

An Academic Teaching File Authoring Environment to Support Higher Education in Medicine

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supporting medical education

- **information dissemination**
 - ↳ **electronic textbooks, atlases, medical & biological databases, scientific press, ...**
- **achieving knowledge & understanding**
 - ↳ **creation, management and dissemination of digital teaching file collections**
 - ↳ **self-evaluation tools and processes**
 - ↳ **mediation of teacher-learner exchange**

teaching files in medicine

- **complete medical case presentations**
 - ↳ **history**
 - ↳ **findings (clinical, imaging, laboratory, ...)**
 - ↳ **diagnosis (& treatment)**
 - ↳ **discussion**
- **either complete reports
or with unknown parts and self-assessment questions**
- **up to now, intended mainly as ...**
 - ↳ **peer-reviewed archival information resources
for formal professional scientific communication**

current state in teaching files

- numerous professional collections on the web
- attempts for some standardization in the description of the content and structure
 - ↳ **Medical Imaging Resource Center:
MIRC network
by RSNA <http://www.rsna.org/mirc/>**
 - ↳ **MIRC server software for teaching file creation and dissemination, and/or**
 - ↳ **MIRC XML document schema for describing teaching files**

current state in teaching files

- a number of authoring tools with varying complexity & functionality
- variable degree of integration with healthcare information systems
 - ↗ import DICOM images in authoring tools
 - ↗ retrieve images directly from PACS via DICOM communication
 - ↗ indicate potential cases during the clinical workflow (IHE integration profile)

what needs to be addressed

? complex search & retrieve of clinical data

↳ based on educational criteria, as opposed to criteria that pertain to clinical patient management

? integration with the academic environment

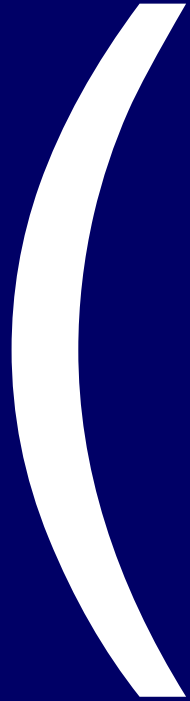
↳ via general purpose learning management systems (LMS) and related educational standards

from

peer-reviewed professional communication

to

educational modules integrated in undergraduate and graduate medical education



***information technology
supporting higher education***

learning management systems (LMS)

advanced web-based software that allows non-programmers to

- ↪ create, manage, present and share educational content
- ↪ create and deploy educational procedures and learning strategies
- ↪ support individualized instruction, and learner progress tracking (self-assessment and/or assessment)
- ↪ promote learner interactions and on-line collaboration
- ↪ help instructors and students organize their private educational portfolio and timetable
- ↪ support administrative tasks (registration, scoring, etc)

SCORM

Sharable Content Object Reference Model

Advanced Distributed Learning Initiative

(<http://www.adlnet.org/>)

- a set of standards to make educational content re-usable independently of the learning management system
 - ↳ model for assembling, labeling and packaging learning content
 - ↳ specifications for the run-time environment in an LMS
 - ↳ rules for sequencing content and navigation

SCORM

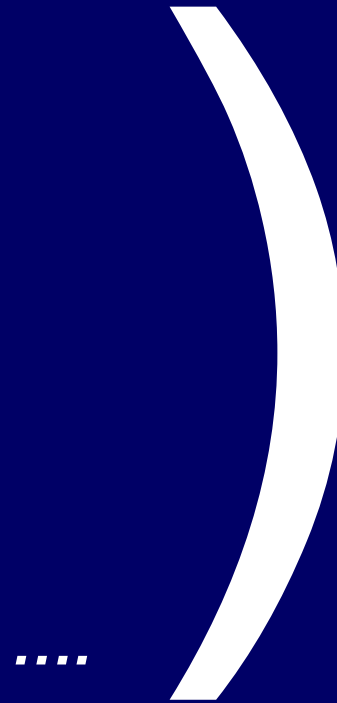
integrates developments from groups such as:

↪ **IMS:** IMS Global Learning Consortium Inc.

