ETSI/IQC Quantum Safe Cryptography Event

National Quantum Safe Network in Singapore

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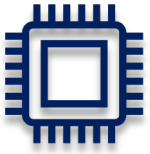
QEP RESEARCH PILLARS AND PLATFORMS

QUANTUM ENGINEERING PROGRAMME SINGAPORE

Quantum Communication & Security



Quantum Computing & Processors

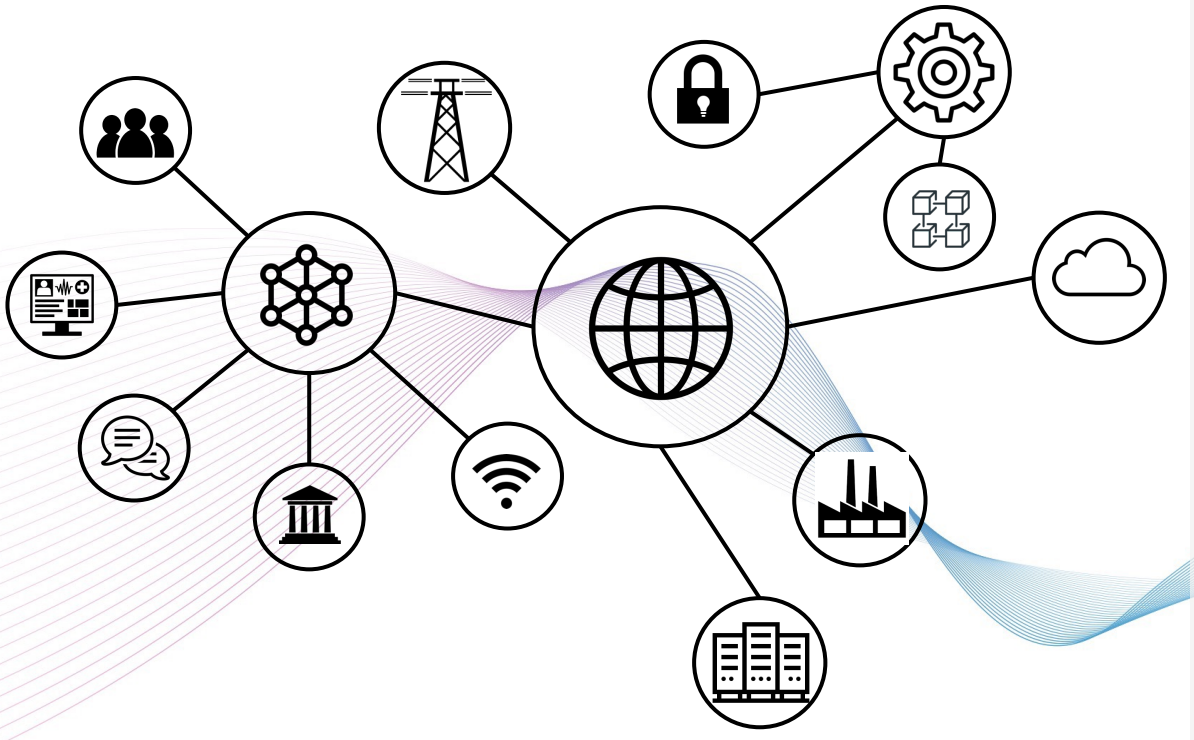
Quantum Sensors

NATIONAL QUANTUM-SAFE NETWORK

NATIONAL QUANTUM COMPUTING HUB

NATIONAL QUANTUM FABLESS FOUNDRY

QUANTUM SAFE NETWORKS



Quantum Communication Technology Landscape

- Government and industry are progressively exploring **Quantum Security** and **Quantum Resilience**
- **Quantum Key Distribution network (QKDN) deployments** starting in
  - IT infrastructures in government
  - Telecommunications
  - Data center sectors
- Envisioning network topologies from terrestrial Point-to-Points to International QKD & End-to-End Quantum Security

