NetWare 2024 & SocSys 2024

PANEL #4

Advances in Systems Resilience and Robustness

IARIA

Panel #4

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FALL 2024

Moderator

Dr. Martin Zinner, Technische Universität Dresden, Germany

Panelists

Project Assoc. Prof. Dr. Hirokazu Hasegawa, National Institute of Informatics, Japan

Eng. Timm Bostelmann, FH Wedel (University of Applied Sciences), Germany

Dr. Svetlana Boudko, Norwegian Computing Center in Oslo, Norway

Prof. Dr. Petre Dini, IARIA, USA/EU

- **Advances in Systems Resilience and Robustness***(fault tolerance, self-healing, adaptability, redundancy, stress testing, risk management robust design, cyber resilience, user roles, etc.)*

Martin Zinner
Technische Universität Dresden

- **Resilience is an essential attribute of manufacturing systems**
  - **as it provides the ability to withstand not-foreseen challenging circumstances**
  - **and adapt to disruptions without incurring significant additional costs.**
- **The five key components of operational resilience namely,**
  - **a) risk identification and management,**
  - **b) business continuity planning,**
  - **c) IT resilience,**
  - **d) crisis management and response, and**
  - **e) adaptive governance and culture,**
- **serve as the foundation for a comprehensive and effective resilience.**

Chair Info

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- **Manufacturing Resilience and Robustness**
  - **Manufacturing is a critical component of economic activity**
    - **a comprehensive approach is needed to fully understand and model resilience**
    - **The incorporation of deep and broad learning has emerged as a promising solution to improve the predictability of the manufacturing sector and strengthen its resilience to changing circumstances.**
  - **Organisations are aware of the importance of resilience, they often struggle to determine the extent of their resilience needs**
    - **they may lack an understanding of the true meaning of resilience**
    - **may not be aware of the appropriate level of investment required for resilience**
    - **may be unsure of the level of effort required to establish a resilient operating framework across their organisation**
  - **To foster resilience, organisations need to develop a wide range of capabilities that allow them to increase visibility, flexibility and speed of response to disruptions.**

Chair Info

Increasing Manufacturing Resiliency

- **Automotive assembly line**
  - workers at assembly lines have to cope with a flexible and rapidly changing production process
  - assistance system is used during the production process to provide workers with instructions regarding changes to the production system.
- **Three steps to a resilient manufacturing environment**
  - 1. increase flexible automation to create resilient operations
  - 2. introduce Digital Twin Technology for remote operations to ensure business continuity in adverse situations
  - 3. adopt a digital infrastructure that connects all parts of the supply chain.
- **Applying lessons learned: Building manufacturing resilience through data-driven transformation.**

Panelist Position

- BCP -> Resilience
  - Buzzword “Resilience”
    - It's used in every kinds of conferences
    - Is there a common understanding of this word?
  - BCP + Recovery = Resilience?
  - Cyber countermeasures have taken BCP into consideration
    - My research topic of master thesis (decade ago)

Hirokazu Hasegawa

National Institute of Informatics, Japan

Panelist Position

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- **User Roles in Cyber Resilience**
  - **Possibility of full automation of cyber resilience -> Maybe no…**
  - **User Role: FINAL judgement of action**
  - **We need to train to improve the skill of judgement**
    - **AI will do? : Expecting**
    - **Younge generation can do? : Cannot say either**

Hirokazu Hasegawa

National Institute of Informatics, Japan

Panelist Position

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1. **Fault Tolerant versus Self-Healing Systems**
   Traditional fault tolerance focuses on passive redundancy. Self-healing systems promise to not only recover from failures but also predict and prevent them actively.
   - Can self-healing only assist or also replace redundancy?
   - What role can, does and should machine learning play (e.g. for the prediction)?
2. **Cyber Resilience: Integrating Security and Robustness from the Ground Up**
   The increasing frequency and sophistication of cyber threats require resilience to be built into systems at every layer, from software to hardware.
   - What is necessary to build systems secure-by-design?
   - How can we do this with legacy systems?
   - Why does secure-by-design not seem to be the default?
   - What are the alternatives?

