

Cyclos 4 PRO Documentation

Welcome to the Cyclos 4 PRO Documentation. First, this manual contains the Installation and maintenance guide. Second, this manual will give a detailed description and some examples of how to connect to Cyclos using the webservices. Subsequently, this manual explains the Cyclos scripts, these scripts can be executed by clicking on a menu link, by a scheduled task or by an extension point on a certain function. These scripts make it possible to add new functions to Cyclos and customize Cyclos exactly to the needs of your payment system. Finally, this manual will give an explanation of how to login to Cyclos from an external website. This can be useful if you have a large CMS as a website and you want to have an integrated login to Cyclos in this website.

There are some important documentation resources that are not part of this manual, these can be found here:

- There are two (end user) Cyclos 4 manuals (make sure you are not logged into communities.cyclos.org):
 - [Administrator manual](#)
 - [User manual](#)
- Next to the manuals some functions are described with much more technical details in our wiki:
 - [Configurations](#)
 - [Groups](#)
 - [Networks](#)
 - [Advertisements](#)
 - [Users records](#)
 - [Transfer authorization](#)
 - [SMS](#)
 - [Imports](#)
- Cyclos instruction videos:
 - [Cyclos 4 communities](#)
 - [Cyclos 4 PRO](#)

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1. Installation & maintenance

This is the installation manual for Cyclos 4 PRO. Be aware that Cyclos is server side software. End users (customers) will be able to access Cyclos directly with a webbrowser or mobile phone. If you have any problems when installing Cyclos using this manual, you can ask for help at our [forum](#).

1.1. Installation steps

System requirements

- Operation system: Any OS that can run the Java VM like Windows, Linux, FreeBSD or Mac;
- Make sure you have at least 500Mb memory available for Cyclos (if the OS runs 64 bits, for 32bits 300Mb should be enough);
- Java Runtime Environment (JRE), Java 7 is required;
- Web server: Apache Tomcat 7 or higher;
- Database server: PostgreSQL 9.3
- Cyclos installation package `cyclos_version_number.war`;

Install Java

You can check if you have Java installed at this site: <http://java.com/en/download/installed.jsp>
If you don't have Java 7 installed proceed with the steps below:

Linux (Ubuntu)

- Install the `openjdk-7-jdk` package.

Windows

- Download and install the last [Java Development Kit \(JDK\)](#)
- Install the program to `<install_dir>` (for windows users e.g. `C:\Program Files\Java\jdk1.7.x_xx`).
- Make sure your system knows where to find JAVA, in windows you should make an environmental variable called "JAVA_HOME" which points to the `<install_dir>`:
 - In windows XP: configuration > System > advanced > environmental variables.
 - In windows 7: Control Panel > System and Security > System > Advanced system settings > Environmental Variable
- To check if Java is correctly installed, go to the windows command line (type `cmd` and press enter) and type:

```
java -version
```

- Now java will reply which version of it is installed

Install PostgreSQL (database)

Windows

- If using Windows, download the latest version of PostgreSQL and PostGIS:
 - PostgreSQL: <http://www.postgresql.org/download/windows> (for example the graphical installer)
 - PostGIS: http://postgis.net/windows_downloads (PostGIS can also be installed using the Stack Builder, that starts after PostgreSQL is installed. Also in this case use the default options.)
- Install both PostgreSQL and PostGIS by following the installer steps (use the default options).
- Make sure the bin directory is included in the system variables so that you can run psql directly from the command line:
 - Go to: "Start > Control Panel > System and Security > System > Advanced system settings > Environment Variables...".
 - Then go to the system variable with the name "Path" add the bin directory of PostgreSQL as a value, don't forget to separate the values with a semicolon, e.g.:
 - Variable name: Path
 - Variable value: C:\Program Files\PostgreSQL\9.3\bin;
- Go to the windows command line and type the command (you will be asked for the password you specified when installing PostgreSQL):

```
psql -U postgres
```

- If you see "postgres=#" you are in the PostgreSQL command line and you can follow the instructions: [Setup cyclos4 database \(common steps for windows and Linux\)](#).

Linux

- If using Ubuntu Linux, [these](#) instructions are followed, type the following commands in a terminal:
- Install PostgreSQL and PostGIS (using the official PostgreSQL packages for Ubuntu)

```
echo "deb http://apt.postgresql.org/pub/repos/apt/ precise-pgdg main" \  
| sudo tee /etc/apt/sources.list.d/postgresql.list
```

```
wget -quiet -O - https://www.postgresql.org/media/keys/ACCC4CF8.asc | sudo apt-key add -
```

```
sudo apt-get update
```

```
sudo apt-get install postgresql-9.3 postgresql-contrib-9.3 postgresql-9.3-postgis-2.1 \  
postgresql-9.3-postgis-2.1-scripts
```

- Access the postgresql command line:

```
sudo -u postgres psql
```

- If you see "postgres=#" you are in the PostgreSQL command line and you can follow the instructions below.

Setup cyclos4 database (common steps for windows and Linux)

- Create the user cyclos with the password cyclos. This password and username you will have to enter in the cyclos.properties file in step 5, so if you do not use the cyclos as password and username please write them down. Type in the PostgreSQL command line:

```
CREATE USER cyclos WITH PASSWORD 'cyclos' ;
```

- Create the database cyclos4, type in the PostgreSQL command line:

```
CREATE DATABASE cyclos4 ENCODING 'UTF-8' TEMPLATE template0;
```

- Make sure the user cyclos can use the database cyclos4, type in the PostgreSQL command line:

```
GRANT ALL PRIVILEGES ON DATABASE cyclos4 to cyclos;
```

- Create the PostGIS extensions on the database, type in the PostgreSQL command line:

```
\c cyclos4  
create extension cube;  
create extension earthdistance;  
create extension postgis;
```

- Exit the PostgreSQL command line by entering "\q" (and pressing enter).

Install Tomcat (web server)

- Download Tomcat (7.0.x core) at <http://tomcat.apache.org/>
- Extract the zipped tomcat file into a folder <tomcat home>.
- Start tomcat: <tomcat home>/bin/startup.bat (Windows) or <tomcat home>/bin/startup.sh (Linux). You might have to give the startup script file execute permissions.
- Open a browser and go to <http://localhost:8080/> and check if tomcat is working.
- The default memory heap size of Tomcat is very low, we recommend increasing it (see [adjustments](#)).

Install Cyclos

Make sure tomcat is working on port 8080 of the local machine (if you don't run Tomcat as root/admin make sure that the user has write access to the webapps directory)

- Download the latest version of Cyclos from the [license server](#).
- Write down or remember the license server user id and password (it will be needed later on).
- Unzip the cyclos_<version>.zip into a temporary directory.
- Browse to the temporary directory and copy the directory web (including its contents) into the webapps directory (<tomcat_home>/webapps) of the tomcat installation.
- Rename this web directory to cyclos. This name will define how users access Cyclos. For example, if you run the tomcat server on www.domain.com the URL would be http://www.domain.com/cyclos. Of course it is also possible to run Cyclos directly under the domain name. This can be done by extracting Cyclos directly in the root of the webapps directory, or putting an Apache web server in front.
- In the folder <tomcat_home>/webapps/cyclos/WEB-INF/classes you'll find the file cyclos-release.properties. The first thing to do is to copy this file and give it the name cyclos.properties. The original name is not shipped, so in future installations you can just override the entire folder, and your customizations won't be overwritten.
- In the cyclos.properties file you can set the database configuration, here you have to specify the username and password, by default we use 'cyclos4' as database name and 'cyclos' as username and password.*

```
cyclos.datasource.jdbcUrl = jdbc:postgresql://localhost/cyclos4
cyclos.datasource.user = cyclos
cyclos.datasource.password = cyclos
```

* Some systems do not resolve localhost and the default postgres port directly. In case of database connectivity problems you might try a URL:

```
cyclos.datasource.jdbcUrl = jdbc:postgresql://local_ip_address:postgresport/cyclos4
example: cyclos.datasource.jdbcUrl = jdbc:postgresql://192.168.1.1:5432/cyclos4
```

** Windows might not see linebreaks in the property file, if this is the case we advice you to download an more advanced text editor such as [Notepad++](#).

*** In windows problems might occur in the Cyclos versions 4.1, 4.1.1, 4.1.2 and 4.2. It can help to set the cyclos.tempDir variable manual. E.g. "cyclos.tempDir = C:\Program Files\Tomcat7\webapps\cyclos\WEB-INF\temp". In some cases even forward slashes need to be used.

Startup Cyclos

- (Re)start tomcat:
 - Unix: `/etc/rc.d/rc.tomcat stop /etc/rc.d/rc.tomcat start`
 - Windows: use TomCat monitor (available after tomcat installation)
 - You can also start through `<tomcat_home>/bin/startup.bat` (Windows) or `<tomcat_home>/bin/startup.sh` (Linux).
- When tomcat is started and Cyclos initialized browse to the web directory defined in step 5 (for the default this would be <http://localhost:8080/cyclos>). Be aware starting up Cyclos for the first time might take quite some time, because the database need to be initialized. On slow computer this could take up to 3 minutes!
- Upon the first start of Cyclos you will be asked to fill in the license information.
- After submitting with the correct information the initialization process will be log you into Cyclos as (global) administrator

Problem solving

- Often problems can be easily detected by looking at the log files, the log files of tomcat can be found in the logs folder inside tomcat. There are two relevant log files:
 - The Catalina log shows all relevant information about the tomcat server itself.
 - The Cyclos log shows all relevant information about the services and tasks that run in Cyclos.
- If the logs can't help you to pin down the problem, you can search the [Cyclos forum \(installation issues\)](#) if somebody encountered a similar problem.
- If this still has no results, you can post the (relevant) part of the logs to the [Cyclos forum \(installation issues\)](#), together with a description of the problem.

An example of an error that sometimes occurs is "WARN RequestContextFilter – Couldn't write on the temp directory". In this case the user that started tomcat doesn't have the write permission. This can be modified in Linux by executing the following commands as root (normally the name of the user is tomcat):

```
chown -R tomcat /var/lib/tomcat7/webapps/cyclos
chmod -R 755 /var/lib/tomcat7/webapps/cyclos
```

1.2. Adjustments (optional)

Enable SSL/HTTPS

Enabling SSL is highly recommended on live systems, as it protects sensitive information, like passwords, to be sent plain over the Internet, making it readable by eavesdroppers. If

the Tomcat server is directly used from the Internet, to enable SSL / HTTPS you first have to enable (un-comment) the https connector in the file <tomcat_home>/conf/server.xml

```
<Connector port="443" maxHttpHeaderSize="8192"  
    maxThreads="150" minSpareThreads="25" maxSpareThreads="75"  
    enableLookups="false" disableUploadTimeout="true"  
    acceptCount="100" scheme="https" secure="true"  
    clientAuth="false" sslProtocol="TLS" />
```

Generate a key with the keytool from Java:

```
$JAVA_HOME/bin/keytool -genkey -alias tomcat -keyalg RSA -keystore /path/to/my/keystore
```

After executing this command, you will first be prompted for the keystore password. Passwords are **case sensitive**. You will also need to specify the custom password in the server.xml configuration file, as described later. Next, you will be prompted for general information about this Certificate, such as company, contact name, and so on. This information will be displayed to users who attempt to access a secure page in your application, so make sure that the information provided here matches what they will expect. Finally, you will be prompted for the key password, which is the password specifically for this Certificate (as opposed to any other Certificates stored in the same keystore file). You **MUST** use the same password here as was used for the keystore password itself. (Currently, the keytool prompt will tell you that pressing the ENTER key does this for you automatically). If everything was successful, you now have a keystore file with a Certificate that can be used by your server.

Adjust Tomcat/Java memory

The default memory heap size of Tomcat is very low. You can augment this in the following way:

Windows

In the bin directory of Tomcat create (if it doesn't exist) a file called setenv.bat, edit this file and add the following line:

```
set JAVA_OPTS=-Xms128m -Xmx512m -XX:MaxPermSize=128M
```

Linux

In the bin directory of Tomcat create (if it doesn't exist) a file called setenv.sh, edit this file and add the following line:

```
JAVA_OPTS="-Xms128m -Xmx512m -XX:MaxPermSize=128M"
```

Clustering

Clustering is useful both for scaling (serving more requests) and for high availability (if a server crashes, the application continues to run). The main reason for configuring a cluster in Tomcat is to replicate HTTP sessions. Cyclos, however, doesn't use Tomcat sessions, but handles them internally. This way, there is no special Tomcat configuration to support a Cyclos cluster.

The Cyclos application, however, needs some small configurations to enable clustering. Cyclos uses [Hazelcast](#) to synchronize aspects (such as caches) between cluster servers. To enable clustering, find in `cyclos.properties` the line containing `cyclos.clusterHandler`, and set it to `hazelcast`.

Some extra configuration can be performed in the `WEB-INF/classes/hazelcast.xml` file. Basically, if the local network runs more than a single Cyclos instance, the group needs to be configured. Configure all files belonging to the same group with the same group name and password. It is also possible to change the default multicast to TCP/IP communication. Just comment the `<multicast>` tag and uncomment the `<tcp-ip>` tag, setting up the hosts / ports which will be part of the cluster. For a TCP/IP cluster, Hazelcast needs the host name / port of at least one node already in a cluster (it is not necessary to set all other nodes on each node).

To setup high-availability at database (Postgresql) level, please, refer to [this document](#).

1.3. Maintenance

Backup

All data in Cyclos is stored in the database. Making a backup of the database can be done using the `pg_dump` command. The only file that you need to back-up (only once) will be the `cyclos.properties` configuration file. The database can be backed up manually as follows (in this example the name of the database is `cyclos4` the username `cyclos` and the command will prompt for the password `cyclos`):

```
pg_dump -username=cyclos -password -hlocalhost cyclos4 > cyclos4.sql
```

Restore

If you want to start using cyclos with the data from a backup. You can just import the backed up database. In this example the name of the database is `cyclos4` the username `cyclos` and command will prompt for the password `cyclos` the name of the backup is `cyclos4.sql` make sure to specify the path if your not in the same directory as the file:

```
psql -username=cyclos -password -hlocalhost cyclos4 < cyclos4.sql
```

2. Web services

Here you will find information on how to call Cyclos services from 3rd party applications.

2.1. Introduction

The entire service layer in Cyclos 4 is accessible via web services. For a client to use a web service, currently, he needs to provide the username and password (according to the password configured on the Channels tab for the user configuration). It is planned for future versions to have access clients, which will belong to an user, being used instead of the username / password authentication.

The available service and API change policy is described [here](#). In terms of security, web services are no more and no less secure than the regular web access, since the service layer is shared, and the same permissions / authorizations are checked in both cases.

Cyclos offers two types of web services: one for native Java clients and another one which is client-agnostic, using JSON requests / responses over HTTP. For the latter, a PHP client library is generated from the services, mirroring all services and methods in a PHP-friendly way.

2.2. Java clients

Cyclos provides native Java access to services, which can be used on 3rd party Java applications.

Dependencies

In order to use the client, you will need some JAR files which are available in the download bundle, on the `cyclos-4.x.x/web/WEB-INF/lib` directory. Not all jars are required, only the following:

- `cyclos-api.jar`
- `log4j-x.x.x.jar`
- `jcl-over-slf4j-x.x.x.jar`
- `slf4j-api-x.x.x.jar`
- `slf4j-log4j12-x.x.x.jar`
- `spring-aop-x.x.x.jar`
- `spring-beans-x.x.x.jar`
- `spring-context-x.x.x.jar`
- `spring-core-x.x.x.jar`

- spring-web-x.x.x.x.jar
- aopalliance.jar

Those jars, except the cyclos-api.jar, are provided by the following projects:

- [Spring framework](#) 4.x.x, distributed under the [Apache 2.0 license](#).
- [SLF4J logging framework](#) 1.6.x, distributed under the [MIT license](#).
- [Apache Log4j](#) 1.2.x, distributed under the [Apache 2.0 license](#).
- [AOP Alliance](#) (required by the Spring Framework), which is licensed as Public Domain.

Using services from a 3rd party Java application

The Java client for Cyclos 4 uses the [Spring HTTP invokers](#) to communicate with the server and invoke the web services. It works in a similar fashion as RMI or remote EJB proxies – a dynamic proxy for the service interface is obtained and methods can be invoked on it as if it were a local object. The proxy, however, passes the parameters to the server and returns the result back to the client. The Cyclos 4 API library provides the [org.cyclos.server.utils.HttpServiceFactory](#) class, which is used to obtain the service proxies, and is very easy to use. With it, service proxies can be obtained like this:

```
HttpServiceFactory factory = new HttpServiceFactory();
factory.setRootUrl("https://www.my-cyclos.com/network");
factory.setInvocationData(new HttpServiceInvocationData("username", "password"));
AccountService accountService = factory.getProxy(AccountService.class);
```

In the above example, the [AccountService](#) can be used to query account information. The permissions are the same as in the main Cyclos application. The user may be either a regular user or an administrator. When an administrator, will allow performing operations over regular users (managed by that administrator). Otherwise, the web services will only affect the own user.

