DoD-VA Collaboration to Develop
a Single Electronic Health Record:
SOA as a Design Pattern

Paul Tibbits, MD
Deputy CIO, Office of Architecture, Strategy, and Design
Jul 14 2011
v5
Agenda

• Value in health care
• Back to basics – LCM and TCO
• Enterprise architecture
• Major transformation initiatives
• Big picture – SECDEF and SECVA design pattern for iEHR
• GUI
• Data
• SOA

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“...Red Tape...”

We Need to Focus on Eliminating the Challenges Facing Veterans and Their Beneficiaries

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DoD-VA iEHR Vision

In March 2011, VA Secretary Eric Shinseki and DOD Secretary Robert Gates agreed on a common EHR technical architecture, data and services and exchange standards for the joint EHR system (aka iEHR), where the joint EHR will include both proprietary and open source software. The secretaries of the Veterans Affairs and Defense Departments met on May 2, 2011 to determine their next steps toward developing a single electronic health record, for the two agencies.

“VA is developing an open source track to modernize VistA and will incorporate the approach in the joint EHR”, Shinseki said. “One of my objectives is to have minimal disruption in the hospitals as we evolve from VistA to the joint EHR system. What I think you will see us do is replace modules, do incremental upgrades…In five or 10 years, there may not be one line of code left from VistA. And in my ideal world, the users will have no idea that I have made any changes.”

VA Secretary Eric Shinseki

“Our goals are to bring in as many private sector modules as possible and selecting the same thing to run between VA and DOD so that we end up with a single, common electronic health record system.” Roger Baker, VA CIO

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Information technology (IT) can transform healthcare as it has in other parts of the US economy. Properly implemented, health IT can

- Integrate technology into clinical workflow as an asset, and minimize unproductive data entry work.
- Give clinicians real-time access to complete patient data, and provide them with information support to make best decisions.
- Help patients become more involved in their own care.
- Enable range of public health monitoring and real-time research.
- Improve clinical trials, and rapid advances in personalized medicine.
- Streamline processes, increase transparency, and reduce overhead.
- Create new high-technology markets and jobs.
- Support economic reforms in healthcare needed to address our Nation’s long-term fiscal challenges.
Value in Health Care

“…Achieving high value for patients must become overarching goal of health care delivery, with value defined as health outcomes achieved per dollar spent…If value improves, patients, payers, providers, and suppliers can all benefit while economic sustainability of health care system increases…”

Life Cycle Management and Total Cost of Ownership “Checklist”

*Infrastructure “Stack” Central to All Initiatives*

[Diagram showing the infrastructure stack with layers such as Enterprise Systems, Networking & Interconnections, Desktop & Mobile Computing and Communicating, and sub-layers like Hardware, Software, People, Funding, Service Levels, Lifecycle, and Security.]
Preface

• “…this includes realizing cost savings through
  – Consolidation & reuse of shared services & elimination of
    antiquated, redundant mission operations
  – Enhancing information sharing through data
    standardization and system integration
  – Optimizing service delivery through streamlining &
    normalization of business processes & mission
    operations…”

• “…EA can simplify, streamline, and clarify
  interdependencies and relationships among
  organization’s diverse mission, mission-support
  operations, and information needs including its
  associated IT environment…”
Goal 3: Raise readiness to provide services and protect people and assets continuously and in time of crisis.

Privacy 300 Exhibit

Connecting the Dots to Enhance the VA Security Infrastructure

T-21 VRM-IAM Initiative

Budget Justification

Investment Control

Architecture Alignment

VA Security Infrastructure Summary and Compliance Guidelines
Planned for Oct 2011

Strategic Goal

Org-Unit

Line of Business

Processes

Data Descriptions

Applications

Services

Infrastructure Components

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OneVA EA Program Purpose
Decision-Enabling Goal and Objectives to Deliver Customer Value

Veterans and Beneficiaries

Objective 1: Enable VA to Eliminate Challenges that Affect Veterans and Their Beneficiaries

Health, Benefits, and Cemeteries

Objective 2: Enable VA’s Veteran-facing Services to Provide High Levels of Service Quality

VACO Staff Offices

Objective 3: Enable VA’s Mission-facing Services to Provide High Levels of Service Delivery

OI&T and T-16 Initiatives

Objective 4: Enable VA’s Business-facing Services with High Levels of Service Productivity

ASD Clients and Customers

OneVA EA Program
One Goal: Serve the Veteran
OneVA EA Program Evolution
From Guidance-Focused Architecture to Decision-Enabling Architecture
OneVA EA Program Evolution
From Guidance-Focused Architecture to Decision-Enabling Architecture

Enterprise Transformation

Business Intelligence

Framework Compliance

Providing Artifacts

Supplying Guidance

Delivering Content

Enabling Decisions

Driving Outcomes

Data Centric

Document Centric

EA Repository
VA Enterprise Architecture

Program Plan
Practice Guidance
Communications Plan
Performance Plan
EA Portal & Repository
Governance
EA Guide

