Contribution to the IASA Conference "Archives speak: who listen?"

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"*Flexible and user-friendly exploitation based on persistent media archives*"

Introduction

User's and Archives requirements

The **cultural, social, economic, politic … values of archives** are directly dependant of three main qualities: the intrinsic interest of their substance; their ability to be easily exploited (retrievable, reachable and usable in a user-friendly way); their persistence (reliable, affordable and manageable). The first quality has an unpredictable value, while the two last have a technology dependant value. The contribution introduces possibilities to enhance that intrinsic interest through restructuring and by adding metadata; to select the appropriate technologies. The result is the exploitation of the archives by a large span of users and user's communities.

The SIP, AIP, DIP architecture in the OAIS model

The OAIS model is a very powerful frame for the creation of vision and of a strategy for managing and exploiting the archives. But its 'Blue Book', as a rule, does not specify any implementation.

The purpose of this contribution to IASA 2005 is to pave one of the ways to realistic implementations of the OAIS model or dynamics.

Any way, the global control of the information packages should be organised in the three OAIS modes: the "**Submission**" (SIP), the "**Archival**" (AIP) and the "**Dissemination**" (DIP). The archival activities are dealing with **original documents** (on any media) which do not meet the OAIS requirements for SIP's. For pragmatic reasons, in the conference, those documents will be called **OIP** (Original Information Packages).

Current projects and services

The AIP material has to be organised in order to facilitate and construct the flexibility and adaptability of the dissemination. The organisation of those properties is based on the experience acquired through several projects in which the author has been involved. They include audio content, video, images and textual. One of them involves the digitisation of analogue originals (the **ASR** project of the **British Library**); another one focuses on the addition of indexes, structures and metadata (and on the retrieval of content) assisted by voice recognition techniques (the **AIDAR** project); another one focuses on the acquisition, structuration and indexation of video rushes in real time from high resolution digital camera from **Panasonic, Sony and Grass Valley** (Thomson); others are focused on Web services (The "Audio Library" and "Video Library" facilities of **Memnon** and **Lsi-e**)and finally, an important one intends to define an open architecture and technical specification implementing the **OAIS** model for **small** and **large** systems: it is the **AXIS** project (Acquisition, eXchange, Indexing & Structuring)

The AAE architecture

To reach long term persistence, the SIP, AIP, DIP architecture can be combined with the approach of the "**Autonomous Assets Entities**"(AAE). The paper introduces its theoretical foundations:

- Using semantic criteria, "**Collections**" of content assets are selected, represented and/or linked following a "**profile**" of standardized formats (metadata, edit-lists, controls, synchronisations …). The backbone of the 'profiles' are **two** types of **orthogonalities**: "Carrier / Data" and "Form / Substance".
- The media **"Projects"** are managed using a reference model including proxies, fitting with the OAIS dynamic. The projects endorse the architecture and, from start, integrate the contents, the metadata and the controls in the Collection.

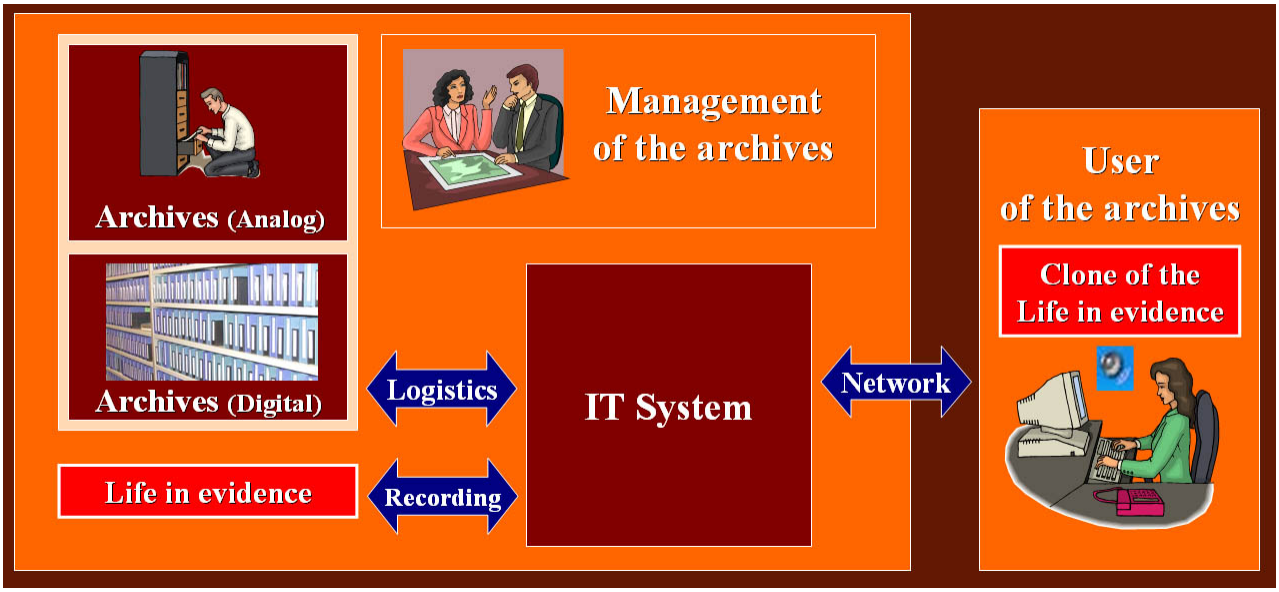
Combining the OAIS model with the AAE architecture

