# Production Operations Manual

Genomic Information System for Integrated Science 2 (Genisis2) Technical Services

Build 7



December 2017

Document Version 6.0

### Department of Veterans Affairs

### Document Revision History

|  |  |  |  |
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Note: The revision history cycle begins once changes or enhancements are requested after the Production Operations Manual has been baselined.

# Artifact Rationale

The Production Operations Manual provides the information needed by the production operations team to maintain and troubleshoot the product. The Production Operations Manual must be provided prior to release of the product.

### Table of Contents

1. [Introduction 5](#_bookmark0)
2. [Routine Operations 5](#_bookmark1)
   1. [Administrative Procedures 5](#_bookmark2)
      1. [System Startup 5](#_bookmark3)
         1. [System Startup from Emergency Shutdown 6](#_bookmark4)
      2. [System Shutdown 6](#_bookmark5)
         1. [Emergency System Shutdown 7](#_bookmark6)
      3. [Back-up & Restore 7](#_bookmark7)
         1. [Back-up Procedures 9](#_bookmark8)
         2. [Restore Procedures 9](#_bookmark9)
         3. [Back-up Testing 9](#_bookmark10)
         4. [Storage and Rotation 9](#_bookmark11)
   2. [Security / Identity Management 10](#_bookmark12)
      1. [Identity Management 10](#_bookmark13)
      2. [Access Control 11](#_bookmark14)
   3. [User Notifications 11](#_bookmark15)
      1. [User Notification Points of Contact 12](#_bookmark16)
   4. [System Monitoring, Reporting, and Tools 12](#_bookmark17)
      1. [Dataflow Diagram for Genisis2 Data Request Workflows 12](#_bookmark18)
      2. [Data Flow Diagram for Genisis2 Terminology Service 12](#_bookmark19)
      3. [Availability Monitoring 13](#_bookmark20)
      4. [Critical Metrics 13](#_bookmark21)
   5. [Routine Updates, Extracts and Purges 13](#_bookmark22)
   6. [Scheduled Maintenance 13](#_bookmark23)
   7. [Capacity Planning 14](#_bookmark24)
      1. [Initial Capacity Plan 14](#_bookmark25)
3. [Exception Handling 14](#_bookmark26)
   1. [Routine Errors 14](#_bookmark27)
      1. [Security Errors 14](#_bookmark28)
      2. [Time-out Errors 14](#_bookmark29)
      3. [Concurrency 14](#_bookmark30)
   2. [Significant Errors 14](#_bookmark31)
      1. [Application Error Logs 15](#_bookmark32)
      2. [Application Error Codes and Descriptions 15](#_bookmark33)
      3. [Infrastructure Errors 15](#_bookmark34)
         1. [Database 15](#_bookmark35)
         2. [Web Server 15](#_bookmark36)
         3. [Application Server 15](#_bookmark37)
         4. [Network 16](#_bookmark38)

[3.2.3.6. Logical and Physical Descriptions 16](#_bookmark39)

* 1. [Dependent System(s) 17](#_bookmark40)
  2. [Troubleshooting 17](#_bookmark41)
  3. [System Recovery 17](#_bookmark42)
     1. [Restart after Non-Scheduled System Interruption 18](#_bookmark43)
     2. [Restart after Database Restore 18](#_bookmark44)
     3. [Back-out Procedures 18](#_bookmark45)
     4. [Rollback Procedures 18](#_bookmark46)

1. [Operations and Maintenance Responsibilities 19](#_bookmark47)
2. [Approval Signatures 20](#_bookmark48)

# Introduction

The Production Operations Manual describes how to maintain the components of the Genomic Information System for Integrated Science 2 (Genisis2), as well as how to troubleshoot problems that might occur with this application in production. The intended audience for this document are the Information Technology (IT) teams responsible for hosting and maintaining the application after production release. This document is normally finalized just prior to production release and includes many updated elements specific to the hosting environment.

# Routine Operations

Table 1 lists the routine operations for Genisis2.

**Table 1: Routine Operations**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Routine Operation** | **Periodicity** | **Role performing the Function** | **Additional External Systems, if Needed** | **Additional Description** |
| System Login Availability from the VA Network | Daily | Genisis2 System Administrator (Super User) | None | Verifies that the system is up and running. |
| Systems Monitoring and Alerting, Escalation | Real time 24/7 | Genisis2 System Administrator (Super User) | VA Systems Monitoring and Alerting Facilities | Monitors each of the Web, Application and Data Servers status. They need to be up and running |

## Administrative Procedures

### System Startup

Table 2 provides the system startup procedures for the Genesis2 servers.

