TSIT01 Datasäkerhetsmetoder

Föreläsning 1: Introduktion

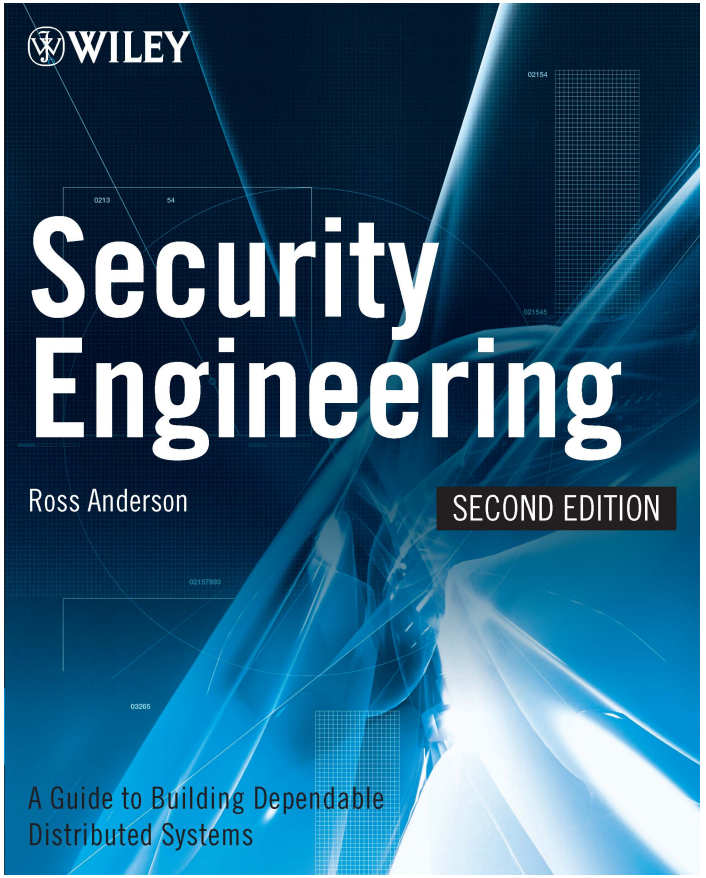
Jan-Åke Larsson

LINKÖPING UNIVERSITY

Kursbok, examination

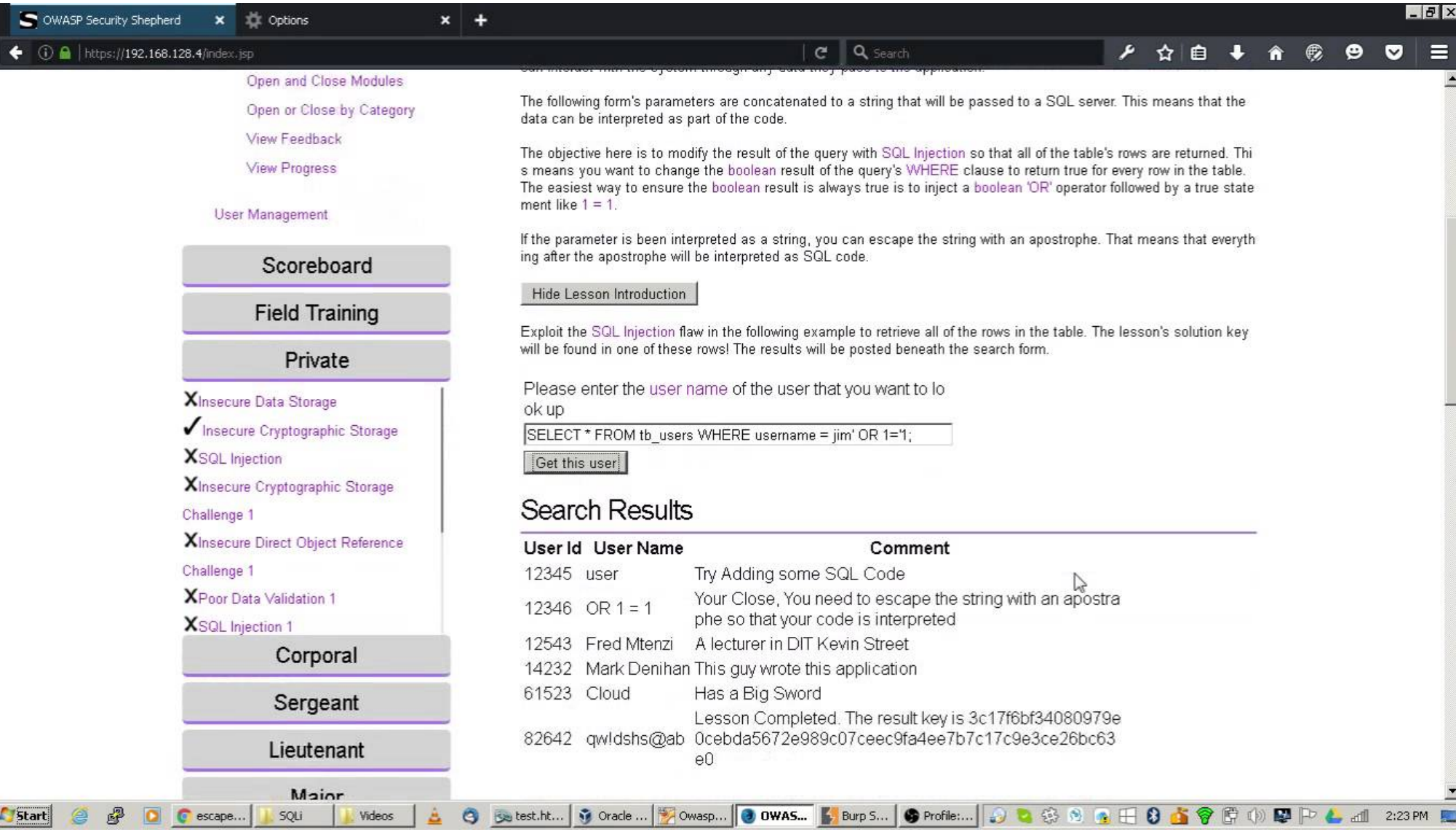
- 10 föreläsningar
- En labbkurs
- Projekt

- Kursboken används i några föreläsningar (finns gratis online)



Nytt för i fjol

- Tidigare kursutvärderingar: Sådär
- Stora förändringar i kursen i fjol
- Helt ny labbkurs
- Moderniserade föreläsningar
- Gästföreläsning: Fokus på industri


