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| ITU-T Study Group 11 |
| Signalling requirements, protocols and test specifications |
| REPORT of ITU-T SG11 TO THE WORLD TELECOMMUNICATION STANDARDIZATION ASSEMBLY (WTSA-16), Part II: QUESTIONS PROPOSED FOR STUDY DURING THE NEXT STUDY PERIOD (2017-2020) |

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| **Abstract:** | This contribution contains the text of the Study Group 11 Questions proposed for approval by the Assembly for the next study period. |

Note by the TSB:

The report of Study Group 11 to the WTSA-16 is presented in the following documents:

Part I: **Document 9** – General

Part II: **Document 10** – Questions proposed for study during the study period 2017-2020

# 1 List of Questions proposed by Study Group 11

| Question number | Question title | Status |
| --- | --- | --- |
| A/11 | Signalling and protocol architectures in emerging telecommunication environments and guidelines for implementations | Continuation of Q1/11 |
| B/11 | Signalling requirements and protocols for service and application in emerging telecommunication environments | Continuation of Q2/11 |
| C/11 | Signalling requirements and protocol for emergency telecommunications | Continuation of Q3/11 |
| D/11 | Protocols for control, management and orchestration of network resources | Continuation of Q4/11 and Q6/11 |
| E/11 | Protocols and procedures supporting services provided by broadband network gateways | Continuation of Q5/11 |
| F/11 | Signalling requirements and protocols for network attachment including mobility and resource management for future networks and 5G/IMT-2020 | Continuation of Q7/11 |
| G/11 | Combating counterfeit and stolen ICT equipment | Continuation of Q8/11 |
| H/11 | Protocols supporting distributed content networking and information centric network (ICN) for FNs and 5G/IMT-2020, including end-to-end multi-party communications | Continuation of Q9/11 |
| I/11 | Service and networks benchmark testing, remote testing including Internet related performance measurements | Continuation of Q10/11 and Q15/11 |
| J/11 | Protocols and networks test specifications; frameworks and methodologies | Continuation of Q11/11 |
| K/11 | Testing of internet of things, its applications and identification systems | Continuation of Q12/11 |
| L/11 | Monitoring parameters for protocols used in emerging networks, including cloud computing and SDN/NFV | Continuation of Q13/11 |
| M/11 | Cloud interoperability testing | Continuation of Q14/11 |
| N/11 | Testing of emerging 5G/IMT-2020 technologies | New Question |
| O/11 | Protocols supporting control and management technologies for 5G/IMT-2020 | New Question |

# 2 Wording of Questions

Draft Question A/11

Signalling and protocol architectures in emerging telecommunication environments and guidelines for implementations

(Continuation of Question 1/11)

### A.1 Motivation

The desire to support services within networks and supported by networks has resulted in a number of architectural solutions being worked on in numerous standardization bodies and forums. A standardized architectural model for a control signalling with regard to the voice and video over LTE based networks (VoLTE/ViLTE), network virtualization, cloud computing, future networks, 5G/IMT-2020 and other emerging technologies is needed.

A standard reference model for the control plane is required to identify a set of interfaces which provide interoperability between telecommunication networks, between equipment from different suppliers, between the cloud computing networks and between virtualized and the physical networks.

As the ITU‑T has developed the standards for existing public networks, including services and control protocols, this question plans to develop the signalling and protocol architectures for the future emerging telecommunication network.

Cooperation with the ITU‑T study groups and with other standards development organizations (SDOs) is required to gather any relevant information from these organizations and take an important role to coordinate them to achieve the global interoperability.

In addition, ongoing studies and results achieved by various international standardization bodies have led to the emergence of different solutions to address convergence and interoperability due to the evolution of protocols in packet-based networks. For this reason, ITU Member States, particularly those in developing countries, have expressed the needs for assistance in understanding network and service deployment strategies and scenarios by developing guidelines on signalling protocols implementations for networks and services.

This Question will maintain the previous Technical Reports and Handbooks on implementation of signalling and protocols developed to support developing countries. In addition it will maintain Recommendations in force for which the Question is responsible, e.g. Q.3030, Q.3040, Q.3050, Q.3051 and Q.3052.

### A.2 Question

Study items to be considered include, but are not limited to:

– What enhancements to the signalling and control architecture are required to model the control plane of future emerging telecommunication networks, taking into account new services and new applications and all types of wireline and wireless public access networks over which these services may be delivered?

– What enhancements to the signalling and control architecture are required to support (VoLTE/ViLTE)?

– What enhancements to the signalling and control architecture are required to support the telecommunication networks evolving to future networks and 5G/IMT-2020?

– What signalling and control architecture and entities are required to assure security of signalling and control?

– What enhancements to the signalling and control architecture are required to support services and/or applications of public interest such as emergency call handling, number portability, privacy, etc.?

– What enhancements to existing recommendations are required to provide energy savings directly or indirectly in information and communication technologies or in other industries? What enhancements to developing or new recommendations are required to provide such energy savings?

– What activity is needed to prepare common guidelines by the ITU‑T and ITU‑D Sectors, containing different aspects related to network and service deployment strategies and scenarios to support the implementation of signalling protocols in networks and services?

– What coordination mechanisms are needed in regards of the signalling and protocol development for emerging telecommunication networks in cooperation with the ITU‑T study groups and with other standards development organizations (SDOs)?

### A.3 Tasks

Tasks include, but are not limited to:

– Determine the requirements that the generic, access-technology-independent telecommunication network signalling control protocol architecture is intended to support. It is anticipated that these requirements will need to be periodically refined to reflecting the evolution of telecommunications and computer communication technologies taking into consideration the signalling control protocol architectures available from ITU‑T and other SDOs;

– Identify modifications and enhancements to the signalling control protocol architecture that will enable the architecture to meet the requirements of the emerging network architecture (including network virtualization, cloud computing, VoLTE/ViLTE, etc.);

– Identify enhancements to the signalling control protocol architecture in support of the telecommunication networks evolving to future networks and 5G/IMT-2020?

– Identify a set of physical interfaces for which interoperability and interworking between different network equipment is desirable and for which detailed signalling requirements need to be studied and control protocols need to be standardized;

– Identify security requirements in support of the overall security framework;

– study and prepare common guidelines containing different aspects related to network and service deployment strategies and scenarios to support the implementation of signalling protocols in networks and services, especially to support developing countries.

– Ensure communication and cooperation amongst study groups and forums related to signalling and protocol development for emerging networks.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### A.4 Relationships

Recommendations:

– Y.2012, Y.3015, Y.351

Questions:

– All Questions of SG11, especially Questions related to signalling architectures and protocols

Study Groups:

– SG13 on architecture of the existing and emerging networks

– SG15 on transport

– SG16 on multimedia services and coding

– SG17 on security framework

– SG20 on IoT and its applications

– ITU‑D SG1 and SG2

Standardization bodies:

– ATIS

– Broadband Forum

– CCSA

– ETSI

– IETF

– IEEE

– W3C

Draft Question B/11

Signalling requirements and protocols for service and application in emerging telecommunication environments

(Continuation of Question 2/11)

### B.1 Motivation

With the ever-increasing number of services and applications, demand has been continuously increasing to enhance the capabilities of next generation networks (NGN). Also new emerging services and applications, including cloud computing and video and voice over LTE (VoLTE/ViLTE), will require new signalling protocols to enable interconnection and proper communication in future networks (FNs) and 5G/IMT-2020. These emerging services and applications, as well as the evolution of existing services and applications, are introducing more and more requirements, which will certainly impact on the signalling and protocol standardization.

One of the objectives of NGN evolution as well as future networks and 5G/IMT-2020 is to support, in a secure fashion, wide range of services, from legacy telephony (e.g. SS7) and intelligent services to innovative services, encompassing audio, data, video broadcast and conversational services, streaming services, interactive games, third party applications, etc.

### B.2 Question

Study items to be considered include, but are not limited to:

– What are the suitable signalling protocols for implementation of different services and applications in emerging telecommunication environment?

