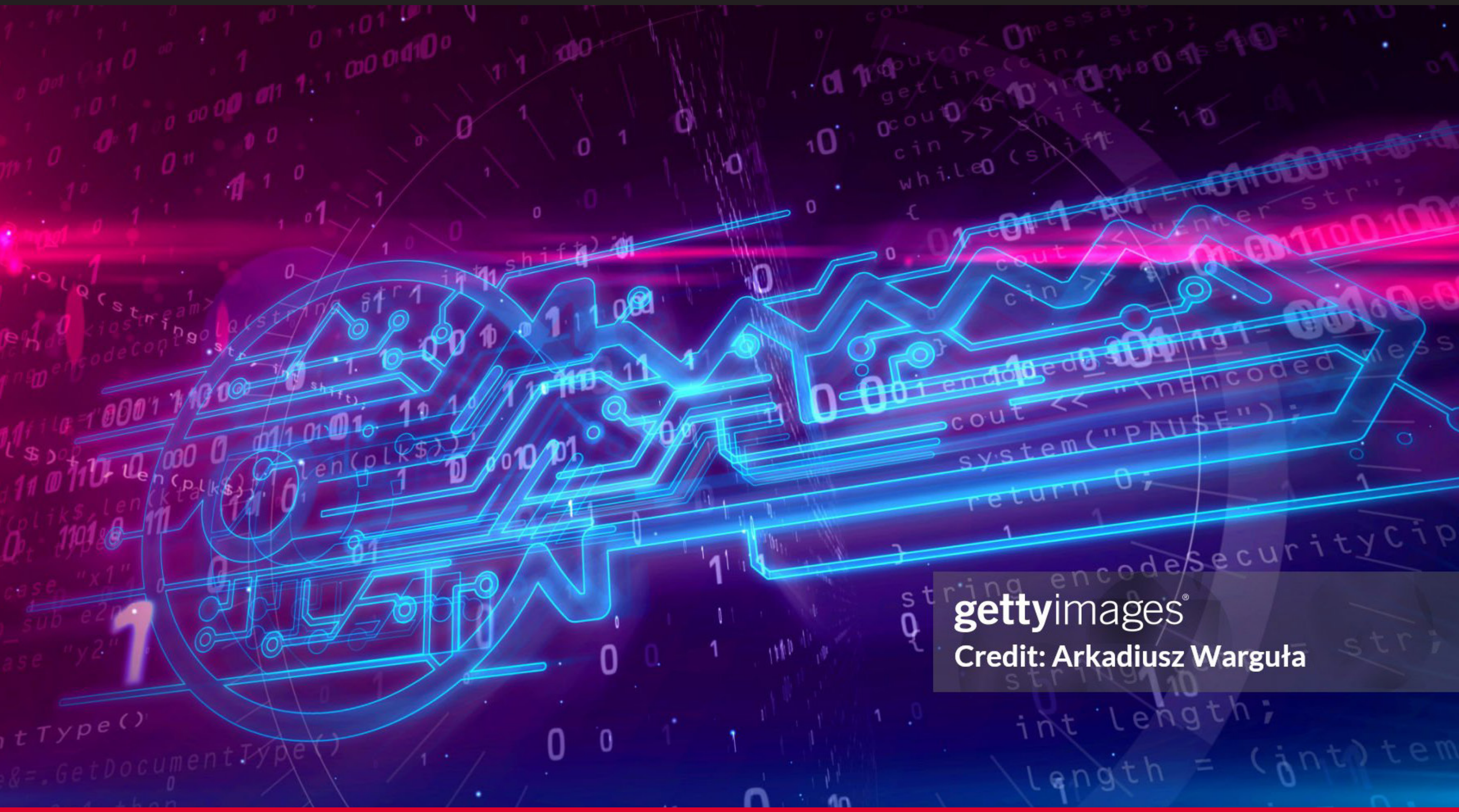


gettyimages

Credit: Arkadiusz Warguła

Post Quantum Cryptography –

Guidelines for Telecom Use Cases

Executive Summary

GSMA™

September 2024

Post Quantum Cryptography – Guidelines for Telecom Use Cases

Executive Summary

gettyimages®
Credit: Andriy Onufriyenko

Post Quantum Cryptography –
Guidelines for Telecom Use Cases

Executive Summary

September 2024

1.0 Why is this document relevant?

Telecommunication networks are the backbone of digitalisation, underpinning many essential services and sectors through trusted and secure communication systems which impact society as a whole. For this reason, ongoing security and integrity must be at the forefront of telecommunication preparedness. This includes planning for the quantum era and the potential threats that quantum computers pose to telecommunications networks, customer data and devices.

