Standards, Changes and Supply chain

High Integrity Software Conference

Lucia Capogna - 22nd October 2024

SYSTRA

SYSTRA: A global leader for transportation solutions

SYSTRA is one of the world's leading engineering and consulting groups specialising in public transport and mobility solutions

+65 YEARS

Figures as at end of 2023

A turnover of **€1.071Bn**

76% of turnover achieved abroad

Orders of **€1.3 Bn**

An operational presence in **80 countries**

SYSTRA has contributed to **1 in 2** High-Speed lines in the world (>250 kph, outside China)

SYSTRA has designed **1** Metro network in service out of **2** in the world

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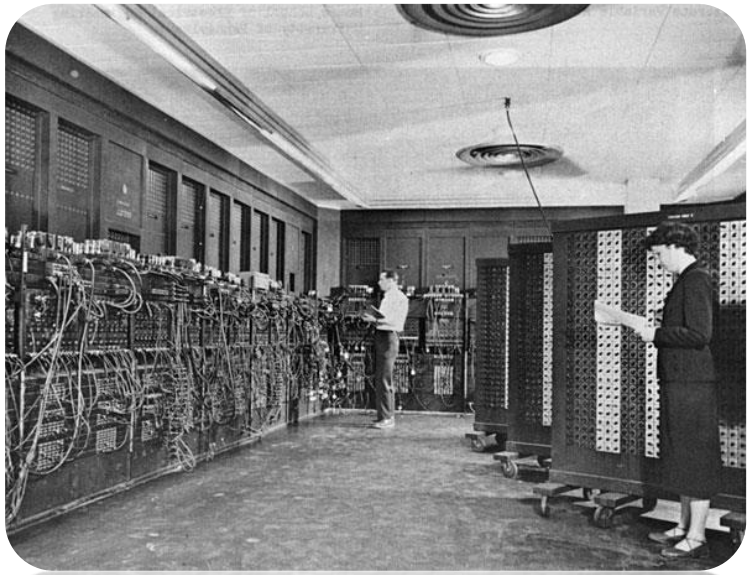
About me

Lucia Capogna

Cyber Security and Software Assurance Team Leader

- Computer Science Engineer (BSc) and Systems Engineer (MSc) with over 17 years of experience in Software, Cyber Security, Requirements Management and Verification & Validation across various industries:
  - Software and Software Assurance Technical Expert
  - Independent Lead Assessor
  - Cyber Security Technical Expert
- Member of several CENELEC (Safety – EN 50129, Cybersecurity - TS 50701 & Software – EN 50716) and IEC Standardisation Groups (Cybersecurity – IEC 63452)
- School of Engineering, University of Birmingham:
  - Industrial Advisory Board member
  - Royal Academy of Engineering Visiting Professor in OT Cybersecurity
- STEM Ambassador & Woman in Rail (WiR) East Midlands committee member

Digitalisation and Software Intro



ENIAC (Electronic Numerical Integrator and Computer) - 1945

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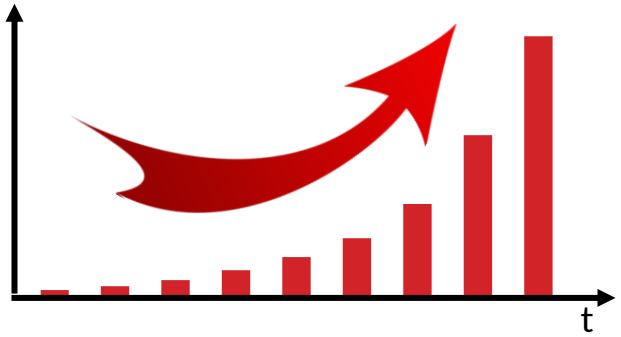
Digitalisation – Stating the obvious

Digitalisation has been exponentially introduced in all industries and solutions



- Software is contributing more and more to safety functions.
- System reliability may be affected by poor software quality.
- Many vulnerabilities are due too poor software quality. → Cybersecurity risks!

