USING BLOCKCHAIN TO MANAGE PRODUCTION AND DISTRIBUTION

Éric Minoli and Ulrich Dessouassi

Groupe Média TFO, Canada

ABSTRACT

Alongside the creative challenge of producing and distributing great video content internationally, there is a huge administrative burden.

The contributors to the production – writers, director, actors, musicians, and more – all have to be paid. Sources of funding have to be reconciled, managed and in due course reimbursed.

Once the content is complete, then revenues must be collected from those who buy it – broadcasters, OTT services, other distributors, the packaged physical media supply chain, and even individuals. Some of those revenues will be retained by the producer; some will be passed on to the supply side.

At Groupe Média TFO we have an excellent reputation for creating content, particularly for children, and we want to expand our capacity. But as a government-funded body we have to work within strict financial constraints.

Working with producers, broadcasters, content funders, government agencies, unions and policies makers, we have developed a prototype platform which uses blockchain to create a completely fresh approach to managing all these relationships.

INTRODUCTION

When a producer sets out to create a piece of content, it requires a large number of contracts with different entities. These might include:

- writers
- actors and performers
- composers and musicians, or music libraries
- freelance camera, sound and other technicians
- directors
- set designers and construction workshops
- costume rental

- location hire
- post production.

You can see how the list can go on.

Each of these relationships needs a contract, which will have payment terms. In some cases these contracts will be direct with the individual concerned; in some it will be via an agency or union.

The payment terms will depend upon timing in the production. Some will be paid daily for their contribution; others may have an initial fee and an agreed share of any profits above a given threshold.

At the same time there is another chain of contracts, with those who are going to show the content:

- broadcasters around the world
- content syndicators
- OTT platforms like YouTube or Netflix
- physical media manufacturers (DVDs)
- download-to-own distributors.

Again, each will have a unique contract with details of the payment due to the producer. These may be one-off fees, or they may be linked to the number of downloads or DVDs sold.

After the initial release of the production there may be continuing fees for further broadcasts or availability. These are potentially many years into the future, when the team originally assembled to manage the commercial side of the production has long since moved on.

Finally, there will be a third group of contracts, for those offering the finance for the production. They could be co-producers, or they could be dedicated funding organisations like the Canadian Media Fund. The production could even be part-funded by crowd-sourcing.

This diagram illustrates these relationships:

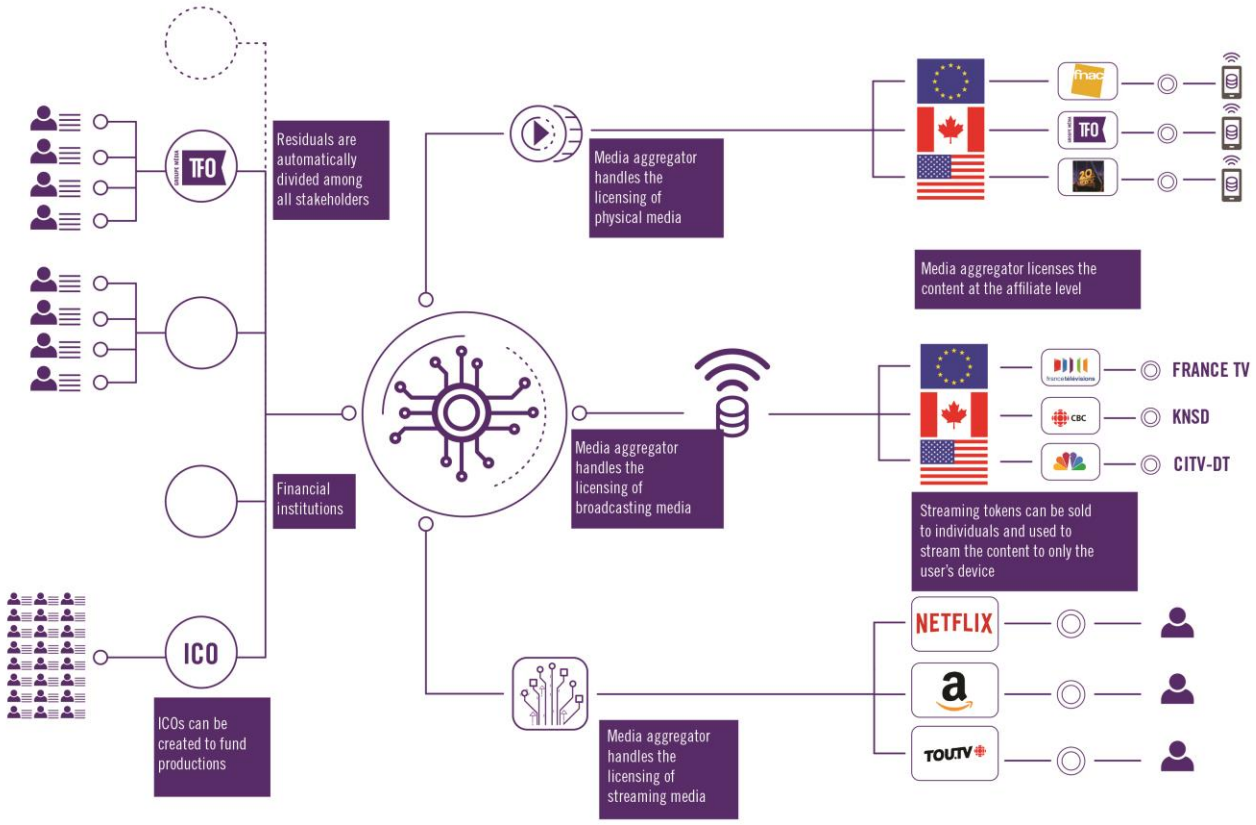

Figure 1 – TFO Blockchain prototype

To simplify this complex commercial process, Groupe Média TFO, with the financial support of the Canadian Media Fund (1), investigated the emerging technology of blockchain. If the resulting system is to be a success it will need widespread acceptance and adoption, so we brought into the project a broad range of potential users. These include producers, broadcasters, unions, funders, government bodies and policy makers.

The project was a collaborative effort which brought together the experience and expertise of this steering group with the technical expertise of specialist partners. The result is a prototype system called Blockchain TFO.

ABOUT BLOCKCHAIN

Distributed ledger technology (DLT) and blockchain are innovations designed to change the way societies create, transfer and store value. The concept of blockchain was invented by Satoshi Nakamoto in 2008 to manage the crypto-currency Bitcoin.

The temptation is to think of blockchain as solely of interest to crypto-currencies. In fact it is a powerful way to provide secure solutions to far broader challenges.

A blockchain is a continuously growing list of records, which are stored not in a single coherent database but distributed across multiple peer-to-peer relationships. It is “append only” in structure, using cryptographic techniques which guarantee that once a record has been added to the ledger, it cannot be modified.

Each block of data contains the previous block, a timestamp and the transaction data which updates the block. Inherent security functionality protects the previous data, and it requires the agreement of both parties to the block to allow changes. It is, therefore, inherently resistant to unwanted modification of the data.

There are two broad classes of blockchain: open and closed. The table (2) below shows the main types of blockchains, segmented by permission model.

Blockchain types		Read	Write	Commit	Example
Open	*Public permissionless*	Open to anyone	Anyone	Anyone*	Bitcoin, Ethereum
Open	*Public permissioned*	Open to anyone	Authorised participants	All or subset of authorised participants	Sovrin
Closed	*Consortium*	Restricted to an authorised set of participants	Authorised participants	All or subset of authorised participants	Multiple banks operating a shared ledger
Closed	*Private permissioned ('enterprise')*	Fully private or restricted to a limited set of authorised nodes	Network operator only	Network operator only	Internal bank ledger shared between parent company and subsidiaries

** Requires significant investment either in mining hardware (proof-of-work model) or cryptocurrency itself (proof-of-stake model).*

Figure 2 – Main types of blockchains segmented by permission model (2)

As the name suggests, an open blockchain is open to all who have an interest. Bitcoin is the classic example of a public, open, permission-less – so-called "censor-proof" – blockchain.

Blockchains can also be built that limit the parties who can transact on the blockchain. Permissions can be given to a number of users to access certain parts of the blockchain, based on a consensus mechanism. This "permissioned blockchain" architecture is most appropriate for businesses in general, and specifically for our requirements. It allows all interested parties to see the relevant parts of the content and value chain.