This document provides detailed insights for preparing a cryptographic migration and implementation of post quantum cryptographic capabilities in the context of telecommunication networks, analysing use cases and architecture, highlighting dependencies on standardisation, solution alignment, performance testing and related topics such as Zero Trust Architecture.

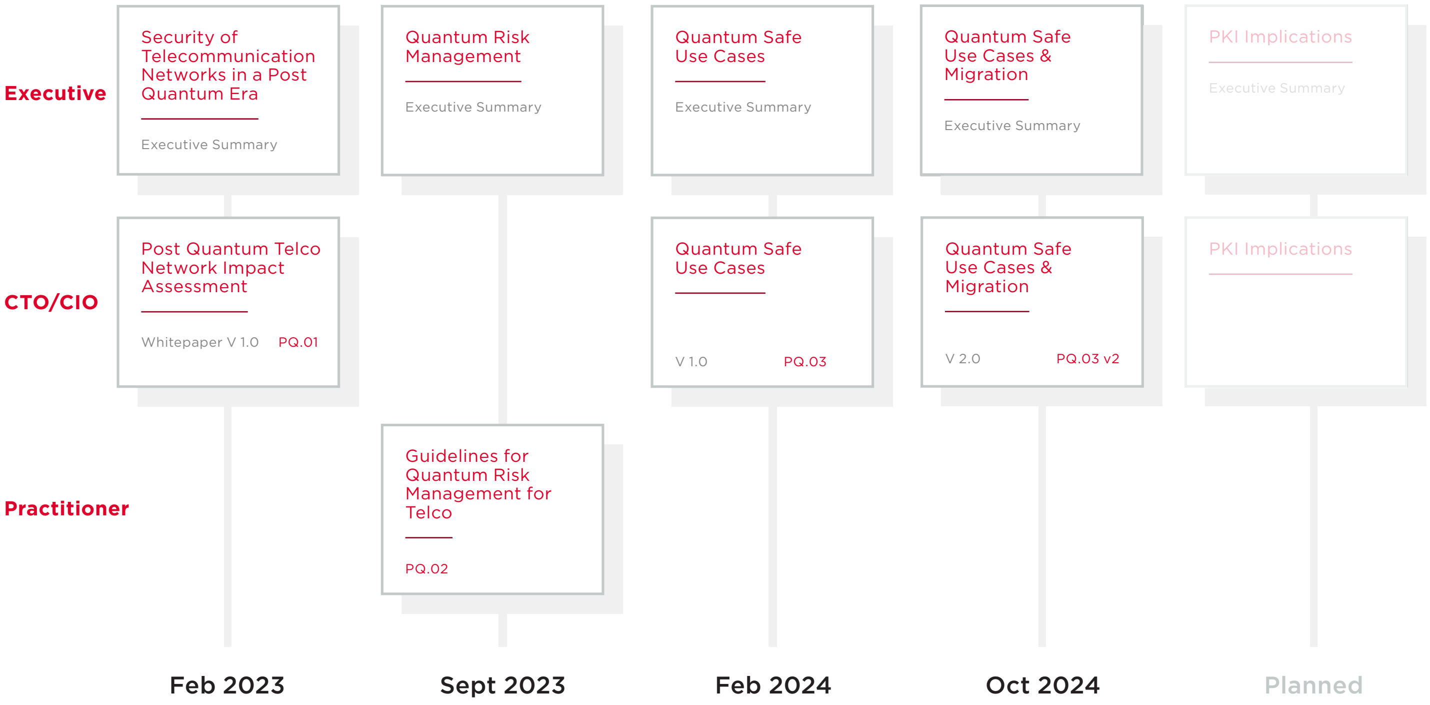
The objective is to build a set of best practice guidelines to support an executable journey to quantum safe for operators and the wider telecommunication ecosystem, leveraging learnings and evolving a collective view of solutions and standards that support interoperability, backward compatibility and performance requirements.

