# How RChain scales like nature

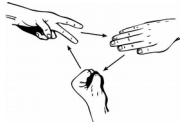
by Philipp Strauch

RCHAIN
COOPERATIVE

**Disclaimer**

All information during this talk is not meant to be investment advice!

- Philipp Strauch
- Physicist by education
- First contact with bitcoin 2010
- Ethereum
  - Contribution esp. with testing
- Focus over the last years more on
  - Computer science
  - Game theory, mechanism design
- Lately:
  - RChain
  - Inblock.io
- Organizer of the meetup in HH: Blockchain & beyond



# Bitcoin mining consumes more electricity a year than Ireland *

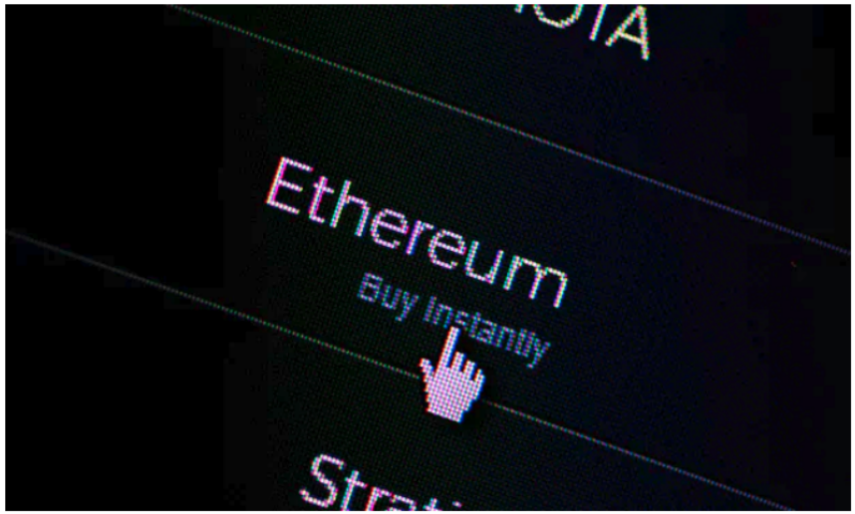
**Network's estimated power use also exceeds that of 19 other European countries, consuming more than five times output of continent's largest windfarm**

* article on guardian.com , 27.11.17

*POW is a rather simple but unsustainable consensus algorithm*

# '$300m in cryptocurrency' accidentally lost forever due to bug *

**User mistakenly takes control of hundreds of wallets containing cryptocurrency Ether, destroying them in a panic while trying to give them back**