– What new recommendations are required to specify signalling requirements and protocols to support services in telecommunication networks evolving to FNs and 5G/IMT-2020?

– What enhancements should be made in existing NGN-related recommendations to support emerging services and applications?

– What new recommendations should be made for cloud computing-related services and applications? What associated mechanisms are required to guarantee signalling and control security?

– What new recommendations are required to specify signalling requirements and protocols to support VoLTE/ViLTE?

– What enhancements should be made in existing series of ITU-T Recommendations describing signalling system number 7 (SS7) to ensure its security?

– What new signalling requirements and protocols are required to support services and/or applications of public interest, such as multimedia emergency communications, privacy, lawful interception, number portability, etc.?

### B.3 Tasks

Tasks include, but are not limited to:

– Develop signalling requirements and protocol profiles for enhanced NGN services and applications;

– Develop signalling requirements and protocols to implement different services and applications in emerging telecommunication environment;

– Develop signalling requirements and protocols to support future services in telecommunication networks evolving to FNs and 5G/IMT-2020;

– Develop signalling requirements and protocols to support cloud computing-related services and applications;

– Develop signalling requirements and protocols to support VoLTE/ViLTE;

– Develop new Recommendations or enhance the existing ITU-T Recommendations to ensure SS7 network’s security;

– Develop specifications for interworking between new and existing signalling and protocols;

– Develop signalling requirements and protocols for public interest;

– Enhance existing signalling protocols based on identified needs.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### B.4 Relationships

Recommendations

– Q.600-series, Q.700-series, Q.900-series, Q.1900-series, Q.2700-series, Q.2900-series, Q.3400-series, Q.3500-series and Q.3600-series

Questions

– All Questions of SG11

Study groups

– SG2 on network management aspects and emergency communications

– SG13 on service requirements, architecture, cloud computing and mobility aspects

– SG15 on smart grid

– SG16 on multimedia services and applications

– SG17 on security aspects

– SG20 on IoT and its applications

Standardization bodies

– ARIB

– ATIS

– Broadband Forum

– CCSA

– ETSI

– IETF

– IEEE

– TIA

– TTA

– TTC

Draft Question C/11

Signalling requirements and protocols for emergency telecommunications

(Continuation of Question 3/11)

### C.1 Motivation

In the emerging network environment, impacts of new emerging technologies, capabilities, and application services (e.g. video and voice over LTE (VoLTE/ViLTE), machine‑to-machine (M2M) communication, Internet of things (IoT), IMT-2020) on emergency telecommunications, including emergency telecommunication service (ETS), will need to be studied. In addition, it is needed to be studied how some of the emerging technologies and application services can be leveraged for the benefit of emergency telecommunications.

There is also a need to continue development of emergency telecommunications applications, e.g. voice, video, data signalling requirements and protocol enhancements.

The Question is responsible to ensuring the maintenance of existing ETS capabilities in SG11 Supplements and Recommendations, e.g. Q.931, Q.761, Q.762, Q.763, Q.764, Q.1902.1, Q.1902.3, Q.1902.4, Q.1950, Q.2630.3, Q.2931, Q-series Supplement 47, Q-series Supplement 49 for ETS specific information, Q-series Supplement 53, Q-series Supplement 57, Q-series Supplement 61, Q‑series Supplement 62, Q-series Supplement 63, and Q-series Supplement 68.

The Question will liaise with regional SDOs dealing with emergency telecommunications or capabilities required for their implementation. For example, 3GPP developments with respect to priority communications; IETF technical solution developments of congestion control techniques, all of which facilitate the implementations of priority communications for emergency telecommunication users; IEEE developments with respect to IEEE 802.11-series which apply to emergency telecommunication users.

### C.2 Question

Study items to be considered include, but are not limited to:

– What signalling requirements and protocol enhancements need to be defined in support of emergency telecommunications?

– What recommendations must be created in response to these requirements because the work is not covered by other SG Questions?

– What changes should be proposed to the overall plans maintained by the respective lead study groups, to provide for new capabilities, to provide better realization of capabilities already being standardized, or to remove obsolete content?

### C.3 Tasks

Tasks include, but are not limited to:

– analysis of emergency telecommunication capabilities to which priority has been assigned by their respective lead study group to determine the specific study tasks that must be added to the work plans of individual SG Questions;

– ensuring that the necessary communications take place at the technical level between the Questions of the study group, so that their work of realization of emergency telecommunication capabilities is effective, consistent, and complete;

– ensuring that the necessary communications take place at the technical level between the Questions of the study group, Questions of other study groups, and other groups defining standards relating to emergency telecommunications, as identified by the plans maintained by the respective lead study groups;

– reviewing capabilities associated with ETS and disaster relief communications specified in recommendations within the area of responsibility of the study group, to ensure that they are still relevant and effective;

– contributing to the development and maintenance of the plans which are the responsibility of the respective lead study groups for emergency telecommunications, including the proposal of new content when this seems appropriate;

– creation of supplements and recommendations defining signalling requirements and protocols in support of emergency telecommunications;

– creation of new recommendations dealing with emergency telecommunication when these fall outside the scope of other Questions of the study group;

An up-to-date status of work under this Question is contained in the SG 11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### C.4 Relationships

Recommendations

– The work that the Question oversees operates within the framework defined by Recommendation ITU‑T Y.1271 and Recommendation ITU‑T Y.2205.

Questions

– All Questions of SG11

Study groups

The Question will relate to the following Study Groups, especially with Questions specifically related to emergency telecommunications:

– ITU‑T SG2

– ITU‑T SG9

– ITU‑T SG13

– ITU‑T SG16

– ITU‑T SG17

– ITU‑T SG20

Standardization bodies

– ARIB

– ATIS

– IETF

– IEEE

– TIA

– TTA

– TTC

Draft Question D/11

Protocols for control, management and orchestration of network resources

(Continuation of Question 4/11 and 6/11)

### D.1 Motivation

During the 2013-2016 study period, ITU‑T SG11 has developed a series of resource control protocols for enhancing NGN capabilities. It is expected that the study of signalling requirements and protocols for control, management and orchestration of network resources continues and expands to new ITU-T study area such as ubiquitous sensor networks (USN), cloud computing networking, smart grid, Software-Defined Networking (SDN), Network Function Virtualization (NFV), International Mobile Telecommunication system 2020 (IMT-2020), future networks (FN), network virtualization, IPv6 transition, etc.

The behaviour of the traffic which is generated by new services, such as the service enabled by SDN, NFV, USN, etc., is very different from the traffic generated by existing NGN services. Accordingly, the architecture to control such new traffic may become more complicated. Bearer signalling requirements are closely related to resource control mechanisms and protocols.

With the emergence of various open source communities the lifecycle of development and testing will be much shortened. Accordingly, it is needed to consider more tight collaboration with these open source communities in order to promote the protocols to be implemented more efficiently. Accordingly, information model and data model-based signalling requirements and protocols are needed to be developed for further implementation using open source.

Recommendations in force for which the Question is responsible: Q.1970, Q.1990, Q.2630, Q.2761-2764, Q.2920, Q.2931 and Q.2932.1, Q.3150/Y.1416, Q.3151/Y.1417, Q.3300, Q.3301.1, Q.3302.1, Q.3303.0, Q.3303.1, Q.3303.2, Q.3303.3, Q.3304.1, Q.3304.2, Q.Suppl.51, Q.Suppl.67, Q.3316.

### D.2 Question

Study items to be considered include, but are not limited to:

– What signalling requirements and protocols are required for control, management, and orchestration of network resources involving new types of transport protocols and transport networks (e.g. USN, cloud computing networking, smart grid, FN, SDN, NFV, network virtualization and 5G/IMT-2020)?

– What new Recommendations are required to support bearer and resource control for new application areas such as unicast/multicast flows for IPTV service, home networking, and mobility?

