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| **TD** | | | | |
| **Source:** | | FG QIT4N Co-chairmen | | |
| **Title:** | | Progress report of the Focus Group on Quantum Information Technology for Networks (FG QIT4N) to TSAG for the February to August 2020 period | | |
| **Purpose:** | | Information and Action | | |
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| **Keywords:** | Progress report; FG QIT4N; TSAG; focus group; quantum information technology |
| **Abstract:** | This TD contains the progress report of FG QIT4N over the February to August 2020 period.   Action for TSAG: TSAG is invited to consider extending the lifetime of the FG-QIT4N by one additional year to December 2021, i.e., two years from the first FG-QIT4N meeting. Under this condition, FG-QIT4N will submit for review its final deliverables to the first TSAG meeting in 2022. |

# Introduction

The ITU-T Focus Group on quantum information technology for networks (FG QIT4N) was established by TSAG in September 2019.

The objectives of FG QIT4N, as per the Terms of Reference (ToR, ref. TSAG-[TD632R3](https://www.itu.int/md/T17-TSAG-190923-TD-GEN-0632/en)), are:

* Considering evolution and applications of QIT for networks.
* The topics of study include:
  + telecom/network aspects of QKD networks that are identified in close coordination with ITU-T SG13 and SG17 as not within the scope of SG13 (QKD network architecture aspects) and SG17 (security aspects of QKD network and applications of QRNG for security).
  + QIN technology and network evolution.
* The FG outputs will focus on terminology and use cases. The FG will reference relevant terminology defined in the pertinent ITU-T SGs. When necessary, the FG will liaise with the relevant SGs if terminology needs to evolve to take into account technology evolution.
* To provide necessary technical background information and collaborative conditions in order to effectively support QIN-related standardization work in ITU-T study groups.
* To provide an open cooperation platform with ITU-T study groups and other SDOs, including collaborative standardization work, co-located meetings, and workshop on quantum topic.

# Focus Group leadership, structure, deliverables and timeline

As of September 2020, the FG QIT4N management team is composed of three co-chairmen appointed by TSAG:

– Mr Alexey Borodin (PJSC “Rostelecom”, Russian Federation)

– Mr James Nagel (L3Harris Technologies, United States of America)

– Mr Qiang Zhang (University of Science and Technology of China (USTC), China)

and eight vice chairmen appointed by FG Membership since first FG-QIT4N meeting:

– Mr Fahad Alduraibi (Communications and Information Technology Commission (CITC), Saudi Arabia)

– Mr Helmut Griesser (Adva Optical Networking, Germany)

– Mr Kaoru Kenyoshi (National Institute of Information & Communications Technology (NICT), Japan)

– Mr Hyungsoo (Hans) Kim (KT Corporation, Korea (Rep. of))

– Mr Junsen Lai (China Academy of Information & Communications Technology (CAICT), China)

– Mr Jiajun Ma (QuantumCTek Co. Ltd., China)

– Mr Momtchil Peev (Huawei Technologies Duesseldorf GmbH (HWDU), Germany)

– Mr Dong-Hi Sim (SK Telecom (SKT), Korea (Rep. of))

FG QIT4N established **three** **working groups** with chairmanship as follows:

– Working Group 0 (WG0): Coordination committee under the chairmanship of the FG QIT4N co-chairmen

– Working Group 1 (WG1): Network aspects of QIT under the chairmanship of Mr Helmut Griesser (Adva Optical Networking, Germany)

– Working Group 2 (WG2): Quantum key distribution networks (QKDN) under the chairmanship of Mr Zhangchao Ma (CAS Quantum Network, China)

Annex A summarizes the Focus Group structure and deliverables under development in an overview with more details includes the list of editors, summary text of the deliverables, targeted date of completion of the deliverables, as well as a hyperlink to the latest baseline text.

# Summary of meetings and participation

FG QIT4N was established for a lifetime of 12 months from its first meeting (December 2019 – December 2020). Since its establishment, FG QIT4N has held five efficient and cooperative meetings and achieved key agreements on the FG leadership, made progress on its tasks and deliverables and collaborated with related groups on topics related to QIT for networks. The summary of meetings is in Table 1 below.

