CVerification

Blockchain-based Recruitment and Background Verification Platform

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1. Executive Summary

CVerification is a blockchain-based recruitment and background verification platform that solves multiple problems. On the one hand, it provides a modern, distributed and secure system on which every user can store a verified testimony of his professional achievements and share it with all potential employers. On the other hand, it gives employers the ability to accept new recruits based on verified information, effectively eliminating the need for background check services.

This way, employers can make informed and safe recruitment decisions and identify the most-qualified candidates before going ahead with the selection process. The platform allows businesses to safeguard their organization and applicants to improve their application credentials.

On top of this, CVerification offers powerful tools for corporations and recruitment consultants, which will enable the efficient search for potential candidates and the successful analysis of different markets and industries, revealing important insights about the relevant employment market. Apart from CVerification, third-party providers will be able to develop analytics tools, integrating them into the platform and reaping profits.

CVerification has the potential to make the whole background check industry obsolete by optimizing existing HR processes and contributing to society. This industry achieves combined annual revenues of $2bn. However, CVerification's market is much bigger.

CVerification is the next-generation background check platform. It is blockchain-based, which makes possible the secure and direct exchange of employment and educational references in an ecosystem with three main parties: previous employers and educational institutions, applicants, and potential employers. Apart from employment references, the core functionality of the CVerification platform will include the verification of academic degrees, certificates, diplomas, professional certifications and licenses.
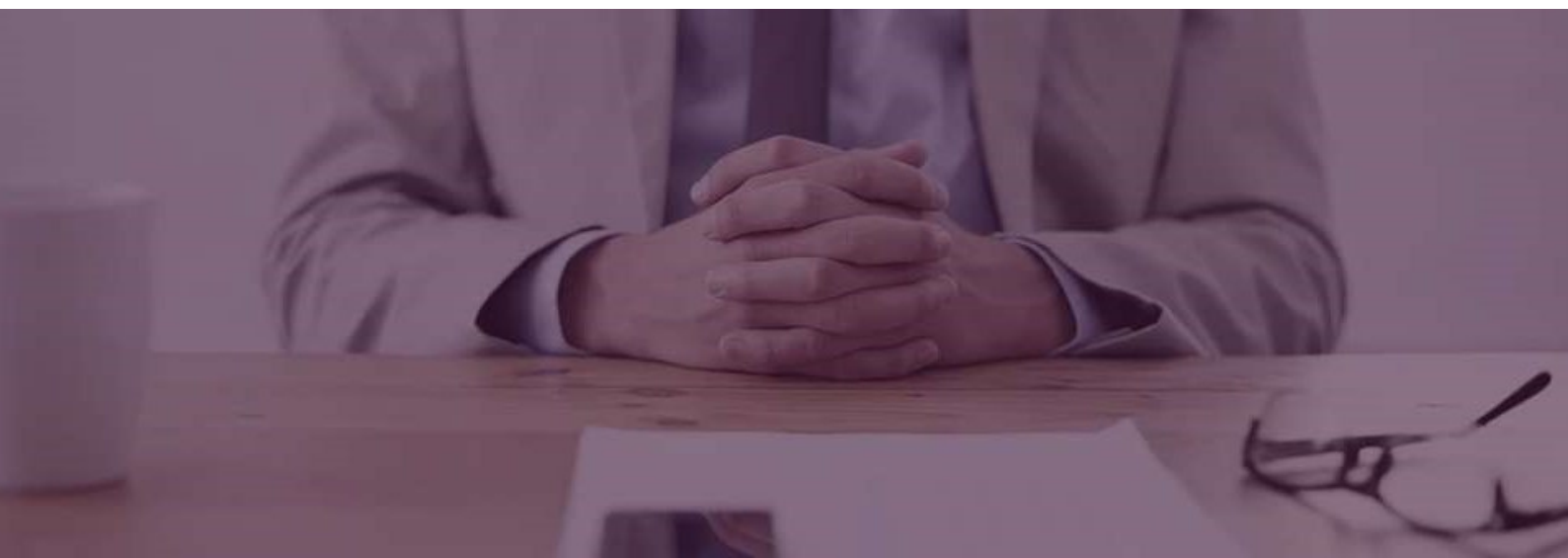
1.1. The Background Check Services Market and its Current Inefficiency

Currently there is no centralized or decentralized service offering comprehensive employment background screening which is simultaneously fast, fully automated and cheap. On the contrary - the existing solutions are slow, require the involvement of multiple personnel and do not guarantee successful background screening that could allow companies to hire with confidence. Those solutions also do not guarantee the security of an applicant's sensitive data.

Nowadays, the exchange of employment references between applicants and their previous employers (and, subsequently, between applicants and the companies to which they are applying for a position) is a standard part of the hiring process. Not only is this system cumbersome for all involved, it also leads to a higher risk of information falsification and manipulation. A dishonest applicant can modify/manipulate the content of the employment reference before using it in his/her application to present himself/herself in a better way than other competing parties and, thus, sway the employer into favoring him/her.

Potential employers do not have many options for dealing with this problem; they can either check the genuineness of the documents by contacting the previous employer directly or use a service provider. Often, references are left unchecked for the following reasons:

- Both processes are **expensive**!
- Both processes **do not guarantee feedback from previous employers**!
- Both processes **do not guarantee the quality of the feedback**!
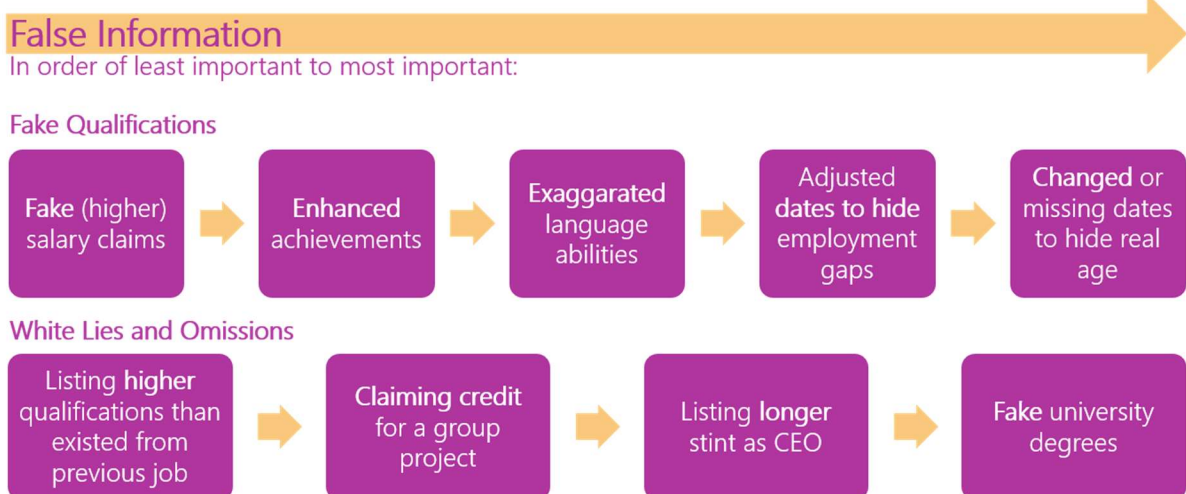
Illustration 1 Problem Solved by CVerification [1]

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1.2. CVerification's Market Niche

The second part of the problem is the lack of a modern platform that can provide the high security standards, ease of use and management capabilities every applicant needs. Even though other solutions for managing online CVs have been developed and are in use by the general public, not even one of them can fulfil all the above conditions and give its users a way to prove the authenticity of their achievements.

