

Smart Contracts & Blockchains

Business Models, Legal Challenges and Impact on the Legal Market

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Universität Ulm

Legal (R)Evolution
The European LegalTech Expo & Congress
Frankfurt a.M., 23 October 2017

Agenda

- Smart Contracts & Blockchains
- Business Models
- Legal Questions and Challenges
- Impact on the Legal Market

SMART CONTRACTS

Gumball machines



An assortment of modern gumball machines on location in a Dallas storefront.
By Photo: Andreas Praefcke (Own work) [Public domain], via Wikimedia Commons

Turnstile / Pay toilets

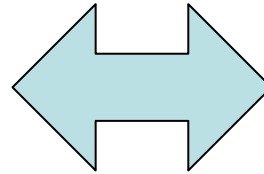
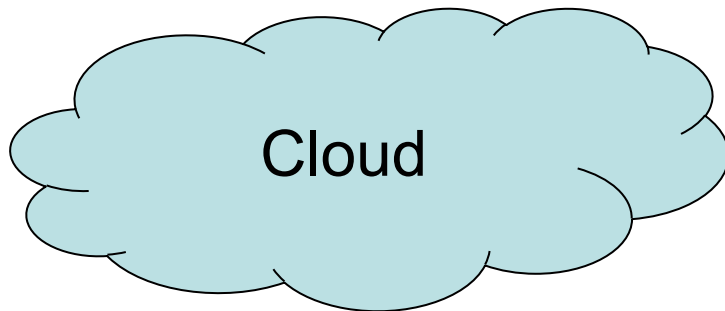


Algorithm 1 Payment enforcement

```
1: procedure ENFORCE( $p$ ,  $term$ ,  $car$ )  
2:   if  $p < term$  then                                ▷ Term fully paid?  
3:     InterruptStarter( $car$ )  
4:   end if  
5: end procedure
```

Tjong Jin Tai, Formalizing Contract Law for Smart Contracts,
Tilburg Private Law Working Paper Series No. 6/2017

Starter Interrupt Device



Frankfurt am Main - Skyline der Banken und Versicherungen -
By Wolfgang Pehlemann (Own work) [CC BY-SA 3.0
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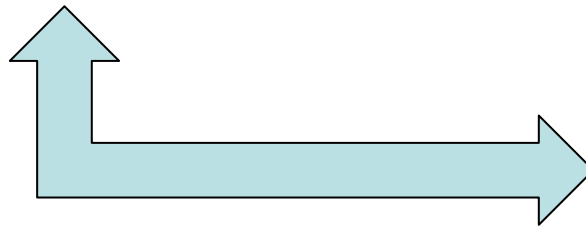
Algorithm 1 Payment enforcement

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Tjong Jin Tai, Formalizing Contract Law for Smart Contracts,
Tilburg Private Law Working Paper Series No. 6/2017



Bugatti Typ 35 B, Baujahr 1925 - By Spurzem - Lothar Spurzem (Own
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Smart Contracts – Really Smart?

Smart Contract Codes – Self Executing Contracts –



Kaugummiautomat, By Rüdiger Wölk (photo taken by Rüdiger Wölk) [CC BY-SA 2.5 (<https://creativecommons.org/licenses/by-sa/2.5>)], via Wikimedia Commons

Algorithm 1 Payment enforcement

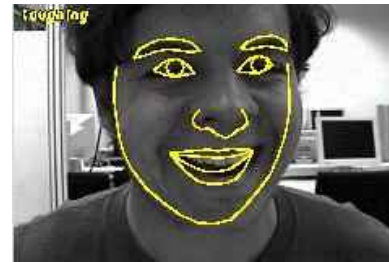
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Tjong Jin Tai, Formalizing Contract Law for Smart Contracts,
Tilburg Private Law Working Paper Series No. 6/2017

Smart Legal Contracts – Artificial Intelligence –



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Haggling - By pmorgan [CC BY 2.0 (<http://creativecommons.org/licenses/by/2.0/>)], via Wikimedia Commons



Amazn Echo - Frmorrisat at English Wikipedia [GFDL (<http://www.gnu.org/copyleft/fdl.html>) or CC BY-SA 3.0 (<https://creativecommons.org/licenses/by-sa/3.0/>)], via Wikimedia Commons

Decentralized Autonomous Organizations (DAO) by Smart Contracts – Electronic Legal Persons

DECENTRALIZED AUTONOMOUS ORGANIZATION TO AUTOMATE GOVERNANCE FINAL DRAFT - UNDER REVIEW

CHRISTOPH JENTZSCH
FOUNDER & CTO, SLOCK.IT
CHRISTOPH.JENTZSCH@SLOCK.IT

ABSTRACT. This paper describes the first implementation of Decentralized Autonomous Organization (DAO) code to automate organizational governance and decision-making. The code can be used by individuals working together collaboratively outside of a traditional corporate form. It can also be used by a registered corporate entity to automate formal governance rules contained in corporate bylaws or imposed by law. First the DAO concept is described, then minority rights is discussed, and a solution to a “robbing the minority” attack vector is proposed. Finally, a practical implementation of a first generation DAO entity is provided using smart contracts written in Solidity on the Ethereum blockchain.

