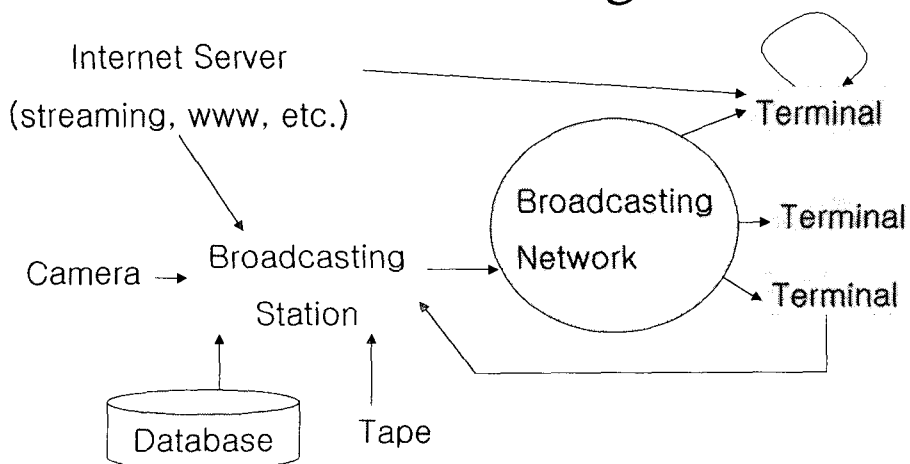


# MPEG-4 기반 대화형 디지털 방송

김해광

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## *Interactive Digital Broadcasting*



## What MPEG-4 provides with for the IDB?

- Rich media coding
  - Media Coding
  - Scene Composition
  - Scripting
  - Interaction (Local, Back channel)
- Metadata
- Multiplexing and Synchronization
- Content Protection
- Delivery Framework
- MPEG-4 over RTP

## What does not MPEG-4 specify for the IDB?

- Transport Mechanism
- Any Transport mechanism may be used for the MPEG-4 contents
  - MPEG-2 TS, TCP/IP
    - ATM, Cable, Satellite, LAN

# MPEG-4 Standard

- Part 1: Systems
  - Scene Composition, Scripting, Interaction
  - Graphics, Text
  - Multiplexing, Synchronization
  - File Format
- Part 2: Visual
- Part 3: Audio
- *Part 4: Conformance testing*
- *Part 5: Reference software*
- Part 6: Delivery Multimedia Integration Framework (DMIF)
- *Part 7: Optimized software*
- Part 8: 4onIP framework
- *Part 9: Reference Hardware Description*
- Part 10: Advanced Video Coding (JVT)

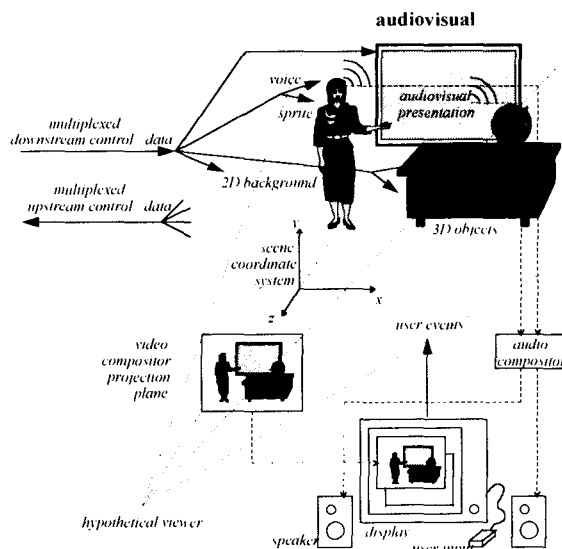
# Media Coding (Visual)

