# Blockchains and smart contracts in the culture and entertainment business

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***Abstract***:
Contracts are omnipresent in the culture and entertainment business, in particular in the film, video and music industries. Whether passed with authors, producers, publishers or distributers, contracts are not always applicable or executed however. The minimum sums guaranteed under a contract might transfer an "excessive" share of the value toward producers and editors; and the absence of legal metadata might reduce the amount paid to the rightful owners, such as performing artists. Is it utopian to imagine a contract that is coded and executed automatically so as distribute a "fair" share of the value to the creators, producers, editors, distributors and consumers of digital contents and to remunerate the rightful owners as a function of consumption (via downloading or audience ratings)? Blockchain technology is part of the answer…

Blockchain technology was first imagined by Satoshi Nakamoto (2008).[1] This system of electronic peer-to-peer (P2P) transactions introduced both the cryptocurrency bitcoins (BTC) and the Bitcoin network. On 3 January 2009, the first block was placed on the Bitcoin blockchain in the Bitcoin network. Other systems using distributed ledger technology (DLT) have followed, such as Namecoin (with the cryptocurrency namecoin), Omni (with omnicoins) and Ethereum (with ethers, ETH), and even asset services (similar to a local cryptocurrency but dependent on an outside system) such as SingularDTV (with the asset SNGLS using Ethereum) or MaidSafeCoin (maids using Omni). On 10 May 2017, 727 cryptocurrencies and 106 assets were in circulation.[2]

[1] This article has been translated from French by Noal Mellott (Omaha Beach, France). The translation into English has, with the editor's approval, completed a few bibliographical references.
[2] For updated statistics, consult: https://coinmarketcap.com/all/views/all/

**Exemples de crypto-monnaies et d'*assets* associés à la technologie *blockchain***

| Crypto-monnaie (code de la monnaie) | Date de création du premier bloc (bloc de genèse) | Réseau de transaction électronique P2P |
|---|---|---|
| bitcoin (BTC ou XBT) | 3 janvier 2009 | *Bitcoin* |
| namecoin (NMC) | 19 avril 2011 | *Namecoin* |
| litecoin (LTC) | 8 octobre 2011 | *Litecoin* |
| nxtcoin (NXT) | 24 novembre 2013 | *Nxt* |
| omnicoin (OMC) | 4 janvier 2014 | *Omni* |
| dash (DASH) | 19 janvier 2014 | *Dash* |
| monero (XMR) | 18 avril 2014 | *Monero* |
| xem (XEM) | 29 mars 2015 | *NEM* |
| ether (ETH) | 30 juillet 2015 | *Ethereum* |
| tao (XTO) | 26 août 2016 | *Tao* |

| *Asset* (code de la monnaie) | Service d'*asset* | Système de transaction électronique P2P |
|---|---|---|
| reputation (REP) | *Augur* | *Ethereum* |
| sngls (SNGLS) | *SingularDTV* | *Ethereum* |
| maid (MAID) | *MaidSafeCoin* | *Omni* |



**Figure 1**: Blockchain technology: Examples of cryptocurrencies and of "assets" with the date of creation of the first (genesis) block and the peer-to-peer network

In this system, each transaction is published on the P2P network. It is incorporated in a block, which is validated from within the network and then added to the blockchain (PONS 2017). A transaction *N* is characterized by its hash (prefix *0x* plus 60 characters), a timestamp, the amount of the transaction, fees, the addresses of the sender *A(N)* and of the receiver *B(N)* (prefix *0x* plus 40 characters), a block number, and input and output scripts. Blockchain.info, Bitcoin's block explorer engine, serves to view transactions.