**Table 2: System Startup**

|  |  |  |
| --- | --- | --- |
| **Component** | **Procedure** | **Additional Comments** |
| Apache Server | sudo service httpd start | For Genisis2 Workflows |
| Genisis2 Application Wildfly Server | nohup ./standalone.sh & | For Genisis2 Workflows |
| Genisis2 Application Tomcat Server | sudo service tomcat start | For Genisis2 Terminology Service |
| Apache Solr Server | cd <<SOLR\_HOME>>  cd /u06/ts/solr-6.0.0  bin/solr start | For Genisis2 Terminology Service - assuming SOLR\_HOME is /u06/ts/solr- 6.0.0 |

|  |  |  |
| --- | --- | --- |
| **Component** | **Procedure** | **Additional Comments** |
| Apache Jena/Fuseki server | cd <<FUSEKI\_HOME>>  cd /u06/ts/fuseki  ./fuseki start | For Genisis2 Terminology Service -assuming FUSEKI\_HOME is  /u06/ts/fuseki |

#### System Startup from Emergency Shutdown

In the event of an emergency shutdown, Table 3 lists the system startup procedures for the Genesis2 servers.

**Table 3: System Startup from Emergency Shutdown**

|  |  |  |
| --- | --- | --- |
| **Component** | **Procedure** | **Additional Comments** |
| Apache Server | sudo service httpd start | For Genisis2 Workflows |
| Genisis2 Application Wildfly Server | cd /opt/wildfly  nohup ./standalone.sh & | For Genisis2 Workflows |
| Genisis2 Application Tomcat Server | sudo service tomcat start | For Genisis2 Terminology Service |
| Apache Solr Server | cd <<SOLR\_HOME>>  cd /u06/ts/solr-6.0.0  bin/solr start | For Genisis2 Terminology Service - assuming SOLR\_HOME is /u06/ts/solr- 6.0.0 |
| Apache Jena/Fuseki server | cd <<FUSEKI\_HOME>>  cd /u06/ts/fuseki  ./fuseki start | For Genisis2 Terminology Service - assuming FUSEKI\_HOME is  /u06/ts/fuseki |

### System Shutdown

Table 4 provides the system shutdown procedures for the Genesis2 servers.

**Table 4: System Shutdown**

|  |  |  |
| --- | --- | --- |
| **Component** | **Procedure** | **Additional Comments** |
| Apache Server | sudo service httpd stop | For Genisis2 Workflows |
| Genisis2 Application Wildfly Server | ps -ef | grep jboss | awk '{print $2}' | xargs kill -9 | For Genisis2 Workflows |
| Genisis2 Application Tomcat Server | sudo service tomcat stop | For Genisis2 Terminology Service |

|  |  |  |
| --- | --- | --- |
| Apache Solr Server | ps -ef | grep solr | awk '{print  $2}' | xargs kill -9 | For Genisis2 Terminology Service |
| Apache Jena/Fuseki server | ps -ef | grep fuseki | awk '{print $2}' | xargs kill -9 | For Genisis2 Terminology Service |

#### Emergency System Shutdown

For an emergency system shutdown, Table 5 lists the system shutdown procedures for the Genesis2 servers.

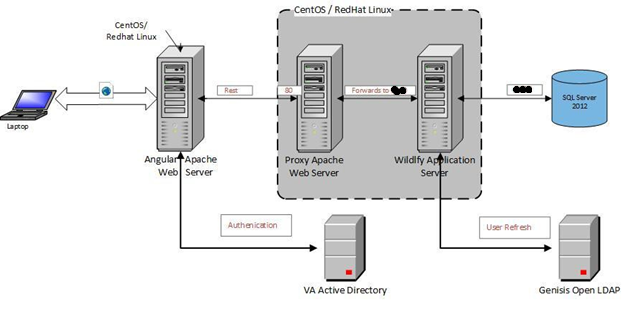
**Table 5: Emergency System Shutdown**

|  |  |  |
| --- | --- | --- |
| **Component** | **Procedure** | **Additional Comments** |
| Apache Server | sudo service httpd stop | For Genisis2 Workflows |
| Genisis2 Application Wildfly Server | ps -ef | grep jboss | awk '{print $2}' | xargs kill -9 | For Genisis2 Workflows |
| Genisis2 Application Tomcat Server | sudo service tomcat stop | For Genisis2 Terminology Service |
| Apache Solr Server | ps -ef | grep solr | awk '{print  $2}' | xargs kill -9 | For Genisis2 Terminology Service |
| Apache Jena/Fuseki server | ps -ef | grep fuseki | awk '{print $2}' | xargs kill -9 | For Genisis2 Terminology Service |