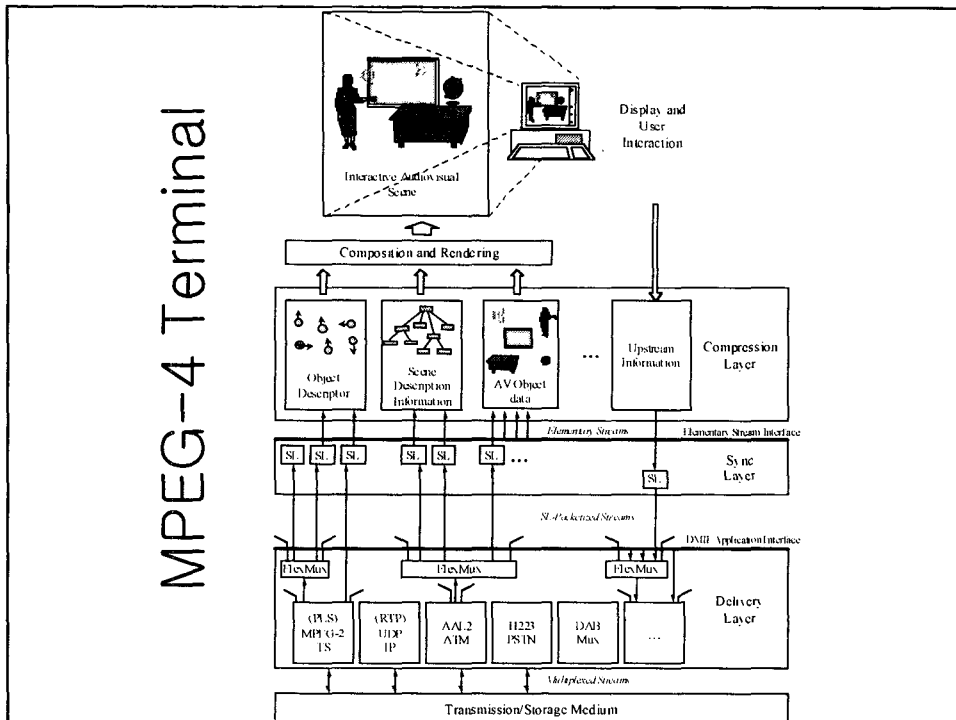
- Part 2 (MPEG-4 Video Coding)
  - Object/Frame Based Coding
  - Sprite coding
  - Wavelet coding for I-Picture
  - Error-resilience
    - Data Partitioning, RVLC, Resynchronization,
- Part 10
  - Multi Picture reference
  - 4x4 integer DCT
  - Entrophy coding (VLC, Arithmetic)

# Media Coding (Audio)

- Part 3 (MPEG-4 Audio Coding)
  - Speech coding
    - HVXC (Harmonic Vector eXcitation Coding)
    - CELP (Code Excited Linear Predictive Coding)
  - General Audio Coding
    - TwinVQ
    - AAC
  - Synthesized Audio
    - TTS
    - SAOL

