ITU Asia-Pacific Centre of Excellence Training
On
"Distributed Ledger Technologies (Blockchain) Ecosystem and Decentralization"

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Distributed Ledger Technologies (Blockchain)

Applications

Dr. Leon Perlman
Head: DFS Observatory @ CITI
Columbia University, New York, USA

Columbia Business School

@leonperlman

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- World's first comprehensive curated library of DFS-related laws, regulations and policies
- Over 780 DFS legal documents from over 55 countries in our searchable database
- Free webinars & quizzes on DFS-related topics, leading to a Certificate Program for registered participants
- Commentaries and policy documents on DFS regulation
- Publications on a range of DFS-related topics, including those from the ITU DFS Focus Group
- Our 7th annual DFS & Emerging Payments Summit on June 8 & 9 in New York

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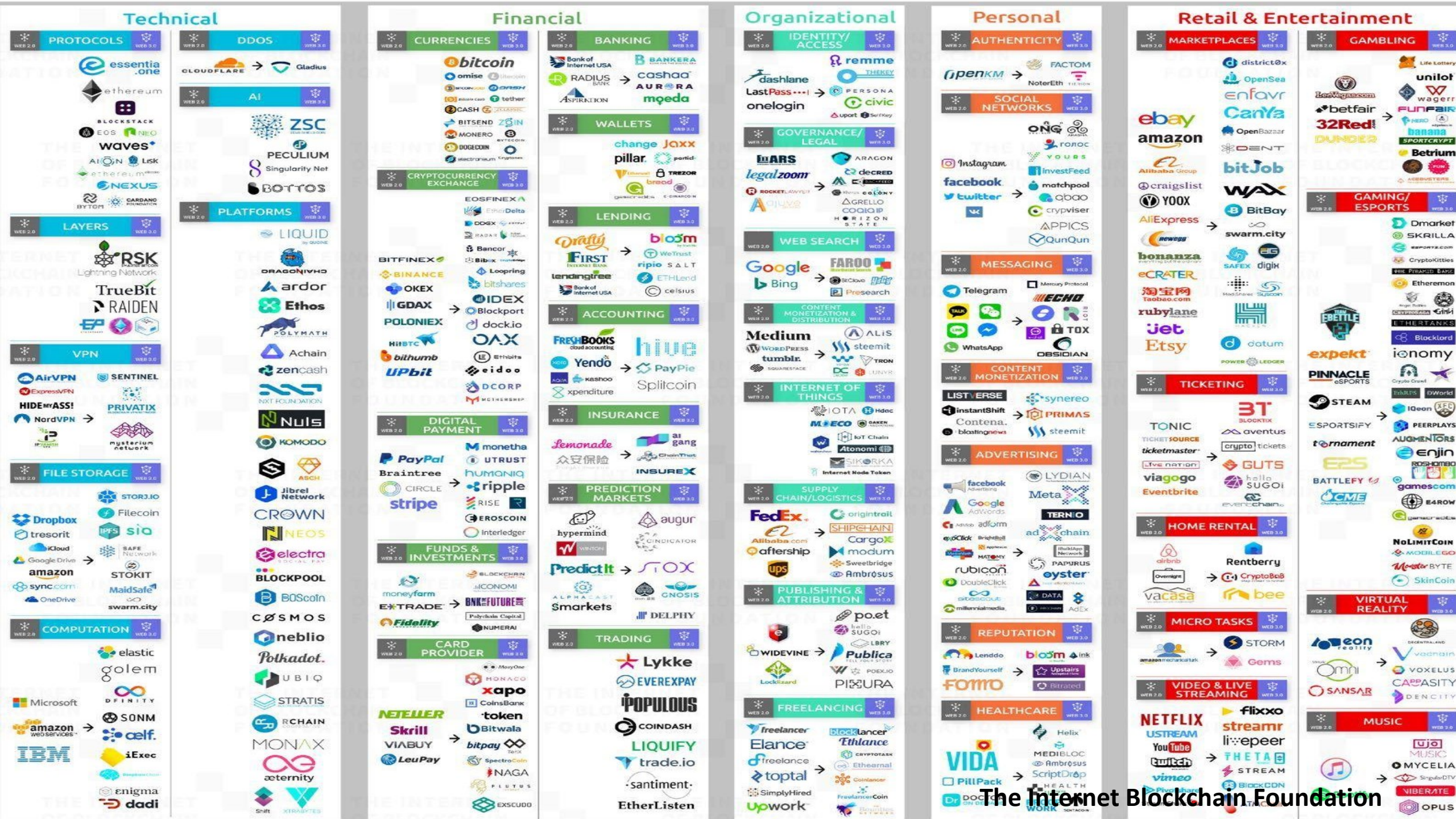
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The Internet Blockchain Foundation

Blockchain Value Chain

Value Exchange
Network Infrastructure & APIs
Document Storage & Delivery
Digital Content
App Development
Marketplaces
Smart Contracts

