

GISC 2025

Global ICT Standards Conference 2025

Quantum Innovation and Standardization Pathway

Development of China's Quantum Communication Network Industry and Standardization

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ICT Standards and Intellectual Property:
AI for All

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03 Development of standardization

Abstract

| Main content of this presentation

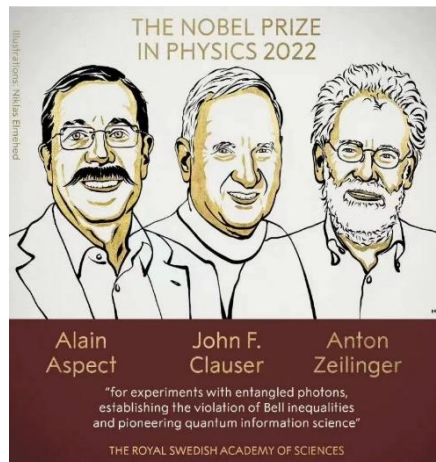
Development of China's Quantum Communication Network Industry and Standardization

- This presentation introduces the recent progress of quantum communication networks in China, including the network topology and the performance
- The standard development related to quantum technologies will also be introduced, mainly focusing on the activities in ITU, ISO and IEC

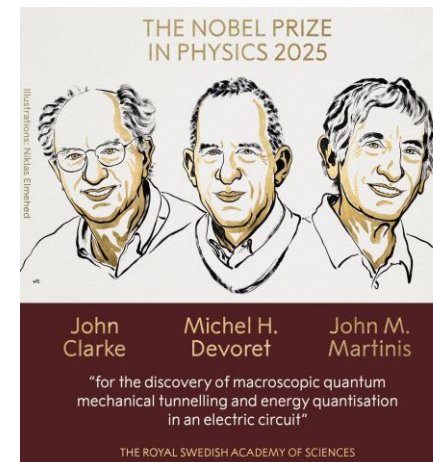
01. Background

| The quantum information era is coming

The Nobel Prize in Physics 2022 was awarded to the field of quantum information science, for "their achievements have paved the way for new technologies based on quantum information, including quantum computers, quantum networks and quantum communications"



The Nobel Prize in Physics 2025 was awarded to the field of quantum mechanics, for "the discovery of macroscopic quantum mechanical tunnelling and energy quantisation in an electric circuit". Lays the scientific foundation for superconducting quantum computing