### Back-up & Restore

Figure 1 represents the Genisis2 server architecture. It consists of the following components that need to be backed up:

* Apache Webserver running Red Hat Enterprise Linux (RHEL)
* Apache Webserver2/Wildfly Application Server running RHEL
* Database Server running Microsoft Windows 2008 R2, SQL Server 2012

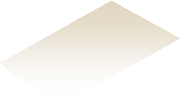
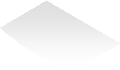
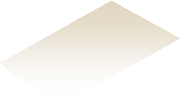


**Figure 1: Genisis2 Server Architecture for Data Request Workflows**

Figure 2 represents the Genisis2 server architecture for Terminology Service. It consists of the following components that need to be backed up:

* Apache Tomcat Application Server running Red Hat Enterprise Linux (RHEL)
* Apache SOLR running RHEL
* Database Server running Microsoft Windows 2008 R2, SQL Server 2012

Centos/RedHat Linux



**Port**

**Port 80**

**Web Server/ Application Server Running**

* + **Apache HTTP**
  + **Tomcat**
  + **Jena/Fuseki**
  + **SOLR**

**Database Server**

* **Windows Server 2008 R2**
* **Microsoft SQL Server 2012**

**Figure 2: Genisis2 Server Architecture for Terminology Service**

#### Back-up Procedures

Table 6 provides frequency recommendations for performing back-ups. Veterans Affairs (VA) Enterprise Operations (EO) follows their Standard Operating Procedures (SOPs) for completing the back-ups.

**Table 6: Component Back-up Frequency**

|  |  |  |
| --- | --- | --- |
| **Category** | **Component** | **Frequency** |
| Applications | Applications | Daily back-ups |
| Application Servers | Apache Web Server Application Server Build Server | Weekly full back-ups |
| Database | Database | Hourly back-ups |
| Database Server | Windows Data Base Server | Weekly full back-ups |

#### Restore Procedures

Restore procedures from back-ups may be necessary. Depending upon what needs to be backed up, VA EO follows their existing SOPs for completing the restores.

Table 7 lists the applicable back-up frequency from which restores can be performed.

**Table 7: Component Restore Frequency**

|  |  |  |
| --- | --- | --- |
| **Category** | **Component** | **Frequency** |
| Applications | Applications | Daily back-ups |
| Application Servers | Apache Web Server Application Server Build Server | Weekly full back-ups |
| Database | Database | Hourly back-ups |
| Database Server | Windows Database Server | Weekly full back-ups |

#### Back-up Testing

Recommendations for back-up testing include performing a restore operation. Specifically:

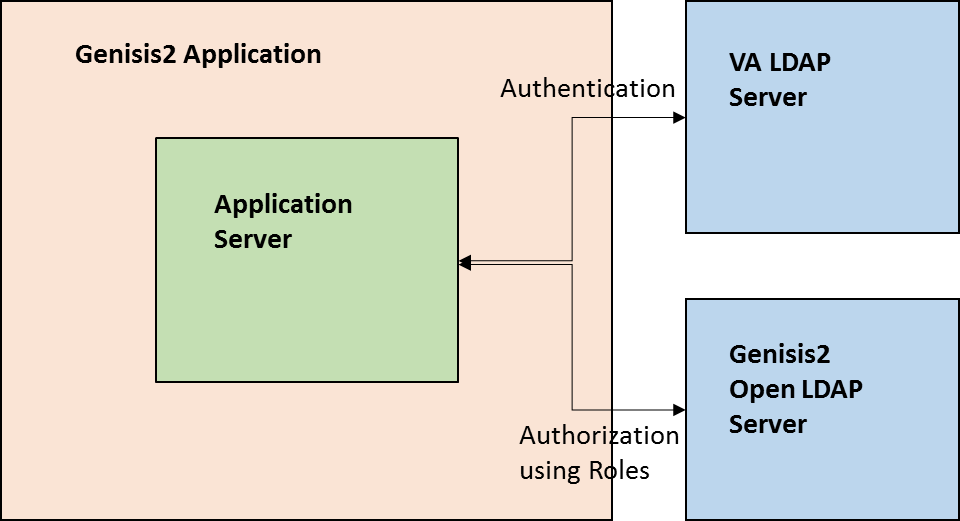
* + - * 1. For applications – follow the standard EO restore procedures for Linux servers.
        2. For database – follow the standard EO restore procedures for the Microsoft SQL server 2012 and the Windows server.

