

Technical Note
n.4001
October 2007

Set up and maintain your P2P network at lower costs:

Integrate P2P in Multi-channel production and distribution: broadcasting, IP/Internet, WEB sites, P2P, mobile, IPTV, interactive TV and channels, etc.

Exploit Video on Demand (VOD), and production on demand solutions

Control P2P content sharing and distribution, involving your customers in distribution (super-distribution)

Involve your customers and final users in content production and social networking

Integrate interoperable DRM into your business

Exploit different business models and/or transactions on the same distribution channels: pay per play, monthly rate, preview, renting, advertising, etc.

Exploit interactivity with cross media models

Adopt advertising (customized and/or real time personalized advertising)

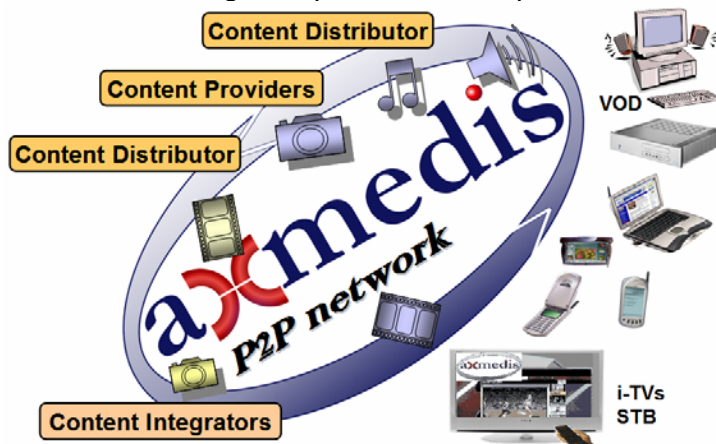
AXMEDIS P2P: for a legal, flexible and controllable P2P

Content sharing via P2P is regarded by many content owners as one of the major reasons for lack of revenues. This opinion has grown on the basis of the way users exploit some P2P applications. However, the same basic technology can be used in many profitable manners which can avoid misuses. Many applications based on P2P have emerged and have proved to be controllable, profitable and efficient for commercial content distribution. It should be noted that currently more than 75% of data downloaded by final users/consumers are obtained via P2P protocols, while only the remaining 25% refers to data directly downloaded from servers.

It should be kept in mind that P2P implies (i) large scale and scalable content distribution, (ii) creation and management of a collectivity of consumers for advertising and profiling, (iii) lower costs for content download, and (iv) lower costs for content distribution since the front end distribution servers do not have to provide all the amount of bytes downloaded by final users. These are the main reasons behind the usage of the P2P protocol for WebTV, IPTV and also content publication.

The AXMEDIS P2P is an open and scalable solution for setting up P2P networks for content distribution and sharing which can be used among business actors or consumers, or for creating thematic or mixed P2P networks for B2C content distribution and sharing. Content in this case, can be any kind, from video to audio, games, documents, etc.

AXMEDIS P2P solution allows content owners and distributors to exploit the capabilities of P2P protocols to create efficient, controllable, legal and secure P2P networks for content distribution and sharing. By using the AXMEDIS P2P solution a distributor may publish content in the P2P network; and the content may freely navigate among peers with the supervision and control of the AXMEDIS protection and monitoring tools. Content distributors may use the AXMEDIS P2P solution to set up legal P2P services for content distribution towards and among their customers, thus reducing their direct costs for distribution and infrastructure. Final users can be profiled and may be stimulated by advertising, and/or promotions of content to acquire licenses to play the content (e.g., pay per play). Other business models such as the monthly rate or the renting for a period are also possible.



