

# ReCiPSS

## D5.1-IoT platform supporting smart washing machines

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## List of abbreviations

<b>Abbreviation</b>	<b>Explanation</b>
<b>AUID</b>	Appliance unique identifier, unique number for the washing machine
<b>BC</b>	Business customer
<b>BUC</b>	Business use case
<b>ERP</b>	Enterprise resource planning
<b>GDPR</b>	General Data Protection Regulation
<b>GOR</b>	Gorenje
<b>ICT</b>	Information and communications technology
<b>IoT</b>	Internet of things
<b>IT</b>	Information technology
<b>JUConnect</b>	Gorenjes cloud platform for connecting washing machines
<b>PPU</b>	Pay per use
<b>ReCiPSS</b>	Resource-efficient Circular Product-Service Systems
<b>SAG</b>	Gorenjes service application
<b>SAP</b>	Enterprise resource planning software from the company SAP
<b>SW</b>	Software
<b>USP</b>	Unique selling point
<b>WM</b>	Washing machine

## Executive Summary

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This deliverable is a result of the development work performed until now within WP5- ICT Platform for Multiple Life Cycles, under T5.1 “Implementing an IoT platform for white goods for monitoring asset usage and condition”.

The results obtained so far in developing the new platform are:

- An overall ICT platform architecture that specifies the sub systems and their responsibility,
- A minimum viable product version of the following sub systems: ReCiPSS web store, ReCiPSS backend server, JUConnect platform and Appliance,
- An implementation of the following business use cases: User Decision, Contract processing, Contract execution, Usage and Billing.

Functionalities still to be done until milestone **MS6: ICT platforms** ready in month 24 (May 2020) are:

- An implementation of the following business use cases: Feedback, Maintenance and Repair, Contract termination and Cleaning/Repair

The work performed in WP5, T5.1, will serve as base for WP6: Whitegoods demonstrator, for the deployment of the platform and for further improvements.

This document describes the business solution for the Whitegoods demonstrator for the ReCiPSS project. It determines the scope of the ICT solution, the stakeholders with their concerns and needs, the business use cases and the solution architecture. The solution architecture described divides the IT solution in smaller pieces, sub systems.

# 1 Business context and business requirements

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## 1.1 Stakeholders

Please find below in Figure 1 a graphical overview of the stakeholders in the Whitegoods demonstrator. The main stakeholders are:

- Gorenje (the Manufacturer) that develops, assembles and produces the washing machines
- Retailers that sell the pay per use contracts to the landlords and private washing machine users
- Logistics and distribution service providers that pick-up and deliver the washing machines to the landlords or users and perform the first installation
- Landlords that install the washing machines in their large flats and allow their renters to use the machines pay per use.
- (Private washing machine) Users that install the washing machine in their own house and use it pay per use.
- Repair/maintain service providers that repair and maintain the washing machines
- Refurbishment service providers (unfortunately missing in Figure 1) that ensure that a washing machine that has been picked up by the logistics and distribution service provider is refurbished so it can be used in the next pay per use lifecycle.
- Investors that provide the capital that is needed to support the pay per use business model

Secondary stakeholders include regulators, part suppliers as well as providers of various services like power, water and internet utilities, billing services, cloud solution providers, waste service providers etc.).



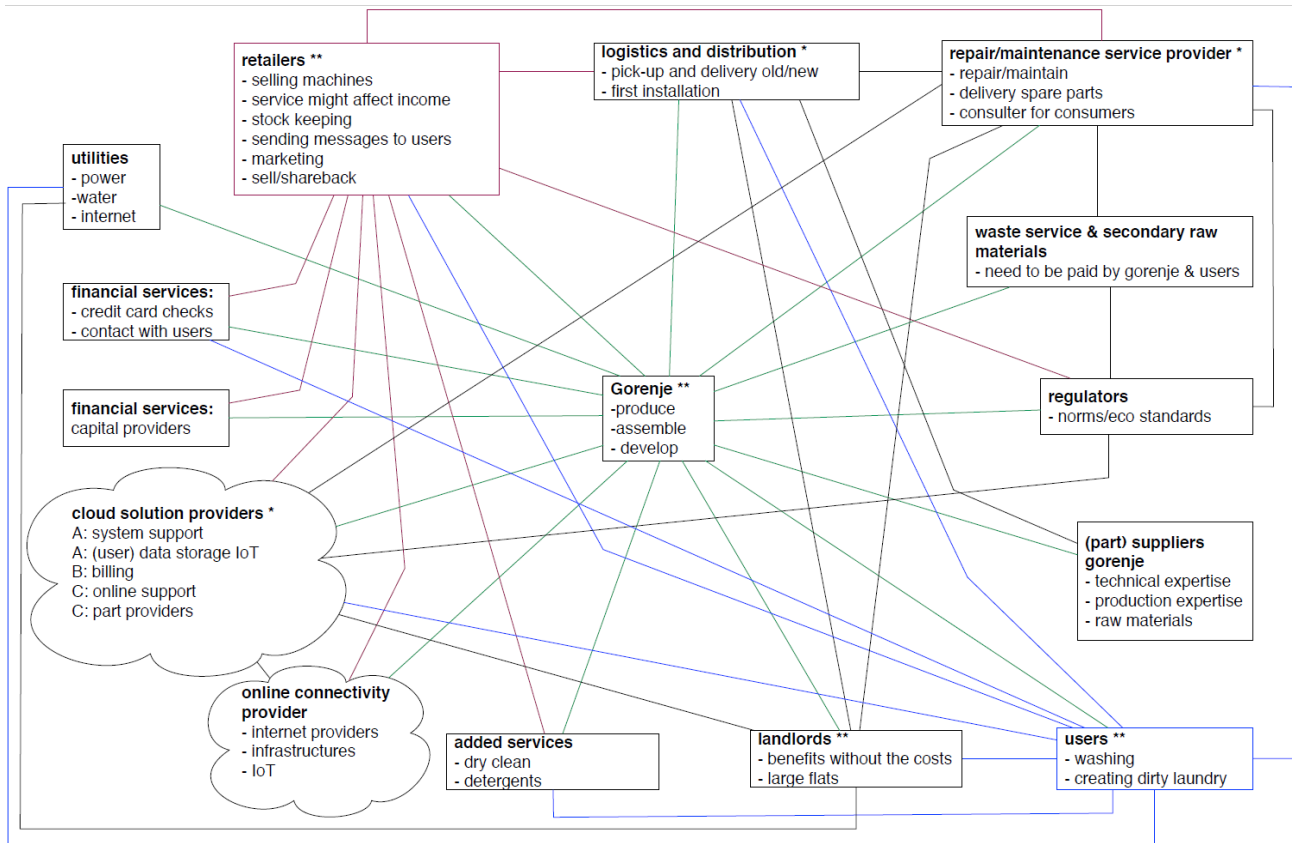


Figure 1: Stakeholders of the Whitegoods demonstrator

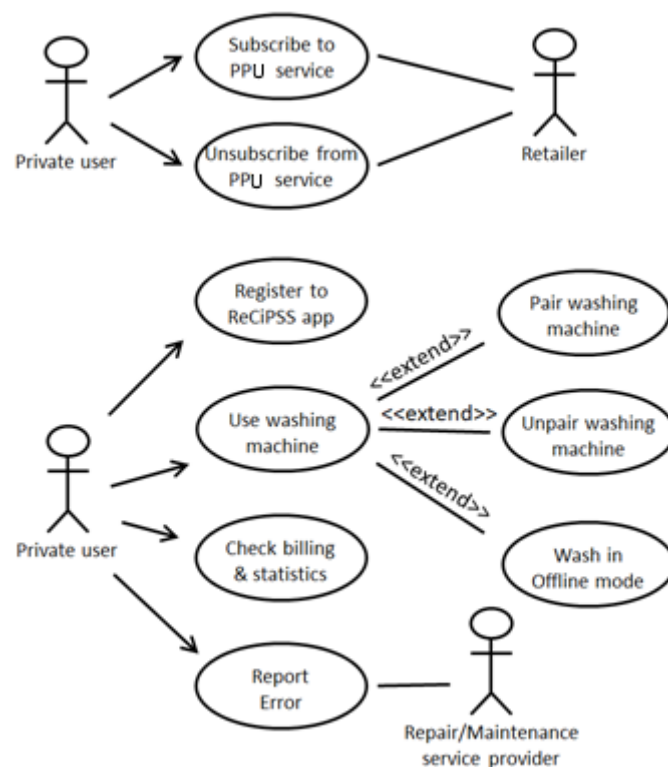
## 2 Business Use Cases

In this chapter we will discuss the main business use cases of the Pay per use service offering for some of the main stakeholders. The scope of the business use cases is the complete Pay per use offering, including the business processes and the technical platform. Business requirements that cannot be grasped by the use cases shall be included in the supplementary requirements.

### 2.1 Overview business use cases

#### 2.1.1 Private washing machine user

Please find in Figure 2 the most important business use cases for the private washing machine user. These cover the lifecycle of the user's engagement from subscribing to the pay per use service, using the washing machine, receiving the bill to ending the pay per use service. These use cases are described in more detail in the next sub chapter.



*Figure 2: Business use cases of the Private washing machine user*

#### 2.1.2 Logistics and distribution service provider

Please find in Figure 3 the most important business use cases for the Logistics and distribution service provider. These cover the first-time installation, replacement and pickup of the washing machine after contract termination. These use cases are described in more detail in the next sub chapter.

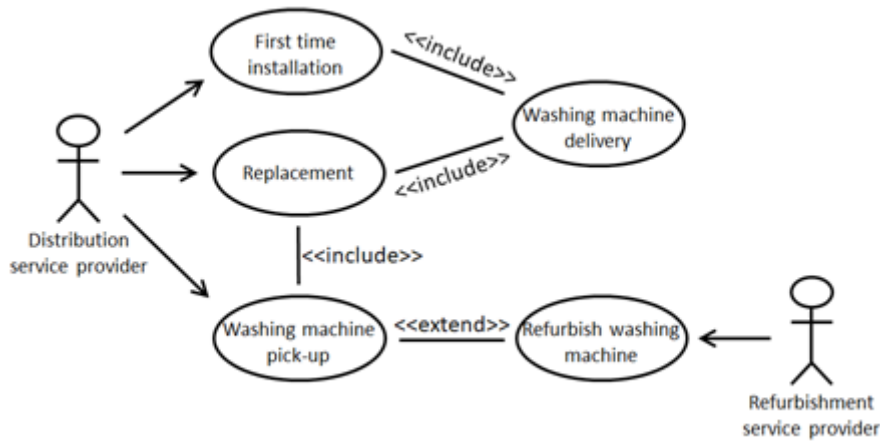


Figure 3: Business use cases of the Distribution service provider

### 2.1.3 Repair and maintenance service provider

Please find in Figure 4 the most important business use cases for the Repair and maintenance service provider. These cover maintenance, repairing and order replacement. These use cases are described in more detail in the next sub chapter.

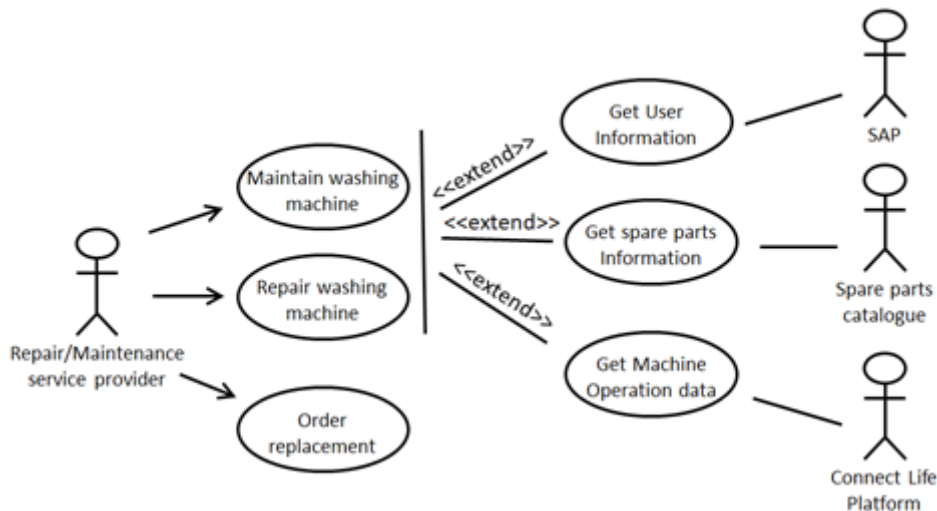


Figure 4: Business use cases of the Repair and maintenance service provider

## 2.2 Detailed business use cases

### 2.2.1 Customer Journey – Overview

Please find in Figure 5 a graphical overview of the customer journey for a landlord or private washing machine user for the lifetime of a pay per use engagement. It starts with gaining interest and awareness of the pay per use offering, moves on to signing a pay per use contract, using the washing machine and terminating the contract. After contract termination, the washing machine is collected, refurbished and returned to the warehouse to be used in another pay per use contract. In this section this workflow and its business use cases will be discussed in further detail.

