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A New Design of Healthcare.gov

Architecture Specification Document

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Executive Summary

This Architecture Specification Document (ASD) describes the architecture of the federal healthcare exchange marketplace, the HealthCare.gov, which allows Americans the ability to purchase health insurance online.

The HealthCare.gov provides American individual and families another way to purchase healthcare insurance online through state or federal healthcare marketplace. Low and middle class Americans will have the option to purchase federally regulated and subsidized insurance through the online marketplace. For individuals who fall below the Federal Poverty Level, the marketplace will help them determine the amount of subsidies or Premium Tax Credit.

Per the basic requirements, the HealthCare.gov is a network-centric software system. Its system architecture is complex and could not be described from a single viewpoint. The Department of Defense Architecture Framework (DoDAF) models are used to create the multiple viewpoints architecture for this system. By using DoDAF models, the system architecture could be represented by multiple viewpoints. In this ASD, the architecture of the HealthCare.gov is described using following viewpoints:

- Operational Viewpoint (OV)
    - OV-1: High-Level Operational Concept Graphic
    - OV-2: Operational Resource Flow Description
    - OV-5b: Operational Activity
- System Viewpoint (SV)
    - SV-1: Systems Interface Description
    - SV-2: Systems Resource Flow Description
    - SV-4: Systems Functionality Description
- Service Viewpoint (SvcV)
    - SvcV-1: Services Context Description
    - SvcV-2: Services Resource Flow Description
    - SvcV-4: Services Functionality Description

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List of Abbreviations and Terms

-ACA: Affordable Care Act
-ASD: Architecture Specification Document
-BPC: Blue Point Consulting
-CMS: Centers for Medicare and Medicaid Services
-CSS: Cascading Style Sheets
-DoDAF: Department of Defense Architecture Framework
-ESB: Enterprise Service Bus
-GSA: General Administration Services
-HHS: Health and Human Services
-HTML: Hypertext Markup Language
-HTTP: Hypertext Transfer Protocol
-HTTPS: HTTP over Transport Layer Security
-IPv6: Internet Protocol Version 6
-OV: Operational Viewpoint
-SBIR: Small Business Innovation Research
-SNMP: Simple Network Management Protocol
-SOA: Services Oriented Architecture
-SOAP: Simple Object Access Protocol
-SV: Service Viewpoint
-SvcV: Services Viewpoint
-TCP/IP: Transmission Control Protocol / Internet Protocol
-TLS: Transport Layer Security
-UDDI: Universal Description, Discovery and Integration
-WSDL: Web Services Description Language
-WWW: World Wide Web
-XML: Extensible Markup Language

1. Introduction

On March 23, 2010, President Obama signed into law The Patient Protection and Affordable Care Act (ACA), which require every American to obtain health insurance or pay a penalty [9]. The purpose of the ACA is to make insurance more affordable by reducing insurance premiums and out-of-pocket cost for Americans who previously could not afford insurance [9].

Furthermore, the law prevents insurance companies from denying Americans health insurance based on pre-existing conditions. Additional benefits of the ACA includes but not limited to no-cost preventative care, coverage for young adults under the age of 26, and no cancellation or lifetime limits on care.

The purpose of this Architecture Specification Document (ASD) is to describe the operational, system, and service views of the healthcare marketplace. The healthcare marketplace provides American individuals and families another way to purchase healthcare insurance online through state or federal healthcare marketplace. Low and middle class Americans will have the option to purchase federally regulated and subsidized insurance through the online marketplace. For individuals who fall below the Federal Poverty Level, the marketplace will help them determine the amount of subsidies or Premium Tax Credit.

The healthcare marketplace (referred to as the HealthCare.gov) shall provide Americans with online capabilities to compare health plans, enroll in a chosen health plan, and calculate any subsidies or credits. The marketplace shall display available plans to User based on the types of plans including Bronze, Silver, Gold and Platinum. The marketplace shall provide an intuitive user interface that allows User to compare the different types of plans based on their medical needs. In addition, the marketplace shall provide User the option to enroll in the chosen health plan. The marketplace shall validate User's eligibility including but not limited to the validity of the SSN, legal resident, employment status, income, and citizenship. Furthermore, the marketplace shall calculate any subsidies and/or credits that the User qualifies based on employment and income levels.

Currently, there are no web-based healthcare marketplaces that are available for the general public to purchase healthcare plan to meet the ACA requirements. Hence, the government is seeking a contractor to build a cloud-based healthcare marketplace that allows users to browse, apply, and purchase healthcare plans. Specifically, the healthcare marketplace needs to address the following challenges:

1. Provide users with a user-friendly web application interface to browse, compare, apply, and purchase healthcare plans online using the Internet
2. Establish call centers including faith based organizations, government affiliates, etc. to help users requiring assistance or those who do not have sufficient Internet connection/bandwidth access to the healthcare marketplace
3. Collect and update healthcare plans from healthcare providers and make the plans available on the healthcare marketplace
4. Create login accounts for users to manage their healthcare plans and user profile

5. Ability for the user to apply for the ACA
6. Calculate healthcare subsidies in real-time as defined by the ACA requirements
7. Leverage third-party services and products to streamline the application and plan purchase process including verification and online payment services
8. Report individuals and their employers to the Internal Revenue Service

Moreover, healthcare providers shall offer users healthcare plans through the marketplace. These plans will be received and updated by the HealthCare.gov system. Blue Point Consulting intends to leverage commercial-off-the-shelf provides and services to expedite the development effort and minimize capital cost. These third-party services include address verification and e-commerce payment.

The development of this healthcare marketplace will be funded through the Department of Health and Human Services (HHS) [11]. Specifically, the Centers for Medicare and Medicaid Services (CMS) have obligated in excess of $840 million dollars to develop the healthcare marketplace. It is the intent of the Blue Point Consulting to develop the healthcare marketplace in concert with Accenture; and to maintain the website on an ongoing basis.

Blue Point Consulting (BPC) was founded in 2005 and headquarters in Reston, Virginia as a software development company. BPC was awarded their first contract through the Small Business Innovation Research (SBIR) program. BPC received Phase I and Phase II funding by the US Navy to research and develop innovative methods to seamlessly integrate a common operating picture across various government agencies using cloud-computing technologies. Through the initial SBIR program, BPC have grown to a 400 employees with annual revenue exceeding $50 million dollars. We believe with our software development and cloud-computing expertise, BPC will be able to help the Accenture team build a user-friendly, robust, and highly available online healthcare marketplace.

In support of this project, BPC has hired 35 new information technology professionals, in addition to our current team, to design and develop this web-based healthcare marketplace. The team consists but not limited to a program manager, project manager, requirements analysts, system architecture, software developers, network engineers, quality assurance and control specialist, release and deployment engineers. The team will support all phases of the software development life cycle until the initial baseline release. After the initial production release, BCP will reduce the team size to address bug fixes and future enhancements and commensurate with the price schedule.

BPC intends to maintain and enhance the healthcare marketing place after the initial development effort. This effort is part of the three base year contract. The maintenance and enhancement of the healthcare marketplace includes new functionality, bug fixes to the website, data updates from third-party providers, generate and deliver reports to the internal revenue service, resolve account management issues, and address payment processing problems. The intent of these services are: 1) to provide users of the healthcare marketplace with a good buying experience, 2) provider users numerous options to purchase the healthcare plans, 3) provide the latest healthcare plans and cost, 4) provide a highly-available, reliable, and intuitive application, and 5) meet the ACA requirements.

BPC proposed a firm-fixed priced contract to support this project, using the labor categories and software development licenses outlined in the General Administration Services (GSA) pricing. All travel expenses will be considered out-of-pocket and billed in the government as required. All hardware and server software licenses will be considered outside the scope of this project. The price proposal is a three-years base contract with five option years as specified in the cost proposal. BPC believes that we are offering the government with the best solution and best value to develop a highly robust system within a very aggressive timeframe. In addition, since BPC is a Virginia based company, this project will help generate revenue for the Commonwealth and for US small businesses.

2. Architecture Specification

This section describes the system architecture of the HealthCare.gov system including the operational views, system views, and service views. This document describes the scope of the architecture, determines the data required to support the system, conducts and analyzes the architectural impact of the system, and identifies key stakeholders.

Since the HealthCare.gov is a network-centric software system and its system architecture is complex and could not be described from a single viewpoint. The Department of Defense Architecture Framework (DoDAF) [15] models are used to create the multiple viewpoints architecture for this system. By using DoDAF models, the system architecture is represented by:

- Operational Viewpoint (OV)
    - OV-1: High-Level Operational Concept Graphic
    - OV-2: Operational Resource Flow Description
    - OV-5b: Operational Activity
- System Viewpoint (SV)
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- Service Viewpoint (SvcV)
    - SvcV-1: Services Context Description
    - SvcV-2: Services Resource Flow Description
    - SvcV-4: Services Functionality Description

2.1 OV-1: High-Level Operational Concept Graphic

The high-level operational concept view depicted in figure 1 below shows how the cloud-based healthcare marketplace will operate in the context of users, healthcare providers, government agencies, and third-party vendors.

