CSE 410/565 Computer Security
Fall 2022

Lecture 21: Security Management

Department of Computer Science and Engineering
University at Buffalo

Lecture Overview

- Physical security
- Risk assessment
- Legal issues
- Privacy

Physical and Infrastructure Security

- Physical threats to computer systems
  - natural disasters
    - tornado, hurricane, earthquake, ice storm, flood, etc.
  - environmental threats
    - inappropriate temperature; fire and smoke
    - water damage; inappropriate humidity
    - infestation, dust, etc.
  - technical threats
    - power problems, electromagnetic interference
  - human-caused physical threats
    - unauthorized physical access, theft, vandalism, misuse

Physical Security

- Threat assessment and planning
  - gather historical information from government agencies, vendors, suppliers, neighboring businesses, etc.
  - identify possible threats
  - for each threat:
    - determine its likelihood
    - approximate direct and indirect costs
    - compute risk factor as: likelihood $\times$ total cost (direct plus indirect)
  - prioritize the threats according to their importance
  - develop a plan and implement it

Physical Security

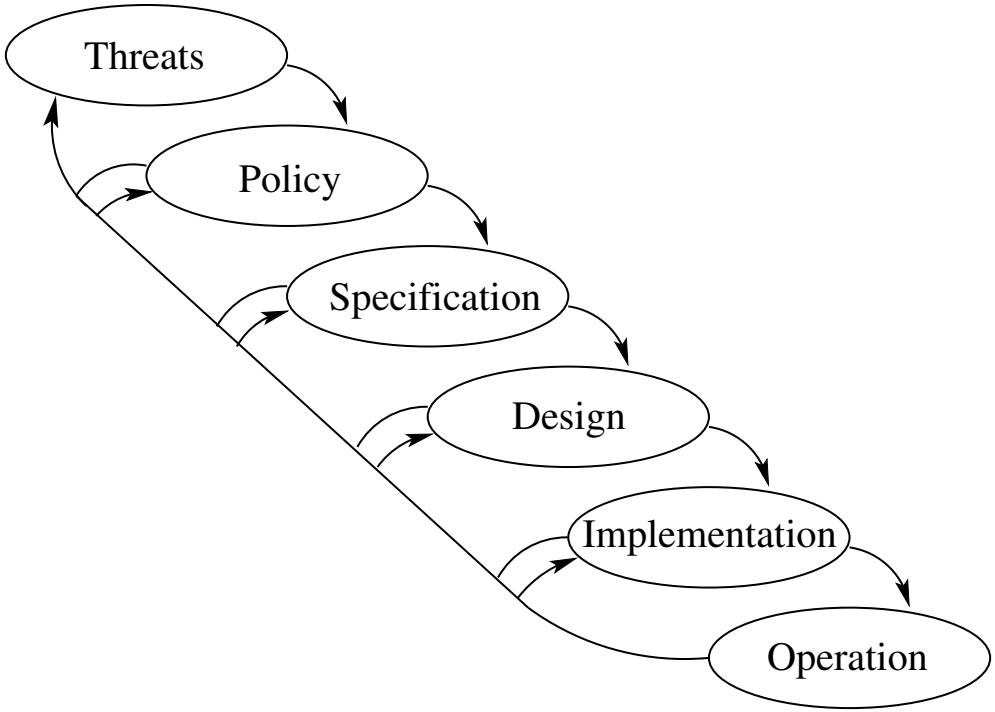
- What measures can be implemented to minimize risks?
  - proper climate control
  - fire detectors and other sensors (water, hazardous materials)
  - positioning of equipment
  - automatic and hand-operated fire extinguishers
  - proper positioning of water supply
  - power-off switch
  - uninterruptible power supplies (UPS), power generators
  - well-known emergency procedures
  - frequently tested emergency equipment
  - anti-theft measures (restricted access, secured facilities)