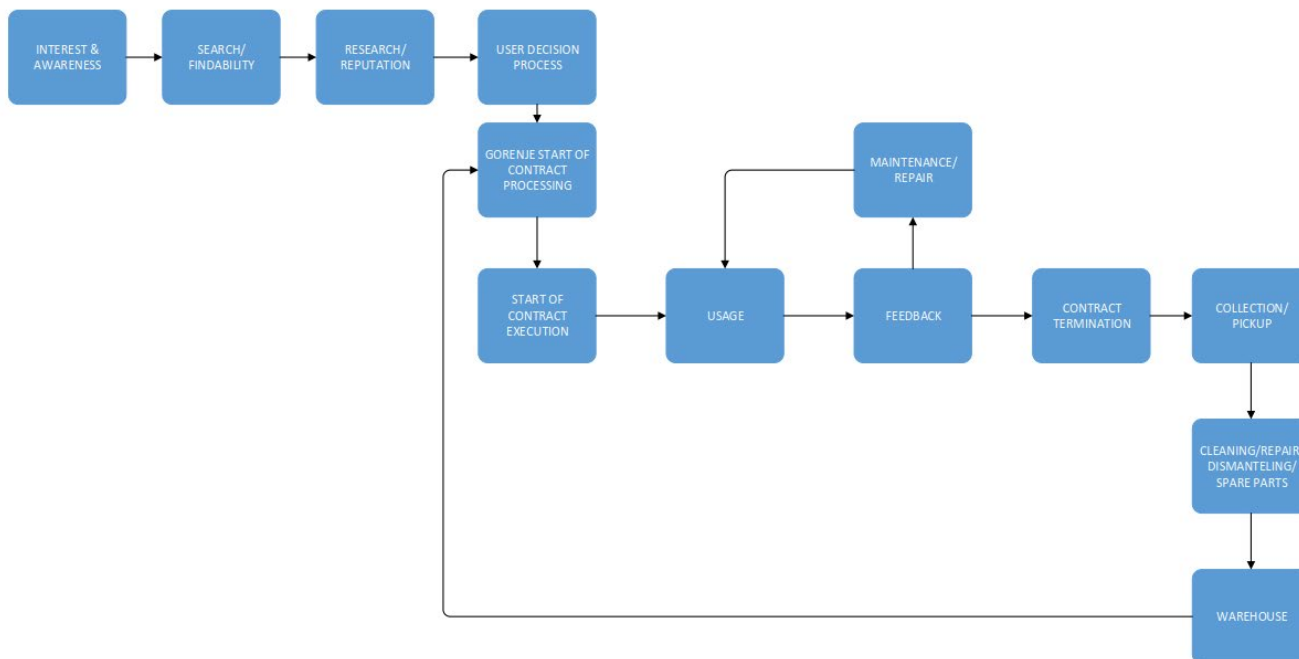


Figure 5: Flow diagram Customer journey overview

There are two customer types: business customers (BC) and private customers. Private customers can have three different user statuses.

USER STATUS	STATUS DESCRIPTION
<b>Master user</b>	<ol style="list-style-type: none"> <li>1. gets WM</li> <li>2. manages access (can give access to his/her WM and billing account to visitors and aliases)</li> <li>3. billing to his/her own account (has contract)</li> <li>4. has automatically visitor status as well</li> <li>5. has control over service-arrangements (can call and schedule)</li> </ol>
<b>Visitor user</b>	<ul style="list-style-type: none"> <li>• no WM</li> <li>• no management access</li> <li>• is allowed to wash in visitor status</li> <li>• billing to his/her own account (has contract)</li> <li>• Can call service but not schedule</li> </ul>
<b>Alias user</b>	<ul style="list-style-type: none"> <li>• No WM</li> <li>• not possible to amend the contract</li> <li>• billing is conducted on the master user’s account (has no own contract)</li> </ul>

Table 1: Status table for private washing machine users

For some of the business customers new business use cases additionally to the ones for private users need to be defined. Business customers can have different statuses according to their role and relation to Gorenje.

MASTER	STATUS AND ROLE OF THE BUSINESS CUSTOMER
<b>Business customer</b>	<ol style="list-style-type: none"> <li>1. BC gets bill and pays to GOR: BC can give alias status to client, client pays to BC according to usage</li> <li>2. BC gets provision + royalties: BC sells visitor-contract to his/her client, client pays to GOR <ul style="list-style-type: none"> <li>○ BC gets provision: BC sells visitor-contract to his/her clients, client pays to GOR</li> <li>○ BC gets royalties: client has visitor-contract, client pays to GOR, GOR pays royalty to BC</li> <li>○ BC gets provision + royalties: BC sells visitor-contract to his/her tenants, tenant pays to GOR</li> </ul> </li> </ol>
<b>Gorenje</b>	<ol style="list-style-type: none"> <li>3. BC gets rent for space, water, electricity from GOR; clients need visitor account, GOR charges client directly</li> </ol>
<b>Private Customer (BC as Retailer)</b>	<ol style="list-style-type: none"> <li>4. BC gets provision: BC sells visitor or master contract to his/her clients, client pays to GOR</li> <li>5. BC gets royalties for usage of client: BC sells visitor or master contract to his/her clients, client pays to GOR, GOR pays royalty to retailer</li> </ol>
<b>Private Customer (BC as Service-provider)</b>	<ul style="list-style-type: none"> <li>- Gets WM + access to cloud and API (usage data + cost table settings etc.)</li> <li>- Uses the service facilities of the manufacturer</li> <li>- Uses own app and billing system</li> <li>- Client of BC is master user</li> </ul> <ol style="list-style-type: none"> <li>6. BC buys the WM</li> <li>7. BC rents the WM</li> </ol>

*Table 2: Status and roles of the business customers in various Master scenarios*

### 2.2.2 User Decision Process

Please find in Figure 6 a graphical overview of the user decision workflow. It shows the steps from the user entering the pay per use web site to the completion of the pay per use contract which is the start of the contract processing workflow. In this section, the business use cases for this workflow will be described.

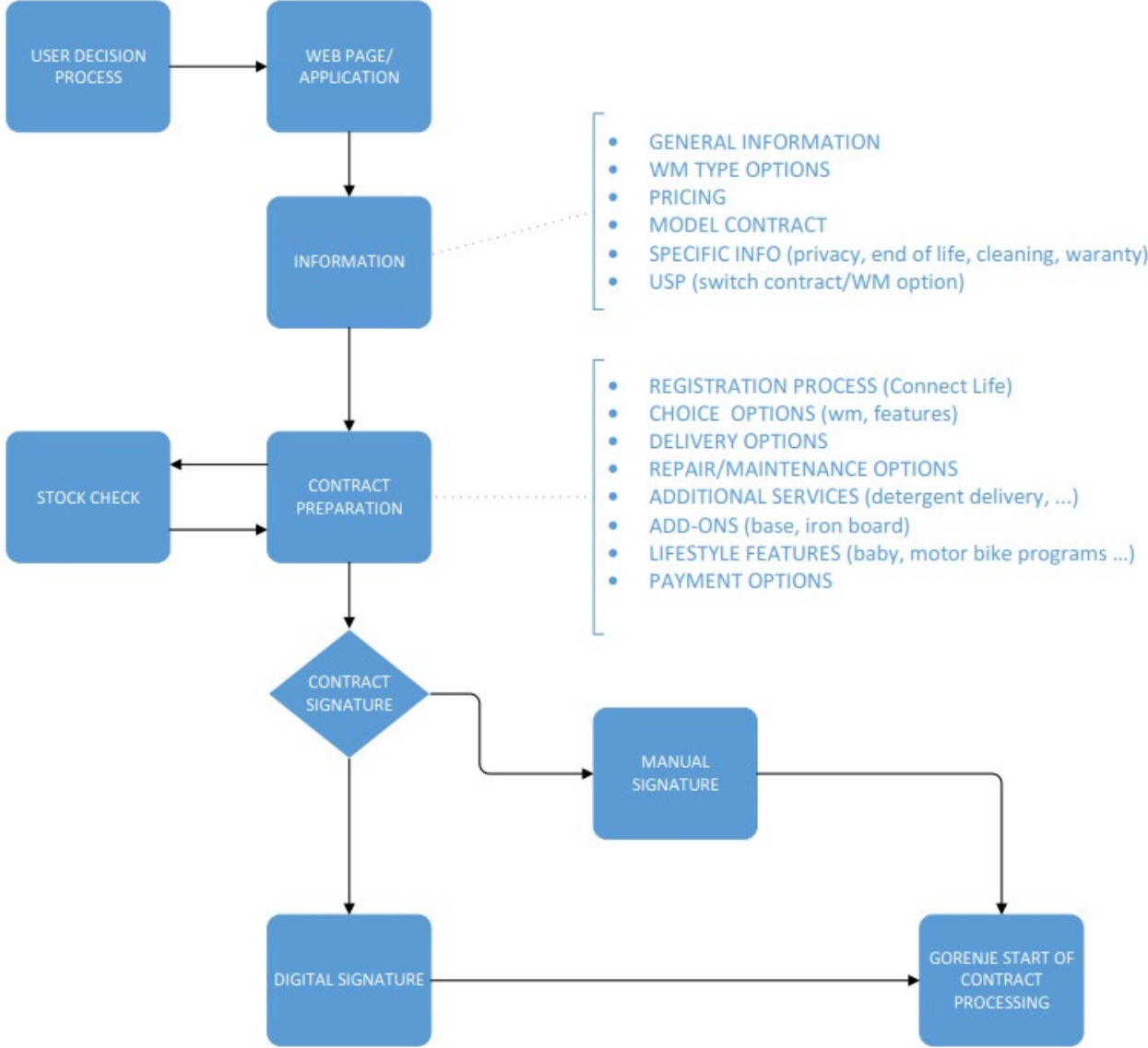


Figure 6: Flow diagram User decision process

#### BUC 1. Registration procedure – PRIVATE customer

For any usage of ReCiPSS services, the user will need a Connectlife User Profile, which is used as a central storage point of user preferences (language ...), user profile information (age ...), paired appliances and other settings.

If the user does not have a Connectlife user profile he/she can create it online via web page or at a later stage, after the App is downloaded, the App offers the possibility to create a new User profile.

For identity purposes, a user can use the Connectlife authentication in which case the user needs to provide a valid email address and a password, or he/she can use existing 3rd party identification:

- Google account,
- Windows Live account,
- Facebook account,
- Twitter account

After entering the identity information (username/password or 3rd party identification) the user must enter (or allow application to automatically obtain) the following information: Full name, email, address, phone, birthdate and other optional information.

### **BUC 2. Contract type and role decision**

The user chooses between BUSINESS and PRIVATE customer (role) and decides for specific contract type.

If the customer chooses BUSINESS CUSTOMER contract type the development will be done in the second phase of project according to demand from the market tailored for specific interest.

