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Approvals

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Introduction

Although public authorities and some private organisations are willing to promote reuse and being a supplier/donor providing its digital devices to electronic reuse platforms, they face two key challenges in that the devices lack proper traceability and customers may not want to buy reusable or reused products. This creates a situation where devices are premature recycled in Europe or illegally exported and potentially pollute the environment. This use case aims to provide the transparency in the reverse supply chain and incentives necessary to guaranteed reuse and ensure safe recycling. We have run a pilot experiment with partners and customers to evaluation (technical and commercial) of the platform resulting from the integration between ereuse and TIS.

Our use case is the implementation of a “Circular Economy” of “slow moving” circular goods (SMCG). Specifically, we work with a key subset of SMCG: digital devices (laptops, desktops, monitors) to extend the lifetimes of digital devices as far as possible by repairing, updating, and reusing them. In our pilot, used SMCG came from the city council of Barcelona, these devices has been inspected internally by refurbishers through analysis software tools (ereuse/TIS workbench), creating for each device a diagnostic reports stored in TIS platform. Sellers of second-hand devices put a diagnostic report link in the product and this create trust on consumers buying through e-commerce.

In addition, the reliability in localization of the devices in the reverse supply chain is generating trust among the stakeholders and customers. With TIS platform the chain of custody of the devices has been traced so the City Council of Barcelona, today knows which agents an users have refurbished, retailed, reused, and finally recycled its devices, thereby creating local jobs, improving efficiency and enlarging trade volumes in the markets of secondhand computers. This has the added benefit of all of the positive externalities in terms of job creation and the economy in the refurbishment, support and recycling sectors.

Section 1 - Explanation of the work carried out and overview of the progress

This deliverable is the update of the deliverable D3.2 use case pilot (interim) with the activities performed in the months M7, M8, M9 and M10. Below we present the activities grouped by each phase and in brackets our customers segment (see 1.1.2 Customer segments and high level value propositions):

Preliminary pilot and integration tests:

- Design of use case and refinement with customers, partners and more tightly with the pilot participants
- Collection, registration, refurbishment and retail of devices using old QR tags but using the new software modules developed during the project and update Reuse modules that do not require smart tags directly
- Adjustment and refinement of TIS requirements
- Data migrations from the old to the new system and integration with Evrythng

First Pilot:

- Run pilot experiment with our primary customer segments (retailers (2), refurbishers (5), ITAD (6), recyclers (7), digital divide initiatives (8) and end-users
- Deployment of smart tags: Registration, refurbishment and retail using smart tags
- Secure validation of smart tags by either scanning it with NFC or scanning the QR and inspecting the veracity of the photochromic tag
- Development and validation of system parts depending on smart tags
- Confirmation of reception of devices through end users
- Recycling of unrefurbishable devices with a recycler

Second pilot:

- Run pilot experiment with our secondary customer segments (buyback (1), service (3), exporters (4)) and validating implementation of fully updated system
- Publishing of refurbished devices in a B2B portal and in Evrytnhg with the participation of at least three retailers
- Iterative training and support to pilot participants on use case model, circular processes, software and services released in WP2
- Quality control and evaluate TIS platform acceptance

1.1 Design of use case and pilots

This chapter describes the design of use case and pilots for the integration between eReuse and TIS. In order to facilitate understanding, we have moved in the annex the mapping of customer value propositions and here we only present the high level ones.

1.1.1 Increase "Circular Economy" of "slow moving" circular goods

Our use case is the implementation of a "Circular Economy" of "slow moving" circular goods (SMCG). Specifically, we work with a key subset of SMCG: digital devices (laptops, desktops, monitors) to extend the lifetimes of digital devices as far as possible by repairing, updating, and reusing them and ensure chain of custody until final recyling.

1.1.2 Customer segments and high level value propositions

We have 8 customer segments with different business needs: **1) Buyback**: use a scoring and pricing systems to automate the price calculation for the purchase or exchange/trad-in of used computers, **2) Retailer**: A business that purchase refurbished computers from refurbishers and need to assess the condition and know the characteristics, **3) Service**: provide post sale channel support and maintenance, **4) Exporters**: secure tags that report and certify the state of, either good operation or its classification as ewaste, of the computers being exported, **5) refurbishers**: tools for device diagnostics and a way to share their stocks with retailers, **6) ITAD/ITAM**: ITADs are IT asset disposal companies and ITAMs are IT asset management companies, they are interested in data security and compliance solutions and stock sharing, **7) Recyclers**: being able to offer their collection services and reporting systems to the competent authorities and, finally **8) Zero Waste and Digital divide initiatives**: public or NGOs, similar to retailers, but must guarantee a fair price to receivers, with a minimal charge for circularity services to support economically disadvantaged recipients while ensuring traceability until final recycling.

1.1.3 Use case participants and system architecture

An eReuse/TIS platform is a set of web tools to support the certify of the device diagnostic report, the stakeholders involved in the reverse supply chain and the circularity of the process. In practice, an eReuse/TIS platform provides donors/suppliers with a guarantee that their devices will be reused and finally recycled, avoiding illegal trade and reducing environmental impact, and to sellers of second-hand devices a service to create diagnostic reports and share it with consumers. In the following figure architecture we present the main interactions between the devices used in the pilot, our customer segments and the TIS platform (see explanation of the description of the system architecture in deliverable 2.1).