Reference Models
Performance
Business
Data
Service
Technical

Baseline Architecture
Baseline Description
- Performance
- Shortfalls
Business Architecture
- Organization
- Processes
- Applications
Data Architecture
- Data Model
- Information Exchange Model
Technology Architecture
- Hardware Profile
- Standards Profile
- Services Catalog

Transition Architecture
Transition Plan
- Transition Strategy
- Sequence Plan
- IPv6 Implementation
IT Project Management Guide

Target Architecture
Target Description
- Segment Architectures
- Transformation Roadmap
Technology Forecast

Segment Architectures
Health
Benefits
Cemeteries
Corporate Mgmt
Financial Mgmt
HR Management
Materiel Mgmt
Cyber Security & Privacy
IT Management

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FSAM and ProPath Fit and Flow
Architecture Views within the VA

OMB Federal Enterprise Architecture

VA Enterprise Architecture (VA, Veterans, and External Partners)

VA Models
- PRM
- BRM
- DRM
- SRM
- TRM

VA Segment Architecture (Operational Environments)

VA Models
- PRM
- BRM
- DRM
- SRM
- TRM

VA Solution Architecture (Initiatives)

VA System Architecture (SDLC)

- Cost Benefit Analysis
- Vulnerability Assessments
- Business Needs
- Interface Requirements
- Deployment Architecture
- Service Delivery Models

- Project Start
- Architecture and Design
- Test Preparation
- Product Build, Test & Certification, Release Management

VA Environments
- Health
- Benefits
- Cemeteries
- Corporate
- Financial Mgmt
- HR Mgmt
- Materials Mgmt
- Security/Privacy
- IT Infrastructure

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Architecture Views within VA

VA Enterprise Architecture

Federal Enterprise Architecture

VA Segment Architecture
Secretary VA: T-16 Initiatives + iEHR

Solution Architecture
AoA: design/select the solution architecture

Business Intake Review Board

SDLC (Software Architecture)
PMAS Start/Re-Start

Cost Benefit Analysis
Security Architecture
Business Needs
Deployment Architecture
Service Delivery Models

Project Start
Architecture and Design
Test Preparation
Product Build
Test & Certification
Release Management

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Reference Model Status

• To satisfy reporting requirements the FEA Reference Models have been adopted

• Subsequently VA EA has expanded the models to address VA specific needs
Development and Maintenance of the Technical Reference Model (TRM):

- Oversee process for content management
- Management of websites

TRM Development and Maintenance

Manage OneVA Technical Reference Model that integrates previous guidance published by four separate OI&T entities:
- Establish understanding of VA TRM strategy
- Identify VA TRM goals, objectives, milestones, and inter-agency collaboration efforts, and infrastructure
- Identify enhancements and clarifications for future TRM releases
- Execute change management procedures for TRM Websites
- Conduct Usability Tests of Websites
- Test (QA) Release activities
- Release enhancements to TRM websites

Oversee TRM for both content and process:
- Resolve issues with TRM content, authoring, approving, publishing
- Escalate unresolved issues to the Monthly Performance Review (MPR) or the Enterprise Architecture Council (EAC) as appropriate
- Publish approved TRM Content
- Work with all major/minor stakeholders to identify needs for standard TRM processes
- Develop and maintain TRM Operational Processes
- Process TRM Data Content Change
- Process Intranet Inquiry
- Process Collaborative Site Functionality Change
- Process Intranet Website Functionality Change
- Measure effectiveness of new Processes introduced

Provide consolidated and coordinated guidance for information technology users and system developers concerning technologies and standards that are allowed and prohibited in the VA environment:
- Solicit Feedback from the stakeholders and end users
- Resolve technology standards issues and conflicting standards

Help improve systems and software development capabilities and interoperability by mandating the use of approved standards and tools throughout VA

Chair TRM Management Group - comprised of members from Product Development, IPRM, EOFD, ASD, VHA, VBA and NCA

TRM Management Group,
TRM Process Sub-Group,
TRM Usability Sub-Group,
TRM Technical Sub-Group

Intranet One VA TRM website

Internet One VA TRM website

TRM Answers, TRM FAQs, Authoring and approval help aids

Administrations, OMB, Federal CIO, Industry Standards
- FEA TRM Taxonomy
- VA Directives, Technical Guidelines, Standards

PMS TRM Support Team
- TRM Initiative plans
- VA TRM strategy
- TRM Management Group Charter
- TRM Communication Plan

VA TRM Users
- New or revised technology requests
- Question about the TRM
- Question on TRM compliance
- Question on Enterprise Licenses

Product Development TRM Support
- Provide resources to support the TRM Published site
- Maintain configuration management of code and the database
- Implementing functional changes to the VA intranet websites, databases;
- Develop and maintain interfaces to the TRM Collaborative site

Product Development, EIE, IPRM, VBA, VHA, NCA, & EA TRM Subject Matter Experts
- Submit technology or standard requests
- Respond to referred TRM inquiries
- Author (Leads) technology standards
- Review technology standards and provide comments/feedback
- Attend and actively participate in TRM Management Group meetings and sub-working groups
- Annual review of technology and standards

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Where is the TRM Published?