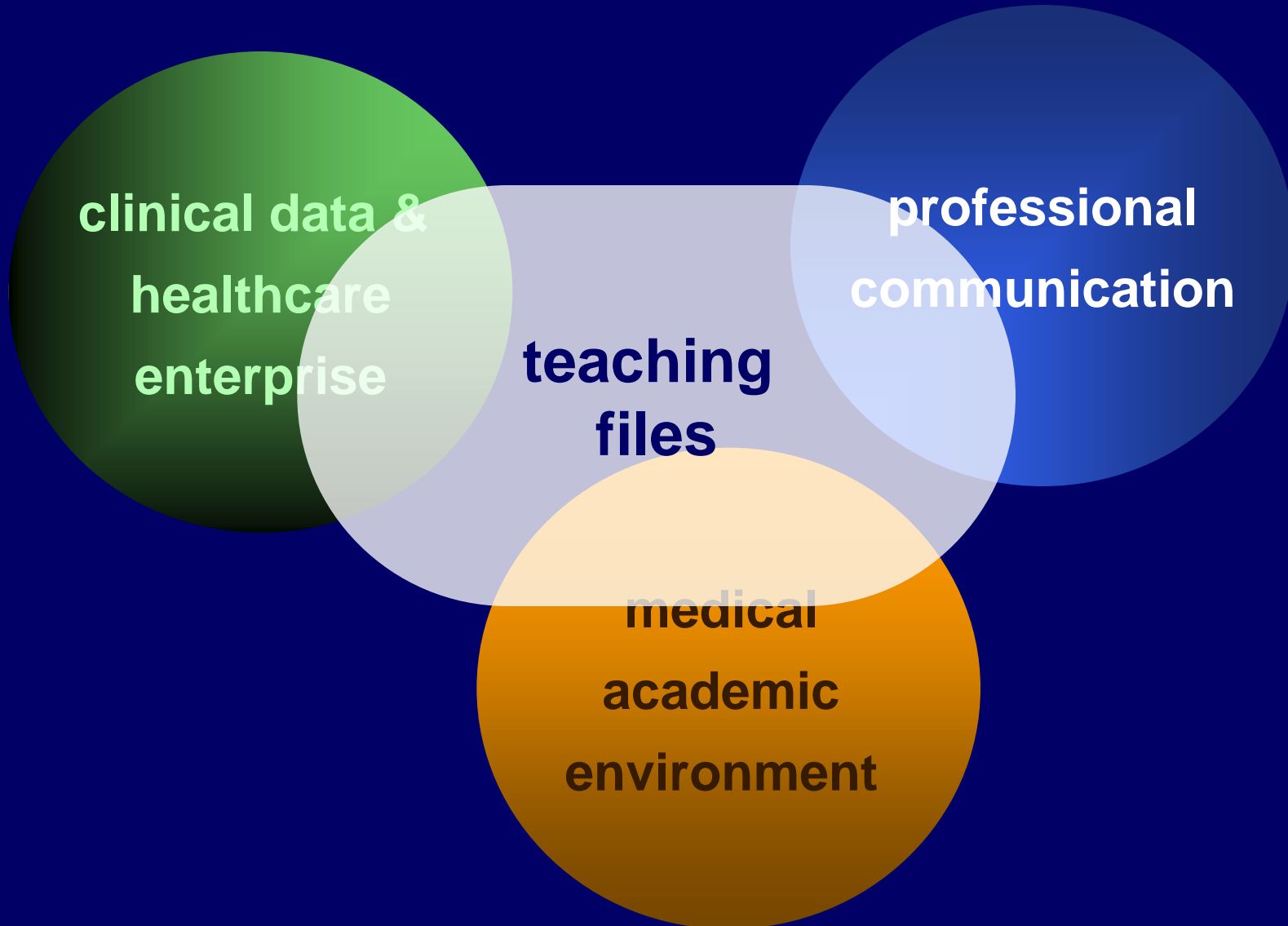
↪ **AICC:** Aviation Industry CBT Committee

↪ **ARIADNE:** Alliance of Remote Instructional Authoring & Distribution Networks for Europe

↪ **IEEE LTSC:** IEEE Learning Technology Standards Committee



teaching files in the medical environment

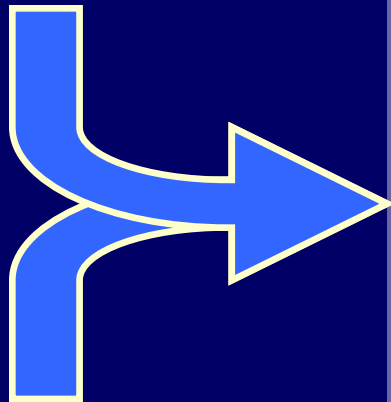


requirements

- **complex search and retrieval of clinical data via healthcare standard interfaces (DICOM in the case of radiology)**
- **integration with commonly available formats and notions for teaching file distribution in professional medical practice (e.g. MIRC specifications)**
- **integration with general purpose learning management systems (via appropriate e-learning standards, e.g. SCORM)**
- **basic standalone functionality, irrespective of the existence of a fully deployed PACS or clinical information system and/or learning management system**

