Vision-and-Strategy for iEHR-Platform Core-Capabilities using Open-Source VistA

based on 5 February 2013 statements of Secretary of Defense Leon E. Panetta, Secretary of Veterans Affairs Eric Shinseki and Representative iEHR artifacts available at www.tricare.mil/iEHR

by
Open Source EHR Agent (OSEHRA) Architecture Work Group (AWG)

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For February 14, 2013 AWG Presentation, DRAFT C
Preface

OSEHRA can NOT bid on Federal Contracts and
OSEHRA does NOT speak for the government!

This Information is provided to encourage vendors
   To form Open-Source Teams and
to bid an Open-Source VistA-based Solution
   for the “iEHR Core Capabilities”
   expected to be solicited
   on-or-about March 15, 2013.

   All information developed in this
   Vision and Strategy is public and
   is freely available to everyone.

   Remember that schedules are tight and
   The governments’ evaluation criteria is generally
   “Best Value to the Government”; consequently,
   You will need a compelling Business Case to win!

   May the Best Vender Win!
Abstract / Executive Summary

- The **goal** of this presentation is to document the open-source VistA community Vision-and-Strategy for the **iEHR-Core Capabilities** using Open-Source VistA.

- The **purpose** of this presentation is to assist vendors to prepare an open-source VistA-based response to the expected government solicitation for the “iEHR Core capabilities”.

- The **iEHR core capabilities** are intended to be a part of an EHR SOA Platform emphasizing the **reuse** of high quality clinical/business, infrastructure services, a Graphical User Interface (**GUI**) and a virtual data repository (**VDR**). The iEHR core/platform is intended to be an interoperability-framework for **COTS** (Commercial Off-The-Shelf), **GOTS** (Government Off-The-Shelf) and open-source components.

- **Medical specialty domains**, such as Joint Immunization Capability (**JIC**), should each be an orchestration of services; where, each medical-specialty domain may have its own data-and-terminology models, business-rules, workflows, reports and displays in accordance with scope-of-practice, organizational policy, iEHR governance and jurisdictional law.

- This document will be updated after each OSEHRA Architecture Work Group (**AWG**) meeting on iEHR-Core Capabilities based-on VistA.
Situation

On 5 February 2013, the DOD and VA Secretaries stated that “in the short term, that we've agreed to

1. **Improve data interoperability** to that integrated electronic health record before the end of this year, **by standardizing health care data** no later than December 2013,
2. **Creating health data authoritative source** no later than September of 2013,
3. **Accelerating the exchange of real-time data** between V.A. and DOD no later than December of 2013, and
4. **Allowing V.A. and DOD patients to download their medical records**, what we call our Blue Button Initiative, no later than May of 2013, and, finally,
5. **Upgrading the graphical user interface**, this thing we call the GUI, **to display the new standardized V.A. and DOD health care data** no later than December of 2013,
6. **Expand the use of the Janus graphical user interface, the GUI**, to seven additional sites and its expansion of two DOD sites no later than July 2013 …
7. **Select a core of -- core set of IEHR capabilities no later than March of 2013 …**
8. **Achievement of the president's goal in 2014** … to do everything possible to try to put the health care systems of both these departments together for the benefit of our troops.”
VA’s Playbook  

_VistA Modernization Working Group Report_, May 4, 2010  
American Council on Technology, Industry Advisory Council

- “VistA is the best health information system in the world, bar none
- At the same time, VistA is very old, very hard to maintain, hard to manage and manipulate, and incredibly expensive to maintain.”
- VistA should be “reengineered” in the sense of creating a new, open source, open standards ecosystem within which the proven functional capabilities of VistA can be replicated, modernized, and enhanced in a sustainable, scalable, and secure environment
- The options boil down to:
  - Restructure the existing VistA system, piece by piece, into a more modular and well behaved application while still using it. (Change the tires, while the car is still on the road.”) and
  - Build a replacement system reusing the business processes, workflow, screen designs, and data models from VistA. This reengineered system must be done using a contemporary architecture, which is more structured and properly componentized (with components from internal VA development, external development by paid contractors, project grants, and open source community, or commercial off the shelf products).
2011 Baseline VistA Architecture (Conceptual View)

**Applications**
- Scheduling
- Pharmacy (Rx)
- Laboratory
- Radiology
- ADT
- 100+ other packages

**Kernel/Tools**
- Security
- Menu Management
- TaskMan, MailMan
- Package Manager, etc.

**FileMan**
- set of APIs
- search, inquire, edit, print
- utility functions
- data dictionary utilities
- transfer entries, etc.

