



# How EuroQCI supports the uptake of QC in the EU/QT communications

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# EuroQCI overview

- An integrated satellite and terrestrial system spanning the whole EU for ultra-secure exchange of cryptographic keys (Quantum Key Distribution)
- The EuroQCI is part of the European Cybersecurity Strategy and is **integrated into IRIS<sup>2</sup>, the new EU Secure Connectivity Programme (Regulation (EU) 2023/588)**

## EuroQCI space segment

Distribution of quantum-secured encryption keys on a global scale

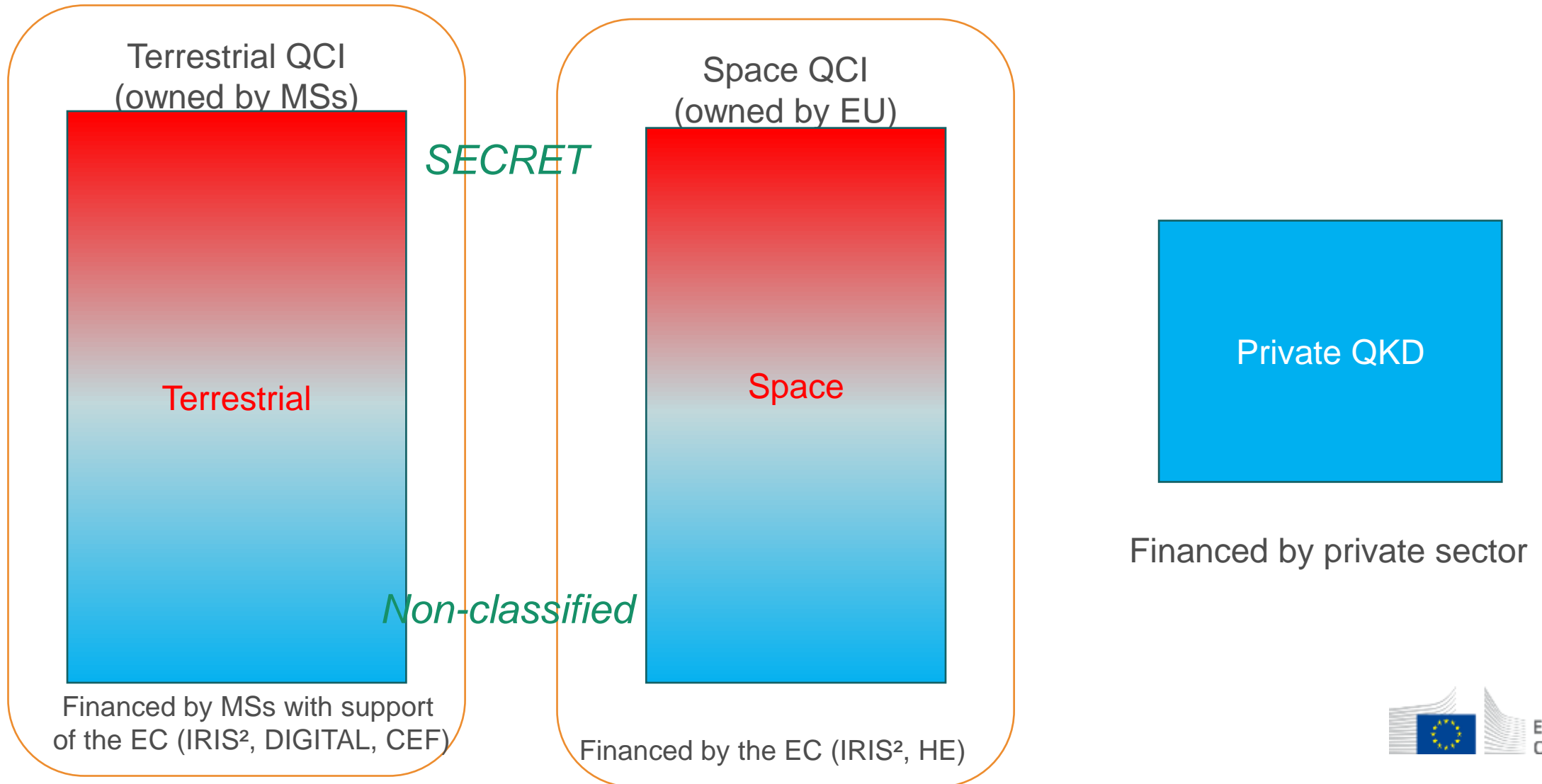


## EuroQCI terrestrial segment

Federation of national terrestrial QCI networks with cross-borders connections



# EuroQCI vision : Delivers a QKD service up to SECRET UE/EU SECRET for the public sector



# EuroQCI in the Secure Connectivity Regulation

- *'EuroQCI aims to deploy a certified secure end-to-end quantum communication infrastructure, enabling information and data to be transmitted and stored and to be capable of linking critical public communication assets throughout the Union.'*
- *'The Programme will contribute to meeting the objectives of the [EuroQCI Declaration, signed by all 27 Member States] by developing a EuroQCI space and ground infrastructure integrated into the governmental infrastructure of the Programme, as well as by developing and deploying the EuroQCI terrestrial infrastructure, which will be owned by the Member States.'*
- *'The EuroQCI space, ground and terrestrial infrastructure should be developed within the Programme in two main phases:*
  - *a preliminary validation phase, which may involve the development and validation of several different technologies and communication protocols,*