Overall IT Security Management

- IT security management is used to achieve and maintain crucial security goals within an organization
  - confidentiality, integrity, availability, accountability, and reliability
- Security management functions include
  - determining security objectives and policies
  - determining security requirements
  - identifying and analyzing threats to assets and risks
  - developing and implementing appropriate security measures
  - monitoring implementation and operation, devising adjustments as necessary
  - detecting incidents and reacting to them

IT Security Management

- IT security management is a cyclic never ending process
  - constantly monitor the system and revise any necessary components
  - be aware of new threats and attacks with rapidly changing technology and environment



IT Security Management

- Risk assessment
  - to devise proper protection mechanisms, we first need to perform risk analysis
  - as a first step, identify assets and their threats
- Risk is computed as the product of the probability that a threat occurs and the cost to organization
  - often, exact numbers are difficult to identify
  - use approximations instead
  - e.g., likelihoods can be chosen from the set extremely unlikely, unlikely, possible, likely, almost certain
  - cost or consequences can be chosen from minor, moderate, major, and catastrophic

Risk Analysis

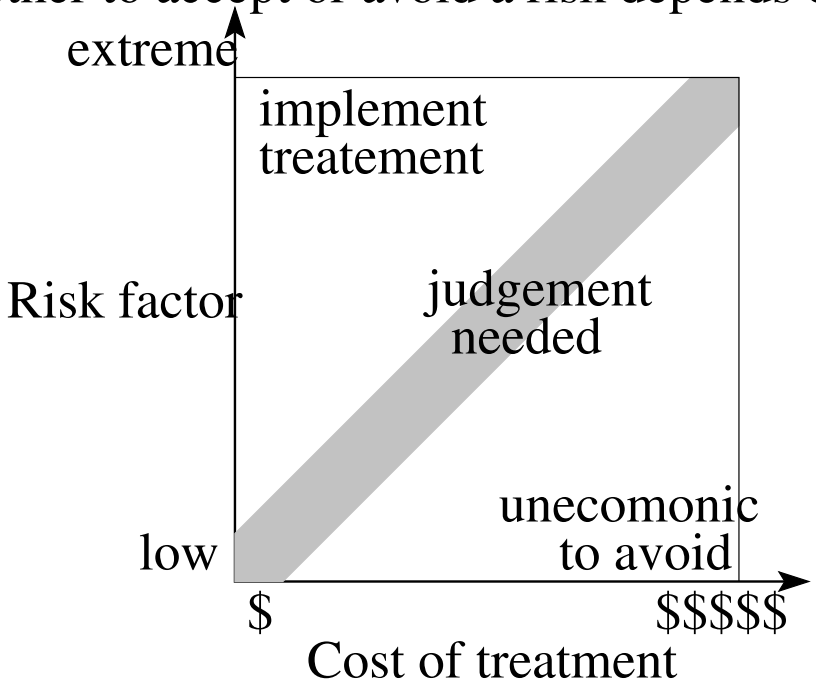
- The resulting risk level can be determined using a table such as

Likelihood	Consequences			
	Catastrophic	Major	Moderate	Minor
Almost certain	extreme	extreme	extreme	high
Likely	extreme	extreme	high	high
Possible	extreme	extreme	high	medium
Unlikely	extreme	high	medium	low
Very unlikely	high	high	medium	low

- Treat risks according to their priority
  - several possibilities
    - risk acceptance
    - risk avoidance
    - risk transferal

Risk Analysis

- Decision whether to accept or avoid a risk depends on the cost of treatment



- Other risk treatment possibilities
  - reduce consequence
  - reduce likelihood

Security Management Implementation

- Identified measures can be implemented through a variety of mechanisms
  - management controls
  - operational controls
  - technical controls
- Each category may include controls for both prevention of security breaches and their detection
- Incident response must be an integral part of the plan

Legal Aspects

- Wide computer use influences the law and we must be aware of legal and ethical aspects of computer security
- Examples of computer-related laws
  - digital signatures
  - posted contents
  - gathering and dissemination of user personal information (privacy)
  - intellectual property
  - computer crime

Legal Aspects

- Computer crime
  - many types of computer attacks can be considered crimes and carry criminal sanctions
  - the US law and international Convention on Cybercrime categorize computer crime based on the target and actions
- Computers can be used as
  - target of attack
    - illegal access, computer-related forgery or fraud
  - storage device
    - storage of stolen credit cards or other sensitive information
  - communication tool
    - traditional crime committed online (illegal sale of drugs, guns, . . .)

