The Challenges of Risk Assessment for Smart Grid

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Risk Assessment: The Basics

- Risk assessment is concerned with understanding the probability of a cyber-attack and its impact

$$\text{risk} = \underbrace{\text{probability}}_{\text{Based on an understanding of } \textbf{threats} \text{ and } \textbf{vulnerabilities}} \times \underbrace{\text{impact}}_{\text{For example, financial loss, damage to equipment, loss of power, …}}$$

- The basis for prioritising how to mitigate threats and apply resources for cybersecurity

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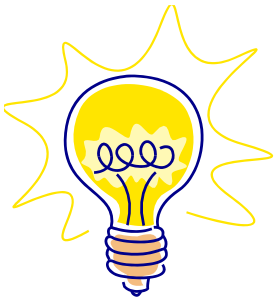
Breakout Session



- Split into groups of three people and appoint a spokesperson
- For ten minutes discuss the challenges of risk assessment for smart grid in your group
  - Write these down on post-it notes and stick on the wall
- Spokesperson presents to the workshop and discuss

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The Challenges We See …

- We have identified five key challenges with carrying out a risk assessment for smart grid:

1. Managing safety and security risks
2. Analysing cyber-physical risks
3. Understanding risks to legacy systems
4. Complex organizational dependencies
5. Understanding cascading effects

- These are not unique to smart grid, but all exist, making risk assessment particularly challenging

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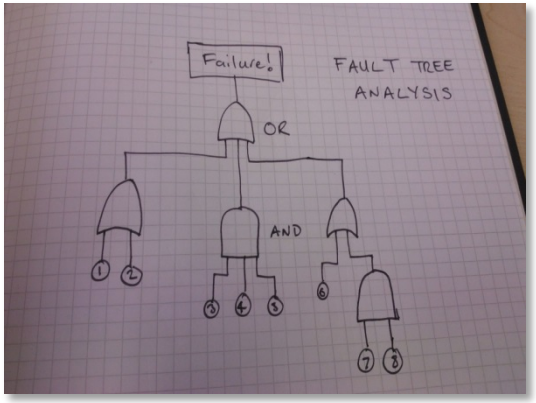
Managing Safety and Security Risks

- Safety analysis methods are widely used in the energy domain
  - Examples include HAZOP, fault-tree analysis, event-tree analysis, FMEA, STAMP/STPA, …
- There are parallels in the security domain, e.g., attack trees
- Benefits can be had by performing security and safety co-analysis
  - Reuse of results across analyses
  - Ability to consistently prioritise different types of threats, i.e., attacks versus faults



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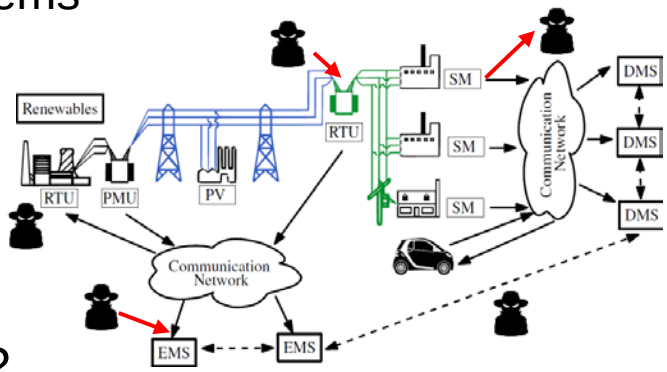
Analysing Cyber-physical Risks

- The smart grid is a cyber-physical system
  - **Power system** and **ICT infrastructure** is tightly coupled through SCADA and control systems

- Traditional IT security provides necessary tools
  - but not sufficient to secure cyber-physical systems

- Need for tools and strategies to understand and mitigate attacks:
  - Which threats should we care about?
  - What impact can we expect from attacks?
  - Which resources should we protect (more)?



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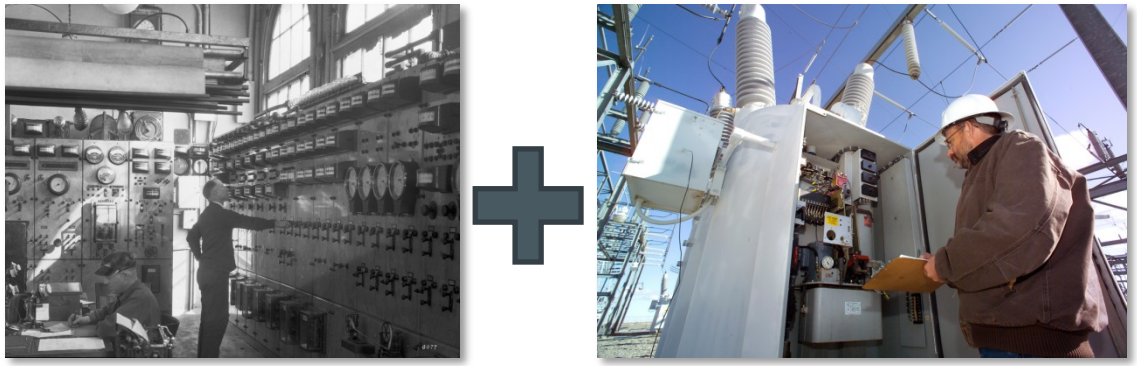
Understanding Risks to Legacy Systems

