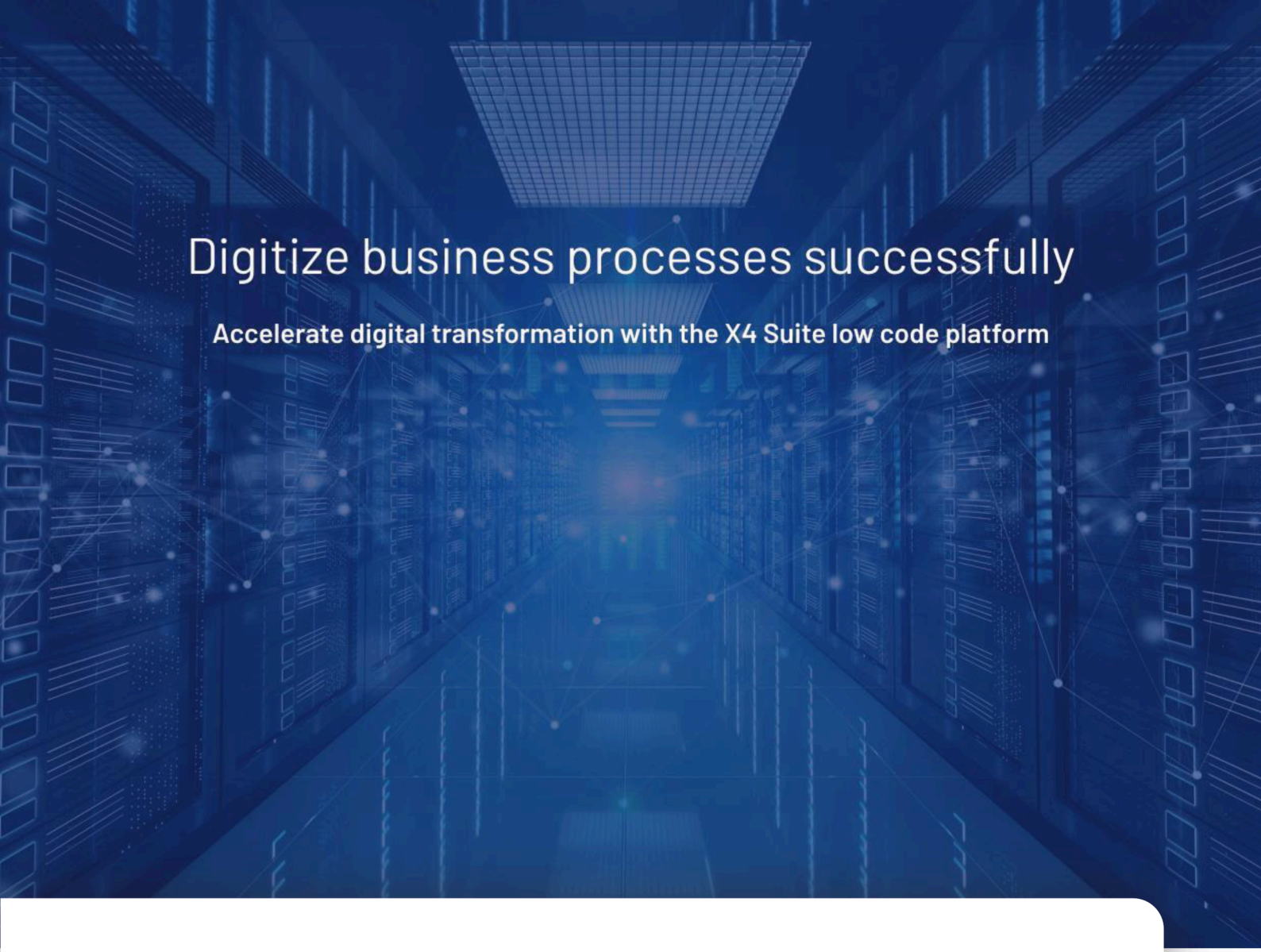
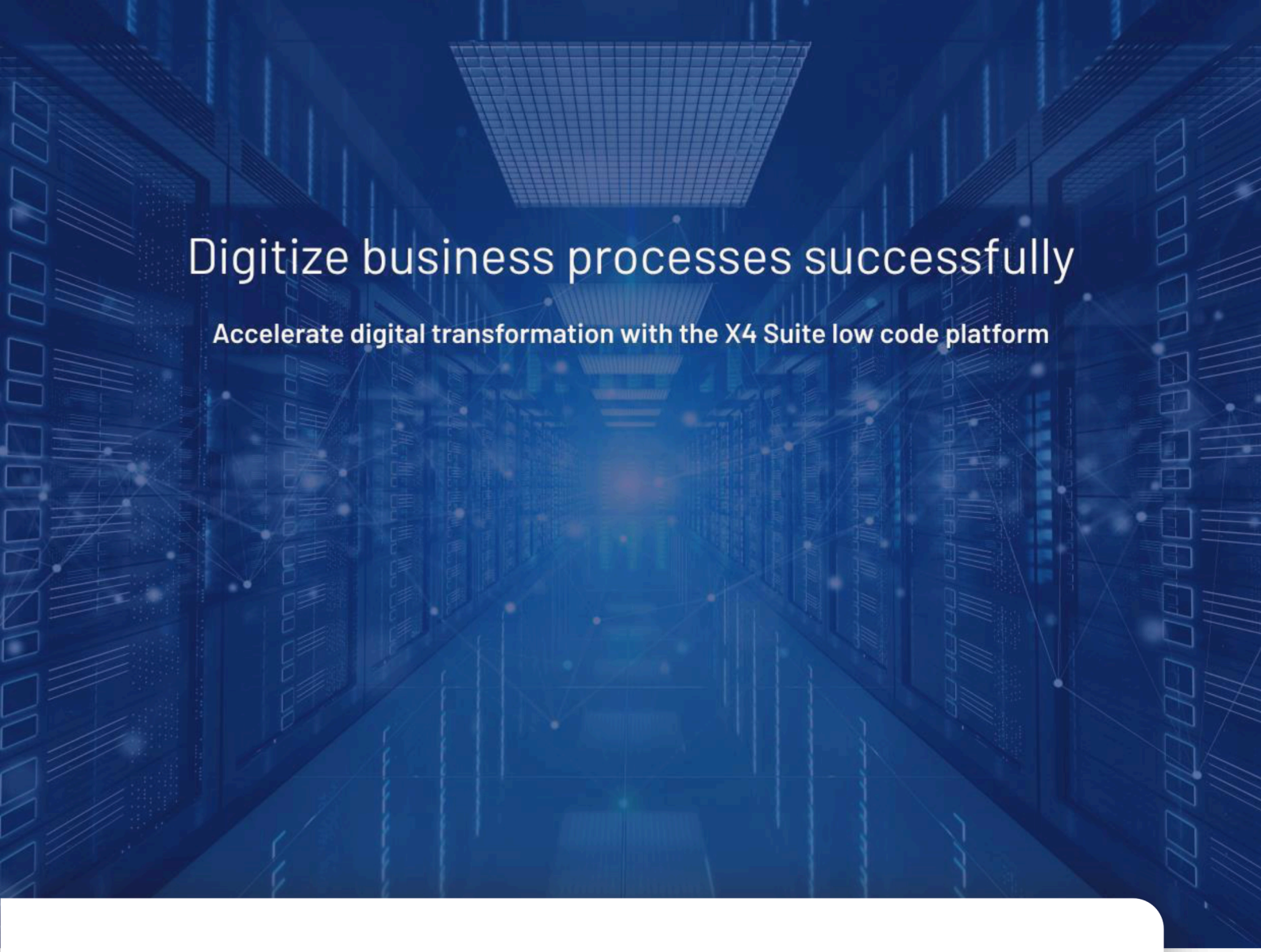


X4 Administration Guide

SoftProject



Digitize business processes successfully

Accelerate digital transformation with the X4 Suite low code platform

SoftProject

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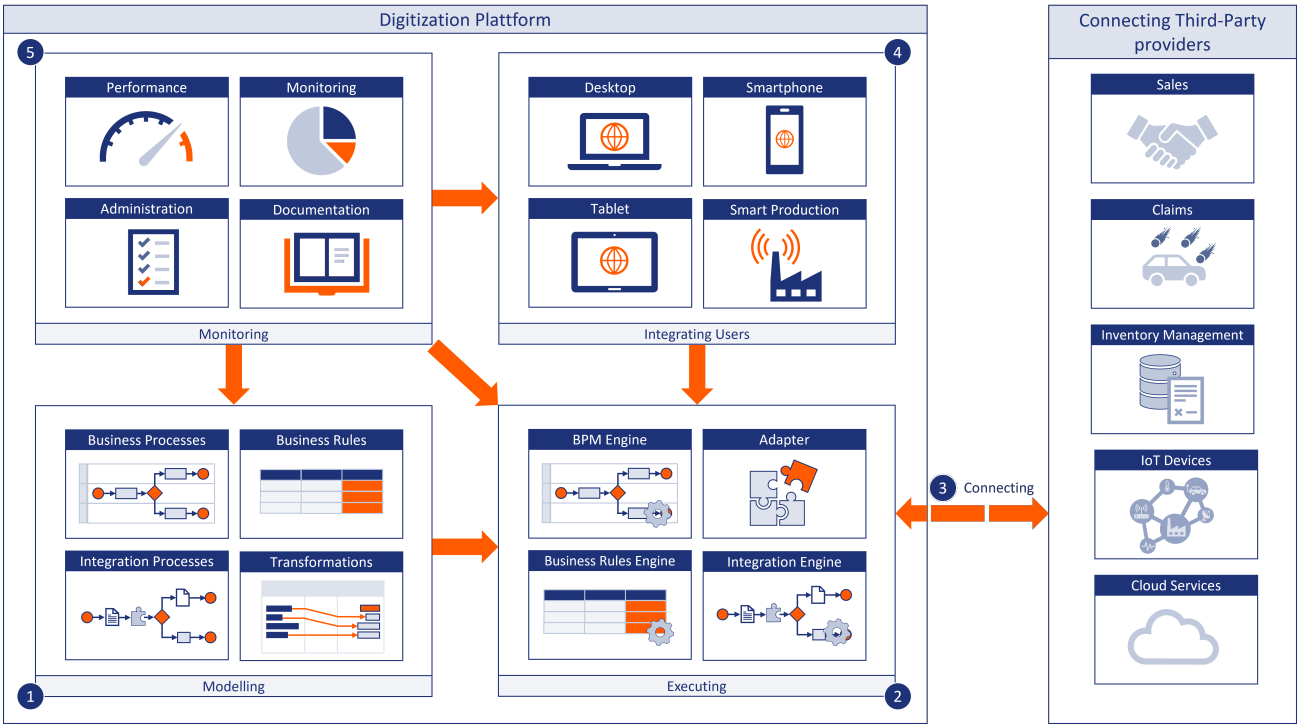
About the X4 BPMS

Digitalization requires a holistic approach, which presupposes that also the used solution has to reflect that. X4 BPMS supports you as a central platform in solving these challenges. The focus is on modeling, implementing and monitoring your business processes. Therefore, the X4 BPMS contains all necessary tools and is compatible with a variety of interfaces and formats. That helps to avoid isolated information silos and media breaks that inhibit productivity, and accelerate digitization at the same time.

Implementing business processes without programming effort enables a large number of users to enter into the management of business processes. That's important, since employees of the specialist department usually know best what is important in the respective business processes. Therefore, you should rely on the X4 BPMS as a platform whose tools reduce complexity to such an extent that business processes can be analyzed, optimized, modeled, as well as controlled and documented even without programming knowledge. All tools support integrated, graphical process modeling and implementation and generate processes that are executed by the X4 BPMS with high performance.

- **X4 Designer:** Modelling processes and rules graphically
- **X4 Server:** Simulating and executing processes and rules
- **X4 Adapter:** Integrating third-party systems into processes
- **X4 Activities**: Providing web apps for employees and customers



Who is the target group of this document?

This document targets administrators who want to install, configure and administer the X4 Server. In addition to detailed technical knowledge of the existing IT infrastructure, basic knowledge of Java EE, XML technologies and the application server is required.

1 Installation and Update

1.1 System requirements

X4 Server

Operating system	• Microsoft Windows Server 2012, 2012 R2, 2016, 2019 • SUSE Linux Enterprise Server 15, Red Hat Enterprise Linux 8, Ubuntu Linux 18.04 LTS, Debian GNU/Linux 10.1 • The X4 Control Center administration interface can be used cross-platform via browser. ⓘ • If you want to use the X4 Server in a different environment, do not hesitate to contact us for advice. • Only 64-bit operating systems are supported (x86_64). • For security reasons, a hardened configuration of the X4 Server is required to use the X4 Proxy Server. Do not hesitate to contact us for advice.

Platform	• **Runtime environment**: X4 Server is based on the Java 11 platform. Azul Zulu 11.0.11 is already included as runtime environment.
	• **Application server**: X4 Server uses an integrated WildFly application server in version 21.0.1.
	• **System database**: X4 Server requires a system database to manage runtime and authentication information. The following databases are supported:
	  • Oracle (11g, 12c, 18c, 19c)
	  • Microsoft SQL Server (2012 Service Pack 4, 2014 Service Pack 3, 2016 Service Pack 2, 2017)
	  • PostgreSQL (11.5, 12.0)
	
	ⓘ • If you have special requirements regarding the Java runtime environment or if you want to use an alternative application servers for customer-specific adaptations, do not hesitate to contact us for advice.
	• If you want to use the X4 Server with a different version of the above database management systems, do not hesitate to contact us for advice.

Hardware requirements	• At least 2 processor cores • At least 5 GB free hard disk space • At least 8 GB RAM ⓘ Starting with a number of 500 processes to be executed, we recommend a system with at least 8 processor cores and 16 GB main memory, which must be available exclusively for X4 Server.

Connectivity / Databases	More than 200 adapters are available to connect the X4 Server to your systems.
	
	• **Supported relational database systems:** All JDBC-compatible databases, e.g.
	  • Oracle Database
	  • Microsoft SQL Server
	  • IBM DB2
	  • PostgreSQL
	  • MySQL / MariaDB
	  • SQLite
	  • H2 Database
	• **Supported No-SQL database systems:**
	  • Apache Cassandra
	  • Elastic Search (Version 5)
	  • Mongo DB
	• **Supported cloud database systems:**
	  • Amazon S3 SimpleDB
	  • Amazon S3 DynamoDB
	  • Google BigTable
	  • Microsoft Azure Table Storage
	• More on request

X4 Web Apps

Operating system	X4 Activities-based web applications can be used cross-platform via browser.
Platform	Current browser (also mobile) with enabled JavaScript: • Google Chrome (from version 83.0.4103) • Mozilla Firefox (from version 68.9.esr) • Microsoft Edge (Chromium based / from version 83.0.478.45 • Apple Safari (from version 13.1) ⓘ Microsoft Internet Explorer and Microsoft Edge ("Project Spartan") are discontinued by Microsoft. Please switch to Microsoft Edge (Chromium-Based) or any other compatible browser.

X4 Designer

Operating system	• Microsoft Windows 8.1, 10 (from version 1803) • Microsoft Windows Server 2012, 2012 R2, 2016, 2019 • X4 Web Designer is cross-platform usable via browser. ⓘ • Only 64-bit operating systems are supported (x86_64). • Only Windows operating systems allowing the execution of desktop applications are supported. Core versions of Microsoft Windows Server are not supported. • Desktop virtualization solutions (e.g. Citrix XenDesktop or Citrix XenApp) are not officially supported. However, some customers are using X4 Designer in environments like these. Do not hesitate to contact us for advice.
Platform	**Runtime environment** X4 Designer is based on the Java 11 platform. AdoptOpenJDK 11.0.9.1 is already included as runtime environment.
	X4 Web Designer You can access X4 Web Designer via a current browser with enabled JavaScript: • Google Chrome (from version 83.0.4103) • Mozilla Firefox (from version 68.9.esr) • Microsoft Edge (Chromium based / from version 83.0.478.45 ⓘ Microsoft Internet Explorer and Microsoft Edge ("Project Spartan") are discontinued by Microsoft. Please switch to Microsoft Edge (Chromium-Based) or any other compatible browser.
Hardware requirements	• At least 2 processor cores • At least 2 GB free hard disk space • At least 8 GB RAM

1.2 Installing and updating the X4 Server

Here you will find information on how to install and update the X4 server.

⚠ Administrator permissions are required for the installation.

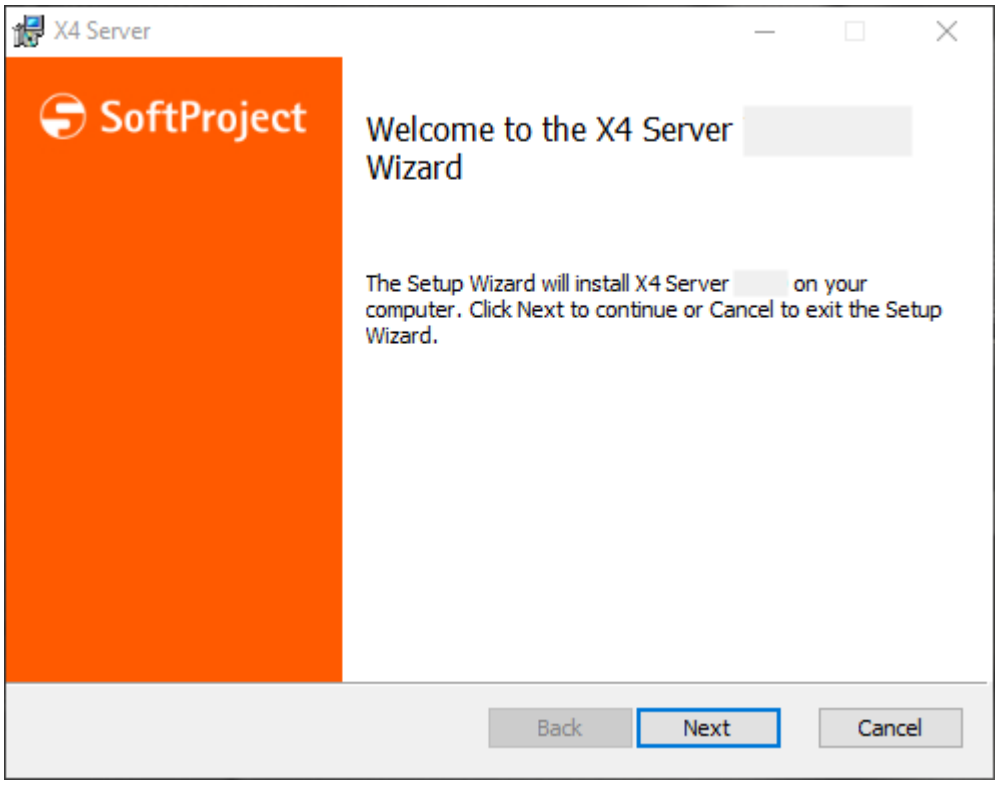
1.2.1 Installation and Update on Windows Systems

How to install and update X4 Server on Windows systems – if required also as NT service.

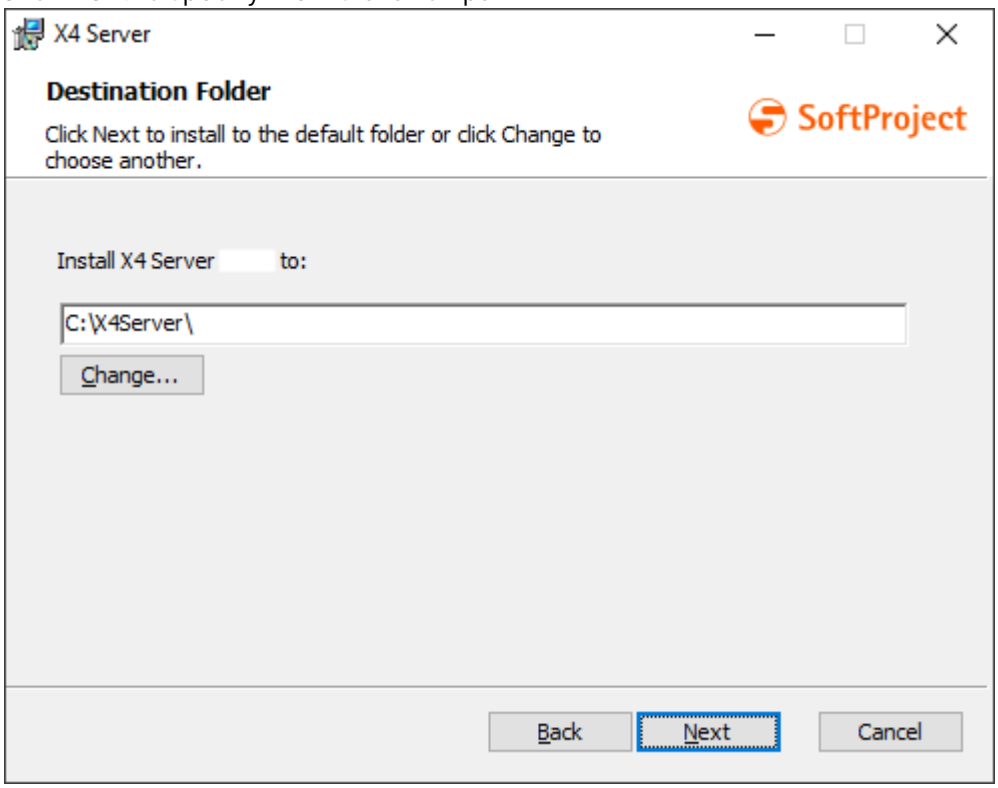
1.2.1.1 Installing X4 Server

1. Execute the installation package `X4ServerSetup_7.v.v_64bit.msi` provided by SoftProject with administrator rights or corresponding writing permissions.

   > Windows Defender SmartScreen issues a warning when starting the installation. Click **Further Information** (**Weitere Informationen**) and run the installation routine as usual with **Run anyway (Trotzdem ausführen)**.



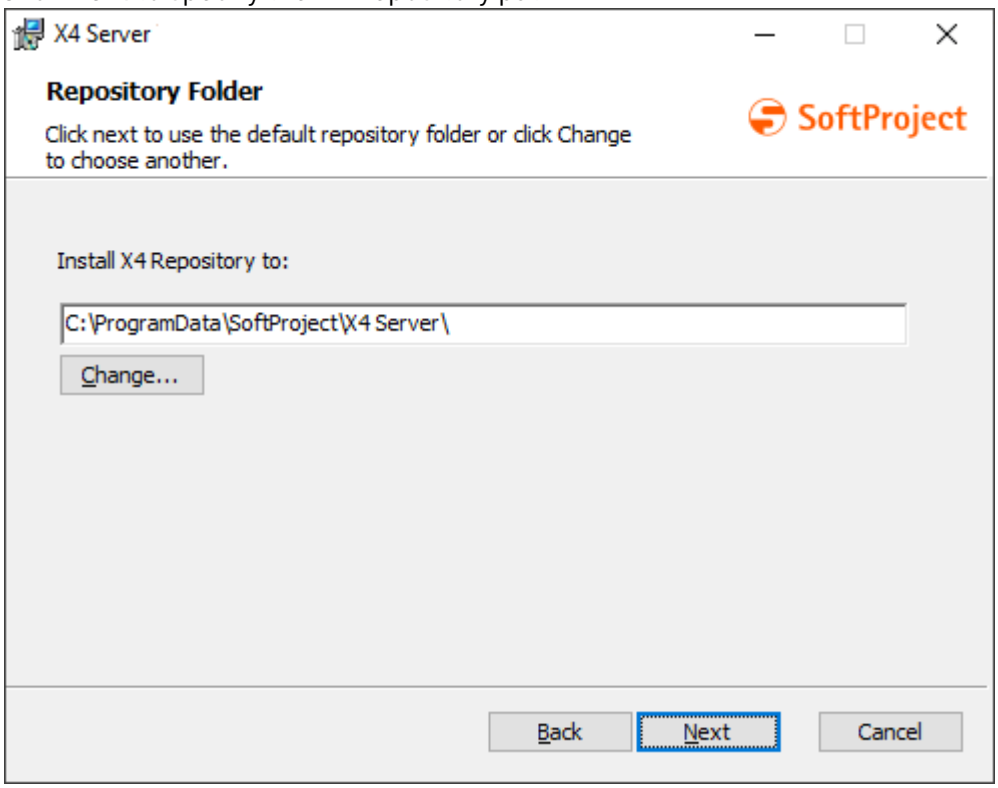
2. Click **Next** to specify the installation path.