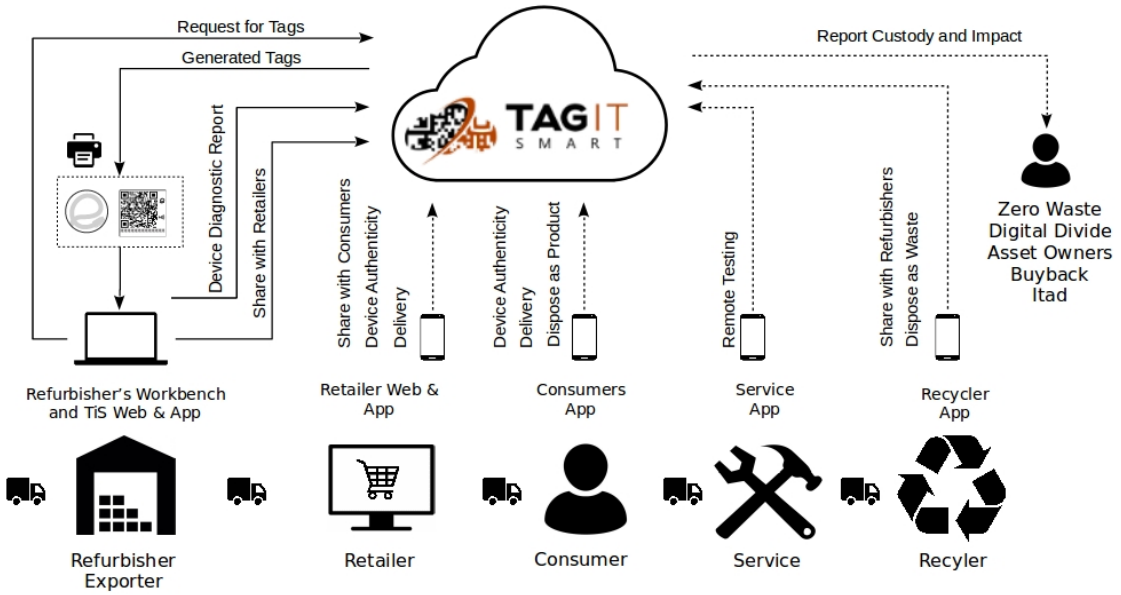


Figure 1: Use case participants and system architecture

There are two level of ereuse platforms, private or collaborative. The first involves only refurbishers, each of which has its own platform. The second level (collaborative) is where an entity focused on zero waste or/and the digital divide creates a collective platform. In our use case this role is done by Pangea.org, a digital divide initiative.

There are four main stakeholders in an electronic reuse collaborative platform:

1. Suppliers: Public administrations or private organizations interested in being suppliers to reuse platforms and ITAMs - IT Asset Management businesses that manage their customers' device fleets.

2. Reuse business: Refurbishers, buyback, ITADs, retailers and service business interested in added value services to distribute, refurbish, repair, retail and maintain secondhand devices.

3. Customers: (i.e. end users) interested in using environmentally friendly or more cost-effective reused devices.

4. Managers of reuse platforms: Zero waste entities and digital divide initiatives focusing on the current digital divide in society. They manage the reuse circuits and assign devices to refurbishers and retailers.

1.1.4 Use case design

In our pilot, used SMCG came from the city council of Barcelona and are donated to Pangea.org association (A **Digital Divide Initiative**), which coordinates the distribution of devices to refurbishers while maintaining traceability and accountability. Pangea.org and the City Council has an agreement, Pangea.org distribute the devices in exchange of social impact for the city council. In this exchange, the association takes the role of buyback, as it acquire used devices from their user. The offer is the social impact that the donation will

have. In this case traceability and proper final recycling is required because the city council want to be able to trace devices to validate the claim on social impact.

At donors facilities, usually there is a selection process through which devices with sufficient use value are assigned to reuse stream and those with insufficient use value to recycling stream. If data of devices has not been erased, data erasure must be carried out by ITAMs at suppliers' facilities, or by refurbishers at their own facilities.

The refurbishers then collects the devices from the donor's facility and repairs, registers and tags the devices. These devices are inspected internally by refurbishers through analysis software tools (ereuse/TIS workbench), creating for each device a diagnostic reports stored in TIS platform. Sellers of second-hand devices put a diagnostic report link in the product and this create trust on consumers buying through e-commerce

This inventory is shared with retailers, such as the work cooperative Abacus.coop (which has more than 800,000 members), or donalo.org (which distributes devices to NGOs). Retailers distribute these devices to users locally or export them to other countries. Consumers buy the devices via e-commerce or in person. They can use a smartphone app to check device authenticity and show key information on purchase moment (see above figure). Some users may need maintenance which is done by service businesses.