Examples

Configure Cyclos

All following examples use the following class to configure the web services:.

```
import org.cyclos.server.utils.HttpServiceFactory;
import org.cyclos.server.utils.HttpServiceInvocationData;

/**
 * This class will provide the Cyclos server configuration for the web service
 * samples
 */
public class Cyclos {
```

```

private static final String      ROOT_URL = "http://localhost:8888/england";

private static HttpServiceFactory factory;
static {
    factory = new HttpServiceFactory();
    factory.setRootUrl(ROOT_URL);
    factory.setInvocationData(HttpServiceInvocationData.stateless(
        "admin", "1234"));
}

public static HttpServiceFactory getServiceFactory() {
    return factory;
}

public static HttpServiceFactory getServiceFactory(
    HttpServiceInvocationData invocationData) {
    HttpServiceFactory factory = new HttpServiceFactory();
    factory.setRootUrl(ROOT_URL);
    factory.setInvocationData(invocationData);
    return factory;
}
}

```

Search users

```

import org.cyclos.model.users.users.UserDetailedVO;
import org.cyclos.model.users.users.UserQuery;
import org.cyclos.services.users.UserService;
import org.cyclos.utils.Page;

/**
 * Provides a sample on searching for users
 */
public class SearchUsers {

    public static void main(String[] args) throws Exception {
        UserService userService = Cyclos.getServiceFactory().getProxy(
            UserService.class);

        // Search for the top 5 users by keywords
        UserQuery query = new UserQuery();
        query.setKeywords("John*");
        query.setPageSize(5);
        Page<UserDetailedVO> users = userService.search(query);

        System.out.printf("Found a total of %d users\n",
            users.getTotalCount());
        for (UserDetailedVO user : users) {
            System.out.printf("** %s (%s)\n", user.getName(),
                user.getUsername());
        }
    }
}

```

Search advertisements

```
import org.cyclos.model.marketplace.advertisements.BasicAdQuery;
import org.cyclos.model.marketplace.advertisements.BasicAdVO;
import org.cyclos.services.marketplace.AdService;
import org.cyclos.utils.Page;

/**
 * Provides a sample on searching for advertisements
 */
public class SearchAds {

    public static void main(String[] args) throws Exception {
        AdService adService = Cyclos.getServiceFactory().getProxy(
            AdService.class);
        BasicAdQuery query = new BasicAdQuery();
        query.setKeywords("Gear");
        query.setHasImages(true);
        Page<BasicAdVO> ads = adService.search(query);
        System.out.printf("Found a total of %d advertisements\n",
            ads.getTotalCount());
        for (BasicAdVO ad : ads) {
            System.out.printf("%s\nBy: %s\n%s\n-----\n",
                ad.getName(),
                ad.getOwner().getName(),
                ad.getDescription());
        }
    }
}
```

Register user

```
import java.util.ArrayList;
import java.util.Arrays;
import java.util.Collections;
import java.util.List;

import org.cyclos.model.system.fields.CustomFieldDetailedVO;
import org.cyclos.model.system.fields.CustomFieldPossibleValueVO;
import org.cyclos.model.users.addresses.UserAddressDTO;
import org.cyclos.model.users.fields.UserCustomFieldValueDTO;
import org.cyclos.model.users.groups.GroupVO;
import org.cyclos.model.users.phones.LandLinePhoneDTO;
import org.cyclos.model.users.phones.MobilePhoneDTO;
import org.cyclos.model.users.users.RegistrationStatus;
import org.cyclos.model.users.users.UserData;
import org.cyclos.model.users.users.UserRegistrationDTO;
import org.cyclos.model.users.users.UserRegistrationResult;
import org.cyclos.model.users.users.UserSearchContext;
import org.cyclos.model.users.users.UserSearchData;
import org.cyclos.services.users.UserService;
import org.cyclos.utils.CustomFieldHelper;

/**
 * Provides a sample on registering an user with all custom fields, adresse
```

```

* and phones
*/
public class RegisterUser {

    public static void main(String[] args) {
        // Get the services
        UserService userService = Cyclos.getServiceFactory().getProxy(
            UserService.class);

        // The available groups for new users are obtained in the search data
        UserSearchData searchData = userService
            .getSearchData(UserSearchContext.REGULAR);
        List<GroupVO> possibleGroups = searchData.getInitialGroups();

        // Find the consumers group
        GroupVO group = null;
        for (GroupVO current : possibleGroups) {
            if (current.getName().equals("Consumers")) {
                group = current;
                break;
            }
        }

        // Get data for a new user
        UserData data = userService.getDataForNew(group.getId());

        // Basic fields
        UserRegistrationDTO user = new UserRegistrationDTO();
        user.setGroup(group);
        user.setName("John Smith");
        user.setUsername("johnsmith");
        user.setEmail("john.smith@mail.com");
        user.setAssignPassword(true);
        user.setPassword("1234");
        user.setSkipActivationEmail(true);
        user.setConfirmPassword(user.getPassword());
        user.setForcePasswordChange(true);

        // Custom fields
        List<CustomFieldDetailedVO> customFields = CustomFieldHelper
            .getCustomFields(data.getCustomFieldActions());
        CustomFieldDetailedVO gender = null;
        CustomFieldDetailedVO idNumber = null;
        for (CustomFieldDetailedVO customField : customFields) {
            if (customField.getInternalName().equals("gender")) {
                gender = customField;
            }
            if (customField.getInternalName().equals("idNumber")) {
                idNumber = customField;
            }
        }
        user.setCustomValues(new ArrayList<UserCustomFieldValueDTO>());

        // Value for the gender custom field
        UserCustomFieldValueDTO genderValue = new UserCustomFieldValueDTO();
        genderValue.setField(gender);
        for (CustomFieldPossibleValueVO possibleValue : gender
            .getPossibleValues()) {

```

```

        if (possibleValue.getValue().equals("Male")) {
            // Found the value for 'Male'
            genderValue.setEnumeratedValues(Collections
                .singleton(possibleValue));
            break;
        }
    }
    user.getCustomValues().add(genderValue);

    // Value for id number custom field
    UserCustomFieldValueDTO idNumberValue = new UserCustomFieldValueDTO();
    idNumberValue.setField(idNumber);
    idNumberValue.setStringValue("123.456.789-10");
    user.getCustomValues().add(idNumberValue);

    // Address
    UserAddressDTO address = new UserAddressDTO();
    address.setName("Home");
    address.setAddressLine1("John's Street, 500");
    address.setCity("John's City");
    address.setRegion("John's Region");
    address.setCountry("BR"); // Country is given in 2-letter ISO code
    user.setAddresses(Arrays.asList(address));

    // Landline phone
    LandLinePhoneDTO landLinePhone = new LandLinePhoneDTO();
    landLinePhone.setName("Home");
    landLinePhone.setRawNumber("+551133333333");
    user.setLandLinePhones(Arrays.asList(landLinePhone));

    // Mobile phone
    MobilePhoneDTO mobilePhone = new MobilePhoneDTO();
    mobilePhone.setName("Mobile phone 1");
    mobilePhone.setRawNumber("+5511999999999");
    user.setMobilePhones(Arrays.asList(mobilePhone));

    // Effectively register the user
    UserRegistrationResult result = userService.register(user);
    RegistrationStatus status = result.getStatus();
    switch (status) {
        case ACTIVE:
            System.out.println("The user is now active");
            break;
        case ACTIVE_GENERATED_PASSWORD:
            System.out.println("The user is now active, "
                + "and a password has been emailed");
            break;
        case INACTIVE:
            System.out.println("The user is in an inactive group, "
                + "and needs activation by administrators");
            break;
        case EMAIL_VALIDATION:
            System.out.println("The user needs to validate the e-mail "
                + "address in order to confirm the registration");
            break;
    }
}

```

```
}
```

Edit user profile

```
import java.util.List;

import org.cyclos.model.users.fields.UserCustomFieldValueDTO;
import org.cyclos.model.users.users.EditProfileData;
import org.cyclos.model.users.users.UserDTO;
import org.cyclos.model.users.users.UserDetailedVO;
import org.cyclos.model.users.users.UserLocatorVO;
import org.cyclos.server.utils.HttpServiceFactory;
import org.cyclos.services.users.UserService;

public class EditUser {

    public static void main(String[] args) {
        // Get the services
        HttpServiceFactory factory = Cyclos.getServiceFactory();
        UserService userService = factory.getProxy(UserService.class);

        // Locate the user by username, so we get the id
        UserLocatorVO locator = new UserLocatorVO();
        locator.setUsername("someuser");
        UserDetailedVO userVO = userService.locate(locator);

        // Get the profile data
        EditProfileData data = (EditProfileData) userService.getData(userVO
            .getId());
        UserDTO user = data.getDTO();
        user.setName("Some modified name");
        List<UserCustomFieldValueDTO> customValues = user.getCustomValues();
        for (UserCustomFieldValueDTO fieldValue : customValues) {
            if (fieldValue.getField().getInternalName().equals("website")) {
                fieldValue.setStringValue("http://new.url.com");
            }
        }

        // Update the user
        userService.save(user);
    }
}
```

Login user

```
import java.util.List;

import org.cyclos.model.access.LoggedOutException;
import org.cyclos.model.access.channels.BuiltInChannel;
import org.cyclos.model.banking.accounts.AccountSummaryVO;
import org.cyclos.model.users.users.UserLocatorVO;
import org.cyclos.model.users.users.UserLoginDTO;
import org.cyclos.model.users.users.UserLoginResult;
import org.cyclos.model.users.users.UserVO;
import org.cyclos.server.utils.HttpServiceFactory;
```

```

import org.cyclos.server.utils.HttpServiceInvocationData;
import org.cyclos.services.access.LoginService;
import org.cyclos.services.banking.AccountService;

/**
 * Cyclos web service example: logs-in an user via web services.
 * This is useful when creating an alternative front-end for Cyclos.
 */
public class LoginUser {

    public static void main(String[] args) throws Exception {
        // This LoginService has the administrator credentials
        LoginService loginService = Cyclos.getServiceFactory().getProxy(
            LoginService.class);

        String remoteAddress = "192.168.1.200";

        // Set the login parameters
        UserLoginDTO params = new UserLoginDTO();
        UserLocatorVO locator = new UserLocatorVO(UserLocatorVO.USERNAME,
            "c1");
        params.setUser(locator);
        params.setPassword("1234");
        params.setRemoteAddress(remoteAddress);
        params.setChannel(BuiltInChannel.MAIN.getInternalName());

        // Login the user
        UserLoginResult result = loginService.loginUser(params);
        UserVO user = result.getUser();
        String sessionToken = result.getSessionToken();
        System.out.println("Logged-in" + user.getName()
            + " with session token = " + sessionToken);

        // Do something as user. As the session token is only valid per ip
        // address, we need to pass-in the client ip address again
        HttpServiceInvocationData sessionInvocationData = HttpServiceInvocationData
            .stateful(sessionToken, remoteAddress);
        // The services acquired by the following factory will carry on the
        // user session data
        HttpServiceFactory userFactory = Cyclos
            .getServiceFactory(sessionInvocationData);
        AccountService accountService = userFactory
            .getProxy(AccountService.class);
        List<AccountSummaryVO> accounts = accountService.getAccountsSummary(
            user, null);
        for (AccountSummaryVO account : accounts) {
            System.out.println(account.getName() + ", balance: "
                + account.getStatus().getBalance());
        }

        // Logout. There are 2 possibilities:

        // - Logout as administrator:
        loginService.logoutUser(sessionToken);

        // - OR logout as own user:
        try {
            userFactory.getProxy(LoginService.class).logout();
        }
    }
}

```

```

    } catch (LoggedOutException e) {
        // already logged out
    }
}
}

```

Get account information

```

import java.math.BigDecimal;
import java.util.List;

import org.cyclos.model.banking.accounts.AccountHistoryEntryVO;
import org.cyclos.model.banking.accounts.AccountHistoryQuery;
import org.cyclos.model.banking.accounts.AccountSummaryVO;
import org.cyclos.model.banking.accounts.AccountVO;
import org.cyclos.model.banking.accounttypes.AccountTypeNature;
import org.cyclos.model.banking.accounttypes.AccountTypeVO;
import org.cyclos.model.users.users.UserLocatorVO;
import org.cyclos.model.users.users.UserVO;
import org.cyclos.model.utils.CurrencyAmountDTO;
import org.cyclos.services.banking.AccountService;
import org.cyclos.utils.Page;

/**
 * Provides a sample on getting the account information for a given user.
 */
public class GetAccountInformation {

    public static void main(String[] args) throws Exception {
        AccountService accountService = Cyclos.getServiceFactory().getProxy(
            AccountService.class);

        // Get the accounts summary
        UserLocatorVO user = new UserLocatorVO();
        user.setUsername("some-user");
        List<AccountSummaryVO> summaries = accountService.getAccountsSummary(
            user, null);

        // For each account, we'll show the balances
        for (AccountSummaryVO summary : summaries) {
            CurrencyAmountDTO balance = summary.getBalance();
            System.out.printf("%s has balance of %.2f %s\n",
                summary.getName(),
                balance.getAmount(),
                balance.getCurrency());

            // Also, search for the last 5 payments on each account
            AccountHistoryQuery query = new AccountHistoryQuery();
            query.setAccount(new AccountVO(summary.getId()));
            query.setPageSize(5);

            Page<AccountHistoryEntryVO> entries = accountService
                .searchAccountHistory(query);
            for (AccountHistoryEntryVO entry : entries) {
                AccountVO relatedAccount = entry.getRelatedAccount();
                AccountTypeVO relatedType = relatedAccount.getType();
                AccountTypeNature relatedNature = relatedType.getNature();
            }
        }
    }
}

```



```

* Provides a sample on performing a payment between an user and a system
* account
*/
public class PerformPayment {

    public static void main(String[] args) {
        // Get the services
        HttpServiceFactory factory = Cyclos.getServiceFactory();
        TransactionService transactionService = factory
            .getProxy(TransactionService.class);
        PaymentService paymentService = factory
            .getProxy(PaymentService.class);

        // The payer and payee
        AccountOwner payer = new UserLocatorVO(UserLocatorVO.USERNAME,
            "user1");
        AccountOwner payee = SystemAccountOwner.instance();

        // Get data regarding the payment
        PerformPaymentData data;
        try {
            data = transactionService.getPaymentData(payer, payee);
        } catch (EntityNotFoundException e) {
            System.out.println("Some of the users were not found");
            return;
        }

        // Get the first available payment type
        List<TransferTypeVO> types = data.getPaymentTypes();
        TransferTypeVO paymentType = CollectionHelper.first(types);
        if (paymentType == null) {
            System.out.println("There is no possible payment type");
        }

        // The payment amount
        BigDecimal amount = new BigDecimal(10.5);

        // Perform the payment itself
        PerformPaymentDTO payment = new PerformPaymentDTO();
        payment.setType(paymentType);
        payment.setFrom(data.getFrom());
        payment.setTo(data.getTo());
        payment.setAmount(amount);

        try {
            PaymentVO result = paymentService.perform(payment);
            // Check whether the payment is pending authorization
            TransactionAuthorizationStatus auth = result
                .getAuthorizationStatus();
            if (auth == TransactionAuthorizationStatus.PENDING_AUTHORIZATION) {
                System.out.println("The payment is pending authorization");
            } else {
                System.out.println("The payment has been processed");
            }
        } catch (InsufficientBalanceException e) {
            System.out.println("Insufficient balance");
        } catch (MaxTransfersPerDayExceededException e) {
            System.out.println("Maximum daily amount of transfers "

```

```

        + e.getMax()
        + " has been reached");
    } catch (MaxTransfersPerWeekExceededException e) {
        System.out.println("Maximum weekly amount of transfers "
            + e.getMax()
            + " has been reached");
    } catch (MaxTransfersPerMonthExceededException e) {
        System.out.println("Maximum monthly amount of transfers "
            + e.getMax()
            + " has been reached");
    } catch (MinTimeBetweenTransfersException e) {
        System.out
            .println("A minimum period of time should be awaited to make "
                + "a payment of this type");
    } catch (MaxAmountPerDayExceededException e) {
        System.out.println("Maximum daily amount of " + e.getMaxAmount()
            + " has been reached");
    } catch (MaxAmountPerWeekExceededException e) {
        System.out.println("Maximum weekly amount of " + e.getMaxAmount()
            + " has been reached");
    } catch (MaxAmountPerMonthExceededException e) {
        System.out.println("Maximum monthly amount of "
            + e.getMaxAmount()
            + " has been reached");
    } catch (MaxAmountExceededException e) {
        System.out.println("Maximum amount of " + e.getMaxAmount()
            + " has been reached");
    } catch (MinAmountExceededException e) {
        System.out.println("Minimum amount of " + e.getMinAmount()
            + " has been reached");
    } catch (Exception e) {
        System.out.println("The payment couldn't be performed");
    }
}
}
}

```

2.3. PHP clients

To make it easier to integrate Cyclos in PHP applications, a PHP library is provided. The library uses [web-rpc calls with JSON objects](#) internally, handling requests and responses, as well as mapping exceptions. A PHP class is generated for each Cyclos service interface, and all methods are generated on them. The parameters and result types, however, are not generated, and are either handled as strings, numbers, booleans or generic objects (stdClass).

