BLOCKCHAIN EDUCATION AND TRAINING IMPERATIVE

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1846

Ph.D. in Computer Engineering: Fault tolerance in distributed systems
Faculty at CSE and University at Buffalo (UB) for the past 3 decades

2008 - 2023: NSF grants: Data-intensive computing EHR(3), DBI, HDR

2010 -2018: SUNY-supported blockchain grants

2018 - present: 4-course certification on blockchain on Coursera MOOC
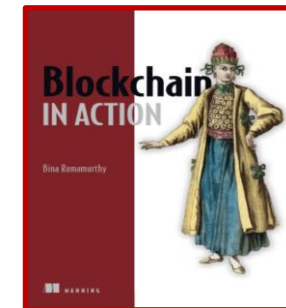   -- More than 300,000 learners and 650,000 visitors from all over the world

2019 SUNY chancellor's award for excellence in teaching

2020 - Published a technical book: Blockchain in Action (Manning.com)
2018 – Three Blockchain Courses – Currently teaching one
2020 - present: Blockchain curriculum development, Book#2, Decentralized Finance (Coursera)
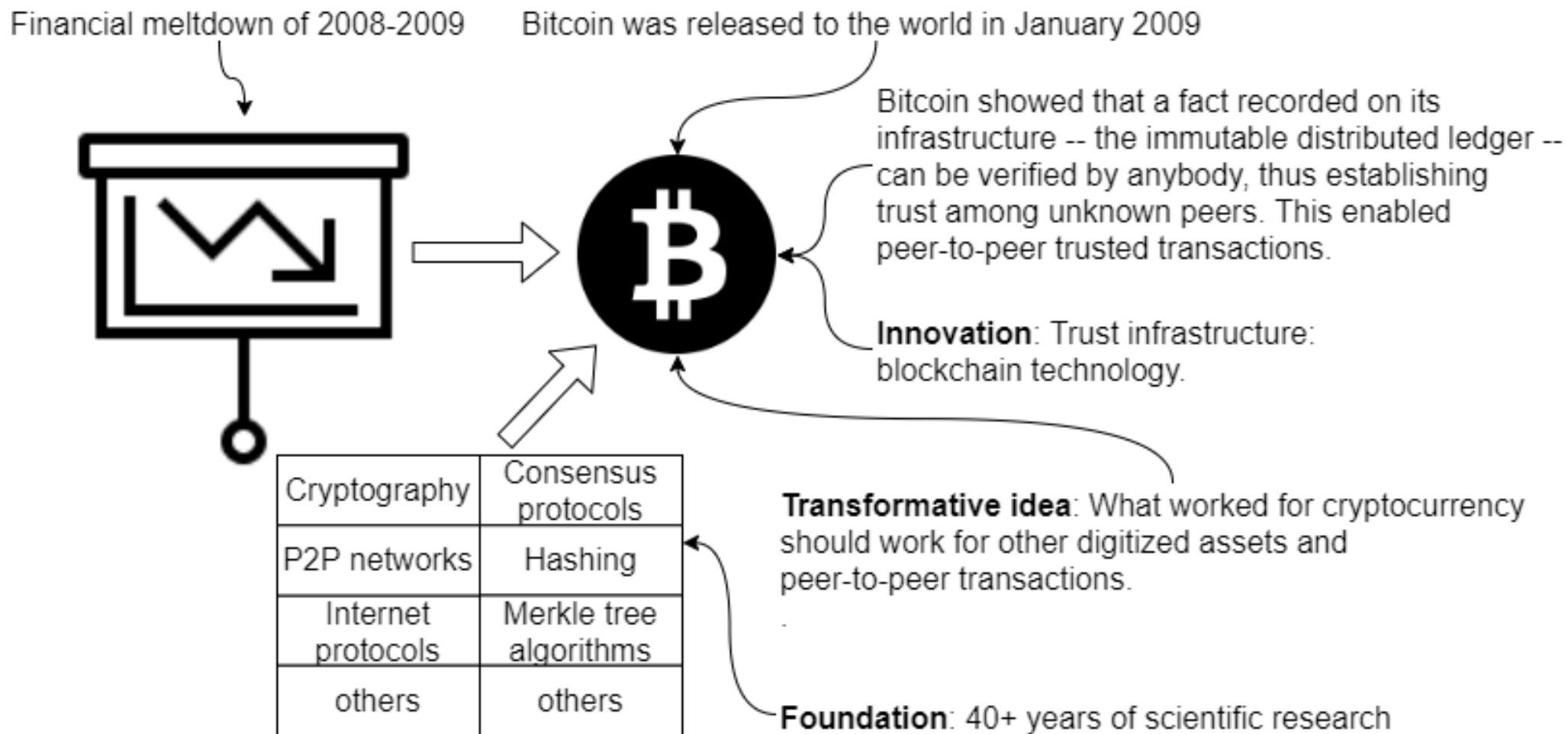
BLOCKCHAIN