2.0
How do we see It evolving?

This is the second version of a working document that covers an initial set of telco use cases impacted by post quantum cryptography. Over time we plan to update and add to these use cases as required, and explore the relevant technology, standards or policies to inform telco ecosystem decision makers.

This will provide a telco-focused, practical and actionable perspective, based on learnings, experience and best practice. The relationship between this document and previous PQTN task force publications is illustrated in Figure 1. In the second revision the timelines and dependencies paragraph has been updated, an algorithm and protocol standards status update has been provided based on the progress since the last revision, Including the standardisation of the first NIST PQC algorithms, announced In August 2024. Focus has been on migration strategy considerations: common dependencies and technical features that apply across use cases as well as use case specific migration approaches.

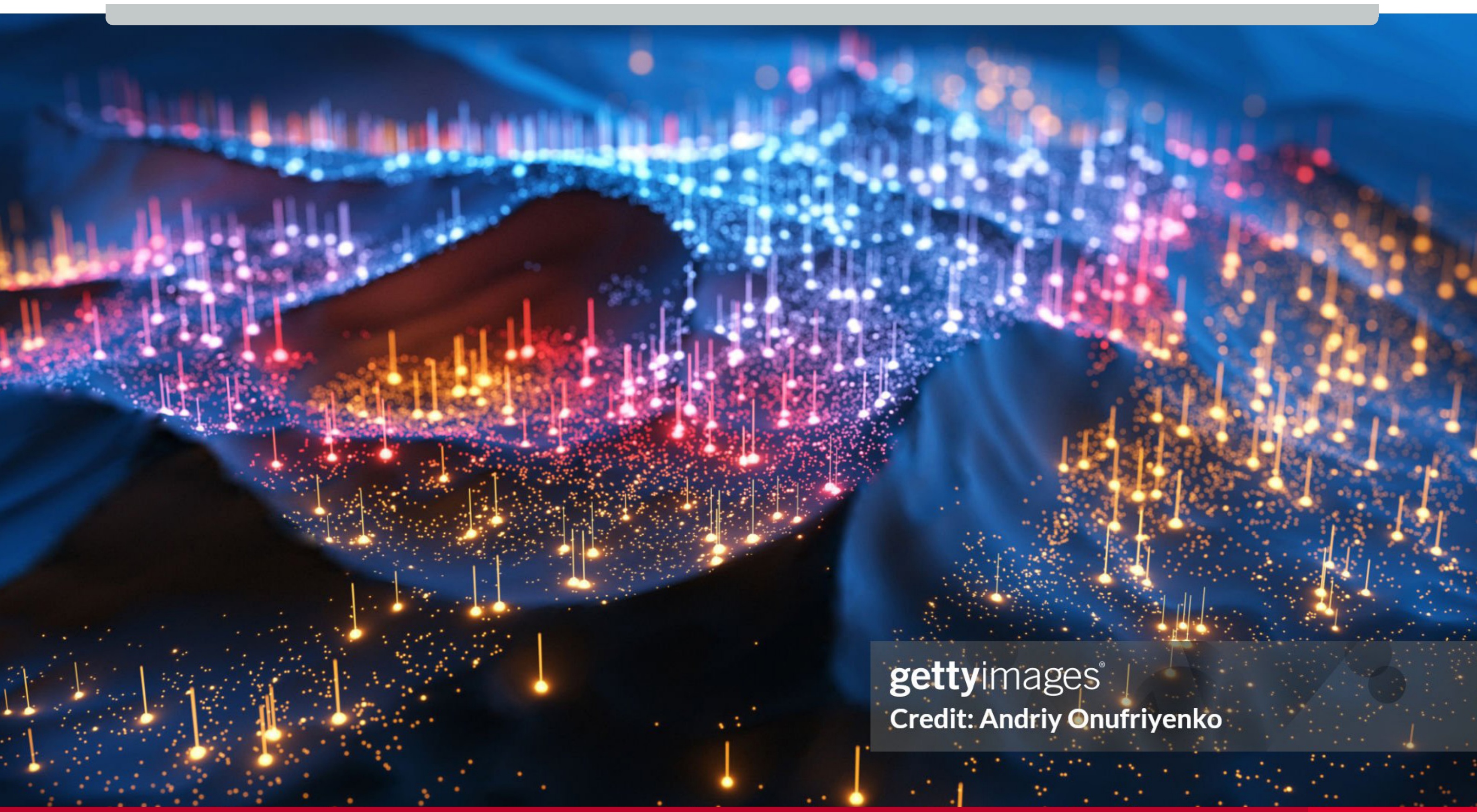
Figure 1
Taxonomy of PQTN task force publications