Turing complete Smart Contract and Decentralized Application Platforms: Ethereum, Monax, Rootstock

Build unstoppable applications

Ethereum is a **decentralized platform that runs smart contracts:** applications that run exactly as programmed without any possibility of downtime, censorship, fraud or third party interference.

These apps run on a custom built **blockchain, an enormously powerful shared global infrastructure that can move value around and represent the ownership of property.** This enables developers to create markets, store registries of debts or promises, move funds in accordance with instructions given long in the past (like a will or a futures contract) and many other things that have not been invented yet, all without a middle man or counterparty risk.

The project was bootstrapped via an ether pre-sale during August 2014 by fans all around the world. It is developed by the **Ethereum Foundation**, a Swiss nonprofit, with contributions from great minds across the globe.



On traditional server architectures, every application has to set up its own servers that run their own code in isolated silos, making sharing of data hard.

If a single app is compromised or goes offline, many users and other apps are affected.

On a blockchain, anyone can set up a node that replicates the necessary data for all nodes to reach an agreement and be compensated by users and app developers.

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www.ethereum.org



www.rsk.co



<https://monax.io>

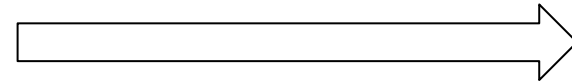
Smart Contracts – Programming Languages

Example: Solidity et. al.



www.ethereum.org

Ethereum Virtual Machine (EVM)
Byte Code

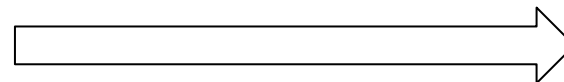


Criticism

- Security Issues
- Hard to validate Script Language
- Permissiveness

Alternative Script Languages

- Serpent (outdated)
- Viper (rising)
- Babbage (discussed)



Smart Contracts

Solidity – Code Example „Creating Contracts“

```
contract TokenCreator {
    function createToken(bytes32 name)
        returns (OwnedToken tokenAddress)
    {
        // Create a new Token contract and return its address.
        // From the JavaScript side, the return type is simply
        // "address", as this is the closest type available in
        // the ABI.
        return new OwnedToken(name);
    }

    function changeName(OwnedToken tokenAddress, bytes32 name) {
        // Again, the external type of "tokenAddress" is
        // simply "address".
        tokenAddress.changeName(name);
    }

    function isTokenTransferOK(
        address currentOwner,
        address newOwner
    ) returns (bool ok) {
        // Check some arbitrary condition.
        address tokenAddress = msg.sender;
        return (keccak256(newOwner) & 0xff) == (bytes20(tokenAddress) & 0xff);
    }
}
```

Smart Contracts – Social Contracts?

Transnational Company and Constitutional Law on Ethereum?



CREATE A DEMOCRATIC AUTONOMOUS ORGANIZATION

Now that you have developed your idea and secured funds, what's next? You have to hire managers, find a trustworthy CFO to handle the accounts, run board meetings and do a bunch of paperwork.

Or you can simply leave all that to an Ethereum contract. It will collect proposals from your backers and submit them through a completely transparent voting process.

One of the many advantages of having a robot run your organization is that it is immune to any outside influence as it's guaranteed to execute only what it was programmed to. And because the Ethereum network is decentralized, you'll be able to provide services with a 100% uptime guarantee.

YOU CAN BUILD:

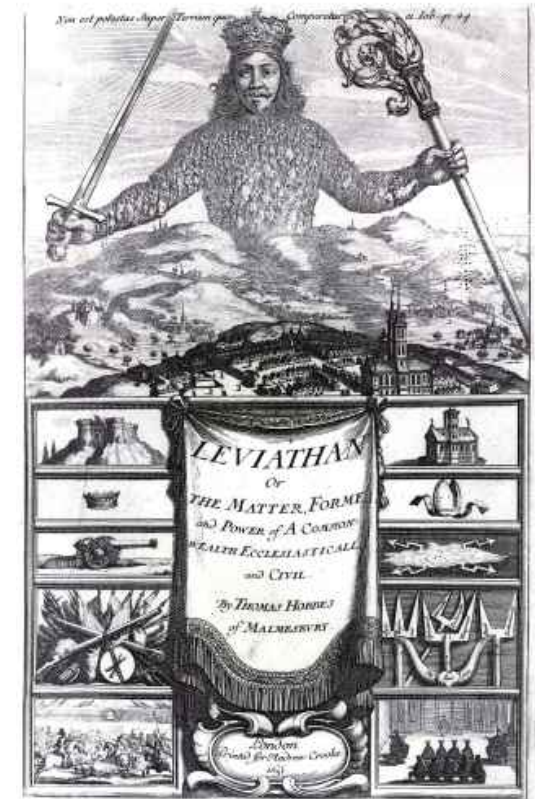
- A virtual organization where members vote on issues
- A transparent association based on shareholder voting
- Your own country with an unchangeable constitution
- A better delegative democracy