TFO APPROACH

To implement this system, TFO worked with Canadian blockchain specialist Three Lefts. This company brought to the project its secure blockchain digital contract editor, StonePaper.io (3).

A critical requirement was to make the prototype accessible to its users through a standard web browser. This eliminates any perceived difficulties for access. Individuals without

specialist skills can register as users on Blockchain TFO, which was vital if the proposal was to reach critical mass – the blockchain approach is only valid if everyone uses it.

There are existing, widely recognised blockchain platforms like Ethereum (4) and Hyperledger (5) Fabric (initially developed by IBM (6)). StonePaper.io is designed to provide a transaction and contractual layer on such a platform.

For Blockchain TFO, Hyperledger Fabric was selected. The primary reasons for this choice is that it supports permissioned blockchains, and its consensus mechanism does not require the use of crypto-currency. With its sophisticated query structure, Hyperledger Fabric represents the best practical solution.

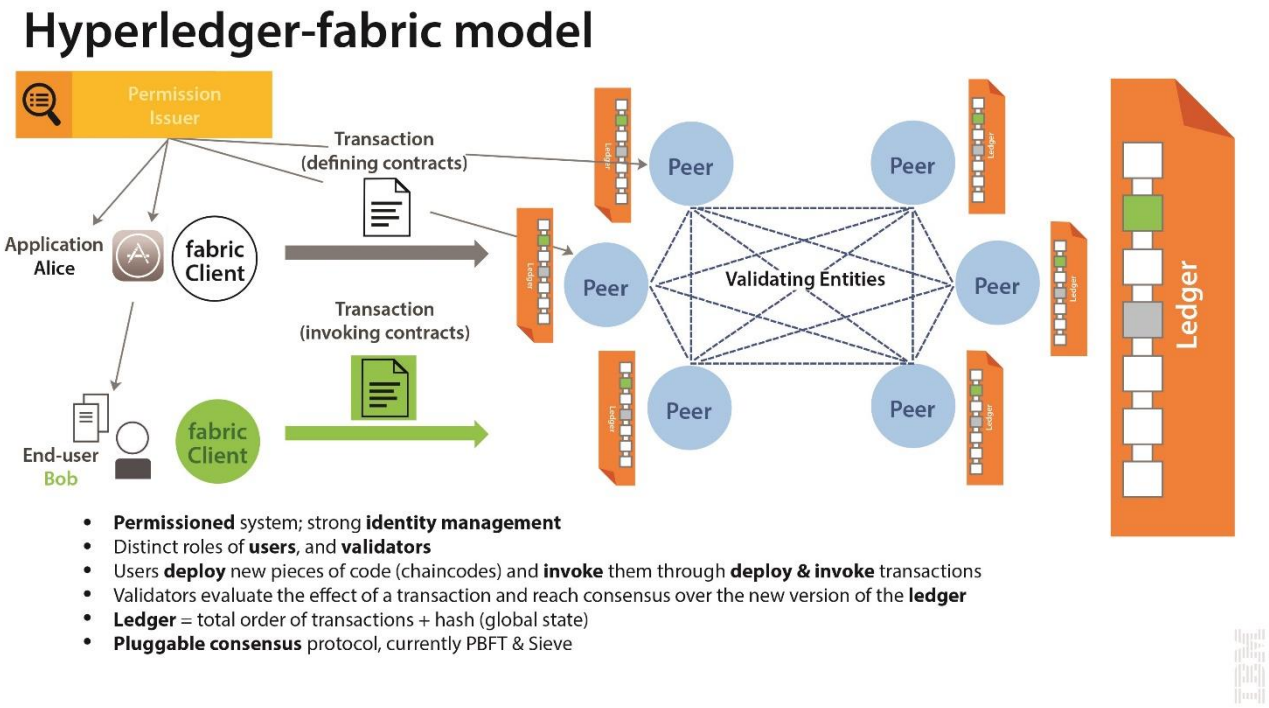

Figure 3 – Hyperledger-fabric model (©IBM)

One important misconception should be addressed straight away. Because of its origins, it is often thought that blockchain is only capable of dealing in crypto-currencies such as Bitcoin. Hyperledger is currency agnostic, and can work with both crypto and fiat currencies – Canadian dollars in our case. This provides financial stability and security to the contracts.

