

X4 Administration Guide

SoftProject

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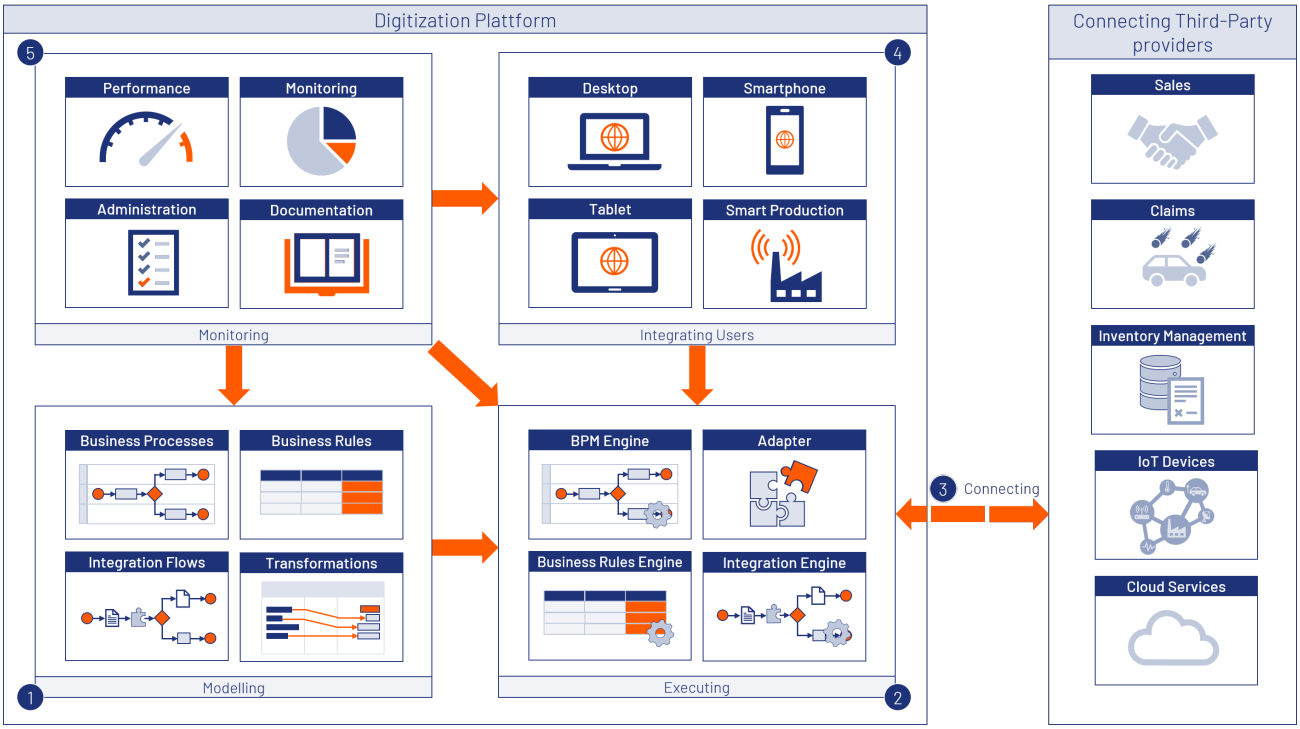
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About the X4 Suite

Digitalization requires a holistic approach, which presupposes that also the used solution has to reflect that. X4 Suite supports you as a central platform in solving these challenges. The focus is on modeling, implementing and monitoring your business processes. Therefore, the X4 Suite 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 Suite 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 Suite with high performance.

1. **X4 Designer:** Modelling processes and rules graphically
2. **X4 Server:** Simulating and executing processes and rules
3. **X4 Adapter:** Integrating third-party systems into processes
4. **X4 Activities**: Providing web apps for employees and customers
5. **X4 Control Center:** Monitoring and managing all processes and apps



Target audience of this documentation

This document is intended for administrators who want to install, configure and administer the X4 Server. Therefore, both detailed technical knowledge of the existing IT infrastructure and basic knowledge of Java EE, XML technologies and the application server are required.

Moreover, you will learn how to monitor, plan, evaluate and document your processes using the X4 Control Center.

1 High Availability

In systems with high workloads or critical services, high availability is an important part of the system landscape. With X4 Suite, 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.

1.1 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.

1.1.1 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.

1.1.1.1 Simple – Direct database access

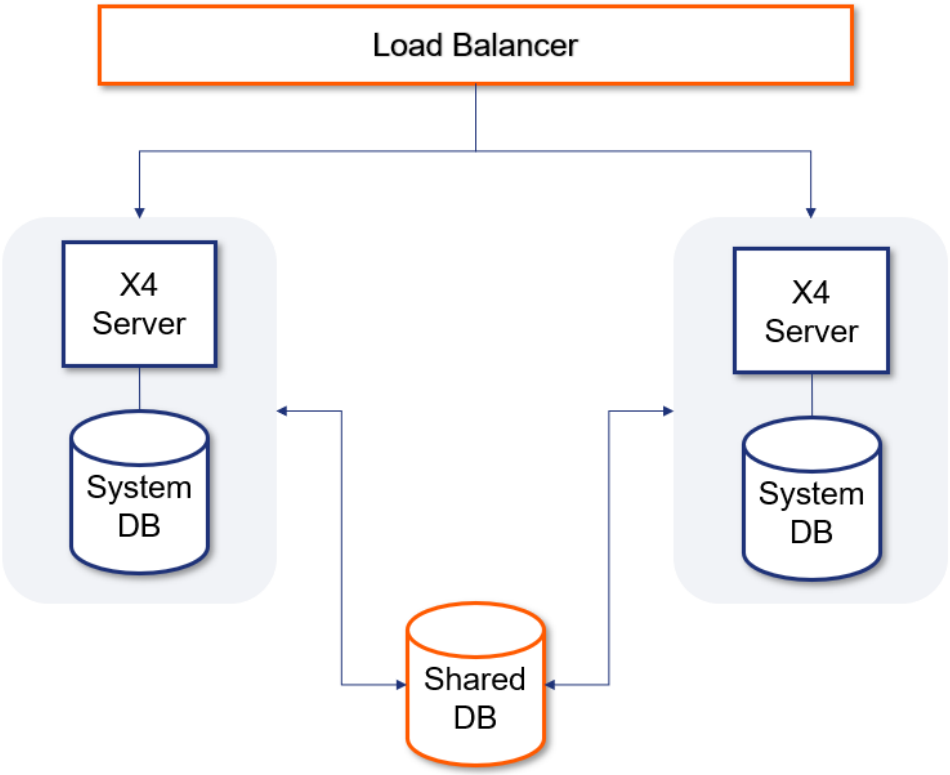


Figure: Direct database access

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.

1.1.1.2 Complex – Shared access via an X4 instance

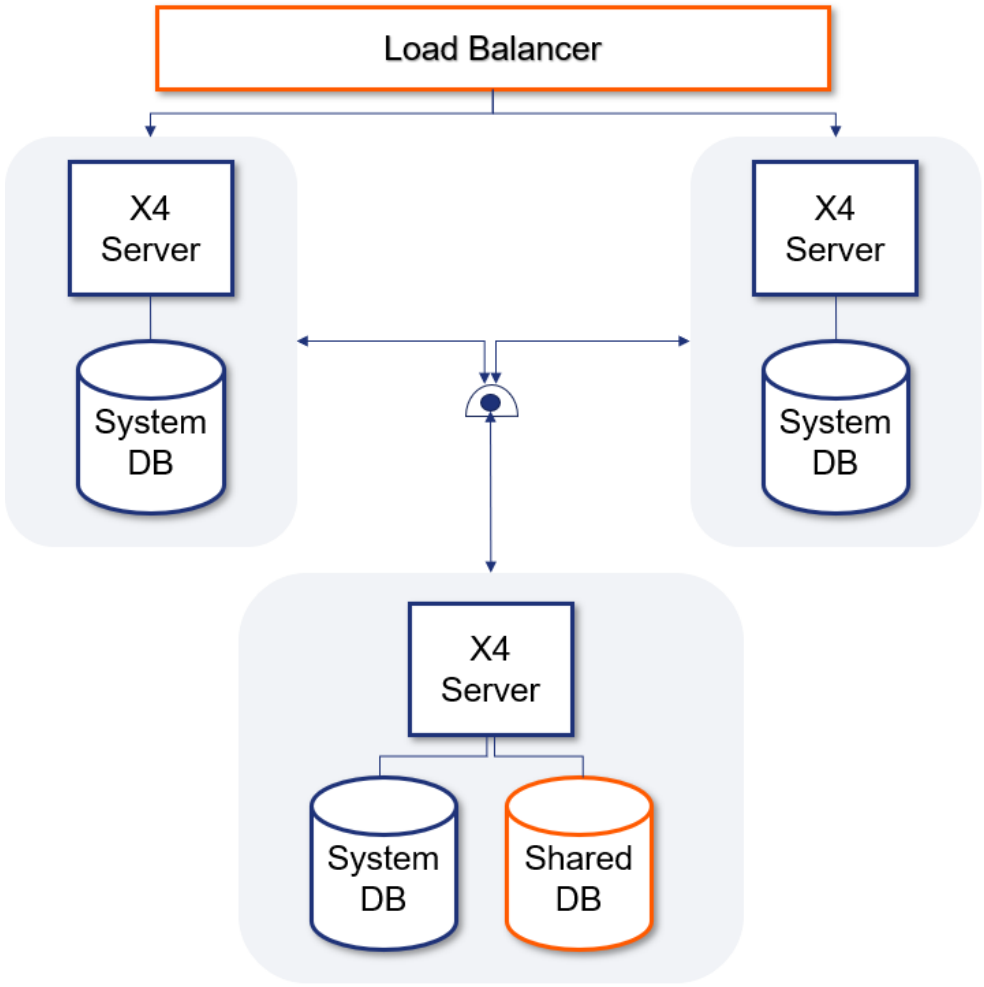


Figure: Shared database access via an X4 instance

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.

1.1.2 Scenario – Shares Access via Message Queue

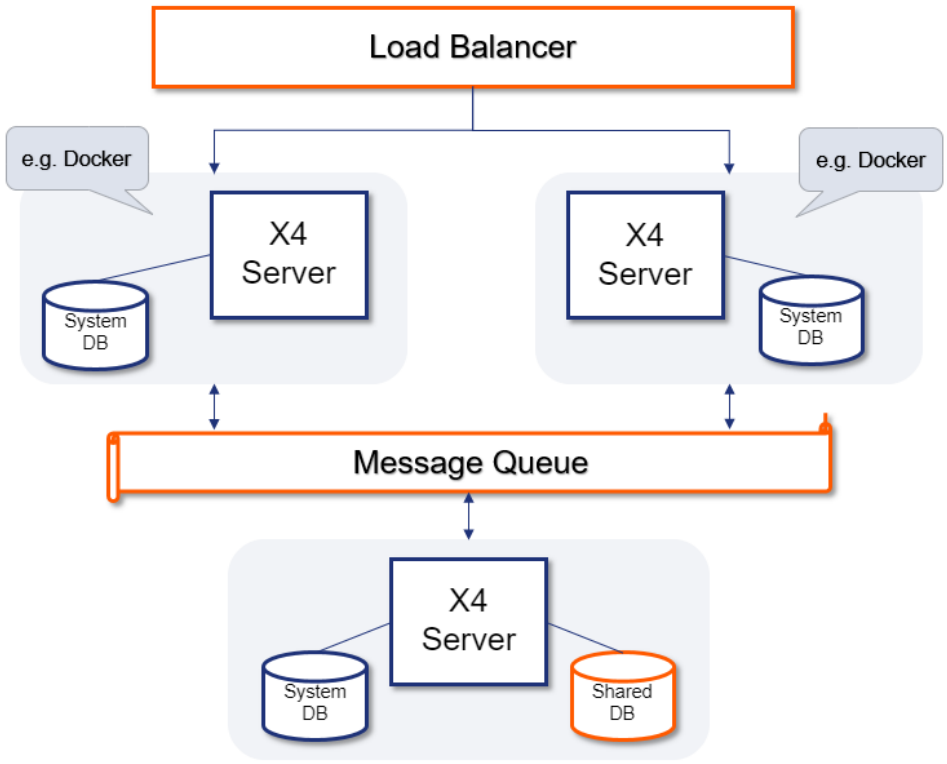


Figure: Shared database access via Message Queue

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.

1.2 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.

1.2.1 Scenario – A Single Exclusive Database

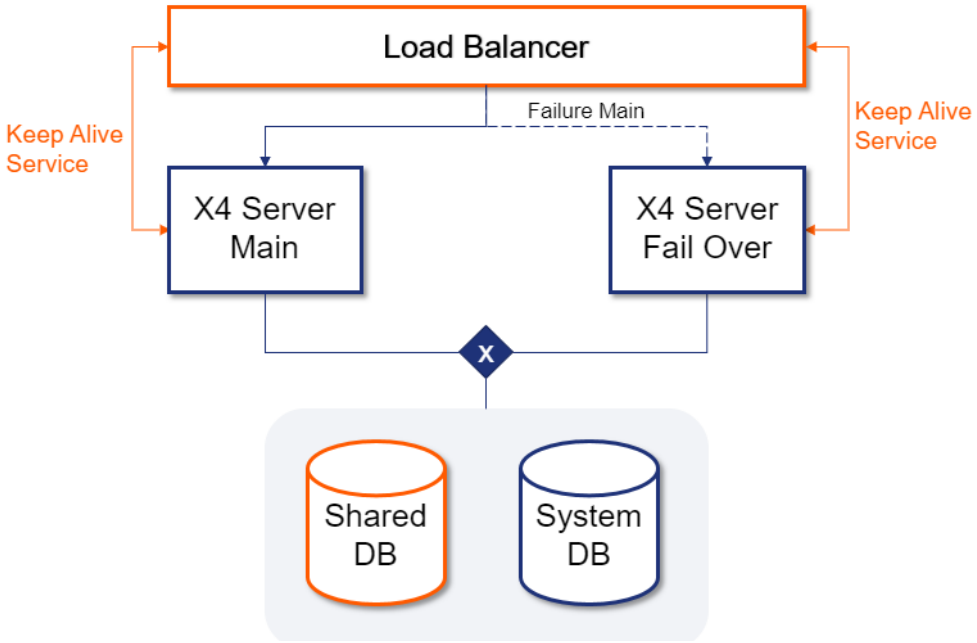


Figure: A single database with exclusive access

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*.

1.2.2 Scenario – System Database per X4 Server

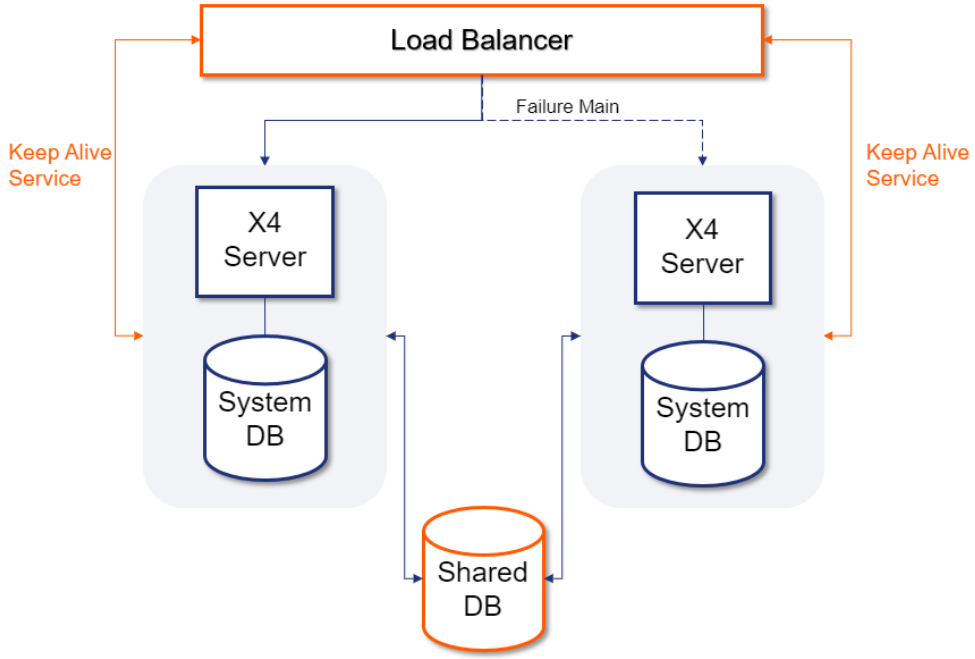


Figure: Separate system databases

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*.

1.3 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.

1.3.1 Scenario – Dedicated X4 Server for Scheduling

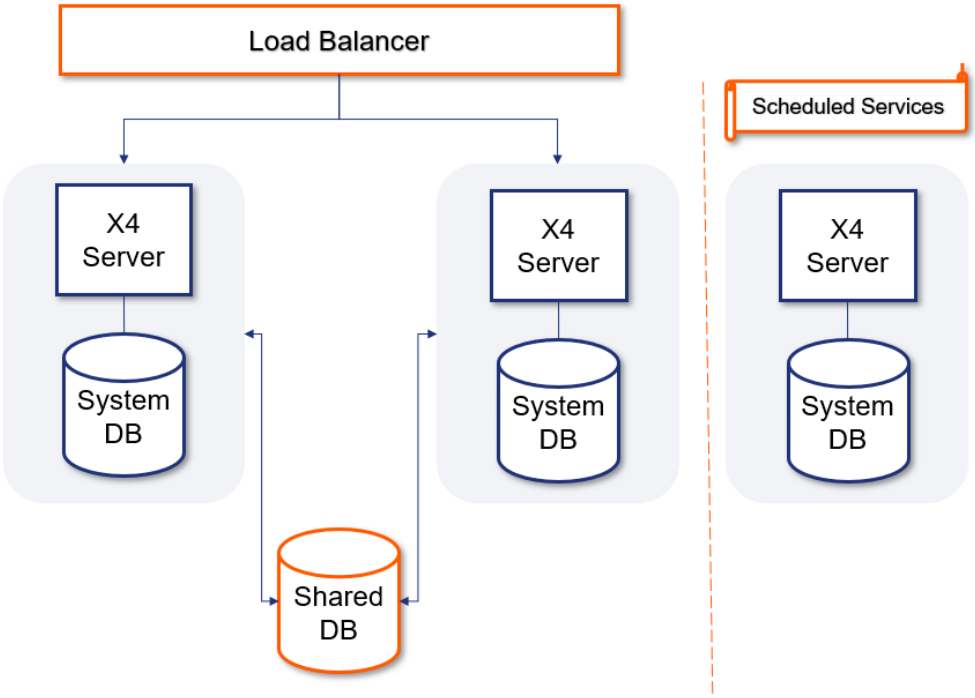


Figure: Dedicated Scheduler X4 Server

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.

1.3.2 Scenario – One Server Responsible for Scheduling

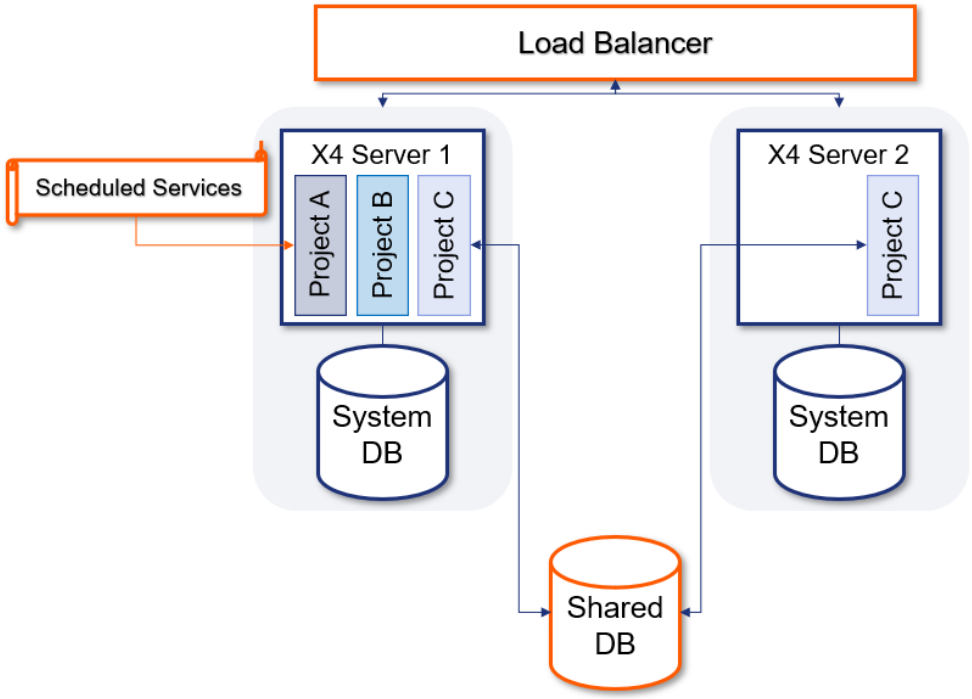


Figure: Planned processes in X4 project

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.

1.3.3 Scenario – External Scheduler

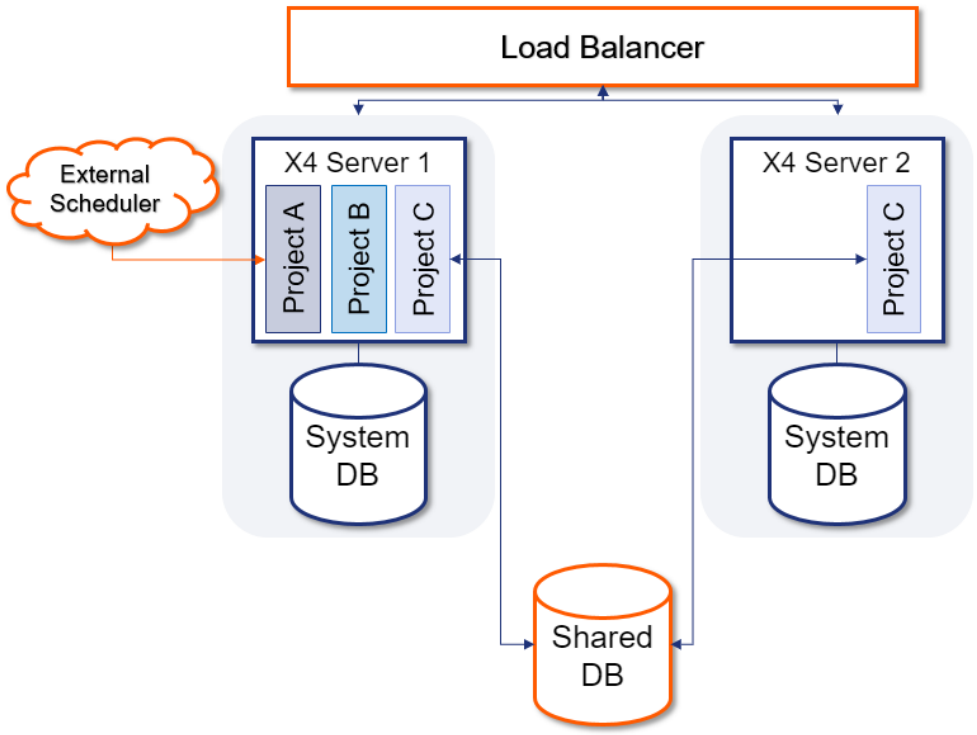


Figure: Planned processes via external scheduler service

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.

2 Operation Scenarios

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

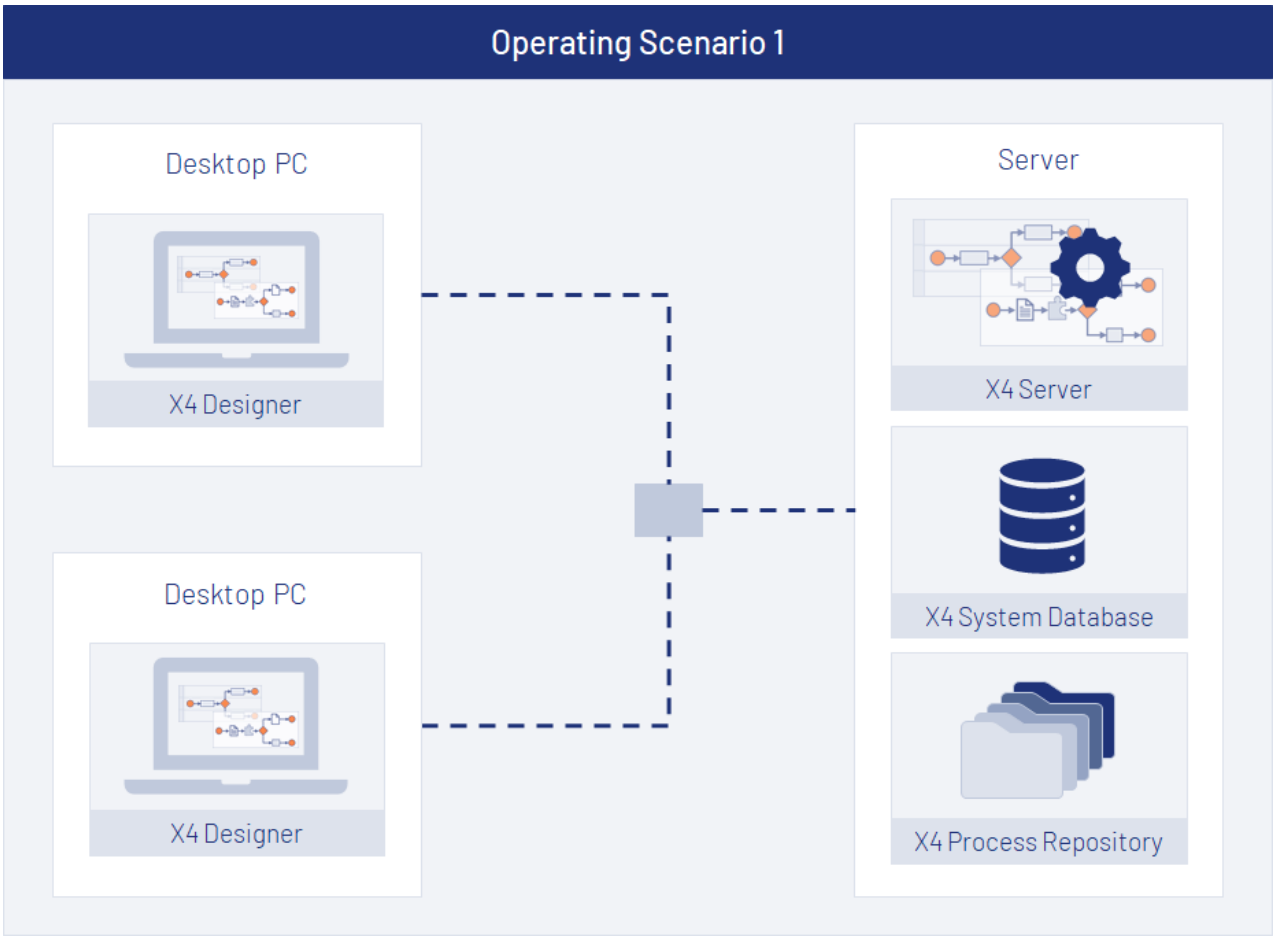
2.1 Operating Scenario 1

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



2.2 Operating Scenario 2

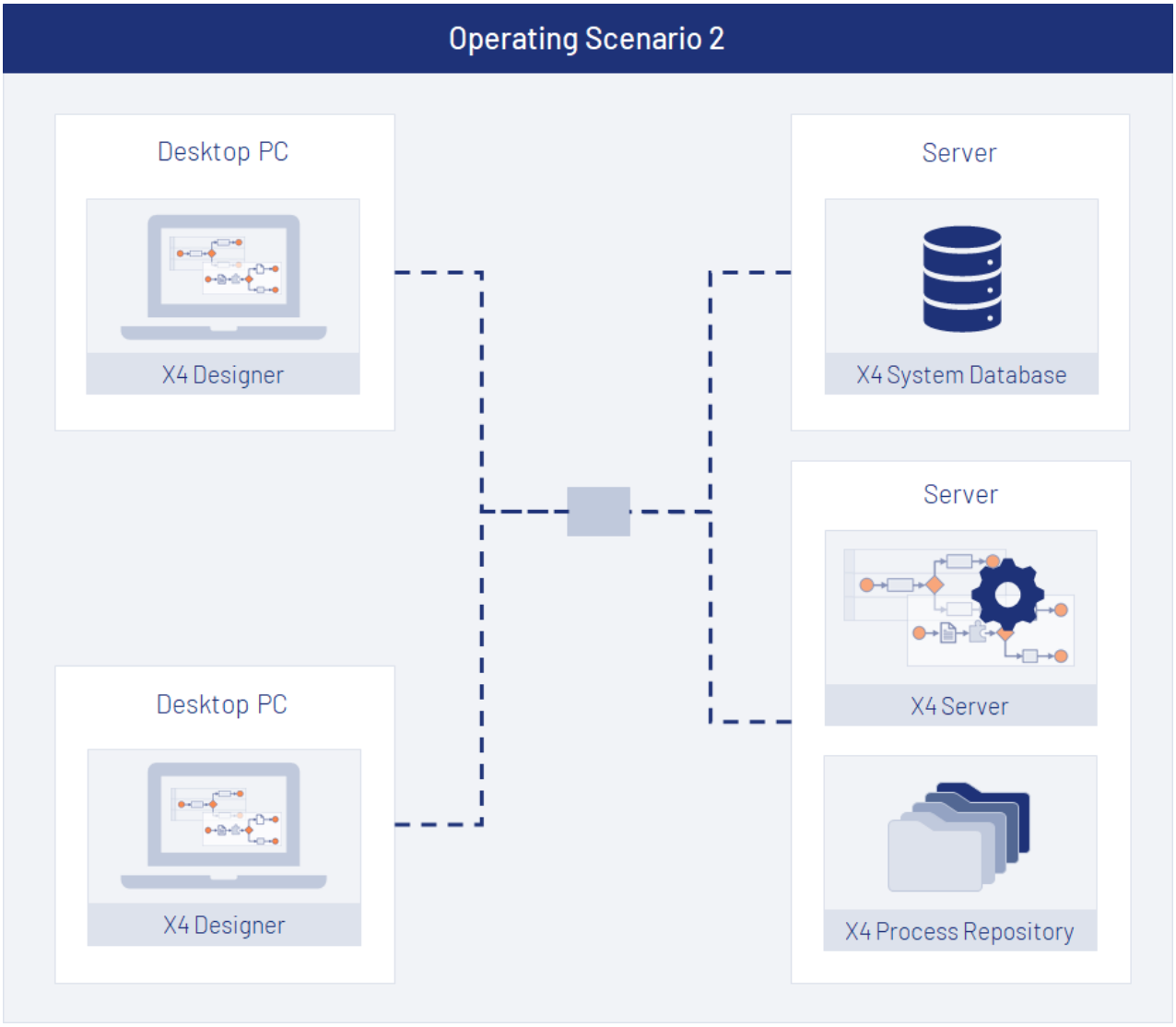
Architecture:

- 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



2.3 Operating Scenario 3

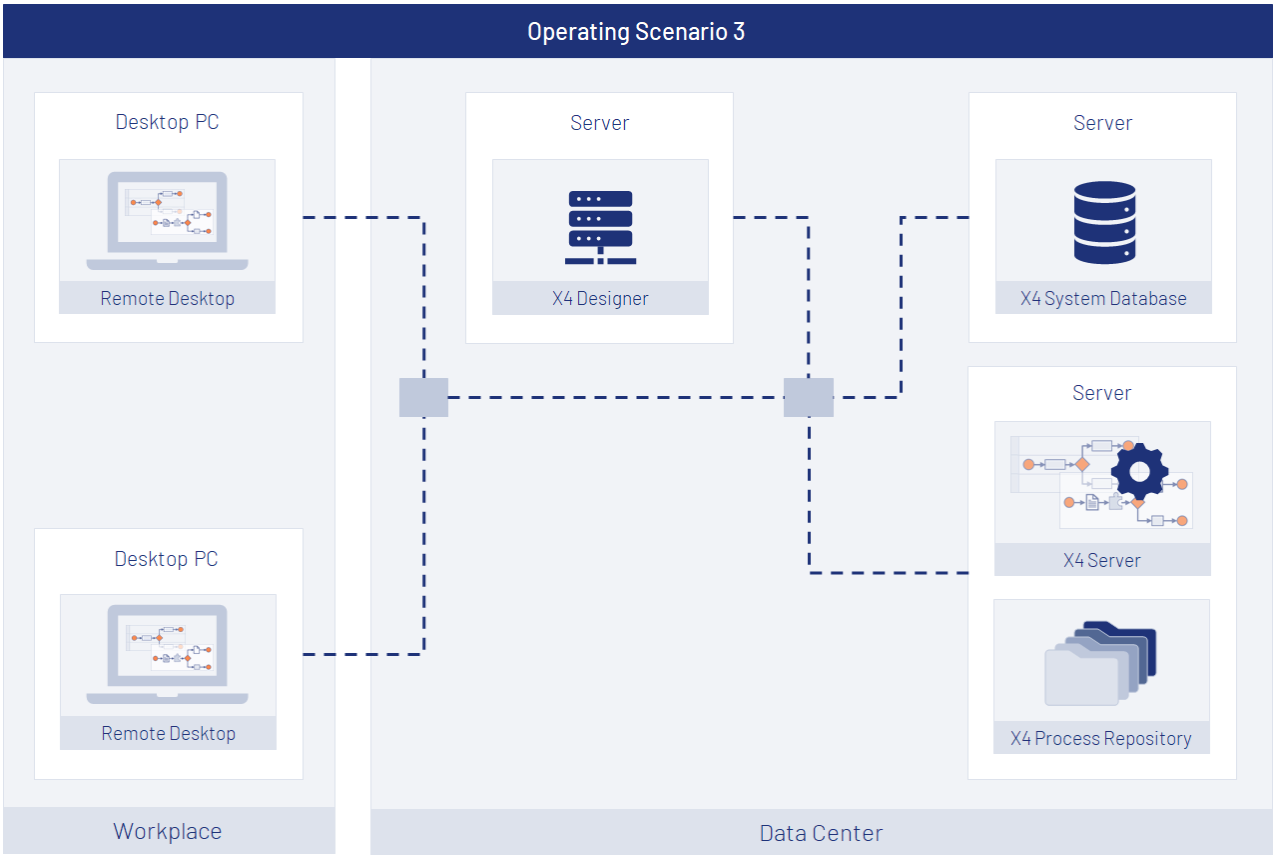
Architecture:

- 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



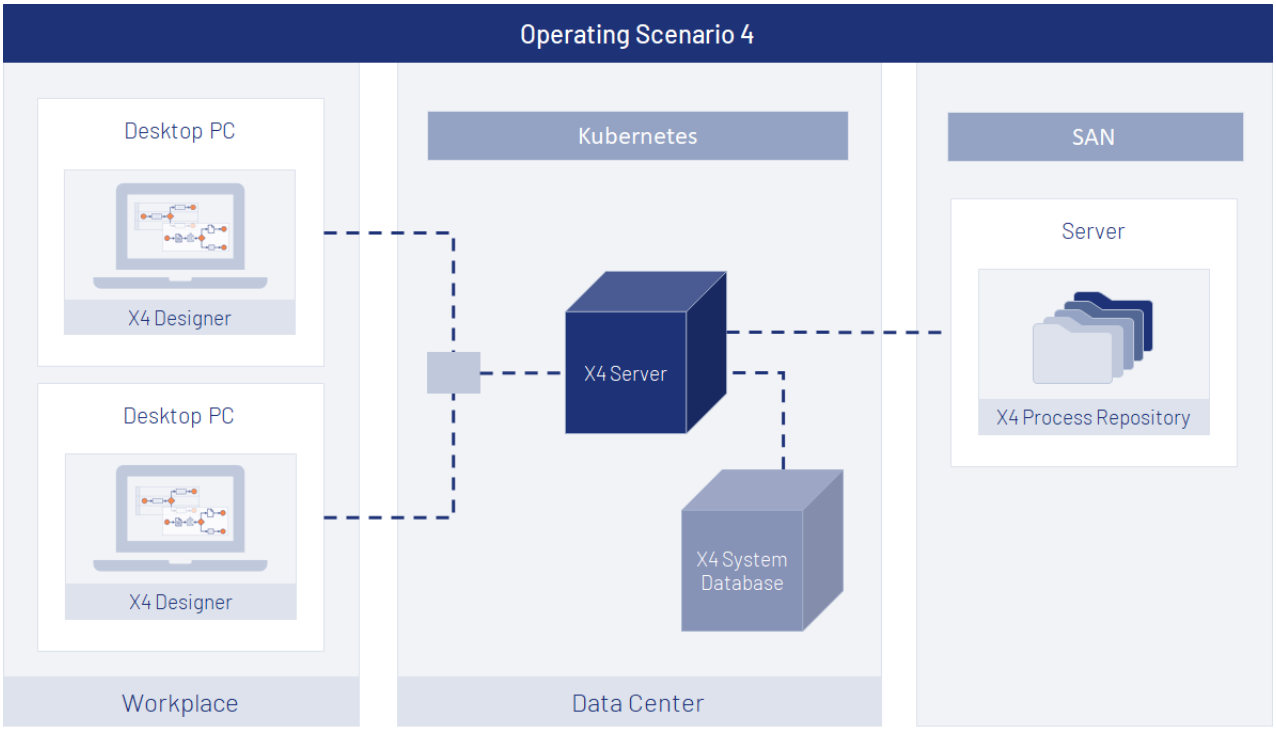
2.4 Operating Scenario 4

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



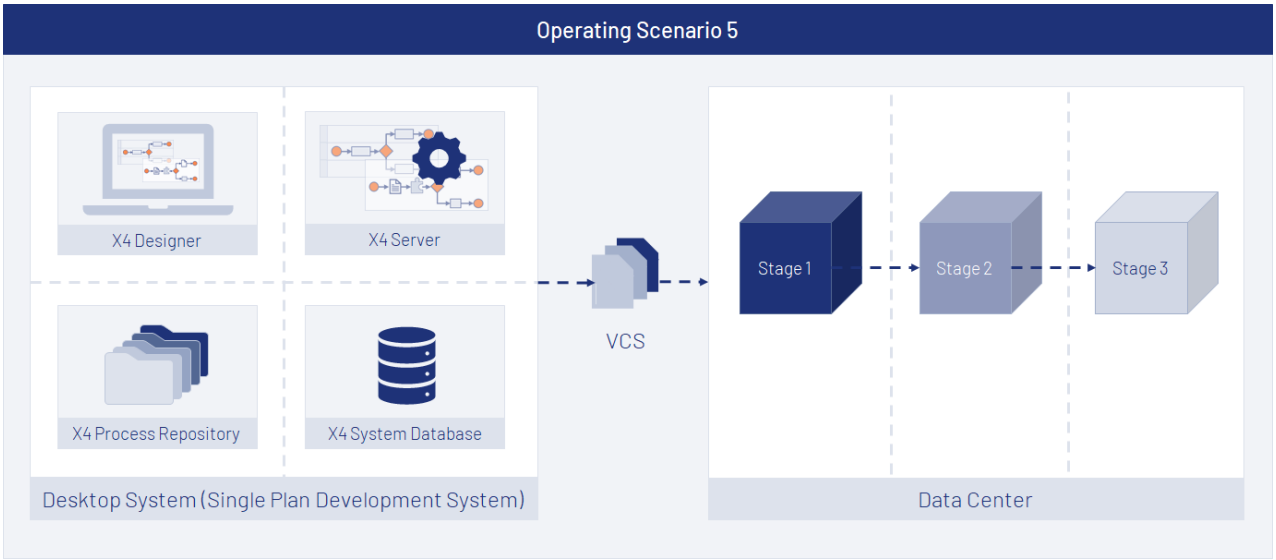
2.5 Operating Scenario 4

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

3 X4 Suite Installation and Update

3.1 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 administration interface X4 Control Center 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. AdoptOpenJDK 11 is already included as runtime environment. • **Application server:** X4 Server uses an integrated WildFly application server in version 18.0.0. • **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 processors • At least 5 GB free disk space • At least 8 GB main memory ⓘ Starting with a number of 500 processes to be executed, we recommend a system with at least 8 processors 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
	• **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
	• Further on request

X4 Activities

Operating system	X4 Activities-based web applications can be used cross-platform via browser.
Platform	**X4 Activities Web Apps** Current browser (also mobile) with enabled JavaScript: • Google Chrome (version 83.0.4103 or later) • Mozilla Firefox (version 68.9.esr or later) • Microsoft Edge (Chromium-based / version 83.0.478.45 or later) • Apple Safari (version 13.1 or later) ⓘ 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 Activities Classic** Current desktop browser with enabled JavaScript: • Google Chrome (version 83.0.4103 or later) • Mozilla Firefox (version 68.9.esr or later) • Microsoft Edge (Chromium-based / version 83.0.478.45 or later) ⓘ 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 (version 1803 or later) • Microsoft Windows Server 2012, 2012 R2, 2016, 2019 • The X4 Web Designer can be used cross-platform 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 is already included as runtime environment. **X4 Web Designer** You can access X4 Web Designer via a current browser with enabled JavaScript: • Google Chrome (version 83.0.4103 or later) • Mozilla Firefox (version 68.9.esr or later) • Microsoft Edge (Chromium-based / version 83.0.478.45 or later) ⓘ 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 processors • At least 2 GB free disk space • At least 8 GB main memory

3.2 Installing and Updating the X4 Server

Here you will learn how to install and update X4 Server.

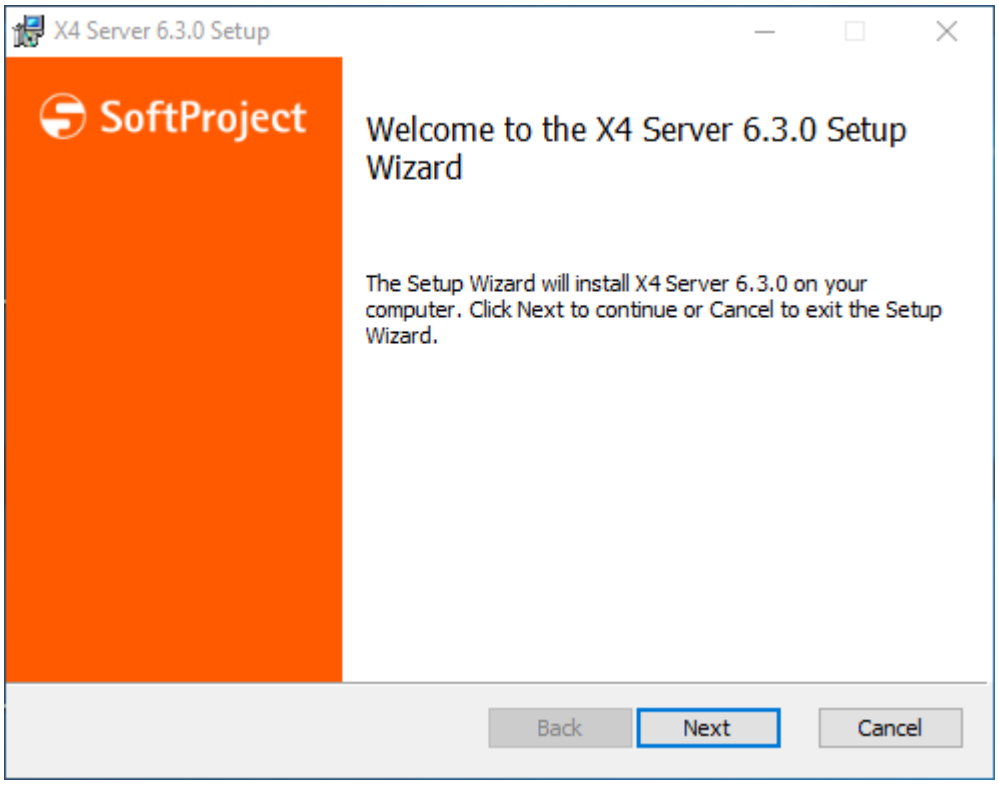
3.2.1 Installation and Update on Windows Systems

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

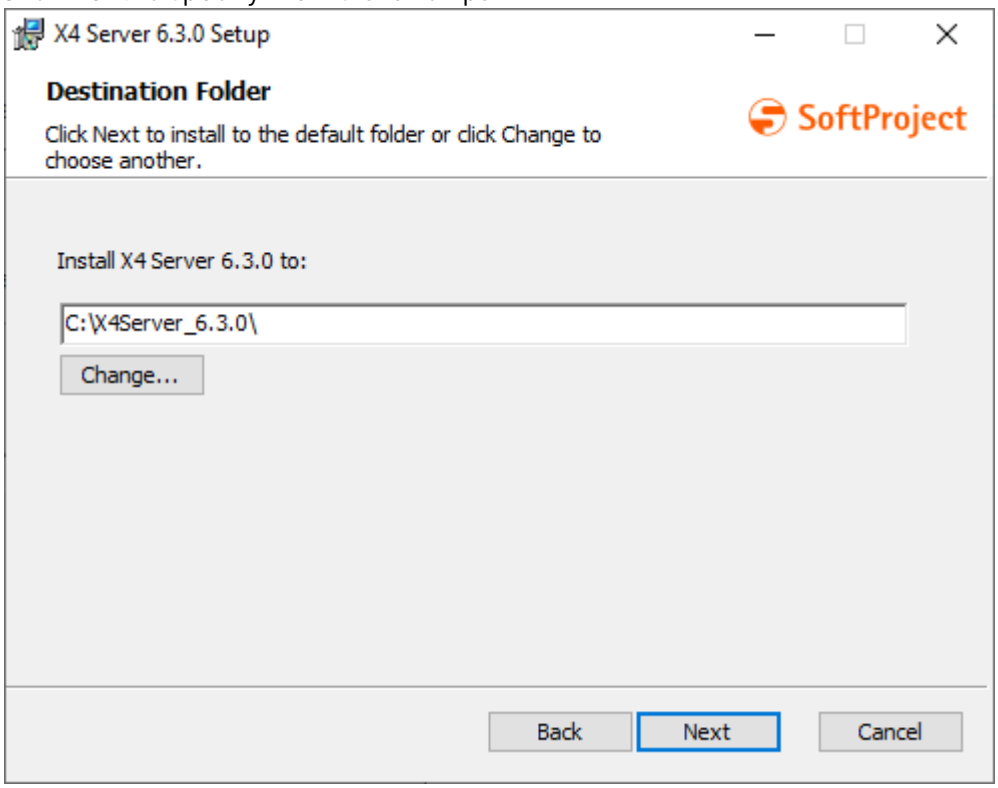
3.2.1.1 Installing X4 Server

1. Double-click the installation package `X4ServerSetup_Rv.v.v_64bit.msi` provided by SoftProject.

> 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)**.



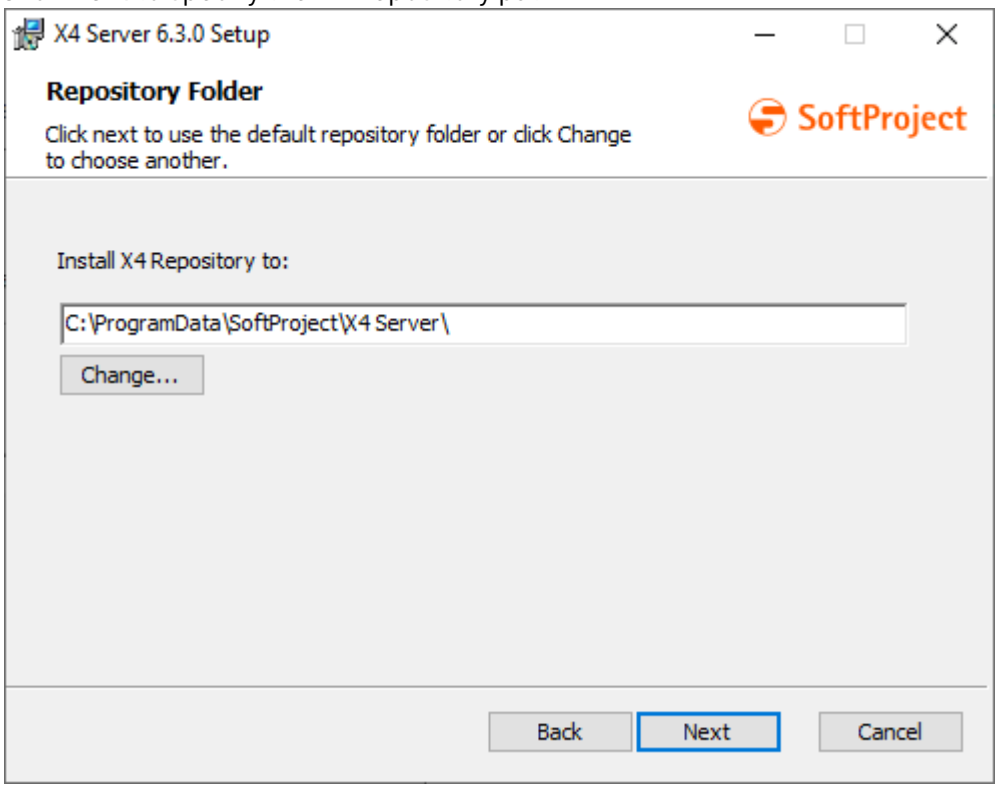
2. Click **Next** to specify the installation path.



ⓘ X4 Server is installed under `C:\X4Server_v.v.v.\` by default. However, the path can be changed via **Change.**

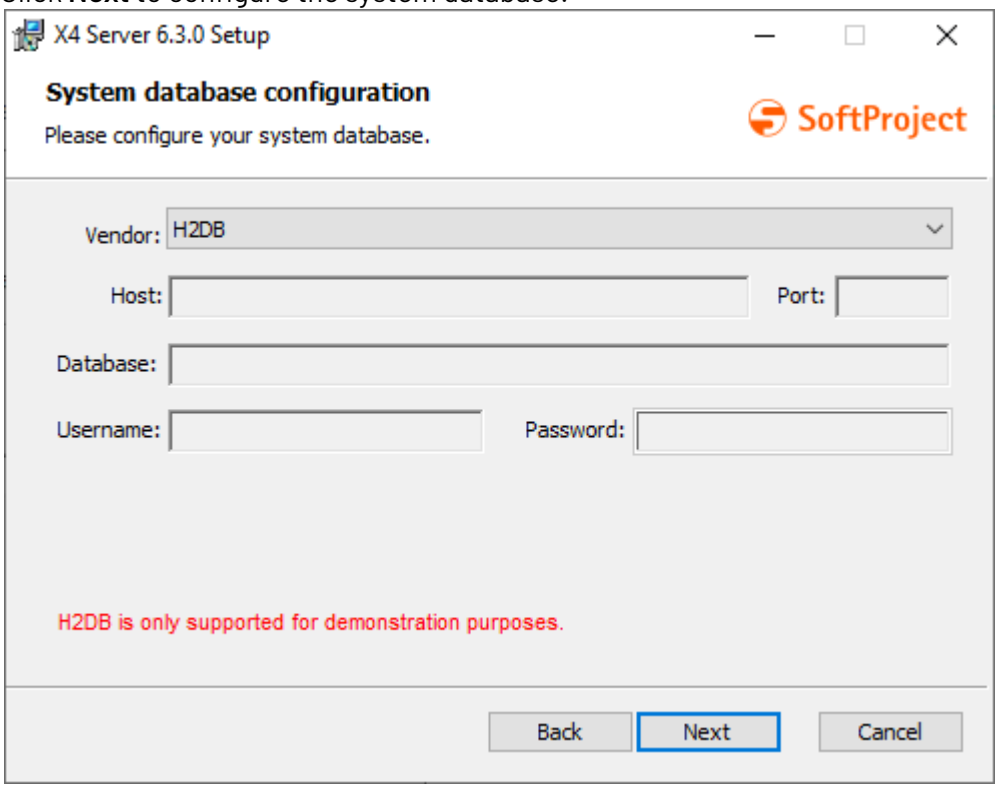
⚠ Make sure not to use any spaces in the installation path. This can lead to errors when installing X4 Server as a service.

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



> The X4 Repository is installed under `C:\ProgramData\SoftProject\X4 Server\` 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`

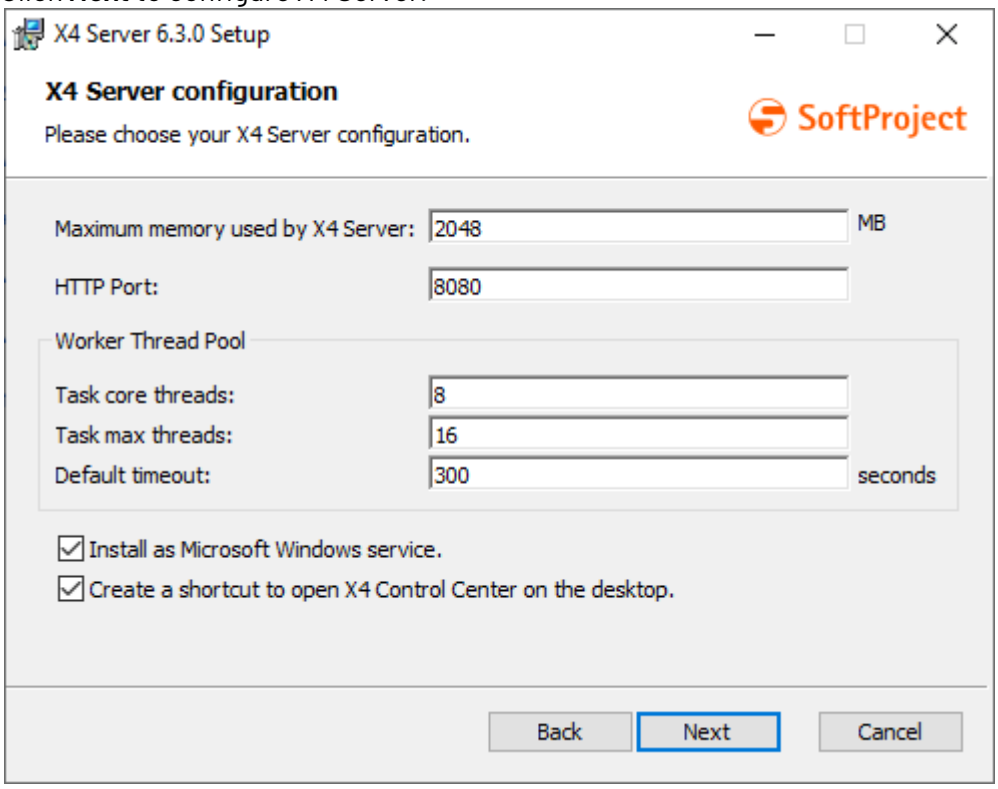
    > ⚠ Note that the database driver for `Oracle Database 12c/18c/19c` is not included in the installation package. The corresponding driver has to be installed separately, see Setting up the Oracle Database.

  - `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.

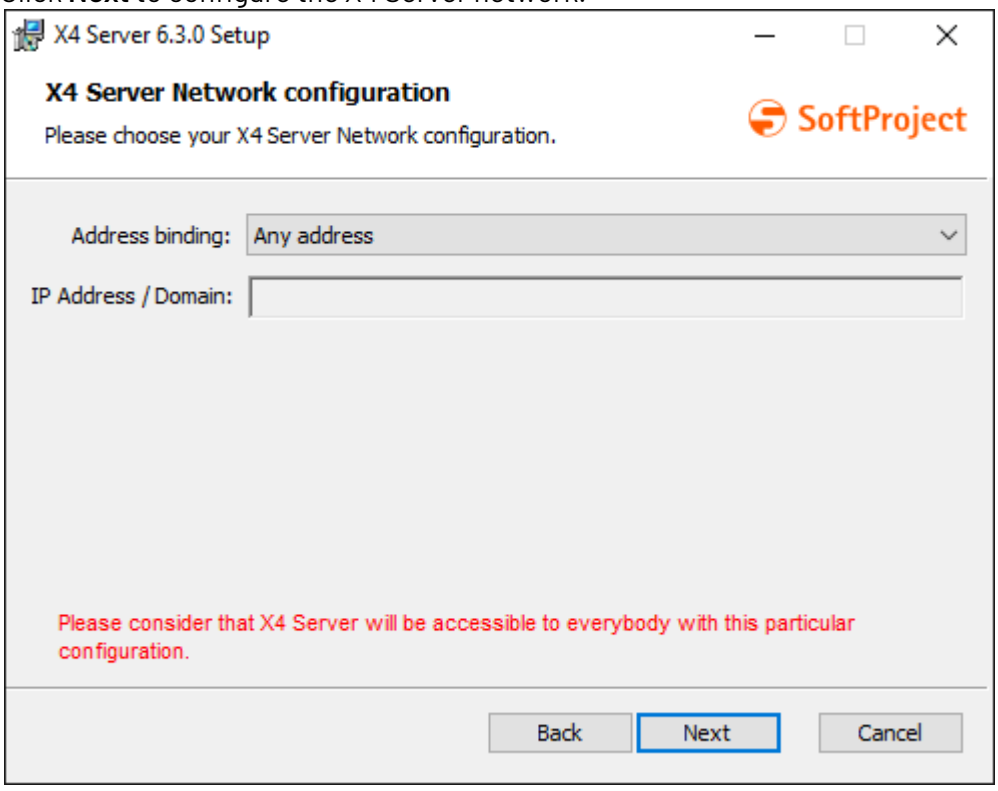
- **Default timeout**: Specify the default transaction lifetime in seconds

  > 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.

3.2.1.2 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_Rv.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 Suite must be specified in the installation and migration tool. For example, the command `java -jar de.softproject.x4.database-6.3.0.jar --installX4path C:\X4\V_6_3_0\X4\Server` migrates all `.war` files that have not already been automatically migrated to the new installation.

3.2.1.3 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.

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

3.2.2 Installation and Update on Ubuntu/Debian Linux Systems

How to install the complete X4 Server automatically based on a Debian package (.deb) as a service on a Ubuntu/Debian Linux host, and how to start and manage this service.

3.2.2.1 Installing X4 Server or Updating an Existing Installation

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 Debian package file `X4-Server_Ubuntu-v.v.v-r.x.86_64` provided by SoftProject onto your Ubuntu or Debian system.
2. Execute the command `sudo dpkg -i X4-Server_Ubuntu-v.v.v-r.x.86_64.deb` in order to start the installation.
   Example: *`sudo dpkg -i X4-Server_Ubuntu-6.3.0-1.x.86_64.deb`* for release `1` of X4 Server version `6.3.0`.

   X4 Server is installed under `/opt/X4` by default. Using the variable `INSTALL_PATH` the installation folder can be changed, e.g. `sudo INSTALL_PATH=/myNewPath/Tools dpkg -i X4-Server_Ubuntu-v.v.v-r.x.86_64.deb`

   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.

   - If an X4 Server installation is already available, the X4 Server core components will be updated automatically when executing installation command `sudo dpkg -i X4-Server_Ubuntu-v.v.v-r.x.86_64.deb`. In subfolder `/opt/X4_backups`, backup files with the configuration files will be created automatically.
   - To migrate files that are not part of the automatic update process, the installation path of X4 Suite must be specified in the installation and migration tool. For example, the specification `/opt/X4/jdk/bin/java -jar de.softproject.x4.database-6.3.0.jar --installX4path /opt/X4/Server` migrates all `.war` files that have not already been automatically migrated to the new installation.
3. Check, if error messages did occur in the server log `/opt/X4/wildfly/standalone/log/server.log`.
   An X4 Server that has been installed and started correctly, will not output any error messages (`E`

RROR or FATAL) in the server log. This should be the case at the latest after the second X4 Server startup.

4. Restart the X4 Server using the command `sudo service X4-Server restart`.
   X4 Server has now been installed successfully and will be executed as service `X4-Server`.

After successfully installing or updating X4 Server from the Debian package, the X4 installation folder has the following contents:

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 for the system database
`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

3.2.2.2 Controlling Service X4-Server

Using the command line, the following options are available to manage the X4 Server respectively service `X4-Server`:

Starting service `X4-Server`:	Execute command `service X4-Server start`
Stopping service `X4-Server`:	Execute command `service X4-Server stop`
Restarting service `X4-Server`:	Execute command `service X4-Server restart`

3.2.2.3 Uninstalling Service X4-Server

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

To remove all installation artefacts including configuration files etc. for service `X4-Server`, execute the command `sudo dpkg -P X4-Server`.

> When uninstalling the X4 Server, the variable `INSTALL_PATH` doesn't need to be specified.

3.2.3 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.

3.2.3.1 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-v.v.v-r.x86_64.rpm` provided by SoftProject on your Red Hat system.
2. Execute the command `sudo rpm -i X4-Server_RHEL-v.v.v-r.x86_64.rpm` to start the installation.
   Example: `sudo rpm -i X4-Server_RHEL-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 -i X4-Server_RHEL-v.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.

Folder	Description
`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

3.2.3.2 Updating an Existing Installation

1. Load the RPM package `X4-Server_RHEL-v.v.v-r.x86_64.rpm` provided by SoftProject on your Red Hat system.
2. Execute the command `sudo rpm -U X4-Server_RHEL-x.x.x-r.x86_64.rpm` to start the update.
   Example: `sudo rpm -U X4-Server_RHEL-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_RHEL-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`.

   > To migrate files that are not part of the automatic update process, the installation path of X4 Suite must be specified in the installation and migration tool. For example, the specification `/opt/X4/jdk/bin/java -jar de.softproject.x4.database-6.3.0.jar --installX4path /opt/X4/Server` migrates all `.war` files that have not already been automatically migrated to the new installation.

3.2.3.3 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`

3.2.3.4 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-x.x.x-r.x86_64`.

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

3.2.4 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.

3.2.4.1 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-v.v.v-r.x86_64.rpm` provided by SoftProject on your SuSe Linux system.
2. Execute the command `sudo rpm -i X4-Server_SLES-v.v.v-r.x86_64.rpm` to start the installation.
   Example: `sudo rpm -i 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 -i X4-Server_SLES-v.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 Suite must be specified in the installation and migration tool. For example, the specification `/opt/X4/jdk/bin/java -jar de.softproject.x4.database-6.3.0.jar --installX4path /opt/X4/Server` migrates 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
`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

3.2.4.2 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`

3.2.4.3 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`.

3.2.4.4 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`.

3.2.4.5 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-x.x.x-r.x86_64`.

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

3.2.5 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 Suite 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`

Application example	Command
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.