[Start your organization](#)



aragon.one

www.ethereum.org



The frontispiece of the book [Leviathan](#) by [Thomas Hobbes](#); engraving by [Abraham Bosse](#)

Smart Contracts – Ethereum Environment and Challenges

Ethereum Virtual Machine *30 July 2015
Hard Fork IV/2016



<https://ethereumfoundation.org/devcon3/>

Challenges

- Trust
- Performance / Scalability

Cryptocurrency **Ether**

- Market Cap at 15 October 2017:
31 Billion \$ (Bitcoin 92 Billion \$)

Ethereum
Foundation, Zug,
Switzerland /
Canadian Roots



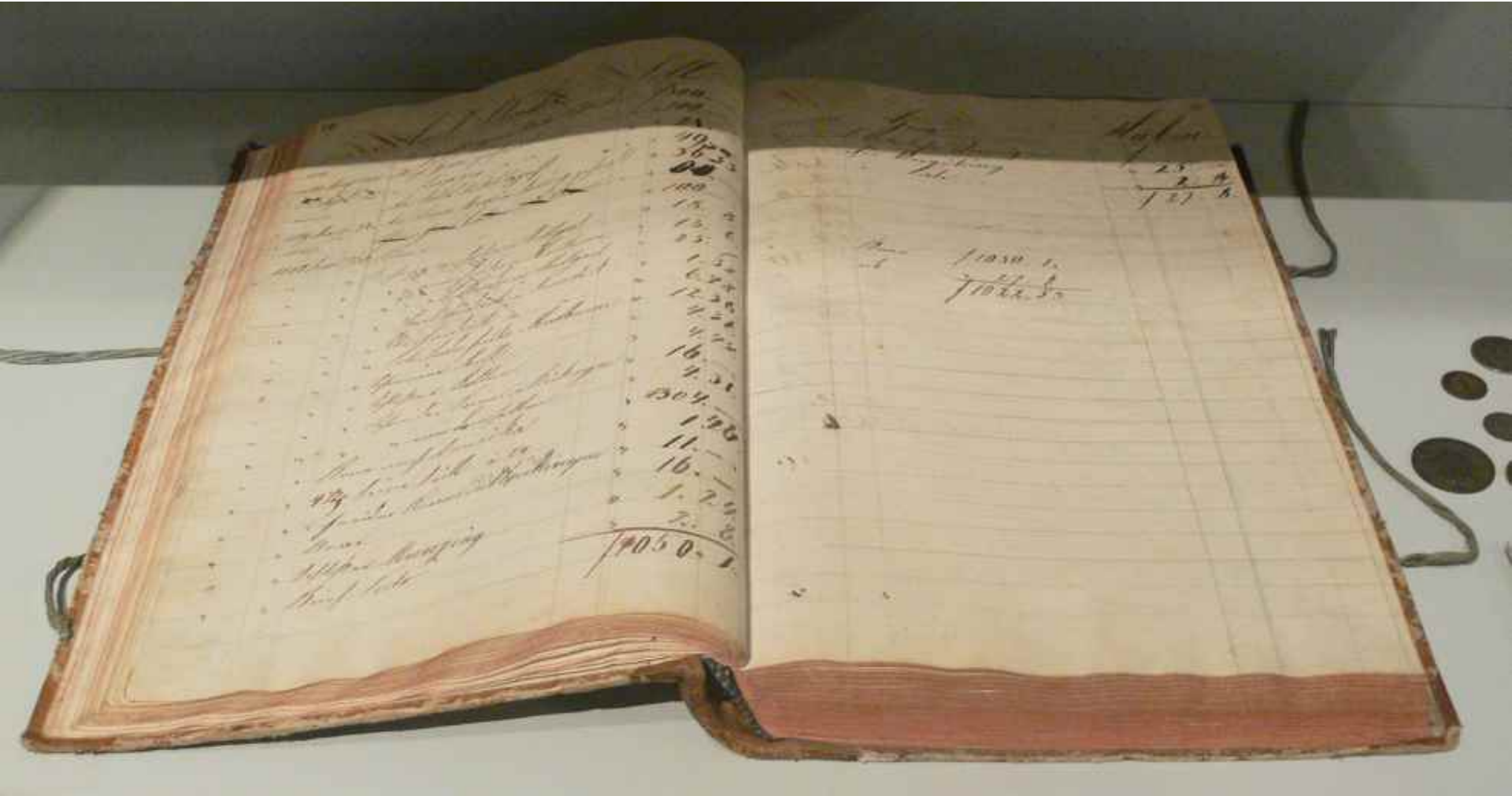
Vitalik Buterin, 2016

By Romanpoet (Own work) [CC BY-SA 4.0
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- Mihai Alisie
- Anthony Di Iorio
- Charles Hoskinson
- Gavin Woods?

