# Project PRIViLEDGE workshop "Close and personal with PRIVILEDGE stakeholders" Report

## Executive Summary

This report provides an overview of PRIViLEDGE workshop "Close and personal with PRIViLEDGE stakeholders" carried out in the form of interviews with our stakeholders. This report has been prepared for circulation to project partners but is also intended as a resource for those interested in PRIViLEDGE use-cases and our exploitation activities.

The H2020 project PRIViLEDGE (Privacy-Enhancing Cryptography in Distributed Ledgers) has developed cryptographic protocols supporting privacy, anonymity, and efficient decentralised consensus for DLTs, to increase the trustworthiness of European ICT services and products and the competitiveness of the European cryptography industry. To demonstrate its wide scope of applications, PRIViLEDGE works with four different use-cases to develop and showcase cryptographic schemes and protocols for privacy and security.

The project is driven by the needs and opportunities of real-world applications and its results are demonstrated through four ledger-based solutions[1]: verifiable online voting (iVoting use-case), contract validation and execution for insurance (health insurance use-case), university diploma record ledger (diplomas use-case), update mechanism for stake-based ledgers (decentralized software updates use-case).

Taking the latter into account we focused on interviewing stakeholders relevant to the project's use-cases while delivering our workshop. Within this workshop, altogether 15 interviews were conducted with the aim to:

1. investigate PRIViLEDGE's use-cases' suitability for application domain and potential users,
2. find matches/mismatches from the value propositions prepared for the end-users,
3. establish mutually beneficial and sustainable relationships with the interviewees.

The interviews of the workshop were carried out in four segments that correspond to PRIViLEDGE use-cases: iVoting, health insurance, Diplomas, decentralized software updates. The grouping of the interviews was important because each PRIViLEDGE use-case

[1] https://priviledge-project.eu/about/project-use-cases



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has their own specific value propositions and stakeholders with whom they engage with. The value propositions of the pilots are as follows:

**“iVoting” - Verifiable online voting with ledgers**

The iVoting use-case offers a solution for voting protocol that allows to publish cryptographic audit trail necessary for the integrity verification in such a manner that it can be made available for everyone on the public ledger without risking the ballot secrecy even in the long term. This makes it possible for election organizers to improve availability of an election by using online voting without losing the transparency and observability of paper-based elections. The iVoting use-case is led by Smartmatic-Cybernetica Centre of Excellence for Internet Voting (SCCEIV).

**“Health insurance” - Distributed ledger for insurance**

The health insurance use-case builds a prototype for health insurance system that combines secure multi-party computation among the “accountable care organization” members with zero-knowledge proofs that enable the insurers to verify the correctness of the reports without leaking the details of individual patients. Showing the possibility of such privacy-preserving reporting will encourage wider deployment of the outcomes-based contracting model and thus advance the efficiency of the medical insurance, and the healthcare sector in general. This use-case is led by Guardtime OÜ.

**“Diplomas” - University diploma record ledger**

The Diplomas use-case focuses on delivering a secure ledger for higher education degrees in Greece that will contain transactions certifying that a student has obtained a degree from a given institution. With this solution it is possible to overcome the disadvantages of paper-based academic certificates. This use-case is led by National Infrastructures for Research and Technology (GRNet) and the Greek Universities Network (GUNet).

**“Decentralized software updates” - Update mechanism for Cardano stake-based ledgers**

The decentralized software updates use-case has developed a novel decentralized software updates framework for stake-based ledger systems that follows a holistic approach and examines a software update throughout its whole lifecycle contrary to the traditional way of handling software updates that are neither decentralised nor secure, nor do they apply the decentralisation and security achieved by modern blockchain technology to the handling of updates for the systems themselves.

**As a result, the workshop interviews provide the following key take-aways:**

1. Most interviewees were able to articulate and discuss clear benefits of implementing a PRIViLEDGE use-case after they were introduced to the project and the use-case specific solution by the interviewers. They were able to see how it can be implemented one way or the other now or in the future.

2. The most important benefits that PRIViLEDGE can provide according to the interviewees are integrity of elections process and higher number of voters for iVoting use-case; precise patient treatment and a more efficient health care system for health insurance use-case; digitalization of the system, tamper-proofness and process effectives (from both HE issuing and HR hiring side) for diplomas use-case; self-



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sustainability, decentralized governance and deep research furthering Cardano for decentralized software updates use-case.

3. The biggest barriers to implementing PRIViLEDGE according to the interviewees are technical integration aspects and general social reluctance to use emerging new technologies, i.e. due to low level of relevant communities and users understanding/being educated on the new technology/solutions the implementation might be hindered.



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# 1. Introduction

The “Close and personal with PRIViLEDGE stakeholders” workshop was organized in accordance with the PRIViLEDGE project’s communication and dissemination plan, and as planned this workshop was dedicated to PRIViLEDGE’s exploitation activities, involving stakeholders’ interviews.

The interviews for this PRIViLEDGE workshop took place between March and April 2021. During this period the world was overtaken by a global pandemic of COVID-19. The latter was the reason why PRIViLEDGE consortium had to pivot from a classical workshop format and took an alternative approach to deliver the workshop that was originally envisioned to be an on location and face-to-face event. As PRIViLEDGE consortium was unable to have a live event with integrated interviews, we performed virtual interviews and combined them into the report at hand delivering it as a materialization of PRIViLEDGE workshop.

This workshop report summarizes the analysis of the qualitative data gathered from 15 interviews with stakeholders relevant to exploiting PRIViLEDGE results. The interviews were segmented into four groups according to use-cases and carried out by five[2] PRIViLEDGE representatives who lead the work on pilots in the project. They inquired relevant stakeholders and field experts from their use-case perspective. Each interviewer had to interview 3-4 people and the interviewees were selected by the interviewers based on relevance to specific PRIViLEDGE use-case and accessibility for interviewing.

Within this workshop 4 interviews were conducted by iVoting use-case, 4 interviews by health insurance use-case, 3 interviews by Diplomas use-case, and 4 by decentralized software updates use-case. Two types of generated data were analysed to draw conclusions:

1. content of the open-ended interviews that followed a pre-posed interview outline (Annex 1).
2. the interviewers’ personal reflections about process of the interviews and gathered feedback.

The raw material of the conducted interviews was prepared for the analysis by respective interviewers and report compiler, Liis Livin (Guardtime). It must be noted that the interviewers were responsible for translations of the interviews in cases where the interviewee did not speak in English during the interview. 7 out of the 15 interviewees were female, and 8 were male. The report brings out the occupations and institutions of the interviewees in cases where they consented to publishing this information. The rest of the personal information of the interviewees remain anonymous. The gathered interview responses will be stored in a privacy preserving manner.

