



Title: *D8.2 Legal, economic and technical evaluation of the second platform and community prototype*

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Identifier: *D8.2*

Type: *Deliverable*

Version: *1.0*

Date: *28.02.2011*

Status: *Final*

Class: *Public*

Summary

In this deliverable a multi-disciplinary evaluation of the work performed during the second cycle of the PICOS project is conducted. Firstly, the maturing of the prototype implementation of the PICOS platform and the deployment for the second version of the Angling Community Prototype will be evaluated, taking into account recommendations drafted under D8.1. Secondly, the PICOS Platform Design and Architecture v2, the PICOS Platform Prototype v2 and the PICOS Gaming Community Application Prototype are evaluated from a legal, economic, technical and usability point of view. This multi-disciplinary evaluation focuses on the privacy and trust related elements of the PICOS project. The three evaluation areas correspond to the work of three distinct work packages, namely WP4, WP5 and WP6, during the second phase of the PICOS project.



Grant Agreement no. 215056

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The PICOS Deliverable Series

D2.1 Taxonomy	July 2008
D2.2 Categorisation of Communities	July 2008
D2.3 Contextual Framework	November 2008
D2.4 Requirements	November 2008
D3.1.2 Trust and Privacy Assurance for the Design Platform v2	January 2011
D3.2.2 Trust and Privacy Assurance for the Platform Prototype v2	January 2011
D3.3.2 Trust and Privacy Assurance for the Community Prototype v2	January 2011
D3.4.1 A summary of PICOS WP3 sub-phase 3.1 deliverables	September 2010
D4.1 Platform Architecture and Design v1	March 2009
D4.2 Platform Architecture and Design v2	September 2010
D5.1 Platform description document v1	October 2009
D5.2a Platform prototype 2a	May 2010
D5.2b PICOS PHASE 2 Platform Description document	November 2010
D6.1 Community Application Prototype 1	December 2010
D6.2a Community application prototype 2	April 2010
D6.2b Community application prototype	October 2010
D7.1a User Evaluation Plan	December 2009
D7.1b Trial plan for the second community prototype	October 2010
D7.2a First Community Prototype: Lab and Field Test Report	February 2010
D7.2b First Community Prototype: Field Trial Report	August 2010
D9.1 Web Presence	February 2008
D9.2.1 Exploitation Planning	May 2009
D9.2.2 Exploitation Plan 2	March 2010
D9.3.1 Dissemination Planning	May 2009
D9.3.2 Dissemination Report V2	March 2010

These documents are all available from the project website <http://picos-project.eu>.



The PICOS Deliverable Series

Vision and Objectives of PICOS

With the emergence of services for professional and private online collaboration via the Internet, many European citizens spend work and leisure time in online communities. Users often consciously leave private information online, but they may also be unaware of leaving such information. The objective of the project is to advance state-of-the-art technologies that provide privacy-enhanced identity and trust management features within complex community-supporting services that are, in turn, built on Next Generation Networks and delivered by multiple communication service providers. The approach taken by the project is to research, develop, build, trial and evaluate an open, privacy-respecting, trust-enabling platform that supports the provision of community services by mobile communication service providers.

The following PICOS materials are available from the project website <http://www.picos-project.eu>.

PICOS documentation

- Slide presentations, press releases, and further public documents that outline the project objectives, approach, and expected results.
- The PICOS global work plan, which provides an excerpt of the contract with the European Commission.

Planned PICOS results

- *PICOS Foundation* is for the technical work in PICOS, and is built on the categorization of communities, a common taxonomy, requirements, and a contextual framework for PICOS platform research and development;
- *PICOS Platform Architecture and Design* provides the basis of the PICOS identity management platform;
- *PICOS Platform Prototype* demonstrates the provision of state-of-the-art privacy and trust technology to the leisure and business communities;
- *Community Application Prototype* is built and used to validate the concepts of the platform architecture and design, and their acceptability, in private and professional community scenarios;
- *PICOS Trials* validate the acceptability of the PICOS concepts and approach chosen, from the end-user point of view;
- *PICOS Evaluations* assess the prototypes from a technical, legal and social-economic perspective, and result in conclusions and policy recommendations;
- *PICOS-related scientific publications* are produced within the scope of the project.



Foreword

PICOS partners from various disciplines have contributed as authors to this document.

As the title of the deliverable “Legal, economic and technical evaluation of the second platform and community prototype” clearly indicates, Deliverable D8.2 is a collective work by the WP8 Evaluation team whose members are listed below. Each partner contributed expertise in different fields of knowledge which resulted in a truly multi-disciplinary evaluation of the PICOS platform design and architecture, the PICOS platform prototype and the PICOS Angling Community Application Prototype.

Special mention goes to Stephen Crane (HP Labs) for providing a very comprehensive summary of the work realised in the context of WP4 (PICOS Platform design and architecture) and WP5 (PICOS Platform Prototype), to Elsa Prieto, for the thorough presentation of the work conducted in WP6 (PICOS Angling (v2) and Gaming Community Prototype) and to Niels Vandezande (ICRI-K.U.Leuven) for his assistance in the editing of this deliverable.

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List of acronyms

<i>API</i>	<i>Application Programming Interface</i>
<i>ENISA</i>	<i>European Network and Information Security Agency</i>
<i>GUI</i>	<i>Graphical User Interface</i>
<i>IdM</i>	<i>Identity Management</i>
<i>J2ME</i>	<i>Java 2 Mobile Edition</i>
<i>LBS</i>	<i>Location Based Services</i>
<i>OTA</i>	<i>Over The Air</i>
<i>PA</i>	<i>Privacy Advisor</i>
<i>PET-USES</i>	<i>Privacy Enhanced Technology – User’s Self Estimation Scale</i>
<i>POI</i>	<i>Point Of Interest</i>
<i>PUC</i>	<i>PICOS Use Case</i>
<i>RPC</i>	<i>Remote Procedure Call</i>
<i>SUS</i>	<i>System Usability Scale</i>
<i>UI</i>	<i>User Interface</i>
<i>v1</i>	<i>version 1</i>
<i>v2</i>	<i>version 2</i>
<i>WSDL</i>	<i>Web Services Description Language</i>



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Introduction

The objective of this present PICOS Deliverable D8.2 “Legal, economic and technical evaluation of the second platform and community prototypes” is, as can be deduced from the title, to conduct a comprehensive evaluation of the research results of the *second* cycle platform architecture, platform design, service prototype construction and trialling of the PICOS project. This deliverable builds upon the path set by PICOS Deliverable D8.1, in which a legal, economic and technical evaluation of the work performed during the *first* cycle of the PICOS project was carried out.

The evaluation conducted under the framework of this deliverable serves a dual purpose. On the one hand, the evaluation focuses on the maturing of the prototype implementation of the PICOS platform and on the deployment for the second version of the Angling Community Prototype. Recommendations drafted under D8.1 were taken into account for the development of the second version of the PICOS platform prototype implementation and the Angling Community Prototype. As the second version of the PICOS platform prototype implementation and the Angling Community Prototype did not implement any major modifications compared to the first version, this initial part of the evaluation will be kept relatively concise. The main focus of the evaluation will lie on the specific changes implemented in the second version of the PICOS platform prototype and the Angling Community Prototype compared to the first version. The work carried out for this part of the deliverable will be included under section A.

The second purpose of this present deliverable is to focus on the specifics regarding the second version of the PICOS Platform design and architecture, the PICOS platform prototype and the PICOS Gaming Community Application Prototype. This work will be done in section B of the present deliverable. This section will follow the same structure that was used in the first evaluation deliverable, D8.1. Therefore, there will be three major parts which will each evaluate three research areas PICOS has been working on during the second cycle. The first research area evaluated here is the second platform design and architecture. Secondly, the second platform prototype will be evaluated. The last research area to be subjected to evaluation will be the Gaming community prototype. Dividing the evaluation performed under section B of the present deliverable into three distinct parts will allow for a clear and comprehensive evaluation of the work that was conducted in the PICOS project during the second cycle of the project. Furthermore, dividing the evaluation allows for the following of a logical methodology, as the three parts listed here correspond to the work of three distinct workpackages, namely WP4, WP5 and WP6.

For the evaluation conducted under section A of the present deliverable, the focus will mainly lie on the matured implementation of the prototype of the PICOS platform for the second version of the Angling community prototype. The main work for this was performed under the ‘Platform Prototype 2a’ as part of deliverable D5.2a. Further focus will lie on the Angling Community Prototype v2, included under deliverable D6.2a. Further regarding the Angling Community Prototype v2, it is clear that the evaluation will mainly focus on the maturing of the implementation of the prototype developed for the PICOS platform during the second cycle of the project.

Next, more can be said on the evaluation of the major deliverables of the second cycle. Firstly, during the evaluation of the platform design and architecture the focus will mainly lie on the evaluation of the Second Platform Design and Architecture. The evaluation of the Deliverable D4.2 “Platform Architecture and Design v2” and other additional functional requirements documents will be included under the scope of the platform design and architecture evaluation. This platform design and architecture evaluation was the first of the three research areas to be subjected to evaluation under section B of this present deliverable to be conducted. In the second part of section B of the present

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The PICOS project receives research funding from the Community’s Seventh Framework Programme.



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deliverable, the evaluation of the second Platform Prototype will be conducted. This evaluation focuses on the documentation of the WP5 and mainly on D5.2b. Finally, the third part focuses on the evaluation of the Gaming Community prototype and will be based on D6.2b.

A. PICOS Platform and Angling Community Prototype upgrade

1 Summary presentation of the upgrade in the PICOS Platform and Angling Community Prototype

The PICOS angler application v2.5¹ is a continuation of the first PICOS angler application (v1.5)², consequence of the WP7 community user trials in Vienna and Kiel³. These trials reported a need for further improvement, especially on the usability side. Therefore the work performed in WP6 (in cooperation with WP5⁴) during the first phase of the second cycle focused on giving answer to questions from the trials (collected in the internal R2 document⁵) more than on the implementation of new functionality.

From an architectural perspective PICOS angler application v2.5 and v1.5 both have the characteristics shown in Figure 1. The PICOS WP6 Client side uses a Nokia 5800 as hardware platform and the J2ME (Java 2 Mobile Edition) environment with the installed PICOS Angler Application.

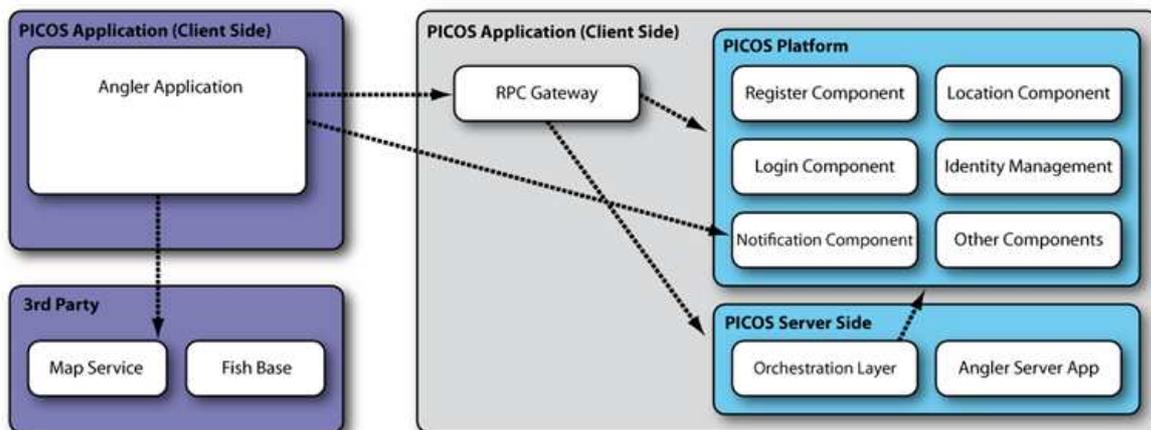


Figure 1: Angler Community prototype architectural overview

Major differences present in v2.5 can be summarized as follows:

- Improved Graphical User Interface by addition of new styles, icons and layout.
- Enhanced usability by addition of help items, aiming at providing a short explanation of certain PICOS concepts or features, and context menus grouping related functionality for easier application handling.

¹ D6.2a First Community Application Prototype v2.

² D6.1 Community Application Prototype 1

³ D7.2a First Community Prototype: Lab and Field Test Report

⁴ D5.2a Platform Prototype 2

⁵ PICOS R2 Investigation Report (Internal deliverable).



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- Enhanced robustness by reducing the number of reported malfunctioning.
- Optimization of processes to provide a faster response to the user.
- Improvement of the file repository performance and container management.
- Addition of a GPS location publishing mechanism to ease the Location Based Services (LBS) when the location settings are enabled.
- Addition of cached fishing spots and watercourses to reuse data stored in local files.
- Addition of new functionalities, such as the possibility to modify posts before rating and the possibility to modify repository categories.

Combination of the mobile application with a webfront platform that replicates a subset of the mobile features (Partial IDs, Contacts, Public Community, Sub Communities and Private Room).

2 Assurance Evaluation for trust & privacy

2.1 Methodology and documentation used

In this part of the (technical) evaluation we will focus mainly on the issues relevant to trust and privacy principles. Trust and privacy are critical objectives in the PICOS Architecture. This evaluation focuses on the upgraded PICOS Platform and Angling Community Prototype. Since the Platform prototype documentation (D5.2a) for the second prototype differs only a little with respect to the first prototype (D5.1), the evaluation of this part overlaps with the first prototype evaluation. The differences between the evaluation of the first platform prototype and the upgrade are highlighted. Focus will be given on the evaluation of the upgraded Angling Community Prototype (D6.2a).

The main sources of documentation for this part of evaluation were D5.2a (Platform Prototype 2a) and D6.2a (Community Application Prototype 2).

2.2 Evaluation of the upgrade in the PICOS Platform and Prototype

This section summarizes the evaluation (related to Trust and Privacy issues) of the upgraded PICOS Platform (based on the results of the lab and field tests).

2.2.1 PICOS Platform upgrade

Second platform prototype upgrade additionally includes (as mentioned in document D5.2a):

- Technical upgrade: UTF-8 encoding for all messages
- Technical upgrade: Support of image formats for Avatars
- Notifications sent by the Privacy Advisor (PA) are now tagged as coming from the Privacy Advisor (i.e., “Privacy advisor says:”)

The purpose of these enhancements is to support the changes developed in the Angling Community Application (WP6).



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All other trust and privacy related issues remained the same as in the Platform Prototype version 1 which was evaluated in detail in document D8.1. Major changes/updates were done in the Community application prototype, which is evaluated in a respective section of this document.

2.2.2 PICOS Community application prototype upgrade

The objective of D6.2a is to provide an upgraded second prototype for the angling community that improves on the first one. A mirror of the mobile applications in a web browser environment was also created. The focus was on the usability perspective, with few alterations on the basic functionality of PICOS. The main changes performed concerned fixing reported bugs, enhancement of response time, improved look and feel of the GUI, inclusion of contextual help and context menu, development of a Web frontend, and improvement of new functionalities and extensions of the capabilities of the existing features. Only the latter is important for evaluation of technical trust and privacy aspects. However, these improvements were mostly related to usability aspects, rather than the basic functionalities of PICOS like registration, creation of Sub Communities, partial identities, etc. Correspondingly, the results obtained in the trust and privacy evaluation of the first prototype are still valid for the second upgraded angling community prototype, which moreover took fully into account also the results from the previous assurance work in WP3. We analyse below the new functionality in the client mobile application with regard to the first angler prototype.

Registration

Two items were added. The first one concerns the help functionality, and consists of the introduction of an “i” icon on some screens of the client application. This new functionality is intended to explain to the user specific functionalities and PICOS concepts, and may be regarded as the most important enhancement with regard to assurance, since it may be used to increase the transparency of the PICOS trust and privacy concepts to the users. Concerning the profile completion, the user is now offered the option to enter personal data into his/her first profile or to postpone this activity to a later point in time, which does not affect the trust and privacy aspects of PICOS.

Partial Id Manager

Users can now decide whether they wish to fill their partial-id data right after the new partial identity is created or to postpone this process. This change does not affect the trust and privacy aspects of PICOS.

Profile Manager

Some profile field were regrouped in order for better structuring. Profile manager also allow direct application of policy rules to Level 1 fields. The structure of the profile can be found in D6.2a, page 15, fig. 4.

Contacts Management

New context menu with several actions was added that can be performed on a selected contact. One of them is “Create policy”, which displays the Privacy Manager in order to assign a privacy rule(s). The basic functionality of the Contacts Management was thus not altered.

Policy Manager

The Policy Manager did not suffer significant changes either: a bug was fixed, the Policy Editor was renamed, and the access point to the Policy Creator was changed. The latter underwent also an internal rearrangement in which policies were modified according to the



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level of granularity allowed in the platform. None of these changes affects the trust and privacy aspects of PICOS.

Privacy Advisor

No changes from the prototype version 1.

Public Community

New functionality was added to the Public Community with regard to the possibility of modifying the content of a post before it has been rated by other members in the community. However, this change in functionality has no influence on trust and privacy aspects.

Location based services

The system of sending/retrieving GPS data (of a device as well as of contacts in contact lists) was upgraded in order to get faster responses.

Real-Time Content Sharing

Concerning Real-Time Content Sharing, only minor changes were introduced concerning usability issues. The notification mechanism was not modified, and the overall functionality is similar to the D6.1 Community Application Prototype.

Web Frontend

Web Frontend (similar to the client application) was developed after the user trials. Some functionality was not implemented (edit privacy rules, location based services).

2.3 Summary of findings and recommendations

Since the additional update of the PICOS Platform Prototype consists of only a few things, the general conclusion remains the same as in the document D8.1.

With regard to the PICOS Community Application Prototype upgrade, it is not clear which user screens in the client application contain the “i” icon and what information it provides. It would be very useful for example to explain the functionality of the Privacy Advisor (PA), as well as to provide some illustrative examples.

Registration – There should be some kind of a reminder that a user still has not filled in his/her profile information.

Partial Id Manager – The same comment as for the Registration.

Contacts management – It is not clear why the “Create policy” was added to the “search” context menu. It remains unclear whether it is possible to select and work with multiple contacts (e.g., create policies).

Policy Manager – It should be clarified whether the described granularity is final or can be re-defined and how.

Location based services – It should be clearly stated whether the “Show my location on map” feature sends the current location to the server or just displays it internally on a device.

Web frontend – It should be good to give users the ability to edit their privacy policies. Web GUI would offer a better view on existing user policies and this would increase both the usage of these policies as well as their privacy-related potential.



3 Technical evaluation

3.1 *Community focus*

The focus of this part of the technical evaluation is

1. On the implementation of the second version of the PICOS platform prototype, especially on the components which have a community focus. Chapter 3.3.2 “Community focus of the Evaluation of the Platform Design & Architecture” in D8.1 has identified the sub community features being the key features regarding the community focus. In D8.1 the platform has been evaluated regarding these features. For the second version of the angler platform no new features with community focus have been specified for the server side. Nevertheless the specified features from the internal R2 (Investigation Report) have some impact on the community platform.
2. On the implementation of the second version of the PICOS community application prototype, especially the components which have a community focus. The Sub Community key features were already identified in chapter 3.3.2 Community focus of the Evaluation of the Platform Design & Architecture of D8.1 and were evaluated against the platform components (D5.1) in chapter 4.3.2 of D8.1. Only one new requirement with community focus can be identified in the investigation report R2 for the second version. This requirement has been postponed to the first release of the second community, i.e. the gaming community. For these reasons there are no changes or additions which have to be made within the evaluation in comparison to D8.1.

3.1.1 Methodology and documentation used

3.1.1.1 *Platform Prototype*

The documentation used for this evaluation are the investigation report R2 and deliverable D5.2a (Platform prototype 2a). D5.2a addresses the current state of the platform prototype and the investigation report R2 addresses the new gathered requirements and the derived features. They are used to evaluate to what extent the WP5 platform meets the gathered requirements.

The goal of the evaluation in this section is to provide information about how far the implemented platform prototype is able to fulfil the features from the investigation report R2, which themselves try to put the associated requirements into practice.

From the investigation report R2 only one feature was identified as being directly related to the community focus. Therefore the implemented platform has to be evaluated regarding this feature.

For the evaluation, a bottom-up approach has been used. Thereto the new feature has to be examined whether the platform realizes the corresponding specific PICOS concept in an appropriate way.

3.1.1.2 *Angling Community Prototype*

The documentation used for this evaluation is the investigation report R2 which addresses the new identified requirements and derives the needed features to fulfil these requirements, as well as the deliverable D6.2a (Community application prototype 2) which addresses the current state of the community application prototype.

The goal of this evaluation is to verify how far the implemented community prototype (described in D6.2a) is able to make use of the platform components described in D5.2a. Because there are no changes on the platform side, no new methodology for the evaluation how the identified components with community focus are implemented in the community prototype is needed, as the only requirement with community focus is not implemented on the server side



3.1.2 Evaluation of the requirements and functionalities of the Platform and Angling Community Prototype upgrade

3.1.2.1 Platform Prototype

As mentioned above the new feature revocation has to be examined whether the platform realizes the corresponding specific PICOS concept in an appropriate way.

In D4.1 a revocation component is mentioned, which is called e.g. whenever a member wishes to leave the community. The component was not realized by the first version of the community platform prototype.

The investigation report R2 mentions a new feature called revocation which should delete all user traces in the community.

The following components (from D5.2a) of the second version of the community platform prototype are affected by this feature:

2.5.1 Registration server

2.5.11 Sub Community server

2.5.6 Public Community server

The revocation feature has not been fully implemented and is postponed to the gamers' release of the PICOS prototype.

3.1.2.2 Angling Community Prototype

For the second community application of the angling prototype 37 requirements were gathered. More than half of them (21) are improvements of existing features and only 16 are new requirements. Only one requirement (R37 Revocation) has a community focus and this requirement has not been implemented on the server side.

Most of the requirements are targeting usability aspects and therefore are not part of the technical evaluation.

3.1.3 Summary of findings and recommendations

3.1.3.1 Platform Prototype

In comparison with the first prototype, the second prototype does not realize a new functionality regarding the community focus. The technical evaluation therefore gets the same conclusion as the technical evaluation in D8.1.

On the one hand due to the selection for the first and second prototype there are still components from D4.1 which are not implemented or which are only partially implemented, respectively. Because of technical reasons new components were added (proxy web service, socket server) and components were split/completed (split: profile manager into profile server and privilege server; completed: public community server).

3.1.3.2 Angling Community Prototype

There are no new server side components which are realized by the second version of the community platform prototype. For this reason the conclusions of the evaluation are the same as the conclusions



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of the evaluation of the first community prototype: There are no platform components which are not used by the client application and there are no additional components which are realized in the client application. This is the consequence of the fact that the community prototype depends on the platform; therefore functionalities cannot be implemented that are not present on the server side.

3.2 Location data

3.2.1 Methodology and documentation used

The evaluation is based on a comparison of the new requirements for the angler application V2, which have been derived from the field and lab tests and documented in the “Investigation report (R2) Version 1.0”⁶ with the final documentation of the angler application V2 D6.2a (Community application prototype 2) and the final documentation of the platform D5.2a (Platform prototype 2a).

The comparison shall assess that the major results from the end user tests have been considered and incorporated in the second application prototype and platform prototype.

3.2.2 Evaluation of the requirements and functionalities of the Platform and Angling Community Prototype upgrade

The new requirements related to location based services and communication features listed in the investigation report R2 are:

- R8: Messages: terminology, navigation
- R18: Special character support
- R13: LBS function navigation: improved GUI, including context menus
- R14: LBS function help text improvements
- R29: LBS functions: reliability improvements
- R21: Camera support
- R19: Remove unnecessary requests to servers

The only platform change (WP5) was necessary for R18: the support of special characters for messages and content. In addition, the client application has also been adapted so that the user is now able to use special characters to provide messages and content in his native language which enhances the usability and user acceptance significantly.

The other requirements have been addressed on the client side and on the orchestration layer level:

The terminology for messages and the navigation have been improved by using icons, context menus and help texts for the whole application. The usage of the mobile phone camera for taking pictures of interesting fishing spots and catch reports has been technically improved (R21).

For the user it is now easier to find the requested feature and to perform the given tasks (R8, R13, R14).

The user trials showed major problems with the location based functions “locate a contact” and the “watercourse advisor”. They were mainly related to the poor network coverage in the angling areas and the pull mechanism which was used for the location function. With angler application V2, the client application has been improved by using a caching mechanism for the watercourse advisor to

⁶ PICOS Internal deliverable



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reduce the network traffic and latency and a push mechanism for retrieving the user locations (R29). The number of requests to the server side has been optimized within the orchestration layer to minimize the network traffic (R19).

The overall application usability has been improved which also enhances the LBS and communication features. The enhancements cover the following aspects:

- Support of additional wait cursors (showed meanwhile the application is performing some action) to give the user better feedback
- Introduction of new look and feel and widget styles for the whole application (i.e. button styles with coloured feedback, used background colours for the screens etc.).
- Support of icons in the menu bar as well as different links and buttons for better user perception and functionality recognition.

We can assess that the usability of the LBS functions has been improved compared to angler V1 and that all requirements have been implemented in the given timeframe.

Nevertheless, the LBS functions are the most complex ones and need an extensive interaction with several server side components, i.e. policy manager, notification component, location sensor. Under bad conditions (poor network quality, bad GPS signal availability) the user experience needs further improvement.

The asynchronous communication between the client and the server side based on notifications seems to be error-prone and should be replaced by a more reliable messaging queue. From the client side development perspective, the server side should be more homogenous and provide a more consistent API so that the client developers need not dig into server side components and struggle with internal details. But because of lack of time, major changes in the architecture were not possible.

3.2.3 Summary of findings and recommendations

The changes from the first to the second version (upgrade) of the angler application prototype were basically related to usability and stability aspects and have been implemented. More enhanced privacy features are intended to be covered in the gamer application prototype.

4 Economic evaluation

4.1 Methodology and documentation used

This current economic evaluation of the second version of the PICOS Platform and Angling Community Prototype is based on the previous economic evaluation of the first version of the PICOS Platform and Angling Community Application Prototype. It examines the changes applied to the second version of the prototype in the context of business aspects like trust, IdM and privacy, as the collection, processing and exchange of information are key economical success factors for online and mobile communities. To keep a focus under the constraints of the scope of this evaluation, this economic evaluation will focus on the business relevance of the implemented prototype.

The goal is to determine, how the PICOS platform and community application prototype 2 for the Angling Community copes with the economic aspects evaluated in the PICOS deliverable D8.1 “Legal, economic and technical evaluation of the first platform and community prototype”, focusing on the impact of the applied changes. The economic evaluation in D8.1 is based on the PICOS

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Requirements and the PICOS Contextual Framework and discusses how well the first prototype meets economic aspects of the PICOS requirements.

The following evaluation has been drafted by comparing PICOS Deliverables D5.1 “Platform Prototype 1” with D5.2a “Platform Prototype 2a”, and comparing the PICOS Deliverables D6.1 “Community Application Prototype 1” with D6.2a “Community Application Prototype 2”. Both comparisons are based on the PICOS principles in the PICOS architecture (D4.1) and on the D2.4 “Requirements” document.

4.2 Evaluation of the requirements and functionalities of the Angling Community Prototype upgrade

The first economic evaluation (D8.1) of the PICOS platform and community application prototype identifies the requirements with an economic relevance and how the first PICOS prototypes satisfy these requirements in terms of the trust (TrP)⁷ and privacy principles (PrP)⁸. Based on these results, at first the changes to the PICOS platform will be evaluated, followed by an evaluation of the PICOS community application prototype for the angling community.

The changes applied to the PICOS platform for the second angling prototype version have the purpose to support the changes developed in the second angling community application prototype. Because of the layered architecture model, only changes related to the “view”-layer are applied to the platform. Furthermore, as the changes to the community application prototype focus on usability and stability, most of the results evaluated in D8.1 are still valid for the second angling prototype. The focus on usability and stability was set, in order to deliver a better user experience, to improve the quality of evaluation of the PICOS concepts during the angler’s field trials.

The idea of the PICOS platform is to provide a set of community services around trust and privacy. From a business perspective, the key to integrate trust and privacy principles elaborated by PICOS and its community services is to meet the privacy demands of the users, and at the same time preserve the economic potential through marketing and advertising activities. An integration of third party services is included in the PICOS platform via external services, defined in the PICOS Architecture Component “External Service Delivery”⁹. Like in the first version of the PICOS platform, this feature is not implemented by the platform as a component, yet. Nevertheless, the feature is integrated in the PICOS platform for the gaming application prototype analysed in this document in Section B, chapter 1.3. Hence no economic requirement (R.A1-R.A5) from the PICOS requirements Deliverable (D2.4) is addressed. Marketing/advertising as a general requirement is implemented in form of context sensitive targeted advertisements in the gaming prototype, which will be examined below.

Along with the evaluation of the advertisement component in Section B, chapter 1.3 and chapter 2.3 of this document the corresponding Trust and Privacy Principles will be evaluated from an economic point of view. Besides the economic relevance of external services for the PICOS Architecture, other already implemented components have to be considered in the evaluation, such as the handling of personal information and data subjects in the Policy server. For instance, if personal information is collected for an external service, the data subject must provide informed consent, unless a law or regulation specifically requires otherwise (PrP6). Thereby, also the implementation of the policy server, content sharing server and notification server has to be evaluated when the external services component is implemented.

⁷ D5.1 Platform Prototype 1, p 94 f

⁸ D5.1 Platform Prototype 1, p. 96 f

⁹ D4.1 Architecture, p. 106 f



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Along with the PICOS platform prototype version 2, the evaluation of PICOS angling community prototype version 2 now follows, respectively its business relevance under protection of the trust (TrP)¹⁰ and privacy principles (PrP)¹¹.

The changes on the angling community prototype concentrate on usability and stability features. Major changes are related to enhanced robustness of the first angler community prototype, enhanced usability due to improvements on the graphical user interface (e.g. new styles, icons, and layout), additional help functions and an additional context menu for operations on the contact list. Furthermore, the internal process was optimized, to provide a better response to the user, the Location Based Services were improved and the PICOS angling client application was in parts also implemented in a web based application.

Due to these changes, no business application processes like, for example, the voucher example described in the PICOS Use Case 6¹² were implemented in the second angling community prototype. Therefore, no business related external services are available in the second version of the angling community prototype. The same counts for the PICOS platform prototype. The advertising component, as a business related feature, is implemented in the gaming prototype, which will be evaluated in section B, chapter 3.3 for the application prototype.

With the retrieval of information from FishBase (an external database on species summaries), the PICOS angling application prototype implemented an example how the integration of an external service into the platform and client could look like. As this component was not changed in the second version of the angling application prototype, the findings of the first evaluation are still valid. By that, the implementation of this service gives a good example on how PICOS is able to provide added value to the community members by integrating external data, and preserving trust and privacy principles at the same time. Although it has to be indicated, that the privacy requirements for this service were limited, due to the fact that no user data was transferred. The integration of services which use more user data, like an advertising service, is harder to implement in terms of privacy.

Another aspect of the client prototype with economic potential is content sharing, including asynchronous messages. The client prototype enables the Privacy Principle of correcting information (PrP17): Data Subjects are able to update or correct personal information held by the platform provider. The user has the possibility to change data subjects via the graphical user interface of the client. The changes applied to the content sharing component in the second version of the angling community prototype, improved the performance of the client, while not breaching the PICOS Privacy Principles.

One special aspect in the context of content sharing is that some data subjects can only be changed in the root identity. A change in the root ID also implies a change in the partial IDs, if the attributes are released. Such a change in attributes of the identity might lead to a certain level of linkability by other users, as the change in several partial IDs is visible to other users or the external service provider. This linkability is also possible in the second community prototype.

The PICOS concepts offer powerful tools to the user to address their privacy needs. One of such tools is the Policy Manager. As for the platform, the user is able to change his policy settings via the client. This allows the user to define fine-grained policies for profiles, presence and location. By that the Client Prototype is fulfilling the Privacy Principle on Changes in Policy or Data Use (PrP3). The applied changes in the second application prototype introduced the meta-objects reference to allow

¹⁰ D5.1 Platform Prototype 1, p 94 f

¹¹ D5.1 Platform Prototype 1, p. 96 f

¹² D4.1 Architecture, p 215 f



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users with more comfort when creating policies. The user was not able to create rules for single objects anymore, but for meta-objects. By that defining one rule for several objects of the same kind is possible. This drastically reduces the amount of privacy notifications for the user, but allows him or her still to manage his privacy up to a certain granularity.

In terms of integrating marketing or advertising functionalities, the Policy Manager will still give the user transparency and control at high granularity. As Privacy Policies are getting more and more complex with the integration of external services, the already existing component of the Privacy Advisor will support the user in understanding the consequences of his actions regarding his personal expectation of privacy and also regarding the possible benefits of targeted advertising activities for the individual user. For example, the implemented Privacy Advisor functionality notifies the user about possible risks with regard to the disclosure of personal data and sharpens the awareness of the user, whereby the Privacy Principle “timing of notification” (PrP4) is supported. The purposes for which personal data are collected should be specified at the time of collecting the data at the latest.