If the customer chooses PRIVATE CUSTOMER contract type two options appear

- a) ORDER WM (contract for appliance + service) -> **BUC 3 Contract preparation – MASTER status**
- b) ACCESS WM (contract only for service, have access to the existing appliance)

1. If the customer chooses ACCESS WM two options appear:

- a) Sign a new contract (**BUC 4 Registration procedure - Visitor status**)
- b) Enter existing contract number (**BUC 5 Registration procedure - Alias status**)

### **BUC 3. Contract preparation – MASTER status**

Master user chooses his/her options in the ReCiPSS contract.

1. Customer is required to enter Country and postal code of delivery.
2. Cloud checks available washing machines type at the assigned logistic centres to that postal code.
3. According to stock only available washing machine types are displayed to the customer
4. Customer makes obligatory choices about WM type
5. Customer selects preselected service packages (exact package options still need to be defined based on market analysis and marketing strategy)
6. Customer is requested to adjust the pre-selections (the choices and options will be added gradually during development and deployment of the ReSiPSS project)
7. Price for the chosen options is displayed and adjusted according to the selection
8. Customer makes obligatory choices about payment options and communication channels
9. Customer makes choices about additional features/services. (The extra costs of the personal choices are added onto the price per wash or monthly fee etc.)

10. At the end of the contract selection process the customer is requested to set his/her privacy settings, which can be edited later during the usage
11. After doing the selections the user can save his/her choices to the shopping bag.
12. To complete the contract ordering the user is required to log into his/her account.

#### **BUC 4. Registration procedure - Visitor status**

Visitor user chooses his/her options in the ReCiPSS contract.

1. Customer selects preselected service packages
2. Customer is requested to adjust the pre-selections
3. Price for the chosen options is displayed and adjusted according to the selection
4. Customer makes obligatory choices about payment options and communication channels
5. Customer makes choices about additional features/services. (The extra costs of the personal choices are added onto the price per wash or monthly fee etc.)
6. After doing the selections the user can save his/her choices to the shopping bag.
7. To complete the contract ordering the user is required to log into his/her account.
  - 7.1. He/she can log in if he/she has an account
  - 7.2. He/she can register

#### **BUC 5. Registration procedure - Alias status**

In contract signature registration process, Alias status is defined

1. Private customer chooses in registration procedure Alias user status.
2. Registration menu opens with fields to fill in personal data and shows minimal requirements, which are NAME, E-Mail and PASSWORD twice (marked with stars\*).
3. Authorization procedure is conducted and user logs in.
4. Alias user has to enter Master user's contract number and additional screen opens which notifies him that he has to wait for approval from Master user.
5. Master user gets notification in application/email that Alias wants to link his account to master's contract. Master users sees Alias' name and email address.
6. Master allows or denies access to his account/billing, two phase notification procedure.
7. Alias user receives confirmation/rejection message on a web and via email. If the request has been confirmed alias user is optionally requested to balance the initial fee. See BUC 7.
8. Master user has a separate screen where all his alias users are displayed so that he can revoke approval.
9. Alias user can choose his/her own feedback/monitoring options within the limits of Master's contract. This selection has no influence on Master's settings.

If master user rejects the request, alias user gets a notification in the email that his request was rejected by the master user, but he/she can get his/her own washing machine.



**BUC 6. Contract confirmation and signing**

User signs the contract and pays the initial fee.

1. User logs into his/her account and is requested to check his/her shopping bag.
2. In the shopping bag the full contract is displayed. The user is requested to check and adjust his/her previous choices.
3. The user can now select “sign the contract” and is forwarded to next page in the application
4. A pdf is downloaded. The user is notified to either:
  - 4.1. Print the pdf and sign it manually and send it to Gorenje/SBU Sales Business Unit address
  - 4.2. Sign it digitally via Adobe Acrobat Reader and save it so a assigned place on his/her account/send via Mail
  - 4.3. Other forms of contract signing
5. As soon as the user has pressed the button and the download has started he/she is requested to pay the initial fee to start contract execution

Alternatively, user chooses his/her contract via a sales agent (in a store) and signs the contract manually (not digitally and via webpage).

**2.2.3 Contract processing and execution**

Please find in Figure 7 a graphical overview of the contract processing workflow. It starts with the master user paying the initial fee and ends with delivery of the pay per use washing machine which is the start of the contract execution process.

Figure 8 provides a graphical overview of the contract execution workflow. It includes the use of the washing machine and the recording the usage.

In this section, the business use cases for these two workflows will be described in further detail.

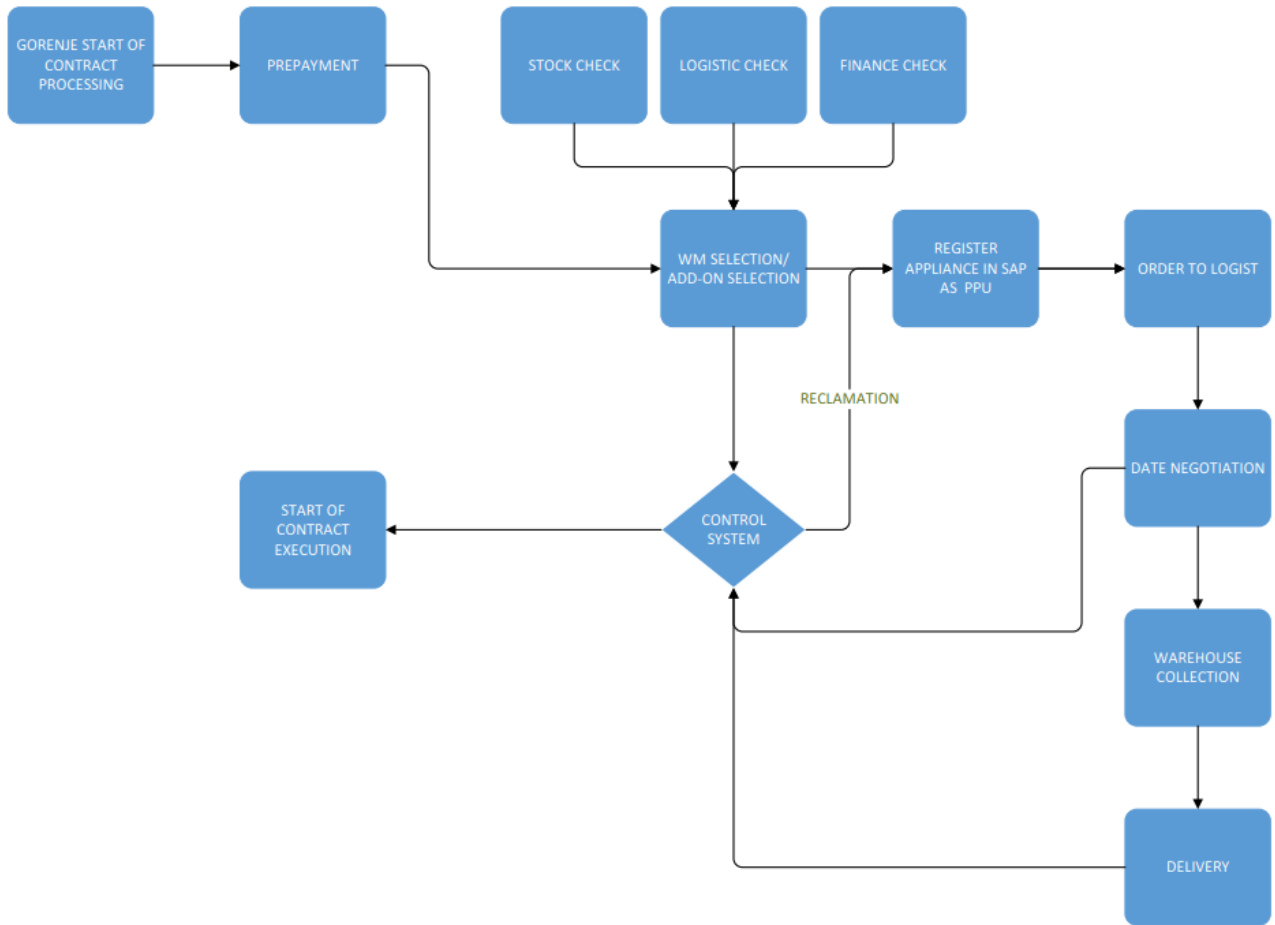


Figure 7: Flow diagram Contract processing

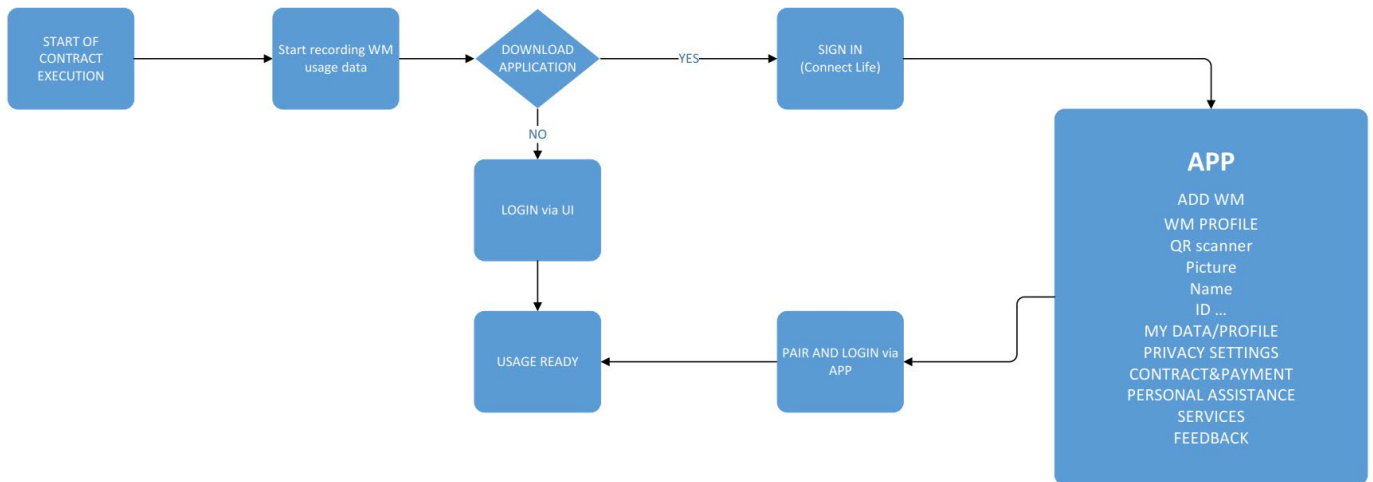


Figure 8: Flow diagram Contract execution

**BUC 7. Initial fee billing**

The customer pays the initial fee.

- 1 User has a new shopping bag item – “Washing machine initial fee”.
- 2 On initial screen of user account there is a message “Check your shopping bag....”
- 3 User opens the shopping bag.
- 4 User gets a message “To complete your order, please balance the outstanding amount. “
- 5 User chooses preferred payment option and pays the bill.
- 6 Gorenje sales agent gets in his system the order from the customer.
- 7 User is notified that the order was forwarded to Gorenje.
- 8 User gets a notification. “For better user experience please download the APP”.

If user pays initial fee:

- a) User has started the process where he/she will get his/her WM delivered
- b) User can start using his/her account as master/visitor/alias

If user fails to pay initial fee:

- a) Contract is not valid and the processing of the contract is suspended
- b) Sales agent gets a notification that contract processing was suspended

**BUC 8. Contract confirmation by the sales agent**

Gorenje sales agent confirms the contract and checks that order was completed successfully.

1. Sales agent gets in his system an order from the customer with suggested appliance (art number/serial number) that was chosen by customer and advised by Logistics.
2. Sales agent has the option to change the appliance in the limits of customer contract.
3. Sales agent confirms model of the machine, approves the contract. Places an order in SAP and organizes the delivery to the customer.
4. Warehouse and logistic provider have all necessary details that the correct machine is delivered to the correct address.
5. On the dispatch the dispatcher has a WM serial number:
  - a. SAP: For specific serial number it must be evident that this WM is in rental (ReCiPSS) mode, location of the device is set designated ReCiPSS location
  - b. ReCiPSS backend (at the installation):
    - i. Gets the AUID and serial number of the machine
    - ii. Connects PERSON-CONTRACT-MACHINE
    - iii. Has address of the WM.
6. ReCiPSS module gets a list of the machines from SAP that were dispatched. For these machines ReCiPSS module checks in regular time intervals with CLOUD, if these machines are connected-online. If they are then the PPU\_FLAG is transferred to the WM.
7. On transferred PPU\_FLAG, ReCiPSS module gets a feedback that this operation was successful, ReCiPSS module stops the check.
8. If machine has not been online, PPU\_FLAG was not transferred for prescribed number of hours after the dispatch, then sales agent gets an email notification.