NQSN MISSION

What

NATIONWIDE COLLABORATION PLATFORM AND FIELD TESTBED FOR QUANTUM-SAFE COMMUNICATIONS

Why

PILOT INFRASTRUCTURE

- Open network accessible for partners to perform field trials and proof of concepts/use cases for technology evaluation

SECURITY FRAMEWORK

- In-depth security evaluation of Quantum communication equipment to seed certification

REFERENCE GUIDELINES

- Build readiness to support companies in adoption and development of national reference specifications

How

TESTBED | **SECURITY LAB** | **ECOSYSTEM** | **STANDARDISATION**

TESTBED

Terrestrial Metropolitan Area Network

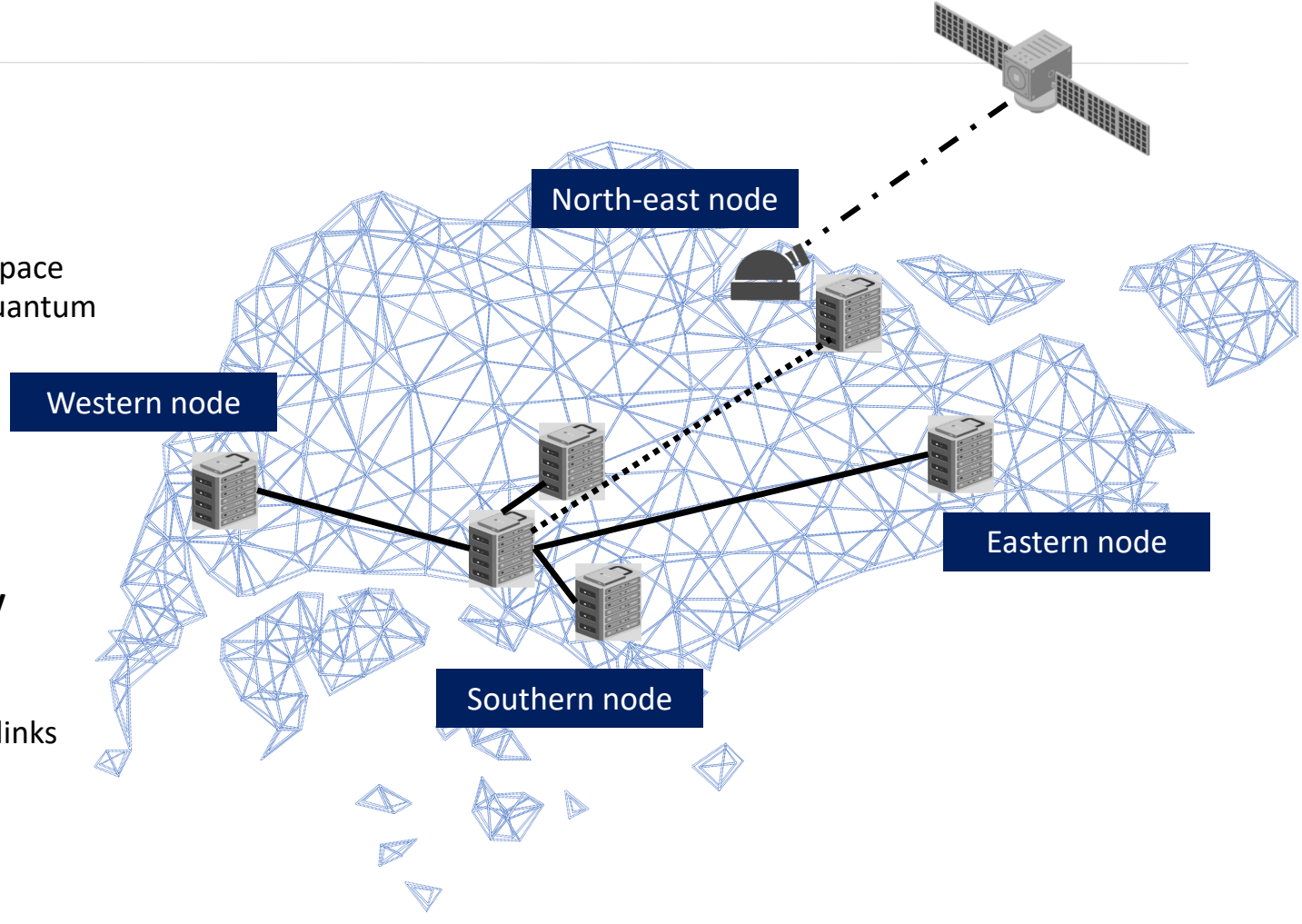
- SG fibre infrastructure & Free-space
- Target for hybrid QKD + Post Quantum Cryptography
- Short-term

