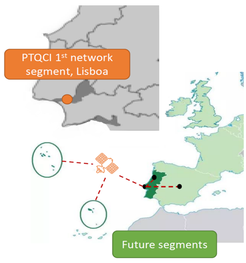
PTQCI

PORTUGUESE QUANTUM COMMUNICATION INFRASTRUCTURE

ABOUT THE PROJECT

The **Portuguese Quantum Communication Infrastructure (PTQCI)** project is the first land segment of the **European Quantum Communication Infrastructure (EuroQCI)** in Portugal and is the first step towards the integration of the European infrastructure.

PTQCI should enable the deployment of a **highly secure, scalable, and resilient network based on Quantum Key Distribution (QKD)** between different public authorities in Lisbon, as well as a testbed network involving academic and private stakeholders, and plan its expansion to other sites in Portugal and Spain, and connection to space assets.



PTQCI will safeguard sensitive data and critical infrastructures by integrating quantum-based cryptographic systems into existing communication infrastructures.

PTQCI is **part of a roadmap for deploying national secure communication infrastructures and technology provision,** and builds on previous milestones achieved, and currently in implementation by the core team on the past few years:

- Advanced theoretical and practical experiments with **quantum key distribution (QKD) and cryptographic protocols** leading to the successful demonstration of a quantum secure link between two PT military sites using exclusively national technology (**QSCRIPT, 2021**);
- PT **leadership of a major project under EDIDP and supported by MoD and industry from Spain, Italy, and Austria** aiming at integrating and combining Software Defined Networks (SDN) and QKD technologies on top of legacy optical networks to build a highly secure, scalable, and resilient network control architecture for advanced operational services and develop national cipher machines (**DISCRETION, 2021**);
- The implementation of the **NATO Cyber Academy Hub** in Lisbon to which the activities of DISCRETION are connected, and the participation of Portugal in the **Space component of EQCI through PTSPACE**.

OBJECTIVES

- **To standardize and deploy an SDN enabled by QKD over existing fiber infrastructures**, making use of European components and PT-designed cipher machines with the objective of sharing secure information between different governmental/public institutions in Portugal;
- **To demonstrate secure communications between public authorities and Defence** buildings, preparing the expansion of the network to farther locations in Portugal, in particular to a favourable location where an Optical Ground Station (OGS) shall be implemented to allow the connection between ground and space segment of EQCI;
- **To implement in parallel a testbed network** to test new technologies preparing the roadmap of PTQCI, using free space links, 5G/IoT, and considering different use cases;
- **To enable training and educational activities,** for instance promoting the use of this infrastructure by the European Cyber Academia and Innovation Hub (EU CAIH) providing a vital contribution to strengthening national, NATO, and EU's capability to defend against the threats of the digital world.

QUANTUM CRYPTOGRAPHY & QKD

Quantum cryptography uses the **principles of quantum physics to provide data encryption**, in contrast to traditional cryptography, which relies on mathematical conjectures and high-demanding computation.

Due to the intrinsic properties of quantum mechanics, **quantum protocols allow for the detection of any eavesdropper**.

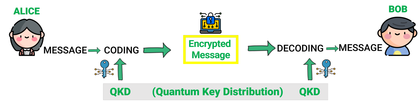
The generation and distribution of quantum keys can significantly improve the quality of cryptography in general.

Quantum cryptography comprises the **exchange of quantum states** (carried by particles of light - photons) through **standard telecom optical fibers or free space optical links**.

Quantum key distribution (QKD) is a new paradigm for secure key exchange.

QKD uses quantum resources to exchange cryptographic keys without using asymmetric cryptographic algorithms. QKD is robust to quantum computer attacks. Moreover, QKD can distribute:

- **symmetric keys: enabling future-proof secure communication services**
- **oblivious keys enabling future-proof secure computing services.**

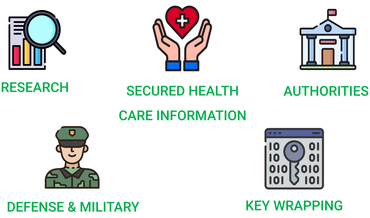


USE CASES

PTQCI's architecture will be defined to address the following **use cases**:

- Establishing secure communication between different sites from **PT Government and Civil Protection** (first segment of PTQCI);
- Establishing secure communications and links to **Azores and Madeira**;
- Establishing secure communication that crosses an infrastructure that is shared among **member states** (link to EQCI).

While the first use case will be implemented in PTQCI action, the second and third use cases will be addressed only up to the design stage.

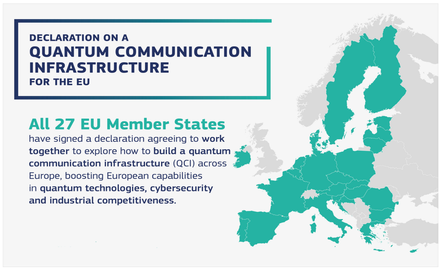


EuroQCI & PETRUS

The **EuroQCI** will be a secure **quantum communication infrastructure** spanning the whole **EU**, including its overseas territories.

PETRUS is the **Coordination & Support Action** for the national Quantum Communication Infrastructures to be rolled out in the **EU Member States** over the coming years and supports the Digital Europe Program projects that will form the basis for a European industrial ecosystem for secure quantum technologies.

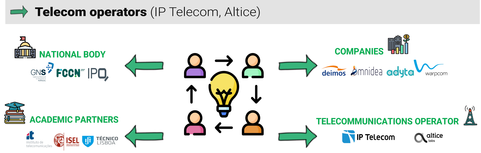
https://petrus-euroqci.eu/



CONSORTIUM & WORK PACKAGES

The consortium that will design and develop PTQCI is constituted by **different types of institutions that are key players in Portugal:**

- **National public institutions** (GNS, FCT, IPQ)
- **R&D and academic players** (IT, ISEL, IST)
- **Telecom and security companies** (Deimos, Omnidea, Adyta, Warpcom)
- **Telecom operators** (IP Telecom, Altice)



The PTQCI project is composed by the following **5 work packages** (WPs):

WP1
Management and Coordination (GNS)

WP2
PTQCI Foundations (GNS)

WP3
Seed PTQCI - Metropolitan Operational Network (DME)

WP4
Metropolitan & Long-Distance Testbeds (IST)

WP5
Dissemination activities (IT)

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This project has received funding from the EU's Digital Europe Programme under the project "Portuguese quantum communication infrastructure" (PTQCI, grant agreement no 101091730).

Co-funded by the European Union
EuroQCI