New security directions and challenges for Infrastructures Operators in an evolving EU Landscape

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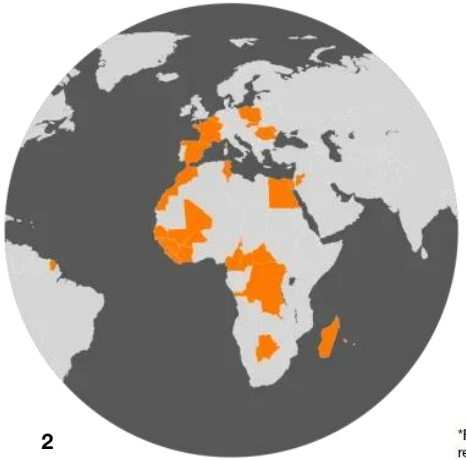
Orange Research in a nutshell

Orange operators

- 36 countries
- 127k employees
- 291M customers
- 40,3Mds €



Research and Intellectual Property in a few figures

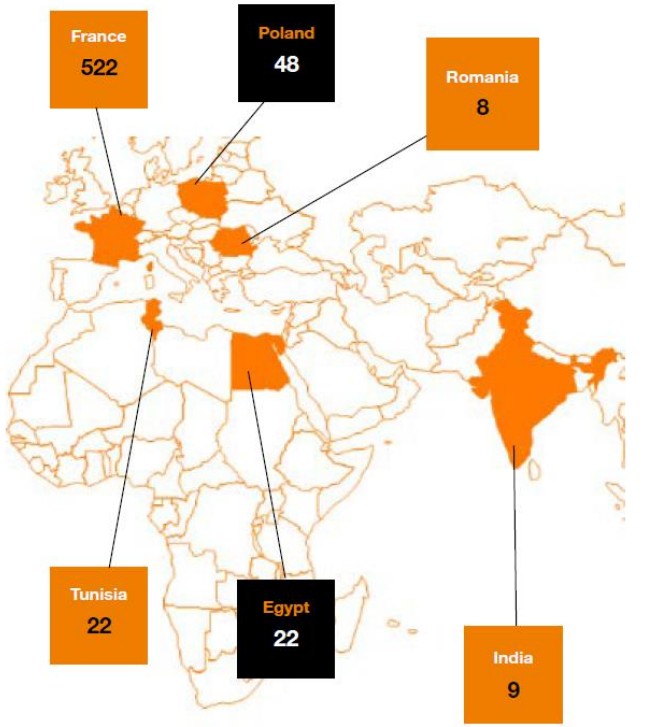
200 new inventions protected by patent on average each year	**115** doctoral and post-doctoral researchers	**+ 110** publications in international conferences or scientific journals, Research Papers
11th in the overall INPI 2024 ranking and 1st European operator	**23** Patent pools in which Orange is engaged	**+ 50** software projects analyzed for their market value
+ 150 partners (laboratories, universities, industries...)	**730*** researchers in France and internationally	**42 %** of Senior Experts contribute to Research
+ 11000 patents and patent applications in our portfolio by the end of 2024	**+ 2000** industries worldwide have licensed our patents	**10** Awards et recognitions

*FTE evaluated based on the total number of person-days reported by Orange Group employees in research projects.

International Research

Number of FTE (Full-Time Equivalent) by country

Here is the distribution of researchers in France and internationally, noting that there are about a hundred more at OAB, Sofrecom, etc. :



EU cybersecurity regulation landscape

EU Legislative Texts: Constraints & Future Challenges for Infrastructure Providers

NIS2 Directive

Constraints:

- Implement comprehensive risk management and security measures.
- Mandatory incident reporting within 24 hours.
- Increased oversight and compliance obligations.

Future Challenges:

- Ensuring continuous compliance across diverse sectors.
- Enhancing incident detection and response capabilities.
- Managing evolving cyber threats and supply chain risks.

AI Act

Constraints:

- Conduct risk assessments for high-risk AI systems.
- Implement transparency and human oversight measures.
- Comply with documentation and testing requirements.

Future Challenges:

- Developing trustworthy AI that balances innovation and safety.
- Ensuring compliance across diverse AI applications.
- Addressing ethical and societal implications of AI deployment.

Cyber Resilience Act

Constraints:

- Incorporate security-by-design in ICT products and services.
- Conduct vulnerability assessments and document security measures.
- Ensure transparency and traceability of security features.

Future Challenges:

- Integrating security requirements into rapid product development cycles.
- Managing vulnerabilities in complex supply chains.
- Adapting to emerging cyber threats targeting ICT products.

DORA (Digital Operational Resilience Act)

Constraints:

- Establish comprehensive ICT risk management frameworks.
- Regular testing and incident reporting.
- Oversight of third-party ICT service providers.

Future Challenges:

- Managing complex third-party dependencies.
- Enhancing resilience against sophisticated cyber-attacks.
- Maintaining operational continuity amid evolving ICT risks.

Other current & future EU legislative texts : scope, application, constraints and challenges for infrastructure providers in relation to NIS2 & CRA

CER Directive on the Resilience of Critical Entities

Scope: Enhances resilience, security, and contingency planning for critical infrastructure sectors (energy, transport, health, etc.).
Applicability: Applies to critical entities operating within the EU, with future expansions to include more sectors and stricter requirements.
Constraints/Challenges: Compliance costs, operational disruptions, and data sharing complexities for infrastructure providers.
Link to NIS2 & CRA: Reinforces cybersecurity measures and resilience standards aligned with NIS2 and the Cyber Resilience Act.

EU Chip Act

Scope: Promotes secure, resilient, and innovative semiconductor supply chains within the EU, supporting technological sovereignty.
Applicability: Targets chip manufacturers, designers, and supply chain stakeholders, with future initiatives to expand manufacturing capacity and R&D.
Constraints/Challenges: High investment costs, supply chain dependencies, and geopolitical risks for infrastructure reliant on chips.
Link to NIS2 & CRA: Secures critical hardware supply chains, essential for maintaining cybersecurity and operational resilience.

