

SMPTE RECOMMENDED PRACTICE

Application of Unique Material Identifiers in Production and Broadcast Environments



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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in its Standards Operations Manual.

SMPTE RP 205 was prepared by Technology Committee 30MR on Metadata and Registers.

Intellectual Property

SMPTE draws attention to the fact that it is claimed that compliance with this Standard may involve the use of one or more patents or other intellectual property rights (collectively, "IPR"). The Society takes no position concerning the evidence, validity, or scope of this IPR.

Each holder of claimed IPR has assured the Society that it is willing to License all IPR it owns, and any third party IPR it has the right to sublicense, that is essential to the implementation of this Standard to those (Members and non-Members alike) desiring to implement this Standard under reasonable terms and conditions, demonstrably free of discrimination. Each holder of claimed IPR has filed a statement to such effect with SMPTE. Information may be obtained from the Director, Standards & Engineering at SMPTE Headquarters.

Attention is also drawn to the possibility that elements of this Standard may be subject to IPR other than those identified above. The Society shall not be responsible for identifying any or all such IPR.

Introduction

This section is entirely informative and does not form an integral part of this Engineering Document.

The Unique Material Identifier (UMID) is a unique audiovisual material identifier standardized by SMPTE as SMPTE ST 330.

In 1998, the EBU/SMPTE Task Force for Harmonized Standards for the Exchange of Programme Material as Bitstreams recommended that a unique material identifier and a single, generic, file wrapper were needed to facilitate the exchange of program material and metadata as bit-streams. These recommendations were realized with the standardization of the Unique Material Identifier (UMID) in the year 2000 and later, with the standardization of the Material eXchange Format (MXF) in the year 2004.

While the UMID itself is independent of any material format or packaging, it was a natural consequence that the UMID was adopted as the mandatory component in the MXF files by which the files, and the material they contain, are uniquely identified. Thus, as MXF has gained an ever increasing role within file-based workflows, the UMID has also become more widely accepted within the industry.

However, in spite of its wide adoption, the usefulness of the UMID as a globally unique material identifier has been very limited. There have been experimental trials and media products that have utilized the UMID as the material identifier by which external metadata is uniquely associated with material. Despite this original intent upon its introduction, the UMID could not effectively be used as a common means to uniquely identify material across applications and vendor products. This failing can be attributed to the following reasons:

Problem 1: No industry wide trust framework has been established, by which the uniqueness and trustworthiness of a UMID can be verified, ,

Problem 2: No industry wide criteria has been defined by which an application can use to determine when a UMID can remain unchanged and when a new UMID must be assigned,

Problem 3: No industry common method has been defined by which a UMID could be resolved to its descriptive and location information, describing and providing access to the identified material.

This Recommended Practice is provided to address the Problems 1 and 2 above.

The primary intent of the UMID is to be a globally unique material identifier. However, the global uniqueness of a UMID can be easily violated if proper, proactive, treatment of the UMID is not practiced. For example, suppose a material asset is copied from one location to another (a.k.a. cloned) and some portion of the picture essence is overwritten, removed, or changed but the UMID is not updated. The resulting material asset will differ from the original, but will be improperly assigned the same UMID identity. To prevent such a scenario from occurring, a UMID must be reassigned in accordance with a common set of principles.

If one creates a new UMID based on SMPTE ST 330 specification, the UMID's global uniqueness is algorithmically guaranteed. Therefore, the integrity of the UMID as a globally unique material identifier is guaranteed, within practical limits, only when one always assigns a newly created UMID to a material asset. This is however equivalent with the use of a proprietary material identifier, which is defined within the scope of a closed application domain, and does not provide the benefits of using a UMID at all.

So what are the benefits of using a UMID as an industry standard unique material identifier?

One of the important benefits is that material assets can be managed, seamlessly, over multiple media products, provided those media products utilize the UMID and adhere to the same UMID creation and reuse rule set. If this is realized, and if more than one material asset is identified by the same UMID, these material assets can be trusted to be identical, regardless of the product managing those material assets. Furthermore, this scenario can be expanded to cover an entire media production system; using the UMID as a common unique material identifier across a heterogeneous system, comprised of numerous media products from different vendors. However, in order to realize this, a universal rule set for UMID applications that provides a means by which the integrity of a UMID attached to a given material asset can be trusted, regardless of the products used to create the UMID and/or attach the UMID to the material asset, is required.

