Patient Records in the Cloud

*Sharing current and archived patient data in the EMC Federation Enterprise Hybrid Cloud*

ECD Healthcare

**Abstract**

This white paper describes a solution that shows Patient Records and Sharing current and archived patient data in the EMC Federation Enterprise Hybrid Cloud. The paper also describes the functionality of the components within the virtualized solution.

January 2016
Copyright © 2016 EMC Corporation. All Rights Reserved.

EMC believes the information in this publication is accurate as of its publication date. The information is subject to change without notice.

All information included in this document is provided "as-is" and does not guarantee EMC’s support or approval. Please consult the official product documentation or the Product Support team regarding any questions of supportability.

Use, copying, and distribution of any EMC software described in this publication requires an applicable software license.

For the most up-to-date listing of EMC product names, see EMC Corporation Trademarks on EMC.com.

All trademarks used herein are the property of their respective owners.

Part Number H14769
Table of contents

Executive summary........................................................................................................................................... 5

Business case.................................................................................................................................................. 6
  Clinical Archiving ........................................................................................................................................ 7
  Document Sharing Services .......................................................................................................................... 7
  Key results/ ............................................................................................................................................... 9
  Recommendations ................................................................................................................................. 9

Introduction.................................................................................................................................................. 10
  Solution Purpose ................................................................................................................................... 10
  Scope ................................................................................................................................................. 10
  Audience .......................................................................................................................................... 10

Technology overview .................................................................................................................................. 11
  Overview........................................................................................................................................... 11
  EMC Federation Enterprise Hybrid Cloud ............................................................................................... 11
  EMC Documentum HIP components ....................................................................................................... 12
  EMC Documentum xDB .......................................................................................................................... 12
  EMC InfoArchive ................................................................................................................................... 12
  EMC Clinical Archiving.................................. ......................................................................................... 13
    Patient Information Objects .................................................................................................................. 14
    HSIPs .............................................................................................................................................. 14
  EMC ArchiveVision ............................................................................................................................... 15
  EMC ViPR ........................................................................................................................................... 15

Architectural overview ................................................................................................................................ 16
  Physical environment .............................................................................................................................. 16

Virtual configuration ..................................................................................................................................... 18
  Federation Enterprise Hybrid Cloud ......................................................................................................... 18
  Virtual machines and software .................................................................................................................. 18

Test results .................................................................................................................................................... 20
  Test objectives ..................................................................................................................................... 20
  Document sharing services (Medical Records Manager / HIP) ............................................................... 20
  Results and observations ......................................................................................................................... 20
    Provide and Register Document Set Execution .................................................................................. 21
    Registry Stored Query Execution ...................................................................................................... 21
    Retrieve Document Set ........................................................................................................................ 21
  Document sharing Clinical Archiving ...................................................................................................... 22
Results and observations

ArchiveVision
ETL Process
Clinical Archiving Registration Job

Conclusion
Summary
Findings

References
Product documentation
Executive summary

This white paper presents emerging cloud-based alternatives for two of EMC’s healthcare solutions; namely, Clinical Archiving and the Document sharing services of Medical Records Manager.

EMC healthcare solutions are designed to give clinicians an integrated view of the longitudinal patient record. This White Paper discusses two solutions that provide such an integrated view:

- Clinical Archiving
- Document Sharing Services

Clinical Archiving allows a healthcare enterprise to consolidate and harmonize disparate patient information archived from various legacy systems. Once archived this patient data is immediately available to the clinician at the point of care. Thus, Clinical Archiving primarily focuses on historical information about the patient.

Document Sharing Services allow clinicians at cooperating hospitals to access the full set of patient documents regardless of which hospital provided the care and regardless of which system was used to record the patient healthcare information. Thus, Document Sharing Services focuses mainly on recent patient documents.

These two solutions have moved to the cloud, which will allow hospitals and other provider organizations to implement these solutions quickly and cost effectively. It will simplify the deployment and operations associated with these solutions. With a combination of Clinical Archiving and Document Sharing Services, doctors will be able to view all information about the patient from a single client, saving time and aggravation and allowing better clinical decisions about diagnosis and treatment of the patient.
Business case

Countries in all parts of the world are struggling to improve the quality and affordability of healthcare services to their citizens. As technology improves, costs should naturally fall and outcomes improve. But this has proved to be an elusive goal. As a result, several organizations have proposed focusing on a small set of goals. For example, the Institute for Healthcare Improvement (IHI), an independent not-for-profit organization based in Cambridge, Massachusetts, is a leading innovator, convener, partner, and driver of results in health and health care improvement worldwide. They have defined what they call the “Triple Aim” in the following way:

- Improving the patient experience of care (including quality and satisfaction)
- Improving the health of populations; and reducing the per capita cost of healthcare.
- Reducing the per capita cost of healthcare.

