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1.0 Introduction

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/services/open-source/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 2GB of system RAM available for ICE to use at all times.

Note that 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.

Recommended Version:

Oracle Java 1.8

Other Functioning Versions:

OpenJDK 9

OpenJDK 8

2.2 Tomcat

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

Recommended Version:

Apache Tomcat 9

Other Functioning Versions:

Apache Tomcat 8

Apache Tomcat 7

2.3 Immunization Tracking System (BI)

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

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

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.

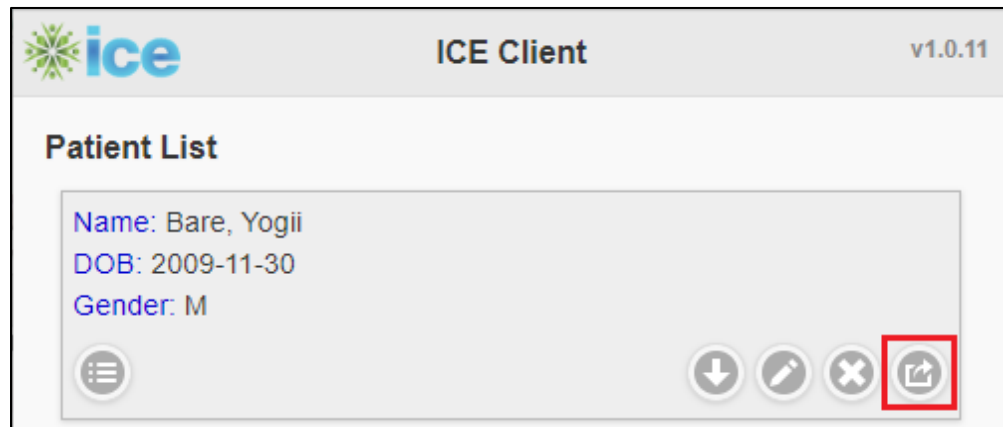


Figure 6-1: ICE test website

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.

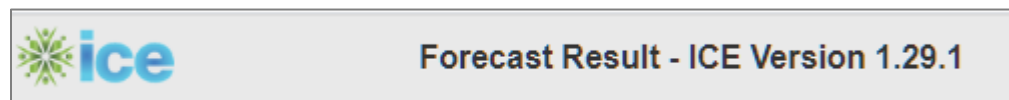


Figure 6-2: ICE version number in forecast result

7.0 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.

7.1 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**.

7.2 Install the New Version of Tomcat

Follow the instructions for installing and configuring Tomcat:

Windows: Sections 3.1.2 and 3.1.3.

AIX: Section 3.2.2.1.

7.3 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.

7.4 Run the ICE Installer

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

7.5 Update the Cron Job (AIX Only)

In Section 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 7-1: crontab command

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 8-7: Identifying the PID of the process

8.3 Tomcat Is Running but Immunization Forecasts Cannot Be Generated

To verify that the ICE Forecaster is running, please follow steps outlined in Section 6.0.

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

9.2 AIX

Table 9-4: ICE

Item	Default Path
Distribution File	ICE_1.33.1.tar.gz
Intermediate File	ICE_1.33.1.tar
Installer Folder	/usr4/ice
Installer Script	deploy_ice.sh

Table 9-5: Tomcat

Item	Default Path
Install Folder	/usr4/tomcat9
Config Script	setenv.sh

Table 9-6: Java

Item	Default Path
Install Folder	/usr/java8_64

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.

Phone: (888) 830-7280 (toll free)

Web: <https://www.ihs.gov/itsupport/>

Email: itsupport@ihs.gov