

## Technical Note August 2011

### Automate your business processes

### Intelligent information management at low cost

Scalable and intelligent  
 information processing.

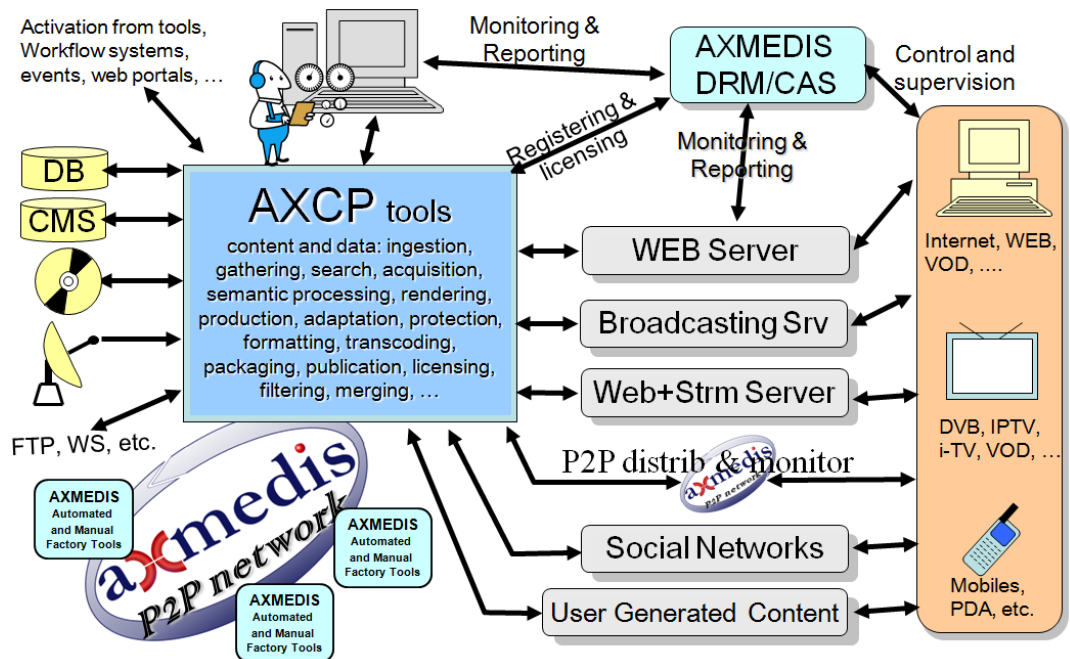
Cloud computing, industrial  
 scalable massive parallel  
 processing platform.

On-demand computing and  
 processing.

#### Applications:

- data processing
- semantic computing
- knowledge management and reasoning
- media grid
- crawling process.
- data reconciliation
- distributed processing
- automated content management
- automated content adaptation
- parallel content repurposing
- parallel simulation
- computational intensive applications
- channel production and distribution: broadcasting, IP/Internet, WEB sites, P2P, mobile, PDA, IPTV, interactive TV and channels, VOD, etc.
- monitoring and control of: web, P2P, OAI-PMH, social networks,
- similarity profile computing, management
- recommendations and advertising
- digital rights management and licensing

The AXCP Content Processing Media Grid is an open solution to set up architectures of media computing and semantic grid, for massive information management following business rules, growth and integration demands. AXCP supports a large range of possible applications for massive and parallel processing integrated with databases, back offices, workflows, data crawling, collectors, Content and Data Management Systems, CMS/DMS, and web servers. AXCP reduces costs and increase efficiency by an automated information, media and content management. AXCP is most complete media grid (see IEEE Multimedia in the 2011). AXCP is a solution to set up scalable grid computing, at low costs, reliable and simple to install; to be used in conjunction with other applications, enforcing scalability, intelligence processing capabilities, batch processing, cloud computing, etc.

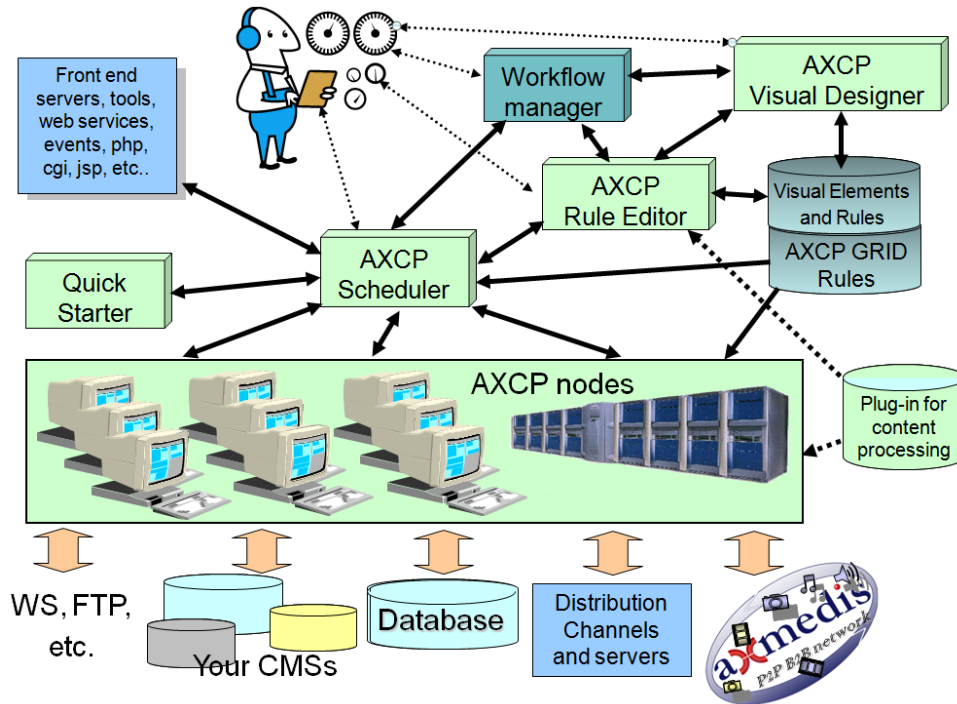


AXCP allows setting up scalable parallel and massive architectures to schedule multiple applications on multiples node clients to automate and organize:

- o data massive and computational intensive parallel processing;
- o intelligent information management with semantic processing;
- o services for content production and/or distribution on demands;
- o events collection, data management, sensors, internet of things, RFIDs, ...;
- o medical applications for data collection and processing;
- o biomedical application in DNA and epidemiological analysis and prediction;
- o social network back office management, content processing, user and content profile processing, recommendations;
- o user generated content processing, adaptation and formatting;
- o monitoring events and status of: WEB/internet sites, P2P networks, databases, ftp sites, ...;
- o content management for production and distribution channels: VOD, IPTV, WEBTV, DVB-T, web, P2P, FTP, HTTP, OAI-PMH, WebServices, etc.;
- o interoperable trust and security rule processing, CAS and/or DRM (digital rights management) MPEG-21 and OMA;
- o processing business models, single and multiple distribution channels: pay per play, subscription, counting, renting, billing, etc., for B2B and B2C;
- o content management system: DMS, CMS, and/or archives;
- o data fingerprint and watermark extraction and insertion.
- o Connection with Europeana

## AXCP Architecture

The **AXCP tools** of the previous figure represent a general purpose solution to set up massive parallel architectures for computing for personal/industrial use. Both data and computational intensive problems can be allocated in easily manner. The following figure reports the AXCP tools and solution for massive computing: an AXCP Scheduler put in execution processes on AXCP Nodes which are computers of your network. The AXCP Nodes can be industrial or desktop computers connected with the AXCP Scheduler via one or more networks.



The AXCP solution is grounded on the concept of Rule. AXCP Rules formalize activities of processing on grid nodes and may activate other Rules on other nodes in the cloud computing architecture on physical machines. AXCP Rules are formalized in AXCP Extended JavaScript language to formalize jobs, logic, deadlines, periodicity, parameters, communication, storage, time, capabilities, etc. The AXCP is endowed of an integrated development environment. Moreover, any executable program in the Operating System can be put in execution by an AXCP Node and thus controlled by the AXCP Scheduler. The hundreds of functionalities accessible by the AXCP Rules are reported at the end of this document, they can be recovered in the manual and in the help provided with the AXCP IDE tools. The AXCP Scheduler can be controlled by other tool via API, Web Services.

The **AXCP Rules** can be produced by the AXCP Rule Editor (java script editing and debug, see on the figure on the right side) or by the AXCP Visual Designer (visual design, editing and verification). Once produced, a AXCP Rule can be put in the pool of Rules of the AXCP Scheduler (data base of AXCP GRID Rules) for their execution on the AXCP Nodes. AXCP Rules can be activated (put in execution) in several manners. The Rules uses may integrate any combination of functionalities included into the Extended Java Script language and provided by the Plug ins (see in the following). They include access to databases, information and data processing, communication, storage, security, semantic processing, security, etc.

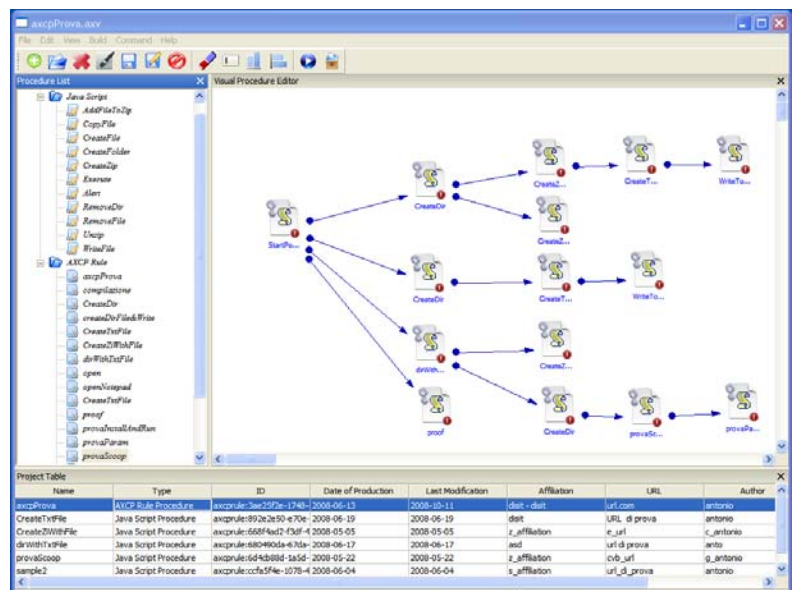
```

170 print("Creating MASTER Copy of AXMEDIS Object");
171 var masterObj = new AxmedisObject();
172 print("Embedding resource into MASTER Axmedis Object");
173 masterObj.addContent(resource);
174 var label = ceTitle+ "MASTER ";
175 createObj(masterObj, label, resource.mimeType);
176 if(!fillObjectCreatorCredentials(masterObj))
177     return false;
178 var axInfo = masterObj.getAxInfo();
179 axInfo.distributorAXID=AXIDID;
180 creatorID = axInfo.getObjectCreatorAXCID();
181 print("Adding PAR to MASTER (A,B1,B3 type)");
182 if(!addPar(masterObj))
183     return false;
184
185 print("Uploading non protected MASTER object on DB: "+masterObj.AXOID);
186 if(!masterObj.uploadToDB(AXDFP_serverEndPoint, AXDFP_user, AXDFP_password, AXDFP_usin))
187 {
188     var error = "Upload request failure: "+masterObj.AXOID;
189     print(error);
190     return false;
191 }
192 var filename = masterObj.AXOID.replace(/:/g, "_")+ "_master.axm";
193 masterObj.save(backFolderPath+filename);
194 appendToFile(productionFilePath, masterObj.AXOID+ " Title: "+title+"\n");
195
196 masterObj.dispose();
197 masterObj = null;
198 return true;
199
200
201
    
```

**AXCP Rule Editor** is used to produce, debug, test, activate and validate AXCP Rules to execute them on AXCP Nodes via AXCP Scheduler. The Rule Editor assists the developers with debug, monitoring and intelligence (word completion, suggestion, user and java script function list, etc.). The AXCP Rule editor can access to the database or Rules of a Scheduler and change them without stopping the AXCP Scheduler and thus the computing. Thus the AXCP tools support the hot plug replacements of AXCP Rules.