Unfortunately, SMPTE ST 330 does not specify nor provide the set of rules required to facilitate the trust framework to guarantee the integrity of a UMID. Therefore additional regulations and rules must be defined to create this trust framework.

In this Recommended Practice, the UMID Application Principles are specified as a set of rules applicable to all UMID applications, which establishes a trust framework for UMID usage. If a media product strictly adheres to the UMID Application Principles, the integrity of the UMIDs attached to material obtained from that product can be trusted, such applications and products are known as "UMID-aware".

Since the means by which the UMID Application Principles are applied depend on the type of product and the type of recording medium used, the Principles are specified in terms of "What to Achieve" versus "How to Achieve Them", and how they are achieved is left up to the implementer of the product. Please refer to Annex B for a typical implementation example of the UMID Application Principles using a UMID as a globally unique material identifier.

Furthermore, since SMPTE ST 330 allows UMIDs to be used for purposes other than globally unique material identity, rules for these additional purposes have been defined within the UMID Application Principles.

In summary, the purpose of this Recommended Practice is to establish a common trust framework by which applications can utilize UMIDs in a consistent, unambiguous, and well-understood manner that allows for the maintenance of the logical relationships between material assets, their metadata, and their instances.

1 Scope

This Recommended Practice defines the UMID Application Principles that must constitute the basis of any UMID application, and recommends several points on UMID use that must be carefully considered for each application. It also provides informative text on the UMID basics, how to implement the UMID Application Principles for a UMID as a globally unique material identifier, various UMID application examples, and frequently asked questions on the UMID applications.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

3 Normative References

Note: All references in this document to other SMPTE documents use the current numbering style (e.g. SMPTE ST 298:2009) although, during a transitional phase, the document as published (printed or PDF) may bear an older designation (such as SMPTE 298-2009). Documents with the same root number (e.g. 298) and publication year (e.g. 2009) are functionally identical.

The following standards contain provisions which, through reference in this text, constitute provisions of this recommended practice. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this recommended practice are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

SMPTE ST 298:2009, Universal Labels for Unique Identification of Digital Data

SMPTE ST 330:2011, Unique Material Identifier (UMID)

4 UMID Application Principles

4.1 Introduction

This section defines a set of UMID Application Principles. Except for this and Section 4.2, each subsection starts with the statement of the principle, followed by implications that will help the reader to obtain a better understanding of the statement.

4.2 Principle 1 – Definitions

For the purpose of describing the UMID Application Principles, the capitalized terms used in the statements below shall have the respective meanings defined as follows:

- **Basic UMID** shall mean the UMID of 32-byte long composed of its 12-byte UL, the 1-byte length field, 3-byte Instance Number Field and 16-byte Material Number Field, specified in SMPTE ST 330. While this term may represent either on its own or the first 32-byte of Extended UMID, the phrase “the Basic part of Extended UMID” may be used to refer to the latter case for its further clarification if needed.
- **Extended UMID** shall mean the UMID of 64-byte long composed of its 32-byte Basic UMID followed by 32-byte Source Pack, used to identify a finer granularity than is identified by its Basic part, specified in SMPTE ST 330.
- **Instance** shall mean a specific item of stored material(s) that shares the same Material Number regardless of its Instance Number value.
- **Instance Number** shall mean the value in the Instance Number Field of the UMID. The Instance Number shall take a value of zero for the original Material and a non-zero value for any copy or derivation of the original Material.

Note: SMPTE ST 330 defines several methods by which the Instance Number value is created. The uniqueness of an Instance Number value is guaranteed only within a predefined closed domain where the uniqueness of an Instance Number is appropriately controlled by using such as local registration. In open domains, the assignment of a new non-zero Instance Number value cannot guarantee a unique value; *i.e.*, there is a small, but finite, probability that duplicate values can occur.