**Database**
- FileMan Manages
  - M global namespaces
- Data Dictionary defines
  - hierarchical file layout
  - Apps., Rx, Lab, Images
  - Common Data
  - >100+ other files

Typically, each VistA application generates at-least-one global data file. Within these files are the clinical, administrative, and computer infrastructure-related information that supports day-to-day operations and contain patients' medical and healthcare utilization histories, including data on demographics, episodes of care, medicines, practitioner information, diagnoses, procedures, etc.
Baseline VistA
“Onion Architecture”

A. FOUNDATIONAL CORE

1. Hardware
   (Raw Computing Power)
2. Operating System & Network
   (Foundational State & Behavior)
   (External-service Frameworks)
3. MUMPS Implementation
   (VISTA’s DNA & the portable virtual machine)
   (Von Neumann Framework)

B. INTEGRATION ENGINE

4. VISTA Globals & Routines
   (integrated, polymorphic database)
   (Compatibility Layer: Patterns, SAC,)
   (VNNS, File Manager compatibility)
   (Non-Von Neumann Integration Layer:)
   (APIs and pointers, incl. metadata)
   (Self-organizing Health Information Space)
5. File Manager
   (VISTA’s heart: database management system)
   (Von Neumann Integration Layer: OO)

C. MODULAR ARCHITECTURE

6. VISTA Infrastructure
   (Kernel, RPC Broker, HL7, etc. packages)
   (extensible frameworks, interfaces, & libraries)
   (also includes infrastructure from other pkgs)
7. Extensions & External Systems
   (modular plug-ins into the frameworks)
   (all the rest of VISTA is here)

An Introduction to VISTA Architecture
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N-tiered iEHR Architecture (Conceptual View)

UX GUI

Virtual Patient Record (“VPR Tier”)
- Data Access Service
- Local Data Cache
- Care Coordination Data
- Care Plan
- Concerns Problems

Capabilities Tier
- Presentation / Business Rules
- Components / Services
- Service Orchestration
- iEHR Core Capabilities
- VA Specific Capabilities
- DOD Specific Capabilities
- Medical Domain Capabilities

Enterprises Services Bus (“ESB Tier”)
- Security Controls
- Service Registry
- Common Services
- Local Data Caches
- Terminology Services
- Template Services
- BITE Services
- ETL / IE Services

CIIF Run Time
- Dynamic Translator for Structures, Codes & Versions

CIIF Design-Time
- IHTSDO Terminology Workbench
- NIST Use Case to Test Tools
- VA Model Driven Health Tool
- DOD & VA UML Tools
- USHIK Metadata Registry
- Mind Map Modeling Tool

CIIF
- Common Information Interoperability Framework

Virtual Data Repository (“VDR Tier”)
- Operational Data
- Data Mart / Warehouse Data
- Legacy Systems Data
- Service Systems
- VistA
- AHLTA

VLER Gateway
- VLER is Virtual Lifetime Electronic Record
- NwHIN is Nationwide Health Information Network

NwHIN Gateway
- Secure Standards-Based Information Exchanges

RLUS (Retrieve, Locate, Update Service) API

VHA Benefits
External Providers
SSA / CMS / PHR

PHR is Personal Health Record
SSA is Social Security Administration
CMS is Center for Medicare and Medicaid Services

BITE is Built In Test Environment
CTR is Clinical Data Repository
CTS is Clinical Terminology Repository
ETL is Extraction, Translation & Load
IE is Interface engine

See Notes Page for Description
Proposed Systems Engineering Approach

Use CIIF & (RLUS + VDR) & (RLUS + VPR)

INTEGRATED iEHR SOLUTION

HEALTHCARE SERVICES PLATFORM (HSP)

