|  |  |  |
| --- | --- | --- |
| ITU logo | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATIONSTANDARDIZATION SECTOR**STUDY PERIOD 2017-2020 | TSAG-TD632R1 |
| **TSAG** |
| **Original: English** |
| **Question(s):** | N/A | Geneva, 23-27 September 2019 |
| **TD** |
| **Source:** | Chairman, Quantum Adhoc Sessions |
| **Title:** | Proposed revision of C97 to set up a new ITU-T Focus Group on Quantum Information Technology for Networks (FG-QIT4N) |
| **Purpose:** | Information |
| **Contact:** | Arnaud TaddeiSymantec CorporationUnited States of America | Tel: +41 79 506 1129E-mail: Arnaud\_Taddei@symantec.com |

|  |  |
| --- | --- |
| **Keywords:** | Focus group; Quantum information technology (QIT); Quantum information network (QIN); Quantum key distribution (QKD); |
| **Abstract:** | This text carries a proposed revision by contributors of C97 to set up a new ITU-T Focus Group on Quantum Information Technology for Networks (FG-QIT4N). It’s initial abstract being: Following the previous Contribution (TSAG-C054), this contribution re-proposes to set up a new ITU-T Focus Group on Quantum Information Technology for Networks (FG-QIT4N). |

1. Introduction

Quantum information technology (QIT) is a class of emerging technology that improves the information processing capability by harnessing principles of quantum mechanics.

* The computational power brought by quantum computing has the promise of improving the performance of signal processing, big data analysis, etc. On the other hand, it will threat many existing cryptography algorithms that are fundamental to ICT security.
* Quantum communication, such as quantum key distribution (QKD), is quantum-safe by default and can provide long-term security guaranteed by the principles of quantum mechanics.
* Quantum metrology aims to enhance the accuracy and sensitivity of measurement with quantum sensors, e.g., it could provide more accurate time reference for ICT networks.
* Quantum information network (QIN) is designed to connect quantum information processing nodes such as QKD nodes, quantum computers and quantum sensors to realize quantum information transmission and networking.

In last decade, the development of QIT research and application have been accelerated globally. QIT has become the centre of focus not only in academia, but also in industry and standardization communities.

QKD-based secure communication networks (QKDN) have been/are being built[[1]](#footnote-1) in many countries. Quantum teleportation (QT) based ‘quantum internet’ project has been initiated in EU quantum flagship. Quantum satellite based wide-area quantum communication experiments have been reported. QIT is more and more considered representing the future of communication infrastructure with integrated security and flexibility. Different kinds of quantum computer prototypes, including superconductive circuits, trapped ions and semiconductor have been demonstrated. Quantum clock, gravimeter, magnetometer and gyroscope have been extensively investigated.

The industrialization of QIT is on the horizon recently, which needs support and guidance from standardization to ensure compatibility, interoperability, quality and security. As noted in ITU’s CJK CTO meeting (16 July 2019) Communique: “*Quantum information technologies such as Quantum Key Distribution (QKD) or Quantum Random Number Generator (QRNG) are proving themselves to be quantum-safe and their level of technology readiness is high enough for large-scale deployment, said CTOs. They noted that the success of these technologies in securing 5G and IoT networks, for example, will demand standards supporting the efficient, cost-effective deployment of quantum devices and their interoperability*”.

Preliminary standardization of QIT has been started in global SDOs including ITU-T, ISO/IEC, IETF, IEEE, ETSI, as summarized in **Appendix I.**

1. QIT standardization discussion in ITU-T

QIT related topics have already attracted great interest in ITU-T.

The Communique of ITU’s CTO meeting (9 September 2018, Durban, South Africa) says: *“The impending arrival of quantum computing poses significant risks to security. Quantum-safe cryptography is essential to preparations for that arrival”, said CTOs.* (ref.TSAG-TD295).

In the last TSAG meeting (10-14 December 2018), the contribution [C054 (revised as TD433R1)](https://www.itu.int/md/T17-TSAG-181210-TD-GEN-0433/en) which proposed to set up a new ITU-T Focus Group on Quantum Information Technology for Networks (FG-QIT4N) had been discussed lively during the four ad-hoc meetings. Although the ad-hoc meetings did not reach consensus to create the FG, TSAG appreciated to take a future-oriented position to conduct further investigation about quantum technology and its standardization requirements. TSAG decided to liaise with relevant ITU-T study groups to solicit possible opinion about this FG proposal (with feedback summarized in **Appendix II**) and to organize an ITU workshop on quantum in China (ref. [**TSAG-R3**](https://www.itu.int/md/T17-TSAG-R-0003/en)).