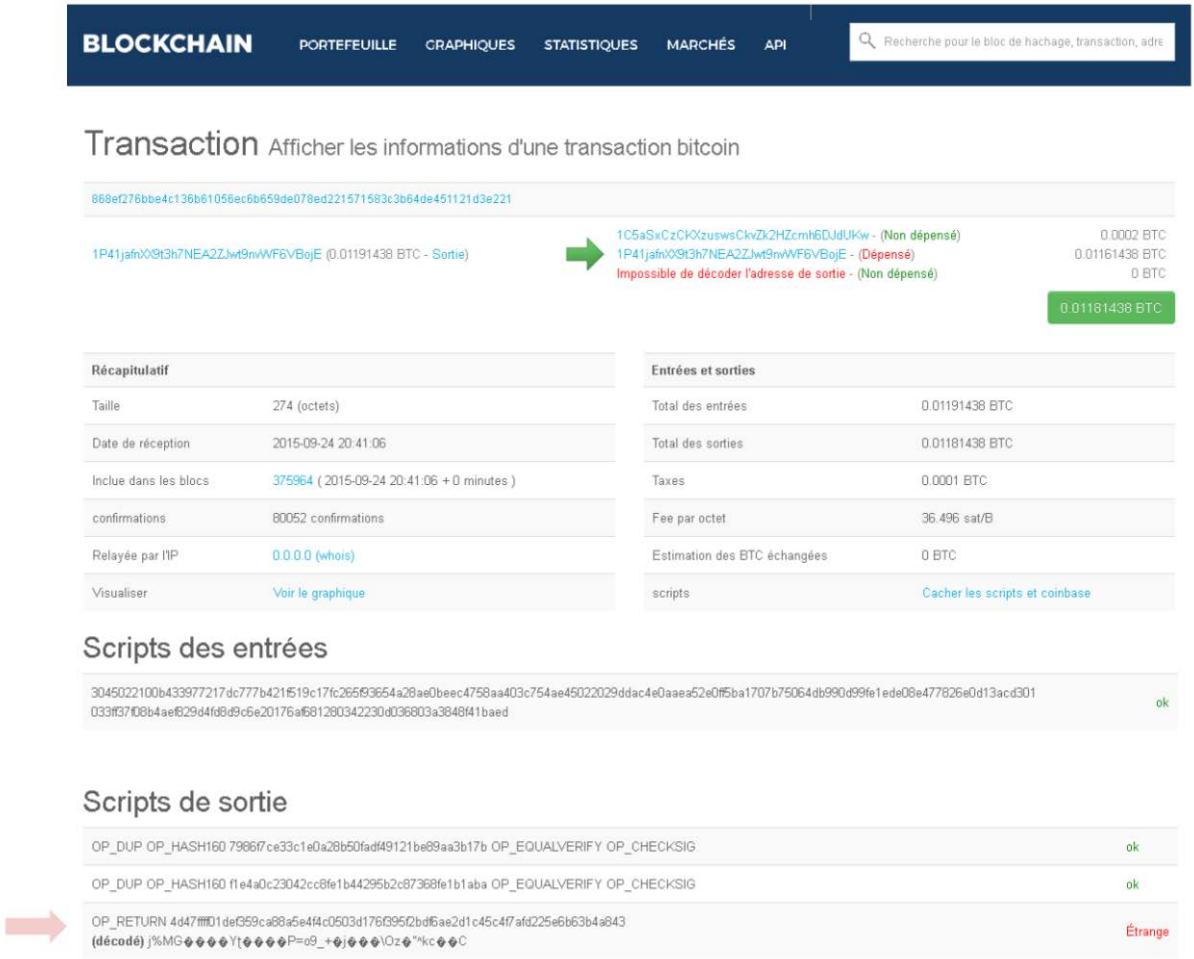


**Figure 2**: A transaction via Monegraph

Figure 2 presents a transaction that, started by Monegraph, incorporates smart contracts linked to the deposit of a graphic.[3] The ouput script's third line is a field free for entering information. It opens the possibility for new applications in the culture and entertainment business, in particular for: creative and productive collaboration, the elimination of intermediaries from the distribution of contents, the management of royalties, contracts and electronic payments. This article takes a closer look at these applications in cinema, video and music.

[3] Respectively: https://www.blockchain.com/
& https://monegraph.com/

# The culture and entertainment business

Given the generalization of distribution via the Internet, most sectors in the entertainment and cultural industry use the same system for transmitting digital contents. The same steps are followed: creation, production, edition/publication, distribution, diffusion/circulation/broadcasting and consumption (PONS 2014).

## The film and video industry

In cinema and video, the timeline for a film's distribution depends on the medium: the film's release in movie theaters, its physical and digital releases (from 4 to 48 months after theaters) and broadcasts on television (from 10 to 30 months after theaters).[4] Processes are organized in a workflow thanks to the international DCI standard (Digital Cinema Initiatives). Given the chaining of these processes, multimedia data and metadata are passed along from one step to the next (PONS 2015a).

| **Acronyms & initialisms used in the graphics** | |
|---|---|
| AàD | audio on demand |
| AFNOR | Association Française de Normalisation (French Association of Standardization) |
| ASIN | Amazon Standard Identification Number |
| CGV | general sales conditions |
| CNC | Centre National du Cinéma, de l'Image et du Son (National Center of Cinema, Image and Sound) |
| DAO | decentralized autonomous organization |
| DCI | Digital Cinema Initiatives |
| DCP | Digital Cinema Package |
| DDEX | Digital Data Exchange |
| DLT | distributed ledger technology |
| EVM | Ethereum Virtual Machine |
| GSA | big retail chain stores |
| GSS | specialized big retail chain stores |
| IPD | International Performers Database |
| IPI | interested parties information |
| IPN | International Performer Number |
| ISAN | International Standard Audiovisual Number |
| ISO | International Standards Organization |
| ISRC | International Standard Recording Code |
| ISWC | International Standard Musical Work Code |
| LLL | Lisp-like (programming) language |
| MBID | MusicBrainz IDentifier |
| MG | guaranteed minimum |
| P2P | peer-to-peer |
| PGHT | wholesale price before taxes |
| PPHT | public sales price before taxes |
| RCA | Registre du Cinéma et de l'Audiovisuel (the CNC's Register of Cinema and Audiovisual) |
| RNPP | net receipts, producer's share |
| SOFICA | Société pour le Financement de l'Industrie Cinématographique et de l'Audiovisuel (Company for Financing the Cinema and Audiovisual Industry) |
| VàD (A) | video on demand (with subscription) |
| VPC | mail-order sales |

[4] For information on releases, see: http://www.csa.fr/.

As Figure 3 shows, contracts are meticulously drawn up, in particular: the author's contract ("author" referring to various creators: filmmakers, script- and screen-writers, as well as authors of a work of literature), the contract of coproduction, the contract with actors, contracts with technical personnel (chief operators, film editors, script supervisors, etc.), contracts for distribution (film runs in theaters and broadcasts on television), and proxies for distribution (video on demand, by subscription, television).

