Question 13/21 – Multimedia streaming-related systems and services including content delivery, application platforms and end systems

(Continuation of Question 13/16)

1 Motivation

As the lead study group on multimedia technologies, applications, systems and services, Study Group 21 meets the demands of a fast-evolving market by producing standards for multimedia communication systems that take advantage of both emerging and existing technologies.

In this regard, the study group has been successful in producing numerous Recommendations that address topical areas such as multimedia terminal design, home networking, multimedia architecture, audiovisual communications, multimedia conferencing, media coding, multimedia content representation and delivery, Internet Protocol Television (IPTV) systems, digital signage (DS) systems, multimedia security, metadata, multimedia directories and multimedia service description.

Since broadband services over various access technologies are constantly evolving and gaining increased popularity, in conjunction with the advances on user interfaces and terminal devices, there is a growing need for new integrated multimedia services where users can seamlessly switch amongst the different multimedia consumption experiences available from multiple sources. IPTV and DS are regarded as the typical multimedia consumption services.

IPTV is a multimedia service including television, video, audio, text, graphics and data delivered over IP based networks that are managed to provide the required level of QoS and QoE, security, interactivity and reliability.

DS systems and services may provide optimal contents containing personalized advertisements that target individual audiences through interactions between the audiences and a digital signage system.

With the study group's success on creating a series of Recommendations covering the diverse aspects of multimedia services, systems and platforms, IPTV and DS services have become mature enough to be one of the most popular services world-widely.

The market now demands standardized interoperable solutions that encompass all forms of IP-based media streaming services including IP-based television service, DS and other media services that would be affected by emerging technologies such as AI. The study group has noticed that the common services capability of IP-based television and DS including content integration, handling and delivery is able to be utilized by more types of multimedia services, based on the technologies that developed by the other SGs or SDOs.

Service providers and network providers are starting to aggregate and support multiple services beyond IP-based television and DS applications themselves from their managed network with QoS and resource provisioning based on their expertise to provide the needed approaches and harmonized solutions for IP-based media integration, handling and streaming (MIHS) services.

This Question is intended to produce deliverables related to study not only the IP-based television services and DS services, but also IP-based media integration, handling and streaming (MIHS) services.

Regarding IP-based television service and DS, the Question concerns their support for interactivity, middleware, multimedia applications, enhanced user interfaces, metadata, content formats and their uses, such as virtual reality (VR), augmented reality (AR) and metaverse.

This Question will also study the mechanisms for media handling and streaming service, including multi-source media content integration, reassembling, handling, content delivery systems and cloud-edge computing needed to facilitate effective and interoperable use beyond IP-based television and DS service.

2 Study items

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

- identify and investigate the use cases, requirements, functional architecture, application platforms and end systems for IP-based television, DS and MIHS services;
- review and analyse existing standards and Recommendations to find gaps seen against the requirements of IP-based television, DS and MIHS services related platforms and end systems, and to identify those requirements where new standards or changes to existing standards are recommended;
- help coordinate, harmonize and encourage interoperability amongst existing systems and standards for IP-based television, DS and MIHS services related platforms and end systems;
- investigate functional architectures for terminals of IP-based television service and DS service;
- identify services and applications relevant to IP-based television, DS and MIHS services related platforms and end systems;
- based on the analysis of requirements and existing standards related to IP-based television service and DS service, investigate the relevant areas, including but not limited to:
  - metadata, i.e. the descriptive data about content and environment;
  - service navigation, channel and menu processing;
  - service discovery;
  - content presentation;
  - integrated service application platforms for IP-based television service and digital signage based on the conventional IPTV functional architecture;
  - IP-based television service and digital signage deployed/enhanced by support of (mobile/multi-access) edge computing;
  - support of extended reality (XR) including augmented reality (AR) , virtual reality (VR) , mixed reality (MR), and other immersive content services;
  - terminal devices for IP-based television service and DS that support multiple sources of content and delivery, such as hybrid terminals;
  - applications using IP-based television service and DS, such as e-services (e.g. e-health and e-learning);
  - audience measurement;
  - IP-based television service middleware and application frameworks;
  - required aspects of security on the related applications;
  - IP-based television service end systems, and interworking between them (such as companion screen, multi-screen, head-mounted displays, AR glasses);
  - conformance and interoperability of IP-based television service systems and services;
  - consider how IP-based television content delivery services (e.g. over-the-top services, IPTV) would integrate with each other and/or take advantage of each of their best features;
  - how to enrich user experience and engagement (e.g. IP-based social TV, recommendation systems, supporting targeted content, including targeted advertisement, enhancing audience measurement, use of big data and of video sensors);