  - *a full-deployment phase including appropriate solutions for inter-satellite connectivity and data relay between satellites, the ground and the terrestrial infrastructure'*

# EuroQCI in Secure Connectivity

- EuroQCI governance part of Secure Connectivity governance:
  - 2 working groups established
    - EuroQCI WG (reporting to the GOVSATCOM configuration of the Space Programme Committee [SPC])
    - EuroQCI Security WG (reporting to the SPC-Security Configuration)
- Gradual integration of EuroQCI QKD service in IRIS<sup>2</sup> service portfolio (once mature)
- In addition to Secure Connectivity budget:
  - DIGITAL 2021-22: EUR 170 million
  - CEF 2024: EUR 90 million
- CNECT lead for implementation of EuroQCI activities

# Roles and responsibilities

- EU owns the EuroQCI space infrastructure
- MSs own their terrestrial infrastructure, including their optical ground stations (OGSs) and related ground equipment
- EU delegates to ESA the design, development, and deployment of the 1<sup>st</sup> generation EuroQCI space infrastructure
- EU supports MSs in the deployment of their terrestrial infrastructure
- Security accreditation:
  - Security Accreditation Board in charge of the EuroQCI space infrastructure
  - MSs (national security authorities [NSAs]) in charge of their infrastructure

# EuroQCI roadmap

## Preliminary validation

- Demonstration:
  - A network of MSs within TerrQCI shall be available for demonstration **by 2025 (DIGITAL)**
  - Space QKD shall be demonstrated in a real environment (**Eagle-1**)

## *1<sup>st</sup> generation: initial capacity*

- EuroQCI space and terrestrial segments shall deliver non-classified quantum key material for public stakeholders
  - Reliance on EU industry where possible
  - 1st generation space satellite(s) – target is 2027