In 5-7 June 2019, ITU organized the [Workshop on Quantum Information Technology for Network](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2019060507/Pages/default.aspx) in Shanghai, China. More than 50 quantum experts from 13 countries delivered excellent presentations and roundtable discussions on quantum computing, quantum communication, quantum metrology and quantum information networks. More than 200 experts and representatives from government, universities, research institutes, enterprises, etc attended the conference. The standardization experts from ITU-T, ISO/IEC JTC 1 and ETSI also joined the workshop to discuss the progress and issues of QIT standardization. The workshop confirmed the importance of standardization for QIT as manifested in the [workshop summary report](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2019060507/Documents/Workshop_Summary.pdf). It is noted that the common concern faced by the very limited expert resources is how to coordinate global standardization activities and collaborate to improve efficiency on quantum standardization, and appeals to ITU to play a leading role to such much-needed global coordination.

In the Communique of ITU’s CJK CTO meeting (16 July 2019, Tokyo, Japan), CTOs highlighted their support for ITU’s ongoing standardization activities on security and network aspects of quantum information technologies, technologies based on the properties of quantum physics. *“CTOs expressed their commitment to the expansion of the ecosystem of quantum specialists within ITU. They encouraged ITU to take a forward-looking approach to quantum information technologies so as to anticipate emerging standardization demands. CTOs also called for ITU to take up a leading role in bringing standards bodies together to ensure the effective coordination of quantum-relevant standardization activities”*.

1. Main problems faced by current QIT standardization in ITU-T

QIT involves many fields of ICT such as computing, communication and metrology. Even though all these fields are based on similar principles of quantum mechanics, there are big gaps in technology maturity among different fields.

As shown in Figure 1, for the near future, the most mature industry deployment of QIT is QKD. QKD network, as both a new kind of security tool and a new form of network infrastructure, requires a systematic set of standardization work traversing multiple SGs of ITU-T, e.g.,

1. Network aspects standardization of QKDN as ongoing in SG13;
2. Security aspects standardization of QKDN as ongoing in SG17;
3. Protocols and signalling for network, user and device interconnection (related to SG11);
4. Network operation related specifications for QKD network (related to SG2);
5. Integration of QKD with classical optical communication networks (related to SG15);
6. QKD applications in data centre interconnection, cloud computing, Internet of Things, mobile network, etc. (related to SG16, SG20)

The challenge on standardization of such emerging/transverse technology is how to aligning the work of different ITU-T SGs and other SDOs to improve efficiency of global standardization.

Medium and long-term development of QIT will include breakthroughs in quantum computing and quantum metrology, and the construction of a new global quantum communication infrastructure in the future. Although industrialization of some of these technologies, e.g., quantum computing, are still in their infancies, given the more and more observed ‘accelerated life cycle’ from innovative technologies to market-disruptive products, it is never too early to carry out pre-standardization study in order to promote their adoption by the ICT sector and to accelerate the industrialization of these new technologies.

In order to aligning the global QKDN standardization as well as to explore the comprehensive QIT scope, an open platform is needed to bring together global experts and industry players, to strengthen cooperation to carry out the forward-looking study on the QITs under one umbrella.



Fig. 1 QIT standardization outlook in ITU-T

1. Opposition opinions to FG-QIT4N in TSAG (Dec 2018)

Opposite opinions to the creation of FG-QIT4N in TSAG Dec 2018 meeting were mainly of the following two concerns:

1. QIT is premature for standardization;
2. Potential duplication with standardization activities already ongoing in ITU-T SGs and other SDOs.

We appreciate that it takes time for all of us to understand such a non-intuitive and complex subject as QIT and to assess standardization needs at such an early stage of an innovative and revolutionary technology. However, the initiation/proliferation/acceleration of more and more standardization activities both within and outside of ITU-T has clearly demonstrated that there is a proven urgent need for QIT standardization and a proven urgent need for effective alignment of global QIT standardization activities.

ITU-T standardization should take into consider and build on the latest development and consensus in QIT wherever/whatever they are. We would welcome input from any individual, SDO and countries to bring such latest consensus to ITU to advance ITU-T standardization. However, we do not believe ‘claimed territory’ of other SDOs is meaningful to ITU members who are not member of those SDOs, thus could not be considered an acceptable reason to prevent proposed work in ITU-T.