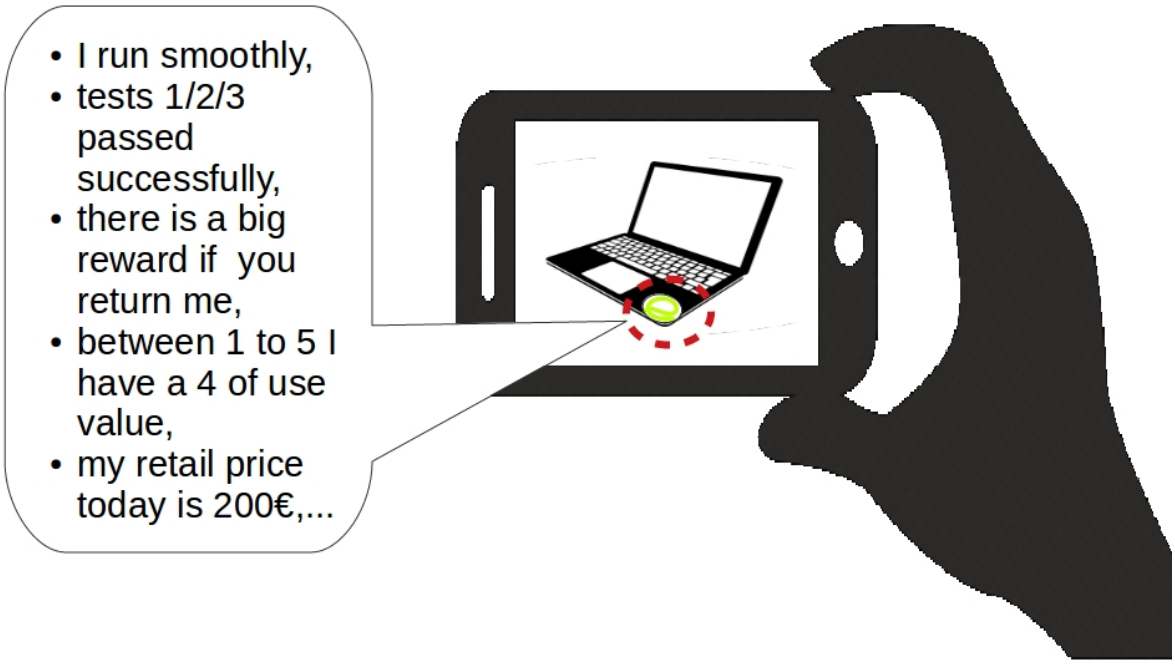


Figure 2: Check device authenticity and show key information on purchase moment

When a user wants to get rid of his device, his retailer makes sure that it enters a reuse platform again if the device still has sufficiently high use value. Otherwise it is send to an authorized recyler.

Platform Managers, Refurbishers and retailers can check the location of any device at any time, as well as monitoring the point at which it is recycled.

1.2 Pilot implementation

Phases	1	2	3	4	5	6	7	8	9	10
Preliminary pilot and integration tests	●	●	●	●	●	●	●	●	●	●
First pilot								●	●	
Second Pilot									●	●

Note: We have extended the project 1 month to finish the integration with Evrthng modules.

Our pilot has been divided into three phases:

1. Preliminary pilot and integration tests.
    - From M1 to M5 preliminary integration tests pilot were done using old QR tags and mostly existing system with primary customer segments (ITAD/ITAM, refurbisher, digital divide initiatives, retail and end-users) refining and detailing TIS requirements and validating implementation of partially updated system.
    - From M6 to M10 we have done the data migrations from the old system to the new system developed with TIS and from M8 to M10 we have finish integrations with Evrthng.
2. First pilot from M8-M9 with TIS smart tags focusing on primary customer segments (retailers (2), refurbishers (5), ITAD (6), recyclers (7), digital divide initiatives (8) and end-users) validating implementation of fully updated system
3. Second pilot in M9-M10 with TIS smart tags focusing on secondary customer segments (buyback (1), service (3), exporters (4)) and validating implementation of fully updated system.

1.2.1 Preliminary pilot and integration tests

Since M1 up to M5 we had 31 end users interacting with the eReuse platform and a total of 174 devices has been registered, refurbished and retailed. While these items do not yet use smart tags, this activity has allowed us to test and validate use cases, processes and system design on a small scale with the most import customer segments: ITAD/ITAM, refurbisher, digital divide initiatives, retailer and end-users. Additionally, in M5 the refurbisher Alencop collected 570 devices from Seidor.es ITAD facilities. These devices have been registered and refurbished.

1.2.2 First pilot

Due delayed availability of smart tags, most activities of the first pilot will be carried out delayed from M8. These activities focus on use cases of basic customer segments (ITAD, refurbishers, retailers, digital divide initiatives, recyclers and end-users) validating the eReuse system fully integrated with TIS.

1.2.2.1 Collection of devices (done)

In June (M5) refurbisher Alencop collected 570 devices from Seidor.es ITAD facilities. This ITAD is responsible for carrying out the disposal of the equipment of the Barcelona municipality. 390 desktops of the ACER, HP and 120 monitors of the ACER, DELL and HP have been collected and will be registered, refurbished and distributed by others retailers and DDI.

Figure 3: Collection of devices by refurbisher Alencop

1.2.2.2 Registration and refurbish

During M7 the refurbisher Alencop made a request for 500 smart tags, see process "Tag provisioning" in deliverable 2.5 Process design (final). Because we didn't have the tags until the M8, we had to do two taggings, the first in the M6 using the previous tag (QR only, first tag from left in the image below), and the second in the M8 with the current smart tag (QR/NFC, middle tag in the image below) and the photochromic tag (right tag in the image below).

Figure 4: ereuse.org tags (normal QR, QR/NFC, photochromic tag)

More than 400 devices were processed in Alencop refurbisher facilities with the ereuse.org workbench tool, see process "Processing a device with Workbench" in deliverable 2.5 Process design (final). At the end of the refurbishment process a diagnostic report per device was generated and stored in ereuse.org DeviceHub and in Evrythng.

The devices that passed the tests were selected as ready for reuse. The refurbisher cannot make any manual change to the device features, this information can only be changed automatically with the ereuse.org workbench tool, and makes the diagnosis of high value to both parties.

