RESOURCE AND PATIENT MANAGEMENT SYSTEM

ICE Forecaster

(BI)

Installation Instructions

Version 1.42.1.4
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Office of Information Technology
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Table of Contents

1.0   Release Notes

The HLN Consulting Immunization Calculation Engine (ICE) Forecaster is a Clinical Decision Support (CDS) engine built on the OpenCDS platform (http://www.opencds.org/) and provides immunization forecasting to health information systems.

Detailed technical information on how the ICE Forecaster works, release notes, and documentation can be found at https://www.hln.com/ice/.

The ICE Forecaster runs as an independent service that is used by the Indian Health Service (IHS) Resource and Patient Management System (RPMS) to get an evaluation of the immunizations and the next doses recommended for a patient.

The ICE Forecaster can be deployed locally, even on the same system where RPMS is installed. It can also be deployed centrally and accessed remotely if desired.

2.0   Requirements

The server where the ICE Forecaster will be installed must meet the following requirements:

1. Must be accessible from all systems where RPMS or RPMS EHR will be used to generate or view immunization forecasts.

2. Must have a supported Operating System: Windows Server 2012 or newer, or AIX 7 or newer.

3. Must have at least 2.5GB of system RAM available for ICE to use at all times.

> **Note**: This requirement is for available RAM, not total system RAM. If 32GB of RAM is installed in the server and 31GB of RAM could potentially be in use the server does not meet the minimum requirement.

2.1   Java

A supported version of Java is required. For information on installing Java see Section 3.0.

Supported Version:

- Oracle Java 1.8 64-bit
- OpenJDK 8 64-bit

2.2   Tomcat

A supported version of Apache Tomcat is required. For information on installing Tomcat see Section 3.0 Installing the ICE Forecaster.

Supported Version:

- Apache Tomcat 9 64-bit

2.3   Immunization Tracking System (BI)

BI version 8.5 patch 1003 or newer must be installed on the RPMS server.

3.0   Installation the ICE Forecaster

The ICE Forecaster requires a 64-bit installation of Java 1.8 or OpenJDK 8, and Tomcat webserver version 9. If you already have a functioning Tomcat9 installation it is recommended that you update it to the latest version by following the instructions in Section 8.0 Upgrading to a new version of Tomcat.

3.1   Confirm Java Version and Architecture

Before beginning the installation process, it is necessary to confirm that a supported version of Java is installed.

3.1.1   AIX

To check which version of Java JRE you have installed (if any), run the command shown in Figure 3-1.

```
# lslpp -L | grep "Java Runtime"
  Java7_64.jre        7.0.0.625   C    F    Java SDK 64-bit Java Runtime
  Java8_64.jre        8.0.0.536   C    F    Java SDK 64-bit Java Runtime
```

Figure 3-1: Verifying the Java version on AIX

The command output shows an installation of "Java8_64.jre", which is a 64-bit instance of Java 1.8. This system has a version of Java which meets the compatibility criteria for the ICE software.

If no compatible version of Java is found with the command above, it is recommended that AIX administrators follow the comprehensive instructions for locating Java versions provided by IBM for AIX systems at: https://www.ibm.com/support/pages/ibm-java-aix-faq-identifying-java-versions-and-java-installation-locations-aix-system

3.1.2   Windows

3.1.2.1   Oracle

The Java installation status can be checked by opening a command prompt and running the "java -version" command.

Java 1.8 64-bit installed:

```
C:\>java -version
java version "1.8.0_341"
Java(TM) SE Runtime Environment (build 1.8.0_341-b10)
Java HotSpot(TM) 64-Bit Server VM (build 25.341-b10, mixed mode)
```

Figure 3-2: Sample output of "java -version" command showing 64-bit installation of Java 1.8

In Figure 3-2 above, the installed version of Java is "1.8.0_341" and the third line of the output declares that it is a 64-bit installation, which satisfies all Java requirements for ICE.

