From Blockchain to Smart Machines
Threats and Opportunities of Automation

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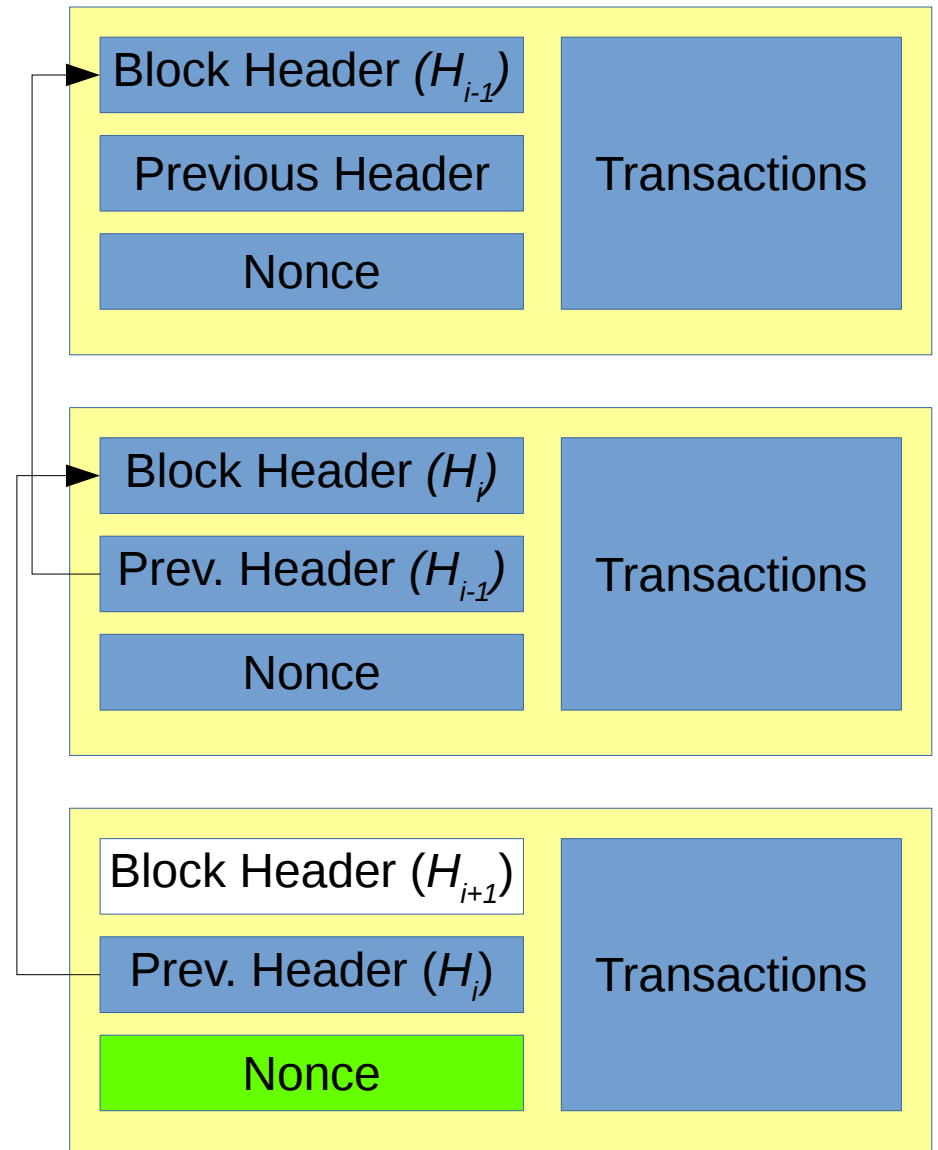
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Automation in the News