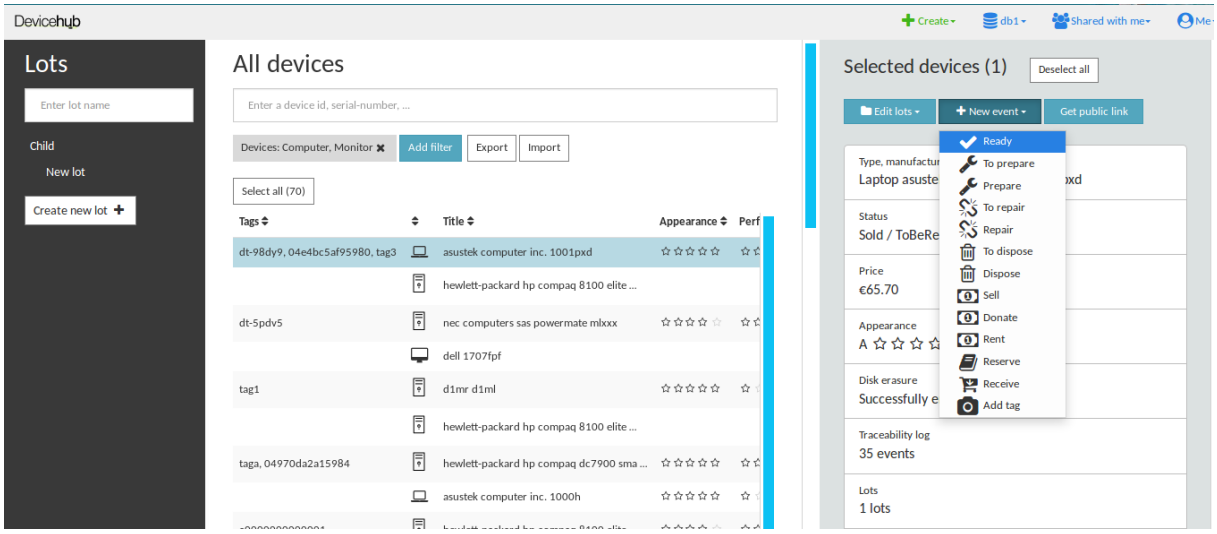


Figure 5: ereuse.org DeviceHub system

1.2.2.3 Share device information with retailers

At this point the devices are ready to be reused in the Alencop refurbisher's facilities. The refurbisher share with the retailer the devices it wants to sell, see process Share device information in deliverable 2.5 Process design (final).

There were at least three retailers participating: donalo.org, abacus.coop, fundesplai and the same Alencop is also retailer. Retailers publish in their e-commerce the devices of the refurbishers. Below is the donalo.org page with an example.

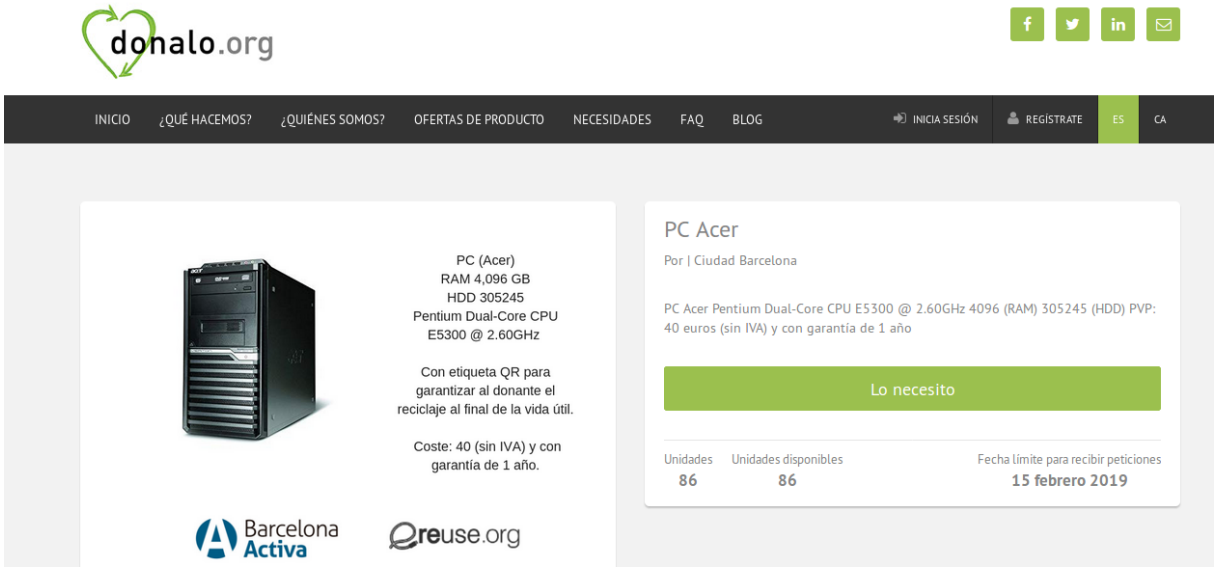


Figure 6: Publishing of devices by retailer Donalo.org on its e-commerce

End users interested in the devices made the request in the e-commerce and received a link to device diagnostic and traceability information. Each device has its own link, for example, this is the information of one of the devices: http://devicehub-teal.ereuse.net/devices/49

The characteristics, rate for main characteristics, current selling price (€85) and the suggested selling price of the algorithm (€72.60) are also shown.

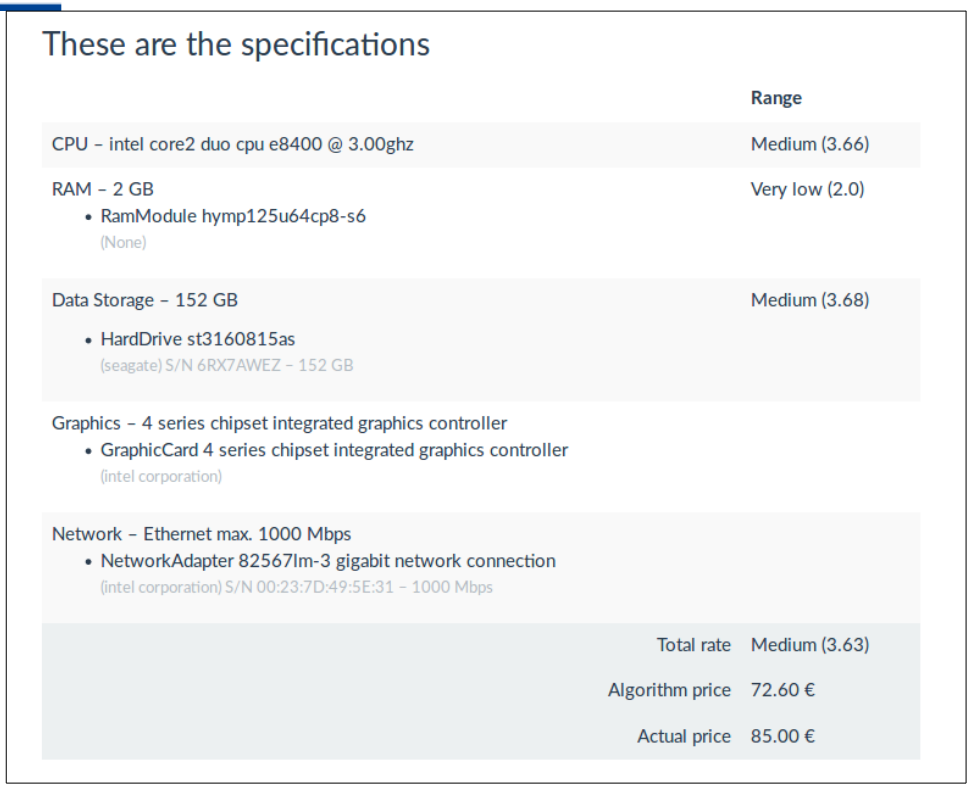


Figure 7: Certified and public information about a device (part 1)

The device url it also shows a traceability log with the main events and tests performed.