Internally, contracts are measured in pseudo-tokens, which StonePaper.io calls Rai, not after the home of IBC but after the stone tokens used for trade by the Pacific Yapese tribes. Rai is only transferrable among individuals on the same blockchain network, but allows businesses to settle payments among multiple parties.

The advantage of the blockchain structure (enabled by smart contracts) is that payments can trigger further payments, which are implemented instantly. So if a royalty payment is received from a streaming site, then every member of the production entitled to a cut receives it automatically and instantly.

The streaming site effectively buys the required number of tokens to pay its royalties. Those tokens are distributed as appropriate, and the individuals and organisations receiving them can redeem them for real money – potentially in a different currency to the input – as they are transferred to their own banks.

Security is provided by 256 bit AES encryption on every transaction. But an auditor with overview privileges can quickly determine the money trail across the entire history of the production.

IDENTITIES

Most users of the system are called “keyed” users. It is central to the integrity of the system that the blockchain (although not necessarily other users) has a clear record of who or what the user is.

Users are registered by a central membership server. In our prototype we have elected to operate this registry, although this service can be outsourced. It means we undertake to verify a party to a contract, by checking incorporation documents and any other legal considerations, before creating the blockchain user.

The user’s name, address and membership status are stored securely in their identity. The user is then and only then given a user name and a one-time password. When the user enters that one-time password, a blockchain identity is created with all the information.

In return, a secure key is created which is stored on the user’s computer (hence keyed user). From that point on, access to the blockchain depends upon that secure key. Unlike a normal database, all transactions – which in this case means any updates to the blockchain data – must be digitally signed by the user’s identity.

While Blockchain TFO does depend upon someone creating users in the first place, it is important not to think of this as a “system administrator”. This is not the case.

The fundamental advantage of blockchain is that it ties together potentially large numbers of individual relationships by providing mechanisms for trust and transparency, without the need for a centrally trusted middleman.

The easiest way to think of the blockchain is as a network of nodes that are connected to each other to form a chain of data. Each user is in charge of its own identity on the blockchain, and all parties have to provide consent to be connected.

It also gives each user complete confidence over the security of its data. One actor might have negotiated a share of ongoing royalties, for example, and does not want fellow actors to know about it. In our solution, the precise terms of each contract are only known by the legal parties to that contract: the actor, the actor’s agent and the producer in this case.

While keyed users provide the main interaction with the blockchain, the system also supports non-keyed users, which we call floating identities. These are for users who view the system but do not interact with it.

Keyed users can apply to be issued with numbers of floating users: the system supports trillions of users. The issuer can then allocate to each floating user specific privileges from within their own contracts.

So if an actor or musician is engaged through an agency or union, it might be that they choose to allow the agency or union to manage the contract, in which case that body would be the keyed user. In turn, the actor or musician could be allowed a floating licence to allow them to see where the contract is being viewed and check on what royalty payments are likely.

Another application would be a streaming service, which would issue a floating key to each subscriber. This allows for automatic tracking of viewing statistics and, if appropriate, royalty payments. Where the streaming service only has the right to offer the content in certain geographies, this would be a way of demonstrating that it is meeting its commitments.

CREATING A PROGRAMME

As already noted, users access the blockchain via a web browser. Once in the decentralised app on the browser, the producer simply builds the information required to create the programme. This will include information which will be used in later stages: there might be a part of the record for different release formats, for instance.

There is likely to be a hierarchical list of geographical territories to determine where a broadcaster or distribution customer can show the programme. The producer might give a distribution company the rights to sales in Latin America, for example. If that distributor then tried to sell it into, say, Spain, then the user identity for the Spanish broadcaster would be identified by the blockchain and the transaction prevented.

This record can be expanded at any time. If, for example, the decision is taken to make the programme available on DVD then this can be added to the record later. The structure supports more than two trillion different types of distribution – more than enough for our purposes!

Metatags can also be added, allowing individual programmes in a series to be treated separately in some cases, as part of the series for others. Broadcasters, for example, are likely to establish a single contract to show the complete series. But an actor who appears in only one episode would have a contract just for that programme.

Having created the programme identity, contracts are attached to the blockchain as they are established. Note that this approach does not change the way contracts are negotiated: producers will still deal with actors and agents, for example, and there is still likely to be a weighty legal document to be filed on paper.

