Using Conquest on LINUX – version 1.5.0beta3 Mar 8, 2020

The server core (**dgate.exe** = **dgate** under Linux) compiles and runs on Linux systems and Solaris. I develop primarily under Windows, but currently I test the code and scripts under Linux Ubuntu 19.10. I also had the server compiled on a Raspberry Pi.

The Linux release of the server core works default with SqLite driver built in into the server (no ODBC). The DbaseIII driver is also supported. Piotr Filipczuk has added a PostGresQL driver. The native MySQL interface also can be used. The graphical user interface has not been ported to Linux, but the WEB interface is provided, either using Apache or a built-in mini web server (Ladle). In this version, most options have been well tested – it is a stable release. However, there are often subtle differences between linux distributions, making installation (and writing a manual) difficult. There are several contributions on the forum, and there are text files with specific command orders to be found in the linux subfolder of the server

To use the server, one needs a valid version of the configuration files and put them in the same directory as the dgate executable. The easiest way to do this is to unpack **dicomserver150beta3.zip** with "unzip dicomserver150beta3.zip".

INSTALLATION

Prerequisites: 1) a running Linux system. 2) sudo installed and enough rights to perform sudo. If not, the script will not be able to install the server as web service for Apache and you need to copy the files by hand. Note that I only test the scripts on Ubuntu, but the web based installer script linux.sh has a bit of info on Fedora.

These packages needed to be installed in a plain Linux system when using SQLite or DbaseIII:

```
sudo apt-get update                                       get compilers
sudo apt-get install make
(or: sudo apt-get install build-essential)
sudo apt-get install g++
sudo apt-get install apache2                              get webserver
sudo apt-get install unzip                                not in Ubuntu server
sudo apt-get install p7zip-full                           parts of the web interface use 7za
sudo apt-get install lua5.1                               since 1.5.0beta3 lua is external
sudo apt-get install lua5.1-dev
sudo apt-get install lua-socket

(or for fedora:
dnf install gcc-c++-sh-linux-gnu.x86_64 gcc-c++-x86_64-linux-gnu.x86_64 clang.x86_64
)

sudo a2enmod cgi                                          enable CGI(d) in web server
sudo systemctl restart apache2
(or for older systems: sudo service apache2 restart)
```

The rest of the installation can be performed manually, or by a web based method, explained below.

The following steps illustrate a minimal installation:

wget http://ingenium.home.xs4all.nl/dicomserver/dicomserver150beta3.zip	get server zip
mkdir conquest	make folder to store conquest
cd conquest	to there
unzip ../dicomserver150beta3.zip	
rm ../dicomserver150beta3.zip	

or:

sudo apt install git	if git not installed yet
git clone https://github.com/marcelvanherk/Conquest-DICOM-Server	get latest from GitHub
cd Conquest-DICOM-Server	

chmod 777 maklinux	make run-able
./maklinux	compile and install web access
choose option 3 or 5	SqLite or SqlLite precompiled
say 'y' to 'Regenerate the database'	**Deletes previous database contents!**
say 'y' to 'Install as service'	Shows status hit 'q' to return

Now the server should be running and http://localhost/cgi-bin/dgate should provide a working web interface.

Note that in dicomserver150beta3 a precompiled dgate (compiled by me on Ubuntu 14.04, using Sqlite database) is included, to try that use option 5 in *maklinux*. Tested on Ubuntu 18.04, 19.10. If used the following packages may be *omitted*: **make, g++, lua5.1-dev**; but if you do omot them then the following package must be *added*: **liblua5.1-0.** This option reduces the size of the Linux system by a few hundred MB.