Variable	Erläuterung
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

3.2.6 Installing the X4 Server on other operating systems

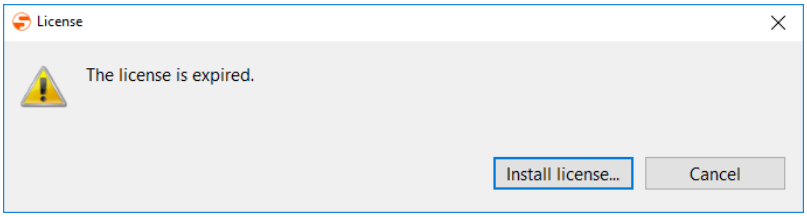
If required, the X4 Server can also be installed on other operating systems. Please contact SoftProject for further information.

3.3 Installing licenses

How to install a new server license via the X4 Designer

3.3.1 Updating an expired license

If your server license has expired, you will be prompted to install a new license as soon as you try to establish a connection with the server.



Moreover, in the server log the following license information is displayed:

```
#################################################################
###
### License is invalid: EXPIRED
###
#################################################################
```

1. Click on **Install new license** to start the installation.
2. Navigate to the corresponding license file within your file system an click **Open**, to upload the license.
   After the license's successful installation, the X4 Designer will be automatically connected with the X4 Server. Moreover, the following information will be displayed in the command line:

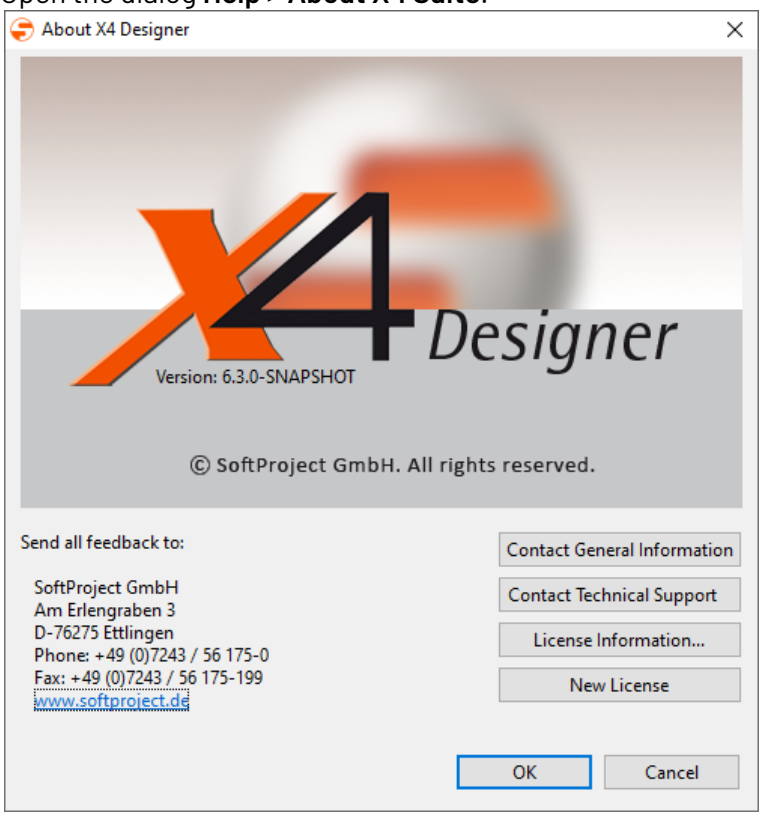
```
*** license status    : OK
*** time of check     : 2014-01-30 16:36:10.103 +0100
*** running version   : 4.6.0 20140129142350
***
*** Licensedetails
*** ==============
*** ID                : 0a57fa7d-5d45-4917-aed2-b29731adf1b7
*** licensed version : 4.6
*** license type      : Trial
*** created on        : 2014-01-21 17:59:36.574 +0100
*** valid until       : 2014-04-15 18:59:36.574 +0200
*** update contract   : no
*** support contract  : 2014-01-21 17:59:36.574 +0100 (EXPIRED)
*** ------------------
*** number of allowed installations
***   1x Trial
*** ------------------
*** properties
***   customer.name   : SoftProject GmbH - Product Development
***   customer.contact.email : x4entwicklung@softproject.de
***   customer.no     : 47110815
***   customer.contact.name : X4 Development
*** ------------------
*** licensed features
***   ADAPTER de.softproject.integration.adapter.ASCII2XML
***   ADAPTER de.softproject.integration.adapter.ASCIIGDV
```

With **Help** > **About X4 Suite** > **License Information** you can view information on your license.

3.3.2 Installing Licenses at Runtime

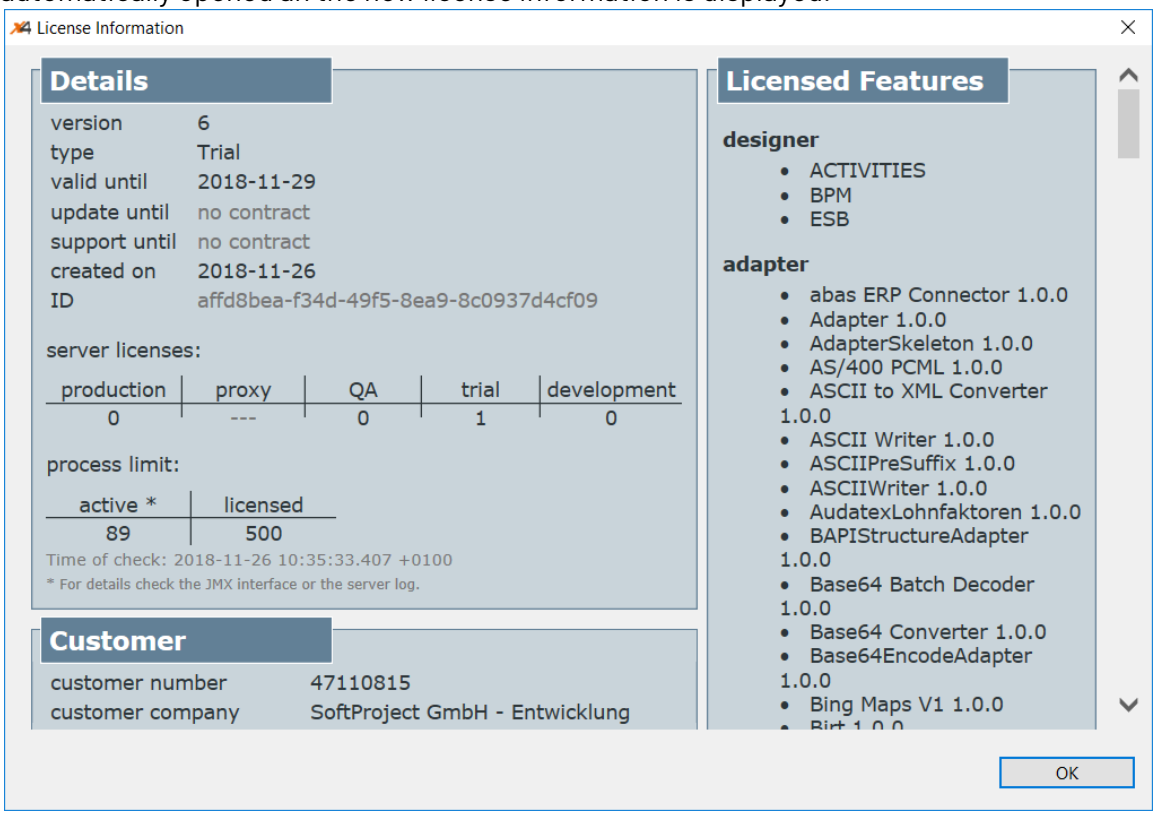
Licenses can also be installed during runtime before they expire. The X4 Designer provides a dialog for this purpose.

1. Open the dialog **Help** > **About X4 Suite**.



2. Click on **New license** to start the installation.
3. Navigate to the corresponding license file within your file system an click **Open**, to upload the license.

After the license's successful installation, the window **License Information** will be automatically opened an the new license information is displayed.



3.4 Installing, updating and uninstalling the X4 Designer

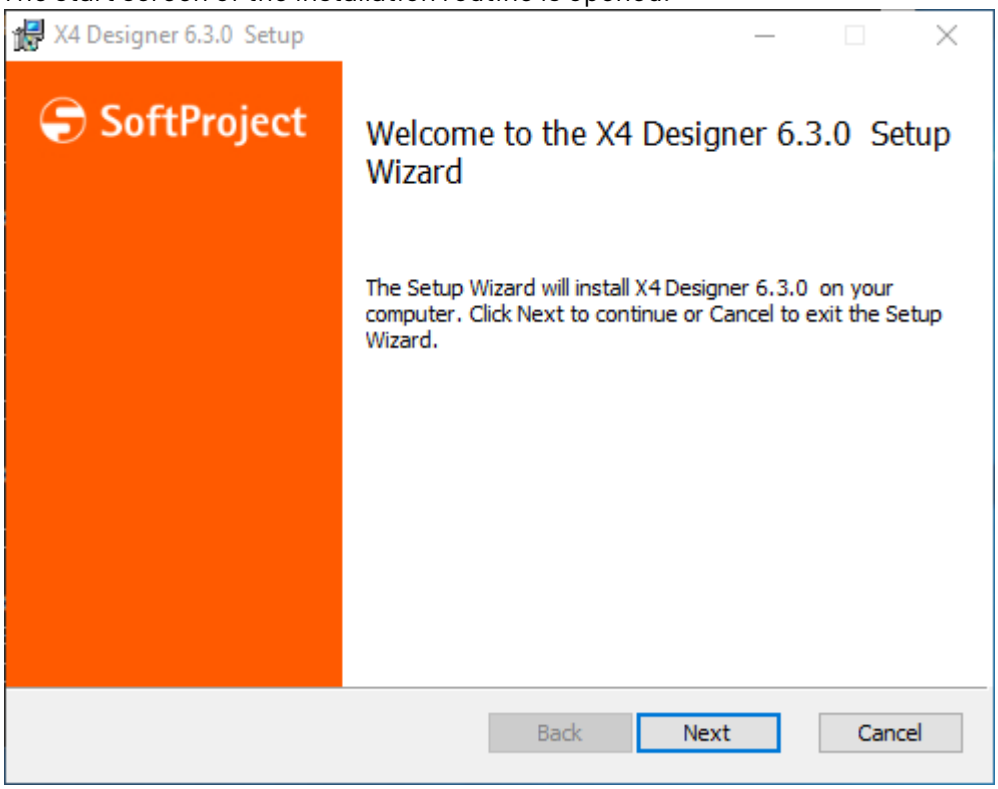
3.4.1 Installing X4 Designer

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*`*.

3.4.2 Updating X4 Designer

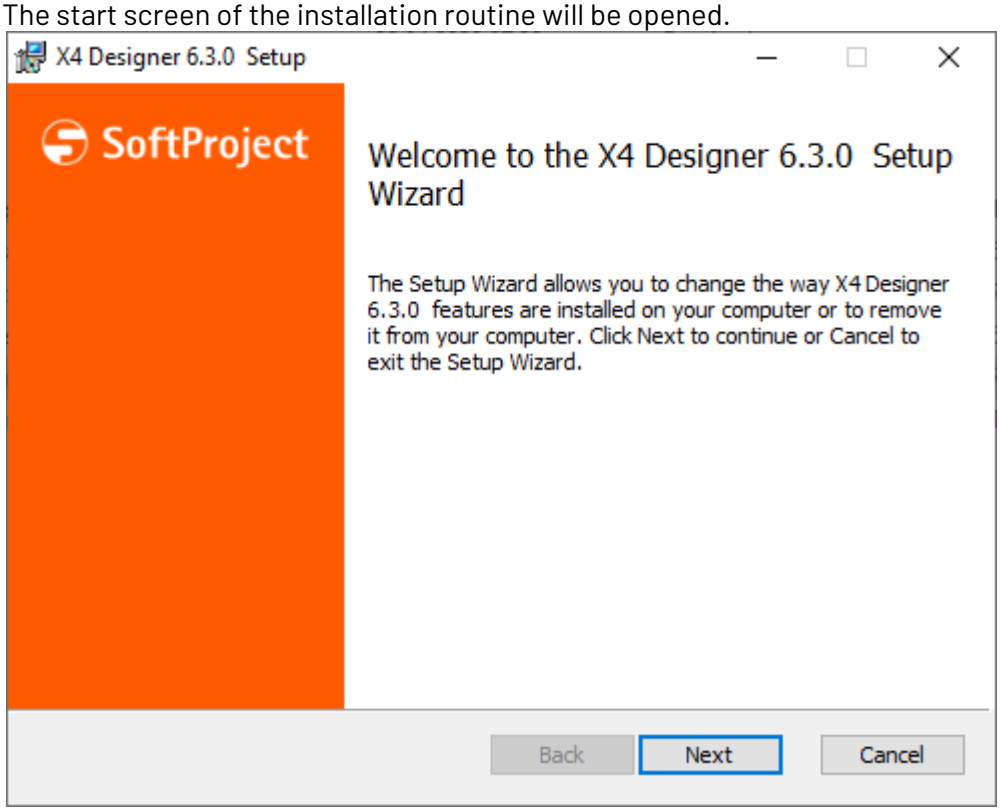
To update the X4 Designer perform a new installation of the X4 Designers.

⚠ 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`.

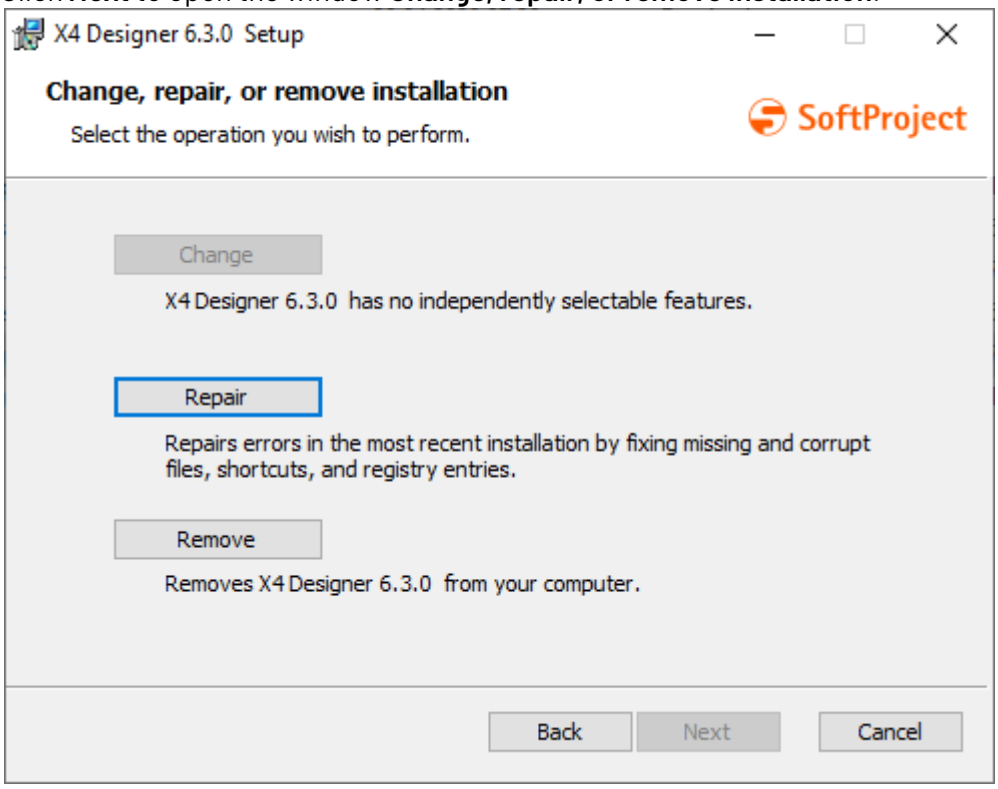
3.4.3 Uninstalling X4 Designer

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.

3.5 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 Suite 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`

3.6 Installing the X4 Server on Windows systems

How to install X4 Suite including the components X4 Server and X4 Designer on Windows systems.

> ⚠ The preferred procedure for installing X4 Suite is to install the individual components separately:
>
> - Installation and Update on Windows Systems
> - Installing, updating and uninstalling the X4 Designer

1. Double-click the installation file `X4Setup_R6.x.x_64bit.exe` provided by SoftProject.

   > ⓘ 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 enter the installation path.
   The X4 Suite is installed under `C:\X4` by default. However, the path can be changed via **Browse.**
3. Click **Next** to select the components to be installed.
4. Select the components to be installed additionally to the X4 Server:
   - Designer
   - Documentation package in PDF format
5. Click **Next** to select additional installation tasks:
   - Desktop shortcuts for the X4 Suite components
   - Install X4 Server as service
6. Click **Next** to continue.
7. Click **Install** to start the installation.
   The installation will start now.
8. If required select the components to be launched after the installation and click **Finish** to finish the installation routine.
   The X4 Suite will be installed and the X4 Designer and X4 Server (as service) will start automatically.
9. Check if error messages did occur 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. This should be the case at the latest after the second X4 Server startup.

4 X4 Suite Configuration

4.1 Configuring the X4 Server

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

4.1.1 Startup script parameters and options

The startup script parameters for Windows systems are specified within the start script `startX4.bat`.
Since the X4 Suite is installed as service in Linux installations the service file `/etc/default/X4-Server` needs to be modified in order to be able to adjust the following parameters.

> If the X4 server is installed as a service, the parameters are adapted in the file `standalone.conf.bat` in the subfolder `\X4\Server\wildfly\bin` of the X4 Suite installation.

4.1.1.1 Java VM Options

Within the start script you can specify how much memory the X4 Server is allowed to use respectively how much memory is initially reserved:

`-Xms`	start size of the allocated memory
`-Xmx`	maximum size of the memory

Examples:

Windows systems	Linux systems
Example for Windows systems `set JAVA_OPTS=%JAVA_OPTS% -Xms128m -Xmx1024m`	**Example for Linux systems** `JAVA_OPTS="$JAVA_OPTS -Xms128m -Xmx2048m"`

4.1.1.2 JMX Server Configuration

We provide a JMX interface for administration purposes. This allows remote systems to access the JMX server via port 12233. In addition, the authentication will be disabled by default.

> **Possible safety risk**
> Opening the JMX server to public networks poses a great security risk. Make sure that no unauthorized persons can access the ports!

Examples:

Windows systems	Linux systems

Example for Windows systems
`@set JAVA_OPTS=%JAVA_OPTS% -Dcom.sun.management.jmxremote.port=12233`
`@set JAVA_OPTS=%JAVA_OPTS% -Dcom.sun.management.jmxremote.authenticate=false`
`@set JAVA_OPTS=%JAVA_OPTS% -Dcom.sun.management.jmxremote.ssl=false`
`@set JAVA_OPTS=%JAVA_OPTS% -Dcom.sun.management.jmxremote`
	Example for Linux systems
	`JAVA_OPTS="$JAVA_OPTS -Dcom.sun.management.jmxremote.port=12233"`
	`JAVA_OPTS="$JAVA_OPTS -Dcom.sun.management.jmxremote.authenticate=false"`
	`JAVA_OPTS="$JAVA_OPTS -Dcom.sun.management.jmxremote.ssl=false"`
	`JAVA_OPTS="$JAVA_OPTS -Dcom.sun.management.jmxremote"`

4.1.1.3 Custom Placeholders

Java parameter `-Dx4.placeholder.PLACEHOLDER=VALUE` allows defining custom placeholders within the *X4 Server*, see Using Custom Placeholders.

Examples:

Windows systems	Linux systems
Example for Windows systems `@set JAVA_OPTS=%JAVA_OPTS% -Dx4.placeholder.FTPSERVER=ftp.prod.de`	**Example for Linux systems** `JAVA_OPTS="$JAVA_OPTS -Dx4.placeholder.FTPSERVER=ftp.prod.de"`

4.1.1.4 Database Configuration

If you use a database other than PostgreSQL, the following Java option must be adjusted in the start script (`startX4.bat` or `startX4.sh`):

Database	Adjustments within the Windows startup script	Adjustments within the Linux startup script
MSSQL	`@set JAVA_OPTS=%JAVA_OPTS% -Dx4p.dbType=MSSQL`	`JAVA_OPTS="$JAVA_OPTS -Dx4p.dbType=MSSQL"`

Database	Adjustments within the Windows startup script	Adjustments within the Linux startup script
Oracle	`@set JAVA_OPTS=%JAVA_OPTS% -Dx4p.dbType=Oracle`	`JAVA_OPTS="$JAVA_OPTS% -Dx4p.dbType=Oracle"`
	For *Oracle 12.2.02* the following additional adjustment must be made: *set JAVA_OPTS=%JAVA_OPTS% -Dhibernate.dialect=org.hibernate.dialect.Oracle12cDialect.*	For *Oracle 12.2.02* the following additional adjustment must be made: *set JAVA_OPTS=%JAVA_OPTS% -Dhibernate.dialect=org.hibernate.dialect.Oracle12cDialect.*
PostgreSQL	`@set JAVA_OPTS=%JAVA_OPTS% -Dx4p.dbType=PostgreSQL`	`JAVA_OPTS="$JAVA_OPTS% -Dx4p.dbType=PostgreSQL"`

4.1.2 Setting up the Database

4.1.2.1 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 Suite 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>
    </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>
    </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>
...
```

Adjusting the Startup parameters

For setting up an Oracle database in version `12.2.02`, the following Java option must also be adjusted in the start script:

- Adjustment in the `startX4.bat` for Windows systems: *`set JAVA_OPTS=%JAVA_OPTS% -Dhibernate.dialect=org.hibernate.dialect.Oracle12cDialect`*
- Adjustment in the `standalone.conf.bat` under `<X4<\Server\wildfly\bin` for Windows systems where X4 Suite is installed as service: *`set JAVA_OPTS=%JAVA_OPTS% -Dhibernate.dialect=org.hibernate.dialect.Oracle12cDialect`*
- Adjustment under `/etc/default/X4-Server` for Linux systems: *`JAVA_OPTS=$JAVA_OPTS -Dhibernate.dialect=org.hibernate.dialect.Oracle12cDialect`*

4.1.2.2 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 Suite 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>
</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>
</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>
</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>
</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>
```

The start script must also be adapted. These are documented in Startup script parameters and options.

4.1.3 Scheduling configuration (schedule.xml)

In the element `<schedule>` within the file `<X4>\X4DB\0\schedule.xml` schedules which allow the scheduled execution of X4 processes are managed.

Schedules are defined within the **Properties** view of the *X4 Designer* using the property `Schedule`.
If you want to edit the configuration file `schedule.xml` manually, e.g. in order to define process that will be executed when starting the server, first shut down the *X4 Server.* Otherwise, your changes will be overwritten automatically when shutting down the *X4 Server* for the next time.

4.1.3.1 Scheduled execution

Each element `<process>` defines a schedule for an X4 process using the following attributes:

`<process>` as child of the element `<schedule>` > `<startup>`	`id`	Path to the X4 process in the repository **Possible values:** Any relative path including the user folder (e.g. *`1/Project/Process.wrf`*)

	`instances`	Number of process instances to be executed on server startup (only for `<process>` elements within the element `<startup>`) **Possible values:** Any positive integer number
`<process>` as child of the element `<schedule>`	`id`	Path to the X4 process in the repository **Possible values:** Any relative path including the user folder (e.g. *`1/Project/Process.wrf`*)
	`startTime`	First date/time to execute the X4 process **Possible values:** Any date/time in the format `YYYY-MM-DDTHH:mm:ss` (e.g. *`2010-01-13T21:03:13`*)
	`period`	Period of time between two scheduled process executions (optional) **Possible values:** Any expression following the Regex pattern `\d+[smhdwMy]`, where `s`, `m`, `h`, `d`, `w`, `M` and `y` are seconds, minutes, hours, days, weeks, months and years (e.g. `2d`)
	`endTime`	End date/time after which the X4 process will no longer be executed (optional) **Possible values:** Any date/time in the format `YYYY-MM-DDThh:mm:ss` (e.g. *`2011-01-13T10:03:13`*)
	`executionCount`	Limit the number of executions of an X4 process (optional) **Possible values:** Any integer number

4.1.3.2 Execute at the Server startup

All processes, defined in an optional element `<startup>` (as first element within the root elements), are executed when starting the *X4 Server* (attributes see above).

4.1.3.3 Example

Excerpt from the `schedule.xml` that specifies a process that will be executed on the server startup with two instances, and two scheduled X4 processes:

```
<schedule>
   <startup><process id="1/Project/requestListener.wrf" instances="2"/></startup>
   <process id="1/Project/Folder/Process.wrf" startTime="2014-05-31T14:00:00"
period="1M" executionCount="100"/>
   <process id="1/Project/Folder/Process.bpm" startTime="2014-01-13T10:00:00"
 endTime="2015-01-15T10:00:30" period="2h"/>
</schedule>
```

4.1.4 Configuring via the X4config.xml

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

4.1.4.1 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)
`<scheduler>`	Enable the scheduling service to execute X4 processes **Possible values:** • *on*: Enable scheduling service (default) • *off*: Disable scheduling service

`<quartzscheduler>`	Enable a CRON-based X4 Scheduler component to execute X4 processes scheduled **Possible values:** • *`on`*: Enable X4 Scheduler component (default) • *`off`*: Disable X4 Scheduler component
`<jcoserver>`	Enable SAP Java Connector service **Possible values:** • *`on`*: Enable JCo service • *`off`*: Disable JCo service (default)

4.1.4.2 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)

4.1.4.3 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.PropertiesPlaceholderSto
rage</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>
```

4.1.4.4 PDP Configuration and Usage

PDP (Policy Decision Point) is the central Server component for authorization check. All defined access authorizations are passed to the PDP, which decides whether the logged-in user has the required authorizations or not.

In the following it is described how a PDP is configured based on the *`restconfig.xml`*.

General Configuration

The PDP configuration is made within the `X4config.xml`. A `pdp` element can be added within the root element `x4`, where the actual configuration is made. Since only one PDP can exist an the server, the PDP implementation to be used is defined here. The PDP can not be changed at run-time.

```
<pdp>
  <class>example.PDP</class><!-- full qualified class name of the implementation to
be used -->
  <config /><!-- optional and depending on the placeholder storage implementation -->
</pdp>
```

Available PDP Implementations

The following three PDP implementations are available by default:

Name	Class name	Description
URM Permission PDP	*de.softproject.integration.pdp.URMPermissionPDP*	Authorization-based check: The implementation compares the requested application and action authorization with the permissions defined within the User Management (URM) (*pepApp = URM Module & pepAction = URM Permissions*).

Name	Class name	Description
Passthrough	*de.softproject.integration.pdp.PassthroughPDP*	This PDP allows to access the resource for each authorization check.

Configuration: URM Permission PDP / URM Role PDP / Passthrough

The PDP implementation doesn't require any further configuration. Thus, the `config` element is not needed.

Sample Configuration for URM Permission PDP:

```
<pdp>
  <class>de.softproject.integration.pdp.URMPermissionPDP</class>
</pdp>
```

pepAction Expressions

It is possible to perform complex action checks. AND operation, OR operation, negation and the bracketing of expressions are thereby possible. Actions separated by space are always linked with `AND`.

URM Permission PDP

When using the *URM Perssions PDP*, the `pepAction` consists of *objecttype:action* and is also checked in PDP against the object types and actions defined in the *User Management.*

Example: *`group:list | group:administer`* – The user gets access, if he has either the action *`list`* or *`administer`* on the object type *`group`*.

4.1.4.5 Configurations for X4 Activities Classic

E-mail Configuration

Within the element `<portal>/<mail>` the parameters for sending "*Can't access*" e-mails are configured as follows:

> ⚠ Note that the element`<portal><mail>` has to be inserted after the `<server>` element and before the `<bam>` respectively the `<xstore>` elements.

```
<x4>
    ...
    </server>
    <portal>
        <mail>
            <sender>test@sp.de</sender>
            <from>test@sp.de</from>
            <login>test@sp.de</login>
            <password>1234</password>
            <smtp>smtp.sp.de</smtp>
            <smtpPort/>
        </mail>
    </portal>
    <bam>
        ...
    </bam>
    <xstore>
    ...
</x4>
```

Extension Points Configuration

Applications using the User Management often need to store additional user data into their business model in order to depict specialized information. If a change is performed within the User Management, the user data also has to be adjusted. To solve this problem, the so-called extension points are used. Thus, whenever a `create`, `update`, or `delete` operation is performed, previously configured technical processes can be executed which will refresh the data of the business model.

Within the element `<urm>/<extensionPoints>` extension points are configured as follows:

> ⚠ Note that the element `<urm>/<extensionPoints>` has to be inserted after the `<server>` element and before the `<bam>` respectively the `<xstore>` elements.

```
<x4>
    ...
    </server>
    <urm>
        <extensionPoints>
            <client id="1">
                <object type="user">
                    <operation name="create">
                        <process>MyProject\insertOperator.wrf</process>
                    </operation>
                    <operation name="update">
                        <process>MyProject\updateOperator.wrf</process>
                    </operation>
                    <operation name="delete">
                        <process>MyProject\deleteOperator.wrf</process>
                    </operation>
                </object>
            </client>
        </extensionPoints>
    </urm>
    <bam>
        ...
    </bam>
    <xstore>
    ...
</x4>
```

An element `<client>` encloses the client configuration. The attribute `id` specifies the name of the client folder (e.g. *1*). Within the element `<client>` configurations for the single object types can be made.

The configuration for the object type is enclosed by an `<object>` element, whereby the attribute `type` specifies the object type. The following object types are available:

`user`	Contains operations on user objects and the assignment of groups and roles to the respective user.
`group`	Contains operations on group objects and the assignment of roles to the respective group.
`role`	Contains operations on role objects and the assignment of permissions to the respective role.
`persmission`	Contains operations on permission objects (only `create` and `delete` possible).

The element `<operation>` contains processes to be executed within the respective client. An element `<operation>` should only contain a `<process>` element. The attribute `name` within the element `<operation>` defines the operation for which the respective process is to be invoked. Technical processes can be invoked with the following operations:

- `create`: A new object is created within the database.
- `update`: An already existing object is updated within the database.
- `delete`: An already existing object is deleted within the database.

Within the element `<process>` the path to the process to be invoked is defined. The process `updateOperator.wrf` would be invoked, if a user (`object type="user"`) was updated (`operation name="update"`).

4.1.4.6 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>
```

4.1.5 Configuring the Logging

How to configure the X4 Server's logging behavior.

4.1.5.1 Logging for the X4 Server and for X4 BAM

The logging for the X4 Server is configured within the global configuration file `X4config.xml`. The following parameters can be defined:

Sample logging configuration

```
<logging file="off" http="off" controlCenter="info" dataLog="off" async="true"
queueSize="100000"/>
<savepoint storage="database"></savepoint>
```

Parameters of the element `logging`:

Attribute	Description
`file`	Defines whether technical events are logged to the log file **Possible values:** • *`off`*: Technical events are not logged to the log file (default) • *on*: Technical events are logged to the log file

Attribute	Description
`http`	Defines whether HTTP logging is enabled *Possible values:* • *`off`*: HTTP logging is disabled (default) • *`on`*: HTTP logging is enabled
`controlCenter`	Defines the logging strategies for technical events **Possible values:** • *`off`*: Technical events are not logged to the X4 Control Center • *`on`*: Only process events are logged to the X4 Control Center • *`info`*: Process events and events triggered by component executions are logged to the X4 Control Center (default) • *`error`*: Only component executions with negative return value are logged to the X4 Control Center
`dataLog`	Defines whether business data logged with the X4 BAM Logging adapter are logged to the X4 Control Center **Possible values:** • *`off`*: Business data are not logged to the X4 Control Center (default) • *`on`*: Business data are logged to the X4 Control Center
`async`	Defines whether messages are logged asynchronously or synchronously **Possible values:** • *`true`*: Messages are logged asynchronously to the database • *`false`*: Messages are logged synchronously to the database (default)
`queueSize`	Defines the maximum number of messages waiting for asynchronous processing **Possible values:** • Integer > *`0`* • *`50.000`* (default) If the queue is full, all following processes that want to write messages must wait.