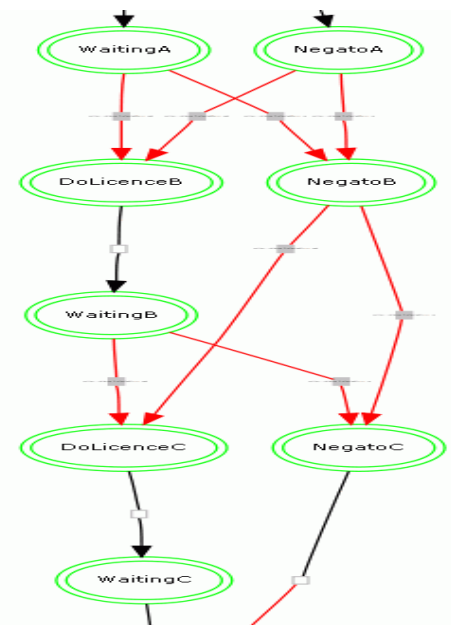
The AXCP Rules can be also produced by using the **AXCP Visual Designer, AXVD**. A visual tool for creating sequences of Rule segments and/or trees of Rules to define flows that can be compounded and activated by the AXCP Scheduler. The AXVD permits to program the AXCP solution in a very simple and accessible manner for non expert users.

A library of AXCP visual components is provided, while additional elements can be created with the AXCP Rule Editor in a very simple manner. Large library are also produced on demand.



**The AXCP solution is flexible** and open, it can be customized in several manners. For example by:

- o creating/customizing AXCP Rules to be executed on AXCP Nodes;
- o creating hierarchies/meshes/networks of cloud computing in which a Scheduler control a number of nodes/peers, and those nodes may activate other Schedulers as well via web services and direct communications;
- o setting up fail over and fault tolerant solutions, creating chains of Schedulers/Nodes in fail over, redundant nodes, etc.
- o customizing, realizing and installing additional AXMEDIS plug-ins to add new formats, encoders, decoders, adapters and converters, etc. The AXMEDIS Plug-in technology is well documented and supported by a development tool kit, and open sources;
- o organizing AXCP GRID Nodes in a hierarchical/net manner. An AXCP Node may control one or more AXCP Schedulers which in turn may control other AXCP Nodes, etc.;
- o dynamically creating rules with other processes, and activating them on the Scheduler;
- o executing operating system processes, passing them parameters/files and getting eventual errors;
- o reporting and managing errors, setting ups recovery by error policies, rules.



The AXCP solution is based on a Service Oriented Architecture (SOA); fully documented APIs for all the functionalities, and WEB Services for accessing and controlling tools, and for distributing produced content towards your front-end distribution servers. This means that the a large range of tools from acquisition, metadata ingestion, data base and distribution servers and solutions may very easily integrated with the AXCP tools. AXCP Rules may lead to put in execution processes, activate other web services, make changes in database, etc.

### AXCP GRID solution main elements:

- **Rules can be:**
  - executed on any AXCP Node, single computer, virtual machine;
  - parameterized for automating management activities;
  - activated according to different policies: periodic, sporadic or on demand;



- activated in synchronous and asynchronous manner and by other AXCP Rules;
- activated to return back any kind of results and error codes;
- activated by other AXCP Rules, third parties external tools, web services, ...;
- dynamically produced, sent to the AXCP Scheduler and thus activated;
- set up to detect changes in the file system, local database, in the P2P, etc.;
- activated by Workflow Management Systems (Open Flow and BizTalk), PHP, JSP, JAVA, Web Service clients, etc.;
- used to schedule other AXCP Rules and AXCP Schedulers;
- **Nodes** are controlled by the AXCP Scheduler, and can be
  - industrial computers or desktop computers in your offices delegating at the AXCP a part of their CPU power detailing the CPU percentage left to AXCP for each single hour of the week, 24/7;
  - executed alone (with the AXCP standalone node) for executing sporadic AXCP Rules for ad-hoc processing and activation without demanding their allocation to the AXCP Scheduler;
- **Standalone Node** allows putting in execution a single AXCP Rule from your applications and servers via a simple shell command, it is an AXCP Rule which can be used without the AXCP Scheduler. It is an easy way to access to the whole functionalities of the AXCP language for executing an asynchronous processes without calling the Web Service AXCP Scheduler.
- **Scheduler allocates and manages AXCP Rules on GRID Nodes:**
  - scheduling and balancing jobs/processes on AXCP Nodes according to the Rule processing needs in terms of plug-ins, time and resources: balancing nodes workloads, Deadline Monotonic, starting time, optimization;
  - activating jobs as sporadic and periodic tasks, controlled by other tools and/or web services;
  - monitoring progress of production processes and their status, via logs and in real time, etc.;
- **Quick Start** permits to activate AXCP Rules in a very simple manner by passing them parameters; for examples a collection of objects, a path, a database, a query, a list of files, etc., or just a click;
- **Standalone Node** allows putting in execution a single AXCP Rule from your applications and servers via a simple shell command. This solution is an easy way to access to the whole functionalities of the AXCP for executing an asynchronous process without calling the Web Service AXCP Scheduler.