Compounding the challenge is the fact that healthcare is fragmented across many systems and institutions that do not communicate or share patient information. By now, most patient information has been converted from paper to digital format, but not all of it. Even if information is now in digital format, problems may still occur. Some parts of the patient record may be located in one hospital with other information located in different hospitals. Or some information may reside in older systems that are no longer in active use. Such fragmentation can prevent doctors from seeing the full patient record, which may lead to sub-optimal care or even serious medical errors.

EMC healthcare solutions are designed to give clinicians a unified view of the longitudinal patient record. Critical to success in this endeavor is to solve the deployment problem. Healthcare IT is expensive. Healthcare organizations are therefore seeking to reduce their dependence on their IT organization so that they can invest more funds in improving patient care, population health, and other strategic initiatives.

EMC helps healthcare organizations solve the deployment problem by offering cloud-based alternatives to traditional data center infrastructure. The EMC hybrid cloud allows the customer to:

- Deploy new solutions without a costly purchase of hardware on premises
- Start small, add capacity in an elastic way, growing as large as the need requires
- Achieve economies of scale by shifting responsibility for upgrades, backups and problem fixing from on-premises IT staff to a cloud-based management team
Another advantage of the cloud is that small hospitals and rural clinics will be able to afford entry-level solutions that would not be possible if they had to invest significant CAPEX and OPEX just to get these offerings into production.

In this paper we address two specific solution areas:

Clinical Archiving
Document Sharing Services

**Clinical Archiving**

Healthcare organizations typically have patient data residing in a variety of back-end systems. This leads to two problems. On the one hand, maintaining these systems is expensive, both in terms of OPEX and CAPEX. On the other hand, it is difficult if not impossible for clinicians to access a complete patient record when pieces of that record reside in a variety of systems. The purpose of Clinical Archiving is to provide clinicians with access in one place to patient information from all the back-end systems. The data is archived from the back-end systems and is then consolidated and harmonized. Thus, the clinician sees a clear, logical, well-organized view of the patient record. Once the data has been transferred to the archive, the back end systems can be decommissioned, resulting in significant savings.

**Document Sharing Services**

EMC has developed a portfolio of integration features needed to share patient records. This portfolio is provided by the EMC product known as “Medical Records Manager.” Three of these capabilities are described below.

1. **Document Sharing.** This capability allows clinicians at different hospitals or clinics to access patient documents that may not reside in their local patient records system. It is based upon a set of profiles defined by the standards organization known as “Integrating the Healthcare Enterprise” (IHE). The set of profiles is called “Cross Enterprise Document Sharing” (XDS). A group of healthcare enterprises can implement the XDS profiles to register documents in a central registry and to query the central registry from any enterprise. EMC Medical Records Manager provides the XDS Registry and associated capabilities.

2. **Patient Privacy.** While sharing of patient information can lead to better outcomes, it raises a question about patient privacy and informed consent. The Medical Records Manager addresses these concerns with a configurable system that enables a provider organization to define privacy policies, establish guidelines for informed consent, and enforce these policies. For example, it can protect a patient’s psychiatric records from access by non-psychiatrists.
3. Healthcare Data Exchange. In an environment consisting of multiple systems, it is essential that these systems can communicate. The standards organization known as “Health Level 7” (HL7) has defined standards for the transmission of healthcare information between systems. For example, when a patient has been admitted to the hospital, a message to that effect will be sent to the central Electronic Medical Records (EMR) system. The Medical Records Manager uses HL7 messages to communicate with the EMR.

This White Paper shows how these Clinical Archiving and Medical Records Manager are configured in an EMC Federation Enterprise Hybrid Cloud.
By implementing both the Medical Records Manager and Clinical Archiving, a health system can achieve remarkable results, including document sharing among hospitals and other healthcare organizations, system interoperability, decommissioning of legacy systems, and centralized access to data archived from back-end systems. What this means in business terms is more informed clinicians, better outcomes, fewer medical errors, improved communication with patients, and lower IT costs.

