

## Volume 8 - Issue 4, 2008 - Cover Story: Cost-Effectiveness in the Imaging Department

### Open Source Software: Cost-Effective Solutions for Medical Imaging

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**Nowadays, most clinical decisions rely on imaging procedures where the diagnostic report generated by a radiologist is often incomplete without supporting images. Radiologists often have to generate additional images using volume rendering and image processing techniques to communicate their findings to clinicians and surgeons.**

**An increasing demand from surgeons and clinicians to be able to manipulate and process the images mean they can't rely on radiologists to generate those images.**

The concept of open source software is unconventional and challenging in the medical imaging arena. It raises the question of the integrity and quality assurance of software developed by a community of users and does not follow the traditional conformity certification required for commercial medical software programmes. On another hand it provides a means for development of innovative solutions designed by the users themselves that are better suited for their specific tasks.

#### The Open Source Revolution in Medicine

The concept of open source software promotes the development and sharing of software source codes under special licensing agreements that protect author copyrights while maintaining the distribution of free and open derivative work based on the original code.

The rationale behind open source is very simple. When a community of programmers can review and modify the source code of a programme, they can contribute to the improvement and evolution of the software code. With the combined synergy of numerous developers this can happen at a speed that exceeds by far the slow pace of conventional software development.

Open source software is slowly emerging in medical applications and in particular in electronic patient record management systems, in medical imaging and PACS applications. The impact of open source is even greater in specialised areas of medicine such medical imaging. These vertical markets have always been a challenge for vendors and manufacturers due to the small size of specialised users and high expectations in terms of complexity and performance.

This has naturally driven the market to high-end and highcost developments and marketing strategies that also try to cope with very rapid evolution of computer technologies and software developments that make most products obsolete in very short time intervals, which does not allow manufacturers to generate sustainable return on investment. Most manufacturers will cover the cost through revenues from other business avenues such as sales of imaging modalities, scanners and imaging devices, or by charging high costs for implementation and support and maintenance contracts of complex integrated information systems.

## What is OSIRIX Designed to Do?

OSIRIX was initiated at the University of California in Los Angeles (UCLA) in 2004 by the authors of this article. Together, we designed and developed this new open source image- processing platform developed on AppleMacintosh computers with the intention to allow users to efficiently and conveniently navigate through large sets of multi-dimensional data without the need for high-end expensive hardware or software.

OSIRIX software was specifically designed to provide advanced image visualisation in a new graphic user interface (GUI) that is more suitable for clinical applications and image interpretation of large multidimensional datasets. It allows one to easily and quickly develop new generation of multi-dimensional viewers that could replace many of the existing functions that are available only on high-end expensive 3D workstations.

We also elected to integrate new emerging technologies from the consumer market industry to expand the capabilities of PACS workstations beyond their current limitations. We selected a set of new products and services recently released by Apple Computers for their general computer products and adapted them for medical imaging applications:

- The iPod, a popular portable music player, was integrated to serve as a high capacity portable DICOMstorage with a high-speed transfer rate.
- iChat AV instant messaging and videoconferencing software was adapted to allow real-time radiology videoconferencing tool for remote image viewing and screen sharing.
- iDisk, an internet service provided by Apple for secure data storage on a virtual hard disk was adopted as a DICOMdata storage and communication alternative.

## What are the Advantages?

### Manipulate and Visualise Large Sets of Image Data

One of the most attractive features of OSIRIX remains its ability to manipulate and visualise large sets of image data using advanced volume rendering and 3D navigation tools. OSIRIX user interface was designed to allow physicians to rapidly become familiar with the manipulation of 3D objects and navigate through large sets of images.

### Suits Multimodality and Molecular Imaging Devices

With the advent of multimodality imaging and molecular imaging devices such as hybrid PET/CT scanners, it is possible now to generate functional images that represent metabolic and biological dimensions superimposed over morphological and anatomical data. OSIRIX was designed to conveniently handle the fusion of metabolic images and anatomical images in a 5D image rendering mode, where the anatomical information is referred to as the fifth dimension.

### It Promotes Global Collaborations to Customise the Application for Maximum Convenience

Developers from all around the world have contributed to the extension of OSIRIX by adding innovative and specialised image processing features. Its software architecture allows for separate processing modules to be added to the programme as plug-ins. Such plug-ins will be embedded in the programme when it is launched but don't have to be integrated in the core of the main programme.

## Who is Using OSIRIX?

According to our latest surveys, an estimated 25,000 active users correspond with us on a regular basis around the world. This number does not account for users that have simply downloaded the software and are using it on their own workstation with no interaction with the rest of the user community. Industry has also started to adopt OSIRIX as a base for new business models where they provide the support and integration services as well as training and customisation of the generic platforms.

Several certified versions for Europe and for the FDA in the US have already appeared on the market recently. And finally, and probably most importantly, the academic community has started to regroup its efforts to support and promote open source initiatives in medical imaging and medical informatics.

OSIRIX software and its source code are available under an open source licensing agreement and can be downloaded free of charge at: <http://www.osirix-viewer.com>

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