



جامعة الشارقة
UNIVERSITY OF SHARJAH



Improved Blockchain Infrastructure with IoT

Dr. Manar Abu Talib

Assistant Dean, College of Sciences

University of Sharjah





Blockchain Technology

“Blockchain Will
Become
‘Beating Heart’
of the
Global Financial
System”

World Economic Forum.

Dramatically Reduce Costs

Reduce Human Errors

**Highest degree of
accountability**

**Enhanced
Security**

**No single
point of
failure**



What is Blockchain?



Do you have properties?

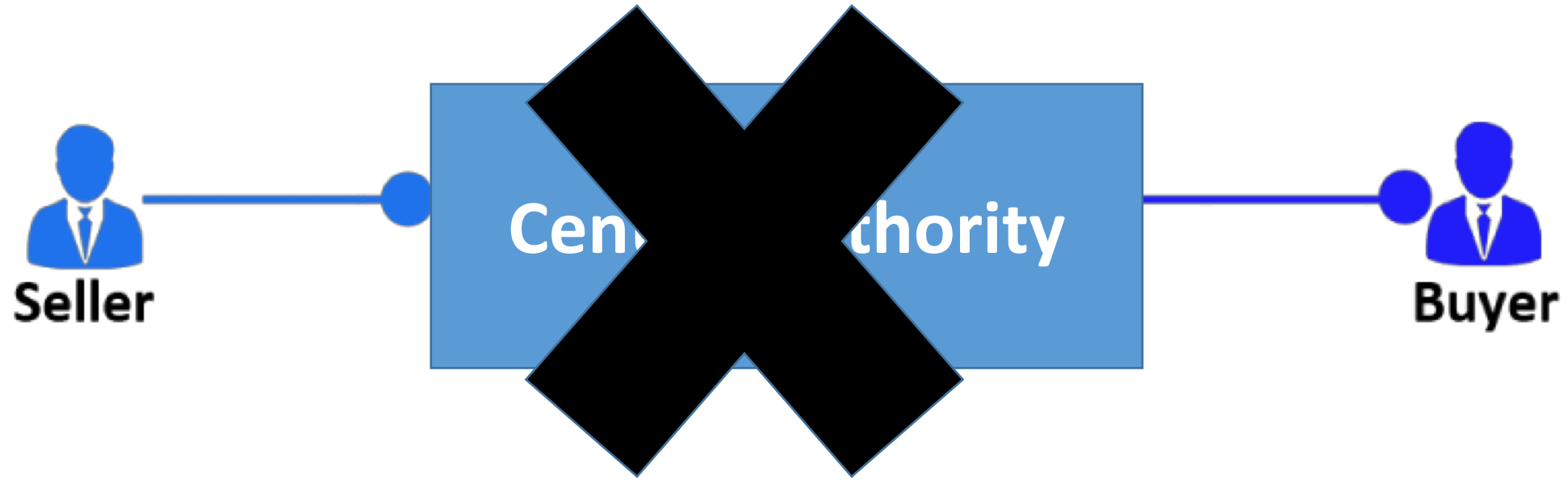
CENTRALIZED



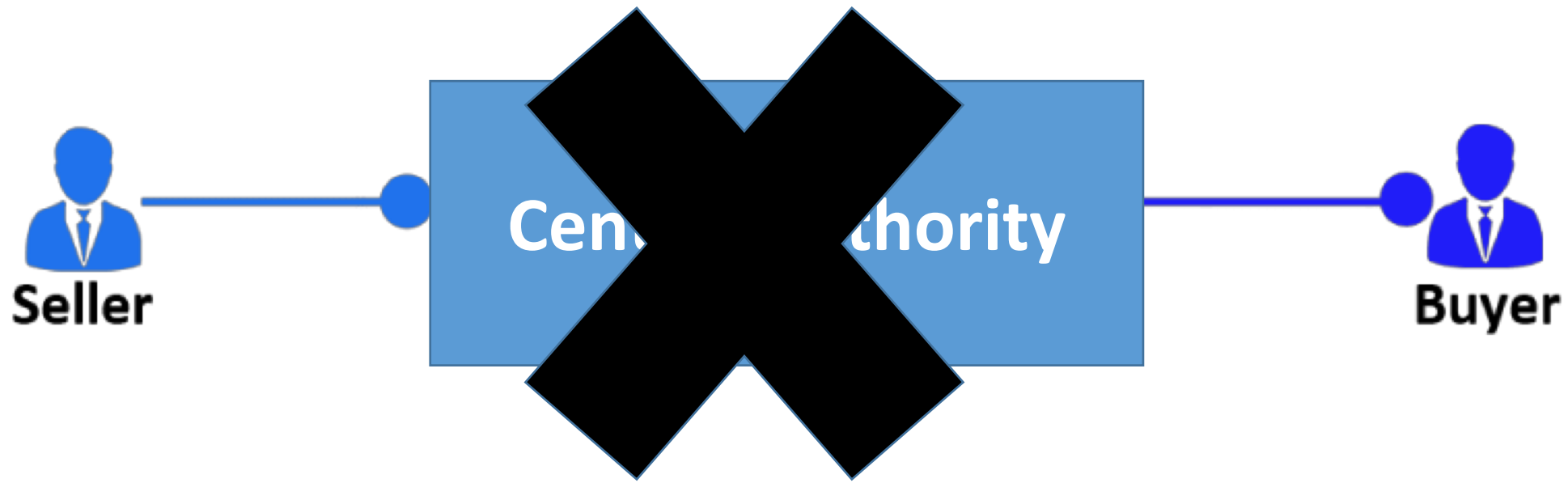
How you register your properties?



