AXMEDIS Tutorial on Content Processing

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AXMEDIS attacks the challenges of digital content processing and distribution

Automating Production of Cross Media Content
for Multi-channel Distribution

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- **Tutorial Objectives & Outcomes**
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  - Core Functionality
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- **AXMEDIS Content Processing (AXCP) – Part II**
  - AXCP Engine
  - AXCP Grid
  - Usage Scenarios
- **Summary, Conclusion and Outlook**
- **Discussion, Questions and Answers**

Tutorial Presentation

- **Rationale**
  - Recommended: General Tutorial
  - Focus: Automatic Content Processing
    - Underlying basics concepts
    - Usage examples of tools
  - Discussion of limits and constraints
- **Documents are available at http://www.axmedis.org**

Tutorial Presentation (II)

- **Intended audience**
  - Decision makers
  - Technical managers
  - Programmers
  - People in the areas of
    - Content production
    - Content distribution and content protection
- **Prerequisites**
  - Basic knowledge of production cycle and tools
  - Basic knowledge of distribution and protection tools

Tutorial Objectives

- Recall overall automatic content processing process
- Overview on individual tools
- AXMEDIS content processing framework usage know-how
- Interaction with tools
- Description of usage scenarios

Tutorial Outcomes

- How to use content processing tools in the AXMEDIS framework
- How to automate content production and processing using AXMEDIS
- Interaction of workflow and content processing
- Distribution of workload by using the AXMEDIS GRID distributed environment

AXMEDIS Tutorial on Content Processing - Part I

- Current Challenges and Key Issues
- AXMEDIS General Overview
- AXMEDIS Content Processing

Current Challenges

- **Very fast growing digital-content market**
- **Major limitations include:**
  - Convergence of the media, interoperability of content
  - DRM applications and introduction in several distribution channel
  - Massive processing of content processing and distribution
- **Real challenges that are currently being discovered**
  - Business-to-Consumer Scenarios (B2C)
  - Business-To-Business Scenarios (B2B)
- **Required: innovative means for various scenarios**

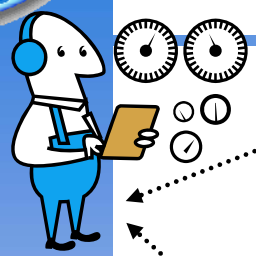
Key Issue: Flexibility

- **Devices and content delivery formats are not static**
  - Emerging devices and formats
  - Dynamic market in terms of possibilities and content types and formats
- **Required: Flexible Software Tools**
  - Support of numerous content types and formats
  - Support of different devices

Key Issue: Automated Processing

- **On-demand distribution:**
  - Production on the basis of requests and profiling (user device, network, etc.), etc.
  - Request depending adaptation and processing
- **Multi-channel distribution**
  - Differing receiving devices
  - Differing distribution modalities
  - Multiple interoperable DRMs, license chain processing
- **Content monitoring**
  - Broadcast channels and networks,
  - Peer-To-Peer networks, Websites, etc.

On Demand Distribution



AXMEDIS Rule Editor

Few Ready to use rules

User and Device profile

Add info

Activate Rule

AXMEDIS Scheduler

Content Databases

Personalized Content on Demand

AXCP GRID

AXMEDIS PMS

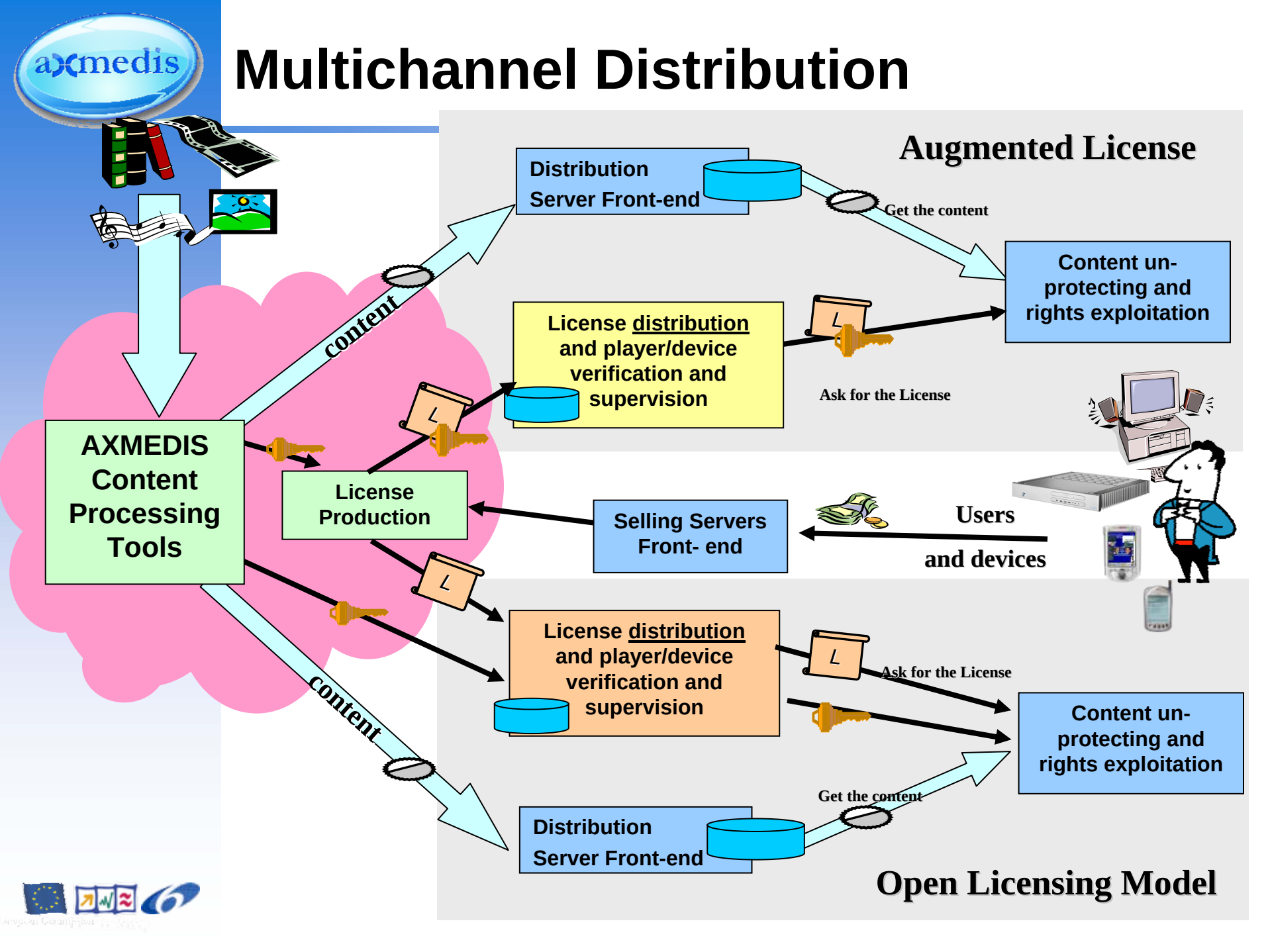
AXMEDIS CS

Distributor front end Server

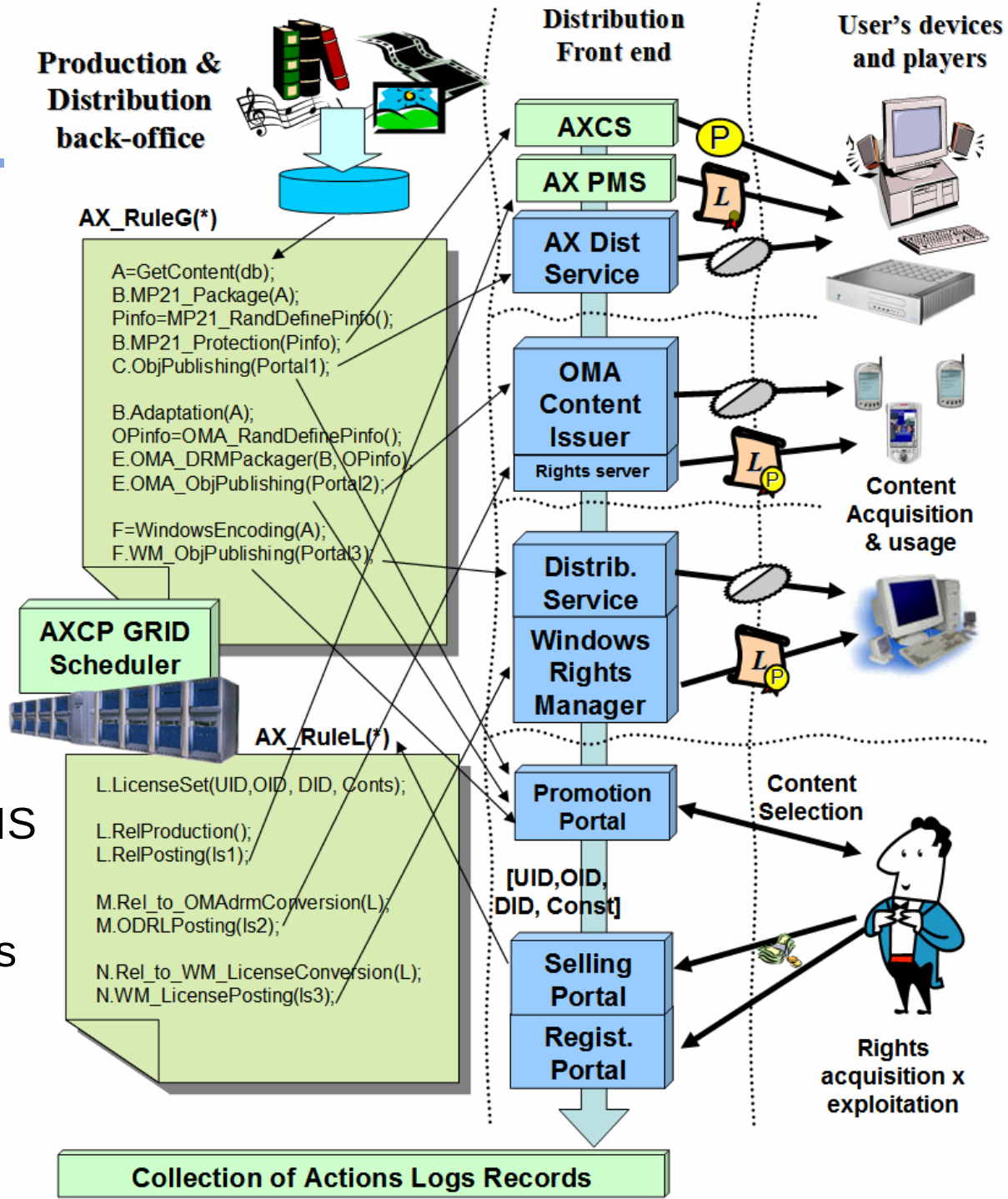
players

Content: Search, Selection, Acquisition, Production, Adaptation, Transcoding, Formatting, Packaging, Protection, Publication and Licensing on Demand

Multichannel Distribution



- **Different channels**
- **Different DRMs**
  - AXMEDIS
  - OMA
  - Windows Media



AXMEDIS Advantages

- **Flexible and innovative solutions for**
  - Content production and management
  - Content distribution and aggregation
  - Digital Rights Management (DRM)
- **Cost Efficiency through underlying principles**
  - Automatic massive content production and processing
  - GRID technology
  - Extensibility through plug-ins technology
- **Cost Efficiency through the integration with**
  - Existing Content Management Systems (CMS)
  - Existing e-Service, e.g. back-office and workflow support

AXMEDIS Advantages (II)

- **AXMEDIS Automated Content Processing**
  - Massive and small scale processing
  - Locally performed or Workflow controlled
  - On any kind of Digital Resource not only AXMEDIS objects
- **AXCP Applications for massive processing as**
  - Production/packaging platform for producers and integrators
  - Protection of objects, and protection information processing
  - Transcoding/adaptation platform for distributors
  - License Production, or as License Sever/processor
  - etc.

Summary: AXMEDIS

- **Intelligent and flexible solution**
  - Automated content processing and production
  - Efficient usage of available resources
  - Interoperability with existing infrastructure
  - Automatic provision of new service

Content Processing With AXMEDIS

Automation of content processing

AXMEDIS General Overview

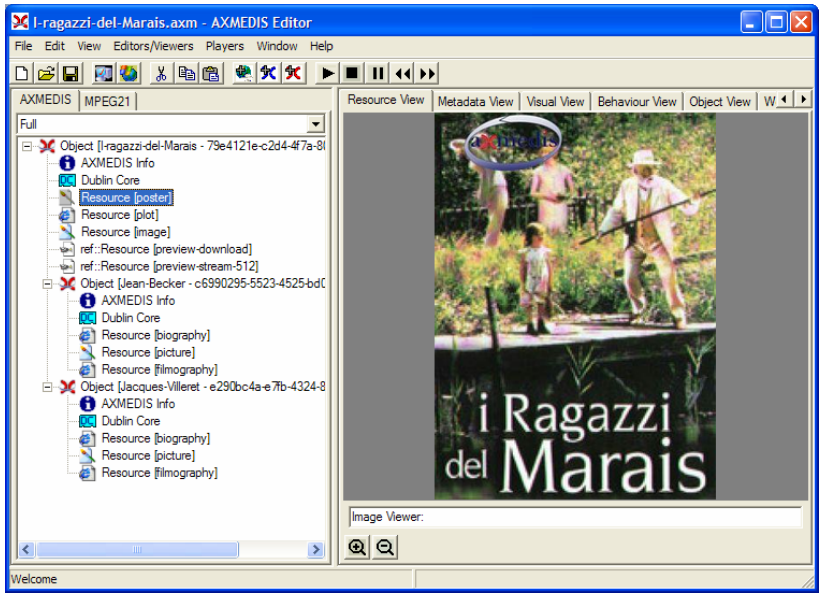
- AXMEDIS Editor
- AXMEDIS Automatic Content Processing
- AXMEDIS Architecture
- AXMEDIS Content Processing

AXMEDIS Editor

- **manual production of AXMEDIS objects**
- **inspection of automatically produced objects**
- **finishing AXMEDIS objects pre-produced automatically**
- **AXMEDIS Tutorial on Content Production,**
  - ➔ LT1: Tuesday, 12th (yesterday)

AXMEDIS Editor

- **It integrates many Editors & Viewers to handle all the aspects of the AXMEDIS Objects production**
  - Resource
  - Metadata
  - DRM
  - Protection
  - Presentation
  - Workflow
  - Annotation
  - …

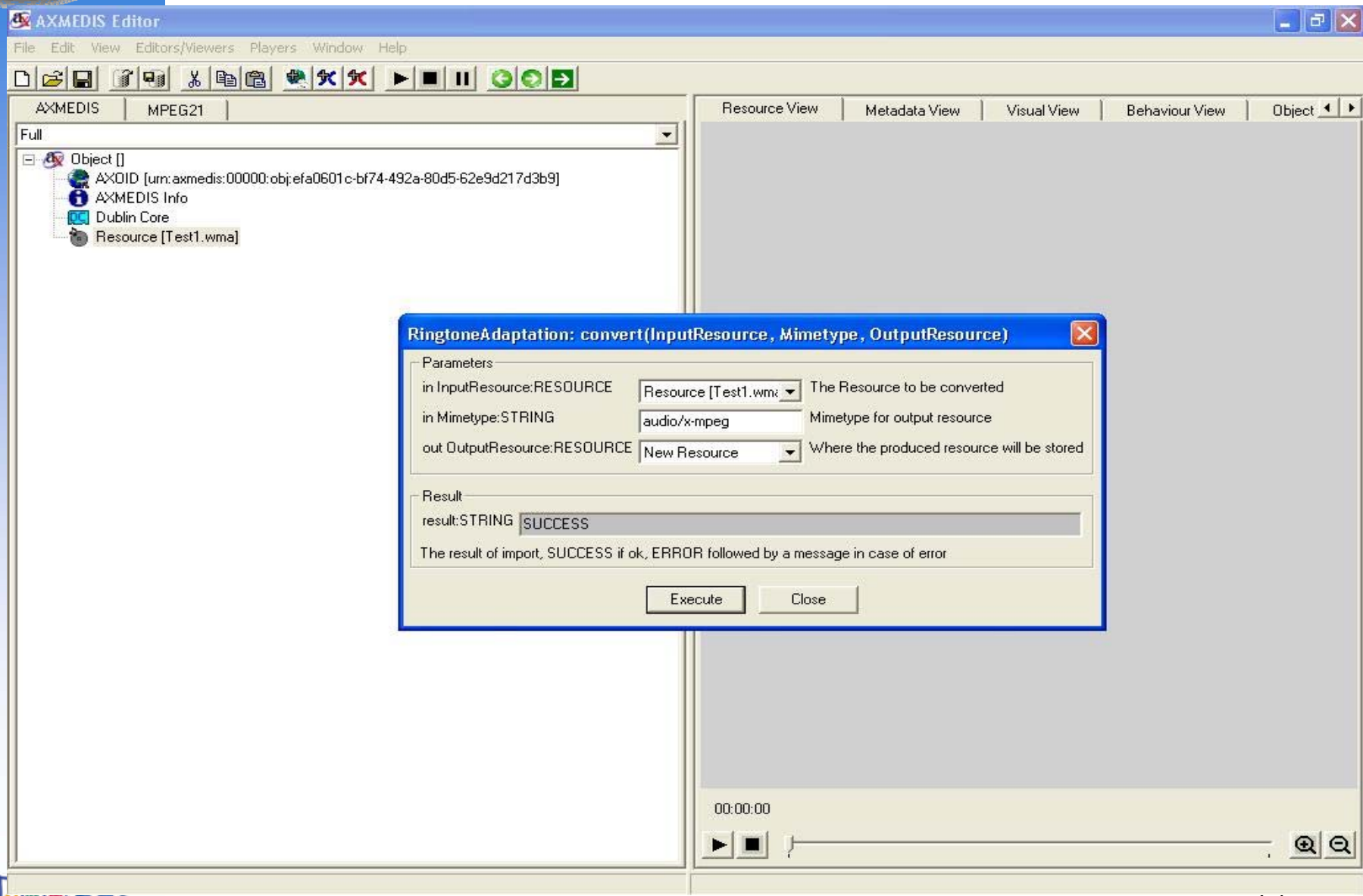


- **AXMEDIS Tutorial on Content Production,**
  - ➔ LT1: Tuesday, 12th (yesterday)