## MPEG-4 Scene example

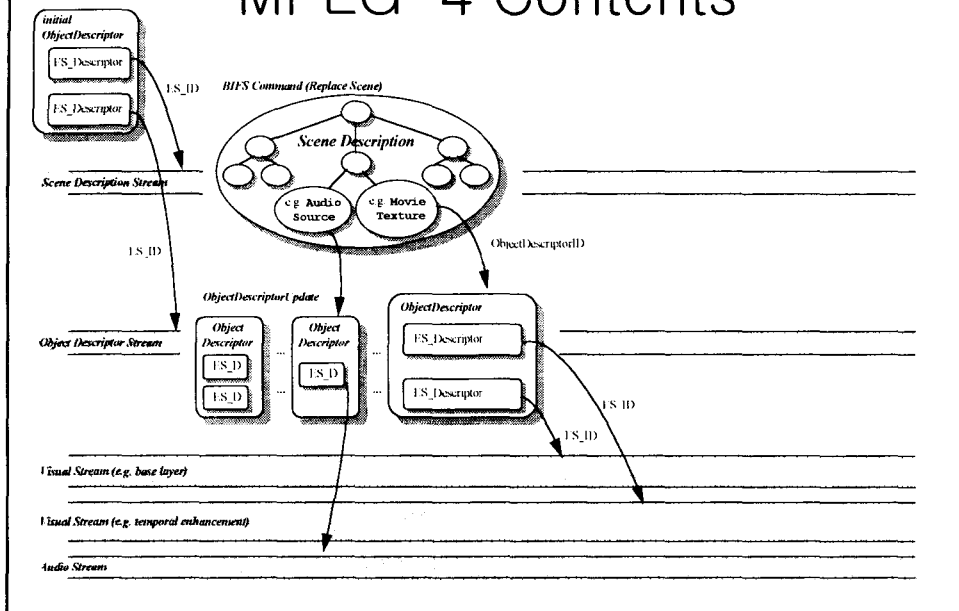




## MPEG-4 System (Part 1)

- Elementary Stream Management
  - Object Descriptor Framework
  - Synchronization of Elementary streams
  - Multiplexing of Elementary streams
  - Back Channel
- Metadata
  - Object Content Information (OCI)
- Content Protection
  - Intellectual Property Management and Protection (IPMP)
- Scene Description (BIFS, MPEG-J, XMT-A, XMT-O)
  - Media Coding (Animation, Graphics, Text)
  - Scene Composition
  - User Interaction
  - Scripting Language

# MPEG-4 Contents



## Binary Formatted Scene Description (BIFS)

- Based on VRML
- Hierarchical Scene Composition
  - Spatio-temporal positioning of objects
  - Grouping of objects
  - 3D audio scene
- Media Coding
  - Animation (Route, Interpolator)
  - Face and Body Animation
  - Graphics, Text
- Local User Interaction
  - Sensors
- Scripting language

## Object Descriptor

- Elementary Stream Descriptor[]
  - DecoderConfigDescriptor, SLConfigDescriptor
  - IPI, IPMP Descriptor, LanguageDescriptor
  - QoS\_Descriptor, Registration Descriptor
- Object Content Descriptor[]
  - Content Classification, Keyword, Rating
  - Language, Short Text, Expanded Text
  - Content Creator Name, Content Creation Date
  - Creator Name, Creation Date, Camera Position
- IPMP Descriptor[]

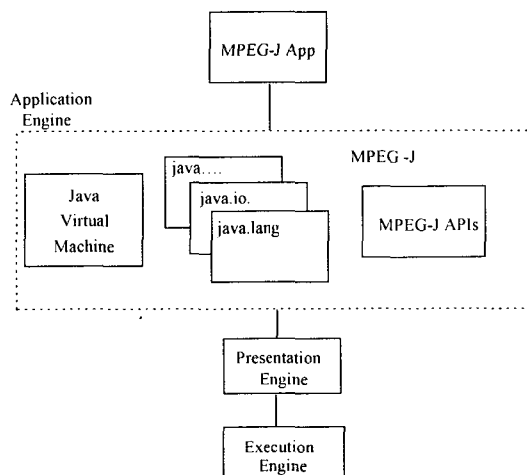
## MPEG-4 Elementary Streams

- BIFS Streams
  - replace/insert/remove Node, Field
- OD Streams
  - update/remove OD, ESD, IPMPD
- Media Elementary Streams
- IPMP Elementary Streams
- MPEG-7 Streams
- OCI Streams
- BIFS-Anim Streams
- Face and Body Animation Streams

# XMT

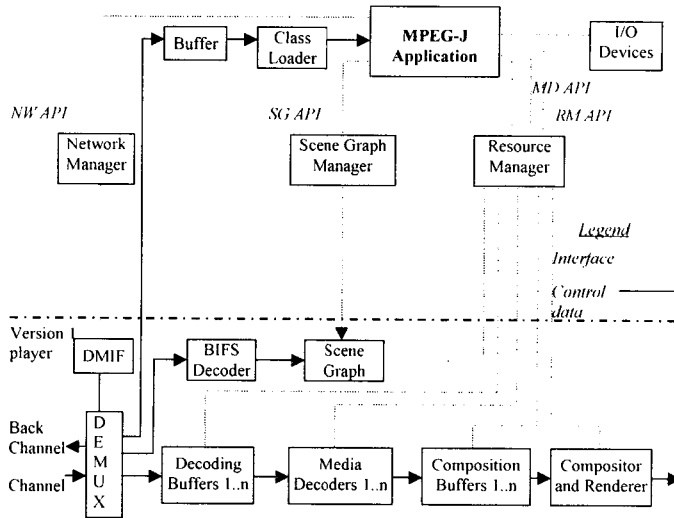
- XMT-A
  - XML based representation of BIFS
- XMT-O
  - High level scene description
  - SMIL-based

