
AI & Blockchain Synergy

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BICA Labs

Laboratories for Biologically Inspired
Cognitive Architectures



iQortex
Business Artificial Intelligence

Blockchain: Distributed Ledger Technology (DLT)

TRUSTED PERSISTENT DATA RECORDS
INSIDE UNTRUSTED ENVIRONMENTS
WITHOUT CENTRAL GOVERNANCE
SECURED BY ECONOMIC INCENTIVES

TECHNOLOGY

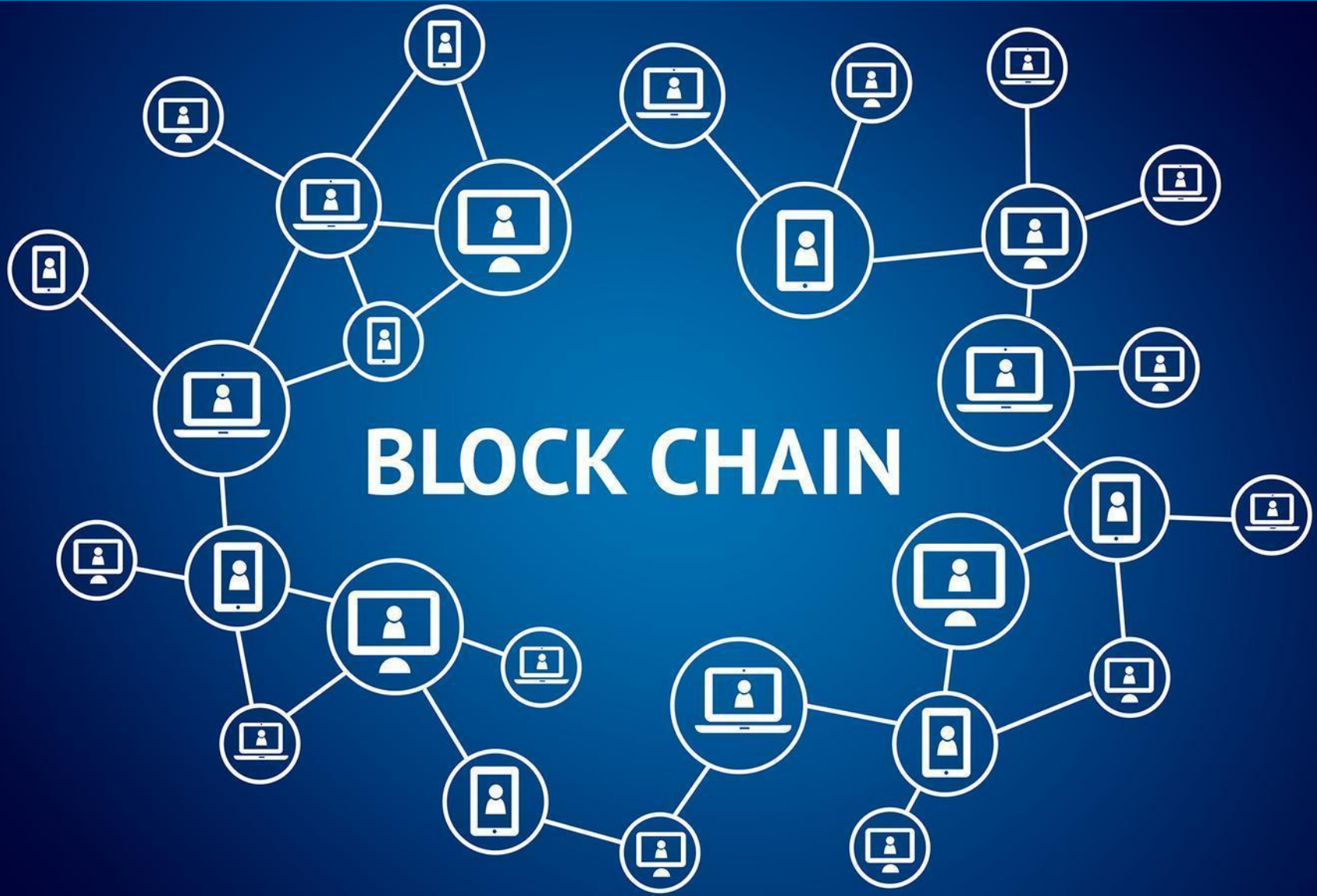
ECONOMICS

BLOCKCHAIN

- Distributed database (ledger)
- Distributed computations (state changes),
Turing-complete OR incomplete
- Peer-to-peer mesh network
- Cryptographically secured

- Multiagent economy
 - Game theory
 - Free open market
 - Non-state decentralized economies linked to particular types of resources or businesses
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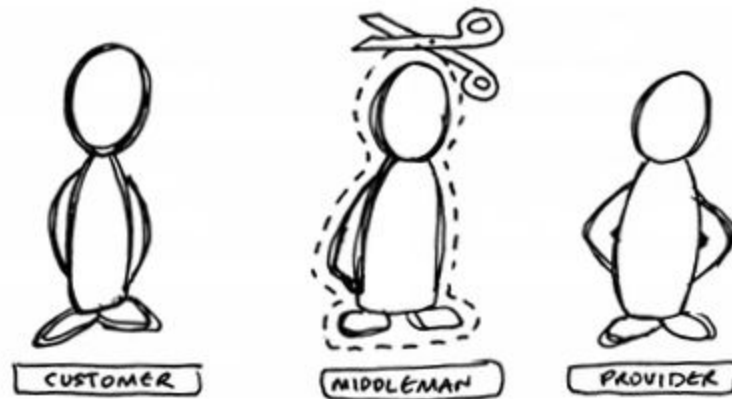
GAME THEORY