1. Benefit to set up a focus group on Quantum Information Technology for Networks

As the United Nations’ specialized agency for ICTs, ITU-T is truly global and the only international standardization platform that covers all major ‘quantum active’ countries thus could bring together world-wide academic institutions, high-tech companies, network operators, system vendors and ICT regulators, to evaluate the research status, application prospects and industry impact of QIT for ICT networks, and to investigate the global standardization requirements and roadmaps.

Focus group has proven to be a useful tool for ITU-T to explore pre-standardization for new technologies, for the following reasons:

1. It is free and open to participation from all entities from any ITU Member State who are interested to contribute their knowledge and expertise;
2. It is, on the one side, ‘informal’, with flexible working methods and its deliverable has no formal/normative status, thus enables wide information sharing and consensus building among all participants; on the other side, ‘within arm-length’ of formal standardization process with systematic channels to ensure its deliverables will be taken into consideration by ITU-T Study Groups;
3. It is facilitated by ITU-TSB with world-class logistics and transparent secretary support.

Hence, in order to build a broader and in-depth platform for investigating QITs, and to lay a more comprehensive and solid foundation for future international standardization in several related Study Groups of ITU-T, it is proposed to set up a new Focus Group on Quantum Information Technology for Networks (QIT4N), which could provide the following benefits:

1. Providing a global platform for QIT standardization, which is open to participation of global QIT experts, especially from non ITU-T member organizations and other SDOs;
2. With wide participation and sharing of information from experts/SDOs and shared objective to avoid duplication of efforts among ITU-T SGs and any SDOs, it can provide effective consolidated platform for future QIT standardization by systematically studying all involved aspects and route for QIT standardization; and
3. Through possible collaborated standardization process, e-meetings and co-location of this Focus Group meetings with related SG Question meetings and other SDO meetings, it can achieve more efficient working mechanism to reduce meeting travels and more extensive and effective cooperation of global standardization activities.

Proposal

Following the previous Contribution C054 and based on above further analysis, we would like to propose again to set up a new ITU-T Focus Group with provisional name “Quantum Information Technology for Networks (QIT4N)”, with the Terms of Reference (in revision mode based on TSAG-TD433R1) as provided below.

 Proposed Terms of Reference:
ITU-T Focus Group on “Quantum Information Technology for Networks” (FG-QIT4N)

**1. Rationale and Scope**

The integration of quantum physics and information technology has forged the so-called quantum information technology (QIT), which could be categorized in three areas:

* quantum computing
* quantum communication
* quantum metrology

QIT has promoted the booming of the second quantum revolution and will have a profound impact on ICT networks.

Quantum computation is a new computation model that follows the laws of quantum mechanics to control quantum information units. Combined with the quantum parallelism, quantum information processing has greater potential than classical information processing. Quantum computers represent a breakthrough in Moore's Law that is limited by the nanoscale, implying enormous computing power potential. Quantum computer has potential applications in many fields, such as optimization over huge data sets and design of new materials and molecular functions. The computational power brought by quantum computing will not only improve the performance of signal processing, but also become a threat to security of existing ICT networks.

Quantum communication includes a class of novel communication technologies that exploit the transmission of quantum signals, such as quantum key distribution (QKD), quantum teleportation, quantum repeater. QKD is one of the most mature QIT application at this moment. Different from the traditional key distribution technology, QKD provides long-term security based on principles of quantum mechanics. The security of QKD still holds even under the attack of quantum computer. Metro/backbone QKD networks have been constructed and satellite-based quantum communication experimental applications have been realized in last decade. In the future, quantum repeater would be an essential building block in constructing distributed quantum computing.

Quantum metrology is the study of measurement techniques that give higher resolution and sensibility in measurements of physical parameters than the same measurement performed in a classical framework. At this stage, quantum metrology is mainly used in the fields of navigation, lidar and time-frequency transmission.

Quantum information network (QIN) is expected to connect quantum information processing nodes, including QKD nodes, quantum computers and quantum sensors, via quantum communication technologies such as quantum teleportation and quantum repeating, to realize quantum information transmission and networking. QIN has potential to provide series of new applications, such as distributed quantum computing and quantum sensor network.

The ITU-T Focus Group on “Quantum information technology for networks” (FG-QIT4N) would provide an open platform to study QIT for networks. It engages researchers, engineers, practitioners, entrepreneurs and policy makers, to take full advantages of ability and potential of QIT in networks.

