



Blockchain For The Internet of Things



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Overview

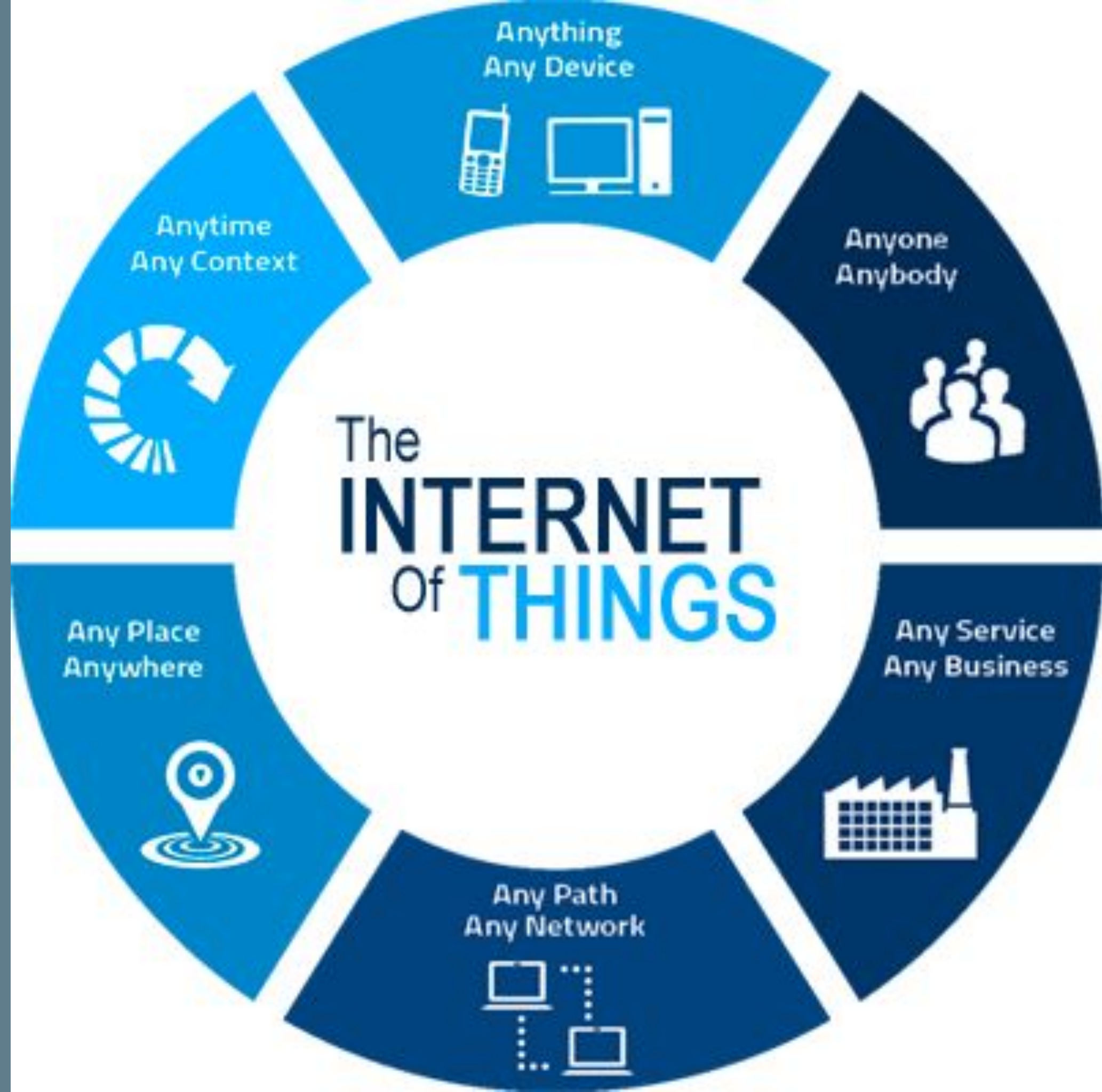
- IoT requirements
- Blockchain characteristics
- Blockchain for IoT
- Platforms
- Projects

Internet of Things (IoT):

A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies.

Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst ensuring that security and privacy requirements are fulfilled

— *Recommendation ITU-T Y.2060*



IoT Challenges

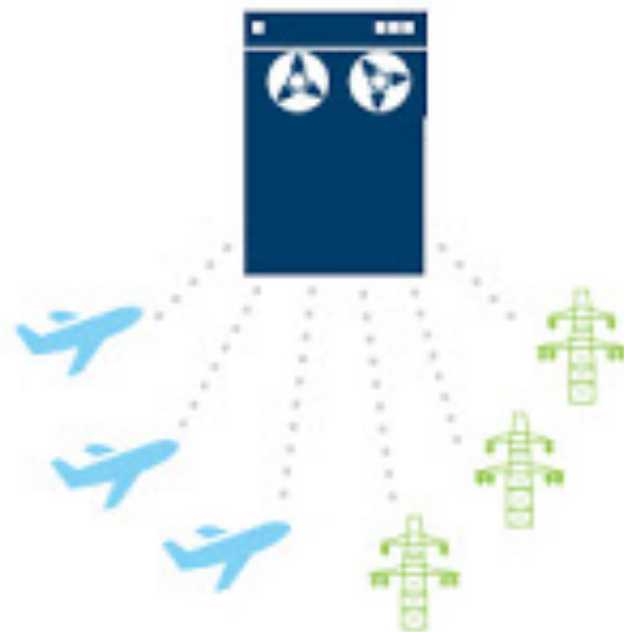
- Heterogeneity (devices, capabilities, networks)
- Lack of common protocols and standards
- Interconnectivity
- (unique) identity
- Authentication
- Authorization
- Security (storage and processing may limit what can be resident)
- Privacy
- Global (cross border movement and compliance)
- Requirements need to be met:
 - inexpensively
 - automatically
 - at scale

The Client-Server Model Won't Scale

- Identification
- Configuration
- Security
- Infrastructure
- Connectivity
- Maintenance

We need to decentralize

Before 2005



Closed and centralized
IoT networks

Today



Open access IoT networks,
centralized cloud

2025 and beyond



Open access IoT networks,
distributed cloud

Decentralized Model

- Sharing of:
 - Devices
 - Platforms
 - Infrastructure
 - Resources
 - Data

... across applications and networks

IoT

IoT Network Functions

- Peer-to-peer communications
- Autonomous device coordination
- Distributed file sharing



Data and Transactions

On the Internet of Things the primary product will be data, and transactions will be the primary unit of interaction

Data will need to be validated, transactions will need to be reconciled, and many activities will need to be regulated

IoT Stakeholders

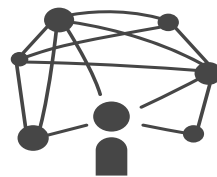
- Many devices, many stakeholders, many requirements
- Complex relationships, business requirements, and contractual obligations
- Different interests and goals
- May need to have input on configuring and maintaining devices
- Regulatory oversight

We need a way to encode behavior,
transactions, and records at scale on
a secure, trusted platform available
to all stakeholders

The Blockchain, Again



A **transaction** is initiated.



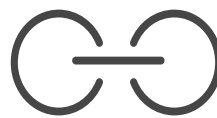
The transaction is **broadcast** to the peer-to-peer blockchain network



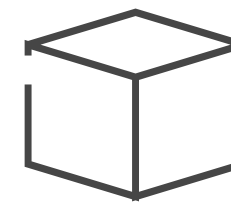
The network cryptographically **validates** the transaction



The transaction is complete. The record is **permanent and immutable**



The block is added to the **blockchain**



The transaction is combined in a **block** with other transactions

Characteristics of the Blockchain

- Peer-to-peer
- Decentralized
- Secure
- Private
- Transparent
- Reliable
- Global

