Delft-FEWS Hardware and software requirements - 2022.02

Introduction

Many clients wish to know what the hardware and operating system requirements are for a Delft-FEWS client-server system. On this page you can find a list of specifications. If you have any question about the list, or you do not see the operating system of your choice: please contact Delft-FEWS Support. This list is not exhaustive.

Delft-FEWS Supported release versions

All recent Delft-FEWS releases require 64-bit hardware and OS. Deltares supports at maximum 5 versions. If still running a no longer supported version it is strongly recommended to upgrade to a supported version.

release	release date	end of support
Delft-FEWS 2022.02	Feb 2023	when 2025.01 is released (approx. Q3 2025)

Central database

Central storage for operational Forecast data. One instance per Master Controller.

Minimum requirements

- Follow database vendor requirements for memory and CPU requirements.
- 4 GB RAM for the database server is required for a small FEWS instance with less than 5 users. 8 GB or more for larger systems.
- The database instance(s) can be hosted on an existing database server or cluster.
- See also Database connection count calculator

The Delft-FEWS client-server system is known to run with the following database versions:

Oracle

- Oracle 19c, 21c
- See https://support.oracle.com/knowledge/Oracle%20Database%20Products/742060_1.html

PostgreSQL

- PostgreSQL 11, 12, 13
- See https://endoflife.date/postgresql
- The maximum size for PostgreSQL database fields in Delft-FEWS is 1 GB. As a result all big files such as Module config files and ColdStates must respect this limit. WarmStates exceeding this size can be stored externally on the file system.

SQLServer

- MS SQL Server 2016 / 2019.
- Managed instances are possible, but In-Memory OLTP is required, see https://learn.microsoft.com/en-us/azure/azure-sql/in-memory-oltp-overview?view=azuresql.
- See https://endoflife.date/mssqlserver
- The maximum size for SQLServer database fields in Delft-FEWS is 2 GB. As a result all big files such as Module config files and ColdStates must respect this limit. WarmStates exceeding this size can be stored externally on the file system.

Delft-FEWS components

Operating Systems

Follow vendor guidelines for minimum requirements. The Delft-FEWS binaries require the x64 instruction set.

Linux

Red Hat Enterprise Linux (7 / 8), AlmaLinux 8

CentOS phased out and replaced by AlmaLinux

- Until 2020, CentOS Linux used to be our main choice as Red Hat Enterprise Linux alternative for Delft-FEWS installations on Linux. The CentOS Linux distribution provided a free and open-source community-supported computing platform, functionally compatible with its upstream source, Red Hat Enterprise Linux. CentOS Linux has proven to be very stable and reliable.
- In 2014 Red Hat took hold of the CentOS project and in 2020 Red Hat announced their decision that CentOS Linux is going to be phased out: CentOS 8 EOL in 2021 and CentOS 7 EOL in 2024. Red Hat will stop supporting CentOS Linux, but instead focuses its efforts on *CentOS Stream*. CentOS Stream is not based on Red Hat Enterprise Linux but on Fedora. We expect our Delft-FEWS RPMs to install fine on CentOS Stream. But since Fedora is mainstream development, in practice this means that CentOS Stream receives new features sooner. It can also lead to *more instability*. Red Hat says CentOS Stream is "not a replacement", but serves as *pre-phase* to Red Hat Enterprise Linux. We conclude for this reason CentOS Stream is well-suited for Delft-FEWS test servers but we cannot recommend it as the best Red Hat Enterprise Linux alternative for production servers.
- There are two well-know mainstream CentOS alternatives: AlmaLinux and Rocky Linux. They are functionally compatible with Red Hat Enterprise Linux and offer the same stability / benefits as CentOS used to provide. Both have successfully been granted secure boot validation by Microsoft since version 8.5. See also https://almalinux.org/ and https://rockylinux.org/.
- Because AlmaLinux is well-established, Deltares ICT and Delft-FEWS developers have chosen to support AlmaLinux for Delft-FEWS. AlmaLinux is a RHEL® fork since 2009 and is not owned by Red Hat / IBM but provided by CloudLinux OS.
- Our Delft-FEWS RPMs were always built and tested on CentOS 7. In the near future these will be primarily built and tested on AlmaLinux. Delft-FEWS on Red Hat Enterprise Linux remains fully supported.