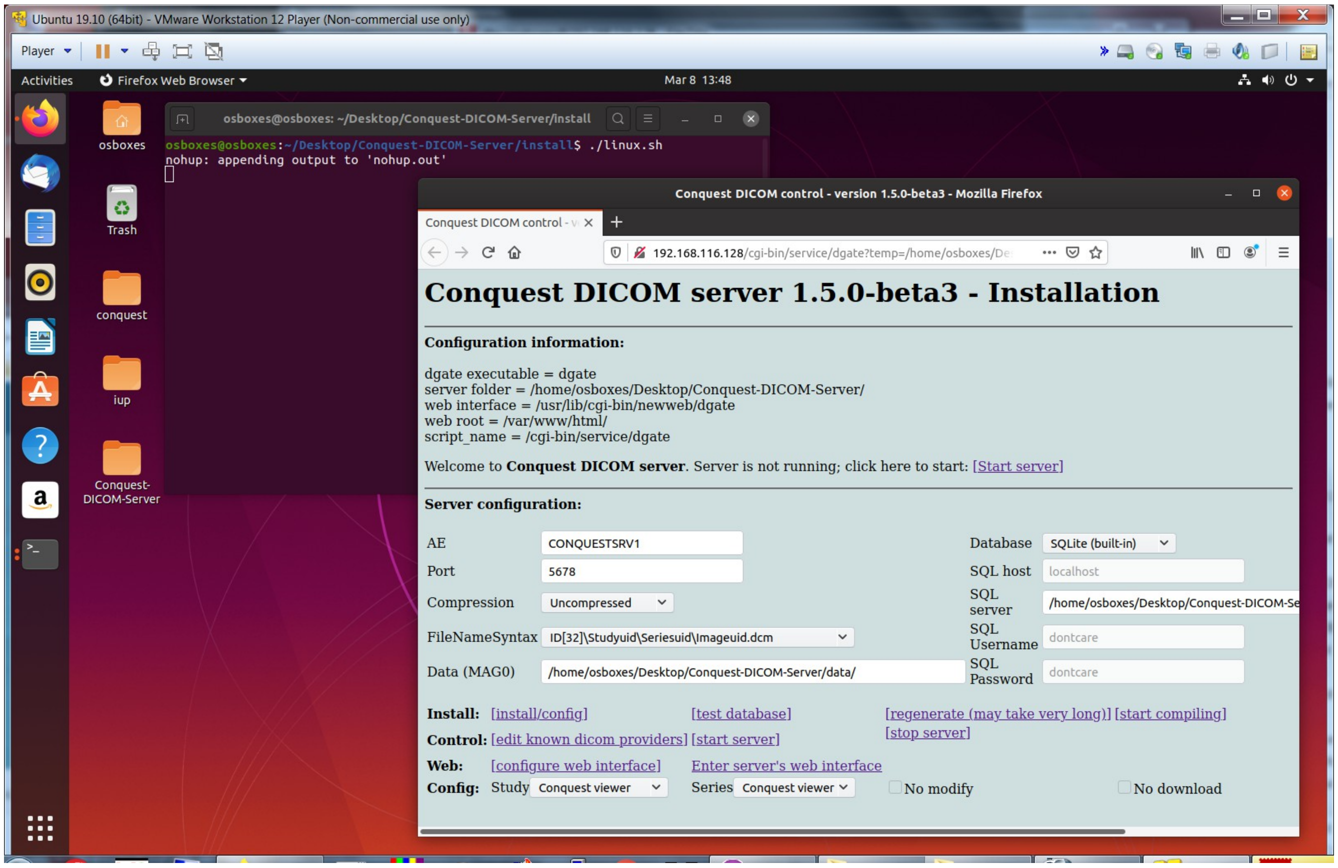
Web based installation

To run the web based installer (install required prerequisites, is supported with compiler and without compiler):

wget http://ingenium.home.xs4all.nl/dicomserver/dicomserver150beta3.zip	get server zip
mkdir conquest	make folder to store conquest
cd conquest	
unzip ../dicomserver150beta3.zip	

chmod 777 linux.sh	make run-able
./linux.sh	

This compiles a minimal server binary (dgatesmall) or uses the precomplied one that is run as service control manager and, if a web server and client (Firefox expected) exist, opens web page http://127.0.0.1/cgi-bin/service/dgate. The resulting web page allows and guides the user through compilation, configuration, re-generation of the database if needes, starting the server, setting up the web server and opening the web client. A screen-shot of the install page is shown below:


Ubuntu 19.10 (64bit) - VMware Workstation 12 Player (Non-commercial use only)
Player
Activities
Firefox Web Browser
Mar 8 13:48
osboxes
Trash
conquest
iup
Conquest-DICOM-Server
osboxes@osboxes: ~/Desktop/Conquest-DICOM-Server/install
Conquest DICOM control - version 1.5.0-beta3 - Mozilla Firefox
Conquest DICOM control
192.168.116.128/cgi-bin/service/dgate?temp=/home/osboxes/De

```
osboxes@osboxes:~/Desktop/Conquest-DICOM-Server/install$ ./linux.sh
nohup: appending output to 'nohup.out'
```