Computer Crime

- The nature of computer crime makes investigation very difficult
  - low success rate, achieving a consistent success rate is even harder
- Unique challenges include
  - investigators need to have a good understanding of technology
  - some investigations require significant resources (computing power, storage, or communications)
  - cybercrime is global and might require cooperation of other law enforcement agencies
  - no cybercriminal database to look for likely suspects

Computer Crime

- Low success rate and concerns about corporate reputation result in low reporting rates by cybercrime victims
  - the situation won't improve without cooperation of organizations
  - law enforcement should be viewed as an additional resource in investigation
  - management needs to understand how the investigation process works and positively contribute to the investigation

Intellectual Property

- Intellectual property (IP) is an asset that consists of knowledge and ideas
  - data, software, music recording, books, technological processes
- Relevant types of intellectual property
  - software (copyrighted or patented)
  - algorithms
  - digital contents (music, video, multimedia, web site contents, etc.)
  - databases
- Enforcement of IP includes technical measures and legal sanctions
  - access to raw data can be controlled by appropriate interface
  - if user possesses the object, technical security measures are limited

Intellectual Property

- Digital Millennium Copyright Act (DMCA) was signed into law to protect copyrighted material specifically in digital format
  - it encourages protection of copyrighted works with technological measures
  - it prohibits attempts to bypass such measures
  - this includes unauthorized decryption of contents and release of tools that bypass encryption or other protection mechanisms
- Why does it matter from a security point of view?
  - copyrighted products might have security vulnerabilities
  - how can we ensure that their use won't compromise security of our system?

Intellectual Property

- The following actions are exempted from DMCA and other laws
  - fair use is allowed for the purposes of review, comment, and discussion
  - reverse engineering of software is allowed if user is authorized to use and wants to achieve interoperability (rather than duplication)
  - security testing is allowed for the purpose of correcting security flaw/vulnerability with permission of the owner
  - good faith encryption research is allowed
  - technological measures can be bypassed if this is the only reasonable way to protect personal privacy
- Despite these exemptions, DMCA is still criticized to hinder legitimate security and encryption research

Privacy

- Today personal information can be collected in various ways
- Storing it in digital form makes it easy to transfer data to third parties
- A number of laws exist to protect personal privacy
  - US Privacy Act states rights of individuals when their personal information is collected and used by federal agencies
  - personal banking and financial information is protected in certain ways under a number of laws
  - medical and health insurance records are protected under the Health Insurance Portability and Accountability Act (HIPAA)
  - Children's Online Privacy Protection Act restricts collection of data from children under 13