- BHIE
- FHIE
- iEHR VDR
- Service Systems

Common Information Integration Framework (CIIF)

iEHR Clinical & Business Services & ESB SOA Suite

RLUS APIs add legacy systems into the iEHR VDR backend. Legacy systems can be shut down when / if iEHR has subsumed their functionality.
Proposed Transition Strategy

iEHR *Linkage to Legacy Systems*

See Notes Page for Description
Givens
iEHR Core Capabilities based-on VistA

• Janus GUI
• Enterprise Service Bus
• Virtual Data Repository (VDR)
  – MDWS data access to VistA
  – RLUS
    • CIIF information models and terminology services
    • 3M HDD
  – Virtual Patient Record (VPR)
• Orders Management and Results Retrieval
The DoD would like analyses, alternatives, timelines, and recommendations and approaches to a Best of Suite (BoS) core followed by Best of Breed (BoB) applications until full capability is deployed. For the purposes of this RFI, the DoD has defined the EHRS core as containing, at a minimum, the following components:

1. **System Management**: Includes support for security (while balancing the need for legitimate access), identity management, disaster recovery, and business continuity

2. **Interoperability**: Ability to communicate and interact with other systems

3. **Data Model**: Permanent data store that guarantees that information is stored for the legally required time and can be retrieved rapidly and flexibly

4. **Clinical Workflow**: Support for the processes involved in clinical care as well as the information needed

5. **Clinical Documentation, Document Management, and Data Capture**: Capture all clinically relevant information at the point of care

6. **Clinical Display / Dashboard** (part of clinical applications): Present data in a meaningful manner that contributes to the clinician’s ability to use the data effectively

7. **Clinical Decision Support (CDS)**: Ability to incorporate rules and decisions

8. **Order Management** (including Computerized Physician Order Entry or CPOE): Support a variety of mechanisms for entry and management of all types of clinician orders
Recommended iEHR Core Capabilities Strategic Initiatives Defined by OSEHRA Open Source Community

• Restructure the existing VistA system, piece by piece, into a more modular and well behaved application while still using it.
  – Separate “core” kernel, as defined by solicitation
  – Separate VA specific packages / routines
  – Separate other non “core” capabilities
  – Repurpose the existing “core” VistA packages and routines

• Collaboration with IPO integration and test teams
  – Updated Architecture and documentation
  – Test fixtures / machines

• TBD on 12 Feb meeting
“The DoD anticipates that the overall replacement EHRS effort may include, but not be limited to: (1) system and software engineering; (2) system integration; (3) installation, testing, and deployment; (4) lifecycle logistics support to include user training; (5) system and data hosting; (6) operations and maintenance (O&M) support; and (7) business intelligence and research.”
Recommended iEHR Core Capabilities Milestone Schedule

TBD by OSEHRA Open Source Community, beginning 12-Feb-13.

TBD by OSEHRA Open Source Community, beginning 12-Feb-13.

12/14
Achievement of the president's goal in 2014 to do everything possible to try to put the health care systems of both these departments together for the benefit of our troops.

1/1/2014 12/31/2014

DRAFT OSEHRA WORKING DOCUMENT; NOT FOR OFFICIAL USE
### Recommended iEHR Core Capabilities Risk Radar Defined by OSEHRA Open Source Community

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“The scope of this anticipated effort is to replace DoD legacy electronic health records systems (e.g., Armed Forces Health Longitudinal Technology Application (AHLTA), Composite Health Care System (CHCS), and Inpatient System Essentris®) with a Generation 3 or better EHRS for clinical and business applications.” [Core EHR]
BACKUP SLIDES
CPR Generations: Available Today

Generation 1: The Collector
These are simple systems that provide a site-specific, encounter-based solution to accessing clinical data.

Generation 2: The Documentor
Basic systems that clinicians begin to use at the point of care for somewhat more than merely accessing clinical data.

Generation 3: The Helper
(Only a few are currently available)
More-advanced systems that support clinical episodes and encounters clinicians. These systems must include integrated pharmacy functionality and cover both ambulatory and acute-care settings. For the first time, the technology can permit a CDO to bring EBM to the point of care.