Organising the management of the media content according to the SIP – AIP – DIP and to the Collection Based (foundation for the creation of persistent "**Autonomous Assets Entities**) approaches offers a large flexibility in the ways of dissemination and gives persistence to the archives. The exploitations can namely be done through the Internet or by nomadic distribution (DVD's, CD,s …). The acquisition, the enrichment, the exploitation and the maintenance of the media assets become easy and powerful.
Since long, the persistent archiving with the 'Information Technologies' was reputed to be unreachable. Now, with the progress of the technologies and with the adoption of new strategies, reliable solutions become possible. These involve construction of persistent archives which can be exploited and enhanced in a flexible and easy way. Through automatic and scalable IT maintenance processes, the persistence is expected spanning centuries.

User's and Archives requirements

The **cultural, social, economic, politic … values of archives** have to be promoted by the 'Management of the Archives'. It will be done by a powerful, flexible architecture of the acquisition, archival and IT systems.

How will the 'Management' meet the requirements of the (future) users and of the archives? Indeed, it could be said that the archives have requirements on behalf of the social communities financing the 'archival' and protection of the cultural, social, political … heritage they represent.



The management teams should not any accept to become captive of "Proprietary Systems"; to pay the price of "Exclusive" suppliers; to suffer the artificial "barriers" and "obstacles" constructed by their suppliers or internal privileges in the flows of their processes.

The archives, as custodians of the social memory, require:

- That they could easily be accessed and exploited
- That they will survive to the progressive physical degradation of their support
- That they will survive to the progressive evolution of the formats of representation
- That they will survive to the changes of industrial policies
- That their existence will be known
- That they will be semantically understood
- That the enrichments will be kept for further exploitation.

An architectural approach

An architecture is organising ways to construct things with specific properties. It is more than a 'model', like the OAIS model. It is less than an implementation. The realisation of an architecture implies to write its "technical specifications".

Based of my experience, ten recommendations seem pertinent for those having to construct an architecture fitting with the local requirements of their organisation taking into account its possible evolutions. The current 'Information technologies' become mature! The definition of 'architectural directives' becomes realistic!

There are many good solutions. Some of the recommendations could not fit with the local constrains or with the characteristics of a specific organisation. Each large organisation should define what I call its 'red line' or its 'strict guidelines'. Those guidelines usually include 'policies', 'technical & technological specifications' and 'structural & managerial facilities'. My recommendations should be seen as a contribution to the local process of defining, refining or modifying its OWN guidelines.

Ten recommendations:

I suggest that the 'management teams' should check their current 'red line' or construct / define it considering the following:

1. Use standards to have full control on the exchanges between functional modules
2. Adopt the SIP, DIP, AIP architecture of the OAIS model
3. Construct 'Logical Entities' from 'Physical Originals' using 'Proxies'
4. Deliver the DIP through various channels
5. Trace always the "Packages"
6. Create "Collection profiles" to enable "Autonomous Assets Entities"
7. Create the AIP's as sets of "Autonomous Assets Entities"
8. Manage the persistence of the AIP's
9. Manage the off-line conservation of the AIP's
10. Adopt the previous nine recommendations for your "Operational Units" and for your "AIP's"

Most of them are obvious and require simple comments.

1. Use standards to have full control on the exchanges between functional modules.

The 'management teams' must have full control on the exchanges made between the elementary functional modules. The availability of the full technical specifications of the IT interfaces and protocols is the main component of that control. Furthermore, if these specifications are based on standards, the management of the persistence becomes trivial and the flexibility is ensured. By 'based on standards' I mean that the specifications is a combination of references to 'International standards' (ISO, ETSI …), to 'National standards' (ANSI, DIN …), to 'Common Industrial or Community standards' (METS, MXF, PDF, Dublin Core) and to local formal definitions expressed according to an IT language and a formalism specified by 'Standards' (XML, XSD …).
This recommendation applies only to the IT representations (data) of the exchanges and exports. It doesn't concern the human interaction, the issue of documents in evidence and of the functions themselves: these aspects are added value and differencing factors for the suppliers.