- **Instance Number Field** shall mean the 24 bits field using bytes 14th-16th of the UMID as specified in SMPTE ST 330.
- **Instance Number Generation Method Field** shall mean the field of the 4 least significant bits (LSBs) of byte 12th of the UMID UL used to identify the method to create the Instance Number field value as specified in SMPTE ST 330. Note that the special value of 15 (F_n) is reserved for this field in order for the UMID with it to be used to signal a live-stream source that has never been fully recorded (and hence has never been instantiated as a persistent and deterministic form of material) rather than to be used as a unique material identifier.
- **Material** shall mean a persistent and deterministic form of unique set of audio and/or visual essence playable on a single timeline, which may be a single item or a set of synchronized items, which shall be continuous along the timeline. Material, often preceded with the term “original”, shall be globally uniquely identified by a UMID with a newly created Material Number together with zero Instance Number, whose global uniqueness is algorithmically guaranteed according to SMPTE ST 330. The essence in the Material may either be a playable bit stream, or an abstract source from which a playable bit stream may be created.
- **Material Number** shall mean a non-zero value for the Material Number Field in the UMID.
- **Material Number Field** shall mean the field of bytes 17th-32nd of UMID as specified in SMPTE ST 330.
- **Material Unit** shall mean the quantum of material composed as its cyclic sampling structure.

- **Source Pack** shall mean the last 32 bytes of the Extended UMID, which contains the information of “when”, “where” and “who” has created the material, as specified in SMPTE ST 330.
- **UL** shall mean the SMPTE Universal Label specified in SMPTE ST 298, which is truncated to 12 bytes length when used in the UMID format. When the UMID UL is extracted for external use, it shall be padded to 16 bytes by appending 4 bytes of zero value and shall change the value of the label size in byte 2nd from 0A_h to 0E_h.
- **UMID** shall mean the Unique Material IDentifier whose format and value creation methods are specified in SMPTE ST 330. The UMID may take the form of either 32-byte Basic UMID or 64-byte Extended UMID, where the Extended UMID is still a UMID, but the one extended with additional 32 bytes of geo-location and other information to form the Source Pack.
- **UMID Managed Domain** shall be an authoritative source in which the uniqueness and meaning of a UMIDs Material Number and Instance Number shall be managed and guaranteed. A UMID Managed Domain may range from a single registry, within a single location, to a large federated registry spanning multiple organizations. UMID Managed Domains shall govern the Law of Identity for UMIDs within their scope of authority.

4.3 Principle 2 – UMID Creation

A UMID based material management system shall create a UMID with a newly created Material Number together with a zero Instance Number in accordance with SMPTE ST 330 for original Material at its point of entry into the UMID Managed Domain.

Implications

- Original Material may be an essence bit stream of its highest quality as a master, or an abstract source from which actual playable bit stream is to be created.
- Material may take the form of a bounded sequence of frames, a single frame or a still image, a bounded sequence of interleaved audiovisual essences, or audio signal occurring on a single timeline.
- A newly created UMID with a zero Instance Number value, based on SMPTE ST 330, is algorithmically guaranteed to be globally unique within practical limits, and therefore only Material with this UMID may be consistently managed in a global sense.
- Source Pack containing “when” “where” and “who” information at the entry may be appended as needed to any Basic UMID with the proviso that the Source Pack data values represent the best effort to establish those values as true and meaningful.

4.4 Principle 3 – UMID Integrity

Different original Materials shall be globally uniquely identified by different UMIDs.

Implications

- The strict definition of “different” shall be understood by the antonym of “identical” used in the Principle 4 (UMID Identification),
- In general, a UMID created somewhere unknown may not be guaranteed to be globally unique even with its zero Instance Number because of a possibility that material that breaches the UMID Integrity might exist elsewhere unknown,
- A UMID with a non-zero Instance Number may not be guaranteed to be unique for all Instances of the same Material except in certain closed and controlled environments. This is because it is finitely possible to create a new Instance of Material with the same Instance Number value using the same number generation method. The specific case where each Instance Number value is guaranteed to be unique for a given Material Number value is where the Instance Number values are assigned based on a common registry. In the general case, a new entry is required for each Instance to be consistently managed as a

new Material, resulting in the UMID being replaced with a newly created value of a new Material Number and a zero Instance Number.