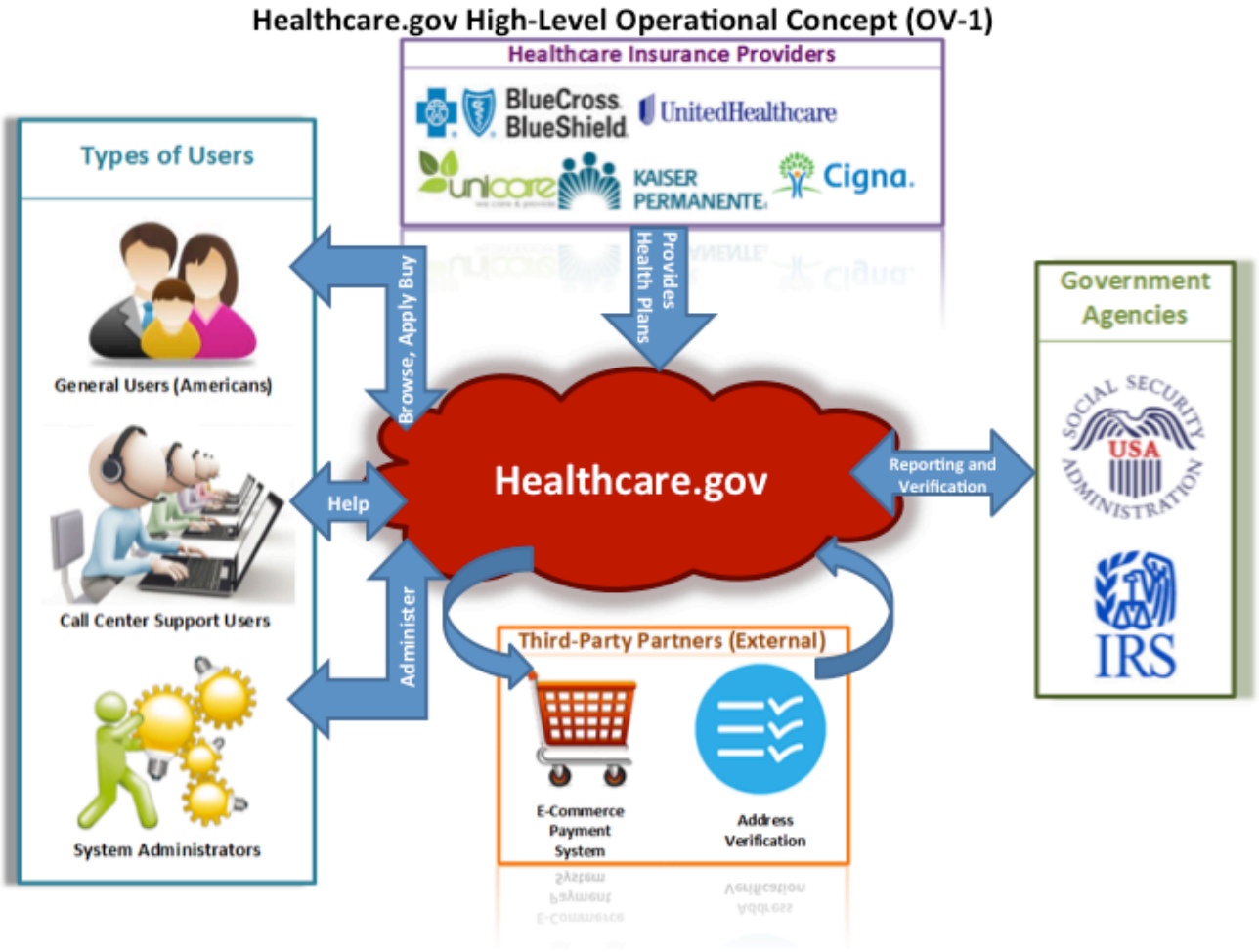

Figure 1- High-Level Operational Concept of the HealthCare.gov

An authorized cloud service provider who shall comply with the FedRamp requirements will host the healthcare marketplace. By leveraging the FedRamp cloud service provider, the government's certification and accreditation requirements will be met. In addition, this will reduce capital cost for hardware and software acquisition, reduce any delays as a result of the procurement process, and maximize the return on investment.

General users will have the ability to browse, apply and purchase health plans using a web-browser. The healthcare marketplace is accessible from any geographic location using a

broadband network connection. Users who do not have access to the Internet or those who need additional assistance use their local call center. The call center will browse, apply, and purchase on the users behalf. Lastly, the system administrator will have the ability to create, reset, or update the user's login account.

Healthcare Insurance Providers will send BCP monthly insurance plans. The plans will be updated into the healthcare marketplace system and made available within the acceptable timeframe defined in the Service Level Agreement.

The healthcare marketplace will leverage third-party partners who will provide e-commerce payment services and address verification capabilities. The address verification is used to ensure that the user's address is most current, accurate, and within the United States and its territories. The e-commerce payment service is used to process the health plan payment.

2.2 OV-2: Operational Resource Flow Description

The purpose of the operational resource flow as depicted in figure 2 is to illustrate how resources flow within the healthcare marketplace system. General user enters their personal, health, and employment information as part of the application process. This information is used to determine if the user qualifies for subsidies. Similarly, the Call Center user can perform the same operation on behalf of the user. In the event that the user is unable to login or create an account, the System Administrator can create, update, or reset the user's account including their password.

During the application process, the HealthCare.gov system will invoke the address verification web service. The HealthCare.gov will send the user's residential address and expects a result code to be returned. Also, the HealthCare.gov will verify that the user's social security is valid by querying the database that houses the latest social security numbers. The database contains the SSN and active status that the Social Security Administration provides BPC on a monthly basis. After the user selects the healthcare plan for purchase, the credit card or bank information is sent to the e-Commerce payment provider to perform the actual transaction. If successful, the payment is debited from the user's account and paid to the healthcare provider.

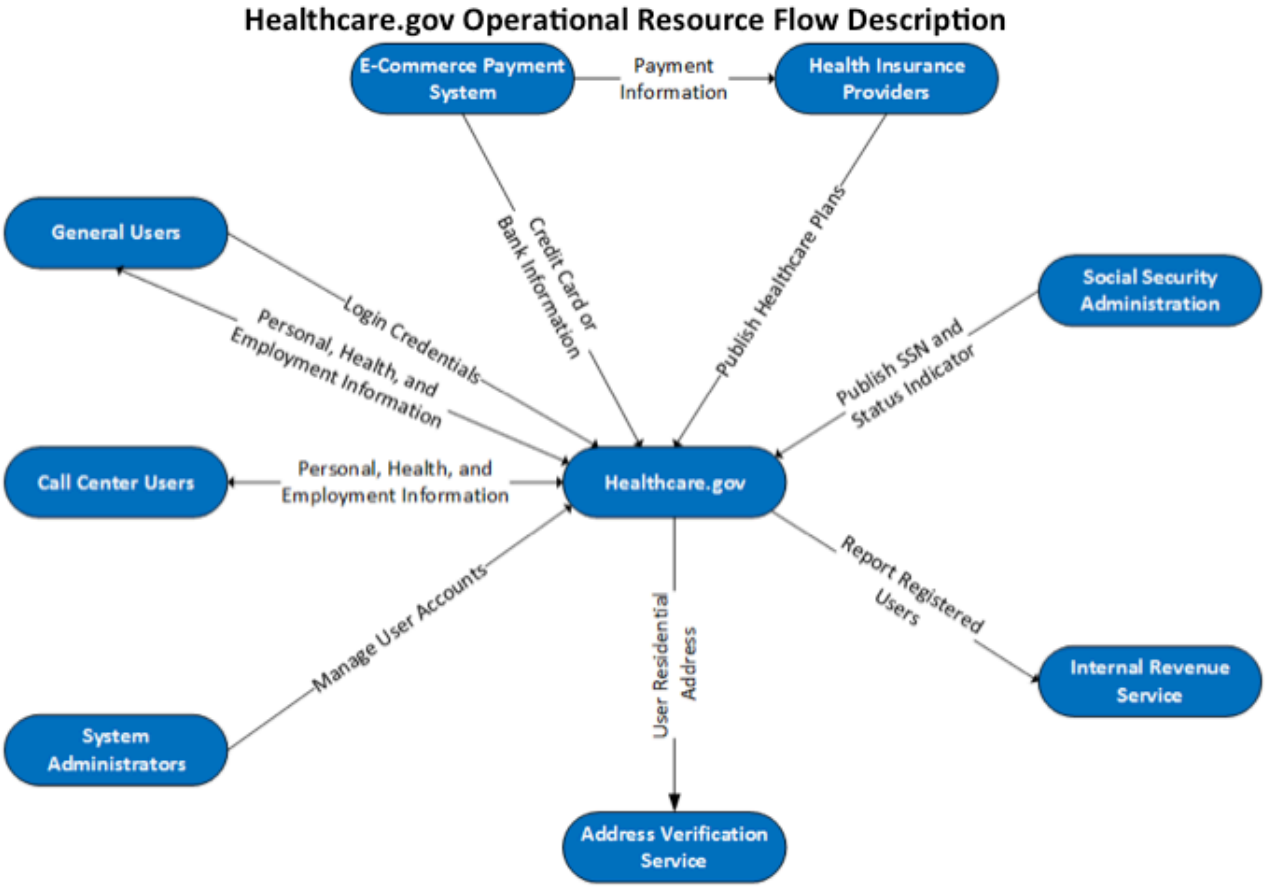

Figure 2 - Operational Flow of the Healthcare.gov

2.3 OV-5b: Operational Activity Model

The Operational Activity Model in figure 3 and 4 describes operational activities and tasks of the healthcare marketplace system. The figures are grouped into four categories: Users, the HealthCare.gov system, the Cloud Service Providers, and the Data Providers. The intent is to delineate the roles and responsibility for each activity.

