Advanced Aspects of Hospital Information Systems: IT Security in Healthcare

Florian Fankhauser, Christian Schanes

INSO – Industrial Software
Institute of Information Systems Engineering | Faculty of Informatics | TU Wien

Agenda

ESSE: Short Introduction

IT Security in Healthcare

Definition of Security/Risk

IT Security Foundations

Risk Analysis

Security Concept

Privacy

Literature

Summary

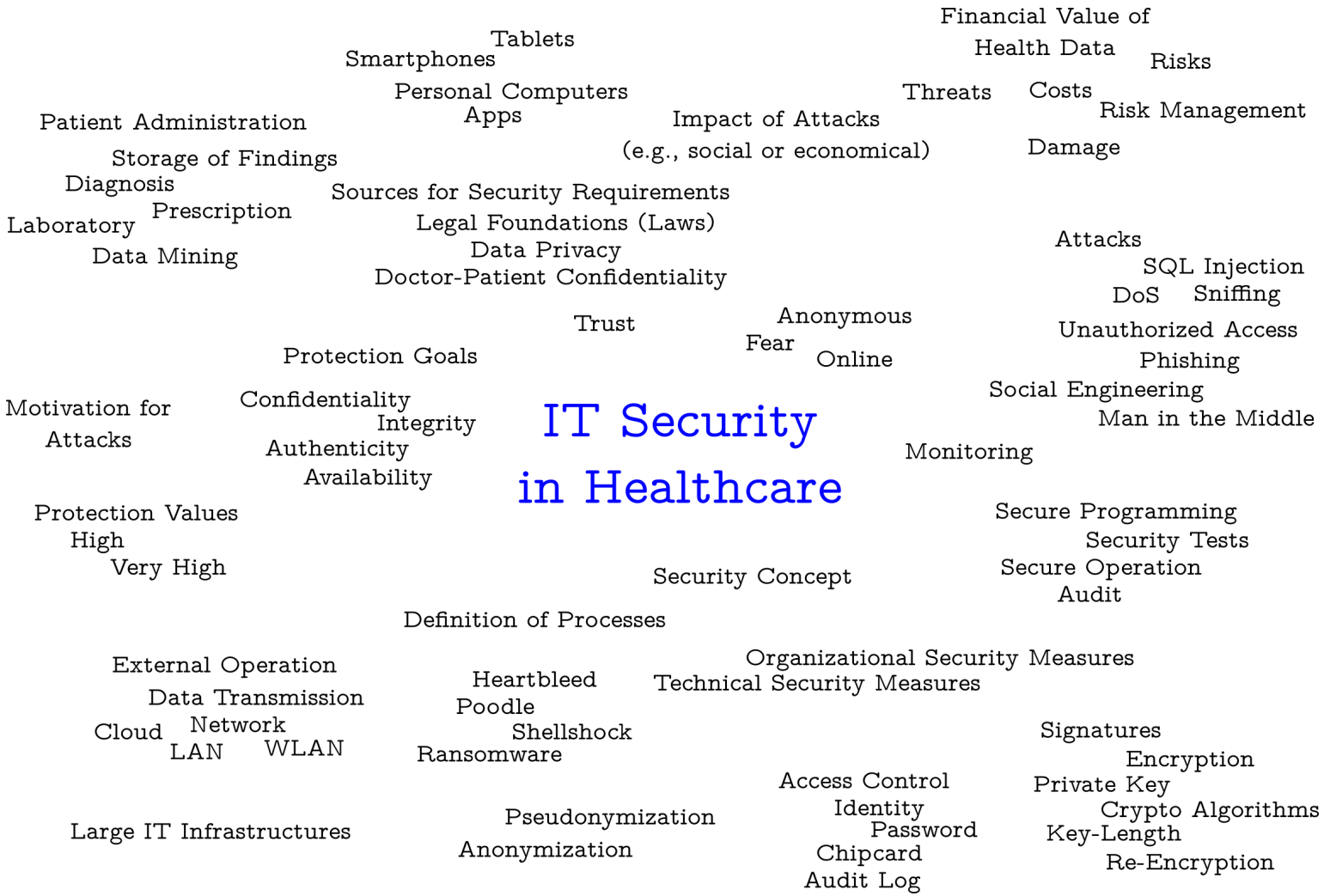
ESSE – Establishing Security

- IT Security is much too complex in order to teach it in 90 minutes :)
- Therefore, only selected topics today
- More ESSE lectures to deepen knowledge of IT Security
  - Introduction to Security *(WS, Bachelor)*
  - Security for Systems Engineering (CTF contest) *(SS, Bachelor)*
  - Advanced Security for Systems Engineering *(WS, Master)*
  - IT Security in Large IT Infrastructures (CTF contest) *(SS, Master)*
  - Seminar aus Security
  - Projects
  - Bachelor thesis, master thesis, thesis