## *2<sup>nd</sup> generation: final capacity*

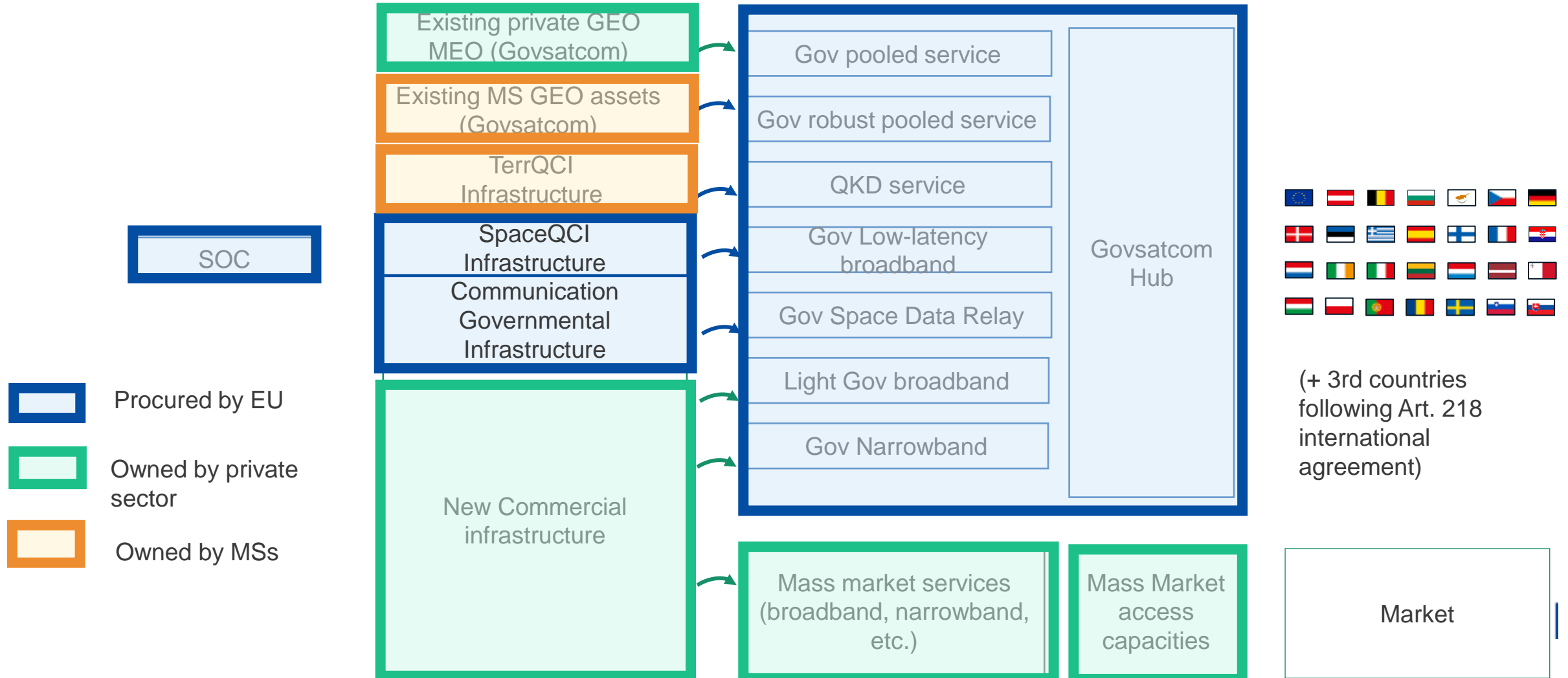
- EuroQCI shall deliver quantum keys meeting SECRET EU/EU SECRET requirements
  - Reliance only on EU industry
  - 2<sup>nd</sup> generation space constellation

# IRIS<sup>2</sup>/Secure Connectivity - Perimeter of programme funding

Infrastructure

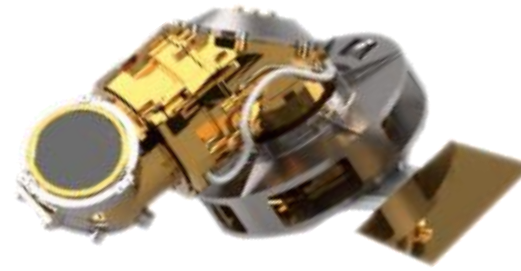
Service

Users





# EuroQCI space segment



## Eagle 1 – LEO satellite for in orbit demonstration and early tests

- Eagle 1 under development, led by ESA
- Funded by Horizon Europe / ESA / industry
- Objective: QKD proof of concept & testing interfaces with OGSs

## 1<sup>st</sup> Generation - deployment of LEO satellites with (mostly) EU technology

- First prototype satellite by EU/ESA
- Possibly additional satellites by Member States
- Operations:
  - Exchange quantum keys between different sites on EU territory
  - First validation of end-to-end system: interconnected LEO satellites + ground stations + terrestrial systems
  - Initial coverage of user and security requirements – incremental approach