DIGITAL
disruption

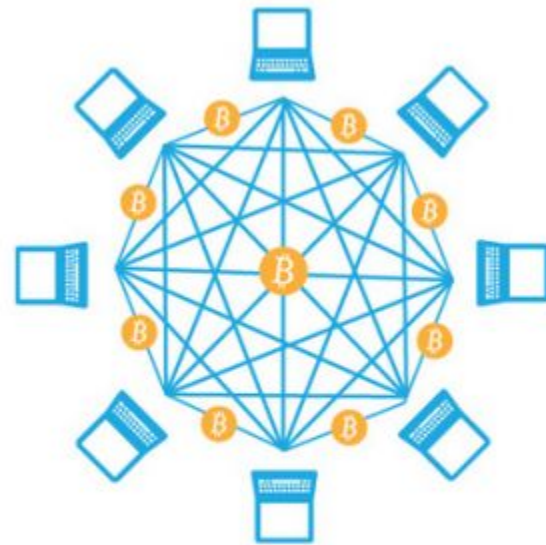
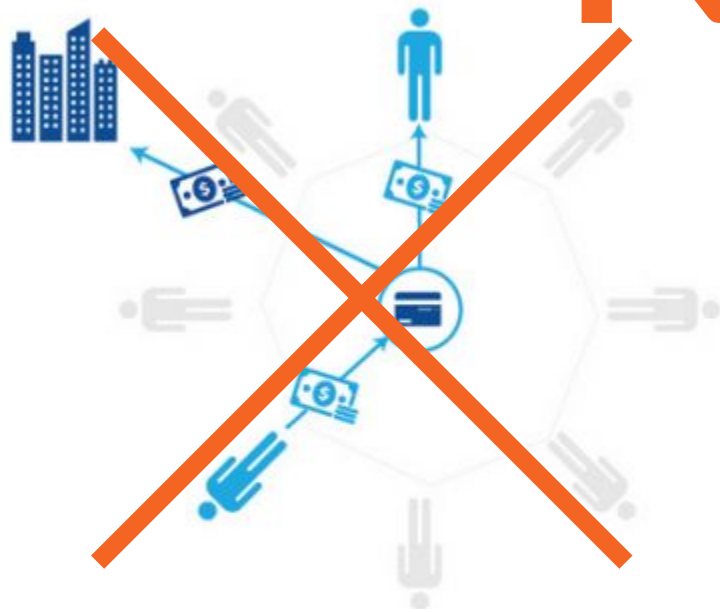


NO



MIDDLEMAN

NO



CENTRALIZATION

NO

Google

facebook

 Microsoft

IBM®

amazon

DATA OLIGOPOLY

NEW



PRIVACY

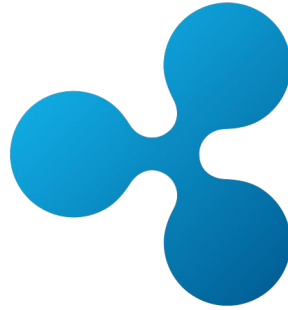
Blockchain tech intro

Important Blockchains



Bitcoin

Most popular
cryptocurrency &
source code base



Ripple

Value transfer network



Ethereum

Smart contracts



NEM

Proof of Importance



Dash

Governance model

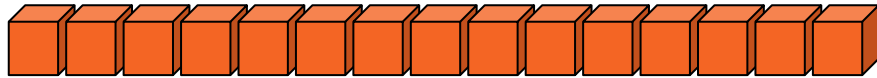


ZCash

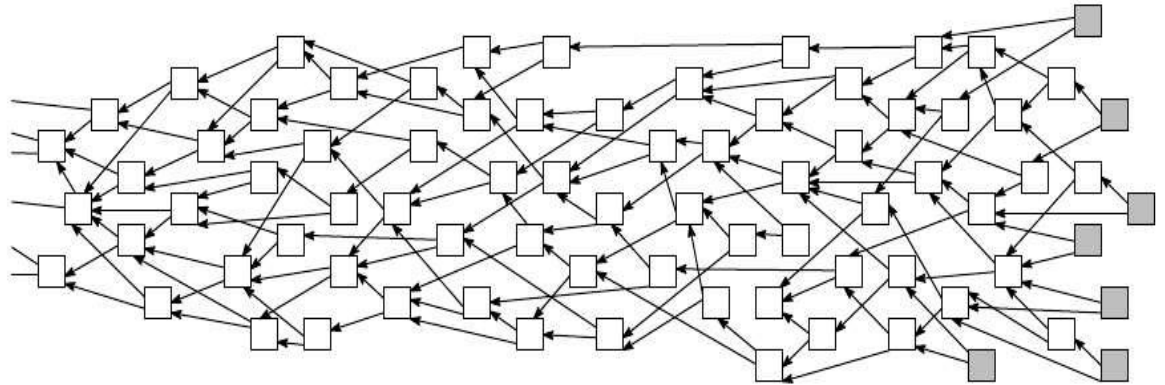
Zero-knowledge

DISTRIBUTED LEDGERS

BLOCKCHAIN



DAG



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Consensus

Secures trustless env
with economic incentives

- Proof-of-work (PoW)
- Proof-of-stake (PoS)
- Proof-of-...