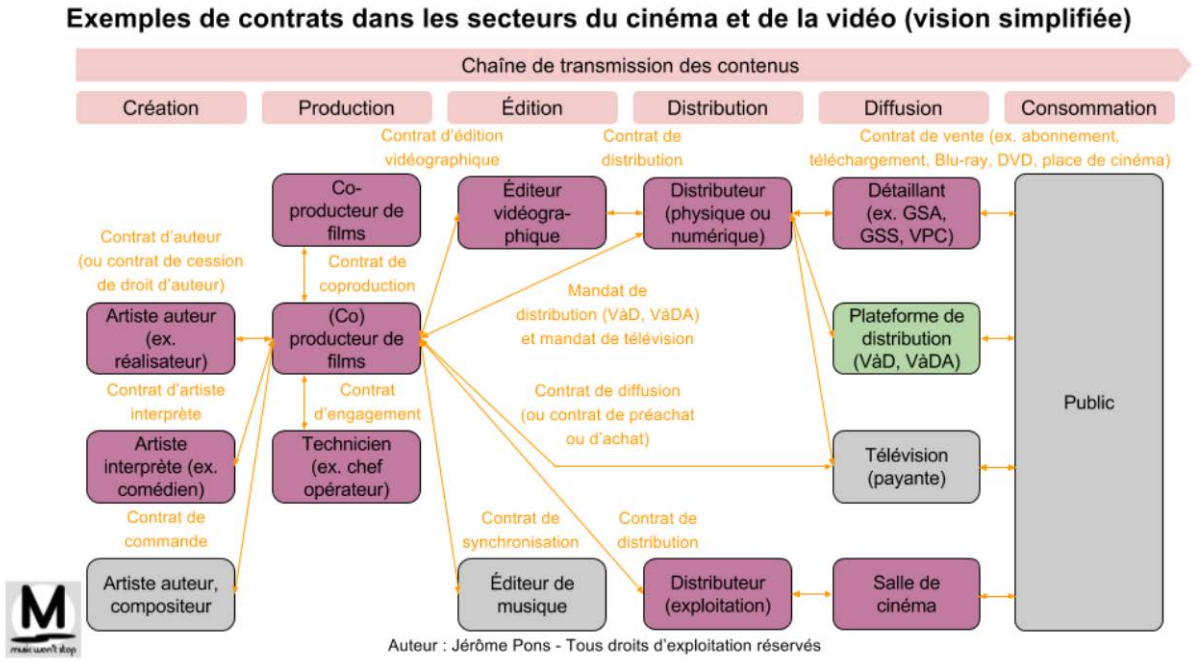


**Figure 3**: Types of contracts in the film and video industry.

In France, the outcome of this process is a degree of transparency about financial flows for making plans (for heavily subsidized films) and drawing up a production budget, which ranges from one to ten million euros. In 2016, the average estimate for a French film was €5.47 million (CNC 2016).

Another result of this process is that metadata are consolidated (completed, standardized and made reliable), in particular the legally required data for copyright management and the data about the contents used in postproduction or predistribution: the poster, the digital cinema package (DCP), etc. Script supervisors, who work with the film director, fill in these metadata through the various documents they file (daily editor log, production reports, etc.) (PANNETIER 2010).

For information on a film prior to its release, several centralized databases can be consulted. The CNC's Register of Cinema and Audiovisual (RCA) records the contracts associated with production (*e.g.*, contracts with authors or coproducers) and delivers a proprietary identification code (the CNC registration number).[5] The CNC also has a database for recording a film's distributor and delivering the administrative release permit.[6] Mention

[5] http://www.cnc-rca.fr/Pages/PageAccueil.aspx

[6] In French: *visa d'exploitation*. http://www.cnc.fr/web/fr/rechercher-une-oeuvre

should also be made of the the International Standard Audiovisual Number database, which delivers a standardized identification number (ISAN) to audiovisual products.[7]

For information following a film's release, other centralized databases can be consulted. Amazon's IMDb provides access to the names of the artists, authors, actors (the cast) and technicians present during shooting. It also has information about technical specifications (*e.g.*, the model of the camera used for shooting), the genre (comedy, drama, etc.), the denominations of the film's distributor and coproducers and the estimated budget (Box Office)[8]

## The music industry

In music, an album is released at the same time for physical and digital distribution, for broadcasting (over the radio or on television) and for concerts during tours. The publication of a release is mainly based on the international standards for data exchanges set by DDEX, assuming that all music producers and editors have, before each phase of distribution, filled in the legal metadata and the metadata about the contents.

Contracts are also meticulously made in the music industry: publishing contracts (songwriters, composers), order contracts (for original music), contracts for live performances (singers, performers), recording contracts (technicians, sound engineers), licenses for distribution or synchronization (See Figure 4).

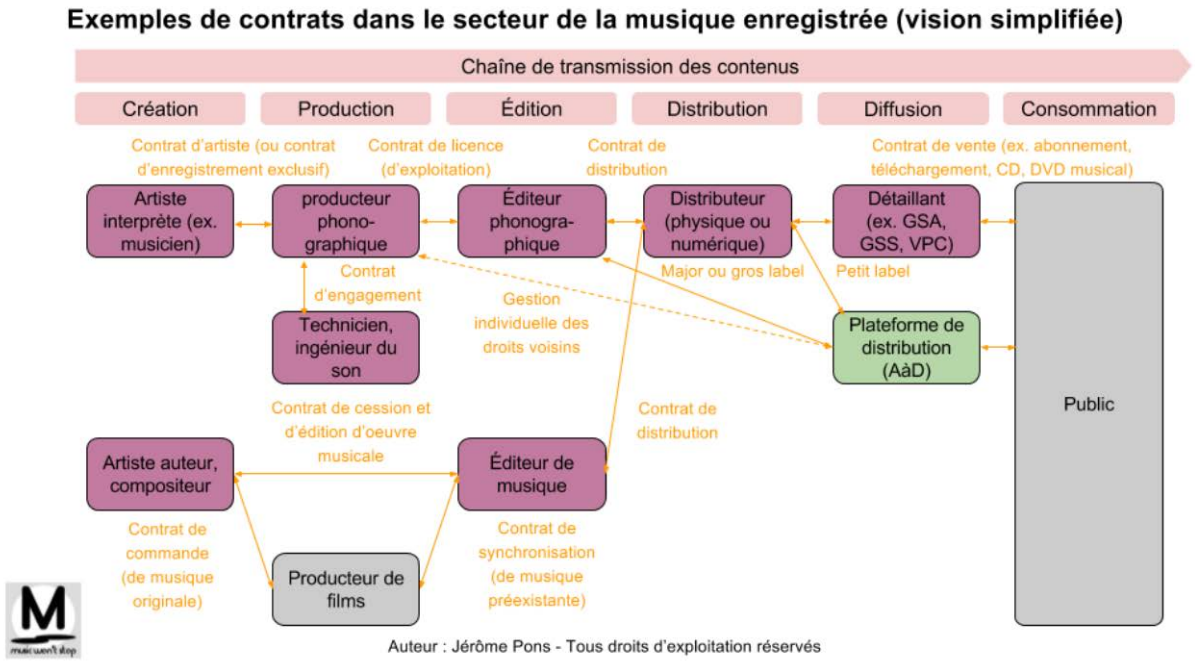


**Figure 4**: Types of contracts and licenses in the recorded music industry.

[7] http://www.isan.org/lookup/

[8] http://www.imdb.com/

The relative opacity of financial flows has, in part, been dissipated owing to the initial public offering of Deezer. In effect, albums are subsidized very little; and the production budget (from €10,000 to €100,000) is less than for a movie. Thanks to the aforementioned procedure, we have learned that 80%-85% of royalties (including the guaranteed minimum) are transferred to record producers and editors; and 10%-15% are transferred to royalty collection organizations (PONS 2015b).

