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| PLENARY MEETING | **Document 13-E** |
|  | **August 2016** |
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| ITU-T Study Group 13 |
| Future networks including cloud computing, mobile and next-generation networks |
| REPORT of ITU-T SG13 TO THE WORLD TELECOMMUNICATION STANDARDIZATION ASSEMBLY (WTSA-16): PART I - GENERAL |

TSB NOTE − The report of Study Group 13 to WTSA-16 is presented in the following documents:

Part I: **Document 13** – General

Part II: **Document 14** – Questions proposed for study during the next study period 2017-2020

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# 1 Introduction

## 1.1 Responsibilities of Study Group 13

Study Group 13 was entrusted by the World Telecommunication Standardization Assembly (Dubai, 2012) with the study of 19 Questions in the area of Future networks, cloud computing, mobile communications and Next Generation Networks (NGN). Study Group 13 was designated the lead study group for future networks, mobility management and NGN and cloud computing. Per the request from the SG13, TSAG, at its meeting of June 2013, assigned Study Group 13 the lead study group role for the software-defined networking (SDN).

## 1.2 Management Team and Meetings held by Study Group 13

Study Group 13 met seven times in Plenary and four times in Working Partiesin the course of the study period (see Table 1) under the chairmanship of Mr Chaesub Lee (Republic of Korea) in
2013 – 2014 and by Mr Leo Lehmann (Switzerland) in 2015 – 2016 and occasionally in 2014. The SG13 Chairman was assisted by the Vice-Chairmen Mr Mohammed Al Ramsi (UAE), Mr Simon Bugaba (Uganda), Mr Jamil Chawki (France), Mr Yoshinori Goto (Japan), Mr Hyoung Jun Kim (Republic of Korea) (who joined the management team in 2015), Ms Hui-Lan Lu (USA), Mr Ahmed Raghy (Egypt), Mr Konstantin Trofimov (Russia), Mr Heyuan Xu (China) and Ms Rim Belhassine-Cherif (Tunisia) who replaced Mr Slaheddine Maaref from the end of 2013.

Changes in the chairmanship of the SG13 was due to the election of Mr Chaesub Lee as TSB Director at the ITU Plenipotentiary Conference 2014. Further to this at its meeting of April 2015 the SG13 convened the election of the new SG13 chairman and a new SG13 Vice-Chairman. As a result of these elections Mr Leo Lehmann (Switzerland) became the SG13 Chairman and
Mr Hyoung Jun Kim (Republic of Korea) joined the SG13 management team as a new SG13 Vice-Chairman. Before his election as SG13 chairman, Mr Leo Lehmann served as a Vice-chairman of the SG13 (2013 – 2014).

TABLE 1
Meetings of Study Group 13 and its Working Parties

| Meetings | Dates | Reports |
| --- | --- | --- |
| Meeting of Study Group 13 | Geneva, 18 February - 1 March 2013 | COM13 – R1 to R6 |
| Working Parties 1, 2 and 3/13 | Geneva, 28 June 2013  | COM13 – R7 to R9 |
| Meeting of Study Group 13 | Kampala, Uganda, 4-15 November 2013 | COM13 – R10 to R14 |
| Meeting of Working Parties 1, 2 and 3/13 | Geneva, 28 February 2014 | COM13 – R15 to R19 |
| Meeting of Study Group 13 | Geneva, 7-18 July 2014  | COM13 – R20 to R23 |
| Meeting of Working Parties 1 and 3/13 | Geneva, 21 November 2014  | COM13 – R24 to R25 |
| Meeting of Study Group 13 | Geneva, 20 April - 1 May 2015 | COM13 – R26 to R29 |
| Meeting of the Working Parties 1, 2 and 3/13 | Geneva, 23 July 2015 | COM13 – R30 to R32 |
| Meeting of Study Group 13 | Geneva, 30 November - 11 December 2015 | COM13 – R33 to R37 |
| Meeting of Study Group 13 | Geneva, 29 April 2016 | COM13 – R38 |
| Meeting of Study Group 13 | Geneva, 27 June - 8 July 2016 | COM13 – R39 to R43 |

In addition many Rapporteurs’ meetings took place during the study period in different locations and electronically.

TABLE 1-bis
Rapporteur meetings organized under Study Group 13 during the study period