– What new Recommendations are required to support handover control for mobility?

– What new Recommendations are required to support security of bearer and resource control and signalling?

– What new functional architecture and protocol enhancements are required to support bearer and resource control for services and applications of public interest, such as emergency call handling and disaster relief?

– What new Recommendations are required to support signalling of quality of service (QoS) information, traffic management?

– What enhancements to existing recommendations are required to provide energy savings directly or indirectly and efficient resource utilization in information and communication technologies or in other industries?

– What enhancements to new recommendations are required to provide such energy savings and efficient resource utilization?

– What new services can be identified for which the introduction of IPv6 is a necessary precondition?

– What new protocol procedures are required to implement the services identified above?

– What new Recommendations on information and data model are required to collaborate with emerging open source community?

### D.3 Tasks

Tasks include, but are not limited to:

– develop signalling requirements and protocols for new bearer services to support traffic of new applications based on future network architectures, including SDN, NFV, network virtualization, 5G/IMT-2020, etc.;

– develop signalling requirements and protocols for admission control coordination;

– develop signalling requirements and protocols for bearer and resource control and traffic management supporting unicast/multicast flows for IPTV service;

– develop signalling requirements and protocols for QoS signalling and traffic management;

– develop signalling requirements and protocols for bearer and resource control supporting home networking;

– develop signalling requirements and protocols to support handover for seamless session mobility;

– develop signalling requirements and protocols for interaction among bearer and resource control domains;

– develop specifications of interfaces to adjacent layers with relevant ITU‑T SG Questions/groups;

– enhance the existing bearer and resource control and signalling related Recommendations;

– Study and develop Recommendations to identify requirements for service dependent bearer control and signalling related mechanisms;

– identify services for which new protocol procedures are required for the transition to IPv6;

– develop new protocol procedures for services identified above;

– develop informational model and data model based signalling requirements and protocols for further implementation using open source.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### D.4 Relationships

Recommendations

– H.248, Q.1950, Y.1541, Y.1221, Y.2111, I.555, Q.1970, Q.1990, Q.263x-series, Q.29xx-series, Y.2121, Y.3300, Y.35xx-series

Questions

– A/11 on signalling and control architecture

– B/11 on application and session control and signalling

– F/11 on network attachment control and signalling

– O/11 on protocols for 5G/IMT-2020

Study groups

– SG15 on transport and ASON technologies, especially on transport network architectures and management and control of transport systems and equipment

– SG16 on multimedia aspects

– SG17 on security aspects

– SG13 on SDN, NFV, Cloud computing networking, network virtualization and 5G/IMT‑2020

Standardization bodies

– ETSI

– IEEE

– IETF

– TIA

Draft Question E/11

Protocols and procedures supporting services provided by broadband network gateways

(Continuation of Question 5/11)

### E.1 Motivation

The broadband network gateway (BNG) is the access point to the provider's IP network for various broadband services bearing by different access technologies, including xDSL, PON,Wifi and other emerging communication technologies suitable for IoT applications, etc. It is therefore a key point of control through which the customer services may be configured at the customer site and within the access network. With the evolution of access network and more strong demands for bearing multi-services, BNG's capabilities need to be enhanced to support the multi‑services and provide better QoS, reliability and security for bearing multi-services.

When introducing the software-defined networking (SDN) and network function virtualization (NFV) technology into access network, it is required to define new interfaces for open network capabilities, define new protocol to control underlay physical transfer devices, define new protocol interactive process to communicate between controller and transfer devices, define new protocols and procedures to improve reliability, resource utilization and flexibly distribute user's policies among the multiple BNGs . Also new protocol procedures are required to enable the rapid provisioning of services over customer IP networks, the services to the customer through multiple broadband network gateways and the open networking value added service (VAS).

### E.2 Question

Study items to be considered include, but are not limited to:

– What new protocols and procedures need to be specified to enable rapid provisioning of services over customer IP networks?

– What new protocols and procedures need to be specified to enable service to the customer through multiple broadband network gateways?

– What new protocols and procedures need to be specified to improve the resource utilization among the multiple BNGs?

– What new mechanisms, protocols and procedures need to be specified to distribute user's policies to control user's access and ensure user's QoS?

– What new protocols and procedures need to be specified to enable open networking value added service (VAS)?

– What new protocols and procedures need to be specified in BNG for bearing multi-services?

### E.3 Tasks

Tasks include, but are not limited to:

– Develop service descriptions for the services, which are not described in other SDOs, and define terms as needed;

– Develop new protocols and procedures to enable rapid provisioning of services over customer IP networks;

– Develop new protocols and procedures to enable service to the customer through multiple broadband network gateways;

– Develop new protocols and procedures to improve resource utilization among the multiple BNGs;

– Develop new protocols and procedures to enable the management and distribution of user's policies by SDN technologies;

– Develop new protocols and procedures to enable open networking value added service (VAS);

– Develop new protocols and procedures for bearing multi‑services on BNG;

– Development of methodology for security testing and test specification for security testing of Protocol procedures relating to services provided by broadband network gateways.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### E.4 Relationships

Recommendations

– Q, Y and H-series

Questions

– A/11, B/11 and D/11 on policy control

– C/11, F/11 and I/11

Study groups

– ITU‑T SG13 and other Study Groups working on NGN, FNs, 5G/IMT-2020 and broadband network gateways

Standardization bodies

– Broadband Forum

– IETF

Draft Question F/11

Signalling requirements and protocols for network attachment including mobility and resource management for future networks and 5G/IMT-2020

(Continuation of Question 7/11)

### F.1 Motivation

During the 2009-2016 study period, ITU‑T has conducted studies on signalling requirements and protocols for network attachment of next generation networks (NGN), focusing on the interfaces between network attachment control functions (NACF) and other entities, including resource and admission control functions (RACF), service control functions (SCF) and mobility management and control functions (MMCF). As identified in the start of 2009-2012 study period, mobility and identification issues in NACF have been introduced in stage two works, to enforce Question 7/11 to work for making revisions on NACF signalling protocols, while taking emerging issues into account during the 2013-2016 study period.

The future networks will involve a wider range of services(e.g. multimedia, sensing, big data, etc.) including convergence aspects, based on its network connectivity capability, to have multiple sources of heterogeneous networks(e.g. 5G/IMT-2020, LTE, 3G, WLAN, BLE, LPWA, etc.) and multiple devices (e.g. smart phone, tablet, laptop, sensors, CCTV etc.) of different capabilities in dynamic combination for collaboration. This is the so called "multi-device, multi-interface, multi‑connection services", and the network attachment functionality and protocols are expected to bridging the source and the device to realize it. Those will involve federated authentication and configuration for dynamic media handover, per-session allocation of IP addresses and terminal configuration, network access authorization checking, in-session modification of service connectivity, attachment control for fixed mobile convergence (FMC), and other functions. These procedures will have to be designed to take into account various protocols such as MMT, HLS, MPTCP, SCTP, PPP, DHCP, RADIUS and DIAMETER.

Maximizing service versatility and device capability also requires the maximization of resource utilization and awareness based control. Accordingly, the core aspects of future networks, such as virtualization and software-defined networking (SDN) for access network, must be considered. It is important to manage resources of network function virtualization (NFV) entities for orchestration such as installing, reconfiguration and customizing. Network attachment will evolve along with the introduction of future networks, while taking SG13 relevant studies into account.

In the future networks, which include SDN/NFV-enabled network, the centralized controller create a traffic path from one edge to the other edge of the network using southbound interface, such as OpenFlow, to program this traffic on each node in the path, including edge, aggregation, and core switches/routers. The first packet of the new traffic is sent to a centralized SDN controller which applies policy, computes the paths, and uses the southbound interface to direct this traffic into each node on the path. At the same time, NFV is a technology that utilizes virtualization technologies to manage network functions via software as opposed to having to rely on proprietary hardware to handle these functions.