Security
Digital Identity Management
Authentication & Authorization
Compliance/KYC/AML
Governance & Risk Management
Auditing

Financial
Currency Exchange & Remittances
Syndicated Loans
Private Shares
Treasury Repos
Loyalty Points
Interbank Payments
P2P Transfers
Insurance

Asset Registries
Gold & Diamonds
Property Titles/Land Records
Data Storage
Supply Chain Management
Logistics
IOT

Sector-specific Applications

- **Remittances:** P2P; Exchanges
- **Interbank transfers:** Use crypto assets
- **Interbank Bank settlement:** Real Time Gross Settlement
- **Digital Fiat Currencies**: Central Bank Issued
- **Telecommunications:** OSS/BSS; clearing houses; contracts; spam
- **IoT:** Connected devices
- **Smartcities**: Integration
- **Energy:** Smartcontract negotiations
- **Logistics:** Shipping
- **Public Assets:** Land titles
- **Food Tracing:** Pathogens, food fraud
- **Identity:** Validation; self-sovreign
- **Education**: Certificates
- **Health**: Records; medicine; authentication
- **Intellectual Property Rights:** Music Royalties

Finance-related

DLT/BC DEVELOPMENT STRATEGIES & METHODOLOGIES

Blockchain Development Solutions

Approach	How its done	Examples
IT Services	Build on request	Consensys
Blockchain	Develop using tools provided by the BC itself	Ethereum, Bitcoin
Development Platforms	Tools for IT professionals	Hyperledger, Tendermint
Vertical Solutions	Industry-specific	Chain, R3
Special APIs & Overlays	DIY Building blocks	Blockstack, Open Assets

Blockchain As A Service (BaaS)

- Setting up an environment to test and research blockchain requires an ecosystem with multiple systems to be able to develop research and test.
- Cloud industry players providing some level of BaaS
- **Pros:**
  - Developers will have single-click cloud-based blockchain developer environment, that will allow for rapid development of smart contracts
  - Users benefit from not having to face the problem of configuring and setting up a working blockchain.
  - No major hardware investments, pay as you go
- **Examples:**
  - Microsoft partnered with ConsenSys to offer Ethereum Baas on Microsoft Azure
  - IBM (BueMix) has partnered with Hyperledger to offer BaaS to its customers
  - Amazon offering BaaS as ‘Templates’ using popular frameworks, Ethereum & Hyperledger Fabric
    - Each template offers distributed consensus algorithms, smart contract functionality, and access control features.

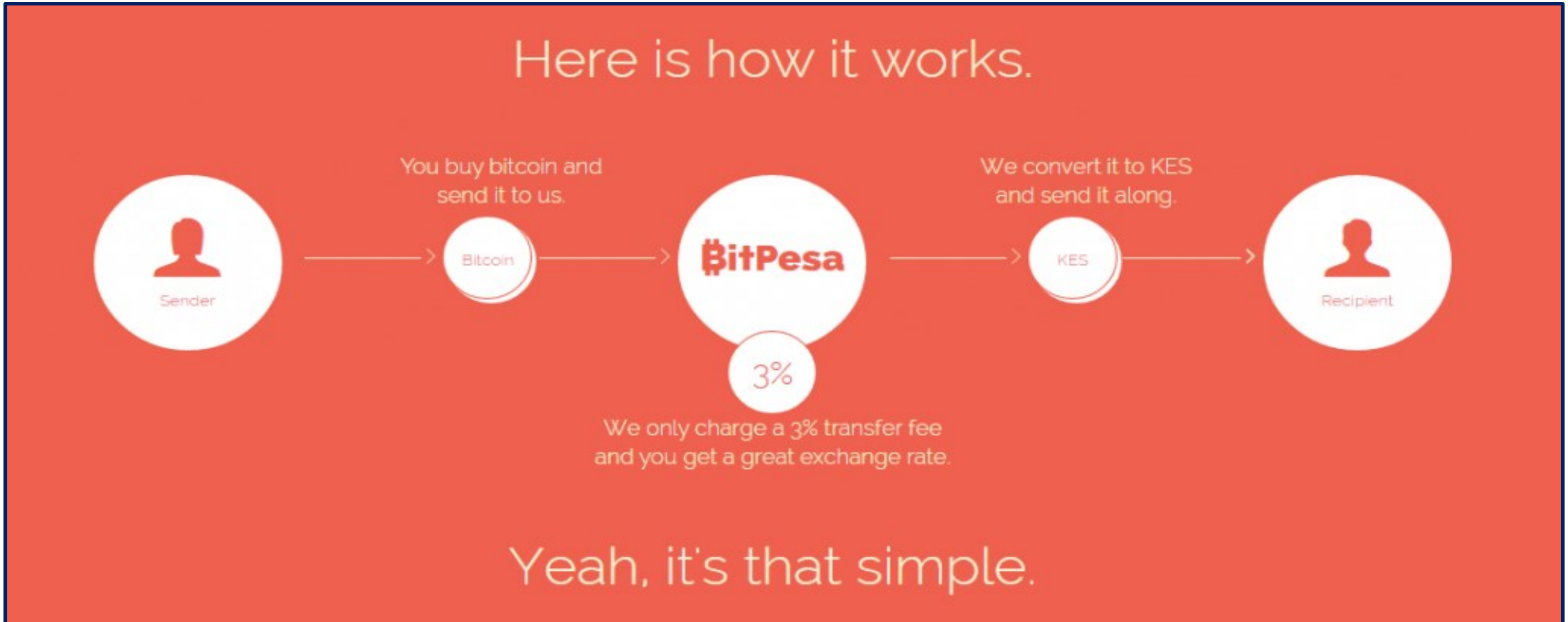
‘DIY Blockchain’