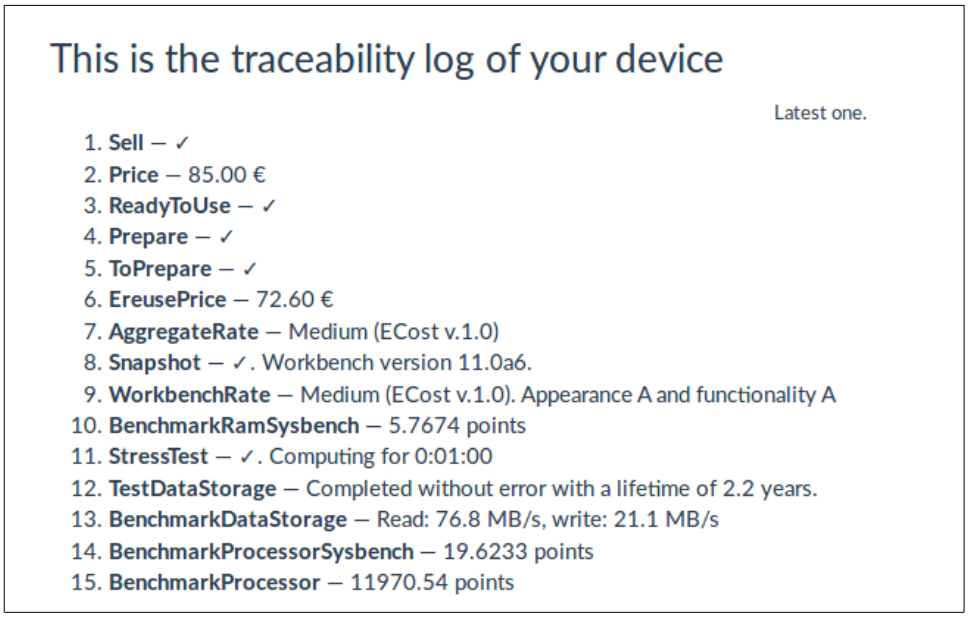


Figure 8: Certified and public information about a device (part 2)

Devices that do not pass certification tests were recycled recycled by Solidança and ACS recycling (see 1.18 Dispose a Device in deliverable 2.5 Process design (Final)).

1.2.2.4 *Transfer to retailers and validation of certified refurbishment*

At the end of September (M8), Fundesplai and Donalo picked up these devices from the facilities of refurbishers and read the smart tag using the smartphone app to confirm the reception and ensure the device is properly refurbished.

Figure 9: A pallet of tagged devices

Reading the NFC displays the device information. In the example above, the last status is shown, which is on the one hand shows the sales status "Sold" and on the other hand its functional status "ReadyToBeused".

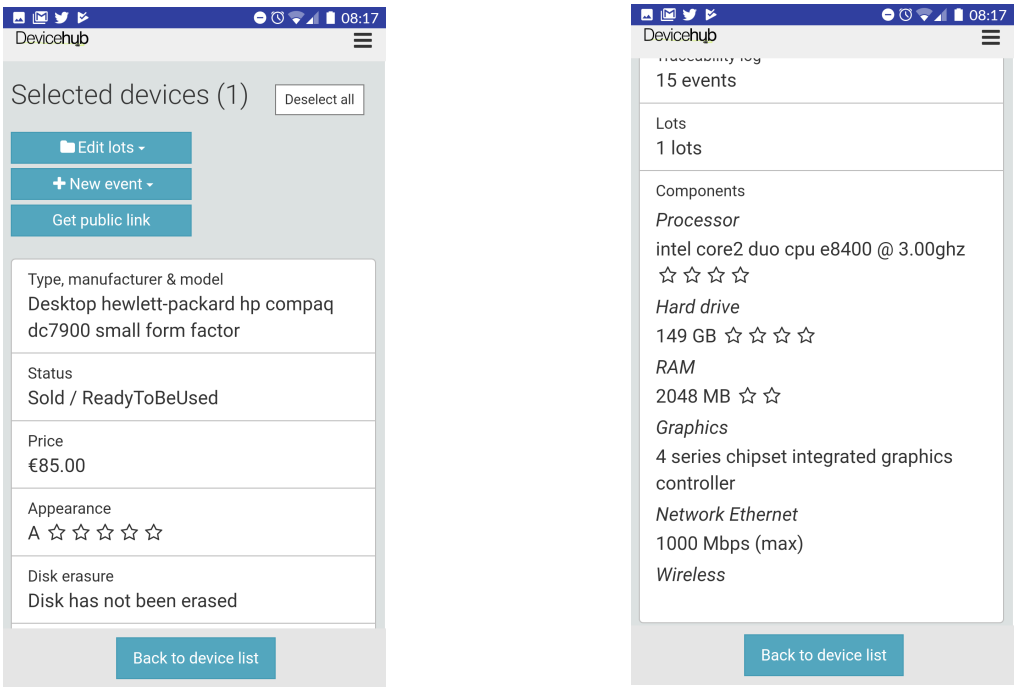


Figure 10: Smartphone app showing device status and value

1.2.2.5 Distribution to end users

These devices were collected in M8 (September) by end users who through the smartphone app validated the device authenticity and status.

