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| **Source:** | | FG QIT4N Co-chairmen | | |
| **Title:** | | Progress report of Focus Group on Quantum Information Technology for Networks (FG QIT4N) to TSAG with updates from the January to September 2021 period | | | |
| **Purpose:** | | Information | | | |
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| --- | --- |
| **Keywords:** | Progress report; FG QIT4N; TSAG; focus group; quantum information technology |
| **Abstract:** | This document contains the progress report of FG QIT4N with updates from the January to September 2021 period.   Action for TSAG: TSAG is invited to note this progress report. |

# 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 December 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 co-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 an initial lifetime of 12 months from its first meeting (December 2019 - December 2020). The lifetime was extended by one additional year to December 2021 at TSAG’s September 2020 meeting (see [TSAG-R10](https://www.itu.int/md/T17-TSAG-R-0010/en)).

Since its establishment, FG QIT4N has held nine efficient and cooperative meetings and achieved key agreements on its 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 October 2021**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Jinan, 9-10 December 2019** | **E-meeting, 18-20 Feb 2020** | **E-meeting, 20-30 Apr 2020** | **E-meeting, 15-26 Jun 2020** | **E-meeting, 27 July - 7 Aug 2020** | **E-meeting, 26 Oct - 6 Nov 2020** | **E-meeting, 25 Jan- 5 Feb 2021** | **E-meeting, 10 - 21 May 2021** | **E-meeting, 9 - 20 Aug 2021** |
| **Host** | Jinan Institute of Quantum Technology (JIQT) | E-meeting | E-meeting | E-meeting | E-meeting | 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) | [22](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/input/Forms/06.aspx) (including [4 LSi](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/liaison/Forms/06.aspx)) | [18](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/input/Forms/07.aspx) (including [1 LSi](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/liaison/Forms/07.aspx)) | [22](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/input/Forms/08.aspx) (including [5 LSi](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/liaison/Forms/06.aspx)) | [25](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/input/Forms/09.aspx) (including [3 LSi](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/liaison/Forms/09.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) | [10](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/Forms/06.aspx) | [13](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/Forms/07.aspx) | [13](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/Forms/08.aspx) | [14](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/Forms/09.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) | [O-073](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B19BD331B-65E7-43C5-8041-0BB2C0416726%7D&file=QIT4N-O-073.docx&action=default) | [O-086](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7b4925CF13-497F-4EE6-99A5-122B0B0D0C0E%7d&file=QIT4N-O-086.docx&action=default) | [O-099](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7b337147BB-9D82-4249-B625-F1B0F2DE6E5F%7d&file=QIT4N-O-099.docx&action=default) | [O-113](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B6A4E0BAA-29FD-4D0E-A400-65E80A2B8379%7D&file=QIT4N-O-113.docx&action=default) |
| **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) | [49](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/output/QIT4N-O-072.pdf) | [69](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7b384CCAB1-073B-40F9-8F51-DCE5BC474744%7d&file=QIT4N-O-085.pdf&action=default) | [83](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7b3F113AA7-7BB1-4D4C-B74B-68CE6CE7A8B9%7d&file=QIT4N-O-098.pdf&action=default) | [73](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B441EAB0F-7E08-4623-88D0-1B4E296CADDB%7D&file=QIT4N-O-111.pdf&action=default) |

The global COVID-19 pandemic disrupted the planning of the FG activities after its first meeting. In consultation with the FG management team and the host organizations, all FG QIT4N meetings since the second meeting were all conducted as e-meetings. The comparison between the early FG 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** | - |
| **6** | **Japan, October 2020** | IRTF QIRG | Co-location with IRTF QIRG | **E-meeting, 26 October - 6 November 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 all subsequent 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** (and **14:00-16:30 CET**) 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. In addition, a series of thematic webinars were organized in 2021 instead.

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

## Future meetings

The final FG QIT4N meeting is scheduled to take place as an **e-meeting** from **15 to 22 November 2021.**

It should be noted that an invitation from the Communications and Information Technology Commission (CITC), Saudi Arabia was received in December 2019 right after the establishment of this FG to host an FG QIT4N meeting in Riyadh. This invitation was accepted by FG QIT4N with appreciation and a meeting in Riyadh was scheduled to take place as the second FG meeting (see Table 2). However, due to the COVID-19 pandemic and upon consultation with the FG QIT4N management team and CITC, the meeting in Riyadh was postponed and optimistically reserved hoping for the improvement of the global travel situation within the lifetime of FG QIT4N.

As the final FG QIT4N meeting approaches and the global travel restriction persists, FG QIT4N will regrettably be unable to conduct a physical meeting in Riyadh. Nonetheless, the FG QIT4N Management team wishes to express their appreciation to the Kingdom of Saudi Arabia and CITC, Saudi Arabia for their support to FG QIT4N and their kind invitation to host a meeting.

# Summary of webinars

To promote the ongoing work of the FG, since March 2021, FG QIT4N successfully organized a series of webinars covering various topics related to its work on quantum information technologies for networks. These webinars attracted over 600 participants and great attention on FG work among the QIT community. The respective links to the reports summarizing the webinar discussions and each webinar’s webpage (containing the recording, Q&A transcript, and presentation slides) can be found in Table 3.