4.3 *Summary of findings and recommendations*

Summarizing, the evaluating the PICOS platform and the PICOS angling application prototype version 2 from an economic point of view leads to similar findings and recommendations as for the first version. The prototypes implement a set of capabilities around trust and privacy, without preventing business applications, which current community platforms do not support. Particularly, the implemented Profile server and Policy server are of special relevance when it comes to business applications under trust and privacy preserving conditions. The evaluation of the capabilities will be done in section B, chapter 1.3 and 2.3. There we will examine how the gaming prototype is able to enable advertisement services, interacting with the other PICOS components of the PICOS platform and the application prototype. Especially, the platform is basis for respecting and integrating the requirements of the user, third parties and marketers.

Regarding the PICOS Angling Community Prototype, in summary it complies with the set of trust and privacy principles, but at the same time it does not provide functionalities to make use of the social capital as a value of the community. In the evaluation of the first prototype, it appeared that the distinction between the functionality of the platform and the application was not always clear. With the evaluation of the second prototypes, the distinction is now well explained.

In summary the second prototypes hold some economic potential not yet accessed. While the second version of the angling prototype was mainly improved with regard to usability and the accessibility of the developed identity management features, the gaming community prototype needs to focus on marketing/advertising much more. In particular a stronger integration of marketing/advertising services as external services or within the PICOS platform itself needs to be further investigated.

5 Legal evaluation

5.1 *Methodology and documentation used*

The legal evaluation of the first PICOS Platform Prototype, as well as the first PICOS Community Application Prototype for the Angling Community was realised in D8.1 “Legal, economic and technical evaluation of the first platform and community prototype”. The methodology used for these legal evaluations will be the same for this current one, which focuses on the upgrade of both the PICOS platform prototype, as described in D5.2a “Platform prototype 2a”, as well as of the PICOS Angling Community Prototype, as described in D6.2a “Community application prototype 2”. The

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evaluation will, thus, be based on the European legal framework on data protection. In the field of European Union law, the Charter of Fundamental Rights of the European Union (hereinafter EU Charter) provides for the respect for private and family life (Art.7) and the protection of personal data (Art.8), while the Data Protection Directive (1995/46/EC) has been adopted to guarantee efficient data protection. The prototypes are evaluated against the Data Protection Directive (1995/46/EC).

The documentation that will be used for this evaluation will mainly be D5.2a “Platform prototype 2a”, as well as D6.2a “Community application prototype 2”

5.2 Evaluation of the requirements and functionalities of the Platform and Angling Community Prototype upgrade

D5.2a “Platform prototype 2a” in its executive summary clarifies that the upgrade of the PICOS platform prototype included a few enhancements in view of the Anglers Field trial. Ultimate goal of these enhancements was to support the PICOS Angling Community application, in making changes that were identified in the community user trials in Vienna and Kiel. D5.2a clarifies that “thanks to a layered architecture model, only a few changes were necessary at the PICOS Platform layer, most of the usability improvements being carried at the PICOS community application layer”¹³. These changes, which were identified in the community user trials in Vienna and Kiel, mainly focused on usability and stability. Their aim was to enhance the user experience and to improve the quality of the usability evaluation of the PICOS concepts during the next angler’s field trials that took place in May 2010. Therefore the upgrade of both the PICOS platform prototype, as well as the PICOS angling community prototype do not introduce any additional features or elements that are of importance for a legal evaluation. The findings of the first evaluation both for the PICOS platform prototype and the PICOS angling community prototype, as described in D8.1 “Legal, economic and technical evaluation of the first platform and community prototype” are valid for the upgrades as well.

Help functionality

One issue that is interesting to be discussed is the item “help functionality”¹⁴ that was included in the new functionality of the client mobile application (angler v2) with regard to the first prototype (angler v1). The “help functionality” consists in an “i” icon, which is available at the bottom right of some screens of the client application. Help information is displayed when the user presses this icon and, in this way, user specific functionalities, such as maps and public community, or PICOS concepts, such as Partial Identities, are explained to the user. From a privacy point of view this new functionality is valuable, as it enhances the transparency principle. The users are in a better position to understand what the various user specific functionalities entail and are empowered to make a better decision, when being better informed.

5.3 Summary of findings and recommendations

In summary, the changes integrated in the upgrade of the PICOS platform prototype and the PICOS angling community prototype focused mainly on usability and stability. Therefore, they don’t introduce amendments of significance for the legal evaluation of the prototypes. The findings of the evaluation of the first PICOS platform prototype and the first PICOS angling community prototype, as described in D8.1, are still applicable.

¹³ D5.2a “Platform prototype 2a”, pp. 1-2.

¹⁴ D6.2a “Community application prototype 2”, p. 12.



6 Usability evaluation

Given the fact that the upgrade of the PICOS platform prototype and the PICOS angling community prototype focused mainly on usability and stability, the new elements they introduced are of more importance for the evaluation from a usability point of view. This chapter reports the requirements deduced from the lab and field test with the angler application v1 and the respective changes of the functionalities in v2. Further it describes the evaluation results of the field trials with the upgraded version – as the continuation of the short lab and field tests, which took place on 27/28 November 2009 in Vienna and on 12/13 December 2009 in Kiel.

6.1 Methodology and documentation used

The following sections describe the requirements collection process for the PICOS angler application v2 based on the first community feedback gathered in lab and field test.

6.1.1 Usability Evaluation of Angler application v1 and Improvements for angler application v2

The collection of the user's impressions and feedback of the first official release of the Angler application (version 1) was important in order to apply the necessary corrections and improvements for a second version which was designated to be used in the scheduled field trials. Thus, short lab and field trials were conducted with 12 participants from Vienna and Kiel in November 2009, who had to complete several tasks (e.g. register and login, create a further identity etc.). After the lab test a qualitative interview regarding strengths and weaknesses of the application was conducted. Three different questionnaires were concerned and were added to the data collection process to gather feedback on usability issues, privacy enhanced technology evaluation and demographic information (for a detailed description see Deliverable 7.2a "First Community Prototype: Lab and Field Test Report"). Especially qualitative data as observations during usability tests and feedback gathered during lab and field tests feed into suggestions for improvements for the second version of the angling prototype. The results are directing the improvements which have to be developed before bringing the prototype into a real-world context during the user trials (see section 6.2.1)

6.1.2 Usability evaluation of angler application v2

The aim of the field trial was to evaluate the upgraded PICOS angler application (installed version 2.2). The field trials were conducted to evaluate the PICOS concepts and application in a real-world context and on a rather long-term scale. For this reason the anglers were encouraged to use the application in their real life, while fishing and with related activities. To achieve this goal the trial period was about four weeks (which turned out to be too short for some participants). Nevertheless, it was assumed, that only the unattended and free usage of the application would provide realistic user statements about the PICOS concepts and the usability in relation to the provided mobile and web application.

The trials were conducted in Vienna from the 1st to the 31st of May 2010 and in Kiel from the 2nd of May to the 2nd of June 2010. Five anglers in Vienna (three males, two females aged between 23 and 37 years, $M = 28,75$) and twelve anglers in Kiel (twelve male aged between 18 and 30 years, $M = 25,28$) committed their participation (thirteen participants committed their participation in Kiel but one angler quit after one week). The debriefing session in Vienna took place on the 31st of May 2010 and in Kiel on the 19th of June 2010. All participants in the field trial had already participated in the lab



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and field test. Thus they were already familiar with the PICOS concepts and consequently also with the features of the PICOS mobile angler application. See **Table 1** for the whole field trial procedure.

Table 1: Field Trial Procedure

Kick-off	
Introduction	Background for the field trial
Execution of field trial period	
Agreement consent form	
Distribution of the trial devices (NOKIA 5800)	
Introduction web interface AnglersBase	
Questionnaires	Demographic background, personal expectations towards PICOS angling application
Field trial phase	
8 tasks and a respective online survey	“add contacts”, “blur position”, “locate contact”, “watercourse description”, “new partial ID”, “private Sub Community”, “Posting”, “Privacy Manager”
Debriefing	
Questionnaires	PET-USES, SUS, Handling of private data in online communities
Group discussion	Organization of field trials, usability of mobile application, usefulness of PICOS concepts on trust and data handling, range of features, evaluation of the results of the questionnaires, discussion about the web frontend
Winner of the angling competition	
Return of devices	
Reimbursement of expenses	

To measure the perceived usability of the application, the users had to finish the “**System Usability Scale**” (SUS) at the beginning of the debriefing. The SUS is a questionnaire which measures the subjective satisfaction of users who rate the usability of a technical system. The 10 items are formulated as statements. The users can express their extent of agreement on a 5 point agreement scale (ranging from 1 = “I agree very much” to 5 = ”I disagree”). Results are reported in section 6.2.2, below.

6.2 Evaluation of the requirements and functionalities of the Angling Community Prototype upgrade

6.2.1 Improvements for angler application v2

This chapter depicts the new functionalities in the client mobile application compared to the first prototype. For a visual comparison between the versions v1 and v2, screenshots are included in Appendix 1.

Registration: Results of the lab and field tests of the angler app v1 showed that many trial candidates did not understand the difference between Login Name and (first) Pseudonym, since differentiating between Login and Pseudonym is not the usual procedure in existing online communities. Although a



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help file exists to explain the partial id concept, it is obviously necessary to extend the help file by explaining the difference between login name and first pseudonym.

- Help functionality: on some screens of the client application an “i” icon is available at the bottom on the right. Help information is displayed when the user presses this icon (
- **Table 6** in Appendix 1). This new functionality aims at concisely explaining the user specific functionalities (e.g. map, public community) and PICOS concepts, such as Partial Identities.
- To avoid confusion help information (
- **Table 6, Table 7**) regarding the difference between Login and Pseudonym was added.

Access to the Community: No major changes were accomplished in the “Access to the Community” use case. Only a house icon was added in the login screen in order to enhance the visual appearance and the mentioned “i” icon to display a help text (**Table 7** in Appendix 1).

Partial Id Manager: A result of the lab and field tests was that it was not obvious for candidates who were creating a new identity, that some personal data from the root profile cannot be changed, such as age and gender (a trust-enhancing feature in the PICOS community). Some candidates expected that the other id could be set up within the profile of the first id. Two major changes were made in this use case in the upgrade of the angling community prototype:

- GUI modification: existing button elements were replaced by links in combination with icons (as shown in
-
-

- **Table 8** in Appendix 1).

Fill profile (

Table 6): An additional dialogue, questioning if the user “(...) want to fill out the profile for this new identity NOW or LATER?” is asked. This enables the user to complete the profile associated to the new identity that s/he is creating. The profile can also be completed later on.

Profile Manager: The changes on this module include:

- The field “Pseudonym” in the root profile was renamed to “Login Name”.
- Profile fields had been regrouped and renamed to fit the platform restrictions about policies to a single field and to a group of fields. The profile fields are now listed this way:
 - “Main Info” has the sub-fields: “Age”, and “Gender”
 - “Location Info” has the sub-fields: “Country” and “Zip Code”
 - “Messaging Info” has the sub-fields: “Email”, “Instant Messaging Name”, and “Preferred contact means”.



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- “Hobbies Info” has the sub-fields: “Hobbies description”, “Fisher Type”, “Experience”, “Fishing Methods”, “Favourite Watercourses”, “Target Species”.
- “Misc Info” has the sub-fields: “Membership clubs”, “Favourite fishing destinations”.

Contacts Management: Some changes were made to the contacts screen in order to ease the managing of the user’s contacts:

- Addition of a context menu: when the user picks up one of his contact from the contact list and presses on hold, a context menu is displayed, showing several actions to execute (the same options available in “Options” command): send a message, show profile, show on map and create policy. This context menu is displayed in relation to a specific contact.
- “Add contacts” link: a new link was added to launch the search for existing members in the Public Community.
- “Create Policy” Option: this new option was added to the search, so when a user selects it, the Privacy Manager will be displayed in order to assign a privacy rule to this contact.
 - Button elements “Search” and “Add contact” were added (see



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- **Table 10** in Appendix 1)
- When the user presses “Search”, a searching of contacts into the public community will be performed, filtering by the string entered as parameter into the field text.
- When the user presses “Add contact”, the selected contact is added to the user contacts list.

Policy Manager: The results of the lab and field tests revealed that it is not obvious for many trial users that the policy creator is behind the wheel. It took time to find these applications. For the PICOS Application Prototype v2 it was suggested that the “policy creator” is renamed as “privacy manager”, which links to the overview of privacy rules and avoid confusion. The privacy manager should provide a function “add new privacy rule”, which leads to the wizard or to a screen for the creation of a new privacy rule. The modifications on this module are:

- Bug was fixed: Policy not correctly applying when the scope was a single contact, and for policies not being correctly created for groups of resources.
- In the wheel menu, the former “Policy Editor” was renamed to “Privacy Manager” to avoid confusion on user side.
- The “Policy Creator” was deleted from the wheel menu, and can now be accessed from a button in the Privacy Manager “Create new rule”.
- The Policy Creator was subjected to internal rearrangement. Policies were modified according to the level of granularity allowed in the platform. It is not possible to create policies on certain objects. For example, to create a rule on “experience”, now the user has to create a policy on the meta-object “Hobbies Information”, where “experience” information is contained. A policy affecting “Hobbies Information” will affect all its sub-objects, including “Hobbies Description”, “Experience”, “Favourite Hobbies Destinations”, etc. These meta-objects are referenced in the Profile screen, as well.

Public Community: New functionality was added with regard to modifying the content of a post when this has not been rated yet by other members of the community. Consequently, this new feature offers the user the option to modify subsequently his previously posted contribution. The steps to perform this action are as follows:

- Select the post text and make the desired changes (writing or adding new text)
- Go to “Options” command and select “Submit changes”
- If this action is processed correctly on the server side, then the client will receive a notification, and the message “your POST was modified correctly” will be displayed to the user.

Public repository: The repository speed and performance was greatly improved. Main changes include:

- Category attributes edition: the category attributes can now be updated by the owner
- Repository performance: the repository screen loads up faster and needs less calls to the platform now since it only loads the content per category on demand (only when the user opens a category).
- Container management improvement: now the content can be deleted quickly without the necessity of an update of the whole list after confirmation.
- The content elements from a category were reorganized for better identification.

General GUI Improvements: A new graphical support was added to improve the usability and to enrich the user experience for the second prototype at the client-side. The trial users of the Angling Community asked for better support of direct manipulation possibilities in order to enhance the interaction at the level of the GUI. They asked explicitly whether context menus for contacts,

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messages, watercourses, fishing spots, and all screens, where meaningful, could be added to the application UI. Furthermore, they asked for context-sensitive help and for the usage of an appropriate community terminology.

The changes were carried out in coordination with CURE usability experts, who continuously evaluated the changes performed (i.e. common remote test session with the real device). The main changes applied are:

- Introduction of new look and feel and widget styles for the whole application (i.e. button styles with coloured feedback, new background colours for the screens etc. were proposed).
- Support of icons in the menu bar, as well as different links and buttons for better user perception and functionality recognition.
- Adding context-sensitive help support at different levels (i.e. context menus and explicit help icons in all screens). The new help structure supports navigation among the different parts of the offered help. This application-wide help structure contains help text especially for those screens that are critical for the usage purposes of PICOS.
- The usage of the links and the styles of textual descriptions in the whole application were also aligned for homogenous and consistent screen presentation, as well as the support of context menus for different items (i.e. contacts, messages, watercourses, fishing spots, etc.). In general, clicking on the item in the corresponding screen shows the context menu and displays selected functionality for the respective item, if supported (e.g. adding or removing a contact from a contact list, showing content of a message etc.).
- Advanced highlighting for selected list elements was added.
- The navigation bar was redesigned to allow easy access to various profiles and privacy related settings, as well as the change of the presence status and of location settings.
- The new home screen of the PICOS client application informs about online contacts.
- CURE experts provided suitable icons and included help texts. The recent released versions of the LWUIT library (from v1.3 on) were included at the client-side. In addition, the whole framework was re-factored for the different GUI elements, which improves its maintainability and performance. Automatic logout is carried out after a given time of inactivity. This inactivity time can be configured in the “settings” options which are presented on the Login screen.

Location based services (fishing spot/watercourse advisor): The LBS use cases can be divided into three groups: The ones that use the user’s own location, the ones that use the location of contacts and the ones that use the location of fishing spots and watercourses. The LBS use cases in the first prototype of angler v1 encountered a number of serious problems, e.g. all previously used access points had to be deleted in order to access the mobile network, the map functionality was not stable or the users did not recognize that their status information was set to “not locatable”. The following fundamental changes were made addressing these problems:

1. Fishing spots and watercourses are persistently cached in the client’s file system. When using them for the first time in a session, the user may choose to reuse the cached data or reload them from the server. The user may load the latest data from the server manually when a fast connection to the server is available and may use cached data when the connection is poor. The thumbnail, reputation and reputation history are attributes of a fishing spot and watercourse and are not retrieved in separate requests.
2. A location listener is registered with the GPS sensor during the startup procedure of the angler application. Therefore now the current position is always available as fast as possible. The location is pushed to the server whenever the location settings change between “off” (set location to null), “on” (set exact location) and “blurred” (set blurred location). Note that this is

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also the case when the current partial identity changes or a logout or exit is executed. Depending on the location settings in the “Settings” dialog, the location is also pushed to the server (only when location is “on” or “blurred”) in a configured time interval or whenever the location changes by more than a configured distance. Note that the listener mechanism enables the user to follow his current position on the map.

3. An update location listener is registered with the server during the startup procedure of the angler application. Therefore, a user will get a notification for each location update of each of his contacts. The former pull mechanism is only used in the case that the location of a contact is not yet known on the client. In this case the contact is notified that the user wants to locate him. The contact has to decide whether he wants to grant or to deny the permission. Note that the listener mechanism enables the user to follow the positions of his contacts on the map.
4. When fishing spots or watercourses have not yet been rated they may be edited or deleted by users with sufficient privileges (depends on the policies of the community).

Additional Improvements: Various improvements were performed for LBS functionality in the second version of the Angler Community Prototype. Those improvements affected both, the client-side as well as the server-side parts (WP6 Orchestration Layer). The improvements are primary targeted enhancing the performance and the usability of the prototype.

The client caching was extended to support watercourses and fishing spots as well as their thumbnails. Cached entries are stored in local files and are valid until following reloads. In addition, the client performs many operations in the background asynchronously in order to ease the interaction at GUI level. For instance loading images of the fishing spots and watercourses is carried out in an asynchronous manner. Another example is the detection of location information with the help of the GPS sensor after the start of the application since such operation takes normally an average of 20 seconds in most of the mobile devices. Further, the client internally uses listeners instead of frequent calls of the WP5 Platform getLocation method. By doing this the interested components will be informed in a push manner instead of pulling this data each time needed. Finally, the configuration was improved by integrating location related settings in the settings dialog.

At the server-side location information is reset each time the user is logged out and whenever the GPS sensor settings changes. Furthermore, the reputation values and the reputation history are integrated into orchestration layer (i.e. new and re-factored methods getReputation and getReputationEvents added to watercourse, getFishingspotsByCoordinates and getFishingspotsByWatercourse replaced by getFishingspots).

In addition to this, many improvements at the GUI level were included to support better user experience and faster interaction:

- Support of additional wait cursors (showed meanwhile the application is performing some action and it' in Map screen).
- Adding Timestamps to reputation history.
- Resizing maps to full screen when starting from locate contact and when turning the screen is now also supported.
- Support of user-controlled reload of fishing spots and watercourses.
- Hiding the image dialog when the fishing spots and watercourses zoom image is clicked.
- Support of context menus for fishing spots and watercourses. For instance, adding fishing spots and watercourses, rating, commenting, and showing them on the map is possible now.
- Opening fishing spots and watercourses by double click (instead of single click).
- Showing message? and stay in contact list if contact cannot be located (message? states possible reasons why the contact cannot be located)

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Real-time Content Sharing - Communication and Notification Means: Content sharing support in PICOS is provided with the help of the real-time content sharing component. It supports communication functions such as those needed for synchronous and asynchronous communication (Chat and Messages Box¹⁵).

Minor changes at the GUI level related to the notification mechanism for the second version of the Community Application Prototype were made. These changes are also based on the outcomes of the user trials and internal investigations documentation. The main changes took place at the level of the GUI primarily those allowing for improving the interaction:

- An explicit tab at the menu bar level allows directly accessing the Message Box. In the first prototype this was only possible through links shown in other screens (e.g. the home screen).

Like in the case of contacts:

- The selected message in the Messages Box list is marked/ highlighted by using a different background colour (red colour). Fast access links for sending new messages or removing them were extended to also support icons next to the text.
- The messages also support direct manipulation. By longer clicking on a message, a context menu is shown where the often-needed functionalities are made accessible (e.g. showing content, replying to the message etc.). Some delicate functionalities, such as removing messages, are still accessible via the Options command menus from the first prototype. The command menus include all available functionalities.

Furthermore:

- The Message Box and Chat tabs in the menu bar are indicated now by icons next to the tab names. This feature was requested by the usability experts.
- The participants' selection screen in the Chat menu is enriched by a context menu and the fast access links supported by icons beside the text. Thereby, only online contacts are offered in the combo box to be added as participants for new chat sessions.

The notification mechanism at the client-side was not modified and its functionality is still similar to the description in D6.1 Community Application Prototype 1.

6.2.2 User based Usability Evaluation of angler application v2

For the field tests with the improved, updated angler application, various instruments were used to collect qualitative and quantitative data to analyse and evaluate among other things the usability of the PICOS angling application.

Results of the SUS

The SUS rating shows that the updated angling community application was evaluated as “acceptable” in Vienna and as “not acceptable” in Kiel (Figure 2).

¹⁵ The “Messages Box” was previously refereed as “Inbox” in PICOS

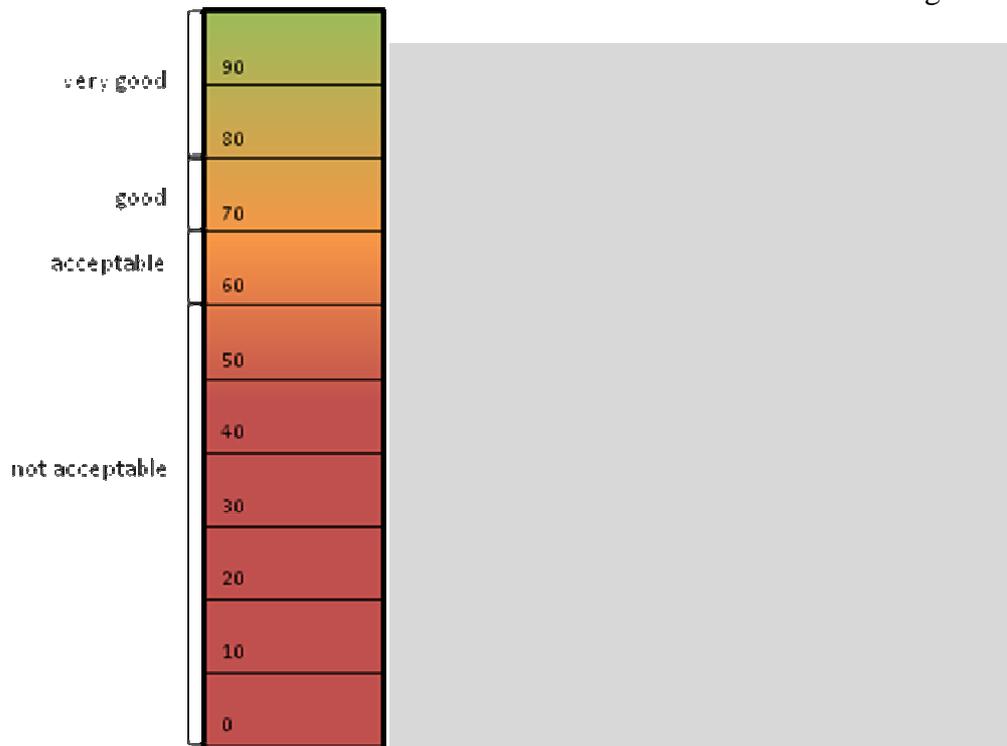


Figure 2: SUS score of PICOS angling application after field trials in Vienna and Kiel

Compared to the Lab tests in November 2009, both scores declined in the particular group (SUS score lab tests Kiel = 72,2; SUS score lab tests Vienna = 67,9) but compared to the short field test in November 2009 the score in Kiel improved (SUS score field test Kiel = 47,9).

A potential explanation for decreasing of the SUS score compared to the lab tests could be attributed to several reasons: During the lab tests in November 2009 the participants had the opportunity to receive hints and explanations from the test facilitators. The participants solved more tasks than in the lab and field test in November 2009 (D7.2a) compared to the task which they stated to solved in the field trials (Vienna: 95% vs. 85%; Kiel: 99% vs. 69%). This could cause a general dissatisfaction with the application which is reflected in the participant's ratings.

However, the SUS score in Kiel increased compared to the SUS score of the field tests in November 2009 indicating an improvement of the community prototype v2 compared to the first version tested last year. Many problems which occurred during the field trials concerning usability of the system became exclusively apparent during an extensive and long-term - thus realistic - usage of the application.

Results of the debriefing and online survey

Collected qualitative data in Vienna and Kiel during the debriefing group discussion and through the online questionnaires indicate that the participants first of all were frustrated by the bad performance of the system. They received a lot of unexplained error messages (Figure 3) and complained about the long- response time of the system which was frustrating for the users. This causes the feeling of uncontrollability.

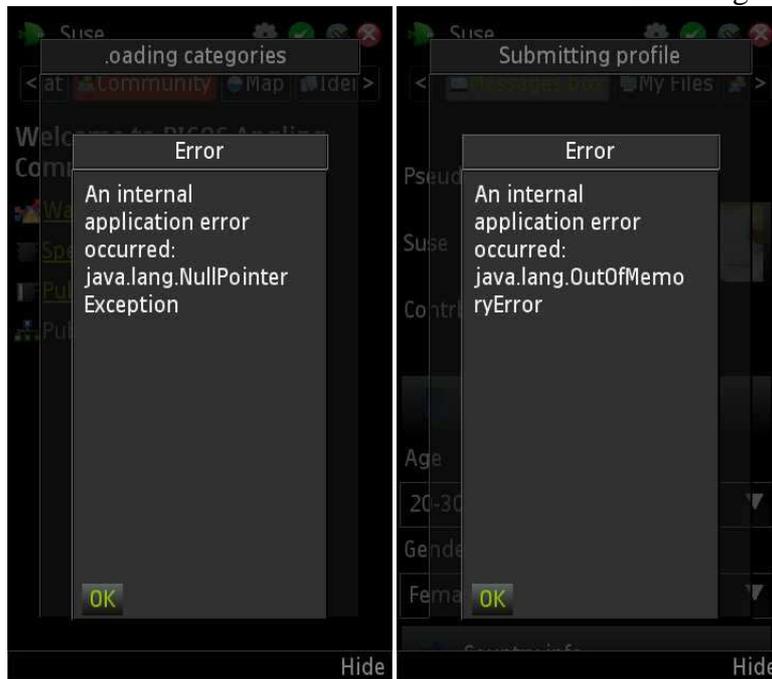


Figure 3: Examples of error messages

The two groups in Vienna and Kiel interacted simultaneously in the community. Unfortunately, the exchange was quite sparse between the two groups and within the two groups as well. This was partly attributed to the short test duration and the small community size. But additionally the users mentioned it was hard to recognize when somebody tried to get in contact with them. Communities and sub communities had to be searched through new posts and the application lacks feedback when a new messages or chat messages was received. The restriction that it is possible to invite online contacts only to a sub community caused reduced exchanged as well.

Related to this, both user groups criticised the handling of the message box. Some users reported that they received hundreds of messages during the trials which had to be deleted one by one and made it impossible to find task messages of the test facilitator or messages from other community members. Basically the participants stated that authorisation requests should be separated from the message box to avoid a “spamming” of the message box. More than one message should be editable (e.g. erasable) and the user should be informed about incoming messages.

Participants in both groups wished to have individual ordering options in the message box as well as in the contacts menu and the forum list of the public community to have the opportunity to order messages, contacts or forums (e.g. in a alphabetic order). The participants stated that it is hard to keep the overview when the amount of data increases.

Basically the users stated that the entry of text and information was very extensive and time consuming caused by handling the mobile device and the detailed information which were requested within the application. Especially during angling the users wish to interact as little as possible with the application and to add information later on via web frontend. The usage of the application was partly evaluated as annoying and interrupting caused by the amount of information which should be added. The device forces the user to operate it with two hands and with the help of the pen. This was impractical during angling. The mobile application should provide information as fast as possible. Interaction steps should be reduced as much as possible e.g. by a favourite functionality lists at the

home screen or reduced text entry possibilities in the catch reports. Participants in both groups evaluated taking a picture as central event during angling which should be easier to handle (with a few interaction steps). Additionally the users had problems to find the folder where the image was saved.

The users suggest the decrease of the amount of text/information entries in the mobile application and the provision of extended possibilities to enter text/information at the web frontend.

Participants of both groups stated that the automatic logout was annoying for them. During angling they interact just from time to time with long lasting breaks in between with the application. The automatic logout leads to offline and not locatable status which decreases the possibilities to interact with the already small amount of community members. The option to change the settings of automatic logout at the login screen (Figure 4) was overlooked.

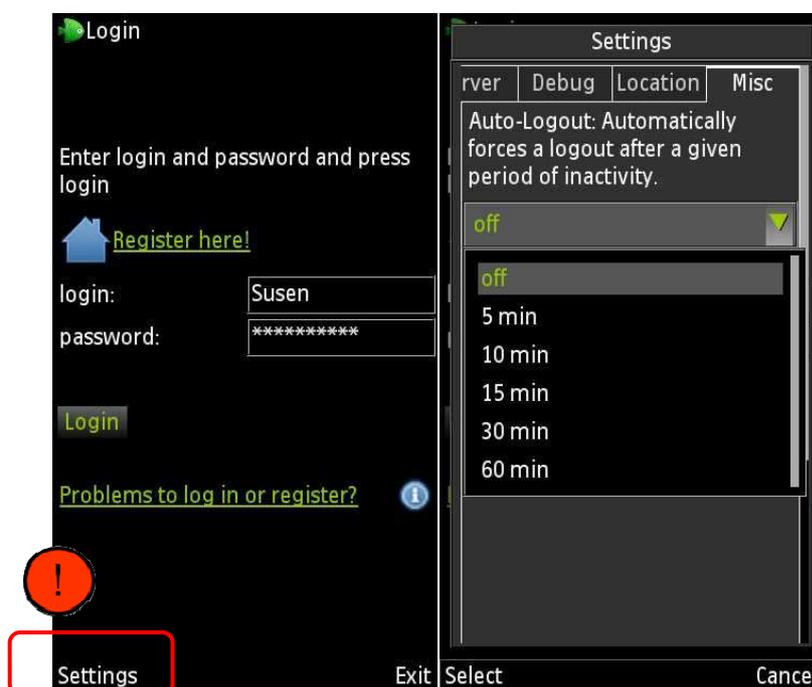


Figure 4: Screenshot of changing auto-logout settings

In general the users often mentioned that scrolling in the application was hard because the scrollbars were too small and did not work in the intuitive direction e.g. in the message box (Figure 5, Figure 9). Here, it was not obvious for the users that the bar on the right side of the screen indicate the screen status which could operate by touch (moving the finger upwards starts a down scrolling indicated by a down moving bar on the right). The users operated the application solely by pen.



Figure 5: Screenshot of the Message Box with highlighted scroll bar; slighting the bar down causes an up scrolling

In any case, there were functionalities which received no critique or were praised because of their user friendliness. The watercourse advisor was mentioned in both groups as an interesting and helpful functionality. It was no problem for the users to register, add a contact and create a Sub Community. The multiple offering of one option in the context menu and with a direct link in the respective screen (e.g., "Send new message" or "Delete identity", Figure 6) was evaluated as helpful. This approach should be realised consistently in the application.

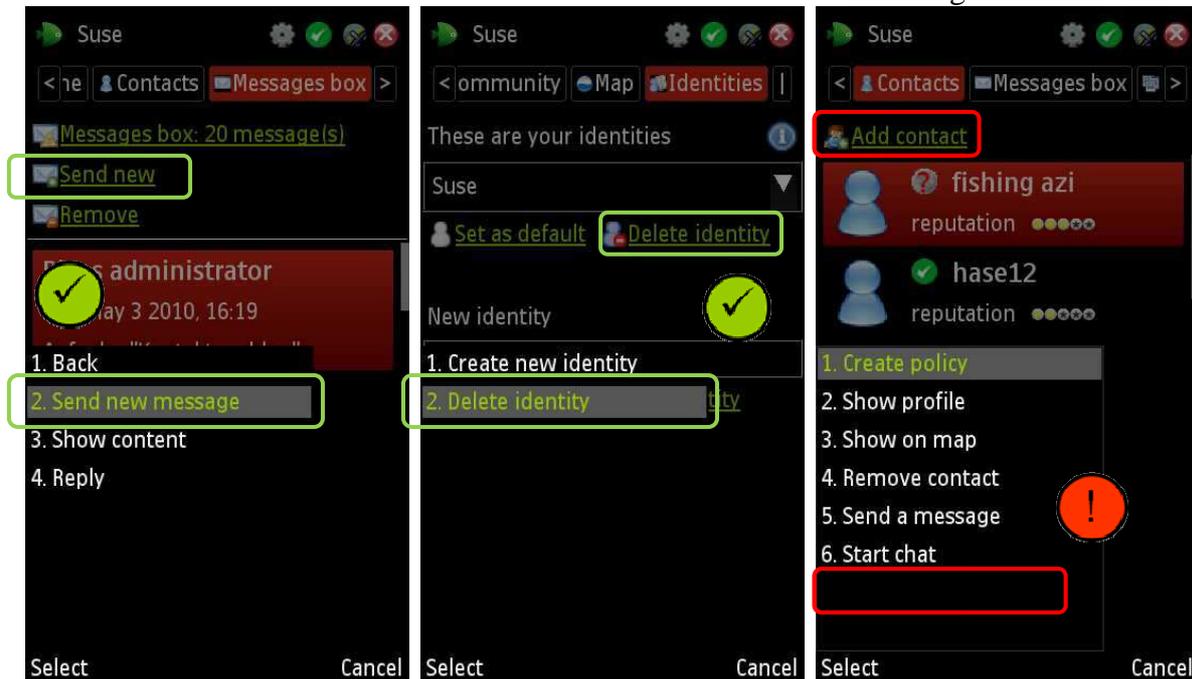


Figure 6: Screenshot of Message Box with highlighted multiple options to send a message

The graphical design was heavily criticised by the users in Kiel. They stated that the application looks old fashioned and is not comparable to applications on up-to-date smart phones. Especially the users in Kiel wish to have the possibility to use the application on another phone.

