

Version: 6.7	Reviewed by:	Approved by:
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User Manual

CharruaPACS – Advanced Edition

Developed by:

CharruaSoft
<http://www.charruasoft.com>

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1. Introduction

CharruaPACS is an easy-to-use PACS server that can be installed and maintained without difficulty. It offers support for DICOM C-STORE SCP, which covers most used SOP classes, with uncompressed, JPEG lossless, JPEG lossy, and JPEG 2000 Transfer Syntaxes. Additionally, it supports C-FIND and C-MOVE SCP Study Root model and C-ECHO Verification as SCP.

CharruaPACS comprises four applications:

Admin: This is for the initial configuration of the server.

DICOM Server: This application runs the DICOM PACS server.

WEB Server: It's CharruaPACS WEB Interface for configuration and accessing images with a web browser.

HTTP Client: This Windows-based visualization application provides access to images in the PACS using the HTTP protocol.

Both servers run as Windows Services for ease of use.

CharruaPACS uses the UCDCM DICOM library by Mark Oskin for its codebase. It also incorporates the Independent JPEG group library for JPEG compression/decompression and the OpenJPEG group library for JPEG 2000 compression/decompression. In addition, the OHIF Viewer, Copyright (c) 2018 Open Health Imaging Foundation, has been added to the package. The advanced version of CharruaPACS uses PostgreSQL as its database. The WebServer component is based on Indy Project TidHTTPServer.

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2. Computer Platform

The minimum configuration is a personal computer with:

Windows 10, Windows Server 2019,
8 GBytes RAM.
1 TBytes HDD in RAID configuration.
100 MBps Network Card.
INTEL i5 Processor or superior.

3. Software Specifications

CharruaPACS has the following characteristics:

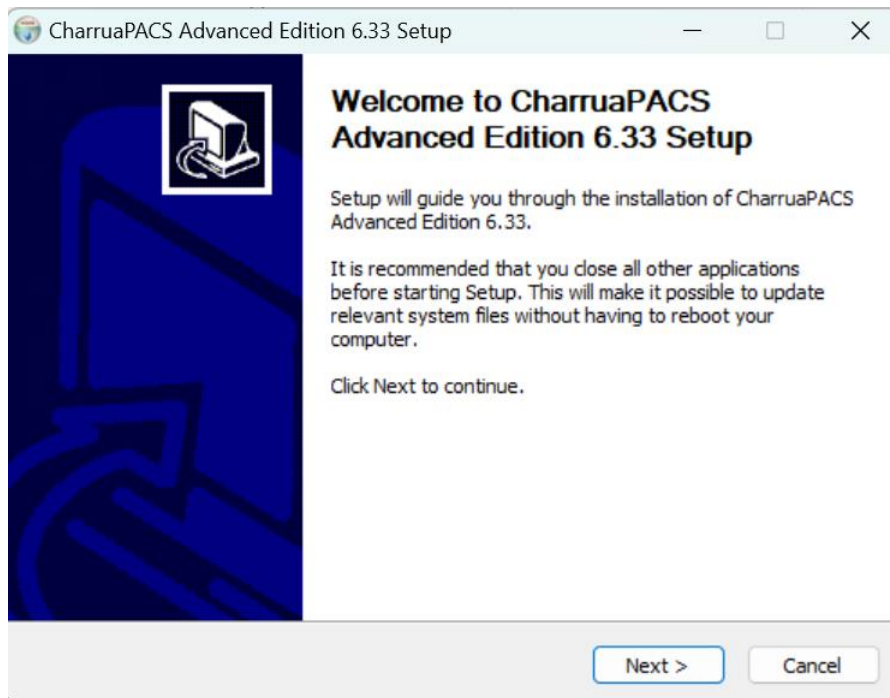
- Installation and configuration tool.
- WEB interface with User Authentication.
- Archive Backup/Restore functionality.
- Database Requirements hold DICOM objects information in a hierarchical structure.
- DICOM Server with querying using different keys to check the DICOM studies and retrieving JPEG or uncompressed renderings.
- HTTP Applications Programming Interface to query and retrieve study/series/objects information using the DICOM Rest protocol. It implements DICOM QIDO-RS, DICOM STOW-RS and DICOM WADO-URI and WADO-RS.

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4. Software installation

Software installation:

1. Download the Installer from: <http://www.charruasoft.com>
2. Unzip the ZIP file downloaded.
3. Install the PostgreSQL in case it is not already installed. (See Appendix 1. for instructions).
4. Run charruapacs_adv_install.exe
5. Follow the Wizard to correctly install the software.



6. When the installation is about to finish, the Wizard closes and the **Admin CharruaPACS** windows opens. Click in **Create dB** to generate the system databases.
7. Close the **Admin** application to finish the installation process.
8. Access to the browser to check that the application is correctly installed (See Chapter 7). For logging in the WEB interface: **user:admin, pass:admin.**

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Note: It is suggested to install the Software in the path recommended in the installation Wizard (C:\CharruaSoft).

5. Admin configuration

Double clicking on the Program (CharruaPACS/admin), you will see the following screen.

5.1 Main Tab

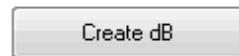
The screenshot shows the 'Admin CharruaPACS' window with the 'Main' tab selected. The window is divided into several sections:

- Database:** Contains buttons for 'Create dB', 'Regen dB', 'Reset Admin Pass.', 'Get New Certificate', 'About', and 'End'.
- WEB Server:** Includes a 'Port' field set to 80, an 'HTTPS Encryption' checkbox (unchecked), a 'Domain' field set to 'localhost', and a 'Logoff' dropdown menu set to '10 min'.
- Server Configuration:** Includes an 'AET' field set to 'CHARRUAPACS', a 'Port' field set to '11112', a 'TLS Encryption' checkbox (unchecked), a 'LOG level' dropdown menu set to 'High Level Message', a 'Key' field set to '8E28E8E8-17F', an 'Erase Older than' dropdown menu set to 'NEVER', and a 'Transfer Syntax' dropdown menu set to 'JPEG Lossless'.
- Select Image Folder:** Includes a text field showing 'C:\CharruaSoft\CP_Advanced\imagebox' and a 'Select Folder' button.
- PostgreSQL:** Includes an 'IP Address' field set to 'localhost' and a 'Password' field with masked characters.

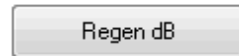
Figure 1. Main Admin

In the **"Database"** section, you can create or regenerate the database.

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“Create DB” button will create a new database “charrua.db” and will fill it with the tables “Study”, “Series” and “Objects”.



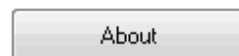
“Regen dB” will create a new database from the information in the saved images.



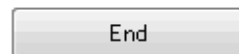
Reset the Admin password to “admin”.



When using HTTPS protocol with an internet Domain, this option gets a 3 month free certificate from Let's Encrypt.



Check the software version.



Close the software and re-starts the Services.

In the section of **“Server Configuration”** the DICOM Application Entity Title and the Port Number for the DICOM server can be set. Also different LOG levels for debugging can be chosen.

“WEB Server” if for the WEB server configuration, selecting HTTPS encryption selects the HTTPS secure protocol. Using the HTTPS option requires getting a domain and a digital certificate for that domain. “Logoff timeout”, is the waiting timer until logging off the current user.

“Select Image Folder” allows you to choose the directory where the images will be stored, and this directory can be changed as the current disk fills up.

Admin will create a “cp_register.txt” file with the registration information. The user will have to send us this file to create the license key.