Satellite

- Mid-term

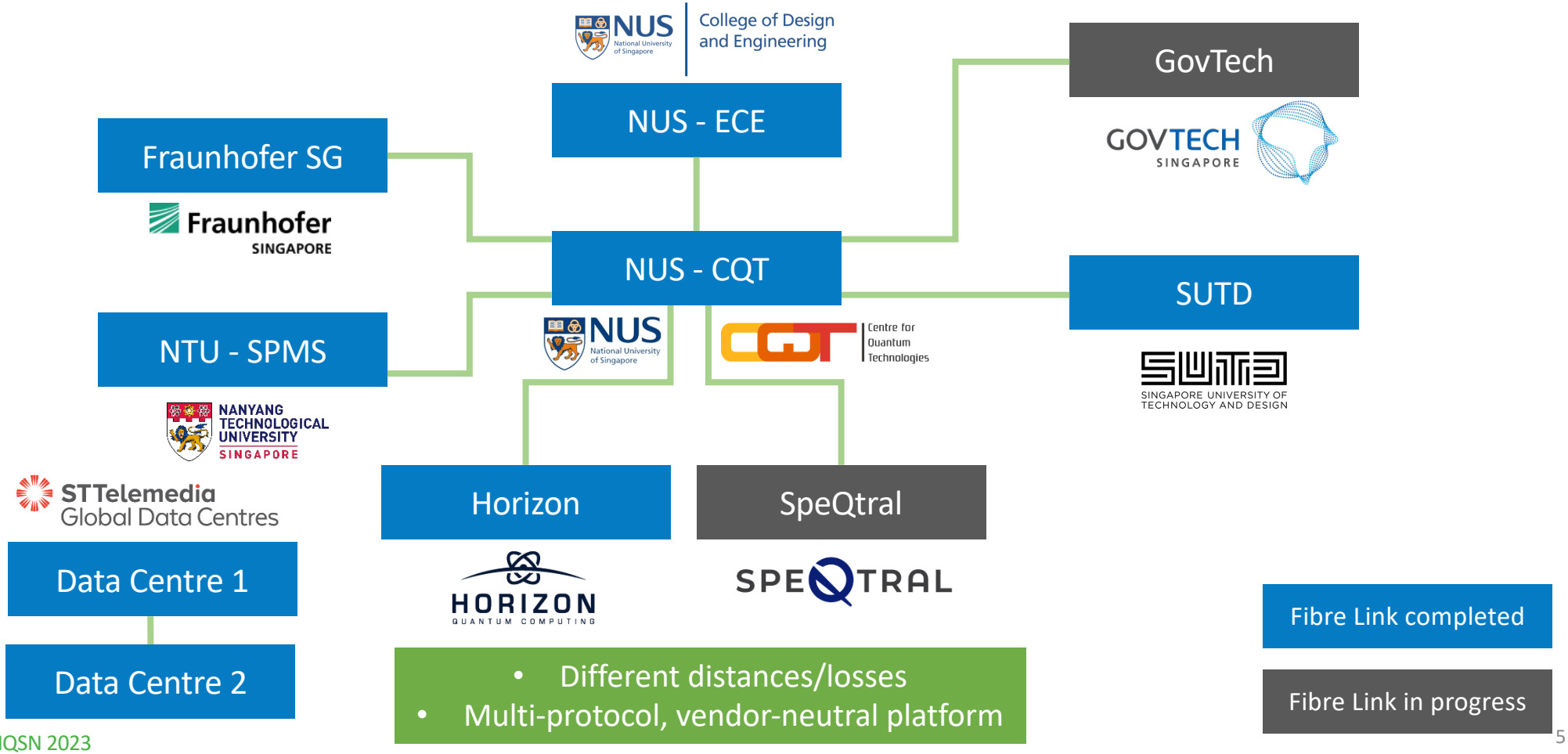
Academic and Private Industry Networks

- Linking major Universities
- Individual private organization links



NATIONAL QUANTUM-SAFE NETWORK

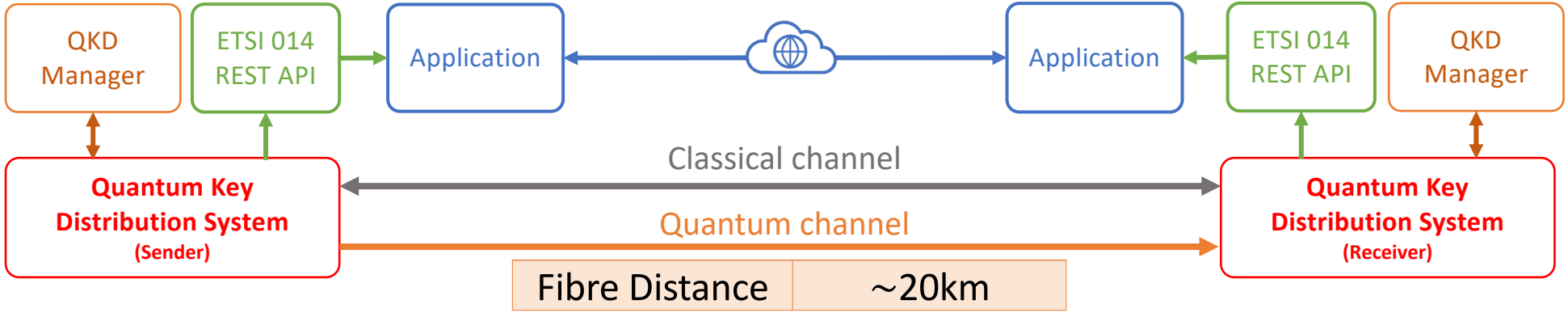
NQSN QUANTUM COMMUNICATIONS INFRASTRUCTURE

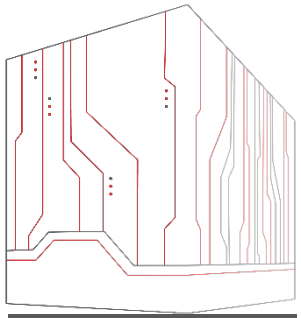


NATIONAL QUANTUM-SAFE NETWORK

USE CASE: DATA CENTRE QKD-SECURED CONNECT

Quantum Key Distribution in **production-grade** fibre at **commercial data centres**