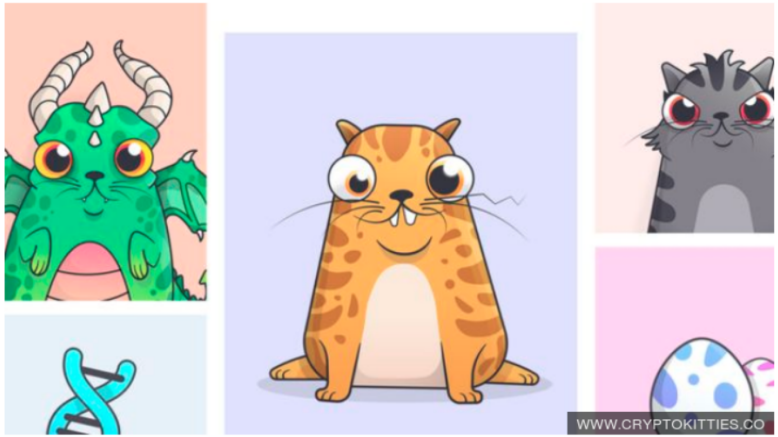



*Writing buggy smart contracts is easy,*
*writing correct ones is hard*

* article on guardian.com , 08.11.17

## CryptoKitties craze slows down transactions on Ethereum*

5 December 2017 Share




*No blockchain scales currently, no blockchain is ready for mass adoption*

* article on bbc.com , 05.12.17

# RChain architecture

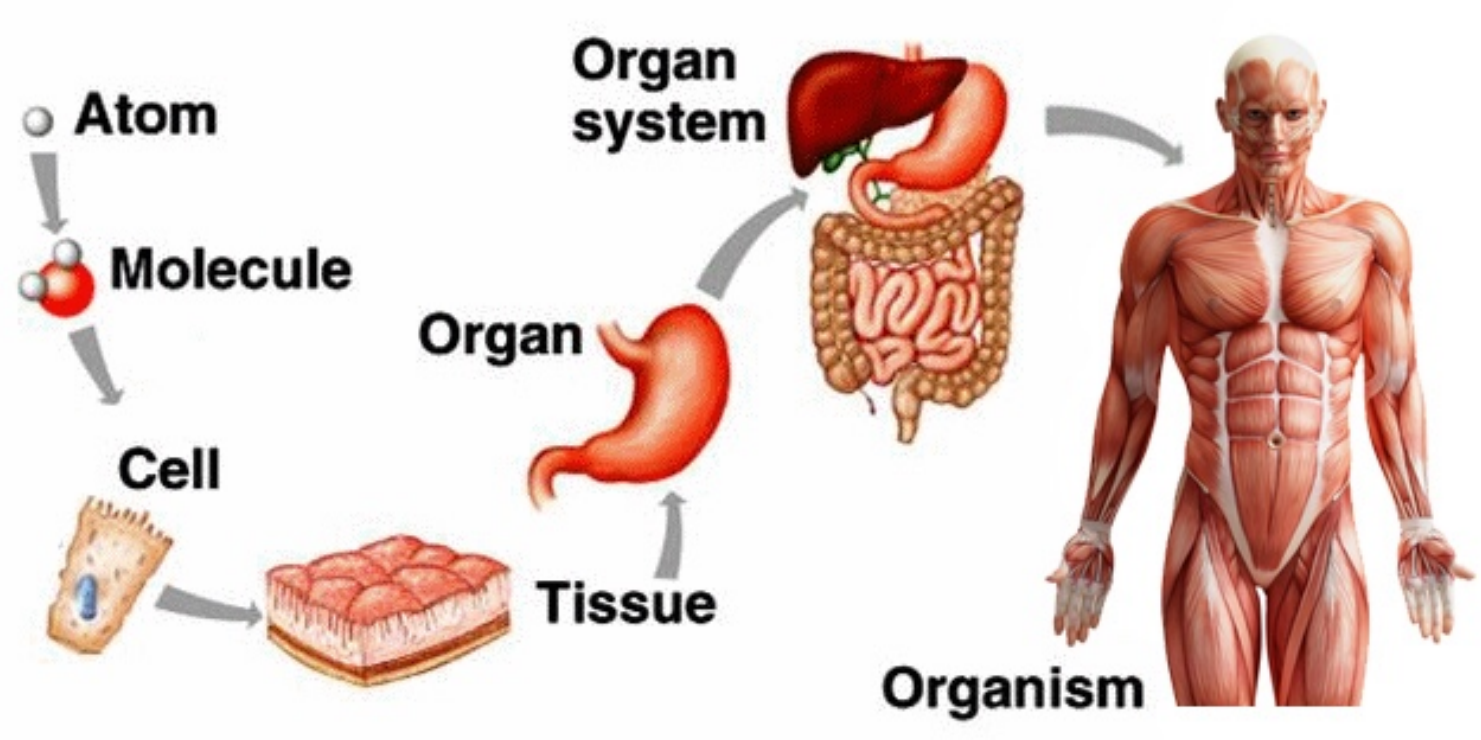
RChain tries to built a general purpose smart contract platform
that enables application to be built in a

- secure,
- sustainable ,
- and scalable

manner.

Approach:

- Scientific, mathematical
  (Category theory, linear logic, comp. calculi)
- Correct by construction


Atom
Molecule
Cell
Tissue
Organ
Organ system
Organism

...