Rule Name	AXCPID	Rule Version	Rule Status	Job ID	Executor ID	Start Time	Start Date	Periodicity	Number of Runs
searchAbo...			completed	9	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	10	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	11	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	12	-1	16:05:11	09/23/05	0	1
searchAbo...			running	13	2	16:05:11	09/23/05	0	0
searchAbo...			completed	14	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	15	-1	16:05:11	09/23/05	0	1
searchAbo...			running	16	3	16:05:11	09/23/05	0	0
searchAbo...			completed	17	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	18	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	19	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	20	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	21	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	22	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	23	-1	16:05:11	09/23/05	0	1
searchAbo...			running	24	8	16:05:11	09/23/05	0	0
searchAbo...			completed	25	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	26	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	27	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	28	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	29	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	30	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	31	-1	16:05:11	09/23/05	0	1
searchAbo...			completed	32	-1	16:05:11	09/23/05	0	1
searchAbo...			running	33	7	16:05:11	09/23/05	0	0
searchAbo...			completed	34	-1	16:05:11	09/23/05	0	1
searchAbo...			running	35	9	16:05:11	09/23/05	0	0
searchAbo...			running	36	6	16:05:11	09/23/05	0	0
searchAbo...			delayed	37	-1	16:05:11	09/23/05	0	0
searchAbo...			delayed	38	-1	16:05:11	09/23/05	0	0
searchAbo...			delayed	39	-1	16:05:11	09/23/05	0	0
searchAbo...			delayed	40	-1	16:05:11	09/23/05	0	0

Executor N...	IP	CPU	Clock	OS	Transfer Rate	HD Space	Status	Rule ID	Executor ID	Workload p...	Start Time	End T
DCST-01	192.168.0.197	ntel	1800	Windows RL...	-1	1072741024	busy	2	1	0.000000	15:04:28	15:04
DCST-04	192.168.0.105	ntel	1800	Windows RL...	-1	412604632	busy	13	2	0.000000	15:04:05	15:04
DCST-03	192.168.0.52	ntel	1800	Windows RL...	-1	89120960	busy	16	3	0.000000	15:27:33	15:27
DCST-02	192.168.0.43	ntel	1800	Windows RL...	-1	94924656	busy	5	4	0.000000	15:45:09	15:45
DCST-01	192.168.0.64	ntel	1800	Windows RL...	-1	1072741024	busy	6	5	0.000000	15:52:36	15:52
WCM-WORK	192.168.0.103	ntel	1800	Windows RL...	-1	-2147483648	busy	36	6	0.000000	16:01:28	16:01
NTS	192.168.0.49	ntel	1800	Windows RL...	-1	-2147483648	busy	33	7	0.000000	16:05:11	16:05
DCST-05	192.168.0.102	ntel	1800	Windows RL...	-1	0	busy	24	8	0.000000	16:25:49	16:25
HOMER	192.168.0.101	ntel	1800	Windows RL...	-1	-2147483648	busy	35	9	0.000000	16:35:48	16:35

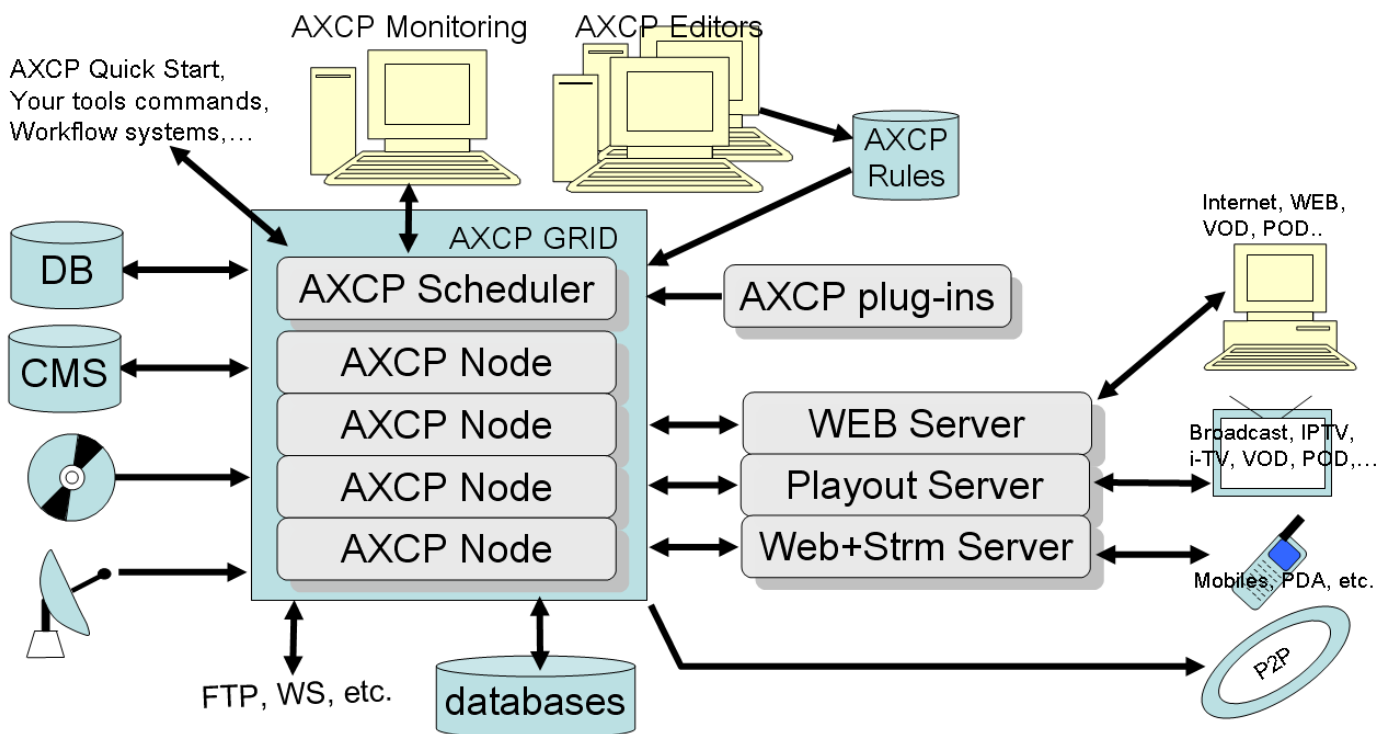
## AXCP for Cross Media, Rich Media and Multimedia Content Processing