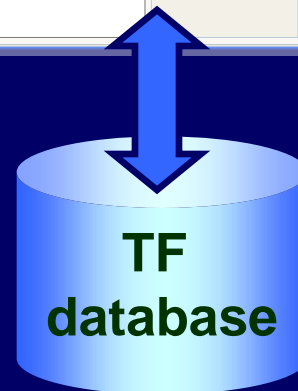
a new teaching file authoring environment

complex
DICOM search
& retrieve

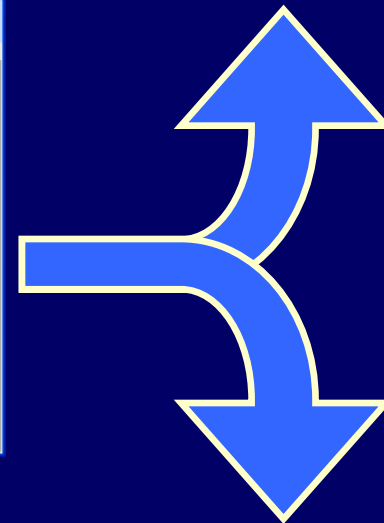


conventional
data entry

**teaching file
authoring tool**



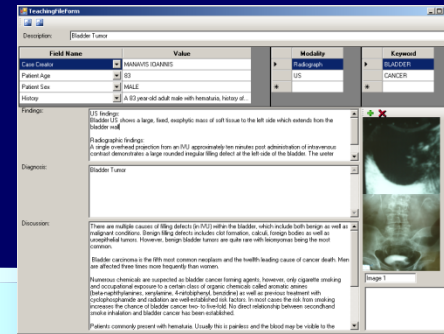
export in SCORM for
integration in LMS



export in standard
presentation formats
(html & MIRC)

retrieving clinical data

teaching file authoring tool



DICOM image servers



teaching & research
end-user
applications

added-value
web services

web services
acting as
application wrappers

conventional
clinical information
systems

teaching file authoring tool

TeachingFileForm

Description: Bladder Tumor

Field Name	Value	Modality	Keyword
Case Creator	MANAVIS IOANNIS	Radiograph	BLADDER
Patient Age	83	US	CANCER
Patient Sex	MALE	*	*
History	A 83 year-old adult male with hematuria, history of...		

Findings:

US findings:
Bladder US shows a large, fixed, exophytic mass of soft tissue to the left side which extends from the bladder wall

Radiographic findings:
A single overhead projection from an IVU approximately ten minutes post administration of intravenous contrast demonstrates a large rounded irregular filling defect at the left-side of the bladder. The ureter

Diagnosis:
Bladder Tumor

Discussion:

There are multiple causes of filling defects (in IVU) within the bladder, which include both benign as well as malignant conditions. Benign filling defects includes clot formation, calculi, foreign bodies as well as uroepithelial tumors. However, benign bladder tumors are quite rare with leiomyomas being the most common.

Bladder carcinoma is the fifth most common neoplasm and the twelfth leading cause of cancer death. Men are affected three times more frequently than women.

Numerous chemicals are suspected as bladder cancer forming agents, however, only cigarette smoking and occupational exposure to a certain class of organic chemicals called aromatic amines (beta-naphthylamines, xerylamine, 4-nitobiphenyl, benzidine) as well as previous treatment with cyclophosphamide and radiation are well-established risk factors. In most cases the risk from smoking increases the chance of bladder cancer two- to five-fold. No direct relationship between secondhand smoke inhalation and bladder cancer has been established.

