SMPTE ST 2110-20:2017
Professional Media over Managed IP Networks: Uncompressed Active Video
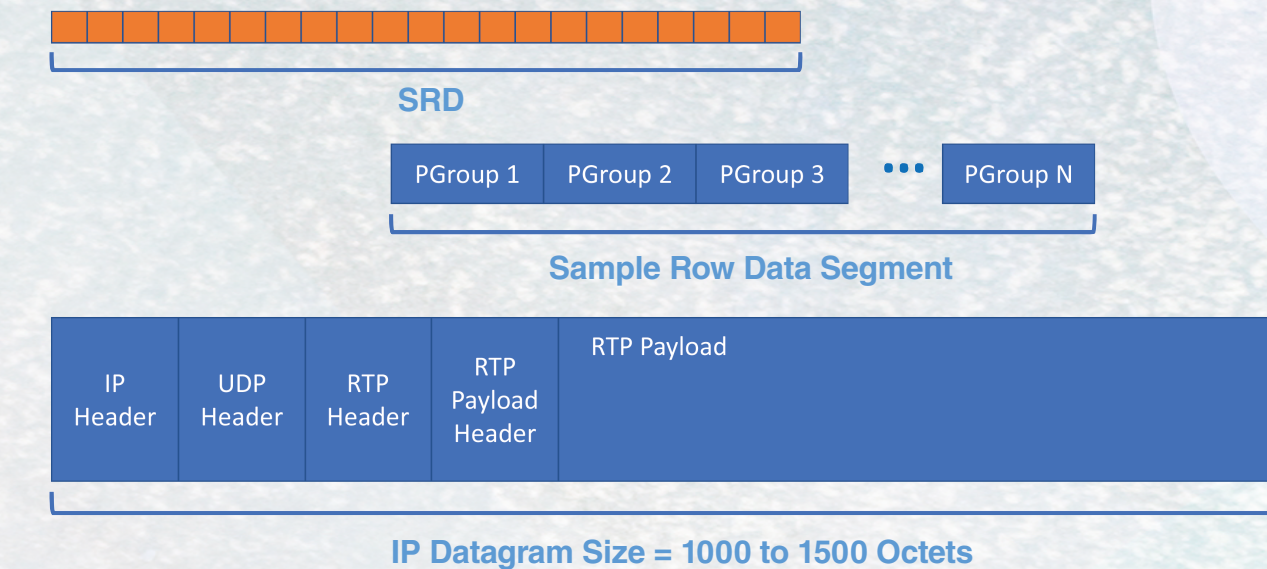
Video Data

