Notat

A short memo on Open Source Software for PACS

Notatnr	**DART/04/05**
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Norsk Regnesentral

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Sammendrag

The note provides a collection of links to Open Source Software used in PACS applications.

Emneord	PACS, Open Source Software, Health Care
Målgruppe	Health Care Enterprises
Tilgjengelighet	Open
Prosjektnummer	
Satsningsfelt	Multimedia-Multichannel
Antall sider	4
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A short memo on Open Source Software for PACS

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1 Open Source Software for use in PACS

The following demo is a collection of links to open source software (OSS) which is used in PACS applications. Since OSS [2] is available in source code which can be altered, this type of software is suitable for experimenting without causing great costs for licenses and purchase. We give an overview of some relevant packages, most of them implementing some aspects of DICOM. We give an overview of some relevant packages, most of them implementing some aspects of DICOM.

The following list of OSS was collected in mid-2004 within the frame of the DISSH project [1], where we had to decide which software to use for testing- and implementation of a prototype system for transmission of digital ultrasound images between hospitals.

The intention of this note is not to give a complete list; several available software packages might have escaped the authors' attention.

Note that not all packages mentioned in the list are OSS, since some are considered as software which can be used without licensing fees. Generally, the open source principle is disjunct from licensing fees, a fact that often is misinterpreted. The advantage of open source software comes from the availability of the source code, which allows adjustments, changes, bugfixes, etc. More on the principles of OSS can be found in an NR-report [2].

2 List of Open Source Software for use in PACS

2.1 Open Source Software for DICOM handling

2.1.1 Dicom toolkit (DCMTK)

DCMTK, available from Offis at `http://dicom.offis.de`, is a collection of libraries that implement large parts of the DICOM standard, written in a mixture of ANSI C and C++. DCMTK is released under a BSD-style license by Offis (a German research institute), and is used often for research, and as a basis for commercial software. DCMTK works on Windows, Linux, Solaris, OSF/1, IRIX, FreeBSD and MacOS X. DCMTK includes also an implementation of lossless JPEG, and a module for transfer of DICOM data via TLS using OpenSSL.

2.1.2 MIR CTN (Central Test Node)

The MIR DICOM Central Test Node Software (CTN) from ERL at Washington University available at `http://www.erl.wustl.edu/`, implements aspects of DICOM for cooperative demonstrations at RSNA annual meetings. The goal was to provide an implementation that facilitated vendor participation based on the evolving DICOM standard. CTN is implemented in C, and works on Windows, and (possibly) Linux.

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2.1.3 David Clunie's dicom3tools

The dicom3tools, available from `http://www.dclunie.com/dicom3tools.html` implement tools and libraries for handling offline files of DICOM 3 attributes, and conversion of proprietary formats to DICOM 3. Can handle older ACR/NEMA format data, and some proprietary versions of that such as SPI. Works on Mac, and Linux. (And maybe windows.)

JPEG-LS, available from `http://www.dclunie.com/jpegls.html`, is an open source implementation of the proposed JPEG-LS standard, DIS 14495; see `http://www.jpeg.org/public/jpegnew.htm`. The implementation is part of the `dicom3tools` package for medical images. The implementation handles one component (i.e., grayscale images) in the current version (dated 2002).

2.1.4 CDmedic

CDmedic, available from `http://cdmedicpacsweb.sourceforge.net`, implements a full featured free PACS based on MIR CTN, DCMTK and mysql, with remote administration using apache mod perl and imaging processing capabilities using ImageMagick, Grevera's dcm2pgm DICOM converter and AFNI. CDmedic is based on the Linux-distribution Knoppix. Released with the GPL license.

2.1.5 OpenEMR

OpenEMR, available from `http://stack.onlyic.org/openemr/`, is a modular, HIPAA compliant, Open Source, cross-platform Electronic Medical Records system (EMRS). It facilitates efficient office management through automated patient record journaling and billing integration, and has been integrated with third-party technologies including speech recognition, secure wireless access, touch screen portables, and biometric authentication. Interface screens are customizable and optimized for consistency, simplicity, speed of access to patient information, and minimum eye strain. OpenEMR works on Linux and Windows platforms, and is released under an OSI-approved license.

2.1.6 Conquest DICOM software

Within the EC Conquest project, (see `http://www.xs4all.nl/~ingenium/dicom.html`) a full featured DICOM server has been developed based on the public domain UCDMC DICOM code developed by Mark Oskin at the Medical Center of the University of California at Davis. Released under a BSD-style license. Works on Windows platforms.