AXMEDIS Adoption and Affiliation Programme

AXMEDIS has been adopted and is under trial by many industrial partners, who have expressed their appreciations (see <http://www.axmedis.org/ibc2007/>). AXMEDIS is open and allows you to access source code, reports, technical support, training days, etc., by means of the affiliation program. AXMEDIS consists of over 35 partners (such as: TISCALI, EUTELSAT, Telecom Italia, TEO, ELION, HP, BBC, Giunti Labs, ACIT, EXITECH, XIM, SIAE, SDAE, etc.). It allows you to exploit innovative results with new tools and solutions for your needs.



AXMEDIS P2P Main Capabilities

The AXMEDIS P2P solution allows to:

- share any kind of content (digital files)
 - limit the content sharing to particular types/formats of content, protected or not;
- publish/distribute content
 - with DRM or not (for example with MPEG-21 REL DRM, but other DRMs are also supported). In the case of DRMed content, different business models can be supported on the same P2P network and on the same content at the same time: pay per play, monthly subscription, renting, etc.
 - in a fast and reliable manner on the P2P network, the so called "immediate seeding" of P2P network, in direct connection with your Content Management Systems;
- create a community among different actors to publish, download and share content and tools
 - set up content distributing/sharing network among business partners: B2B solution;
 - set up content distributing/sharing network among consumers: C2C solution;
 - set up content distributing/sharing network among mixed community of business partners and consumers: B2B2C. In this case, both of them may enjoy the sharing of files (faster download) for different purposes;
- monitor the activity of the P2P network including
 - monitoring and measuring performances in particular points of the geographical P2P network;
 - information regarding the status and profile of the P2P control nodes and of peers;
 - statistics about the status of the whole P2P network;
 - detailed reporting about the activity related to each content/object on the P2P network;
- filter content that is not
 - authorized to be shared on the network, for example when a content is infringed with some Intellectual Property. The filtering can be based on detection of content on the basis of fingerprint or watermark solutions, or of simple IDs;
 - conformant to some standard or format;
- control the activity of the P2P network
 - automated content publication and/or download;
 - managing black lists of P2P clients and content;
 - strategies for the publication, polishing and maintenance of the P2P network;
- easily and immediately integrate with any WEB portal and/or services for content distribution and sale;
 - starting the download with P2P client tools by just a click from any WEB page;
 - promoting new content, top/premium content, advertising, etc., towards the users connected with the P2P network via P2P Clients;
 - bringing users to a specific WEB page for each DRMed content to provide additional information for sale and/or promotion of related products;

