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Hardware Security Analyses in Advanced Manufacturing Industry

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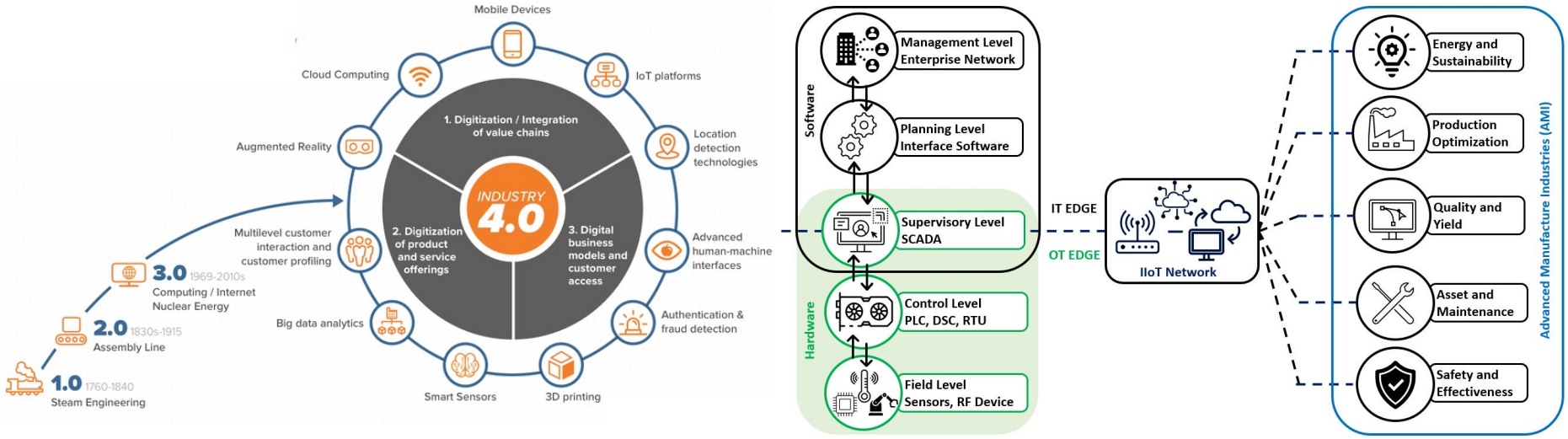
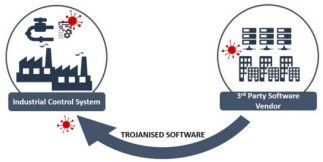
Advanced Manufacturing

- Advanced manufacturing is the use of innovative technology to improve products or processes, with the relevant technology being described as **advanced**, **innovative**, and **cutting edge**



Hardware Security Threats from Supply Chain of Advanced Manufacturing Industry (AMI)



Supply Collection
- Raw materials
- Unfinished components
- Replacement parts

Setup Assembly
- Initial machine setup
- Obsolete device replacement
- Machine upgrade

Customized Configuration
- Special manufacturing request
- Configuration setting revision

Operation Maintenance
- Operation condition sensing
- Behavioral anomaly detection
- Yield rate prediction

Hardware Attacks:

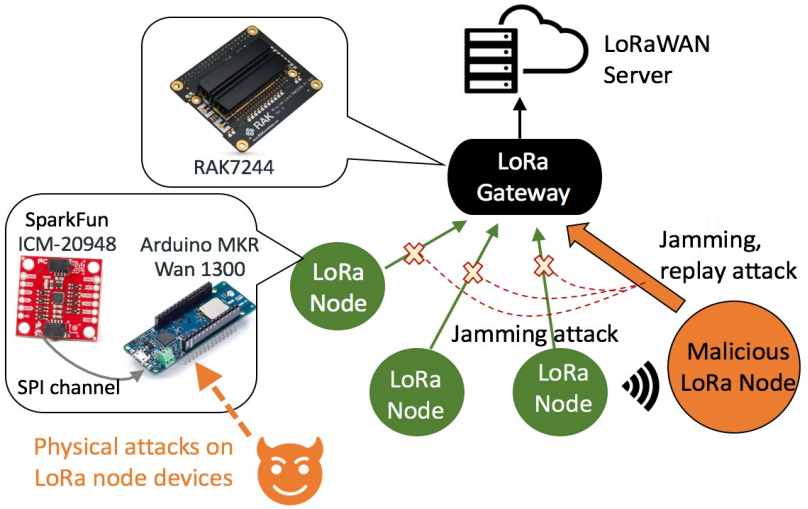
- Untrusted 4th /5th parties
- Backdoor in discrete components
- Inequivalent replacement