You can download the PHP client for the corresponding Cyclos version [here](#).

Dependencies

- PHP 5.3 or newer
- PHP CURL extension (package php5-curl in Debian / Ubuntu)
- PHP JSON extension (package php5-json in Debian / Ubuntu)

Using services from a 3rd party PHP application

In order to use the Cyclos classes, we first register an autoload function to load the required classes automatically, like this:

```
function load($c) {
    if (strpos($c, "Cyclos\\") >= 0) {
        include str_replace("\\", "/", $c) . ".php";
    }
}
spl_autoload_register("load");
```

Then, Cyclos is configured with the server root URL and authentication details:

```
Cyclos\Configuration::setRootUrl("http://192.168.1.27:8888/england");
Cyclos\Configuration::setAuthentication("admin", "1234");
```

Afterwards, services can be instantiated using the new operator, and the corresponding methods will be available:

```
$userService = new Cyclos\UserService(); $page = $userService->search(new stdClass());
```

Examples

Configuration

All the following examples include the `configureCyclos.php` file, which contains the following:

```
<?php

function load($c) {
    if (strpos($c, "Cyclos\\") >= 0) {
        include str_replace("\\", "/", $c) . ".php";
    }
}

spl_autoload_register('load');

Cyclos\Configuration::setRootUrl("http://192.168.1.27:8888/england");
Cyclos\Configuration::setAuthentication("admin", "1234");
```

Search users

```
<?php

require_once 'configureCyclos.php';

$userService = new Cyclos\UserService();
```

```

$query = new stdClass();
$query->keywords = 'Consumer*';
$query->pageSize = 5;
$page = $userService->search($query);

echo("Found a total of $page->totalCount users\n");

if (!empty($page->pageItems)) {
    foreach ($page->pageItems as $user) {
        echo("** $user->name ($user->username)\n");
    }
}

```

Search advertisements

```

<?php

require_once 'configureCyclos.php';

$adService = new Cyclos\AdService();
$query = new stdClass();
$query->keywords = 'Computer*';
$query->pageSize = 10;
$query->orderBy = 'PRICE_LOWEST';
$page = $adService->search($query);

echo("Found a total of $page->totalCount advertisements\n");

if (!empty($page->pageItems)) {
    foreach ($page->pageItems as $ad) {
        echo("** $ad->title\n");
    }
}

```

Login user

```

<?php

// Configure Cyclos and obtain an instance of LoginService
require_once 'configureCyclos.php';
$loginService = new Cyclos\LoginService();

// Set the parameters
$params = new stdClass();
$params->user = array('username' => $_POST['username']);
$params->password = $_POST['password'];
$params->remoteAddress = $_SERVER['REMOTE_ADDR'];

// Perform the login
try {
    $result = $loginService->loginUser($params);
} catch (Cyclos\ConnectionException $e) {
    echo("Cyclos server couldn't be contacted");
    die();
} catch (Cyclos\ServiceException $e) {
    switch ($e->errorCode) {

```

```

case 'VALIDATION':
    echo("Missing username / password");
    break;
case 'LOGIN':
    echo("Invalid username / password");
    break;
case 'REMOTE_ADDRESS_BLOCKED':
    echo("Your access is blocked by exceeding invalid login attempts");
    break;
default:
    echo("Error while performing login: {$e->errorCode}");
    break;
}
}
die();
}

// Redirect the user to Cyclos with the returned session token
header("Location: "
    . Cyclos\Configuration::getRootUrl()
    . "?sessionToken="
    . $result->sessionToken);

```

Perform payment from system to user

```

<?php
require_once 'configureCyclos.php';

$transactionService = new Cyclos\TransactionService();
$paymentService = new Cyclos\PaymentService();

try {
    $data = $transactionService->getPaymentData('SYSTEM', array('username' => 'c1'));

    $parameters = new stdClass();
    $parameters->from = $data->from;
    $parameters->to = $data->to;
    $parameters->type = $data->paymentTypes[0];
    $parameters->amount = 5;
    $parameters->description = "Test from system to user";

    $paymentResult = $paymentService->perform($parameters);
    if ($paymentResult->authorizationStatus == 'PENDING_AUTHORIZATION') {
        echo("Not yet authorized\n");
    } else {
        echo("Payment done with id $paymentResult->id\n");
    }
} catch (Cyclos\ServiceException $e) {
    echo("Error while calling $e->service.$e->operation: $e->errorCode");
}
}

```

Perform payment from user to user

```

<?php
require_once 'configureCyclos.php';

//Perform the payment from user c1 to c2

```

```

Cyclos\Configuration::setAuthentication("c1", "1234");

$transactionService = new Cyclos\TransactionService();
$paymentService = new Cyclos\PaymentService();

try {
    $data = $transactionService->getPaymentData(
        array('username' => 'c1'),
        array('username' => 'c2'));

    $parameters = new stdClass();
    $parameters->from = $data->from;
    $parameters->to = $data->to;
    $parameters->type = $data->paymentTypes[0];
    $parameters->amount = 5;
    $parameters->description = "Test payment to user";

    $paymentResult = $paymentService->perform($parameters);
    if ($paymentResult->authorizationStatus == 'PENDING_AUTHORIZATION') {
        echo("Not yet authorized\n");
    } else {
        echo("Payment done with id $paymentResult->id\n");
    }
} catch (Cyclos\ServiceException $e) {
    switch ($e->errorCode) {
        case "VALIDATION":
            echo("Some of the parameters is invalid\n");
            var_dump($e->error);
            break;
        case "INSUFFICIENT_BALANCE":
            echo("Insufficient balance to perform the payment\n");
            break;
        case "MAX_AMOUNT_PER_DAY_EXCEEDED":
            echo("Maximum amount exeeded today\n");
            break;
        default:
            echo("Error with code $e->errorCode while performing the payment\n");
            break;
    }
}

```

2.4. Other clients

For other clients, a "REST level 0", or RPC-like interface is available, using JSON encoded strings for passing parameters and receiving results from services. Each service responds to POST requests to the following URL `http[s]://cyclos.url/[network/]web-rpc/<short-service-name>`, where the short-service-name is the service with the first letter as lowercase. So, for example, `https://my.cyclos.instance.com/network/web-rpc/accountService` is a valid URL, being mapped to [AccountService](#). For authentication, the username and password should be passed as a HTTP header using the standard basic authentication – a header like: "Authentication: Basic <Base64-encoded form of username:password>". Additional fields can

be used to identify the user, not only the username, by prepending the "username" with the following values:

- username:<value> – Identify the user by the login name (same as not using any prefix at all). For example: username:someuser
- id:<value>: Identify the user by the internal id. For example: id:1234567
- email:<value>: Identify the user by e-mail. For example: email:someuser@email.com
- mobilePhone:<value> – Identify the user by mobile phone. For example: mobilePhone:+555199999999
- customField:<field>:<value> – Identify the user by custom field (by internal name) value. For example: customField:externalId:1234567
- customFieldId:<id>:<value> – Identify the user by custom field (by id) value. For example: customFieldId:987654:1234567

The request body must be a JSON object with the 'operation' and 'params' properties, where operation is the method name, and params is either an array with parameters, or optionally the parameter if the method has a single parameter (without the array) or even omitted if the method have no parameters. For objects, the parameters are expected to be the same as the Java counterparts (see the [JavaDocs](#) for a reference on the available properties for each object).

As result, if the request was successful (http status code is 200), an object with a single property called result will be returned. The object has the same structure as the object returned by the service method, or is a string, boolean or number for simple types. Requests which resulted in error (status code distinct than 200) will have the following structure:

- errorCode: A string generated from the exception java class name. The unqualified class name has the Exception suffix removed, and is transformed to all uppercase, separated by underlines. So, for example, for [org.cyclos.model.ValidationException](#), the error code is VALIDATION; for [org.cyclos.model.banking.InsufficientBalanceException](#), the error code is INSUFFICIENT_BALANCE, and so on.
- Any other properties (public getters) the thrown exception has will also be mapped as a property here, for example, [org.cyclos.model.ValidationException](#) holds a property called validation which contains an object representing a [org.cyclos.utils.ValidationResult](#).

Apart from that, all objects, when converted to JSON, will have a property called class, which represents the fully-qualified Java class name of the source object. Most clients can just ignore the result. However, when sending requests to classes that expect a polymorphic object, the server needs to know which subclass the passed object represents. In those cases, passing the class property, with the fully qualified Java class name is required. An example is the [AdService](#). When saving an advertisement, it could either be a simple advertisement ([AdvertisementDTO](#)) or a webshop advertisement ([AdWebShopDTO](#)). In this case, a class

property with the fully qualified class name is required. Note, however, that in most cases, the class information is not needed.

Examples

Assuming that <root url> points to correct URL, and that the authentication header is correctly passed, the following request can be performed to search for users: The same example call previously shown in Java can be obtained by, posting the following JSON to <https://my.cyclos.instance.com/network/web-rpc/userService> (assuming the correct request headers / authentication):

```
{
  "operation": "search",
  "params": {
    "keywords": "consumer",
    "pageSize": 5
  }
}
```

The resulting JSON will be something like:

```
{
  "result": {
    "class": "org.cyclos.utils.PageImpl",
    "currentPage": "0",
    "pageSize": "20",
    "totalCount": "2",
    "pageItems": [
      {
        "class": "org.cyclos.model.users.users.UserDetailedVO",
        "id": "-2717327251475675143",
        "name": "Consumer 1",
        "username": "c1"
      },
      {
        "class": "org.cyclos.model.users.users.UserDetailedVO",
        "id": "-2717467988964030471",
        "name": "Consumer 3",
        "username": "c3"
      }
    ]
  }
}
```

2.5. Available services and API Changes

The available services are documented in the [JavaDocs](#), under each org.cyclos.services subpackage.

For the full set of API changes, please, refer to the [online documentation](#).

3. Scripting

3.1. Scripting engine

The Cyclos scripting module (available from version 4.2 onwards) provides an integration layer that allows connecting from Cyclos to third party software, as well executing custom operations and scheduled tasks within Cyclos self. The scripting module offers an easy way to customize and extend Cyclos, without losing compatibility with future Cyclos versions. The scripting engine can access the full Cyclos services layer which makes it a powerful feature. For security reasons only global administrators can add scripts. Network administrators can be given permissions to bound the scripts to elements such as extension points (eg. payment, user profile, advertisement), custom validations (for input fields), custom calculations (account fees, transaction fees), custom operations and scheduled tasks. Any internal entity in Cyclos (e.g. user, address, payment, authorization, reference etc.) can be accessed by the scripts. When developing custom operations it is likely that you want to store and use new values/entities. It is possible to create specific record types and custom fields and make them available to the scripts. The record types can be of the type 'system' or 'user' depending on the requirements.

On this page you will find links with documentation about the available extensions and examples. In the future we will add a repository of useful scripts. If you wrote a script that could serve other projects we will be happy to add it. Please post it on our [Forum](#) or send it to info@cyclos.org.

Global admins can write and store scripts directly within Cyclos. Each script 'type' has its own functions which have to be implemented. A network admin can chose from the available scripts and bind them to Cyclos operations and events, or to new operations. The variables used in the scripts can be managed outside the scripts in the extensions self (by the network admin). This avoids the need for a global admin having to modify a script every time a new or different input value is required. It is also possible to define additional information and confirmation texts that can be displayed to the user when a custom operation is initiated or submitted.

The scripting language currently supported is [Groovy](#). It offers a powerful scripting language that is very similar to Java, with a close to zero learning curve for Java developers. It is possible to write scripts that will be available in a shared script library, so that other scripts within the same context can make use of it. All scripts are compiled to Java bytecode which makes them highly performatic. Currently Cyclos requires Java 7 or above. Be aware that JDK 7 versions ranging from 7u21 to 7u55 have bugs are buggy with regards to invokedynamic (see [information here](#)). If you plan to use Cyclos scripting, make sure you either use 7u56+ or JDK 8

Variables bound to all scripts

When running, scripts have a set of bindings, that is, available top-level variables. At runtime, the bindings will vary according to the script type and context. For example, each extension point type has one or more specific bindings. On all cases, however, the following variables are bound:

- `scriptParameters`: In the script details page, or in every every page where a script is chosen to be used (for example, in the extension point or custom operation details page) there will be a textarea where parameters may be added to the script. They allow scripts to be reused in different contexts, just with different parameters. The text is parsed as [Java Properties](#), and the format is [described here](#). The library parameters are included first (if any), then the own script parameters (if any), then the specific page parameters. This allows overriding parameters at more specific levels.
- `scriptHelper`: An instance of [org.cyclos.impl.system.ScriptHelper](#). It contains some useful methods, like:
 - `wrap(object[, customFields])`: wraps the given object in a Map, with some custom characteristics:
 - If the wrapped object contains custom fields, it will allow getting / setting custom field values using the internal name
 - Values will be automatically converted to the expected destination type
 - If a list of custom fields are passed, then they are considered. If not, will attempt to read the current fields for the object, which might not always be available (for example, when creating a new record) or even no longer active (for example, when the product of an user just removed a field, and the value is still there)
 - Example:

```
def bean = scriptHelper.wrap(user)
def gender = bean.gender
// gender will be a org.cyclos.entities.system.CustomFieldPossibleValue
// if gender is an enumerated field
def date = bean.customDate
// date will be a java.util.Date if customDate is a date field
def relatedUser = bean.relatedUser
// relatedUser will be an org.cyclos.entities.users.User
// if relatedUser is linked entity field of type user
```

- `bean(class)`: returns a bean by type. The class reference needs to be passed.
- `addOnCommit(runnable)`, `addOnRollback(runnable)`: Adds callbacks to be executed after the main database transaction ends, either successfully or with failure. Be aware that those callbacks will be invoked outside any transaction scope within Cyclos, so things like `scriptHelper.sessionData.loggedUser` won't work (because it requires retrieving the User object from the database). However, it is more efficient, as no new database access needs to be done. This is mostly useful to notify an external application that some data has been persisted in Cyclos (after we're 100% sure that the data is persistent). Keep in mind

that there is a (very) small chance that the main transaction is committed / rolled back but then the server crashes, and the callback weren't yet called. So, when synchronizing with external systems, it is always wise to do some form of timeout / recovery mechanism.

- `addOnCommitTransactional(runnable)`, `addOnRollbackTransactional(runnable)`: Same as the non-transactional counterparts, but they are executed inside a new transaction in Cyclos
- `sessionData`: The currently bound [org.cyclos.impl.access.SessionData](#).
- `formatter`: A [org.cyclos.impl.utils.formatting.FormatterImpl](#).
- `Services and Handlers`: All `*ServiceLocal` and `*Handler` objects are bound via simple names, starting with lowercase characters. Services are bound as 'nameService' and handlers as 'nameHandler'. For example, [org.cyclos.impl.users.UserServiceLocal](#) is bound as `userService`, and [org.cyclos.impl.access.ConfigurationHandler](#) is bound as `configurationHandler`.

3.2. Script types

Library

Libraries are scripts which are included by other scripts, in order to reuse code, and are never used directly by other functionality in Cyclos.

Each script (including other libraries) can have any number of libraries as dependencies. However circular dependencies between libraries (for example, A depends on B, which depends on C, which depends on A) are forbidden (validated when saving a library).

The order in which the code on libraries is included in the final code respects the dependencies, but doesn't guarantee ordering between libraries in the same level. For example, if there are both C and B libraries which depend on A, it is guaranteed that A is included before B and C, but either B or C could be included right after A. So, in the example, your code shouldn't rely that B comes before C. In this case, the library C should depend on B to force the A, B, C order.

Contrary to other script types, libraries don't have bound variables per se: the bindings will be the same as the script including the library.