You want to sell your land



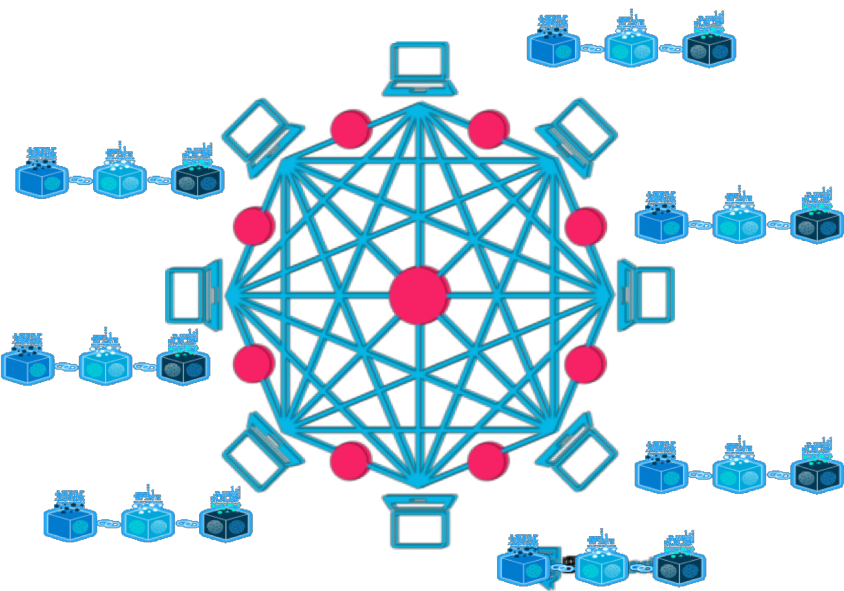
Blockchain is decentralized



No need for a third party



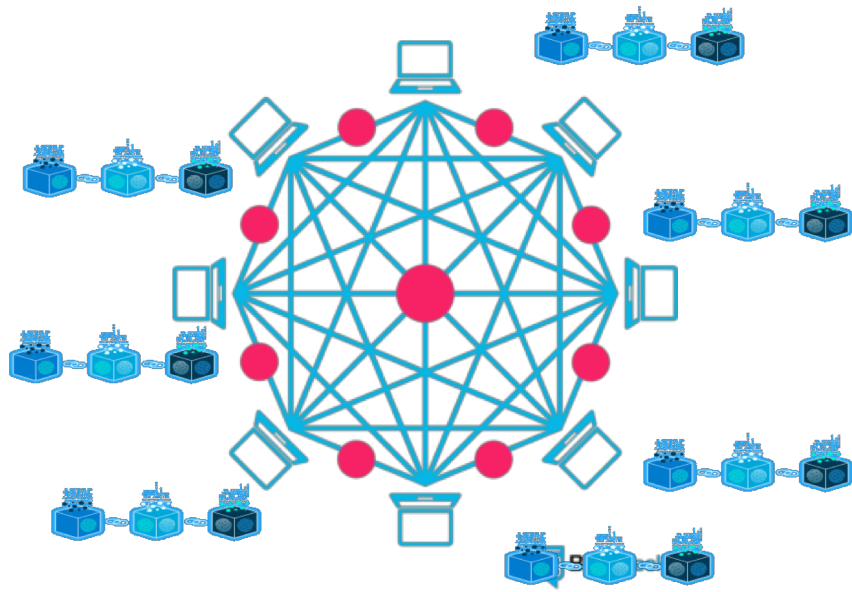
Blockchain is distributed



Node

Computer connected to the blockchain network using a client that performs the task of validating and relaying transactions) gets a copy of the blockchain, which gets downloaded automatically upon joining the blockchain network

A network of so-called computing “nodes” make up the blockchain.

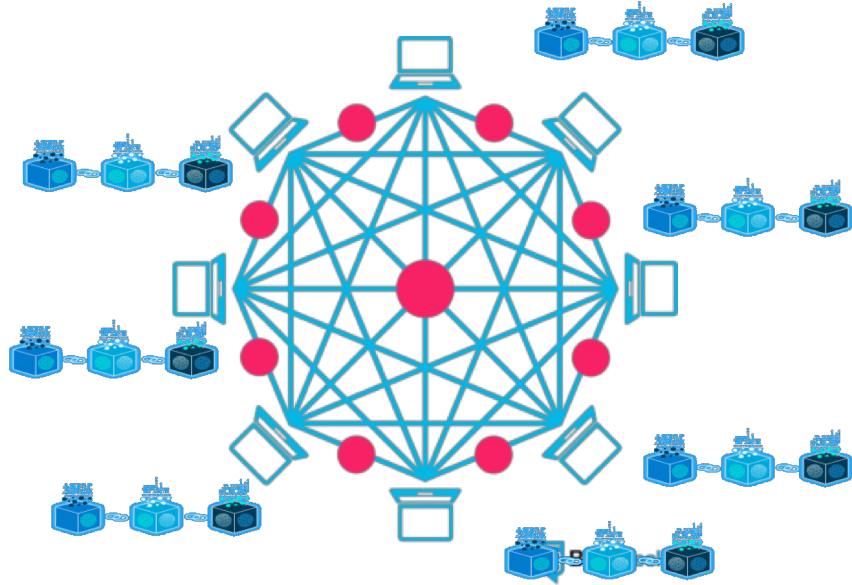


Consensus

The blockchain network lives in a state of consensus, one that automatically checks in with itself every ten minutes.

Transparent and incorruptible

Smart Contract



1



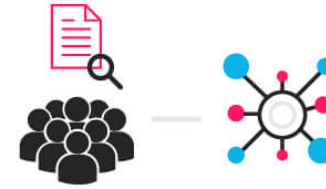
An option contract between parties is written as code into the blockchain. The individuals involved are anonymous, but the contract is the public ledger.

2



A triggering event like an expiration date and strike price is hit and the contract executes itself according to the coded terms.

3

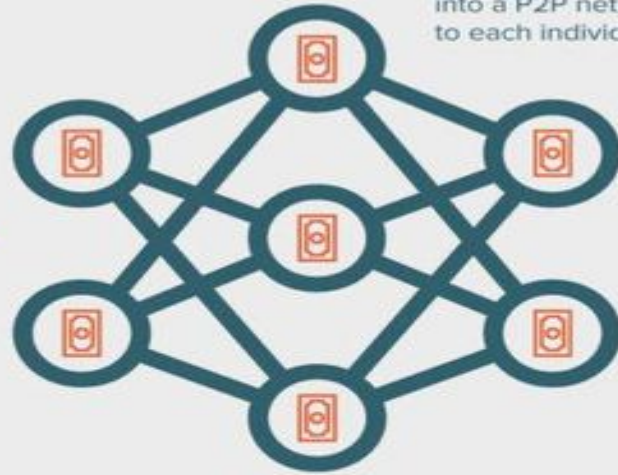


Regulators can use the blockchain to understand the activity in the market while maintaining the privacy of individual actors' positions

Distributed ledgers enable the coding of simple contracts that will execute when specified conditions are met.

HOW DOES BLOCKCHAIN WORK?

One party requests a transaction.



Requested transactions are funneled into a P2P network and broadcast to each individual computer (or node).



Individual nodes receive the request and validate the transaction using an algorithm.

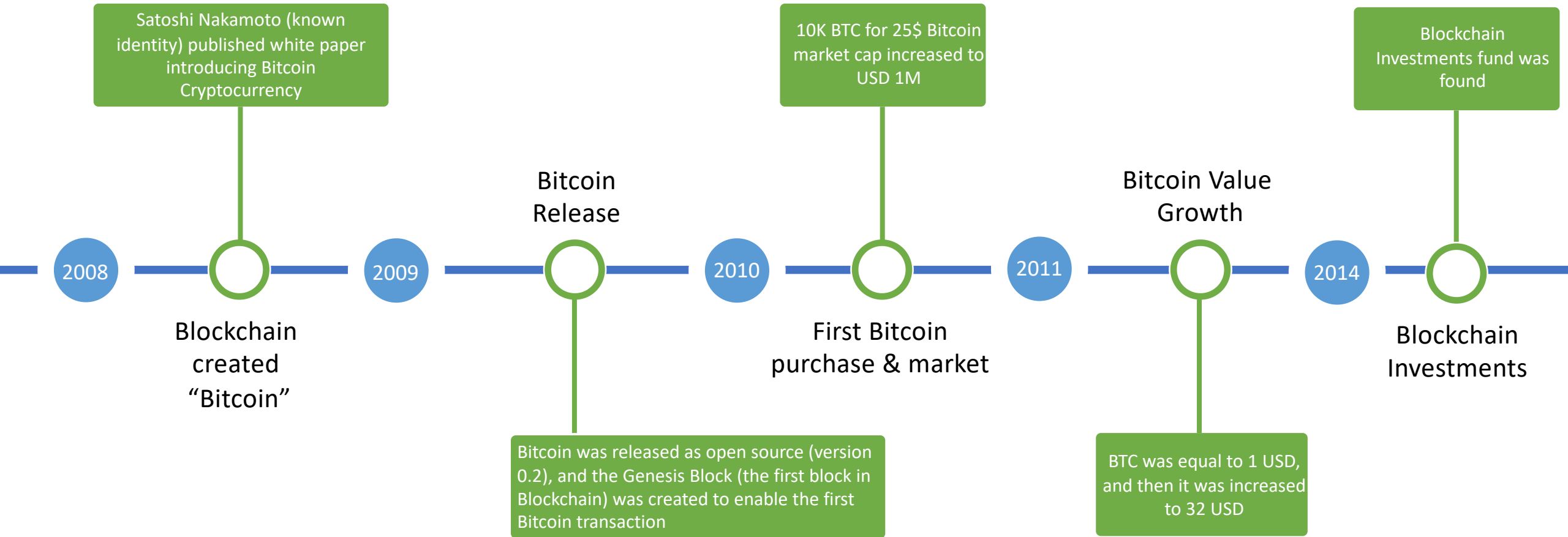


Once the block is added to an existing chain, transactions are complete and permanent.

