Common Ember+ Sub-Tree for Receivers and Senders in SMPTE ST2022-6 and ST 2110 Endpoints

VERSION 1.1

The propose of this document is to provide a lightweight straightforward interface for control systems to create and manage multicast connections between SMPTE ST 2110 devices, or SMPTE ST 2022-6 devices. The interface described herein uses the well-documented Ember+ protocol to manage information flow between the controller and the device; a specific sub-tree structure is defined which can be common across devices. The controller uses this sub-tree to understand the sender and receiver configurations and to enable the control system to direct the receivers to the correct signals, through the exchange of properly formatted SDP values.

Ember + descriptions and documentations, and licensing information (its free) can be found at https://github.com/Lawo

This document is presently a draft for comments – but the intent is that the common interface sub-tree and a guide to its use will be maintained at the above Github and change-controlled there.

If you have questions on this document, please contact Albert Faust at Albert.Faust@lawo.com

Scope of proposal

The scope of this interface sub-tree is to allow for the exchange of SDP information via Ember+ from a transmitter to receiver for SMPTE ST 2110 and/or ST 2022-6 IP flows. It is also to be used to expose the receiver structure in term of signal capacity and structure of video, audio and metadata. This will enable a control system to know the signal information of the various video & audio transmitters within a device (from their exposed SDPs) and to convey that information to other receivers in an organized way. This interface enables the switching signals by switching SDP values, enabling transition from one stream to another. This interface also provides limited status of the state of a receiver and whether the streams are present or impaired.

Out of Scope

This proposed interface does not replace the normal configuration, status, alarm, or user-facing interfaces which any product has. Setup and configuration of the device, outside of receiver SDP values, remains the responsibility of existing device interfaces. This proposed interface only augments existing capability.

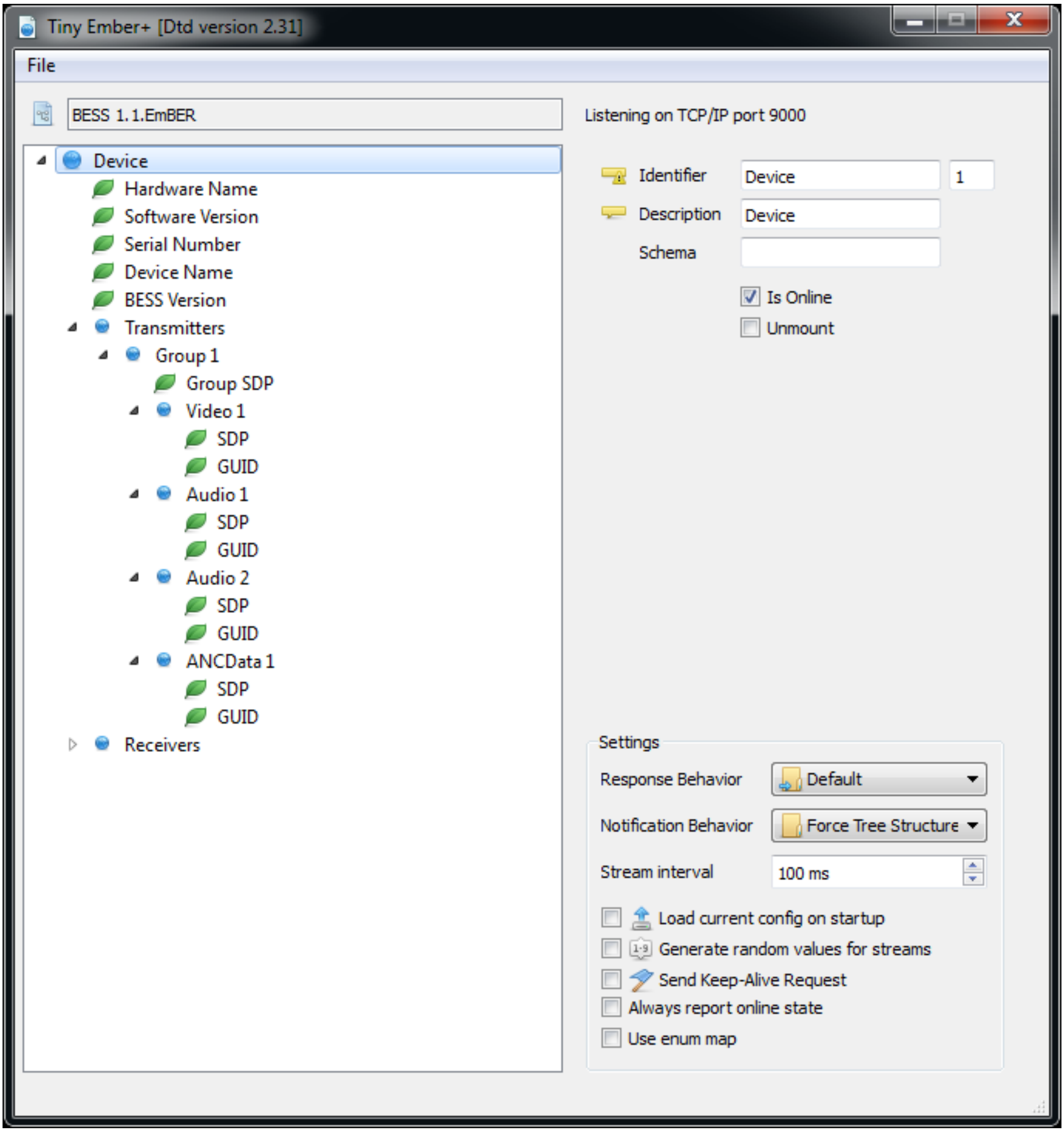
This proposed interface also does not control or manage network switches, though many systems will be built on the assumption that receivers will utilize IGMP in order to join multicast streams in response to SDP values written through this interface.