Java 1.8 32-bit installed:

```
C:\>java -version
java version "1.8.0_341"
Java(TM) SE Runtime Environment (build 1.8.0_341-b10)
Java HotSpot(TM) Client VM (build 25.341-b10, mixed mode, sharing)
```

Figure 3-3: Sample output of "java -version" command showing 32-bit installation of Java 1.8

In Figure 3-3 above, the installed version of Java is "1.8.0_341", which satisfies the version requirement, but the third line does not indicate that this is a 64-bit installation. This is a 32-bit installation and does not satisfy the Java requirement for ICE.

Java 1.8 not installed:

```
C:\>java -version
'java' is not recognized as an internal or external command,
operable program or batch file.
```

Figure 3-4: Sample output of "java -version" command showing Java is not installed.

3.1.2.2   OpenJDK

Adoptium OpenJDK installs JDK instances to the following path by default:

- C:\Program Files\Eclipse Adoptium\

OpenJDK 8 versions will be contained in subdirectories of the above path and the folder name will start with "jdk-8.0".

3.2   Windows Installation

3.2.1   Step 1: Install Java

See Section 3.1 Confirm Java Version and Architecture to determine the current version and architecture of Java on the system, then proceed accordingly.

3.2.1.1   When Java 1.8 or OpenJDK 8 is not currently installed

To install Oracle Java version 1.8 on Windows:

1. Navigate to https://www.java.com/en/.

2. Click **Java Download**.

3. Ensure that the Java version queued for download includes "64-bit" in the title.

4. Click **Download Java**.

5. Run the downloaded file to install Java 1.8.

To install OpenJDK version 8 on Windows:

1. Navigate to
    https://adoptium.net/temurin/releases/?os=windows&arch=x64&version=8&package=jdk.

2. Click the button to download the .msi version.

3. Run the downloaded file to install OpenJDK 8.

3.2.1.2   When a 64-bit version of Java 1.8 or OpenJDK 8 is currently installed

A compatible version of Java is already installed, and installation may proceed atSection 3.2.2.

3.2.1.3   When a 32-bit version of Java is currently installed

Because ICE requires more system memory than a 32-bit version of Java can supply, it is necessary to ensure that a 64-bit installation of Java is available. Instructions on the process of updating from a 32-bit version of Java to a 64-bit version of Java can be found in section 7.0.

3.2.2   Step 2: Install Tomcat

Navigate to http://tomcat.apache.org/download-90.cgi.

Select the 32-bit/64bit Windows Service Installer.

Install the application, following all standard installation prompts. It is recommended that the default installation path be used.

3.2.3   Step 3: Update the Tomcat Configuration

Before installing the ICE Forecaster, it is necessary to modify the Tomcat configuration settings to ensure proper operation of Tomcat and ICE.

1. Navigate to the Tomcat/bin directory (by default this is **C:\Program Files\Apache Software Foundation\Tomcat 9.0\bin**).

2. Double-click the **Tomcat9w.exe** executable. Click **Yes** if the **User Account Control** box displays.

3. Select the **Java** tab.

4. If using OpenJDK, please ensure that the "Java Virtual Machine" path is pointing to the most recent version of OpenJDK installed on the system. The full path should be:
    C:\Program Files\Eclipse Adoptium\jdk-8.0[version]\jre\bin\server\jvm.dll
    Where [version] is the latest version of jdk-8.0 installed in the Eclipse Adoptium folder.

5. Update **Initial Memory Pool** to **256**.

6. Update **Maximum Memory Pool** to at least **2560**.

7. Select the **General** tab.

8. Change **Startup Type** to Automatic.

9. Click **Stop** (if not greyed out).

10. Click **Start**.

11. Click **OK** to save changes and exit.

3.2.4   Step 4: Install ICE Forecaster

The ICE Forecaster application is tested and packaged for deployment at IHS facilities by the IHS Office of Information Technology (OIT). This distribution contains scripts for automatically configuring the ICE Forecaster. Versions of the ICE distributed by HLN should not be directly used to install or update the ICE Forecaster as they will not function without additional configuration.