OWASP Security Shepherd
Options
https://192.168.128.4/index.jsp
Search
Open and Close Modules
Open or Close by Category
View Feedback
View Progress
User Management
Scoreboard
Field Training
Private
XInsecure Data Storage
✓Insecure Cryptographic Storage
XSQL Injection
XInsecure Cryptographic Storage Challenge 1
XInsecure Direct Object Reference Challenge 1
XPoor Data Validation 1
XSQL Injection 1
Corporal
Sergeant
Lieutenant
The following form's parameters are concatenated to a string that will be passed to a SQL server. This means that the data can be interpreted as part of the code.
The objective here is to modify the result of the query with SQL Injection so that all of the table's rows are returned. Thi s means you want to change the boolean result of the query's WHERE clause to return true for every row in the table. The easiest way to ensure the boolean result is always true is to inject a boolean 'OR' operator followed by a true state ment like 1 = 1.
If the parameter is been interpreted as a string, you can escape the string with an apostrophe. That means that everyth ing after the apostrophe will be interpreted as SQL code.
Hide Lesson Introduction
Exploit the SQL Injection flaw in the following example to retrieve all of the rows in the table. The lesson's solution key will be found in one of these rows! The results will be posted beneath the search form.
Please enter the user name of the user that you want to lo ok up
SELECT * FROM tb_users WHERE username = jim' OR 1='1';
Get this user
Search Results
User Id User Name Comment
12345 user Try Adding some SQL Code
12346 OR 1 = 1 Your Close, You need to escape the string with an apostra phe so that your code is interpreted
12543 Fred Mtenzi A lecturer in DIT Kevin Street
14232 Mark Denihan This guy wrote this application
61523 Cloud Has a Big Sword
82642 qwldshs@ab Lesson Completed. The result key is 3c17f6bf34080979e 0cebda5672e989c07ceec9fa4ee7b7c17c9e3ce26bc63 e0
Start
escape...
SQLi
Videos
test.ht...
Oracle ...
Owasp...
OWAS...
Burp S...
Profile:...
2:23 PM

Organisation

- Jan-Åke Larsson (Föreläsningar, Examination)
- Jonathan Jogenfors (ev Föreläsningar)
- Niklas Johansson (Labbar)
- Ingo Hölscher (Biometri-föreläsningar)

Kommunikation

- Kurshemsida: `http://www.icg.isy.liu.se/courses/tsit01/`
- Lisam
- E-postutskick

Anmälan till labbar öppnar onsdag eftermiddag kl. 15. Ni måste anmäla er snarast!

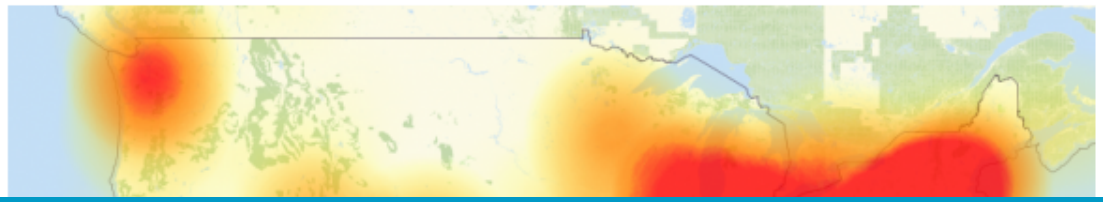
Oktober 2016: IoT-botnet

KrebsonSecurity
In-depth security news and investigation

21 OCT 16 Hacked Cameras, DVRs Powered Today's Massive Internet Outage

A massive and sustained Internet attack that has caused outages and network congestion today for a large number of Web sites was launched with the help of hacked "Internet of Things" (IoT) devices, such as CCTV video cameras and digital video recorders, new data suggests.

Earlier today cyber criminals began training their attack cannons on **Dyn**, an Internet infrastructure company that provides critical technology services to some of the Internet's top destinations. The attack began creating problems for Internet users reaching an array of sites, including Twitter, Amazon, Tumblr, Reddit, Spotify and Netflix.



Tillgänglighet = Säkerhet!

The 1960s — the dawn of computer security

- Multi-user systems emerge
- Users need to be restricted, so use authentication (Ch 4)
- Your data needs to be protected from other users
- "Protection rings" (Ch 4.3) is from this period

The 1970s — the era of mainframes

- "the Anderson report", mainly to protect classified information
- the Bell-LaPadula formal model (Ch 8) regulates access to classified information
- Larger storage (35 MB) enabled data processing for US government departments
- Access control mechanisms (Ch 4) were created

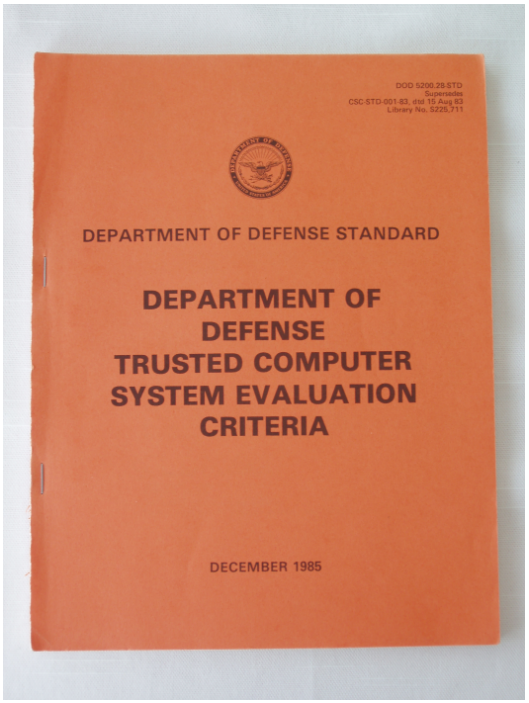
The 1970s — the era of mainframes

- Encryption was also needed, hence the creation of the Data Encryption Standard (Ch 5)
- Proposal of Diffie-Hellman public key distribution (Ch 5)
- Database security was starting to matter (Ch 4)
- The legal system was adapted

The 1980s — the rise of personal computers

- Single user machine: multi-level multi-user security irrelevant
- "The Orange Book" is published
- Security research continued: database security for entering data
- The Clark-Wilson and Chinese Wall models were created for commercial systems, in the late eighties (Ch 9)
- The first worms and viruses appear