**Table 1 - Summary of FG QIT4N meetings and their participation as of August 2020**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Jinan, 9-10 December 2019** | **E-meeting, 18-20 February 2020** | **E-meeting, 20-30 April 2020** | **E-meeting, 15-26 June 2020** | **E-meeting, 27 July - 7 August 2020** |
| **Host** | Jinan Institute of Quantum Technology (JIQT) | E-meeting | E-meeting | E-meeting | E-meeting |
| **Input documents** | [54](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/input/Forms/01.aspx) (including [5 LSi](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/liaison/Forms/01.aspx?View=%7b4F977A2E-7FED-4B98-B1E4-2F9435D52A2D%7d&FilterField1=Type_x0020_of_x0020_Liaison&FilterValue1=Incoming)) | [41](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/input/Forms/02.aspx) (including [4 LSi](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/liaison/Forms/02.aspx?View=%7b4F977A2E-7FED-4B98-B1E4-2F9435D52A2D%7d&FilterField1=Type%5Fx0020%5Fof%5Fx0020%5FLiaison&FilterValue1=Incoming)) | [46](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/input/Forms/03.aspx) (including [1 LSi](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/liaison/QIT4N-LSi-010.zip)) | [34](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/input/Forms/04.aspx) (including [2 LSi](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/liaison/Forms/04.aspx?View=%7b4F7388C1-2657-48D7-A88B-D3C39E4E8708%7d&FilterField1=Type%5Fx0020%5Fof%5Fx0020%5FLiaison&FilterValue1=Incoming)) | [30](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/input/Forms/05.aspx) |
| **Output documents** | [6](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/input/Forms/01.aspx) | [14](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/Forms/02.aspx) | [13](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/Forms/03.aspx) | [14](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/Forms/04.aspx) | [16](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/Forms/05.aspx) |
| **Meeting report** | [O-006](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/QIT4N-O-006.docx?d=w1f11fb4e6b4442f9b2c93d810a6e7f98) | [O-020](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B6F2508E9-0AD7-4AD2-A2A1-E3C64089BE02%7D&file=QIT4N-O-020.docx&action=default) | [O-033](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B84AEC5A3-7FA4-4775-B87C-61ED12E711AF%7D&file=QIT4N-O-033.docx&action=default) | [O-047](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B4F49D60B-C8A1-42ED-BA5E-B8320AB0F749%7D&file=QIT4N-O-047.docx&action=default) | [O-063](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/QIT4N-O-063.docx) |
| **Total participants** | [109](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/QIT4N-O-005.pdf?d=wb2b087760bb74bbc8a0c884734e56e78) (including 10 remote) | [95](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/QIT4N-O-019.pdf) | [82](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/QIT4N-O-031.pdf) | [80](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/QIT4N-O-044.pdf) | [62](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B046E7A4A-E426-4E52-B84F-428D12A5869F%7D&file=QIT4N-O-061.docx&action=default) |

Due to the global COVID-19 pandemic and its impact on travel limitations and in consultation with the FG management team and the host organizations, the formats of the second to fifth FG QIT4N meetings were converted to e-meetings. The comparison between the activities planned and activities conducted is summarized in Table 2.

**Table 2 – Comparison between planned FG QIT4N activities and activities conducted**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **ACTIVITIES PLANNED** | | | **ACTIVITIES CONDUCTED** | |
|  | **Meeting dates** | **Host organization** | **Co-located events** | **Meeting dates** | **Co-located events** |
| **2** | **Riyadh, 18-20 February 2020** | CITC, Saudi Arabia | Thematic workshop on QIT, 17 February 2020 | **E-meeting,** **13, 17-20 February; 28 and 31 March 2020** | - |
| **3** | **St. Petersburg, 20-23 April 2020** | PJSC “Rostelecom”, Russian Federation | Thematic workshop on QIT, 20 April 2020  Joint meeting with ISO/IEC JTC 1 SC 27 | **E-meeting, 20-30 April 2020** | Joint meeting with ISO/IEC JTC 1 SC 27, 21 April 2020 |
| **4** | **London, 10-12 June 2020** | ETSI ISG QKD | Joint meeting with ETSI ISG QKD, 10 June 2020 | **E-meeting, 15-26 June and 3 July 2020** | Joint meeting with ETSI ISG QKD, 10 June 2020 |
| **5** | **Washington DC, 3-7 August 2020** | L3Harris Technologies, USA | Thematic workshop on QIT  Co-location with IEEE (Not confirmed) | **E-meeting, 27 July - 7 August 2020** | - |