Relationship to AMWA IS04 and IS05

This proposed interface is designed specifically to co-exist well with AMWA NMOS in systems which implement NMOS.

Sub-Tree Details

The subtree is composed of a “Transmitters” branch and a “Receivers” branch. The Receivers branch is shown below. The Transmitters branch and Receivers branch shall each be children of the device’s Ember+ root. Other child nodes of the Ember+ root may exist.



Device

Schema Identifier: com.lawo.emberplus.nmos-interop.device

Hardware Name

Type: String
Access: Read Only

Deivce name that includes a manufacterer identification

Software Version

Type: String
Access: Read Only

Version ID of Current Software

Serial Number

Type: String
Access: Read Only

Serial Number of Device

Device Name

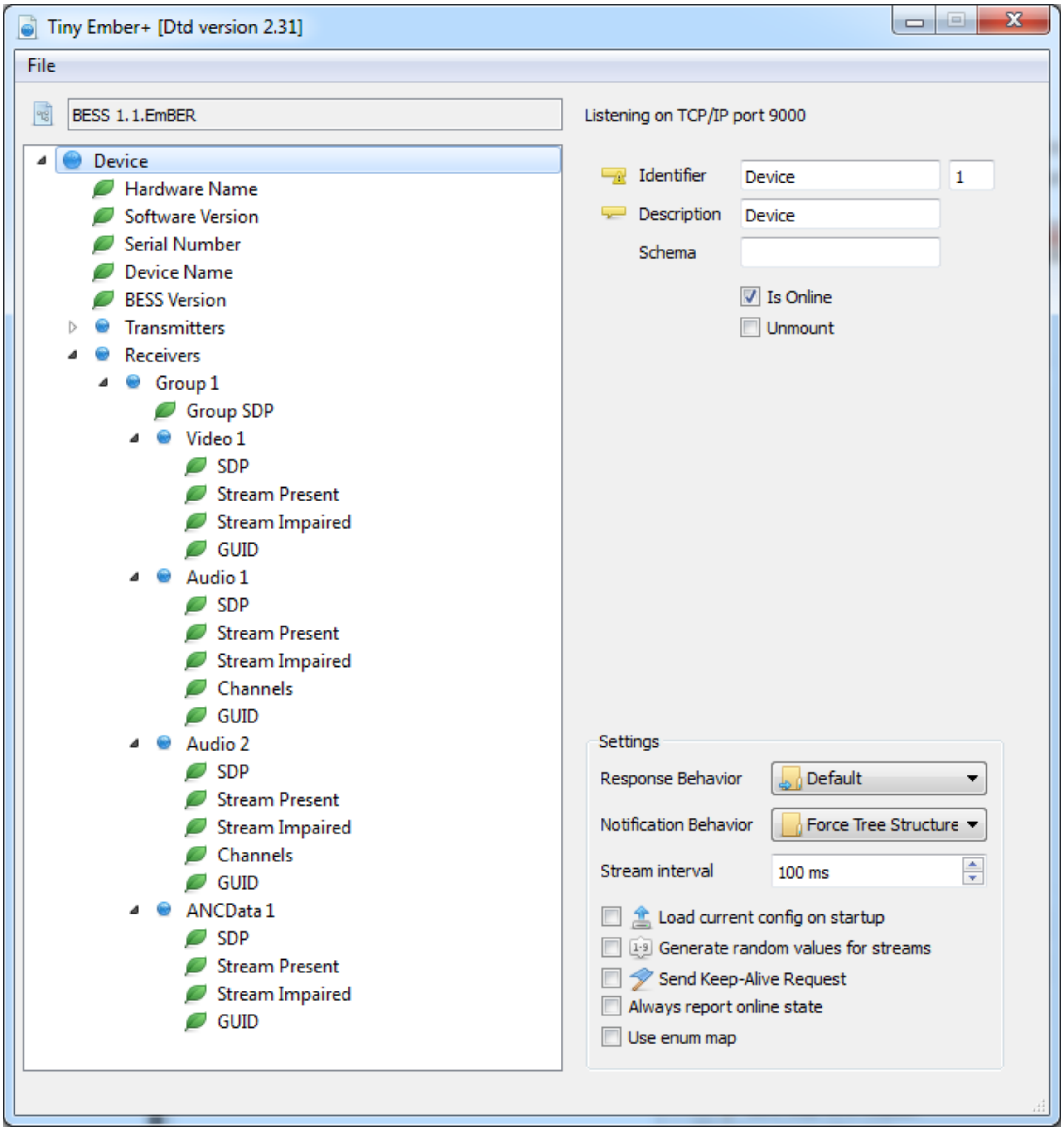
Type: String
Access: Read Only

User definable system name

BESS Version

Type: String
Access: Read Only

Version of BESS Schema



Syntax Elements in the Receiver Subtree

SDP

Type: String

Access: Read/Write

SDP values as defined by SMPTE ST 2110-20 (for video), 2110-30/31 (for audio), or 2110-40 (for ANC data). For the case of SMPTE 2022-6, the SDP definition of SMPTE 2022-8 is used. Example SDP values are shown later in the document.

At the “Group” node, the SDP can contain multiple section for video, audio, and data streams. At the “Video”, “Audio” or “Data” node level, the SDP value is expected to be a single-stream SDP (or a duplicated pair of streams for redundancy purposes).

GUID

Type: String

Access: Read Only

The endpoints exposed through this interface may also be advertised via AMWA IS-04, and control systems need a way to identify the correspondence between IS-04 senders and receivers and elements under these Transmitters and Receivers trees. The elements under the Transmitters tree should have GUIDs which match with IS-04 senders if IS-04 is active, and likewise the elements under the Receivers tree should have GUIDs which match with IS-04 Receivers. Devices which do not implement IS-04 should still create GUIDs and expose them via this interface. The GUIDs must be persistent across power cycles and reboots.

Stream Present

Type: Integer

Enumeration: 0=both, 1=primary, 2=secondary, 3=lost

Access: Read Only

- both == the receiver is receiving (perhaps with some errors) both the primary and secondary network streams
