
MPEG: Vision and facts behind the name

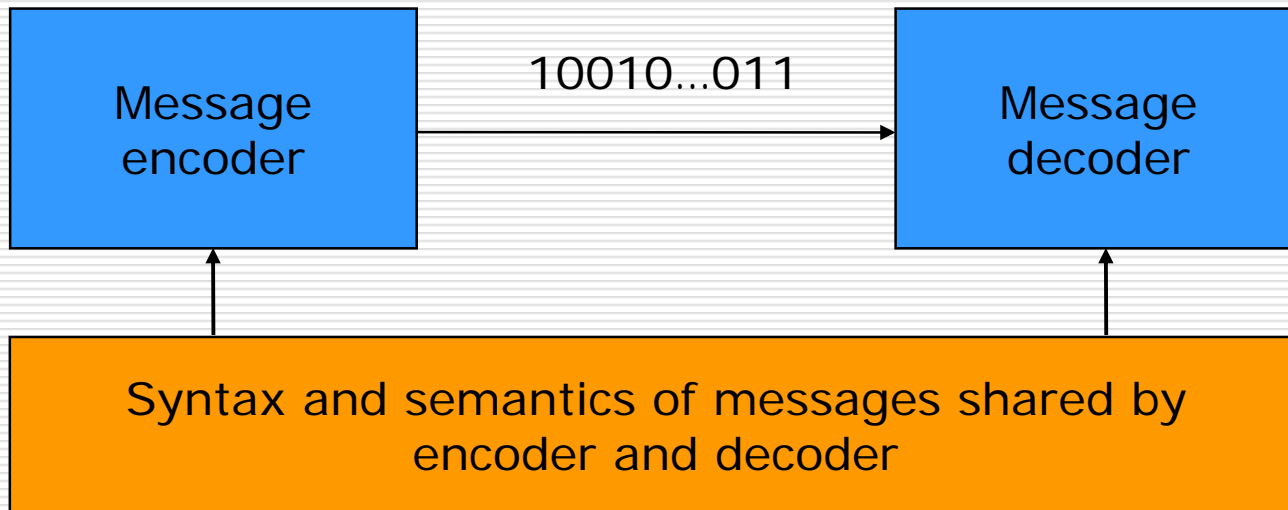
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Tokyo – 2008/11/08

Communication theory...

- Two devices can communicate when they share the syntax and semantics used to represent messages



20 years ago...

- Exploitable results for Audio and Video (AV) compression
- Implementation of effective AV compression algorithms possible in VLSI
- Digital media – unlike analogue media – can be delivery system independent
- A single digital AV standard to
 - Create a huge global market of devices
 - Enable seamless global AV communication

Who defines the syntax and semantics?

- International standards bodies (ISO, IEC, ITU)
- Regional/National standards bodies (ETSI, ANSI, ...)
- Industry groupings (IEEE, SMPTE, ...)
- Private companies (Microsoft, Real Networks, ...)
- A private group of people...
- It is all a matter of how “easy” it is to
 - Define an effective syntax and semantics
 - Make the corresponding devices

End 1980s: Defining syntax and semantics

- ❑ ANSI: ASCII
- ❑ ISO TC 94/SC2: character sets
- ❑ ITU-T: G.711 – PCM coding of speech
- ❑ COST 211: Videoconference at 2 Mbit/s
- ❑ ITU-T: H.120 – Videoconference at 1.5/2 Mbit/s
- ❑ ITU-T: H.261 – Video coding at px64 kbit/s
- ❑ Philips and Sony: Stereo sound for CD recording
- ❑ And more...

In search of the Holy Grail...

- A place to define a digital representation of audio and video
 - Independent of applications (e.g. delivery)
 - Of global scope
- A bridge between R&D results and standards
 - Different industries could send their experts
 - Different competences would add
 - Different agendas would neutralise
- Slogan
 - A fight between technologists less expensive than a fight between assembly lines
 - and the result is better!

Easier said than done

- ITU-T
 - Speech (SG XV WP 1) and video (SG XV WP 2)
- ITU-R
 - Audio (SG 10) and video (SG 11)
- IEC
 - Recording of audio (SC 60 A) and video (SC 60 B)
 - Audio-visual equipment (TC 84)
 - Receivers (SC 12A and G)
- ISO
 - Photography (TC 42)
 - Cinematography (TC 36)
 - Character sets (TC94/SC2)

MPEG – what it is

- ❑ A working group of ISO/IEC
- ❑ Established 20 years ago
- ❑ Meeting quarterly (86th meeting closed 3 weeks ago in Busan)
- ❑ ~25 countries and ~200 companies/institutions represented
- ❑ Hundreds of standards and amendments produced
 - 3 standards jointly developed with ITU SG 16
- ❑ Liaisons with ~50 organisations

MPEG-1

- Start from promising expected markets
 - Interactive video on CD
 - Digital Audio Broadcasting
- The drivers:
 - Compact Disc Interactive
 - Digital Compact Cassette
 - Digital Audio Broadcasting
- The results:
 - CD-i is dead
 - DCC is dead
 - DAB is (almost) dead

MPEG-1 a failure?

- Video CD thrives
 - Hundreds of million players sold
 - Billions of titles sold
 - A “better” VHS
 - Industrial policy of some governments
- MP3 thrives
 - About the quality of CD
 - Billions of MP3 files
 - New ways of experiencing music
- Customers know better?