[2] The interviewers were: Sven Heiberg and Ivo Kubjas (Smartmatic-Cybernetica Centre of Excellence for Internet Voting) for the iVoting use-case, Mirjam Kert (Guardtime) for the health insurance use-case, Nikos Voutsinas (GUNet) for the diplomas use-case and Nikos Karagiannidis (I.O. Research) for the decentralized software updates use-case.



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## 2. PRIViLEDGE workshop interviews

This chapter offers a deep dive into each of the interviews conducted for this workshop. During the interviews the interviewees were asked general questions, followed by PRIViLEDGE specific questions. First, the interviewees had to give an overview of their occupation and scope of their company, explaining the tasks they fulfil at the company that they represent. After that, the interviewees got more precise questions that related to the use-case. Among other things they were asked to describe the possible advantages and disadvantages of the presented PRIViLEDGE solution. During the interview process the interviewer explained the value proposition to the respondents and promoted the PRIVILEDGE results in general in a way that was suitable for each separate individual. As explained above the interactions were use-case specific and the interviews were conducted in the corresponding framework. For example, the focus of health insurance use-case interviews was on gathering expert feedback on that topic and thus, did not tap into description and explanation of other use-cases during the conversations.

### 2.1 “iVoting” - Verifiable online voting with ledgers

#### Introduction

The iVoting use-case focuses on auditing of election. The goal is to release a prototype voting system that shows how DLT can be put to use for enabling verifiable online voting to achieve meaningful level of universal verifiability under the condition of secret ballot. Together with accompanying audit tools and procedural guidelines it shows how instead of trusting single service provider, it is possible to independently verify the correctness of the voting result in privacy preserving manner.

The interviews for iVoting were carried out by Sven Heiberg and Ivo Kubjas from Smartmatic-Cybernetica Centre of Excellence for Internet Voting (SCCEIV) who is the lead of the use-case in the project. The primary strategic stakeholders for iVoting are (e-)election organizers both from the governmental and non-governmental background, election technology vendors and other researchers. For the purpose of the PRIViLEDGE workshop SCCEIV representative interviewed four stakeholders: one researcher (University of Tartu (UT), Estonia), head of eGovernment (Smartmatic, Global), one election technology policy adviser (ANO[3]) and one consultant (State Electoral Office of Estonia, under the Chancellery of the Riigikogu). All the profiles of interviewees correspond well to the determined stakeholder groups for this use-case. Two out of four interviewees had previously heard of PRIViLEDGE and were familiar with the use-case. Nevertheless, all participants were well informed and were able to identify both the pros and cons of the suggested iVoting solution and discuss a wider spectrum of ideas and challenges when it comes to online voting.

It should be noted that, in addition to the general guiding questions prepared for the interviews, the iVoting use-case interviewers asked three additional questions from all interviewees to investigate the interviewees take (1) on importance of voter privacy and election result integrity conflict, (2) on relevance of data audits and (3) perceived difference between observation of paper-based elections and auditing online voting.

#### Results of the interviews

Firstly, the **researcher and information security team lead from UT,** Institute of Computer Science brought numerous insights to the conversation. As a person who is devoted to

[3] This interviewee requested to keep his organization affiliation anonymous.



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studying internet voting the interviewee recognized that the problem iVoting use-case is determined to solve is relevant, highlighting the importance of verifiability and election auditability which the public bulletin board in this case helps to achieve. Nevertheless, the interviewee remained sceptical towards the principal importance of having a public bulletin board at all and argued that the process of auditing is more important, seeing as the possibility to offer absolutely everyone the opportunity to verify the election process is not tangible.
While discussing the technical barriers that might hinder the integration of the solution, the interviewee brought out two bottlenecks that he observes. He stated that the use of Hyperledger causes problems when trying to ensure immutability (hard to get several trusted parties). He also mentioned the inherent need to have an organization within the process as a challenge, as well as the authentication of voters. Unfortunately, he did not offer many insights to the reasoning of the latter two challenges. According to his understanding there should be no legal challenges to using or integrating this solution, or even if there are they should be modified in a way that they would support online voting.

When the interviewer investigated whether the interviewee knew about other solutions that do the same job as the iVoting use-case aspires to, the interviewee referred to his own work and publication[4], stating that his work achieves exactly the same security properties and verifiability without the need of public bulletin boards. According to his understanding the only new thing iVoting use-case is offering is re-randomization - a voter cannot determine the value that will be made public.

In addition, the interviewer presented the interviewee with the hypothetical conflict of voter privacy vs election result integrity scenarios. Here the interviewee argued for the integrity aspect to be more important than the secrecy requirement. According to his opinion secrecy and privacy are just ways to ensure integrity. Furthermore, when inquired about the importance of independent data audits, the interviewee expressed the outmost importance of data audits for electronic voting, as they provide the security guarantees for the voting process. The interviewer was also interested to learn what the interviewee thinks of the differences of observing voting on paper and online. He concludes that there is no problem or difference either way, because the election participants must rely on someone's (e.g election observer) acquaintance in both cases. Nevertheless, he elaborates that the traditional paper voting is easily observable, people can comprehend how it is done, and thus this is a sufficient method to convince the participants of election fairness. But when it comes to observing any kind of computer processes, it is harder for "just anyone" to understand it, so people must rely on experts. This makes the observation procedure less appealing, efficient and fair.

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Secondly, like the previous interviewee, the **head of eGovernment from Smartmatic** had previously heard about PRIViLEDGE as well as the iVoting use-case. But unlike the UT researcher, he had not heard of any other similar solutions. As the head of eGoverment the interviewee is responsible for discovering opportunities, commercial opportunities, understanding client requirements, mapping them to solutions and bidding to win those commercial opportunities in the realm of online voting. According to him, the problem the use-case is solving is very important and beneficial to democracy in general, considering that it aspired to provide assurance for correctly operating online voting. He also saw that in the future the things developed in iVoting use-case can improve the integrity of elections and increase the number of voters, which all would be positive. Moreover, when talking about the advantages the solution could have in his organization, the interviewee highlighted that the iVoting use-case solution would be able to provide enhanced set of tools that would help to meet customer requirements and earn revenue. According to his assessment the most

[4] Homomorphic Tallying for the Estonian Internet Voting System. A. Parsovs. 2016. https://eprint.iacr.org/2016/776



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important thing from the business perspective is the accurate response to the fear of vote manipulation and anything that can remove those concerns, improves the market situation in this field.

Achieving general comprehension about the meaning of data, technology, and electronic elections, was one of the interviewee's biggest concern and a challenge for this use-case. He expressed the need to educate people on electronic elections and to gather their feedback to be better at it. When discussing the possible legislative barriers to the integration of this solution, the interviewee was not able to bring out any specific law or regulation but stated in general, that as the technology progresses and we want to take advantage of it, then consequently we also need to adjust the legislative framework accordingly.

