Towards a user-centric IAM entitlement shop - Learnings from the e-commerce

Markus Hornsteiner
University of Regensburg
93053 Regensburg, Germany
markus.hornsteiner@stud.uni-regensburg.de

Sebastian Groll
University of Regensburg
93053 Regensburg, Germany
sebastian.groll@ur.de

Alexander Puchta
Nexis GmbH
93053 Regensburg, Germany
alexander.puchta@nexis-secure.com

ABSTRACT

Nowadays, the use of identity and access management systems is the norm in large organizations. Therefore, great efforts are made in science and practice to ensure that these systems will cope with their tasks in the future. However, from a scientific point of view, an important part of the systems has been neglected so far: the user who uses the systems for ordering software or authorizations daily. Therefore, this paper first examines through a survey the challenges these users face and then presents opportunities on how these challenges can be solved. For this, concepts from e-commerce are used, as there are various mechanisms which are already studied both in science and practice.

CCS CONCEPTS

• **Security and privacy** → *Usability in security and privacy*; **Access control**.

KEYWORDS

Identity and access management, usability, transferring concepts, entitlement shop, IAM

ACM Reference Format:
Markus Hornsteiner, Sebastian Groll, and Alexander Puchta. 2020. Towards a user-centric IAM entitlement shop - Learnings from the e-commerce. In *13th International Conference on Security of Information and Networks (SIN 2020), November 4–7, 2020, Merkez, Turkey*. ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/3433174.3433585

1 INTRODUCTION

Identity and access management (IAM) systems have become essential in the IT infrastructure of large companies. IAM systems are used, among other things, to grant users access to resources of IT systems or to assign users licenses for software. The complexity of these systems is constantly increasing as the world around them continuously changes [4, 6, 10, 14]. A great deal of research is carried out in the scientific community to ensure that authorization workflows are adapted to constantly changing conditions [4, 8, 12]. To the best of our knowledge, however, one area of IAM systems, has so far received little attention from the scientific side: the user who is required to work with these systems on a daily basis. In this context, a user is a member of the group of people who are managed by the IAM systems. Besides managing user's authorization, advanced IAM systems offer self-service portals in which the individual user can take an active role and order authorizations or licenses independently. These portals, such as the One Identity self-service access portal[1] serve as an interface between the user and the actual IAM system. These portals offer users services such as independent modification of personal data, ordering software packages, applying for access rights or, depending on the characteristics of the IAM system, other services. We refer to these portals in the following as entitlement shops. The content that can be requested by users via the entitlement shops is referred to as *r*esources.
This work aims to identify the challenges users of entitlement shops are facing and to find solutions using concepts from e-commerce. We use concepts from e-commerce, because our research indicated, that the general processes of those are similar to entitlement shops. This is explained in more detail in Section 4. The present paper is structured as follows. In the first step, unstructured interviews with users of entitlement shops were conducted. These answers were used to create a survey. Then the results of our survey are interpreted in Section 3. In Section 4, we show ways in which the challenges identified could be solved using concepts from e-commerce.

2 RELATED WORK

IAM systems are nowadays a de-facto standard application in medium and large-sized companies. As a result, a great deal of research has been carried out to ensure that IAM is always adapted to current requirements and prepared for future demands. To the best of our knowledge, this research has never focused on user-centric entitlement shops. Jaferian et al. [8] describe a way to improve the verification of access rights, which can be seen as an improvement in the usability of these systems. But even this research does not aim at the users, who are concerned with requesting resources but rather to managers and executives, responsible for reviewing access privileges. We address this issue by drawing from literature and concepts of the e-commerce research realm. Koren and Bell [9] show how collaborative filters have helped to significantly improve the suggestions that recommender systems make for customers in e-commerce. In their work, Abbattista et al. [1] demonstrate how a simple content-based recommender system can already produce useful suggestions in e-commerce and thereby increase user

[1] One Identity's "self-service access portal" https://www.oneidentity.com/products/identity-manager/

SIN 2020, November 04–07, 2020, Istanbul, Turkey

ACM ISBN 978-1-4503-8751-4/20/09…$15.00
https://doi.org/10.1145/3433174.3433585

satisfaction. Thorat et al. by applying a framework, Eskildsen & Kristensen [5] suggest that service transparency is an important part of customer satisfaction. These areas already researched in e-commerce have not yet been addressed in IAM research, so users of these systems do not yet benefit from systematic research on better usability.