The innovation

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Financial meltdown of 2008-2009

Bitcoin was released to the world in January 2009

Bitcoin showed that a fact recorded on its infrastructure -- the immutable distributed ledger -- can be verified by anybody, thus establishing trust among unknown peers. This enabled peer-to-peer trusted transactions.

Innovation: Trust infrastructure: blockchain technology.

Cryptography	Consensus protocols
P2P networks	Hashing
Internet protocols	Merkle tree algorithms
others	others

Transformative idea: What worked for cryptocurrency should work for other digitized assets and peer-to-peer transactions.

Foundation: 40+ years of scientific research

The birth of blockchain technology [1]

4

Blockchain enables trust in a trustless world.

Blockchain: A Trust Layer over the Internet

- Trust is a critical component for trade and any business transaction.

- We develop and model our trust based on ad hoc means, recommendation systems, knowledge, business experts on the news, etc.

- Blockchain is about "trust automation."

- Please take a look at the evolution of our Internet, as shown here.
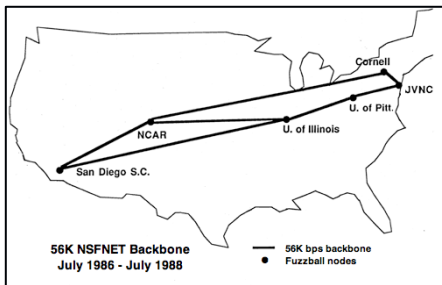
1988 NSFNET

Positioning the trust layer:
Let us understand this concept with an example.

Year 1991, RFC 7230

Year 2000, RFC 2818 Standard

Year 2009,
Blockchain-based trust
No standards yet

Web application
HTTP

Secure web application
HTTPS Security

Secure & Trusted web application	
HTTPS Security	Blockchain Trust

The Internet

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Smart contracts: Concise code for governance, rules, policies, and verification, validation.

E-Commerce Communication mobile apps ...