If the element `logging` is not set in the `X4config.xml` no technical and business data are logged.

Parameters of the element `savepoint`:

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

If the element `savepoint` is not set within the `X4config.xml`, no save points are saved.

Sample configurations

- *X4 Server without logging to the X4 system database*

```
<logging file="on" controlCenter="off" dataLog="off" />
<savepoint storage="filesystem" />
```

Using this setting, technical events are written to the log. Events of the X4 BAM Logging adapter are not written to the log file to prevent the log file of being filled excessively. Save points are written to the server directory `savepoints`.

- *X4 Server with logging to the X4 system database*

```
<logging file="off" controlCenter="info" dataLog="on" />
<savepoint storage="database" />
```

Using this setting all process and component executions are logged to the X4 system database. Events of the X4 BAM Logging adapter are logged to the same database, as well as save points.

4.1.5.2 HTTP Logging

Event	Description	Log category
`Request received`	Will be triggered, if an HTTP request was accepted.	`x4.log.http.received`
`Routing unsuccessful`	Will be triggered, if no valid processing was found for an HTTP request (e.g. no process has been declared, or missing authorization).	`x4.log.http.routing.unsuccessful`
`Routing successful`	Will be triggered, if a valid processing was found for an HTTP request. If it is a process execution, it will start after the event.	`x4.log.http.routing.successful`

Event	Description	Log category
`Process ended`	Will be triggered, if the process for which the request has been executed, is finished.	`x4.log.http.processend`
`Request finished`	Will be triggered after the processing of an HTTP request was finished, i.e. the response was transferred to the HTTP server in order to be sent to the caller.	`x4.log.http.finished`

The possible event chains are the followings:

1. The request can't be forwarded for processing:
   - `Request received`
   - `Routing unsuccessful`
   - `Request finished`

2. The request can be forwarded for processing and triggers an X4 process:
   - `Request received`
   - `Routing successful`
     - The process is executed and is traceable via `Tech` logging
   - `Process ended`
   - `Request finished`

3. The request can be forwarded for processing, but doesn't trigger any X4 process (e.g. a File Service)
   - `Request received`
   - `Routing successful`
   - `Request finished`

4.1.5.3 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.

4.1.5.4 Audit Trail for the User and Rights Management

The Audit trail feature allows to track all user actions performed within the *User Management*.

To use this function, the following handlers and loggers need to be specified in the configuration file `Standalone.xml` within the element `<subsystem xmlns="urn:jboss:domain:logging:3.0">`:

Handler

```
<periodic-rotating-file-handler name="URM_AUDIT_LOG" autoflush="true">
  <formatter>
    <pattern-formatter pattern="%d{yyyy-MM-dd HH:mm:ss,SSS} %-5p %s%e(%t)%n"/>
  </formatter>
  <file relative-to="jboss.server.log.dir" path="urm_audit_log.log"/>
  <suffix value=".yyyy-MM-dd"/>
  <append value="true"/>
</periodic-rotating-file-handler>
```

Logger

```
<logger category="de.softproject.portal.urm">
    <level name="INFO"/>
    <handlers>
            <handler name="URM_AUDIT_LOG"/>
    </handlers>
</logger>
```

4.1.5.5 Ad Hoc Logging During Runtime

For extended error analysis, the X4 Server now allows to log the output of individual process steps during process runtime. It is neither necessary to change the `.wrf` file of the respective technical process nor to restart the server. Moreover, conditional logging for sub-processes is enabled, e.g. if a sub-process has been called by a particular main process.

Configuration

The logging behavior can be controlled via the `tracelog.properties` file under `X4\Server\X4DB\0`. Here, you can find the expected format, if you want to address a process or process step and to enable logging:

- **Logging single process steps:** Single process steps to be logged can be specified using the following pattern: *<User>/<Process_path>/<ActionID> = 1*
- **Conditional logging of sub-process steps:** Single process steps of a sub-process to be logged, if the process is called by a certain parent process, can be specified using the following pattern: *<Executing_User>/<Path_Parent_Process>/<User>/<Path_Subprocess>/<ActionID> = 1*

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

If changes have been made to the `tracelog.properties` file, the configuration must be reloaded. The reload of the configuration file can be initiated easily via the **Administration** interface within *X4*

Control Center. To do this, click on the operation **reloadTraceLogSettings** under **Administration** > **X4 Management**.

Sample Configurations

Logging Single Process Steps

Sample configuration for logging a certain 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 Sub-process Steps

Sample configuration for conditional logging of subprocess steps

```
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*

4.1.6 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*.

4.1.7 Managing the X4 Designer Access

How to create and manage users for the *X4 Designer*

4.1.7.1 Configuration file tblAccess.xml

Within the element `<permissions>` in the file `<X4>\X4DB\0\tblAccess.xml` all users (clients) of the X4 Designer are managed.

A user has individual access data to log in to the X4 Server via X4 Designer, and also an individual user repository.

User configuration

Each element `<user>` contains user information within the following child elements:

`<id>`	User ID which is equivalent to the user repository folder name **Possible values:** ASCII string without special characters or whitespaces (*`Aa-Zz 0-9`*); due to legacy compatibility in most cases an integer number (e. g. *`1`*)
`<login>`	Unique user name **Possible values:** ASCII string without special characters or whitespaces (*`Aa-Zz 0-9`*)
`<password>`	MD5-hashed password, see Passwort verschlüsseln **Possible values:** Any MD5-hashed password (lowercase letters must be converted to uppercase)
`<firstName>`	First name of the user **Possible values:** Any string
`<secondName>`	Last name of the user **Possible values:** Any string

<groups>	Assigns the user to a group; contains at least 1 element <group> that contains the user group ID **Possible values:** Any group ID (e. g. *1*)
<sharing>	(no function)

Group configuration

Within the element <group> a default user group is defined. Within the element <server> various modules and functions are configured.

⚠ Never change the values within the element <server>!

Example
Excerpt from the tblAccess.xml with a default user configuration:

```
<user>
   <id>1</id>
   <login>demo</login>
   <password>FE01CE2A7FBAC8FAFAED7C982A04E229</password>
   <firstName>Test</firstName>
   <secondName>Tester</secondName>
   <groups>
        <group>1</group>
    </groups>
   <sharing>
        <groups>
            <group>1</group>
        </groups>
   </sharing>
</user>
```

4.1.7.2 Creating users

The element <permissions> within the file <X4>\X4DB\0\tblAccess.xml is used to manage all users of the *X4 Designer*.

ⓘ New users, groups and user repositories will only be available after restarting the *X4 Server*.

1. In <X4>\X4DB\0\tblAccess.xml copy an already existing element <user> with all its child elements and insert it within the element <users>.
2. Change the user information:
   - Enter a new user ID within the element <id>, see Configuration file tblAccess.xml.
     Example: 2 or *TestRepository*

- Enter a unique user name within the element `<login>`.
- Create an MD5-encrypted password for this user, see Passwort verschlüsseln.
- Change other user information if necessary

3. Create a new user repository folder in `<X4>\X4DB\` whose name corresponds to the user ID.
   Example: If in `<X4>\X4DB\0\tblAccess.xml` a usere with the ID `101` has been created, a repository folder `<X4>\X4DB\101` must be created.
4. Restart the *X4 Server*, see Controlled shutdown of the X4 Server (via JMX).

4.1.7.3 Encrypting the password

If you create a new user, normally you will need a new password to be stored encrypted within the file `<X4>\X4DB\0\tblAccess.xml`.

1. Encode the plain text password bytewise as UTF-8.
2. Generate an MD5 hash of the UTF-8 string.
3. Transform the MD5 bytes by hexadecimal spelling into a string.
4. If required: convert lowercase letters within the MD5 string to uppercase.
   The password is now in the expected format.
5. In `<X4>\X4DB\0\tblAccess.xml` insert the password for the corresponding user within the element `<password>`.

4.1.8 Securing the X4 Control Center Access

> **Potential vulnerability**
> With the X4 Suite's trial installation, two X4 Control Center users `demo` and `admin` are included. When turning the system into a productive system, this may pose a potential security vulnerability. It is obligatory to secure these user accounts.

You have two possibilities to secure the demo users:

1. Change the access data of the two users
2. Deactivate the user `demo`

4.1.8.1 Creating a New User with Administrator Permissions

1. Log in to the X4 Control Center with demo user *`admin`* and password *`demo`*.
2. Open the *User Management* by clicking the corresponding tab.
3. Create a new user by clicking on **Create user**.
4. Enter the user information within the **User properties**:
   - in **User name** the user's name
   - in **First name** the users first name
   - in **Last name** the users last name
   - in **E-mail address** the user's e-mail address
   - in **Passwort** the corresponding password
   - with **Active** activate the user

5. Assign the user to the default group **Administrators** and to other groups, if necessary. Select the group from the list of available groups and click on **Assign**.
6. If necessary, assign the user an application-specific role. Select the role from the list of available roles and click on **Assign**.
7. Click on **Save** to save the settings and to create the user.
   The new user with administrator rights has been created.

4.1.8.2 Changing the Demo Users' Access Data

1. Make sure that you have created a new user within X4 Control Center's *User Management* with administrator permissions.
2. Log in to the X4 Control Center as user having administrator permissions.
3. Select the demo user `admin` within the *User Management*, in order to edit the user information.
4. Enter the new user information within the **User properties**:
   - in **User name** the user's name
   - in **First name** the users first name
   - in **Last name** the users last name
   - in **E-mail address** the user's e-mail address
   - in **Passwort** the corresponding password
   - with **Active** activate the user
5. Assign the user to the default group **Administrators** and to other groups, if necessary. Select the group from the list of available groups and click on **Assign**.
6. If necessary, assign the user an application-specific role. Select the role from the list of available roles and click on **Assign**.
7. Click on **Save** to save the settings.
8. Select the second demo user `demo` within the user overview, in order to edit the user information.
9. Repeat the steps 3-5.
10. Click on **Save** to save the settings.
    The access data of the two demo user has been changed.

4.1.8.3 Deactivating the Demo Users

1. Log in to the X4 Control Center as user having administrator permissions.
2. Select the user `demo` within the user overview.
3. Deactivate checkbox **Active**.
4. Click on **Save** to save the settings.
   The user has been deactivated.

4.1.9 Enabling SSL and HTTPS for X4 Server

4.1.9.1 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:10.0">`:

```
<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">
        <any-address/>
     </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/`.

4.1.9.2 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/`.

4.1.9.3 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/.

4.1.9.4 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
```

4.1.9.5 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>
```

4.1.10 Server configuration for X4 Activities

Within the global X4 Server configuration, settings are made which are equal for all X4 Activities applications per server instance.

Available configuration options

Key	Description	Example
x4p.x4.host	Host name of the X4 Server, which serves as destination server for X4 ReST calls performed by X4 processes	*-Dx4p.x4.host=localhost*
x4p.x4.httpPort	HTTP port of the X4 Server, which serves as destination server for X4 ReST calls performed by X4 processes	*-Dx4p.x4.httpPort=80*
x4p.x4.httpsPort	HTTPS port of the X4 Server (if SSL is activated within the application server) **Note:** Required, if the communication via HTTPS is activated.	*-Dx4p.x4.httpsPort=443*
x4p.x4.secure	Activates SSL for the HTTP communication • `true`: Communicate with the X4 Server via HTTPS (optional) • `false`: Do not use HTTPS (default)	*-Dx4p.x4.secure=true*
x4p.login.showCantAccessLink	Display the link **Forgot password / Can't Access** in the Login application (optional) • `true`: Display the link **Forgot password / Can't Access** • `false`: Hide the link **Forgot password** (default)	*-Dx4p.login.showCantAccessLink=true*
x4p.login.enablePlainPassword	Allows the user to display the password during the login in plain text (optional) • `true`: Password can be displayed in plain text • `false`: Only a default password field is displayed (default)	*-Dx4p.login.enablePlainPassword=true*

4.2 Configuring the X4 Designer

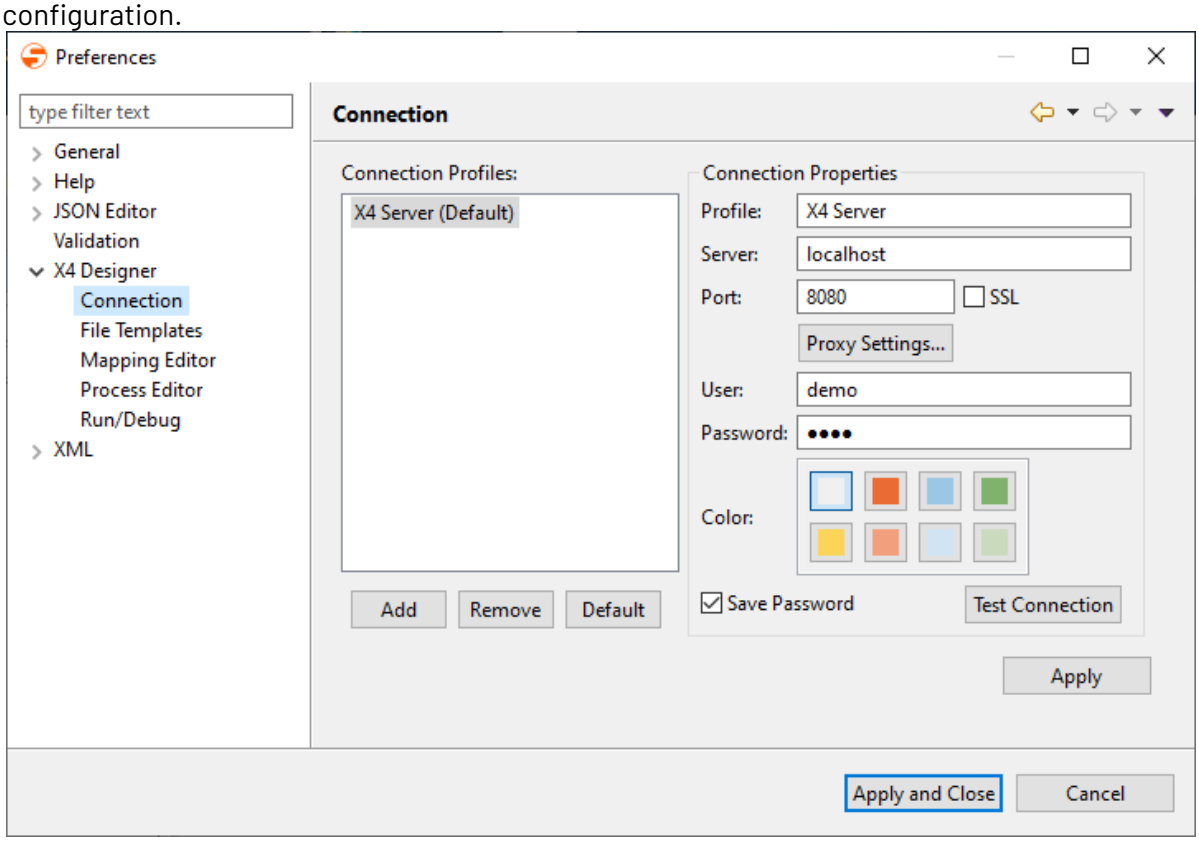
How to customize the appearance and behavior of the *X4 Designer*

4.2.1 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)

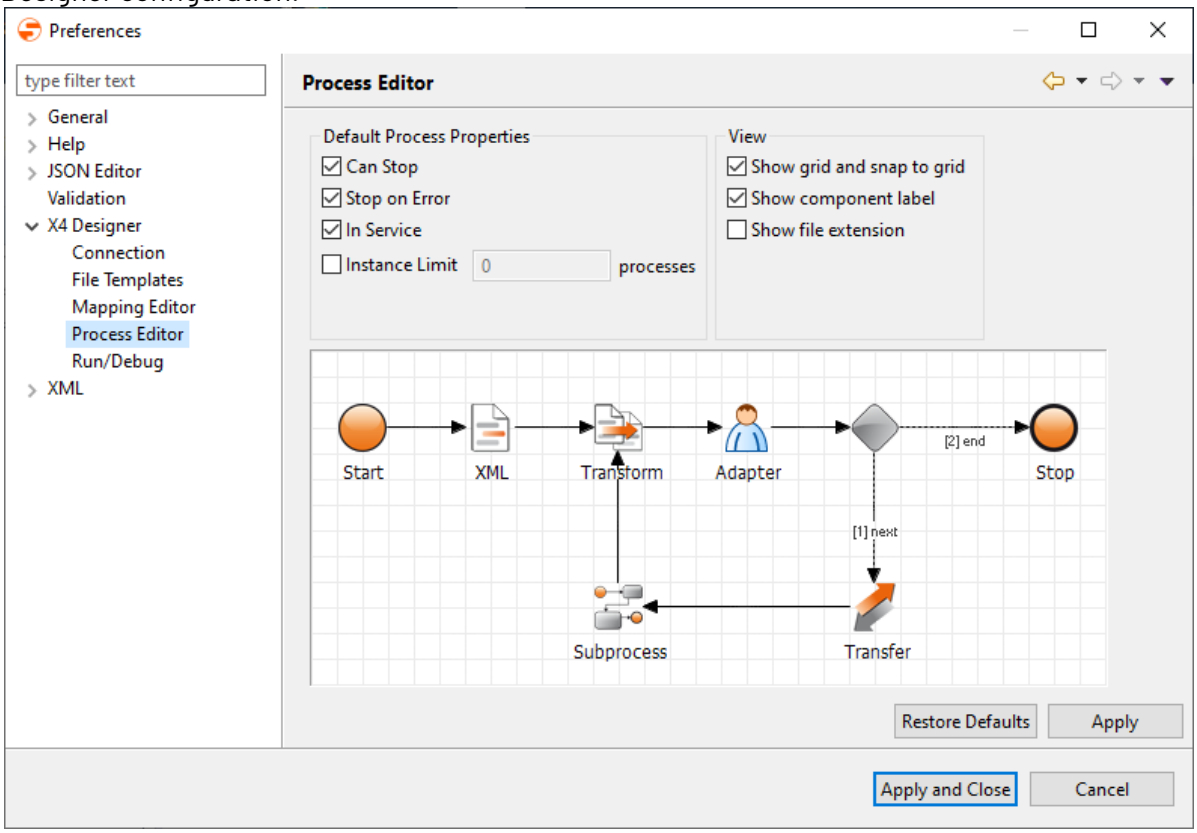
     The color will be displayed in the *X4 Designer*'s status bar on the next connect and helps you to differentiate between different *X4 Servers*.
4. Click **Test Connection** to check if the connection functions properly.
5. Click **Apply and Close** to save the configuration and close the window.

4.2.2 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.



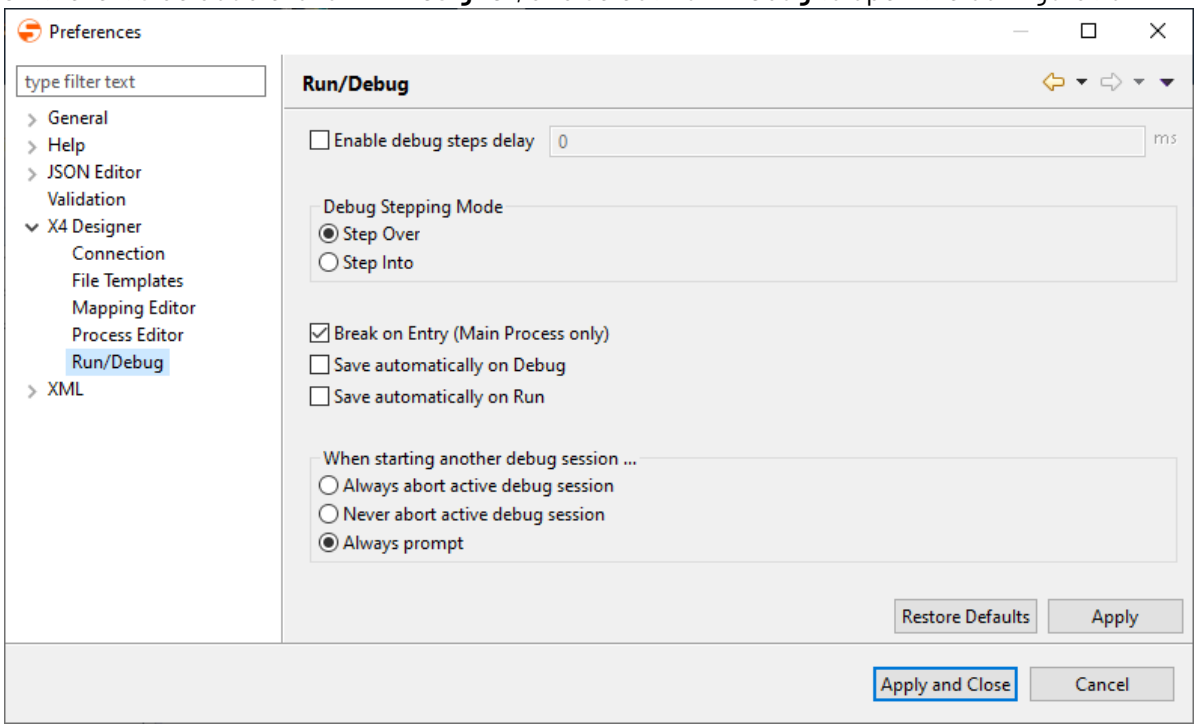
3. Edit default behavior and properties of new processes in **Default Process Properties**:
   - **Can Stop:** Allows the process to be terminated
   - **Stop on Error:** Cancels process execution automatically when an error occurs
   - **Public/Private:** Process is executable
   - **Instance Limit:** 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.

4.2.3 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.

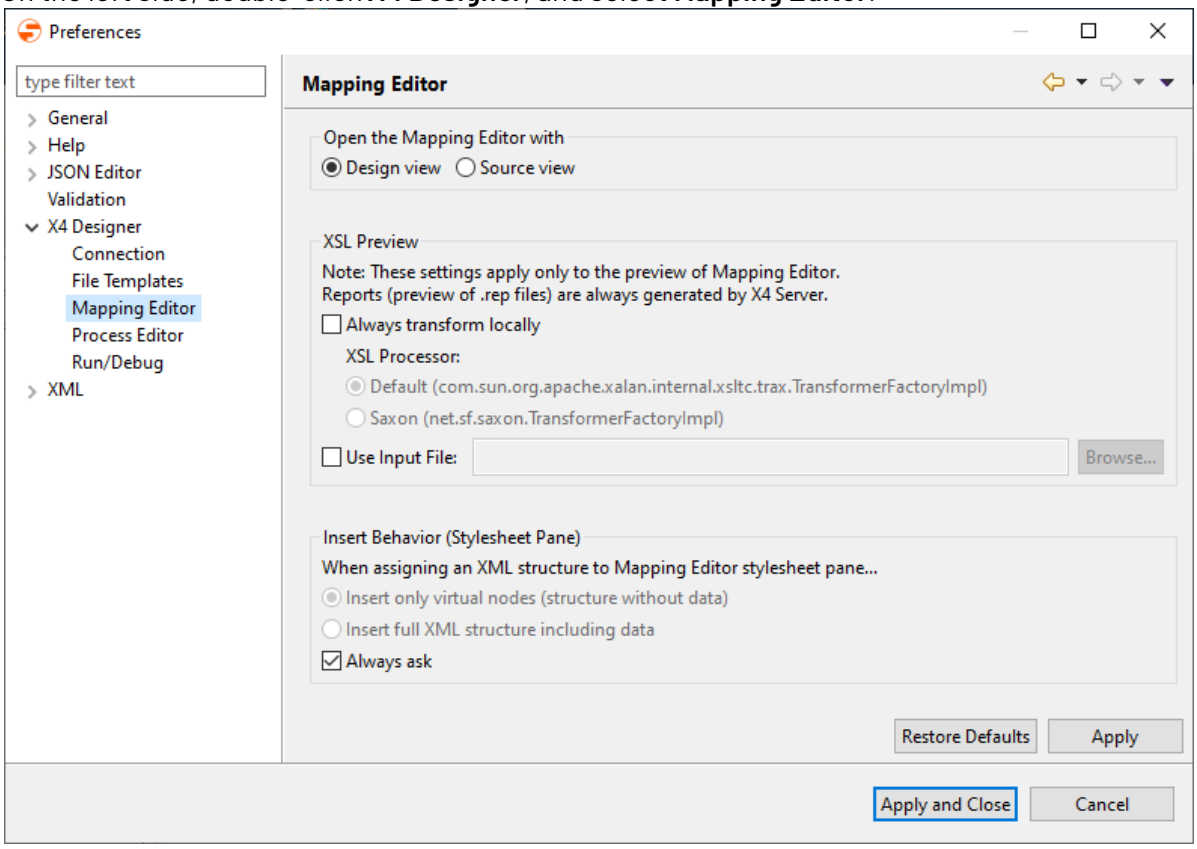
     The debugging can always be restarted via the F4 key.
4. Click **Apply and Close** to save the configuration and close the window.

4.2.4 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**.



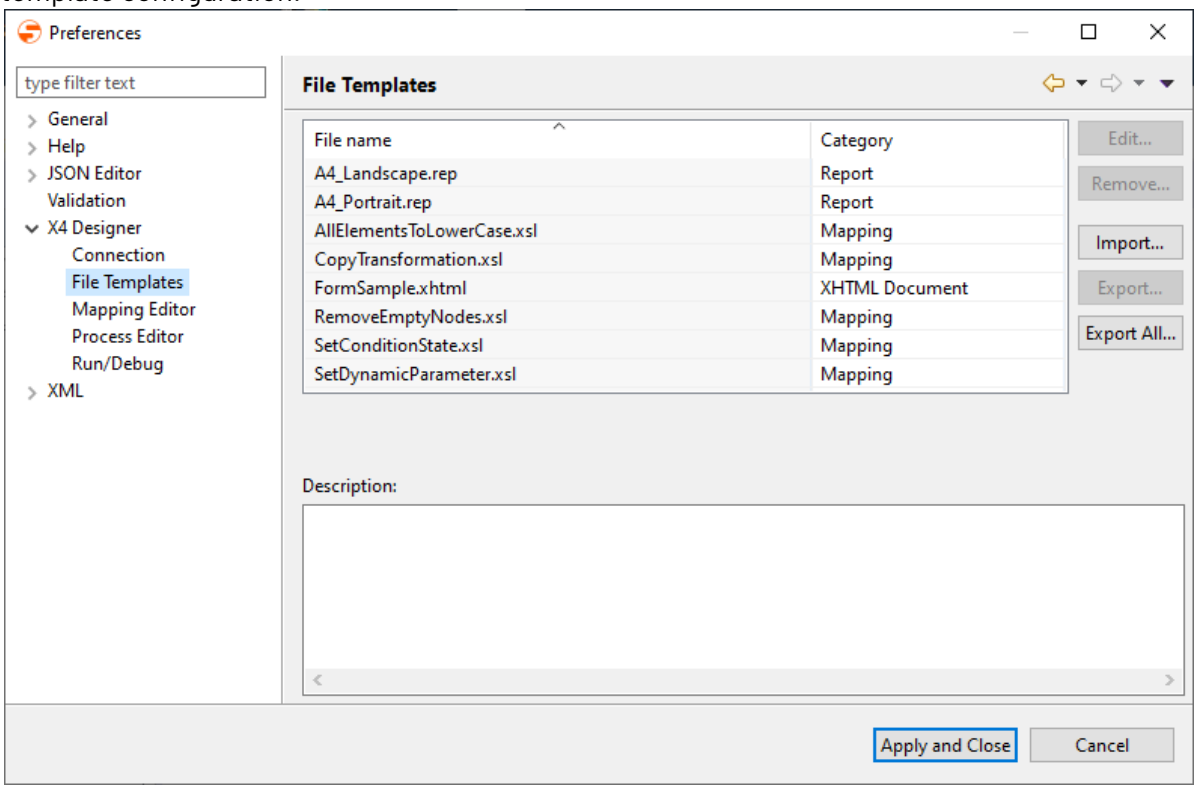
3. Configure the Mapping Editor's behavior:
   - In **Open the Mapping Editor with** define how XSL mappings shall be opened:
     - **Design view:** Open in the graphical mapping view (default)
     - **Source view:** Open in the source code view
   - In **XSL Preview** configure the behavior of XSL 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.

4.2.5 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.



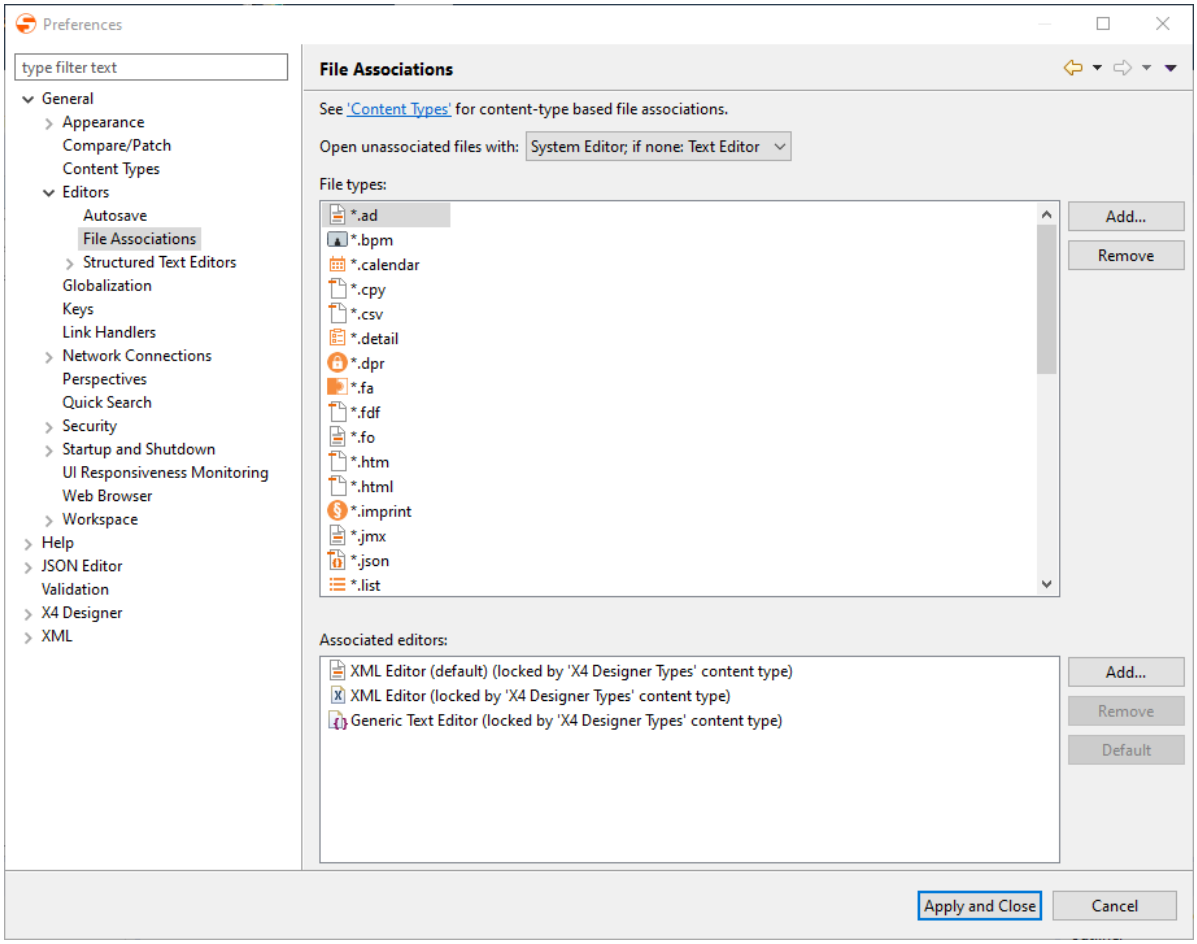
3. Manage the templates as desired:
   - **Edit:** Edit the template's name or description text
   - **Remove:** Delete a selected template
   - **Import:** Import an existing template folder
     Only template directories with the same structure as the folder `<X4>/X4DB/0/Templates` can be imported.
   - **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.