Multi-interface, multi-connection streaming technologies regarding the heterogeneous networks (e.g. 5G/IMT-2020, LTE, WLAN, BLE, LPWA, etc.) potentially impact NACF; a huge number of peers can generate excessive signalling traffic simultaneously, short and frequent traffic from the machine devices could be unsuitable for traditional network attachment. Wider range of QoS categories could be required to allocate attachments, and multi-interface communication might need to support the access infrastructure. This aspect will impact NACF while providing new requirements to attachment functionalities and signalling protocols.

Recommendations in force: Q.3201, Q.3202.1, Q.3223, Q.3221, Q.3222, Q.3220, Q.3203, Q.3230, Q.3232, Q.3231, Q.3228, Q.3229, as well as Q.suppl.58.

### F.2 Question

Study items to be considered include, but are not limited to:

– What new and revised Recommendations are required to handle the revisions of NACF signalling protocol requirements?

– What new Recommendations are required to specify signalling requirements and protocols to support attachment for multi-device/interface/connection services?

– What associated mechanisms are required with attachment signalling to assure security for multi-device/interface/connection services?

– What control mechanisms are required with attachment signalling to support the mobility management and virtual resource management?

– What functional architecture and entities are required for network attachment to support future networks and 5G/IMT-2020 network, including SDN and NFV in access network?

– What functional architecture and entities are required to support multi-interface streaming services focusing on its access attachment signalling and protocols?

### F.3 Tasks

Tasks include, but are not limited to:

– Development of signalling requirements and protocols to support revisions of network attachment protocol requirements;

– Development of signalling requirements and protocols to support attachment procedures for multi-devices, multi-connections, and multi-interfaces for future networks (e.g., SDN, NFV) and 5G/IMT-2020 network ;

– Development of signalling requirements and protocols to support multi-interface streaming capability for its network attachment functions;

– Development of signalling requirements and protocols to support mobility management and resource management functions in access networks.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### F.4 Relationships

Recommendations

– Y-series Recommendations on requirements and architecture of FNs and 5G/IMT-2020 networks

– Q-series Recommendations on signaling requirements, protocols, measurement and testing

Questions

– Questions A/11, B/11 D/11, N/11, O/11.

Study groups

– SG13 on requirement and architecture of future networks and 5G/IMT-2020 networks, including mobility management and virtualization of resources

– SG16 on multimedia services over multi-device/interface/connection environments

– SG20 on M2M and IoT services and protocols

– SG17 on security and identity management

Standardization bodies

– ISO/IEC JTC1/WG7

– IETF

– OMA

Draft Question G/11

Combating counterfeit and stolen ICT equipment

(Continuation of Question 8/11)

### G.1 Motivation

The work of this Question during the last study period was mainly focused on the development of recommendations and technical reports on combating counterfeit ICT equipment. The growing usage of ICT Equipment in people’s daily lives in recent years resulted in increased problems related to the sale, circulation and use of counterfeit equipment in most markets as well as their adverse consequences for manufacturers, users and governments.

A considerable number of ICT equipment have been found to be counterfeit and have created concerns about national security, performance, quality of service delivery and revenue losses for all stakeholders. This has led to calls by ITU Member States, particularly those in developing countries to address the issue, especially the negative effects and to study any positive impact of measures taken.

In addition, the demand for services, resulting in the increased production and availability of ICT equipment has also seen the rise of stolen equipment. Some of these equipment are returned to the market after they have been tampered with and their identity modified, hence bypassing identity blacklisting solutions implemented by Governments and mobile network operators. Consequently, most countries around the world are not only engaged in combating counterfeit ICT equipment, but also have put in place measures against theft of ICT equipment and some of them to tackle stolen equipment with modified identities from reactivating on networks and to effectively manage the situation.

During the last study period, a technical report on “Counterfeit ICT Devices” was published by ITU-T and a number of new work items have been established.

Within the ITU and around the world, there have been debates as to whether or not conformance and interoperability testing could be one of the solutions to combat counterfeit ICT equipment. ITU Resolution 188 (Busan, 2014) of the Plenipotentiary Conference, invites Member States to take all necessary measures to combat counterfeit telecommunication/ICT devices. Any unique and persistent identifiers could allow the recognition of genuine products. This Question intends to explore all possibilities to address this problem and in particular its relations to products supply chain identity management, traceability, security, privacy and trust of people and networks.

Cooperation among ITU‑T study groups, between ITU‑T and ITU‑D as well as with external bodies outside the ITU (in particular with SDOs), will be required to gather a complete information and understanding on the subject including the organization of seminar/workshops in collaboration with stakeholders. Coordination among relevant organizations is also necessary to fulfil these tasks.

This Question will maintain the Technical Report on Counterfeit ICT equipment (December 2015).

### G.2 Question

Study items to be considered include, but are not limited to:

– What technical reports are needed to raise awareness of the problem of counterfeiting of ICT equipment and the dangers they pose?

– Can Conformity and interoperability testing and assessment schemes be used to combat counterfeit ICT equipment?

– What technologies may be used as a tool for combating counterfeit, tampered and stolen ICT equipment?

– What identity management frameworks are appropriate to combat counterfeit and stolen ICT equipment with their identity modified?

– What kind of Recommendations, technical reports and guidelines should be developed to combat ICT counterfeiting, tampering, modification and/or duplication of unique device identifiers?

- What kind of Recommendations, frameworks, technical reports and guidelines should be developed to assist ITU Members, in cooperation with ITU-D Sector, on combating counterfeit and mitigate the use of stolen ICT equipment?

– What ITU Recommendations are required to secure the supply chain management (from manufacturing, importation, distribution and marketing) to ensure traceability, security, privacy and trust of people, products and networks?

– In this field, what should be taken into account to provide energy savings, directly or indirectly, in ICTs or in other industries?

### G.3 Tasks

Tasks include, but are not limited to:

– develop Recommendations, technical reports and guidelines to assist ITU Members, in cooperation with ITU-D Sector, on combating counterfeit ICT equipment;

– develop Recommendations, technical reports and guidelines to address the problem of stolen ICT equipment and to assist the Member States, in cooperation with ITU-D Sector, in deploying solutions to and mitigate the use of stolen equipment;

– study any possible solutions, including identity management frameworks, to combat counterfeit and stolen ICT equipment with their identities modified;

– study any technologies that can be used as a tool for combating counterfeit and tampered ICT equipment;

– organize workshops and events across ITU regions in cooperation with the ITU-D Sector to promote the work of ITU-T in this field and involve stakeholders;

– study possible conformity and interoperability testing (C&I) solutions to combat counterfeiting of ICT equipment, taking into account the activities of the ITU-T CASC;

– study results achieved by various international standardization bodies and develop technical specifications to feed the standardization work of the Question.

An up-to-date status of work under this Question is contained in the SG 11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### G.4 Relationships

Resolutions

– Resolution 188 (Busan, 2014) of the Plenipotentiary Conference, on Combating counterfeit telecommunication/information and communication technology devices;

– Resolution 189 (Busan, 2014) of the Plenipotentiary Conference; on Assisting Member States to combat and deter mobile device theft;

– Resolution 79 (Dubai, 2014) of the WTDC, on the role of telecommunications/ICT in combating and dealing with counterfeit telecommunication/ICT;

– Resolution 76, WTSA, 2012 (Dubai) on Studies related to conformance and interoperability testing, assistance to developing countries, and a possible future ITU Mark programme.

Recommendations

– ITU-T X.1255, ITU-T X.660

Questions

– All Questions of SG11, especially Questions relating to control, signalling architectures, protocols, conformance and interoperability testing

Study groups

– ITU‑T SG2

– ITU-T SG3

– ITU-T SG5

– ITU‑T SG12

– ITU-T SG13

– ITU‑T SG17

– ITU‑T SG20

– ITU‑D SG1 and SG2

Standardization bodies

– ETSI

– IEC

– IEEE

– IETF

– ISO/IEC JTC 1

Draft Question H/11

Protocols supporting distributed content networking and information centric network (ICN) for FNs and 5G/IMT-2020, including end-to-end multi-party communications

(Continuation of Question 9/11)

### H.1 Motivation

The emerging multimedia services and applications require various functions and facilities. One of the key features of the multimedia applications that require multi-party communication capability is end-to-end multicast transport functions. Based on this motivation, a set of recommendations have been developed on frameworks and protocols for group management and end-to-end multicast communications over IP multicast as well as non-IP multicast network environments.