Patients commonly present with hematuria. Usually this is painless and the blood may be visible to the

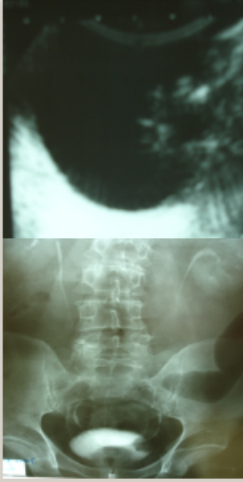


Image 1

exporting teaching files → MIRC

```
<?xml version="1.0" encoding="UTF-8"?>
<MIRCdocument as-mode="false" display="mstf" first-tab="2"
path="documents/20060531141911506/MIRCdocument.xml">
<document-type>Radiologic Teaching File</document-type>
<publication-date>2006-05-31</publication-date>
<creator>Academic TF Author</creator>
<title>Bladder Cancer</title>
<author>
  <name>Manavis Ioannis</name>
  <affiliation>DUTH</affiliation>
  <contact></contact>
</author>
<keywords>Cancer Bladder</keywords>
<section heading="History" visible="yes">
  <p>A 83 year-old adult male with hematuria, history of tobacco use</p>
</section>
<section heading="Findings" visible="yes">
  <p>US findings: Bladder US shows a large, fixed, exophytic mass of soft tissue to
the left side which extends from the bladder wall.</p>
.....
</MIRCdocument>
```

creating quizzes

LessonForm

Lesson Description: Lesson

With the patient history and the evidence presented in the existing diagnostic

Question: What is the most possible symptom with which the patient presented

Answers

	AnswerText	IsCorrect	AnswerDiscussion
▶	urine retention	<input type="checkbox"/>	bladder distention is observed
	pelvic pain	<input type="checkbox"/>	e.g. no acoustic shadow is observed
	hematuria	<input checked="" type="checkbox"/>	The mass described above could cause hematuria
	back pain	<input type="checkbox"/>	The radiological findings of a mass extruding from the bladder wall do not correlate ...
*		<input type="checkbox"/>	

Fields

- Findings : US findings: Bladder US shows a large, fixed, exophytic mass of soft tissue to the left side
- Diagnosis : Bladder Tumor
- Discussion : There are multiple causes of filling defects (in IVU) within the bladder, which include
- Fields
 - Case Creator : MANAVIS IOANNIS
 - Patient Age : 83
 - Patient Sex : MALE
 - History : A 83 year-old adult male with hematuria, history of tobacco use
- Modalities
 - Modality : Radiograph
 - Modality : US
- Keywords
 - Keyword : BLADDER
 - Keyword : CANCER

LessonForm

Lesson Description: Lesson

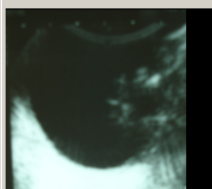
With the patient history and the evidence presented in the existing diagnostic data which is the most likely diagnosis

Question: With the patient history and the evidence presented in the existing diagnostic data which is the most likely

Answers

	AnswerText	IsCorrect	AnswerDiscussion
▶	calculi	<input type="checkbox"/>	No relevant image findings, especially no acoustic shadow in the US image
	blood clot	<input type="checkbox"/>	A blood clot would not present as an exophytic mass extending from the bladder wall
	foreign body	<input type="checkbox"/>	No relevant image findings or patient history
	bladder tumor	<input checked="" type="checkbox"/>	See discussion
*		<input type="checkbox"/>	


Images



exporting teaching files → SCORM

The screenshot shows the Reload Scorm 1.2 Player interface within a Microsoft Internet Explorer browser. The browser address bar shows the URL: `http://127.0.0.1:8080/reload-scorm-player/pages/LMSMain.htm`. The player title is "Reload Scorm 1.2 Player".

The main content area displays a lesson titled "What is the most possible symptom with which the patient presented". The lesson content is organized into a table with three rows: Findings, Diagnosis, and Discussion.

Findings	US findings: Bladder US shows a large, fixed, exophytic mass of soft tissue to the left side which extends from the bladder wall. Radiographic findings: A single overhead projection from an IVU approximately ten minutes post administration of intravenous contrast demonstrates a large rounded irregular filling defect at the left-side of the bladder. The ureter appears attenuated at the point of bladder insertion, but there is no evidence of obstruction. Enlarged prostate.
Diagnosis	<p>Microsoft Internet Explorer</p> <p> The mass described above could cause hematuria Score : 10/10</p> <p>OK</p>
Discussion	

Below the table, there is a quiz question in Greek: "Ερώτηση 1" (Question 1). The question text is "What is the most possible symptom with which the patient presented". The options are:

- urine retention
- pelvic pain
- hematuria
- back pain

An "OK" button is located at the bottom of the quiz area.