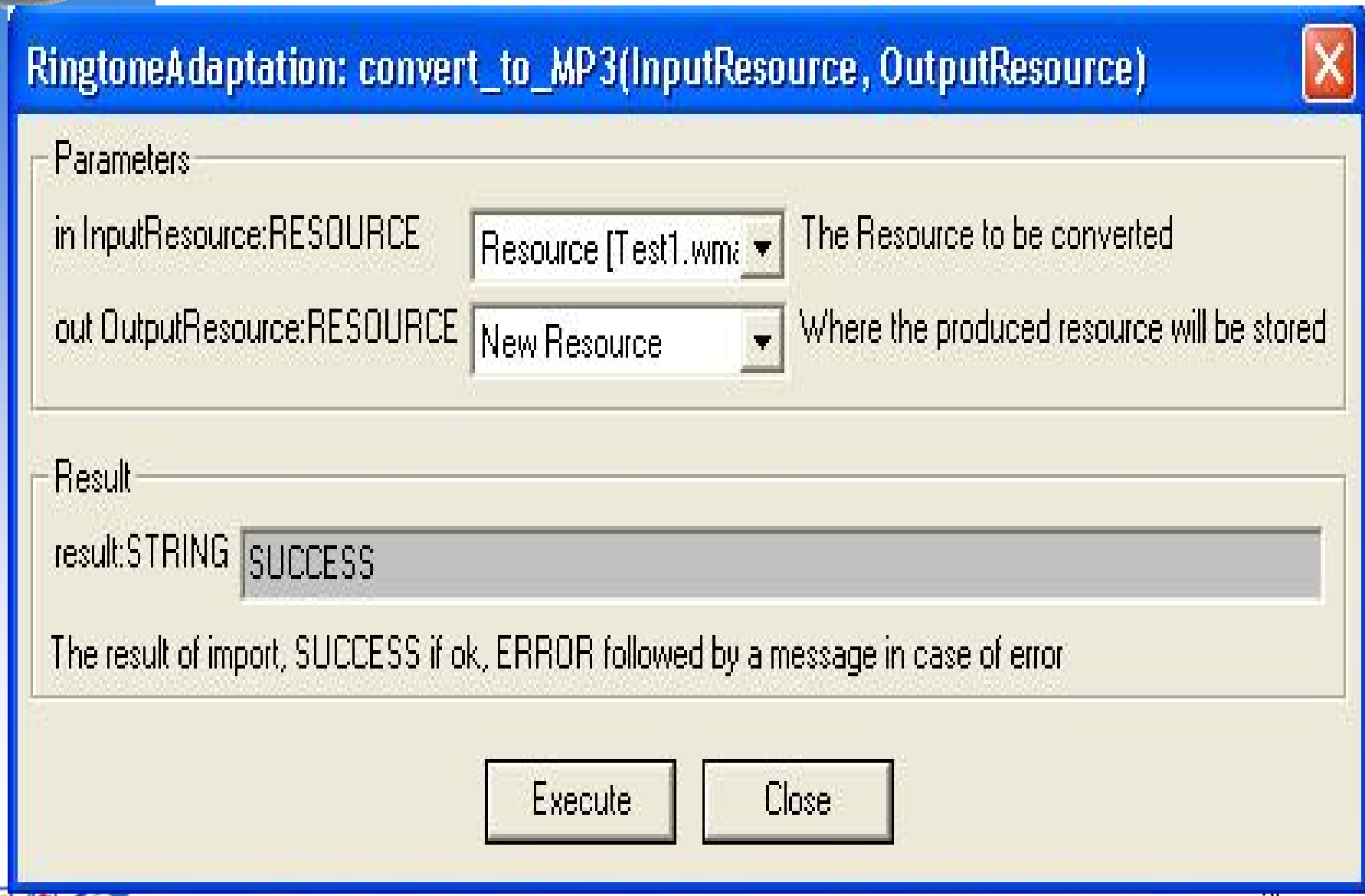
Ringtone Adaptation Plug-in

- **Adaptation of Ringtones of popular formats**
- **Transcoding on-demand.**
- **Main functions**
  - Convert to different formats
    - MP3, Wav, etc
  - Resample the Frequency, Bit rate etc
  - Clip to 5 sec, 30 sec clip etc

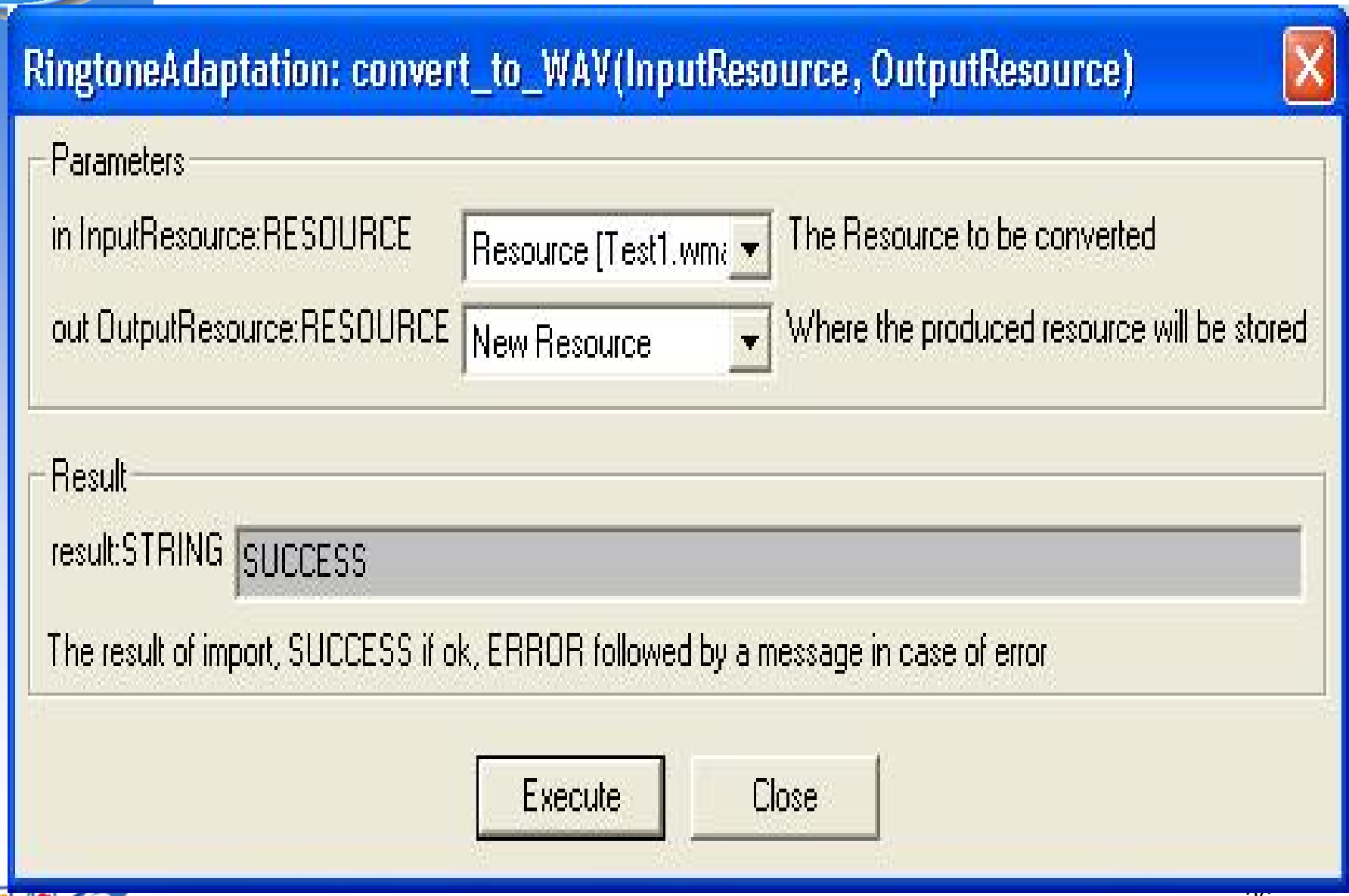
Convert


AXMEDIS Editor
File Edit View Editors/Viewers Players Window Help
AXMEDIS
MPEG21
Full
Object []
AXOID [urn:axmedis:00000:obj:efa0601c-bf74-492a-80d5-62e9d217d3b9]
AXMEDIS Info
Dublin Core
Resource [Test1.wma]
Resource View
Metadata View
Visual View
Behaviour View
Object
RingtoneAdaptation: convert(InputResource, Mimetype, OutputResource)
Parameters
in InputResource:RESOURCE
Resource [Test1.wma
The Resource to be converted
in Mimetype:STRING
audio/x-mpeg
Mimetype for output resource
out OutputResource:RESOURCE
New Resource
Where the produced resource will be stored
Result
result:STRING
SUCCESS
The result of import, SUCCESS if ok, ERROR followed by a message in case of error
Execute
Close
00:00:00

