

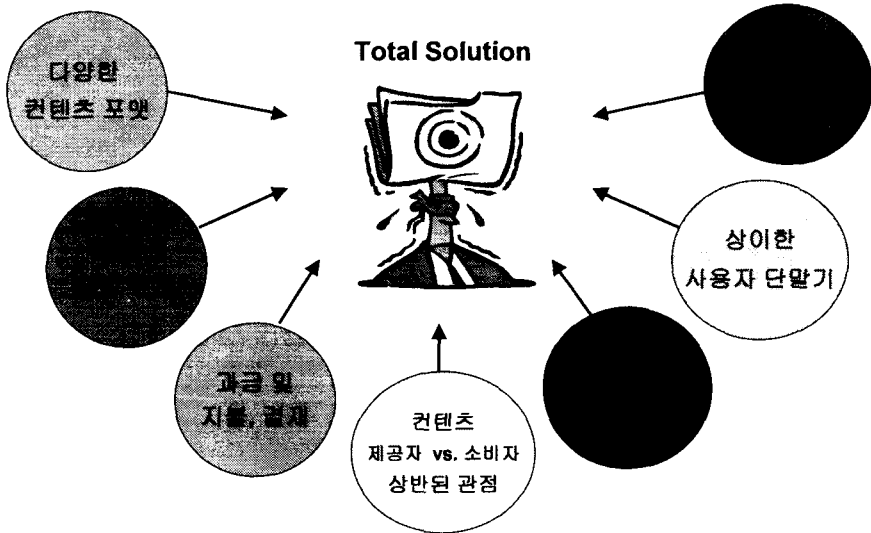
# MPEG-21- 멀티미디어 프레임워크 표준

김 형 중  
강원대학교

## Acknowledgment

- 발표자료를 제공해주신 아래 여러분에게 감사의 말씀을 전합니다.
- 김만배(강원대), 조용주(ETRI), 김문철(ICU), 김종남(KBS), 문남미(SIT)

# 컨텐츠 유통 체계



# MPEG-21 탄생 배경

## Contents & Rights holder

- We want....
- No piracy
  - No illegal distribution
  - Safe collection of \$\$
  - etc., etc.

## Consumers

- We want....
- Privacy
  - Simple terminal
  - Easy to find, pay, share
  - etc., etc.

Integrated Framework is necessary !!



MPEG-21 Multimedia Framework

## MPEG-21 목적

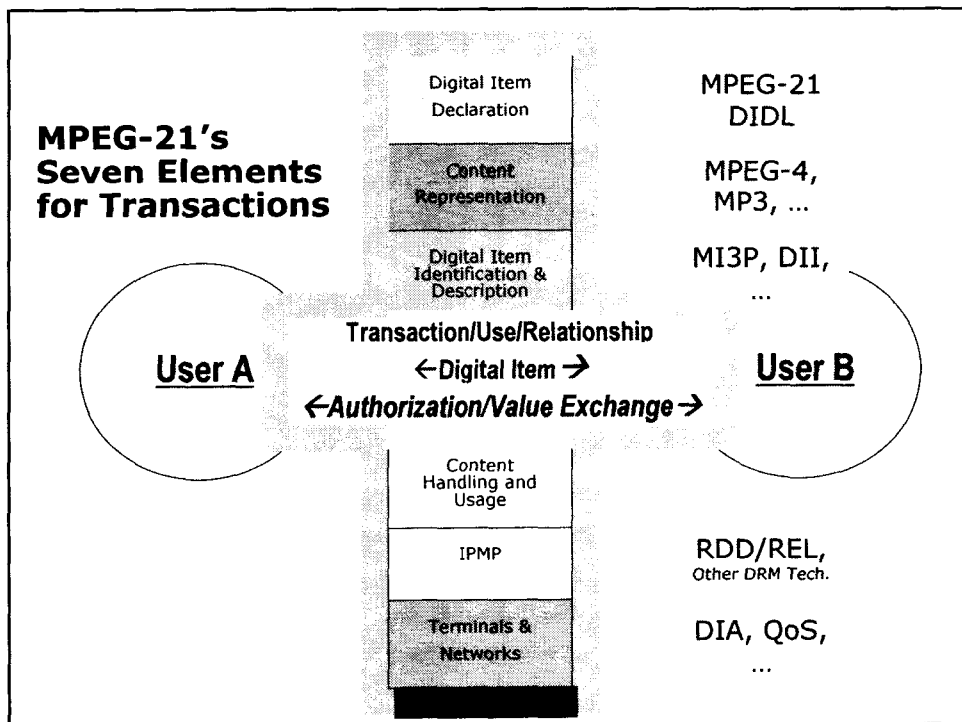
- ◆ 멀티미디어 유통을 위한 프레임워크의 주요 요소와 상호 관계를 정의.
- ◆ 새로운 규격을 제정함
  - 다양한 네트워크 및 장비를 통한 멀티미디어 객체의 접근, 사용, 가공, 재활용
  - 권리 보호 및 지불 등의 기능이 요구되는 여러 종류의 상거래 모델(Business Model)의 구현
  - 콘텐츠 사용자의 사생활(Privacy) 보호
- ◆ 멀티미디어 콘텐츠의 생성, 관리, 전송, 처리, 분배 및 소비를 위하여 필요한 기술들의 조화를 지원하기 위한 통합 표준 확립.