- primary == the receiver is receiving (perhaps with errors) the primary but NOT the secondary. Receivers which are only capable of receiving one stream (no protection implemented) would signal primary when getting the one stream that they can.
- secondary == the receiver is receiving (perhaps with errors) the secondary but NOT the primary
- lost == the receiver is not receiving either stream

Stream Impaired

Type: Boolean

Access: Read Only

- true if the stream contains uncorrectable errors even after applying the packets from the protect stream when available.
- If Stream Present = lost, then Stream Impaired should also be true.

Channels (Audio Only)

Type: Integer

Access: Read Only

- Indicates the number of mono channels the audio stream receiver is setup to receive

Subtree Node Numbering/Naming Methodology

Ember+ tree nodes are identified by names. The names of the nodes in this tree are mechanically generated in order to reveal the relationships of the video and audio receivers. The groups will be numbered sequentially within the transmitter tree starting with "Group 1", and similarly within the receiver tree starting with "Group 1". Within each group, the video, audio, and data nodes are numbered sequentially starting with 1 inside each group.

Example

- Group 1
  - Video 1
  - Audio 1
  - Audio 2
  - Audio 3
  - ANCData 1

- Group 2
  - Video 1
  - Audio 1
  - Audio 2
  - Audio 3
  - Audio 4
  - ANCData 1
  - ANCData 2
- Group 3
  - Video 1
  - Audio 1
  - Audio 2
  - Audio 3
  - ANCData 1
  - ANCData 2

SDP Examples

<u>SDP example for 2110 – 20</u>

v=0
o=- 123456 11 IN IP4 192.168.100.2
s=Example of a SMPTE ST2110-20 signal
i=this example is for 720p video at 59.94
t=0 0
a=group:DUP primary secondary
m=video 50000 RTP/AVP 112
c=IN IP4 239.100.9.10/32
a=source-filter: incl IN IP4 239.100.9.10 192.168.100.2
a=rtpmap:112 raw/90000
a=fmtp:112 sampling=YCbCr-4:2:2; width=1280; height=720; exactframerate=60000/1001; depth=10; TCS=SDR; colorimetry=BT709; PM=2110GPM; SSN=”ST2110-20:2017”;
a=ts-refclk:ptp=IEEE1588-2008:39-A7-94-FF-FE-07-CB-D0:37
a=ssrc:12345 cname:user1@example.com
a=mediaclk:direct=0
a=mid:primary
m=video 50020 RTP/AVP 112
c=IN IP4 239.101.9.11/32
a=source-filter: incl IN IP4 239.100.9.11 192.168.101.2
a=rtpmap:112 raw/90000
a=fmtp:112 sampling=YCbCr-4:2:2; width=1280; height=720; exactframerate=60000/1001; depth=10; TCS=SDR; colorimetry=BT709; PM=2110GPM; SSN=”ST2110-20:2017”;
a=ts-refclk:ptp=IEEE1588-2008:39-A7-94-FF-FE-07-CB-D0:37
a=ssrc:12345 cname:user1@example.com
a=mediaclk:direct=0
a=mid:secondary