#	Media name	Incoming rate	Upload rate	Downloaded	Size	Progress	Remaining time	Elapsed time	Start date	End date	AVOID	Status
14	mp4 test_4.axm	9.61 KB/s [1]	0 bytes/s [0]	450.92 kb	450.92 kb	100.00 %	0 s	5 m 23 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
20	axmedis-playres-full-version-pc-activex-skill-v...	4.80 KB/s [1]	0 bytes/s [0]	120.80 kb	267.81 Mb	0.04 %	15 h 50 m 41 s	3 m 53 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
0	slac-presentation-feb2007-new.exe	41.06 KB/s [2]	0 bytes/s [0]	2.25 Mb	62.28 Mb	3.60 %	24 m 20 s	6 m 24 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
7	FC 6 i386 DVD.iso	33.81 KB/s [3]	0 bytes/s [0]	2.83 Mb	3.28 Gb	0.09 %	1 d 4 h 13 m 4...	6 m 42 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
22	batman-reg.axm	3.86 KB/s [1]	0 bytes/s [0]	70.81 kb	330.82 kb	21.39 %	1 m 24 s	38 s	Tue Apr 10 12:...		URMCAXMEDIS:F...	Downloading
13	title-vampire-trailer-mpeg4.axm	25.33 KB/s [2]	0 bytes/s [0]	893.55 kb	7.10 Mb	12.14 %	4 m 15 s	5 m 23 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
4	axmedis-2006-general-tutorial-part5.mpg	243.50 KB/s [3]	0 bytes/s [0]	159.50 Mb	454.05 Mb	35.14 %	20 m 30 s	8 m 2 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
10	selvofurmenovak-trailer-mpeg4.axm	23.29 KB/s [2]	0 bytes/s [0]	1.28 Mb	7.22 Mb	17.71 %	4 m 21 s	8 m 2 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
5	axmedis-2006-general-tutorial-part6.mpg	218.24 KB/s [3]	0 bytes/s [0]	47.75 Mb	459.00 Mb	10.37 %	32 m 13 s	7 m 14 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
19	AXMEDIS DVD Tools Docs Examples Tutorials ...	19.88 KB/s [2]	0 bytes/s [0]	1.03 Mb	4.31 Gb	0.02 %	2 d 14 h 55 m ...	4 m 37 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
12	miractemsker-trailer-mpeg4.axm	19.95 KB/s [2]	0 bytes/s [0]	1.12 Mb	6.52 Mb	17.23 %	4 m 37 s	5 m 23 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
17	Audio-Collection2.axm	14.46 KB/s [2]	0 bytes/s [0]	1.10 Mb	18.07 Mb	6.10 %	20 m 2 s	4 m 39 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
16	AXMEDIS-Req-Use-Cases-Tests-2006.axm	13.67 KB/s [1]	0 bytes/s [0]	1.07 Mb	7.57 Mb	14.15 %	8 m 6 s	4 m 39 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
9	xim-ansc.html flash example.html files.v2.axm	12.73 KB/s [1]	0 bytes/s [0]	575.95 kb	13.04 Mb	4.30 %	16 m 43 s	6 m 2 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
18	Flash-example-2.AXMEDIS-WFDEL.axm	12.66 KB/s [1]	0 bytes/s [0]	574.52 kb	1.87 Mb	20.86 %	1 m 46 s	4 m 39 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
21	axmedis-major-tools-full-version-author-grid-v...	0 bytes/s [0]	0 bytes/s [0]	0 bytes	537.76 Mb	0.00 %		3 m 53 s	Tue Apr 10 12:...		urmcaxmedis:00...	Downloading
1	AXMEDIS-2006-General-Tutorial-part2.mpg	0 bytes/s [0]	0 bytes/s [0]	445.60 Mb	445.60 Mb	100.00 %		3 m 9 s	Tue Apr 10 12:...	Tue Apr 10...		Seeding
0	axmedis-2006-general-tutorial-part1.mpg	0 bytes/s [0]	0 bytes/s [0]	363.37 Mb	363.37 Mb	100.00 %		4 m 4 s	Tue Apr 10 12:...	Tue Apr 10...		Seeding
2	AXMEDIS-2006-General-Tutorial-part3.mpg	0 bytes/s [0]	0 bytes/s [0]	336.10 Mb	336.10 Mb	100.00 %		3 m 55 s	Tue Apr 10 12:...	Tue Apr 10...		Seeding
3	axmedis-2006-general-tutorial-part4.mpg	0 bytes/s [0]	0 bytes/s [0]	367.77 Mb	367.77 Mb	100.00 %		4 m 25 s	Tue Apr 10 12:...	Tue Apr 10...		Seeding
6	axmpool-p2p-setup-v3-2-6.axm	0 bytes/s [0]	0 bytes/s [0]	15.32 Mb	15.32 Mb	100.00 %		39 s	Tue Apr 10 12:...	Tue Apr 10...		Seeding
11	mp4-example.axm	0 bytes/s [0]	0 bytes/s [0]	3.48 kb	3.48 kb	100.00 %		1 m 47 s	Tue Apr 10 12:...	Tue Apr 10...	urmcaxmedis:00...	Seeding
15	earth-photo-reg.axm	0 bytes/s [0]	0 bytes/s [0]	0 bytes	161.16 kb	0.00 %		5 m 23 s	Tue Apr 10 12:...		URMCAXMEDIS:...	Downloading

