VA Enterprise Design Patterns:

2. Enterprise Architecture

2.4 User Interaction Capabilities

Office of Technology Strategies (TS)
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1.0 INTRODUCTION

VA projects face a reoccurring challenge connecting web-based applications to disparate enterprise resources, including Enterprise Shared Services (ESS). VA addresses this challenge by separating concerns between the user interface (UI), request processing, and business logic, resulting in improved testability and time to market. These applications use industry standard technologies including "web technologies" (Hypertext Markup Language 5 (HTML5), Cascading Style Sheets (CSS), and JavaScript) to maximize user interactivity and responsiveness.

1.1 Business Need

Users (Veterans and VA staff) access, view, and update VA information in a constantly evolving customer-centric environment. Web applications are not only easier and cheaper to develop, they offer increased functionality and can be accessed on any device. These applications include web technologies that allow clients to call services in a browser without depending on business logic. Applications also include enterprise portals that aggregate data from different sources using a common look and feel. This supports a standardized "front end" that allows VA to provide optimal user experiences while migrating back-end systems to Enterprise Shared Services (ESS). Separating the front end from the back end allows for greater flexibility to present information to users as project-specific business needs evolve.

1.2 Approach

This Enterprise Design Pattern aligns with VA's overall IT strategy for supporting "any device, anywhere, anytime" for VA patients, customers, staff, and partners through modern applications. Modern applications integrate with collaboration services and leverage a standard set of user interaction capabilities aligned to industry best practices. VA will provide these capabilities through the following near-term activities:

- Migrate "thick client" applications with tight coupling between presentation and business logic to "thin client" applications (e.g., HTML5) that have separation between presentation and business logic.
- Institutionalize enterprise portals with a common visualization for users.
- Mandate use of approved frameworks and libraries in the Technical Reference Model (TRM) for all new web applications.
- Evaluate emerging frameworks and libraries, and approve their use in the TRM depending on usage trends and industry acceptance.

This approach establishes a framework for browser-independent and device-independent capabilities by following the latest industry standards (HTML5, CSS, and JavaScript). Native mobile applications and non-browser based technologies are outside of the scope of this document, as described in Appendix A.

2.0 CURRENT CAPABILITIES AND LIMITATIONS

2.1 Current Capabilities

All VA projects are now required to develop applications using responsive design technologies, and these technologies are already mandated through the TRM and the VA Enterprise Technical Architecture (ETA) Compliance Criteria. These applications allow clients to interact with a server in an asynchronous fashion so minor updates do not require a full refresh of the website. These applications are called "single page applications" because they generally fit onto a single web page. They leverage browser-independent application frameworks and libraries (e.g., jQuery) that use the client for local processing, leading to faster processing speeds and improved server performance. Each application framework has distinct approaches to separating client requests from business logic and website rendering. The Enterprise Health Management Platform (eHMP) is a prominent example that implements these technologies to support clinical decisions without tight coupling to legacy VistA business logic. Appendix D provides technical references containing coding-level guidance to help developers select the approach that best suits their requirements.

Web applications also provide users access to portals, which aggregate information from different services. Portals integrate with commercial off-the-shelf (COTS) content management systems providing website authoring, collaboration, and administration tools. VA has established an initial enterprise portal framework that provides common layout styles for all users, as described in the SOA Layer Implementation Guide (Appendix D). The eBenefits and MyHealtheVet are examples that fit within this framework and integrate with back-end systems. Enterprise portals provided an early approach to creating composite applications, and VA will continue to leverage them in its long-term IT strategy.

2.2 Limitations

Modern application technologies replace legacy applications that have the following limitations:

- Lack of separation of presentation and business logic, presenting challenges to efficient testing and maintenance over time
- Non-use of web-based browsers with modern user interaction capabilities

The Computerized Patient Record System (CPRS) is a prominent example of a legacy application with these limitations. CPRS provides a "thick client" approach using proprietary technology that communicates with VistA remote procedure calls directly from the client. CPRS does not leverage web technologies or modern development frameworks. VA plans to replace CPRS completely with eHMP by FY18, per the VistA Evolution Product Roadmap. The VA Enterprise Technical Architecture Compliance Criteria currently prohibits new applications from mixing

presentation and business logic, and requires all projects to demonstrate the separation of these areas in their System Design Documents (SDD).