BLOCKCHAIN

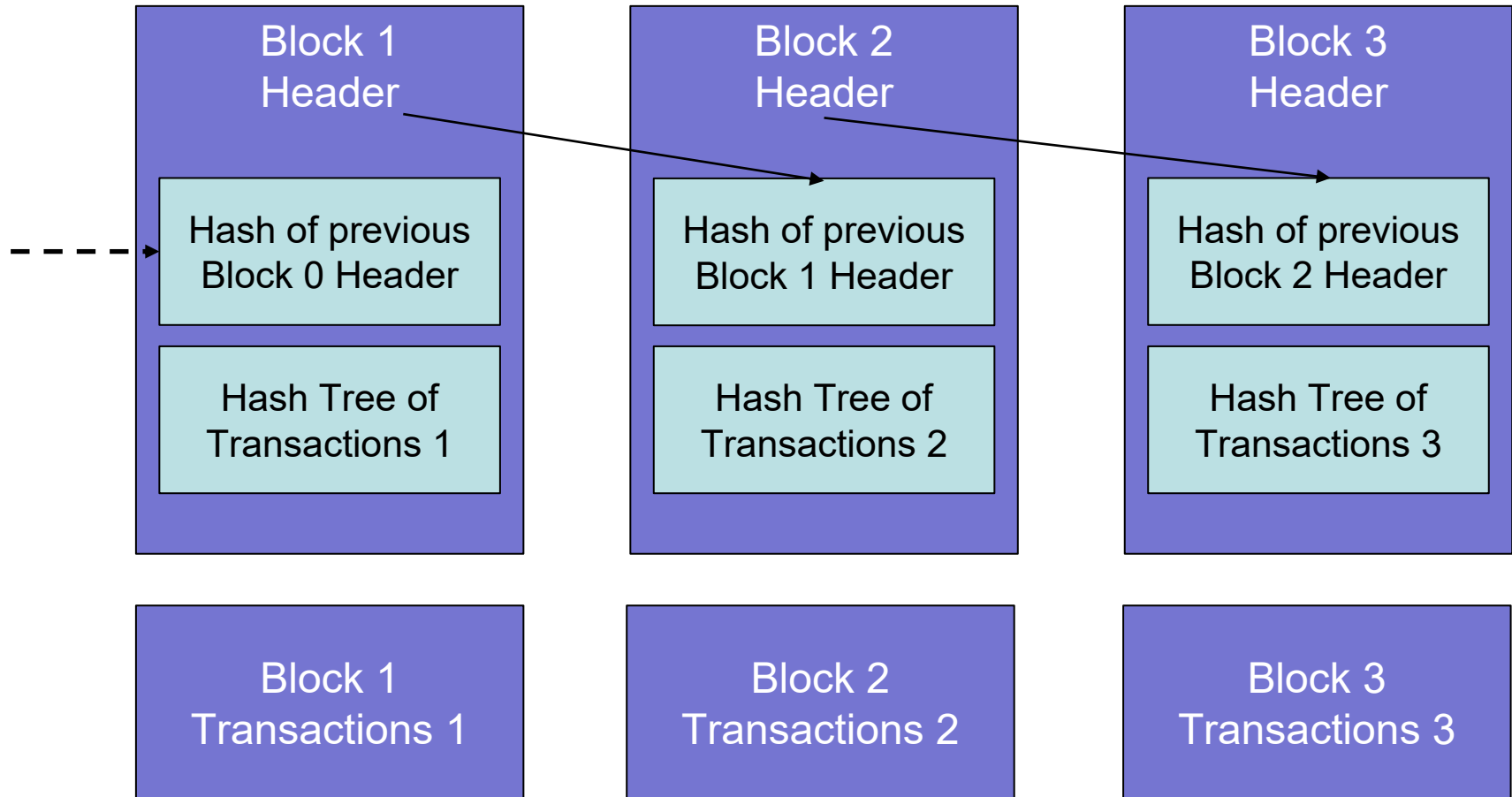
„Block“chain



Early 19th-century German ledger (Hauptbuch der Gemischtwarenhandlung Hochstetter, vor 1828
Landesmuseum Württemberg)

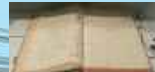
By Photo: Andreas Praefcke (Own work) [Public domain], via Wikimedia Commons

Block“chain“



Distributed Ledger

The image shows a world map with a network of nodes and connections. Nodes are represented by open book icons, and lines connect them across the globe, illustrating a distributed ledger system. The map includes labels for various countries and regions, such as Canada, Mexico, Central America, South America, Europe, and Africa. The title "Distributed Ledger" is written in green text in the upper left corner.