SMART GRID PROTECTION AGAINST CYBER ATTACKS

- The smart grid will consist of **legacy** systems and **new ICT components** that implement advanced measurement and control functions
- It is often not clear what impact new components will have on legacy systems, and vice versa
- Legacy industrial control systems are known to be fragile to active security testing techniques

➢ A risk assessment method should account for these characteristics of the smart grid



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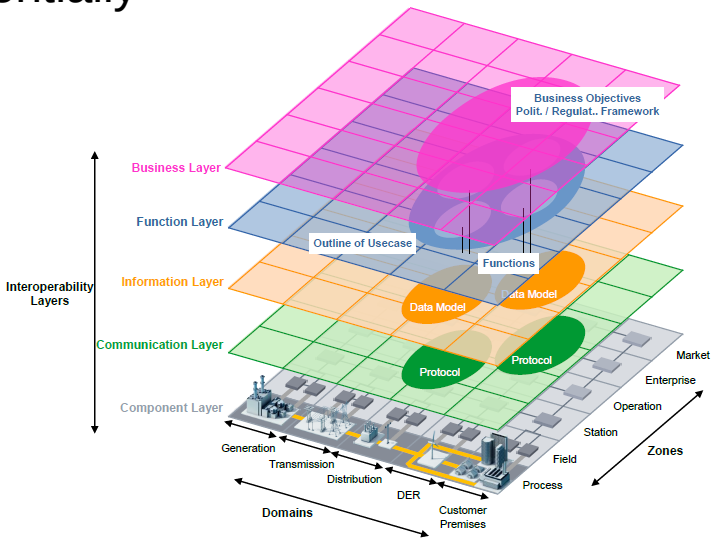
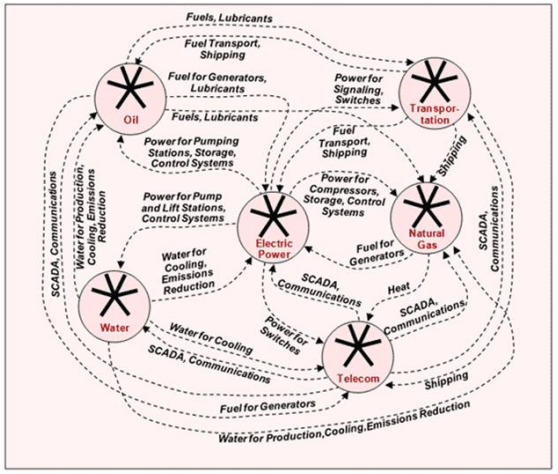
Complex Organisational Boundaries

- In a liberalised European energy market there are many actors
  - Energy producers, Transmission and Distribution System Operators (TSOs and DSOs), and Energy Suppliers
- Others from the ICT sector are emerging as being important
  - E.g., telecommunications operators and cloud providers
- Energy consumers become providers, potentially as part of virtual power providers
- A diverse and complex supply chain is emerging
- This complex web of dependencies can make risk assessment challenging



Understanding Cascading Effects

- The smart grid consists of a number of sub-systems that support an underlying grid infrastructure
- The failure of a sub-system could cascade into another
  - This problem is closely related to cyber-physical impact analysis
- A pathological case:
  1. A cyber-attack causes a failure in the energy grid, resulting in a blackout
  2. ICT systems start to run on Uninterruptable Power Supply (UPS)
  3. The UPS runs out before the grid has recovered
  4. ICT systems fail



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Conclusion

- SPARKS is aiming to develop a risk assessment framework that accommodates these challenges
- Suitable analysis techniques can be “plugged into” the framework to address the challenges
- Starting point is to consider the suitability of the SGIS toolbox
- We have a position paper in the main symposium tomorrow that describes these issues …

Cybersecurity Risk Assessment in Smart Grids

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Abstract – Smart grids will make extensive use of information and communication technology (ICT) to enable the integration of renewable energy sources. Consequently, future power grids

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Questions?