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Introduction to Cybersecurity

History of Cybersecurity

Safeguarding against Phishing in the age of 4th Industrial Revolution
www.cyberphish.eu
This project has been funded with support from the European Commission.
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Learning Goals

Learn a brief history of how approaches to cyber-attacks have changed over time, leading to increased measures and hence the counter measures against cyber-attacks

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Student Workload

Lecture	1 h
Audio and video material	1 h
Case studies	1 h
Further reading	2 h
Preparation for exam	1 h

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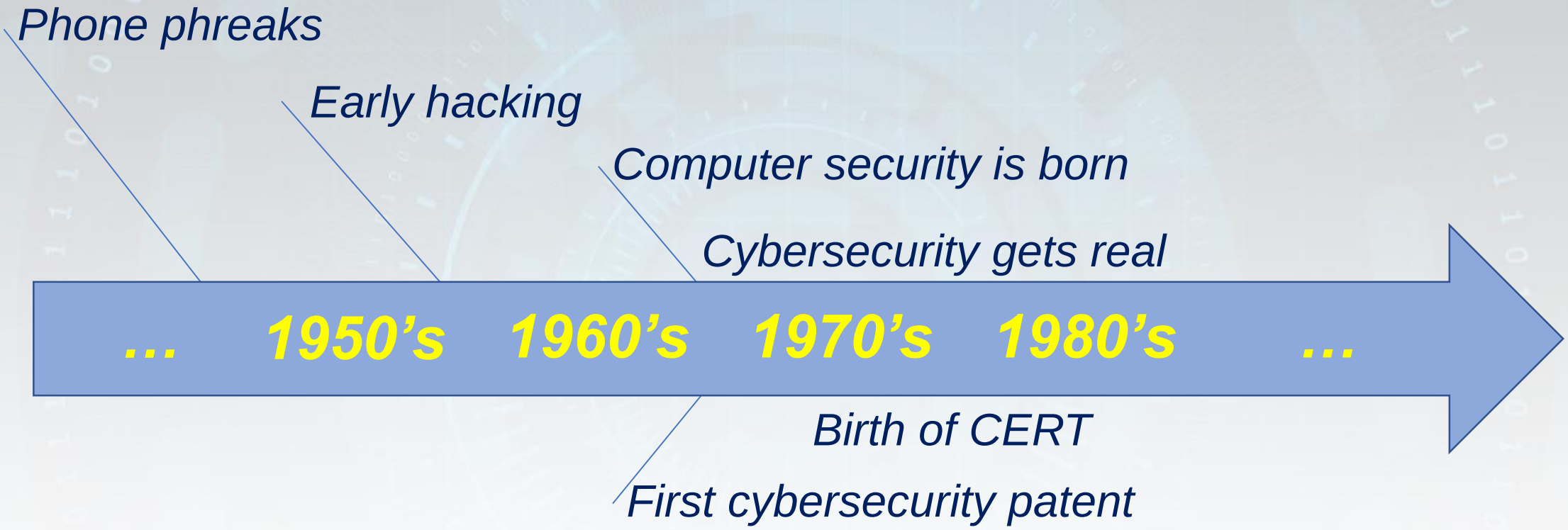
Phone phreaks
Early hacking
Computer security is born
Cybersecurity gets real
… 1950's 1960's 1970's 1980's …
Birth of CERT
First cybersecurity patent