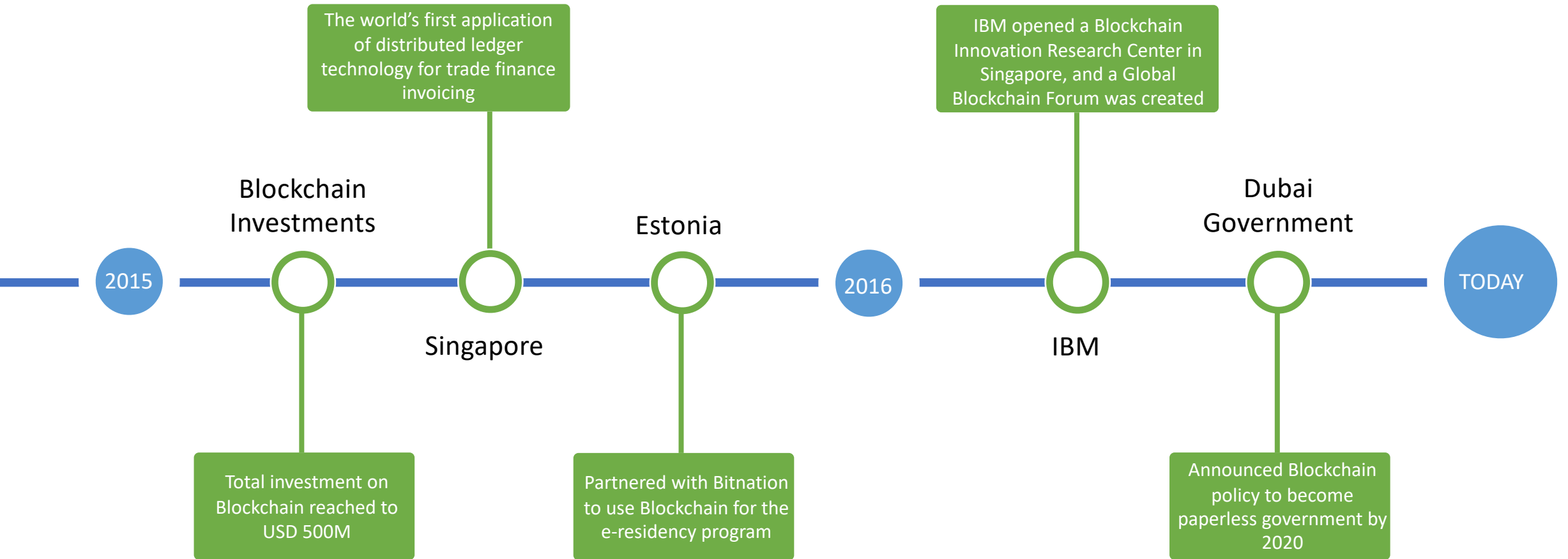


Approved transactions are represented as blocks and added to a public ledger.

Blockchain History



Blockchain History



\$1.1 BILLION
INVESTED

BY PRIVATE
SECTOR IN
2016 ALONE

\$290 BN
VALUE

EXPECTED
MARKET
VALUE IN 2019

BLOCKCHAIN

THE INTERNET OF TRANSACTIONS

THE SIMPLEST, SAFEST, MOST SECURE WAY TO
EXCHANGE INFORMATION

600 NEW
COMPANIES

ACTIVE IN
BLOCKCHAIN
TODAY

LEADING
GOVERNMENTS

EXPLORING
BLOCKCHAIN
TECHNOLOGY

DUBAI BLOCKCHAIN STRATEGY

GOVERNMENT
EFFICIENCY



100%
ON BLOCKCHAIN

DUBAI GOVERNMENT TRANSACTIONS
ON BLOCKCHAIN BY 2020

INDUSTRY
CREATION



1000
NEW BUSINESSES

NEW BUSINESSES SUPPORTED BY
BLOCKCHAIN BY 2020

INTERNATIONAL
LEADERSHIP



27
COUNTRIES

INTERNATIONAL PARTICIPATION
FOR GLOBAL TRAVEL

EXAMPLE

FAMILIES IN DUBAI GENERATE

100 MILLION
PAGES OF
DOCUMENTS EVERY YEAR

THE STRATEGY WILL SAVE

25.1 MILLION
HOURS
OF PRODUCTIVITY
PER YEAR JUST ON
PAPERWORK

DRIVERS WILL AVOID

411 MILLION
KILOMETERS
OF TRAVEL EACH
YEAR IN
PROCESSING
PAPERWORK

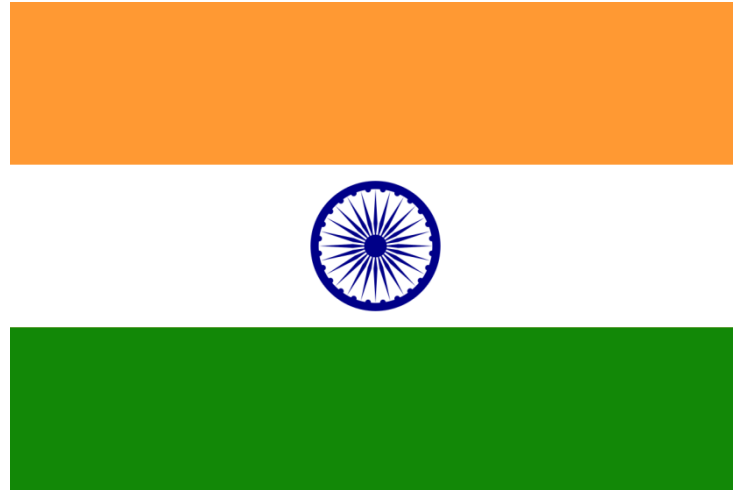
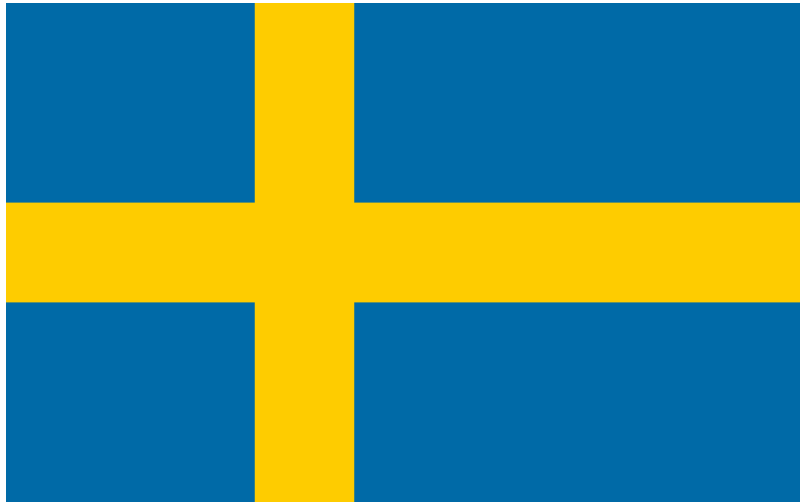
114 MTON in carbon emissions

مؤسسة دبي للمستقبل
Dubai Future Foundation



دبي الذكية
SMART DUBAI
حياة أفضل
HAPPY LIVING

DUBAI WILL BE THE FIRST BLOCKCHAIN POWERED GOVERNMENT
DRIVING THE FUTURE ECONOMY



Who applied Blockchain?