In addition, the interviewer presented the interviewee with the hypothetical conflict of voter privacy vs election result integrity scenarios. Here as well, the interviewee argued that the integrity of the election is ultimately the most important thing but evaluated that actual risks to both voter privacy and election result integrity should be mitigated. To the question about the importance of independent data audits, the interviewee expressed the critical importance of independent data audits, describing it as the final part of the puzzle to push online voting further. When discussing the observability of paper and electronic voting, the interviewee said that although paper elections are perceived as "easily" observable then actually electronic elections are even now more transparent. During the paper voting, the participants have to have rely on good faith when it comes to tampering of votes, but the online voting systems are constantly improving and trying to improve the transparency of the process. The same cannot be said for paper voting.

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Thirdly, the iVoting use-case interviews **an election technology policy adviser** from UK, whose work entitles studying different technologies, online voting included and the benefits it could have on different societal groups, the financial implications of it and how to address the related security challenges. He had not heard of the project before. Nevertheless, once the use-case was explained to him, he assessed that what we are trying to achieve is important. From his perspective the option and realization of online voting is essential for providing democracy, seeing as voting is a human right that some marginalized groups are deprived from in the case of paper voting. According to his assessment solutions that offer secure way to vote often and cheaply would open up new and interesting was of how democracy is done.

The interviewee assessed the transparency aspect to be the biggest legal/ethical challenge of electronic voting and the solution iVoting is providing. He illustrated this with the idea that companies like Google/Facebook, who could essentially integrate this system and run elections could collect the voters' data and miss-use it, e.g., for targeted political advertising. When discussing additional barriers this interviewee also expressed the concern of low general education level of people when it comes to understanding the electronic voting system. The interviewee also pointed out potential usability issues with the verifiability provided by the iVoting prototype and suggested further research to increase the trust through improving the usability.

The interviewer also presented the interviewee with the hypothetical conflict of voter privacy vs election result integrity scenarios. The interviewee told that the secrecy of the election (voter privacy) is the ultimate property of free election, thus this is more important. Also, similarly to the previous interviews the interviewee said that independent data audits are important for election transparency. While discussing the reply to the question that concern the observability of paper vs online elections, the interviewee found bottleneck from both observation process but assessed that paper voting is still more decentralized and electronic voting centralised.



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Nevertheless, he concluded that in both cases if tampering with the results is possible, then the obvious next good thing would be to know about the tampering.

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Fourthly, **a consultant of the State Electoral Office of Estonia**, was interviewed for this use-case whose main focus is to provide advice on electronic voting and election organizing. The interviewee has had no prior knowledge about PRIViLEDGE and the use-case and stated that theoretically there are things developed similar to this solution, but this is the most implementable and practical solutions he has encountered so far.

The interviewee was somewhat doubtful when replying to the question of the solution's importance. As he has seen IVXV registration system[5] developed, in comparison, he was unsure of what the blockchain could provide, questioning the value of decentralization (that blockchain provides). Nevertheless, the admitted that the work done for the solution in PRIViLEDGE is still necessary in a general sense because it helps to develop and discuss electronic voting issues, even when the details of the practical application itself would still need to be worked out. But on the prototype level this work is definitely important. He saw no technical obstacles to integrate the solution. But while considering whether our solution could fit into his organizations existing operating system, the interviewee found that only if the current protocol would fail to justify itself and the society would demand electronical voting, then an option that offers decentralized and transparent solution for voting, could be considered. Nevertheless, he stressed that until the current system works there is no rational need to change it.

From the legal challenges perspective, the interviewee explained that it would be impossible on a national (election) level to define a "shared responsibility" of independent parties. It is impossible to assign a public task to an independent party. Considering additional barriers, he highlighted the same issue of social acceptance and level on understanding of the process of electronical voting. The more complex the systems get, the harder it is to explain them to the citizens.

This interviewee also considers independent data audits to be important for election transparency. Also, the interviewee evaluated the election secrecy as outmost important when the interviewer presented the hypothetical voter privacy vs election result integrity scenarios to him. To him the infringement of personal rights is a greater violation compared to organizational. As in previous interviews, the interviewer inquired about the perceived differences of observing voting on paper and online, and like the other interviewees in this group he concluded that the observation/auditing of electronic elections requires special knowledge. Therefore, the access to observation/audit is limited and the election participants must trust the (s)elected representatives with relevant know-how to assure them about the correctness of the process.

To sum up, all interviewees in this use-case segment saw potential benefits of iVoting solution even when several of them also argued well for the potential bottlenecks this solution might face. The solution in principle was assessed as relevant as it can improve the integrity of elections, increase the number of voters, and help to exercise democracy.

## 2.2 "Health insurance" - Distributed ledger for insurance

[5] IVXV registration system is a ledger component of Estonian online voting system IVXV. This ledger component is hosted independently of the rest of the system. It is neither blockchain based nor distributed, it is trust-service in terms of eIDAS.



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The health insurance use-case focuses on investigating DLT applications on this field with the aim to help to shift the medical domain and pharmaceutical industry towards outcome-based contracting by delivering a prototype health insurance system that enables the insurers to verify the correctness of the medical reports without leaking the details of individual patients.

The interviews for health insurance use-case were carried out by the project manager Mirjam Kert from Guardtime. The primary strategic stakeholders for the health insurance use-case are insurers, health-care providers, governmental agencies related to health-care services.

For the purpose of the PRIViLEDGE workshop Guardtime representative interviewed four stakeholders: one board member of a medical centre (North Estonian Medical Centre) one innovation lead of a health insurance fund (Estonian Health Insurance Fund), a representative of Estonian Ministry of Social Affairs[6] and one head of innovation (Tallinn University of Technology, Taltech). All the profiles of interviewees respond quite well to the determined stakeholder groups for this use-case. None of the interviewees had previously heard of PRIViLEDGE nor were familiar with the use-case but after the introduction to project, they were able to discuss the solution and the related advantages and barriers.

**Results of the interviews**

The first interviewee for this use-case was the **board member** of the North Estonia Medical Centre who is responsible for research and innovation, customer service quality management, and personnel trainings. According to her, the PRIViLEDGE health insurance solution would benefit if it would take into account how an agreement between parties on how the data is entered to the system is reache/supported. She expanded by explaining that currently there is no guarantee about data quality as it includes a lot of manual data entering and human error may occur. Nevertheless, she admitted that generally, things are moving in the same direction in health care system and patient care what PRIViLEDGE is trying to achieve with proposing this use-case and prototype.