New technologies and digitalisation provide a railway that is:

- more flexible,
- inter-connected,
- easier to enhance/customise,
- more advanced,
- more responsive to sub-system failures.

Digitalisation is achieved with the introduction of large number of software applications:

- Systematic failures,
- Unpredictable and almost infinite failure modes,
- Context dependent,
- No exhaustive testing possible

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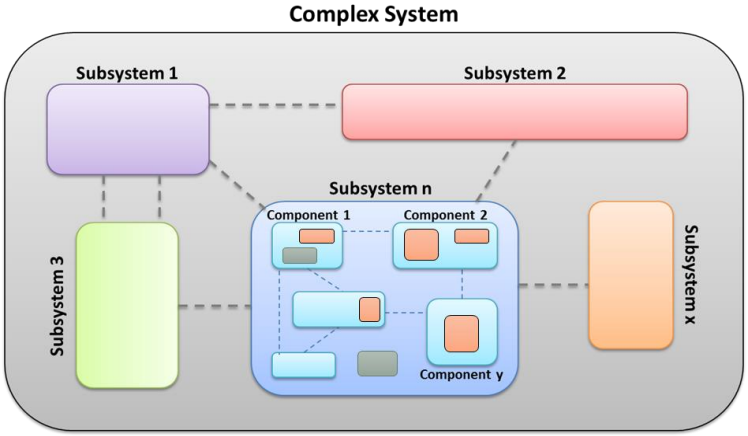
Software and complex systems

A **complex system** is characterised by the **intricate interactions and interdependencies** among its components. These systems often exhibit **behaviours** and properties **that are not easily predictable from the individual parts alone**. Complexity in such systems can arise from the **interaction** of people, organisations, and the environment, **not just from the technical aspects**.

INCOSE



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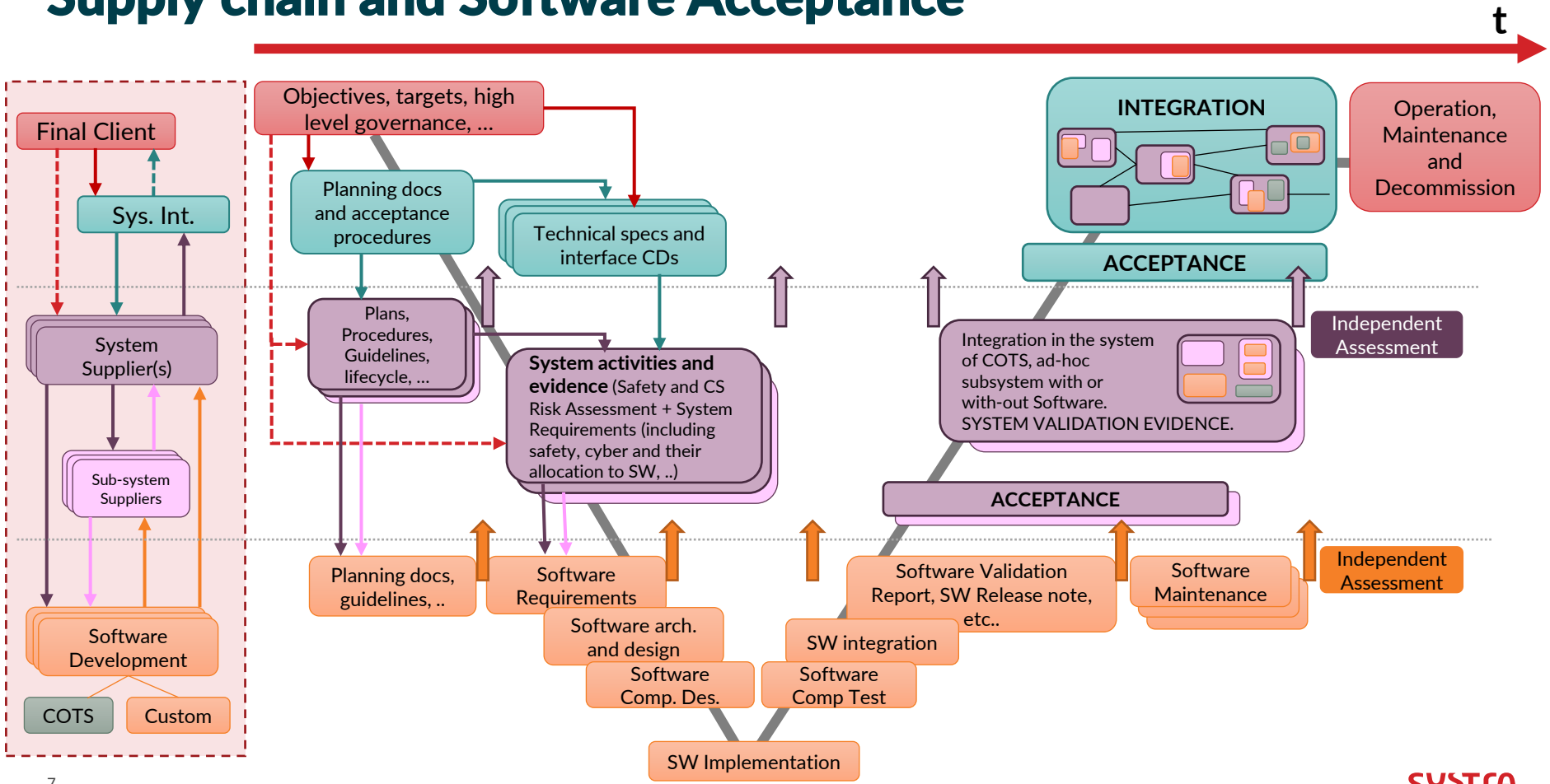
Supply chain and Software Acceptance