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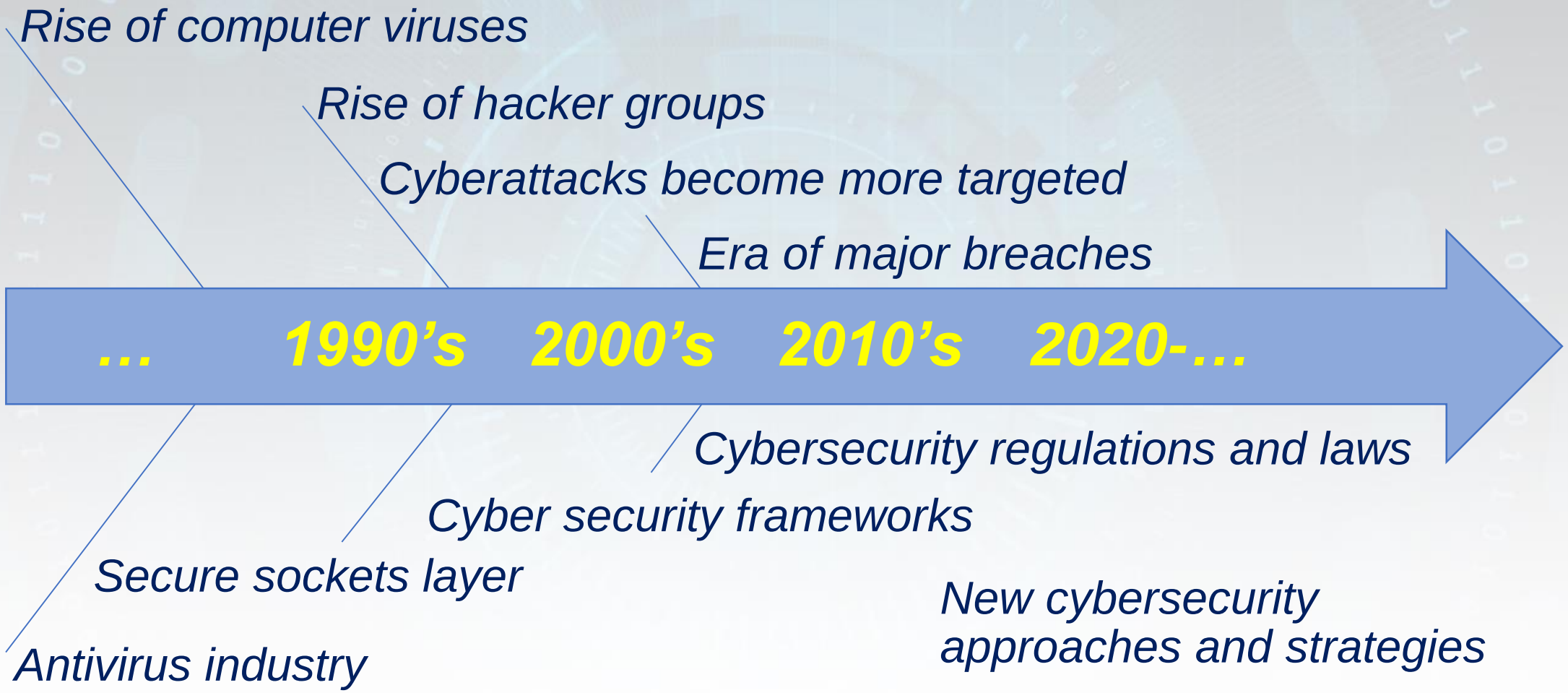

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Phone Phreaks

In the 1950's, phones were the cutting-edge of technology

- **Phone phreaks**
  - Learned to control the phone lines by listening to the sounds as calls were connected by operators
  - Read phone company technical journals
  - Breaking into offices to develop their own hardware

[*Lapsley, 2013*]

Phone phreaks were starting the hacking mindset before there was a computer around to hack

Early Hacking

In the 1960's, computers were giant mainframes, locked in rooms

Hacking developed as a positive practice intended to help computer systems improve

This resulted in some of the first ideas for defensive programs that could stop hackers

