

SMPTE OVERVIEW DOCUMENT

Broadcast Exchange Format — Roadmap for the 2021 Document Suite



Document Roadmap

The SMPTE 2021 suite of documents specifies the Broadcast eXchange Format (BXF). This particular document (SMPTE 2021-0:2018) serves as a roadmap to the entire suite of 2021 documents, as well as other related files.

Documents in the SMPTE 2021 Suite

SMPTE RP 2021-1 – General Information and Informative Notes (Normative and Informative Sections)

This document serves as the base standard document for the 2021 suite. It includes a comprehensive set of definitions, discussion of system data flow, security, configuration, and a large set of informative notes. This document is critical to anyone implementing BXF, as it is referenced by all other documents in this suite.

The distribution of SMPTE ST 2021-1 also includes:

Schema Definition File Collection (2021-1a-2009 Schema.zip)

This is the collection of XSD files which are required to implement BXF.

HTML Schema Documentation (2021-1b-2009 Schema HTML.zip)

This is a visual representation of the entire BXF schema, including all XSDs. It provides a graphical, non technical view into the structure of the schema from top to bottom, including relationships between portions of the schema, as well as complete documentation of all schema attributes and elements.

SMPTE ST 2021-2 – Protocol (Entirely Normative)

This document specifically and exclusively deals with issues surrounding protocol as it relates to BXF. It addresses the nature of BXF TCP/IP connections, sending of messages, dealing with inactive connections, initiation of servers, timeout of services, encryption of BXF messages, message formats, as well as file-based transport.

SMPTE EG 2021-3 – Engineering Guideline – BXF Use Cases (Entirely Informative)

This document provides a rich set of use cases, illustrating the use of BXF in real-world scenarios, complete with XML samples. The use cases cover such examples as: schedule, dub order, purge order, record order, transfer order, content notification, queries, invoking schedules, heartbeat messages, as runs, playlist updates, and acquisition failures. This document is intended to assist those wishing to implement BXF in specific ways.

SMPTE ST 2021-4 –BXF Schema Documentation

This document provides documentation of each of the schema definition files included with 2021 (the XSDs). It covers all of the XSD files and explains all of the attributes and elements contained in each.

SMPTE RP 2021-5 – Recommended Practice - Using Ad-ID and EIDR as alternate identifiers in SMPTE BXF and ATSC PMCP

This document was created to assist BXF implementers with a recommendation for use of the two commonly used identifiers (Ad-ID and EIDR) in a BXF environment.

SMPTE RP 2021-9 – Recommended Practice (Normative and Informative Sections)

This document was created to assist BXF implementers who have read the other documents in the 2021 suite to create interoperable implementations. It covers such topics as: wellformedness and validation, processing model, general conventions related to various messages, as well as transport protocol (both connection-based and file-based). Perhaps the most useful portion of this Recommended Practice is its enumeration of message types that are typically used by different types of applications. If you are implementing BXF for an automation system, for instance, you can go directly to that portion of the document to see what parts of BXF are specifically applicable to your system. The document then goes into each major subset of BXF (configuration, content, content transfer, format, and schedule) in detail. The document also includes annexes covering: supported extensions, message type usages, error handling, and protocol transport.

Changes Contained In BXF 2.0

BXF 2.0 consists of a collection of four significant schema updates, adding new capabilities required by implementers. It is important to note that these changes are all backward-compatible. Existing BXF implementations will continue to operate as they always have. A new set of XSD (schema definition files) as well as XML samples is included in the 2021 package.

Below is an outline of the changes included within BXF 2.0.

1. Change to all XSD headers for this new release:

In order to distinguish BXF 2.0 schemas from those of BXF 1.0, the headers in each of the BXF XSD files have been updated to reflect the new version, as well as a new location for the BXF 2.0 schemas.