## MPEG-21 (ISO/IEC 21000-1)

- Part 1: Vision, Technologies and Strategy
- Part 2: Digital Item Declaration (DID)
- Part 3: Digital Item Identification (DII)
- Part 4: Intellectual Property Management and Protection (IPMP)
- Part 5: Rights Expression Language (REL)
- Part 6: Rights Data Dictionary (RDD)
- Part 7: Digital Item Adaptation (DIA)
- Part 8: Reference Software
- Part 9: File Format
- Part 10: Digital Item Processing
- Part 11: Evaluation Tools for Persistent Association
- Part 12: Test Bed of MPEG-21 Resource Delivery
- Others: Event Reporting

# MPEG-21 "Multimedia Framework"

- **MPEG-21 will enable**
  - All-electronic creation, delivery and trade of digital multimedia content
  - Transparent usage of various content types on network devices
  
- **For this,**
  - Documented 'big picture' around any interaction with multimedia content
    - 'ISO/IEC TR 21000-1: Vision, Technologies & Strategy'
  - Identified seven architectural elements



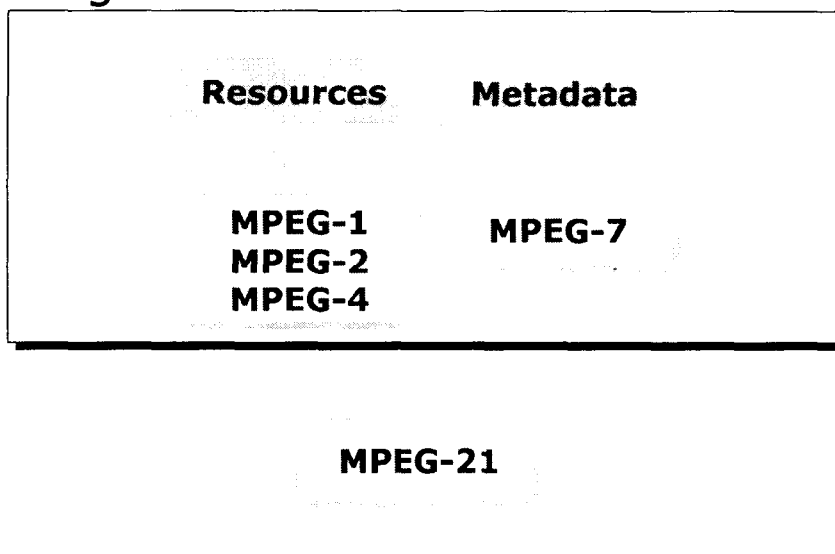
## MPEG-21 Architectural Elements

- Digital Item Declaration
- Digital Item Description & Identification
- Content Representation
- Content Handling & Usage
- Terminals & Networks
- Intellectual Property Management & Protection
- Event Reporting

## Digital Item

- The fundamental unit of distribution & transaction in the MPEG-21 framework
- Digital Item =  
resources + metadata + structure
- Resource: individual asset
- Metadata: data about or pertaining to the Item
- Structure: relationships among the parts of the Item

## Digital Item



## Part 2: DID

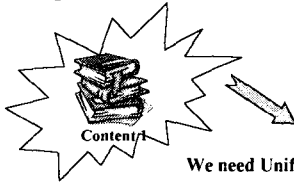
- DID = Digital Item Declaration
- Realize
  - *general, flexible and interoperable* solution for all kinds of content in any context.
  - uniform way of *linking* all types of *descriptive information* to any kind of media resource
  - ability to intelligently *manage collections of content* of diverse types and from all sources

# DID

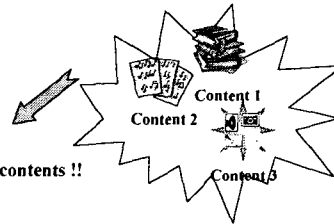
## ◆ Need

- "Digital Item"의 구성 요소 및 범위를 명확히 할 수 있는 "정의"가 필요함
  - 다양한 "Use"를 가능하게 하여야 함
  - 다양한 형태 및 장르의 콘텐츠를 포함
  - 명확한 규정 (Unambiguity)
  - 콘텐츠와 이에 대한 설명(Description)을 모두 포함

Digital Item : 1 content



Digital Item : Multiple contents



We need Uniform way for handling contents !!

# DID

## ◆ 모델

- Represent abstract structure of a Digital Item
  - Container, Item, Component, Descriptor, Resource
  - Condition, Choice, Select, Assertion, Statement, Anchor, Fragment

## ◆ 표현

- Normative description of the syntax and semantics
  - of each DID element

## ◆ 스키마(Schema)

- The entire grammar of the DID representation in XML

## Part 3: DII

- Digital Item Identification
- MPEG-21 uses Uniform Resource Identifiers (URIs) to identify
  - Digital Items
  - Metadata Schemes
  - Users
  - Other entities (e.g., territories, rights expressions, terminals, ...)
- URIs allow industry-specific identification schemes to be used within MPEG-21 framework
  - URLs (e.g., <http://www.kangwon.ac.kr/mpeg-21.html>)
  - URNs (e.g., <urn:isbn:0-672-30894-0>)

## DII

- 필요성
  - 현재 대부분의 콘텐츠는 식별을 위한 ID가 없음.
    - No name (or ID), no explanation, only content as is
  - We need Identification in order to do:
    - IPMP, search, filtering, cataloging
- DII는 다른 식별체계를 포괄하여 사용 가능한 generic 형태
  - Many *identification systems* have been implemented or are in progress
    - ISBN (Int'l Standard Book Number)
    - ISRC (Int'l Standard Recording Code)
    - ISWC (Int'l Standard musical Work Code)
    - ISAN (Int'l Standard Audio-visual Number)
    - URN, URI
    - DOI (Digital Object Identifier)
    - cIDf (content IDentification Forum)



## Part 4: IPMP

- ◆ IPMP = Intellectual Property Management and Protection
  - IP (지적 재산)
    - 지적, 정신적인 창작활동의 결과인 지식 또는 정보를 표현한 것
  - Management (관리)
    - 사용 권한의 부여와 그에 따른 사용 및 유통에 대한 감시
  - Protection (보호)
    - 사용 권한이 없는 사람이 그 콘텐츠를 접근하거나 사용할 수 없도록 하는 것
- ◆ Digital Content delivery
  - Internet : Napster
    - Music, Video, eBooks, Games
  - Digital Broadcast
    - STB with HDD, PDR, DVCR
  - Industry is expecting increasing revenue from Digital delivery
  - But, there is no proper IPMP systems yet

## IPMP

- ◆ Current Situation
  - Most of the e-content is governed by at best rudimentary IPMP systems
  - No de-facto standard IPMP system yet
  - Lack of interoperability between IPMP systems
    - A framework required
  - Requires
    - the freedom to exercise their rights by choosing channels and technologies
    - the freedom to manage their privacy
      - interacting with content anonymously
  - Existing IPMP systems cannot deal with the subtleties of issues related to Intellectual Property Law.