| Dates | Place/Host | Question(s) | Event name |
| --- | --- | --- | --- |
| 2013-04-24to2013-04-29 | Seoul, Republic of Korea | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1214&Group=13) | Q1/13 meeting |
| 2013-04-29to2013-05-03 | E-Meeting | [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1215&Group=13) | Q11/13 meeting |
| 2013-04-29to2013-05-03 | E-Meeting | [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1216&Group=13) | Q16/13 meeting |
| 2013-05-15to2013-05-16 | Beijing, China  | [Q12/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1219&Group=13) | Q12/13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland  | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1220&Group=13) | Q1/13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1221&Group=13) | SG13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland | [Q3/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1222&Group=13) | Q3/13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland | [Q9/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1226&Group=13) | Q9/13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland | [Q10/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1227&Group=13) | Q10/13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland | [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1234&Group=13) | Q11/13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland | [Q12/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1235&Group=13) | Q12/13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland | [Q13/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1236&Group=13) | Q13/13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1237&Group=13) | Q14/13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland | [Q15/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1238&Group=13) | Q15/13 meeting |
| 2013-06-17to2013-06-27 | Geneva, Switzerland | [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1239&Group=13) | Q16/13 meeting |
| 2013-06-19to2013-06-21 | Geneva, Switzerland | [Q4/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1223&Group=13) | Q4/13 meeting |
| 2013-06-24to2013-06-27 | Geneva, Switzerland | [Q7/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1225&Group=13) | Q7/13 meeting |
| 2013-06-24to2013-06-28 | Geneva, Switzerland | [Q17/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1228&Group=13) | Q17/13 meeting |
| 2013-06-24to2013-06-28 | Geneva, Switzerland | [Q18/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1229&Group=13) | Q18/13 meeting |
| 2013-08-29to2013-09-06 | Seoul, Republic of Korea | [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=91&Group=13)[Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=92&Group=13) | Q11/13 and 16/13 Rapporteur group meetings |
| 2013-09-02to2013-09-04 | Seoul, Republic of Korea | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=93&Group=13) | Q14/13 Rapporteur group meeting |
| 2013-09-02to2013-09-06 | E-Meeting | [Q7/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1240&Group=13) | Q7/13 meeting |
| 2013-09-09 | Algiers, Algeria  | [Q5/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=90&Group=13) | Q5/13 Rapporteur group meeting |
| 2013-09-12 | Beijing, China  | [Q12/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=94&Group=13) | Q12/13 Rapporteur group meeting |
| 2013-09-12 | Beijing, China | [Q10/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=131&Group=13) | Q10/13 Rapporteur group meeting |
| 2013-09-16to2013-09-20 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=139&Group=13) | Q2/13 Rapporteur group meeting |
| 2013-09-26to2013-10-01 | Seoul, Republic of Korea  | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1241&Group=13) | Q1/13 meeting |
| 2013-12-20 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=365&Group=13) | Q14/13 Rapporteur group meeting |
| 2014-01-16 | Beijing, China | [Q12/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=366&Group=13) | Q12/13 Rapporteur group meeting |
| 2014-01-22to2014-01-24 | Tokyo, Japan | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=310&Group=13) | Q14/13 Rapporteur Group meeting |
| 2014-02-17to2014-02-28 | Geneva, Switzerland | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=311&Group=13)[Q3/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=351&Group=13)[Q4/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=313&Group=13)[Q5/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=315&Group=13)[Q6/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=312&Group=13)[Q8/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=316&Group=13)[Q9/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=322&Group=13)[Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=314&Group=13)[Q12/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=317&Group=13)[Q13/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=318&Group=13)[Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=319&Group=13)[Q15/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=320&Group=13)[Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=321&Group=13) | February 2014 Rapporteur group meetings  |
| 2014-02-19to2014-02-28 | Geneva, Switzerland | [Q10/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=323&Group=13)[Q17/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=324&Group=13)[Q18/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=325&Group=13) | February 2014 Rapporteur group meetings  |
| 2014-02-24to2014-02-28 | Geneva, Switzerland | [Q7/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=326&Group=13) | Q7/13 Rapporteur group meeting |
| 2014-02-26to2014-02-27 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=327&Group=13) | Q19/13 Rapporteur group meeting |
| 2014-03-25to2014-03-28 | Seoul, Republic of Korea | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=328&Group=13)  | Q1/13 Rapporteur group meeting |
| 2014-04-29 | Tunis, Tunisia  | [Q5/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=494&Group=13) | Q5/13 Rapporteur group meeting |
| 2014-04-30 | E-Meeting | [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=563&Group=13)  | Q11/13 Rapporteur group meeting |
| 2014-04-30 | E-Meeting | [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=564&Group=13)  | Q16/13 Rapporteur group meeting |
| 2014-05-06to2014-05-07 | E-Meeting | [Q18/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=543&Group=13) | Q18/13 Rapporteur group meeting |
| 2014-05-07 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=490&Group=13) | Q2/13 Rapporteur group meeting |
| 2014-05-08 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=491&Group=13) | Q2/13 Rapporteur group meeting |
| 2014-05-08 | E-Meeting | [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=570&Group=13) [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=571&Group=13)  | Q11/13 Rapporteur Group meeting |
| 2014-05-12 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=492&Group=13) | Q2/13 Rapporteur group meeting |
| 2014-05-14 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=493&Group=13) | Q2/13 Rapporteur group meeting |
| 2014-05-27 | E-Meeting | [Q12/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=545&Group=13) | Q12/13 Rapporteur group meeting |
| 2014-07-15to2014-07-16 | Geneva, Switzerland | [Q19/13](http://www.itu.int/en/ITU-T/jrg/ccm/Pages/default.aspx) | JRG-CCM meeting |
| 2014-09-16to2014-09-18 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=697&Group=13)  | Q2/13 Rapporteur Group meeting |
| 2014-09-17to2014-09-18 | E-Meeting | [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=674&Group=13)  | Q11/13 Rapporteur Group meeting |
| 2014-09-17to2014-09-18 | E-Meeting | [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=675&Group=13) | Q16/13 Rapporteur Group meeting |
| 2014-09-22to2014-09-23 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=678&Group=13)  | Q19/13 Rapporteur Group meeting |
| 2014-09-23to2014-09-25 | E-Meeting | [Q9/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=677&Group=13)  | Q9/13 Rapporteur Group meeting |
| 2014-09-23 | E-Meeting | [Q6/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=676&Group=13)  | Q6/13 Rapporteur Group meeting with Q4/11 |
| 2014-09-24to2014-09-25 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=698&Group=13)  | Q2/13 Rapporteur Group meeting |
| 2014-09-30to2014-10-02 | Seoul, Republic of Korea | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=679&Group=13)  | Q1/13 Rapporteur Group meeting |
| 2014-10-09 | E-Meeting | [Q12/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=696&Group=13)  | Q12/13 Rapporteur Group meeting |
| 2014-10-28 | E-Meeting | [Q6/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=680&Group=13)  | Q6/13 Rapporteur Group meeting with Q4/11 |
| 2014-11-11to2014-11-12 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=719&Group=13)  | JRG-CCM meeting |
| 2014-11-10to2014-11-21 | Geneva, Switzerland | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=710&Group=13) [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=699&Group=13) [Q3/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=701&Group=13) [Q4/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=703&Group=13) [Q6/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=700&Group=13) [Q7/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=715&Group=13)[Q10/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=702&Group=13) [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=704&Group=13) [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=707&Group=13) [Q15/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=708&Group=13) [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=709&Group=13) [Q17/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=711&Group=13) [Q18/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=712&Group=13) [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=713&Group=13) | November 2014 Rapporteur Group meetings  |
| 2015-01-27to2015-01-29 | Seoul, Republic of Korea | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=831&Group=13)  | Q1/13 Rapporteur Group meeting |
| 2015-01-29to2015-01-30 | E-Meeting | [Q18/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=832&Group=13)  | Q18/13 Rapporteur Group meeting |
| 2015-02-04to2015-02-13 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=836&Group=13)  | Q2/13 Rapporteur Group meeting |
| 2015-02-11to2015-02-13 | Warsaw, Poland  | [Q17/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=837&Group=13)  | Q17/13 Rapporteur Group meeting |
| 2015-02-13 | E-Meeting | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=718&Group=13)  | JRG-CCM meeting |
| 2015-03-02 | E-Meeting | [Q12/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=833&Group=13)  | Q12/13 Rapporteur Group meeting |
| 2015-03-02to2015-03-04 | Tokyo, Japan  | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=834&Group=13)  | Q14/13 Rapporteur Group meeting |
| 2015-03-18to2015-03-20 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=686&Group=13)  | JRG-CCM meeting |
| 2015-03-18 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=982&Group=13)  | Q14/13 meeting preparations conference call |
| 2015-03-20 | E-Meeting | [Q6/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=835&Group=13)  | Q6/13 and 4/11 Rapporteur Group meeting |
| 2015-04-02 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=983&Group=13)  | Q14/13 second preparatory teleconference |
| 2015-04-28to2015-04-29 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1025&Group=13)  | Joint Rapporteur Group on Cloud Computing Management (JRG-CCM) meeting |
| 2015-05-14 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1163&Group=13)  | Discussion on SDN and SAME |
| 2015-05-27 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1164&Group=13)  | Discussion on SDN and SAME |
| 2015-06-10 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1156&Group=13)  | Africa IoT requirements informal session |
| 2015-06-10 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1165&Group=13)  | Discussion on SDN and SAME |
| 2015-06-17 | E-Meeting | [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1168&Group=13)  | Q11/13 meeting |
| 2015-06-17 | E-Meeting | [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1169&Group=13)  | Q16/13 meeting |
| 2015-06-23 | E-Meeting | [Q6/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1170&Group=13)  | Q6/13 and Q4/11 meeting |
| 2015-07-13to2015-07-23 | Geneva, Switzerland | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1171&Group=13)  | Q1/13 meeting |
| 2015-07-13to2015-07-23 | Geneva, Switzerland | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1172&Group=13)  | Q2/13 meeting |
| 2015-07-13to2015-07-23 | Geneva, Switzerland | [Q3/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1173&Group=13)  | Q3/13 meeting |
| 2015-07-13to2015-07-23 | Geneva, Switzerland | [Q4/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1174&Group=13)  | Q4/13 meeting |
| 2015-07-13to2015-07-23 | Geneva, Switzerland | [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1180&Group=13)  | Q11/13 meeting |
| 2015-07-13to2015-07-23 | Geneva, Switzerland | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1185&Group=13)  | Q14/13 meeting |
| 2015-07-13to2015-07-23 | Geneva, Switzerland | [Q15/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1188&Group=13)  | Q15/13 meeting |
| 2015-07-13to2015-07-23 | Geneva, Switzerland | [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1189&Group=13)  | Q16/13 meeting |
| 2015-07-14to2015-07-17 | Geneva, Switzerland | [Q7/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1177&Group=13)  | Q7/13 meeting |
| 2015-07-14to2015-07-20 | Geneva, Switzerland | [Q18/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1191&Group=13)  | Q18/13 meeting |
| 2015-07-15to2015-07-16 | Geneva, Switzerland | [Q10/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1179&Group=13)  | Q10/13 meeting |
| 2015-07-15to2015-07-23 | Geneva, Switzerland | [Q17/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1190&Group=13)  | Q17/13 meeting |
| 2015-07-20to2015-07-22 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1192&Group=13)  | Q19/13 meeting |
| 2015-07-20to2015-07-22 | Geneva, Switzerland | [Q9/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1178&Group=13)  | Q9/13 meeting |
| 2015-07-20to2015-07-22 | Geneva, Switzerland | [Q6/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1176&Group=13)  | Q6/13 meeting |
| 2015-07-21 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1202&Group=13)  | JRG-CCM meeting |
| 2015-07-29 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1303&Group=13) | Discussion on SDN |
| 2015-08-05 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1304&Group=13)  | Discussion on SDN |
| 2015-08-19 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2304&Group=13)  | Discussion on SDN |
| 2015-09-01to2015-09-03 | Warsaw, Poland  | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1193&Group=13) | Q14/13 meeting |
| 2015-09-02 | E-Meeting | [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2306&Group=13)  | Q16/13 meeting |
| 2015-09-16to2015-09-18 | Busan, Republic of Korea | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2307&Group=13)  | Q1/13 meeting |
| 2015-09-22to2015-09-24 | Beijing, China  | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1203&Group=13)  | JRG-CCM meeting |
| 2015-09-22to2015-09-24 | Beijing, China | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1196&Group=13)  | Q19/13 meeting |
| 2015-10-06 | Tokyo, Japan  | [Q15/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1302&Group=13)  | Q15/13 Interim meeting |
| 2015-10-06to2015-10-07 | E-Meeting | [Q9/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2310&Group=13)  | Q9/13 meeting |
| 2015-10-07 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2327&Group=13) | Q14/13 meeting |
| 2015-10-08to2015-10-16 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1198&Group=13)  | Q2/13 meeting |
| 2015-10-17to2015-10-18 | Geneva, Switzerland | [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2311&Group=13)  | Q11/13 meeting |
| 2015-10-17to2015-10-18 | Geneva, Switzerland | [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2312&Group=13)  | Q16/13 meeting |
| 2015-10-22 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2400&Group=13)  | Discussion on SDN |
| 2015-10-27to2015-10-28 | E-Meeting | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2404&Group=13)  | JRG-CCM Editor’s meeting |
| 2015-10-29 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2401&Group=13)  | Discussion on SDN |
| 2015-11-01 | E-Meeting | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2305&Group=13) | JRG-CCM meeting |
| 2015-11-06 | E-Meeting | [Q6/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2314&Group=13)  | Q6/13 and Q4/11 meeting |
| 2015-11-09 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2315&Group=13)  | Q2/13 meeting |
| 2015-11-13 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2402&Group=13)  | Discussion on SDN |
| 2015-11-25 | E-Meeting | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2403&Group=13)  | Discussion on SDN |
| 2015-12-01to2015-12-09 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=1201&Group=13) | JRG-CCM meeting |
| 2016-01-20to2016-01-22 | Geneva, Switzerland | [Q19/13](http://www.itu.int/en/ITU-T/jrg/ccm/Pages/default.aspx) | JRG-CCM meeting |
| 2016-01-25to2016-01-27 | E-Meeting | [Q18/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2441&Group=13)  | Q18/13 meeting |
| 2016-01-25to2016-01-27 | Seoul, Republic of Korea | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2440&Group=13)  | Q1/13 meeting |
| 2016-02-01to2016-02-03 | E-Meeting | [Q18/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2443&Group=13)  | Q18/13 meeting |
| 2016-02-17to2016-02-19 | Beijing, China  | [Q17/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2444&Group=13)  | Q17/13 meeting |
| 2016-02-22to2016-02-24 | Tokyo, Japan  | [Q14/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2458&Group=13)  | Q14/13 meeting |
| 2016-02-24 | E-Meeting | [Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2459&Group=13)  | Q16/13 meeting |
| 2016-03-02 | Tokyo, Japan | [Q15/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2460&Group=13)  | Q15/13 meeting |
| 2016-03-03to2016-03-04 | E-Meeting | [Q2/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2445&Group=13)  | Q2/13 meeting |
| 2016-04-26to2016-04-27 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=2470&Group=13)  | JRG-CCM meeting |
| 2016-05-27to2016-05-31 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=4572&Group=13)  | JRG-CCM meeting |
| 2016-06-13to2016-06-14 | Busan, Republic of Korea  | [Q1/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=4574&Group=13)  | Q1/13 meeting |
| 2016-06-28to2016-07-06 | Geneva, Switzerland | [Q19/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=4575&Group=13) | JRG-CCM meeting |
| 2016-08-30\*to2016-09-01 | E-Meeting | [Q11/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=4668&Group=13)[Q16/13](http://www.itu.int/net/itu-t/lists/rgmdetails.aspx?id=4669&Group=13) | Q11/13 and Q16/13 interim meeting  |
| 2016-09-12\*to2016-09-14 | E-Meeting  | Q18/13 | Q18/13 meeting |
| 2016-09-14\*to2016-09-23 | Geneva, Switzerland | Q19/13 | JRG-CCM meeting |
| 2016-10-10,\*2016-10-11,2016-10-14 | E-Meeting | Q2/13 | Q2/13 meeting |
| 2016-10-12\*to2016-10-18 | E-Meeting  | Q11/13Q16/13 | Q11/13 and Q16/13 interim meeting |
| First half of October 2016 (date TBD)\* | Tokyo, Japan | Q15/13 | Q15/13 meeting |
| 2016-10-26\*to2016-10-28 | Busan, Republic of Korea | Q1/13 | Q1/13 meeting |