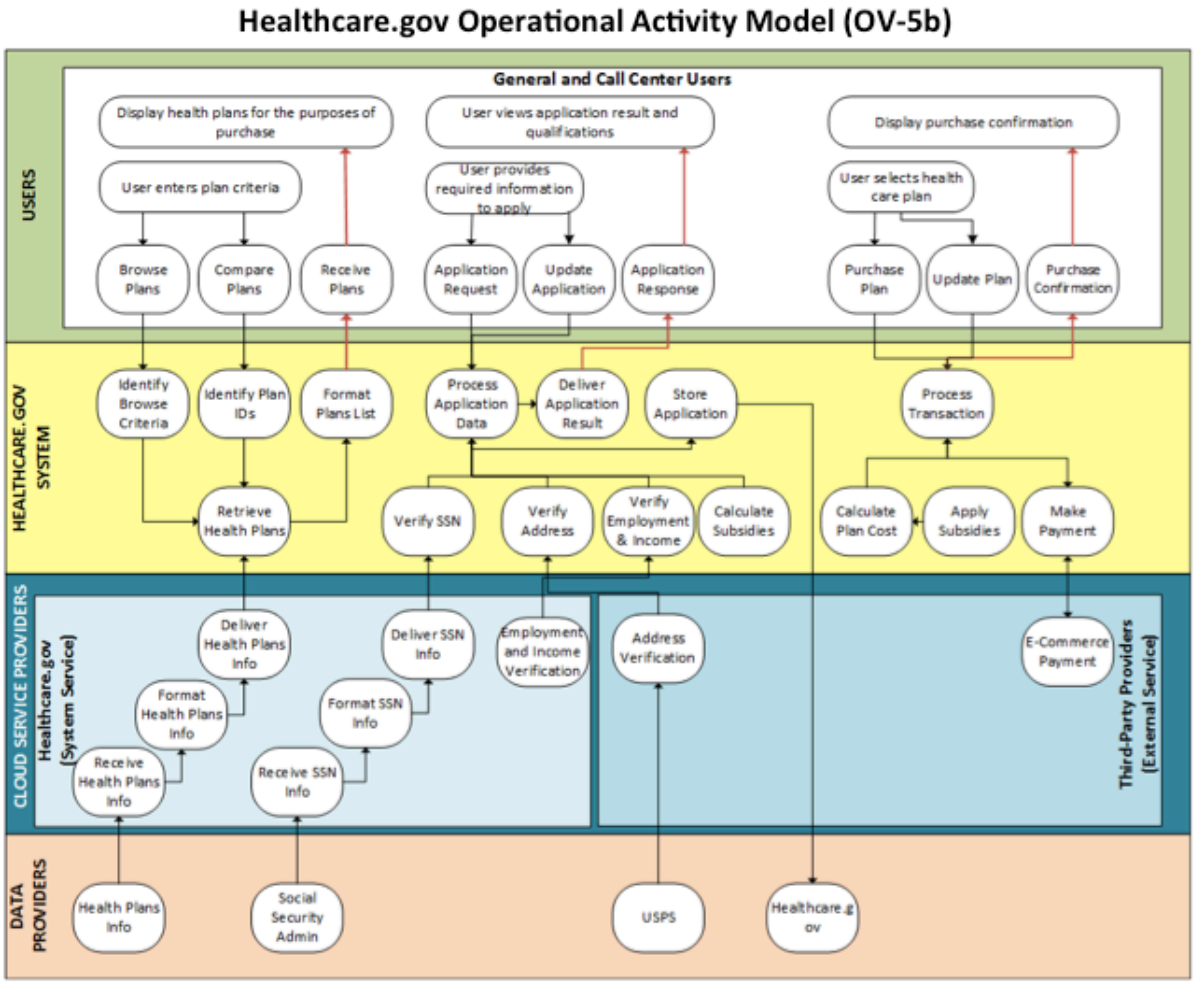

Figure 3 - Operational Activity Model for HealthCare.gov

The User category encompasses both General Users and Call Center Users. Call Center Users will operate the system on behalf of the user in the call centers. The diagram depicts the high-level activities of users including account creation, application login, browse and compare healthcare plans, apply for and review the status of the application results, and purchase and update the healthcare plan.

When the user wants to browse and compare healthcare plans, the request is sent to the HealthCare.gov system. The HealthCare.gov evaluates the browse criteria, retrieve the plans from the service providers based on the criteria, identify the plans, and format the results and

display to the user. The cloud service provider returns the result from a data repository that has been pre-processed containing the healthcare plans and its offerings.

The application request and update invoked by the user is sent to the HealthCare.gov system. The HealthCare.gov system perform a series of real-time verification as depicted in the figure 3 including verify the social security number to ensure that it is valid, verify the residential address for completeness and deliverability, and verify the employment and income level. The SSN verification is performed using the HealthCare.gov services, which uses the SSA data that is sent to the HealthCare.gov on a monthly basis. The address verification services are performed in real-time using third-party providers including USPS and Experian. The employment and income verification will be performed within the context of the healthcare.gov system. If the verification process is successful, the system will determine and calculate any applicable subsidies that the user is entitled. The result is delivered to the user and the application data is stored in the HealthCare.gov database.

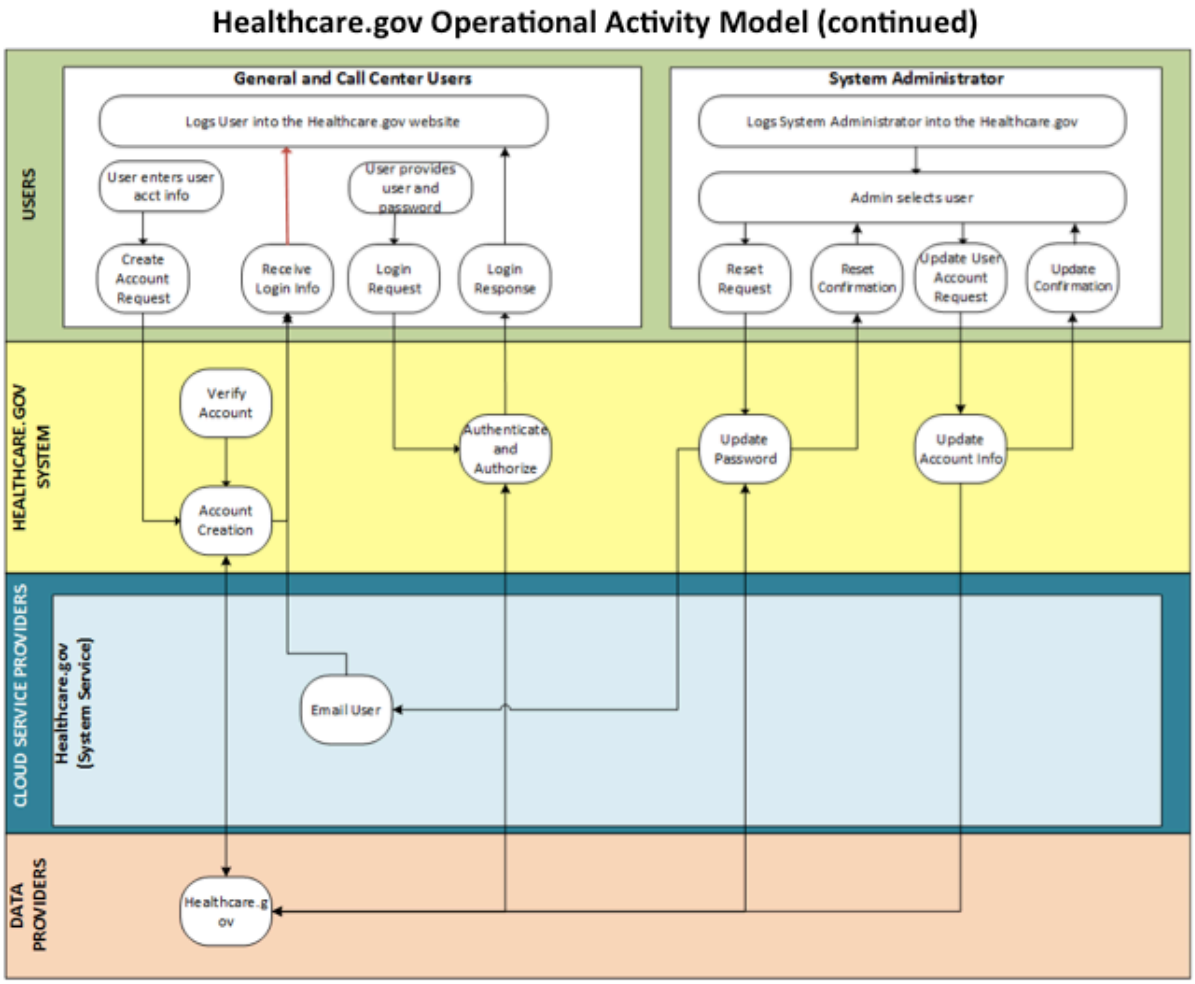

Figure 4 - Operational Activity Model (continued) for the HealthCare.gov

After the user has selected the healthcare plan for purchase, the request is made by the user and sent to the HealthCare.gov system as illustrated in figure 3. The HealthCare.gov system processes the request including calculating the final cost, apply subsidies, and invoke a third-party cloud-service payment system to conduct the e-commerce transaction. The confirmation result along is returned to the user.

Users have the ability to create an account on the HealthCare.gov website. When the user initiates the request, the HealthCare.gov perform a verification process, stores the account information in the data store, emails the user using the cloud service, and returns the result to the user. A similar process occurs when the user logs into the HealthCare.gov system. The system authenticates and authorizes the user and logs the user into the system. For a system administrator, the HealthCare.gov allows the administrator to update the user's password and account information as shown in figure 4. The HealthCare.gov service emails the updated password to the user while the system stores the information in a data store.

2.4 SV-1: Systems Interface Description

The systems design is primarily based on scalable virtual systems. We rely on two types of servers to provide web services. A static web server will be used for serving content that does not require authentication. For example, access to general information about the health care law.

All images, CSS (Cascading Style Sheets) [4] files, java script files and other files are stored on a static files server and is distributed with a content delivery system to ensure faster and more reliable content delivery.

All systems that store or serve secure information are located within a firewall and have limited access to outside world.

A web application (referred to as web app) server provides web services, web interface, mobile web interface, and security services. The load balancer redirects the incoming request to an available instance of the web application server to ensure workload is optimally distributed across the web application cluster.

Automated services are managed by web worker which is scalable similar to the web app server. The capacity will automatically scale if the volume of tasks increases.

A queuing service communicates messages between the web app and the web worker. For example, when the user completes an application, a message is added to the queue or processing the application. The worker will read the application and process messages from the queue and run it in the background.

A Redis server is used for caching and performance improvement. Frequently used queries and data are stored with keys and values on the Redis server.

A database cluster with multiple master and slave databases is used to store the data. The master/slave setup allows us to scale the database cluster serving capacity based on the volume of traffics. In addition, it provides redundancy and failover to ensure a high-availability of the system.

Each component of this setup use TCP network transport protocol to communicate data packets. The ports, which are used for the communication, are shown on the diagram.