The 1980s — the rise of personal computers



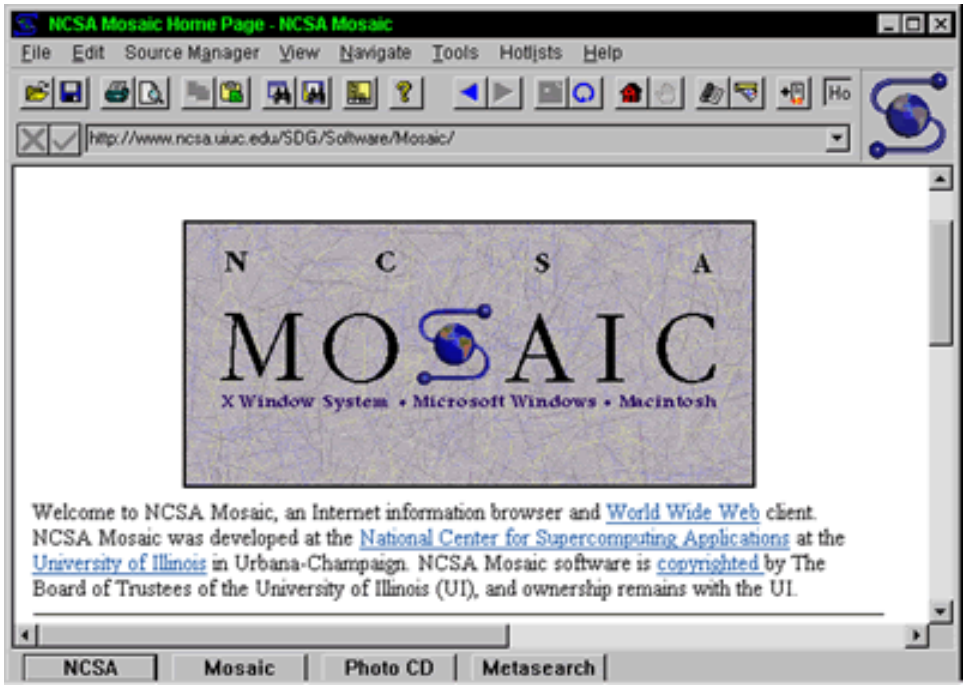
- Single user machine: multi-level multi-user security irrelevant
- "The Orange Book" is published
- Security research continued: database security for entering data
- The Clark-Wilson and Chinese Wall models were created for commercial systems, in the late eighties (Ch 9)
- The first worms and viruses appear

The 1980s — the rise of personal computers

- The "Morris worm" of 1988 infected 5-10% of all machines connected to the internet
- Used a buffer overrun in the *fingerd* daemon of VAXes running BSD Unix

```
push1 $68732f          push '/sh, <NUL>'
push1 $6e69622f        push '/bin'
mov1  sp, r10          save stackp in r10 (string beginning)
push1 $0               push 0 (arg 3 to execve)
push1 $0               push 0 (arg 2 to execve)
push1 r10              push string beginning (arg 1 to execve)
push1 $3               push argc
mov1  sp, ap           set argv to stackp
chmk  $3b              perform 'execve' kernel call
```

The 1990s — the era of the internet



- Creation of the Hypertext transfer protocol
- Security = communication security = strong cryptography (Ch 16)
- PC now connected, so needs software security, an example is the Java security model (Ch 4)
- Denial-of-service attacks appeared and needed to be protected against (Ch 21)

The 2000s — the era of the web

- Tech from the 90's but much larger user space
- Commercial applications
- SQL injection, cross-site scripting (Ch 23), attacks on DNS (Ch 21)
- Attracts criminals
- More low profile attacks
- . . . but higher economical losses

The 2010s — the era of the cloud/social networks

- Online storage/communication service
- Can only you access your data?
- Is it the same when you retrieve it?
- Can you always retrieve it?

- Many security issues in social networks

The 2010s — Internet of Things

- Smart phones that store our lives
- More and more connected devices – Internet of Things
- Our devices know everything about us . . . Privacy issues
- Cars can be hacked (Jeep)
- . . . and car manufacturers cheat with software (Dieselgate)

- Bitcoin

- Government surveillance – See: Snowden leaks
- Ransomware trojans are here to stay (Cryptolocker, Cryptowall)


Your files are encrypted.
To get the key to decrypt files you have to pay 750 USD/EUR. If payment is not made before the cost of decrypting files will increase 2 times and will be 1500 USD/EUR
Prior to increasing the amount left:
42h 48m 35s
Your system: Windows 7 (x64) First connect IP: Total encrypted files.
Refresh
Payment
FAQ
Decrypt 1 file for FREE
Support
We are present a special software - CryptoWall Decrypter - which is allow to decrypt and return control to all your encrypted files.
How to buy CryptoWall decrypter?
bitcoin
1. You should register Bitcon wallet (click here for more information with pictures)
2. Purchasing Bitcoins - Although it's not yet easy to buy bitcoins, it's getting simpler every day.
Here are our recommendations:

Computer security

- Computer security deals with the *prevention* and *detection* of *unauthorized* actions by users of a computer system

- Computer security is concerned with the measures we can take to deal with *intentional* actions by parties behaving in some unwelcome fashion

Other words similar to security

- In general engineering, defending against accidents and other malfunctions is called reliability
- Robustness, resilience, safety, . . .
- There are differences in what you stress using these words instead of security, but no strictly differentiating definitions
- Safety is slightly different and means “no threat to human life or health”
- Svenska: “Säkerhet” betyder både “Security” and “Safety”

Terminology: Prevention-Detection-Reaction

- Prevention aims to hinder damage to your assets
  - Typical tools are encryption, firewalls, ...
- Detection aims to discover damage to your assets, how it has been damaged, and who caused the damage
  - Typical tools are IDSs, digital signatures, ...
  - Can also be used to detect that an attack is on its way
- Reaction aims to mitigate damage, recover assets, and enhance existing protection

Example: Prevention-Detection-Reaction

Prevention aims to hinder damage to your assets

- Use encryption when placing an order using your credit card number
- Merchant should perform checks (delivery address for example)
- Don't use card number on the internet

Example: Prevention-Detection-Reaction

Detection aims to discover damage to your assets, how it has been damaged, and who caused the damage

- A transaction you did not authorize appears on your card statement
- Amount and place of withdrawal (delivery address) can be used to track the perpetrator

Example: Prevention-Detection-Reaction

Reaction aims to mitigate damage, recover assets, and enhance existing protection

- Report incident, invalidate card
- Cost is covered by card holder, merchant, or card issuer depending on cause for vulnerability
- Stop using card on unencrypted connections, . . .