Feedback from the wider ecosystem is essential for the continued relevance of the document. Recognising that many aspects regarding standards, policy and solutions are evolving in parallel and have multiple dependencies, the GSMA PQTN Task Force welcomes the opportunity to engage and foster cooperation between all relevant stakeholders.

Alignment around technology decisions is likely to become critical in the context of interoperability, backward compatibility, and performance.

Developing proofs of concept and testing are essential for timely deployability of commercial solutions.


gettyimages
Credit: Andriy Onufriyenko

3.0
What is the Quantum Threat?

The evolution of quantum computing capabilities poses a threat as they have the potential to render obsolete the most used cryptographic algorithms, such as public key cryptography, which underpin the cyber security solutions we rely on today to keep information and communications safe.

The timing of the threat is uncertain, however significant progress is being made in the evolution of quantum computing performance, quantum algorithms, and error correction.

The telco industry should start now to plan for the post quantum migration. An immediate threat to consider is "Store now decrypt later", where encrypted data is harvested in anticipation of being decrypted in the future.

This is particularly relevant for data that has a long shelf life when considering the possible availability of cryptographically relevant quantum computers in the coming years.

gettyimages
Credit: blackdovfx

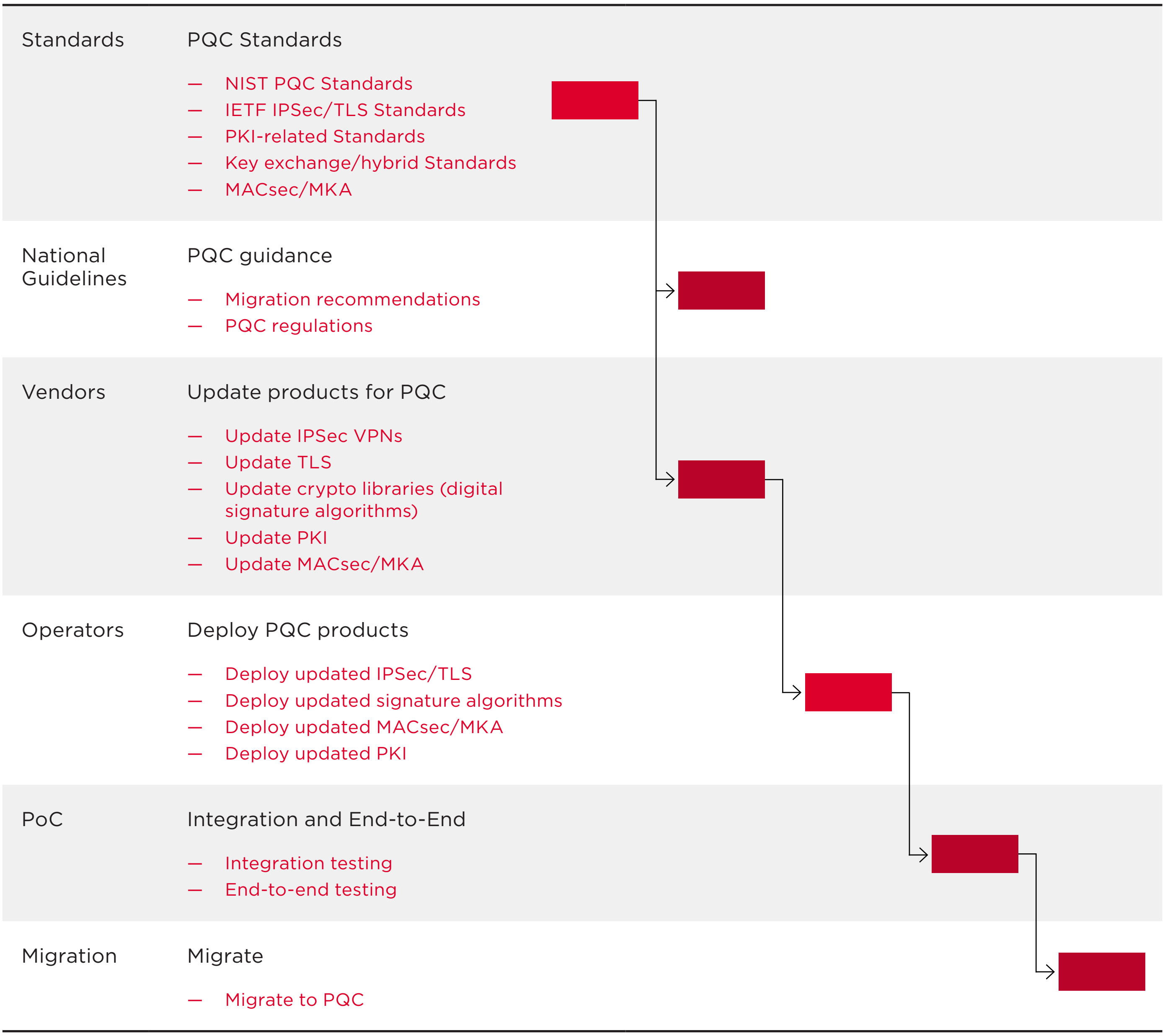
4.0 Use cases, risk analysis and business Impact