2. Adopt the SIP, DIP, AIP architecture of the OAIS model

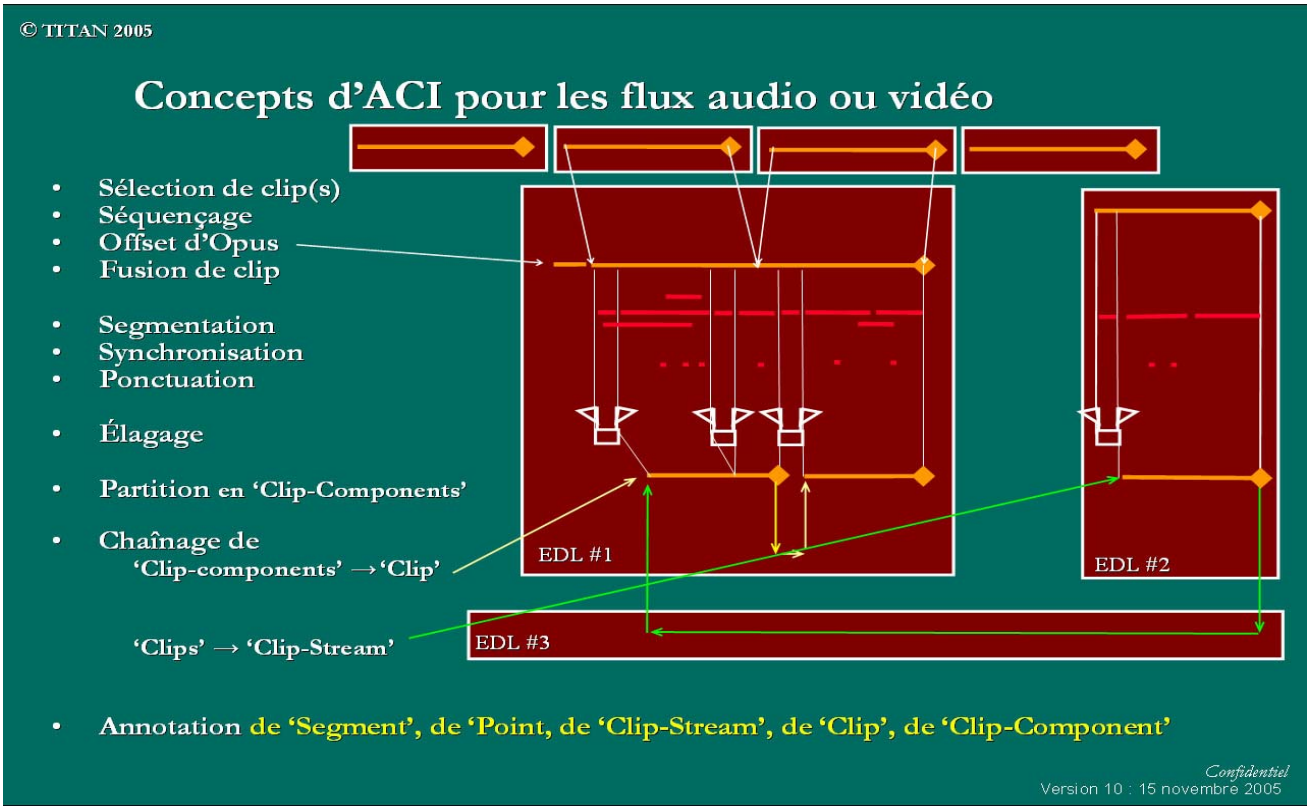
The OAIS model is very rich and is targeted on the archival. I could be understood that an organization decides not adopt the full OAIS model. But simply adopting the OAIS model for all the imports and exports is an easy management decision (elementary and cheap if the recommendation 1 is endorsed). The concept of 'package' is essential to the OAIS. It includes not only the 'Content Information' but also the 'Preservation Description Information', both wrapped by the 'Packaging Information'. The PDI covers all what is required for managing the preservation of the Information: the provenance, the context, the references and the fixity. The OAIS reference model is available at http://public.ccsds.org/publications/RefModel.aspx

3. Construct 'Logical Entities' from 'Physical Originals' using 'Proxies'

The OAIS model doesn't prescribe how the contents should be represented and structured. The cultural heritage of the organizations / institution in charge of the archives gives them the priority of protecting the physical original carrier. In the IT world (in particular, in the OAIS model) the priority is the understanding and protecting the contents. The data carriers are simply accidental and commodities.

In the IT world, the 'logical entities' are the ontological and semantic primitives of the management of the contents: acquisition, archival, exploitation. A 'logical entity' is, for example, one of the movements of a symphony; another one is the symphony as a chain of its movements. The 'physical entity' is the physical carrier with its contents which could be a casual assembly of logical entities. This aspect is further developed and illustrated in the last part (AXIS concepts).

To manage the conversion, 'Clip Management Facilities' must be available. The following figure illustrates the capabilities assumed to be present in such a 'CMF'.



4. Deliver the DIP through various channels

The OAIS model doesn't prescribe how the contents should be disseminated and exploited. But the organization of the AIP should be made to anticipate a large variety of usage. Some of the organizations have only one main mission (Broadcasting of television programs, for example). Even in that case, the productions of DVD's, the production of new programs from the archives and from the rushes, the presentation on the Web … require the possibility of exploitation and dissemination through various channels.

5. Trace always the packages

The tracing should cover all the exports and imports and of the structural links between physical and logical. The tracing start from the acquisition of packages (direct through the OPI and SIP; indirect by acquiring in one module from AIP or even from DIP), ensure the tracing of the AIP's and of the logistics of each of their copies and, finally, lock the tracing of rights and proxies associated with each issue of a DIP (all exploitations, including the internal ones).
They are many ways for ensuring that tracing. One of the most powerful ways to ensure the tracing is to implement the 'certificates of traceability' for all exports and imports of one module.

6. Create "Collection profiles" to enable "Autonomous Assets Entities"

Often one organization is managing 'logical entities' of the same type (music, movies, books, photography's …) or of the same semantic context (sport, news, interviews…). The representation of all the aspects of one logical subject (called 'opus' in AXIS) could be expressed by a combination of standards and local formalism. That combination is called a 'profile'. As soon as such a profile is defined, it could be use to create 'opuses' occurrences of the profile. An 'Autonomous Asset Entity' is the assembly of a set of 'opuses' with all the involved profiles. This construction is a fundamental management tool for constructing and tracing the packages.

