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Prevention of Piracy in Entertainment Media Sector Using Blockchain Technology

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Abstract: ***In the recent decade with the improvement in network technology and easy access to cheap internet plans, more than 59% of the world is online.*** [1] ***With the growing online population, illegal redistribution of digital content is also growing, costing content creators and owners millions of dollars. Blockchain, the revolutionary technology behind the popular crypto currency Bitcoin, has been deemed as a great solution for resolving piracy issues. This paper first looks into the blockchain technology and identifies the ways in which piracy is carried out. Then it proposes novel solutions in which blockchain technology can be used to prevent piracy in the entertainment media sector.***

Keywords: Blockchain, Distributed Ledger Technology, Cybersecurity, Online Piracy

I. INTRODUCTION

With the onset of the 21st century, development in information and digital technologies has opened many avenues for distribution of media content. While in the older days, content distribution was limited to broadcasting on cable TV or sale of physical media like cassettes, videotapes, DVD, and so forth, the birth of Web 2.0 in the early 2000's paved the way for the internet to emerge as an efficient content distribution medium. From streaming services to peer-to-peer (p2p) network-based distribution system and file hosting services, accessing entertainment content has become easier than ever. With the ease in accessing content also came ease in illegally copying, modifying, and redistributing copyrighted content colloquially known as piracy.

Piracy has become one of the major problems in today's world where downloading content illegally is just few clicks away. Piracy has a drastic effect on multimedia content creators costing them huge financial losses and their royalties due to unpaid and unauthorised downloads. What is more concerning is the fact that piracy has been normalised by the society. A lot of measures to counter piracy have been developed over time collectively known as digital rights management (DRM) tools. It includes technologies like watermarking, coded anti-piracy (CAP) marks, metadata tacking, persistent online authentication, and so on. The problem with these traditional anti-piracy measures is that they are easily avoidable like CAP marks can be removed easily during video transcoding or slightly shifting colours and cropping frames makes watermarks unidentifiable. Thus, the world is in dire need of new and effective anti-piracy measures.

Blockchain technology is something which has risen and gained popularity in the past few years. It is the backbone of the highly popular crypto currencies and has seen use in other fields like recordkeeping or for transfer of ownership. The highly secure and tamper proof nature of blockchains is the reason why it has gathered so much popularity among the public. So, the question arises whether blockchain technology can be used to prevent piracy or not.

The objective of this paper is to answer the question, can blockchain technologies be used to enable piracy prevention and provenance and provide content creators with tools to protect their copyrights. To this end the paper looks into the bare working of blockchain technology and identifies the most common methods in which piracy is carried out. The research data acquired is then combined to propose effective solutions and methods to prevent digital piracy.

II. LITERATURE REVIEW

A. Blockchain Technology

Blockchain is essentially a database, a list of records called blocks linked to each other cryptographically. It is "an open, distributed ledger that can record transactions between two parties efficiently and in a permanent way". [2] Each block is time stamped and contains cryptographic hash of previous block along with transaction data. The blocks are therefore linked to each other forming a kind of chain, thus the name blockchain.

New blocks in a blockchain are stored linearly and chronologically. They are always added at the end of the blockchain. After a block is added to the chain, it is very improbable and quite impossible to remove it or change its content due to hashes. Hash is a string of alphanumeric characters formed by converting the information data in a block using a complex math function.

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Each block contains its own hash, along with the hash of the previous block. If the information in a block is changed, its hash changes as well. In a hypothetical situation, if a hacker changes the transaction data in a block, the block's hash will change. But the next block in the chain will contain the old hash. Therefore, to cover the traces of hacking the hacker will need to change the hash of that block too. This cycle will continue till the end of the chain. Therefore, in order to change a single block, all the blocks after it in the chain need to be changed. Recalculating all those hashes would require tremendous computational power which is near to impossible in big commercial chains.