BUSINESS MODELS

Smart Contracts – Application Sharing Economy



slock.it



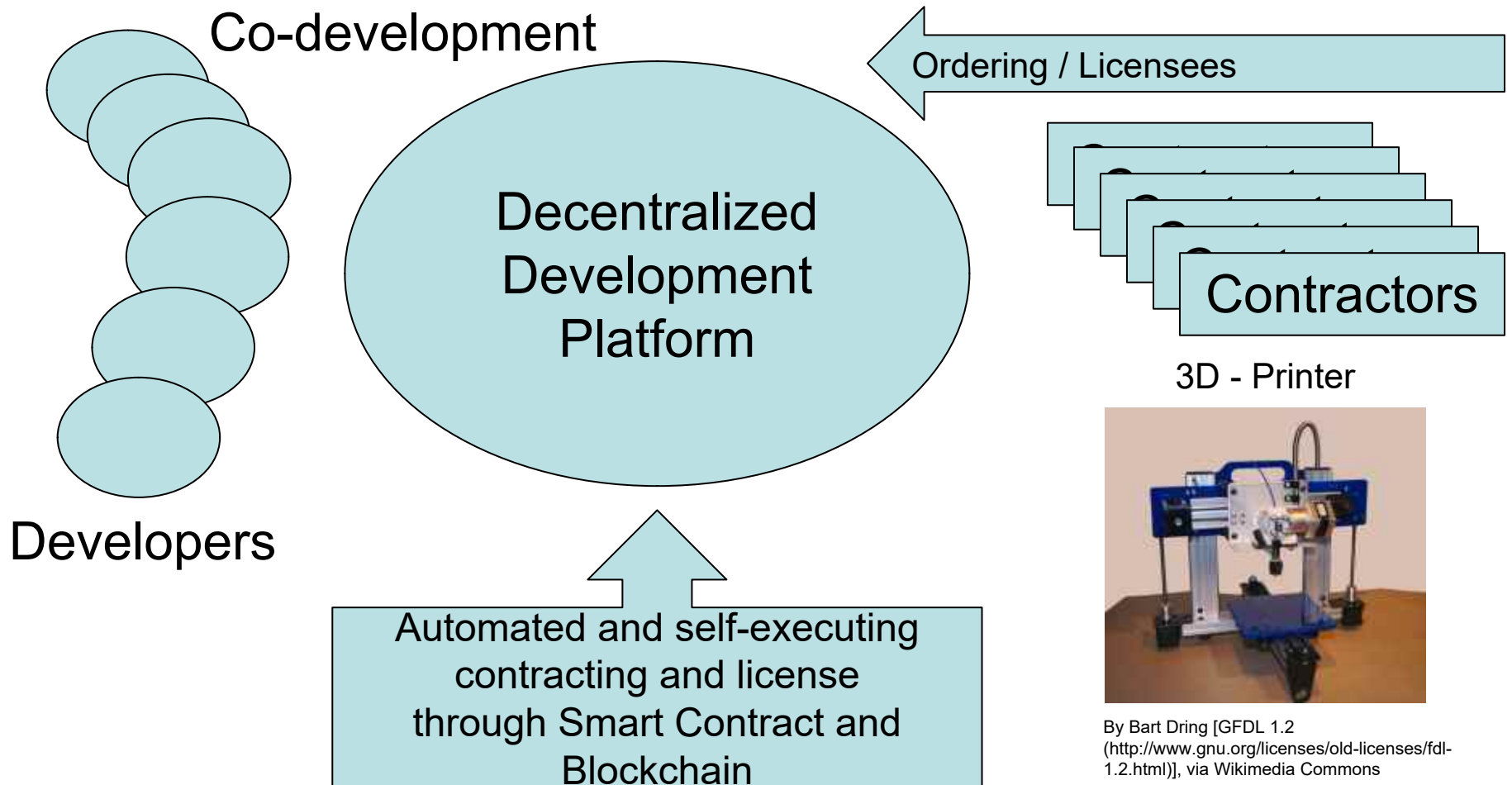
https://www.youtube.com/watch?time_continue=8&v=qYQ4JFnXOE