Pgroups

10-bit 4:2:2 (2 pixels) (5 octets)
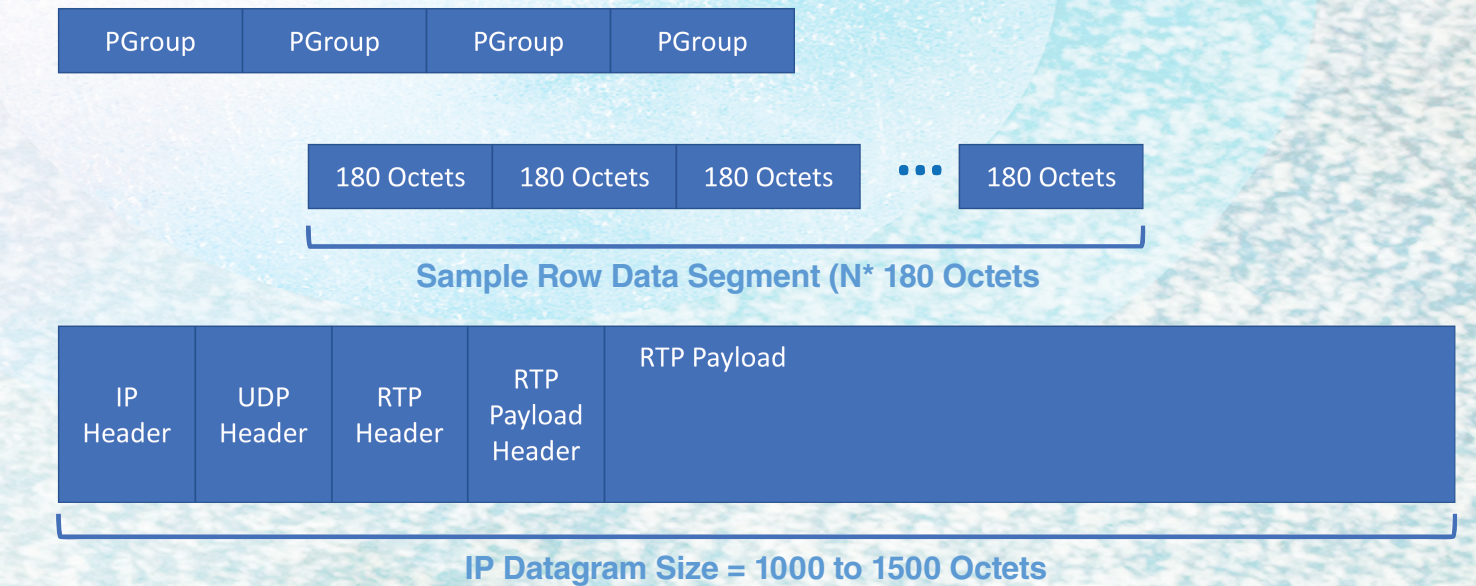
C'B Y0' C'R Y1'

1 2 3 4 5
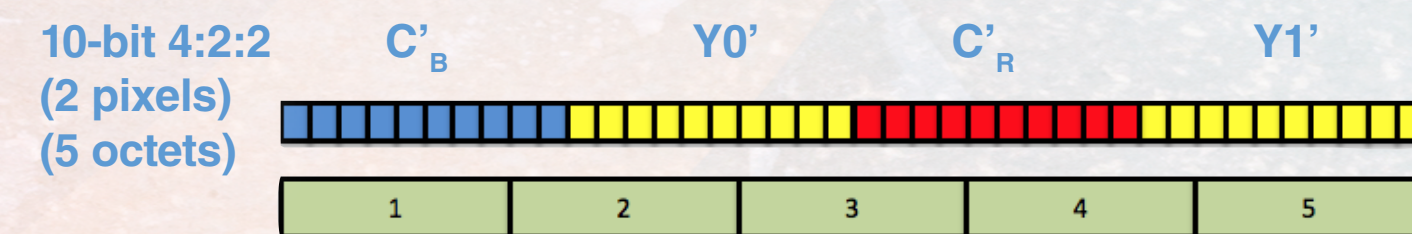
A "pixel group" (pgroup) is the minimal group of video data samples that make up an integer number of pixels and also align to an octet boundary. The example above is for Y'CB'CR' 4:2:2 10-bit sampling, which has a pgroup two pixels wide made up of four samples and thus five octets. Sample Row Data (SRD) segments are made of an integer number of pgroups. Pgroups ensure that no SRD segment or RTP payload contains a partial sample or pixel.

General Packing Mode (GPM)