#### Storage and Rotation

Recommendations for storage and rotation are that EO follows their standard disaster recovery procedures currently in place.

## Security / Identity Management

Figure 2 represents the Genisis2 security architecture.



**Figure 2: Genisis2 Security Architecture**

User Names and Passwords are controlled by centralized VA LDAP access control processes. Password Expiry and other administrative processes are controlled by VA LDAP group.

Genisis2 uses integrated PIV/Windows Authentication that the VA LDAP server supports. When a user logs into the VA Network using their PIV card, they are authenticated initially. Genisis2 uses browser-based Windows Authentication to authenticate the login of this user and then uses Genisis2 Roles to allow access to parts of the Genisis2 application. User Roles are managed in a separate Genisis2 Open LDAP server like other Million Veteran Program (MVP) applications. If a user does not have a role within Genisis2, they cannot proceed beyond the login page. Genisis2 user types are utilized by the Genisis2 application to provide each user with certain functionality, depending upon their role. For example, a user is recognized as a Researcher, Genisis2 Manager, VINCI Manager, or Genisis2 System Administrator, and are afforded different levels of functionality within the application.

### Identity Management

Genisis2 supports the following user types for Genisis2 Data Request Workflows:

* + - 1. Researcher
      2. Genisis2 Manager
      3. VINCI Manager
      4. Genisis2 System Administrator

***Please note that Genisis2 Build 7 is a Researcher ONLY release. The only role recognized in Release 7 is the Researcher role in the set of roles above.***

The Researcher has the minimum set of activities they can access and perform in the application. For example, the Researcher can generate and track their own data requests.

The Genisis2 Manager has all the capabilities of a Researcher, but can review and approve requests, review and approve data results, and track requests more broadly.

The VINCI Manager addresses any questions about the data that they may have with the Researcher (through the Genisis2 Manager and not directly), prepares and places the data in a Source landing zone database, and notifies the Genisis2 Manager of its location.

The Genisis2 Manager will then copy the data over from the Source landing zone database to the Destination landing zone database, extract the data to a flat file, and perform any additional cleanup that may be required. Personally Identifiable Information (PII) and Protected Health Information (PHI) information is then removed from this data and copied over to the specific Study Mart set up for the Researcher.

The Genisis2 System Administrator is a super user that can perform all the functions that the Researcher and the Genisis2 Manager can. In addition, the Genisis2 System Administrator can synchronize with the Open LDAP server on-demand or periodically on schedule to retrieve and store the latest set of users and their roles.

Genisis2 supports the Researcher user type for Terminology Service. The Researcher uses Terminology Service to locate the data elements they need by navigating a set of Concepts from many Ontologies like SNOMED-CT, HP, NCIT, etc. The goal of Terminology Service is to let Researchers start their searches with the clinical and bio-medical language they are familiar with, and arrive at concepts in these Ontologies. The concepts are attached to specific data elements in Genomic, Survey and Clinical data. Terminology Service provides a guided search capability to data elements of interest for research use.

### Access Control

As indicated in Section 2.2, User Names and Passwords are controlled by centralized VA LDAP access control processes. Password Expiry and other administrative processes are controlled by the VA LDAP group.

Genisis2 uses browser-based Windows authentication for username and password authentication. Genisis2 manages user types and provides the user with access to specific functionality as described in Section 2.2.1.

## User Notifications

EO may have specific user notification and escalation protocols for attending to systems that are down with other applications and servers on which they are hosted.

Recommendations for user notifications for any scheduled or unscheduled changes in the system state such as planned outages, patch upgrades, etc. are that EO follows their standard procedures for user notifications/escalations currently in place.