Old Version of all headers:

```
<!-- Copyright 2008 Society of Motion Picture and Television Engineers. All rights reserved. -->
<xs:schema xmlns="http://smpte-ra.org/schemas/2021/2008/BXF"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:pmcp="http://www.atsc.org/XMLSchemas/pmcp/2007/3.1" targetNamespace="http://smpte-
ra.org/schemas/2021/2008/BXF" elementFormDefault="qualified" attributeFormDefault="unqualified"
version="1.000">
```

New Version of all headers:

```
<!-- Copyright 2011 Society of Motion Picture and Television Engineers. All rights reserved. -->
```

```
<xs:schema xmlns="http://smpte-ra.org/schemas/2021/2011/BXF"  
xmlns:xs="http://www.w3.org/2001/XMLSchema"  
xmlns:pmcp="http://www.atsc.org/XMLSchemas/pmcp/2007/3.1" targetNamespace="http://smpte-  
ra.org/schemas/2021/2011/BXF" elementFormDefault="qualified" attributeFormDefault="unqualified"  
version="2.000">
```

2. Addition of support for sponsored secondary events

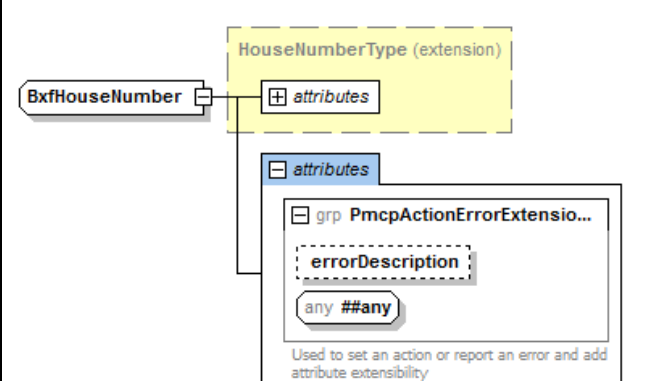
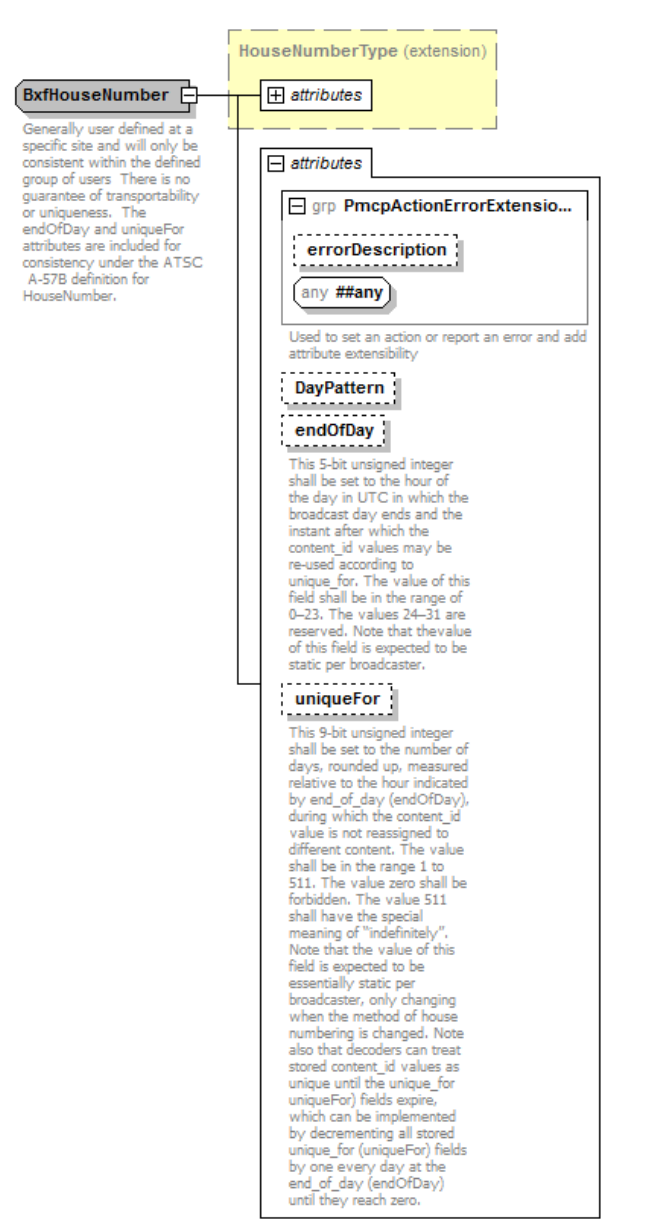
A new structure has been added within the BXF nonprimaryevent.xsd schema definition. This allows a non-primary event to be either a standard non-advertising related event (as was allowed in BXF 1.0), or an advertising-related event (indicated in the schema as a NonProgramEvent). This allows the scheduling of a non-primary program event that plays concurrently with the primary event being played. An example would be the squeezed-back end credits of a program (non-primary event) that airs concurrently with the primary event start of the following program.