## 2<sup>nd</sup> Generation - deployment of a fully operational system integrated with IRIS<sup>2</sup> for secure connectivity

Full coverage of user and security requirements

# EuroQCI terrestrial segment



20 21 22 23 24 25 26 27 28

**Studies :**  
**Design & architecture**

## Preparatory and first deployment phase

- Establishing first national networks to experiment with QKD technology

Start DIGITAL projects

## Operational deployment phase

- Operational deployment, testing, validation, and operationalisation

Start second phase

## Key activities supported from DIGITAL and CEF

- Maturing EU quantum communication technologies (DIGITAL)
- Building the national QCI networks (DIGITAL)
- Cross-border links between national networks (CEF) – **planned for 2024**
- Optical ground stations (CEF) – **planned for 2024**
- Deployment of a European testing and evaluation infrastructure (DIGITAL)
- Co-ordination of national activities (DIGITAL)

# Digital Europe Programme 2021-22

## QCI 2021 - DIGITAL call for proposals

**Topic 1:** Create a European Industrial Ecosystem for Secure QCI technologies and systems  
[EUR 44 million]

**Topic 2:** Deploying advanced national QCI systems and networks [EUR 108 million]

**Topic 3:** Coordinate the first deployment of national EuroQCI projects and prepare the large-scale QKD testing and certification infrastructure - Coordination and Support Action [EUR 2 million]

## QCI 2022 – DIGITAL procurement action

**Topic 4:** Deploy a large-scale testing and certification infrastructure for QKD devices, technologies and systems enabling their accreditation and rollout in EuroQCI [EUR 16 million]

**Total for EuroQCI in DIGITAL: EUR 170 million**

# Topic 4: Deploy a large-scale testing and certification infrastructure [EUR 16 million]

## Main activities

- Development of test methods and protocols for assessing QKD devices and systems, in particular on security aspects
- Establishing the product security baseline for QDK devices
- Building of a testing and evaluation infrastructure
- Operating the testing and evaluation infrastructure
- Transfer to a hosting entity for long-term operations

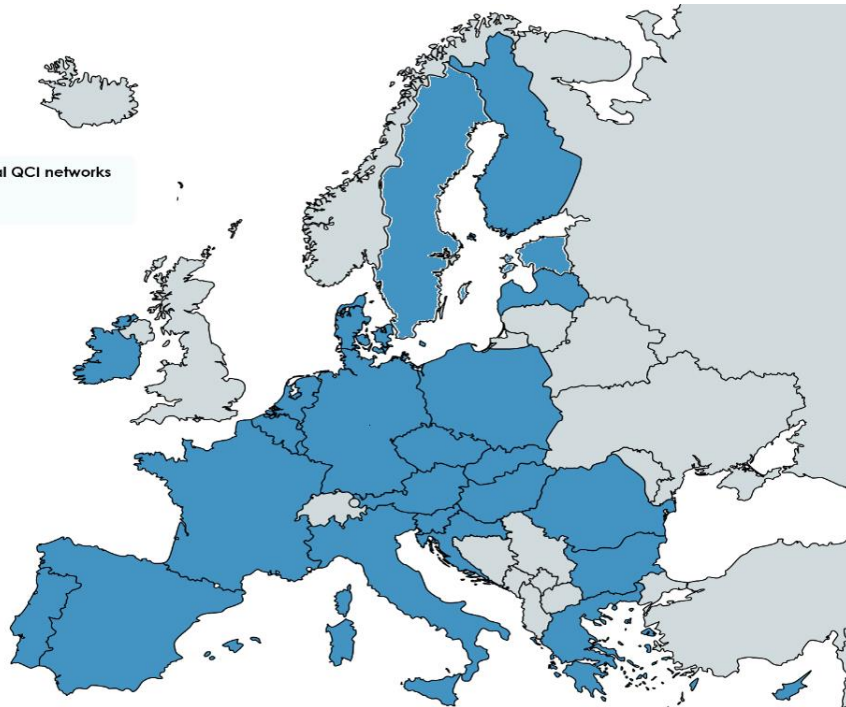
Official Journal: 'Call for tenders CNECT/2023/OP/0032 - Testing and evaluation infrastructure for EuroQCI'