Also, as libraries are just included in other scripts, no direct examples are provided here. The provided example [scripting solutions](#), however, use libraries.

Custom field validation

These scripts are used to validate a custom field value. The field can be of any type (users, advertisements, user records, transactions and so on). The script code has the following variables bound (besides the [default bindings](#))

- object: The DTO which holds the custom field values. May be an instance of:
 - [org.cyclos.model.users.users.UserDTO](#)
 - [org.cyclos.model.marketplace.advertisements.BasicAdDTO](#)
 - [org.cyclos.model.users.records.UserRecordDTO](#)
 - [org.cyclos.model.banking.transactions.PerformTransactionDTO](#)
 - [org.cyclos.model.contentmanagement.documents.ProcessDynamicDocumentDTO](#)
 - [org.cyclos.model.system.operations.RunCustomOperationDTO](#)
- field: The [org.cyclos.entities.system.CustomField](#).
- value: The actual custom field value. Depends on the custom field type. May be one of:
 - String (for single line text, multi line text, rich text or url types)
 - Boolean (for boolean type)
 - Integer (for integer type)
 - BigDecimal (for decimal type)
 - [org.cyclos.entities.system.CustomFieldPossibleValue](#) (for single selection type)
 - [org.cyclos.entities.system.CustomFieldPossibleValue](#) (for multiple selection type)
 - [org.cyclos.model.system.fields.DynamicFieldValueVO](#) (for dynamic selection type)
 - [org.cyclos.entities.users.User](#) (for user type)

The script should return one of the following:

- A boolean, indicates that the value is either valid / invalid. When invalid, the general "<Field name> is invalid" error will be displayed;
- A string, means the field is invalid, and the string is the error message. To concatenate the field name directly, use the {0} placeholder, like: "{0} has an unexpected value";
- Any other result will be considered valid.

Examples

CPF Validation

In Brazil, people are identified by a number called CPF (Cadastro de Pessoas Fisicas). It has 2 verifying digits, which have a known formula to calculate. Here's the example for validating it in Cyclos:

```
import static java.lang.Integer.parseInt

def boolean validateCPF(String cpf) {
    // Strip non-numeric chars
    cpf = cpf.replaceAll("[^0-9]", "")
```

```

// Obvious checks: needs to be 11 digits, and not all be the same digit
if (cpf.length() != 11 || cpf.toSet().size() == 1) {
    return false
}

int add = 0
// Check for verifier digit 1
for (int i = 0; i < 9; i++) add += parseInt(cpf[i]) * (10 - i)
int rev = 11 - (add % 11)
if (rev == 10 || rev == 11) rev = 0
if (rev != parseInt(cpf[9])) return false

add = 0;
// Check for verifier digit 2
for (int i = 0; i < 10; i++) add += parseInt(cpf[i]) * (11 - i)
rev = 11 - (add % 11)
if (rev == 10 || rev == 11) rev = 0
if (rev != parseInt(cpf[10])) return false

return true
}

return validateCPF(value)

```

Dynamic custom field handling

These scripts are used to generate the possible values for custom fields of type 'dynamic selection'. Each possible value is an instance of [org.cyclos.model.system.fields.DynamicFieldValueVO](#). The field can be of any type (users, advertisements, user records, transactions and so on).

The script code has the following variables bound (besides the [default bindings](#)):

- field: The [org.cyclos.entities.system.CustomField](#)

Also, depending on the custom field nature, there are the following additional bindings:

User (profile) fields:

- user: The [org.cyclos.entities.users.User](#). Even when registering an user, will always have the 'group' property set with the [org.cyclos.entities.users.Group](#) instance.

Advertisement fields:

- ad: The [org.cyclos.entities.marketplace.BasicAd](#). Even on inserts, is guaranteed to have the 'owner' property set with the [org.cyclos.entities.users.User](#) instance.

Record fields:

- record: The [org.cyclos.entities.marketplace.BasicAd](#). Even on inserts, is guaranteed to have the 'owner' property set with the [org.cyclos.entities.users.User](#) instance.

Transaction fields:

- paymentType: The transaction type, as [org.cyclos.entities.banking.PaymentTransferType](#)
- fromOwner: The [org.cyclos.model.banking.accounts.AccountOwner](#) performing the payment (either [org.cyclos.model.banking.accounts.SystemAccountOwner](#) or [org.cyclos.entities.users.User](#))
- toOwner: The [org.cyclos.model.banking.accounts.AccountOwner](#) receiving the payment (either [org.cyclos.model.banking.accounts.SystemAccountOwner](#) or [org.cyclos.entities.users.User](#))

Custom operation fields:

- customOperation: The [org.cyclos.entities.system.CustomOperation](#).
- user: The [org.cyclos.entities.users.User](#). Only present if the custom operation's scope is user.

Dynamic document fields:

- document: The [org.cyclos.entities.contentmanagement.DynamicDocument](#).

In all cases, the script must return either one or a collection of:

- List of array of Strings: In this case, each element will have only values, and the corresponding labels will be the same values.
- [org.cyclos.model.system.fields.DynamicFieldValueVO](#) (or compatible object / Map): The dynamic field value, containing a value (the internal value) and a label (the display value). The value must be not blank, or an error will be raised. If the label is blank, will show the same text as the value. Also, the first dynamic value with 'defaultValue' set to true will show up by default in the form.

Examples

User profile field – values depending on the user group

This examples returns distinct values according to the user group. It should be used by an user custom field (also called profile fields).

```
import org.cyclos.model.system.fields.DynamicFieldValueVO

def values = []
// Common values
values << new DynamicFieldValueVO("common1", "Common value 1")
values << new DynamicFieldValueVO("common2", "Common value 2")
values << new DynamicFieldValueVO("common3", "Common value 3")
if (user.group.internalName == "business") {
    // Values only available for businesses
    values << new DynamicFieldValueVO("business1", "Business value 1")
    values << new DynamicFieldValueVO("business2", "Business value 2")
}
```

```

    values << new DynamicFieldValueVO("business3", "Business value 3")
  } else if (user.group.internalName == "consumer") {
    // Values only available for consumers
    values << new DynamicFieldValueVO("consumer1", "Consumer value 1")
    values << new DynamicFieldValueVO("consumer2", "Consumer value 2")
    values << new DynamicFieldValueVO("consumer3", "Consumer value 3")
  }
  return values

```

Transfer fee calculation

These scripts are used to calculate the amount of a transfer fee (a fee triggered by another transfer). The script code has the following variables bound (besides the [default bindings](#)):

- fee: The [org.cyclos.entities.banking.TransferFee](#)
- transfer: The [org.cyclos.entities.banking.Transfer](#) which triggered the fee.

The script should return a number, which will be rounded to the currency's decimal digits. If null or zero is returned, the fee is not charged.

Examples

Charging a fee according to an user profile field

This example allows choosing a distinct fee amount based on a profile field of the paying user. It is assumed a custom field of type single selection with the internal name rank. It should have 3 possible values, with internal names bronze, silver and gold. The script then chooses a different percentage according to the user rank.

```

if (transfer.fromSystem) {
  // Only charge users
  return 0
}

// Depending on an user custom field, we'll pick the fee amount
def percentages = [bronze: 0.07, silver: 0.05, gold: 0.02]
def from = scriptHelper.wrap(transfer.fromOwner)
def rank = from.rank?.internalName ?: "bronze"
def percentage = percentages[rank]
return transfer.amount * percentage

```

Account fee calculation

These scripts are used to calculate the amount of an account fee (a fee which is charged periodically or manually over many accounts, according to the 'charged account fees' setting in member products). The script code has the following variables bound (besides the [default bindings](#)):

- fee: The [org.cyclos.entities.banking.AccountFee](#)

- account: The [org.cyclos.entities.banking.UserAccount](#)
- executionDate: The expected fee charge date (of type [java.util.Date](#)). When scheduled, charges usually happen a bit after the exact expected date. For manual account fees, this will be the time the fee has started.

The script should return a number, which will be rounded to the currency's decimal digits. If null or zero is returned, the fee is not charged.

Examples

Charge a different amount according to the user rank

This example allows choosing a distinct account fee amount based on a profile field of the paying user. It is assumed a custom field of type single selection with the internal name rank. It should have 3 possible values, with internal names bronze, silver and gold.

```
// Depending on an user custom field, we'll pick the fee amount
def amounts = [bronze: 10, silver: 7, gold: 5]
def user = scriptHelper.wrap(account.owner)
def rank = user.rank?.internalName ?: "bronze"
return amounts [rank]
```

Password handling

These scripts are used to check passwords. In order to use them, the password type's password mode needs to be "Script". The script code has the following variables bound (besides the [default bindings](#)):

- user: The [org.cyclos.entities.users.BasicUser](#) whose password is being checked
- passwordType: The [org.cyclos.entities.access.PasswordType](#) being checked.
- password: The password value being checked (string).

The script should return a boolean, indicating whether the password is ok or not.

Examples

Matching passwords to the script parameters

This is a very simple example, which checks for passwords according to the script parameters. The parameters can be set either in the script itself or in the password type. This example is very insecure, and shouldn't be used in production. Normally, scripts to check passwords would connect to third party applications, but this is just a very basic example.

```
// Just read the password value from the script parameters
return scriptParameters[user.username] == password
```

Extension points

These scripts are used on extension points (user, user record, transfer, ...), and are attached to specific events (create, update, remove, chargeback, ...). The extension point scripts have 2 functions:

- The data has already been validated, but not saved yet. In this function, we know that the data entered by users is valid, but the main event has not been saved yet.
- The data has been saved, but not committed to database yet. For example, if the script code throws an Exception, the database transaction will be rolled-back, and no data will be persisted.

Here are some example scenarios for performing custom logic, or integrating Cyclos with external systems using extension points:

- limit. When an user is performing a payment, an extension point of type transaction could be used, in the function invoked after validation, to check the current balance. If the balance is not enough for the payment and the user has credit limit, a payment from a system account could be done automatically to the user, completing the amount for the payment.
- A [XA transaction](#) could be done with an external system by creating data in the external database in the function which runs after validating, then preparing the commit in the function after the data is saved, and finally registering both a commit and a rollback listener (see the ScriptHelper in [default bindings](#)) to either commit or rollback the prepared transaction.
- It is also possible to 'bind' Cyclos entities with extension points. For example a payment could create a new user record of a specific type and set some values in the record. When a user record value is changed this could trigger another action, for example changing the (bookkeeping) status of a payment.
- A simple notification of performed payments could be implemented by registering a commit listener (see the [ScriptHelper](#) in [default bindings](#)) to implement the notification.
- The profile information of an user needs to be mirrored in an external system. In this case, an user extension point, with the create / update events can be used to send this information. Additional information on addresses and phones can use the same mechanism (they are different extension points). Finally, a change status event for users, to the status [REMOVED](#) indicates that the user has been removed.
- There could be payment custom fields which are not filled-in by users when performing payments, but by extension points of type transaction. Payment custom fields may be configured to not show up in the form, only automatically via extension points.
- An extension point on a new Cyclos advertisement could publish the advertisement as well in an third party system.

These are just some examples. There are many possible uses for the extension points. In the future we will publish usefull extension points at this site.

All extension points have the following additional variables bound to its execution:

- extensionPoint: The [org.cyclos.entities.system.ExtensionPoint](#)
- event: The [org.cyclos.model.system.extensionpoints.ExtensionPointEvent](#). The specific implementation depends on the extension point type.
- context: A java.util.Map<String, Object> which can be used to store attributes to be shared between, for example, the script which runs after the data is validaded, and the one which runs after the data is saved

The following types of extension points exist:

User extension point

Extension points which monitor events on users. Additional bindings:

- user: The [org.cyclos.entities.users.User](#)

Events:

- create: An user is being registered. IMPORTANT: When e-mail validation is enabled, the user will be pending until confirming the e-mail. If you have e-mail confirmation enabled, this event might not be what you need, but activate instead.
- activate: An user is being activated for the first time. For example, if e-mail validation is enabled, after the user confirming the e-mail address this event will be triggered. However, the initial status for users (set in group) might be, for example, disabled. In that case, only when the user is first activated this event will be triggered.
- update: An user profile (name, username, e-mail or custom fields) is being edited. Additional bindings:
 - currentCopy: A detached copy of the user being edited, as [org.cyclos.entities.users.User](#)
- changeGroup: The user's group is being changed.
 - oldGroup: The current [org.cyclos.entities.users.Group](#)
 - newGroup: The new [org.cyclos.entities.users.Group](#)
 - comments: The comments, as provided by the administrator when changing the group, as string.
- changeStatus: The user's status is being changed. Argument Map:
 - oldStatus: The current [org.cyclos.model.users.users.UserStatus](#)
 - newStatus: The new [org.cyclos.model.users.users.UserStatus](#)

- comments: The comments, as provided by the administrator when changing the status, as string.

Address extension point

Extension points which monitor events on addresses. Additional bindings:

- address: The [org.cyclos.entities.users.UserAddress](#)

Events:

- create: An address is being created.
- update: An address is being updated. Additional bindings:
 - currentCopy: A detached copy of the address being edited, as [org.cyclos.entities.users.UserAddress](#)
- delete: An address is being deleted.

Phone extension point

Extension points which monitor events on user phones. Additional bindings:

- phone: The [org.cyclos.entities.users.Phone](#)

Events:

- create: A phone is being created.
- update: A phone is being updated. Additional bindings:
 - currentCopy: A detached copy of the phone being edited, as [org.cyclos.entities.users.Phone](#)
- delete: A phone is being deleted.

User record extension point

Extension points which monitor events on user records. Additional bindings:

- userRecord: The [org.cyclos.entities.users.UserRecord](#)

Events:

- create: An user record is being created.
- update: An user record is being created. Additional bindings:
 - currentCopy: A detached copy of the user record being edited, as [org.cyclos.entities.users.UserRecord](#)
- delete: An user record is being created.

Advertisement extension point

Extension points which monitor events on advertisements. Additional bindings:

- ad: The [org.cyclos.entities.marketplace.BasicAd](#)

Events:

- create: An advertisement is being created.
- update: An advertisement is being updated. Additional bindings:
 - currentCopy: An advertisement is being updated. Additional bindings: [org.cyclos.entities.marketplace.BasicAd](#)
- delete: An advertisement is being deleted.

Transaction extension point

Extension points which monitor events on performed transactions.

The following additional bindings are available for both preview and confirm events:

- performTransaction: The [org.cyclos.model.banking.transactions.PerformTransactionDTO](#)
- paymentType: The transaction type, as [org.cyclos.entities.banking.PaymentTransferType](#)
- fromOwner: The [org.cyclos.model.banking.accounts.AccountOwner](#) performing the payment (either [org.cyclos.model.banking.accounts.SystemAccountOwner](#) or [org.cyclos.entities.users.User](#))
- toOwner: The [org.cyclos.model.banking.accounts.AccountOwner](#) receiving the payment (either [org.cyclos.model.banking.accounts.SystemAccountOwner](#) or [org.cyclos.entities.users.User](#))
- authorizationLevel: The [org.cyclos.entities.banking.AuthorizationLevel](#) of the transaction, if it would be pending authorization, or null if already processed. For the confirm event, will only be available in the script which runs after save.

Events:

- preview: The user is previewing the transaction. Note that, as there is nothing really being saved, both scripts will run at the same time, i.e., there's no phase 'after validate' and 'after save'. Additional bindings:
 - preview: The [org.cyclos.model.banking.transactions.TransactionPreviewVO](#)
- confirm: The transaction has been confirmed, that is, is being performed. Additional bindings:
 - transaction: The [org.cyclos.entities.banking.Transaction](#). Only available for the script which runs after save.
- change status: A scheduled payment status has changed. Additional bindings:

- transaction: The [org.cyclos.entities.banking.ScheduledPayment](#).
- oldStatus: The previous status, as [org.cyclos.model.banking.transactions.ScheduledPaymentStatus](#).
- newStatus: The new status, as [org.cyclos.model.banking.transactions.ScheduledPaymentStatus](#).
- change installment status: A scheduled payment installment status has changed. Additional bindings:
 - installment: The [org.cyclos.entities.banking.ScheduledPaymentInstallment](#).
 - oldStatus: The previous status, as [org.cyclos.model.banking.transactions.ScheduledPaymentInstallmentStatus](#).
 - newStatus: The new status, as [org.cyclos.model.banking.transactions.ScheduledPaymentInstallmentStatus](#).