CDO = care delivery organization
EBM = evidence-based medicine
CPR Generations: Available in the Future

**Generation 4: The Colleague**  
(Available 2010?)

Advanced systems that provide substantial functionality for nurses, physicians and pharmacists. These systems have more decision support and workflow capabilities along with tools that permit CDOs to more easily bring EBM to the point of care.

**Generation 5: The Mentor**  
(Available sometime after 2015?)

Complex, sophisticated and fully integrated context-aware systems that cover the full continuum of care and care givers, and that can actually guide clinicians when appropriate.
Remarks by Secretary Panetta and Secretary Shinseki from the Department of Veterans Affairs

(FACILITATOR): The assistant secretary on public intergovernmental affairs. Secretary Shinseki and Secretary Panetta have just concluded another joint meeting, their ninth such meeting of the last 18 months. Their close working relationship is a testament to their shared commitment to taking on the common issues that affect our departments.

At this point, I'd like to welcome Secretary Shinseki and Secretary Panetta.

SECRETARY ERIC SHINSEKI: Good afternoon, everybody. Am I on, Tom?

(FACILITATOR): You're up.

SECRETARY SHINSEKI: Well, good afternoon, afternoon. I'm personally very proud to have this opportunity to be able to thank my friend, Secretary Leon Panetta, for his many years of devoted public service, dedicated specifically to taking care of the men and women who wear on nation's uniforms and for those who in years past have worn those same uniforms.

We just concluded our ninth meeting, I believe, in 18 months. As always, you come out of these meetings great things accomplished, but more work to do, and that will always be true. But with the president's leadership and guidance, we have brought our two departments much closer together, closer than ever before. And that's good for our people.

We had previously indicated our commitment of both of our departments to a single, common, joint integrated electronic health record, the IEHR. And today we affirm again our commitment to achieving the president's goal in 2014.
Today's meeting was about how to get there and, in the short term, we've agreed to improve data interoperability to that integrated electronic health record before the end of this year, by standardizing health care data no later than December 2013, creating health data authoritative source no later than September of 2013, accelerating the exchange of real-time data between V.A. and DOD no later than December of 2013, and allowing V.A. and DOD patients to download their medical records, what we call our Blue Button Initiative, no later than May of 2013, and, finally, upgrading the graphical user interface, this thing we call the GUI, to display the new standardized V.A. and DOD health care data no later than December of 2013, all of this focused on an initial operating capability in 2014.

We've also approved plans to expand the use of the Janus graphical user interface, the GUI, to seven additional sites and its expansion of two DOD sites no later than July 2013. And then, finally, we'll select a core of -- core set of IEHR capabilities no later than March of 2013. All of these milestones enable achievement of the president's goal in 2014.

Secretary Panetta and I have been working side by side for 18 months now to ensure service members and veterans receive the care they've earned. And I just want to extend my thanks once again to the secretary for his leadership and his partnership, and as I've said several times before, even in testimony, the veterans couldn't have a stronger ally in their corner than Leon Panetta.

So with that, Mr. Secretary?
SECRETARY OF DEFENSE LEON E. PANETTA: Thank you very much. Thanks, Ric, and good afternoon to everybody.

It is, as always, a great pleasure to be back here at the Department of Veterans Affairs and to have a chance to discuss the new steps our departments are taking to integrate electronic health records on an accelerated basis. Upfront, let me take this opportunity to deeply thank you, Ric, for your cooperation, for your friendship, and for your great willingness to work with us during the time that I've been secretary of defense. Ric is an outstanding leader. He served his country with distinction. And it's been my great pleasure to have the opportunity to continue to work with him in this job.

We've met on a regular basis. We've had a number of meetings. And, you know, some of them have been pretty tough meetings. But we are grateful that progress is being made towards a common goal of trying to support those in uniform and their families. There's no distinction here between veterans and those who serve in uniform. We're talking about the same individuals who serve this country. And that's what we've tried to do with the Department of Defense and the Department of Veterans Affairs, is to recognize that we both serve the same individuals who put their lives on the line for this country.

