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| **Abstract:** | This document carries the report from the Chairman of the Quantum Adhoc sessions to the TSAG closing plenary. |

# Introduction

At the TSAG opening plenary, based on different views expressed on written contribution [C97](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-C-0097) from CAS Quantum Network Co., Ltd., QuantumCTek Co., Ltd., KT corp., China Mobile, China Telecom, China Unicom, Huawei Technologies Co., Ltd., ZTE Corp., BUPT, and China Information Communication Technologies Group Corp., proposing the establishment of a Focus Group on Quantum Information Technology for Networks (FG-QIT4N), including interventions proposing to establish a JCA , TSAG created an Adhoc discussion on QIT4N. Its mandate is to discuss [C97](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-C-0097) in further details and propose a way forward for TSAG closing plenary consideration. M. Arnaud Taddei accepted his nomination as Chairman for this Adhoc discuss with the secretary support from Mrs Xiaoya Yang from ITU-TSB.

# Method followed

As the experience of chairing the adhoc quantum session at the December TSAG meeting, Chairman could this time anticipate a bit more this mandate and be more prepared.

Chairman recognized upfront a number of dimensions to the problem and realized that a traditional method to approach these quantum sessions by directly looking at C97 text would provide a significant limitation to the discussions and more important to the general mutual understanding.

Chairman was inspired by 2 considerations:

* A veteran delegate joining back the ITU and attending the recent SG17 meeting shared that in older days of the ITU, delegates were not jumping straight to text reviews but were taking the time of a first ‘philosphical’ discussion to align themselves
* The value of the result of a negotiation is proportional to the information shared by the parties

The above lead Chairman to recognize the monumental amount of work required and the small amount of time to process it at this TSAG meeting.

So Chairman had to make a hard unliateral decision on the designing an experimental approach which consisted of

* To keep the main goal as to help the team’s position to get as close as possible to each other
* Not to let the team go to a straight text review of the potential ToR
* To prioritize the quality of the debate on its entirety to maximize the mutual understanding
* To support the above priorities by creating a live document for clarity and efficiency purposes
* To not have any concern and problems unaddressed as a ‘non negotiable’
* To put the chairman in a position of a ‘fuse’ to decrease potential frictions between delegates and let chairman absorb them to maximize ‘open doors’ between delegates
* To maximize the time allocated to discussions and offline discussions rather than in excessive documentation
* To exhaust the full review of the list of all logical aspects of the negotiation

This approach has a ‘cost’ that it didn’t allow to produce a minute after each session but rather all the interventions and notes are captured in the live document. So, nothing should be lost but it is simply harder to follow the whole sequence of events.

This approach was not perfect and Chairman reflected on that (and should take a step back on how to improve for the future) but Chairman considers it brought a lot of fruits among which

* The live document allowed a lot of visualizations and clarifications
* It allowed to decompose the problem in steps and align all the understandings across the participants
* It allowed to have a complete critique positive and negative about what happened so that we could derive some lessons learnt, that was unpleasant at times but was sane and allowed the team to move on
* It allowed to extract probably a very high rate of all the information that should have been extracted, be explained, be valued and be debated
* It allowed to depersonalize a lot of the debates and keep brains concentrated on the understanding, the qualification and sometimes the resolution.

# Discussion in three Adhoc sessions

This Adhoc held three evening sessions (all started from 18:00) on Tuesday 24 September, Wednesday 25 September and Thursday 26 September 2019 respectively.

In the first adhoc session, Chairman prepared agenda in [TD619](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0619) with a Chairman’s proposal of this Adhoc meeting session planning in Annex 1 and the list of docs assigned by TSAG plenary to this Adhoc in Annex 2. More importantly, Chairman prepared [TD620](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0620) “Chairman’s proposal on a shared vision for adhoc sessions on Quantum” as “a live document toward a common shared vision for consensus or not, before engaging in any ToR drafting work.” (ref. [TD620](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0620)). This Chairman’s proposal was much appreciated by participants as it greatly helped this Adhoc discussion.

Upon request of Adhoc Chairman, secretary of this Adhoc took notes of all interventions made during the Adhoc discussion based on her understanding. Those notes of the three Adhoc Sessions were posted in [TD620R2](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0620), [TD620R3](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0620) and [TD620R4](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0620) respectively, after Adhoc Chairman’s review after each respective session.