Cryptocurrency: Bitcoin: 2008/2009

Autonomous, Decentralized systems & applications: 2013

1

2

Validation, Verification Immutable recording

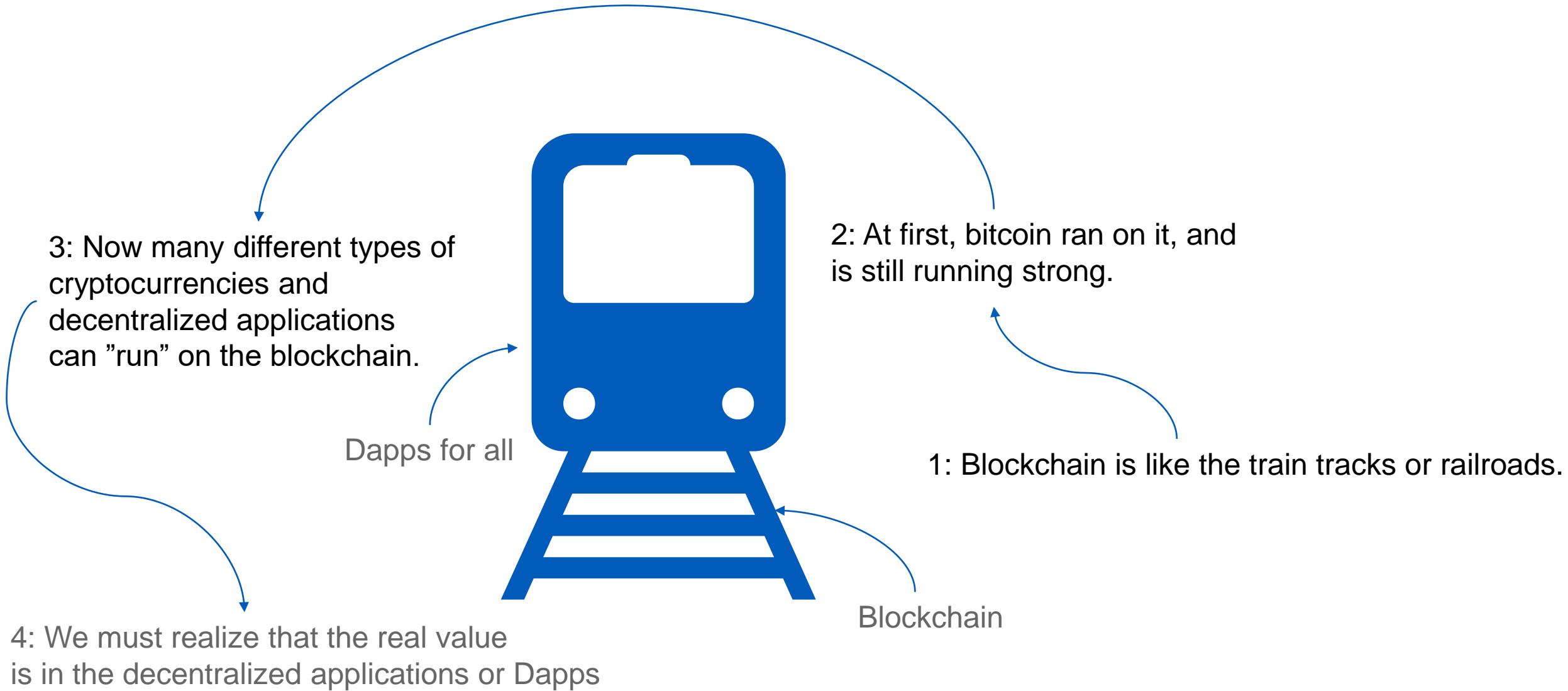Computing infrastructure: **Smart contracts**

The Blockchain

3

4

The Internet

Common mistake: Porting your centralized application literally with condition, computations, loops of heavy code.

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3: Now many different types of cryptocurrencies and decentralized applications can "run" on the blockchain.

2: At first, bitcoin ran on it, and is still running strong.

Dapps for all

1: Blockchain is like the train tracks or railroads.

Blockchain

4: We must realize that the real value is in the decentralized applications or Dapps

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- Here are some ways you commonly identity yourself to the system you are in the real world: Driver's license, social security number, person number in an education institution, employee number.

- Think about these; these are all your affiliations to centralized institutions.

- In a decentralized system, where participants are unknown and can join and leave as they wish, how can we identify them?

- This identity can be self-generated by any of you within about 5 minutes using cryptographically strong algorithms and tools.

- And you need a wallet (a browser plugin or a mobile wallet) that stores your account #s and balances.