X4 Server is installed under `C:\X4Server_7.v.v.\` by default. However, the path can be changed via **Change.**

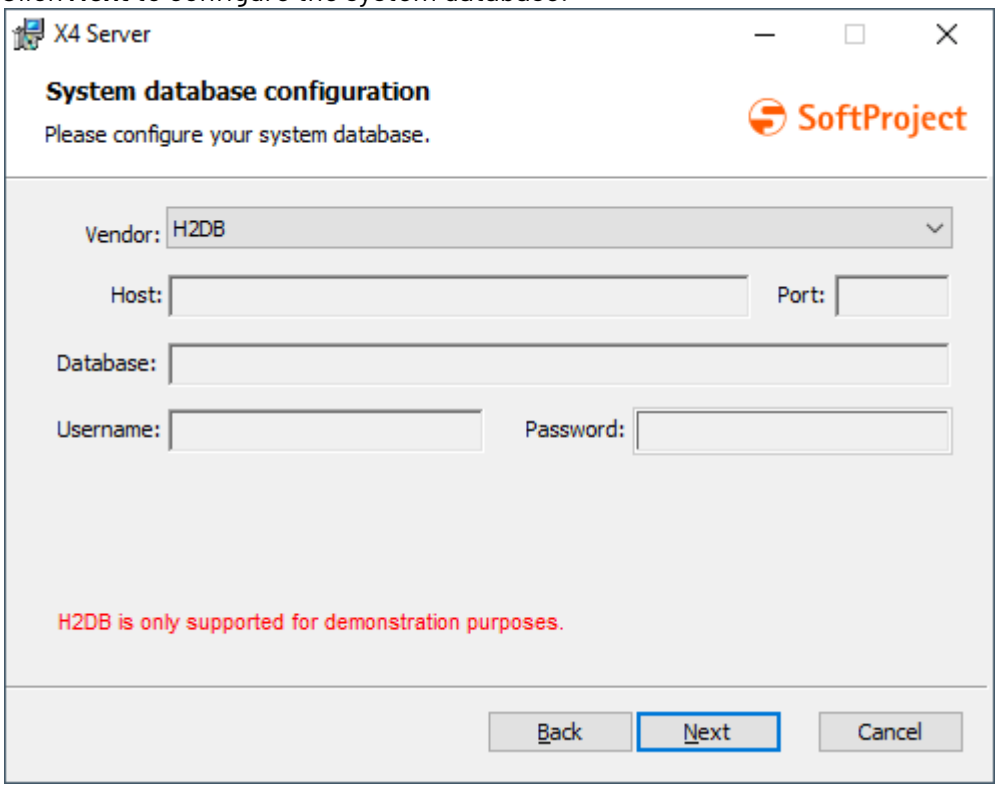
Make sure not to use any spaces in the installation path. This can lead to errors when installing X4 Server as a service.

3. Click **Next** to specify the X4 Repository path.



The X4 Repository is installed under `C:\ProgramData\SoftProject\X4Server\` by default. However, the path can be changed via **Change.**

4. Click **Next** to configure the system database.



5. Configure the system database
   - **Vendor**: Specify the database vendor
     - `H2DB`

       > ⚠ Note that `H2DB` is not suitable for productive use!

     - `Microsoft SQL Server`
     - `Oracle Database 11g`

       > ⚠ Note that the database driver for `Oracle Database 11g` is not included in the installation package. The corresponding driver has to be installed separately, see Setting up the Oracle Database.

     - `Oracle Database 12c/18c/19c`

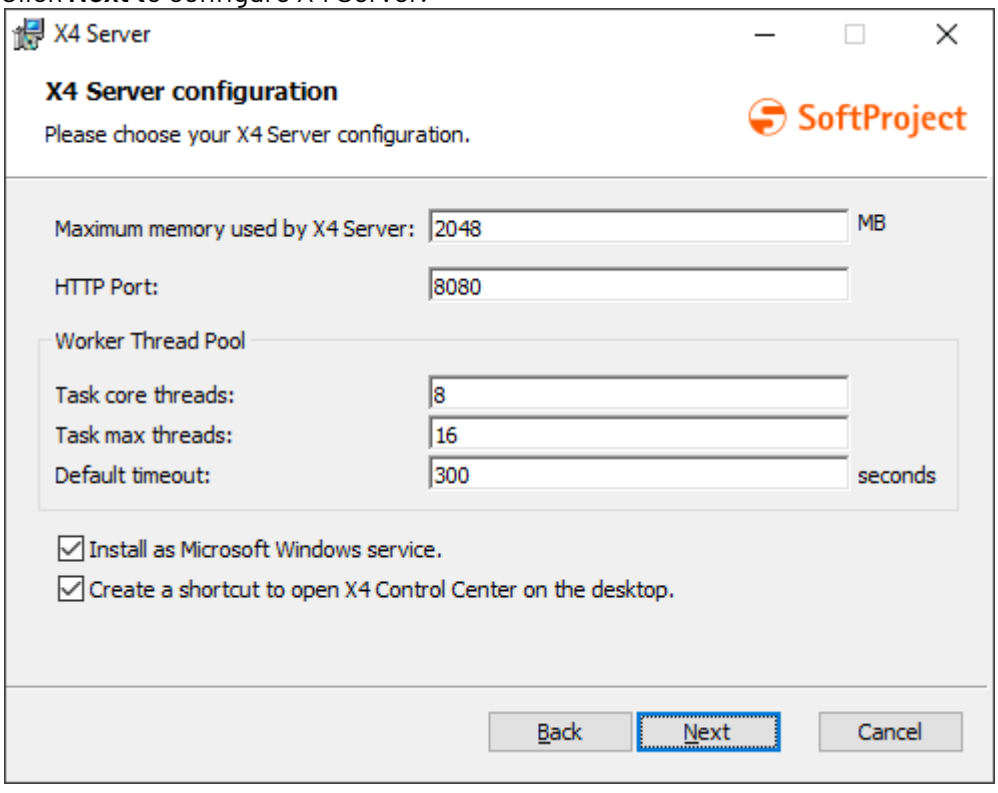
> ⚠ Note that the database driver for `Oracle Database 12c/18c/19c` is not included in the installation package. The corresponding driver has to be installed separately, see Setting up the Oracle Database.

  - `PostgreSQL`
- **Host**: Specify the database host
- **Port**: Specify the database port
- **Database**: Specify the database
- **Authentication**: Specify the authentication method with `SQL Server Authentication` or `Windows Authentication`

  > ⓘ This parameter is only available for `Microsoft SQL Server`.
  > If `Windows Authentication` is specified as authentication method, the parameters **Username** and **Password** don't need to be specified, since the Windows access data is used.

- **Username**: Specify the user name for the database connection
- **Password**: Specify the password for the database connection

6. Click **Next** to configure X4 Server.



7. Configure X4 Server:
   - **Maximum memory used by X4 Server**: Set the maximum memory
   - **HTTP Port**: Specify the HTTP port for X4 Activities
   - Configure the **Worker Thread Pool**:
     - **Task core threads**: Specify the starting number of threads for the worker task thread pool.

- This number is the minimum of threads that the server uses.
- The amount of the core threads should be able to deal with the normal request load.

- **Task max threads**: Specify the maximum number of threads for the worker task thread pool.

  - If not set, the default value is used which is calculated by formula cpuCount * 16, as long as the jmx property `MaxFileDescriptorCount` allows that number, otherwise the calculation takes `max` into account to adjust it accordingly.
  - This property depends on the server hardware, given that there is a maximum number of threads that the hardware can provide. It is used to control the maximum system resource allocation on high load.
  - The number of threads will be between the value of task core threads and the value of task maximum threads.

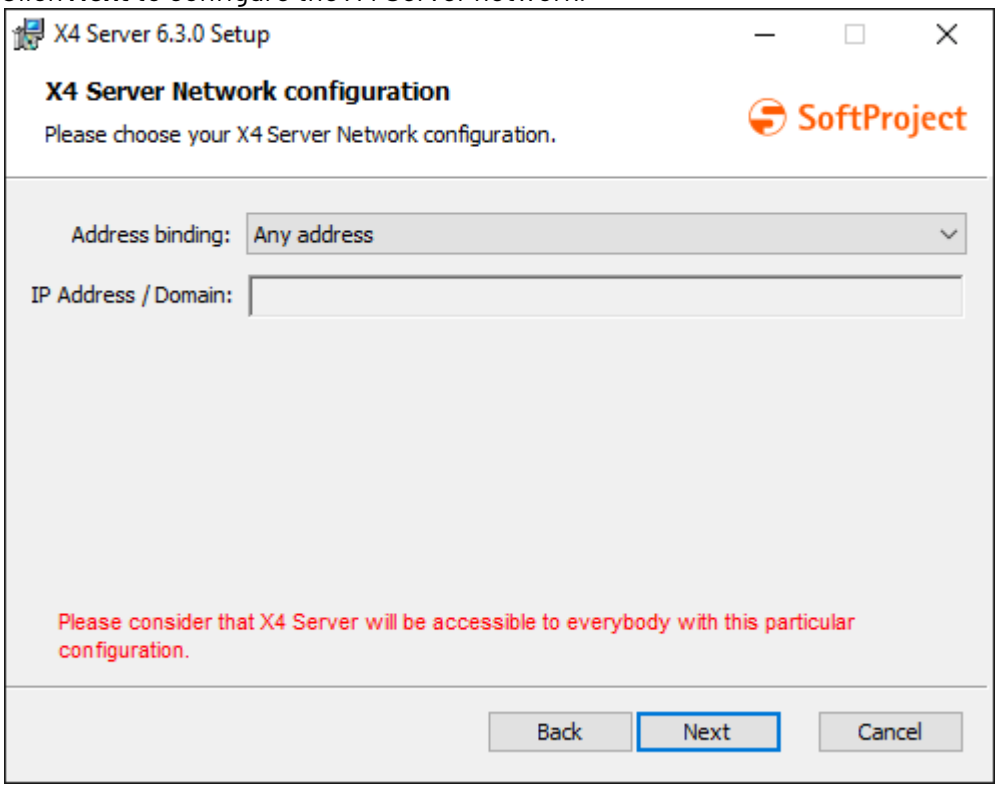
- **Default timeout**: Specify the default transaction lifetime in seconds

  If you have long-running transactions, in WildFly it can happen that you run into a timeout during your processing EJB method. In this case, you can change the default timeout from 300 seconds via the `standalone.xml` file.

- **Install as Microsoft Windows service**: Enable, if you want to install X4 Server as service
- **Create a shortcut to open X4 Control Center on the desktop**: Enable, if you want to create a desktop shortcut for X4 Control Center
- **Create a shortcut for X4 Server on the desktop**: Enable, if you want to create a desktop shortcut for X4 Server

  This option is only available, if `Install as Microsoft service` is enabled.

8. Click **Next** to configure the X4 Server network.



   - `Address binding`: Specify the address binding
     - `Any address`: Any address

       > ⚠ Note that by specifying `Any Address` the X4 Server will be publicly accessible.

     - `IP Address/Domain`: Particular IP address and domain
   - **IP Address / Domain**: Specify the IP address and domain
9. Click **Next** to confirm the settings.
10. Click **Install** to perform the installation.
    X4 Server is now being installed.
11. If required, enable the option **Launch X4 Server when setup exists** to start the Server after the installation.
12. Click **Finish** to finish the installation.
    The installation is now complete.
13. Check, if error messages are output in the server log.
    An X4 Server that has been installed and started correctly, will not output any error messages (`ERROR` or `FATAL`) in the server log.

1.2.1.2 Updating an Existing Installation Versions 6.3.0 and Later

⚠ Note that the update described here applies to X4 Server installations beginning with version 6.3.0 and later.
For updates of the versions 6.0.X, 6.1.0 and 6.2.0 the manual steps described in the next section must be performed.

1. Double-click the installation package `X4ServerSetup_7.v.v_64bit.msi` provided by SoftProject.
2. Follow the steps described in section Installing X4 Server to update to a newer version.

   ⓘ All configurations from the installed previous version are taken over automatically.

   After the update, a backup folder `X4_Backup` is created in the installation directory, which contains the repository directory and the various configuration files.

   ⓘ To migrate files that are not part of the automatic update process, the installation path of X4 BPMS must be specified in the installation and migration tool. For example, the command `java -jar de.softproject.x4.database-7.0.0.jar --installX4path C:\X4\V_7_v_v\X4\Server` migrates all `.war` files that have not already been automatically migrated to the new installation.

1.2.1.3 Updating an Existing Installation of the Versions 6.0.X, 6.1.0 and 6.2.0

1. Install X4 Server based on the installation package and according to the installation described in section Installing X4 Server .

   ⚠
   - It is required that both the outdated and the new X4 Server versions are installed.
   - The outdated X4 Server version may only be uninstalled after running the migration tool.

2. Stop X4 Server, if not already done.
3. Migrate the configurations files, if required.

   ⚠ All configuration settings done during installation of new version could be overwritten by migration process. You have the following possibilities:
   - To keep the old values for your new installation execute the migration tool as described in the following.
   - To keep the new values set during the installation as described in the section *Installing X4 Server* you do not need to migrate the configuration files via the migration tool.

To do this, run the migration tool `de.softproject.x4.database-x.x.x.jar` specifying the old and the new installation path.
Example: Running the command `java -jar de.softproject.x4.database-6.3.0.jar --installX4pathFrom C:\X4\V_6_1_0\Server --installX4path C:\X4\V_6_3_0\X4\Server` the configuration files from version 6.1.0 are migrated to version 6.3.0 of the X4 Server.

Using the option `--help` additional information will be displayed:

```
Option                          Description
------                          -----------
-?, -h, --help                  Displays command-line help.
-b, --backup                    Full qualified path to the backup
folder.
                                Required parameters: --installX4path
-i, --installX4path             Full qualified path to x4 installation.
                                Required parameters: --backup or --
installX4pathFrom
--if, --installX4pathFrom       Full qualified path to x4 installation
for the previous X4 version to migrate.
                                Required parameters: --installX4path
-j, --jdbc                      JDBC URL for the database connection.
-p, --password                  Password for the database user.
-s, --synchronize               Synchronizes classic projects. All files
from the file system will be added to the project.
-u, --user                      Database user.
-v, --version <\d{1,2}){2}>     The installed x4 version. Only required
if you are updating from version 5.5.4. or 5.8.2.
-x, --x4db                      Full qualified path to x4db folder.
```

Additional information:

- `--backup (-b)`: Backup folder for configuration files of the X4 Server version to be updated, e.g. `"<X4>/backup/6.2.0/1400"`. If the parameter `backup` is set, the parameter `-i` with the installation path has to be set, too.
- `--installX4path (-i)`: X4 Server installation path, usually `"<X4>/Server"`. This parameter can also be used alone, e.g. in order to update files that are not part of the automatic update process in an existing installation. The parameter can be used in the same way as the parameter `--x4db`, but instead of specifying the X4DB folder, any other directory in the installation folder is specified. Moreover, the parameter can be used together with the parameters `-b` or `--if` to migrate some backed up configuration files to the new installation.
- `--installX4pathFrom (--if)`: Path of the previous X4 Server version, i.e. the installation to be migrated, usually `"<X4>/Server"`. If the parameter `installX4pathFrom` is set, the parameter `-i` with the installation path has to be set, too.

4. Rerun the migration tool `de.softproject.x4.database-<Version>.jar`, to update the SQL database first and then to update the X4DB. The required parameters are listed in the

section Updating the X4 Server.

> Note that the already integrated H2 database (only suitable for test purposes!) cannot be migrated via the migration tool.

5. Uninstall the deprecated X4 Server version manually.

1.2.1.4 Parameters of the unattended installation

To perform an unattended installation using the command line, the following parameters have to be set:

> If a parameter is not specified, the default value is used during installation.

Parameter	Description
`INSTALLFOLDER`	Installation path **Possible values** • Path specification (default: `C:\X4Server_<version>\`)
`PRODUCTNAMEDIRECTORY`	X4 Repository folder • Path specification (default: `C:\ProgramData\SoftProject\X4Server\`) > Do not use spaces in the installation path. This may cause errors when installing the X4 server as a service.
`INSTALLSERVICE`	Install X4 Server as Windows Service **Possible values** • `True` (default): X4 server is installed as a Windows service • `False`: X4 server is not installed as a Windows service
`INSTALLDESKTOPSHORTCUT`	Create X4 server desktop shortcut (only possible if X4 server is not installed as Windows service) **Possible values** • `True` (default): Desktop shortcut is created • `False`: Desktop shortcut is not created

Parameter	Description
DATABASETYPE	Database type **Possible values** • h2 (default): H2 • postgresql: PostgreSQL • sqlserver: Microsoft SQL Server • oracle11: Oracle Database 11g • oracle12: Oracle Database 12c/18c/19c
HOSTDB	Database host • IP address (example: 127.0.0.1)
PORTDB	Database port • Integers (example: 3307)
DATABASENAME	Database name
USERNAMEDB	Username for authentication to the database
PASSWORDDB	Password for authentication to the database
MEMORY	Maximum used memory in MB • Integers (default: 2048)
HTTPPORT	HTTP port • Integers (default: 8080)
AUTHENTICATION_SQLSERVER	Database authentication type **Possible values** • sqlserver (default) • windows
TASKCORETHREADS	Minimum number of threads **Possible values** • Integers (default: 8)
TASKMAXTHREADS	Maximum number of threads **Possible values** • Integers (default: 16)
DEFAULTTIMEOUT	Timeout in seconds **Possible values** • Integers (default: 300)

Parameter	Description
ADDRESSTYPE	Address type **Possible values** • anyAddress (default): any address ⚠ Note that with this configuration the X4 server is accessible to everyone. • ipDomain: IP address/domain
EXTERNALLIP	IP address/domain (only relevant if ADDRESSTYPE=ipDomain) **Possible values** • IP address (example: 127.0.0.1)

1.2.2 Installation and update on Ubuntu/Debian Linux systems

The following describes how the X4 Server based on a Debian package (.deb) can be automatically installed or updated on an Ubuntu or Debian Linux system, registered as a service, started and administered.

1.2.2.1 Install X4 Server or upgrade existing installation

ⓘ **Note!**

- The installation package is started with sudo permissions.
- During the installation of the X4 Server, a new user X4 and a new group X4 are created.
- After installation, the X4 Server file system belongs to the user X4 and the group X4.
- The installed service X4 Server is started with sudo permissions, but the user X4 is the owner of this service execution.
- Make sure that you have the appropriate rights for the specified installation path.

1. Load the Debian package X4-Server_Ubuntu-7.v.v-r.x.86_64 provided by SoftProject onto the Ubuntu or Debian system.
2. Run the installation with the command sudo dpkg -i X4-Server_Ubuntu-7.v.v-r.x.86_64.deb.
   Example: *sudo dpkg -i X4-Server_Ubuntu-7.0.0-1.x.86_64.deb* for Release 1 of X4 Server Version 7.0.0.

   ⓘ The X4 Server is installed under /opt/X4 by default. The INSTALL_PATH variable can be used to change the installation path, e.g. sudo INSTALL_PATH=/myNewPath/Tools dpkg -i X4-Server_Ubuntu-7.v.v-r.x.86_64.deb

The X4 Server is now installed in the specified folder, registered as the `X4-Server` service and started directly. This process may take a few seconds.

> - If an installation of the X4 Server already exists, the central components of the X4 Server are automatically updated when the installation command `sudo dpkg -i X4-Server_Ubuntu-7.v.v-r.x.86_64.deb` is executed again. Backup copies of the configuration files are created in the subfolder `/opt/X4_backups`.
> - To migrate files that are not part of the automatic update process, the installation path of the X4 BPMS must be specified in the installation and migration tool. For example, specifying `/opt/X4/jdk/bin/java -jar en.softproject.x4.database-6.3.0.jar --installX4path /opt/X4/Server` will migrate all `.war` files that have not already been migrated automatically to the new installation.

3. Check whether error messages occurred in the server log `/opt/X4/wildfly/standalone/log/server.log`.
   A correctly installed and started X4 Server does not give any error messages (`ERROR` or `FATAL`) in the server log. This should be the case at the second start of the X4 Server at the latest.
4. Restart the X4 Server with the command `sudo service X4-Server restart`.
   The X4 Server has now been successfully installed and is running as service `X4-Server`.

After successfully installing or updating the X4 Server via a Debian package, the installation folder contains the following items:

Folder	Explanation
`X4_backups`	During a new installation (update of the X4 Server), backup copies of the adapters, configuration files as well as the `H2DB` and the `X4DB` are automatically created in this folder
`jdk`	Contains the current Java runtime version as runtime environment for the WildFly application server
`SQL`	Contains the supplied in-memory database for test purposes in subfolder `H2DB`
`Tools`	Contains the migration tool for the system database
`wildfly`	Contains the pre-configured WildFly application server
`X4DB`	Contains the central X4 repository
`x4.license`	Licence file for the X4 Server, see Installing licences via the Designer
`X4config.xml`	Central configuration file of the X4 Server, see Configuration via X4config.xml

1.2.2.2 Control options for the X4 Server service

The following options are available via the command line to control the X4 Server or its service `X4-Server`:

Start `X4-Server` service:	Execute the command `service X4-Server start`.
Stop `X4-Server` service:	Execute the command `service X4-Server stop`.
Restart the `X4-Server` service:	Execute the command `service X4-Server restart`.

1.2.2.3 Uninstall X4-Server service

To uninstall an X4 Server installed via Debian package and its corresponding service `X4-Server`, enter the command `sudo dpkg -r X4-Server`.

For a clean removal of all installation artefacts including configuration files etc. from the `X4-Server` service run the command `sudo dpkg -P X4-Server`.

> When uninstalling, it is not necessary to set the `INSTALL_PATH` variable.

1.2.3 Installation and Update on Red Hat Enterprise Linux Systems

How to install the complete X4 Server automatically based on an RPM package (`.rpm`) on a Red Hat Enterprise Linux system, and how to register, start and manage this service.

1.2.3.1 Installing the X4 Server

> Before installation, make sure that the IP address of the server and the host name are entered under `/etc/hosts`.
> *Example*: *`192.168.147.153 vmettopensuse01`*

> **Please note!**
>
> - The installation package is started with `sudo` privileges.
> - During the X4 Server installation a new user `X4` and a new group `X4` are created.
> - After the installation the X4 Server file system belongs to the user `X4` and the group `X4`.
> - Although the installed service `X4-Server` is launched with `sudo` privileges, the user `X4` i s owner of this service execution.
> - Make sure that you have the appropriate rights for the specified installation folder.

1. Load the RPM package `X4-Server_RHEL-7.v.v-r.x86_64.rpm` provided by SoftProject on your Red Hat system.
2. Execute the command `sudo rpm -i X4-Server_RHEL-7.v.v-r.x86_64.rpm` to start the installation.
   Example: `sudo rpm -i X4-Server_RHEL-7.0.0-1.x86_64.rpm` for release `1` of X4 Server version `7.0.0`.

   > X4 Server is installed under `/opt/X4` by default. Using the parameter `--prefix` the installation folder can be changed, e.g. `sudo rpm -i X4-Server_RHEL-7.v.v-r.x86_64.rpm --prefix=/new_path`

X4 Server is now being installed automatically in the specified folder, registered as service `X4-Server` and started. This operation may take a few seconds.