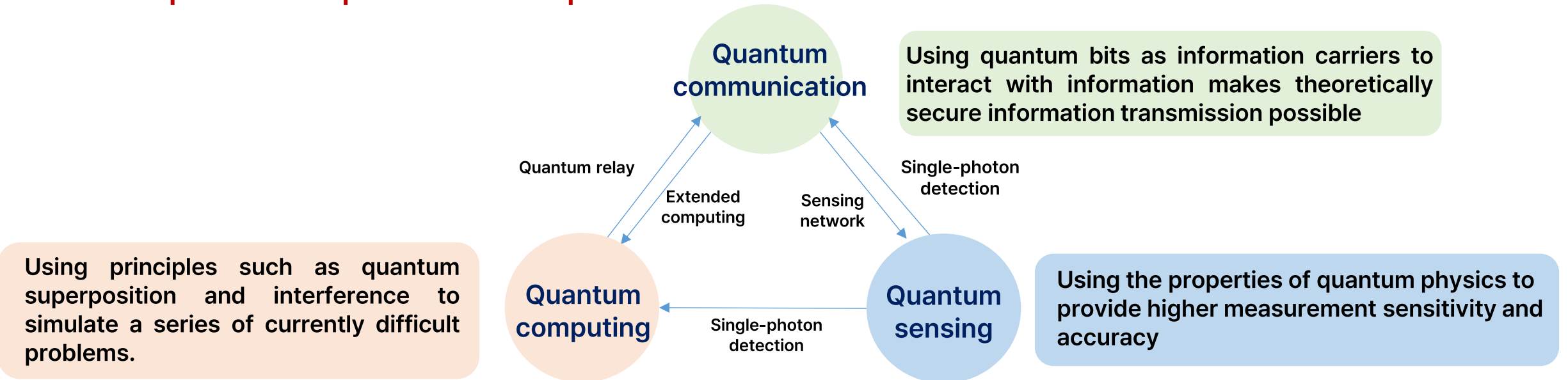


01. Background

| The ultimate goal: Quantum Internet

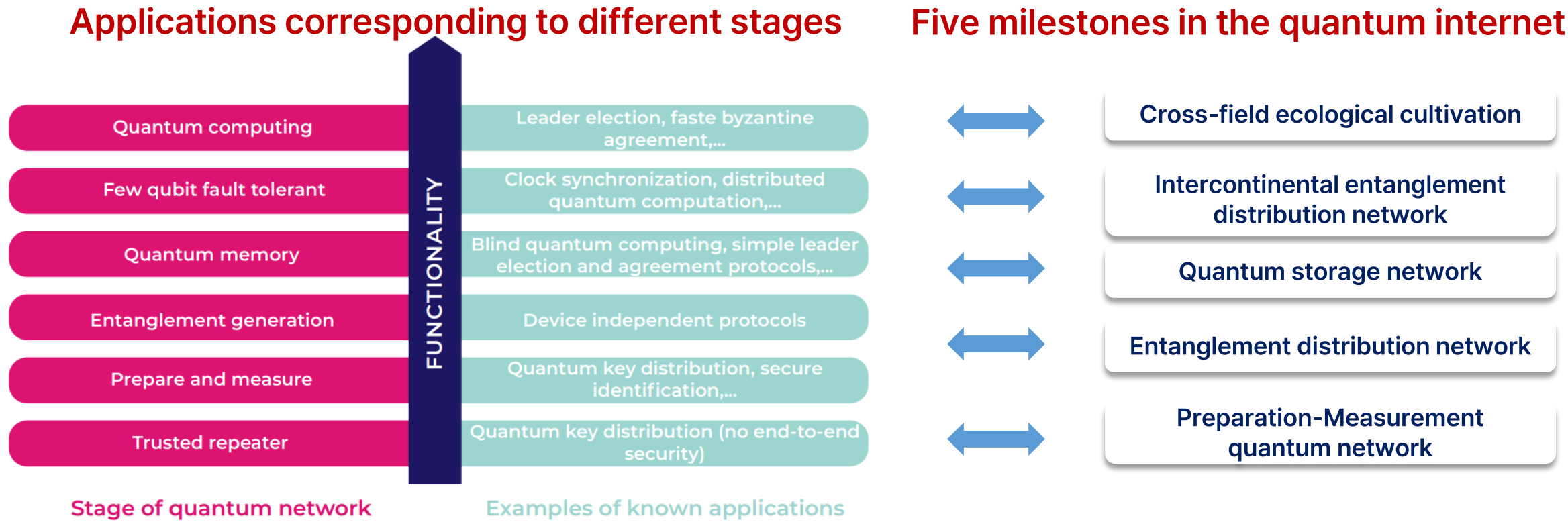
- The quantum internet refers to a global system that **transmits, processes, and stores** quantum information by interconnecting various quantum information processors or sensors.
- The first stage of the quantum internet is the **quantum key distribution network**, which will eventually develop into a full **quantum network** that uses quantum bits and quantum entanglement as basic resources.

Three important components of the quantum internet



01. Background

| Evolution stages of quantum internet



Strategic Research and Industry Agenda 2030¹

Quantum Internet Blueprint by U.S. DOE in 2020²

1. Strategic-Reseach-and-Industry-Agenda-2030.pdf (qt.eu)
2. QuantumWkshpRpt20FINAL_Nav_0.pdf (energy.gov)

01. Background

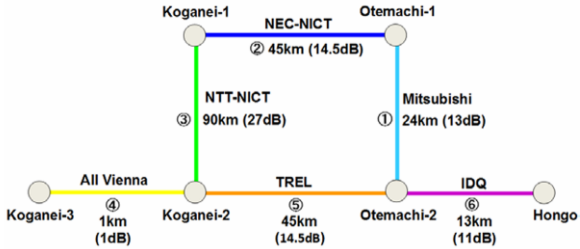
Many countries are working on quantum communication networks



PIONIER-Q in Poland



Q-net-Q in Germany

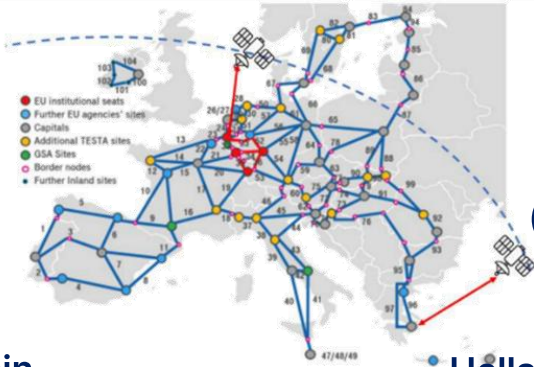


Quantum network in Japan (2011)



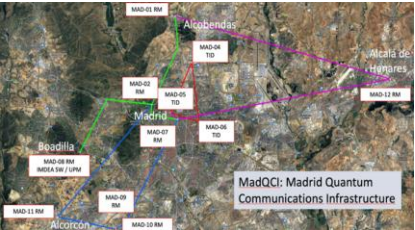
Quantum network in UK (2019)

EuroQCI (in progress)



EuroQCI (in progress)

