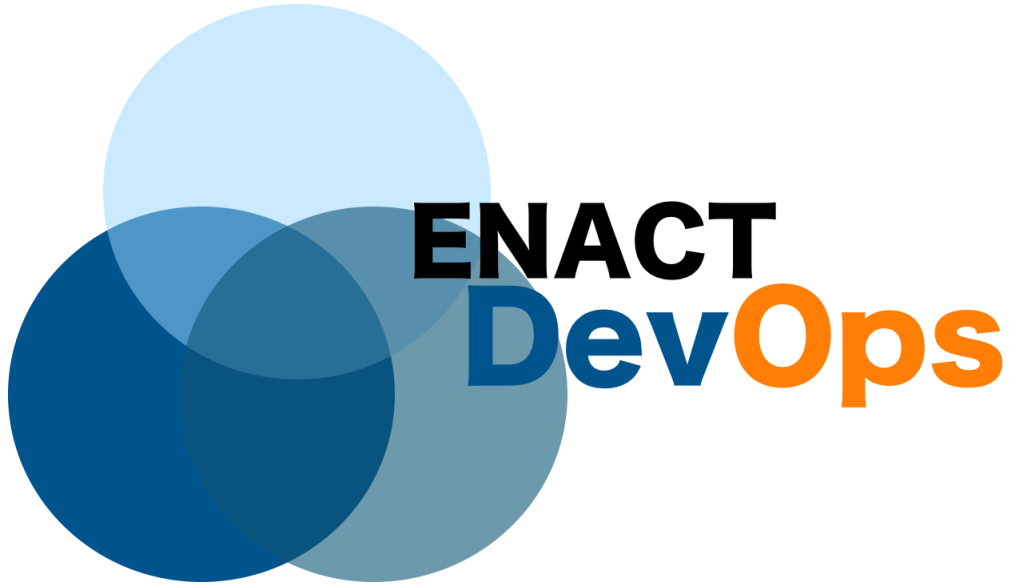


ENACT: Development, Operation, and Quality Assurance of Trustworthy Smart IoT Systems

Nicolas Ferry

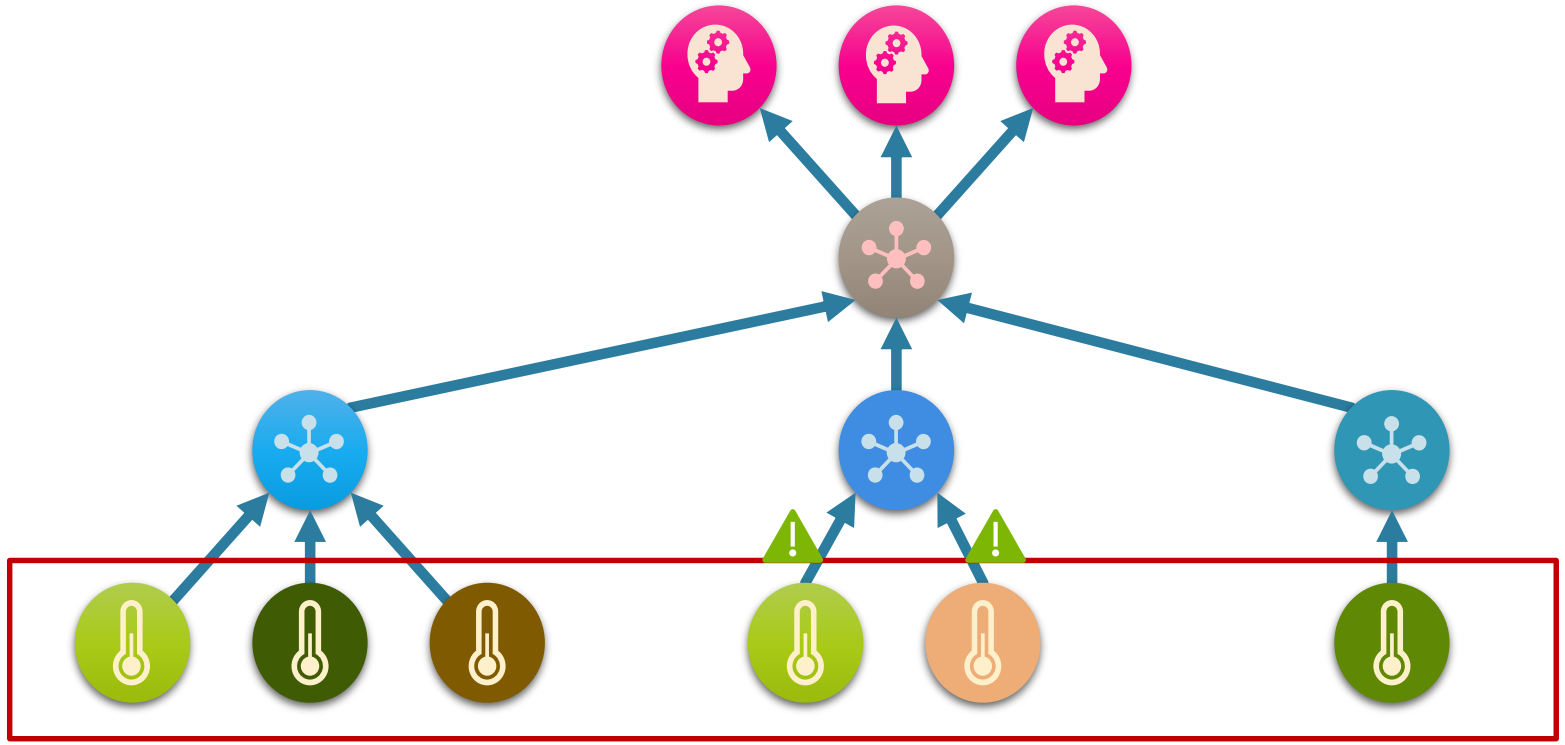
December 11th, 2018

European Commission

www.enact-project.eu

Context

- IoT system innovations were focused on:
  - From **sensors to the cloud** for processing and analysis.
  - Handling **heterogeneity**, **scalability** and **dynamicity** of IoT systems.