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5.2 Backup/Restore Tab

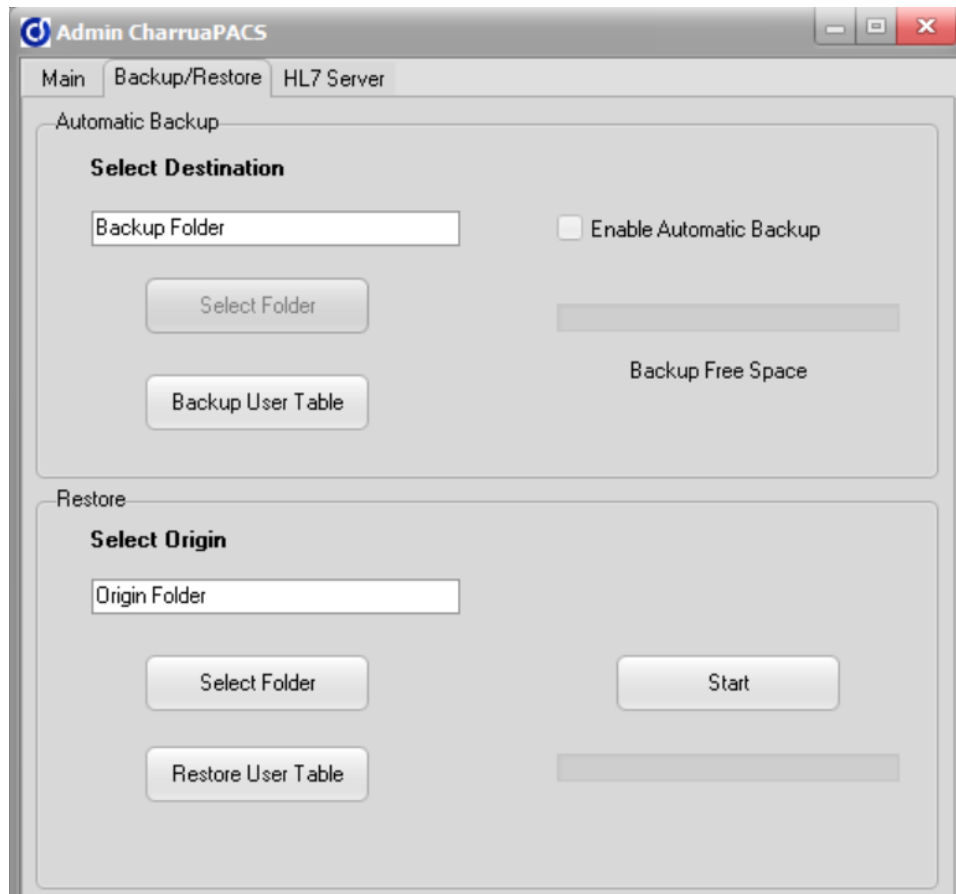


Figure 2. Backup/Restore Tab

- **Automatic Backup:**

The Automatic Backup is only available for CharruaPACS Advanced in REAL mode. The Automatic Backup tab enables automatic backup, selecting from an external drive for backup, and testing the available space.

Whenever comes a DICOM object to the server, it is marked on the database as pending. Once the backup could be performed (periodically, each hour) it is marked as done. If the system cannot access to the external disk, the backup fails, and it is marked in the log as pending.

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Check Appendix 3 for adding networked drives.

Backup User Table: backups all the users and user filters in the database for security or migration purposes.

-Restore:

Restoring the backup is as simple as selecting the origin folder, clicking on the “Start” button, the system will start loading the images into the PACS archive.

The “Restore User Table” button will read the backed-up users configuration from the source folder.

5.3 HL7 Server Configuration.

Description	DICOM	HL7
Patient's Name	(0010,0010)	PID-5
Patient's ID	(0010,0020)	PID-3
Patient's BirthDate	(0010,0030)	PID-7
Patient's Sex	(0010,0040)	PID-8
Contrast Allergies	(0010,2110)	
Accession Number	(0008,0050)	OBR-18
Modality	(0008,0060)	OBR-24
Study Instance UID	(0020,000D)	ZDS-1
Requesting Physician	(0032,1032)	OBR-16
Requested Procedure Description	(0032,1060)	OBR-44
Requested Contrast Agent	(0032,1070)	
Sched. Station AET	(0040,0001)	OBR-21
SPS Start Date	(0040,0002)	OBR-6
SPS Start Time	(0040,0003)	OBR-6
Sched. Ref. Physician	(0040,0004)	OBR-24

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In this tab the HL7 Server parameters are set. The HL7 Port, the timeout for worklist entries, and the HL7 to DICOM mapping.

6. DICOM Server Operation

The CharruaPACS DICOM Server operates as a multi-threaded DICOM Storage SCP, Verification SCP, and Query/Retrieve SCP. It has additional functionality for being used as a DICOM router, allowing for the definition of rules for forwarding DICOM files. Additionally, the server has an HL7 listener and can provide DICOM Modality Worklist SCP.

The DICOM Server runs as a Windows Service, and its configuration and operation are controlled by the Admin application. In the event of any errors during the operation of CharruaPACS, please send the log file to info@charruasoft.com for support.

7. WEB Server

The WEB Server serves as the User Interface for CharruaPACS, and it utilizes port 80 by default. It can be accessed by typing <http://localhost> on the local machine or via the IP address or Domain of the server machine when accessed from a remote machine.

The WEB Server runs as a Windows Service, and its configuration and operation are managed by the Admin Application.

When logging in for the first time on the WEB interface, the default username and password are both "admin."

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7.1 Main WEB Page

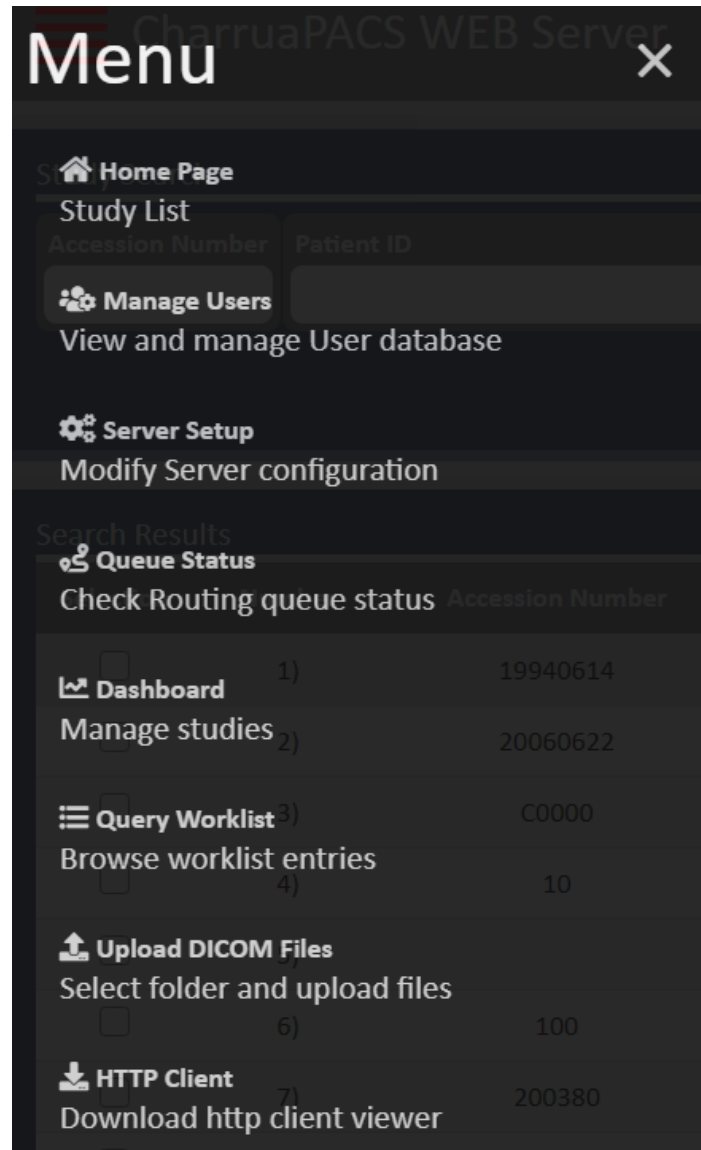


Figure 4. Main Web Page

Home Page: query page for viewing the DICOM studies.

Manage users: for creating or updating users information.

Server Setup: DICOM and WEB Server configuration page.

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Queue Status: check the routing queue.

Query Worklist: query page for viewing the DICOM worklist entries.

Upload DICOM Files: page for upload DICOM Files from the local system.

HTTP Client: download the HTTP Client DICOM Viewer.