Blockchain in the recent years has seen increased funding and investments by banks, companies and other institutes who are interested in the technology and want to adopt it to provide a more secure and transparent transaction medium. Bitcoin, the widely popular crypto currency which uses blockchain as its core technology has also seen a 400% gain in the user base from 2016 to 2019. With the increased interest in the technology by the masses, blockchain is evolving rapidly and seeing use in domains other than finance. According to a recent PWC report, 77 percent of financial institutions are expected to adopt blockchain technology as part of an in-production system or process by 2020. [3]

B. Current State of Piracy

Digital piracy is the act of illegally downloading, consuming, or redistributing copyrighted content without the permission of the owner. Piracy has been there since the arrival of the first personal computer. During the initial years of personal computers, piracy was carried out by copying content from physical media such as cassettes and floppy disks and then distributing it through Bulletin Boards.

In the early 90's with the introduction of internet and World Wide Web, piracy became an international phenomenon. File Transfer Protocol (FTP) was introduced, which made distribution of files easier. Piracy sites known as "Warez" started popping up all over the internet. Near the end of the decade, there was almost a 3000% increase in internet speeds. This led to faster download times, making pirated content instantly available. With the increase in piracy, Warez sites started experiencing difficulties since they were not able to handle so many users at once. This led to the development of peer to peer (p2p) file sharing technology, which eliminated the need of a central server thus abating the problem of server load.

Even though p2p file sharing was an efficient way of carrying out piracy, it was susceptible to litigation, putting its users into legal jeopardy. This issue was obviated with the introduction of a new p2p protocol called BitTorrent in the early 2000s. In this protocol, users share encrypted parts of the content rather than the content itself, thus saving them from legal lawsuits. Parallelly the world saw the rise of a highly compact mass storage device aka Universal Serial Bus (USB). A large amount of pirated content can now be carried around in drives the size of a finger, making illegal redistribution very easy and common.

Piracy today is such a big phenomenon that to understand it completely we have to divide it into different categories depending on the type of content and the platform they are carried on. Figures 1 and 2 show the estimated revenue lost by different media vendors due to piracy.

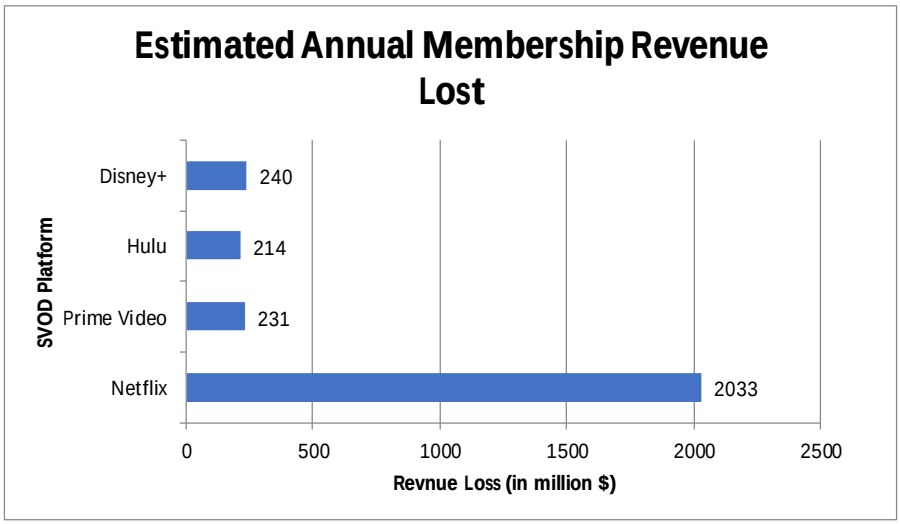


Fig. 1 Revenue lost by SVOD platforms [10]