4.2.6 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`.

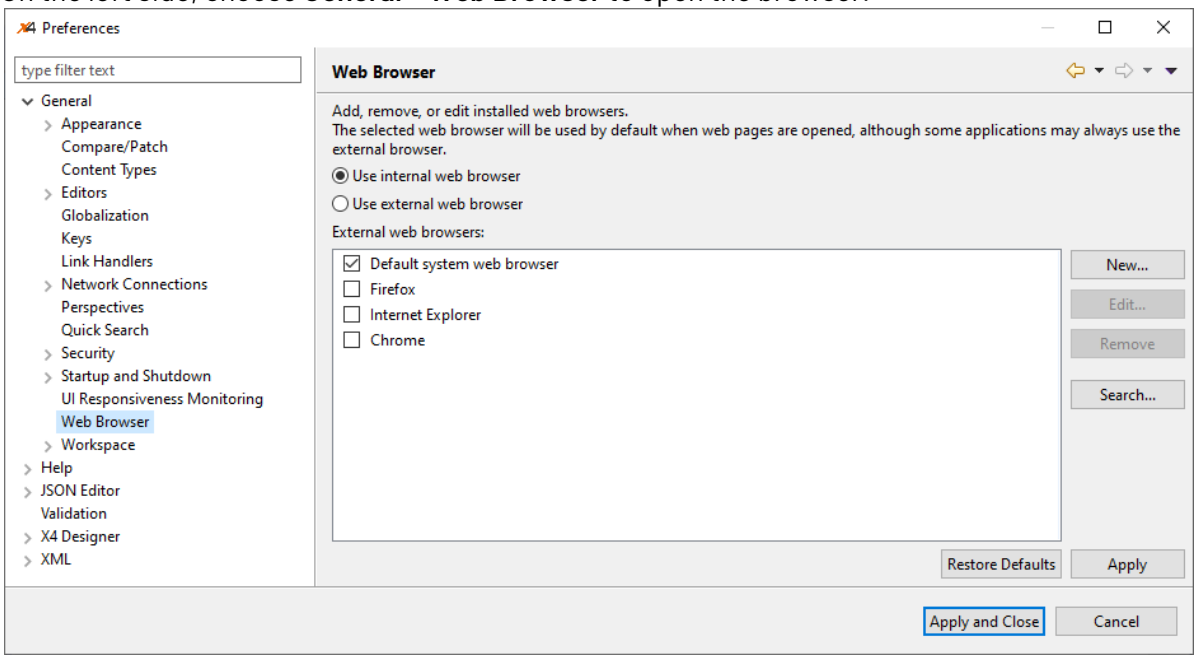
> If the file type shall be opened by default with a selected editor, click **Default**.

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.

4.2.7 Configuring the Web Browser

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

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.

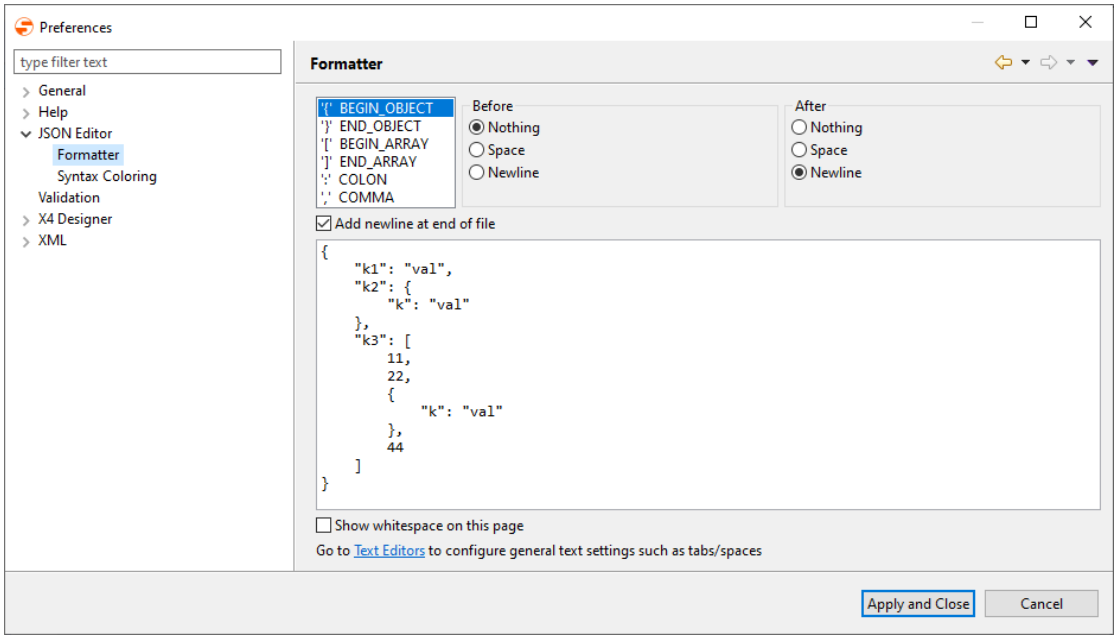
   > To use Microsoft Edge the following must be entered:
   > **Location:** File system path to Microsoft prompt, e.g. *C:\Windows\System32\cmd.exe*
   > **Parameters:** /c "start microsoft-edge:%URL%"

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

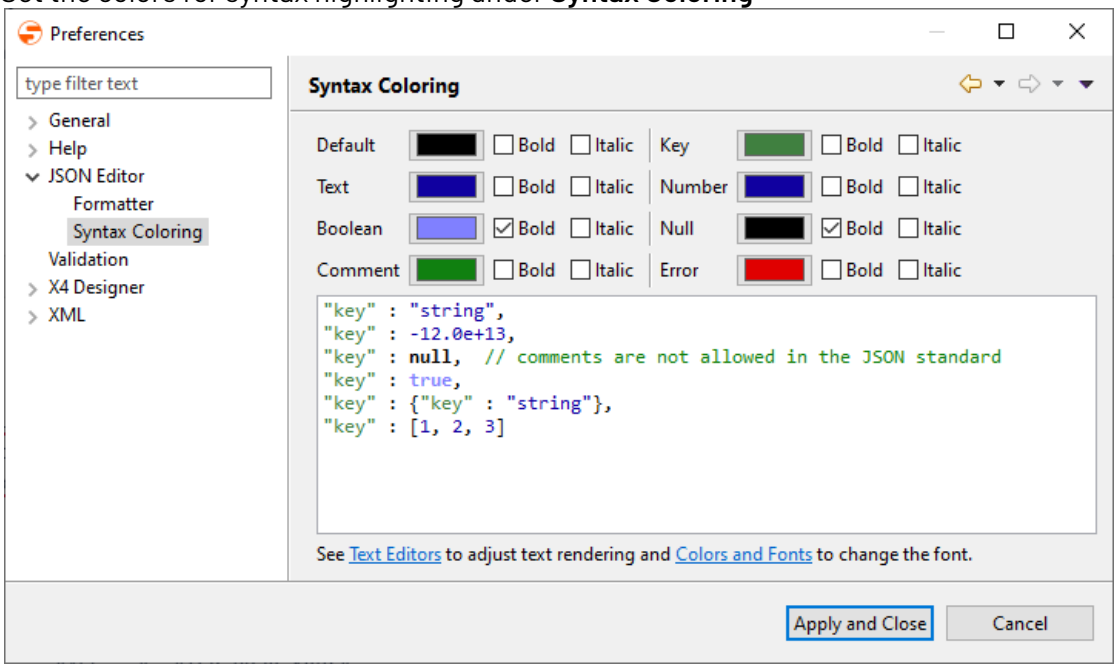
4.2.8 Configuring the JSON Editor

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.

4.2.9 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 Suite.

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.

5 Administering the X4 Server

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

5.1 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.

5.2 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.

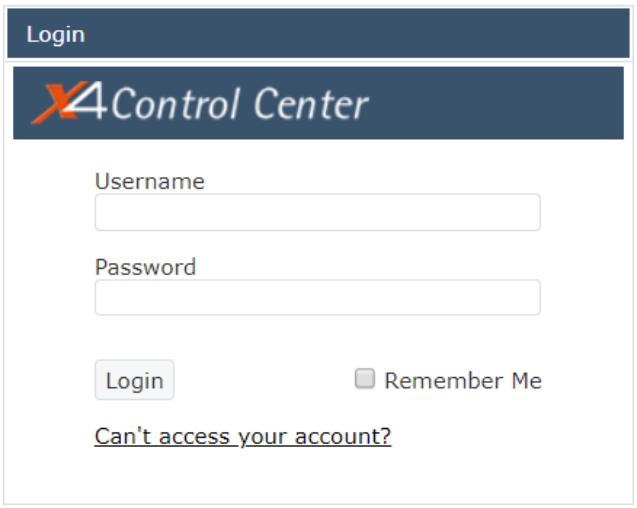
5.3 X4 Server administration via X4 Control Center

5.3.1 Logging in to X4 Control Center

To start the X4 Control Center open the respective server URL (e. g. test or production server) within the browser.

> You can also start X4 Control Center from within the X4 Designer by clicking **Tools > X4 Control Center** and logging in with an authorized user, e.g. `admin` and password `demo`.

> **Control Center does not open?**
> If the Control Center does not open in the browser, the configuration of the web browser used may be incorrect. For more information see Configuring the Web Browser.



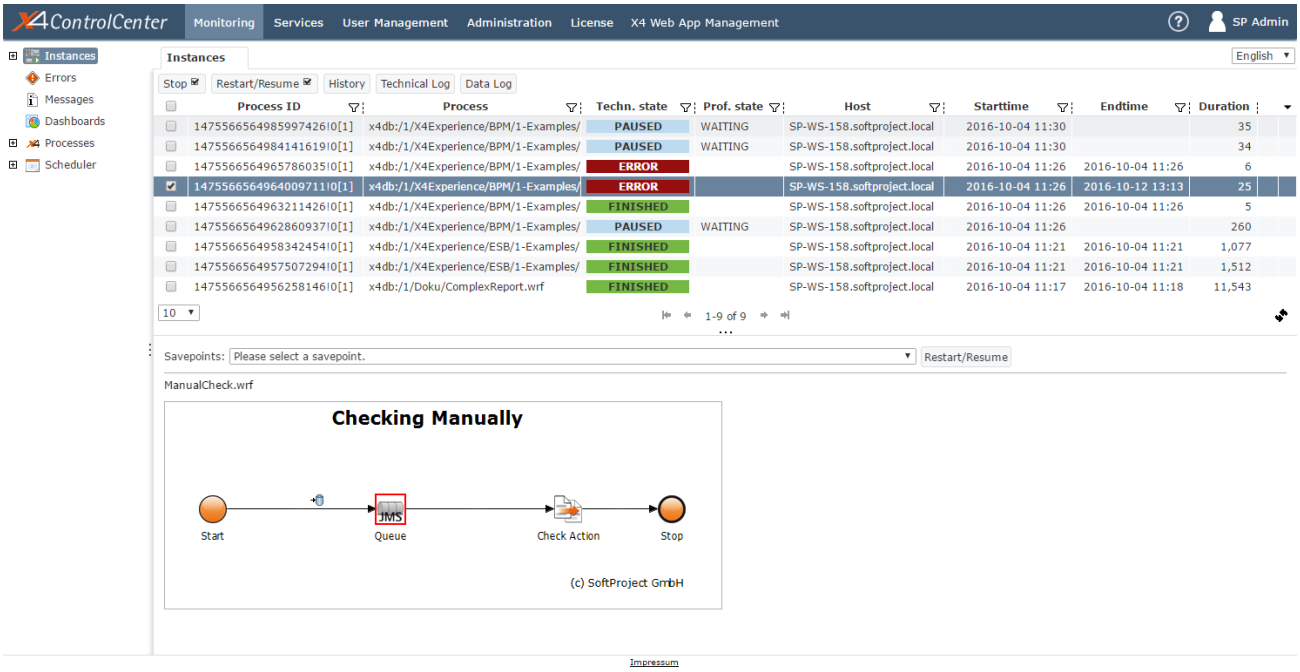
After successfully logging in, the X4 Control Center's homepage will be opened. From here, you have access to its components.

Forgot password?
If you have forgotten your password, you can request a new one by clicking on **Can't access your account?** and entering your e-mail address.
If the link is not available, this function may have been disabled by your administrator.

5.3.2 The X4 Control Center's Interface

The X4 Control Center's user interface is typically divided into the following areas.

The upper area contains a title bar with the logo, the different components, credentials and a language selection. On the left side a tree structure or list of menu items is displayed, which depends on the authorization of your current user. On the right side, it contains the list view including the process list and the action bar, and the detail view showing details to the process selected within the list view.



Click the *X4 Control Center* icon to open the web application's home page.

5.3.2.1 Navigator

Depending on the user rights, a tree structure is displayed on the left side of the main view. Here, menu items are displayed in a node.

You can expand the tree elements within the navigator by clicking on

⊞

and collapse them by clicking on

⊟

.

5.3.2.2 List view

Within the list view on the right side of the main view, a list of available data is displayed depending on the selected menu item.

The first table row contains the column headers. This header has various functions for sorting, filtering, and adjusting the displayed columns. These functions are described in the following.

Sorting columns

For each column in the list view a default sorting is defined, which influences how the entries are displayed on the various pages of the list. You can change this sorting manually as follows:

- *Click on a column title:* sort in ascending order based on this column
- *Click once again on the column title:* sort in descending order based on this column

Filtering list entries

Click on the filter icon

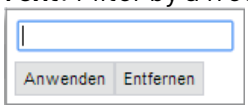


next to the column title to open the context menu. Depending on the data type, different filter options are available:

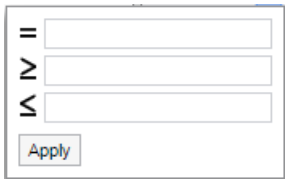
- **Date:** Filter operations over a specific period by entering the start date (**From**) and the ending date (**To**).



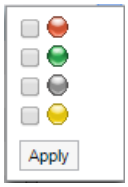
- **Text:** Filter by a free text.



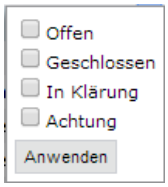
- **Number:** Limit the number's range of values by using operators.



- **Status:** Filter operations by means of traffic light-like filtering system.



- **Boolean values:** Filter operations based on Boolean values.



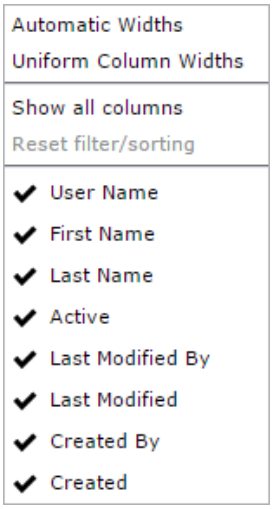
Columns already applying a filter are marked with



. Moreover, set filters are shown as mouse-over effect.

Adjusting the column display

Open the context menu allowing to change the display of the columns by clicking on the symbol
on the rights side of the table header:



Functions to adjust the column display:

- **Automatic Widths**: Distribute all displayed columns optimally across the entire width of the list view
- **Uniform Column Widths:** Distribute all displayed columns across the entire width of the list view with a uniform column width
- **Save Filters and Sorting:** Save user-defined configuration
- **Load Filtert and Sorting:** Use the saved display configuration of the current user
- **Organize Filters and Sorting:** Show and organize saved display configurations
- **Show all columns:** Display all available columns within the list view
- **Reset filtering/sorting:** Reset the changed filtering/sorting

> You can show/hide individual columns within the list view by clicking on the respective column name within the column context menu.

Scrolling between list pages

For the List view, the number of displayed entries on a page can be defined by means of a selection box. Further list entries are displayed on additional pages and you can scroll between them using the navigation buttons below the list.



5.3.2.3 Action bar

The action bar is located above the list view and allows to perform actions to a selected list element.

5.3.2.4 Detail view

The detail view displays the data for the selected list item, usually in the form of form fields, which can be readable or writable, depending on their type and the user's rights. Moreover, also application-specific functions can be available here.

5.3.3 Monitoring

The *Monitoring* interface allows X4 processes to be monitored and controlled. *Monitoring* enables to identify problems such as data overload, slow response times and violations of service level agreements.

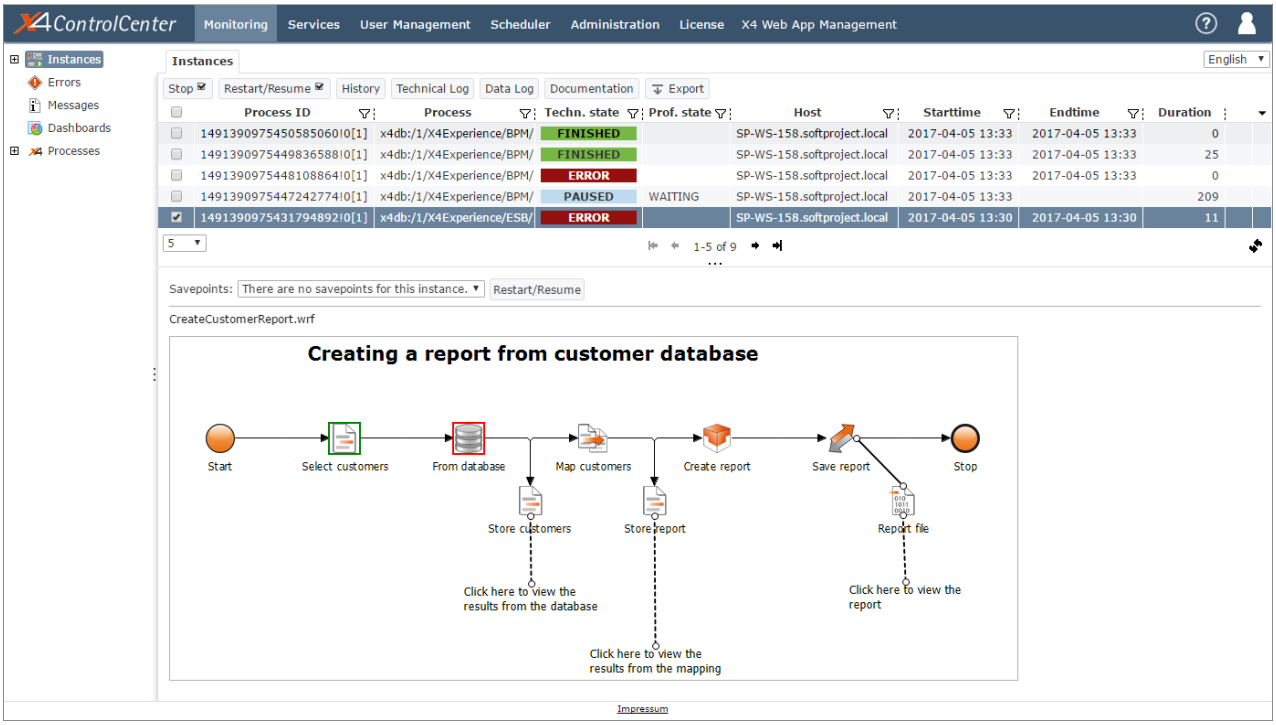
The main functions of the *Monitoring* interface are:

- Display of technical and business processes
- Start and stop processes
- Restart held processes from save points
- Identify indicators such as process runtime or PID
- Display of process diagrams
- Technical logging and content logging

5.3.3.1 Instance View

Within the instance view, information to the instances of a technical or business process are displayed. It is thereby differentiated between **running instances** and **instance history**, i.e already executed instances.

> ⓘ The time span for the display of process instances can be adjusted at any time via the custom placeholder `MonitoringDays` within the Administration interface, see Custom Placeholders.



Process Instance List

Within the instance view, all process instances are displayed in a table. To each instance information such as process ID, process path, technical and professional status, start, end and execution time in milliseconds are displayed.

In the action bar above the table different actions can be performed:

- **Stop:** Stop the currently running process instance
- **Restart/Resume:** Restart the currently running process instance from a save point or resume a via the save point operation `Save+Stop` persisted and stopped process instance
  To resume a stopped process instance select the desired save point and resume the process with **Restart/Resume**.
- **History:** Open the process history in a new window
- **Technical Log:** Open the technical log in a new window
- **Data Log:** Open the data log in a new window
- **Documentation:** Generate documentation and open it in the browser
- **Export:** Export list of process instances as CSV file

Switching Between the Views

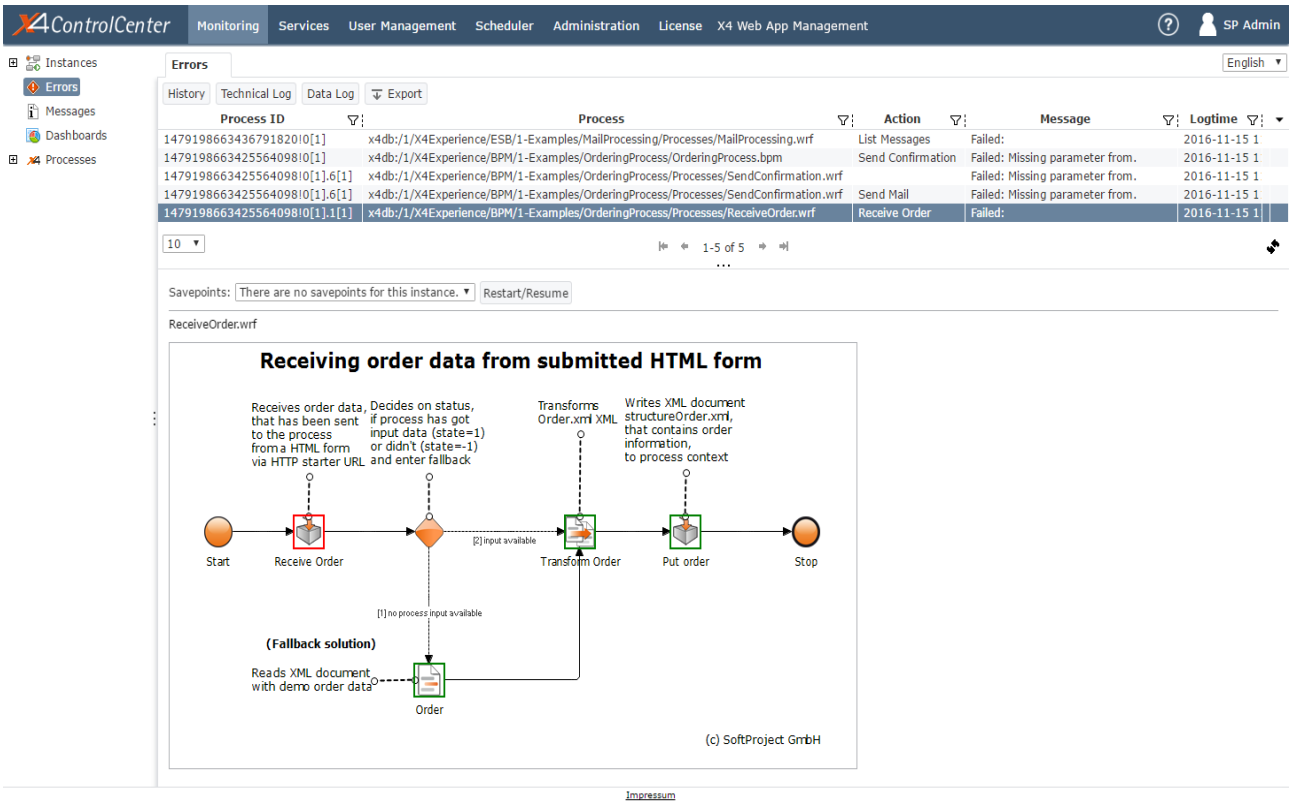
- By double-clicking an entry within the process list you can change to the instance view.
- To terminate the instance view, close the corresponding tab.

5.3.3.2 Errors and Messages

Logging events such as errors and messages are listed in a separate node.

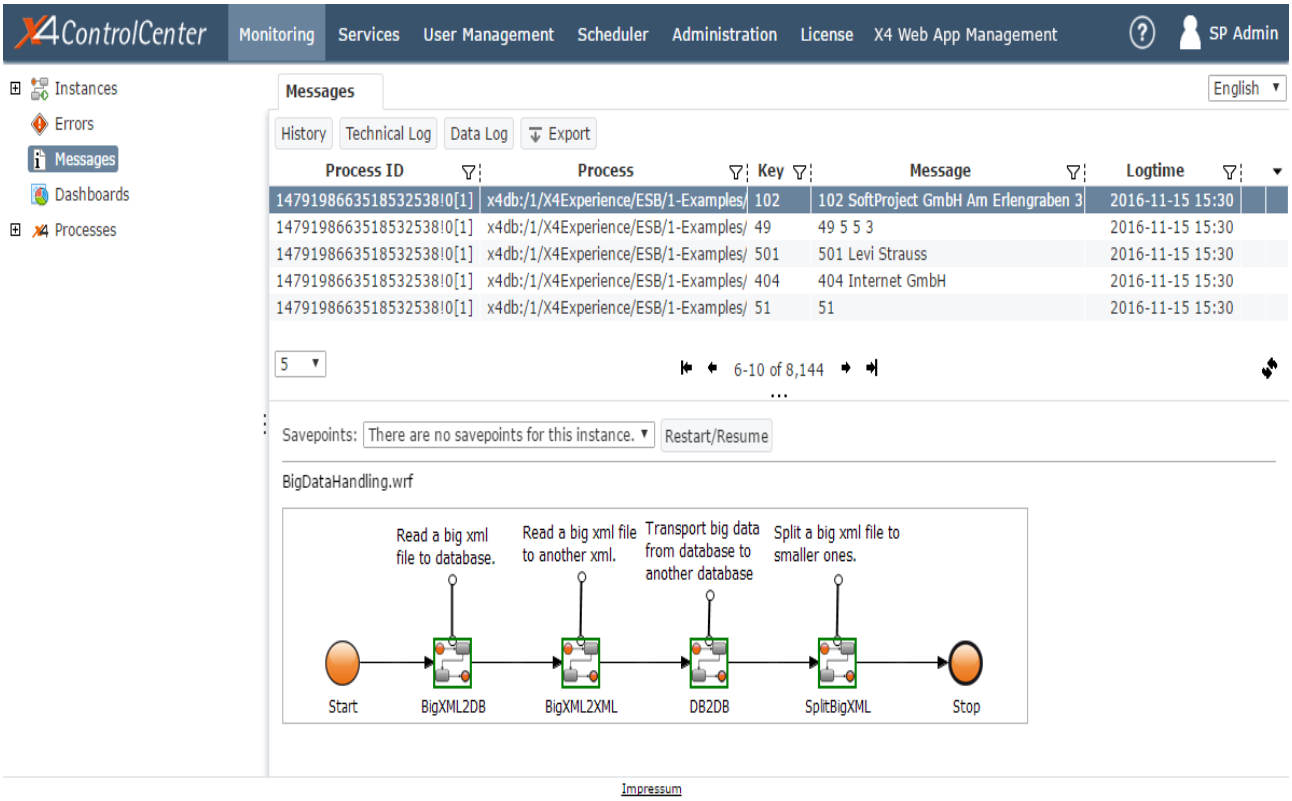
Errors

Within the **Errors** view, events with an error status are logged based on the process instance ID in an own entry. The process diagram of the corresponding process instance is shown within the detail view.



Messages

Within the **Messages** view, data log events are logged based on the process instance ID and a possibly existing key (parameter `key`). The process diagram of the corresponding process instance is shown within the detail view.



