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Session 6

Algorithmic Governance and DAOs

BLOC 515: Blockchain and entrepreneurship management

Session Objectives

- In this section, we will go through yet another area, that is bound to be shaken by blockchain technology and its implications of decentralization – ***governance***

- In this regards, blockchain can be helpful not only for enabling transparent decision-making, but also increasing public participation. Nonetheless, when algorithms take over ever larger parts of our lives, we need to be aware of many risks this brings.

- Overview of decentralized/distributed autonomous organizations

- Understand the various aspects of algorithmic governance

- Explore modern operations of DAOS
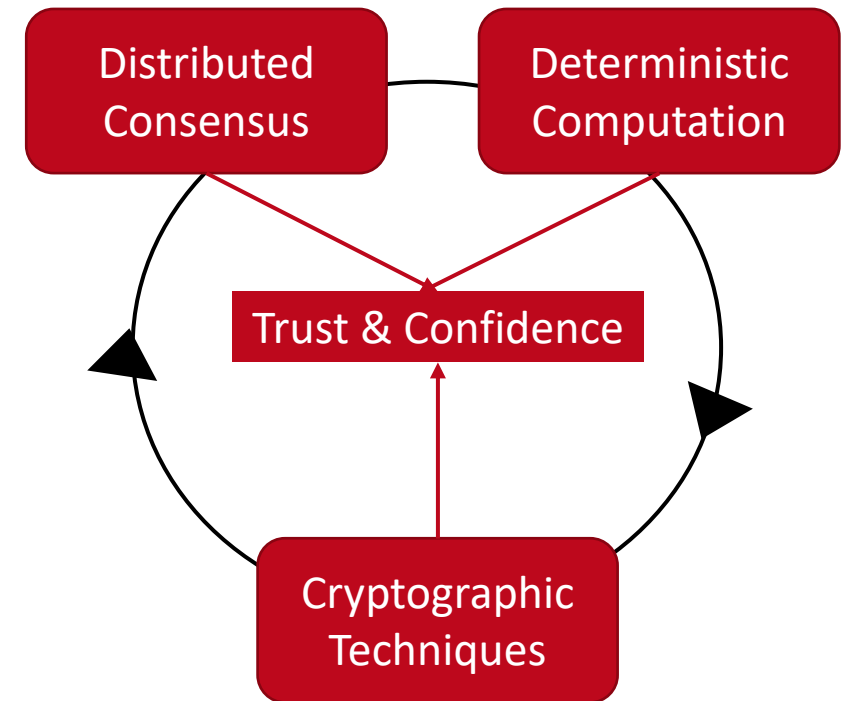
Agenda

1. Re-establishing Trust

2. Potentials of Algorithmic Governance

3. Decentralized Autonomous Organizations

4. Other Ideas

5. Conclusions

6. Glossary

7. Further Readings

1. Re-establishing Trust

Re-establishing Trust

- As previously discussed Nakamoto proposed an alternative perspective of building trust.

- This trust machine has motivated by:
  - the global financial crisis in 2008, which has been commonly attributed to the failure of trusted institutions such as banks and other financial institutions.
  - abuses of information and communication technologies for surveillance, dissemination of disinformation, and public coercion have come to light.
    - A growing loss of trust in governmental authorities [3]
    - Centralization of Tech giants like Facebook, Google and Twitter [1, 2]

- These developments have triggered a *new attitude* towards sociotechnical systems where the requirement to trust a third party is considered a disadvantage.

Distributed Consensus — Deterministic Computation — Trust & Confidence — Cryptographic Techniques

[1] https://theintercept.com/2019/08/19/twitter-ads-china-uighurs/ [2] https://theintercept.com/2019/08/18/google-egypt-office-sisi/
[3] https://theintercept.com/2014/03/12/nsa-plans-infect-millions-computers-malware/

Trust & Confidence

- In blockchain systems we can distinguish between the definitions of trust and confidence
  - **Trust:** refers to potential vulnerabilities of such systems and how risk is mitigated
  - **Confidence:** refers to expectation guarantees deriving from knowledge that builds from past experiences
- The above characteristics relate with the shared expectations to the way the technology operates, and how correct the operations are.
- Therefore, the increased trust and confidence that ultimately the technology provides depends on a variety of factors that relate with the collective operation of the network.

