

**VA Enterprise Design Patterns  
Enterprise Architecture**

# **User Interaction Capabilities**

**OFFICE OF TECHNOLOGY STRATEGIES (TS)  
OFFICE OF INFORMATION AND TECHNOLOGY (OI&T)**

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## REVISION HISTORY

Version	Date	Approver	Notes
1.0	11/17/2015	Tim McGrail (ASD TS)	Final version for TS leadership approval and signature, including all applicable updates addressing stakeholder feedback and Section 508 Compliance
2.0	06/16/2017	Nicholas Bogden (ASD TS)	Incorporated additional information on Human Centered Design and usability design standards.

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## QUICK JUMP

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**Current Capabilities**



**Future Capabilities**



**Use Cases**



**One-VA Technical Reference  
Model**



**The Veteran-Focused  
Integration Process**



**Enterprise Design Pattern  
Scope**

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## 1 INTRODUCTION

As Veterans and other stakeholders interface with web technologies at the Department of Veterans Affairs (VA), VA embraces the Human Centered Design (HCD) framework to achieve a streamlined, optimal user experience (UX). HCD uses a creative and iterative approach to finding new solutions to human needs.<sup>1</sup> HCD provides a methodology that can help VA offer more effective information technology (IT) to enhance “user interaction capabilities” through a deeper understanding of the desires, requirements, and motivations of its users.<sup>2</sup> VA will also need technology standards that embody the principles of HCD for the user-facing applications that deliver user interaction capabilities. The following sections describe the guiding principles that support the acquisition, development, and delivery of user interaction capabilities that implement the HCD approach.

### 1.1 Business Problem

In 2014, the VA Center for Innovation (VACI) evaluated the UX at VA through the participation of Veterans across a range of demographics and locations.<sup>3</sup> The VA UX observations are as follows:

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<sup>1</sup> October 2015, Version 1.0. VA Center for Innovation: Designing for Veterans: A Toolkit for Human-Centered Design

<sup>2</sup> July 2014. Findings Report. Toward a Veteran-Centered VA - Piloting Tools of Human-Centered Design for America's Vets

<sup>3</sup> July 2014. Findings Report. Toward a Veteran-Centered VA - Piloting Tools of Human-Centered Design for America's Vets

- The experience of poor service delivery is interpreted by Veterans as a lack of thoughtfulness and insensitivity to the needs of the end user.
- Even one uncomfortable service experience for a Veteran can evoke a memorable negative feeling and perception about service delivery. The perception is likely to remain for an inordinate time period.

A response to these and similar issues will include establishing standards that support the design and development of user interaction capabilities that produce an optimal UX. The capabilities will promote the continued use of VA services and satisfy the needs of users across the enterprise, including Veterans and VA staff.

## **1.2 Business Need**

Even though HCD resources exist at VA, there is no VA enterprise implementation of HCD. To enable the implementation of HCD, VA must adopt standards for user interaction capabilities that provide an optimal UX. Standards pertain to the manner in which users will access, view, and update VA information, within a constantly evolving customer-centric environment. These applications include web technologies that allow clients to call services within a browser, without depending on business logic. Web applications are easier and more economical to develop. They offer increased functionality and can be accessed from any device.

Web applications also include enterprise portals that aggregate data from different sources, using a Common Look and Feel (CLF). These portals support a standardized “front end” that allows VA to provide an optimal UX, while migrating back end systems to Enterprise Shared Services (ESS). As project-specific business needs evolve, separating the front end from the back end allows greater flexibility for presenting information to users.

VA project teams can also implement the HCD framework for mobile applications. The technologies used to develop web applications and portals are different from that of mobile applications. Guidance on mobile applications can be found in the Mobility Enterprise Design Patterns (EDPs).<sup>4</sup>

## **1.3 Business Case**

The following benefits can be achieved by utilizing enterprise HCD to enhance user interaction capabilities at VA:

- Deliver a positive and valuable UX for Veterans.<sup>5</sup>

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<sup>4</sup> [https://www.ea.oit.va.gov/EA\\_OIT/VA\\_EA/ENTERPRISE\\_DESIGN\\_PATTERNS.asp](https://www.ea.oit.va.gov/EA_OIT/VA_EA/ENTERPRISE_DESIGN_PATTERNS.asp)

<sup>5</sup> July 2014. Findings Report: Toward a Veteran-Centered VA - Piloting Tools of Human-Centered Design for America's Vets

- Equip VA staff with more intuitive applications to improve service delivery to Veterans.
- Guide project teams to follow common best practices when developing human-centric solutions and addressing challenges.
- Enhance the use of agile methods (rapid iterations, testing multiple solutions) at VA.
- Assist VA Lines of Business (LOBs) to identify customer pain points that become business needs, while also assisting IT project teams to incorporate human factors into requirements analysis and solution design.