To facilitate participation in the e-meetings, the following was taken into account in the organization of the e-meetings:

1) The FG QIT4N e-meetings were organized as a series of e-meeting sessions spanning several weeks in the case of the 2nd FG QIT4N meeting (13, 17-20 February; 28 and 31 March 2020) and spanning 2 weeks in the case of the third, fourth and fifth FG QIT4N meetings.

2) In the 2nd FG QIT4N meeting, a rotating time plan was adopted in attempt to strike a balance between late nights and early mornings amongst the meeting’s participants from the various regions represented. However, after the 2nd FG QIT4N meeting, all e-meetings were conducted between **15:00-17:30 CEST** as this was deemed the most favourable in accommodating the time difference.

3) Priority was given to advancing the work on the FG QIT4N deliverables and on facilitating collaboration activities on QIT. Thus, the thematic workshops planned to precede the second, third and fifth FG QIT4N meetings did not take place and would be organized at a future date in co-location with future FG QIT4N meetings.

Meetings are announced via TSB Circular, the Focus Group website and email reflectors. Remote participation is offered for all meetings.

## Future meetings

Future FG QIT4N meetings are scheduled as follows:

– **E-meeting, 26 October – 6 November 2020**.

– **Riyadh, December 2020** hosted by Communications and Information Technology Commission (CITC), Saudi Arabia

The organization of the planned meeting in Riyadh in December 2020 will depend on the global travel situation pertaining to the COVID-19 pandemic. If the pandemic persists and disables on-site participation at this venue, this meeting might also be further postponed or converted to an e-meeting.

Further additional meetings may be held if TSAG approves an extension of the Focus Group lifetime.

# Relationships and efficient transfer of deliverables to ITU-T study groups

As an open and collaborative platform on the pre-standardization aspects of QIT for networks, FG QIT4N has established liaison relationships with relevant groups i.e. ITU-T Study Groups SG2, SG11, SG13, SG15 and SG17; ETSI ISG QKD, IEEE, ISO/IEC JTC 1/SC 27/WG3, IETF/IRTF, CEN-CENELEC FG QT, IEC TC 86.

ETSI ISG QKD, ISO/IEC JTC1 SC27, ITU-T SG13 and SG17 presented their work on quantum information technology to the first meeting of the Focus Group. IEC TC86 also presented their work in the fifth meeting of the Focus Group, with a clear direction on potential topics of cooperation between FG-QIT4N and IEC TC86. All FG QIT4N meetings have reviewed incoming liaison statements from ITU-T Study Groups (2, 13 and 17), ITU-T Focus Groups (FG AI4EE and FG ML5G) and external groups (ETSI ISG QKD and ISO/IEC JTC 1/SC 27 WG3).

FG QIT4N has also regularly reported its progress on its draft deliverables to all its liaison groups (ITU-T SG2, SG11, SG13, SG15 and SG17; ETSI ISG QKD, IEEE, ISO/IEC JTC 1/SC 27/WG3, IEEE, IETF/IRTF, CEN-CENELEC FG QT, IEC TC 86).

To facilitate these liaison relationships, the following FG QIT4N representatives have been appointed to act as liaison officers and represent FG QIT4N in their respective groups, summarized in Table 3.

**Table 3 - List of FG QIT4N liaison officers**

|  |  |
| --- | --- |
| **Group** | **Representative** |
| ETSI ISG QKD | Mr. Momtchil Peev (Huawei Technologies Duesseldorf GmbH (HWDU), Germany) |
| IEEE | Mr. James Nagel (L3Harris Technologies, United States of America) |
| IEC TC 86 | Mr. Bernard Lee (Senko Advanced Components, Malaysia) |
| IETF/IRTF | Mr. Fred Baker (Internet Systems Consortium (ISC), United States of America) |
| ISO/IEC JTC 1/SC 27 | Mr. Jiajun Ma (QuantumCTek Co. Ltd., China) |
| ITU-T SG11 | Mr. Kaoru Kenyoshi (NICT, Japan) |
| ITU-T SG13 | Mr. Zhangchao Ma (CAS Quantum Network, China​​​) |
| ITU-T SG17 | Mr. Dong-Hi Sim​ (SK Telecom, Korea (Rep. of)) |

In anticipation of the completion of its work, FG QIT4N will collaborate with relevant Study Groups in the transfer of its deliverables as appropriate.