1.3. The Solution

CVerification is the next-generation recruitment and background verification platform. It is blockchain-based, which enables the secure and direct exchange of employment references in an ecosystem with three main parties: previous employers or educational institutions, applicants and potential employers. The use of client-side encryption guarantees that applicants have full control over their employment references and can authorize previous and potential employers to upload and download them. Every reference stored in CVerification's system is intrinsically saved and, through the blockchain's underlying properties, protected from any form of tampering. Thus, all parties can blindly trust each other and the genuineness of the exchanged documents.
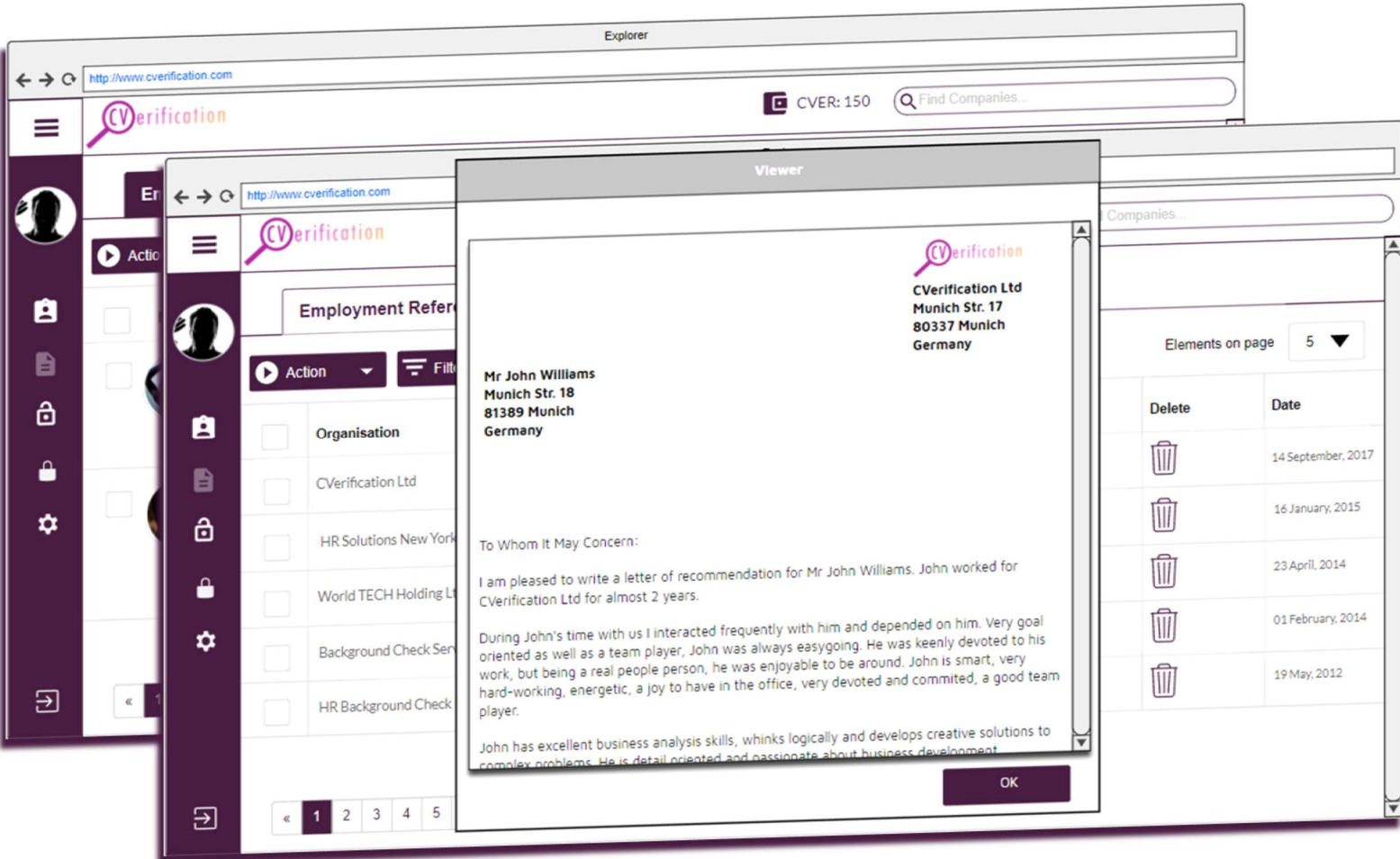
1.3.1. CVerification's Proposition

CVerification is a blockchain-based platform through which employers and educational institutions can both: (1) upload genuine employment references for departing employees upon authorization and (2) download the genuine employment references of applicants when those applicants authorize them to do so.

CVerification enables applicants to receive their employment references without the risk of loss and to authorize potential employers to access their employment references. Applicants will also be able to back up their credentials so that they can apply with verified credentials, as well as monetize their profiles by making them public, thereby boosting their chances of finding their dream jobs.

Furthermore, the platform will offer the following services for employers and recruiters: the conducting of candidate searches and the use of analytics tools. Third-party providers will be able to integrate analytics tools as well.

The platform will introduce a feature which will give users with verified credentials the chance to endorse each other. In contrast to the popular professional social networks, this service eliminates the risk of falsified endorsements from manipulated profiles.

In the following stages of development, the CVerification platform will partner with industry-leading solution providers in the fields of Human Resources Systems and Applicant Tracking Systems and will offer integration support.

The CVerification product portfolio will gradually expand through the development of new products, e.g.:

- Criminal Background Checks
- Identity Checks
- Drug & Health Checks
- Driving Record

1.3.2. Benefits of CVerification

Both employers and applicants benefit from the usage of CVerification.

Benefits for employers:

- **Save** money and time on background and reference checks and on the exchange of references by mail/email.
- Receive verified references **immediately** upon authorization by the applicant.
- Make the hiring processes **easier**, because nobody will have to compare references.
- Increase the **quality** of background and reference checks because they will receive access to more references through the platform than if they were to gather the information themselves or through a service provider.
- Make hiring decisions based on **verified** information.

Benefits for applicants:

- **Save** money and time on sending and storing their employment references.
- Obtain access to verified references **immediately** upon verification.
- Make the application process **easier** because there is no need to structure and format the files before authorizing access to them.
- Increase the **quality** of their application, which leads to a competitive advantage over other applicants.
- Apply with **verified** references.

1.3.3. Is the use of CVerification optional among candidates?

No. If some applicants don't use it and exploit it, others will!

Obviously, some applicants will not want to register and participate. This will lead to "self-selection" (self-selection vs. hidden information), which makes the platform even better.

> „Typically, individuals with different privately-observed characteristics (good candidates vs. bad candidates) will have different preferences over available two-dimensional options (participation vs. no participation)."[2]

2. Business Model and Use Case Scenarios

We differentiate between three types of CVerification users in the top layer – employers/educational institutions, applicants and recruitment consultants. CVerification offers different features to these three user groups; the features are presented in the following use case scenarios. In this section we also discuss the business model. All business aspects of each use case scenario are shown in each use case.

The CVerification business model is aligned with our vision of a future with autonomous ecosystems free of charge to the end users.

Our business model reflects our beliefs as follows:

- CVerification, unlike other endeavors in this field, is not under the control, influenced by or partnered with corporations in the background check industry. We can improve the industry's current inefficient processes without having to consider external factors arising from partnerships with corporations stuck in outdated revenue models. We don't aspire to help these organizations stay in business at the expense of end users. Indirectly, this will increase the speed at which information is delivered to corporations, which leads to a better product – even from the perspective of a corporation. Through this approach, we distance ourselves from competing projects in the field.
- We have built a system which offers all its core features free of charge to the end users; only corporations bear the costs of using CVerification. In contrast to competing endeavors in this field, we have recognized the fact that our system creates efficiencies for corporations. We believe that this makes the system more user-friendly and will result in higher acceptance. The amount corporations spend on our services is a fraction of the amount they would spend on traditional background check service providers. Due to the higher acceptance by end users (and, consequently, the positive network effect), corporations will prefer our service over competing projects in the field.

2.1. Use Case Scenarios for Employers and Educational Institutions

The following use case scenarios are relevant for employers and educational institutions.

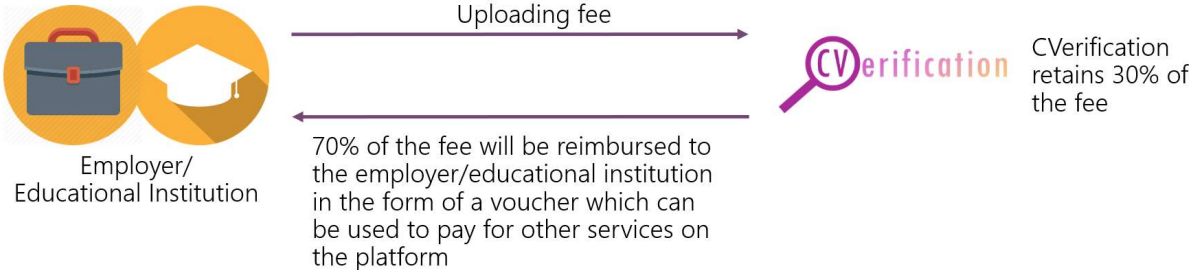### 2.1.1. Uploading Genuine Employment and Educational References

Corporations and educational institutions can save time and money by uploading the references of departing employees and successful scholars directly on CVerification (instead of sending them by mail) upon receiving authorization from those employees/scholars.