SV-1 Healthcare.gov Systems Interface Description

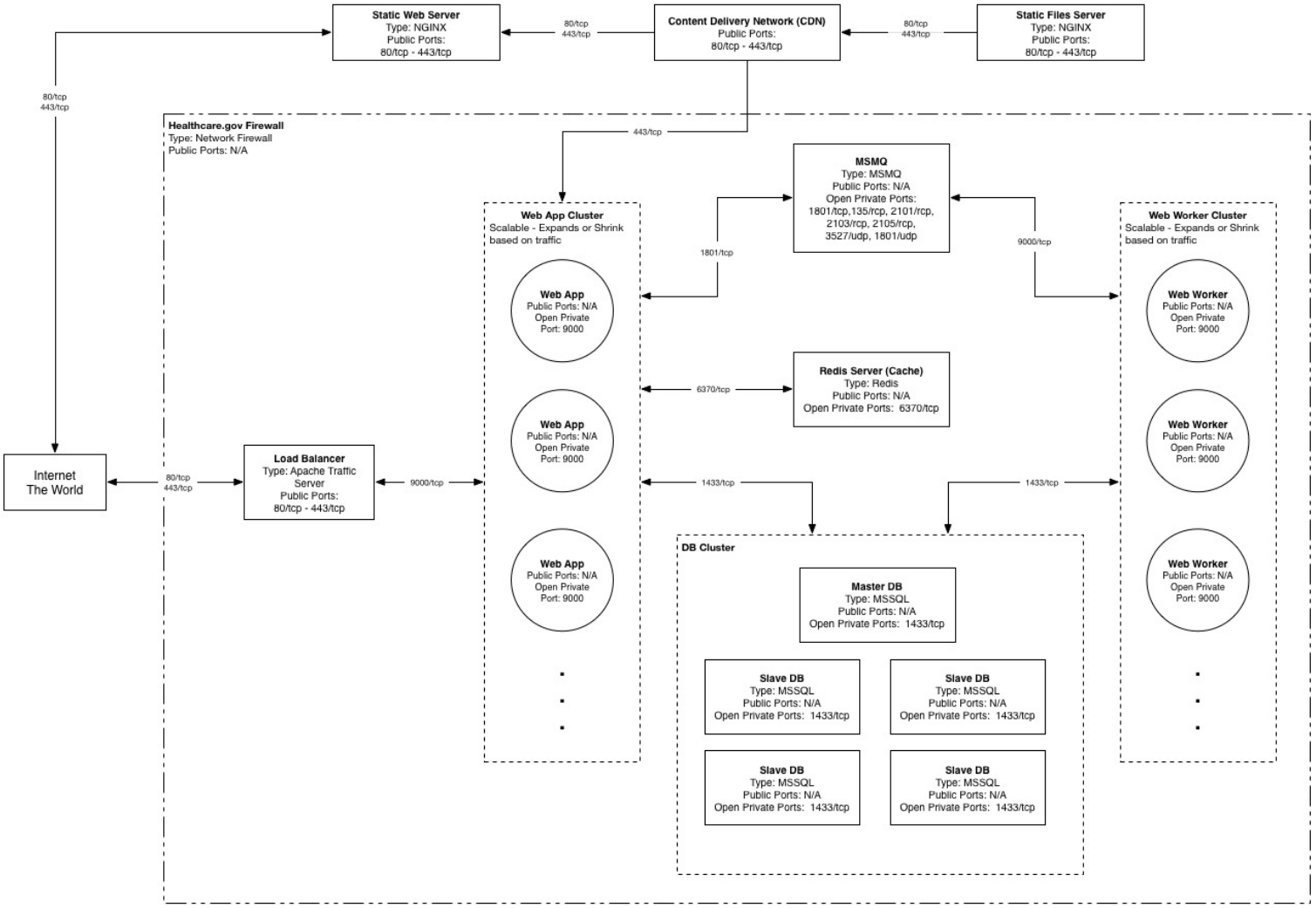

Figure 5 - Systems Interface Description of HealthCare.gov

2.5 SV-2: Systems Resource Flow Description

The diagram below shows how the information flows across system resources. The diagram shows how authenticated and unauthenticated requests are directed to different web servers.

For authenticated server, a complex chain of flow is started based on the type of request.

The diagram also shows which system is responsible for accessing third party services such as Address Verification Service, etc.

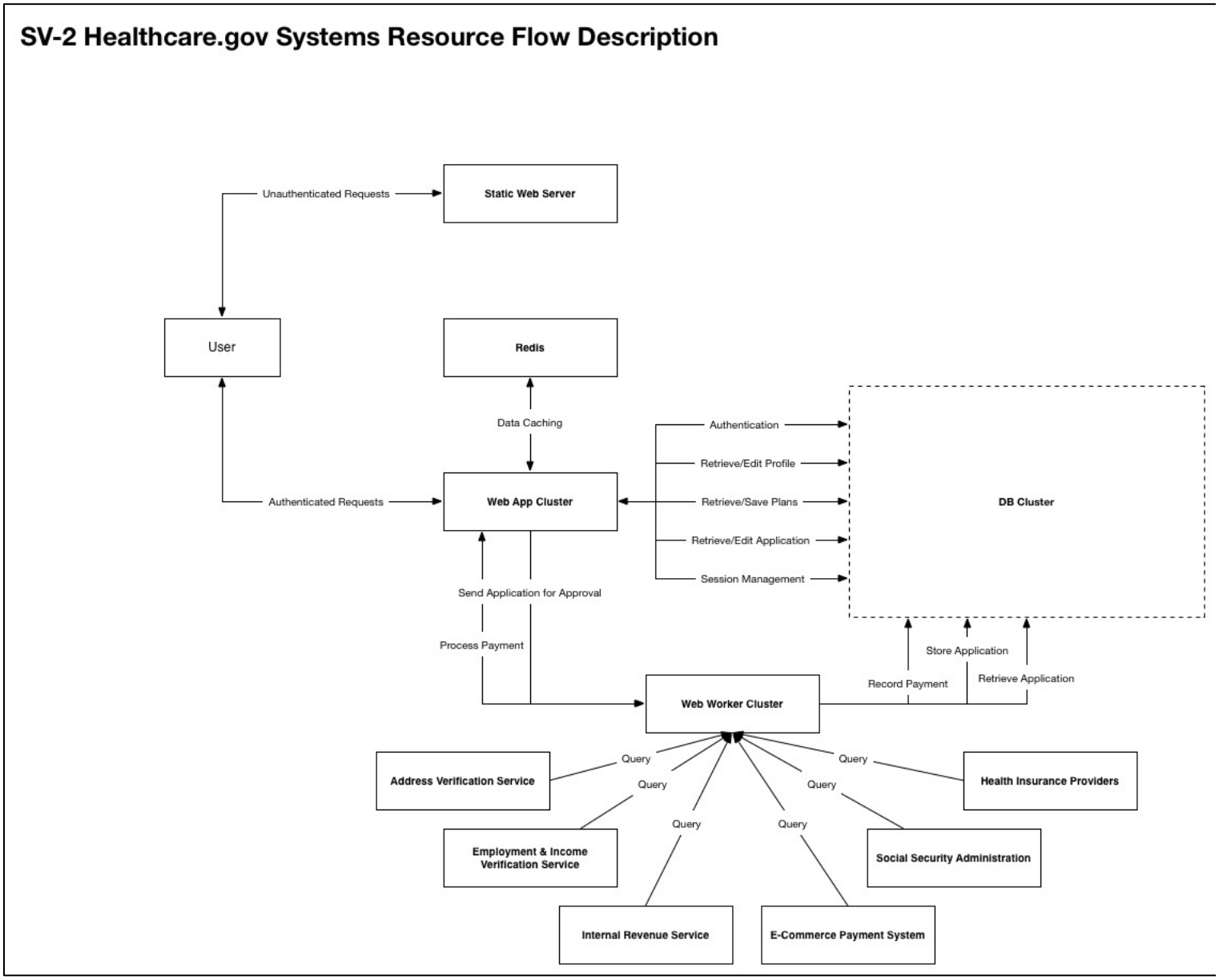

Figure 6 - Systems Resource Flow Description of HealthCare.gov

SV-4: Systems Functionality Description

This diagram shows the functions are available in each system. For example, the web app includes user registration, login, profile editing and making payments.

The diagram also shows how each function interacts with other functions. For example, the MMQ system is used for queuing messages and web worker uses the queued messages to run scheduled and automated tasks.