Conquest DICOM server 1.5.0-beta3 - Installation

Configuration information:

dgate executable = dgate
server folder = /home/osboxes/Desktop/Conquest-DICOM-Server/
web interface = /usr/lib/cgi-bin/newweb/dgate
web root = /var/www/html/
script_name = /cgi-bin/service/dgate

Welcome to **Conquest DICOM server**. Server is not running; click here to start: [Start server]

Server configuration:

AE	CONQUESTSRV1	Database	SQLite (built-in)
Port	5678	SQL host	localhost
Compression	Uncompressed	SQL server	/home/osboxes/Desktop/Conquest-DICOM-Se
FileNameSyntax	ID[32]\Studyuid\Seriesuid\Imageuid.dcm	SQL Username	dontcare
Data (MAG0)	/home/osboxes/Desktop/Conquest-DICOM-Server/data/	SQL Password	dontcare

Install: [install/config] [test database] [regenerate (may take very long)] [start compiling]
Control: [edit known dicom providers] [start server] [stop server]
Web: [configure web interface] Enter server's web interface
Config: Study Conquest viewer Series Conquest viewer No modify No download

The required steps (most are shown in the welcome area) are:

1) Select required database type (start with SQLite if unsure)
2) Start compiling → compile jpeg6c, compile openjpeg, compile charls, compile sqlite3, compile dgate; [done].
   If any of the compilation steps fails error messages can be found in file nohup.out. If the compilation information disappears click start compiling again.
3) Set other parameters (keep defaults if unsure)
4) Configure server
5) Start server (may need be repeated a few times if does not start)
6) Regenerate database
7) Configure web interface (select viewers and access rights)
   Note that if you want to use weasis as viewer, the weasis folder from weasis_portable.zip (v3), must be placed in your web servers root folder
8) Enter server's web interface

Feedback on this new installation method would be appreciated. After installation, the server runs as part of the control manager. To make it run permanently, stop the server control manager (dgatesmall) with ^C, and use the new start-stop-daemon method described above or the old one below. Note that stopping the server using this web page on Linux disables restarting it for a minute or so (due to an IP port being blocked). Be patient when it fails not restart and try again after a while.

Deamon configuration

Both the web install and maklinux now create a deamon as follows, adjusting the location where the server is located:

```
sudo cp conquest.service /etc/systemd/system/conquest.service
sudo systemctl daemon-reload
```

After installation you can control the conquest service as follows:

```
sudo systemctl stop conquest.service
sudo systemctl start conquest.service
sudo systemctl enable conquest.service
sudo systemctl status conquest.service                        hit 'Q' to return
```

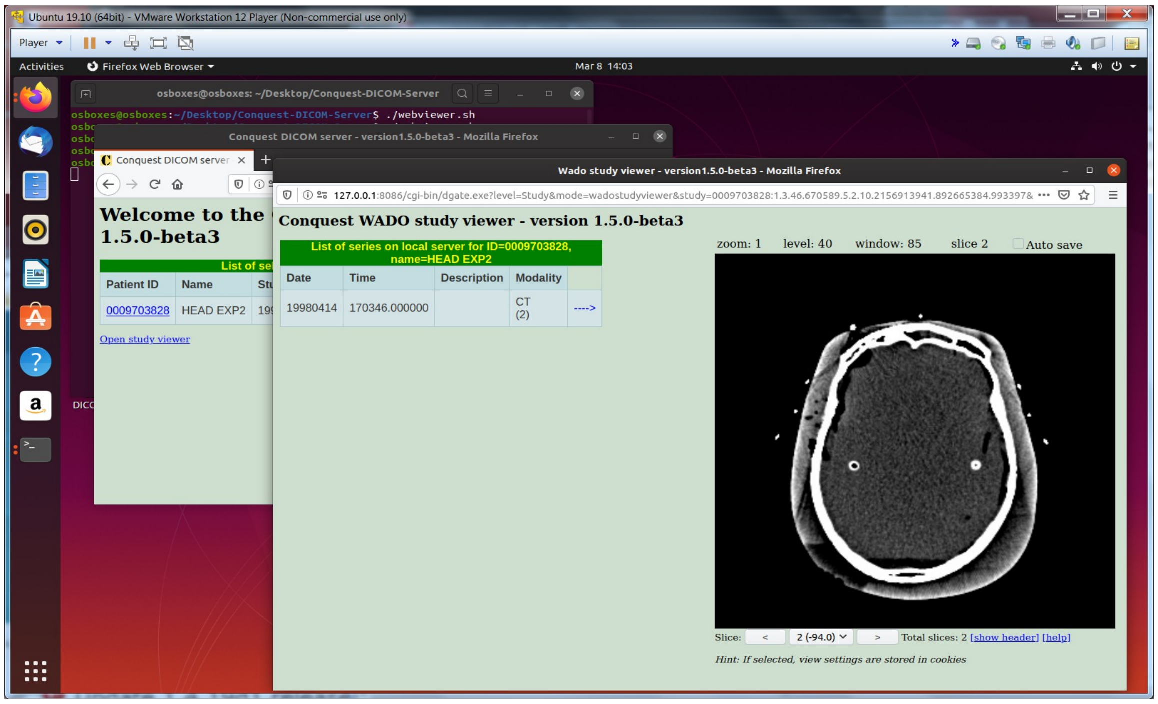
Now the server should be running, also after a system restart, and localhost/cgi-bin/dgate should provide a working web interface.