3.1 Future Capabilities

The future state of user interaction capabilities consists of:

- A complete phase-out of legacy applications mixing presentation and business logic
- All applications leveraging industry standards (HTML5, CSS, JavaScript) and frameworks to separate presentation and business logic
- Use of enterprise portals to provide seamless access to Enterprise Shared Services (ESS)
- Continuous evaluations of new technologies for inclusion in the TRM

HTML5 is currently the industry standard for user interfaces, and the underlying technology enables user interaction without browser add-ons or extensions. HTML5 is the replacement for Adobe Flash and Microsoft Silverlight plug-ins. VA is currently deprecating plug-ins in favor of pure HTML5-based technologies, and these updates will be reflected in the TRM. This ensures that all new applications and portals seamlessly integrate with back-end systems and Enterprise Shared Services (Appendix E) without vendor lock-in or local web development standards.

3.1 Alignment to Technical Reference Model (TRM)

All projects are constrained by approved technologies catalogued in the TRM, and any technology not approved by the TRM requires a waiver. Current technologies include:

Table 1: TRM User Interaction Categories and Approved Technologies

Tool Category	Example Approved Technologies
Application development tools	Backbone.js, Node.js, AngularJS
User Interaction (UI) design tools	Kendo UI, Handlebars
Web Authoring tools	CSS, jQuery Mobile, Liferay Portal
Web UI Framework	AJAX, Apache Tiles, Java Server Faces (JSF)
Portlets	Portlet Specifications (JSR 168 and JSR 286), Web services for Remote Portlet (WSRP)
Content Management	Drupal, WordPress
Rich Internet Application (RIA) Framework	Adobe AIR, Apache Pivot, Google Web Toolkit (GWT)

Each technology has its own set of implementation guidance to support decisions about which ones to use. The TRM requires flexibility to stay current with these technologies as developers embrace emerging technologies (e.g. Facebook's React.js). Developers submit requests to the

TRM Management Group about candidate technologies for approval consideration. This ensures the TRM provides VA developers appropriate boundaries on the latest standards and technologies to develop dynamic applications that align with industry trends.

4.1 Use Cases

The use case below represents a generic situation in which a VA clinical staff member with access privileges uses a portal for a Veteran's appointment scheduling status. A web browser renders the portal's scheduling information produced from various back-end systems. It also provides a real-time update of scheduling information without requiring a complete refresh of the portal. The following steps depicted in Figure 2 assume the user successfully logs in to the portal using enterprise single sign-on capabilities:

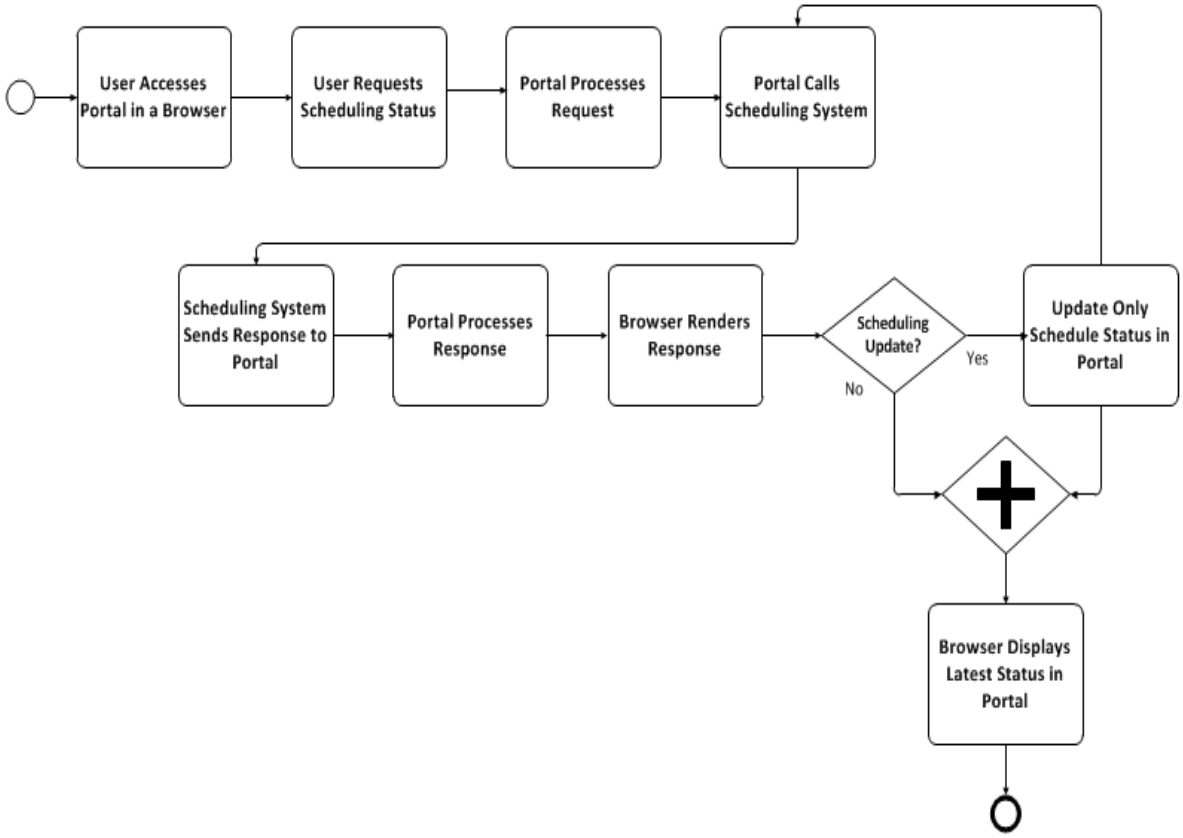

Figure 1: Access to Veteran Appointment Scheduling Information with a Portal

1. User logs into portal through a web browser
2. User enters request for appointment status
3. Browser processes request to portal
4. Portal makes request to scheduling system
5. Scheduling system provides response to the portal
6. Browser displays response shown in the portal

7. Does the schedule status change while portal is open?
8. If No, then the browser makes no updates
9. If Yes, then the portal processes changes
10. Browser shows status change while the rest of the page is unchanged

This use case aligns with those identified for the Medical Appointment Scheduling System (MASS), which is currently under development. The VistA Evolution Product Roadmap provides additional architectural details about MASS.

Appendix A. DOCUMENT SCOPE

Scope

This document provides high-level guidance on a common set of current and future capabilities available throughout VA that enable consistent user interaction. These capabilities help projects develop web applications or leverage portals in standardized ways. The capabilities also support a client-independent set of functionality separately consumed and rendered through both client platforms and devices.

The following content is beyond scope, but may be referenced to guide further planning:

- Implementation details for specific application development frameworks (covered in references about specific technologies in the TRM)
- Integration with Identity and Access Management (IAM) services for single sign-on
- Section 508 compliance testing
- Technologies for native mobile applications (covered by Mobility Design Patterns)

Document Development and Maintenance

This document was developed collaboratively with internal stakeholders from across the Department and included participation from VA's Office of Information and Technology (OI&T), Product Development (PD), Office of Information Security (OIS), Architecture, Strategy and Design (ASD), and Service Delivery and Engineering (SDE). Extensive input and participation was also received from Administration representatives. In addition, the development effort included engagements with industry experts to review, provide input, and comment on the draft document. This document contains a revision history and revision approval logs to track all changes. Updates will be coordinated with the Government lead for this document, which will also facilitate stakeholder coordination and subsequent re-approval depending on the significance of the change.

Appendix B. DEFINITIONS

Key Term	Definition
Rich Internet Application (RIA)	Applications that mimic characteristics of desktop application software, typically delivered through browser plug-ins, independent sandboxes, or virtual machines.
Service	A mechanism to enable access to one or more capabilities, where the access is provided using a prescribed interface and is exercised consistent with constraints and policies as specified by the service description.
Service Oriented Architecture	A paradigm for organizing and utilizing distributed capabilities that may be under the control of different ownership domains. It provides a uniform means to offer, discover, interact with and use capabilities to produce desired effects consistent with measurable preconditions and expectations.
Single-page Application (SPA)	Websites that fit onto a single web page with the goal of providing a more fluid user experience. The page does not reload at any point in the process, nor does it control transfer to another page.
User Interface	The means by which a user and a computer system interact, particularly through the use of input devices and software.
Portal	Web-based application that provides personalization, single sign-on, content aggregation from different sources and hosts the presentation layer of Information Systems.
Portlets	Portlets are used by portals as pluggable user interface components that provide a presentation layer to Information Systems.
Web Content Management System (WCMS)	Software systems that provide website authoring, collaboration, and administration tools designed to allow users with little knowledge of web programming languages or markup languages to create and manage website content.