7.2 Manage Users

Figure 5. Manage Users

This page is only available to the Admin user role. Here new users can be created, or existing users can be modified.

Different rights could be assigned to each kind of user: General, Admin, Radiologist, Referring, Manager.

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- Admin, has no limits, it can change server configuration, edit/delete studies.
- Manager, cannot change server configuration or modify users, but can edit/delete studies.
- Radiologist can inform studies.
- Referring and General can only view studies.

The Transfer syntax set here is used for the HTTP Client application. The JPEG Lossy option is recommended for WEB distribution and integration with HIS/RIS.

There is another page for setting user Filters:

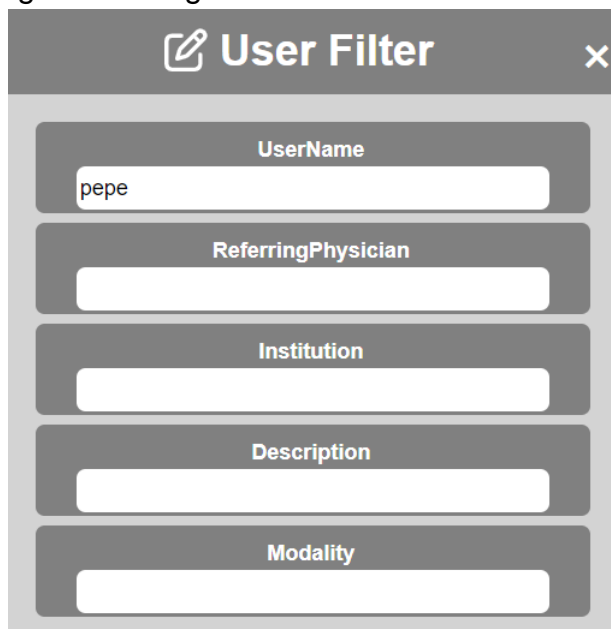


Figure 6. Manage User Filters

If the filters are empty the user will be able to see all studies. If we set Modality = CR, then the user can only see CR images.

Admin, Manager and Radiologist user roles can do DICOM/Windows printing and CD/DVD burning in the HTTP Client. Printer AET selects the DICOM Film Laser printer where the user prints to.

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7.3 Server Setup

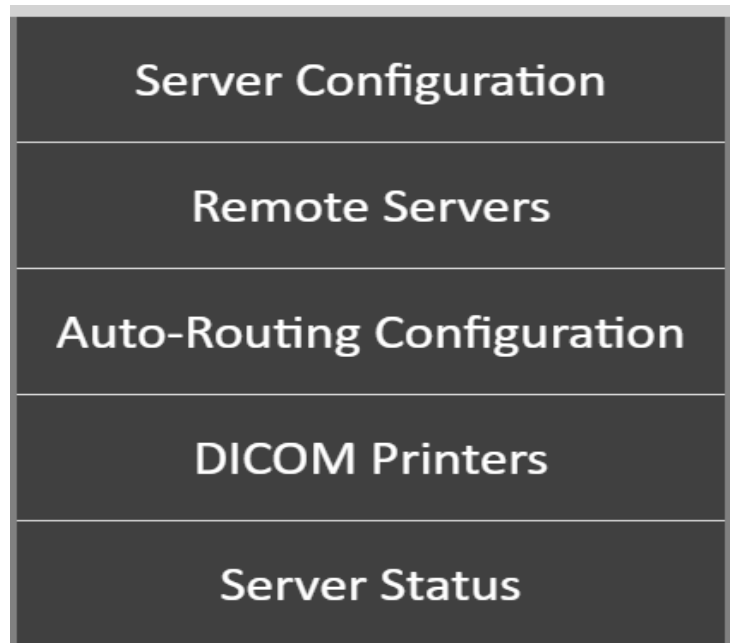


Figure 7. Server Setup

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7.3.1 Server Configuration

Server configuration is for main server parameters.

Figure 8. Server Configuration

Allows the configuration of the PACS server parameters:

- Application Entity Title to identify the server in the DICOM network.
- DICOM Port is the port number where the server will be listening.
- Log level is for debugging purposes.
- Query, Maximum Results. Set a limit for the number of query results.
- Retrieve, Maximum Results: Set a limit for the number of retrieve results.
- Concurrent Routing Threads: set a limit to the number of sending threads in the Auto-Routing section.

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- Enable Download in Viewer, enables the Download button in the Cornerstone Viewer.
- Enable Patient Portal, enables the patient Portal, for using Patient ID and Accession Number as user/password to view studies.
- Verify remote AETs, only known AETs are allowed.
- Store Accept Empty Patient Name: accept/reject studies with empty Patient Name.
- Store Accept Empty Patient ID: accept/reject studies with empty Patient ID.
- Store Check Same Patient ID & Name for Study: accept/reject studies where Patient ID or Patient Name varies from image to image.
- Worklist Filter By Station AET: Use modality AET for filtering the Worklist.
- Enable CORS: Allow Cross-Origin Resource Sharing.
- Shared Link in DICOM format, when sharing studies with encrypted links, the images will be in DICOM format, instead of JPEG lossy.
- Authentication for DICOM Rest: request authentication for using Rest resources.

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7.3.2 Remote Servers

Remote Servers page allows adding and editing remote servers.

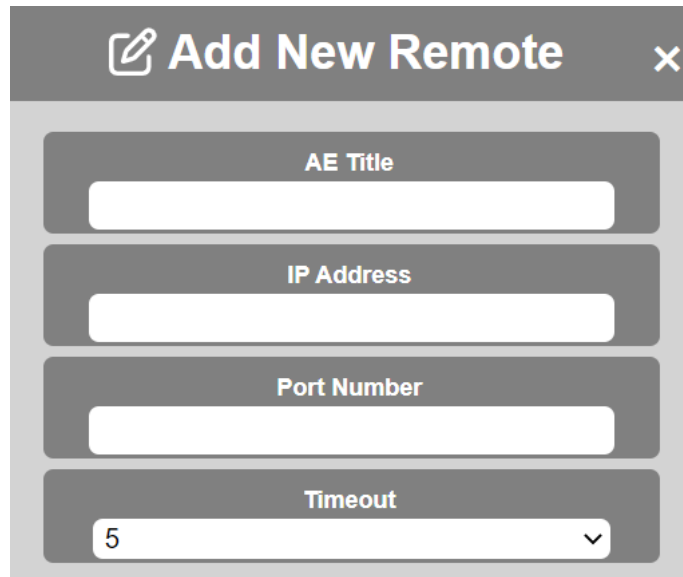


Figure 9. Remote Servers

Remote servers should be added for Query & Retrieve operations.

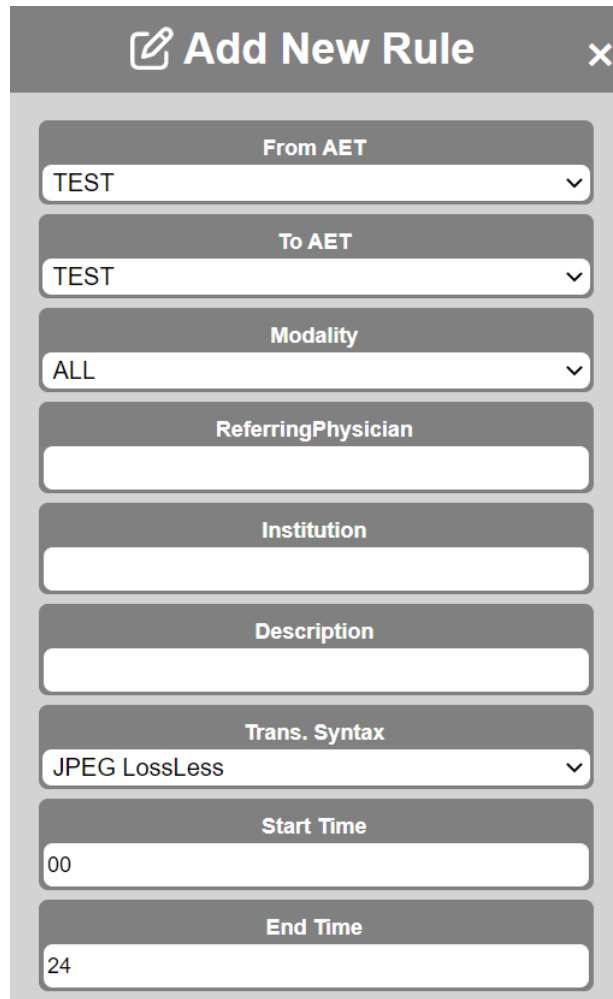
The required parameters for adding a new Remote Server are: DICOM Application Entity Title, IP Address, Port Number and Timeout.