For the use cases listed in the table below, an analysis has been provided to inform both business risks and subsequent technology choices, with the addition of information designed to inform a migration strategy such as Gantt Charts, analysis of migration options and dependencies.

NETWORK OPERATOR USE CASES	CUSTOMER IMPACTING USE CASES
Protection of interface between base stations & security gateway	Virtual Private Network services
Virtualized network functions	SD-WAN services
Cloud Infrastructure	IoT Smart Meters
SIM (physical)	IoT Automotive
eSIM Provisioning (remote)	Lawful Intercept
Devices and firmware upgrade	Privacy of customer data
Concealment of the Subscriber Public Identifier	Enterprise Data
Authentication and transport security in 4G and 5G	
Network Function Authorization	

Figure 2

Gantt chart for VPN PQC migration



Standards

PQC Standards

- NIST PQC Standards
- IETF IPSec/TLS Standards
- PKI-related Standards
- Key exchange/hybrid Standards
- MACsec/MKA

National Guidelines

PQC guidance

- Migration recommendations
- PQC regulations

Vendors

Update products for PQC

- Update IPSec VPNs
- Update TLS
- Update crypto libraries (digital signature algorithms)
- Update PKI
- Update MACsec/MKA

Operators

Deploy PQC products

- Deploy updated IPSec/TLS
- Deploy updated signature algorithms
- Deploy updated MACsec/MKA
- Deploy updated PKI