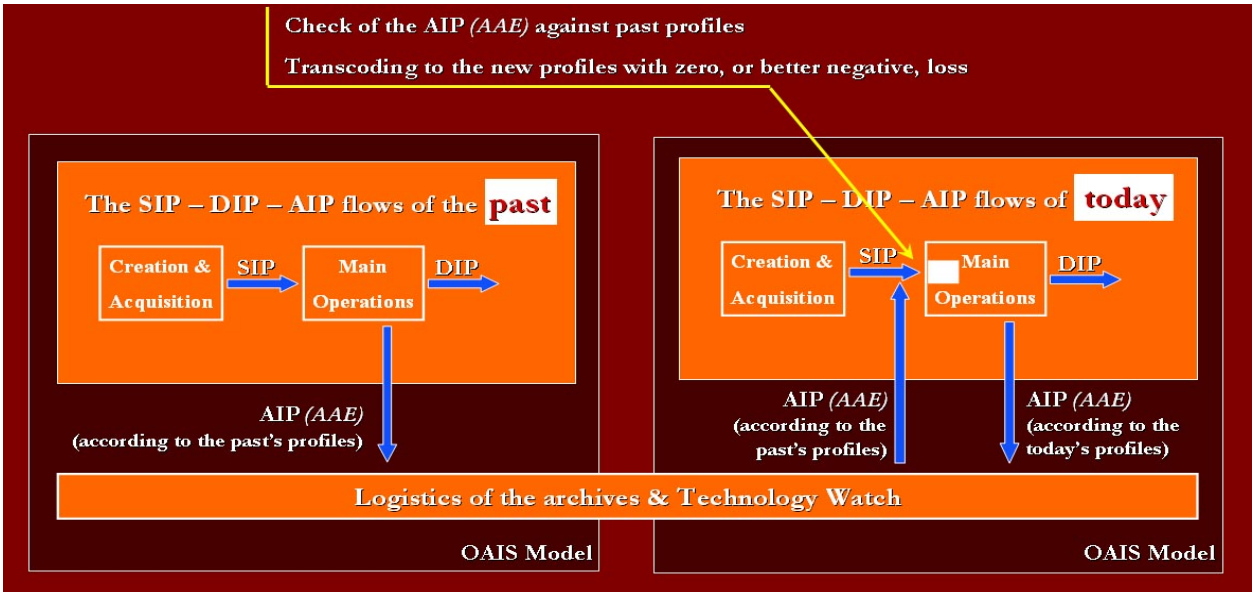
7. Create the AIP's as sets of "Autonomous Assets Entities"

The creation of AIP's as sets of AAE's means that the management of the exploitations and of the persistence can be made in a very simple way. The management of the 'rights' and of the 'obsolescence' can be made easily because the entities are logical and represented according to standards.

8. Manage the persistence of the AIP's through the AAE's

The creation of AIP's as sets of AAE's means that the management of the exploitations and of the persistence can be made in a very simple way. The management of the 'rights' and of the 'obsolescence' can be made easily because the entities are logical and represented according to standards. The persistence has to cover the assurance of the integrity, the resistance against the obsolescence of the carriers, contexts (infrastructures …) and of the formats and, whenever applicable, the consequences of the policy changes of the suppliers.

When changes have to occur, the key is to define new profiles. The technology watch made on the profiles allows identifying the AIP's having to be upgraded to the new profiles. They will be extracted from the archives and presented to the current systems like being SIP. The acquisition will ensure the upgrade (see the next figure)



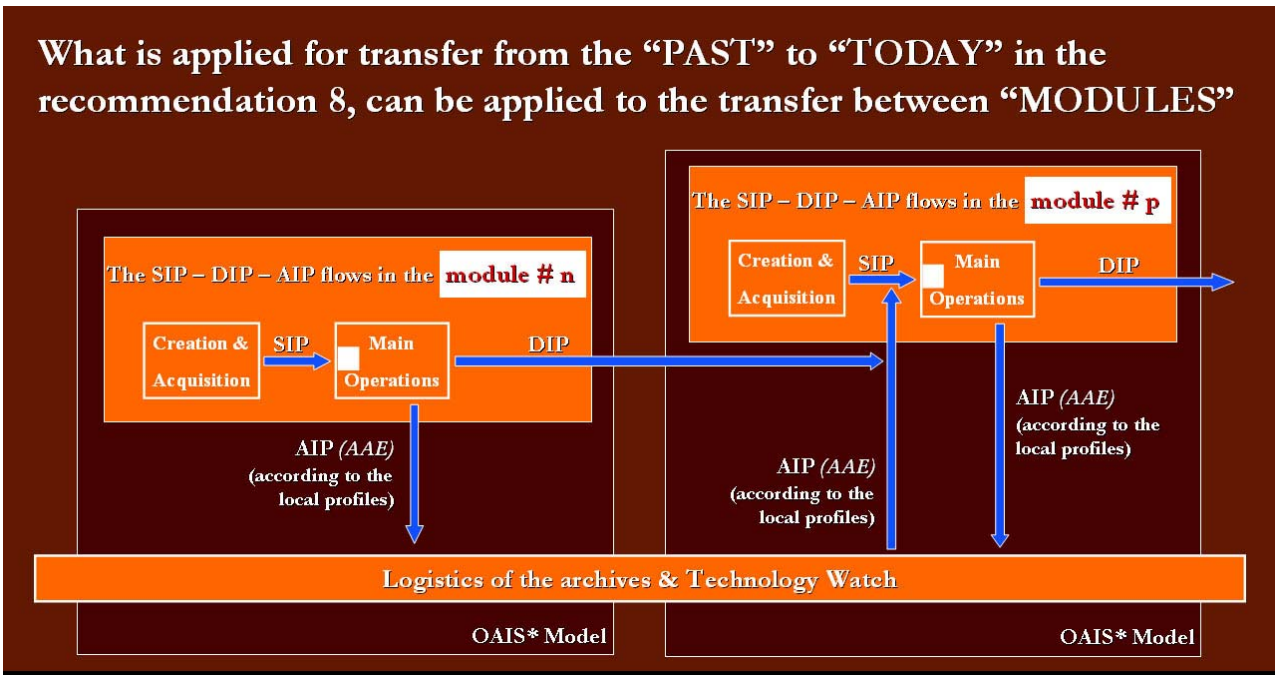
9. Manage the off-line conservation of the AIP's