The metadata of works of music are displayed unconsolidated, in particular the legal data for managing copyrights and related rights. An improvement would be for the sound engineer during recording sessions to systematically enter this information (names of composers, singers, the distribution of royalties, etc.). As much can be said about the metadata about a recording's contents, which are gathered for publication (liner notes, sheet music, MP3 file via the ID3 tag) (PONS 2015c).

For information on an album prior to its release, there are the centralized proprietary (unaccessible) databases. For instance, members of the SCPP (Society Civile des Producteurs Phonographiques), SPPF (Society Civile des Producteurs de Phonogrammes en France), SACEM, Adami (Society Civile pour l'Administration des Droits des Artistes et Musiciens-Interprètes) or SPEDIDAM (Society de Perception et de Distribution des Droits des Artistes-Interprètes), may register their works or recordings of music in the organization's database. The IPI database of CISAC (Confederation Internationale des Sociétés d'Auteurs et Compositeurs) and the IPD of IPDA/SCAPR respectively deliver standardized identification codes to stakeholders (IPI code) and performance artists (IPN code). Other databases, such as CISAC's ISWC and IFPI's ISRC, provide access to standardized identification codes for works, respectively, of music (the ISWC code) and recorded music (the ISRC code).

Following an album's release, centralized proprietary databases. ,n particular BIPP (Base de Données Interprofessionnelles des Producteurs Phonographiques of SNEP/UPFI/Kantar Media) accesses the catalogs of record producers in the French market. Mention should also be made of BOEM (Base d'Oeuvres de l'Édition Musicale of CSDEM/SEAM: Chambre Syndicale de l'Édition Musicale/Société des Éditeurs et Auteurs de Musique) for song lyrics. Other databases, though accessible, are not always consolidated such as: SACEM's, which links ISWC codes to IPI codes (but not to the ISRC codes); or MusicBrainz, which links a recording artist, album or piece of music to external databases (such as Discogs, IMDb and Wikidata), to its own or external identification codes (MusicBrainz's MBID or bar codes, IPI, ISNI, Amazon's ASIN, Discogs' ID code, AcoustID) and to distribution platforms (such as iTunes and Spotify).

## The major types of contracts

In the culture and entertainment business, money questions — funding, the transparency of financial transfers and the distribution of receipts — are normally analyzed in relation to the contracts signed. Information also figures in reports and in protocols for collective agreements. So, let us next look at the principal contracts made in this industry, at their contents and forms.

## In the film and video industry

The Chevalier report (2008) discussed the issues related to the *"contract of association with production*" (via SOFICA). The Bonnell report (2008) focused on the author's (artist's) contract, while a 2010 protocol for a multiparty agreement in the movie industry concerned contracts with authors and for video editions.[9] The Gomez report (2011) analyzed contracts for video editions, distribution and exportation, while the Lescure (2013) report examined cultural policies in all fields: cinema, video and recorded music. Another report (COUR DES COMPTES 2014) has gone into the details of contracts (of association with production, of purchase and prepurchase, of distribution, with performing artists) and too, of licenses for distribution. It even proposed a *"contract of objectives and means*".

## In the music industry

The Zelnik (2010) report described contracts for singer-songwriters and of distribution, as well as various licenses, while the Hoog Engagements[10] concentrated on general sales conditions, the duration and stability of contracts, the justification for advance payments, transparency with regard to the guaranteed minimum, and the deadlines for distributing payments to recording artists. The Selles (2011) report extended this analysis to music publishing contracts and licenses for synchronization. It also proposed adopting a *"contract of association with production*" in the music industry and a *"contract of objectives and means*". The Phéline (2013) report focused on "sharing value" while describing licenses and contracts with recording artists. The protocol of the Schwartz Agreement in 2015 advocated a code of good contractual practices and a fair remuneration of singer-songwriters.[11]

## A model of contracts

After analyzing the usual contracts in the music industry, the following points (mostly drawn from the Gomez report) were retained for drafting a model: the header, recurrent clauses, financial conditions, general conditions, ender and appendices (See Figure 5). In the contract with recording artists, notice that the producer makes the engagement to obtain only the legal metadata needed for his payment (for instance, the ISRC code) but not for the payment of music composers or publishers (the ISWC code).

[9] "Protocole d'accord relatif à la transparence dans la filière cinématographique", 21p., the protocol for a multiparty agreement in the movie industry, 16 December 2010. Available at:
http://guildedesscenaristes.org/uploads/ressbao/accords/protocole_accord_transparence_filiere.pdf

[10] The Hoog Engagements, an agreement, "13 engagements pour la musique en ligne", worked out on 17 January 2011 by the mediator, E. Hoog, with: Adami, Apple/ITunes, Beezik, Deezer, Geste, MMFF, NRJ, Orange/France Télécom, SACEM, SCPP, SDLC, SFA, SNAM, SNEP, SPEDIDAM, SPPF, Starzik.Com, Syrol, upfi, VirginMega. Available at:
http://blogs.lesechos.fr/IMG/pdf/13_engagements_pour_la_musique_en_ligne-2.pdf

[11] An agreement, "Pour un développement équitable de la musique en ligne", 2 October 2015, by the mediator M. Schwartz, with: CFDT-F3C, ESML, FELIN, GAM, IDOL, MMFF, PRODISS, Qobuz, SACEM, SCPP, SFA, SMA, SNACOPVA CFE-CGC, SNAM-CGT, SNAPS-CFE-CGC, SNEP, SPPF & UPFI. See the press release at:
www.culturecommunication.gouv.fr/Presse/Communiques-de-presse/Accord-historique-pour-la-filiere-de-la-musique