The AXCP is largely adopted the intelligent and integrated management of content distribution channels, taking into account formats, devices, business models, services, etc. AXCP can be used for the automated management, of data and content processing, pre-/post-production processing and for distribution of a large range of content formats, for automatically producing, crawling, metadata ingestion and processing, processing, packaging, adapting, transcoding, formatting, and/or repurposing content, files, user registrations, profiles, licensing, etc., of content and data of any kind. AXCP reduces the costs of content management, supports the whole value chain and makes real the convergence of media, and the interoperability of content enabling multi-channel distribution (e.g., mobile, web, satellite, kiosk, iTV, P2P, interactivity, etc), and provides a flexible and interoperable DRM, for both B2B and B2C across traditional and P2P distribution platforms.

The AXCP offers functionalities to support and set up integrated activities of:

- content Ingestion and gathering, database management, crawling, indexing, archiving, gathering from OAI, etc.;

- query, download and publication on social networks: YouTube, Flickr, XMF, Cineca;
- content storage and retrieval, active querying;
- content processing, repurposing, adaptation, transmoding, transcoding for text, docs, images, audio, video, multimedia, XML, SMIL, HTML, styles, MXF, newsML, MPEG-4, MPEG-21, etc.;
- metadata repurposing, adaptation, transcoding, integration, enrichment, validation;
- content descriptors, extraction and comparison, fingerprint, MPEG-7, MPEG-21, etc.;
- content composition, formatting, layout, styling;
- communication with databases, FTP, HTTP, P2P and distribution servers via several protocols;
- content packaging: MPEG-21, MXF, OMA, newsML, ZIP, etc.;
- content protection via several algorithms;
- content DRM with MPEG-21 and OMA, with tracking and reporting rights exploitation;
- content licensing, licensing the production of licenses;
- content publication and distribution toward multiple channels;
- workflow management integration with BizTalk and OpenFlow;
- massive execution of parallel processes exploiting Rapid Miner, ImageMagik, FFmpeg, keyword cloud generation, DRM, etc.;
- user management: registration, licensing, profiling, advertising.

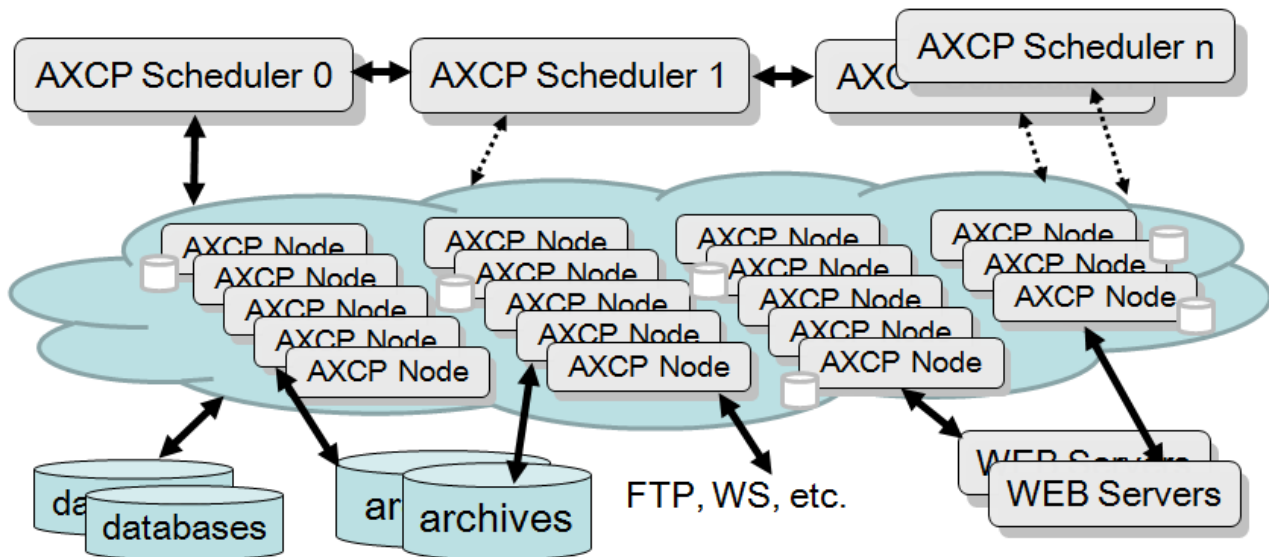


## AXCP Solution Reliability and Redundancy

The AXCP solution is scalable in terms of number of AXCP Nodes and AXCP Schedulers. The AXCP solution is highly reliable, scalable and fault tolerant. It may be used to create redundant architectures in which multiple Schedulers and multiple Nodes are organized in clusters and fail over in chains. In this case, an AXCP Scheduler will take the role of master, and the others will be in the chain but ready to cover that role in the case of failure or for rotation policies. AXCP cloud/grid solutions may be used to set up highly reliable architectures in which each computer (scheduler or node) can be put off-line for maintenance without stopping the processes and at no risk for the running jobs.

AXCP can run multiple copies of the same rules on different AXCP Nodes making possible the set up of fault tolerant solutions. Moreover, AXCP Nodes automatically reconnect with the AXCP Scheduler after a lack of connection. The status conditions in terms of tasks to be processed and running activities of the AXCP scheduler is continuously saved on net HD, and allows disaster recovery. This information can be

shared among the several AXCP Schedulers in the same chain to set up automated recovering. In the case of changing Scheduler (one abandoned or it has been rebooted for failure), the next one takes the control immediately. Thus, the AXCP Nodes are automatically reconnected to the new one. The replaced Scheduler can be reboot and posed in the chain. The correct implementation of the highly reliable solution implies the usage of multiple network cards, and reliable industrial computers. The solutions can be setup on different kind of operating systems such as Windows XP, Vista, 7, home and professional, and also on 64 bits server versions. Virtual machines and appliance are provided as well.