Available actions for Errors and Messages

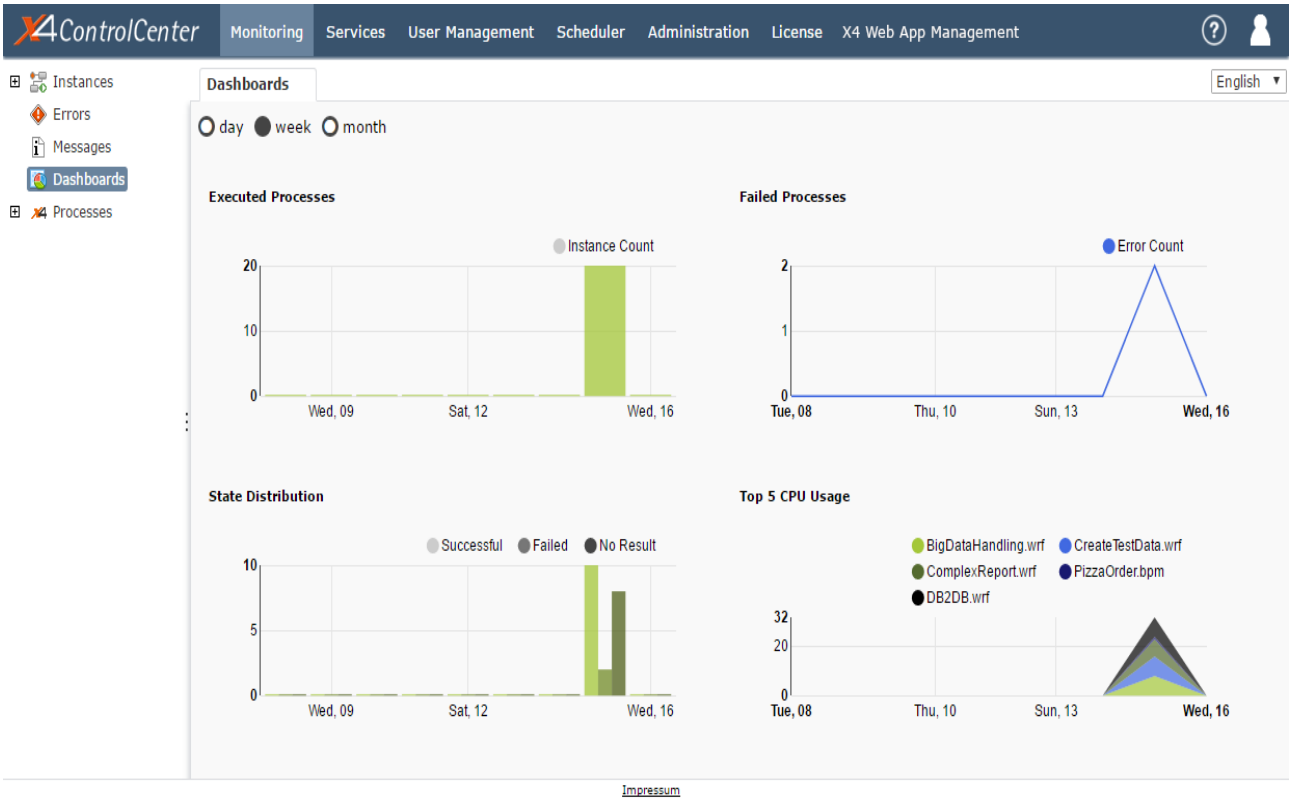
In the action bar different actions can be performed based on the single states:

- **Restart/Resume:** Restart the currently running process instance from a save point or resume a process instance persisted and stopped via the save point operation `Save+Stop`
  To resume a stopped process instance, select the desired save point and resume the process with **Restart/Resume**.
- **History:** Open the process history in a new window
- **Technical Log:** Open the technical log in a new window
- **Data Log:** Open the data log in a new window
- **Export:** Export list of failed processes as CSV file

5.3.3.3 Dashboards

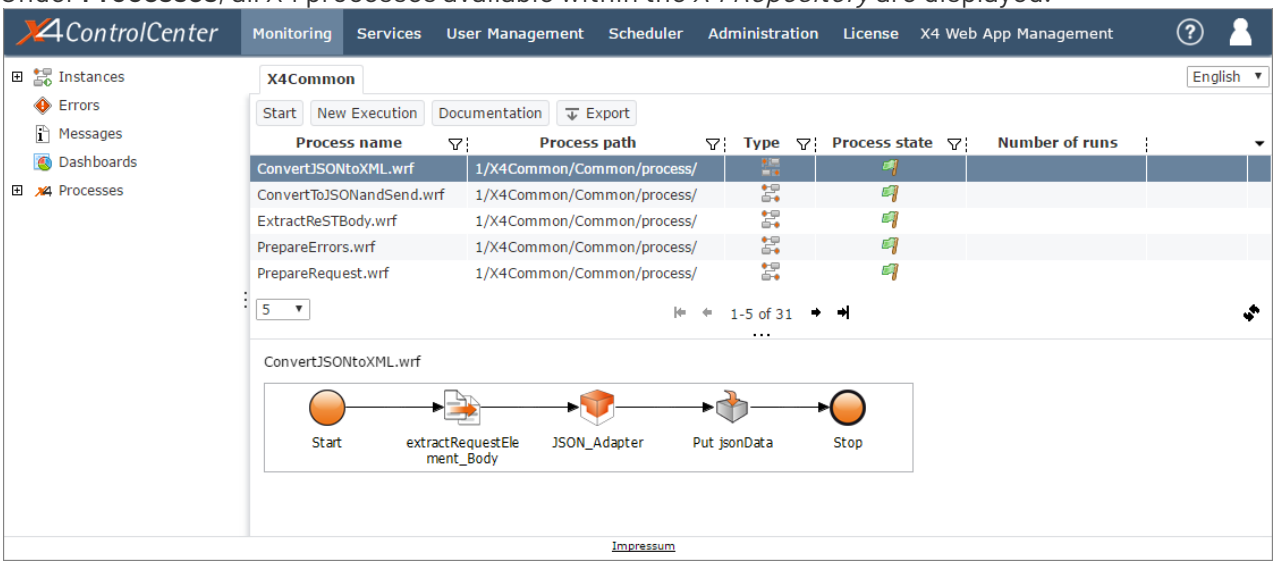
The **Dashboards** view displays different statistics for the executed X4 processes. Thereby, it can be specified whether the process executions of the last 24 hours, the last 7 days or the last month are to be displayed.The following dashboards are provided within the interface:

- **Executed Processes**: All executed processes
- **Failed Processes**: All failed processes
- **State Distribution**: Executed processes based on the state
- **Top 5 CPU Usage**: Top 5 of the processes with the highest CPU usage



5.3.3.4 Process View

Under **Processes**, all X4 processes available within the *X4 Repository* are displayed.



List

In the main view, all processes available within the selected navigator folder are displayed in a table. To each process additional information such as the path, status and the number of already executed process instances are displayed.

The action bar above the list provides different actions which can be executed:

- **Start**: start the execution of the selected process

- **New Execution**: define new scheduled execution for the selected process, see also Scheduled Process Execution.
  The process path will be set automatically
- Documentation: generate process documentation and open it in the browser
- **Export**: export the list of processes as CSV file

> If you add new X4 processes to the *X4 Repository* at the same time, they will be displayed only after reloading the application. Therefore you can use the reload/refresh function of your browser.

Instance View

By double-clicking an entry in the process list, you can change to the instance view.

> To finish the instance view, click on *X4 Control Center* in the breadcrumb.

5.3.3.5 Available Protocols within the Monitoring Interface

The *Monitoring* interface provides different technical and professional information for the executed processes.

Technical Log

The technical log shows the status of the process components during the process instance's execution. Similar to the debug mode of the *X4 Designer*, occurring errors are marked in red.

To open the technical log, double-click a process within the **Process** list, select a process instance in the list and click on **Logs** > **Technical log** within the detail view.

Data Log

The Data Log allows process developers to store process data for control purposes. For this purpose, the X4 BAM Logging adapter is used. Alternatively, it can also be defined a logging action on a transition line using the property `BAM Logging`.

> The length of the messages stored via `Log Message` may not exceed 2000 characters!

For the operation `Log Message`, you can also set the parameter `key` within the *X4 BAM Logging*adapter in order to assign logged values to a specific custom keyword. Subsequent analyzes of the *BAM*databases can be then performed based on these keywords.

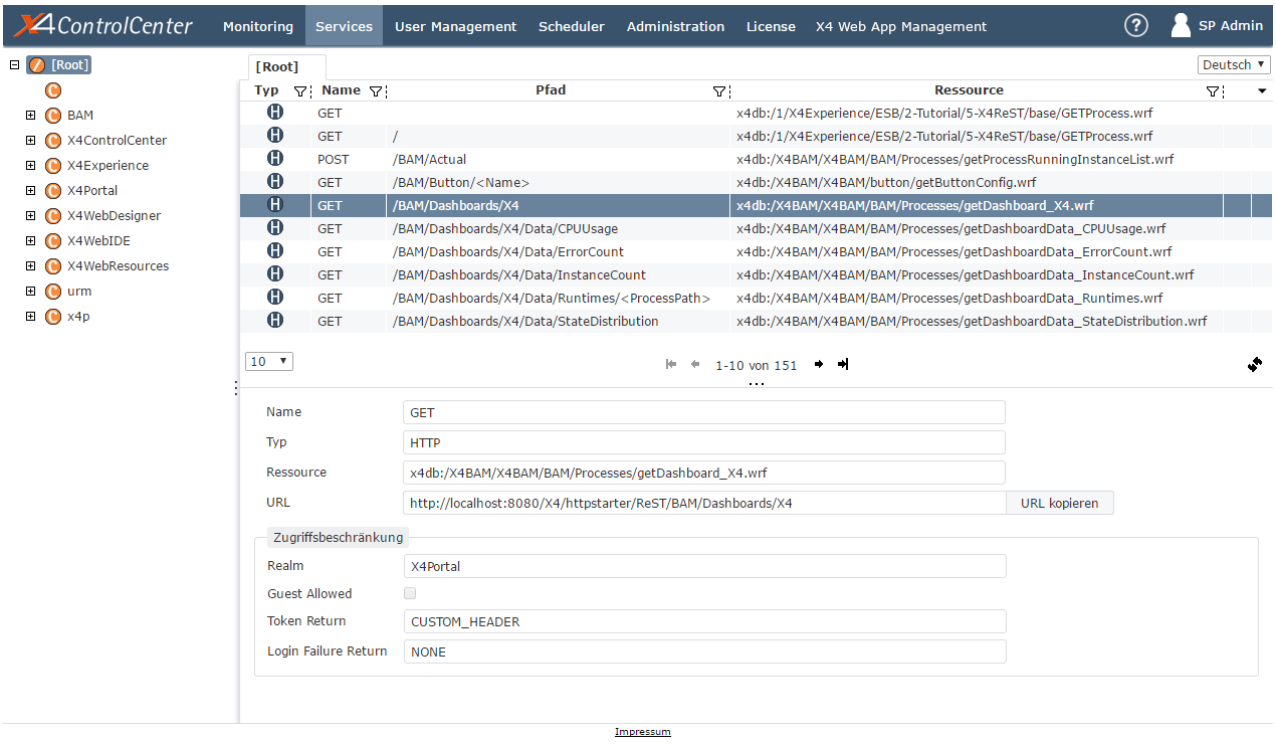
To access the *Data Log*, double-click a process within the **Process** list, select a process instance in the list and click on **Logs** > **Data log** within the detail view.

5.3.4 Services

Within the Services interface, all web services provided by X4 Server are displayed in an overview. It is thereby distinguished between SOAP, ReSTful and file services.

The main functions of the *Services* interface are:

- Overview of the provided web services
- Determining and copying the endpoints (URL) of services
- Retrieving WSDL files from SOAP services
- Retrieving WADL files from restful services
- Displaying processes implementing the services



5.3.5 User Management

The *User Management* allows users, groups, roles and rights to be defined and managed for an application. Roles and rights can not only be defined for the *User Management* itself, but also for the *Monitoring* interface.
The main functions of the *User Management* are:

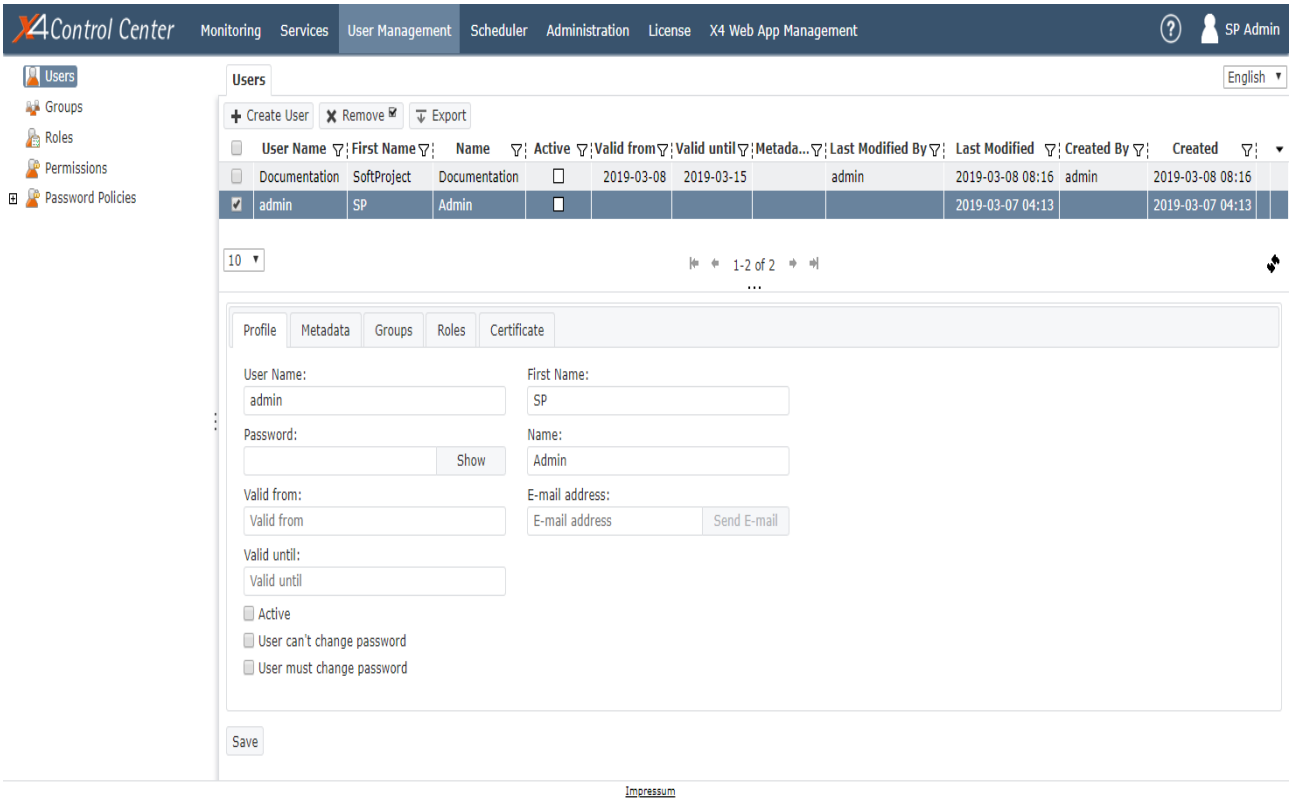
- Manage users, groups, roles and rights
- Manage users in groups
- Manage rights in roles
- Application-specific roles and rights

Please note the following restrictions:

- Hierarchical/nested groups are not possible
- Rights can't be defined subtractively ("must not")
- In case of very granular permission definitions (1000 elements ore more), the system becomes unperformant since XML documents are processed
- Do not create more than 1000 data records

5.3.5.1 User Management

Within the User Management all users defined for the application are displayed. To each user, additional information such as the user name is shown.
By selecting a user in the lister view, user-specific information is shown in the detail view. Administrators with role `X4 User Management Administrator` can edit the a selected user 's information in the detail view or by double-clicking a user in the lister.



Using the integrated filter function you can search for specific users. For example, click on



within the field **User Name** to open the filter and to enter the search term. Start the search with **Apply**.
Columns already containing filters, are marked with



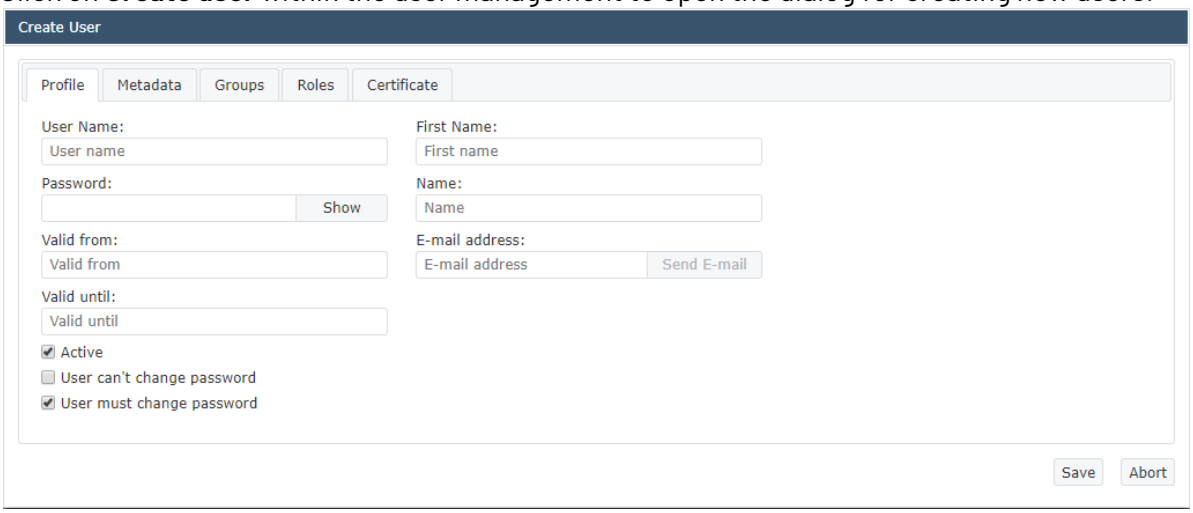
. Moreover, set filters are shown as mouse-over effect.

⚠ Performance issues may occur in case of numerous groups/roles/permissions. Thus please consider in your permission concept to define only those groups/roles/permissions that are actually business-relevant.

Creating New Users

As user with corresponding rights, you can create users and assign them different groups and roles at any time.

1. Click on **Create user** within the user management to open the dialog for creating new users.



2. Enter required user information within the tab **Profile:**
   - In **User Name**, enter the user account name.
   - In **Password**, enter the password.
   - In **First Name**, enter the user's first name (optional).
   - In **Name**, enter the user's name (optional).
   - In **E-mail address** the user's email address.

     ✓ Button **Send E-mail** allows you to directly send an email to the corresponding user.

   - If required, restrict the validity of the user account with **Valid from** and **Valid until**.
   - Specify whether the user should be activated or not by enabling or disabling the checkbox **Active.**

     ⓘ Not activated users are not able to log in to the corresponding application.

   - Specify whether the user has the rights to change his password by enabling or disabling the checkbox **User can't change password**.
   - Specify whether the user must change his password when logging in for the first time by enabling the checkbox **User must change password**.
3. Enter further information:
   - User metadata in tab **Metadata.**
   - Group assignments in tab **Groups**.

- Role assignments in tab **Roles**.

  > Roles of a group will be passed on to the user automatically.

- If required, upload a certificate or generate a self signed certificate in tab **Certificate**, see below.

4. Click **Save** to save the user information.

Activating or deactivating users

As long as users are deactivated, no communication is possible with them and they cannot log on. To activate an inactive or deactivated user (or vice versa), proceed as follows:

1. Select the desired user in the user list.
2. Open the **Profile** tab in the detail view.
3. Check the option **Active** to activate the user, respectively uncheck the option **Active** to deactivate the user.
4. Click **Save.**
   The user has now been activated, respectively deactivated.

Assigning groups to a user

To assign one or several groups to a user, proceed as follows:

1. Select the desired user in the user list.
2. Open the **Group** tab in the detail view.
3. Select the desired group(s) from the available groups and add them via **Assign.**
   The roles of a group are automatically inherited by the user.

   - The option **Assign all** allows to add all available groups at once and **Remove all** to remove all assigned groups at once.
   - Already assigned groups can be removed with **Remove.**

4. If necessary, assign additional roles to the user within the tab **Roles.** Select the desired role(s) from the available roles and add them via **Assign.**

   - The option **Assign all** allows to add all available roles at once and **Remove all** to remove all assigned roles at once.
   - Already assigned roles can be removed with **Remove.**

5. Click **Save** to take over the settings.

Assigning roles to a user

To assign one or several roles to a user, proceed as follows:

1. Select the desired user in the user list.
2. Open the **Roles** tab in the detail view.
3. Select the desired role(s) from the available roles and add them via **Assign.**

- The option **Assign all** allows to add all available roles at once and **Remove all** to remove all assigned roles at once.
- Already assigned roles can be removed with **Remove.**

4. Click **Save** to take over the settings.

Removing Users

As user with corresponding rights, you can remove already created users at any time.

1. Select the desired user in the main view.

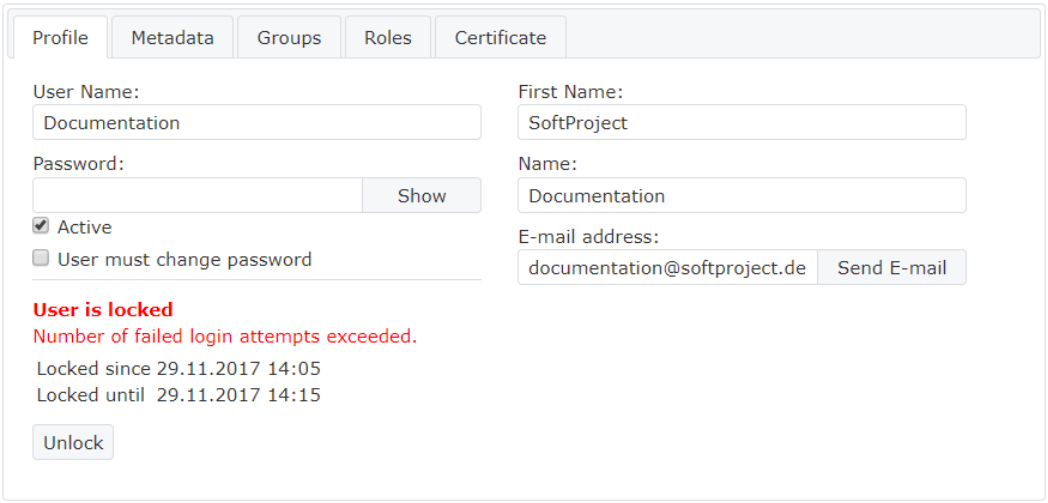
   You can delete multiple users at once by selecting them via the corresponding checkboxes.

2. Click **Remove** and confirm with **Yes**.
   The user has now been deleted

Unlocking Users

If a user account has been locked, e. g. by entering the wrong password repeatedly, you can also unlock users.

1. Select the locked user in the lister to display its user information.



2. Enter a new password and activate the checkbox **User must change password**, to enable the user to change its password when logging in for the next time.
3. Click **Unlock** to unlock the user account.
4. Click **Save** to save the new user information.
   The user has been unlocked and is now able to log in again.

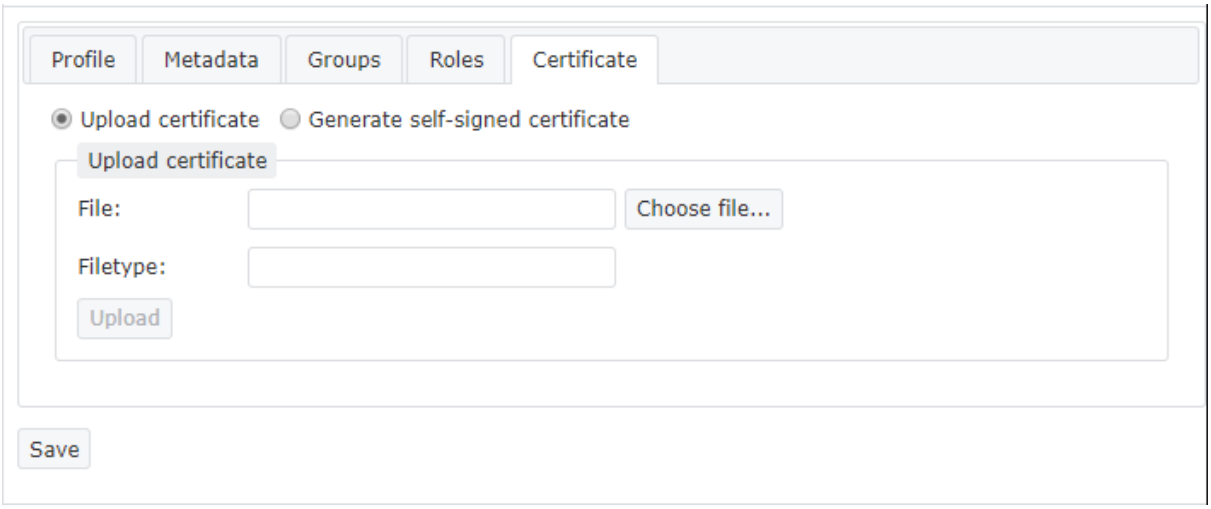
Exporting User List

The list of available users can be exported as CSV file, if required. To do this, click on **Export** within the action bar.

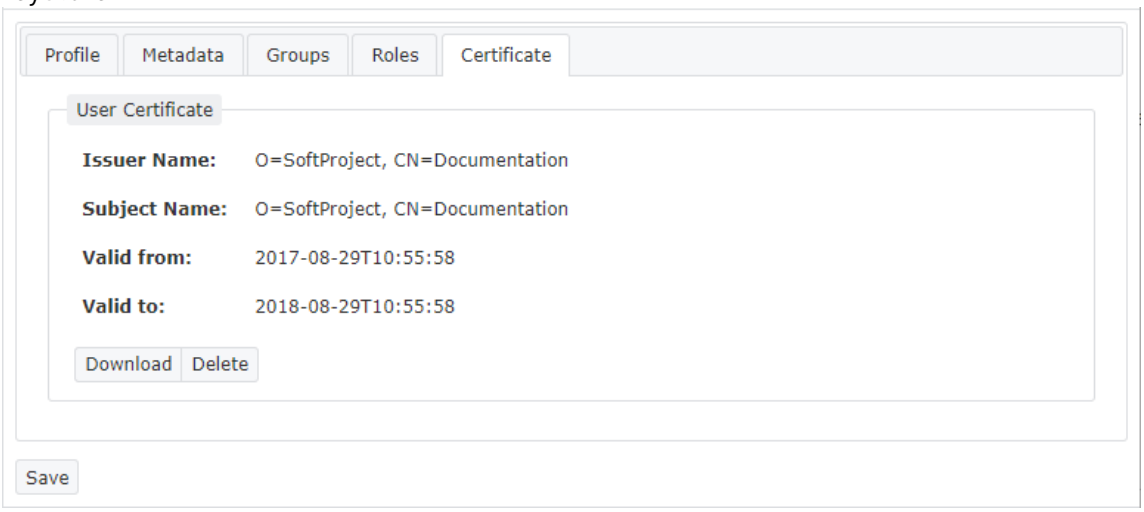
Uploading Certificates

X.509 certificates (`.crt`) can be uploaded both when creating new users and when editing already existing users.

1. Select the user from the lister.
2. Open tab **Certificate**.



3. Select option **Upload Certificate**.
4. Click **Choose file** to select the desired certificate file in `.crt` format.
   File name and file type will be filled automatically.
5. Click **Upload** to add the certificate.
   The certificate information are now displayed and the certificate is automatically saved to the keystore.



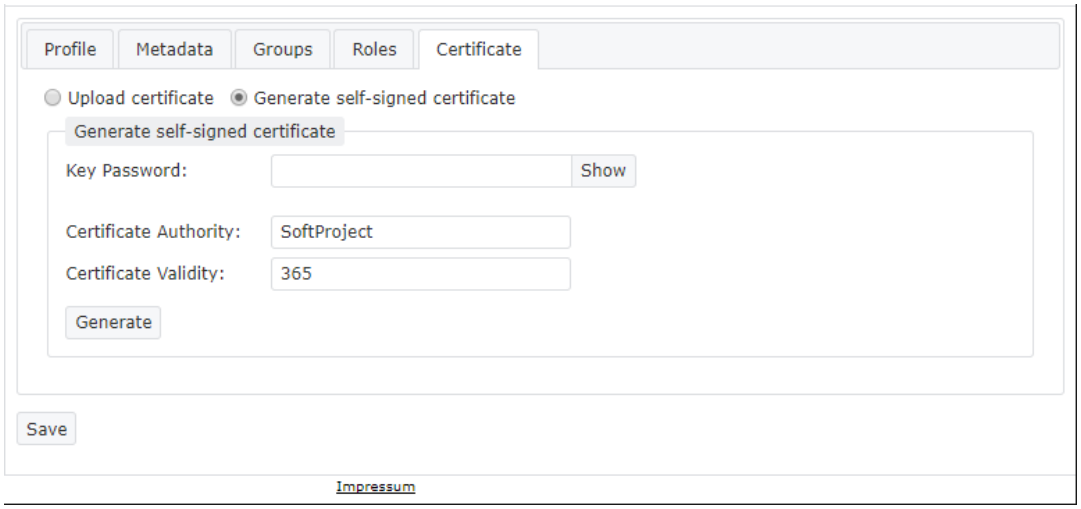
6. Click **Save** to save changes.

Generating Self Signed Certificates

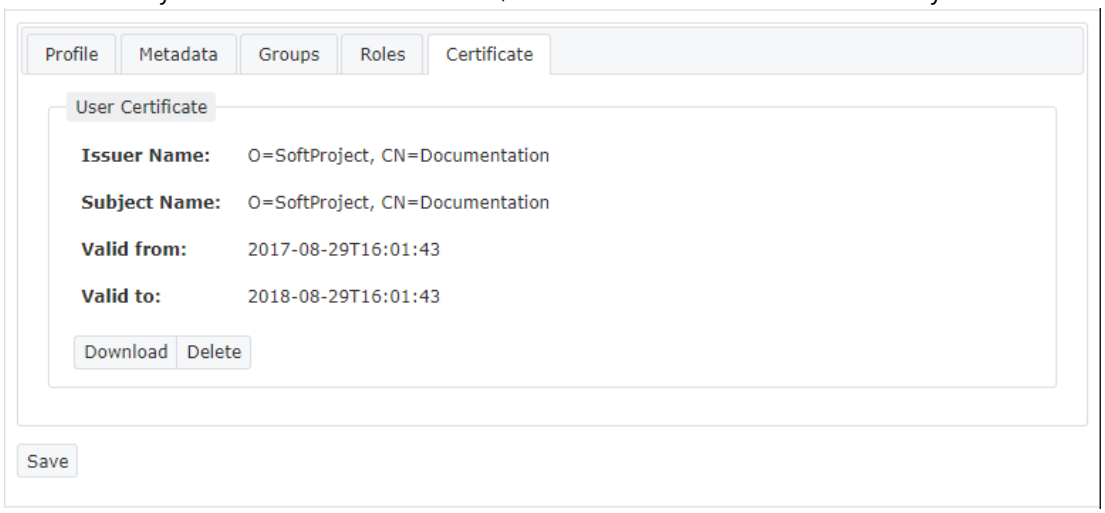
Self signed certificates can be generated both when creating new users and when editing already existing users.

Both a so-called private key (`.p12`) and an X.509 certificate (`.crt`) are generated. While the private key must be saved by the user, the X.509 certificate is automatically stored in the keystore after being created.

1. Select the user from the lister.
2. Open tab **Certificate**.



3. Select option **Generate self-signed certificate**.
4. Enter a **Key password** as private key.
5. Enter the certificate issuer in **Certificate Authority**.
6. Enter a differing **Certificate validity**, if required.
7. Click **Generate** to create the private key (`.p12`) and the X.509 certificate.
   The certificate information is now displayed and the download of the private key is automatically started. At the same time, the certificate is stored to the keystore.

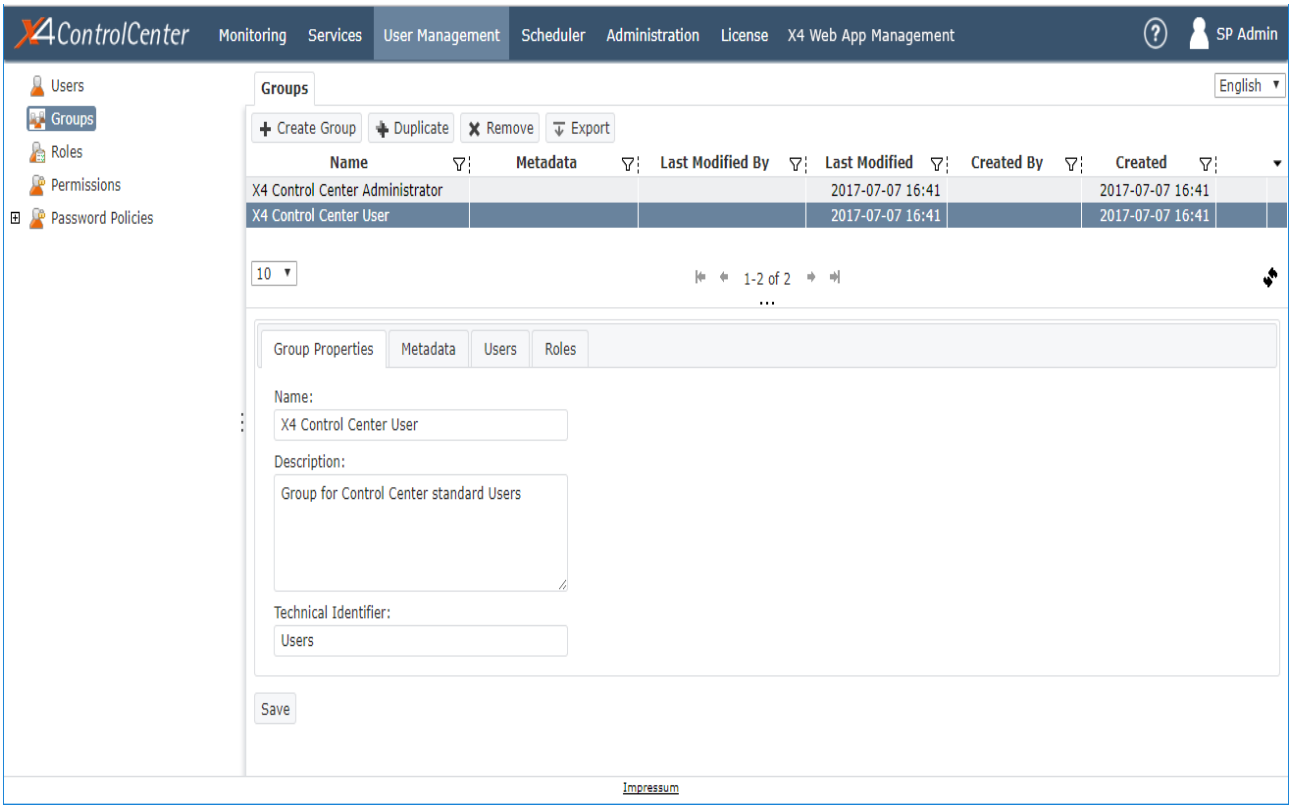


> Make sure you save the private key to a suitable position, since it is only generated once.