\* NOTE – Planned meetings at the time of preparation of this report.

# 2 Organization of work

## 2.1 Organization of studies and allocation of work

**2.1.1** At its first meeting of the study period, Study Group 13 decided to establish three working parties.

**2.1.2** Table 2 shows the number and title of each Working Party, together with the number of Questions assigned to it and the name of its Chairman and Vice-Chairman.

TABLE 2
Organization of Study Group 13

| Designation | Questions to be studied | Title of the Working Party | Chairmenand Vice-Chairmen |
| --- | --- | --- | --- |
| WP 1/13 | 1, 2, 3, 4, 5 | NGN-e and IMT | Mr Yoshinori Goto (NTT, Japan), Mr Heyuan Xu (China), Chairmen, andMr Simon Bugaba (Uganda), Mr Konstantin Trofimov (Russia), Vice-Chairmen |
| WP 2/13 | 6, 7, 8\*, 9, 10, 17, 18, 19 | Cloud Computing and Common Capabilities | Mr Jamil Chawki (Orange, France), Ms Hui-Lan Lu (Alcatel-Lucent, USA), Chairmen, andMr Mohammed Al Ramsi (UAE),Mr Ahmed Raghy (Egypt), Vice-Chairmen |
| WP 3/13 | 11, 12, 13, 14, 15, 16 | SDN and Networks of Future | Mr Hyoung Jun Kim (ETRI, Republic of Korea), Mr Leo Lehmann\*\* (Switzerland) in 2013 – 2014, Mr Gyu Myoung Lee (Republic of Korea) in 2015 – 2016, Chairmen, andMr Maurice Ghazal (Lebanon), Mr Alojz Hudobivnik (Slovenia), Vice-Chairmen |

Legend: \* - deleted during the reported study period.

 \*\* - resigned from this position.

In addition to that, Mr Naotaka Morita\* (NTT, Japan) served as SG13 mentor in 2013-2014 and Mr Marco Carugi (NEC, Japan) was SG13 mentor in 2014-2016.

**2.1.3** The Joint Coordination Activity on Cloud Computing (JCA-Cloud) was carried over from the previous study period. The first TSAG meeting in the reported study period approved its continuation with the revised terms of references.

In the middle of the reported study period (April 2015) Study Group 13 agreed to terminate its activities as accomplishing its mandate regarding coordination of the cloud computing studies across ITU-T study groups. Ongoing project on the maintenance of the cloud computing standards roadmap was entrusted to Question 17/13.

Subsequent TSAG meeting (June 2015) endorsed discontinuation of the JCA-Cloud.

**2.1.4** The two collaborative teams between WP6/13 and ISO/IEC/JTC 1/SC 38/WG 3 to explore the area of Cloud Computing overview and vocabulary (CT-CCVOCAB) and Cloud Computing reference architecture (CT-CCRA) were carried over from the previous study period. In the reported study period the WP2/13 was responsible for these collaboration projects. The groups terminated their activities in the middle of 2014 having exhausted their mandates.

**2.1.5** In line with WTSA-12 Resolution 54, WTSA-12 established the new regional group for Africa under the Study Group 13.At its first meeting in February - March 2013 Study Group 13 nominated the leadership to the new Study Group 13 Regional Group for Africa (SG13RG-AFR). The SG13RG-AFR will continue its activities in the next study period.

**2.1.6** TSAG, at its meeting of June 2013, agreed to establish a Joint Coordination Activity on Software-Defined Networking (JCA-SDN). It satisfied the request from SG13 about new group creation. Furthermore, in 2015 TSAG assigned Study Group 13 as the parent group to this activity. (Before 2015 the parent group was TSAG.) SG13 agreed to continue the activities of the JCA-SDN for one more year in the next study period.

**2.1.7** At its meeting in April – May 2015 Study Group 13 established a Focus Group on IMT-2020 with the objective of by fostering participation of all telecommunications’ and ICT experts to collect the information and develop the document with the gap analysis in standardization efforts in 5G (network part) area. Results of its work will be helpful for developing Recommendations for network aspects of IMT-2020. The Focus Group was in operation from May 2015 until the day this report was written. It has a mandate to continue its work until December 2016.

**2.1.8** The joint project between two ITU-T SGs, the Joint Rapporteur Group on Cloud Computing Management (JRG-CCM) was established by SG2 at its meeting of May 2014 and SG13 at its meeting of July 2014. It runs its activities till the end of the reported study period.

**2.1.9** Table 3 shows all the above groups along with their respective leaders.

TABLE 3
Other Groups

| Title of the Group | Chairman | Vice-Chairmen |
| --- | --- | --- |
| Focus Group on IMT-2020 (FG IMT-2020) | Mr Peter Ashwood-Smith, (Huawei Technologies, Canada) | Mr Yachen Wang, China Mobile, ChinaMr Nam-Seok Ko, ETRI, KoreaMr Hideo Imanaka\*\*, NTT, Japan, in 2015Mr Yoshinori Goto, NTT, Japan, in 2016Mr Luca Pesando, Telecom Italia, Italy |
| ITU-T SG13 Regional Group for Africa (SG13RG-AFR) | Mr Simon Bugaba, Uganda | Mr Ahmed Raghy\*\*, Egypt, in 2013 - 2014Ms Soumaya Benbartaoui, AlgeriaMr Brice Murara, Rwanda Ms Rim Belhassine- Cherif, Tunisia Telecom, Tunisia, in 2014 - 2016 |
| Joint Coordination Activity on Software-Defined Networking (JCA-SDN) | Mr Takashi Egawa (NEC, Japan) | Ms Ying Cheng (China Unicom, China) |
| Joint Rapporteur Group on Cloud Computing Management (JRG-CCM) | Co-Rapporteur (from SG13): Mr Mark Jeffrey\*\*, Microsoft, USA, in 2014-2016 Mr Emil Kowalczyk, Orange, Poland in 2016Co-Rapporteur (from SG2): Ms Wang Yanchuan, China Telecom  |  |
| Joint Coordination Activity on Cloud Computing (JCA-Cloud)\* | Ms Monique Morrow (Cisco, USA) |  |
| Collaborative Team WP 2/13 with ISO/IEC/JTC 1/SC 38/WG 3 for Cloud Computing Overview and Vocabulary (CT-CCVOCAB)\* | Mr Jamil Chawki (Orange, France) |  |
| Collaborative Team WP 2/13 with ISO/IEC/JTC 1/SC 38/WG 3 for Cloud Computing Reference Architecture (CT-CCRA)\* | Mr Jamil Chawki (Orange, France) |  |

Legend: \* - Closed in the reported study period.