3. If necessary, copy your license file `x4.license` into the X4 Server installation folder.
   Example: `sudo cp x4.license /opt/X4`
4. Check, if error messages are output in the server log `/opt/X4/wildfly/standalone/log/server.log`.
   A correctly installed and started X4 Server does not issue error messages (`ERROR` or `FATAL`) in the server log. This should be the case at the second start of the X4 Server at the latest.

After successfully installing or updating the X4 Server via RPM package, the installation folder contains the following elements:

Folder	Description
`X4_backups`	After a re-installation (when updating X4 Server), a backup of the adapters, configuration files and of folder `H2DB` and `X4DB` will be created
`jdk`	Contains current Java Runtime version as runtime environment for the WildFly applications server
`SQL`	Subfolder `H2DB` contains the provided memory database for testing purposes.
`Tools`	Contains the migration tool to migrate configuration files, the system database and projects
`wildfly`	Contains a preconfigured WildFly application server
`X4DB`	Contains the central X4 Repository
`x4.license`	License file for X4 Server, see Lizenzen über den Designer installieren
`X4config.xml`	Central X4 Server configuration file, siehe Konfiguration über X4config.xml

1.2.3.2 Updating an Existing Installation

1. Load the RPM package `X4-Server_RHEL-7.v.v-r.x86_64.rpm` provided by SoftProject on your Red Hat system.
2. Execute the command `sudo rpm -U X4-Server_RHEL-7.v.v-r.x86_64.rpm` to start the update.
   Example: `sudo rpm -U X4-Server_RHEL-7.0.0-1.x86_64.rpm` for release `1` of X4 Server version `7.0.0`.

   > ⓘ X4 Server is installed under `/opt/X4` by default. Using the parameter `--prefix` the installation folder can be changed, e.g. `sudo rpm -U X4-Server_RHEL-7.v.v-r.x86_64.rpm --prefix=/new_path`

   The X4 Server core components will be updated automatically and copies of the configuration files are created in the subfolder `opt/x4_backups`.

> To migrate files that are not part of the automatic update process, the installation path of X4 BPMS must be specified in the installation and migration tool. For example, the specification `/opt/X4/jdk/bin/java -jar de.softproject.x4.database-7.0.0.jar --installX4path /opt/X4/Server` migrates all `.war` files that have not already been automatically migrated to the new installation.

1.2.3.3 Controlling the Service X4-Server

From the command line, the following options are available to control the X4 server or its service `X4-Server`:

Starting service `X4-Server`:	Execute command `systemctl start X4-Server`
Stopping service `X4-Server`:	Execute command `systemctl stop X4-Server`
Restarting service `X4-Server`:	Execute command `systemctl restart X4-Server`
See status of service `X4-Server`:	Execute command `systemctl status X4-Server`
Reload service `X4-Server`:	Execute command `systemctl reload X4-Server`

1.2.3.4 Uninstalling the Service X4-Server

To uninstall an X4 Server and its corresponding service `X4-Server` that was installed via RPM package, enter the command `sudo rpm -e X4-Server_RHEL-7.v.v-r.x86_64`.

During uninstallation, backup copies of the configuration files, the system database and the X4DB are automatically created under `opt/x4_backups`.

1.2.4 Installation and Update on SuSe Linux Systems

How to install the complete X4 Server automatically based on an RPM package (`.rpm`) on an Open Suse Linux system, and how to register, start and manage this service.

1.2.4.1 Installing X4 Server or Updating an Existing Installation

> Before installation, make sure that the IP address of the server and the host name are entered under `/etc/hosts`.
> *Example*: *`192.168.147.153 vmettopensuse01`*

Please note!

- The installation package is started with sudo privileges.
- During the X4 Server installation a new user X4 and a new group X4 are created.
- After the installation the X4 Server file system belongs to the user X4 and the group X4.
- Although the installed service X4-Server is launched with sudo privileges, the user X4 i s owner of this service execution.
- Make sure that you have the appropriate rights for the specified installation folder.

1. Load the RPM package X4-Server_SLES-7.v.v-r.x86_64.rpm provided by SoftProject on your SuSe Linux system.
2. Execute the command sudo rpm -i X4-Server_SLES-7.v.v-r.x86_64.rpm to start the installation.
   Example: *sudo rpm -i X4-Server_SLES-7.0.0-1.x86_64.rpm* for release 1 of X4 Server version 7.0.0.

   X4 Server is installed under /opt/X4 by default. Using the parameter --prefix the installation folder can be changed, e.g. sudo rpm -i X4-Server_SLES-7.v.v-r.x86_64.rpm --prefix=/new_path

   X4 Server is now being installed automatically in the specified folder, registered as service *X4-Server* and started. This operation may take a few seconds.

   To migrate files that are not part of the automatic update process, the installation path of X4 BPMS must be specified in the installation and migration tool. For example, the specification /opt/X4/jdk/bin/java -jar de.softproject.x4.database-7.0.0.jar --installX4path /opt/X4/Server mi grates all .war files that have not already been automatically migrated to the new installation.
3. If necessary, copy your license file x4.license into the X4 Server installation folder.
   Example: *sudo cp x4.license /opt/X4*
4. Check, if error messages are output in the server log /opt/X4/wildfly/standalone/log/server.log.
   A correctly installed and started X4 Server does not issue error messages (ERROR or FATAL) in the server log. This should be the case at the second start of the X4 Server at the latest.

After successfully installing or updating the X4 Server via RPM package, the installation folder contains the following elements:

Folder	Description
X4_backups	After a re-installation (when updating X4 Server), a backup of the adapters, configuration files and of folder H2DB and X4DB will be created
jdk	Contains current Java Runtime version as runtime environment for the WildFly applications server

Folder	Description
`SQL`	Subfolder `H2DB` contains the provided memory database for testing purposes
`Tools`	Contains the migration tool to migrate configuration files, the system database and projects
`wildfly`	Contains a preconfigured WildFly application server
`X4DB`	Contains the central X4 Repository
`x4.license`	License file for X4 Server, see Lizenzen über den Designer installieren
`X4config.xml`	Central X4 Server configuration file, siehe Konfiguration über X4config.xml

1.2.4.2 Controlling the Service X4-Server

From the command line, the following options are available to control the X4 server or its service `X4-Server`:

Starting service `X4-Server`:	Execute command `systemctl start X4-Server` or `service X4-Server restart`
Stopping service `X4-Server`:	Execute command `systemctl stop X4-Server` or `service X4-Server stop`
Restarting service `X4-Server`:	Execute command `systemctl restart X4-Server` or `service X4-Server restart`
See status of service `X4-Server`:	Execute command `systemctl status X4-Server` or `service X4-Server status`
Reload service `X4-Server`:	Execute command `systemctl reload X4-Server` or `service X4-Server reload`

1.2.4.3 Updating an Existing Installation Version 6.1.0 or Later

⚠ Note that the update described here applies to X4 Server installations beginning with version 6.1.0 and later.
For updates of the versions 6.0.X the manual steps described below must be performed.

1. Load the RPM package `X4-Server_SLES-v.v.v-r.x86_64.rpm` provided by SoftProject on your SuSe Linux system.
2. Execute the command `sudo rpm -U X4-Server_SLES-x.x.x-r.x86_64.rpm` to start the installation.
   Example: `sudo rpm -U X4-Server_SLES-6.3.0-1.x86_64.rpm` for release `1` of X4 Server version `6.3.0`.

   ⓘ X4 Server is installed under `/opt/X4` by default. Using the parameter `--prefix` the installation folder can be changed, e.g. `sudo rpm -U X4-Server_SLES-v.v.v-r.x86_64.rpm --prefix=/new_path`

The X4 Server core components will be updated automatically and copies of the configuration files are created in the subfolder `opt/x4_backups`.

1.2.4.4 Updating an Existing Installation of the Versions 6.0.X

1. Create a backup folder to save important resources with the command `mkdir -p /opt/X4_backups/v.v.v/YYYYMMDD/HHMM/`.
   Example: *`mkdir -p /opt/X4_backups/6.0.0/20200429/1146/`*
2. Save the important resources to the created backup folder with the following commands:
   - `cp -r <FolderPath> <BackupFolderPath>`, e.g. `cp -r /opt/X4/X4DB /opt/X4_backups/6.0.0/20200429/1146/` to copy the `X4DB` folder
   - `cp <FilePath> <BackupFolderPath>`, e.g. `cp /opt/X4/X4config.xml /opt/X4_backups/6.0.0/20200429/1146/` to copy the file `X4config.xml`

   > It is recommended to save the following files and folders:
   > - `X4DB` folder under `/opt/X4/X4DB`
   > - `adapter` folder under `/opt/X4/wildfly-14.0.1.Final/modules/system/layers/base/de/softproject/x4/adapter`
   > - `X4config.xml` under `/opt/X4/X4config.xml`
   > - `x4.license` under `/opt/X4/x4.license`
   > - `application-roles.properties` under `/opt/X4/wildfly-14.0.1.Final/standalone/configuration/application-roles.properties`
   > - `application-users.properties` under `/opt/X4/wildfly-14.0.1.Final/standalone/configuration/application-users.properties`
   > - `mgmt-groups.properties` under `</opt/X4/wildfly-14.0.1.Final/standalone/configuration/mgmt-groups.properties`
   > - `mgmt-users.properties` under `/opt/X4/wildfly-14.0.1.Final/standalone/configuration/mgmt-users.properties`
   > - `module.xml` under `/opt/X4/wildfly-14.0.1.Final/modules/system/layers/base/de/softproject/x4/extensions/main/module.xml`
   > - `standalone.xml` under `/opt/X4/wildfly-14.0.1.Final/standalone/configuration/standalone.xml`
   > - `X4-Server` under `/etc/default/X4-Server`
   > - `version.txt` under `/opt/X4/version.txt`
   > - `application.keystore` under `/opt/X4/wildfly-14.0.1.Final/standalone/configuration/application.keystore`
3. Uninstall the deprecated X4 Server installation with the command `sudo rpm -e X4-Server_SUSE-x.x.x-r.x86_64`.
   Example: `sudo rpm -e X4-Server_SUSE-6.0.0-1.x86_64` for release `1` of X4 Server version `6.0.0`.

4. Install the new package with the command `sudo rpm -i X4-Server_SLES-x.x.x-r.x86_64.rpm`.
   Example: *`sudo rpm -i X4-Server_SLES-6.3.0-1.x86_64.rpm`* for release `1` of X4 Server version `6.3.0`.
5. Stop the X4 Server execution with the command `sudo systemctl stop X4-Server`.
6. Start the migration of the configuration files with the command `sudo <InstallationPath>/jdk/bin/java -jar <InstallationPath>/Tools/de.softproject.x4.database-v.v.v.jar --backup <BackupPath> --installX4path <InstallationPath>`.
   Example: *`sudo /opt/X4/jdk/bin/java -jar /opt/X4/Tools/de.softproject.x4.database-6.3.0.jar --backup /opt/X4_backups/6.0.0/20200429/1146/ --installX4path /opt/X4`* for an X4 Server in Version 6.3.0 installed under `/opt/X4` and backup copies of an X4 Server installation 6.0.0 within the folder `/opt/X4_backups/6.0.0/20200429/1146/`.
7. Rerun the migration tool `de.softproject.x4.database-<Version>.jar`, to update the SQL database first and then to update the `X4DB`. The required parameters are listed in the section Installation and Migration of the System Database and the X4DB.

   > Note that the already integrated H2 database (only suitable for test purposes!) cannot be migrated via the migration tool.

8. If required, check whether you have permissions for the migrated files. To do this, enter the following command:

   ```
   ls -l /opt/X4/X4DB/1
   ```

   If no permissions are set for `X4`, execute the following commands from the command line:

   ```
   cd /opt/X4/X4DB/1
   sudo chown -R X4:X4 UpdateTest
   ```

9. Start X4 Server with the command `sudo systemctl start X4-Server`.

1.2.4.5 Uninstalling the Service X4-Server

To uninstall an X4 Server and its corresponding service `X4-Server` that was installed via RPM package, enter the command `sudo rpm -e X4-Server_SLES-7.v.v-r.x86_64`.

During uninstallation, backup copies of the configuration files, the system database and the X4DB are automatically created under `opt/x4_backups`.

1.2.5 Installing the X4 Server in Docker

In this section, you will learn how to install the X4 Server in a docker and run it as a docker container.

Prerequisites

- Docker has to be installed and set up on your system. You can find information within the Docker documentation under https://docs.docker.com/.
- Knowledge of the docker mode of operation is assumed.
- `x4_server:6.x.x` refers to the current X4 BPMS version.

1. Load the installation package `x4-server-image.tar` provided by SoftProject to your system using the command `docker load -i x4-server-image.tar`.
2. Run the docker using the command `docker run -d -p 8080:8080 --name x4-servercontainer softprojectgmbh/x4_server`.

Further helpful commands:

Application example	Command
Run a container and display the logs after creating the container:	`docker run -d -p 8080:8080 --name x4-server-container softprojectgmbh/x4_server && docker logs x4-server-container`
Run X4 Server with a PostgreSQL database X4 • Host: `10.0.75.1` • Default PostgreSQL port: `5432`	`docker run -d -p 8080:8080 -e DATABASE_MODE='postgresql' -e DATABASE_HOST='10.0.75.1' softprojectgmbh/x4_server`
Run X4 Server with port 8081 and a PostgreSQL database X4 • Host: `10.0.75.1` • Port: `5435`	`docker run -d -p 8081:8080 -e DATABASE_MODE='postgresql' -e DATABASE_HOST='10.0.75.1' -e DATABASE_PORT='5435' softprojectgmbh/x4_server`
Run X4 Server with port 8081 and a PostgreSQL database X4 • Access data: `postgres/postgres` • Host: `10.0.75.1` • Port: `5435`	`docker run -d -p 8081:8080 -e DATABASE_MODE='postgresql' -e DATABASE_USER='postgres' -e DATABASE_PASSWORD='postgres' -e DATABASE_HOST='10.0.75.1' -e DATABASE_PORT='5435' softprojectgmbh/x4_server`
Run X4 Server with an MS SQL database X4 • Access data: `X4/X4` • Host: `10.0.75.1` • Port: `1434`	`docker run -d -p 8080:8080 -e DATABASE_MODE=sqlserver -e DATABASE_HOST=10.0.75.1 -e DATABASE_NAME=X4 -e DATABASE_PORT=1434 -e DATABASE_USER=X4 -e DATABASE_PASSWORD=X4 softprojectgmbh/x4_server`
Run X4 Server and map the X4DB folder from an external path to the X4DB folder within the container (only for Linux)	`docker run -d -p 8080:8080 -v /home/anyUser/X4/X4DB/1:/opt/X4/X4DB/1 softprojectgmbh/x4_server`

Environment variables

Variable	Erläuterung
`X4_UID`	The unix user ID the technical process is run as
`X4_GID`	The unix group ID the technical process is run as
`JAVA_XMS`	Initial heap space for the JVM Default value: *`512M`*
`JAVA_XMX`	Maximum heap space for the JVM Default value: *`2048M`*
`DATABASE_MODE`	Determines the database connection driver and strategy Possible values are `h2` (default), `postgresql` and `sqlserver`
`DATABASE_HOST`	Host name of the database server (if not `h2`) The default value is `database`, obliging you to change it.
`DATABASE_PORT`	Port number of the database server (if not `h2`). The default port for PostgreSQL server (`postgres`) is 5432. The default port is not set automatically.
`DATABASE_NAME`	Name of the database hosted within the database server to use for the X4 Server (if not `h2`)
`DATABASE_USER`	Name of the database user
`DATABASE_PASSWORD`	Password to access the database

1.2.6 Installing the X4 Server on other operating systems

If required, the X4 Server can also be installed on other operating systems. Please contact SoftProject for further information.

1.3 Initially installing a licence

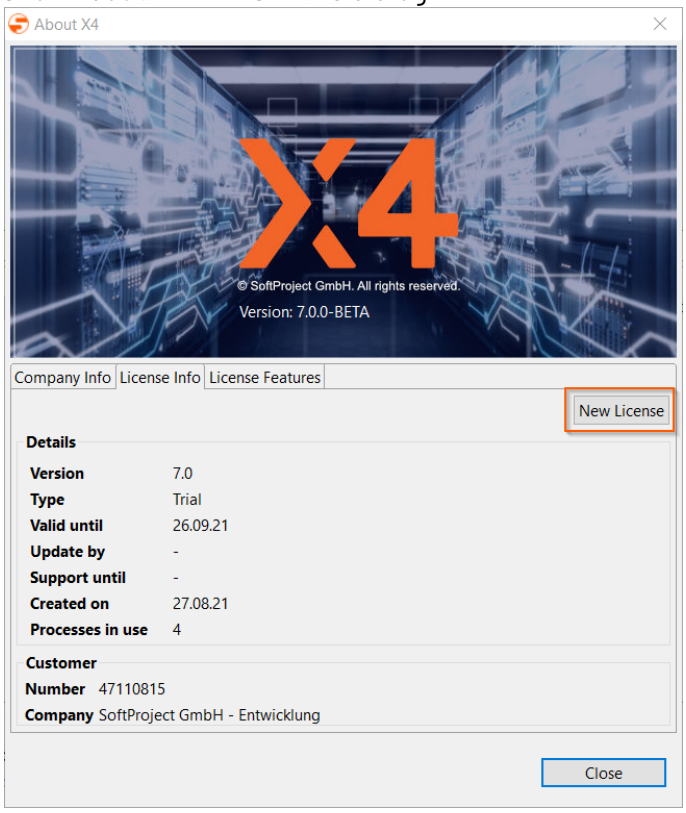
1. Click the  icon in the toolbar.
2. Click **Install license**.
3. Select X4 license
4. Click **Open**.
   Your new license is now installed. In the status bar at the bottom of X4 Designer you can see how long your license is still valid.

Via **Help** > **About X4 BPMS** > **License Information** and **License Features** you have the possibility to retrieve information about your license at any time.

1.4 Renewing license

⚠ To renew a license, you must have previously installed a license.

1. Click **Help** in the menu bar.
2. Click **About X4 BPMS** in the dialog.



3. Under **License Info** click **New license**.
4. Navigate to the new license and click **Open**.
   If the installation is successful, the license information will update automatically after a short time.

1.5 Displaying license information

⚠ To display license information, a license must be installed.

1. In the X4 Designer menu bar, click **Help > About X4 BPMS** .
2. To view the license information, click the **License Info** tab or the **License Features** tab.

1.6 Installing, updating and uninstalling the X4 Designer

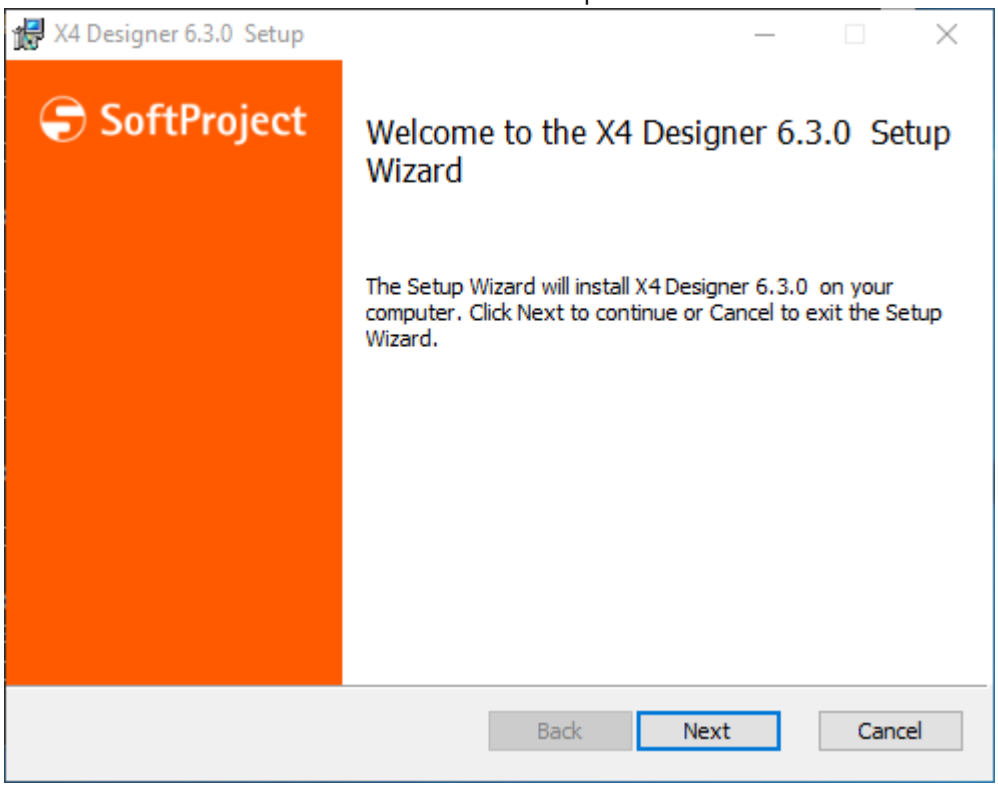
1.6.1 Installing X4 Designer

X4 Designer is provided as installation package for Windows operating systems.

1. Double-click the executable file `X4Designer_Setup.msi` to start the installation.

   > Windows Defender SmartScreen issues a warning when starting the installation. Click **F urther Information** (Weitere Informationen**)** and run the installation routine as usual with **Run anyway (Trotzdem ausführen)**.

   The start screen of the installation routine is opened.



2. Click **Next**.
3. Enter the installation path for X4 Designer.
4. By enabling the option **Create a shortcut for X4 Designer on the desktop** create a shortcut to the desktop, if requited.
5. Click **Next** to confirm the path.
6. Click **Install** to perform the installation.
   The progress of the installation is now displayed.
7. Click **Finish** to finish the installation.

> By enabling the option **Launch X4 Designer when setup exists**, the X4 Designer will start automatically after the installation.

The X4 Designer will be installed under the specified path.

8. If not already done automatically, start the X4 Designer to check the installation.

> **Silent installation**
> The X4 Designer can also be installed via a silent installation. Enter the following command in the command line: *`*C:\Installionsort der MSI /q/n /L*V "C:\temp\test.log*`*.

1.6.2 Updating X4 Designer

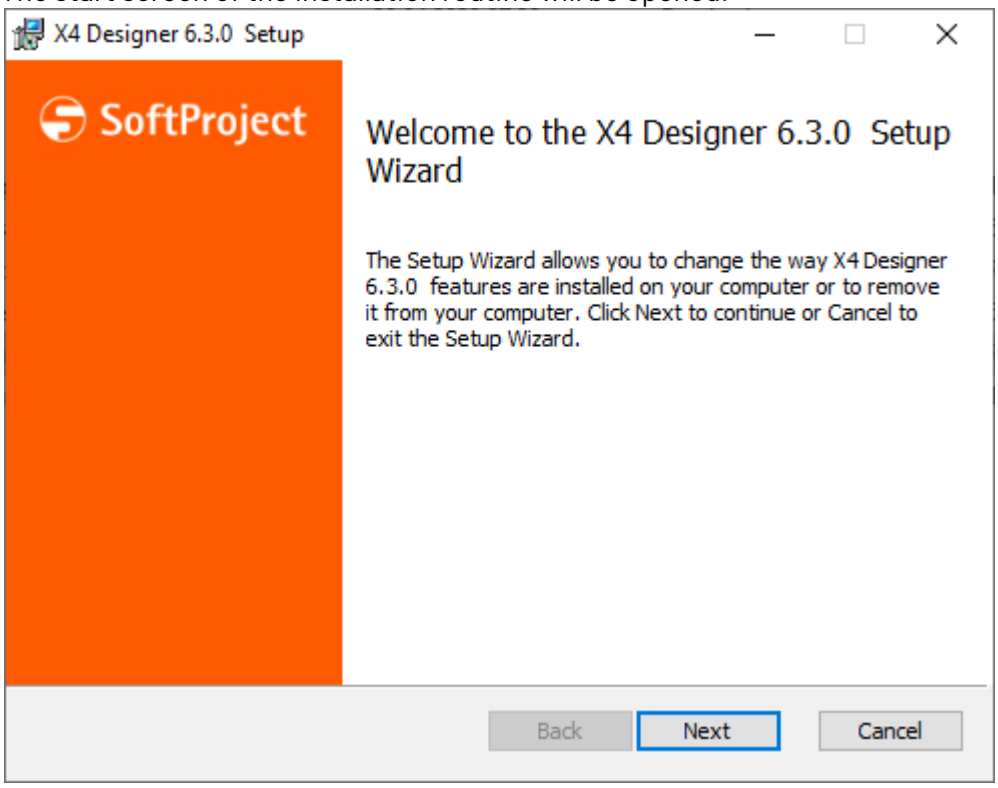
To update the X4 Designer perform a new installation of the X4 Designers.