MadQCI in Spain



HellasQCI in Greece



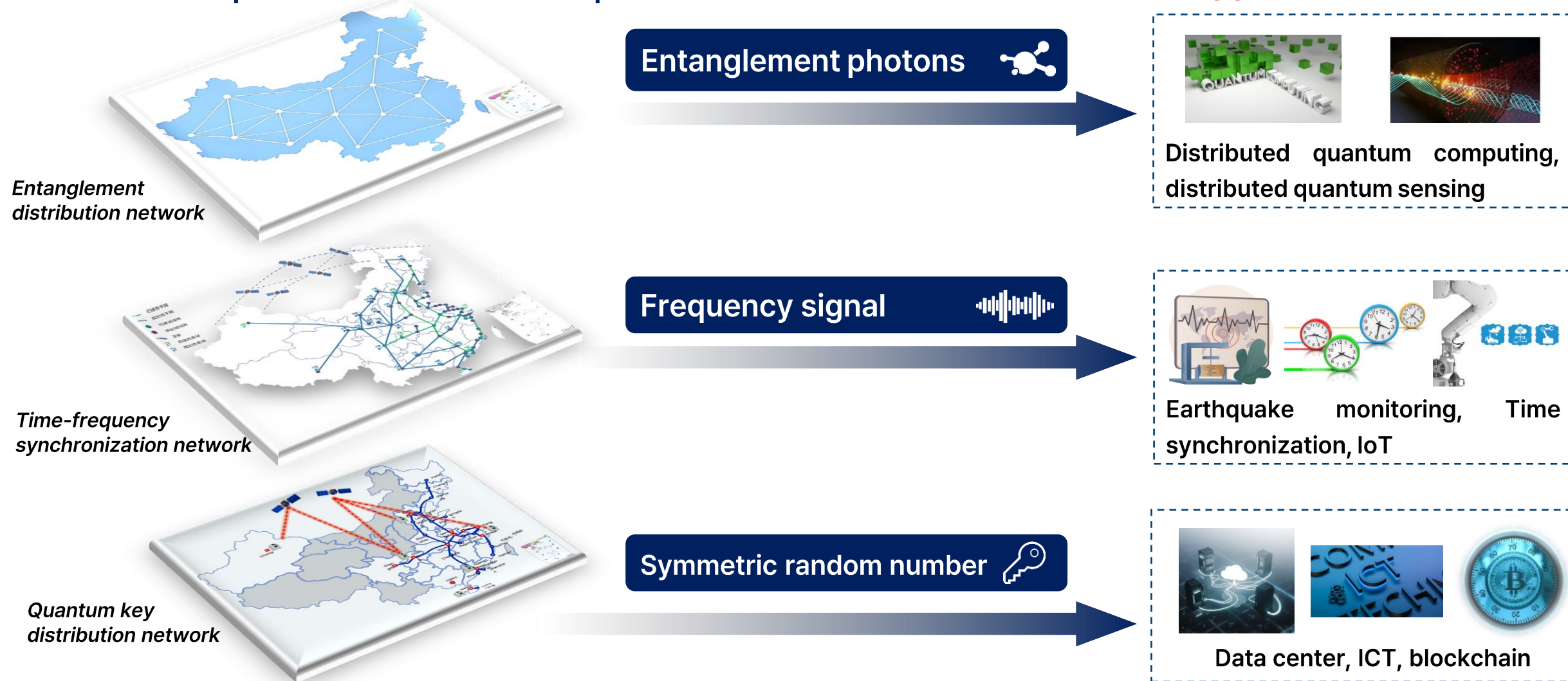
Quantum network in Korea (2022)



Quantum corridor project in America (2023)