These standardization works have been progressing successfully in collaborative manner with ISO/IEC JTC 1/SC 6 to develop common text standards for both standardization bodies. The common text standards developed by collaborative team for multi-party communications include ITU-T X.606-series | ISO/IEC 14476-series, ITU-T X.607-series | ISO/IEC 14476-series, ITU-T X.608-series | ISO/IEC 14476-series, ITU-T X.602 | ISO/IEC 16513, ITU-T X.603-series | ISO/IEC 16512-series, ITU-T X.604-series | ISO/IEC 24793-series, ITU-T X.605 | ISO/IEC 13252. These Recommendations will need to be continuously maintained and updated if any further requirements from the market arise.

Various distributed and conversational multimedia services, such as multimedia telephony, telepresence, IPTV, smart TV, VoD, personal broadcasting service, network multimedia streaming and other emerging contents delivery services require efficient communications capability over various network environments. Distributed service networking protocols based on peer-to-peer (P2P) technology can be one of the useful solutions for supporting new emerging applications which require high performance and scalable communication capability.

During 2013~2016 study period, SG11 has been developing Recommendations on signalling architecture and protocols for managed P2P communications and end-to-end multimedia streaming services including video streaming. There is a need to continue development of such protocols in the next study period. The set of Recommendations developed will provide solutions and guidelines for the vendors and providers who want to implement and deploy content distribution and delivery services using P2P technologies.

Another important area of study by SG13 concerns requirements and architectural issues for future networks (FNs) and 5G/IMT-2020 networks. Therefore, it is required to develop protocols and mechanisms supporting content networking to meet requirements and architecture of FNs as well as 5G/IMT-2020 networks. Especially, multimedia content delivery and service networking related issues need to be initially focused on but the work should be extended to support other capabilities of FNs. Protocols and mechanisms for content discovery, distribution and delivery based on information centric network (ICN) technology will constitute very important emerging issues to support related requirement and capabilities of 5G/IMT-2020.

Another emerging issue for multi-party, multimedia communications is audio-visual streaming to support various services and applications including personal broadcasting. The efficient signalling protocols and mechanisms to support these emerging new audio-visual services including personal broadcasting services are urgently required by the market.

Recommendations under responsibility of this Question include: X.601, X.602, X.603, X.603.1, X.603.2, X.604, X.604.1, X.604.2, X.605, X.606, X.606.1, X.607, X.607.1, X.608 and X.608.1, X.609, X.609.1, X.609.2.

### H.2 Question

Study items to be considered include, but are not limited to:

– What maintenance or enhancements to existing Recommendations on end-to-end multicast need to be developed in response to new market requirements?

– What Recommendations need to be developed to provide protocols for content discovery, distribution and delivery to support requirements and functional architectures of legacy and FNs?

– What Recommendations need to be developed to provide protocols for content discovery, distribution and delivery based on ICN technology which are taken into account in 5G/IMT-2020 network environments?

– What Recommendations need to be developed to provide protocols to support managed peer-to-peer communications?

– What Recommendations need to be developed to provide protocols to support emerging multi-party, multimedia end-to-end communications services and applications in FNs and 5G/IMT-2020 network environments?

### H.3 Tasks

Tasks include, but are not limited to:

– maintenance and enhancement of Recommendations X.60x‑series, including common text standards for multi-party communications with ISO/IEC JTC 1 in response to new market requirements;

– developing Recommendations on protocols to support DSN;

– developing Recommendations on protocols to support contents discovery, distribution and delivery issues for legacy network and FNs;

 – developing Recommendations on protocols to support contents discovery, distribution and delivery issues based on information centric network (ICN) technology for 5G/IMT-2020 networks;

– developing Recommendations on protocols to support managed peer-to-peer communications;

– developing Recommendations on protocols to support end-to-end multi-party, multimedia communications including personal broadcasting services and applications.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### H.4 Relationships

Recommendations

– X-series Recommendations on multi-party, multimedia communications

– Y-series Recommendations and Supplements on IPTV, content delivery, DSN, FNs and 5G/IMT-2020

– H-series Recommendations on multimedia services and applications

– Q-series Recommendations on signalling, protocols, measurements and test specifications

Questions

– All Questions of SG11

Study groups

– ITU‑T SG13 on FNs, and 5G/IMT-2020

– ITU‑T SG16 on multimedia services and applications

Standardization bodies

– ISO/IEC JTC 1/SC 6

– IETF

Draft Question I/11

Service and networks benchmark testing, remote testing including Internet related performance measurements

(Continuation of Question 10/11 and 15/11)

### I.1 Motivation

The diversification of ICT network solutions, services and technologies causes some problems at the operator's networks, which relate to lack of complete standardized approaches how to estimate the performance of the vendor's service platforms, e.g. IP Multimedia subsystem (IMS), 5G/IMT‑2020.

In general, benchmarking is a common approach used for the measurement and testing of signalling parameters against the performance design objectives, which should help to provide the end to end service delivery and ensure network reliability.

Benchmarking in the case of 5G/IMT-2020 is not limited only to the transport layer and includes performance, quality and reliability of virtual platforms.

The issues of finding the values of network performance and productivity for services with required quality of service (QoS) is an important question for operators and their users.

For example, the Internet-related performance measurement systems, which are publically available on the Internet, do not provide reliable and comparable measurements. Beyond the lack of standardized metrics for Internet speed in ITU-T Recommendations, the obtained test results, which can be achieved by an existing testing method, may vary from the results achieved by other methods. Obviously, the testing results depend on the network segments which are used during e2e connection. Particularly, it is not possible to guarantee that the e2e connection is based on the telecom operator’s network only and does not include other network segments which may belong to other operators.

The development of a unified approach to Internet-related performance measurement is important for all ICT players (operators, regulators, the Internet community, and so on) and especially for operator’s customers.

For example, a standardized approach to measure the Internet-related performance on the operator’s network segments will support an open and trustable measurement which could be used to guarantee the customers with the requested performance indicated in their Service Level Agreements.

Also, this standardized approach will support the development of “*a regulation framework of delivering of ICT services with the guaranteed QoS and requested performance on the fixed and mobile data networks*” which is an ongoing project of ITU-T SG3 as well as other regulatory national, regional and international initiatives in this area.

In addition, one of the Pillars of the ITU Conformity and interoperability (C&I) programme is aimed at assisting the creation of regional testing centres. A testing centre may be implemented using cloud computing technologies that have the ability to enable a new concept of remote testing which may be named Testing as a Service (TAAS). This new ITU‑T research area will allow testing laboratories to identify the requirements and principles of the remote testing procedures.

The characteristics of 'adaptive networks' such as virtualization, self-organization, self-configuration, self-optimization, self-healing and self-learning offer huge advantages in future networks. While technologies such as network functions virtualization (NFV), self-organizing networks (SON), mobile edge computing (MEC) and autonomic network infrastructure (AFI) may not each exhibit all the characteristics, they do have one thing in common: they are all dynamic rather than static, reacting to dynamic traffic conditions, applications, service demands as well as to changes in the eco-system environment. The task is to develop a methodology (guide) that will extend current experience and testing approaches for 5G/IMT-2020.

NOTE − The QoS parameters and requirements are defined by ITU‑T SG12.

### I.2 Question

Study items to be considered include, but are not limited to:

– What kind of service platforms could be benchmark tested?

– What kind of testing scenarios could be used for benchmark testing?

– What type of traffic could be simulated for benchmark testing?