## IPMP

- ◆ specifies communication protocols for the access to protected Digital Items
  - For creation and consumption of content
  - Standardised messages between 'IPMP Tools'
    - Authentication
    - Cryptographic containers
    - Watermarking
    - Payment systems
    - Key management, ...
- ◆ Does not standardise Specific Tools

## Part 5: REL

- ◆ REL = *Rights Expression Language*
- ◆ Based ContentGuard's XrML
- ◆ "Programming" language for the creation of rights expressions
- ◆ XML Schema based
- ◆ Intended for digital and non-digital resources in media and non-media space
- ◆ Dependent on MPEG's RDD

## Part 6: RDD

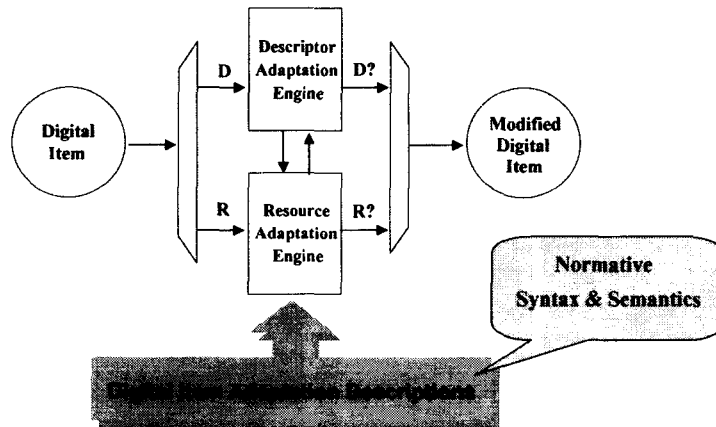
- ◆ RDD = *Rights Data Dictionary*
- ◆ An interoperable Dictionary of Terms for use in Rights Management
- ◆ Includes Descriptive Metadata and Rights Metadata
- ◆ Machine actionable, therefore automatable
- ◆ Provides mechanisms for transformation from one schema to another with minimal loss of semantic precision
- ◆ Provides definitions for MPEG's REL

## Part 7: DIA

- ◆ DIA = Digital Item Adaptation
- ◆ To achieve *interoperable transparent* access to (distributed) advanced multimedia content by
  - shielding users from *network* and *terminal* installation, management and implementation issues
  - allowing the multimedia applications to connect diverse sets of Users, such that the *quality of the user experience* will be guaranteed
- ◆ A Digital Item is subject to a *resource adaptation engine*, as well as a *descriptor adaptation engine*, which produce together the adapted Digital Item

# DIA

## Digital Item Adaptation



## Possible DIA Technologies (examples)

- DID Adaptation
  - Using audio instead of text resource
  - Include subtitles into video stream
  - And: Audio description for video scenes
- Resource Adaptation
  - Transcoding, bit rate conversion, ...
  - Magnifying
  - Text-to-speech modules
  - Extracting information from resources and presenting it to Users (for EPG)

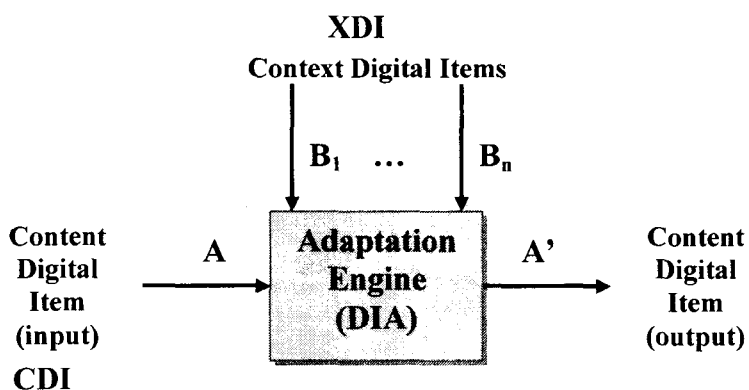
## DIA - Status

- Call for Proposal on technology issued June 2002
  - After MPEG-internal requirements gathering process
- Technology selection under way – SoCD 5.0
- FCD expected

## Part 8: Reference Software

- MPEG-21의 Parts의 기능을 통합적이고 체계적인 소프트웨어로 구현할 목적
- MPEG-21 표준 규격안에 기반한 소프트웨어 개발에 관심 있는 단체들의 관련 소프트웨어 제공을 추천
- CD에 등록되기 전에 제출해야 함.