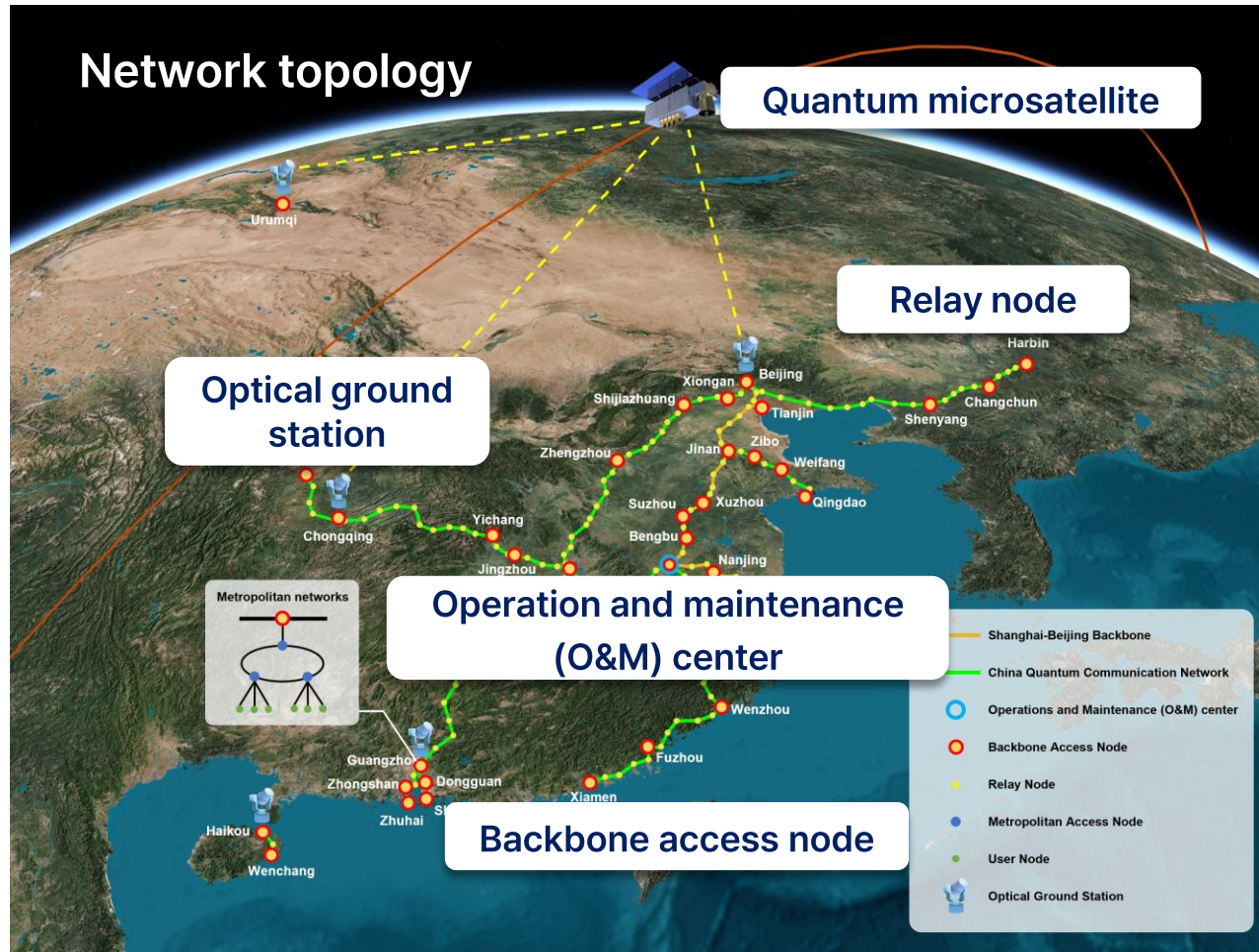
01. Background

| Outlook of quantum networks development in China



02. Introduction of China's Quantum Communication Network

Overview of China Quantum Communication Network (CN-QCN)¹



● Remarkable parameters:

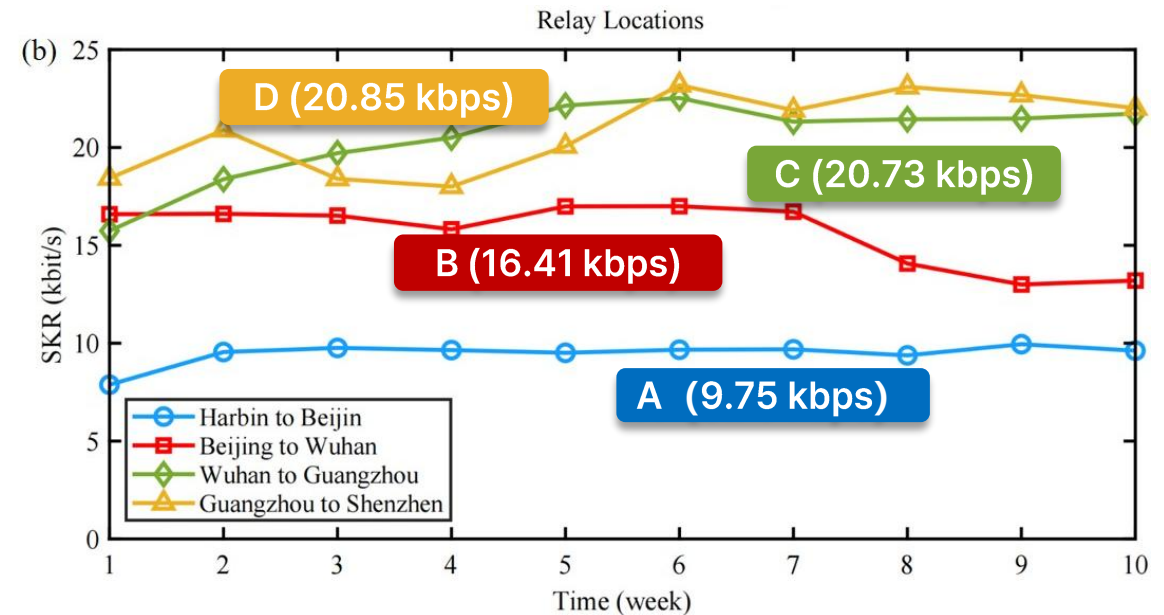
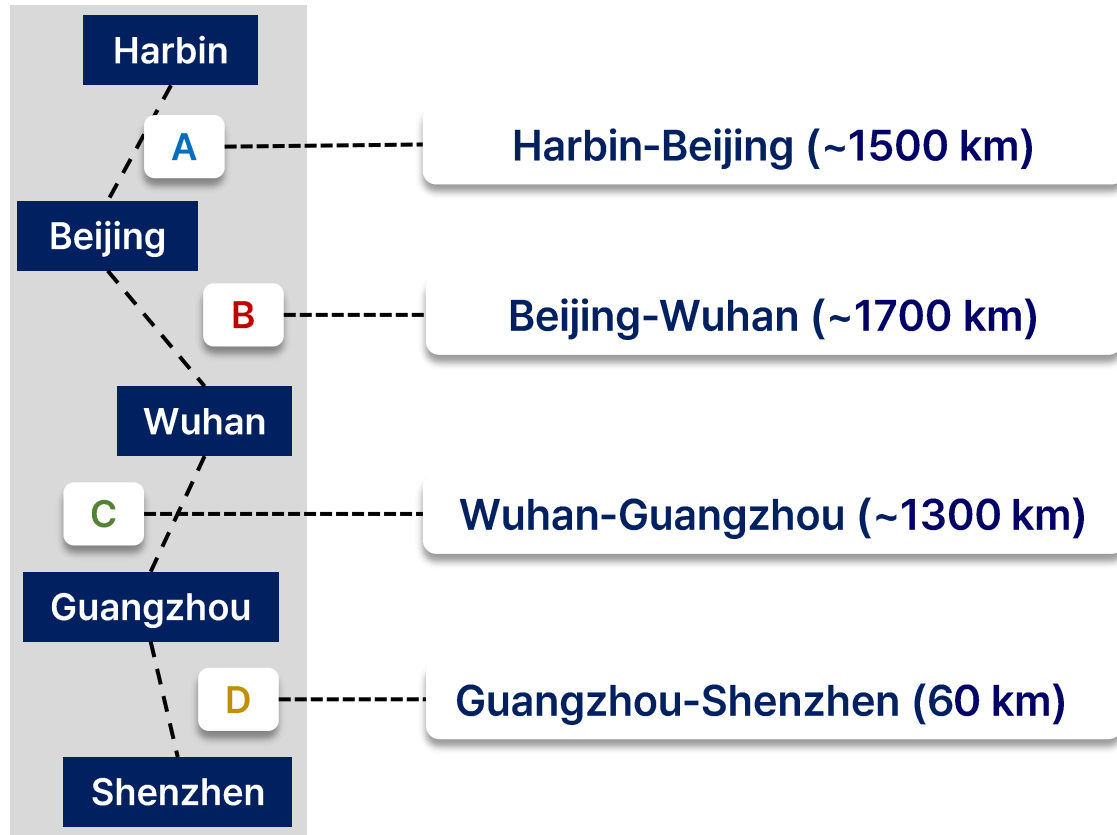
- Total optical fiber length approximately **10,103 km**
- **145** backbone nodes
(41 backbone access node + 104 relay nodes)
- Cover **17 provinces and 80 cities**
- Deployed 6 ground stations linked with **Jinan-1 quantum microsatellite**
- Achieve multi-type QKD hybrid networking