SRD

PGroup 1 PGroup 2 PGroup 3 ••• PGroup N

Sample Row Data Segment

IP Header | UDP Header | RTP Header | RTP Payload Header | RTP Payload

IP Datagram Size = 1000 to 1500 Octets

An RTP packet can contain up to three SRD segments, each containing pixels from all or part of a row of video. The order of the segments in the RTP payload shall correspond to the order of the headers that precede them. The General Packing Mode (GPM) places no specific additional requirement on the length of the SRD segments.
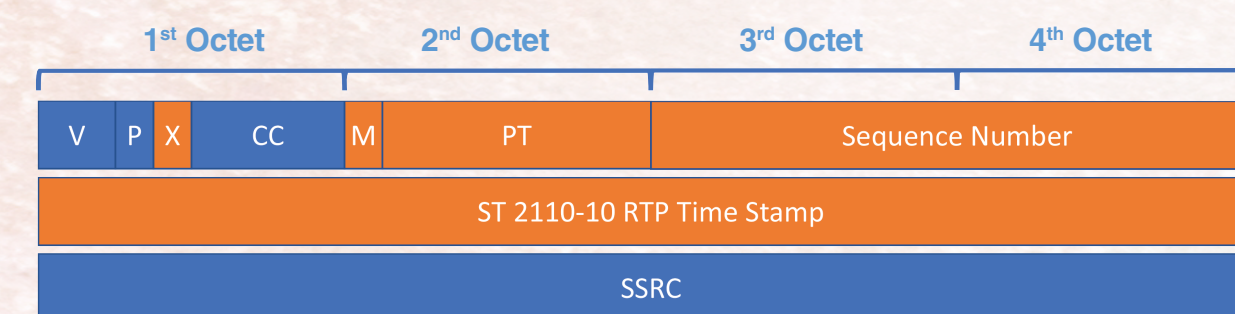
Block Packing Mode (BPM)

PGroup | PGroup | PGroup | PGroup

180 Octets | 180 Octets | 180 Octets | ••• | 180 Octets

Sample Row Data Segment (N° 180 Octets)

IP Header | UDP Header | RTP Header | RTP Payload Header | RTP Payload

IP Datagram Size = 1000 to 1500 Octets

The Block Packing Mode (BPM) is a constrained subset of GPM, in which the sum of the SRD lengths in the RTP packet must be a multiple of 180 octets. This mode is included to simplify interchange with certain pre-ST 2110 uncompressed video systems based on MPEG-2 TS.
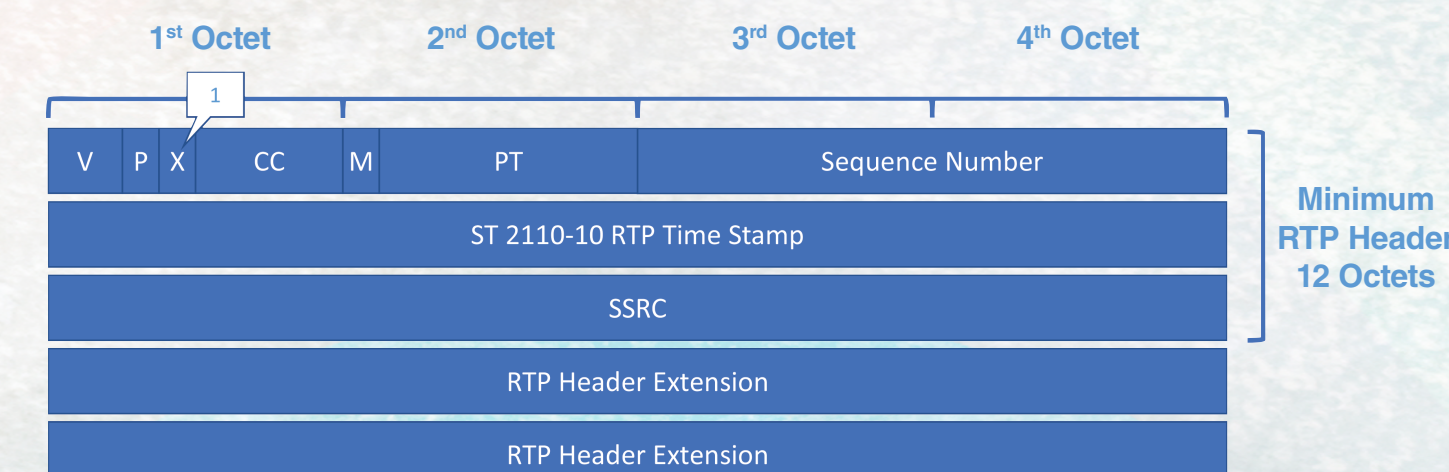
RTP Header

