Department of Veterans Affairs

Automated Surgical Risk Calculator (ASRC)

System Administrator Guide



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# System Business and Operational Description

The Automated Surgical Risk Calculator (ASRC) Tool is used at the time the patient is considered for surgical referral by a primary care provider, and when a surgeon is requesting a surgery. This Tool will support clinical decision-making regarding perioperative risk (includes preoperative, intraoperative, and postoperative).

Providers will verify patient-specific data that is automatically pulled from available data sources, enter remaining fields, and be provided with a real-time individual risk calculation of perioperative surgical mortality based on historic Veterans Affairs Surgical Quality Improvement Program (VASQIP) data and current VASQIP risk-adjusted models that are specialty-specific. The data entered and the calculated results will be available for viewing in the Computerized Patient Record System (CPRS) as a progress note. The data will also transfer and store as discrete fields in Veterans Health Systems and Technology Architecture (VistA) and a Structured Query Language (SQL) database for use by the National Surgery Office (NSO).

This document accompanies the prototype of the Tool developed as a VA Innovation project. Much of the content in a standard Production Operations Manual is not applicable to a prototype and is therefore outside the scope of this document.

## Logical System Description

The system consists of only one logical component, the ASRC Web Application. This component interfaces with other systems such as VistA.

There is an associated VistA Surgery patch to support ASRC but VistA Surgery is not considered a component of the system for the purposes of this document.

See the ASRC Technical Manual for more information.

## Software Description

The ASRC Web Application is a Java Enterprise application running on Glassfish 3, a Java Enterprise Edition (Java EE) Application Server. It uses MySQL as the backend relational database. The target host operating system is Windows Server 2012 R2.

See the ASRC Technical Manual for more information, including the specific versions of the above software components.

### Background Processes

The only background processes that run as part of the system are provided by the off-the-shelf software, namely:

* The Glassfish Server
* The MySQL Server

### Job Schedules

The system has no associated periodic jobs.

### Dependent Systems

The systems on which the ASRC system depends are depicted below:



Figure 1 - Dependent Systems

VistA is required for normal operation of ASRC.

The *National ASRC Results Database* could be considered part of the ASRC system itself, but other users access the database so it is depicted separately.

# Routine Operations

This section describes at a high level what is required of system administrators and other Information Technology (IT) support staff to maintain the system at an operational and accessible status.

## Administrative Procedures

### System Start-up

No manual action must be taken to start ASRC beyond simply booting the host web server. All services are configured to start automatically.

### System Shut-down

To shut down the ASRC system, simply shut down the host web server.[[1]](#footnote-1) Since any user operations in progress will be lost, ensure that no users are accessing the system when it is shut down.

### Back-up & Restore

As a prototype, no back-up procedures, restore procedures, or backup testing procedures have been created. If the system is to be used in production, backup and restore procedures will be necessary for the SQL database. Backup procedures may be desired for the GlassFish server logs and configuration, but restore procedures are not necessary. No other system components store dynamic data.

## Security/Identity Management

All external interaction with the system occurs through the Java Web Application. Security in the Web Application is provided by the Spring Security Framework[[2]](#footnote-2). All authentication and authorization are performed on HyperText Transfer Protocol (HTTP) requests. (No method-level security is applied.)

See the ASRC Technical Manual for more information on the system’s security.

### Identity Management

As described in the ASRC Technical Manual, there are two distinct groups of users: clinical users and administrative users. A user cannot belong to both groups. These user groups access distinct parts of the application and authenticate using different methods, as shown in the below table.

Table 1 - User Group Authentication and Authorization

| User Group | User Store | Authentication Method | Authorized to Access |
| --- | --- | --- | --- |
| Clinical Users | VistA (NEW PERSON file) | VistA Access/Verify Codes or Clinical Context Object Workgroup (CCOW) | Risk Calculations |
| Administrative Users | Static application configuration | Username and Password | Risk Model Administration and Administrative Reports |

As shown, VistA provides user accounts for clinical users and the standard procedures should be followed to add new users and deactivate users. For a user to be authorized to access the Tool, however, he or she must be granted the SR ASRC menu option as a Secondary Menu Option in VistA. Removing this Secondary Menu Option from a user denies access to the Tool. See the ASRC Installation Guide for more information.

Administrative users, on the other hand, are currently listed in static application configuration. Administrative users may therefore be created and deleted by modifying the application configuration (specifically the Spring Application Context Extensible Markup Language (XML) file, applicationContext.xml). This configuration mechanism, however, is only appropriate for the prototype, so if more administrative users must be added, then the Tool should be enhanced to rely on a more sophisticated user store.