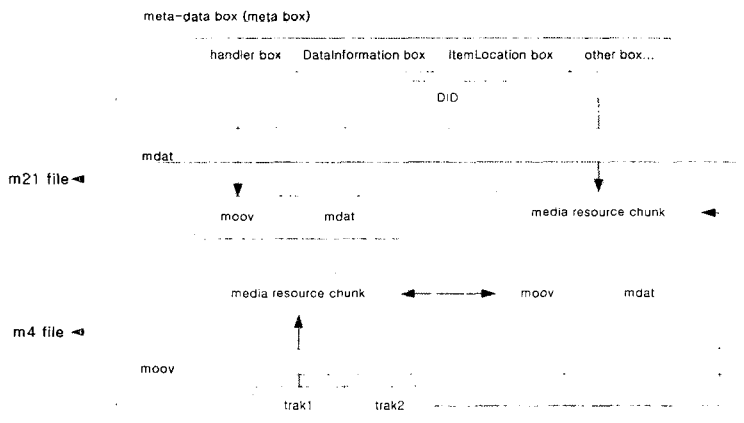
## DIA Processing



## Part 9: File Format

- Standardized file format for MPEG-21 Digital Items
  - Combines MPEG-4 features with new MPEG-21 features
  - Will accommodate a valid DID, media resources and references to external resources
- Currently, Working Draft v.1.0 published

## MPEG-21 (ISO) File Format



## MPEG-21(ISO) File Format

- ◆ Based on WD1.1
  - ISO media file format
- ◆ Supports backward compatibility with mp4
  - Moov + mdat (media resources)
- ◆ Supports media resource addressing structurally from mp21 and mp4 at the same time
  - Address different types of media resources
  - Address more than one mp4 presentation
  - Address an ES in a mp4 presentation

## Media Resource Addressing Method

### • Media Resource in a m21 file

- `<Resource target="#offset=1000" mimeType="video/mp4" >`  
for a mp4 presentation
- `<Resource target="#offset=1000/moov/trak[1]"`  
`mimeType="video/mp4" >`  
for the first track in a mp4  
or
- `<Resource target="#offset=1000//trak[1]"`  
`mimeType="video/mp4" >`  
for the first track in a mp4

## Media Resource Addressing Method

### • Media Resource in a m21 file

- `<Resource target="#offset=1000/moov/trak[1]/mdia"`  
`mimeType="video/mp4" >`  
for the media under the first track in a mp4  
or
- `<Resource target="#offset=1000//trak[1]/mdia"`  
`mimeType="video/mp4" >`  
for the media under the first track in a mp4
- `<Resource ref="#offset=1000:odid=0x10&esid=0x11" >`  
for a media resource(ES) with ODID and ESID



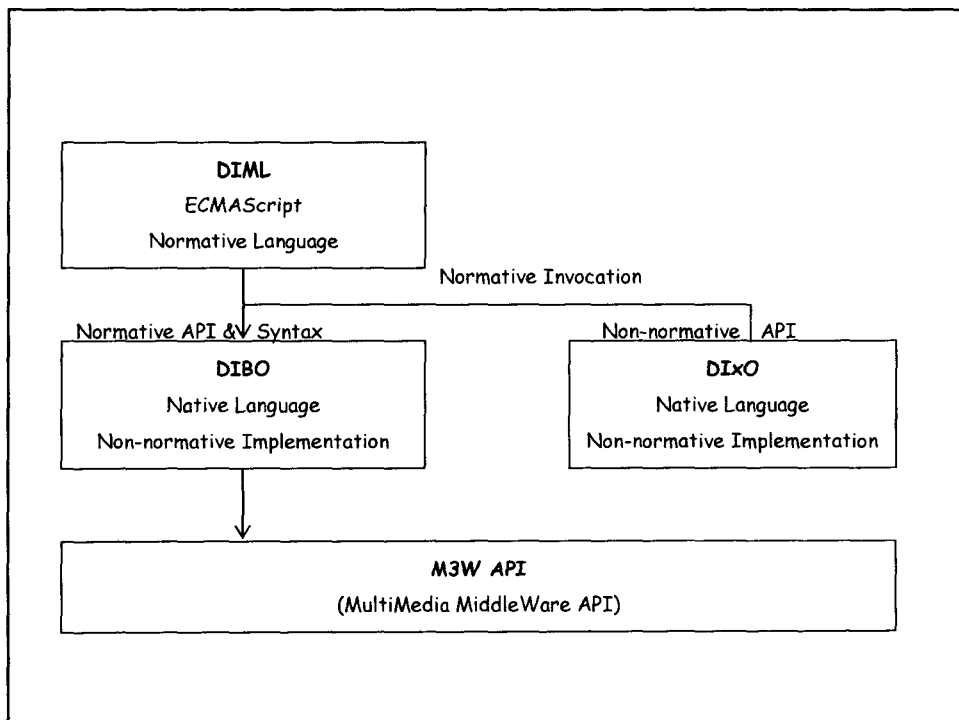
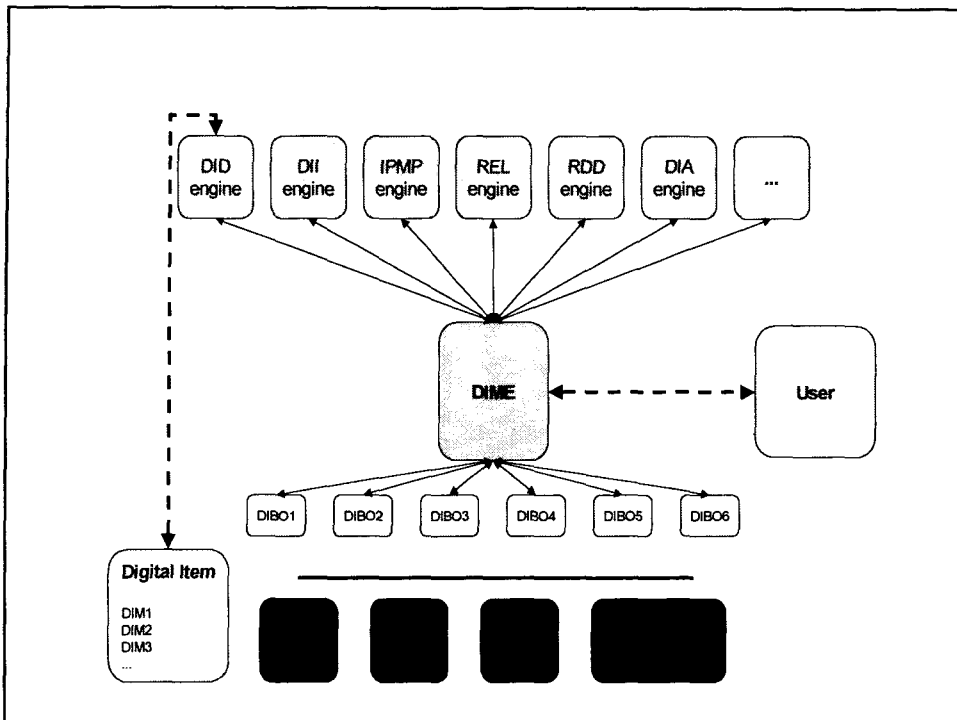
## Media Resource Addressing Method