## Modélisation du contrat traditionnel (vision simplifiée)

| Elément constitutif | Sous-élément | Secteur du cinéma et de la vidéo | Secteur de la musique |
|---|---|---|---|
| En-tête | Nature du contrat | Ex. contrat d'auteur (ou contrat de cession de droit d'auteur) | Ex. contrat d'artiste (ou contrat d'enregistrement exclusif) |
| | Dénominations des parties | Ex. nom et prénom de la personne physique, dénomination sociale de la personnes morale | |
| | Codes d'identification des parties | Ex. numéro de sécurité sociale de la personne physique, numéro SIRET de la personne morale | |
| | Qualités des parties | Ex. artiste auteur (réalisateur), producteur de films | Ex. artiste interprète (musicien), producteur phonographique |
| Clauses contractuelles récurrentes | Objet du contrat | Ex. réalisation d'un film | Ex. fixation d'œuvres musicales |
| | Durée d'exécution ou période d'exploitation | Ex. durée de la cession | |
| | Lieu d'exécution ou territoire(s) d'exploitation | Ex. territoires de la cession | |
| | Mode(s) d'exploitation | Ex. exploitation cinématographique, exploitations secondaires (télédiffusion, vidéogramme) et dérivées | Ex. exploitation phonographique, exploitations secondaires (radiodiffusion, télédiffusion, synchronisation, vidéogramme) et dérivées |
| Conditions financières | Rémunération | Ex. rémunération proportionnelle (pourcentage calculé sur l'assiette des recettes d'exploitation cinématographique et autres exploitations), rémunération pour droit d'auteur (gestion collective), rémunération pour copie privée (gestion collective), rémunération au forfait | Ex. redevances ou *royalties* (pourcentage calculé sur l'assiette des recettes d'exploitation phonographique et autres exploitations), rémunération équitable et pour copie privée (gestion collective et individuelle) |
| | Avance sur recettes ou minimum garanti (MG) | Ex. avance (non remboursable) sur la rémunération proportionnelle | Ex. avance récupérable sur les redevances |
| | Frais | | |
| | Assiette des recettes | Ex. prix public hors taxes (PPHT), recettes nettes part producteur (RNPP) | Ex. prix de gros hors taxes (PGHT) diminué d'un abattement BIEM (exploitation phonographique), prix de gros des vidéogrammes diminué d'un abattement forfaitaire pour conditionnement (exploitation secondaire) |
| | Modalités de paiement | Ex. règlement par chèque ou virement bancaire | |
| Conditions générales | Cession de droits | Ex. droit de reproduction et droit de représentation (exploitation cinématographique), droit d'exploitations secondaires (télédiffusion) et dérivées | Ex. droit exclusif de reproduction et de représentation (exploitation phonographique), droit exclusif d'exploitations secondaires et dérivées, droits voisins |
| | Obligations des parties | Ex. découpage technique du film, choix des artistes interprètes, techniciens et collaborateurs, montage du film par le réalisateur, direction technique et artistique et conservation des éléments ayant servi à la réalisation par le producteur du film | Ex. établissement du programme des séances d'enregistrement par l'artiste interprète, direction technique et artistique et conservation des éléments ayant servi à l'enregistrement du disque par le producteur phonographique |
| | Publicité et promotion | Ex. crédits (affiche et générique du film) | Ex. promotion du disque par l'artiste interprète, engagement de promotion et de marketing par le producteur phonographique |
| | Garanties | Ex. garantie des droits cédés par le réalisateur au producteur de films | |
| | Assurances | | |
| | Registres | Ex. dépôt du contrat au registre RCA du CNC par le producteur de films, obtention du code ISAN par le producteur de films | Ex. obtention du code ISRC de chaque enregistrement par le producteur phonographique |
| | Clauses spécifiques | Ex. exclusivité de la réalisation, reddition des comptes, droit de préférence | Ex. exclusivité de l'enregistrement, état de redevances, nombre minimum d'enregistrements (albums) |
| | Modalités de résiliation du contrat | Ex. manquement par l'une des parties à l'une de ses obligations | |
| | Règlement des litiges et droit applicable | Ex. règlement amiable, recours à un médiateur, recours au tribunal compétent | |
| En-queue | Date de contractualisation | | |
| | Lieu de contractualisation | | |
| | Nombre d'exemplaires originaux du contrat | Ex. 2 exemplaires | |
| | Signatures des parties | | |
| Annexes contractuelles | Fixation des prix et recettes | Ex. définition des RNPP (rémunération proportionnelle) | |



**Figure 5**: Model of "traditional" contracts in the cinema/video and music industries.

How to turn this traditional contract into a smart contract?

# The application of smart contracts in culture and entertainment

A decentralized autonomous organization (DAO) would be capable of following up on creators and producers (PONS 2017). A smart contract for doing this could describe a task — artistic (*e.g.*, writing a script or a verse in a song, being an actor on stage) or technical (*e.g.*, shooting a scene, recording a piece of music, or entering metadata) — and even the amount of payment or royalties.

For the sake of brevity, I shall leave aside herein the concepts of digital identification, electronic signatures, oracles and decentralized or distributed applications.

## A smart contract's principles

According to the American cryptographer Nick Szabo (1994), *"A smart contract is a computerized transaction protocol that executes the terms of a contract. The general objectives of smart contract design are to satisfy common contractual conditions (such as payment terms, liens, confidentiality and even enforcement), minimize exceptions both malicious and accidental, and minimize the need for trusted intermediaries. Related economic goals include lowering fraud loss, arbitration and enforcement costs, and other transaction costs.*" From a legal viewpoint, smart contracts are *"autonomous programs, encoded in a blockchain, that automatically execute a contract in full or in part without human intervention. When one of the preprogrammed conditions in the smart contract is realized, the clause corresponding to it is automatically executed*" (VERBIEST 2016).

There are three steps to making a smart contract:

— The first step is to program the smart contract so that it transposes one or more clauses (*e.g.*, on payments) from the traditional contract into the programming (script) language used by the blockchain.

— The second is to register in the blockchain the software associated with the smart contract.