But the key information from this contract is extracted to form the smart contract. Because blockchain is built on one-to-one relationships, the producer and agent (for example) have to agree that the smart contract is an accurate representation of the commercial terms before it can be added to the blockchain. Once added, it can only be updated by mutual agreement: neither party can make unilateral changes.

Smart contracts are established for writers, musicians, actors, technicians and others in the same way. It is up to the individual if they appear as entities on the blockchain or they devolve this to their agents or unions. In either case, they can then offer floating licences to related parties to monitor the contract.

Below is a screen capture from the prototype system, showing the set-up of a programme called Paw.

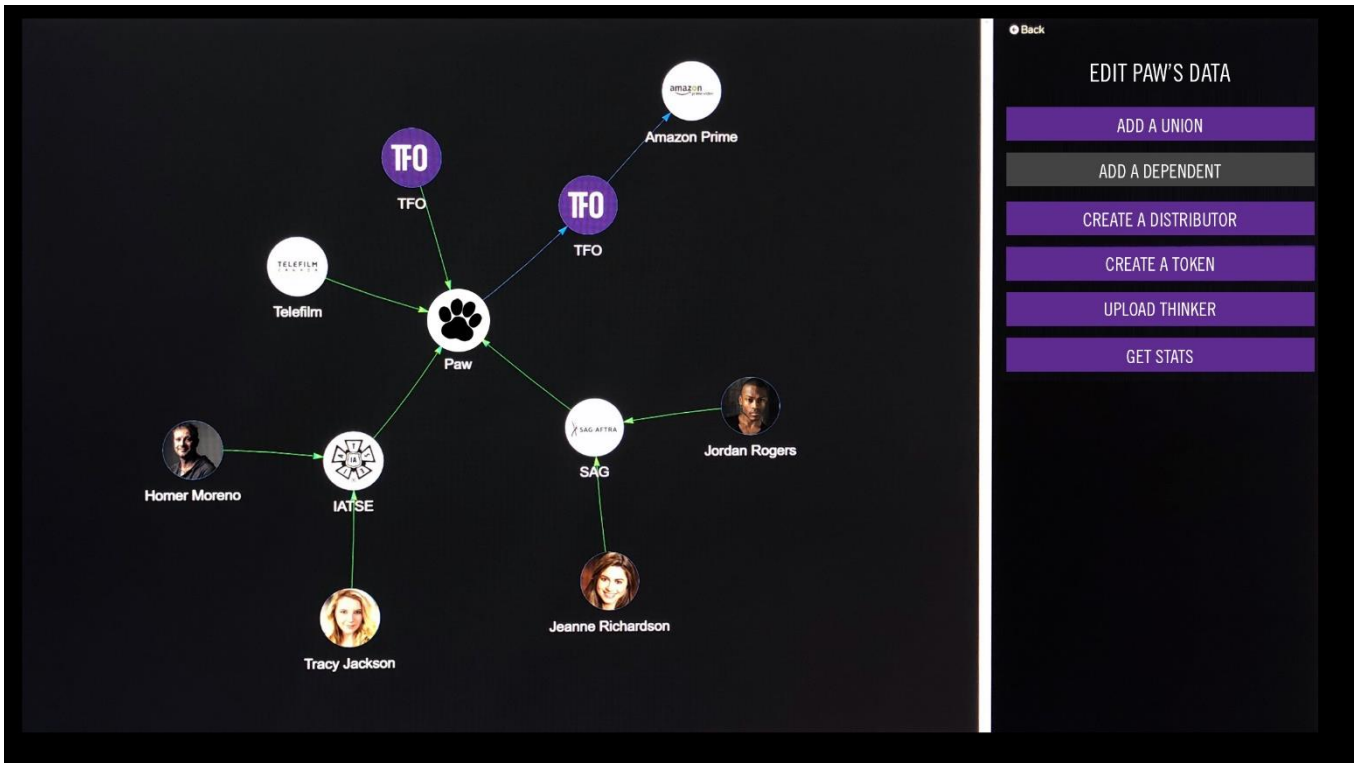

Figure 4 – Prototype system: set-up of a programme

DISTRIBUTION

Once the production is under way, the producer will look to create a second batch of contracts for those who will show the programme. These might include broadcasters, OTT networks, and online and physical media sales. Typically, these will buy the rights for a specific time and/or a specific number of transmissions, and for a defined geographical area. All of these are defined in the smart contract.