#### **1.4 Approach**

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

- Utilize HCD best practices to develop user interaction capabilities.
- Migrate “thick client” applications, those with tight coupling between presentation and business logic, to “thin client” applications; these include separation between presentation and business logic, such as utilization of the fifth version of Hypertext Markup Language (HTML5).
- Institutionalize enterprise portals with a common visualization for users.
- Mandate the use of approved frameworks and libraries for all new web applications, as indicated in the One-VA Technical Reference Model (TRM).
- To identify technologies that can be approved for use by the One-VA TRM, evaluate emerging frameworks and libraries that align with industry trends and acceptance.

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



## 2 CURRENT CAPABILITIES AND LIMITATIONS

### 2.1 Current Capabilities

VACI offers in-person and virtual training on the four main stages of the HCD process: Frame, Discover, Design, and Deliver. VACI also educates VA staff on how to utilize the VA HCD Toolkit.<sup>6</sup> The VA HCD Toolkit provides the following:

- The purpose, tools, and outcomes of each stage of the HCD process
- The information to plan and execute key activities at each stage
- References to resources for further study
- A set of highly usable HCD skills to implement Veteran-centric design

As part of the enterprise alignment to the HCD framework, VA has identified a need to deliver services that provide an optimal UX. This includes the development of web applications that use responsive design technologies that are currently approved in the One-VA TRM. These applications allow clients to interact with a server in an asynchronous fashion, such that minor updates do not require a full refresh of the website. These applications are called “single-page applications” (SPAs) 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 Veterans Health Information Systems and Technology Architecture (VistA) business logic. Appendix D provides technical references that contain coding-level guidance to help developers select the approach that best suits their requirements.

Web applications also provide user access to portals that aggregate information from different services. Portals integrate with commercial off-the-shelf (COTS) content management systems (CMSs), providing website authoring, collaboration, and administration tools. VA has established Vets.gov as the enterprise portal framework for integrating VA portal resources. Vets.gov provides common layout styles for all users, as described in the Service-Oriented Architecture (SOA) Layer Implementation Guide (Appendix D). Enterprise portals support the development of composite applications.

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<sup>6</sup> October 2015 Version 1.0: VA Center for Innovation: Designing for Veterans: A Toolkit for Human-Centered Design.

## 2.2 Current Limitations

The current standards used to develop user interaction capabilities do not reference the HCD framework. Modern application technologies that support user interaction capabilities will replace legacy applications. Legacy applications include the following limitations:

- Lack of separation of presentation and business logic, presenting challenges to efficient testing and maintenance over time
- Use of web-based browsers without modern user interaction capabilities

The Computerized Patient Record System (CPRS) is an 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 is currently replacing CPRS with eHMP, which is based on modern web technologies.



## 3 FUTURE CAPABILITIES

A summary of the compliance criteria for user interaction capabilities is shown in Figure 1. The future state of user interaction capabilities at VA consists of the following:

- A complete phase-out of legacy applications, mixing presentation and business logic
- Successful completion of all phases and deliverables in the HCD Framework<sup>7</sup>
- Continuous evaluations of new technologies for inclusion in the One-VA TRM
- Use of enterprise portals (Vets.gov, Usability.gov, US Web Design Standards) to provide seamless access to ESS
- All applications leveraging industry standards (HTML5, CSS, JavaScript) and frameworks to separate presentation and business logic

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<sup>7</sup> October 2015 Version 1.0: VA Center for Innovation: Designing for Veterans: A Toolkit for Human-Centered Design.