Transaction authorization extension point

Extension points which monitor transaction authorization actions. Additional bindings:

- transaction: The [org.cyclos.entities.banking.Transaction](#)
- currentLevel: The current [org.cyclos.entities.banking.AuthorizationLevel](#)
- comment: The comment entered by the user performing the action, as string

Events:

- authorize: The transaction is being authorized. Be careful: there might be more authorization levels which need to be authorized before the transaction is finally processed. Additional bindings:
 - nextLevel: The next current [org.cyclos.entities.banking.AuthorizationLevel](#). If the transfer should be processed after the current authorization is saved, this value will be null.
- deny: The transaction is being denied by the authorizer.
- cancel: The transaction is being canceled by the performed.

Transfer extension point

Argument Map (common for all events):

- transfer: The transfer being affected.

Events:

- create: A transfer is being created.
- chargeback: A transfer is being charged-back. Additional bindings:

- chargeback: The [org.cyclos.entities.banking.Chargeback](#). Only available in the script which runs after the data is saved.
- changeStatus: The transfer is being set to a new status. Additional bindings:
 - flow: The [org.cyclos.entities.banking.TransferStatusFlow](#) of the status being changed
 - oldStatus: The current [org.cyclos.entities.banking.TransferStatus](#)
 - newStatus: The new [org.cyclos.entities.banking.TransferStatus](#)
 - comments: The comments, as provided by the administrator when changing the status, as string.

Examples

Granting extra credit (on demand) before payments

This example allows, with a custom profile field, to define an extra credit limit the user can use on demand. When performing a payment, if the available balance is not enough, a payment is performed from a system account to the user, up to the limit specified in that profile field. Once the payment is done, the profile field is subtracted. This example expects the system account to have the internal name debitAccount, and it should have a payment transfer type to the user account. That payment transfer type should have the internal name extraCredit. Finally, the custom profile field needs to have the internal name availableCredit, and needs to be of type decimal, and enabled for the user. Then create an extension point of type Transaction, enabled and for the confirm event.

```
import org.cyclos.entities.banking.Account
import org.cyclos.entities.banking.PaymentTransferType
import org.cyclos.entities.banking.SystemAccountType
import org.cyclos.model.banking.accounts.SystemAccountOwner
import org.cyclos.model.banking.transactions.PerformPaymentDTO
import org.cyclos.model.banking.transfertypes.TransferTypeVO

// Only process direct payments. Scheduled payments are skipped
if (!(performTransaction instanceof PerformPaymentDTO)) {
  return
}

// Get the available credit as a profile field
def payer = scriptHelper.wrap(fromOwner)
BigDecimal availableCredit = payer.availableCredit?.abs()
if (availableCredit == null || availableCredit < 0.01) {
  // Nothing to do - no available credit
  return
}

// Get the account and balance
Account account = accountService.load(fromOwner, paymentType.from)
BigDecimal availableBalance = accountService.getAvailableBalance(account, null)
BigDecimal needs = performTransaction.amount - availableBalance
if (needs > 0 && needs < availableCredit) {
```

```

// Needs some extra credit, and has it available - make a payment from system
// Find the system account and payment type
SystemAccountType systemAccountType = entityManagerHandler.find(
    SystemAccountType, "debitAccount")
PaymentTransferType paymentType = entityManagerHandler.find(
    PaymentTransferType, "extraCredit", systemAccountType)
PerformPaymentDTO credit = new PerformPaymentDTO()
credit.from = SystemAccountOwner.instance()
credit.to = fromOwner
credit.type = new TransferTypeVO(paymentType.id)
credit.amount = needs
paymentService.perform(credit)
// Now there should be enough credit to perform the payment

// Update the user available credit
payer.availableCredit -= needs
}

```

Custom operations

These scripts are invoked when an user runs a custom operation. A custom operation is configured to return different data types, and the script must behave accordingly (see [System - Operations](#) for more details).

Custom operations can have different scopes:

- System: Those are executed by administrators (with granted permissions), directly from the main menu
- User: Custom operations which are related to an user, and can either be executed by the own user (with granted permissions), from the main menu or run by administrator or brokers (also, with granted permissions) when viewing the user profile. In both cases, the custom operation needs to be enabled to users via member products. For example, there might be operations which applies only to businesses, not consumers, and even administrators with permission to run them shouldn't be able to run them over consumers. It is enforced that administrators / brokers will only be able to run custom operations over users they manage.

Bound variables:

- customOperation: The [org.cyclos.entities.system.CustomOperation](#)
- user: The [org.cyclos.entities.users.User](#). Only present if the custom operation's scope is user.
- inputFile: The [org.cyclos.model.utils.FileInfo](#). Only present if the custom operation is configured to accept a file upload, and if a file was selected.
- formParameters: A `java.util.Map<String, Object>`, keyed by the form field internal name. The value depends on the field type. Could be a string, a number, a

boolean, a date, a [org.cyclos.entities.system.CustomFieldPossibleValue](#) or a collection of [org.cyclos.entities.system.CustomFieldPossibleValue](#).

- **currentPage:** An integer indicating the current page, when getting paged results. Starts with zero. Only available if the result type is result page.
- **pageSize:** An integer indicating the requested page size when getting paged results. Only available if the result type is result page.
- **returnUrl:** Only if the custom operation return type is external redirect. Contains the url (as string) which Cyclos expects the external site to redirect the user after the operation completes.
- **request:** The [org.cyclos.model.utils.RequestInfo](#). Only if the custom operation return type is external redirect. Contains the information about the current request, so the script function which handles the callback can identify the context to complete the process.

Return value: The required return value depends on the custom operation result type:

- **Notification:** The script must return a string which will be shown as a notification to the user. If the string starts with the following special prefixes: [INFO], [WARN] or [ERROR], those prefixes are removed from the notification and the notification style for the corresponding types is chosen (for example, shows a yellow notification with a warning icon when [WARN]). If no such prefixes, assumes an information notification.
- **Plain text:** The script should return a string, which is interpreted as plain text. The text is shown in the page body and can be printed by the user.
- **Rich text:** The script should return a string, which is interpreted as HTML text. The text is shown in the page body and can be printed by the user.
- **File download:** The script should return an instance of [org.cyclos.model.utils.FileInfo](#), or an object or Map with the same properties. The properties are:
 - **content:** Required. The file content. May be an InputStream, a File or a String (containing the file content itself).
 - **contentType:** Required. The MIME type, such as text/plain, text/html, image/jpeg, application/pdf, etc.
 - **name:** Optional file name, which will be used by browsers to suggest the file name to save.
 - **length:** Optional file length, which may aid browsers to monitor the progress of file downloads.
- **Page results:** The script should return an instance of [org.cyclos.model.system.operations.CustomOperationPageResult](#), or an object or Map with the same properties. The properties are:
 - **headers:** Required. A list containing the column headers.

- results: Optional. A list of lists, containing the table cells. The inner lists should have the same size as the headers.
- totalCount: Optional. The total count of records. For example, if all matching records are 1000, but the page size is 20, the results would normally have 20 records, and the total count would be 1000. This allows paginating through the results. When not returned, the results won't be paginable.
- External redirect: The first script function must return a string, representing a valid URL. That URL will be used to redirect the user to the external site. The second script function (called after the external site redirects the user back to Cyclos) must return a string, which will be shown as a notification to the user (with support for the same prefixes as the Notification result type above). As the return url will make the Cyclos application have no context (which is maintained as JavaScript in the browser page), the user will see the home page with that notification.

Examples

Returning a string (notification / rich / plain text) and external redirect

Examples of a custom operation which returning a text (a notification in that case) can be found in the [loan solution example](#). An example of an external redirect is the [PayPal integration example](#).

Returning a file

This is an example where the user selects a document to download. It is assumed that the custom operation has a form field of type single selection with internal name file. Then, each possible value should have the internal name corresponding to a pdf file in a given folder. Once the user chooses the file, it is downloaded.

```
import org.cyclos.model.ValidationException

// Assume there is a pdf file for each possible value of the field
String fileName = formParameters.file.internalName
String dir = scriptParameters.dir ?: "/usr/share/documents"
File file = new File(dir, "${fileName}.pdf")
if (!file.exists()) {
    throw new ValidationException("File not found")
}
return [
    content: file,
    contentType: "application/pdf",
    name: file.name,
    length: file.length(),
    lastModified: file.lastModified()
]
```

Returning a result list

In this example, an user can see the other users he has traded with (either performed or received payments). The custom operation needs to have user scope and result type list.

```
import org.cyclos.entities.banking.QTransaction
import org.cyclos.entities.users.QUser

import com.mysema.query.types.QList

QTransaction t = QTransaction.transaction
QUser u = QUser.user
List<Object> results = entityManagerHandler
    .from(t)
    .innerJoin(u)
    .on(t.fromUser().id.when(user.id)
        .then(t.toUser().id)
        .otherwise(t.fromUser().id)
        .eq(u.id))
    .where(t.fromUser.eq(user).or(t.toUser.eq(user)))
    .groupBy(u.username, u.name)
    .orderBy(u.username.asc())
    .list(new QList(u.username, u.name, u.id.count()))
return [
    headers: [
        "Login name",
        "Full name",
        "Transactions"
    ],
    results: results
]
```

Custom scheduled tasks

These scripts are called periodically by custom scheduled tasks. See [System - Scheduled tasks](#) for more details.

The bound variables are:

- scheduledTask: The [org.cyclos.entities.system.CustomScheduledTask](#) being executed
- log: The [org.cyclos.entities.system.CustomScheduledTaskLog](#) for this execution

Return value:

- The script should return a string, which is logged as message, and can be viewed on the application

Examples

Periodically update a static HTML page

In this example, every time the scheduled task runs, a static HTML file is updated. In the file, it is written the total number of users and the balances of each system account.

```
import groovy.xml.MarkupBuilder

import org.cyclos.entities.users.QUser
import org.cyclos.model.banking.accounts.AccountSummaryVO
import org.cyclos.model.banking.accounts.SystemAccountOwner
import org.cyclos.model.users.groups.BasicGroupNature
import org.cyclos.model.users.users.UserStatus

def now = new Date()

QUser u = QUser.user
int users = entityManagerHandler
    .from(u)
    .where(u.status.ne(UserStatus.REMOVED),
        u.group.nature.eq(BasicGroupNature.USER_GROUP))
    .count()

List<AccountSummaryVO> accounts = accountService.
    getAccountsSummary(SystemAccountOwner.instance(), null)

File out = new File("/var/www/html/summary.html")

def sessionData = binding.sessionData
def formatter = binding.formatter
MarkupBuilder builder = new MarkupBuilder(new FileWriter(out))
builder.html {
    head {
        title "${sessionData.configuration.applicationName} summary"
        meta charset: "UTF-8"
    }
    body {
        p {
            b "Total users"
            span ": ${users}"
        }
        accounts.each { a ->
            p {
                b a.name
                span " balance: ${formatter.format(a.balance)}"
            }
        }
        br()
        br()
        br()
        p style: "font-size: small", "Last updated: ${formatter.format(now)}"
    }
}
return "File ${out.absolutePath} updated"
```

Custom SMS operations

These scripts are invoked when an user executes a custom sms operation, as configured in the sms channel in the configuration. The function should implement the logic for that operation.

Bound variables:

- configuration: The [org.cyclos.entities.system.CustomSmsOperationConfiguration](#). With it, it is possible to navigate up to the [org.cyclos.entities.system.SmsChannelConfiguration](#).
- phone: The [org.cyclos.entities.users.MobilePhone](#)
- sms: The [org.cyclos.impl.utils.sms.InboundSmsData](#), containing the operation alias and the operation parameters
- parameterProcessor: The [org.cyclos.impl.utils.sms.SmsParameterProcessor](#), which is a helper class to obtain operation parameters as specific data types

There are no expected return values for this script.

Examples

Pay taxi with an SMS message

In this example SMS operation, users can pay taxi drivers via SMS. It expects a single transfer type for the SMS operations channel to be enabled, and the user performing the operation needs to have permission to perform that payment. Besides, a custom profile field with internal name `taxid` of type single line text, and marked as unique needs to be enabled for the product of taxi owners. Then, in the configuration details, in the channels tab, enable SMS operations and add an operation with alias `taxi` and the selected script. Then, customers can perform the payment by sending an sms in the format: `taxi <taxi id> <amount>`

```
import org.cyclos.model.ValidationException
import org.cyclos.model.banking.TransferException
import org.cyclos.model.banking.transactions.PerformPaymentDTO
import org.cyclos.model.banking.transactions.PerformPaymentData
import org.cyclos.model.messaging.sms.OutboundSmsType
import org.cyclos.model.system.fields.CustomFieldVO
import org.cyclos.model.users.fields.UserCustomFieldValueVO
import org.cyclos.model.users.users.UserLocatorVO

// Read the parameters
String taxiId = parameterProcessor.nextString("taxiId")
BigDecimal amount = parameterProcessor.nextDecimal("amount")

// Find the user by taxi id
def locator = new UserLocatorVO()
locator.fieldValue = new UserCustomFieldValueVO([
    field: new CustomFieldVO([internalName: "taxiId"]),
    stringValue: taxiId
])
```

```

// Find the payment type
PerformPaymentData data = transactionService.getPaymentData(
    phone.user, locator)
if (data.paymentTypes?.size == 0) {
    throw new ValidationException("No possible payment types")
}

// Perform the payment
def pmt = new PerformPaymentDTO()
pmt.amount = amount
pmt.from = data.from
pmt.to = data.to
pmt.type = data.paymentTypes[0]
try {
    vo = paymentService.perform(pmt)
    outboundSmsHandler.send(phone,
        "The payment was successful",
        OutboundSmsType.SMS_OPERATION_RESPONSE)
    // Also notify the taxi, for example, by connecting to the
    // taxi company system, which notifies the taxi driver...
} catch (TransferException e) {
    outboundSmsHandler.send(phone,
        "The payment couldn't be performed",
        OutboundSmsType.SMS_OPERATION_RESPONSE)
}

```

Outbound SMS handling

These scripts are invoked to send SMS messages. By default, Cyclos connects to gateways via HTTP POST / GET, which can be set in the configuration. However, the sending can be customized (or totally replaced) via a script. As in most cases the custom sending just wants to customize some aspects of the sending, not all, it is possible that the script just creates a subclass of [org.cyclos.impl.utils.sms.GatewaySmsSender](#), customizing some aspects of it (for example, by overriding the buildRequest method and adding some headers, or the resolveVariables method to have some additional variables which can be sent in the POST body).

Bound variables:

- configuration: The [org.cyclos.impl.system.ConfigurationAccessor](#)
- phone: The [org.cyclos.entities.users.MobilePhone](#). May be null, if is a reply to an unregistered user.
- phoneNumber: The international phone number, in the [E.164](#) standard string. Never null.
- message: The SMS message to send

Return value:

- An [org.cyclos.model.messaging.sms.OutboundSmsStatus](#) enum value
- A string which represents the exact name of an [OutboundSmsStatus](#) enum value

- If null is returned, it is assumed a sending success

Examples

Sending SMS requests as XML

This example posts the SMS message as XML to the gateway, and awaits the response before returning the status:

```
import static groovyx.net.http.ContentType.*
import static groovyx.net.http.Method.*
import groovyx.net.http.HTTPBuilder

import java.util.concurrent.CountDownLatch

import org.cyclos.model.messaging.sms.OutboundSmsStatus

// Read the gateway URL from the configuration
def url = configuration.outboundSmsConfiguration.gatewayUrl

// Send the POST request
def http = new HTTPBuilder(url)
CountDownLatch latch = new CountDownLatch(1)
def error = false
http.request(POST, XML) {
    // Pass the body as a closure - parsed as XML
    body = {
        "sms-message" {
            "destination-phone" phoneNumber
            text message
        }
    }

    response.success = { resp, xml ->
        latch.countDown()
    }

    response.failure = { resp ->
        error = true
        latch.countDown()
    }
}

//Await for the response
latch.await()
return error ? OutboundSmsStatus.SUCCESS : OutboundSmsStatus.UNKNOWN_ERROR
```

Inbound SMS handling

These scripts are invoked when a gateway sends SMS messages to Cyclos. There are two functions in this script: one to generate the gateway response and another one to resolve basic SMS data from an inbound HTTP request. Both functions are optional, defaulting to the normal behavior (when not using a script).

