INNOVATIVE SECURE SENSOR NETWORKS AND MODEL-BASED ASSESSMENT TOOLS FOR INCREASED RESILIENCE OF WATER INFRASTRUCTURES

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Cyber Security

Impact and Risk Analysis of the IT Infrastructure for Water Utilities

David Meier

French-German project funded by ANR/BMBF

Critical Infrastructure Protection Call

PICS 2014 – Final meeting

Dresden, the 26th June 2018

Overview

- Cyber Security Approach
  - Building a Cyber Security Management System
- Risk analysis
- Risk addressing
- Results and Outlook

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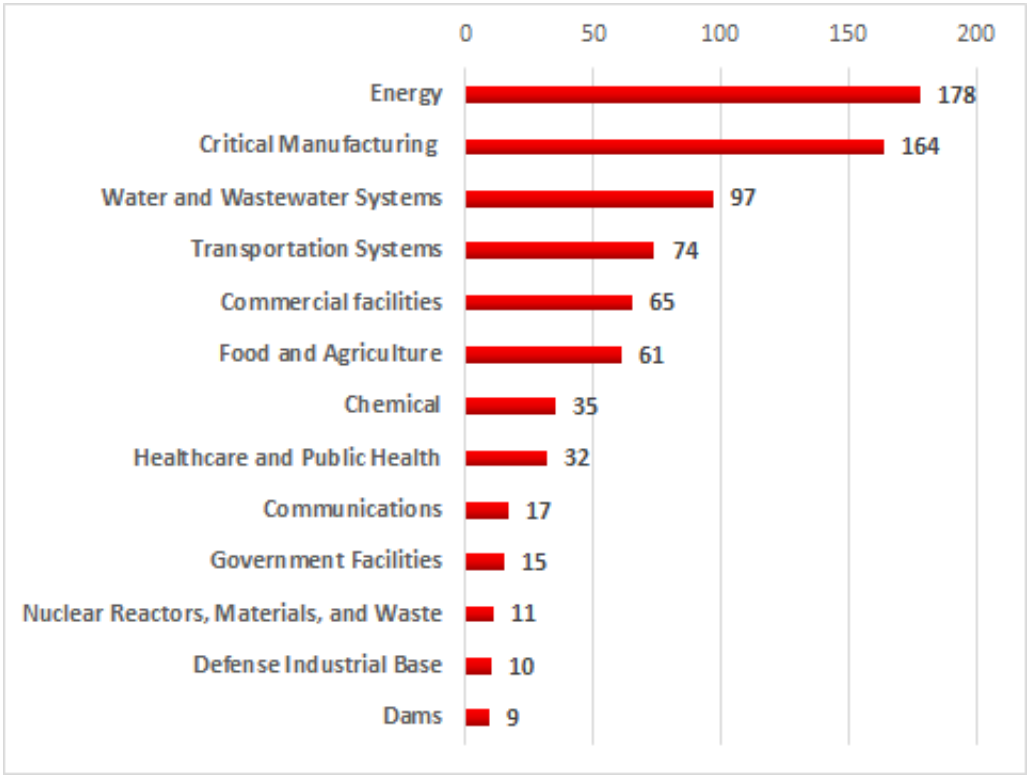
Motivation

- Threat landscape is increasing
- All industrial areas are affected
- High impact potential
- Safety implications

Number of vulnerable products (ICS-Cert 2017)



https://ics-cert.kaspersky.com/reports/2018/03/26/threat-landscape-for-industrial-automation-systems-in-h2-2017/#_Toc509229750

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Cyber Security Approach

- Creation of a basic study of the communication architectures of BWB and EMS in respect to IT security
- Performing an IT security risk analysis
  - Incorporating scenarios from ResiWater WP1
- Providing recommendations for increased resilience against cyber threats

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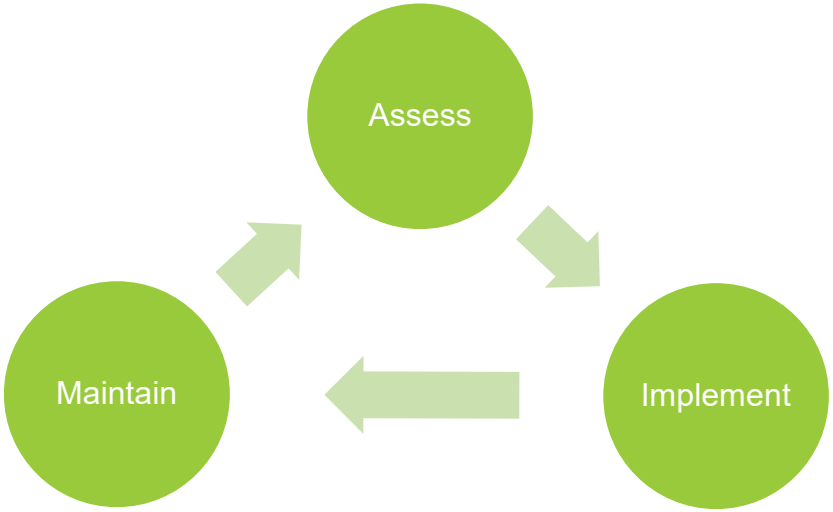
Securing Industrial Control Systems

CYBER SECURITY MANAGEMENT SYSTEM

- Risk analysis is the building block for a CSMS
  - „Cyber security management system“
- Following industrial security standard IEC 62443
  - Standard for Industrial Communication System (ICS) security
  - Establishing security for industrial automation and control systems