nonprimaryevent.xsd	
Version 1.0	Version 2.0
New Version supports a choice between NonProgramEvents and ProgramEvent	
<p>Diagram illustrating the structure of the <code>NonPrimaryEvent</code> element in Version 1.0. The structure includes:</p> <ul style="list-style-type: none"><code>attributes</code><code>NonPrimaryEventName</code>: Used to define the type of event (eg. Key, GPI, Tone, Audio or Video Effects) (See Configuration Section in BXF Protocol Documentation)<code>OptionalFlag</code>: Optional event, will not air unless triggered<code>PrimaryEventId</code>: Linkage to the primary event id. Not required for auxiliary events. Required to be a UUID.<code>NonPrimaryElementId</code>: A UUID that is used to link to the format structure's non-primary element definition<code>Offset</code> (0..2): The definition of how a non-primary event should run relative to the primary event either using the start or end points of either event.<code>Macros</code> (0..∞)<code>NonProgramEvents</code>: Used to specify non-primary events that use specific interstitial content<code>PrivateInformation</code>	<p>Diagram illustrating the structure of the <code>NonPrimaryEvent</code> element in Version 2.0. The structure includes:</p> <ul style="list-style-type: none"><code>attributes</code><code>NonPrimaryEventName</code>: Used to define the type of event (eg. Key, GPI, Tone, Audio or Video Effects) (See Configuration Section in BXF Protocol Documentation)<code>OptionalFlag</code>: Optional event, will not air unless triggered<code>PrimaryEventId</code>: Linkage to the primary event id. Not required for auxiliary events. Required to be a UUID.<code>NonPrimaryElementId</code>: A UUID that is used to link to the format structure's non-primary element definition<code>Offset</code> (0..2): The definition of how a non-primary event should run relative to the primary event either using the start or end points of either event.<code>Macros</code> (0..∞)A choice between <code>NonProgramEvents</code> (Used to specify non-primary events that use specific interstitial content) and <code>ProgramEvent</code> (Used to specify non-primary events that use specific program content)<code>PrivateInformation</code>
<pre><xs:element name="NonProgramEvents" type="NonProgramEvent" minOccurs="0"> <xs:annotation> <xs:documentation>Used to specify non-primary events that use specific interstitial content</xs:documentation> </xs:annotation> </xs:element></pre>	<pre><xs:choice minOccurs="0"> <xs:element name="NonProgramEvents" type="NonProgramEvent"> <xs:annotation> <xs:documentation>Used to specify non-primary events that use specific interstitial content</xs:documentation> </xs:annotation> <xs:element name="ProgramEvent" type="ProgramEvent"> <xs:annotation> <xs:documentation>Used to specify non-primary events that use specific program content</xs:documentation> </xs:annotation> </xs:choice></pre>

	<pre></xs:element> <xs:element name="ProgramEvent" type="ProgramEvent"> <xs:annotation> <xs:documentation>Used to specify non-primary events that use specific program content</xs:documentation> </xs:annotation> </xs:element> </xs:choice></pre>
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3. Support for Reuse of House Numbers