## 2.2.2 RChain architecture - How does nature scale?

1. Compositionality

2. Concurrency

3. Coordination through message passing

Concurrency vs. parallelism

*Parallelism*:
No changing lanes allowed

*Concurrency*:
Changing lanes allowed,
Signaling / messages (blink

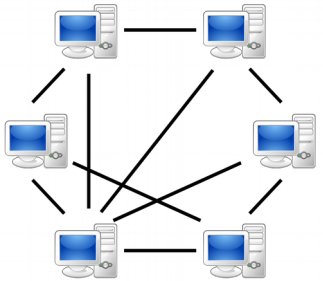
Resource management

Requirements for models of computation in the domain of blockchains:

- **C**ompleteness
- **C**ompositionality
- **C**oncurrency
- **C**omplexity
- Type theory
- Meta programming

Some known computation models:
Turning machine, lambda-calc., petri nets, pi-calc., rho-calc.

- Robin Milner, pi calculus in mid 90s
- Idea: better model for computation
  - Each computer processes a piece of information
  - Messages to coordinate

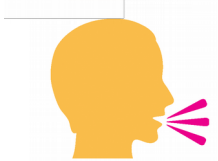


- Nature does the same

- i.a. Greg Meredith, Rho-calculus in mid 200
  - **R**eflective **h**igher **o**rder process calculu

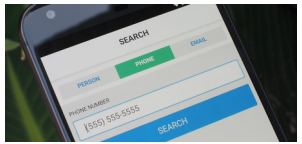

Do nothing

Listen with your ears for something, then do ...



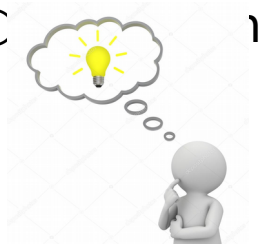
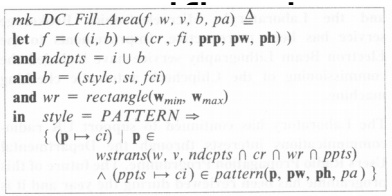
Call a telephone number (channel) and tell something ...


Do two things in parallel




Get the phone to a given a phone number

| | |
|---|---|
| P, Q :: = | |
| 0 | Do nothing, termination process |
| for (x <- y) | When receiving pattern x on channel y, do P |
| {P} | Send P on channel x |
| x!(P) | Run P and Q in parallel |
| P \| Q | Dereference x, evaluation of x |
| *x | Names are quoted processes |
| x, y :: = @P | |

- Concurrent programming language
- Derived from the rho-calculus
  - Syntactically close to the formalism
- Spatial types
- Behavioral types: later release
  - Makes it easy to reason about behavior of the program
  - C   >  ntation
  - Program search regarding behavior

- Expressive namespace system
  - Sharding on steroids
- Nesting of namespaces
  - Similar to urls: www.developer.rchain.coop
- Launch: Regions with different policies
- Validators inhabit regions
- Set S of namespaces is powerset of regions
- Validator set of NS  (X∨Y)
  - v(X) ⋃ v(Y)

# Thanks!

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inblockio

- RChain is organisational structure
  - Cooperative, similar to German ‘Genossenschaft’
- Principle: one member, one vote
- Open membership, once $20
- Actively working on improving governance processes

- i.a board members of RChain coop:
  - Greg Meredith
  - Vlad Zamfir (Ethereum Casper research lead)
  - Kenny Rowe (MakerDAO)

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- To become a member:
  - www.member.rchain.coop
- Developer resources:
  - www.developer.rchain.coop
    - Architecture paper
    - Rholang spec
    - Roadmap
- Bounty system
- Telegram
  - www.t.me/rchain_coop
- Discord channel
  - www.tinyurl.com/rchainDiscord

- Videos from developer conference in Apr 2018, Boulder
  - www.tinyurl.com/RChainDevcon
- Videos from governance forum in Feb 2018, Seattle
  - www.tinyurl.com/RChainGovForum
- Rholang in 5mins
  - www.tinyurl.com/Rholang5min

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