Stateful

Ledger (i.e. database) with
defined final states

- Money or tokens
- Computations
- Any data records

Mixes mutability with
immutable track

Merkle tree

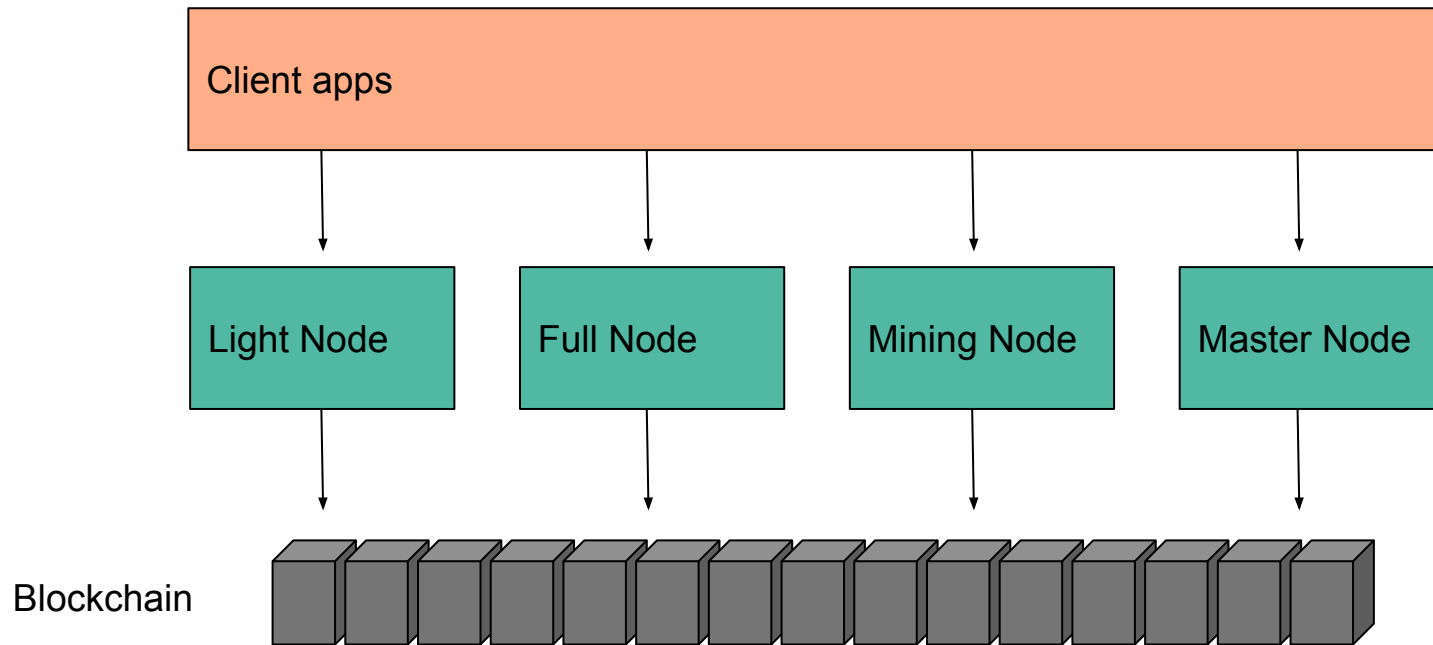
Multiagent

Independent free actors

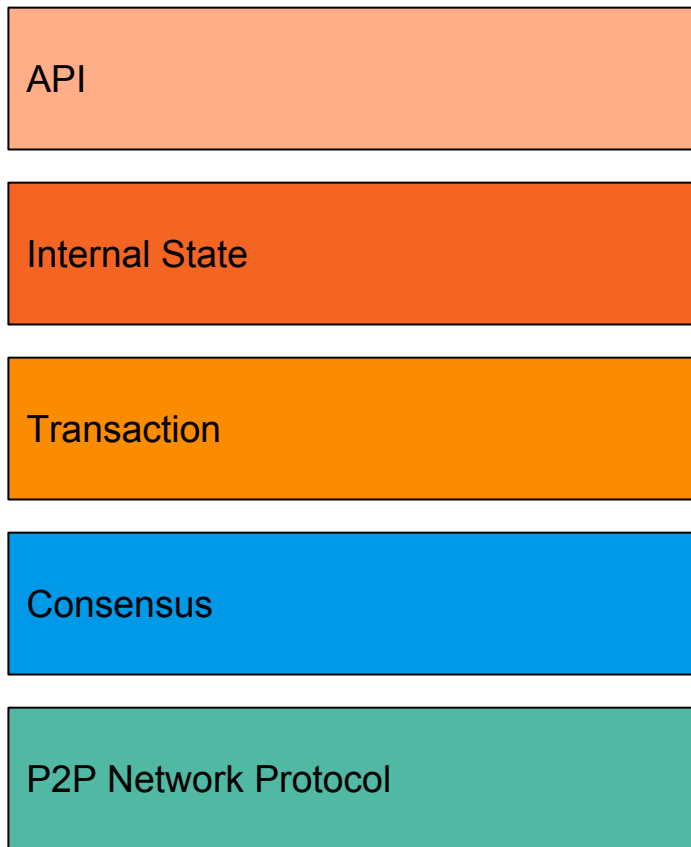
Private key signatures

Mesh P2P network

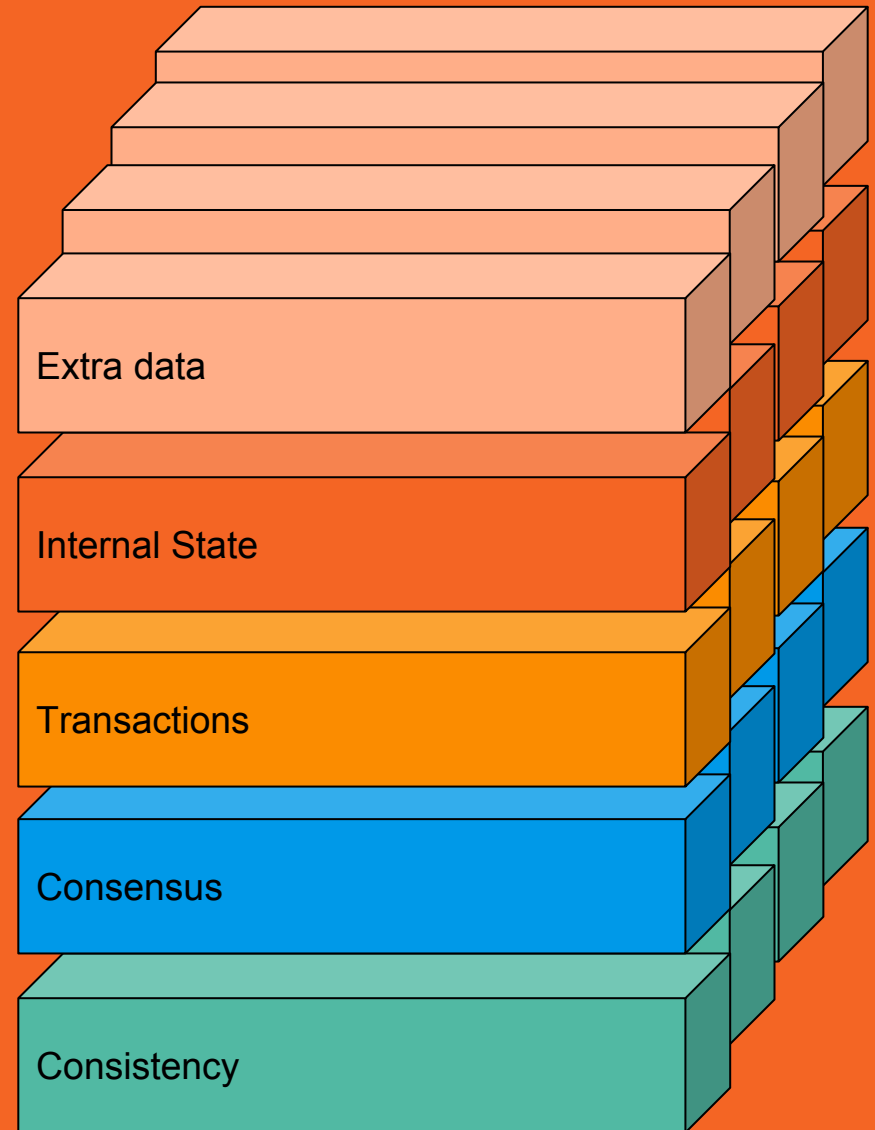
Architecture of DLTs solutions



NODE



BLOCK



Most important ready-to-go DLTs cores

	Bitcoin Core	Graphene	Scorex	Tendermint	Ripple / Stellar
Language	C/C++	C++	Scala	Go	C++
Consensus	PoW	dPoS	PoW, 2x PoS	PoS	
Blockchains	Bitcoin, Dash, Litecoin, ...	BitShares, Steem, Golos	– (Waves experiments)	Cosmos (under dev)	Ripple, Stellar, Infra (e-Auction)
“+”	Most proved	Blazingly fast	Modular	PoS	Fast & proved
“_”	Hard to understand	Complex model	Limited functionality, no real-world impl	Immature	Complex model

Languages for working with DLTs cores

- C/C++ — Bitcoin, Graphene, Ripple: performance
 - Go — Ethereum, Tehndermint
 - Python — Ethereum + experiments with blockchain
 - Rust — Ethereum, Bitcoin: performance + efficient code
 - Scala — Scorex (fast blockchain prototyping)
 - Java — NEM

 - JavaScript (Angular, React): UI & APIs
-

Meta-languages for smart contracts

- Solidity: JavaScript-like
 - Serpent: Python-like
 - Viper: Python-like (Serpent 2.0)
-

