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"The use of Blockchain technology to improve workflow systems"

DOCMANS

ONLINE VERSION

INTRODUCTION

The rapidly developing IT-infrastructure contributes to the implementation of various solutions that optimize integral processes both in business and at the state level. One of these areas, of course, can be considered office work, which was previously carried out through voluminous and laborious paper archives. The implementation of the paperless office concept is associated with technological progress, which affects the need for rapid exchange of information.

Electronic workflow is a comprehensive solution created to automate the work with documents, which are presented in digital format.

Using this approach, the efficiency of production is increased, and within the framework of state institutions, electronic workflow contributes to the control of internal management and also helps the interaction of the state with the citizen.

Electronic document management systems (EDMS) began to be introduced more than 20 years ago. At the initial stage of development, EDMSs had rather limited functionality and were often used only for registering paper documents. To date, these systems have evolved greatly and undermined the entire paper workflow. At the same time, the faster technologies are improved, the more shortcomings are manifested in the electronic workflow. This material reveals the possibilities of electronic workflow in the corporate and public sectors when introducing blockchain technology into EDMS systems.
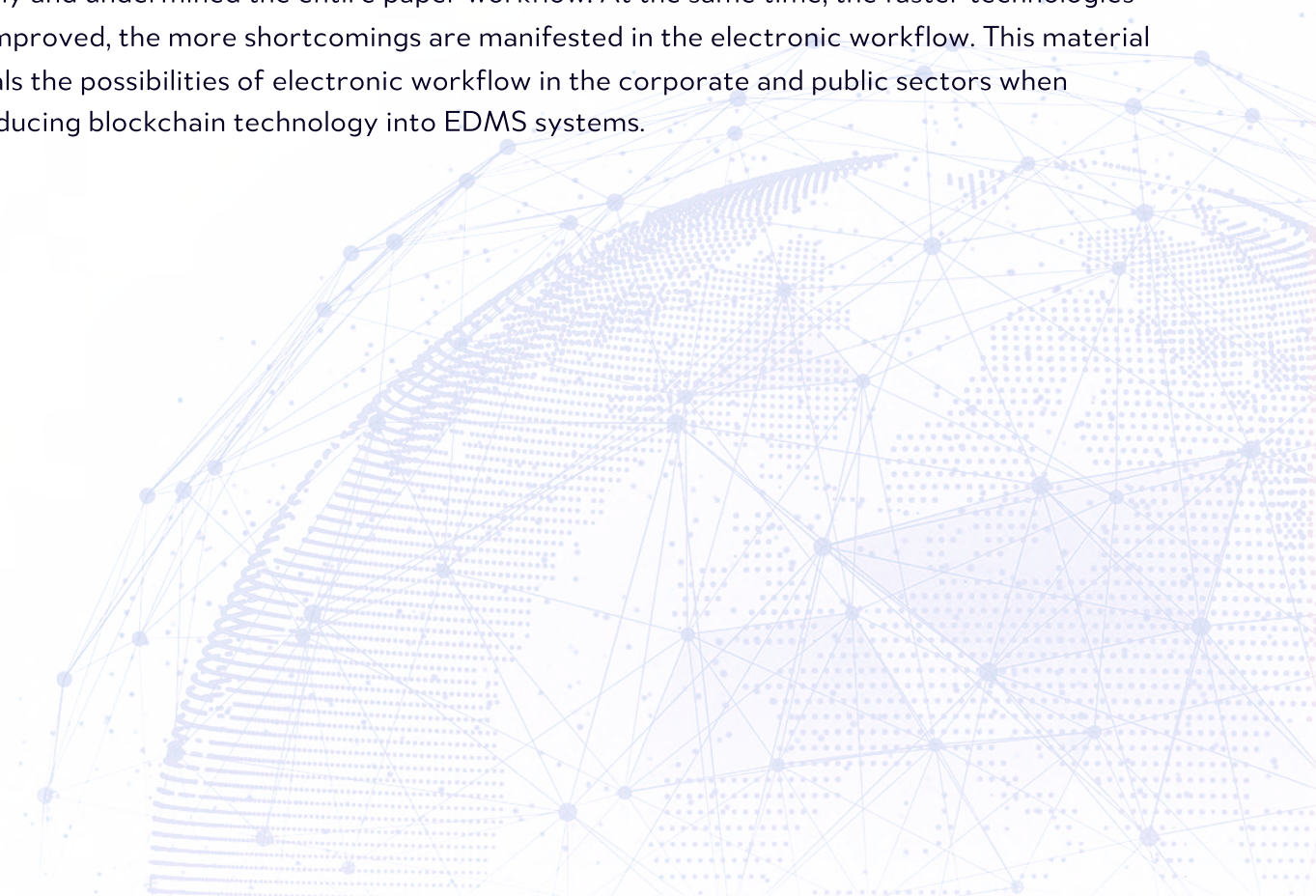
The role of electronic document management systems in the corporate and public sectors