This enables customers to utilize EMC Document Sharing (Medical Records Manager) and Clinical Archiving within the EMC Federation Enterprise Hybrid Cloud. By choosing a hybrid cloud for deployment, the customer can get systems up and running more quickly, start small and expand as needed over time, buy only what is actually needed but scale upwards as large as necessary, simplify the operation of their systems, and free up funds for more strategic projects.

Our recommendation for a prospective customer is to start by identifying the critical problems to solve, such as document sharing or legacy archiving. In some parts of the world the priority may be to archive and decommission systems as the customer makes a transition to a next-generation EMR. In other parts of the world the priority may be to adopt international standards such as XDS.

Implement the desired solution in a hybrid cloud on a small scale to verify that the desired benefits are being achieved. Once that has been established, begin to scale to other hospitals or to incorporate other forms of patient information. Whenever possible, measure outcomes and costs against a benchmark to establish a solid business case for management.
Introduction

Solution Purpose  We now validate

The test methodology used to determine the functionality of EMC Document sharing services (Medical Records Manager / HIP) and Clinical Archiving in an EMC Federation Enterprise Hybrid Cloud.

Scope  The scope of this white paper includes validating the functionality of EMC Document sharing services (Medical Records Manager / HIP) and Clinical Archiving in an EMC Federation Enterprise Hybrid Cloud.

The scope of this white paper does not include the building of the EMC Federation Hybrid Cloud nor the deployment of the EMC Document sharing services (Medical Records Manager / HIP) and Clinical Archiving solution.

Audience  This white paper is intended for EMC employees, partners, and customers, including IT planners and EMC field personnel who are tasked with deploying such a solution in a customer environment. It is assumed that the reader is familiar with the various components of the solution.
Technology overview

Overview

This section provides an overview of the primary technologies included in this solution:

- EMC Federation Enterprise Hybrid Cloud
  - VMware vRealize Suite
  - VMware vRealize Automation
  - VMware vRealize Automation Application Services
  - VMware vRealize Orchestrator
  - VMware vSphere ESXi
- EMC Documentum HIP components:
  - XDS Registry
  - XDS Repository
- EMC Documentum xDB
- EMC InfoArchive
- EMC Clinical Archiving
- EMC ArchiveVision
- EMC ViPR

EMC Federation Enterprise Hybrid Cloud

The Federation Enterprise Hybrid Cloud is an engineered solution that offers a simplified approach to IT functionality for IT organizations, developers, end users, and line-of-business owners. In addition to delivering baseline infrastructure as a service (IaaS), built on the software-defined data center architecture, the Federation Enterprise Hybrid Cloud also delivers feature-rich capabilities to expand from IaaS to business-enabling IT as a service (ITaaS).

VMware vRealize Suite is a cloud management platform purpose-built for the hybrid cloud. It enables IT to quickly deliver infrastructure and applications without sacrificing the control IT requires. It provides comprehensive management stack for IT services on VMware vSphere and other hypervisors, physical infrastructure, Openstack and external clouds.

VMware vRealize Automation automates the delivery of personalized infrastructure, applications and custom IT services. This cloud automation software lets you deploy across a multi-vendor hybrid cloud infrastructure, giving you both flexibility and investment protection for current and future technology choices.

VMware vRealize Automation Application Services is a model-based application provisioning solution that simplifies creating and standardizing application deployment topologies on multiple infrastructure clouds. Application architects can use a graphic-based canvas with a drag-and-drop interface to model application deployment topologies called application blueprints.
VMware vRealize Orchestrator simplifies the automation of complex IT tasks and integrates with VMware vCloud Suite components to adapt and extend service delivery and operational management, effectively working with existing infrastructure, tools and processes.

VMware vSphere uses the power of virtualization to transform data centers into simplified cloud computing infrastructures and enables IT organizations to deliver flexible and reliable IT services. vSphere virtualizes and aggregates the underlying physical hardware resources across multiple systems and provides virtual resource pools to the data center.

As a cloud operating system, vSphere manages large infrastructure collections (such as CPUs, storage, and networking) as a seamless and dynamic operating environment. It also manages the complex operations of a data center.

**EMC Documentum HIP components**

The Healthcare Information Portfolio (HIP) XDS Registry is the directory or “white pages” for medical and administrative content that provides applications within the enterprise with the ability to discover and then access information. Based on the implementation of Integrating Healthcare Enterprise's (IHE) XDS Registry specifications, it provides a central catalog for documents that reside in a federated system or in repositories, either heterogeneous or geographically distributed.