1. Hao-Ze Chen, et al., Implementation of carrier grade quantum communication networks over 10000 km, NPJ Quantum Information, 2025 11:137

02. Introduction of China's Quantum Communication Network

Secure key rate (SKR) performance analysis of CN-QCN

- Harbin-Shenzhen: **Northernmost point** to the **southernmost point** in mainland, total optical fiber length is about **4,660 km** as the **longest routine**, being divided into four segment (A to D):

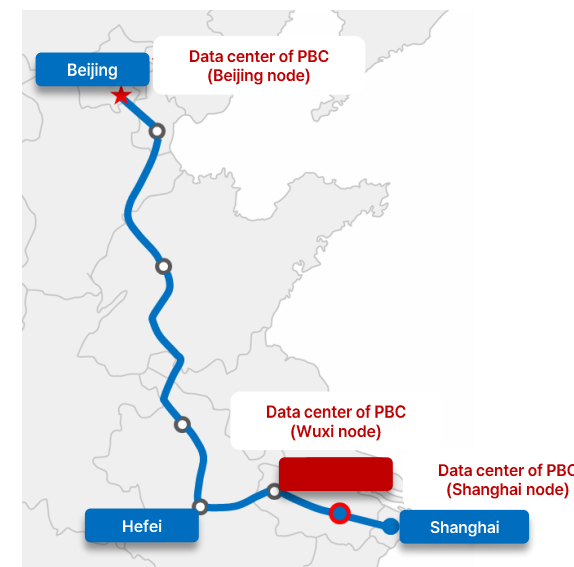
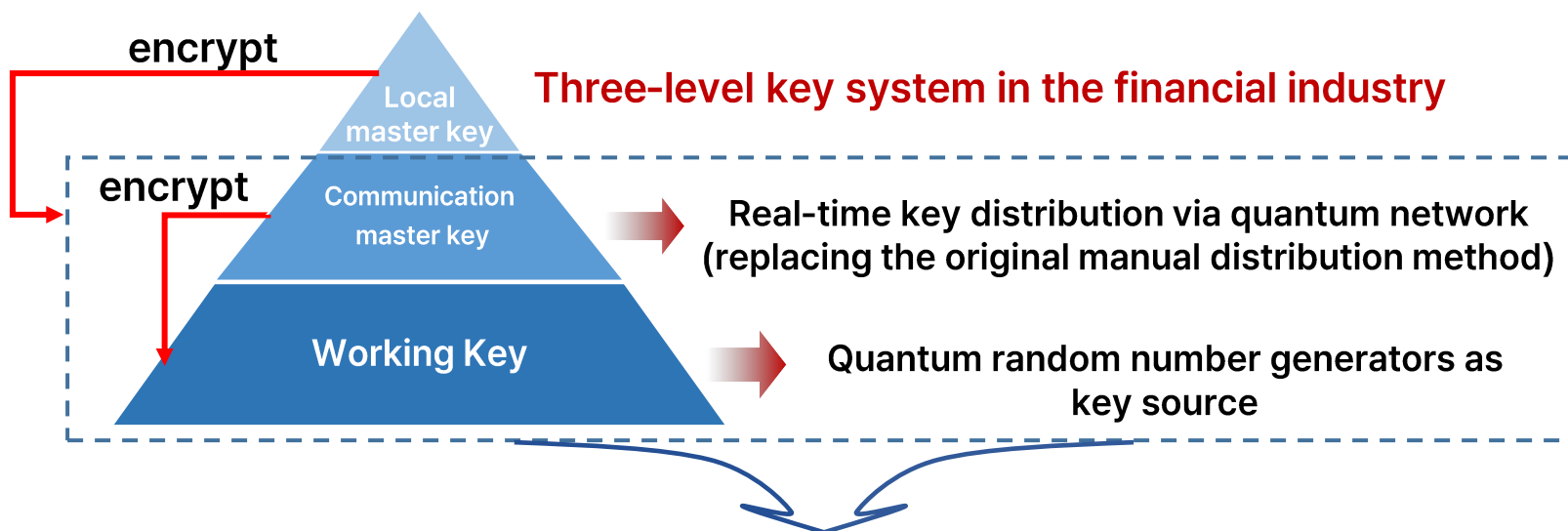