While discussing the importance of the health insurance solution, the interviewee concluded that it is relevant. But only if the medical data was collected, analysed, and reported in the way PRIViLEDGE proposed would be complemented by good processes on how to sort the data (that would also account for e.g., uneven medical terminology) would it make curing people and developing various guidelines for precise treatments, easier.

On the other side, the interviewee expressed several challenges connected to the solution PRIViLEDGE is proposing. For example, in Estonia there are various health databases with different type of data units and not all of them are accessible. For example, the national health insurance database does not include data on specifics of the illness or the patient, and hence it would not be possible to issue an invoice, hence, it would not always allow further comprehensive analysis and secondary use of data. Moreover, from the legal perspective the interviewee indicated that the data protection laws may make things more complicated, in particular secondary use of data. She also emphasizes that implementing new technologies and ideas in the health sector demands internal and clinical interest. But if pushing for implementation of new technologies is external then the argumentation for them should be strong and clear - like the promise of cutting costs, saving medical workers' time and/or producing qualitatively better care results for patients.

When the interviewer investigated whether the interviewee knows of similar solutions, she mentioned examples of unified electronic medical database, such as TrinetX and Clinerion.

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[6] This interviewee requested to keep her occupational and organizational affiliation anonymous.



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The **innovation lead** of Estonian Health Insurance Fund was interviewed as a second expert for this workshop. This interviewee was selected because her task is to support the uptake and development of new solutions in the Estonian health-care system at the Fund. Although she had not previously heard of PRIViLEDGE, she understood the relevance of the health insurance use-case, as she sees that the healthcare field is moving towards outcome-based contracting. According to her, this solution could help in cases where sharing data with third parties is required. Although, in the Estonian case, for outcome-based contracting, anonymised information is already used. Also, she assessed that in general, the PRIViLEDGE solution could fit in the cost sharing payment model. Nevertheless, she added that, in Estonia the Fund already has contracts with pharmaceutical companies and they use the digital receipt system and the health information system data for that.

When discussing the limitations and barriers of integrating the PRIViLEDGE solution the interviewee thought that this would require a system rebuild. She elaborated, saying that the Fund is actually testing different prototypes to learn how to unify the billing and the treatment results to get better overview and analysis of the situation, while still deriving data from different databases and then comparing it. The interviewee was not able to mention any specific legal challenges, as in Estonia the laws are already changing in the favour of outcome-based contracting. Finally, she did not mention any specific similar solution to PRIViLEDGE but said that private hospitals in Europe are already practicing outcome-based medicine/insurance.

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For this use-case a **representative** from the Estonian Ministry of Social Affairs was interviewed whose main focus is on funding of the health services from the equity perspective. She had not heard of PRIViLEDGE before and was unsure if the outcome-based contracting, that PRIViLEDGE aspires to enhance with this use-case, is principally effective or not. She noted that the privacy of patient data is different in Estonia than in other countries, making it easy to combine data from different data-bases. And as Estonia has only one insurer, she believes anonymizing the data is not a problem.

Nevertheless, she estimated that the PRIViLEDGE solution could help the health care system become more effective and it raises the sense of responsibility for the outcome of the treatment. She elaborated that if the developed prototype helps to get and exchange data more efficiently it would help the national health insurance fund a lot.

As barriers for integrating and implementing the PRIViLEDGE solution the interviewee mentioned a few that connect more to outcome-based insurance scheme in general: 1) the capacity to analyse the data to assure proper outcome-based contracting, 2) getting the hospitals on board, 3) opposition of the service provider (because the patient is responsible for her/his electronic health data, not the doctor).

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The **head of innovation** at FinEst Twins Smart City Centre of Excellence at TalTech who evaluates the work done in the health insurance use-case important. She believes that in general the outcome-based contracting could motivate doctors and patients to be more proactive.

Although this interviewee was not selected from the focus field (healthcare), she provided valuable feedback and proved that the foundation of what we are trying to achieve in this use-case, could be applicable in other domains. For example, integrating data sets and providing unified reports could help in the smart city project, e.g., people want to buy a single ticket that would give them the access to drive a train, bus, tram or ride an electrical bike etc of their



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choosing, and they want to do it anonymously without anyone tracking their whereabouts. The interviewee explained that the outcome of this use-case could help to achieve the transformation of combining multiple transportation tickets into a single access ticket. This would require bringing together various datasets between different service providers that the PRIViLEDGE solution could be suitable for.
According to the interviewee the most challenging technical aspect for the PRIViLEDGE solution integration would be unifying various software and data sets and then assuring appropriate system updates. The latter is also related to the possible legal barriers, because in Estonia a patient can choose what information they reveal in their electronic health data history. So, if they do not reveal the data about the medication they consume, then it is impossible to connect the medication with successful/unsuccessful treatment in an insurance case.

To sum up, the selected stakeholder evaluated the use-case to be relevant, especially from the perspective that it aspires to support moving towards outcome-based contracting in the health insurance domain. Additionally, other potential implementation verticals were detected, which gives this use-case outlooks to be used outside of the health domain. Nevertheless, as all the interviewees were Estonian, they also shared, in general, the experience that currently, either a) medical data sharing/compilation between different databases is done via some alternative method and/or b) there are already other prototype(s) being investigated and to be integrated that do the job that this use-case aspires to do.

## 2.3 “Diplomas” - University diploma record ledger

The diplomas use-case’s goal is to develop and deploy a digital certification scheme that allows the transfer of certificates between public sector entities and universities, offering a standardized, automated and secure solution for issuing diplomas and an excellent alternative for paper-issued diplomas.

The interviews for health insurance use-case were carried out by one of the use-case leaders Nikos Voutsinas from Greek Universities Network (GUNet). The primary strategic stakeholders for the diplomas use-case are the higher education institutions as diploma issuers, the recruitment and employment offices operating in the private or public sector, the citizens as diploma holders and finally the governmental agencies responsible for digital strategy of the education sector.

For the purpose of the PRIViLEDGE workshop the GUNet representative interviewed three stakeholders: one head of e-Government and interoperability (Hellenic Ministry of Digital Governance, Greece), one director of HEI (National and Kapodistrian University of Athens, Greece) and one director of digital solutions (Vivartia Food Services, South Eastern Europe). These selected stakeholder suit very well for the interviews and they are essential for the implementation of the diplomas use-case.

**Results of the interviews**

Firstly, the **head of e-Government and interoperability** whose job among other things is to assure the alignment of European guidelines and initiatives regarding e-Government at national level who had not heard of the PRIViLEDGE diplomas use-case or anything similar before the interview. Nevertheless, after the introduction, the interviewee was able to detect



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clear benefits of the solution and articulate clearly how this solution could fit into the current digital system in Greece.