Participants of both groups rated the title bar (Figure 7) as usable. The participants stated that it online status, location detection and logout were intuitively and easy to use.

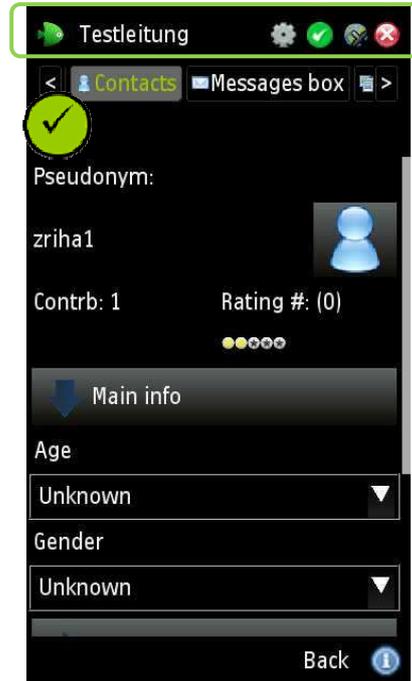


Figure 7: Screenshot with highlighted title bar

The participants stated, that they did not use the privacy manager during the field trials in a great extent the organisation and visualisation of the privacy manager was criticised. The principles of organisation were not transparent for the users at the first sight. This was attributed to the fact that the important information (the “attribute”) of the privacy manager was not visible in the upright format. The privacy manager was rated as more usable in the landscape format (Figure 8).

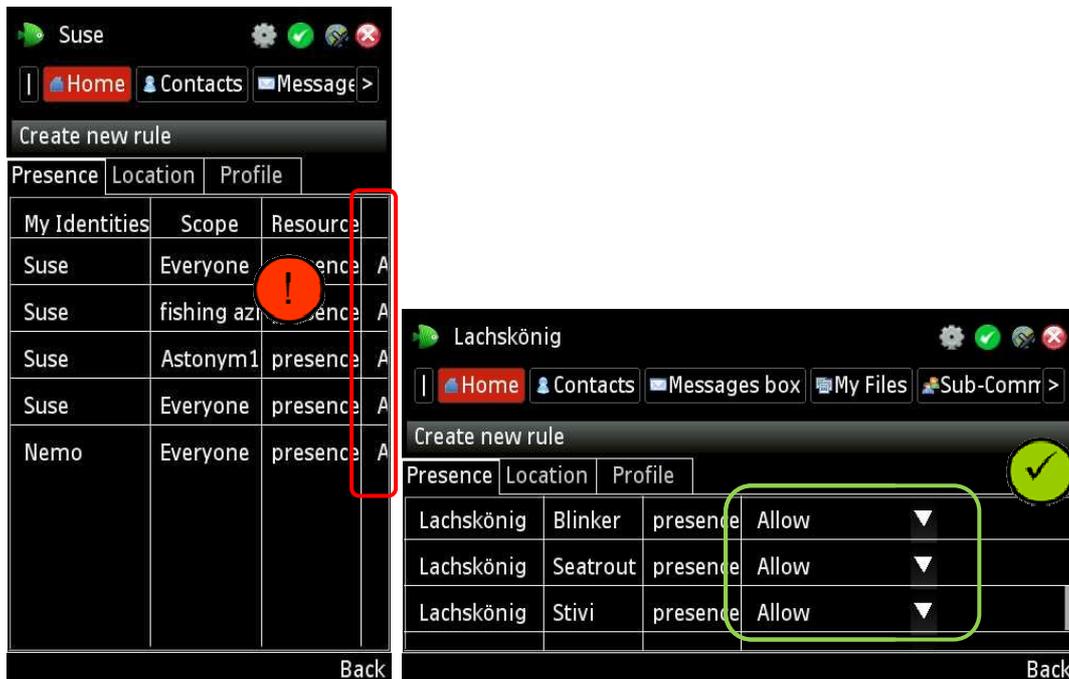


Figure 8: Screenshots of the privacy manager in upright and horizontal format

The horizontal format causes in both groups for several participants some confusion because central interaction elements (e.g. Login Button) were not visible. The scroll bar was overlooked that's why the participants had the impression that the button disappeared (e.g. on the login screen or the watercourse description screen, Figure 9).

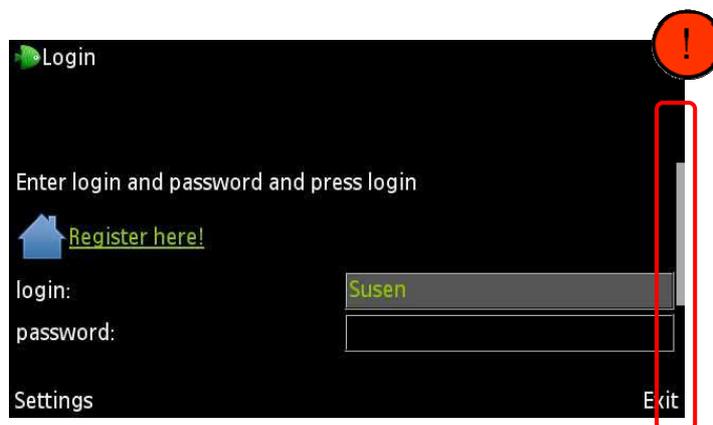
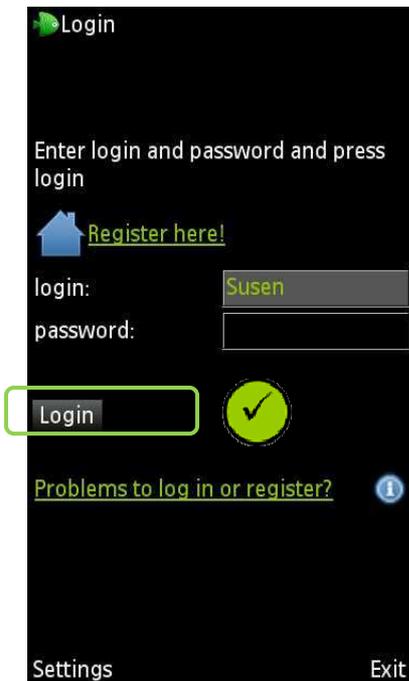
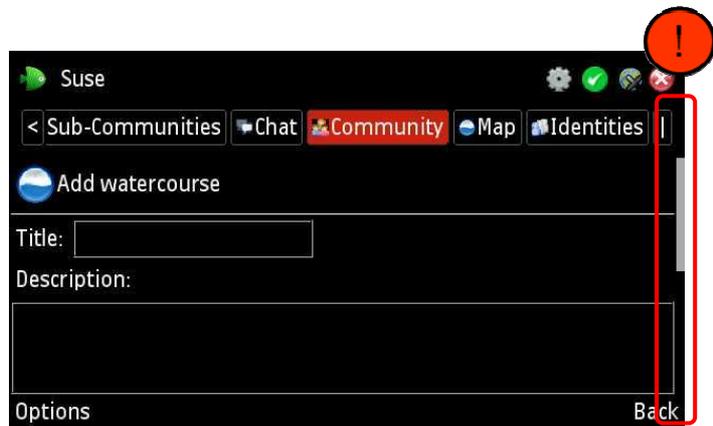
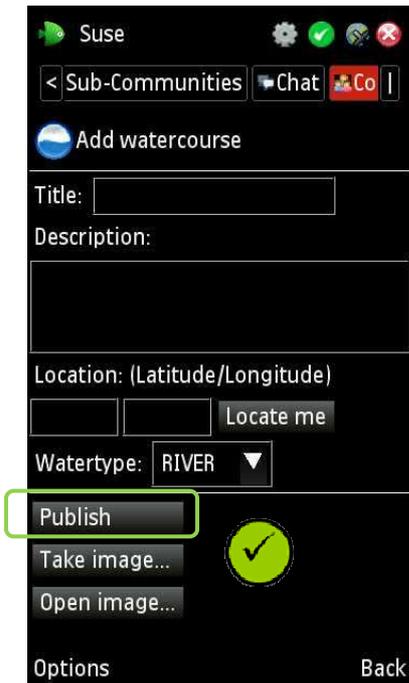


Figure 9: Screenshots comparing upright and horizontal format of the add-watercourse and login-screen

An additionally usability problem with the privacy enhancing technology was mentioned in both groups while creating a new identity: Participants in Kiel and Vienna were confused about the check boxes in front of the text entry fields. When they entered text and select the checkbox in front, the text was deleted (**Figure 10**).

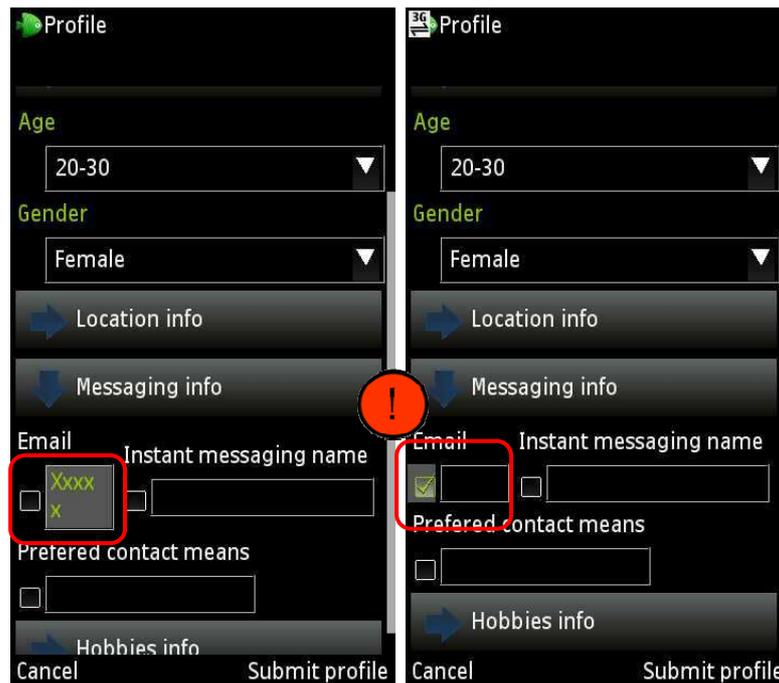


Figure 10: Screenshots profile setting screens

6.3 Summary of findings and recommendations

Summarizing qualitative results of the field trial, participants reported to be demotivated to use the application over a long period of time caused by the bad performance of the application. Certain experiences, as inscrutable error messages, long response time and message box overflow resulted in several carry-over effects regarding the detailed evaluation of the application especially its PET features. Several basic usability issues regarding the handling of the device (e.g. text entry) had impact on the evaluation of the application and the PICOS privacy features, thus although the focus in Picos is not on usability, it has to be considered as prerequisite of privacy enhanced user interfaces evaluation.

Main critique in both trial groups focuses on the message box and the related problem of the overflow of authorization requests. Users suggested to separate authorization requests and messages. Additional suggestions were made to rearrange the message box to improve usability. The PICOS PET features, such as the privacy manager, received critique due to its complexity. Suggestions were made e.g. to simplify the process of creating a privacy rule by using a wizard. Basically, the users stated that the entry of text and information was very time consuming caused by handling the mobile device and the detailed information which were requested within the application. Under outdoor conditions angler rather want to receive messages and reply very brief, instead of sending longer once by themselves; more information and annotations will be rather submitted via web frontend.



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Quantitative results showed that trial participants evaluated the usability of the PICOS application as “acceptable” (SUS score Vienna) and “not acceptable” (SUS score Kiel). Many problems which occurred during the field trials concerning usability of the application (e.g. handling of the Message Box) were caused by extensive and long-term - thus realistic - usage of the application and/or a lack of performance. Therefore scalability and stability of the platform needs improvement. These results show that the users perceived that the PICOS application is still on a prototype level (which was announced to the test participants before the field trials) and needs improvement regarding its real world applicability.

The participants stated that in principle the PICOS concepts were interesting but they didn't use the implemented features during the trials. The users criticized the application heavily especially during the debriefing. Therefore experiences which were made by the users underlie several biases of memorization. The negativity bias which describes the phenomenon that humans tend to give more weight to negative rather than positive experiences describes such a typical bias. Furthermore negative information has greater impact and creates more attention than similar positive information in the form of affirmation.

The results of the field trials indicate very clearly, that performance and usability is a complete and utter prerequisite for the perception, understanding, comprehension and the usage of PICOS PET concepts. Only if the implementation of PICOS PET concepts works error-free on the functional level and presented well on the usability level the advantages of them are easy to carry out for the users and they are able to understand, evaluate and use these concepts.

Following recommendation based on the first community trial results should be taken into concern for the second community prototype:

1. **Improve performance:** The participants stated that they got frustrated using the application because of the amount of error messages which appeared and were not comprehensible for them.
2. **Improve feedback times:** Participants complained about slow reaction times which caused double and wrong clicks.
3. **Improve information content at the home screen:** Participants suggest placing “news” on the home screen, which should contain posts or comments on posts in the subscribed forum. An additional suggestion was to place links to favourite functionalities at the home screen instead of online contacts
4. **Inform the user about incoming messages or chat messages.**
5. **Reduce specifications at the mobile application**
6. The **web frontend** should contain all functionalities of the mobile application.
7. **Improve consistency of web frontend and mobile application:** Web frontend and mobile application should look similar concerning the graphical design.
8. **Enrich information** (e.g. add examples) **on privacy functionalities** of the application. Many participants didn't understand the practical benefit of another partial ID.
9. **Improve layout and functionality of the message box.** It should be possible to edit several messages (e.g. deleting) at one time. Most of the participants stated that they were not aware of receiving a new message because latest messages were shown at the end of the screen. Additionally scrolling is counterintuitive. It should be possible to create folders (e.g. for authorisation requests).
10. **Improve highlighting of different chat participants.**

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11. The **scroll-bars** should be improved and designed in a consistent way compared to the mobile device. Scroll-bars were rated to be too small; especially if the user wants to use the application with touch it is not possible to scroll.
12. **Highlight important interaction elements** (e.g. create rule button in the privacy manager) and ensure their visibility in the landscape format.
13. It should be possible to **invite offline contacts** to a private sub-community to support private communication
14. The action to take a picture was evaluated as a central event while using the mobile application. The participants had difficulties to retrieve the picture in internal folders of the device. Starting from using the application it should be easy to **take and save a picture**.
15. **Improve map functionalities**: The participants wish to have the opportunity to set a maker on the map to add a watercourse and add the possibility to blur the own position here.
16. **Add privacy wizard** to the Privacy Manager to create a rule.
17. **Improve graphic design**: The participants stated that the mobile application looks old fashioned.
18. **Develop mobile application for other mobile devices**: The participants wish to use mobile devices with enhanced graphical design.
19. Participants evaluated the automatic logout as annoying and didn't recognize that logout time could be changed. **Remove the settings for logout from the login screen** and or highlight it.



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B. Evaluation of the second PICOS platform design and architecture, platform prototype and Gaming Community Prototype

1 Evaluation of the Platform Design & Architecture (WP4)

1.1 Summary presentation of the Platform Design & Architecture

1.1.1 Introduction to D4.2

PICOS deliverable D4.2 Platform Architecture and Design 2 is the second and final version of the PICOS architecture. D4.2 brings together two threads of work activities. The first part reports on the outcome of the *research thread*; the second part reports on the outcome of the *prototype enhancement thread*.

1.1.2 Introduction to the D4.2 Architecture

D4.2 describes an architecture for online communities, focusing on communities with an emphasis on mobility / mobile users.

The PICOS project draws on a set of reference communities for inspiration and guidance, and in the later stages of the project for validation. As a consequence the PICOS architecture is firmly grounded in the needs of today's online communities, recognising their value, the tensions and dilemmas – particularly around trust, privacy identity management and general security – that their users encounter every day.

The reference communities are not the only factors influencing the architecture. Legislation needs to be complied and assurance – the ability and proof that the architecture delivers on its promise – must be demonstrated. For these reasons, legal, assurance, prototyping and trialling were key threads that ran in parallel to architecture design, and had a strong influence.

In developing the architecture, the PICOS team addressed several open questions, for example how to balance anonymity and accountability in a pragmatic and practical way. This led to innovative solutions that the PICOS architecture captures, for example partial identities, the privacy advisor, and trust through reputation and openness. Of course, there still are open research questions that to some extent remain unanswered, for example around reputation management, which have to be explored by future projects.

The PICOS team believes that the needs of online communities are changing with heightened awareness of users of the consequences of poor privacy and misplaced trust. Operators and developers of online community platforms and services are aware of changing attitudes. These range from the current open 'social networking', where information is shared freely, through to networks where access to information is tightly controlled. The PICOS architecture is well placed to address this emerging gap in expectations between user and provider.

The 'cost' of security, in particular privacy and IDM, is often seen as an inhibitor to change, either because there is a direct financial cost that is difficult to accommodate, or because a successful business model is disrupted in some way by the changes. PICOS is conscious of this fact, and has strived to design an architecture that satisfies both requirements, for example in the choice of trust model for the prototypes. Advertising is seen as a successful means to fund online communities, but

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the motivation of advertisers is often considered to be at odds with the privacy needs of users, especially when advertisers turn to marketing techniques directed at specific individuals.

1.1.3 Visualising the D4.2 Architecture

PICOS has adopted a service-orientated design with services targeting the community member in the first instance but supporting inter-member relationships and community management.

The PICOS approach to privacy is dominated by the use of partial identities. Partial identities provide community members with the ability to operate anonymously while at the same time ensuring that other community members and the community operator (which in a peer-to-peer configuration may simply be a collection of other members) are confident (have trust) in the integrity of others and can fulfil legislative requirements. Partial identities offer conditional anonymity but support law enforcement and a desire for enhanced trust and openness between members. The condition element of conditional anonymity is governed by a trusted authority which can be an external independent body, a trusted collection of members or an outsourced hosting entity.

Individuals mainly establish trust using the specially designed reputation mechanisms, although the openness and informative style of the architecture also help. These same mechanisms help the whole community understand any risks associated with sharing personal information and as such raise the level of trust throughout the community and between individuals. Privacy respecting reputation ensures that despite members being allowed to have multiple (partial) identities, they remain accountable through a single private overarching identity. The reputation management features of the architecture satisfy the subjective nature of reputation. They provide a reputation defining mechanisms but do not set thresholds for trustworthy member behaviour.

A privacy advisor further enhances member privacy by checking member activities in real-time, by (1) looking for evidence of activities that may undermine the member's attempt to remain private, and (2) by educating the member when the subtleties of a member's actions may expose sensitive personal information. The privacy advisor acts solely on behalf of and is loyal to a community member, except where member actions are not in the best interest of the community as a whole, or where the action may be illegal within the jurisdiction(s) where the community operates. In this respect, the privacy advisor is truly personal.

Members preserve privacy by interacting with one another in private 'rooms' (they can also interact in a more ad-hoc public manner but must acknowledge some loss of privacy). Private rooms allow members to share content in a controlled way, restricting readership with regard to the reputation and privacy concerns of targeted members. Content can be anything from simple messages through to multi-media attachments. The potential for the member to accidentally reveal private information about themselves during this type of exchange is minimised by the use of the privacy advisor.

In summary, the architecture consists of modules that provide: registration, multiple (partial) identities, access management, privacy advisor, social presence, reputation, revocation, external services, Sub Communities and content sharing.

1.2 Assurance Evaluation for Trust & Privacy

In this section, we present both a separate evaluation of the PICOS Architecture with regard to the initial set of PICOS Trust and Privacy Principles (as identified in D4.1), and the results of an extensive threat analysis of the PICOS Architecture based on the threats and recommendations presented in

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several papers published by ENISA (European Network and Information Security Agency). Each one of these topics is dedicated to a special section below.

1.2.1 Assurance Evaluation of PICOS trust and privacy principles and features

In this part of the technical evaluation we present an evaluation of the PICOS Architecture with regard to the initial set of PICOS Trust and Privacy Principles (as identified in D4.1). Trust and privacy are critical objectives in the PICOS Architecture. We will discuss scenarios, features and components relevant to trust and privacy their relevancy and technical aspects. The main source of documentation for this part of evaluation is D4.2 “Platform Architecture and Design 2”. In principle the architecture was changed only a little with regard to the Trust and Privacy issues (from D4.1 to D4.2).

PICOS principles are used for architecture design. There are seven basic PICOS principle categories – one of these categories addresses directly trust (PICOS principles: PP5, PP6, PP12, PP13, PP14, PP16, PP21, and PP23) and another one addresses directly privacy (PICOS principles: PP8, PP9, PP11, PP17, PP18, and PP19). It can be seen that the majority of PICOS principles fall into either trust or privacy category. This is an indication that these two aspects are of great importance for the PICOS architecture. In the following text we will evaluate these trust and privacy related PICOS principles in more detail. A description of all PICOS principles can be found in D4.2, Appendix B “PICOS Principles”.

PP5 – Openness and transparency (PP_trust)

The PICOS Architecture must offer services to members in an open and transparent way.

Members will be more trusting if they fully understand the implication to their privacy of using services that handles their personal information. This PICOS principle aims to increase Members’ trust in the Architecture by providing them with information how their private data will be processed, stored and used. This information should be formulated in well-understandable fashion so that Members will be motivated to read such text and understand it.

PP6 – Trust between Communities (PP_trust)

The PICOS Architecture must recognize trust as a common currency when exchanged between PICOS Communities.

Members may belong to several PICOS communities. They will expect a seamless experience when interacting with Members across community boundaries, recognising that different communities focus on different 'themes', and different member’s values, rules, behaviours. Portability of trust (or reputation) is highly desirable.

The goal of “trust between Communities” is to allow Members from different Communities to “transfer” trust (or reputation) from one Community to another.

PP8 – Data minimization (PP_privacy)

The PICOS Architecture must support the concept of data minimization. Only data absolutely necessary for the provision of the service should be collected.

While recognizing that data minimisation is a principle adopted in European law, PICOS also appreciates that data is required in order to allow a community to grow. For example, Web 2.0 services are data-rich. A challenge for PICOS is to achieve an acceptable balance between these

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two demands. A solution may lie in the formation of trust, which allows greater use to be made of information in the knowledge that it is unlikely to be misused.

Data minimization principle requires that members provide only the necessary information for getting access to the service. This is a natural privacy-related principle and can also help to build members' trust in such systems. At the beginning of the process, members should not be pushed to provide more information than that is actually needed in order to complete the process of getting access to the service.

PP9 – End-to-end privacy

The PICOS Architecture must support end-to-end privacy.

End-to-end privacy (as defined in the PICOS Architecture) is a way for protecting private information in the PICOS Architecture. It's accomplished by legal obligations placed on the community operators, who may have access to private information. End-to-end privacy can help to increase trust in the architecture. Some cryptographic mechanism must be used in order to prevent an attacker to gain access to the sensitive data.

PP11 – Use of pseudonyms

The PICOS Architecture must present members with the facility to be anonymous, to use pseudonymous identities or to use identities that are legally binding to that member.

Use of pseudonyms is closely related to PP 18 (multiple personae). Users can operate in the system under different pseudonyms that must not be linkable between each other as well as with the real identity of a user. Members will wish to interact with other Members and services, while still able to restrict how much identifying information is shared. They may vary the information shared for each interaction or vary it during an interaction.

PP12 – Provenance

The PICOS Architecture must ensure that members can rely on the provenance of information that they receive from other members/PICOS Communities, subject to the member choosing to state the provenance and there being no conflict or risk of undermining other privacy principles.

The goal of this property is to increase members' trust in information received from other members or PICOS Communities. Because it may be difficult to guarantee the accuracy of information, this property may provide information about the level of trust (based on reliability of the source, or reputation score).

PP13 – External services

The PICOS Architecture must ensure that externally hosted services are delivered in a trustworthy way as internally hosted services are, or that members are aware when an external service is (potentially) less trustworthy than an internal service.

Trustworthiness of externally provided services is a problematic issue if members must have trust to the whole system. PICOS will solve this issue by an explicit indicator to the members that a service is provided externally and that the service is potentially less trustworthy. Members may use services hosted by the Community to which they are currently connected, and Service provided by other PICOS communities. Ideally, all communities would operate at the same trust level, but in



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practice this is unlikely. Members should be able to determine from the nature of the Service, and not from a dependence on the hosting environment, how much trust to place in a Service.

PP14 – Audit

The PICOS Architecture must allow all services to be fully auditable by an entity trusted by all members.

If something goes wrong, Members will expect to be able to recover and prevent a repeat of the event. Members will also expect accountability, both at Member and (if applicable) Community Operators level. There may be Legal or regulatory requirements to provide auditing for some community applications. Auditing must not lead to sensitive data disclosure.

PP16 – Objective and subjective trust

The PICOS Architecture should support both objective and subjective methods for assessing trust.

Subjective trust is assessed by members based on their experience and, e.g., reputation management services. Objective trust, on the other hand, is presented as being based on objective methods including trusted computing base and reputation management system or hard facts. This description is not very specific and, especially in case of the objective trust, should be clarified in a more precise fashion.

PP17 – Authentication

The PICOS Architecture should support multiple forms of member authentication, while continuing to respect privacy.

The PICOS Architecture specifies three possible methods for authentication (know/possess/are). It is not clear which one will be implemented as mandatory and which of them will be implemented as optional (if any). Health-related information must be adequately protected if such authentication method is available.

PP18 – Multiple personae

The PICOS Architecture should allow members to have multiple personae.

This property allows members to define and use different identities. This is a privacy-enhancing issue which helps to protect members' real identity and limit linkability between user identifiers and performed actions. Members must be informed about this feature in a convenient way.

PP19 – Sub-groups

The PICOS Architecture must support the creation of sub-groups within the Community.

Support of multiple sub-groups within one community is natural and may help to protect private information that is share only within such sub-group(s). Members must be informed about the sub-groups functionality in order to understand the idea and to be able to use it.

PP21 – Diversity

The PICOS Architecture should be designed in such a way that no single entity can act in a way that might compromise the trust and privacy of the community.

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Privacy and trust related principle that ensures that single entity cannot harm privacy and trust of the Community. Communities rely on community operators that must be trusted (see PP9 and PP14).

PP23 – Trust

The PICOS Architecture should ensure that members are accountable for their actions while a member of the community.

This property should work together with audit (see PP14) in order to acquire information about all activity within the system, communities and Sub Communities. It should be clearly stated how the gathered information will be protected and who has access to it.

1.2.2 Threat analysis of the PICOS Architecture

The focus for the following analysis of the PICOS architecture described in D4.2 was establishing how the architecture defended against a set of known threats and vulnerabilities. The threat analysis performed was based mainly on the threats and recommendations presented in three papers published by ENISA, European Network and Information Security Agency. These papers provide a systematic way of approaching the security issues for online social networks and reputation-based systems.

The first one of these papers, the ENISA position paper *Security Issues and Recommendations for Online Social Networks*¹⁶ provides an introduction to security issues in the area of Social Networking, a list of the most important threats, and a set of recommendations for action and best practices intended to reduce the security risks of the users on online social networks. The nine Threats mentioned in this document regarding Privacy and Identity Management and their corresponding recommendations have been analysed in the context of PICOS.

The second one is the ENISA position paper *Reputation-based Systems: a security analysis*¹⁷. It provides an introduction to security issues concerning Reputation-based Systems and identifies a number of threats and attacks that could affect these systems. The paper includes also a set of security requirements that should be fulfilled by Reputation-based systems, as well recommendations for action and best practices to reduce security risks. Since reputation is an important feature in PICOS, we decided to analyse the PICOS reputation system in the light of these security issues, requirements, and recommendations.

The third ENISA paper, *Online as soon as it happens*¹⁸, is a white paper providing recommendations for raising the awareness of users of social networking sites, in particular social mobile users, with regard to the risks and consequences to their privacy and security stemming from the improper use of those sites. In contrast to the other two papers, this one is more general in character and has been useful to us in a more indirect way because of the background information it provides.

The evaluation work was carried out in the shape of questions and answers associated with the threats and recommendations extracted from the above literature. The recommendations are not part of the PICOS Requirements, but we believe that the analysis of PICOS against these recommendations may

¹⁶ Security Issues and Recommendations for Online Social Networks. ENISA Position Paper No.1. Editor: Giles Hogben, October 2007

¹⁷ Reputation-based Systems: a security analysis. ENISA Position Paper No. 2. Editors: Elisabetta Carrara and Giles Hogben, December 2007

¹⁸ Online as soon as it happens. ENISA, February 2002

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give us a useful idea of what might be expected from PICOS in this regard, and also influence the future development of the PICOS platform.

The results of the assurance evaluation can be classified into three main categories: privacy, trust, and safeguards.

Concerning privacy, the results may be regarded as satisfactory. Users are notified of the applicable policies in terms of consent, access and disclosure. Notice of collection, terms and conditions, and policies, are provided at an appropriate time. Data collected by the platform are completely under the control of the end user. The user is able to manage consent via the policy rules that can be modified with the aid of the client application. Personal data is collected by fair and lawful means, used only for the purposes stated at time of collection, retained no longer than necessary and only personal information relevant for the stated purpose is collected. Data subjects are able to update or correct personal information held by the community operator.

When the user is revoked, all user attributes are deleted. The event logging is kept for auditing purpose, but no user data is kept in the event logging files. Any data collected on the end user is made available to him or her through the client application. The PICOS Architecture upholds the member's wishes with regard to information flow. Consent of the data subject is required to disclose information to third parties. No user data is disclosed outside the community, and within the community the disclosure is managed by the end user via the privacy rules. However, the role of the Privacy Advisor is still open to discussion and should be further investigated.

Safeguards, on the other hand, are largely a concern of the platform and the prototypes. Multiple methods of authentication are enabled through the Authentication Selector Method. Authorisation is implemented within each WP5 component with support from the Policy Component. Confidentiality, on the other hand, is enforced within the platform.

Concerning trust, the Accountability Component monitors the behaviour of members and enforces accountability with the aid of the event logging mechanism, which enables a step by step control of any user action. PICOS ensures also that members can rely on the provenance of information, an issue that is treated mainly at the platform level. This may be done also with help of the Non-Repudiation Component, which adds a non-reputable binding to all content that is provided to the community.

A good reputation system enhances trust. In PICOS, reputation is based on rating of imported content and contributions pushed to the community or Sub Community repositories. The Reputation Component is designed to filter reputation attacks. Although several issues related to reputation have been addressed in developing the architecture, there are open research questions that to some extent remain unanswered and might be the subject of future research in PICOS. For details, see Section 3.3 in D3.1.2

Summing up, we may conclude that the PICOS architecture meets the established requirements in a satisfactory way. Reputation is the area where we believe that there is more room for further improvement in PICOS, especially in connection with the notion of Partial Identity. Although privacy is clearly enhanced by the notion of Partial Identity, we consider that the trustworthiness of a system based on this concept is still an open issue that should be further researched in the future.

1.2.3 Summary of findings and recommendations

This section presents an analysis of how the PICOS architecture follows the recommendations and defends against a set of threats and vulnerabilities presented in a series of papers published by ENISA, the European Network and Information Security Agency. These papers provide a systematic way of approaching security issues for online social networks and reputation-based systems. It was shown

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that the PICOS architecture meets the privacy requirements in a satisfactory way, but that with regard to trust further improvement is possible concerning the reputation system.

1.3 Technical evaluation

1.3.1 Community focus

The focus of this part of the technical evaluation is on the PICOS Requirements, Principles and Components of its architecture, which have a community focus. Because PICOS has researched, developed, trialled and evaluated a platform that supports the provision of community services, principally every requirement, principle and component of the architecture has a “community-focus”. As in section B, chapter 1.2.1 trust, privacy and other technical elements are evaluated and in section B, chapter 1.2.3 location information and location based services, this chapter 1.2.2 will get down to one of the key concepts of the PICOS Platform, the Sub Community and additionally the Private Room Concept. Please keep in mind that the discussion of the Private Room and Sub Community Component cannot be considered completely separate from the trust, privacy and IdM aspects of the PICOS Architecture and Design.

1.3.1.1 Methodology used

Components of a software architecture have to be evaluated at least regarding three questions:

- (1) Are the components suitable to fulfil the requirements?
- (2) Are the components appropriately cut to size?
- (3) Are the relationships/interactions between the components appropriately constructed?