If logistic provider delivers wrong machine to the end customer and the machine never receives the PPU flag, sales manager notifies the logistic provider about the error and requests pickup and new delivery.

### 2.2.4 Usage

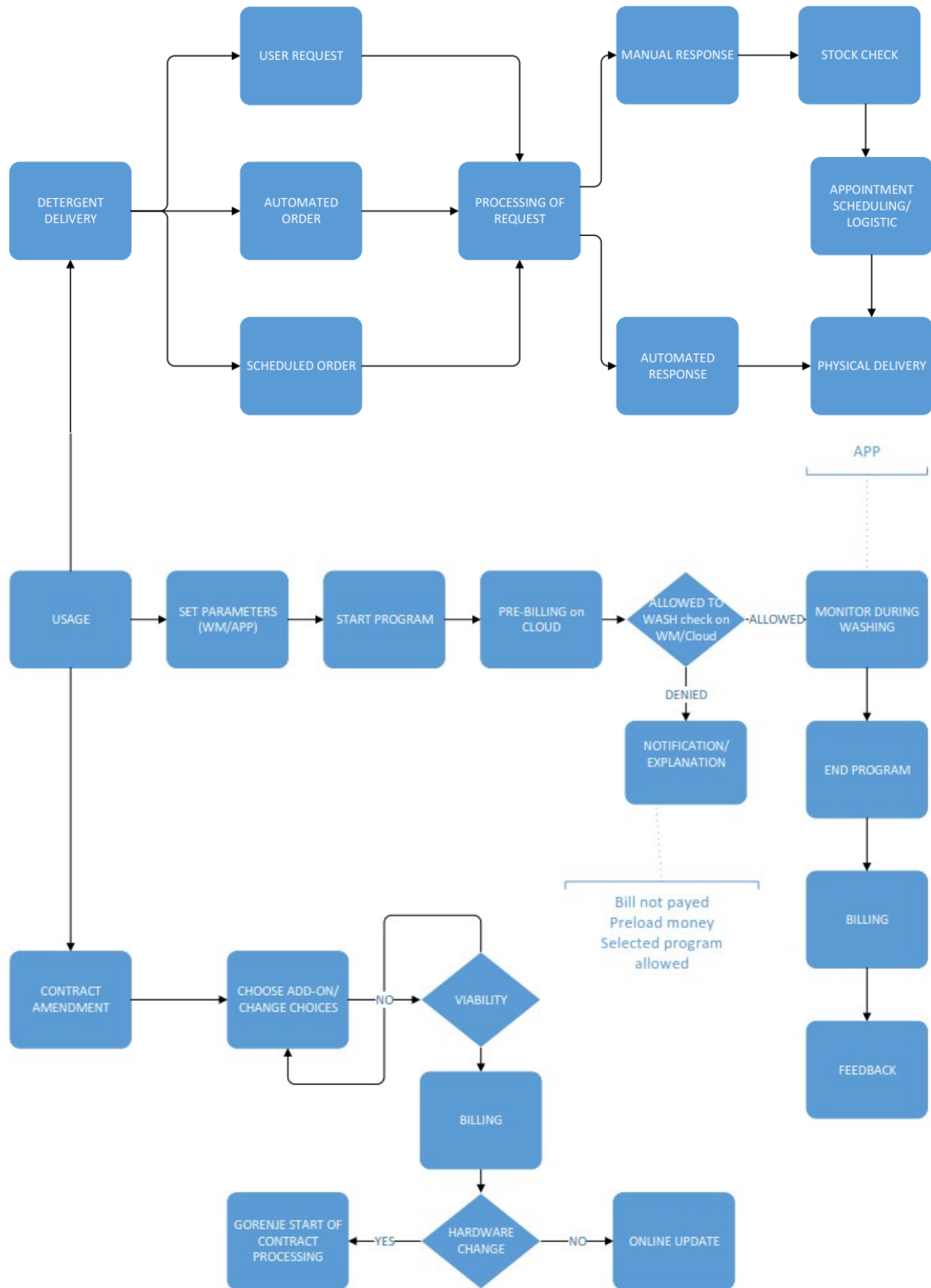


Figure 9: Flow diagram Usage

Please find in Figure 9 a graphical overview of the usage workflow. The business use cases for this workflow are discussed in further detail in this section.

### **BUC 9. Washing machine installment**

Local service partner delivers washing machine to the customer, installs and configures the machine, inputs the serial number- AUID to the ReCiPSS backend

1. Local service partner delivers and installs the washing machine to the customer delivery address
2. Delivery/service man inputs the serial number and contract number to the service application. Service application transfers this data to the ReCiPSS backend. ReCiPSS backend compares with its' own data whether the serial number matches the correct address.
3. Local service partner helps customer to connect the machine to the WiFi.
4. AUID is transferred to the cloud.
5. ReCiPSS backend has a list of WMs that have not yet synced the PPU\_FLAG. For these and only these machines ReCiPSS backend checks in regular time intervals with cloud if the WM is online.
6. When ONLINE PPU\_FLAG is transferred, the appliance works as PPU WM.

### **BUC 10. Connect life shop contract amendment**

Customer changes his/her pay per use contract.

1. Customer chooses amend contract icon where his contract details are shown.
2. System checks the valid contract limitations and greys out non-amendable choices with additional explanation that this is not editable under current conditions.
3. Customer changes choices described in the use case and saves the contract
4. Sign the contract.
5. Customer can also order add-ons or additional programmes by clicking order button in the Connect life shop/ app (lower priority)
6. In the case 5, the system checks if the item is already included in the offer.
7. If the contract already includes the item, its price will be set to FREE
8. If the contract doesn't include the item then the system checks if the item is valid under the current contract number, if it is not, then grey out the item with additional explanation that it is unavailable under current contract number
9. If the item is not already bought/included in the offer and the contract number allows the purchase, then customer can buy this item
10. Sign the contract
11. If the item requires hardware change then the purchase is forwarded to responsible sales agent
12. If the item only requires software update, then update is started.

**BUC 11.Pairing**

Pairing procedure as on other appliances.

- 1.) Refer to CPR2012 Appliance Connectivity UI controls.pdf that describes how appliances are connected to the JUConnect platform and how the pairing procedure is implemented.
- 2.) Application checks if appliance AUID is linked to ReCiPSS contract
- 3.) Application checks if user is registered as ReCiPSS user
- 4.) If points 2 and 3 are true, pairing will be successful

**BUC 12.Generating 4-digit user pass code**

User gets unique 4-digit code at pairing which allows him to start the wash without the application.

**BUC 13.Unpair**

Unpairing procedure as on other appliances

- 1.) Refer to CPR2012 Appliance Connectivity UI controls.pdf

**BUC 14.Washing machine is turned ON**

Washing machine is set to PPU mode

- 1) WM is turned ON
- 2) WM is online
- 3) PPU mode is synced (PPU\_FLAG) as soon as the machine gets online.
  - a) Once the flag is synchronized the washing machine goes to the washing machine PPU mode

PPU flag can be reset only by certified repairman.

**BUC 15.Usage of WM by private customer with application**

User has an individual contract for appliance rental and wants to start washing.

1. User opens/logins to the applications
2. Dashboard screen is shown:
  - a. Customer sees quick overview of washing behaviour in current month
    - i. Total # washes
    - ii. Total costs
    - iii. Total water usage
    - iv. Total electricity usage
    - v. Sustainability index score based on previous washes
  - b. Application displays all paired appliances and ADD new appliance (USE CASE ID: ConnectLife) if user doesn't find desired appliance in the list
3. User selects appliance from the dashboard which brings up single appliance status screen
4. Subscription status, status of the appliance is shown, ...
5. Customer puts the washing machine in the REMOTE start mode
6. User selects START/PROCEED button to display parameter selection screen
7. User selects WM PROGRAM, TEMPERATURE, RPM, MODE and optionally selects ADVANCE functions
8. Applications checks if user is allowed to use selected parameters and in case of negative answer program parameters are greyed out in the application.
9. WM/APP shows exact costs + estimated finish time + quick ECO impact

- a. App shows how wash will contribute to award level, and what wash alternative would contribute more towards next award level. Customer gets alternative wash suggestion before wash programme confirmation, showing potential savings (feature needs to be able to be turned off) APP
10. User selects START immediately or DELAY start and selects RUN which sends parameters to cloud where they are evaluated by the cost table and funds are reserved in case of instant pay and-pre-pay. In case of post billing there is no reservation of funds.
11. In case of missing funds user is notified that the washing cannot be started.
12. In case of successful financial validation cloud sends parameters and starts the program signal to WM and brings up progress monitoring screen
13. WM / APP show remaining wash time
14. When washing is finished user is notified about the status (success, failures, cancel) and adequate funds are withdrawn from user account.
15. Application displays feedback on request
16. Feedback display shows resource consumption (energy, water, detergent, price, eco signs, ...)
17. When wash is finished, app shows new award level
18. User is redirected back to dashboard screen

#### **BUC 16. Usage of WM by private customer without application**

User has an individual contract for appliance rental and wants to start washing without application.

1. User turns washing machine ON
2. User selects WM PROGRAM, TEMPERATURE, RPM, MODE and optionally selects ADVANCE functions
3. User selects START or DELAY start
4. WM checks if it is online and if yes cloud checks if the user has necessary funds.
5. If it is offline WM checks if the credit table is not full. If yes, he/she can wash.
6. WM checks ALLOW\_WASH\_MACHINE flag
7. WM starts the operation and saves PROGRAMID and PROGRAM TIME in electronics on WM (pipeline for billing).
8. When washing is finished user is notified about the status (success, failures, cancel) on the WM-UI and adequate funds are withdrawn from user account.
9. Feedback is saved on cloud, on user request also sent via email
10. Feedback shows resource consumption (energy, water, detergent, price, eco signs, ...)

#### **BUC 17. Privacy settings in Application and at contract preparation**

This business use case describes the additional choices the user can make concerning the information he/she is willing to give in exchange for which extra-service. It serves to transmit transparency to the customer and enable a more customized user experience and marketing.

In contract:

1. GDPR compliance is assured in contract
- Customer is informed which data about his washing behaviour specifically is collected and how it is treated in order to give the feedback statistics and where they are saved [automatized

process] → customer needs to be able to download all the information the company has saved about him/her

2. Customer is requested to tick the additional information he/she is willing to give for a certain added value: Simple explanation what each information is needed for → what the customer's added value would be
3. He/she can change this later in the app under "personal settings".

### **BUC 18. Personal settings in Application**

This business use case defines where, how and about what the customer can change certain settings to customize his/her user experience, especially the communication (notifications, feedback, privacy etc.)

### **BUC 19. Information on App**

This business use case defines what and where data will be displayed in the App.

### **BUC 20. Advice & secret features**

This business use case describes how the customer can get information about how to wash more ecologically, qualitatively, etc. (self-improvement).

### **BUC 21. User washing machine permission management**

WM user has access only to the washing programs that are part of his/her contract.

### **BUC 22. Washing and crediting on the washing machine**

Usage data is collected on WM and transferred to the cloud.