- A material with a UMID that signals the "Live stream" value (F_n) at the Instance Number Generation Method Field may not be uniquely determined because it is open-ended (a.k.a. the file is 'growing'). A new entry shall be required for the resulting persistent and deterministic material to be consistently managed in a global sense, resulting in the UMID being replaced with a newly created value of a new Material Number and a zero Instance Number.
- If a device creates more than one item of recorded material simultaneously, it shall be the responsibility of the device to assign different UMIDs, each with either a new different Material Number value and zero Instance Number or the same Material Number but different Instance Number, in order to unambiguously distinguish them, unless they are proven to be identical.

4.5 Principle 4 – UMID Identification

If more than one material is uniquely identified by a single UMID, their representations at playout shall be identical bit by bit on the timeline.

Implications

- The UMID shall be understood to uniquely identify a material representation at its playout, which is intrinsic to the material regardless of its specific instantiation stored in a persistent and deterministic fashion.
- Identical materials may share the same UMID value (as it occurs in a simple copy operation).
- The materials in different mathematically lossless compression schemes may share the same UMID if their playout representations are identical.
- Materials of different bit streams resulted from such as padding/filler items insertion, different descriptive metadata or file wrapper of the Materials, may share the same UMID if their playout representations are identical.
- Playable data such as the edit decision list (EDL) or the playlist may share the same UMID as that to be attached to the Material generated from the data because of their identical playout representations.

4.6 Principle 5 – UMID Inheritance

Any Instance derived from an original Material may be attached with a UMID composed of Material Number inherited from that of the original Material together with the non-zero Instance Number.

Implications

- A specific derivation method may vary depending on the application such as transcoding, partial retrieval, color correction, and so on, which is beyond the scope of these principles.
- The uniqueness of Instance Number may be guaranteed only within a predefined closed domain where the uniqueness of Instance Number is appropriately controlled.
- Instances with non-zero Instance Number but sharing the same Material Number shall be deemed to belong to the same group composed of Instances derived from a certain original Material as an anchor.
- Any Instance may be considered as original Material at its new entry, when a newly created UMID with a zero Instance Number replaces the existing one regardless of its creation history.

4.7 Principle 6 – Extended UMID

Any Extended UMID attached to a Material Unit belonging to the same material shall share the same Basic UMID that uniquely identifies the material as a whole.

Implications

- An extended UMID should be used to uniquely identify a finer granularity of material called the Material Unit.
- The Extended UMID may be used to uniquely identify the Material as a whole when its Material Unit is identical with the entire Material.

4.8 Principle 7 – Source Pack

The Source Pack should identify the time, space and ownership properties of the material at its point of creation or capture. If present as a part of an Extended UMID, its values shall not be replaced with new ones when the basic part of its UMID is inherited.

Implications

- When absent in an incoming essence file or stream, a newly created Source Pack may be appended if needed provided that meaningful and accurate values are determined.
- The Source Pack, if received as a part of the Extended UMID, may be replaced with new values at the point of entry of the Material when the basic part of its UMID is also newly created. However, doing this might then lose all reference to the origin of the Material and thus discouraged.
- The Source Pack, if received as a part of the Extended UMID, may be inherited as is regardless of the treatment of the Basic part of its UMID.

5 UMID-Aware Application Considerations

5.1 Introduction

This section describes several points on UMID usage that need to be carefully considered for UMID-aware applications in addition to the UMID Application Principles.

5.2 UMID Managed Domain

5.2.1 What is the UMID Managed Domain?

To embody the UMID Application Principles, a concept called UMID Managed Domain is introduced. The UMID Managed Domain is defined as an authoritative source or domain composed of materials, each of which is appropriately managed using UMID for its identity.

By definition, a UMID assigned to a material in a UMID Managed Domain shall be a valid UMID in accordance with the UMID Application Principles. Furthermore, because the UMID, by itself, is an identifier and not a locator, it contains no information for accessing the material it uniquely identifies. Therefore the information used to access the identified material, such as a URL (Uniform Resource Locator), shall be managed and associated with the UMID in the UMID Managed Domain. The UMID Managed Domain shall also provide the means by which a UMID is resolved to zero or more locators (e.g., absolute URIs and/or URLs), known as the UMID Resolution Protocol, which shall facilitate locating and accessing the identified material instances.