MPEG-1 teaches a couple of lessons

- MPEG-1 is composed of

- Systems
- Video
- Audio

but can be used independently

- MPEG only defines syntax and semantics, but products need “maximum parameter values”
 - Constrained Parameter Set
- Not everybody needs the same amount of technology

MPEG-2, or how devil and holy water can live together

- Systems
 - Some want it ATM-friendly
 - Some want it interfaced with physical channels
 - Some want it storage-friendly
- Video
 - European broadcasters and telcos want scalable video
 - American broadcasters want non-scalable and high definition video
 - Japanese broadcasters want non-scalable and standard definition video
- Audio
 - Some want it backward compatible with MPEG-1
 - Some want it independent of MPEG-1

We managed the challenges ☺

- Profiles
 - A large number of them, but only 2 used
- Levels
 - Sets application-driven parameter values
- Systems
 - Solution for physical channels
 - Solution for DVD
- >1 million photocopies at
 - Seoul (CD)
 - Singapore (FDIS)

Although we do not claim any merit...

- MP3 licensing model very good
 - Pay apiece for hardware
 - Pay one-time for software
- MPEG-2 Systems and Video licensing model matched user expectations

Mid 1990: success breeds challenges

- The premises of MPEG-1/2 are uprooted
 - Software implementation becomes possible
 - Audio and video on internet become possible
 - New constituencies affirm their presence
- MPEG-4: coding for a much broader range of applications
 - Very low bitrate for video (but also very high!)
 - Reduced bitrate for audio
 - Composition
 - File format
 - 3D Graphics...

We did (almost) all right – the software copyright disclaimer/1

- This software module
 - Is an implementation of one or more tools as specified by the <standard>
 - Was originally developed by <...> and edited by <...> in the course of development of the <standard> for reference purposes
 - Its performance may not have been optimized

We did (almost) all right – the software copyright disclaimer/2

- ISO/IEC gives users
 - Free license to this software module or modifications for use in products claiming conformance to audiovisual and image-coding related ITU Recs and/or ISO/IEC ISs
 - The same free license to this software module or modifications for research purposes and further ISO/IEC standardisation
- ISO/IEC have no liability
 - For use of this software module or modifications

We did (almost) all right – the software copyright disclaimer/3

- Those intending to use this software module in products are advised that its use may infringe existing patents
- <...> retains full right to
 - Modify and use the code for its own purpose,
 - Assign or donate the code to a third party
 - Inhibit third parties from using the code for products that do not conform to audiovisual and image-coding related ITU Res and/or ISO/IEC ISs

In MPEG collaboration comes first

- In November 1995 MPEG deployed an electronic document facility
- Main purpose: to upload and distribute
- MPEG achieved unprecedented levels of technical collaboration
- With its document facility MPEG has
 - Improved collaboration
 - Saved money
 - Protected the environment

We certainly do not claim any demerit...

- ❑ But the MPEG-4 Visual licensing killed half of the standard
- ❑ MPEG-4 Visual thrives whenever it copies the “analogue” MPEG-2 licensing models
- ❑ The “use fee” licensing model facilitated the widespread use of proprietary codecs
- ❑ Creative licensing?

Others struggle with licensing...

- ❑ The recording industry was taken by surprise by the MP3 phenomenon
- ❑ With MP3 people can find any song any time anywhere on any device over and beyond the “compilation straightjacket”
- ❑ Instead of giving more to their customers of what they wanted, they have brought them to court...
- ❑ In the 2000 the recording industry was worth 50% more than it is worth today...

MPEG-7

- Description, a new type of coding for MPEG
- Too much conservatism in incumbents
 - Virtually no metadata to end users
- Metadata, the right business tool for digital media
- MPEG-7 at the basis of some application standards (e.g. TV Anytime)

MPEG-21

- To enable *diffuse trading* of content where every human is potentially an element of a network involving billions of content providers, value adders, packagers, service providers, resellers, consumers ... (October 1999)
- Basic elements
 - **Digital Item:** a structured digital object with a standard representation, identification and metadata
 - **User:** any Creator, End User or Intermediary that interacts in the MPEG-21 environment or makes use of Digital Items

MPEG is not everything, but a lot of it

- ❑ In the second half of the 1990s MPEG repeatedly invited ITU-T to collaborate on MPEG-4 Visual
- ❑ The lack of collaboration produced the alternative H.263 Recommendation, similar – but not quite – to MPEG-4
- ❑ In 2000 the ITU-T VCEG claimed breakthrough in video coding
- ❑ In 2001 MPEG and VCEG created the Joint Video Team (JVT) with members from both VCEG and MPEG

Time for an assessment

- The AVC standard has brought new life to digital video
 - AVC: needs half the bitrate for the same quality
 - SVC: finally delivers inexpensive scalability
 - MVC: opens the way to 3D Video
- The standard is called Advanced Video Coding in both ISO and ITU-T
- Pacta sunt servanda