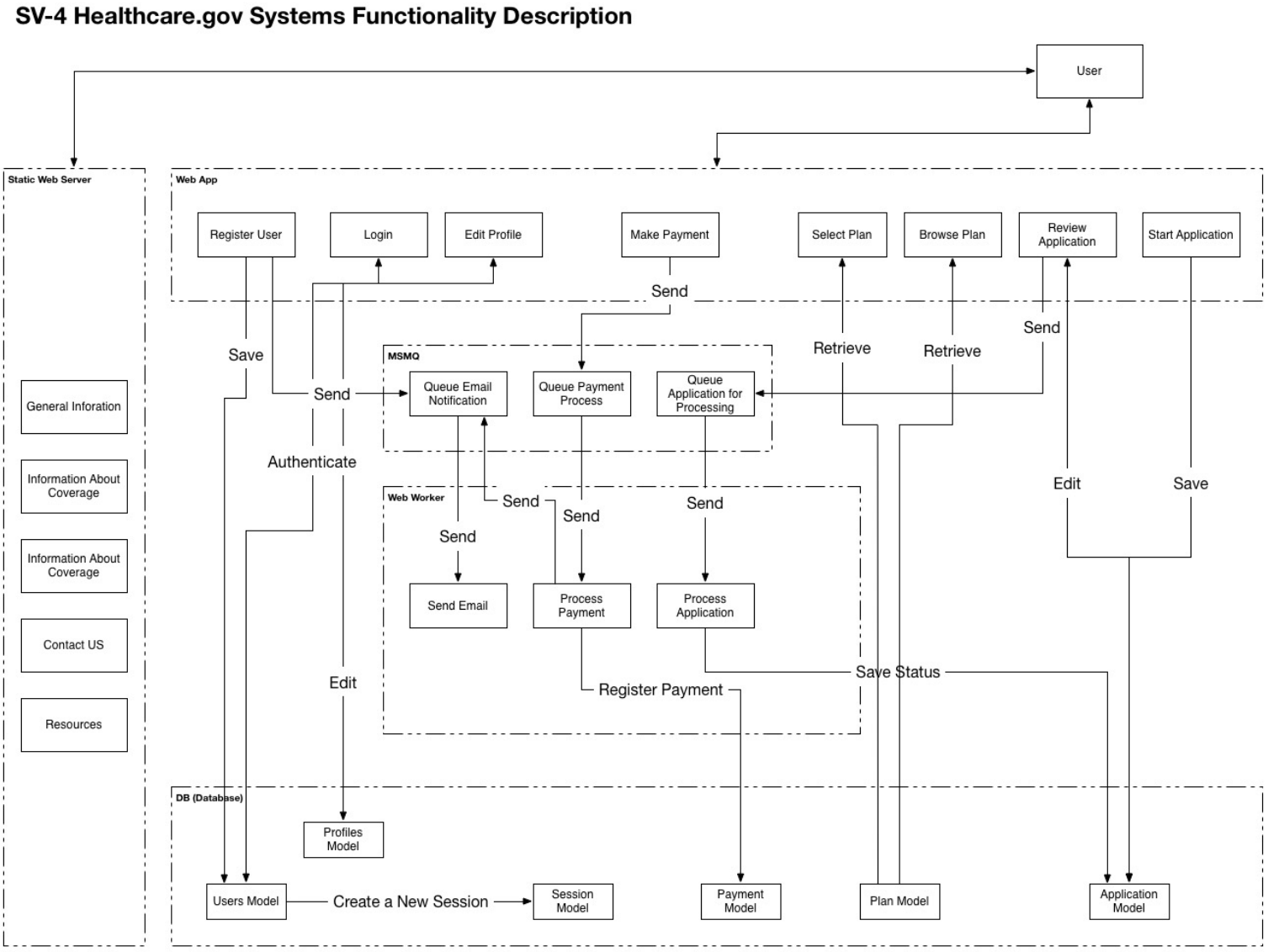

Figure 7 - System Functionality Description of HealthCare.gov

2.6 SvcV-1: Services Context Description

In the previous section, we defined the Operational resources in OV-2. Those resources need to be supported by one or more services. In this section, we continue to architect the HealthCare.gov network-centric software system from the services viewpoints.

With the service viewpoint models, we could identify and associate the service resources to the operational and capability requirements.

2.6.1 Services Concepts and Services Options

The requirement is to design a network-centric software system. For this section, by using the Service Oriented Architecture (SOA) design pattern, we are able to demonstrate how the components provide services to other components via communications protocols, the Internet network in this case.

First, by going over the conceptual layer of the service architecture, we could identify and to define the major service components. Some of the components could be outside of the scope of this ASD but need to be listed for the completed views.

The HealthCare.gov network-centric software system includes:

- Physical nodes & Transportation: The network of server and client computers that are connected over the Internet. As mentioned in Operational Viewpoint, the authorized and qualified cloud service providers will provide the based infrastructure for this system. In our design pattern, we will mention but do not focus on the physical infrastructure services.

- Protocols: In our design, this software system will use the common protocols for network and web services.

- Transmission Control Protocol / Internet Protocol (TCP/IP [13])
- Internet Protocol Version 6 (IPv6 [5])
- Simple Network Management Protocol (SNMP [3])

- Web Core Services: Those could be considered as the software infrastructure services. The cloud service provider will provide the core services that supports for the main web application services. The web core services are defined depending on the technologies that will be used in the application. Some highlighted services are:

- Hypertext Markup Language (HTML [2]) is the standard markup language used to create web pages.
- Hypertext Transfer Protocol (HTTP [1]) is “an application-level protocol for distributed, collaborative, hypermedia information systems. HTTP is the foundation of data communication for the World Wide Web (WWW).”

- HTTP over Transport Layer Security (TLS [6]), referred to as HTTPS [12], is the communication protocol for secure communication over a computer network.
- Simple Object Access Protocol (SOAP [14]) is "an XML-based [7] messaging protocol used to encode the information in web service request and response messages before sending them over a network."
- Web Services Description Language (WSDL [17]) is "an XML-formatted language used to describe a Web service's capabilities".
- Extensible Markup Language (XML [7]) is a standard that used to describe the data. It is very common used in web application.

- **Enterprise Service Bus (ESB [8]):** An article from Oracle provides a definition for ESB as "A style of integration architecture that allows communication via a common communication bus that consists of a variety of point-to-point connections between providers and users of services."

With ESB, the services of the system are divided into the service providers and the service consumers. That means the services provide and consume the service resource of each other.

In this ESB software architecture model, there are system services that control the internal system activities flows. In this ASD, the ESB layer is a conceptual layer. The ESB keeps an essential role to handle the Web Application Services, the Web Core Services, and the infrastructure services. The ESB is used to monitor and control the routing of the services communications and transformations. The Universal Description, Discovery and Integration (UDDI [16]) is a web-based distributed directory that enables listing of web services and discovering each other.

- **Orchestration (Automation):** The services that are automated and provide supports for other services of the system.

- **Services Presentation and Management:** The security layer to manage the accessibility to the web application services.

Figure 8 shows the layered architecture of the HealthCare.gov.

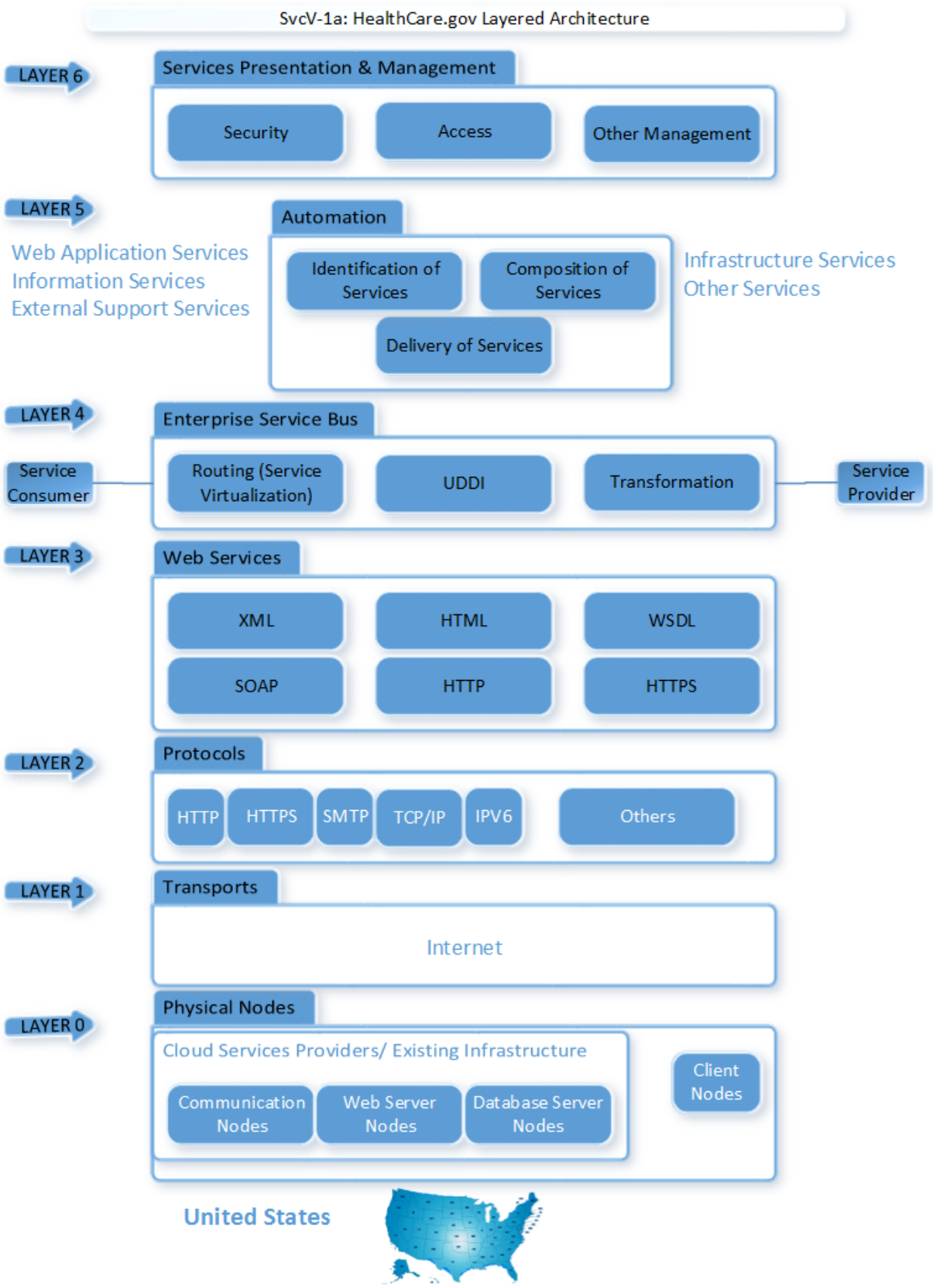

Figure 8 - Conceptual Layered Architecture of the HealthCare.gov

2.6.2 Services Integration Planning and Management

Expanding from the conceptual layers viewpoint, the system is made up from multiple service components. There are basic groups of services and the flow of interaction between those groups of services. The services flows are not limited to internal system and application services. The service groups also include the services related to the human interactions and managements.

Below, figure 9, is the SOA overview of the HealthCare.gov. This diagram shows the basic integration of the service components in the system.

The network-centric software system consists of the basic service components as seen above in the conceptual layers. ESB is the central component, which controls and interacts with the system services: Database Services, Security Services, Automation Services, UDDI Registry, Web Core Services, and Web Service Interfaces. Over common protocols, the backend web application and the third-party services (external services from the providers) could access and use the central system resource. Similarly, over the same protocols, the administrator could access and use the web system administration services. The front-end users include the Call Center users and the generic users. Those users could access the web interface using different devices and over the same protocols. The Call Center users also manage the assistant services to assist the generic users.