https://blog.avast.com/history-of-cybersecurity-avast

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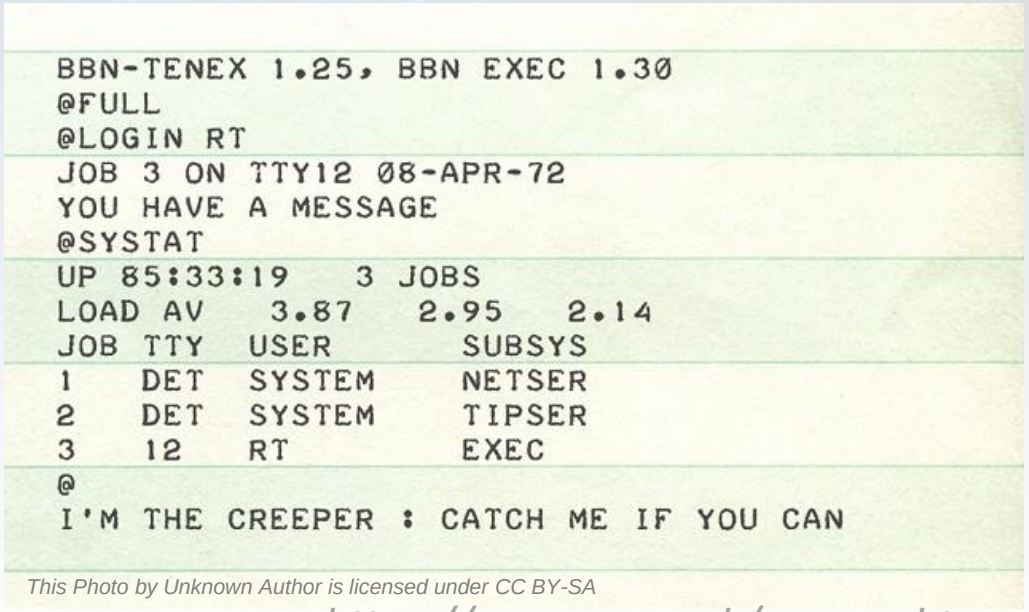
Computer Security is Born

1971: **I am the creeper: catch me if you can**

- Researcher **Bob Thomas** created a **Creeper** that could move across ARPA network
- **Ray Tomlinson** wrote the **Reaper**, which chased and deleted Creeper
  - Reaper was the very first example of antivirus software
  - Reaper was also the first self-replicating program, making it the first-ever computer worm



https://corewar.co.uk/creeper.htm

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https://www.javatpoint.com/history-of-cyber-security

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First Cybersecurity Patent

1983: Cryptographic Communications System and Method

RSA

- Granted to the Massachusetts Institute of Technology (MIT)
  - **RSA** (Rivest-Shamir-Adleman) algorithm, which was one of the first public key cryptosystems

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https://www.secureworld.io/industry-news/historic-hacking-brief-history-cybersecurity

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Cybersecurity Gets Real

Hacking became an issue of national security in the 1980's

- In 1986, **Marcus Hess**, a German citizen, hacked into **400 military computers**
  - He intended to sell secrets to the KGB
- Attack method
  - Used Lawrence Berkeley Laboratory (LBL) to "***piggyback***" to ARPANET and MILNET
- An astronomer, **Clifford Stoll**, used ***honeypot*** to detect the intrusion and foil the plot

Birth of CERT

1988: Morris worm or Internet worm – the first network virus

- **The Morris worm**
  - The program went through networks, invaded Unix terminals, and copied itself
  - Infected a computer multiple times
  - Each additional process would slow the machine down, eventually to the point of being damaged

- R. Morris was charged under the **Computer Fraud and Abuse Act**
  - The act itself led to the founding of the **Computer Emergency Response Team**, *a.k.a.*, **CERT**

https://www.javatpoint.com/history-of-cyber-security

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The 1990's: Rise of Computer Viruses

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- Inadequate security solutions caused a huge number of unintended victims to be affected
- Most of the virus attacks were primarily concerned with financial gains or strategic objectives

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May 2000: *I LOVE YOU*

- **An email message**
  - subject line "ILOVEYOU" and
  - attachment "LOVE-LETTER-FOR-YOU.txt.vbs"
- **Opening the attachment**
  - activates the Visual Basic script
    - Overwriting image files,
    - Sent a copy of itself to the first 50 addresses in the Windows Address Book used by Microsoft Outlook