Timm Bostelmann
FH Wedel
(University of Applied Sciences)

Panelist Position

- **Use of Artificial Intelligence (AI) technologies: AI can assist in predicting, adapting to, and effectively responding to changes and potential disruptions.**
  - **AI-enhanced resilience: enabling predictive maintenance, real-time anomaly detection, and automated recovery processes**
  - **AI-enhanced robustness: fortifying systems against a range of threats. Machine learning models can be trained to recognize patterns indicative of a cybersecurity threat, initiating defensive protocols automatically (learn from past incidents and adapt responses for future threats)**
  - **AI systems can reroute resources and optimize responses to ensure that critical functions remain operational**
  - **Integration of AI with other technologies like blockchain for secure, decentralized data management and IoT for enhanced connectivity and data collection**

Svetlana
Boudko
Norwegian
Computing
Center

Panelist Position

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Petre Dini
IARIA

- **Robustness (early phase, prevention by design, maintenance)**
  - Ability to maintain operational functionality under a range of conditions, pressures, or stresses
  - Strength and stability, ensuring the system can withstand external disruptions without significant perf
    degradation
- **Resilience (after, exception handling, risk management, by design, enforced)**
  - Capability to recover quickly from difficulties, adapting effectively to significant changes or disruptions
  - Flexibility and recovery, enabling a system to return to its original state or evolve into a new, functional state following a disturbance.

- **Quick outcome**
  - Design, resources, planning, budgets, law enforcement, risk management, training, awareness
  - Human behavior (designer, control and management, user)
  - Interagency cooperation (governments, police, administration, stakeholders, owners, service providers)
  - Large spectrum of approaches for enabling the robustness ability and resilience capability, for each kind of system
  - Technology seems the least obstacle
  - Mostly humans and Rule of Laws; since, AI-based tools cannot to much, but speeding a resolution.

Panelist Position

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Petre Dini
IARIA

- **Industrial Chain systems**
  - Resilience: Adaptative supply chains, regulatory compliance, Financial stability, long-term environmental considerations and risk assessment
  - Robustness: Supply chin disruption control, quality control variability, technological obsolesce, cybersecurity threats
- **Agriculture Crops systems**
  - Resilience: Climate adaptation, economic viability, Technological integration, community and knowledge sharing
  - Robustness: Pest and disease management, Soils health, Water Management Genetic diversity
- **Agriculture livestock systems**
  - Resilience: Breeding, Biosecurity, Market flexibility, Resource management
  - Robustness: Disease control, Generic robustness, Feed availability, Housing and infrastructure, Medical assistance

Panelist Position

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Petre Dini
IARIA

- **Political system**
  - Resilience: Adaptative to change (crisis, social movements, market), Institution redundancy (to continue under stress), Social cohesion (national identity), International relations
  - Robustness: Corruption, Transparency, Rule of law, Citizen pollical participation, media freedom,
- **Social systems**
  - Resilience:, Strong community networking, adaptive governance, social mobility, communication channels
  - Robustness: Economic inequality, healthcare accessibility, education disparities, institutional trusts
- **Firefighting systems**
  - Resilience: Mental health support, interagency cooperation (police, health< etc.), community engagement and preparedness, adaptation (climate, wildfires)
  - Robustness: aging infrastructure (machinery), Technology integration, Training and preparedness, Funding and resource allocation

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Petre Dini
IARIA

- **Airport systems**
  - Resilience: Emergency response, Recovery (crisis), capacity and flexibility (for surge in numbers) an mai QoS, sustainability practices (environment), stakeholder communication (gvnt, airlines, serv providers)
  - Robustness: Infrastructure vulnerabilities (runways, terminals, air traffic control towers), cybersecurity threats (flight schedules, security systems), interdependencies of systems (baggage handling, fuel supp..., compliance with regulations
- **Disability systems (in Cities)**
  - Resilience: Emergency preparedness, adaptive urban planning, unforeseen traffic disruption, vulnerability to extreme weather, elderly reduced mobility
  - Robustness: Accessibility and mobility (universally accessible sidewalks, crossings, and public transit option), consistent service provider (healthcare, education, and social support), assistive technologies into public infrastructure, enforcing policies that mandate accessibility (across different areas)
- **Disability systems (in an Airport)**
  - Resilience: Crisis mgmt. (evacuation), service continuity (wheelchair assistance and priority boarding), adaptive policies (feedback from disabled travelers), coordination (airlines, airport authorities, and ground service providers)
  - Robustness: inclusive design (from check-in to boarding), staff training and awareness, assistive technologies (malfunctioning wheelchairs or inadequate hearing loop systems), accessibility (braille, large print, and audible info)