For public blockchains:
  - Collective management at different levels, from consensus to the protocol's source code
  - Verifiable confidence
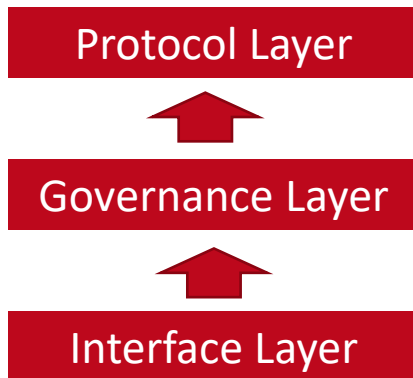
For private permissioned blockchains:
  - A pre-existing trust is assumed over the network
  - A permissioned governance is enforced to the network by the administrator that restricts how participants are performing actions or access the blockchain.

For consortium blockchains:
  - Assuming a level of pre-existing trust over the network - shared values
  - Governance is defined as a set of rules that govern the organizational and operational partnership of the consortium
  - These rules focus on the operation of the consortium, their roles or responsibilities and the decision making

Governing Open Protocols (Cont.)

- Referring to the abstract architecture of a DLT system and assuming an open, public and permissionless instantiation of such a network. There are different levels of power (influence) and politics that are played out in such systems.
  - These levels are organized under the following layers: protocol, governance, and interfaces.

```
┌─────────────────────┐
│   Protocol Layer    │
└─────────────────────┘
          ▲
┌─────────────────────┐
│  Governance Layer   │
└─────────────────────┘
          ▲
┌─────────────────────┐
│   Interface Layer   │
└─────────────────────┘
```

Internal Actors:
- The consensus algorithm plays a significant role in the governance
- The internal protocol rules, embedded in the technical details e.g., source code, databases, repositories
- Incentivization structures: intended to help governing behavior towards activities beneficial for the system

External Actors:
- The miners, users that participate to the consensus rounds
- The project maintainers, that build the technology
- The developers of smart contracts

- As we will be discussing it turns out that not all users are the same. Each node has different interests and incentives that are external to the protocol instead (e.g., electricity costs). Therefore, in conflicting events these conditions are likely to influence the evolution of the protocol.

2. Potentials of Algorithmic Governance

Requirements for Algorithmic Governance

- Organizing businesses and states requires ongoing actions from a hierarchy of delegated people. As we've seen so far, there are central points of control that are necessary for the organization to operate. Even if process automation and controlling were made more efficient through information technologies and *rules of running of organization could already be codified decades ago*, securing it still relied on central entities with administrative privileges – there simply was no other way.

- With blockchain, organization rules and constraints, defined in smart contracts, would be, in essence, self-sufficient, *harder to break* or stop, as their exact replicas would be distributed to all participants – with no central authorities, but with each node independently performing only valid actions.

- A 100% pure algorithmic governance would be a technocratic dystopia. There is no denial about the evolution and proliferation of Robotic Process Automation (RPA), combining artificial intelligence and software robots. No denial about the power that algorithms have over human quirks. No denial about the benefits of transparency in decentralized "autonomous" organizations. There is also no denial about the many problems of contemporary governance models. We just mustn't forget what would be the *purpose* of an algorithmic governance – and prepare contingency plans.

The Power of Algorithms

The reliance on algorithms has deep sociological and political implications. T. Gillespie analyzed six dimensions of public relevance algorithms that are affecting human discourse and knowledge*:

1. Patterns of inclusion: what data actually gets to the algorithm
2. Cycles of anticipation: the implications of predicting users' needs and actions
3. The evaluation of relevance: how algorithms decide what is relevant – to their structure/goals and to users
4. The promise of algorithmic objectivity: can algorithms' technicalities provide impartiality *per se*
5. Entanglement with practice: how users reshape their practices to suit the algorithms and how algorithms in turn influence their lives
6. The production of calculated publics: how algorithmic presentation of what is „hot" or what „others are doing" shapes users self-image

A deeper examination is beyond the scope of this session, but do think about what implications would a DAO have, when on one hand all its actions and algorithms are completely transparent, yet they are very complex and they might only have informal, voluntary support and no person to be held responsible for any incidents.