— The third step is to execute the software. Execution might be immediate (*e.g.* electronic payment) or delayed until it is triggered internally (by an event foreseen in the contract, *e.g.*, a date of payment set for the transaction) or externally (by an event independent of the contract or by an oracle, as defined by the English mathematician and cryptologist Alan Turing) (THOMPSON *et al*. 2017).

## Smart contracts in the Bitcoin network

The Bitcoin network's script language (called Script) is said to lack Turing completeness, since it does not allow for creating loops with recursive functions.[12] This language is presented in stacks, each line of which has a string of binary elements or characters. The instructions are processed sequentially till the end of the script, without any looping. Approximately a hundred script operators are used (See Figure 6).

[12] See "Script" on http://en.bitcoin.it/wiki/Script

**Exemples d'opérateurs de scripts utilisés par les systèmes *Bitcoin* et *Ethereum***

| Type d'opérateur | Opérateurs du système *Bitcoin* |
|---|---|
| Ajout d'une constante à la pile, manipulation de la pile, de la chaîne de caractères, contrôle de flux | OP_i, OP_DUP (duplication de ligne), OP_PICK ou OP_ROLL (copie ou déplacement de ligne en haut de la pile), OP_SIZE, OP_IF, OP_ELSE, OP_RETURN (indique la présence d'un *smart contract*)… |
| Manipulation d'éléments binaires | OP_EQUAL, OP_EQUALVERIFY... |
| Opérateur arithmétique | OP_ADD, OP_SUB, OP_MUL ou OP_DIV (addition, soustraction, multiplication ou division)... |
| Fonction cryptographique | OP_HASH160 ou OP_HASH256 (fonction de hachage générant une empreinte de 160 ou 256 bits), OP_CHECKSIG (vérification de signature)... |
| Temporisation | OP_CHECKLOCKTIMEVERIFY... |

| Type d'opérateur | Opérateurs du système *Ethereum* |
|---|---|
| Manipulation de la pile, de la mémoire, du stockage, contrôle de flux et enregistrement | PUSHi (ajout d'élément), DUPi (duplication d'élément), SWAPi (échange d'éléments), POP (suppression d'élément de la pile), GAS ("jauge de carburant"), JUMP, JUMPI ou JUMPDEST (commandes de saut), LOGi... |
| Manipulation d'éléments binaires | AND, OR, XOR... |
| Opérateur arithmétique | STOP (interruption de l'exécution), ADD, MUL, SUB ou DIV (addition, multiplication, soustraction ou division)... |
| Fonction cryptographique | SHA3 (fonction de hachage générant une empreinte de 256 bits) |
| Information d'environnement, de bloc | ADDRESS, BALANCE, CODESIZE, GASPRICE ("prix du carburant"), BLOCKHASH, TIMESTAMP, NUMBER... |
| Opérateur système | CREATE (création d'un nouveau compte), CALL (envoi d'un message à un compte), RETURN, SUICIDE (destruction d'un compte)... |



**Figure 6**: Examples of script operators and functions used by, respectively, the Bitcoin and Ethereum networks.

A transaction is associated with either an electronic payment service (which uses basic script operators mainly for exchanging bitcoins between a sender and a receiver), or a service that, based on scripts, uses basic and more advanced operators but does not have the single purpose of transferring bitcoins. In particular, the advanced script command *OP_RETURN* signals a free field containing a smart contract's data.

## Smart contracts in Ethereum

EVM, the script language of the Ethereum network, is said to be Turing-complete, since it allows for looping and calls. To keep a transaction from looping indefinitely and blocking the network, its execution is limited by what is called "gas". When the order for a transaction is entered, the gas is paid in advance to cover the cost of executing the transaction. A transaction that runs out of gas is canceled, thus putting an end to the risks of infinite looping. This language, executed by the Ethereum Virtual Machine, is presented in stacks in the form of strings of characters. The instructions are processed sequentially but allow for loops; they are based on more than a hundred script operators (WOOD undated).

From the start, a transaction is associated with a script-based service called a "smart contract" that uses basic and advanced operators, and exchanges ethers. Electronic payment is but one use case of a smart contract.

The smart contract is seen as a virtual entity with its own script code capable of sending and receiving messages and ethers, creating other contracts or destroying itself. It cannot initiate a transaction, but it can be activated by another transaction that it receives (BUTERIN 2014).

Besides the EVM language, high-level script languages can be used, such as Solidity, Serpent or LLL. In practice, EtherScripter can transpose certain clauses from a traditional contract (*e.g.*, a sales contract) and translate them into a high-level script language such as Serpent or LLL (See Figure 7).[13]