Built-in WEB Viewer

A new single user web viewer can be run as follows:

```
chmod 777 webviewer.sh
./webviewer.sh
```

This is the same web viewer as can be accessed from a full featured web server, but instead it runs on 127.0.0.1:8086, using Ladle (single user web server) as mini web server. After stopping the browser, the Ladle function is stopped. It takes a minute or so for the used port (8086) to be released. Until then attempting to start the web viewer fails.



Ubuntu 19.10 (64bit) - VMware Workstation 12 Player (Non-commercial use only)
Player
Activities
Firefox Web Browser
Mar 8 14:03
osboxes@osboxes: ~/Desktop/Conquest-DICOM-Server
Conquest DICOM server - version1.5.0-beta3 - Mozilla Firefox
Conquest DICOM server
Wado study viewer - version1.5.0-beta3 - Mozilla Firefox

```
osboxes@osboxes:~/Desktop/Conquest-DICOM-Server$ ./webviewer.sh
```

Welcome to the 1.5.0-beta3

Patient ID	Name	Stu
0009703828	HEAD EXP2	19

Open study viewer

127.0.0.1:8086/cgi-bin/dgate.exe?level=Study&mode=wadostudyviewer&study=0009703828:1.3.46.670589.5.2.10.2156913941.892665384.993397&

Conquest WADO study viewer - version 1.5.0-beta3

List of series on local server for ID=0009703828, name=HEAD EXP2

Date	Time	Description	Modality	
19980414	170346.000000		CT (2)	---->

zoom: 1 level: 40 window: 85 slice 2 Auto save

Slice: < 2 (-94.0) > Total slices: 2 [show header] [help]

Hint: If selected, view settings are stored in cookies

Example of built-in web viewer running on Ubuntu 19.10

Installing with Postgres

To install with Postgres as database, these commands are needed to install and setup Postgres:

```
sudo apt-get install libpq-dev                    Postgres development tools
sudo apt-get install postgresql                   Postgres database
sudo su                                           become superuser

su – postgres                                     become postgres user
psql                                              set the passwork to postgres
\password
postgres                                          (password)
postgres                                          (repeat password)
\q
createdb conquest                                 create database conquest
exit
exit

./maklinux                                        compile and install web access
choose option 2                                   Postgres
```

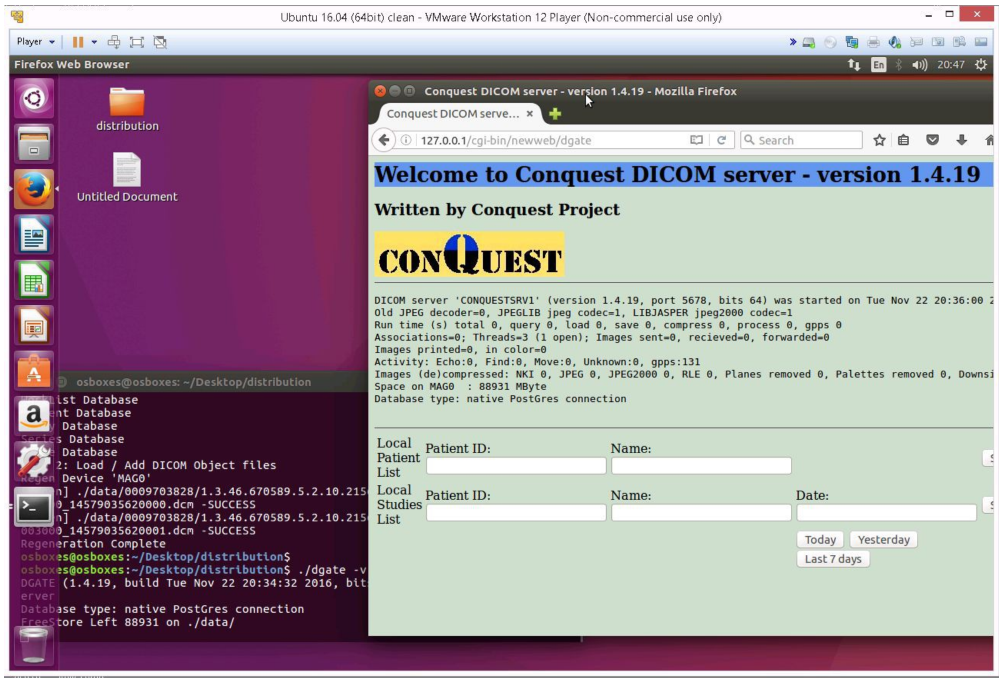
The build process always gives a few error messages that can be ignored:

```
/usr/bin/install: cannot create regular file '/usr/local/man/man1/cjpeg.1': No such file or directory

Makefile:200: recipe for target 'install' failed

mkdir: cannot create directory ‘data/dbase’: File exists
```