## MPEG-J Software Architecture

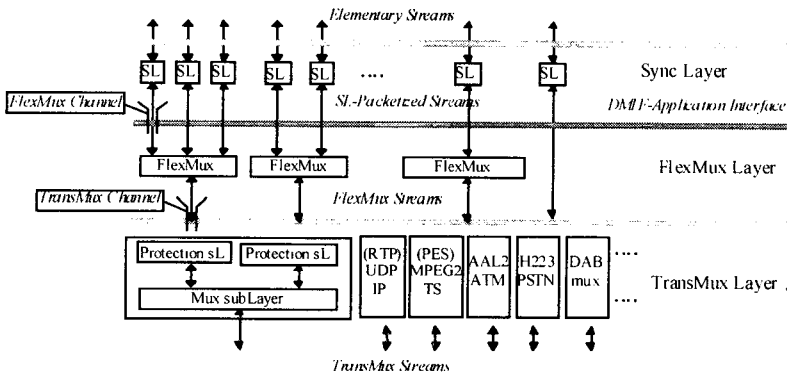




# MPEG-J Enabled MPEG-4 System



# MPEG-4 Sync and Mux layer



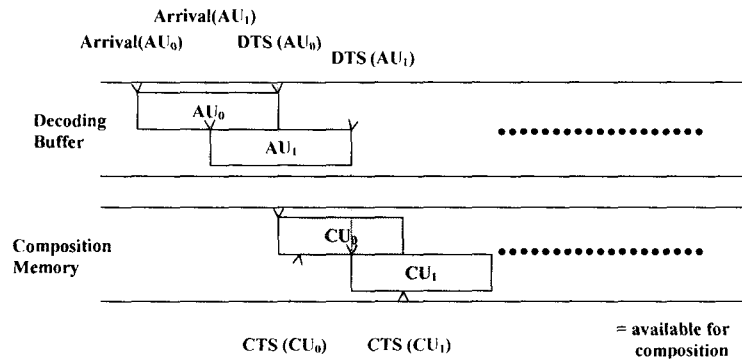
## SL Config Descriptor

- Flags
  - useAccessUnitStartFlag, useAccessUnitEndFlag
  - useRandomAccessPointFlag, useTimeStampsFlag
  - useIdleFlag, durationFlag;
- Time Stamps
  - timeStampResolution, OCRResolution;
  - timeStampLength, OCRLength
- Access Units
  - AU\_Length, instantBitrateLength,
  - degradationPriorityLength, AU\_seqNumLength
  - packetSeqNumLength

## SL Packet Header

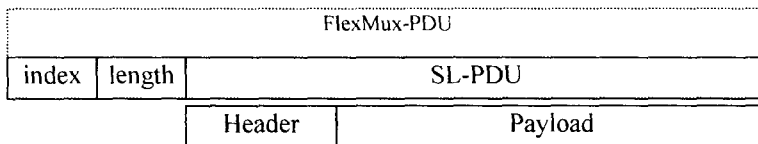
- Flags in SL Configuration Descriptor
- Packet Sequence Number
- Degradation Priority
- Object Clock Reference
- AU Sequence Number
- Decoding Time Stamp
- Composition Time Stamp
- Access Unit Length
- Instant Bit Rate