Windows

Windows 8.1 / 10, Server 2012(R2), 2016, 2019.

JDK

JDK	remarks
Amazon Corretto 11 TLS	For Delft-FEWS components other than Tomcat and model adapters, there is no need to download the JDK since it is distributed as part of the binaries.

Master Controller Server

Server for workflow management, event processing, sending system alerts and cleaning up expired records. Synchronizes from other Master Controllers in multi-MC systems. Multi-MC systems are useful for redundancy and / or for cooperation between organizations.

Minimum requirements

- OS minimum +1 GB RAM (multi Master Controller systems +2 GB)
- OS minimum +1 CPU per Master Controller instance
- 10 GB free diskspace

Admin Interface

Web application for super-users for monitoring, system control and task scheduling.

Minimum requirements

- See Tomcat requirements - 2022.02 and before, +512 MB RAM.
- At least -Xmx512m
- Webbrowser with javascript and session cookies enabled.
- Load balancers must use sticky sessions.
- Supported browsers (recent version):
    - Chrome
    - Firefox
    - Edge

Support for external authentication (optional)

- oauth2

Config Manager

Used by the application manager to control the Delft-FEWS configuration in the central database. In multi Master Controller systems the Config Manager always operates on the primary Master Controller database.

- usable in Citrix
- no admin privileges required

Minimum requirements

- OS minimum +2 GB RAM
- OS minimum +1 CPU
- 20 GB free disk space

Support for external authentication (optional)

- Open ID Connect when using Database proxy.

Operator Client / Stand alone

Thick GUI client for end users. When connected to the central database it is referred to as the Operator Client. When operating on a local datastore without connecting to the central database, it is referred to as the Stand alone Client. Memory settings depend on number of locations and the size (relative view period) of the time series in calculations.

- usable in Citrix
- no admin privileges required

Minimum requirements

- OS minimum +2 GB RAM
- OS minimum +1 CPU
- 20 GB free disk space

Support for external authentication (optional)

- Open ID Connect when using Database proxy.

Forecasting Shell Server

Server for execution of forecast runs and import tasks.

Low duty / Heavy duty FSS Groups

It is good practice to categorize workflows on basis of cpu / memory requirements to specialized Forecasting Shell Server Groups. Simple import workflows often require less resources than heavy duty forecast models.

Minimum requirements

- OS minimum +2 GB RAM + model requirements
- OS minimum +1 CPU per FSS instance + model requirements
- 20 GB free disk space + model requirements

Database Proxy

Optional server for enabling http(s) access to the central database. Typically used in combination with a reverse proxy server. Typically used for connecting Operator Clients to the central database. Never used by the FSS. Sometimes used for ConfigManager / MC-MC synchronisation with external networks.

Minimum requirements

- See Tomcat requirements - 2022.02 and before, +1 GB RAM.
- At least -Xmx1024m
- Load balancers must use sticky sessions.

Support for external authentication (optional for OC / CM, not available for MC-MC synch)

- Open ID Connect (oauth2)

Delft-FEWS Web Services

Optional service which allows PI-REST clients to interact with and retrieve data from the Delft-FEWS system.

Minimum requirements

- See Tomcat requirements - 2022.02 and before, +1 GB RAM +1 CPU
- At least -Xmx1024m
- Preferably not on the same machine as the master-controller.

Deltares Open Archive

Minimum requirements

- Failsafe storage. Any RAID (https://en.wikipedia.org/wiki/RAID) with ample capacity will be sufficient.
- OS minimum +3 GB RAM.
- OS minimum +3 CPUs.
- See Tomcat requirements.
- Load balancers must use sticky sessions.
- Permissions for the file system containing archive data:
    - Must be accessible by the THREDDS server with read permissions.
    - Must be accessible by the Archive Server with full permissions.
    - Must be accessible by the Forecasting Shell Servers with write permissions.