The installer must be run on the server itself, as the installer requires environment information from the system which will be serving the ICE Forecaster. It is not sufficient to run the installer on a workstation and install to a network location on the server.

Due to the very long file paths and names used by the ICE Forecaster it is necessary to place these files as close to the root of a drive as possible. The recommended location is **C:\ICE**.

To install ICE, use the following steps:

1. Create the directory **C:\ICE**.

2. Download the newest version of the ICE Forecaster installer from IHS File Transfer Protocol (FTP).

3. Right-click on the downloaded zip file and extract the contents to **C:\ICE**.

4. Navigate to **C:\ICE** and run the file **ICE Installation Manager.exe**. You may be asked to provide Tomcat's location to the installer if Tomcat was installed to a non-default location.

5. Click the **Install** button and follow the prompts. You will be asked to verify the install path to ensure it is correct. Close the application when the installation is completed.

3.2.5   Step 5: Installation Verification

Table 3-1: Installation Verification Steps

Completed?	Steps
☐	Java is installed
☐	Tomcat is installed
☐	Tomcat Configuration has been updated
☐	ICE Forecaster is installed

3.3   AIX Installation

Formatting Note: This section contains terminal snippets which include a shell prompt character at the beginning of each input line (#) (Figure 3-5).

```
# uname
  AIX
```

Figure 3-5: Terminal snippet example

The shell prompt character is intended to make clear which lines are console input and which are the output of console commands. When entering commands, or pasting commands into the terminal, this shell prompt character should be excluded.

Path Note: During the installation and configuration process there are several default paths which will be referenced. If using an existing installation which is placed in a different directory, or if you wish to install something to a different directory than the listed default, you may do so and replace all references to the default path in these instructions with the path where the resource is located on your system. Your Java JRE directory may vary depending on your Java version.

Default Paths:

- **Java 8 JRE:**   /usr/java8_64/jre
- **Tomcat 9:**   /usr4/tomcat9
- **ICE:**   /usr4/ice

3.3.1   Step 1: Install Java

To check which version of Java JRE you have installed (if any), run the command shown in Figure 3-6.

```
# lslpp -L | grep "Java Runtime"
  Java7_64.jre        7.0.0.625   C    F    Java SDK 64-bit Java Runtime
  Java8_64.jre        8.0.0.536   C    F    Java SDK 64-bit Java Runtime
```

Figure 3-6: Verifying the Java version

If Java is not installed, or the installed version is lower than Java 8, you can download the latest version from IBM at this link: https://www.ibm.com/support/pages/java-sdk-aix.

Once downloaded, install it with the commands shown in Figure 3-7 (the version number may vary):

```
# tar -xopf Java8_64.jre.8.0.0.536.tar
# installp -agXYd . Java8_64.jre
```

Figure 3-7: Java download commands

3.3.2   Step 2: Install and Set up Tomcat

3.3.2.1   Install Tomcat

Download the binary distribution of Apache Tomcat as a tar.gz from the following site: http://tomcat.apache.org/download-90.cgi.

Once downloaded, run the commands shown in Figure 3-8 to install Tomcat. If the Tomcat installer downloaded has a more recent version number than 9.0.87, please substitute the version number of your file for the below commands:

```
# gzip -d apache-tomcat-9.0.87.tar.gz
# tar -xopf apache-tomcat-9.0.87.tar
# mv apache-tomcat-9.0.87 /usr4/tomcat9
```

Figure 3-8: Tomcat extraction commands

3.3.2.2   Install Crontab Command

To prevent the Tomcat server and ICE application from encountering memory issues, it is necessary to restart Tomcat regularly. The following instructions will install a command in the crontab file that the AIX cron utility uses to run scheduled maintenance activities. The command will stop and then restart Tomcat every day at 2:00 a.m.