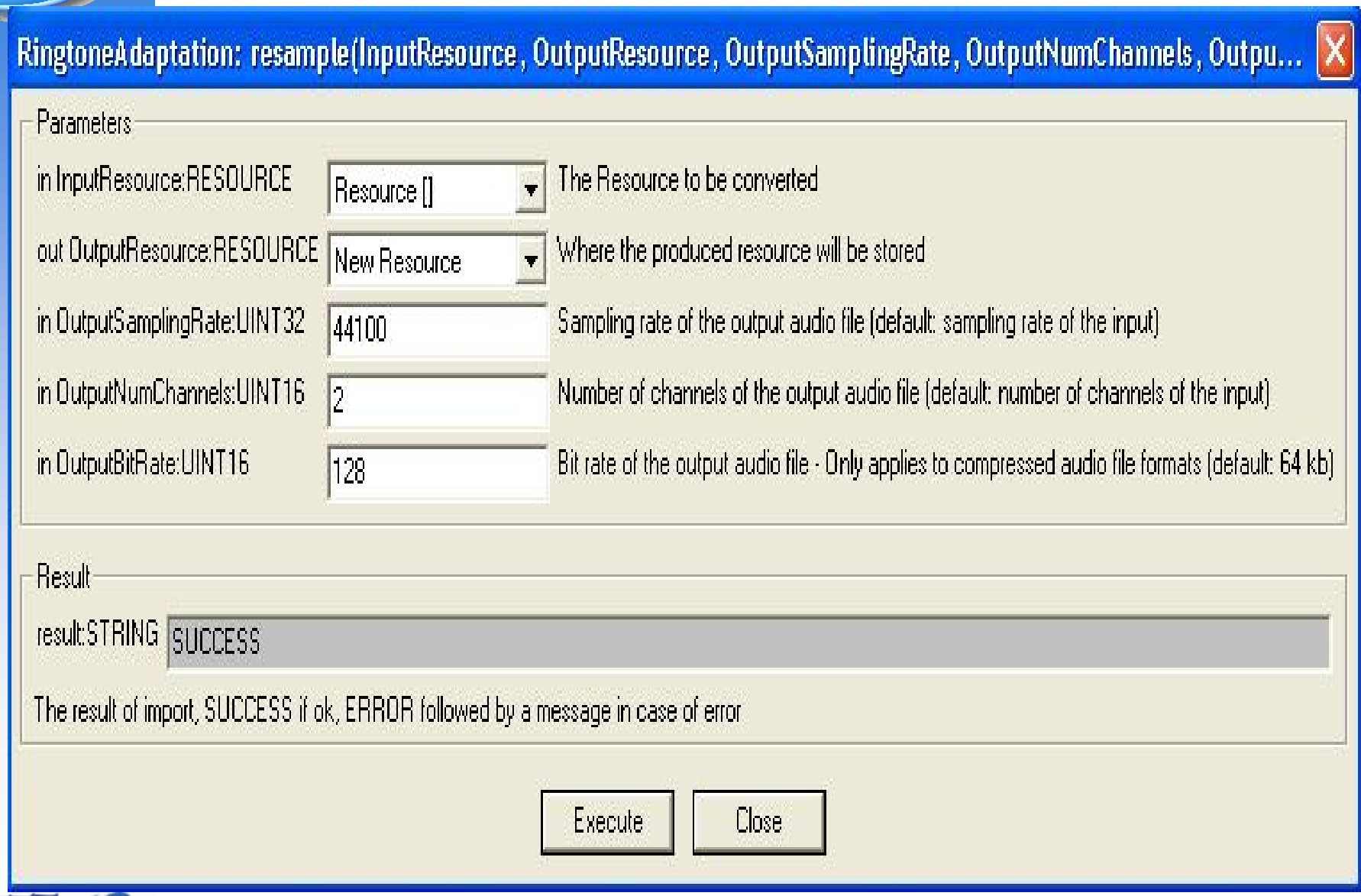
Convert to MP3



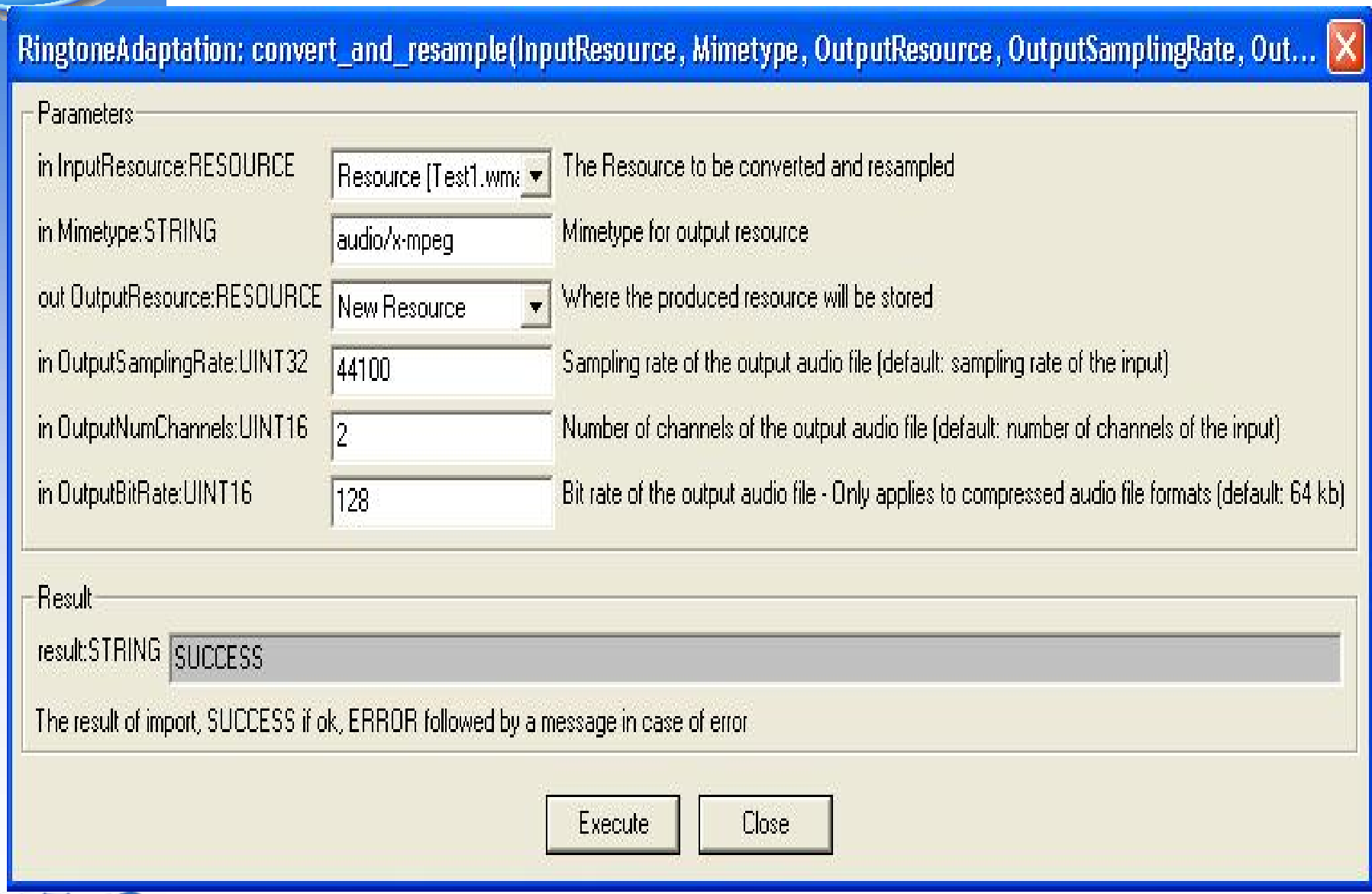
Convert to Wav



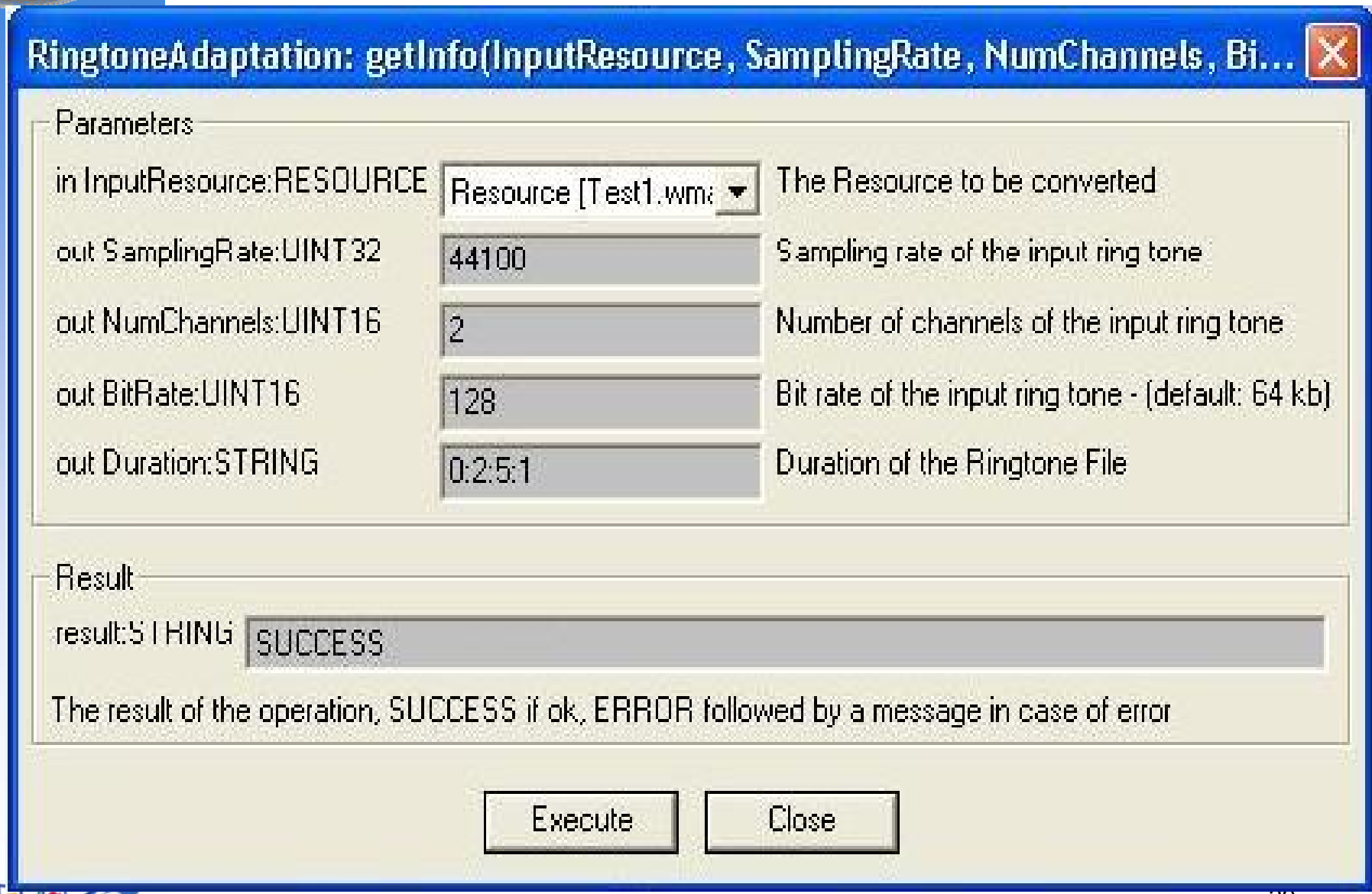
Resample


RingtoneAdaptation: resample(InputResource, OutputResource, OutputSamplingRate, OutputNumChannels, Outpu...
Parameters
in InputResource:RESOURCE
Resource []
The Resource to be converted
out OutputResource:RESOURCE
New Resource
Where the produced resource will be stored
in OutputSamplingRate:UINT32
44100
Sampling rate of the output audio file (default: sampling rate of the input)
in OutputNumChannels:UINT16
2
Number of channels of the output audio file (default: number of channels of the input)
in OutputBitRate:UINT16
128
Bit rate of the output audio file - Only applies to compressed audio file formats (default: 64 kb)
Result
result:STRING
SUCCESS
The result of import, SUCCESS if ok, ERROR followed by a message in case of error
Execute
Close

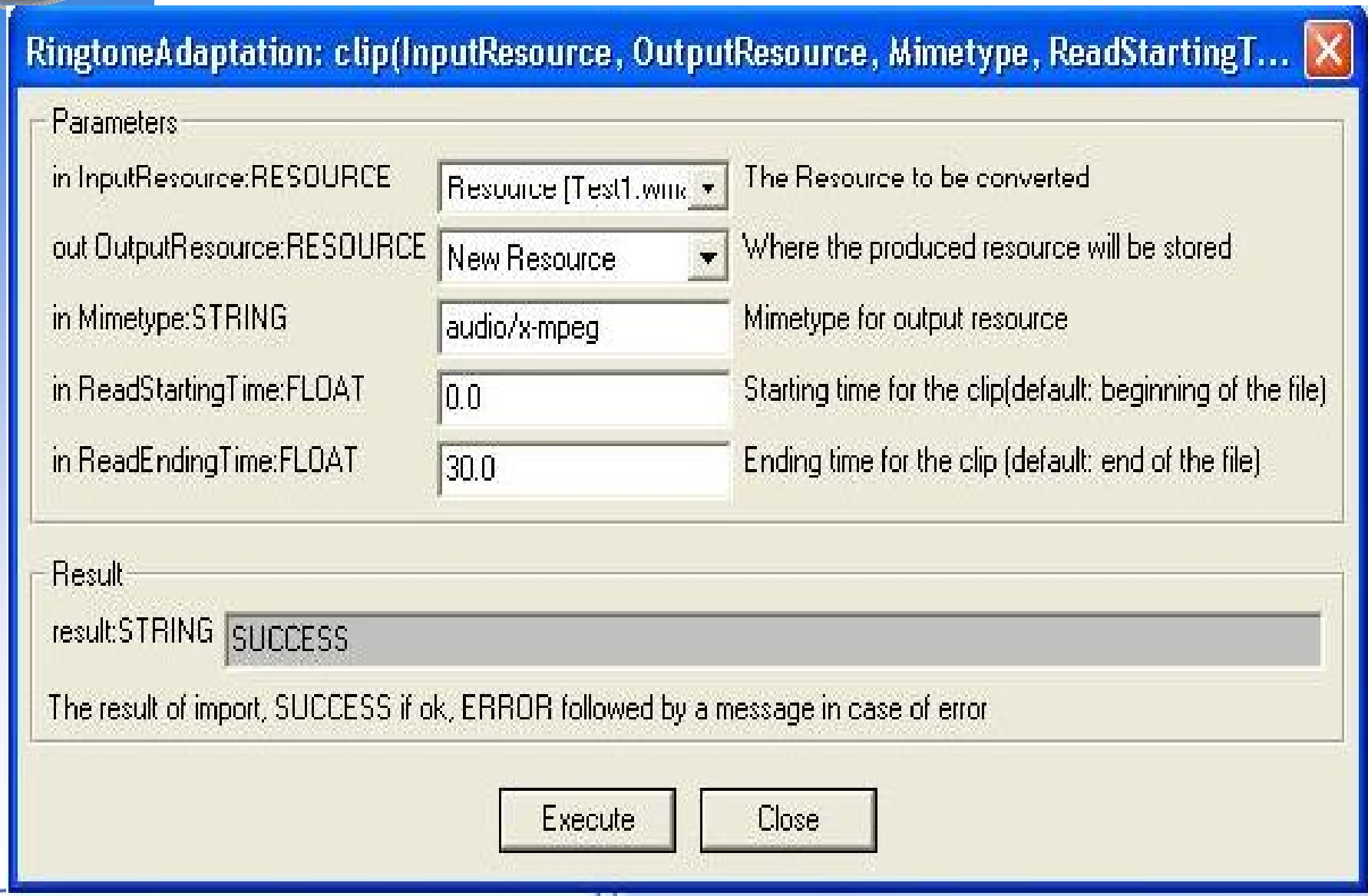
Convert & Resample



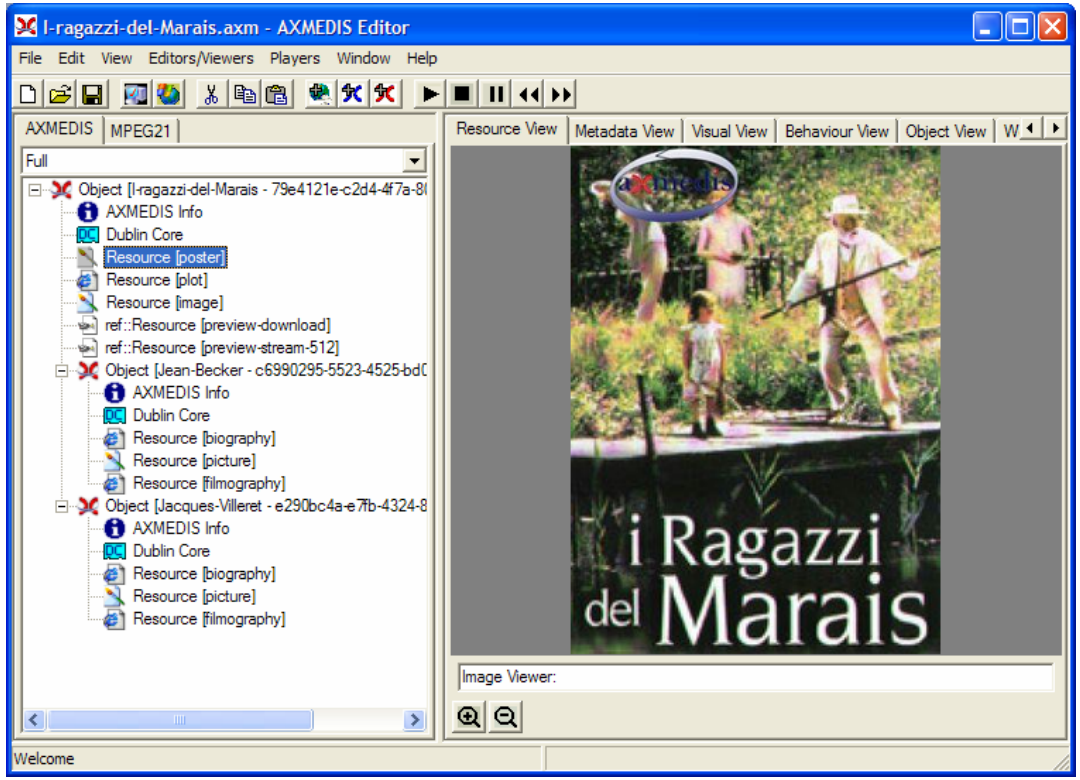
GetInfo


RingtoneAdaptation: getInfo(InputResource, SamplingRate, NumChannels, Bi...
Parameters
in InputResource:RESOURCE
Resource [Test1.wm
The Resource to be converted
out SamplingRate:UINT32
44100
Sampling rate of the input ring tone
out NumChannels:UINT16
2
Number of channels of the input ring tone
out BitRate:UINT16
128
Bit rate of the input ring tone - (default: 64 kb)
out Duration:STRING
0:2:5:1
Duration of the Ringtone File
Result
result:STRING
SUCCESS
The result of the operation, SUCCESS if ok, ERROR followed by a message in case of error
Execute
Close

Clip


RingtoneAdaptation: clip(InputResource, OutputResource, Mimetype, ReadStartingT...
Parameters
in InputResource:RESOURCE
Resource [Test1.wmv
The Resource to be converted
out OutputResource:RESOURCE
New Resource
Where the produced resource will be stored
in Mimetype:STRING
audio/x-mpeg
Mimetype for output resource
in ReadStartingTime:FLOAT
0.0
Starting time for the clip(default: beginning of the file)
in ReadEndingTime:FLOAT
30.0
Ending time for the clip (default: end of the file)
Result
result:STRING
SUCCESS
The result of import, SUCCESS if ok, ERROR followed by a message in case of error
Execute
Close

AXMEDIS Editor



- **AXMEDIS Tutorial on Content Production,**
  - ➔ LT1: Tuesday, December, 12th, 2006 (yesterday)

AXMEDIS Automated Content Processing Tools

Available functionalities in the AXMEDIS Framework

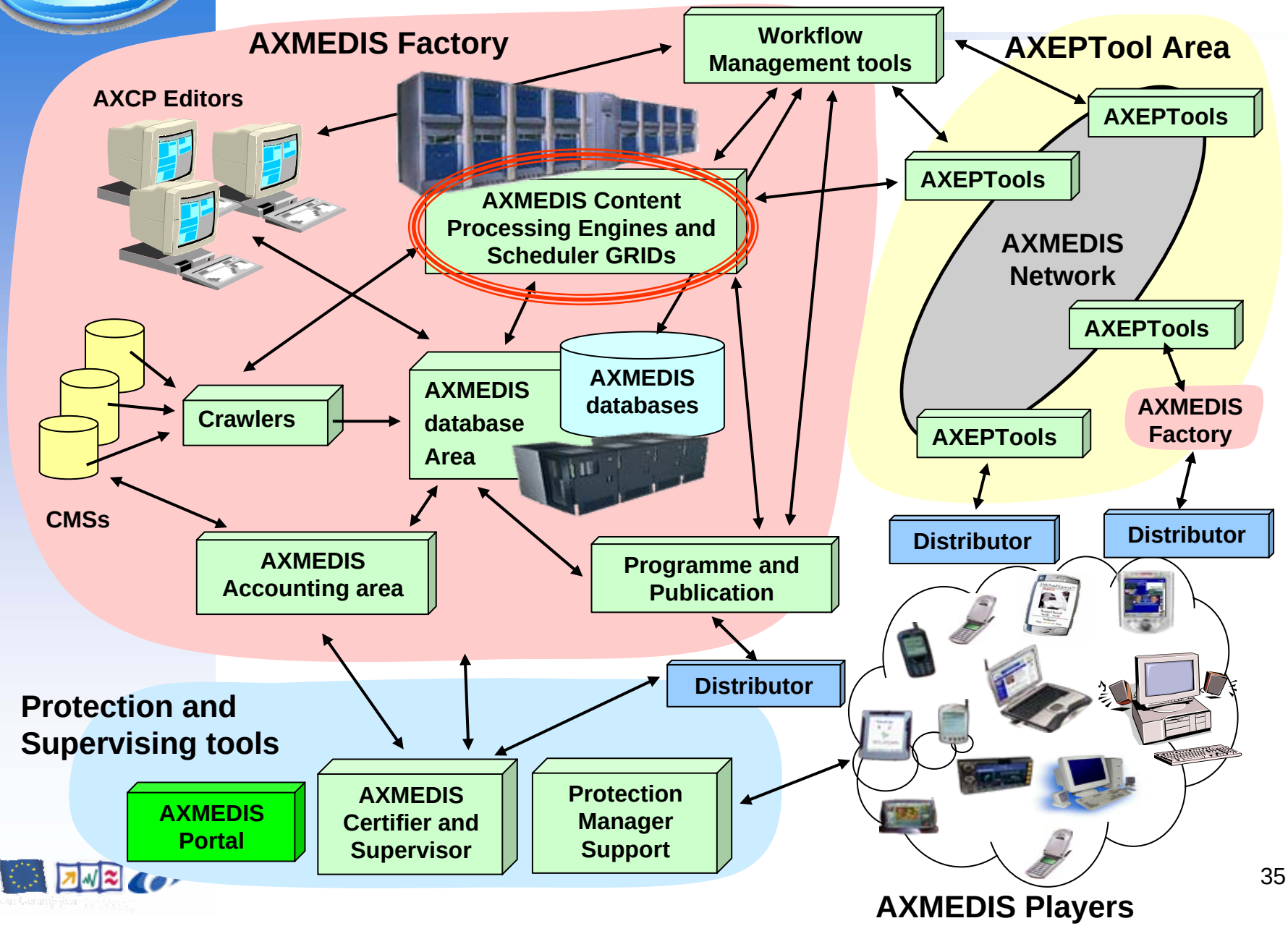
AXMEDIS Automated Content Processing Area