Blockchain Records Are

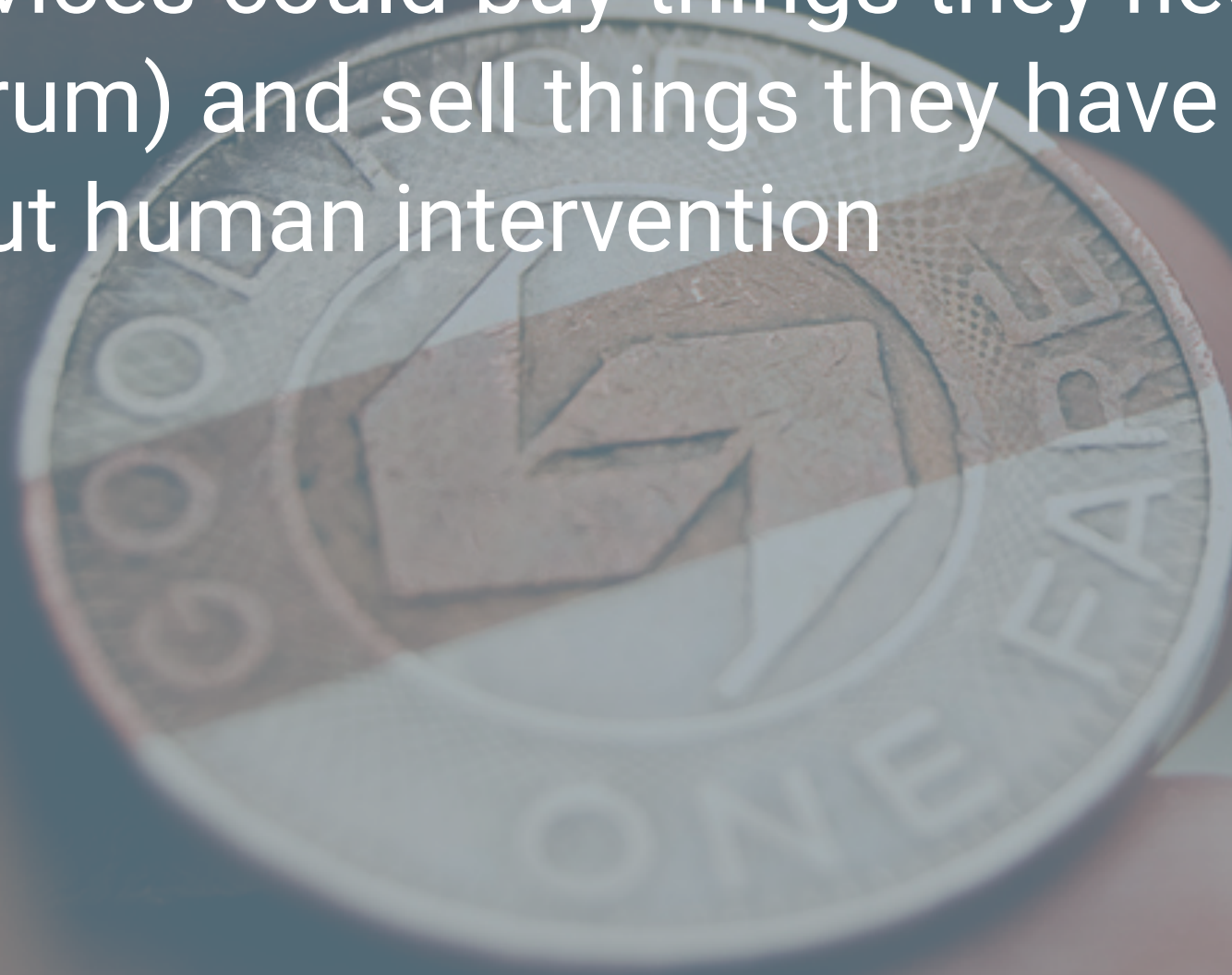
- Secure
- Private
- Transparent
- Auditable
- Trustworthy

Blockchain Advantages for the IoT

- Not centralized
- No intermediary required
- Reduced cost of:
 - Transactions
 - Record keeping
 - Reconciliation

A Machine Currency Token?