The common bound variables are:

- configuration: The [org.cyclos.impl.system.ConfigurationAccessor](#) for the inbound SMS
- channelConfiguration: The [org.cyclos.entities.system.SmsChannelConfiguration](#)

The functions are:

- Resolve basic SMS data: Function used to read an inbound sms request and return an object containing the phone number, the SMS message and the splitted SMS message into parts. Only the phone number and SMS message are required. If the message parts are empty, it will be assumed the message will be split by spaces.
 - Bound variables:
 - request: The [org.cyclos.model.utils.RequestInfo](#)
 - Return value:
 - An [org.cyclos.impl.utils.sms.InboundSmsBasicData](#) instance, or a compatible Object or Map
 - If null is returned, falls back to the default processing
- Generate gateway response: Function used to determine the HTTP status code, headers and body to be returned to the SMS gateway. It can be called either when the bare minimum parameters – mobile phone number and sms message – were not sent by the gateway or when the gateway has sent a valid SMS. Keep in mind that if an operation has resulted in error, from a gateway perspective, the SMS was still delivered correctly, and the response should be a successful one. Maybe when the bare minimum parameters weren't send, the script could choose to return a different message. When no code is given, the default processing will be done, returning the HTTP status code 200 with "OK" in the body.
 - Bound variables:
 - request: The [org.cyclos.model.utils.RequestInfo](#) Only present if the inbound SMS was valid (there was a phone number and sms message)
 - inboundSmsData: The [org.cyclos.impl.utils.sms.InboundSmsData](#), which contains the operation alias and parameters
 - inboundSms: The [org.cyclos.entities.messaging.InboundSms](#), which is a log of the incoming message
 - Return value:
 - An [org.cyclos.model.utils.ResponseInfo](#) instance, or a compatible Object or Map
 - If null is returned, falls back to the default processing

Examples

Receiving a SMS with a custom format

This example reads the phone number from a request header, and the message from the request body:

```
import org.apache.commons.io.IOUtils
import org.cyclos.impl.utils.sms.InboundSmsBasicData

// Read the phone from a header, and the message from the body
InboundSmsBasicData result = new InboundSmsBasicData()
result.phoneNumber = request.headers."phone-number"
result.message = IOUtils.toString(request.body, "UTF-8")
return result
```

Transfer status handling

These scripts are used to determine to which status(es) a transfer may be set after the current status. By default, if no script is used, the possible next statuses (as configured in the transfer status details page) will be available. Using a script, however, allows using finer-grained controls. For example, an specific status could be allowed only by specific administrators, or only under special conditions (for example, checking the account balance or any other condition).

The script code has the following variables bound (besides the [default bindings](#)):

- transfer: The [org.cyclos.entities.banking.Transfer](#)
- flow: The [org.cyclos.entities.banking.TransferStatusFlow](#) of the status being affected.
- status: The [org.cyclos.entities.banking.TransferStatus](#)

The script should return one of the following:

- A single [org.cyclos.entities.banking.TransferStatus](#) (only that status is available as next);
- An array / list / iterator of [org.cyclos.entities.banking.TransferStatus](#) (all are available as next, possibly empty);
- Null – assumes the default behavior: the possible next configured in the status are assumed.

Examples

Restricting a specific status for administrators

In this example, any user can change a transfer status in a given flow. However, only administrators can set a transfer to the status with internal name finished.

```
import org.cyclos.model.access.Role
```

```
// Only administrators can set the status to finished
return status.possibleNext.findAll { st ->
    sessionData.hasRole(Role.ADMIN) || st.internalName != "finished"
}
```

3.3. Solutions using scripts

Examples of solutions that require a single script can be found directly in the specific script description page (links directly above). Solutions that need several scripts and configurations can be found in this section.

PayPal Integration

It is possible to integrate Cyclos with [PayPal](#), allowing users to buy units with their PayPal account. This is done with a custom operation which allows users to confirm the payment in PayPal and then, once the payment is confirmed, a payment from a system account is performed to the corresponding user account, automating the process of buying units. However, keep in mind the rates charged by PayPal, which vary according to some conditions.

To do so, first you'll need a PayPal premium or business account (for testing – using PayPal sandbox – any account is enough). You'll need to go to the [PayPal Developer page](#) to create an application, and get the client id and secret.

Then several configurations are required in Cyclos. Scripts can only be created as global administrators switched to a network, so it is advised to use a global admin to perform the configuration. Carefully follow each of the following steps:

Check the root URL

Make sure that the configuration for users use a correct root url. In System > System configuration > Configurations, select the configuration set for users and make sure the Main URL field points to the correct external URL. It will be used to generate the links which will be sent to PayPal redirect users back to Cyclos after confirming / canceling the operation.

Enable transaction number in currency

This can be checked under System > Currencies select the currency used for this operation, mark the Enable transfer number option and fill in the required parameters.

Create a system record type to store the client id and secret

Under System > System configuration > Record types, create a new system record type, with the following characteristics:

- Name: PayPal Authentication
- Internal name: paypalAuth

- Display style: Single form
- Editable: yes

For this record type, create the following fields:

- Client ID
 - Internal name: clientId
 - Data type: Single line text
 - Required: yes
- Client Secret
 - Internal name: clientSecret
 - Data type: Single line text
 - Required: yes
- Token
 - Internal name: token
 - Data type: Single line text
- Token expiration
 - Internal name: tokenExpiration
 - Data type: Date

Create an user record type to store each payment information

Under System > System configuration > Record types, create a new user record type, with the following characteristics:

- Name: PayPal payment
- Internal name: paypalPayment
- Display style: List
- Editable: checked

For this record type, create the following fields:

- Payment ID
 - Internal name: paymentId
 - Data type: Single line text
 - Required: no
- Amount
 - Internal name: amount

- Data type: Decimal
- Required: no
- Transaction
 - Internal name: transaction
 - Data type: Linked entity
 - Linked entity type: Transaction
 - Required: no

Create the library script

Under System > Tools > Scripts, create a new library script, with the following characteristics:

- Name: PayPal
- Type: Library
- Included libraries: none
- Parameters:

```
# Settings for the access token record type
auth.recordType = paypalAuth
auth.clientId = clientId
auth.clientSecret = clientSecret
auth.token = token
auth.tokenExpiration = tokenExpiration

# Settings for the payment record type
payment.recordType = paypalPayment
payment.paymentId = paymentId
payment.amount = amount
payment.transaction = transaction

# Settings for PayPal
mode = sandbox
currency = EUR
paymentDescription = Buy Cyclos units

# Settings for the Cyclos payment
amountMultiplier = 1
accountType = debitUnits
paymentType = paypalCredits

# Messages
error.invalidRequest = Invalid request
error.transactionNotFound = Transaction not found
error.transactionAlreadyApproved = The transaction was already approved
error.payment = There was an error while processing the payment. Please, try again.
error.notApproved = The payment was not approved
message.canceled = You have cancelled the operation.\nFeel free to start again if needed.
message.done = You have successfully completed the payment. Thank you.
```

- Script code:

```

import static groovyx.net.http.ContentType.*
import static groovyx.net.http.Method.*
import groovyx.net.http.HTTPBuilder

import java.util.concurrent.CountDownLatch

import org.apache.commons.codec.binary.Base64
import org.cyclos.entities.banking.PaymentTransferType
import org.cyclos.entities.banking.SystemAccountType
import org.cyclos.entities.users.RecordCustomField
import org.cyclos.entities.users.SystemRecord
import org.cyclos.entities.users.SystemRecordType
import org.cyclos.entities.users.User
import org.cyclos.entities.users.UserRecord
import org.cyclos.entities.users.UserRecordType
import org.cyclos.impl.banking.PaymentServiceLocal
import org.cyclos.impl.system.ScriptHelper
import org.cyclos.impl.users.RecordServiceLocal
import org.cyclos.impl.utils.IdMask
import org.cyclos.impl.utils.persistence.EntityManagerHandler
import org.cyclos.model.EntityNotFoundException
import org.cyclos.model.banking.accounts.SystemAccountOwner
import org.cyclos.model.banking.transactions.PaymentVO
import org.cyclos.model.banking.transactions.PerformPaymentDTO
import org.cyclos.model.banking.transfertypes.TransferTypeVO
import org.cyclos.model.users.records.RecordDataParams
import org.cyclos.model.users.records.UserRecordDTO

/**
 * Class used to store / retrieve the authentication information for PayPal
 * A system record type is used, with the following fields: client id (string),
 * client secret (string), access token (string) and token expiration (date)
 */
class PayPalAuth {
    String recordTypeName
    String clientIdName
    String clientSecretName
    String tokenName
    String tokenExpirationName

    SystemRecordType recordType
    SystemRecord record
    Map<String, Object> wrapped

    public PayPalAuth(Object binding) {
        def params = binding.scriptParameters
        recordTypeName = params.'auth.recordType' ?: 'paypalAuth'
        clientIdName = params.'auth.clientId' ?: 'clientId'
        clientSecretName = params.'auth.clientSecret' ?: 'clientSecret'
        tokenName = params.'auth.token' ?: 'token'
        tokenExpirationName = params.'auth.tokenExpiration' ?: 'tokenExpiration'

        // Read the record type and the parameters for field internal names
        recordType = binding.entityManagerHandler
            .find(SystemRecordType, recordTypeName)
    }
}

```

```

        // Should return the existing instance, of a single form type.
        // Otherwise it would be an error
        record = binding.recordService.newEntity(
            new RecordDataParams(recordTypeId: recordType.id))
        if (!record.persistent) throw new IllegalStateException(
            "No instance of system record ${recordType.name} was found")
        wrapped = binding.scriptHelper.wrap(record, recordType.fields)
    }

    public String getClientId() {
        wrapped[clientIdName]
    }
    public void setClientId(String clientId) {
        wrapped[clientIdName] = clientId
    }
    public String getClientSecret() {
        wrapped[clientSecretName]
    }
    public void setClientSecret(String clientSecret) {
        wrapped[clientSecretName] = clientSecret
    }
    public String getToken() {
        wrapped[tokenName]
    }
    public void setToken(String token) {
        wrapped[tokenName] = token
    }
    public Date getTokenExpiration() {
        wrapped[tokenExpirationName]
    }
    public void setTokenExpiration(Date tokenExpiration) {
        wrapped[tokenExpirationName] = tokenExpiration
    }
}

/**
 * Class used to store / retrieve PayPal payments as user records in Cyclos
 */
class PayPalRecord {
    String recordTypeName
    String paymentIdName
    String amountName
    String transactionName

    UserRecordType recordType
    Map<String, RecordCustomField> fields

    private EntityManagerHandler entityManagerHandler
    private RecordServiceLocal recordService
    private ScriptHelper scriptHelper

    public PayPalRecord(Object binding) {
        def params = binding.scriptParameters
        recordTypeName = params.'payment.recordType' ?: 'paypalPayment'
        paymentIdName = params.'payment.paymentId' ?: 'paymentId'
        amountName = params.'payment.amount' ?: 'amount'
        transactionName = params.'payment.transaction' ?: 'transaction'
    }
}

```

```

    entityManagerHandler = binding.entityManagerHandler
    recordService = binding.recordService
    scriptHelper = binding.scriptHelper
    recordType = binding.entityManagerHandler.find(UserRecordType, recordTypeName)
    fields = [:]
    recordType.fields.each {f -> fields[f.internalName] = f}
}

/**
 * Creates a payment record, for the given user and JSON,
 * as returned from PayPal's create payment REST method
 */
public UserRecord create(User user, Number amount) {
    RecordDataParams newParams = new RecordDataParams(
        [userId: user.id, recordTypeId: recordType.id])
    UserRecordDTO dto = recordService.getDataForNew(newParams).getDTO()
    Map<String, Object> wrapped = scriptHelper.wrap(dto, recordType.fields)
    wrapped[amountName] = amount

    // Save the record DTO and return the entity
    Long id = recordService.save(dto)
    return entityManagerHandler.find(UserRecord, id)
}

/**
 * Finds the record by id
 */
public UserRecord find(Long id) {
    try {
        UserRecord userRecord = entityManagerHandler.find(UserRecord, id)
        if (userRecord.type != recordType) {
            return null
        }
        return userRecord
    } catch (EntityNotFoundException e) {
        return null
    }
}

/**
 * Removes the given record, but only if it is of the
 * expected type and hasn't been confirmed
 */
public void remove(UserRecord userRecord) {
    if (userRecord.type != recordType) {
        return
    }
    Map<String, Object> wrapped = scriptHelper
        .wrap(userRecord, recordType.fields)
    if (wrapped[transactionName] != null) return
    entityManagerHandler.remove(userRecord)
}
}

/**
 * Class used to interact with PayPal services
 */

```

```

class PayPalService {
    String mode
    String baseUrl
    String currency
    String paymentDescription

    String accountTypeName
    String paymentTypeName
    double multiplier

    SystemAccountType accountType
    PaymentTransferType paymentType

    private ScriptHelper scriptHelper
    private PaymentServiceLocal paymentService
    private IdMask idMask
    private PayPalAuth auth
    private PayPalRecord record

    public PayPalService(
        Object binding, PayPalAuth auth, PayPalRecord record) {

        this.auth = auth
        this.record = record

        scriptHelper = binding.scriptHelper
        paymentService = binding.paymentService
        idMask = binding.applicationHandler.idMask

        def params = binding.scriptParameters

        mode = params.mode ?: 'sandbox'
        if (mode != 'sandbox' && mode != 'live') {
            throw new IllegalArgumentException("Invalid PayPal parameter " +
                "'mode': ${mode}. Should be either sandbox or live")
        }
        baseUrl = mode == 'sandbox'
            ? 'https://api.sandbox.paypal.com' : 'https://api.paypal.com'

        currency = params.currency
        if (currency == null || currency.empty) {
            throw new IllegalArgumentException(
                "Missing PayPal parameter 'currency'")
        }

        EntityManagerHandler emh = binding.entityManagerHandler
        accountTypeName = params.accountType
        if (accountTypeName == null || accountTypeName.empty)
            throw new IllegalArgumentException(
                "Missing PayPal parameter 'accountType'")
        paymentTypeName = params.paymentType
        if (paymentTypeName == null || paymentTypeName.empty)
            throw new IllegalArgumentException(
                "Missing PayPal parameter 'paymentType'")
        accountType = emh.find(SystemAccountType, accountTypeName)
        if (!accountType.currency.transactionNumber?.used) {
            throw new IllegalStateException("Currency " + accountType.currency
                + " doesn't have transaction number enabled")
        }
    }
}

```

```

    }
    paymentType = emh.find(
        PaymentTransferType, paymentTypeName, accountType)

    multiplier = Double.parseDouble(params.amountMultiplier ?: "1")
    paymentDescription = params.paymentDescription ?: ""
}

/**
 * Creates a payment in PayPal and the corresponding user record
 */
public Object createPayment(User user, Number amount, String callbackUrl) {

    // Create the UserRecord for this payment
    UserRecord userRecord = record.create(user, amount)

    Long maskedId = idMask.apply(userRecord.id)
    String returnUrl = "${callbackUrl}?succes=true&recordId=${maskedId}"
    String cancelUrl = "${callbackUrl}?cancel=true&recordId=${maskedId}"

    def jsonBody = [
        intent: "sale",
        redirect_urls: [
            return_url: returnUrl,
            cancel_url: cancelUrl
        ],
        payer: [
            payment_method: "paypal"
        ],
        transactions: [
            [
                description: paymentDescription,
                amount: [
                    total: amount,
                    currency: currency
                ]
            ]
        ]
    ]
    // Create the payment in PayPal
    Object json = postJson("${baseUrl}/v1/payments/payment", jsonBody)

    // Update the payment id
    def wrapped = scriptHelper.wrap(userRecord)
    wrapped[record.paymentIdName] = json.id

    return json
}

/**
 * Executes a PayPal payment, and creates the payment in Cyclos
 */
public Object execute(String payerId, UserRecord userRecord) {
    Object wrapped = scriptHelper.wrap(userRecord)
    String paymentId = wrapped[record.paymentIdName]
    BigDecimal amount = wrapped[record.amountName]
    BigDecimal finalAmount = amount * multiplier

```

```

// Execute the payment in PayPal
Object json = postJson(
    "${baseUrl}/v1/payments/payment/${paymentId}/execute",
    [payer_id: payerId])

if (json.state == 'approved') {
    // Perform the payment in Cyclos
    PerformPaymentDTO dto = new PerformPaymentDTO()
    dto.from = SystemAccountOwner.instance()
    dto.to = userRecord.user
    dto.amount = finalAmount
    dto.type = new TransferTypeVO(paymentType.id)
    PaymentVO vo = paymentService.perform(dto)

    // Update the record, setting the linked transaction
    wrapped[record.transactionName] = vo
    userRecord.lastModifiedDate = new Date()
}
return json
}

/**
 * Performs a synchronous request, posting and accepting JSON
 */
private postJson(url, jsonBody) {
    def http = new HTTPBuilder(url)
    CountDownLatch latch = new CountDownLatch(1)
    def responseJson = null
    def responseError = []

    // Check if we need a new token
    if (auth.token == null || auth.tokenExpiration < new Date()) {
        refreshToken()
    }

    // Perform the request
    http.request(POST, JSON) {
        headers.'Authorization' = "Bearer ${auth.token}"

        body = jsonBody

        response.success = { resp, json ->
            responseJson = json
            latch.countDown()
        }

        response.failure = { resp ->
            responseError << resp.statusLine.statusCode
            responseError << resp.statusLine.reasonPhrase
            latch.countDown()
        }
    }

    latch.await()
    if (!responseError.empty) {
        throw new RuntimeException("Error making PayPal request to ${url}"
            + ", got error code ${responseError[0]}: ${responseError[1]}")
    }
}