VA Internal Access
trm.oit.va.gov
- TRM content
- Ability to inquiry
- Ability to request technology assessment

TRM Team Collaboration Site
http://private URL
- Content authoring
- Wiki-based
- Pushed to published sites

Public Access
www.va.gov/trm
- TRM content

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## Service Aware Interoperability Framework (SAIF)

<table>
<thead>
<tr>
<th>ECCF</th>
<th>Enterprise Dimension</th>
<th>Information Dimension</th>
<th>Computational Dimension</th>
<th>Engineering Dimension</th>
<th>Technical Dimension</th>
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<tbody>
<tr>
<td>✓ Inventory of</td>
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<td>✓ Inventory of</td>
<td>✓ Inventory of</td>
<td>✓ Inventory of</td>
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<tr>
<td>• User Cases, Contracts</td>
<td>• Domain Entities</td>
<td>• Functions-services</td>
<td>• SW Platforms, Layers</td>
<td>• HW Platforms</td>
<td></td>
</tr>
<tr>
<td>• Capabilities</td>
<td>• Activities</td>
<td>• Requirements</td>
<td>• SW Environments</td>
<td>• HW Environments</td>
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<tr>
<td>✓ Business Mission, Vision, Scope</td>
<td>• Associations</td>
<td>• Accountability, Roles</td>
<td>• SW Components</td>
<td>• Network Devices</td>
<td></td>
</tr>
<tr>
<td>✓ Information Requirements</td>
<td>• Information Models</td>
<td>• Functional Requirements</td>
<td>• SW Services</td>
<td>• Communication Devices</td>
<td></td>
</tr>
<tr>
<td>✓ Information Models</td>
<td>✓ Conceptual</td>
<td>• Profiles, Behaviors, Interactions</td>
<td>• Technical Requirements</td>
<td>✓ Technical Requirements</td>
<td></td>
</tr>
<tr>
<td>• Domain</td>
<td>✓ Interfaces, Contracts</td>
<td>• Key Performance Parameters</td>
<td>• Enterprise Service Bus</td>
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</tbody>
</table>

### Conceptual Perspective
- Business Policies
- Governance
- Implementation Guides
- Design Constraints
- Organization Contracts

### Logical Perspective
- Business Nodes
- Business Rules
- Business Procedures
- Business Workflows
- Technology Specific Standards

### Implementable Perspective
- Schemas for
  - Databases
  - Messages
  - Documents
  - Services
  - Transformations

- Automation Units
- Technical Interfaces
- Technical Operations
- Orchestration Scripts

- SW Specifications for
  - Applications
  - GUIs
  - Components
  - SW Deployment Topologies

- Models, Capabilities,
  - Features and Versions for
    - SW Environments
    - SW Capabilities
    - SW Libraries
    - SW Services
    - SW Transports

- Models, Capabilities,
  - Features and Versions for
    - HW Platforms
    - HW Environments
    - Network Devices
    - Communication Devices

### Technical Dimension
- SW Specifications for
- HW Specifications
- HW Deployment Specifications
- HW Execution Context
- HW Application Bindings
- HW Deployment Topology
- HW Platform Bindings

**Five (5) Teams:** Capability | Mission | Business Process | Infrastructure/Enterprise Architecture | Interoperability
Transformation Initiatives

0. EHR
1. Eliminate Veteran Homelessness (EVH)
2. Enable 21st century benefits delivery and services (e.g., backlog reduction) (Veterans Benefits Management System - VBMS)
3. Automate GI Bill benefits (GIBILL)
4. Implement Virtual Lifetime Electronic Records (VLER)
5. Improve Veteran mental health (IVMH)
6. Build Veteran Relationship Management (VRM)
7. Design a Veteran-centric healthcare model and right-sized infrastructure to help Veterans navigate the health care delivery system and receive coordinated care (New Health Care Model – NHCM)
8. Expand health care access for Veterans, including women and rural populations (ACCESS)
9. Ensure preparedness to meet emergent national needs (e.g., hurricanes, H1N1 virus) (Integrated Operations Center – IOC)
10. Develop capabilities and enabling systems to drive performance and outcomes (Enterprise Wide Cost Accountability – EWCA)
11. Establish strong VA management infrastructure and integrated operating model (IOM)
12. Transform human capital management (Human Capital Improvement Plan - HCIP)
13. Perform research and development (R&D) to enhance the long-term health and well-being of Veterans
14. Optimize utilization of VA’s Capital Portfolio by implementing and executing the Strategic Capital Investment Planning Process (SCIP) process
15. Health Care Efficiency: Improve the quality of health care while reducing cost
16. Transform health care delivery through health informatics
iEHR Implementation Plan: “To Be” Architecture

Program Execution
Notes
- Tripler Demo – Complete
- Targeted Deployment – 1 July 11
- Purchase Decision in Work
- Notional architecture for joint operations – completed
- Work continues to put into place the Common Information Model and develop Translation Service

Common DoD-VA Measures of Effectiveness, Measures of Performance and Key Performance Parameters
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Presentation Layer: Common GUI
Build Out Beyond July 1: Medium-term

- **Integrate** information, communication, and workflows
- Identify dependencies with data, architecture, & capabilities
Common Services

