

iEHR Web Application Framework System Architecture Document



Version 1.3

October 2011

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Revision History

Date	Version	Description of Change	Author
6/20/11	1.0	Initial Draft	Danette Amoy
8/3/11	1.1	Changed title of document from "iEHR Framework System Architecture Document" to "iEHR Web Application Framework System Architecture Document." Changed reference from "iEHR" to "iEHR Web Application."	Danette Amoy
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1. System Architecture

The iEHR Web Application framework is an n-tier hierarchical model comprising the presentation, abstraction, and data/storage tiers as shown in Figure 1-1. The key principle of this hierarchical design is that each element in the hierarchy has a specific set of functions and services that it offers and a specific role to play in each tier of the design.

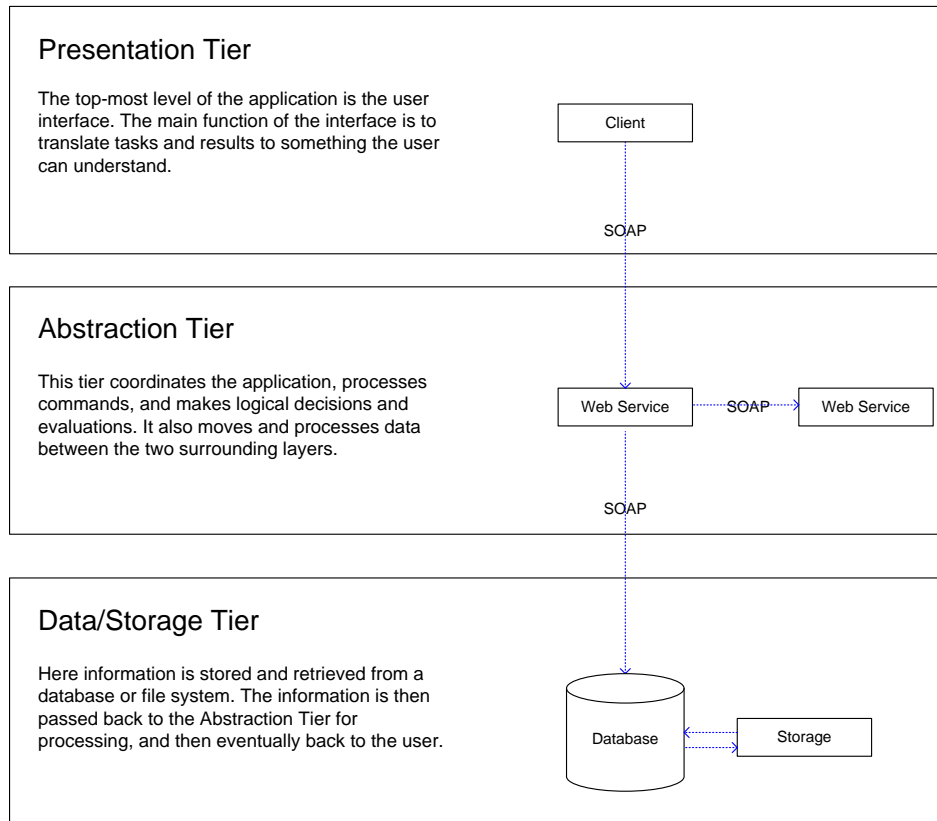


Figure 1-1. Example of an N-Tier Architecture

1.1 Presentation Tier

The presentation tier, or client tier, is the top-most level of the n-tier architecture and is the user interface. The main function of the interface is to translate tasks and results for the client to understand.

1.2 Abstraction Tier

The abstraction tier, or application tier, is the tier that the presentation tier and the data/storage tier use to communicate with each other. It moves and processes data between the presentation tier and the data/storage tier. The abstraction tier coordinates the application, processes commands, and makes logical decisions and evaluations. The process of abstracting the data sources from the application takes place here.

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1.3 Data/Storage Tier

The data/storage tier is basically where a source application's data is stored and from where data is retrieved. The data access components in the abstraction tier are used for communication between the presentation and data/storage tiers.