Note	The command is shown on multiple lines in this document due to space restrictions; this is a single command and should be fully entered (or copied and pasted into the terminal, excluding the terminal prompt #) before pressing the return key (Figure 3-9).

```
# echo "0 2 * * * /usr4/tomcat9/bin/shutdown.sh > /tmp/tomcat.out 2>&1 &&
/usr4/tomcat9/bin/startup.sh >> /tmp/tomcat.out 2>&1" >>
/var/spool/cron/crontabs/root
```

Figure 3-9: Scheduled maintenance command

Once completed, run the following command in Figure 3-10 to verify the command was added successfully.

```
# crontab -l | grep tomcat
0 2 * * * /usr4/tomcat9/bin/shutdown.sh > /tmp/tomcat.out 2>&1 &&
/usr4/tomcat9/bin/startup.sh >> /tmp/tomcat.out 2>>&1
```

Figure 3-10: Added successfully verification

3.3.2.3   Start Tomcat

To start the Tomcat application manually, run the following command (Figure 3-11).

```
# /usr4/tomcat9/bin/startup.sh
```

Figure 3-11: Manual start command

3.3.3   Step 3: Install the ICE Forecaster

The ICE Forecaster application is tested and packaged for deployment at IHS facilities by the IHS OIT. This distribution contains scripts for automatically configuring the ICE Forecaster. Versions of ICE distributed by HLN should not be directly used to install or update the ICE Forecaster as they will not function without additional configuration.

To install the ICE Forecaster, log in as root, go to the location where you have downloaded the file, and run the commands shown in Figure 3-12.

```
# mkdir -p /usr4/ice
# mv ICE_1.42.1.4.tar.gz /usr4/ice
# cd /usr4/ice
# gzip -d ICE_1.42.1.4.tar.gz
# tar -xopf ICE_1.42.1.4.tar
# chmod +x deploy_ice.sh
# ./deploy_ice.sh
```

Figure 3-12: ICE Forecaster install commands

The script will walk you through the installation process and will automatically configure the ICE application. If Tomcat was not installed to the default path the script will ask for the location of Tomcat. Once the installation has completed, restart Tomcat by running the commands in Figure 3-13.

```
# /usr4/tomcat9/bin/shutdown.sh
# /usr4/tomcat9/bin/startup.sh
```

Figure 3-13: Tomcat restart

3.3.4   Step 4: Installation Verification

Table 3-2: Installation Verification

Completed?	Steps
☐	Java is installed
☐	Tomcat is installed
☐	ICE Forecaster is installed

4.0   Updating the ICE Forecaster

4.1   Confirm a compatible version of Java is installed

The initial version of the ICE software released for IHS sites had a minimum memory requirement within the range available to 32-bit versions of Java, so 64-bit Java was not listed as a requirement. Recent versions of the ICE software now require more system memory than a 32-bit version of Java can supply.

If you have not already evaluated the version and architecture of Java present on the server running the ICE software to confirm you are running a 64-bit version of Java and Tomcat, follow the instructions in Section 3.1.

If it is determined that you do not have a compatible 64-bit installation of Java on the server, follow the instructions to update in Section 7.0.

4.2   Windows Update

1. Confirm the latest version of Tomcat9 is installed

    a. Search for "Tomcat" in Apps and Features and confirm that the installed version matches the latest version listed on the Tomcat9 website: https://tomcat.apache.org/download-90.cgi

    b. If your version is out of date, please follow the instructions in Section 8.0.

2. Download the newest version of the ICE Forecaster installer.

3. Extract the downloaded ICE installer zip to **C:\ICE**.

4. Navigate to **C:\ICE** and run the **ICE Installation Manager.exe** file.

5. The newest version available will already be selected. Click **Update** and follow the prompts. Close the application when the installation is completed.