 \*\* - Resigned from this position.

**2.2** **Study Group 13 organized and conducted seven workshops in the 2013-2016 study period:**

− Algiers, Algeria, 8 September 2013: [ITU Workshop on Standardization on IMT, M2M, IoT, Cloud Computing and SDN](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/standardization/201309/Pages/default.aspx)​

− Tunis, Tunisia, 28 April 2014: [Second Study Group 13 Regional Workshop for Africa on "Future Networks: Cloud Computing, Energy Saving, Security and Virtualization"](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/sg13/201404/Pages/default.aspx)

− Geneva, Switzerland, 14 November 2014: [ITU Workshop on "Cloud Computing Standards - Today and the Future"](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/cc/Pages/default.aspx)

− Livingstone, Zambia, 23-24 February 2015: [Third SG13 Regional Workshop for Africa on “ITU-T Standardization Challenges for Developing Countries Working for a Connected Africa”](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/standardization/022015/Pages/default.aspx)

− Geneva, Switzerland, 24 April 2015: [ITU Workshop on "Future Trust and Knowledge Infrastructure", Phase 1](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/24042015/Pages/default.aspx)

− Accra, Ghana, 14-15 March 2016: [Fourth SG13 Regional Workshop for Africa on "Future Networks for a better Africa: IMT-2020, Trust, Cloud Computing and Big Data"](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/standardization/201603/Pages/default.aspx)

− Geneva, Switzerland, 1 July 2016: [ITU Workshop on "Future Trust and Knowledge Infrastructure, Phase 2"](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/01072016/Pages/default.aspx)

In addition, members of the Study Group 13 leadership team and others participated in SG Leadership Assembly and multiple events organized by ITU-T and ITU-D as well as related events organized by others contributing to their success both as speaker, panellist and participants.

# 3 Questions and Rapporteurs

## 3.1 WTSA-12 assigned to Study Group 13 the 19 Questions listed in Table 4.

TABLE 4
Study Group 13 – Questions assigned by WTSA-12 and Rapporteurs

| Questions | Title of the Questions | WP | Rapporteur(Associate Rapporteur) |
| --- | --- | --- | --- |
| 1/13 | Service scenarios, deployment models and migration issues based on convergence services | 1/13 | Mr Heechang Chung |
| 2/13 | Requirements for NGN evolution (NGN-e) and its capabilities including support of IoT and use of software-defined networking | 1/13 | Mr Marco Carugi(Mr Qian Wang\*\*)(Mr Xiao Su) |
| 3/13 | Functional architecture for NGN evolution (NGN-e) including support of IoT and use of software-defined networking | 1/13 | Ms Yuan Zhang |
| 4/13 | Identification of evolving IMT systems and beyond | 1/13 | Mr Brice Murara |
| 5/13 | Applying IMS, IMT and other new technologies in developing country mobile telecom networks | 1/13 | Mr Simon Bugaba |
| 6/13 | Requirements and mechanisms for network QoS enablement (including support for software-defined networking) | 2/13 | Mr Taesang Choi |
| 7/13 | Deep packet inspection in support of service/application awareness in evolving networks | 2/13 | Mr Guosheng Zhu\*\*Mr David Dai |
| 8\*/13 | Security and identity management in evolving managed networks (including software-defined networking)  | 2/13 | Mr Igor Faynberg(Mr Xiao He) |
| 9/13 | Mobility management (including support for software-defined networking) | 2/13 | Mr Kyounghee Lee\*\*Mr Seng Kyoun Jo |
| 10/13 | Coordination and management for multiple access technologies (Multi-connection) | 2/13 | Mr Yachen Wang(Mr Oscar Lopez-Torres) |
| 11/13 | Evolution of user-centric networking, services, and interworking with networks of the future including Software-Defined Networking | 3/13 | Mr Gyu Myoung Lee |
| 12/13 | Distributed service networking | 3/13 | Mr Jin Peng\*\*Mr Chen Wei |
| 13/13 | Requirements, mechanisms and frameworks for packet data network evolution | 3/13 | Mr Jiguang Cao |
| 14/13 | Software Defined-Networking and Service-aware networking of future networks | 3/13 | Mr Takashi Egawa |
| 15/13 | Data-aware networking in future networks | 3/13 | Mr Alojz HudobivnikMr Daisuke Matsubara\*\*Mr Ved P. Kafle |
| 16/13 | Environmental and socio-economic sustainability in future networks and early realization of FN | 3/13 | Mr Gyu Myoung Lee(Mr Maurice Ghazal) |
| 17/13 | Requirements, ecosystem, and general capabilities for cloud computing and big data | 2/13 | Mr Kangchan Lee(Mr Youngshun Cai) |
| 18/13 | Cloud functional architecture, infrastructure and networking | 2/13 | Mr Mingdong Li\*\*Mr Dong Wang(Ms Orit Levin\*\*) (Mr Olivier Le Grand) |
| 19/13 | End-to-end Cloud computing management and security | 2/13 | Mr Richard Brackney\*\*\*Mr Mark Jeffrey (Ms Ying Cheng) |

Legend: \* - Closed in the reported study period.

 \*\* - Resigned from this position.

 \*\*\* - Passed away.

Study Group 13 revised the text of the Questions 2/13, 3/13, 5/13, 6/13, 8/13, 9/13, 11/13, 14/13 (twice), 17/13, and 19/13 in this study period. The above table shows the title of these Questions as they were in force by the end of the study period (time this report was developed).

## 3.2 The Questions listed in Table 5 have been adopted during this period.

TABLE 5
Study Group 13 – New Questions adopted and Rapporteurs

| Questions | Title of the Questions | WP | Rapporteur |
| --- | --- | --- | --- |
| None |  |  |  |

## 3.3 The Questions listed in Table 6 have been deleted during this period.

TABLE 6
Study Group 13 – Questions deleted

| Question | Title of Question | Rapporteurs | Results |
| --- | --- | --- | --- |
| 8/13 | Security and identity management in evolving managed networks (including software-defined networking) | Mr Igor Faynberg(Alcatel-Lucent, USA)Mr Xiao He(China Telecom), Associate rapporteur | The Q8/13 work items on cloud computing were passed over to the Q19/13; remaining work items of Question 8/13 were discontinued. |

# 4 Results of the work accomplished during the 2013-2016 study period

## 4.1 General

During the study period, Study Group 13 examined **1337** contributions and generated a large number of TDs and liaison statements.

On the basis of these documents and of an extremely large number of temporary documents, Study Group 13:

– drew up 82 new Recommendations;

– amended/revised 5 existing Recommendations;

– developed 10 Supplements;

– produced one technical report and four technical papers.

## 4.2 Highlights of achievements

The main results achieved on the various Questions assigned to Study Group 13 are briefly summarized below. Formal replies to the Questions are given in a synoptic table in paragraph 5 of this document.

**NGNe**

The fundamental Recommendation developed by the Study Group 13 on NGN evolution was a new Recommendation ITU-T Y.2340 “Overview of Next Generation Network evolution phase 1”. It was consented at the last SG13 meeting in the reported study period.

New elements covering the support of sensor control networks and related applications were developed as part of NGN evolution work.

SG13 developed Recommendations on requirements and capabilities in support of the network intelligence capability enhancement (NICE), Recommendation ITU-T Y.2301; functional architecture for NICE, Recommendation ITU-T Y.2302; requirements and capability framework for NICE implementation making use of SDN technologies, Recommendation ITU-T Y.3321; requirements for virtualization of control network entities in NGN evolution, Recommendation ITU-T Y.2320; and some more in the NGN evolution domain.

SG13 contributed to the environment protection by developing the Supplement on greenhouse gas monitoring service over NGN and a number of Recommendations on energy saving solutions to be applied to the current and future networks (Recommendation ITU-T Y.3022 on the ways to measure the energy in network, Recommendation ITU-T Y.2064 on energy saving using smart objects in home networks, Recommendation ITU-T Y.2070 on requirements and architecture of the home energy management system and home network services and Recommendation ITU-T Y.2071 on framework of a micro energy grid).