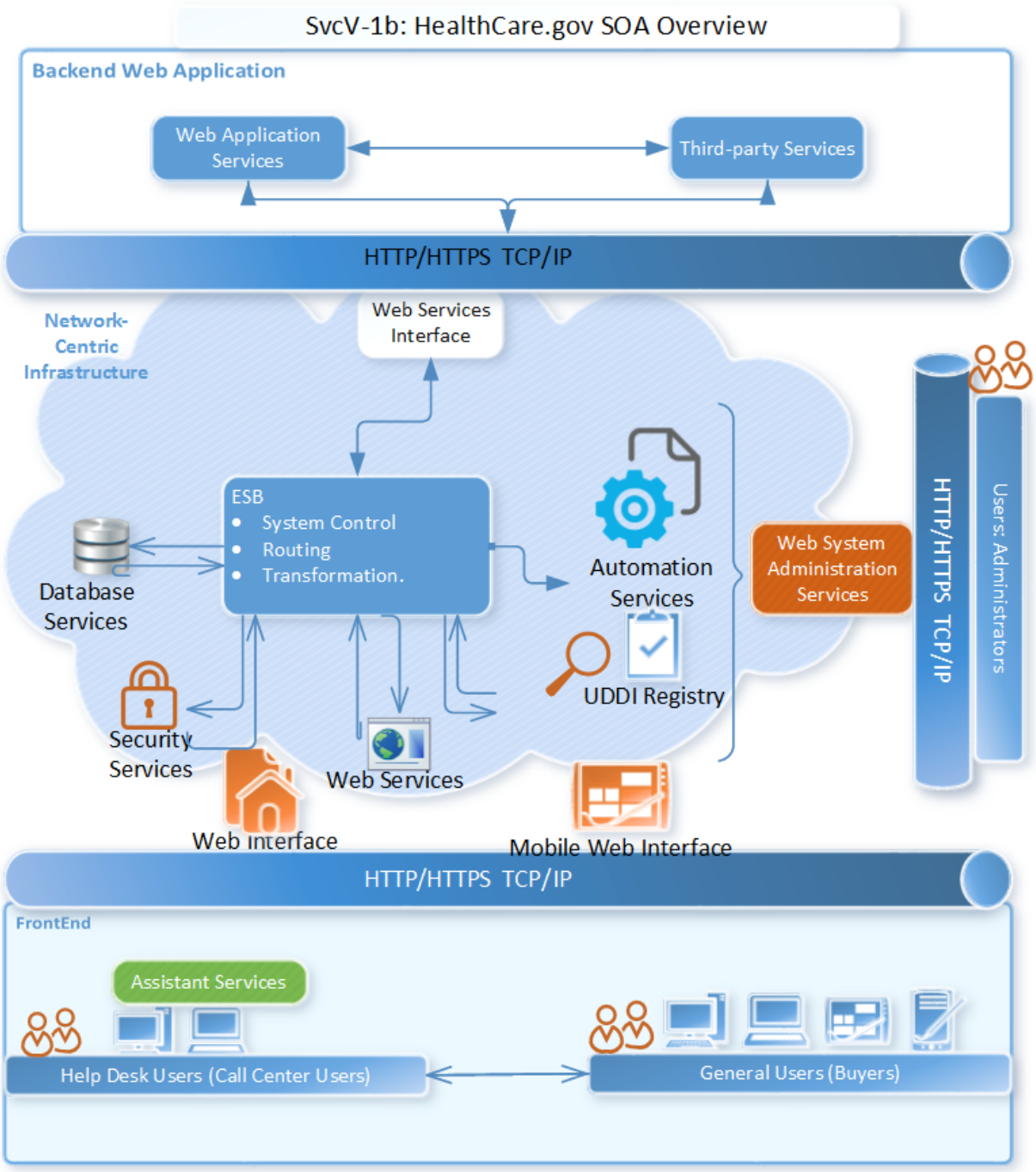

Figure 9 - SOA Overview of the HealthCare.gov

2.6.3 Services Context Description

In addition to the basic layers and the integration of basic service components, the detail service context plays an important role in SOA design pattern. It describes the services layout that required for the operations of the system.

According to the requirement specifications and the Operational View, we have the following services and service components (figure 10).

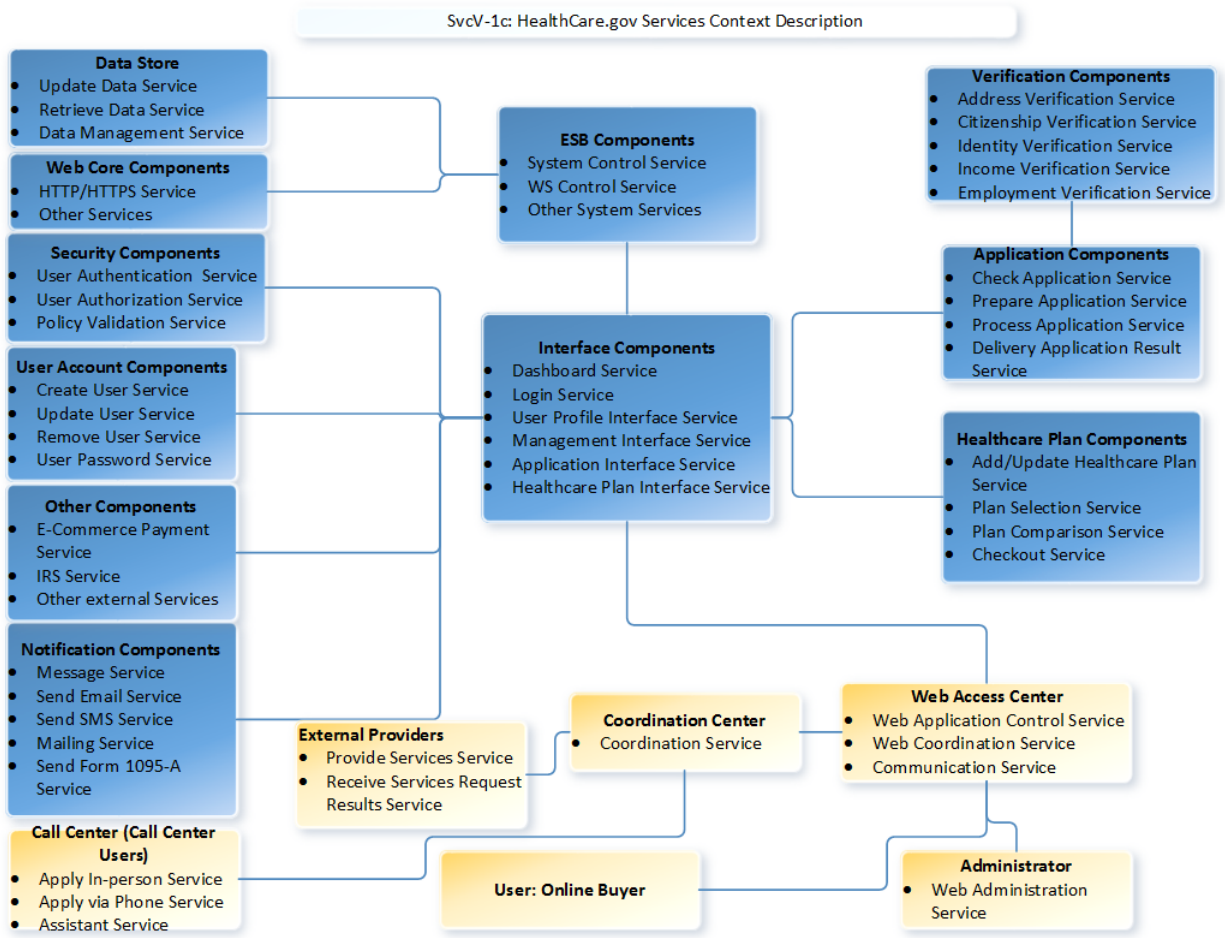

Figure 10 - Services Context Description of the HealthCare.gov

2.7 SvcV-2: Services Resource Flow Description

By expanding the Service Context Description, we have the services and service flows that described in Figure 11.

The ESB services provide the core services to coordinate request and processes that occur in the backend of the system. It would process the service request and service response for accessing or updating the data services and the web core services.

The Interface services contain the interface of the major component of this system such as: Dashboard, Login, User Profile, Application, and Healthcare Plan. Each interface service would interact with multiple functional components. The Interface services could be considered as the action controller of the system: all the functional services are being called from the uses of interface services. During processing the service request, the interface services could send and receive the service requests for accessing or updating the data services and the web core services.

There are the service components to support the interface services and the service components to support the system.

The User Account services would be used to support the User Profile Interface service and some other related services. The User Account services receive the requests related to user managements and send the approximate reply.

The Security services keep a major role in the system. The Security services could interact directly with the Login service. And the Security services could interact indirectly with every other services of the system.

The Application services are being used for handling the application process and interact directly with the Application Interface service.

The Verification services support for the Application services. The Verification services receive the service requests from the Application services, process the request, and reply to the requests.

The Healthcare Plan services work for the Healthcare Plan Interface service. Once receiving the requests for plan purchase, the Healthcare Plan services process and reply with the results.

The Notification services are being used to support for the whole web application and send the approximate notifications per request.

There is also the External Support services, which are the services provided by external service providers.

While accessing the system, each type of user would have different type of service requests. The Web Access Center would coordinate the service request from the users and send the request to the interface components. The interface components would process and decide the service to handle the request from the Web Access Center. After processing, the interface components

would send the replies to the Web Access Center; the Web Access Center would process and send the replies to the user's requests.