The content itself is not stored as part of the blockchain. It is likely to be stored in the cloud, with access to it granted by successful compliance with the terms of the blockchain contract.

Where the contract limits the use of the programme to, say, six transmissions within two years, then the blockchain would issue six time-limited tokens to the broadcaster, with each being “paid” at the point of transmission.

If the financial terms of the contract include part payment on each transmission, then the transfer of the play token would also trigger the transfer of the appropriate number of tokens. Blockchain TFO includes the ability to prevent the playout of the content if payment is overdue.

If it is a streaming site that has the rights to unlimited streams of the content, then simply issue a million or a billion tokens – it is as easy to track 100 billion tokens as it is to store one. These tokens could have a sunset date if you sell the rights for a limited time.

The blockchain will record the precise time each token is “spent”, immediately giving the producer a view on who is watching the content, at what times, and where in the world. If an OTT distributor uses a social media account for log-in, you get granularity down to the individual user with no additional effort.

While DVDs might be seen as a dying business, they are still popular in some markets – and a popular route for piracy. The Blockchain TFO system covers this, again by using the token system.

Each individual disk has its own token – remember you can have as many tokens as you like – and that token number could be printed as a QR code on the face of the disk. Any DVD without the QR code, or with an invalid token number, is a counterfeit.

All this happens automatically across the blockchain. The producer does not need to employ staff to manage contracts long-term: they are all embedded in the blockchain and will be implemented and enforced by it. Even if the producer should go out of business, payments which go from the consumers of the content to the creators of the content will still be made.

The two screen captures below show how a distributor is attached to a programme.