## Collaboration activities on QIT

To foster cooperation on the development of topics related to QIT, FG QIT4N has leveraged its liaison relationships and successfully held two joint meetings with liaison groups as follows:

– **E-meeting, 21 April 2020:** Joint ITU-T FG QIT4N and ISO/IEC JTC1/SC27/WG3 meeting

– **E-meeting, 10 June 2020:** Joint ITU-T FG QIT4N/ETSI ISG QKD meeting on quantum information technology

As a follow-up activity to the 21 April 2020 joint session with ISO/IEC JTC1 SC27/WG3, FG QIT4N was invited to contribute to the development of the work item ISO/IEC 23837 (*Security requirements, test and evaluation methods for quantum key distribution - Part 1: Requirements and Part 2: Test and evaluation methods*). Comments from FG QIT4N were reviewed in its fifth meeting and submitted to ISO/IEC JTC1 SC27/WG3 for their consideration.

The joint meetings were well attended and areas of future coordination and cooperation with ISO/IEC JTC1 SC27 and ETSI ISG QKD were identified. Following the joint activities, active participation by experts from both groups was noted in FG QIT4N’s activities through their attendance in meetings and submission of input documents for discussion in FG QIT4N meetings.

More collaboration activities are planned in future to encourage additional cooperation on topics related to QIT for networks and are scheduled as follows:

– **TBC: 2021** potential co-location with IRTF QIRG.

# Proposed extension

TSAG set the lifetime of FG QIT4N to 12 months from its first meeting (December 2019), thus, requiring FG QIT4N to complete its mandated activities by December 2020.

Since its first meeting held December 2019 in Jinan, China, considerable progress has been made by the FG-QIT4N in its pre-standardization activities. However, due to several extenuating circumstances that will now be discussed, meaningful and substantial work remains to still be done.

First, given the nascency of QIT for networks, especially for applications and usages beyond QKD, the practitioners of the said technology have predominantly come from academic backgrounds. It is only very recent that industry has shown an acute awareness of the implications of QIT on both current ICT and future networks. As such, many of the initial FG-QIT4N discussions in WG1 have been underscored by significant differences in opinion among participants regarding the study topic “QIN technology and network evolution” listed in the Terms of Reference (ToR). Consequently, some FG WG1 deliverables have been constrained by the need to resolve scope, to which consensus among the FG-QIT4N participants has only been achieved in June 2020.

To this end, the FG-QIT4N Co-chairs recognize that a greater diversity of FG-QIT4N participants will improve the quality of the final deliverables and are currently developing a strategic plan for increasing FG participation across the broader international community and stakeholders in industry, academia, and government.

It is also noteworthy that within just the last few months, several significant global developments with respect to quantum information networks have been announced, such as the Quantum Internet initiative in the United States[[1]](#footnote-2) and long-distance entanglement-based Quantum Key Distribution through the Chinese-sponsored Micius satellite[[2]](#footnote-3). Further opportunities to solicit FG-QIT4N contributions from outreach to those involved in these efforts in the coming months will offer an additional perspective that is important for the FG’s final deliverables.

Last but not least significant, the global COVID-19 pandemic has presented challenges to the work of the FG-QIT4N. Travel and health restrictions have placed an unprecedented burden on the typical ITU-T consensus building process by eliminating the possibility for in-person meetings. While adjustments were made, adapting to this “new mode” of operation initially proved difficult, impeding progress on the FG-QIT4N deliverables and the ability to hold relevant topical workshops that also play an important role within an ITU-T Focus Group.