The HIP XDS Repository stores structured and unstructured healthcare information where all patient-centric documents, images, and media are available via the XDS-specification for applications to consume—even when the clinical, financial and operational content was not created via an XDS specification.

**EMC Documentum xDB**

EMC Documentum xDB is a native XML database. Its scalable architecture and complete support for the XQuery language enables any organization to warehouse content in an application-neutral format. These databases do not depend on a proprietary application for information retrieval.

Unlike relational databases, xDB enables you to easily modify content schemas to adapt to changing information requirements and supports queries against complex data structures that are not easily modeled in rows and columns. In addition, with its powerful and extensible development and runtime toolset, xDB is a powerful platform for the most complex and demanding content-centric applications.

**EMC InfoArchive**

InfoArchive is a solution for long term, compliant archiving of structured data and unstructured content. It archives the information in xml format, which is non-proprietary and future proof. Users can then access archived data from the built-in user interface or from their existing applications.
EMC’s healthcare solution for clinical archiving, called EMC Clinical Archiving, is built upon InfoArchive, the EMC archiving product. Clinical Archiving extends InfoArchive by allowing healthcare providers to share archived documents across enterprises, by implementing the IHE standard “Cross Enterprise Document Sharing” (XDS).

The following figure shows four source systems, whose data is moved into the Clinical Archiving. This data – or a subset of this data – will be presented in a clinician user application, called ArchiveVision.

**Figure 1. Clinical Archiving architecture**

The patient record contains both structured and unstructured data

**Structured data:** Structured data is data that is organized in a fixed field structure. It can be extracted, interpreted and acted upon by machines and humans. Structured data is often created by data entry devices and can be populated in electronic templates by selecting from pull down menus, check boxes or options. Structured data is easily searchable and aggregated, can be analyzed and reported. Examples: Date, Patient Name, patient ID, Age and so on.

**Unstructured data:** Unstructured data consists of data that exists in the form of free form notes/narratives or transcripts and requires human effort to read, capture and interpret it properly. It includes machine-written and handwritten information on paper forms, audio recordings, dictations, attachments, and typed transcriptions and so on.

Clinical Archiving enables the customer to archive both structured and unstructured data. This is because it is an extension of InfoArchive, which provides this capability.
**Patient Information Objects**

Information in the source systems consists of different types, for example, problems, medications, image reports, or clinical notes. A single unit of information of a patient medical record is called a Patient Information Object (or just Information Object if there is no ambiguity). Each Information Object has a type. The following figure shows a representation Information Object of type “Clinical Note.”

**Example: Clinical Note**

<table>
<thead>
<tr>
<th>Date</th>
<th>Author</th>
<th>Media Type</th>
<th>Size</th>
</tr>
</thead>
</table>

This Information Object has four metadata fields and a final field that contains a rendering of the Clinical Note in PDF format. The fields would be quite different for an Information Object of type “Medication.” In this case, the Information Object has content. Not all Patient Information Objects will have content elements. Some Information Objects consists exclusively of structured data.

**HSIPs**

EMC Clinical Archiving is built upon InfoArchive, which can archive scanned documents, recorded videos, business data from an ERP system, and documents from EMC Documentum Content Server. InfoArchive is designed to be highly scalable. To achieve this scalability, data and documents are packaged into Submission Information Packages (SIPs) before they are ingested into InfoArchive. This approach is consistent with the recommendations of the Open Archival Information System (OAIS).

A SIP is a data container used to transport content to be archived from the source applications to InfoArchive. In the context of Clinical Archiving, SIPs hold Patient Information Objects. In the healthcare solutions, we will often refer to an HSIP – or “Healthcare SIP.”

An HSIP will hold multiple patient Information Objects, often on the order of thousands or tens of thousands. Typically we strive to minimize the number of HSIP per patient. In most cases patients have such small records that several patient records can fit into a single HSIP. Once an HSIP has been ingested into InfoArchive, it is converted into an archival information package (AIP) and stored in the system.
In EMC Clinical Archiving, clinicians access the archived information in a clinician-friendly web application called ArchiveVision. This web application organizes all clinical information into a set of tabs, in which each tab represents one type of medical information. The clinician selects a tab and the patient Information Objects are presented, from there the archived documents can be opened directly from ArchiveVision.

