# Risk and Vulnerability Management

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Introduction to Risk and Vulnerability Management tCSC 2023

Risk and Vulnerability Management is a wide area. We will only have a generic view on Risk Management and some hints why this would be very helpful for the organisations Operational Security team. As for vulnerability management we will take a look on how its done in EGI. A much more complete online training on Vulnerability Management is available at GÉANT: https://learning.geant.org/ domain-name-system-dns-protection-operational-network-

# Risk Management

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#### Subsection 1

#### How decisions are taken

#### Decision making processes

#### Decision making process

- Slow: Reflecting systems, conscious/controlled.
- Quick: Automatic system/gut feeling, interpretations, auto correction.

Decision making and Information Security Projects

- Information systems are complex, to get to quick results often "gut feeling" approaches, "drive-by risk assessment" is used.
- Doing incident response activates the "reflecting system". (Oh look, this log file entry looks interesting ...).
- Implementing a Risk management system requires you to reflect on your security posture.

Incident Response, Reflecting system, and all the Rest

When doing incident response Reflecting System kicks in, you usually ask:

- Why could this incident happen? (Status of your security controls).
- Why wasn't it detected? (Status of your sensors)
- How can we prevent the same incident from happening again?

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#### Subsection 2

#### Towards Risk Management

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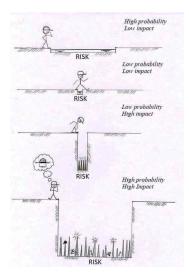
Definitions of Risk in context of Risk management:

- Old: chance or probability of loss (assets)
- New: effect of uncertainty on (reaching the) objectives (of an organisation) (ISO 31k).

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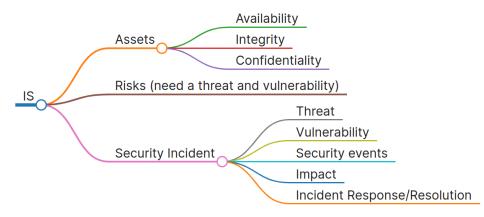
Risk Management is management of an organisation while taking into account the risks.

#### Towards Risk management Processs



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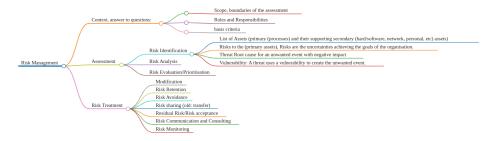
# Towards Risk management Processs, add-hoc Information Security



## ad-hoc IS management, questions

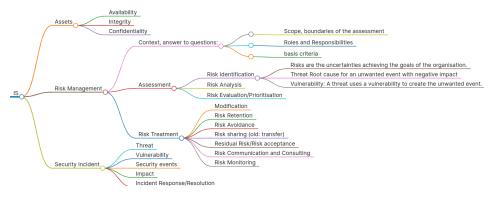
- What was the impact? were you just lucky that not more happened? or ...
- Do you really know your assets?
- Do you really know the risks to your assets?
- Did you know the affected entities in your organisation?
- Could you do proper communications related to the incident?
- If these left a nagging feeling with you, continue ...

# Risk management Process



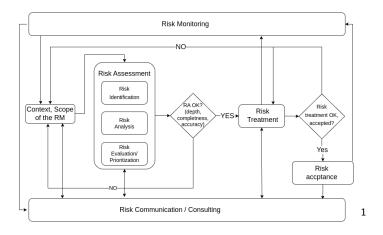


# Information Security Management



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## **Risk management Process**



<sup>1</sup>S. Klipper, Information Security Risk Management  $\bigcirc$   $\bigcirc$   $\bigcirc$   $\bigcirc$   $\bigcirc$   $\bigcirc$   $\bigcirc$   $\bigcirc$   $\bigcirc$ 

## Risk, Threats and all the rest

Risk can be expressed as:

 $VxTxI = Risk^2$ 

therefore ... for a Risk to exist a Vulnerability and a Threat needs to exist.

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<sup>&</sup>lt;sup>2</sup>V: Vulnerability, T: Thread, I: Impact

#### Oh Dear, a lot input needed

To implement a Risk Management Process a lot of information is needed, good thing ISO 2700 $\{1,2,5\}$  and 31010 can help. .

- 27005 Information Security Risk Management (Annex on Threats, Vulnerabilities.)
- ENISA ThreatLandscape
- SANS YYYY Top New Attacks and Threat Report (also Controls)
- https://www.cisa.gov/ known-exploited-vulnerabilities-catalog

Monitoring of the Risk Management Process requires current input on threats and security controls.