2.1.7 Java DICOM Tools

The Java DICOM Tools, available at `http://www.tiani.com/JDicom/` implement a collection of tools for DICOM in Java. Built partially on Softlink's javadicomtoolkit. The use is free of charge, but only for special use. Source-code is not available. The PACS of the Java DICOM tools supports the transfer of images using the JPEG baseline transfer syntax.

2.1.8 dcm4che

dcm4che, available at `http://dcm4che.sourceforge.net/`, is an implementation of DICOM in Java. The sample applications may be useful on its own. It also includes an IHE compliant Image Archive application, based on J2EE.[1] Released under the LGPL.

2.1.9 MRIConvert

MRIConvert, available at `http://lcni.uoregon.edu/~jolinda/MRIConvert.html`, is a medical image file conversion utility that converts DICOM files to SPM99/Analyze, BrainVoyager, and

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[1]Software is of alpha quality.

MetaImage volume formats. It runs on newer Windows platforms. MRIConvert was written using wxWindows, an open-source library for cross-platform GUI development. Free use, but source-code not available. Binary for windows available.

2.1.10 PacsOne

PacsOne, available at `http://www.pacsone.net`, is a DICOM 2.0-compliant PACS application including a DICOM server, the MySQL database, and the Apache 2.0 Web server. The implementation is free in the basic edition, and low cost in a premium edition. PacsOne is partly based on open source software for various Windows platforms and Linux.

2.2 Dicom viewers

We present DICOM viewers in a separate section. In the DISSH project it was considered to use DICOM viewers that can be started directly from the web application.

2.2.1 Dicomviewer

DICOM Viewer, available at `http://mars.elcom.nitech.ac.jp/dicom/index-e.html`, is used to access DICOM data that are stored on a server. It is written in Java, by Nagoya Institute of Technology, Iwata laboratory and Takahiro Katoji. The software is under the GPL; however there is an additional claim that the URL of the web page, or the reference to the article [3] are included. *Dicomviewer* does not seem to be capable of showing the images from VingMed, neither in compressed nor uncompressed format.

2.2.2 Dicomworks

Dicomworks is a DICOM viewer for Windows, available at `http://dicom.online.fr/`, developed by radiologists. Can open most kinds of DICOM-images, also compressed images, and series of images. The program is rather slow, and uses much of system resources. The software can be downloaded for free. A registration is required to get full functionality. Support for DICOM query/retrieve is planned.

2.2.3 Medview

Medview for Windows, available at `http://www.viewtec.ch/meddiv/medview_e.html`, was not tested by us, but it seems to offer much functionality, and support for most DICOM files. License costs ca. 300 Euro.

2.2.4 Tomovision

Tomovision for Windows, available at `http://www.tomovision.com/download/tomovision.htm`, offers a simple user interface with not so much functionality. Can open all sorts of DICOM images. Freeware.

2.2.5 ezDicom

exDicom for Windows, available at `http://www.psychology.nottingham.ac.uk/staff/cr1/ezdicom.html` has quite good functionality. Can open all sorts of images, but gives wrong colours on some images. Open source software.

2.2.6 Rubo Medical Imaging Dicomviewer

RuboMed for Windows, available at `http://www.rubomed.com`, offers not so much functionality. Can open all sorts of files. Costs ca. 1000 Euro per license.

2.2.7 AccuLite

AccuLite for Windows, available from Accuimage at `http://www.accuimage.com/` can open most sorts of images, but has troubles with some. Freely downloadable.

2.2.8 Dicomviewer (Nagoya Institute of Technology)

The Dicomviewer by Nagoya Institute of Technology (`http://mars.elcom.nitech.ac.jp/dicom/index-e.html`) is Java-based, which can be used on all platforms. It is specially designed for use in a web-server with a suitable user interface, and can open all kinds of DICOM files. However, it is rather slow. GPL license.

2.2.9 Imread Dicom viewer

The Imread DICOM viewer (`http://www.uchsc.edu/sm/neuroimaging/download/imread/imread1.htm`) is Java-based. Works with simple DICOM images, but does not support compressed images, or series of images. Freely downloadable.

2.2.10 DicomScope

DicomScope for Windows from Offis, availabe at http://dicom.offis.de/dscope.php.en, offers a messy user interface. Does not support compressed DICOM images. Freeware.

2.2.11 Osiris

Osiris, available at `http://www.expasy.org/www/UIN/html1/projects/osiris/osiris.html`, is a DICOM-viewer for Windows and UNIX. Does not support compressed images. Freeware.

2.2.12 Dicom Image Viewing Software

The DICOM Image Viewing Software (`http://www.ee.bilkent.edu.tr/~cetin/dvs.html`) is a DICOM-viewer for Windows. The software did not work in our environment.

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