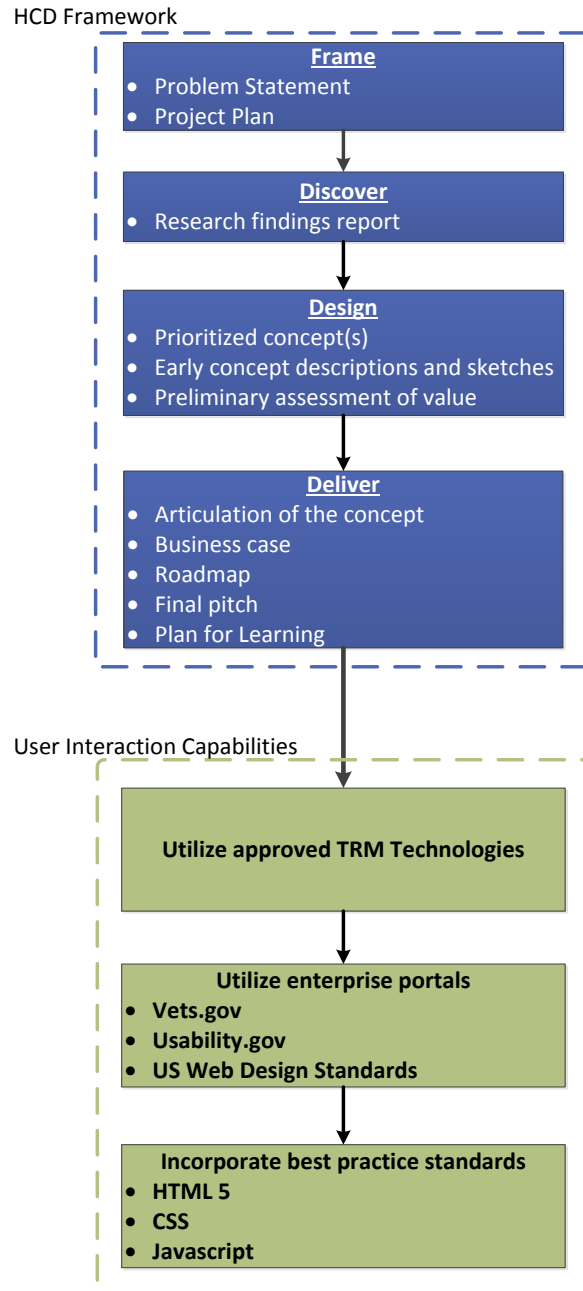


FIGURE 1: USER INTERACTION CAPABILITIES COMPLIANCE CRITERIA.

### 3.1 Human Centered Design (HCD) Framework

The four phases of HCD framework—Frame, Discover, Design, and Deliver—allow developers to fuel and evolve their solution-based application designs with user influence. The HCD process is aimed at moving beyond assumptions that block solutions. HCD uses factual input from the Veteran to benefit the VA infrastructure and the application’s ease of use. Each beneficial phase fuels the next to produce innovative Veteran-centric sustainable solutions. The artifacts listed in

each phase of the HCD Framework in Figure 1 are required to complete each phase, as well as the life cycle of the solution.

Developers utilize the Frame phase as an opportunity to draw on their creative possibilities to problem-solve and plan the project with the objective of purposefully targeting their actions for service to Veterans. The Discover phase is grounded in the desires of the users, the Veterans. Interviews with Veterans provide a clear understanding of their desires through theme interpretation of the application. Developers utilize the Design phase to narrow identified themes and other information that is gleaned from Veteran interviews and translate them into a few distinct concepts through brainstorming. These ideas drive the solution. Thus, the ideas create a valuable opportunity to thoroughly understand the usability of the application from the user's perspective. Bringing ideas to life occurs in the Deliver phase. This phase is used to refine, improve, grow, and finally test, using simple prototypes of the ideas. The Deliver phase also outlines implementation and future improvements for presentation to VA leadership. Refer to the VACO (<https://www.innovation.va.gov/hcd.asp>) HCD toolkit for a comprehensive description of the HCD framework.

### **3.2 User Interaction Capabilities**

VA will utilize the usability design standards and guidelines outlined by

- Vets.gov (<https://www.vets.gov/playbook/design/>)
- US Web Design Standard (<https://standards.usa.gov/getting-started/>)
- Usability.gov (<https://webstandards.hhs.gov/>)

Development of web-facing sites will leverage Vets.gov as the official enterprise portal.

Development of web-facing sites will include compliance to Section 508 Information and Communication Technology (ICT) accessibility standards. Project teams will refer to Usability.gov for detailed Section 508 compliance guidelines.

This EDP provides an authoritative source for technologies in the One-VA TRM that enable standardized user interaction capabilities and should be consistent with industry best practices. HTML5 is currently the industry standard for user interfaces (UIs). 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. These updates will be reflected in the One-VA TRM. This ensures that all new applications and portals seamlessly integrate with back-end systems and ESS, without vendor lock-in or local web development standards.