Download interface of the P2P clients

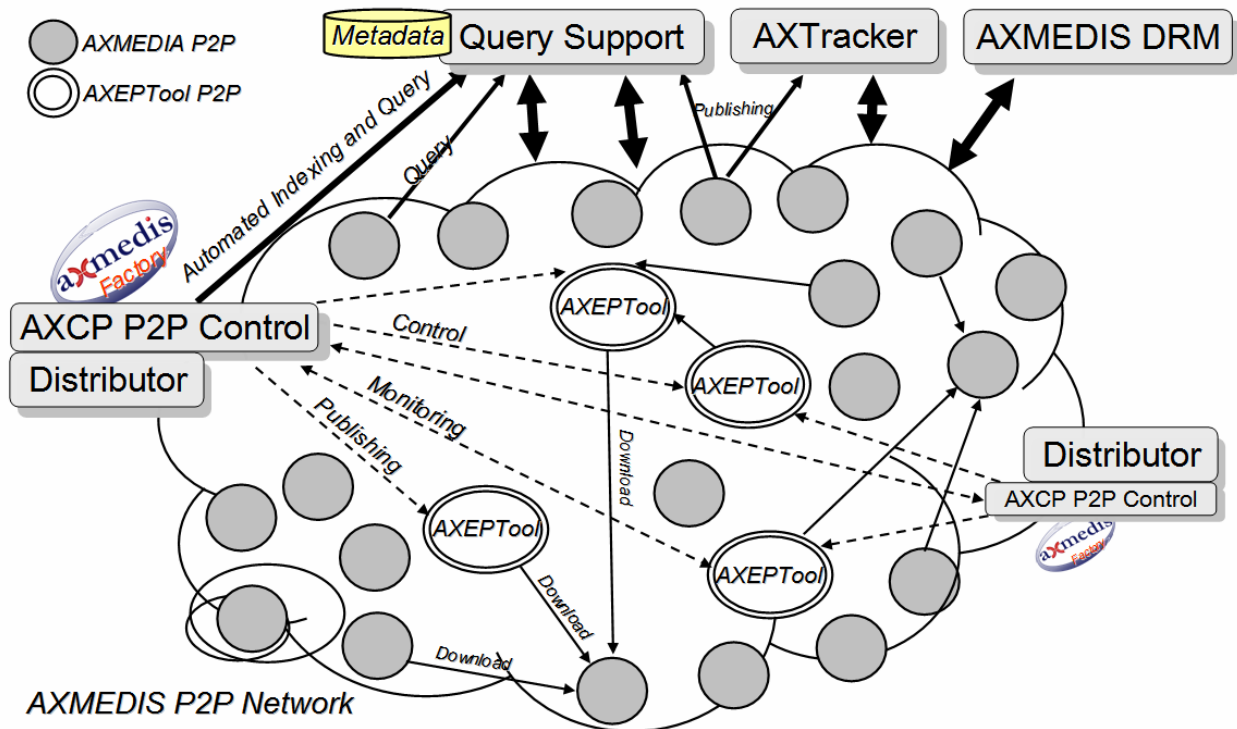
With the AXMEDIS P2P solution, it is also possible to

- have facilities to make queries into the P2P network. This search facility is provided for MPEG-21 objects and it is based on Dublin Core metadata and classification model plus additional business information such as licensing information, distributor information, etc.;
- expose the whole content catalogue to your P2P network clients;
- have a direct integration of P2P tools with your content management systems, CMS;
- have a direct integration of P2P tools with your workflow management systems, WFMS;

AXMEDIS P2P is fully integrated with the AXMEDIS GRID for Content Processing, AXCP, which is an open and scalable solution for automating content production, management and protection for multichannel distribution. AXCP allows setting up integrated and automated content management systems for pre- and post-production, following your business growth and integration demands. The AXMEDIS P2P solution provides the above mentioned capabilities of control and monitoring when it is integrated with the AXCP tools and facilities. Direct integration with your existing factory and tools is also possible.