8. If required, click **Download** to also download the corresponding X.509 certificate.
9. Click **Save** to save the changes.

5.3.5.2 Group Management

Within the group management all groups defined for the application are displayed. To each group, additional information such as the group name is shown.
By selecting a user from the lister, its information are displayed in the detail view. Users with corresponding rights can also create new groups, duplicate selected groups or delete selected groups.



Using the integrated filter function, you can search for specific groups. For example, click on



within the field **Name** to open the filter and to enter the search term. Start searching with **Apply**. Columns already containing filters, are marked with



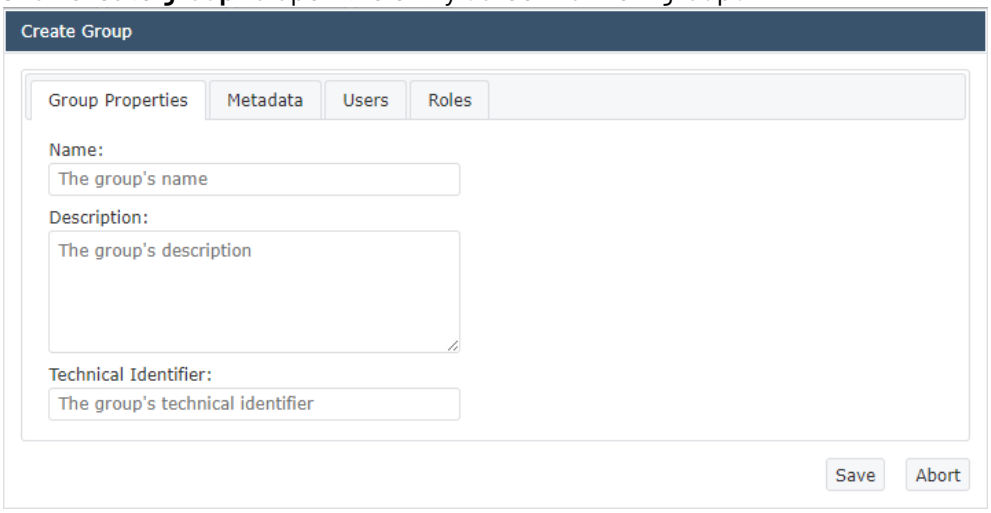
. Moreover, set filters are shown as mouse-over effect.

Performance issues may occur in case of numerous groups/roles/permissions. Thus please consider in your permission concept to define only those groups/roles/permissions that are actually business-relevant.

Creating New Groups

As an administrator with corresponding permissions, you can create groups and assign them different roles.

1. Click **Create group** to open the entry screen for new groups.



2. Enter the required group information within the tab **Group Properties**:
   - In **Name**, enter the group name.
   - In **Description**, enter a description for the group.
   - In **Technical identifier**, enter a shortcut for the group.
3. Enter required metadata information within tab **Metadata**.
4. Assign the desired users to the group within tab **Users**. To do this, select the user(s) from the list of available users and click **Assign.**

   - A filter allows to search for certain users, which can then be added to the group
   - You can assign all available users with **Assign all** or remove them all with **Remove all**
   - Already assigned users can be removed with **Remove**

5. Assign application-specific roles to the group within the tab **Roles**. To do this, select the required role(s) from the list of available roles and click **Assign**.

   Roles of a group will be passed on to the user automatically.

   - Limit the display of available roles by using the **Application** drop-down list.
   - A filter allows to search for certain roles, which can then be added to the group.
   - You can assign all available roles with **Assign all** or remove them all with **Remove all.**
   - Already assigned roles can be removed with **Remove.**

6. Click **Save** to apply the settings.

Duplicating Groups

Using the **Duplicate** option, you can duplicate already configured groups. This is useful when similar groups are needed, for example if groups only differ with respect to additional roles.

1. Select the group and click **Duplicate**.

> The roles of the duplicated group will be taken over automatically.

2. Enter the required group properties within tab **Group Properties**.
3. Enter requited metadata information within **Metadata**.
4. If required, assign additional users to the group within tab **Users**.
5. If required, assign additional roles to the group within tab **Roles**.
6. Click **Save** to apply settings.

Removing Groups

As an administrator with corresponding permissions, you can remove already created groups at any time.

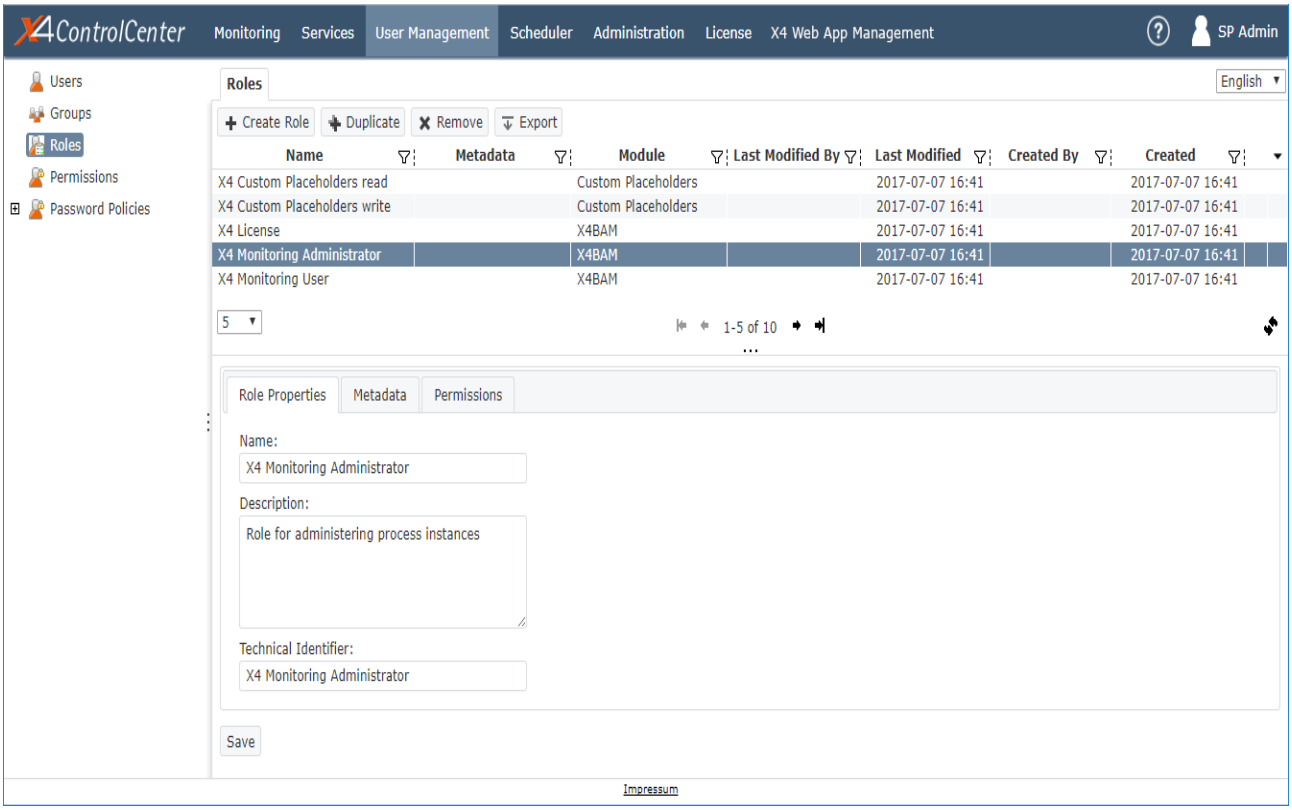
1. Select the desired group in the main view.
2. Click **Remove** and confirm with **Yes**.
   The group has now been deleted.

Exporting Group List

The list of available groups can be exported as CSV file, if required. To do this, click on **Export** within the action bar.

5.3.5.3 Role Management

Within the role management all roles defined for the application are displayed. To each role, additional information such as the role name is shown. Administrators with corresponding permission can also create new roles, duplicate roles or delete already existing ones.
By selecting a role in the lister, role-specific information is shown in the detail view. You can access selected roles in the detail view or by double-clicking it from the lister.



Using the integrated filter function, you can search for specific roles. For example, click on



within the field **Name** to open the filter and to enter the search term. Start the search with **Apply**. Columns already containing filters, are marked with



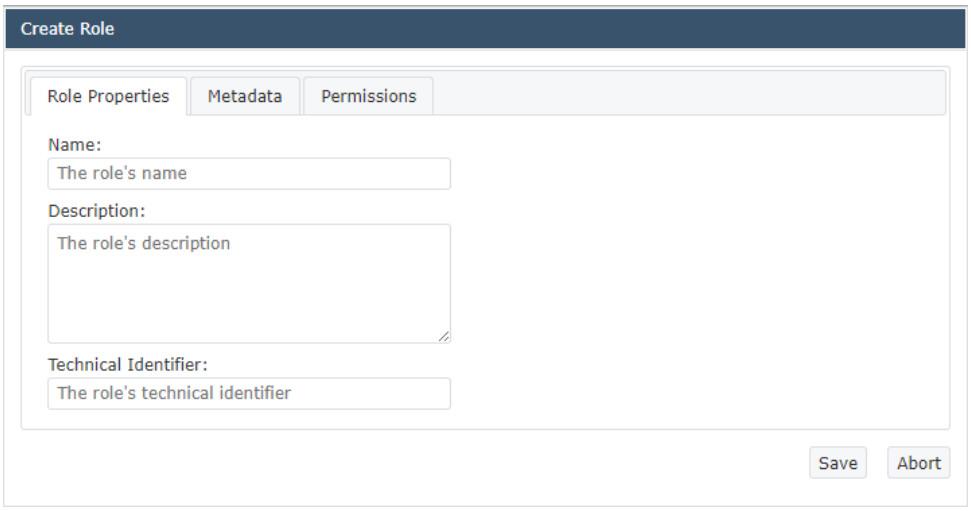
. Moreover, set filters are shown as mouse-over effect.

Performance issues may occur in case of numerous groups/roles/permissions. Thus please consider in your permission concept to define only those groups/roles/permissions that are actually business-relevant.

Creating New Roles

As user with corresponding permissions, you can create roles and assign them different users or groups at any time.

1. Click **Create role** within the role management to open the entry screen for new roles.



2. Enter the required information within tab **Role Properties**:
   a. In **Name**, enter a role name.
   b. In **Description**, enter a description for the role.
   c. In **Technical identifier**, enter a role ID.
3. Enter required metadata information within tab **Metadata**.
4. Define the application for which the role is to be created and assign the required permissions in tab **Permissions**:

   > Roles are always limited to one module respectively one application. Since permissions are also associated with a module, a role can only be assigned permissions of the same module. The permission's module must therefore correspond to the role's module.

   - Select the application for which the role should be created from the list.
   - Assign one or several permissions to the role. To do this, select the permission(s) from the list of available permissions and click **Assign**.

     - A filter allows to search for certain permissions, which can then be added to the role.
     - You can assign all available permissions with **Assign all** or remove them all with **Remove all.**
     - Already assigned permissions can be removed with **Remove.**
5. Click **Save** to apply the settings.

Duplicating Roles

Using the option **Duplicate,** you can duplicate already available roles. This feature is especially useful when similar roles are needed, for example if they only differ with respect to additional permissions.

1. Select the desired role within the role management a click **Duplicate**.

   > The permissions of the duplicated role will be taken over automatically.
2. Enter the required role properties within tab **Role Properties**.

3. Enter requited metadata information within tab **Metadata**.
4. If required, assign additional permissions to the role within tab **Permissions.**
5. Click **Save** to create the duplicated role.

Deleting Roles

As user with corresponding permissions, you can delete already available roles at any time.

1. Select the desired role in the main view.
2. Click **Remove** and confirm with **Yes**.
   The role has now been deleted.

Exporting Role List

The list of available roles can be exported as CSV file, if required. To do this, click on **Export** within the action bar.

User Management Roles

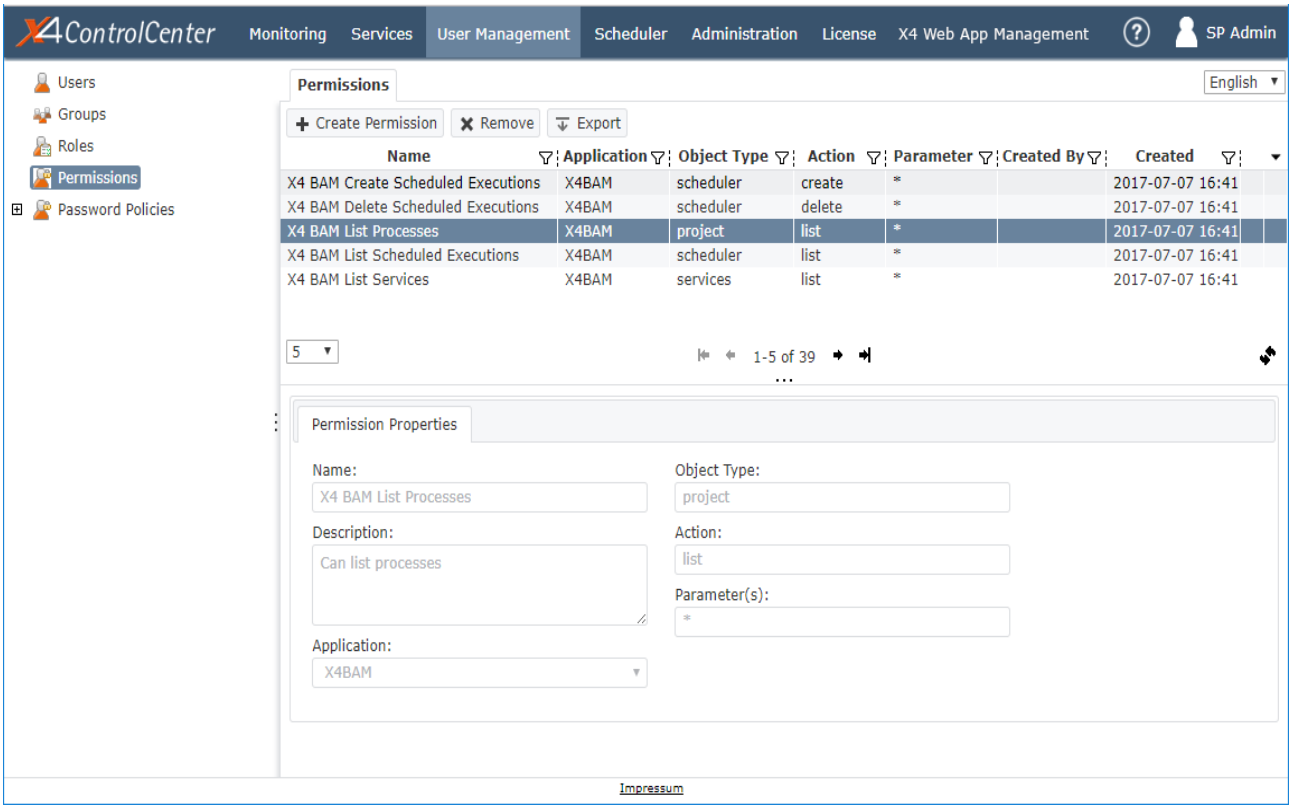
The *User Management* component provides the following application-specific roles, which can be assigned to users:

Application	Role	Description
User Management (URM)	`X4 User Management User`	• Viewing users • Viewing groups • Viewing roles • Viewing permissions • Viewing password policies
	`X4 User Management Administrator`	• Creating, editing and removing users • Creating, editing and removing groups • Creating, editing and removing roles • Creating, editing and removing permissions • Editing password policies
Monitoring (X4BAM)	`X4 Monitoring Administrator`	• Starting processes • Restarting/resuming processes from a save point • Stopping processes • all rights of the `X4 Monitoring User`
	`X4 Monitoring User`	• Viewing the number of run processes • Viewing single instances of a process • Viewing the technical log of a process instance • Viewing available clients

	X4 Scheduler User	Scheduled process executions
	X4 Scheduler Administrator	• Creating new scheduled process executions • Editing scheduled process executions • Deleting scheduled process executions • Reload configuration
	X4 Services User	Viewing services
	X4 Services Administrator	Managing services
	X4 JMX Administrator	Accessing JMX administration within the Administration interface
Custom Placeholders	X4 Custom Placeholders write	Editing custom placeholders
	X4 Custom Placeholders read	Viewing custom placeholders

5.3.5.4 Permission Management

Within the permission management all permissions for applications are displayed. To each permission, additional information such as the permission name or the corresponding application is shown.
By selecting a permission in the main view, permission-specific information is shown in the detail view. Administrators with corresponding permission can also create new permissions or delete already existing permissions.



Using the integrated filter function, you can search for specific permissions. For example, click on

within the field **Name** to open the filter and to enter the search term. Start the search with **Apply**. Columns already containing filters, are marked with

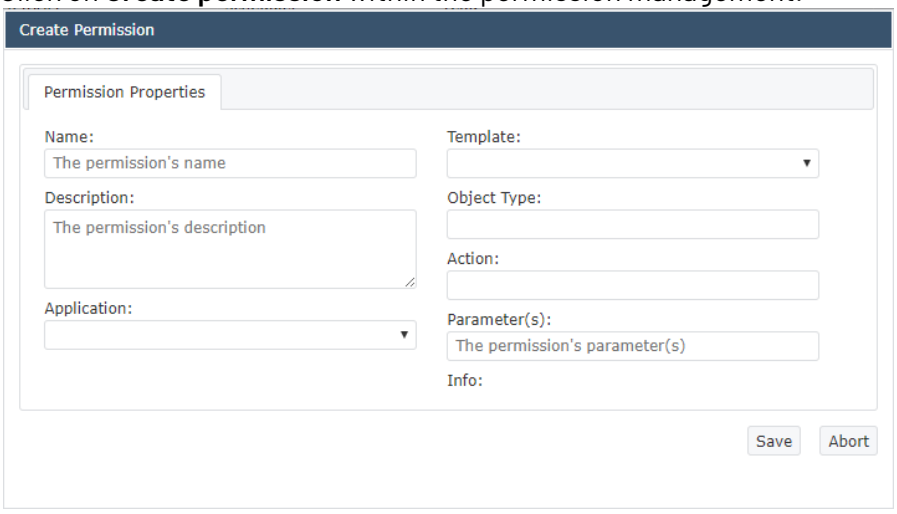
. Moreover, set filters are shown as mouse-over effect.

Performance issues may occur in case of numerous groups/roles/permissions. Thus please consider in your permission concept to define only those groups/roles/permissions that are actually business-relevant.

Creating New Permissions

Administrators with corresponding permissions can create permissions and assign them to different roles.

1. Click on **Create permission** within the permission management.



2. Enter the required information within the **Permission properties**:
   - In **Name**, enter the permission name.
   - In **Description**, enter a description for the permission.
   - Select the application for which the permission is intended from drop-down list **Application**.

   Permissions are always limited to one module respectively one application. To a permission a module, an object type, an action and a parameter must be assigned:
   - The object type describes the objects affected by the permission.
   - The action describes the allowed operation for these objects.
   - The parameter allows a limitation of the permission. This limitation may consist of the specification of object IDs to which the action can be applied.

- Select a suitable template for the specified application within **Template.**
  The **object type** and **action** will be filled automatically, depending on the selected template.
- Enter permission Parameter(s).

3. Click **Save** to apply the settings.

> After creating the permission, you can delete it, but it is no longer possible to edit the permission.

Deleting Permissions

As administration with corresponding permissions, you can delete permissions.

1. Select the desired permission in the main view.
2. Click **Remove** and confirm with **Yes**.
   The role has now been deleted.

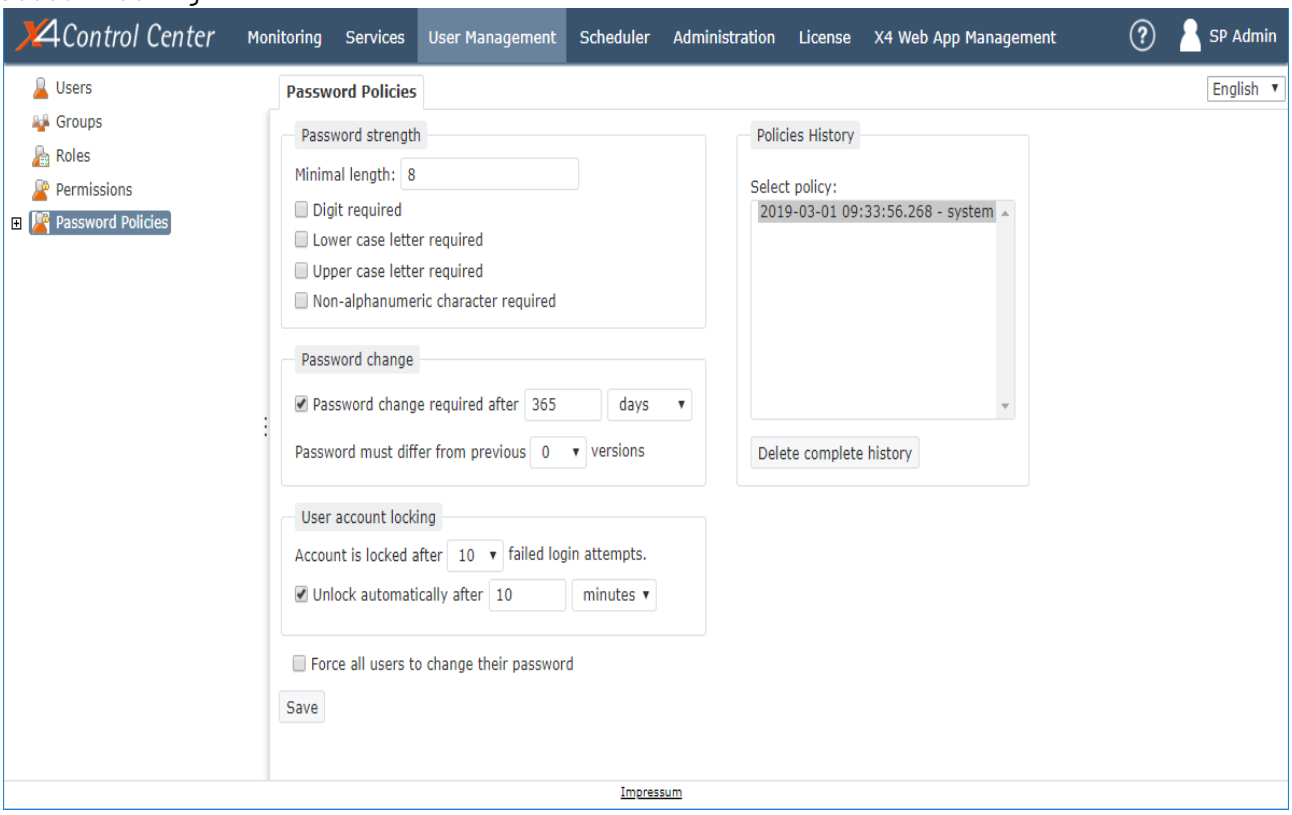
Exporting Permission List

The list of available permissions can be exported as CSV file, if required, by clicking **Export** within the action bar.

5.3.5.5 Password policies

Within the **Password Policies**, administrators can define password policies, including guidelines for password length and allowed characters, time intervals for the password change, and rules for

account locking.



Defining New Password Policies

Administrators with corresponding permissions can define password policies for all users.

> The **Policies History** allows you to see policy changes and to apply older password policies, if required.

1. Open **Password Policies** within the *User Management*.
2. Define the password length and the allowed characters under **Password strength**:
   - **Minimal length:** the password's minimal length as number
   - **Number character required:** The password must contain numbers.
   - **Lower case letter required:** The password must contain lowercase letters.
   - **Upper case letter required:** The password must contain uppercase letters.
   - **Non-alphanumeric character required:** The password must contain special characters.
3. Specify **Password change** policies:
   - Define whether and after how many days/hours/minutes/seconds a password change is required.
   - Select the number of previous passwords that must differ from the new password.
4. Specify **User account** policies:
   - Select the number of failed login attempts until the account will be locked.
   - Define whether and after how many days/hours/minutes/seconds users will be unlocked automatically.
5. Select if users should be forced to change their password.
   If this option has been activated, users must define a new password after the next login to the corresponding application.

6. Click **Save** to apply the settings.

> You can test the current policies for the validation of passwords by entering the password to be validated under **Password Policies > Password Validation Test**.

5.3.6 Scheduler

The Scheduler interface gives an overview of all processes for which a time-controlled execution has been defined. Moreover, it allows to configure new schedules or to edit and delete already existing schedules.When defining schedules, it can be distinguished between the following execution options:

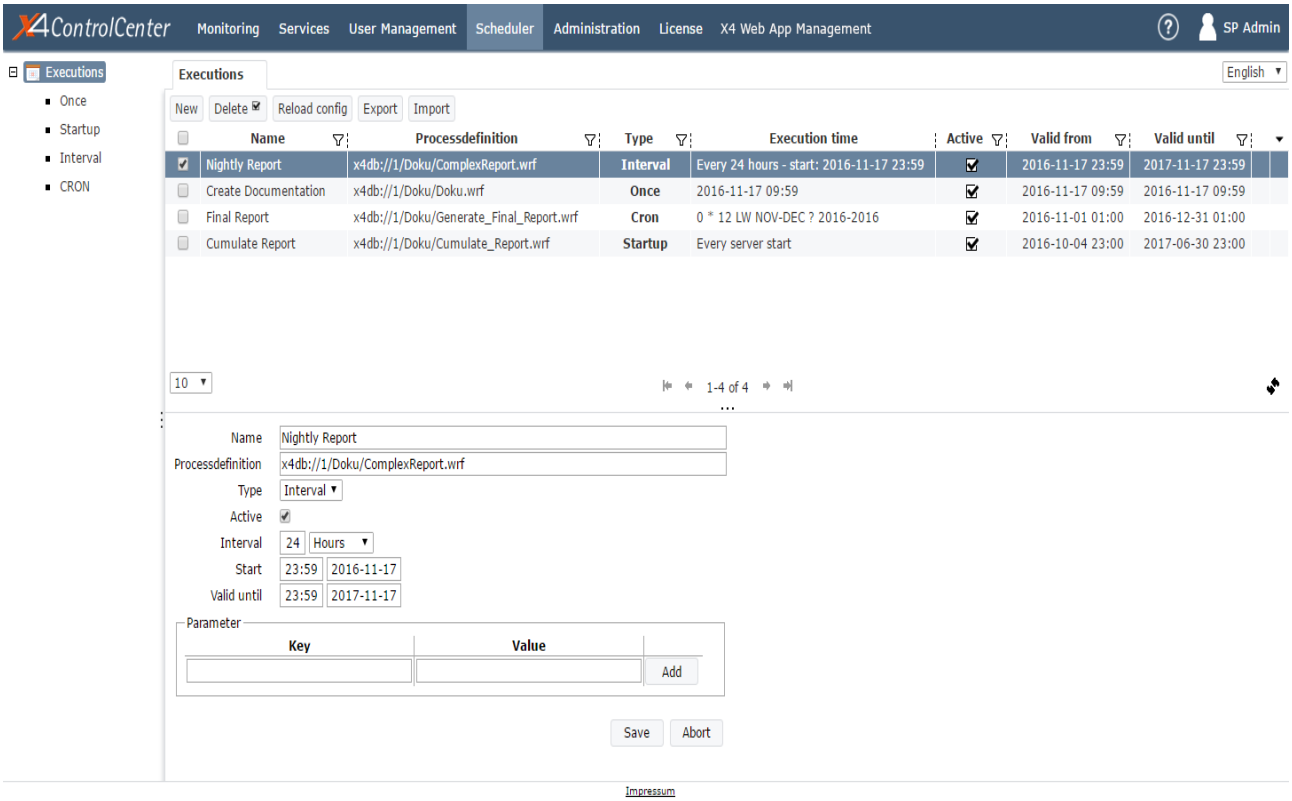
- **Once**: Unique execution of a process
- **Startup**: Process execution at server startup
- **Interval**: Process execution at specified intervals
- **CRON**: Process execution based on CRON patterns

The main *Scheduler* functions are:

- Overview of the consisting schedules
- Creating/editing any number of execution points and intervals per process (schedule patterns, repetitions and parameters)
- Different execution options: once, startup, interval, CRON

5.3.6.1 Scheduler Functions

The *Scheduler* component provides several functions accessible via the action bar.



- **New**: create a new execution configuration

  Please note: New and adjusted execution configurations will be created on the server with **Reload config** or after a server restart.

- **Delete**: delete a selected execution configuration

  Caution: The selected execution configuration will be deleted immediately after clicking **Delete.**
  This action can't be undone!

- **Reload config**: Reload and provide execution configuration after editing
- **Export**: Export execution configuration as XML file
- **Import**: Import execution configuration with a certain XML structure

Execution configurations can be edited and changed in the detail view. The available options depend on the particular execution type.

Input XML Structure for Processes

An X4 process started via the Scheduler has an input document with the following XML structure:

```
<Schedule jobId="Job-ID" jobName="Job name"
          executionId="Execution configuration ID"
          executionName="Execution configuration name">
    <Parameters>
        <Parameter name="Parameter name 1">Parameter value 1</Parameter>
        <Parameter name="Parameter name n">Parameter value n</Parameter>
    </Parameters>
</Schedule>
```

5.3.6.2 Scheduled Process Execution

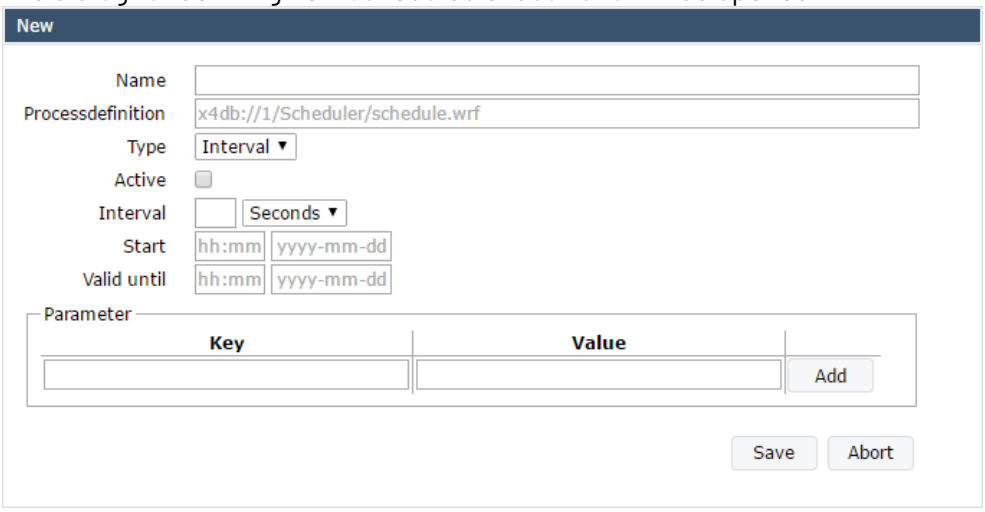
For the scheduled execution of X4 processes, the following four options can be distinguished:

- Unique process execution
- Process execution at server startup
- Process execution at specified intervals
- Process execution based on CRON patterns

Define a new Scheduled Process Execution

Ta define a scheduled process execution, proceed as follows:

1. Click **New** within the **Scheduler** interface.
   The dialog for defining new scheduled executions will be opened.



2. Enter the execution's **Name**.
3. Make the desired configuration.

   For the different configuration possibilities of the single execution types, see:

4. Click **Save** to save the scheduled execution.

Once

With the menu item **Once** you get an overview of all processes for which a unique execution has been defined using the *Scheduler.*Execution configurations selected in the overview, can be edited or changed at any time.