Moreover, they will save on HR expenses because their HR departments will be contacted less often by companies conducting background checks. This could lead to a substantial expense reduction.

The fee for uploading references will be partially reimbursed in the form of a voucher which can be used to pay for the process of downloading references. This makes the process of uploading references even cheaper than the traditional process of issuing references and sending them by mail.

Monetary Outcome:

Corporations and educational institutions will be charged a minimal fee for each document they upload to the platform. This fee prevents misuse of the platform. CVerification will retain 30% of the fee, while 70% will be reimbursed to the issuer of the uploaded document in the form of a voucher which can be used to purchase other services on the platform, such as downloading documents, searching and analyzing.

Uploading fee

CVerification retains 30% of the fee

Employer/ Educational Institution

70% of the fee will be reimbursed to the employer/educational institution in the form of a voucher which can be used to pay for other services on the platform

2.1.2. Downloading Applicants' Genuine Employment and Educational References

Employers can download the original employment references of their job candidates. Although this feature is most relevant to employers, it can also benefit educational institutions and recruitment consultants.

With this feature, CVerification helps employers make informed and safe recruitment decisions, sorts out unsuitable candidates before the selection process and allows businesses to safeguard their organizations.

CVerification offers all this at a much higher quality than – and for a fraction of the costs associated with – background checks performed by a company's own HR employees or third providers.

CVerification

On top of this, authorized employers can read personal endorsements of the candidate written by previous colleagues or associates. This can be done for free upon payment of the downloading fee.

Monetary Outcome:

The monetary outcome depends on the applicant's privacy preference for the respective document.

The party downloading the document will be charged a fee for this service.

If the applicant's profile – including all documents associated with it – is private, but the party downloading the document has been authorized by the applicant to do so, the party downloading the document will be charged a fee, which will be fully retained by CVerification.

Employer/
Educational Institution

Downloading fee

CV erification

CVerification
retains 100%
of the fee

If the applicant opens his or her profile – including all associated documents – to the public, the party downloading the document does not need authorization to download it, but will be charged a fee for this service. CVerification will receive 30% of the fee and 70% will be paid to the applicant who owns the profile.

Employer/
Educational Institution

Downloading fee

CV erification

CVerification retains
30% of the fee

70% of the fee will be
paid to the applicant

Applicant

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2.2. Use Case Scenarios for Recruitment Consultants

The following use case scenarios are relevant for recruitment consultants.

CVerification enables talent scouts to search for candidates based on various criteria and keywords in profiles and/or references. CVerification will offer also analytics tools which analyze public references and deliver insights about candidates or the market.

These features could be relevant to employers and, in some cases, to educational institutions. Only references disclosed to the public by their owners can be found or analyzed.

The candidate search engine and the analytics tools are based on machine learning.

Monetary Outcome:

The candidate search engine and analytics tools will be offered to users who have a premium account. These users will be charged a monthly or annual fee for the premium account. The account gives them the right to use the candidate search feature and the analytics tools for free.

CVerification retains 30% of the revenues associated with the premium accounts and distributes 20% of the revenues associated with the premium accounts equally among users with public profiles who have more than two verified references. Fifty percent of the revenue associated with the premium accounts will be distributed equally among users with public profiles and public references who have more than two verified references.
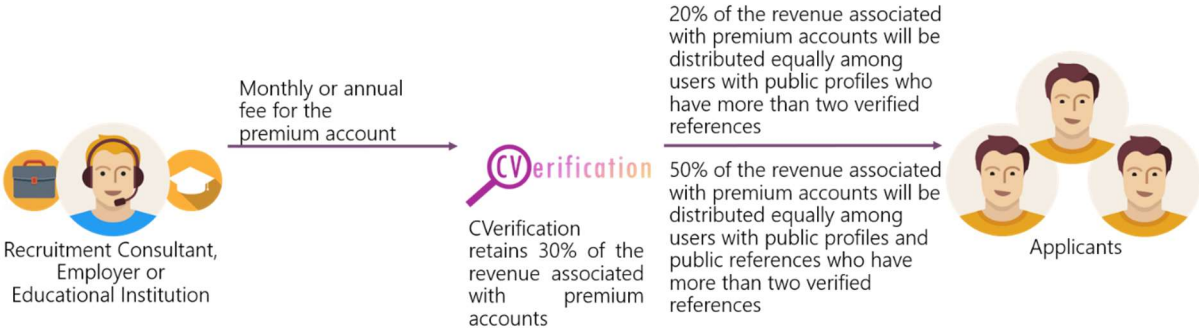
2.2.1. Conducting a Candidate Search

For the candidate search engine service, users pay a fraction of the fee they would pay on a job portal. In return, they get more precise information which has never been accessible on job portals. With CVerification, they will have a broader pool of candidates,

with public profiles and more information, as many candidates will give public access to their references, making the search results more precise.

2.2.2. Use Analytics Tools of Service Providers

In contrast to the candidate search, the analytics tools are developed with the aim of giving market insights to researchers, corporations and talent scouts. With CVerification analytics tools, one can answer market-, industry- and company-related questions.

Examples of market-related questions:

- How often, on average, do employees change jobs?
- Are there regional factors influencing decisions concerning a job change and are there preferred cities?
- How long do students look for a job after graduation?

Examples of industry-related questions:

- Which industries have relevance to our industry and which industries offer lateral entry employees for our industry?
- Which companies are preferred by employees in our industry?
- How long, on average, do employees of a given company stay with that company?
- Are there any seasonal tendencies in terms of the time of year when employees change their jobs in our industry, and can we allocate marketing and recruitment investments more efficiently?
- From which universities do competitors' employees graduate?

Examples of company-related questions:

- From which universities do competitors' employees graduate?
- Which competitors attract our previous employees?

2.3. Use Case Scenarios for Applicants

The following use case scenarios are relevant for applicants.

2.3.1. Receiving Verified Employment References

By authorizing previous employers or educational institutions to upload his/her employment references and educational credentials and link them to his/her profile, an applicant gets fast, easy and secure access to his/her employment references and educational credentials. Even more important, these documents are verified by the employer/educational institution. If a potential employer conducts a background check, the applicant no longer depends on his/her previous employer. Even in cases of the loss

of an employment reference or educational credential, or an inability to verify it, the previous employer cannot influence the application due to the fact that all the information is securely saved on the blockchain.

Monetary Outcome:

Applicants receive employment references and educational credentials for free.

Free download of employment references and educational credentials

Applicant
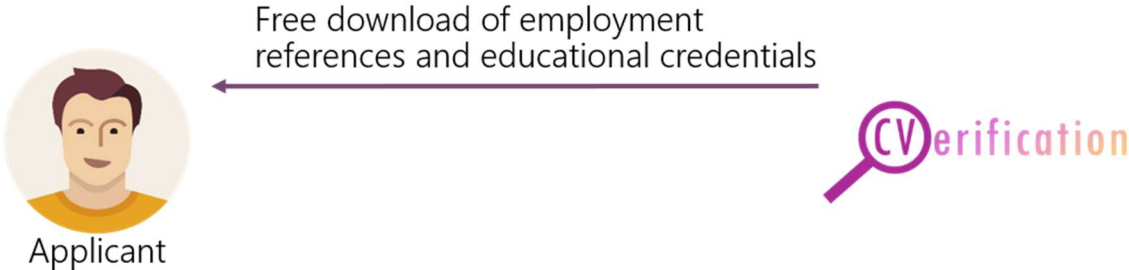
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2.3.2. Back Up Verified Employment References

Building out the CVerification infrastructure will not only ensure that references are never lost or damaged, but also that applicants will have quick access to them with a global presence. After being uploaded on blockchain-based, end-to-end encrypted, distributed object storage, all documents will be stored forever. Each file is shredded, encrypted and spread across the network; only the applicant and parties authorized by the applicant have access to the applicant's employment references.