- Properties
- Architecture
- AXMEDIS Content Processing Engine
- AXMEDIS GRID

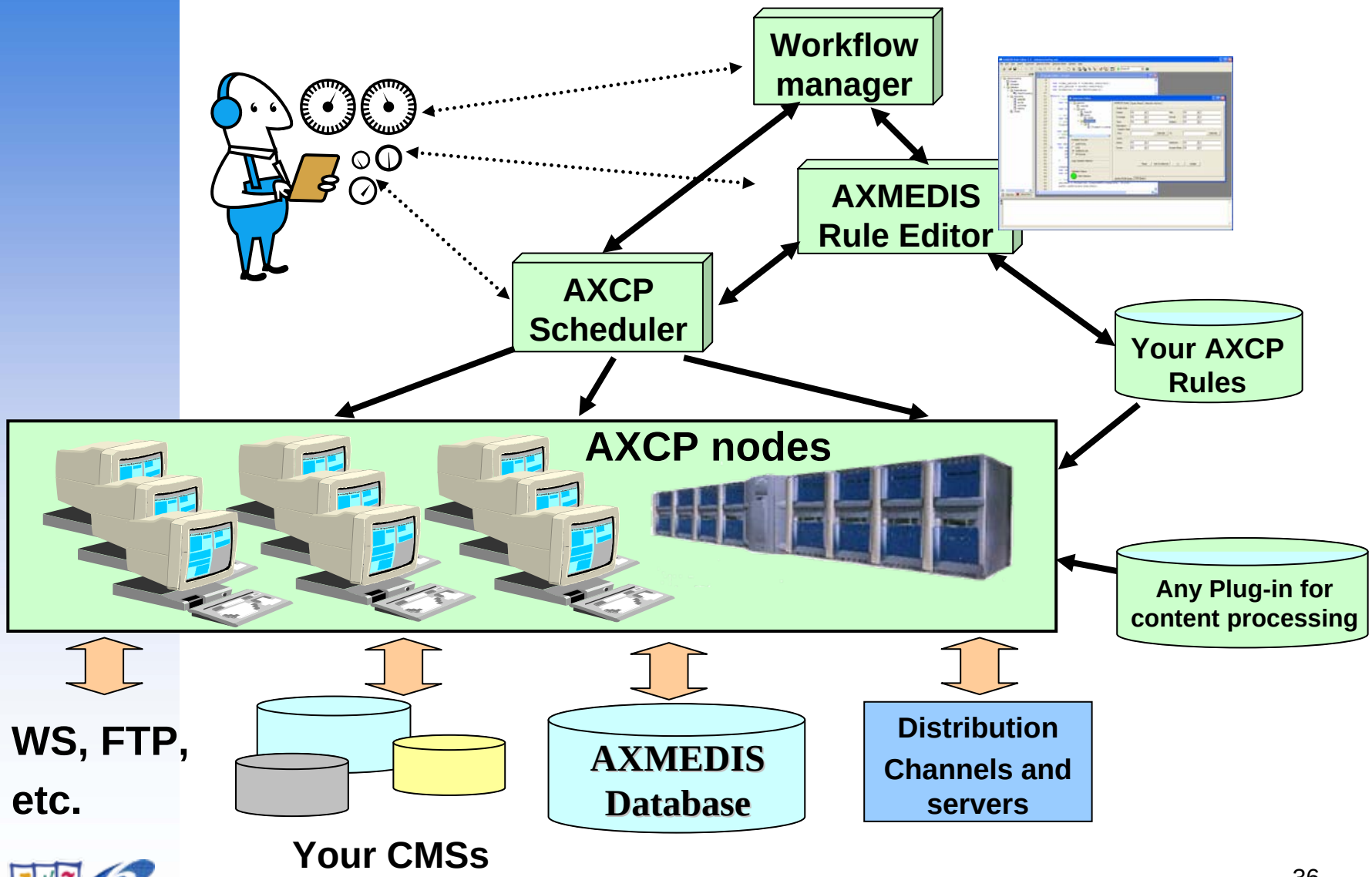
Automatic Content Processing

- **Content distribution and production characteristics:**
  - Content lifetime
  - Demand is time dependent
  - …
- **Example:**
  - Creating a content for a current event
  - Now: winter scenario … started to snow (… or not)
  - ➔ Manual production is (too) time consuming
- **How can the AXMEDIS Automatic Content Processing (AXCP) Area support you?**
  - Scalability
  - Extensibility
  - ➔ Essential functionality to fulfil real world's requirements

AXCP in the AXMEDIS Architecture



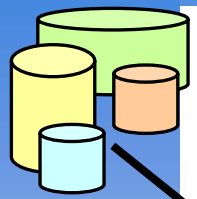
AXMEDIS Content Processing GRID



AXMEDIS Automated Content Processing Capabilities

- **Automated Content and Metadata Retrieval**
  - Content and Metadata Ingestion and Gathering
  - Content Query, Retrieval and Storage
- **Automated Content and Metadata Processing**
  - Content Adaptation and Transcoding
  - Metadata Generation and Mapping
  - Content Composition and Formatting
  - Content Protection and Licensing
- **Automated Content Distribution**
  - Content Publication
  - Content Distribution
  - Profile management and processing
  - Production of Content on Demand

Content production, protection and distribution



Your CMSs

Automatic Content Crawling and AXMEDIS Component Production

Distribution channels

AXMEDIS database

Integrators

Composing

Formatting

P2P B2B network

Providers

Providers

Fingerprint

Adaptation

Protection

Fingerprint Extraction, Descriptor Extraction, etc.

Adaptation of Content, Metadata, DRM, etc.

Object Protection, Encoding, License gen, Governed Object Gen

Content and Metadata Retrieval

- **Access to numerous existing DBs and CMSs for**
  - Content and Metadata Ingestion and Gathering
  - Content Query, Retrieval and Storage
  - Automatic migration of digital contents
- **Access to several different resources**
  - File Systems: Win, Linux, MAC, etc.
  - ODBC, JDBC, etc.
  - Native DB: DB2, Oracle, MS-SQL, MySQL, etc.
  - Protocols: IMAP, POP, Z39.50, etc.
  - XML databases
- **Automation of**
  - Loading and saving of AXMEDIS objects

Content and Metadata Processing

- **Metadata Generation**
  - Calculation of Low and High Level Descriptors
  - For AXMEDIS objects and included resources
- **Metadata Mapping**
  - Managing generic, AXInfo and DublinCore Metadata
- **Content Composition**
  - Putting together content different kinds of raw assets to create a new digital item
    → AXMEDIS Object (or MPEG-21 format)
  - Composing different AXMEDIS objects selected from the AXMEDIS database

Content and Metadata Processing (II)

- **Content Adaptation and Transcoding**
  - Adaptation of content (digital item adaptation, DIA)
  - For distribution via different channels to users' platforms such as i-TV, mobile, PC, etc…
- **Content Formatting**
  - Modifying digital resources according to a specific format
    - File format and properties
  - Applying a (content dependent) formatting style
    - graphic layout
    - spatial constraints
    - quality limitations
    - synchronization between audio and images, etc.

Content and Metadata Processing (III)

- **Content Protection**
  - Preventing un-authorized content access
  - Preventing un-authorized content manipulations
- **Content Licensing**
  - DRM and License production
  - DRM and Licence processing
  - Offline and on-demand services

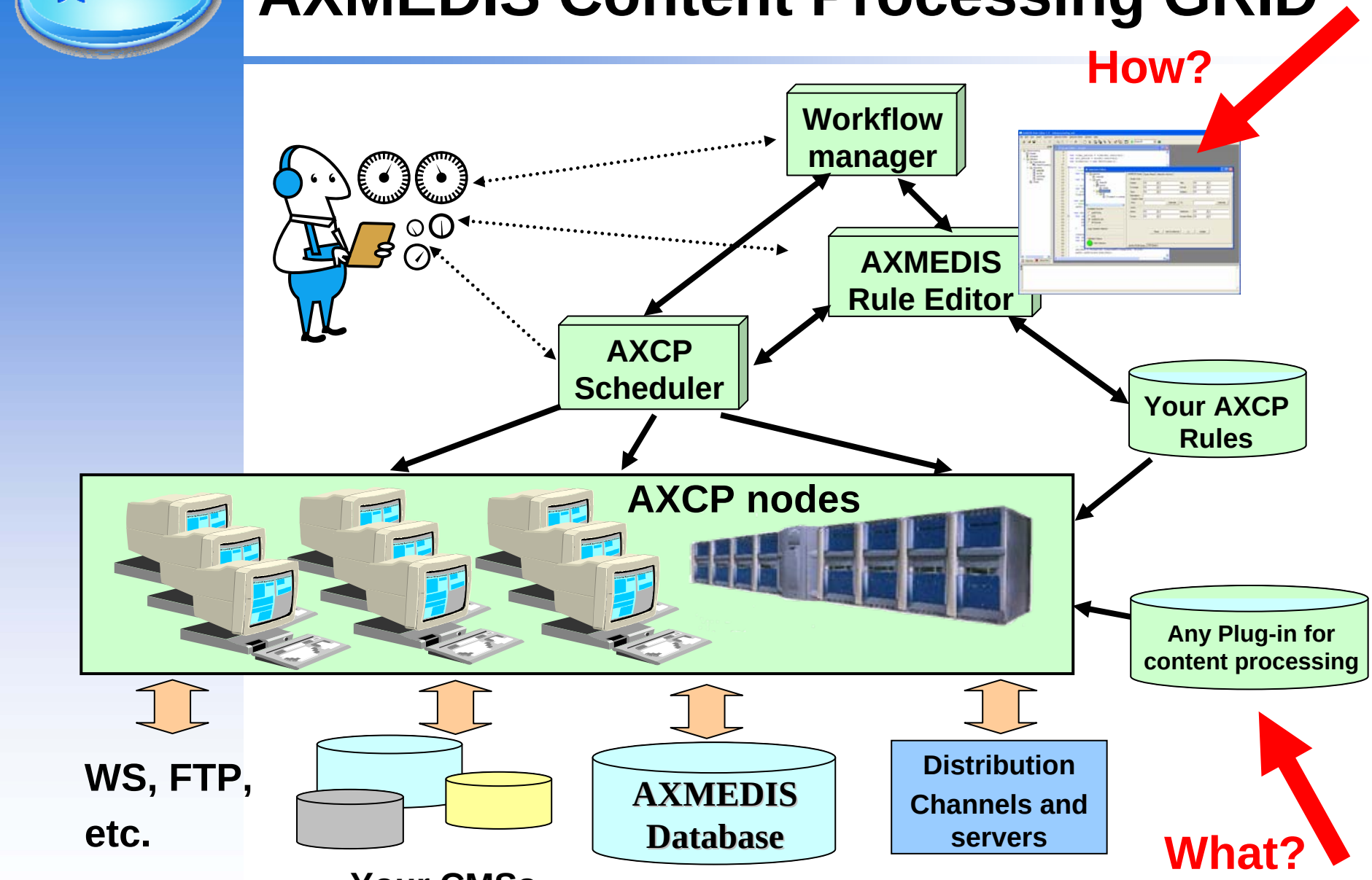
Content Distribution

- **Content Publication**
  - metadata adaptation and mapping
  - publication of AXMEDIS objects on external channels in the B2B distribution (AXEPTools)
- **Content Distribution**
  - AXMEDIS objects distribution via available channels in the B2C scenarios
- **Profile management and processing**
  - Considering the characteristics of transmission channels and receiving device
- **Production of Content on Demand**
  - Creating new content upon customer‘s request

Extensibility

- **Provided functionality is extensible**
- **Plugin Interface**
  - To include further existing tools
  - To include future tools
- **Plugin SDK (Software Development Kit)**
  - For easy integration of your algorithms as plugins
  - Including documentation and source code examples

AXMEDIS Content Processing GRID



How can you automate content processing within AXMEDIS?

Definition of rules for automated content processing

AXMEDIS Scripting Language

- **Rules are expressed in a scripting language**
  - What is a rule?
  - What can be done with a rule?
  - How to write, test and finalize a rule?
  - How to execute a rule?

Rules within AXMEDIS

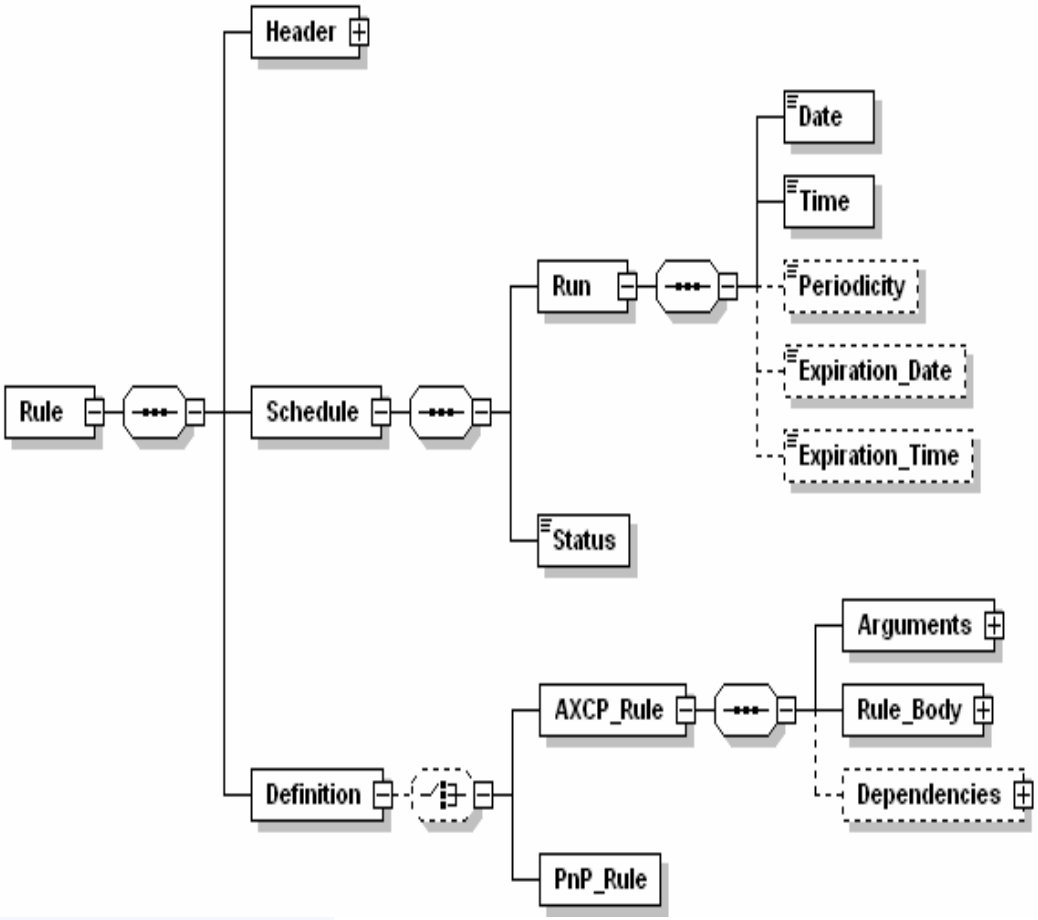
- **An AXCP Rule is a scripted procedure:**

$$R = f(S_1, S_2, .., S_n, P_1, \ldots, P_m)$$

Where:

- S_i is a database Selection
  - **It is a sequence of queries to be sent to the AXMEDIS Database to retrieve objects IDs;**
- P_i is a parameter (basic type as integer, string, Boolean, etc.);
  - For example, coordinates for a formatting, size or value of object collection to be created, destination of the objects, name of the author, etc.
- f is the identifier of rule (name of rule or an ID);
- R is the result of the rule application.
  - **It can be a new AXMEDIS object, or a metadata manipulation, the license of an AXMEDIS object, a message to be returned to invokers, etc…**

AXCP Rule XML description



- General metadata regarding: rule name, AXRID (rule identifier), rule version, rule type, software name, version of software, date of production, time of production, author, affiliation, URL, comment, last modification and terminal ID. (*Header*)
- Temporal metadata describing conditions for firing the rule, expiration time, periodicity and the rule status (“active” or “inactive”) and (*Schedule*)
- List of arguments (parameters and selections), list of dependences (required AXMEDIS plug-ins) and the rule body (the script code to run).(*Definition*)

AXCP Script Language

- **AXCP Rules are formally based on a script language**
- **Basis: Javascript Language (Spidermonkey by Mozilla)**
- **Extended functionality that is provided by the AXMEDIS framework for managing**
  - AXMEDIS Objects, Digital Resources
  - License, Metadata
  - Network, Database Access and Web Service
  - Profiling (user, device, context)
  - ...
- **Additional functions/utilities**
  - File System management
  - Invoking/Execution of external tools
  - MimeType management
  - Zip/Unzip Archive

➔ **Everything that can be done manually with AXEditor can be done automatically with the AXCP**

➔ **… and more ☺**

AXCP Tools:
Rule Editor

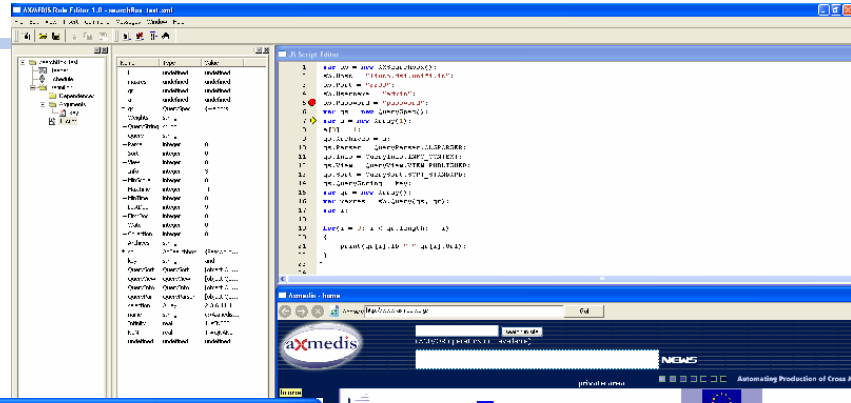
Where and how to write, test and execute rules

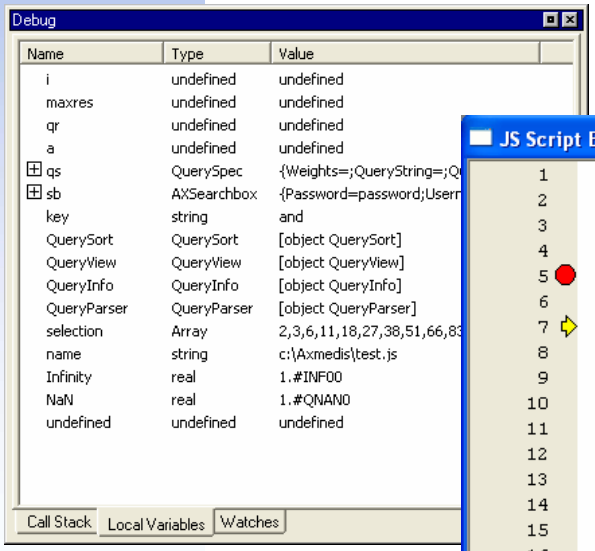
AXCP Rule Editor

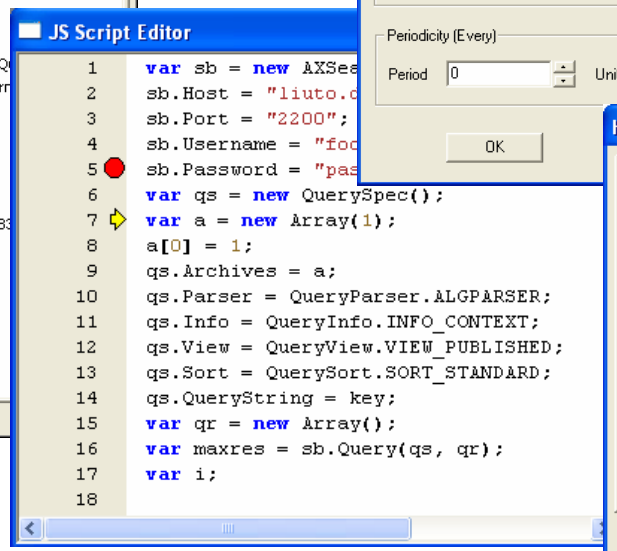
- **IDE (integrated development environment) for creating, testing and managing AXCP rules**
- **Provides a set of tools and views to help the user during the editing and building of rule.**
- **Integrates the AXCP rule executor in order to provide functionalities for:**
  - executing, debugging, testing and validating
- **Provides an online help**
  - Documentation about script functions and classes of the AXCP Script Language.
  - List of AXCP Plugins and documentation about exposed functionalities