It is possible **every** person in the world can self-generate their identity and with a (mobile) wallet can be participant on a blockchain and benefit from it.
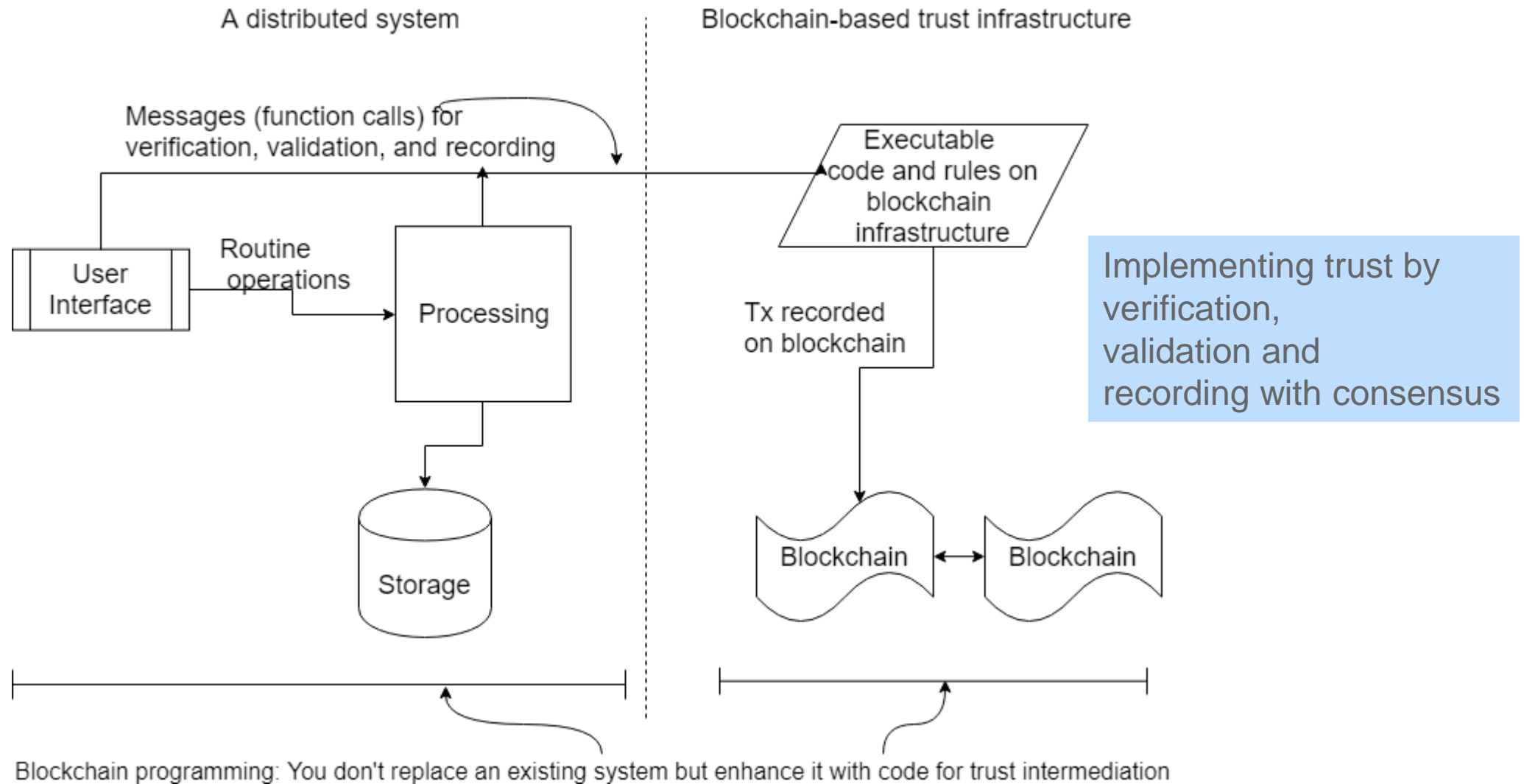
A distributed system

Blockchain-based trust infrastructure

Messages (function calls) for verification, validation, and recording

Executable code and rules on blockchain infrastructure

User Interface

Routine operations

Processing

Tx recorded on blockchain

Storage

Blockchain ↔ Blockchain

Implementing trust by verification, validation and recording with consensus

Blockchain programming: You don't replace an existing system but enhance it with code for trust intermediation

- Automatic and consistent data collection, and operations

- Timely information sharing (9/11, FBI office in Minnesota, [Texas shooting](#))

- Verifiable compliance (HIPPA and FERPA laws for example)

- Blockchain-based governance (Governments: Please take note, host a full node)

- DAO (Decentralized Autonomous Organization)

- Attribution of actions (Legal and Law enforcement)

- Decentralized (Localized) Pandemic management

- Self-sovereign Identity

- Autonomous systems and infrastructure

- Global decentralized efforts (hunger, climate, energy , soil, human trafficking …)

