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[D3.4] – Cross Skill® - a self-assessment tool adapted to PAsCAL needs

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List of acronyms	
Acronym	Meaning
CAV	Connected and Autonomous Vehicles
CAVA	Connected and Autonomous Vehicles Acceptance Assessment Tool
EBU	European Blind Union
G2A	Guide2Autonomy
LIST	Luxembourg Institute of Science and Technology (LU)
UUID	Random unique ID
WP	Work package

Notice

This document partly complies with the European Blind Union's guidelines (<http://www.euroblind.org/publications-and-resources/making-information-accessible-all>) in order to be accessible to anyone, including blind and partially sighted people, and at the same time and at no additional cost.

Table of contents

EXECUTIVE SUMMARY	8
1. INTRODUCTION.....	10
1.1 Purpose and organization of the document.....	10
1.2 Intended audience of this document	10
2 CROSS SKILL® FOR PASCAL AS A WP3 SURVEY TOOL	11
2.1 PAsCAL needs in terms of survey	11
2.2 The self-assessment process.....	11
2.2.1 The input needed to allow the automatic questionnaire generation	12
2.2.2 The self-assessment starting page	13
2.2.3 The self-assessment sequence	15
2.2.4 Self-assessment results	18
2.3 GDPR and legal notice	19
2.4 Cross Skill® technical details	22
2.4.1 Installation prerequisites	22
2.4.2 Cross Skill® developments	22
3 CROSS SKILL FOR PASCAL AS A RECOMMENDER SYSTEM FOR THE G2A	25
3.1 A new entry point to the Guide2Autonomy	25
3.2 Adaptations for the Cross Skill integration with the G2A and the provision of personalised recommendations	28
3.3 Questionnaire adaptation to G2A needs	29

4 CONCLUSION	32
5 REFERENCES.....	34
6 ANNEXES	35
6.1 User interest questions.....	35
6.2 Key topic area knowledge self-assessment.....	37
On CAV digital infrastructure & CCAM (Cooperative, connected and automated mobility) services	37
On CAVs legislation, regulation, and insurance.....	38
On CCAM (Cooperative, connected and automated mobility) and local economy, networks, social inclusion, and sustainability	39
On In-vehicle CAV ICT developments	40
6.3 Cross Skill® adaptations	42
Test direct guest access feature	42
Guest result extraction feature	44
Delete extracted test results feature	45

Table of Figures

Figure 1 CAVs key thematic areas	12
Figure 2 Self-assessment question composed of a stem (red) and a key thematic area (green) – CAV legislation, regulation, and insurance	13
Figure 3 Screenshot of the landing page of the self-assessment	14
Figure 4. Cross Skill question progression (from 1 to 4)	15
Figure 5 Question on user interests about CAV key areas	16
Figure 6 Sequence diagram describing the user's path through the self-assessment website and Cross Skill software	17
Figure 7 Results of the self-assessment questionnaire.....	18
Figure 8 Data flow of the self-assessment process.....	20
Figure 9 Data management lifecycle in PAsCAL (from D2.3, page 18) .	21
Figure 10 A graph representation of the recommendations available in the G2A.	26
Figure 11 Sequence diagram presenting how the Cross Skill® based self-assessment tool is integrated with the G2A	28
Figure 12 The self-assessment results on top (related to WP3) and a personalised list of recommendations at the end of the page (related to WP8)	29
Figure 13 The Key thematic areas identified in WP3 are used to annotate the recommendations from the G2A. Each content is assigned by the project experts a level of expertise in 2 main areas. By adapting the Cross Skill® questionnaire self-assessment, we can identify which content is “appropriate” for the G2A user based on their proficiency level.....	30
Figure 14 Question on user interests No. 1.....	35
Figure 15 Question on user interests No. 2.....	36
Figure 16 Question on user interests No. 3.....	36
Figure 17 Self-assessment on CAV digital infrastructure & CCAM services - lvl1.....	37
Figure 18 Self-assessment on CAV digital infrastructure & CCAM services - lvl2.....	38
Figure 19 Self-assessment on CAV digital infrastructure & CCAM services - lvl3.....	38

Figure 20 Self-assessment on CAV digital infrastructure & CCAM services - lvl4.....	38
Figure 21 Self-assessment on CAVs legislation, regulation, and insurance - lvl1	38
Figure 22 Self-assessment on CAVs legislation, regulation, and insurance - lvl2	39
Figure 23 Self-assessment on CAVs legislation, regulation, and insurance - lvl3	39
Figure 24 Self-assessment on CAVs legislation, regulation, and insurance - lvl4	39
Figure 25 CCAM and local economy, networks, social inclusion, and sustainability - lvl1	39
Figure 26 CCAM and local economy, networks, social inclusion, and sustainability - lvl2	40
Figure 27 CCAM and local economy, networks, social inclusion, and sustainability - lvl3	40
Figure 28 CCAM and local economy, networks, social inclusion, and sustainability - lvl4	40
Figure 29 In-vehicle CAV ICT developments - lvl1.....	40
Figure 30 In-vehicle CAV ICT developments – lvl2.....	41
Figure 31 In-vehicle CAV ICT developments - lvl3.....	41
Figure 32 In-vehicle CAV ICT developments - lvl4.....	41
Figure 33 Cross Skill® test direct guest-access API	43
Figure 34 Cross Skill® get test results API	44
Figure 35 Cross Skill® delete results API	45

List of tables

Table 1 Excerpt of the table of recommended contents linked to Cross Skill.....	31
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Executive summary

The PAsCAL project aims to improve the understanding of the implications of connected and automated vehicles (CAVs) on society. It addresses important issues relating to the role of humans in this evolution, ranging from real-time driving control to long-term training needs for jobs, in particular appropriate interactions of the autonomous vehicles with different road users including disabled people and non-drivers.

To fulfil these purposes, PAsCAL project has conducted surveys (e.g., online, face-to-face interviews) on public acceptance, simulated driving scenarios and training and education. To validate the findings, PAsCAL carried out 5 real-world pilots which cover different situations including different vehicles, user groups, levels of automation and driving experiences.

All the collected data were analysed and brought together in a systematic and detailed analysis that assesses the potential impacts of various levels of user acceptance on CAVs.

All the new knowledge is incorporated into the "Guide2Autonomy", one of the main deliverables of PAsCAL, which will be available online for all relevant stakeholders and whose the aim is to support decision makers in considering the pros and cons of future CAV solutions.

In the framework of WP3, several ways of assessing CAV public acceptance were envisioned, including surveys and self-assessment tool. **This deliverable is specifically focusing on the work carried out in task 3.5 for the design and implementation of a self-assessment tool named Cross Skill® that complements the surveys conducted in the previous tasks of WP3.**

The aim of this tool is to allow users to self-declare their expertise about CAV related thematic areas resulting to an estimation of their CAV expertise level. We consider that this approach can help users increase their CAV awareness and, by extension, to positively influence CAV public acceptance.

The advantages of using **Cross Skill®** are the following:

- 1) It uses a specific rating format and algorithm, that allows to reduce common inaccuracy bias of self-assessment (under or overestimation).

- 2) It includes an automatic self-assessment generator, so the costs to administer and deliver the assessment is very small (a few clicks are sufficient to upload contents and generate questions).

The deliverable presents some technical aspects of the tool.

In the frame of the PAsCAL project, the self-assessment questionnaire was generated thanks to the input coming from a workshop involving members from WP3 and 8 who defined a list of CAV acceptance dimensions and key thematic areas.

Following the self-assessment sequence made by a user, a mapping between each answer and their corresponding expertise value (e.g., Novice or Expert) is done.

In addition to the CAV expertise level, the deliverable also addresses the opportunity that the PAsCAL consortium seized during the G2A development (WP8). This includes to improve the recommendations findability, by proposing to leverage the results of this self-assessment to curate a personalised list of recommendations that fit the actual profile of the user.

The deployed instance of the self-assessment tool and recommender for the G2A, free of charge, is accessible at:
<https://recommender.pascal-project.eu>

1. Introduction

1.1 Purpose and organization of the document

The purpose of this document is to present Cross Skill®, its features and the rationale behind its development and use as a survey self-assessment tool of acceptance dimensions in WP3. Cross Skill® is a computer-based self-assessment tool able to automatically generate assessment.

As stated in the D3.2 introduction, WP3 literature reviews and surveys targeted factors and determinants of the public acceptance of CAVs.

In parallel to Tasks 3.1-3.4 leading to the development of the Connected and Autonomous Vehicles Acceptance Assessment Tool (CAVA), Cross Skill® was developed and tailored to offer an alternative way of considering key determinants of CAV acceptance.

Following the Introduction (Section 1), the document is divided into two main sections.

In Section 2, Cross Skill for Pascal is described: from the needs in terms of survey, to the self-assessment process, to GDPR challenges and to technical details.

Section 3 develops how we took the opportunity to extend Cross Skill® as an additional tool to access the Guide2Autonomy.

The document ends with a concluding section (Section 4) followed by references and annexes.