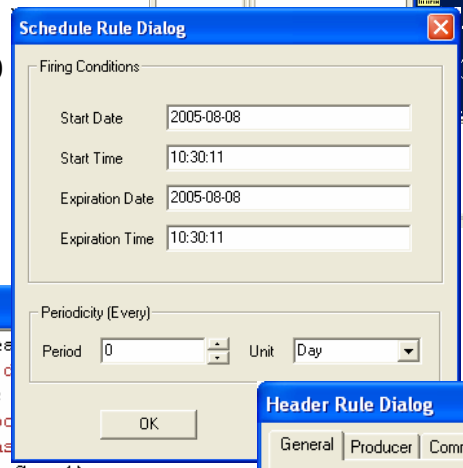
AXMEDIS Content Processing Area: *AXCP Rule Editor*

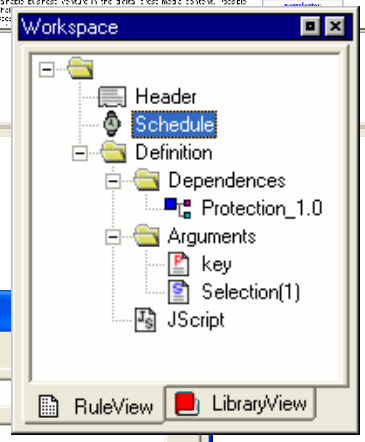
- It is an IDE tool for:
- Creating and editing AXCP Rules
- Defining parameters and required AXMEDIS Plugins
- Editing, checking and debugging JS code
- Activating AXCP Rules into the AXCP Rule Engine

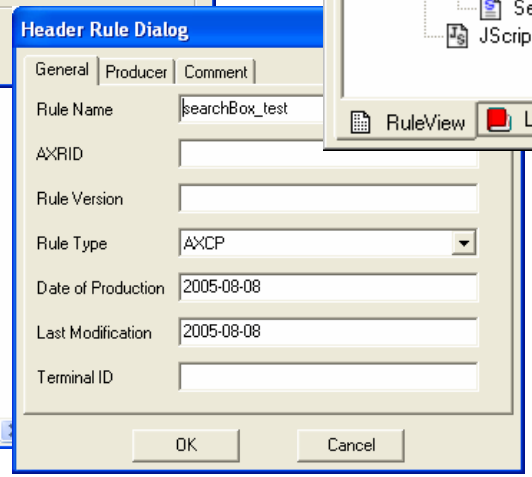




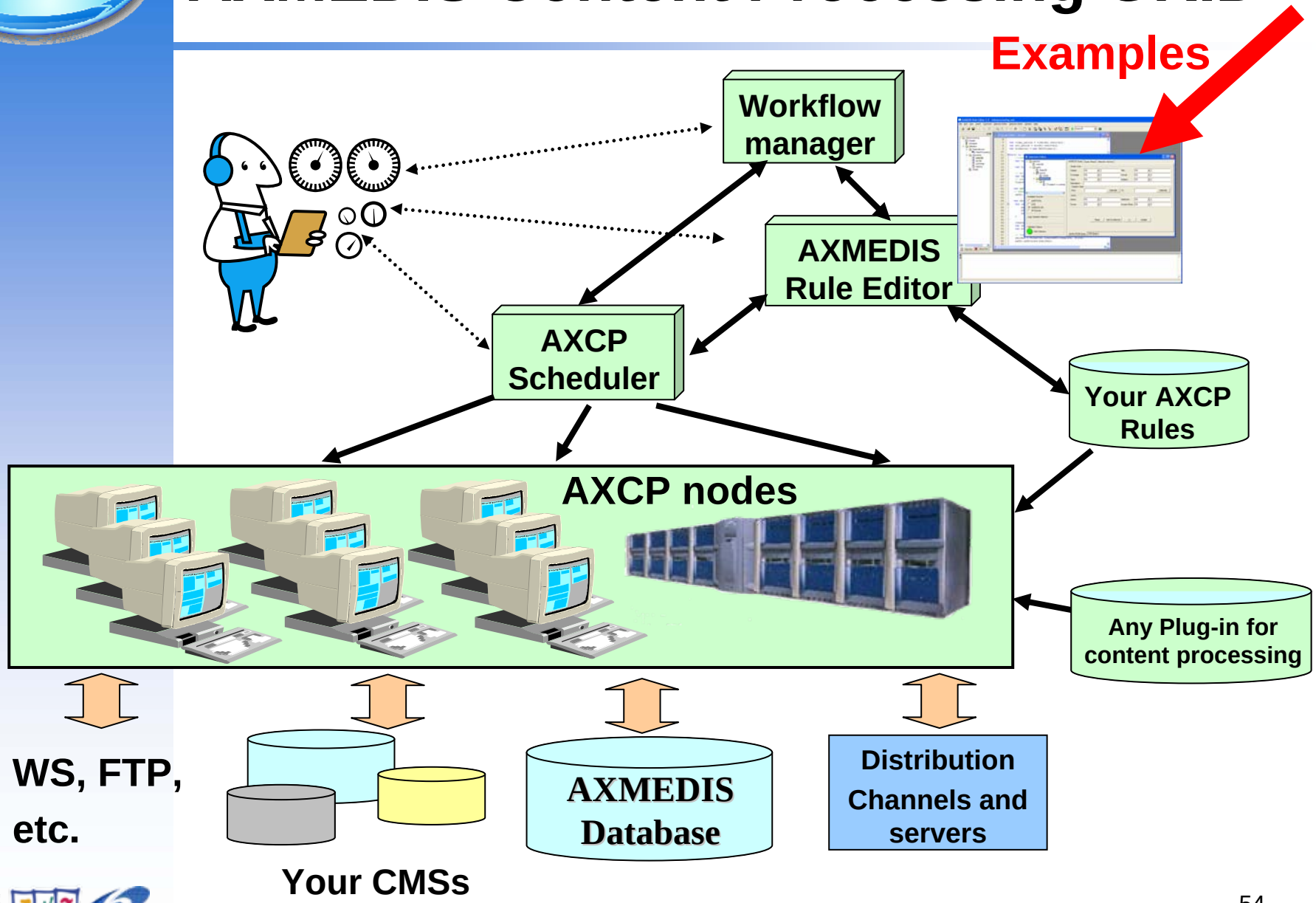








AXMEDIS Content Processing GRID



Examples

Using the Available Functionality for Automated Content Processing

Simple Rule without parameters

- **Example 1 of the User Manual DE5.0.1.1**
- **Goal:**
  - Create a simple script for resizing an image resource named AXMEDIS_logo.png stored in the C:\\ path and saving the new resized image on the disk.
- **Method:**
  - Writing and debugging the script
  - Comparing the original and new to see the result

Steps

1. Create an empty digital resource (image)
2. Load the image file into the resource
3. Use the Image Processing plug-in for scaling the image resource
4. Saving the scaled image resource

Rule Parameters

- **Example 2 of the User Manual DE5.0.1.1**
- **Goals:**
  - Create a simple script for resizing an image resource stored on file system and saving the new resized image on the disk.
  - Generalize the previous script inserting some arguments in the script.
    - Location for loading and saving the image
    - Resulting image dimensions
    - Output image format
  - Obtain a rule that will remain valid and will be not modified in the future.
- **Method:**
  - Writing and debugging the script

Steps

Parameter definition

1. Definition of rules arguments (*input_path, output_path, width, height, out_mime_type*)

2. Create an empty resource

Parameter usage

3. Load the image file by the *input_path* argument

4. Use the Image Processing plugin for *scaling* the image

5. Use the Image Processing plugin for *conversion* the image

6. Resulting image is saved in the location specified by the *output_path* argument

Creating AXMEDIS Objects

- **Example 3 of the User Manual DE5.0.1.1**

- **Goal:**
  - Example 2 (Loading manipulating image resource)
  - Converting the resource into a different format
  - Create an AXMEDIS object
  - Filling metadata
  - Embedding an image resource
  - Storing on disk and/or uploading on DB

- **Method**
  - Write and debugging the script
  - Show of the produced AXMEDIS Object with AXEditor

Steps:

1. Definition of rules arguments (*input_path, output_path, width, height, out_mime_type*)
2. Create an empty resource
3. Load the image file by the *input_path* argument
4. Use the Image Processing plugin for *scaling* the image
5. Use the Image Processing plugin for c*onversion* the image

AXMEDIS objects

6. Creating an empty AXMEDIS object
7. Adding meta data and the image resource
8. Save the AXMEDIS object
9. Open the AXEditor for visualisation

“Full Round” AXMEDIS Automated Object Production

- **Steps:**
  - Example 3 (previous example: AXObject creation)
    - Filling metadata
    - Embedding a resource
    - Adapting the resource into a different format
  - Registering Object
  - Protecting Object
  - Creating and storing licenses
  - Storing on disk and/or uploading on DB

- **Method**
  - Write and debugging the script
  - Show of the produced AXMEDIS Object with AXEditor

Steps:

1. Setting of the license related parameters
2. Create an empty resource and AXMEDIS object
3. Load the resource
4. Adding meta data and the resource in the AXMEDIS object

DRM operations

5. Save the AXMEDIS object on disk and AXMEDIS database
6. Creating licences for distribution
7. Creating license for the end user
8. Fruition – Using the AXMEDIS object

Automated Content Processing

- **What you have seen**
  - What is a rule and what can be done with it?
  - Writing a rule in the AXCP Rule Editor for automated content processing?
  - How to execute and testing a rule in the AXCP Rule Editor?
- **Next:**
  - Extended functionalities for content processing

Which further functionalities are available?

Extended functionalities provided by the AXMEDIS Framework for Automated Content Processing

Examples: Extended Functionalities

- Content Description and Meta Data Creation
- Meta Data Mapping
- Adaptation and Transcoding
- Content Authentication

Content Description and Meta Data Creation

- **Automatic extraction/calculation of**
  - Low Level Descriptors (LLDs)
  - Perceptual Hashes/Content Fingerprints
  - High Level Descriptors (LLDs)

- **List of available functionalities**
  - Audio - LLDs
    - MPEG-7 AudioWaveform
    - MPEG-7 AudioPower
    - MPEG-7 AudioSpectrumEnvelope
    - MPEG-7 AudioSpectrumCentroid
    - MPEG-7 AudioSpectrumSpread
    - MPEG-7 AudioSpectrumFlatness
    - Mel-Frequency Cepstrum Coefficients

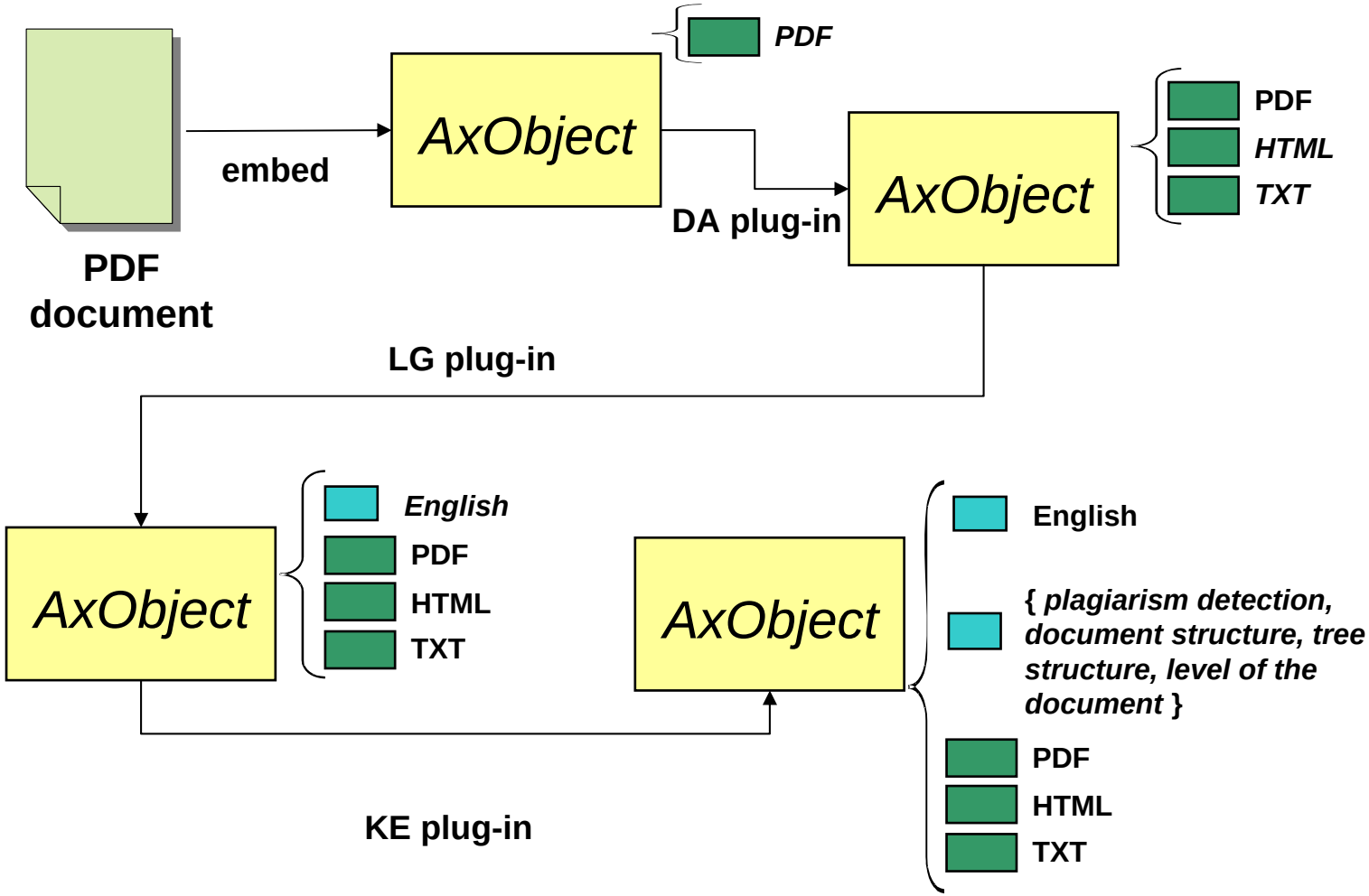
Content Description and Meta Data Creation (II)

- **Continued list of available functionalities**
  - Audio – HLDs
    - Rhythm
    - Audio File Segmentation
    - Music Genre
  - Video
    - Basic Integration of MPEG-7 reference implementation
  - Text
    - Language Guesser
    - Keyword Extraction

Demonstration: Text processing

- **Document Adaptation (DA)**
  - transcoding between various text formats (PDF, HTML, Postscript, RTF, plaint text)
- **Language guesser (LG)**
  - Retrieving the main language from a plain text document
- **Keyword extractor (KE)**
  - Extraction of mono-term and multi-term keywords from an plain text (English, Italian, German, Spanish and French, only English is implemented so far)
- **Automatically extracted descriptors can be used to fill AXMEDIS objects metadata, allowing better search results.**