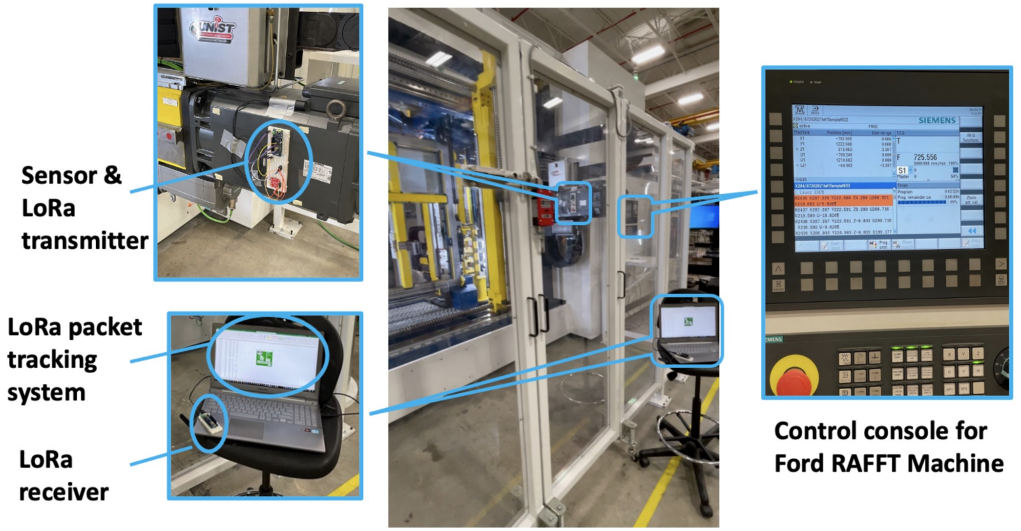
- Mismatch interface
- Imperfect communication protocols
- System design bugs

- Configuration setting spoofing
- Configuration setting tampering
- Hijacking reconfiguration

- Tamper with real-time sensing readings
- Mute anomaly alerts
- Sabotage system feedback loops

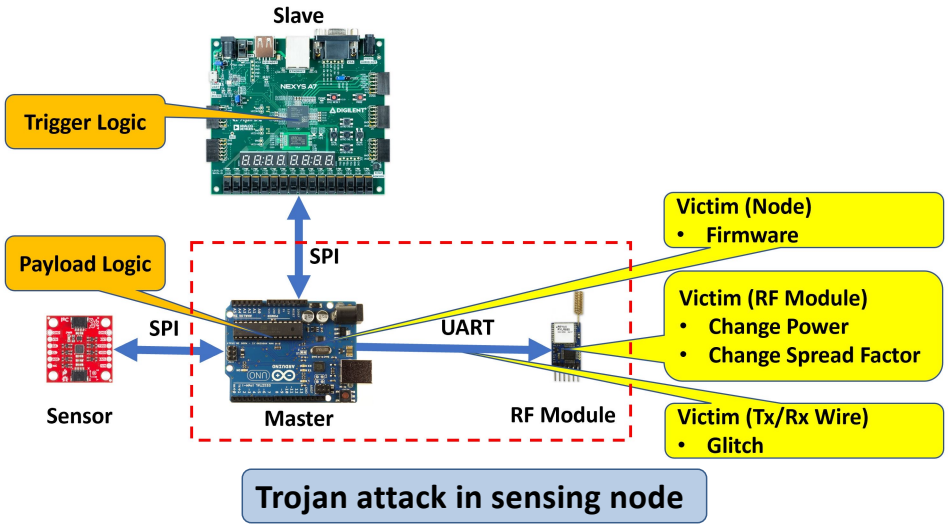
Hardware Security in LoRa-based Monitoring System

