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The Center for Education and Research in Information Assurance and Security

Determining System Requirements for Human-Machine Integration in Computer Security Incident Response

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SUMMARY

Incident response teams in cyber defense (CSIRTs) play a critical role in mitigating security events. Advancement in the field requires integrating approaches from social and behavioral sciences to better understand the humans in the system. This research investigates incident response (IR) tasks and the humans that perform them, and uses Human Factors methods to determine functional requirements for possible automated solutions. Findings presented in a systems engineering language will inform algorithmic development from other scientific fields currently addressing cyber defense with computational methods.

PROBLEM

CYBER SECURITY IS A **TOP GLOBAL THREAT[1]** WITH MANY NEGATIVE INFLUENCERS

- ANALYST SUPPLY SHORTAGE
- PATCH & PRAY MENTALITY
- ADVANCING THREAT LANDSCAPE
- AGING HARDWARE
- GROWING ATTACK SURFACE

Current approaches to addressing these issues lack expertise in other areas, which limits effectiveness, validity, and generalizability of solutions.

MAKE OR FIND MORE ANALYSTS

CREATE MORE AUTOMATION

DESIGN BETTER ANALYST TOOLS

There's a skills gap being approached in two different (and ineffective) ways.

There's a gap between current security science research and social and behavioral sciences. [2]

BACKGROUND

Computer Security Incident Response Teams (CSIRTs) provide critical defense to companies, organizations, and countries.

- CSIRTs vary in roles and expertise
- Team structures vary greatly across cyber organizations
- CSIRTs may perform many different services, including incident handling

- Incident response is knowledge work; expertise is central to doing the job
- Information sharing is a key aspect of incident response
- Automation roles in incident response are not well understood

This exploratory research aims to **identify the current state** of expertise and automation in CSIR handoffs, **determine gaps** as requirements for future state automated solutions, and **translate findings** into actionable items.

PROPOSED METHODOLOGY

1 OBSERVATIONAL FIELD STUDIES / INTERVIEWS

3-4 DIFFERENT CSIRTS
40 HOURS PER CSIRT

- Document context and environment
- Identify critical information handoffs in IR
- Map handoff process steps
- Map information flows for handoffs
- Identify struggle points within handoffs

2 COGNITIVE TASK ANALYSIS INTERVIEWS

4-6 EXPERTS
2 HOURS PER INTERVIEW

- Identify points in IR that require expertise
- Identify expertise areas needed for IR handoffs
- Identify common scenarios
- Identify cues and strategies for navigating

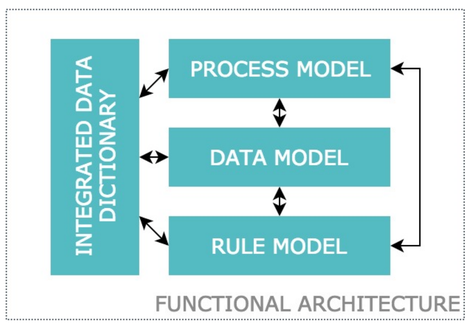
3 KNOWLEDGE ASSET MAPPING SURVEYS

3-4 CSIRTS (SAME AS STUDY 1)

- Determine subjective expertise by area
- Determine where certain expertise can be found on each team
- Determine key differences across teams
- Determine knowledge sharing patterns

4 SYSTEM REQUIREMENTS & FUNCTIONAL ARCHITECTURE[3]

- Capture context, environment, human-driven automation needs
- Target critical handoffs & struggle points
- Convert the process / information flows to software requirements



PROCESS MODEL
- Process flow per handoff
- Information flow per handoff

DATA MODEL
- Information needed per scenario
- Existing information sources

RULE MODEL
- Conditions per scenario
- Cues and strategies per scenario

IMPACT

- Provides rich context and insights about CSIRTs, how they differ; Automation opportunities by team
- Lays groundwork to address a major gap between Computer Science and Behavioral/Social Science
- Translates findings of qualitative research into actionable results for system designers / developers
- Provides methodology for additional work in InfoSec, as well as human-automation collaboration in general

[1] Coats, D. R. (2017). Worldwide Threat Assessment of the US Intelligence Community. Washington, DC, USA.
[2] National Academies of Sciences Engineering and Medicine. (2017). Foundational Cybersecurity Research. (Millett, Fischhoff, & Weinberger, Eds.). Washington, DC, USA: National Academies Press. http://doi.org/10.17226/24676
[3] Levis, A. H., & Wagenhals, L. W. (2000). C4ISR architectures: I. Developing a process for C4ISR architecture design. Systems Engineering, 3(4), 225–247.

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