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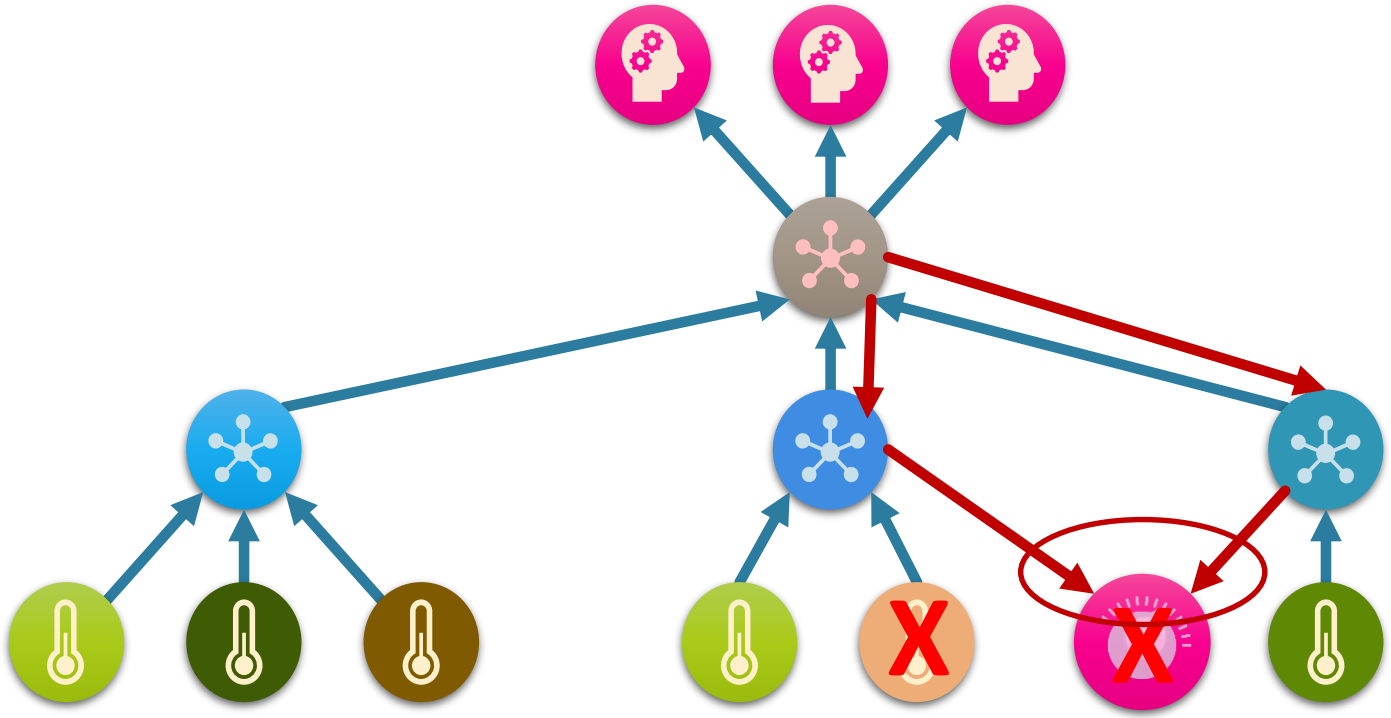
Towards Smart IoT Systems

- The next generation of **Smart IoT Systems** need to:
  - manage the closed loop **from sensing to actuation**,
  - be distributed accross **IoT, edge and cloud** infrastructures,
  - and operate in an **unpredictable physical world.**

