
Basics of a UPF

NEMLA

***The New England Chapter of the Music
Library Association***



Oct. 3, 1997

Introduction

- ***Domain of a UPF:***
 - ***Physical format & Compression***
 - ***Metadata***
 - ***Wrappers***



Signals: Composite vs Component

- **Composite:**

- uses one cable to carry B&W and color info
- intergrates red, green, blue, and monochrome video info.
- requires less processing, easier & cheaper to produce
- potential problems: “hanging dots” and “cross color”
- current distribution method for broadcast & cable TV

- **Component:**

- uses three separate wires to carry three distinct signals: B&W plus two color signals
 - signals never get mixed together
 - used for production purposes
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Video Tape : Analogue

- Analog video signal
 - each frame represented by a fluctuating voltage signal (analog wave form)
- composite analog video
 - combined into a single signal
 - color bleeding, low clarity, high generational loss
- component analog video
 - takes different components and breaks them into separate signals
- bottom line: analog formats are susceptible to quality loss from generation to generation, maxing out at 10 generations

from "Optibase Digital Video Primer," <http://www.optibase.com/dprimer.htm>

Video Tape Recorders: Digital

- lots of zeros and ones
 - digital nature: editable...
 - composite and component
 - early formats: primitive, large, compromised
 - D-1
 - D-2
 - modern formats: robust, error correction
 - D-3
 - Digital Betacam
 - DVCPRO
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Digital Formats

There are over a dozen digital tape formats:

- D-1
 - D-1 SP
 - D-2
 - D-3
 - D-5
 - D-6
 - Digital Betacam
 - Betacam SX
 - Ampex DCT
 - Consumer DV
 - DVCAM
 - DVCPRO
 - Digital S
 - Sony DTF
 - & many more coming!
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D-1

- introduced by Sony in 1986
- 1st digital tape format
- 8 bit recording format : only 256 shades of gray
- does not allow video **pre-reads**: the ability to play a tape and record onto itself

D-2

- introduced in 1988
 - high quality composite digital tape format
 - designed (& abandoned) by Ampex for CART machines
 - still used for high end post-production
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D-3

- introduced by Panasonic in 1991
- composite digital format
- low-cost, general purpose 1/2" digital videotape
- used extensively by NBC and PBS
- similar in size to standard VHS

Ampex dct:

- introduced by Ampex in 1993
- component digital format
- based on D-2 VTRs

Digital Betacam

- introduced by Sony in 1993
 - component digital format
 - 1/2" tape, uses 2:1 compression
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D-5

- **introduced by Panasonic in 1994**
- **1/2" tape, variety of cassette sizes**
- **no compression**
- **can playback a D-3 composite tape**

Betacam SX

- **introduced by Sony in 1996**
- **intended for low-cost general professional use**
- **same tape used for analog Beta SP, and some machines can playback analog Betacam**

Digital S

- **introduced by Panasonic in 1996**
 - **1/2" tape, same cassette as VHS**
 - **less compression than Betacam SX**
 - **Digital-S machines can also play S-VHS**
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General Observations: Analog vs Digital

- **Deterioration of analog recording: gradual & discernible.**
- **Deterioration of digital : abrupt & irretrievable.**
- **Digital tape copies are identical to original source tape.**
- **Analog copies include any noise inherent in the tape or recording device.**
- **Analog tape recordings are cheaper to record and play back than digital tape recordings.**

(Van Bogart, Dr. John W. C., "Magnetic Tape Storage and Handling : A Guide for Libraries and Archives"; The Commission on Preservation and Access, Washington, DC; June 1995, pp. 8-9.)