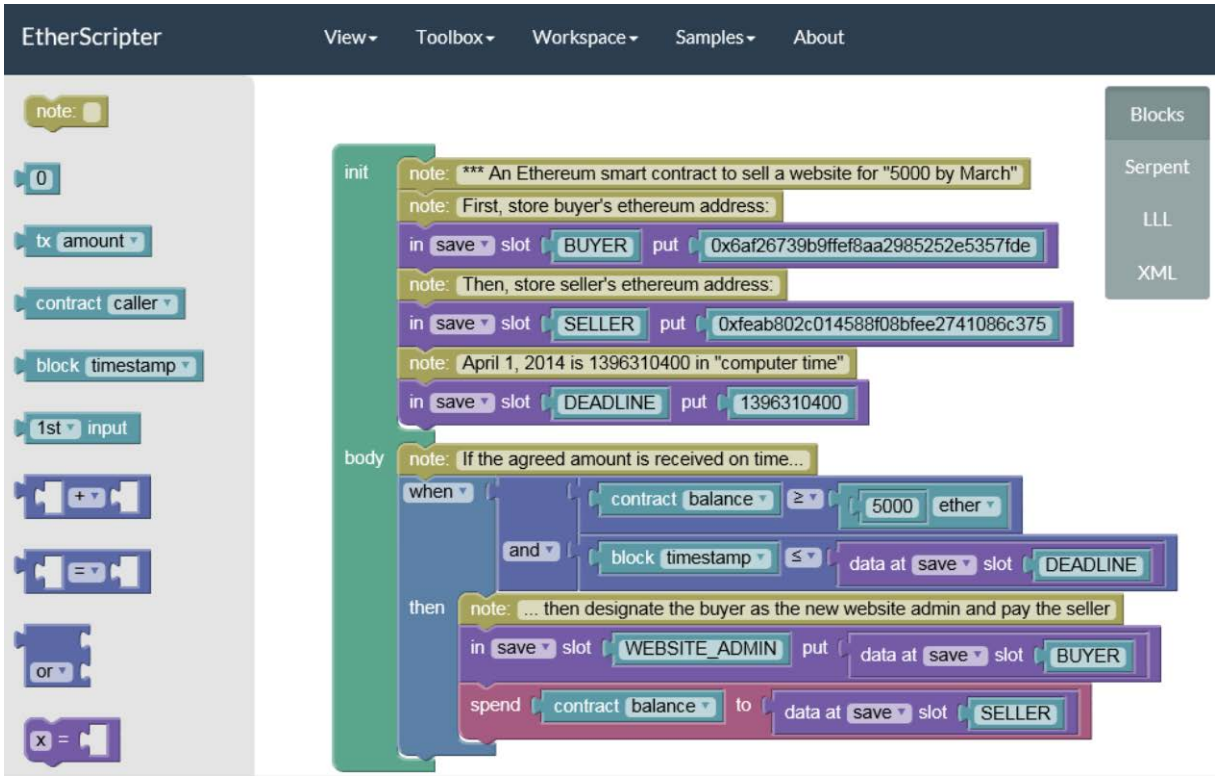


**Figure 7**: Transposition by EtherScripter of certain clauses of a traditional contract into a high-level script language

## A use case experiment, Ujo Music

When the alpha version of Ujo Music was launched on 2 October 2015, only Imogen Heap's single "Tiny human" was available. Neither this work nor its recordings were registered in the ISWC or ISRC databases. However this English singer was identified by an ISNI code (0000000078404022) with credits as author, singer-songwriter, arranger and producer of the recording.

[13] http://www.etherscripter.com/0-5-1/

Five distribution options were proposed for the piece, including downloading at a sales price of $0.60 and streaming at $0.006 per listening experience. General sales conditions indicated that receipts would be distributed as follows: 91.25% to Imogen Heap and 1.25% to each of the six musicians and the sound engineer. The purchase and downloading of the single involved a smart contract on the Ethereum network. Ujo Music hooked up to Kraken, a cryptocurrency exchange platform, to indicate the conversion rate of the sales price (*e.g.* $0.60 = 0,48 ETH) so that the buyer could create an electronic wallet, obtain an account address, fund the account and enter the order at the address indicated by Ujo Music.[14]

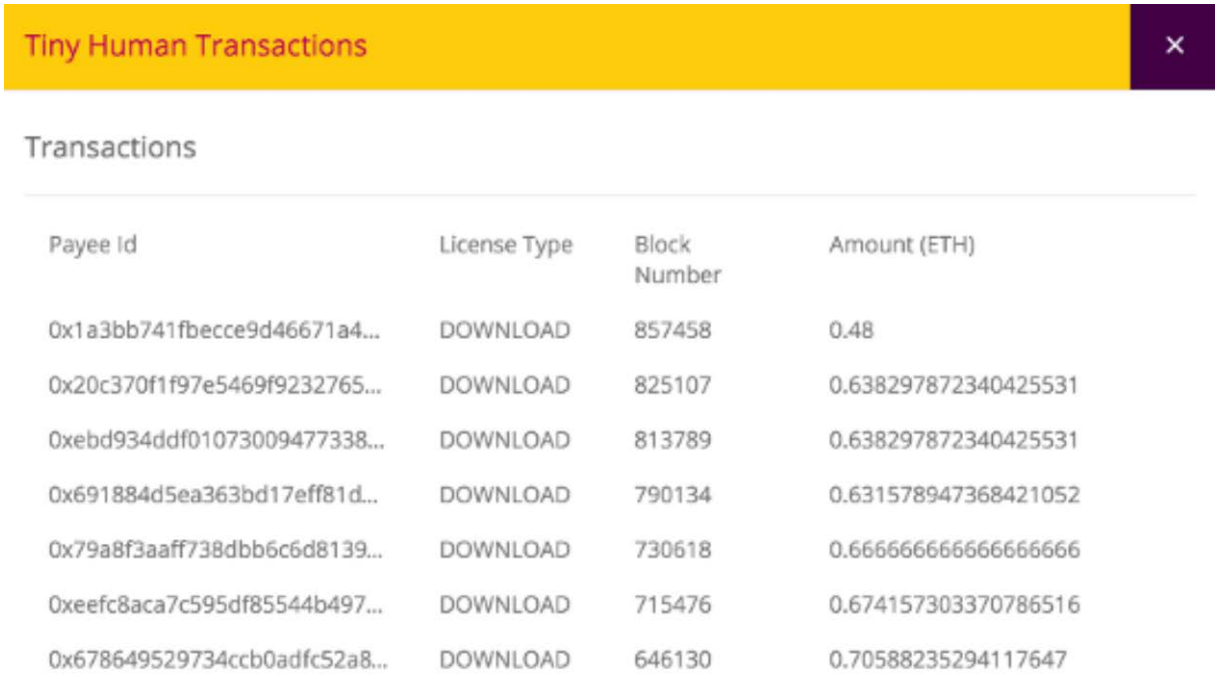


**Figure 8**: List of transactions involving Imogen Heap's "Tiny human".

Ujo Music provides a fully transparent list of transactions involving the piece (Figure 8). Etherscan, Ethereum's token tracker, can be used to find the block number (857458) at the top of the list and view the foregoing transaction at 0,48 ETH, which incorporates a smart contract for downloading the song (Figure 9).