2. Major Components

The jMeadows implementation of the iEHR Web Application framework is presented in Figure 2-1. In this diagram, five major components and the messaging method are identified:

- Component #1 is the iEHR Web Application, which is the client.
- Component #2 is the jMeadows Data Service, which is a web service.
- Component #3 is the Patient Cross-Reference Index (PIX), which is a web service.
- Component #4 is comprised of the data source interfaces, which are the CHCS Data Service, Vista Data Service, and BHIE Relay Service. These data source interfaces are web services.
- Component #5 is comprised of data source storage containers that hold patients' electronic medical records (EMRs). These data source storage containers are accessed by the data source interfaces.
- The messaging protocol that communicates between the systems is SOAP (Simple Objects Access Protocol) version 2.0.

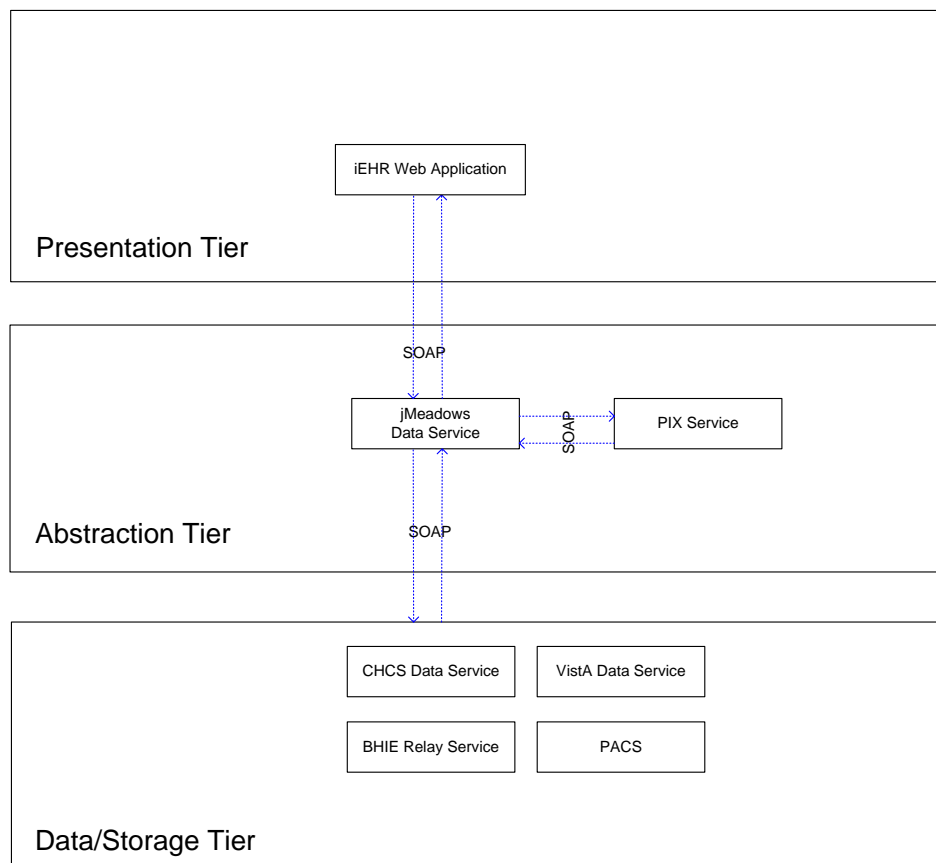


Figure 2-1. iEHR Web Application Architecture

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2.1 iEHR Web Application

The iEHR Web Application provides the ability to view specific clinical data stored in any electronic medical record systems available to the abstraction tier. Authorized users access a patient's clinical data via a web front end via a browser from within the site's intranet. The iEHR Web Application provides a common data view of read-only, real-time patient information from separate and distinct electronic medical record systems. The iEHR Web Application uses a Java 2 Platform Enterprise Edition (J2EE) object-oriented platform. J2EE is an Open Source standard and can be shared with other Open Source development efforts.