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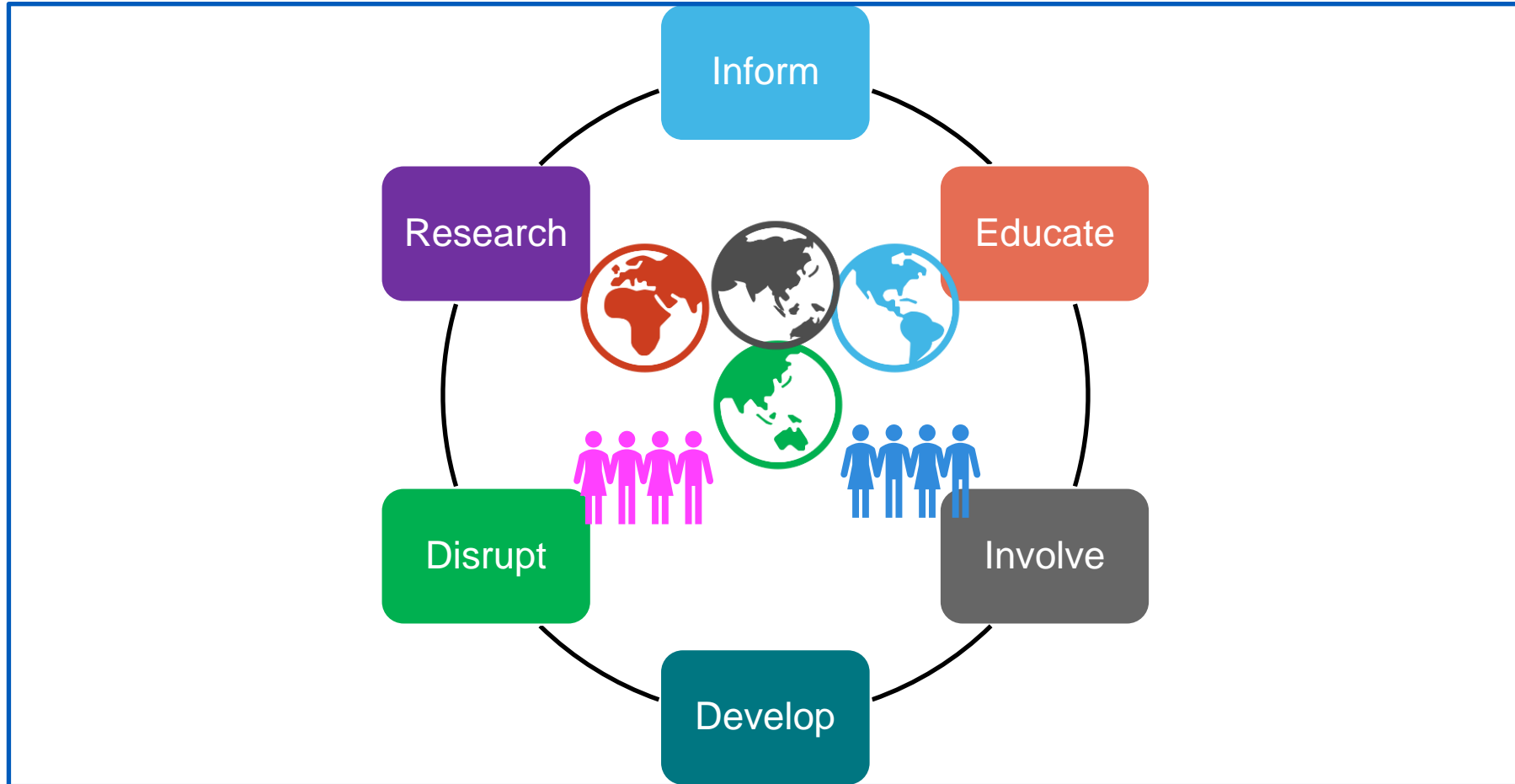
- **Inform** everyone about this technology, its use, benefits and perils: public education.

- **Educate** our workforce to conceptualize and design systems with a blockchain trust layer.

- **Involve** everyone: There is a role for everyone: federal, state, local government, businesses, organizations, NSF, educational institutions, United Nations, and others have to strategize to get **involve**d. Allocate budget for exploring integration into their operations.

- **Develop** and deploy proof of concepts to demonstrate and showcase the capabilities.

- **Disrupt** existing systems to address gaps. Think and imagine out of the box for using the blockchain capabilities.