Monetary Outcome:

With CVerification, applicants can back up employment references and educational credentials for free.

Free backup of employment references and educational credentials

Applicant
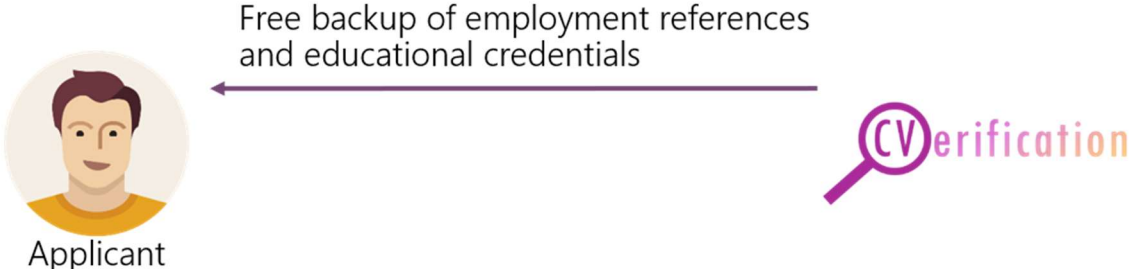
CVerification

2.3.3. Applying with Verified Employment References

Applying with verified employment references increases an applicant's chances of being hired. It speeds up and improves the application process because it eliminates the need for a background check. Sometimes this can be crucial, especially in cases when a background check is needed but time is of the essence.

Applying with verified employment references passively increases an applicant's chances by incentivizing the employer to choose him/her over other applicants who have not provided verified references. This happens for reasons such as:

- Background checks are costly. Usually, companies outsource the process to third parties, which charge high fees. In some cases, the background check could end up without results because the previous employers are not obligated to provide information about employees or their references in a timely manner.
- Background checks cannot fully verify the content of the references because they are not guaranteed to be authentic compared to the original document. The company conducting the background check usually does not receive a copy of the original reference.

Monetary Outcome:

Applicants will be able to attach a link/QR code to their job applications, or they will be able to send an email from the platform to inform a potential employer about their profile on CVerification. This feature will be free of charge.

Free application with verified employment references and educational credentials

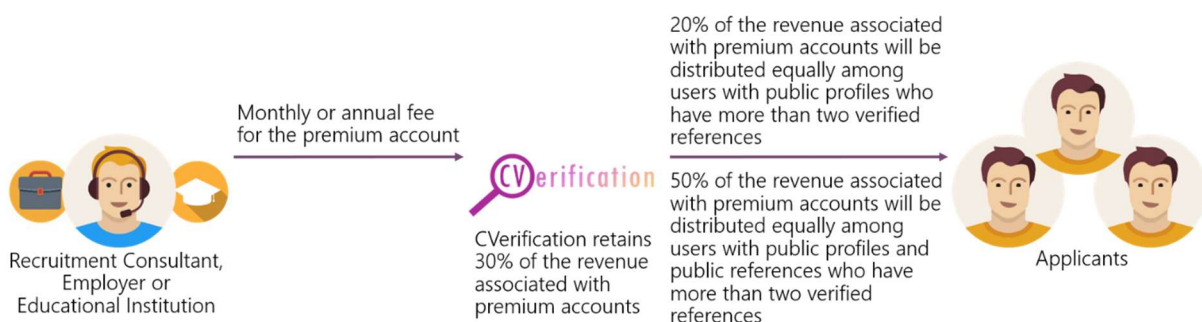Applicant   CVerification   Employer

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2.3.4. Monetizing One's Own References by Disclosing Them to the Public

CVerification allows applicants to disclose their profiles and/or employment references and educational credentials to the public. By doing so, applicants grant access to anybody who is interested in their profiles/documents. Such people could include an employer or talent scout looking for talents like those the applicant possesses. They will be able to search for fitting references based on various criteria, while applicants increase their chances of being contacted by their dream employers.

Monetary Outcome:

On top of this, applicants can earn money because, while CVerification retains 30% of the revenues associated with the premium accounts, it distributes 20% of the revenues associated with the premium accounts equally among users with public profiles who have more than two verified references. Fifty percent of the revenues associated with premium accounts will be distributed equally among users with public profiles and public references who have more than two verified references.

Monthly or annual fee for the premium account

Recruitment Consultant, Employer or Educational Institution

CVerification retains 30% of the revenue associated with premium accounts

20% of the revenue associated with premium accounts will be distributed equally among users with public profiles who have more than two verified references

50% of the revenue associated with premium accounts will be distributed equally among users with public profiles and public references who have more than two verified references

Applicants

2.3.5. Publishing and Receiving Personal Endorsements by/from Previous Colleagues or Associates

Employers try to identify team players who are competent and loyal to their colleagues and associates. Employment references do not always describe these qualities objectively. CVerification offers a solution to this problem through a feature which gives users the opportunity to be assessed by their previous colleagues. Upon authorization, these colleagues can write a short resume about the respective user and their collaboration, and publish it on the user's profile. The user cannot modify any of these resumes, and they are fully objective. The user being assessed authorizes the potential resume writer to write a resume about this person.

To prevent manipulation and fake publishers, only users with at least one verified employment reference or educational credential can be authorized by a user to publish an endorsement of him/her.

Monetary Outcome:

A small fee will be transferred to CVerification, and CVerification will retain 30% of this fee. Upon successful publication of the resume/endorsement, the writer will be paid 70% of the initial fee in CVER tokens which he or she can use to incentivize another colleague to publish a resume/endorsement.
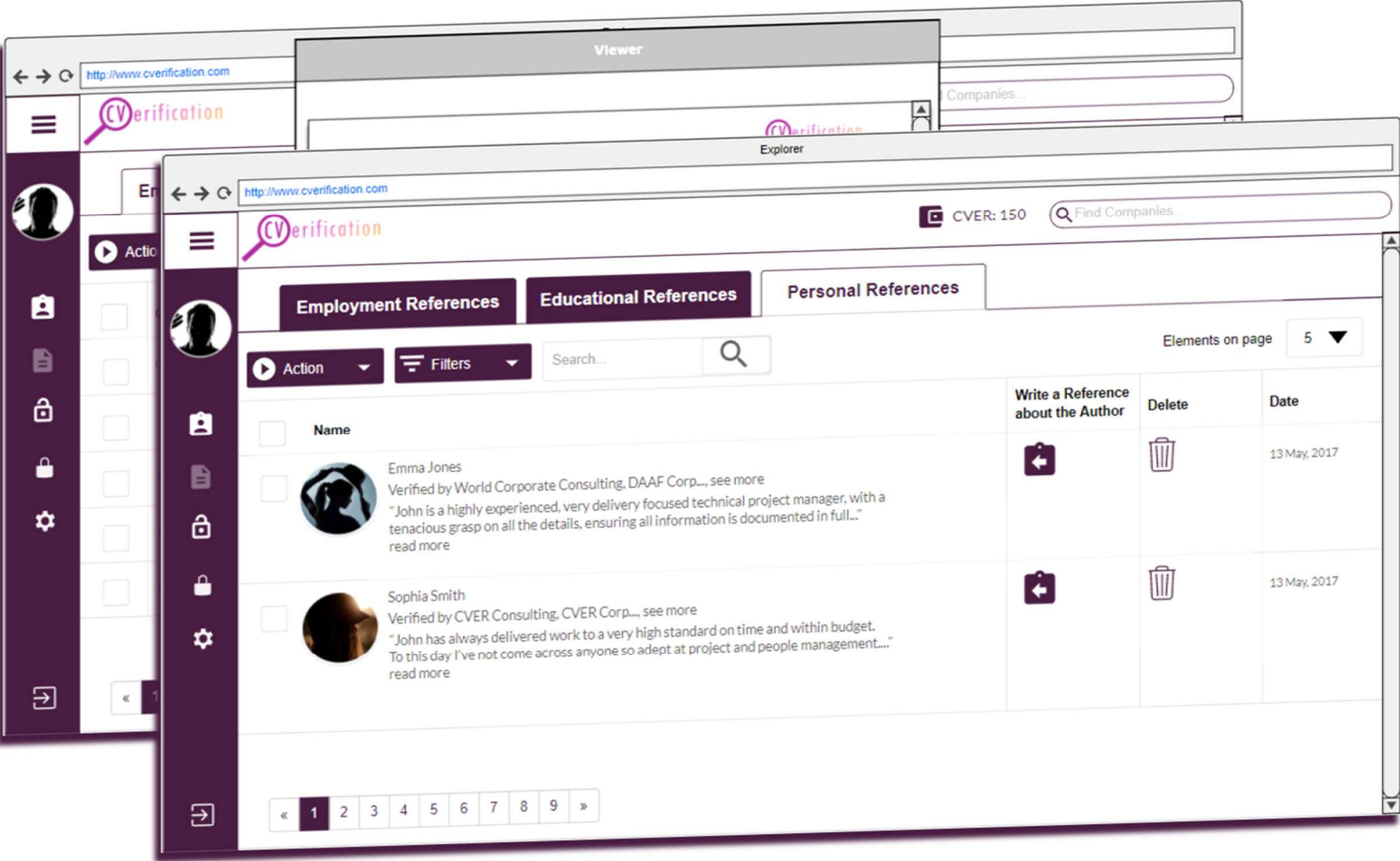
2.4. Use Case Scenarios for Third-Party Developers