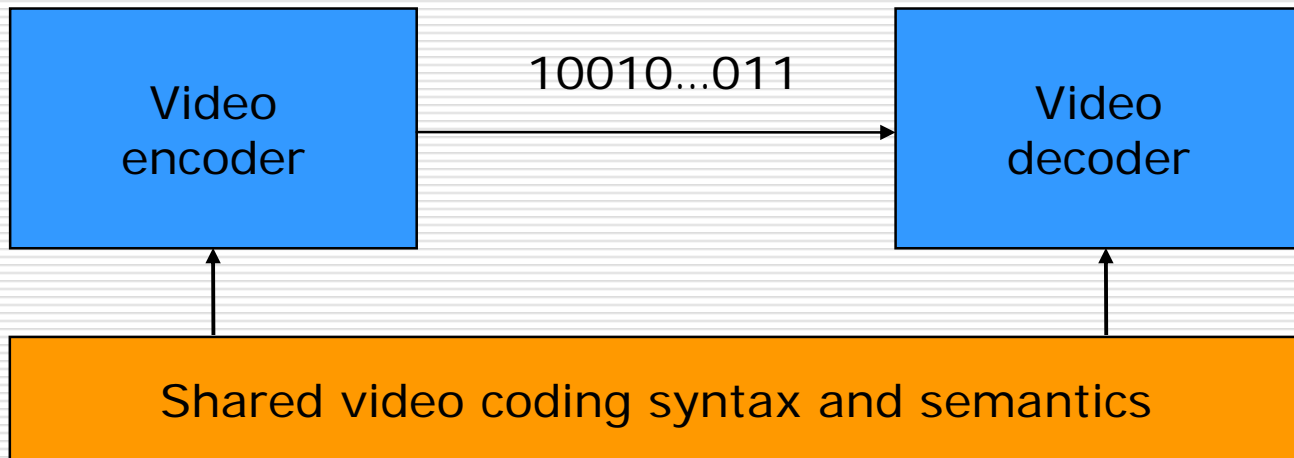
20 years after MPEG was born

- There are just too many video codecs...
 - Compression technology has advanced
 - The entry level to make video codecs is getting lower
 - Many devices have to support many different codecs
- Platform agnostic codecs
 - Service providers and end users like them
 - But no evolution beyond Profiles and Levels
- Platform specific codecs
 - Reduced freedom for service providers and end users
 - Large scope for evolution

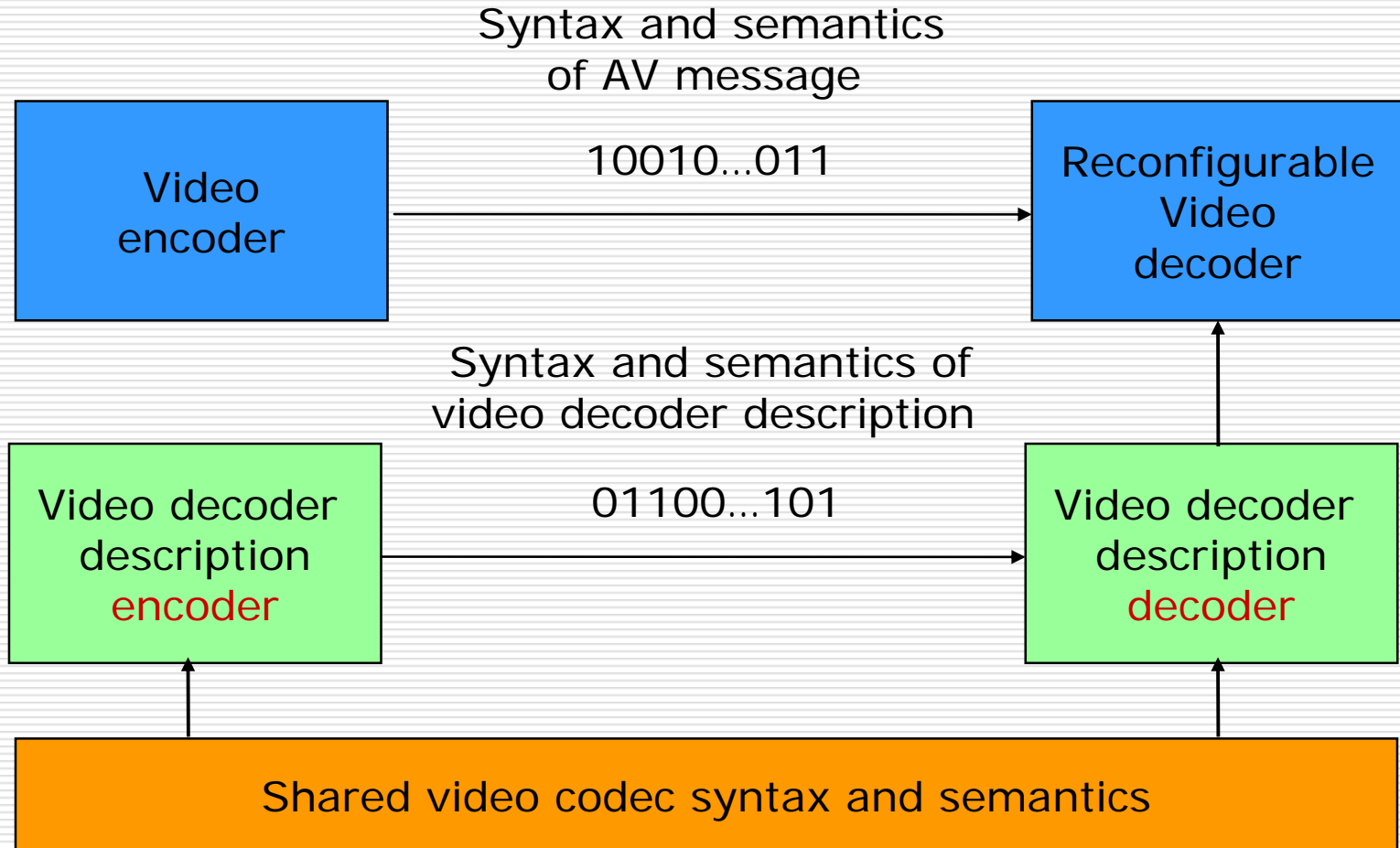
Can we do something about it?