Blockchain & AI Technical Synergy

AI

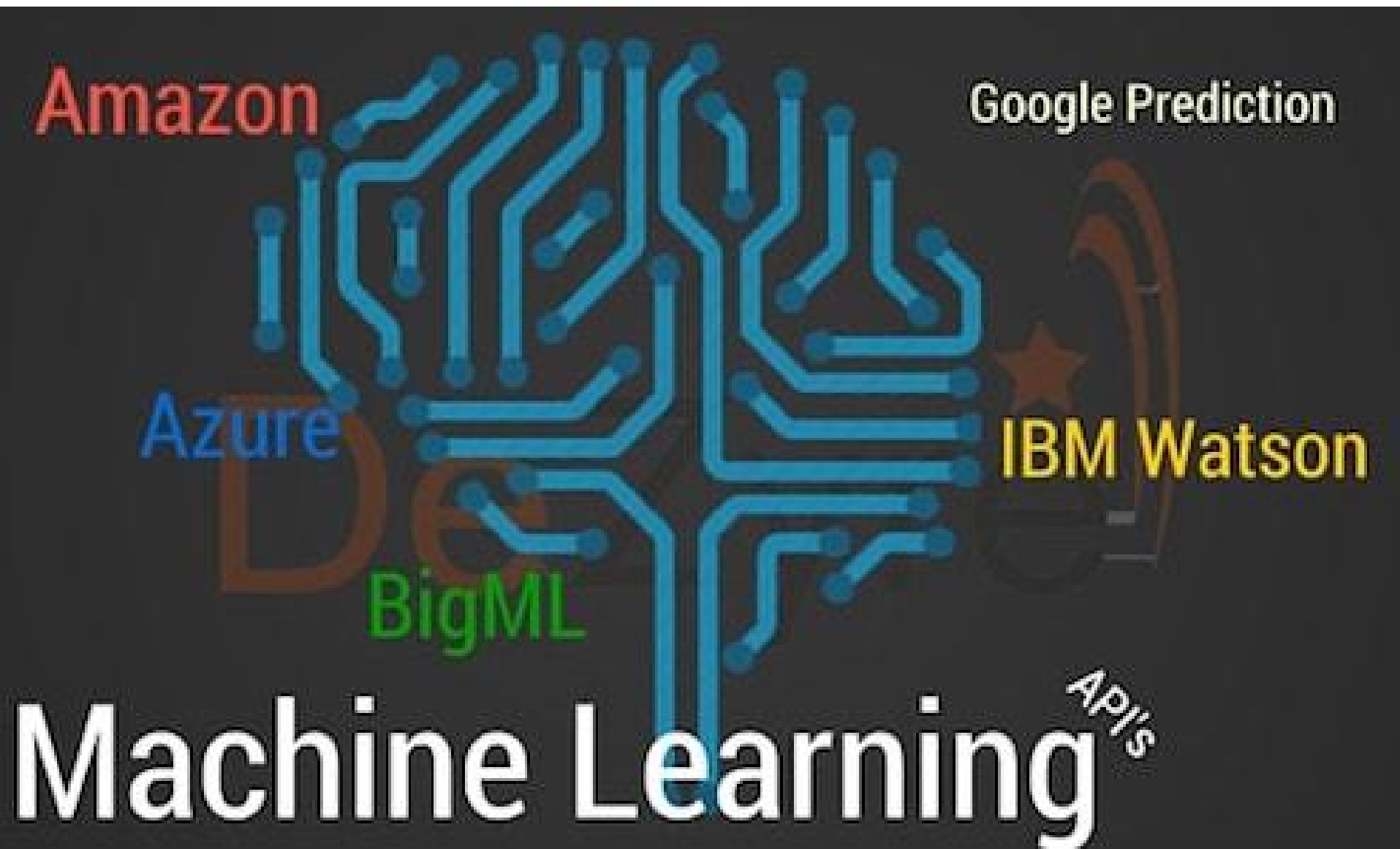
FROM THE POINT OF
VIEW OF
BLOCKCHAIN

- Economical agents
- Data consumers
- Data producers
- Miners?

Blockchain & AI

1. Open Data for Machine Learning
2. AI Data Exchange in Trustless Envs
3. AI Evolution towards Human+ AI

DATA RULES MACHINE LEARNING



DLTs OPEN DATA FOR AI

TODAY

- Financial Transactions:
no more banks & VISA/MC monopoly
 - Bitcoin, Ripple, Dash
- Smart Contracts:
 - Ethereum
- GovTech: open civic data
 - e-Auction

TOMORROW

- Energy consumption
 - Goods transportation
 - Legal records & registries (incl. property, land etc)
 - Smart city data
 - Autonomous vehicles data
 - ... digitized picture of the world
-