### 3.3 Alignment to the One-VA Technical Reference Model (TRM)

All projects will leverage the approved technologies and standards included in the One-VA TRM<sup>8</sup> in order to comply with the architectural guidance provided by this authoritative source from the VA production computing environment. Table 1 lists the approved tools for this EDP. There are currently approved technologies that are not aligned to the standards referenced in Section 3.2. The EDP will reflect future standards that are currently not reflected in the One-VA TRM.

TABLE 1: LIST OF APPROVED TOOLS AND STANDARDS FOR USER INTERACTION CAPABILITIES

Technology Category	Example 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)



### 3.4 Alignment to Veteran-Centric Integration Process (VIP)

All projects subject to the Veteran-Centric Integration Process (VIP) will leverage enterprise services to support user interaction capabilities, instead of implementing a custom solution. VIP is a Lean-Agile framework that serves the interest of Veterans through efficiently streamlining activities that occur within the enterprise. The VIP framework unifies IT delivery oversight and will more securely and predictably deliver IT products. VIP is the follow-on framework from the Project Management Accountability System (PMAS) for the development and management of IT projects; it will propel VA with even more rigor toward the Veteran-focused delivery of IT capabilities. The purpose of taking the HCD framework into consideration is to provide guidance concerning requirements analysis that project teams will need to conduct during the VIP process.

More information can be found here: <https://vaww.oit.va.gov/veteran-focused-integration-process-vip-guide/>.

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<sup>8</sup> <http://trm.oit.va.gov/>

### 3.5 Summary

Projects that implement user interaction capabilities should incorporate requirements based on this EDP into project requirement documentation. Table 2 highlights key areas of content that can assist projects to develop requirements for future user interaction capabilities at VA.

TABLE 2: CONSIDERATIONS TO INFORM REQUIREMENTS

Section #	Requirements Considerations
<b>3.1 HCD framework</b>	VA projects will perform each phase of the HCD framework.  VA projects will complete the HCD framework prior to development of user interaction capabilities.
<b>3.2 User Interaction Capabilities</b>	VA projects will use approved frameworks and web development tools in the One-VA TRM.  VA projects will use the usability design standards and guidelines in accordance with Vets.gov, Usability.gov, and the US Web Design Standards.



## 4 USE CASES

### 4.1 Utilizing a Portal for a Veteran's Appointment Scheduling Status

#### 4.1.1 Purpose

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 steps depicted in Figure 1 assume that the user successfully logs in to the portal using enterprise single sign-on capabilities.

#### 4.1.2 Assumptions

- The web-facing application complies with the HCD framework.
- The web-facing application complies with approved technologies in the One-VA TRM.
- The web-facing application complies with enterprise usability standards and industry best practices.

### 4.1.3 Use Case Description

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.