– What performance design objectives need to be benchmark tested?

– How performance design objectives impact the QoS?

– What kind of Internet measurements need to be standardized?

– What is the framework of Internet-related performance measurement?

– How to measure Internet-related performance within the fixed and mobile operator’s network?

– How to measure Internet-related performance beyond the fixed and mobile operator’s network (that is between users of the operator’s network and a particular Internet resource)?

– How to guarantee users of Operator’s network that the Internet-related performance indicated in their service level agreements (SLA) is achieved?

– What kind of parameters/technologies/services may be tested remotely?

– What procedures need to be developed to implement remote testing?

– What is the network architecture to be used for remote testing?

– Who can be involved in the remote testing and their roles?

### I.3 Tasks

Tasks include, but are not limited to:

– determine the types of service platforms, which could be benchmark tested;

– develop the testing scenarios for benchmark testing;

– identify the type of traffic to be simulated for benchmark testing;

– define the performance measurement objectives that need to be benchmark tested;

– determine how the performance measurement objectives impact the QoS;

– identify what kind of Internet measurements need to be standardized;

– develop a framework for Internet-related performance measurement;

– specify how to measure the Internet-related performance within the fixed and mobile operator’s networks;

– specify how to measure the Internet-related performance beyond the fixed and mobile operator’s network (that is between users of the operator’s network and a particular Internet resource);

– study how to guarantee to the users of Operator’s network that the Internet-related performances indicated in their service level agreements (SLA) is achieved;

– identify the parameters/technologies/services which may be tested remotely;

– develop the procedures needed to implement remote testing;

– specify the network architecture to be used for remote testing;

– research on roles and responsibilities of stakeholders who may be involved in the remote testing;

– develop a methodology (guide) that will extend current experiences and testing approaches to 5G/IMT-2020;

– development of procedures for 5G/IMT-2020 performance analysis, such as life cycle tests that include life cycle KPI’s, workload tests that include Service KPI’s and cloud event tests that include service KPI, resource KPI and Cloud native KPI.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### I.4 Relationships

Recommendations

– Q, Y, H, I, M, F, P, E and G-series

Questions

– J/11, K/11, M/11 and N/11

Study groups

– ITU‑T SG3 on policy issues

– ITU‑T SG12 on parameters and requirements of QoS

– ITU‑T SG13 on future networks architecture and Cloud computing

– ITU‑T SG16 on multimedia services and applications

– ITU-D SG2 on remote test centres

Standardization bodies

– ETSI

– IETF

Draft Question J/11

Protocols and networks test specifications; frameworks and methodologies

(Continuation of Question 11/11)

### J.1 Motivation

ITU-T Resolution 76 – Studies related to conformance and interoperability testing, assistance to developing countries, and a possible future ITU Mark programme – resolves that ITU-T Study Group 11 coordinates the sector’s activities related to the ITU Conformance and Interoperability (C&I) programme across all study groups and reviews the recommendations in the C&I business plan for the long term implementation of the C&I programme.

ITU T is producing a large number of Recommendations. To achieve interoperability and conformity, one of the important aspects of the ITU C&I Programme concerns the development and maintenance of testing frameworks and methodologies.

It is essential that conformance and interoperability testing methodologies used by all study groups engaged in testing are aligned and consistent with each other. To achieve interoperability on a global scale, the ITU-T Recommendations must be developed and maintained with conformance and interoperability in mind according to the relevant methodology.

The objective of conformance testing is to determine how completely and correctly the requirements stated in the Recommendation have been met by the implementation. On the contrary, in interoperability testing, the objective is to determine if two or more implementations of the same Recommendation communicate and correctly exchange information with each other. It is generally assumed that the conformity of an implementation have been tested prior to perform an interoperability testing assessment.

The best practice of the C&I programs of SDOs and forums (such as IECEE, IEEE ICAP, BBF, MEF, Bluetooth, Wi-Fi Alliance, WiMAX Forum, etc.) shows that a recognition procedure of testing laboratories (TL) is a possible way to ensure the credibility of their testing programme. In this regard, the development of ITU-T testing laboratory recognition procedure may allow ITU-T to provide developing countries a list of TLs which are competent in particular ITU-T Recommendations and continue studies on how to populate the [ITU Product Conformity Database](http://www.itu.int/net/itu-t/cdb/ConformityDB.aspx). This Question plans to collaborate with the ITU-T conformity assessment steering committee (CASC) which is mandated to explore further this recognition procedure.

Most of the telecom operators are implementing various emerging technologies and migrate from circuit-switched to the packet-switched networks, trying to provide their services using “all over IP” concept. As a result, operators face some issues which are in general related to the compatibility and interoperability of the used ICT equipment and the interconnection of IP-based networks (e.g. 4G, 5G), which, among others, will be used for roaming/nomadic services. For example, providing voice and video over LTE (VoLTE/ViLTE) roaming services pose some challenges to the operators due to the lack of agreed roaming procedures among stakeholders, various available VoLTE/ViLTE implementation scenarios and other not standardized issues (e.g. ENUM, emergency call, etc.). The conformance and interoperability testing of network-network interfaces (NNI) against ITU-T Recommendations may help operators to be sure that their VoLTE/ViLTE solutions are ready for interconnection. This interconnection approach may be also used for future packet-based networks, e.g. 5G/IMT-2020 and beyond.

This Question is responsible for Q.39xx-series (testing for next generation networks), Q.1912.x‑series, X.290-series (except X.292), X.Suppl.4, X.Suppl.5 and Z.500-series.

### J.2 Question

Study items to be considered include, but are not limited to:

– What are the general test procedures for conformance testing?

– What are the existing ITU-T Recommendations which include test suites?

– What extensions or enhancements to existing ITU-T Recommendations are required to achieve conformity and interoperability?

– Which technologies that are being developed for the ICT market require conformity and interoperability testing (taking into account market needs)?

– What new ITU-T Recommendations, Supplements or other provisions are required (if any) to define or revise the definitions of testing methodologies and frameworks?

– What types of protocols need a testing description?

– What is the testing framework of interconnection of IP-based networks (e.g. 4G, 5G)?

– What kind of test suites are needed for IP-based networks interconnection?

– What are the test specifications to be used on UNI and NNI, especially in emerging technologies?

### J.3 Tasks

Tasks include, but are not limited to:

– study the general test procedures for conformance testing;

– identify the existing ITU-T Recommendations which include test suites;

– identify the extensions or enhancements to existing ITU-T Recommendations which need to achieve conformity and interoperability;

– identify market driven ICT technologies, which require conformity and interoperability testing;

– study new ITU-T Recommendations, Supplements or other provisions which need to define or revise the definitions of testing methodologies and frameworks;

– identify types of protocols which need a testing description;

– develop the testing framework of interconnection for “all over IP” networks (e.g. 4G, 5G);

– develop test suites to be used for testing interconnection;

– develop test suites to be used for testing UNI and NNI of the emerging technologies.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### J.4 Relationships

Recommendations

– Q, Y, H, G, E, I, M, X, Z and F-series

Questions

– All ITU-T SG11 Questions

Study groups

– ITU‑T SG13 on future network architectures

– ITU‑T SG15 on core and access technologies

– ITU‑T SG16 on multimedia services, applications and e-health

– ITU-T SG17 on testing languages, including TTCN-3

– All other ITU-T SGs that are involved with C&I activities

– ITU‑D SG1 and SG2

Standardization bodies

– ETSI (especially ETSI TC INT and ETSI TC NTECH)

– IETF

– IEEE

Draft Question K/11

Testing of internet of things, its applications and identification systems

(Continuation of Question 12/11)

### K.1 Motivation

In a broad perspective, the Internet of things (IoT) can be perceived as a vision with technological and societal implications. From the perspective of technical standardization, IoT can be viewed as a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies. Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst maintaining the required privacy. The concepts of u1-society, u-network, u-city and others have been formulated in support of the worldwide perspective for IoT applications, services and technologies which may be enabled by radio frequency identification (RFID), ubiquitous sensor network (USN), machine-oriented communication (MOC), machine-to-machine (M2M) communication, smart device communication (SDC), Cloud-enabled IoT services (CIS), where RFID has been taken into account by ISO/IEC JTC 1/SC 31, sensor network technologies by ISO/IEC JTC 1/WG 7, USN by ITU‑T SG20, MOC by ITU‑T SG13, M2M by ITU‑T and ETSI, SDC by TIA, CIS by ETSI, OGC, and W3C.