AXMEDIS P2P Architecture and Solution

AXMEDIS P2P is based on the BitTorrent technology for P2P distribution and sharing. The AXMEDIS P2P technology enhances the classical BitTorrent solution with several innovations to realize the possibilities of: monitoring and controlling the network, managing DRMed content, making queries, deriving statistics, managing protected and non protected content, distributing MPEG-21 objects, automating publication and download, creating P2P networks for e-commerce at business and consumer levels, accelerating the publication up the immediate distributed seeding of content in the network, filtering content on the P2P network, and more.



A minimal AXMEDIS P2P network is comprised of:

- an AXTracker that manages and defines the P2P community. Multiple AXTrackers can be used to manage large communities;
- an unlimited numbers of AXMEDIS P2P clients, called AXMEDIA tools. They are the P2P clients for the hands of final users with the above mentioned capabilities of publishing, downloading, receiving advertising, etc. They are Java-based applications which are easy to be installed on a large range of systems. Simplified versions are also available for mobiles and STB/PVR.

Additionally, an AXMEDIS P2P network may have:

- a Query Support to allow indexing of content that is published in the P2P network thus making available a



query portal for your users. The indexing is based on Dublin Core plus other additional information depending on the MPEG-21 model. In principle any kind of metadata can be added;

- one or many P2P super nodes (AXEPTool), that are substantially points of control (control nodes) in the P2P network directly managed by one or more content Distributors or by whom is devoted to monitoring the correctness of the content shared on the P2P; for example, by filtering unauthorized content. AXEPTools should be installed by your business and/or affiliated partners. These control nodes of the P2P network can be controlled and monitored by one or more AXCP P2P Control servers;
- one or many AXCP P2P Control servers to control and exploit the P2P network which includes monitoring files, automatic publication, automatic download, accelerating seeding, etc. These are the engines to control one or all the super node AXEPTools in the network. Specific policies can be set up according to your needs for seeding and controlling the network. A set of predefined rules is provided, while additional rules can be easily defined in Javascript;
- an AXMEDIS DRM server to set up and manage digital rights management policies on protected objects shared on the P2P network or directly distributed from your servers (it works mainly according to the MPEG-21 standard, but other DRM models can be integrated). Protected content is licensed to the user defining the rights that he/she can exploit on the content. The DRM server allows to authorize the final users' players and to keep trace of activities performed by the users on the content for accounting and reporting them in details to the Distributors and/or content owners.

Customization of AXMEDIS P2P Architecture and Tools

AXMEDIS P2P can be fully customizaed in all its parts: filtering, publication, monitoring, query, classification, indexing, profiling, advertising, user interface, integration with other tools, etc., plus all the AXCP details to control and monitoring the network.

Summary of AXMEDIS P2P Node Status

Node Profile (.....)

AXEPTool Version	Online since	Operating System	Username	JVM memory used
3.2.30	Wed Oct 24 18:48:46 CEST	Windows 2003 OSArch:86 OSVersion:5.2	Administrator	291.24 MB