#### Risk, Threats and all the rest

- STRIDE: A model of what can go wrong:
- Spoofing, Tampering, Repudiation, Information Disclosure, Denial of Service, Elevation of Privilege.
- Is used in threat modelling, see Adam Shostack's book Threat Modeling: Designing for Security https://shostack.org or https://www.youtube.com/watch?v=DMFF8zQqEVQ

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## Threats a card game

Elevation of privilege, threat modelling card game for developers.



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Not prepared yet, please come back later this year ...

https://attack.mitre.org/ MITRE ATT&CK is a globally-accessible knowledge base of adversary tactics and techniques based on real-world observations. From here you get information on:

- Which APT group is focusing on your sector?
- What is their motivation?
- What are the typical attacks, tools (threats) they use to exploit the resp. vulnerabilities.

# Threat Modelling with MITRE ATT&CK

- Pick an organisation,
- Set up context,
- Find Threats to this organisations Assets.
- Threat modeling in security operations

A first version in the Hands-On, please come back next year for a more complete versio ...

# Why Risk management?

#### Leverage the outcome of a Risk Assessment, examples



# Incident Response for High impact incident

- To get started, ... lets look at the debriefing of a successful ransom attack and the problems you may run into, like:
- How to prioritize what systems to bring back first. (Business Continuity Plan)
- What is lost? GDPR relevant data loses need to be reported to the authorities.
- do useable back-ups of important (for business continuity) datasets exist?
- Note, at this stage its not about what security controls failed.
- Risk analysis helps to know your assets and protective measures in place.

#### Subsection 3

#### Preparation for Risk Analysis



Risk Analysis is a process. An objective analysis of the effectiveness of the current security controls that protect an organization's assets and a determination of the probability of losses to those assets. <sup>3</sup>

When doing it for an organisation, this is rather a project with involvement of senior management and other key-personal. At the end of this project the Risk Management Process should be started.

<sup>&</sup>lt;sup>3</sup>The Security Risk Assessment Handbook A Complete Guide for Performing Security Risk Assessments, Douglas J. Landoll

# Phases/Steps in Risk Analysis

There are multiple methods and frameworks available for Risk Management <sup>4</sup>. Remember, this is a project which requires the usual project management (with senior management contribution/support). The methods differ in details/organisation of the following phases. Which method to use is also subject to the goal of the Risk assessment (Compliance with security regulations, ISO-27K, NIST-800, etc)

<sup>4</sup>https://www.enisa.europa.eu/publications/ interoperable-eu-risk-management-framework (B) (E) (E) (E) (E) (C)

# Info Gathering Phase

Large parts of the info gathering is already done in the project planning part. Information Gathering, Identify:

- Assets, Primary Assets (Business Processes), Secondary Assets (Hardware, Software, Personal/Experts, Data Sets/Bases) supporting the primary Assets, are used in the processes.
- ▶ Threats, use OSINT, see also the hands-on <sup>5</sup>.
- identify Critical systems (ex. systems that automate critical business functions)

<sup>5</sup>https://www.enisa.europa.eu/topics/

threat-risk-management/threats-and-trends + ( )

#### Get Info on available Controls

- Administrative (policies, procedures)
- Technical (Design, Architecture, Configuration, AuthNZ)

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Physical (physical access control, CCTV etc)

#### Subsection 4

**Risk Analysis** 



## **Risk Analysis**

Bringing together the gathered data/information.

- Asset valuation, example: Low (little to no impact), Medium, High, Critical (Indicates that compromise of the asset would have grave consequences). Various valuation approaches.
- Threat and Vulnerability mapping,
- Risk Calculation. (Here the above information is used to get a qualitative (low, moderate, high) or quantitative value)

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 Risk Mitigation: Safeguard selection, Safeguard effectiveness(cost-value ratio)

## **Risk mitigation**

- Safeguard/Control selection
- Safeguard/Control effectiveness (cost-value ratio)
- Risk reduction (improve existing controls, apply additional controls)
- Result: Residual security risk (that remains after implementation of recommended safeguards). This will be treated in the next step.

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#### Recommendations, Reporting and Resolution

Senior manager must decide to reduce the security risk, accept the residual security risk, or delegate the security risk to someone else (example: insurance).

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- Risk transfer.
- Risk acceptance.
- Risk assignment.