SG13 developed the reference model for the actualized convergence service for agriculture, Recommendation ITU-T Y.2238 “Overview of Smart Farming based on networks” (06/2015), that defines service capabilities for Smart Farming for agriculture as a solution to cope with various problems caused by severe conditions and provides a reference model for Smart Farming, and identifies network capabilities required to produce an infrastructure which supports Smart Farming.

**IPTV**

In the technical area of IPTV standardization the new Recommendation Y.1903 (01/2014) “Functional requirements of mobile IPTV” was approved complementing the well-recognized Recommendations of Y.1900-series on IPTV.

**Future Networks**

Future networks were developed as framework of data-aware networking, Recommendation ITU-T Y.3033; requirements of networks virtualization, Recommendation ITU-T Y.3012; socio-economic assessment of future networks by tussle analysis, Recommendation ITU-T Y.3013; functional architecture of network virtualization for future networks, Recommendation ITU-T Y.3015, and some others.

Distributed service networking (DSN) related study was conducted as a part of future network activities and led to the development of several Recommendations such as Recommendation ITU-T Y.2082 on DSN relay functions, Recommendation ITU-T Y.2083 on multimedia telephony over DSN, Recommendation ITU-T Y.2084 on DSN content distribution functions and Recommendation ITU-T Y.2085 on DSN service routing.

Study Group 13 continued the development of the concept of smart ubiquitous networks (SUN) more in depth by means of 5 Recommendations covering the overview, context and content awareness framework and traffic control and resource management functions. SUN is seen as a short term realization of Future Networks.

**Mobile Networks**

Study Group 13 continued the practice from the former study period of referencing of core network specifications from the IMT-2000 family member “ANSI-41 evolved Core Network with cdma2000 Access Network” and “GSM evolved UMTS Core Network” family member in the ITU-T Recommendations of Q.174X-series.

Different aspects of mobility management were developed and approved in Recommendation ITU-T Y.2813 “Mobility management framework for applications with multiple devices” (02/2016), Supplement on N-screen service scenarios for fixed mobile convergence and technical paper on this technical topic.

SG13 daughter group, Focus Group on IMT-2020, delivered the gap analysis document (overview of technical developments at the network part of the 5G networks) with 85 technical areas for application of the standardization efforts in the future.

SG13 launched the new work on requirements of IMT-2020 fixed-mobile convergence; mobile network slicing orchestration and management; and requirements and architectural aspects of multi-layer, multi-domain, and multi-technology orchestration in large-scale SDN.

**Internet of Things (IoT)**

Study Group 13 continued following the Internet of Things Global Standardization Initiative (IoT-GSI) where some of its Questions worked closely with relevant Questions of Study Groups 11 and 16 to develop the ITU-T Recommendations on IoT.

Based on the successful grounds set up in the previous study period by means of fundamental Recommendation ITU-T Y.2060 “Overview of Internet of Things”, from the beginning of the reported study period SG13 continued its developments on IoT. That resulted in accomplishing the work on the 12 new Recommendations covering common requirements of IoT (Recommendation Y.2066), functional framework and capabilities of IoT (Recommendation ITU-T Y.2068), semantics based requirements and framework of the IoT (Recommendation ITU-T Y.2076), Common requirements and capabilities of a gateway for Internet of things applications, (Recommendation ITU-T Y.2067), and some others.

E-health monitoring services were also addressed via the development of service and capability requirements for e-health monitoring services (Recommendation ITU-T Y.2065) and capability framework for e-health monitoring services (Recommendation ITU-T Y.2075).

FFurther to the TSAG (June 2015 meeting) decision on creation of a new Study Group for IoT (SG20), SG13 concluded its activities on IoT, having approved 5 last Recommendations on this topic between middle 2015 and early 2016. The rest on the work was left for the SG20. In total by two instalments SG13 passed over to the SG20 18 work items to be further developed as Recommendations.

**Cloud Computing**

The work on cloud computing continued from the previous study period. In particular, SG13 drew the framework, high-level requirements, infrastructure requirements and end to end cloud computing resource management.

The two common texts with ISO/IEC JTC 1/SC 38/WG 3 on cloud computing overview and vocabulary (Recommendation ITU-T Y.3500 | International standard ISO/IEC 17788) and on cloud computing reference architecture (Recommendation ITU-T Y.3502 | International standard ISO/IEC 17789) were seen as a very successful collaboration effort.

The above were complemented by Recommendations on cloud computing infrastructure requirements, framework of inter-cloud, Desktop as a Service requirements, functional requirements of Network as a Service and of Infrastructure as a Service and functional architecture for Desktop as a Service. In addition, as a result of a joint Rapporteur group effort with ITU-T SG2, a Recommendation on the overview of end-to-end cloud computing management was finalized.

SG13 started working on Recommendations for requirements for containers and micro-services, functional requirements of physical machine, requirements for cloud service brokerage, functional architectures of Network as a Service and inter-cloud, and distributed cloud overview and high-level requirements.

SG13 maintained up to date the cloud computing roadmap.

**Big Data**

In the reported study period SG13 started looking at the big data technical topic from the cloud computing perspective. It approved new Recommendation Y.3600 “Big data – cloud computing based requirements and capabilities” (11/2015) dealing with the requirements, capabilities and use cases of cloud-based Big Data as well a high-level ‘system context’ view and its relationships with other entities. Also, the big data standardization roadmap, a document that collects at one place the standardization efforts on big data (standardization bodies, their activities and deliverables), was agreed in July 2016 for publication as Supplement 40 to Y.3600-series Recommendations.

Work is in progress on functional architecture of Big Data as a Service (BDaaS), Big data exchange framework and requirements, and requirements for data provenance.

**Software-Defined Networking (SDN)**

SG13 developed the first 6 Recommendations on SDN. Those include standards on SDN framework, functional requirements and functional architecture for SDN as well as requirements for applying formal methods to software-defined networking.

JCA-SDN maintains the roadmap with the SDN related studies and standards developed all over the world.

**Trust in ICT**

Taking from the four objectives and associated 12 design goals for the future networks, set up in Recommendation ITU-T Y.3001 (social and economic awareness, in particular), SG13 started elaborating the topic of trust since 2014 by initiating the work on trusted environment in ICT, definition of trust in the context of ICT and basic principles of application of trust to telecommunication environment. By the end of the study period, a technical report on Trust provisioning for future ICT infrastructures and services was developed and agreed. Based on its findings the new work on overview of trust provisioning in ICT infrastructures and services, framework of trustworthy smart media services, trust architectural framework, trustworthy communication network and trustworthy device selection was agreed at the June - July 2016 SG13 meeting.

Two dedicated workshops on Trust “[ITU Workshop on "Future Trust and Knowledge Infrastructure](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/01072016/Pages/default.aspx)” (phases I and II) took place in Geneva on 24 April 2015 and 1 July 2016.

# 5 List of Recommendations approved during the study period

The list of new and revised Recommendations approved during the study period is found in Table 7.

