



NTNU

Norwegian University of
Science and Technology

Blockchain: Trust and Transparency in Digital Society Through Blockchain Technology

Summary Overview @ NTNU Digital Transformation Finalisation
02 December 2022

Project Overview

Main goal

Advance knowledge and understanding of the technology, and its societal impact and application potential.

Resources

An interdisciplinary team led by Prof. **Colin A. Boyd**, IIK/IE

- 12 supervisors from 7 dept. departments (IDI, IIK, IMF, INB, ISS, IØT, IVB) at 5 faculties (IE, MH, SU, ØK, IV)
- 6 PhDs + 2 associated PhDs

Main deliverables (D)

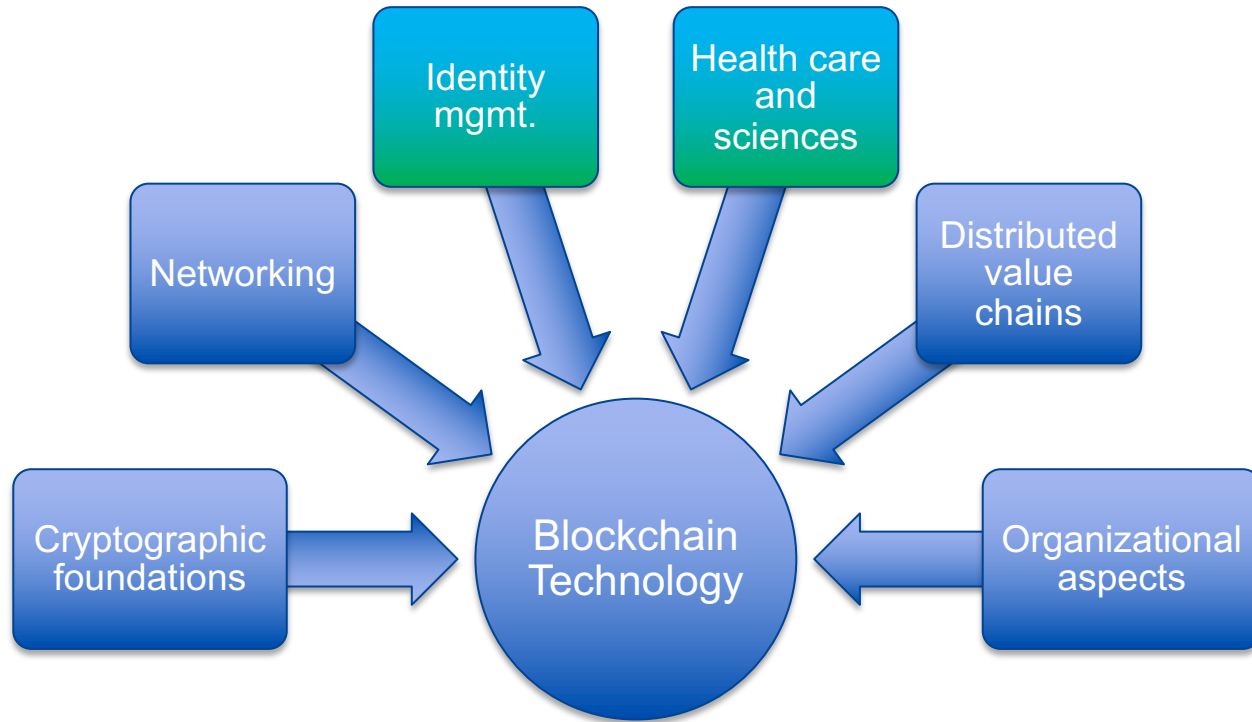
1. Establish NTNU as a centre of excellence in blockchain research (D1)
2. Train a cohort of blockchain experts with cross-disciplinary understanding (D2)
3. Develop a blockchain testbed at NTNU suitable for supporting a range of research problems and demonstrating innovative schemes (D3)

D1: 50 Best Universities for Blockchain 2022

- CoinDesk

2022 Rank (+/- 2021)	University Name	Total Score	Courses	Region	Regional Rank
36 (NEW)	Norwegian University of Science and Technology	47.35	14	Europe	7

D2: Six Interrelated PhD Sub-Projects



Health care

PhD student: Anton Hasselgren, INB/MH

Supervisors: Prof. **Arild Faxvaag**, INB/MH; Prof. Danilo Gligoroski, IIK/IE, Assoc. Prof. Katina Kralevska, IIK/IE

Research results:

- Cf. Talk by Anton Hasselgren: VerifyMed

Identity management

PhD student: Abylay Satybaldy, IDI/IE

Supervisors: Assoc. Prof. **Mariusz Nowostawski**, IDI/IE;
Assoc. Prof. Bian Yang, IIK/IE

Research results:

- Cf. Talk by Mariusz Nowostawski and Abylay Satybaldy:
Identity management

Distributed value chains

PhD student: Paul Wan Keng Fai, IVB/IV

Status: Thesis, September 2021

Supervisors: **Assoc. Prof. Lizhen Huang**, IVB/IV; Prof. Halvor Holtskog, IØT/ØK,
Assoc. Prof. Mariusz Nowostawski, IDI/IE

Research results: (5 conference / journal papers / book chapters, including 2 level 2)

- A systematic literature review on the current state of the art in information sharing using blockchain.
- Three case studies: health care, and the smart city and energy sectors, all different in nature, are examined. Blockchain-based frameworks are designed in accordance with their boundary conditions and requirements respectively.
- Another outcome of this research on horizontal information sharing is that the latter gives patients in the healthcare sector certain benefits, such as reducing preventable medication error through collaborative care decisions and clinician burn-out. Blockchain can also reduce the dependence on third parties and complement the centralized database.