<u>SDP example for 2110-30 Eight channel (5.1 plus stereo)</u>

v=0
o=- 123456 11 IN IP4 192.168.100.2
s=Example of a SMPTE ST2110-30 signal
i=this example is for 8 channel at 1 millisecond
t=0 0
a=group:DUP primary secondary
m=audio 5004 RTP/AVP 98
c=IN IP4 239.100.9.10/32
a=source-filter: incl IN IP4 239.100.9.10 192.168.100.2
a=rtpmap:98 L24/48000/8
a=framecount:48
a=ptime:1
a=fmtp:101 channel-order=SMPTE2110.(51,ST)
a=ts-refclk:ptp=IEEE1588-2008:39-A7-94-FF-FE-07-CB-D0:37
a=ssrc:12345 cname:user1@example.com
a=mediaclk:direct=0
a=mid:primary

m=audio 5004 RTP/AVP 98
c=IN IP4 239.101.9.10/32
a=source-filter: incl IN IP4 239.100.9.11 192.168.101.2
a=rtpmap:98 L24/48000/8
a=framecount:48
a=ptime:1
a=fmtp:101 channel-order=SMPTE2110.(51,ST)
a=ts-refclk:ptp=IEEE1588-2008:39-A7-94-FF-FE-07-CB-D0:37
a=ssrc:12345 cname:user1@example.com
a=mediaclk:direct=0
a=mid:secondary

SDP example for Group 2110 – 20 and 30

v=0
o=- 123456 11 IN IP4 192.168.100.2
s=Example of a SMPTE ST2110-20 signal
i=this example is for 720p video at 59.94
t=0 0
a=group:DUP primary secondary
m=video 50000 RTP/AVP 112
c=IN IP4 239.100.9.10/32
a=source-filter: incl IN IP4 239.100.9.10 192.168.100.2
a=rtpmap:112 raw/90000
a=fmtp:112 sampling=YCbCr-4:2:2; width=1280; height=720; exactframerate=60000/1001; depth=10; TCS=SDR; colorimetry=BT709; PM=2110GPM; SSN=”ST2110-20:2017”;
a=ts-refclk:ptp=IEEE1588-2008:39-A7-94-FF-FE-07-CB-D0:37
a=ssrc:12345 cname:user1@example.com
a=mediaclk:direct=0
a=mid:primary
m=video 50020 RTP/AVP 112
c=IN IP4 239.101.9.11/32
a=source-filter: incl IN IP4 239.100.9.11 192.168.101.2
a=rtpmap:112 raw/90000
a=fmtp:112 sampling=YCbCr-4:2:2; width=1280; height=720; exactframerate=60000/1001; depth=10; TCS=SDR; colorimetry=BT709; PM=2110GPM; SSN=”ST2110-20:2017”;
a=ts-refclk:ptp=IEEE1588-2008:39-A7-94-FF-FE-07-CB-D0:37
a=ssrc:12345 cname:user1@example.com
a=mediaclk:direct=0
a=mid:secondary
v=0
o=- 123456 11 IN IP4 192.168.100.2
s=Example of a SMPTE ST2110-30 signal
i=this example is for 8 channel at 1 millisecond
t=0 0
a=group:DUP primary secondary
m=audio 5004 RTP/AVP 98
c=IN IP4 239.100.9.10/32
a=source-filter: incl IN IP4 239.100.9.10 192.168.100.2

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a=rtpmap:98 L24/48000/8
a=framecount:48
a=ptime:1
a=fmtp:101 channel-order=SMPTE2110.(51,ST)
a=ts-refclk:ptp=IEEE1588-2008:39-A7-94-FF-FE-07-CB-D0:37
a=ssrc:12345 cname:user1@example.com
a=mediaclk:direct=0
a=mid:primary
m=audio 5004 RTP/AVP 98
c=IN IP4 239.101.9.10/32
a=source-filter: incl IN IP4 239.100.9.11 192.168.101.2
a=rtpmap:98 L24/48000/8
a=framecount:48
a=ptime:1
a=fmtp:101 channel-order=SMPTE2110.(51,ST)
a=ts-refclk:ptp=IEEE1588-2008:39-A7-94-FF-FE-07-CB-D0:37
a=ssrc:12345 cname:user1@example.com
a=mediaclk:direct=0
a=mid:secondary
```