EU eIDAS2

Scope: Modernizes electronic identification and trust services for secure digital transactions across the EU.
Applicability: Applies to digital identity and trust service providers, and users, with future updates to enhance interoperability and security.
Constraints/Challenges: Integration costs, interoperability issues, and ensuring security of digital identities for infrastructure providers.
Link to NIS2 & CRA: Strengthens digital trust and secure communication channels critical for infrastructure cybersecurity.

Other current & future EU legislative texts : scope, application, constraints and challenges for infrastructure providers in relation to NIS2 & CRA

EU Cyber Solidarity Act

Scope: Facilitates coordinated EU responses to large-scale cyber incidents and crises, promoting mutual assistance.
Applicability: Applies to EU member states and relevant cybersecurity authorities, with potential inclusion of private sector cooperation.
Constraints/Challenges: Coordination complexities, resource allocation, and legal jurisdiction issues during crises for infrastructure providers.
Link to NIS2 & CRA: Enhances collective cybersecurity resilience, directly supporting infrastructure security and incident response.

EU DMA, DSA

Scope: Regulates digital market fairness (DMA) and online content moderation (DSA) to ensure a safe and competitive digital environment.
Applicability: Applies to large digital platforms and online service providers operating within the EU, with ongoing updates to address emerging digital challenges.
Constraints/Challenges: Compliance costs, operational adjustments, and potential restrictions on platform operations for infrastructure-dependent services.
Link to NIS2 & CRA: Improves cybersecurity posture and operational resilience of digital platforms, aligning with broader EU digital security objectives.

Other current & future EU legislative texts : scope, application, constraints and challenges for infrastructure providers in relation to NIS2 & CRA

EU DNA (not yet on the table – expected Q4 25)

Scope: Focuses on digital network architecture, data management, and interoperability standards for secure digital infrastructure.
Applicability: Targets digital infrastructure providers, data operators, and network service providers, with future developments to improve security and interoperability.
Constraints/Challenges: Standardization costs, legacy system integration, and ensuring security across diverse infrastructure components.
Link to NIS2 & CRA: Provides foundational standards that support cybersecurity and operational resilience of digital infrastructure.

EU AI Liability (on table for withdrawal by the EC)

Scope: Establishes liability rules for AI systems to ensure safety, accountability, and transparency across sectors.

We have only addressed MNOs related regulations,
Sectorial industries related regulations are not investigated.

Implication for a telecom infrastructure operator

Complex situation, but manageable, we will comply !!

Some Challenges :

- Some Regulation are not consistent and diverge in their requirements
- Some Regulation will be dependant of National transposition, generating complexity for international organisation
- How to industrially rationalize international organisation ? Optimize cost and processus for conformity ?

Implication of NIS2 Directive

150.000 industries or entities may be subject to NIS2 conformity evaluation

EU : 28 countries / certification every 2 years / 200 working days per year

➔14 entities or industries to be certified NIS2 per day per National Cybersecurity Certification Authorities (NCCAs) ….

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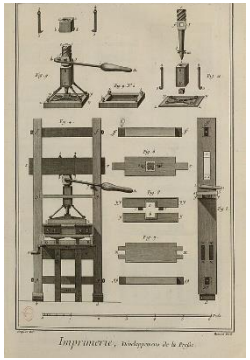
‘manual/paper based’ (descriptive) certification + Pentest



Source : https://gallica.bnf.fr/ark:/12148/bpt6k323141z/f69.item#

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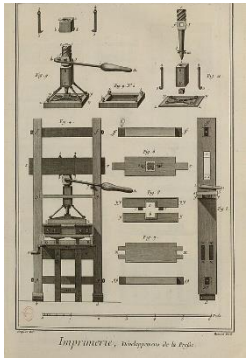
How to evolve from ‘paper’ to ‘AI’ ?

‘manual/paper based’ (descriptive) certification + Pentest



‘automatized’ (evidences based) certification

- **Knowledge Base per system**
- **Structured data exchange**
- **Attestations/evidences enforceable**
- **AI Data mining**
- **Continuous evaluation**
- **replicability**

Source : https://gallica.bnf.fr/ark:/12148/bpt6k323141z/f69.item#

New EU certification schemes

EU certification schemes :

- EUCC already published
- EUCS, EU5G, EUDIW under development

EU to recognize the use of EUCC certification(1) to demonstrate conformity with the CRA in a seamless way.

EU5G potentially splits in two parts,

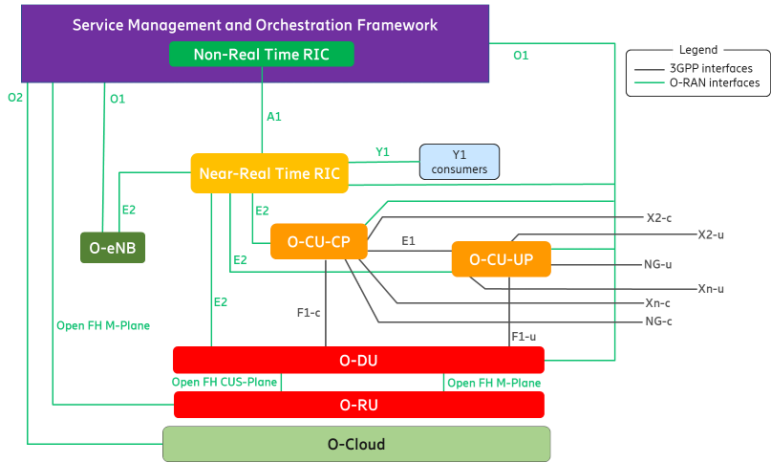
- one dedicated to critical Network Functions and Equipment (level **High** under EU CSA),
- the second focusing on equipment certified at level **Substantial** under EU CSA, that may be delegated to an assimilated GSMA NESAS(2) scheme (similar to CRA conformity, and directly managed by Network equipment suppliers)