4.3   AIX Update

4.3.1   Confirm that the latest version of Tomcat9 is installed:

Compare the version of Tomcat in the "RELEASE-NOTES" text file in your Tomcat directory against the latest release at the site:

https://tomcat.apache.org/download-90.cgi

If your version of Tomcat is out of date, please follow the instructions in Section 8.0.

4.3.2   Update ICE:

Log in as root, navigate to where you placed the latest version of ICE, and run the
following commands in Figure 4-1.

```
# mv ICE_1.42.1.4.tar.gz /usr4/ice
# cd /usr4/ice
# gzip -d ICE_1.42.1.4.tar.gz
# tar -xopf ICE_1.42.1.4.tar
# chmod +x deploy_ice.sh
# ./deploy_ice.sh
```

Figure 4-1: AIX update command

5.0   Security–Post-Update

The ICE updater will contain historical copies of previously installed versions as well as a backup of the ICE directory taken before each update. Under special circumstances, such as the discovery of critical security vulnerabilities in the libraries delivered with ICE, it may be necessary to delete all copies of updaters and backups prior to a specific release.

5.1   Log4Shell

In December 2021 Apache disclosed a critical remote code execution vulnerability in its Log4J library. Due to this, the following should be performed to remove ICE-related copies of the vulnerable files from your system:

1. Update to ICE version 1.33.1 or higher immediately.

2. Navigate to the ICE installer directory on your system (default location is "C:\ICE" in Windows or "/usr4/ice" on AIX).

3. Under the "**Backups**" folder:

    a. Delete all backups with a date prior to 2022-01-01.

4. Under the "**Updaters**" folder:

    a. Delete all updaters with a version number lower than 1.33.1.

5. Under the "**Config**" folder:

    a. Go into the "**1**" folder and delete the "**Decommissioned**" subfolder.

6.0   Validating the ICE Forecaster

Once the ICE Forecaster has been installed and Tomcat is running, it is recommended that the availability of the ICE Forecaster be verified by the following procedure:

1. Open any web browser.

2. To access the ICE test website, navigate to the following URL, replacing {server} with the name or IP of the server with ICE installed, and {port} with the port number that Tomcat is configured to use (default is 8080):

    {server}:{port}/iceweb

3. The ICE test website contains a list of patients, and for each patient there is a button to generate an immunization forecast (indicated in Figure 6-1). Click the far-right button on the default patient (named "Bare, Yogii") to generate a sample forecast.

Figure 6-1: ICE Test website

4. A page containing a grid of immunizations and forecast information for each immunization should display. If an error message displays instead of the immunization forecast page, then there is an issue with the ICE installation or configuration. If no error displays, then the ICE Forecaster has been installed and configured correctly.

5. The top of the forecast results page declares the version of the ICE forecaster. Ensure that this number matches the version which was just installed.
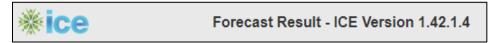

Figure 6-2: ICE version number in forecast result

7.0   Migrating from 32-bit JAVA to 64-bit JAVA

7.1   AIX

Due to the potential complexity of Java installations on AIX, a single process cannot be recommended for all systems. If you have confirmed that you only have a 32-bit installation of Java on an AIX server, please submit a support ticket for assistance.

7.2   Windows

7.2.1   Evaluate existing Tomcat applications

Migrating to 64-bit Java and Tomcat will require that existing Tomcat applications (if any) be backed up and restored after 64-bit Tomcat is installed.

Tomcat is a web server application which can serve many different applications, including applications not authored or supported by IHS. Any applications installed in your 32-bit Tomcat webapps directory (C:\Program Files (x86)\Apache Software Foundation\Tomcat 9.0\webapps) will be affected by migrating to 64-bit Java and Tomcat.

The following IHS-supported applications are considered in the migration process and can be safely migrated using this guide:

1. Immunization Calculation Engine (ICE)

2. Simple Message Mover (SMM)

Any other applications present in your Tomcat webapps directory should have their migration process evaluated by a system administrator before beginning the process of migrating to 64-bit Tomcat.