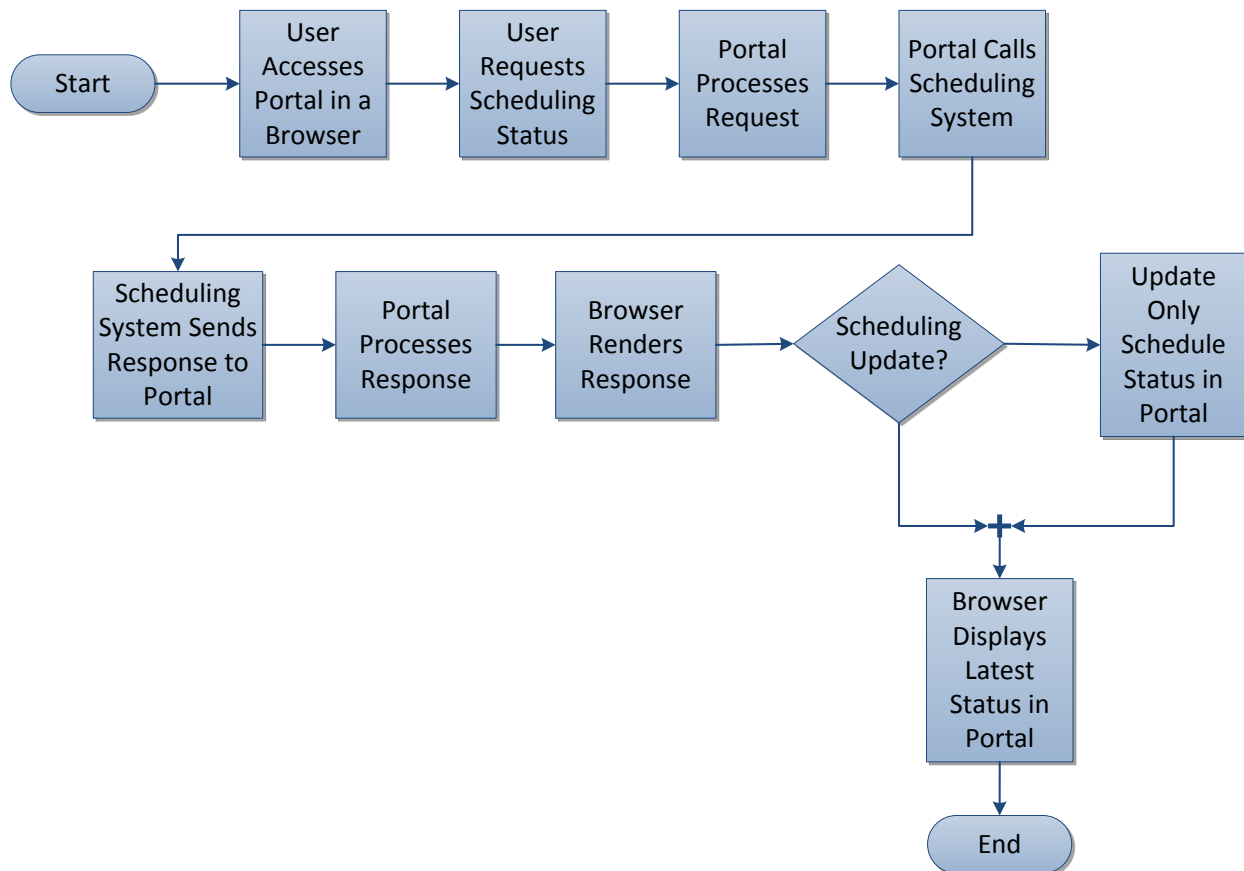


FIGURE 2: ACCESS TO VETERAN APPOINTMENT SCHEDULING INFORMATION WITH A PORTAL

#### **Step 1**

User logs into portal through a web browser (i.e., Vets.gov).

#### **Step 2**

User enters request for appointment status.

#### **Step 3**

Browser processes request to portal.

#### **Step 4**

Portal makes request to scheduling system.

#### **Step 5**

Portal makes request to scheduling system.

**Step 6**

Browser displays response shown in the portal.

**Step 7**

Does the schedule status change while portal is open? If no, then the browser makes no updates. If yes, then the portal processes changes.

**Step 8**

Browser shows status change, while the rest of the page is unchanged.



## **APPENDIX A. 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 that is 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 to specific technologies in the One-VA 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 EDPs)

### **Document Development and Maintenance**

This EDP was developed collaboratively with internal stakeholders from across VA, including participation from subject matter experts (SMEs) from OI&T pillars, including the Enterprise Program Management Office (EPMO), the Office of Information Security (OIS), Architecture, Strategy and Design (ASD), and Information Technology Operations and Services (ITOPS). Extensive input and participation was also received from Veterans Health Administration (VHA), Veterans Benefits Administration (VBA), and National Cemetery Administration (NCA). In addition, the development effort included engagements with industry experts to review, provide input, and comment on the proposed pattern. 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

This appendix provides definitions for terms used in this document, particularly those related to databases, database management, and data integration.

Key Term	Definition
Human Centered Design (HCD)	HCD is an approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques.
Rich Internet Application (RIA)	RIA includes applications that mimic characteristics of desktop application software, typically delivered through browser plug-ins, independent sandboxes, or virtual machines.
Service	Service is 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 (SOA)	SOA is 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)	SPA describes websites that fit onto a single web page with the goal of providing a more fluid user experience (UX). The page does not reload at any point in the process, nor does it control transfer to another page.
User	The user is a person who accesses information systems (ISs) to use programs or applications in order to perform an organizational task
User Interface (UI)	The UI is the means by which a user and a computer system interact, particularly through the use of input devices and software.
User Experience (UX)	User experience (UX) focuses on a deep understanding of users, including their needs, values, abilities, and limitations. It takes into account the business goals and objectives of the group managing the project. UX best practices promote improving the quality of the user's perceptions and product interactions and any related services <sup>9</sup> .