IT in Healthcare

Tag Cloud IT Security in Healthcare

Tag Cloud IT Security in Healthcare



Examples for Security Incidents in Healthcare

- Healthcare workers prioritize helping people over information security (disaster ensues)
- Schönheitsklinik gehackt: 25.000 Fotos im Netz
- Ransomware-Virus legt Krankenhaus lahm
- Gehackte Medizintechnik: FDA will mehr Sicherheit durchsetzen
- 780 HIV-Patienten geoutet: Datenpanne in Londoner Klinik
- Hacker erbeuten Daten von 4,5 Millionen Patienten in den USA
- Oklahoma Department of Health Says 133,000 Medical Records Taken in Laptop Theft
- Österreichische Patientendaten landeten im Netz
- Patientenakten wurden in Deutschland zu Faschings-Konfettis
- Krankenakten von Stars in aufgelassener Klinik gefunden

Case Example: Manipulation of Medical Devices at DeepSec 2013

- Live manipulation of a patient monitor
- Despite patient being dead, patient monitor shows normal vital parameters
- A way was found to get into the communication process and send information to the patient monitor system

- Man in the Middle (MitM)
- Vulnerabilities
  - Unencrypted Communication
  - Missing (client) Authentication

(See `http://futurezone.at/science/medizingeraete-lassen-sich-leicht-hacken/37.040.304`)

Definition Security/Risk

- Merriam-Webster Online Dictionary: *the quality or state of being secure: as a: freedom from danger*
- This means: There are no risks
- We know: There is nothing like 100% security
- Therefore, we have to
  - Find and measure the risks
  - Define a limit for acceptable risks
  - Eliminate all risks that are greater than the acceptable risk
- Risk = expected loss when a specific threat occurs $*$ probability of this specific threat

(See DIN VDE 31000)

Recap: Basic Protection Values

- Confidentiality
  - Access of data only for authorized persons
  - Avoid data theft
- Integrity
  - Unauthorized manipulation must be detectable
- Availability

(See Bundesamt fuer Sicherheit in der Informationstechnik (2005))

Recap: More Basic Protection Values

- Authenticity
  - Unambiguous link to an identity
- Non-Deniability
  - e.g., Digital Signature
- $\rightarrow$ Depending on the project more protection values can be defined

(See Bundesamt fuer Sicherheit in der Informationstechnik (2005))

Recap: IT Security Levels/Protection Needs Determination

- Most of the time the importance of data/components can't be exactly estimated
- Therefore, IT Security Levels got introduced

- Levels can be among others
  - small
  - normal
  - high
  - very high
  - normal
  - high
  - very high

Motivation of Attackers/Implications of Attacks

- Financial Value of Medical Data
- Blackmail

- Financial Implications
  - Organization
  - Persons affected
- Social Implications

EN ISO 14971: Risk Management in Healthcare

- Application of risk management to medical devices
- Procedure by which a manufacturer can
  - identify threats,
  - estimate risks,
  - evaluate risks,
  - control risks,
  - monitor the effectiveness of the control.
- Applicable to all stages of the life cycle of a medical device

(See EN ISO 14971)

Risk Analysis

- Risk analysis procedure must be established and conducted
- Identification and description of medical device regarding the safety of the device
- Identification of known or foreseeable threats
- Risk analysis
  - Different techniques are used, e.g., Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA)
- Risk control
- (Overall) Residual risk evaluation
- Monitoring of the device during use
- Documentation of the process!

Goals of a Security Concept

- Details for security of medical device need to be documented
- → *Security Concept*

- Definition of framework conditions for...
  - Architecture
  - Functional services
  - Operators
  - ...
- Definition of all relevant security aspects of a project

Security Concept

- Risk analysis
- Security requirements
- Technical measures
- Organizational measures
- Effectiveness analysis

Case Example: General Security Concept in German Health Infrastructure

There are many sections, among them are

- Privacy concept
- Authorization concept
- Cryptography concept (key management!)
- Zone concept
- Logging concept
- Protection needs determination
- Operating requirements, policies
- Requirements for specific security concepts
- Residual risk analysis

Privacy as Basis for Security Requirements

- *Doctor-patient confidentiality* as *trust principle* for treatments!
- *Data privacy* as *basis* for eHealth!
- $\rightarrow$ legal consequences!
- Operation of IT systems by external contractors (see, e.g., Biewald)
  - Doctor-patient confidentiality?
  - Anonymization, Pseudonymization
  - Encryption
  - Errors, Error Analysis?
- Deduction of organizational and technical security measures

Input Validation as a Mechanism Against Many IT Security Attacks

- SQL Injection
- Command Injection
- Cross Site Scripting (XSS)
- Lightweight Directory Access Protocol (LDAP)
- Buffer Overflows
- Redirection Errors
- ...

- *Correct implementing* Input Validation *helps!*

Tag Cloud IT Security in Healthcare

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- OWASP: Top Ten Web Vulnerabilities
- Gehackte Medizintechnik: FDA will mehr Sicherheit durchsetzen
- Ransomware-Virus legt Krankenhaus lahm
- Ransomware: Neben deutschen Krankenhäusern auch US-Klinik von Virus lahmgelegt

Summary

- IT security and privacy are vital cornerstones for eHealth
- Legal requirements
- Risk analysis
- Security concept
- Technical and organizational security measures are required

- Only selected aspects of IT security today
- Visit more ESSE lectures :-)

Thank you!

Florian Fankhauser, ESSE – Establishing Security

esse@inso.tuwien.ac.at

https://security.inso.tuwien.ac.at/

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Institute of Information Systems Engineering | Faculty of Informatics | TU Wien