

# AXMEDIS Framework for Programme and Publication and On-Demand Production

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## Abstract

*This paper presents the design issues and discusses various scenarios and usages of a cross-media production framework under the AXMEDIS project [1, 2, 4] which aims to create a framework for the automatic production and distribution of digital cross-media contents over a range of different media channels with digital rights management.*

*The paper discusses the overall processes and flow, from specifying a programme (time-table/schedule for a particular channel, digital objects to be consumed), to the processing and delivering of the cross-media objects which is automatically checked, monitored and produced, depending on the targeted distribution server.*

*Besides creating and editing a programme for a distribution channel, this paper also present presents the “on-demand” production scenario for interactive queries of content by the consumer. If the customer is interested in a content that is not yet available in a compatible format, for the particular channel, the content can be automatically generated and delivered for immediate consumption, with the framework.*

## 1. Introduction

Digital media sector is urging for better pricing and better value-for-money for the products and services. In order to create and sustain a viable business venture in this market, key issues to be considered include the containment of content sale prices and the accessibilities to the contents, with reduced cost and increased quality and availability.

This paper provides an overview discussion on the design issues for part of a cross-media production

cycle for the AXMEDIS (Automating Production of Cross Media Content for Multi-channel Distribution) project [1, 2, 4]. It is an initiative supported by the European Commission (EC) IST FP6 with a consortium of 20 partners, to create an innovative technology framework for the automatic production and distribution of digital cross-media contents over a range different media channels with digital rights management and protection, including distribution towards PC (on the internet), PDA, kiosk, mobile phones, satellite and i-TV (interactive-TV).

AXMEDIS aims to satisfy the digital media market demand by:

- reducing the costs of content management
- reducing content distribution and aggregation costs in order to increase exploitation and accessibility
- providing new methods and tools for the protection of the digital contents (digital right management)

In addition to creating and processing of the programme, this paper also discusses “on-demand” production scenario which allow a user to search and request selected objects which may require on-demand processing.

The presentation of this paper includes an interactive demo on the inter-connection of the modules discussed in this paper.

## 2. Programme and Publication (P&P)

The AXMEDIS project is focused on the automated production and distribution of cross-media objects with support to a number of different distribution channels such as PC, mobile devices, PDA, kiosk and others.

The “Programme and Publication” section sits in the middle of the overall framework and responsible for two main tasks:

- 1) A Graphical User Interface for a user to create and edit a programme for the publication of one or more objects and their schedule. In this case, the “Programme” can be viewed as a form of TV/Radio programme (schedule) with particular digital objects to be delivered and consumed on the scheduled date and time, together with the “channel” of the distribution servers;
- 2) an active engine, which processes and monitors all the programmes (created using the above mentioned GUI or using the on-demand interface as discussed in the later section) to ensure the correct delivery of the digital media in the correct format and specification for the particular channel.

## 2.1. Overview of P&P

On the final integrated framework for AXMEDIS, these modules are interconnected and monitored using a Workflow process, passing to and from, and logging, all the requests and answers between major modules (e.g. between the P&P Engine and the On-Demand module) in order to provide an overall consistency and overall control to the whole system. This paper only focuses on the P&P section and hence the interconnection with workflow, content processing tools for content adaptation and other parts of the overall AXMEDIS framework is simplified.

## 2.2. P&P Editor

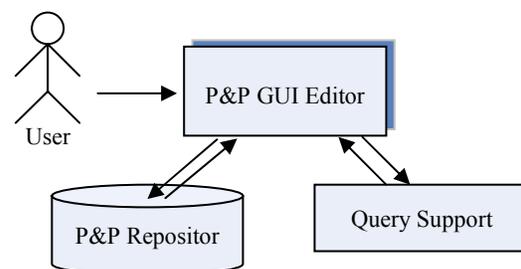
This is a GUI which is designed to provide the user of the AXMEDIS framework the functionality to create programmes. A programme, in this context, is a container (a file) which consists of one or more “rules”. A “rule” is used to specify the digital objects to be distributed with the specified consumption time together with the targeted channel of delivery. A programme can also hold other global information such as the optional periodicity information to allow the programme to repeat daily, weekly, monthly, or other time intervals.