Our vision is that, as time passes and our user base grows and changes, so will our platform. We will provide a powerful open API which will enable third-party developers to rapidly develop new intelligent services and utilize the hidden potential of the user's data. The best part about it is that users have complete ownership and control over what and with whom they share. Both the third-party developers and the sharing users will receive a portion of the generated revenue as a reward for their participation on the platform.

Monetary Outcome:

The services third-party developers offer will be used mainly by recruitment consultants, employers and educational institutions. The third-party developers will be able to set their own prices for the usage of the services they developed. CVerification retains 30% of the revenues associated with the service; if the service uses information made public by users, CVerification will distribute half of the retained revenue among these users.
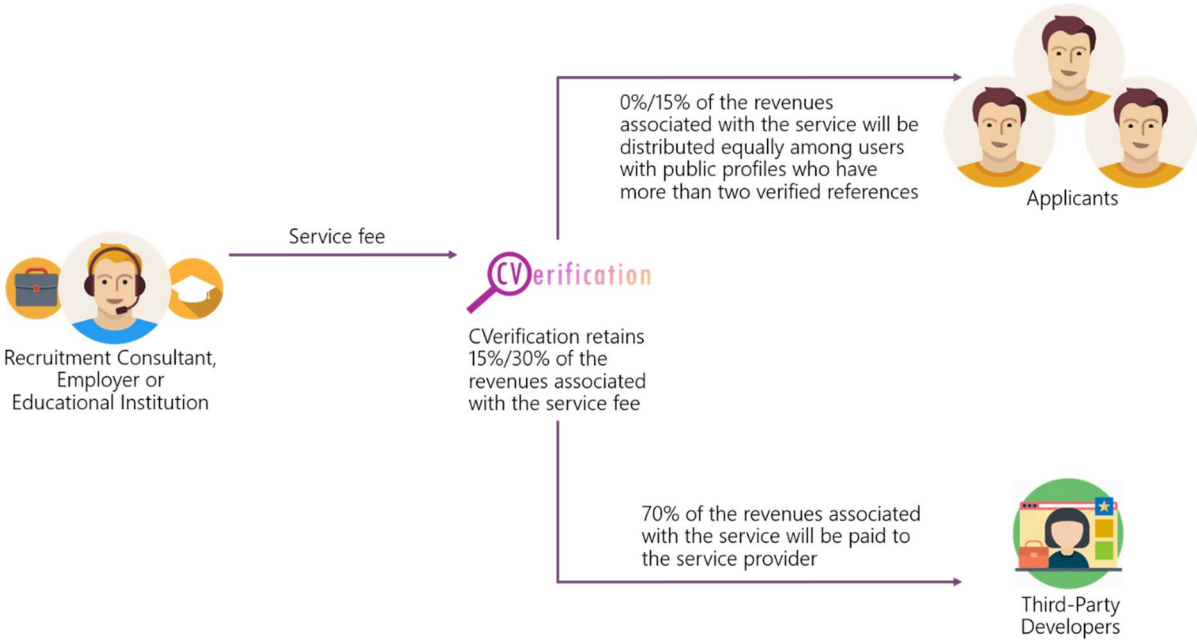
3. CVerification Detailed Overview

In the following sections we will give details, examples, and proposed design of our platform. We begin with the architectural design of the platform and how it relates to a decentralized stack by moving through the individual layers. Next, we discuss how this architecture and design implementation supports the proposed features.

3.1. Architecture

The CVerification ecosystem will be built in 3 layers with the base layer composed of a decentralized stack of the Ethereum Blockchain and BigchainDB.
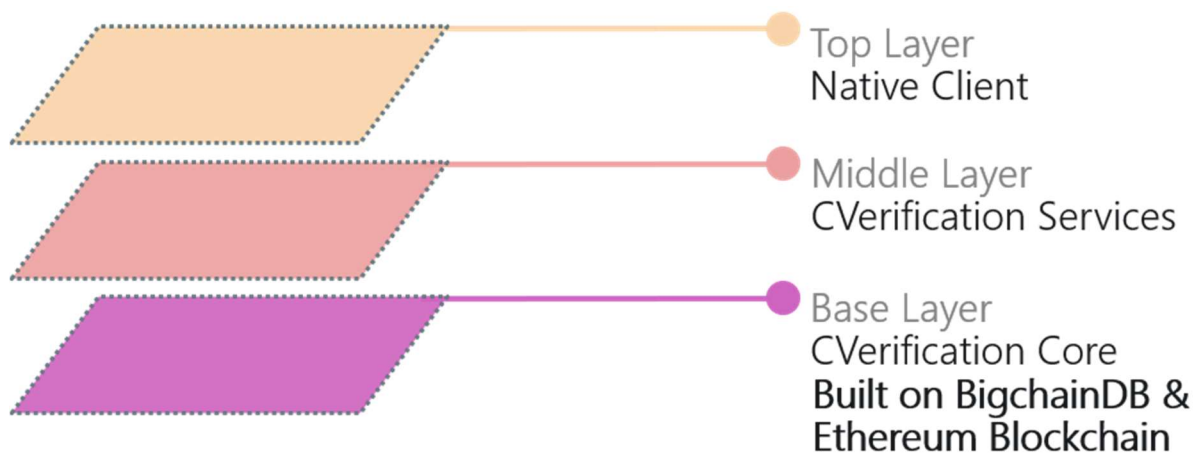
Illustration 2: Platform Layers

3.1.1. Base Layer - CVerification Core

The base layer provides the foundation for CVerification's use. Creating new services is near zero marginal cost in order to foster a thriving ecosystem of developers that contribute to the platform. The primary goals of this layer are scalability, immutability, and decentralization.

The core of our system will be based on BigchainDB, a scalable, decentralized database, and on Ethereum's blockchain via smart contracts. This combination of the latest technologies creates a future-proof base layer that solves the problems of scalability when focused on a blockchain-only based solution, yet retains the decentralized and immutable characteristics that make blockchain technology so powerful.

The last and probably most important aspect that needs to be addressed is the privacy of the data. Even though the information stored on CVerification's platform, including on a decentralized database system and on the blockchain, is public and accessible to everyone, our encryption scheme keeps it private and anonymous. No unauthorized party will be able to decrypt the stored data.

These two complementary systems, BigchainDB and Ethereum Smart Contracts, form our base layer for the platform. Firstly, foundational smart contracts will be developed that interact with the blockchain natively for requirements of stateful logic. Secondly, storage of the uploaded data via BigchainDB to retain decentralization and immutability, yet have the transaction throughput for scalability.

3.1.2. Middle Layer - Services

The CVerification services layer will offer additional services on top of the CVerification base layer.

These will include features developed by CVerification. For instance, one possible feature will be analysis of user's references and CVs who choose to make them publicly accessible. Term frequency-inverse document frequency is an analysis technique to rank how important a term is in a set of documents. A human resources department could utilize our tool in order to gather information about the most important characteristics for a certain job role.