RTP Header

1st Octet | 2nd Octet | 3rd Octet | 4th Octet

V | P | X | CC | M | PT | Sequence Number
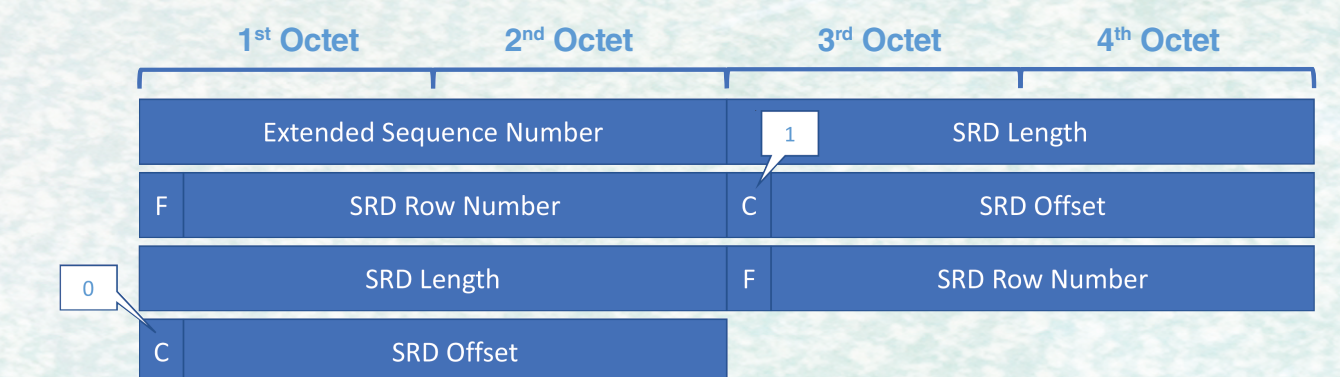
ST 2110-10 RTP Time Stamp

SSRC

The ST 2110-20 RTP header follows the header structure described in IETF RFC 3550 "RTP: A Transport Protocol for Real-Time Applications". The RTP header fields marked in orange are specifically discussed in ST 2110-20.

RTP Header Extension

1st Octet | 2nd Octet | 3rd Octet | 4th Octet

V | P | X | CC | M | PT | Sequence Number

ST 2110-10 RTP Time Stamp

SSRC

RTP Header Extension

RTP Header Extension

Minimum RTP Header 12 Octets

The extension flag (X), if set to 1, signals RTP header extensions are present in a RTP packet. RTP header extensions can be used to provide identifiers for references to external information sources. The RTP header has a length of 12 octets if no RTP header extensions are used. This is the minimum RTP header size. ST 2110 does not prohibit the use of header extensions.
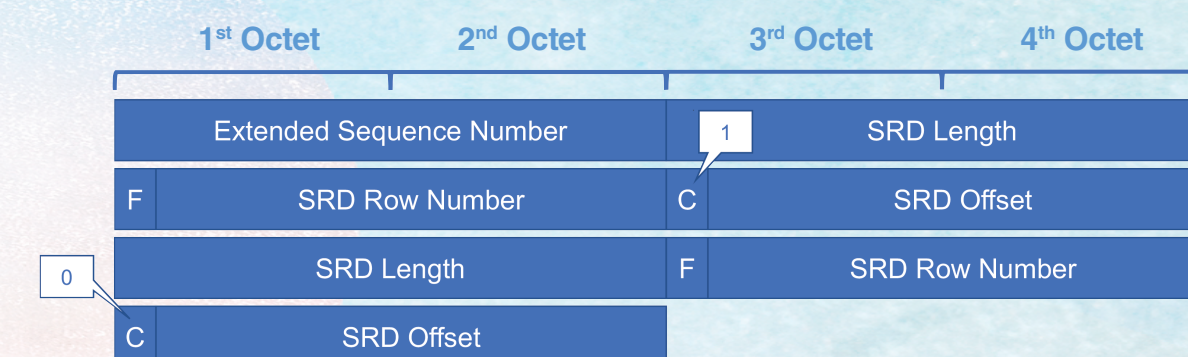
RTP Payload Header