## Next steps:

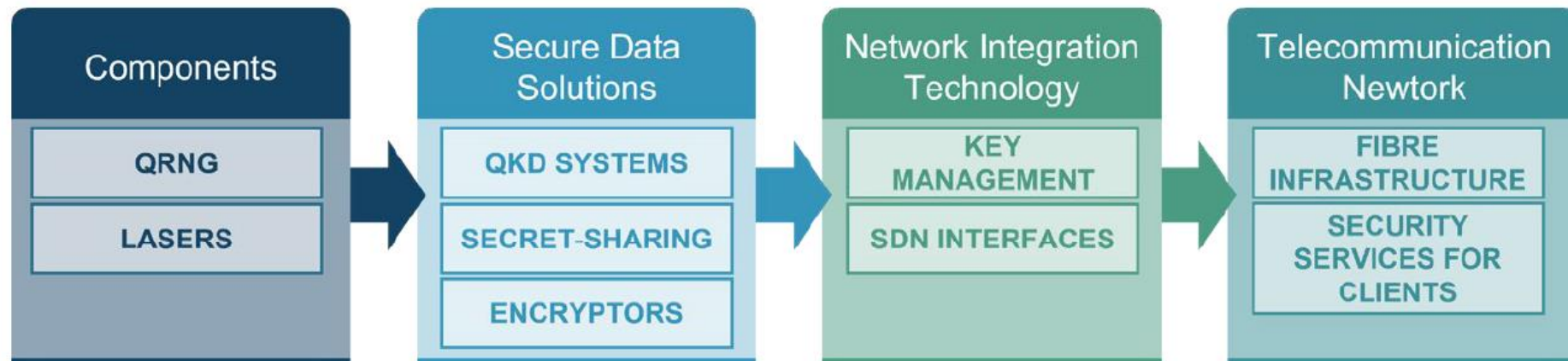
- Publication in July 2023
- Tender evaluation in September
- Contract to be signed in December



# EuroQCI Terrestrial state of play



- **26 Member States starting to deploy national QCI networks**
  - DIGITAL projects started 1 January 2023, 30 months
  - Initiate MS to QKD use, mature skills, test architecture, develop use cases, prepare for full deployment
- **6 DIGITAL industry projects started for maturing EU QCI technologies:**
  - QKD systems ready for integration into telecommunication networks
  - QKD modules (QRNG, optical component), key management software, encryptors. QKD protocols (e.g. CV-QKD and MDI-QKD)
- **Procurement of a European testing and evaluation infrastructure (publication planned for July 2023)**
- **Cross border & deployment of optical ground stations (CEF) planned for 2024 (to synchronise with Eagle 1)**



# Deploying national QCI systems and networks in 26 Member States

## Participants

- Academics
- Large industry consortia
- Involvement of ministries and/or governments
- Involvement of national security authorities and national cyber-security agencies (NSA/NCSAs)
- Joint cooperation with other projects

## Scope

- Research vs commercialisation
- Quantum layer only vs full network stack (incl. Key management system (KMS), controllers, encryptors, etc.)
- Terrestrial segment only vs inclusion of optical ground station (OGS) for satellite segment

## Architecture & Design

- Complex topologies vs single hops
- Modular interoperability vs monolithic solutions
- Key forwarding mechanism vs per-hop encryption
- Software defined network (SDN) vs hierarchy
- Open vs closed end-user groups
- Variety of protocols (P&M, entanglement)

## Deployments

- Testbeds vs production networks
- Unclassified vs classified networks
- Highly secure trusted nodes vs no security hardening
- Laboratory vs field installations
- Dark fibre vs classical fibre

# Thank you



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