For answering question (1) the second version of the PICOS Platform Design and Architecture (as described in the deliverable D4.2) has to be evaluated in the light of the gathered requirements (described in the deliverable D2.4 and the investigation report R2). D4.2 “Platform Architecture and Design” follows a user-centric and scenario-based proceeding for eliciting the requirements from D2.4 “Requirements”: A heavyset user story describes features of the Angler Community which has been selected for the first prototype; then PICOS Principles, PICOS Features and finally the PICOS Components are specified.

The innovative concepts of the PICOS Platform, especially in form of the Sub Community concept (and additionally the Private Room Concept) cannot be derived directly from the requirements gathered in D2.4. In fact they are aiming at providing useable, user-friendly and convenient concepts which meet the requirements best. Therefore the correlation between the gathered needs and requirements for the community focus on one side and the platform design and architecture on the other hand has to be evaluated “forward” (from the requirements to the user story, to the principles, to the features, to the components) and as well “backwards” (from the user story, to the principles, to the features, to the components to the corresponding requirements).

For answering question (2) the specification of the components is relevant, too.

For answering question (3) the description of the interactions between the components, the picture of the overall PICOS Architecture and the discussion of the use cases are relevant.

1.3.1.2 Documentation used

As mentioned above, the documentation used for this evaluation are deliverable 2.4 “Requirements”, deliverable 4.2 “Platform Architecture and Design” and the investigation report R2. D2.4 addresses the requirements and needs for the PICOS Platform, D4.2 the current state of the platform design and

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architecture and the investigation report R2 addresses the new requirements for the second version of the community prototype.

1.3.1.3 Evaluation of the requirements and functionalities of the PICOS Platform Design and Architecture

The second version of the architecture is mainly a refinement of the first architecture. The refinement especially concerns a new view model, a more elaborate use of architectural tiers, a better alignment between prototype and architecture, and a general improvement of the document's structure. Furthermore a new component was added regarding the requirements from the marketing point of view. This component has no relevance for the evaluation of D4.2 with respect to the community focus. Therefore at this point only the new way of describing the architecture has to be evaluated.

As already stated in D8.1, all components are suitable to fulfil the requirements of the community focus, the components are adequately cut to size and the interactions between the components are appropriately constructed. Furthermore we state that the new refinements of the architecture document do not change the result of the D8.1 evaluation.

1.3.1.4 Summary of findings and recommendations

From the community focus point of view D4.2 incorporates the same components as D4.1. Therefore the overall results of the D4.1 evaluation are still valid for the D4.2 evaluation. But D4.2 now uses additional state-of-the art artefacts to design the PICOS architecture, especially a view model and the three perspectives "legislation", "economy", "assurance". The artefacts are plausible and comprehensible; this is especially true for the new view model and the use cases with community focus.

The interactions between the components are described in the new view model and – with more details – in the use cases. Due to this the discussion of the interactions between the components has significantly been improved.

Furthermore D4.2 clearly points out the connection between requirements and architecture.

In sum, the architectural documentation D4.2 has to be rated as a considerable improvement of architectural documentation D4.1.

1.3.2 Location data

In order to evaluate the Platform Design & Architecture of WP4, the respective design document "D4.2 Platform Architecture and Design 2" is analysed and checked, whether the requirements for the gamer application, defined in "Investigation Report R2 Version 1.0"¹⁹, are considered appropriately in the platform architecture and design to enable the platform development team (WP5) and the application development team (WP6) to build the gamer application on top of it and to realize all requested features.

The comparison shall assess that all requirements have been taken into account and incorporated in the second version of the platform design and architecture.

¹⁹ Internal PICO deliverable



1.3.2.1 Evaluation of the requirements and functionalities of the Platform design and architecture

The new requirements for the gamer application related to location based services and communication features listed in the investigation report are:

- R1: Sharing contact list
- R2: Support contact list per identity
- R10: Real chat
- R21: Real time content sharing
- R16: Public Point of Interest
- R20: Private or public POI
- R17: Meeting with nearby players
- R22: Archive chat
- R23: Advertising services
- R36: Social presence awareness

For each requirement a short assessment is given with an indication on possible improvements:

R1: Sharing contact list

The privacy principle “PrP10: Fair and Lawful Means” (8.4.2) includes the user option to grant access to his contact list by other users. The privacy principle “PrP15: Access to Information” (8.4.2) states the possibility for a user, to have access to collected data by the client application. The components description for “Policy Management” (Appendix E.33) describes the policy setup to grant access to the contact list and the policy enforcement. The use case “display contact list of a selected contact” in the “Contacts Management” component design paragraph (E.50) describes the architecture for supporting R1 in an appropriate level of detail.

R2: Support contact list per identity

The component description for “Contacts Management” (E.50) describes the feature of a contact list for a selected contact. Because a contact is modelled as a partial id and a user can have several partial ids (see PUC 4: Multiple partial identities (A.4)) this implies, that the architecture supports a contact list per identity. However, this could be stated more clearly in the contacts management description chapter.

R10: Real chat

The real chat is covered by “PUC 14: Real-time communication” and “PUC 17: Multi-communication” and describes the use case related to chat. The “Content Sharing” component (E.44) describes content sharing in a broader way with a focus on content sharing in (sub) communities. The specific online message transfer should be described in more detail. Nevertheless, the function has already been used by the angler application and is available for the gamer application as well.

R21: Real time content sharing



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The exchange of multi-media messages in a chat is described in “PUC 17: Multi-communication”. The component “Content Sharing” (E.44) is responsible for the content exchange. Further information with regard to multi-media messages is not provided. The multi-media content may be covered by the content type in general.

R16: Public Point of Interest

The support for POIs is related to the component “Location Based Services” (E.53). The features and functions which shall be supported by the architecture are listed in the respective paragraph. More information about the way, the points of interest are stored and how the access policy enforcement is done is missing. A description should be added that shows how the POI component uses other components (content sharing, public community, policy management) to realize the mentioned functions.

R20: Private or public POI

The differentiation between private and public POIs is related to an access policy. The user shall be able to define a private POI, i.e. a POI is only visible to him, by creating a corresponding access policy. This mechanism should be similar to the access control to any other content published in a (sub) community. No more information about the kind of policy rule is given.

R17: Meeting with nearby players

The requirement is described for the component “Location Based Service” (E.53) with a use case diagram. The platform is shown as a black box. Further information on how the feature is reflected in the architecture is missing. Especially the location data flow and the access control, important aspects for the platform and application implementation, are not covered.

R22: Archive chat

A new component “Archive Chat” (E.57) has been added to the architecture to support the archiving and restoring of chat sessions. The description implies that it matches the requirement and provides the needed functionality.

R23: Advertising services

The advertising requirements related to the location based services and described in the Investigation Report R2 are:

1. Commercial POIs
2. Recommendations

The commercial POIs are a special form of a normal POI, where additional information about the target user profile is given. If a user approaches such a commercial POI and the user profile matches the commercial POI target user profile, then an advertisement shall be prompted to the user.

The architecture design document describes a new component “Advertising Services” (E.54) which handles both requirements. A use case diagram shows the different activities and the roles that triggers each activity. Some more information could be given on how the component interacts with other components, how the matching process is done and how the data flow and access control look like.

For the recommendations of POIs from user to user, a subscribe and notification mechanism is described.

R36: Social presence awareness

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The requirement “social presence awareness” covers a location based policy rule, where the user can define private sites with dedicated policy rules. Depending on the location context, different privacy policies are applied to user sensitive data. From the user perspective, this feature looks like an automatically adjusted privacy manager depending on the place where the user stays.

Enhancements of the “Policy Management” component (E.33) and the “Location Based Services” component (E.53) are described in the respective chapters. Use case diagrams give a brief overview.

Some more helpful suggestions to the platform implementers would be appreciated. This is important, because the social presence awareness/private site concept is one of the most complex use cases with an extensive setup (commercial POI definition, user profile setup, user access policy rule definition), an online tracking and matching process (locate users in the near of the commercial POI, match the user profile settings with the POI’s target profile definition) and a notification/recommendation phase at the end.

1.3.2.2 Summary of findings and recommendations

The evaluation of the architecture and design document with a focus on the additional LBS and communication features for the gaming prototype shows, that all requirements are considered and reflected in the architecture.

Especially the new components and the requirements they have to fulfil are described sufficiently from a high level perspective.

However, the architecture document should give more insight on each component and its work and the interaction between components, especially for more enhanced use cases. We suggest adding “components interaction diagrams” and “sequence diagrams” to guide the platform and client application developers.

The content sharing use cases can be split in offline content sharing (e.g. publish a comment in a Sub Community thread) and online content sharing (e.g. send a picture in a chat to other users). The architecture document does not distinguish between both uses cases. As they are fundamentally different, they should be described separately.

The LBS and communication use cases suffer from situations, where users are offline and do not react immediately. Such use cases and solutions on how to deal with them should also be considered in the architecture.

1.4 Economic evaluation

1.4.1 Methodology and documentation used

Based upon the economic evaluation of the first PICOS Platform Design & Architecture (D4.1), the following section will focus on how well the second version of the PICOS Platform Design & Architecture (D4.2) handles the area of conflict between users privacy versus marketing and advertising needs. The evaluation examines the updated architecture feature “Advanced Targeted Advertising” along with the Privacy Advisor feature, in the context of business aspects, trust, IdM and privacy. Furthermore it is evaluated how findings and recommendations of the last economic evaluation like transparency for the user on the usage of his data, or a balance of data minimization and marketing was taken into account.



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The following evaluation has been drafted by analyzing PICOS Deliverables D4.2 “Platform Design and Architecture 2”, comprising its predecessor Deliverable D4.1 “Platform Design and Architecture”, the investigation report (R2) and the initially produced Deliverables D2.3 “Contextual Framework” and D2.4 “Requirements”.

The PICOS Contextual Framework (D2.3) describes contextual aspects of online and mobile communities like technological and business aspects. The PICOS Requirements (D2.4) contains the collected, community specific and generalised requirements and thereby provides the basis on which the architecture was developed.

The PICOS Architecture (D4.1) documents the PICOS platform architecture itself, including features, components and their relations. It delivers a complete overview of the PICOS functionality and technological aspects and is further developed in the PICOS Architecture 2 (D4.2).

The investigation report (R2) document provides an analysis of the previously gathered requirements (R1), for the mobile angler community prototype v2 and the gaming community prototype. Based on this analysis, it contains prioritized features to address the requirements and estimations of effort for their implementation.

1.4.2 Evaluation of the requirements and functionalities of the Platform Design and Architecture

Trust is the central factor that makes online communities work. Trust is protected and preserved in PICOS by implementing security and privacy features that allow the user to manage his privacy and identity and give him transparency on how his data is used. The implemented security features not only affect the underlying network, but also include safeguards, threat analysis and recommendations regarding security. Today’s Social Networks, act as service providers to the users of online communities, offering them community services through their systems. These service providers rely on successful business models that finance the offered services. In the near past, privacy and security features were often understood to be in conflict with or even disrupt the existing business models. PICOS is aware of this fact and attends the needs of both sides. The first part of this economic evaluation will be an analysis how PICOS meets these requirements.

Before proceeding, it has to be mentioned, that the PICOS research focus is limited to advertising, as one aspect of marketing. Other marketing aspects such as the pricing of products are not researched. Nevertheless, advertising represents the central aspect of today’s social networks’ business models, to generate revenues, besides other aspects. Because of that PICOS is focusing on communities that require a funding model, probably based around advertising, to operate successfully.

PICOS identifies targeted marketing, to extend the classical boundaries of content related marketing. Current state of the art targeted marketing activities range from simple banners, displayed, based on profile attributes of users, up to mobile reward systems for “checking in” at specific locations (e.g. restaurants, shops, cafés) - latter mostly implemented in Location Based Social Networks (LBSN). These marketing activities do allow the marketer to target users individually, but at the same time compromise the user’s privacy and transparency on the usage of his data. Because of that the motivation of advertisers is often considered to be contraire to the privacy needs of the user. The PICOS approach to targeted marketing provides a solution where the platform provider acts as an intermediary between the user and the marketer (**Figure 11**), carrying out the targeting process for the marketer and by that solving the conflict, that user data is transferred to third parties.

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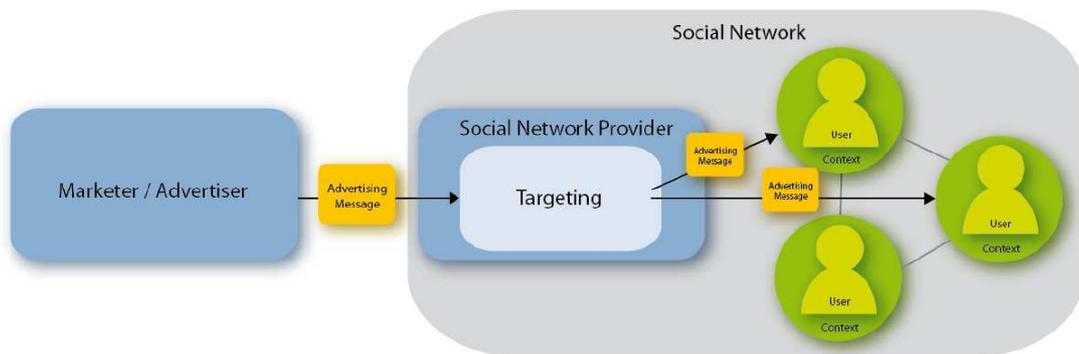


Figure 11: The Social Network Provider as an intermediary between Advertiser and User

By focusing on the social network provider as an intermediary, the PICOS architecture intends to address the needs of users, community providers and third-party organisations in a way that provides a positive benefit for all. PICOS differs between C2C and B2C communication. The B2C communication process presented in PICOS is divided in four steps, which are namely configuration, analysis, matching and display.

The configuration phase allows the marketer to configure his targeted adverts via target profiles, which allow him to describe the type of advertisement, and the attributes of the target group, including the context in which the advert is displayed to the user.

The analysis phase determines which advertisement might be relevant for particular users, for which information about the user is required. The PICOS Advertising Component therefore performs three analyses: A context analysis, a profile analysis and a communication analysis. PICOS includes numerous attributes of the user, along with context information and communication information about the user, by that generating dynamic user profiles.

Having gathered the necessary information, the marketing profile has to be matched with the dynamic user profile, to identify the users to which specific advertisements should be shown.

In the final step the advertisement is shown to the matching users, under consideration of the users' device, which might imply technical limitations, making it necessary to adapt the advertisement.

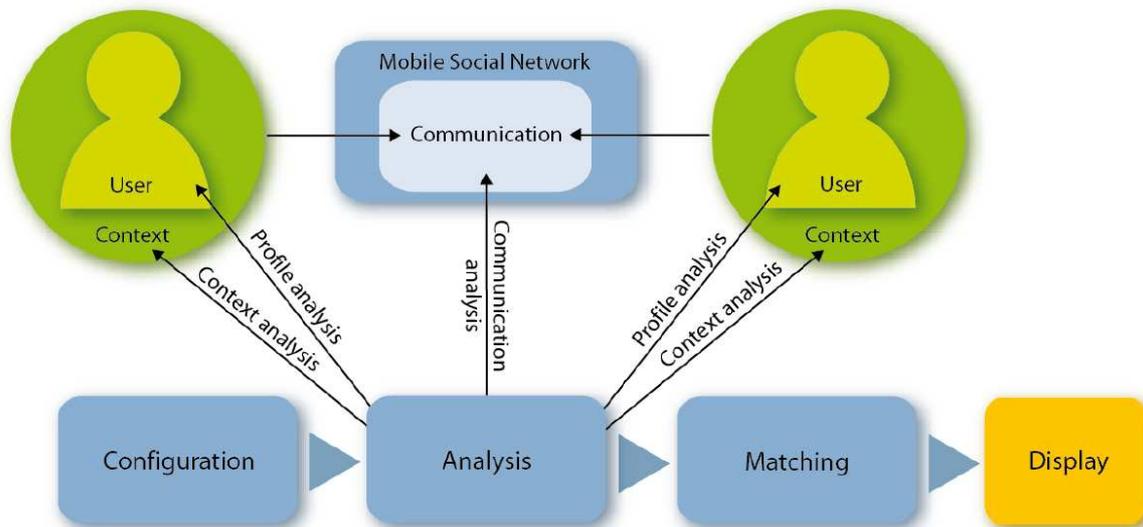


Figure 12: The process to support targeted advertising (B2C)

The usage of marketing profiles for the marketers to describe their target groups enables context sensitive targeted marketing. At the same time, by encapsulating all communication steps where individual user data is used in the platform itself, the described B2C communication process, secures the users privacy and gives him transparency on the usage of his data via the PICOS Components, namely the Privacy Advisor and the Policy Manager. Especially the introduced enhanced content awareness of the Privacy Advisor supplies the user with transparency on the implications of his actions on his privacy.

Besides the B2C communication, PICOS identifies C2C communication, namely viral marketing, as an attractive field. Social networks are ideal for this type of marketing, with their communication intensive environments, especially communication occurring on a personal level. In viral marketing, the advertisement is seeded to special key users in the community and if the content is perceived as relevant and useful information, users might recommend the content to other users who have similar interests. This transforms the advertisement into content which is contributed to groups, walls and profiles, which then becomes shared information within the social network.

The communication process to support viral marketing in a PICOS Platform is similar to the B2C communication and comprises the steps configuration, analysis and matching, followed by two new steps, the seeding and triggering.

The configuration works similar to the configuration in a B2C communication configuration, with the difference that the advertiser defines the characteristics of the key users, which then are intended to further spread the advertisement. These users are regarded as opinion leader, who have a stronger influence on their social surrounding. The identification of the right target group is even more crucial for the success of the advertisement. In contraire to the B2C communication configuration, more general data about users are required, like number of friends and activity in the target community.

The analysis and matching process is similar to the B2C communication. The difference is that only a limited number of matching users are addressed.



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The seeding process replaces the display process, supplying the key user with the advertisement. To ease the forwarding of the delivered message, advertisements should contain a possibility to immediately share them with other users.

In a last step, the advertisement is distributed by the user. This is called Triggering. Triggering strongly relies on existing intrinsic motivation of users to forward the advertised message and the technical possibility to easily forward the message. Because of that, finding the right users is crucial for the success of viral marketing. Triggering is not specifically a part of the Advertising component, it is part of various different elements of a social community, e.g the mechanism of recommendations used in PICOS to trigger users to forward advertised *points of interest* (POI).

Implementing viral marketing mechanisms in a social network implies certain risks, in terms of the PICOS Principles Trust and Control, as viral marketing can also be seen as spam. As outlined earlier the platform provider's role as intermediary strongly relies on the trust of the users towards the platform, which could get eroded if users perceive the viral marketing activities as spam.

But on the other hand, especially regarding mobile communities, viral marketing's strength, the personal link between the sender and the receiver, helps to overcome the user's low tolerance for viewing ads. The low tolerance derives from technical constraints in a mobile scenario, such as the storage of data and cookies is limited in a mobile, limited communications speed and bandwidth, or the small handset display. The small handset display in combination with the mobile environment, the user is most of the time when using his mobile en route; the attention of the user is limited.

Speaking of trust and control, this brings us back to one of the main questions, from the PICOS perspective, which is to what degree users are able to control for themselves the use of their personal information. The PICOS Architecture provides the user with the appropriate components in form of the Privacy Advisor and Policy Manager, which allow the user to be in control on what data is used for marketing.

The second version of the PICOS Architecture takes this into account, and introduces new functions for the Privacy Advisor, namely the Enhanced Content Awareness, Privacy Rule Matching and Social Presence Awareness, to support the user in terms of managing his privacy. With this tool set the Privacy Advisor gives the user the possibility to define the amount of information he wants to share with third parties for marketing purposes. First of all it supplies the user with more transparency on the extent of data he releases to third parties. Especially for context related information, a global one time release is not suitable, as the scale of global releases on personal context information like presence or location is difficult to capture for the average user. How far the implemented privacy features constrain advertising, due to insufficient information about the target user, was not evaluated in the PICOS user trials.

1.4.3 Summary of findings and recommendations

In summary, the first recommendation of the last economic evaluation of the PICOS Architecture has been taken into account, and the PICOS Architecture 2 was extended by an economic perspective, especially focusing on "Targeted Advertising" as a marketing feature. The advertising approach developed builds upon previous research with regard to context aware targeted advertising, which was enhanced and applied in the context of PICOS. By focusing on the social network provider as an intermediary, the PICOS Architecture addresses the needs of users, community providers and third-party organisations in a way that provides a positive benefit for all. For the marketer, marketing profiles are utilized, to allow the marketer to describe and focus on his target groups. As the platform provider conducts the analysis, matching and display of the advertising process, the user's privacy towards the advertiser is preserved. Furthermore the user's privacy is secured and transparency is

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ensured on the usage of his data via the PICOS Components, e.g. the Privacy Advisor and the Policy Manager. Having this intermediary role, the platform provider has to take care of the privacy principles of trust and control, as it is crucial to the underlying business model. Getting the balance right between protection and usefulness is not easy, and challenging for privacy respecting advertising.

Besides, dealing with the area of conflict between the user control over his data and marketing, the PICOS Architecture 2 was also able to integrate communication information into the advertising process, but without describing in detail how context and communication contribute to targeted advertisements in given situations. Further research has to be conducted in this area, to fully understand the mechanisms. We expect the gamer trial to raise further questions in this area too.

1.5 Legal evaluation

1.5.1 Methodology and documentation used

Deliverable 4.2 “Platform Architecture and Design 2” presents the second (and final) version of the architecture. It describes the evolution of the first platform architecture and design deliverable (D4.1) and presents an improved technical architecture and design for the PICOS Identity Management Platform. The legal evaluation of the second version of the Platform Architecture and Design 2 will be based on D4.2 “Platform Architecture and Design 2”. Scope of the legal evaluation is to examine the compliance of the PICOS Platform Architecture and Design with the European legal framework on privacy and data protection. As the future platforms and community applications will be based on the PICOS Architecture, its compliance to the European legal framework is of great importance.

D4.2 “Platform Architecture and Design 2” in its section 7.9 “Legislative perspectives” provides detailed insight on the relevant legal framework for the PICOS evaluation. In summary the PICOS Architecture and Design has to take into account Articles 7 and 8 of the Charter of Fundamental Rights of the European Union (“EU Charter”²⁰): Article 7 provides for the respect for private and family life and Article 8 for the protection of personal data. The later Article is specified in the European legal framework mainly via Directive 1995/46/EC (“Data Protection Directive”), which will be the main legal instrument for the evaluation.

D4.2 is based on the first PICOS Architecture and Design that was documented in D4.1 “Architecture”. The majority of the changes that are inflicted in the second PICOS Architecture, compared to the first one, do not have an influence on the legal evaluation of the PICOS Architecture, as it has been presented in D8.1 “Legal, economic and technical evaluation of the first platform and community prototype”. The PICOS Principles that were identified in D4.1 and were the core focus of the legal evaluation, are exactly the same in the second architecture, as documented in D4.2 (Table 4, page 69 D4.2). The findings of the legal evaluation of the first PICOS Architecture and Design, which examined its compliance to the data protection principles²¹, are still valid and applicable to the second PICOS Architecture and Design. Instead, this legal evaluation will concentrate on advanced targeted advertising²², which was one of the new elements on which the architectural features and components research focused in D4.2.

²⁰ Charter of Fundamental Rights of the European Union, O.J. 2000, C 364/1 (18.12.2000).

²¹ See Section 3.2 “Legal Evaluation”, pp. 21-25 of 8.1 “Legal, economic and technical evaluation of the first platform and community prototype”.

²² See section 9.2.1 of D4.2 “Platform Architecture and Design 2”.

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1.5.2 Evaluation of the requirements and functionalities of the Platform Design and Architecture

Advanced targeted advertising

With regard to marketing in social networks, the research focus of PICOS lies only on targeted advertising. Such targeted advertising can be achieved either as direct marketing from the marketer or the advertiser to the user (B2C communication), or in the form of viral marketing from a user to another user (C2C communication). Although the financial benefit of targeted advertising is undoubted, it goes beyond saying that the current implementations of targeted advertising in social networks entail dangers against the privacy of the users. PICOS, as a platform that values the privacy of its users, introduces a privacy-enhanced model for targeted advertising in both aforementioned expansions, B2C and C2C. For our analysis, we will mainly focus on the description of the PICOS architectural features and components on advanced targeted advertising, as made in section 9.2.1 of D4.2, and we will examine the legal issues that relate to the privacy and the protection of personal data of the users.

Business to Consumer (B2C) Communication for advanced targeted advertising: Instead of enabling a direct communication between the advertiser and the user, PICOS proposes that

“the social network provider (e.g. a Game developer in the case of the Gaming Community example) serves both the advertisers and the consumers, while respecting their specific interests (e.g. privacy of users). In particular the PICOS platform needs to provide on one hand an interface for advertisers, which allows them to configure what they want to advertise and to whom. On the other hand the provider needs to identify the users for which a particular advertisement might be relevant and provides them with this advertisement”²³.

The user of the PICOS platform will be given the opportunity to specify the relevant rules in his profile via the policy manager the policy manager, enforced by the PICOS platforms policy component. The social network provider will serve as an intermediary between the advertiser and the user and he will be responsible for making the matching between the advertisement and the user it should be addressed to, based on specific attributes. Such an approach definitely protects the privacy of the users as no cookie or similar identifier is available to the advertiser and no further profiling can be realised on the user, based on his attributes and on the advertisements he is interested in. However, we should examine whether the model that is proposed by PICOS is in compliance with the European legislation.

The social network provider is trusted by the users and is the one who acts as the intermediary between the advertiser and the user for the delivery of the advertising. The “analysis” (Step 2) and the “matching” (Step 3) steps for the supporting of B2C communication by PICOS are important for our legal analysis. These two steps entail that the requested information, which is relevant for the delivery of the advertisement, is gathered from the user profile, when the user has explicitly allowed this by creating such a rule; moreover, the matching to the target profile as defined by the advertiser is done by the social network provider, as explicitly mentioned in p. 125 of D4.2.

What is, however, meant by information about the user that is gathered from his profile? D4.2 clarifies that “the requested information is gathered from the user profile, the user’s context and communications/interactions with other users”.²⁴ This means that besides the specified attributes that the user specifies in his profile, the social network provider gathers additional information deriving

²³ D4.2 “Platform Architecture and Design 2”, p. 125.

²⁴ D4.2 “Platform Architecture and Design 2”, p. 126.



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from the user's context and his communications and interactions with other users. Such information enable the delivery of a specific category of targeted advertising, namely behavioural advertising. Therefore, it has to be examined whether such a practice from the social network provider of analysing and matching user data to target profiles provided by advertisers, as suggested by PICOS, is compliant to the European privacy and data protection legal framework.

Recently, the Article 29 Data Protection Working Party adopted an opinion on online behavioural advertising.²⁵ A fundamental difference between the PICOS model and behavioural advertising, as described by the Article 29 Working Party, is that the latter relies on the use of cookies or other unique identifiers by the advertiser. Moreover, a major difference is that while in the traditional model the user data are collected and processed by the advertiser, in PICOS such information is not transmitted to the advertiser: instead, the social network provider is responsible for the matching of the user attributes to the target profile. From the description of the PICOS targeted advertising model it seems that the social network provider does not make any use of unique identifiers to an advertising end.

Since the above said matching of the user information to the target profile constitutes processing of personal data, the social network provider will have to comply with the provisions of the Data Protection Directive. Article 7 of the Data Protection Directive provides that one of the grounds that is specified in this Article should be applicable in order for the processing of the data to be legitimate. In the context of social networking usually the processing is based on the consent of the data subject. However, the Data Protection Directive provides an exception for the processing of personal data for direct marketing purposes. Article 14(b) in particular grants the data subject the right

[...] (b) to object, on request and free of charge, to the processing of personal data relating to him which the controller anticipates being processed for the purposes of direct marketing, or to be informed before personal data are disclosed for the first time to third parties or used on their behalf for the purposes of direct marketing, and to be expressly offered the right to object free of charge to such disclosures or uses.²⁶

Applying this Article to the PICOS targeted advertising model would imply that the user should be informed before the matching of his data to the target profile of the advertiser or that he should be given the right to object to such processing. PICOS, as a privacy-friendly identity management system, does not allow the processing of user data for targeted advertising purposes without the user's prior authorisation, which is expressed via the creation of a relevant rule.

However, given that the processing of user data for targeted advertising purposes is provided via an information social service (social network service) there is one more legal condition that has to be examined. It has been repeatedly stated in various PICOS deliverables that Directive 2002/58/EC (ePrivacy) applies only to the processing of personal data in publicly available electronic communications services in public communications networks and is therefore not applicable to PICOS. Nevertheless, some specific provisions of the ePrivacy Directive exceptionally apply to other types of networks and services. Recently, the ePrivacy Directive was amended by Directive 2009/136/EC (Citizens' Rights Directive), which, among others, extended the scope of specific provisions of the ePrivacy Directive to other types of networks and services in order to tackle the challenges posed by the information society.

Interesting for our analysis is Article 5(3) of the ePrivacy Directive, as amended by the Citizens' Rights Directive, which has also been in the spotlight of the Article 29 Working Party in its opinion on online behavioural targeted advertising. Article 5 of the ePrivacy Directive protects the confidentiality

²⁵ Article 29 Working Party, Opinion 2/2010, WP 171, adopted on 22 June 2010.

²⁶ Article 14(b) of the Data Protection Directive.



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of the communications in general. Article 5(3) of the ePrivacy Directive was amended to read as follows:

(3) Member States shall ensure that the storing of information, or the gaining of access to information already stored, in the terminal equipment of a subscriber or user is only allowed on condition that the subscriber or user concerned has given his or her consent, having been provided with clear and comprehensive information, in accordance with Directive 95/46/EC, inter alia, about the purposes of the processing. This shall not prevent any technical storage or access for the sole purpose of carrying out the transmission of a communication over an electronic communications network, or as strictly necessary in order for the provider of an information society service explicitly requested by the subscriber or user to provide the service.

The social network provider, in order to match the user data to the target profile of the advertiser and in order to be able to deliver the targeted advertising, “gains access to information already stored” in the terminal equipment of the PICOS users. The PICOS Architecture allows for the storing of user information both at the client as well as at the server side. In any case, the user profile of the user even when it is stored on the server side, it could be still considered as terminal equipment (or an extended concept of it), but this is an open issue that requires further research outside the scope of PICOS.

Since the social network provider “gains access to information already stored” in the terminal equipment of the PICOS users, such gaining access to this information (which constitutes in fact processing of the data) “*is only allowed on condition that the subscriber or user concerned has given his or her consent, having been provided with clear and comprehensive information, in accordance with Directive 95/46/EC, inter alia, about the purposes of the processing*”²⁷. Hence, the processing of user information by the social network provider for the delivery of targeted advertising in the PICOS model should be done under two conditions: (a) the user has given his consent to the processing of his data for targeted advertising purposes, and (b) the user is provided with clear and comprehensive information that the data will be processed for targeted advertising purposes.

Given these strict requirements, it is questionable whether the current process for setting up a rule by the user that allows the processing of his information for targeted advertising purposes, satisfies Article 5(3) of the ePrivacy Directive. It is recommended that, when the user wishes to establish a rule for targeted advertising, he is provided with clear and comprehensive information, possibly via a pop-up. The information should cover not only the types of his data that are going to be collected, but it should also specify that the data are going to be used for targeted advertising purposes. Additionally, the consent of the user should be obtained before the social network provider realises any matching activity. The creation, configuration and activation of the relevant rule can be considered as consent of the user to the processing of his data for targeted advertising purposes. The consent of the user can be valid for subsequent collection of data for targeted advertising purposes, but only for a limited period of time, for example one year.²⁸ Finally, the user should be given the opportunity to amend the targeted advertising rule and object to the further processing of his information for targeted advertising purposes.

Viral Marketing – Consumer to Consumer (C2C) Communication for advanced targeted advertising: Besides the delivery of targeted advertising via Business to Consumer (B2C) communication, as described above, PICOS supports also consumer to consumer communication for targeted advertising. In this case, “the marketing message is spread from one user to another users (and so on) just like a

²⁷ Article 5(3) ePrivacy Directive.

²⁸ The Article 29 Working Party make a similar suggestion for the expiration of cookies that are used for targeted advertising purposes: Article 29 Working Party, Opinion 2/2010, WP 171, adopted on 22 June 2010, p. 16.

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virus”²⁹, based on the principle of viral marketing. PICOS designed its viral marketing model, in order to allow users to pass the delivered marketing message to other users. This can be done in various ways, such as context Link on a specific website, Banner with possibility to forward etc.