- The **end-to-end SKR** is determined by the **minimum SKR** among all km-links between adjacent nodes
- **Different user needs** in different regions have to taken consideration when deploying the networks

02. Introduction of China's Quantum Communication Network

Applications: Provide services for many banks based on systematic quantum key

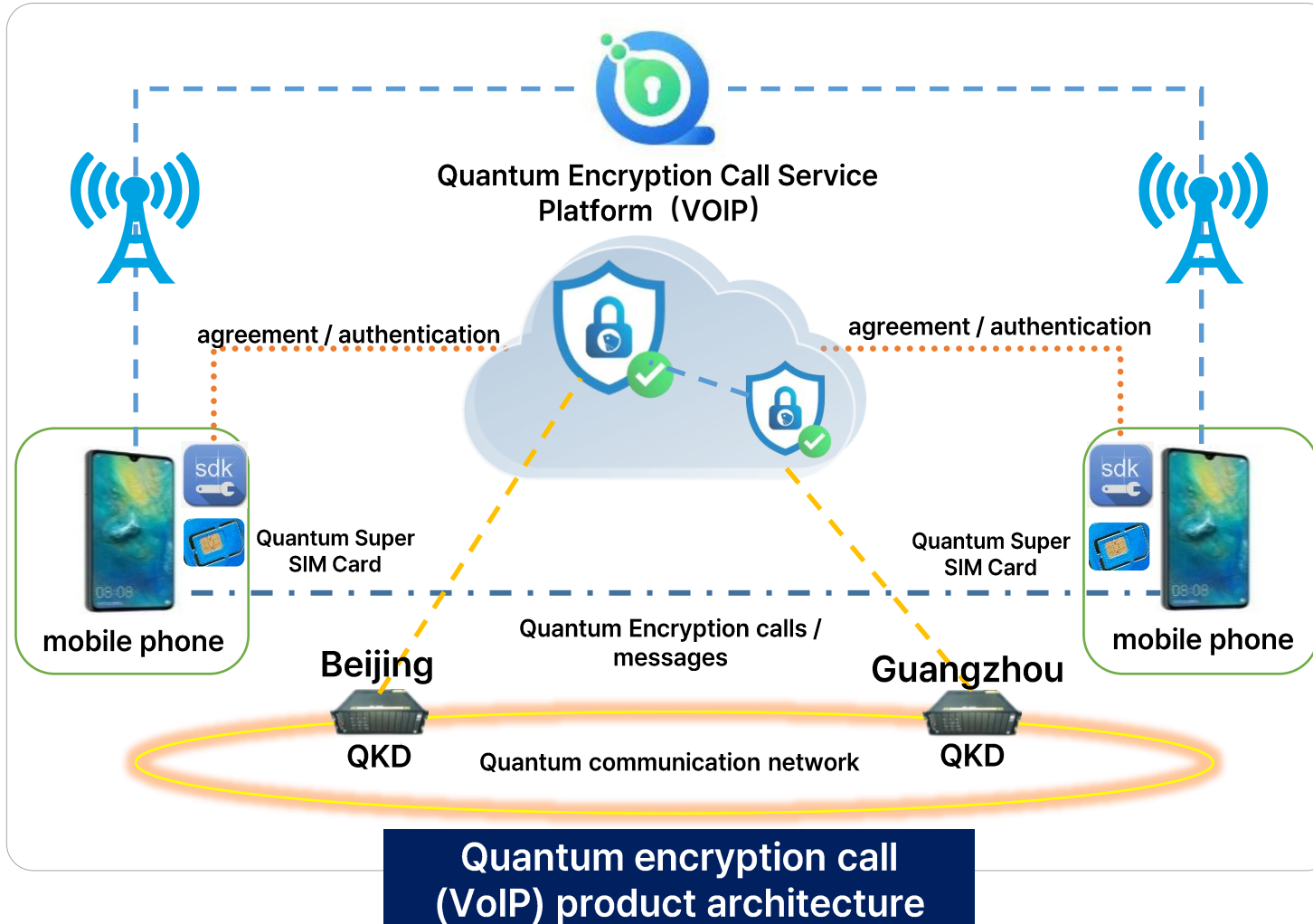
Key generation, distribution and update between bank clearing data center nodes based on quantum technologies