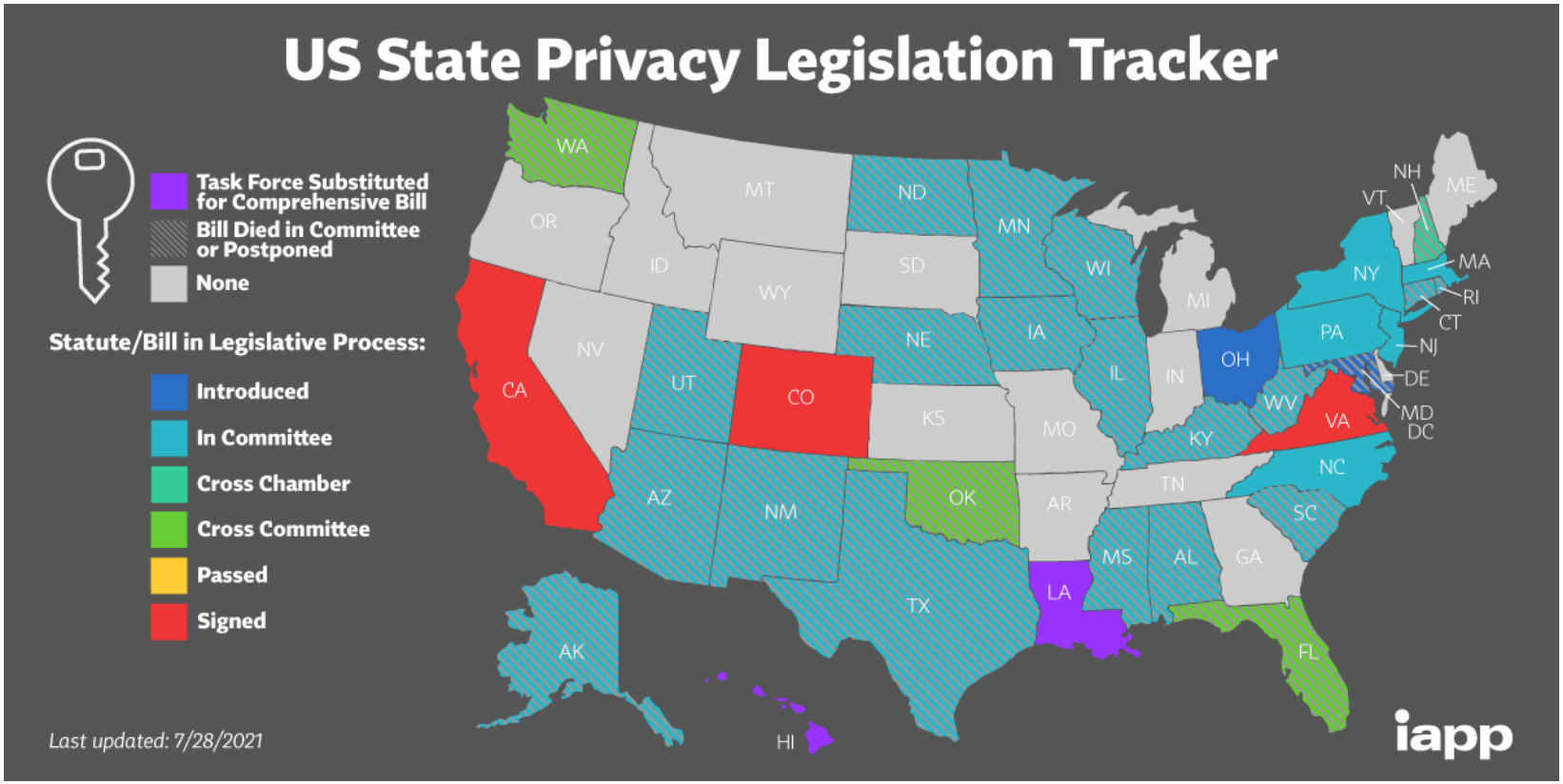
Privacy

- Organizations handling data protected under these laws need to deploy management and technical controls to comply with the law
- Does it mean our privacy is well protected?
  - companies often have vague or ambiguous privacy policies
  - explanation of privacy policies is not easy to get
  - usage of personal information is decided without user consent
    - can always choose not to use the service
    - often can opt out from at least some dissemination of your personal information
  - the government can buy information compiled by non-government companies