Figure 1 below illustrates a UMID Managed Domain. In this figure, “Material 1”, “Material 2”, “Material 3”, and “Material 4” are recorded on a certain physical medium as media files, while “Material 5” and “Material 6” are stored elsewhere on a separate medium. A Material Manager shall be provided to ensure the validity of UMID and to maintain information associated with UMIDs within the UMID Managed Domain. The Material Manager shall implement the UMID Resolution Protocol, shall provide a means to generate unique Material and Instance Numbers, shall provide a means to validate the uniqueness of UMIDs, and may contain any other descriptive metadata associated with the UMIDs within the UMID Managed Domain. The red arrows in Figure 1 from the Material Manager to the materials denote that the Material Manager recognizes the materials

(“Materials 1”, “Material 2”, “Material 4” and “Material 5”) as media files via their UMIDs (U_1 , U_2 , U_4 and U_5) and contains the URLs for the respective media files. Therefore, the Material Manager can provide the URL(s) for any of those materials in response to the UMID for one of them.

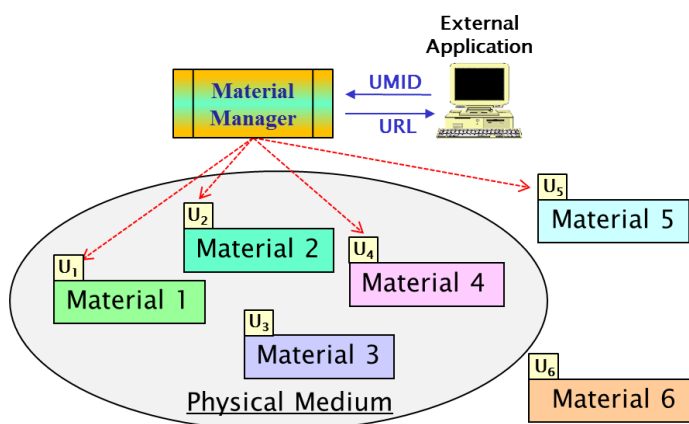


Figure 1 – UMID Managed Domain

Note that only the materials managed by the Material Manager (via their UMIDs) can constitute the UMID Managed Domain. In other words, materials that are not recognized by the Material Manager are out of scope of the UMID Managed Domain regardless of their location. As a result, even materials recorded on the same physical medium, such as “Material 3”, cannot be a part of the same UMID Managed Domain, if they are not managed by the same Material Manager (*i.e.*, no red arrow from the Material Manager to the material in Figure 1) while materials recorded elsewhere, such as “Material 5”, can be a part of the UMID Managed Domain because they are known to the Material Manager.

Also note that because external applications interact with the Media Manager to query information about the material it is managing, only information about material known to the Media Manager, including that for accessing the material uniquely identified by its UMID, can be returned (*i.e.*, material within the UMID Managed Domain). In other words, materials that are not recognized by the Material Manager *cannot be seen* from the external applications.

5.2.2 Material Manager Requirements

It shall be the responsibility of the Material Manager to maintain the integrity of the UMIDs that are assigned to the materials within the UMID Managed Domain that is managed by the Material Manager. Furthermore, to facilitate the UMID Resolution Protocol, it shall be also the Material Manager’s responsibility to track the information required to access the material identified by each UMID within the UMID Managed Domain. Consequently, the material manager shall be involved in any kinds of material manipulation within the UMID Managed Domain.

Note: This does not mean that the Material Manager always needs to keep watching the UMID inside a media file on a recording medium. For a recording device with a removable recording medium such as an optical disc as the UMID Managed Domain, the Material Manager installed in the device would be directly involved in re-writing a media file with a newly created UMID. For large media storage system composed of multiple storage devices, each of which constitutes the UMID Managed Domain, the Material Manager that governs the entire system would delegate actual UMID manipulation to the media file writer assigned to each storage device and request them to report when any change happens to the UMID and/or its associated access information.

While the detailed behaviors of the Material Manager to be implemented are application specific, any Material Manager shall take into account the following points:

- The Material Manager shall provide a globally unique UMID Material Number in accordance with SMPTE ST 330 upon demand.
- The Material Manager may provide a unique UMID Instance Number for a given Material Number upon demand.
- The Material Manager shall maintain the global uniqueness of UMID with zero Instance Number.
- The Material Manager may maintain the uniqueness of UMID with non-zero Instance Number for a given Material Number.
- The Material Manager shall implement the UMID Resolution Protocol, providing with zero or more information to access a material identified by a UMID in question.
- The Material Manager may store and retrieve descriptive metadata associated with unique UMIDs.