1st Octet | 2nd Octet | 3rd Octet | 4th Octet

Extended Sequence Number

SRD Length

F | SRD Row Number | C | SRD Offset

SRD Length | F | SRD Row Number

C | SRD Offset

The ST 2110-20 RTP payload header begins with the 16 high order bits of the extended 32-bit sequence number, providing support for RTP packet re-ordering over a longer period. It also contains one to three SRD headers, which contain SRD Length, SRD Row Number and the field identification flag (F). Each SRD header refers to an SRD segment that follows the RTP payload header.
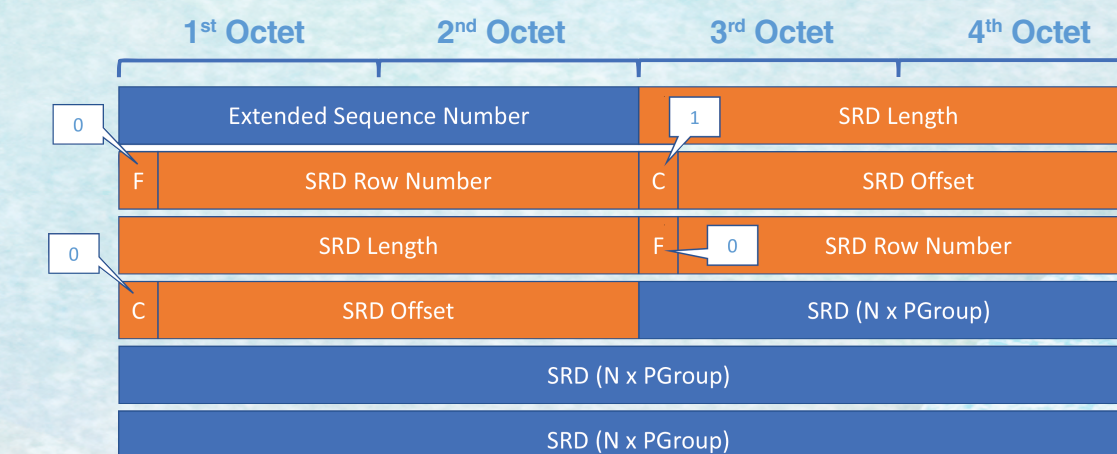
RTP Header Bits and Time Stamp