Text Processing



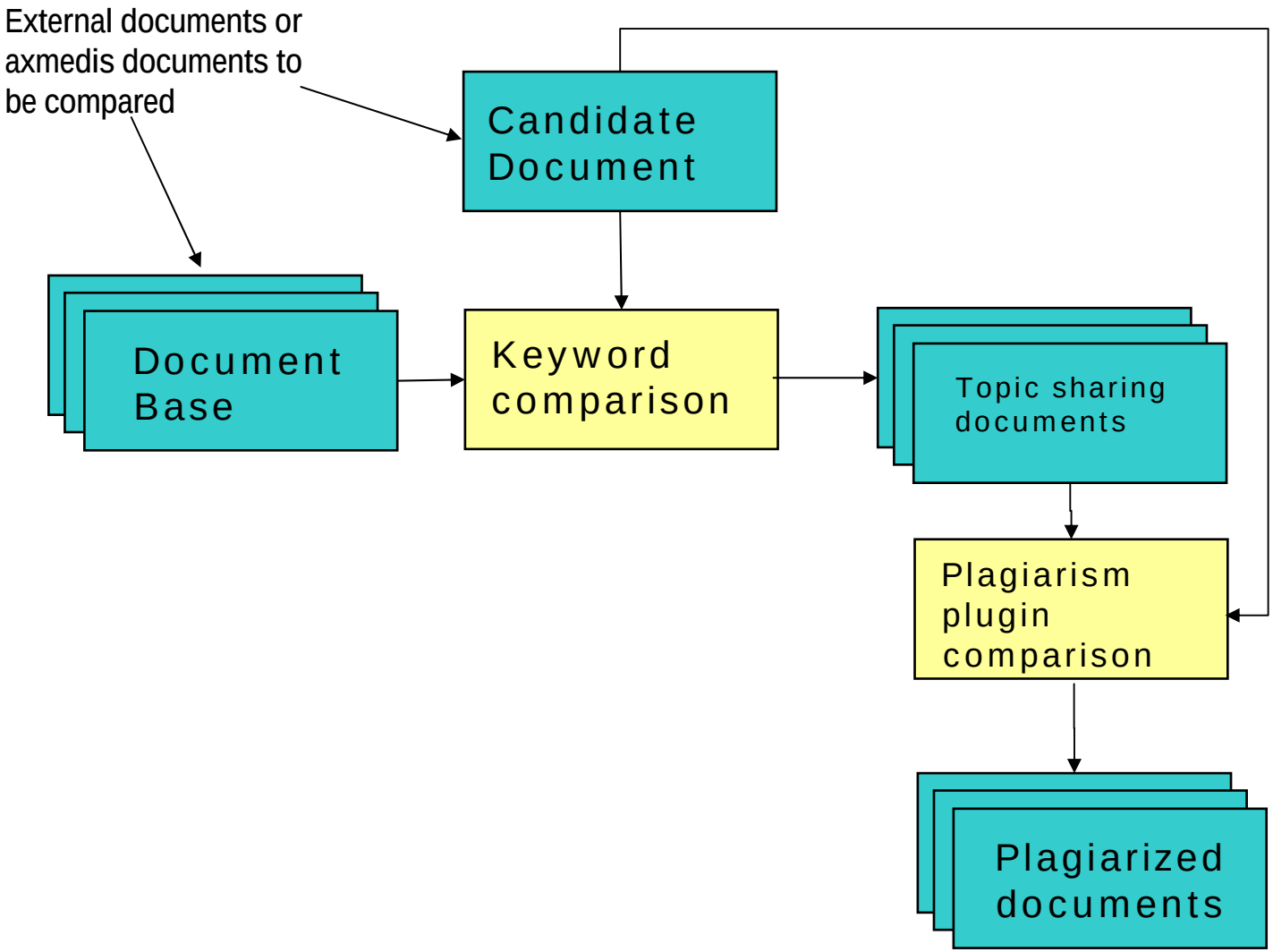
Steps

1. Loading resource
2. Transcoding to HTML
3. Embedding the HTML resource in the object
4. Transcoding to plaint text
5. Embedding the plain text resource in the object

Plagiarism detection plug-in

- Detection of plagiarism behaviour: plagiarism between two textual documents
- Basic model: a set of modifications (insertion, deletion, substitution) performed
- Return value: normalised similarity value
- Can be combined with other tools, e.g. keyword extractor

Plagiarism plugin usage scenarios



Steps

1. Defining the reference document
2. Defining the documents to compare with
3. Comparing the documents

Adaptation and Transcoding

- **Transcoding to and from numerous formats**
- **Supported media types:**
  - Audio
  - Images
  - Text
  - Video
- **Metadata Adaptation**
- **Rights Information Adaptation**
  - Licenses: MPEG-21 ←→ OMA
- **Dynamic Transcoding**
  - ➔ See: Workflow Tutorial, today, starting 2pm

Audio Adaptation

- **Goal:**
  - Genre detection (only possible with WAVs)
- **Steps**
  - Loading the input resource (MP3 format)
  - Converting the input resource to WAV
  - Apply a genre detection
  - Output: genre

Meta Data Mapping

- **Manages**
  - Generic, AXInfo and DublinCore Metadata
- **Provides functionalities for**
  - Extracting Metadata from an AXMEDIS Object
  - Adapting Metadata
    - Loading adaptation style sheet
    - Transforming extracted metadata
  - Embedding the transformed metadata into an AXMEDIS Object

Steps

1. Open AXMEDIS object
2. Initialize the Metadata Mapper
3. Extract the Metadata from the AXMEDIS object
4. Load the saved XSLT file from the disk
5. Transform the metadata producing the new Metadata
6. Embed the new metadata into an AXMEDIS Object
7. Save the AXMEDIS Object

Content Authentication

- **Cryptographic Hash Functions**
  - All kind of content
- **Perceptual Hash Functions**
  - Audio
  - Images
  - Video

Further Functionalities

- I/O functions
- File and directory access
- Profiling of devices, distribution channels and users
- Network access: FTP, HTTP, ODBC, webservices, ...

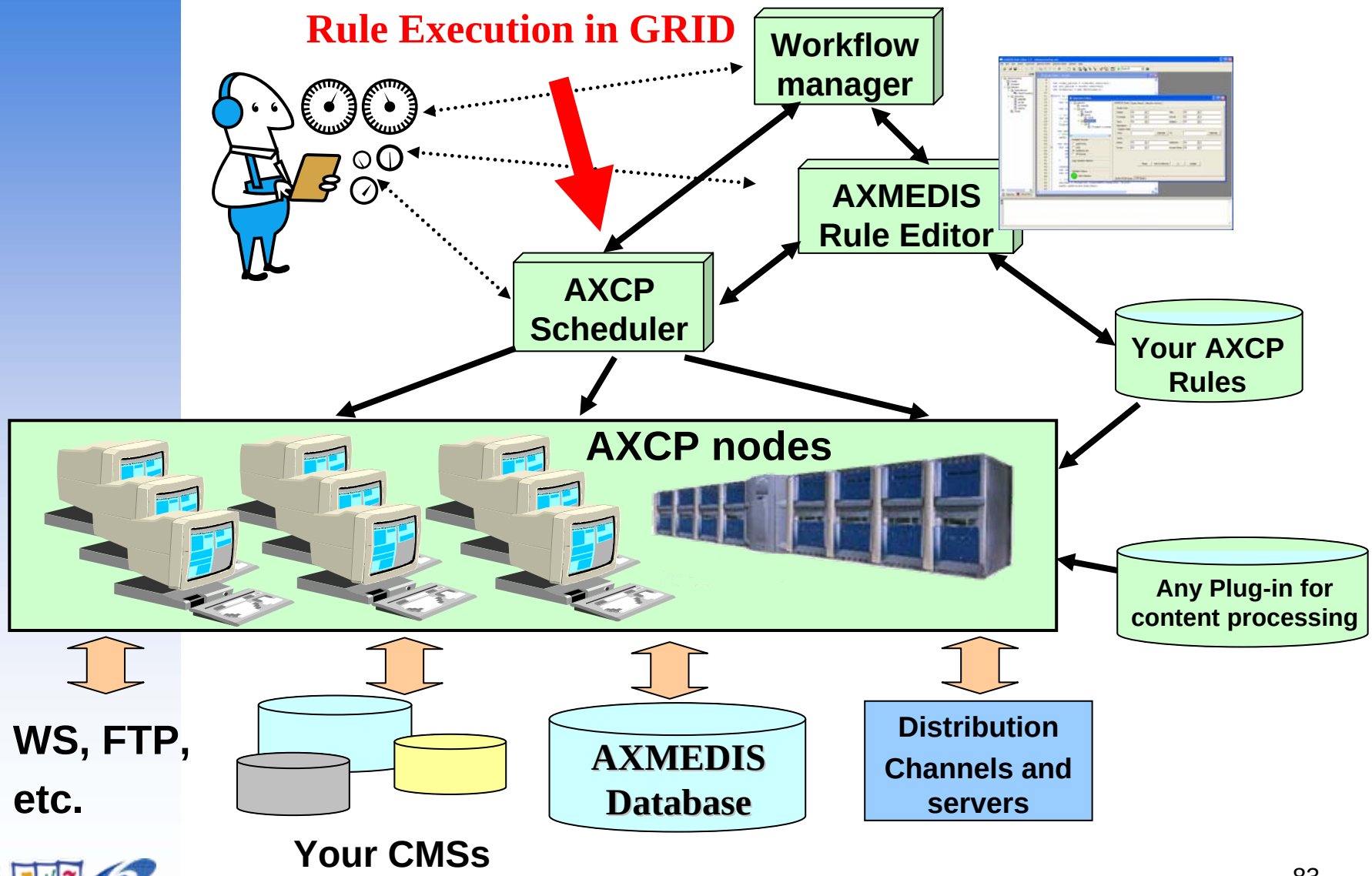
Summary

- **Why to automate content processing processes**
- **Automated content processing in AXMEDIS**
  - Writing, executing and debugging rules
  - Available functionality
  - Examples for using the available functionality

AXMEDIS Tutorial on Content Processing - Part II

- AXCP Rule Scheduler
- AXCP GRID
- Complex Scenarios
- Summary and Conclusion
- Discussion, Questions and Answers

AXMEDIS Content Processing GRID



AXCP Rule Engine

Managing the Rule Execution in the AXMEDIS Grid

AXCP Rule Engine

- **Consists of**
  - Rule Scheduler (Server Side)
  - Rule Remote Executor (Client Side): AXCP GRID Node
- **Rule Scheduler: Internal Scheduler and Dispatcher for**
  - rule installation
  - rule firing
  - rule executor discovering and management
  - rules scheduling and dispatching according to the executor profile
  - communication with the AXMEDIS environment (workflow)
  - ...
- **Rule Remote Executor**
  - Consisting of the same JavaScript engine

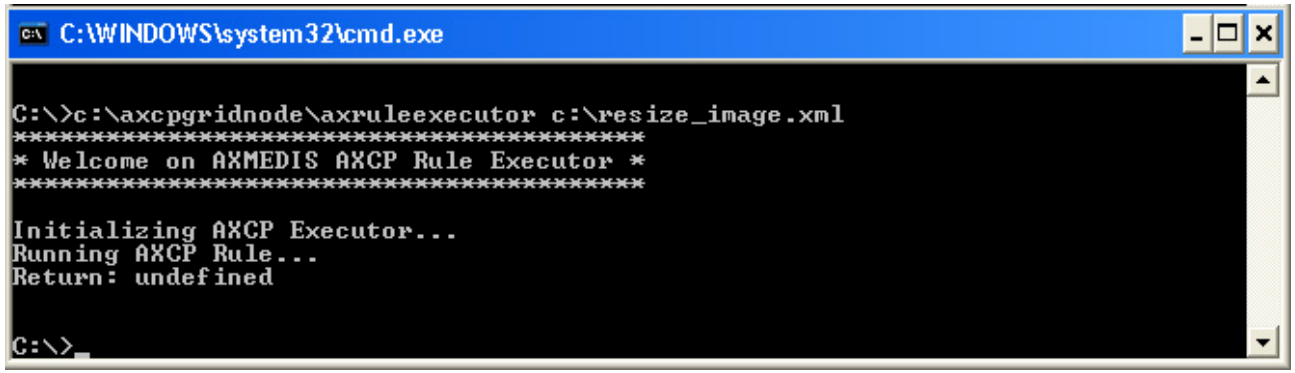
AXCP Scheduler: Functionalities

- Install & Activate a Rule in AXCP Grid
- Run a Rule in AXCP Grid
- Deactivate a Rule
- Suspend a Rule
- Pause a running Rule
- Resume a previously suspended Rule
- Kill a Rule immediately
- Remove a Rule from the AXCP Grid
- Determine the Status for any Rule in the Grid
- Retrieve the Logs for any Rule in the Grid
- Retrieve the List of Rules in the Grid
- Retrieve a particular Rule in the Grid

➔ manually or with a remote client (e.g. workflow)

Remote Rule Executor

- **Application**
  - Standalone



  - Node of the GRID

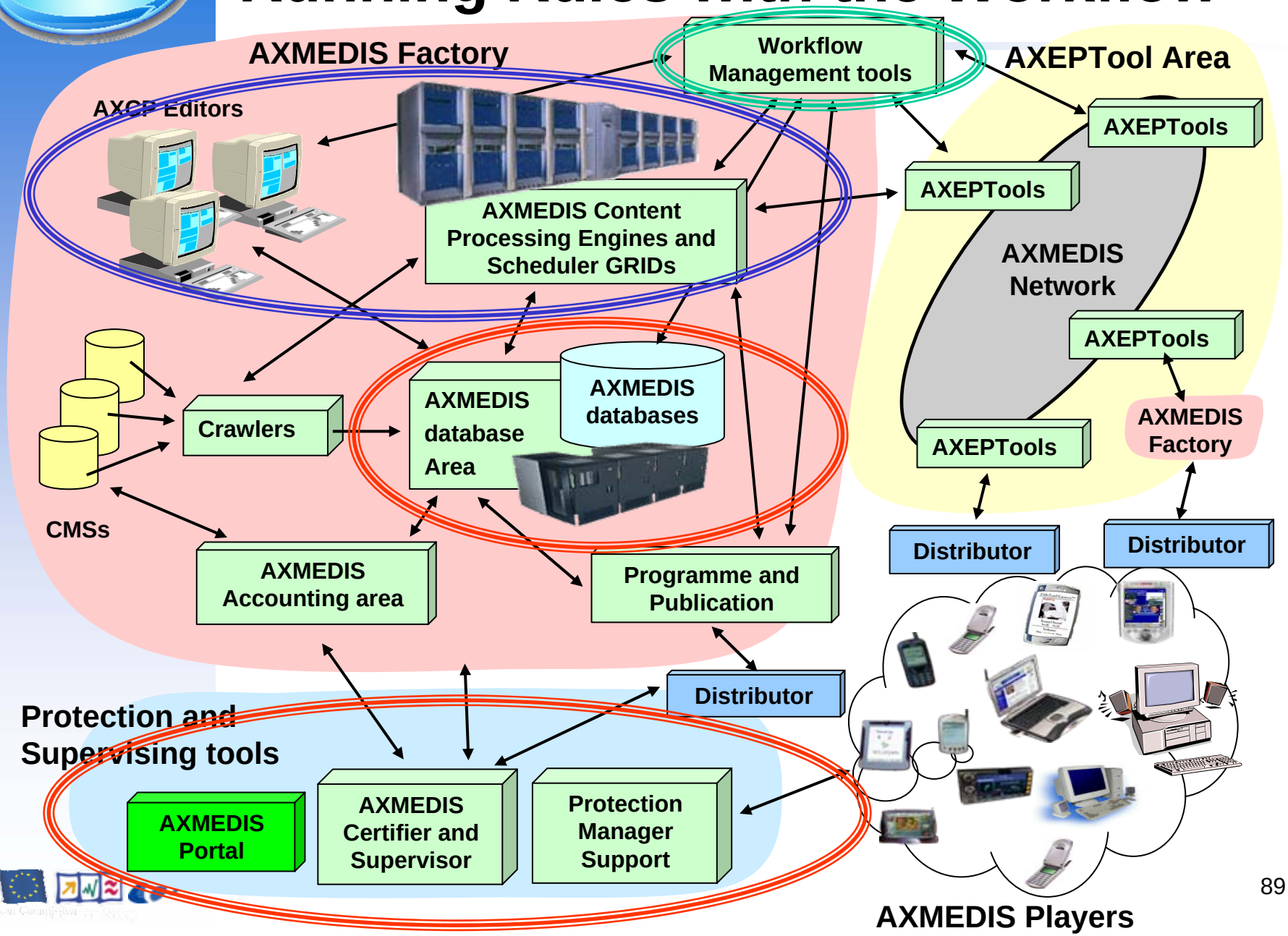
- **Properties**
  - CPU Monitoring
  - CPU Workload Constraints
  - Communication with the Scheduler (GRID Node)

AXCP GRID Node

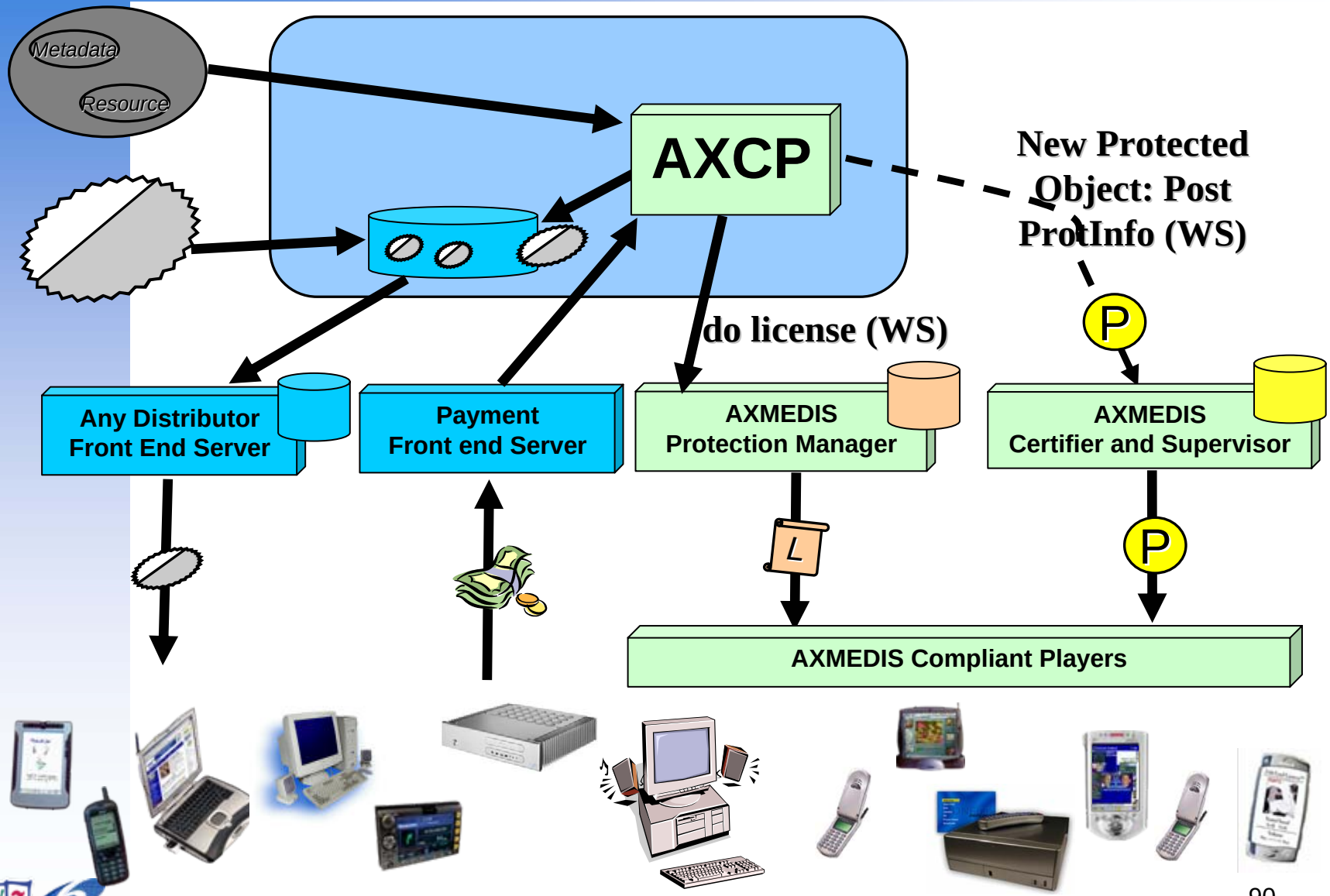
- **Workload setting (see configuration.xml)**

```
<Module category="" id="WORKLOAD_SETTINGS">
    <Parameter name="MON" type="string">
        0;0;0;0;0;0;30;50;30;30;20;30;45;50;20;30;45;50;30;30;0;0;0;0
    </Parameter>
    <Parameter name="TUE" type="string">
        0;0;0;0;0;0;30;30;30;30;20;30;45;50;20;30;45;50;30;30;0;0;0;0
    </Parameter>
    <Parameter name="WED"  type="string">
        0;0;0;0;0;0;30;30;50;60;20;30;45;50;20;30;45;50;30;30;0;0;0;0
    </Parameter>
    <Parameter name="THU" type="string">
        0;0;0;0;0;0;60;60;60;60;20;30;45;50;20;30;45;50;30;30;0;0;0;0
    </Parameter>
    <Parameter name="FRI" type="string">
        0;0;0;0;0;0;50;50;50;50;20;30;45;50;20;30;45;50;30;30;0;0;0;0
    </Parameter>
    <Parameter name="SAT" type="string">
        0;0;0;0;0;0;50;50;50;50;20;30;45;50;20;30;45;50;30;30;0;0;0;0
    </Parameter>
    <Parameter name="SUN" type="string">
        0;0;0;0;0;0;50;50;30;70;20;30;45;50;20;30;45;50;30;30;0;0;0;0
    </Parameter>
</Module>
```