https://en.wikipedia.org/wiki/ILOVEYOU

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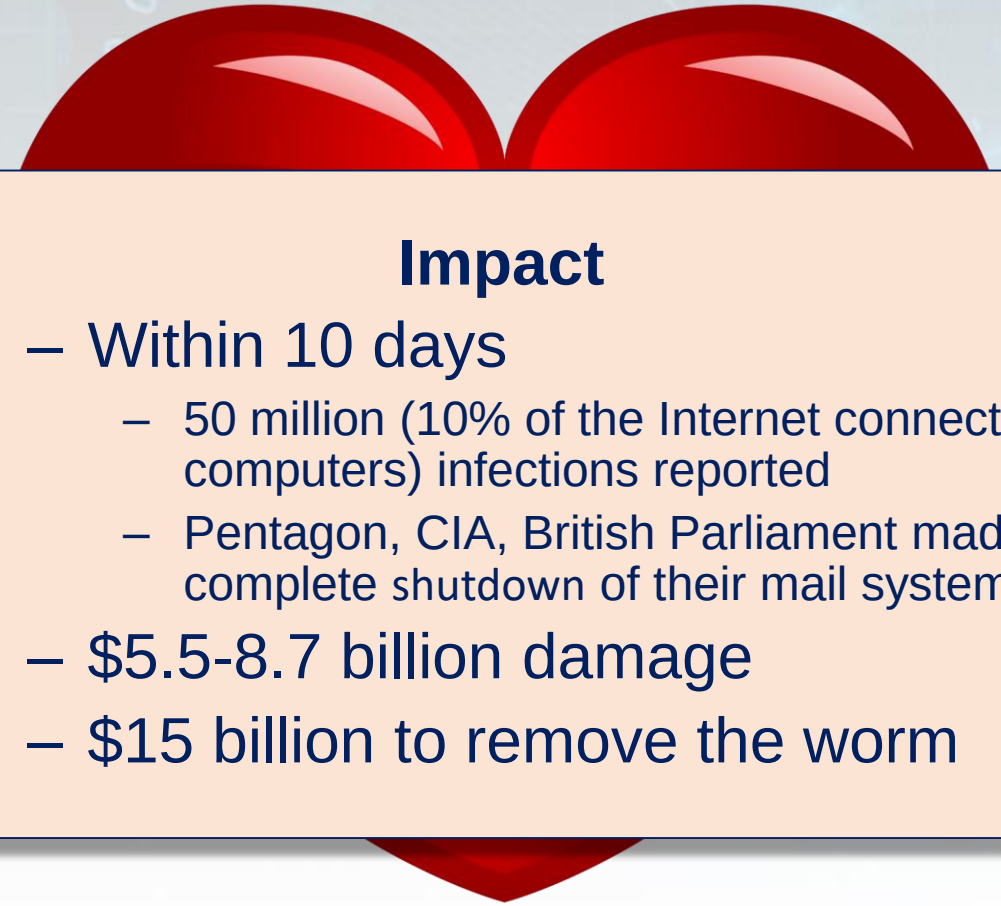
May 2000: *I LOVE YOU*



Impact

- Within 10 days
  - 50 million (10% of the Internet connected computers) infections reported
  - Pentagon, CIA, British Parliament made a complete shutdown of their mail systems
- $5.5-8.7 billion damage
- $15 billion to remove the worm

Success

- Scripting engine is enabled
- Advantage of Microsoft algorithm to hiding file extensions
- Social engineering
- Microsoft design weakness
  - Access to operating systems
  - Secondary storage

Pet Shop Boy's "E-mail"
https://youtu.be/AEF8hAAm_sg

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Antivirus Industry

The early 1990s: a sharp growth of antivirus products

Growth of malware programs
from **few thousands** in the 1990s to **at least 5 million** by the year 2007

- First commercial antivirus programs in 1987:
  - Antivirus for the Atari ST
  - The NOD antivirus
  - McAfee VirusScan
- Antivirus programs **scanned** and **tested** IT systems with ***signatures*** written in a database
  - An intensive use of resource
  - A large number of false positive

- **Endpoint protection platforms**
  - Identify ***malware families***
  - Premise: malware samples deviate from existing samples
  - Possible to detect and stop unknown malware since only a signature of other existing malware was required

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https://cyberexperts.com/history-of-cybersecurity/

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Secure Sockets Layer

1995: SSL rears its head

- **SSL**
  - Developed by Netscape shortly after released of the first internet browser
  - Core for developing languages such as HyperText Transfer Protocol Secure (HTTPS)
  - Enables users to access the web securely and perform activities such as online purchases