**2. Objectives of the FG-QIT4N**

This Focus Group is to provide a collaborative platform for pre-standardisation aspects of QIT for the ICT networks, with the following objectives:

1. Considering emerging technologies and applications of QIT for networks.
2. the object of study consists of:
	1. the supplementary aspects of QKD networks beyond the scope of SG13 (QKD network architecture aspects) and SG17 (security aspects).
	2. QIN technology and network evolution.
3. On the above objects, the main outputs will prioritise on terminology and use cases.
4. To provide necessary technical background information and collaborative conditions in order to effectively support current and future standardization work in study groups.
5. To provide an open cooperation platform with study groups and other SDOs, including collaborated standardization work, co-located meetings, and workshop on quantum topic.

**3. Structure**

The FG-QIT4N may establish sub-groups if needed.

**4. Specific Tasks and Deliverables**

The expected tasks with potential deliverables for QIT4N are listed below:

1. To collaborate and cooperate with study groups and other SDOs, such as ETSI specific ISGs, IEEE, ISO/IEC JTC1, IETF.
2. To develop technical report(s) about emerging technologies and applications of QIT (e.g., quantum computing, quantum metrology and quantum communication) for networks.
3. To develop technical report(s) on supplementary aspects of QKD networks beyond the scope of SG13 and SG17, including terminologies, new use cases, protocols, co-fibre transmission issues and the merger with quantum relay and quantum repeater technologies in this prioritized order.
4. To develop technical report(s) on the evolution of QIN ~~[QIT4N]~~ including terminologies, user cases, requirements, key components, enabling technologies and potential architectures.
5. To organize thematic workshops on QIT for networks, which will bring together all kinds of players to promote the FG activities, and encourage both ITU members and non-ITU members to jointly contribute on this topic.

**5. Relationships**

This Focus Group will work in close collaboration with all ITU-T study groups, especially SG13, SG17, SG15, SG2 and SG11.

This FG QIT4N will collaborate with relevant entities, in accordance with Recommendation ITU-T A.7. These entities include the following: SDOs, industry forums and consortia (such as ISO/IEC JTC 1, ETSI ISG-QKD, IEEE-SA), tech companies, academic institutions, research institutions and other relevant organizations.

**6. Parent group**

The parent group is ITU-T TSAG.

**7. Leadership**

See clause 2.3 of Recommendation ITU-T A.7.

**8. Participation**

See clause 3 of Recommendation ITU-T A.7. A list of participants will be maintained for reference purposes and reported to the parent group.

It is important to mention that the participation in this Focus Group has to be based on contributions and active participations.

**9. Administrative support**

See clause 5 of Recommendation ITU-T A.7.

**10. General financing**

See clauses 4 and 10.2 of Recommendation ITU-T A.7.

**11. Meetings**

The schedule and location of meetings will be determined by the Focus Group and the overall meetings plan will be announced after the approval of the terms of reference. The Focus Group will work electronically using teleconferences and with face-to-face meetings. Meetings will be held as determined by the Focus Group and the meetings will be announced by electronic means (e.g., e-mail and website, etc.) at least four weeks in advance.

**12. Technical contributions**

See clause 8 of Recommendation ITU-T A.7.

**13. Working language**

The working language is English.

**14. Approval of deliverables**

Approval of deliverables shall be taken by consensus.

**15. Working guidelines**

See clause 13 of Recommendation ITU-T A.7.

**16. Progress reports**

See clause 11 of Recommendation ITU-T A.7.

**17. Announcement of Focus Group formation**

The formation of the Focus Group will be announced via TSB Circular to all ITU membership, via the ITU-T News log, press releases and other means, including communication with the other involved organizations.

**18. Milestones and duration of the Focus Group**

The Focus Group lifetime is set for one year from the first meeting but extensible if necessary by decision of the parent group. (see ITU-T A7, clause 2.2).

**19. Patent policy**

See clause 9 of Recommendation ITU-T A.7.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Appendix I:

The current standardization activities for quantum information technologies can be briefly summarized as the following three major subject categories.

1. **Quantum computing:**

In 2018, ISO/IEC JTC1 established two study groups, i.e., SG2 and SC7/SG1 on Quantum Computing. In 2019, ISO/IEC JTC1 reconstituted an Advisory Group (AG) on Quantum Computing after the term ‘study group’ was abandoned in ISO/IEC JTC1.