Appendix C. Acronyms

Acronym	Description
AJAX	Asynchronous JavaScript and XML
ASD	Architecture, Strategy and Design
CPRS	Computerized Patient Record System
CSS	Cascading Style Sheets
eHMP	Enterprise Health Management Platform
ESS	Enterprise Shared Services
HTML	Hypertext Markup Language
JS	JavaScript
JSON	JavaScript Object Notation
MASS	Medical Appointment Scheduling System
RIA	Rich Internet Application
SDD	System Design Document
SOA	Service-oriented Architecture
TRM	Technical Reference Model
UI	User Interface
VistA	Veterans Health Information Systems and Technology Architecture
WCMS	Web Content Management System
WSRP	Web Services for Remote Portlets

Appendix D. Applicable References, Standards, and Policies

This Enterprise Design Pattern is aligned to the following VA OI&T references and standards applicable to all new applications being developed in the VA, and are aligned to the VA ETA:

#	Issuing Agency	Applicable Reference/Standard	Purpose
1	VA OIS	VA 6500 Handbook	Directive from the OI&T OIS for establishment of an information security program in the VA, which applies to all applications that leverage ESS. http://www1.va.gov/vapubs/
2	VA ASD	Enterprise Design Patterns, Office of Technology Strategies	Provides references to the use of enterprise capabilities as part of the integration with SOA support infrastructure services. These documents are intended to standardize and constrain the solution architecture of all healthcare applications in the VA. http://www.techstrategies.oit.va.gov/docs_design_patterns.asp
3	VA ASD	ESS Strategy Document and Directive	Provides the overarching strategy for developing, deploying, and managing ESS throughout the VA. http://vaww.ea.oit.va.gov/enterprise-shared-services-service-oriented-architecture/
4	VA ASD	EAA SOA Layer Implementation Guide Section 2	A 2012 reference that includes guidance for presentation services in the VA, including lower-level guidance on JavaScript programming techniques, templates, and separation of concerns between the UI and business logic. http://vaww.ea.oit.va.gov/enterprise-architecture/enterprise-technical-architecture/
5	VA ASD	One-VA TRM	http://www.va.gov/TRM/ReportVACategoryMapping.asp

Additional technical references are as follows:

1. *Microsoft Application Architecture Guide* – Chapter 6 and 11 describe vendor-agnostic fundamentals of presentation layer technologies

http://msdn.microsoft.com/en-us/library/ee658100.aspx

https://msdn.microsoft.com/en-us/library/ee658081.aspx

2. Developing Modern Web Apps

https://msdn.microsoft.com/en-us/library/hh994907.aspx

3. Background on Model-View-Controller and related web development approaches

http://channel9.msdn.com/Events/TechEd/NorthAmerica/2011/DPR305

Appendix E. Alignment to Enterprise Shared Services

User interaction capabilities provide a standard entry point for Enterprise Shared Services (ESS) and enable users to customize preferences, integrate with applications (including portals and web applications), and expose underlying service functionality. The following figure shows a notional application stack demonstrating the interaction through different layers using portals or web content management systems. The consuming application may also be a traditional web application or a Rich Internet Application (RIA).