Scalability and virtualisation

Scalability, number of servers

The components mentioned above can all be located on one (powerful) server or each on an individual machine, with all possible configurations in between. It is however common practice to separate the Forecasting Shell Server from the Master Controller Server. When using multiple machines it is essential that all machines have matching clocks. This can be achieved by making use of one and the same NTP server.

A typical configuration is:

- Database Server
- Master Controller server running Master Controller(s), Apache Tomcat for Admin Interface
- Forecasting Shell Server(s)
- Open Archive Server

Typically in a dual Master Controller setup every Master Controller has its own machine so that maintenance can take place without offline time.

Virtualization

It is very well possible to deploy the Delft-FEWS components in virtualized environments. The Deltares ICT team has most experience with Delft-FEWS on VMWare VSphere with in-depth knowledge but Delft-FEWS is also known to run on Microsoft Hyper-V. Virtualization of the Delft-FEWS back-end services can generally be done without problems. The Forecast modelling software determine requirements or limitations with respect to virtualization of the Forecasting Shell Servers.

Security

Read more about the shared responsibility model. >>

Security - Shared responsibility model for Delft-FEWS system installations

The Delft-FEWS server software historically was most commonly installed on-premise at the customer site on servers that were not directly connected to the internet. Nowadays, there are also more and more Delft-FEWS applications that are being deployed in the cloud. This means security standards and guidelines for the installation of live systems have become more critical than ever before. Delft-FEWS runs on top of a stack of components like 3rd party components: databases, Tomcat and an embedded JRE.

> *It is the primary responsibility of the customer to apply the latest security fixes to the OS, database, Tomcat and all other components.*

For updates for the embedded JRE it is recommended to contact Deltares. The role of Deltares is to supply guidelines and facilitate security best practices where possible. Deltares maintains a separate section on the WIKI especially for system and database administrators. To view these pages, personal credentials can be supplied. These pages contain highly detailed information for installing and upgrading Delft-FEWS, amongst others about security aspects. For the near future it is foreseen that more and more managed services from cloud providers (e.g. Tomcat, database) can be applied. All Delft-FEWS developers are security aware and evaluate the existing and potential vulnerabilities on a regular basis. Together with our colleagues from our ICT department they meet regularly to discuss (potential) improvements for each Delft-FEWS release.

Tomcat

Tomcat is required for the deployment of the Admin Interface, Database HTTPS Proxy, Fews Webservices and the Deltares Open Archive. Tomcat is installed and maintained by the customer organization. Deltares indicates which version of tomcat is compatible with / required for which version of Delft-FEWS. All security related aspects available in Tomcat can be applied and are under the responsibility of the customer organization.

> For Admin Interface clients / proxies that are exposed to the internet it is crucial that the highest stable release version of Tomcat with security fixes is used. This prevents exposure from common vulnerabilities and exposures (CVEs).
>
> For releases up to 2022.02, any tomcat9 version should be able to work for our Admin Interface / HttpProxy / PI Service / ArchiveServer web containers. This requires that the correct Java version matching the indicated JRE version for the Delft-FEWS release version is used and this Java version must be compatible with the Tomcat distribution.
>
> See http://tomcat.apache.org/security-9.html
>
> - Run Tomcat server as an unprivileged user and NOT root / Administrator.
> - Tomcat user has read-only permission to the contents of the `conf/`, `bin/`, and `lib/` directories in `${CATALINA_HOME.}`.
> - Limit the Tomcat user's access and permissions to only the needed directories and files work / temp / webapps / logs.
> - Uninstall all non-essential web applications in the `webapps/` directory, including the applications that come with Tomcat.

