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Recommendation ITU-R BT.2137-0
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**Technologies applicable to Internet Protocol
interfaces for programme production**

BT Series
Broadcasting service
(television)

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RA	Radio astronomy
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S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
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Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R BT.2137-0

**Technologies applicable to Internet Protocol interfaces
for programme production**

(2020)

Scope

Programme production using a managed Internet Protocol (IP) network makes use of technologies from various areas such as media transport, signalling, synchronization, and codecs. This Recommendation provides guidance on choosing technologies applicable to real-time programme production using IP-based interfaces on a managed network.

Keywords

IP interface, programme production, programme exchange, RTP, PTP, IPv4 and IPv6

The ITU Radiocommunication Assembly,

considering

- a) that a high-speed IP transmission over wide area telecommunication networks has been available;
- b) that the IP can transport various signals, including real-time uncompressed audio/video signals, real-time compressed audio/video signals, ancillary data, and non-real-time data;
- c) that numerous technical elements such as media transport, signalling, synchronization, and codecs should be specified to ensure interoperability among devices connected with IP interfaces,

recognizing

- a) that the Real-time Transport Protocol (RTP) over IP specified in IETF RFC 3550 can transport various media data such as uncompressed audio/video, compressed audio/video and ancillary data;
- b) that the SMPTE ST 2110 suite has been published, which supports the separate transport of uncompressed audio, video and ancillary signals over RTP;
- c) that the Precision Time Protocol (PTP) specified in IEEE Std 1588 has been widely used for synchronization, and using PTP for synchronization between devices for programme production is specified in SMPTE ST 2059-1 and ST 2059-2;
- d) that lightweight image coding systems, including ISO/IEC 21122-1, also known as “JPEG XS”, have been developed for the efficient transport of UHD TV signals by reducing the bandwidth consumed,

recommends

that when an IP interface is implemented for programme production, the profiles listed in Annex 1 should be taken into account.

References

- SMPTE ST 337: Format for Non-PCM Audio and Data in an AES3 Serial Digital Audio Interface.
- SMPTE ST 338: Format for Non-PCM Audio and Data in AES3 – Data Types.
- SMPTE ST 2022-6: Transport of High Bit Rate Media Signals over IP Networks (HBRMT).
- SMPTE ST 2059-1: Generation and Alignment of Interface Signals to the SMPTE Epoch.
- SMPTE ST 2059-2: SMPTE Profile for Use of IEEE-1588 Precision Time Protocol in Professional Broadcast Applications.
- SMPTE ST 2110-10: Professional Media Over Managed IP Networks: System Timing and Definitions.
- SMPTE ST 2110-20: Professional Media Over Managed IP Networks: Uncompressed Active Video.
- SMPTE ST2110-22: Professional Media Over Managed IP Networks: Constant Bit-Rate Compressed Video.
- SMPTE ST 2110-30: Professional Media Over Managed IP Networks: PCM Digital Audio.
- SMPTE ST 2110-31: Professional Media Over Managed IP Networks: AES3 Transparent Transport.
- ISO/IEC 21122-1: Information technology – Low-latency lightweight image coding system – Part 1: Core coding system.
- IETF RFC 3190: RTP Payload Format for 12-bit DAT Audio and 20- and 24-bit Linear Sampled Audio.
- IETF RFC 3551: RTP Profile for Audio and Video Conferences with Minimal Control.
- IETF RFC 4301: Security Architecture for the Internet Protocol.

Annex 1

Profiles for IP interfaces for programme production and exchange

1 Overview of profiles

Profiles specify restrictions on applied specifications and their parameter values, and hence limit on the capabilities needed to send/receive and process the IP packets. Profiles may also be used to indicate interoperability points between individual device implementations.

Each profile specifies a combination of applied specifications and their restricted parameter values that should be supported by all devices conforming to that profile.

2 Profiles for video

2.1 Baseline video profile

The Baseline video profile has the maximum interoperability among devices within this Recommendation. When a device cannot communicate with the other devices by using the other profiles described in this Recommendation, it should try to use the Baseline video profile. For the IP version in the Baseline video profile, either IPv4 or IPv6 is used.

When video signals need to be protected from unauthorized access, the Security Architecture for Internet Protocol (IPSec) version 3 specified in IETF RFC 4301 may be used for encrypting IP packets carrying an SDP object and video signals.

TABLE 1

Parameters and their restrictions for baseline video profile

Technical element	Parameters and their restrictions
Sub image	Not used
Picture coding	Not used
Synchronization	SMPTE ST 2059-1 and ST 2059-2
Transport layer protocol for video	SMPTE ST 2110-10 and ST 2110-20
	UDP size is up to 1 460 bytes
IP version	IPv4 or IPv6
Encryption for IP packets	IPSec may be used for encrypting IP packets

2.2 Compressed video profile

The Compressed video profile enables higher-efficient usage of bandwidth by using picture coding. The applied picture coding scheme is signalled through the Session Description Protocol (SDP) as per SMPTE ST 2110-22. The RTP payload format for the coded pictures is specified in IETF RFC(s). For the IP version in the Compressed video profile, either IPv4 or IPv6 is used.

When compressed video signals need to be protected from unauthorized access, IPSec version 3 may be used for encrypting IP packets.

TABLE 2

Parameters and their restrictions for compressed video profile

Technical element	Parameters and their restrictions
Picture coding	JPEG-XS (ISO/IEC 21122-1)
Synchronization	SMPTE ST 2059-1 and ST 2059-2
Transport layer protocol for video	RTP/UDP as per SMPTE ST 2110-10
	UDP size is up to 1 460 bytes
IP version	IPv4 or IPv6
Encryption for IP packets	IPSec may be used for encrypting IP packets

3 Profiles for audio

3.1 PCM and non-PCM audio profile

The PCM and non-PCM audio profile is defined for the carrying of audio signals. Non-PCM Audio and Data may be used as specified in SMPTE ST 337 and ST 338. For the IP version in the PCM and Non-PCM audio profile, IPv4 is used.

When PCM or non-PCM audio signals need to be protected from unauthorized access, IPsec version 3 may be used for encrypting IP packets.

TABLE 3

Parameters and their restrictions for PCM and non-PCM audio profile

Technical element	Parameters and their restrictions
IP version	IPv4
Transport layer protocol	RTP/UDP as per SMPTE ST 2110-10
	UDP size is up to 1 460 bytes
Synchronization	SMPTE ST 2059-1 and ST 2059-2
Payload format	L16: 16-bit audio data samples specified in IETF RFC 3551 L24: 24-bit audio data samples specified in IETF RFC 3190 AM824: AES3 transport format specified in SMPTE ST 2110-31
Data type	Linear PCM (16 bits or 24 bits) specified in SMPTE ST 2110-30 Non-PCM Audio and Data specified in SMPTE ST 337 and ST 338
Encryption for IP packets	IPsec may be used for encrypting IP packets

4 Other profiles

The serial digital interface (SDI) is widely used in programme production and exchange. The SDI profile is defined to carry the entire payload of the SDI signal containing video, audio and ancillary data over IP environments. For the IP version in the SDI profile, either IPv4 or IPv6 is used. When SDI signals need to be protected from unauthorized access, IPsec version 3 may be used for encrypting IP packets.

TABLE 4

Parameters and their restrictions for SDI profile

Technical element	Parameters and their restrictions
Picture coding	Not used
Media transport for video	SMPTE ST 2022-6
Media transport for audio	
IP version	IPv4 or IPv6
Encryption for IP packets	IPsec may be used for encrypting IP packets