Open-Source PACS Systems Software Research

Introduction

Picture Archiving and Communication Systems (PACS) are integral to modern medical facilities for archiving, storing, querying, and communicating medical images. They have replaced traditional physical storage of medical images with digital storage, enabling easier and faster access to patient data.

PACS system is comprised of the following components

- Image Modalities. These are systems that perform the actual scanning of patients to produce medical images e.g. X-Rays, MRIs, Ultrasounds
- Database. This is for storing, indexing and retrieving DICOM files and reports.
- Workstation. These machines render the user interface for viewing images.
- Secure Network. Ensures information and data is protected from unauthorized access.

Preferred PACS Systems

ORTHANC

Orthanc is an open source, modular, lightweight DICOM server designed by Sebastien Jodogne and maintained by a Belgian company called UCLouvain. It has rich documentation, RESTful API endpoints and several plugins and configurations to support connectivity with different databases and image viewing modules.

Key Features

- ❄ Lightweight and Fast. Orthanc is designed to be lightweight and efficient.
- ❄ Cross-Platform. Orthanc software is compatible with Linux, Windows, OS X and Docker Images.
- ❄ DICOM Compliance. Orthanc is built on top of DCMTK ensuring full compliance with DICOM standards.
- ❄ Developer-Friendly. Orthanc offers a RESTful API, JSON, and PNG support.
- ❄ Viewer Plugins. Orthanc provides plugins and various configurations for viewing and managing DICOM files.
- ❄ Standalone: No need for complex database administration or third-party dependencies.

Pros

- ❖ Ease of Setup and Management. Orthanc has simple installation and configuration process.
- ❖ Integrated Viewer Components. Orthanc supports various viewer components for display and manipulating and automated analysis.
- ❖ DICOM functionalities and protocol. Orthanc supports DICOM scripting and functionalities like C-Move, C-Store, C-Find.

Cons

- ▪ Orthanc Explorer is not very user-friendly.

OHIF Viewer

The Open Health Imaging Foundation (OHIF) was launched in 2015 through a development partnership between Massachusetts General Hospital (MGH) Department of Radiology and Radical Imaging to create an open-source web-based medical imaging platform for the global community.

Key Features

- ❄ Speed and Performance. OHIF is efficient in handling and rendering large datasets.
- ❄ User-Friendly Interface. OHIF has an intuitive design focused on enhancing user experience.
- ❄ Customizability. OHIF is highly customizable with reusable components and plugin frameworks.
- ❄ Community support. OHIF is backed by a thriving open-source community.

Pros

- ❖ OHIF is designed to load large radiology studies quickly.
- ❖ Advanced Visualization: OHIF supports multi-modal image fusion, multi-planar reformatting, and more.
- ❖ OHIF has GPU-accelerated image rendering and multi-threaded image decoding ensuring high performance.
- ❖ Remote accessibility from anywhere with no installation required i.e. via URL.
- ❖ Custom Workflows. Supports custom workflows and user-centered experiences.
- ❖ Flexible and Extensible. OHIF is free, open-source, and actively supported by the community.
- ❖ Standards Compliant: Works with standard APIs like DICOMWeb and OpenID Connect.

Cons

- Complexity: May require more expertise to set up custom workflows and extend functionalities.

Comparative Analysis

Feature Set

- Orthanc: Provides core PACS functionalities with a focus on simplicity and ease of integration.
- OHIF Viewer: Offers advanced visualization, custom workflows, and high performance, making it suitable for more complex use cases.

Ease of Use

- Orthanc: Easier to set up and manage but has a less user-friendly interface.
- OHIF Viewer: More user-friendly with a focus on usability but may require more expertise for setup and customization.

Scalability

- Orthanc: Scalable with its plugin architecture suitable for small and medium setups
- OHIF Viewer: Highly scalable with support for large datasets and complex workflows.

Community and Support

- Orthanc: Supported by a dedicated active community and rich documentation.
- OHIF Viewer: Supported by an active open-source community and professional partnerships, offering extensive collaboration and innovation opportunities.

Conclusion

Both Orthanc and OHIF Viewer are robust open-source PACS systems with distinct purposes. By leveraging Orthanc for the PACS server and OHIF for the image viewer, the system benefits from the strengths of both platforms. Orthanc provides a lightweight, fast, and extensible DICOM server, while OHIF offers a powerful, web-based image viewer with advanced visualization capabilities. Orthanc is ideal for facilities seeking a lightweight, easy-to-manage solution with core PACS functionalities. It is suitable for smaller setups or those looking to integrate a DICOM server without complex requirements.

OHIF Viewer is more suited for image visualization, manipulation and automated analysis. Its high performance and user-centered design make it a strong choice for comprehensive imaging applications.