The programme uses the eXtensible Markup Language (XML) as the representation format since XML is a simple and very flexible format popularly used for the exchange of a wide variety of data over the Web and other network environment [8].

The P&P Editor provides the user functionalities to save, create and edit new programmes. The user can

search for multimedia objects available in the whole AXMEDIS framework (including all the connected databases and peers) and select the object of interests using a tool provided in the AXMEDIS framework called Query-Support. The Query-Support allows the retrieval of both individual objects as well as a “Selection” (i.e., group of objects, or nested queries). The user selects and adds one or more objects of interest, to build up a P&P programme. After that the schedule, delivery channel and other information and setting can be configured using the GUI provided by the P&P Editor.

All P&P programme (complete, draft) can be saved in the P&P Repository, and they can be reloaded for further editing when necessary (see Figure 1).



**Figure 1. Overview of the P&P Editor context.**

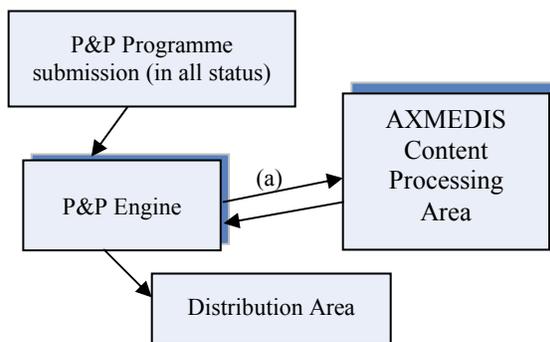
Once a programme is completed, the user may submit the programme to the P&P Engine for processing (see next sections). However, before putting the programme to be operated by the P&P Engine, the user may choose to perform a trail run in order to check the validity of the programme and to discover any unforeseen obstacles such as overlapping schedule, formatting, sizing and sampling issues.

At this stage, there are three options: (i) submit and activate the programme; (ii) quick trail; and (iii) full trail. All these options will submit a request to the P&P Engine (discussed in the next section) to load and parse a given (completed) programme. A quick trial is used to test the programme without performing any real formatting related processing which may be time consuming. It is designed to provide a quick check and report any errors detected. A full trail involved in all processing including content formatting/adaptation if necessary without actual delivery. Full trial is the same as activating the programme with the exception that the final distribution does not take place.

### 2.3. P&P Engine

The P&P Engine is activated on start-up of the overall AXMEDIS framework. It remains active at all times and responds to the submission of P&P programme in a number of modes (i.e., quick/full trails or real activation).

The Engine has three main functions: (i) on receiving a new programme, it parses and checks each rules of the programme to estimate the actual delivery time using the channel profile and bandwidth information to transmit the object so that it is ready for consumption at the correct scheduled time; (ii) checks capability of the object to the target delivery channel. If it is not compatible, the Engine requests for formatting processing from the Content Processing Area (discussed later); (iii) sleeps until the estimated delivery time, and to wake up and distribute the object with the appropriate method depending on the distribution channel. The scenario is illustrated in Figure 2.



**Figure 2. P&P Engine scenario: receiving P&P Programme submission; parse and check for compatibility and request for any necessary formatting processing (a); and delivery object to distribution channel on schedule.**

The Engine receives activated programmes via two routes. In the case of a defined programme created by the P&P Editor, the programme is submitted (activated) from the P&P GUI Editor. Additionally, the Engine can also respond to on-demand request from the distribution area (through the AXMEDIS Workflow), where live requests for selected objects can be processed and delivered immediately using the

“On-Demand” production scenario as discussed in the later section.