Rise of Hacker Groups

2003: Anonymous – the first hacker group

Anonymous – October 1, 2003:

- First: hacked a website belonging to the *Church of Scientology* using **DDoS**
- Doesn't have a particular leader
- Members from different offline and online communities
- To date – linked to many high-profile attack incidents
- Main cause is protecting citizens' privacy
- Motivated other groups to execute large-scale cyberattacks
  - *Lazarus* and *Apt38*, etc

Credit Card Hacks

Between 2005 and 2007: cyberattacks more targeted

- **Albert Gonzales**:
  - Created a cybercriminal ring
  - Compromise credit card systems
  - Confidential information from at least ***45.7*** million cards
  - Loss amounting to ***$256*** million
  - Funds to compensate the affected victims

TJX was unprotected when the breach occurred and other organizations saw this as a cue for protecting themselves with sophisticated cybersecurity program

https://cyberexperts.com/history-of-cybersecurity/

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The 2010s: Era of Major Breaches

- **Snowden & The NSA, 2013**:
  - former CIA employee and contractor for the US Government – copied and leaked classified information from the National Security Agency (NSA)
  - highlighted the fact that the government was "spying" on the public
- **Yahoo, 2013 – 2014**:
  - Hackers used ***spear-phishing*** techniques to install malware on Yahoo's servers, allowing them unlimited backdoor access
  - Jeopardise the accounts and personal information of ***three billion*** users
  - Yahoo was fined ***$35*** million for failing to disclose news of the breach
  - Sale price decreased by ***$350*** million as a result
- **WannaCry ransomware cryptoworm, 2017**:
  - Targeted computers running the Microsoft Windows operating system
  - Demanded ransom payments in the Bitcoin cryptocurrency
  - In only one day, the worm infected over ***230.000*** across ***150*** countries

https://www.ifsecglobal.com/cyber-security/a-history-of-information-security/

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May 12-15, 2017: *WannaCry*

- Microsoft design weakness
  - Propagated through EternalBlue
  - Took advantage of installing backdoors onto infected systems
- While Microsoft had released patches
  - Organizations had not applied these, or were using older Windows systems

https://www.avast.com/c-wannacry

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Cybersecurity Frameworks

- **Standards**
  - ISO/IEC 2700x series
  - NIST special publication
  - BSI standard 100 for information security
  - Common criteria
  - …
- **Techniques**
  - Misuse cases
  - Mal-activity diagrams
  - SecureUML
  - UMLsec
  - Agile security requirements engineering

- **Frameworks**
  - Framework for security requirements engineering: representation and analysis
  - Security-by-ontology: a knowledge-centric approach
  - …
- **Processes**
  - CC-based security engineering process
  - Security requirements for software product lines
  - Requirements reuse for improving system security
  - …
- **Methods**
  - Secure Troops
  - SQUARE
  - SREBP
  - …

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Cybersecurity Regulations and Laws

1996: **HIPPA** – Health Insurance Portability and Account Act

1999: **GLBA** – Gramm-Leach-Bliley Act

2003: **FISMA** – Federal Information Security Management Act

2018: **GDPR** – General Data Protection Regulation

2020: **CCPA** – California Consumer Privacy Act

New Cybersecurity Approaches and Strategies

- **MFA** – multi-factor authentication
- **NBA** – network behavioural analysis
  - identify malicious files based on behavioural deviations or anomalies
- **Threat intelligence** and update automation
- **Real-time protection**
  - on-access scanning, background guard, resident shield and auto-protect
- **Sandboxing**
  - an isolated test environment to execute a suspicious file or URL
- **Forensics**
  - replaying attacks to help security teams better mitigate future breaches
- **Back-up** and mirroring
- **WAF** – Web application firewalls
  - against cross-site forgery, cross-site-scripting (XSS), file inclusion, and SQL injection.

https://blog.avast.com/history-of-cybersecurity-avast

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Summary

- Phone phreaks
- Early hacking
- Cyber security is born
- Computer virus
- Hacker groups
- Major breaches
- Cybersecurity patent
- CERT
- Antivirus industry
- SSL
- Security frameworks
- Regulations and laws

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Assignments

Discuss what lessons should be learnt from the Phone Phreaks cases

Compare ***I LOVE YOU*** and ***WannaCry*** attacks

Which Cybersecurity frameworks have you studied or read about?