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Securing Industrial Control Systems

CYBER SECURITY MANAGEMENT SYSTEM

- Consisting of three main parts:
  1. Risk analysis (risk identification, classification and assessment)
  2. Risk addressing (security policies, awareness, countermeasures)
  3. Monitoring and improvement

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Cyber Security Risk

CYBER SECURITY MANAGEMENT SYSTEM

- Based on simple risk definition
  - Risk = Threat x Vulnerability x Consequence
- Threat
  - likelihood that a threat against an asset is realized
- Vulnerability
  - how likely it is that a vulnerability can be exploited
- Consequences
  - the negative impact on the organization after a successful attack

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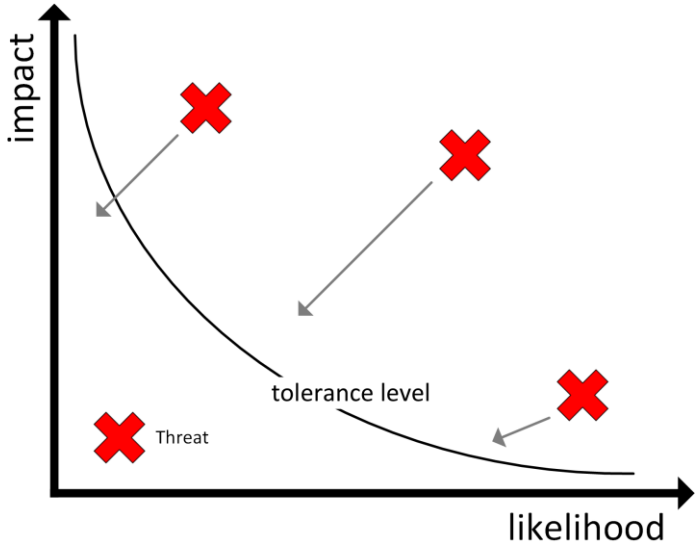
Cyber Security Risk

CYBER SECURITY MANAGEMENT SYSTEM

- Focus in risk analysis
  - Risk identification (which risks/threats exist?)
  - Risk classification (properties of risks/threats)



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Risk Analysis

RISK IDENTIFICATION, CLASSIFICATION AND ASSESSMENT

- Risk analysis incorporating results from WP1 (use cases)
  - Analysed per operator

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Risk Analysis

IDENTIFIED RISK AREAS

- Identified crucial assets and systems components affected by scenarios

- PLCs and programming stations
  - Can be manipulated (different process logic, false process data)

- Control authorization and handover concept
  - Control safeguarding crucial to failover concepts

- System and sensor monitoring
  - Manipulated data can lead to bad decisions

- Network design
  - Decreases vulnerability and increases resilience

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Risk Analysis
IN RESIWATER

- Performing interviews with key staff
  - BWB (August 2016)
  - EMS (September 2016)

- Example questions:
  - How is the system structured?
  - What IT security topics have already been addressed?
  - What systems are in use, how are they secured?
  - How are IT security procedures implemented?

- Performing analysis of results
  - Benefitting from differences between BWB and EMS
  - Focus on identified risk areas

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Securing Industrial Control Systems

CYBER SECURITY MANAGEMENT SYSTEM

- In order to reduce risk, it needs to be addressed
- Concentrate on policies, countermeasures and implementation details

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Risk Addressing

SECURITY POLICY, ORGANIZATION AND AWARENESS

- CSMS Scope
  - Organization has to decide what will be covered by CSMS
- Organize for security
  - Responsible staff has to be named and process needs to established
- Staff training and security awareness
  - Includes sub-contractors
- Business continuity plan
  - Disruption recovery plans, includes testing
- Security policies and procedures
  - Define security program, set risk acceptance levels

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Risk Addressing

SECURITY COUNTERMEASURES

- Personnel security
  - Security policy, screening, segregates duties and responsibilities
- Physical and environmental security
  - Physical protection, including against environment
- Network segmentation
  - Separate network elements, usage of conduits, block non-essential communication
- Access control
  - Account administration
    - Assign accounts to individual entities, review state
  - Authentication
    - Authenticate all users, log and review
  - Authorization
    - Role-based access control, who is granted privileges?

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Risk Addressing

IMPLEMENTATION

- Risk management and implementation
  - Manage risks at accepted level, decide which countermeasures to use („common set of countermeasures“)
- System development and maintenance
  - Maintain security status while evolving assets (e.g. introduction of new components, changes to the system)
- Information and document management
  - Ensure long-term records, classify information assets
- Incident planning and response
  - Prepare reaction to incidents (includes detection of incidents)
  - Practice incident response
  - Address discovered issues

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Securing Industrial Control Systems

CYBER SECURITY MANAGEMENT SYSTEM

- Recommendations for addressing risk areas
- Based on risk analysis results and available controls

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Recommendations

BASED ON RISK ANALYSIS

- System hardening
  - Limit systems to only required functionality
- Secure network design, defence in depth
  - BWB analysis result demonstrates effectiveness of thorough network security design
- Deployment of secure technology
  - Reduce vulnerabilities
- Policies
  - Concrete rules are needed
  - Orientation for staff
- Organisation wide security concept
  - Combine corporate and operational efforts
- Raising awareness
  - Awareness of personnel is the key to success

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Conclusion and Outlook

- Cyber Security threat landscape is growing
  - Needs to be addressed for increased resilience
- Cyber Security is a process
  - Constant monitoring and improvement needed

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Thank you for your attention
Any questions?

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