Please note: New and adjusted execution configurations will be created on the server with **Reload config** or after a server restart.

Configuring Unique Executions

New configurations for unique executions can be created using the **New** button. Thereby, various options and parameters are available. These are explained in the following.

Options

Name	Arbitrary name for the execution
Process definition	Absolute path to the process within the `X4DB` *Example*: `x4db://1/Project/Prozess.wrf`

Type	Execution type The following execution types are available: • *Once*: Unique process execution • *Startup:* Process execution at server startup • *Interval:* Process execution at specified intervals • *CRON:* Process execution based on Cron patterns
Active	Enable execution **Possible values:** • `true`: Execution has been enabled • `false`: Execution has been disabled
Start	Starting time of the execution in the format `hh:mm tt-mm-jjjj` *Example:* `10:00 07-10-2014` The start date must be set to the future.

Parameters

Under **Parameter**, you can define any number of parameters for the execution configuration.

Key	Parameter name (any string, ideally `NCName`)
Value	Optional parameter value
Add	Add new parameter with the defined properties
X	Delete parameter immediately without confirmation ***Caution:*** This action can't be undone!

Startup

With the menu item **Startup** you get an overview of all processes for which an execution at server startup has been defined using the *Scheduler.* Execution configurations selected in the overview, can be edited or changed at any time.

> *Please note*: New and adjusted execution configurations will be created on the server with **Reload config** or after a server restart.

Configuring Startup Execution

New configurations for executions at server startup can be created using the **New** button. Thereby, various options and parameters are available. These are explained in the following.

Options

Name	Arbitrary name for the execution

Process definition	Absolute path to the process within the `X4DB` *Example*: `x4db://1/Project/Prozess.wrf`
Type	Execution type The following execution types are available: • *Once*: Unique process execution • *Startup:* Process execution at server startup • *Interval:* Process execution at specified intervals • *CRON:* Process execution based on Cron patterns
Active	Enable execution **Possible values:** • `true`: Execution has been enabled • `false`: Execution has been disabled
Valid from	Starting time of the execution in the format `hh:mm tt-mm-jjjj` *Example: `10:00 07-10-2014`* The start date must be set to the future.
Valid until	Ending time of the execution in the format `hh:mm tt-mm-jjjj` *Example: `10:00 07-10-2014`* The end date must be set to the future.

Parameters

Under **Parameter**, you can define any number of parameters for the execution configuration.

Key	Parameter name (any string, ideally `NCName`)
Value	Optional parameter value
Add	Add new parameter with the defined properties
X	Delete parameter immediately without confirmation; ***Caution:*** This action can't be undone!

Interval

With the menu item **Interval** you get an overview of all processes for which an execution interval has been defined using the *Scheduler.* Execution configurations selected in the overview, can be edited or changed at any time.

> *Please note*: New and adjusted execution configurations will be created on the server with **Reload config** or after a server restart.

Configuring Execution Intervals

New configurations for executions at a certain interval can be created using the **New** button. Thereby, various options and parameters are available. These are explained in the following.

Options

Name	Arbitrary name for the execution
Process definition	Absolute path to the process within the `X4DB` *Example*: `x4db://1/Project/Prozess.wrf`
Type	Execution type The following execution types are available: • *Once*: Unique process execution • *Startup:* Process execution at server startup • *Interval:* Process execution at specified intervals • *CRON:* Process execution based on Cron patterns
Active	Enable execution **Possible values:** • `true`: Execution has been enabled • `false`: Execution has been disabled
Interval	Execution interval **Possible values:** • `Seconds`: Number of seconds (repeat each n^{th} second) • `Minutes`: Number of minutes (repeat each n^{th} minute) • `Hours`: Number of hours (repeat each n^{th} hour)
Start	Starting time of the execution in the format `hh:mm tt-mm-jjjj` *Example: `10:00 07-10-2014`* The start date must be set to the future.
Valid until	Ending time of the execution in the format `hh:mm tt-mm-jjjj` *Example: `10:00 07-10-2014`* The end date must be set to the future.

Parameters

Under **Parameter**, you can define any number of parameters for the execution configuration.

Key	Parameter name (any string, ideally `NCName`)
Value	Optional parameter value

Add	Add new parameter with the defined properties
	Delete parameter immediately without confirmation ***Caution:*** This action can't be undone!

CRON

Via menu item **CRON** you get access to an overview of all processes for which a Cron execution has been defined using the *Scheduler* component.

You can edit execution schedules at any time by selecting them in the overview.

> New and adjusted execution schedules will be created on the server with **Reload config** or automatically after restarting the server.

Configuring Cron Patterns

New configurations for executions based on a Cron pattern can be created using the **New** button. The following options and parameters are available.

Options

Name	Name for the execution schedule
Process definition	Absolute process path inside the `X4DB` *Example*: `x4db://1/Projekt/Prozess.wrf`
Type	Execution type Available execution types: • *Once*: One-time execution of a process • *Startup:* Process execution on server startup • *Interval:* Process execution based on specific intervals • *Cron:* Process execution based on Cron expressions (see below)
Active	Enable scheduled execution **Possible values:** • `true`: Scheduled execution is enabled • `false`: Scheduled execution is disabled
Start	Start time of the process execution in format `hh:mm tt-mm-jjjj` *Example:* `10:00 07-10-2014` The start date must be set to the future.

End	End time of the process execution in format `hh:mm tt-mm-jjjj` *Example:* `10:00 07-10-2014` The end date must be set to the future.

Cron expression

When choosing execution type Cron, you can define a Cron expression for scheduled process execution.

More information on *Cron* patterns can be found under: http://www.quartz-scheduler.org/documentation/quartz-2.1.x/tutorials/crontrigger.

Second	Second within the minute to execute the process **Possible values:** • `1 … 59`: 1st–59th second within a minute, e.g. *3* for the 3rd second • `*`: each second **Allowed special characters:** • `,`: Specify multiple values, e.g. *`1,5,7`* for the 1st, 5th and 7th second • `-`: Period of time *from...to*, e.g. *`5-7`* • `*`: Each second • `/`: Increment seconds, e.g. *`1/5`* if the process shall be executed every 5 seconds beginning with the 1st second
Minute	Minute within the hour to execute the process **Possible values:** • `1 … 59`: 1st–59th minute within the hour, e.g. *3* for the 3rd minute • `*`: each minute **Allowed special characters:** • `,`: Specify multiple values, e.g. *`1,5,7`* for the 1st, 5th and 7th minute • `-`: Period of time *from...to*, e.g. *`5-7`* • `*`: Each minute • `/`: Increment minutes, e.g. *`1/5`* if the process shall be executed every 5 minutes beginning with the 1st minute

Hour	Hour within the day to execute the process **Possible values:** • `1 … 23`: 1st–23rd hour of the day, e.g. *`3`* for the 3rd hour • `*`: each hour **Allowed special characters:** • `,`: Specify multiple values, e.g. *`1,5,7`* for the 1st, 5th and 7th hour • `-`: Period of time *from...to*, e.g. *`5-7`* • `*`: Each hour • `/`: Increment hours, e.g. *`1/5`* if the process shall be executed every 5 hours beginning with the 1st hour
Day of month	Day within the selected month to execute the process Only editable, if no **Day of week** has been selected. **Possible values:** • `1 … 31`: 1st–31st day of the month, e.g. *`3`* for the 3rd day Values >28 will be ignored, if the actual number of days of the respective month (e.g. February) is smaller than the specified value. • `*`: Each day • `L`: Last day of month • `W`: On working days (Monday–Friday) If the specified day is not a working day, the process will be executed on the next working day. **Allowed special characters:** • `,`: Specify multiple values, e.g. *`1,5,7`* for the 1st, 5th and 7th day of the month • `-`: Period of time *from...to*, e.g. *`1-15`* • `*`: Each day • `/`: Increment days, e.g. *`1/5`* if the process should be executed every 5 days, beginning with the 1st day of the month • `?`: No determined value; This expression is set, if under `Day of week` another value has been set.

Month	Month to execute the process **Possible values:** • `1 … 12`: 1st-12th month, e.g. *3* for March • `JAN … DEC`: Months from January to December • `*`: Each month **Allowed special characters:** • `,`: Specify multiple values, e.g. *`1,5,7`* for January, May and July • `-`: Period of time *from...to*, e.g. *`JAN-JUL`* • `*`: Each month • `/`: Increment months, e.g. *`1/5`* if the process shall be executed every 5 months beginning with the January
Day of week	Day of the week to execute the process Only editable, if no **Day of month** has been selected. **Possible values:** • `1 … 7`: 1st-7th day of week, whereby the counting begins with Sunday, e.g. *3* for Tuesday • `SUN … SAT`: Days from Sunday to Saturday • `*`: Each day of week **Allowed special characters:** • `,`: Specify multiple values, e.g. *`1,5,7`* for *`Sunday, Thursday`* and *`Saturday`* • `-`: Period of time *from...to*, e.g. *`SUN-TUE`* • `L`: The last weekday of the month • `#`: nth day of week within the month, e.g. *`6#3`* for the third Friday of the month It is currently not possible to specify multiple nth weekdays, such as *`6#3,5#2,7L`*.
Year	Year to execute the process **Possible values:** • `1970 … 2099`: Year between 1970 and 2099 • `*`: Each year **Allowed special characters:** • `,`: Specify multiple values, e.g. *`2015, 2016, 2020`* • `-`: Period of time *from...to*, e.g. *`2009-2060`* • `*`: Each year • `/`: Increment years, e.g. *`2015/3`* if the process shall be executed every 3 years beginning 2015

Parameters

In the **Parameter** section, you can define any number of parameters for the execution schedule.

Key	Parameter name (any `NCName` string)
Value	Optional parameter value
Add	Add new parameter with the defined properties
X	Deletes a parameter immediately without confirmation ***Caution:*** This action cannot be reverted!

Example

A process with the execution time `0 * 12 LW MAR-OCT ? 2014-2020`, is defied as follows and has the following properties:

	Cron expression	Property
Second	*0*	0^{th} second
Minute	***	each minute, i. e. from the 1^{st} to the 59^{th}
Hour	*12*	12^{th} hour
Day of month	*LW*	last working day of the month
Month	*MAR-OCT*	from March to October
Day of week	*?*	last working day of the week, see Cron expression **Day of month**
Year	*2014-2020*	between 2014 and 2020

5.3.7 Administration

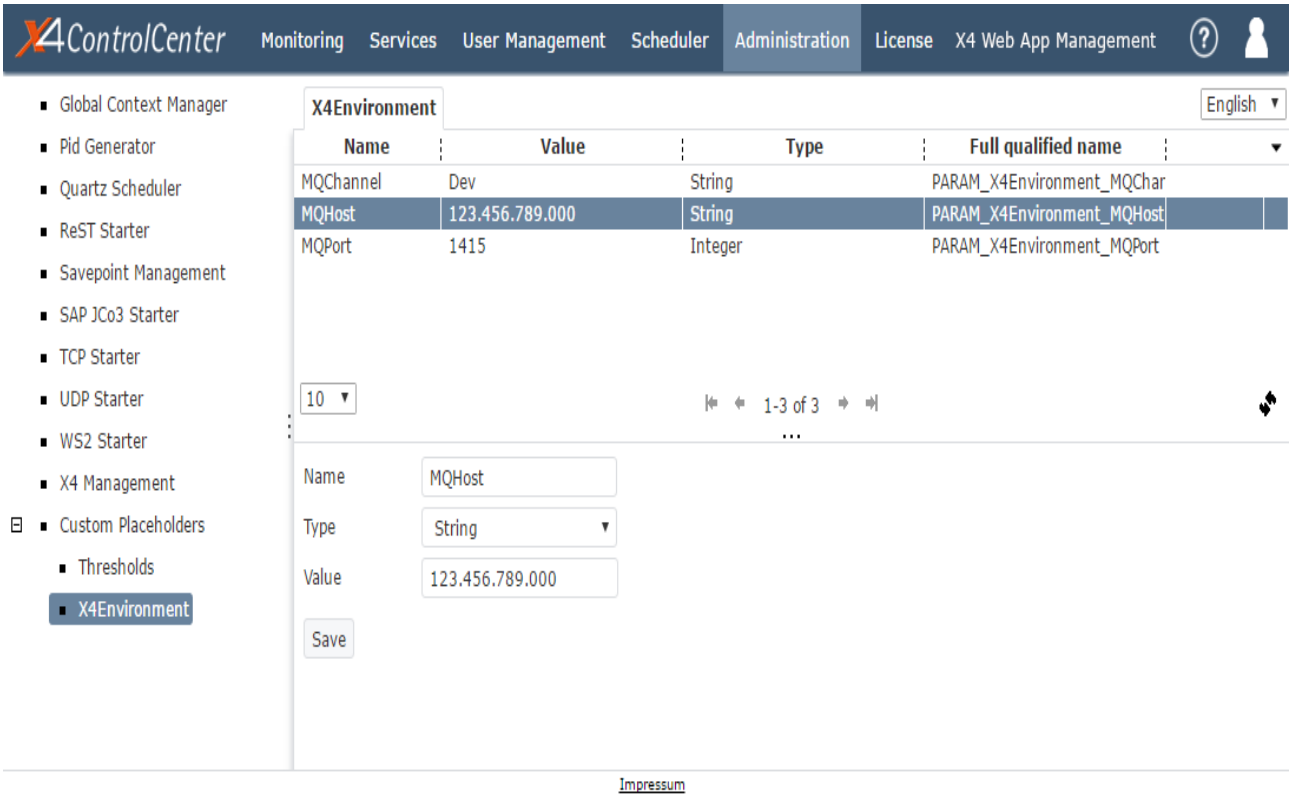
The *Administration* interface allows to access all management functions of the *X4 ESB Server*, which are also available via JMX, using the Web interface of the *X4 Control Center*.

The main functions of the *Administration* interface are:

- Activate and deactivate single services of the server
- Activate and deactivate single or all processes
- Manage process save points
- Reset the X4 ESB Server cache
- View and edit custom parameters

5.3.7.1 Custom Placeholders

Custom placeholders managed within X4 Designer via the Custom Placeholder Storage Editor can be viewed within the *X4 Control Center's* Administration interface, and edited, if required. The node **Custom Placeholders** contains all already available placeholder groups. By selecting a placeholder group, the placeholders within the group will be displayed as list. They can be edited in a detail view, if required.



Default Placeholder Groups

The following placeholder groups are available by default:

Placeholder group	Placeholder name	Possible values	Usage
`X4BAM`	*MonitoringDays*	• `-1`: no time restriction for the display of process executions • `positive integer`: time restriction in days for the display of process executions	Global time filter to limit the displayed process executions within the monitoring interface

Placeholder group	Placeholder name	Possible values	Usage
`UserManagement`	*CertificateAuthority*	`any string`: certificate issuer, e.g. *`SoftProject`*	Specifies the certificate issuer ℹ This information is displayed as certificate metadata after its creation.
	CertificateValidity	`positive integer`: certificate validity in days	Specifies the certificate validity in days ℹ This information is displayed as certificate metadata after its creation.

Editing Custom Placeholders

To edit a custom placeholder, proceed as follows:

1. Select the desired placeholder group within the Navigator node **Custom Placeholders**.
   An overview of the available placeholder within the group will be opened.
2. Select the placeholder to be edited or open it by double-click.
3. Make the required changes:
   - If required, specify with `String`, `Boolean`, `Integer`, `Decimal` or `Date` a new placeholder type
   - If required, enter a new placeholder value
4. Click **Save** to save the changes.
   The changes are now active and considered during process execution.

Assigning Users Permissions for Custom Placeholders

The User Management interface allows to assign permissions for custom placeholders to already available users or to new users. They can be added both reading and writing permissions.

1. Select an already existing user within the user management or create a new user via **Create User**.
2. If required, edit the **User Properties**.
3. If required, assign an additional group to the user in **Groups**.
4. Assign an application-specific role via **Roles**. In this case for `Custom Placeholders`.

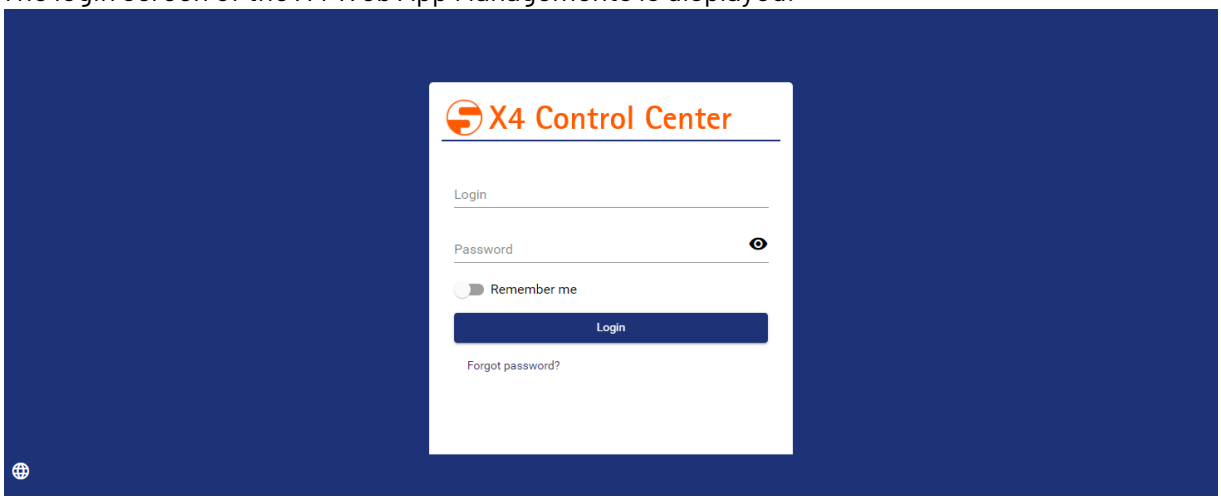
   ✓ If you select `Custom Placeholders` within **Application**, only roles of this application will be displayed.

5. Select the desires role(s) from the list of available roles and add them via **Assign**.
   The following roles are already defined for custom placeholders by default:
   - `X4 Custom Placeholders Read Data`: Only read data for custom placeholders.
   - `X4 Custom Placeholders Write Data`: Read and edit data for custom placeholders.
6. Click **Save** to save the user information.

5.3.8 X4 Web App Management

5.3.8.1 Logging in to X4 Web App Management

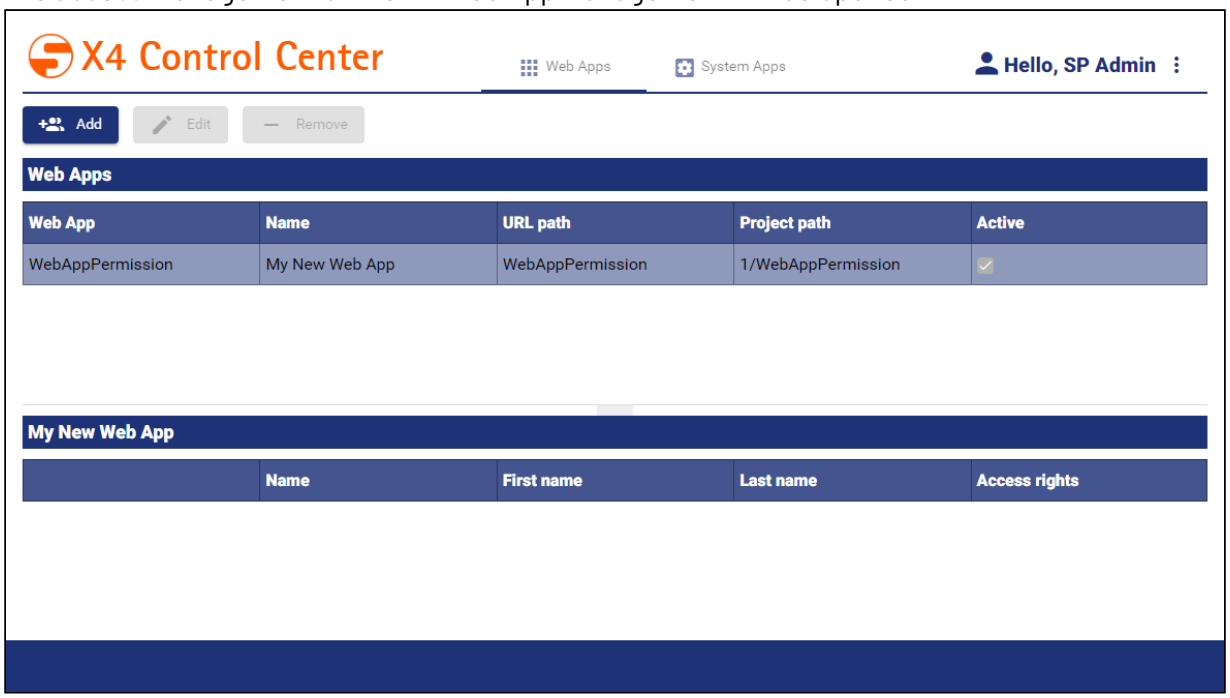
1. In X4 Designer click on **Tools** > **X4 Web App Management**.
   The login screen of the X4 Web App Managements is displayed.



2. Log in with user name and password.

> The default access data is user `admin` and password `demo`.

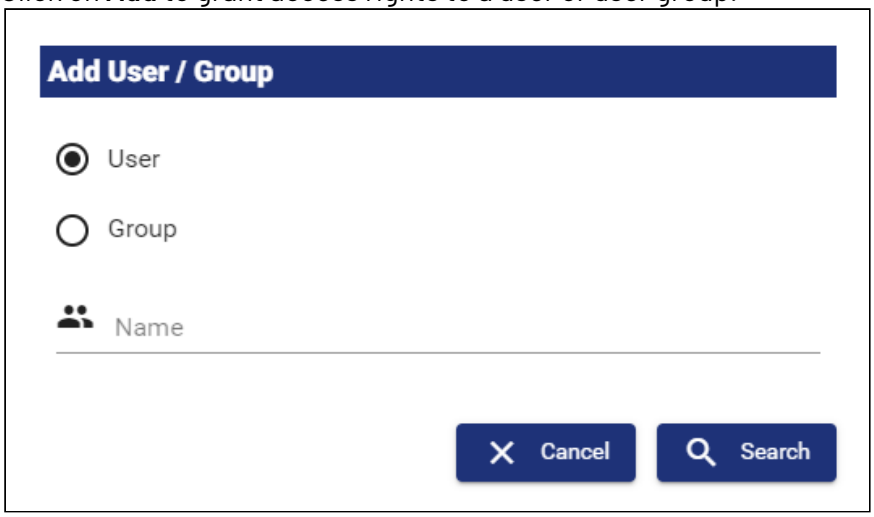
3. The access management of the X4 Web App Management will be opened.



- In der Komponente **Web Apps** werden alle im X4 Repository verfügbaren Web-App-Projekte angezeigt. Hier lassen sich auch die im X4 Control Center verfügbaren Benutzer und Gruppen den einzelnen Projekten zuweisen und mit Zugriffsrechten ausstatten.
- In der Komponente **System Apps** lassen sich bei Bedarf Zugriffsrechte für die System-Web-Apps vergeben.

5.3.8.2 Granting Access Rights to Users and User Groups

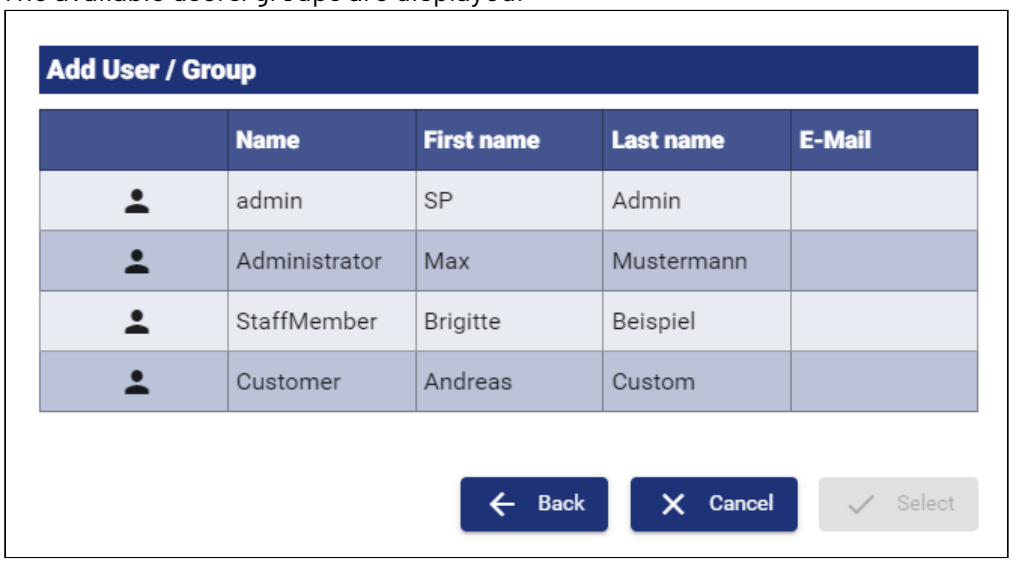
1. Select the web application for which you want to grant access rights.
   The detail view displays already assigned users and user groups.
2. Click on **Add** to grant access rights to a user or user group.



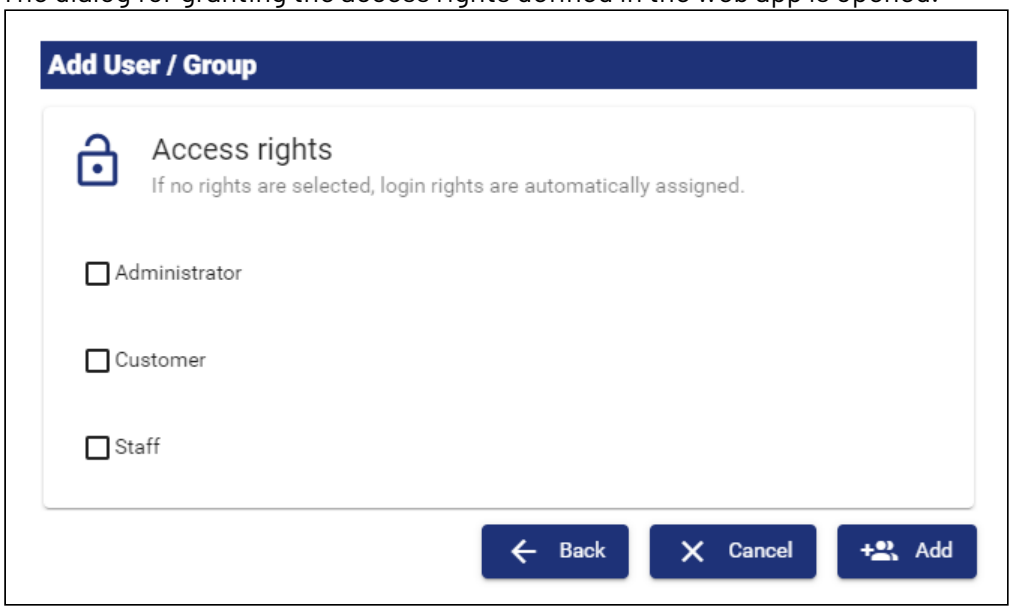
3. Specify whether the access right are to be granted to a **User** or a **Group**.
4. Enter the name of the user or the group, to search for a specific user/group.

If no user or group name is entered, all available users/groups will be displayed.

5. Click **Search** to display the users/groups.
   The available users/groups are displayed.



6. Select the user or user group to whom the access rights are to be granted.
7. Click **Select**.
   The dialog for granting the access rights defined in the web app is opened.



8. Select one or several access rights for the user/group.

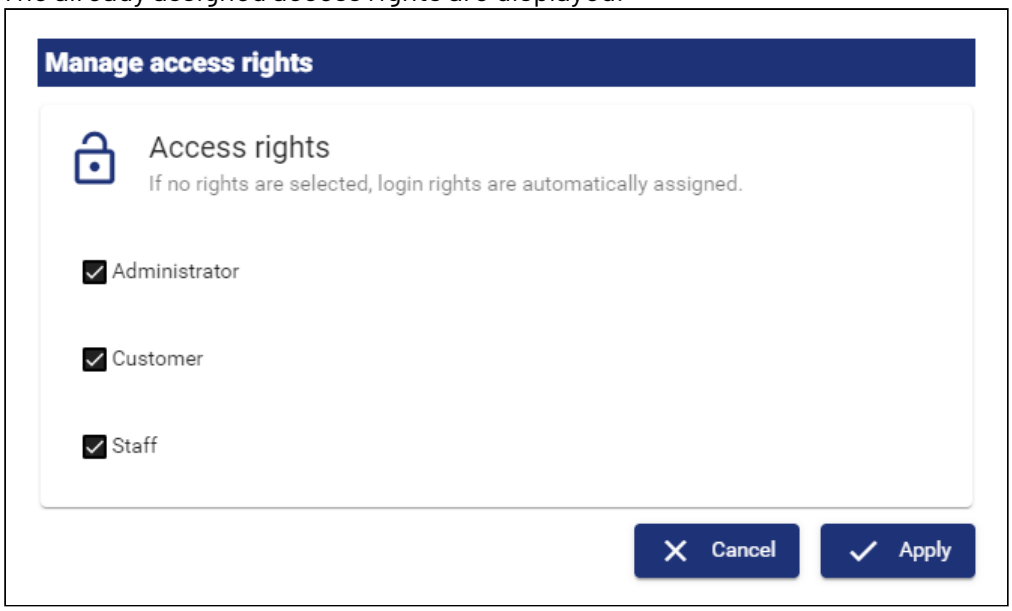
> ⚠ Note that the user can log in to the Web App even if no access rights have been assigned.

9. Click **Add**.
   Access rights are granted for the user or the user group.

5.3.8.3 Editing Access Rights

1. Select the web application for which you want to edit access rights.
   The detail view displays already assigned users and user groups.

2. Select the user or group whose access rights are to be edited.
3. Click on **Edit**.
   The already assigned access rights are displayed.



4. Perform the desired changes and click **Apply**.
   The changes are now applied.

5.3.8.4 Removing Access Rights

1. Select the web application for which you want to remove access rights.
   The detail view displays already assigned users and user groups.
2. Select the user or group whose access rights are to be deleted.
3. Click on **Remove**.
4. Confirm the dialof for deleting access rights with **Remove**.
   The access rights for the user or the user group are removed.

5.4 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