NOTE 1 – "u" stands for "ubiquitous" which has been interpreted as a capability for any services at anytime and anywhere through any devices.

All these keywords have some similar use cases and imply some identical functions but consider some different technology views. The IoT may be seen as an umbrella for all these technology keywords.

Since the IoT has such broad concept and may be associated with various enabling technologies, interoperability issues shall be considered.

In general, IoT discovers various new types of connectivity which may be used in different customer-oriented applications (e.g. flying ubiquitous sensor networks (FUSN), IoT-based augmented reality (AR) and so on).

Also, taking into account the secure authentication mechanism used by IoT-based technologies and IoT identity, IoT may be considered as one of the tools to be used for combating counterfeiting.

Bearing in mind all above, the testing of the IoT technologies/applications are becoming more important today, especially in terms of interoperability of the IoT devices and trust of the used IoT systems.

### K.2 Question

Study items to be considered include, but are not limited to:

– What is the architecture of the model network for testing IoT and its applications?

– What types of IoT devices/tags/network elements may be tested on the model network?

– What types of tests are needed for IoT network elements?

– What are the testing scenarios to be used for testing IoT devices/tags on the model network?

– What test suites need to be developed for testing IoT identification/authentication procedures?

– How to test the security of the IoT identity?

– How to test IoT technical solutions to be used for combating counterfeiting?

– What new recommendations need to be developed for testing new types of connectivity triggered by IoT-based technologies (e.g. FUSN)?

– What new recommendations need to be developed in order to provide mechanisms to test the interoperability of the standard IoT protocols developed by ITU-T and other standard bodies?

– What new recommendations need to be developed in order to provide mechanisms to test the IoT applications, including the security and privacy aspects?

– What new recommendations need to be developed in order to provide mechanisms to test the interoperability, capability, and security of IoT identification systems?

### K.3 Tasks

Tasks include, but are not limited to:

– determine the architecture of the model network used for testing IoT and its applications;

– list the IoT devices/tags/network elements to be tested on the model network;

– develop the test suites to be used for testing IoT network elements on the model network;

– develop the test suites to be used for testing IoT devices/tags on the model network;

– develop the methodology for security testing and test specification related to security testing of IoT on the model network;

– develop test suites for testing IoT identification/authentication procedures;

– study how to test the security of the IoT identity;

– develop test suites for testing IoT technical solutions to be used for combating counterfeiting;

– develop new recommendations for testing new types of connectivity triggered by IoT-based technologies (e.g. FUSN);

– develop the methodology and/or mechanism for testing the interoperability of the standard IoT protocols developed by ITU-T and other standard bodies;

– develop the methodology and/or mechanism for testing the IoT applications, including the security and privacy aspects;

– develop the methodology and/or mechanism for testing the interoperability, capability, and security of IoT identification systems.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### K.4 Relationships

Recommendations

– Q, Y, H, I, M and F-series

Questions

– G/11

Study groups

– ITU‑T SG2

– ITU‑T SG13

– ITU‑T SG16

– ITU‑T SG17

– ITU‑T SG20

Standardization bodies

– ETSI

– IEEE

– IETF

– ISO/IEC JTC 1 (especially ISO/IEC JTC 1/WG 7, ISO/IEC JTC 1/SC 6, ISO/IEC JTC 1/SC 31, ISO/IEC JTC 1/WG 10)

– OGC

– TIA

– W3C

Draft Question L/11

Monitoring parameters for protocols used in emerging networks, including cloud computing and SDN/NFV

(Continuation of Question 13/11)

### L.1 Motivation

During the last Study Period the following emerging networks have been identified: future networks (FNs) ubiquitous sensor networks (USN), Internet of things (IoT), VoLTE/ViLTE-based networks, 5G/IMT-2020 etc. In order to reduce investment and operating costs, software defined networking (SDN) as well as network function virtualization(NFV) will be deployed in emerging networks to achieve the separation of control and service, control and bearer, hardware and software.

Cloud computing is also becoming the infrastructure of the cyber world. In this new emerging environment, operators and end-users should have capabilities in place to monitor whether the infrastructure they are using can support applications and services.

Standardization of monitoring system parameters for emerging networks, including cloud computing, will give operators, administrations and end-users monitoring information that is compatible and comparable across network operators, service providers and end-users. Moreover, it could be useful to help resolve points of disagreement.

In the 2017-2020 study period, ITU-T Recommendations for monitoring parameters should be developed, including but not limited to:

– monitoring subsystem to assess network performance;

– monitoring subsystem for cloud computing;

– monitoring subsystem for NFV;

– monitoring subsystem for SDN;

– monitoring subsystem for emerging networks, applications and services;

– monitoring subsystem to be used for security purposes.

### L.2 Question

Study items to be considered include, but are not limited to:

– What is the minimum parameter set, which need to be used to assess network performance?

– What is the minimum parameter set, which need to be used for monitoring cloud computing?

– What is the minimum parameter set, which need to be used for monitoring NFV?

– What is the minimum parameter set, which need to be used for monitoring SDN?

– What is the minimum parameter set, which need to be used for monitoring emerging networks, applications and services?

– What kind of parameters need to be used for monitoring security issues?

### L.3 Tasks

Tasks include, but are not limited to:

– develop a minimum parameter set and a methodology for its measurement, which need to be used to assess network performance;

– develop a minimum parameter set and a methodology for its measurement, which need to be used to assess cloud computing;

– develop a minimum parameter set and a methodology for its measurement, which need to be used to assess NFV;

– develop a minimum parameter set and a methodology for its measurement, which need to be used to assess SDN;

– develop a minimum parameter set and a methodology for its measurement, which need to be used to assess emerging networks, applications and services;

– study what kind of parameters need to be used for monitoring security issues.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### L.4 Relationships

Recommendations

– ITU‑T Q, Y, H, I, M, F and P-series

Questions

– A/11, B/11, D/11, F/11, I/11 and K/11

Study groups

– ITU‑T SG3 on policy and regulatory issues

– ITU‑T SG12 on QoS/QoE issues

– ITU‑T SG13 on FNs, SDN/NFV, cloud computing and emerging networks architecture

– ITU‑T SG16 on multimedia services and applications

– ITU‑T SG17 on security issues

– ITU‑T SG20 on IoT and its applications

Standardization bodies

– ETSI

– IEEE

– IETF

Draft Question M/11

Cloud interoperability testing

(Continuation of Question 14/11)

### M.1 Motivation

Cloud computing is a paradigm for enabling network access to a scalable and elastic pool of shareable physical or virtual resources with self-service provisioning and administration on-demand. Interoperability in the context of cloud computing includes the ability of a cloud service customer (CSC) to interact with a cloud service and exchange information according to a prescribed method and obtain predictable results. Typically, interoperability implies that the cloud service operates according to an agreed specification, one that is possibly standardized. The interoperability of cloud services can be categorized by the management and functional interfaces of the cloud services. Interoperability also includes the ability for one cloud service to work with other cloud services, either through an Inter-cloud provider relationship, or where a cloud service customer uses multiple different cloud services in some form of composition to achieve its business goals. Interoperability stretches beyond the cloud services themselves and also includes the interaction of the cloud service customer with the cloud service management facilities of the cloud service provider. The main purpose of interoperability testing is to evaluate the interaction between cloud service customer and cloud service provider to obtain predictable results, also to foster collaboration among different cloud services and consistency and interoperability of management interface across different services.