**Action for TSAG:** Despite these particular circumstances, momentum has been maintained and progress made towards the final FG-QIT4N deliverables. Nonetheless, given the remaining work and open opportunities for improving the quality of its deliverables, TSAG is invited to consider extending the lifetime of the FG-QIT4N by one additional year to December 2021, i.e., two years from the first FG-QIT4N meeting. Under this condition, FG-QIT4N will submit for review its final deliverables to the first TSAG meeting in 2022.

# Annex A – Overview and status of FG QIT4N deliverables

| **WG** | **Title** | **Objectives** | **Chair(s)** | **Deliverables (Number, link, title)** | | **Description** | **Responsible** | **Delivery date** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | Coordination committee | To provide internal coordination amongst the FG-QIT4N technical Working Groups; facilitate a common framework for deliverables; coordinate FG-QIT4N liaison activities; provide all communications with and to coordinate all reporting to TSAG and provide context to the technical Working Groups in the form of generalized architecture criteria. | FG-QIT4N co-chairmen | D0.1 | **QIT4N standardization landscape and outlook** | To provide a survey of relevant QIT4N standardization activities. | FG-QIT4N co-chairmen | December 2021 |
| 1 | Network aspects of QIT | To provide technical context in relation to the study topics and deliverables related to network aspects of quantum information technology | Mr. Helmut Griesser, Adva Optical Networking, Germany | [D1.1](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B45366F5D-A2D1-48AB-B5EC-A8FCB18E50F4%7D&file=QIT4N-O-058.docx&action=default) | **QIT4N terminology part 1: Network aspects of QIT** | This Technical Report will provide a survey of terminology relevant to the network aspects of quantum information technology for networks (beyond QKDN) that supports the building blocks for QINs, application-driven network requirements, the benefits to classical networks and that will support the deliverables of FG-QIT4N WG1. | **Leader & chief editor:**  Mr. Minghan Li (JIQT, China) | December 2021 |
| [D1.2](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B53B63A0A-8626-4F62-977A-040861A07488%7D&file=QIT4N-O-057.docx&action=default) | **QIT4N use case part 1: Network aspects of QIT** | This Technical Report will study the various use cases of quantum information technologies for networks (beyond QKDN) describing use cases based on QIN, use cases beneficial to classical networks and use cases where the network plays an intrinsic role for the QIT applications. | **Leader & chief editor:** Mr. JiDong Xu (ZTE, China)  **Co-editor:** Mr. Meng Zhang (CAICT, China) | December 2021 |
| [D1.3](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BA39C4946-0F4A-4F8B-953C-07A496DE2268%7D&file=QIT4N-O-056.docx&action=default) | **Implications of quantum information technology on networks** | This Technical Report will study the implications of quantum information technologies for networks describing the building blocks for QINs, application-driven network requirements and the benefits to classical networks. | **Leader & chief editor:** Mr. Fred Baker (ISC, USA)  **Co-editors:**   * Mr. Man-Hong Yung (Huawei, China) * Mr. Bo Lv (CAICT, China) * Mr. Minghan Li (JIQT, China) | December 2021 |
| [D1.4](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B90438C1E-89C6-483E-8004-684B4E16EA56%7D&file=QIT4N-O-055.docx&action=default) | **QIT4N standardization outlook and technology maturity part 1: Network aspects of QIT** | This technical report provides a snapshot of the standardization landscape of QIT for networks, prospects and barriers to the development and adoption of standards for QIT for networks and a review of methodologies for assessing technology maturity and standardization readiness of QIT for networks. | **Leader & chief editor:** Ms. Barbara Goldstein (NIST, USA)  **Co-editor:** Mr. Bo Lv (CAICT, China) | December 2021 |