> **Warning**: Do not proceed until all applications in the Tomcat webapps directory have a known migration process. Once you begin the migration, any unmigrated applications will be rendered inoperable.

7.2.2   Back up Tomcat webapps directory

If Tomcat is already installed, it will be necessary to back up the currently installed Tomcat applications before proceeding. The following directory should be copied and stored in a safe location to be restored in Section 7.2.3 below:

- C:\Program Files (x86)\Apache Software Foundation\Tomcat 9.0\webapps

7.2.3   Install Java and Migrate Tomcat to 64-bit

1. Follow the Java installation process detailed in Section 3.2.1.1.

2. Uninstall Tomcat (if it is currently installed).

3. Follow the Tomcat installation process detailed in Section 3.2.2.

4. Now that a 64-bit version of Java is installed, the Tomcat installer will detect 64-bit Java and install the 64-bit version of Tomcat.

5. If Tomcat was installed previously, copy all files and folders in the webapps directory backed up in Section 7.2.1 above and paste them into the new 64-bit Tomcat webapps directory (C:\Program Files\Apache Software Foundation\Tomcat 9.0\webapps).

6. Stop the Tomcat service in the Services management panel.

7. Open the ICE installer directory (C:\ICE) and look for the file "tomcat.path". If this file is present, delete it.

8. Proceed with the ICE install or update process.

8.0   Upgrading to a new version of Tomcat

The process for upgrading to a new version of Tomcat is outlined sequentially below. Follow each step in the order it appears.

8.1   Stop the Old Version of Tomcat

Before the new version of Tomcat can be started, the old version must be stopped.

In Windows, stop the old Tomcat version's service in the Services management panel and set the service startup type to **Manual** to prevent it from starting automatically.

In AIX, go to the old Tomcat version's folder, enter the "bin" directory, and run the file **shutdown.sh**.

8.2   Uninstall the Old Version of Tomcat (Windows)

A new version of the Tomcat application cannot be installed on Windows until the previous version is removed. Please uninstall the application through the Windows "Apps and Features" utility before proceeding.

When prompted if you wish to "**Remove all files in your Apache Tomcat 9.0 Tomcat9 directory?**" select "**No**".

8.3   Install the New Version of Tomcat

Follow the instructions for installing and configuring Tomcat:

Windows: Sections 3.2.2 and 3.2.3.

AIX: Section 3.3.2.1.

8.4   Update ICE Updater Path

The ICE Forecaster installer tracks the location of Tomcat so updates can be applied to the correct location even if Tomcat is installed in a non-default location or multiple instances of Tomcat exist on the server.

To direct the ICE Forecaster installer/updater to the new Tomcat location, go to the ICE installer folder and replace the contents of the file "tomcat.path" with the path to the new Tomcat installation.

8.5   Run the ICE Installer

To install ICE to the new version of Tomcat, follow the instructions in Section 4.0.

8.6   Update the Cron Job (AIX Only)

In Section 3.3.2.2, an entry is created in the Crontab file to automatically restart Tomcat every night. When migrating to a newer version of Tomcat this must be updated to point to the new Tomcat version.

While logged in as root, enter the following command:

```
# crontab -e
```

Figure 8-1: crontab command

This will open the Crontab file for root in the default text editor. Update any references to the old Tomcat path to point to the new Tomcat version's location instead.

8.7   Start the New Version of Tomcat

In Windows, start the new Tomcat version's service in the Services management panel and set the service startup type to **Automatic**. If the service is already running, restart the service.

In AIX, go to the new Tomcat version's folder, enter the "**bin**" directory, and run the file **startup.sh**.