3 INVESTIGATE USERS CHALLENGES

Before conducting our survey, we interviewed employees of companies using IAM systems with entitlement shops. We talked to them about the benefits these systems bring to their daily work, as well as the challenges they face in general and how they experience the interaction with the entitlement shops. It became clear that a lack of transparency and little support in search processes is a challenge for the users. Based on the questions raised in the interviews, a questionnaire was then developed to collect users' opinions of the entitlement shops.

3.1 Conduct of our survey

We created this survey based on the positive and negative information we had found through the previous unstructured interviews in order to quantify the problems and create a database on which to base further research efforts. In total, we asked 21 questions to the participants. The amount of questions was chosen to get more answered questionnaires and to avoid the fatigue of the participant. The questions were divided into four areas and structured as follows:

General questions. Questions about the industry, company size, and position of the respondent. Additionally, general questions on frequency of use and parameters such as feeling towards the entitlement shop and how often it was able to help.

Time related questions. Time related questions on search duration and duration of resource provision. For example, how long does a user need on average to find the resources she was looking for. Also, how long does it take on average until the requested resource was authorized and to find a contact person in case of a problem.

Usability related questions. Questions about how easy it was to use the companies entitlement shop and search for resources.

Information quality. Questions about the availability, quality, timeliness, and relevance of the resource information provided.

3.2 Findings

We conducted our survey using an online survey tool and collected responses over a period of one month. All ten of the participants work in companies that have at least 1.000 employees. Five of the respondents work in companies related to the automobile industry, one work in a company in the trade, and four are employed in the IT industry. In the following we summarize the results of the conducted survey: Most of the users have the feeling that the entitlement shops can help them and have an indiscriminate attitude towards them. They find it easy to navigate around and, provided they know what they are looking for, they have no problems finding it. However, the ease of finding the required resource diminishes if users do not know exactly what they are looking for, but are given a task to solve. For example, when they have to edit a photo without being told that one need photo editing software to do it. Here difficulties arise to find relevant resources. This could be related to the fact that on average the information given by the entitlement shops on the individual resources was not particularly relevant. Another major problem for users is also related to the information available. After submitting a request the users do not know how long the authorization workflow would take. Furthermore it is also very difficult for them to find out in advance. For example, one user told us in the interviews that *"if you're unlucky, they're on vacation, and then you have to wait without being able to do anything"*. This again underlines the problem that the entitlement shops do not allow enough transparency towards the user. To address these problems, in the following section we suggest well-established concepts from e-commerce which can be adopted to entitlement shops in order to address these issues.

4 APPLYING CONCEPTS FROM E-COMMERCE TO ENTITLEMENT SHOPS

The work is based on the assumption that the entitlement shops are functionally similar to e-commerce. Therefore, findings from e-commerce can be transferred and profitably applied. In both worlds, users can search for products or content, select what they want and then request it. The factors for delivery then differ depending on the context. For example, if you take Amazon as a basis, goods are always delivered to a buyer if she can pay for them. In the entitlement shops, the relevant factor that determines the delivery of a product is not whether a successful payment has taken place, but whether the customer has been approved to get the authorization. On an abstract level, the requesting process is the same except for the determinant that controls whether the requested item is delivered or not.

The procedure within this section is as follows. First, we explain a concept from e-commerce using an example and explain how it has led to better user-friendliness. We then show which of the problems we have identified can be solved by this concept. Finally, we explain utilizing an example, how the concept can be used to solve this problem.

4.1 Recommendation of suitable resources

Recommender systems have to provide personalized information about items to a user, which are likely to be of use to her [3]. In the field of e-commerce, the recommendations that are provided to the user by such systems most likely include products or services. In the context of entitlement shops, the items that should be recommended by the system are software licenses and access to certain network resources as described in Section 1. Since our survey shows that users have problems finding suitable resources if they do not know exactly what they are looking for, we examined e-commerce for concepts that could be applied in these cases.