In Annex B, some typical behaviors the Material Manager will take in the case of a UMID as a globally unique material identifier for the material server equipped with rewritable recording medium are discussed in details.

5.3 UMID Material Number as a Dumb Number

The role of the UMID Material Number is nothing more than a theoretically proven globally unique value. Any meaning embedded in the UMID Material Number is accidental to the method of creating a globally unique value, and therefore, under all circumstances the value of the UMID Material Number shall be treated as a dumb number or a token; *i.e.*, the UMID Material Number value should not parse to obtain information from it.

Behind this requirement, on the other hand, an artificial modification of a field value in the UMID Material Number should be acceptable in order to create another theoretically proven globally unique value.

Suppose a situation where more than one material is generated simultaneously by a single recording device. According to the SMPTE Method for the UMID Material Number creation specified in SMPTE ST 330 Annex A, the UMID Material Number is created as a combination of 8-byte time snap value, 2-byte random number and 6-byte device node number as depicted in Figure A.1 of the Annex A. Therefore, when multiple materials are created simultaneously by a single recording device, such as in the case of stereoscopic 3D image or multichannel audio recording, there is a possibility that the same UMID Material Number will be assigned to those materials if the same value is generated more than once for the 2-byte random number.

To avoid such a problem, instead of using a random number generator, a method of assigning distinct values to the 2-byte random number field of each Material Number and/or duplicate prevention mechanisms to prevent the same random number from being generated more than once within the same unit of time may be implemented.

Furthermore, because the aforementioned time snap value itself is not significant (it is just for distinguishing the UMID Material Numbers created under a given device node number), its artificial modification should be also permitted. For example, if two UMID Material Numbers are required for a couple of materials simultaneously created by a single recording device, such a method is permitted that an original time snap value is used for the first Material Number creation while a time snap value intentionally incremented by one unit since the original value is used for the second Material Number creation in order to guarantee the distinction between those two UMID Material Number values.

Such an artificial treatment of the field values shall be acceptable only for the UMID Material Number creation in order for its value to be a theoretically proven globally unique dumb member. Because the date stamp and unit count component of the UMID Source Pack (a.k.a. the “When” component) is significant to identify the time and date of origin of the material unit with which the Source Pack is associated, the creation of the component value shall strictly follow what is specified in SMPTE ST 330.

Note: Even if an identical value is created for the “When” component of the UMID Source Pack over the simultaneously created multiple materials, a material unit attached with the Source Pack within a certain material is made distinct from that within another material by the Basic part of the Extended UMID attached to the material unit.

When materials of different material types are created simultaneously, their distinction via their UMIDs shall be made by specifying the correct material type to the 11th byte of the UMID (see Annex A.2). Because UMID is evaluated by the 32-byte long value as a whole, even if their UMIDs share the same UMID Material Number, materials of picture and sound material types simultaneously created by a single recording device can be made distinct with the 11th byte of their UMIDs as, e.g., YCbCr picture type (06_h) and stereo sound type (09_h), respectively.

In general, no relationship shall be assumed among UMIDs sharing the same Material Number but have different material types. Its interpretation is left to each application's discretion and thus beyond the scope of this Recommended Practice.

5.4 UMID as a Wrapper for the Globally Unique Value

As introduced in Annex A.2, the Basic UMID is composed of four fields called SMPTE Universal Label (UL), Length, Instance Number (Inst.#) and Material Number (Mat.#). When a UMID is used as a globally unique material identifier with zero Inst.# as shown in Figure C.1 in Annex C, the UMID is regarded as a *wrapper* of the 16-byte Mat.# which is globally unique on its own.

SMPTE ST 330 Annex A specifies four methods for the Mat.# creation. Because they are independent one another, there is a possibility that the Mat.# values created by different Mat.# creation methods collide. Thanks to the top nibble of the UL 12th byte of UMID specifying the Mat.# creation method, even the UMIDs that happen to have the same Mat.# value created by different Mat.# creation methods are made distinct.