In 2018, IEEE initiated two work items on Quantum Computing Definition (P7130) and Performance Metrics & Benchmarking (P7131). In June 2019, IEEE revised P7130 into Standard for Quantum Technologies Definitions, providing a general nomenclature for Quantum technology

The standardization on quantum computing is still at a very initial stage, mainly aims to clarify concepts, define terminologies, identify standardization needs and provide performance metrics & benchmarking.

1. **Quantum communication:**

Quantum key distribution, as the most mature application of quantum communication in ICT networks, has induced a series of standardization activities in ETSI, ISO/IEC JTC 1 and ITU-T as shown below.

Besides, IEEE has initiated P1913 - Software-Defined Quantum Communication in 2016, which aims to define the Software-Defined Quantum Communication (SDQC) protocol that enables configuration of quantum endpoints in a communication network in order to dynamically create, modify or remove quantum protocols or applications.

However, some important standardization issues, e.g., QKD network interoperability, QKD security certification, have not been resolved yet. Further coordination and collaboration are needed to improve efficiency for QKD standardization.

**QKD related activities in ETSI:**

ETSI initiated the industry specification group (ISG) on QKD in 2008. ETSI ISG-QKD has published nine specifications on QKD until 2019 and have several work items ongoing as listed in table 1.

Table 1. QKD related work in ETSI

|  |  |  |
| --- | --- | --- |
| **ETSI** | **Specification/Report** | **Publish date** |
| GS QKD 002 | Quantum Key Distribution (QKD); Use Cases | 2010-06 |
| GR QKD 003 | Quantum Key Distribution (QKD); Components and Internal Interfaces | 2018-03 |
| GS QKD 004 | Quantum Key Distribution (QKD); Application Interface | 2010-12 |
| GS QKD 005 | Quantum Key Distribution (QKD); Security Proofs | 2010-12 |
| GR QKD 007 | Quantum Key Distribution (QKD); Vocabulary | 2018-12 |
| GS QKD 008 | Quantum Key Distribution (QKD); QKD Module Security Specification | 2010-12 |
| GS QKD 010 | Quantum Key Distribution (QKD); Implementation security: protection against Trojan horse attacks in one-way QKD systems | Drafting |
| GS QKD 011 | Quantum Key Distribution (QKD); Component characterization: characterizing optical components for QKD systems | 2016-05 |
| GS QKD 012 | Quantum Key Distribution (QKD) Device and Communication Channel Parameters for QKD Deployment  | 2019-02 |
| GS QKD 013 | Quantum Key Distribution (QKD); Characterisation of Optical Output of QKD transmitter modules | Drafting |
| GS QKD 014 | Quantum Key Distribution (QKD); Protocol and data format of key delivery API to Applications; | 2019-02 |
| GS QKD 015 | Quantum Key Distribution (QKD); Quantum Key Distribution Control Interface for Software Defined Networks | Drafting |

**QKD related activities in ITU-T:**

ITU-T SG 13 ‘future network’ and SG17 ‘security’ has initiated 11 work items on security and network aspects of QKD networks since 2018 as listed in table 2.

Table 2. QKD related work in ITU-T

|  |  |  |  |
| --- | --- | --- | --- |
| **ITU-T** | **Recommendation/Report** | **Timing** | **SG** |
| Y.3800 | Framework for Networks to supporting Quantum Key Distribution | Consented in 2019-06 | SG13 |
| Y.QKDN\_Arch  | Functional architecture of the Quantum Key Distribution network  | 2020-07 | SG13 |
| Y.QKDN\_KM | Key management for Quantum Key Distribution network  | 2020-07 | SG13 |
| Y.QKDN\_SDNC | Software Defined Network Control for Quantum Key Distribution Networks | 2021-09 | SG13 |
| Y.QKDN\_CM | Control and Management for Quantum Key Distribution Networks | 2021-03 | SG13 |
| X.qrng-a | Quantum Noise Random Number Generator Architecture | Consented in 2019-09 | SG17 |
| X.sec\_QKDN\_ov | Security Requirements for QKD Networks - Overview | 2019-09 | SG17 |
| X.sec\_QKDN\_km | Security Requirements for QKD Networks - Key Management | 2019-09 | SG17 |
| X.cf\_QKDN | The use of cryptographic functions on a key generated by a Quantum Key Distribution networks | 2019-09 | SG17 |
| X.sec\_QKDN\_TN | Security requirements for Quantum Key Distribution Networks-Trusted node | 2021-03 | SG17 |
| TR.sec\_QKD | Security framework for Quantum Key Distribution in Telecom network | 2019-09 | SG17 |

**QKD related activities in ISO/IEC JTC 1:**

ISO/IEC JTC 1/SC 27 initiated the study period "Security requirements, test and evaluation methods for quantum key distribution" in 2017. In 2019, the study period was finished and new work item ISO/IEC 23837 (Part 1&2) was established as listed in table 3.

