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| ITU logo | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATION STANDARDIZATION SECTOR**STUDY PERIOD 2017-2020 | TSAG-TD891 |
| **TSAG** |
| **Original: English** |
| **Question(s):** | N/A | E-Meeting, 21-25 September 2020 |
| **TD(Ref.:** [SG13-LS165](http://handle.itu.int/11.1002/ls/sp16-sg13-oLS-00165.docx)) |
| **Source:** | ITU-T Study Group 13 |
| **Title:** | LS on Deliverables of Focus Group ML5G to ITU-T, ITU-R study groups and other groups [from ITU-T SG13] |
| **Purpose:** | Information |
| **LIAISON STATEMENT** |
| **For action to:** | - |
| **For comment to:** | - |
| **For information to:** | 3GPP, ISO/IEC JTC1/SC29, ITU-R, GSMA, IETF, IEC, IEEE, NGMN, WiFi Alliance, SG2, SG3, SG5, SG9, SG11, SG12, SG15, SG16, SG17, SG20, TSAG, WBA, ONAP, IIC, BDVA, ETSI ISG ZSM, ETSI ISG ENI, ISO/TMB, AIRI, 5GAA, 5G PPP, ISO/IEC JTC1/SC42 |
| **Approval:** | ITU-T Study Group 13 virtual meeting (31 July 2020) |
| **Deadline:** | N/A |
| **Contact:** | Leo LehmannOFCOMSwitzerland | Tel: +41 58460 5752 E-mail: Leo.Lehmann@bakom.admin.ch  |

A new liaison statement has been received from SG13.

This liaison statement follows and the original file can be downloaded from the ITU ftp server at <http://handle.itu.int/11.1002/ls/sp16-sg13-oLS-00165.docx>.

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| ITU logo | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATIONSTANDARDIZATION SECTOR**STUDY PERIOD 2017-2020 | SG13-LS165 |
| **STUDY GROUP 13** |
| **Original: English** |
| **Question(s):** | All/13 | Virtual, 20 – 31 July 2020 |
| **Ref.: SG13-TD293-R2/PLEN** |
| **Source:** | ITU-T Study Group 13 |
| **Title:** | LS/o on Deliverables of Focus Group ML5G to ITU-T, ITU-R study groups and other groups |
| **Purpose:** | Information |
| **LIAISON STATEMENT** |
| **For action to:** | - |
| **For comment to:** | - |
| **For information to:** | TSAG, ITU-T study groups, ITU-R study groups, IEEE, IETF, Wifi Alliance, ETSI Industry Specification Group ISG ENI, ISG ZSM, ISO/IEC JTC1 SC42, ISO/IEC JTC1 SC 29/ WG11 (MPEG), Wireless Broadband Alliance, 3GPP, 5GAA, IEC MSB (Market Strategy Board), ISO TMB (Technical Management Board), 5GIA (Infrastructure Association) and other verticals: Alliance for IoT Innovation, AIIA (Artificial Intelligence Industry Alliance, China), 5GPPP, GSMA, BDVA (Big Data Value Association), IIC (Industrial Internet Consortium), Wireless AI Alliance (China), 5G Americas, Telecom Infra Project, SDNIA (China), AIRI (Korea), ONAP (open source project for network orchestration), Acumos (open source AI platform supporting network), RIKEN Center for Advanced Intelligence Project (AIP, Japan), NGMN |
| **Approval:** |

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| **ITU-T Study Group 13 virtual meeting (31 July 2020)** |

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| **Deadline:** | N/A |
| **Contact:** | Leo LehmannOFCOMSwitzerland | Tel: 41 58460 5752E-mail: Leo.Lehmann@bakom.admin.ch  |

ITU-T Study Group 13 would like to inform you that its Focus Group on Machine Learning for Future Networks including 5G ([FG ML5G](https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/default.aspx)) has accomplished its mission. FG ML5G was active from January 2018 until July 2020.

FG ML5G approved ten technical specifications. Four of those specifications have already been approved by ITU-T SG13 as recommendations (three) and supplement (one) and published by ITU. Six further technical specifcations are being considered by ITU-T SG13. The summary of each of the ten technical specifications are reproduced in the Annex. Documents 1.1 – 1.4 are publicly available free of charge. Documents 3.1 – 3.5 are publicly available free of charge from the FG ML5G website (user account necessary but granted immediately and automatically – see [FG ML5G](https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/default.aspx) website for the procedure).

FG ML5G also produced an information document “[Gap analysis – next steps in machine learning in future networks including IMT-2020](https://extranet.itu.int/sites/itu-t/focusgroups/ML5G/_layouts/15/WopiFrame.aspx?sourcedoc=%7B46684E01-F905-48AB-BB5B-292F0EFC8B2B%7D&file=ML5G-O-034.docx&action=default).”

The [ITU AI/ML in 5G Challenge](https://www.itu.int/en/ITU-T/AI/challenge/2020/Pages/default.aspx) is building on ITU’s ML5G standards work by conducting a global competition on the theme “How to apply ITU’s ML architecture in 5G networks.” The Challenge is administered by TSB and runs until the end of the year. Several hundred of professionals and students have signed up for the Challenge.

We invite you to consider the output of FG ML5G (in particular the gap analysis). ITU-T SG13 will welcome future collaboration with you on those studies.

**Annex**

## 1 Deliverables already processed by ITU-T SG13 and published by ITU

### 1.1 [Y.Sup55: ITU-T Y.3170-series - Machine learning in future networks including IMT-2020: use cases](https://www.itu.int/rec/T-REC-Y.Sup55-201910-I)

This Supplement describes use cases of machine learning in future networks including IMT-2020. For each use case description, along with the benefits of the use case, the most relevant possible requirements related to the use case are provided. Classification of the use cases into categories is also provided.