If the AIP's have been created according to the previous approaches, their management (in particular their conservation) becomes a logistic problem.
The most flexible way is to manage the logistics according to a three axis orthogonal identification system: each carrier, each contents and each location are identified independently.

10. Adopt the previous recommendations for your "Functional modules" and "AIP's"

This recommendation is a simple extension to the previous. The key idea is to declare the capacity of autonomy of the internal functional modules of an organization. In that case, each organization could supply DIP's or AIP to the next one's in the flow; in turn they will acquire that DIP or AIP as being a SIP and further process the AAE; and so on. The result is the flexibility of rearrangements of the flows

and of the functions, the very simple tracing and the overall control of the intellectual, cultural, social… assets managed by the organization.



This recommendation has an important indirect consequence! It introduces the OAIS-Plus architecture, which includes in the model the acquisition phase of the media life-cycle

The OAIS architecture focuses on the construction of persistent and complete archives allowing the largest variety of exploitations channels and services (the DIP's)

However, the contents are assumed fed in the 'Open Archival Information System' by SIP's. The process for the creation of SIP's is considered by the OAIS standard as 'external'. When the OAIS standard is enriched by the concepts presented above, it can be extended to cover the "Acquisition" stage of the media life cycles. The SIP, AIP, DIP architecture, combined with the OIP, AAE, the 'profiles' and a few new concepts is often named "Open Assets Information Systems" (OAIS+) The OAIS+ covers three additional content based interfaces:

OPR: The Original Physical Reality is the acquired physical-spacio-temporal reality

OPC: The Original on its Original Physical Carrier is a representation of the contents on its original carrier

OIP: The Original Information Package is a package representing the contents according to the initial original representation fulfilling the OAIS requirements for a 'package'.

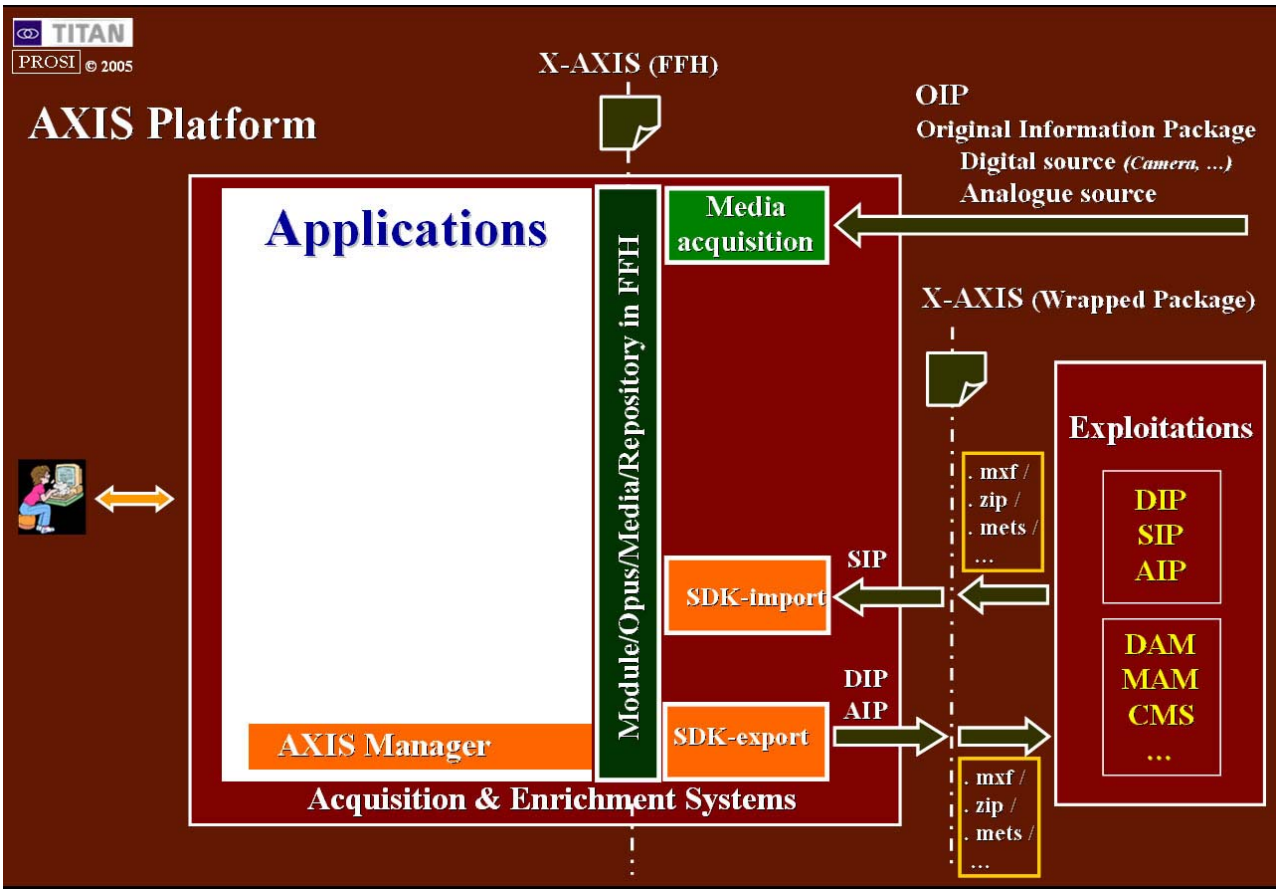
The AXIS architecture and technical specification