* The Relevance of Algorithms, Tarleton Gillespie, 2013

The Power of Algorithms (Cont.)

There are many cases of *use* and *misuse* of the powers of algorithm, but one should suffice for illustration.

"If you recognize native advertising, it was insufficiently executed. Good native advertising offers the reader the content, that is of interest to the reader and can help him in his life …

It is long true, that on the Internet, you don't search for things, but things search for you."

- Igor Lahav, Outbrain, published in 2017 in a commentary for a major Slovenian newspaper.

Outbrain is a large advertising company, using behavioral targeting which serves billions of recommendations and site views per month. It is a global player, with high-profile customers, like CNN and Bild.

What can blockchain do in this case? Several things, but not just yet: disintermediation can bring a larger piece of the pie to the producers, multiple user-controller personas on blockchain could help users protect their privacy by selective revealing their data and monetize it directly, reducing fraud by having better publisher identification options *etc*.

3. Decentralized Autonomous Organizations

Smart Contracts

"Smart contracts are computer programs that can be consistently executed by a network of mutually distrusting nodes, without the arbitration of a trusted authority." – [Bartoletti & Pompianu, 2017]

- Smart contracts are tiny pieces of code, that are executed on "all"* nodes in the network and their output is the same for all nodes. Once deployed on the blockchain, they start their own life, which cannot be altered, stopped or deleted (unless explicitly programmed to be able to do so).

- The "smart" part relates to the certainty of the contract fulfillment, relying on the decentralized and cryptographically secured technology – and not relying on third parties.

- Agreements between parties are inseparable from execution.

Agreement **+** Execution

decentralized and cryptographically secured
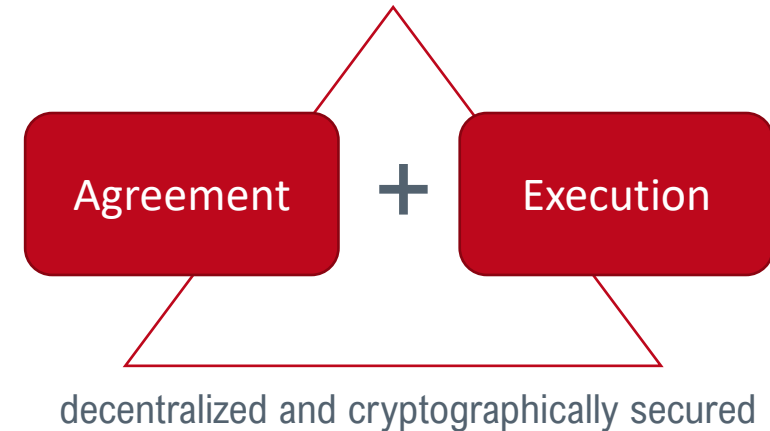
Smart Contract Types

Defining smart contracts depends on the context. Most often they are not really smart, they *don't improve by obtaining new knowledge*, but *they do run autonomously*, interact with others and have a certain degree of "memory". A better term would probably be **chaincode**, coined by IBM for Hyperledger.

We can generalize the concept into 3 types:

1. **Bitcoin script**, executing transactions (scripts) when conditions are met

```
smart contract = predicate (yes/no function)
```

2. **Ethereum contract**, using Turing complete programming language

```
smart contract = automated execution of an agreement (code)
```

3. **Ricardian agreements**, using Ricardian contracts

```
smart contract = automated execution & enforceability of an agreement
(code + legal prose)
```

Towards a "DAOism"