“Don’t Depend on Digital Tape”

- **Panel discussion at AES ‘95**
 - **archivists issued plea to manufacturers to quickly create reliable long-term storage media for analog and digital recordings**
 - **Marc Kirkeby (Sony archives): “We have tapes from 1949 that sound wonderful. We have tapes from 1989 that are shot to hell. And it’s all just chance.”**
 - **DAT cassettes are notoriously unreliable.**
 - **problem areas: low tolerance, alignment of DAT machines**

Recommendations from Two Jims

Lindner & Wheeler, AMIA Newsletter

- **“Spread the risk,” says Jim Lindner**
 - record on at least 2 formats simultaneously
 - at least one should be a simple analog
 - “no single universal ideal preservation format”
 - **“Don’t use DAT only,” says Jim Wheeler**
 - many archives use both reel-to-reel and DAT
 - beware of compression levels; not designed for archival purposes
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**Task Force for Harmonized Standards
for the Exchange of Program Material
as Bit Streams**

**First Report:
User Requirements**

April 1997



European Broadcasting Union



**Society of Motion Picture
and
Television Engineers**

Compression

What is Compression?

- “the process of reducing the number of bits required to represent information by removing redundancy.”
- “In the case of information content such as video and audio it is usually necessary to extend this process by removing in addition information that is not redundant but is considered less important.”

(EBU/SMPTE, 1. “Compression Issues”)

Compression

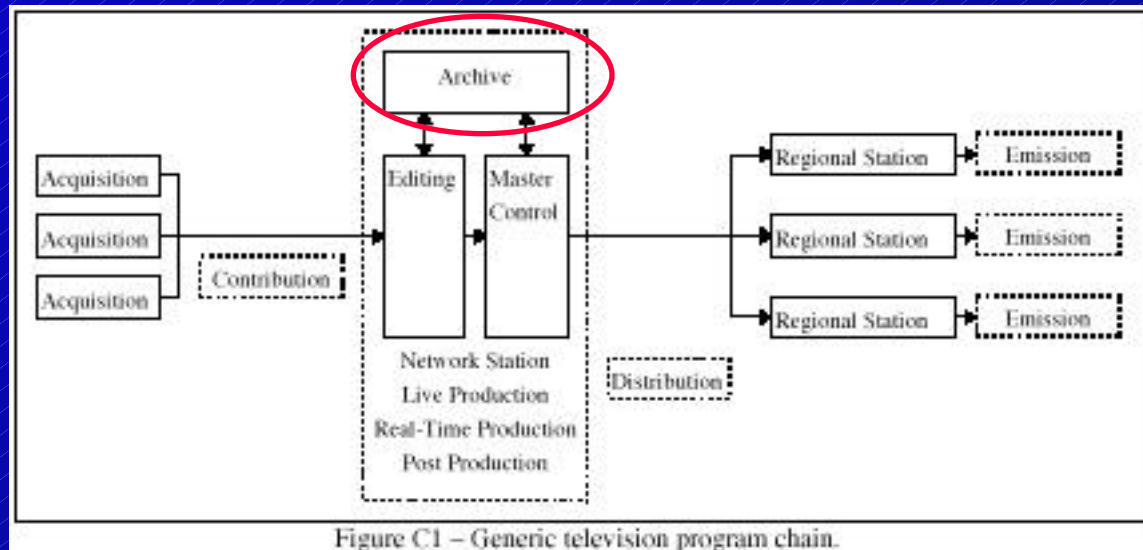
Lossless vs Lossy

- **Lossy**
 - some info is tossed out
 - original data not fully recovered
 - decompression produces an approximation of original data
 - greater compression = less accurate data
 - **Lossless**
 - original data exactly reproduced
 - no data lost
 - but can reduce space by about 50%
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Compression : SMPTE says...

- **Compression algorithms and transport schemes should be based on Open Standards.**
- **The highest compression quality:** to archive program content which is likely to be re-used in conjunction with subsequent processing.
- **Middle compression quality:** to archive program content which may be re-used but unlikely to involve significant additional processing.
- **Lower compression quality:** not to be used to archive program content.

Compression Application Model



- **On-line archiving: quality level of browse mode only required to support picture recognition.**
- **Near-line archiving: browse mode stored for rapid access with content stored off-line on a remote server.**
- **Deep/long-term archiving: content + metadata stored in archive with only metadata and browse mode images accessed for archive browsing.**

Compression and Bento

“Bento allows compression and decompression to be done on values. This mechanism is extensible, so a clever new compression scheme could be used that takes advantage of the characteristics of animation. Furthermore, the mechanism is transparent to the application, so the compression mechanism might be provided by a third party, and even added after the initial animation application has been written.”