4.1.1 Collaborative filtering. Collaborative filtering (CF) is used for producing user-specific recommendations based on explicit or implicit feedback from other users about items [9]. One of the best-known examples for CF are associations as they are commonly known from Amazon. These associations are structured like the following example: "Customers who bought product x also bought product y" [11]. In e-commerce, this concept is used to make more

relevant suggestions to customers. One problem we found in our survey is that when users are looking for a resource to solve a specific task, they do not feel adequately supported by the entitlement shop. However, it is very unlikely that a user in a certain position will get a task that no one else has ever solved before. Therefore, by CF, the system can provide the user with a perfect suggestion for the problem she needs to solve. Newly recruited employees can be provided with relevant resource recommendations when they join the company and set up their accounts for the first time based on the resources their co-workers or predecessor have requested. A second potential use case is utilizing CF to create new recommendations after a user requests a new resource. For example, if a user requests software for creating presentations, she could be provided with a recommendation on also requesting access to the network drive where the company templates are located. This has the benefit that employees no longer have to search for resources for a long time, but can start work faster, which increases their productivity.

4.1.2 Content-based filtering. A content-based filter recommends items based on preferences of the user and the content of an item, while collaborative filters recommends items based on the correlation between people with similar preferences [16]. There are again two approaches of content-based filtering. Both generate a model of the user utilizing attributes such as age, gender, origin, interests and additionally monitor activities like search queries or the time spent on a specific website. The resulting model of the user, which reflects her interests, is then used to compare it with the information of the offered goods using mathematical models and to offer them to the user based on these models [17]. This model is used in e-commerce for example to make book suggestions to a customer based on their previous activities. This can increase the user's satisfaction and thus the probability of purchase [1]. To improve entitlement shops, the approach can be used to solve the challenge that users find it difficult to find a suitable resource when they have a task to do but do not know exactly what resources they need. A purely content-based approach could already be of great help here since a lot of information is already available about the user in the company and she is probably willing to enter more information when searching. If, for example, she is to give a lecture, she can enter this information and the system will suggest presentation software that she can use to create an accompanying presentation for her lecture.

4.1.3 Collaborative tagging. Collaborative tagging is used to allow users to collaboratively add metadata to resources or information. This metadata can then be used by other users to organize, search for, or filter content [7]. This concept, for example, is implemented, to make more relevant suggestions to users of music streaming services and thus improve their experience [13]. From the results of our survey it can be seen that when users are given a task but do not know what resources they need, they do not get relevant information from the entitlement shop. This concept can also be used in entitlement shops in the following way. IAM users can independently add tags to resources to indicate which tasks they have used the resource for or which tasks the resource has helped them with. If another user is now assigned a new task that she does not yet know how to solve, she can search the entitlement shop for relevant keywords and receive potentially suitable suggestions from it. This can solve the challenge that was identified in our survey, namely that the entitlement shops are not considered helpful if the user needs a resource to solve a challenge, but is not aware of the suitable resource she needs to do so. Also, the collaborative tagging of content enriches the resources with more detailed metadata, which increases the quality of the proposals of the recommender systems presented in Section 4.1 [2].

4.2 Transparency

According to Eskildsen & Kristensen transparency can be a relevant factor in customer satisfaction [5] . Since transparency is a relevant factor, entitlement shops should act accordingly and should try to give users relevant information. Besides, transparency can lead to employees being able to identify and implement improvement opportunities for workflows in companies. This can lead to higher efficiency and thus to cost savings [15]. Our survey shows that two main transparency-related questions are relevant for users. First, that they cannot see in advance how long the request would take. Second, that the users cannot see the state of their current request. For example, a request for a specific resource may need the authorization of two different managers, however, users can not see which manager is currently processing their request. To address these problems, we analyzed e-commerce literature for concepts that offer a solution, as explained below.