TABLE 7
Study Group 13 – Recommendations approved

| Recommendation | Approval | Status | TAP/AAP | Title |
| --- | --- | --- | --- | --- |
| Q.1741.8 | 13/04/2013 | In force | AAP | IMT-2000 references to Release 10 of GSM-evolved UMTS core network |
| Q.1741.9 | 29/06/2015 | In force | AAP | IMT-2000 references to Release 11 of GSM evolved UMTS core network |
| Q.1742.10 | 13/04/2013 | In force | AAP | IMT-2000 References (approved as of 31 December 2011) to ANSI-41 evolved Core Network with cdma2000 Access Network |
| Q.1742.11 | 13/04/2014 | In force | AAP | IMT-2000 References (approved as of 31 December 2012) to ANSI-41 evolved Core Network with cdma2000 Access Network |
| Y.1271 | 14/10/2004 | Superseded | TAP | Framework(s) on network requirements and capabilities to support emergency telecommunications over evolving circuit-switched and packet-switched networks |
| Y.1271 Revised | 18/07/2014 | In force | TAP | Framework(s) on network requirements and capabilities to support emergency telecommunications over evolving circuit-switched and packet-switched networks |
| Y.1903 | 13/01/2014 | In force | AAP | Functional requirements of Mobile IPTV |
| Y.2028 | 29/06/2015 | In force | AAP | Intelligent access selection in multi-connection |
| Y.2029 | 29/06/2015 | In force | AAP | A multi-path transmission control in multi-connection |
| Y.2040 | 13/02/2016 | In force | AAP | Flow-based service continuity in multi-connection |
| Y.2064 | 13/01/2014 | In force | AAP | Energy saving using smart objects in home networks |
| Y.2065 | 22/03/2014 | In force | AAP | Service and capability requirements for e-health monitoring services |
| Y.2066 | 22/06/2014 | In force | AAP | Common requirements of Internet of Things |
| Y.2067 | 06/06/2014 | In force | AAP | Common requirements and capabilities of a gateway for Internet of Things applications |
| Y.2068 | 22/03/2015 | In force | AAP | Functional framework and capabilities of the Internet of Things |
| Y.2070 | 13/01/2015 | In force | AAP | Requirements and architecture of home energy management system and home network services |
| Y.2071 | 29/09/2015 | In force | AAP | Framework of micro energy grid |
| Y.2074 | 13/01/2015 | In force | AAP | Requirements for Internet of Things devices and operation of Internet of Things applications during disaster |
| Y.2075 | 29/09/2015 | In force | AAP | Capability framework for e-health monitoring services |
| Y.2076 | 13/02/2016 | In force | AAP | Semantics based requirements and framework of the Internet of Things |
| Y.2077 | 13/02/2016 | In force | AAP | Requirements of the Plug and Play capability of the Internet of Things |
| Y.2078 | 13/02/2016 | In force | AAP | Application support models of the Internet of Things |
| Y.2082 | 13/08/2013 | In force | AAP | Distributed Service Networking Relay Functions |
| Y.2083 | 29/08/2014 | In force | AAP | Multimedia telephony over Distributed Service Networking |
| Y.2084 | 13/06/2015 | In force | AAP | Distributed Service Networking content distribution functions |
| Y.2085 | 13/06/2016 | In force | AAP | Distributed Service Networking Service Routing |
| Y.2222 | 13/04/2013 | In force | AAP | Sensor Control Networks and related applications in Next Generation Network environment |
| Y.2238 | 13/06/2015 | In force | AAP | Overview of Smart Farming based on networks |
| Y.2239 | 13/02/2016 | In force | AAP | Requirements for Information Control Networks and related applications |
| Y.2253 | 13/01/2014 | In force | AAP | Capabilities for multi-connection to support streaming service |
| Y.2254 | 13/01/2014 | In force | AAP | Capabilities of multi-connection to support enhanced Multimedia Telephony (eMMTel) services |
| Y.2301 | 13/08/2013 | In force | AAP | Network Intelligence Capability Enhancement - Requirements and Capabilities |
| Y.2302 | 29/08/2014 | In force | AAP | Functional Architecture for Network Intelligence Capability Enhancement (NICE) |
| Y.2303 | 13/01/2015 | In force | AAP | Network Intelligence Capability Enhancement - Awareness functional architecture |
| Y.2320 | 29/09/2015 | In force | AAP | Requirements for Virtualization of Control Network entities in Next Generation Network evolution |
| Y.2616 | 29/08/2014 | In force | AAP | Interworking mechanisms in public packet telecom data network (PTDN) |
| Y.2617 | 13/06/2016 | In force | AAP | QoS guaranteed mechanisms and performance model for Public packet Telecommunication Data Network (PTDN) |
| Y.2705 | 01/03/2013 | In force | TAP | Minimum Security Requirements for Interconnection of Emergency Telecommunications Service (ETS) |
| Y.2723 | 15/11/2013 | In force | TAP | Support for OAuth in next generation networks |
| Y.2724 | 15/11/2013 | In force | TAP | Framework for supporting OAuth and OpenID in next generation networks |
| Y.2725 | 18/07/2014 | In force | TAP | Support of OpenID in Next Generation Networks |
| Y.2771 | 18/07/2014 | In force | TAP | Framework for deep packet inspection |
| Y.2772 | 29/04/2016 | In force | TAP | Mechanisms for the network elements with support of Deep Packet Inspection |
| Y.2813 | 13/02/2016 | In force | AAP | Mobility management framework for applications with multiple devices |
| Y.3012 | 13/04/2014 | In force | AAP | Requirements of network virtualization for Future Networks |
| Y.3013 | 29/08/2014 | In force | AAP | Socio-economic Assessment of Future Networks by Tussle Analysis |
| Y.3014 | 13/02/2016 | In force | AAP | Resource Control and Management Function for Virtual Networks for Carriers (vRCMF) |
| Y.3015 | 06/04/2016 | In force | AAP | Functional architecture of network virtualization for future networks   |
| Y.3022 | 13/08/2013 | Superseded | AAP | Energy measurement of networks |
| Y.3022 Revised | 13/08/2014 | In force | AAP | Revision to Y.3022: Measuring energy in networks |
| Y.3032 | 13/01/2014 | In force | AAP | Configurations of node identifiers and their mapping with locators in future networks |
| Y.3033 | 13/01/2014 | In force | AAP | Framework of Data Aware Networking for Future Networks |
| Y.3034 | 13/06/2015 | In force | AAP | Architecture for interworking of heterogeneous component networks in ID/locator split-based future networks |
| Y.3035 | 13/06/2015 | In force | AAP | Service Universalization on Future Networks |
| Y.3041 | 13/04/2013 | In force | AAP | Smart Ubiquitous Networks – Overview |
| Y.3042 | 13/04/2013 | In force | AAP | Smart Ubiquitous Networks - Smart Traffic Control and Resource Management Functions |
| Y.3043 | 13/08/2013 | In force | AAP | Smart ubiquitous networks - Context awareness framework |
| Y.3044 | 13/08/2013 | In force | AAP | Smart ubiquitous networks - Content awareness framework |
| Y.3045 | 13/01/2014 | In force | AAP | Smart Ubiquitous Networks - Functional architecture of content delivery |
| Y.3300 | 06/06/2014 | In force | AAP | Framework of Software-Defined Networking |
| Y.3320 | 29/08/2014 | In force | AAP | Requirements for applying formal methods to software-defined networking |
| Y.3321 | 13/06/2015 | In force | AAP | Requirements and capability framework for NICE implementation making usage of software defined networking technologies |
| Y.3500 | 13/08/2014 | In force | AAP | Cloud computing - Overview and Vocabulary |
| Y.3501 | 22/05/2013 | Superseded | AAP | Cloud computing framework and high-level requirements |
| Y.3501 Revised | 13/06/2016 | In force | AAP | Cloud computing - Framework and high-level requirements |
| Y.3502 | 13/08/2014 | In force | AAP | Cloud computing - reference architecture |
| Y.3503 | 22/05/2014 | In force | AAP | Requirements for desktop as a service |
| Y.3504 | 13/06/2016 | In force | AAP | Functional Architecture for Desktop as a Service |
| Y.3510 | 22/05/2013 | Superseded | AAP | Cloud computing infrastructure requirements |
| Y.3510 Revised | 13/02/2016 | In force | AAP | Cloud computing infrastructure requirements |
| Y.3511 | 09/03/2014 | In force | AAP | Framework of inter-cloud computing |
| Y.3512 | 29/08/2014 | In force | AAP | Cloud computing - Functional requirements of Network as a Service |
| Y.3513 | 29/08/2014 | In force | AAP | Cloud computing - Functional requirements of Infrastructure as a Service |
| Y.3520 | 22/06/2013 | Superseded | AAP | Cloud computing framework for end to end resource management |
| Y.3520 Revised | 29/09/2015 | In force | AAP | Cloud computing framework for end to end resource management |
| Y.3521/M.3070 | 15/03/2016 | In force | AAP | Overview of end-to-end cloud computing management |
| Y.3600 | 06/11/2015 | In force | AAP | Big data – cloud computing based requirements and capabilities |

# 6 List of Recommendations determined/consented at the last meeting

TABLE 8
Study Group 13 – Recommendations consented/determined at the last meeting

| Recommendation | Consent/Determination | TAP/AAP | Title |
| --- | --- | --- | --- |
| Q.1743 | Consented | AAP | IMT-Advanced references to Release 11 of LTE-Advanced Evolved Packet Core (EPC) network |
| Y.2330 | Consented | AAP | Requirements of Next Generation Network evolution for supporting Freedata service |
| Y.2340 | Consented | AAP | Overview of Next Generation Network evolution phase 1 |
| Y.2321 | Consented | AAP | Functional Architecture for supporting VCN in NGN |
| Y.3322 | Consented | AAP | Functional architecture for NICE implementation making use of software-defined networking technologies |
| Y.3323 | Consented | AAP | Requirements of Soft network Architecture for MobilE (SAME) |
| Y.3301 | Consented | AAP | Functional requirements of software-defined networking |
| Y.3302 | Consented | AAP | Functional architecture of software-defined networking |
| Y.2773 | Determined | TAP | Performance models and metrics for deep packet inspection |
| Y.3522 | Consented | AAP | End-to-end Cloud Service Lifecycle Management Requirements |

# 7 List of Recommendations deleted during the study period

TABLE 9
Study Group 13 – Recommendations deleted during study period

| Recommendation | Last version | Withdrawal date | Title |
| --- | --- | --- | --- |
| None |  |  |  |

# 8 List of Recommendations submitted to WTSA-16 for approval

TABLE 10
Study Group 13 – Recommendations submitted to WTSA-16

| Recommendation | Proposal | Title | Reference |
| --- | --- | --- | --- |
| None |  |  |  |