An additional webinar is planned to take place on the **2 November 2021** on “*Joint Symposium on Quantum Photonic Integrated Circuits (QPICS)*”. The webinar’s programme and registration details are available on its webpage: <http://itu.int/go/QIT-06>.

**Table 3 – Summary of FG QIT4N webinars and their participation**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Date** | **Title** | **Co-organizers** | **Viewership** | **Report** |
| 23 March | [Joint Sy](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2021/0323/Pages/default.aspx)[mposium on Standards for Quantum Technologies](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2021/0323/Pages/default.aspx) | IEC and IEEE UK & Ireland Photonics Chapter | 438 unique viewers from 45 countries | [I-246](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B24E3766B-C6CD-4495-A177-110810B23A4B%7D&file=QIT4N-I-246.docx&action=default) |
| 8 April | [Cybersecurity in the quantum era](https://www.itu.int/net4/wsis/forum/2021/Agenda/Session/266) (Held at the WSIS Forum 2021) | ETSI | 392 unique viewers from 57 countries | [I-251](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BADBA6F61-859C-48DB-8ADA-1B9E006934F4%7D&file=QIT4N-I-251.docx&action=default) |
| 28 April | [Joint Symposium on Quantum Transport Technology](https://www.itu.int/en/ITU-T/webinars/20210428/Pages/default.aspx) | IEC and IEEE UK & Ireland Photonics Chapter | 226 unique viewers from 49 countries | [I-247](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BCCDB9BF0-AC42-4571-9875-58CE285796D5%7D&file=QIT4N-I-247.docx&action=default) |
| 26 May | [Quantum Information Technologies (QIT) for networks – Use cases](https://www.itu.int/en/ITU-T/webinars/20210526/Pages/default.aspx) | - | 175 unique viewers from 31 countries | [I-264](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BB1E39025-570E-4540-8C36-DA3598182793%7D&file=QIT4N-I-264.docx&action=default) |
| 23 June | [Harmonisation of Terminology in Standards for Quantum Technology](https://www.itu.int/en/ITU-T/webinars/20210623/Pages/default.aspx) | ETSI, IEC and IEEE UK & Ireland Photonics Chapter | 115 unique viewers from 37 countries | [I-265](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B960BD8FC-0EFC-431B-9D84-690630DBE3E2%7D&file=QIT4N-I-265.docx&action=default) |
| 2 November | [Joint Symposium on Quantum Photonic Integrated Circuits (QPICS)](http://itu.int/go/QIT-06) | IEC and IEEE UK & Ireland Quantum group & Photonics Chapter | TBD | TBD |

The FG QIT4N management team appreciate the moderators, panellists, viewers, and all involved in the successful organization of the FG-QIT4N webinars, particularly the co-organizers from ETSI, IEC and the IEEE UK & Ireland Chapter for their valuable partnership.

# 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, ISO/IEC JTC 1/WG14, IETF/IRTF, CEN-CENELEC FG QT and 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 and ISO/IEC JTC 1/WG14 also presented their work in the fifth and seventh FG QIT4N meetings respectively, outlining clear directions on potential topics of cooperation. The BSI UK BSI Quantum Technology Panel also presented their work during the ninth FG QIT4N meeting.

All FG QIT4N meetings have reviewed incoming liaison statements from ITU-T Study Groups (2, 11, 13 and 17), ITU-T Focus Groups (FG AI4EE and FG ML5G) and external groups (ISO/IEC JTC 1/SC 27 WG3 & WG4 and ETSI ISG QKD).

FG QIT4N has taken note of the ongoing QIT-related standardization activities and work items across ITU-T Study Groups (11, 13 and 17) and has 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, ISO/IEC JTC 1/WG14, 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 4.

**Table 4 – 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. Hao QIN (National University of Singapore (NUS), Singapore) |
| 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 at its November 2021 meeting, FG QIT4N will collaborate with relevant Study Groups in the transfer of its deliverables as appropriate. A preliminary proposal, still under discussion, for potential recipients of its deliverables and the way forward for QIT work in ITU-T is presented in Table 5.

**Table 5 – List of FG QIT4N deliverables and draft assignment to ITU-T study groups**

| **Deliverable** | | **Proposed SG(s)** |
| --- | --- | --- |
| D0.1 | Background and overview of FG-QIT4N | **ALL** |
| D1.1 | Network aspects of QIT – terminology | **13, 17** |
| D1.2 | Network aspects of QIT – use cases | **11, 13, 15, 17** |
| D1.3 | Implications of QIT on networks | **11, 13, 15** |
| D1.4 | Network aspects of QIT – standardization outlook and technology maturity | **ALL** |
| D2.1 | QKDN terminology | **13, 17** |
| D2.2 | QKDN use cases | **13**, 17, 15, 11 |
| D2.3 | QKDN protocols part 1: Quantum layer | **17**, 13, 11, 15 |
| D2.3 | QKDN protocols part 2: Key management layer, QKDN control layer and QKDN management layer | **11**, 13, 17, 2 |
| D2.4 | QKDN transport technologies | **15** |
| D2.5 | QKDN standardization outlook and technology maturity | **ALL** |

It is well understood that the further development and adoption of the deliverables after TSAG’s review at the time of closure of FG QIT4N would require a continued collaborative approach between the recipients, other ITU-T study groups working on QIT, and with external bodies working on the topic. To this end, FG QIT4N plans to organize briefing sessions to introduce its deliverables to the proposed relevant Study Groups as identified in Table 5.