4.2.1 Delivery time. One feature that is commonly known from today's e-commerce is to specify the delivery time of an item. Hereby, the customer is told when she can expect her parcel before ordering an item. Our survey showed that users of entitlement shops cannot see how long it would take to provide an resource before requesting. Through the previously carried out interviews we found that users tend to waste time if they are not aware of how long a specific workflow would last, which leads to unnecessary costs for the company. To use this concept, historical data could be evaluated and the average delivery time could be measured, which can then be displayed to the user during the requesting. This approach would have several direct advantages for the user, as well as for the company in which the system is used. For example, when requesting, the user would be able to estimate how long she has to plan for the provision of a resource and thus align the scheduling of her work accordingly. In addition to the advantages for the user, there is also an opportunity for the company to identify potential workflow improvements. Inefficient decision nodes can be very quickly uncovered and solved, which otherwise would not have been seen without the average time.

4.2.2 Delivery status. Another concept, which is known especially from large delivery companies, is the possibility to view the current delivery status of a package. After purchasing a product, the customer is provided with a link that allows her to track the delivery of the parcel. This possibility of online tracking is one of the most used services in the mail-order business [2]. One of the problems our survey showed is that users find it difficult to find out through the system who is responsible for authorizing resources. This concept

[2]https://de.statista.com/statistik/studie/id/45733/dokument/versand-im-online-handel/

from e-commerce can be applied here. The user can be shown at each step in the authorization hierarchy who is responsible for a authorization and contact them in case of problems. Besides, a user can see immediately if her request is attached to a person who is on vacation, for example, and therefore cannot give the authorization of the requested resource. Such a system can help to significantly reduce the time it takes for a authorization.

5 RESULTS & CONCLUSION

This work aimed to identify the challenges of users of entitlement shops and to develop possible solutions with the help of concepts from e-commerce. For this purpose, a survey was conducted and the most relevant results are depicted in this work.[3] Afterwards, possible solutions and their applications are presented. In the *1. General questions* category of our survey, it was found that users are generally rather satisfied with the results of the portals and have a rather positive attitude towards them. However, it also shows that users rarely use the portals. In the *2. Time related questions* category, it was found that users mostly had difficulties in finding the right contact person when problems arose. Though, users had no problems in understanding the entitlement shops themselves or finding the resources they were looking for if they already knew what they were looking for. There seems to be room for improvement in terms of the time required before the requested resources are made available. In the *3. Usability related questions* category, it was found that the biggest problem for users is to find out how long an authorization workflow would take before it is completed. In addition, users had greater difficulty in finding a suitable resource unless they were looking for something specific. The third major problem in this area was for users to find the right contact person if the authorization workflow took longer. Users are mostly satisfied with the usability in general and the search. In the area of *4. Information quality*, it can be seen that, as already indicated in *3. Usability related questions*, users have no way of knowing how long the workflow of authorizing a requested resource would take. In addition, this area shows that the information provided on the resources is of little relevance to the users. To solve the problem that users have difficulty finding resources when they are given a task and they do not know what specific resources they need, recommender systems are proposed. In order to increase the general transparency of internal processes towards the user, i.e. the possibility to display the approximate duration of the authorization workflow before placing a request and to provide information on the right contact person in case of problems, the paper proposes two methods from e-commerce, which focus on transparency. The first method is the introduction of the display of delivery times, as is often found in today's e-commerce. The second suggestion made by the paper is to display a "shipping status", which is also known from the today's e-commerce. Finally, the paper proposes the introduction of collaborative tagging. This would help to optimise the results of recommender systems and enrich resources with relevant information. This can solve the challenge of users not seeing relevant information and the difficulty of finding resources when they don't know what to look for.

[3]The results of the survey, which are presented in this chapter, will be made available to anyone who is interested on request at one of the authors' e-mail addresses.

IAM systems as the de-facto standard for granting access to network drives and software to employees still have great potential for improvements on the user side. The entitlement shops of these systems currently do not yet provide users with the support and information they need to work satisfactorily with them. There are various approaches from the field of e-commerce that can be used to remedy these weaknesses. Our task for the future is now to find a partner in the IAM sector to implement the concepts developed in this paper and evaluate the proposed improvements in a real-world project.

REFERENCES

[1] Fabio Abbattista, Marco Degemmis, Nicola Fanizzi, Oriana Licchelli, Pasquale Lops, Giovanni Semeraro, and F Zambetta. 2002. Learning User Profiles for Content-Based Filtering in e-Commerce. (August 2002).