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<sup>9</sup> <https://www.usability.gov/what-and-why/user-experience.html>



Key Term	Definition
Portal	The portal is a web-based application that provides personalization, single sign-on, and content aggregation from different sources and hosts the presentation layer of information systems (ISs).
Portlets	Portlets are used by portals as pluggable UI components that provide a presentation layer to information systems (ISs).
Web Content Management System (WCMS)	WCMSs are software systems that provide website authoring, collaboration, and administration tools that are designed to allow users with little knowledge of web programming languages or markup languages to create and manage website content.
Human Centered Design (HCD)	HCD is an approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques.
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User Interface (UI)	The UI is the means by which a user and a computer system interact, particularly through the use of input devices and software.

Key Term	Definition
User Experience (UX)	User experience (UX) focuses on having a deep understanding of users, what they need, what they value, their abilities, and also their limitations. It also takes into account the business goals and objectives of the group managing the project. UX best practices promote improving the quality of the user's interaction with and perceptions of the product and any related services <sup>10</sup> .
Portal	The portal is a web-based application that provides personalization, single sign-on, and content aggregation from different sources and hosts the presentation layer of information systems (ISs).
Portlets	Portlets are used by portals as pluggable UI components that provide a presentation layer to information systems (ISs).
Web Content Management System (WCMS)	WCMSs are software systems that provide website authoring, collaboration, and administration tools that are designed to allow users with little knowledge of web programming languages or markup languages to create and manage website content.

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<sup>10</sup> <https://www.usability.gov/what-and-why/user-experience.html>

## APPENDIX C. ACRONYMS

The following table provides a list of acronyms that are applicable to and used within this document.

Acronym	Description
AJAX	Asynchronous JavaScript and XML
ASD	Architecture Strategy and Design
CLF	Common Look and Feel
CMS	Content Management System
COTS	Commercial Off-the-Shelf
CPRS	Computerized Patient Record System
CSS	Cascading Style Sheets
EDP	Enterprise Design Pattern
eHMP	Enterprise Health Management Platform
EPMO	Enterprise Program Management Office
ESS	Enterprise Shared Services
ETA	Enterprise Technical Architecture
HTML	Hypertext Markup Language
IAM	Identity and Access Management
ICT	Information and Communication Technology
IS	Information System
IT	Information Technology
ITOPS	Information Technology Operations and Services
JS	JavaScript
JSF	Java Server Faces
JSR	Java Specification Request
LOB	Line of Business
MASS	Medical Appointment Scheduling System
NCA	National Cemetery Administration
OI&T	Office of Information and Technology
OIS	Office of Information Security
PMAS	Project Management Accountability System
RIA	Rich Internet Application
SDE	Service Delivery and Engineering
SME	Subject Matter Expert
SOA	Service-Oriented Architecture
SPA	Single Page Application
TRM	Technical Reference Model
UI	User Interface
UX	User Experience
VA	Department of Veterans Affairs

Acronym	Description
VACI	VA Center for Innovation
VBA	Veterans Benefits Administration
VHA	Veterans Health Administration
VIP	Veteran-Centric Integration Process
VistA	Veterans Health Information Systems and Technology Architecture
WCMS	Web Content Management System
WSRP	Web Services for Remote Portlets

## APPENDIX E. REFERENCES, STANDARDS, AND POLICIES

This EDP 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 Enterprise Technical Architecture (ETA):

#	Issuing Agency	Policy, Directive, or Procedure	Purpose
1	VA	VA Directive 6551	Establishes a mandatory policy for establishing and utilizing EDPs by all Department of Veterans Affairs (VA) projects developing information technology (IT) systems, in accordance with VA's Office of Information and Technology (OI&T) integrated development and release management process, the Veteran-focused Integration Process (VIP)
2	VA OIS	VA 6500 Handbook	Directive from the OI&T OIS for establishment of an information security program at VA, which applies to all applications that leverage ESS
3	VA ASD	ESS Strategy Document and Directive	Provides the overarching strategy for developing, deploying, and managing ESS throughout VA <a href="http://vaww.ea.oit.va.gov/enterprise-shared-services-service-oriented-architecture/">http://vaww.ea.oit.va.gov/enterprise-shared-services-service-oriented-architecture/</a>
4	VA ASD	EAA SOA Layer Implementation Guide Section 2	A 2012 reference that includes guidance for presentation services at VA, including lower-level guidance on JavaScript programming techniques, templates, and separation of concerns between UI and business logic. <a href="http://vaww.ea.oit.va.gov/enterprise-architecture/enterprise-technical-architecture/">http://vaww.ea.oit.va.gov/enterprise-architecture/enterprise-technical-architecture/</a>

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