The AXIS architecture, combined with the X-AXIS technical specifications defines a specific powerful implementation of the OAIS+.

- **The AXIS architecture** introduces an open way to structure and to represent the contents, the metadata, the controls and the standards meeting the OAIS+ model
- **The X-AXIS specification** defines the interface for export or import of AAEs and to acquire OPRs, OPCs and OIPs.

The **SIP, AIP, DIP** architecture, combined with the OIP, AAE and the 'profiles' is currently used in several projects mentioned above. The technical specifications are almost ready and the simplicity has been confirmed by the practical implementation.

The AXIS platform for one functional module is presented at the next figure. The white rectangle represents the large variety of applications which can be included. The human interface is not part of the architecture and of its specification. The only functional specifications concerns the "AXIS manager" which is a simple file, folder and hyperlink editor not dealing with the contents of the files except for the RDF / Dublin Core definitions included in an XML node called "axisFootPrint". The X-AXIS (FFH) expresses the data independently of any carrier. The X-AXIS (WP) expresses the exports and imports in terms of Wrapped Packages. The X-AXIS (FFH) could remain an abstraction while the X-AXIS (WP) is a reality with a physical carrier.



Conclusions

Each organisation should define its own strict guide-lines (architectural and technical).

The implementation of the OAIS+ model can be made progressively and in a simple way if the previous recommendations are followed.

Your guidelines can ensure that your **media assets** will be listened or seen for centuries!

APPENDICE:

GLOSSARY

Carrier

The carrier is a physically independent support for the information.
The carrier is a media (ready for) carrying a representation of information.
The representation can (could be) be analogue or digital. The digital carrier is limited by its ability to store a maximum number of bits.
The representation can be spatial, temporal or spatio-temporal

For example: A CD-R disk ready for engraving is a digital and spatial carrier.
After engraving, the CD-R disk is a carrier of the written information.
A compact cassette, coarse-groove 78 rpm discs are analog & spatial
A Fiber-optic link is digital and temporal.
A PC infrastructure equipped with an Operating System is a spatio-temporal carrier.

Carrier-component

Each of its physically bounded / limited parts of a carrier is a 'carrier-component'.

For example: Each of the two face of a microgroove is a carrier-component. The independent digital carriers can store data in files and/or folders. The single layer of a DVD5 (4.7 GB) is one carrier. The two layers of a DVD9 (8,5 GB) is one carrier: each of the layers is a carrier-component. A book is a 'carrier' made of pages, each page being a 'carrier-component'.

Carrier-Stream

A chained set of carriers is a 'Carrier-Stream'. For example, the two faces of a microgroove, the two faces of a cassette tape.

Clip

A chained set of media representing an 'Opus' is a clip. The clip is represented by a set of files (essence, controls and metadata). The representation of a 'Opus-component' is a 'Clip-component'. A 'Clip-stream' is one representation of an 'Opus-stream'.

Collection

A 'collection' is any consistent set of information. In AXIS, a 'collection' is expressed as being one (or more) OPUS or Packages; a logical 'collection' is expressed as being one (or several) OPUS; a physical 'collection' is expressed a being one or several 'packages'.

Container

The 'containers' are means to wrap and document in evidence one (or several) volume(s) in order to constitute one SIP or one AIP or one DIP.

Package

A 'package' is an 'embodiment' of information. A 'package' is a set of 'volumes' wrapped in a 'container'.

Index

The expression of a sequential link between items. Any coding of the index could be used providing that it represents correctly the sequence.