### User Notification Points of Contact

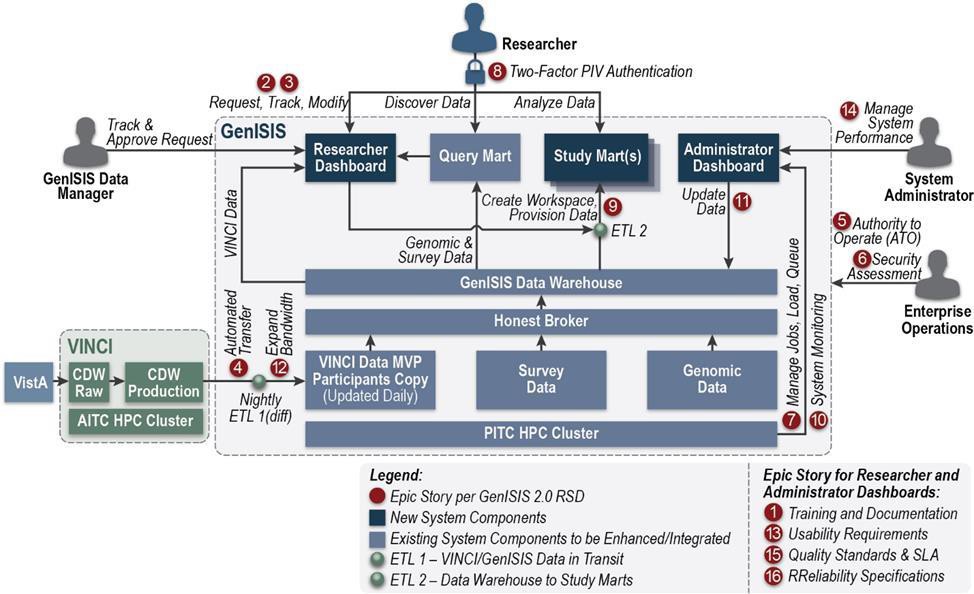
Recommendations for user notifications for any scheduled or unscheduled changes in the system state such as planned outages, patch upgrades, etc. are that EO follows their standard procedures regarding specific notification points of contact (POCs) currently in place.

## System Monitoring, Reporting, and Tools

Recommendations for system monitoring, reporting, and tools are that EO follows their standard procedures for such activities currently in place. These same tools and processes can be used for with Genisis2 servers.

### Dataflow Diagram for Genisis2 Data Request Workflows

The Genesis2 Request flow is depicted in Figure 4.



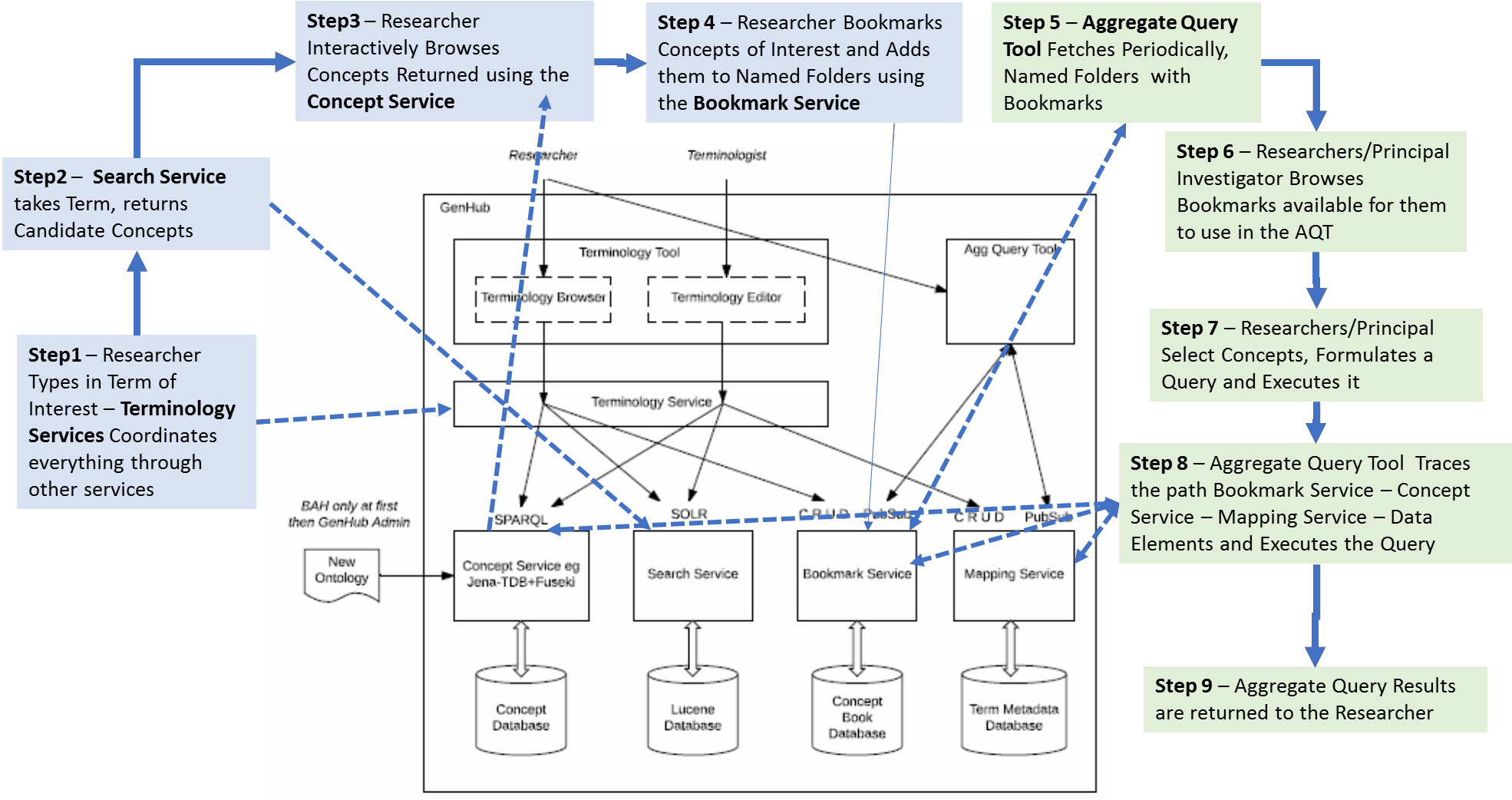
***Smart orchestration and automation of***