– based on the analysis of requirements and existing standards related to IP-based MIHS, investigate the relevant areas, including but not limited to:
  - IP-based multimedia content distribution, delivery system and networking, including low latency and ultra-high bandwidth;
  - open service application platforms and open API for ingesting content and services from other content/service providers;
  - content handling services from the multiple sources;
  - multimedia content delivery from multiple sources and their integration;
  - enhanced user interaction in content delivery services and interactive services;
– consideration on the new technologies and new services which could impact the service development of IP-based television, DS and MIHS, but not limited to:
  - consideration of new emerging technologies such as artificial intelligence, natural language translation, motion recognition, immersive experiences, UHD including 4K and 8K, XR (such as AR,VR and MR), and IMT-2020/5G for providing enhanced DS, IP-based television, and IP-based MHIS service;
  - facilitate DS, IP-based television and IP-based MIHS service converging with cross-industry new technologies, help the coordination of the related standards and evolution of the related specifications;
  - considerations on how the evolution of cloud computing, big data, network functions virtualization (NFV), software defined networks (SDN), and other trending ICTs may help deploying IP-based television, DS and IP-based MIHS services as well as enhance them and implement new applications;
  - considerations on how the evolution of mobile networks (IMT-2020/5G and beyond) and the mobility capability may impact IP-based television, DS and IP-based MIHS services;
  - considerations on the innovation of requirements, use cases, application platform, multimedia content delivery system and end system for providing DS and IP-based television services in the metaverse environment;
– based on the service features provided by IP-based television and DS services, investigate the relevant areas, including but not limited to:
  - considerations on how media accessibility may rely on multiple aspects of IP-based television services and DS, together with Questions focused on accessibility and human factor aspects;
  - consideration on how digital divide may be mitigated by applying already existing mature and stable technologies rather than only on future advanced technologies;
  - consideration on providing emergency information services including early warning by DS systems and IP-based television services in the disaster environment;
  - consideration on providing accessibility for persons with disabilities and specific needs (including foreign visitors) by DS and IP-based television services;
  - considerations on how to help measure power consumption and mitigate disaster and climate change;

3 Tasks

Tasks include, but are not limited to, the development of deliverables on the IP-based television, DS and MIHS services in following areas:

– use cases, requirements, functional architectures, framework and protocols for IP-based television, DS and MIHS services;

– required aspects of the related application platform and end systems, such as Connected TV, Smart TV, OTT TV and IPTV;
– required aspects of middleware and application platforms;
– required aspects of IP-based video content handling, reassembling, adaptation, distribution and delivery;
– required aspects of open/integrated application platform;
– configuration of IP-based television, DS and MIHS services ;
– deployment scenarios of IP-based television, DS and MIHS services;
– interface between content providers and service providers;
– IP-based television service audience measurement, including the use of video sensors;
– IP-based television service widgets and widget service;
– multiple IP-based television and DS terminal devices, their interworking and multi-device services;
– IP-based television terminal device models, including mobile model and virtualized model;
– multimedia application frameworks for IP-based television, DS and MIHS services;
– enhanced user interface for IP-based television service and DS;
– XR (such as AR, VR and MR) and multi-viewing support in IP-based television and DS service;
– IP-based television service metadata, including scene-based metadata;
– conformance and interoperability testing on IP-based television, DS and MIHS services;
– framework and protocols to provide services having public characteristics, including emergency warning and notification, and accessibility for persons with disabilities and specific needs over IP-based television service and DS systems;
– implementation, migration and integration of IP-based television service and DS service within metaverse environment;
– enhancement and maintenance of ITU-T H.700-series (including ITU-T H.780, H.781, H.782, H.783, H.784, H.785.0, H.785.1), H.644-series (including ITU-T H.644.1, H.644.2, H.644.3, H.644.4, H.644.5), T.170-series, T.180, H-series Supplement 3 and relevant Technical Papers on IPTV and DS systems and services.

An up-to-date status of work under this Question is found in the SG21 work programme (https://itu.int/ITU-T/workprog/wp_search.aspx?sp=18&q=13/21).

4 Relationships

Recommendations:

– E, F, G, H, I, Q, T, V, X, Y-series Recommendations under the responsibility of SG21

Questions:

– All Questions of Study Group 21

Study groups:

– ITU-T SGs 2, 5, 11, 12, 13, 15, 17 and 20
– ITU-R SG5 and SG6

Other bodies:

– ATIS, CTA (ex CEA), DLNA, Broadband Forum, DVB, ARIB, ABNT, ATSC, APT, HGI, OASIS, WHO, Personal Connected Health Alliance (Continua), DTG
– ISO, IEC, ISO/IEC, ETSI, IETF, W3C