D4.2 clarifies that

*“One step that supports this [i.e. not only to identify adequate users and provide them with the advertising message, but also to provide or support a motivation to these users to forward the advertisements they receive] is the targeting itself, considering that we aim to provide only highly relevant advertisements to users. Furthermore, an existing intrinsic motivation of users to forward advertised messages can further be supported by the availability of technical possibilities, which allow and simplify a further recommendation to other users. In the PICOS Gaming Community Application prototype such a support will be e.g. realised by providing a forward button in the advertisements for the so-called ‘commercial Points of Interest’.”*³⁰

Besides the particular legal issues that may arise with regard to viral marketing, it is questionable whether a privacy-friendly identity management system, such as PICOS, should developed enhanced functionalities of viral marketing techniques. While the model developed for B2C targeted advertising, the PICOS model for C2C targeted advertising, wishes “not only to identify adequate users and provide them with the advertising message, but also to provide or support a motivation to these users to forward the advertisements they receive”.³¹ None of these aims is driven by privacy related grounds. For a human rights point of view, the forwarding of marketing information by other PICOS users, albeit interesting, may result in an infringement of the privacy of the targeted user, a right that is safeguarded in Article 7 of the EU Charter (as well as Article 8 of the ECHR). Unlike the B2C model, where the user can modify the relevant targeted advertising rule and object to the further processing of his information for targeted advertising purposes, the proposed PICOS model for viral marketing does not seem to allow the targeted users to reject the receipt of such messages when coming from other PICOS users.

Besides the general right to privacy of the users, Article 13 of the ePrivacy Directive is applicable to viral marketing. When the key PICOS user sends the marketing information via e-mail, he is sending unsolicited communication for direct marketing. Article 13(1) of the ePrivacy Directive provides that

“1. The use of automated calling and communication systems without human intervention (automatic calling machines), facsimile machines (fax) or electronic mail for the purposes of direct marketing may be allowed only in respect of subscribers or users who have given their prior consent.”

According to this Article, the prior consent of the recipient is required for the sending of the e-mail for direct marketing by the key user. It can, however, be supported that the provision is not applicable, as the user does not satisfy his own targeted advertising purposes. This issue has recently arisen in the information society and has not been yet definitely resolved. When the users make use of any other means for viral marketing, Article 13(3) of the ePrivacy Directive is of application, which reads as follows:

3. Member States shall take appropriate measures to ensure that unsolicited communications for the purposes of direct marketing, in cases other than those referred to in paragraphs 1 and 2, are not allowed either without the consent of the subscribers or users concerned or in respect of

²⁹ D4.2 “Platform Architecture and Design 2”, p. 127.

³⁰ D4.2 “Platform Architecture and Design 2”, p. 129.

³¹ D4.2 “Platform Architecture and Design 2”, p. 129.

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subscribers or users who do not wish to receive these communications, the choice between these options to be determined by national legislation, taking into account that both options must be free of charge for the subscriber or user.

This provision clarifies that in any case, that users should either give their consent to receiving targeted advertising messages or they should be given a means to express their objection to receiving such communications. The current PICOS viral targeted advertising does not seem to provide such alternatives to the targeted users. Given that PICOS is a privacy-friendly identity management system, the viral marketing model should be abandoned.

1.5.3 Summary of findings and recommendations

The second PICOS architecture and design (D4.2) does not present major differences with the principles respected and the functionalities offered in the first one (D4.1). Therefore the findings of the legal evaluation of the first PICOS Architecture and Design, as described in D8.1 “Legal, economic and technical evaluation of the first platform and community prototype”, are still valid and were not repeated. However, the legal evaluation focused on the targeted advertising models that were introduced in D4.2 for the first time and consisted in (a) Business to Consumer (B2C) Communication for advanced targeted advertising and (b) Viral Marketing – Consumer to Consumer (C2C) Communication for advanced targeted advertising.

Notwithstanding the fact that the PICOS implementation of the Business to Consumer (B2C) Communication for advanced targeted advertising is privacy enhanced compared to current targeted advertising systems, the legal evaluation came to the conclusion that some modifications are required for the system to be fully legally compliant. It is thus recommended that, when the user wishes to establish a rule for targeted advertising, he is provided with clear and comprehensive information. This could be realised via a pop-up screen. The consent of the user should be obtained before the social network provider realises any matching activity. The creation, configuration and activation of the relevant rule can be considered as consent of the user to the processing of his data for targeted advertising purposes. Finally, the user should be given the opportunity to amend the targeted advertising rule and object to the further processing of his information for targeted advertising purposes.

With regard to the viral marketing communication, the legal evaluation was not able to identify the added value for privacy. To the contrary, the elaboration of viral marketing techniques could result in violation of the privacy of the users, who may not wish to receive such communications and will not be able to express in any way their objection. Therefore, it is suggested that viral marketing methods are not implemented in PICOS, which is privacy-friendly identity management system.

2 Evaluation of the Platform Prototype (WP5)

2.1 Summary presentation of the Platform Prototype

2.1.1 Introduction to D5.2

D5.2 shows how the PICOS architecture components have been implemented in the first PICOS prototype.

The approach taken to scope the platform work was to use a community agnostic service approach so that most of the WP5 platform can be reused for the support of another community like the online

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gamers. No compromise was made on this rule which will ease the PICOS phase II project. This led to the definition of the WP5/WP6 split between the platform and the application

The global client server architecture has used innovative new models of communication which allow client application developers to focus on user experience rather than protocol implementation. On the server side, web service interfaces are mature and easy to use technologies to speed up prototyping of research concepts.

Mobile networks still have constraints that can degrade the user experience if strict rules are not followed in the development of the client server interface. One crucial factor concerns how the client and platform structure their communication. The goal is to minimise the level of service orchestration necessary at the platform, ideally to where one user action leads to just one server interaction. The architecture of the first prototype has rigorously scrupulously followed a modular approach for the functionality split with an object oriented modelling of the mobile community resources. This modular approach forms the foundation of the interface specifications, and is reflected in the architecture. This approach can also be seen in the foundations for a toolbox approach for PICOS dissemination strategies

The fact that the policy server is generic is one of the key successes of the platform. It has demonstrated its ability to support a rich set of rule conditions for policy definition that were necessary to manage privacy of a large set of user attributes and privileges within PICOS project. The module doesn't need to be modified to support definition of new policies on new resources or new community roles or new actions to evaluate.

The selection of an agile methodology as well as web technologies like web services and PHP language were key decisions to successfully deliver the platform on time and build this fairly complete mobile service. PHP is ideally suited to implementing services that need to respond to changing needs, i.e. are highly dynamic. For example, management of the policy engine data would have been very difficult to implement using a more traditional language. The richness of the PHP environment makes complex operations easy to implement without compromising the capabilities and the control of system interfaces.

The test suite has been an indispensable tool for validation of iterative versions of the platform. Written in PHP, it allowed validating complex scenarios involving numerous interactions with platform components emulating client request/response as well as notification decoding and answers. Having the test suite has helped deliver the platform early in the prototype development cycle, allowing the application team extra time for server integration.

The first prototype of the PICOS platform is then seen as a strong foundation for demonstrating PICOS value proposition and which can easily evolve in the next PICOS phases.

2.1.2 First platform prototype

The first PICOS prototype is made of two elements: the WP5 PICOS platform and the WP6 application. Most of the WP6 work is around the development of a handset client application but also WP6 brings a server layer to make the client server exchange over-the-air (OTA) more efficient in some situation. The following sections explain these two processes in more detail.

User Scenarios are composed of a chained set of operations also called orchestration. The end user orchestrates actions (End User orchestration) via the functions made available by the client application. These functions and display of information also requires a chaining of operations (Application orchestration) via the platform components. The platform component also manages chaining of basic operations called function orchestration.

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A design goal of the first platform prototype was to demonstrate an optimised user experience (User orchestration) in a way that minimises the number of exchanges necessary between the client and the platform. The WP6 server operates some application orchestration to collect information and deliver it to the client into a single response. The WP5 platform only deals with function orchestration. Note that the application orchestration differs from the function orchestration because it is specific to an application (and then a community)

A design goal of the WP5 platform was to offer community agnostic services so that its services can be re-used to support not only the angler community but other communities in the future. Any angler community specific requirement was then translated into a generic description of a platform feature.

2.1.3 Platform objects

In order to exemplify the PICOS value proposition around identity, privacy and trust, it was necessary to have a community platform that was offering “traditional community services” in a way that was compatible with the PICOS requirements. The need for users to manage 1) multiple identities, which are seen as multiple instances of the same users, 2) the use of a generic policy engine for privacy/privilege management and enforcement, 3) integration of the reputation functionality across the platform, and 4) integration of the privacy advisor, encouraged us to develop several PICOS-ready community services (namely forums, Sub Community, chat, content sharing). The result was a coherent architecture with the full flexibility to evolve in the future with the minimum constraints.

An object oriented model has been selected to describe the main elements of the platform and how they're connected together. This hierarchical description has been used to formalize the definition of the PICOS resources.

At the end, a component is defined to manage one or multiple objects, the access to its attributes and implement the Object methods.

2.1.4 Mobile access to the WP5 platform

The WP5 PICOS platform implements a set of components for community management with enforced capabilities around identity, policies, privacy and trust. These components are called by the WP6 client application to implement the PICOS use cases.

The WP5 PICOS platform interface is defined as a web service interface. However to ease the client development, a client RPC library is provided in the handset J2ME environment to access the WP5 PICOS platform using a Remote Procedure Call (RPC) rather than managing protocols. This means that design of client and platform functionality could proceed independently, with the final design of the interface (API) occurring later.

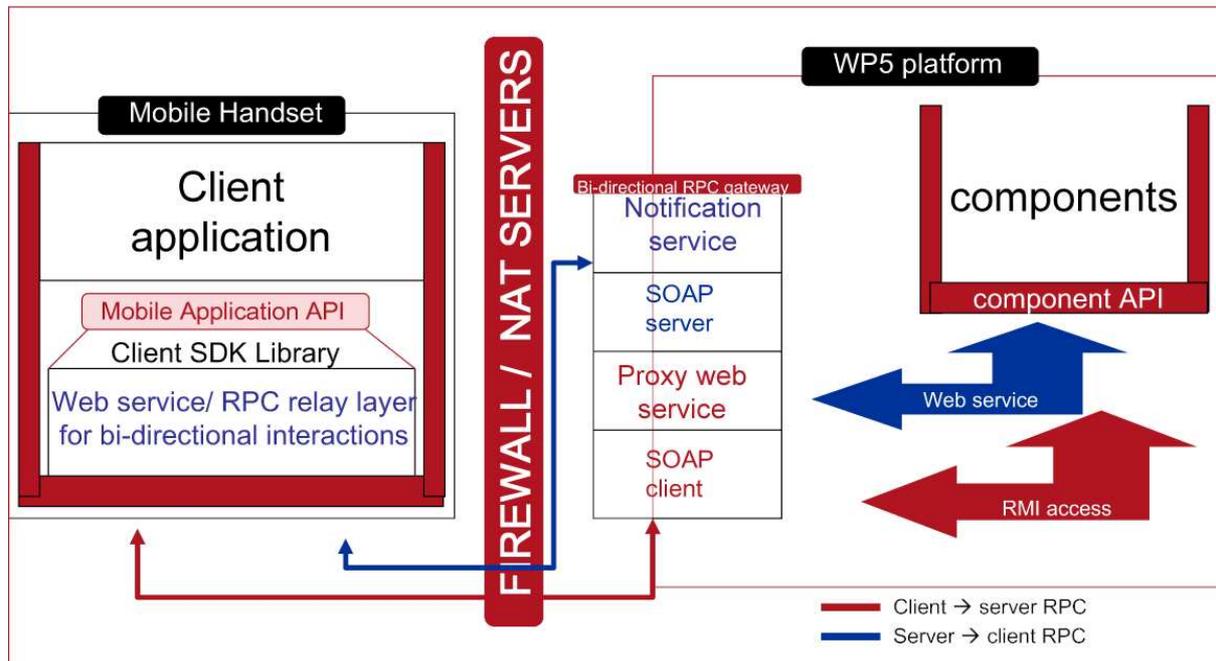


Figure 13: Interfacing the WP5 platform

The WP5 PICOS platform embeds a RPC gateway that acts as a front-end signalling relay for all the mobile interactions towards the WP5 services. The RPC gateway is a HP asset brought by the HP France team. This gateway also manages the access control to the platform by enforcing the authentication of the requester and only relaying the requests when login credentials have been validated (except for register and login methods).

2.2 Assurance Evaluation for Trust & Privacy

2.2.1 Methodology and documentation used

In this part of the technical evaluation we will focus on the issues relevant to trust and privacy principles in the platform prototype. Trust and privacy are basically critical objectives in the PICOS platform prototype. Structure of the evaluation is: a) features and components relevant to trust and privacy, and b) their relevancy and technical aspects. The main source of documentation for this part of evaluation was document D5.2b.

2.2.2 Evaluation of the requirements and functionalities of the Platform Prototype

We will start with the list (and short description) of newly proposed/extended privacy and trust related features of the second prototype implementation (extending the platform prototype v1). We will not list those features that remained the same as in platform prototype v1.

- PICOS policy model – this engine is in charge of storing rules attached to various Objects or attribute of Object as well as evaluate user actions based on the set of rules. Each component



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is responsible for asking the policy manager to evaluate action on resources like user attributes (privacy) as well as community resources for user privilege.

The PICOS policy model stores various Objects or attributes and evaluate actions, but it is not specified how this content is secured or prevented from unauthorized access on server side.

- Ability to share Contact lists – a community member has the ability to retrieve contact list of his friends and optionally store received contacts into his own contact list. This is achieved by defining a policy rule which is associated to the contact list attribute of a particular identity.

In the next five cases, we discuss a new extension which allows for a finer control about who, when and how can access (possibly private) information. This is very important for users of the Platform, since it increases the trustworthiness of it. Privacy aware users want to know who has access to their information and how they can control access policies.

- Access restriction to Public-community Objects (the same holds for sub-community) – The phase 2 offers the ability to define custom access rules for public-community Objects and attributes (e.g. new content in a public content repository can be accessed by a specified set of contacts only).
- Enhanced policies with new date condition – This is mainly used to prepare categories/content/forum and make the object available starting from a particular date or during a limited amount of time.
- Enhanced policies with new site condition – it can also be specified “where” the content can be accessed (e.g. “at home”).
- Support authorization request for any Object – before performing an action, it is needed to get approval from the resource owner. This is configured by defining a status: askOnce or askAlways associated to an action.
- Enhanced status of policy rules – The phase 2 introduces parameters attached to the status. It characterizes how the “action” should be handled. The new feature is used in phase 2 to specify the precision of the location information when a user allows others to access his/her location information. The status parameter has been defined as an array of couple of (name, value) to be used in many situations.

Privacy and trust related features of the first prototype that remained unchanged were evaluated in document D8.1.

2.2.3 Implementation of platform components

This section will focus on how trust and privacy related component of the PICOS platform were implemented in Phase 2. Newly added components in prototype version two are site component and subscription component. Some of other components were updated and are discussed again.

Sub Community server

A user can freely create private or public Sub Communities. Other users can freely join public Sub Communities where as for membership in a private Sub Community an invitation by the creator is needed. The shared desk is a kind of special type of Sub Community. A user can freely create a shared desk. Creator has read and write access. Other users can only be invited to participate (only read access) in this special kind of group.

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Public community server

Phase 2 introduces support of content publisher revocation, category creator revocation and forum creator revocation. It also enforces rules per instance of category, forum, forum-thread and contribution Objects. It supports content access history, forum-thread history and notification of new action on public community objects.

Partial identity server

Phase 2 introduces support of new status feature “add/remove status”. Authorization requests are processed by the policy server. Phase 2 introduces centralized repository for user data storage and centralized traces.

Presence server

Phase 2 introduces support of new status feature “add/remove status”. Authorization requests are processed by the policy server. Phase 2 introduces centralized repository for user data storage and centralized traces.

Location server

Phase 2 introduces the support of Point of Interest, advertising profile and support to search NearByUsers. It also moved authorization requests processing to the policy server.

Policy server

Authorization requests are processed by the policy server. Phase 2 introduces centralized repository for policy data storage and centralized traces. It also adds site conditions.

Subscription server

This component is responsible for managing profiles attached to identities (either root or partial). The profile server enforces the policies defined in the policy server.

2.2.4 Summary of findings and recommendations

User object attributes are not described/discussed in the 5.2b documentation at all. As this is a platform update, this description should be here or at least mentioned as a reference to the platform version one documentation (if there were no changes of user object attributes). It is also not clear how is the user content stored (and secured) on a server side. The same recommendation is for the Public Community object. The discussion in the document D5.2b should follow the structure used in platform v1 documentation (D5.1). This will help readers to better understand what changes (and where) were made in PICOS platform version 2.

2.3 Technical evaluation

2.3.1 Community focus

The focus of this part of the technical evaluation is on the implementation of the PICOS gamer platform prototype, especially on the components which have a community focus. As a reminder, under chapter 3.3.2 “Community focus of the Evaluation of the Platform Design & Architecture” in D8.1, the sub community features were identified as being the key features regarding community focus. Given the fact that these sub community features are identified as being the key features, it will



have to be evaluated how far they are implemented on the platform side. For the gamer platform five new features with community focus have been specified.

2.3.1.1 Methodology and documentation used

The documentation used for this evaluation are investigation report R2 and deliverable D5.2b. D5.2b addresses the current state of the platform prototype and R2 addresses the new gathered requirements and the derived features. They are used to evaluate to what extent the WP5 platform meets the gathered requirements.

The goal of the evaluation in this section is to provide information about how far the implemented platform prototype is able to fulfil the features from investigation report R2, which themselves try to put the associated requirements into practice.

Within investigation report R2 only five features can be identified which are directly related to the community focus. The implemented platform has to be evaluated regarding these features.

For the evaluation a bottom-up approach has been used. Thereto the new features have been examined whether the platform realizes the corresponding specific PICOS concept in an appropriate way.

2.3.1.2 Evaluation of the requirements and functionalities of the Platform Prototype

The new features within investigation report R2 are:

Gamers R5: Notification for new available content

Gamers R8: Virtual marketplace

Gamers R9: Shared desk

Gamers R11: Publish private records

Gamers R12: Access to private room

As mentioned above every single feature; which is relevant for the community focus has to be examined whether the platform realizes the corresponding specific PICOS concept in an appropriate way.

The following table shows, which feature, component or use case has been realized by which platform component.

Table 2: Realization of features by platform components

Type	Investigation Report R2	Corresponding Platform Component in D5.2b
Feature	Gamers R5: Notification for new available content	4.3.15 Subscription
Feature	Gamers R8: Virtual marketplace	Not implemented
Feature	Gamers R9: Shared desk	4.3.19 Sub Community

Feature	Gamers R11: Publish private records	Already implemented in the angler community platform
Feature	Gamers R12: Access to private room	Not implemented

2.3.1.3 Summary of findings and recommendations

For the technical evaluation of the community aspects of WP5 the related components identified in the evaluation of the Platform Design & Architecture were reviewed against the results of WP5 (D5.2b).

The feature R8, R11 and R12 are mentioned in the investigation report, but are not included in D5.2b.

The feature Gamers R8: virtual marketplace was not implemented because of time restrictions.

The feature Gamers R11: publish private records already was implemented in the community angler platform.

The feature Gamers R12: access to private room was not implemented, because otherwise the private room concept would have been weakened. Furthermore, the shared desk feature does already provide a very similar functionality.

2.3.2 Location data and communication features

2.3.2.1 Methodology and documentation used

The evaluation of the Platform Prototype of WP5 is based on an analysis of the corresponding documents “D5.2b WP5 PICOS PHASE 2 Platform Description document” and “D 5.2a Platform prototype 2a” and an assessment, whether the requirements for the gamer application, defined in “Investigation Report R2 Version 1.0”³², are considered and implemented in a way, that the gamer application prototype of WP6 can be built on top of it so that all requirements can be fulfilled by the final application.

In this evaluation, both platform description documents D5.2a and D5.2b are used for the evaluation, because some requirements for the gamer application were already realized by the initial platform version and described in D5.2a, but not used by the angler application. D5.2b focuses on the changes from the angler to the gamer platform and together with D5.2a form the complete platform documentation which is assessed here.

2.3.2.2 Evaluation of the requirements and functionalities of the Platform Prototype

The new requirements for the gamer application related to location based services and communication features listed in the investigation report are:

- R1: Sharing contact list

³² Internal PICOS deliverable



- R2: Support contact list per identity
- R10: Real chat
- R21: Real time content sharing
- R16: Public Point of Interest
- R20: Private or public POI
- R17: Meeting with nearby players
- R22: Archive chat
- R23: Advertising services
- R36: Social presence awareness

For each requirement a short assessment is given with an indication on possible improvements:

R1: Sharing contact list

The access to the user's contact list shall be enabled for other users. In chapter 3.2.1 of D5.2b the ability to share contact lists is described. The enhancement is basically implemented by a specific privacy rule defined for the contact list. The contact list is private by default and can be disclosed to other users by configuring policy rules. An example is given to describe the policy setup and policy evaluation process in more detail.

The additional feature is incorporated in a natural way to the existing access control model and allows a smooth integration into the gamer application.

R2: Support contact list per identity

The support of a contact list per identity is already available in the first platform release. In Figure 4: "Major platform Objects and their object hierarchical links" of D5.2a the data model shows, that a contact list can be attached to a user object or a partial id object. The partial id object represents an identity and it can have a dedicated contact list.

R10: Real chat

The real time chat is provided by the "Real time content sharing server" described in chapter 2.6.16 of D5.2a and already implemented in the angler application prototype.

R21: Real time content sharing

The real time chat of the angler application shall be extended to support not only text messages but also multimedia content. The first release of the platform already supported a wide variety of content types (2.5.15 of D5.2a), also image/jpeg that have been used for the gamer application.

R16: Public Point of Interest

The Points of Interests (POIs) are addressed in chapter 3.4 of D5.2b. All functions to administrate POIs (create, edit, delete, get etc.) are listed. Further details of the functions and their attributes are missing.



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The formal definition of the interface is given by the WSDL files. The semantic of methods and attributes should be described in an updated version of the platform specification document³³.

The feature POI is comparable with the fishing spots from the angling application. The same platform implementation shows that the platform is community agnostic and serves both communities.

From the functional point of view, we can assess that the platform capabilities are sufficient to serve the gamer application requirements.

R20: Private or public POI

The differentiation between private and public POIs is related to an access policy. The user shall be able to define a private POI, i.e. a POI is only visible to him, by creating a corresponding access policy. The mechanism is briefly described in chapter 3.4 of D5.2b.

R17: Meeting with nearby players

The platform offers a function to retrieve the users that are located in a defined area around a specific position (chapter 3.8 of D5.2b). The users need to disclose their position to be listed. Again the platform feature allows the client application to implement the requested application function.

R22: Archive chat

The chat initiator or any chat participant can archive a chat and retrieve it later on (chapter 3.10). The feature is described and provided by the platform. The client application proofs the correctness of the function. Further methods to manage archived chats, e.g. to remove a chat are not mentioned and should be added.

R23: Advertising services

The advertising requirements related to the location based services and described in the Investigation Report R2 are:

- Commercial POIs
- Recommendations

The commercial POIs are a special form of a normal POI, where additional information about the target user profile is given. If a user approaches such a commercial POI and the user profile matches the commercial POI target user profile, then an advertisement shall be prompted to the user.

Chapter 3.5 of D5.2b specifies the function in more detail and explains the advertising service with regard to POIs in a dedicated scenario 1. The high level description is sufficient to understand the concept. A more detailed specification of methods and attributes is appreciated.

R36: Social presence awareness

The requirement “social presence awareness” introduces new conditions to privacy rule. The user is able to define areas, so called private sites, and he can link them to privacy rules. For example he can define his home location and define a privacy rule that discloses his location only with a precision of 5km; additionally he defines a working location where he discloses his precise location. Setting up these rules once, the platform takes care to apply the adequate privacy rule where appropriate.

³³ PICOS D.5.1b “PICOS Platform Functional Specification Document of the First prototype” (Confidential deliverable)



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The principal mechanism is described in chapter 3.2.4. The interface to define private sites and the policy setup is not described.

The feature is implemented and successfully used by the client application.

2.3.2.3 Summary of findings and recommendations

The evaluation of the platform prototype with the focus on location based services and communication features based on the documentation and the implementation of the client application confirms the successful implementation of the platform architecture and design. All requested functions have been provided in a community agnostic manner. Although the platform is not mature enough to be used for a productive environment, the platform is a solid basis for the user trials with a limited number of participants.

From the gamer prototype developer's perspective, we see some improvement potential regarding the documentation and the alignment of interfaces.

The first platform release comes with a functional specification of all its features accompanied by an interface specification with a description of all functions and attributes. For the second platform release, a delta platform description (D5.2b) has been provided that summarises the new features. We recommend updating the first functional specification to have a complete and consistent view of the new platform.

During the development phase often questions came up regarding the identifiers of items (root id, partial id, requester id, etc.), the definition of policy rules or the structure of the content repositories which resulted in additional work for the client application developers due to misunderstandings. For a later release we recommend to tidy up all interfaces in order to have a consistent and unambiguous naming convention and to document the mentioned aspects in a more comprehensive way.

2.4 Economic evaluation

2.4.1 Methodology and documentation used

For the economic evaluation of the second PICOS platform prototype, namely the second platform prototype release for the gamers, the requirements derived from a trust and privacy oriented perspective are tested against the implemented functionalities and put, if applicable, into a current context. The evaluation is performed under the consideration of the results of the first economic evaluation of the PIOS platform in Deliverable D8.1 "Legal, economic and technical evaluation of the first platform and community prototype", with a focus on the newly implemented features. To keep a focus under the constraints of the scope of this evaluation, this economic evaluation will focus on the business relevance of the platform prototype.

The goal is to determine, how the PICOS second platform prototype, in special the newly introduced concept of point of interests and the included advertisement feature, copes with the economic aspects of the PICOS requirements. The discussion examines how well the platform meets economic aspects of the PICOS requirements.

This economic evaluation of the PICOS Platform has been drafted by comparing PICOS Deliverable D5.2.b "WP5 PICOS PHASE 2 Platform Description Document" and the PICOS Deliverable D2.4 "Requirements", under consideration of the PICOS principles in the PICOS Deliverable D4.2 "Platform Architecture and Design 2".



2.4.2 Evaluation of the requirements and functionalities of the Platform Prototype

The PICOS phase 1 platform has been designed to support any kind of community. The second platform prototype implemented in PICOS phase 2 keeps that design criteria considering that all the additional features can be used by any community and are not specific to (but important for) the Gamers community. Having evaluated the new features of the client, a lot of them are focusing on extending the use of policies, to handle finer control on any object of the community and its community members. The phase 1 Policy engine, which was implemented, is re-used and enhanced to address new use cases that were developed for the Gamers community support. At the first glance, these enhanced policy features, are not directly important for an evaluation of the second platform prototype versus the economic PICOS requirements (RA1 – RA9), but online advertisements and in particular mobile advertisements are context sensitive, making use of data derived from the platform and its users. Policies allow the user to manage how and for what purpose his data is used by advertisement features. Therefore new relevant features will be introduced when appropriate.

The most relevant feature in terms of economic aspects implemented in the second platform prototype is the commercial Points of Interest (POI). The second platform prototype allows the definition of POIs to the users of the platform. A POI is basically a location and an associated POI type. These POI types can be “internet cafe”, “hotspots”, “shop”, “restaurant”, or “museum”. The location of a POI is defined using GPS coordinates (using decimal degree format)³⁴. Due to the GPS coordinates, POIs can be listed (per type) and shown on a map by a client application. POIs are public objects, and are directly attached to the public-community Object (the POI is an attribute of the public-community object). However, the owner (the creator) of the POI can define access rules. All the facilities of the PICOS rules can be used to define policies for POIs (identity condition, date condition, reputation condition...).

Besides the public POIs, a POI can be associated to an advertising profile by registered marketers. These POIs are then considered as commercial POIs (e.g. a shop). If there is no associated advertising profile to a POI, it is not considered as a commercial POI and cannot be advertised. The advertising profile contains profile information about the target user “segment” for that commercial POI, including the target gender (optional), the age interval (optional), a set of keywords and associated commercial announcement (mandatory), an area around the location of the POI in which, advertising is valid (mandatory). The advertising profile is used to deliver advertising that matches the member profiles. If no target gender is defined, then the gender of the receiver can be male or female. If no target age interval is defined, then the age of the receiver is not checked.

Two advertising scenarios have been implemented in the second platform prototype. First, the most valuable advertising is pushed to the user depending on where he is. Second, when a user reads a contribution in a forum, extra advertising contributions that match the contribution, POI keywords and user interest will be shown.

For the first scenario, the user’s location sensor has to be enabled; the client application periodically sends some location updates, providing new GPS coordinate data to the platform.

When the platform receives a location update related to a particular user, it checks the commercial POIs within a certain range around this user and tries to match the POI advertising profile with the user profile. The matching is performed via the following profile fields: User profile age versus advertising profile age interval, user gender versus advertising profile gender and user profile hobby

³⁴ D5.2b PICOS Platform description, page 29



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list versus POI keyword list. With this minimal set of user data a context sensitive advertisement is possible, preserving transparency and data minimisation for the user. The customised advertisements avoid that people with minor or no interest in the advertised topic are targeted. By that the second platform prototype fulfils R.A3 “Determining and Negotiating the Right Set of Necessary Personal Information”.

The advertisement feature is implemented in a way, that if multiple POIs match the above criteria, the platform selects the one that has the highest number of matches between the list of POI keywords and the list of hobbies. The second selection criterion is the proximity of the POI for the user. By performing this matching, the advertisements are personalized and dependent on the context of the user. Therefore, the second platform prototype fulfils the PICOS requirement R.A4 “Finding the Advertisers of interest”, as it offers advertisements in an intuitive manner.

By default the user does not receive advertising notifications. He must enable reception in the client application settings. With this configuration, the users have the ability to express their consent, or more over, revoke their consent and thus stop storage and processing of their data in the whole lifecycle if they wish to do so. Rational Processing, especially of personal data, needs informed consent, which implies that the data subject has the opportunity to revoke consent with all its consequences on processing and storing of data at any time. By that, the second platform prototype fulfils R.A8 “Providing Consent and Revocation of it at Any Time”.

The POI advertising is started when a user enters an area centred on the POI and if the user has enabled reception of advertisements in the client settings. Each time, a notification is sent to an identity, the platform remembers it to avoid pushing multiple times the same notification. If the user leaves the area and re-enters it again, he might receive the notification related to that specific site again. Once the POI is selected, a notification is sent to the user related to the commercial POI. With this location and distance dependent notification, the second platform prototype fulfils RA.5 “Advertisement at the Right Point in Time and Place”. Besides finding an advertiser that is able to provide appropriate advertisements, the advertiser is providing advertisements according to the current context of the user.

Note that due to enhanced policies with new site condition, the second platform prototype is able to provide a mechanism to the user where he is able to define privacy rules, dependent on his current location. E.g. a user can define a policy that if he enters his home zone, the current location cannot be accessed by other users. Thereby the user is also able to define “private zones”.

Note that only the best POI is selected and pushed but as one POI advertising notification cannot be sent multiple times unless the user exits and re-enters the advertising zone, advertising for other POI might be sent as well later on, when location is updated. Strategies on pushing advertisements might be refined to be well accepted by the end user. By that the platform gives the user the possibility of pre-filtering potential Advertisers, by enforcing strictly that unwanted advertisements are not submitted to the community. The PICOS requirement R.A2 “pre-filtering of potential Advertisers” is fulfilled by the second platform prototype.

In the second advertising feature, commercial POIs are shown, when a user reads a forum thread. Each contribution in a forum contains text. For each contribution, the platform detects any matching between the contribution text words, the list of keywords of defined commercial POIs and the list of hobbies of the thread reader. Prerequisite is that the user has released his hobbies for the matching process in his privacy settings. Any non null matching will lead to the insertion of a virtual advertising contribution that provides information on the advertised POIs. With the implementation of this automatized matching agent, it is taken care to comply with the privacy preferences of the user and offering him personalized advertisements. Thereby a mechanism is offered, to build trust between the

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advertiser and the community members, by which the second platform prototype fulfils PICOS requirement R.A7 “Building Trust between Advertisers and Community Members”.

The inserted advertisement is valid for a particular reader and is not stored in the platform. This minimizes data collection and storage in the platform, but at the same time allows the advertiser to measure the efficiency of their invested money. There exists a clear need on the side of advertisers to allocate only as much money to a marketing campaign as necessary for achieving the defined goal. However, “non-linkability” to the user has to be assured, as otherwise the users consent is needed for gathering his data. The platform solves this issue, by keeping the user anonymous to the advertiser. Therefore R.A6 “Measuring the Success of Advertisements vs. Privacy and Tracking Users” is fulfilled by the second platform prototype. Furthermore, transparency regarding stored and processed data is given, as an inserted advertisement is valid for a particular reader and is not stored in the platform. Additionally the user does not receive advertising notifications by default, but has to allow or disallow it in his personal settings. Transparency means giving data subjects the opportunity for regular checks which data has been collected, stored and processed. This is appropriate and is a competitive advantage for honest advertisers. If people consent that their data can be shared with a specific group of third parties, the entity providing the data wants some assurance that the data is shared only in the defined group of recipients. The implemented POI based advertisement features in combination with the overview on released advertising policies in the policy manager fulfil the PICOS requirement R.A9 “Transparency Regarding Stored and Processed Data”.

Concluding, the implemented advertisement features fulfil the PICOS economic requirements R.A2 – R.A9. Thus the second platform prototype can be rated to treat personal data fair and responsible, providing a safe environment, to build trust in the community. For most business models affecting communities, personal data plays an important role; incidents could terminate communities immediately. Regardless, whether data is shared with advertisers or any other third party, uncontrolled releasing, processing and granting other parties access to these data is one of the most serious risks that could affect e.g., the acceptance of a community. Thus, the Meta requirement R.A1 “Considering Social Capital as Value of Communities” is also fulfilled by the second platform prototype.