Terminology: CIA

Three traditional areas of computer security

Confidentiality: Only authorised persons can read the protected information

Integrity: Only authorised persons can write or change the protected information

Availability: Authorized persons *can* read or write the information (in a timely manner)

CIA på svenska

Tre traditionella områden av datasäkerhet

Sekretess: Hålla data hemliga

Tillförlitlighet/Riktighet: Data ska vara oförvanskade

Tillgänglighet: Data ska finnas tillgängliga

OBS: Blanda inte ihop I-kravet med ett annat svenskt ord!

Terminology: Confidentiality

- We want to prevent that unauthorised persons read sensitive data
- Historically, confidentiality and security were closely linked, and are sometimes thought to be the same even now
- May refer to hiding information, but also to hiding that information exists

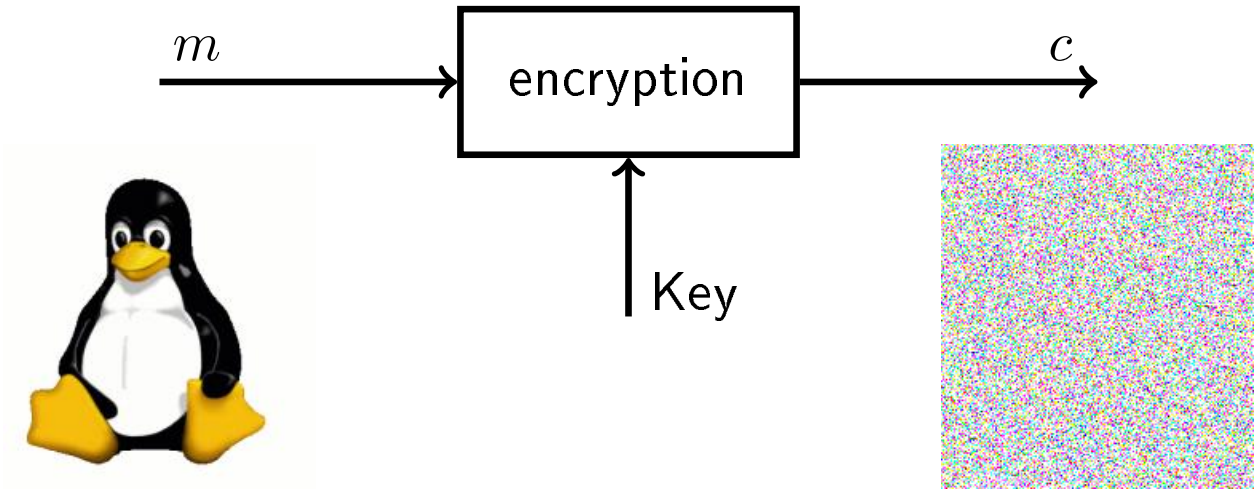
- Note that "access" is not a suitable verb, since it means both "read" and "write/change".

Tools for confidentiality

- Physical access restrictions
- Computer theft precautions (alarms etc.)
- Access control in the computer systems
- Encryption in communication and storage
- Bug-free programs

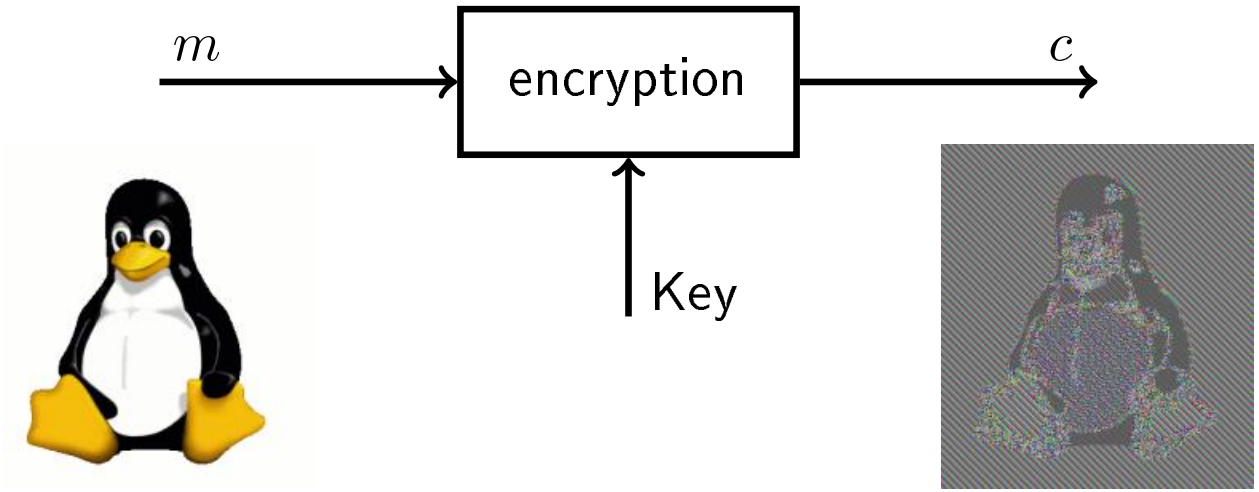
Tools for confidentiality: Encryption

- A message is encrypted using a key
- The idea is that the message should be kept secret to those who do not have the key
- There are variants, where everyone can encrypt but only some can decrypt



Tools for confidentiality: Encryption

- A message is encrypted using a key
- The idea is that the message should be kept secret to those who do not have the key
- There are variants, where everyone can encrypt but only some can decrypt

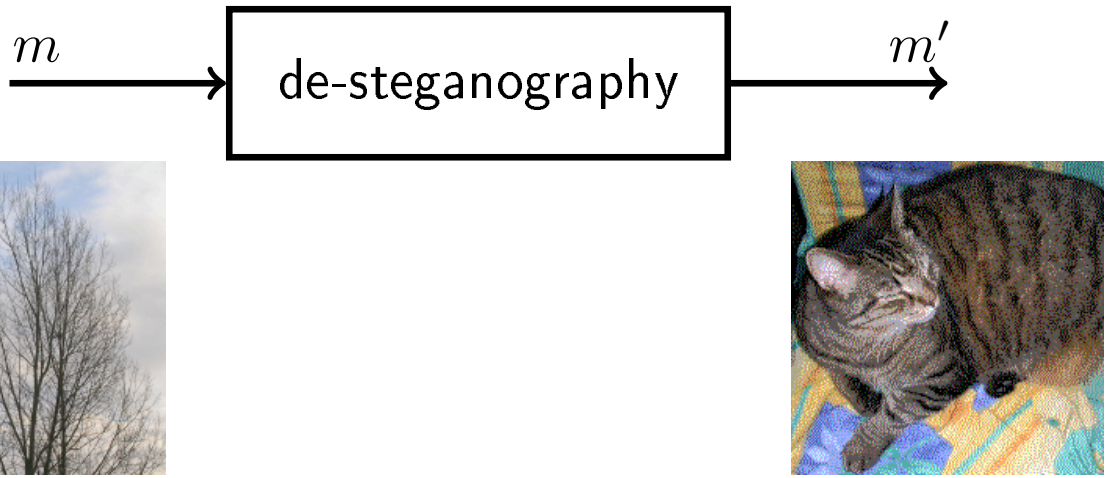


Tools for confidentiality: steganography

- In this case, the message is hidden inside another message
- Usually there is no secret key in this case
- The purpose is to conceal the existence of the message
- A modern example is al-Qaeda hid secret documents in a video found in Berlin in 2011 (NSFW)