Electronic document management systems play a key role in the office work of organizations in various industries.

Previously, electronic document management tools contributed to the surface automation of classical processes – document archiving. Now, the EDMS allows operating not only with correspondence and internal documents but also to work with contracts, project documentation, as well as to organize complex personnel activities of organizations.

Separately, it is worth highlighting the possibility of EDMS to set up interaction with clients, which consists of processing requests, accepting orders, managing projects, and operating contracts.

As for the public sector, the indisputable feature of its work is the documentation that occurs at every stage of the work. Electronic workflow is involved in the completion of the reports and orders, as well as in the appeals of citizens and the provision of official statements. In addition, it is necessary to take into account voluminous internal correspondence that requires the proper level of confidentiality.

Benefits of electronic workflow

The introduction of electronic document management systems provides organizations with many advantages, namely:

❯ REDUCED TIME COSTS

Often, working with paper documents takes less time than finding them in classic archives. In turn, the creation of a single electronic database with file backup eliminates the risks of losing documents and also minimizes the time to search for the necessary information.

❯ OPTIMUM SPACE USING

Data management through electronic workflow contributes to freeing up the workspace, which in the "paper era" was filled with folders with the necessary documentation. After the expiration of the relevance of the documentation, there is no need for its disposal, since removal from the database will take no more than 30 seconds.

❯ TRANSPARENCY INCREASING

EDMS can provide the ability to track the document status, which is important for the documentation with which various departments of the company or public sector departments work. Moreover, using this approach, when introducing special functionality, it can be traceable when and who had access to the document or made changes to it.

❯ NO DEPENDENCE ON A SPECIFIC LOCATION

Electronic access to the necessary files allows users to work with documents remotely, without being tied to their workplace.

❯ MINIMIZING THE RISK OF LOSING DOCUMENTS

The physical form of documentation is always at risk of loss or damage. In turn, electronic versions, if they are regularly copied, are much safer, because they cannot be forgotten somewhere or intentionally damaged.

❯ COST SAVINGS

With electronic document management systems, there is no longer any need to allocate funds for paper and mail forwarding, as files can be moved quickly and reliably, regardless of the distance between the sender and the recipient.

Problems and threats of EDMS implementation

Despite the advantages described above, electronic document management systems have a number of vulnerabilities that expose companies and organizations to certain risks.

> UNAUTHORIZED ACCESS

Some documents with the "confidential" status may become available to third parties, who subsequently can use the information received at their discretion. In this case, the company is exposed to reputational and financial risks.

> POSSIBILITY OF INTENTIONAL DELETION

The possibility of backup has already been described above, which minimizes the risks of documentation loss. However, it will not eradicate the problem, since, in such a scenario, it will take more time and technical knowledge to delete the file.

> DOCUMENT FRAUD

With a chain of interacting individuals consisting of several people, there is always space for making changes or even replacing a document. Thus, if four people are involved in working with a file, then each may have a different version. As a result, this can provoke lengthy investigations, disputes, as well as financial losses.

> DATA LEAKS

Electronic document management systems are susceptible to hacker attacks and vulnerable to data leaks. This can happen intentionally or due to the influence of the human factor. Confidential documents can become the property of cybercriminals who can subsequently use them in blackmail or fraud.

> LACK OF TRUST

This problem is clearly presented in the public sector when you need to be sure of the data authenticity. The state budget, the results of the elections, as well as the reports, are presented ready-made, citizens will not be able to track how and how much money was spent and for what needs. Thus, a layer of distrust of the population towards the authorities is formed.