Cooperation with ITU‑T SG13 (the lead SG on cloud) is necessary. Testing activities will start after terminology and architecture are identified by SG13.

### M.2 Question

Study items to be considered include, but are not limited to:

– What new Recommendations should be developed regarding the internetworking between Cloud Service Customer (CSC) and Cloud Service Provider (CSP); CSP and CSP; and CSP and Management interface for interoperability testing?

– What new Recommendations should be developed with three cloud capability types (infrastructure, platform, and application) for cloud computing interoperability testing?

– What collaboration is necessary to minimize duplication of efforts with other SDOs?

– What collaboration is necessary to utilize open source community?

### M.3 Tasks

Tasks include, but are not limited to:

– developing Recommendations for cloud computing interoperability testing between CSC and CSP;

– developing Recommendations for cloud computing Interoperability testing between CSP and CSP;

– developing Recommendations for cloud computing interoperability testing between CSP and management interface;

– developing Recommendations for cloud computing interoperability testing with different cloud capabilities types (infrastructure capabilities type, platform capabilities type, and application capabilities type) or services.

– providing the necessary collaboration with external SDOs, consortia and forums and open source communities.

– maintenance and enhancement of the Recommendations for which the Question is responsible.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### M.4 Relationships

Recommendations

– Q, Y, H, I, M and F-series (especially Cloud computing and testing related Recommendations)

Questions

– A/11, B/11, C/11, D/11, F/11, I/11 and K/11

Study groups

– SG2 on Operational aspects

– SG12 on QoS/QoE

– SG13 on future network architecture and cloud computing

– SG16 on multimedia services and applications

– SG17 on security

Standardization bodies

– ISO/IEC JTC 1 (especially ISO/IEC JTC 1 SC 38)

– IETF

– ETSI

– IEEE

– OASIS

– NIST

– TM Forum

Draft Question N/11

Testing of emerging 5G/IMT-2020 technologies

(New Question)

### N.1 Motivation

The recent trends (such as 5G/IMT-2020, IoT technologies) may lead to changing the architecture of the existing networks that will require higher network performance.

The 5G-based technologies are basically created for developing super-dense heterogeneous networks which can be used for establishing sessions/connections among various types of terminal equipment such as mobile phones/tablets, sensor nodes, vehicular ad hoc networks (VANET) terminals, the medicine terminals and so on. Furthermore, the mesh networking principles which aimed at establishing peer-to-peer connection, e.g. device to device (D2D) connection, between two and more terminal devices without using network infrastructure (e.g. base stations) may be considered as a kind of scenario used in such heterogeneous networks. The development of a testing methodology and test suites for technologies used on the super-dense heterogeneous networks such as 5G/IMT-2020 networks is important in terms of interoperability and interconnection.

In addition, these kind of networks should form a platform for new services as tactile Internet services which will be made available in the near future. The tactile Internet service requires an end‑to-end delay of not more than 1 ms (ultra-low latency) and therefore will demand the modification and decentralization of the current network architecture. The development of the methodology and test suites of tactile Internet services is considered an important issue for 5G/IMT‑2020 networks.

### N.2 Question

Study items to be considered include, but are not limited to:

– What is the methodology for testing 5G/IMT-2020 technologies to be used in super-dense heterogeneous networks?

– What is the methodology for testing services which require ultra-low latency?

– What is the architecture of the model network to be used for testing 5G/IMT-2020 technologies?

– What is the architecture of the model network to be used for testing tactile Internet services?

– What are the test suites for testing 5G/IMT-2020 technologies to be used in super-dense heterogeneous networks?

– What are the test suites for testing tactile Internet services?

– What are the test suites for testing D2D connections/scenarios?

### N.3 Tasks

Tasks include, but are not limited to:

– determine the methodology for testing 5G/IMT-2020 technologies to be used in super-dense heterogeneous networks;

– determine the methodology for testing services which require ultra-low latency;

– determine the architecture of the model network to be used for testing 5G/IMT-2020 technologies;

– determine the architecture of the model network to be used for testing tactile Internet services;

– develop the test suites for testing 5G/IMT-2020 technologies to be used in super-dense heterogeneous networks;

– develop the test suites for testing tactile Internet services;

– develop the test suites for testing D2D connection/scenario.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### N.4 Relationships

Recommendations

– Q, Y, H, G, I, M, X, Z and F-series

Questions

– All ITU-T SG11 Questions

Study groups

– ITU‑T SG13 on future networks (e.g. SDN, NFV) and IMT-2020 networks

– All other ITU-T SGs that are involved with 5G/IMT-2020 technologies

Standardization bodies

– ETSI

– IEEE

– IETF

Draft Question O/11

Protocols supporting control and management technologies for 5G/IMT-2020

(New Question)

### O.1 Motivation

The development of Recommendations on the requirements, capabilities, and architecture for 5G/IMT‑2020 will be a very important subject of ITU-T SG13 in this study period. Accordingly, the protocols and mechanisms on key technologies to support the requirements and capabilities of 5G/IMT-2020 should be specified and provided urgently to meet the market requirements and to align SG11 work with the standardization effort of ITU-T SG13.

The key technologies to realize 5G/IMT-2020 include control for 5G/IMT-2020 network, orchestration, network slicing, network capability exposure, identification, device authentication, fixed/mobile convergence, network management of heterogeneous network environments, etc. Especially, protocols and mechanisms to control 5G/IMT-2020 network for low latency, low jitter and packet loss, guaranteed bandwidth, very large scale network, flexible connectivity and topology, resources assignment and sharing, and network slicing should be developed with high priority. Also, protocols and mechanisms on common management system for 5G/IMT-2020 accommodating both fixed and mobile networks are other important issues that have to be resolved in the future activities based on the outcomes of FG IMT-2020.

Currently, there is no Recommendation under responsibility of this Question.

### O.2 Question

Study items to be considered include, but are not limited to:

– What protocols and mechanisms need to be defined in response to gap analyses developed by relevant SDOs?

– What protocols and mechanisms need to be defined in support of service scenarios, requirements, capabilities, and architecture for 5G/IMT-2020 provided by ITU-T SG13 and other SDOs?

– What protocols and mechanisms need to be defined for the key technologies to realize 5G/IMT-2020 including control for transport network, orchestration, network slicing, network capability exposure, identification, device authentication, fixed/mobile convergence, network management of heterogeneous network environments, etc., for 5G/IMT-2020?

– How to utilize and guide the open source software, in collaboration with relevant bodies, related to key technologies of 5G/IMT-2020 to implement the developed Recommendations on the protocols and mechanisms?

### O.3 Tasks

Tasks include, but are not limited to:

– Development of Recommendations on protocols, including mechanisms, to control 5G/IMT-2020 transport network with enhanced features, supporting very large scale network, flexible connectivity and topology, fixed/mobile convergence, etc.;

– Development of Recommendations on protocols, including mechanisms, to support 5G/IMT-2020 by using technologies such as network slicing, resource virtualization, orchestration, etc.;

– Development of Recommendations on protocols, including mechanisms, for other key technologies of 5G/IMT-2020 including identification, device authentication, and network capability exposure, etc.;

– Development of Recommendations on protocols, including mechanisms, for common management system for 5G/IMT-2020;

– Development of Supplement, Technical Report, Guidelines on the best practices and implementations of protocols, including mechanisms, for 5G/IMT-2020 including open source software, in collaboration with relevant bodies.

An up-to-date status of work under this Question is contained in the SG11 work programme (http://itu.int/ITU-T/workprog/wp\_search.aspx?Q=xx/11).

### O.4 Relationships

Recommendations

– Y-series and Q-series

Questions

– QD, QF, QH, QM

Study groups

– ITU-T Study Group 2

– ITU-T Study Group 13

– ITU-T Study Group 15

– other SGs involved with 5G/IMT-2020 studies

Standardization bodies

– ITU-R

– ETSI

– IETF

– IEEE

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