- **Research at all levels of the blockchain stack**

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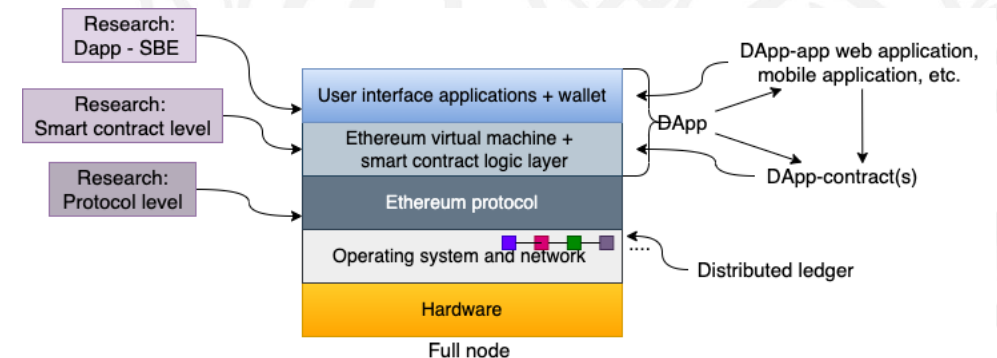
- Encompasses most disciplines.
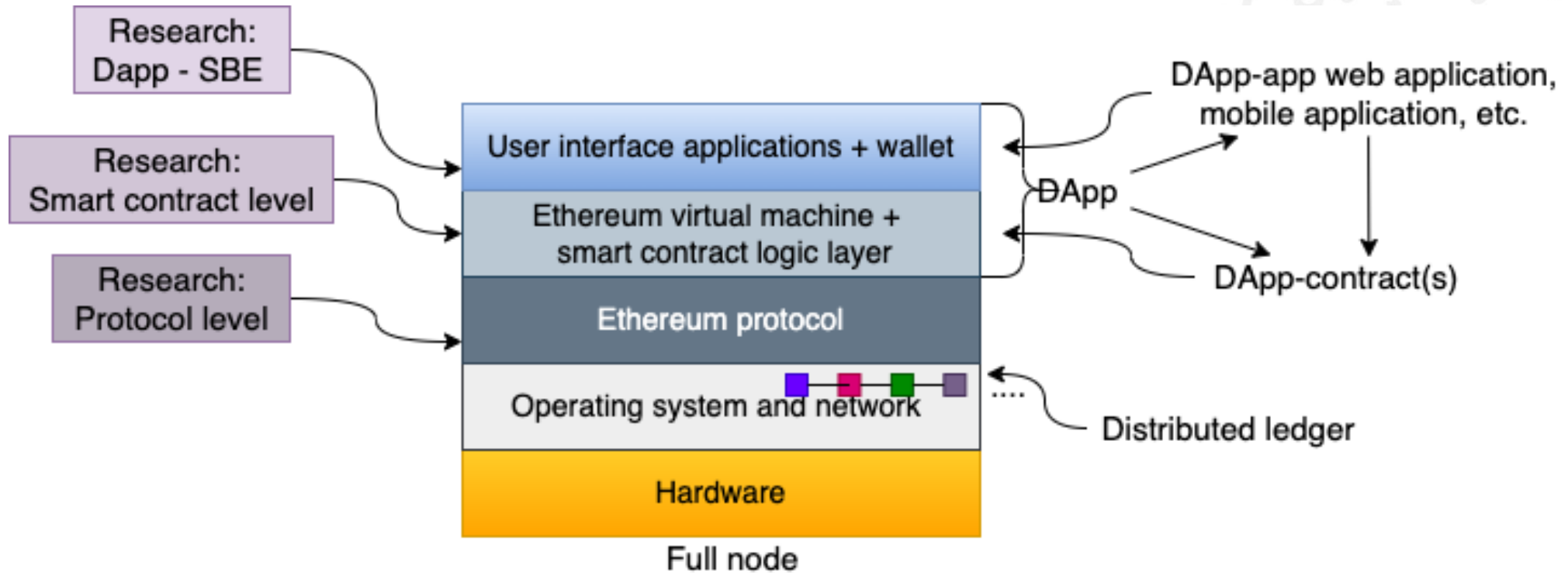
How can you get involved? Here are some ideas.

- Teach a single course: Blockchain Foundations or Blockchain Application Development.

- Create a blockchain certificate program.

- Design and develop a blockchain minor.

- Design and develop training program for the community of learners outside the enrolled students.

- Develop a research program for blockchain-based research. Enormous opportunity.

- Participate in the blockchain and cryptocurrency community as a contributor (code, funds, transact, etc.)

- Develop a community organization, lab, club around blockchain.

- Blockchain technology is not about cryptocurrency anymore.

- Blockchain can enable an inclusive economy.

- Blockchain can create exciting new opportunities and innovative application models:

    - Global collaboration systems, self-governing systems, open government.

    - Private, public and permissioned models to meet diverse business needs.

    - It is here to stay, in one form or another.

    - We have prepare everyone for this impending opportunity which anyone can participate and benefit from.

    - We do not want to leave anyone behind.