Running Rules with the Workflow



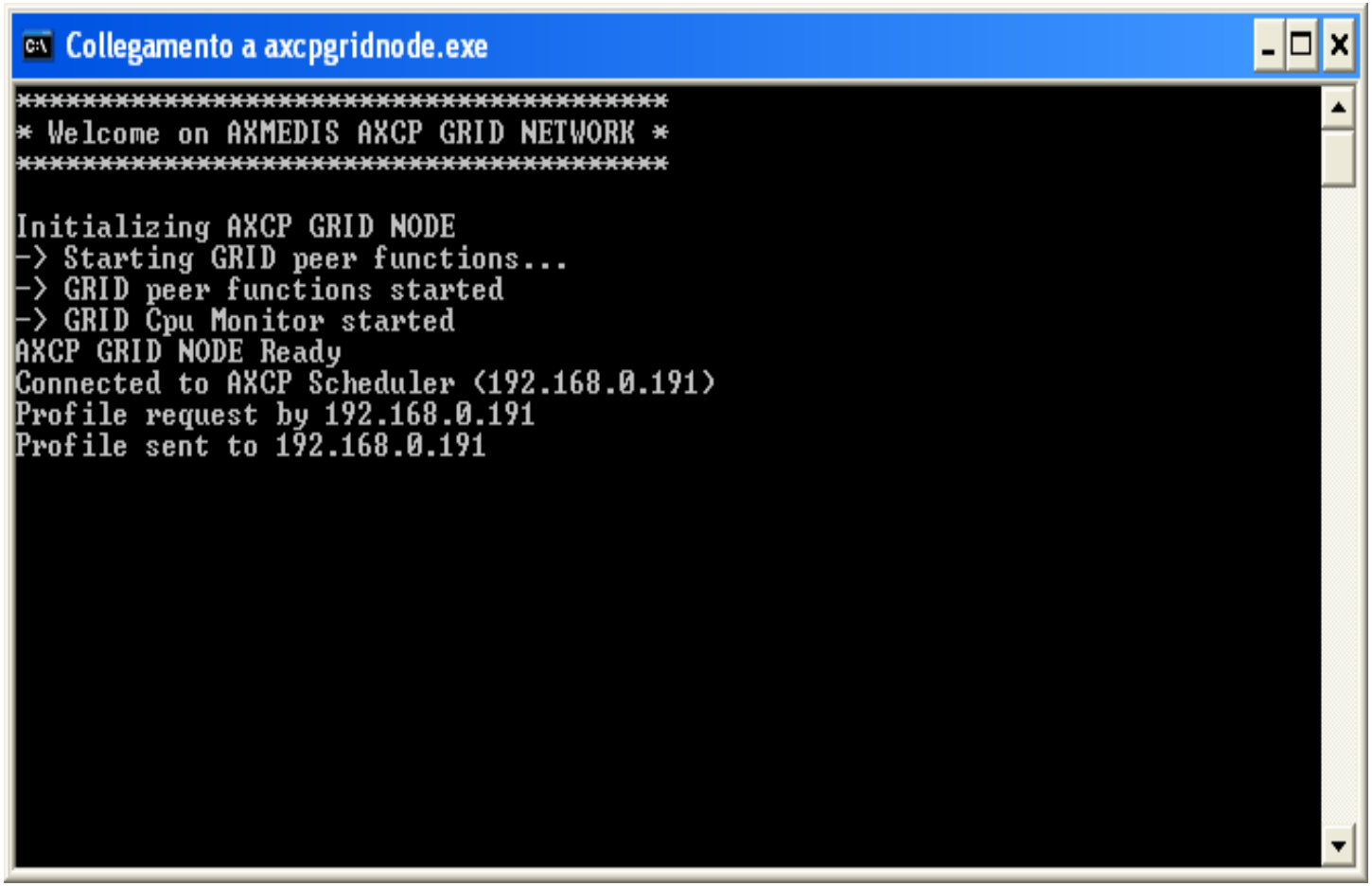
AXMEDIS The Protection and Control Process



GRID in action

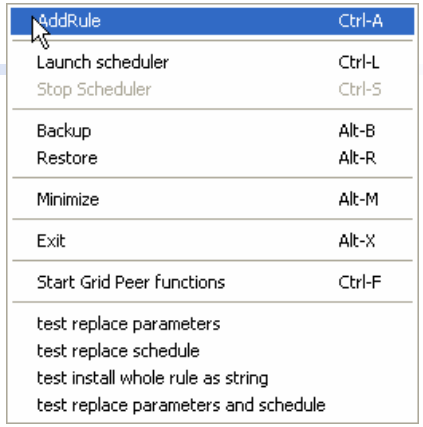
- Put in Execution the Scheduler
- Put in Execution the single GRID Nodes
- Joining of nodes to the GRID
- On the AXCP Editor: Installing Rules
- On the Scheduler: Running Rules with the Workflow

Discovered AXCP GRID Node



Installing Rules

- **Manually using the scheduler**



- **Installing rules with the AXCP Editor**
  - Script for Automated Production of content and production of licenses
- **Activating rule using external application**
  - AXCP Rule Editor, Workflow, …
  - Workflow is activating them
- **Running a rule**
  - On-demand execution

```
sending message: refName=Mario Rossi to scheduler..
sending message: status=U to scheduler..
sending message: toolProdRegDate= to scheduler..
sending message: toolProdRegDeadline= to scheduler..
sending message: toolProdStatus= to scheduler..
sending message: typeOfUser=1001 to scheduler..
sending message: webSite=http://www.axmedis.org/ to scheduler..
sending message: Adding PAR (A,B1,B3 type) to ADAPTED object to scheduler..
sending message: Uploading unprotected ADAPTED object on Factory DB to scheduler
..
sending message: Adapted Object: Asking for definitive AXOID to AXCS to schedule
r..
sending message: Uploading unprotected ADAPTED object on Factory DB to scheduler
..
sending message: Applying Protection Info to ADAPTED object to scheduler..
sending message: Registering ADAPTED object to AXCS to scheduler..
sending message: Uploading protected ADAPTED object in Distribution DB to schedu
ler..
sending message: Creating Licenses (MA,MB1 and MB3) to scheduler..
sending message: Creating License MA to scheduler..
sending message: 200:LID662 to scheduler..
sending message: Creating License MB1 to scheduler..
sending message: 200:LID663 to scheduler..
sending message: Creating License MB3 to scheduler..
```

Program Settings View Commands ?

Rule Name	AXRID	Rule Version	Rule Status	Job ID	Executor ID	Start Time	Start Date	Periodicity	Number of ...	Installation ...	Expiration ...
ScriptProduc...	axcprule:1...		running	3	1	21:22:49	12/12/2006	0 Day(s)	0	2006-12-12...	2006-12-13...
ScriptProduc...	axcprule:1...		delayed	4	-1	21:22:50	12/12/2006	0 Day(s)	0	2006-12-12...	2006-12-13...

Executor N...	IP Address	CPU Type	Clock	OS	Transfer Rate	HD Space	Status	Job ID	Executor ID	Cpu Usage	From
IVAN-PORTA...	192.168.0.191	x86 Family ...	1.60 (GHz)	Windows N...	1 (MB/s)	20.80 (GB)	busy	3	1	0.00%	21:00:00
SIEMENS	192.168.0.216	x86 Family ...	798.00 (MHz)	Windows N...	185 (KB/s)	27.55 (GB)	ready	-1	3	0.00%	20:00:00
PC1355	192.168.0.247	x86 Family ...	1.79 (GHz)	Windows N...	187 (KB/s)	21.09 (GB)	ready	-1	4	0.00%	21:00:00
BAZOOLA	192.168.0.242	x86 Family ...	1.73 (GHz)	Windows N...	115 (KB/s)	12.46 (GB)	ready	-1	5	0.00%	21:00:00

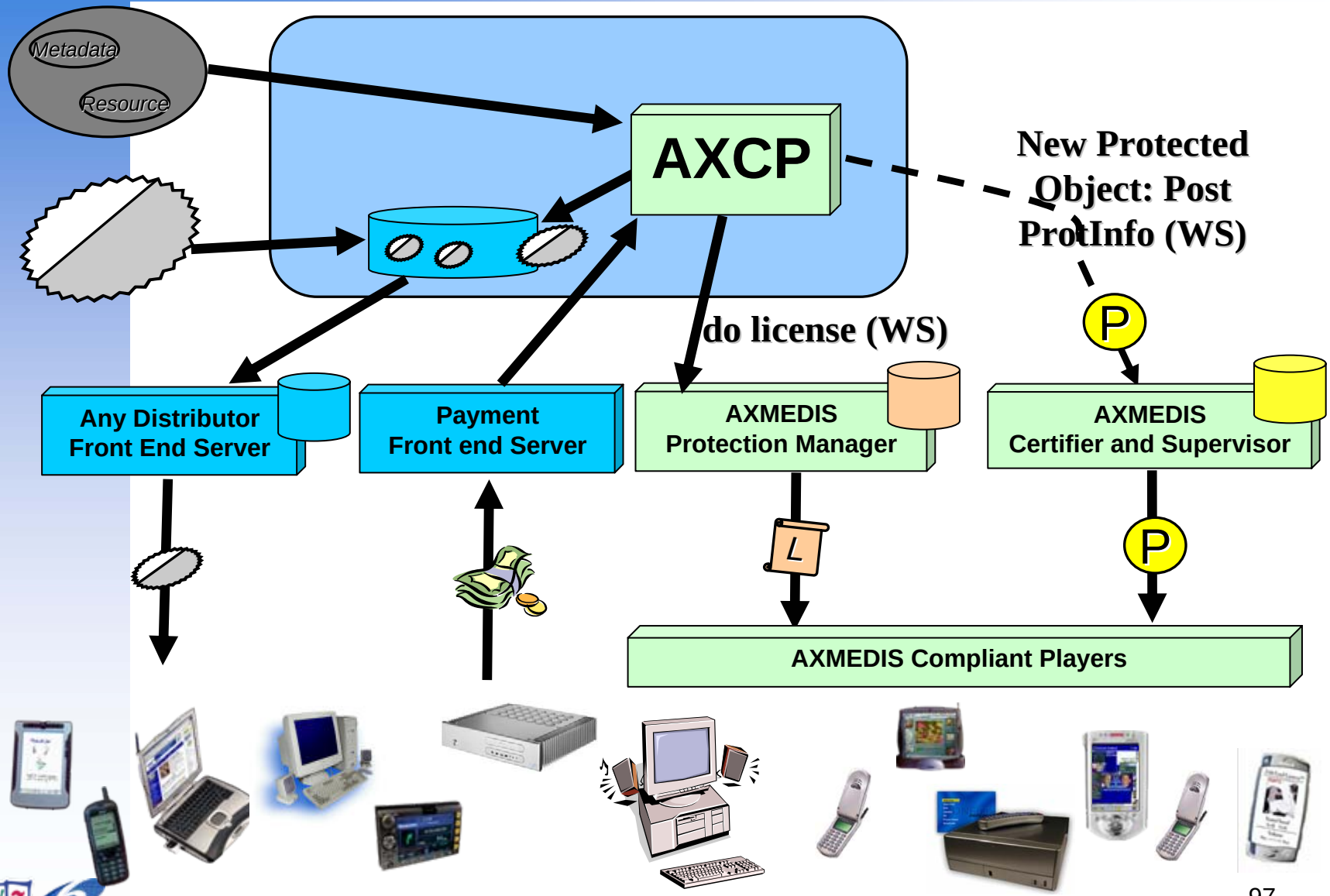
Massive Production of AXObjects

- **Distributed workload**
  - Steps
    1. Loading raw resources from file system
    2. Content adaptation
    3. Content protection
    4. Posting protection information on AXCS
    5. DRM Licensing:
       1. Production of Mother license for distribution
       2. Posting of licenses on the PMS
       3. Production of some final user licenses only for adapted objects
       4. Posting of licenses on the PMS
    6. Distribution
  - Results
    1. Master Version (protected and unprotected)
    2. Adapted Objects (protected and unprotected)

What is produced

- **Some Different GRID nodes**
  - only two of them have capabilities to manage the rules in terms of plugins installed
- **Two rules activated on two different nodes**
- **The rules work on some resources**
  - a PDF is adapted to produce two objects in TXT and HTML
  - From an MP3 is produced an object
  - A wav file is adapted to produce an object with an MP3
  - From images in different formats, some adaptation resizing are performed
- **More than 30 AXMEDIS objects are created**

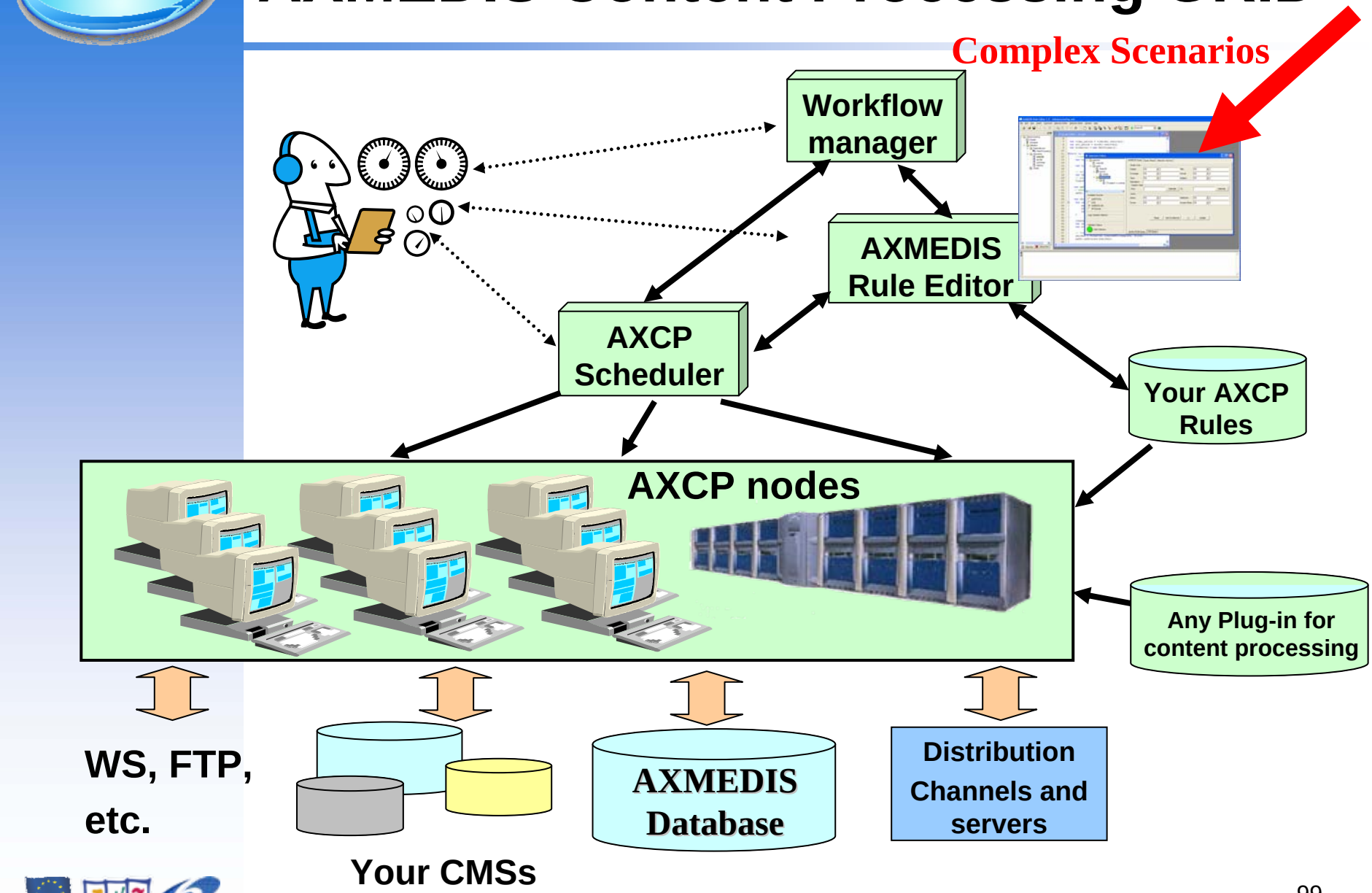
AXMEDIS The Protection and Control Process