```

```

    return responseJson
}

/**
 * Refreshes the access token
 */
private void refreshToken() {
    def http = new HTTPBuilder("${baseUrl}/v1/oauth2/token")

    CountdownLatch latch = new CountdownLatch(1)
    def responseJson = null
    def responseError = []

    http.request(POST, JSON) {
        String auth = Base64.encodeBase64String((auth.clientId + ":"
            + auth.clientSecret).getBytes("UTF-8"))
        headers.'Accept-Language' = 'en_US'
        headers.'Authorization' = "Basic ${auth}"

        send URLENC, [
            grant_type: "client_credentials"
        ]

        response.success = { resp, json ->
            responseJson = json
            latch.countDown()
        }

        response.failure = { resp ->
            responseError << resp.statusLine.statusCode
            responseError << resp.statusLine.reasonPhrase
            latch.countDown()
        }
    }

    latch.await()
    if (!responseError.empty) {
        throw new RuntimeException("Error getting PayPal token, " +
            "got error code ${responseError[0]}: ${responseError[1]}")
    }

    // Update the authentication data
    auth.token = responseJson.access_token
    auth.tokenExpiration = new Date(System.currentTimeMillis() +
        ((responseJson.expires_in - 30) * 1000))
}

// Instantiate the objects
PayPalAuth auth = new PayPalAuth(binding)
PayPalRecord record = new PayPalRecord(binding)
PayPalService paypal = new PayPalService(binding, auth, record)

```

Create the custom operation script

Under System > Tools > Scripts, create a new custom operation script, with the following characteristics:

- Name: Buy units with PayPal
- Type: Custom operation
- Included libraries: PayPal
- Parameters: leave empty
- Script code executed when the custom operation is executed:

```
def result = paypal.createPayment(user, formParameters.amount, returnUrl)

def link = result.links.find {it.rel == "approval_url"}
if (link) {
    return link.href + "&useraction=commit"
} else {
    throw new IllegalStateException("No approval url returned from PayPal")
}
```

- Script code executed when the external site redirects the user back to Cyclos:

```
import org.cyclos.entities.users.UserRecord

def recordId = request.parameters.recordId as Long
def payerId = request.parameters.PayerID

// No record?
if (recordId == null) {
    return "[ERROR] " +
        (scriptParameters.'error.invalidRequest' ?: "Invalid request")
}

// Find the corresponding record
UserRecord userRecord = record.find(applicationHandler.idMask.remove(recordId))
if (userRecord == null) {
    return "[ERROR] " +
        (scriptParameters.'error.transactionNotFound' ?: "Transaction not found")
}
def wrapped = scriptHelper.wrap(userRecord)

if (request.parameters.cancel) {
    // The operation has been canceled. Remove the record and send a message.
    record.remove(userRecord)
    return "[WARN]" + scriptParameters.'message.canceled'
    ?: "You have cancelled the operation.\nFeel free to start again if needed."
} else {
    // Execute the payment
    try {
        def json = paypal.execute(payerId, userRecord)
        if (json.state == 'approved') {
            return scriptParameters.'message.done'
            ?: "You have successfully completed the payment. Thank you."
        }
    }
}
```

```

    } else {
        return "[ERROR] " + scriptParameters.'error.notApproved'
            ?: "The payment was not approved"
    }
} catch (Exception e) {
    return "[ERROR] " + scriptParameters.'error.payment'
        ?: "There was an error while processing the payment. Please, try again."
}
}

```

Create the custom operation

Under System > Tools > Custom operations, create a new one with the following characteristics:

- Name: Buy units with PayPal (can be changed – will be the label displayed on the menu)
- Enabled: yes
- Scope: user
- Script: Buy units with PayPal
- Script parameters: leave empty
- Result type: External redirect
- Has file upload: no
- Main menu: Banking
- User management section: Banking
- Information text: you can add here some text explaining the process – it will be displayed in the operation page
- Confirmation text: leave empty (can be used to show a dialog asking the user to confirm before submitting, but in this case is not needed)

For this custom operation create the following field:

- Name: Amount
- Internal name: amount
- Data type: Decimal
- Required: yes

Configure the system account from which payments will be performed to users

Under System > Accounts configuration > Account types, choose the (normally unlimited) account from which payments will be performed to users. Then set its internal name to some meaningful name. The example configuration uses debitUnits as internal name, but it can be changed. Save the form.

Configure the payment type which will be used on payments

Still in the details page for the account type, on the Transfer types tab, create a new Payment transfer type with the following characteristics:

- Name: Units bought with PayPal (can be changed as desired)
- Internal name: paypalCredits (can be changed as desired, but this name is used in the example configuration)
- Default description: Units bought using PayPal (can be changed as desired, is the description for payments, visible in the account history)
- To: select the user account which will receive the payment
- Enabled: yes

Grant the administrator permissions

Under System > User configuration > Groups, select the Network administrators group. Then, in the Permissions tab:

- In System > System records, make the Paypal authentication record visible and editable
- In User data > User records, make the Paypal payment visible only (not editable, as it is not meant to be manually edited)
- Save the permissions

Setup the PayPal credentials

Click Reports & data > System records > Paypal authentication. If this menu entry is not showing up, refresh the browser page (by pressing F5) and try again. Update the Client ID and Client Secret fields exactly with the ones you got in the application you registered in the [PayPal Developer page](#). Remember that PayPal has a sandbox, which can be used to test the application, and a live environment. For now, use the sandbox credentials. The other 2 fields can be left blank. Save the record.

Once the record is properly set, if you want to remove it from the menu, you can just remove the permission to view this system record in the administrator group page.

Grant the user permissions / enable the operation

In System > User configuration > Products (permissions), select the member product for users which will run the operation. In the Custom operations field, make the Buy units with PayPal both enabled and allowed to run. From this moment, the operation will show up for users in the banking menu. Also on the Records enable the PayPal payment record.

Configuring the script parameters

In the PayPal library script, in parameters, there are several configurations which can be done. All those settings can be overridden in the custom operation's script parameters, allowing using distinct configurations for distinct operations. For example, it is possible to have distinct operations to perform payments in distinct currencies. In that case, the script parameters for each operation would define the currency again.

Here are some elements which can be configured:

- Internal names for the records used to store the credentials and payments.
- Paypal mode: the 'mode' settings can be either sandbox or live, indicating that operations are performed either in a test or in the real environment. To go live, you'll need a premium or business account in PayPal, and you need to use the live credentials (client ID and client secret) in Cyclos.
- Payment currency: the 'currency' defines the 3-letter, [ISO 4217](#) code for the currency in PayPal. Sometimes, according to country-specific laws, the currency used for payments may be limited. For example, Brazilians can only pay other Brazilians in Reais.
- Description for payments in PayPal: using the 'paymentDescription' setting.
- Amount multiplier: Sometimes it may be desired that the payment performed in Cyclos isn't of the exact amount of the payment in PayPal. This can normally be resolved using transfer fees, but it could also be handy to use this multiplier. If left in 1, the payment in Cyclos will have the same amount as the one in PayPal. If greater / less than 1, the payment in Cyclos will be greater / less than the one in PayPal. For example, if the multiplier is 1.05, and the PayPal payment was 100 USD, the payment in Cyclos will have the amount 105. Or, if the multiplier is 0.95 and the PayPal payment was 200 EUR, the payment in Cyclos will be of 190.
- System account from which the payment will be performed to users: the 'accountType' setting is the internal name of the system account type from which payments will be performed, as explained previously. Make sure it is exactly the same as set in the account type.
- Payment type: the 'paymentType' setting is the internal name of the payment transfer type used. Make sure it is exactly the same internal name set in the payment type that was created in previous steps.
- Messages: several messages (displayed to the user) can be set / translated here.

Other considerations

Make sure the payment type is from an unlimited account, so payments in Cyclos won't fail because of funds. The way the example script is done, first the payment is executed in PayPal and, if authorized, a payment is made in Cyclos. If this payment fails, there could be an inconsistency between the Cyclos account and the PayPal payment. Improvements could

be done to the script, to handle the case where the Cyclos payment failed. To do this, the [ScriptHelper.addOnRollbackTransactional](#) method can be used, for example, to notify some specific administrator or to refund the PayPal payment. But this handling is outside the scope of this example.

Loan module

Loan features in Cyclos 4 can be implemented using scripting. As loans tend to be very specific for each project, having it implemented with scripts brings the possibility to tailor the behavior to each project.

The example provided works as follows:

- An administrator has a custom operation to grant the loan, setting the amount, number of installments and first installment date.
- The loan is a payment from a system account to an user. It has a status, which can be either open or closed.
- The same custom operation also performs a scheduled payment from the user to system, with each installment amount and due date corresponding to the loan installments. This scheduled payment has (with a custom field) a link to the original loan. Also, the loan payment has a link to the scheduled payment, making it easy to navigate between them.
- Each installment will be processed at the respective due date, allowing users to repay the loan with internal units. The administrator can, however, mark individual installments as settled, which means the installment won't be repaid internally, but with some other way (for example, with money or using other Cyclos payments).
- Once the scheduled payment is closed, an extension point updates the status of the original payment to closed.

In order to configure the loan script, follow carefully each of the following steps:

Enable transaction number in currency

This can be checked under System > Currencies select the currency used for this operation, mark the Enable transfer number option and fill in the required parameters.

Create the transfer status flow

Under System > Accounts configuration > Transfer status flows, create a new one, with the following characteristics:

- Name: Loan status (can be changed as desired)
- Internal name: loan (can be changed as desired, but this name is used in the example configuration)

After saving, create the following statuses:

- Closed (can be changed as desired)
 - Internal name: closed
- Open (can be changed as desired)
 - Internal name: open
 - Possible next statuses: Closed

Create the payment custom fields

Under System > Accounts configuration > Payment fields, create a new one, with the following fields:

- Loan
 - Name: Loan (can be changed as desired)
 - Internal name: loan (can be changed as desired, but this name is used in the example configuration)
 - Data type: Linked entity
 - Linked entity type: Transaction
 - Required: yes
- Repayment
 - Name: Repayment (can be changed as desired)
 - Internal name: repayment (can be changed as desired, but this name is used in the example configuration)
 - Data type: Linked entity
 - Linked entity type: Transaction
 - Required: no

Configure the system account from which payments will be performed to users

Under System > Accounts configuration > Account types, choose the (normally unlimited) account from which payments will be performed to users. Then set its internal name to some meaningful name. The example configuration uses debitUnits as internal name, but it can be changed later. Save the form.

Create the payment type which will be used to grant the loan

Still in the system account type details page for the account type, on the Transfer types tab, create a new Payment transfer type with the following characteristics:

- Name: Loan (can be changed as desired)

- Internal name: loanGrant (can be changed as desired, but this name is used in the example configuration)
- Default description: Loan grant (can be changed as desired, is the description for payments, visible in the account history)
- To: select the user account which will receive the payment
- Transfer status flows: Loan status
- Initial status for Loan status: Open
- Enabled: yes

After saving, on the Payment fields tab, add the custom field named Repayment.

Configure the user account which will receive loans

Under System > Accounts configuration > Account types, choose the user account which will receive payments. Then set its internal name to some meaningful name. The example configuration uses userUnits as internal name, but it can be changed later. Save the form.

Create the payment type which will be used to repay the loan

Still in the user account type details page, on the Transfer types tab, create a new Payment transfer type with the following characteristics:

- Name: Loan repayment (can be changed as desired)
- Internal name: loanRepayment (can be changed as desired, but this name is used in the example configuration)
- Default description: Loan repayment (can be changed as desired, is the description for payments, visible in the account history)
- To: select the system account which granted the loan
- Enabled: yes
- Allows scheduled payment: yes
- Max installments on scheduled payments: 36 (any value greater than zero is fine)
- Show scheduled payments to receiver: yes
- Reserve total amount on scheduled payments: no

After saving, on the Payment fields tab, add the custom field named Loan.

Create the library script

Under System > Tools > Scripts, create a new library script, with the following characteristics:

- Name: Loan

- Type: Library
- Included libraries: none
- Parameters:

```

# Loan configuration
loan.account = debitUnits
loan.type = loanGrant
#loan.description =

# Repayment configuration
repayment.account = userUnits
repayment.type = loanRepayment
#repayment.description

# Payment custom fields
field.loan = loan
field.repayment = repayment

# Monthly compound interest rate (zero for none)
monthlyInterestRate = 0

# Transfer status configuration
status.flow = loan
status.open = open
status.closed = closed

# Custom operation configuration
operation.amount = amount
operation.installments = installments
operation.firstDueDate = firstDueDate

# Messages
message.invalidInstallments = The number of installments is invalid
message.invalidLoanAmount = Invalid loan amount
message.invalidFirstDueDate = The first due date cannot be lower than tomorrow'
message.loanGranted = The loan was successfully granted

```

- Script code:

```

import org.cyclos.entities.banking.Payment
import org.cyclos.entities.banking.PaymentTransferType
import org.cyclos.entities.banking.ScheduledPayment
import org.cyclos.entities.banking.SystemAccountType
import org.cyclos.entities.banking.TransactionCustomField
import org.cyclos.entities.banking.Transfer
import org.cyclos.entities.banking.TransferStatus
import org.cyclos.entities.banking.TransferStatusFlow
import org.cyclos.entities.banking.UserAccountType
import org.cyclos.entities.users.User
import org.cyclos.impl.banking.PaymentServiceLocal
import org.cyclos.impl.banking.ScheduledPaymentServiceLocal
import org.cyclos.impl.banking.TransferStatusServiceLocal
import org.cyclos.impl.system.ConfigurationAccessor
import org.cyclos.impl.system.ScriptHelper
import org.cyclos.impl.utils.persistence.EntityManagerHandler

```

```

import org.cyclos.model.ValidationException
import org.cyclos.model.banking.accounts.SystemAccountOwner
import org.cyclos.model.banking.transactions.PaymentVO
import org.cyclos.model.banking.transactions.PerformPaymentDTO
import org.cyclos.model.banking.transactions.PerformScheduledPaymentDTO
import org.cyclos.model.banking.transactions.ScheduledPaymentInstallmentDTO
import org.cyclos.model.banking.transactions.ScheduledPaymentVO
import org.cyclos.model.banking.transfers.TransferVO
import org.cyclos.model.banking.transferstatus.ChangeTransferStatusDTO
import org.cyclos.model.banking.transferstatus.TransferStatusVO
import org.cyclos.model.banking.transfertypes.TransferTypeVO
import org.cyclos.server.utils.DateHelper
import org.cyclos.utils.BigDecimalHelper

class Loan {
  Map<String, Object> config
  EntityManagerHandler entityManagerHandler
  PaymentServiceLocal paymentService
  ScheduledPaymentServiceLocal scheduledPaymentService
  TransferStatusServiceLocal transferStatusService
  ScriptHelper scriptHelper
  ConfigurationAccessor configuration

  double monthlyInterestRate
  SystemAccountType systemAccount
  UserAccountType userAccount
  PaymentTransferType loanType
  PaymentTransferType repaymentType
  TransactionCustomField loanField
  TransactionCustomField repaymentField
  TransferStatusFlow flow
  TransferStatus open
  TransferStatus closed

  Loan(binding) {
    config = [:]
    def params = binding.scriptParameters
    [
      'loan.account': 'systemAccount',
      'loan.type': 'loanGrant',
      'loan.description': null,
      'repayment.account': 'userUnits',
      'repayment.type': 'loanRepayment',
      'repayment.description': null,
      'field.loan': 'loan',
      'field.repayment': 'repayment',
      'monthlyInterestRate' : null,
      'status.flow': 'loan',
      'status.open': 'open',
      'status.closed': 'closed',
      'operation.amount': 'amount',
      'operation.installments': 'installments',
      'operation.firstDueDate': 'firstDueDate',
      'message.invalidInstallments':
      'The number of installments is invalid',
      'message.invalidLoanAmount': 'Invalid loan amount',
      'message.invalidFirstDueDate':