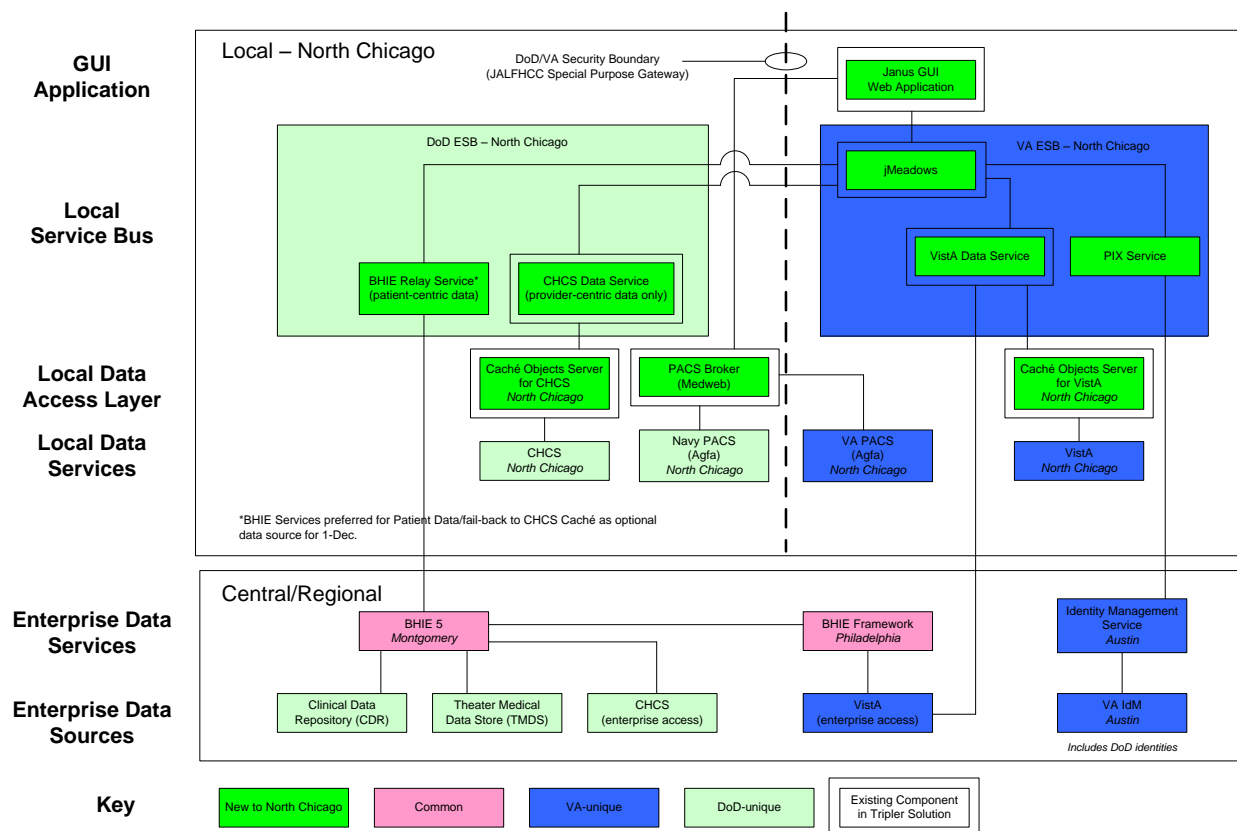


Figure 2-2. Logical Diagram of the iEHR Web Application Framework Implemented at Local Vista

2.2 jMeadows Interface

The jMeadows interface is a web service that retrieves clinical data from EMR systems. The jMeadows interface issues a patient lookup against the Patient Cross-Reference Index (PIX) service for patient location information. If the PIX search is successful, the PIX Service returns patient identifiers associated with the patient locations to the jMeadows interface. Then, the jMeadows interface reviews the list of patient locations and queries the locations for patient clinical data.