1.2 Intended audience of this document

The audience for this document is:

- (1) the consortium members of the PAsCAL project.
- (2) the stakeholders, including policy makers, CAV service providers and those with an interest in using a guiding tool to select CAV content recommendations.
- (3) the general audience who wish to self-assess their CAV awareness.

2 Cross Skill® for PAsCAL as a WP3 survey tool

This section details the rationale of using Cross Skill® – a self-assessment tool. As written in WP3 description of work, several ways of assessing CAV public acceptance are envisioned, including a survey and Cross Skill®. Then the whole self-assessment process is defined. In a last section, the technical details of Cross Skill® are detailed.

2.1 PAsCAL needs in terms of survey

The CAVA (D3.3) assesses multiple factors, such as intentions to use CAVs, cognitive and affective evaluation people make about CAVs, consequences of CAVs, etc. to consider public acceptance.

As stated in Task 3.5 description, Cross Skill® was envisioned to provide a complementary survey to the ones offered by the CAVA. Therefore, we considered the possibility to assess other dimensions and factors (than the CAVA did): we chose to focus on the self-declared expertise about CAV related thematic areas.

In other words, we hypothesize that assessing self-declared knowledge/literacy of a specific domain can also be helpful to help users increase their CAV awareness and, by extension, to positively influence CAV public acceptance.

In addition to the Cross Skill® ability to self-assess the abovementioned dimensions, Cross Skill® offers at the same time two advantages:

1. As Cross Skill® is an automatic self-assessment generator, the cost to administer and deliver the assessment is very small (few clicks to upload contents and generate questions, see section 3.1.3).
2. As Cross Skill® uses a specific rating format and algorithm, it allows to reduce common inaccuracy bias of self-assessment (under or overestimation) as detailed in Baudet, Ras & Latour (2018).

2.2 The self-assessment process

We chronologically define the input needed to automatically create question items, the starting page where users can begin an assessment, the self-assessment itself (sequence of questions), and finally end with the self-assessment results.

2.2.1 The input needed to allow the automatic questionnaire generation

As part of its hardcoded features, Cross Skill® contains generic assessment templates (also named stems) which are automatically filled with an external input to become a contextualized assessment question. For the Pascal context, consortium members from WP3 and 8 provided the input, which is a list of CAV acceptance dimensions and key thematic areas.

Thanks to WP8 workshops (influenced by WP3 results), the following five key thematic areas about CAV (see figure 1 below) have been identified and are the external inputs used by Cross Skill®.

These thematic areas, linked to acceptance dimensions identified in previous deliverables, are key to increase CAV acceptance (see the Conclusion of D3.1 for greater details about the dimensions).

For example, the *CAV legislation, regulation, and insurance* thematic area has an obvious link to the *Road safety* dimension but also to the *Privacy* factor, identified in D3.1. Regarding the thematic area *CAV and Economy, network, social and sustainability*, it has a direct link with the environmental dimension of CAV acceptance.

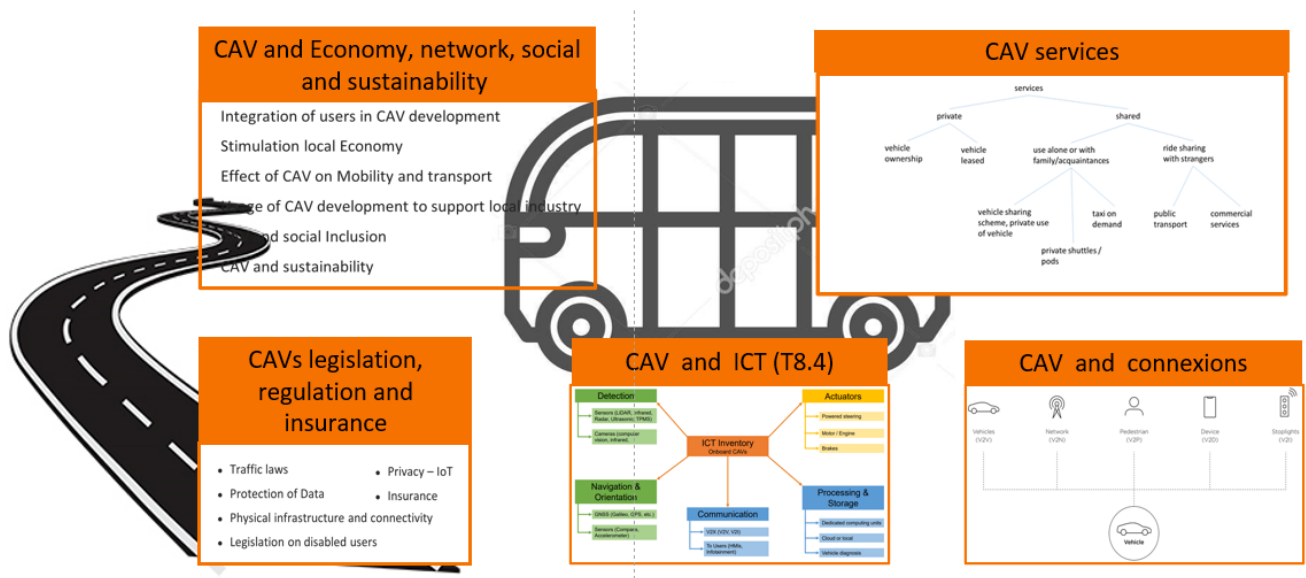
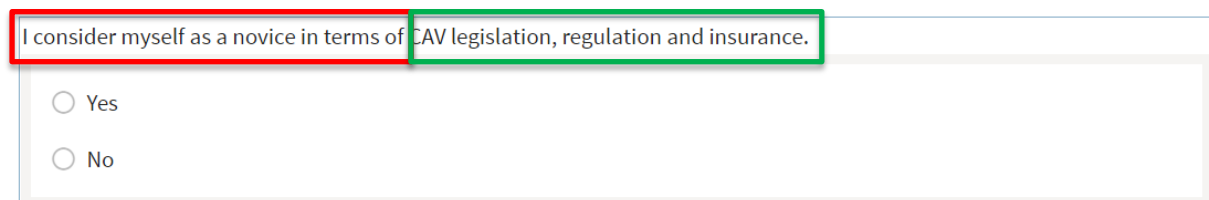


Figure 1 CAVs key thematic areas

As displayed in the lower left part of the previous figure, the *CAV legislation, regulation and insurance* key thematic area is one of the inputs for which Cross Skill will automatically generate self-assessment items.

In the figure 2 example below, the (generic) hardcoded Cross Skill® stem is represented in the red rectangle, and the last part of the sentence (green rectangle) represents the external input – the thematic area – to be uploaded into Cross Skill® to automatically generate the question below. To fully understand the sequence of questions (beyond a simple question), the most relevant way is to pass the test by yourself as shown in Section 3.3.

Note that a dichotomous answer option (Yes/No) has been chosen to force people to position themselves, but their final proficiency score will be determined after several questions (and not only after this question displayed below). “Transparent” scales with all proficiency scores displayed at once were avoided to reduce inaccuracy, as suggested in personality tests (Mc Farland & Ryan, 2000). In other words, the more a construct (any element to assess) is transparent, the more you can distort (fake) its measure.



I consider myself as a novice in terms of CAV legislation, regulation and insurance.

☐ Yes

☐ No

Figure 2 Self-assessment question composed of a stem (red) and a key thematic area (green) – CAV legislation, regulation, and insurance

2.2.2 The self-assessment starting page

LIST developed a static website¹ to:

- present the context of the self-assessment questionnaire powered by Cross Skill® and act as a landing page.
- present the results of the self-assessment test in an easy-to-read manner.

¹ https://en.wikipedia.org/wiki/Static_web_page

The landing page, illustrated in figure 3 below, provides a short introduction to Cross Skill® and invites the user to start their self-assessment.

In addition to the specific algorithm and random questioning² to decrease under or over-estimation of user's self-declared knowledge, the user is asked to be honest and spontaneous during the test. As simple as it is, a warning against distortion (faking his answers) is efficient. The meta-analysis of Dwight and Donovan (2003) showed that warnings and suggestion to be honest could decrease by up to 30% the distortion and assessment inaccuracy.