| 2 | Quantum key distribution networks (QKDN) | To provide technical context in relation to the study topics and deliverables related to quantum key distribution networks and those aspects not covered by ITU-T SG 13 and ITU-T SG 17. | Mr. Zhangchao Ma (CAS Quantum Network, China) | [D2.1](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B7DBDAA5C-C394-4443-B6E5-9FC1B067E735%7D&file=QIT4N-O-048.docx&action=default) | **QIT4N terminology part 2: quantum key distribution network** | This technical report on existing terminology lists relevant to QKDN that exist or are in preparatory phases, with identification of any gaps or opportunities that other efforts may have been overlooked. | **Leader & chief editor:** Mr. K. Karunaratne (Qubitekk, USA)  **Co-editor:** Ms. Yan Jiang (QuantumCTek, China) | December 2021 |
| [D2.2](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B09911C7A-C0AC-411D-B33E-24758E9CA50B%7D&file=QIT4N-O-049.docx&action=default) | **QIT4N use case part 2: quantum key distribution network** | This Technical Report will study use cases of quantum key distribution networks highlighting the competitive advantage of use cases brought by QKDN, the main barriers to QKDN adoption, and the benefits and needs for future standardization efforts. | **Leader & chief editor:** Mr. Andreas Poppe (AIT, Austria)  **Co-editors:**   * Mr. Thomas Laenger (AIT, Austria) * Mr. Zhangchao Ma (CAS Quantum Network, China) * Mr. Dong-Hi Sim (SKT, Korea (Rep. of)) | December 2021 |
| [D2.3.1](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BD647895D-47D7-4DE6-95EF-6502BA51EC35%7D&file=QIT4N-O-050.docx&action=default) | **QKDN protocols part I: Quantum layer** | This technical report studies and reviews protocols in the quantum layer of the quantum key distribution network. In particular, the scope of this draft technical report includes different types of QKD protocols, their workflows, protocol features, parameters, commercialization status, security proofs, potential to be integrated in the future network etc. and discussions & suggestions on future plans. | **Leader & chief editor:** Mr. Kaoru Kenyoshi (NICT, Japan)  **Co-editors:**   * Mr. Peng Huang (XT Quantech; Shanghai Jiao Tong University, China), * Mr. Hao Qin (CAS Quantum Network, China), * Mr. Hongyu Wu (QuantumCTek, China), * Mr. Eldar Gayfutdinov (PJSC “Rostelecom”, Russian Federation) | December 2021 |
| [D2.3.2](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BFDE845BD-3A2E-433C-92FF-96843F700F84%7D&file=QIT4N-O-051.docx&action=default) | **QKDN protocols part II: Key management, QKDN control layer and management layer** | This technical report studies communication protocols related to key management layer, QKDN control layer, and QKDN management layer in the QKDN. In particular, the scope of this draft technical report includes Protocols with respect to key management layer, protocols with respect to QKDN control layer, protocols with respect to QKDN management layer and provides suggestions for future works. | December 2021 |
| [D2.4](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BFDE845BD-3A2E-433C-92FF-96843F700F84%7D&file=QIT4N-O-051.docx&action=default) | **QKDN transport technologies** | This Technical Report includes studies of QKDN transport technologies such as transport system components, technical solutions, requirements for co-fibre transmission of quantum and classical signals, etc. The studies are organized with two parts: DV (Discrete-Variable)-QKD and CV (Continuous-Variance)-QKD. | **Leader & chief editor:** Mr. Yalin Li (QuantumCTek, China)  **Co-editors:**   * Mr. Ming Cheng (China Telecom) * Mr. Junsen Lai (CAICT, China) * Mr. Chunxu Zhao (China Unicom) * Mr. Yingming Zhou (XTQuantech, China) * Mr. Yi Qian (CICT, China) | December 2021 |
| [D2.5](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B71A87960-4AAC-4FF6-9096-27CBE3C3A207%7D&file=QIT4N-O-053.docx&action=default) | **QIT4N standardization outlook and technology maturity part 2: quantum key distribution network** | This Technical Report studies standardization outlook and technology maturity of quantum key distribution networks (QKDN). In particular, the scope of this draft technical report includes an overview of QKDN technologies and industry development, assessment of QKDN technologies maturity, QKDN standardization landscape and gap analysis and an outlook of QKDN standardization. | **Leader & Chief editor:** Mr. Junsen Lai (CAICT, China)  **Co-editor:** Mr. Zhangchao Ma (CAS Quantum Network, China) | December 2021 |

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1. <https://www.energy.gov/articles/quantum-internet-future-here> [↑](#footnote-ref-2)
2. J. Yin, et al., “Entanglement-based secure quantum cryptography over 1,120 kilometres,” *Nature* **582** (2020). [↑](#footnote-ref-3)