Among those Mat.# creation methods, the most well-known one is the UUID method, which is commonly used in order to globally uniquely identify any entity in a generic information technology (IT) system.

Because no collision occurs as long as the 16-byte value is created by a single Mat.# creation method, the Mat.# created based on the UUID Method is guaranteed not to collide with any other UUID values created elsewhere. As a result, a material assigned with a UUID as a globally unique material identifier for the material to be managed in a global sense by following the convention of a generic IT system may be treated seamlessly with the materials having UMID of the UUID Method in principle because the difference between those unique material identifiers remains as a pure UUID or it is wrapped to form a 32-byte UMID.

Care should be taken, however, that how to treat UMID shall be strictly regulated by the UMID Application Principles specified in Section 4 in order to make it as, e.g., a trusted globally unique material identifier.

In fact, an assumption behind the seamless treatment of materials described above is that not only the UUID Method based UMID but also the pure UUID are treated by strictly following the UMID Application Principles. In other words, because UUID itself is just a pure globally unique value whose treatment depends on an application, it also could be used as a content identifier that does not distinguish a high resolution material from its low resolution proxy sharing the same content, which cannot be mapped to the UMID that requires a strict distinction between them.

5.5 UMID for Abstract Original Material

While UMID has been originally intended to globally uniquely identify a physical material which is playable by itself, it may be also used to uniquely identify an abstract material that is not playable by itself but can be used to instantiate actual playable materials when the object oriented design approach is taken into consideration.

In this approach, an original material is regarded as an abstract class logically representing the material, from which any actual playable physical material is created in a similar way to an instance being instantiated from a class in the object oriented design. This abstract original material is in fact metadata that describes its common basic technical properties at its playout such as types of essence and duration. In addition, the basic descriptive properties commonly applied regardless of its instantiation, such as an originally created date, title, content description, and usage information, can be also included in the abstract original material if needed. Figure 2 below shows such a use of UMID.

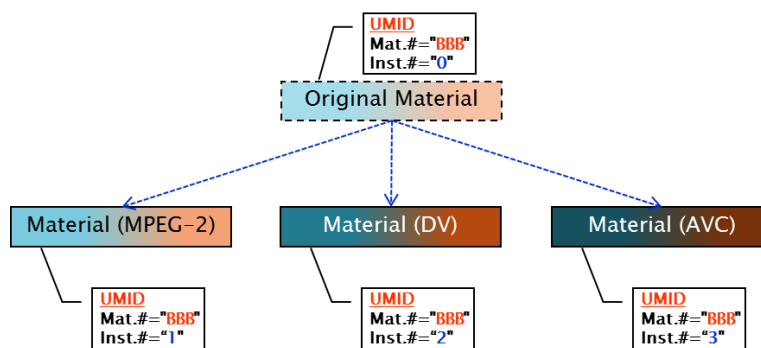


Figure 2 – Abstract Original Material and its Playable Instances

In this figure, the abstract original material is globally uniquely identified by a newly created UMID of zero Instance Number (Inst.#) while an actually playable physical material is attached with the UMID that inherits the Material Number (Mat.#) of the abstract original material and has the non-zero Inst.# depending on e.g., the codec kind (“1”, “2” and “3” for “MPEG-2”, “DV” and “AVC”, respectively).

Although those physical materials themselves are not identical according to the UMID Application Principle 4 (UMID Identification), they are known to share the same content because of their common parent class (the abstract original material). In other words, assuming the abstract original material as an original baseband signal for its ingestion, those physical materials are regarded as the ones specifically encoded from the original baseband signal, which are distinguished by its codec kinds specified as the Inst.# values within a closed domain where such an Inst.# assignment is defined elsewhere in advance.

Note: The Inst.# treatment described above is provided as an example only, which is effective only within a predefined closed domain fully controlled by the application, and thus beyond the scope of this Recommended Practice.

One of the benefits of this approach is a codec independent content edit. As the number of program delivery channels increases, the number of codec required for each of them will diverse. Because the abstract original materials in this approach are codec-free, an Edit Decision List (EDL) obtained from an edit of the originals (or, practically speaking, the EDL obtained from an edit of certain physical materials and their Inst.# being set to zero) is independent of any specific codec and therefore easily tailored to the EDL that meets the need of a specific delivery channel.