Trustworthiness



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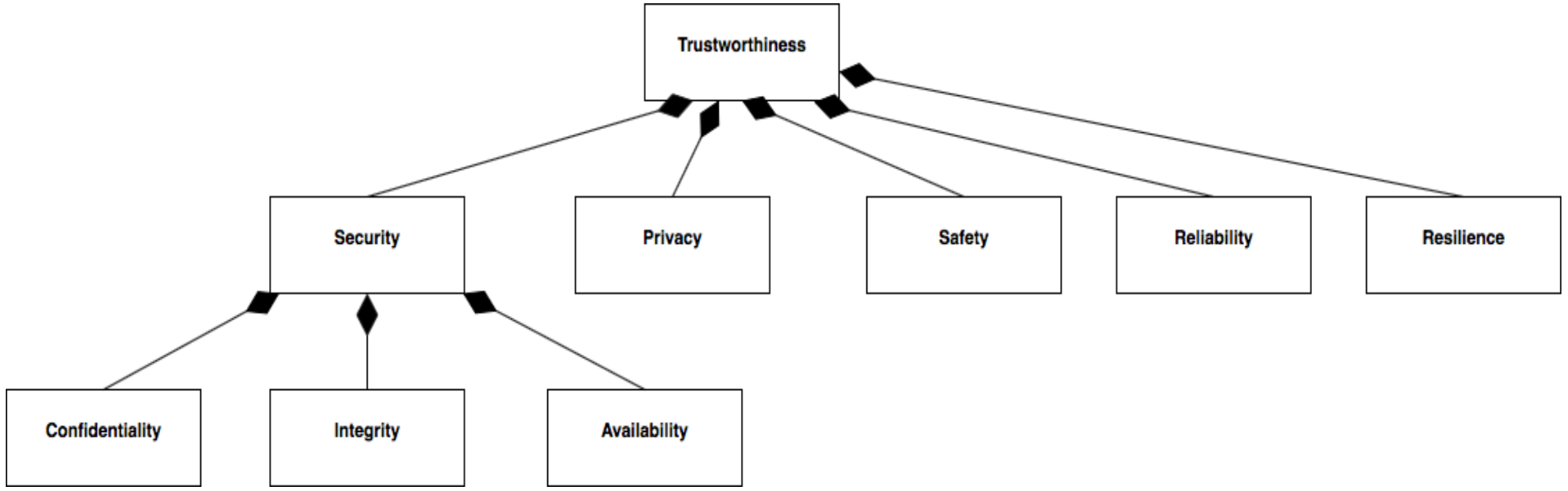
Trustworthiness



*"**Trustworthiness** refers to the preservation of security, privacy, safety, reliability, and resilience**

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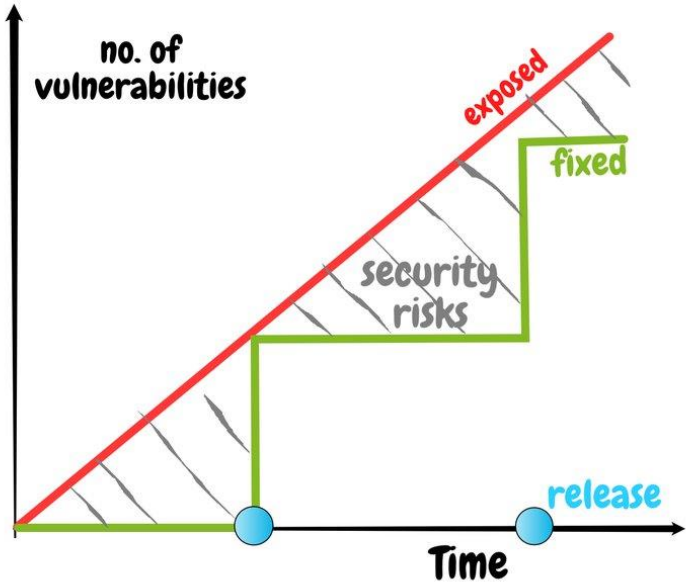
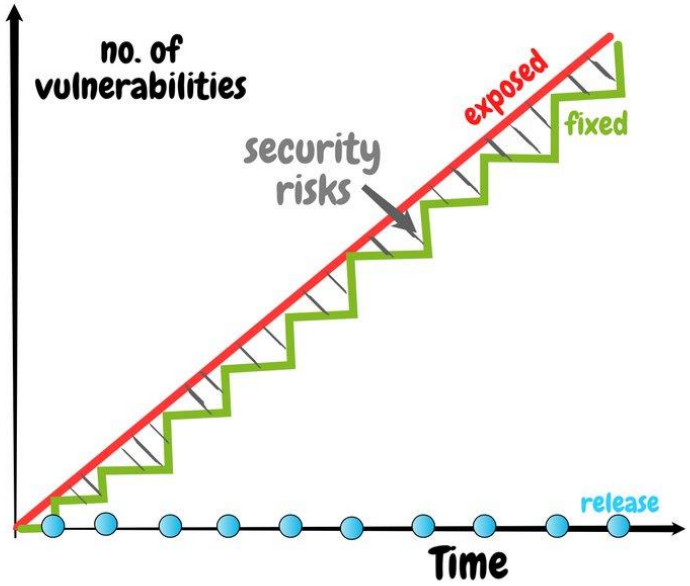
* National Institute of Standards and Technology. NIST SP 1500-201, Framework for Cyber-Physical Systems: Volume 1, Overview, V1.0, 2017.

Continuous Evolution & Trustworthiness

- SIS Infrastructure, requirements, context, might **frequently change** thus **introducing** new internal/external **threats to trusworthiness**
- The ability of these systems to **continuously evolve** to their evolving environment is decisive to ensure and increase their **trustworthiness and quality**.