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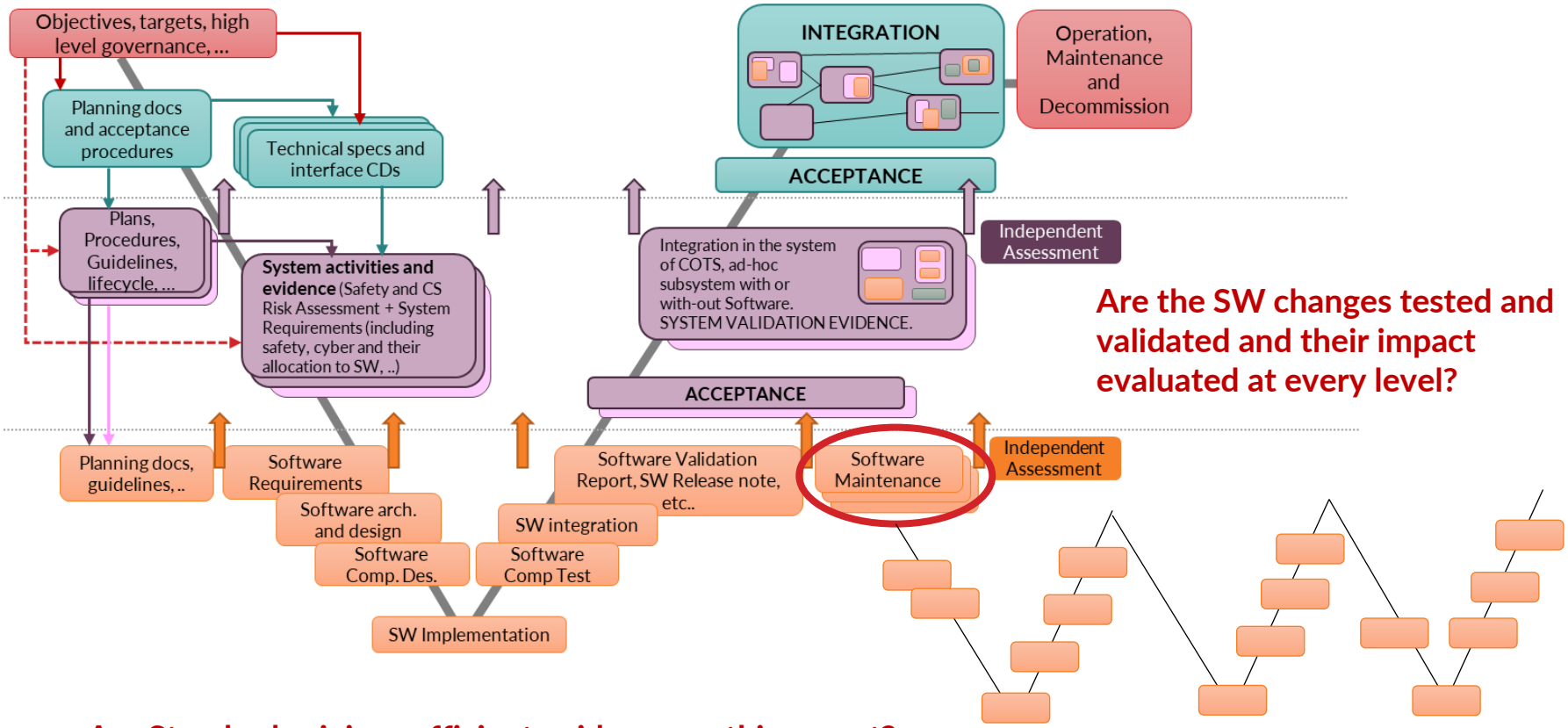
Software Changes in the systems of system context