2.3 Patient Cross-Reference Index (PIX)

The Patient Cross-Reference Index is implemented as a web service that correlates information about a single patient from sources that are known by different patient identifiers (e.g. DoD EDIPN, VA ICN, VA

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IEN, and CHCS IEN). These cross-referenced patient identifiers are used by identity consumer systems to map patient information.

2.4 Data Source Interface

A data source interface is a web service implemented by the jMeadows interface when it queries patients' locations. The following are data source interface web services currently supported at local VistA:

- VistA Data Service
- CHCS Data Service
- BHIE Relay Service

2.5 Data Source Storage

Currently, the EMR systems available at local VistA are:

- Composite Health Care System (CHCS) (via the DoD ESB)
- Veterans Health Information Systems and Technology Architecture (VistA) (via the VA ESB)
- Bidirectional Health Information Exchange (BHIE) – BHIE 5 Montgomery (via the DoD ESB)
- Navy Picture Archive and Communication System (PACS) (via the DoD ESB)
- VA Picture Archive and Communication System (PACS) (via the VA ESB)

3. jMeadows Implementation

The iEHR Web Application framework uses Java-based web services technology to specify a web service interface. The iEHR Web Application framework uses request- and response-driven transactions for the web service system interfaces (see Figure 3-1 and flowchart, below). The jMeadows interface server provides a web service implemented per SOAP version 2.0. When a SOAP request is received for a patient, the jMeadows interface issues a PIX lookup to determine where the patient has data. jMeadows then interfaces with the data source web services to call each EMR system at which the patient is registered. If data from the EMR systems are retrieved, the necessary data conversions and sorting will be performed prior to returning the requested data as a SOAP response.

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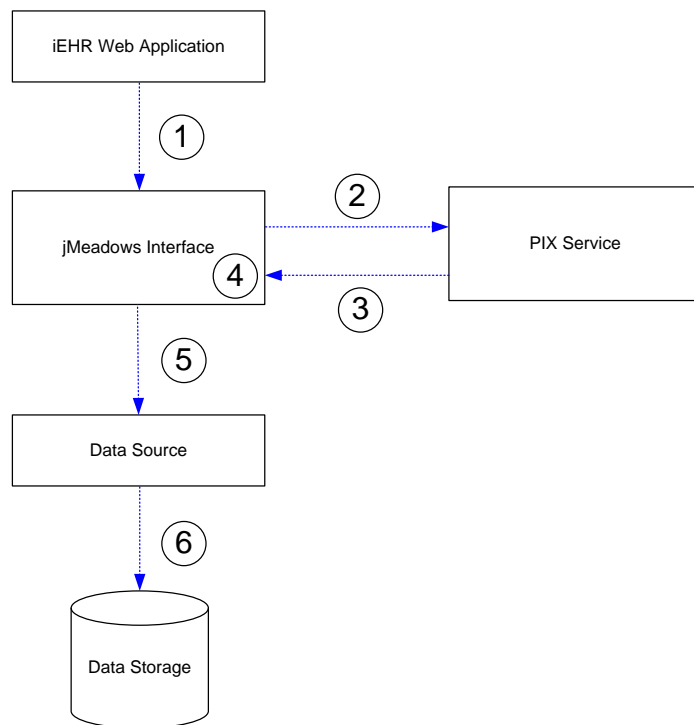


Figure 3-1. Flowchart of the iEHR Web Application and jMeadows Interface

1. The iEHR Web Application requests patient information from the jMeadows interface.
2. The jMeadows interface checks the PIX Service to find locations for the patient.
3. The PIX Service returns a list of locations for the patient.
4. The PIX Service returns a DoD location (if the patient has DoD records) with the patient's DoD EDIPN or a VA location (if the patient has VA records) with the patient's VA IEN.
5. The jMeadows interface: (a) uses the DoD EDIPN to retrieve data from the CHCS Data Service, (b) uses the VA IEN and VA ICN to retrieve data from the VistA Data Service, or (c) passes in the local CHCS IEN from the BHIE Relay Service.
6. The patient clinical data is retrieved and sent back to the requestor.