## FG collaboration activities with external SDOs

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 follow-up activities to the 21 April 2020 joint session with ISO/IEC JTC1 SC27/WG3, FG QIT4N has received three invitations 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) and has submitted comments to their draft standard 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.

FG-QIT4N has also effectively collaborated with external groups in the organization of the following joint webinars:

– **23 March 2021,** joint webinar with IEC and IEEE UK & Ireland Photonics Chapter

– **8 April 2021,** joint webinar with ETSI

– **28 April 2021,** joint webinar with IEC and IEEE UK & Ireland Photonics Chapter

– **23 June 2021,** joint webinar with ETSI, IEC and IEEE UK & Ireland Photonics Chapter

# Conclusion and action for TSAG

FG QIT4N will submit its completed deliverables and final report to the next TSAG meeting including its final proposal for the recipients of its deliverables in the ITU-T Study Groups and suggestions for the way forward for QIT-related work for their consideration.

In the interim, FG QIT4N intends to organize briefing sessions for relevant ITU-T Study Groups (see Table 5) to introduce its deliverables and its suggestions for the way forward for QIT-related standardization. Noting the importance of this activity, the FG QIT4N invites (also via liaison) all Study Group chairmen and Rapporteurs of QIT-related Questions to take this into their consideration and inform FG QIT4N of their interest and potential dates when these briefings could be held (either at SG level or Question level).

**Action for TSAG:** TSAG is invited to note this progress report.

# Annex A – Overview and status of FG QIT4N deliverables

| **WG** | **Title** | **Objectives** | **Chair(s)** | **Deliverables (Number, link, title)** | | **Description** | **Responsible** | **Completion status** | **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 | **Background and overview of FG-QIT4N** | This informative report will provide some background on the technical discussions leading up to the formation of FG-QIT4N and provide context on the scope definition process for FG-QIT4N. | **Co-editors:**   * Mr. Qiang Zhang (USTC, China) * Mr. James Nagel (L3Harris Technologies, USA) * Ms. Barbara Goldstein (NIST, USA) | - | 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=%7BB846A108-F933-4476-91E9-13DF5E1D213B%7D&file=QIT4N-O-106.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) | 95% | December 2021 |
| [D1.2](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BFEC8E6A4-068E-4CFE-9480-D6FF30E65192%7D&file=QIT4N-O-107.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. Yuan Gu (ZTE, China)  **Co-editor:** Mr. Meng Zhang (CAICT, China) | 90% | December 2021 |
| [D1.3](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B81ADC19B-5074-4F86-A9A1-A7A7C213BB04%7D&file=QIT4N-O-080.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) | 50% | December 2021 |
| [D1.4](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BA1EA1730-9DA8-4FE4-9A35-79ABC821F717%7D&file=QIT4N-O-108.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) | 75% | 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=%7BE9E7AB66-52FD-4358-A77F-FAE36A866558%7D&file=QIT4N-O-100.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) | 95% | December 2021 |
| [D2.2](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BE1841532-1D1A-4AFB-97BD-300DFD4FB12C%7D&file=QIT4N-O-101.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. | **Co-editors:**   * Mr. Zhangchao Ma (CAS Quantum Network, China) * Mr. Dong-Hi Sim (SKT, Korea (Rep. of)) * Mr. Terrill L. Frantz (Harrisburg University of Science and Technology, USA) | 85% | December 2021 |
| [D2.3.1](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7BEDA3CE97-3138-469D-BA9B-1AC2FBEAFB40%7D&file=QIT4N-O-102.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 (NUS, Singapore), * Mr. Hongyu Wu (QuantumCTek, China), * Mr. Eldar Gayfutdinov (PJSC “Rostelecom”, Russian Federation) | 90% | December 2021 |
| [D2.3.2](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B90A5691B-235C-453D-9D9E-7A6F547A98D5%7D&file=QIT4N-O-103.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. | 90% | December 2021 |
| [D2.4](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B39D79F0D-C2DC-4CE5-85B2-24A8896269AB%7D&file=QIT4N-O-094.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) | 90% | December 2021 |
| [D2.5](https://extranet.itu.int/sites/itu-t/focusgroups/qit4n/_layouts/15/WopiFrame.aspx?sourcedoc=%7B9F5E2C84-75DA-4461-B9A8-FED512C27960%7D&file=QIT4N-O-104.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-editors:**   * Mr. Zhangchao Ma (CAS Quantum Network, China) * Mr. Yi Qian (CICT, China) | 90% | December 2021 |

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