It is a reality that house numbers are re-used in broadcast operations worldwide. The ATSC's A/57B standard accommodates this fact with support for a “duration of effectiveness” for house numbers. In BXF 2.0, support has been added to the bxfcontentid schema definition file to include four new attributes to allow for support of this.

bxfcontentid.xsd	
Version 1.0	Version 2.0
New Version supports the ability to set the duration of effectiveness for a house number and to make it compatible with A/57’s definitions.	
	 <p>Generally user defined at a specific site and will only be consistent within the defined group of users. There is no guarantee of transportability or uniqueness. The endOfDay and uniqueFor attributes are included for consistency under the ATSC A-57B definition for HouseNumber.</p> <p>errorDescription any ##any Used to set an action or report an error and add attribute extensibility</p> <p>DayPattern</p> <p>endOfDay This 5-bit unsigned integer shall be set to the hour of the day in UTC in which the broadcast day ends and the instant after which the content_id values may be re-used according to unique_for. The value of this field shall be in the range of 0–23. The values 24–31 are reserved. Note that the value of this field is expected to be static per broadcaster.</p> <p>uniqueFor This 9-bit unsigned integer shall be set to the number of days, rounded up, measured relative to the hour indicated by end_of_day (endOfDay), during which the content_id value is not reassigned to different content. The value shall be in the range 1 to 511. The value zero shall be forbidden. The value 511 shall have the special meaning of “indefinitely”. Note that the value of this field is expected to be essentially static per broadcaster, only changing when the method of house numbering is changed. Note also that decoders can treat stored content_id values as unique until the unique_for (uniqueFor) fields expire, which can be implemented by decrementing all stored unique_for (uniqueFor) fields by one every day at the end_of_day (endOfDay) until they reach zero.</p>
<pre><xs:complexType name="BxfHouseNumber"> <xs:complexContent> <xs:extension base="pmcp:HouseNumberType"></pre>	<pre><xs:complexType name="BxfHouseNumber"> <xs:annotation> <xs:documentation>Generally user defined at a specific site and will only be consistent within</pre>