Tools for confidentiality: steganography

- In this case, the message is hidden inside another message
- Usually there is no secret key in this case
- The purpose is to conceal the existence of the message
- A modern example is al-Qaeda hid secret documents in a video found in Berlin in 2011 (NSFW)



Terminology: Integrity

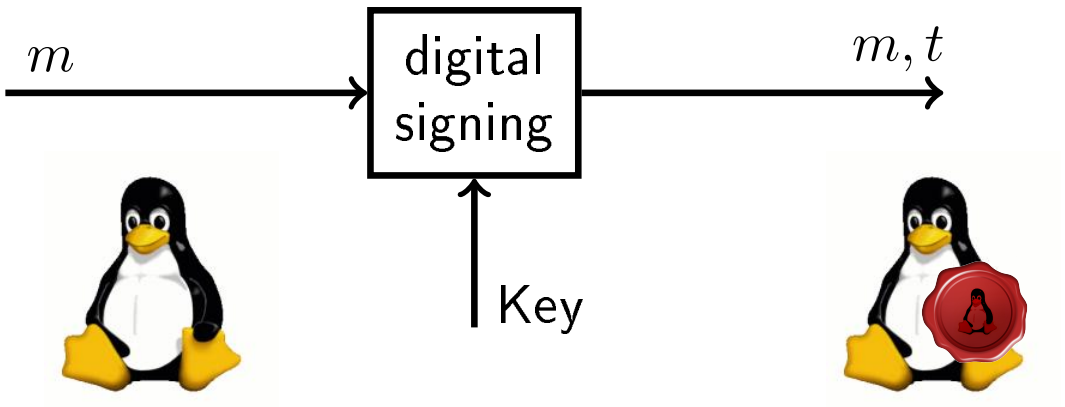
- We want to prevent that unauthorised persons write or change sensitive data
- A good example of how difficult this can be is the "telephone game" (viskleken)
- Historically, integrity was ensured by writing in un-erasable ink and appending a signature ("blue-ink signature"), a seal, or a stamp
- More recently, integrity could be ensured by writing in unchangeable storage, WORM memory

Tools for integrity

- Physical access control
- Computer-based access control
- Checksums: values that can be used to check for random changes, like transmission or storage noise, “bitrot”
- Protecting against intentional changes requires stronger (cryptographic) tools
- Backups are used to restore data if unauthorized changes are noticed

Cryptographic tools for integrity

- A digital signature or MAC created using a key
- Integrity is checked by detecting changes in stored or transmitted data, by comparing a newly generated verification item with the old one
- The idea is that it should be hard to create the correct verification item without the key



Confidentiality and integrity

Confidentiality and integrity protection are often based on the same techniques.

- No physical access to storage media
- Access control on all logical access paths to data
- Cryptographic techniques

Terminology: Availability

- ISO7498-2: "The property of being accessible and usable upon demand by an authorized entity"
- Basically, to prevent denial-of-service
- Not about data being unavailable to unauthorized users, which is really C+I

Tools for Availability

- Protection against physical threats and attacks
  - Uninterruptable Power Supplies
  - Fire precautions
  - Flooding precautions
  - Temperature and humidity control
  - Storm resistant buildings
- Hindering secondary damage from data integrity attacks
  - Backups, backups and backups

Tools for Availability

- Countermeasures against system overload
  - Redundancy in server farms, or disks
  - Equipment that can detect and counter DOS attacks
- Countermeasures against system crashing
  - Check all user input for “out of bounds” values
  - Switch off unused services and functions
  - And of course follow and install supplier updates and patches

Terminology: CIA

Three traditional areas of computer security

Confidentiality: Only authorised persons can read the protected information

Integrity: Only authorised persons can write or change the protected information

Availability: Authorized persons *can* read or write the information (in a timely manner)

Assurance, Authenticity, and Anonymity (AAA)

- These are related to CIA; their internal relation is different
- Assurance (in computer security) is how trust is provided and managed in computer systems
- Authenticity is related to integrity, and has to do with tracing ownership and changes
- Anonymity is related to confidentiality, as mentioned before

Assurance

- In computer security this refers to management of trust
- Trust is difficult to quantify
- But trust, and management of trust, is essential
  - Can we trust that the OS is bug-free?
  - Can the computer trust that the user is who he claims to be?
  - Can the movie site trust you won't redistribute the movie?
  - Can the computer trust that the IP recieved from a name lookup is correct?

"Tools" for assurance

- In computer security this refers to management of trust
- Trust is difficult to quantify
- But trust, and management of trust, is essential

Policies	specify behavioral expectations, of systems and people on themselves and each other
Permissions	describe allowed behavior
Protections	are mechanisms that enforce permissions

Authenticity

- Different from authentication
- Not quite integrity either
- Integrity refers to integrity of data in the system
- Authenticity refers to the ability to determine that statements, policies and permissions are authentic

Terminology: non-repudiation

- Repudiation means denial
- So non-repudiation is the inability to deny issuing a statement
- The most common example is an order of goods, but there are many other examples in computer security
- Inside computer security, non-repudiation is how to provide unforgeable evidence of an action (or the validity of a contract)

Non-repudiation, and accountability

- If the worst occurs, we want to be able to trace what has happened and who did it
- We want to hold the perpetrator accountable

- As prevention, it is aimed to dissuade attackers
- As compensation, it is aimed to recover losses from the attack
- As improvement, it is aimed to tell us how to harden our system

Tools for accountability: Audit trail, and digital signatures

- An audit trail is primarily to enable accountability
- A secondary goal is to find the vulnerability that enabled an attack
- Another goal is to find and/or restore changes

- Digital signatures is also a tool, binding an entity to an issued statement, or an action