- We would like
 - To support many different codecs on the same hardware
 - To allow extensive codec evolution
 - To introduce new codecs
 - On any platform
 - With optimised decoder solutions for each platform
- We need a novel communication level with syntax and semantics of new entities
- For video (as a start...)

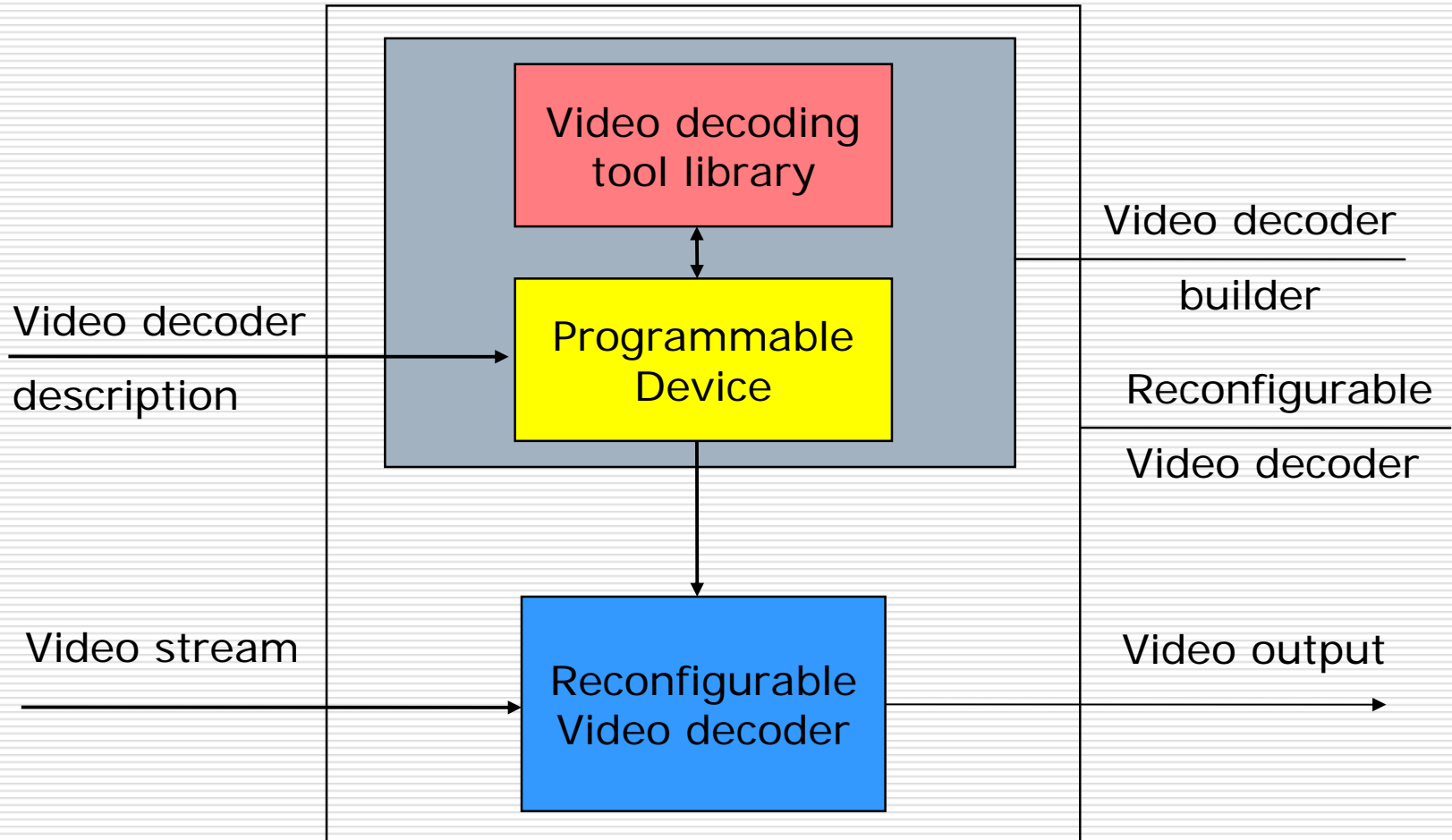
Video communication, so far



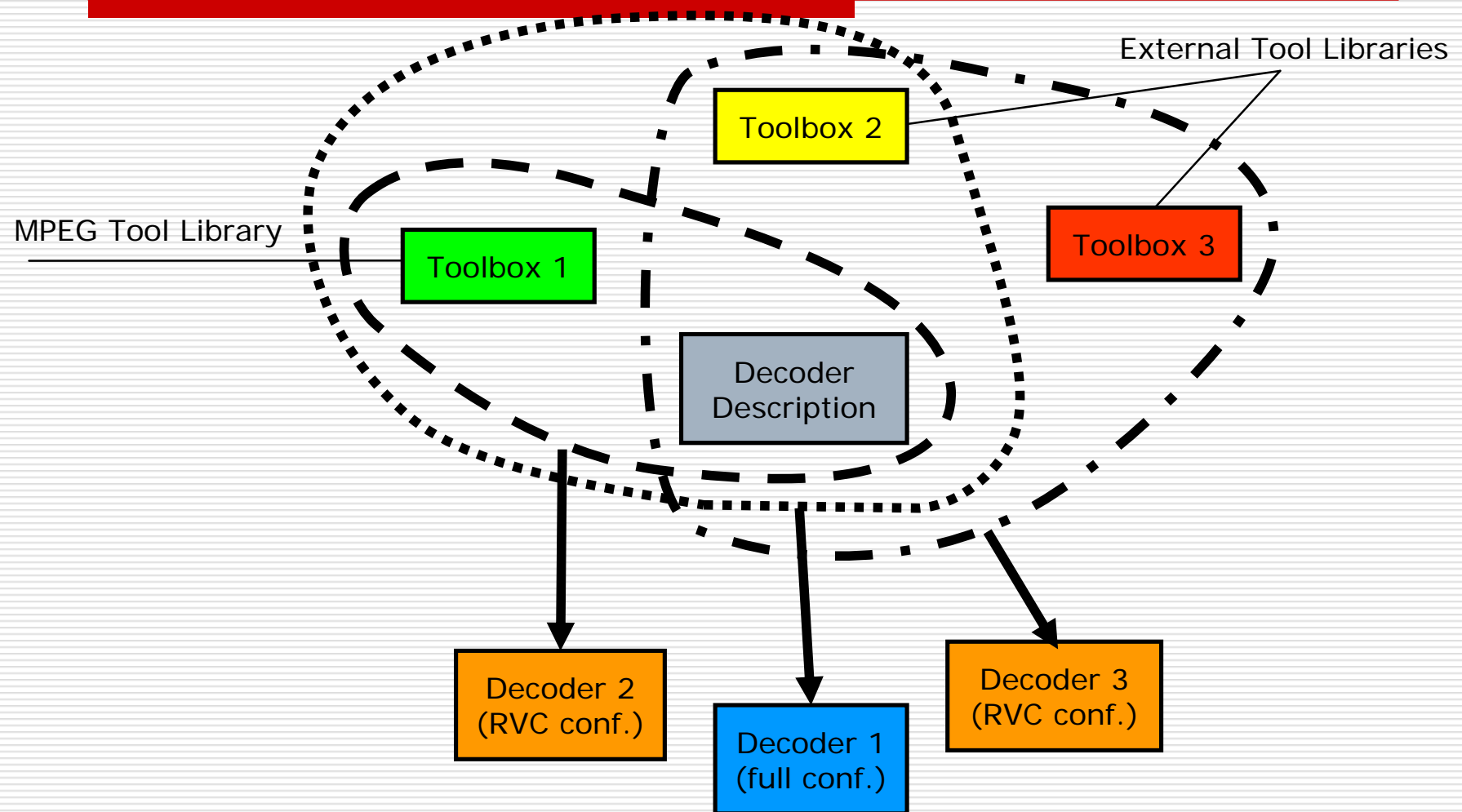
Video communication, the next level



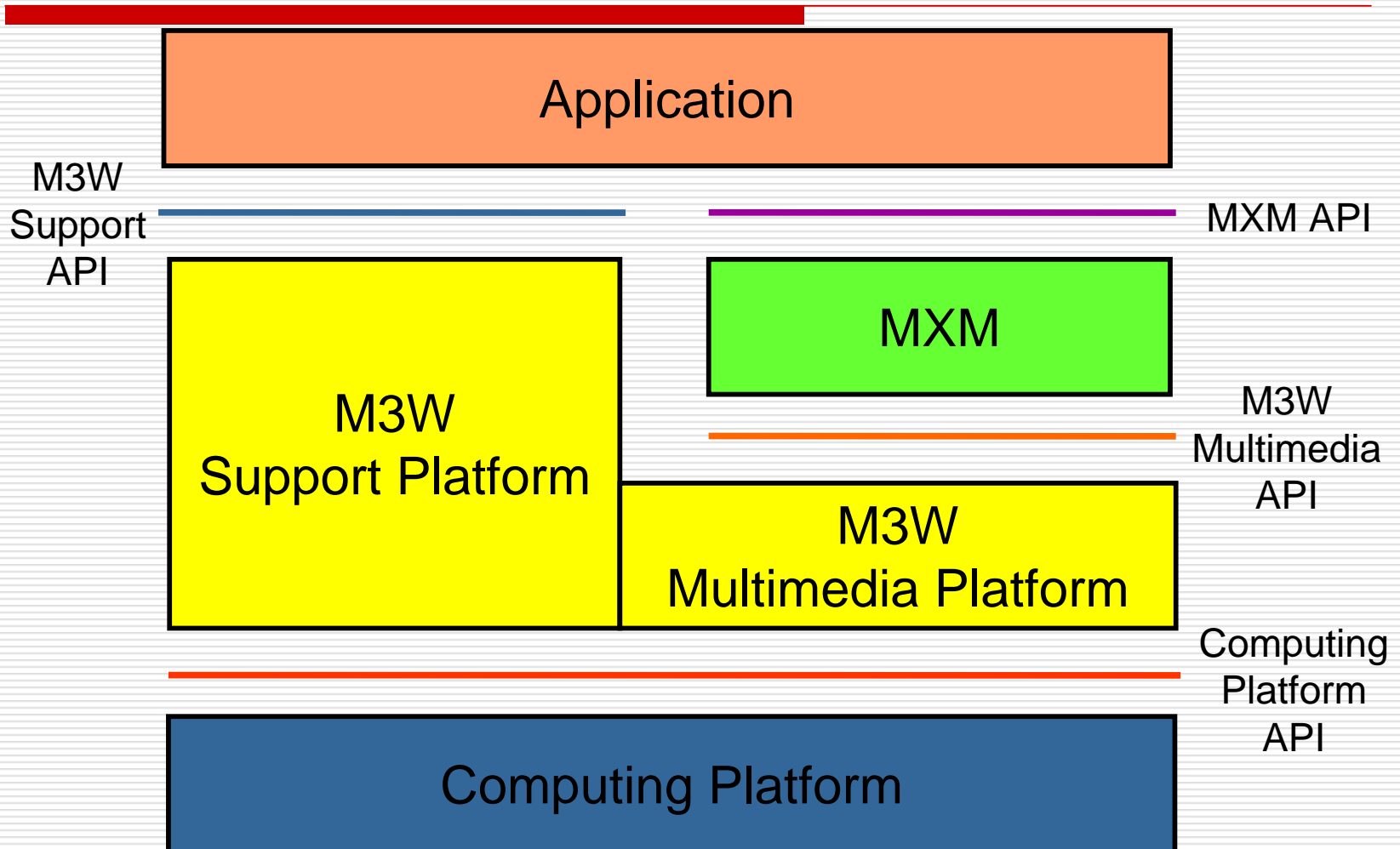
Implementing the new video decoder interoperability



What is RVC "conformance"?



MPEG Multimedia Middleware (M3W)