PoC

Integration and End-to-End

- Integration testing
- End-to-end testing

Migration

Migrate

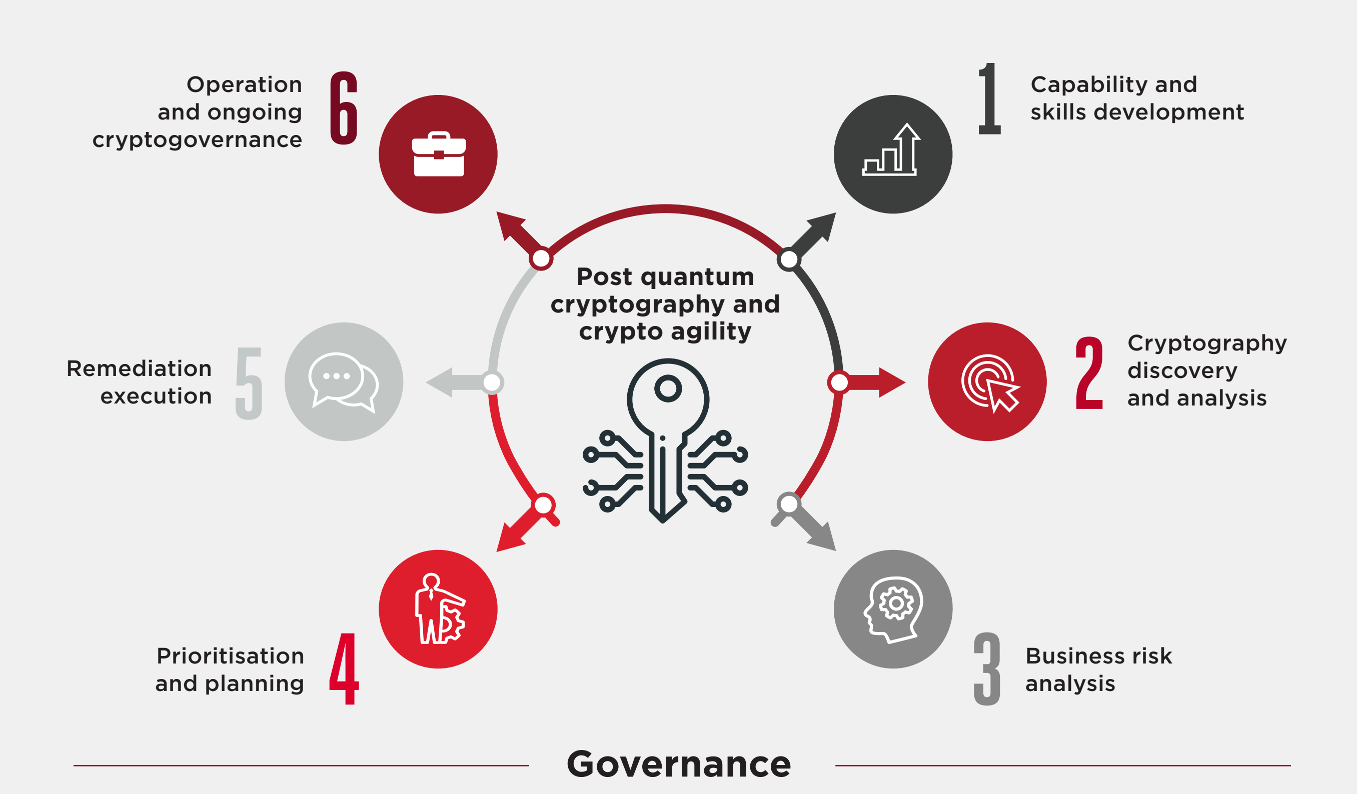
- Migrate to PQC

5.0 Importance of planning and preparation

The document provides practical guidelines on how organisations can start to plan, engage with internal and external stakeholders, quantify risk and take action.

Forward planning will provide significant benefits to organisations in managing risks and optimising costs of the post quantum migration. A definition of high-level phases to support the journey to Post Quantum Cryptography and subsequent management is outlined in Figure 2, illustrating the iterative nature of the phases and the importance of governance.

Figure 3
A phased journey towards Quantum safe


Operation and ongoing cryptogovernance
6
1
Capability and skills development
Post quantum cryptography and crypto agility
Remediation execution
5
2
Cryptography discovery and analysis
Prioritisation and planning
4
3
Business risk analysis
Governance

Examples of related programmes

- PKI evolution
- Crypto agility
- Hardware/software refresh cycles
- Technology refresh cycles and retirement of legacy capabilities
- Identity management refresh

Supporting Companies:

3 United Kingdom
AKAYLA
Arqit
AT&T Mobility
Cellular South Inc. d.b.a. C Spire
China Telecom
China Unicom
CK Hutchison
Deutsche Telekom AG
EE Limited
Ericsson
F5, Inc.
Fortinet
Giesecke+Devrient Mobile Security
Hewlett Packard Enterprise
Huawei
IBM
IDEMIA
IMDA
Infineon Technologies AG
Infobip Ltd
Juniper Networks
Kigen
KT Corporation
Maxis Broadband Sdn. Bhd.
National Cyber Security Centre
Nokia
NXP
OFCOM
Orange
Orange France
Palo Alto Networks Inc.
PQ Shield
Proximus Belgium
Qualcomm
Samsung Electronics Co Ltd
SandboxAQ
SK Telecom Co., Ltd.
stc Group
STMicroelectronics
Telcel
Telefonica
TELUS Communications Inc.
Thales
The MITRE Corporation
TIM
Turkcell
Utimaco
Verizon
Vodacom
Vodafone Group

GSMA Head Office
1 Angel Lane
London
EC4R 3AB
United Kingdom
Tel: +44 (0)20 7356 0600
Fax: +44 (0)20 7356 0601