The third A: Anonymity

- Confidentiality of user identity
- Hiding the content, or that there is a message is sometimes not enough — Who has been in contact with who is also information
- Traffic analysis of metadata (or "surveillance" as Bruce Schneier calls it) is used to detect links between people
- The technical term for confidentiality here is "unlinkability"
- This has become one of the current buzzwords

Tools for anonymity

- On the web: proxies. Proxies are trusted agents that act for an individual so that the actions cannot be traced back to that individual. An example is The Onion Router
- Pseudonyms are fictional identities that fill in for real ones, and can only be traced back by a trusted entity
- Aggregation is combining data from many individuals so that statistical outputs cannot be traced back to individuals
- "Mixing" is a term that uses a quasi-random way of blending data so that searches can be performed without revealing individual identities

Security policy

- A statement that defines the security objectives of an organization
  - it has to state what needs to be protected
  - it may also indicate how this is done
- To formulate such a policy you need to know
  - what needs to be protected
  - how it might be vulnerable
  - what threatens the vulnerability
  - and how the threats can be countered

Security policy, example on physical access

- Who has access to company premises?
- Are there restricted areas?
- Is access by key, card, security guard checkpoint, . . . ?
- Do you need to wear an ID badge (visible)?
- Must visitors be accompanied?
- Are their bags checked upon entry/exit?
- When are buildings locked?
- Who has access to keys?

Security policy, example on passwords

- How long should a password be?
- Are all-lowercase ASCII passwords OK?
- Is there a dictionary attack on password creation, or on a regular basis in the system?
- How often is there a forced renewal?
- From where can users log in?
- What clients can be used?

Terminology: Assets

- First step: Identify assets, and their value
  - Hardware
  - Software
  - Data and information
  - Reputation
- The value is sometimes hard to estimate
- Monetary value, or in terms of (company) survival if asset is compromised

Terminology: Vulnerabilities

- Vulnerabilities are weaknesses that can be unintentionally or intentionally exploited to damage assets
- *Vulnerability scanners* are automated tools for detection (e.g., Nexpose)
- Risk analysis needs to measure their severity
- Examples:
  - Admin accounts with default passwords
  - Programs with unnecessary priviliges
  - Programs with known flaws
  - Weak access control settings
  - Weak firewall configurations

Terminology: Threats

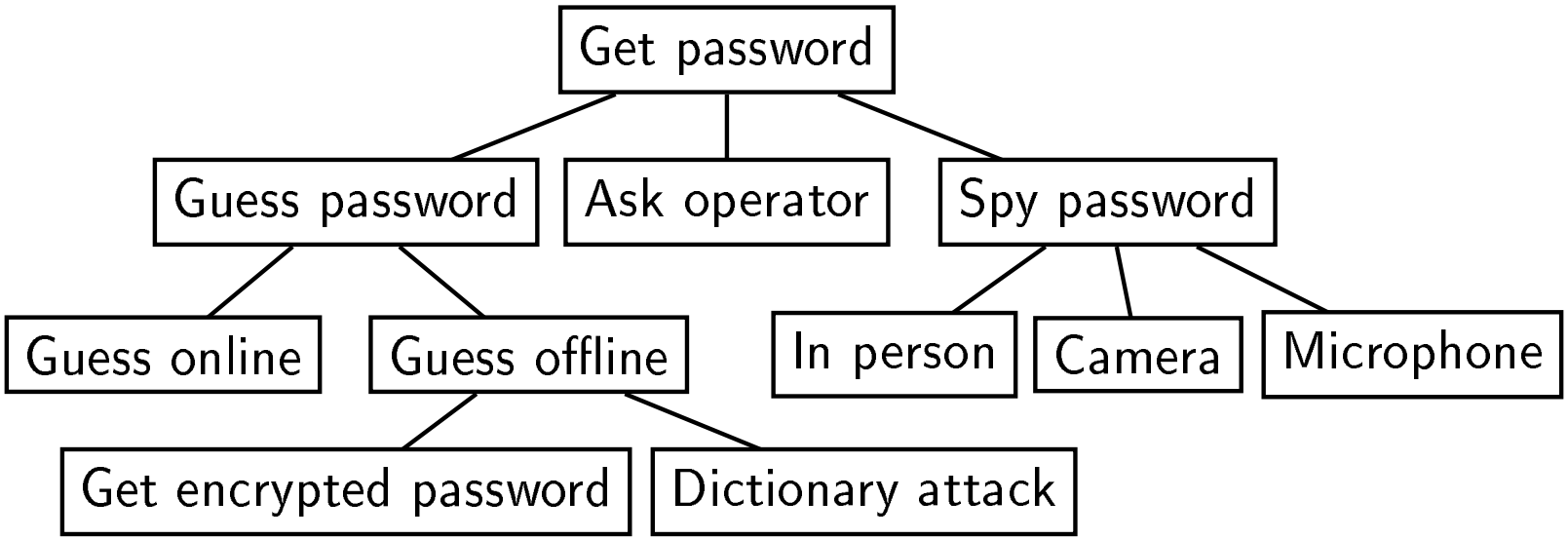
- A threat is a possible negative effect on your assets
- These can be categorized by the impact, e.g., Microsoft's STRIDE threat model:
  - Spoofing identities
  - Tampering with data
  - Repudiation
  - Information disclosure
  - Denial of service
  - Elevation of privilige
- An alternative is to identify threats by source

Unintentional versus intentional threats

- Threats can be
  - unintentional, or
  - intentional (willfully caused by a human)
- Protection against accidents is usually covered by full protection against intentional events
- Full protection against accidents almost never covers all possibilities for intentional attacks
- This course is about protection from intentional attacks

Terminology: Attacks

- An *attack* is a sequence of steps needed to realize a threat
- There may be several attacks that realizes a given threat
- Often, an *attack tree* is constructed



Attackers' goals and tools

- Financial gain, often C-attacks
  - Skimming, phishing, industrial espionage
- To show off, be noticed, often I-attacks
  - Virus writing, web site defacement etc.
- Sabotaging opponent, often A-attacks
  - DDoS, system crashing etc.