USE CASES

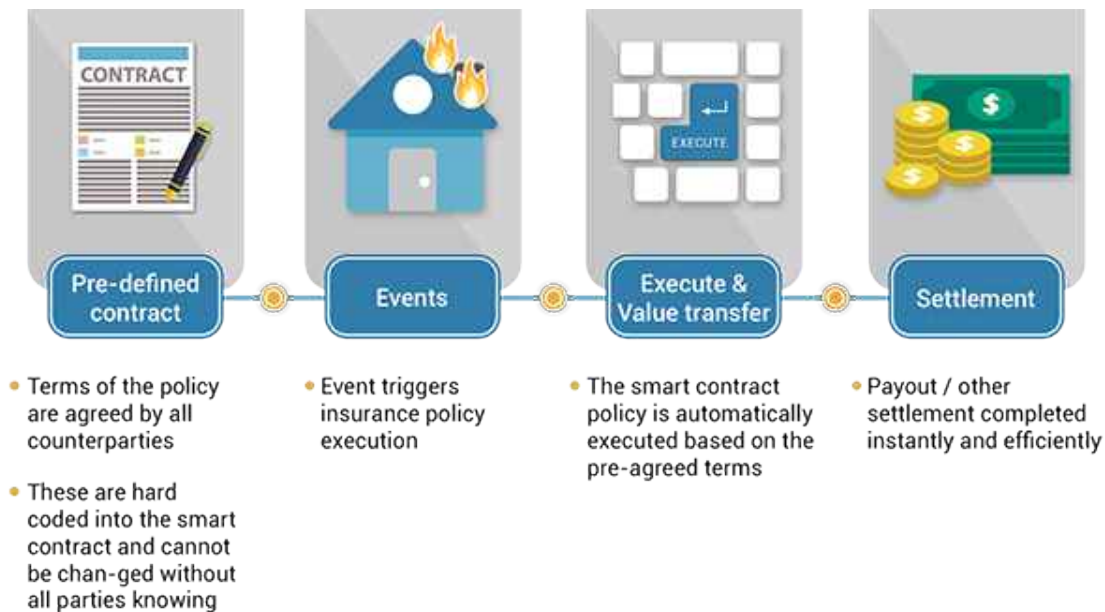


mybit.io

Smart Contracts & Blockchain – Application: Development, Collaboration, Contracting, Licence Management and Fulfilment



Smart Contracts – Application: Insurance Contracts



A simplified example of how a smart contract would work in an insurance environment. Created 17th April, 2017 . By draglet GmbH (Own work) [CC BY-SA 4.0 (<https://creativecommons.org/licenses/by-sa/4.0/>)], via Wikimedia Commons

AXA turns to smart contracts for flight-delay insurance

BI Maria Terekhova, Business Insider
© 15.09.2017, 15:48 84

10 September 2017

B3i launches working reinsurance blockchain prototype

B3i, the Blockchain Insurance Industry Initiative, announces launch of market beta-testing of its reinsurance blockchain prototype.

<https://www.munichre.com/en/media-relations/publications/company-news/2017/2017-09-10-company-news/index.html>

Blockchain ledgers and smart contracts: the future of marine insurance?

September 11, 2017 | United Kingdom, United States

<https://www.willistowerswatson.com/en/insights/2017/09/blockchain-ledgers-and-smart-contracts-the-future-of-marine-insurance>

Smart Contracts & Blockchain – Application: Bonds Emission

Börsen-Zeitung

Zeitung für die Finanzmärkte

Ausgabe 122 vom 29.06.2017, Seite 3

LBBW begibt Blockchain-Schuldschein

Pilotprojekt für Landesbank und Daimler – Regulatorische Hürden bestehen

Börsen-Zeitung, 29.6.2017
Stuttgart – Die Landesbank Baden-Württemberg (LBBW) und der Autokonzern Daimler haben erstmals gemeinsam bei einer Finanztransaktion die Blockchain-Technologie eingesetzt. In einem Pilotprojekt platzierte die LBBW für den Konzern ein Schuldscheindarlehen über 100 Mill. Euro mit einer Laufzeit von einem Jahr bei drei Sparkassen.

Beide Konzerne wollen so die Technologie testen. Die LBBW kann sich vorstellen, Blockchain künftig bei Konsortialkrediten oder in der Handels- und Exportfinanzierung

einzusetzen, und will entsprechende Projekte mit Partnern aus Industrie und Handel durchführen. Daimler will laut Treasury-Leiter Kurt Schäfer Standards für die Technologie in für den Konzern interessanten Gebieten mit erarbeiten. Etwa für Kundenbeziehungen, Handel und Vertrieb, Lieferanten-Management, digitale Services und Finanzdienstleistungen. Weitere konkrete Projekte seien jedoch noch nicht in der Pipeline.

Ein wirtschaftlicher Faktor ist die Technologie für beide Konzerne noch nicht. Offene Fragen bestehen generell bei Datenschutz, Sicherheit

und den regulatorischen Rahmenbedingungen für den Einsatz von auf Computerprotokollen basierenden Smart Contracts. Die Platzierung wurde daher doppelt durchgeführt: auf dem klassischen Weg mit der Bank als Intermediär zwischen Darlehensnehmer und Investoren und über eine nichtöffentliche Blockchain, bei der alle Prozesse von der Auszahlung bis zur Rückzahlung des Darlehens automatisiert ablaufen. Die LBBW habe die Technologie und mögliche Klärungsthemen aus regulatorischer Sicht mit der BaFin angesprochen und will dies vertiefen.

Smart Contracts – Application – Crowdfunding

List of highest funded crowdfunding projects

From Wikipedia, the free encyclopedia

This is an incomplete list of the highest funded **crowdfunding** projects, either successful or not.