During database creation (dgate -v -r) there can be error messages about non-existing databases, e.g. for postgress:

```
osboxes@osboxes:~/Desktop/distribution$ ./dgate -v -r

Regen Database

Step 1: Re-intialize SQL Tables

*** ERROR:  relation "dicomworklist" does not exist

LINE 1: SELECT DICOMWorkList.PatientID FROM DICOMWorkList
                                 ^

Dropping Existing tables (if-any)

Worklist is empty

Dropping worklist

*** ERROR:  table "dicomworklist" does not exist

***Failed PGSQLExec : DROP TABLE DICOMWorkList

….

***Error: ERROR:  table "uidmods" does not exist
```

```
WorkList Database

Patient Database

Study Database

Series Database

Image Database

Step 2: Load / Add DICOM Object files

Regen Device 'MAG0'

[Regen] ./data/0009703828/1.3.46.670589.5.2.10.2156913941.892665339.860724_0001_002000_14579035620000.dcm
-SUCCESS

[Regen] ./data/0009703828/1.3.46.670589.5.2.10.2156913941.892665339.860724_0001_003000_14579035620001.dcm -SUCCESS

Regeneration Complete

osboxes@osboxes:~/Desktop/distribution$ ./dgate -v

DGATE (1.4.19, build Tue Nov 22 20:34:32 2016, bits 64) is running as threaded server

Database type: native PostGres connection
```


Ubuntu 16.04 (64bit) clean - VMware Workstation 12 Player (Non-commercial use only)
Player
Firefox Web Browser
20:47
Conquest DICOM server - version 1.4.19 - Mozilla Firefox
Conquest DICOM serve...
127.0.0.1/cgi-bin/newweb/dgate
Search
distribution
Untitled Document
osboxes@osboxes: ~/Desktop/distribution

Welcome to Conquest DICOM server - version 1.4.19

Written by Conquest Project

```
DICOM server 'CONQUESTSRV1' (version 1.4.19, port 5678, bits 64) was started on Tue Nov 22 20:36:00 2
Old JPEG decoder=0, JPEGLIB jpeg codec=1, LIBJASPER jpeg2000 codec=1
Run time (s) total 0, query 0, load 0, save 0, compress 0, process 0, gpps 0
Associations=0; Threads=3 (1 open); Images sent=0, recieved=0, forwarded=0
Images printed=0, in color=0
Activity: Echo:0, Find:0, Move:0, Unknown:0, gpps:131
Images (de)compressed: NKI 0, JPEG 0, JPEG2000 0, RLE 0, Planes removed 0, Palettes removed 0, Downsi
Space on MAG0  : 88931 MByte
Database type: native PostGres connection
```

Local Patient List	Patient ID:	Name:	
Local Studies List	Patient ID:	Name:	Date:

Today Yesterday Last 7 days

```
ist Database
nt Database
 Database
s Database
 Database
2: Load / Add DICOM Object files
Regen Device 'MAG0'
n] ./data/0009703828/1.3.46.670589.5.2.10.215
0_14579035620000.dcm -SUCCESS
n] ./data/0009703828/1.3.46.670589.5.2.10.215
003000_14579035620001.dcm -SUCCESS
Regeneration Complete
osboxes@osboxes:~/Desktop/distribution$
osboxes@osboxes:~/Desktop/distribution$ ./dgate -v
DGATE (1.4.19, build Tue Nov 22 20:34:32 2016, bit
erver
Database type: native PostGres connection
FreeStore Left 88931 on ./data/
```