Report of activity on P2P node at

Object n.	Filename	Size	Download (%)	Start date	End date	AXOID	Status	Number of seeds	Number of peers
1	VRS-1-0c.axm	246.40 MB	100	Monday, October 22, 2007 17:18:23	Monday, October 22, 2007 20:27:11	um:axmedis:00002:obj:e6ac1ee5-7be8-38bc-b17a-29688acee123	Seeding	6	8
2	raw_ec3.axm	262.24 MB	100	Monday, October 22, 2007 18:21:17	Monday, October 22, 2007 20:18:12	um:axmedis:00000:obj:dd43b7be-f6c6-4bcf-9091-65ccba0b807f	Seeding	12	74
3	Xim-garden-P6201687-Mobile.axm	51.05 KB	100	Monday, October 22, 2007 17:10:50	Monday, October 22, 2007 19:36:18	um:axmedis:00000:obj:02ad02c9-1c66-4803-bd39-c73f6129721e	Seeding	10	48
4	VRS-059-Signalers.axm	54.78 MB	100	Monday, October 22, 2007 18:21:32	Monday, October 22, 2007 19:59:54	um:axmedis:00002:obj:7596a254-552b-3790-92d7-825644d8ba46a	Seeding	134	348
5	Xim-garden-P6201658-HiRes.axm	677.01 KB	100	Monday, October 22, 2007 17:10:22	Monday, October 22, 2007 18:50:17	um:axmedis:00000:obj:55033b54-63fc-48ba-af77-c8d025b8785e	Seeding	390	456
6	Xim-garden-P6201675-PDA.axm	116.89 KB	100	Monday, October 22, 2007 17:10:40	Monday, October 22, 2007 18:34:33	um:axmedis:00000:obj:2f476004-b695-4187-a4e9-cea51bee189d	Seeding	5	9
7	Xim-garden-P6201663-PDA.axm	120.11 KB	100	Monday, October 22, 2007 17:10:27	Monday, October 22, 2007 18:26:23	um:axmedis:00000:obj:2bf0c77c-4ff6-4cbf-adfc-459a8141015c	Seeding	456	563
8	REVIEW2007_18_OCT_REVIEW2007_18_Oct_tiscalitest_Akkordzither.axm	546.71 KB	100	Monday, October 22, 2007 18:21:43	Monday, October 22, 2007 18:24:33	um:axmedis:00000:obj:0db9bf4d-2b00-43ac-b39e-61ab118aba88	Seeding	76	82
9	REVIEW2007_15_OCT_B002_4_image.jpg_MASTER_REVIEW2007_IvanOCT_15.axm	255.96 KB	100	Monday, October 22, 2007 18:21:20	Monday, October 22, 2007 18:24:07	um:axmedis:00000:obj:e5fc2444-979c-4611-993f-942c145a5652	Seeding	45	58
10	VRS-demo-0c-mpeg4.axm	61.27 MB	100	Monday, October 22, 2007 17:09:47	Monday, October 22, 2007 18:13:28	um:axmedis:00000:obj:e4497340-ff6c-4c4d-b6f9-2c86f8326825	Seeding	12	85

Number of objects	Total Disk Space	Free Disk Space	Total Objects Size
2172	219.83 GB	192.82 GB	14.63 GB

AXMEDIS 2007 - Thu Oct 25 2007 12:48:42 GMT+0200 (ora legale Europa occidentale)

Summary reporting page of a AXEPTool P2P client



AXCP Open Architecture and Solution

AXCP P2P Control is realized by using the so called AXMEDIS GRID solution which allows automated management of content, metadata and licensing information, and so on, with the operations of ingestion, crawling, database management, indexing, processing, adaptation, transcoding, encoding, decoding, description extraction, recognition, filtering, production, archiving, storing, packaging, preview, extracting fingerprint, licensing, DRM, profiling, protection, encryption, accounting, enrichment, network management, and much more. Additionally, the AXCP tools can be integrated and controlled by your applications and/or workflow management systems.

In summary, the AXCP solution is based on AXCP Rules formalized in JavaScript and XML to define jobs, processes and their features (deadlines, needs, etc.). An AXCP solution is open since it can be expanded and/or customized for your needs by:

- o creating and customizing AXCP Rules to be executed;
- o entering in execution Rules according to different policies such as: periodic, sporadic or on demand from third parties, external tools, web services, 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 open, well documented and supported by a development tool kit; etc.

The AXCP tools are based on a Service Oriented Architecture (SOA); fully documented APIs for all the JavaScript functionalities and WEB Services for accessing and controlling tools and distributing produced content towards your front-end distribution servers. *For additional details see the last technical note on AXCP:* http://www.axmedis.org/documenti/view_documenti.php?doc_id=3455

AXMEDIS P2P Reliability and Scalability

The AXMEDIS P2P solution is reliable, scalable and fault tolerant and can grow with your needs.