> Before performing an update, make sure you save the configurations stored for the X4 Designer. They are stores e.g. under `C:\Users\Benutzername\AppData\Roaming\X4Designer\workspace`.

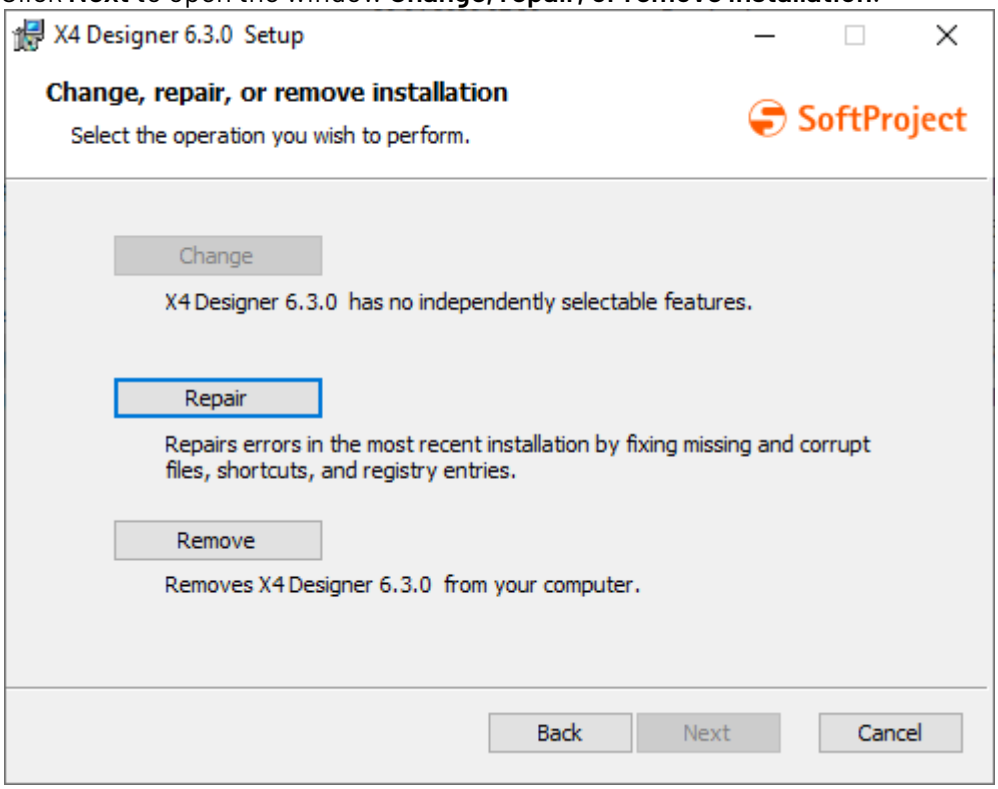
1.6.3 Uninstalling X4 Designer

The X4 Designer can be uninstalled either via the Windows start menu, the Windows Control Panel or by re-running the installation file.

1. Double-click the executable file `X4Designer_Setup.msi`.
   The start screen of the installation routine will be opened.



2. Click **Next** to open the window **Change, repair, or remove installation**.



3. Click **Remove**.

4. In the next window, click **Remove** again to begin uninstalling.
   The progress of the uninstallation is now displayed.
5. Click **Finish** to finish uninstalling.
   The X4 Designer has now been uninstalled.

1.6.4 Parameters of the unattended installation

To perform an unattended installation using the command line, the following parameters must be set:

Parameters	Description
`INSTALLFOLDER`	Installation path

1.7 Installation and Migration of the System Database and the X4DB

For the migration of the configuration files, the X4DB and for the installation and update of the system database an installation and migration tool is available, which is stored within the directory `<X4>/Server/Tools/`.

> ⚠ If you want to migrate the X4 Server from a previous product line to the current product line, it is recommended to request migration support from a SoftProject consultant. If you upgrade by yourself, no guarantee can be given from SoftProject.

> ⓘ **Prerequisites:**
> Before running the migration/installation tool, you must first create an empty database named `X4`.

1. Run the migration tool `de.softproject.x4.database-<version>.jar` under `<X4>/Server/Tools/` with the command *`java -jar de.softproject.x4.database-x.x.x.jar`*.

Using the option `--help` additional information will be displayed:

```
Option                          Description
------                          -----------
-?, -h, --help                  Displays command-line help.
-b, --backup                    Full qualified path to the backup
folder.
                                Required parameters: --installX4path
-i, --installX4path             Full qualified path to x4 installation.
                                Required parameters: --backup or --
installX4pathFrom
--if, --installX4pathFrom       Full qualified path to x4 installation
for the previous X4 version to migrate.
                                Required parameters: --installX4path
-j, --jdbc                      JDBC URL for the database connection.
-p, --password                  Password for the database user.
-s, --synchronize               Synchronizes classic projects. All files
from the file system will be added to the project.
-u, --user                      Database user.
-v, --version <\d{1,2}){2}>     The installed x4 version. Only required
if you are updating from version 5.5.4. or 5.8.2.
-x, --x4db                      Full qualified path to x4db folder.
```

Additional information:

- `--backup (-b)`: Backup folder for configuration files of the X4 Server version to be updated, e.g. `"<X4>/backup/6.2.0/1400"`. If the parameter `backup` is set, the parameter `-i` with the installation path has to be set, too.
- `--installX4path (-i)`: X4 Server installation path, e.g. `"<X4>/Server"` for Windows systems. This parameter can also be used alone, e.g. in order to update files that are not part of the automatic update process in an existing installation. The parameter can be used in the same way as the parameter `--x4db`, but instead of specifying the X4DB folder, any other directory in the installation folder is specified. Moreover, the parameter can be used together with the parameters `-b` or `--if` to migrate some backed up configuration files to the new installation.
- `--installX4pathFrom (--if)`: Path of the previous X4 Server version, i.e. the installation to be migrated, e.g. `"<X4>/Server"` for Windows systems. If the parameter `installX4pathFrom` is set, the parameter `-i` with the installation path has to be set, too.

2. Set the desired parameters.

When setting parameter values, set paths containing spaces in quotation marks in order to avoid errors, e.g. *`java -jar de.softproject.x4.database.x.x.x.jar --backup`* **`"path_to_backup_folder"`** *`--installX4path`* **`"path_to_x4_installation_folder".`**

After running the migration tool a log file <backupPfad>/backup.log will be created in the backup folder. Possible errors occurring during the migration are listed here.

The file backup.log contains additional information provided as checklist, in order to ensure the functionality of the new installation.

```
#################################################################################################################
#                                                                                                               #
#   1. Please, check that the memory setting is adapted to the new X4 version and meet the minimun requirements #
#       1.1. Check the startX4.bat file for windows installation and X4-Server file for Linux installations     #
#       1.2. Check the standalone.conf.bat file for windows installation in case that the X4 Server is installed as a service#
#   2. Please, check the standalone.xml file to ensure that the datasources are correctly configured           #
#   3. For Oracle Database installations:                                                                       #
#       3.1.  You need to install the appropriate driver after the migration                                    #
#   4. All configuration files that are not part of X4 will not be migrated. Please, migrate them manually     #
#                                                                                                               #
#################################################################################################################
```

3. Test your processes if their behavior differs after the migration.

Sample Calls:

In Linux environments, be sure to place parameter values with special characters (e.g. ;) in single or double quotation marks. This ensures that the parameter value is interpreted as a whole.
The following applies to installations of the X4 BPMS in version **6.0.X**:

- For Linux systems, replace the path specification `Server/wildfly/` by `Server/wildfly-14.0.1.Final/`.
- For Windows systems, replace the path specification `Server\wildfly\` by `Server\wildfly-14.0.1.Final\` and `..\jdk\` by `..\jdk-11\`.

Make sure that the parameters `dbHostIp`, `dbName`, `dbAdmin`, `dbAdminPWD`, `hostIP`, `port` and `SID` are set based on the used system and database and according to your local configuration.

- **Calling the migration tool for MSSQL**
  - *Linux*: `sudo ../jdk/bin/java -jar de.softproject.x4.database-X.X.X.jar --x4db /opt/X4/X4DB --jdbc jdbc:sqlserver://dbHostIp:port;databaseName=dbName -u dbAdmin -p dbAdminPWD`
  - *Windows:* `..\jdk\bin\java.exe -jar de.softproject.x4.database-X.X.X.jar --x4db X4Installation\Server\X4DB --jdbc jdbc:sqlserver://dbHostIp:port;databaseName=dbName -u dbAdmin -p dbAdminPWD`
- **Calling the migration tool for Oracle (creation with service name)**
  - *Linux:* `sudo ../jdk/bin/java -cp "*:/opt/X4/wildflyFOLDER/modules/oracle/jdbc/main/*" de.softproject.x4.database.Main --x4db /opt/X4/X4DB --jdbc jdbc:oracle:thin:@dbHostIp:port/oracleServicename -u dbAdmin -p dbAdminPWD`
  - *Windows:* `..\jdk\bin\java.exe -cp de.softproject.x4.database-X.X.X.jar;X4Installation\Server\wildfly\modules\oracle\jdbc\main\ojdbc8`

```
.jar de.softproject.x4.database.Main --jdbc
jdbc:oracle:thin:@hostIP:port/oracleServicename -u dbAdmin -p
dbAdminPWD
```

- **Calling the migration tool for Oracle (creation with SID)**
  - *Linux:* `sudo ../jdk/bin/java -cp "*:/opt/X4/wildflyFOLDER/modules/oracle/jdbc/main/*" de.softproject.x4.database.Main --x4db /opt/X4/X4DB --jdbc jdbc:oracle:thin:@dbHostIp:port:SID -u "dbAdmin as sysdba" -p dbAdminPWD`
  - *Windows:* `..\jdk\bin\java.exe -cp de.softproject.x4.database-X.X.X.jar;X4Installation\Server\wildfly\modules\oracle\jdbc\main\ojdbc8.jar de.softproject.x4.database.Main --jdbc jdbc:oracle:thin:@hostIP:port:SID -u "dbAdmin as sysdba" -p dbAdminPWD`
- **Calling the migration tool for PostgreSQL**
  - *Linux:* `sudo ../jdk/bin/java -jar de.softproject.x4.database-X.X.X.jar --x4db /opt/X4/X4DB --jdbc jdbc:postgresql://dbHostIp:port/dbName -u dbAdmin -p dbAdminPWD`
  - *Windows:* `..\jdk\bin\java.exe -jar de.softproject.x4.database-X.X.X.jar --x4db X4Installation\Server\X4DB --jdbc jdbc:postgresql://dbHostIp:port/dbName -u dbAdmin -p dbAdminPWD`

2 Configuration

2.1 Configuring the X4 Server

How to customize the configuration of the *X4 Server* to your environment

2.1.1 Setting up the Database

- Setting up the Oracle Database
- Configuration for MSSQL and PostgreSQL

2.1.1.1 Setting up the Oracle Database

If you are using an Oracle database, the following additional settings must be made:

Using the migration/installation tool with Oracle

> **Note:**
>
> - The migration/installation tool must be run even if no migration of an existing X4 BPMS installation is intended.
> - Before running the migration/installation tool, you must first create an empty database named `X4`.
> - To use the migration tool (see Updating the X4 Server) with Oracle, the Oracle driver must be added to the classpath when starting the tool.
> - You can find drivers for the corresponding Oracle database under https://www.oracle.com/database/technologies/appdev/jdbc.html.

Providing the driver as WildFly module

1. Download the corresponding driver under https://www.oracle.com/database/technologies/appdev/jdbc.html.
2. Create a WildFly module for the JDBC driver. Therefore, create the folder structure `oracle\jdbc\main` under `X4\Server\wildfly\modules\`.
3. Unpack the JDBC driver (e. g.: *`ojdbc.jar`*) within the folder structure created above.
4. Create the file `module.xml` with the following content:

module.xml

```
<module xmlns="urn:jboss:module:1.5" name="oracle.jdbc"><!-- The namespace
urn:jboss:module:1.5 may differ depending on the WildFly version. -->
  <resources>
    <resource-root path="ojdbc.jar"/><!-- Enter the file name of the JDBC
driver to be used and which is situated within the specified folder here. -->
  </resources>
  <dependencies>
    <module name="javax.api"/>
    <module name="javax.transaction.api"/>
  </dependencies>
</module>
```

The module `oracle.jdbc` is now available.

Registering the driver within the standalone.xml

To use the driver within the datasources, register the driver within the `standalone.xml` under `X4\Server\wildfly\standalone\configuration\`:

```
...
<subsystem xmlns="urn:jboss:domain:datasources:5.0">
  <datasources>
    ...
    <drivers>
      ...
      <driver name="oracle" module="oracle.jdbc"><!-- Enter the module name here -->
        <driver-class>oracle.jdbc.driver.OracleDriver</driver-class>
      </driver>
    </drivers>
  </datasources>
</subsystem>
...
```

Configuring the datasources

Configure the Oracle datasources within the `standalone.xml` under `X4\Server\wildfly\standalone\configuration\`:

```
...
<subsystem xmlns="urn:jboss:domain:datasources:5.0">
  <datasources>
    ...
    <datasource jta="false" jndi-name="java:/X4BAM_DS" pool-name="X4BAM_DS" enabled="
true" use-java-context="true">
      <connection-url>jdbc:oracle:thin:@localhost:1521/pluggable-database</connection-
url><!-- Enter the corresponding Host, Port, SID or Service name here -->
      <driver>oracle</driver><!-- Enter the driver name here -->
      <security>
        <user-name>X4SERVER</user-name>
        <password>X4</password>
      </security>
      <statement>
        <prepared-statement-cache-size>32</prepared-statement-cache-size>
      </statement>
      <!-- In <validation> and <timeout> define settings for automatic reconnection
-->
      <validation>
        <check-valid-connection-sql>select 1 from dual</check-valid-connection-sql>
        <validate-on-match>false</validate-on-match>
        <background-validation>true</background-validation>
        <background-validation-millis>1000</background-validation-millis>
      </validation>
      <timeout>
        <allocation-retry>60</allocation-retry>
        <allocation-retry-wait-millis>1000</allocation-retry-wait-millis>
      </timeout>
    </datasource>
    <datasource jta="true" jndi-name="java:/PermissionDS" pool-name="PermissionDS"
enabled="true" use-java-context="true">
      <connection-url>jdbc:oracle:thin:@localhost:1521/pluggable-database</connection-
url><!-- Enter the corresponding Host, Port, SID or Service name here -->
      <driver>oracle</driver><!-- Enter the driver name here -->
      <security>
        <user-name>X4SERVER</user-name>
        <password>X4</password>
      </security>
      <statement>
        <prepared-statement-cache-size>32</prepared-statement-cache-size>
      </statement>
      <!-- In <validation> and <timeout> define settings for automatic reconnection
-->
      <validation>
        <check-valid-connection-sql>select 1 from dual</check-valid-connection-sql>
        <validate-on-match>false</validate-on-match>
        <background-validation>true</background-validation>
        <background-validation-millis>1000</background-validation-millis>
      </validation>
      <timeout>
        <allocation-retry>60</allocation-retry>
        <allocation-retry-wait-millis>1000</allocation-retry-wait-millis>
      </timeout>
    </datasource>
```

```
    <drivers>
      ...
      <driver name="oracle" module="oracle.jdbc"><!-- Enter the module name here -->
        <driver-class>oracle.jdbc.driver.OracleDriver</driver-class>
      </driver>
    </drivers>
  </datasources>
</subsystem>
...
```

2.1.1.2 Configuration for MSSQL and PostgreSQL

If you are using a PostgreSQL or MS SQL database, the following additional settings must be made:

Using the migration/installation tool with Oracle

> The migration/installation tool must be run even if no migration of an existing X4 BPMS installation is intended, see Updating the X4 Server.
> Before running the migration/installation tool, you must first create an empty database named `X4`.

Configuring the datasources

Configure the datasources within the `standalone.xml` under `X4\Server\wildfly\standalone\configuration\` as follows:

```
...
<!-- PostgreSQL -->
<datasource jta="false" jndi-name="java:/X4BAM_DS" pool-name="X4BAM_DS" enabled="true
" use-java-context="true">
    <connection-url>jdbc:postgresql://localhost:5432/X4</connection-url>
    <driver>postgresql</driver>
    <new-connection-sql>SET search_path TO X4SERVER;</new-connection-sql>
    <pool>
        <max-pool-size>20</max-pool-size>
    </pool>
    <security>
        <user-name>x4</user-name>
        <password>x4</password>
    </security>
    <statement>
        <prepared-statement-cache-size>20</prepared-statement-cache-size>
        <share-prepared-statements>true</share-prepared-statements>
    </statement>
    <!-- In <validation> and <timeout> define settings for automatic reconnection -->
    <validation>
        <check-valid-connection-sql>select 1</check-valid-connection-sql>
        <validate-on-match>false</validate-on-match>
        <background-validation>true</background-validation>
        <background-validation-millis>1000</background-validation-millis>
    </validation>
    <timeout>
        <allocation-retry>60</allocation-retry>
        <allocation-retry-wait-millis>1000</allocation-retry-wait-millis>
    </timeout>
</datasource>
<datasource jndi-name="java:/PermissionDS" pool-name="PermissionDS" enabled="true"
use-java-context="true">
    <connection-url>jdbc:postgresql://localhost:5432/X4</connection-url>
    <driver>postgresql</driver>
    <new-connection-sql>SET search_path TO X4SERVER;</new-connection-sql>
    <pool>
        <max-pool-size>20</max-pool-size>
    </pool>
    <security>
        <user-name>x4</user-name>
        <password>x4</password>
    </security>
    <statement>
        <prepared-statement-cache-size>20</prepared-statement-cache-size>
        <share-prepared-statements>true</share-prepared-statements>
    </statement>
    <!-- In <validation> and <timeout> define settings for automatic reconnection -->
    <validation>
        <check-valid-connection-sql>select 1</check-valid-connection-sql>
        <validate-on-match>false</validate-on-match>
        <background-validation>true</background-validation>
        <background-validation-millis>1000</background-validation-millis>
    </validation>
    <timeout>
```

```
        <allocation-retry>60</allocation-retry>
        <allocation-retry-wait-millis>1000</allocation-retry-wait-millis>
    </timeout>
</datasource>
<!-- MSSQL -->
<datasource jndi-name="java:/PermissionDS" pool-name="PermissionDS" enabled="true"
use-ccm="true">
    <connection-url>jdbc:sqlserver://localhost:1433;databaseName=X4</connection-url>
    <driver>sqlserver</driver>
    <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
    <pool>
        <min-pool-size>5</min-pool-size>
        <max-pool-size>20</max-pool-size>
    </pool>
    <security>
        <user-name>x4s</user-name>
        <password>x4</password>
    </security>
    <!-- In <validation> and <timeout> define settings for automatic reconnection -->
    <validation>
        <check-valid-connection-sql>select 1</check-valid-connection-sql>
        <validate-on-match>false</validate-on-match>
        <background-validation>true</background-validation>
        <background-validation-millis>1000</background-validation-millis>
    </validation>
    <timeout>
        <allocation-retry>60</allocation-retry>
        <allocation-retry-wait-millis>1000</allocation-retry-wait-millis>
    </timeout>
</datasource>
<datasource jta="false" jndi-name="java:/X4BAM_DS" pool-name="X4BAM_DS" enabled="true
" use-ccm="true">
    <connection-url>jdbc:sqlserver://localhost:1433;databaseName=X4</connection-url>
    <driver>sqlserver</driver>
    <transaction-isolation>TRANSACTION_READ_COMMITTED</transaction-isolation>
    <pool>
        <min-pool-size>5</min-pool-size>
        <max-pool-size>20</max-pool-size>
    </pool>
    <security>
        <user-name>x4s</user-name>
        <password>x4</password>
    </security>
    <!-- In <validation> and <timeout> define settings for automatic reconnection -->
    <validation>
        <check-valid-connection-sql>select 1</check-valid-connection-sql>
        <validate-on-match>false</validate-on-match>
        <background-validation>true</background-validation>
        <background-validation-millis>1000</background-validation-millis>
    </validation>
    <timeout>
        <allocation-retry>60</allocation-retry>
        <allocation-retry-wait-millis>1000</allocation-retry-wait-millis>
    </timeout>
</datasource>
```

```
...
<drivers>
    ...
    <driver name="postgresql" module="org.postgresql">
        <driver-class>org.postgresql.Driver</driver-class>
    </driver>
    <driver name="sqlserver" module="com.microsoft.sqlserver">
        <driver-class>com.microsoft.sqlserver.jdbc.SQLServerDriver</driver-class>
    </driver>
    ...
</drivers>
```

2.1.2 Configuring via the X4config.xml

The global configuration file `X4config.xml` allows you to change various setting of the X4 Server.

2.1.2.1 iXServ configuration

Within the element `server > services>` of the `X4config.xml` you can enable and disable different X4 Server services.

`<snmpagent>`	Enable SNMP (Simple Network Management Protocol). A properly configured SNMP Trap Appender is required, see SNMP trap appender. **Possible values:** • *on*: Enable SNMP service • *off*: Disable SNMP service (default)
`<sms>`	Enable short message service via SMS (Short Message Service) via serial interface **Possible values:** • *on*: Enable SMS interface • *off*: Disable SMS interface (default)
`<jcoserver>`	Enable SAP Java Connector service **Possible values:** • *on*: Enable JCo service • *off*: Disable JCo service (default)

2.1.2.2 SNMP configuration

Within the element `<snmp>` of the `X4config.xml` you can configure various settings for the *Simple Network Management Protocol* (SNMP). MIB files that are required therefore can be requested at the SoftProject support team.

`<readCommunity>`	Configure the SNMP *Read-only Community String* **Possible values:** *`public`*: Public (default)
`<writeCommunity>`	Configure the SNMP *Write Community String* **Possible values:** *`private`*: Private (default)
`<agentPort>`	Port at which the SNMP agent listens **Possible values:** • Any integer number • *`10161`*: Port 10161 (default)
`<version>`	Used SNMP version **Possible values:** • *`1`*: Use SNMP version 1 • *`2`*: Use SNMP version 2 (default)

2.1.2.3 Configuring the Placeholder Storage for X4 Server

A placeholder storage is configured within the file `X4config.xml` . The root element `x4` can be added a `placeholder` element where the configuration is made.

```
<placeholder>
    <storage>
        <class>example.PlaceholderStorage</class><!-- Fully qualified class name of
the implementation to be used. -->
        <config /><!-- Optional and depending on the placeholder storage
implementation. -->
    </storage>
</placeholder>
```

Available Placeholder Storages

The following three placeholder storages are available by default:

Name	Class name	Description
Properties Placeholder Storage	de.softproject.integration.engine.placeholder.PropertiesPlaceholderStorage	Placeholders are stored in `Properties` files in the file system. The directory containing the files is configurable.
SQL Placeholder Storage	de.softproject.integration.engine.placeholder.SQLPlaceholderStorage	Placeholders are stored in an SQL database. The target database is configurable.
In-Memory Placeholder Storage	de.softproject.integration.engine.placeholder.InMemoryPlaceholderStorage	Placeholders are stored in main memory and are therefore NOT persistent. If no or no valid placeholder storage is defined, it will be used as fallback.