Are the SW changes tested and validated and their impact evaluated at every level?

Are Standards giving sufficient guidance on this aspect?

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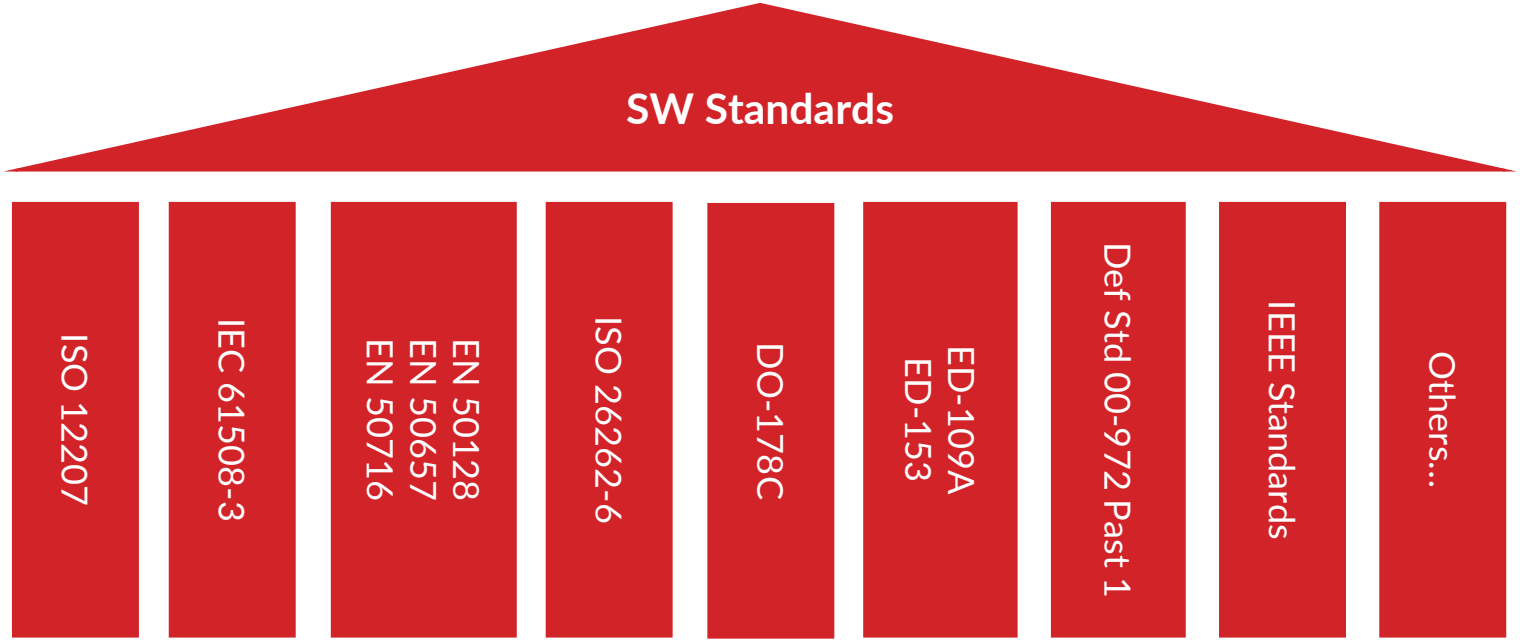
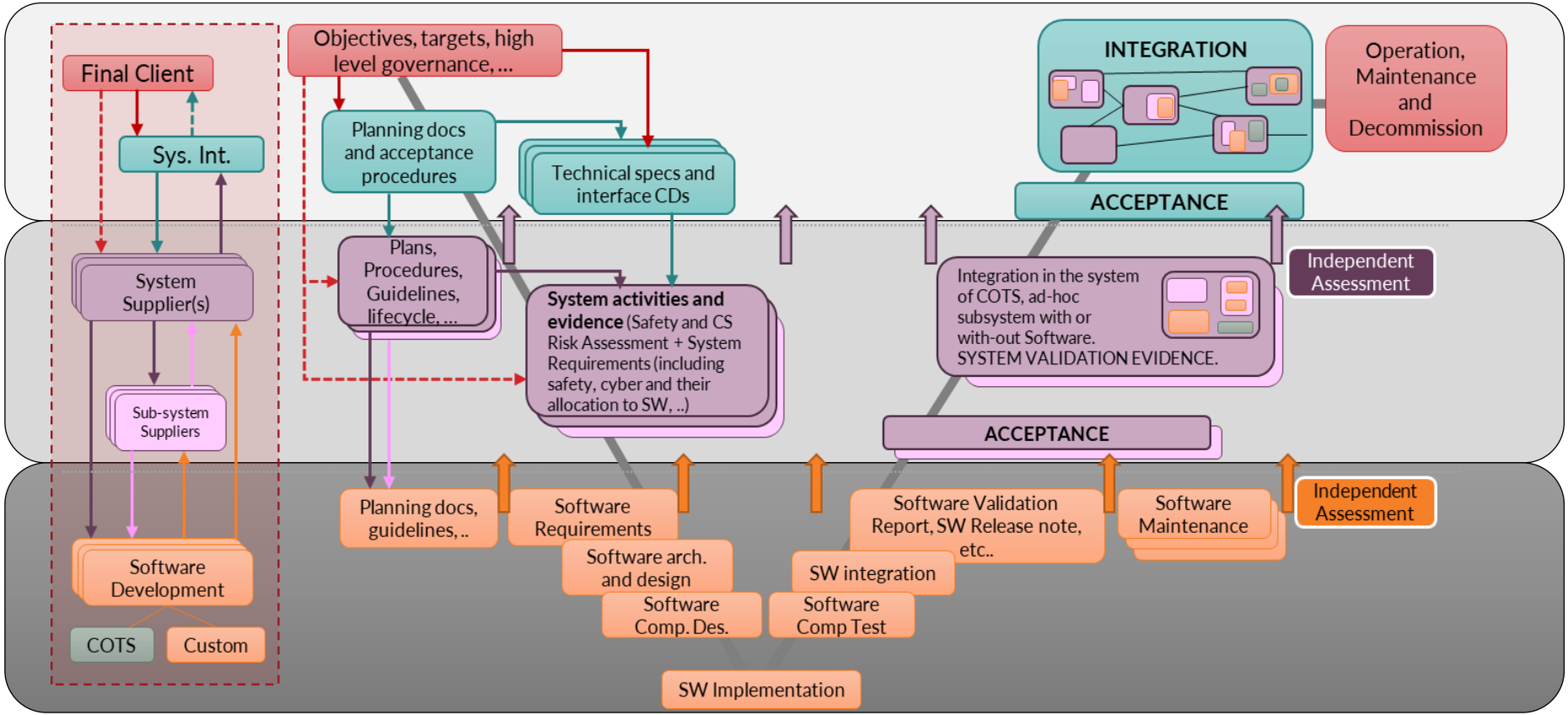
Standardisation