In the Remote Server list there are two buttons, one for Editing the information and the other for deleting the server.

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7.3.3 Auto-Routing configuration

Auto-Routing configuration is for adding routing rules.



Add New Rule ✕

From AET
TEST

To AET
TEST

Modality
ALL

ReferringPhysician

Institution

Description

Trans. Syntax
JPEG LossLess

Start Time
00

End Time
24

Figure 10. Auto-Routing Configuration

Auto-Routing rules can be added for forwarding any incoming file.

The rules consider “From AET” for selecting incoming AET, “To AET”, where the images are forwarded, Modality, the preferred Transfer Syntax and the Start and End Time for scheduling routing within certain hours. Can add filters also for Referring Physician, Institution Name or Study Description.

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There are three virtual servers for special processing:

- The JPEG server is a destination for converting DICOM images into JPEG files. Files are saved on the jpeg folder under a Modality/Patient Name_Patient_ID subfolder.
- The REPORTS server is a source server, allowing to route all received DICOM SR objects to any destination.
- The JSON Server is a destination, it receives DICOM-SR objects, and converts them to JSON format.

7.4 Routing Queue Status

Routing Queue Status						
Number	AET	Patient Name	Images	Timestamp	Status	Select
1	JPEG	AL KAMYANI^KHALSA^NASSER YAQOOB^^	1	06/01/2020	ERROR	<input type="checkbox"/>
<div> <div>Send Selected</div> <div>Send All</div> <div>Delete Selected</div> <div>Delete All</div> </div>						

Figure 11. Routing Queue Status

Routing Queue Status shows pending routing jobs, the user can re-send, or delete routing jobs. If failed the jobs will be sent 4 times, 1 hour after the first try, 24 hours after, two days after, and 1 week after.

7.5 Query Studies

Study Search				
Accession Number	Patient ID	Patient Name	Date From	Date To
<input type="text"/>	<input type="text"/>	<input type="text"/>	mm/dd/yy <input type="text"/>	mm/dd/yy <input type="text"/>

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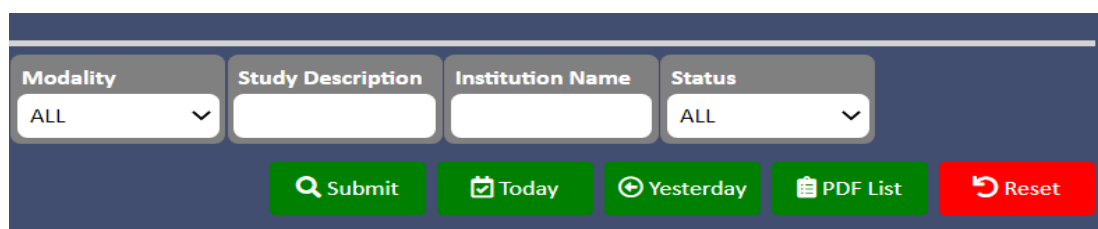


Figure 12. Query Studies

Any field can be used for the Query studies, even partial matches are accepted. **Today** button will bring all studies for the day, filtered by the filled fields. **Yesterday** button will bring all studies for the day before, filtered by the filled fields. PDF List will create a PDF document with the selected studies.

When the query is done it will show a list of studies that match it, selecting one of them will take to the series list, and after selecting one, it will show the images:

Search Results										
Selection	Number	Accession Number	Patient ID	^ Patient Name	Study Date/Study Time	Study Description	Modality	Institution Name	Status	
<input type="checkbox"/>	1)	19940614	19940614	Cerebellar, Atrophy	10/25/2002 10:39	MRI Head	MR	IMAGE Information Systems Ltd.	Unread	
<input type="checkbox"/>	2)	20060622	20060622	Culare, Navi	12/12/2005 07:30	Wrist	CT	IMAGE Information Systems Ltd.	Unread	
<input type="checkbox"/>	3)	C0000	00003	Hodgkin, Sabine	07/08/2005 12:49	Thorax	CR	IMAGE Information Systems Ltd.	Unread	

Figure 13. Query Studies list

Clicking on the patient's name will open the image viewer.

When selecting a patient several options are available:

- **Send:** Send the study to the selected server.
- **Edit** is for updating patient data in the selected study.
- **Report** allows adding a DICOM Structured Report text to the selected study.

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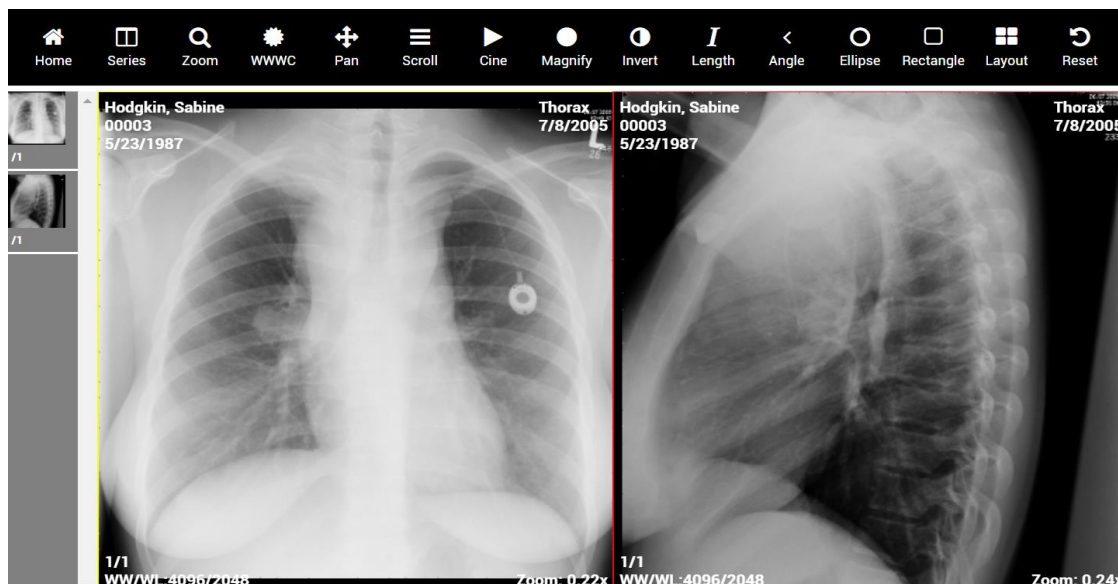
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- **Attach File**, with this option DOC, JPEG, PDF or MP4 files can be added to the selected study.
- **Share** creates an encrypted link for sharing the study.
- **Assign** allows to assign a study or series to another Patient. Selecting a single study allows assigning to a Worklist entry.
- **Delete** will delete the selected studies from the archive. Selecting a single study allows to delete at the Series level.

Cornerstone HTML5 viewer.



We are using the Cornerstone viewer; it has the following advantages:

HTML5/Javascript based library to easily add interactive medical images to web applications. Supports all HTML5 based browsers including mobile, tablet and desktop Displays all common medical image formats (e.g. 8 bit grayscale, 16 bit grayscale, RGB color). High performance image display. Support for changing viewport properties (e.g. ww/wc, zoom, pan, invert).

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Tools:



1. WW/WC – Change Window Width/Window Center, moving the mouse with left button pressed.
2. Invert – Inverts the image.
3. Zoom – moving the mouse with left button pressed changes image zoom.
4. Pan – move image with mouse when left button is pressed.
5. Scrolls through the image stack.
6. Linear Measurements.
7. Angle Measurements.
8. Elliptical ROI. (Region of Interest).
9. Rectangle ROI (Region of Interest).
10. Cine Display.
11. Stop Clip.
12. Reset display.
13. Modify display grid.