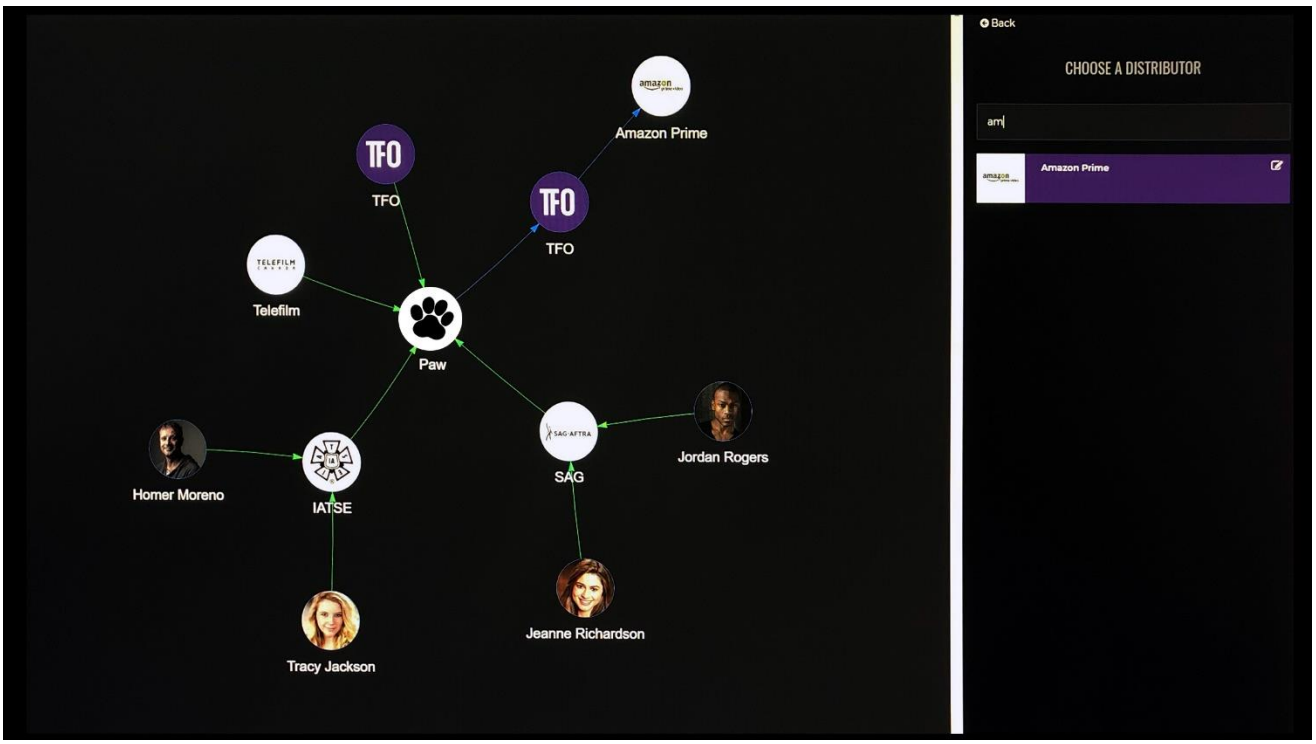

Figure 5 – Prototype system: how a distributor is attached to a programme (step #1)

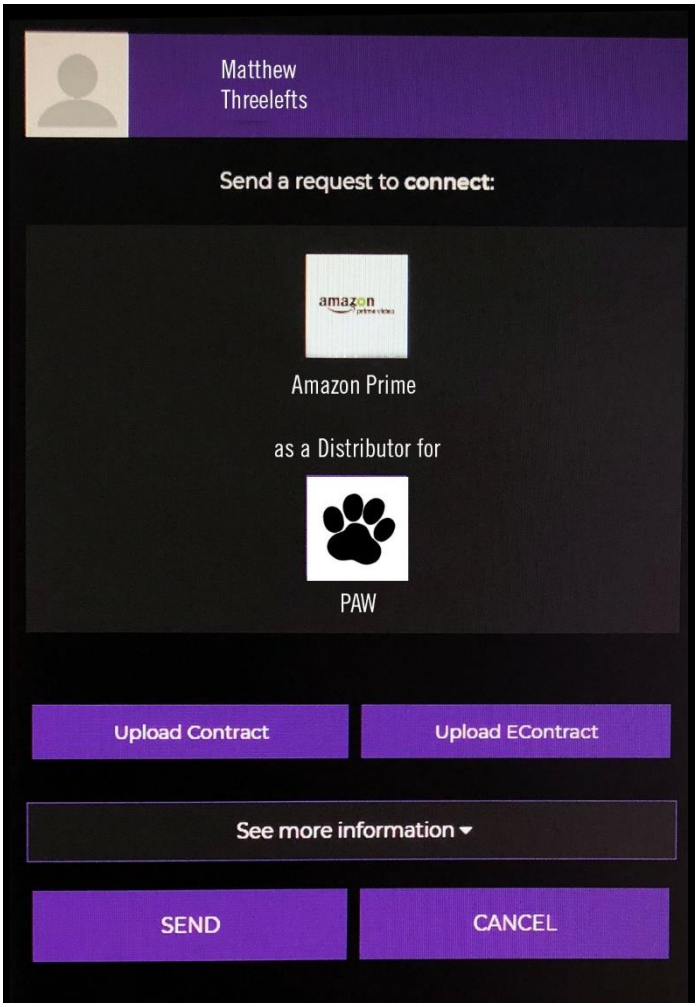

Figure 6 – Prototype system: how a distributor is attached to a programme (step #2)

FINANCIAL RECONCILIATION

Because the money involved in the production has to exist in the real world, there has to be a bank account associated with each production. In the Blockchain TFO prototype, we use the pseudo-currency Rai to provide financial transactions. Rais are stored in the virtual wallet of each participant.

Rais allow a distributor to purchase the rights to use the content. The purchase, and transfer of Rais, is disseminated through the blockchain, effectively instantaneously, so the system can confidently be used for day and date release.

The income for the producer can then be split into as many outgoings as are defined in the whole collection of contracts. So if an actor or composer is entitled to a percentage of the royalties once they reach a certain point, then the appropriate number of Rai are transferred to the contributor's bank account.

The contract might determine that royalty payments are made every three months, or you may decide to accumulate royalties until there is a worthwhile sum to transfer: it can be disheartening for an actor to be told they have a royalty payment only to discover it is only a few cents!

As noted before, the recipient is the keyed user, with the possibility of a floating user monitoring their part of the contract. So an agent could reconcile payments from a number of productions into a single payment to an actor, but the actor could see what income was likely from any project managed by the blockchain.

This architecture also supports sources of funding for a production. In our case, we might agree advance funding from the Canadian Media Fund, in return for a cut of the return.