4. Interface Transactions

The transactions between the iEHR Web Application and the data source systems are request- and response-driven for the web service system interfaces.

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5. Web Service Transactions

5.1 VistA Data Service Interface

Upon receipt of a SOAP request from the iEHR Web Application, the VistA Data Service interface determines if the site ID of the requesting entity is listed as a valid Caché site. If it is listed as a valid Caché site, the VistA Data Service interface server queries the VistA system using Caché Objects. The VistA Data Service interface server formulates a SOAP response and returns it to the requestor. The SOAP messages are sent to the VistA Data Service web service as Hyper Text Transmission Protocol (HTTP) over Secure Sockets Layer (SSL) via TCP/IP.

If the VistA Data Service interface cannot validate the site ID as a Caché site, then the VistA Data Service interface server queries the VistA system using remote procedure calls (RPCs).

The VistA Data Service interface aggregates the VistA data and formulates a SOAP response and returns it to the requestor.

5.2 CHCS Data Service Interface

Upon receipt of a SOAP request from the iEHR Web Application, the CHCS Data Service interface server queries the CHCS system using Caché Objects for provider-centric data. The Caché Objects calls the Caché database for data. The results of the query are sent to the CHCS Data Service interface server. The CHCS Data Service interface server formulates a SOAP response and returns it to the requestor. The SOAP messages are sent to the CHCS Data Service web service as HTTP/SSL via TCP/IP.

5.3 BHIE Relay Service Interface

Upon receipt of a SOAP request from the iEHR Web Application, the BHIE Relay Service queries the BHIE 5 Montgomery system for patient-centric data. This interface was developed by VA/DoD Enterprise for the BHIE project. The iEHR Web Application Framework is re-using this interface.

6. Caché Servers

TBD

7. Application Servers

TBD

8. Database Server

TBD

9. Physical Architecture

TBD

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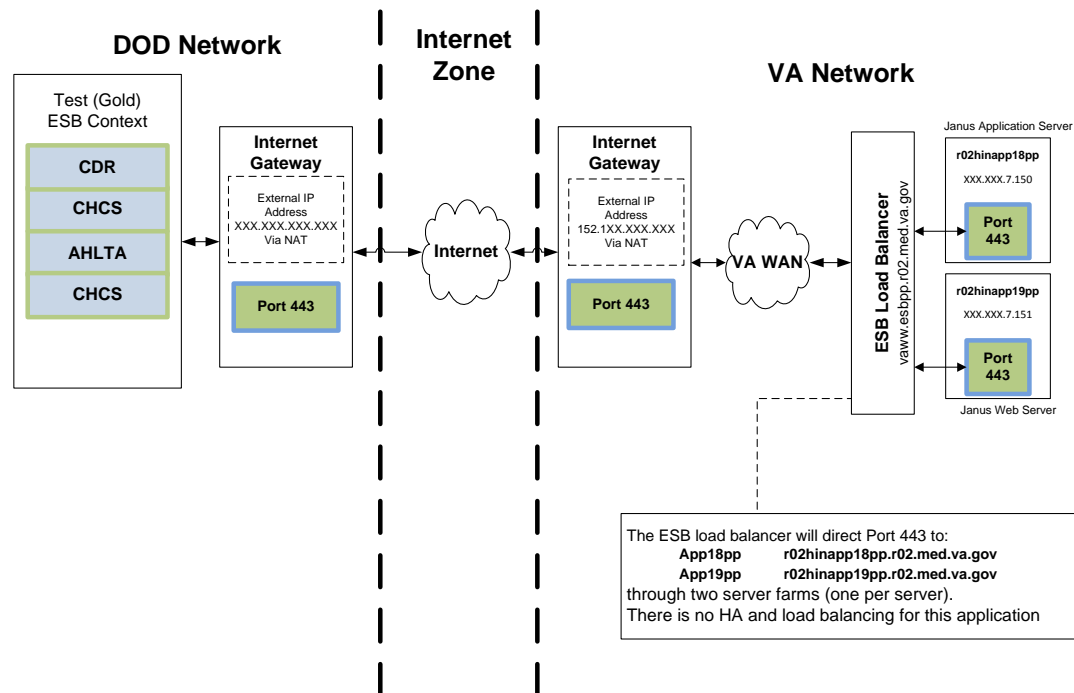