While this is a simple example of the utility of our platform, many more tools will be developed by CVerification and various service providers to take advantage of the decentralized database repository. Developers that build additional applications based on our Core layer will be rewarded with tokens distributed in such a way as to incentivize continuous community involvement.

3.1.3. Top Layer - Native Client

The top layer is the application layer which will represent the user interface (UI) for applicants and employers. It will be web-based and does not require any experience with cryptocurrencies and blockchain-based services in order to be used. The CVerification team will build applications, including the UI and API, for uploading, downloading, and management of references and CVs.

3.1.3.1. Implementation of the Main Features

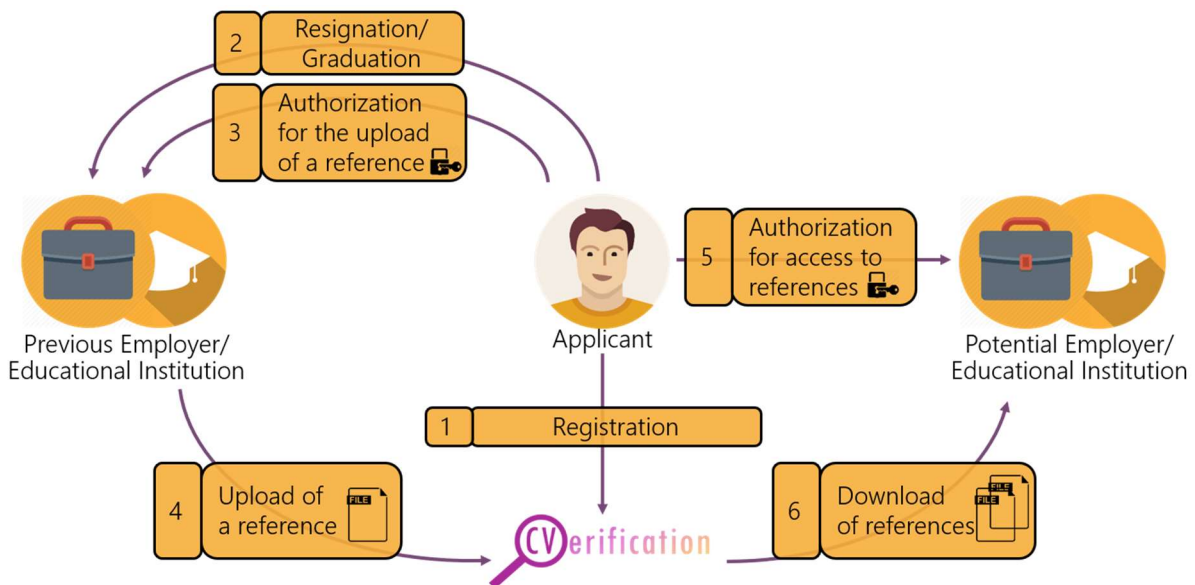In the top layer corporations and individuals will be able to exchange references.

Illustration 3: Main Features

Organizations can use the following features:

- **Upload genuine references, transcripts, certifications, and documents**
  Upon completion of employment, university, or a certification program, genuine and verified documents can be uploaded to CVerification by the issuing institution. A user of the verified institution, for instance a member of the HR department, can use their private key to access the address of the company (in some cases a company will be able to have multiple addresses). They then choose the appropriate party and upload the corresponding genuine file. After acceptance by the employee, the file will be connected to the address of his/her profile. The reference is then encrypted at this point and can be decrypted with the user's private key in order to share the verified reference with other desired parties such as future employers, universities, certification boards, etc.

- **Download genuine employment references of applicants**
  Upon authorization by an applicant the organization can download and decrypt all or some of the references connected to the address of the user.

- **Conduct candidate search**
  A company can use the native client to search for potential applicants based on different criteria. This service helps employers to effectively manage their recruiting process. CVerification will have a built-in solution for this purpose and

only references disclosed by their owners will be taken into consideration during the search.

- **Use analytics tools of service providers**
  Employers can use features developed by service providers and CVerification. These features will be based on the CVerification Core and will be used for analysis of large sets of data.
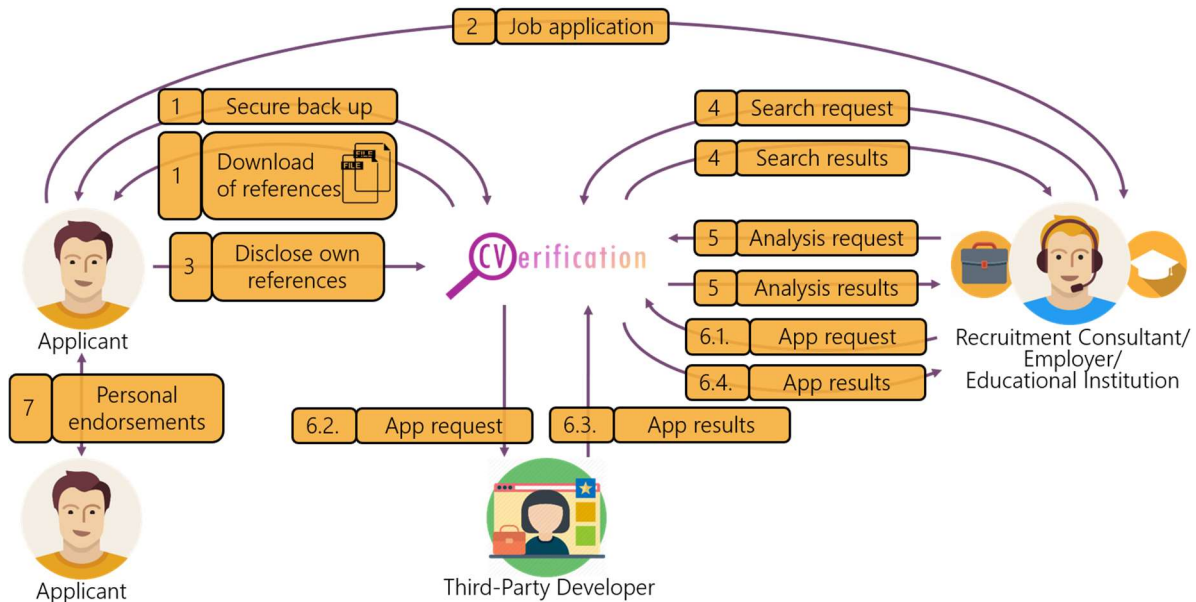
Illustration 4: Additional Features

Applicants will be able to:

- **Authorize organizations to get access to their references**
  Applicants can authorize organizations to access all or some of the documents connected to their address. This can include employment records, letters of recommendation, transcripts, certifications, etc.
- **Receive verified documents**
  Upon the upload by a verified organization, an applicant can download and decrypt his/her verified files. To do so, the applicant needs their own private key in order to authorize this 'transaction'.
- **Immutable and backed-up references**
  A built-in feature of CVerification will be the storage of data. Data is encrypted and stored across a globally distributed federation of nodes that form a consortium via BigchainDB. To ensure immutability, anti-tampering, and decentralization of data several mechanisms can be implemented. Specifically,

sharding of data across nodes of the consortium, voting privileges, cryptographic signing of all transactions, and regular database backups.

- **Apply with verified documents**
  All documents connected to the address of a user contain the address of the author (verified organization). The user can authorize the accessibility of their documents to various other parties, for instance, providing access of their verified references to a potential employer. When they do so, the potential employer will be able to see the public address of the originating organization associated with each document along with the entity's name.

- **Monetize own references by disclosing them to the public**
  Applicants can choose to disclose their own specific verified references. It allows everybody to access files connected to their respective profile. The files can be used by service providers, talent scouts and employers, thus facilitating a large collection of trusted data that can be analyzed or used in development of applications in the Services layer.

3.2. Architecture Details

The following section introduces a detailed explanation of a potential implementation of the CVerification system.

3.2.1. Base Layer

The base layer will consist of smart contracts interacting with the Ethereum blockchain and data structures in the form of a BigchainDB consortium, which will provide all of the described functionality (encrypting, storing, and retrieving data) and will guarantee the security of our user's information.