Security management

- Security is a people problem
- If it is awkward to follow security policy, it will likely not be followed
- This is especially true if the policy is not supported by the management
- A security policy should contain
  - Why security is important for individuals and the organization,
  - what is expected from individuals, and
  - which good practices they should follow.
- To anchor this in an organization, often a security awareness program is used

Security management

- A security policy should contain
  - Why security is important for individuals and the organization,
  - what is expected from individuals, and
  - which good practices they should follow.
- To anchor this in an organization, often a security awareness program is used
  - Example: NIKE employees have the sentence “Security is everyone’s responsibility” on the login screen

Measuring security

- Assign a numeric value to security
  - Severity of damage
  - Probability of damage
- Value is sometimes hard to measure
  - number of open ports
  - number of users (with weak passwords)
  - number of unpatched programs
  - cost of restoring data (in € or man hours)
  - lost reputation (arbitrary units)

Measuring security

- Security costs do not generate revenue
  - cost must be motivated
  - ideally, a quantitative measure is needed
  - but often a qualitative measure is obtained

Standards for measuring security

- Some organizations have prescriptions for security management standards
  - Financial sector
  - Government departments
  - . . . often regulated in law
- There are also codes of best practice, one example is ISO27002
  - Many topics including Security policy, HR security, Physical security, Access control, Incident response, Business continuity, Compliance, . . .
  - Achieving compliance is a large task, and is not covered in its entirety in this course

Risk analysis, basic entities

Three entities must exist for a risk to exist:

- Threat — the cause of damage to asset(s)
- Vulnerability — the unwanted system property that enables the threat
- Damage — the adverse effect of an unwanted event

Example, basic entities

Theft by a pickpocket is a risk to you when:

- Threat — there can be pickpockets in places where you are
- Vulnerability — you carry your wallet where a skilled pickpocket can pick it in a crowd
- Damage — possible loss of your wallet with its contents

Properties of threats

- A threat is caused by a threat agent
- Accidental agents have no specific goal
- Deliberate threat agents have individual varying goals
- Each threat agent has individual resources, like time, computer power, knowledge etc.
- Threat agents have different probabilities of attacking your system
- Thus: Know the threats against your system!

Examples of threat agents

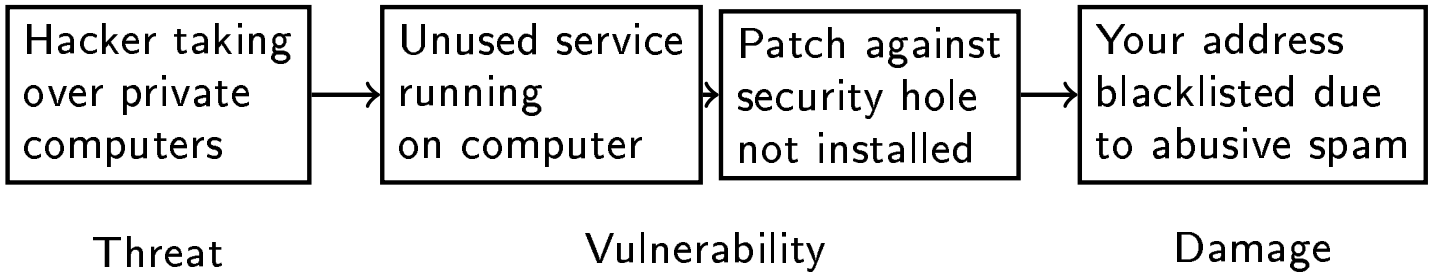
- Thunderstorms can be a threat to availability
  - Lightning strikes blindly
  - The power to destroy equipment is immense
  - The probability of a hit depends on geographical location, surroundings, any lightning rods etc. etc.
- An embezzling employee is a threat to finances via violations of data integrity
  - The employer provides computer resources
  - The employee has some system knowledge and can learn more

Identifying vulnerabilities

- Vulnerabilities are properties of your system
- A vulnerability can exist inside the system or in its close surroundings
- If you remove a vulnerability, its specific threat can no longer cause its damage (unless a parallel vulnerability remains)

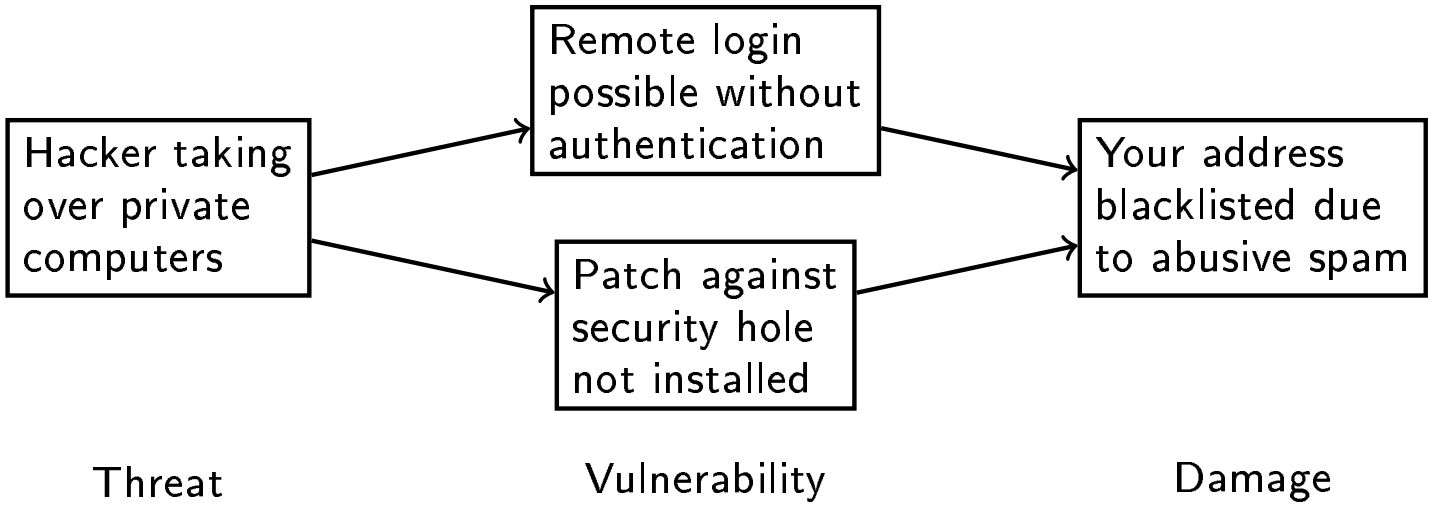
Properties of vulnerabilities

- Vulnerabilities often form a chain of steps from the threat action to the damage
- The links in the chain can be parallel: any of them will enable the final damage, or serial: all are necessary in turn for the final damage
- Removing one serial link is sufficient, but with parallel links all must be removed



Properties of vulnerabilities

- Removing one serial link is sufficient, but with parallel links all must be removed



Identifying damages

- A damage is a loss of value to the system users
- Thus the damage is normally the effect outside the computer system when a threat occurs
- Sometimes you must analyse damages to the computer system itself, like corrupted access control data
- Primary damages fall into the CIA categories, which apply to data, but risk analysis treats the final effects of damaged data on system users

Properties of damages

- Normally you regard the damage to data as primary damage, and the effect of this as secondary damage
- It is secondary damage that counts (and costs)
- Some damages can be measurable in economic terms, but others concern ethics, reputation, laws etc.