1. There is a table available in washing machine flash memory with N predefined slots (washtable)
  2. Customer starts program with specific settings on WM or APP.
  3. WM checks PPU\_flag (pay per use) in internal memory if it is set to TRUE. (This flag is synced each time wifi connection is established)
  4. Washing machine starts the program:
    - 4.1. Selected program is stored in credit table under PID.
    - 4.2. Wash finished is set to FALSE in credit table
    - 4.3. Minutes of the program in program run state is stored in credit table (this is updated every minute)
  5. Program finished successfully:
    - 5.1. Time is updated
    - 5.2. Wash finished status is set to TRUE
    - 5.3. ReCiPSS backend is pulling the parameters, after the wash finished parameter is set to true for individual wash billing is performed and wash finished parameter set to FALSE.
    - 5.4. When wash finished parameter is set to false on appliance, wash entry is deleted.
  6. Program finished in error state:
    - 6.1. Time is updated
    - 6.2. Wash finished status is set to TRUE
    - 6.3. ReCiPSS backend is pulling the parameters, after the wash finished parameter is set to true for individual wash billing is performed and wash finished parameter set to FALSE.
    - 6.4. When wash finished parameter is set to false on appliance, wash entry is deleted.
- Please note that solving the error state is not in the scope of this business use case.



### **BUC 23.Price & ECO indication on UI**

In PPU mode there is additional information available to the customer on the UI about the cost of the program and eco sign.

1. At pairing, the data about the cost of the program is gathered from the cloud
2. Based on this data €/ \$ signs are presented on UI
3. ECO sign is displayed based on information in the WM.

### **BUC 24.Program cost table**

Sales agent defines cost for a specific program and connects this cost table with a contract.

1. Sales agent can create “Program price plan (for each program Cotton, Synthetics, Wool, …)” where he/she defines “Program cost table” for each available program
2. Program price plan is connected to WM user at contract creation and can be later modified by the sales agent.
3. Cost of the program is based on “Program cost table”
4. WM sends data PID, CHARGED TIME to the ReCiPSS backend
5. ReCiPSS backend calculates the costs
6. Each option has own PID and weight on the program cost

### **BUC 25.WM– Personal settings**

Master user and Alias user can set his/her pairing/unpairing settings: stay paired or auto-unpair after each finished or cancelled wash.

Visitor has per default set that he/she is always unpaired of the appliance after program finished or cancelled.

### 2.2.5 Billing

Please find in Figure 10 a graphical overview of the billing workflow. The business use cases related to this workflow are discussed in this section.

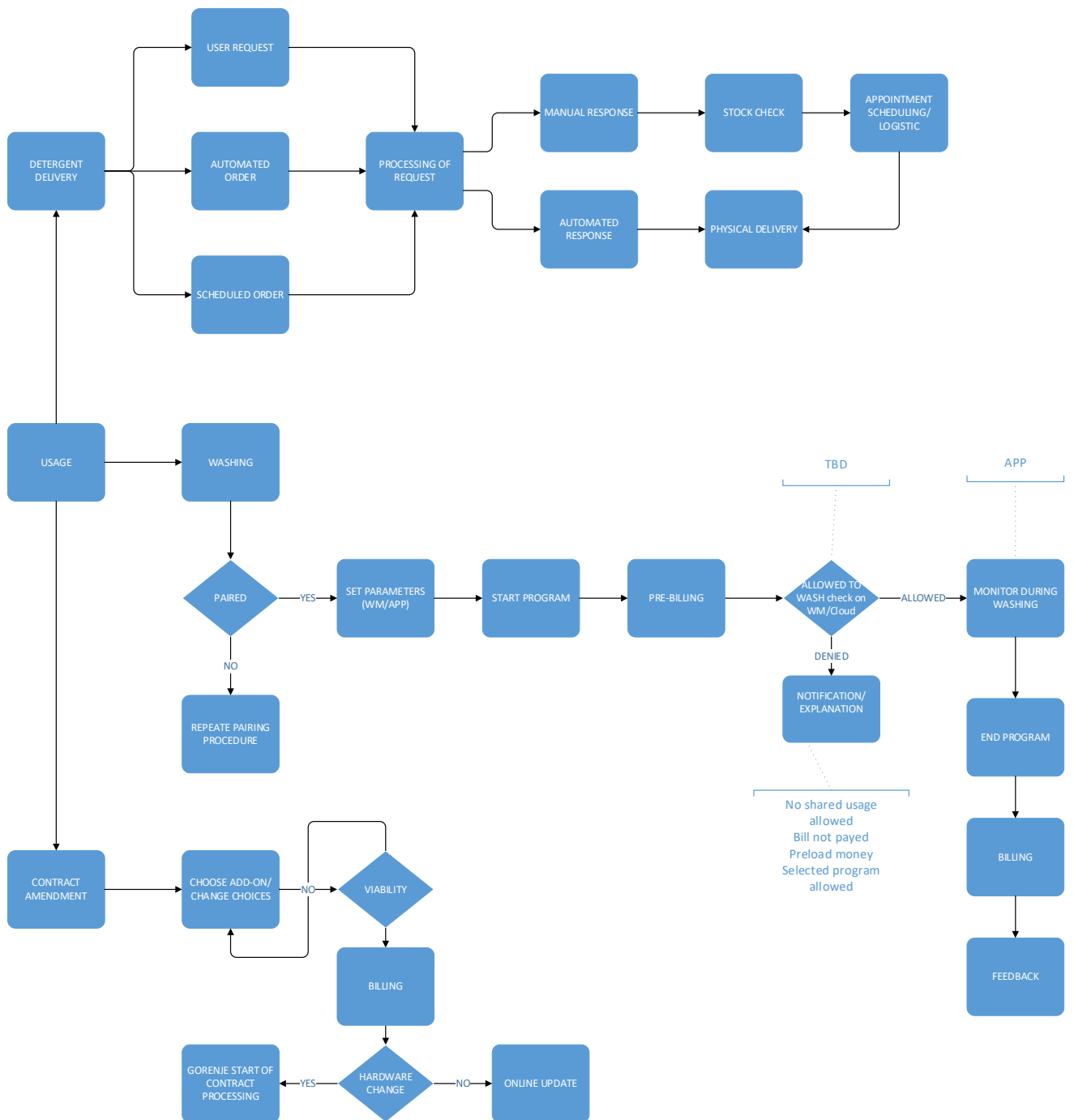


Figure 10: Flow diagram Billing

**BUC 26. Customer billing post-billed**

At the end of the month ReCiPSS backend sums all the costs and sends them to the payment module (Hybris), where bill is generated.

- 1) Data from credit table in WM is synced to the ReCiPSS module
- 2) Each time AUID or cycle number are changed new entry is created in below table.
- 3) REAL USED TIME is continuously synchronized (to ReCiPSS module) and summed up in this entry during the wash
- 4) CHARGED TIME is minimum from (REAL USED TIME, TIME AT START)
- 5) Charged time is continuously sent to cost table
- 6) Cost table calculates and returns the CHARGED COSTS
- 7) At the end of the month costs are summed up and sent for billing to the Hybris. New billing period is started.
- 8) Hybris issues an invoice based on received data.

**BUC 27. Customer billing pre-paid**

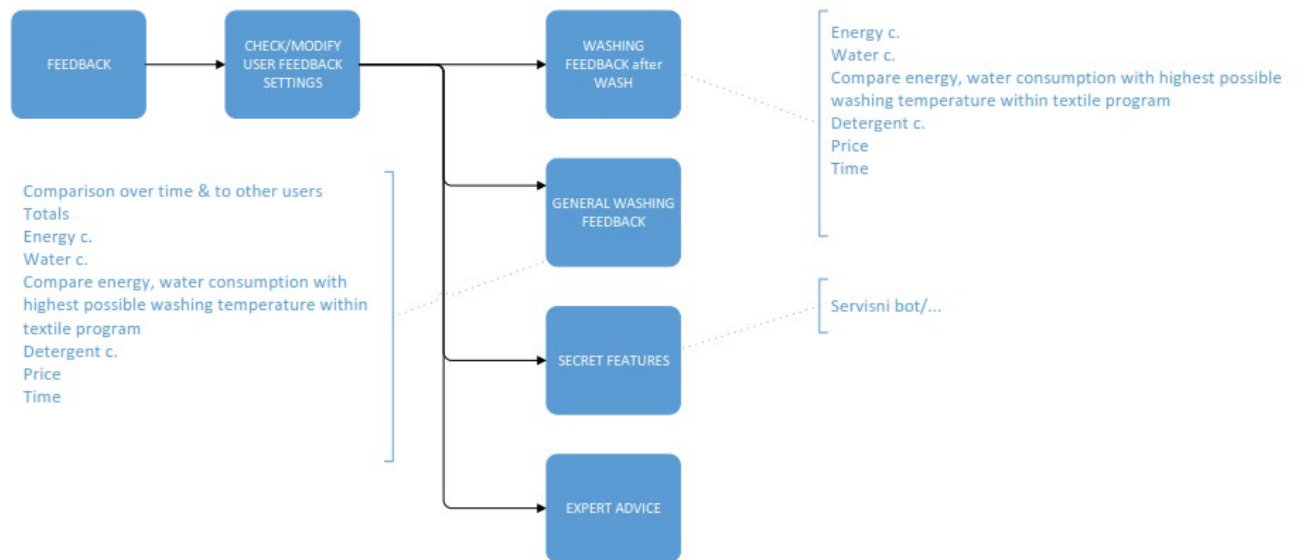
ReCiPSS backend continuously calculates costs and deducts them from user credit.

- 1) Data from credit table in WM is synced to the ReCiPSS module
- 2) Each time AUID or cycle number are changed new entry is created in below table.
- 3) REAL USED TIME is continuously synchronized (to ReCiPSS module) and summed up in this entry during the wash
- 4) CHARGED TIME is minimum from (REAL USED TIME, TIME AT START)
- 5) Charged time is continuously sent to cost table
- 6) Cost table calculates and returns the CHARGED COSTS
- 7) ReCiPSS backend continuously calculates costs and deducts them from user credit.

User with pre-paid bill can have negative status after credit table synchronization. The contract decides the maximum limit (number of washes in negative status).

## 2.2.6 Feedback

Please find in Figure 11 a



**Figure 11: Flow diagram Feedback**

### BUC 28. Feedback on usage behaviour

This business use case describes where, how and about what the customer can change certain settings to customize his/her user experience, especially the communication (notifications, feedback, etc.):

- get a feedback on the cost structure of all my laundry costs
  - get feedback about the resource consumption of each cycle so that I know how much water, energy, and money, detergent is used
  - get feedback on my user behaviour and money I saved with it over a period of time
  - Comparison to others
1. Customer opens "Washing statistics"
  2. Customer can scroll down between following submenus.
    - a. My last wash
      - i. Data about usage (water, energy, program settings, cost, detergent ...)
      - ii. Optimal load statistic
    - b. Monthly overview
      - i. Data about usage statistics
      - ii. Comparison to others (top 10%) (possible to share on social app)
      - iii. Personal sustainability index (standard set by ASKO) (possible to share on social app)
      - iv. Show % of washes that are optimal (standard set by ASKO) (possible to share on social app, see Figure 12).