- Media Resource externally referenced

- `<Resource ref="http://www.etri.re.kr/test.mp4" mimeType="video/mp4">` for a mp4 presentation referenced
  
- `<Resource target="http://www.etri.re.kr/test.mp4:moov/trak[1]" mimeType="video/mp4" >`  
for the first track in a mp4  
or
- `<Resource target="http://www.etri.re.kr/test.mp4:/trak[1]" mimeType="video/mp4" >`  
for the first track in a mp4

## Part 10: Digital Item Processing

- DID에 특정 동작을 처리할 수 있는 기능을 부여하고 기능들의 처리과정에서의 호환성 유지
- DIM (Digital Item Method) + DIME(DI Method Engine) + DIBO(DI Basic Operation) + DIML(DI Method Language)



## MPEG-21 DIP WD 1.0

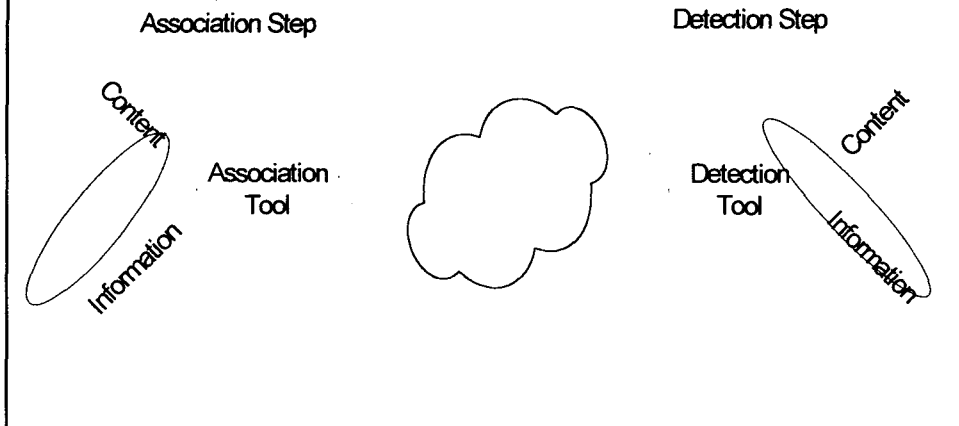
- ◆ DIM
  - Provides a *tool for expression the intended interaction* of a User with a DI at the level of DID.
- ◆ DIBO
  - Provides *functionality* at the DID element level, not at the level of individual resources.
- ◆ DIXO
  - Motivation
    - *Extensibility.*
    - Any language can delegate for complex processing of additional application requirement.
  - Example
    - TypeText, IMGTree, SlideShow, SearchHighlightText, etc.

## MPEG-21 DIP WD 1.0

- ◆ DIML
  - ECMAScript, DOM level 2
  - Object Types
    - MpegDIPEXception
      - Exception.
    - MpegDIPOBJECTMap [getNumberOfTypes(), getTypeName(), etc.]
      - DIP Object Map.
    - MpegDIDDocument
      - DID instance document.
    - DIDL element objects
      - Element object.
    - MpegDIPResourceStatus [isPlaying()]
      - Status of resources.

## Part 11: Persistent Association Tech

- Generic PAT Reference Model



## The Goal of MPEG-21 Part 11

- MPEG-21 (ISO/IEC TR 21000-11) documents best practice in the evaluation of Persistent Association Technologies.
- PAT TR provides "yard sticks" to be used to benchmark PAT
- Only for audio and video data, now.
- Expected that the scope of this Technical Report will be enhanced in future to cover other media types including still pictures and text
- Now, WD 3.0

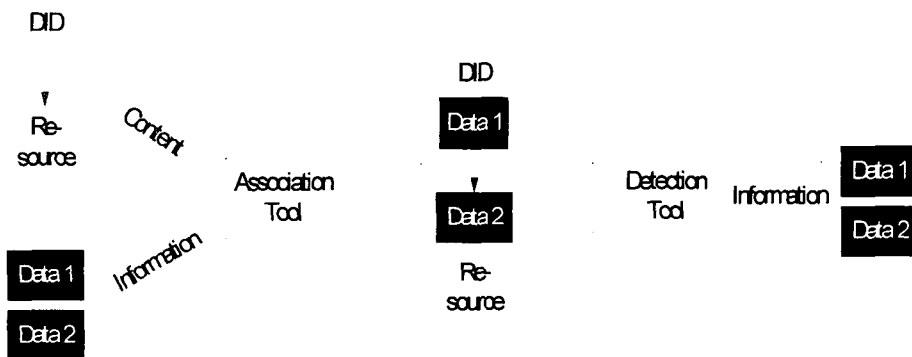
# Recent Activity of Part 11

## - 65th AhG on MPEG-21 Part 11

- o Check EBU requirements on PAT (Pattaya input) against the requirements contained in Annex A of WD V3
- o Distribute WD V.3 and invite relevant video experts inside and outside MPEG to join the discussion
- o Discuss video related issues and provide input to the next meeting
- o Enhance the WD V.3 concentrating on (i) converting audio clauses into test recommendations and (ii) use cases for evaluation of persistent association technologies