RTP Continuation Bit

1st Octet | 2nd Octet | 3rd Octet | 4th Octet

Extended Sequence Number | SRD Length

F | SRD Row Number | C | SRD Offset

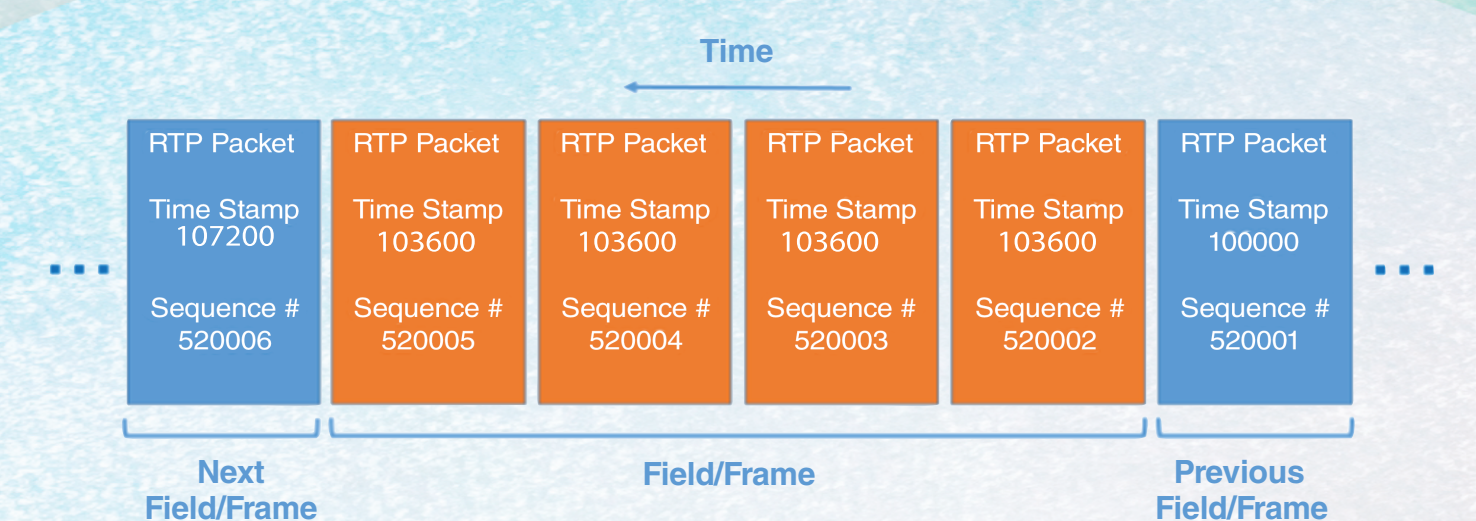SRD Length | F | SRD Row Number

C | SRD Offset

The use of the C flag is optional in GPM and mandatory in BPM. In BPM, the use of multiple SRD's in a packet is used to ensure an even packing with multiples of 180 octets.

RTP Payload

1st Octet | 2nd Octet | 3rd Octet | 4th Octet

Extended Sequence Number | SRD Length

F | SRD Row Number | C | SRD Offset

SRD Length | F | SRD Row Number

C | SRD Offset | SRD (N x PGroup)

SRD (N x PGroup)

SRD (N x PGroup)

The SRD headers are associated with the SRD segments in the payload. Every SRD segment must have a SRD header. The field identification flag (F) indicates which field (for interlaced) or segment (for PsF) the image data belongs to. It is always set to 0 in non-segmented progressive. The SRD segments are after the SRD headers and contain an integer multiple of pgroups.

RTP Time Stamp

Time

RTP Packet	RTP Packet	RTP Packet	RTP Packet	RTP Packet	RTP Packet
Time Stamp 107200	Time Stamp 103600	Time Stamp 103600	Time Stamp 103600	Time Stamp 103600	Time Stamp 100000
Sequence # 520006	Sequence # 520005	Sequence # 520004	Sequence # 520003	Sequence # 520002	Sequence # 520001

Next Field/Frame | Field/Frame | Previous Field/Frame

Every RTP packet containing media like uncompressed active video will carry a time stamp, which is sampled from the RTP clock of a sender. All RTP packets derived from the same field or frame have the same RTP time stamp. In addition each RTP packet has a sequence number, which increases by one in each RTP packet over time.

SMPTE ST 2110-20 transports uncompressed video signals, much like the SDI suite of standards, which today find widespread use across the television industry. There are applications in which the latency and expense of video compression are more than offset by the reduced cost of bandwidth, and work is underway to extend the 2110 suite of standards to include compressed video essence in order to address these applications. 2110 as published supports HDR, WCG, various sampling structures including RGB and XYZ 4:4:4, and bit depths up to 16 bit float. It also supports arbitrary image sizes up to 32K x 32K, and arbitrary frame rates.

AJA VIDEO SYSTEMS
Blackmagicdesign
deluxe
evertz
intoPIX
Imagine COMMUNICATIONS
matrox® Digital Video Solutions
M3L
RIEDEL www.riedel.net
SONY
TSL Products

SMPTE