Contents [hide]

- 1 Over 10 million
- 2 5–10 million
- 3 1–5 million
- 4 See also
- 5 References

Over 10 million [edit]

Rank ↕	Project ↕	Category ↕	Platform ↕	Campaign end date ↕	Campaign target ↕	Amount raised ↕
1	<i>EOS</i>	Blockchain	Ethereum	June 26, 2017	\$100M	\$185,000,000+ ^[1]
4	<i>The DAO</i>	Blockchain	Ethereum	May 28, 2016 ^[7]	\$500K	\$150,000,000 ^[8]
5	Status ^[9]	Blockchain	Ethereum	June 21, 2017	\$12M	\$103,000,000 ^[9]

Smart Contracts – DAO – Cryptocurrencies

Initial coin offerings have raised \$1.2 billion and now surpass early stage VC funding

- The amount of money raised by start-ups via so-called initial coin offerings (ICOs) has surpassed early stage venture capital (VC) funding for internet companies.
- ICOs are a way for start-ups to raise money by selling investors tokens in exchange for equity, similar to an initial public offering (IPO).

Arjun Kharpal | @ArjunKharpal

Published 7:13 AM ET Wed, 9 Aug 2017 | Updated 9:17 AM ET Wed, 9 Aug 2017

<https://www.cnbc.com/2017/08/09/initial-coin-offerings-surpass-early-stage-venture-capital-funding.html>

Börsen-Zeitung

Zeitung für die Finanzmärkte

Ausgabe 13 vom 19.01.2017, Seite 2

Initial Coin Offerings bedrohen Venture-Capital-Modell

Technologiefirmen gehen dazu über, Risikokapital mittels Kryptowährung direkt bei Investoren einzusammeln – Handelsfunktionen auf Plattformen ein Bonus

Börsen-Zeitung

Zeitung für die Finanzmärkte

Ausgabe 170 vom 05.09.2017, Seite 2

INITIAL COIN OFFERING

Chinas Zentralbank zieht den Stöpsel bei ICOs

Krypto-Börsengänge werden als illegale Kapitalbeschaffung verboten – Angst vor Missbrauch mit neuen Spekulationsinstrumenten

LEGAL QUESTIONS AND CHALLENGES

Basic Questions regarding Smart Contracts

- Legal nature: Smart Contracts are Contracts – aren't they?
- Conclusion of contract: Special requirements?
- Interpretation of contract: Basis for Interpretation, Code versus Law, Coding the contract purpose
- Vague legal terms – undefined legal concepts
- Legal limits of contractual freedoms: agreement contra bonos mores and usury
- Place of jurisdiction and governing law: Are Smart Contracts forming transnational law in a stateless Virtual Machine?
- Arbitration clauses and proceedings in and through Smart Contracts
- Decentralized Autonomous Organizations (DAO) and Numerus Clausus of the legal forms of companies: Is it possible to create new forms of legal persons through Smart Contracts?

Basic Questions regarding Blockchain

- Burden of proof
- Good faith
- Rescission of transactions
- Transfer of Token (Intellectual Property?, Rights? Securities?)
- Copyrights
- Data protection

Regulatory Framework – Need for legislative action

- Burden of proof
- Consumer protection
- Banking Law and Capital markets law
- Anti money-laundering legislation
- Data protection regulation
- Competition and antitrust law
- Tax law

Interpretation of Smart Contracts Code versus Law

Börsen-Zeitung

Zeitung für die Finanzmärkte

Ausgabe **138** vom **21.07.2016**, Seite 2

GASTBEITRAG

Blockchain, Smart Contracts und der Einlagenschutz

„Search for Intention

(...) Difference between 'implementation' and 'intention'. (...) Either, in the sense of 'Code is Law', the implemented program code (and then, if applicable, including any errors) must have final validity, or an existing law outside the block chain applies. The decision of the Dao community ultimately supports the idea of a right outside the blockchain and puts it above the implementation in the code - but at the price of the fact that the absolute code postulated as "absolute" loses its absoluteness."

Own translation. German by Udo Milkau, Leiter der Geschäftsfeldsteuerung
Transaction Banking, DZ Bank / Thomas Schönfeld, Director im Bereich
Financial Services, PwC

Legal challenges regarding Smart Contracts: Incorrect and incomplete performance, contract adjustment, invalidity, rescission

- Priority of substantive law?
- Implementation Challenges in the Blockchain:
 - Objections (Einreden und Einwendungen)
 - Retention rights
 - Reversal and rescission
 - Reclaiming
- Adjustment of the contract after discontinuation of the business basis
- Offset

IMPACT ON THE LEGAL MARKET

Loss of importance of intermediaries and central public registers mediating trust

Notaries



Interior view with a young notary at his desk; oil on canvas; 38.4 x 34.5 cm By anonymous German painter (<http://www.bassenge.com/>) [Public domain], via Wikimedia Commons

Trusted public registers



By Klaus Graf (Own work) [CC BY-SA 3.0 (<https://creativecommons.org/licenses/by-sa/3.0/>)], via Wikimedia Commons

Banks



Palazzo San Giorgio — in Genoa - By Jensens (Own work) [Public domain], via Wikimedia Commons

Fiduciaries, Lawyers,
Certified public accountants?