The following diagram shows the ArchiveVision architecture:

![ArchiveVision architecture](image)

**Figure 2. ArchiveVision architecture**

EMC ViPR is software-defined storage to manage and automate all storage resources for traditional and next-generation cloud storage platforms. EMC ViPR Controller is storage automation software that centralizes and transforms storage into a simple, extensible, and open platform. It abstracts and pools resources to deliver automated, policy-driven storage services on demand through a self-service catalog – reducing time, cost, and risk.
Architectural overview

This white paper characterizes and validates EMC Document sharing services (Medical Records Manager / HIP) and Clinical Archiving in an EMC Federation Enterprise Hybrid Cloud.

VMware vRealize suite is used to provide the virtualization layer.

Figure 3 shows the physical environment of the solution.
Figure 4 shows the Healthcare POD consisting of the EMC Document sharing services (Medical Records Manager / HIP) and Clinical Archiving in an EMC Federation Enterprise Hybrid Cloud.
To obtain the full list of software resources used to build the EMC Federation Enterprise Hybrid Cloud please use the following link:

**Foundation Infrastructure Reference Architecture**

Table 1 lists the virtual machines in the Document sharing services (Medical Records Manager / HIP) and the software components installed on each machine.

### Table 1. Document sharing services (Medical Records Manager / HIP) Virtual machines

<table>
<thead>
<tr>
<th>Virtual machine</th>
<th>Quantity</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documentum Content Server and Docbroker</td>
<td>1</td>
<td>- Microsoft Windows Server 2012 R2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Apache Tomcat 7.0.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Microsoft SQL Server 2012 SP 2 Client</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Java JDK 1.7.0_67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Documentum Content Server 7.2 containing:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- XDS Repository</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Content Storage Services enabled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Retention Policy Services enabled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Trusted Content Services enabled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Documentum Docbroker</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Solution custom DAR file installed to XDS Repository</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- VMware tools</td>
</tr>
<tr>
<td>HIP XDS Registry</td>
<td>1</td>
<td>- Microsoft Windows Server 2012 R2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Java JDK 1.7.0_67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Documentum HIP Registry 1.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tomcat 7.0.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- VMware tools</td>
</tr>
<tr>
<td>HIP XDS Repository</td>
<td>1</td>
<td>- Microsoft Windows Server 2012 R2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Java JDK 1.7.0_67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- HIP Repository 1.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tomcat 7.0.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- VMware tools</td>
</tr>
<tr>
<td>xDB Server</td>
<td>1</td>
<td>- Microsoft Windows Server 2012 R2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Java JDK 1.7.0_67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Documentum xDB 10.5.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Tomcat 7.0.53</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- VMware tools</td>
</tr>
<tr>
<td>Virtual machine</td>
<td>Quantity</td>
<td>Software</td>
</tr>
<tr>
<td>--------------------------</td>
<td>----------</td>
<td>----------------------------------------------------</td>
</tr>
</tbody>
</table>
| Microsoft SQL Server 2012| 1        | • Microsoft Windows Server 2012 R2  
                          |           | • Microsoft SQL Server 2012 SP2                        |

Table 2 lists the virtual machines in the Clinical Archiving Environment and the software components installed on each machine.

**Table 2. Clinical Archiving Virtual machines**

<table>
<thead>
<tr>
<th>Virtual machine</th>
<th>Quantity</th>
<th>Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database Server</td>
<td>1</td>
<td>• REDHAT 6.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Oracle 11.0.2.3</td>
</tr>
<tr>
<td>InfoArchive Server</td>
<td>1</td>
<td>• REDHAT 6.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Java 1.7.0_72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Apache Tomcat 8.0.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Documentum Content Server 7.2 P01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• xDB 10.5.11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• InfoArchive 3.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clinical Archiving 1.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• HIP 1.8 Registry</td>
</tr>
<tr>
<td>Web Application Server</td>
<td>1</td>
<td>• REDHAT 6.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Apache Tomcat 8.0.14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Documentum Administrator</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• EIA GUI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Archive Vision</td>
</tr>
</tbody>
</table>
Test results

Test objectives

The objective of the testing was to validate the functionality of the Document sharing services (Medical Records Manager / HIP) and Clinical Archiving solution in the EMC Federation Enterprise Hybrid Cloud.