# PAT (1)

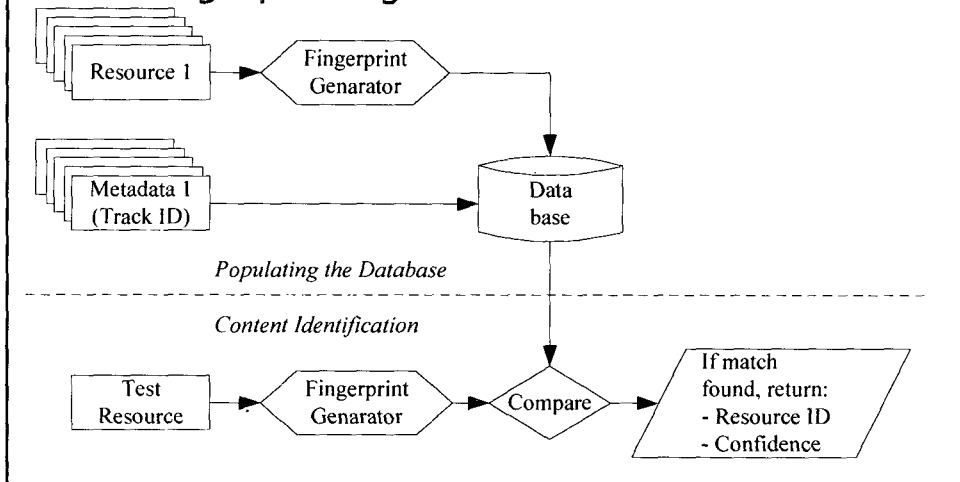
## ◆ Header Reference Model





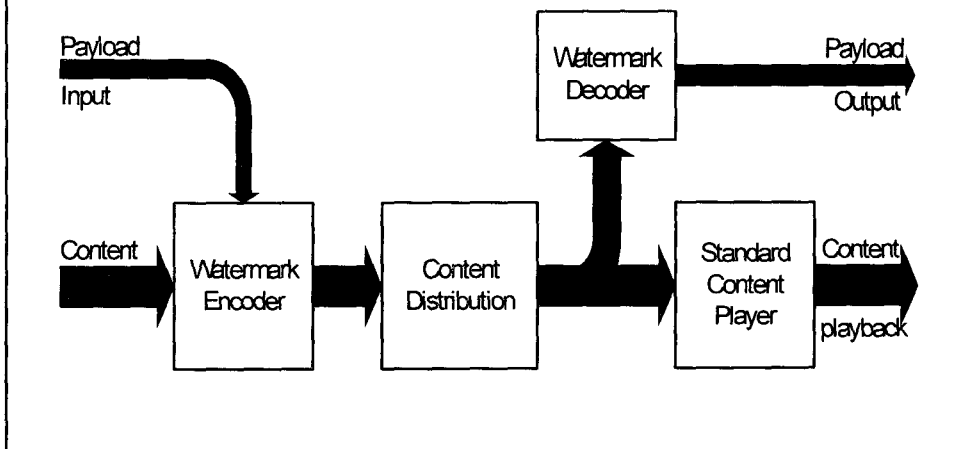
## PAT (4)

### ◆ Fingerprinting Reference Model



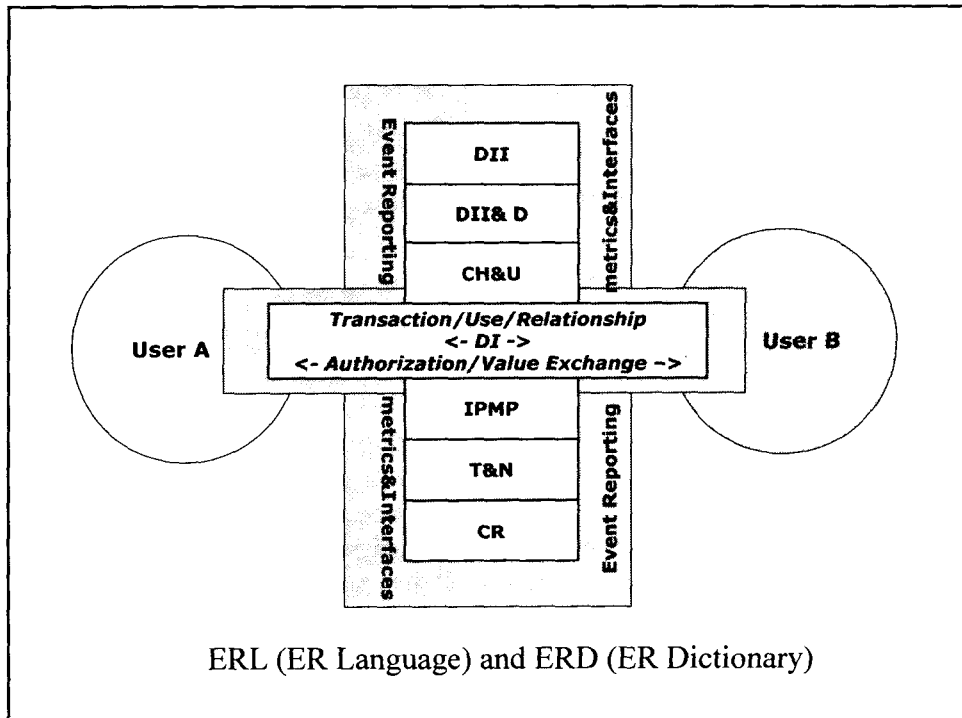
## PAT (5)