### 2.4. P&P Engine and Content Processing

Bandwidth issues often constrain the quality of the dissemination of digital content particularly on mobile devices [3, 5]. In order to support multi-channel distribution, AXMEDIS framework maintains and tracks the performance of each channel and updates the information in the respected profile in order to estimate timely and effective distribution. P&P Engine also takes advantage of the functionalities of the AXMEDIS Content Processing Area to allow automated adaptation of the digital cross-media objects if required. On the processing of a given programme, the P&P Engine investigates the original format of the object and its compatibilities with the targeted distribution channel based on the distribution server profile information. If necessary, formatting requests can be forwarded to the AXMEDIS Content Processing Area.

The P&P Engine submits the request to the AXMEDIS Content Processing Area for the execution of a particular formatting rule on the object in question and a set of parameters related to the profile of the specific distribution server. A formatting-rule in this case could include format conversion, re-sizing, re-sampling and other functionalities that satisfy delivering channel and user’s profile. The Engine carries out the necessary processing, creates a new object and returns the reference of the resulted object to the P&P Engine.

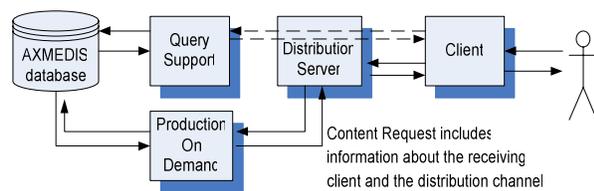
The P&P Engine submits the request to the AXMEDIS Content Processing Area with the object in question and the profile of the particular distribution server. The requested formatting process carries out the necessary processing, creates a new object and returns the reference of the resulted object to the P&P Engine.

## 3. On-Demand Production

In addition to the basic functionality using the GUI Editor to create and edit one or more programme, this section discusses the scenario whereby “on-demand” request to digital objects can be carried out.

The “On-Demand” module provides the functionality whereby a user can enter a query to the AXMEDIS database using a Client GUI. A list of available and relevant contents is then returned to the user. From the list of available contents the user selects relevant content to purchase. If the selected content is not yet available (in the appropriate format) it can be

produced (automatically processed) for and transmitted to the requesting user immediately (see Figure 3).



**Figure 3. A user submits query for relevant contents. From the result list s/he selects the object(s). If the selected content is not in the appropriate format for the distribution server the content is automatically produced.**

### 3.1 Database Querying

Imagine a user with a PDA interested to obtain a specific piece of music, e.g., a song, and the user may have a rough idea about the title and/or the year of this item. The user enters this information in a simple form on a web-page that is displayed on the PDA. Based on this information, a query message in XML is created and sent to the AXMEDIS Distribution Server.

This message includes the Client-Profile which specifies the capabilities of the client device, e.g. screen size or CPU (e.g., Composite Capabilities Preference Profiles [6]). At the Distribution Server a Distribution-Profile is added and the query is passed on to the Query Support (for Distribution Channels) within the AXMEDIS framework. The query is verified and a query to the AXMEDIS database for the requested content is created that takes the Client- and Distribution-Profiles into account. Further parameters are added and adjusted according to the Client- and the Distribution-Profiles. The query is then sent to the web service interface [7] of the AXMEDIS database. It is worth noting that Queries are not limited to local databases. The framework allows query to be forwarded and submitted to all the content available and connected to the AXMEDIS P2P (peer-to-peer) network [2, 4].

### 3.2 Content Selection and Production On-Demand

The results of the query to the AXMEDIS database are passed back to the client via the Query Support and the Distribution Server. The results are then presented to the user on a web-page, and the user can now

browse through the list of available contents and select one or more specific objects according to the interest. This selection is then passed on to the Distribution Server.

The on-demand section makes use of the standard Programme and Publication framework as described earlier. However, it specifies the processing of the task in hand as “immediate” in order to put the request to be process straight away.

## 4. Acknowledgement

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