(Harris, Jed and Ira Ruben, Bento Specification, “Compression and Other Data Transformations.”)

Wrapper and Metadata : SMPTE says...

- **Develop an extensible hierarchical classification of Metadata varieties, including the notion of Metadata Sets appropriate to particular uses.**
- **Establish a single registry of Metadata identifiers and definitions.**
- **Standardize a single generic Wrapper format for Metadata streaming, which can be mapped onto existing and emerging signal transport layers.**
- **Standardize a single generic Wrapper format for applications requiring arbitrary richness of Content of all types, including Metadata and Essence, which must be highly compatible with the streaming format described above.**
- **Standardize a single format for a “unique identifier” or at least register existing and new identifier formats within the Metadata registry.**

Metadata Initiatives

- **Dublin Core/ Warwick Workshop**
 - **Berkeley Distributed Video-on-Demand**
 - **Berkeley Finding Aid Project : EAD**
 - **Digital Object Identifier System**
 - **MIT Headers and Descriptors Research**
 - **HyTime : Hypermedia/Time-based Document Structuring Language**
 - **Scorpion : automatic subject recognition**
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Dublin Core Metadata Set

- a simple yet usable set of metadata elements to describe the essential features of networked or “document type” documents
 - focus is primarily but not exclusively on the description of objects
 - intended to be used by resource discovery tools on the Internet
 - contains 13 elements
 - mapping between fields in the Core to more specialized descriptive systems such as library cataloging
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Dublin Core Elements

- **Subject**
- **Title**
- **Author**
- **Publisher**
- **OtherAgent:** editor, transcriber
- **Date**
- **ObjectType:** novel, poem
- **Form:** data representation
- **Identifier:** object's unique string or number
- **Relation:** to other objects
- **Source:** objects -- print or electronic -- from which this object is derived
- **Language**
- **Coverage:** spatial locations and temporal duration

- **permits additional site or domain specific data elements**
 - **all elements are optional in any specific description of an object**
 - **all elements are repeatable: example, multiple authors**
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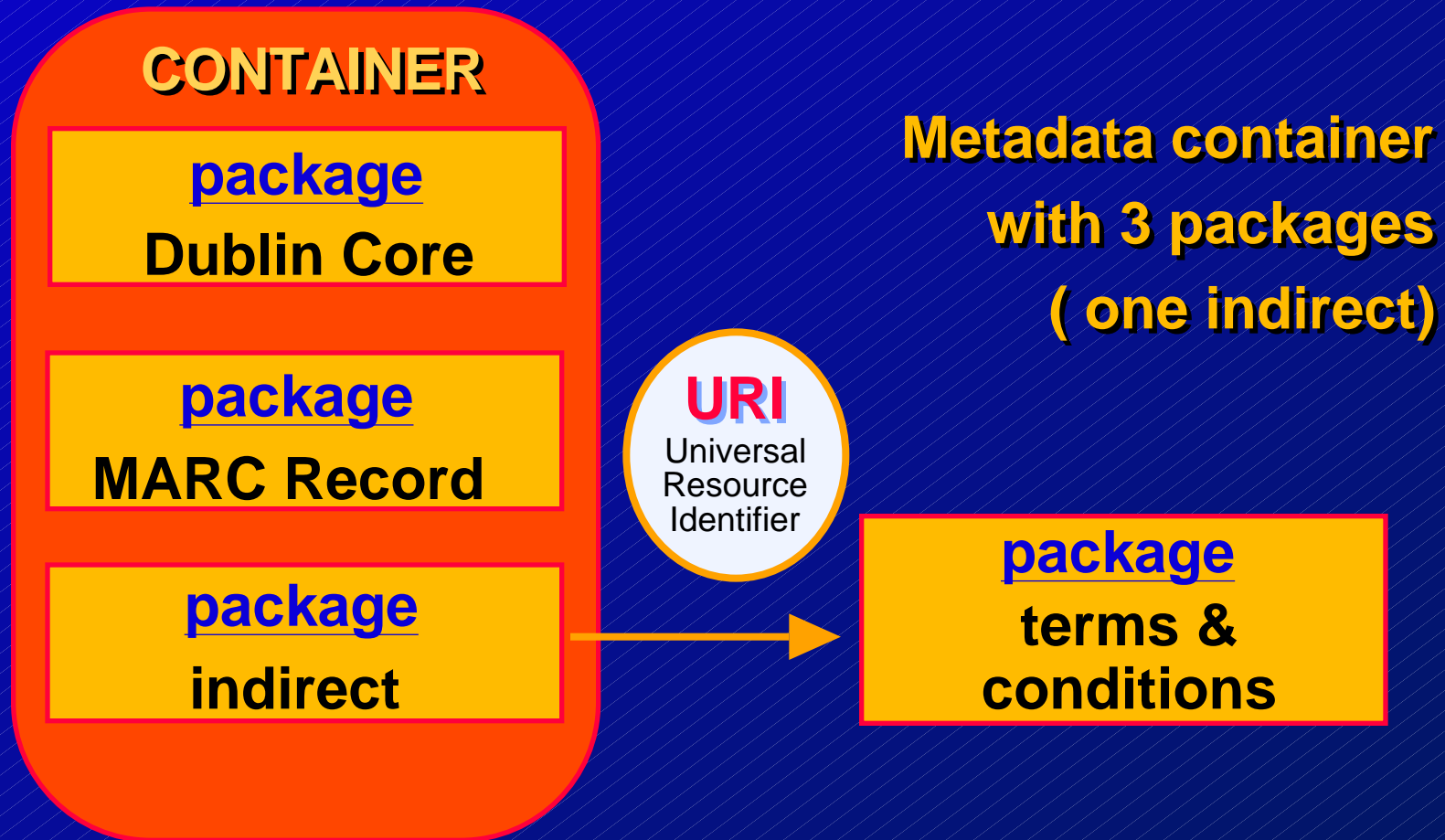
Dublin Core