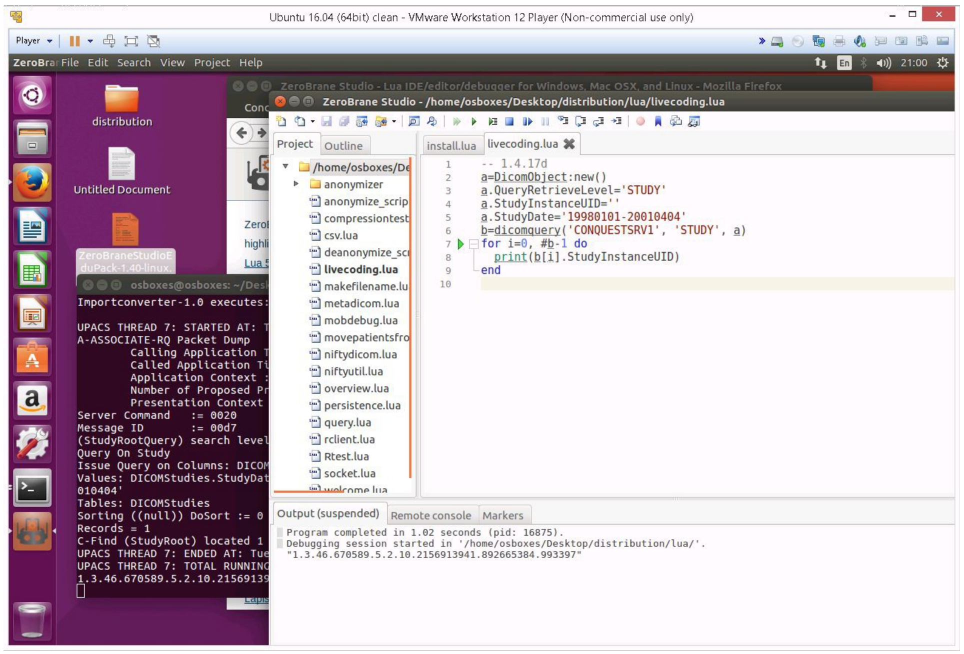
Older Conquest in action on Ubuntu16.04, with web interface

ZerobraneStudio IDE

To install and use ZeroBrane Studio with the conquest DICOM server under Linux, take these steps. First download ZeroBraneStudioEduPack-xxx-linux.sh. Then in a command prompt run:

```
chmod 777  ZeroBraneStudioEduPack-xxx-linux.sh
sudo ./ZeroBraneStudioEduPack-xxx-linux.sh
```

After installation is done run ZeroBrane Studio from the command prompt as “sudo zbstudio” and run the install script /dicomserver/ZeroBraneStudio/install.lua in ZeroBrane Studio as described in this file. After running the conquest install script as root, ZeroBraneStudio can be run as a normal user.



```
-- 1.4.17d
a=DicomObject:new()
a.QueryRetrieveLevel='STUDY'
a.StudyInstanceUID=''
a.StudyDate='19980101-20010404'
b=dicomquery('CONQUESTSRV1', 'STUDY', a)
for i=0, #b-1 do
  print(b[i].StudyInstanceUID)
end
```

```
Importconverter-1.0 executes:

UPACS THREAD 7: STARTED AT: T
A-ASSOCIATE-RQ Packet Dump
        Calling Application T
        Called Application Ti
        Application Context :
        Number of Proposed Pr
        Presentation Context
Server Command   := 0020
Message ID       := 00d7
(StudyRootQuery) search level
Query On Study
Issue Query on Columns: DICOM
Values: DICOMStudies.StudyDat
010404'
Tables: DICOMStudies
Sorting ((null)) DoSort := 0
Records = 1
C-Find (StudyRoot) located 1
UPACS THREAD 7: ENDED AT: Tue
UPACS THREAD 7: TOTAL RUNNING
1.3.46.670589.5.2.10.21569139
```

```
Program completed in 1.02 seconds (pid: 16875).
Debugging session started in '/home/osboxes/Desktop/distribution/lua/'.
"1.3.46.670589.5.2.10.2156913941.892665384.993397"
```