On the blockchain, we allocate a funding token to CMF, and set a rule in the contract that this token is worth whatever we agreed. It might be 15% of the gross revenue, or of the net profit once production costs are recovered. Whatever it is, the blockchain simply follows the rules and transfers the appropriate proportion of the income as it becomes available.

The same structure could even be used to crowd-fund a project. Say you need to raise a million dollars to complete a production. You might invite funding from individuals: you could create 1000 tokens and ask people to put up $1000 each. Or you could create 10,000 tokens and ask for $100 each – remember you can create as many tokens as you like.

Each crowd-funder would then have an electronic contract, under terms to be agreed. You might reserve 10% of the gross revenue to return to the crowd-funders. If you then received payments from broadcasters worldwide totalling two million dollars, $200,000 would be split off, broken down into 10,000 payments of $20 each, and sent to the individuals.

Every time the project received income, the sources of funding would be recompensed in exactly the same way. The administrative overhead of managing funding from such a large number of contributors has meant that crowd-funding has been impractical in the past, but using blockchain it becomes simple.

Given co-operation with the production to reissue keyed user status, it would even be possible to create a market in shares in a production, allowing individuals to gamble on whether to stick with the prospect of continuing future income or sell the share now.

Across the whole blockchain, the identity, contract and payment record of everyone who holds payment tokens is stored in encrypted form. An authorised third-party agent – such as the government tax authority – can be given permission to decrypt specific information to build an audit trail.

ELECTRONIC CONTRACTS

The prototype Blockchain TFO allows for two types of electronic contracts (smart contracts), both in JSON format. Note that a fake virtual currency (pseudo token) is used which has no corresponding value in any fiat currency.

Distribution contracts specify the medium, region, price breaks and costs in percentage and dollars that a particular individual has to pay to view content.

Medium is the first identifier, stored as a long 64-bit integer.

Regions are 16-bit unsigned integers stored as a long 64-bit integer. Each number specifies the region with increasing levels of specificity. First is the continent:

All – 0
Africa – 1
Asia – 2
Caribbean – 3
Central America – 4
Eastern Europe – 5
Western Europe – 6
Middle East – 7
North America – 8
Oceania – 9
South America – 10

The second 16-bit integer is the country, then states or provinces and cities for areas where the market is segmented at that level.

Price breaks are specific values in which the profits of the production will be split in different ways.

So for example a distributor that purchased a movie for 200,000 might want to retain the first 200,000 of earnings. As such the e-contract's first financial bracket from 0 to 200,000 would go directly to the distributor, with future profits being split between the distributor and the creator.

Hard costs represent money that needs to be paid for each view of the production. These can include residual payment to actors or licensing costs for music. Hard costs are calculated first.

Points represent percentage profits from the production. So for example an individual that wished to receive 25% of the profits from a movie would receive 25 points. Points are only calculated from the value in the chain directly above them.

So for instance if TFO promised 25 points to Telefilm, and then licensed it to Alliance Atlantis with a hard cost of $10 and Alliance Atlantis sub-licensed it to Netflix for $2, every time it was played on Netflix, Telefilm would receive $2.50: 25 points on the value in the chain immediately above it. Alliance Atlantis might in turn have a points agreement with Netflix.

Union contracts follow the exact same format as distribution contracts except they are applied to all crew members. As such they contain an additional attribute called role.

Role is a long 64-bit integer that is used to indicate the role of the individual. So for example actor, director and cinematographer might all be roles in the system that each correspond to a different number.

CONCLUSION

The goal of this project was to help the audiovisual industry better understand the capabilities and possibilities which blockchain offers. In particular, we wanted to identify practical savings in administration not just at the time of setting up a production, but into the future when continuing payments are still contractual obligations but the production

company may no longer have the resources available to complete them – indeed, it may not exist at all.

With the support of Canadian Media Fund, and with the active engagement of a broad group of industry collaborators, we have developed a working prototype of Blockchain TFO. It is currently in use in Canada and in France, and is available for other media groups to further their own understanding of the advantages blockchain brings.

Besides TFO, CBC (7), the main public broadcaster in Canada has already used the prototype, along with a group of independent producers, public funding agencies like Telefilm (8), the CMF (1), OMDC (9), CNC (10), federal government regulatory agencies, graduate university students in media production (11) and many more.

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