**WHAT**

- Reusable SW Components
- OI&T Services

**WHERE**

- Enterprise Wide Requirements
- Incremental Delivery Synchronized Integrated Schedule

**WHEN**

<table>
<thead>
<tr>
<th>3Q FY11</th>
<th>4Q FY11</th>
<th>1Q FY12</th>
<th>2Q FY12</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSOi v1 Identify Proofing v1</td>
<td>Digital Signature v1 * Identity Proofing v2</td>
<td>Content Management v1 * SSOe Encryption v1 * HL7 Messaging v1</td>
<td>SSOi v2 * Data Transfer * HL7 Messaging v2</td>
</tr>
</tbody>
</table>

**Core Dimensions**

- Functionality
- Data Structure
- Interface Control
- Security
- Service Level Agreements

**Level of Effort**

- 6-8 FTE
- ~6 Month Budget
- PM, SE, Developer

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Unified VIM

Unified VA Information Model (VIM)
An Enterprise View

Source-Target Mapping

VA-wide Meta Data Repository
Data Architecture Repository

Data Governance
Data Stewardship

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Problem: Data Access Today in VA

Architectural Issues

• Many point-to-point connections
• Data transformations responsibility of each system/service/application
• Modernization efforts are adding data stores at a faster rate than they are being retired
• New external interface standards and 3rd parties are demanding more data and in different formats (e.g. VLER, NHIN, EHRWF, and NIEM)

Developer Issues

• Where does the data reside?
• How do I access that data store and gain access to that data?
• What will the data look like?
• How do I transform it into the data formats that I use within MY application?
• Who else do I have to share data with?
• What data formats do they require?
DA Vision Statement

Provide unified data architecture in order to achieve data integrity, consistency, and availability across VA thereby

• **Streamlining** development activities
• Reducing cost for redundant development and maintenance of data bases
Data Virtualization Is Critical To Spend Reduction If VA Is To Enhance Service To Veterans While Reducing Overall Spend

• Data Virtualization
  – Abstracts data contained within multiple sources (stores) so that they may be accessed without regard to their physical storage or heterogeneous structure
  – Commonly used within data integration, master data management, cloud computing, business intelligence systems and enterprise search

• Resulting Benefits
  – Flexibility in achieving modernization goals
  – Improved data quality enforcement
  – Development speed
  – Improved data governance
  – Cost economies
Build a modular architecture that treats data integration, metadata management and analysis as separate but linked components.

- Ad hoc analytics environments should be treated as incubators for new reports.

1. Data Integration: Loose data coupling through data virtualization enables new data to be brought online and bad data to be purged without the time and effort of physical integration.

2. Metadata Management: The Information Catalog is maintained independently from the other layers of the stack by both knowledge workers and IT.

3. Front-End Analysis: Mashup layer can be upgraded or replaced without disruption to the rest of the components.

Offer visibility into the enterprise’s data assets in business-friendly terms to enable knowledge workers to conduct their own ad hoc analysis.

- An Information Catalog is a product offered by IT that presents information through an intuitive user interface that enables knowledge workers to conduct ad hoc analysis and help maintain data.
- and show knowledge workers as self-service consumers of the data.
- and show knowledge workers as contributors to data improvement.


“... We’re meeting end-user demand for more agile reporting without adding to their workload, and we get more accurate data quality requirements and prioritization as a result.”

Jim Luish, Director, Architecture and Governance, MetLife Bank

ENGAGEMENT THROUGH AN INTEGRATED UI

<table>
<thead>
<tr>
<th>Information Catalog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search Information Catalog</td>
</tr>
<tr>
<td>Data Search Results: 1</td>
</tr>
<tr>
<td>- Customer householding</td>
</tr>
<tr>
<td>- Credit Scores</td>
</tr>
<tr>
<td>- Loan applications</td>
</tr>
<tr>
<td>Add to Cart</td>
</tr>
</tbody>
</table>

- Ability to conduct rich analysis by searching, aggregating and reporting across a variety of data sources.
- Confidence in the data through visual quality indicators.
- Clarity of knowledge worker needs through feedback loops.

OVERVIEW COLLABORATIVE METADATA INFORMATION CATALOG MODULAR ARCHITECTURE DATA-CENTRIC LIFE CYCLE RESULTS IMPLEMENTATION GUIDE

1. Knowledge worker alerts data stewards about questionable data elements
2. Data steward coordinates fix
3. A “tactical team” implements changes to data virtualization, mashups or data feeds

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A DELIVERY MODEL FOR DATA

Why You Need a Data-Centric Life Cycle

Traditional "Systems-Centric" SDLC
Why Data Is Different
Prototyping Doesn’t Work for Data
Requirements aren’t just vague but intrinsically uncertain. Consumers must use the final product before knowing if it meets their needs.

Emerging “Data-Centric” Delivery Model
Shifts focus from defining process-specific analytics to designing a sustainable, technical environment that enables rapid integration of data into the final products.

Data Needs Inherit the Volatility of the Environment
Data values and combinations are constantly changing and evolve at an unpredictable pace.

