# ASECAP DAYS

MILANO 2024

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CONCESSIONI
AUTOSTRADALI
VENETE

ASECAP DAYS
MILANO 2024

# TITLE PRESENTATION:

# Quantum technology to safeguard CAV's smart roads cyber security

Veneto Quantum Infrastructure for CYBER SECURITY

Quantum 4°-Roads

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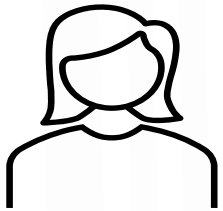
# CAV INTRODUCTION

Concessioni Autostradali Venete is a joint-stock company established by ANAS S.p.A. and Regione Veneto, with the task of managing the complex crossing system of North-Eastern Area and recovering resources to be allocated to further infrastructure investments.

CAV is committed to INNOVATION with strategic projects such as:

- Drones for monitoring and enhancement of asset management
- Hypertransfer feasibility
- Quantum Communications

# INTRO ON QUANTUM COMMUNICATIONS



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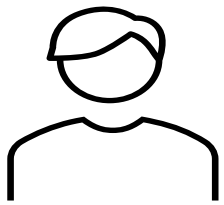
**Cryptographic Keys**



Current cryptographic techniques are based on the difficulty of solving "complex" computational problems

The development of mathematical techniques and the advent of quantum computers will make current cryptographic methods vulnerable

Thanks to the maturity of quantum technologies, cryptographic keys can be distributed out using the physical state of the photons.
As a result, possible attacks can be identified by applying quantum properties.

**Quantum Key Distribution 'QKD'**

# CAV CONTEXT ANALYSIS AND PROJECT DEFINITION

Back in 2022, CAV carried out a preliminary assessment on the security aspects potentially enhanced by quantum technologies in the field of Transport & Digital Transformation.

The following frameworks were identified:

1. (short-term) Quantum Cryptography to enhance the protection of internal data within an identified Area Network;
2. (medium-term) Quantum Security Infrastructure for fucture E-ROADS Q4ER

By the end of 2022, the first Quantum Key Distribution link was implemented within the CAV data network

# 1. Ven-QCI: Veneto Quantum Infrastructure for Cyber Security

In the context of communications security, a quantum network project has been defined for the Veneto region with ambitious medium-long term objectives.
The first phase of this process consists of the creation in the short term of a network for the exchange of quantum keys, the implementation of use cases between the Veneto Region, CAV SpA and the University of Padua (Vsix and QUTECH) and the analysis of the governance scenarios of a future regional quantum network: ***VenQCI Project***

## PROJECT PARTNERS

**CAV** active on Innovation Initiatives in the field of Transport & Digital Transformation

**Veneto Region** Agenda Digitale

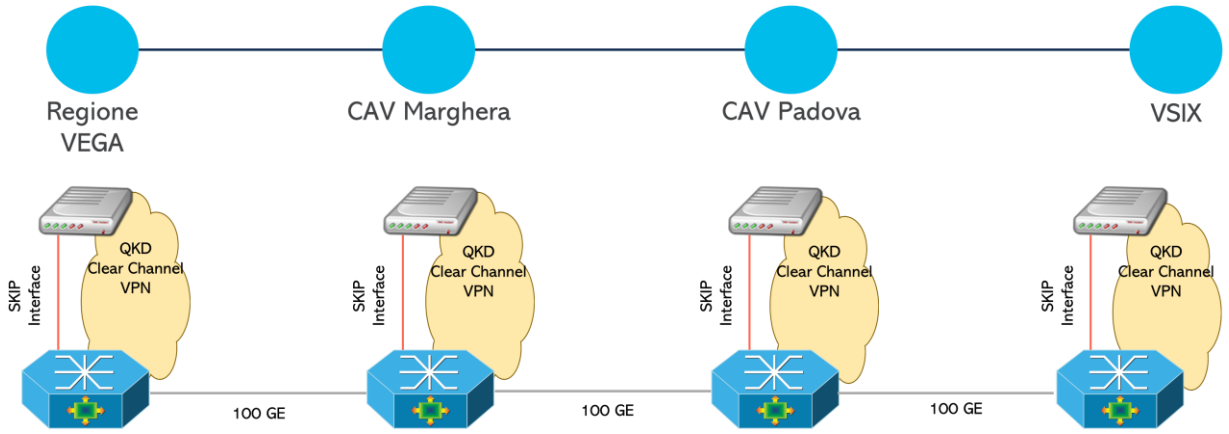
**University of Padua**

- QuTech Center [Quantum Technologies Center]
- Vsix [Neutral Access Point for the Italy North-East]

Project coordination and execution: CAV
Technology Partner: ThinkQUANTUM

## 1.Ven-QCI: CAV Layer Topology

| PoP A | PoP B | Distance (Km) | C-Band Loss (Db) | Quantum – Data on Single Fiber | Link Speed (Gbps) |
|---|---|---|---|---|---|
| Regione VEGA | CAV Marghera | 10 | 6 | Y | 100 |
| CAV Marghera | CAV Padova | 25.8 | 6.6 | N | 100 |
| CAV Padova | VSIX | 10 | 6 | N | 100 |