9.0   Troubleshooting

9.1   How to Check if Tomcat Is Running

You can determine if Tomcat is running by directing a web browser to the endpoint Tomcat listens on. Navigate to the following URL in your browser, replacing {server} with the name or IP of the server with ICE installed, and {port} with the port number that Tomcat is configured to use (default is 8080):

http://{server}:{port}

If the Tomcat default page displays, it confirms that Tomcat is running. If you receive an error page instead it suggests that Tomcat is not running, however it is also possible that Tomcat has encountered an issue which does not prevent it from starting, but which does prevent it from responding to requests (e.g., the port is in-use by a different process).

9.1.1   Windows

Open the Services management panel and locate the service whose name starts with **Apache Tomcat** (exact name will vary depending on version of Tomcat installed). If Tomcat is running the **Status** column will display **Running**.

9.1.2   AIX

Run the following command:

```
ps -ef | grep tomcat
```

Figure 9-1: grep tomcat command

If Tomcat is not running the output will contain only a single line for the grep command:

```
# ps -ef | grep tomcat
root 39846216  8454722   0 08:10:14 pts/70  0:00 grep tomcat
```

Figure 9-2: Single-line grep command–Tomcat is not running

If Tomcat is running the output will contain lines describing the Tomcat process:

```
# ps -ef | grep tomcat
root 28246284 36307204   0 07:50:27 pts/89  0:00 grep tomcat
root 43712896        1 331   Feb 23      - 4657:38
/usr/java8_64/jre/bin/java -Djava.utit
root 24183422        1   2 07:48:42 pts/89  0:18 /usr/java8_64/jre/bin/java
-Djava.util.t
```

Figure 9-3: Tomcat process

9.2   Tomcat Fails to Start

9.2.1   Check the Java Installation Path

If the Java installation path has been modified, Tomcat will be unable to start. This should not occur on AIX unless the Java installation is intentionally modified, so this section will focus on troubleshooting in Windows.

When the Java updater installs an update on Windows new versions are placed in a folder whose name contains the new version number, and the previous version of Java is uninstalled. Applications which are configured to use a previous version of Java will fail to launch until they are updated to look for Java in the new path.

9.2.1.1   Windows

The steps below will use the path for 64-bit Tomcat 9 and Java JRE 1.8 or OpenJDK 8. If the 64-bit Tomcat is installed it is highly recommended that only 64-bit versions of Java be used in conjunction with Tomcat. If your system has 32-bit Tomcat and 32-bit Java installed or a different Tomcat or Java version is installed (e.g., version 1.7) please make the appropriate substitutions to file paths.

1. Open the Tomcat configuration utility. For Tomcat 9 the default location is:

    C:\Program Files\Apache Software Foundation\Tomcat 9.0\bin\Tomcat9w.exe.

2. Select the **Java** tab and check the "Use default" checkbox at the top of the window. Click "**Apply**" to apply the change and attempt to start Tomcat.

    If Tomcat has not started successfully, uncheck the "**Use Default**" checkbox and change the **Java Virtual Machine** field to the path of the newest Java/OpenJDK version.

    For Oracle Java 1.8:
    Installations are stored in **C:\Program Files\Java**\. The full path should follow one of these patterns (depending on the type of Java installation your system has and if it is 32-bit or 64-bit). [release number] will depend on the release version of Java the system has updated to:

    C:\Program Files\Java\jre1.8.0_[release number]\bin\server\jvm.dll
    C:\Program Files\Java\jdk1.8.0_[release number]\jre\bin\server\jvm.dll

    C:\Program Files (x86)\Java\jre1.8.0_[release number]\bin\client\jvm.dll
    C:\Program Files (x86)\Java\jdk1.8.0_[release number]\jre\bin\client\jvm.dll

For OpenJDK:
Installations are stored in **C:\Program Files\Eclipse Adoptium**. The full path will be:
"C:\Program Files\Eclipse Adoptium\jdk-8.0.[version]\jre\bin\server\jvm.dll"

Where [version] is the latest version number you have installed.