When To Use a Data-Centric Life Cycle

Animating Question for the Traditional System-Centric Development Life Cycle: What process does the application need to support and what data does it use?

[Diagram showing application data flow with labels: Application 1, Application 2, Application 3, ..., Application "n"]/n
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Current 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”**
- M global namespaces
- data dictionary
- hierarchical files
  > 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.
Future State Architecture

Problems Being Addressed

1. **Innovation** to revitalize VistA
2. **Interoperability** among DoD, VA and purchased care partners
3. **Transition** from legacy systems and data to future-state-architecture
4. **Agility** to respond to rapid healthcare change and related legislation
   - ICD 9 \(\rightarrow\) ICD 10
   - ARRA Meaningful Use Objectives and criteria Stage I, II, III
   - HHS Mandated HITSP-constructs and HHS mandated standards
5. **High costs**
   - Separate DoD and VA systems
   - Semantic Interoperability among trading partners (consults and transfers-of-care)
   - Application acquisition or development
   - Commercial Off the Shelf (COTS) Integration
   - Sustainment
   - Test and certification
6. **Patient Safety** issues resulting from software changes.
7. **Open Source Community Enablement (Technical)**
Great Impact on links between components (e.g., Interoperability)

Little Impact on links between components (e.g., Interoperability)

Architectural Innovation

Incremental Innovation

Little impact on components

Great impact on components

Modular Innovation

Radical Innovation

Problem
Little innovation, long lead times and high costs resulting from complex highly-coupled components

Goal
A domain-specific component-architecture emphasizing interoperable standards-based services, resulting-in simpler, loosely-coupled, and less-costly module-level innovation.

Start

Year 1 End

Architectural Vision for Semantic Interoperability

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Future-State Architecture (Conceptual View)

Key points:
- VLER w/ iEHR
- NwHIN within VLER
- Applications-database decoupling
- iEHR 3-tier extendible architecture
- Use of Open Health Tools' MDHT(s)
- CIIF is key to semantic interoperability
- CIIF Run-Time environment w/ iEHR
- CIIF Design-Time environment w/ iEHR Run-Time
- BITE to facilitate performance & payload-data-integrity testing
- NIST 7497 Security Architecture Design Process for Health Information Exchanges (HIEs)
- DoD 8500 (series) Information Assurance Controls

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

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Future State Architecture

Architectural Changes Mapped to Problems

1. **Innovation** to revitalize VistA
   - Services within a standards-based component-architecture encourage lower-cost component innovation without requiring enterprise wide expertise.

2. **Interoperability** among DoD, VA and purchased care partners
   - CIIF canonical information and terminology models can map among heterogeneous system information exchanges. By adopting common data, terminology, and communications standards, data from multiple organizations can be shared more readily.

3. **Transition** from legacy systems and data to future-state-architecture
   - Virtualization-Layers of Federated Standards-Based Services applications, databases and infrastructure, where legacy and new COTS, GOTS and open source software can coexist.

4. **Agility** to respond to rapid healthcare change and related legislation
   - Services within a standards-based component-architecture encourage lower-cost changes within components without requiring enterprise wide expertise.

5. **High costs**
   - Virtualization-Layers of Federated Standards-Based Services make possible applications, databases and infrastructure, which can be treated as commodities and can be tested efficiently. Interchangeable-components can compete based, on black-box functionality, quality, performance vs. cost, usability and supportability. BITE identifies faults early, improving system robustness.

6. **Patient Safety** issues resulting from software changes.
   - BITE identifies faults early, improving system robustness and patient safety.

7. **Open Source Community Enablement (Technical)**
   - Virtualization-Layers of Federated Standards-Based Services make possible applications, databases and infrastructure, which can be a combination of MUMPS, COTS, GOTS and other open source code, which meets the specific-needs of various stakeholder-and-user communities.
## Future State Architecture

### Notional List of Applications

<table>
<thead>
<tr>
<th>Application Area</th>
<th>Application</th>
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<tbody>
<tr>
<td>Registration</td>
<td>Outpatient Pharmacy</td>
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<tr>
<td>Secure Messaging</td>
<td>Disability Evaluation</td>
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<tr>
<td>Laboratory</td>
<td>Patient Education</td>
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<tr>
<td>Diagnostic Imaging</td>
<td>Emergency Department Care</td>
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<td>Private Sector Data Access</td>
<td>Dental Care</td>
</tr>
<tr>
<td>Global Image Access</td>
<td>Inpatient Orders Management</td>
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<tr>
<td>Personal Health Record</td>
<td>Alerts and Reminders</td>
</tr>
<tr>
<td>Outpatient Orders Management</td>
<td>Immunization</td>
</tr>
<tr>
<td>Neurocognitive Assessment Tool (NCAT)</td>
<td>Patient Questionnaire</td>
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<tr>
<td>Anatomic Pathology</td>
<td>Document Management</td>
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<tr>
<td>Patient Consent</td>
<td>Patient Portal</td>
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<tr>
<td>Consult and Referral Management</td>
<td>Inpatient Pharmacy</td>
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<tr>
<td>Patient Self Reporting</td>
<td>Barcoding</td>
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<tr>
<td>Portable and/or Re-configurable user interfaces</td>
<td>En-route care</td>
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<td>XML Forms Tool</td>
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<td>Registries</td>
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<td>Genomics</td>
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<td>Long Term Care</td>
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<td>A Real-Time Order Checking Decision Support System</td>
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<td>Remote Access</td>
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<td>Imaging Data Viewing</td>
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Future-State Architecture