Finally, as performed in previous economic evaluations, the applicability of the PICOS platform is evaluated. Today’s Social Networks providers, act as service providers to Online Communities, relying on the features their community platforms provide. Although in 2010 the Social Networks started to enhance their privacy features, they still not support privacy features, as multiple identities and privacy advisor. As more and more specialized communities emerge, the users start to participate in multiple communities at the same time. Existing platforms provide few features to successfully transfer user data between communities or even comply with privacy settings from other communities. The internal and external interfaces of the second platform prototype have been defined using Web Service Description Language (WSDL), describing the platform interface in a single WSDL document, offering transparent APIs to other platforms, and being flexible as new features can be added to the platform in future. Flexibility and interoperability is a central success factor for future platforms, as members of a community not only work with one device or technology in one community, but with a wide variety of technology and hardware, switching between various communities.

2.4.3 Summary of findings and recommendations

In summary, the PICOS second platform prototype implemented a set of capabilities around trust and privacy, without disabling business applications. The new features developed for the gamer client, showed the scalability and adaptability of the PICOS platform and its concepts to new communities and new demands. Current community platforms have enhanced their privacy features, but still not

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support privacy features as multiple identities and privacy advisor. As more and more specialized communities emerge, flexibility and interoperability is a central success factor for future platforms, as members of a community will move between the communities, making use of a wide variety of technology and hardware. The concept of appearing as one web service server to connected clients, described in a virtual WSDL interface provides the second platform prototype the necessary flexibility and interoperability.

The second platform prototype complies with all nine economic PICOS requirements and thereby proves that implementing modern marketing concepts like context sensitive personalized advertisements, is possible in a privacy respecting environment.

Also still valid since the first evaluation of the PICOS platform, the second platform prototype provides strong privacy mechanisms to put users into control over their data subjects and gives them full transparency over the data usage. In correspondence with the economic evaluation of the PICOS Platform Design & Architecture earlier in this deliverable, the implemented functionalities for marketers did not negatively affect the trust and privacy principles. By that the second platform prototype is able to take a role as an intermediate in regards to sharing of personal data for marketing and advertising activities. It is capable via the described advertisement profiles, to match the community members to context sensitive advertisements, respecting the privacy of the user at the same time, considering his preferences. From the economic point of view, the platform integrates the requirements of the user and the marketers.

2.5 Legal evaluation

2.5.1 Methodology and documentation used

This legal evaluation is focused on the PICOS platform developments for phase 2, as described in D5.2b³⁵. This document is the source for the carrying out of the legal evaluation of the “second PICOS platform prototype”, as we will refer to the relevant platform prototype in this section. It has already been specified in the legal evaluation of the first PICOS platform prototype, which is contained in section 4.2 of the first evaluation deliverable³⁶, that aim of this legal evaluation was the evaluation of the platform prototype against the data protection principles that are included in the Data Protection Directive (1995/46/EC). D5.1³⁷ focused on the compliance to the privacy principles that were already identified in the first PICOS Architecture and specified in detail how the WP5 PICOS platform implemented the PICOS privacy principles. D5.2b does not repeat the content of D5.1 but rather translates the major set of requirements that were identified for the phase 2 platform (mainly from the support of the Gamers Community) into generic and community agnostic new platform features. Therefore the PICOS privacy principles are not repeated in D5.2b. Consequently, the findings of the legal evaluation of the first PICOS platform prototype, as described in section 4.2 of the first PICOS evaluation³⁸ are still valid and will not be repeated in this section.

This legal evaluation will focus on two new platform features that were evolved for the support of the gamers community, namely: “Advertising of Commercial Points of Interest” (section 2.5 of D5.2b) and “meet with nearby Users” (section 2.8 of D5.2b). For this evaluation, the current European legal framework on privacy and data protection will be taken into account: the Charter of Fundamental Rights of the European Union (hereinafter EU Charter) provides for the respect for private and family life (Art.7) and the protection of personal data (Art.8), while the Data Protection Directive

³⁵ PIOCOS D5.2b “WP5 PICOS PHASE 2 Platform Description document”.

³⁶ PICOS D8.1 “Legal, economic and technical evaluation of the first platform and community prototype”

³⁷ PICOS D5.1 “WP5 PICOS Platform Description document”

³⁸ PICOS D8.1 “Legal, economic and technical evaluation of the first platform and community prototype”

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(1995/46/EC) has been adopted to guarantee efficient data protection. Additionally, the ePrivacy Directive (2002/58/EC, as modified by Directive 2009/136/EC – Citizens’ Rights Directive) contains specific provisions on the processing of location data for value added services. However, the ePrivacy Directive applies only to the processing of personal data in relation to publicly available electronic communications services and public communications networks. The potential applicability of this Directive to the second PICOS Platform prototype will be analysed. The relevant Opinion of the Article 29 Data Protection Working Party on the use of location data with a view to providing value added services will also be examined.³⁹

2.5.2 Evaluation of the requirements and functionalities of the Platform Prototype

As explained above, the legal evaluation of the second PICOS platform prototype will focus on two new platform features that were evolved for the support of the gamers community, namely: “Advertising of Commercial Points of Interest” (section 2.5 of D5.2b) and “meet with nearby Users” (section 2.8 of D5.2b).

The feature Advertising of Commercial Points of Interest can be applicable in two scenarios: (a) Advertising on location and (b) advertising in forums. The legal issues with regard to advertising in general, as well as those that could arise with regard to the latter scenario (advertising in forums), that does not involve the processing of location information of the user, have been discussed above in section B, chapter 1.4 (Legal Evaluation of the PICOS Architecture and Design v2). The “advertising based on location” scenario and the “meet with nearby users” feature entail the processing of location data of the users, for the delivery of advertising communication in the first case, and for the spotting of nearby users in the second case, respectively. The location component is fundamental in both cases (section 3.3.9 of D5.2b). Both services are value added services that are based on the processing of location data and belong to the category of services that are commonly known as Location Based Services. Thus, the legal analysis will focus on the processing of location data of the users for the delivery of these services.

Article 9 of the ePrivacy Directive regulates the processing of location data for the provision of value added services. The first paragraph of this Article reads as follows:

“1. Where location data other than traffic data, relating to users or subscribers of public communications networks or publicly available electronic communications services, can be processed, such data may only be processed when they are made anonymous, or with the consent of the users or subscribers to the extent and for the duration necessary for the provision of a value added service. The service provider must inform the users or subscribers, prior to obtaining their consent, of the type of location data other than traffic data which will be processed, of the purposes and duration of the processing and whether the data will be transmitted to a third party for the purpose of providing the value added service. Users or subscribers shall be given the possibility to withdraw their consent for the processing of location data other than traffic data at any time.”

Article 9 of the ePrivacy Directive is the only provision relating to the processing of location data for location based services and instinctively one could say that it would be also applicable to the processing of location data in the frame of PICOS by the PICOS provider. However, the case is more complicated. Article 9 explicitly clarifies that the provisions of this article apply only the processing of location data “relating to users or subscribers of public communications networks or publicly

³⁹ Article 29 Data Protection Working Party, Opinion on the use of location data with a view to providing value-added services (WP11), adopted on 25 November 2005.



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available electronic communications services”. PICOS, as an identity management system, qualifies neither as a public communications network nor as publicly available electronic communications service. As it has already been discussed in other deliverables, most likely PICOS communities would qualify as information society services that fall outside the scope of Article 9 and of the ePrivacy Directive in general. This situation is indeed problematic, as it illustrates that the processing of location data for the provision of a location based service will be covered under different rules, depending on the type of the network used for the delivery of the service or the type of service offered based on the processing of the same user location data. In the PICOS case, the processing of location data by the mobile operator for the provision of the value added service would have to comply with Article 9 of the ePrivacy Directive, while the processing of the same data for the same purpose by the PICOS provider would be covered only by the provisions of the general Data Protection Directive. The example of PICOS reveals that technological developments and the creation and implementation of new systems and services tackles the reasoning of the ePrivacy Directive, which should be rethought in order to ensure the same level of protection to the user irrespective of the nature of the provider who is processing his data.

This issue has already been criticised by the Article 29 Working Party in a broader context. The Article 29 Working Party⁴⁰ in its proposal in the context of the review of the European electronic communications framework criticised the exclusion of private networks from the scope of the ePrivacy Directive:

“...the fact that provisions of the ePrivacy Directive only apply to provision of publicly available electronic communications services in public communications networks is regrettable because private networks are gaining an increasing importance in everyday life, with risks increasing accordingly”⁴¹.

Similarly, the European Data Protection Supervisor repeated this statement and made similar remarks considering an actual –and still unsolved under the revised ePrivacy Directive– issue “the extent to which semi-public providers of electronic communications services are covered by the ePrivacy Directive”.⁴²

The location component is not new in the WP5 platform prototype and its implementation is compliant with the data protection legislation, as described in the legal evaluation of the first PICOS platform prototype. The user is creating a rule for allowing the collection, processing and eventual transmission of his location data for the provision of advertising based on location service or for meeting with nearby users. This rule can be considered as an indication of the consent of the user for the provision of the service.

Although we came to the conclusion that Article 9 is not applicable for the processing of location data by the PICOS provider, for reasons of completeness of the research, we will present shortly at this

⁴⁰ Under Article 29 of the Data Protection Directive, a Working Party on the Protection of Individuals with regard to the Processing of Personal Data is established, made up of the Data Protection Commissioners from the Member States together with a representative of the European Commission. The Working Party is independent and acts in an advisory capacity. The Working Party seeks to harmonize the application of data protection rules throughout the EU, and publishes opinions and recommendations on various data protection topics.

⁴¹ Article 29 Data Protection Working Party, Opinion 8/2006 on the review of the regulatory Framework for Electronic Communications and Services, with focus on the ePrivacy Directive, WP 126 (2006).

⁴² European Data Protection Supervisor, Opinion on the Proposal for a Directive of the European Parliament and of the Council amending, among others, Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications), adopted on 14 April 2008 [2008] OJ C181/01 (18.07.2008), para. 12



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point what would be the additional requirements that would need to be complied with and we will examine how PICOS could comply with them. According to Article 9, before obtaining the consent, the provider of the location based service must provide the individual with specific information regarding the type of location data that will be processed, of the purposes and the duration of the processing and whether the data will be transmitted to a third party for the purpose of providing the Location Based Service (Art. 9(1) ePrivacy Directive). More information needs to be given to the user according to the provisions of the Data Protection Directive (and potentially from Article 6 of the ePrivacy Directive). Such information deriving from articles 10 Data Protection Directive and articles 6 and 9 ePrivacy directive is: the identity of the controller and of his representative, if any, the purposes of processing, the type of location data processed, the duration of processing, whether the data will be transmitted to a third party for the purpose of providing the value added service, the right of access to and the right to rectify the data, the right of users to withdraw their consent at any time or temporarily refuse the processing of such data, and the conditions on which this right may be exercised, the right to cancel the data.⁴³

Currently, the user is given the opportunity to establish a rule relating to his location data being processed. However the additional information requirement is not covered. One potential solution for solving this issue would be the inclusion of a pop-up window that would contain all this information and that would be presented to the user before he can finalise the establishment of the relevant rules for the processing of his location data. In any case, this information is provided to the user via the privacy policy that accompanies each PICOS community application.⁴⁴ Finally, it should be noted that the PICOS systems gives the user at any point the possibility to withdraw his consent, as he can modify the relevant rule in his privacy settings.

2.5.3 Summary of findings and recommendations

The legal evaluation of the second PICOS platform prototype focused on two new platform features that were evolved for the support of the gamers community, namely: “Advertising of Commercial Points of Interest” (section 2.5 of D5.2b) and “meet with nearby Users” (section 2.8 of D5.2b). They both entail the processing of location data. Therefore the legal analysis focuses on the relevant provisions surrounding the processing of location data in the relevant European legal framework. Examination of the ePrivacy Directive revealed that Article 9 of the ePrivacy Directive that regulates the processing of location data for the provision of value added services is not applicable on the PICOS service. The processing of location data has to be done in accordance with the general provisions of the Data Protection Directive. It is reminded that, as it has already been stated in D4.2 Platform Architecture and Design 2, the ePrivacy Directive applies to providers of publicly available electronic communications services in public communications networks, leaving outside its scope private or semi-public services, as well as information society services. Therefore, it does not apply to the PICOS service.

⁴³ Article 29 Data Protection Working Party, Opinion on the use of location data with a view to providing value-added services (WP11), adopted on 25 November 2005, p. 4-5.

⁴⁴ The PICOS Gaming Community Privacy Policy can be found as Annex 7 to D7.3 “Second Community Trial Report”

3 Evaluation of the Gaming Community Prototype (WP6)

3.1 Summary presentation of the Angling Community Prototype

The PICOS Gamer application v1.6 is basically an evolution of the second prototype for the angler community (angler v2.5) targeting the needs and requirements of the second community under PICOS project consideration: the gaming community.

The PICOS client application is built with J2ME (Java 2 Mobile Edition) and is designed to run on a Nokia 5800 XpressMusic (Operating System: Symbian 9.4.).

From an architectural perspective the gamers application presents the same structure than anglers prototype, as shown in Figure 14. This is a client-server topology connected through a Remote Procedure Call (RPC) Gateway. The client side also communicates with a third party map service (Google Maps). All exchanges between the WP6 client application and the WP5 platform are carried over a secure channel using https (Hypertext Transfer Protocol Secure).

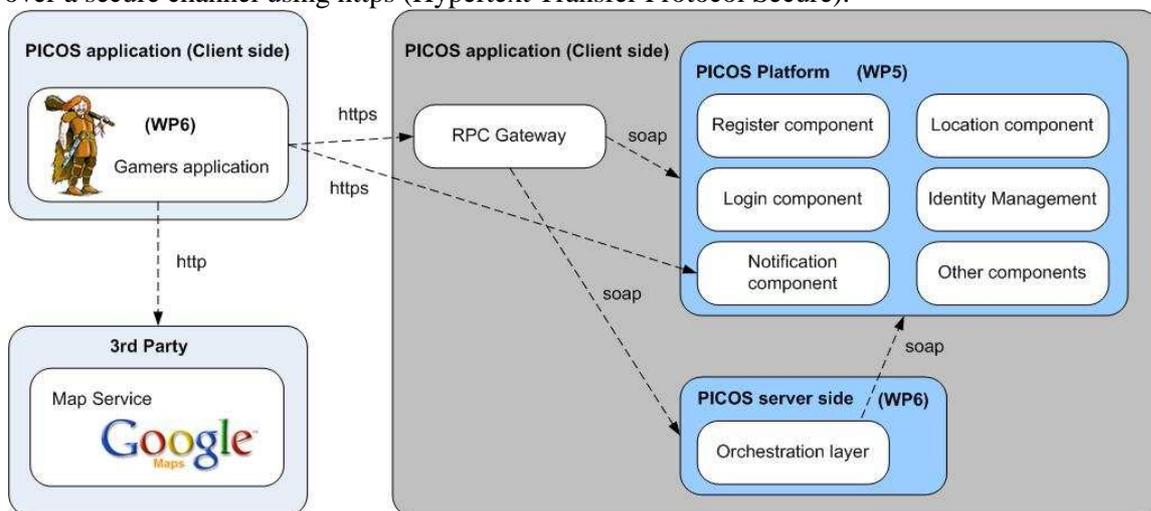


Figure 14: Gaming Community prototype architectural overview

The difference with the anglers prototype architecture lies in the disappearance of those elements specific for the angler community, such as the Species Summary server and the Fishbase database.

From a functional perspective, specific Anglers features, such as the watercourses and fishing-spots management, were also dropped from the gamers prototype, as they were not necessary for the gaming community. Instead the remaining features were modified and adapted to new necessities. Additional features were implemented as well, according to the users' requirements collected in the internal R2 document (WP4)⁴⁵.

The following list summarizes the changes and developments in the new application. We strongly recommend consult deliverable D6.2b for further information.

- Extension of existing functionalities:
 - Adaptation of root profile for gamers.
 - Presence manager
 - Possibility to share the contact list.
 - Availability display through calendars.

⁴⁵ R2 Investigation Report (Internal deliverable). PICOS_Investigation_Report_v1_0_Final.doc



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- Extended scanning of profile fields for the Privacy Advisor.
- Possibility to share content within “My Files”.
- Automated blurring around “Private sites” defined by the user.
- Real-time content sharing (chats with files (images))
- Chat archiving.
- Improvements:
 - New Policy Manager.
 - Offline notifications mechanism.
 - Revocation of accounts.
- New features:
 - Contact restrictions to published content in the public community, the public repository and Sub Communities.
 - Date restrictions to published content in the public community, the public repository and Sub Communities.
 - Availability of a content access history in the public community, the public repository and Sub Communities.
 - Notification of new content available in public-community, the public repository and Sub Communities.
 - Possibility to define, share and rate Points of interests (POIs).
 - Information about nearby gamers.
 - Advertising services: creation and alerts.

Even though R2 can be considered the main input for W6 work, the feedback from anglers trials played also a significant role in the new developments, mainly in terms of usability enhancements.

WP6 work was also oriented to support the activities of other work packages. The resulting prototype will be treated from WP3 (assurance), WP7 (user trials), WP8 (evaluation) and WP9 (dissemination).

The delivery of gamers application v1.6 and its corresponding document D6.2b closes the implementation activities in PICOS project.

3.2 Assurance Evaluation for Trust & Privacy

3.2.1 Threat analysis of the angling community prototype

The evaluation of the angling community prototype focused mainly on an analysis of threats, risks and vulnerabilities concerning trust and privacy in PICOS. The analysis was based on the threats and recommendations extracted from the three ENISA papers presented in Sect. B 1.2.2.

It should be noted that the prototypes depend on the platform, and therefore the results of the evaluation of the prototypes depend on the results of the evaluation of the platform and also help clarifying many aspects related to the latter. Hence, the evaluation of the prototypes may be seen as an extension of the evaluation of the platform. We note also that from the point of view of privacy and trust there are no substantial differences between the two community prototypes, the anglers and the gamers, and therefore both have been treated together in the assurance evaluation.

The results were classified into three main categories: privacy, trust, and safeguards.

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Concerning privacy, we highlight the following findings. With regard to notice and other information provided to users, the community terms and conditions are used in the prototypes to explain the global community policies related to data collection and data retention, and they are displayed during the registration before any data is collected and are always available for inspection. Concerning the collection and use of personal data, within the community disclosure is managed by the end user via the creation of privacy rules. The user is able to manage consent via the policy rules that can be modified via the client application. Any data collected on the end user is made available to him or her through the client application. Finally, with regard to data and identity disclosure we highlight the fact that no user data is disclosed outside the community, and within the community the disclosure is managed by the end user via the privacy rules. Our view is therefore that privacy has been treated in a satisfactory way in the implementation of the prototypes.

With regard to the safeguards associated with the prototypes, PICOS uses standard security mechanisms such as SSL (HTTPS), a protocol in widespread use today for securing internet transactions which for the nature of the PICOS applications can be judged as appropriate. The prototypes support one way of authentication, by username/password, since currently only this form has been implemented in the platform. After authentication, a session token is used by the Client Application to reconnect transparently to the user. Access to the platform is performed using the root identity, but once authenticated a member can select any of his or her partial identities to access the community and its services. Finally, the server is protected and located in a Demilitarized Zone, and access to the server is only granted to specific administration staff.

Concerning trust, we note that this is mainly the responsibility of the platform. PICOS ensures that members can rely on the provenance of information, an issue that is treated mainly at the platform level. The prototypes support the functionality concerning reputation aspects, e.g. rating. A lot can be done to enhance transparency with regard to this issue, but this is basically a concern of the platform. The same can be said about the transparency of the notion of partial identity.

Summing up the results, we may conclude the PICOS prototypes meet the established requirements concerning privacy in a satisfactory way and that the included security mechanisms are adequate for the kind of applications targeted by PICOS.

3.2.2 Summary of findings and recommendations

This section presents an analysis of how the PICOS angling community prototype follows the recommendations and defends against a set of threats and vulnerabilities presented in a series of papers published by ENISA, the European Network and Information Security Agency. These papers provide a systematic way of approaching security issues for online social networks and reputation-based systems. It was shown that the privacy requirements are met by the prototype in a satisfactory way as far as those requirements are met satisfactorily by the platform server. The security mechanisms included in the prototype are judged as appropriate for this kind of application, but trust may be enhanced by increasing the transparency for the user of both the reputation system and the notion of partial identity.

3.3 Technical evaluation

3.3.1 Community focus

The focus of this part of the technical evaluation is on the implementation of the PICOS gaming community application prototype, especially the components which have a community focus. The sub-community key features were already identified in chapter B 1.3.1 “Community focus” of the

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Evaluation of the Platform Design & Architecture of this present deliverable and were evaluated regarding the platform components (D5.2b). The identified platform components are now evaluated regarding the implemented gamer community prototype (D6.2b).

3.3.1.1 Methodology and documentation used

The documentation used for this evaluation is investigation report R2 as well as deliverable D6.2b. Investigation report R2 addresses the new identified requirements and derives the needed features to fulfil these requirements. Deliverable D6.2b addresses the current state of the community application prototype. The goal of this evaluation is to verify how far the implemented community prototype (described in D6.2b) is able to make use of the platform components described in D5.2b.

In chapter 3.2.2 (Community focus) five features were identified which are directly related to the community focus. Two components were identified from D5.2b which realize the features. These components now are evaluated regarding D6.2b and the implemented gamer community prototype.

From this bottom-up point of view it will be evaluated if all components were realized in a way that meets the PICOS specific approach.

3.3.1.2 Evaluation of the requirements and functionalities of the Gaming Community Prototype

For the gaming community application prototype 37 new requirements were gathered in R2 Investigation Report. Only five have a community focus – R5, R8, R9, R11 and R12.

For the evaluation of the new requirements and functionalities of the Gaming Community Prototype, the community related platform components were identified and have to be approved regarding the implemented gamer community prototype.

The platform components which were identified in D5.2b are:

4.3.15 Subscription

4.3.19 Sub-community

The following table shows, how the community prototype uses these platform components:

D 5.2b Platform Component	D 6.2b Gamer Application Prototype Design	D 6.2b The Gamer Community Prototype from the user perspective
4.3.19 Sub-community	4.8 My Files (refers to the shared desk design)	
4.3.15 Subscription	4.6.3 Subscription to receiving new available content in threads of the public community	2.2.6.4 Notification for new available content 2.2.7.3 Notification for new available content 2.2.9.3 Notification for

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		new available content
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3.3.1.3 Summary of findings and recommendations

For the technical evaluation of the community aspects of the gamer community prototype the related platform components were reviewed regarding the results of community prototype (D6.2b). It was determined that the community prototype makes use of all evaluated and implemented platform components identified in D5.2b. There are no platform components which are not used by the client application and there are no additional components realized in the client application. This is because the community prototype strictly depends on the platform components and additionally implemented features cannot be used if they are not present on the server side.

3.3.2 Location data and communication features

3.3.2.1 Methodology and documentation used

The Gaming Community Prototype is the final outcome of a development process, starting with the architecture design (WP4), followed by the platform implementation (WP5) and ending with the application development (WP6). The evaluation of the last step's result is done based on a comparison of the initial requirements from the user community (defined in "Investigation Report R2 Version 1.0"⁴⁶) with the application prototype documentation ("D6.2b - Community application prototype") and the application itself.

The comparison shall assess from a user perspective, that all requirements have been taken into account and incorporated in the gaming prototype.

3.3.2.2 Evaluation of the requirements and functionalities of the Gaming Community Prototype

The new requirements for the gamer application related to location based services and communication features listed in the investigation report are:

- R1: Sharing contact list
- R2: Support contact list per identity
- R10: Real chat
- R21: Real time content sharing
- R16: Public Point of Interest
- R20: Private or public POI
- R17: Meeting with nearby players
- R22: Archive chat
- R23: Advertising services
- R36: Social presence awareness

⁴⁶ Internal PICOS deliverable



For each requirement a short assessment is given with an indication on possible improvements:

R1: Sharing contact list

The “Contact list sharing” feature is described from the user point of view in chapter 2.2.3.1 of D6.2b. A user can select one of his contacts and open the contact’s contact list. The contact needs to authorize the access. The following chapter 2.2.4 “Policy Manager” explains how to setup a policy rule for the contact list access by using the new policy wizard.

The design chapter 4.3 “Contacts management” shows the software architecture and the way, the requirements have been implemented. It starts with a use case diagram that is composed of all considered use cases, followed by a sequence diagram that visualizes the interaction between the different components.

Finally a class diagram shows the different classes, attributes, methods and their connections. We can access, that the requirement R1 is completely fulfilled and well documented.

R2: Support contact list per identity

The support of different contact lists per identity is not explicitly mentioned in D6.2b because it was already implemented in the angler application.

A quick check with the real application on the mobile phone confirms that the requested feature is available.

R10: Real chat

The basic chat functionality was already available for the angler application where the user can start a chat by selecting one or more users from his contact list.

This feature has been enhanced in the gamer application. Here, the user can start a chat with the users nearby. First he locates the users in a specific radius around and secondly, he can select one or several of them to start a chat. More details to the new LBS function are given in the evaluation of requirement R17 below.

R21: Real time content sharing

Additionally to the exchange of text messages mentioned in R10, the transfer of multi-media messages shall be supported.

WP6 and WP5 have decided to support the exchange of photos taken by the mobile phone’s camera and pictures selected from the phone’s file system. Videos, audio or other content types are not supported.

Chapter 2.2.11 describes the real time content feature from the user perspective. As the implementation is straight forward, details about the content types can be found in the WP5 platform documentation.

R16, R20: Public or Private Point of Interests

The points of interests (POI) are covered in chapter 2.2.10.2. A description is given on how to add a new POI to the list of POIs. The user can specify a POI by several attributes (name, description, location etc.) and define whether the POI is visible to the whole community or only to himself.



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The software design is described in chapter 4.10.1. A deployment diagram shows the overall components and the allocation to the different servers.

All use cases are briefly described and some implementation hints are given.

We can assess that the requirements are completely fulfilled and that the POI service is easy to use and reliably offered to the user.

R17: Meeting with nearby players

The implementation of this feature is described in chapter 2.2.10.3. The user activates a search of the gamers nearby from the community screen. He defines the maximum distance and a search is automatically started. When one or more gamers could be found, they can be shown on the map or a chat can be started to arrange a meeting.

Details about the implementation are given in chapter 4.10.4. A sequence diagram visualizes the component's interaction and how the list of nearby gamers is filled.

In the first gamer application release, a nearby user can be found, if the user has disclosed his location to the whole community or to the specific user who perform the search. A user that has been successfully located can be shown on the map, either with his precise location or with blurred coordinates depending on his privacy settings.

In a further release it may be interesting to add a specific rule for the “search nearby users” scenario. A user could setup a privacy rule and allow being located for this kind of search (also for unknown people) and being displayed in a list with no possibility to show the user on the map. On the other hand, he can disclose his location to his friends so that they can see his location on the map. This extension would enable unknown users to get in contact while respecting their privacy and use more precise localization features to stay in contact with known users.

R22: Archive chat

The WP5 platform provides a new function to store and retrieve chat messages. The WP6 gaming application provides access to this platform function. A description from the user perspective is given in chapter 2.2.11.2. More technical details are missing, potentially due to the small complexity.

The gamer application fulfils the requirement and provides a simple to use store and retrieve mechanism for chats. All chat participants are able to access the chat. Because of a prototype implementation and the aim, to demonstrate the feature in general, further functions, like delete chat, search chat, continue chat are not available.

R23: Advertising services

As said in the evaluation of WP4, the advertising requirements related to the location based services and described in the Investigation Report R2 are:

1. Commercial POIs
2. Recommendations

The commercial POIs are a special form of a normal POI, where additional information about the target user profile is given. If a user approaches such a commercial POI and the user profile matches the commercial POI target user profile, then an advertisement shall be prompted to the user. The additional information can be entered in a dedicated dialog, which is described in chapter 2.2.13.

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Alternatively, the commercial POIs can be administrated by using the admin console – a WP5 platform GUI.

If the user approaches a commercial POI with a user profile that matches an advertisement in form of an asynchronous message is sent to the user's inbox.

The user can then recommend this POI and also any other POIs to his friends. Again, asynchronous messages are used for this kind of recommendations.

The underlying mechanism is explained in chapter 4.13. We assess that the advertising service is implemented in way that it can be used to demonstrate the feature in general. For further investigations in the context of a user trial, this function lacks of a missing link to a real advertising provider to have a more realistic scenario.

R36: Social presence awareness

The social presence awareness is addressed in chapter 2.2.10.1. A user can define private sites and attach policy rules to the private sites. If the user is within a private site, the corresponding privacy settings are automatically applied.

The design is given in chapter 4.10.3. All use cases are briefly described. Some more technical information with regard to the component interaction and the overall user story containing the private site definition and the appliance of the private site specific privacy rules may be appreciated.

This feature is one of the most complex privacy related ones and demands a lot of knowledge from the end user. It will be interesting how this function is accepted during the user trials and what improvements, especially in the usability area are discovered.

3.3.2.3 Summary of findings and recommendations

The evaluation of the gaming community prototype shows, that all requirements have been addressed and implemented. In general the functions are easy and user friendly to use and reliable with a degree, that can be expected from a prototype.

Some more information about the technical realization would be appreciated. It may be useful to describe a kind of user story with the underlying technical interactions so that the interested user of the applications and the reader of the documentation get some more insights. The additional information would help users to better understand the features and to give a more substantiated feedback for improvements and to figure out and describe more precisely the problems they have had.

Some functions suffer from platform limitations, e.g. users are offline but the platform does not know, but these limitations are of course explainable by the prototype character of the whole application.

The angler application suffered from the missing community functions that were needed to build a community before starting with the more privacy related and from PICOS perspective interesting features. In the gaming application the focus was more on privacy related features and therefore many interesting features have been realized. Also the usability improvements of the second angler prototype have helped to make the gaming application attractive to be used.



3.4 Economic evaluation

3.4.1 Methodology and documentation used

The following economic evaluation puts the PICOS Community Application Prototype for the Gamers Community in the context of business aspects of trust, IdM and privacy, as the collection, processing and exchange of information are key economical success factors for online and mobile communities. To keep a focus on the constraints of the scope of this evaluation this economic evaluation will focus on the business relevance of the Application Prototype.

The aimed goal is to determine, how the PICOS Community Application Prototype for the Gamer Community copes with the economic aspects of the PICOS Requirements and with the economic view expressed in the PICOS Contextual Framework.

This evaluation has been drafted by considering PICOS Deliverable D6.2b “Community Application Prototype” and PICOS Deliverable D2.4 “Requirements”, under consideration of the PICOS principles in the PICOS Deliverable D4.2 “Platform Architecture and Design 2”.

3.4.2 Evaluation of the requirements and functionalities of the Gaming Community Prototype

Corresponding to the second PICOS platform prototype evaluation (D5.2b), the PICOS Gaming Community Prototype is reviewed along its implemented components in an economic context, respectively their business relevance under protection of the trust (TrP) and privacy principles (PrP).

The Gamer Community Prototype aims at showing that PICOS solution and concepts can be extended and adapted to other groups’ needs, building on a pre-existing architecture common to all of them.

Besides new community features for the communication intensive gamers and usability improvements, Advertising Services based on commercial Point of interests (POIs) were implemented. This new feature is first evaluated regarding the following privacy principles:

- PrP9 Limitation of Collection: Only personal information relevant to the identified purpose may be collected. The Gamer Community Prototype achieves this Privacy Principle by a minimum of mandatory fields that need to be filled in for a partial identity. Therefore only information a user is willing to share is available to the Advertising Service and can be used in the matching process with the advertising profile.
- PrP11 Acceptable Uses: Personal data may only be used for the purposes stated at the time of collection. The application allows the user to set the rules and conditions which data are shared with whom in the community, including customised order level of detail (e.g., for location). As the commercial POIs are by standard deactivated, the user has to activate the commercial POIs actively, thereby authorizing the Advertisement service.
- PrP13 Third-Party Disclosure: Notice and consent of the Data Subject is required to disclose information to third parties. The PICOS architecture must uphold the member’s wishes with regard to information flows. Disclosure is managed by the user via the privacy rules. Data will not be distributed to third parties without the explicit consent of the user.
- PrP14 Third Party Policy Requirements: Organisations must ensure that any third parties are informed of their privacy policies and will follow them or possess equivalent policies. If personalised services will be supported in the application prototype a consistent process



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through notification and policy management must be established to sustain the privacy of the user.

The implemented Advertising Service is based upon the usage of commercial POIs. A marketer can create commercial POIs as commercial user. The commercial POIs consists of the same profile as a public POIs, namely a title, a description, type of POIs, Keywords, Location details and a Image. But additionally contains the marketing profile to identify the users to be targeted with the commercial POIs. The marketing profile consists of an age range, the gender and the hobbies of a user. **Figure 15** shows the mentioned POI's target profile for a commercial POI.