**Warwick
Framework**

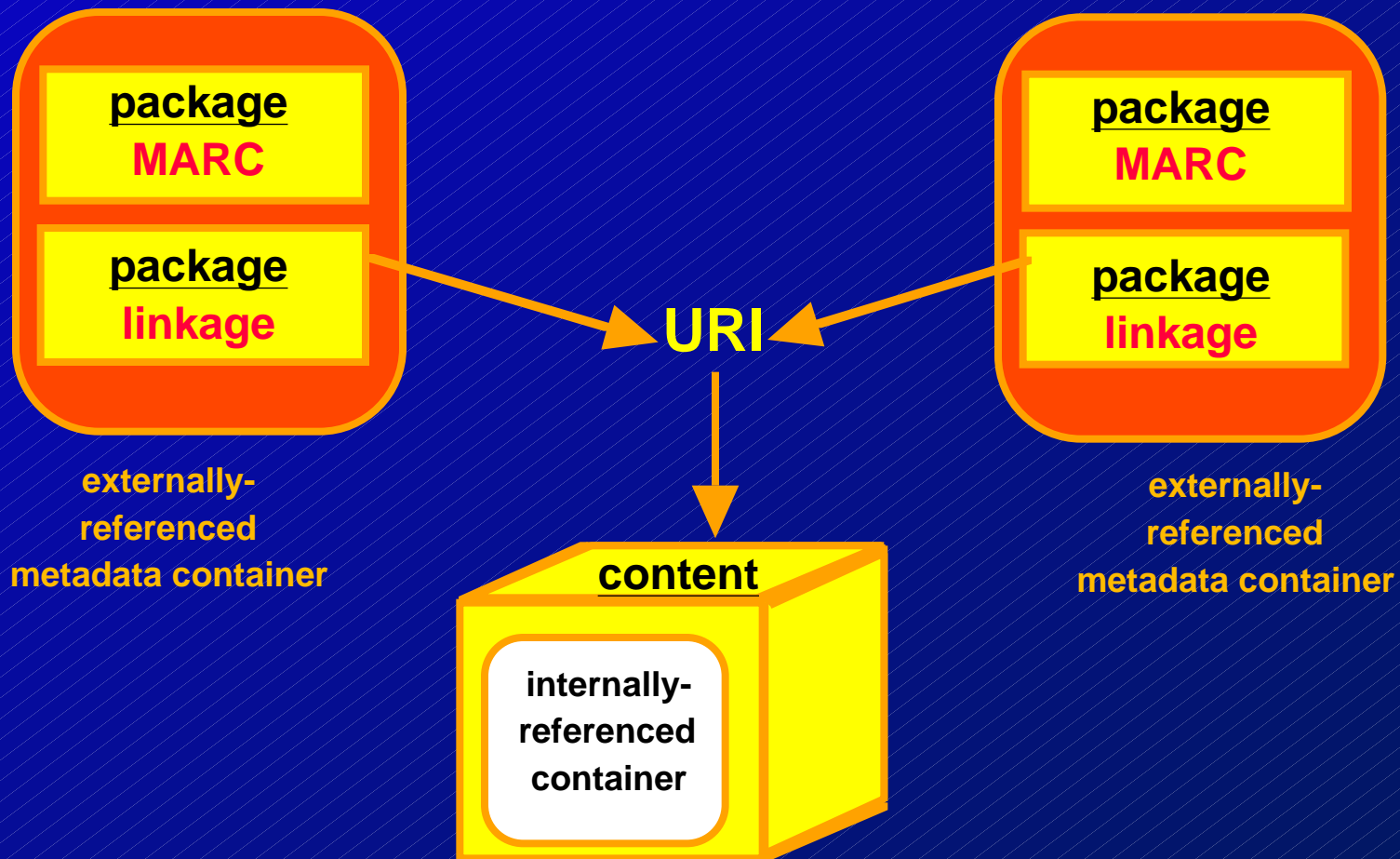
- **Containers**
 - **unit for aggregating the typed metadata sets**
 - **transient: exists as transport object between or among repositories, clients, and agents**
 - **persistent: exists as a first-class object in the information infrastructure**
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The Warwick Framework Architecture