# Finally

The Risk assessment report will help the Operational Security team to prioritize the available resources to:

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- Security Monitoring (ex. access control)
- System audits, log processing, alerting
- Back-up Strategy

# Threat Modelling with MITRE ATT&CK

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#### Subsection 1

#### MITREATT&CK

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# MITRE ATT&CK

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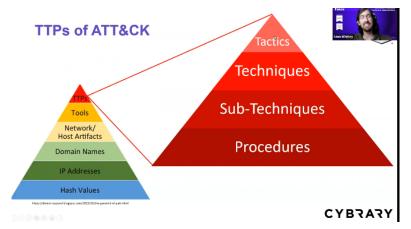
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# MITRE ATT&CK

MITRE ATT&CK Matrices capture the relationship between:

- Tactics (Column headers), Represent (intermediate) goals of an adversary, for example lateral movement.
- Techniques (Column entries)
  - are the means/tools how the adversary achieve their goals/tactics
  - are written/used by the adversaries, entries describe and capture how an adversary performs each action or behaviour.
  - Subtechniques describe adversary behaviour at a lower level then the resp. technique.
  - are often platform specific, Example: Technique = Command + Scripting Interpreter, the Subtechniques are: Powershell ... Windows; Unix shell ... Unix; python, Javascript ... Cross platform.

# MITREATT&CK

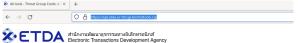


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# OSINT

#### https://apt.etda.or.th/cgi-bin/listtools.cgi



Groups Tools Search Statistics



lome > List all tools

Search

Threat Group Cards: A Threat Actor Encyclopedia

#### All tools

Changed	Name
<u>Fools</u>	
	3102 RAT
	3PARA RAT
	3proxy
	3Rat Client
	404-Input-shell web shell
	4H RAT, 4h_rat
	7Logger
	7-Zip

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### OSINT

#### https://apt.etda.or.th/cgi-bin/listtools.cgi Database search

Actor	Source country	<b>v</b>
	Victim country	Netherlands v or Worldwide
	Victim sector	Education
	Motivation	<b>v</b>
	Free text search	(can use ** and '?' wildcards)
		Searchl

Tool	Category	<b>v</b>	
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# OSINT

#### https://apt.etda.or.th/cgi-bin/listgroups.cgi?c= &v=Netherlands&s=Education&m=&x=

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	APT 29, Cozy Bear, The Dukes		2008-Oct 2022	Q
	APT 41	•0	2012-Aug 2022	4
	Circus Spider	[Unknown]	2019-Feb 2022	q
	Cutting Kitten, TG-2889	٠	2012-Mar 2016	G
	Dark Caracal		2007-2020	
	Desert Falcons	[Gaza]	2011-Nov 2021	4
	Equation Group		2001-Aug 2016	٩
	FIN11	[Unknown]	2016-Dec 2022 💧	٩
	MuddyWater, Seedworm, TEMP.Zagros, Static Kitten	٠	2017-Late 2021	0
	Shadow Network	•0	2010-2010	4
	Sofacy, APT 28, Fancy Bear, Sednit		2004-Sep 2022	4
	TeamSpy Crew		2010-Feb 2017	
	Turla, Waterbug, Venomous Bear		1996-Sep 2022	
Other	groups			
	Fxmsp		2016-Jul 2020	4

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#### MITREATT&CK, and OSINT

Use the APT group information from the previous step in MITREATT&CK  $\ldots$ 

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#### MITRE ATT&CK® Navigator

The ATT&CK Navigator is a web-based tool for annotating and exploring ATT&CK matrices. It can be used to visualize defensive coverage, red/blue team planning, the frequency of detected techniques, and more.

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Create New Layer	Create a new empty layer	^
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earch Open febsites/Domains (0/2)		Trusted Relationship	Shared Modules	Create or Modify System Process (2010)	Event Triggered Execution 12/16	Guardralis (0/1)	Modify Authentication Process (1/7)	Control Abuse Elevation Control
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			Windows Management Instrumentation	Flow (3/12) Implant Internal	Process Injection (1/12) Scheduled	Hijack Execution Flow (0/12)	Generation Network Spiffing	Mitigations (43)		
				Modify Authentication	Task/Job (0/5)	Impair Defenses (1/9) Indicator Removal (1/9)	OS Credential Dumping	Campaigns (13)		

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			Management Instrumentation	Implant Internal Image	Injection (1/12) Scheduled	Hijack Execution Flow (0/12)	Network Sniffing	Mitigations (43)		
				Modify	Task/Job (0,15)	Impair Defenses (1/8)	OS Credential Dumping	Campaigns (13)		

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#### Subsection 2

#### What to do with MITREATT&CK

# Use MITREATT&CK, for...

- Threat modelling with MITRE ATT&CK is certainly not complete.
- It depends on your (time consuming) OSINT, to get the groups that could possibly be interested in your assets.

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Still it will give you a pretty good start on ...

# Use MITREATT&CK, for...

- Data Sources (do you have the logs for the threats identified).
- Detection/analysis (sensors, where to place them)
- Mitigation (security controls)

As a result you get a good indication of your security posture against the groups, techniques in scope. Map it against your SOC settings/capabilities

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#### Thanks for your attention, Questions?