The two options were tested:

1. the first is the safest, an is using the smart tag with a NFC cryptographically protected chip with a QR code printed on the chip. The smartphone app reads the URL inside the NFC chip, not the QR url.
2. the second is less safest because use the QR url, is for end-users who do not have an NFC reader on their mobile, and to ensure that the refurbisher/retailer is reliable, they read the photochromic tag. The device page explains how the end-user should do this process.

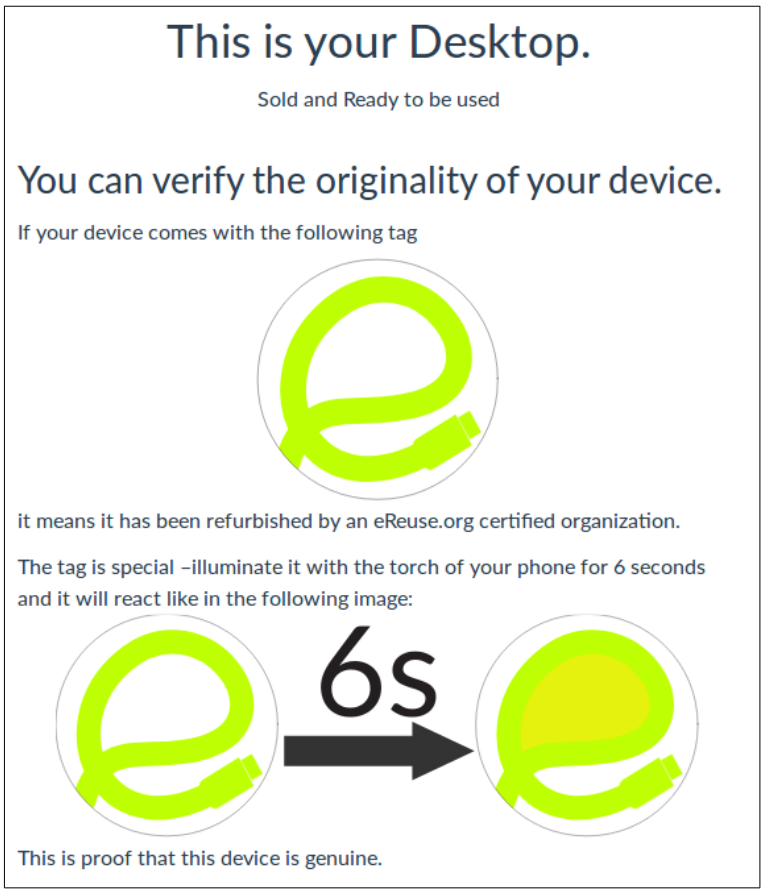


Figure 11: explanation of the photochromic tag validation process

1.2.2.6 Recycling of non-refurbishable devices by Solidança and ACS recycling

Devices not able to refurbish were delivered to Solidança and ACS for final recycling. Recycling operators read the smart tag and confirm reception and recycling.

1.2.3 Second pilot

The second and final pilot were carried out during M8 to M9 and were focused on secondary customer segments: exporters, buyback and service and EVRYTHNG integration.

- Gatxan.net (service)
- Pangea (buyback)
- Computeraid and bancderecursos (exporters)

1.2.3.1 Service pilot

BCN Activa, the local development agency of Barcelona city council, has contracted a renting of 13 devices for one year starting in M9 (November). The contract is made by retailer donalo and the service by gatxan.net company. When the service company has a problem with the devices it can report incidents via the smartphone app or the web.

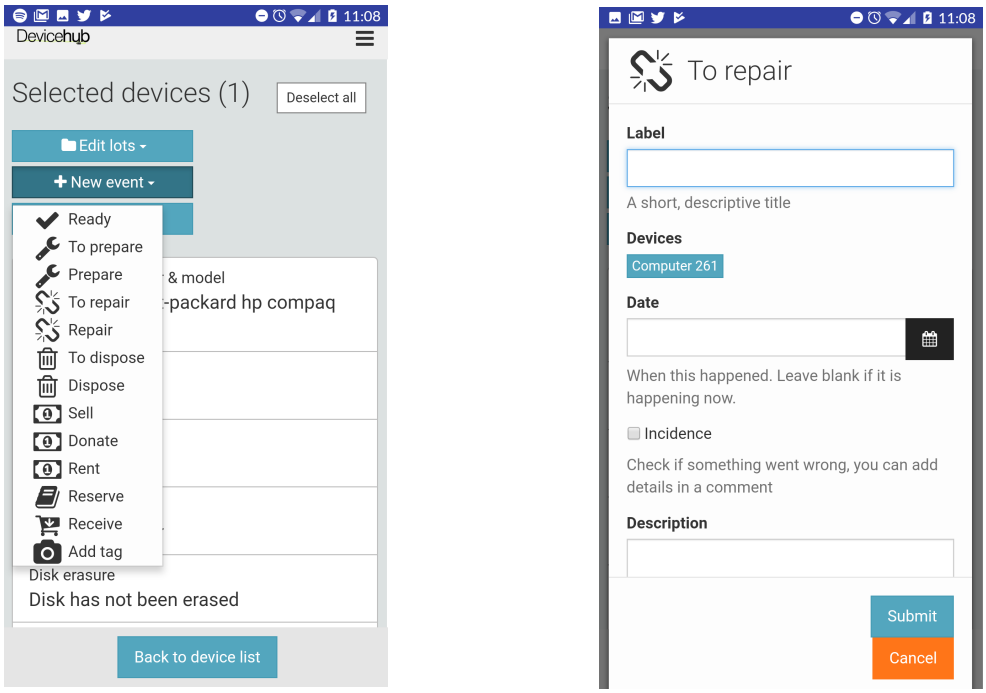


Figure 12: Smartphone app showing events

1.2.3.2 Export

The companies that have exported have been computeraid and bancderecursso. These companies have used the system to generate the reports required by the customs authorities. The reports basically need the information from the internal serial numbers and the device. This information with the new system is obtained with greater precision thanks to the improvements made to the hardware detector.