Complex Scenarios

Real Scenario taken from
Accademia Nazionale di Santa Cecilia

AXMEDIS Content Processing GRID

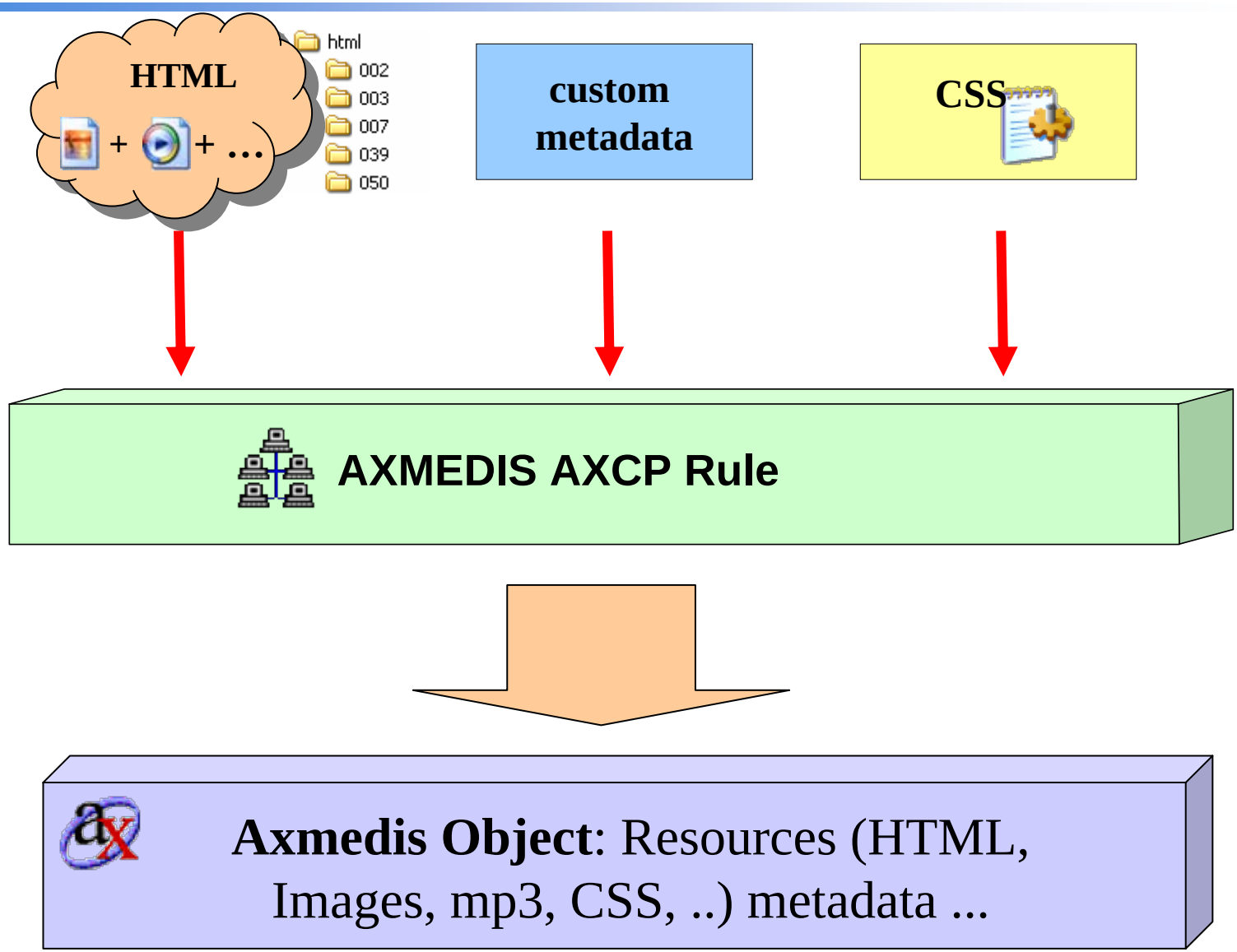


Complex Scenarios

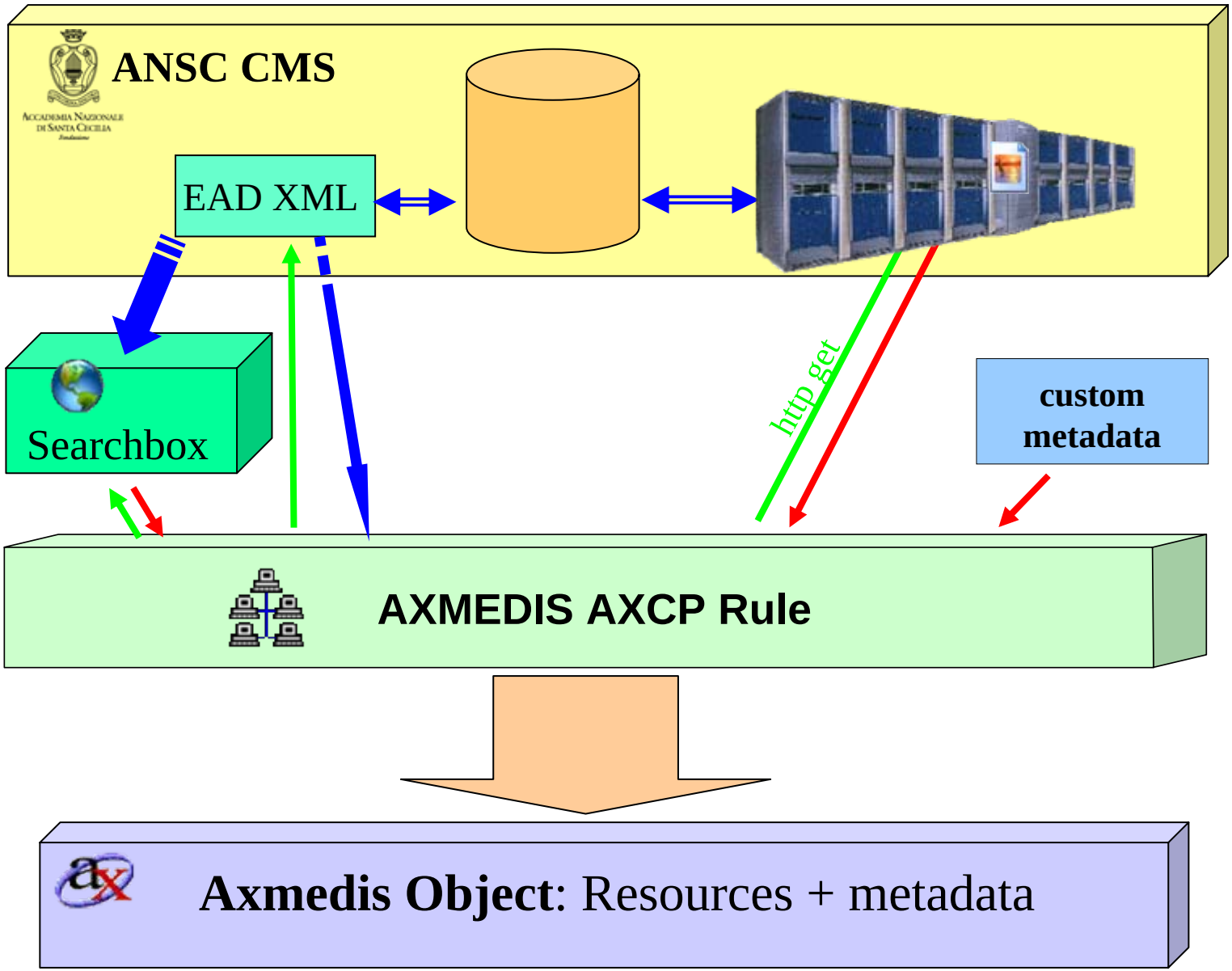
- **Accademia Nazionale di Santa Cecilia,** http://www.santacecilia.it

- **Examples:**
  - Content gathering from file system
  - Crawling from CMS using SearchBox Tool
  - Automatic SMIL representation

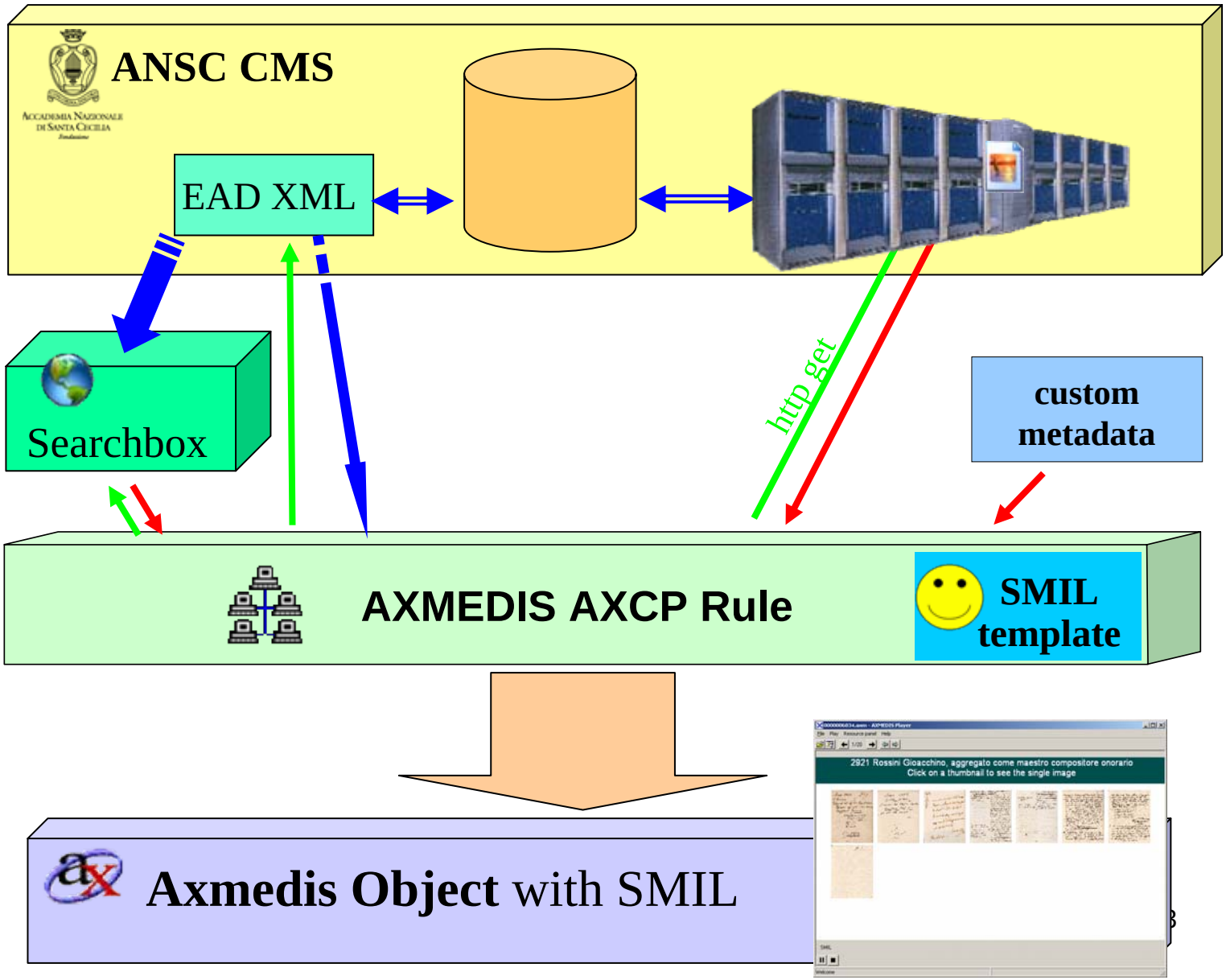
Content gathering from file system



Crawling from CMS using SearchBox Tool



Automatic SMIL Representation



Summary

- Rules Definition, test and validation
- Rules installation and Execution
- Rules Scheduling
- AXMEDIS GRID management

Adding Your Plugins

- **Flexible Plugin Interface already used to integrate the extended functionality**
- **Examples:**
  - ImageMagick,
  - FFMPEG,
  - CryptLib,
  - MPEG-7 reference implementation,
  - ...
- **External tools**
  - M2ANY: AudioID (integrated)
  - ISHCE: Audio Watermarking (under development)

Conclusions

- **The AXMEDIS Scripting Language provides a flexible solution for automatic content processing.**
- **The AXMEDIS Core Functionality provides the basic method for the management of digital content and corresponding rights.**
- **External Functionality included in AXMEDIS enriches the basic functionality to cover daily tasks.**
- **The AXMEDIS GRID allows a dynamic load balancing.**
- **The extensibility of the AXMEDIS Framework provides the flexibility for future scenarios:**
  - scripting and creation of new AXMEDIS plugins.

Conclusions

- **AXMEDIS reduces costs for content management by providing a solution for automating the content processing, production, protection and distribution.**

- **AXMEDIS reduces distribution and aggregation costs in order to increase accessibility with a**
  - Peer-to-Peer platform at Business-to-Business level
  - Integration of content management systems
  - Integration of workflows

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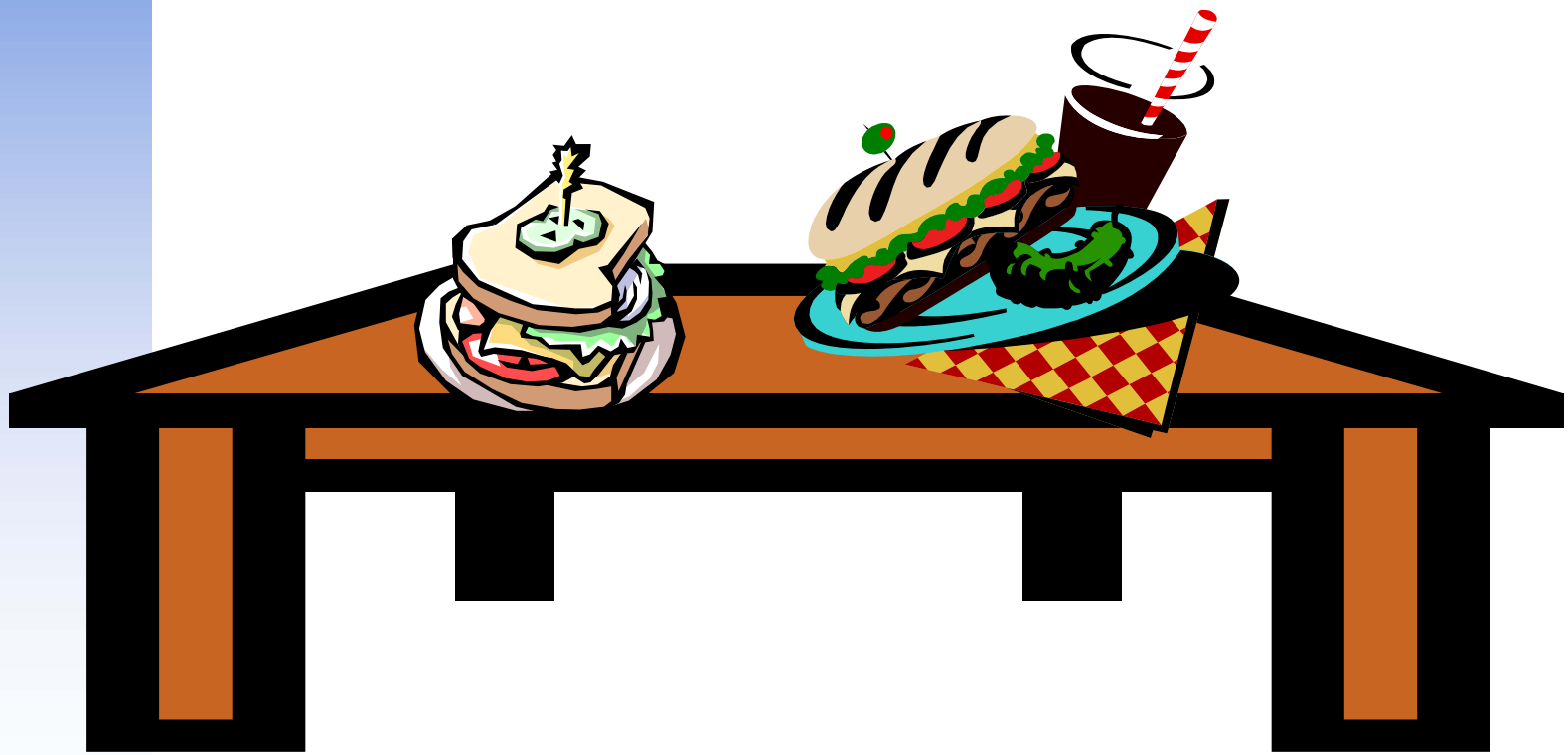
  Web: http://www.AXMEDIS.org

Lunch Break



Steps

1. Open AXMEDIS object
2. Initialize the Metadata Mapper
3. Extract the Metadata from the AXMEDIS object
4. Load the saved XSLT file from the disk
5. Transform the metadata producing the new Metadata
6. Embed the new metadata into an AXMEDIS Object
7. Save the AXMEDIS Object

AXMEDIS Tutorial on Content Processing

Version 1.4
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