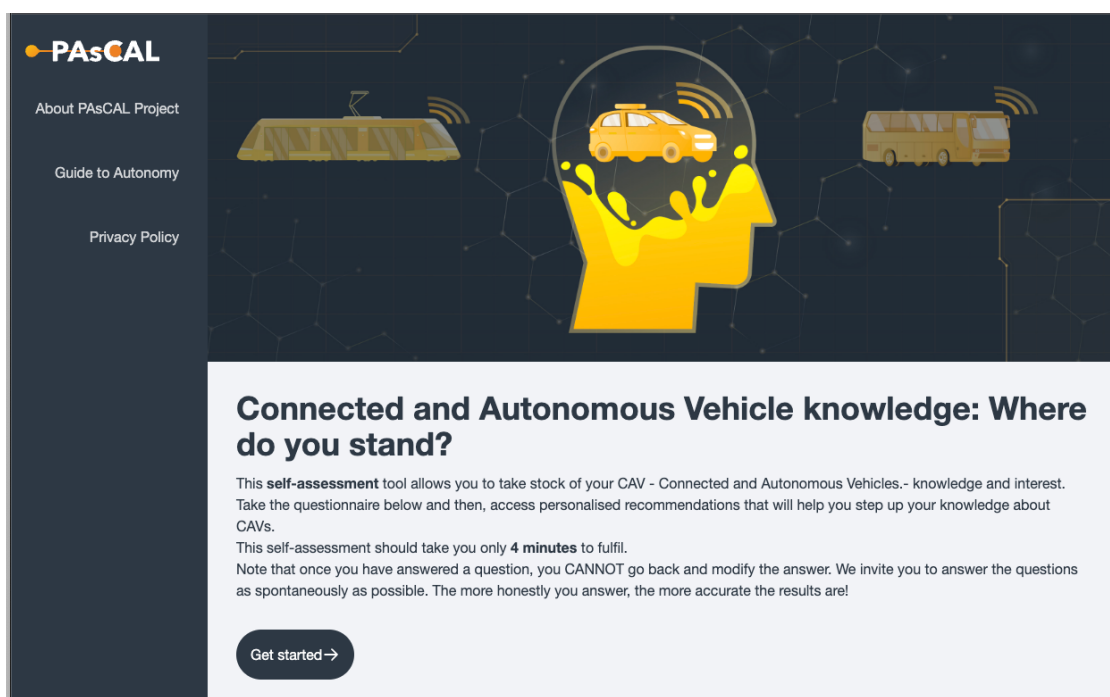


Figure 3 Screenshot of the landing page of the self-assessment

By clicking the “Get started” button, the Cross Skill questionnaire is started with a “Guest Account”, i.e., that the user does not need to create an

² Regarding a domain X assessed through Cross Skill, the user will not have to answer every question related to domain X sequentially. Instead, the user will have first a question related to domain X, followed by a question related to domain Y, then Z, etc. and later another question related to domain X.

account first. When clicking the “Get Started” button, a random unique ID (UUID) is generated on the user web browser and passed to Cross Skill® to identify the current user session and to allow the retrieval of the results later.

2.2.3 The self-assessment sequence

Following the landing and starting page, a user starts the self-assessment questionnaire sequence. The questionnaire is built by using the following elements (blue circles from 2 to 4), displayed in the Figure below. These external inputs come from the WP8 G2A framework.

As displayed in the figure 4 below, from left to right,

- Cross Skill® for PAsCAL is only focused on one type of user (1): service providers.
- Service providers might have one or several CAV related specific interests (2) to select – named key thematic area in the figure below.
- Service providers can mention that they are interested in several levels of impact (3) (individual, vulnerable road users or macro- A, B, C).
- Finally, Service providers can select the type of tool (4) they are interested in.

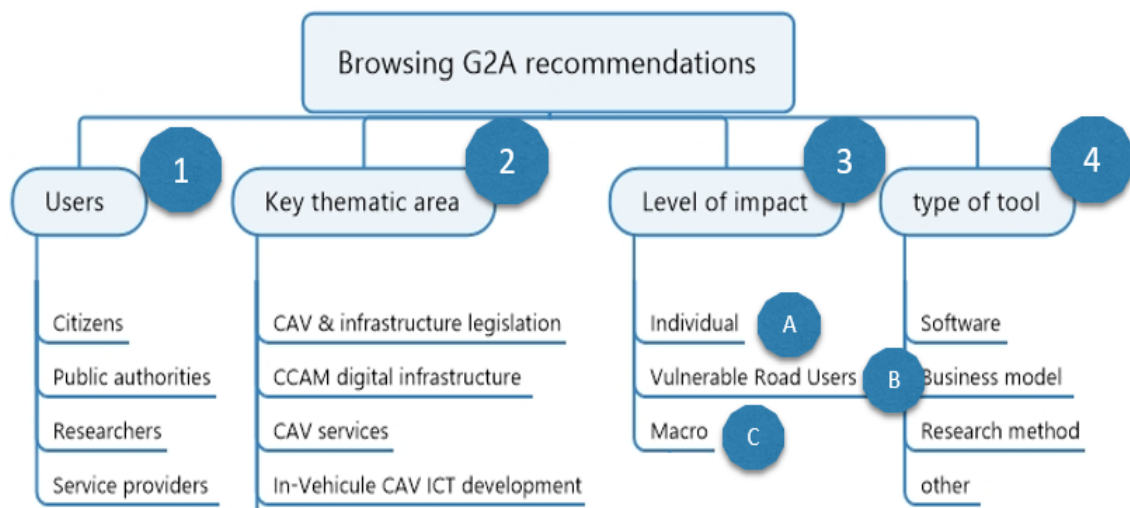


Figure 4. Cross Skill question progression (from 1 to 4)

As a concrete example, a user must declare his/her interests in terms of CAV related key areas (see figure 5 below).

The screenshot shows a web application interface for PAsCAL. At the top, there is a header bar with the 'CROSS SKILL' logo, a 'LIST' button, and the 'PAsCAL' logo. To the right of the header are navigation links: a home icon, 'TAO Guest', and 'Logout'. Below the header, a progress bar indicates '10%' completion. The main content area displays a question: '3) Which one of the following key areas are you interested in?'. Below the question is a green box with a checkmark icon and the text 'You must select at least 1 choice'. Underneath this is a list of four options, each with a checkbox: '1. CAV legislation, regulation and insurance', '2. In-vehicle CAV ICT developments' (which is checked), '3. CAV digital infrastructure & CCAM (Cooperative, connected and automated mobility) services', and '4. CCAM (Cooperative, connected and automated mobility) and local economy, networks, social inclusion and sustainability'. At the bottom right of the form area is a 'Next' button with a right-pointing arrow. The footer of the page contains the copyright notice: '© 2013 - 2022 - 2021.11 - QAT S.A. - All rights reserved.'

Figure 5 Question on user interests about CAV key areas

Once the user has completed the questionnaire, they are redirected back to the website where the test results are displayed. The webpage fetches the results from Cross Skill® by using the generate UUID and triggers the deletion of the user results from the Cross Skill® server.

Figure 6 below presents a sequence diagram summarizing the process described above.