### 1.2 [ITU-T Y.3172: Architectural framework for machine learning in future networks including IMT-2020](https://www.itu.int/rec/T-REC-Y.3172/en)

ITU-T Y.3172 specifies an architectural framework for machine learning (ML) in future networks including IMT-2020. A set of architectural requirements and specific architectural components needed to satisfy these requirements are presented. These components include, but are not limited to, an ML pipeline as well as ML management and orchestration functionalities. The integration of such components into future networks including IMT-2020 and guidelines for applying this architectural framework in a variety of technology-specific underlying networks are also described.

### 1.3 [ITU-T Y.3173: Framework for evaluating intelligence levels of future networks including IMT-2020](https://www.itu.int/rec/T-REC-Y.3173/en)

ITU-T Y.3173 specifies a framework for evaluating the intelligence of future networks including IMT-2020 and a method for evaluating the intelligence levels of future networks including IMT-2020 is introduced. An architectural view for evaluating network intelligence levels is also described according to the architectural framework specified in Recommendation ITU-T Y.3172.

In addition, the relationship between the framework described in this Recommendation and corresponding work in other standards or industry bodies, as well as the application of the method for evaluating network intelligence levels on several representative use cases are also provided.

### 1.4 [ITU-T Y.3174: Framework for data handling to enable machine learning in future networks including IMT-2020](https://www.itu.int/rec/T-REC-Y.3174/en)

ITU-T Y.3174 describes a framework for data handling to enable machine learning in future networks including International Mobile Telecommunications (IMT)-2020. The requirements for data collection and processing mechanisms in various usage scenarios for machine learning in future networks including IMT-2020 are identified along with the requirements for applying machine learning output in the machine learning underlay network. Based on this, a generic framework for data handling and examples of its realization on specific underlying networks are described.

## 2 Deliverable already at and advanced stage in ITU-T SG13

### 2.1 Draft Recommendation ITU-T Y.3176 “ML marketplace integration in future networks including IMT-2020”

This document is a draft Recommendation Y.ML-IMT2020-MP under study by Q20 of SG13. This draft Recommendation provides the architecture for integration of ML marketplace in future networks including IMT-2020. The scope of this draft Recommendation includes: - Challenges and motivations for ML marketplace integration - High level requirements of ML marketplace integration - Architecture for integration of ML marketplace in networks.

## 3 Deliverables which FG ML5G submitted to ITU-T SG13 for consideration at its 20-31 July 2020 meeting

### 3.1 FG ML5G specification: “[Requirements, architecture and design for machine learning function orchestrator](https://extranet.itu.int/sites/itu-t/focusgroups/ML5G/_layouts/15/WopiFrame.aspx?sourcedoc=%7BFF1D3964-1562-41FF-B710-D0674281764F%7D&file=ML5G-O-038.docx&action=default)”

This technical specification discusses the requirements for machine learning function orchestrator (MLFO). These requirements are derived from the use cases for machine learning in future networks including IMT-2020. Based on these requirements, an architecture and design for the machine learning function orchestrator is described.

### 3.2 FG ML5G specification: “[Serving framework for ML models in future networks including IMT-2020](https://extranet.itu.int/sites/itu-t/focusgroups/ML5G/_layouts/15/WopiFrame.aspx?sourcedoc=%7BCF7FF25F-49E9-4EB3-B3E5-EFDB8FD93F57%7D&file=ML5G-O-036.docx&action=default)”

This specification describes a serving framework for ML models in future networks including IMT-2020. The specification includes requirements and architecture components for such a framework.

### 3.3 FG ML5G specification: “[Machine Learning Sandbox for future networks including IMT-2020: requirements and architecture framework](https://extranet.itu.int/sites/itu-t/focusgroups/ML5G/_layouts/15/WopiFrame.aspx?sourcedoc=%7BDE867B22-A47D-4261-9A74-9F89DE6EF69C%7D&file=ML5G-O-035.docx&action=default)”

Use cases for integrating machine learning (ML) to future networks including IMT-2020 has been documented in Supplement 55 and an architecture framework for this integration was specified in ITU-T Y.3172. However, network stakeholders are apprehensive about using ML-driven approaches directly in live networking systems because it can lead to unexpected situations that can degrade KPIs. This is mostly due to the apparent complexity of ML mechanisms (e.g., deep learning), the incompleteness of the available training data, the uncertainty produced by exploration-exploitation approaches (e.g., reinforcement learning), etc. In the face of such impediments, the ML Sandbox emerges as a potential solution that allows mobile network operators (MNOs) for improving the degree of confidence in ML solutions before their application to the network infrastructure. This technical specification deals with the requirements, architecture, and implementation examples for ML Sandbox in future networks including IMT-2020.

### 3.4 FG ML5G specification: “[Machine learning based end-to-end network slice management and orchestration](https://extranet.itu.int/sites/itu-t/focusgroups/ML5G/_layouts/15/WopiFrame.aspx?sourcedoc=%7B9572D359-9A94-4AF4-BD93-FD25CB175841%7D&file=ML5G-O-037.docx&action=default)”

This document proposes the framework and requirements of machine learning based end-to-end network slice management and orchestration in multi-domain environments.

### 3.5 FG ML5G specification: “[Vertical-assisted Network Slicing Based on a Cognitive Framework](https://extranet.itu.int/sites/itu-t/focusgroups/ML5G/_layouts/15/WopiFrame.aspx?sourcedoc=%7BA3B49DCC-CEFA-4ED6-9B4F-65099CE10D26%7D&file=ML5G-O-039.docx&action=default)”

This technical specification proposes a new framework that enables vertical QoE-aware network slice management empowered by machine learning technologies.

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