Blockchain as a solution to electronic workflow problems

Based on the above-described problems and threats of modern workflow, it is necessary to consider these systems through the prism of modern technologies that can eradicate them. A safe and technically feasible solution can be considered distributed ledger technology.

Distributed ledger technology (DLT) can be called distributed storage technology. Blockchain is one of the forms of a distributed registry that forms a list of ordered records and forms blocks of them. Each block contains a timestamp and a link to the previous block.

It is worth noting that the blockchain implementation guarantees the immutability of data by persons not entitled to it, through the use of encryption. Only the "owner" of private keys has the right to change data, without these keys writing to the registry is impossible. Thus, a document management system using blockchain technology is able to establish a trusted working environment with the protection of confidential data from third parties, as well as establish communication channels between partners and interacting departments.

Due to the distributed storage of information, hackers are deprived of the chance to carry out an attack on such systems, as well as documents are protected from falsification, since all those who have access to read it cannot make changes.

Achieved solution at the R&D stage

At the R&D stage, a platform based on Blockchain and IPFS technologies was developed for internal document exchange of companies and organizations with high requirements for information confidentiality. To implement Blockchain technology, Parity Ethereum is used.

Blockchain technology guarantees the immutability and authenticity of data and also makes impossible their hidden change. Since the data is immutable, we can always establish a true file owner and get the history of its changes. With the help of Parity Ethereum, which is used as a system of access rights management based on a smart contract, access is restricted to persons who don't have the necessary access rights.

The IPFS technology was used to create a file system (directory structure and tools for working with files).
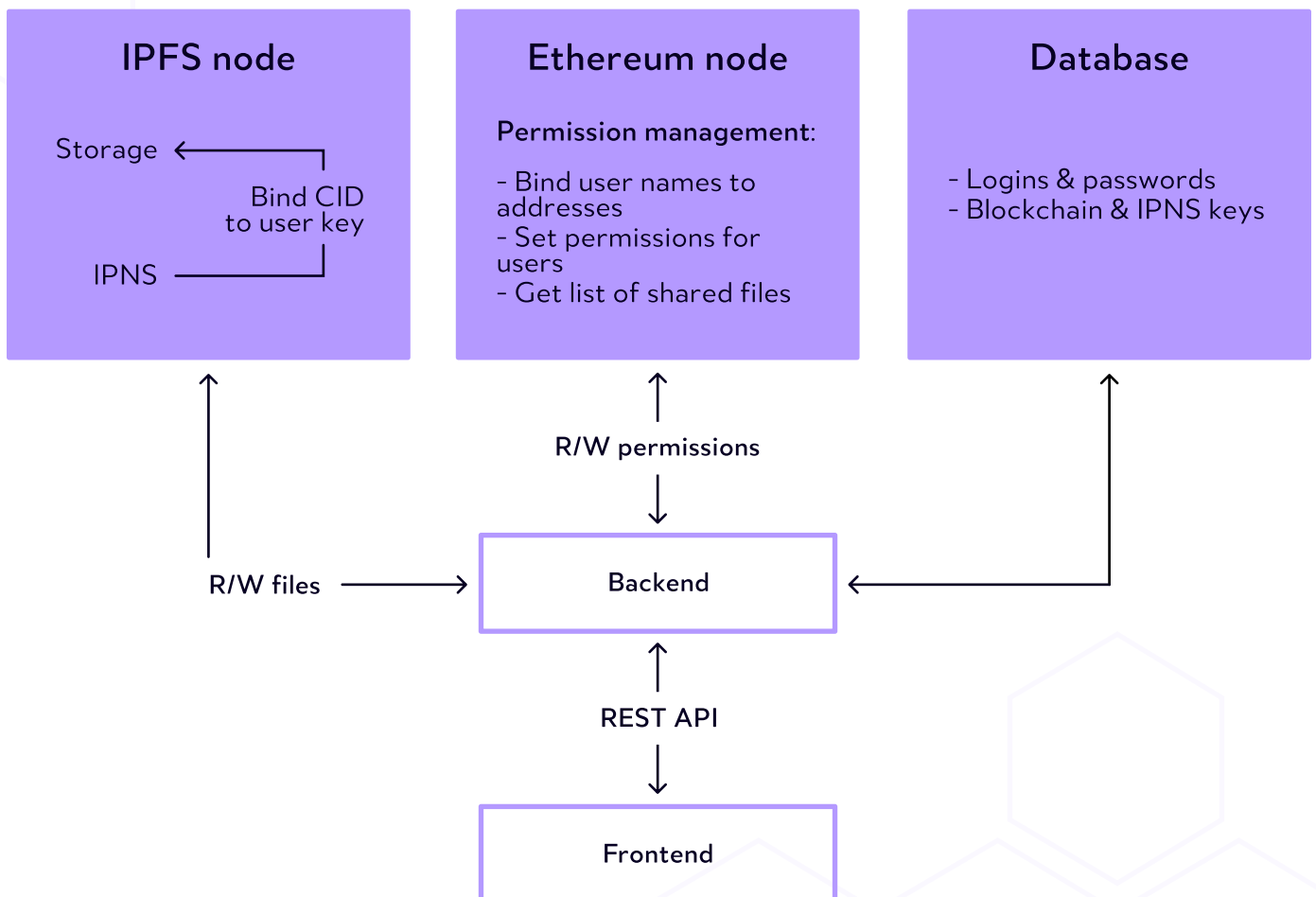
How it works