# 9 Other publications

## 9.1 Supplements

TABLE 11
Study Group 13 – Supplements

| Supplement | Agreed | Doc. type | Title |
| --- | --- | --- | --- |
| Q.1740-series Supplement 66 | 2014-07-18 | Supplement | Scenarios and requirements in terms of services and deployments for IMT and IMS in developing countries |
| Y.2000-series Supplement 21  | 2013-03-01 | Supplement | NGN requirements for interworking with legacy IP-based networks |
| Y.2200-series Supplement 22  | 2013-06-28 | Supplement | Greenhouse gas monitoring services provided over NGN |
| Y.2770-series Supplement 23  | 2013-11-15 | Supplement | Deep Packet Inspection terminology |
| Y.2000-series Supplement 24  | 2013-11-15 | Supplement | N-Screen service scenarios over FMC |
| Y.2770-series Supplement 25  | 2015-05-01 | Supplement | DPI use cases and application scenarios |
| Y.2600-series Supplement 26 | 2015-12-11 | Supplement | Scenario and requirements of reconfigurable networking based on minimum network functions & network polymorphism in future packet based network |
| Y.3300-series Supplement 35  | 2016-04-29 | Supplement | Data-aware networking – scenarios and use cases |
| Y.3600-series Supplement 40 | 2016-07-08 | Supplement | Big Data Standardization Roadmap  |
| Y.2200-series Supplement 41 | 2016-07-08 | Supplement | Deployment Models of Service Function Chaining |

## 9.2 Technical reports and technical papers’

TABLE 12
Study Group 13 – Technical Reports

|  |  |  |  |
| --- | --- | --- | --- |
| **Document** | **Agreed** | **Doc. type** | **Title** |
| Trust provisioning for future ICT infrastructures and services | 2016-04-29 | Technical report | Trust provisioning for future ICT infrastructures and services |

TABLE 13
Study Group 13 – Technical Papers

| Document | Agreed | Doc. type | Title |
| --- | --- | --- | --- |
| Migration scenarios from legacy networks to NGN in developing countries | 2013-03-01 | Technical paper | Migration scenarios from legacy networks to NGN in developing countries |
| How to increase QoS/QoE of IP based Platform | 2013-03-01 | Technical paper | How to increase QoS/QoE of IP based Platform |
| Mobility Management in ITU-T | 2013-03-01 | Technical paper | Mobility Management in ITU-T: Its Current development and Next Steps Heading Towards Future Networks |
| Applications of Wireless Sensor Networks in Next Generation Networks | 2014-02-28 | Technical paper | Technical paper on Applications of Wireless Sensor Networks in Next Generation Networks |

# 10 Report of lead study group activities, GSIs and JCAs

WTSA-12 and TSAG assigned Study Group 13 to be the lead study group:

– for future networks

– on mobility management and NGN

– on cloud computing

– on software-defined networking

Per the request from the SG13, TSAG, at its meeting of June 2013, assigned Study Group 13 the lead study group role for the software-defined networking (SDN).

## 10.1 Lead study group activities on future networks

As part of its task as lead study group for future networks SG13 took advantage of promoting its work in this area at almost every workshop it organized in this study period having a dedicated presentation at 5 out of 7 workshops. See also clause 2.2.

In addition, Study Group 13 created a focus group on IMT-2020 (FG IMT-2020). It has been in operation since 2015 and it expected to conclude its activities with the workshop and about six output documents by the end of 2016. These output documents will then be passed over to the SG13 for further improvement towards draft Recommendations.

In total 13 new Recommendations, one revised Recommendation and one Supplement were progressed in the future networks domain during the reported study period. Those includes the elaboration of the concepts of smart ubiquitous networks as short-term realization of future networks and data-aware networking.

SG13 is open to international collaboration in development of the future networks via its correspondence group (set up between Q14/13 and ISO/IEC JTC 1 SC 6) back in 2011.

Finally, SG13RG-AFR has Future Networks as part of its mandate.

## 10.2 Lead study group activities on mobility management and NGN

In its activities devoted to the lead study group’s function for NGN and mobility management Study Group 13 developed 13 new Recommendations, 4 Supplements in this domain and 3 technical papers.

In preparations for the next study period, SG13 drafted the new Question text with particular focus on fixed-mobile convergence for the 5G environment. Also, the FG IMT-2020 is developing the baseline document to describe requirements and capabilities to support fixed-mobile convergence in IMT-2020 networks.

## 10.3 Lead study group activities on cloud computing

JCA-Cloud was instrumental in achieving the goals of coordination the studies in the area of cloud computing including the interactions with other relevant study groups and SDOs. (See also clause 10.5 of this report.) As one of its tasks the JCA-Cloud developed and kept up-dated at each meeting the cloud computing standardization roadmap. Further this task was followed by the Q17/13.

Two collaborative teams (CTs) between ITU-T WP 6/13 and ISO/IEC JTC 1/SC 38/WG 3 continued its work on development the common text in the area of cloud computing overview, vocabulary and reference architecture initiated in the last study period. As a result of these efforts in the middle of 2014 SG13 saw successful completion of the work on two common texts with ISO/IEC/JTC1/SC38 on cloud computing overview and vocabulary (Recommendation ITU-T Y.3500 | International standard ISO/IEC 17788) and on cloud computing reference architecture (Recommendation ITU-T Y.3502 | International standard ISO/IEC 17789).

Collaborative teams were in operation from June 2012 to July 2014. Collaboration along the way of its operation was positively evaluated by the CTs participants and its management.

To ensure successful collaboration (without duplication of efforts) of ITU-T recommendations related to cloud computing management a joint rapporteur group between SG13 and SG2 was established in June-July 2014. Group successfully delivered two new Recommendations on cloud computing management.

SG13RG-AFR has cloud computing as part of its mandate.

Cloud computing was a topic at 5 out of 7 workshops SG13 convened during 2013 – 2016. In addition, to report the ITU-T achievements in this domain of knowledge, SG13 organized a dedicated workshop on cloud computing entitled “[Cloud Computing Standards - Today and the Future"](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/cc/Pages/default.aspx), on 14 November 2014, in Geneva.

**10.4 Lead study group activities on software-defined networking**

Following the direction of WTSA-12 Resolution 77 on SDN, SG13 at its first meeting in the reported study period established the necessary structure to perform the work on SDN in a more visible manner. In particular, it revised 7 out of 19 Questions texts to give more focus and visibility of the SG13 work on SDN. At its first meeting in the study period it also developed the action plan and made a proposal to set up the Joint Coordination Activity on SDN (JCA-SDN) within ITU-T.

In the middle of 2013 Study Group 13 was assigned the lead Study Group responsibly for software-defined networking. This task was mainly performed by the JCA-SDN that was run under the TSAG supervision in 2013 – middle of 2015 and under Study Group 13 supervision from the middle of 2015. (See also clause 10.5 of this report.)

The main objective of the JCA-SDN was to collect the material for developing and maintaining up to date the roadmap on standardization activities world-wide on SDN. As parent to JCA-SDN since June 2015, SG13 agreed to continue the activities of this coordination panel for one more year in the next study period.

Six ITU-T recommendations on SDN were developed over the study period.

## 10.5 Joint coordination activities (JCAs)

Study Group 13 is the parent group for JCA-Cloud and JCA-SDN.

The Joint Coordination Activity on Cloud Computing (**JCA-Cloud**) held ten meetings under the chairmanship of Ms Monique Morrow (Cisco Systems, USA) in the period 2013 – 2016. JCA-Cloud periodically reported its progress to Study Group 13 and TSAG.

JCA-Cloud was instrumental in achieving the goals of coordination the studies in the area of cloud computing including the interactions with other relevant study groups and SDOs. (See also clause 2.1.3 of this report.) JCA-Cloud brought value in the issue of separation of the work between SG13 and SG17 on cloud computing security.

As one of its tasks the JCA-Cloud developed and kept up-dated at each meeting the cloud computing standardization roadmap.

JCA-Cloud was closed by its parent group, SG13, in April 2015 as accomplishing its mandate. Further coordination work on cloud computing was entrusted to SG13 as well as maintenance of the cloud computing roadmap.

The Joint Coordination Activity on Software-Defined Networking (**JCA-SDN**) held nine meetings under the chairmanship of Mr Takashi Egawa (NEC, Japan) assisted by JCA-SDN Vice-chairman Ms Ying Chen (China Unicom), in the period 2013 – 2016. JCA-SDN periodically reported its progress to TSAG and Study Group 13. (See also clauses 2.1.6 and 10.5 above.)

From its set up in 2013 JCA-SDN established the good communication with different standards development organizations working in the area of software-defined networking.

JCA-SDN initiated the roadmap for SDN standardization. This roadmap is maintained up to date after each meeting of the group.

At its last meeting in the reported Study Period SG13 agreed to continue the activities of JCA-SDN for one more year in the next study period.