- Vitalik [1] attempts to shed light towards the various concepts mentioned in the literature around **decentralized automation.**
  - **Smart Contracts:** are the simplest form of decentralized automation
  - **Autonomous Agents:** while some degree of human effort might be necessary to build the agent (wither software or hardware), in general there is no necessity for any specific human involvement at all for the operation or existence of an autonomous agent e.g., a computer virus
    - What about AI autonomous agents? How can we enforce a level of governance on such agents?
  - **Decentralized Applications:** Vitalik focuses on ***anonymous decentralized applications*** (where each user is anonymous, and the system executes their atomic interactions) and ***reputation-based decentralized applications*** (where the system keeps a history o the interactions in building a mechanism that ensures trust).
  - **Decentralized Organizations:** Instead of a hierarchical structure managed by a humans interacting with each other, a decentralized organization involves humans interacting with each other according to a protocol specified in code and enforced on the blockchain.
  - **Decentralized Autonomous Organizations:** Describes an entity that lives on the internet and exists autonomously, but also heavily relies on hiring individuals to perform certain tasks that the automaton itself cannot do.
    - Bitcoin "hires" miners to participate to the consensus
    - AI driven DAOs will be completely autonomous, whereas a DAO still requires heavy involvement from humans specifically interacting according to a protocol defined by the DAO in order to operate.

[1] https://blog.ethereum.org/2014/05/06/daos-dacs-das-and-more-an-incomplete-terminology-guide/

Distributed Business Entities

We usually talk about blockchain technology lowering transaction costs and increasing speed in operating a business. However, there is potential for it to impact corporate architecture, also. Don and Alex Tapscott predictions [Blockchain Revolution, 2016]:

- **Search costs** – finding new talent and customers
  - beyond internet search: respecting people's privacy through selective revealing data, multidimensional searching not just data at that particular time, but through all its lifecycle, and account for value in search queries

- **Contracting costs** – reaching an agreement and commit to it
  - smart contracts

- **Coordination costs** – internal managing of people
  - distribution of responsibility, authority and power is easier with blockchain as it provides persistence and stability in an organization, even when there is no hierarchy

- **Costs of (re-)building trust** – preserving integrity
  - transparency and trust codified in software

Distributed Business Entities

Tapscotts also defined **four categories of new business models**, varying in the degree of functional complexity and of human involvement:

▼ **Smart Contracts** – when considering them on their own, they involve the least complexity and human interaction

▼ **Open Networked Enterprises** – utilizing smart contracts, enterprises can „open up" and couple with others in the network

▼ **Autonomous Agents** – more or less sophisticated devices or software, that adjusts its own actions in order to achieve its goals and can be owned by nobody but themselves

▼ **Distributed Autonomous Enterprises** – the most complex model, in which members participate through smart contracts to seek common goal, where actions are not triggered only by humans, but by any thing that can interact with blockchain
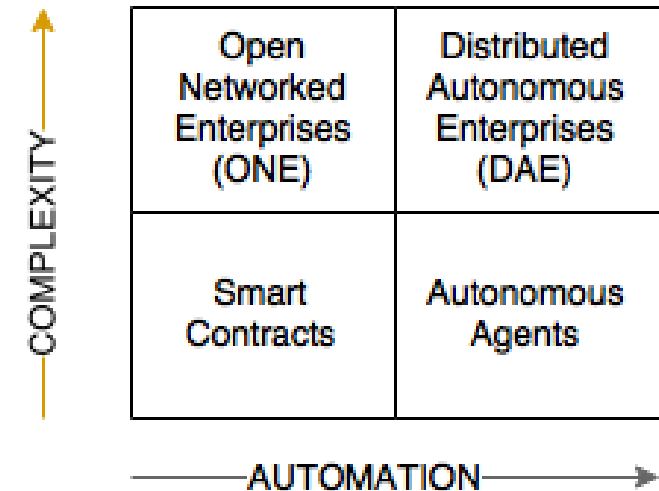
Introduction to DAOs

- In late 2013, a topic of *decentralized organizations* came forward (Bitshares, Dapps, DAC ...). The idea was that along with smart contracts, even the structures of organizations could be managed through "smart" code.

- **Decentralized Autonomous Organization** is an organization that is completely defined online, with all its management rules written in smart contracts. It doesn't rely on people for making decisions, but rather „hires" people to do the things it cannot do: interacting with the real world. By way of example, a DAO can pay a human contractor from its internal capital to do some real-world task, which is determined by the rules of the DAO itself (often participants in the DAO cast votes for what is to be done).