The user is registered in the system with a unique name (identifier). This user is assigned a personal root folder, where he can create other folders or upload files to it.

The user receives ownership of his created folders and uploaded files by him. The user can upload files to any folders to which he has ownership or update rights.

For each object, the user can see his rights to the data file or folder. The user can create or change the right (access) to read or write to files or folders if he has the right to own them. Also, the user can transfer the ownership of the file or folder to another user while retaining the right to view and update this object until the new owner changes the data rights.

SOLUTION ARCHITECTURE

IPFS node

Storage ←

Bind CID
to user key

IPNS

Ethereum node

Permission management:

- Bind user names to addresses
- Set permissions for users
- Get list of shared files

Database

- Logins & passwords
- Blockchain & IPNS keys

R/W permissions

R/W files →

Backend

REST API

Frontend

How it works

- **Database** - the database is used to manage users (storing login-password pairs) and private keys for Ethereum and IPNS. This is done for the convenience of using the system through the API and eliminating the need for the user to install additional software for working with Ethereum and IPFS.

- A **smart contract** for managing access rights to files and directories runs on the **Ethereum** private blockchain. This smart contract has the following functionality:

    - The user can provide rights to view and update directories and files to other users.
    - The user can view file permissions.
    - The user can get a list of directories and files available to him indicating their owners.

Important note: all directories and files must be pre-registered in the smart contract.

- **IPFS** provides distributed storage of user files and directories.

- **IPNS** is a distributed registry for files and directories. The principle of IPNS is that users publish a fixed resource address, which is stored in IPFS, signed with a key from a public-private key pair. Updating a record in IPNS can only be done with the key used to create the record. This system allows providing a permanent address to a resource when it is updated, which is a necessity since resources in IPFS are addressed by their hash sums (content ID, CID) and when the file is updated, its CID changes.

# The MVP version of the solution

The following functionality is included in the MVP version of the solution:

1. The file owner, when selecting a file, sees all its versions. The file owner has the ability to download any previous file version and compare the changes.
2. The file owner can delete the final version of the file available to him.
3. The user can search among the files available to him.
4. The user has the ability to receive notifications about actions with files that he has access to.

Conclusion

Existing document management systems, although they have undergone significant changes in recent years, and also contributed to the optimization of many processes, are still not perfected and have many vulnerabilities.

In turn, blockchain technology in conjunction with IPFS provides a safe and functional solution that allows establishing smooth operation with important documents within companies and government agencies. At the same time, the proposed system has undeniable advantages, since users of such a solution are provided with a trusted and secure working environment where no one can affect the reliability of the data, as well as deliberately capture them.
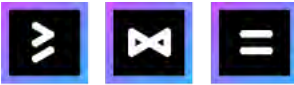
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482.solutions is a technology company specializing in the development and integration of distributed systems and solutions using Blockchain technology since 2013.

The company is known for its innovative views on technological progress and IT developments using blockchain technology in the areas of R&D, IoT, Smart City, eGovernment, Energy, and Robotics. 482.solutions is a regular contributor to working groups and technology implementation initiatives in the real economy and in the public sector.