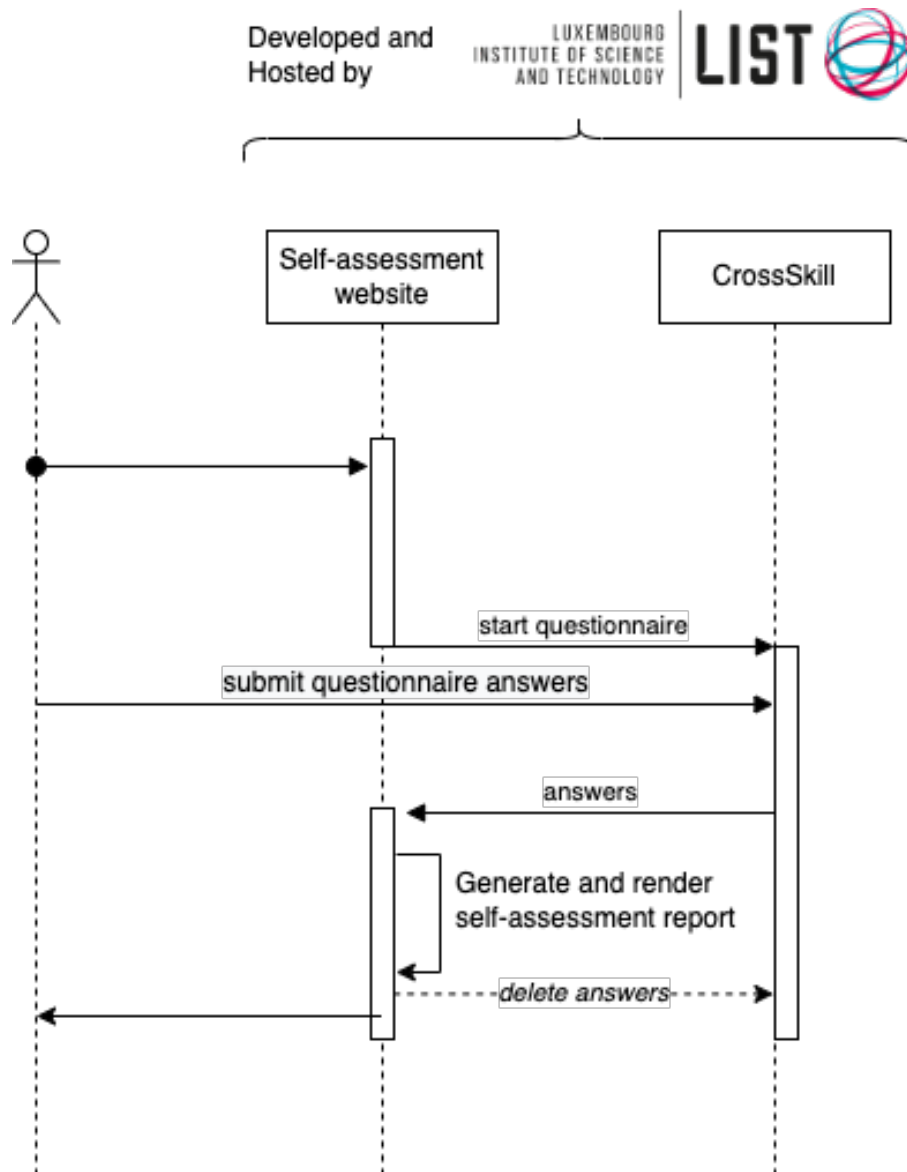


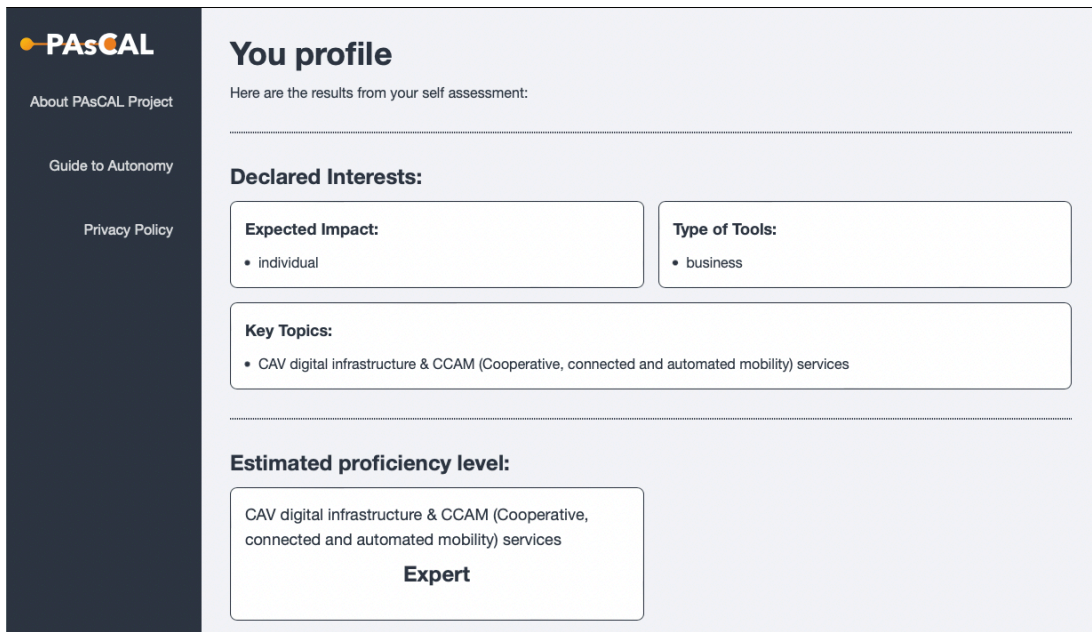
Figure 6 Sequence diagram describing the user's path through the self-assessment website and Cross Skill software

The whole set of questions is detailed in Annexes 6.1 and 6.2.

2.2.4 Self-assessment results

Following the self-assessment sequence, a mapping between each answer and their corresponding expertise value (e.g., Novice or Expert) is done. Then the results are presented on the top of the page (figure 7 below) as following:

- Declared Interests: **Expected Impacts, Type of Tools, Key topics**
- **Estimated proficiency level**, per key topic selected by the user.
According to the example given in the figure below, the user only selected two Key topics (CAV digital infrastructure and CCAM services)



The screenshot shows the 'You profile' section of the PAsCAL interface. On the left is a dark sidebar with the PAsCAL logo and links: 'About PAsCAL Project', 'Guide to Autonomy', and 'Privacy Policy'. The main content area is light gray and titled 'You profile' with the subtitle 'Here are the results from your self assessment:'. Below this, under 'Declared Interests:', there are three boxes: 'Expected Impact:' containing 'individual', 'Type of Tools:' containing 'business', and 'Key Topics:' containing 'CAV digital infrastructure & CCAM (Cooperative, connected and automated mobility) services'. Under 'Estimated proficiency level:', there is a box for the same key topic showing the proficiency level as 'Expert'.

Figure 7 Results of the self-assessment questionnaire

2.3 GDPR and legal notice

Figure 8 (page 20) presents the data flow of the system.

As described in the previous section, the user is redirected between different webpages. Once a user completes the questionnaire, the data is temporarily saved on the Cross Skill® server. Once the user is redirected to the system website, the data is loaded into the user web browser and deleted from the Cross Skill® server.

A scheduled task is also configured to periodically delete user data from the Cross Skill® server. This means that the system does not store user questionnaire answers longer than required to serve content to the user.

In summary, the system does not require personal data to operate and only store user data long enough to perform its task, making it very privacy friendly by design and compliant with a very strict interpretation of GDPR.

PASCAL – CROSS SKILL® DATA FLOW

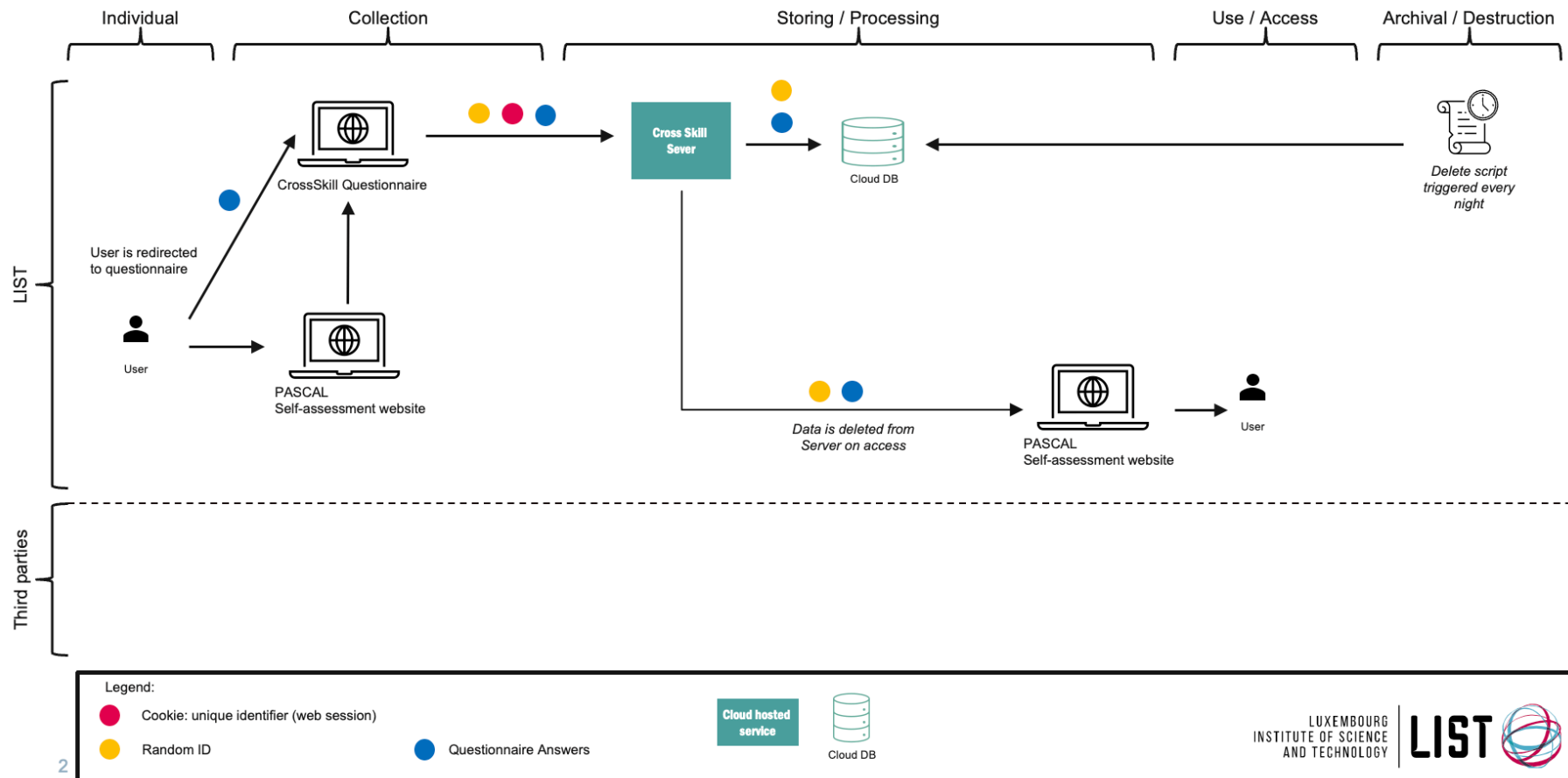


Figure 8 Data flow of the self-assessment process

As a general guideline, this deliverable and Cross Skill® by extension, applies rules and best practices defined in Deliverable 2.3 - Data Protection Handbook, including:

- the Section 3 of D2.3 (pp 18-20). PAsCAL data management lifecycle and especially the data storing, retention and destruction.
- the Section 4.1 of D2.3 - Data collection (pp 21-28), processing, storage, and usage and Section 4.2, Data sharing, retention, and destruction.