***workflows and ETL processes will allow GenISIS 2.0 to preserve data integrity and scale to meet escalating demands of a national resource***

**Figure 4: Genisis2 Request Flow**

### Data Flow Diagram for Genisis2 Terminology Service

The Genesis2 Terminology Service flow is depicted in Figure 5.



**Figure 5: Genisis2 Terminology Service Flow**

### Availability Monitoring

Recommendations are that for Genisis2, EO follows their standard procedures for monitoring the availability of other applications, and monitoring the performance of applications for capacity planning purposes.

### Critical Metrics

There are no metrics specific to the Genisis2 application regarding uptime or downtime. EO may have standard uptime metrics in place for monitoring the availability of applications. Our recommendations are to use the same ones for the Genisis2 application.

## Routine Updates, Extracts and Purges

Genisis2 does not and should not require any routine data purges. The application needs to maintain a history of requests from Day 1 and keep them for posterity. The data stored is not so large as to require purges for the near future.

## Scheduled Maintenance

Genisis2 scheduled maintenance requires routine patches for these software components:

* Red Hat Linux
* Microsoft Windows Server 2008 R2
* Microsoft SQL Server 2012

EO can use their standard operating procedures to schedule a maintenance window at a time that is convenient for and in coordination with the user base.

## Capacity Planning

Genisis2 is not such a performance intensive application that it requires periodic capacity planning reviews. The current capacity planned in terms of number of servers, memory, and disk space assigned is more than sufficient to handle over 50 times the current user base expected.

### Initial Capacity Plan

The initial number of users expected over the next two years is a maximum of 100, with no more than 50 users expected to be logged in concurrently. The current capacity planned in terms of number of servers, memory, and disk space assigned is more than sufficient for 3+ years of operation.

# Exception Handling

Recommendations are that EO follows the standard Tier1 and Tier2 support processes currently in place for Genisis2 exception handling that it uses for other VA applications.

## Routine Errors

### Security Errors

Authentication and Authorization errors can be expected. Since Genesis2 uses the VA LDAP system, standard VA Tier 1 and Tier 2 support processes currently in place for the inability to log in because of a wrong password, wrong username, etc. are recommended for Genisis2.

### Time-out Errors

Genisis2 time-out errors may occur when the webserver is not available. Standard VA Tier 1 and Tier 2 support processes currently in place for unavailable applications due to the webserver or network being down are recommended for Genisis2.

### Concurrency

Genisis2 concurrency errors are not expected or identifiable separate from application errors. Standard VA Tier 1 and Tier 2 support processes currently in place for unavailable applications are recommended for Genisis2.

## Significant Errors

Significant errors can be defined as errors or conditions that affect the system stability, availability, performance, or otherwise make the system unavailable to its user base. The following subsections contain information to aid administrators, operators, and other support personnel in the resolution of significant errors, conditions, or other issues.

### Application Error Logs

The application error logs are located as follows: - /opt/genisis-application-wildfly- 10.0.0/standalone/log/server.log

### Application Error Codes and Descriptions

No application specific error codes exist for the Genisis2 application.