- A standard unit of value transfer
- lot devices could buy things they need (like spectrum) and sell things they have (like data) without human intervention



Platforms

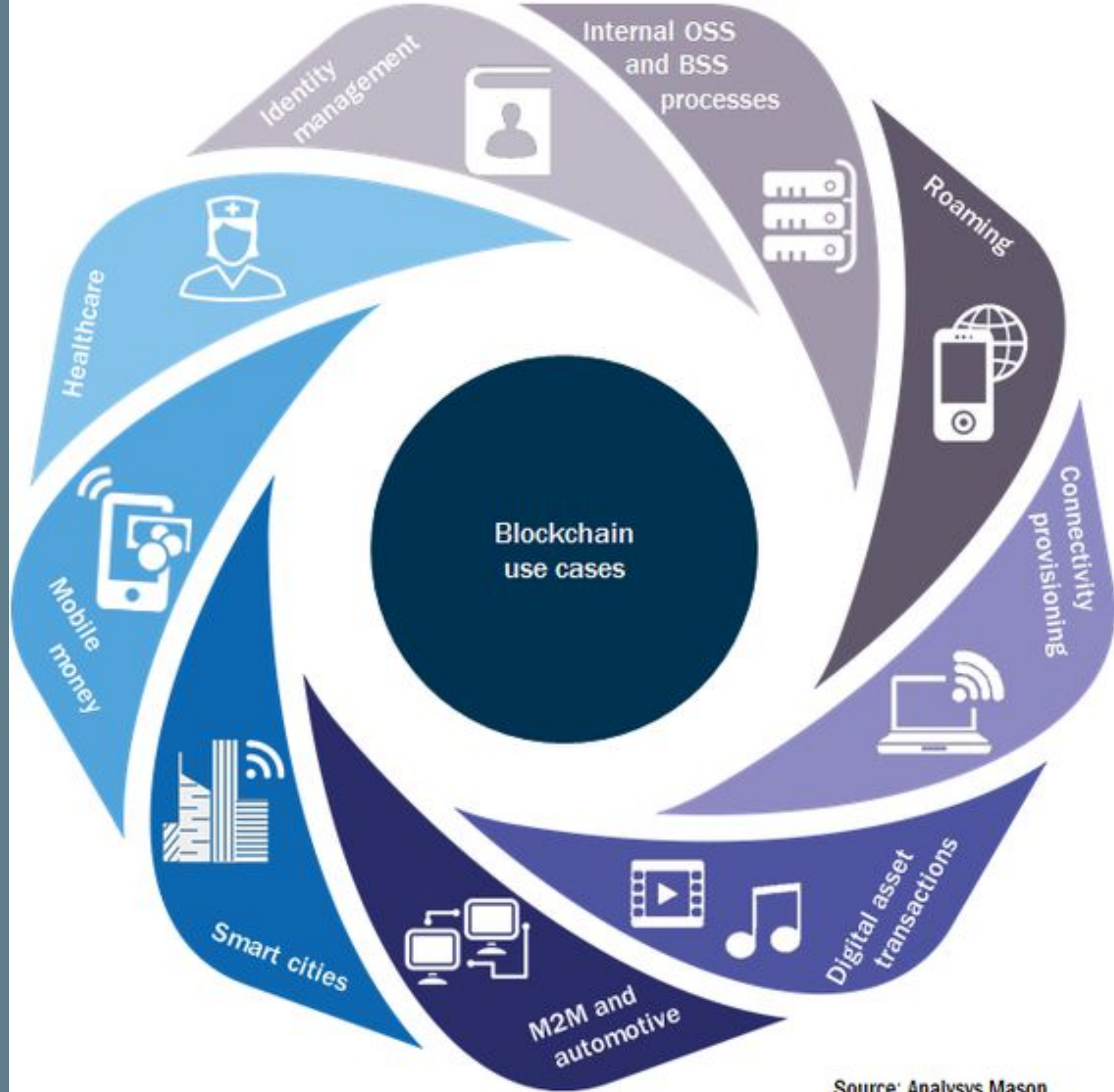
- Ethereum (smart contracts)
- IBM (Watson, BlueMix)
- Hyperledger (Linux Foundation)
- chimera-inc.io/
- iota.org

Projects

- Slock (smart lock)
- Everledger (diamond tracking)
- Filament (networking)