AXCP nodes can run multiple copies of the same rules on the same content making possible the setting up of fault tolerant solutions and recovery solutions in case of server or disk failure.

The AXMEDIS P2P solution is scalable in terms of number of P2P clients, AXTracker, AXEPTools and AXMEDIA tools. It may work with small networks or with a very large and geographic number of users, with multiple trackers, etc.

AXMEDIS P2P Technical Information

The AXMEDIS P2P servers (Query Support, AXTracker) are run on Linux and based and P2P clients are mainly run on MS Windows. AXMEDIS P2P Solution is fully scalable according to your needs, with or without DRM support, with or without AXCP, as software or as an integrated hardware-software solution ready to be included in your company according to your needs. Specific customizations have to be negotiated on the basis of your needs. Training, integration and service level agreement are also available.

Testing a Trial AXMEDIS P2P Network

You can join a TRIAL AXMEDIS P2P network by downloading and installing your AXEPTool P2P Client from the following link: http://www.axmedis.org/documenti/view_documenti.php?doc_id=3611 After that you can start downloading and publishing files, then observing them on the catalogues, etc. if you are interested in the fast seeding you have to contact us to see a demo from an AXEPTool controlled by an AXCP.

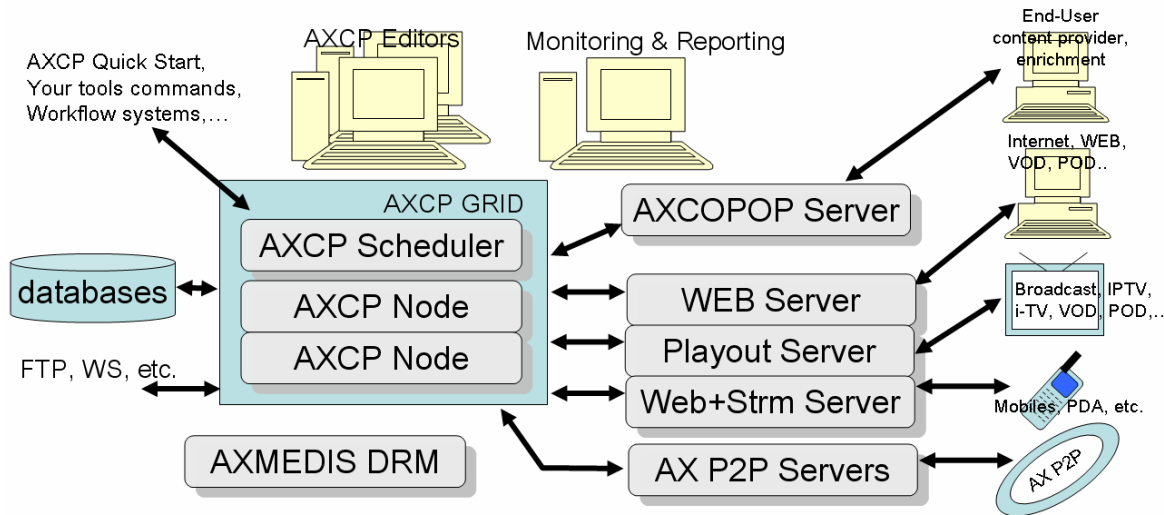
AXMEDIS Integrated Solutions

The described solution is independent, but it has also been designed to be used with:

- **AXMEDIS DRM**, a solution to adopt MPEG-21 DRM, or other DRM solutions, including servers and licensing tools which allow digital rights management, detection of attacks, black list management, collection of actions logs containing traces about the rights exploitation, tools for administrative management, etc.
- **AXMEDIS Editor and Players, tools for MPEG-21 and AXMEDIS authoring** (SMIL, HTML, MPEG-4, or any other kinds of digital resources), DRM, licensing, protection, packaging, workflow, playing, etc. AXMEDIS authoring on Windows. AXMEDIS players running on: MS Windows, Mac OS X, Linux,