- **Security improvement:** Root key security guaranteed, high-frequency large-scale key distribution enabled
- **Cost reduction:** All sub-service systems can share the common quantum-based security infrastructure via flexible APIs, needless for separate development

02. Introduction of China's Quantum Communication Network

| Applications: Commercial quantum secure applications for mobile telecom terminals



🚩 The number of user has exceeded **4,000,000**

Components

- **Quantum super SIM card**
Provided by **China Mobile**, is used to **store quantum keys**
- **Quantum Communication network**
Based on CN-QCN built and operated by **CAS Quantum Network Co., Ltd.**

03. Standard development

| Standard development related to quantum communication networks

QKD

Published **13** standards

- QKD use cases
- Component
- Terminology
- Interface
- ...



2008~2019

QKDN

Developed **39** standards

- Architecture
- Functional requirement
- Security management
- Interface Protocol
- ...



2019~

QIT

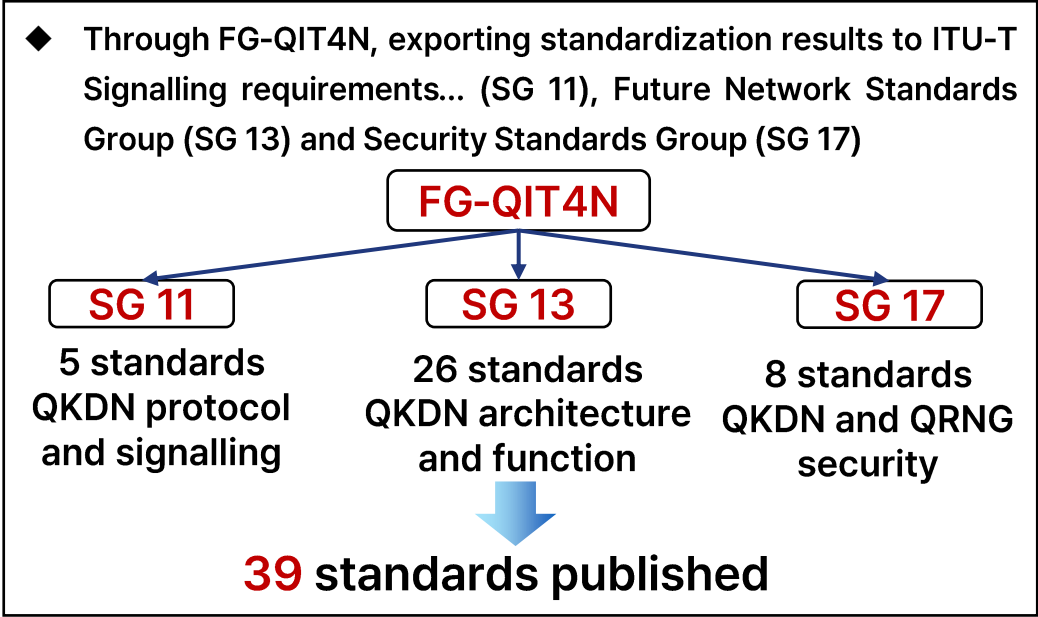
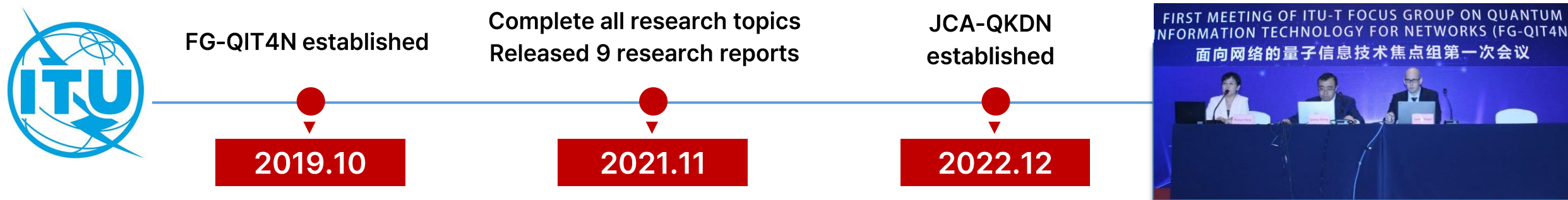
IEC and ISO jointly established the Joint Technical Committee on **Quantum Technologies**, namely **IEC/ISO JTC 3**, focusing on QITs in January 11, 2024



2024~

03. Standard development

| Standard activity of quantum technologies in ITU



Actively participated in SG 11, SG 13 and SG 17

- Chinese experts have actively participated in 29 standards in these study groups, in which 5 standards in SG 11, 20 standards in SG 13, and 4 standards in SG 17, including frameworks of QKD network and security, and is developing standards such as QKD network interconnection and interface protocols

03. Standard development

Actively participated in ISO and IEC



Established in January 11, 2024, focusing on standardization of quantum technologies

IEC/ISO JTC 3 First Plenary Session (May, 2024, Seoul)

- Set up six ad hoc groups, covering terminology, quantum random number generator, etc



