Implementation of Bahmni: An Open-Source Electronic Health Record for Rural Healthcare

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Abstract: Access to full electronic health record (EHR) systems is still limited in many rural and low-resource areas because of cost, weak infrastructure and limited technical skills. Bahmni, an open-source system built on OpenMRS, OpenERP (Odoo) and other community tools, provides an affordable and flexible option for such settings. This study explores how Bahmni can be used as a EHR for rural hospitals, focusing on its design, and real-world. The system combines different parts of hospital work, including patient records, laboratory results, pharmacy data and administrative tasks into one connected platform. Examples from rural hospitals show that Bahmni can improve record keeping, help share information between different departments and support better clinical decisions. It is also useful for teaching health informatics students how real EHR systems work. However, some challenges remain, such as the need for stronger decision support tools, regular technical support, and better scalability. In general, Bahmni proves that it is possible to build and run an open-source EHR that fits the needs of rural healthcare while helping local teams to develop digital health skills.

Keywords: Bahmni, open-source, electronic health record, electronic medical record, rural, healthcare

1. INTRODUCTION

The move toward digital health records has become a key step in improving the quality, safety, and efficiency of healthcare delivery worldwide; however, in many developing and rural areas, healthcare systems still depend heavily on paper-based record keeping. These traditional systems often result in missing or inaccurate patient data, slow information flow, and difficulty tracking long-term health outcomes. The lack of digital tools also limits the use of data for public health planning, performance monitoring, and research. Consequently, many health facilities in low-resource settings continue to face challenges in maintaining accurate, timely, and accessible patient information. While high-income countries have made significant progress in adopting electronic health record (EHR) systems, low- and middle-income regions struggle because of financial barriers, weak infrastructure, and limited technical capacity. Commercial EHR solutions are often expensive, require high-end hardware, and depend on continuous technical support — conditions that are rarely available in rural health facilities. Therefore, there is an urgent need for affordable, adaptable, and open-source systems that can meet the requirements of these environments without compromising quality or functionality. Bahmni is one such solution. It is an open-source, integrated hospital management and electronic health record system built on OpenMRS, Odoo (formerly OpenERP), and other community-developed components. Bahmni, designed specifically for low-resource settings, combines clinical documentation, laboratory management, pharmacy operations, billing, and reporting in a single modular platform. Its open architecture allows for customization to local needs and easy integration with other public health information systems. Bahmni's community-driven development model also encourages knowledge sharing and sustainability, making it a strong candidate for long-term use in public healthcare.

This study explored Bahmni as a reliable and practical open-source EHR for rural healthcare delivery. It

reviews the system architecture, implementation experiences, and challenges faced during deployment. This study also highlights how Bahmni supports better data management, improves coordination between departments, and builds local capacity for digital health innovation. Through this analysis, we demonstrate that Bahmni offers a feasible path toward effective and sustainable EHR adoption in rural and resource-limited healthcare systems.

2. DEVELOPMENT

This section describes how to set up and explore Bahmni as an open-source electronic health record system. It presents the main components of the system and shows how they are connected to support hospital workflows. This section also outlines the steps for installing and running Bahmni on a local system for testing and learning purposes. The goal is to provide readers with a clear idea of how Bahmni functions as a modular platform that can be adapted for rural healthcare. The following subsections provide an overview of the system, its workflow, and the methodology used for the setup.

2.1. SYSTEM OVERVIEW

Bahmni is built on a modular framework combining multiple open-source components. The core patient data management is handled by OpenMRS, financial and inventory operations are managed by Odoo, laboratory data are processed through OpenELIS, and imaging data are stored using dcm4chee. These modules communicate through RESTful APIs and are deployed within a Linux-based server environment.

2.2. SYSTEM ARCHITECTURE

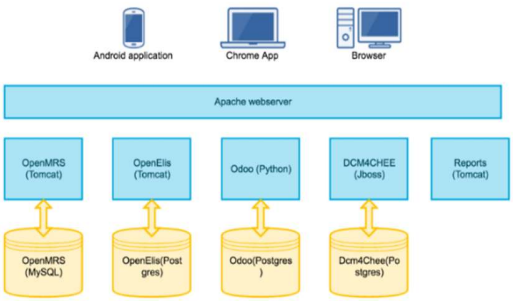

Fig1.1: Bahmni Component Architecture

3. METHODOLOGY

The development process follows a modular integration approach. Each subsystem is to be deployed and tested independently before being connected to the Bahmni core services. Configuration scripts are to be used to ensure consistency across the OpenMRS and Odoo modules. The methodology also emphasizes containerized deployment and environment reproducibility to enable local installations and scalability.

