

# **BLOCKCHAIN & IOT**

# BLOCKCHAIN & IOT

## Introduction

*“In the next decade, nearly every consumer gadget, every household appliance, and every industrial device will be connected to the Internet. These connected devices will also become more intelligent with the ability to predict, talk, listen, and more. The companies who manufacture these devices will have an opportunity to reimagine everything and fundamentally transform their businesses with new product offerings, new customer experiences, and differentiate against competition with new business models.*”

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## Outline

- Blockchain

- IOT

- Use Cases

- Summary

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## Blockchain

- Basics

- Currency history

- Barter systems – direct exchange
    - Tokens to enhance barter systems
    - Value anchors to enhance tokens
    - “Fiat” money – no intrinsic value
    - Trust – stable govt and economy
    - Cyber currency – distributed, cryptographic integrity, virtual token

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## Blockchain

- Basics

- Hashing

- Algorithms that perform one way encryption
    - Map variable length data to a fixed length text string
    - Example:
      - Input data:
        - » U.S. Declaration of Independence (1 page of text)
        - » “When in the Course of human events, it becomes necessary for one people to dissolve the political bands which have connected them with another, and to assume among the powers of the earth, the

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## Blockchain

- Basics

- A journal/history of transaction blocks
  - Each block includes a hash from the previous



- Tamper proof
- Distributed publicly

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## Blockchain

- Basics

- Coins and mining

- The purpose of mining is to produce a hash that can be trusted
    - A public competition to find a difficult to produce hash is motivated by a reward
    - Called “mining” because the production of new blocks is accompanied by the production of new coins (fractions)

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## Blockchain

- Benefits

- Wide distribution with no central authority
  - High level of integrity
  - Shared consensus
  - High level of trust
  - “Distributed trust” = people who don’t know each other can trust the integrity of the chain\*
- \* - this is important**

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## Blockchain

- Requirements

- Authentication process (PKI)
  - Transactions
  - Mining
- Hashing to ensure integrity
- Trust – balance among factors:
  - Effort/cost/time (proof of work)
  - Security
  - Distributed trust (usability)

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## IOT

- Basics

- Connecting many devices in an area
- Low power wireless “mesh” networks
- Currently lacking security protocols
- Growing fast
- Becoming pervasive - smart homes, smart cars, smart cities, smart business...

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## IOT

- Benefits
  - Automation
  - Embedded intelligence
  - Connections

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## IOT

- Needs

- Standards for connectivity
- Security and privacy concerns
- Trust issues \*

\* - this is important

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## Use Cases

- Use Cases
  - Car safety recall
  - Shipping logistics
  - Inventory lifecycle
  - Supply chain (food)
  - Infrastructure management
  - Education

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## Use Cases

- Use Cases
  - Car safety recall
    - Issue recall notice directly to vehicle
    - Monitor response rate by vehicle
    - Produce safety record for each vehicle
    - Benefits:
      - Automation saves time, cost
      - Record of transactions that can be trusted
    - Design for software updates to fix problems

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## Use Cases

- Use Cases

- Shipping logistics

- Complex combinations: partners, transportation, locations, information systems, bureacracies...
    - Large time and effort overhead
    - Blockchain solution:
      - Reduce time, effort, waste, fraud
      - Improve information, management, trust

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## Use Cases

- Use Cases
  - Inventory lifecycle
    - RFID tags on everything enable tracking
    - Sensor data: location, movement, temperature...
    - Distributed across lifecycle
    - Trust across ownership boundaries

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## Use Cases

- Use Cases
  - Supply chain (food)
    - RFID tags and sensor data
    - History
    - Trust across system boundaries

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## Use Cases

- Use Cases
  - Infrastructure management
    - Transportation
    - Communication
    - Utility supply

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## Use Cases

- Use Cases
  - Education
    - Credentials as a currency
    - From degrees to accumulation of competencies
    - No resume fraud
    - Value of learning divorced from tuition payments

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## Use Cases

- Issues

- Authentication overhead (PKI)
- Blockchain generation overhead
  - CPU time
  - Storage space (BC = 122 GB and growing)

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## Use Cases

- Solutions

- Authorization w/low overhead?
- Encryption is optional
- Scaling with off chain artifacts
- Scaling with archiving
- Embedding intelligence

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## Summary

- Summary
  - IOT is coming fast and everywhere
  - Trust and security are dire needs
  - Blockchain may offer solutions

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## Summary

- Reference:
  - <https://www.ibm.com/blogs/internet-of-things/>
  - <https://www.ibm.com/blogs/internet-of-things/iot-blockchain-use-cases/>
  - <https://www.ibm.com/blockchain/use-cases/>