IEC/ISO JTC3 1st Plenary Meeting
Seoul · Korea

May, 2024

IEC/ISO JTC 3 Second Plenary Session (October, 2024, Edinburgh)

- Explicitly include the field of QKD in the scope of work of ahG 4



IEC/ISO JTC3 2nd Plenary Meeting
Edinburgh · UK

October, 2024

IEC/ISO JTC 3 Third plenary Session (May, 2025, Tokyo)

- Approved to establish 5 WGs, Chinese expert serve as the convenor of the WG 13 QRNG



IEC/ISO JTC3 3rd Plenary Meeting
Tokyo · Japan

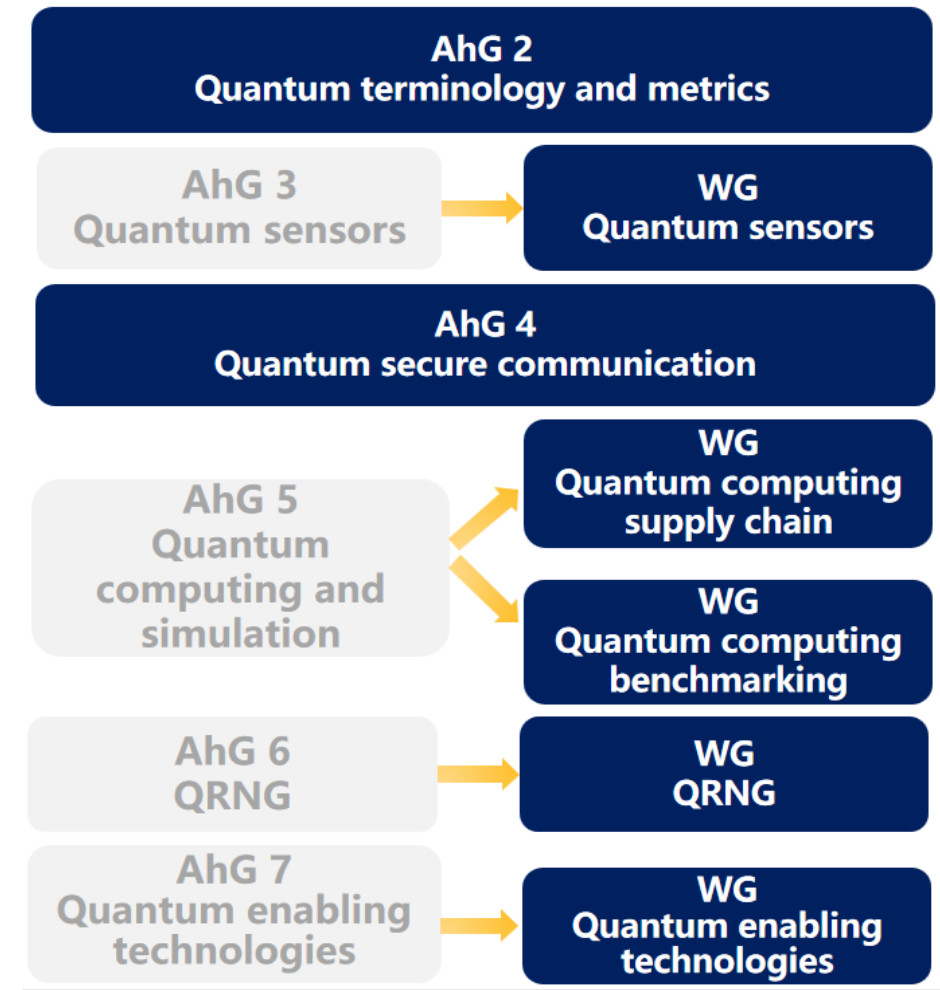
May, 2025

03. Standard development

Actively participated in ISO and IEC

After the third plenary meeting (May, 2025) of IEC/ISO JTC 3

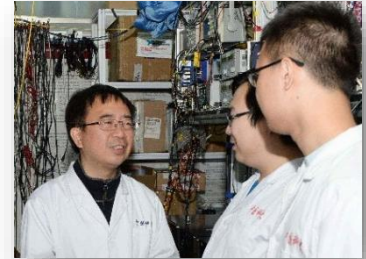
- According to the resolutions, there are **2 ad hoc groups** and **5 working groups**, where the Chinese expert served as the convenor of WG 13 QRNG
- The structure of JTC 3 reflects the integration of quantum technology with different technical fields and demonstrates the strong potential of future quantum fusion networks



Evolution of ad hoc groups and wgs in IEC/ISO JTC 3

03. About us and call for cooperation

- Founded jointly by the Chinese Academy of Sciences Holdings Co., Ltd., the University of Science and Technology of China (USTC) in 2016.
- Relying on the technical advantages of Academician Jian-Wei Pan's team.
- Provide services of quantum technology and ICT, including quantum cryptography, application, quantum-safe cloud service, quantum enhanced data storage, etc.



<https://qtict.com/english>



Quantum-safe cloud service



Quantum-safe gateway



Quantum-safe push-to-talk



Quantum-secured lease line

Facing the next-generation quantum internet, which call for the cooperation in the global interested parties in varies of relevant industrialization



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- Thank you -

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