- A DAO that seeks financial benefits, usually in the form of receiving dividends, is called **Decentralized Autonomous Corporation or DAC**.
  - Idea was firstly introduced by Bitshares where market participants were able to create decentralized autonomous corporations (DACs) based on smart contracts.
  - This was later evolved into a Decentralized Exchange

Legal status of a DAO

- Considering the traditional legal frameworks in most jurisdictions, a DAO is not easy to define:
  - *general partnership*, in which members own the assets of their business, but are personally liable and any member that could represent a DAO could be sued
  - *unincorporated association*, where some members have limited liability, but generally don't create a legal entity, any member that the state first observes the contact with can be sued
  - *joint venture* ...

- There is a problem defining it as a partnership, as participants have <u>only one common thing</u>, they sent some tokens to the smart contract. Also, there is usually no restrictions who can join, either.

Blithic

- By the ***nearest person theory***, the creator of a DAO would be held responsible for any damages resulting from the operation of DAO. However, what happens when DAO has multiple and even unknown creators? Maybe the members of DAO could be jointly held liable, as they are funding a DAO and possibly expect direct or indirect profits. If that would be the case, how can users be responsible for others' actions or bugs in the code?

- Note, with *in rem* jurisdiction (rights over property), legal actions are taken against the property, even when persons are unknown. The state will not allow illegal actions no matter what, and despite not knowing who the members in a DAO are, it can forbid it nonetheless.

DeFi Governance VS Corporate finance

- The ambition of every DeFi and dApp platform is to become more decentralized overtime. Therefore many of the corporation processes have been altered and renewed to **best fit the blockchain ecosystem**.

- So let's take step-by-step:

Corporation goes public	VS	Decentralized Autonomus Organization
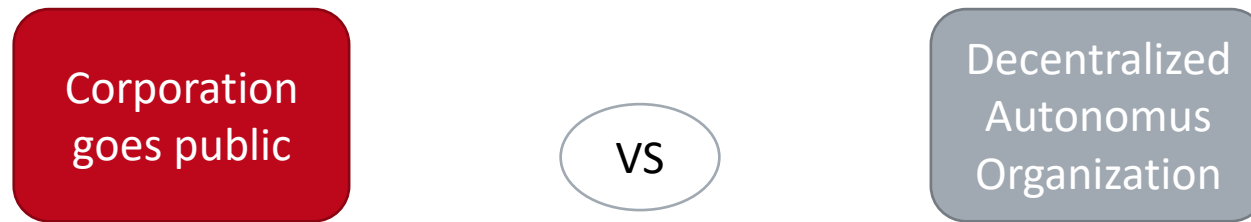
- In the DeFi and blockchain space, Decentralized Autonomous Organizations (DAOs) are responsible for the **governance** and **operations**.

- A main difference with ICOs is that any type of organization can create and publish their DAO without restrictions.

DeFi Governance VS Corporate finance (Part II)

Stock holder

VS

Governance
Token holders
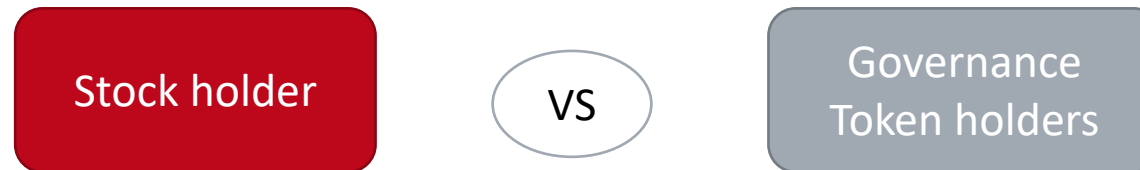
- This Layer of governance structure is similar to both cases. In both cases, people that hold a specific asset have to opportunity to be a part of the decision making processes in a organization

- But there are some major differences:
  - *In most of the cases it is mandatory to self-delegate or delegate to another wallet the voting and proposing rights that come with each governance token*
  - *Delegates can vote on any proposed decision and can post proposals.*
  - *Governance tokens purchased from a DEX without any KYC or any other middle man*

# Governance in DeFi is typically expressed through governance tokens

- Most DeFi projects issue **governance tokens** that aim to decentralize the governance of the underlying protocol.
  - *Owning a governance token may provide voting and/or profit sharing rights, as per the protocol's structure – things are not as standardized as in corporate governance.*

- Governance tokens can be:
  - *Earned, by participating in certain activities, such as providing liquidity.*
  - *Minted, for protocol creators and early investors.*
  - *Gifted, to addresses that fulfil specific criteria in a process known as an airdrop.*
  - *Bought and sold in exchanges, like any other token.*

- Governance tokens may be different from **utility tokens**, which are used for specific services within each protocol ecosystem.