Achieving the goal has taken a tremendous amount of collaboration at all levels. But I'm proud to say that our departments are now working together more closely than ever before. We recognize that bringing together two large bureaucracies, trying to make those bureaucracies work together to form a seamless support system for all service members and veterans is not an easy challenge. It's tough. But we also know how important it is to cut through the regulations and the red tape and deliver quality services for our troops, for our veterans and to their families. Ric and I have always said that this cannot be about turf, this cannot be about turf, this has to be about what's best in serving our veterans.
One of the most complex challenges we face is, obviously, the whole issue of health records. Our service members often have extensive records. The last thing they need is to worry about their doctors having all of the information that they need in order to provide them the care that they deserve. That's the last thing they ought to worry about.

It's frustrating. It's been inefficient for service members to have to hand-deliver records from one system to another when they get out of the military. It doesn't make a hell of a lot of sense. As President Obama directed in 2009, we can and we must do better. And that means improving the quality and availability and interoperability of our health record systems.

As you know, our two departments have been moving toward a plan to build a single customized, integrated electronic health record system from the ground up, to meet the president's directive and modernize our legacy IT systems. **Our goal had been to complete this effort by 2017.** I think over the last few months, Ric and I both have recognized that, you know, our worry is, how long is it going to take to get to that goal? And what is going to be the price tag to get to that goal? And how many times is it going to be delayed?

So we asked the managers of the joint program to take a step back, take a step back and assess whether we could achieve the president's directive much sooner and for much less money than had been budgeted. With advantages in technology, thank God, and the work that our two agencies have already done, it turned out that we could.

So today, Ric and I agreed to make a series of important changes to simplify this program, cut costs, and to get our veterans the key benefits of this new system much sooner. Rather than building a single integrated system from scratch, we will focus our immediate efforts on integrating V.A. and DOD health data as quickly as possible, by focusing on interoperability and using existing solutions.

This approach is affordable, it's achievable, and if we refocus our efforts, we believe we can achieve the **key goal of a seamless system for health records between V.A. and DOD** on a greatly accelerated schedule. We're now directing our departments to do just that.
We've already identified ways to standardize V.A. health data and align it with DOD data. It's not an easy task, but it's making good progress, and it's been done by both agencies. And we are continuing enhancements, as Ric pointed out, on the so-called Blue Button effort that will allow doctors and patients to access health records at any DOD or V.A. facility.

**By this summer**, DOD and V.A. will field and begin conducting a pilot program on the common interface for doctors at seven joint rehab centers across the country and we'll also expand its use at two other sites. All of these facilities will be interoperable by the end of July 2013, so fast time track, but we think we can get it done.

**By January of 2014**, we will meet the president's directive for standardizing and aligning data in a way that enables both V.A. and DOD beneficiaries to download their own health information. The bottom line is this, that we now have a clear and achievable path to meet the president's directive to implement the seamless electronic health record system for our troops and for our veterans.

**Coming out of a decade of war, we owe it to the service members and veterans to do everything we can to help them succeed in life after the military.** That includes helping them prepare for the transition at the Department of Defense and giving them the information and support that they need when they come home or leave the military.

This is a struggle. This is a struggle that has gone on for a long number of years. Some have argued that we should build a perfect system. Some argued that we'll never be able to do this. But for the first time, both DOD and V.A. have come together to say we can get this done, we can get it done in an effective way that does the job and does it in an expeditious way in order to make sure that we best serve our veterans and we best serve those who put their lives on the line. I'm proud to be able to make this announcement today, because I believe that both departments has met the challenge that the president has given us to try to do everything possible to try to put the health care systems of both these departments together for the benefit of our troops. Thank you.
iEHR Update to OSEHRA AWG by Steve Hufnagel DoD & IPO Support Contractor 5 February 2013

Presentation Based on December 17, 2013 Version 7 of iEHR Technical Specifications Summary (TSS) Available at iEHR Public Website http://tricare.mil/ipo/xyz/ Click on Vender Information
Abstract

iEHR is converging on its development / deployment approach. This discussion will review the 2014 Proof-of-Concept Initial Operational Capability (IOC) plans for San Antonio TX and Hampton Roads, Virginia. This IOC will be an iEHR “core” platform, including Laboratory, Immunization and Pharmacy (for North Chicago). The next milestone is for the Full Operational Capability by 2017, which will include 40+ capabilities.