Figure 12: Example of washing habits screen in social app

- v. Optimal load statistic
- c. Comparison to others inside peer group.
  - i. User can choose group parameters he/she would like to compare to.
  - ii. Customer can choose any of the shown parameters, but none are obligatory.
  - iii. Groups parameters:
    1. Country, 2. Family size, 3. WM Type
- d. Savings (based on program settings, number of performed cycles we get feedback)
  - i. Money savings
  - ii. Resource/Water/Energy savings
  - iii. ECO performance
- e. Rewards (see Figure 13 for examples in social app)

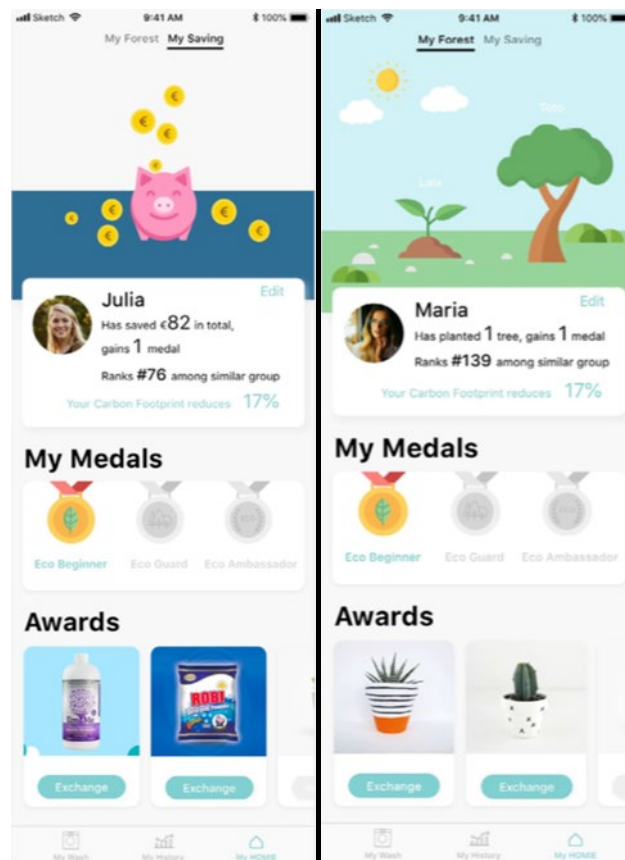
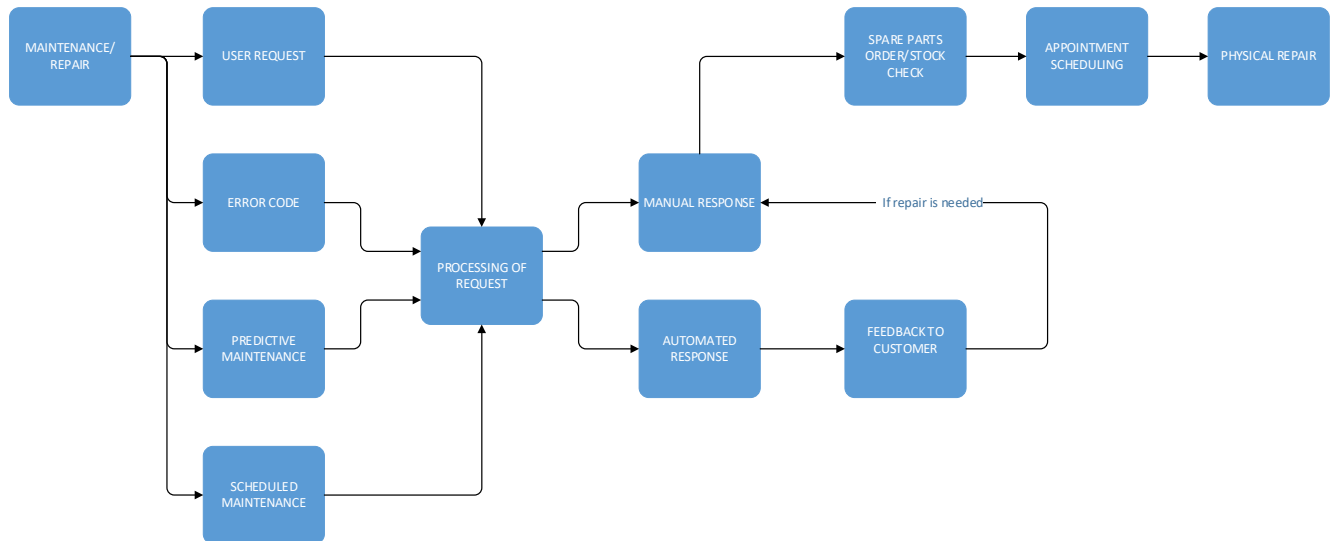


Figure 13: Examples of rewards given in the social app

## 2.2.7 Maintenance and Repair

Please find in Figure 14 below a graphical overview of the maintenance and repair workflow. The related business use cases are discussed in this section.



*Figure 14: Flow diagram Maintenance and repair*

### BUC 29. Maintenance – User request

An error message appears on WM showing error code. User uses the app to solve the problem. In case user can't solve the problem he/she reports the error to maintenance department using app or phone call.

In case user uses an app:

1. User logs in to the app
2. User finds description of displayed error
3. User solve small problem (filter cleaning ...) by himself/herself
4. User presses **SERVICE REQUEST** or **PROBLEM SOLVED**
5. User has also an easy to find option to click **SERVICE REQUEST** button in app where user can describe a problem and sends a service request to local Service partner.
6. An operator in call centre receives information
7. An operator creates a service request
8. Repairer repairs WM on user location

In case user calls the maintenance call centre:

1. Customer calls a maintenance call center to report the error
2. An operator suggests how to solve the problem

3. In case user cannot solve the problem, an operator creates a service request
4. Repairer repairs WM on user location

### **BUC 30.Maintenance – Error Code**

An error occurs on WM. WM reports the error to the cloud.

1. An error appears on WM
2. WM reports an error to the cloud
3. The cloud software relays this information to the user.
4. User receives a push up message with possible solutions
5. User can press SERVICE REQUEST or PROBLEM SOLVED
6. In case the user can't solve the problem he/she requests a physical repair
7. An operator creates a service request
8. Repairer repairs WM on user location

### **BUC 31.Maintenance – Predictive maintenance**

WM continuously checks status of vital parts and sends data to the cloud. In case of recognized high risk failure, the “predictive maintenance software” reports this WM to the call centre.

1. WM continuously checks status of vital parts and sends data to the cloud
2. Cloud software for predictive maintenance checks status of components
3. In case of predicted failure, the software reports expected failure to call center
4. An operator in call center receives information
5. Maintenance call center define the date of maintenance together with user
  - 5.1. Call user or
  - 5.2. Send an email or
  - 5.3. Send a push up message in app with suggested dates that user can choose immediately (low priority)
6. An operator creates a service request for maintenance
7. Repairer repairs WM on user location

### **BUC 32.Maintenance – Scheduled maintenance**

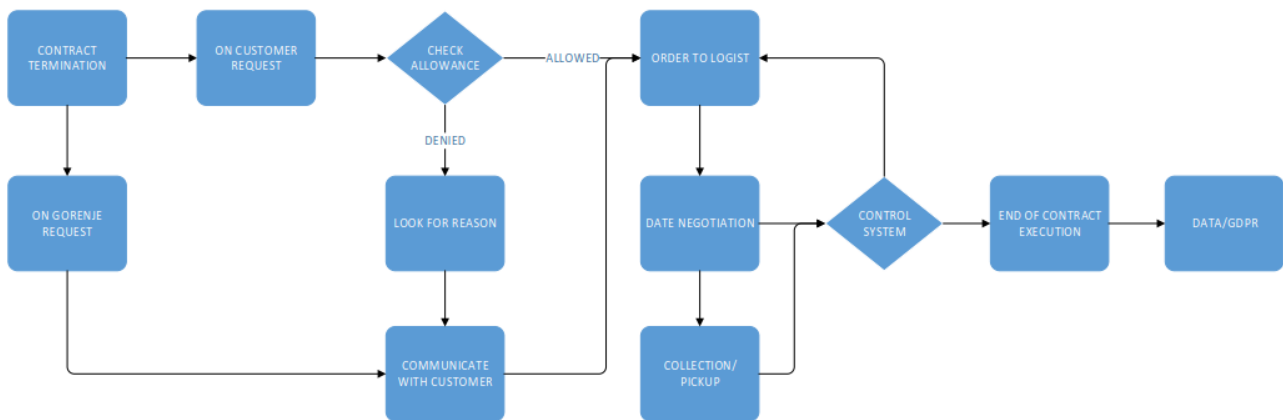
Maintenance call center defines date of maintenance according to predefined time schedule and user's availability.

1. Manufacturer sets regular maintenance procedure
2. Agreement with the customer on date of visit before creating a service request
3. Maintenance call centre define together with user the date of maintenance

- 3.1. Call user or
- 3.2. Send an email or
- 3.3. Send a push up message in app with suggested dates that user can choose immediately (low priority)
4. An operator creates a service request
5. Repairer maintenance WM on user location

## 2.2.8 Contract termination

Please find in Figure 15 below a graphical overview of the contract termination workflow.



*Figure 15: Flow diagram Contract termination*

### BUC 33.Contract termination

When the contractor or business customer terminates the contract or in the end of the regular contract period the WM needs to be picked up and delivered back to warehouse.

On costumer request:

1. Costumer requests contract termination via web, application or a call
2. Operator checks allowance to terminate the contract

If allowed:

3. Gorenje issues an order for transport to logist
4. Logist negotiate a date of picking up the WM
5. Logist collect the WM
6. Logist deliver WM to local warehouse
7. Gorenje ends the contract period with date of pick-up



If denied:

3. Gorenje looks for the reason
4. Gorenje contacts customer
5. Gorenje issues an order for transport to logist
6. Logist negotiate a date of picking up the WM
7. Logist collect the WM
8. Logist deliver WM to local warehouse
9. Gorenje ends the contract period with date of pick-up

On Gorenje request:

1. Gorenje requests contract termination (due to no payment, etc.)
2. Gorenje informs the user about contract termination
3. Gorenje issues an order for transport to logist
4. Logist negotiate a date of picking up the WM with customer
5. Logist collect the WM
6. Logist deliver WM to local warehouse
7. Gorenje ends the contract period with date of pick-up

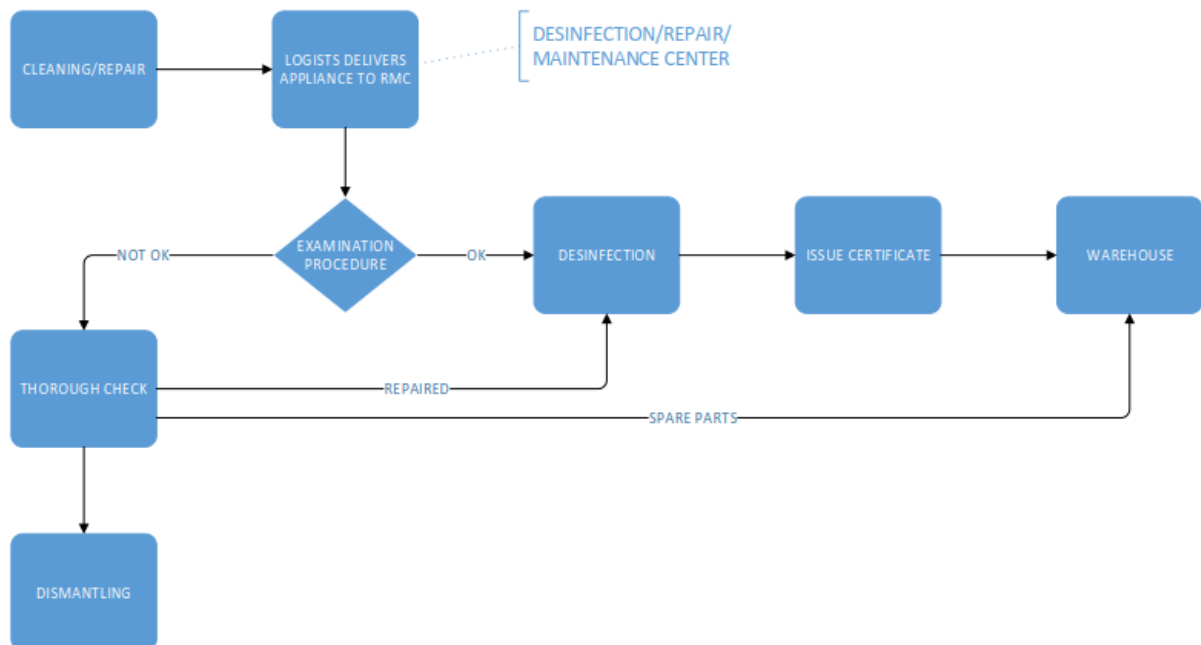
#### **BUC 34.Contract termination execution**

When PPU contract is terminated by Gorenje or the customer, user data will be handled according to GDPR. WM will be reset, SAP and ReCiPSS data about the WM will be updated

1. When the contract is terminated or modified in a way that specific WM serial number is not part of the contract anymore, ReCiPSS backend location has to be updated to the warehouse location.
2. Appliance data on cloud and service base is saved (Problem history, servicing issues and maintenance)
3. User data is handled according to GDPR
4. WM is repaired/refurbished and the software (SW) is reset

## 2.2.9 Cleaning/Repair

Please find in Figure 16 a graphical overview of the cleaning and repair workflow. This section discusses the business use cases related to this workflow.