**Software Development Kit (SDK)**

Draft Specifications needed in first 120 days

1. **Built-In-Test-Environment (BITE) Service Specification** to support automated fault-detection of distributed ad-hoc partners & plug-and-play application.
   - *Model-Driven Health-Tool*, which defines schemas and schematron test fixtures.
   - *Cross Reference Tool Specification* to map module dependencies, which will support automated BITE software quality standards (SQS) testing and certification.
   - *Pretty Printer Tool Specification* to BITE to check syntax and reformat each program module to conform to SQS and standards of presentation.
   - *Performance Monitoring Component Service Specification* BITE to trace execution pathways and measure latency, which will support, system tuning, automated testing and certification.
   - *Code Coverage Regression Test and Stress Test Tool Specification*, which will support automated BITE testing and certification of fault recovery pathways.

2. **SAIF ECCF Implementation Guide (IG)** for documenting component Interoperability Specifications, which will support new development, repurposing, reimplementation, automated testing and certification.
   - *SAIF ECCF Tool Specification* to manage module Interoperability Specifications, which will support new development, repurposing, reimplementation, automated testing and certification.


4. **Database Services Specification** of Tier 2-3 Database Virtualization-Layer of federated standards-based services.
Manage EHR Open Source Architecture

**Custodial Agent** shall provide definition of components of codebase, how they function, and how they interact. CA shall provide, within thirty (30) days after award, initial documentation of existing architecture and shall provide regular updates, as needed.

**DELIVERABLE:** VistA System Architecture (SA) model. VistA SA model will be based-on and include links-to the online VistA documentation library*. The VistA SA tool will contain HL7 SAIF ECCF Interoperability Specifications (ISs) including but-not-limited to:

- components modeled as UML classes, showing
  - component-component dependencies
  - component-data dependencies
  - deployment-configurations
- Component definitions
- Component functional-descriptions
  - based on HL7 EHR System Functional Model (EHR-S FM)
  - Including EHR-S FM conformance criteria to support test and certification
  - ARRA Meaningful use objectives and criteria
  - Applicable HHS mandated HITSP-constructs and other HHS mandated standards.
- Application Program Interfaces (APIs)

- Contract Deliverable will be an SA-tool-generated report.
- osEHRca website will contain an SA-tool-generated HTML-navigable VistA SA model, appropriately linked to VistA Documentation Library*.
- Approach to future updates will be vetted within open-source community.

* The VistA Documentation Library is available at [http://www.va.gov/vdl/](http://www.va.gov/vdl/)
Manage EHR Open Source Product Definition

• CA shall maintain a definition of the Open Source EHR product including a functional description of the software and features as well as supported components (such as client and server operating systems, database managers, application program interfaces, etc.). The product definition shall include an installable version of the EHR Open Source product.

• Contractor shall provide an initial definition of the Open Source EHR product within thirty (30) days following activation of the CA.

• Contractor shall provide a product roadmap reflecting a series of product releases, estimated to occur quarterly.

**DELIBERABLE:** VistA SA model will be extended to include:

(A) supported components for GT.M & InterSystems-Cache installations.

(B) **Future-State Architecture** and a **Plan of Actions and Milestones** (POA&M) showing quarterly-phased transitioning architectural-views will be vetted within open-source community. Community recommended changes will be harmonized with joint DoD-VA iEHR initiative.
PROVIDERS’ EHR DATA REUSE ACROSS EPISODES OF CARE

- Patient Demographics
- Provider Demographics
- Insurer Demographic

- Chronic Diagnoses
- Procedure History

- Patient History
- Summary Lists
  - Medication List
  - Allergy/Adverse Reaction List
  - Immunization

Reusable Services

Data Must Be Verified And Updated

Current Episode Of Care EHR

Previous Episode Of Care EHR
SOA Layers

Focus on the Business Processes and Services [Thomas Erl]