NO

Google

facebook

 Microsoft

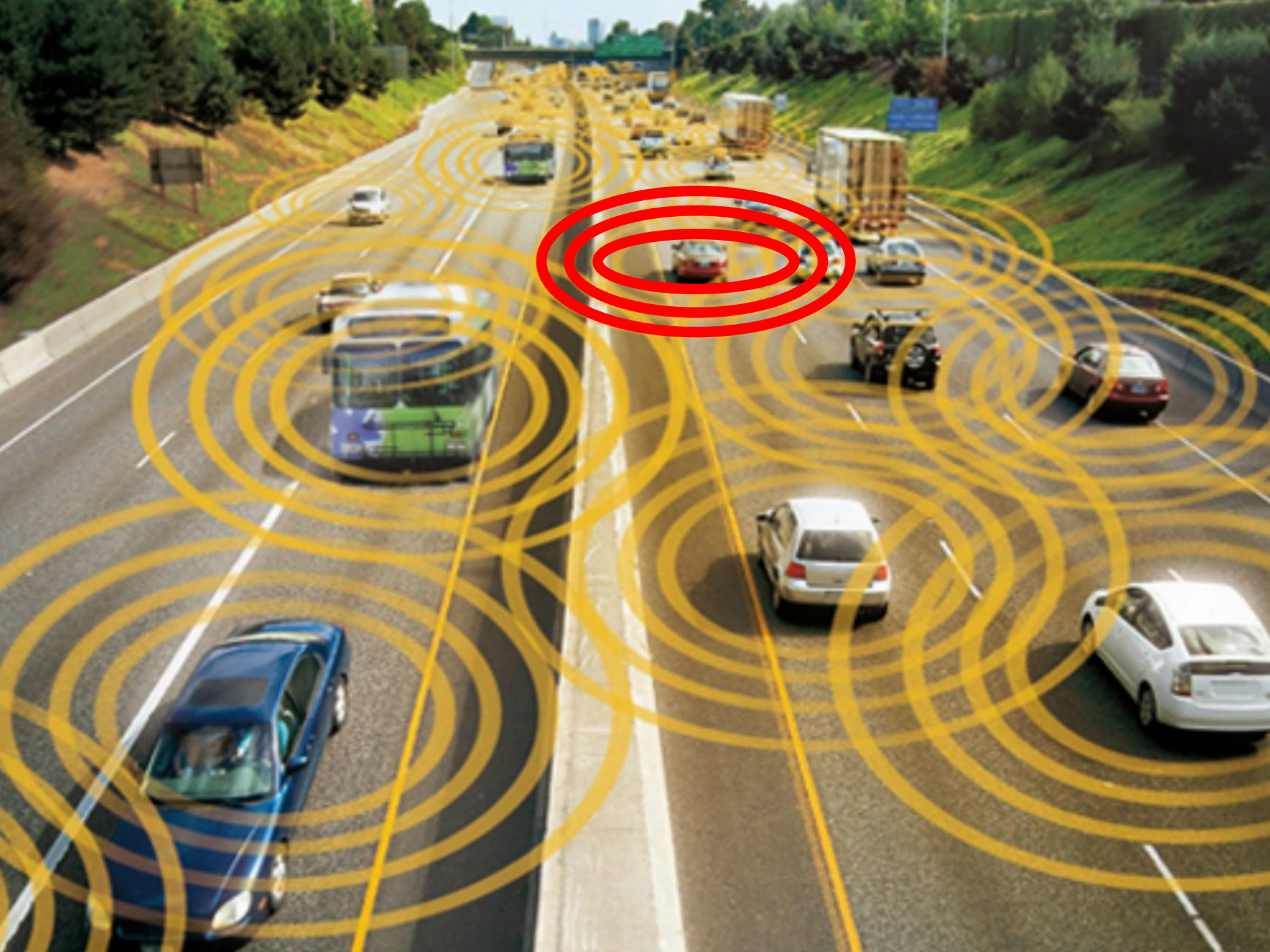
IBM®

amazon

DATA OLIGOPOLY

AI Data Exchange in Trustless Environments





BLOCKCHAIN
ALLOWS
**MALICIOUS AGENT
DETECTION IN
AUTONOMOUS
AI-DOMINATED SYSTEMS**



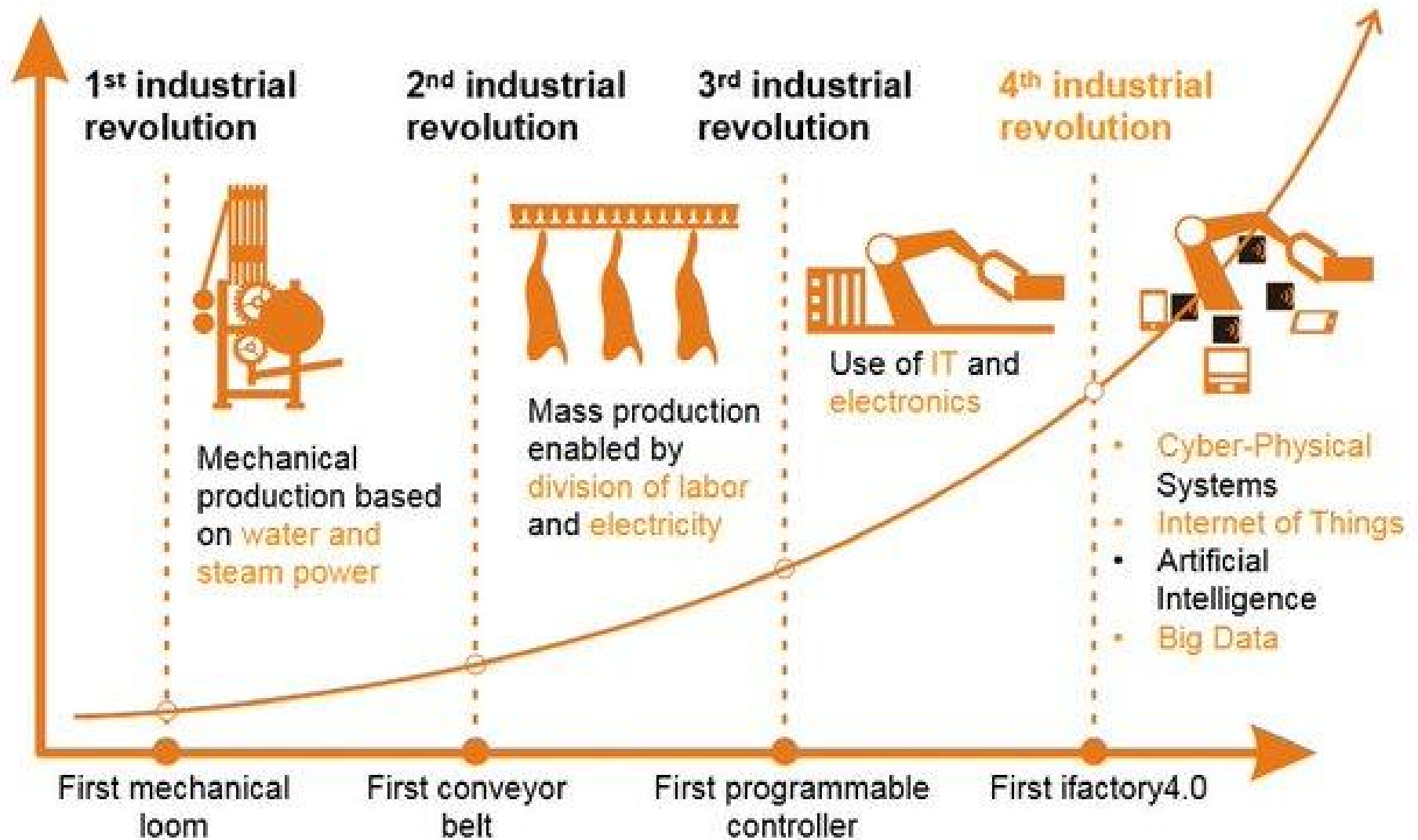
PERSPECTIVE:

THE BIG PICTURE ON **AI & BLOCKCHAIN**



INDUSTRY 4.0





Industry 4.0 key factors

- Internet of Things
- Big data
- Cyber-physical
- Specialized AI

IoT

Big Data

Cyber-physical

Learns on
data

AI

VR + AR

NCI / BCI

Powers IoT

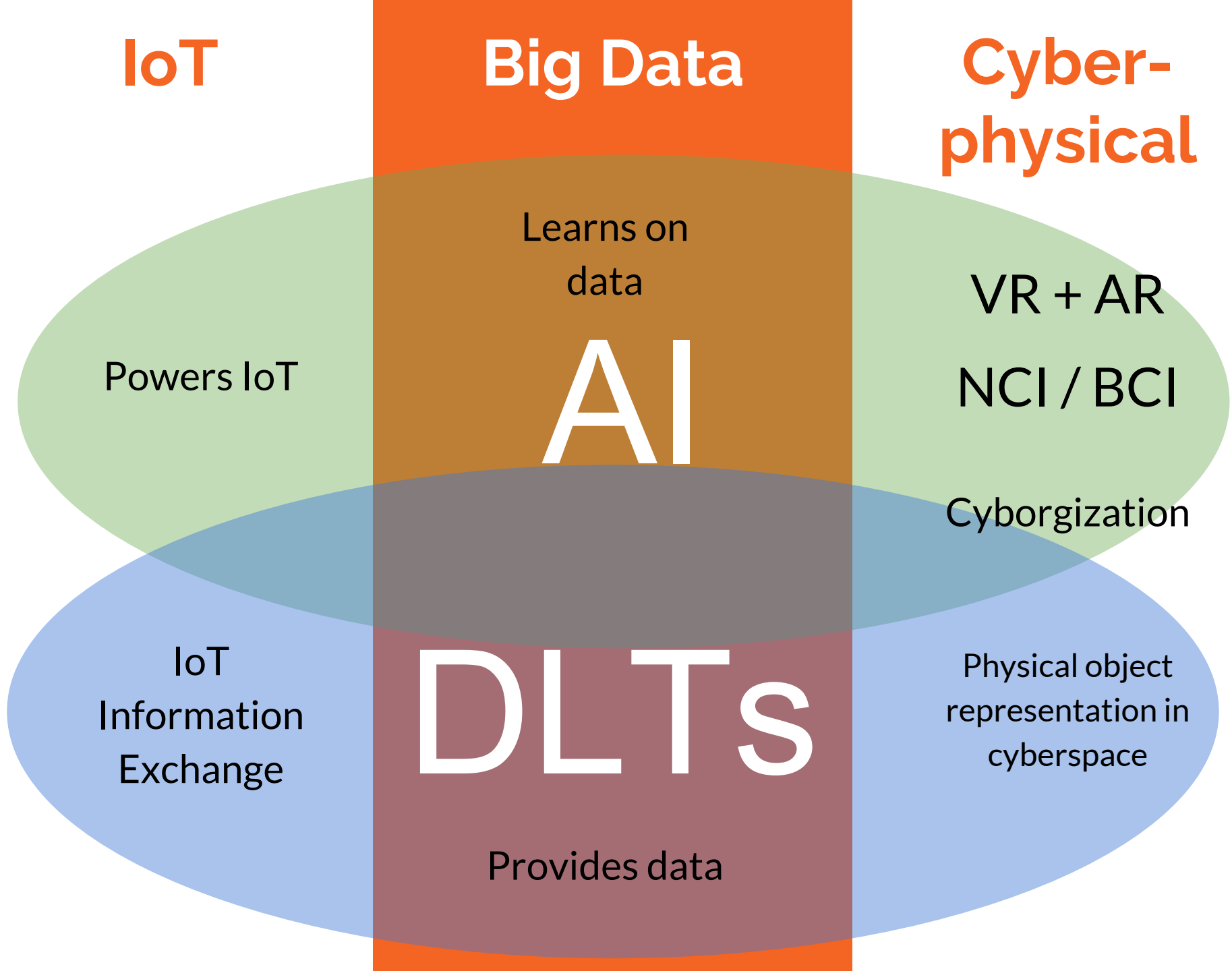
Cyborgization

IoT
Information
Exchange

DLTs

Physical object
representation in
cyberspace

Provides data



Agrarian revolution

from
goods gathering
to
goods production

$$\text{GDP} \sim N$$

Human labor
(N - no of humans)

Manufact. revolution

from
manual labor
to
tools production

$$\text{GDP} \sim k^* N$$

More efficient
manual labor

Industrial revolution

from
manual tools
production
to
tools producing
tools

$$\text{GDP} \sim N^\alpha$$

Automated
production

AI / H+ revolution

from
static tools
to
learning tools

$$\text{GDP} \sim e^N$$

Automated
intelligence,
producing
automation for
production

SINGULARITY

Civilization 4.0 key factors

- Quantum Computing
 - Generic Artificial Intelligence
 - Transhumanism
 - Life extension
 - Cyborgization
 - Cosmic Expansion
-

AI + P2P

Decentralization => Evolution

From specialized AI towards Generic AIs



<https://medium.com/bica-labs/how-blockchain-relates-to-artificial-intelligence-f0111f39afc9>

MODERN AI IS OUTDATED

Modern approach to #AI has grown from research of 1950s-60s and is outdated

- **(quasi)Supervised Learning**
No ad hoc concept creation and feature extraction without previous knowledge
- **Not a Brain**
Sampled after brain regions, but a brain region can't mimic the whole
- **Lack of Multiplicity**
Leads to noncompetitive development
- **Enclosed**
There is no reflection and cross-agent knowledge exchange

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EVOLUTION

HAPPENS WHEN
SELECTION ACTS ON A
DIVERGING POPULATION

WHILE

MODERN NEURONETS
ARE SINGULAR



Multiagent

Game theory: why it matters

INFORMATION TRANSFER:

- species exchanges genes via viruses
- cells emit chemical and electric signals
- animals communicate via mimics and emotions
- humans—via language

WHAT ABOUT #AI?