## 1. Ven-QCI: Solution Adopted

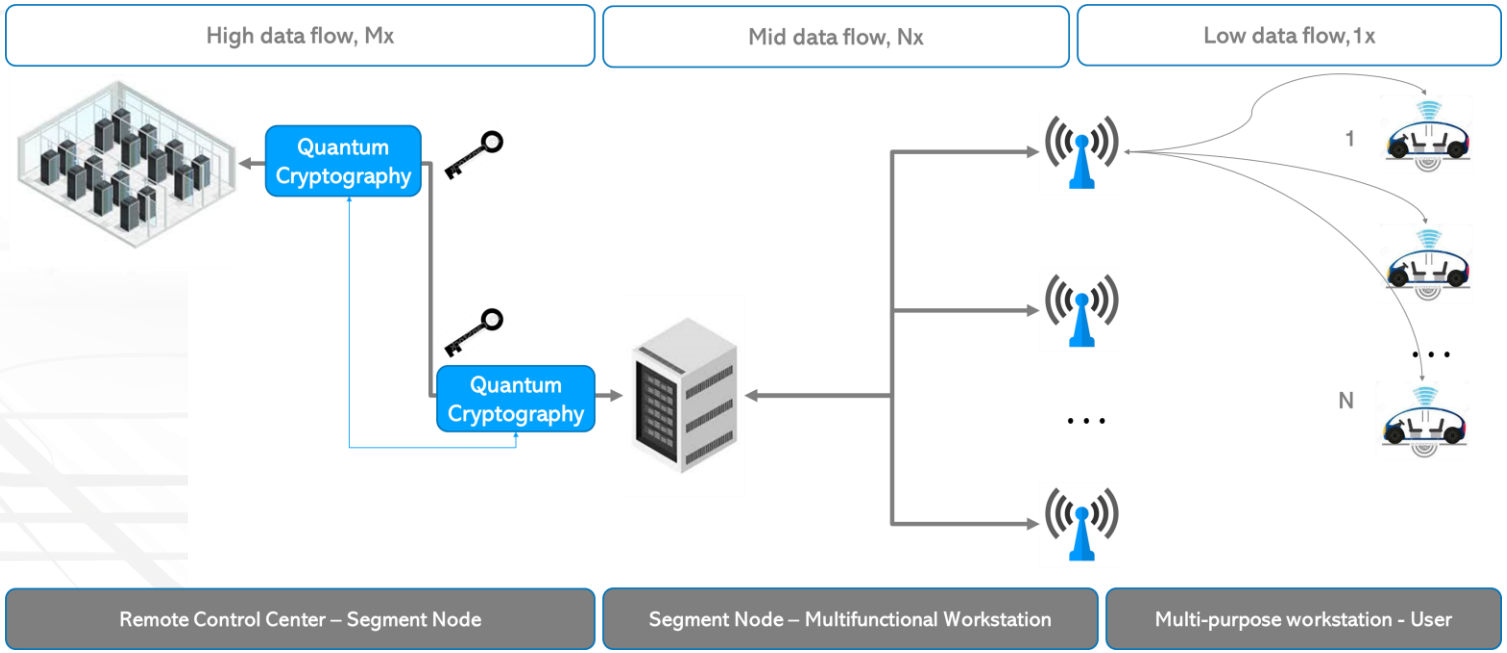
- A state-of-the-art multi-service network based on IP/MPLS technologies was built, using L2 encryption with postquantum preshared keys provided by QKD systems:
  - 10GE/100GE links
  - Rock-solid IP/MPLS technology and features for aggregation networks
  - Line-rate MACSec
  - Secure Key Exchange Protocoll to interact with the ThinkQuantum QKD systems
- Innovative architecture that transmits Quantum channel and data channel on the same pair of fibers:
  - Routed Optical Networking architecture to simplify the network layers

## 2. Q4ER: Quantum4E-Roads

Data exchange, at the base of future road networks, involves single cars (low data flow, 1x), antennas (medium data flow, Nx), infrastructure (high data flow, Mx). The data transmitted and received, in addition to involving privacy, are of high importance in terms of road safety (critical infrastructure)

**GOAL:** analysis of the specificities of transport infrastructures and the opportunities to raise the security profile through the use of quantum technologies, monitoring of cyber security developments in the e-roads field (study tables, regulatory committees,...).

## 2. Q4ER: Simplified Schematic



# Q4ER/Quantum4ERoads: Prospettive

Having ascertained the breadth of the theme Cybersecurity in E-ROADS and the time horizon (medium-term) an in-depth study on the topic has started, an Industrial doctorate was activated at Unipd by CAV in collaboration with ThinkQuantum.

**Themes**

Analysis of medium-term scenarios related to cyber security in infrastructure and transport in a quantum-safe perspective, evaluation of technological solutions at the level of devices and systems and their integration into networks;

Participate in discussion tables and e-roads standardization committees on behalf of CAV;

Development of QKD systems in free space, with possible applications in the field of infrastructures.

*PhD student: Alberto De Toni*

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# THANK YOU

## *GRAZIE*

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Massimo Pasqualato
Simone Capeleto

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