[2] Hossein Arabi and Vimala Balakrishnan. 2014. Social tagging in Recommender Systems. In *2014 International Conference on Computational Science and Technology (ICCST)*. Kota Kinabalu, Malaysia, 1–5.

[3] Robin D. Burke. 2007. Hybrid Web Recommender Systems. In *The Adaptive Web, Methods and Strategies of Web Personalization*. 377–408.

[4] R. Deep Dhungana, Alam Mohammad, Ayush Sharma, and Ingmar Schoen. 2013. Identity management framework for cloud networking infrastructure. In *2013 9th International Conference on Innovations in Information Technology (IIT)*. IEEE, 13–17.

[5] Jacob Eskildsen and Kai Kristensen. 2007. Customer Satisfaction – The Role of Transparency. *Total Quality Management & Business Excellence* 18, 1-2 (February 2007), 39–47.

[6] Ludwig Fuchs and Günther Pernul. 2007. Supporting Compliant and Secure User Handling - A Structured Approach for In-House Identity Management. In *Proceedings of the The Second International Conference on Availability, Reliability and Security, ARES 2007, The International Dependability Conference - Bridging Theory and Practice, April 10-13 2007, Vienna, Austria*. IEEE Computer Society, 374–384.

[7] Scott A. Golder and Bernardo A. Huberman. 2005. The Structure of Collaborative Tagging Systems. *CoRR* abs/cs/0508082 (2005). arXiv:cs/0508082

[8] Pooya Jaferian, Hootan Rashtian, and Konstantin Beznosov. 2014. To Authorize or Not Authorize: Helping Users Review Access Policies in Organizations. In *Tenth Symposium on Usable Privacy and Security, SOUPS 2014, Menlo Park, CA, USA, July 9-11, 2014*, Lorrie Faith Cranor, Lujo Bauer, and Robert Biddle (Eds.). USENIX Association, 301–320.

[9] Yehuda Koren and Robert M. Bell. 2015. Advances in collaborative filtering. In *Recommender Systems Handbook*, Francesco Ricci, Lior Rokach, and Bracha Shapira (Eds.). Springer, 77–118.

[10] Michael Kunz, Matthias Hummer, Ludwig Fuchs, Michael Netter, and Günther Pernul. 2014. Analyzing Recent Trends in Enterprise Identity Management. In *25th International Workshop on Database and Expert Systems Applications, DEXA 2014, Munich, Germany, September 1-5, 2014*. IEEE Computer Society, 273–277.

[11] Greg Linden, Brent Smith, and Jeremy York. 2003. Amazon.com Recommendations: Item-to-Item Collaborative Filtering. *IEEE Internet Computing* 7, 1 (2003), 76–80.

[12] Nitin Naik and Paul Jenkins. 2016. A Secure Mobile Cloud Identity: Criteria for Effective Identity and Access Management Standards. In *4th IEEE International Conference on Mobile Cloud Computing, Services, and Engineering, MobileCloud 2016, Oxford, United Kingdom, March 29 - April 1, 2016*. IEEE Computer Society, 89–90.

[13] Alexandros Nanopoulos. 2011. Item Recommendation in Collaborative Tagging Systems. *IEEE Trans. Systems, Man, and Cybernetics, Part A* 41, 4 (2011), 760–771.

[14] Alexander Puchta, Fabian Böhm, and Günther Pernul. 2019. Contributing to Current Challenges in Identity and Access Management with Visual Analytics. In *Data and Applications Security and Privacy XXXIII - 33rd Annual IFIP WG 11.3 Conference, DBSec 2019, Charleston, SC, USA, July 15-17, 2019, Proceedings*, Simon N. Foley (Ed.). Lecture Notes in Computer Science, Vol. 11559. Springer, 221–239.

[15] Wil M. P. van der Aalst. 2011. *Process mining - discovery, conformance and enhancement of business processes*. Springer.

[16] Robin van Meteren and Maarten van Someren. 2000. Using content-based filtering for recommendation. 30 (2000), 47–56.

[17] He Weihong and Cao Yi. 2006. An E-commerce recommender system based on content-based filtering. *Wuhan University Journal of Natural Sciences* 11, 5 (September 2006), 1091–1096.