(1) : EUCC has to evolve for this equivalence
(2) : see https://www.gsma.com/solutions-and-impact/industry-services/assurance-services/network-equipment-security-assurance-scheme-nesas/

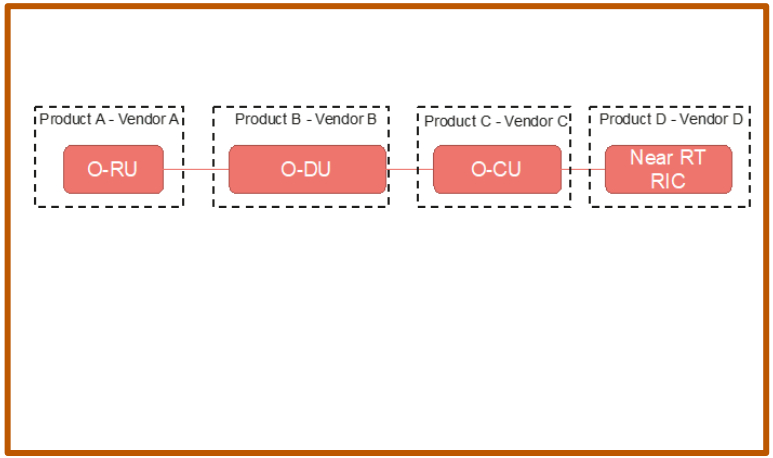
Practical use case with O-RAN

Under ENISA Risks Analysis, O-RAN network elements will have to be certified at level High under EU-CSA.

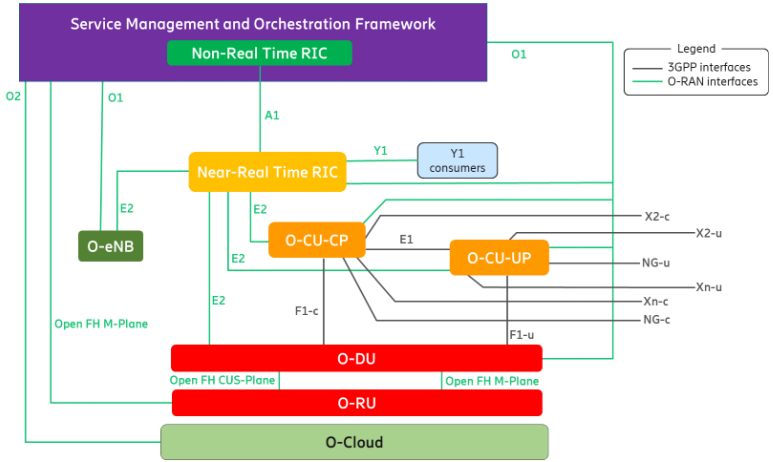
➔Problem position : software certification under EU-CSA at High level or EUCC at least at EAL4 or AVA-VAN3 ?



O-RAN system view (Source: O-RAN alliance)



O-RAN components certification ?



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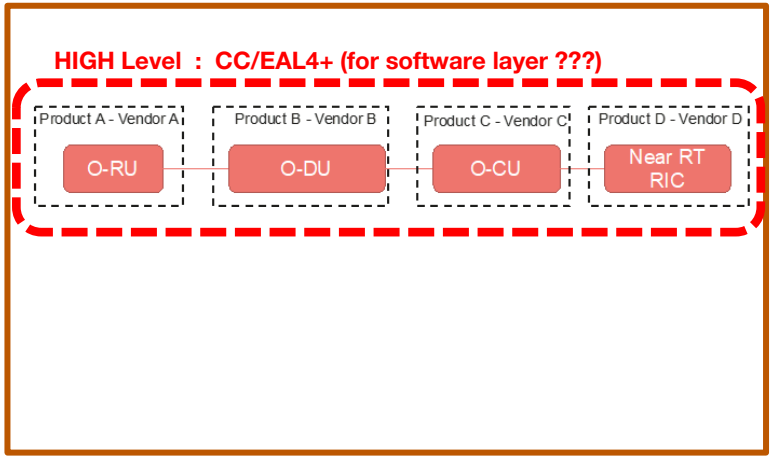

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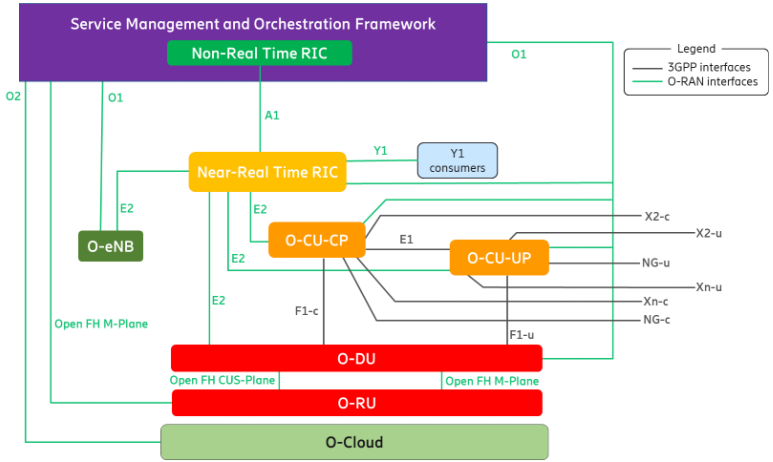