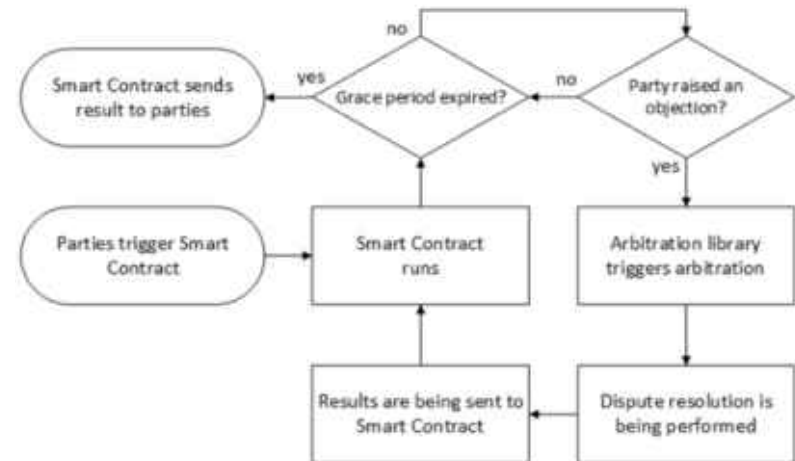
Changes in the significance of central dispute settlement institutions



Gerichtssitzung zu Vendôme - Kriminalmuseum Rothenburg
By User:Mattes (Own work) [Public domain], via Wikimedia Commons

World's First Smart Contract Based Arbitration Proceedings Conducted

July 17, 2017 2:42 pm



The smart contract arbitration process.

<http://www.trustnodes.com/2017/07/17/worlds-first-smart-contract-based-arbitration-proceedings-conducted>

Changes in the competition of the legal systems



<http://www.lawmadeingermany.de>



Artificial intelligence disrupting the business of law

Firms are recognising that failure to invest in technology will hinder ability to compete in today's legal market

Financial Times, October 6, 2016 by Jane Croft

Changes in the competition between legal service providers

Future of lawyers?

Legal service: Proportions between craftsmanship and bulk production?

What will the future law firm look like?

The legal profession will be radically different in ten years. On the whole, we expect the following:

- fewer traditional lawyers in law firms
- A new mix of skills among the elite lawyers
- Greater flexibility and mobility within the industry
- A reformed workforce structure and alternative progression routes
- A greater willingness to source people from other industries with non-traditional skills and training.

Deloitte, Developing legal talent Stepping into the future law firm, February 2016

Significance gain of software auditing

Verification of Smart Contracts – and Education!

Formal Verification of Smart Contracts

Short Paper

Karthikeyan Bhargavan¹, Antoine Delignat-Lavaud², Cédric Fournet²,
Anitha Gollamudi³, Georges Gonthier², Nadim Kobeissi¹, Natalia Kulatova¹,
Aseem Rastogi², Thomas Sibut-Pinote¹, Nikhil Swamy²,
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D. Magazzeni, P. McBurney and W. Nash,
"Validation and Verification of Smart Contracts:
A Research Agenda," in *Computer*, vol. 50, no.
9, pp. 50-57, 2017.

<https://securify.ch>



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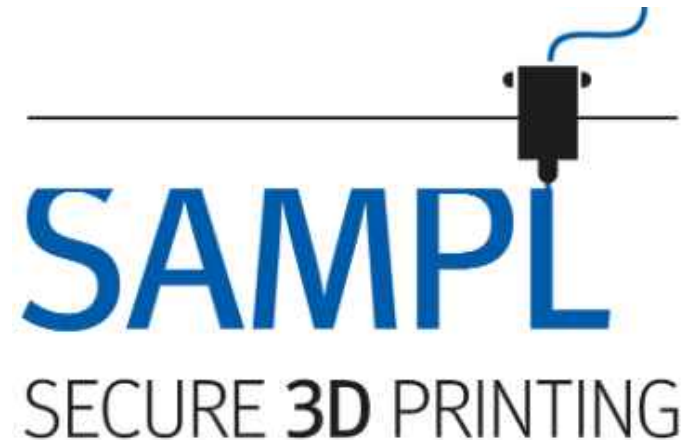
ulm university universität
uulm

Computational Methods in Law

www.uni-ulm.de/cml



http://www.jura.uni-heidelberg.de/digitales_recht/index_e.html



Institute of Distributed Systems, Prof. Dr. Frank Kargl, <https://www.uni-ulm.de/in/vs/res/proj/sampl/>

Prof. Dr. iur. Heribert M. Anzinger

Universität Ulm

Faculty of Mathematics and Economics

Institute of Accounting and Audit
Section Business and Taxation Law

www.uni-ulm.de/taxlaw