Study Group 13 representatives took part in some JCA-IdM, JCA-AHF and JCA-CIT meetings. Study Group 13 has liaison relationships with some other JCAs.

## 10.6 Global Standards Initiatives (GSIs)

Some Questions of Study Group 13 took part in the Internet of Things Global Standards Initiative (**IoT-GSI**) since its introduction in 2011 and until its closure in 2015. IoT-GSI formed a good environment for the development of new ITU-T Recommendations jointly with other Study Groups including Study Groups 16 and 11.

See also clause 4.2 for achievements in this domain.

## 10.7 Focus group

The Focus Group on IMT-2020 (**FG IMT-2020**) was established on 1 May 2015 by Study Group 13 with the objective to foster the studies on the network aspects of 5G networks (leaving all the work on frequencies and radio interfaces to a counterpart in ITU-R (SG5 and its WP5D)).

Since its creation Focus Group held six meetings worldwide and accomplished its first big project by delivering the gap analysis document on standardization efforts in 5G (network part) area. Two more meetings are planned till the end of 2016. The latter will be complemented by the workshop. Lifetime of the FG runs up to the end of 2016.

Currently the group is working on a number of technical reports to cover network management framework and requirements for IMT-2020, framework of IMT-2020 network architecture, application of network softwarization to IMT-2020 and some others.

Its deliverables will then be passed over to the Study Group 13 (its parent study group) for further consideration and development as ITU-T Recommendations.

See also clauses 2.1.7 and 10.1.

# 11 Observations concerning future work

This clause contains the Study Group 13 vision on its area of responsibility and mandate for the next study period (2017 – 2020). Material provided below was agreed by the SG13 meeting (June - July 2016). Study Group 13 proposes 13 Questions covering network related technical areas including cloud computing, IMT-2020 and programmable networking solutions.

## 11.1 Up-dates to Resolution 2

The responsibilities and mandate of Study Group 13 should be amended as shown below based on the relevant portions of [WTSA-12 Resolution 2](http://www.itu.int/en/ITU-T/wtsa16/Documents/CPI/ITU-T_Res2_2016-E.docx) and TSAG decision applicable to the SG13.

PART 1 - General areas of study

**Study Group 13**

Future networks, with focus on IMT-2020, cloud computing, big data and trusted network infrastructures

ITU-T Study Group 13 is responsible for studies relating to the requirements, architectures, capabilities, and APIs as well as softwarization and orchestration aspects of converged future networks specifically focusing on IMT-2020 non-radio related parts. This also includes IMT-2020 project management coordination across all ITU-T study groups and release planning and implementation scenarios. It is responsible for studies relating to cloud computing technologies, big data, virtualization, resource management, reliability and security aspects of the considered network architectures. It is responsible for studies relating to FMC, mobility management, and enhancements to existing ITU-T Recommendations on mobile communications including the energy saving aspects. Furthermore, SG13 responsibility includes studies on emerging network technologies for IMT-2020 networks and future networks such as Information Centric Networking (ICN)/Content Centric Networking (CCN). Study Group 13 is also responsible for studies relating to standardization of concepts and mechanisms to enable trusted ICT, including framework, requirements, capabilities, architectures and implementation scenarios of trusted network infrastructures and trusted cloud solutions in coordination with all study groups concerned.

PART 2 - Lead Study Group in specific areas of study

Lead study group on future networks such as IMT-2020 networks (non-radio related parts)

Lead study group on mobility managementLead study group on cloud computing and big data

Lead study group on trusted network infrastructures

**Annex B**(to WTSA Resolution 2)

**Points of guidance to study groups for the development
of the post-2016 work programme**

**Study Group 13**

The key areas of competence of Study Group 13 include:

– IMT-2020 network aspects: studies on the requirements and capabilities for the networks of IMT-2020 based on the service scenarios of IMT-2020. This includes development of Recommendations on the framework and architecture design of IMT-2020 based on, but not limited to, the above identified requirements, capabilities and the gap analysis identified by FG on IMT-2020 including also IMT-2020 network-related aspects of reliability, QoS and security. Furthermore, it includes the interworking with current networks including IMT-Advanced, etc.

– Software-defined networking (SDN), network slicing and orchestration aspects: studies on SDN and data plane programmability to support functions such as network virtualization and network slicing necessary for exploding and diversifying services taking into account scalability, security and distribution of functions. Development of Recommendations on the orchestration and related management-control continuum capabilities/policies of network function components, softwarized network and network slices including enhancement and support of distributed networking capabilities.

– Open source aspects: study of potential utilization and guide of open source software activities related to the scope of SG13.

– Next-generation network (NGN) evolution aspects: Based on emerging advanced communication and information technologies (e.g., SDN, NFV and CDN) and related use cases, study of enhancements to NGN in terms of requirements for supporting capabilities, functional architecture and deployment models.

– Information Centric Networking and Public packet Telecom Data Network aspects: studies related to analysis of ICN applicability to IMT-2020 and future network. Development of new Recommendations on ICN general requirements, functional architecture and mechanisms of ICN networking and use-case specific mechanism and architectures including identifiers. Development of Recommendations on packet data network based on the study of requirements, frameworks and candidate mechanisms. Development of Recommendations on architecture, network virtualization, resource control and other technical issues of Future Packet Based Network (FPBN) including migration from the conventional IP-based network to FPBN.

– Fixed-mobile convergence aspects: studies related to access-agnostic core which integrates fixed and mobile core. This includes the development of Recommendations on network architecture enhancements to support Fixed-Mobile Convergence and mobility management between fixed and mobile access.

– Knowledge centric trustworthy networking and services aspects: studies related to requirements and functions to support building of trusted ICT infrastructures. Development of Recommendations regarding environmental and socio-economic awareness in order to minimize environmental impact by future networks including IMT-2020 as well as to reduce the barriers to entry for various actors involved in the network ecosystem.

– Cloud computing and big data aspects: Studies of the requirements, functional architectures and their capabilities, mechanisms and deployment models of cloud computing, covering inter- and intra-cloud computing as well as distributed cloud aspects. This study includes the development of technologies supporting “XaaS
(X as a service)” such as virtualization, resource and service management, reliability and security. Developing Recommendations for high-level big data requirements and general capabilities including cloud computing based big data, big data exchange framework.

Study Group 13 activities will also cover regulatory implications, including deep packet inspection, telecommunications for disaster relief, emergency communications and lower energy consumption networks. Furthermore it includes activities related to innovative service scenarios, deployment models and migration issues based on future network including IMT-2020 and trusted network.

In order to assist countries with economies in transition, developing countries and especially the least developed countries in the application of networks of the future including IMT-2020 and other innovative technologies, SG13 continues a dedicated Question on this topic and its regional group for Africa. By this consultations should be enabled with representatives of the ITU Telecommunication Development Sector with a view to identifying how this assistance might best be done through an appropriate activity conducted in conjunction with ITU-D.

Study Group 13 shall maintain strong cooperative relations with external standards development organizations (SDOs) and develop a complementary programme. This shall also explicitly include open source communities. It shall proactively promote communications with external organizations to allow for normative referencing in ITU-T Recommendations of specifications developed by those organizations.

When meeting in Geneva, Study Group 13 will hold collocated meetings with Study Group 11.

Joint rapporteur group activities of different study groups (under a global standards initiative (GSI) or other arrangements) shall be seen as complying with the WTSA expectations for collocation.

**Annex C**(to WTSA Resolution 2)

**List of Recommendations under the responsibility of the respective
study groups in the 2017-2020 study period**

Study Group 13

ITU-T F.600-series

ITU-T G.801, ITU-T G.802, ITU-T G.860-series

ITU-T I-series, except those under the responsibility of Study Groups 2, 12 and 15, and those having double/triple numbering in other series

ITU-T Q.933, ITU-T Q.933*bis*, ITU-T Q.10xx-series and ITU-T Q.1700-series

ITU-T X.1 - ITU-T X.25, ITU-T X.28 - ITU-T X.49, ITU-T X.60 - ITU-T X.84, ITU-T X.90 - ITU-T X.159, ITU-T X.180 - ITU-T X.199, ITU-T X.272, ITU-T X.300-series

ITU-T Y-series, except those under the responsibility of Study Groups 12, 15, 16 and 20

## 11.2 SG13 view on the future structure of ITU-T

In addition, Study Group 13 examined the TSAG’s vision on the possible future structure of ITU-T and expressed its opinion as follows:

– SG13 sees its continuation as a stand-alone study group with the reshaped set of Questions.

– It sees very little synergy with the work performed in 2013 - 2016 in Study Groups 2, 11 and 15.

– It is in favour of shorten the SG meeting duration.

– Current practice with 1 - 2 SG/WP meetings per year and 1 – 2 co-located rapporteur groups meetings work well and deserves to be continued.

– Co-location with SG11 works well and it recommended to be kept in the future.

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