DeFi Governance VS Corporate finance (Part III)

| Board Of Directors | Day-to-Day Operations | VS | Proposals and Dev Team | Smart contracts |
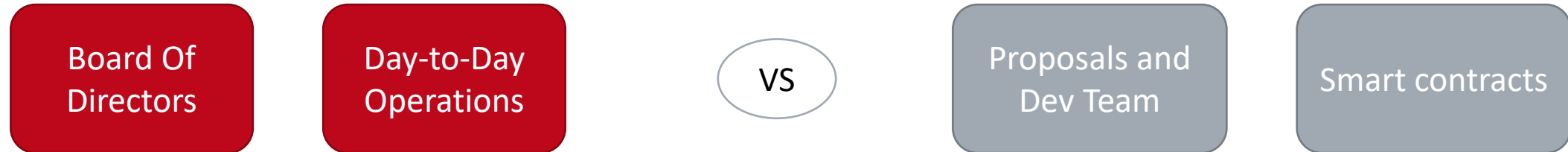
- In most cases of DeFi governance, there are is not any central team that is taking major decisions for the organization's operations. DAOs use proposals, that come from the governance token delegates, as a mean of taking new decisions.

- Then if the proposal is successful, then is automatically implemented in the blockchain

- Although all financial organizations need humans, the core operations are taking place in the decentralized and trustful blockchain environment.

Typical DeFi DAO governance visualized
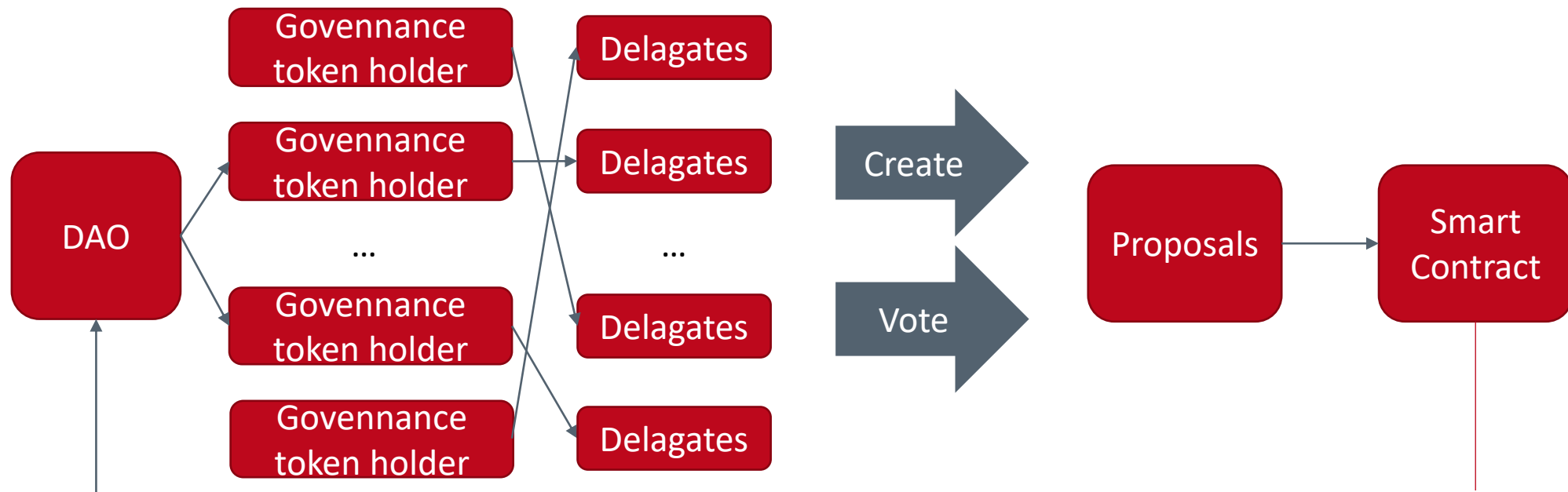
4. Other Ideas

Blockchain and the Gonverence with AI and IoT

- Several propositions from the literature suggest that blockchains can resolve problems of authority and political power through a decentralized system.