### Infrastructure Errors

#### Database

Microsoft SQL Server 2012 is a component of the Genisis2 application. Generic database errors troubleshooting can be found in the Microsoft web pages located at <https://msdn.microsoft.com/en-us/library/aa952081.aspx>. The site discusses typical connectivity, permissions, and database sizing problems. Standard VA Tier 1 and Tier 2 support processes currently in place are recommended for Genisis2.

Genisis2 application errors are manifested as application errors and are covered in the **Genisis2 Maintenance and Troubleshooting Guide.**

#### Web Server

The troubleshooting guide for the Apache Web Server is located at <https://httpd.apache.org/docs/2.4/custom-error.html>.

#### Application Server

The troubleshooting guide for the JBOSS Wildfly Application Server is located at [https://docs.jboss.org/author/display/WFLY10/Troubleshooting+Common+Issues.](https://docs.jboss.org/author/display/WFLY10/Troubleshooting%2BCommon%2BIssues)

The troubleshooting guide for Apache Tomcat Application Server is located at <https://wiki.apache.org/tomcat/FAQ/Troubleshooting_and_Diagnostics>

The troubleshooting resource for Apache Jena/Fuseki is located at [https://jena.apache.org/help\_and\_support/#email-support-lists](https://jena.apache.org/help_and_support/" \l "email-support-lists)

The troubleshooting resources for Apache SOLR are located at <https://lucene.apache.org/solr/community.html>

#### Network

EO manages the network where the servers are hosted for the Genisis2 application. Standard VA help desk operational processes currently in place for addressing network errors are recommended for Genisis2. The Genisis2 application has been configured and tested with a standard set of network parameters. Due to security protocols, any changes in these parameters should be addressed by EO.

#### Authentication and Authorization

User Names and Passwords are controlled by centralized VA LDAP access control processes. Password Expiry and other administrative processes are controlled by that group. (Refer to Figure 2 for the Genisis Security Architecture diagram.)

Genisis2 uses integrated PIV/Windows Authentication that the VA LDAP server supports. When a user logs into the VA Network using their PIV card, they are authenticated initially. Genisis2 uses browser-based Windows Authentication to authenticate the login of this user and then uses Genisis2 Roles to allow access to parts of the Genisis2 application. User Roles are managed in a separate Genisis2 Open LDAP server like other Million Veteran Program (MVP) applications. If a user does not have a role within Genisis2, they cannot proceed beyond the login page. Genisis2 user types are utilized by the Genisis2 application to provide each user with certain functionality, depending upon their role. For example, a user is recognized as a Researcher, Genisis2 Manager, VINCI Manager, or Genisis2 System Administrator, and are afforded different levels of functionality within the application.

Errors relating to Authentication and Authorization may lead a user to the VA LDAP, since that group manages the Username/Password authentications for Genisis2. EO or the appropriate VA LDAP help desk would be the authorities that address these errors through the use of Tier 1 and Tier 2 support procedures currently in place.

#### Logical and Physical Descriptions

Genisis2 Data Request Workflows: Refer to Figure 1 for the Genisis2 server architecture diagram.

The Webserver consists of Apache running on RHEL. It employs Angular JS as the User Interface (UI) framework.

The Wildfly Application Server runs on RHEL. It supports two main components: the Application Code in Java and the Java Business Process Management (JBPM) engine.

The Database Server runs Microsoft Windows 2008 R2 and hosts a Microsoft SQL server 2012. The Genisis2 Databases are hosted here.

Genisis2 Terminology Service: Refer to Figure 2 for the Genisis2 Terminology Service server architecture diagram.

The Webserver consists of Apache running on RHEL. It employs Angular JS as the User Interface (UI) framework.

The Tom Application Server runs on RHEL. It supports multiple main components: the Application Code in Java, Jena/Fuseki, and SOLR servers.

The Database Server runs Microsoft Windows 2008 R2 and hosts a Microsoft SQL server 2012. The Genisis2 Terminology Service databases are hosted here.

## Dependent System(s)

Genisis2 acquires the usernames/passwords and other user details from the VA LDAP system. Genisis acquires the user roles from the Genisis2 Open LDAP server. Genisis2 is dependent upon the VA LDAP and is in programmatic communication with it automatically.

Errors/troubleshooting are handled by the appropriate VA LDAP and Genisis2 help desks.

## Troubleshooting

The step by step process for troubleshooting when the system is not up and the users not able to log in:

#### Genisis2 Data Request Workflows:

* + 1. Ensure that the Apache and Wildfly servers are up and running.
    2. Ensure that the correct configuration files are present in each server and are pointing to the correct end points.
    3. Ensure that the firewall ports are open and the servers can communicate with each other.
    4. Ensure that the SQL server is up and running and correct access credentials are present (edited).
    5. Ensure that SQL server user has adequate database permissions for CRUD operations.