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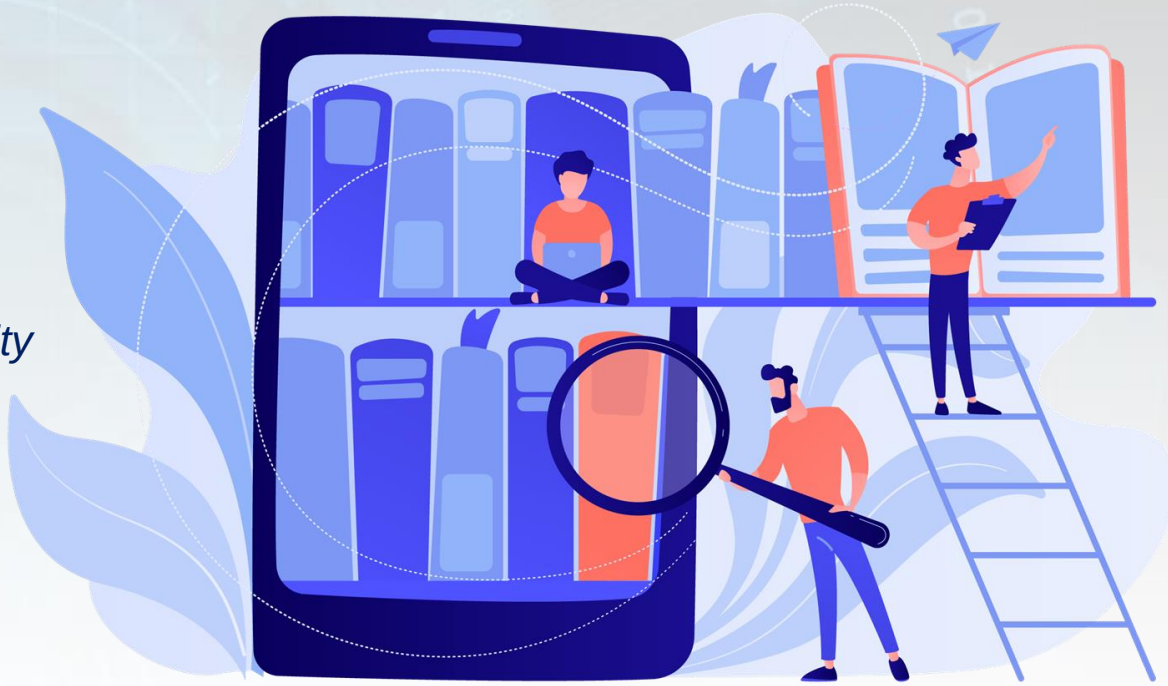
Further Reading

History of Cybersecurity

Material used in preparation of this lecture

- *https://cyberexperts.com/history-of-cybersecurity/*
- *https://elevenfifty.org/blog/a-decade-by-decade-history-of-cybersecurity/*
- *https://www.secureworld.io/industry-news/historic-hacking-brief-history-cybersecurity*
- *https://www.jigsawacademy.com/blogs/cyber-security/cyber-security-history*
- *https://www.javatpoint.com/history-of-cyber-security*
- *https://blog.avast.com/history-of-cybersecurity-avast*
- *https://www.ifsecglobal.com/cyber-security/a-history-of-information-security/*



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Short Videos

- A Brief History of Cybersecurity and Hacking
  https://youtu.be/V6p7lFsokXo
- History of Cybersecurity
  https://youtu.be/CFwmTzCVuFQ
- Evolution of Cybersecurity from 80s to Today
  https://youtu.be/wKaRdugeAPs
- Top Cyber Attacks In History
  https://youtu.be/fUeJtM1bgGo
  https://youtu.be/lJc3viPKXk4

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Thank you!