Blockchain Use Cases for Governments

GULF NEWS
GOVERNMENT

February 1, 2017 | Last updated 2 minutes ago

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Dubai launches Blockchain strategy to become paperless by 2020

Hamdan unveils ambitious plan to save 25 million work hours annually through paperless transactions

Published: 20:22 October 5, 2016
WAM

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Dubai: Dubai government on Wednesday said it will become paperless by shifting all transactions to Blockchain — an online encrypted database — by 2020.

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August 1, 2016

THE UK GOVERNMENT NOW HAS ITS FIRST OFFICIAL BLOCKCHAIN PROVIDER FOR PUBLIC SERVICES

Every single p
blockchain tec
fintech startup
the potentially

The recently published Land Transport Regulation 2040 **report** by Australia's National Transport Commission (NTC) suggested blockchain technology could change its existing transport model.

Also read: [Australia's Treasurer: Progress Made to End Bitcoin Double Tax](#)

Transforming the Current Transport Model

The National Transport Commission (NTC) is undertaking strategic work called Land Transport Regulation 2040. The aim is to answer the question of "How could or should we regulate land transport in the future?"

The NTC will be using the report to converse with shareholders from October through December.

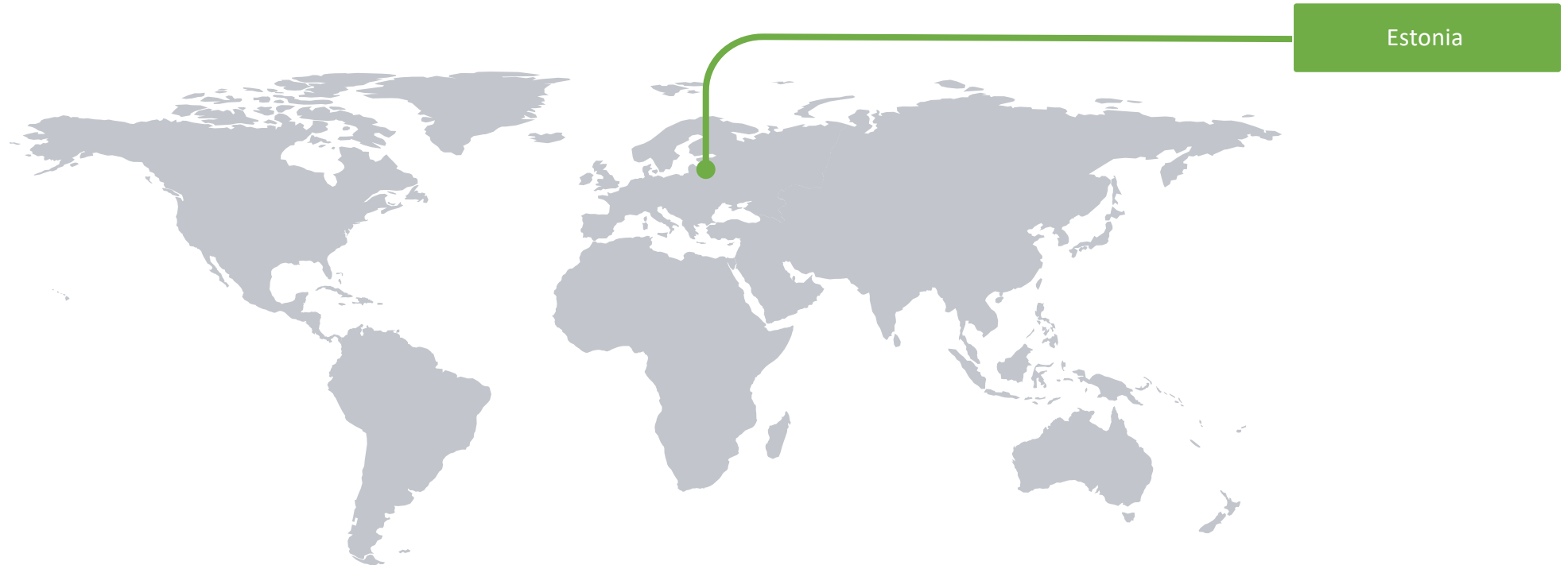


National Transport Commission

Blockchain Use Cases for Governments

Identity Management and Record Keeping

- Allow government entities to manage and maintain digital identities of individuals to support the processing of various government services

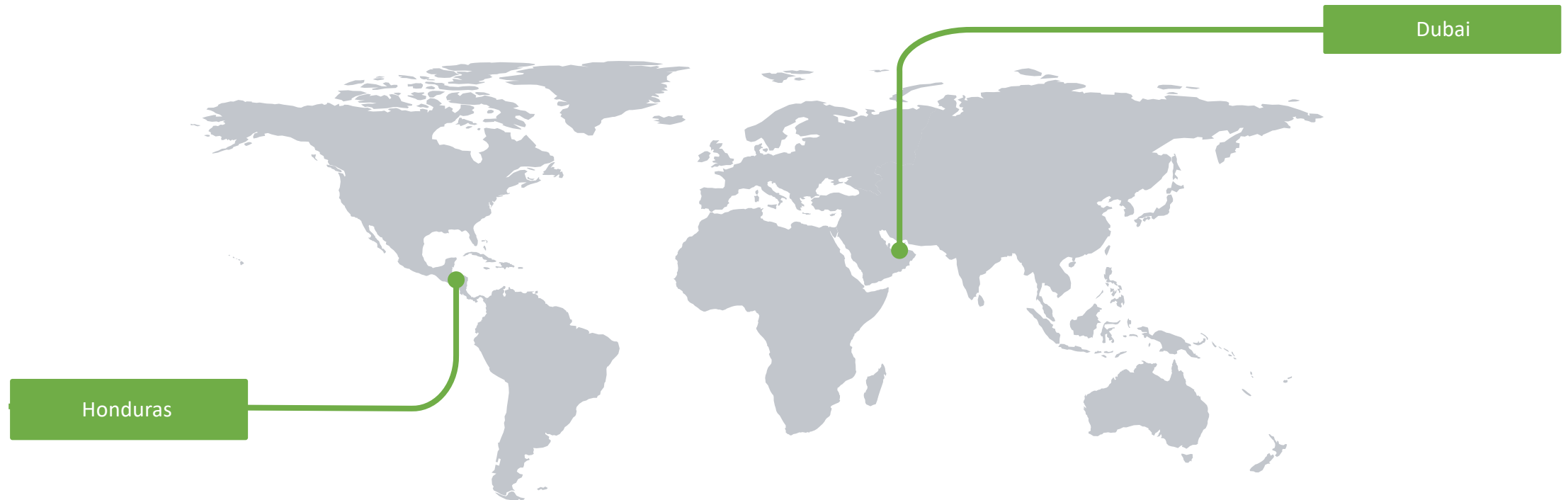


Estonia is collaborating with Bitnation to offer public notary services to Estonian e-Residents. Estonian e-Residents can notarize official documents such as birth certificates, marriage arrangements, testaments, business contracts, land titles, and other from anywhere in the world