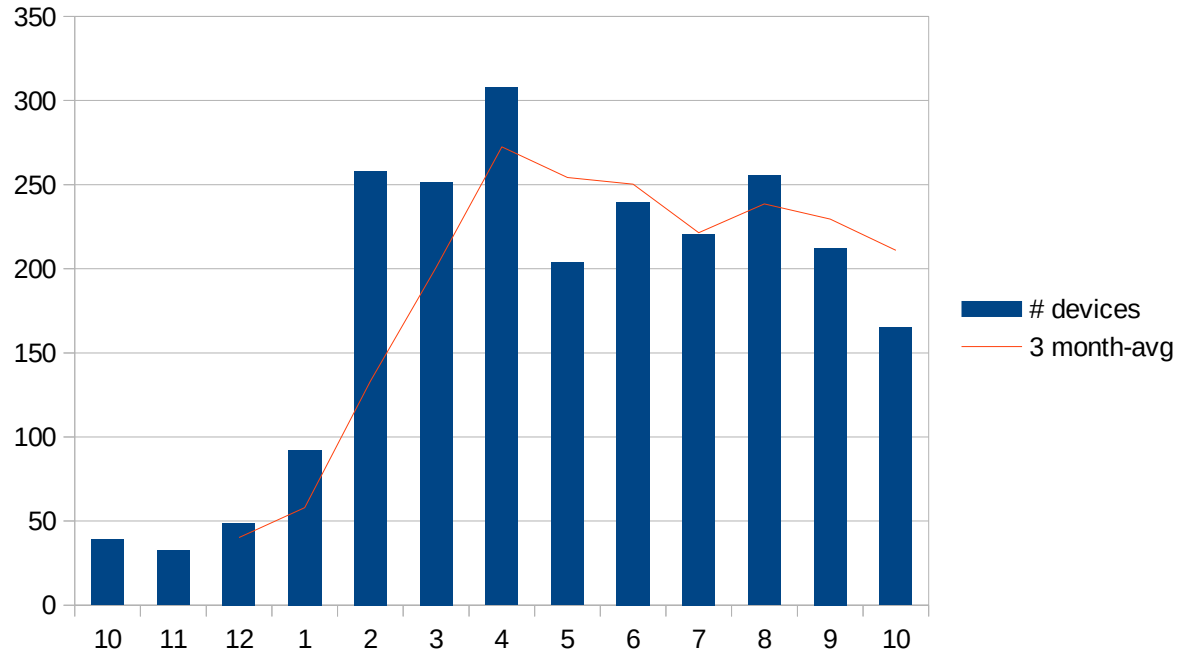
1.2.3.3 Buyback

Buyback requirements were validated by Pangea, which obtains devices regularly from different suppliers in exchange for social impact and is also investigating in buying devices. The suppliers of Pangea, private company and public administration, have valued very positively the traceability information offered by the TIS system. Each supplier receives a report on the impact of reuse, from an economic, environmental and social point of view.

1.3 Impact on platform usage

During the pilots, we measure the following metrics to track our performance and validate the use case model described above as well as circular processes, software and services released in WP2 and WP3.

We have statistical data on the use of the platform since October 2017. The following chart shows number of devices registered in the platform per month from 2017-10 to 2018-10 and a rolling average (3-months).



Thanks to the new functionalities offered by the TIS, in the last year:

- we have had a growth of more than 500%, starting from October 2017 with a 3-month average of 40 devices per month, until October 2018 with an average of 210 devices per month.
- we have doubled in 2018 the number of active users of the system, from 9 to 18, for next quarter we expect the entry of 12 new users who have already expressed their intention, resulting a total of 30 users by the end of next quarter, 21 of them from the TIS project.

Section 2 - Conclusions

Although public authorities and some private organisations are willing to promote reuse and being a supplier/donor providing its digital devices to electronic reuse platforms, they face two key challenges in that the devices lack proper traceability and customers may not want to buy reusable or reused products. This creates a situation where devices are premature recycled in Europe or illegally exported and potentially pollute the environment.

This use case with the Barcelona City Council aims to provide the transparency and incentives necessary to guaranteed reuse and ensure safe recycling. We have run a pilot experiment with partners and customers to evaluation (technical and commercial) of the platform resulting from the integration between ereuse and TIS. Our use case “Circular Economy” of “slow moving” circular goods (SMCG), has been tested in TIS platform with devices that came from the city council of Barcelona. These devices has been inspected internally by refurbishers through analysis software tools (ereuse/TIS workbench), creating for each device a diagnostic reports stored in TIS platform.

With TIS platform, both the City Council of Barcelona, the reuse businesses and the reuse platform manager can check the location of any device at any time, as well as monitoring the point at which it is recycled. Today TIS platform shows which agents an users have refurbished, retailed, reused, and finally recycled its devices. Reuse platform stakeholders relies much more on this data because the fears of duplication of tags and malicious alteration of data have disappeared because TIS non-duplicable smart tags and because transactions are recorded in a distributed ledger tecnology (ereuse/TIS DeviceHubs) and cannot be retroactively altered without the alteration of all subsequent blocks. The next step is record price transactions in a public ledge such as blockchain and this feature is offered by blockchain EVRYTHNG modules.

We've successfully mapped high level value propositions and service offerings for different customer segments. We have focused on second-hand device sellers such as refurbishers and retailers and we have evaluated the value-added TIS platform provide to them. Today, with rising prices and the durability of devices, the second-hand consumer wants to know what he is buying. TIS platform can generates a certified document (and url) with the characteristics and operating status of the devices. This service is feasible and creates trust, and can be offered to sellers, marketplaces or individual users who want to sell second-hand devices.