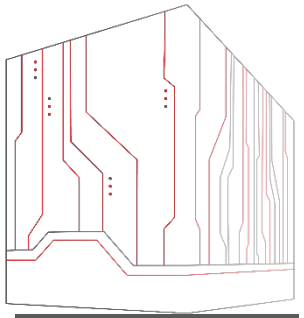




Data Centre 1

Main Results

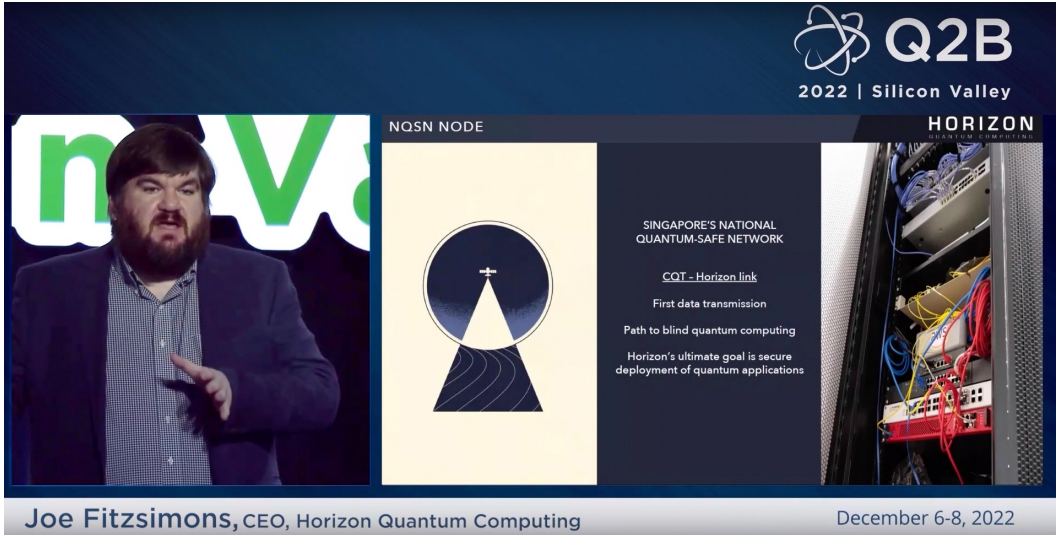
- QKD system operated **stably & continuously** over commercial-grade fibre
- More than **2 Gbit of AES-256** QKD keys exchanged
- Loss Test: Key rate reduces with increasing attenuation
- Application: Demonstration of secure data transfer over QKD-key encrypted (cloud-based) VPN



Data Centre 2

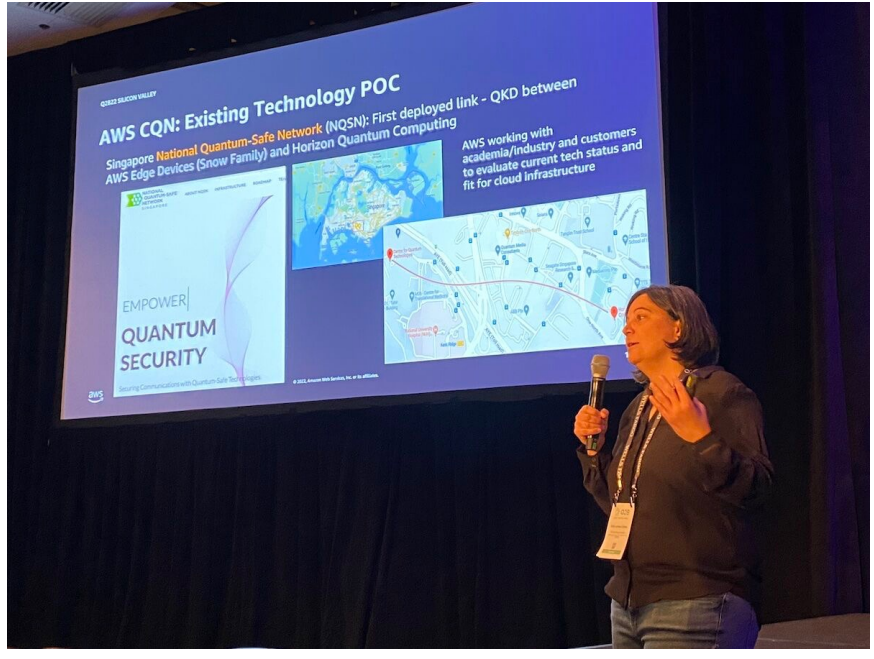
NQSN PARTNERS USE CASES – NQSN-CQT, AWS, HORIZON, FORTINET

Milestone: Quantum-secured VPN for edge-cloud quantum computing applications



https://youtu.be/li844KxVRBQ?t=383

- Presentation at **Q2B 22 Silicon Valley (Dec 2022)** by Horizon Quantum Computing & AWS Center for Quantum Networking (CQN)
- CQT-Horizon **quantum-secured VPN link** established with QKD technology, AWS Edge Computer, Fortinet hardware (over Netlink Trust fibre network)



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Quantum Security Lab

Research of Quantum Security Building Blocks & Vulnerabilities (upstream)

Practical Security Evaluation of Quantum Communication Systems (downstream)