### Access control

The Tool does not support any detailed access control. All clinical users granted the SR ASRC menu option may access the risk calculation functionality of the Tool and all existing administrative users may access administrative functionality.

## System Monitoring, Reporting & Tools

This section describes the high-level approach to system monitoring.

The following diagram depicts the tools available for monitoring the system.



Figure 2 - Available Tools for Monitoring ASRC

### Monitoring Tools

The best methods of monitoring the ASRC system are JConsole (provided with the Java Development Kit [JDK]), the Glassfish Administration Console, and the GlassFish log file.

#### Monitoring with JConsole

The JDK includes a monitoring tool called JConsole, which connects to a running Java Virtual Machine (JVM) via Java Management Extensions (JMX). JConsole provides graphs of the JVM memory and thread statistics as well as a low-level view of various Management Beans (MBeans) provided by the JVM and Glassfish.

To monitor ASRC via JConsole:

1. Open a Remote Desktop connection to the target ASRC Web Server.
2. Run %JAVA\_HOME%\bin\jconsole.exe.
3. Find the line in server.log (see Primary Application Log) the prints the JMX Uniform Resource Locator (URL), e.g.:  
     
   [#|2015‑03‑26T17:35:41.565+0000|INFO|glassfish3.1.2|javax.enterprise.system.jmx.org.glassfish.admin.mbeanserver|\_ThreadID=65;\_ThreadName=Thread-2;|JMX005: JMXStartupService had Started JMXConnector on JMXService URL service:jmx:rmi://10.146.174.8:8686/jndi/rmi://10.146.174.8:8686/jmxrmi|#]
4. Enter the JMX URL (in bold above) into the Remote Process text box.
5. Enter admin into the Username box.
6. Enter the configured password into the Password box. (This was configured during server installation, see the ASRC Installation Guide.)
7. Click Connect.

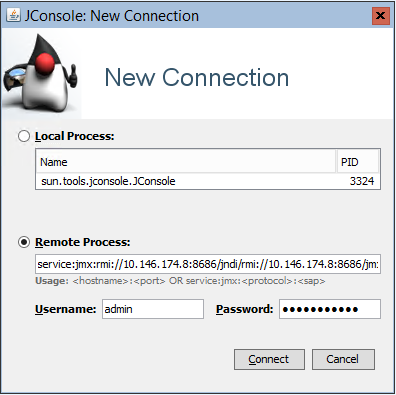


Figure 3 - Connecting via JConsole

A discussion of the various data available via JConsole is out of the scope of this document. For more information, see Oracle’s Using JConsole[[3]](#footnote-3).

#### Monitoring via the GlassFish Administration Console

The GlassFish Server Administration Console provides a browser interface for configuring, administering, and monitoring GlassFish Server.

To access the console:

1. Open a Remote Desktop connection to the target ASRC Web Server.
2. Open Internet Explorer and navigate to <http://localhost:4848/>. (Although this is a web interface, it is only accessible from localhost.)
3. Enter credentials.
   1. *User Name*: admin
   2. *Password*: the password configured during installation.
4. Click *Login*.
5. On the left navigation bar, click *Server (Admin Server)*.
6. On the top tab bar, click *Monitor*.
7. Various monitoring data are available on the sub-tabs.

Note that, although GlassFish provides many monitored points, not all monitoring is enabled out-of-the-box. See the GlassFish Administration Guide for information on enabling monitored points.

#### Monitoring via the Log Files

Log files are primarily useful for troubleshooting errors, but may also be monitored for error or warning messages to detect issues. See Section 3.2.1, Application Error Logs, below for information on accessing the logs.

##### Routine Log File Messages

Due to factors beyond the development team’s control, the system will sometimes emit error or warning log messages that do not indicate an operational issue and need no investigation. The following table lists these spurious errors and warnings.