Properties Placeholder Storage Configuration

The directory where the `Properties` files are located can be defined within the `config` element as follows:

```
<placeholder>
    <storage>
        <class>de.softproject.integration.engine.placeholder.PropertiesPlaceholderStorage</class>
        <config>
            <path>C:/X4/PlaceholderStorage/</path>
        </config>
    </storage>
</placeholder>
```

SQL Placeholder Storage Configuration

The database to be used can be defined within the `config` element as follows:

> ⚠ The corresponding tables must exist in the *X4Server schema*!

```
<placeholder>
    <storage>
        <class>de.softproject.integration.engine.placeholder.SQLPlaceholderStorage</class>
        <config>
            <jndi>java:/X4BAM_DS</jndi>
        </config>
    </storage>
</placeholder>
```

2.1.2.4 LDAPS Configuration

To allow self-signed certificates for LDAPS, the path to the trust store and the corresponding password must be specified in the configuration file `X4config.xml` via the elements `<trustStore>` and `<trustStorePassword>`.

```
<x4>
...
    <webContainerURL/>
    <trustStore>TrustStore path</trustStore>
    <trustStorePassword>TrustStore password</trustStorePassword>
    <logging/>
...
</x4>
```

2.1.3 Configuring the Logging

How to configure the X4 Server's logging behavior.

2.1.3.1 Save Point Configuration for the X4 Server

The Save Point configuration for the X4 server can be configured via the `X4config.xml`. The following parameters can be defined:

Sample logging configuration

```
<savepoint storage="database"></savepoint>
```

Explanation of the parameters of the `savepoint` element:

Attribute	Description
`storage`	Defines the location for processing save points in the X4 server *Possible values:* • *`filesystem`*: Save Points are written to the filesystem, to the server directory `savepoints` • *`database`*: Save Points are written to the X4 system database

If the `savepoint` element in the `X4config.xml` is removed, then no save points are saved.

2.1.3.2 SNMP trap appender

As an extension for Log4j you can use an appender for Simple Network Management Protocol (SNMP) traps. It allows to output log events as formatted string to a specific Management Host as an SNMP trap.
To generate SNMP traps it is required to configure an SNMP trap appender for Log4j, and to assign a corresponding category to the appender.

2.1.3.3 Ad hoc logging at runtime

For extended error analysis, it is possible to log the output of individual process steps at runtime. This requires neither changing the `.wrf` file of the related technical process nor restarting the server. In addition, conditional logging in sub-processes is also made possible, e.g. if a sub-process was called by a certain main process.

Configuration

The logging behaviour can be controlled via the `tracelog.properties` file under `X4\Server\X4DB\0`. The expected format is also described here, among other things, if a process or process step is to be addressed and logging is to be switched on:

- **Log individual process steps:** Individual process steps that are to be logged can be specified according to the following scheme: *<user>/<process path>/<ActionID> = 1*
- **Conditional logging of subprocess steps:** If single process steps are to be logged in a subprocess that was called by a specific parent process, this can be specified using the following scheme: *executor_user>/<process_path_parent>/<user>/<process_path_subprocess>/<ActionID> = 1*

The content of the log output corresponds to the content of the logging via *Log4J* on a transition, i.e. the status or the data of the last process step is logged via *Log4J*. The Log4J logger used is `de.softproject.integration.logging.integrated.TraceLog` and the Log4J log level is `INFO`.

If changes have been made in the `tracelog.properties` file, the configuration must be read in again. The reading of the configuration can be triggered via the MBean. To do this, execute the MBean operation **reloadTraceLogSettings**.

Sample configurations

Log single process steps

Sample configuration for logging a specific process step

```
1/Test/Log/logtest.wrf/2 = 1
```

Explanation

Logging is enabled for:

- user *1*
- Process *Test/Log/logtest.wrf*
- Process component with *Action ID 2*

Conditional logging of subprocess steps

Sample configuration for conditional logging of a subprocess

```
1/Test/Log/logtestParent.wrf/1/Test/Log/logtestSub.wrf/2 = 1
```

Explanation

Logging is enabled for:

- User *1*
- Process *Test/Log/logtestSub.wrf*
- Process component with *Action ID 2*

Condition:

- Process *Test/Log/logtestParent.wrf* was executed by
- user *1*

2.1.4 Configuring the production mode

As the most common way to improve the performance, the *X4 Server* provides a production mode. Thereby, the caching for the repository is activated.

1. In the central configuration file `X4config.xml` set the value of `<productionMode>` to *on*.
2. Restart the X4 Server, see Controlled shutdown of the X4 Server (via JMX).
   The production mode respectively the caching is enabled after the restart.

Please note:

- To disable the production mode, set the value of `<productionMode>` back to *off* and restart the server.
- To edit the repository during the production mode, e.g if you want to modify processes and schedules, it is not required to restart the *X4 Server*.

2.1.5 Enabling SSL and HTTPS for X4 Server

2.1.5.1 Securing the X4 Server per HTTPS/SSL

To configure SSL and make it available via HTTPS, make the following changes in `<WildFly>\standalone\configuration\standalone.xml`.

1. Add a new security realm for SSL in `<server><management><security-realms>`:

   Example

   ```
   <security-realm name="SSLRealm">
       <server-identities>
           <ssl>
               <keystore path="softproject.keystore"
                alias="softproject" keystore-password="123456" />
           </ssl>
       </server-identities>
   </security-realm>
   ```

2. Add an HTTPS listener in `<server><profile><subsystem xmlns="urn:jboss:domain:undertow:11.0">`:

   ```
   <server name="default-server">
       <https-listener name="default-https-ssl" socket-binding="https" security-realm="SSLRealm" enable-http2="true"/>
   </server>
   ```

3. In `<server><interfaces>`, add the following interfaces:

   ```
   <interfaces>
       <interface name="management">
           <inet-address value="${jboss.bind.address.management:127.0.0.1}"/>
        </interface>
       <interface name="public">
           <any-address/>
       </interface>
   </interfaces>
   ```

4. Save the configuration file and restart X4 Server.
   WildFly application server is now accessible via `https://localhost:8443/`.

2.1.5.2 Securing the WildFly Management Console via HTTPS/SSL

To additionally secure the Management Console via HTTPS/SSL, in `<WildFly>\standalone\configuration\standalone.xml` make the following changes:

1. Add a new server identity definition for SSL in `<server><management><security-realms><security-realm name="ManagementRealm">`

Example

```
<server-identities>
    <ssl>
        <keystore path="softproject.keystore" relative-to="jboss.server.config.
dir"
         keystore-password="123456" alias=" softproject"/>
    </ssl>
</server-identities>
```

2. Add a new server identity definition for SSL in `<server><management><security-realms><security-realm name="ApplicationRealm">`,

Example

```
<server-identities>
    <ssl>
        <keystore path="application.keystore" relative-to="jboss.server.config.
dir"
         keystore-password="123456" alias="application" key-password="123456"/>
    </ssl>
</server-identities>
```

3. Modify the HTTP interface's socket binding to HTTPS in `<server><management><management-interfaces>`:

```
<management-interfaces>
    <http-interface security-realm="ManagementRealm" http-upgrade-enabled="true
">
        <!--<socket-binding http="management-http"/>-->
        <socket-binding http="management-https"/>
    </http-interface>
</management-interfaces>
```

4. Save the configuration file and restart X4 Server.
   The WildFly management console is now available via `https://localhost:9993/`.

2.1.5.3 Deactivating HTTP Connection for WildFly

To deactivate HTTP connections for WildFly, make the following changes in `<WildFly>\standalone\configuration\standalone.xml`:

1. Make sure that HTTPS/SSL has already been enabled for WildFly application server, and that the WildFly management console was secured via HTTPS/SSL (see above).

2. Modify the remote connector for HTTPS in `<server><profile><subsystem xmlns="urn:jboss:domain:remoting:3.0">`,:

```
<http-connector name="http-remoting-connector" connector-ref="
 default-https-ssl" security-realm="ApplicationRealm"/>
```

3. Modify the extension name in `<server><extensions>`:

```
<extension module="org.wildfly.extension.messaging-activemq"/>
```

4. In `<server><profile><subsystem xmlns="urn:jboss:domain:messaging-activemq:1.0"><server name="default">`, change elements `<http-connector>` and `<http-acceptor>` to HTTPS:

Example

```
<http-connector name="http-connector" socket-binding="https"
 endpoint="http-acceptor"/>
<http-connector name="http-connector-throughput" socket-binding="https"
 endpoint="http-acceptor-throughput">
    <param name="batch-delay" value="50"/>
</http-connector>
<http-acceptor name="http-acceptor" http-listener="default-https-ssl"/>
<http-acceptor name="http-acceptor-throughput"
 http-listener="default-https-ssl">
    <param name="batch-delay" value="50"/>
    <param name="direct-deliver" value="false"/>
</http-acceptor>
```

5. Remove the socket binding for HTTP in `<server><socket-binding-group>`:

Example

```
<socket-binding-group name="standard-sockets" default-interface="public"
   port-offset="${jboss.socket.binding.port-offset:0}">
    <!--<socket-binding name="management-http" interface="management"
     port="${jboss.management.http.port:9990}"/>-->
    <socket-binding name="management-https" interface="management"
     port="${jboss.management.https.port:9993}"/>
    <socket-binding name="ajp" port="${jboss.ajp.port:8009}"/>
    <!--<socket-binding name="http" port="${jboss.http.port:8080}"/>-->
    <socket-binding name="https" port="${jboss.https.port:8443}"/>
    <socket-binding name="txn-recovery-environment" port="4712"/>
    <socket-binding name="txn-status-manager" port="4713"/>
    <outbound-socket-binding name="mail-smtp">
        <remote-destination host="localhost" port="25"/>
    </outbound-socket-binding>
</socket-binding-group>
```

6. Save the configuration file and restart X4 Server.
   Wildfly is from now on only available via `https://localhost:8443/`.

2.1.5.4 Creating a Self-signed Java Certificate

For testing purposes, to create your own Java certificate perform the following steps:

1. In the WildFly configuration folder (typically `wildfly\standalone\configuration`), create a self-signed certificate with the Java keytool using the following commands:

   ```
   keytool -genkey -alias softproject -keyalg RSA -keystore softproject.keystore
   -validity 365
   keytool -genkey -alias application -keyalg RSA -keystore application.keystore
   -validity 365
   ```

   Files `softproject.keystore` and `application.keystore` are generated in the WildFly configuration folder.
2. Modify the WildFly configuration for SSL as described above.
3. Check certificates in the Java keystore, and import non-existing certificates from the certificate hierarchy, if required.
   Example: With Mozilla Firefox, certificates can be displayed and exported in a convenient way.
4. Import your exported certificates into the Java keystore.

```
C:\Program Files\Java\jdk-11\bin>keytool -keystore ..\jre\lib\security\cacerts
-importcert -alias godaddysecurecertificateauthority-g2 -file
C:
\Users\SoftProjectAdmin\Desktop\Installation\GoDaddySecureCertificateAuthority-
G2.crt

C:\Program Files\Java\jdk-11\bin>keytool -keystore ..\jre\lib\security\cacerts
-importcert -alias softproject -file
C:\Users\SoftProjectAdmin\Desktop\Installation\softproject.crt
```

2.1.5.5 Configuring X4 Server for HTTPS

1. In startup script `startX4.bat` or `startX4.sh`, change the values of the following lines:

```
JAVA_OPTS=%JAVA_OPTS% -Dx4p.x4.httpsPort=443
...
JAVA_OPTS=%JAVA_OPTS% -Dx4p.x4.secure=true
```

2. In `X4config.xml`, change the web container URL:

```
<webContainerURL>https://<Hostname>:localhost</webContainerURL>
```

2.2 Configuring the X4 Designer

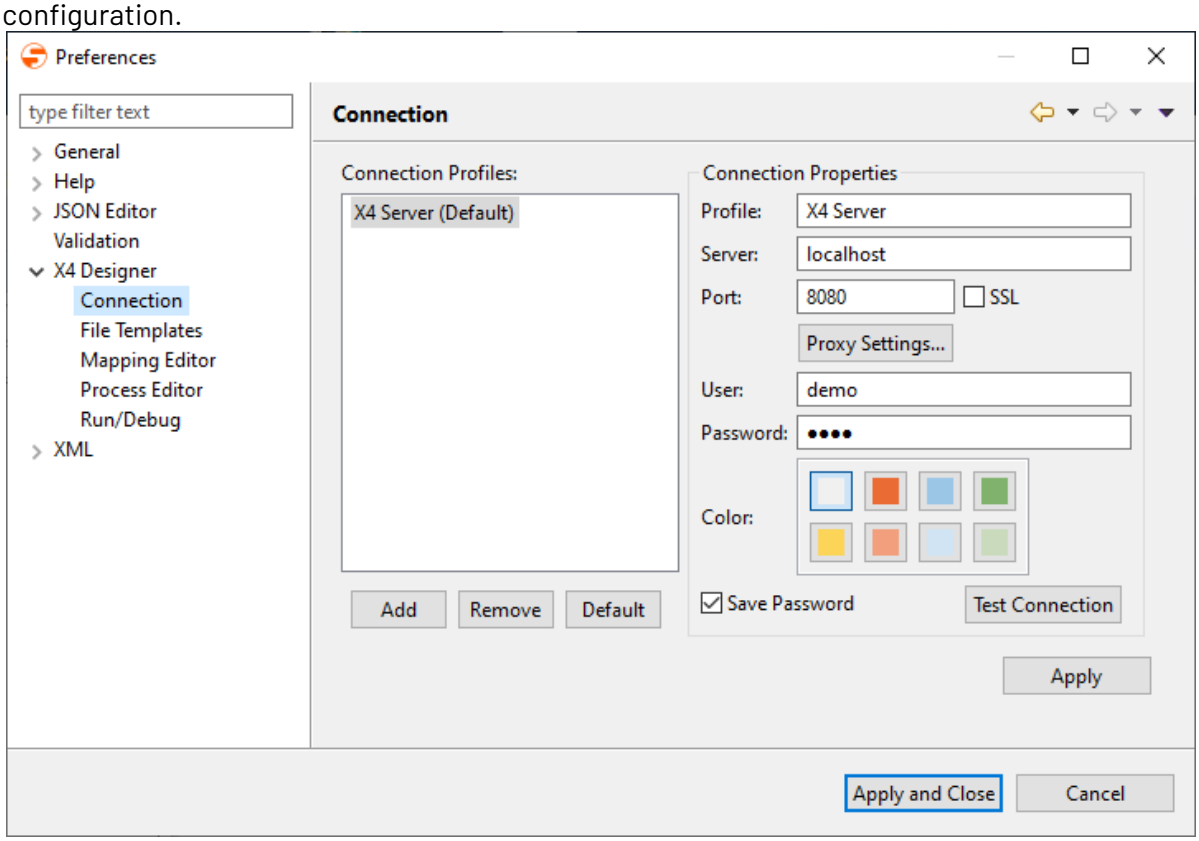
How to customize the appearance and behavior of the *X4 Designer*

2.2.1 Editing the connection configuration

Connection profiles with the respective profile data can be stored under **Connection.**

1. Select menu **Tools> Options**.

2. On the left side, double-click **X4 Designer**, and select **Connection** to open the connections configuration.



3. Make the required connection settings:
   - **Profile:** Name of the connection profile (arbitrary)
   - **Server:** IP address or host name of the *X4 Server* (Example: `localhost`)
   - **Port:** Port number
   - **Proxy Settings:** Default settings for proxy servers and your internet connection
   - **User:** Name of the repository user
   - **Password:** Corresponding password
   - **Color:** Color for the connection setting (optional)

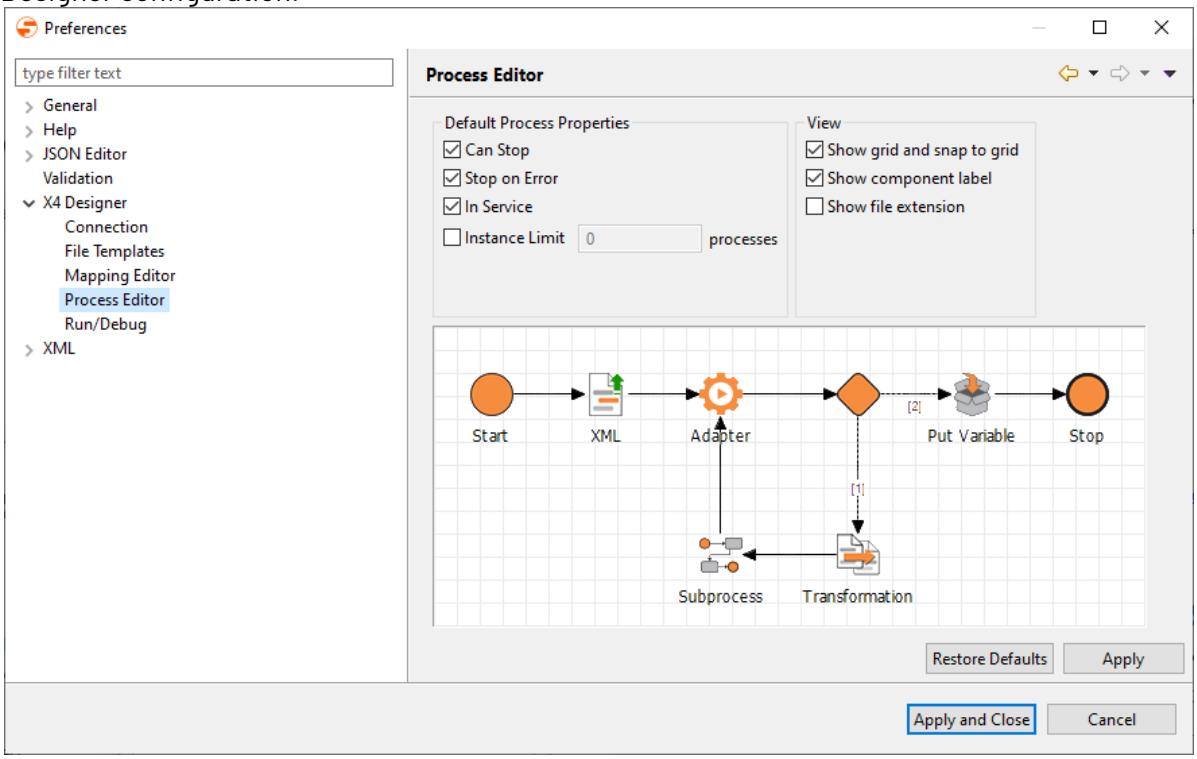
     The color will be displayed in the *X4 Designer*'s status bar on the next connect and helps you to differentiate between different *X4 Servers*.
4. Click **Test Connection** to check if the connection functions properly.
5. Click **Apply and Close** to save the configuration and close the window.

2.2.2 Configuring the Process Editor

Under **Process Editor** , settings for the representation of processes can be stored.

1. Select menu **Tools> Options**.

2. On the left side, double-click **X4 Designer**, and select **Process Editor** to open the Process Designer configuration.



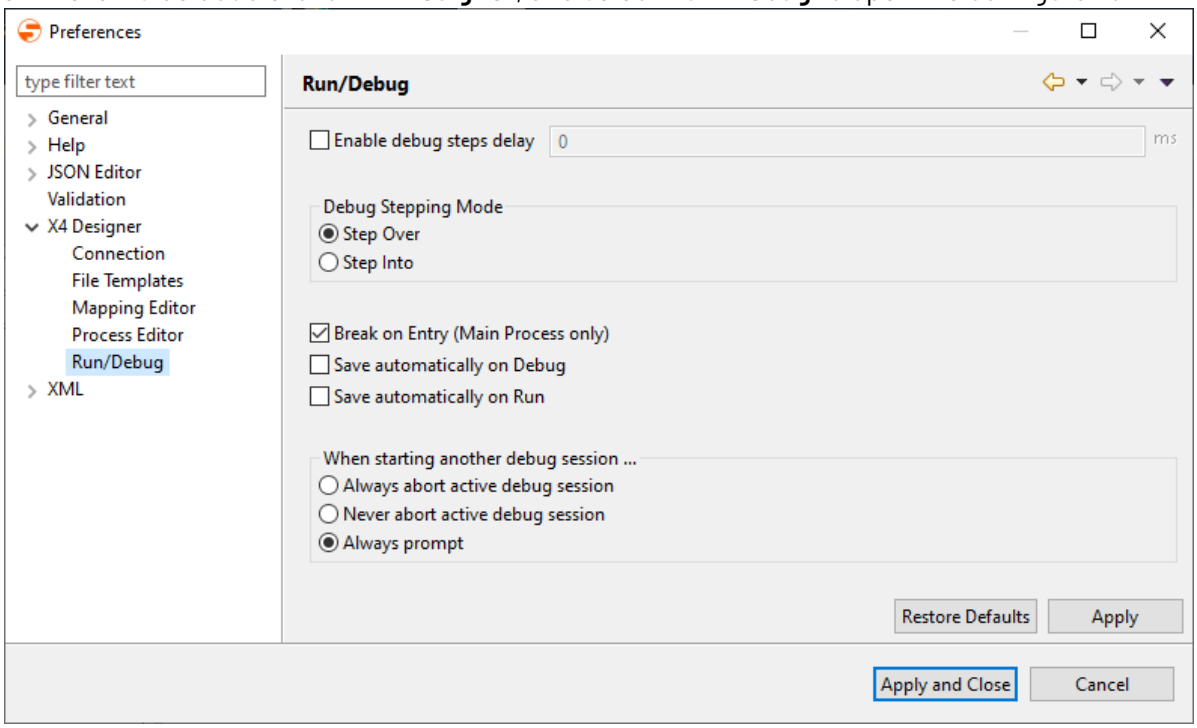
3. Edit default behavior and properties of new processes in **Default Process Properties**:
   - **Can Stop:** Allows the process to be terminated
   - **Stop on Error:** Cancels process execution automatically when an error occurs
   - **Public/Private:** Process is executable
   - **Instance Limit:** Limit the number of process instances
   - **Show grid and snap to grid:** Display a grid and align all symbols to the grid lines
   - **Show component label:** Display a text label below process component symbols
   - **Show file extension:** Show process components with their file extensions (deactivated by default)
4. Click **Apply and Close** to save the configuration and close the window.

2.2.3 Configuring the Run/Debug Mode

You can define the behavior of processes when they are run or debugged in the *X4 Designer*.

1. Select menu **Tools > Options**.

2. On the left side double-click **X4 Designer**, and select **Run/Debug** to open the configuration.



3. Make the required settings:
   - **Enable debug steps delay:** Define the delay (in milliseconds) between each run process step in debug mode
     The delay is only applied, if the process execution is continued via **Resume**.
   - **Debug Stepping Mode:** Default appearance of debugged process steps:
     - **Step Over**: Execute steps and debug each sub-process as one step
     - **Step Into**: Execute steps, jump into sub-processes, and display each sub-process action in debug mode
   - **Break on Entry (Main Process only):** Stop debugging after executing the first process action
   - **Save automatically on debug:** Save the process automatically before debugging
   - **Save automatically on run:** Save the process automatically before running
   - **When starting another debug session:** The debugger's bahaviour when another debugging session is already active:
     - **Always abort active debug session:** The active debugging session will be aborted, and a new debugging session will start immediately.
     - **Never abort active debug session:** The active debugging session will never be aborted when trying to start another session (the active session must be aborted manually by the user).
     - **Always prompt:** When starting debug mode you will be prompted to abort.