Finally, this reliability in the condition (diagnostics) and localization (traceability of the chain of custody) of the devices is generating trust among the stakeholders and customers of the reverse supply chain of SMCG products. City councils and private organizations with TIS platform can donate depreciated devices to citizens and organisations, thereby creating local jobs, improving efficiency and enlarging trade volumes in the markets of secondhand computers. This has the added benefit of all of the positive externalities in terms of job creation and the economy in the refurbishment, support and recycling sectors

Section 3 - Annexes

1.4 Customer goals and pains

Customers of TIS service providers usually have more than one role among those presented below.

Customer segment	Gains	Pains
(1) Buyback	Repurchase from consumer, trade-in programs to reduce the money consumers has spend and exchange for social impact	Rating, pricing, inventory management, marketplace, chain of custody during reuse and until recycling.
(2) Retailers	Purchase refurbished devices, sells via website, physical storefront, offers warranty, distribution, post sales support	Certified marketplace (rating, pricing, refurbish), chain of custody during reuse and until recycling.
(3) Service	Repair, Field Service, Maintenance	Internal device tracking, remote testing, help desk.
(4) Exporter	Import/export refurbished devices, similar to retailers	Certify refurbished devices to governments during export process and ensure final recycling of exports.
(5) Refurbisher	Refurbish, testing, software licensing & data security, warehouse	Certify refurbished devices to retailers, tagging, testing, pricing, inventory management, marketplace.
(6) ITAM / ITAD	Asset IT management, data security and downstream compliance until disposal	Tagging assets, data wiping, ensure recycling after reuse and chain of custody to donors.
(7) Recylers	Recycling of devices and traceability until final disposal	Ensure and report final recycling to the competent authorities or to reuse circuits they collaborate
(8) Digital Divide and Zero waste Initiatives	Capture donor devices, distribute devices to social recipients, prevent waste generation, close digital divide	Idem buyback but compensates from the social or environmental impact generated by reuse, idem retailers addressed to social recipients and must guarantee severe donors compliance and ensure

waste prevention performance.

1.5 Value propositions

Main value proposition is ensure condition (diagnostics) and localization (traceability of the chain of custody) of the devices. This is generating trust among the stakeholders of the reverse supply chain of SMCG products.

1. between sellers (refurbishers) and buyers (retailers and final users) of second hand devices because now have certified information about the status of the devices they want to buy.
2. between suppliers of digital devices (ex: The city council of Barcelona) and the zero waste or digital divide organizations receiving this devices and managing a reuse platform, because the supplier is capable to know which agents an users have managed, refurbished, retailed, reused, and finally recycled its devices.

List of value propositions:

- **(1) buyback**: purchase used products directly from consumers or recyclers and compensate them economically.
  - use a scoring and pricing systems to automate the price calculation for the purchase of used computers. Easy bulk processing of devices.
  - use a channel as an installed app in a refurbished devices for consumers to assess the value of devices and buy them from the consumer.
- **(2) retailer**: purchase refurbished devices from refurbishers/brokers/renting/ marketplaces, sells via website, has physical storefront, offers warranty, distribution, post sales support in agreements with maintenance service providers.
  - request secure tags and supply them to its partners (buyback, refurbishers).
  - use a B2B service to confidently purchase refurbished computers to refurbishers and to assess the state of functioning and features of computers in order to offer warranty or its extension to consumers.
  - use a B2C services (online or physical) and secure tags to enable customers to ensures quality control and brand protection.
  - offer warranty models to help businesses to move from selling to renting.
  - use a device tracking system to ensure chain of custody during reuse and offer takeback mechanisms to collect devices from consumers.
- **(3) service**: repair and maintenance service to device users.
  - a desktop application that allows to check the incidences of an individual computer registered in the system,
  - use a device management system with hardware details about each component and provide post sale channel support.
- **(4) exporter:** Import and/or export refurbished devices
  - use a system to certify the state of refurbished devices to governments, either good operation or its classification as ewaste, during export process and usage of secure tags linked to a certified registry.
  - similar to retailers use a device tracking system to ensure chain of custody during reuse and offer takeback mechanisms to collect devices from consumers.
- **(5) refurbisher**: Refurbish from retailers' devices or digital divide and zero waste initiatives,

- add secure tags to devices
- use an embedded system to optimize refurbishment and management of device stocks.
- use a scoring systems to asses the potential for reuse.
- use a shared traceability system to ensure chain of custody with device suppliers, retailers and recyclers
- a B2B system to share and sell their certified stocks with retailers.

- **(6) ITAM / ITAD**: Management of IT infrastructures, data security and downstream compliance until disposal.
  - a software to certify data wiping process.
  - use a shared traceability system to ensure final recycling.
  - use a scoring and pricing systems to automate the price calculation for the selling of used computers.
  - a B2B to share and sell their stocks with buybacks.
- **(7) recyclers**: Recycling of devices and traceability until final disposal
  - use a shared traceability system with device suppliers (collection points, OEMs,..), refurbishers and retailers.
  - ensure and report final recycling to the competent authorities.
  - being able to offer their collection services to retailers.
- **(8) digital divide and zero waste initiatives**: Capture donor devices and distribute to social recipients ensuring waste prevention and closing the digital divide. They act as a buyback, but instead of purchasing devices the initiatives usually get them through donations, reporting the impact of such donations to the donors. In some cases it also plays the role of retailer, but the selling price of the products and potential receivers is conditioned by the license defined by the donors, for example the licence obligates a guarantee for fair pricing to receivers, with a minimal charge for circularity services to support economically disadvantaged receivers.
  - request TIS secure tags and supply them to its partners (refurbishers).
  - use a shared traceability system with device suppliers (donors), refurbishers, retailers and recyclers.
  - use a system to define a license fixed to devices to ensure compliance during full device lifespan.
  - use a system to report to donors the social, economical and environmental impact of reuse.
  - other requirements of buyback and retailer role.