She assessed that the diplomas use-case is important for the accomplishment of digitalization of processes in the domain of education both nationally and on the European level, seeing as it offers both citizens and administrations digital service under a unified infrastructure incorporating the once only principle regarding diplomas' data, and has important value in solving issues such as reliability of diplomas. Furthermore, she estimated the diplomas solution can be utilized under the national single digital gateway in Greece, elaborating that diplomas solution incorporates all the characteristics of Ministry of Digital Governance e-government approach so It can be used as best practice scenario for policy reasons and further utilized for production ones.

During the discussion the challenges diplomas solution might encounter, the interviewee said that the interoperability between different systems could be an obstacle and thus interfaces should be aligned, and semantic issues should also be considered when integrating. From the legal perspective she highlighted the need to take GDPR regulation under consideration, especially as this solution deals with sensitive personal data. She concluded that a legal framework on the provision of the digital service will also be necessary to be established and while implementing this type of a new digital service usually organizational issues arise, which could be overcome with political commitment.

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Secondly, a **higher education institution director** was interviewed to gather feedback and validation for this use-case. Unlike the previous interviewee, she had heard about PRIViLEDGE and the use-case. She also was familiar with similar works referencing the work done in QualiChain[7] project. Overall, the interviewee showcased a deep understanding of what the use-case aims to achieve and recognized how the solution could be implemented within her institution. Among other things, she highlighted that the outcome of research projects such as the PRIViLEDGE are highly anticipated with the hope that these will expedite the materialization of the advancements in the data privacy field.

She believes that PRIViLEDGE is trying to solve an important and essential problem. From here perspective the effect of technology on academic operations is profound. The primary goal for her institution is to provide an alternative to the paper-based diplomas validation processes and move towards a fully digital process that will guarantee the privacy of diplomas data at the highest level, that would also inherently eliminate the phenomenon of fake and counterfeit degrees, which is a long-standing problem for HEI. Additionally, referring to the Diplomas (https://ediplomas.gr) solution she expressed her confidence that it would help to achieve the goals she mentioned. A widely deployed network of diplomas issuers and validators would not only simplify citizens' perception but will also facilitate the transformation of the department and the re-engineering of the supported workflows, she explained.

She listed several advantages of the solution: 1) a welcomed change in the burdensome process how diplomas are currently issued and validated, that would require less resources; 2) an improvement in the quality of service to the public and 3) a sustainable solution that enables to use much less paper. When asked about the integration aspects to the institution's system the interviewee offered the diplomas solution could fit in the roadmap of the Registrars' Digital Services Department with the cooperation of UoA's IT Centre. But she also admitted that from the technical perspective the system might lack some features to implement diplomas at this point. Also, she stressed that the personnel would need technical training to roll out this solution and that for this endeavour to be successful it has to become (a legal) norm around the country.

[7] QualiChain project's website: https://qualichain-project.eu/



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When additional barriers to the solution implementation were discussed, the interviewee offered that the adoption of this type of solution/service nation-wide and the evolution of the organization's processes to be able to accept and process digital copies of diplomas might be difficult. She expanded that, it probably requires a nationwide communication plan, the development of content to support citizens and organizations in this process and technical support of the companies that decide to follow the integrated approach.

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Thirdly, a **digital solutions director** for foodservice provider was interviewed to get the viewpoint of a large company who could use the diplomas solution e.g., in the hiring process. The interviewee is responsible for responsible for the Digital Transformation Roadmap of the Organization and had several valuable insights of how useful the diplomas solution could be even though she had not previously heard about PRIViLEDGE or diplomas use-case' aspirations.

In general, the interviewee assessed the offered solution to be very important. From her perspective a digital solution that streamlines the process of accessing diploma information on demand, in a way that is GDPR compliant, addresses the pressure that the GDPR has put HR as it needs to collect manage and store a large amount of data. During recruiting and managing excysting staff, the process of collecting, storing, managing access to, and complying with rules of sensitive diploma information, are risky and resource heavy tasks.

According to her, the PRIViLEDGE effort towards digitizing the diplomas validation affects two aspects of the HR function, the recruiting process as well as the hiring process and maintenance of accurate and up to date employee and job applicant records. As far as recruiting is concerned, the company receives monthly a few hundreds of applications both for jobs openings in the central management workforce as well as in the network of 560 stores. The applicants that manage to enter the shortlist of a position are required to submit soft copies of their diplomas, which are stored in our records until the job opening is closed. Applicants need to sign a form that authorizes to keep these records for as long as is needed. HR deletes the diploma files of non-successful applicants when an opening is closed. New employees during the hiring process need to provide hard copies of their relevant diplomas and for as long as they belong to the workforce of the organization, they can also provide any new diploma they might acquire. In their contract it is stated that the organization has the right of keeping these records for as long as they work there. In case the employee exits the organization for any reason the records are deleted manually. At no point during the recruiting or hiring processes, HR verifies the submitted diplomas with the issuing institution.

To sum up, both processes will be positively impacted from a digital solution that provides verified up to date diploma information on demand as the need for several manual steps of those processes will no longer exist. She also added that, as a result, the diplomas solution would simplify the HR processes that govern recruiting and maintenance of employee records saving the organization valuable time and effort and it would reduce the storage costs and would additionally protect the organization from fraud and will allow to have a highly skilled workforce, as it would ensure that every diploma submitted during the recruitment or hiring process is valid.

The interviewee admitted that t's not clear to her what would be integration path in functional and technical terms, but she estimates that large companies would be willing to invest into this type of solution. The only issue, according to her, could nevertheless be the initial cost that might hinder the penetration of the solution to smaller companies or companies without IT departments.



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Finally, the interviewer also asked the interviewee to estimate how much the company would save by using a digital process for diplomas retrieval and verification as the one that PRIViLEDGE intends to showcase. She forecasted that it would require 10% less resources during the recruitment and onboarding phase and 2% less storage needs. In addition, it minimizes the risk of a GDPR incident, which can have a financial impact of as high as 3% of the company's turnover which is at the range of tenths of thousands.

To sum up, the interviews with the selected stakeholders proved that the diplomas use-case has a viable and suitable value proposition for the stakeholder, seeing as the interviewees were able to articulate very well PRIViLEDGE benefits and discuss the diplomas implementation from their respective standpoints.

## 2.4 "Decentralized software updates" - Update mechanism for Cardano stake-based ledgers

The focus this use-case is to develop an update mechanism for Cardano stake-based ledgers based on the mathematical foundations of decentralised software update systems and implementing a research prototype based on those foundations. As a result, the systems will be greatly simplified but even more importantly become essentially decentralized.