INFORMATION TRANSFER

REQUIRES

CONSENSUS AND

PERSISTENCE

—

CONSENSUS:

each agent gets the same
sense of a signal as others

- DNA translation will be the same for bacteria as for a human being
- written text is understood in the same way by all native speakers

PERSISTENCE:

**the sense of the signal does
not diminish with time**

- DNA in chromosomes do not change during the live of the most cells
- Egyptian hieroglyphs could still be understood by researchers

BLOCKCHAIN

IS PERFECT BOTH FOR

CONSENSUS AND

PERSISTENCE

RENDERING MULTI-AGENT **#AI** AS AN
EVOLVING SELF-ORGANIZED SYSTEM

Distributed storage

Hash Tables
Torrents, IPFS

Distributed ledger

Blockchain & DAGs

What blockchain lacks to enable more efficient AI

- Geo-binding
(spatial bindings)
 - Oracles
(physical world bindings)
 - Distributed data
storage
(IPFS etc)
 - Speed
higher transaction rates
 - Application-level
languages
with new paradigms
-



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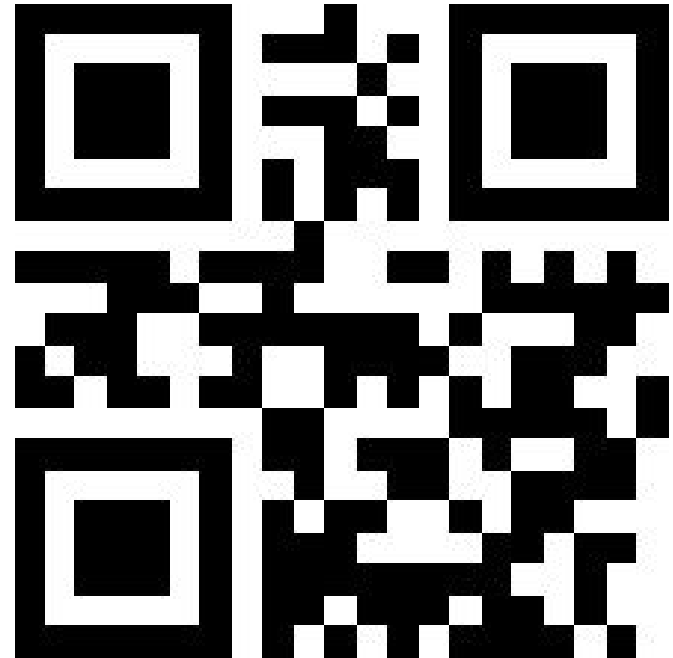
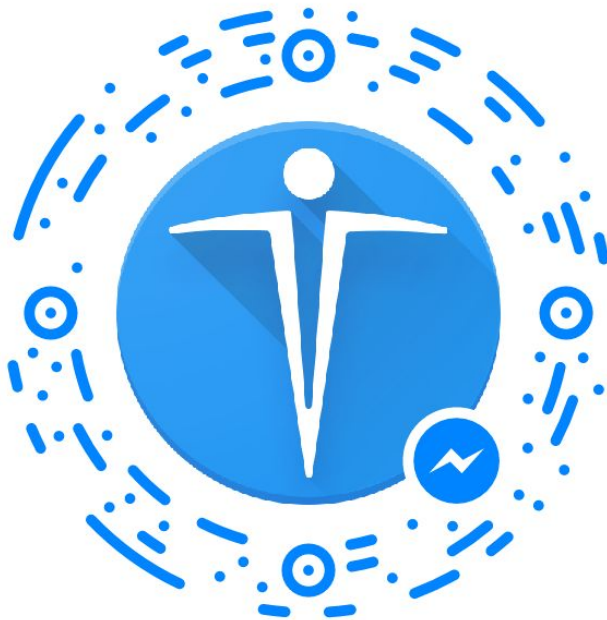
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Private foundation & task force supporting
disruptive technologies and radical innovations
having potential to change the world

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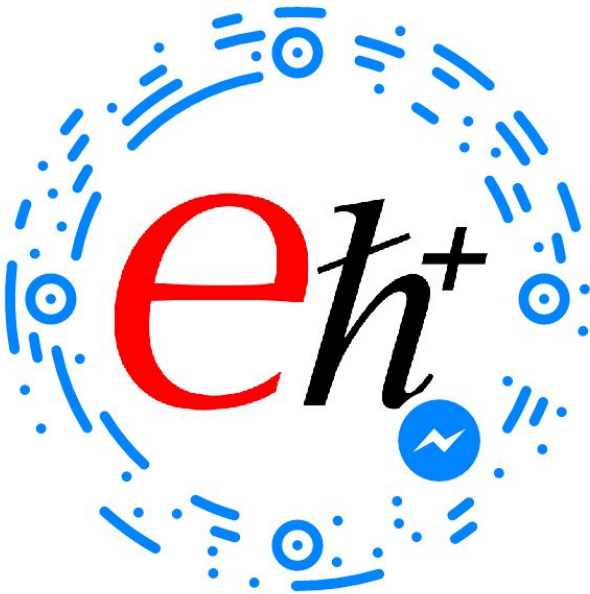
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