Table 2 - Routine Log File Messages

|  |  |  |
| --- | --- | --- |
| Sample Log Message | Cause | Justification for Ignoring |
| [#|2015‑09‑03T15:59:03.434‑0400| SEVERE|glassfish3.1.2| gov.va.med.net.SocketManager|\_ThreadID=58;\_ThreadName=Thread‑2;|gov.va.med.vistalink.adapter.spi.VistaSocketConnection[mdi]gov.va.med.vistalink.adapter.spi.VistaLinkManagedConnection[]107.22.175.92[]8001[]1[]J2EE[fdi]2[mdi]2028  receiving data exception-> dataRead value: 0  java.net.SocketException: Connection reset  at [ stack trace omitted ]  |#] | VistALink logs this error whenever a connection to VistA is dropped. Note that the VistALink code which logs this error also throws an Exception which must be handled by calling code. | Since the calling code handles the exception (usually by reopening the connection), no action need be taken. Dropped connections occur regularly due to various network characteristics. This log message should probably be at info or debug level, but the development team does not have the ability to modify the level chosen by VistALink. |
| [#|2015‑09‑09T10:43:58.136‑0400| SEVERE|glassfish3.1.2| javax.enterprise.system.ssl.security.com.sun.enterprise.security.ssl.impl|\_ThreadID=97;\_ThreadName=Thread-2;|SEC5054: Certificate has expired: [  [  Version: V3  Subject: CN=GTE CyberTrust Root 5, OU="GTE CyberTrust Solutions, Inc.", O=GTE Corporation, C=US  [ remaining message omitted ] | One of the security certificates packaged with GlassFish 3 has expired. | The prototype does not use any security based on security certificates. This error may need to be resolved before the system can be used in production. |

### Availability Monitoring

As shown in Figure 1 - Dependent Systems, the system depends on the site VistAs and the relational database. Therefore, if the following components are operating correctly, then the system is fully operational and working correctly:

* The Tool itself, running on the GlassFish Application Server;
* The relational database; and
* All associated VistA instances (along with the VistALink connection to each).

The following procedure may therefore be followed to determine if the system is fully operational and working correctly.

1. Launch the Tool (e.g., from CPRS) as a clinical user at an associated VistA site.
2. Ensure the correct patient name and a list of possible specialties is displayed.
3. Repeat the above steps for each associated VistA site.

This procedure verifies VistA connectivity (used for authentication) and database connectivity (use to display the list of specialties).

### Performance/Capacity Monitoring

No performance or capacity monitoring has been designed as part of this prototype.

### Critical Metrics

No critical metrics have been identified as part of this prototype.

## Routine Updates, Extracts and Purges

The only routine maintenance defined for the ASRC system is a software update. No routine extracts or purges are required.

### Updating the ASRC Software

Use the following process to update the ASRC software deployed to a server.

1. Ensure no users are using the system.
2. Download the desired release zip file from the project’s GitHub repository (<https://github.com/VHAINNOVATIONS/ASRCM/releases/>).
3. Extract the zip file to any directory on the server accessible by your user. This unzipped directory will hereafter be referred to as the *Installation Files Directory*.
4. Build the srcalc.war application archive (see the ASRC Developer Guide) and transfer it to the server. Place it into the install directory in the *Installation Files Directory*.
5. If the update includes database schema changes, update the schema using specific instructions included with the release.
6. Using the same command prompt, execute: deploy.bat
7. Launch the application from CPRS as usual to smoke-test the deployment.

## Scheduled Maintenance

As ASRC is currently an innovation project and not in production, no scheduled maintenance is defined. A maintenance schedule should be defined before the system is in production.

## Capacity Planning

As ASRC is currently an innovation project and not in production, no capacity planning process is defined. A process should be defined before the system is in production.

# Exception Handling

This section gives a high-level overview of how system problems should be handled. It describes how system administrators and other operations personnel should respond to and handle problems. It also defines a boundary between the type of issues that are appropriate for system administrators to resolve and those that need escalation up the support structure.

## Routine Errors

Like most systems, ASRC may generate a small set of errors that may be considered routine in the sense that they have minimal impact on the user and do not compromise the operational state of the system. Most of the errors are transient in nature and only require the user to retry an operation. The following subsections describe these errors, their causes, and what, if any, response an operator needs to take.

While the occasional occurrence of these errors may be routine, getting a large number of an individual error over a short period of time is an indication of a more serious problem. In that case the error needs to be treated as an exceptional condition.

### Security Errors

The only routine security error that a user may encounter is a failed login. Most users will authenticate via Single Sign-On (SSO), but if SSO is unavailable users must authenticate by entering their access and verify codes. Entering the wrong codes will result in a failed login and the user should simply check and re-enter his or her credentials.

As stated above, however, a large number of failed logins may indicate a communication issue with VistA. See Section 3.3 below for more information on VistA communication issues.

### Time-outs

The only routine time-out error that a user may encounter is a session time-out. The GlassFish server has a configurable session time-out (default 30 minutes). If a clinical user starts a calculation but, part way through, performs no action for the time-out period, he or she will encounter a “Session Timed Out” screen and must re-launch the application. Administrative users’ sessions may also time out but they will simply be prompted to re-authenticate before continuing their work.