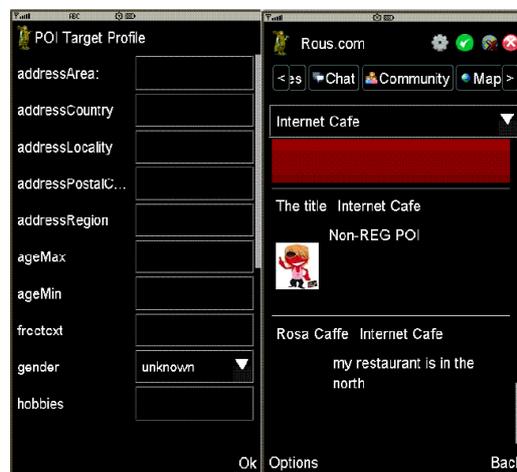


Figure 15: Commercial Point of Interest Screen showing the advertisement Profile

The distance upon which the commercial POI is pushed to the user is not defined in the client, but by the platform. As the activation distance is crucial for successful marketers and a central attribute for mobile advertisers, an additional field in the target profile should be added, namely the activation distance. With that the advertiser is able to define the proximity of the user, in which he is addressed by the advertisement. The user himself is able to configure his advertisement settings in the privacy manager.

With the improved Policy Manager, the Gamer Application prototype offers a powerful tool to the user to meet his privacy need. As for the platform, the user is able to change his policy settings via the client. This allows the user to define fine-grained policies for profiles, presence and location. By that the Client Prototype is fulfilling the Privacy Principle on Changes in Policy or Data Use (PrP3). This principle states that notice must be provided when any changes are made to the applicable privacy policies or in case that the information collected is used for any reason different from the initially stated purpose.

In terms of integrating the advertising service, the improved Policy Manager gives the user transparency and control at a very high granularity. As Privacy Policies are getting more and more complex with the integration of the advertising service, the already existing component of the Privacy Advisor will support the user in understanding the consequences of his actions regarding his personal expectation of privacy. For example, the implemented Privacy Advisor functionality notifies the user about possible risks with regards to the disclosure of personal data and sharpens the awareness of the



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user, by that implementing the Privacy Principle “timing of notification” (PrP4). The purposes for which personal data are collected should be specified at the time of collecting the data at the latest.

The implemented advertising service and policy manager adoptions in the client enable the users to handle their privacy settings regarding advertising, at the same time allowing marketers to place context sensitive advertisements. As described in chapter 8.4 the platform takes the technical and connectional role as a intermediary between the two parties. Unfortunately the implemented advertisement feature for the forum was not implemented in the client.

As the Anglers Client prototype, the Gamer Client prototype uses a Nokia 5800 as a hardware platform and the J2ME (Java 2 Mobile Edition) environment. The Gamer application communicates via https with the RPC Gateway and via http with a third party map service. Because the external interfaces of the second platform prototype have been defined using the WSDL language, describing the platform interface in a single WSDL document, it is possible to build Client Applications also on other hardware platform, e.g. based on Android or other mobile OS.

3.4.3 Summary of findings and recommendations

In this chapter, we have presented an analysis and evaluation of the business potential and economic functionalities of the gamer community prototype, described in D6.2b. In summary, the PICOS Gamer Application Prototype in its current state and its user centric view complies with the set of trust and privacy principles, and at the same time does provide functionalities to make use of the social capital as value of the community. In the last evaluation it was unclear to distinct between functionality processed by the platform and functionality processed by the client. Regarding the implementation of the advertising service, it got very clear that the client provides the interface for the users and marketers to configure their advertisement settings, and the platform of the platform enforcing the policies and rules.

Although the PICOS prototypes implement strong privacy mechanisms, they are able to integrate features for marketers, and make use of personal information provided by the community. The implemented scenario of commercial POIs showed that context sensitive advertisement is possible even within such a privacy friendly setup.

In the previous economic evaluation it was proposed to implement an advertisement engine, which could gather anonymous cross-sectional data from the platform, which then is provided to the marketers in form of different target profiles, or target groups. The implemented advertising feature does not go that far. By that marketers cannot adapt their advertisements to the target community needs in a more personalized way, as the background information about the community is missing to them. Key factor regarding advertisements as a business model to finance community platforms is the trust of the user. The implemented gamer client is able to provide the technical requirements to support the trust of the user.

In summary the client prototype showed that marketing mechanisms can be integrated in privacy strong community platforms, preserving the users’ privacy and at the same time giving the community provider the chance to create a profitable business model.

3.5 Legal evaluation

3.5.1 Methodology and documentation used

The Gamers application prototype is described in D6.2b “Community application prototype”. Similar to the evaluation of the other application community prototypes, the legal evaluation examines the

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compliance of the gaming community prototype to the European legal framework on privacy and data protection. Within the European Union, the Charter of Fundamental Rights of the European Union (hereinafter EU Charter) provides for the respect for private and family life (Art.7) and the protection of personal data (Art.8), while the Data Protection Directive (1995/46/EC) has been adopted to guarantee efficient data protection. The implementation of the first angling community prototype was evaluated against the European Data Protection Directive (1995/46/EC) and mainly against the data protection principles contained in it.

However, the structure and the focus on the Gamers application prototype, as described in D6.2b “Community application prototype” are significantly different. It is explicitly clarified that “the Gamers application has the same functionalities as the previous [angling] prototype. Nevertheless appropriate modifications and extensions have been made to adapt the Anglers application to the specific needs of the gamers.”⁴⁷ Given that the Gamers application prototype is in reality an evolution of the Angling community prototype, D6.2b did not repeat the features and requirements that were unchanged between the two prototypes. Therefore the deliverable does not include a description of how the PICOS Gamers community application prototype contributes to trust and privacy principles in PICOS and how it addresses the community requirements. This was done in Chapter 4 of D6.1” Community Application Prototype 1”, which was the core for conducting the legal evaluation of the angling community prototype. However it was not needed to be repeated, as all these principles are still respected in the Gamers community prototype. Similar to practice of PICOS in the angling community application prototype, the participants in the Gamers application lab tests and field trials were provided for the PICOS privacy policy and a user consent form, which are available in Annexes A6 and A7 of D7.3 “Second Community Trial report”.

Focusing on the additional information that is available in D6.2b “Community application prototype”, we will focus on some issues that arise only in the Gamers community application prototype and we will examine them in view of the European legal framework on privacy and data protection.

3.5.2 Evaluation of the requirements and functionalities of the Gaming Community Prototype

The discussion on the advanced targeted advertising, as well as the one of the processing of location data in PICOS, are also relevant for this section. As they have been extensively treated in other points of this deliverable, i.e. advanced targeted advertising in section 2.4 and processing of location data in section 3.4, these discussions are not repeated in this section

One new feature that is included in the Gamers community application prototype is the one relating to “revocation”. Revocation was identified as one of the new requirements (R37) in PICOS Investigation report (R2) and a new feature was deemed necessary for its implementation. This feature was simply called “revocation” and was implemented in the Gamers Community Application Prototype (section 2.2.14 of D6.2b).

*Revocation occurs when a member leaves a community. When this happens PICOS platform retains the content/files/posts uploaded by that user in the community for other members to keep access to it, but it replaces the partial ID of the no longer existing owner by the label “anonymous”.*⁴⁸

When a user chooses to leave the community, he may wish his name to be eliminated from the public community and the Sub Communities he has participated in. The revocation feature enables exactly

⁴⁷ PICOS D6.2b “Community application prototype”, p. 13.

⁴⁸ PICOS D6.2b “Community application prototype”, p. 40.



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this. The contentPublisherName of the content attributes is erased and in this way the partial identity of the user is replaced by the label “anonymous”.

The revocation feature allows the users who wish to leave a PICOS community to remove their name from posts they have done on the various PICOS communities. This means to delete “digital traces” a demand that is gaining more and more significance in the digital era and can be seen as a measure that safeguards the privacy of the users. However, given that the actual content of the posts that will remain in the forums, even when the name of the user will be removed, may lead to the identification of the user. Therefore, a criticism that could be raised with regard to revocation related issues is that PICOS should potentially give the opportunity to the users that wished to, to ask for the full and automatic removal of all their posts and related data, when they decide to leave their community. However, given the technical difficulties relating to such a choice for PICOS, as a research project, along with the possible distortion to the flow of discussions in various threads the full deletion of the posts of a user who wished to leave the community was not promoted.

3.5.3 Summary of findings and recommendations

The PICOS Gamers Application Prototype ensures a legally compliant application that respects the privacy of its users, as it largely relies on the PICOS implementation for the anglers prototype that has received a very positive legal evaluation. The provision of detailed information to the users that was realised via the PICOS Gamers Community Terms & Conditions, the PICOS Gamers Community Privacy Policy and the Consent form that was signed by the participants in the lab tests and fields trials ensures the maximum protection of the users and the adherence to the relevant data protection legislation. The implementation of the Gamers Community Prototype further introduced the revocation feature, which allows the removal of names of users from content that was posted by users that wish to leave the community, enhancing in this way their privacy.

3.6 User based Usability evaluation

This chapter reports the findings of the prototype evaluation of the second community prototype deduced from the lab test and field trials with the gamer application v1 conducted in October and November 2010.



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Figure 16: Participants in Brno exploring the Picos Gamer application during and after the field trial Kick Off

The second community lab tests and field trials follow the approach of the first community evaluation phase and are a continuation of the user based evaluation process of the PICOS prototype. This second evaluation circle provides the possibility to evaluate PICOS concepts by another community and therefore provide further insides on the application context of these concepts.

3.6.1 Methodology and documentation used

The aim of the second community lab tests and field trials was to evaluate the PICOS gamer application (version 1). The goal was to evaluate the PICOS concepts and application in a controlled lab and a real-world and long-term usage setting. During and after the lab tests and field trials qualitative and quantitative methods were combined to evaluate the PICOS application and the implemented concepts. Based on the experience from the first community trial and the different arrangement of the work plan for the second community, the second community trial was arranged in a slightly different way.

The first community prototype evaluation consisting of lab test, field test and field trials (with a 5 month lasting break in between) was replaced by: a) an intensive preparation phase before, b) lab tests and c) immediately following field trials. Lab tests are characterized by a minimal degree of freedom regarding the interaction of the test participant with the application. Contrary, the field trials afford a maximal degree of freedom. Hence, both test situations are the endpoint of a continuum and were chosen caused by their special value to gather feedback on the application. During the preparation phase WP5, WP6 and WP7 partners investigate on bug fixing. Additionally a usability report on the gamer application (v1.2) was delivered to the WP6 partners to improve major usability issues.

Consequences and implications from the execution and results of the first community prototype evaluation for the test and trial planning of the second community prototype are described below.

Feedback debriefing first community trial: Participants of the first community trials agreed with the proceeding of sending out the tasks via application and the later questionnaire via Email. However, due to their crowded message box after receiving hundreds of “authorization requests”, participants reported that they were not always aware they got a new task.

Implication second community trial: This had functional implications for the improvement of the PICOS application concerning the authorization requests which were separated from (non automatic) messages which the user receives from other community members. The general proceeding of sending tasks during the field trials via PICOS application was continued.



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Feedback debriefing first community trial: Participants stated they were willing to fulfil more than 2 tasks per week.

Implication second community trial: In preparation of the trials more tasks were prepared and the frequency of tasks during the trials increased.

Feedback debriefing first community trial: Privacy features were rarely used in the first community trials. Participants stated that there was no special need to focus on privacy settings, because they know each other well and didn't provide sensible data. Additionally, privacy features like the Policy Manager were hard to use due to its complexity.

Implication second community trial: Travian as a game implies private content sharing which may enhance naturally the usage of PICOS PET features. Competition tasks were conducted to force users to use the PET concepts of PICOS. Special effort was investigated to evaluate the PET features on a concept level by presenting a scenario as a first step during the lab tests. The Policy Manager was improved.

Experience first community trial: Some pre-registered participants for the field trial had withdrawn their participation shortly before the trials were commenced and in the first week of the trial, thus the sample size decreased unexpectedly.

Implication second community trial: Consequently the sample size for the second community trials was increased substituted potential drop outs and to approach realistic community conditions.

Furthermore and in order to meet the request to gather more detailed feedback of the users concerning PICOS concepts, scenarios were presented in the first part of the lab test to the participants. Scenarios offer a way to imagine design concepts in use without a direct usage of a system.

Lab test and field trial agenda

The evaluation of the PICOS gamer application started with the lab tests which were split into two major parts: As mentioned above the first part of the lab test was addressed to the evaluation of PICOS concepts. The second part included the usage of the PICOS prototype by providing the users several tasks. This second part was conducted in a similar way compared to the first community lab tests: a test conductor was sitting next to each participant, observing her/him during the competition of the task, taking notes regarding problems or questions which came up and interviewed the participant afterwards.

The second community field trials started one day after the lab tests took place. The participants were asked to use the application as often as possible, once a day was suggested to be a desirable frequency. The participants received the tasks via message and subsequently a link (URL) to a short online questionnaire was forwarded to the trial user via Email, with the request to deal with the questionnaire at the same day. Towards the end of the trial period, a more detailed questionnaire was submitted and the trial users were asked to complete the questionnaire before the final debriefing meeting. During the whole field trial phase a gaming competition was conducted (for a detailed description see D7.1b). According to the first community trial competition the idea was to encourage the trial participants to intensify the usage of the PICOS application and specifically to encourage the exchange of posts within the trial community. The lab tests and field trials followed the procedure listed in **Table 3** below.

Table 3: Procedure of the lab and field trials of the gaming prototype evaluation

Lab Test	
Kick Off	
Introduction	Welcome of the test participants, Introduction of test conductors and participants, aim of the lab tests and field trials

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Picos Project Concepts	Introduction on PICOS project partners, central concepts of PICOS project, scenario presentation and evaluation
Nokia Device	Introduction of the hardware
Questionnaires	Demographical data, Attitude towards ICT, Privacy and Trust in online Communities
Lab test procedure	Twelve tasks were tested during a one hour lasting test session: Register, free exploration, Create partial ID1, Create a second Partial ID and change the profile settings, Change between the two Partial Ids, Add contact, Send a message, Start a chat, Change the privacy settings for the contact, locate the contact, Create a post in a Thread of a public Sub Community, upload a picture to My files. Observation by a test conductor Qualitative interview afterwards
Questionnaires	PET-USES, SUS
Reimbursement of expenses	50€ were paid for the participation at the lab tests
Field trial phase	
Kick Off	Aims of the field trials, organization; upgrade procedure, trial support, the gamer application and the competition were explained
Field trials	
12/13 tasks and a respective online survey	Following tasks were send out during the trials: “list points of interest”, “define points of interest”, “recommend points of interest”, “chat”, “private sites”, “public Sub Community”, “rate posting”, “blur position”, “transfer file”, “access history”, “advertisement”, “Recommend advertisement”, “calendar” (this task was added for the participants in Vienna)
Final online Questionnaire	Overall evaluation of the PICOS gamer application
Debriefing	
Questionnaires	PET-USES, SUS, Usage of the application during the field trials
Group discussion	Organization of field trials, usability of mobile application, usefulness of PICOS concepts on trust and data handling, strengths and weaknesses of the application
Return of devices	
Winner of the angling competition	
Reimbursement of expenses	130€ were paid for the participation at the one month lasting field trials, extra expenses were paid to the winners of the competition

Participants

The lab test was conducted on the 12th October 2010 in Brno and on the 15th October 2010 in Vienna. The field trials started immediately afterwards on the 13th October 2010 in Brno and on the 16th October 2010 in Vienna. Fifteen gamers in Brno (eleven male 73,33% and four female 26,67% aged between 18 and 23 years ; M = 20,33; SD = 1,80) and eleven gamers in Vienna (ten male 91% and one female 9% aged between 23 and 32 years; M = 27, 00; SD = 3,90) committed their participation in the lab tests. All participants except one gamer in Vienna, who was not willing to participate at the field trial, committed their participation at the field trials. The final debriefing session took place on the 16th of November 2010 in Brno and on the 19th and 20th of November 2010 in Vienna.

To ensure the mix of known and unknown community members and to follow the wish of the PICOS consortium to increase the number of trial participants, 10-15 participants were targeted. Due to the limited number of test devices 25 was the maximum of participants which could be tested in parallel.



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The results of the privacy and trust pre-test questionnaire indicate that the participants in Brno and Vienna were already sensible for privacy and trust issues in online communities. The statement: “I trust online communities that they are dealing carefully with my data” receives the highest rejection in Brno and Vienna, as well as indicating the doubt of participants that their data are not treated carefully.

Additionally the participant’s attitude towards ICT was gathered by a short questionnaire, indicating that the participants in Brno had a very positive attitude towards information and communication technology.

Concluding from the results of all pre-questionnaires our participants in both cities meet the following recruiting criteria:

- Experienced in the usage of mobile devices and with online communities
- Active Travian gamers
- Able to handle the application in English.
- Diverse demographic background: according to gender, age between 18 and 35, nationality
- A mixture of known and unknown gamers within the groups.

3.6.2 Evaluation of the requirements and functionalities of the Gaming Community Prototypes

The gamers’ application was built on the anglers’ application v2.5. Some new features have been incorporated according to the requirements contained in the internal deliverable R2a and appropriate modifications have been made to adapt the application to the needs of the gamers. A detailed upgrade of the changes in gamers’ profile: some outdated attributes referred to anglers have been renamed/ removed and new ones have been added.

The starting point for this development phase was the investigation of requirements collected from the gamer community in the internal document R2. R2 (WP4) contained new features to develop for the second prototype, but it also inherited some anglers’ requirements that had not been taken into account for the anglers’ second prototype. Some new features have been incorporated according to the requirements contained in the internal deliverable R2a and appropriate modifications have been made to adapt the application to the needs of the gamers. A detailed upgrade of the changes in gamer prototype is described in D6.2b and a summary of new features for the gamer prototype is shown in **Table 4** below.

Table 4: Summary of new features in Gamers prototype

Application Component	Functionality	Nature	Related PICOS principle
Profile manager	Gamers profile	Extension	Privacy
Presence manager	Enriched status	Extension	Trust
Contacts management	Contact list sharing	Extension	Trust
Policy Manager	New version.	Improvement	N/A
Privacy Advisor	Enhance Content Awareness.	Extension	Privacy
Public community	Restriction to published content (contact condition)	New	Privacy
	Restriction to published content	New	Privacy

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	(date condition)		
	Content access history	New	Privacy
	Notification of new content available in public-community	New	N/A
Public repository	Restriction to published content (contact condition)	New	Privacy
	Restriction to published content (date condition)	New	Privacy
	Content access history	New	Privacy
	Notification of new content available in public repository	New	N/A
My Files (private room)	Shared-desk	Extension	Privacy
Sub Communities	Restriction to published content (contact condition)	New	Privacy
	Restriction to published content (date condition)	New	Privacy
	Content access history	New	Privacy
	Notification of new content available in Sub Communities	New	N/A
LBS	Social presence awareness (automated blurring)	Extension	Privacy
	Points of interests (POIs)	New	Privacy, Trust
	Information about nearby gamers	New	Privacy, Trust
Advertising services	Creation of advertisements based on commercial POIs (cPOIs) Subscription to advertising services.	New	N/A
Content Sharing	Real chats with files (images)	Extension	N/A
	Archive chats	Extension	N/A
Notifications	Offline notifications	Improvement	N/A
Membership	Revocation	Improvement	Trust

The first version used during the lab tests in Brno and Vienna was the Gamer App v1.3. Following improvements were made during the field trial period and released to the gamers. Three updates of the gamer prototype were sent out during the field trial phase and are described in detail in D7.3.

During the final group discussion the participants in both cities stated that they missed a direct link to the game. Participant's mental model of a gamer community included specific features or processes that were not included into the application. They mentioned that it was even more complicated to use a separated communication platform. The calendar was mentioned once as helpful for organizing players.

The mobile availability was perceived as advantageous for the usage on the way. For this mobile use case the participants stated that a reduced offering of functionalities would be enough. According to this the participants stated that a Web-Frontend would have been interesting for them. As the PC is the main device for the trial participants they are used to a fast text entry by keyboard.

However, whereas the angling community appreciates a direct involvement into their leisure time activities, the gamer rather identified an indirect usefulness (i.e. implementation of the PICOS concepts into existing social communities like Facebook) but not a direct usefulness related to their gaming environment. They criticised the lack of integration with the Travian game which could not be implemented due to a lack of collaboration with Travian providers.

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During the group discussion all features of the gamer prototype were evaluated in detail. A summary of strengths and weaknesses of the improved PICOS privacy and trust features mentioned by the participants in Brno and Vienna are listed in **Table 5** below. The full set of strengths and weaknesses is listed in D7.3.

Table 5: Strengths and Weaknesses of new gamer prototype features

Application Component	Related PICOS principle	Strength	Weakness
Profile manager	Privacy	<ul style="list-style-type: none"> Design of the Drop Down menus 	<ul style="list-style-type: none"> Submit Button should be placed in a more prominent position at the end of the screen (now only in the context menu)
Contacts management	Trust	<ul style="list-style-type: none"> Context menu options (show on map) Add and search contact was easy 	<ul style="list-style-type: none"> Sort options, "Reputation" principle not clear (does the system rate the user?), intransparent mechanisms Indication of contact is member of same SC, To mark and add more than one contact should be possible, Add Button should be displayed below the search results
Policy Manager	N/A	<ul style="list-style-type: none"> Feature makes a lot of sense Changes in policies possible at every time Overview policies 	<ul style="list-style-type: none"> To create a rule for a specific group of contacts (e.g.) should be possible, Finish or Exit Button after finishing to create a rule
Privacy Advisor	Privacy	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Notifications during log out process
Public community	Privacy	<ul style="list-style-type: none"> Useful function 	<ul style="list-style-type: none"> Response time
Public repository		<ul style="list-style-type: none"> Function interesting (publish content accessible for other community members) 	<ul style="list-style-type: none"> Response time No highlighting of new posts
My Files (private room)	Privacy	<ul style="list-style-type: none"> All information on one screen, no scrolling 	<ul style="list-style-type: none"> Preview of file, Directly take a

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		<ul style="list-style-type: none"> needed, Easy to use 	<ul style="list-style-type: none"> picture out of the application, Display properties of file
Sub Communities	Privacy	<ul style="list-style-type: none"> Create new SC was easy Distinction private and public SC (concept) 	<ul style="list-style-type: none"> No feedback when there is a new post in a subscribed forum Response time when loading a post Search Button should be placed below the search field Reduced size of drop downs could be used for content
LBS	Privacy	<ul style="list-style-type: none"> Function interesting especially for mobile app Rich context menu options 	<ul style="list-style-type: none"> Performance (displayed position of user or buddies wrong) and response time Wrong clicks during zooming (buttons too small)
Advertising services	N/A	<ul style="list-style-type: none"> Advertisement (commercial POI) is a promising feature 	<ul style="list-style-type: none"> Didn't work during the tasks
Notifications	N/A		<ul style="list-style-type: none"> Notifications during log out process

A summary of the gathered quantitative and qualitative feedback during the lab tests and field trials can be found in the following section.

3.6.3 Summary of findings and recommendations

The participants were not satisfied with the performance of the application especially the response time and the amount of error messages they got during the trials and field trials. The participants in both Kiel and Brno stated that they missed a direct link to the game. As mentioned above, this could not be provided due to the lack of collaboration. The participant's mental model of a gamer community included specific features or processes that were not included into the application. Only the calendar was mentioned once as helpful for organizing players. In several situations a lack of feedback (e. g. when new messages appeared or new posts in Sub Community) was detected or caused uncertainty about effectiveness of actions (e. g. if a file was uploaded, a message was sent, the profile was submitted).

Participants generally evaluated the PICOS PET features positive and regarded them as the special advantage of the application, e. g. the option to switch between partial identities, although they almost never used this option or blur their location for contacts. But besides the positive perception of the



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PICOS concept, the implementation was criticized. The users reported problems when using PET features. Participants experienced problems to discover how to create a second partial identity, switch between two partial identities or how to set privacy settings affecting specific contacts. In general the users appreciate the implementation of PICOS concepts but see their benefits in a much broader context than in one single community. This will be discussed in the section (PICOS Concept evaluation) in further detail.

Participants of both groups had no problems to find, write and send messages, to register or to upload a file. Some participants experienced the usage of the pen as a disadvantage of the application in comparison to touch interaction. Participants were hindered through several confirmation pop-up dialogs, which had less relevance for them and cause a reduced work flow (e. g. During login the several confirmations of the selected internet connection).

Based on the reported problems and suggestions from the participants during the lab tests and the field trials following central issues which should be improved are formulated:

1. **Improve Performance:**

- Response time; long response time was reported as annoying and caused sometimes crashes of the application because of multiple clicking.
- Reduce amount of error messages

2. **Enlarge size of interaction elements and fonts:** the mandatory usage of the pen was criticized especially on the way. Even when using the pen, the participants reported wrong clicks. Especially the main menu, the top right icons and the navigation on the map was hard to use

3. **Add sort options** to deal with a huge amount of content (e.g. in the message box, contacts menu, POIs)

4. **Improve feedback:**

- If something significant for the user happens in the community (new chat message, new message, new post in a subscribed Sub Community)
- If an action was successful (send a message should be stored in an outbox, submit profile, recommend POI)

5. **Link to the privacy manager**, where access to content could be restricted; e.g. on the screen where a POI or a private Site is created or directly in the contacts menu.

6. **Improve efficient handling of the application by**

- Saving last settings: users complained that the application switched often back to the default settings (online status: offline, location detection off)
- Allowing multiple selection of content (e.g. during adding contacts, in the message box)

7. **Consistent placement of OK and BACK;** avoid especially missing Back options

8. **Improve visual distinction:** in the profile menu it was not clear for the users which information was editable and which not. In the Calendar menu the users stated that past days should be marked in a different colour.

9. **Rearrange screen elements:** central functions on a screen (such as “create identity”, “submit profile”, “start chat”, “join SC” or the “add contact” button were sometimes overlooked by



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the participants. It was suggested to present these important buttons on a prominent location on a screen in the right order of interaction steps.

10. **Improve design:** users stated that the application looks old fashioned, icons should be enlarged and the colouring was criticized as too dark.

User based evaluation of the usability of the second community prototype

The SUS score in both test groups indicate that the participants were not satisfied with the usability of the application. An efficient handling was remarked as important especially by the participants in Vienna, who were more limited in their spare time (due to their demographical background/employment status). Furthermore, they seemed to be more affine to mobile services and due to their ability to afford modern IT technique (caused by their age and employment status) more used to every day usage of smoothly working up to date technologies. This could cause a general dissatisfaction after the long term usage of the PICOS application, which is reflected in the participant's SUS ratings after the field trials.

Evaluation of the qualitative data, which were acquired in Brno and Vienna during the debriefing group discussion and through the online questionnaires, indicated that the participants first of all were frustrated by the bad performance of the system. The participants of both test groups complained about the long- response time of the system which was frustrating for them. They received unexplained error messages, which caused the feeling of uncontrollability.

Although it was announced before the lab tests and field trials that the application is still on a prototype level and some participants seemed to be experienced in programming (especially in Brno) and could deal with the content of the error messages, the participants mentioned that the frequently appearing error messages were annoying for them. This main focus on response time is probably based on the fact that especially the response time of a communication platform for Travian gamers is central with regard to the relevance for gamers to react and communicate very fast. Furthermore, the response time is an underling factor for the feeling of barrier free interaction with a technical system which has a huge impact on the user satisfaction.

One additional central point of critique by the users was that the application lacks giving feedback what's going on in the community. The users reported that they were not informed when they received a new message or if new content was posted in the communities and Sub Communities. They were forced to go through the whole application to check for news. This had implications for the communication between the community members during the whole trial period. The participants made several suggestions for improvements, e.g. a highlighting of the menu tab as an indication of a new event or to use the home screen to display news. The actual content of the home screen is redundant if an ordering option in the contacts menu would be added. The highlighting of news is a central issue in a social community platform which improves the efficient handling and increases the on-going exchange with community members. The lack of indication of new content led to reduced communication and therefore decreases the interaction with community members and exploring the PICOS functionalities in detail. Regarding the communication tools in the PICOS application the participants stated that a chat was started in only a few cases. This was caused by a wrong indication of the online status of participants. This was probably related to the fact that several users didn't logout correctly. This happened when the application crashes. The Message Box as central communication tool for the trial conductor receives a lot of critique (limitation of characters in the message box, disappearing of messages) and suggestions for improvements were made (Outbox, ordering of old and new messages, highlighting of unread messages). The participants stated that due

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to the difficulties with the communication tools of the PICOS application they switched rather to generic Travian communication tools.

In general, the participants complained about the exhausting text entry, which was too time-consuming. According to the participants, a Web-Frontend would have been interesting for them. As the PC is as main device for the trial participants for playing Travian they are used to a fast text entry by keyboard. The mobile availability was perceived as advantageous for the usage on the way. Especially location based services (such as POIs and map functionalities) were mentioned as useful on the way. For a mobile use case, the participants stated that a reduced offering of functionalities would be enough.

Another issue which is related to the usability of the device was the keyboard for the text entry. When the user wants to type, the screen changes several times depending on what keyboard version is used. Several screen changes during one interaction with a system (e.g. during the login to the PICOS gamer app) increases the work load of the user because the user is forced to remember the initial screen.

Due to the above mentioned importance for gamers to react and communicate fast, the participants in both groups made several suggestions to improve efficient handling of the PICOS application. Additional ordering and filtering options, e.g. in the Contacts menu or in the message box, were requested and could lead to and less time demanding and more efficient. Additional ordering options, e.g. for POIs, were mentioned as important for the users in expectation that the community and the posted content will grow. The participants reported that the application lacks to save setting as the location setting or online status. The participants experienced the resetting of status information every time after login as annoying.

Furthermore the participants complained about the pen-orientated usage of the application which is especially complicated to use on the way. The size of the screen elements, such as scroll bars and the main menu tabs, was criticized and should be enlarged, so that the application is operable by touch in an ore easier way. In contrast, the size of the drop down menus (e.g. in the profile menu) was appreciated. This is probably caused by the participants experience with today's mobile devices and applications, which are often touch operated. One user suggested placing the main menu options on the home screen. This suggestion was based on his/her experience with the iPhone. Before lab test and field trials, it was announced to the participants that the PICOS application is still on a prototype level. Nevertheless the participants evaluated the application referring to their experiences.

Regarding the usability of the GUI of PICOS gamer application, the participants made several suggestions during the lab tests and after the field trials. During filling out profile information the participants reported problems to differentiate between editable and non-editable information. The calendar doesn't meet the expectations of the users who assume to find a calendar on the first screen and not a screen where the user could set a status. The participants mentioned that they missed from time to time a back option (e.g. in the Wizard of the Privacy Rule creation). An absent Back option has proved effects on the user experience, which is to be caught in a blind alley.

Additionally, some rearrangements of screen elements especially during the lab tests were requested e.g. when searching and adding a contact the "Add" button was assumed below the search results. The list Sub Communities was expected to be displayed below the search field. The "Submit" option in the profile manager was criticized as to hidden. The participants in both groups remarked that double and single click caused different actions (e.g. to open content by single or double click). This should be implemented in a consistent manner.

In contrast, the Registration and My files screen was evaluated as clear and well arranged. Rich context menu options in the map and contacts menu were appreciated by the participants. Especially

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the map functionalities were mentioned as most interesting to use. To add a contact or the Sub-Community screens were easy to handle for the participants and should be maintained.

PICOS Concept evaluation

As the quantitative data indicate, the participants in Brno and the participants in Vienna were already very sensitive on privacy and trust issues. This was additionally confirmed for instance by the fact that three participants in Vienna denied their signature to be videotaped during the discussion sessions.

In general, the PICOS concepts were evaluated as very positive. The participants appreciated the several possibilities to control their release of data on a very granular level, which was perceived as not common within a social community. On a concept level, the participants were interested in the partial ID concept and the blurring functionality. Regarding the blurring function, the users mentioned that the blurring could be improved by adding a broader range to blur their position or set a range by their own.

The Privacy Manager received some positive feedback, which was that it gives a good overview on the already applied rules. The tab structure of the Privacy Manager was positively evaluated as well. During the usage (especially during the lab tests), the participants had problems to find where to create a privacy rule. The Privacy Manager functionalities were assumed in the main menu (e.g. in the context menu of the Contacts menu) because the functionality of the Privacy Manager always effects the contacts (in fact their access rights to personal data of the user).

Main critique received the notifications (Privacy Adviser function) which appeared. The notifications were displayed, when the participants wanted to logout and were perceived as annoying due to the timing and their amount. Notifications should appear more unobtrusively during the usage of the PICOS application.

The participants stated that during the trials they made only little usage of the PET features. This was caused by different reasons. The participants stated that they did not create additional partial IDs to avoid an increased amount of notifications and they evaluated it as confusing to have several partial IDs and additionally their Travian pseudonym. As Travian gamers, they have already a pseudonym and for joining the Travian community or participating in a game, no personal data entry is requested. Some of the users stated that they did not enter profile data (e.g. profile data) at all, when they wanted to keep it private. The gamers questioned the data security on server side and raised the question where their profile data is saved. They had concerns that if they fill out several profiles all the saved data would give a full overview on their personal data. This indicates that from a user perspective the feeling of privacy and trust is not only satisfied by individual possibilities to control the release of private data but also a question of the storage of data.

Furthermore the participants reported that in the context of the trials they were not afraid to release private data because they trusted the other trial participants. If private communication was necessary they used the private Sub Community.

Regarding the Reputation system the users stated that it was not clear to them how the reputation was calculated. One user in Brno assumed that the application rate the person itself. This confusion is probably related to the placement of the reputation which is displayed directly next to the pseudonym and the avatar and not to the rated content. The reputation was implemented with the aim to give the users a hint regarding the reliability of content and followed the example of commercial reputation systems of e.g. Amazon and Ebay. To what extend a reputation system could be adapted from a commercial platform and how this could be implemented in a social community context is a question for further research.