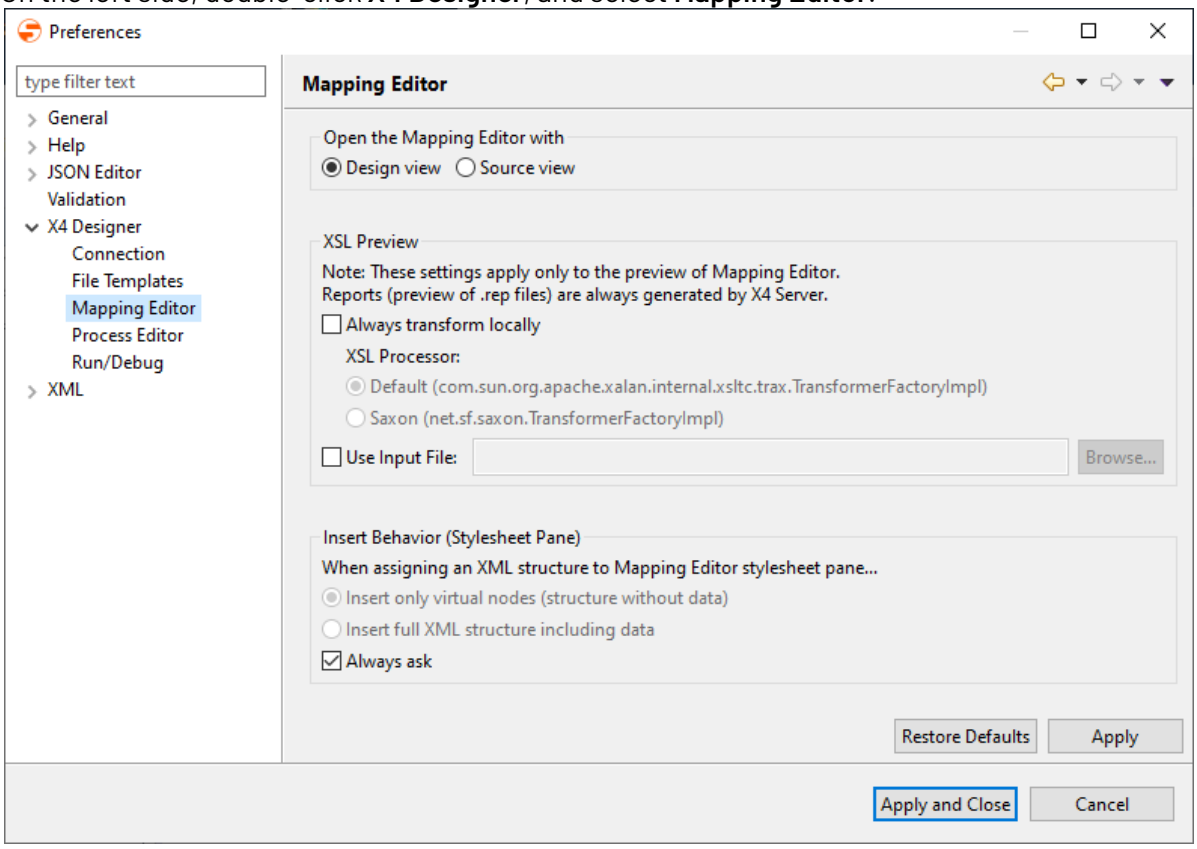
     The debugging can always be restarted via the F4 key.
4. Click **Apply and Close** to save the configuration and close the window.

2.2.4 Configuring the Mapping Editor

For the Mapping Editor's transformation preview, you can define whether the transformation is executed by the X4 Server or locally by the X4 Designer. In addition, you can configure if XML structures shall be inserted with or without content.

> This configuration applies only to the Mapping Editor when clicking  or when pressing the **F9** key! XSL mappings in executed processes are always transformed on the X4 Server!

1. Select menu **Tools > Options**.
2. On the left side, double-click **X4 Designer**, and select **Mapping Editor**.



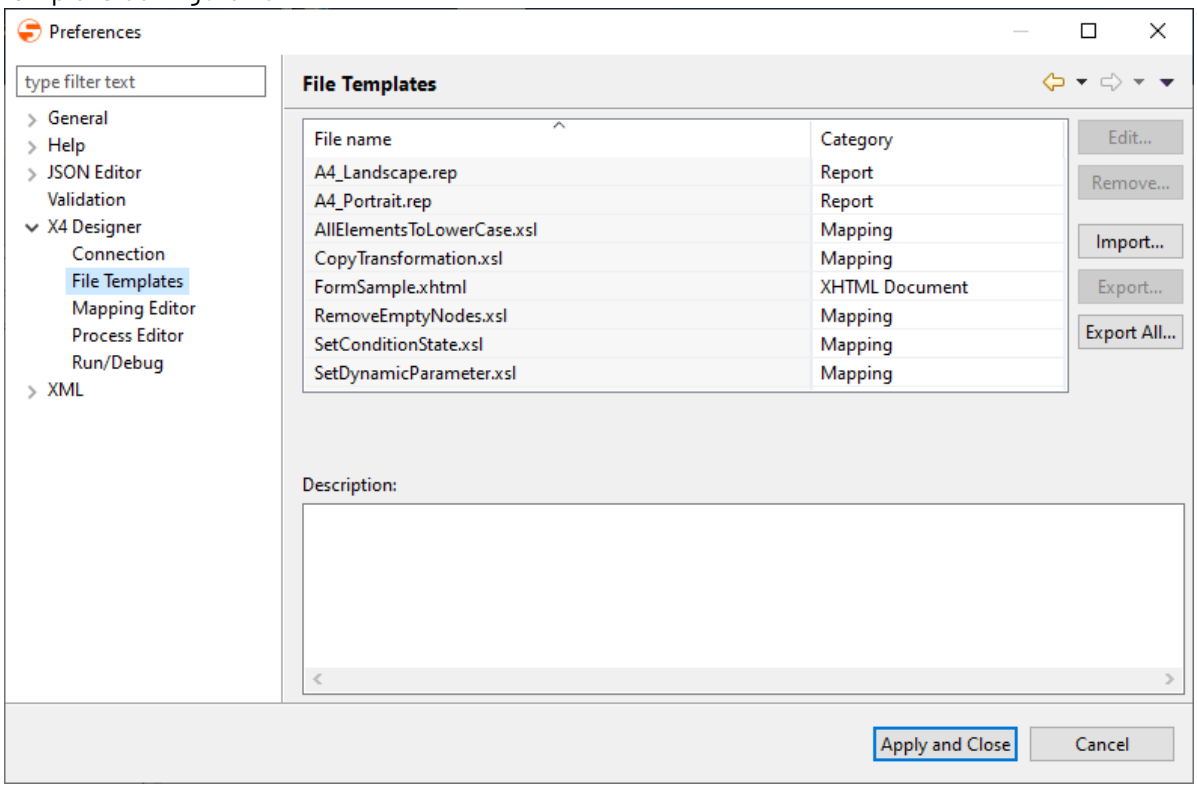
3. Configure the Mapping Editor's behavior:
   - In **Open the Mapping Editor with** define how XSL mappings shall be opened:
     - **Design view:** Open in the graphical mapping view (default)
     - **Source view:** Open in the source code view
   - In **XSL Preview** configure the behavior of XSL transformation previews
   - In **Insert Behavior (Stylesheet Pane)** define the default behavior when inserting XML:
     - **Insert only virtual nodes:** Display only the structure as virtual nodes in the Stylesheet pane
     - **Insert full XML structure including data:** Insert the full XML document structure including values
     - **Always ask:** Always ask when inserting XML via drag&drop, via the context menu or by **Strg+V** (checked by default

4. Click **Apply and Close** to save the configuration and close the window.

2.2.5 Managing templates for repository elements

X4 Designer allows to define file templates for processes, process components or folders enabling to create repeating patterns quickly and easily.

1. Select menu **Tools > Options**.
2. On the left side, double-click **X4 Designer**, and select **File templates** to open the template configuration.



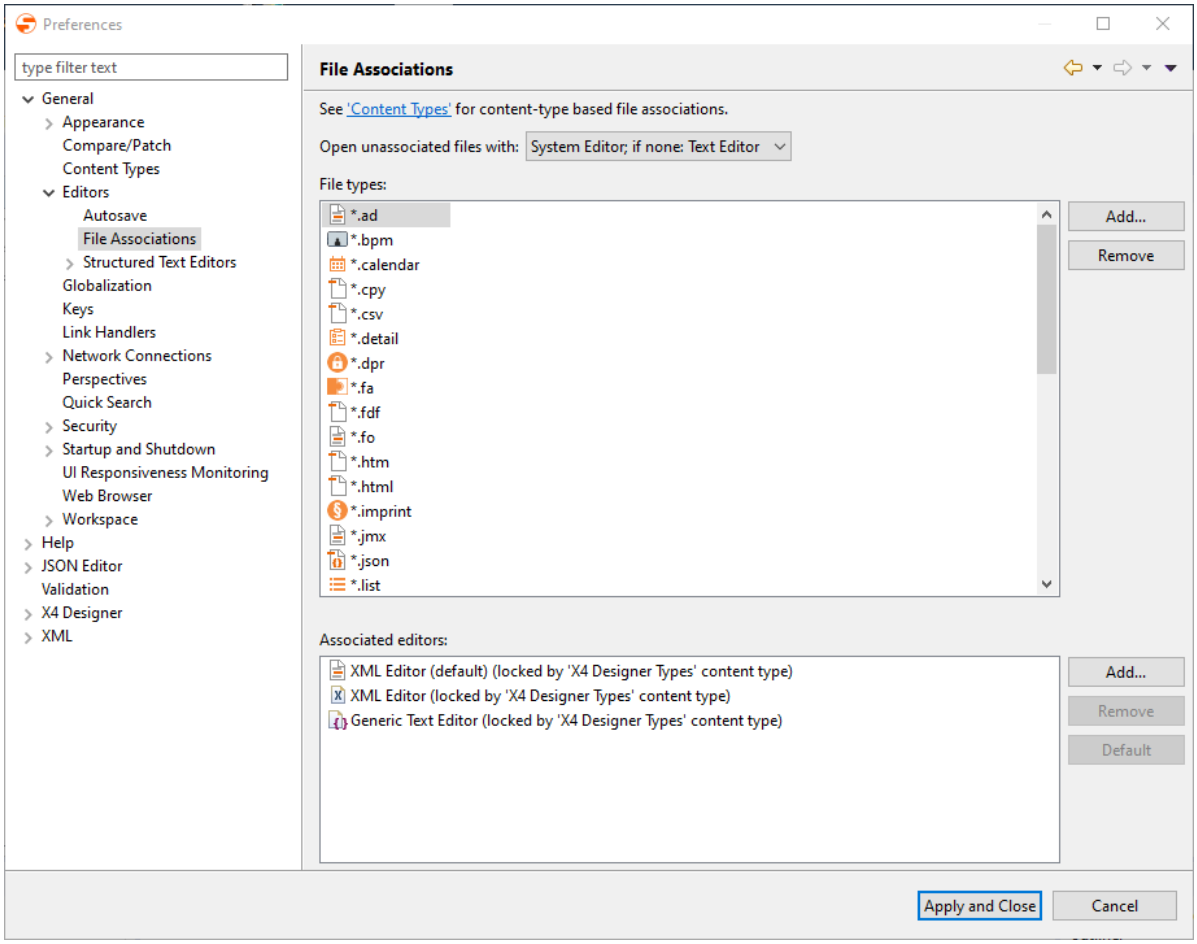
3. Manage the templates as desired:
   - **Edit:** Edit the template's name or description text
   - **Remove:** Delete a selected template
   - **Import:** Import an existing template folder
     Only template directories with the same structure as the folder `<X4>/X4DB/0/Templates` can be imported.
   - **Export** respectively **Export All:** Export a selected template respectively all templates as template directories
4. Click **Apply and Close** to save the configuration and close the window.

2.2.6 Assigning file types to external or internal editors

X4 Designer allows to link any file types with editors and other programs.

1. Select the menu **Tools > Options**.

2. On the left side, select **General > Editors > File Associations** .



3. In **File types**, select an existing file type or add a new by clicking **Add**.

> You can either define a file extension using a * wildcard or a full file name. Example: `*.xyz or Filename.xyz`

4. In **Associated editors**, select a suitable editor for the file type, or open the **Editor Selection** window by clicking **Add**. Then select the editor from a list of available editors.

> If you want to use an external editor, choose the option **External programs** within the **Editor Selection** window and click **Browse** to select the file of the external *application.* *Example:* `C:\Program Files\Notepad++\notepad++.exe`.

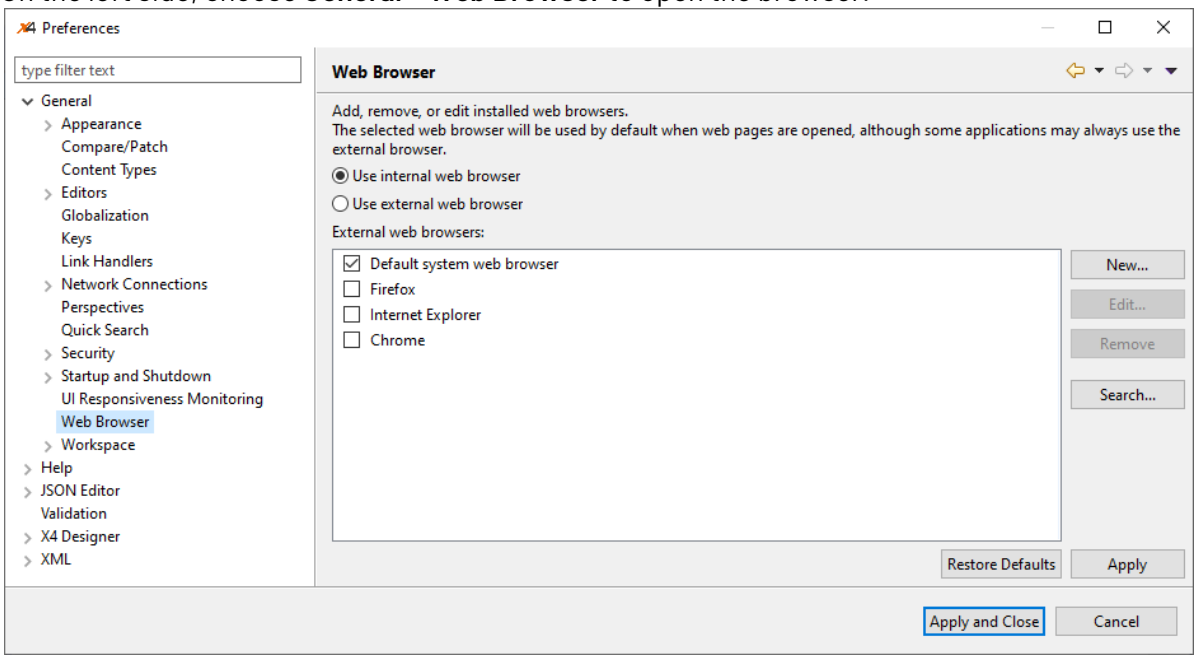
> If the file type shall be opened by default with a selected editor, click **Default**.

5. Click **Apply and Close** to save the settings and close the window.
The **Repository Navigator**'s context menu entry **Open with** now provides all internal or external editors assigned to this file type.

2.2.7 Configuring the Web Browser

Different browsers can be used to display browser-based components of the X4 BPMS (see System requirements). The browser used can be specified in the X4 BPMS.

1. Open **Tools> Options**.
2. On the left side, choose **General** > **Web Browser** to open the browser.



3. Choose one of the defined browsers or click **New**.
4. If **New** was clicked:
   - **Name:** Display name of the browser configuration
   - **Location:** File system path to the browser
   - **Parameters:** Parameters that are to be used when the browser is called.

   > To use Microsoft Edge the following must be entered:
   > **Location:** File system path to Microsoft prompt, e.g. *C:\Windows\System32\cmd.exe*
   > **Parameters:** /c "start microsoft-edge:%URL%"

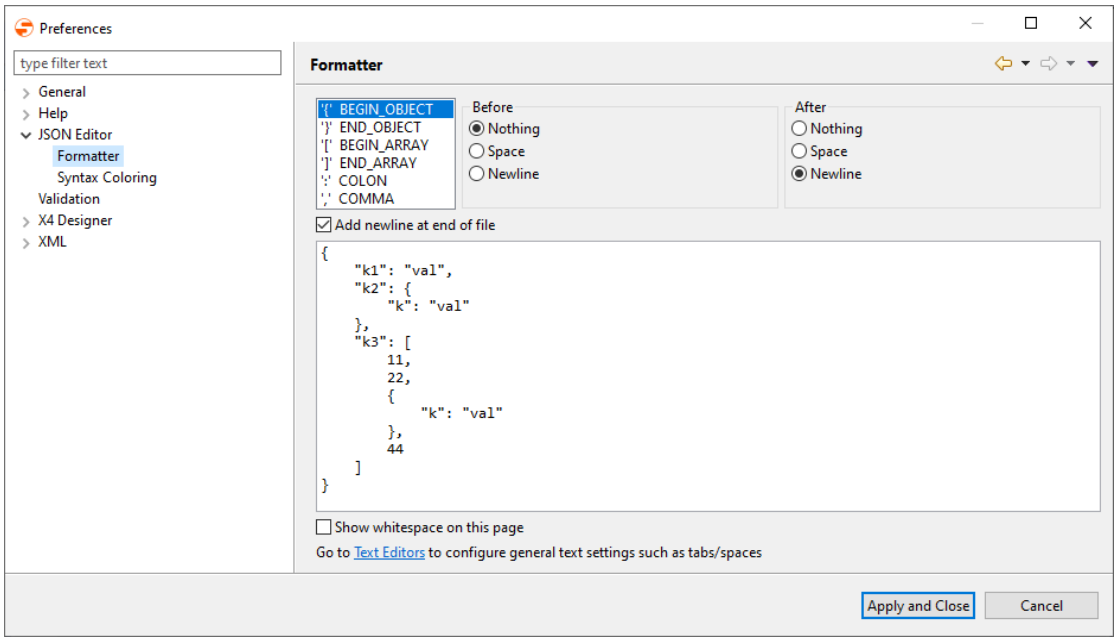
5. Confirm the settings with **OK**.
6. Click **Apply and Close** to save the configuration and close the window.

2.2.8 Configuring the JSON Editor

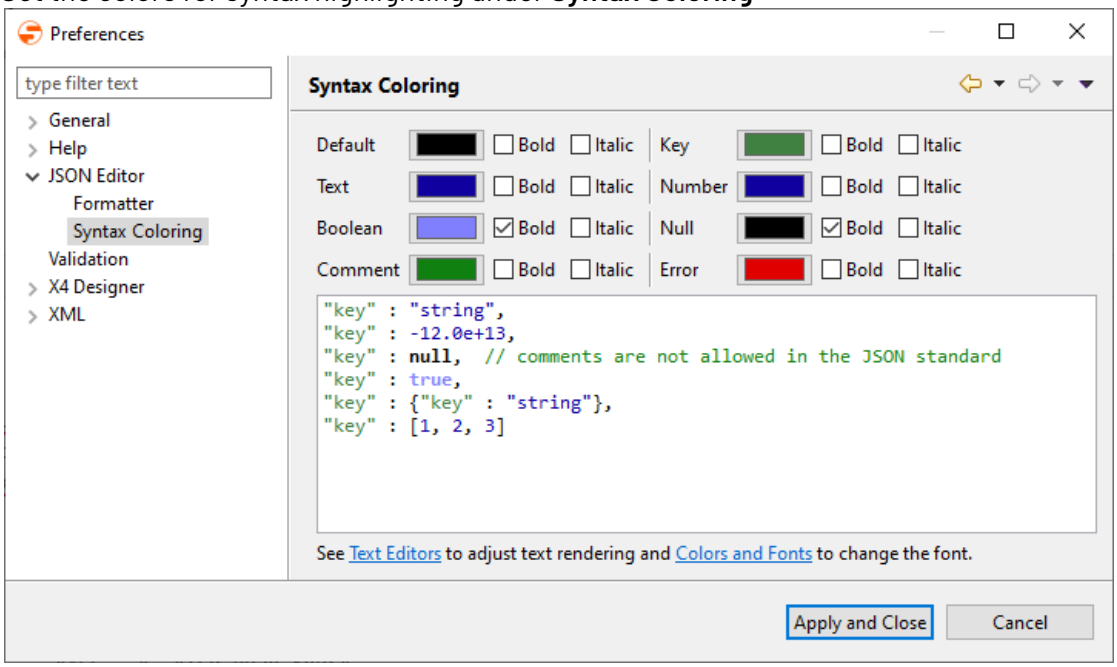
Under **JSON Editor**, settings for the JSON Editor can be stored.

1. Select menu**Tools> Options**.
2. On the left side, double-click**JSON Editor** to open the editor configuration.
3. Make the desired settings:

- Set the formatting of the JSON code under **Formatter**



- Set the colors for syntax highlighting under **Syntax Coloring**



4. Click **Apply and Close** to save the configuration and to close the window.

2.2.9 Changing the Help Language

The integrated help can be opened in a separate window via the menu **Help > Help Contents**. The help is divided into books, each one focusing on a different topic within the context of the X4 BPMS.

The language of the displayed help contents is based on the specified system language. However, it is possible to change the language at any time. If the system language is neither German nor English,

the help will be displayed in English by default.

The language can be adjusted within the file `X4Designer.ini` under `<X4>/Designer`. To switch the language, the language specification `en` for English or `de` for German must be adjusted.

Example: Adjustment for english help contents

```
-startup
plugins/org.eclipse.equinox.launcher_1.2.0.v20110502.jar
--launcher.library
plugins/org.eclipse.equinox.launcher.win32.win32.x86_1.1.100.v20110502
-nl
en
-vm
jre\bin\
-vmargs
-Xms64m
-Xmx1024m
-XX:MaxPermSize=128m
```

After restarting the X4 Designer, the help contents are available in the respective language.

3 Administering the X4 Server

Learn how to administer a productive X4 BPMS installation via JMX.

3.1 Updating the X4 Repository in production mode

In the X4 Server's production mode the caching for the X4 Repository is enabled. You can update repository project without restarting the server.
To avoid that outdated cache files will be used, the cache must be reset after updating the X4 Repository. This can be done with a JMX Management Bean (MBean) provided by the X4 Server with the name `X4Management`.

> The JMX MBean `X4Management` allows to reset the cache using the method `resetCache()`. In addition, caching statistics can be accessed with the method `cacheStatistics()` and an SAP JCo server can be restarted using the method `restartSAPJcoServer()`.

1. Update your X4 Repository.
2. Open the JMX MBean `X4Management`
   - Start the jconsole tool.
   - Open the JMX MBean `X4Management` in a domain `de.softproject.X4`
3. Invoke the MBean method `resetCache()`.
   The cache will be reset.

3.2 Controlled shutdown of the X4 Server (via JMX)

How to shut down the *X4 Server* in a controlled way during processes are running

> **Prerequisites for shutting down**
> A controlled shutdown of the X4 Server ensures that all currently running processes are fully executed and no more processes are started. This requires that the property `Can Stop` is not set for processes that are not allowed to be stopped. Moreover, endless processes must be modeled in such a way that they interrupt processing at regular intervals so that they can be stopped.
> Depending on the message queue adapter, this can be done as follows:
>
> - *JMS* and *RequestReply Transfer*: Specify a timeout in parameter `timeout`. If the adapter returns the status *0*, the queue is empty and the process control goes back to the adapter, allowing the process to be halted.
> - *MQ Series Transfer* and *WebSphere MQ*: Enable the parameter `MQGetMessageOptions.options.MQC.MQGMO_WAIT` to activate waiting for a message, and specify in parameter `MQGetMessageOptions.waitInterval` a timeout in milliseconds that will be waited until an appropriate message can be received.

1. Access the MBean `X4Management`

- Start the jconsole tool.
- Open the MBean `X4Management` in a domain `de.softproject.X4`

2. Invoke the MBean method `setAllOutOfService()`.
   The property `OutOfService` will be set for all processes. This causes that no more processes can be started.
3. Invoke the MBean method `stopAllProcesses()`.
   All processes that are currently executed and are allowed to be stopped, will be terminated.
4. Wait until the MBean method `runningWorkflowCount()` displays *0*.
   No process is executed any longer.

> Alternatively, you can also invoke the method `shutdownAllProcesses(longtimeoutInMS)`. This causes the MBean methods `setAllOutOfService()`, `stopAllProcesses()`, and `runningWorkflowCount()` to be executed consecutively.
>
> - In **ParamValue** specify a timeout in milliseconds, to be handed over to the method as parameter `longtimeoutInMS`.
> - Click **Invoke** to execute the method. This returns *True*, if `runningWorkflowCount()` displays *0* before the timeout exceeds.