The interviews for the decentralized software updates use-case were carried out by the use-case leader Nikos Karagiannidis from Input Output Research (I.O. Research) and the primary strategic stakeholders for this use-case are blockchain governance experts, developers and product managers.

For the purpose of the PRIViLEDGE workshop the I.O Research representative interviewed four stakeholders: one product manager (IOHK), one technical project manager (Cardano Foundation) and one researcher (IOHK) and one engineer (IOHK). IOHK stakeholders were primarily selected because the main goal of this use-case is to influence the decentralized governance roadmap of the Cardano blockchain. All the interviewed experts were very aware of the PRIViLEDGE project and elaborated extensively on the topic of the relevance, advantages, and bottlenecks the PRIViLEDGE work and results evoke. In addition to the general guiding questions, the interviewer had several in depth expanding and clarifying question to all the interviewees that helped to widen the scope of discussion and gather extra feedback for the use-case validation. These additional questions and related answers are presented un the analysis of each interview.

**Results of the interviews**

Firstly, **the product manager** whose main job is to manage the project Catalyst and Voltaire product, expressed his deep knowledge about the PRIViLEDGE project and how the results produced by the project can be applied to Cardano. Even though he listed several other industry leaders doing similar work, he admitted that problem that PRIViLEDGE tries to solve is very important from the novel perspective of looking into the decentralization of governance of the blockchain itself and using this solution can have an extremely positive impact in blockchain industry and in the governance industry. Especially because, PRIViLEDGE produces an actual prototype, which validates the feasibility of this approach and proves that it can be applied to many different types of blockchains not just the Cardano chain.

The interviewee complemented the latter with several advantages that he observes, like 1) the actual thinking of the details from prototyping to thinking how the enactment system looks like, 2) introducing a scientific framework and 3) the engagement between PRIViLEDGE and Voltaire (the Cardano release that will enable decentralized governance) teams, which has



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and will create a culture of mutual feedback. He stated that the decentralized software updates use-case fit well into the Cardano, as he has seen the prototype successfully being implemented over one of the testnets.

While discussing technical and legal challenges that integrating the discussed PRIViLEDGE solution, the interviewee admitted that he does not have a full picture of either but assumes that for example capacity and handling things at emergency state might become a concern at some point from the technical viewpoint. And from the legal side things connected to accountability might cause issues. More on the topic, a barrier that should be mitigated is the educational preparation of the people using the system (experts), they will need training and on-boarding of how to use the system. Additionally, to assure great system navigation, coherence and understandability should be considered during implementation, because complex systems and process are hard to understand for an average user but in this case even for the experts.

From this interviewee the interviewer among other things also asked about the 1) importance and 2) problems of decentralized governance and 3) the decentralized governance roadmap of Cardano and 4) PRIViLEDGE's relevance to the latter; as well as 5) how important it is to have a secure update system for blockchain and what are the related risks, 6) what are the challenges in building decentralized update system for Cardano, 7) whether developing research prototypes is beneficial for IOHK and the interviewees ideas to 8) what should be done to communicate the software update mechanism.

According to the interviewees estimation, the decentralized governance is critical for Cardano and because governance at its core is a "human thing" it is a root of multifaceted problems, the interview listed several: 1) safe maintenance (multiple attack vectors should be considered), 2) assurance of impact (not knowing the outcomes of decisions) and 3) understandability (how much processed information we can parse correctly and especially in relationship to the amount of time and energy we have).

When discussing the decentralized governance roadmap for Cardano the interviewee explained the current Voltaire roadmap with 3 major categories: a treasury governance mechanism, a software updates mechanism and the CIP (Cardano Improvement Proposal) process. The roadmap consists of two elements, one is prototyping and experimentation of governance tools, in order to validate their visibility, impact and acceptance within the Cardano community, and the second one is actually decentralizing that. He explained that the prototyping and the theoretical work, conceptualization, using frameworks etc are really important in executing the roadmap and for that the PRIViLEDGE team and has given unique insight to understand what is possible and what is not possible to maintain integrity of the system. So overall, the interviewee concluded that the prototype is very beneficial for IOHK because it gives a scientific perspective of governance and bring about changes the discourse, allowing people to design the systems to be sustainable and robust.

The interviewee also listed several risks for secure update system for blockchain, like 1) an exploit of the system, 2) low engagement of voters (this might result in an organized group miss-using their voting power or money to "capture the system" and 3) systemic misalignment of incentives. Moreover, specifically for Cardano one risk is the time required for implementation - by the time you get to a perfect system you have already been pushed out by competitors.

Finally, when inquired about the best practices of communication, the interviewee concluded that the system needs to be understandable, representative, and easy to engage with. Plus, it led to net positive financial gain.

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The second interview for this use-case was conducted with **technical project manager** who focuses on governance, token engineering and cross-organizational coordination. He evaluated the problem that PRIViLEDGE is trying to solve, as essential and said that from Cardano's perspective this use-case presents a prime module, and this decentralized-minded mechanism is something that they want to push for. The biggest advantage to him is the research orientation of the project and use-case and give reason to hope that this solution betters the general Cardano ecosystem and sees it working well with the Cardano Improvement Proposal (CIP) framework. Nevertheless, he admitted that functionally, this solution is blazing new trails, and at the forefront of decentralized governance and decision-making.

As a primary technical challenge, the interviewee mentioned the fact that Cardano is using Catalyst as a side-chain which he assumes might not fit with the concept of decentralised updates. It was difficult for the interviewee to name any legal obstacles because according to him the legal individuals have not reach the necessary level of understanding of the mechanism, so we could be even able to discuss this topic. In general, misunderstandings are one of the primary barriers that hinder the implementation of this use-case's solution, e.g., he stressed that "governance" is not just "who decides" but it's the translation mechanism of an idea into decentralized understanding.

Similarly to the previous interview the interviewer also investigated about the 1) importance and 2) problems of decentralized governance and 3) the decentralized governance roadmap of Cardano and 4) PRIViLEDGE's relevance to the latter; as well as 5) how important it is to have a secure update system for blockchain and what are the related risks, 6) what are the challenges in building decentralized update system for Cardano,7) whether developing research prototypes is beneficial for his organization and the interviewees ideas to 8) what should be done to communicate the software update mechanism.

Like the previous respondent, this interviewee also said that the decentralized governance is critically important for blockchains as well as for Cardano. When discussing the decentralized governance roadmap for Cardano the interviewee explained that from his side he is facilitating the interweaved control that IOHK has on the actual blockchain and trying look after the democratic aspects of the process of IOHK letting the community govern Cardano in a decentralized manner. And in this respect PRIViLEGE is very important as the work done under this use-case is the vehicle that coordinates it all and developing such research prototypes like done in PRIViLEDGE, are important as it opens up new opportunities and fields.