The HTML5 viewer can be configured with lossless or jpeg lossy images. In case jpeg lossy is selected, the measurement tools will not be enabled.

OHIF Viewer

Another option is to use the OHIF viewer, this option is set in the charruapacs.ini configuration file setting:
Use_OHIFViewer=1

After saving the changes to charruapacs.ini, restart the Windows Services or run and close the Admin application.

The OHIF Viewer provides a full set of tools for image processing and also has MPR reconstruction for MR and CT sets.

More information about the OHIF viewer:
<https://ohif.org/>

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7.6 Download HTTP Client.

By downloading the HTTP Client, you can have a complete **DICOM Viewing** application that communicates with the WebServer using the HTTP protocol. It can be used through the port 80 for enabling the communication even when firewalls are set. Using a VPN connection, it can be deployed on remote location for accessing the PACS through the internet.

Selecting one or more studies, it will download them to a cache temporary directory, and show them as they arrive. The images are transferred as DICOM, so window/levelling is done over the entire 16 bits, in case of grayscale images.

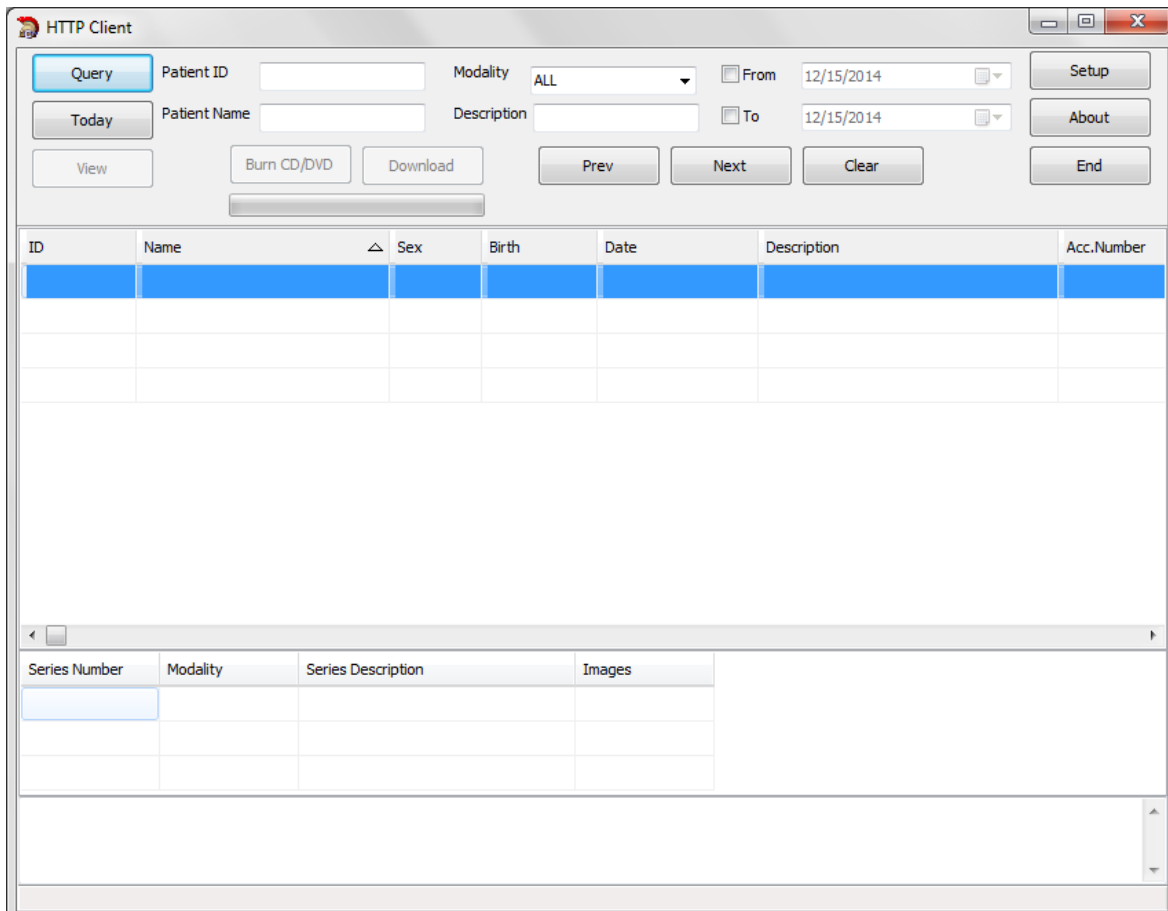


Figure 14. HTTP Client 1

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The Query button will bring the first twenty studies that match the selected filter.

Burn CD/DVD will create a CD/DVD with the selected studies and include a light viewer in the media.

Download will download the selected studies from the server to the local cache.

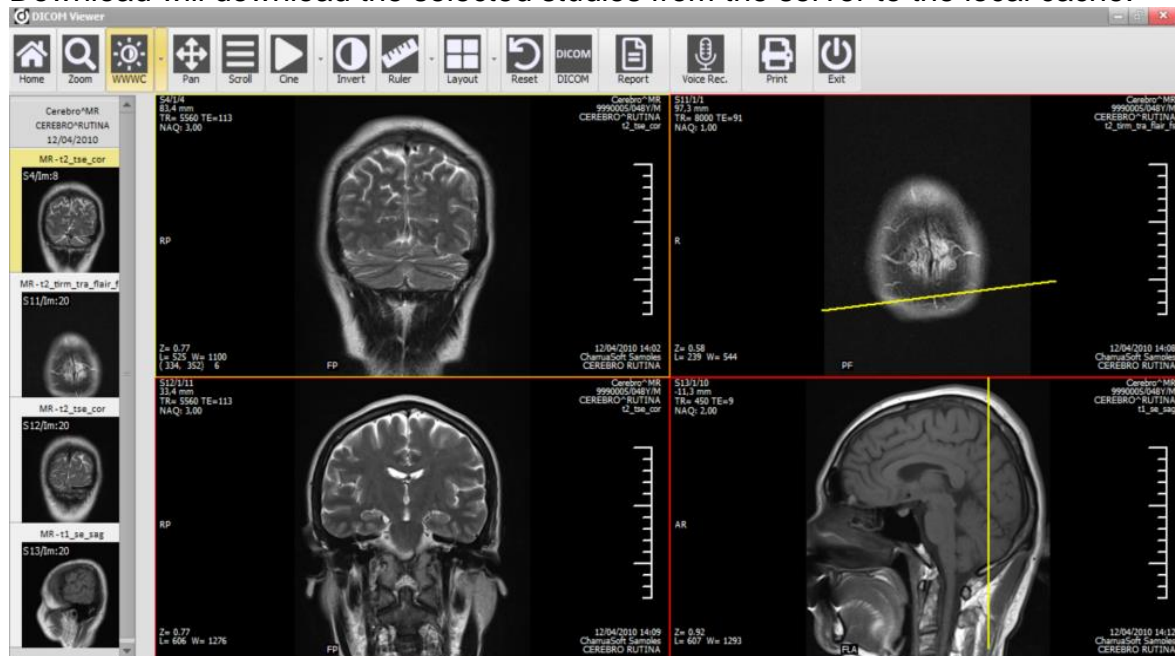


Figure 15. HTTP Client 2

The viewer has the most used tools:

- Window/Level with the mouse right click button.
- Zoom/Pan.
- Scroll/Cine.
- Inverted Image.
- Annotations, linear measurements, angle measurements, ROI.
- 1x1, 1x2, 1x3, 2x2, 2x3 layouts.
- Report Writing as DICOM Structured Report Text.
- Voice Recording

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- DICOM/Windows printing for Admin and Radiologist users. When printing DICOM the AET is "HTTPCLIENT".