5. Shut down the X4 Server.

3.3 Providing Process Libraries

Process libraries provide an easy way to use process models for multiple users. They allow know-how to be bundled, stored centrally and to be reused in a targeted manner.

To provide process libraries the following steps are required:

1. *Installing the process library*: Place the process library as `ZIP` or `jar` file under `Server\X4DB\X4modules`.
2. *Configuring and providing the process library*: Configure and provide the process library on the Server via the file `modules.xml` (`Server\X4DB\X4modules\`).

Sample configuration via the modules.xml

```
<?xml version="1.0" encoding="UTF-8"?>
<modules>
    <global project="MyFirstLibrary" jar="MyFirstLibrary.zip"/>
    <local userId="1" project="MySecondLibrary" jar="MyFirstLibrary.jar"/>
</modules>
```

Explanation:

Element	Description
`global`	The library is provided globally and thus available for all users
`local`	The library is provided locally and thus available only for a certain user
`userId`	User who can access the library
`project`	Project name; The project name must correspond to the project name of the process library.
`jar`	Reference to the `ZIP` or `jar` file of the process library

4 High Availability

In systems with high workloads or critical services, high availability is an important part of the system landscape. With X4 BPMS, there are several scenarios for implementing high availability.

Basically, three different use cases are described: load balancing, fail over and high availability with planned process executions.

With high availability, data integrity often plays a role and must therefore be guaranteed. Thus, it is important to consider the database in the system landscape.

The load balancer is an external system component that must be set up based on the environment. It receives the external requests and forwards them to the corresponding X4 Server instance. This makes external callers independent of the underlying system landscape and allows extensions to be made without having to perform changes on client side.

4.1 Load Balancing

In the case of load balancing, the problem is caused by many simultaneous requests and their processing. More requests are to be processed simultaneously by connecting several X4 Server instances behind a load balancing system, thus achieving higher computing power. This enables a high demand-driven scalability. However, it must be ensured that the shared data of the X4 systems is known to all systems. Therefore, there are different scenarios depending on the application.

4.1.1 Scenario – Few Mainly Reading Database Accesses

If the processes contain mainly calculations or additional services are addressed, a load distribution can be realized over several X4 Servers, each of them managing its system database, and another database containing the shared data. Here, two expansion stages can be distinguished.

4.1.1.1 Simple – Direct database access

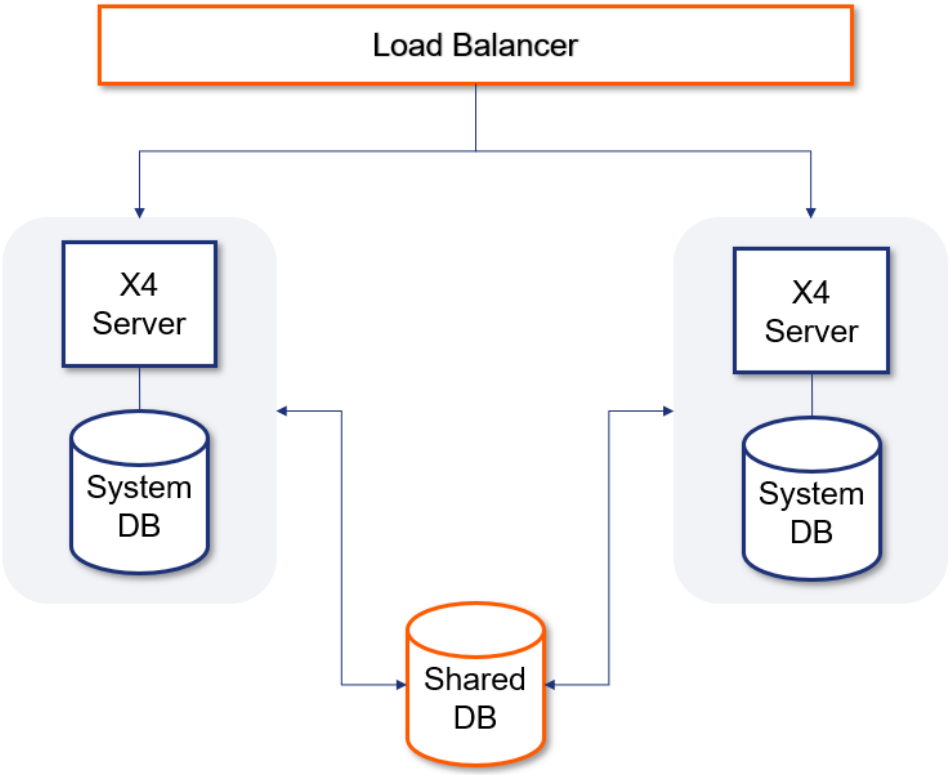


Figure: Direct database access

Access to the shared data can be managed directly via the database' access layer. This is the simplest solution to the problem and a good solution for small systems since the database itself cannot be easily decoupled.

4.1.1.2 Complex – Shared access via an X4 instance

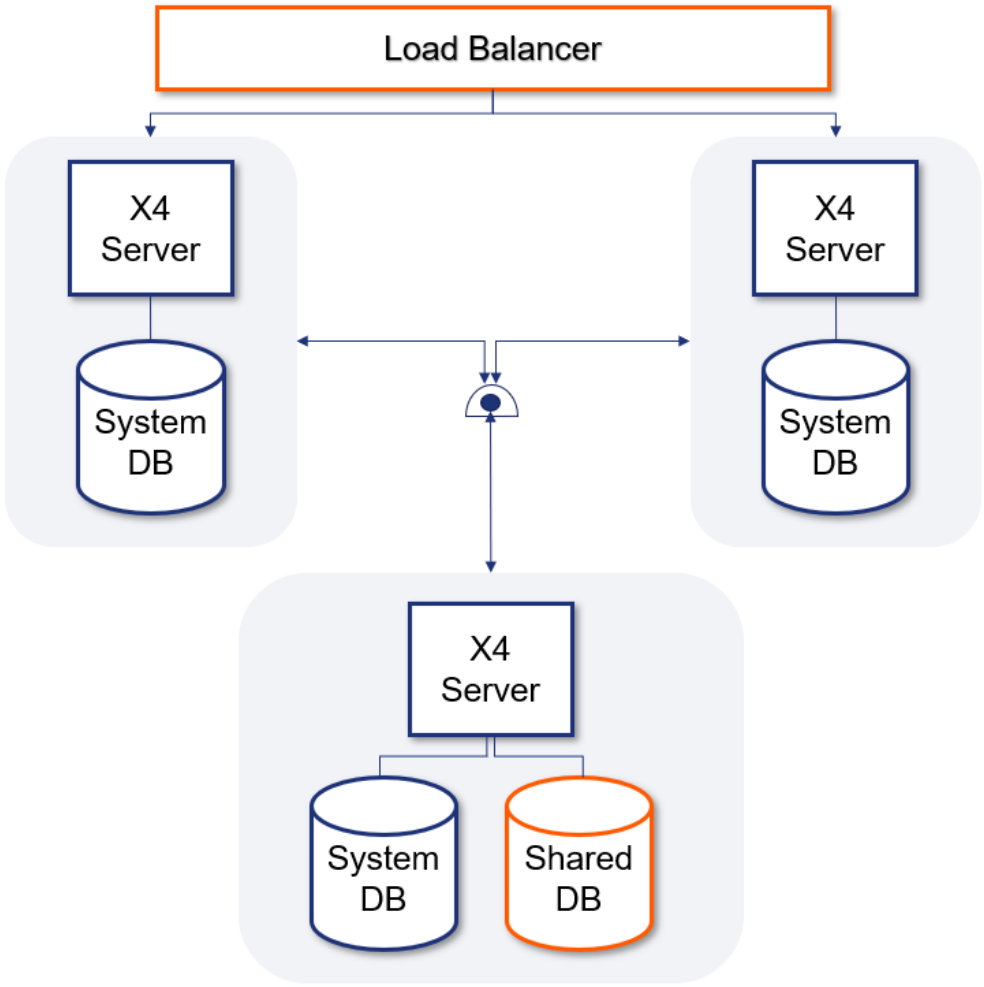


Figure: Shared database access via an X4 instance

If the database should be decoupled, it is a good idea to insert a service layer between the database and the X4 Servers. It encapsulates the common database and thus makes the data storage layer exchangeable. This is important for larger systems in order to better guarantee maintainability, testability and integrity.

4.1.2 Scenario – Shares Access via Message Queue

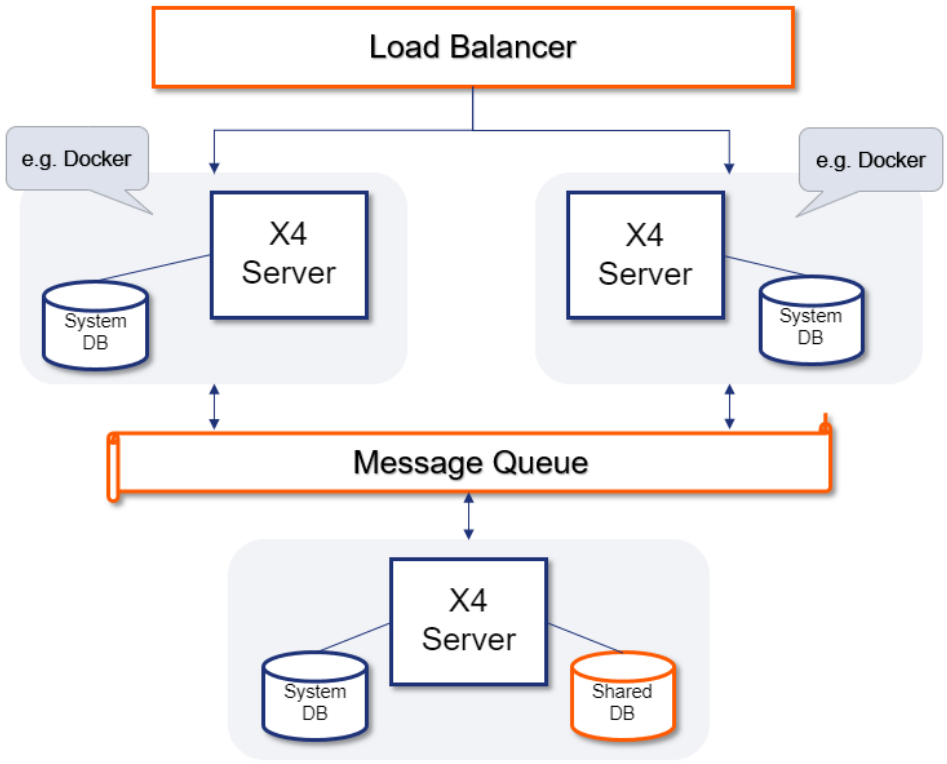


Figure: Shared database access via Message Queue

Another possibility to decouple the database is via a middleware. This is recommended for critical applications where no messages may be lost between the X4 Servers and the X4 Server of the shared database. The middleware ensures that messages are kept persistent until they have been processed by the recipient.

4.2 Fail Over

In contrast to load balancing, fail over operation requires that the system is accessible at all times. However, usually only one server is primarily used for requests. If this server fails, the second server is used and the end user does not notice the failure.

A keep-alive service ensures that the load distributor is notified if a system failure occurs. This allows to immediately switch over to the second server.

4.2.1 Scenario – A Single Exclusive Database

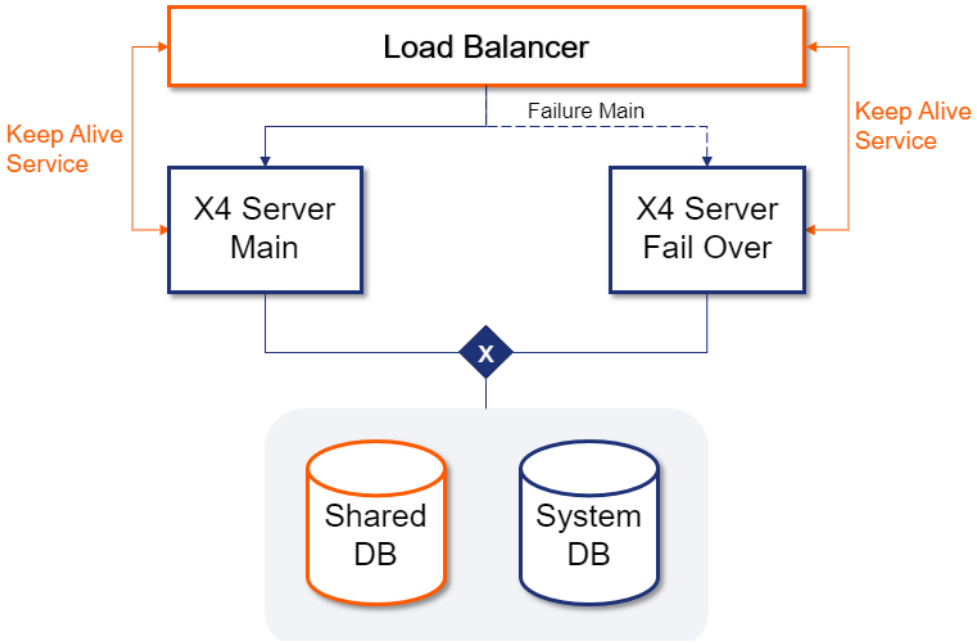


Figure: A single database with exclusive access

The simplest system contains two X4 Server instances that can receive both requests. A single database is used for both servers. Thus, for data integrity it is important that only one of the two servers has access to the database at a time.

Scheduled services can be implemented using an external scheduler or a logical lock on a table of the shared database *Shared DB*.

4.2.2 Scenario – System Database per X4 Server

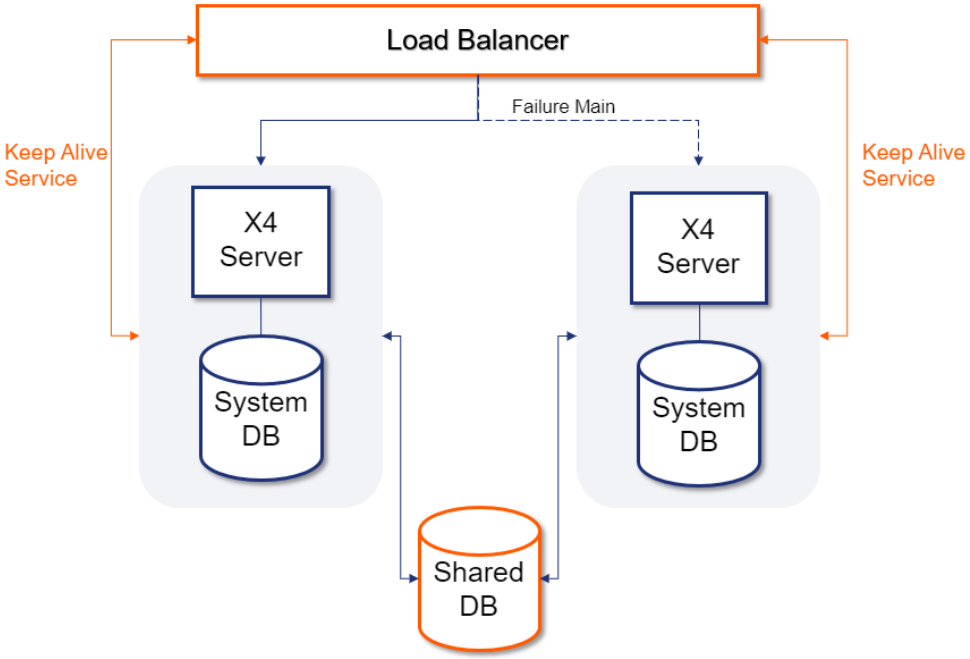


Figure: Separate system databases

If load balancing and fail over are to be provided through the system structure, each X4 Server requires its own system database. This allows each X4 Server to respond to requests. If only ail over is to be ensured, all requests are redirected to only one of the two X4 Servers.

Scheduled services can be implemented using an external scheduler or a logical lock on a table of the shared database *Shared DB*.

4.3 Load Balancing via Scheduler

If, in addition to load balancing, processes are to be started automatically via a scheduler, it must be ensured that execution is not triggered multiple times.

4.3.1 Scenario – Dedicated X4 Server for Scheduling

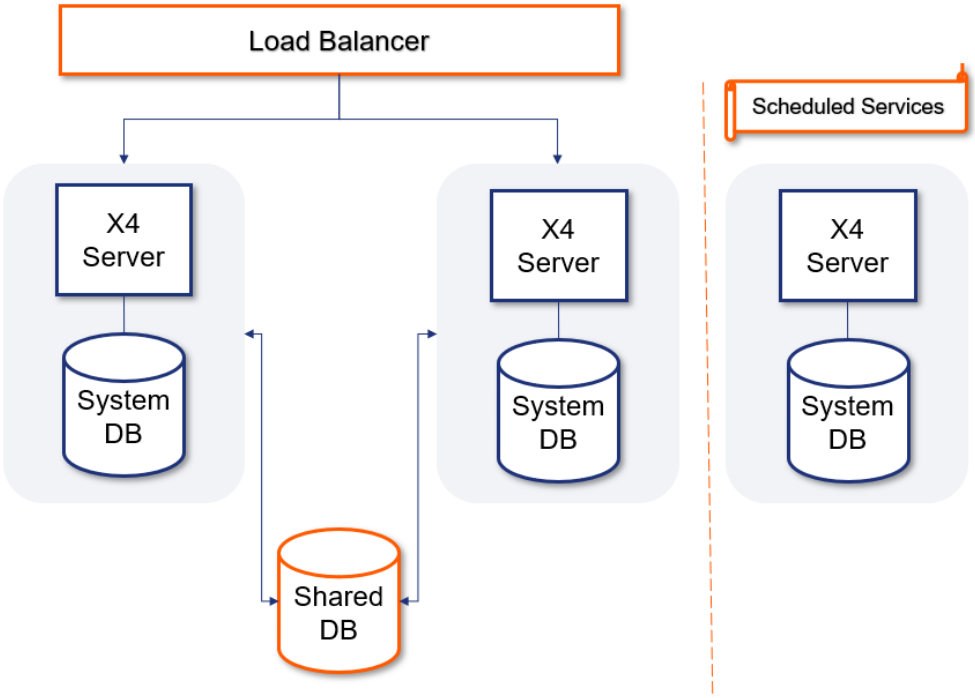


Figure: Dedicated Scheduler X4 Server

If scheduling should take place independently of the current load distribution, a dedicated X4 Server is set up containing only the automatically started processes. This X4 Server instance has the possibility to notifying the other X4 Systems via the shared database. As described in the section *Scenario – Shared Access via Message Queue*, it is also possible to exchange messages with the shared database via a message queue.

4.3.2 Scenario – One Server Responsible for Scheduling

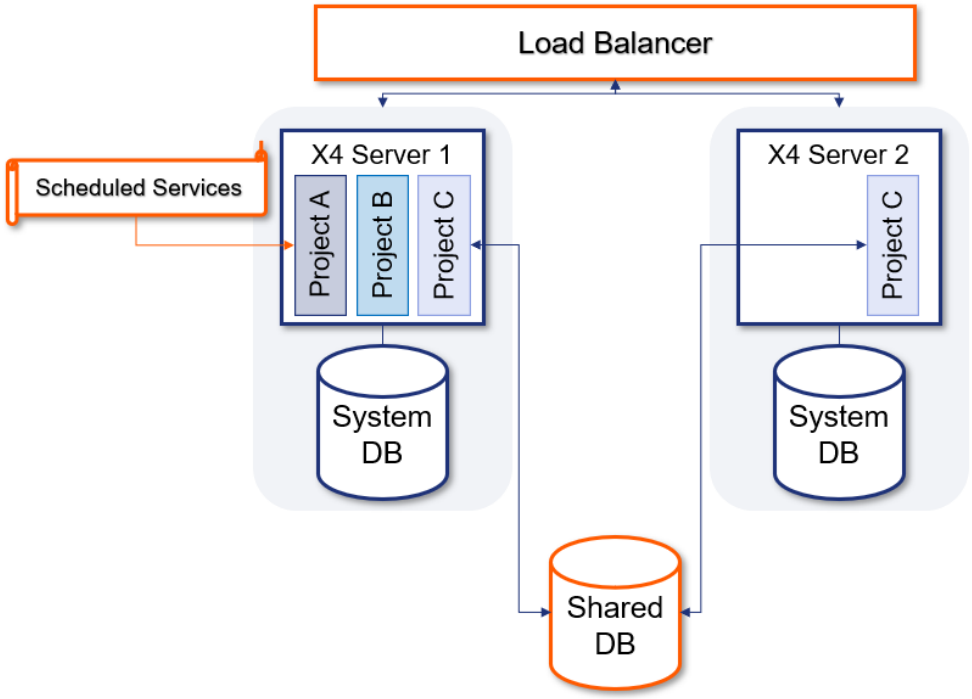


Figure: Planned processes in X4 project

If no additional X4 Server instance should be used for the automatic execution of processes, a separate project within the X4 projects can be used for these processes. This project is then installed exclusively on one of the two X4 Servers. This ensures that only this server instance executes the processes.

4.3.3 Scenario – External Scheduler

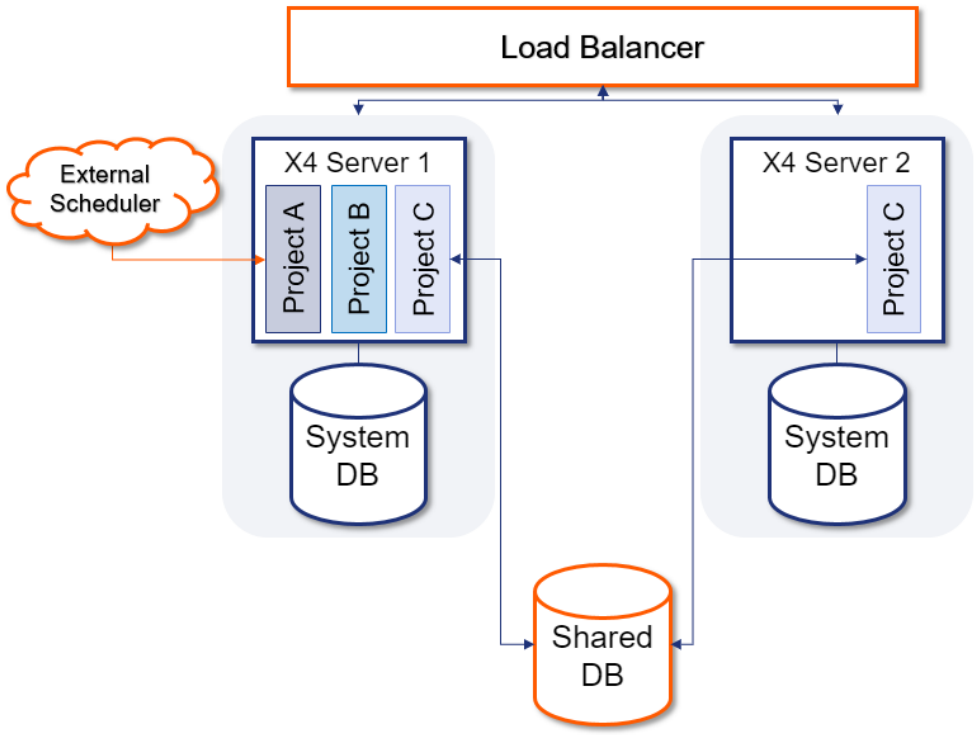


Figure: Planned processes via external scheduler service

In addition to the scheduler included in the X4 Server, an external service can also start processes automatically. This service addresses the processes to be executed directly on the server on which *project A* is installed.