### ◆ Watermarking Reference Model



## Part X: Event Reporting

- **Event?**
  - **Every interaction with a Digital Item in the multimedia framework**
  - **About User-User, User-Digital Item, Digital Item-Digital Item interaction**
- **What is Event Reporting**
  - **Metrics and interfaces that enable Users to understand precisely the performance of all reportable events within the framework**
  - **Refers to identified Digital Items, environments, processes, transactions and Users**

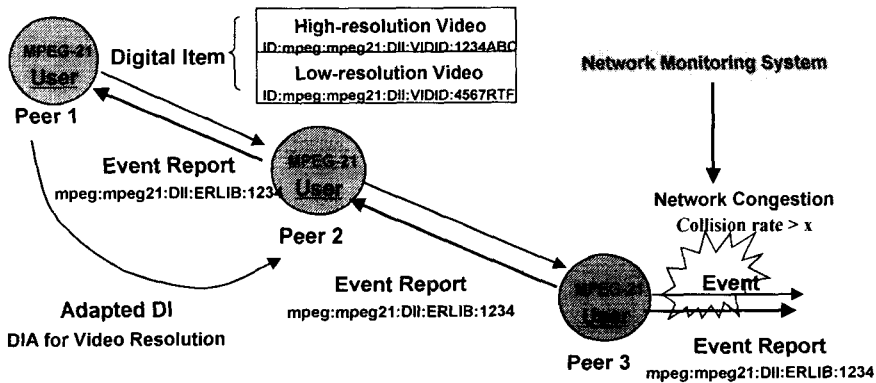




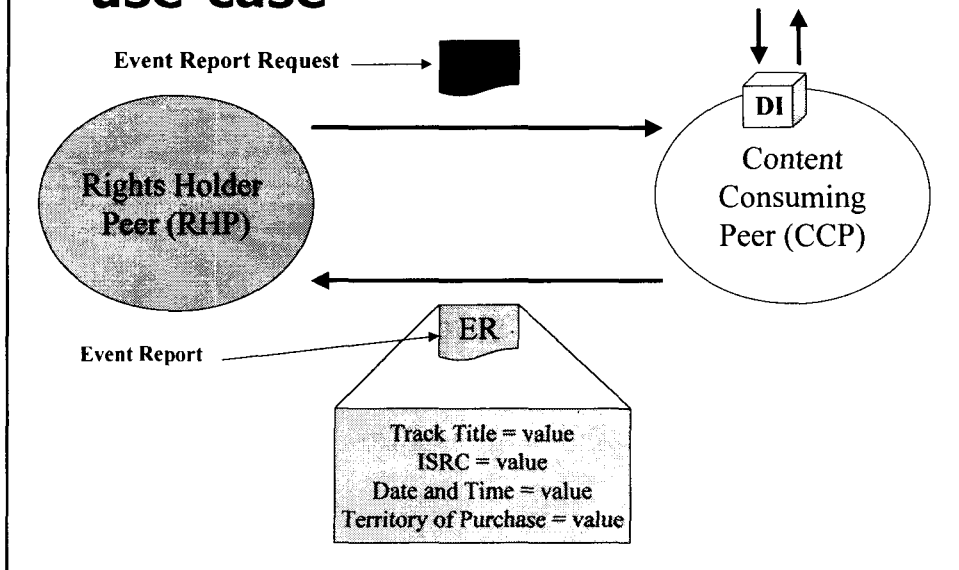
# Examples

- ◆ **Technical reports**
  - **Bandwidth usage/Availability**
  - **Network congestion**
  - **Load balancing**
- ◆ **Usage reports**
  - **Copyright reports**
  - **Performances**
  - **Copies**
- ◆ **Financial reports**
  - **Proof of purchase**
  - **License Purchase and delivery**