The first Adhoc accomplished discussion of TD620 until Section 5 “Proposition”, including a detailed review of quantum related work in ITU-T. Most of the discussion was around the qualification of the problem including a primary objective to bring full clarity on a number of questions and in particular fighting ‘believes’ or killing any denial of any issue. In particular it concentrated on checking the premises of a a Focus Group proposal and established a few critical points:

* There are a lot of aspects in QKD that were not yet approached and in a pre-standardisation scenario would be candidates for pre-standardisation
* In a pre-standardisation scenario we move from the position in December were no work was identified to now a lot and perhaps too much work would be for pre-standardisation
* The nature of what could be the candidates deliverable from pre-standardisation to standardization were identified

This opened too a discussion on different understanding of the FG proposal and the possibility of a JCA as an possible solution to issues identified. In fact the essence of the gap that it revealed was really about:

* On side considers there is indeed enough work, ITU is a standardization place and so it should go straight to Study Groups, yet a JCA will be regardless necessary
* The other side considers that whilst a lot of work indeed is identified it is not all ready for standardization and a pre-standardisation phase is necessary.

The second Adhoc session and focused on “review of proposals” (ref. Agenda of send Adhoc session on Quantum in [TD629](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0629)) in Section 5 of TD620. It reviewed new contributions to the live document including a Venn Diagram about the coverage of various constituencies of the general Quantum scope in mind and with two refined views of the Focus Group potential future from the Contributors and from Huawei but from his ETSI background. This lead to a significant 3 batches of interventions and helped prepare the next steps so the contributors of C97 could propose a new ToR later. The need to discuss the differences of a FG and a JCA continued . The meeting reached a certain milestone with, in essence, most of the logical arguments on the table and positions started to converge to a more narrow focused FG (prioritizing on terminologies and use cases) and for 1 year initial life time to **collaborate** with SGs and SDOs, and (i.e., the so-called ‘dual model’ in [TD620R3](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0620)) a JCA to **coordinate** work in ITU-T groups and SDOs. At the end of second Adhoc session Chairman requested C97 contributor to revise FG ToR for consideration by the third Adhoc session.

The third Adhoc session (agenda is found in [TD634](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0634)) first reviewed the progress achieved in previous two sessions as reflected in [TD620R3](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0620), and discussed revised FG ToR in [TD632](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0632) which was produced upon request of Adhoc Chairman. The third Adhoc session conducted a lengthy and detailed discussion and further revised terms of reference [TD632](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0632), before it moved to the last discussion whether the FG proposal with this revised ToR should be proposed to TSAG closing plenary.

Concerning the ToR we captured all the online clarification remarks yet we could not include some agreed remarks because we were in clarification mode, not in revision mode. To make sure we capture those agreed remarks we list here

* Regarding terminology we need the focus group to find an agreed mechanism regarding potential terminology conflicts between the current work being done in SG13 and SG17 and the terminology developed by the focus group. Several mitigation models are possible but may not need to be detailed at ToR level
* The list of sub items (protocols, etc.) cause a problem in the sentence because it gives a false perception that we are adding coverage whilst in fact there are examples. In fact they were put here with the intention to put some potential priorities and so a proposal would be to complete the sentence with ‘in this prioritized order’.
* What is the best choice in 4.4: QIN or QIT4N or both? Contributors would like to keep QIN
* We need to explicit the scope of SG13 and SG17 and not just refer to them. We could propose for example: beyond the scope of SG13 (QKD network architecture) and SG17 (security aspects)
* We need to be more precise in which SDO groups we refer too

# Chairman observations

In general Chairman observes that:

* The whole team was significantly and sometimes passionately engaged and we had several times up to more than 20 interventions on some questions, we had very relevant in writing contributions to the live document. It is undeniable that there is interest
* The whole team was very opened and transparent as much as their own mandates restrictions allowed them to do and it included other SDOs
* Not all but a significant amount of positions obviously moved during the 3 sessions and it was measurable
* Unlike in December, this time, Chairman didn’t need to invite people for offline discussions, they happened naturally, another sign that the team is collectively more comfortable to interact and shows the good maturity progress
* In general it was a good atmosphere and even a very good atmosphere with a few moments of collective laugh. Yet a very small amount of specific discussions were about unpleasant topics or got robust, yet with no drama at all
* Chairman was actually surprised by how could most of time explain beyond perhaps sometimes perceived as dogmatic positions, and rather go the core of the real problem which leads Chairman consider that the gap between the parties exists but is healable.
* Chairman understands too his own limits and areas of improvements for the next time especially regarding the procedure aspects, and how to help even further the development of propositions to yet another level.