Blockchain Use Cases for Governments

Value Registry

- Allow users to store documents along with the signature and timestamp which can be validated by any participant in the network having the user's discretion



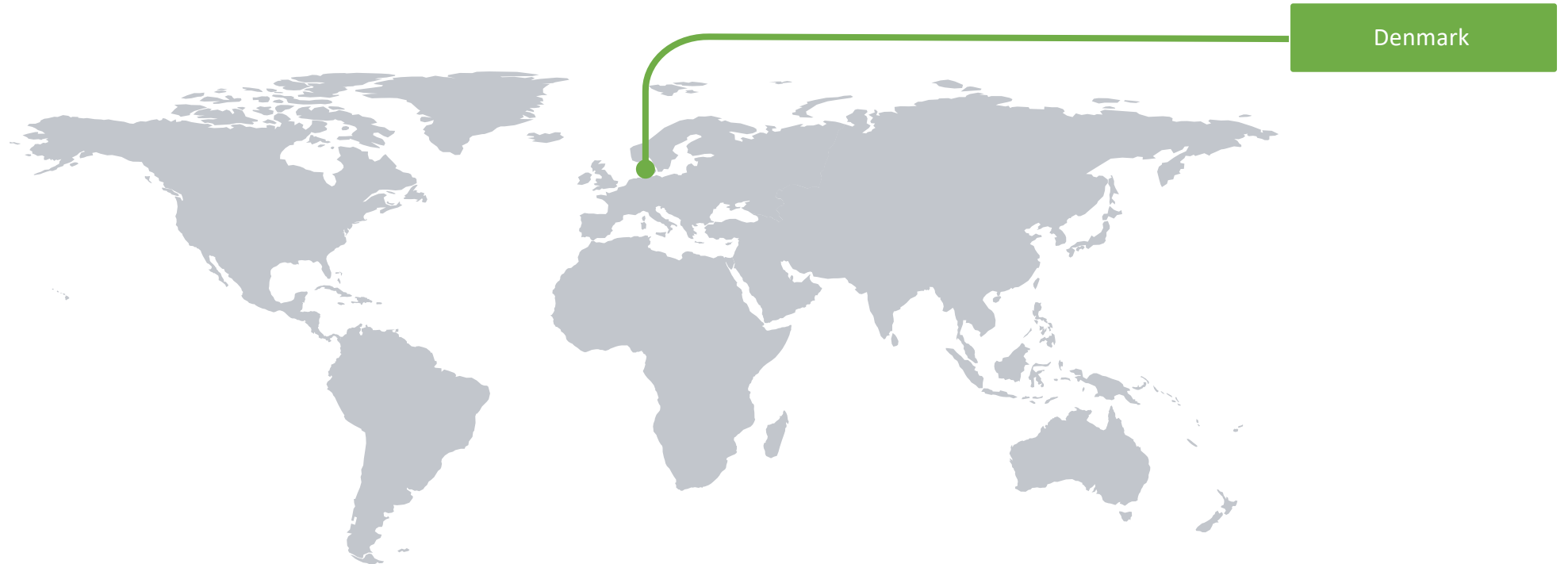
Dubai Multi Commodities Centre (DMCC) is engaged in a test case related to the authentication and the transfer of Kimberley certificates.

*Honduras uses Blockchain (Factom) to store **proof of land ownership** that other government entities can rely on*

Blockchain Use Cases for Governments

Voting System

- Implementing voting systems, which provide transparency in the voting process and maintains immutable records for the voting

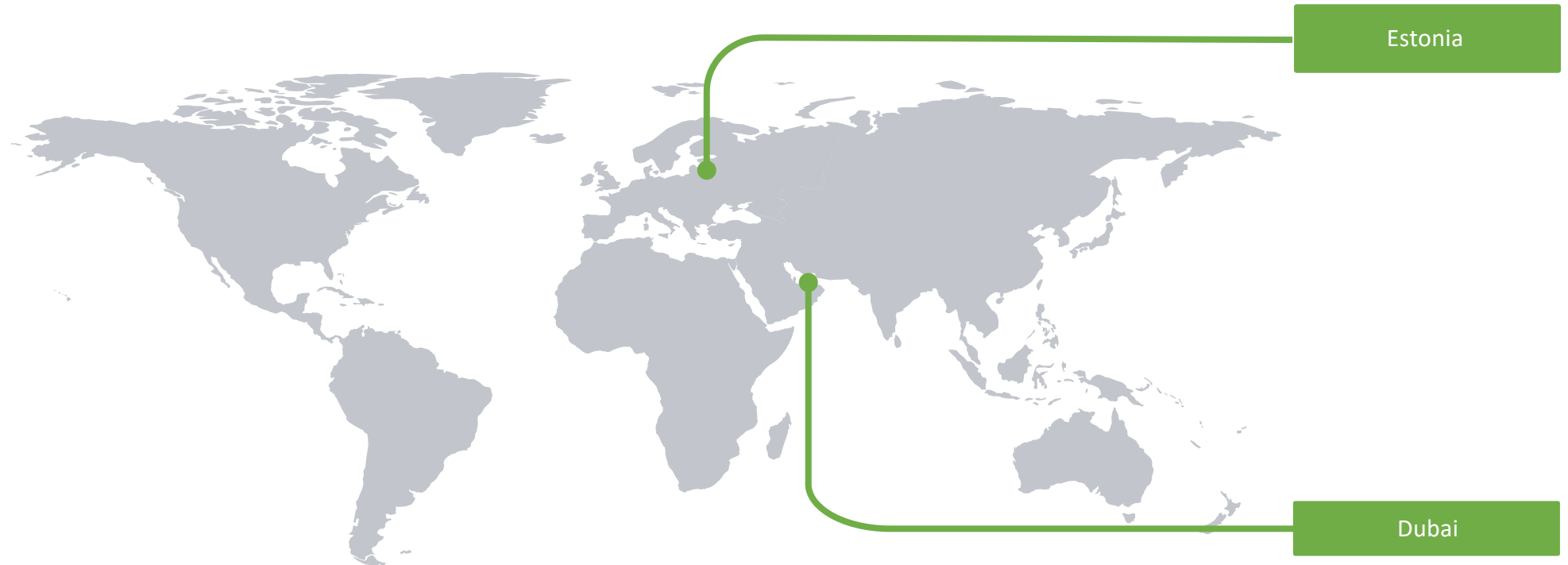


Denmark's Liberal Alliance party announced the plan to use blockchain technology for electronic voting (e-voting)

Blockchain Use Cases for Governments

Health Care

- Enable government entities to better provide health care services through keeping the health records of patients that can be shared with other service providers



*The Emirates Integrated Telecommunication corporation (Du) is piloting a use case for health record to **share data records between service providers***

*Estonia is targeting to use Blockchain to facilitate **better healthcare, achieve transactions efficiency, and empower patients***

Blockchain Limitations

Scalability

Anything that happens on it is a function of the network as a whole.