- Blockchain – going to disrupt future societies
- AI – disrupting everyday activities
  - Google Assistant, Siri, Amazon Alexa
  - Self-driving cars
  - Companion robots
  - Caregiver robots
- Concerns:
  - Is there any limit?
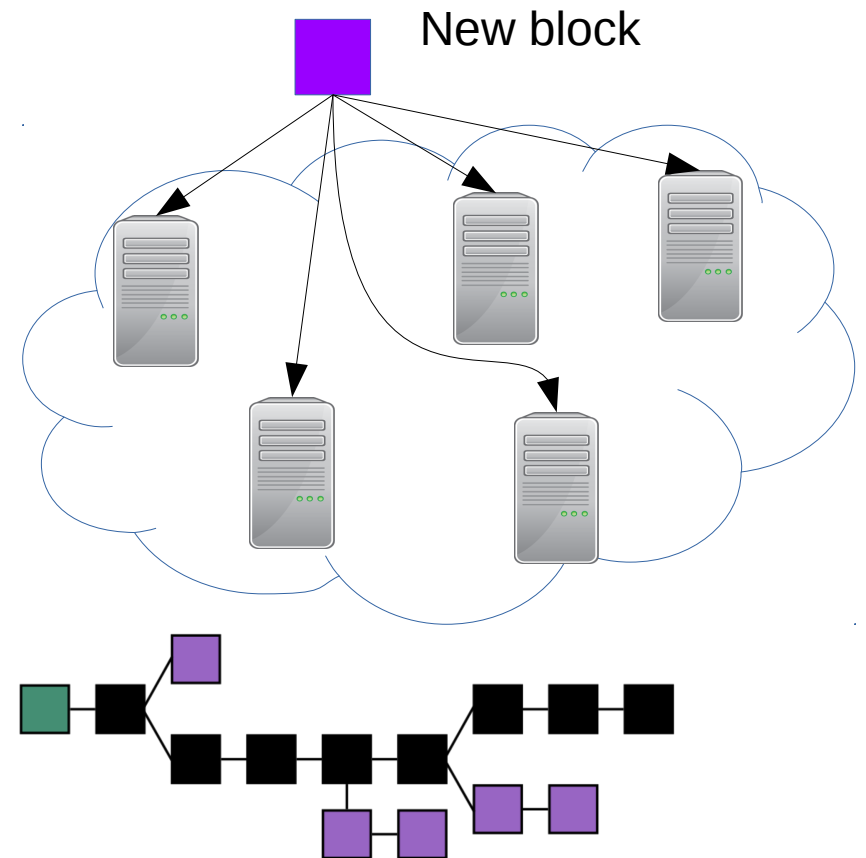 - Is it safe?
  - Can it be trusted?

Bitcoin and Blockchain

- Bitcoin – digital currency
    - Launched 2009
- Public ledger stored as a sequence of blocks (blockchain)
- 1 block: several transactions + validation / linking
- Transactions are digitally signed
- Blockchain is tamper-proof
    - Internally consistent sequence of blocks

Block Header (H_{i-1})	
Previous Header	Transactions
Nonce	

Block Header (H_i)	
Prev. Header (H_{i-1})	Transactions
Nonce	

Block Header (H_{i+1})	
Prev. Header (H_i)	Transactions
Nonce	

Blockchain => no TTP

- All nodes get same block data

- Race to be first to find legal header. (Rewarded by currency)

- Record is public, protected by consensus

- Idea: accounts can be owned by software agents

  - Transactions can trigger code that locks/releases assets

  - → Smart contracts

New block

Smart Contracts Are Disruptive

Smart contracts – simple to complex

Use case examples

Digital value exchange	Smart right and obligation	Basic smart contract	Multiparty smart contract	Distributed autonomous business unit	Distributed autonomous organization	Distributed autonomous government	Distributed autonomous society
A family member sends some bitcoin to another family member	Consumer buys a digital content stream	Landlord remotely locks nonpaying tenant out of apartment	Seller lends buyer funds to buy a house	Unit of a corporation issues its own bonds, and buyers monitor payments via a shared ledger	Self-driving trucks make P2P deliveries, pay local toll road fees, and buy local electricity	Settlers of a previously uninhabited area code their own self-enforcing government services	Groups of settlers from different areas establish self-enforcing trade agreements

Simple → Complex

Source:PriceWaterhouseCoopers via https://blockchainhub.net/smart-contracts/

Advancement of AI

- History of over-promising
- 1965 - 1990
  - Niche applications (vision, speech, games)
- 1996 – 1997
  - Challenge and beat World Chess Champion
- 2011 - IBM Watson
  - beats Jeopardy champions
  - Does cancer research
- 2016 – Everything changes

AI over the past 5 years

- Improved natural language processing

- Better game playing
    - AlphaGo beats World Go Champion
        - Trained with human-human game positions
    - AlphaZero beats AlphaGo
        - Trained only with rules of Go
    - AlphaZero beats StockFish at Chess
        - Trained only with rules of Chess (in < 5 hours!)
- Real-time video editing
    - Change license plate on car
    - Change background of scene
    - Change what characters in a scene are saying

The Technology

- The great AI debate:

    - Symbolic (Top down)

        – Model the system, use rules to implement intelligence

    - Connectionist (Bottom up)

        – Model the brain (ANN) train it

- All recent success due to Deep Learning

    - Due to improvement in computational power

    - Advantage: can behave very intelligently

    - Disadvantage: we don't understand how / why

Threats

- Job redundancy

- Higher risk of software bugs

- Opacity

- Disinformation propagation

- *Complacency*

  - Technological Regression

  - Bad legislation (based on assumptions of how tech works)

  - Personal security (e.g. privacy) risk

Opportunities

- New jobs
  - Improved earning potential
- Reduced costs
  - Lead to higher efficiencies
- Bespoke manufacturing (e.g. with 3D printing)
  - Highlights creative talent
- Information processing emphasis
  - Talent can be remote
  - Potential circumscribed only by education
  - Lower barrier to entry

Strategic Positioning

- Education is key!

  - Resilience to threats

    - If focus on principles

  - Access to opportunities

    - If it imparts skills and disposition

  - Should be competence focused

    - Competence = knowledge + skills + disposition (*ACM IT2017)*

- Legal framework for intangibles

  - IP protection

  - Status of Blockchain transactions

  - Competent courts

Thank You!