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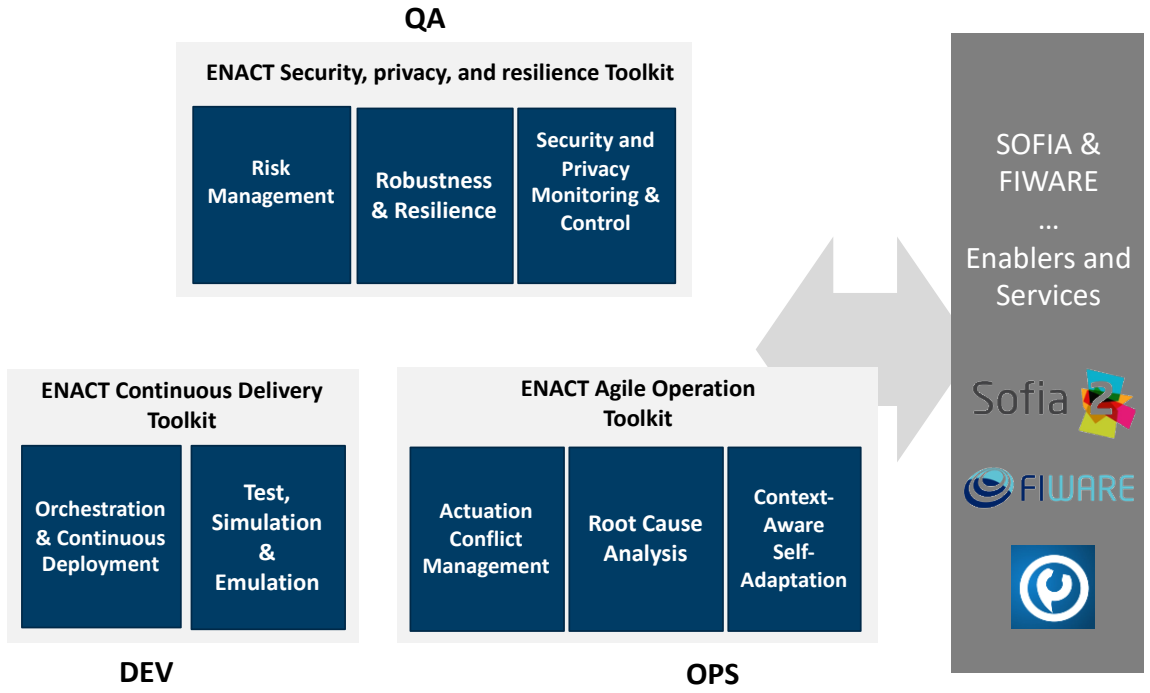
ENACT Objective

*“**ENACT** will deliver a set of loosely coupled **enablers** to support the continuous **development** and **operation** of **trustworthy** Smart IoT Systems*



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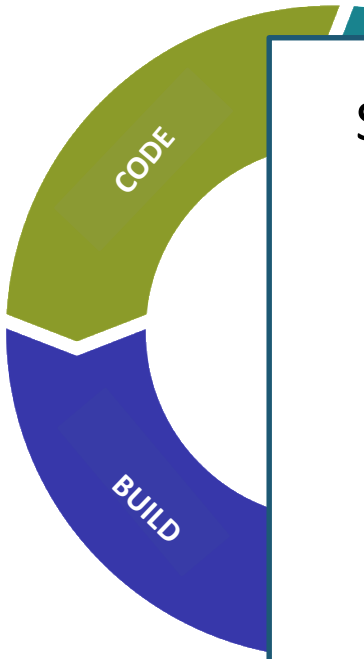
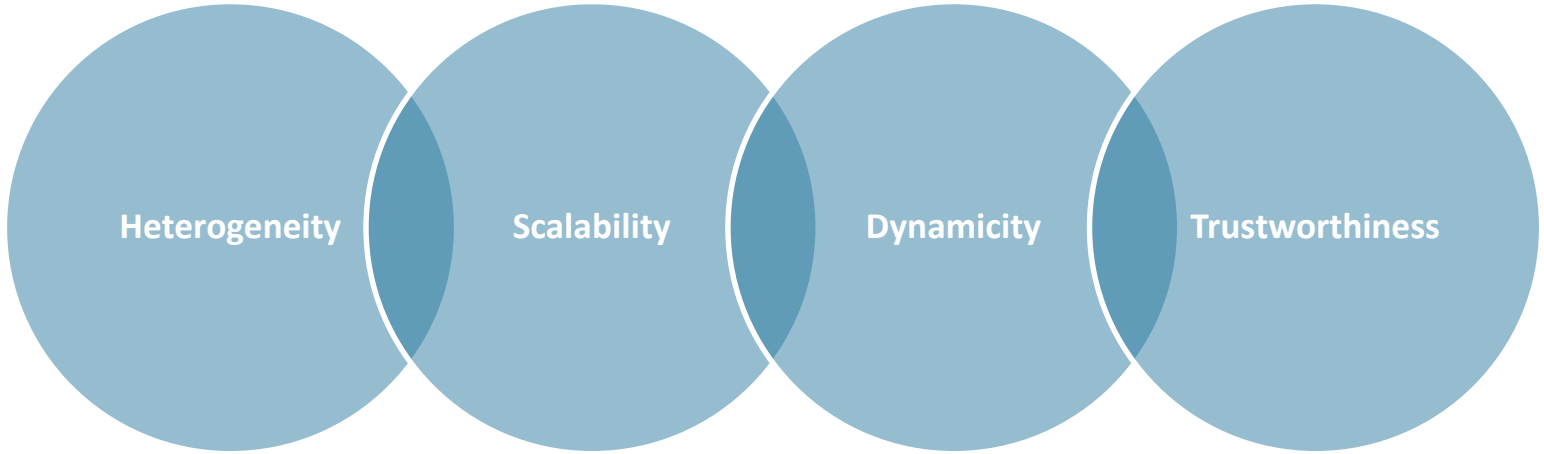
DevOps in a nutshell