Lack of resources and undocumented successful case studies on Blockchain implementations in other countries



Not having enough expert opinion for treatment validation phase due to lack in the expertise in the Blockchain security domain, and the availability and promptness of the experts to our study.



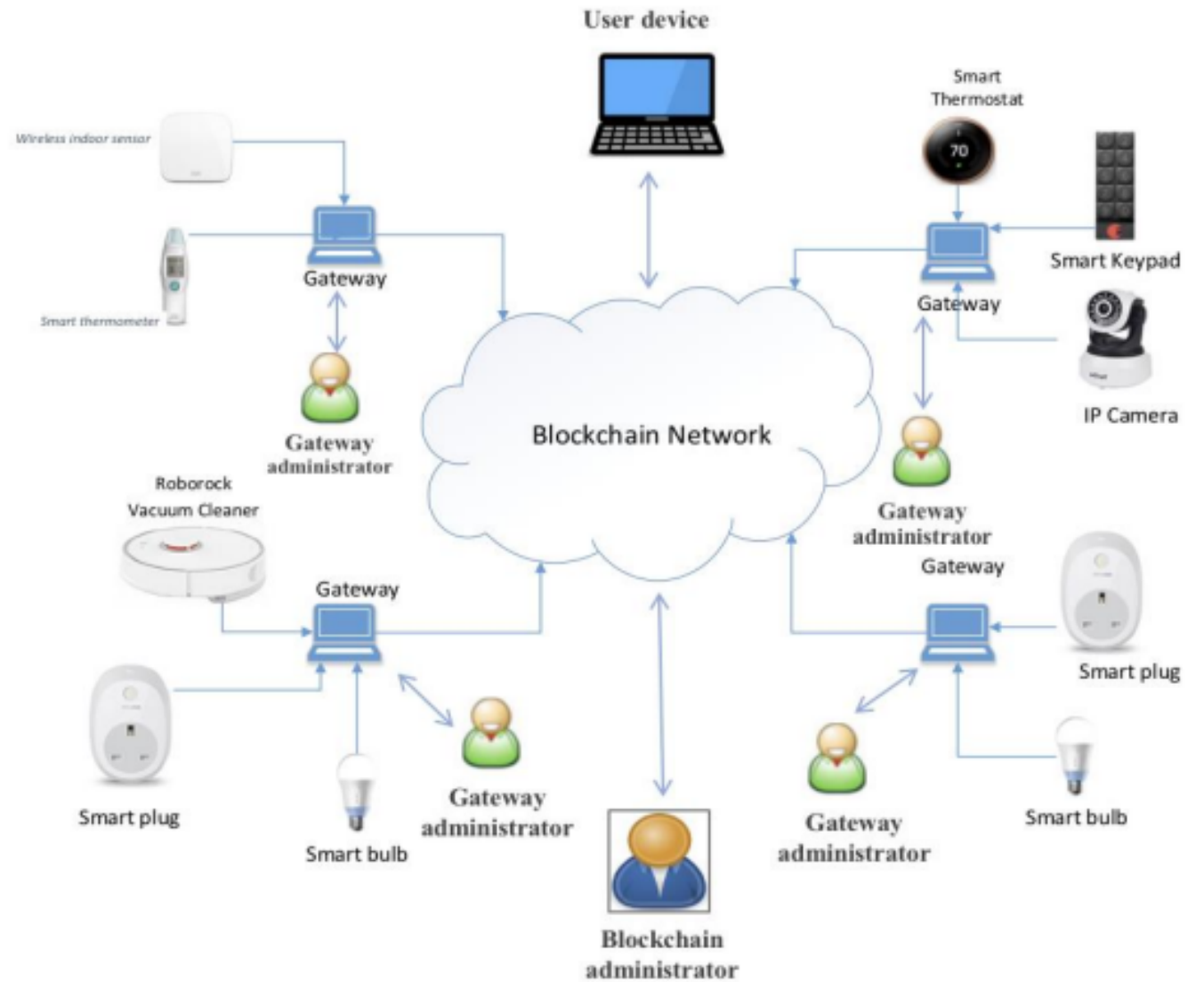
Improved Blockchain Infrastructure with IoT

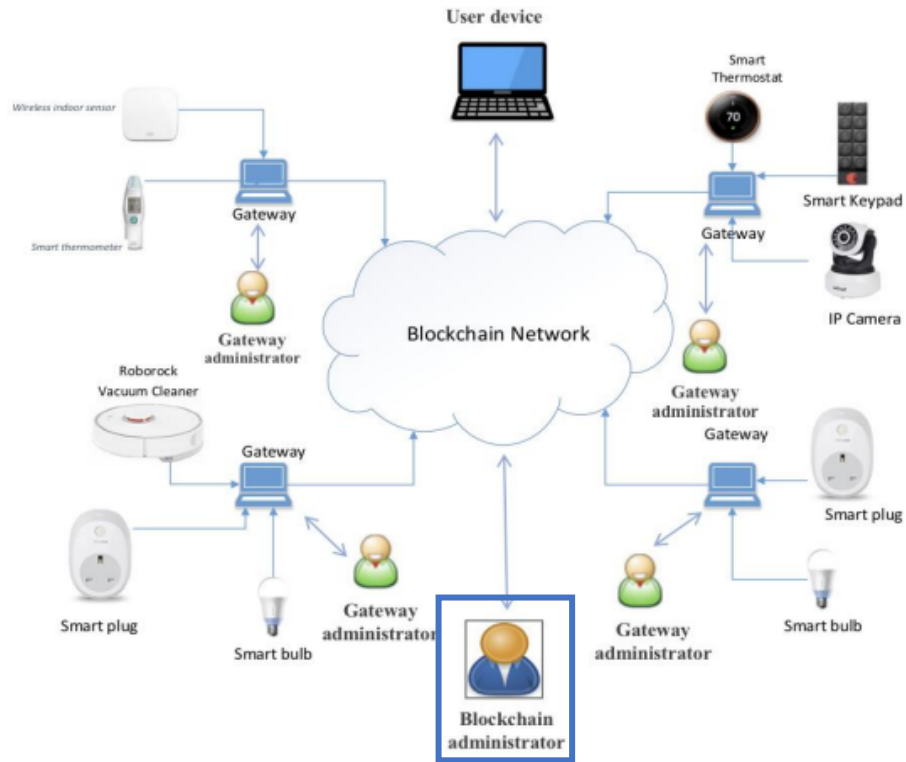
Introduction

- The main contribution of this research project is to introduce a **blockchain-based architecture for IoT** that **delivers lightweight and decentralized security and privacy**.