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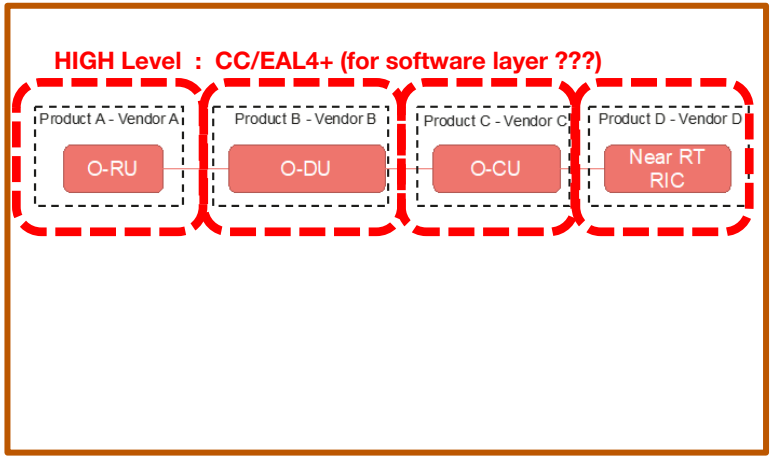
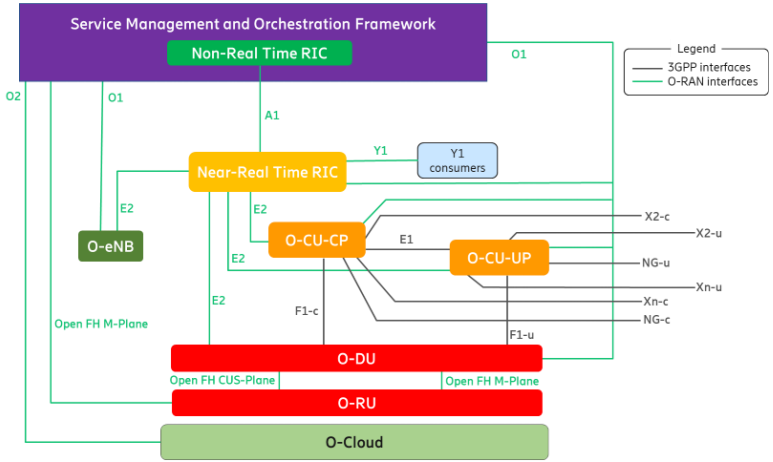


Proposition :

Escape from impossibility of software certification at High level by referring to an external element serving as a trusted anchor for the provision of proofs/evidences.

O-RAN components certification : based on continuous monitoring ?



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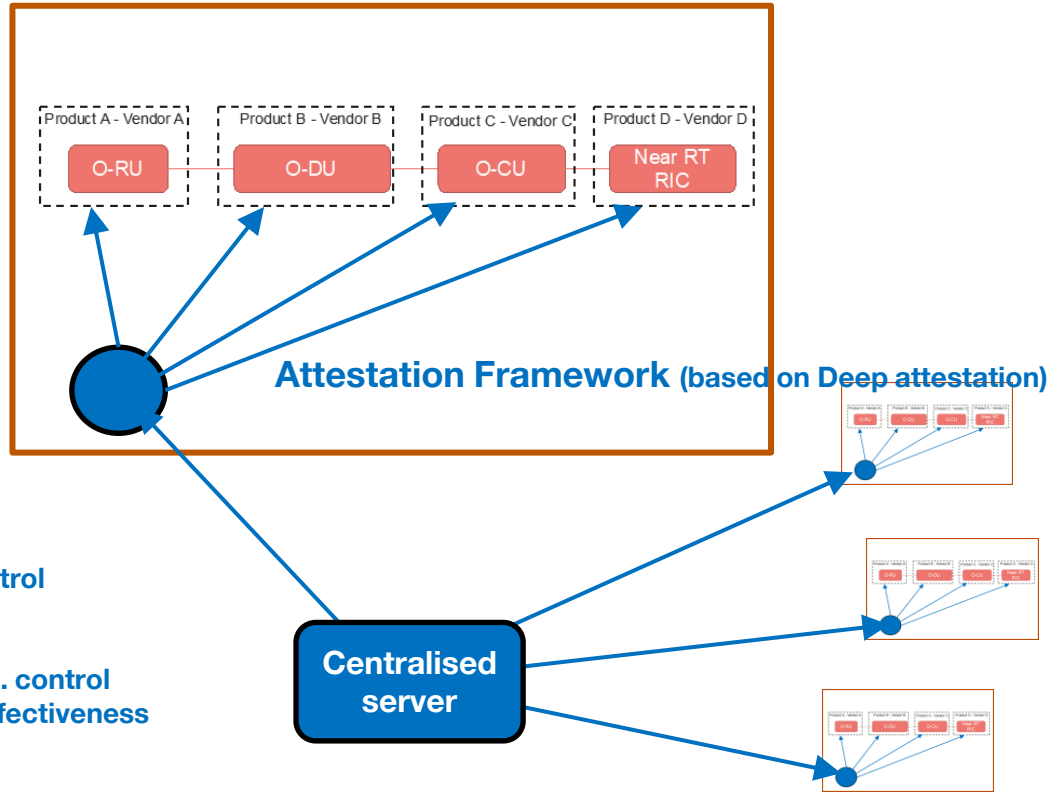
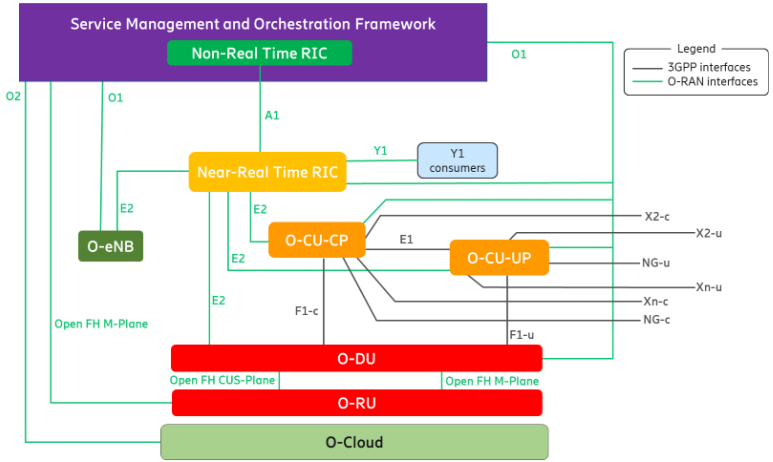


Attestation Agent

- Component Integrity Control
- Proof of Origin
- Parameters control
- Inter Components Comm. control
- OS / Patchs : Control / Effectiveness
- .....