Report Workflow:

1. The reports are written in the client's text editor.
A template can be loaded according to the study description.
The text must be unformatted and should not include any parameters from the DICOM header.
2. Once the report is written, it can be saved as preliminary or final.
By default, they are saved as preliminary. In preliminary mode they are only visible by other radiologists or administrators, general users can only access the final report. After 24 hours the report goes from preliminary to completed automatically, this configuration is optional and can be changed in charruapacs.ini
3. The report in preliminary mode can only be modified by any radiologist user. Also, a radiologist user can sign another user report in preliminary mode. Changes in the report will be audited. If the report is completed only addendas are accepted.
4. In the image viewer, selecting the report and opening the text editor will load the current report.
5. When the report is in the text editor it is possible to print it formatted using a print template. The print template has a header image jpeg, found in the server "templates" folder, and a footer image jpeg, also in the "templates" folder.

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7.7 Query Worklist

The screenshot shows a 'Study Search' interface with various filters and a table of results.

Search Filters:

- Acc. Number: [Empty]
- Patient ID: [Empty]
- Patient Name: [Empty]
- Date From: yyyy-mm [Calendar icon]
- Date To: yyyy-mm [Calendar icon]
- Modality: ALL [Dropdown arrow]
- Description: [Empty]
- Status: [Dropdown arrow]

Action Buttons: Q Submit, Today, Yesterday, PDF List, Reset

Table of Results:

Selection	Acc. Number	Patient ID	Patient Name	Start Date/Time	Modality	Description	Status
<input type="checkbox"/> 1)	134356	55555	Smith^John	2023-03-24 - 11:00	CR		SCHEDULED

Figure 16. Query worklist

You can search by the criteria in figure 17 and you can also add a new entry in the Worklist. The filters by status are SCHEDULED, COMPLETED, or DISCONTINUED.

The screenshot shows a form for adding a new entry with the following fields:

- Patient ID:** 123456
- Modality:** CR [Dropdown arrow]
- Patient Name:** Ramirez^Pepito
- Referring Physician:** Dr. Miller
- Patient BD:** 01/01/2000 [Calendar icon]
- Description:** Description number one
- Patient Sex:** Male [Dropdown arrow]
- Start Date:** 10/08/2021 [Calendar icon]
- Status:** SCHEDULED [Dropdown arrow]
- Start Time:** 03:00 PM [Clock icon]

Figure 17. Adding a new Entry

Studies status is set to DISCONTINUED, once the Worklist timeout is fulfilled, the default timeout is 24 hs.

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Appendix 1. PostgreSQL Installation

For downloading PostgreSQL go to this web link:

<https://www.enterprisedb.com/downloads/postgres-postgresql-downloads>

Select to download the Windows Binary package (in the latest version, 13.10 or superior) and run the installation procedure.

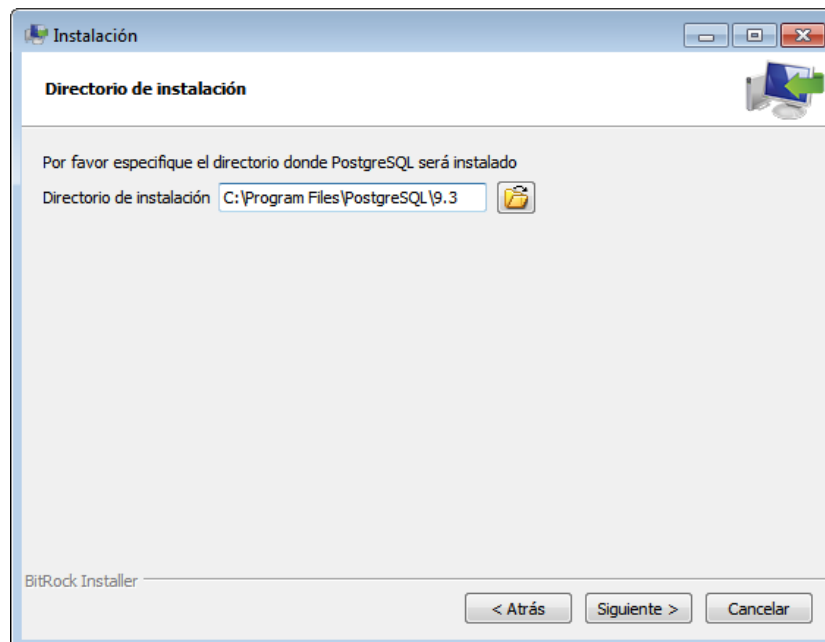


Figure 20. PostgreSQL Installation – Setting folder installation

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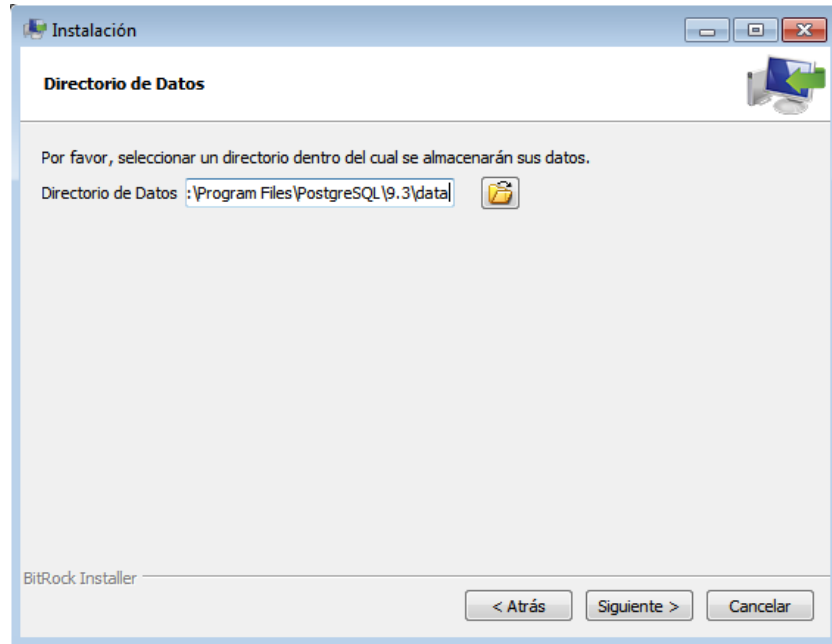


Figure 21. PostgreSQL Installation – Setting folder to save data

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Select “**postgres**” as the database password.

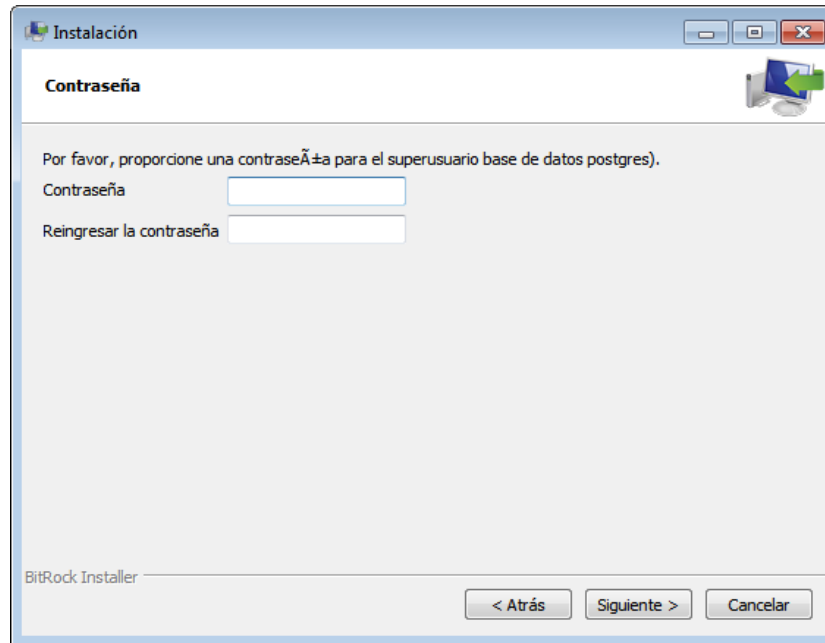


Figure 22. PostgreSQL Installation – Setting password

Unmark the box selected and finish the installation.