Table 3. QKD related works in ISO/IEC JTC1

|  |  |  |
| --- | --- | --- |
| **ISO/IEC** | **Standard/Report** | **Status** |
| Study Period | Security requirements, test and evaluation methods for quantum key distribution | Finished |
| ISO/IEC 23837-1 | Security requirements, test and evaluation methods for quantum key distribution Part 1: requirements | Ongoing |
| ISO/IEC 23837-2 | Security requirements, test and evaluation methods for quantum key distribution Part 2: test and evaluation methods | Ongoing |

1. **Quantum Internet in IETF:**

IETF established the Quantum Internet Research Group (QIRG) in 2018. There are four documents under drafting as listed in table 4.

Table 4. Quantum Internet related works in IETF

|  |  |  |
| --- | --- | --- |
| **IETF** | **Internet-Drafts** | **Status** |
| [draft-irtf-qirg-principles-00](https://datatracker.ietf.org/doc/draft-irtf-qirg-principles/)  | Architectural Principles for a Quantum Internet | I-D Exists IRTF stream |
| [draft-dahlberg-ll-quantum-02](https://datatracker.ietf.org/doc/draft-dahlberg-ll-quantum/)  | The Link Layer service in a Quantum Internet | I-D Exists  |
| [draft-kaws-qirg-advent-03](https://datatracker.ietf.org/doc/draft-kaws-qirg-advent/)  | Advertising Entanglement Capabilities in Quantum Networks | I-D Exists  |
| [draft-van-meter-qirg-quantum-connection-setup-00](https://datatracker.ietf.org/doc/draft-van-meter-qirg-quantum-connection-setup/)  | Connection Setup in a Quantum Network | I-D Exists  |

Appendix II:

TSAG has sent a liaison ([TSAG-LS19 -E](http://handle.itu.int/11.1002/ls/sp16-tsag-oLS-00019.zip)) to invite the relevant ITU-T study groups to report on their respective activities on quantum matters, including all views and comments on the attached material on the proposed ITU-T Focus Group on Quantum Information Technology for Networks (FG-QIT4N).

TSAG has received six input liaisons from SG3, 5, 13, 15, 16, 20 in response to [TSAG-LS19 -E](http://handle.itu.int/11.1002/ls/sp16-tsag-oLS-00019.zip), which are briefly summarized as below:

1. In SG13 liaison ([TD-GEN-0532](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0532)), the potential standardization items for the QKD network have been identified of common interests among related SGs. SG13 sees a strong need to coordinate with different SGs (e.g., SG2, 13, 11, 15, 17) and other SDOs (e.g., ETSI-ISG-QKD), that should be discussed to provide an efficient coordination method in TSAG meeting further.
2. In SG15 liaison ([TD-GEN-0572](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0572)), it states that SG15 has received a number of contributions on the topic of Quantum Key distribution, but SG15 do not have any activities on quantum matters to report at this stage and no further comments or additional suggestions.
3. In SG3 liaison ([TD-GEN-538](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0538)) , it states that SG3 do not have feedback on the proposed new ITU-T Focus Group on Quantum Information Technology for Networks (FG-QIT4N);
4. In SG5 liaison ([TD-GEN-560](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0560)), it states that SG5 is considering to develop a new work on the environmental impact of Quantum Information Technology;
5. In SG16 liaison ([TD-GEN-526](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0526)), is states that SG16 does not foresees forthcoming studies regarding quantum information technologies at this time being, and it welcome information sharing for any work that is to be or being carried out on quantum related subjects that will benefit multimedia e-services and applications in any new group created in the future or in any existing groups within ITU-T
6. In SG20 ([TD-GEN-553](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0553)), it inform TSAG that ITU-T SG20 may consider the possibility to start new work on emerging technologies, which could include Quantum Information Technology, in the future.
7. SG5 and SG20 has designated representative to participate in the ITU Workshop on "Quantum Information Technology for Networks" in Shanghai.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. <https://ec.europa.eu/digital-single-market/en/news/future-quantum-eu-countries-plan-ultra-secure-communication-network?from=singlemessage&isappinstalled=0> [↑](#footnote-ref-1)