# Decoding Time Stamp and Composition Time Stamp

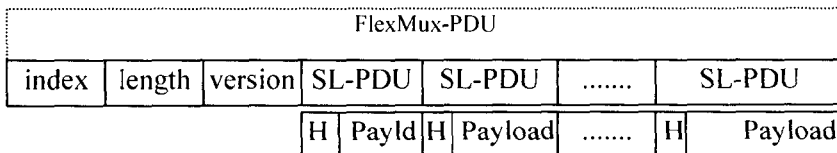


# Multiplexing (Flexmux)

- Simple Mode

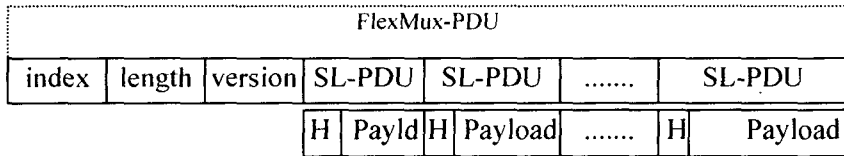


- Muxcode Mode



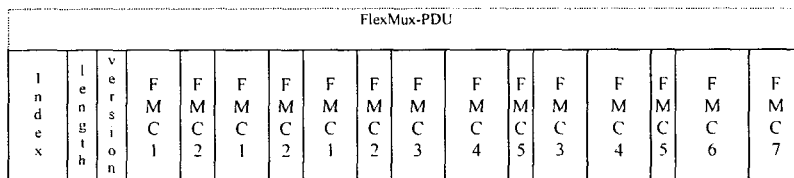
# Multiplexing

- MuxCode