[14] For a fuller description see: "Part 1: How we tried to buy Imogen Heap's song on Ethereum", *Hatching Amazing*, 24 January 2016. Available at: http://medium.com/hatching-amazing/part-1-how-my-ssn-prevented-me-from-buying-music-on-the-blockchain-and-why-blockchain-for-music-a85eaeaca7ad

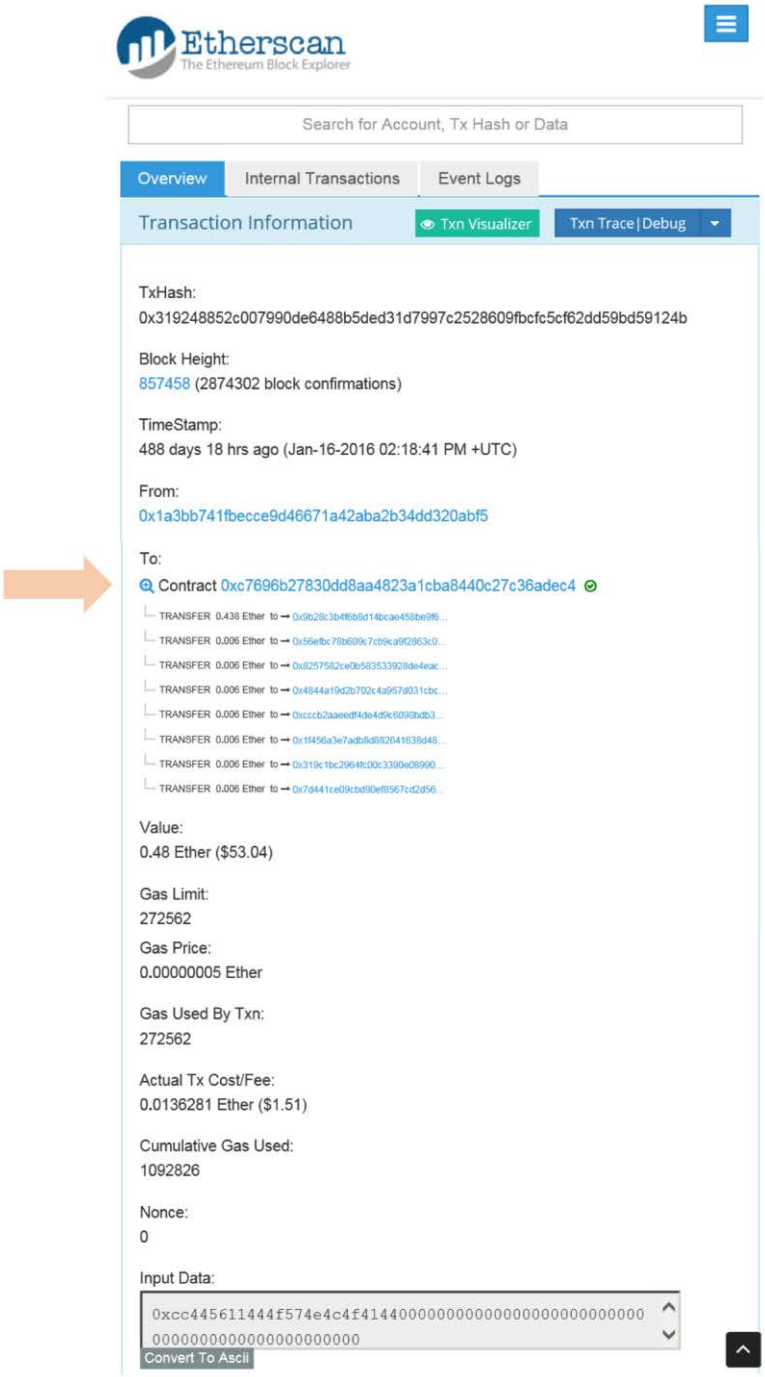


**Figure 9**: View of a transaction on Ujo Music.

Identified by its hash, the transaction bears a timestamp (16 January 2016 02:18:41 PM), and indicates the gas price, transaction fees and smart contract. The immediate execution of this smart contract distributes the amount of the transaction (0.48 ETH) to the receivers' addresses: 0.438 ETH for Imogen Heap and 0.006 ETH for each of the seven associates. Receipts are distributed according to the clause set in the contract's general sales conditions.

## The prospects for smart contracts in culture and entertainment

Using blockchain technology for smart contracts in the culture and entertainment business entails a dialog between computer scientists, legal experts and the parties in the chain of transmission of digital contents. This means adopting a cryptocurrency (*e.g.*, Bitcoin, Ethereum, Omni) or an asset, a choice that will orient the decision made in favor of a specific blockchain network. These parties must then transpose one or more clauses from a traditional contract into the network's script language and, using the network's token tracker, verify whether the smart contract has effectively been executed.

A blockchain helps solve familiar problems in recorded music, such as matching the ISRC and ISWC codes. For this purpose, three copyright collection organizations (ASCAP in the United States, PRS for Music in the United Kingdom and SACEM in France) formed a partnership with IBM in April 2017, a partnership based on Hyperledger Fabric. Out of this project might emerge smart contracts for automatically assigning a pair of ISRC/ISWC codes and simplifying the management of royalties.[15]

The identification codes (ISAN, ISRC, ISWC…) were adopted as standards by the International Organization for Standardization (ISO). In 2016, the ISO set up a technical committee (ISO/TC 307 with 19 participating countries, France being represented by AFNOR) on blockchain and distributed ledger technology (DLT). This committee met for the first time in April 2017. It voted to set up a study group on smart contracts (ISO/TC 307/SG5) for examining the application of programming methods and script languages that would enable persons other than computer scientists to formulate clauses.[16]

The upsurge of blockchain technology is placing the music industry, once again, in the forefront of the digital transition. The movie and video industry will probably soon follow suit. The work on international standards for smart contracts will help clarify matters.

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[15] See the press release of 7 April 2017, "SACEM, ASCAP et PRS for Music s'engagent ensemble dans un projet de blockchain en vue d'améliorer l'identification des œuvres pour les ayants-droit". Available at: https://societe.sacem.fr/ressources-presse/par-publication/communiques/ascap-sacem-et-prs-for-music-sengagent-ensemble-dans-un-projet-de-blockchain-en-vue-dameliorer-lidentification-des-oeuvres-pour-les-ayants-droit

[16] ISO/TC 307 Blochain and distributed ledger technologies: www.iso.org/fr/committee/6266604.html

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