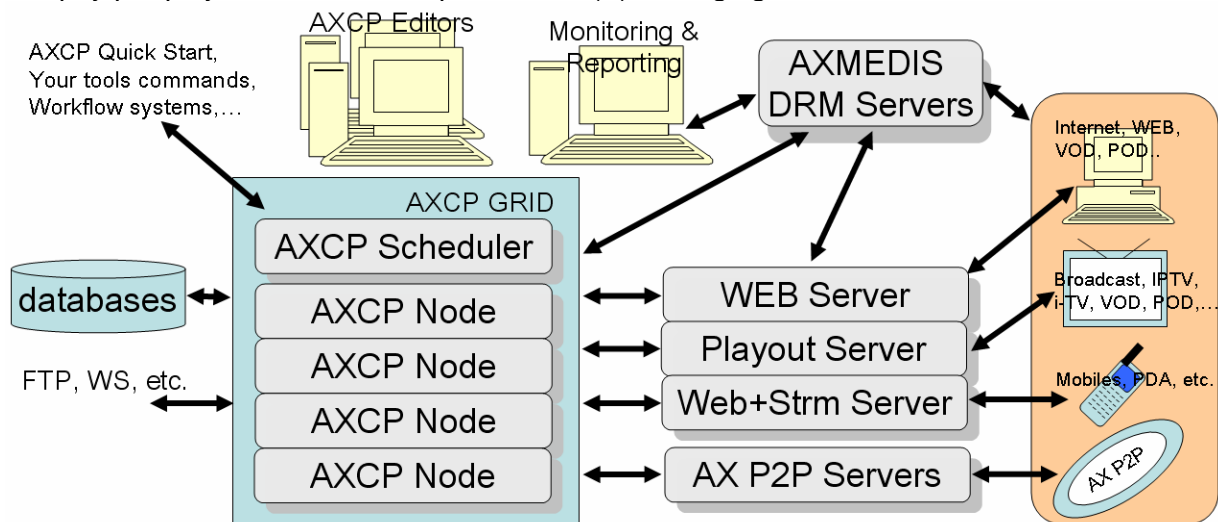
Windows Mobile 5, and java mobiles, are available for PC, STB/PVR/HDR, Media Centers, PDA, and mobiles. Their GUI and functionalities can be customized (examples of customizations are available).

- **AXMEDIS COPOP**, content posting solution, to involve your final users, to collect their content and redistribute it for social networking and content enrichment, and/or integrate it in your content business solutions.



The above example describes an AXCP based solution in which AXMEDIS COPOP is used to collect content provided by final users. The content is distributed (after being processed, adapted, protected, etc.) in the traditional multichannel distribution as well as in the AXMEDIS P2P controlled network for PC and Mobiles.

The following example presents an AXCP solution for automated production, protection and distribution of content with DRM. This solution allows the reduction of costs for content post-production and management for DRMed distribution. In this case, the DRM technology can be MPEG-21 or OMA to distribute content according to several different business models (pay per play, monthly rate, etc.), setting up different rights (play, print, etc.), with different conditions (times of play, duration, etc.). The AXCP allows (i) producing content on demand on the basis of final user profiles (device, network, etc.); (ii) producing licenses on demand for pay per play and new subscriptions; and (iii) managing black lists of terminals and/or users.



AXMEDIS tools (AXMEDIS P2P, AXCP, AXMEDIS DRM, AXCOPOP, AXP2P, etc.) have been designed on the basis of a large set of requirements collected by AXMEDIS Consortium partners. AXMEDIS tools are based on modular components which can be reused to set up a large range of different configurations. They are open to be customized to cover your needs and business ideas.

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