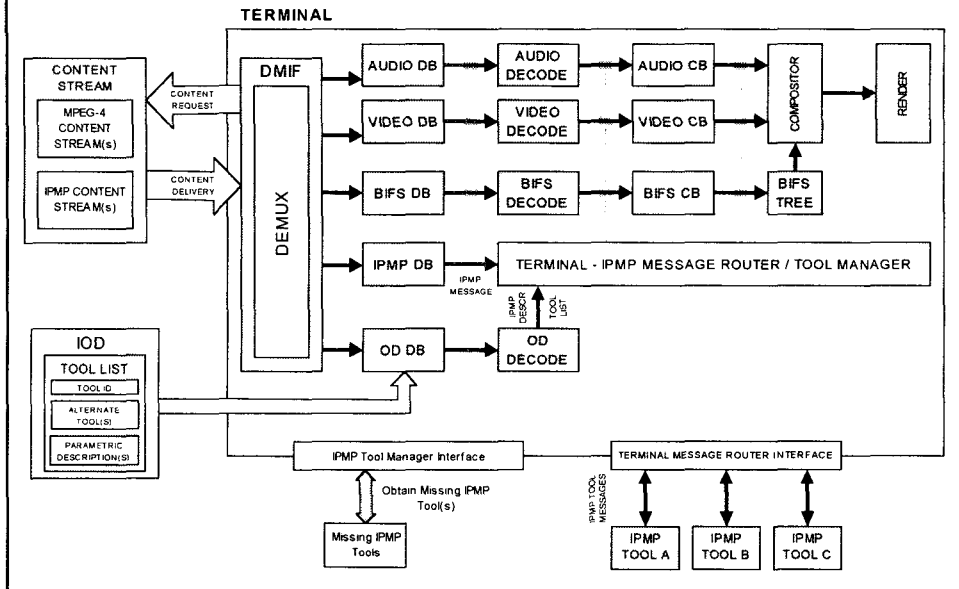


## Mux Code Example

- substructureCount = 3
- slotCount[i] = 2, 3, 2
- repetitionCount[i] = 3, 2, 1



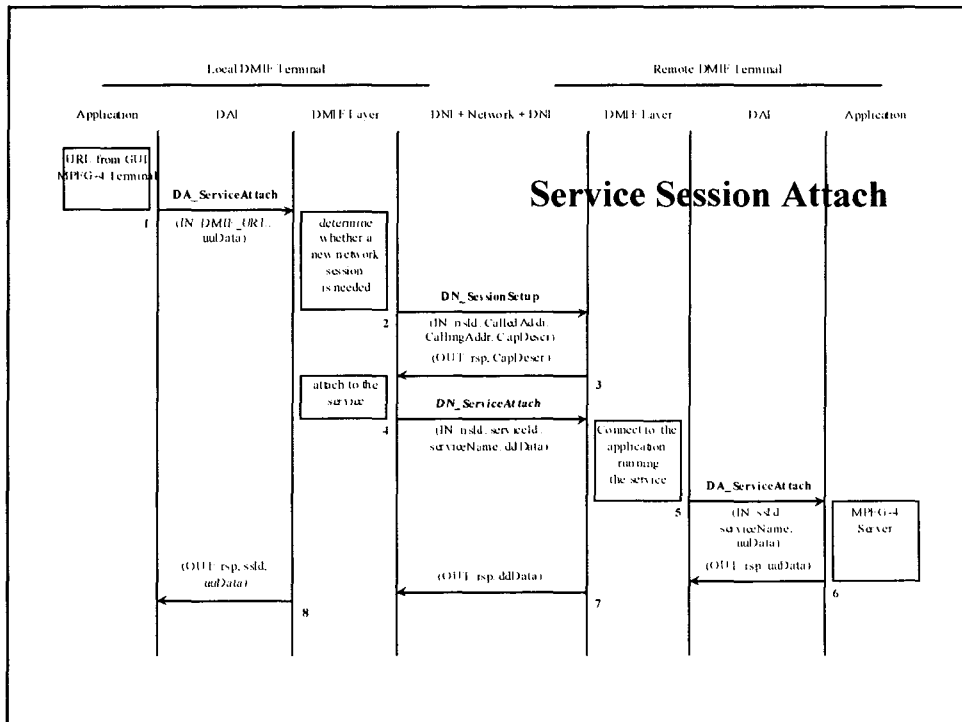
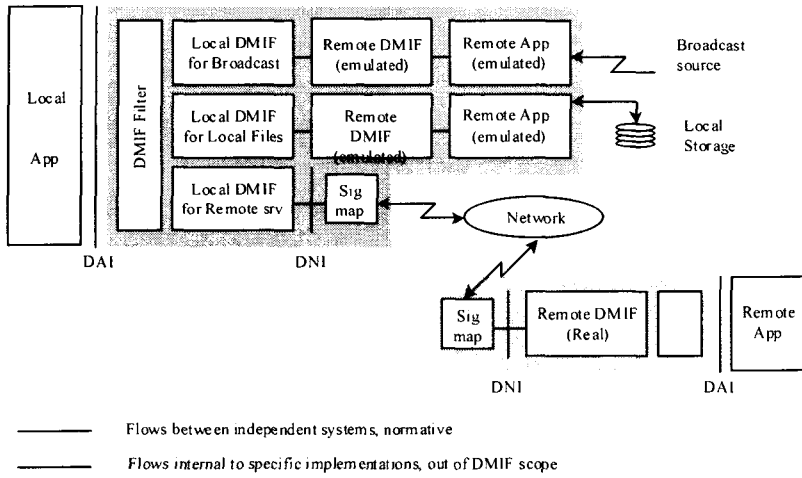
# MPEG-4 IPMP extension