Blockchain Projects I Am Working On

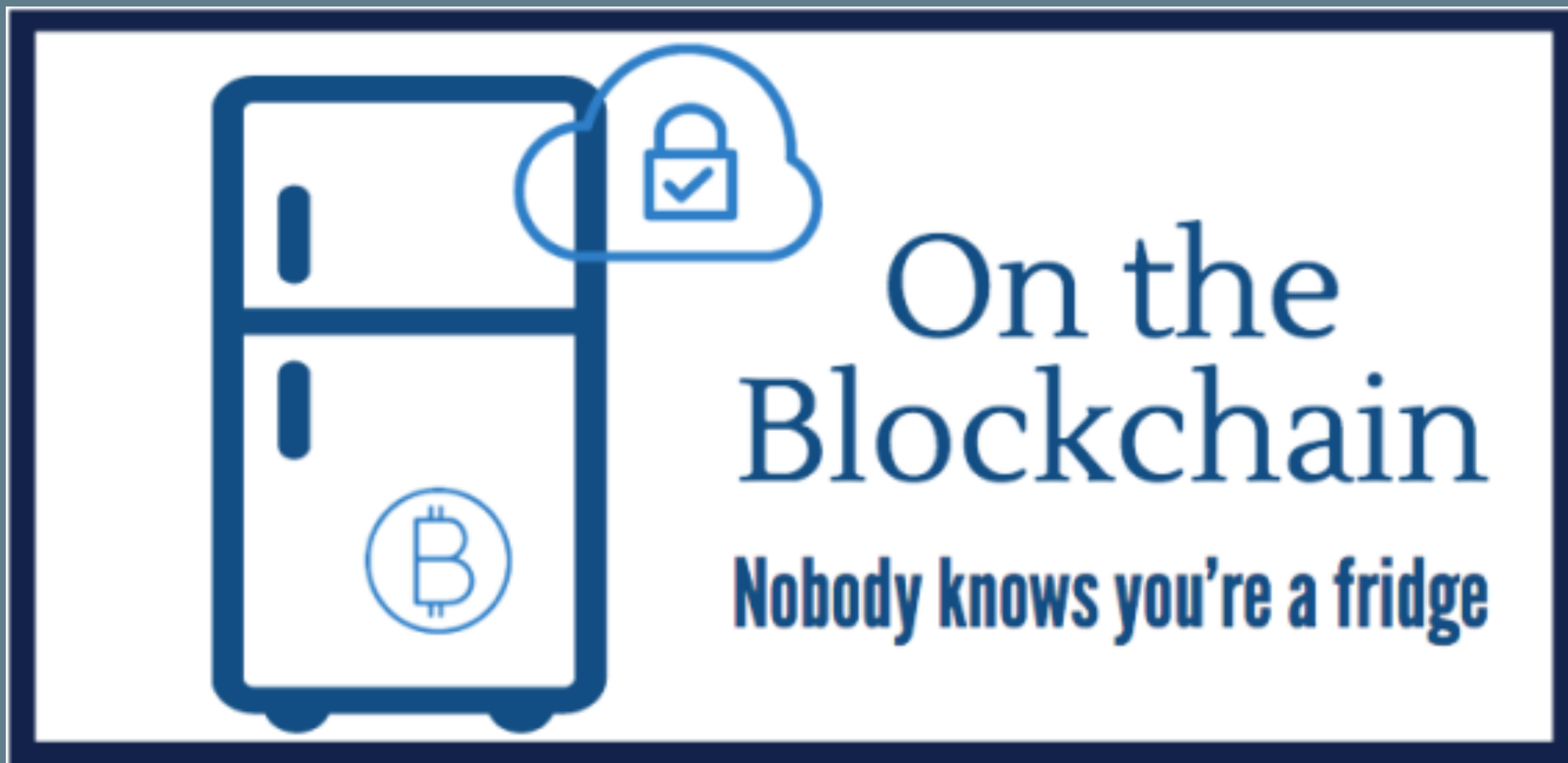
- Tracking conflict minerals
- Savings and credit cooperative (SACCO)
- Spectrum management



Source: Analysys Mason

IoT and Blockchain

- A good match
- But it's early. We have a lot of work to do.





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