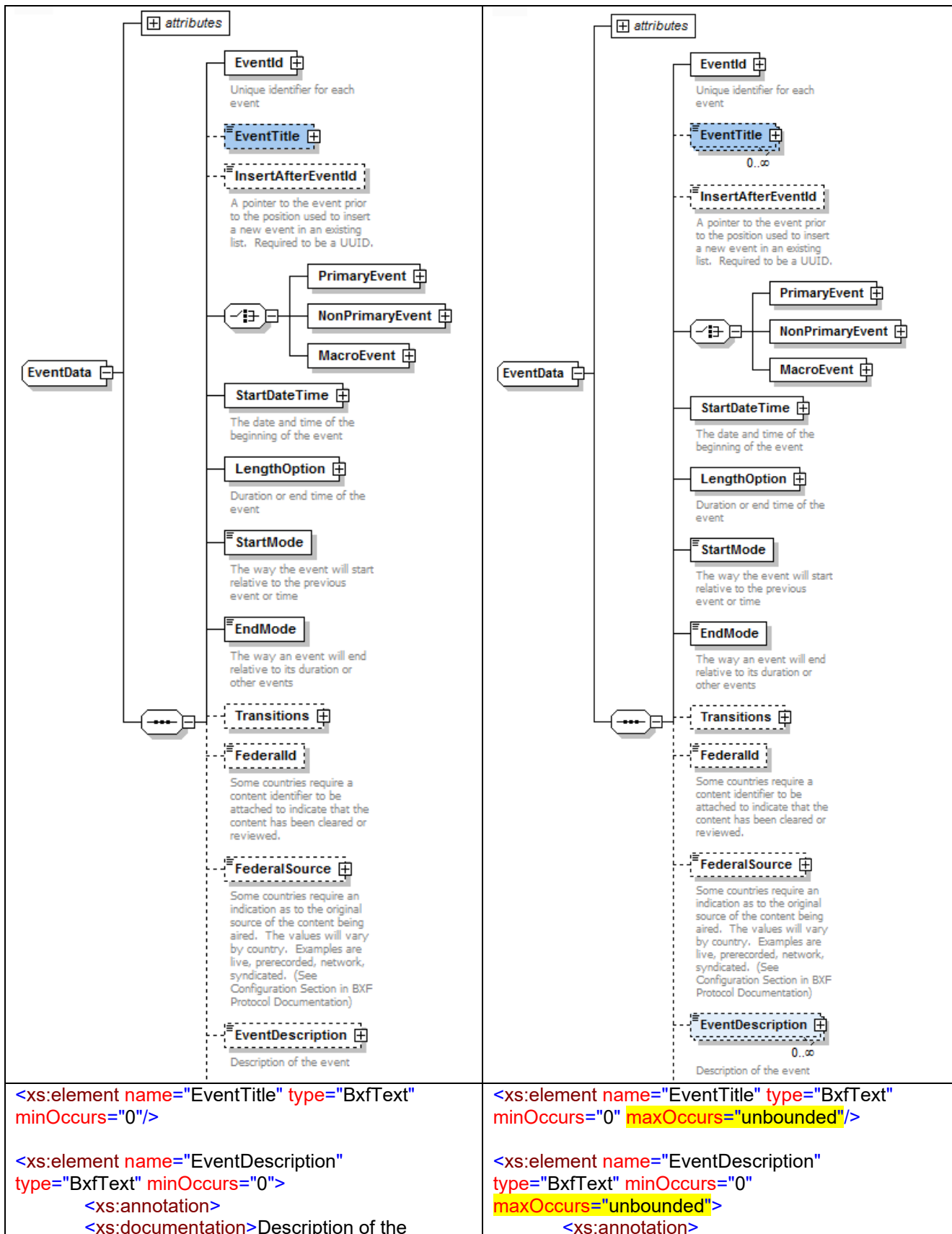
<pre> <xs:attributeGroup ref="PmcpActionErrorExtensionGroup"/> </xs:extension> </xs:complexContent> </xs:complexType> </pre>	<p>the defined group of users. There is no guarantee of transportability or uniqueness. The endOfDay and uniqueFor attributes are included for consistency under the ATSC A-57B definition for HouseNumber.</p> <pre> </xs:documentation> </xs:annotation> <xs:complexContent> <xs:extension base="pmcp:HouseNumberType"> <xs:attributeGroup ref="PmcpActionErrorExtensionGroup"/> <xs:attribute name="DayPattern" type="DayPattern"/> <xs:attribute name="endOfDay" fixed="5"> <xs:annotation> <xs:documentation>This 5-bit unsigned integer shall be set to the hour of the day in UTC in which the broadcast day ends and the instant after which the content_id values may be re-used according to unique_for. The value of this field shall be in the range of 0–23. The values 24–31 are reserved. Note that the value of this field is expected to be static per broadcaster. </xs:documentation> </xs:annotation> <xs:simpleType> <xs:restriction base="xs:unsignedInt"> <xs:minInclusive value="0"/> <xs:maxInclusive value="23"/> </xs:restriction> </xs:simpleType> </xs:attribute> <xs:attribute name="uniqueFor" fixed="9"> <xs:annotation> <xs:documentation>This 9-bit unsigned integer shall be set to the number of days, rounded up, measured relative to the hour indicated by end_of_day (endOfDay), during which the content_id value is not reassigned to different content. The value shall be in the range 1 to 511. The value zero shall be forbidden. The value 511 shall have the special meaning of “indefinitely”. Note that the value of this field is expected to be essentially static per broadcaster, only changing when the method of house numbering is changed. Note also that decoders can treat stored content_id values as unique until the unique_for (uniqueFor) fields expire, which can be implemented by decrementing all stored unique_for (uniqueFor) fields by one every day at the end_of_day (endOfDay) until they reach zero. </xs:documentation> </xs:annotation> <xs:simpleType> <xs:restriction base="xs:unsignedInt"> <xs:minInclusive value="1"/> <xs:maxInclusive value="511"/> </pre>
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	<div></xs:restriction></div> <div></xs:simpleType></div> <div></xs:attribute></div> <div></xs:extension></div> <div></xs:complexContent></div> <div></xs:complexType></div>
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4. Multi Language Support