JRE/Java

In several components of Delft-FEWS a (stripped down) version of Java/JRE (Java Runtime Environment) is embedded. This JRE folder is a recognizable and standard part of the Delft-FEWS binary package for Operator Clients and Forecasting Shell Servers. This means that Deltares delivers an *optimized* (and minimal) Java Runtime Environment based on Amazon Corretto's series. This so-called base-build can be updated and Deltares will release new base-builds if required. Since the JRE folder is recognizable within the Delft-FEWS binaries, organizations may decide to replace this JRE folder in favour of another (compatible) version of the JRE. It is certainly possible to use a different provider (e.g. Oracle Sun or the openJDK). Replacing the JRE can be done by creating a soft link to the JRE directory or by replacing the JRE folder.

Local databases (Operator Client, Stand Alone)

In recent versions of Delft-FEWS there is no need for a local database (datastore) for an Operator Client (OC) in a client-server environment. Although it is still possible to have a 'fully synchronized' (local) database in an OC or to create a 'replicate' of the central database to continue working as a standalone (SA). There are two data formats available: Derby or Firebird. These are just *local files* (just like any other file on the file system) and they do not require any software installed for managing it. The Delft-FEWS Operator Client or Stand Alone application just reads from and writes to this database format. This mechanism cannot be used as a 'hub' to enter other server side components.

Central Database access

Delft-FEWS can be equipped with one of three common brands of central databases: Oracle, PostgreSQL or MS SQLServer. Access to the central database is required for several Delft-FEWS servers side components. These components are normally located behind the organization's firewall (same network) or in the secure domain of a data centre or cloud provider. Operator client access to this database is also required, but when set up from 'outside' the organization's network, a https (proxy) server (including IP whitelisting) should be in between. Deltares can provide this.

Forecasting Shells

1. The Delft-FEWS binaries folder should be made read-only.
2. Forecasting Shell Servers (FSS) should have limited permissions (rights). Only write access within their own directory.
3. Only provide access to the data feed shared folders for FSSs.
4. The account for *installing* should be different than the account *running* processes
5. When applying external simulation software, ensure the executables and other libraries have only permission to be run locally.

Operator clients

1. The Delft-FEWS binaries folder should be made read-only.
2. When using the optional JCEF browser, white-listing is used to grant access to webpages.

Multi-layered security approach

- The inner layer is the central database (and optionally Deltares Open Archive).
- The middle layer are Delft-FEWS components that communicate directly with the database using encryption.
- The third layer (optional) is a reverse proxy to the database that can be accessed externally.
- The outer layer is the bastion host (optional).

End-Of-Life of third party components

Deltares cannot support any release that is marked as end of life by the supplier. For a quick check whether a component is still supported:

category	product	external link to End-Of-Life schedules	security bulletin
Database	Oracle	https://www.oracle.com/support/lifetime-support/index.html, https://support.oracle.com/knowledge/Oracle%20Database%20Products/742060_1.html	https://www.oracle.com/security-alerts/
	PostgreSQL	https://endoflife.software/applications/databases/postgresql, https://endoflife.date/postgresql	https://www.postgresql.org/support/security/
	Microsoft SQL Server	https://support.microsoft.com/lifecycle/, https://endoflife.date/mssqlserver	https://docs.microsoft.com/en-gb/security/
Operating System	AlmaLinux	https://endoflife.date/almalinux	https://errata.almalinux.org/
	CentOS	https://endoflife.software/operating-systems/linux/centos, https://endoflife.date/centos	https://blog.centos.org/
	RedHat	https://access.redhat.com/support/policy/updates/errata/, https://endoflife.date/rhel	https://access.redhat.com/security/vulnerabilities
	Windows	https://support.microsoft.com/lifecycle/, https://endoflife.date/windows, https://endoflife.date/windowsserver	https://docs.microsoft.com/en-gb/security/
Java	java	https://www.oracle.com/support/lifetime-support/index.html	https://www.oracle.com/security-alerts/
	RedHat openjdk	https://access.redhat.com/articles/1299013	https://access.redhat.com/security/vulnerabilities
Webcontainer	Tomcat	http://tomcat.apache.org/whichversion.html	https://markmail.org/search/list:org%2Eapache%2Etomcat%2Eannounce