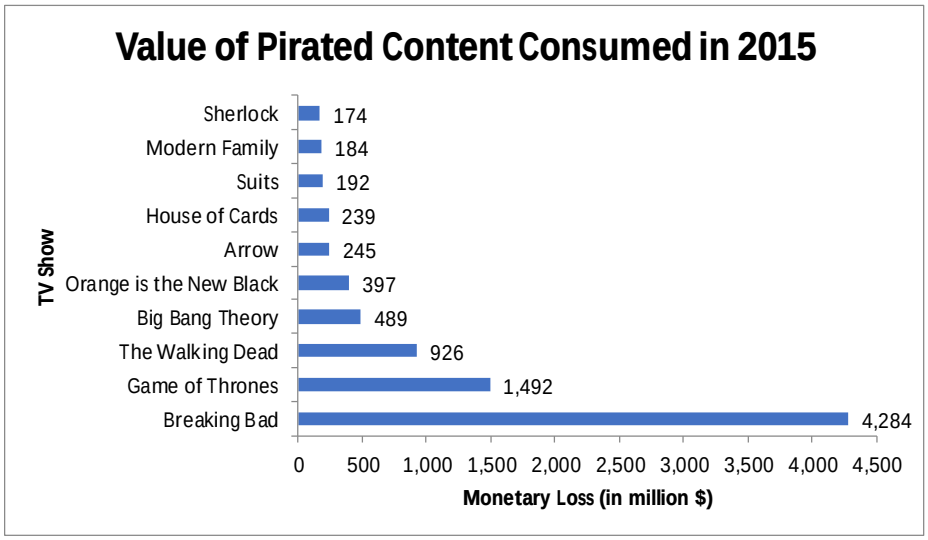


Fig. 2 Loss incurred by TV show producers due to piracy[9]

III.PROPOSED SOLUTIONS

A. Bounty Hunting

Bounty hunting, as the name suggests, is a process where certain searching and hunting is done to receive a bounty or reward. A monetary reward like a Bitcoin can be embedded inside the media file. This would incentivize people outside of the media space to hunt for pirated content and report them to earn bitcoins. The main advantage of this system is that as the file is redistributed among more people, it becomes more susceptible to be hunted down by a bounty hunter, thus using the fast-spreading nature of pirated material against it.

Custos Media Technologies, a South African company, is the first to develop a proprietary blockchain based watermarking system. They have developed an affordable forensic watermark that is secure, imperceptible, and impossible to remove without damaging the media file. The watermark also contains a bitcoin token. Whenever a bounty hunter reports a pirated file, they earn the bitcoin token and Custos analyses the watermark to find the original owner of the file. By using normal people as bounty hunters, they ensure that almost every piracy site, be it small or big is covered.

B. Content Surveillance

Content surveillance basically refers to monitoring the entire lifecycle of content, from origin to delivery and post-delivery. If the content is redistributed illegally, then it is caught by the surveillance system. Blockchain with its immutable ledger can help in content surveillance greatly. Several ventures have used blockchain to assist in content surveillance.

Digital Passport has been seen as the digital equivalent of DRM. The idea comes from a company named Everledger. Everledger uses blockchain and smart contracts to track and record the provenance of diamonds. It assigns a digital passport to every diamond and with blockchain, its origin and trail of ownership is recorded in an immutable format. This technology can be used in the media sector too. Content can be given a unique digital passport and the ownership can be tracked, making it a blockchain based watermark. Vevue is the first blockchain based streaming service. It is working on a technology named surveillance smart contract, which combines blockchain and patent pending tracking technologies that will be able to track the life cycle of any content. The founder, Thomas Olson has stated “If someone copies content tracked by our technology by any possible means, including videoing or recording a screen, our platform will be able to identify the owner of the device/system where the content was last played.”

C. Blockchain Based Distribution Platform

The streaming platforms of today work on a Server-Client model. The clients or the consumer ask the server or the streaming platform for certain content and the server gives it to the client. While this system is effective in terms of security it is not cost effective. P2P distribution on the other hand has several advantages like scalability, cost-efficiency, fault tolerance, etc. The only thing stopping the industry from adopting it is the lack of copyright protection management systems within these technologies.