5 Operation Scenarios

The X4 BPMS can be operated in different ways. Basically, the following five operating scenarios can be distinguished:

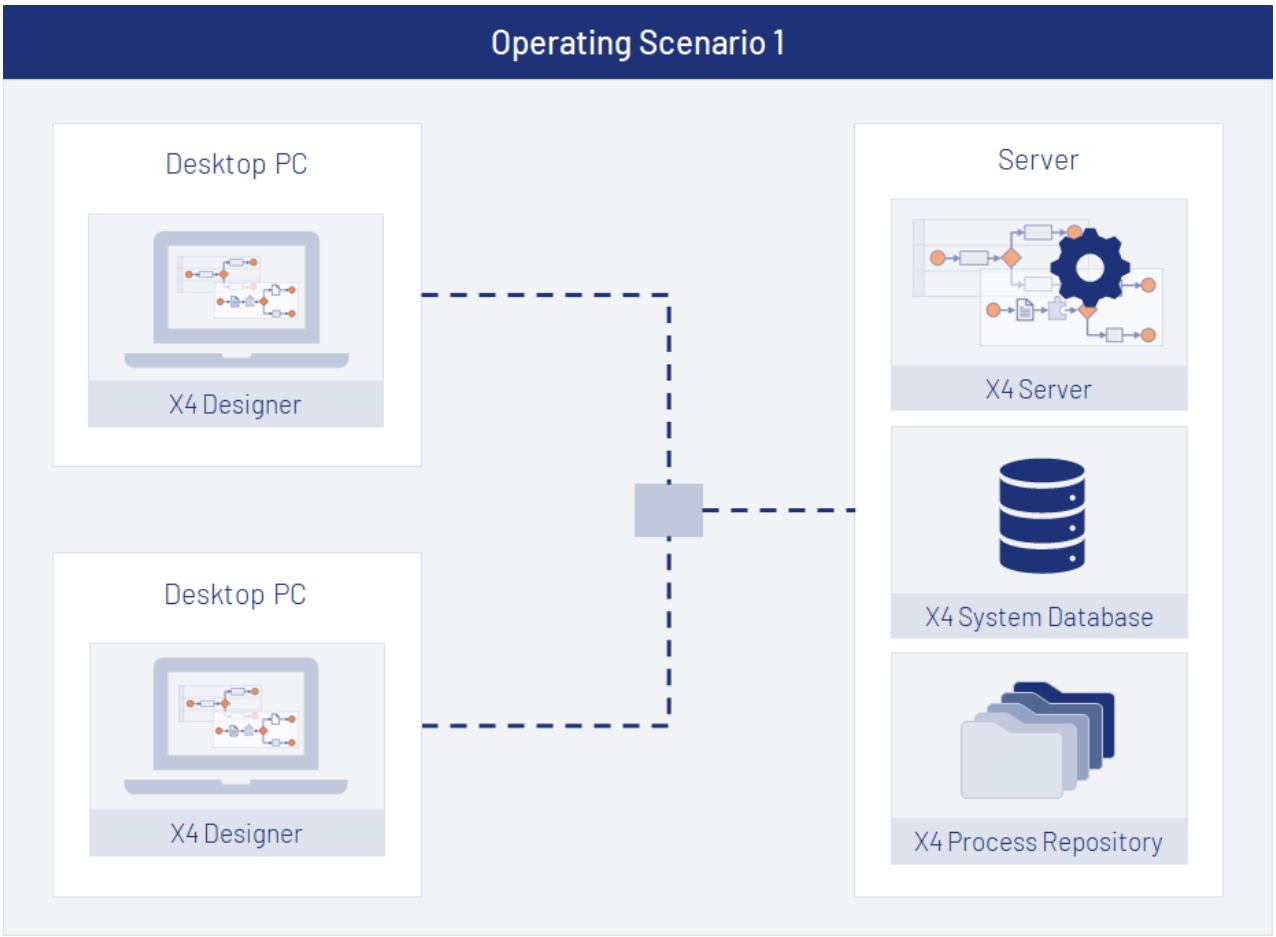
5.1 Operating Scenario 1

Architecture:

- The single X4 Designer installations are each located on a client.
- The X4 Server, the X4 System database, and the X4 Repository are located on the same server

Advantages and disadvantages:

- Suitable for smaller environments and individual production servers
- Easy to install, to maintain and to backup
- Limited scalability



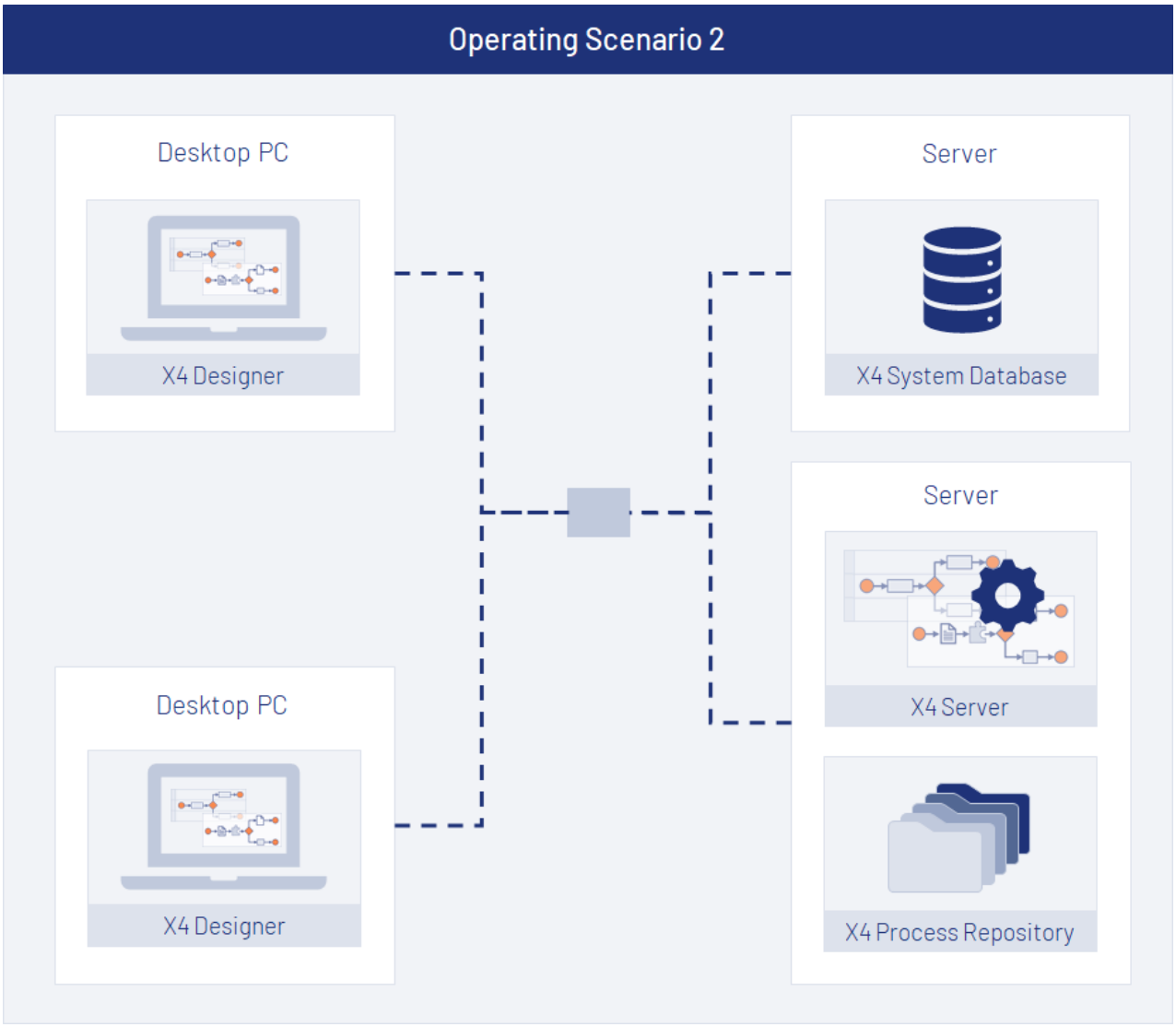
5.2 Operating Scenario 2

Architecture:

- The single X4 Designer installations are each located on a client.
- The X4 System database is located on its own database server.
- X4 Server and the X4 Repository are located on the same server.

Advantages and disadvantages:

- Suitable for larger environments
- Expandable for failover cluster situations
- Increased scalability
- More complex installation, maintenance and backup



5.3 Operating Scenario 3

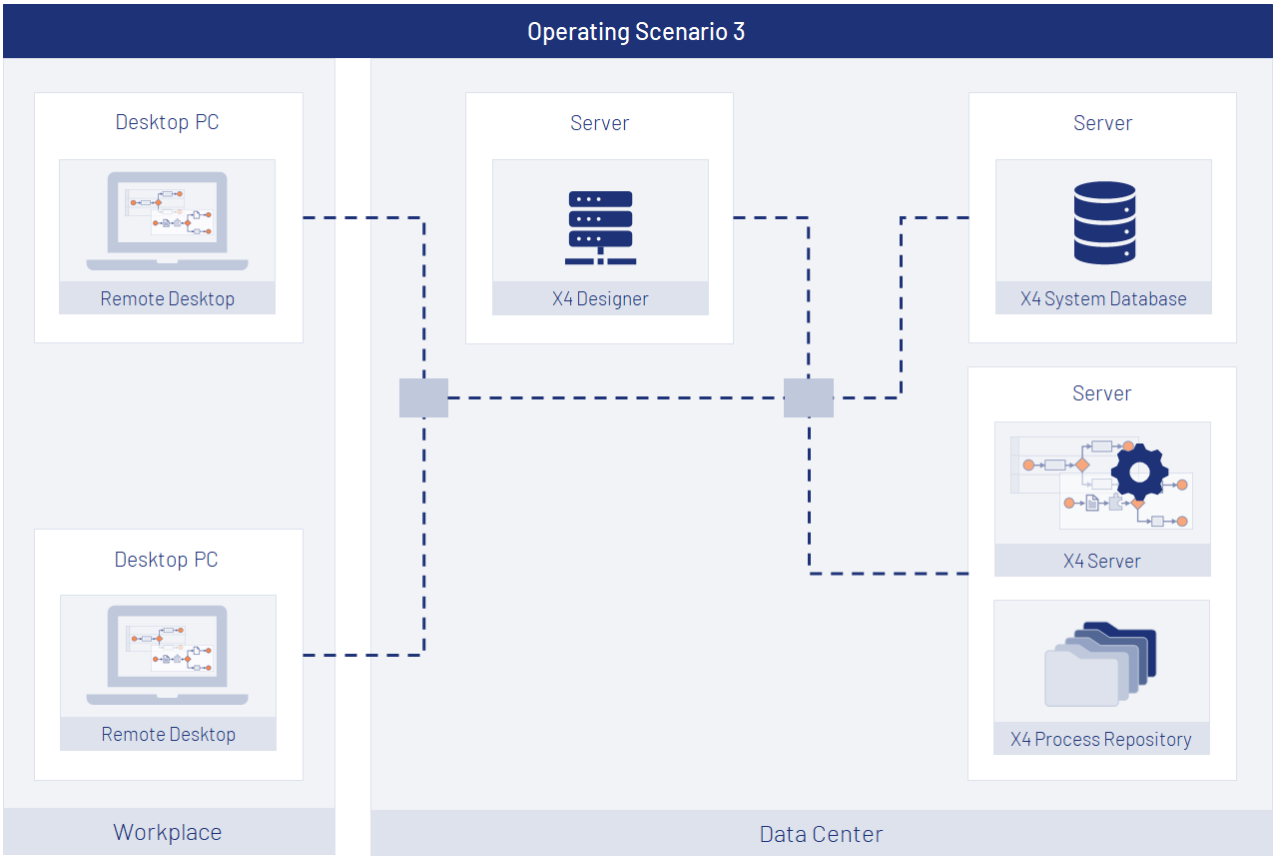
Architecture:

- The X4 Designer is located on a server in the data center.
- The X4 System database is located on its own server in the data center.
- X4 Server and the X4 Repository are located on the same server in the data center.

- Individual users access the software remotely from their workstations.

Advantages and disadvantages:

- Suitable for larger environments
- Suitable for environments where users do not have a fixed workstation (e.g. thin clients only) or need to change their work environment (e.g. many people share the same workstation or work from remote locations via narrowband networks)
- Expandable for failover cluster situations
- Increased scalability
- Complex installation, maintenance and backup



5.4 Operating Scenario 4

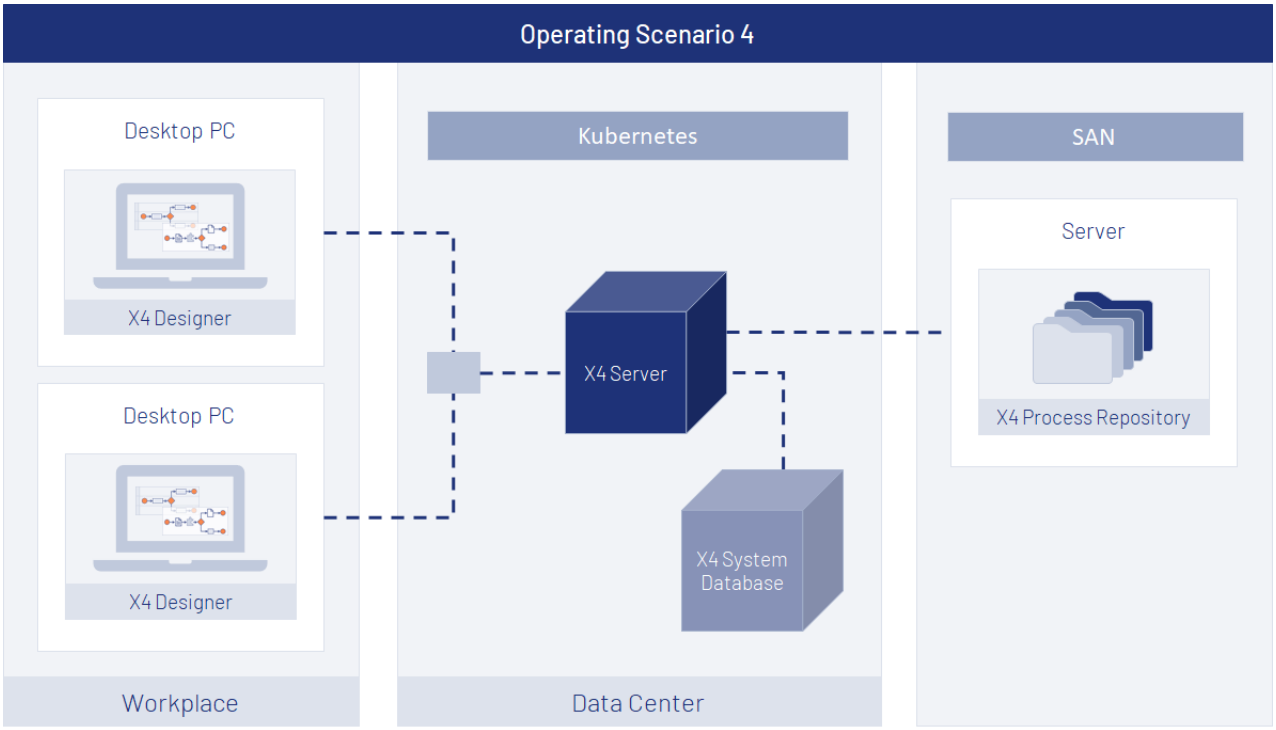
Architecture:

- The single X4 Designer installations are each located on a client.
- The X4 System database is located on its own database server and provided as container in Kubernetes.
- The X4 Server is provided as container in Kubernetes.
- The X4 repository is located on a storage network (SAN).

Advantages and disadvantages:

- Suitable for use in the largest environments (scaling up and down on the fly)

- Best approach for distributed systems (hybrid cloud etc.)
- Maximum scalability
- Complex installation and maintenance, requires professional backup concepts



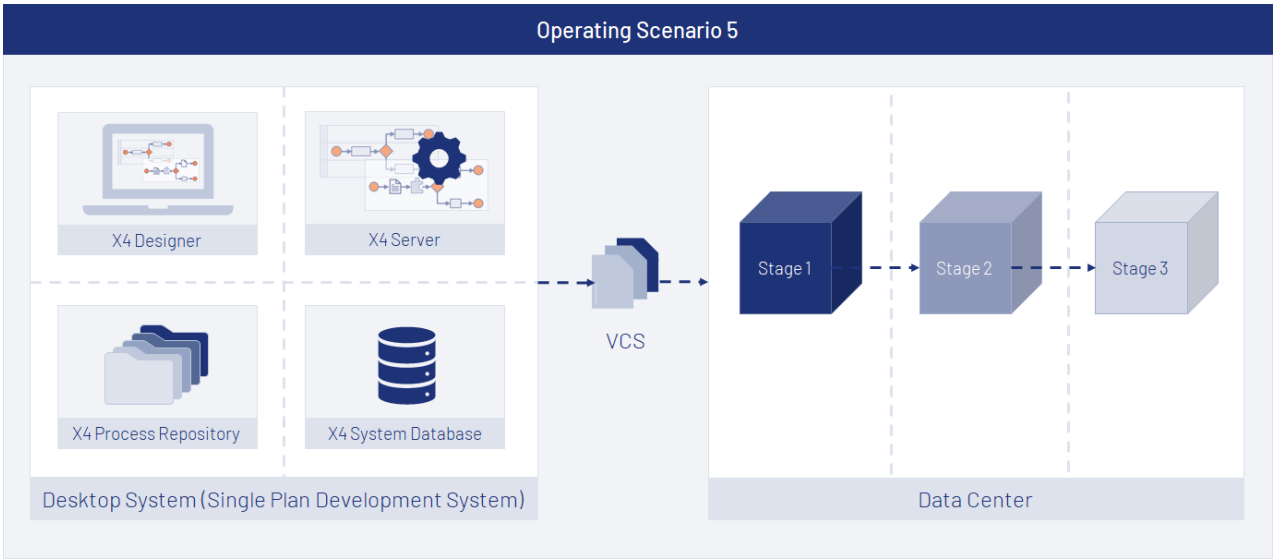
5.5 Operating Scenario 4

Architecture:

- X4 Designer, X4 Server, the X4 System Database, and the X4 Repository are located on one client (Single Plan Development System).
- Versioning takes place in the data center via a version control system.

Advantages and disadvantages:

- Local development scenario
- Each user has a complete environment on his machine
- Allows to build a staging architecture
- The use of a version management system (VCS such as GIT) is required for collaboration.
- Enables easy development since there is no common environment, but makes collaboration more difficult because the integration is complex.


Operating Scenario 5
X4 Designer
X4 Server
X4 Process Repository
X4 System Database
Desktop System (Single Plan Development System)
VCS
Stage 1
Stage 2
Stage 3
Data Center

6 User and role management

⚠ Keycloak must be installed to use the X4 BPMS.

The users, groups and roles are managed in the open source solution Keycloak. We support Keycloak version 14.0.0.

The Keycloak Administration Console can be opened via the URL http://localhost:8085/auth/admin/.

⚠ **Potential security risk**
A default user with administration permissions is pre-installed in the test version of the X4 BPMS. The default user is a potential security risk when the system goes live, so it is mandatory to secure the default user. Deactivate the default user or change the password in the Keycloak administration console.

ⓘ **Keycloak**
Default user

- Username: admin
- Password: demo

Available roles

- default-roles-x4realm
- x4_admin_access
- x4_dev_access

ⓘ **X4 Designer**
Default user

- Username: demo
- Password: demo

ⓘ **X4 Web Apps**
Default user

- Username: demo
- Password: demo

The Documentation can be opened via the URL https://www.keycloak.org/documentation.html.

6.1 OpenID Connect

To configure Keycloak manually, a Keycloak configuration file can be created in the server directory at **\configuration\keycloak_config.json**.

The configuration is defined in the `connection` element.

Example

```
{
"connection": {
  "realm": "X4Realm",
  "auth-server-url": "http://<host>:<port>/auth/",
  "resource": "X4",
  "credentials": {
  "secret": "XXXX"
}
}
```

For more information about the configuration file, see https://www.keycloak.org/docs/latest/securing_apps/index.html#_java_adapter_config.

6.2 Connecting your own Keycloak installation

If the included Keycloak installation is to be replaced by your own Keycloak installation, a Keycloak configuration file must be created in the server directory under **\configuration\keycloak_config.json**.

The configuration is done in the `connection` element.

Example

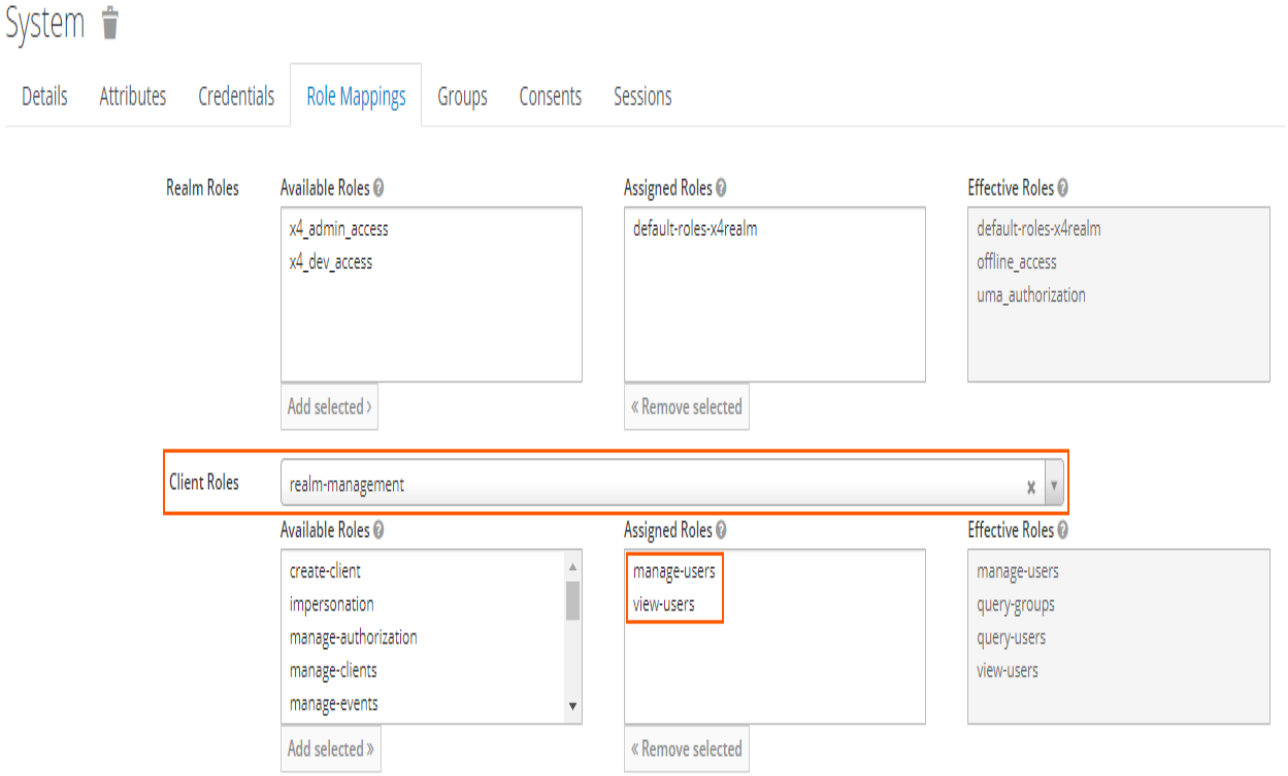
```
{
"connection": {
  "realm": "X4Realm",
  "auth-server-url": "http://<host>:<port>/auth/",
  "resource": "X4",
  "credentials": {
    "secret": "XXXX"
  },
   "rest-api-credentials": {
     "user": "username",
     "password": "password"
    }
}
```

The following roles must be created in Keycloak:

Role	Description
x4_admin_access	Gives access to the X4 ReST API.
x4_dev_access	Gives access to the X4 Designer.

To use the X4 ReST API, the following rights must be granted to the corresponding user:

Client Roles	• realm-management
Assigned Roles	• manage-users • view-users



For more information on the configuration file, see https://www.keycloak.org/docs/latest/securing_apps/index.html#_java_adapter_config.