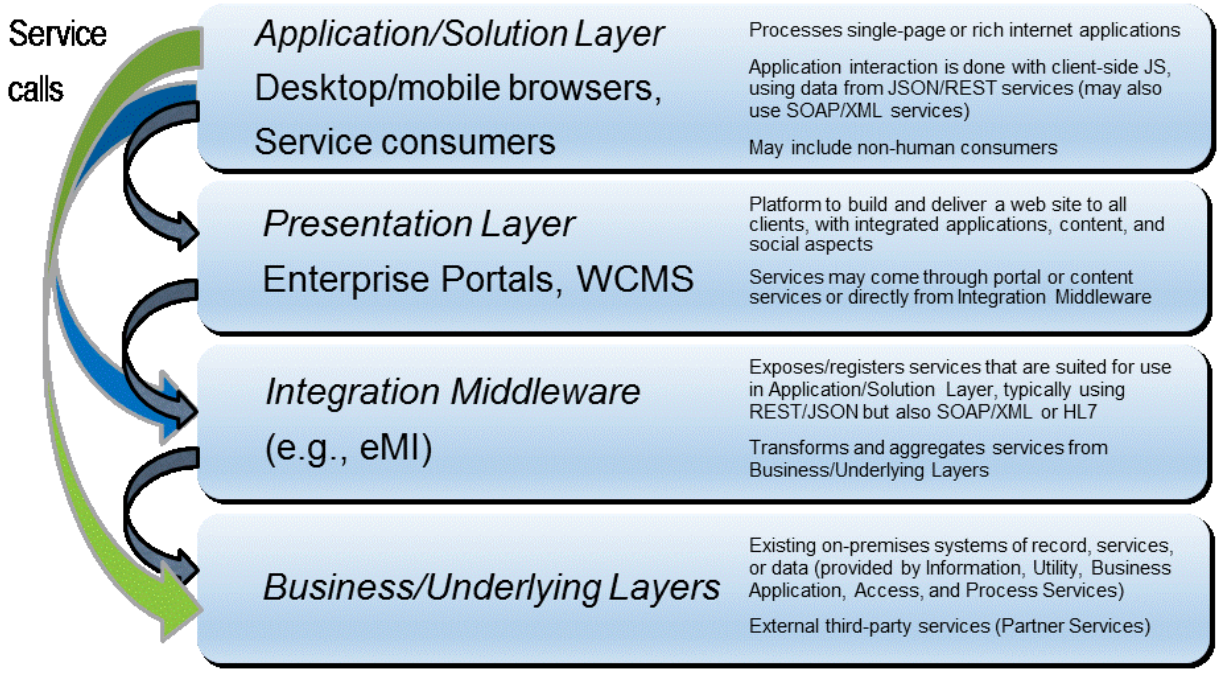

Figure 2: Notional Depiction of User Interaction with ESS

User interaction capabilities align to interaction services to make up both Presentation and Application/Solution layers, as shown in the ESS SOA architecture framework:

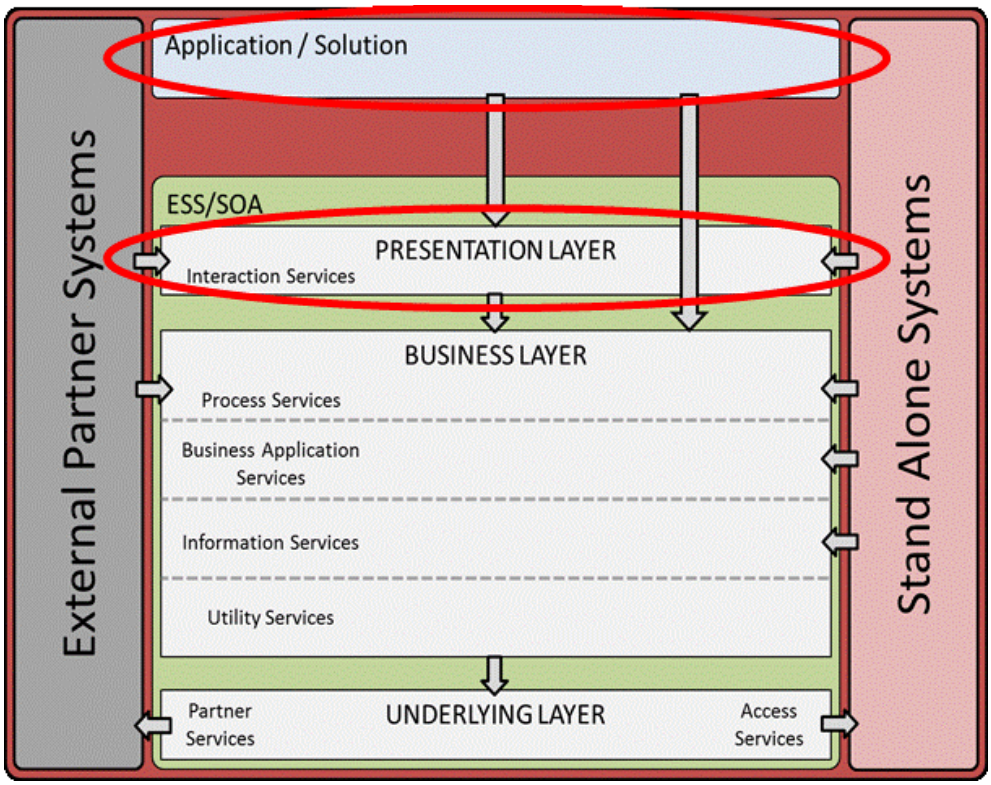

Figure 3: User Interaction Capabilities Aligned to the ESS Architecture Framework

The Presentation layer provides client-centric services (e.g., web servers, portlets, or load balancers) tied to organizational roles and solution applications. This layer currently does not align to a specific ESS. Rather, it refers to a standard approach to making service calls to ESS using either integration middleware or point-to-point connections. The technical requirements driving the solution architecture dictates the information flow across different layers in the stack.