- **DevOps core values:**

Smart IoT Systems characteristics challenge DevOps practices



e.g., coordinated behavior distributed locally in its own open context

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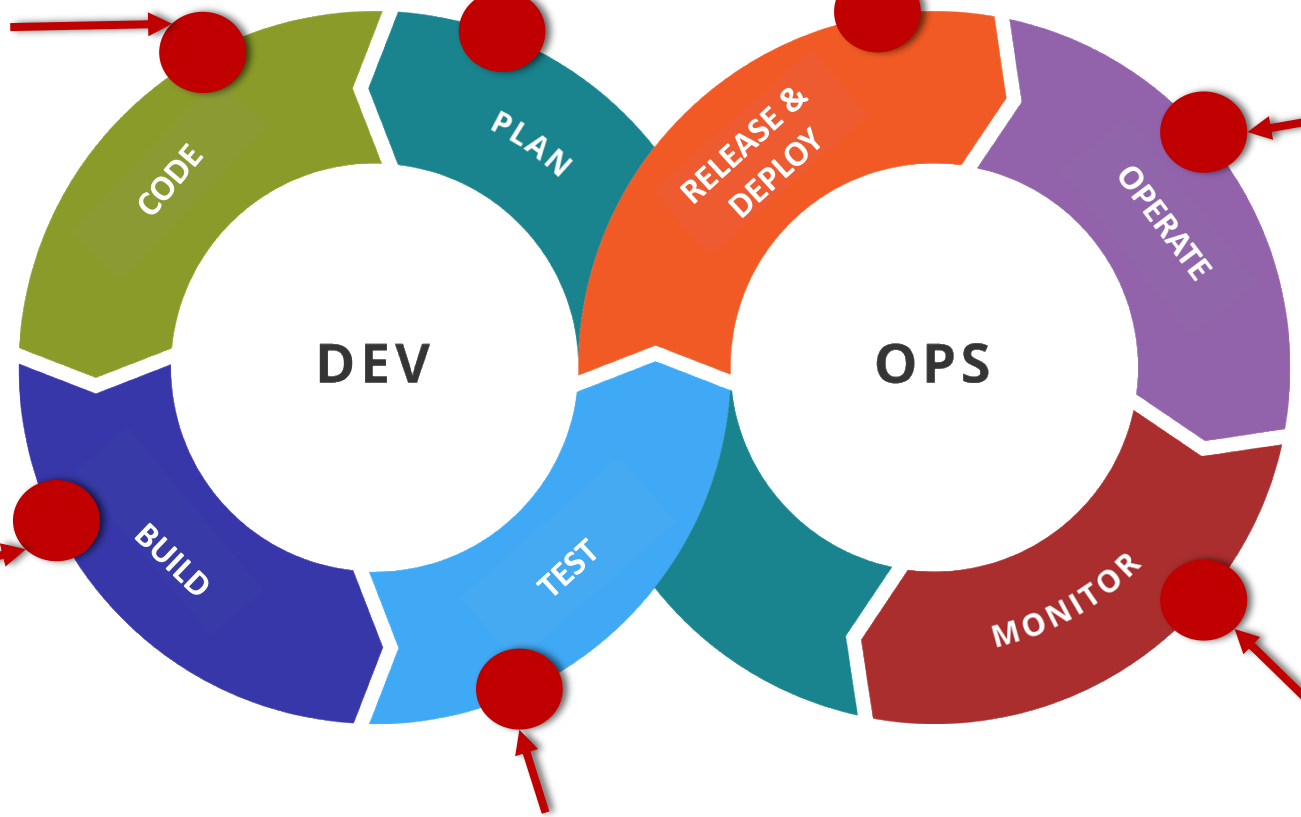
ENACT DevOps for Smart IoT Systems



Thing Functional Modelling & Orchestration of sensors, actuators, and software services and trustworthiness mechanisms

Continuous Risk Management (business and non-functional risks)

Continuous deployment of trustworthy SIS & security mechanisms

Context-aware Access control, Security control, Adaptation improvement

Automatic building of ENACT generated code & Software diversification

SIS simulation and security, privacy and scalability testing

Security and privacy monitoring, Behavioral drift analysis, Deployment status, Application execution flow, Root cause analysis