#### Genisis2 Terminology Service:

1. Ensure that the Apache and Tomcat servers are up and running.
2. Ensure that the correct configuration files are present in each server and are pointing to the correct end points.
3. Ensure that the firewall ports are open and the servers can communicate with each other.
4. Ensure that the SQL server is up and running and correct access credentials are present (edited).
5. Ensure that SQL server user has adequate database permissions for CRUD operations.

## System Recovery

EO manages the servers for the Genisis2 application. Standard system recovery processes currently in place should be used for bringing the systems back online. If all servers are back online, then Genisis2 services are also restored. Genisis2 application components communicate using REST calls and were configured and tested with these calls.

### Restart after Non-Scheduled System Interruption

Since EO manages the servers for the Genisis2 application, standard system recovery processes currently in place should be used for bringing systems back online after a non-scheduled system interruption.

### Restart after Database Restore

Since EO manages the servers for the Genisis2 application, standard system recovery processes currently in place should be used for bringing systems back online after a database restore operation.

### Back-out Procedures

The back-out procedures for the Application Server and the Webserver are as follows:

#### Genisis 2 Data Request Workflows:

* + - * Wildfly Application Server: Delete the Wildfly War file from deployment directory.
      * Apache Webserver: Delete all contents under /var/www/html/.

#### Genisis 2 Terminology Service:

* + - * Wildfly Application Server: Delete the Tomcat file directory from deployment directory.
      * Apache Webserver: Delete all contents under /var/www/html/.

### Rollback Procedures

Release 1 will be running on the PRE-PROD environment with the database frozen as of the date of Release 2. Follow the installation procedures for Release 1 on the PROD environment. Copy the Release 1 Database from the PRE-PROD database server to the PROD server. This will rollback Release 2 to Release 1 on the PROD production servers. Restart services on the PROD machines. Release numbers 1 and 2 are used here to illustrate how roll back is done. In general, it will be Release N and Release N-1, where N is the current release.

# Operations and Maintenance Responsibilities

|  |  |
| --- | --- |
| **Service** | **Group** |
| **Application Administration** | Genisis2 Sustainment Team |
| **Application Testing** | Genisis2 Development Team; after the warranty period, Genisis2 Sustainment Team |
| **Application Installation** | Genisis2 Development Team; after the warranty period, Genisis2 Sustainment Team |
| **Application Architecture** | During development, the Genisis2 Application Architect; after the Warranty Period, Genisis2 Sustainment Team |
| **Asset Management** | Genisis2 System Administrator (SA) |
| **Desktop/Client Support** | Dr. Saiju Pyarajan, Business Owner Paul Hsieh, Genisis2 Sustainment PM |
| **Linux Systems Administration** | Genisis2 Linux SA Team |
| **Windows Systems Administration** | Genisis2 Windows SA Team |
| **Capacity Management** | Genisis2 Linux SA Team Genisis2 Windows Team |
| **Release Management** | Genisis2 Development Team; after the warranty period, Genisis2 Sustainment Team |
| **Project Management** | Kim Nix, Genisis2 PM  Paul Hsieh, Genisis2 Sustainment PM |
| **Storage Management** | Genisis2 SA |
| **Security Management** | Genisis2 Sustainment Team |
| **Database Administration** | Genisis2 SA/Database Administration Team |
| **Network/Infrastructure Administration** | Pittsburgh Infrastructure/Networking Team |

# Approval Signatures

REVIEW DATE: SCRIBE:

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### Template Revision History

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| --- | --- | --- | --- |
| **Date** | **Version** | **Description** | **Author** |
| March 2016 | 1.6 | Updated to remove PMAS references and to include VIP references.  Eliminated unnecessary text and most instances of passive voice. | Wichita VIP Release Process Team |
| June 2015 | 1.5 | Updated cover and edited for Section 508 conformance and remediated with Common Look Office tool | Process Management |
| May 2015 | 1.4 | Revised content by PMAS Process Improvement Lockdown and reordered cover sheet to enhance SharePoint search results | Process Management |
| November 2014 | 1.3 | Updated Section 4 for url change to the Operations and Maintenance Responsibility Matrix | Process Management |
| December 2013 | 1.2 | Correction to headings | Process Management |
| March 2013 | 1.1 | Formatted to documentation standards and edited for Section 508 conformance | Process Management |
| January 2013 | 1.0 | Initial Document | PMAS Business Office |