*Figure 16: Flow diagram Cleaning and repairing*

### BUC 35.Cleaning/repair

When the WM is returned to the warehouse, it needs to be checked, renewed and disinfected in order to reach a like new WM specifications for the next contractor.

1. Logist returns the WM back to the warehouse
2. The warehouse worker takes over the WM
3. The thorough check is performed

In case the WM is still appropriate for the next contractor:

4. WM is repaired
5. WM is disinfected and certificate is issued
6. WM is recorded in ReCiPSS backend as available

In case the WM is not appropriate for the next contractor:

4. WM is dismantled
5. WM is removed from SAP
6. Good spare parts are delivered and recorded to maintenance department warehouse

### 3 Solution design and system requirements

Figure 17 shows the solution design for the pay per use ICT platform. The washing machine connects to the JUConnect platform (previously known as Connect Life Platform) to report the usage of the machine. This information is received by the ReCiPSS backend server. User and appliance profiles are retrieved from the Enterprise Server Bus (ESB) that is implemented by SAP PI. Contract creation is initiated in the ReCiPSS Web store that is based on the SAP Hybris framework. The contract is managed and stored in the ReCiPSS backend server that communicates with the service application SAG and the enterprise resource planning application SAP to ensure delivery and billing respectively. The ReCiPSS mobile application connects to the backend server through the JUConnect API.

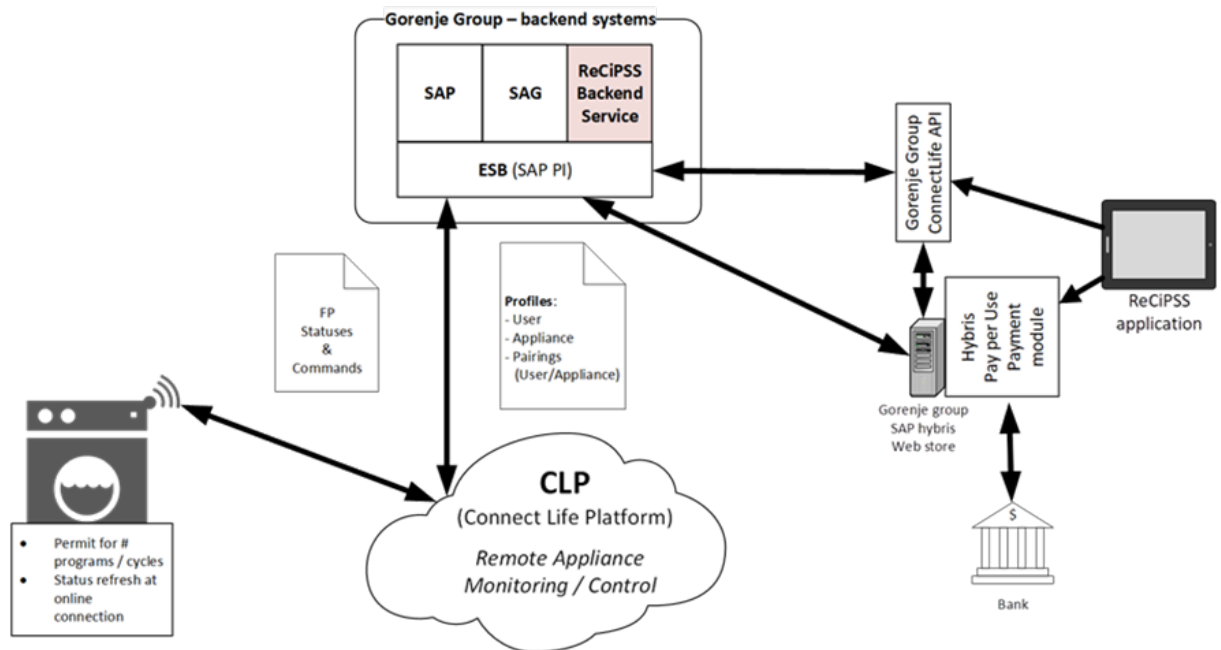


Figure 17: Solution design pay per use ICT platform

## 4 Final remarks

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IoT platform that supports smart washing machines, represents the most critical part and one of the most important steps of ReCiPSS project implementation for white goods demonstrator.

As seen in the previous chapters, the IT platform is very complex and involves coordination and contribution of different IT specialists and experts from legal department, accounting, tax department, R&D, logistic, repair, international trade and GDPR, not only from project partners involved in demonstrator, but also within Gorenje services and our sales and business units in countries where white goods demonstrator will be implemented.

The complexity and unforeseen technical obstacles and difficulties, that we could not foresee at the preparation phase may result in slight deviation of final IoT platform from the described one.

The consortium will put out most effort to fulfil the set development task within the time and content frame.

## Appendix ICT platform implementation

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### Background

The project ReCiPSS tries to solve the contradiction between the overproduction of cheap short-lived products and sustainable production with high quality long lasting products.

The idea explored in this project is simple. The manufacturer should sell the service of quality washed clothes, rather than a washing machine appliance. The customer is not worried about the price of a washing machine and related repair costs. The manufacturer therefore gains the incentive to build "build to last" products that will be making money for years to come. This will reduce the consumption of natural resources and at the same time provide high quality products to the market.

The ReCiPSS project for Gorenje is not to develop pay per use model for the washing machines, but rather to develop new business model that can include any connected appliance produced by Gorenje or Hisense. Professional washing machine ASKO WM75.C and WM85.C was chosen for the demo because the nature of this product is already very much aligned with the principles of the eco-friendly production and refurbishment process. This product is built to last, with regular checkups or refurbishments it should be able to be in operation for at least ten times longer than current domestic washing machines in the market.

The main customers of these appliances are typically shared laundry rooms in the multiapartment buildings and small and medium enterprises, such as laundry saloons or small hotels. These appliances can be a heavy financial burden for these customers and it makes sense for them to rather pay for what they are actually using with included service costs than buying an appliance. There is an additional benefit of this model in the scenarios of the shared usage, as each customer is billed for what is washing and not paying a flat rate regardless of the usage.

There is no reason to limit the offer only to above mentioned business users, as the product can equally well serve the private users, even families. Our calculations showed that our product in the second life cycle gets very competitive comparing to the new domestic machines on the market, with added value of using a well build, high quality machine produced from steel rather than plastic and optimized for energy efficient washing reducing the total cost of ownership of the product.

This demo project will be performed in Slovenia, Austria, Netherlands, and Denmark. At first ASKO Professional washing machines will be deployed, with possible expansion to other WM brands.

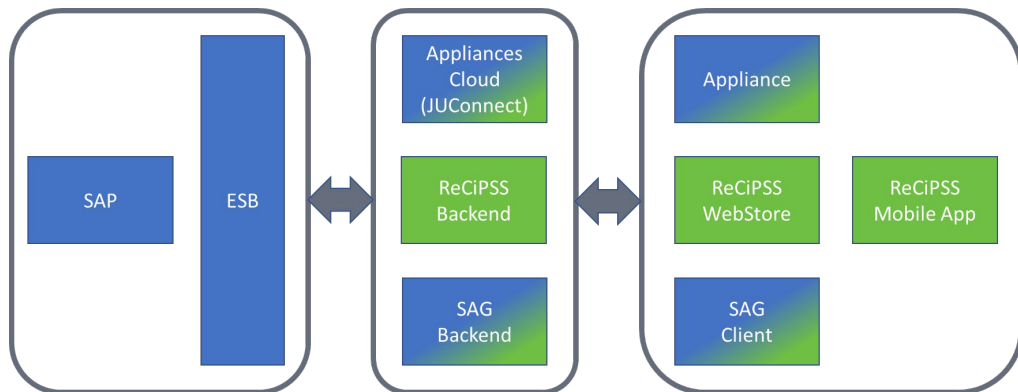
SBUs in demo countries are responsible for marketing, sales, organization of a local logistic support to and from the customer and repair/maintenance/regular check-ups. The SBU service can include delivery and installation, depended on the contract.

The ICT platform developed for this purpose is mainly supporting the marketing of the pay per use mode, contract creation, billing and feedback to the user.

## Whitegoods ICT platform architecture

The Whitegood demonstrator ICT platform enhances Gorenje’s existing ICT platform so that Gorenje can support new business models for the Circular Manufacturing and Circular Economy. The business model at hand is a Pay Per Use business model for Gorenje washing machines. By offering washing machines through a Pay Per Use model, the washing machines can go through multiple life cycles. They will be owned by Gorenje, who will take care of logistics, replacement, refurbishment and maintenance. In this way the total lifetime of a washing machine can be extended significantly, contributing to a more sustainable society.

One of the challenges is that the Whitegoods demonstrator ICT platform is not a new platform from scratch but must be implemented within the boundaries of a platform already in place. It needs to coexist with the existing infrastructure, enhance it but not interfere with the current functionality and processes. In Figure 18, the components of the ICT platform that already exist today are shown in blue and the components that will be developed specifically for ReCiPSS are shown in green. Components that are both blue and green are existing components that are adapted for the sake of ReCiPSS.



*Figure 18: Systems architecture of the Whitegoods demonstrator ICT platform*

## ReCiPSS Web store

First part of this platform is ReCiPSS web store, where user can get the information about the pay per use model and immediately create the contract/ buy the service. ReCiPSS Webstore is developed using SAP Hybris. Hybris core is an ecommerce platform that has several stand-out features which allow developing a full omni-channel solution. This means you can sell online, mobile, in-store and via a contact centre. The development was made using the B2C accelerator. Each of the Commerce Accelerator applications include extensions that offer ready-to-use storefronts and use state-of-the-art web technologies such as Spring MVC 3, the Blueprint CSS framework , jQuery JavaScript library, HTML and Bootstrap, all integrated in the modular SAP Hybris Commerce platform.

Besides the default themes (Alpha and Lambda) we created our own custom theme, and that is how the platform’s homepage is looking:

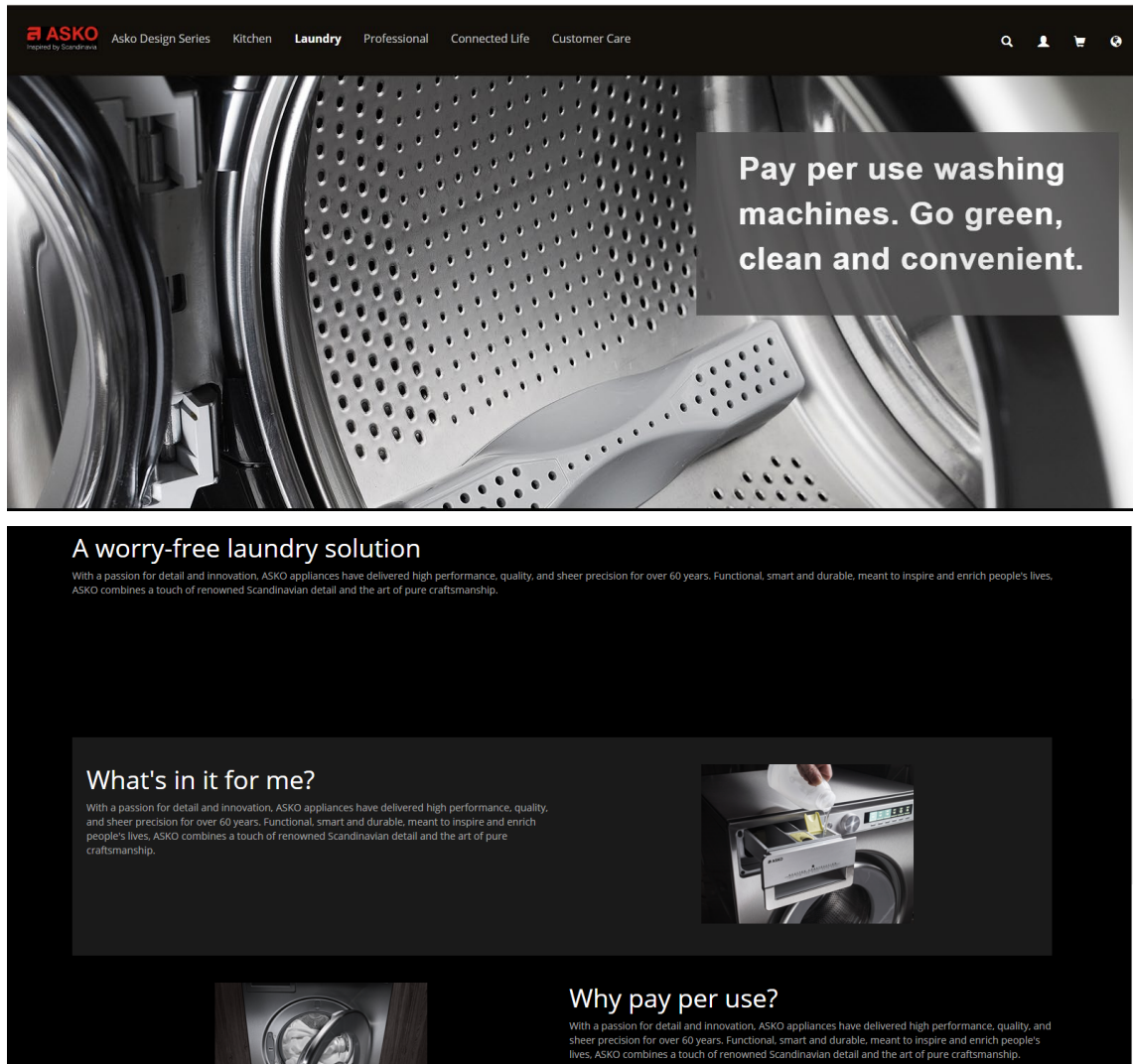


Figure 19: Webstore homepage

By clicking on the second glyph icon (glyphicon-user) the user reaches the login page of the platform. The user enters the data in the LOGIN FORM.

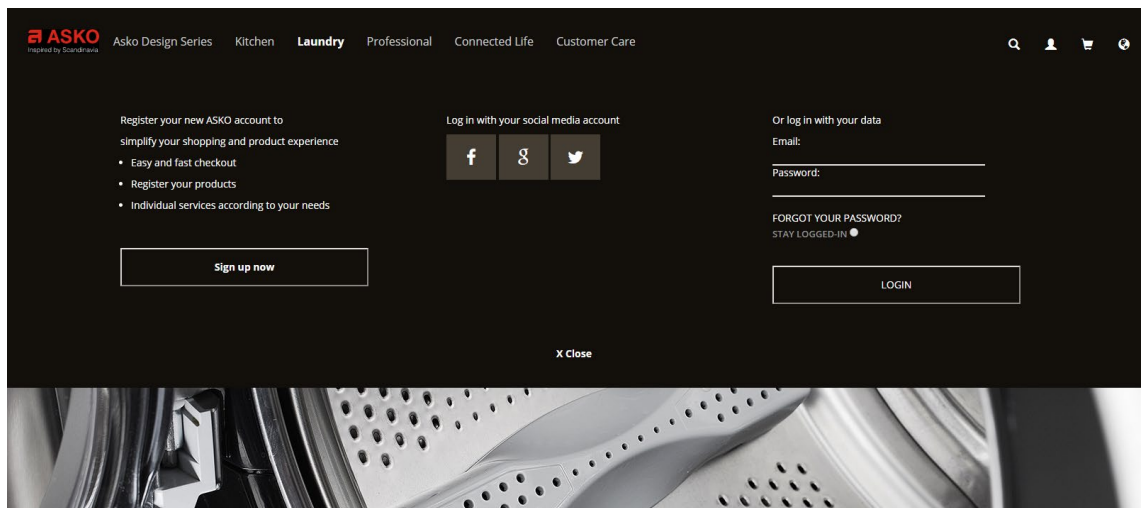


Figure 20: Webstore login page

By clicking on the first glyph icon (glyphicon-search) the user reaches the Product Listing Page of the platform.

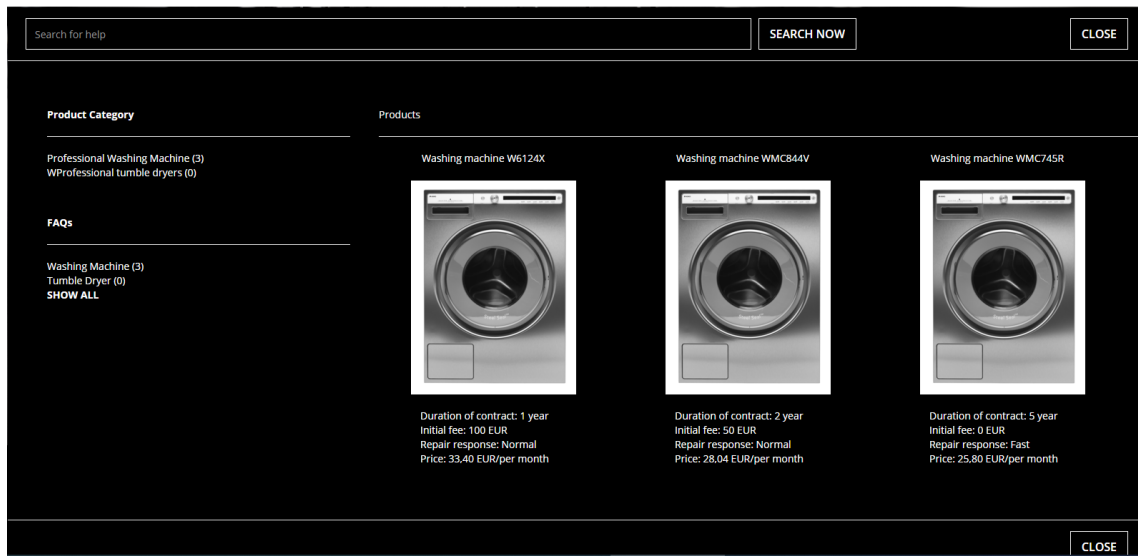


Figure 21: Product listing page

If user wants to read more details about a washing machine, he/she has to click on it. One example:

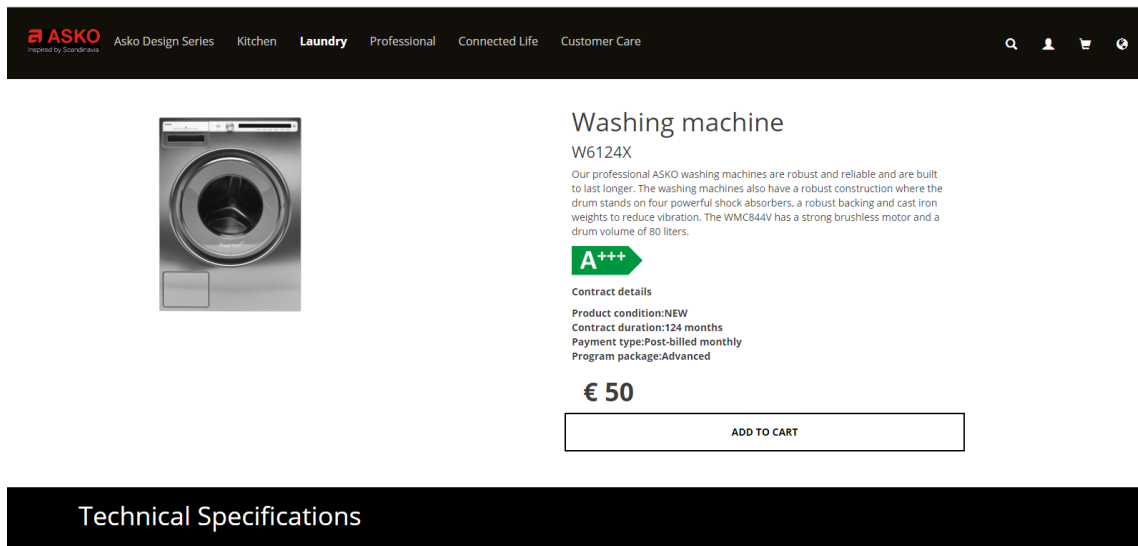


Figure 22: Product landing page



CONSTRUCTION & PERFORMANCE	
Door sealing	Smart Seal™
Drum	Long lasting stainless steel drum
Active Drum™ technology	Yes
Heater capacity (W)	23000 W
Precise temperature control (max deviation: +/- 1°C)	Yes
Water level sensor	Yes
Drum volume	80 l
Motor	Brushless motor
Shortest program time	25 min
Drain system	Valve
USE & FLEXIBILITY	

Figure 23: Product details page

If the client decides on a washing machine, he/she has to click on the Add to cart button. There is opening the first page of contract preparation, Address & Shipping.

Figure 24: Address and shipping page

## Appliance (washing machine)

The next part of the platform is WiFi connected washing machine (appliance), which is able to exactly track the usage on the machine and check if all needed conditions for operation are fulfilled. This data is transferred to the appliance cloud (JUConnect) and subsequently send to all Gorenje internal backend systems, including the ReCiPSS backend service which acts as a central point supporting this business model. Washing machines will be taken from five different sources:

- 1) A brand-new appliance from stock.
- 2) New but damaged in transport.
- 3) Sold to the end customer but returned.

- 4) Used in Gorenje laboratories for testing.
- 5) A returned machine in the pay per use system.

Usage data is collected on washing machine and transferred to the cloud. The usage data is stored and processed by the ReCiPSS backend server.

Every washing machine produced in Gorenje will be able to support the pay per use model as it will be configured as such at delivery and installation or via the internet connection.

When appliances are returned from the customer they need to be checked and cleaned to be ready for a new customer.

The refurbishment and cleaning will be done in:

1. Slovenija - Velenje
2. Austria - Vienna
3. Netherlands - Duiven
4. Denmark -Copenhagen

Where available the delivery of the appliance to the customer and back to the refurbishment facility will be done by a Gorenje service, otherwise by a 3rd party.

The machine can have multiple lifecycles because it will undergo a refurbishment process when needed. Refurbishment means that the worn-out parts will be replaced either with new or used (refurbished) parts. At the end of the lifecycle, the machine is disassembled and parts that can be reused in another machine are stored. Other material goes into recycling.

## ReCiPSS backend server

The ReCiPSS backend service has an overview of all created contracts and users in this business model, it checks if running a program on the washing machine is allowed, calculates the costs of specific program and aggregates these costs into the correct form for billing. It holds the data about the price of each program and send the payment order to the SAP system. The ReCiPSS backend module also gathers the user's usage profiles and sends them to the user mobile application.

The ReCiPSS backend server functionality is exposed through a REST interface. The code is built on ASP.Net core technology and data stored in an SQL Server database. The ReCiPSS backend server will be delivered through Docker containers.

## ReCiPSS mobile application

The ReCiPSS Mobile App will be developed starting the beginning of February 2020. The researches done by TU Delft and Homie will be taken into account , as described in D6.2 - Novel user interface design report, to enhance the user's awareness of sustainability in washing and stimulating long term changes towards more sustainable usage behaviour.

## SAP and SAG

SAP and SAG systems are internal Gorenje systems where all corporate business logic and processes are defined. The role of these two systems in this project is to keep track of the whole logistic process including the storage location, appliance usage status and delivery and

installation process. Additionally, SAP takes care of the payment process after it receives the usage data from the ReCiPSS backend module.

Delivery and installation of the washing machine will be included in the pay per use service offer. At installation a Gorenje certified person will put the data about the contract number (marked in yellow) and appliance data (marked in blue). This data is sent to IoT platform so the system knows exactly where (at which address) each of the appliance is and in turn also knows to whom costs needs to be charged.



Figure 25: SAG client interface

## JUConnect platform

JuConnect is a common cloud platform used for all Hisense connected appliances including Gorenje and ASKO brand connected machines. This means that all connected appliances have an established WiFi connection with this cloud, communicating - both ways - all parameters and control actions. Cloud forwards the needed information to the SAP PI and ReCiPSS backend system. SAP PI has the responsibility of integrating different SAP and non-SAP systems in the Heterogeneous Landscape.