Note: Such an EDL instance itself can be also regarded as an abstract material if it is managed with the newly created UMID being attached to it.

Note, however, that because the UMID attached to a physical material is not a globally unique material identifier in this case, it cannot be used for the physical material to be managed in a global sense. In other words, if each physical material is also desired to be managed with its UMID in the same way as for the abstract original material, it also shall be attached with a newly created UMID of zero Inst.#, resulting in that the inheritance of the physical material from its abstract original material is no more described but should be supplemented by other external methods.

5.6 Identical Materials via UMID

According to the UMID Application Principle 4 (UMID Identification), materials whose playout results are identical may share the same UMID. To obtain better understanding of the meaning of this identicalness, Figure 3 below demonstrates an extreme case of three identical materials that can share a single UMID.

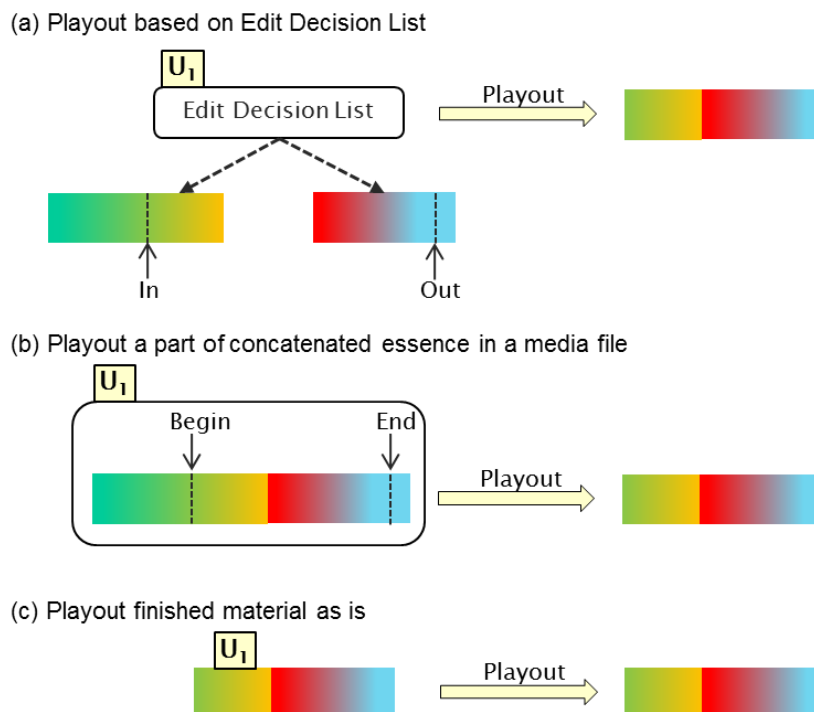


Figure 3 – Possible Identical Materials Sharing a Single UMID

Figure 3 (a) depicts a playout of EDL describing a concatenation of a part of existing materials specified by the In and Out points of the materials. Figure 3 (b) shows those existing materials being concatenated and stored into a file wrapper as an essence to form a media file, and a playout of a part of the inner essence by specifying its Begin and End timecodes corresponding to the In and Out points in Figure 3 (a), respectively, as is supported by certain media file formats such as MXF. Figure 3 (c) shows the finished material resulted from the execution of edit process specified in Figure 3 (a) or (b), and can be played out “as is”.

Because (a), (b) and (c) in Figure 3 provide an identical representation at their playout by definition, they can share the same UMID according to the UMID Application Principle 4 (UMID Identification).

Note that the Principle does not exclude an attempt to assign different UMIDs to identical materials. If an application desires to distinguish and separately manage those three materials in Figure 3 in a global sense for some reasons, it may assign a newly created UMID of zero Instance Number to each of them.

5.7 UMID for Growing Material

When audiovisual material is created as a media file such as at the live recording, it is often hard to determine when the file creation is finished in advance. It is therefore desirable for the material being created to be made accessible even before its completion of creation, which is known as read-while-write operation, resulting in so called a growing material as shown in Figure 4 below.