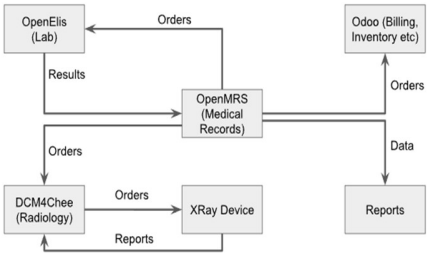

Fig 1.2 : Dataflow in Bahmni

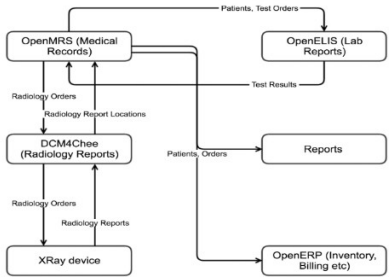

Fig 1.3 : Core Dataflow in Bahmni

3.1. INSTALLATION AND LOCAL SETUP

3.1.1 Prerequisites

- OS: CentOS 7(Version as per use) / Ubuntu (if using dockerized version)
- Hardware: 4+ GB RAM, 2+ CPU cores
- Dependencies: Linux Commands, Java (JDK 11), PostgreSQL/MySQL, Python, Node.js, Angular JS.

3.1.2. Installation Steps

The Bahmni system is installed using the Standard Bahmni Installer, which is commonly used for production deployments. This approach allows a local instance to be set up efficiently for testing, demonstration, and learning purposes. The installer handles the configuration of core components, including OpenMRS, Odoo, and the supporting modules, ensuring that the system functions as an integrated electronic health record platform. Once installed, the local setup provides access to essential functionalities such as patient registration, consultation, laboratory management, pharmacy, and reporting.

Step 1) Download the CentOS-7-x86_64-Minimal-2009.iso file (version as per requirement)

Step 2) Centos version check

Bash : cat /etc/centos-release

Step 3) Now in terminal enter **ping 8.8.8.8** to check whether the ip address is responding or not. “8.8.8.8 is the Ip address for google.”

After the installation of CentOS now the Bahmni installation is carried through standard Bahmni installer.

In this case, Bahmni 0.92 is installed :

Bahmni(0.92) Installation :

Steps :

Prerequisite for the fresh installation of Bahmni

Bash:

yum install -y https://kojipkgs.fedraproject.org//packages/zlib/1.2.11/19.fc30/x86_64/zlib-1.2.11-19.fc30.x86_64.rpm

Due to the non-availability of certain python distributions, the following steps needs to be executed to have a successful installation.

Bash:

sudo yum install epel-release

sudo yum install python-pip

sudo pip install pip==v19.0

sudo pip uninstall click

sudo pip install click==v7.0

sudo pip install pyusb

sudo pip install babel==v0.9.6

sudo pip install decorator==v3.4.0

sudo pip install beautifulsoup4

Install the bahmni command line program (Choose the version you want)

Bash :

yum install https://repo.mybahmni.org/rleases/bahmni-installer-0.92-155.noarch.rpm

Confirm that the bahmni command is correctly installed (you should see a help message for the command)

Bash : bahmni --help

Now setup a configuration file for bahmni command in /etc/bahmni-installer.

Bash : curl -L https://tinyurl.com/yyoj98df >> /etc/bahmni-installer/setup.yml

Edit the setup.yml file and add the Bahmni Repo URL (for version 0.92 and earlier)

Bash : vi /etc/bahmni-installer/setup.yml

Add this link to the above location

bahmni_repo_url:https://repo.mybahmni.org/releases/

Confirm the contents of the file. (https://goo.gl/R8ekg5)

Bash : cat /etc/bahmni-installer/setup.yml

The setup.yml, has a timezone entry. You can change it to suit your timezone if you like. For valid options Please read this document.

https://bahmni.atlassian.net/wiki/display/BAH/List+Of+Configurable+Installation+Variables

Set the inventory file name to local in BAHMNI_INVENTORY environment variable. This way you won't need to use the '-i local' switch every time you use the 'bahmni' command.