Privacy

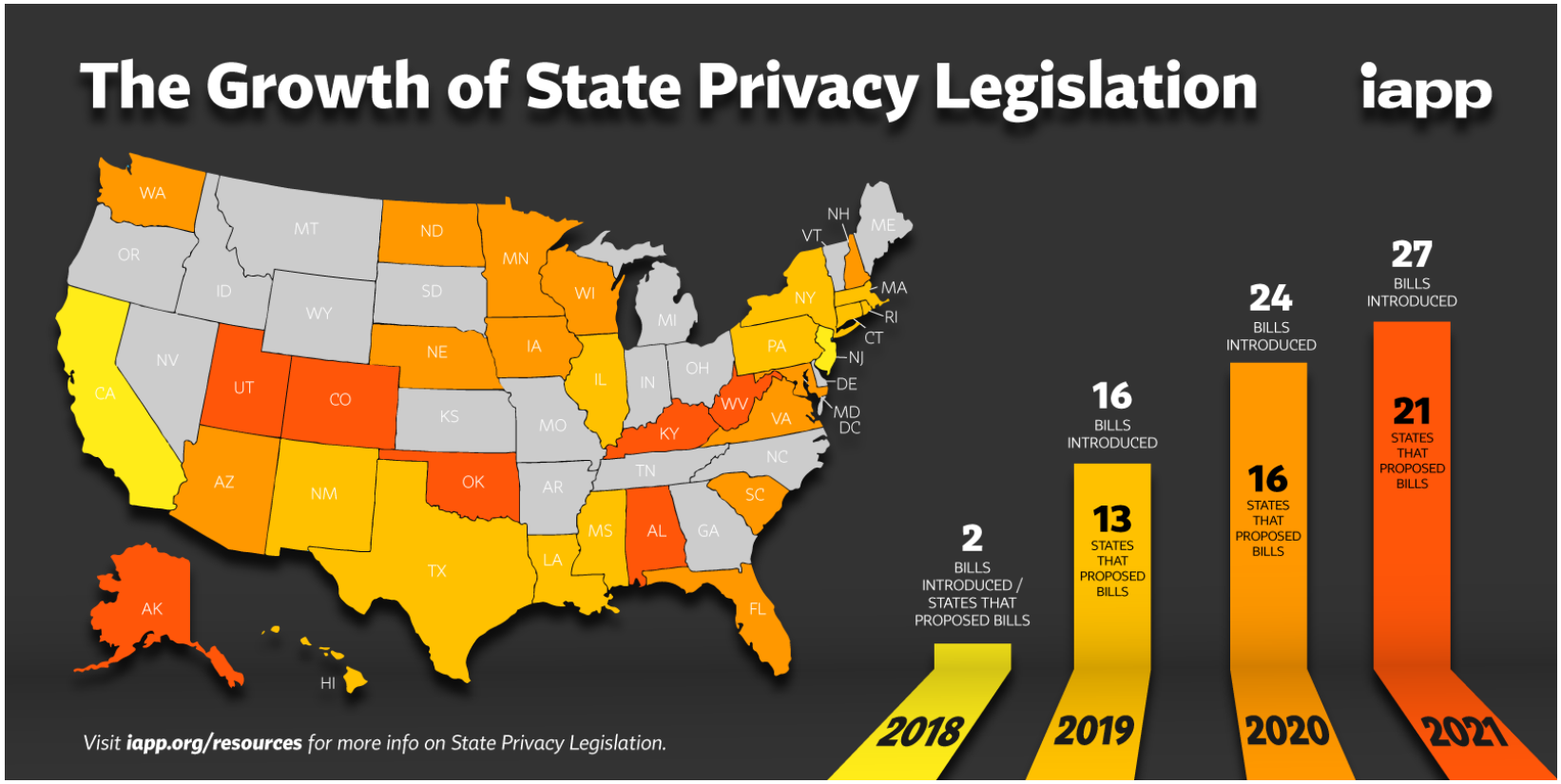
- The introduction of new European Union privacy law had a significant impact on companies world wide
  - EU General Data Protection Regulation (GDPR) was signed into the law in 2016 and took effect in May 2018
  - it places users in charge of their data (the right to know how their personal data is used, the right to data erasure)
  - privacy policies and personal data use have to be explained in accessible language
- Since its introduction, GDPR had significant impact worldwide
- US States are developing privacy laws
  - California was the first to adopt such a law, others followed

US Privacy Laws



- See https://iapp.org/resources/article/state-comparison-table/ for more information

US Privacy Laws



Privacy

- Often computer use is allowed to be anonymous
- Services might still be able to gather information about users
- Various anonymity tools exist to respect personal privacy
  - randomized routing in the internet
    - mixes, proxies, onion routing (TOR)
  - location privacy in other applications
  - pseudonyms in computer systems
  - anonymous credentials for service access