The interviewee said that a secure update system for blockchain is important but did not elaborate on related risks. Nevertheless, he brought a critical challenge for building decentralized update system for Cardano specifically. According to him, the biggest challenge is designing the system. It's critical and the designer (IOHK) is kept accountable for it because it is easy to fall into a system design that subconsciously advantages the individual designing that system.

He concluded that education to raise awareness, clear PR messages and skilful communication have significant importance when pushing for high level community participation in the process of decentralized software update mechanism.

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A **researcher** who studies blockchain systems, governance systems and cryptography and who is leading the research for the Cardano treasury system, was the third interviewee for the decentralized software updates use-case. He was familiar with the work done in PRIViLEDGE and said that problem we are working on is extremely important as it deals with the security



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and the future of the blockchain systems. According to his belief, without providing security for software updates we will not have a sustainable system at all. He also saw a clear connection between his work tasks and how PRIViLEDGE fit in. According to him the main value that the use-case produces stands in a more sustainable blockchain system, which as a result decreases the human factor in decision making and will make the system much more robust and self-sustainable and will better the Cardano.

As the primary challenge, the interviewee brought out the constraint terms for implementation and from the actual using part the community participation in the update process might become an obstacle. From the legal perspective the interviewee suggested that as long as there is a stake that belongs to people and when a ledger rule is changed (via the software updates mechanism), stake is affected and that can pose some legal questions that are currently hard to foresee.

During this interview, he was asked among other things about 1) problems of decentralized governance research, 2) how important it is to have a secure update system for blockchain and what are the related risks, 3) what are the challenges in building decentralized update system for blockchain, 4) whether developing research prototypes is beneficial for IOHK and the interviewees ideas to 5) what should be done to communicate the software update mechanism.

The interviewee listed two main problems that might come up in decentralized governance research: 1) involving people and 2) making responsible decisions that are high quality and well supported decisions to make influence on the system.

While discussing the secure update system for blockchain, the interviewee admitted that this is a vital question because if there is a vulnerability in a software updates system, then nothing else matters. For example, in the case that an attacker takes control of the blockchain update system, he can do anything to the system. So, to avoid that, the update system must be the most secure part of the blockchain system. Furthermore, from the perspective of building a decentralized update system for blockchain the biggest challenge according to the respondent is ensuring its security and reliability.

The interviewee concluded that the PRIViLEDGE prototype is beneficial because it gives access to high quality researcher in this field, plus it generated feedback and IOHK can use these prototype results in its products. He also suggested that to achieve a high level of participation from the community there should be is a reliable delegation in the decision-making process and activities that raise the awareness (like marketing, advertising) about the decentralized software mechanism and the perspectives of Cardano.

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The fourth interviewee for this use-case was engineer whose main job responsibilities include blockchain system formal design, formal specification creation etc. He had heard about the PRIViLEDGE project from colleagues and noted that the problem the project is solving is very important because, as he sees it, everybody else is attempting to solve the problem through “social agreement” whereas in PRIViLEDGE it is done on protocol level, making things explicit. When asked about his opinion how the use-case solution can affect the future work on this field, the interviewee believed that Cardano needs to move out from this federated system and the work and results produced in PRIViLEDGE are a necessity for that.

The interviewee was not able to put a finger on any specific technical or legal obstacles that integrating the PRIViLEDGE solution to Cardano might cause. Nevertheless, while discussing other possible barriers that might hinder the implementation, the interviewee stated that



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funding might become an obstacle and how the update system co-exists smoothly with the treasury system (Catalyst).

From this interviewee the interviewer among other things also asked about 1) the challenges of building a decentralized update system for a blockchain and 2) whether developing research prototypes is beneficial for IOHK and 3) if there has been any improvement made in Cardano codabase triggered by PRIViLEDGE prototype. Additionally, the interviewer also asked his 4) opinion on best ways to validate the prototype.

According to the interviewee, getting the incentives right and the consensus aspect are the main challenges of building a decentralized update system for a blockchain. He also stressed the magnitude of the things that are at stake with the update mechanism: “You fork the network. All the nodes might crash. It is a scary moment.”

Coming to the topic of prototype, the interviewee expressed his support towards the whole process and idea, saying that he advocates for property-based testing and he believes that working on a prototype and thoroughly testing it, is very important. This, according to him is also the best/right way to validate a prototype because one can test the “update logic”. He also confirmed that there are improvements in Cardano codabase thanks to the PRIViLEDGE prototype, it primarily manifests in abstracting the ledger and making it more contained and cleaner.

To sum up, the key stakeholders of this use-case seem to be well aware of the work done in PRIViLEDGE and have a solid understanding of the research and the future potential of the innovation we have delivered with this use-case. Although, the interviewees expressed some concerns for the implementation process (especially the educational and general awareness aspects), they also clearly expressed the novel approach and future potential of the results (especially the prototype itself) produced by this use-case.

## 3. Experiences from interviewers

This chapter reflects on what the interviewers learned and gained from this workshop progress where they got to interview the stakeholders important for their use-case’s exploitation. This chapter brings out the most important aspects, gained knowledge and results from the interviewers’ personal perspective and offers some future perspective for the connections that were formed as an inherent result of this workshop.

### 3.1 “iVoting” - Verifiable online voting with ledgers

It was our intention to get diverse group of interviewees to discuss the online voting. Since the PRIViLEDGE project itself represents strong research perspective, it was more important to get the opinion from the field – election organizers, policy influencers, technology vendors. We also included a researcher who has experience with online voting technologies and has clear ideas about the desired properties themselves.

The interviewees did not need any convincing to participate. In 90 minute meeting they were given an introduction and a demo of the system, after election specific warm-up questions, more general questions were asked to get the uniform experience over all use-cases. All interviews were recorded and transcribed using either English or Estonian automated transcribers.

The interviews reflected the nature of iVoting – in many occasions, all stakeholders were in agreement – data audits are must have for online voting, observation of i-voting is very



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different problem from the observation of p-voting and has much higher entry level for the auditors to be. On some occasions – integrity vs privacy - the stakeholders were on completely opposite positions and both standpoints could've been argued for. This is classical online voting problem – a solution to handle both integrity and confidentiality at the same level is not even theoretically possible, which leaves many room for interpretations and different systems for different circumstances / situations.

Maybe the most important lessons came from the least technical interviewees pointing out following:

- the verifiability achieved by cryptographic schemes must be packaged in a manner that a lay person can use and trust it – a challenge unsolved so far
- the distribution of responsibility and power, which is the basis of cryptographic ledgers, is hard to achieve in actual election setting, where a central institution is responsible for successful organization of the election.