The more detail flows and descriptions could be seen in figure 11 below:

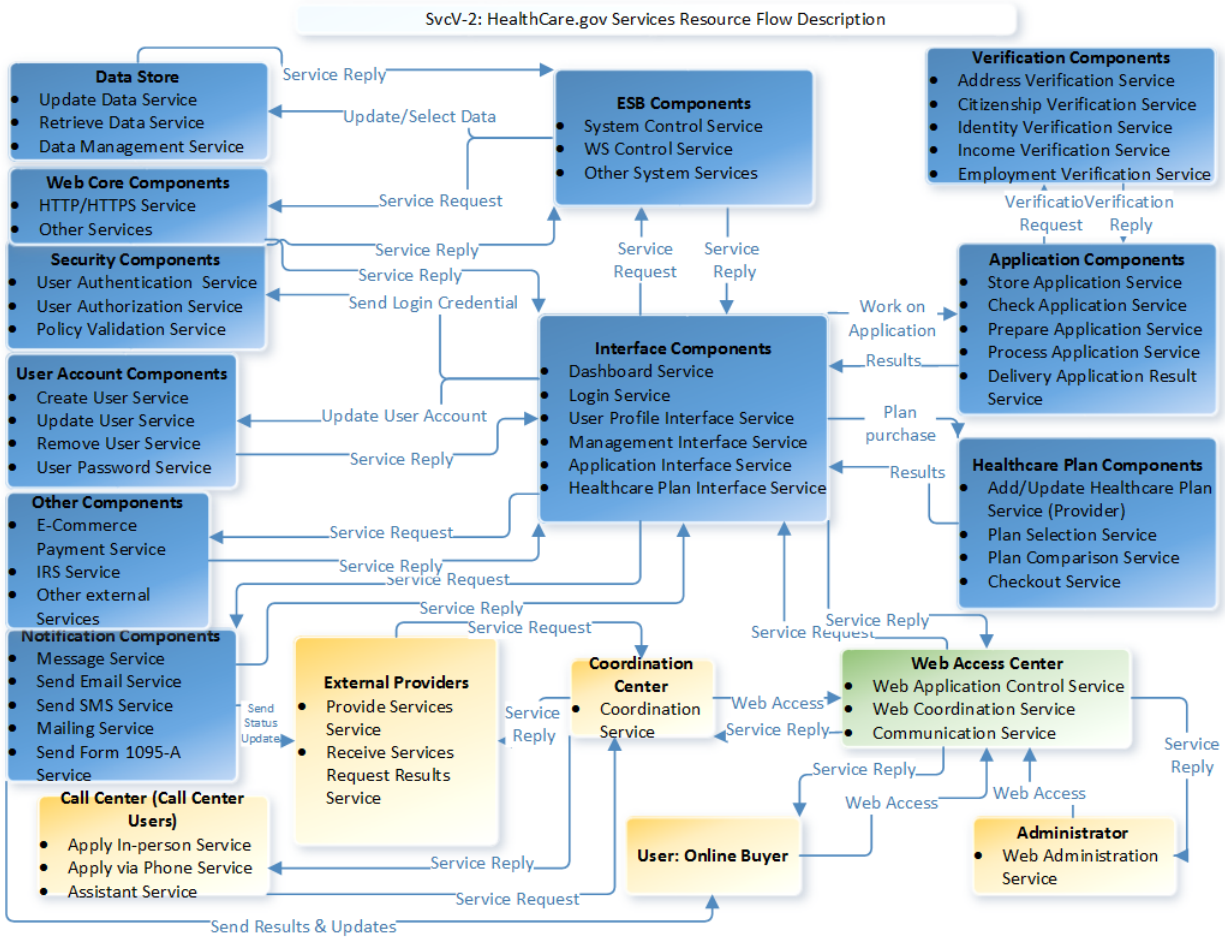

Figure 11 - Services Resource Flow Description of the HealthCare.gov

2.8 SvcV-4: Services Functionality Description

Service Functionality Description describes the functions performed by services and the service data flows among service functions.

This section identifies and describes the allocation of service functions to resources and the flow of resources between service functions.

The overview and the integrations of service functionalities are described in Figure 12 and the detail functionality description is described in Figure 13.

In general, the system consists of Web-based Application service, web core services, ESB services, External Support services, Infrastructure services, and the External Consumer services (Human Interaction services).

As mentioned previously, ESB and Web Core Services provide the core software base for the system.

The Web-based Application services have the following basic functionalities: Operations, Account Management, Application, and Plan Purchase.

The External Support services are the group of system services that linked to the service providers. These services provide the support functionalities to the core web application.

The Infrastructure services, which are provided by cloud service provider and are not in the scope of the current design architecture, provide the base for the whole system.

The External Consumers services maintain the functionality to support and to work with each type of users.

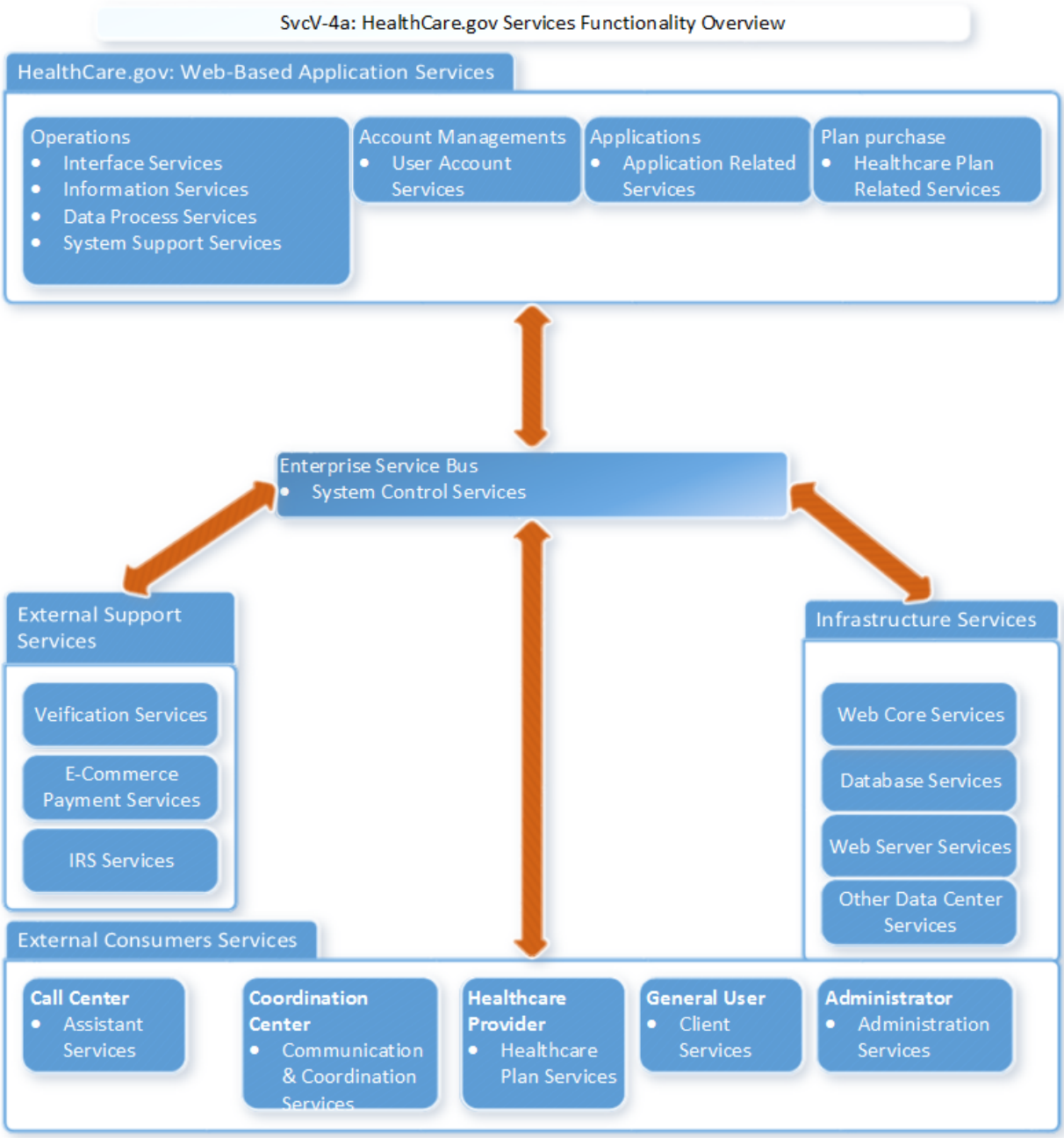

Figure 12 - Services Functionality Overview of the Healthcare.gov

In detail, the HealthCare.gov network-centric web-based system contains of the following core sets of service functionality:

- Front-end Web Services.
- Core Services.
    - ESB Services
    - Web Core Services
- Web-based Application Services.

- Core function Services
    - User Management Services
    - Application Services
    - System Support Services
        - Data Processes & Functions Services
- Interface Services
    - User Management Interface Services
    - User Dashboard Services
    - Application Interface Services
    - Healthcare Plan Interface Services
- Information Services
    - Security Services
    - Notification Services
- External Support Services.