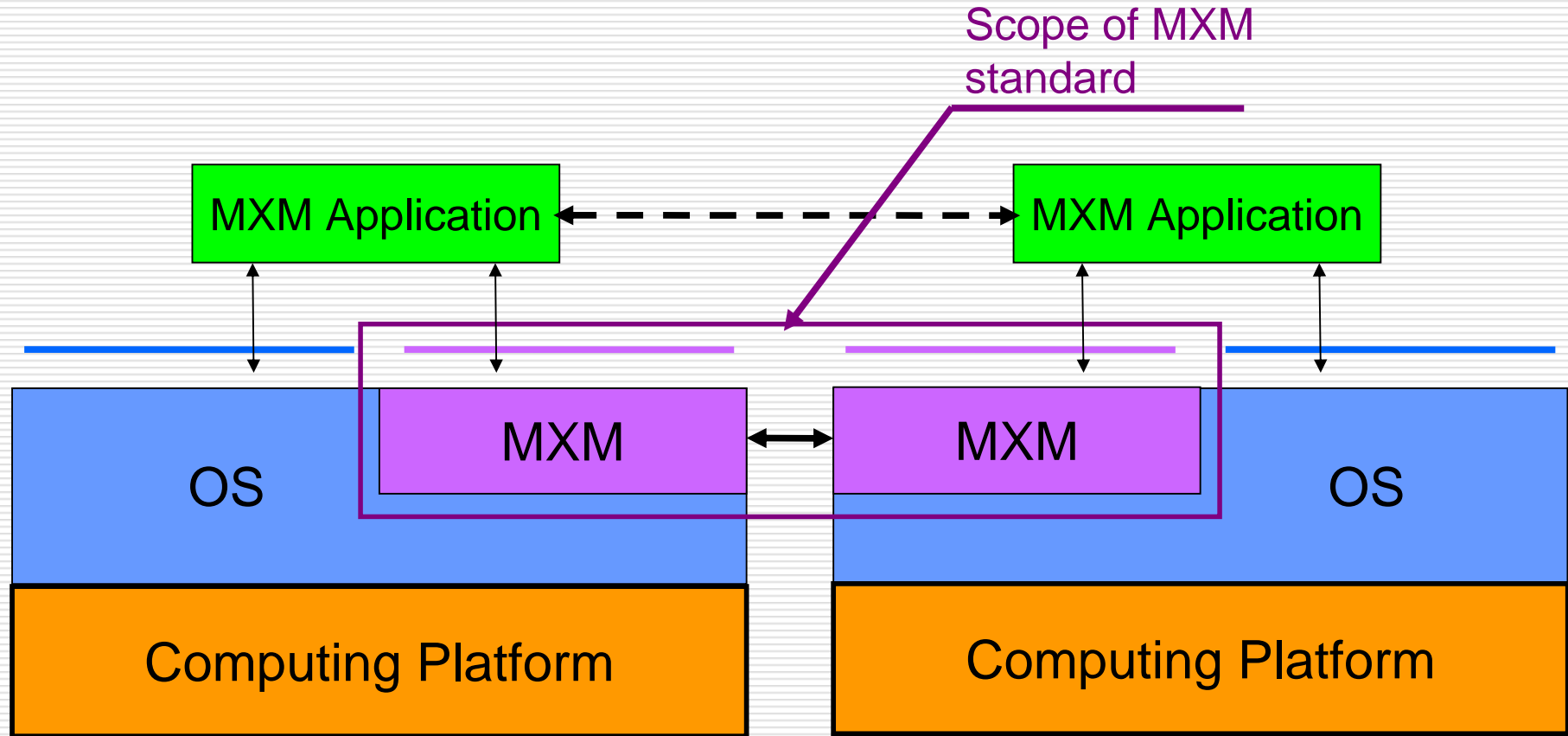
MPEG eXtensible Middleware requirements

- Access selected MPEG technologies through standard APIs
 - Codecs, players, descriptors, presentation, IPMP etc.
 - Create/edit/parse (Metadata, Digital Items, licences, files, streams)
 - Stream/consume content
 - Communicate between devices
 - Store/retrieve content in distributed (P2P) environments
 - Interface with security elements e.g. ISO/IEC 11889 (TPM)