Since Blockchain is also a p2p based technology, it might be the solution to an effective and secure p2p based distribution system. Simply put, a video system built on the blockchain would assume controlling the asset at all times, i.e., knowing who downloads, watches, and owns the video. Every party in this arrangement ensures visibility of transfers. *Qureshi et al.* [11] have proposed the framework of a blockchain based p2p multimedia content distribution platform in their paper. They have also provided a solution to collusion fingerprinting which is common in p2p based platforms. This makes the platform extremely secure, and piracy can be traced instantly.

IV. LIMITATIONS AND CHALLENGES

A. Practical Use

Blockchain is mostly used as a ledger in different domains. Most of the anti-piracy solutions we saw also had blockchain working as a ledger in them. For general adoption we have to fully realise the potential of the technology and find practical uses for the technology that solve real world problems rather than acting as a ledger.

Presently, blocks in a blockchain can hold 1-4 Megabyte of data at most, which is insignificant for practical purposes. Storing entire movies and shows on a blockchain is still farfetched. While Liu et al. [12] have suggested a framework for adaptive block sizes to make blockchain based streaming possible, it is still quite a time before it is tested and fully implemented.

It should also be mentioned that the ideal environment for the solutions to work effectively would be a fully blockchain based internet where everything can be monitored, which is not quite possible with current technology.

B. Potential Vulnerabilities

The advocated premise is that blockchain, due to its distributed nature, is harder to attack – less vulnerable. Hackers don't have a single server or central database to attack. Bad actors have to put in considerable effort to reap rewards.

But it is possible. Despite the hype and the potential surrounding it, blockchain is a nascent technology. It's still not known how secure the system is or where unforeseen vulnerabilities may emerge. Only when the technology is used more widely will the extent of potential vulnerabilities be uncovered.

Some of these vulnerabilities have come to light. In fact, one caused the June 2016 split to Ether and Ethereum Classic. A hacker took advantage of a DAO vulnerability which resulted in a USD $50 million heist of Ether. Another example is the hacking of Coinbase - the world's largest exchange for trading cryptocurrency.

C. Adverse Environmental Effects

Most of the blockchains work on Proof of Work consensus model. To perform the difficult calculations, special tools are needed. The special tools also known as mining hardware consume a lot of energy. Special data centres are made which are filled with these mining tools to solve the mathematical problems. These data centres generate a lot of CO_2 and consume energy in Terawatts, thereby contributing to global warming. Nicholas Weaver, of the International Computer Science Institute at the University of California, Berkeley examined blockchain's online security, and the energy efficiency of proof-of-work public blockchains, and in both cases found it grossly inadequate. The 31—45 TWh of electricity used for bitcoin in 2018 produced 17—22.9 $MtCO_2$.

V. CONCLUSIONS

The paper gave an overview of how blockchain works, what are its types and the field in which blockchain is being used these days. Also, the different types of piracy and their impacts have been reviewed. The existing anti-piracy measure present to protect content on different entertainment platforms and their shortcomings has also been reviewed. Using the data from the review, certain blockchain based solutions to counter piracy have been proposed. The disadvantages and limitations of blockchain technology have also been discussed.