Do the SW Standards cover the supply chain management or the software acceptance principles and requirements?

Software Standards



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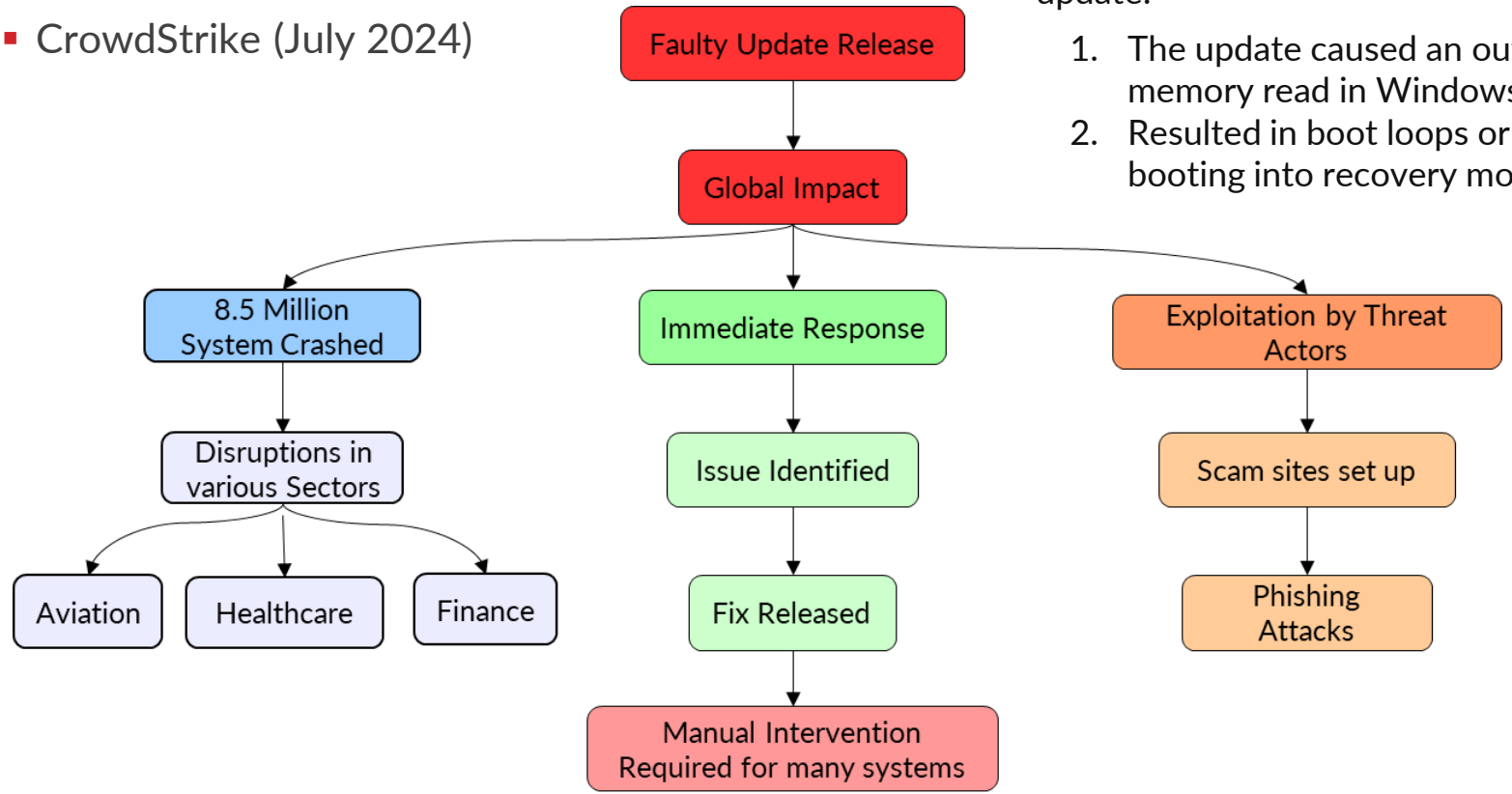
Example - CrowdStrike