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Concluding, the gamers were interested in the PICOS PET features. They would appreciate their implementation in a broader application context, e.g. as an add-on in popular social communities, such as Facebook.

4 Conclusions

As stated in the introduction, the objective of this present PICOS Deliverable D8.2 “Legal, economic and technical evaluation of the second platform and community prototypes” was to conduct a comprehensive evaluation of the research results of the *second* cycle platform architecture, platform design, service prototype construction and trialling of the PICOS project. This deliverable built upon the path set by PICOS Deliverable D8.1, in which a legal, economic and technical evaluation of the work performed during the *first* cycle of the PICOS project was carried out.

This deliverable followed a dual structure. Firstly, under section A, the evaluation focused on the maturing of the prototype implementation of the PICOS platform and on the deployment for the second version of the Angling Community Prototype. The **upgrade of the PICOS Angling Community Prototype** (v2.5) consisted mainly in the improvement of the first PICOS Angling Community Prototype with regard to usability issues, as it was been specified in section A1 of this present deliverable. Therefore the upgrade of the prototype focused mainly on answering usability-related questions that arose during the lab tests and the field trials of the first PICOS Angling Community Prototype rather than on the implementation of new functionalities. This has been reported in the legal, assurance, technical and economic evaluation of the PICOS Platform and Angling Community Prototype upgrade, which found that the results of the respective evaluations of the first PICOS Angling Community Prototype were still valid.

However, the usability evaluation of the PICOS Angling Community Prototype upgrade rendered interesting results, exactly because usability was the focus of the actual upgrade. The usability evaluation resulted in a number of recommendations that should be taken into account for the development of the Gaming Community Prototype. These recommendations aimed at improving the usability of the PICOS prototype by the users and the better acceptance of the PICOS concepts and included: Improved performance, feedback times and information content at the home screen, provision of information to the user about incoming messages or chat messages, reduction of specifications at the mobile application, enrichment of information (e.g. add examples) on privacy functionalities of the application, improvement of the layout and functionality of the message box, as well as of the highlighting of different chat participants and scroll-bars, highlighting of important interaction elements, possibility to invite offline contacts to a private sub-community to support private communication, enhancing of actions relating to pictures, Improvement of map functionalities, addition of a privacy wizard to the Privacy Manager to create a rule, improvement of graphic design, development of mobile application for other mobile devices and removal of the settings for logout from the login screen or highlight it. With regard to the web frontend the usability evaluation revealed a request from the users that it should contain all functionalities of the mobile application and suggested an improvement in the consistency of web frontend and mobile application, so that they look similar concerning the graphical design.

Secondly, under section B, the present evaluation focused on the second version of the PICOS Platform design and architecture, the PICOS platform prototype and the PICOS Gaming Community Application Prototype. The work under section B was divided into three major parts which each evaluated three research areas PICOS has been working on during the second cycle and corresponded to the respective workpackages. These three parts evaluated here were (1) the Platform Design and the

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Architecture (WP4), (2) the Platform Prototype (WP5) and (3) the Gaming Community Prototype (WP6).

The evaluation of the **second PICOS Platform Design and Architecture** presents significant improvements compared to the first one. The assurance evaluation revealed that the PICOS Architecture meets the privacy requirements in a satisfactory way, but further improvements can be made with regard to trust, especially in relation to the reputation system used in PICOS. The technical evaluation rated the second PICOS Platform Design and Architecture as a considerable improvement of first architectural documentation (D4.1) and made some suggestions that could give the architecture document more insight on each component and its work and the interaction between components, especially for more enhanced use cases. Finally, it was suggested that the content sharing use cases can be split in offline content sharing and online content sharing, and that use cases (for instance, where users are offline and do not react immediately) are considered. The economic evaluation found that the second PICOS Platform Design and Architecture was extended by an economic perspective, especially focusing on “Targeted Advertising” as a marketing feature and that the needs of users and marketers, as well as privacy considerations, were taken into account. Although communication information was integrated into the advertising process, it was not described in detail how context and communication contribute to targeted ads in given situations. Therefore the economic evaluation recommended that further research has to be conducted in this area, to fully understand the mechanisms. The legal evaluation focused on the PICOS implementation of the Business to Consumer (B2C) Communication for advanced targeted advertising that was first introduced in the second PICOS Platform Design and Architecture. The legal evaluation concluded that some modifications are required for the system to be fully legally compliant: the user should be provided with clear and comprehensive information and his consent should be obtained before the social network provider realises any matching activity. Also, the user should be given the opportunity to amend the targeted advertising rule and object to the further processing of his information for targeted advertising purposes. Finally, from a legal point of view it is recommended that viral marketing methods not be implemented in PICOS.

The documentation on the **second PICOS Platform Prototype** (D5.2b) was in general criticised, as it did not follow the structure used in the first PICOS Platform documentation (D5.1) and in this way the current structure left it unclear for the reader to understand the changes made in the second PICOS Platform Prototype. However, the actual PICOS Platform Prototype was found as a solid basis for the user trials with a limited number of participants, with some potential for improvement regarding the alignment of interfaces. The technical evaluation revealed a need for “tidying up” all interfaces in order to have a consistent and unambiguous naming convention. From the economic point of view, the platform integrates the requirements of the user and the marketers. The economic evaluation concluded although the second PICOS Platform Prototype implemented a set of capabilities around trust and privacy without disabling business applications, privacy features as multiple identities and privacy advisor are still not supported. As flexibility and interoperability are central success factors for future platforms, they should be taken into account. As the implemented functionalities for marketers did not negatively affect the trust and privacy principles, the second PICOS Platform Prototype is able to take a role as an Intermediate in regards to sharing of personal data for marketing and advertising activities. Finally, the legal evaluation revealed that Article 9 of the ePrivacy Directive that regulates the processing of location data for the provision of value added services is not applicable on the PICOS service and that therefore the processing of location data has to be done in accordance with the general provisions of the Data Protection Directive.

The last part of the second section of the evaluation deliverable was dedicated to the evaluation of the **PICOS Gaming Community Application Prototype**. The assurance evaluation showed that the

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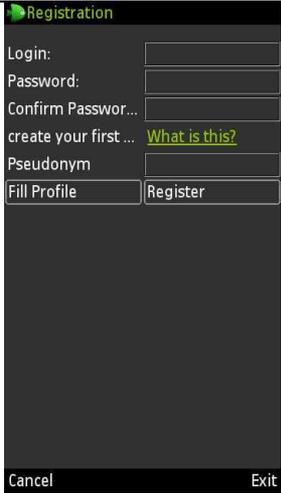
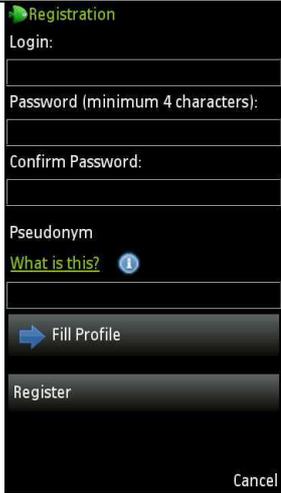
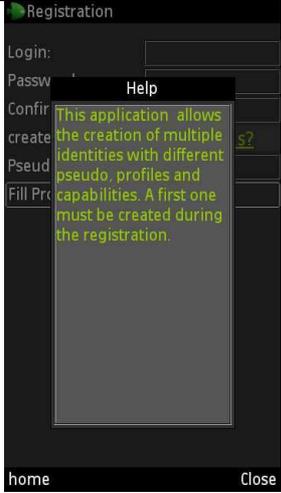
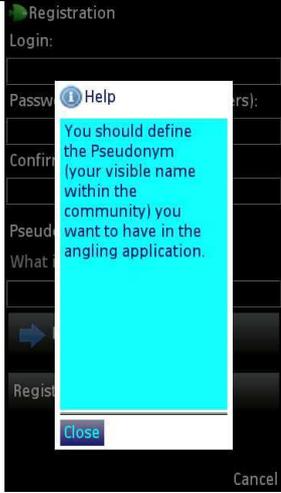


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privacy requirements are met by the PICOS Gaming Community Prototype in a satisfactory way, as far as those requirements are met satisfactorily by the platform server. Although security measures were found to be appropriate, trust may be enhanced by increasing transparency for the user of both the reputation system and the notion of partial identity. The technical evaluation revealed that all technical requirements have been addressed and implemented in the PICOS Gaming Community Prototype. However, some more information about the technical realization would be appreciated. Additional information would help users to better understand the features and to give a more substantiated feedback for improvements and to figure out and describe more precisely the problems they have had. The angler application suffered from the missing community functions that were needed to build a community before starting with the more privacy related and from PICOS perspective interesting features, something that is improved in the Gaming Community Prototype. It was reported that some functions suffer from platform limitations, but these limitations are of course explainable by the prototypical character of the whole application. The economic evaluation found that the PICOS Gaming Community Prototype in its current state and its user centric view complies with the set of trust and privacy principles, and at the same time provides functionalities to make use of the social capital as value of the community. The implemented advertising feature, however, does not go as far as gathering anonymous cross-sectional data from the platform, which would then be provided to the marketers in form of different target profiles or target groups. From a legal perspective, it was found that the PICOS Gaming Community Prototype ensures a legally compliant application that respects the privacy of its users, as it largely relies on the PICOS implementation for the anglers' prototype that has received a very positive legal evaluation. Detailed information that was provided to the users through the PICOS Gaming Community Terms & Conditions, the Privacy Policy and the Consent form ensures maximum protection of the users and the adherence to the relevant data protection legislation. Positive with regard to the privacy of the users was the introduction of the revocation feature in the implementation of the Gaming Community Prototype which allows the removal of names of users from content that was posted by users that wish to leave the community. The usability evaluation revealed that there are still improvements to be made in the PICOS Gaming Community Prototype (and future PICOS Applications). The PICOS concepts relating to privacy and trust were generally evaluated in a positive way and were regarded as the special advantage of the application, e. g. the option to switch between partial identities, although they almost never used this option or blur their location for contacts. Despite the positive perception of the PICOS concepts, the usability evaluation revealed that their implementation should be enhanced and improved.

Appendix 1

Table 6: comparison angler app v1 and v2 registration screens

	Angler App v1	Angler App v2
Registration Screen		
Help information		



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Profile completion

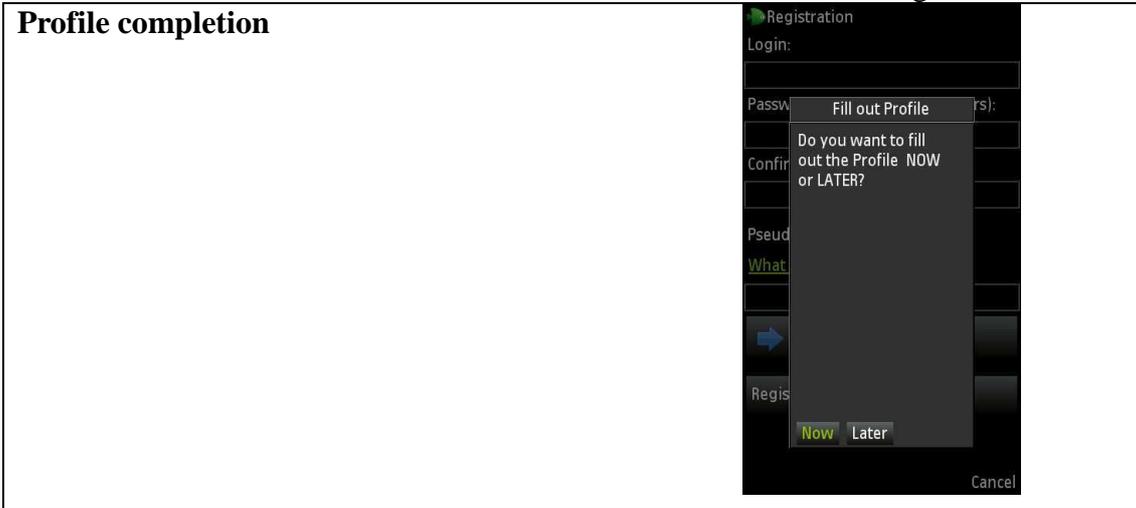


Table 7: comparison angler app v1 and v2 login screens

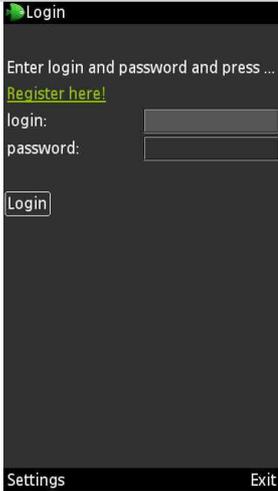
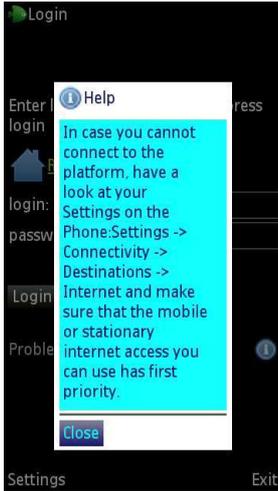
	Angler App v1	Angler App v2
Login Screen	 <p>The screenshot shows a dark-themed login screen. At the top, it says 'Login' with a green arrow icon. Below that is the instruction 'Enter login and password and press ...'. There is a green link 'Register here!'. Below are two input fields labeled 'login:' and 'password:'. At the bottom is a 'Login' button. The bottom navigation bar has 'Settings' and 'Exit' options.</p>	 <p>The screenshot shows a dark-themed login screen. At the top, it says 'Login' with a green arrow icon. Below that is the instruction 'Enter login and password and press login'. There is a blue house icon followed by a green link 'Register here!'. Below are two input fields labeled 'login:' and 'password:'. At the bottom is a 'Login' button. Below the button is a green link 'Problems to log in or register?' with an information icon. The bottom navigation bar has 'Settings' and 'Exit' options.</p>
Help information		 <p>This screenshot shows the same login screen as the previous one, but with a cyan help overlay box. The overlay has a title 'Help' and contains the following text: 'In case you cannot connect to the platform, have a look at your Settings on the Phone: Settings -> Connectivity -> Destinations -> Internet and make sure that the mobile or stationary internet access you can use has first priority.' There is a 'Close' button at the bottom of the overlay. The background login screen elements are partially visible behind the overlay.</p>

Table 8: comparison angler app v1 and v2 partial ID manager screens

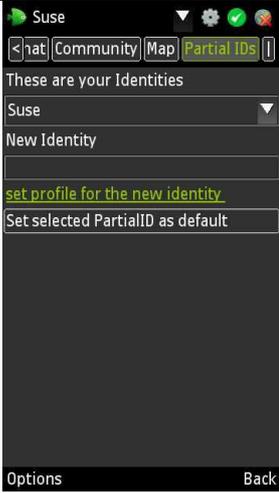
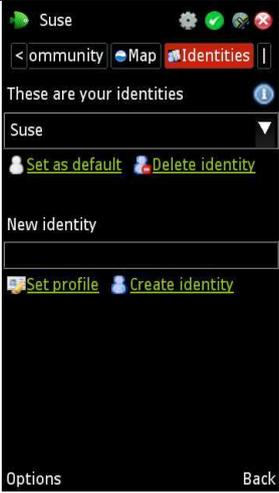
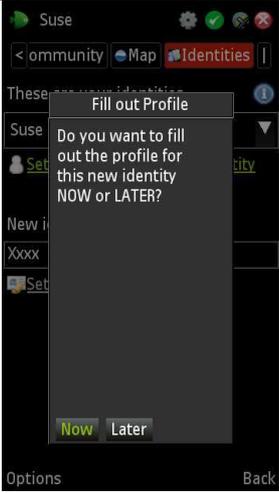
	Angler App v1	Angler App v2
Partial Identity Menu Screen		
Complete Profile		

Table 9: comparison angler app v1 and v2 profile screen

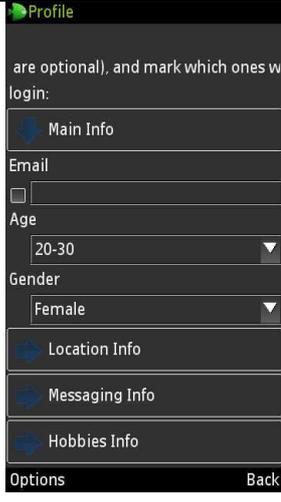
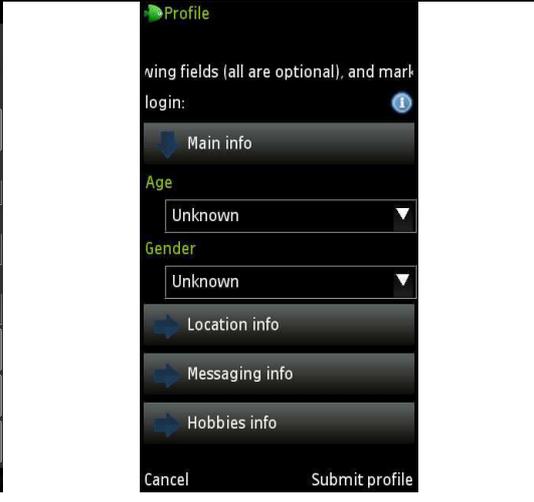
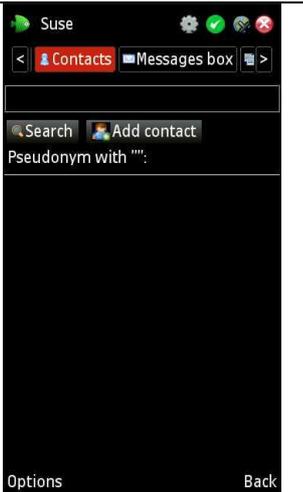
	Angler App v1	Angler App v2
Set Profile Screen	 <p>The screenshot shows a 'Profile' screen with a title bar. Below the title, there is a line of text: 'are optional), and mark which ones w login:'. This is followed by a 'Main Info' button. Below that are three input fields: 'Email' with a checkbox, 'Age' with a dropdown menu showing '20-30', and 'Gender' with a dropdown menu showing 'Female'. At the bottom, there are three more buttons: 'Location Info', 'Messaging Info', and 'Hobbies Info'. The footer contains 'Options' and 'Back'.</p>	 <p>The screenshot shows a 'Profile' screen with a title bar. Below the title, there is a line of text: 'wing fields (all are optional), and mark login:'. This is followed by a 'Main info' button. Below that are two dropdown menus: 'Age' showing 'Unknown' and 'Gender' showing 'Unknown'. At the bottom, there are three buttons: 'Location info', 'Messaging info', and 'Hobbies info'. The footer contains 'Cancel' and 'Submit profile'.</p>

Table 10: comparison angler app v1 and v2 contact screens

	Angler App v1	Angler App v2
Contacts Menu Screen	 <p>Screenshot of the Contacts Menu Screen in Angler App v1. The screen shows a list of contacts with a search bar at the top. The contacts listed are: fishing azi (reputation 4/5), hase12 (reputation 5/5, location: Wien (Österreich)), Tinitus (reputation 3/5), Dr.Esox (reputation 4/5, location: Wien (Österreich)), and Astonym1. The 'fishing azi' contact is highlighted.</p>	 <p>Screenshot of the Contacts Menu Screen in Angler App v2. The screen shows a list of contacts with a search bar at the top. The contacts listed are: fishing azi (reputation 4/5), hase12 (reputation 5/5), Tinitus (reputation 3/5), Dr.Esox (reputation 4/5), Astonym1 (reputation 3/5), and Seatrout (reputation 3/5). The 'fishing azi' contact is highlighted in red.</p>
Search for Contacts	 <p>Screenshot of the Search for Contacts screen in Angler App v1. The screen shows a list of contacts with a search bar at the top. The contacts listed are: fishing azi (reputation 4/5), hase12 (reputation 5/5, location: Wien (Österreich)), Tinitus (reputation 3/5), Dr.Esox (reputation 4/5, location: Wien (Österreich)), and Astonym1. The 'fishing azi' contact is highlighted.</p>	 <p>Screenshot of the Search for Contacts screen in Angler App v2. The screen shows a search bar with the text 'Pseudonym with ""'. There are buttons for 'Search' and 'Add contact'.</p>

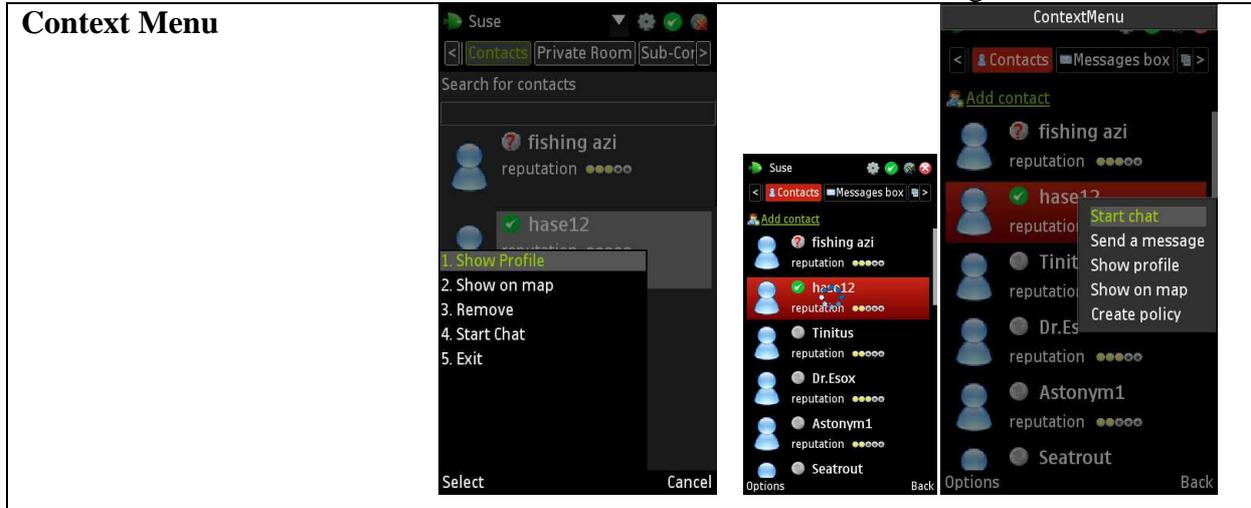
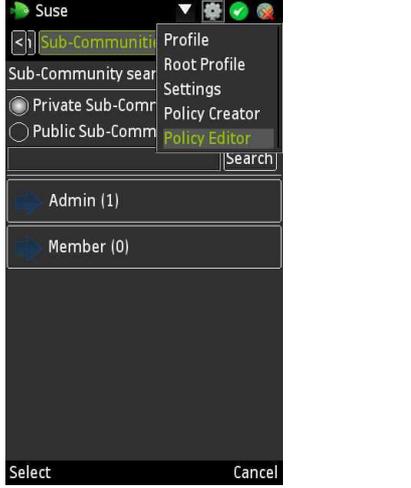
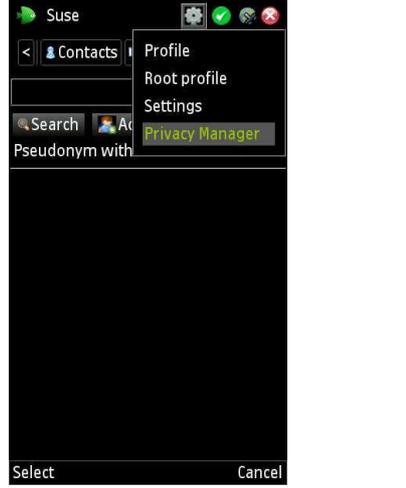
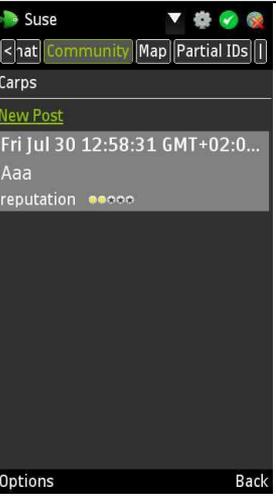


Table 11: comparison angler app v1 and v2 policy manager screens

	Angler App v1	Angler App v2
<p>Policy Editor/Privacy Manager</p>		

<p>Policy Creator/Privacy Wizard</p>		
		

Table 12: comparison angler app v1 and v2 of editing a post in the public community thread

	Angler App v1	Angler App v2
<p>Change post</p>		

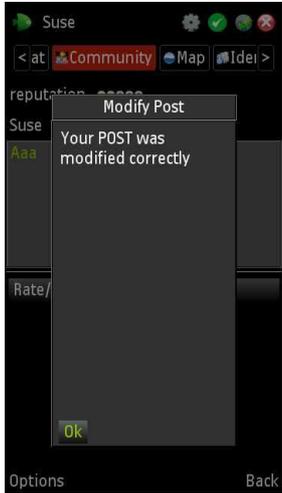
 <p>post description reputation ●●●●● Aaa</p> <p>Rate/Comment</p> <ol style="list-style-type: none"> 1. see content attributes 2. see attached file 3. Back 4. Exit <p>Select Cancel</p>	 <p>Suse < at Community Map Idei ></p> <p>reputation ●●●●● Suse said: Aaa</p> <ol style="list-style-type: none"> 1. Changed Attached File 2. Submit changes 3. see content attributes 4. see attached file 5. Back Posts <p>Select Cancel</p>  <p>Suse < at Community Map Idei ></p> <p>reputation ●●●●● Suse Aaa</p> <p>Modify Post Your POST was modified correctly</p> <p>Ok</p> <p>Options Back</p>
---	---

Table 13: comparison angler app v1 and v2 of public repository screens

	Angler App v1	Angler App v2
<p>Public Repository</p>	 <p>Suse < at Community Map Partial IDs </p> <p>Catch Reports</p> <p>Thu Apr 29 08:43:18 GMT+02:00 2010 Description: Catch Reports of the Public Community</p> <p>Founder: Add Content</p> <p>Sat Jun 19 15:51:19 GMT+02:00 2010 Title: 020420101... Owner: TruttenT... Description: Regenbogenforelle</p> <p>Delete Rate</p> <p>●●●●● (1)</p> <p>Options Back</p>	 <p>smtp < at Community Map Iden ></p> <p>Founder: smtp</p> <p>Add content Update Attributes</p> <p>Content B Wed Mar 23 2010, 02:58 created by smtp</p> <p>Description B</p> <p>Location: <input type="text"/> <input type="text"/></p> <p>Delete Rate & Comment</p> <p>Options Back</p>



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Table 14: comparison angler app v1 and v2 general GUI screens 1

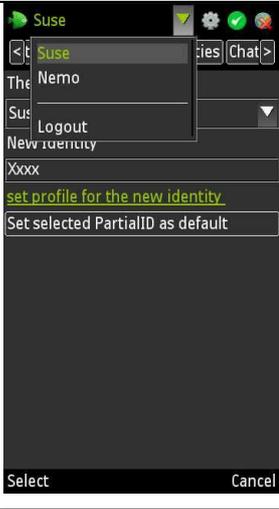
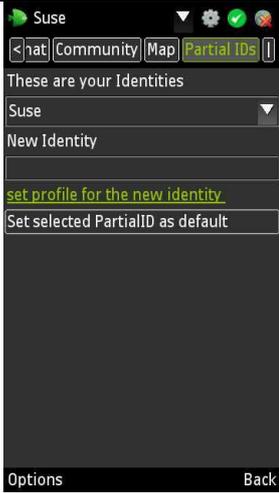
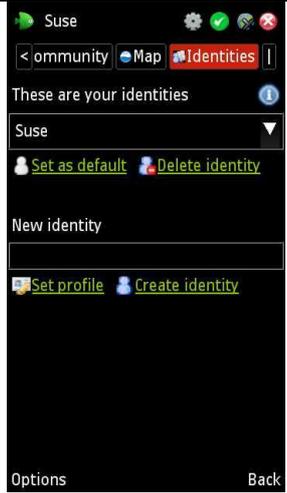
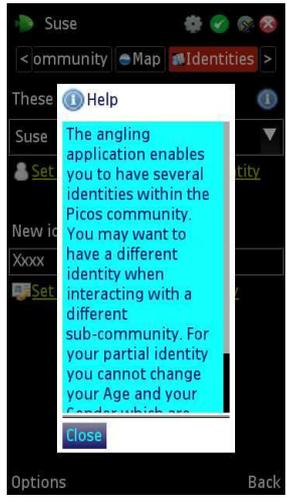
	Angler App v1	Angler App v2
<p>Menu Bar Improvement</p>		
<p>Partial Identity Menu Screen</p>		 

Table 15: comparison angler app v1 and v2 general GUI screens 2

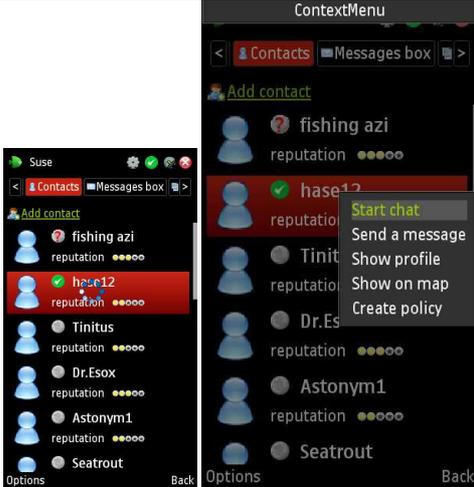
Angler App v1	Angler App v2
<p>Improved highlighting</p> 	
<p>Context menu</p> 	

Table 16: comparison angler app v1 and v2 navigation bar

	Angler App v1	Angler App v2
Profile and privacy settings		
Presence status		
Location setting		



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Logout functionality

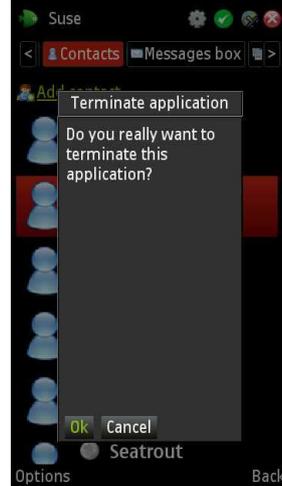


Table 17: comparison angler app v1 and v2 home screen

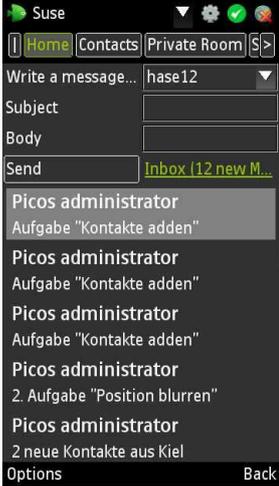
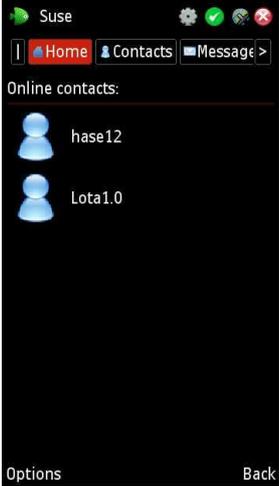
	Angler App v1	Angler App v2
Home Screen	 <p>The screenshot shows the 'Write a message...' screen in Angler App v1. The recipient is 'hase12'. The 'Send' button is highlighted, and a list of messages is visible below, including several from 'Picos administrator' and one from '2. Aufgabe "Position blurren"'. The bottom bar contains 'Options' and 'Back'.</p>	 <p>The screenshot shows the 'Online contacts:' screen in Angler App v2. It lists two contacts: 'hase12' and 'Lota1.0'. The bottom bar contains 'Options' and 'Back'.</p>

Table 18: comparison angler app v1 and v2 message box screens

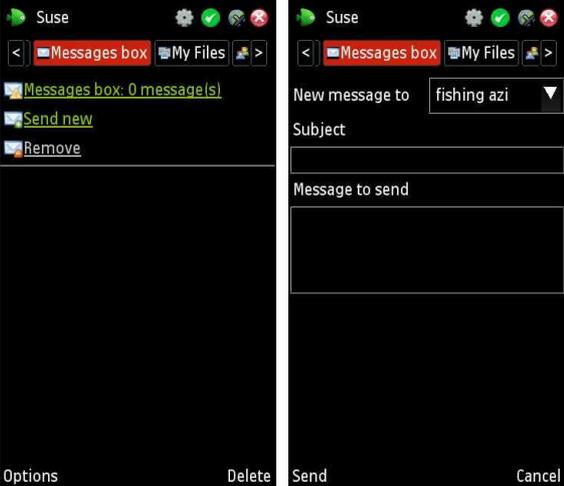
	Angler App v1	Angler App v2
Write a message	 <p>The screenshot shows the 'Write a message...' screen in Angler App v1. The recipient is 'fishing azi'. The 'Send' button is highlighted, and a list of messages is visible below. The bottom bar contains 'Show' and 'Exit'.</p>	 <p>The screenshot shows the 'Messages box' screen in Angler App v2. It displays 'Messages box: 0 message(s)' and options for 'Send new' and 'Remove'. The bottom bar contains 'Options', 'Delete', and 'Cancel'.</p>

Table 19: comparison angler app v1 and v2 chat screen

	Angler App v1	Angler App v2
Starting a chat		