Prevention-Detection-Recovery needs to be balanced

- Damage will eventually be detected (maybe indirectly, but still)
- If recovery at that time is cheaper/better than prevention would have been, don't do prevention
- Early detection may save you expensive prevention

- What is "cheap" should be evaluated over the whole system life
- Remember to follow laws, and to include costs for possible loss of reputation

Strict risk analysis

- In risk analysis we evaluate the possible damage and magnitude of the threat in order to find out if the cost of removing a vulnerability is warranted
- If we gain more by introducing the countermeasure than the countermeasure costs us, we should use the countermeasure

Calculating the risk cost

- Calculate the average risk cost per year, r
- First find the average cost of the damage every time the threat causes a damage, d
- Then find the average number of times per year that you can expect the threat to cause a damage, f
- The risk cost $r = f \cdot d$

Using the risk cost

- Calculate the average risk cost per year before introducing a countermeasure, r_b
- Calculate the average risk cost per year after introducing a countermeasure, r_a
- Calculate the average cost per year for the countermeasure, c
- Introduce the countermeasure if $c < r_b - r_a$

Qualitative risk analysis

- Estimate roughly the magnitude of damage:
  - Negligible?
  - Bearable?
  - Serious?
  - Catastrophic?
- Estimate roughly the probability:
  - Almost impossible?
  - Possible?
  - Likely?
  - Almost certain to happen?

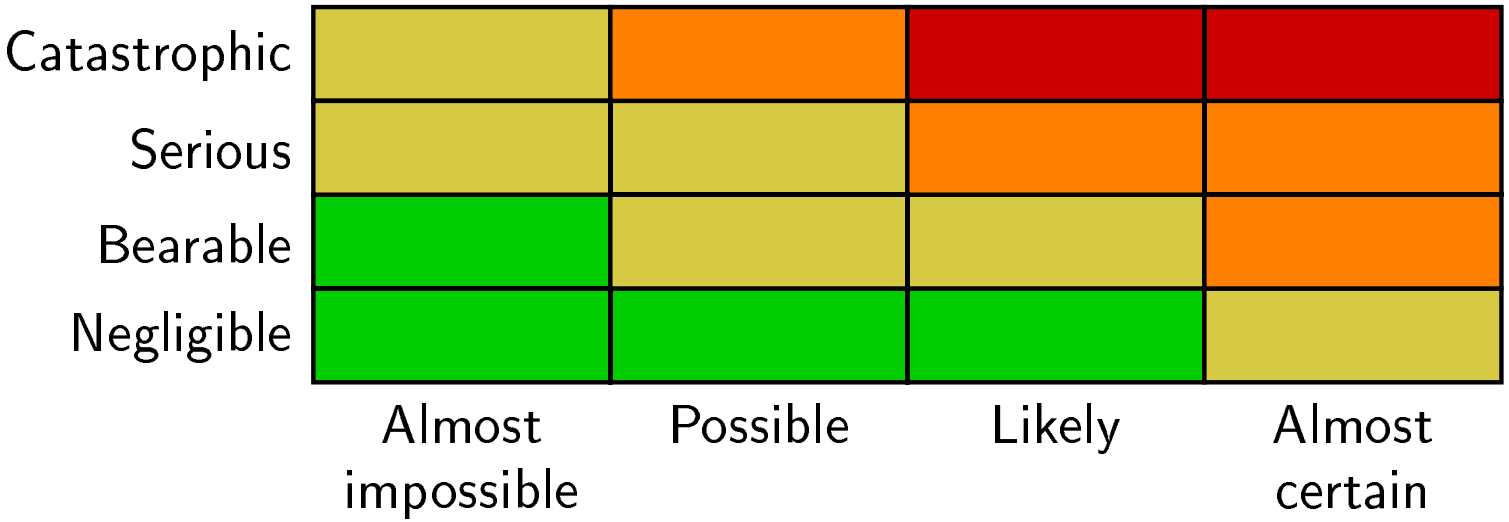
Qualitative risk analysis

- Put your estimates in a grid:

Catastrophic				
Serious				
Bearable				
Negligible				
	Almost impossible	Possible	Likely	Almost certain

Qualitative risk analysis

- Treat events in order of priority!



Tools to evaluate security

- Simple check lists (yes/no)
- Conditional check lists (different recommendations for different needs)
- Differentiate items according to importance and severity
- Expert system tools calculating levels and answering "what if" and "how come" questions

- When using these kinds of evaluations, get one which includes possibilities to find the crucial deficiencies in your answers
- Never trust the evaluation blindly — evaluate its emphasis and prejudices

Simple check lists

- Useful, but limited
- Work as short reminding texts
- Exhaustive check lists are immense
- Often used when buying systems, as list of properties a system must have
- Useful in single instances, less useful as a general tool

Conditional check lists

- Makes one general list work better for many different users
- Will still presuppose a lot of things “if this is true, you need this”
- Or will require the user to do critical evaluations “if you make this evaluation, you should as a consequence...”

Differentiate items according to importance and severity

- Formulate a question, and judge its importance (assign a value)
- List the possible answers, and identify if there are problems if this answer holds
- Estimate severity of problem (assign a value)
- Multiply value of question with value of answer, and calculate total
- Compare with some bound you set

Differentiate items according to importance and severity

Example from protection against theft

Question (weight 4):
Are the doors to the server room locked?

- Yes (4)

- No (0)

Possible contributions to sum: 0, or 16

Differentiate items according to importance and severity

Example from protection against theft

Question (weight 4):
Are the doors to the server room locked?

- Yes (4)
- Yes, except when someone is in the room (3)
- Yes, outside office hours (1)
- No (0)

Possible contributions to sum: 0, 4, 12, or 16

Differentiate items according to importance and severity

- Level bounds, weights of questions and weights of answers must be carefully balanced
- Good example: Weights of basic questions dominate, so you can't get a good rating by having no basic security but a lot of extras
- Bad example: Extreme security for message integrity and no user authentication is marked as "high security"

Summary of first lecture

- Models for security
- CIA
- Security policy
- AAA
- Threat, Vulnerability, Damage
- Measuring security
- Risk analysis

Next two lectures: Authentication

- Authentication, to certify that an entity is who/what it claims to be
- Authorization is a different concept, and is to allow or deny a request from an entity based on what permissions that entity has
- Biometry: A method for authentication