Infrastructure Overview

The proposed Blockchain/ IoT Infrastructure





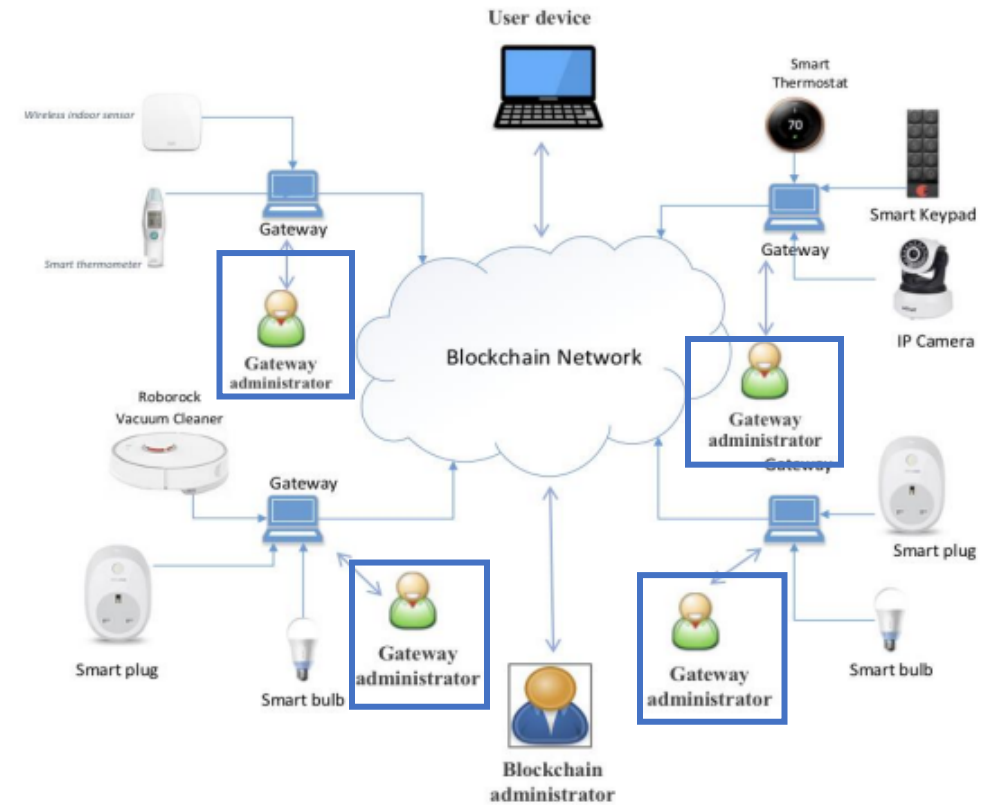
Roles

1. user administration (create, delete, update, etc)
2. manage privacy policies
3. create device register chaincode
4. security check for the users in the network

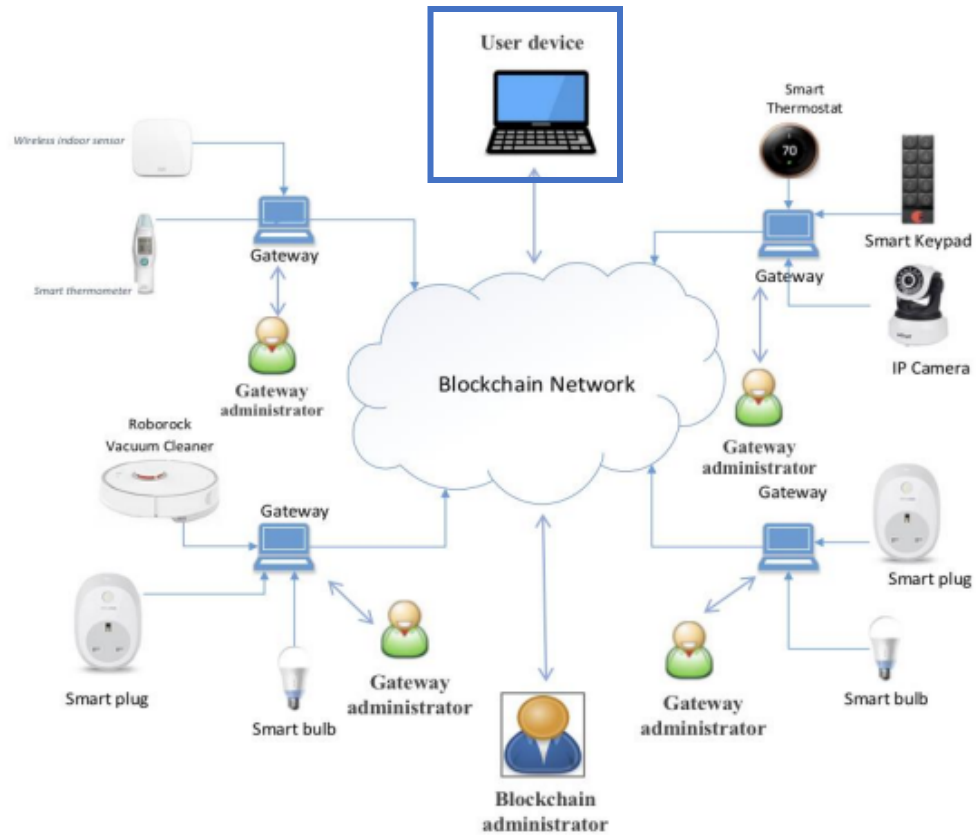
Blockchain Administrator

Roles

1. create a chaincode for the gateway
2. create a chaincode for the devices
3. link the chaincode of the device to the chaincode of the gateway
4. use the chaincode to manage the device's information
5. stores preference data in the gateway and in the blockchain network



Blockchain Gateway Administrators



Roles

interact with the blockchain network to control IoT devices

End User

Application (Use Case)

- We explore our approach in a smart home as a representative case study for broader IoT applications. Most smart home solutions can perform simple things, such as turn **lights on and off, turn on the entertainment system and automate tasks** based on pre-defined user profiles, scenes), and events.



IoT Devices

- The IoT devices used are smart home appliances. The requirement for choosing these devices is that they communicate using **Wi-Fi or Bluetooth**, for easy integration into a house.



#	Item
1	IP Camera
2	Smart Thermostat
3	Wi-Fi Smart Plug
4	Smart Lock
5	Smart wi-fi light bulb
6	Connected speaker
7	Smart Thermometer
8	Roborock Vacuum Cleaner

IoT Gateway

Why do we need Gateway



- **Mediator** to forward data from and to IoT
- **Interface for the administrator** to manage the privacy preferences for the users.
- Hardware Options:
 - 1) Laptop
 - 2) Dell Embedded Box PC 5000/3000

Gateway Software

Why do we need gateway software:

1. Discover, Monitor and Control different IoT devices.
2. Facilitate the interaction with IoT devices on the BC.

Software Options:

1. Thingsboard
2. Mozilla Things
3. Kura-eclipse.

Software Architecture



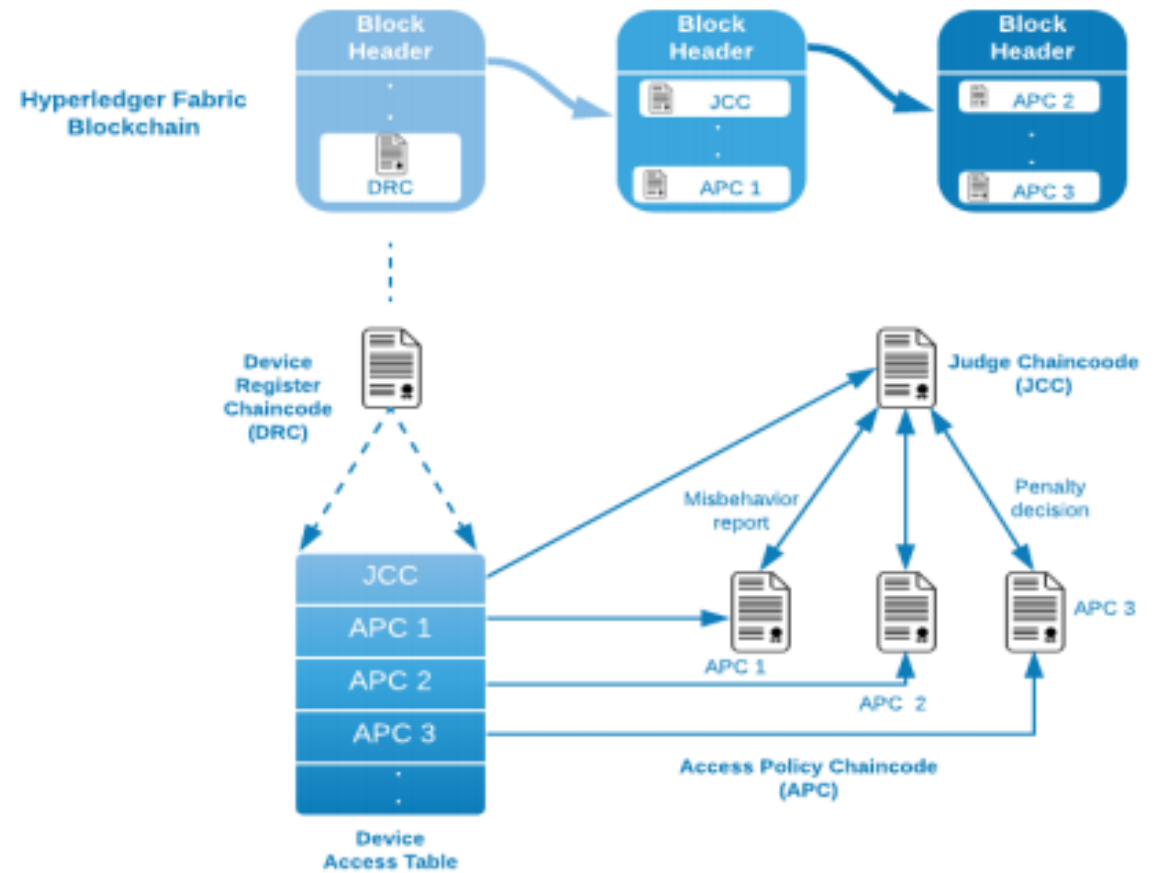
Hyperledger Fabric

- Hyperledger Fabric is an enterprise-grade **open source platform** that is maintained **by IBM and Linux Foundation**.
- Unlike Bitcoin and Ethereum, Hyperledger fabric does not have any cryptocurrency, where the access to the network **is restricted to the network members only, and not anyone can join the network**.

Chaincodes

Smart contract-based BC/IoT framework is used to achieve distributed and trustworthy access control for IoT systems, which consists of:

- multiple access policy chaincodes (APCs)
- one judge chaincode (JCC) (to be implemented by American University Of Sharjah)
- one device register chaincode (DRC)

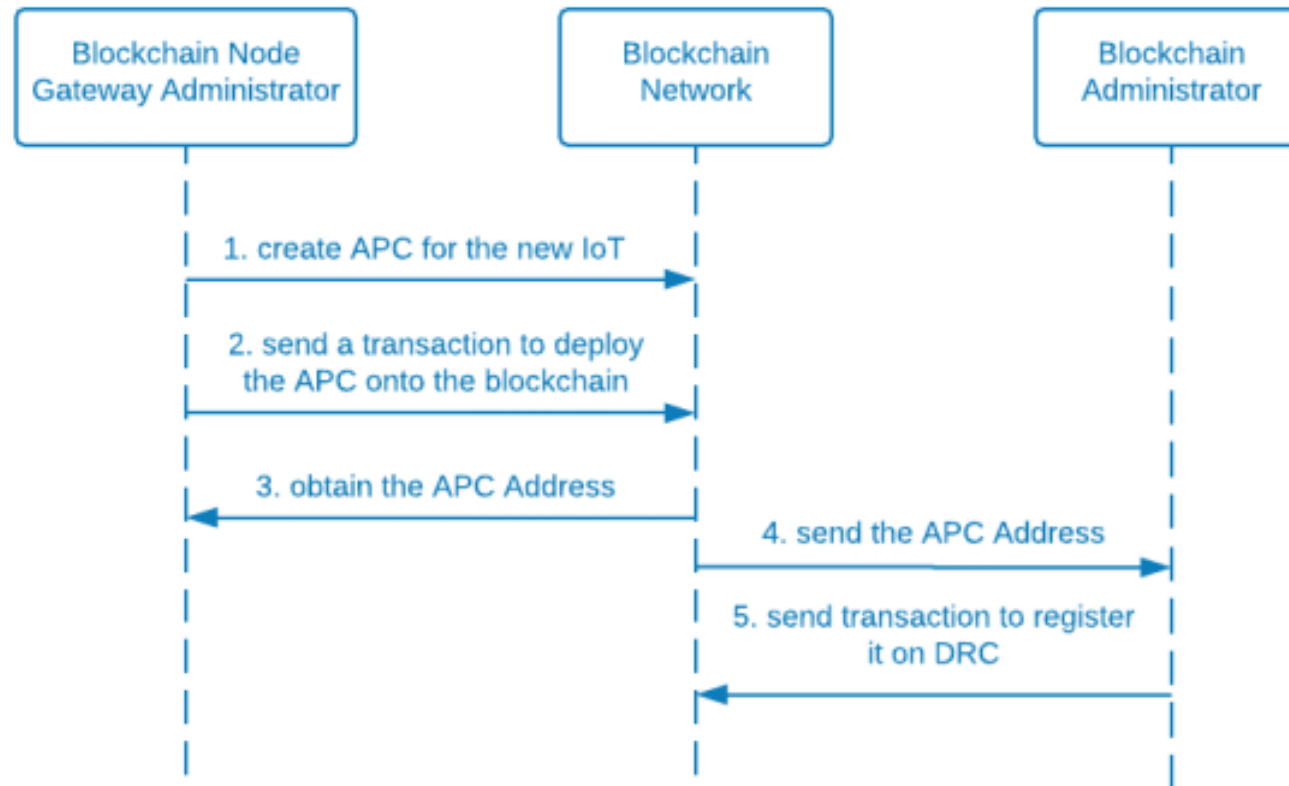


Device Registry Chaincode (DRC)

The DRC registers the information of the access control and misbehavior-judging methods as well as their chaincodes, and provides functions (e.g., register, update and delete) to manage these methods.

IoT ID	IoT Name	Number Of Attributes	Joining Date
IPCam1	X1_IP Camera	2	XX-XX-XXXX
Smart Plug1	X1_Smart Plug	4	XX-XX-XXXX
Smart Keypad1	X1_Smart_Key_Pad	3	XX-XX-XXXX
....

IoT ID	IoT Attribute	Attribute Function	Last access Date
SmartPlug1	Power	ON/OFF	XX-XX-XXXX
Smart bulb	Lamp	ON/OFF	XX-XX-XXXX
....



Device Binding/Registration

Thank You

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