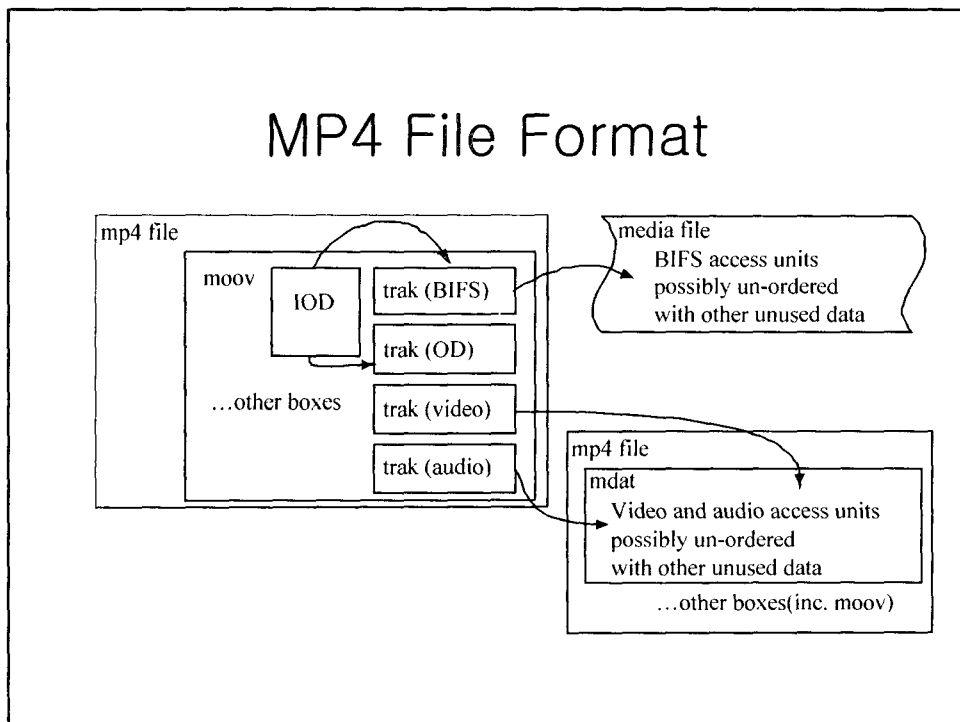
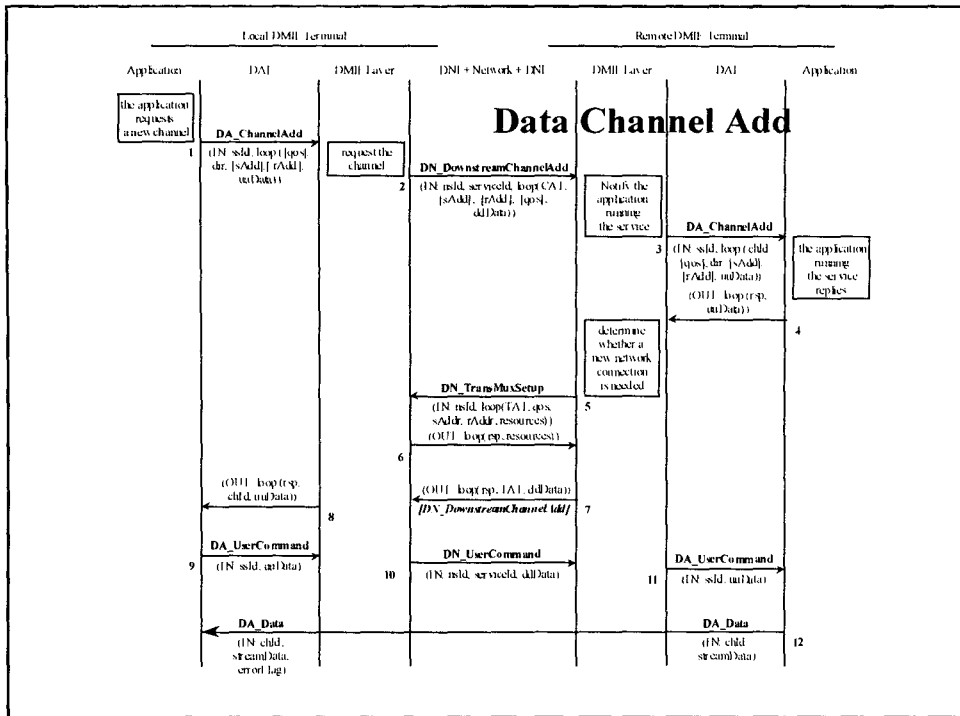


## DMIF (Part 6)

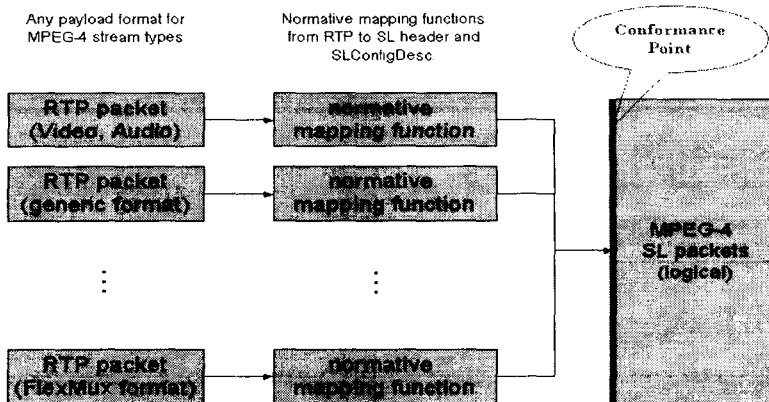
- Each delivery technology transparent to application developers.
- DMIF-Application Interface (DAI)
  - broadcast, local storage and remote interactive scenarios
  - maintaining uniformity across all cases.
- Ability to bundle connections into sessions
- QoS metrics which relate to the media and not to the transport mechanism,
  - hides the delivery technology details to applications.

# DMIF Communication Architecture





# MPEG-4 Over IP



## RTP Carrying Single ES

- • RTP timestamp
  - the presentation time (e.g. CTS) of the earliest AU within the packet.
- • RTP sequence numbers in transmission order
  - The payloads logically or physically have SL Sequence numbers, which are in decoding
- • RTP time scale
  - timeStampResolution
- • default payload format
  - "draft-ietf-avt-mpeg4-multisl-00.txt"