a North Korean citizen last known to be in North Korea. Park has traveled to China in the past and conducted hacking [illegible] work under the front company [illegible] of the Korean Expo Joint Venture in addition to activities conducted on behalf of North Korea's Reconnaissance General Bureau.

CAUTION

Park Jin Hyok is allegedly a North Korean computer programmer who is part of a state-sponsored hacking organization responsible for some of the [illegible] computer intrusions in history, including the cyber attack on Sony Pictures Entertainment, [illegible] across the world that collectively attempted to steal more than one billion dollars, and the WannaCry ransomware attack that affected tens of

Allegedly part of hacking team responsible for WannaCry ransomware, attack on Sony Pictures, and others



WANTED BY THE FBI

CHINA MSS GUANGDONG STATE SECURITY DEPARTMENT HACKERS

Unauthorized Access; Conspiracy to Access Without Authorization and Damage Computers; Conspiracy to Commit Theft of Trade Secrets; Conspiracy to Commit Wire Fraud; Aggravated Identity Theft

Li Xiaoyu

Dong Jiazhi

CAUTION

On July 7, 2020, a grand jury in the United States District Court for the Eastern District of Washington indicted Li Xiaoyu and Dong Jiazhi for their alleged participation in a long-running campaign of computer network operations targeting the networks of United States and foreign companies across a wide variety of industries, including high tech manufacturing; civil, heavy, and medical device engineering; business, educational, and gaming software; solar energy; pharmaceuticals; and defense. The indictment highlighted Li and Dong's alleged actions, including a

Allegedly responsible for stealing terabytes of data, including coronavirus research, from western companies in 11 nations

Lack of Distinction in Data

- All bits look the same
- How can you tell which data is malicious?

Networked Computer vs. Real-World Risks

- **Physical world risks are low (for most of us)**
  - Most people are not attacked
  - Most people are not victims of espionage
- **Same threats in cyberspace as real-world threats:**
  - Theft, vandalism, extortion, fraud, coercion, con games
- **Same motivation by criminals**
  - But the mechanisms, risks, and access are different

The End