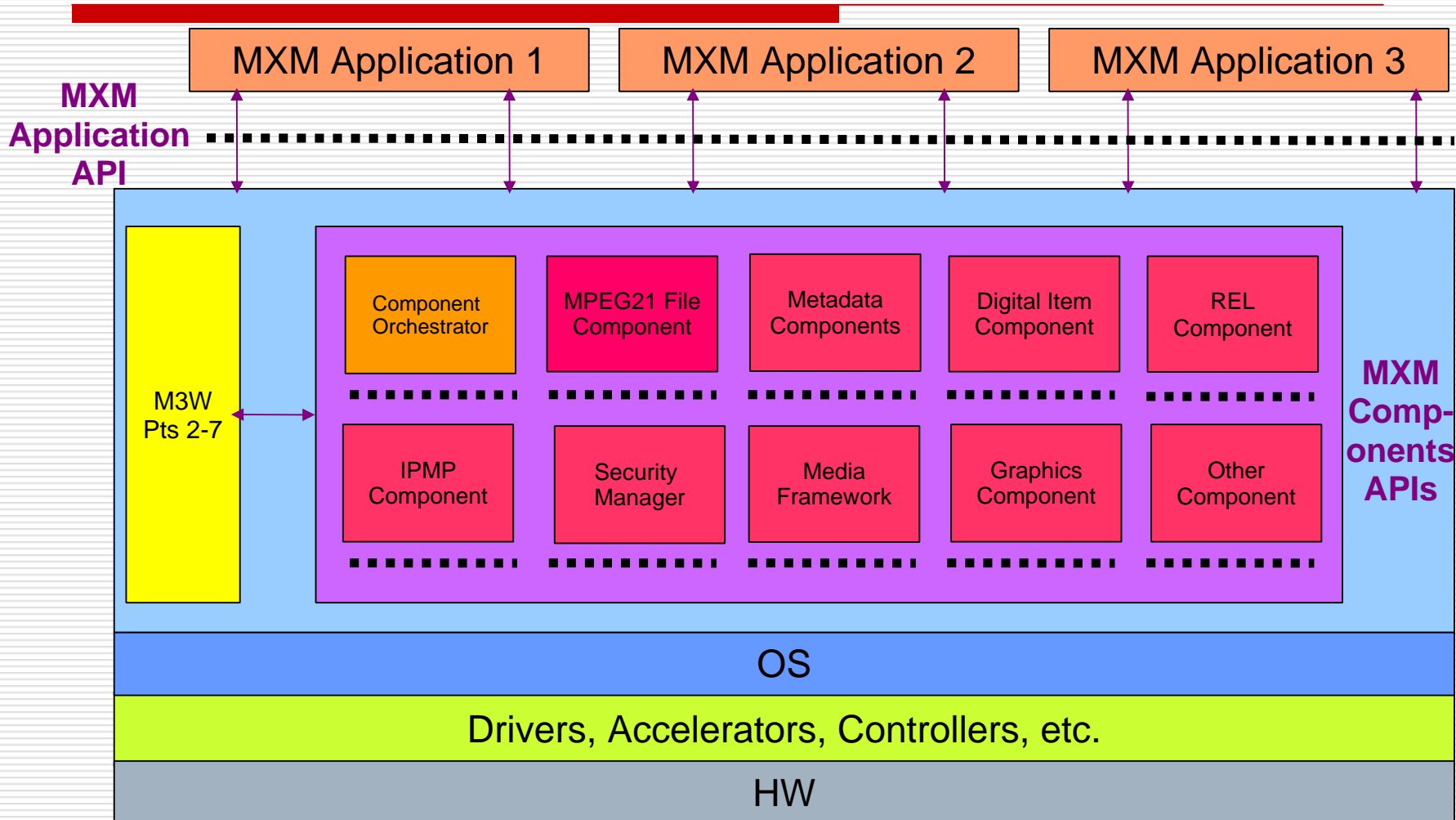
MXM requirements/2

- Modular to enable easy customisation for specific needs
- Re-usable in complete environments e.g. M3W
- Documented APIs
 - In at least one Programming Language
 - Programming Language independent (desirable)
- Available as
 - A human-readable specification
 - A reference implementation released as Open Source Software

MXM devices interoperability



The MXM architecture



Is there no limit to compression?