“Continuous certification” for O-RAN certification ?



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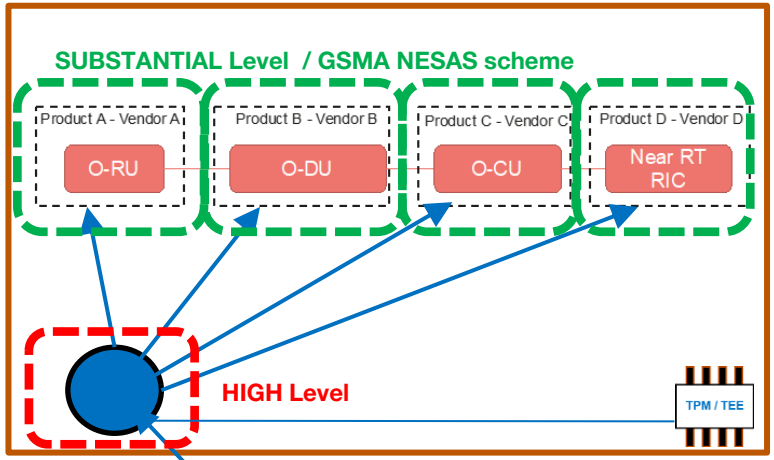

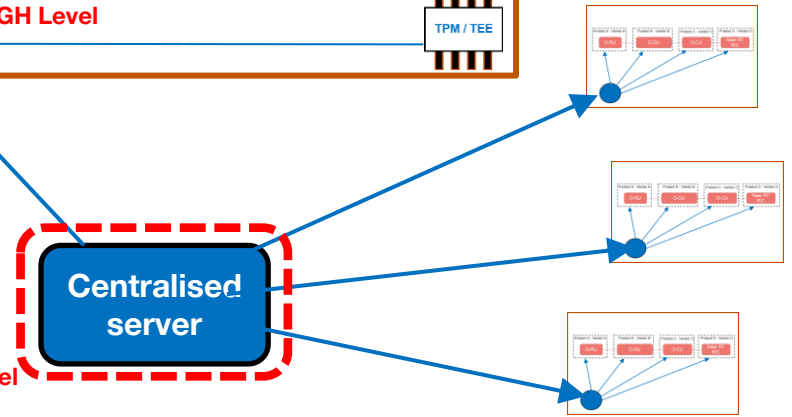

Attestation Agent

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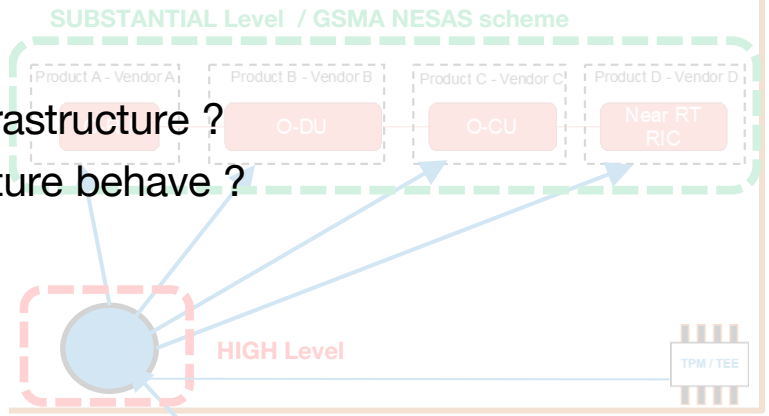
“Continuous certification” for complex infrastructures ?

Could we generalize this approach, in order to be in capacity to commit on some properties ?

- To achieved which measures in the infrastructure ?
- To deliver which KPIs on the infrastructure behave ?



For which business ?
A capacity to sell SLAs ?

Could we demonstrate security ‘equivalence’ with CSA level High for specific security objectives ?

Attestation Agent

- Component Integrity Control
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“Continuous certification” for complex infrastructures ? Some “native” Metrology framework ?

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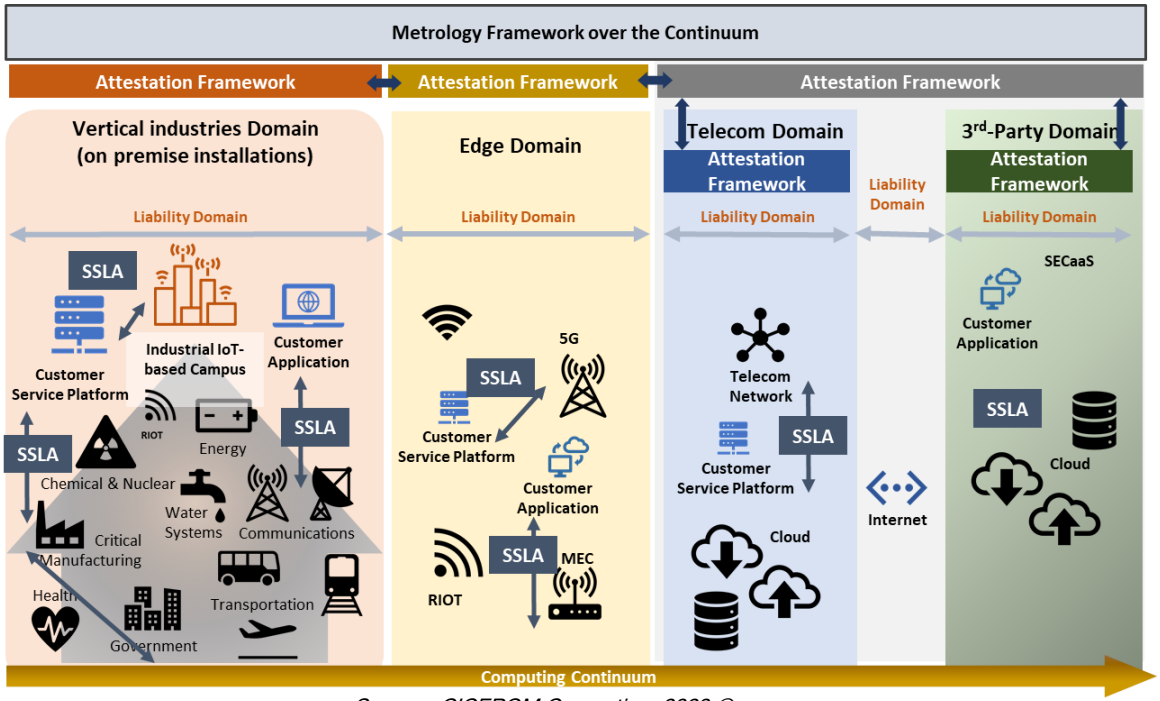
Could we demonstrate security ‘equivalence’ with CSA level High or specific usage for EUCS ?