Integration with Zerobrane studio

CONFIGURATION

Configuration files under Windows and Linux are the same except for the use of a forward slash instead of back slash in directory paths. The following essential entries are therefore different for Linux (these are the defaults):

SQLServer	=	/home/user/conquest/data/dbase/conquest.db3
MAGDevice0	=	/home/user/conquest/data/

See the Windows manual for more details about the configuration files (you need at least to edit **acrnema.map** to define DICOM systems that will be retrieving information from your server). All configurations options in **dicom.ini** (e.g., for DICOM routing) are listed in **windowsmanual.pdf**. You may also need to edit the web server configuration file **/usr/lib/cgi-bin/dicom.ini** to set the correct IP address of the machine. If not some of the web server functions fail.

If needed, you can regenerate the database at any time (**losing its contents**) with “conquest/dgate –v –r” then run the server with “conquest/dgate –v &” or “conquest/dgate -^serverstatus.log”. NOTE: regeneration is only needed after an upgrade if **dicom.sql** is updated. If you want to avoid regeneration do NOT replace **dicom.sql**

The building process for the server was tested with Ubuntu 14, 18 and 19. Both 32 and 64 bit OS's are supported. Warnings are produced but these do not impact server operation.

Also MySQL support is provided. It requires creating a DB called "conquest" with phpmyadmin and installing libmysqlclientdev with: “*apt-get install libmysqlclient-dev*” before running maklinux_mysql. These are the settings in dicom.ini for MySQL:

```
SQLHost             = localhost
SQLServer           = conquest
Username            = root
Password            =
Mysql               = 1
DoubleBackSlashToDB = 1
```

The PostGres system can be setup to the defaults, and a database named ‘*conquest’* made. For postgres to work you need to check some values in dicom.ini (using the default postgres account assuming password postgres, note that parameter ‘*SQLServer*’ sets the database to conquest). A copy from **dicom.ini.postgres** to **dicom.ini** would set the following values:

```
SQLHost             = localhost
SQLServer           = conquest
Username            = postgres
Password            = postgres
PostGres            = 1
DoubleBackSlashToDB = 1
UseEscapeStringConstants = 1
```

It is advised to use a normalized database (as defined in **dicom.sql**) for postgres operation, e.g., by copying **dicom.sql.postgres** to **dicom.sql** and a denormalized database for DbaseIII, e.g., by copying **dicom.sql.dbase** to **dicom.sql**.

The following are older donated scripts by Mark Pearson for start/stop and rotating logfiles, information for expert users only:

To install this script (it is in the distribution as nconquest-pacs.sh) do:

```
sudo cp nconquest-pacs.sh /etc/init.d/
sudo chmod 755 /etc/init.d/nconquest-pacs.sh
sudo apt-get install authbind
sudo /etc/init.d/nconquest-pacs.sh start
```

```
#!/bin/bash
#
# conquest-pacs.sh      SysV init script for Conquest PACS.
#
#       Written by Miquel van Smoorenburg <miquels>.
#       Modified for Debian GNU/Linux by Ian Murdock <imurdock>.
#       Customized for Conquest by Mark Pearson <markp>
#
#       HOME and PACSUSER should be the only variables that may need to be
modified.
#
PATH=/sbin:/bin:/usr/sbin:/usr/bin

# Modify HOME to suit your environment.
HOME=/usr/local/conquest
# This is the user to run as. Modify it if you don't use username conquest.
PACSUSER=conquest

DAEMON=$HOME/dgate
INI=$HOME/dicom.ini
NAME=conquest_pacs.sh

# All defaults here will be overridden by values from $HOME/dicom.ini
STATUSLOG=$HOME/serverstatus.log
PORT=104
DESC="Conquest PACS Server"

STOPPACS=$HOME"/dgate --quit:"
STARTAS=$DAEMON

test -f $DAEMON || echo "Cannot find $DAEMON" exit 0
test -f $INI || echo "Cannot find $INI" exit 0

set -e

if  grep "TCPPort" $INI > /dev/null ; then
        PORT=`egrep -i '^*TCPPort *= ' $INI | sed 's/\r//' | awk '{ print  $3}'`
fi

if [ $PORT -le 1024 ]; then
        test -f /usr/bin/authbind || echo "authbind is needed for access to ports <
1024" exit 0
        STARTAS="/usr/bin/authbind "
fi

if  grep -is "^ *StatusLog" $INI > /dev/null ; then
        STATUSLOG=`egrep -i '^*StatusLog' $INI | sed 's/\r//'  | awk '{ print
$3}'`
fi


PIDFILE=/var/run/$NAME.$PORT.pid
if [ $STARTAS = $DAEMON ]; then
        ARGS=" -^$STATUSLOG"
else
        ARGS="$DAEMON -^$STATUSLOG"
fi

case "$1" in
  start)
        if [ -f $HOME/disable_autostart ]; then
                echo "Not starting $DESC: disabled via $HOME/disable_autostart"
                exit 0
        fi


        echo -n "Starting $DESC: "
        start-stop-daemon --start --quiet --pidfile $PIDFILE \
                --chuid $PACSUSER --chdir $HOME --exec $DAEMON \
                --startas $STARTAS --background -- $ARGS
        echo "$NAME."
        ;;
  stop)
        echo -n "Stopping $DESC: "
        cd $HOME
        $STOPPACS

        start-stop-daemon --oknodo --stop --quiet --pidfile $PIDFILE \
                --exec $DAEMON -- $ARGS
        echo "$NAME."
        echo
        ;;

  restart|force-reload)
        echo -n "Restarting $DESC: "
        start-stop-daemon --stop --oknodo --quiet --pidfile $PIDFILE  \
                --exec $DAEMON -- $ARGS
        sleep 1
        start-stop-daemon --start --quiet --pidfile $PIDFILE \
                --chuid conquest --chdir $HOME --exec $DAEMON -- $ARGS
        echo "$NAME."
        ;;
  *)
        N=/etc/init.d/$NAME
        echo "Usage: $N {start|stop|restart|force-reload}" >&2
        exit 1
        ;;
esac

exit 0
```