9.2.2   Check if Tomcat Is Already Running

If Tomcat is currently running, a second process from the same Tomcat installation will not be able to be started. To determine if another instance of Tomcat is running follow instructions in Section 9.1.

9.2.3   Check Available Memory

When configured according to Section 3.2.3, Tomcat will require a minimum of 2.5 gigabytes of available RAM. If there is not enough available RAM Tomcat may fail to start and may lock up or encounter errors when trying to shut down.

9.2.4   Check the Port Availability

By default, Tomcat will bind to port 8080. If any other applications (e.g., other instances of Tomcat, IIS, Apache) are running which have bound to the port Tomcat uses, Tomcat will start and run; however, the ICE Forecaster will be unable to generate immunization forecasts.

9.2.4.1   Windows

At a command shell or PowerShell, run the command:

```
netstat -aon | findstr {port}
```

Figure 9-4: Port availability command

Where {port} is the port number Tomcat is configured to use.

If the output is empty, the port is free for Tomcat to use. If the port is already in use, the last column of the output will contain the PID of the process which is using the port.

```
C:\>netstat -aon | findstr 8080
TCP    0.0.0.0:8080            0.0.0.0:0             LISTENING       93984
TCP    [::]:8080               [::]:0                LISTENING       93984
```

Figure 9-5: Identifying the PID of the process

9.2.4.2   AIX

While logged in as root, run the command:

```
lsof -i :{port}
```

Figure 9-6: Port availability command

Where {port} is the port number Tomcat is configured to use.

If the output is empty, the port is free for Tomcat to use. If the port is already in use, the second column of the output will contain the PID of the process which is using the port.

```
# lsof -i :8080
COMMAND PID   USER    FD    TYPE DEVICE SIZE/OFF NODE NAME
java    981 tomcat   56u   IPv4  25141      0t0  TCP *:http-alt (LISTEN)
```

Figure 9-7: Identifying the PID of the process

9.3   Tomcat Is Running but Immunization Forecasts Cannot Be Generated

To verify that the ICE Forecaster is running, please follow steps outlined in Section 5.0.

If ICE is not running, please restart Tomcat. If the issue persists, please open a support ticket for further assistance.

10.0   Default Paths and Names

This section contains the file names and default paths for ICE, Tomcat, and Java. These may be referenced to quickly locate a path or file.

10.1   Windows

Table 10-1: ICE

Item	Default Path
Distribution File	ICE 1.42.1.4.zip
Installer Folder	C:\ICE
Installer Executable	ICE Installation Manager.exe

Table 10-2: Tomcat

Item	Default Path
Install Folder	C:\Program Files\Apache Software Foundation\Tomcat 9.0
Config Executable	Tomcat9w.exe

Table 10-3: Java

Item	Default Path
Install Folder	C:\Program Files\Java\

Glossary

Immunization Forecaster

A software that, when provided with patient disease and immunization history, provides a schedule of upcoming or due immunizations.

Resource and Patient Management System

A decentralized integrated solution for management of both clinical and administrative information in these healthcare facilities. Flexible hardware configurations, over 50 software applications, and network communication components combine to create a comprehensive clinical, financial, and administrative solution; a solution that can stand alone or function in concert with other components as needed. Professionals in American Indian, Alaska Native, and private sector health facilities use RPMS every day to efficiently manage programs, maximize revenue generation, and most important, to provide high-quality care for patients.

Tomcat Webserver

A web hosting software provided by the Apache Software Foundation used to host websites and web applications.

Acronym List

Acronym	Term Meaning
CDS	Clinical Decision Support
FTP	File Transfer Protocol
ICE	Immunization Calculation Engine
IHS	Indian Health Service
JRE	Java Runtime Environment
OIT	Office of Information Technology
RPMS	Resource and Patient Management System
SMM	Simple Message Mover
TCH	Texas Children's Hospital

Contact Information

If you have any questions or comments regarding this distribution, please contact the IHS IT Service Desk.

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