OAIS

The reference model known under the "Open Archival Information Systems" is defined by two documents (one in English the other in French) available at www.ccsds.org. It defines a model for constructing "Information Systems" able at building archives and exploiting them. The model constructs, in a predictable way, the persistence and the interoperability of the archives. The OAIS is based on three content based interfaces named:

- **SIP** Submission Information Package
- **AIP** Archive Information Package
- **DIP** Dissemination Information Package

OAIS+

An extension of the "Open Archival Information Systems" model in currently worked-out aiming at covering the acquisition of contents and constructing the metadata, structure, projects, semantics, ontology, … associated with the essences representing the target content to be preserved and exploited. The acronym OAIS+ is often named "Open Assets Information Systems". The OAIS+ covers three additional content based interfaces:

- **OPR** Original Physical Reality
- **OPC** Original on its Original Physical carrier
- **OIP** Original Information Package

These concepts are further explained here after.

Opus
An OPUS is a complete semantic item. The semantic item could include the 'project' managing the realization of the intention; the 'resources' required to realize it and the 'results' of the project. The OPUS is not packaged but could define a packaging. The OPUS is represented by files and folders independently of any carrier, volumes and packages.

Opus-component
An elementary part of an 'opus' such as each of the four movements, typically, of a string quartet or elementary thematic breaks within the chapters of a book.

Opus-stream
An ordered set of 'opus' such as each of the 32 sonatas of Ludwig van Beethoven.

Original

The word "original" means the 'package' instance issued at creation time of the 'package'. When the first issue has generated a set of package, each of the issued 'packages' is reputed being an original. Example: an engraving issued in 16 'trade-originals' (marked 1/16 up to 16/16) and two 'artist-proof-engravings' (with one of them destroyed because badly processed) means 17 originals. See also the concepts of OPR, OPC and OIP in the OAIS+ model.

Point
A 'location' in a stream: the location could be expressed in various ways (for example, time code, a tag or mark or chunk); metadata or synchronization could be connected to the point.

Segment
A part of a stream defined by two 'locations'; metadata or synchronization could be connected to the segment.

Volume
A 'volume' is the assembly data representing information expressed on one carrier. The data could be represented in analog form (a microgroove disk, for example) or in digital [ideally expressed according to standardized data-sets and formats (expressed according to a standardized character set) and included in files and folders (expressed in a standardized format).

Volume-Stream
A chained set of 'volumes'.

Wrapper
A technology for bundling metadata, files and folders pertaining to an item (logical and/or physical).

Summary:

The Opus is the entity ensuring the logical wrapping of the representation of an intention and of its realization. They are expressed exclusively in Bits, Files and Folders.

The Clips are the logical items, independent of any carrier, representing the results of the intention.
The Opus's can be issued as 'packages' from the information available in a Module or can be created inside the Module from a set of presented original 'packages'.

The Carriers are physical item able to hold (or holders of, after the issuing process) information (coded in analogue or digital form).

A Volume is the assembly of one Carrier with its hold information.
The Package is the 'trade' / 'dissemination' / 'import-export' / … item realized as a set of volumes packaged by Containers.

The items have natural physical or logical limits. They can have components (and components in components) and they can be streamed in set (and streams in streams).

Segments and points can be defined in the items.

Illustration of the definitions and of the CONCEPTS of 'Logical' and 'Physical' in AXIS

The pianist Wilhem Kempff has rendered many times part or the whole of the 32 sonatas for piano composed by Ludwig van Beethoven. Three times the full rendering have been recorded:

Recorded in 1926 on shellacs and marketed on shellacs.

Recorded in 1945 on coarse-grooves and marketed on coarse-groove; then on microgroove; then on audio-CDs.

Recorded from 1964 to 1965 on original magnetic tapes with Polidor as producer
First issue by Polidor in 1965 on 15 dual faces microgrooves
Last issue by Deutsche Grammophon in 1993 on 8 Audio CD, as the set n°5 of 14 sets representing all the Beethoven recording marketed by Deutsche Grammophon.

The 32 sonatas constitutes an OPUS *(of the type **Clip-Stream**)* as composed by Beethoven.
Each of the sonatas constitutes an OPUS *(of the type **Clip**)* as composed by Beethoven
Each of the movement of each sonata constitutes an OPUS *(of the type **Clip-Component**)* as composed by Beethoven.

The set of the three full recordings rendered by Wilhelm Kempff constitutes an OPUS *(of the type **Clip-Stream**)*, further split into three OPUS (each of the full recordings).
Each of these three full recordings rendered by Wilhelm Kempff constitutes again an OPUS *(of the type **CLIP-Stream**)*, further split into 32 OPUS (each sonata). Each of the recording of one of the sonatas constitutes an OPUS *(of the type **CLIP**)* as rendered by Wilhelm Kempff. Each of the sonatas is further split into movements. Each of the movement of each sonata constitutes an OPUS *(of the type **CLIP-Component**)* as rendered by Wilhelm Kempff.

For the third rendering, the 126 magnetic tapes recorded in 1964-1965 constitute the **originals**.
The 2 x 15 faces of the microgrooves constitute a **Volume-stream** of 30 **Volumes** (on 15 **Carriers**). Those carriers are wrapped by a **container** (brochure, paper slips and illustrated box). The marketed product in 1965 is the '**package**'.