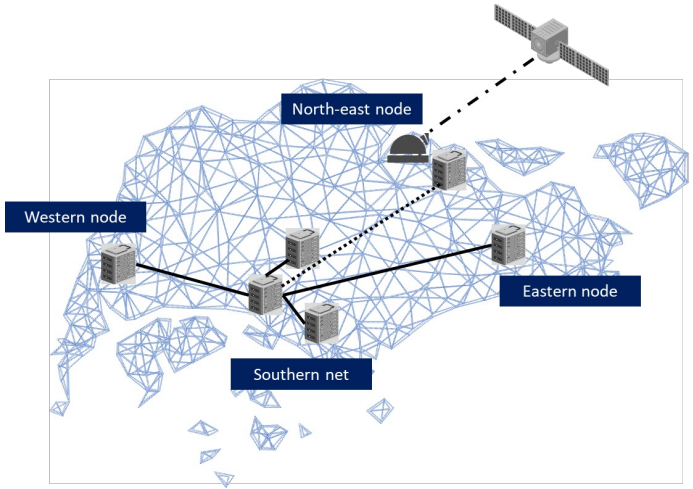
Development of Security Testing & Evaluation Methodologies & Tools

01 Security **evaluation** of Quantum Communications implementation via prototyping & modelling

02 **Security testing** mechanisms exploiting quantum hacking techniques & functionalities validation

03 Joint lab capabilities with industry **certification** labs & academic research labs for expertise development

STANDARDISATION



Adoptions to local Standards and Technical Report

Contributions & Collaborations & Supports

Quantum Communication Networks Task Force (QCN TF) has been setup under the Infocomm Media Development Authority (IMDA) Telecommunications Standards Advisory Committee (TSAC) with the participation of governmental and industrial partners to:

1. **Develop** local technical and reference specifications on quantum technologies with the adoption of international standards; and
2. **Share** the experience of NQSN and contribute to quantum related standardisation works in international Standards Development Organisations.

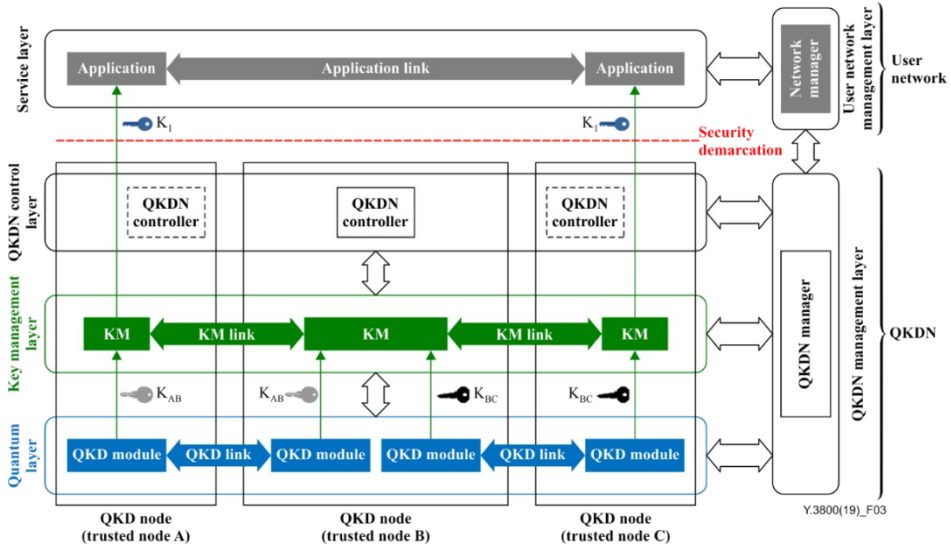
STANDARDISATION

❑ IMDA TSAC QCNTF :

- Established under IMDA in 2022
- TF members from 20 government agencies and industry partners
- Standardisation to support QKDN deployment & practical use

❑ Singapore's first local standard on QKD: RS QKDN guideline

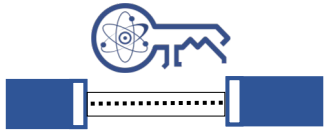
- To be published in 2023
- An overall introduction on the fundamental aspects
- High level requirements of QKDN: QKDN framework, quantum layer, key management layer, control & management layer, use case
- Aligned with international standards/ specifications on QKDN: ITU-T, ETSI