Organizational context

PhD student: Margareth Horn, ISS/SU

Status: Thesis to be finished

Supervisors: **Prof. Arne Krokan**, ISS/SU; Assoc. Prof. Mariusz Nowostawski, IDI/IE, Assoc. Prof. Bian Yang, IIK/IE

Research:

- Study how the technology will affect organisations in both private and public sectors.
- Focus on the legal, ethical, and social impacts of using smart contracts to encode and manage rights

Networking impact

PhD student: Befekadu G. Gebraselase, IIK/IE

Status: Thesis, October 2022

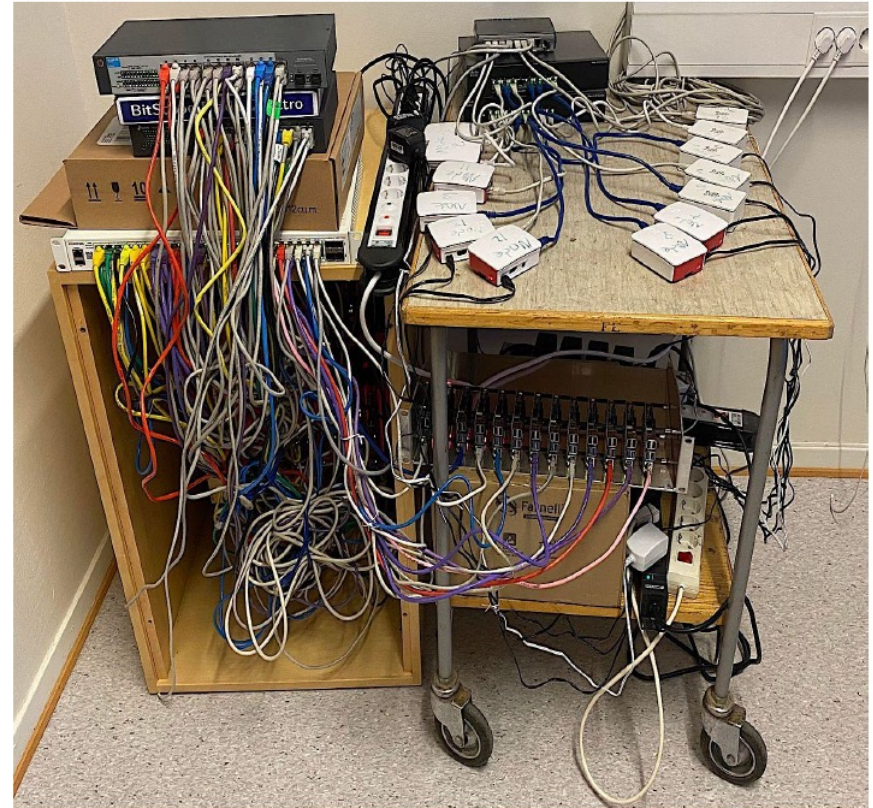
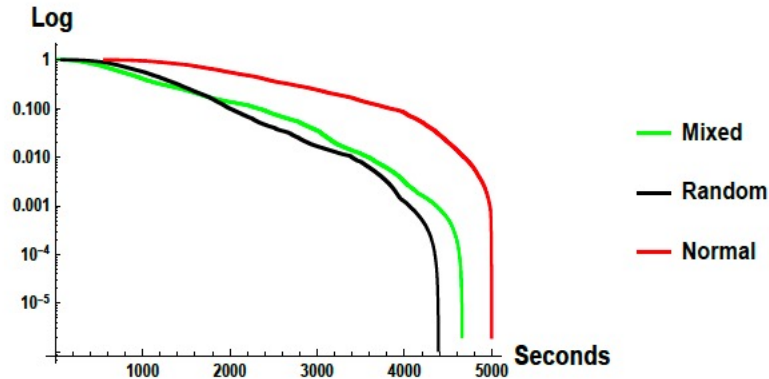
Supervisors: Prof. Bjarne Helvik and Prof. Yuming Jiang, IIK/IE

Research results:

- Suitability of blockchains to enable and support networking functions (2 papers)
- Transaction characteristics and handling in Bitcoin (2 papers)
- Effect of miner incentive on Bitcoin transactions (1 paper)
- A testbed study of the effect of peer selection on Bitcoin (IEEE Transactions paper)

D3: Bitcoin testbed

- 104 Raspberry Pis
- Bitcoin core 0.21.0
- 6 switches
- 2 blade rack



Cryptographic foundations

PhD student: Shuang Wu, IMF/IE

Status: Thesis, August 2022

Supervisors: Prof. Kristian Gjøsteen, IMF/IE; Prof. Colin Boyd, IIK/IE

Research results:

- Connecting chains (1 paper)
- Blockchain banks: cryptographic support for privacy (2 papers)
- Cryptographic support for health applications (2 papers)

What use are blockchains?

I claim:

- Permissionless blockchains are not useful.
 - Incentive requirements implies large total cost
 - Cheaper ways to achieve same effect
- Tools and techniques used in blockchains can be useful.
 - Signed hash chains for integrity and transparency
 - SNARKs for less data in hash chains