AXCP solution may be set up on a single computer with all inside as well as on many industrial or desktop computers (that may put at disposal a part of their CPU power and file system). Each node may share file systems and access independently on the network and thus on databases. Thus, solutions with large numbers of distributed databases are possible; to realize data and/or computational GRID solutions with shared or partitioned databases and data sources.

The AXCP can be used to set up hierarchical solutions, in which multiple AXCP Schedulers with their nodes are activated by other nodes and Rules. This allows setting up hierarchical networks, meshes, cube and other parallel and distributed configurations for computing on physical and/or on the cloud.

## Other AXCP based integrated solutions

The AXCP solution can be used as an independent tool, but it has also been designed to be used with:

- **P2P Controlled Network**, for content distribution via P2P, B2B and B2C BitTorrent Technology with queries and catalogue, for protected content or not, automating content publication/distribution, controlling the P2P network, extracting statistical data and reports. AXMEDIS P2P network has P2P clients for PC and Mobiles.  
[http://www.axmedis.org/documenti/view\\_documento.php?doc\\_id=3612](http://www.axmedis.org/documenti/view_documento.php?doc_id=3612)
- **AXMEDIS DRM**, is a solution to adopt MPEG-21 DRM with other DRM solutions, includes servers and licensing tools and allows DRM, detection of attacks, black list management, collection of actions logs containing traces about the rights exploitation, tools for administrative management, etc.  
[http://www.axmedis.org/documenti/view\\_documento.php?doc\\_id=3616](http://www.axmedis.org/documenti/view_documento.php?doc_id=3616)
- **AXMobile**: the end-to-end solution for mobile content production and distribution;
- **AXMEDIS Editor and players, tools for MPEG-21 and AXMEDIS authoring** (SMIL, HTML, MPEG-4, and of any kind of digital resource), DRM, licensing, protection, packaging, workflow, playing, etc. AXMEDIS authoring on Windows. AXMEDIS players for: MS Windows, Linux as core, Windows Mobile 5 and 6, and java mobiles, java for PC, STB/PVR/HDR, Media Centers, PDA, and mobiles. They can be customized as GUI and functionalities. Examples of customizations are available.  
[http://www.axmedis.org/documenti/view\\_documento.php?doc\\_id=3634](http://www.axmedis.org/documenti/view_documento.php?doc_id=3634)

## Examples of solutions exploiting AXCP

- **ECLAP:** European Collected Library of Performing art, <http://www.eclap.eu>, for an infrastructure and solution for Best Practice Networking among performing art professionals and lovers, with the automated content ingestion, annotation, enrichment, multilingual additions, contextualization and posting information on Europeana EDM. **AXCP is adopted in ECLAP** portal as the back office engine for automating: gathering content, processing metadata, estimating similarities, multilingual semantic indexing with solr, crawling OAI-PMH, multichannel content adaptation and repurposing, watch dog of the cloud services, producing recommendations, semantic computing.
- **Mobile Medicine:** <http://mobmed.axmedis.org> multichannel social network for medical personnel, portal to support mobile content production and distribution, medical procedures, production of mini-applications for dosage estimation and decision taking support, applications in the areas of: emergency, educational, critical conditions, etc. **AXCP is adopted** for automated production of intelligent content for pc and mobile, iPhone (see Mobile Medicine on Apple Store), iPad, PDA, semantic computing, estimation of recommendations, symbolic similarity, multilingual indexing and fuzzy search;
- **APRE Toscana:** <http://bpnet.apretoscana.org> a best practice network, collaborative work portal and blog for stimulating access at the European Commission funding and accessing to related information and events. **AXCP is adopted** as the back office engine for automating: gathering content, processing metadata, estimating similarities, multilingual semantic indexing with solr, multichannel content adaptation and repurposing, producing recommendations, semantic computing.
- **OAI-PMH Monitoring & Crawling facility** at DISIT: **AXCP is adopted** for automated ingestion of worldwide Open Access archives via OAI PMH, assessment of quality of metadata, archives and services, semantic reasoning, automated metadata reconciliation and mapping, automated repurposing and distribution;
- **Monitoring P2P Bittorrent** networks. **AXCP is adopted** for accessing at sanitized information regarding P2P workload and activities, assessment of quality of metadata, archives and services, semantic reasoning, automated reconciliation, production of reports.



**ITALIA DEGLI INNOVATORI**  
Agenzia per la Diffusione delle Tecnologie per l'Innovazione  
Presidenza del Consiglio dei Ministri

AXCP is an innovative solution and technology selected in the 2011 by the Italian National Agency for the Diffusion of Innovative Technologies, at the Premiership of the Italian Ministry Council. They are defined as "Innovations selected by the Italian Innovators", namely "**Innovazioni selezionate dall'Italia degli Innovatori**" in Italian language.

**AXCP:** see the [linked page at the Ministry portal](#), or see the link at [DISIT DSI University of Florence](#); This innovation has been initially developed within the [AXMEDIS Project](#), while it has been strongly improved during last years, thus adding innovative functionalities and robustness. In general terms, the innovative solution consists in a language for programming multimedia grid for semantic computing and processing. The solution has been identified as one the most innovative solution for media processing, by other Research and Innovation agencies and it is also described in IEEE Multimedia, IEEE Computer Soc Press, paper being in printing in 2011, and in other papers.