Source : CICEROM Consortium 2023 ©

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For which business ?
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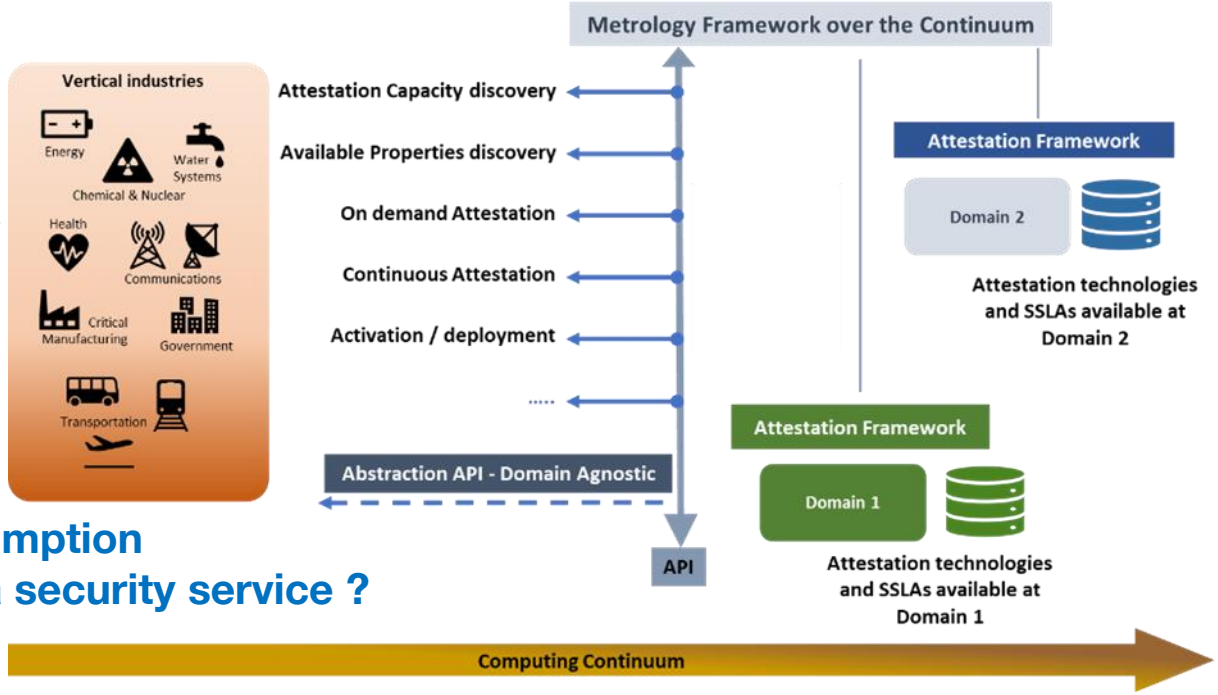
A capacity to control some assumption of compliance or realization of a security service ?



Source : CICEROM Consortium 2023 ©

How to pave the way to Delegation of security (services) ?

Flexible delegation of security- related responsibilities while optimizing costs and complexity

➔Dynamic control capabilities

Management of on-demand SSLA responsibilities and dynamic achievement demonstration

➔Ability to allocate / redistribute responsabilities

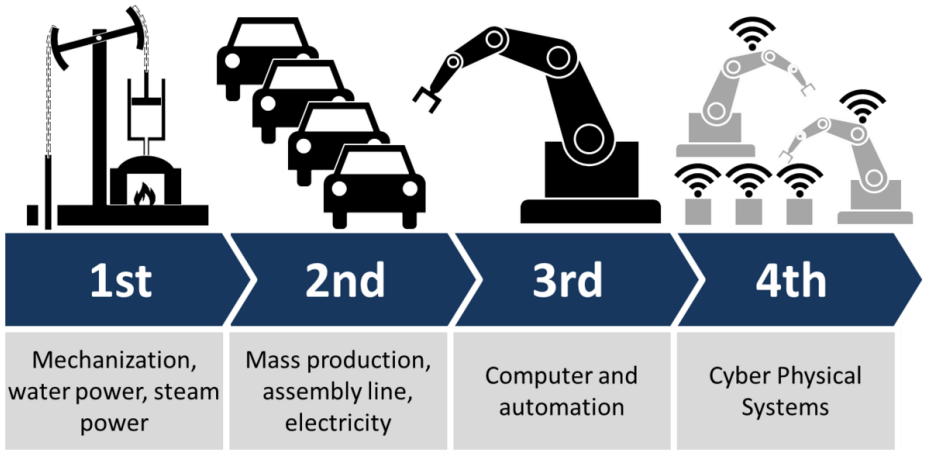
Challenge : How to contract and/or control a SLA in a multi-parties / multi-layers or evolving structure or platform ?