Figure 27. PostgreSQL Installation – Finish installation

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After the database server is installed run the Admin application for creating the database tables.

Appendix 2. CharruaPACS.ini

The configuration file charruapacs.ini has 2 different sections corresponding to different modules.

a. PACS Server Configuration [CP_Config]:

- AET – PACS Application Entity Title. Identifies the PACS Service in a DICOM network.
- DCMPort – PACS Server Port Number.
- HL7Port – PACS HL7 Server Port Number.
- TransferSyntax - Sets the Transfer Syntax or Compression for the image archiving. 0 – Default Compression, 1 – Little Endian Explicit, 2 – Little Endian Implicit, 3 – JPEG Lossless, 4 – J2K Lossless.
- LogLevel – Sets the Logging level for both the PACS and WEB Services. 0 – Only Error log, 1 – High level messages, 2 – DICOM Tags level message.
- DeleteOld – deletes older studies based on arrived date. 0 – Never, 1 – 2 Years, 2 – 1 Year, 3 – 6 months, 4 – 3 months, 5 – 2 months, 6 – 1 month.
- AutomaticBkp – 0 – Don't do Automatic Backup, 1 – Use automatic Backup, the BkpFolder must be set also.
- BkpFolder – Path to backup images in automatic Backup mode. The disk drive has to be different to the one were the PACS is installed. In case of a networked drive the UNC Path is used.
- Imagebox=, Imagebox path for saving the images.
- ImgBoxUserName=UserName, user name for Imagebox access.
- ImgBoxPassWord=PassWord, password for Imagebox access.
- Key – License key to activate the application.

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- AcceptEmptyName – 0 - PACS Store SCP does not accept empty Patient Names, 1 – PACS Store SCP accepts empty Patient Names and replaces it with a Timestamp.
- AcceptEmptyID – 0 - PACS Store SCP does not accept empty Patient IDs, 1 – PACS Store SCP accepts empty Patient IDs and replaces it with a Timestamp.
- SameIDName – 0 - PACS Store SCP does not check Patient Name and ID for images within a single study, 1 – PACS Store SCP checks that Patient Name and ID remain the same within a single study.
- WLFILTERByStationAET, 0 – Worklist does not filter by Station AET, 1 – Worklist filters Query by Station AET.
- QueryResults – Limits the number of Query Results, if 0 there is no limit, if results are greater than the limit an error is set at the end of the query.
- RetrieveResults – Limits the number of Move Results, if 0 there is no limit, if results are greater than the limit an error is set at the end of the move.
- RoutingThreads – Number of simultaneous routing threads.
- VerifyAETs – if 1 verifies if the remote AET is one of the known AETs.
- TLSEncryption – if 1 enables DICOM TLS encryption.
- SPSTimeoutIndex – Timeout for Worklist appointments, 0 – 24 hs., 1 – 12 hs., 2 – 6 hs., 3 – 3 hs.
- SendPartialSR=1, distribute reports with preliminary status.
- SRCompletionEnabled=1, set preliminary reports to final after 24 hs.
- JSONURL=http://localhost:8080, Send SR report into JSON URL.

b. WEB Server Configuration [WEB_Config]:

- WEBPort – WEB Server Port Number.
- WEBAuthentication – 0 – WEB interface does not require authentication, 1 – WEB interface requires authentication.
- WLDefaultModality – Selects the default modality for the Add Worklist WEB Form.

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- ShareLinkValidity – Sets the validity time of the Shared Links. 0 – 1 day, 1 – 2 days, 2 – 30 days, 3 – no time limit.
 - ShareLinkDICOM – 0 the shared images are JPEG Lossy, 1 the shared images are DICOM full.
 - HTTPSEncryption – if 1 it will use HTTPS encryption.
 - PatientPortal – if 1 it will enable access to the WEB interface using Patient ID as username and the Accession Number as password.
 - EnableDownload – if 1 it will add a download button to the HTML 5 viewer, enabling to download a zip file with the study DICOM images and a lite viewer.
 - Display SR – if 1 it will show the DICOM SR as PDF in a new WEB browser tab, if 0 the DICOM SR will be shown as a link in the thumbnails.
 - SessionTimeout – Timeout for WEB browser logoff, 0 – Deshabilitado, 1 – 5min., 2 – 10min., 3 – 20min., 4 – 60 min.
 - Domain – It is used to assing an internet Domain to the WEB Server.
 - RestAuthentication=1, enable authentication for REST access.
 - RestrictAudioReports=1, enable audio reports distribution.
 - Domain=localhost, WEB PACS domain for registering certificates.
 - EnableCORS=0, enable Cross-Origin Resource Sharing.
- c. Active Directory – For using LDAP authentication.
- ADEnable – 0 Active Directory is Disabled; 1 Active Directory is Enabled.
 - ADDomain – the Active Directory Domain.
 - AD_AdministratorsGroup, Administator role definition for Active Directory.
 - AD_RadiologistsGroup, Radiologist role definition for Active Directory.

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- AD_ReferringsGroup, Referring role definition for Active Directory.
 - AD_ManagersGroup, Manager role definition for Active Directory.
- d. Template – Is for customizing the report printing template.
- ReportTitle – Title for the report.
 - Header – Path to Header jpeg image.
 - Footer – Path to Footer jpeg Image.
- e. Database – for customizing the PostgreSQL database connection
- DBIPAddress, Database IP Address.
 - DBUserName, Database User Name.
 - DBPassWord, Database Password.

Apendix 3. Adding a networked disk as backup.

Windows Service can't access mapped network drives. The reason is that the Windows Service starts before any user is logged in, and the mapped network drives depend on the logged user.

Actions to be taken:

1. Open folder CharruaSoft\CP_Advanced and double click Configuration file "charruapacs.ini"
2. Change AutomaticBkp=0 to AutomaticBkp=1
3. Change BkpFolder= into BkpFolder=\\Server\share\path\, or the corresponding UNC path of your networked hdd.
4. Close the Notepad window and save the changes.
5. Go to Windows Start and select Control Panel, then select Administrative tools and a new window opens. Double click on "Services" which will open the list of (local) services.
6. Select "CharruaPACS_ADVANCED" and right mouse click this (blue) line.

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7. Select “Properties” from the menu list
8. A new window opens. Select the tab “Log On”
9. Select “This account”, click “Browse” and click “Advanced”
10. Click “Find Now”
11. From the list that shows up, pick the second line. This MUST be the user account of the PACS computer which shows up at start.
12. Click “OK” and again “OK”
13. You will see at “This account” the user account displayed with .\ in front
14. Replace the black dots in the password fields with the password that you wrote down initially.
15. Click “Apply” and “OK”
16. Now repeat line 6 to and including 15 for service “CharruaWEB_ADVANCED”.
17. Close the open window.
18. Switch off the computer and wait 10 seconds, then switch on again
19. Wait for 5 minutes to let the Charrua services start up
20. Open Windows explorer
21. Go to folder CharruaSoft (on drive J, K or I) and open this folder
22. Open folder CP_Advanced and then open folder “logs”
23. Go to the last file in the list, type _server and double click to open the file in Notepad.
24. Go to the bottom of the file where the last six lines should show:
4:01:53 PM, INFO, **** CharruaPACS V6.27.1 is starting ****
4:01:53 PM, PACSServer V6.27.1 starting in REAL mode
4:01:53 PM, INFO, trying to open charrua.db
4:01:53 PM, INFO, charrua.db opened successfully
4:01:53 PM, Initialize port: 104
4:03:53 PM, INFO, Checking Pending Backup
25. If this is correct, go to instruction line 59
26. If you see a last line saying:
4:03:53 PM, ERROR, CheckPendingBackup, Automatic Backup Disc is not available:...
27. This means that the networked HDD is not connected to the PACS computer in the right way.
28. First check if the LAN cable is connected to the networked HDD and it is switched on.

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30. Check if you can open the networked HDD with Windows explorer.

31. The final step is to do the data backup for the patient cases in the past. After the implementation of this FCO, CharruaPACS will transfer all new DICOM cases to the networked HDD, but will not automatically do a backup of the past months. This must be done manually.