* Conceptual structures of a QKDN and a user network in Rec. ITU-T Y.3800 (10/2019)

NQSN ECOSYSTEM

TERRESTRIAL INFRASTRUCTURE



PERFORMANCE & INTEROPERABILITY TESTING

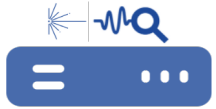
END-TO-END HYBRID PQC/QKDN

DEVOP OPERATIONS

CONTINUOUS COLLABORATIONS
(WITH MORE THAN 15 PUBLIC & PRIVATE PARTNERS)

QUANTUM SECURITY LAB

MODELING & SYSTEMATIC EVALUATION OF VULNERABILITES



BUILDING CAPABILITIES FOR PRACTICAL TESTING & ASSESSMENT

STANDARDISATION & CERTIFICATION

DEVELOPMENT OF THE REFERENCE SPECIFICATION

CERTIFICATION PILOT FOR QKD SYSTEMS

Ecosystem Outreach

COLLABORATION WITH THE INDUSTRY ECOSYSTEM

END-USER ADVISORY, RECOMMENDATIONS FOR DEPLOYMENT

AWARENESS ACTIVITIES

OUR PARTNERS AND COLLABORATORS

NATIONAL QUANTUM-SAFE NETWORK

nqsn.sg

We work together with both public and private partners to achieve the mission of a nationwide quantum-safe communications platform.

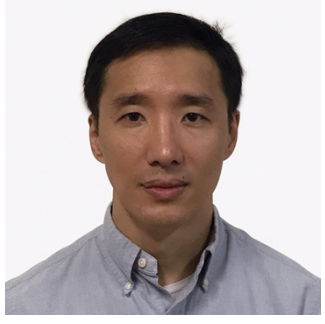
aws
ciena
Centre for Quantum Technologies
CSA SINGAPORE
DSO NATIONAL LABORATORIES
FORTINET
Fraunhofer SINGAPORE
GOVTECH SINGAPORE
HORIZON QUANTUM COMPUTING
HTX
INFOCOMM MEDIA DEVELOPMENT AUTHORITY
SG NSCC SINGAPORE National Supercomputing Centre
NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE
NUS National University of Singapore
NetLinkTrust the fibre of a smart nation
SPEQTRAL
ST Engineering
STTelemedia Global Data Centres
SUTD SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN
TERRABIT NETWORKS We connect. We transform.
THALES Building a future we can all trust
T-Systems Let's power higher performance
UL

Open for proposals & collaborations

https://www.nqsn.sg/#Collaboration

NATIONAL QUANTUM-SAFE NETWORK SINGAPORE

NQSN TEAM – PIs & STAFF



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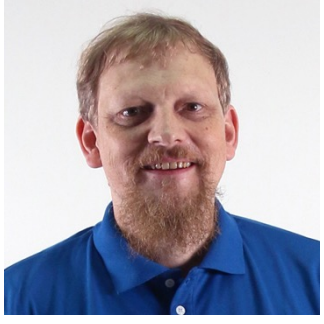

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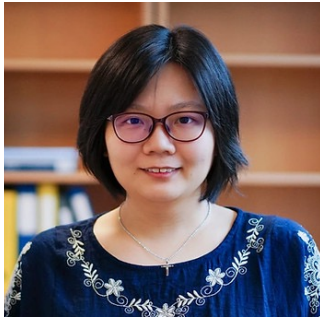

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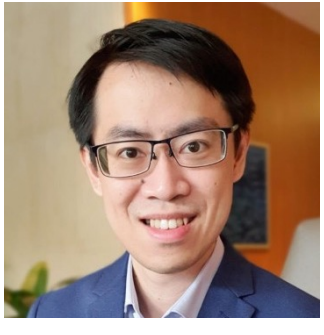

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NATIONAL QUANTUM-SAFE NETWORK SINGAPORE

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EXPERIENCE |

QUANTUM SECURITY

Securing Communications with Quantum-Safe Technologies

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