How to address Industry needs with On Demand-security ?

Industries cyber threats exposure

Industries attack surface is extended by the integration of :

- cyber-physical systems,
- Industrial Internet of Things (IIoT),
- cloud-connected platforms



Source : https://commons.wikimedia.org/wiki/File:Industry_4.0.png

Safety and Cybersecurity can no longer be treated as separate disciplines(1).

- Functional safety focuses on ensuring that systems perform their intended functions without leading to hazardous situations(2).
- Cybersecurity addresses intentional threats that target system vulnerabilities(3).

Challenges consideration of Safety and Cybersecurity

A cybersecurity breach can now directly compromise safety functions[4].

The deeper we analyze industrial infrastructure cybersecurity risks, the more underlying safety challenges we uncover.

➔no safety without cybersecurity.

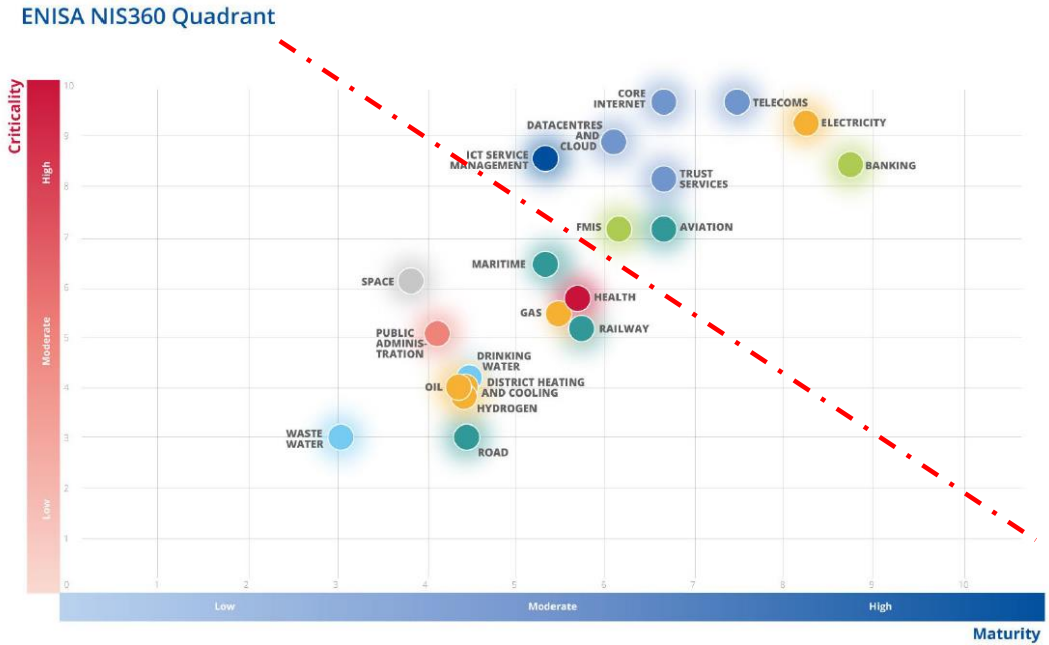
➔Safety and Security requirements should be jointly investigated[5].

Safety and Cybersecurity are commonly built on risk-based and risks reduction approaches.

See Technical report IEC TR 63069 (guidance document for integrating functional safety and cybersecurity in Industrial Automation and Control Systems (IACS))

Business Contraints

Could « Critical Industry » constraints (regulation) become security means obligation ?



Business Contraints

Could « Critical Industry » constraints (regulation) become security means obligation ?

Safety requirements / objectives → **Security requirements / objectives**

Industries → Operators

Evolution : 2/3/4G (Best Effort) → 5/6G with specific security & safety means obligation ?

Business Contraints

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Safety requirements / objectives
Industries

→

Security requirements / objectives
Operators

Evolution : 2/3/4G (Best Effort)

→

5/6G with specific security & safety means obligation ?

« 5G trusted network »

→ **?**

« 5G trustable network »

towards an industrial use of the Attestation/Metrology Framework

source : H2020 INSPIRE5G+ (2022)

Demonstration of a first prototype to operate an obligation of 'result' of security property (through SLA) for critical industry verticals (NIS2 & CSA)

- SLA : "*Your applications only share physical resources (over a Cloud or virtualized infrastructure like 5G/MEC) with applications with levels of criticality equivalent or greater*"

- Placement optimization under constraints for criticality and latency (over K8S)

Which set of SLAs ?

- isolation under constraints : criticality, latency, energy efficiency & cost
- authentication of chain of components or of the underlying system (OS, VM, containers, applications)
- effective availability of allocated resources (CPU, memory, TPM, TEE, bandwidth) on physical servers and / or the chain of components
- Only ‘qualified’ or agreed components are put in production to serve Customers.
- composition and insertion of additional services are effective
- authentication at boot-time and at run-time of critical components of the Customer
- critical segments of the Customer are only operated in a protected environment (TEE / HSM).
- software / data zoning : critical components of the Customer are only available and/or executable on identifiable target zones
- data security (integrity and confidentiality) during processing
- ……

➔Potentiality of commercial scheme, based on legal agreement “Convention of Proof” to commit parties on On-demand Security.

How to reuse it to ease NIS2 certification ?

SLA under convention of proof could be continuously monitored, with continuous collect of attestations/evidences enforceable.

➔Vertical could potentially delegate some of their security objectives to third parties

➔National Security Agencies may be in capacity to continuously monitor specific SLAs delivered for a Vertical operated over the infrastructure

How to demonstrate those equivalences between SLAs and Security needs of certification schemes ?