On the right side of the player, there is a vertical panel with a radiographic image labeled "Image 2" showing a bladder ultrasound scan.

implementation issues

- **teaching file authoring tool**

- ↪ **C# (MS .Net Framework 2.0)**

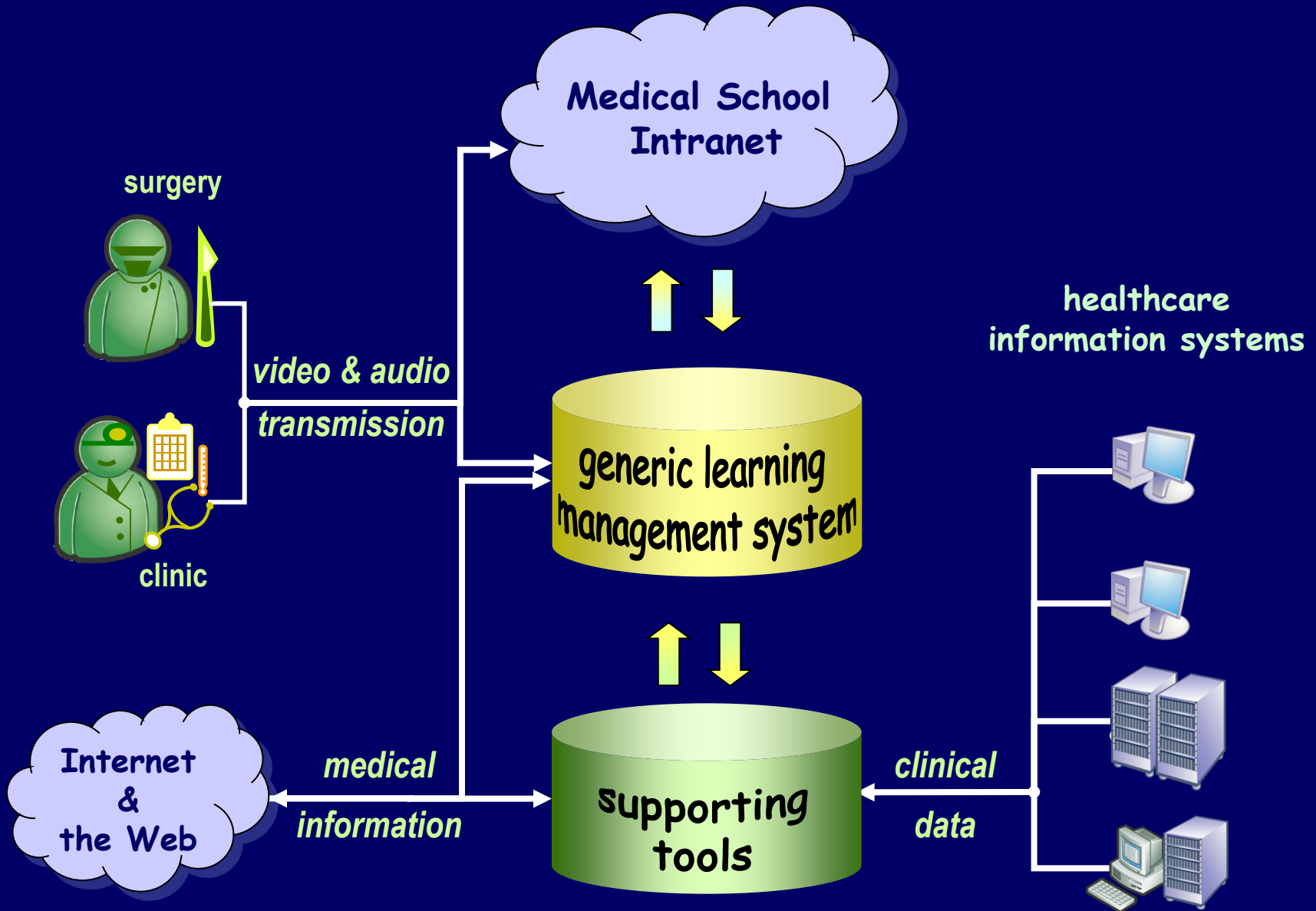
- ↪ **MS SQL Server Desktop Engine**

- **web services**

- ↪ **C# (MS .Net Framework 2.0)**

- ↪ **DicomObjects 4.1 (Medical Connections)**

<http://iris.med.duth.gr/>



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funding: EU Community Initiative Programme INTERREG III B ARCHIMED

cite as

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