- MPEG
 - Has been made aware of new results in video compression, particularly for high resolution pictures
 - Issued a Call for Test Material
- Plan
 - Will issue a Call for Evidence in February 2009
 - Will assess the results in April 2009
- If compression results confirmed, MPEG will issue a Call for Proposals
- The High Performance Video Coding (HVC) standard could be completed in 2012

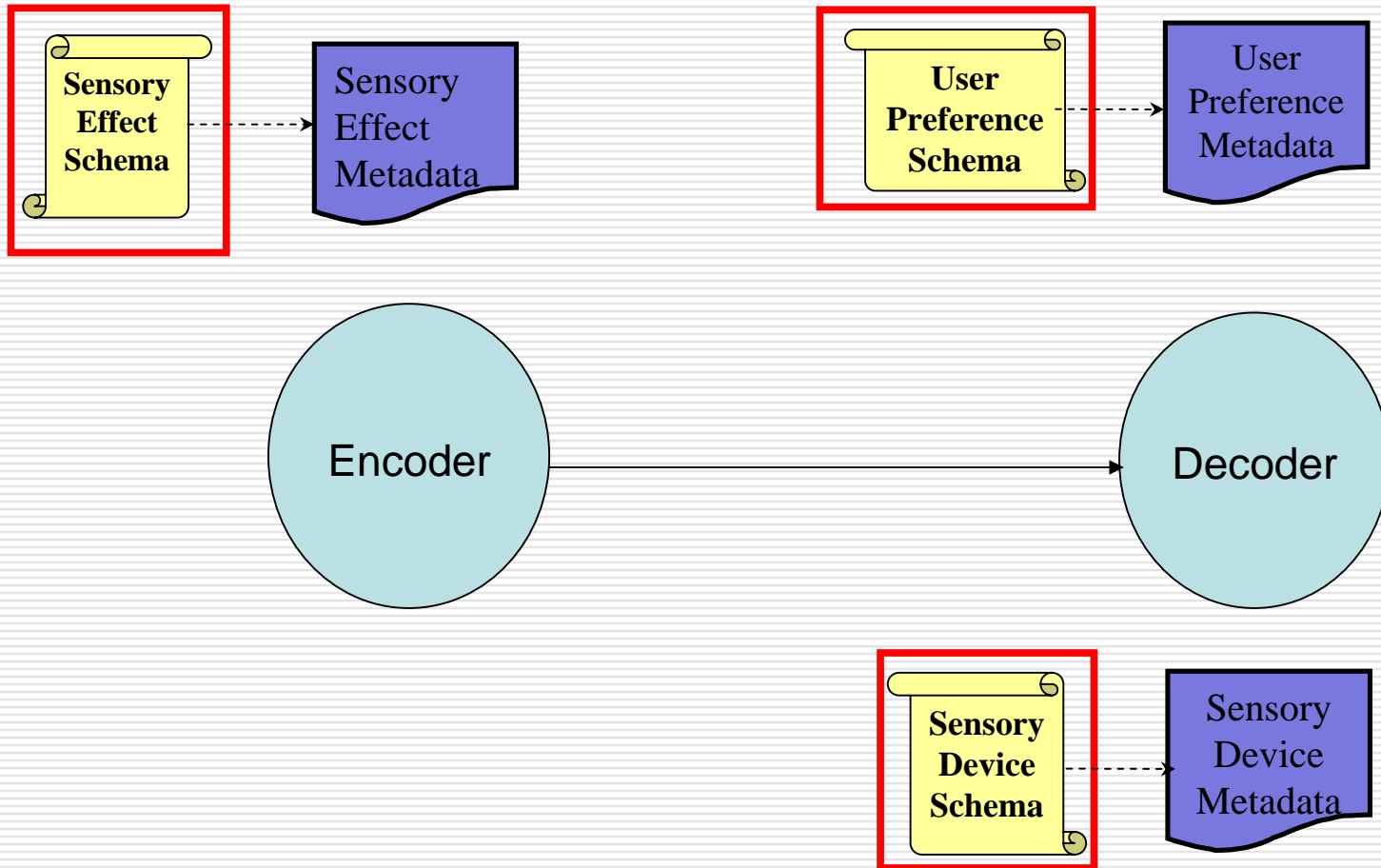
Unified Speech and Audio Coding

- Goal: To develop a single coding technology that
 - Can encode mixed content
 - Speech
 - Music
 - Speech mixed with music
 - Is consistently as good as the best of:
 - AMR-WB+ (state of the art speech coder)
 - HE-AAC V2 (state of the art music coder)
 - In the range: 24 kb/s stereo to 12 kb/s mono
- We already have it!

Representation of Sensory Information (RoSE)

- So far MPEG has provided technology to efficiently encode audio and video information
- Adding “Sensory Effects” to an AV presentation will yield more realistic experiences when consuming audiovisual contents

RoSE Model



Collaboration is always on the agenda

- In Busan ITU-T Q13/16 and MPEG meeting agreed on a joint project of “Advanced IPTV Terminal”
- Main goals
 - To provide advanced user experiences by using the latest media and communication technologies
 - To support the continuous evolution of user experience enhancing advanced services (e.g. via terminal reconfigurability)
 - To improve user experience through seamless integration of content/services from multiple sources

To know more

<http://www.chiariglione.org/leonardo/publications/scholarpedia/>