For security reasons I have added a user "conquest" and the package authbind to allow access to priveleged ports. I added the following entries to dicom.ini:
HomeDir = /usr/local/conquest
StatusLog = /var/log/conquest/NMPACS.serverstatus.log

TroubleLog = /var/log/conquest/NMPACS.PacsTrouble.log

The file /etc/cron.weekly/conquest_rotate does weekly log rotation for me.

```
#!/bin/bash

# conquest_rotate      Cron script to rotate conquest log files.
#     Keep files for 365 days
#     Read filenames from dicom.ini
#
#
#               Written by Mark Pearson 20070711 <markp>.
#

# Modify this line to suit your environment
HOMES=(/usr/local/conquest /usr/local/conquest-icon)
for i in ${HOMES[@]}; do

        INI=${i}/dicom.ini
        STATUSLOG=${i}/serverstatus.log
        TROUBLELOG=${i}/PacsTrouble.log

        set -e

# defaults will be overridden by values from ${i}/dicom.ini
        if  grep -is "^ *StatusLog" $INI > /dev/null ; then
                STATUSLOG=`egrep -i '^*StatusLog' $INI | sed 's/\r//'  | awk
'{ print  $3}'`
        fi
        if  grep -is "^ *TroubleLog" $INI > /dev/null ; then
                TROUBLELOG=`egrep -i '^*TroubleLog' $INI | sed 's/\r//'  | awk
'{ print  $3}'`
        fi

        if [ -s $TROUBLELOG ]; then
                savelog -p -c 365 -n -q $TROUBLELOG
        fi

        if [ -s $STATUSLOG ]; then
                savelog -p -c 365 -n -q $STATUSLOG
        fi
done
```

This copes with multiple pacs instances on the same host. The advantage of using savelog is that old logfiles are compressed. It should be quite simple to edit the files to have executable or log in /opt. Also, don't forget to set the appropriate file permissions for the user that runs conquest.

Finally, Here are the command lines to compile the server under OS X xcode using 10.4u sdk on a PowerPC (not recently tested):

```
 g++ -isysroot /Developer/SDKs/MacOSX10.4u.sdk -arch ppc -Wno-multichar
-I/usr/local/mysql/include -L/usr/local/mysql/lib -DDARWIN -DUSEMYSQL -DHAVE_LIBJASPER
-DHAVE_LIBJPEG  -DB_DEBUG -o dgate total.cxx -lpthread -lgcc_s.10.4 -lstdc++.6 -lmysqlclient
```

-lz

And to compile under SOLARIS 10:

```
 /usr/sfw/bin/g++ -DUNIX -DNATIVE_ENDIAN=1 -DHAVE_LIBJASPER -DHAVE_LIBJPEG
-DSOLARIS total.cxx -o dgate -lpthread -lsocket -lnsl -lposix4
```