Source: Service-Oriented Architecture, Thomas Erl
## SOA Service Models

### Potential Service Layers

<table>
<thead>
<tr>
<th>Service Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Service</td>
<td>A generic category used to represent services that contain logic derived from a solution or technical platform. Services are generally distinguished as application services when creating abstraction layers.</td>
</tr>
<tr>
<td>Business Service</td>
<td>A generic category used to represent services that contain business logic. When establishing specialized service layers, services that fall into the business service layers are collectively referred to as business. However, individually these services are classified as entity-centric (e.g., information) or task-centric business services.</td>
</tr>
<tr>
<td>Controller Service</td>
<td>A Service that composes others. Variations of this model exist, depending on the position of the controller in the composition hierarchy. The patent controller service can be classified as the master controller and a service that composes a subset of a larger composition can be labeled as sub-controller.</td>
</tr>
<tr>
<td>Coordinator Services</td>
<td>Three service models are derived from the concept of coordination: the coordinator, the atomic transaction coordinator, and the business activity coordinator. All three models are specific to the WS-Coordination specification and related protocols.</td>
</tr>
<tr>
<td>Entity-centric Business Service</td>
<td>A business process-agnostic variation of the business service that represents one or more related business entities. This type of service is created when establishing a business service layer.</td>
</tr>
<tr>
<td>Hybrid Service</td>
<td>A service that contains both business and application logic. Most services created as part of traditional distributed solutions fall into this category. When organizing services into abstraction layers, hybrid services are considered part of the application service layer.</td>
</tr>
<tr>
<td>Integration Service</td>
<td>An application service that also acts as an endpoint to a solution for cross-referencing integration purposes.</td>
</tr>
<tr>
<td>Process Service</td>
<td>A service that represents a business process as implemented by an orchestration platform and described by a process definition. Process services reside in the orchestration service layer.</td>
</tr>
<tr>
<td>Task-Centric Business Service</td>
<td>A business process-specific variation of the business service that represents an atomic unit of process logic. Task-centric services are different from process services in that the process logic is provided by the underlying service logic, not by a separate process definition.</td>
</tr>
</tbody>
</table>
# Healthcare SOA Reference Architecture (H-SOA-RA)

Based on HL7 EHR System Functional Model & Thomas Erl’s SOA Layers

<table>
<thead>
<tr>
<th>HL7 System Functions</th>
<th>Direct Care</th>
<th>Supportive</th>
<th>Information Infrastructure</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Process Value Chains</td>
<td>Federated Composition (e.g., Choreograph or Orchestration) Within and Across Business Areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite Services</td>
<td></td>
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</tr>
</tbody>
</table>

## Core Business Services

| | Functional Areas + Focal Classes | Functional Areas + Focal Classes | Functional Areas + Focal Classes | Functional Areas + Focal Classes |
| | Information Management | Information Management | Information Management | Information Reporting and Management |

## Agnostic Services

Cross Technical “Common Services” (e.g., Security, Privacy, Auditing, Logging...)

## Application Services

Ambulatory Care Systems, In Patient Care Systems

Logistics Systems, Financial Systems, Decision Support Systems

Data Marts, Repositories

Business Objects

## Implementation Profiles

Integrated Healthcare Enterprise (IHE) Profiles

Analysis Profiles

Communications Profiles/Stacks

Implementation Profiles
ANATOMY OF AN ANCILLARY SYSTEM

LABORATORY  RADIOLoGY  PHARMACY  CARDIOLOGY  OT/PT/SPEECH

IDENTITY  TERMINOLOGY  AUTHORIZATION  SCHEDULING  SUPPLY CHAIN (ORDER/CHARGE)

DOCUMENT  RECORDS MANAGEMENT  DECISION SUPPORT  PERFORMANCE  DATA MANAGEMENT

ENABLING BUSINESS SERVICES

Health IT SOA 2011 v5
INTEGRATED REQUIREMENTS DESIGNS: Putting the H-SOA-RA Pieces Together

Federated Services, may be categorized by:
- Encounter Types
- CMS billing category
- Record type
- Care setting type
- etc.

Data sets are defined for each system functional-capability-service module.
Critical Success Factors

• For EA-driven Transformation
  ✓ Enterprise Strategic Plan
  ✓ EA influenced investment process
  ✓ Business owner commitment, responsibility, and engagement
  ✓ SME availability and participation
  ✓ Sufficient EA staff and tools
    ✓ EA Portal and Cloud-based EA Repository & Tool Suite
    ✓ Cloud-based Solution Provides Pay-As-You-Go Scalability
  ✓ Participation of product developers and operators
  ✓ Collaboration skills
Summary & Discussion

- EA is evolving services and offerings
- Fast track for developing content focused on VA T-16 + iEHR
- EA has executive support
  - DAS/DCIOs engaged and take responsibility for governance/decision-making
    - Self-policing
    - “Brokered” peer pressure
  - Structural & staffing challenges are being addressed
  - Funded to acquire & deploy EA repository & portal
  - Chief Enterprise Architect position in recruiting
  - Fully implement VA Directive 6051- implement EA
Why SecureVA

- Targeted attacks against VA senior leadership

SecureVA established as a programmatic approach to enhancing security
- Focus on Defense in depth: from the boundary down to the desktop
- Visibility included Configuration, patch and vulnerability Management and medical device isolation architecture (MDIA) enhancement
- SecureVA contract to provide IS program support

Progress to date
- Visibility to the Desktop – Currently obtaining configuration information on 360,000 desktops and laptops
- MDIA phase I completed. 3720 enclaves created to host nearly 50,000 biomed devices
- Initial Operating Capability (IOC) dashboard created
What is Security Architecture?

- Security Architecture is application of Enterprise Architecture techniques and best practices to the development and management of Information Protection Program.
- Key inputs/artifacts:
  - As-Is Architecture
  - To-Be Architecture
  - Transition plan
- Security Architecture treats Cyber Security, Privacy, and HIPAA Compliance as Business Line requirements.