Users may also encounter session time-outs when an application update is deployed because GlassFish times out all user sessions in this case.

### Concurrency

No routine concurrency errors have been identified for the system.

## 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 errors, conditions, or other issues.

### Application Error Logs

This section describes the applications error logging functionality, lists the locations of where they are stored and what, if any, special tools are needed to view the log entries.

#### Primary Application Log

The primary log file of the ASRC system is the Glassfish server log: C:\asrc\glassfish3\glassfish\domains\domain1\logs\server.log

Glassfish automatically rotates this log file when it reaches 2MB. Rotated files are named server.log\_*date*, which *date* is the date and time the log file was rotated. Ten rotated log files are retained.

All of these files are plaintext with newline-delimited log entries. Each entry has an associated level (e.g., SEVERE or INFO), and certain log entries may be suppressed if their associated levels are below the configured level. For example, if the configured log level is INFO, then a FINE-level log entry will be omitted from the log file. The configured level can be changed while the server is running using the GlassFish Administration Console. (See Monitoring via the GlassFish Administration Console above.)

See the *GlassFish Administration Guide*, chapter 7, for more information on the log files’ format and rotation.

#### Other Logs

MySQL and system services log to the Windows Event Log. These logs may be viewed with the Windows Event Viewer. MySQL logs to the Application log, other system services log to various other logs.

The ASRC system does not send logs or any kind of alarm messages to external systems.

## Dependent System(s)

The only system on which ASRC depends for normal operation is VistA. If VistA is inaccessible or behaving abnormally, the users may be able to launch the application but will receive an error mentioning the VistA interface. Note that one deployment of ASRC may communicate with multiple VistA instances, so ASRC may operate normally for some users but not for others.

To resolve VistA communication errors, contact the support team for the appropriate VistA instance.

## Troubleshooting

This section contains helpful information on troubleshooting the system that has been learned as part of the development and testing process, or from the operation of similar systems. The information is grouped into sub-sections based on visible symptoms.

### *HTTP Status 404*

If users receive an *HTTP Status 404* error upon launching the application, check the server log (see Primary Application Log) for any deployment errors.

The most common error is that the MySQL database server is not running. In this case, the server log will contain an exception such as:

org.hibernate.HibernateException: Connection cannot be null when 'hibernate.dialect' not set

To resolve, start the MySQL database server and restart the GlassFish server.

## System Recovery

The following subsections define the process and procedures necessary to restore the system to a fully operational state after a service interruption. Each of the subsections starts at a specific system state and ends up with a fully operational system.

### Restart after Non-Scheduled System Interruption

If the application crashes, simply restart the host web server by following the procedures in System Shut-down and System Start-up.

### Restart after Database Restore

Since no backup or restore procedures have been defined (see Section 2.1.3), no procedure for restarting the system after restoring from a database backup has been defined.

### Rollback Procedures

The MySQL Database Server automatically performs rollback procedures after a server crash and should bring the database to a consistent state. See Section 14.16.1 of the MySQL Reference Manual[[4]](#footnote-4) for more information on the crash recovery process.

1. Appendix A – Acronym Glossary

Table 3 - Acronym Glossary

| Acronym | Meaning |
| --- | --- |
| ASRC | Automated Surgical Risk Calculator |
| CCOW | Clinical Context Object Workgroup |
| CPRS | Computerized Patient Record System |
| HTTP | HyperText Transfer Protocol |
| IT | Information Technology |
| Java EE | Java Enterprise Edition |
| JDK | Java Development Kit |
| JMX | Java Management Extensions |
| JVM | Java Virtual Machine |
| MBeans | Management Beans |
| NSO | National Surgery Office |
| SQL | Structured Query Language |
| SSO | Single Sign-On |
| URL | Uniform Resource Locator |
| VASQIP | Veterans Affairs Surgical Quality Improvement Program |
| VistA | Veterans Health Systems and Technology Architecture |
| XML | Extensible Markup Language |

1. Both GlassFish and MySQL are configured as Windows Services, so they shut down cleanly when the operating system shuts down. Shutdown order is not guaranteed, thus the database may shut down before the application: hence the importance of ensuring no users are currently accessing the system. [↑](#footnote-ref-1)
2. <http://projects.spring.io/spring-security/> [↑](#footnote-ref-2)
3. <http://docs.oracle.com/javase/7/docs/technotes/guides/management/jconsole.html> [↑](#footnote-ref-3)
4. <http://dev.mysql.com/doc/refman/5.6/en/innodb-recovery.html> [↑](#footnote-ref-4)