Many users of BXF must deal with on-air material that exists in multiple languages. BXF 1.0 only allowed for a single Event Title and Event Description on each event. This meant that a single language had to be chosen. BXF 2.0 adds support for multiple Event Titles and Event Descriptions, allowing the title and description to be included in multiple languages.

eventdata.xsd	
Version 1.0	Version 2.0
New Version supports the ability to enter multiple EventTitles and EventDescriptions so that more than one language can be included in a single message.	



<code>event</xs:documentation></code> <code></xs:annotation></code> <code></xs:element></code>	<code><xs:documentation></code> Description of the <code>event</xs:documentation></code> <code></xs:annotation></code> <code></xs:element></code>
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5. Ability to communicate events surrounding currently airing event

As BXF has introduced the ability for systems to exchange data relating to schedules and as runs in near real time, the need has arisen for a simple structure to communicate a quick update, showing events just aired, the event currently airing, and events about to air. BXF 2.0 adds this ability to the schedule schema definition via a new node (RealTimeDetail). Using this new structure the current event, “x” events immediately prior to the one currently airing (a negative value in the RealTimeSequence node), as well as “y” events immediately following the one currently airing (a positive value in the RealTimeSequence node) can be communicated.

schedule.xsd	
Version 1.0	Version 2.0
New Version supports the ability to handle real time actions on the automation event process. This would allow the communication of the prior event completed, the event that is currently running and the event that is next up.	
	<pre> <xs:element name="RealTimeDetail" minOccurs="0"> <xs:complexType> <xs:sequence maxOccurs="unbounded"> <xs:element name="EventId" type="EventExtId"> </xs:annotation> </pre>

	<pre> <xs:documentation>Links to the events as described in ScheduledEvent if in the future or in the AsRun if current or in the past. Can be null if the event was added manually. </xs:documentation> </xs:annotation> </xs:element> <xs:element name="RealTimeSequence" type="xs:integer"> <xs:annotation> <xs:documentation>If zero, indicates the current airing event; if negative, indicates that the event was in the past and has aired; if positive, indicates an event that will air. The integer number indicates the sequence order going forward or backward in time. </xs:documentation> </xs:annotation> </xs:element> <xs:element name="EventStartTime" type="BxfDateTime" minOccurs="0"> <xs:annotation> <xs:documentation>Either the actual start time if the event already aired or is airing or the expected start time if in the future. </xs:documentation> </xs:annotation> </xs:element> <xs:element name="PrivateInformation" type="BxfPrivateInformation" minOccurs="0"/> </xs:sequence> </xs:complexType> </xs:element> </pre>
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Changes Contained In BXF 3.0

The enhancements to BXF included in the “3.0” suite of documents and schema are enumerated in EG 2021-4:2013 – Schema Documentation.

Each XSD that has been updated as part of the BXF 3.0 effort will have a subsection under its own XSD heading (e.g. Audio.XSD), labeled “BXF 3.0 Changes”. In these subsections, the changes affecting the schema in question are listed and described.

Changes Contained In BXF 4.0

BXF 4.0 includes changes to the following documents in the SMPTE 2021 suite:

- ST 2021-1 Broadcast Exchange Format Requirements and Informative Notes
- EG 2021-2 Broadcast Exchange Format (BXF) Protocol
- EG 2021-3 Broadcast Exchange Format (BXF) Use Cases
- EG 2021-4 Broadcast Exchange Format (BXF) Schema Documentation
- RP 2021-9 Implementing Broadcast Exchange Format (BXF)

In addition, the schema collection, use cases, and HTML schema representation have been updated.

In ST 2021-1, the only significant changes are in section 8 (Configuration), where the new configuration items (AuthoritativeIdSource, FederalType, JobInstructionType, and OverlayOpportunityType) are highlighted. Section 3 (Document Elements) is updated to reflect the current URL for schema validation.