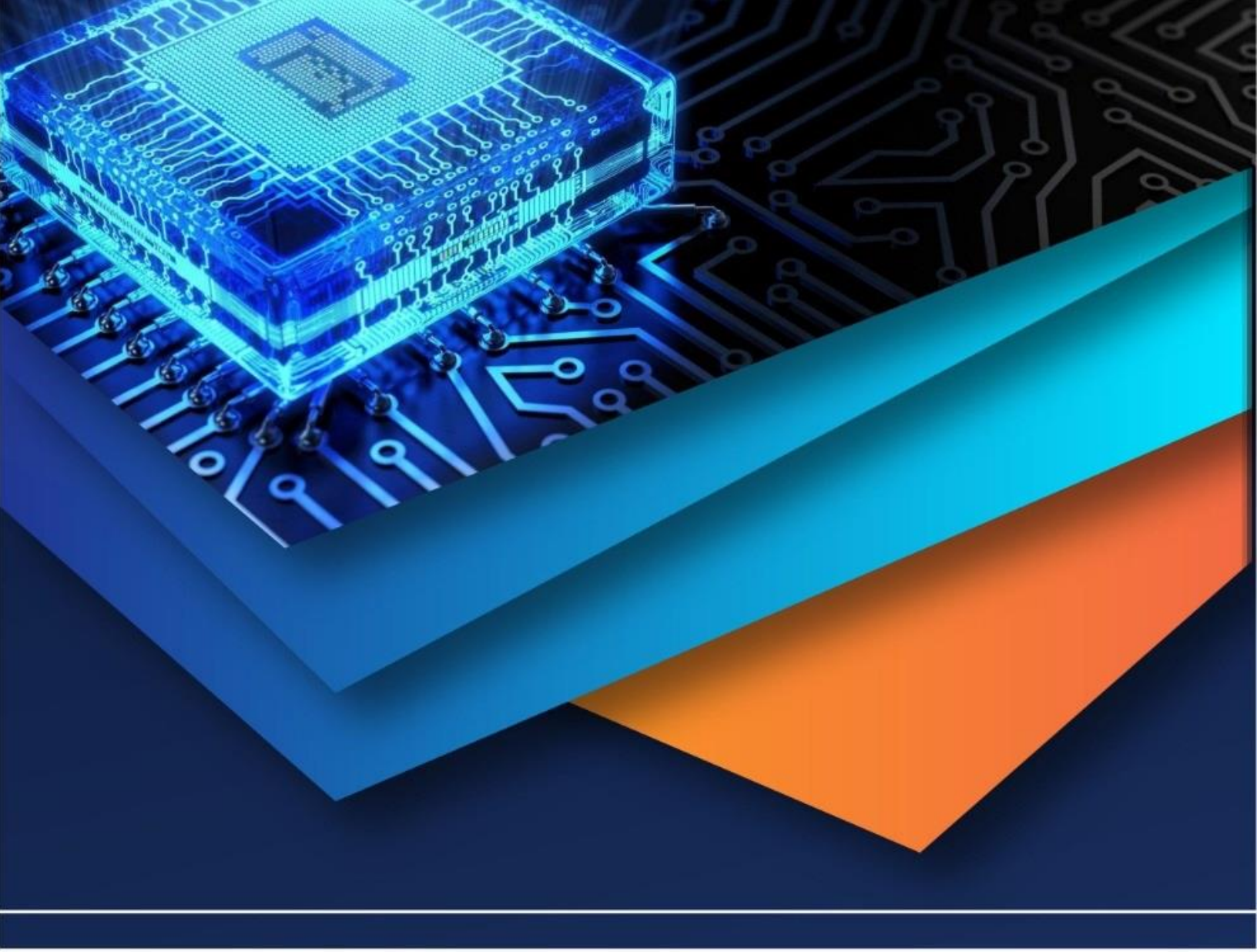
The objective of the paper was to answer the question, "Can blockchain technology stop piracy?" Blockchain might be able to stop piracy completely in the near future but right now its applications are limited and can only make carrying out piracy difficult, at its best.

The technology is still relatively new and there are certain limitations and disadvantages in using it. These challenges may be solved in the future when we can realise the full potential of blockchain and use it effectively to stop piracy. That said, blockchain is still being rapidly adopted by companies and institutions, hence a lot of people are working behind it to make it better. In the future we may see blockchain being used in day-to-day life and acting as more than a ledger for cryptocurrency transactions.

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