iEHR is intended to be a **Healthcare Services Platform (HSP)** emphasizing the **reuse** of high quality clinical/business, infrastructure services, a User Experience (**UX**) framework and a virtual data repository (**VDR**). The HSP is intended to be an interoperability-framework for COTS (Commercial Off-The-Shelf), GOTS (Government Off-The-Shelf) and open-source components. All medical specialty domains, such as **Joint Immunization Capability (JIC)**, should each be an orchestration of HSP services; where, each medical-specialty domain has its own data-and-terminology models, business-rules, workflows, reports and displays in accordance with scope-of-practice, organizational policy, iEHR governance and jurisdictional law.
2014 iEHR Platform

The iEHP technical vision is a SOA Platform constructed from

• SOA Suite/ESB (Enterprise Service Bus); plus,
• Core Clinical/Business Services; plus,
• UX GUI Framework (User Experience Graphical User Interface); plus,
• CIIF normalized VPR (Common Information Interoperability Framework, Virtual Patient Record)
• VDR with RLUS API (Virtual Data Repository, Retrieve Locate Update Service, Application program interface); where,

The iEHR Platform is intended to be an interoperability-framework for

• COTS (Commercial Off-The-Shelf),
• GOTS (Government Off-The-Shelf), and
• Open-source components.
Agile & SOA Principles

Bottom Up Agile Application Lifecycle Management (ALM) stress:

1. Evolve process definitions, based on vendor, developer and partner lessons learned.
2. Embrace heterogeneity to achieve best-of-class capabilities.
3. Build the right thing based on trial-and-error lessons learned.
4. Practice continuous build-test-deliver cycles to refine requirements and user satisfaction.
5. Orchestrate iEHR capabilities, constructed from reusable services.

Top Down SOA principles stress that iEHR

1. Clinical-business capabilities must be able to adapt and align to evolving users’ needs.
2. Reuse Services and get rid of duplication to achieve consistency, quality and cost reduction.
3. Capabilities are constructed from orchestrated clinical, business and infrastructure services leveraging the work of others within and outside the enterprise.
Agile-SOA Best Practices

Several Agile SOA best-practices have emerged:

• Sponsors, developers, integrators and testers have a cross-services and cross-capabilities (possibly virtual collaboration site) war-room for shared resources and shared Q&A.

• SOA teams communicate via tests (e.g., connect-a-thons) and not just documents

• Keep services simple; where, services have at least two users.

• Design services to accommodate change by separating data, code, business rules and APIs
iEHR Agile-SOA Best Principles (1)

1. The key iEHR capabilities’ SOA principles and requirements are that capabilities:

2. Be built on end-to-end business processes that reflect clinical workflow, *with abstraction of common workflow steps into single concepts*, such as *one* order entry process that is used (and re-used) for all order types (lab, Rx, Radiology, etc.);

3. Show why standard processes, supported by SOA services, are best for health care delivery (one order entry metaphor for a physician, not a different one for each order type;)

4. Show better patient safety and cost avoidance with consistency from:
   1. training clinicians once,
   2. writing, testing and certifying software once,
   3. order checking once,
      1. across all order types; such as,
      2. drug interaction checking;
iEHR Agile-SOA Best Principles (2)

5. Show how interaction with **ESB** (Enterprise Service Bus) allows safe interaction with legacy systems;

6. Show how interaction with **CIIF** (Common Information Infrastructure Framework) VDR and VPR with RLUS APIs will result in semantic harmonization across modules; even-in the worst-case, where each COTS product comes with its own ontology of clinical concepts.

7. Show how each capability will use and support the DoD-VA common presentation layer, including its access control and context management, resulting in user-application experience consistency.