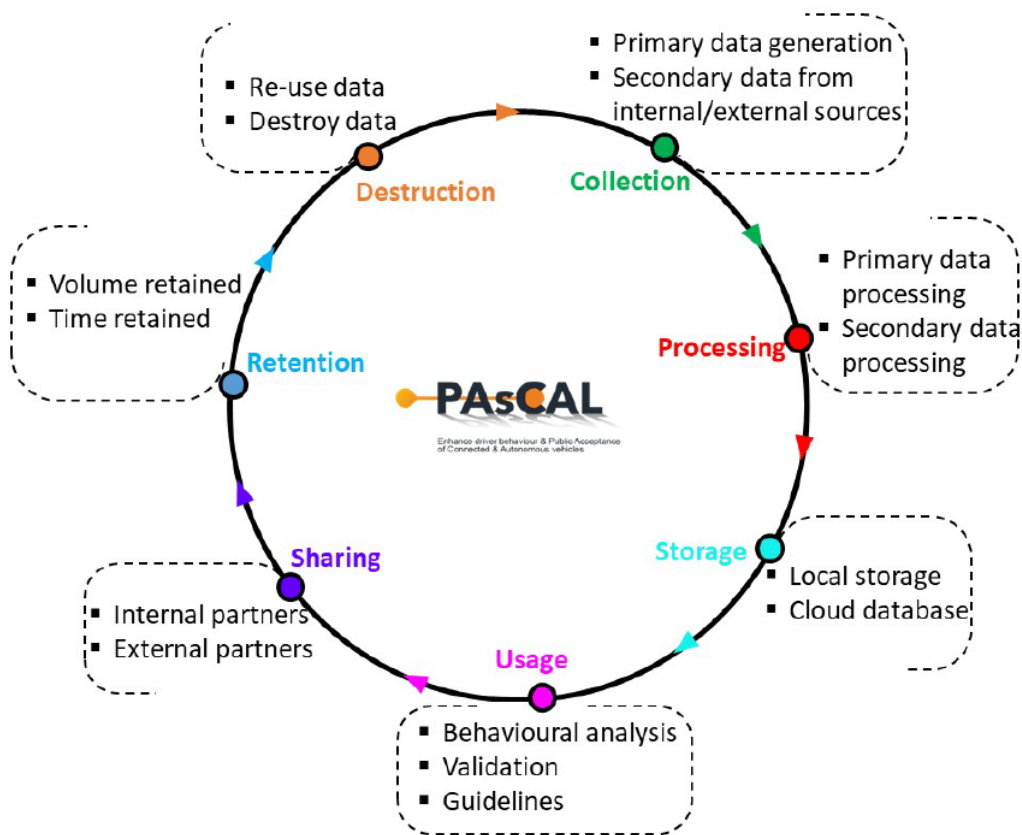


Figure 9 Data management lifecycle in PAsCAL (from D2.3, page 18)

Here is the disclaimer link: <https://recommender.pascal-project.eu/privacy-policy>

2.4 Cross Skill® technical details

This section presents the technical details of the PAsCAL Cross Skill® installation.

The installation prerequisites (Section 2.4.1) precede the developments made to update the original version of Cross Skill® into a tailored version aligned with WP3 needs.

2.4.1 Installation prerequisites

The Cross Skill® software is packaged as Docker® containers, i.e., standardised units packaged with their configured operating system and dependencies into one asset that can be deployed in any environment, from a workstation to a virtual machine or a cloud infrastructure.

The minimum hardware requirement is 8 GB of RAM, 8 GB of disk space and a 4 core CPU.

2.4.2 Cross Skill® developments

2.4.2.1 Cross Skill® upgrade

Cross Skill® is an extension of an open-source software named TAO³. TAO provides an architecture for computer-assisted test development and delivery.

Initially (before the start of the PAsCAL project) based on the TAO version 3.3, an update to the most up to date version available of TAO was needed - version 3.5.0⁴ update corrected many known security vulnerabilities.

The use of TAO 3.5.0 implied the use of PHP version 7. As the original Cross Skill® was written for PHP version 5, some adaptations had to be performed to the Cross Skill® codebase. It served to mainly stop to use new reserved words in the PHP code; those words are reserved to the PHP core engine and cannot be used by programmers anymore⁵.

In addition to these PHP challenges, the main upgrade was focused on modifications due to internal TAO features that have changed with version 3.5.0:

- the format of each call from the TAO user interface to the backend,

³ <https://www.taotesting.com>

⁴ <https://github.com/oat-sa/package-tao/releases/tag/3.5.0>

⁵ the list is available here: <https://www.php.net/manual/en/reserved.other-reserved-words.php>

- the use of constants that were previously available at the global scope and are now available on different services scope on which they depend on,
- or the use of services instead of classes, etc.

Moreover, the following upgrade were deployed:

- the extension installation that turns TAO into Cross Skill®,
- the upgrade of the item generation of Cross Skill®,
- the upgrade of the test generator of Cross Skill®,
- and the upgrade of the Cross Skill® results access module.

2.4.2.2 TAO patches

To seamlessly integrate Cross Skill® in the PAsCAL website, some modifications in TAO code were performed.

As TAO is an open-source project under GNU General Public License, version 2 (GPLv2), every modification of the code must be redistributed. To ease the redistribution i.e., to avoid distributing the whole TAO code with modifications performed on it, we created patch files.

“A patch file is a text file that consists of a list of differences and is produced by running the related Unix program "diff" program with the original and updated file as arguments” (Wikipedia⁶). The patch can be applied with the Unix program "patch".

Here is the list of the patches created for the project:

- "End-test-redirect": a functional patch that forces TAO to redirect the user to a specific page i.e., the results website, at the end of a test instead of redirecting to the TAO default list of available tests.
- "Footer-oat-short-name": a design patch that uses the acronym of the OAT (maintainer of TAO) company name instead of the full name to avoid visual artefacts on small display i.e., on smartphones. That is a bug fix.
- "Import-report": a functional patch to correctly display the TAO reports that are shown when imports are performed like importing a test in TAO. That is a bug fix.
- - "PAsCAL/bars-colour": a design patch to use the PAsCAL website colour for the TAO footer and header and the TAO test runner footer and header.

⁶ [https://en.wikipedia.org/wiki/Patch_\(Unix\)](https://en.wikipedia.org/wiki/Patch_(Unix))

- - "PAsCAL/logo": a design patch to add the PAsCAL logo in the TAO header.

As mentioned previously, the TAO license imposes a code modification redistribution. The patches are available at <https://crossskill.pascal-project.eu/tao/views/patches.zip>

In appendix 6.3, please find a detailed list of the Cross Skill adaptations related to API⁷, for an IT-competent audience.

⁷ Application programming interface

3 Cross Skill for PAsCAL as a recommender system for the G2A

As described in the previous section, the system can assess the proficiency level of a user for specific topics related to CAVs.

In relation to the activities of WP8 to create the Guide2Autonomy, we saw an opportunity to improve recommendations findability, and proposed to leverage the results of this self-assessment to curate a personalised list of recommendations that fit to the actual profile of the user.

3.1 A new entry point to the Guide2Autonomy

The main output of the PAsCAL project is the Guide2Autonomy⁸ – G2A (see D8.2 for greater details).

The G2A and its recommendations will provide the different Connected and Autonomous Vehicles (CAV) stakeholders the means to increase awareness and user acceptance of CAVs. The G2A, as an open access and data platform, will offer over 100 recommendations coming from the PAsCAL project and from sister projects.

As originally planned, a toolbox and a chatbot (detailed below) were the entry points of the G2A. But to multiply the chance to get and keep visitors and to better serve the audience targeted, the PAsCAL consortium agreed that those recommendations could also be accessed through an additional entry point: Cross Skill®.

Therefore, the three entry points of the G2A are the following ones:

1. Thanks to a multi-criteria search function called the **Toolbox**, a visitor can freely browse the available contents (1).
2. Thanks to a chatbot (2) that mimics human-like conversations with users via text, this would be the second entry point to the G2A content. As determined in WP8, the chatbot supports knowledge transfer to vulnerable user groups (especially visually impaired users).
3. The access to the recommendations will be provided through an updated version of the **Cross Skill® instance, originally developed in the context of WP3**. Based on the self-assessment,

⁸ It can be found at www.guide2autonomy.eu

visitors will get personalized recommendations, related to their level of interest, awareness, and proficiency with key CAV areas. As determined in WP8, Cross Skill® specifically targets CAV Service providers.

As illustrated in Figure 10, the G2A contains many different recommendations that are interconnected across different dimensions. In Figure 10, recommendations are the yellow nodes. Recommendations are related to key topics (in red), types of tools (in blue), discuss different impact levels (in orange) and are addressed to different target audience (in purple).

Considering the variety of content, it can be complex for the user to explore it. Therefore, we believe that automating the curation of a personalized list of recommendation that fits the user's profile provides some extra value to the G2A.