```

```

    'The first due date cannot be lower than tomorrow',
    'message.loanGranted':
    'The loan was successfully granted to the user'
  }.each { k, v ->
    def value = params[k] ?: v
    config[k] = value
  }
  entityManagerHandler = binding.entityManagerHandler
  paymentService = binding.paymentService
  scheduledPaymentService = binding.scheduledPaymentService
  transferStatusService = binding.transferStatusService
  scriptHelper = binding.scriptHelper
  configuration = binding.sessionData.configuration

  systemAccount = entityManagerHandler.find(
    SystemAccountType, config.'loan.account')
  if (systemAccount.currency.transactionNumber == null
  || !systemAccount.currency.transactionNumber.used) {
    throw new IllegalStateException(
      "The currency ${systemAccount.currency.name} doesn't "
      + "have transaction number enabled")
  }
  loanType = entityManagerHandler.find(
    PaymentTransferType, config.'loan.type', systemAccount)
  userAccount = entityManagerHandler.find(
    UserAccountType, config.'repayment.account')
  repaymentType = entityManagerHandler.find(
    PaymentTransferType, config.'repayment.type', userAccount)
  if (!repaymentType.allowsScheduledPayments) {
    throw new IllegalStateException("The repayment type " +
      "${repaymentType.name} doesn't allows scheduled payment")
  }
  loanField = entityManagerHandler.find(
    TransactionCustomField, config.'field.loan')
  repaymentField = entityManagerHandler.find(
    TransactionCustomField, config.'field.repayment')
  if (!loanType.customFields.contains(repaymentField)) {
    throw new IllegalStateException("The loan type ${loanType.name} "
      + "doesn't contain the custom field ${repaymentField.name}")
  }
  if (!repaymentType.customFields.contains(loanField)) {
    throw new IllegalStateException("The repayment type "
      + "${repaymentType.name} doesn't contain the "
      + "custom field ${loanField.name}")
  }
  flow = entityManagerHandler.find(
    TransferStatusFlow, config.'status.flow')
  open = entityManagerHandler.find(
    TransferStatus, config.'status.open', flow)
  closed = entityManagerHandler.find(
    TransferStatus, config.'status.closed', flow)
  monthlyInterestRate = config.monthlyInterestRate?.toDouble() ?: 0
}

def BigDecimal calculateInstallmentAmount(BigDecimal amount,
  int installments, Date grantDate, Date firstInstallmentDate) {

  // Calculate the delay

```

```

Date shouldBeFirstExpiration = grantDate + 30
int delay = firstInstallmentDate - shouldBeFirstExpiration
if (delay < 0) {
    delay = 0
}

double interest = monthlyInterestRate / 100.0
double numerator = ((1 + interest) **
    (installments + delay / 30.0)) * interest
double denominator = ((1 + interest) ** installments) - 1
BigDecimal result = amount * numerator / denominator
return BigDecimalHelper.round(result, systemAccount.currency.precision)
}

def grant(User user, formParameters) {
    BigDecimal loanAmount = formParameters[config.'operation.amount']
    int installments = formParameters[config.'operation.installments']
    Date firstDueDate = formParameters[config.'operation.firstDueDate']
    Date minDate = DateHelper.shiftToNextDay(
        new Date(), configuration.timeZone)
    if (installments < 1 || installments > repaymentType.maxInstallments)
        throw new ValidationException(config.'message.invalidInstallments')
    if (loanAmount < 1)
        throw new ValidationException(config.'message.invalidLoanAmount')
    if (firstDueDate < minDate)
        throw new ValidationException(config.'message.invalidFirstDueDate')

    // Grant the loan
    PaymentVO loanVO = paymentService.perform(new PerformPaymentDTO([
        from: SystemAccountOwner.instance(),
        to: user,
        type: new TransferTypeVO(loanType.id),
        amount: loanAmount,
        description: config.'loan.description'
    ]))
    Payment loan = entityManagerHandler.find(Payment, loanVO.id)

    // Ensure the initial status is correct
    Transfer loanTransfer = loan.transfer
    if (loanTransfer == null) {
        throw new IllegalStateException(
            "The loan was not processed (probably pending authorization)")
    }
    TransferStatus currentStatus = loanTransfer.getStatus(flow)
    if (currentStatus != open) {
        throw new IllegalStateException(
            "The initial status for flow ${flow.name} in ${loanType.name} "
            + "is not the expected one: ${open.name}, "
            + "but ${currentStatus} instead")
    }

    // Perform the repayment scheduled payment
    PerformScheduledPaymentDTO dto = new PerformScheduledPaymentDTO()
    def bean = scriptHelper.wrap(dto, [loanField])
    bean.from = user
    bean.to = SystemAccountOwner.instance()
    bean.type = repaymentType
    bean.amount = loanAmount
}

```

```

bean.description = config.'repayment.description'
bean.installmentsCount = installments
bean.firstInstallmentDate = firstDueDate
bean[loanField.internalName] = loan

// Interest
if (monthlyInterestRate > 0.00001) {
    BigDecimal installmentAmount = calculateInstallmentAmount(
        loanAmount, installments, new Date(), firstDueDate)

    dto.installments = []
    Date dueDate = firstDueDate
    for (int i = 0; i < installments; i++) {
        def installment = new ScheduledPaymentInstallmentDTO()
        def instBean = scriptHelper.wrap(installment)
        instBean.dueDate = dueDate
        instBean.amount = installmentAmount
        dto.installments << installment
        dueDate += 30
    }
    bean.amount = installmentAmount * installments
}

ScheduledPaymentVO repaymentVO = scheduledPaymentService.perform(dto)
ScheduledPayment repayment = entityManagerHandler.find(
    ScheduledPayment, repaymentVO.id)

// Update the loan with the repayment link
bean = scriptHelper.wrap(loan, [repaymentField])
bean[repaymentField.internalName] = repayment
}

def close(ScheduledPayment scheduledPayment) {
    Payment loan = scriptHelper.wrap(scheduledPayment)
    [loanField.internalName]
    Transfer loanTransfer = loan.transfer
    TransferStatus status = loanTransfer.getStatus(flow)
    if (status != closed) {
        // The loan was not closed: close it
        transferStatusService.changeStatus(new ChangeTransferStatusDTO([
            transfer: new TransferVO(loanTransfer.id),
            newStatus: new TransferStatusVO(closed.id)
        ]))
    }
}

}

Loan loan = new Loan(binding)

```

Create the custom operation script

Create a new script for the custom operation, with the following characteristics:

- Name: Grant loan
- Type: Custom operation

- Included libraries: Loan
- Parameters: leave empty
- Script code executed when the custom operation is executed:

```
loan.grant(user, formParameters)
return loan.config.'message.LoanGranted'
```

Create the extension point script

Create a new script for the transaction extension point, with the following characteristics:

- Name: Loan closing
- Type: Extension point
- Included libraries: Loan
- Parameters: leave empty
- Script code executed when the data is saved:

```
import org.cyclos.model.ValidationException
import org.cyclos.model.banking.transactions.ScheduledPaymentStatus

if (transaction.status == ScheduledPaymentStatus.CANCELED) {
    // Should never cancel a loan scheduled payment
    throw new ValidationException("Cannot cancel a loan")
} else if (transaction.status == ScheduledPaymentStatus.CLOSED) {
    // Close the loan
    loan.close(transaction)
}
```

Create the custom operation

Under System > Tools > Custom operations, create a new one, with the following characteristics:

- Name: Grant loan (can be changed, is the label displayed to users)
- Enabled: yes
- Scope: User
- Script: Grant loan
- Script parameters: leave empty
- Result type: Notification
- Has file upload: no
- Main menu: Banking
- User management section: Banking

- Information text: you can add here some text explaining the process – it will be displayed in the operation page
- Confirmation text: add here some text which will be displayed in a confirmation dialog before granting the loan

After saving, create the following fields:

- Amount
 - Internal name: amount
 - Data type: Decimal
 - Required: yes
- Installment count
 - Internal name: installments
 - Data type: Integer
 - Required: yes
- First due date
 - Internal name: firstDueDate
 - Data type: Date
 - Required: yes

Create the extension point

Under System > Tools > Extension points, create a new of type Transaction, with the following characteristics:

- Name: Close loan
- Type: Transaction
- Enabled: yes
- Transfer types: Units account – Loan repayment (choose the loan repayment type)
- Events: Change status
- Script: Loan closing
- Script parameters: leave empty

Grant the administrator permissions

Under System > User configuration > Groups, select the Network administrators group. Then, in the Permissions tab:

- Under User management > Run custom operations over users, check the Grant loan operation and save
- Under Accounts > Transfer status flows, make Loan visible, but not editable.

Enable the custom operation for users which will be able to receive loans

In System > User configuration > Products (permissions), select the member product for users which will be able to receive loans. In the Custom operations field, make the Grant loan operation enabled. Leave the run checkbox unchecked (or users would be able to grant loans to themselves!).

You can permit users to repay loan installments anticipated in Units. For this you have to check in the member product 'process installment' and the user need to have permissions to make a payment of the transaction type used for the loan repayments.

4. External login

Starting with Cyclos 4.2, using [web services](#) together with the right configuration, it is possible to add a Cyclos login form to an external website. The user types in his/hers Cyclos username and password in that form and, after a successful login, is redirected to Cyclos, where the session will be already valid, and the user can perform the operations as usual. After the user clicks logout, or his/hers session expires, the user is redirected back to the external website.

4.1. The following aspects should be considered:

- It is needed to have an administrator whose group is granted the permission "Login users via web services". This is needed because the website will relay logins from users their clients to Cyclos.
- The website needs to have that administrator's username and password configured in order to make the web services call. It is planned for Cyclos 4.3 the creation of access clients, which will allow using a separated key instead of the username / password.
- It is a good practice to create a separated configuration for that administrator. That configuration should have an IP address whitelist for the web services channel. Doing that, no other server, even if the administrator username / password is known by someone else, will be able to perform such operations.
- The Cyclos configuration for users needs the following settings:
 - Redirect login to URL: This is the URL of the external website which contains the login form. This is used to redirect the user when his session expires and a new login is needed, or when the user navigates directly to some URL in Cyclos (as guest) and then clicks "Login";
 - URL to redirect after logout: This is the URL where the user will be redirected after clicking "Logout" in Cyclos. It might be the same URL as the one for redirect login, but not necessarily.
- Finally, the web service code needs to be created, and deployed to the website. Here is an example, which receives the username and password parameters, calls the web service to create a session for the user (passing his remote address), redirecting the user to Cyclos.

```
<?php

// Configure Cyclos and obtain an instance of LoginService
require_once 'configureCyclos.php';
@loginService = new Cyclos\LoginService();

// Set the parameters
$params = new stdClass();
$params->user = array('username' => $_POST['username']);
$params->password = $_POST['password'];
$params->remoteAddress = $_SERVER['REMOTE_ADDR'];
```

```

// Perform the login
try {
    $result = $loginService->loginUser($params);
} catch (Cyclos\ConnectionException $e) {
    echo("Cyclos server couldn't be contacted");
    die();
} catch (Cyclos\ServiceException $e) {
    switch ($e->errorCode) {
        case 'VALIDATION':
            echo("Missing username / password");
            break;
        case 'LOGIN':
            echo("Invalid username / password");
            break;
        case 'REMOTE_ADDRESS_BLOCKED':
            echo("Your access is blocked by exceeding invalid login attempts");
            break;
        default:
            echo("Error while performing login: {$e->errorCode}");
            break;
    }
}
die();
}

// Redirect the user to Cyclos with the returned session token
header("Location: "
    . Cyclos\Configuration::getRootUrl()
    . "?sessionToken="
    . $result->sessionToken);

```

4.2. Important notes

- In case there is a wrong configuration for the "Redirect login to URL" setting, it won't be possible anymore to login to Cyclos. In that case, if the configuration problem is within a network, it is possible to use a global administrator to login in global mode (using the <server-root>/global/login URL), then switch to the network and fix the configuration. If the configuration error is in global mode, you can use a special URL to prevent redirect: <server-root>/global/login!noRedirect=true . However, this flag only works in global mode, to prevent end-users from using it to bypass the redirect.
- Users should never have username / password requested in a plain HTTP connection. Always use a secure (HTTPS) connection. Also, just having an iframe with the form on a secure page, where the iframe itself is displayed in a plain page would encrypt the traffic, but browsers won't show the page as secure. Users won't notice that page as secure, could refuse to provide credentials in such situation.

4.3. Creating an alternate frontend to Cyclos

It is possible to not only place a login form in an external website, but to create an entire frontend for users to interact with Cyclos. At first glimpse, this can be great, but consider the following:

- It is a very big effort to create a frontend, as there are several Cyclos services involved, and it might not be clear without a deep analysis on the [API](#) which service / method / parameters should be used on each case.
- The API will change. Even if we try not to break compatibility, it is possible that changes between 4.x to 4.y will contain (sometimes incompatible) [changes to the API](#).
- You will always have a limited subset of the functionality Cyclos offers. You may think that only the very basic features are needed, there will inevitably be the need for more features, and the custom frontend will need to grow. By using Cyclos standard web, all this comes automatically.

Nevertheless, some (large) organizations might find it is better to provide their users with a single, integrated interface. In that case the application server of that interface will be the only one interacting with Cyclos (i.e, users won't directly browse the Cyclos interface). The application will relay web service calls to Cyclos in behalf of users.

To accomplish that, it is needed to first login users in the same way as explained in the previous section. However, after the login is complete, instead of redirecting users to Cyclos, the application needs to store the session token, and probably the user id (as some operations requires passing the logged user id) – both data received after logging in – in a session (in the interface application server). Then, the next web service requests should be sent using that session token and client remote address, instead of the administrator credentials. The way of passing that data depends on the web service access type being used:

- Java clients: Create another [HttpClientFactory](#), using a stateful [HttpClientInvocationData](#). Here is an example:

```
import java.util.List;

import org.cyclos.model.access.LoggedOutException;
import org.cyclos.model.access.channels.BuiltInChannel;
import org.cyclos.model.banking.accounts.AccountSummaryVO;
import org.cyclos.model.users.users.UserLocatorVO;
import org.cyclos.model.users.users.UserLoginDTO;
import org.cyclos.model.users.users.UserLoginResult;
import org.cyclos.model.users.users.UserVO;
import org.cyclos.server.utils.HttpServiceFactory;
import org.cyclos.server.utils.HttpServiceInvocationData;
import org.cyclos.services.access.LoginService;
import org.cyclos.services.banking.AccountService;

/**
 * Cyclos web service example: logs-in an user via web services.
```

```

* This is useful when creating an alternative front-end for Cyclos.
*/
public class LoginUser {

    public static void main(String[] args) throws Exception {
        // This LoginService has the administrator credentials
        LoginService loginService = Cyclos.getServiceFactory().getProxy(
            LoginService.class);

        String remoteAddress = "192.168.1.200";

        // Set the login parameters
        UserLoginDTO params = new UserLoginDTO();
        UserLocatorVO locator = new UserLocatorVO(UserLocatorVO.USERNAME,
            "c1");
        params.setUser(locator);
        params.setPassword("1234");
        params.setRemoteAddress(remoteAddress);
        params.setChannel(BuiltInChannel.MAIN.getInternalName());

        // Login the user
        UserLoginResult result = loginService.loginUser(params);
        UserVO user = result.getUser();
        String sessionToken = result.getSessionToken();
        System.out.println("Logged-in" + user.getName()
            + " with session token = " + sessionToken);

        // Do something as user. As the session token is only valid per ip
        // address, we need to pass-in the client ip address again
        HttpServiceInvocationData sessionInvocationData = HttpServiceInvocationData
            .stateful(sessionToken, remoteAddress);
        // The services acquired by the following factory will carry on the
        // user session data
        HttpServiceFactory userFactory = Cyclos
            .getServiceFactory(sessionInvocationData);
        AccountService accountService = userFactory
            .getProxy(AccountService.class);
        List<AccountSummaryVO> accounts = accountService.getAccountsSummary(
            user, null);
        for (AccountSummaryVO account : accounts) {
            System.out.println(account.getName() + ", balance: "
                + account.getStatus().getBalance());
        }

        // Logout. There are 2 possibilities:

        // - Logout as administrator:
        loginService.logoutUser(sessionToken);

        // - OR logout as own user:
        try {
            userFactory.getProxy(loginService.class).logout();
        } catch (LoggedOutException e) {
            // already logged out
        }
    }
}

```

- PHP clients: In the configuration file, instead of calling `Cyclos \Configuration::setAuthentication($username, $password)`, call the following: `Cyclos \Configuration::setSessionToken($sessionToken)` and `Cyclos \Configuration::setForwardRemoteAddress(true)`, which will automatically send the `$_SERVER['REMOTE_ADDR']` value on requests.
- WEB-RPC: If sending JSON requests directly, instead of passing the Authentication header with the username / password, pass the following headers: Session-Token and Remote-Address.