- Warwick Framework

- metadata may be embedded in document
- or may link to separately stored container(s)



What's Happened to Bento?

- **QuickTime 3.0 (Apple)**
 - **industry-standard, software architecture**
 - **standard for the storage of digital media compositions**
 - **container format**
 - **widest possible range of digital media**
 - **platform neutral, open, extensible**
 - **consists of 3 elements:**
 - **QuickTime Movie file format**
 - **QuickTime Media Abstraction Layer**
 - **Quicktime media services**

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- **QuickTime as Movie File Format**
 - **digital video file format support**
 - AVI
 - OMF
 - MPEG-1
 - DV
 - **audio file support**
 - AIFF
 - WAVE
 - Sound Designer II
 - Sun's AU
 - MPEG layer 2 audio streams
 - **animation file support**
 - Flic files (AutoDesk)
 - Adobe Photoshop
 - QuickDraw
 - MBL, GIF, JPEG...

<http://www.quicktime.apple.com/qt30/whitepaper>

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- **QuickTime Media Abstraction Layer**
 - **Timing and synchronization**
 - **Audio and image data compression and decompression**
 - **Image blitting, format conversion, scaling, composition, and transcoding**
 - **Audio mixing, sample rate conversion, format conversion**
 - **Audio and video effects and transitions**
 - **Synchronized storage read and writeMedia capture**
 - **Media import and export**
 - **Standard user interface elements, such as movie controllers, media previewers, and media capture dialogs**

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- **Quicktime media services**
 - **Image Compression Manager**
 - **ability to work with nearly any video compression format**
 - **also with uncompressed video**
 - **hardware abstraction layer**
 - **isolates tools from the underlying implementation of each compression format**
 - **allows users to install and use new video hardware**
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- **QuickTime & OMF (Open Media Framework)**
 - **OMF Importer: new extension to QuickTime**
 - **developed by Avid in cooperation with post-production and broadcast industries**
 - **OMF previously not supported by desktop-editing applications**
 - **now easy for QuickTime-enabled tools to work with OMF**
 - **allows users to use OMF files directly, requiring no recompression**
 - **Does this make QuickTime a suitable format for archiving digital information?**