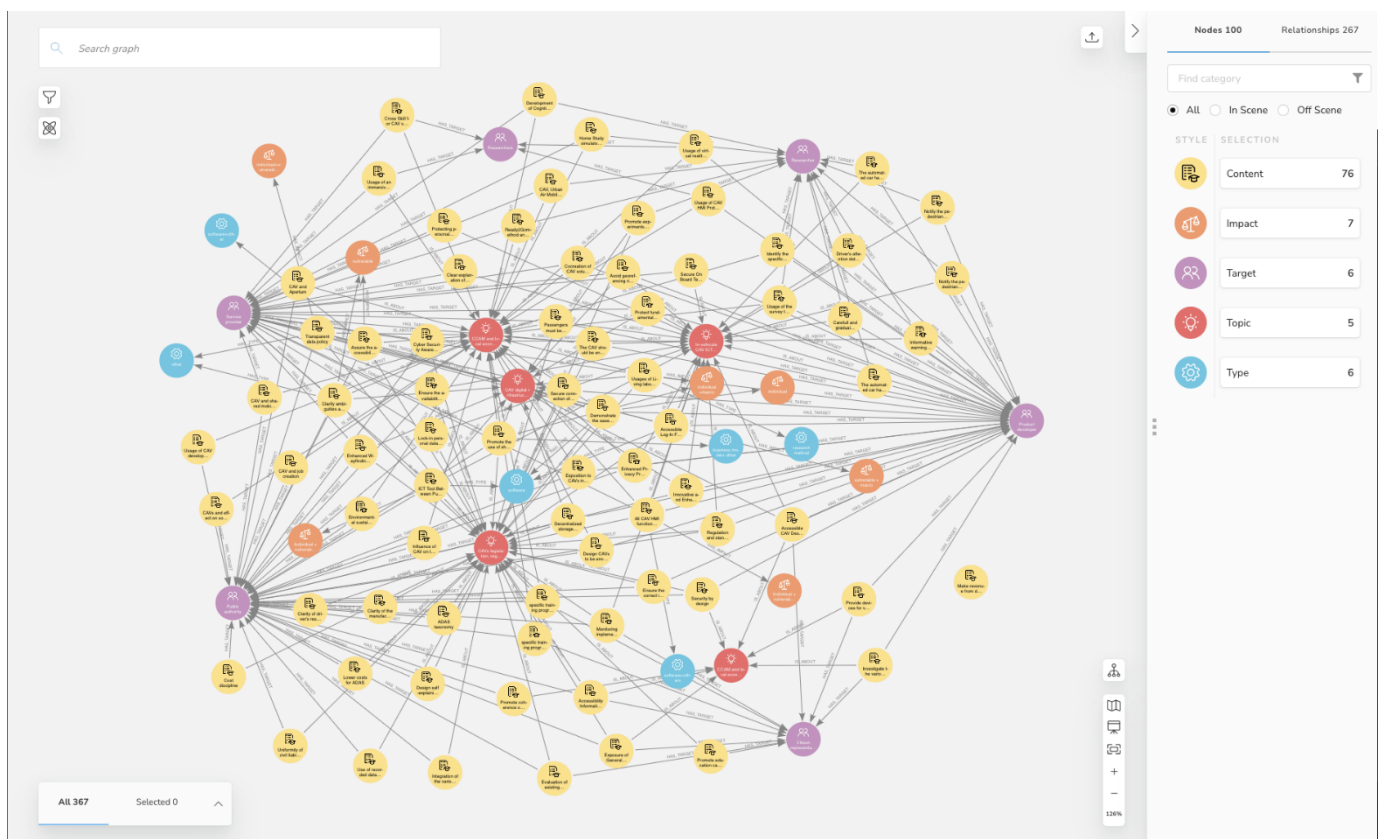


Figure 10 A graph representation of the recommendations available in the G2A.

In this context, we propose to use Cross Skill® to generate a list of personalized recommendations for a sub-category of the target audience of the G2A: the CAVs Service Providers. In that regard, and in the rest of this document, the self-assessment website will be referred to as the “Service Providers website”.

3.2 Adaptations for the Cross Skill integration with the G2A and the provision of personalised recommendations

It is quite straightforward to adapt the Cross Skill® self-assessment tool to integrate it with the G2A and to generate a personalised list of recommendations derived from the questionnaire results.

Figure 11 presents a sequence diagram illustrating how this integration was performed. In short, the G2A provides a link to the systems landing page (detailed in Section 2.2.2).

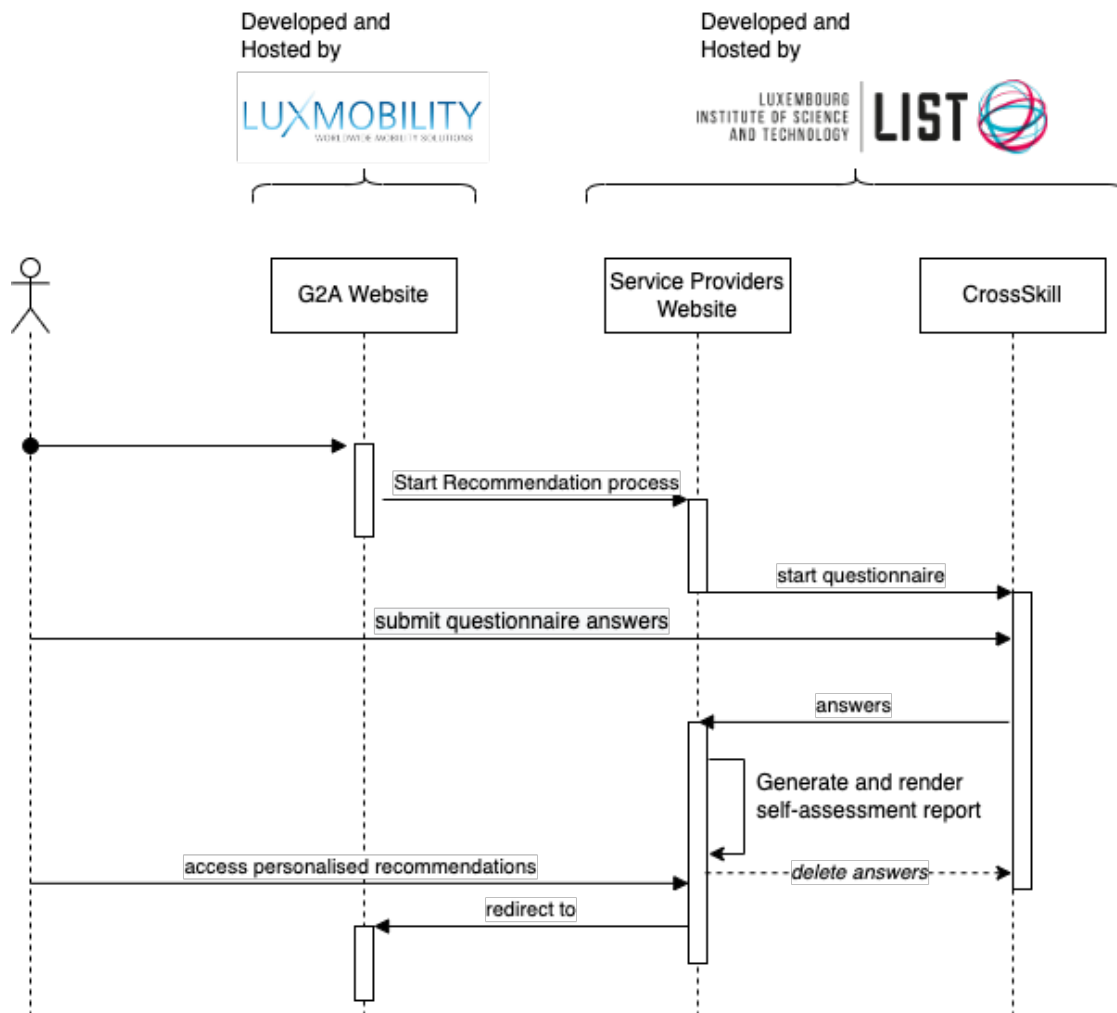


Figure 11 Sequence diagram presenting how the Cross Skill® based self-assessment tool is integrated with the G2A

In addition to displaying the self-assessment results, the website also generates a list of personalised recommendations from the G2A as illustrated in Figure 12. The system picks a list of the top 10 recommendations from the G2A that are the closest to the user expressed interests and proficiency level.

The screenshot shows a web browser window with the URL `recommender.pascal-project.eu`. The page has a dark blue sidebar on the left with the PAsCAL logo and links: "About PAsCAL Project", "Guide to Autonomy", and "Privacy Policy". The main content area is titled "You profile" and displays the results of a self-assessment. Under "Declared Interests:", there are two boxes: "Expected Impact:" with a bullet point for "individual" and "Type of Tools:" with a bullet point for "business". Below these is a "Key Topics:" box with a bullet point for "CAV digital infrastructure & CCAM (Cooperative, connected and automated mobility) services". Further down, the "Estimated proficiency level:" is shown as "Expert" for the same topic. At the bottom, a section titled "10 Personalized recommendations:" features a card for "Promote the use of shared modes of transport". This card includes tags for "Content Type: business model+ other" and "Impact: individual+macro", a brief description, and a "Read more →" button.

Figure 12 The self-assessment results on top (related to WP3) and a personalised list of recommendations at the end of the page (related to WP8)

3.3 Questionnaire adaptation to G2A needs

Complementing the question sequence envisioned in Section 2.2.3, an additional block of questions related to WP8 has been considered.