Why a Decentralized Database?

As applications are developed further on the blockchain ecosystem and are adopted more in the mainstream market, scalability of the network becomes a primary concern. While scaling solutions are being investigated with respect to blockchain technologies, none can match the throughput capacity of a database.

BigchainDB is a decentralized database that is complementary to processing technologies like the Ethereum Virtual Machine. It is decentralized as the data can be sharded across multiple nodes in order to form a consortium or federation of nodes. Therefore, the data is distributed across multiple parties, with no one entity having control of the database. As more nodes are added to a consortium, the number of transactions per second increases accordingly, thus scalability is achieved.
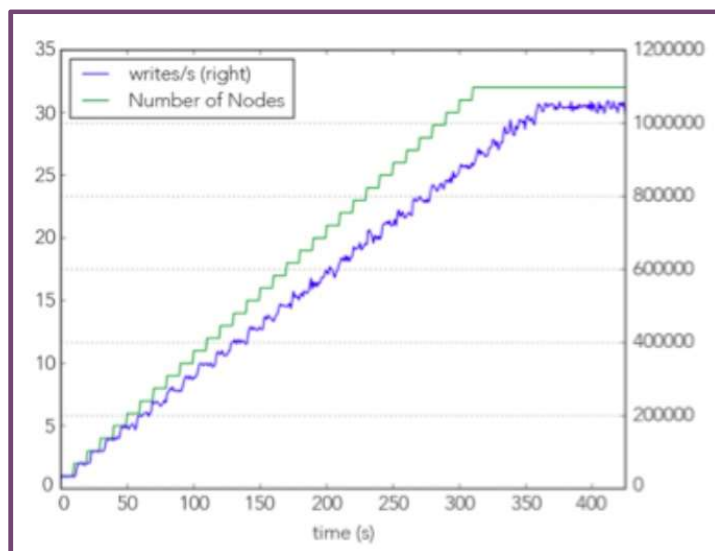
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Illustration 5: Scalability of BigchainDB[3]

Why Smart Contracts?

In addition to a decentralized database, we will also incorporate Smart Contracts written in Solidity into the application's infrastructure. This step is taken to ensure that we have proper processing power for more complex logic when required as the Ethereum Virtual Machine is Turing Complete and stateful. There will be some cases where simple stateless logic, which can be incorporated with crypto-conditions via BigchainDB, won't be enough for our purposes. An example of a use case a smart contract will be required for is the distribution of revenues to users in the form of a fee split that decide to make their documents public. The testing and validation of our smart contract functionality will be done with Truffle[4] following by subsequent audits from 3rd party.

Due to our complementary systems, we ensure immutability (information can not be changed), decentralized (no one entity has access or administrative privileges of the information), and scalability (massive amounts of data can be stored cheaply).

Below is an example architecture implementation of CVerification based on the specific use-case of uploading and downloading a reference. This is to provide insight into how the software architecture synergizes with the usability of the system.

2. Employer uploads reference via UI and signs with private key.

1. Request for reference via CVerification

Previous Employer

5. User reviews reference. They will sign with their private key, if accepted. Else, they can reject to repeat the process.

Individual

Potential Employer

A. User can send chosen references to a potential new employer. In order to download by the employer, a fee must be paid.

B. User can open their references up to be accessible to everyone where they will be paid.

BIGCHAIN DB

3. Reference is stored on BigchainDB and a CREATE TX is generated linked to the employer's public key.

4. Employer sends reference to individual which initiates a TRANSFER TX.
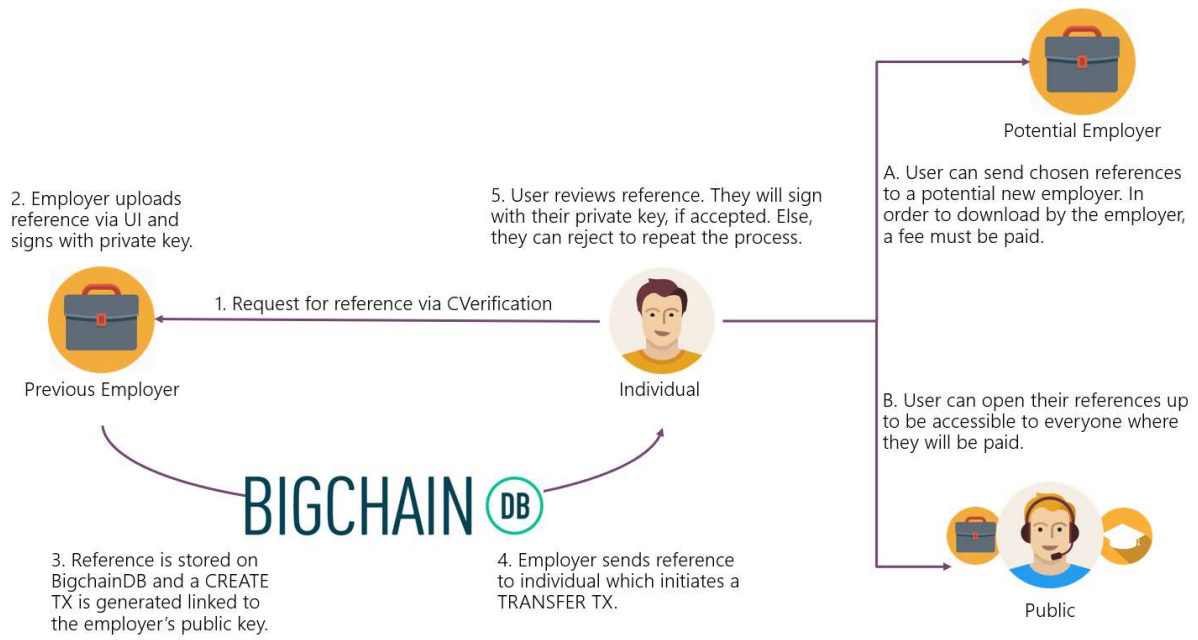
Public

Illustration 6: Example Architecture Implementation

CVerification

3.2.1.1. Registration

Each user of the system will have an account with a pair of private and public keys, analogically to the standard used by cryptocurrencies, e.g. Bitcoin. When registering for our service, parties will undergo an identity verification process, which will bind their public keys to their accounts on success. Initially, this will likely be done manually but as we scale automated solutions will be investigated in detail. An example is the use of uPort[5] as an out-of-the-box solution. The public keys will be linked to the user or organization, which could be used by everybody to verify the signatures on the downloaded documents that it matches the verified party's public key. The private key will be used as means of authentication, signature generation, transaction of assets, and for various cryptographic operations.

3.2.1.2. Reference Upload

The process of uploading and verifying a reference is an important part of our system's functionality and contains several steps:

1. A user submits a request for a reference upload to their previous employer via CVerification after resignation.

2. The employer uploads the reference on the platform by utilizing their private key associated with their verified identity. This creates an asset on BigchainDB with a unique transaction ID. An asset can refer to a reference letter, transcript, contract, or other documents that are desirable to be verified. The transaction ID is associated with the instantiating institution's public key. Additional information such as type of document, reason for the request, or hierarchy of the asset are encoded as metadata of the asset. **Note: Various departments in an organization can have separate private keys in order to provide a smooth workflow for upload.**

3. The user is then prompted to confirm the reference by signing with their private key. Once verified, the asset will be transferred to the user's public key address. The reference's history will be able to be verified via the transaction history of the asset on BigchainDB.

This paradigm guarantees the authenticity of the transmitted information and the identities of the parties.

When an employee would like to receive a reference from his employer, he needs only to select the public address of the employer and send a request through the system. The employer is then notified by the system and can subsequently create and upload a reference for the employee. Once the employer uploads the reference and then signs with their private key, the asset is linked to the employer's address in the blockchain database. This way it can be traced back to the employer and be verified from everybody by using the known public key and transaction trail.

The user/employee will then receive a notification and an option to review the reference. The user is able to either accept the document or turn it back together with their comments. This process is repeated until consensus between the parties. Once the user decides to accept a reference, they will sign the review with their private key which will transfer the asset to them.

3.2.1.3. Reference Download

We distinguish between two cases – downloading a candidate's references after receiving their permission or downloading a reference that has been made publicly available by the respective user.