- Infrastructure Services (provided by external services providers – cloud services providers).
    - Data Center Services
    - Networking Services
        - Communication Connectivity Services

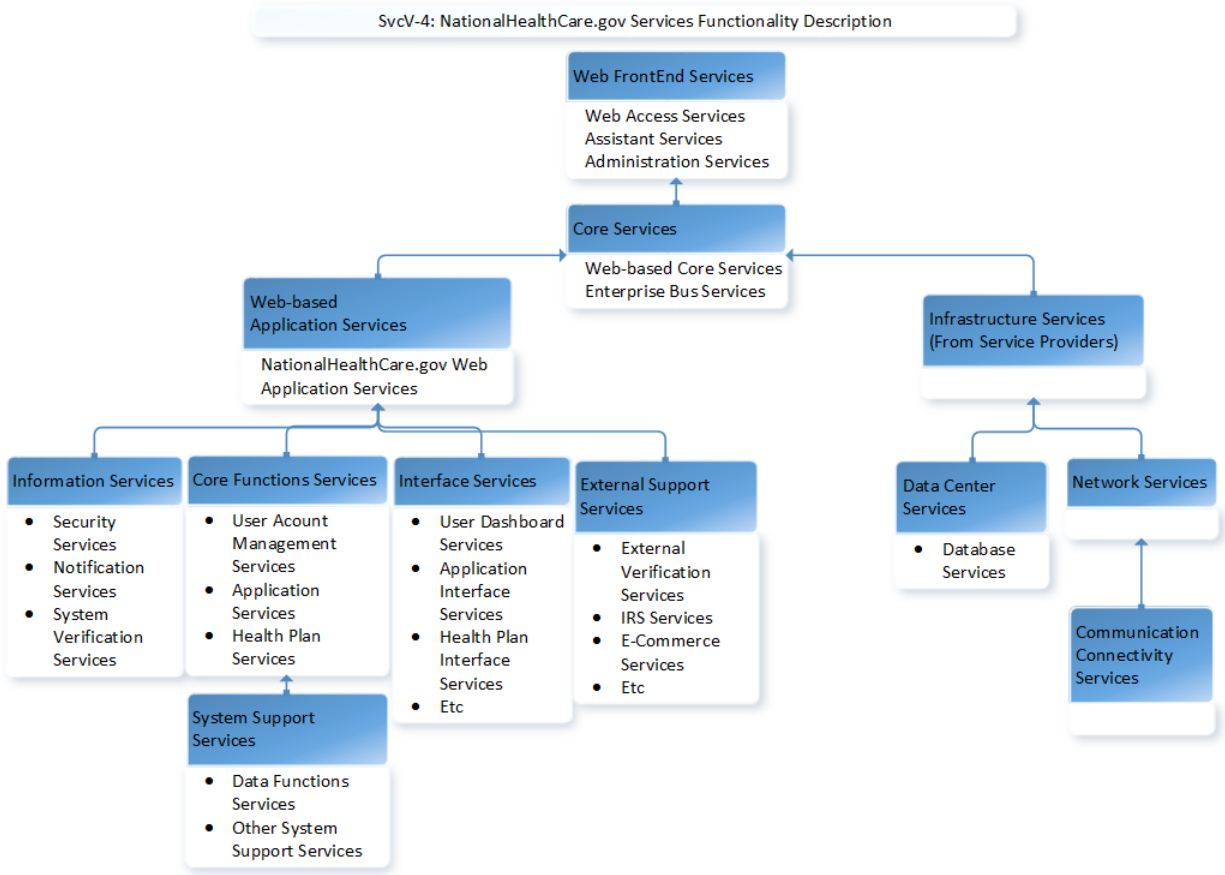

Figure 13 - Services Functionality Description of the HealthCare.gov

3. Concluding Remarks

This ASD describes the operational, system, and service viewpoints of the network-centric HealthCare.gov system. The DoDAF models have been used to describe and present the architecture viewpoints of the HealthCare.gov system.

From the different viewpoints, the architecture of the HealthCare.gov system is complex. The software engineer must take extra cautious while working on the detail of each viewpoint and the connections between the viewpoints. It is necessary to review the system from those viewpoints in order to prepare for and to process the further steps of software engineering.

The architecture specifications in this document provide the information to continue with the design specifications.

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Appendix A: Meeting minutes, Attendance, and Project Management Related Information.

1. Tools of Communication and Collaboration

- Email: Regular discussions and file sharing.
- Google Hangout: Online meeting.
- Google Drive: File sharing.
- Microsoft Office Word: Document Editor, Track Changes.
- Omnigraffle: Tool for Drawing Diagrams.
- Mkdocs: For HTML Document Creation.

2. Meeting Minutes, Attendance, and Email Communications

Types	Time	Attendees	Agenda	Actions	Status
Email	Friday 03/13/2015	Dat Hoang Danh Huynh Alireza Jazayeri	Discuss about project timeline and schedule the first meeting.	***Action** -Review course material and project requirements ***Schedule** -Next meeting: Wednesday 03/18/2015 9:00PM	Completed

Meeting	Wednesday 03/18/2015 9PM - 9:30PM	Dat Hoang Danh Huynh Alireza Jazayeri	**Potential Discussions** Problem. Tools. Schedule. Shared works. Individual works.	*** Tools & Communication:** 1- Diagram: http://www.gliffy.com/uses/uml-software/ 2-File managements: Google Drives (shared) 3-Meeting: Google Hangout *** Work sharing** 1-Document owner: **Alireza** 2-HTML: **Alireza** 3-Executive summary: **Danh** 4-Introduction: **Dat** 5-Architect Specifications (Overview): **Dat** 6-Concluding remarks: **Danh** 7-OV 1,2,5b: **Dat** 8-SV 1,2,4: **Alireza** 9-SvcV 1,2,4 **Danh** *** Schedule** -Initial draft: by March 26 2015 -Final draft: by April 06 2015 **-Due date April 07 2015** -Next meeting: 9pm March 26 2015	Completed
Email	Thursday 03/19/2015	Dat Hoang Danh Huynh Alireza Jazayeri	Update on Tools to use.	***Action** -Use MS Office Tools for Diagrams	Completed
Email	Tuesday 03/24/2015	Dat Hoang Danh Huynh Alireza Jazayeri	Update on work status	***Action** -Sent out the initial diagrams to the team.	Completed
Meeting	Thursday 03/26/2015	n/a	n/a	***Action** n/a ***Schedule** -Next meeting: Sunday 03/29/2015 3:30PM	Cancelled due to Travelling Issue

Meeting	Sunday 03/29/2015	n/a	n/a	***Action** n/a ***Schedule** -Next meeting: Monday 03/30/2015 4:30PM	Cancelled due to Emergency Issue
Email	Sunday 03/29/2015	Dat Hoang Danh Huynh Alireza Jazayeri	Update work status and reschedule meeting	***Action** -Sent out the initial diagrams and description to the team. -Reschedule meeting ***Schedule** -Next meeting: Monday 03/30/2015 4:30PM	Completed
Meeting	Monday 03/30/2015 4:30PM - 4:50PM	Dat Hoang Danh Huynh	**Potential Discussions** Works Status. Works Integration. Schedule for final drafts and submission.	***Action** -Ask Dr. Balci for grading scale. -Continue to work on current assigned tasks. -Danh and Dat will have the assigned tasks done by this Thursday. -After that, Danh will update the Executive Summary and Concluding Remarks. -Email to discuss more about actions, schedules and, meetings. At least 2meetings: 1 during the week and 1 on Sunday. ***Work sharing** 1-Document owner: **Alireza** 2-HTML (if needed): **Alireza** 3-Executive summary: **Danh** 4-Introduction: **Dat** 5-Architect Specifications (Overview): **Dat** 6-Concluding remarks: **Danh** 7-OV 1,2,5b: **Dat** 8-SV 1,2,4: **Alireza** 9-SvcV 1,2,4 **Danh** ***Schedule** -Submission date: by April 06 2015 **-Due date April 07 2015** -Next meeting: **Alireza's decision**	Completed

Email	Monday 03/30/2015	Alireza Jazayeri	Keep up with meeting discussion and update work status	***Action** -Absent due to communication issue (work travelling) -Send diagrams and update work status. -Keep up with discussion from last meeting.	Completed
Email	Tuesday 03/31/2015	Dat Hoang Danh Huynh Alireza Jazayeri	**Potential Discussions** Works Status. Works need to be discussed. Schedule for final drafts and submission.	*** Action** -Danh and Dat updated the assigned documentations, the diagrams, and the diagram descriptions -Alireza updated HTML version with the initial contents. -Schedule for next meeting with the potential issues/clarifications for discussion. *** Work sharing** 1-Document owner: **Alireza** 2-HTML (if needed): **Alireza** 3-Executive summary: **Danh** 4-Introduction: **Dat** 5-Architect Specifications (Overview): **Dat** 6-Concluding remarks: **Danh** 7-OV 1,2,5b: **Dat** 8-SV 1,2,4: **Alireza** 9-SvcV 1,2,4 **Danh** *** Schedule** -Submission date: by April 06 2015 **-Due date April 07 2015** -Next meeting: **Thursday 04/02/2015 6:15PM**	Completed
Meeting	Thursday 04/02/2015 6:15PM - 7:00PM	Dat Hoang Danh Huynh Alireza Jazayeri	**Potential Discussions** Works Status. Works Integration. Schedule for	*** Action** **-Alireza:** Update the descriptions, Draft done by Friday noon, Update SV-2 to reflect Dat's changes in OV-2. **-Danh:** Update description to for	Completed

			final drafts and submission.	ESB and SOA architecture to reflect Alireza's viewpoints and explain the current viewpoints. Update naming and diagrams to clarify things. Update meeting notes and project management notes (will update the changes while doing the review on Saturday.) **-All:** Review and update assigned individual works if needed. Follow the reviewing schedule to submit on time. *** Pending action** *** Schedule** -By the end of Friday: Initial full document (Alireza) By the end of Saturday: First revision. (Danh) -By the end of Sunday: Second revision. (Dat) By Tuesday: Last revision and final submission. (Alireza) -Submission date: by April 07 2015 **-Due date April 07 2015** -Next meeting: **Sunday April 05 8pm**	
Email	Friday 04/03/2015	Dat Hoang Danh Huynh Alireza Jazayeri	Update works	***Action** -Alireza sent out the initial draft for final submission (text version) -Dat update the assigned documentation. -Danh will work on the first review/revision.	Completed
Email	Saturday 04/04/2015	Dat Hoang Danh Huynh Alireza Jazayeri	Update works	***Action** -Danh sent out First reviewed Word Docs draft and the correlated text file for HTML version. -Dat will work on the second	Completed

				review/revision.	
Meeting	Sunday 04/05/2015 8:00PM-8:15PM	Dat Hoang Danh Huynh	**Potential Discussion** Work status update. Finalize the works for submission	***Action** Danh & Dat: completed 1st and 2nd reviews. Alireza: -Update the diagrams. -Update this meeting note into the ASD docs. -Update the HTML view. -Review final ASD docs. -Prepare and submit the final ASD before deadline (both docs and HTML version) -Please remove or change the linked references in the Word Docs before submitting. -CC the team when submit to Dr. Balci ***Schedule** -Final Submission by (Time decided by Alireza) Tuesday April 07	Completed

Appendix B: Percentages of Contribution

Name	Percentages of Contribution	Signature
Dat Hoang	33.333	
Danh Huynh	33.333	
Alireza Jazayeri	33.333