The AXCP innovative tool can be used for a very large range of media computing applications ranging from DRM to P2P monitoring, from adaption to distribution and CDN, semantic computing, etc. In ECLAP, the AXCP is used for automating:

- adaptation of content during ingestion, so as to produce the content for PC and mobiles and manage cross media content;
- calculation of semantic distances among users and objects and among objects and objects, with clustering technologies;
- social network management.

## AXCP Rules Functionalities

In the AXCP JavaScript language, the following functionalities are accessible as native operators and/or plug ins. The addition of new functionalities is possible by adding new plug ins, or by creating Javascript functionalities. Most of the following capabilities are available on the basic light version of the AXCP tools, while a few of them are only accessible in the full professional version that can be obtained on demand only, see on the portal for details.

### Firing and control activities

- Activation via AXCP scheduler web service
- Activation via AXCP Quick Start tool
- Activation via Workflow tools
- Activation via your Applications, Java, C++, PHP, JSP, CGI, etc.
- Activation via detection of files changing, changing in databases, etc.
- Cross activation of a rule via another rule, usage of multiple schedulers and nodes
- Time periodic and/or sporadic activations
- Dynamic production, allocation and activation of rules
- Dynamic update of the grid node executable and libraries.

### Content and metadata access, ingestion and gathering from

- CMSs and databases:
  - ODBC, MySQL,
  - XML databases, Tamino, eXact
  - Lobster@, MSSQL, HP DMP, ..
- OAI PMH, Open Archive based accesses;
- Main communication protocols:
  - SQL, Web Services, FTP, HTTP,
  - SFTP, HTTPS
  - WebDAV, SMB, Gopher, NNTP
- operating systems files:
  - MS Windows
- Rich media formats:
  - MXF, NewsML, IMS SCORM, MPEG-21, HTML, SMIL, etc.
- A range of Crawling and data mining tools

### Content and metadata management and retrieval

- from multi-archive content crawling, extraction and aggregation with metadata
- from any databases via HTTP and/or ODBC, etc.
- from AXMEDIS database (MPEG-21 database) or from others
- actualizing the queries into the scripts, definition of active/dynamic queries
- from P2P AXMEDIS network
- indexing of metadata and full text with Lucene and/or Solar
- integration with HP DMP, Digital Media Platform
- Integration with other solutions for content distribution see <http://WWW.AXMEDIS.ORG>

### Metadata models and processing

- metadata models and extensions:
  - Dublin Core full set
  - complex metadata such as: EAD, DC
  - eClap metadata
  - multiple Unique IDs and descriptors: UUID, ISBN, ISRC, ISAN, ISMN, etc., your IDs
  - business metadata such as: AXInfo
  - Potentially Available Rights, PAR, Licensing

- information in MPEG-21 REL
- any custom metadata
- Workflow information
- Protection information
- Content descriptors as Metadata
- MPEG-7 descriptors
- Content fingerprint for recognition and monitoring distribution channels
- Europeana metadata
- metadata manipulation and processing:
  - mapping via XSLT (production of mapping with specific editor)
  - filtering via XSLT, processing via XSLT

### Content Processing for audio videos, document, images, and any files:

- digital resources adaptation and transcoding
- extraction of descriptors and/or fingerprints
- watermarking
- indexing, classification
- summarization
- filtering
- repurposing
- recognition
- search and retrieval
- production of simple and animated thumbnails, icons
- MIME type description and access of files

### Semantic Processing, intelligence reasoning

- Data Clustering
- Production of recommendations: user and content
- Processing of ontologies
- Distances of profiles: users and media
- Processing of Taxonomies
- TILCO temporal logic engine

### Text/Document processing, adaptation and transcoding:

- text processing with regular expressions and other techniques
- text language detection
- text language translation with external tools
- text transcoding by format:
  - PDF-TXT, HTML, PS, RTF,
  - MS-Word, Plain text, ....
- text keywords Multilanguage:
  - Extraction from comparison (corpus based)
  - Extraction from semantic analysis
- text fingerprint:
  - Extraction
  - Plagiarism detection
- Full text indexing with Lucene and/or Solr.

### Audio Processing, adaptation and transcoding:

- Audio transcoding and processing of:
  - WAV, WMA, MPEG, VORBIS, AC3, DV,
  - MACE, ADPCM, AAC, real audio, AIFF,
  - PARIS, NIST, SVX, IRCAM, W64, SD2, MP3, etc.
- Audio descriptors extraction and recognition:
  - Low level descriptors extractor: waveform, spectrum, centroid, MFE, MFCC, ZCR, Spectral Flatness, onset and offsets, etc.
  - High level descriptors extractor: audio segmentation, music genre, rhythm, silence detection, spoken/music content, noise



- Polyphonic audio transcoding
- Audio fingerprint estimation and recognition:
  - M2Any fingerprint algorithm and recognition
  - Philips fingerprint algorithms
  - Audioid fingerprint algorithm
  - extractors and comparison of fingerprints
  - detection of plagiarism
- RingTones:
  - Operations of: resample, clip, etc.

#### Video Processing, adaptation and transcoding:

- Video transcoding and processing of
  - FFmpeg and other libraries
  - MPEG-1, MPEG-2, MPEG-4, VC1, H.261,
  - RealVideo 1.0, RealVideo 2.0, MJPEG,
  - RAW, lossless MJPEG, FLV,
  - H.263, WMV, ASF, ASUS, DV, YUV, ASV1,
  - ASV2, SVQ1, SVQ2, AVI, FLAC, DAUD, AVS,
  - H.264, VP3, FFW, Flash, VCR1, VCR2,
  - CLJR, Apple, DXA, THP, AAC, DVD, 3GPP,
  - etc.
- Video descriptors MPEG-7
  - GoF/GoP, and dominant color
  - Homogeneous Texture
  - Color Structure
  - Contextual descriptors
  - production of simple and animated thumbnails, icons
- Video fingerprint:
  - extractors and comparison of fingerprints
  - detection of plagiarism

#### Image Processing, adaptation and transcoding:

- Image conversions of more than 150 different formats:
  - JPG, GIF, PNG, BMP, TIF, SVG, PS, PDF, MPEG,
  - PCX, PGH, PICT, PIX, RGB, TGA, TXT,
  - WMF, XPM, YUV, YCbCr, YcbCrA, etc.
- text to image conversion
- Image processing algorithms:
  - Contrast, edge, blur, media, mirror, equalize,
  - magnify, resize, roll, scale, shade,
  - negate, noise, filtering, rotate, past, spread,
  - extract, overlap, replace, shear,
  - production of thumbnails, icons, ....