# Network Traffic Analysis

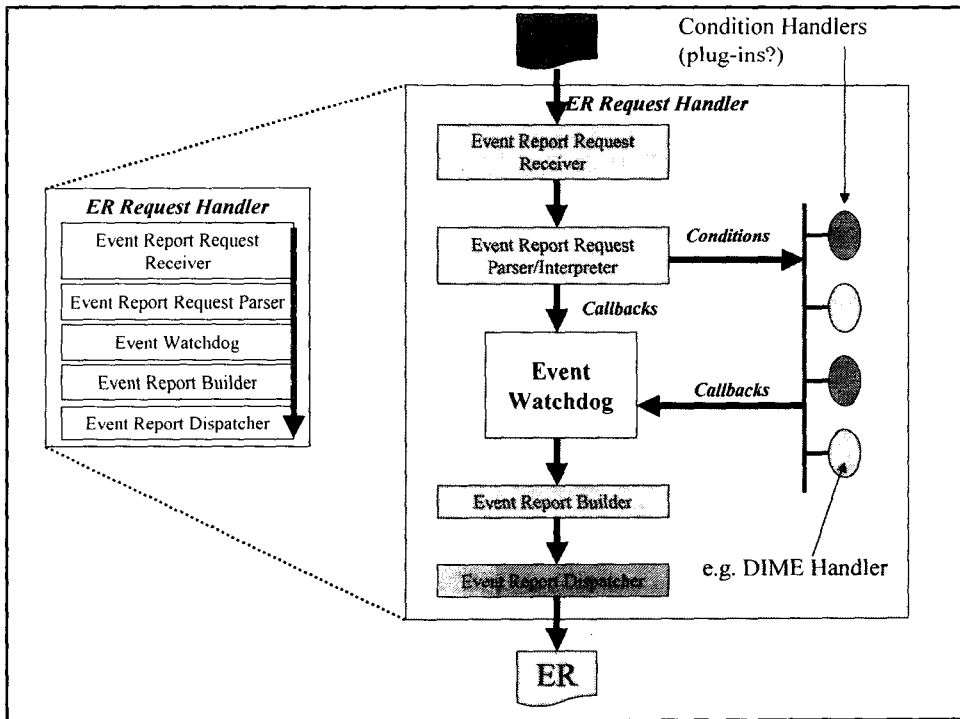
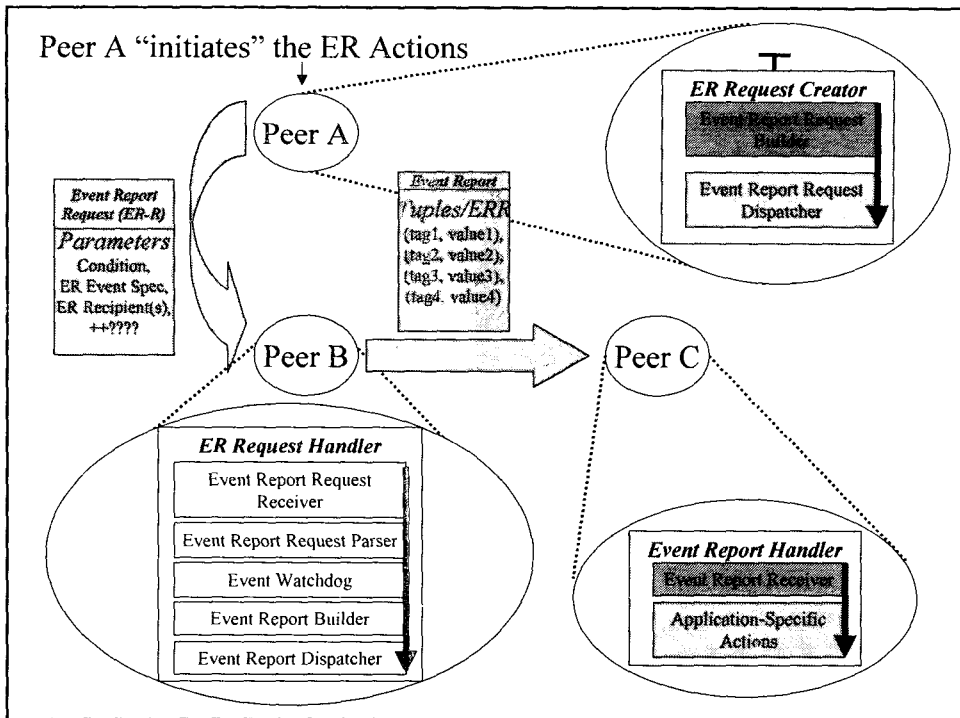


## Overview of a simple ER use-case



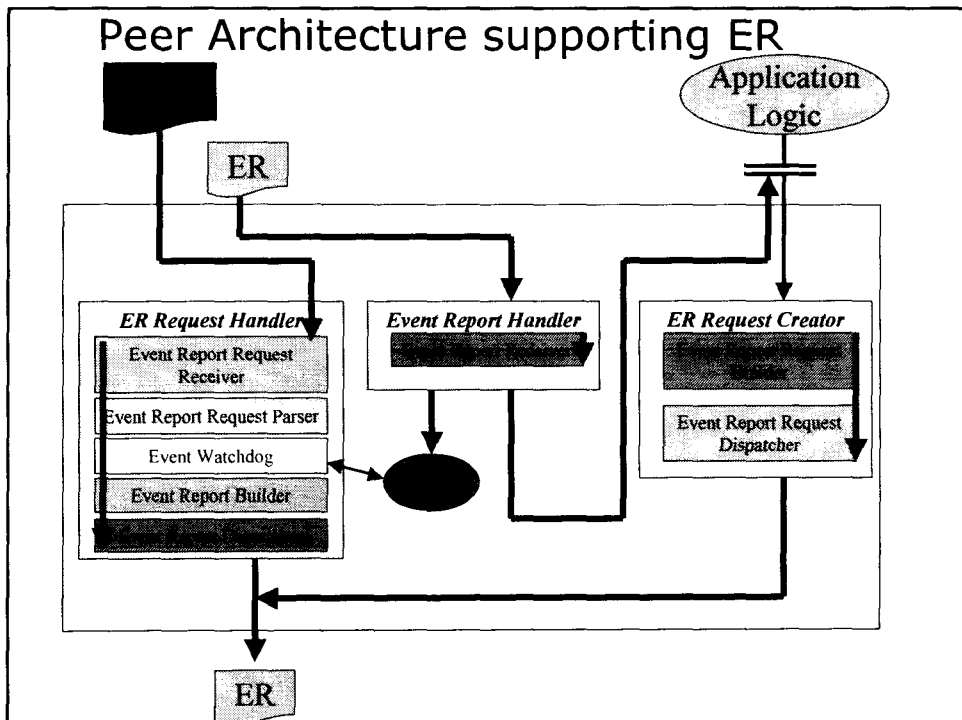
## Use Case Walkthrough

1. Content Consuming Peer (CCP) obtains the DI it wishes to use.
2. The CCP obtains a license for the content which contains an ER-R.
3. The CCP **"Plays"** a track.
4. This action results in fulfillment of the ER-R's specified condition.
5. This results in an ER being created and sent to the RHP (containing the specified data fields).



## Simple Extension:

- Use of ER-R's within ER's – this allows delegation of ER functionality – DI usage aggregation use-case illustrates this



## **Possible Extensions**

- ◆ A query mechanism that allows querying for the "ER Plugins" (types and versioning) that are hosted by the peer (makes "unknown event handler plug-in" errors less likely).
- ◆ Need to provide apps with a mechanism to allow them to create ER's themselves (without an ER-R).

## **Part 12: MPEG-21 Testbed**

- ◆ **No Standard**
- ◆ **MPEG 기술을 활용하여 testbed 구현함**