Why is it important to VA?

- The complexity of VA’s information infrastructure and information protection responsibilities mandates a comprehensive, integrated, managed and measurable solution which is possible only through an Enterprise Security Architecture approach.

What is its relationship to T-21 objectives and OIG recommendations?

- VA-ESA treats VA 21st Century Transformation (T-21) objectives and VA Inspector General (OIG) recommendations as business requirements that must be satisfied in the target state.
- VA-ESA builds on T-21 and OIG efforts and integrates ongoing and future efforts as a key element of the Enterprise Architecture.
- VA-ESA institutionalizes the work of T-21 and OIG efforts, and ensures that follow-on work takes place to secure VA.
Alignment of VA’s Enterprise Architecture with Security & Privacy

Federal Enterprise Architecture Framework

- Assure VA Strategic Plans
- Account for Security & Privacy
- Performance Reference Model

- Advanced Training Courses and Partnerships

- VA Information = Shared Asset
- Data Reference Model

- Integration of VA Security & Privacy Milestones into SDLC

- Audit Vulnerabilities with Enterprise Monitoring & Forensic Tools

- VA Compliance with Standards and Best Practices Enforced through Monitoring
The Phases of SecureVA

- **Visibility 2 the Desktop Phase I**
  - Acquired visibility to 350,000 desktops and laptops
  - Completed the initial Medical Device Isolation Architecture (MDIA) (3270 VLANS)

- **Visibility Phase II**
  - Work in progress to gain visibility to the server environment
  - Strong authentication for system administrators
  - Software management. Disposition the use of software at the desktop level
  - MDIA enhancements includes visibility into the secure enclaves

- **Visibility Phase II.1**
  - Parallel to gaining visibility to the server environment, we are also gaining visibility to our network infrastructure

- **Visibility III**
  - Gain situational awareness
  - Build out the infostructure, which is the integration of all relevant security tools and infrastructure devices and services
  - Make well informed decision to enhance the security posture. We’ll do this by;
  - Preparing a PWS to develop the ConOps, integration strategy and implementation plan
Delivering Value through Decision-Enabling Transition Planning
Quarterly Updates
### Decision-Enabling EA Questions to Deliver Customer Value

#### Key Questions for Decision-Enabling EA Content

<table>
<thead>
<tr>
<th>Question</th>
<th>EA Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where are your initiatives, programs, and projects falling short of desired outcomes?</td>
<td>Assisting Implementation of Security Strategic Plans VA-wide by Enabling Initiatives, Programs, and Projects to Achieve Defined Milestones and Metrics</td>
</tr>
<tr>
<td>Where are improvements needed within your business to meet customer expectations?</td>
<td>Fostering Strategic Relationships w/ VA Organizations, Federal Agencies, Military Institutions, Non-Profits and Private Industry to Pursue Common Goals</td>
</tr>
<tr>
<td>What types of information does your business need to optimize decision-making and business performance?</td>
<td>Implementing Information Management, Information Sharing, and Data Loss Prevention Controls</td>
</tr>
<tr>
<td>Where can integration and modernization play a role within your application environment?</td>
<td>Extending Information Protection Perimeter to include Development and Testing Environments</td>
</tr>
<tr>
<td>How could the consolidation or expansion of technology within your facilities, data centers, and networks increase productivity?</td>
<td>Expanding Multi-Layer Network Controls to Leverage and Protect Critical Information Assets over their Lifespan</td>
</tr>
</tbody>
</table>

#### As-Is Decision Support → Transition Decision Support → To-Be Decision Support

<table>
<thead>
<tr>
<th>Transition Planning Services</th>
<th>Operations Mgt</th>
<th>Business Dev Mgt</th>
<th>Product &amp; Service Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy Planning Services</td>
<td>Contract Mgt</td>
<td>Emergency Prep</td>
<td>Service Delivery</td>
</tr>
<tr>
<td>Strategy Planning Services</td>
<td>Budget Plans</td>
<td></td>
<td></td>
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<tr>
<td>Strategy Planning Services</td>
<td>Resource Mgt</td>
<td></td>
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<tr>
<td>Strategy Planning Services</td>
<td>Strategic Plans</td>
<td></td>
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<tr>
<td>Strategy Planning Services</td>
<td>Acquisition</td>
<td></td>
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</tr>
</tbody>
</table>

#### Other Services
- Transition Planning Services
- Transition Planning Services
- Transition Planning Services
- Transition Planning Services
- Transition Planning Services

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FSAM Process: Rigorous, Repeatable, Consistent, yet Flexible
Supports Entire Lifecycle From Strategic Planning To Execution

- Strategic Planning
  - Architecture
  - Multi-Year Programming
  - Budget
  - Execution

Enterprise Strategic Planning

Segment Strategic Planning

Solution Acquisition Strategy

- Define Stakeholder Needs
- Analyze & Design
- Develop Services
- Implement & Test
- Deploy Desired Outcomes

- Evaluate Transition Progress
- Update Enterprise Transition Strategy

- Multi-Year Programming
- Budget
- Execution

Approve Modernization Blueprint

Define Solution Architecture

14 Jul 2011