Figure 9-1. System Diagram of the iEHR Web Application Framework

10. Transport Security (SSL)

The Transport Security mechanism protects the application during transport using Secure Sockets Layer (SSL) for authentication and confidentiality. Transport-layer security is provided by the transport mechanisms used to transmit information over the wire between clients and providers, thus transport-layer security relies on secure HTTP transport (HTTPS) using SSL. Transport security is a point-to-point security mechanism that can be used for authentication, message integrity, and confidentiality. When running over an SSL-protected session, the server and client can authenticate one another and negotiate an encryption algorithm and cryptographic keys before the application protocol transmits or receives its first byte of data. Security is “live” from the time it leaves the consumer until it arrives at the provider or vice versa. The problem is that it is not protected once it gets to its destination. For protection of data after it reaches its destination, one of the security mechanisms that uses SSL and that also secures data at the message level will be utilized.

Digital certificates are necessary when running HTTPS using SSL. The HTTPS service of most web servers will not run unless a digital certificate has been installed. Digital certificates have been created for the GlassFish server, and the default certificates are sufficient for running this mechanism, and are required when using atomic transactions. However, the message security mechanisms require a newer version of certificates than is available with the GlassFish server.

11. Message Authentication over SSL

The Message Authentication over SSL mechanism attaches a cryptographically secured identity or authentication token with the message and uses SSL for confidentiality protection.

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12. Configuration and Code Management

Currently, Mercurial is used as the code repository management software. The following have been implemented to support version control:

- iEHR products will have the tag JANUS_IEHR_0_1_0. The first “0” in the tag represents “major.” The “1” in the tag represents “minor.” The second “0” in the tag represents “build.”
- Whenever there are new features in the push, the “minor” number will be incremented.
- Whenever there are bug fixes to the feature set, the “build” number will be incremented.
- It is not necessary to tag all of the projects each time something is pushed. It is assumed that the latest tag should be compatible with any projects with later tags.

Release documentation can be found at:

<https://sp.pacifichui.org/dev/Dev%20Wiki/Release%20Documentation.aspx>

Server deployment information can be found at:

<https://sp.pacifichui.org/dev/Dev%20Wiki/Server%20Deployments.aspx>

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Appendix A: Definitions, Acronyms, and Abbreviations

BHIE	Bidirectional Health Information Exchange
CHCS	Composite Health Care System - DoD
DICOM	Digital Imaging and Communications in Medicine
DoD	Department of Defense
EDIPN	Electronic Data Interchange Person Number
eDR	Enhanced Document Referral
EMR	electronic medical record
ESB	enterprise service bus
HL7	Health Level 7
HTTP	Hyper Text Transfer Protocol
IDE	integrated development environment
ICN	internal control number
IEN	internal entry number
J2EE	Java 2 Platform, Enterprise Edition
JALFHCC	Captain James A. Lovell Federal Health Care Center – North Chicago
jMeadows	Meadows Web Service
JMS	Java Message Service
LOINC	Logical Observation Identifiers Names and Codes
MUMPS	Massachusetts General Hospital Utility Multi-Programming System (also known as “M”)
PDTS	Pharmacy Data Transaction Service

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PIX	Patient Cross-Reference Index
RAID	redundant array of independent disks; term for computer data storage
RPC	remote procedure call
SOAP	Simple Object Access Protocol
SQL	structured query language
SSL	Secure Sockets Layer
TCP/IP	Transmission Control Protocol/Internet Protocol
VA	Veterans Administration
VAMC	Veterans Administration Medical Center
VistA	Veterans Health Information Systems and Technology Architecture - VA
WSDL	Web Services Description Language