#### Digital File Fingerprint and recognition

- Estimation of fingerprint of digital files:
  - MD5, SHA-1, base64, ascii-bin, etc.
- Recognition of fingerprint by similarity

#### Content Composition Presentation and Interactive models

- creation of cross media and multimedia content combining raw assets such as text, images, audio, video, animation, metadata, descriptors, licenses, and other
- multimedia objects in formats
  - MPEG-4, HTML, SMIL
  - MPEG-21 (supported by AXMEDIS Editor and players for MPEG-21)
  - NewsML (load), MXF (load and save)

#### Multimedia and cross media adaptation/processing

- Create MPEG-4
- Create MPEG-4 SMR (Symbolic Music representation)
- Audio visual processing:

- concatenation, delay, extract
- MPEG-4 remove tracks
- conversions:
  - MPEG-4 to 3gp
  - MPEG-4 to AVI
  - MPEG-4 to ISMA
  - SMIL to HTML

#### General Information Processing of:

- Load/import, production and saving of XML files for commands and/or metadata
  - based on E4X model
- Load/save any file from/to the operating system, server, FTP etc.
- Production of custom, template and/or behavior-based, HTML pages
- Production of custom, template and/or behavior-based, SMIL scenes
- Processing XSLT with XALAN

#### Distribution and control of P2P network

- Monitoring of P2P nodes and network status
- Automatic publication of content into the P2P network
- Automatic download of content from the P2P network
- Control the seeding capabilities
- Accessing to reporting and statistics
- Remote control of P2P network
- Removing obsolete content from P2P network

#### Integration with Social Networks

- YouTube: query, download and upload, processing
- Flickr: query, download and upload, processing
- XMF social network tool to make your social network: query, download and upload, processing, <http://xmf.axmedis.org>
- Posting of news on social networks with social icons

#### Communication Capabilities:

- Massive Content ingestion and processing
- Access via a large range of databases
- Access via Web Services; dynamic client generator based on WSDL
- Access via FTP/SFTP sites, GET/PUT, etc.
- Access via operating system, activating shells, etc.
- Sending commands HTTP, HTTPS
- Sending Mails, with attachments and/or HTML
- Sending SMS
- Creating reports and newsletters in:
  - TXT, CSV, HTML/CSS, XML, XHTML, ...

#### Workflow management Production Process

- integration of the AXCP tools with OpenFlow and BizTalk Workflow Management systems
  - receive commands
  - activate scripts passing parameters
  - returning values and results
- definition of full customized solution for workflow management
- WEB based interfaces for creating GUI to control AXCP GRID processing
- WEB based interface for monitoring AXCP reports and results
- Collaborative Workflow solutions

#### Content Packages, Media Containers and DRM

- MPEG-21 file read and production, with any digital resource inside, from other MPEG-21 to HTML, SMIL, groups of files and related resources
- MPEG-21 to keep joined your metadata and digital resources as well as to package and delivering them as unique chunks of information with DRM
- OMA files production
- IMS SCORM ingestion
- ZIP ingestion and production
- production of MPEG-2 TS streams
- RSS ingestion and production
- ATOM ingestion and production (in progress)
- MXF ingestion and production
- newsML ingestion and production

### WEBtv, IPTV

- ingestion and processing of EPG, XML EPG for DVB-T, DVB-S, ..
- Integration from Sky EPG server

### Content Formatting

- structuring and styling content elements by means of SMIL based templates
- applying style-sheets to define the usage interface (format, layout) of the whole collection of content elements and the interested content usage paradigms
- Genetic Algorithms for best time fitting, etc.

### Profiling and their management

- Reading and manipulating:
  - user profiles
  - network profiles
  - context profiles
  - device profiles
- Recommendations, favorites, voting, etc. based on static and dynamic profiles and similarities
- Reasoning based on Clustering: k-medoid, K-Means and other algorithms
- Reasoning based on profile distances.

### Content Adaptation Process

- Based on profiling and rule based
- Digital Item Adaptation based on MPEG-21 DIA
- Decision taking engine for DIA based on the above mentioned profiles.
  - Rule based
  - Ontology and inferential engine based
- Scripting capabilities for expanding DIA and decision taking engine

### Content Protection and DRM

- Content registration (unique IDs) and verification
- Content and digital files signature
- Content fingerprints and watermarks
- Protection of digital resources and objects with MPEG-21 IPMP, OMA
- protection/encryption:
  - AES, DES, 3-DES, blowfish, Cipher, CAST
- Tracking exploited rights and reporting actions performed to the content owner, distributors, collecting societies, etc.
- Manipulating MPEG-21 protected objects according to AXCP Node license
- Open to integrate other DRM solutions

### Content Licensing and DRM

- generating license from license model and additional information, storing licenses, and posting to license server automatically
- supporting transcoding/translating licenses (MPEG-21 REL, OMA ODLR);
- posting licenses on license server
- verification of licenses
- resolving nationality from IPs

### Content Publication and Distribution

- supporting distribution towards multiple channels, for one or more: Internet, satellite, mobile, P2P distributions
- producing, monitoring and editing programmes and schedules
- controlling P2P AXMEDIS network in downloading and publishing reducing the seeding time to zero
- connecting other AXMEDIS Factories of content integrators, producers, and distributors
- posting content on the EUTELSAT Carousel for broadcasting.

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