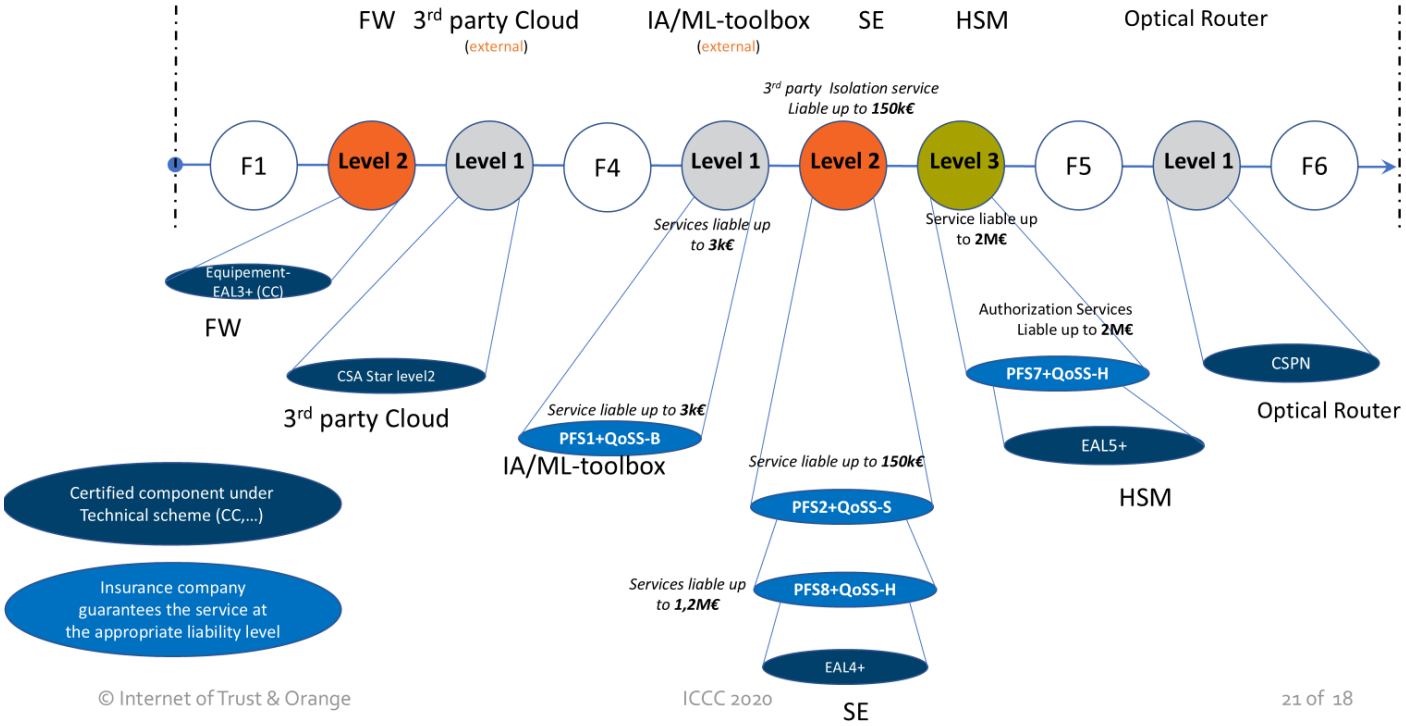
- establish an equivalence between sets of SLAs, which are assessed through the attestations, that are dynamic, and sets of security objectives, dealt with in certification schemes, but in a static manner.

How to reuse it to ease NIS2 certification ?

How to shift from a **static evaluation / certification** of a service/platform before production to a **continuous monitoring**, thank to certified attestation framework ?

- a potential framework to **adapt dynamically an E2E robustness level** to allow continuity of critical activities upon the detection of incidents.
- **a hybrid approach combining security objectives and SLAs** to identify necessary conditions to dynamically change the robustness level for the dedicated infrastructure in the computing continuum.
- **a new composition scheme** between a set of Security Objectives and SLAs with associated evidence collection, (combining SSLA measures and the Metrology Framework for attestation)

Get appropriate assurances



Source : ICCC 2020, Claire Loiseaux, "Trust model for verticals over 5G"

➔how to allow an E2E robustness level evaluation for a dedicated service over a multi-parties infrastructure in the computing continuum ?.

Future challenges to achieved a composable NIS2 certification of infrastructure

Today under Common Criteria and EUCC scheme we know how to certifiy a system composed of multiple components already certified (see eUICC certification at High level, managed by GSMA).

But this composition of components is dedicated to a close environment (the TOE Target of Evaluation under CC/EUCC) and rely on environmental hypothesis (not really structured).

- How to define the composition of components (‘Lego(1)‘ approach) in an open system (a cloud infrastructure or 5G core infrastructure) ?
- Do we have to constraints some ‘EUCC compatibility’ regarding environmental hypothesis of each of those ‘Lego bricks’.
- Which tools and data structures will have to be define ? Do we have to reconsider the CC/EUCC Protection Profil (PP) concept and declined it for a specific platform, in a way we can use automatic tooling to perfom those ‘additions’ between components ?

(1) Lego™

Future challenges to achieved a composable NIS2 certification of infrastructure

Today, there is no real technological nor theorical lock identified that may prevent to consider or propose a Platform oriented PP/Lego(1) Bricks composition framework.

An Hybrid framework combining commercial / liability SLAs delegation, certified Attestation framework with Security Objectives and PP/TOE (CC / EUCC) per platform.

Some additional challenges and investigations :

- Usage of xxBOM(2) structures for CRA compliance and vulnerabilities qualification ?
- Usage of attack paths for CRA or NIS2 compliance ?
- Automatic generation of Knowledge-Base per platform to ease CRA and NIS2 compliance ?

- How to take into account in the proposed Hybrid scheme new On-Demand-Security based on Moving Target Defense (MTD) technology ?
- How to certify at the upper EU CSA level an MTD offer ?

(1) Lego™ (2) See : https://cyclonedx.org/

Thanks