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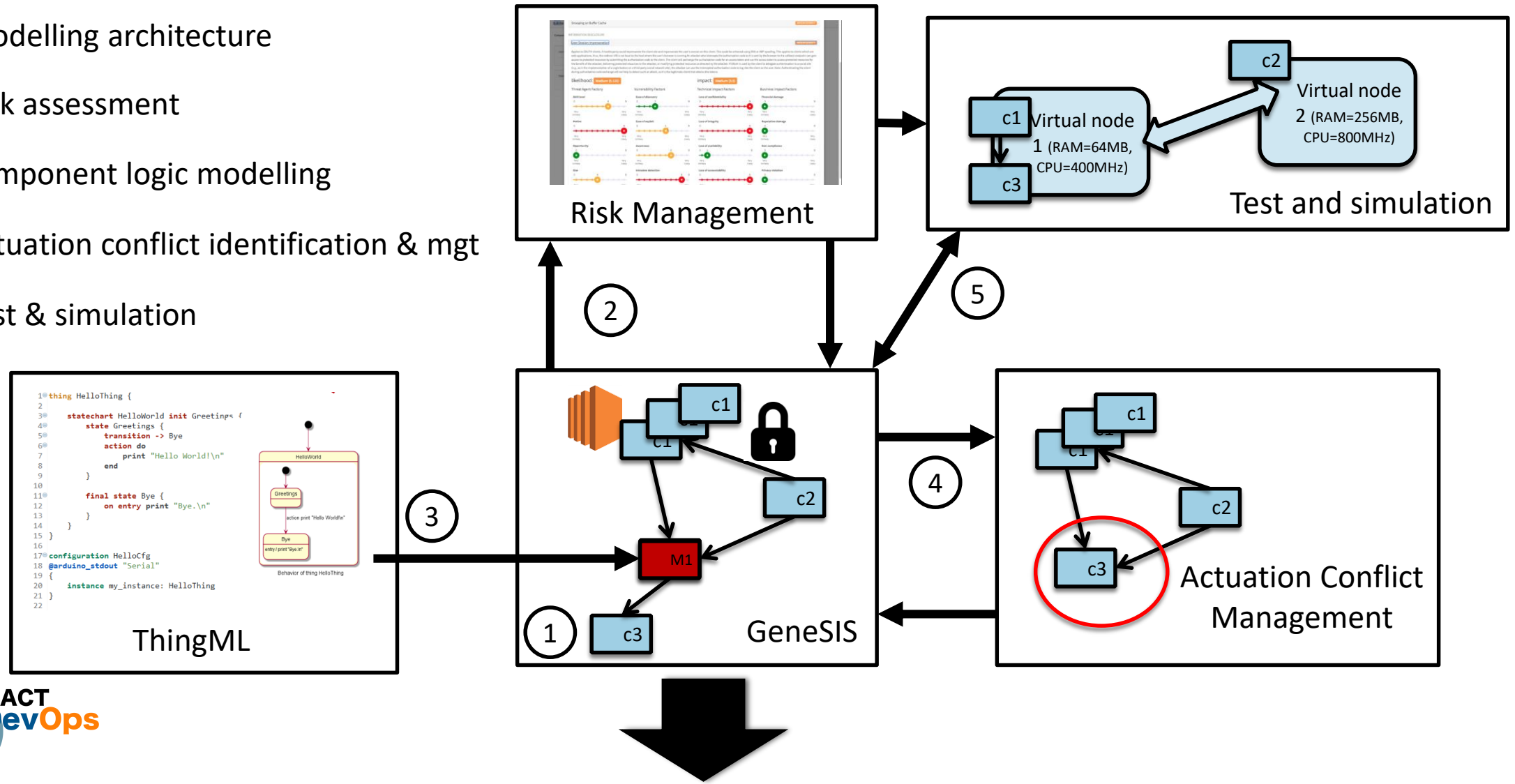
An example

1. Modelling architecture
2. Risk assessment
3. Component logic modelling
4. Actuation conflict identification & mgt
5. Test & simulation



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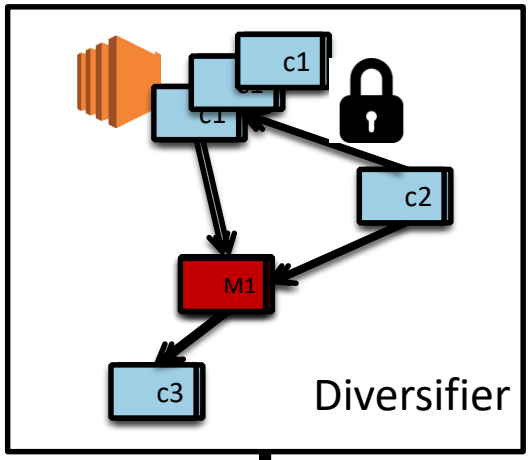
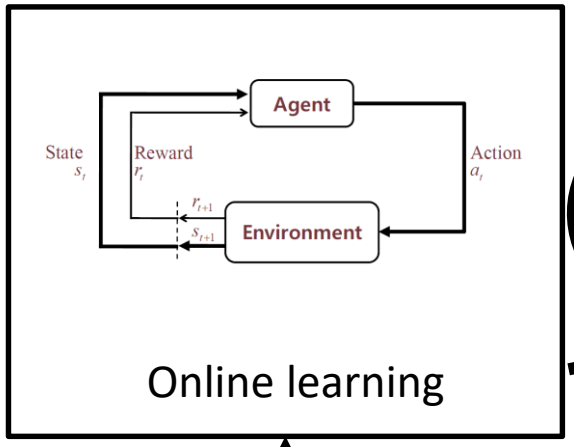
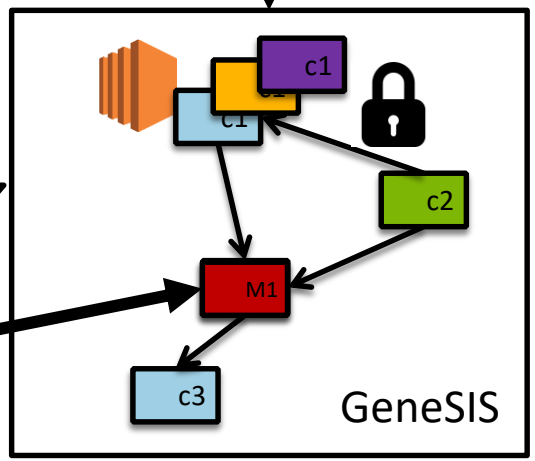
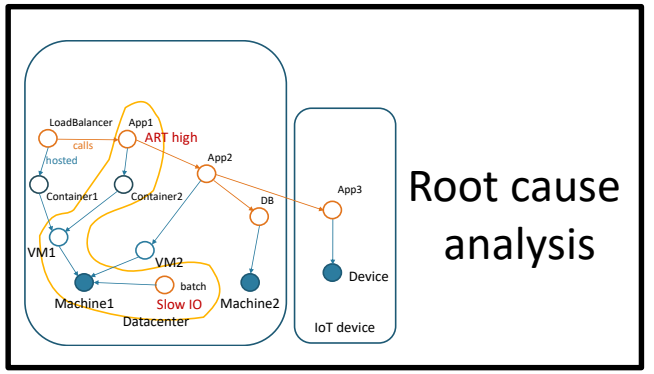
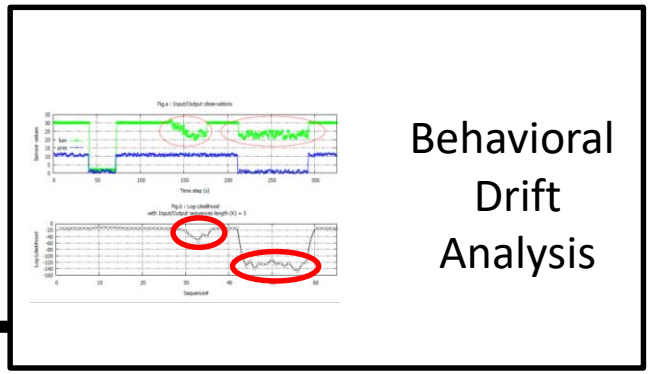
An example