After asking the user their interest in terms of key thematic area, level of impact, type of tool, this updated version of Cross Skill® allows to self-

assess the knowledge of the selected key thematic area, as a fifth step (5) as displayed in figure 13 below.

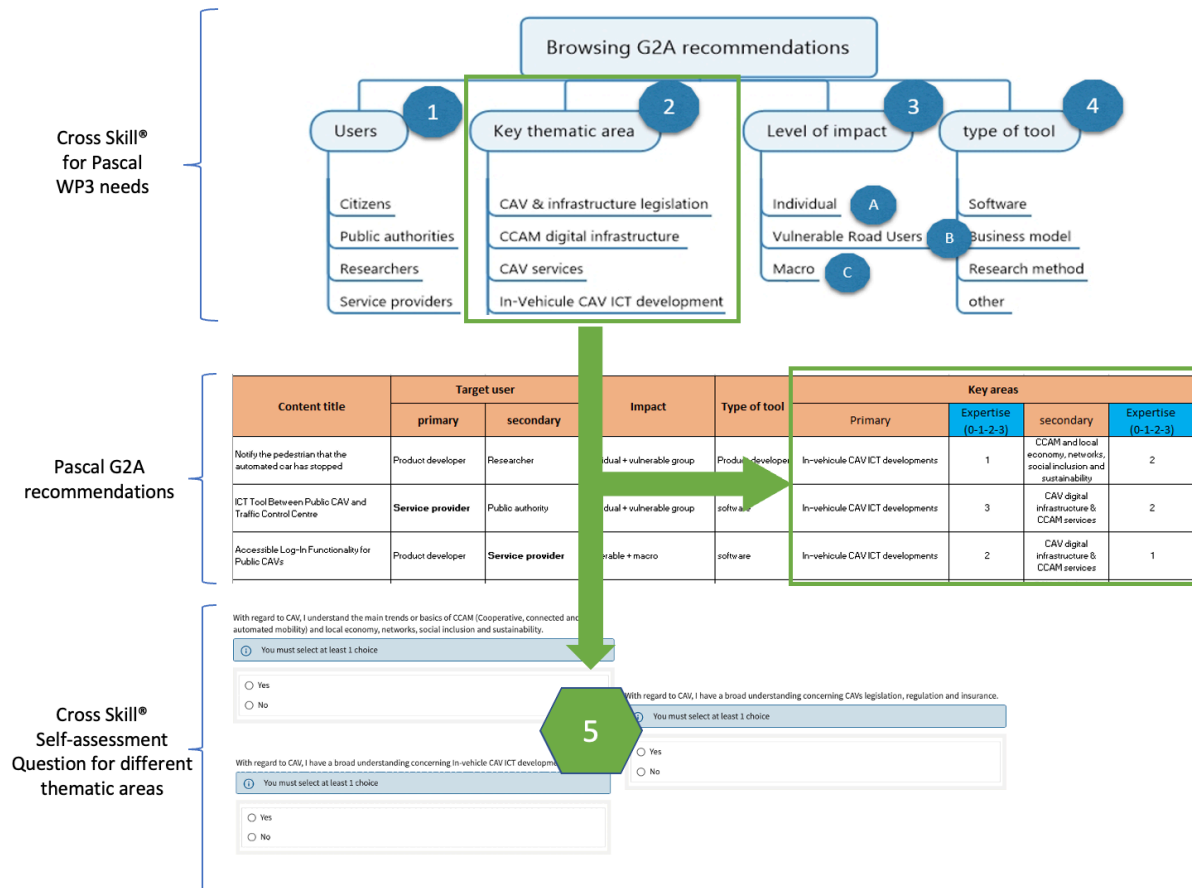


Figure 13 The Key thematic areas identified in WP3 are used to annotate the recommendations from the G2A. Each content is assigned by the project experts a level of expertise in 2 main areas. By adapting the Cross Skill® questionnaire self-assessment, we can identify which content is “appropriate” for the G2A user based on their proficiency level.

As detailed in D8.2 and illustrated in Figure 13, each content of the G2A is categorized (target user, impact, type of tool, key areas and expertise related to the key areas) by content makers.

The excerpt table below (table 1 below) illustrates this. It shows three recommendations. Of these three, only the last two will be considered through Cross Skill and could be recommended as we only consider the Service provider target user.

The first relevant content (third line of the table) targets Service providers as their primary target; this content has a dual impact (individual +

vulnerable group); is a software (type of tool) and deals with two main key areas (which will be measured through self-assessment) and with two different expertise levels (3 for expert and 2 for medium expertise). The last content (last line of the table) could also be recommended to Service providers but as it is ranked as a secondary target user, Product developer are the most relevant user for this content. In terms of impact, this last content helps to consider vulnerable road users and macro impact; it is a software and is ranked through two key areas with two different level of expertise.

Table 1 Excerpt of the table of recommended contents linked to Cross Skill

Content title	Target user		Impact	Type of tool	Key areas			
	primary	secondary			Primary	Expertise (0-1-2-3)	secondary	Expertise (0-1-2-3)
Notify the pedestrian that the automated car has stopped	Product developer	Researcher	Individual + vulnerable group	Product developer	In-vehicle CAV ICT developments	1	CCAM and local economy, networks, social inclusion and sustainability	2
ICT Tool Between Public CAV and Traffic Control Centre	Service provider	Public authority	Individual + vulnerable group	software	In-vehicle CAV ICT developments	3	CAV digital infrastructure & CCAM services	2
Accessible Log-In Functionality for Public CAVs	Product developer	Service provider	vulnerable + macro	software	In-vehicle CAV ICT developments	2	CAV digital infrastructure & CCAM services	1

As a usable example of the Section 3, you can have access to the deployed instance of the Cross Skill self-assessment tool and recommender for the G2A, free of charge:

<https://recommender.pascal-project.eu/>

4 Conclusion

As a complementary assessment tool of the CAVA, Cross Skill has been developed to serve originally one purpose: offer a survey tool considering acceptance dimensions highlighted in WP3 through self-assessment (section 2).

Catching an opportunity highlighted during the G2A development (WP8), we decided to extend Cross Skill (see figure 13 previously): going from a self-assessment tool to a self-assessment tool enriched with a recommender to better guide people looking for CAV related content.

Ultimately, even if the purpose of Cross Skill is doubled, the overarching goal remains the same: increase awareness about CAVs to increase CAV acceptance.

From a sustainability and success of the G2A point of view, Cross Skill offers a new entry point to the G2A, in addition to the Toolbox and the chatbot.

From a personalisation perspective, the system currently does not ask the user to login and does not store the personalised recommendations generated. Although this is very beneficial from a privacy perspective, this implies some limitations.

Indeed, it makes it impossible for the PAsCAL project team to 1) evaluate the quality of the proposed personalisation 2) to perform statistical analysis of the recommended content (e.g., what is the most suggested recommendation). This could be remedied in the future by implementing web analytics solutions on top the existing system to gather anonymous usage traces.

Finally, the G2A-recommender personalisation “quality” heavily relies by design on the quality of the input (e.g., expertise ranking for each content) provided by experts. Indeed, it is the projects experts who assess to which target audience (Service provider or not, expert or novice) each recommendation can be relevant.

As any manual process, bias can emerge which might impact the quality of the content selected for each user by the system. Again, asking for explicit feedback from the users or relying on a “crowdsourced” rating of each recommendation could help mitigate this risk in the long run.

Independently of the specific use of Cross Skill (survey, content recommendation, etc.), we strongly believe that the more means the CAV

community puts together to assess, to inform, to train... the easier the mission to increase CAV awareness and acceptance of the society will be.

5 References

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6 Annexes

As mentioned in Section 3.3, a user must pass two main filter-blocks: the first one dedicated to the self-assessment of their interests in terms of content (level of impact, type of tool, key topic area) and the last one related to their self-declared expertise regarding the key thematic area they showed interest in. Let us dive into both filter-blocks.

6.1 User interest questions

1) What type of impact do you want to consider through contents we recommend to you? (one or several answers possible)

 You must select at least 1 choice

☐ 1. Contents dealing with the perception of individuals (e.g., drivers, cyclists, pedestrians), acceptance of technology and willingness of use Connected and Autonomous Vehicles

☐ 2. Contents dealing with the impacts to specific needs of vulnerable groups (e.g., elderly, impaired, children)

☐ 3. Contents dealing with wider societal impact (societal, economic, environmental)

Figure 14 Question on user interests No. 1

What type of impact do you want to consider through contents we recommend to you? (one or several answers possible)


- Contents dealing with the **perception of individuals** (e.g., drivers, cyclists, pedestrians), acceptance of technology and willingness of use Connected and Autonomous Vehicles
- Contents dealing with the impacts to **specific needs of vulnerable groups** (e.g., elderly, impaired, children), including a spatial division between urban and rural areas
- Contents dealing with wider societal impact (societal, economic, environmental)

2) What type of tool are you looking for? (one or several answers possible)

- ☐ 1. Software
- ☐ 2. Research method
- ☐ 3. Business model
- ☐ 4. Others

Figure 15 Question on user interests No. 2

3) Are you interested in contents dealing with the one or several of the following key areas ?