32. From now on all received DICOM files will be backed up automatically

Appendix 4. DICOM Rest Interface.

1. Query – (QIDO-Rest Service)

Look up DICOM objects based on any metadata, the url is:
`http://Server_IP_Address::Server_Port_Number/qido-rs/`

Calling it without parameters brings all available studies in JSON or XML format, depending on the Request Accept HTTP Header. “application/json” for JSON format, or “multipart/related; type=application/dicom+xml” for XML format. The result limit is the same as the DICOM Query.

1.1 Study Level (study)

`../qido-rs/studies`

Available query parameters are:

- PatientID, PatientName, StudyModality, StudyDescription, StudyDate, offset, limit.

The following DICOM tags are returned:

(0008, 0020), StudyDate

(0008, 0030), StudyTime

(0008, 0050), AccessionNumber

(0008, 0061), StudyModality

(0008, 0080), InstitutionName

(0008, 1030), StudyDescription

(0010, 0010), PatientName;

(0010, 0020), PatientID

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(0010, 0030), PatientBD
(0010, 0040), PatientSex
(0020, 000D), StudyInstanceUID
(0020, 0020), StudyID

1.2 Series Level (series)

../qido-rs/studies/StudyInstanceUID/series

Available query parameters are:

Modality, StudyInstanceUID, SeriesInstanceUID, SeriesNumber.

The following DICOM tags are returned:

(0008, 0060), Modality
(0008, 103E), SeriesDescription
(0020, 000E), SeriesInstanceUID
(0020, 0011), SeriesNumber

1.3 Instance Level (instances)

../qido-rs/studies/StudyInstanceUID/series/SeriesInstanceUID/instances

Available query parameters are:

SOPClassUID, SOPInstanceUID, StudyInstanceUID, SeriesInstanceUID,
InstanceNumber, sortorder

The following DICOM tags are returned:

(0008, 0018), SOPInstanceUID
(0020, 0013), image Number

sortorder is a digit between 0 y 5:

- 0 – Default Order.
- 1 – AcquisitionNumber, ImageNumber order.
- 2 – ImageNumber, AcquisitionNumber order.
- 3 – SliceLocation, Ascend order.
- 4 – SliceLocation, Descend order.
- 5 – AcquisitionTime order.

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2. WEB Access to DICOM Objects (WADO-URI Service).

Can get one DICOM objects calling this URL:

`http://Server_IP_Address::Server_Port_Number/wado/`

To get the DICOM object need to know all its UUIDs:

StudyInstanceUID, SeriesInstanceUID, SOPInstanceUID.

The call returns the DICOM object, if it is an image it can be in DICOM or JPEG format according to the “contenttype” parameter.

3. WEB Access to DICOM Objects. (WADO-RS Service).

It is similar to WADO-URI, except it can bring multiple DICOM objects.

3.1 RetrieveStudy.

Get a whole study with StudyInstanceUID and the following URL:

`http://Server_IP_Address::Server_Port_Number/wado-rs/studies/{StudyInstanceUID}`

3.2 RetrieveSeries.

Get a whole series, with StudyInstanceUID and SeriesInstanceUID:

`http://Server_IP_Address::Server_Port_Number/wado-rs/studies/{StudyInstanceUID}/series/{SeriesInstanceUID}`

3.2 RetrieveInstance.

Get a single DICOM object with this URL:

`http://Server_IP_Address::Server_Port_Number/wado-rs/studies/{StudyInstanceUID}/series/{SeriesInstanceUID}/instances/{SOPInstanceUID}`

4. DICOM Objects Storage (STOW-RS).

Upload DICOM objects to the server, using a POST call.

`http://Server_IP_Address::Server_Port_Number/stow-rs/studies/{StudyInstanceUID}`

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Appendix 5. CharruaPACS REST Interface.

1. Encrypted link creation:

To share images from a procedure in through a WEB browser, it is necessary to create an URL calling the WEB server:

From the HIS call the encrypted link function with admin credentials, this call needs the accession Number parameter for the study:

<http://ipserver/createlink?AccessionNumber=12345678>

The call returns an encrypted link, this link can be called without credentials from the HIS. Link validity timeout can be set in the configuration file, charruapacs.ini, ShareLinkValidity=2 (0 is one day, 1 is two day, 2 is thirty days and 3 is forever).

2. Send Study. From PACS to a remote AET.

URL: /routingqueue

Command: POST

Parameters – JSON format:

- **AET:** Destination DICOM Node AE Title.
- **TS:** Selected Transfer Syntax:
 - **0:** Default
 - **1:** LE Explicit.
 - **2:** LE Implicit.
 - **3:** JPEG Lossless.
 - **4:** JPEG Lossy
 - **5:** JPEG 2K Lossless.
 - **6:** JPEG 2K Lossy.
- **PatientName:** Selected Patient Name.
- **StudyInstanceUID:** Selected study StudyInstanceUID.

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3. Edit Study. Edit patient and study data.

URL: /updatestudy

Command: POST

Parameters – in JSON format:

- **Name:** Patient Name.
- **ID:** Patient Id.
- **BD:** Patient Birthdate.
- **Sex:** Patient Sex.
- **Comments:** Clinical Data.
- **Date:** Study Date.
- **Description:** Study Description.
- **Institution:** Institution Name.
- **Modality:** Study Modality.
- **AccessionNumber:** Accession Number.
- **StudyInstanceUID:** Study Instance UID, this is the key for the study table.
- **Status:** Study Status: 0 – Unread, 1 - Preliminary, 2 – Dictated, 3 – Transcribed, 4 – Final.

4. Create Report for Study. Add Text, images or PDF to study

URL: /reportstudy

Command: POST

Parameters – in multipart/form-data:

- **PatientName:** Patient Name.
- **StudyInstanceUID:** Study Instance UID.
- **Text:** Report Text.
- **SOPInstanceUID:** previous report Instance UID, if used, it will replace it.
- **Comments:** Clinical Data.
- **Status:** Study Status.
- **File:** file archive in JPEG or PDF format.

5. Assign Studies. Assign series from one study into another or to a Worklist entry.

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URL: /assignseries

Command: POST

Parameters – in JSON format:

- study – Same format as “Edit Study”. This is the destination study.
- priorstudyuid – Prior Study Instance UID.
- priorname – Prior Patient Name.
- series – series Array with the following format each entry:
 - seriesInstanceUID: Series Instance UID.
 - modality: Series Modality.
 - seriesNumber: Series Number.
 - descr: Series Description.

6. Delete Study. Delete the selected study.

URL: /deletestudy

Command: POST

Parameters – in JSON format:

- **PatientName:** Patient Name.
- **PatientID:** Patient ID.
- **StudyInstanceUID:** Study Instance UID.

Appendix 6. SSL based Encryption.

Starting with version 6.29, CharruaPACS will offer PKI based encryption for both DICOM TLS and HTTPS protocols, based on the OpenSSL library.

The installer will create an account certificate, a self signed certificate and private and public keys. All of them are in PEM format. This self-signed certificate should be only used for testing. For production operation the customer can create his own free 3 months certificate for his domain from Let's Encrypt, using the Generate Certificate Button in the Admin app, or will have to buy a commercial digital certificate from any Certificate Authority.

DICOM TLS Encryption.

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TLS encryption allows for secure communication between the two parties. Our implementation does not check the other side identity, the encryption is used only to encode the transmitted data.

HTTPS Encryption.

The standard secure port used is 443. The transmitted data is encrypted.

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8. Document Change History

Document Version	Date	Changed performed by	Change description
6.2	1/3/2017	Rafael Sanguinetti	Appendixes were added and the screen print of the CharruaPACS 6,29
6.3	31/07/18	Rafael Sanguinetti	Changes on report writing for HTTP client
6.4	30/06/20	Pierre Poymarac	Several changes reflecting V6.31
6.5	08/10/21	Rafael Sanguinetti	Several changes reflecting V6.32
6.6	4/10/2022	Rafael Sanguinetti	Several changes reflecting V6.32.5
6.7	01/12/2022	Rafael Sanguinetti	Several changes reflecting V6.33