A. Downloading after Receiving Permission

When a candidate applies for a position at a potential new work place, the user could select his potential employer through the system and provide the organization with access to one or more of their references and personal files (such as CV) by signing with their private key. This model can also work for organizations that are not yet in CVerification's ecosystem by means of generating a limited public and private key for the non-affiliated organization that is meant for one-time use due to non-verification.

The metadata associated with the assets the user wishes to exchange is updated with the public key of the organization they are sending to in line with BigchainDB's role-based access control protocols. This provides the permission with which the organization can now access the encrypted documents. Time limits, alteration of permissions, and various other preferences can be specified cryptoconditions designated for the transaction.

B. Downloading Public References

Some users may wish to open their CVs, references, transcripts, or certificates for all to access. The benefit is that employers are able to find and easily see a user's credentials, experience, and track record in a verifiable format to open up new job opportunities for them. Additionally, users are also rewarded with tokens from the platform to incentivize this behavior.

In this case, permissioning will be determined by our role-based access protocols where the metadata that controls access to the documents will be changed to a public key that will be searchable and identifiable for everyone on the platform in a user-friendly format for easy searching.

3.2.2. Middle Layer

The middle layer will provide the backend functionality for our web and mobile interfaces and will hide the complexity of our cryptographic processes.

Many organizations who claim decentralization due to using blockchain technology, in fact, utilize a centralized server in order to handle data storage needs. However, our platform can integrate cohesively with the decentralized database and server, ensuring that our ecosystem is decentralized end to end. Since it is also based off of an established database in MongoDB, the backend functionality will be cohesive with traditional web development standards, yet still have the benefits of decentralization.

We plan to use NodeJS[6] as our server, due to it being proven as a reliable choice by many other Dapps. It will also serve as a great base for our third-party API, which will enable other developers to create independent modules based on our bottom layer to further improve the overall ecosystem.

3.2.3. Top Layer

The top layer will be built and optimized for web and mobile use in a user-friendly format. The first stage will introduce a web platform written in the latest web development frameworks and web3 in order to interact with the Ethereum blockchain where necessary. Furthermore, dedicated mobile apps will be developed in order to enhance the user experience while interacting with the platform.

The top layer will provide the user or organization with access to their account information, an overview of all of their associated documents, as well as an interface for interacting with other users or searching the open access data. Basic data about the user or organization will be associated with the account, for instance if they have been verified via their public key. Every user will be able, but not obligated, to provide personal information for utilizing the benefits in the aforementioned public access scheme.

Lastly, the native client will have a built-in editor which will produce PDF files, but the data will be stored in a text format in the base layer.

4. Team

4.1. Our Mission

With CVerification we want to:

- introduce a new product which has not existed before,
- use an innovative technology based on blockchain, ensuring the product's efficiency,
- contribute to society.

4.2. Our Values

Clarity and simplicity

We strive to make our products simple to understand and easy to use by both corporations and individuals. We take extra care to think and communicate with absolute clarity, be it with our customers, our partners or internally.

Trust and honesty

Our brand is built on principles of trust and honesty.

Serve the community

We will take into consideration the needs of all parties involved in the model and act accordingly. Our goal is to serve the CVerification community.

4.3. Our Team

The CVerification team comprises industry experts and technology and blockchain innovators who passionately believe in the huge benefits this platform offers companies and professionals. We work to influence the recruitment processes and background check services. We have amassed years of experience in technology firms and industry-leading companies in the field of background check services.

4.3.1. Executive Team

Milko Filipov, MBA

Founder & CEO

Milko is an expert in the areas of payment systems, card payments, e-banking and has a strong interest in innovative solutions and technology, cryptocurrencies and decentralized applications. Milko brings broad industry experience, having undertaken roles as Business Analyst, Business Architect and Consultant in global projects at companies such as Wirecard, NTT DATA, KUKA Robotics, BMW, Commerzbank, Fiducia & GAD, Capgemini. Milko holds an MBA with focus on finance and strategic management from the Katz Graduate School of Business at the University of Pittsburgh. As an Associate Trainer at Certificate in Finance and Technology (CFT) in the area of Payments and Cryptocurrency he enjoys helping technologists working for financial institutions better understand the success factors in the industry in order to provide a better banking environment.

James Lawton

Co-Founder & CTO

In the blockchain world since 2010, James is at the forefront of decentralized application principles and design having worked on multiple DAPP prototypes and implementations that include complex smart contract architecture, various encryption schemes, and establishing verifiable data provenance across financial, E-government, and automotive sectors. Having a diverse background in the latest technologies including Iota, Ethereum, BigchainDB and others as a blockchain researcher at Fortiss, a prominent research institute in Germany, ensures that the ideal tool for the job will be utilized. Previously, James worked as an Engineering Data Analyst using machine learning and graphical modeling to analyze supply chains, manufactural inefficiencies, and modularize their product line to reduce expenditures at a large scale.

Evgeni Pirianov

Co-Founder & CIO

Evgeni is an engineer with seven years of experience in C++ computational algorithms in the fields of engineering, Finite Element Methods and nonlinear iterative solvers. For the last two and a half years he has been specializing as a full-stack developer and a Blockchain Developer at a Frankfurt-based financial trading platform. Some of the projects he was involved in include Ethereum-based DAPPs, an OTC-derivatives exchange platform and a financial instruments numerical library. Evgeni holds a MSc degree from Imperial College London and brings mathematical and programming know-how as well as fundamental knowledge of the numerical analysis of various financial instruments.

Evgeni is a passionate programmer and a dedicated Blockchain follower with profound interest in cryptocurrencies and blockchain real-world applications.

5. The Market

CVerification will disrupt the background check services industry which achieves combined annual revenues of $2bn.[7]

5.1. Industry Statistics and Market Size

| Revenue:
$2bn | Employment:
14,804 | Annual
Growth:
1.3% | Largest Firms:
First Advantage
HireRight
Sterling
Infosystems |

5.2. Industry Threats and Opportunities

- Declining unemployment is increasing the need for businesses to screen potential job candidates
- Industry operators will continue to experience a rise in regulation and oversight
- Continued labor market improvement will aid industry growth

5.3. Industry Analysis and Industry Trends

The Background Check Services industry enjoyed encouraging growth over the past five years. The industry performed poorly in the wake of the economic downturn. However, declining unemployment increased the need for businesses to screen for job candidates. In the coming years, industry operators will benefit from an improvement in the labor market. However, strong growth will be mitigated by an increase in vacancy rates, which will diminish demand from apartment leasing companies.

In 2016, the three largest firms are expected to account for close to 40.0% of industry revenue, indicating a low to moderate level of market share concentration.

Historically, industry operators required considerable expertise to conduct investigations and detailed background checks. However, the growth of online technology over the past decade has provided an opportunity for firms to enter this industry. According to the National Association of Professional Background Screeners, most industry operators are

small firms focused on aggregating public records. Less than 2.0% of industry firms are large background screening providers that operate at a national or international level.

The Background Check Services industry has grown over the past five years, although it has experienced some variability. As macroeconomic conditions improved, industry revenue grew, and posted good results overall for the five-year period. IBISWorld expects industry revenue to grow at an annualized rate of 1.3% in the five years to 2016. In 2016 alone, industry revenue is expected to increase 0.3% to $1.8 billion.

Illustration 7: Problem Solved by CVerification – Dishonest Applicants [8]

„63% of applicants provide false information on job applications to potential employers, according to leading candidate due diligence company, HireRight"[9]

"A 2014 poll from CareerBuilder found that 58% of hiring managers caught applicants exaggerating or fudging details about previous roles, skills, or awards. And entry- or mid-level workers aren't the only ones guilty of fibbing. Top execs have done it, too."[10]

6. Vision

The end goal for CVerification is to create the leading decentralized background verification platform used globally by employers and applicants maintaining a thriving ecosystem of users across all industries.

CVerification recognizes the potential benefits of an integration of the CVerification functionality into existing Applicant Tracking Systems (ATS) and Human Resources Systems (HRS) and will strengthen its market position by making this possible for ATS and HRS.

The main role of CVerification is to develop the technology required for running the decentralized CVerification platform and network and create a successful model incentivizing applicants and employers to join the network.

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