- CrowdStrike (July 2024)

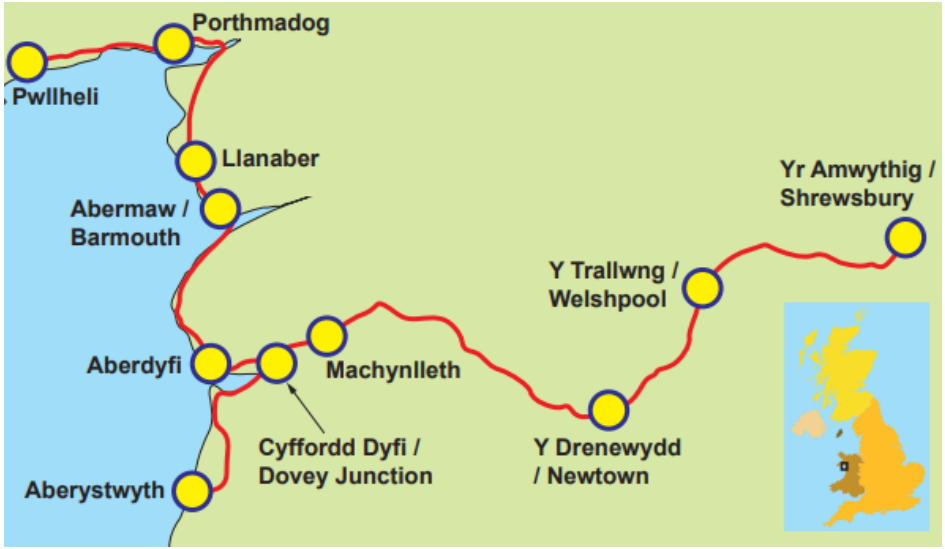


CrowdStrike distributed a faulty configuration update:

1. The update caused an out-of-bounds memory read in Windows systems.
2. Resulted in boot loops or systems booting into recovery mode.

Example – Cambrian Coast Line

- **Cambrian Coast Line, Oct 2017**
  - ✓TSR data not sent via signalling system
    → Loss of safety critical signalling data
    → Excessive speed over Level Crossing
  - ✓The signalling control centre wrongly showed these restrictions as being applied correctly



- ✓TSR data was not uploaded to the RBC (Radio Block Centre) after a software rollover
  → many SW related causal factors, including SW requirements insufficiently defined

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Conclusions

- Industrial automation Standards and sector/industry specific Standards support software development and assurance
- Systems are becoming more complex and integrated/interconnected
- Standards do not cover completely the software supply chain management or the software acceptance in complex systems or in the system of systems context
- Additional best practice and guidance are needed for:
  - Software acceptance
  - Software configuration and compatibility (complex systems/system of systems context)
  - Software change management in a complex supply chain
  - Supply chain management
  - Integration of new technology or new approaches

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