The first of these bullets is something that the security and usability experts can work with, the second bullet requires a paradigm shift in the election organization. It must be noted that there are structures where this shift could happen more easily. For example, the EU member states could create a joint ledger that would be hosted in distributed manner by member-states and that could be used by these states for their own, mostly centrally organized elections.

## 3.2 "Health insurance" - Distributed ledger for insurance

We planned to interview all parties in the healthcare system in order to get a fuller picture of the system. Also, because our use case is quite unique in Europe and as there is no data and proof how it works then it is important to get the opinion of all parties. Getting the interviewees to commit and to actually do the interviews was not difficult. All of them were willing to participate and share their ideas. Some of them I knew from my previous work and some I approached via email. The main idea that I took from these interviews was that data sharing is a complicated topic in general but even more so in the healthcare sector as the data shared is very delicate.

Despite being complicated it is also a very necessary thing to do in order improve the quality of our healthcare services, pharmaceuticals, and the diagnosis that doctors give to the patients today. The more knowledge and examples of various diseases or recovery methods the more the healthcare sector can improve.

## 3.3 "Diplomas" - University diploma record ledger

We invited representatives from four Universities, two Government Agencies and two private companies. Finally, we conducted three interviews with three professionals, one from the private sector, one from the government sector and one from the academic sector, with all of which we had had the opportunity to collaborate with in other projects. The interviews were conducted remotely due to the Covid 19 pandemic and were organized in two phases. The first phase was mostly introductory about the PRIViLEDGE project and the concept of the diplomas use case. During the first phase we also provided them with the list of questions they needed to prepare. We replied to interviewees questions and provided to them the links to the project page. The actual interviews took place on the second phase, which focused on the Q/As.



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While all the interviewees had an IT background, none of them was familiar with crypto specific technologies and the latest developments on the field. They were merely aware of the blockchain concept thus they couldn't follow the technological details which differentiate specifically the PRIViLEDGE use case. That is why we focused on the general concept of digitizing the diplomas retrieval and verification process.
Also, the fact that at the time the interviews were conducted some aspects of the implementation weren't finalized and we could not show case the overall solution hindered the process.

All the interviewees were collaborative and gave us positive feedback. In fact they were enthusiastic of having a privacy enhanced solution for the retrieval and verification of HEIs diplomas. They expressed interest in becoming early adopters of the solution and asked to be notified when a working prototype would be available for public evaluation. The academia representative though expressed concerns on the applicability and efficiency of solutions driven by research initiatives in a production environment and mentioned that during the rollout a series of practical issues would arise.

### 3.4 "Decentralized software updates" - Update mechanism for Cardano stake-based ledgers

A key take-away from the conducted interviews has been that decentralized governance for blockchain system is a very difficult problem and currently there definitely is no silver bullet to solve it. Software updates are a central piece in the decentralized governance puzzle and the most critical one. One clear message that we received from all the interviewees was that we cannot afford not to get this right. Once this mechanism is subverted then there is no blockchain. The need for community awareness is another important message from the interviews and education is a core means to achieve it. Also, low participation is an important risk that must be mitigated.

Regarding the work of PRIViLEDGE the theoretical results and the prototype developed in use case 4, all interviewees expressed their enthusiasm and strong support as well as their belief it will play a major role in the governance decentralization journey of Cardano.

## 4. Conclusions

This workshop report provides the results of analysis of fifteen interviews conducted by the representatives of PRIViLEGDE use-cases. The aim of these interviews was to engage with the stakeholders and investigate how the PRIViLEDGE use-cases suit for their relevant application domains and potential users and to find matches/mismatches from the value propositions prepared for the end-users. Moreover, it was important to establish mutually beneficial and sustainable relationships between the PRIViLEDGE representatives and stakeholder who were interviewed.

The interviews for this workshop were carried out in accordance with PRIViLEGE's real-life use-cases on the fields of verifiable online voting (iVoting use-case), contract validation and execution for insurance (health insurance use-case), university diploma record ledger (diplomas use-case), update mechanism for stake-based ledgers (decentralized software updates use-case. The responses of the interviews were analysed by PRIViLEDGE projects' WP5 lead Liis Livin (Guardtime).

During the interviewing process the interviewees were highly responsive and collaborative, although some of them confessed that they had not heard (much) about PRIViLEDGE before. Moreover, in most cases the interviewees were able to expand the discussion at hand and



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think along with the interviewer, as well as exhibit deeper interest towards the specific prototype and its application possibilities under discussion. In several cases the interviewees were aware of (what they consider) similar solution(s) that were presented for them during the interview, nevertheless they also were able to then determine the novel aspects of what PRIViLEDGE is offering.

As a result of the workshop, it was confirmed that all the use-cases solve important problems and offer novel solutions. Also, the value offers of all use-cases match the stakeholder's expectations either completely or partially. Potential technical integration obstacles and general low understanding level of society and related communities were determined as potential bottlenecks in many cases. Thus, risks related to those aspects should be mitigated when the prototypes are pushed to implementation phases.



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## 5. Annexes

During the interviews the interviewers used the guiding questions presented below. They also could ask complementary questions that came up during the process of the interview. In those cases, the extra questions were added under the respective chapter of those interviews in this report.

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**Guiding questions for interviewers**

**General questions about the interviewee:**

1. **First Name:**
2. **Surname:**
3. **Gender:**
4. **What is your occupation/title?**
5. **What organization/company do you work for?**
6. **What country/region does the organization/company operate in?**
7. **Please, describe the field and scope of your organization/company and the product/service that you provide.**
8. **Please describe your main job responsibilities:**

**Specific questions:**

1. **Before this interview, had you ever heard about project PRIViLEDGE? If you replied "yes" - what did you know? Please describe.**

2. **In your opinion, is the problem we solve with PRIViLEDGE use-case name important? Explain in what way or on what level or in what field.**

3. **What is your estimation how using PRIViLEDGE's use-case name solution in the future could affect the field you work in (both positive and negative aspects can be considered)?**
4. **In your opinion, what are the advantages of PRIViLEDGE use-case name for your organization/company or the tasks you perform professionally?**

5. **What part of your organization/company's existing operating system PRIViLEDGE's use-case name offer/solution could fit in?**

6. **What are or could be the technical challenges when using and/or integrating the discussed PRIViLEDGE solution to (your) existing systems? Please describe.**

7. **What are or could be the legal challenges when using and/or integrating the discussed PRIViLEDGE solution to (your) existing systems? Please describe.**
8. **Are there any other barriers that hinder implementation of PRIViLEDGE's use-case name solution in general and/or in your organization/company?**

9. **Do you know any other solution that does the job PRIViLEDGE's use-case name aspires to do? Please describe.**

10. **Other questions and answers. Please indicate a question with letter "Q" and answer with letter "A".**



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