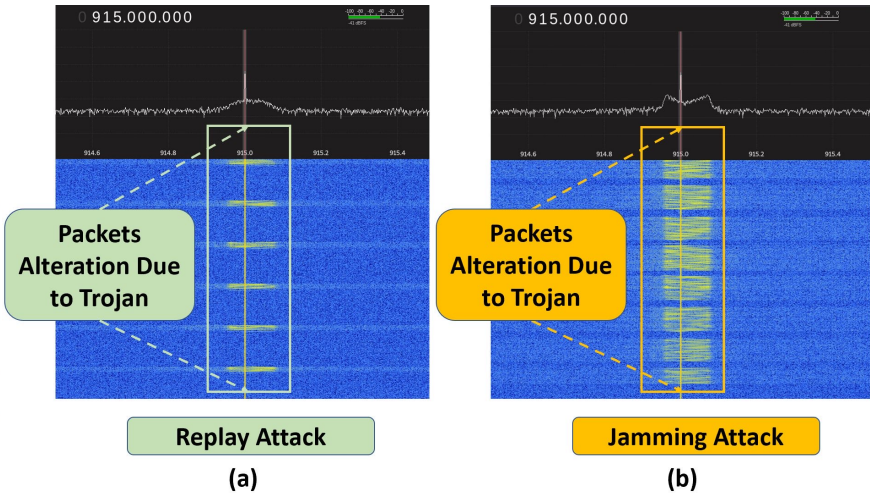




Hardware Trojan in LoRa Nodes

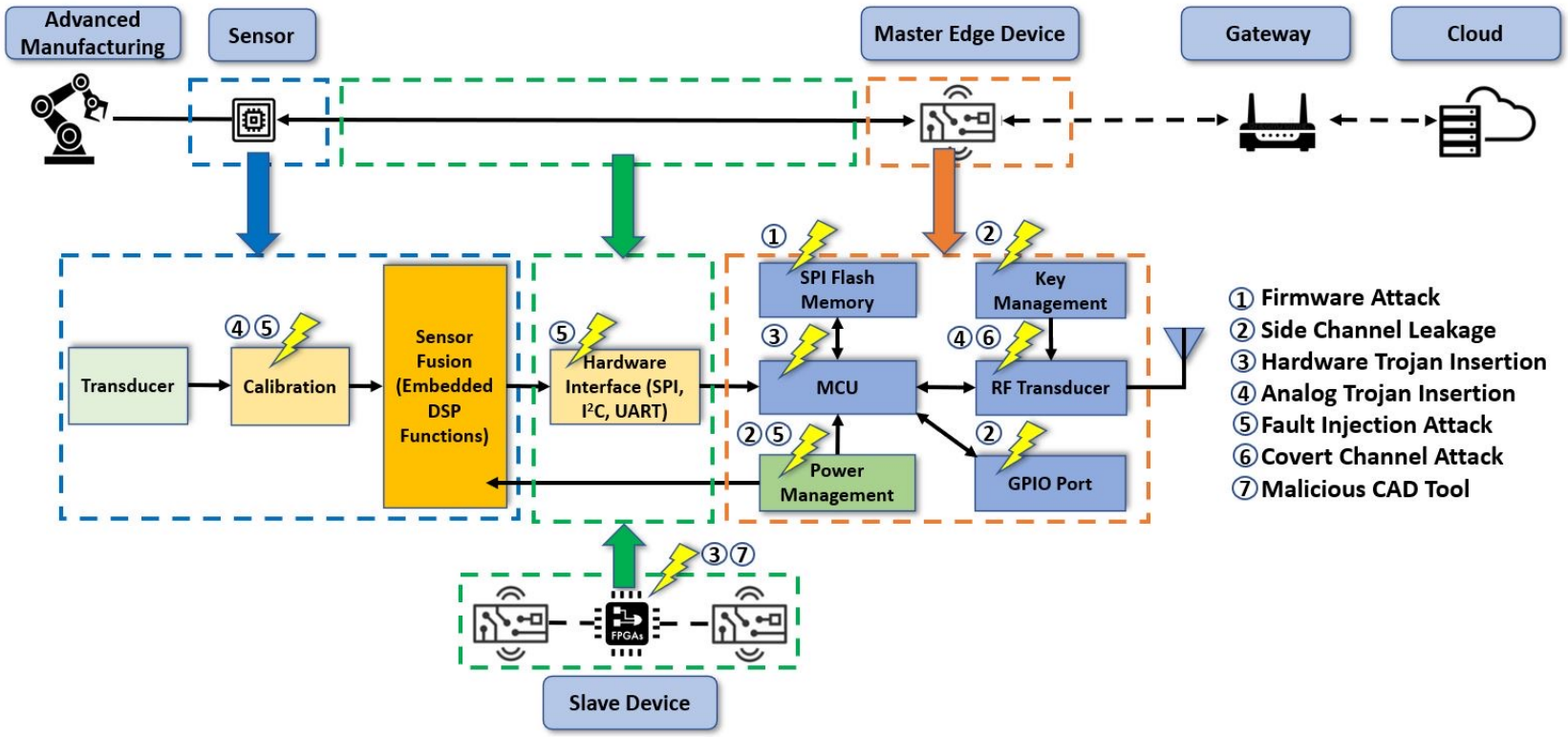
- Hardware Trojan changes the LoRa transmission
  - Cause packet drop by re-sending the previous value
  - Inject dummy data to jam the transmission link





M. Monuir and Q. Yu, GLSVLSI'22

Security Vulnerability of Hardware Components in AMI



Conclusion

- As more network connectivity is enabled in advanced manufacturing, the security of hardware deployed to manufacturing should be re-examined.
- More demonstration of practical attack cases will be helpful to refine the AMI-specific attack models.
- We suggest new investigation to study the impact of environmental noise in advanced manufacturing on the efficiency of existing attack detection and mitigation methods.

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Thank you !
Q&A