8. CIIF assures semantic interoperability, where, the data is aggregate-able, analyzable, computable and comparable.
iEHR Architectural Best Practices

The desired iEHR technical-solution demonstrates orchestrated IEHR Platform services for medical-domain capabilities and the desired solution follows software engineering / SOA “best practices” to loosely-couple and separate:

1. Data, Business rules, Application code, Presentation framework services,
2. Common services (e.g., SOA Suite, Enterprise Service Bus, security, UX framework, reporting tools),
3. Core business services and orchestrated business workflow & business “value chain” services.
Core Clinical / Business Services (1)

1. **VDR (Virtual Data Repository) DB** component with RLUS (Retrieve, Locate Update Service) API.

1. **RLUS** is an HL7-OMG standard API; but its implementation should be more than a database API / facade. RLUS implementations should work with CDS (Clinical Decision Support); where, the RLUS implementation needs to be coupled with aggregation, terminology normalization and translation, and confidentiality / access control.

2. **CIIF (Common Information Interoperability Framework) services** assure semantic interoperability across IE (Information Exchange) and VPR content; so that, data is aggregate-able, analyzable, computable and comparable within CDS algorithms.
Core Clinical / Business Services (2)

3. **Virtual Patient Record (VPR)** with RLUS API cache, which collates patient data from legacy sources and presents it as if it were coming from one-source. VPR contains patient-centric aspects of the medical record and provides for longitudinal (life-time) records and care, coordination among providers. VPR caching can enable COOP (continuity-of-operation), detached operation (e.g., TMIP) and Ux and application performance tuning.

1. **Care Coordination Data** is the majority of the VPR, enabling “medical-home” type patient-care management.
   1. **Concerns**, including problems, medication allergies/intolerances, past medical history, and diagnoses.
   2. **Care plans**, including medication, procedure, intervention and evaluation/test orders.
   3. **Care Records**, including histories, previous-medications and procedure, intervention, evaluation/test results.
   4. **Demographics**
   5. **Advance Directives**, including Patient / Family Preferences.
3. Virtual Patient Record (VPR)
   1. **Order Management Service** should be integrated with the Care Plan to avoid duplicate entry
   2. **Clinical Note Service**, with multiple entry modes should be integrated with the Care Record to avoid duplicate entry
   3. **Results Retrieval Service**, including Radiology Reports, Radiology Images, Pulmonary Function Tests, Electrocardiograms, Laboratory Test Results, Microbiology Results, Pathology Reports, Synoptic Pathology Reports, Pathology Images, should be integrated with the Care Record to avoid duplicate data.

4. **Inventory and Funds Control Management Service**

5. **CDS (Clinical Decision Support) Service**; where, CDS might use the SOA Suite Business Rules Management System (**BRMS**) for several different functions, including orchestration of other CDS, dispatching events, generation of alerts/notifications, and clinical logic. A mature CDS will also use non-BRMS components, such as neural nets, **BBNs** (Bayesian Belief Networks), predictive analytics, etc.
Core Clinical / Business Services (4)

6. **UX Framework** enabling SSO (single sign on), CM (context management), AM (access management), ID (identification), using portlets, which are pluggable user interface components for secure-mobile devices and specific medical-domains.

7. **Identity and Access Management Services**, including RBAC (role-based access-control) and ABAC (attribute-based access-control) needed for entity management, provider/service/location directory services (see HL7/OMG standard), privilege management, entity-role capacity, and entity-role tracking.

The currently identified business services, which vendors and developers must use, are:

1. Access Control
2. Allergies
3. Business Intelligence
4. Clinical Decision Support/Alerts and Reminders
5. Credentialing
6. Drug Interactions
7. Encounter Coding
8. Document Management
9. Global Image Access
   – Which is likely to be merged with Radiology
10. Inventory Management
11. Medical Device Management
The currently Identified business Services, which vendors and developers must use, are:
12. Medical Record Data (Read-Only), such as RLUS assuming updates are enforced through a rules engine
13. Patient Identity Management
14. Patient Safety Reports
15. Private Sector Data Access
16. User Experience
17. User Experience/Documentation
18. Orders Service
19. Personal Health Record
20. Scheduling Appointment
21. Secure Messaging
   – Including Provider-Provider and Patient-Provider
22. Tele-consultation