- Anticipating the combinations of blockchain with AI there is a control layer that is removed from humans. Instead, this control layer is assigned to systems with forms of reasoning that are non-human (e.g., computational agents).

- Think of a system where smart contracts, transactions, agreements and various other actions and reasoning can take place between digital entities, or physical things (IoT) that have been granted digital identities.

- Several considerations to think of here:
  - We need a control layer to resolve disputes
  - We need a control layer to determine whether a task is most fit to be executed by an algorithmic agent (a machine) or a human
  - What is a reasonable degree of algorithmic authority? How much algorithmic freedom? How much algorithmic centralization?
  - What would be a reasonable governance layer that will diffuse the dynamics implied from a "singularity" event?

5. Conclusions

Conclusions

- In this session, we have discussed yet another potential, enabled by blockchain and smart contracts – an alternative organization structure with decentralized governance.

- While blockchain systems and smart contracts themselves raise many legal and regulatory questions, creating whole corporations on top of them is even more unclear. Questions about their legal status when no legal entity exists, or no member is personally identified still remain to be answered. Or maybe a certain level of identification will turn out to be a necessity, imposed by governments.

- We observed a remarkable interest from the community investing into first Distributed Autonomous Organizations and difficulties when dealing with autonomously running code that gets exploited.

- Visualized the modern DAO governance structures

6. Glossary

Glossary

Distributed Autonomous Organizations (DAOs): is an organization that is completely defined online, with all its management rules written in smart contracts.
Autonomous Agents: more or less sophisticated devices or software, that adjusts its own actions in order to achieve its goals and can be owned by nobody but themselves
Distributed Autonomous Enterprises: the most complex model, in which members participate through smart contracts to seek common goal, where actions are not triggered only by humans, but by anything that can interact with blockchain
Oracle: A blockchain oracle is a (third-party) computational elements meant to connect a blockchain-based application with external (i.e., out-of-blockchain) resources (typically, information sources).

7. Further Readings

Further Reading

Bootstrapping A Decentralized Autonomous Corporation, Vitalik Buterin, 2013

•https://bitcoinmagazine.com/articles/bootstrapping-a-decentralized-autonomous-corporation-part-i-1379644274

•https://bitcoinmagazine.com/articles/bootstrapping-an-autonomous-decentralized-corporation-part-2-interacting-with-the-world-1379808279

•https://bitcoinmagazine.com/articles/bootstrapping-a-decentralized-autonomous-corporation-part-3-identity-corp-1380073003

(A series of „old", but thought-provoking articles from the founder of Ethereum about automating the management of a corporation: part 1 is about how this can be achieved, part 2 is about solving the challenge of obtaining external data from the real world, part 3 is about added value of decentralized corporations.)

Decentralized Blockchain Technology and the Rise of Lex Cryptographia, Aaron Wright & Primavera De Filippi, 2015

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2580664
(Read section F about Distributed Real-time Governance for further details about how blockchain enables alternative ways of governing)

Blockchain Governance: Programming Our Future, Fred Ehrsam, 2017

https://medium.com/@FEhrsam/blockchain-governance-programming-our-future-c3bfe30f2d74
(A comprehensive post on the importance of governing schemes in the blockchain space, highly recommend if you want to explore this space more.)

Further Reading (Cont.)

- [Hazard, 2017] Hazard, James, and Helena Haapio. "Wise contracts: smart contracts that work for people and machines." In Trends and communities of legal informatics. Proceedings of the 20th international legal informatics symposium IRIS, pp. 425-432. 2017.

- De Filippi, P., Mannan, M., & Reijers, W. (2020). Blockchain as a confidence machine: The problem of trust & challenges of governance. Technology in Society, 62, 101284.

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Questions?

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