On the core of the problem Chairman considers that:

* Both sides recognize that there is a need for coordination, there is a need for work to be done and to some degree Chairman would argue that both side recognize there is a need for pre-standardisation work AND that there is work to be done here
* The gap, at this stage of the report, lies in the way to implement and the choice in the ITU ‘entity’ to use
* In other words, the team doesn’t disagree on the problem, but has a gap on what is the most effective way to resolve it

#  Conclusions

## Conclusion for decision at closing plenary

In the end, Adhoc Chairman had to conclude and report to TSAG closing plenary that:

There was a C97 proposing a FG. There were many discussion and effort to revise this proposal toward a focused ToR in revised [TD632R1](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-190923-TD-GEN-0632) outcome of the third and last Adhoc session.

Throughout the three sessions of the AHG, there was significant support for the creation of the FG on QIT4N, there was some opposition, and there was support for creating a FG on QIT4N and a JCA QIT4N.

## Quote from China

Chairman is here inserting as requested the statement that China made during the last session:

*Mr. Chairman,*

*We should have our meeting and proceed it complying with the rule and procedure of ITU-T. We have a proposal for the creation of a Focus Group on QIT4N on the table. During the discussion in the ad hoc meetings, we have revised the ToR according to the opinions and suggestions received from the meetings, and we have got many supports. We would like to thank Brazil, Egypt, Jordan, Nigeria, Russia Federation, Saudi Arabia, United Arab Emirates, Zimbabwe, and so on for supporting the focus group. We also have the support from many sector members and academia members including Tunisia Telecom, KT, SK Telcom, CAS Quantum Network, QuantumCTek, China Mobile, China Telecom, China Unicom, Huawei Technologies, ZTE Corporation, Beijing University of Posts and Telecommunications, and China Information Communication Technologies Group Corporation. We also have got support from study groups including SG11, SG13, SG16, and SG17. We would like to thank the constructive suggestions from France, Japan, and SG13 Chairman for helping us to improve our proposal. We would also like to thank Canada, the USA, Germany and the UK for their comments and suggestions.*

*We request to capture this statement in your Chairman report.*

*Thank you.*

## Further considerations for the future

As well, after the meeting, Adhoc Chairman had to take a step back on what happened and check if there was not any other outcome that came out of these meetings as there is at least one key point that Chairman cannot not report here.

Indeed chairman recognized that in this whole discussion one point needs to progress further irrespective of the decision of a Focus Group and in the future which concerns the coordination (which btw a Focus Group cannot address coordination by law)

Chairman requests TSAG to consider to enforce point 7 2 c) of the report of the last December TSAG meeting in [TD443](https://www.itu.int/md/T17-TSAG-181210-TD-GEN-0443/en) and given the obvious knowledge and skills of Study Group chairs in coordination, Chairman would recommend them to develop of TD on how they propose to organize coordination with ITU and with other SDOs on the matter.

Chairman would like TSAG to consider too, that good creative contributions at the next TSAG meeting should be welcome.

Indeed even if there would be progress on this area in the coming two TSAG meeting, time constraints and timeouts will make it that it will take a significant amount of time before any coordination can be put in place and time is of essence now on the topic of Quantum.

## Acknowledgment

Chairman would like to warmly thank all the participants in this highly sophisticated problematic for their engagement, passion and commitment to make the correct choice for the ITU

Chairman would like too to warmly thank his counselor Mrs. Xiaoya Yang for the very hard work she had to do to script as best as possible the interventions and help more broadly and in many ways the Chairman in his mission

# Annex 1 – Latest draft ToR status

For reference the latest draft ToR text as per TD632R1:

[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 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.]

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