In EG 2021-2, section 5.2.3 (Message Format) is updated to reflect the current URL for schema validation.

In EG 2021-3, the Introduction has been updated, removing redundant information that is included in ST 2021-1. Conformance Notation and Normative References have been removed. Section 5 (Use Cases) has been updated to include updated BXF 4.0 use cases.

EG 2021-4 documents the schema changes in BXF 4.0. In this document, each XSD that has been updated as part of the BXF 4.0 effort has a subsection under its own XSD heading (e.g. Audio.XSD), labeled "BXF 4.0 Changes". In these subsections, the changes affecting the schema in question are listed and described.

RP 2021-5 is not changed in BXF 4.0.

RP 2021-9 contains changes in section 9.2.1 (BXF Configuration Types), adding in the new items listed in the ST 2021-1 change notes above. It also contains some corrections in section 12 (Format).

Changes Contained In BXF 5.0

BXF 5.0 includes changes to the following documents in the SMPTE 2021 suite:

- ST 2021-1 Broadcast Exchange Format Requirements and Informative Notes
- EG 2021-2 Broadcast Exchange Format (BXF) Protocol
- EG 2021-3 Broadcast Exchange Format (BXF) Use Cases
- EG 2021-4 Broadcast Exchange Format (BXF) Schema Documentation
- RP 2021-9 Implementing Broadcast Exchange Format (BXF)

It also includes a new document

- ST 2021-6 BXF SDK Documentation

In ST 2021-1, the only significant change is the shift of background information to a new informative section. are in section 8 (Configuration), where the new configuration items (AuthoritativeIdSource, FederalType, JobInstructionType, and OverlayOpportunityType) are highlighted. Section 3 (Document Elements) is updated to reflect the current URL for schema validation.

In EG 2021-2, EG 2021-3, and RP2021-9 a few editorial changes were made.

EG 2021-4 documents the schema changes in BXF 5.0. In this document, each XSD that has been updated as part of the BXF 5.0 effort has a subsection under its own XSD heading (e.g. Audio.XSD), labeled “BXF 5.0 Changes”. In these subsections, the changes affecting the schema in question are listed and described.

Changes Contained In BXF 6.0

BXF 6.0 includes changes to the following documents in the SMPTE 2021 suite:

- RP 2021-1 Broadcast Exchange Format Requirements and Informative Notes
- EG 2021-2 Broadcast Exchange Format (BXF) Protocol
- EG 2021-3 Broadcast Exchange Format (BXF) Use Cases
- EG 2021-4 Broadcast Exchange Format (BXF) Schema Documentation

ST 2021-1 was changed from an ST to an RP. It now refers to Library and Air Ready Masters, and to QC Systems as well as Mastering and Library systems. Significant cleanup was done throughout the document, as well.

EG 2021-2 contains minimal edits. EG 2021-3 gained a new use case around multi-channel audio.

EG 2021-4 documents the schema changes in BXF 6.0. In this document, each XSD that has been updated as part of the BXF 6.0 effort has a subsection under its own XSD heading (e.g. Audio.XSD), labeled “BXF 6.0 Changes”. In these subsections, the changes affecting the schema in question are listed and described.

Changes Contained In BXF 7.0

BXF 7.0 includes changes to the following documents in the SMPTE 2021 suite:

- RP 2021-1 Broadcast Exchange Format Requirements and Informative Notes
- ST 2021-4 Broadcast Exchange Format (BXF) Schema Documentation

EG 2021-4 was changed from an EG to an ST. It documents the schema changes in BXF 7.0. In this document, each XSD that has been updated as part of the BXF 7.0 effort has a subsection under its own XSD heading (e.g. Audio.XSD), labeled “BXF 7.0 Changes”. In these subsections, the changes affecting the schema in question are listed and described.

The most significant changes contained in BXF 7.0 include:

- Comprehensive HDR (PQ and HLG) structure
- J2K IMF Application Constraint
- UHD Air Read Master