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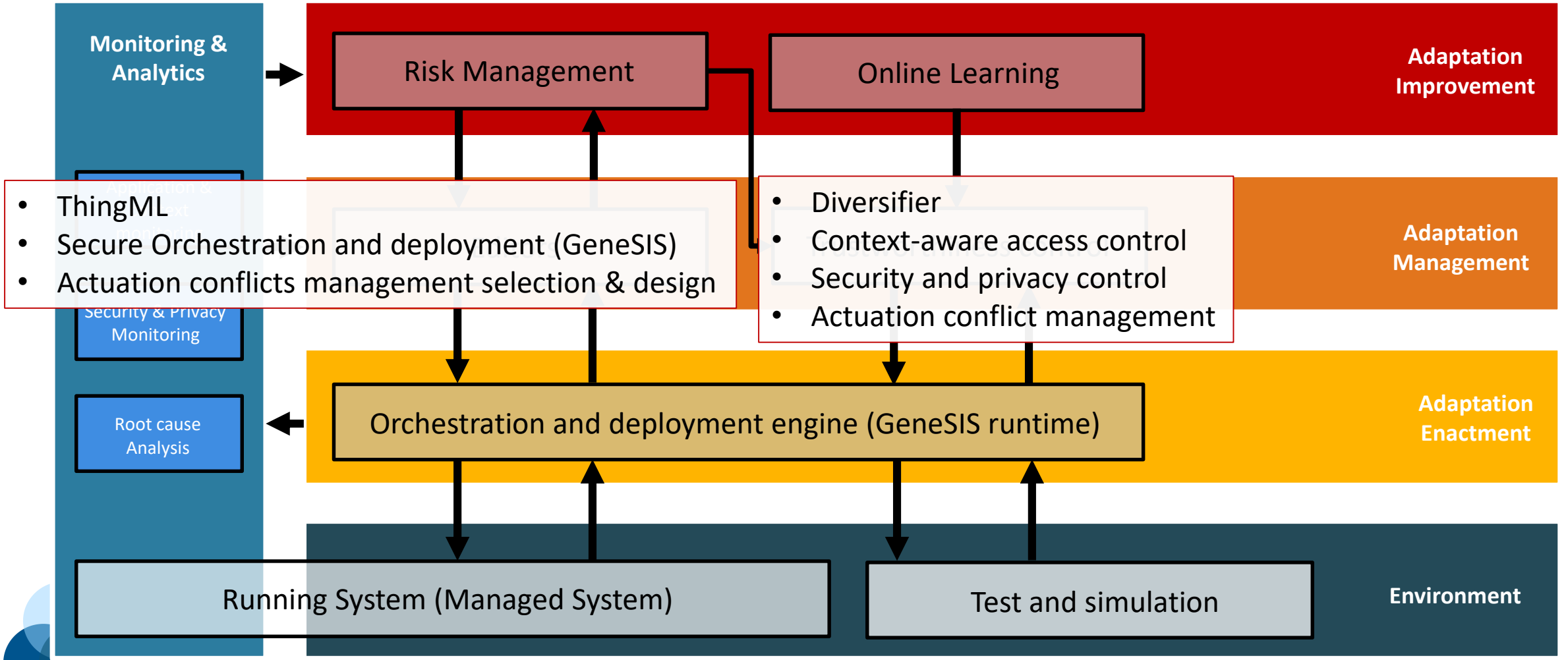
Architecture



Case studies

Rail Domain

indra

INSTITUTE OF ELECTRONICS AND COMPUTER SCIENCE

BOSC

Smart Building

tecnalia

I.S.R.A.A.
Istituto per Servizi di Ricovero e Assistenza agli Anziani

eHealth

tell.u

Enhancing train integrity control	Smart Energy Efficiency and Smart User Comfort applications	Personal health gateway Customization to end user needs

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Enablers/use cases matrix

ENACT Framework	Enabler	ITS Domain (Rail)	Digital Health	Smart Building
Continuous Delivery toolkit	Orchestration and Continuous Deployment Enabler	X	X	X
	Test, Emulation and Simulation Enabler	X	X	
Agile Operation toolkit	Context-Aware Self-Adaptation Enabler			X
	Run-time Quality Assurance and Root Cause Analysis Enabler		X	
	Context Monitoring and Actuation Conflict Management Enabler	X		X
Trustworthiness Toolkit	Robustness & Resilience Enabler		X	
	Risk-Driven Decision Support Enabler		X	X
	Security and Privacy Monitoring and Control Enabler	X	X	X