You can also configure custom inventory file instead of local.

Bash : echo "export BAHMNI_INVENTORY=local" >> ~/.bashrc source ~/.bashrc

Now fire the installer, the installation should be done in about 15 - 30 minutes depending on your internet speed.

For 0.92 or earlier

Bash :

bahmni -aru https://repo.mybahmni.org/releases/ansible-2.4.6.0-1.el7.ans.noarch.rpm install

Verify installed components using the command:

Bash : yum list installed | grep bahmni

Run these commands to see status of openmrs, lab and odoo

Bash : sudo systemctl status openmrs

Bash : sudo systemctl status bahmni-lab

Bash : sudo systemctl status odoo

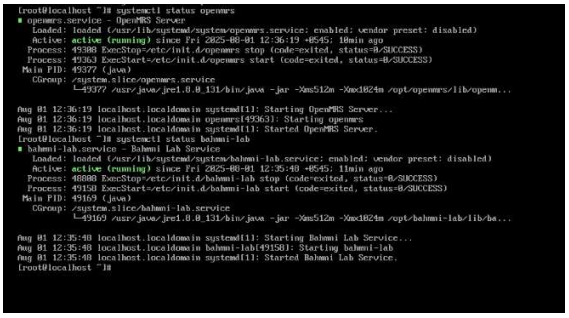

Fig 1.4 : Status of OpenMRS and Bahmni Lab

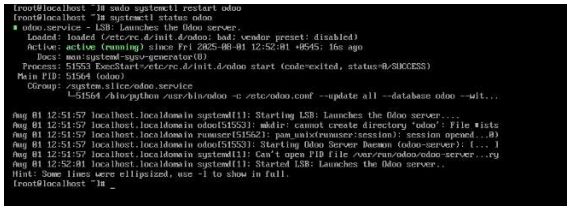

Fig 1.5 : Status of OpenERP(Odoo)

4. CHALLANGES AND FIXES

During the installation and implementation there may occur many errors. Some of the challenges and errors are encountered here given the way to solve it.

Sometime installation is incomplete if CentOS-Base.repo file not being changed correctly inside the /etc/yum.repos.d directory. So, it needs to be changed correctly through ssh command.

Issue: failed=1 (Unable to start service Odoo)

Fix with Bash :

pip install --upgrade pip

pip install ofxparse

pip install passlib

pip install psycogreen

pip install pypdf

pip install pyserial

pip install python-chart

pip install qrcode

pip install requests

pip install suds-jurko

The Babel version needed to be degraded so use following command to do it

pip install babel==1.0.0

Again, use these commands to solve LSB error

pip install xlsxwriter

pip install python-stdnum

Restart odoo again with this command

sudo systemctl restart odoo

After completing all the above steps run this command again to ensure everything is fully installed and working

bahmni -aru https://repo.mybahmni.org/releases/ansible-2.4.6.0-1.el7.ans.noarch.rpm install

Check the ip address using following command and run that ip in browser

ip add

or

ip address show

Sometimes odoo does not load login page so run these commands to fix the port issue:

sudo firewall-cmd --permanent --add-port=8069/tcp

sudo firewall-cmd --reload

Fig 1.6 : Bahmni in users ip address(as given)

5. DISCUSSION

We have successfully implemented Bahmni, an open-source electronic health record system, on our local setup. The system integrates patient management, laboratory, pharmacy, and administrative functions, and can be customized according to clinical and hospital needs. The initial implementation shows that Bahmni is technically feasible, usable, and compatible with typical hospital workflows in rural settings. It can now be further configured and deployed in production environments. The application is accessible through the assigned IP address, and corresponding screenshots are attached. This implementation demonstrates the potential of Bahmni to support efficient digital healthcare delivery and provides a foundation for further enhancements and scaling in similar healthcare settings.

6. CONCLUSION

Bahmni offers an open-source electronic health record system designed for use in rural healthcare environments. It combines patient management, laboratory services, pharmacy operations, and administrative tasks into one cohesive platform. The system can be installed on-site using the Standard Bahmni Installer, and all primary modules, such as OpenMRS, Lab, and Odoo, were successfully implemented.

Fig 1.7 : Bahmni EMR loaded and working

Fig 1.8 : Bahmni Lab loaded and working

Fig 1.9 : Odoo loaded and working

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