



Press release

EU-funded project delivers an integrated Compliance-as-a-Service framework validated across four real-world pilots. EMERALD completes its journey towards continuous cloud certification.

Pisa, Italy, October 2026

The EU-funded **EMERALD project (Evidence Management for Continuous Certification as a Service in the Cloud)** has completed its three-year research and innovation programme, **delivering an integrated Compliance-as-a-Service (CaaS) framework** designed to support more continuous, automated and evidence-based approaches to cloud certification.

Bringing together **11 partners from six European countries** (Tecnalia, Fraunhofer, Fabasoft, Consiglio Nazionale delle Ricerche, Software Competence Center Hagenberg, Know Center, CaixaBank, IONOS, CloudFerro, OpenNebula and DNV/Nixu), EMERALD has combined expertise in cloud computing, cybersecurity, artificial intelligence, certification and software engineering to address the growing complexity of compliance in cloud environments. The final framework achieved requirements, across all pilots, bringing together the technical developments produced throughout the project into a common operational environment.

EMERALD demonstrates how innovative technologies can help make cybersecurity compliance more continuous, efficient and evidence based. By bringing together automated evidence collection, assessment and certification in an integrated environment, the project provides a strong foundation for future cloud certification approaches.

From evidence collection to certification

A key achievement of EMERALD is the integration of different sources of certification evidence. The evidence extractors developed in the project (Clouditor-Discovery, Codyze, eknows-e3, AI-SEC and AMOE) are able to collect and analyse evidence from cloud infrastructures, applications and source code, machine learning models and documents, respectively.

These different types of evidence are brought together through **CertGraph**, a graph-based knowledge structure that provides a common representation of certification information. CertGraph enables evidence to be linked, combined and traced back to its original source, supporting a more consistent approach to automated assessment.

EMERALD also developed **AIOX**, an AI-assisted tool that helps experts extend the certification ontology when new security metrics are introduced. The tool identifies concepts that are not yet represented and suggests their relationships and placement, while keeping human experts responsible for validating the proposed changes.

The project's assessment and certification components were integrated into a common workflow through the **EMERALD Orchestrator**. This workflow connects evidence management with the **Repository of Controls and Metrics** and intelligent regulatory **Mapping and Assessment** functions,

enabling collected evidence to be evaluated against selected security metrics and certification requirements.

The **Trustworthiness System** further supports the integrity and authenticity of evidence and assessment results through blockchain-based verification.

Validation through four pilots

The integrated solution was tested through **four pilots**, covering different cloud service models, organisational contexts and certification needs:

- **Pilot 1, led by IONOS**, evaluated EMERALD in a large public cloud environment, combining infrastructure, source-code, organisational and AI-related evidence and exploring its use for continuous compliance monitoring.
- **Pilot 2, led by CloudFerro**, tested the framework across both Infrastructure-as-a-Service and Platform-as-a-Service environments, combining evidence from OpenStack and Kubernetes with organisational evidence extracted from policy documents.
- **Pilot 3, led by Fabasoft**, explored assisted certification for a cloud-based software environment, including scenarios related to EUCS and BSI C5, and demonstrated the integration of dedicated evidence collectors with the common EMERALD workflow.
- **Pilot 4, led by CaixaBank and OpenNebula**, validated the framework in a hybrid cloud-edge environment for the financial sector, applying requirements based on ENS, ISO 27001, NIST and CIS and testing evidence collection across distributed infrastructures.

The pilot activities combined technical testing with mini-audits, final audits, business-driven evaluation criteria, impact KPIs and user feedback. The **results provided evidence of the EMERALD CaaS framework's applicability**, identified practical opportunities for improvement and supported the final evaluation of its usability, effectiveness and potential impact.

Supporting Europe's cybersecurity certification ecosystem

Alongside technology development and validation, EMERALD has contributed to wider European collaboration on cybersecurity certification. The project founded and contributed to the [European Cluster for Cybersecurity Certification \(EC3\)](#) bringing together nine European projects working on next-generation certification approaches. EMERALD has also contributed to activities related to **OSCAL and ETSI**, supporting interoperable and machine-readable approaches to security controls, metrics and evidence. The project also participated in the Third Cohort of the European Blockchain Sandbox with one of the components of the EMERALD CaaS Framework, namely the Trustworthiness System.

Project Website

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This project has received funding from the European Union's Horizon Europe programme under grant agreement No 101120688. Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union. The European Union cannot be held responsible for them.