ENACT in the cluster of IoT projects

- ENACT provides mechanisms and tools to facilitate the instantiation, integration and maintenance of trustworthiness mechanisms into IoT systems.
  - Contrary to other projects we do not necessarily contribute with new mechanisms for security and privacy.
  - But we can integrate, leverage, or support (e.g., the deployment) the mechanisms from the other projects

ENACT involvement and contribution

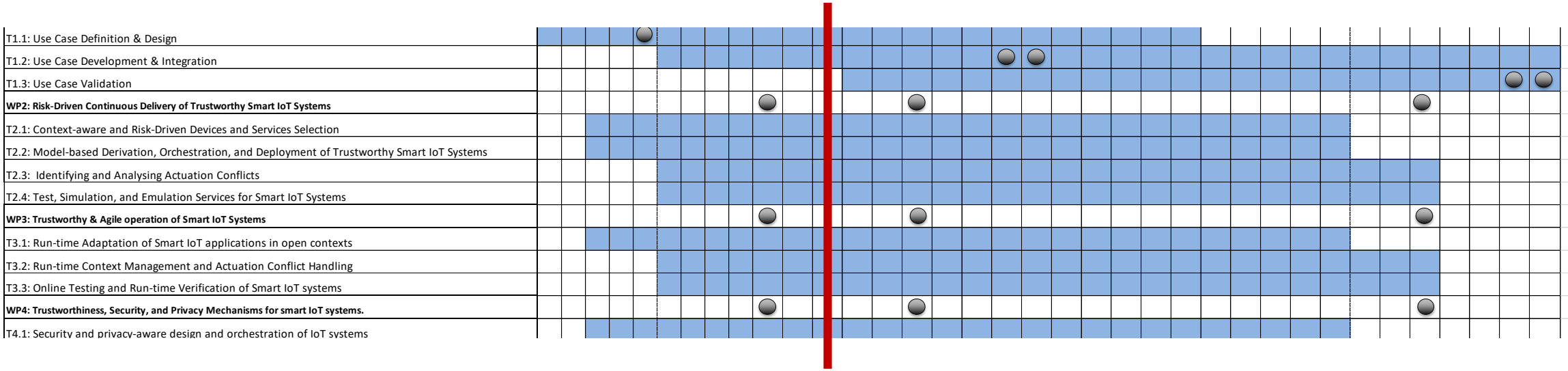
- We contributes to the following topics:
  - *IoT Platform Interoperability.*
  - *Identify relevant existing standards for lifecycle management of security and trust.*
  - *Risk management and assessment.*

- We lead the activity on building a *"**repository of tools and approaches** to support/enforce the **trustworthiness of IoT systems** at design- and/or run-time "*

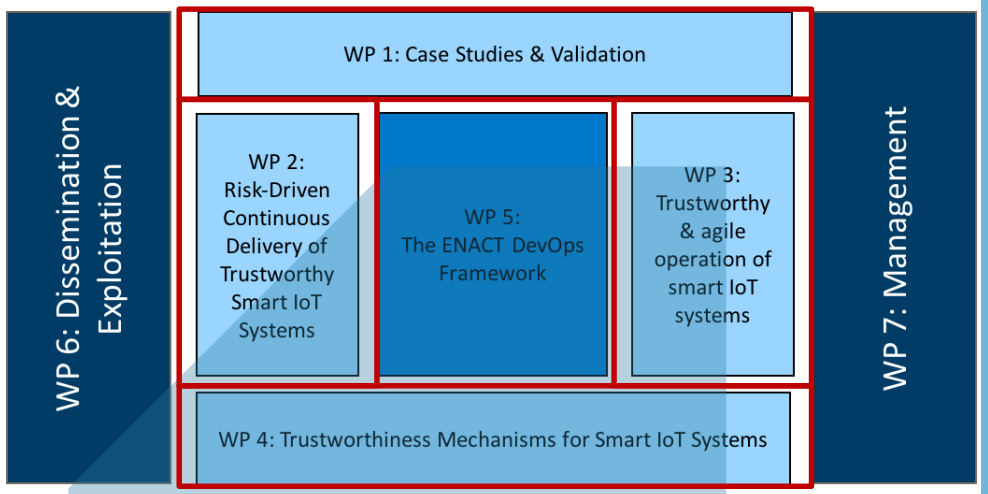
- We are involved and contributed to several dissemination activities:
  - ICT event, CHARIOT workshop, ETSI security week

Brief overall status M12

- First technical deliverables all submitted
- Next deliverables are due at M15



In the next presentations



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Project highlights

- **Technical highlights:**
  - Extensive state-of-the-art analysis (including SLR, and SMS)
    - That illustrates the needs for ENACT
  - Some initial prototypes (e.g., GeneSIS, Access control) & design of all enablers
  - First architecture
  - Integration guidelines

- **Dissemination:**
  - 7 publications
  - Organized 1 conference (QUATIC) and 1 research workshop (MDE4IoT)
  - 1 Video of prototype
  - Invited lectures

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Development, Operation, and Quality Assurance of Trustworthy Smart IoT Systems.

***Contact**: nicolas.ferry@sintef.no*