The 8 Audio-CDs constitute a **Volume stream** of 8 **Volumes** (on 8 **Carriers**). Those carriers are wrapped by two levels of **Containers**: At the lower level, two CD Jewel-cases designed to hold 4 CDs and each with a front and a back cover and one booklet; at the upper level, a hard-paper box wrapping the three items.

The three Volumes of the scores of the 32 sonata published by the editions "Breigtoff" constitute a Volume-Stream split in 3 volumes. Each of the sonatas is a volume-component. Each of the pages is a carrier-component.

The mapping expresses the links between the elementary (or complex items):
The track 9 of the volume 4 (compact disk 4) of the Deutsche Grammophon issue of 1993 is mapped on the first movement of the sonata n° 14 (opus 27 n°2) "Mondschein-Sonate" represented on the second volume of the "Breigtoff" edition starting page 22 (carrier-component).

Comment on the definition of 'package':

All the information managed in a 'module' is defined without any reference to a specific 'carrier', nor 'package'.

Any specific implementation of a 'module' runs obviously on a specific infrastructure: however, the representation of the information is structured data using only 'folders', 'files', 'data-sets', records … coded according to 'norms' or 'standards'. The 'package' entity is used in the main following situations:

- For the 'Import' and 'Export' facilities of the 'Module', a specific 'embodiment' is required for the interchange of the data with the other 'Modules' and the acquisition, management or exploitation systems.
  These 'packages' are usually qualified according to three types (OAIS terminology).
  SIP: The Submission Information Package is a package presented to an Information system as being candidate for its integration in the data management system. After appropriate conformity and quality assurance check and proper transcoding, if required, the information included in the SIP will be integrated.
  AIP: The Archival Information Package is a package issued by an Information system including all the information available pertaining to a 'Collection', including the used formats, coding, norms and standards and the 'package' information.
  DIP: The Dissemination Information Package is a package issued by an Information system targeted to a specific (trade) audience and/or dissemination channel. Many dissemination processes could be marketed simultaneously: Each of the episodes of a TV series can be broadcasted once a week, while selling the whole series onto a DVD jewel-case.

The OAIS model does not cover the acquisition phase of audio-visual-textual-… contents, controls and metadata.
To cover that phase, three additional 'packages' have to be added:
OPR: The Original Physical Reality is the acquired physical-spacio-temporal reality
OPC: The Original on its Original Physical Carrier is a representation of the contents on its original carrier

OIP: The Original Information Package is a package representing the contents according to the initial original representation fulfilling the OAIS requirements for a 'package'.

- The 'module' has the capability to define the existence of 'packages': it is the case when the 'package' is produced outside the 'module'.
- The 'module' has the capability to define the process required to produce 'packages'. In that case, the 'package' is defined in the 'OPUS' entity.

Comment on the links between 'Clips' (logical 'Opus') and 'Packages' (physical 'Opus').

The indexing allows identifying and mapping 'Clips' and 'Packages'. For example:

- The Bach's Matthäus-Passion BWV244 could be managed as one 'Opus' having one 'Clip' composed of sixty eight 'Clip-components', which could be indexed 01 to 68.
- The 'Opus' contains a 'project' for the management of the planning, of the resources and of the recordings (made on 25 – 29 August 1998) of the public performance of BWV244, conducted by Philippe Herreweghe.
- One of the 'deliverables' of the mentioned project of the 'Opus' is the issuing by Harmonia Mundi of a 'Package' of that BWV244 under the identifier HMC951676.78. The issue is constituted of:
  A Container box containing:
  - One Container folder holding three Audio-CD
  - One Container folder holding one CD-ROM containing
    - One User manual
  - One book.

  The three Audio-CD's could be indexed AA, AB and AC
  The twenty nine tracks of the first Audio-CD could be indexed AA, AB, AC, …, BA, BB, BC.

  It means that the third track of the second Audio-CD (indexed ABAC) is a representation, coded in .wav, of the 'Opus-component' [*Und da sie ihn verspottet hatten*] (indexed 55).

  On the CD-ROM, the representation, coded in .mp3, of the same 'Opus-component' could be indexed CC (CC is the 55th item in the coding AA to ZZ) while the corresponding 'Clip-component' could be indexed BWV244-55.

  This expresses the possibilities of identification and mapping of the logical 'Opus' and 'Opus-components' onto one specific embodiment while creating or receiving 'packages'.

Comment on the representation of the structures.

The expression of structures in AXIS can occur at three hierarchical levels:

1. The hierarchy or chaining of Opus's expresses the first level.
   Example of applications:
   - To express the five episodes of a series.
   - To express the components of Collection
   - To bundle and chain daily programs (TV news, …)

   The associated metadata are expressed in the .afp file of the Opus's or in dedicated / personalized added file (see details here after).
2. The hierarchy or chaining of Clip's expresses the second level.
   The associated metadata are expressed in the .afp or .aci file of the Clip's or in dedicated / personalized added file (see details here after under Clip's and Clip-Stream's).
3. The logical structure within a Clip expresses the third level.
   That structure is expressed by the metadata attached to segments and points of the Clip as defined in the .aci file. Simple attachments, i.e. the attachment of metadata to one segment or to one point, do not express structure. But multiple attachments allow expressing any kind of structures. The use of the SMIL syntax is a priori selected.