The following tests were performed against the Document sharing services (Medical Records Manager / HIP) solution using SOAP UI Pro as the test harness in the EMC Federation Enterprise Hybrid Cloud:

- ITI-41 Provide and Register Document Set
- ITI-18 Registry Stored Query
- ITI-43 Retrieve Document Set

The following tests were performed against Clinical Archiving solution using multiple scripts in the EMC Federation Enterprise Hybrid Cloud:

- Extract Transform Load (ETL) Process
  - HSIP Creation
  - InfoArchive Receive job
  - InfoArchive Ingestor job
  - InfoArchive Confirmation job
- Clinical Archiving registration job

Document sharing services (Medical Records Manager / HIP)

Results and observations

This chapter describes the behavior and observations of the Document sharing services (Medical Records Manager / HIP) solution during the XDS testing.

The XDS transaction flow is shown in Figure 5
Provide and Register Document Set Execution

A project was created in SOAP UI Pro to emulate how a Healthcare facility would create a patient record (including a sample 50kb PDF attachment) in the Healthcare cloud. When the loading successfully completed, multiple ITI-41 Provide and Register Document Set operations had been loaded to the EMC XDS Repository server.

Registry Stored Query Execution

An additional project was created to emulate how a Healthcare facility would retrieve the previously loaded patient records from the Healthcare cloud.

When the project executed successfully, multiple ITI-18 Registry Stored Query had been retrieved from the EMC XDS Registry server.

Retrieve Document Set

To prove the validity of a Healthcare facility being able to retrieve a patient document from the Healthcare cloud a project was created to issue a Retrieve Document Set operations against previously loaded patient records.

When the project executed successfully, multiple ITI-43 Retrieve Document Set had been retrieved from the EMC XDS Repository server.
ArchiveVision

ArchiveVision is invoked from an EMR system or from a physician's portal. The EMR system must pass the patient ID to InfoArchive to retrieve the patient information from InfoArchive and display it to the user. If the user is authorized to view the information, ArchiveVision queries InfoArchive and displays the patient information objects.

Figure 6 shows the ArchiveVision architecture:

![ArchiveVision Architecture Diagram](image)

ETL Process

A Submission Information Package (SIP) consists of a series of Information Objects. Each such object pertains to a single patient. A SIP can contain records of multiple patients. In the context of Clinical Archiving, we refer to the SIPs used as Healthcare SIPs or HSIPs, since they are organized and sorted based on patient information.

The Extract Transform and Load (ETL) process extracts data from each source system and transforms it into a compressed format referred to as a Healthcare Submission Information Package (HSIP).

In order to simulate this ETL process a HSIP was created using sample data. This was then stored in an xDB Staging Database.

The process below was then followed to ingest the HSIP into the Archive.
As part of the COMMIT process a Registration XML file is produced and used as input to the Clinical Archiving Registration job.

After successful ingestion, the archived data was searchable via ArchiveVision, hence validating the ETL process in the EMC Federation Enterprise Hybrid Cloud.

**Clinical Archiving Registration Job**

The Clinical Archiving Registration batch job takes the generated Registration XML file as input and issues Clinical Archiving Register Document Set transactions (ITI-42) to the XDS Registry. The registration process is typically automatically generated on the triggering of a storage event.

On successful completion of registration, the patient data is searchable and retrievable within the XDS landscape and can be verified from any XDS client.
Conclusion

Summary

This EMC Federation Enterprise Hybrid Cloud solution enables customers to build an enterprise-class multitenant, scalable, platform for complete infrastructure service lifecycle management. This solution provides on-demand access and control of infrastructure resources and security while enabling customers to maximize asset utilization. Specifically, the solution integrates all of the key functionality that customers demand of a hybrid cloud and provides a framework and foundation for adding other services.

The solution uses the best of EMC and VMware products and services to empower healthcare customers to accelerate the implementation and adoption of a hybrid cloud.

Both the Document sharing services (Medical Records Manager / HIP) and Clinical Archiving solutions were deployed and functional tested within the EMC Federation Enterprise Hybrid Cloud.

Findings

- The suitability of a EMC Federation Enterprise Hybrid Cloud for hosting:
  - A Document sharing services (Medical Records Manager / HIP) solution
  - A Clinical Archiving solution.

- A strategy for migrating legacy EMR data into a cloud based Clinical Archiving solution.
References

For additional information, see EMC.com and the product documents listed below.

- *Industry Solutions on EMC.com*
- *Choosing an xDB Configuration*
- *EMC Medical Image Management with Document Sharing Solution (Enterprise) – Business Continuance*