 You must select at least 1 choice

- ☐ 1. CAVs legislation, regulation and insurance
- ☐ 2. In-vehicle CAV ICT developments
- ☐ 3. CAV digital infrastructure & CCAM (Cooperative, connected and automated mobility) services
- ☐ 4. CCAM (Cooperative, connected and automated mobility) and local economy, networks, social inclusion and sustainability

Figure 16 Question on user interests No. 3

6.2 Key topic area knowledge self-assessment

To reduce common over- and underestimation bias in self-assessment, Cross Skill allows random questioning, meaning that two test-takers will not have the same assessment sequence.


Nevertheless, to show to the reader of this deliverable the whole range of possible questions that a G2A user may answer when using Cross Skill for PAsCAL, see below the full set of questions related to self-assessment (4 questions for the 4 level of expertise, multiplied by the four key topic area a user can select).

Note that no test-taker will have to answer the full set of questions: with 4 questions per assessment element, at maximum, a naïve or expert test-taker will have 3 questions to answer and at minimum only two questions.

Each key topic area question is displayed below to show the full set of questions available through Cross Skill, without being forced to launch the test several times, to see every possible sequence (regarding randomization).

On CAV digital infrastructure & CCAM (Cooperative, connected and automated mobility) services

I consider myself as a novice in terms of Connected and Autonomous Vehicle digital infrastructure and CCAM (Cooperative, connected and automated mobility) services.

 You must select at least 1 choice

☐ Yes

☐ No

Figure 17 Self-assessment on CAV digital infrastructure & CCAM services - lvl1

I understand the main trends or basics of CAV digital infrastructure & CCAM (Cooperative, connected and automated mobility) services.

☐ Yes

☐ No

Figure 18 Self-assessment on CAV digital infrastructure & CCAM services - lvl2

I have a broad understanding of CAV digital infrastructure & CCAM (Cooperative, connected and automated mobility) services.

☐ Yes

☐ No

Figure 19 Self-assessment on CAV digital infrastructure & CCAM services - lvl3

I consider myself an expert in terms of CAV digital infrastructure & CCAM (Cooperative, connected and automated mobility) services.

☐ Yes

☐ No

Figure 20 Self-assessment on CAV digital infrastructure & CCAM services - lvl4

On CAVs legislation, regulation, and insurance

I consider myself as a novice in terms of CAV legislation, regulation and insurance.

☐ Yes

☐ No

Figure 21 Self-assessment on CAVs legislation, regulation, and insurance - lvl1

I understand the main trends or basics of CAV legislation, regulation and insurance.

- ☐ Yes
- ☐ No

Figure 22 Self-assessment on CAVs legislation, regulation, and insurance - lvl2

I have a broad understanding concerning CAV legislation, regulation and insurance.

- ☐ Yes
- ☐ No

Figure 23 Self-assessment on CAVs legislation, regulation, and insurance - lvl3

I consider myself as an expert in terms of CAV legislation, regulation and insurance.

- ☐ Yes
- ☐ No

Figure 24 Self-assessment on CAVs legislation, regulation, and insurance - lvl4

On CCAM (Cooperative, connected and automated mobility) and local economy, networks, social inclusion, and sustainability

I consider myself a novice in terms of CCAM (Cooperative, connected and automated mobility) and local economy, networks, social inclusion and sustainability.

- ☐ Yes
- ☐ No

Figure 25 CCAM and local economy, networks, social inclusion, and sustainability - lvl1

I understand the main trends or basics of CCAM (Cooperative, connected and automated mobility) and local economy, networks, social inclusion and sustainability.

- ☐ Yes
- ☐ No

*Figure 26 CCAM and local economy, networks, social inclusion, and sustainability -
lvl2*

I have a broad understanding concerning CCAM (Cooperative, connected and automated mobility) and local economy, networks, social inclusion and sustainability.

- ☐ Yes
- ☐ No

*Figure 27 CCAM and local economy, networks, social inclusion, and sustainability -
lvl3*

I consider myself an expert in terms of CCAM (Cooperative, connected and automated mobility) and local economy, networks, social inclusion and sustainability.

- ☐ Yes
- ☐ No

*Figure 28 CCAM and local economy, networks, social inclusion, and sustainability -
lvl4*

On In-vehicle CAV ICT developments

I consider myself as a novice in terms of In-vehicle CAV ICT developments.

- ☐ Yes
- ☐ No

Figure 29 In-vehicle CAV ICT developments - lvl1

I understand the main trends or basics of In-vehicle CAV ICT developments.

- ☐ Yes
- ☐ No

Figure 30 In-vehicle CAV ICT developments – lvl2

I have a broad understanding concerning In-vehicle CAV ICT developments.

- ☐ Yes
- ☐ No

Figure 31 In-vehicle CAV ICT developments - lvl3

I consider myself an expert in terms of In-vehicle CAV ICT developments.

- ☐ Yes
- ☐ No

Figure 32 In-vehicle CAV ICT developments - lvl4

6.3 Cross Skill® adaptations

The three following features will be detailed below:

- Test direct guest access feature
- Guest result extraction
- Delete extracted test results

Test direct guest access feature

Cross Skill® relies on TAO to deliver a test/questionnaire to users.

To start the test, a user must either log-in with their credentials, or they can access TAO as an anonymous user. Then, in both cases, they end up on a page that lists all available tests for a user.

As the goal of Cross Skill® is to ease users answering questions, and not deal with log-in, page navigation, or test selection before answering questions, a guest access feature to directly start a test had to be developed and exposed to the Service providers Website.

After the test, users are, by default, redirected to the page that lists all available tests. A redirect to the service providers website must be performed instead of the default redirect. These two features result in a new endpoint i.e., access point, in the API of Cross Skill® to start a test (see figure below).

The required parameters to start a test are:

- URI: the test identifier as it is stored in Cross Skill®.
- language-tag: the language identifier to set the Cross Skill® language User Interface, this parameter is optional, by default: English.
- UID: a unique identifier that will be linked to the test results to be able to retrieve the results after the test
- URL: the URL to redirect the user just after the end of the test i.e., after the last question, by default: the default TAO page that lists all available tests.

taoSkillcard extension guest access API 1.0 OAS3

Servers

<http://crossskill.pascal.local/taoSkillcard/GuestAccess> ▾

default

GET

/guest

start a new test aka a new TAO delivery execution

Parameters

Try it out

Name	Description
uri ★ required string(\$uri) (query)	URI of the packaged test (aka TAO delivery) <input type="text" value="http://sample/first.rdf#i626aa54703ba7825a5150b3126"/>
uid string(\$uid) (query)	custom unique ID that has to be linked to the test to be able to fetch related results afterwards <input type="text" value="13456-789ab-defg!"/>
lg string(\$language-tag) (query)	User interface language Examples: <input type="text" value="en-US"/> ▾ <input type="text" value="en-US"/>
redirect string(\$url) (query)	URL to which the browser has to be redirected when the test ends <input type="text" value="http://google.com/?q=test"/>

Responses

Code	Description	Links
302	redirect to the test engine	No links

Figure 33 Cross Skill® test direct guest-access API

Guest result extraction feature

To make recommendations based on the user answers, these answers must be extracted at the end of the test thanks to the UID generated and linked to the test when it started.

By default, TAO is not able to expose results based on a specific criterion like the UID. A dedicated search based on the UID and a corresponding endpoint API to expose the matching results have been added to Cross Skill® (see Figure 34 below).

taoSkillcard extension results API 1.0 OAS3

Servers

http://crossskill.pascal.local/taoSkillcard/GuestAccess
▼

default ^

GET
/deleteResult
▼

GET
/getResultWithUID
^

get test results aka TAO delivery execution result linked to a Unique ID

Parameters Try it out

Name	Description
uid * required string(\$uid) (query)	<div style="border: 1px solid #add8e6; padding: 2px; margin-top: 5px;">13456-789ab-defg!</div>

Responses

Code	Description	Links
200	list of delivery execution result	No links

Media type

application/json
▼

Figure 34 Cross Skill® get test results API

Delete extracted test results feature

When the test results have been extracted there is no need to continue to store them: for Cross Skill use and data privacy matters. A dedicated endpoint API has been added to Cross Skill® to delete each result (see figure below).

taoSkillcard extension results API 1.0 OAS3

Servers

http://crossskill.pascal.local/taoSkillcard/GuestAccess

default

GET
/deleteResultWithUID

delete all test results aka all TAO delivery execution results linked to an UID

Parameters
Try it out

Name	Description
uid ★ required string(\$uid) (query)	custom unique ID that is linked to the test result <div>13456-789ab-defg!</div>

Responses

Code	Description	Links
207	list of delivery execution status <div> Media type <div>application/json</div> Controls Accept header. Example Value Schema <div> [{ "uri": "http://sample/first.rdf#i627248d24ed3f8249ceac56f851751e", "status": 200, </div> </div>	

 No links |

Figure 35 Cross Skill® delete results API

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