- Work directly with the given blockchain tools and stack
  - eg Bitcoin, Ethereum
  - Able to create ambitious end-to-end, peer-to-peer applications such as OpenBazaar (on Bitcoin), or Ujo Music (on Ethereum).
- **Pros**:
  - Working directly with the blockchain provides a good degree of innovation eg building dApps.
- **Cons**:
  - Assembly is required’
  - Need significant expertise as many of the technologies are still developing and evolving.

FINANCE-RELATED

Remittances

- Send value via DLT ‘rails’ versus banks, SWIFT, Western Union, etc.



Innovations In Stock Markets

- Tallin Stock Exchange (Estonia)
  - Using BC run proxy voting that allowed investors to vote online during investor meetings or transfer their voting rights to a proxy
- NASDAQ (USA)
  - DLT system to cover margin calls through a DLT network among collateral givers, takers and intermediaries.
    - Now no need to deposit funds or securities to cover potential losses
  - Nasdaq developed the PoC for the distributed network, while ABN AMRO Clearing and EuroCCP created a front-end interface and managed integration into the services.
- Singapore Stock Exchange
  - Developing a **Delivery versus payment** mechanism that enables institutions to transact and settle securities – tokenized digitally – across different blockchain platforms while eliminating securities risks and improving operational efficiency.
  - Will deploy blockchain technology to efficiently link up funds transfer and securities transfer, eliminating both buyers' and sellers' risk in the DvP process."

Improving Trade Finance

- US$9tn market for trade finance
- In many markets, small suppliers have to wait 60-90 days to be paid for delivered goods
  - Due to paper-heavy transactions prone to human error and delays along the supply chain.
  - Hinders their access to working capital.
- New **IBM trade platform** uses DLT to:
  - Better tracking of goods as they're shipped and delivered
  - Encrypt documentation more securely
  - Make it easier for all to authenticate a transaction more quickly, thereby reducing shipment and financial transaction times.
- Some European banks have set up the **we.trade DLT platform** to more seamlessly facilitate and finance cross-border transactions
  - Barclays executed the first live trade finance DLT transaction in 2018
    - Letter of credit between Irish farming cooperative and buyers in Seychelles for cheese & Butter
    - Whole administrative process, and settlement reduced from days to **5 hours**

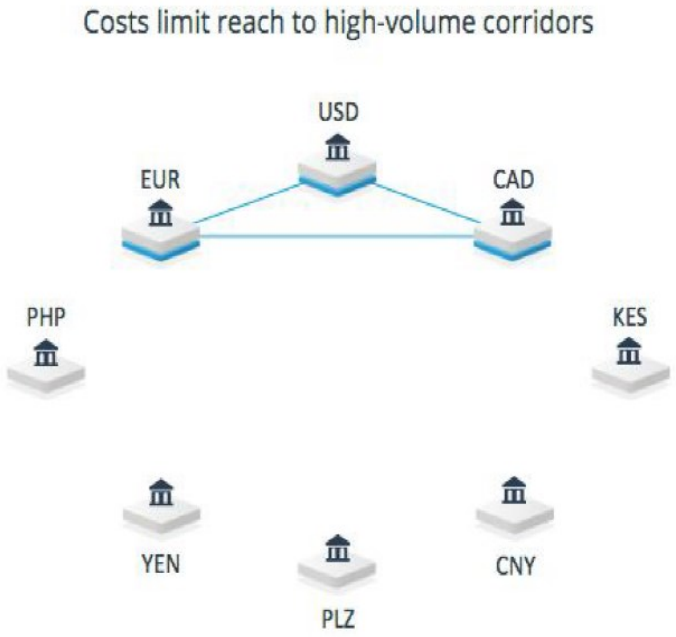
Financial Markets

- R3 and a range of financial institutions have developed a permissioned platform called **Corda**
- Adapted for financial markets applications
  - Transactions of currency and securities.
- Provides for settlement finality and legal recourse (via contracts and the courts)
- May help overcome errors, delays, or risks in having documentation related to financial transactions spread across multiple systems and organizations.

Cross-border Payments

Problem:

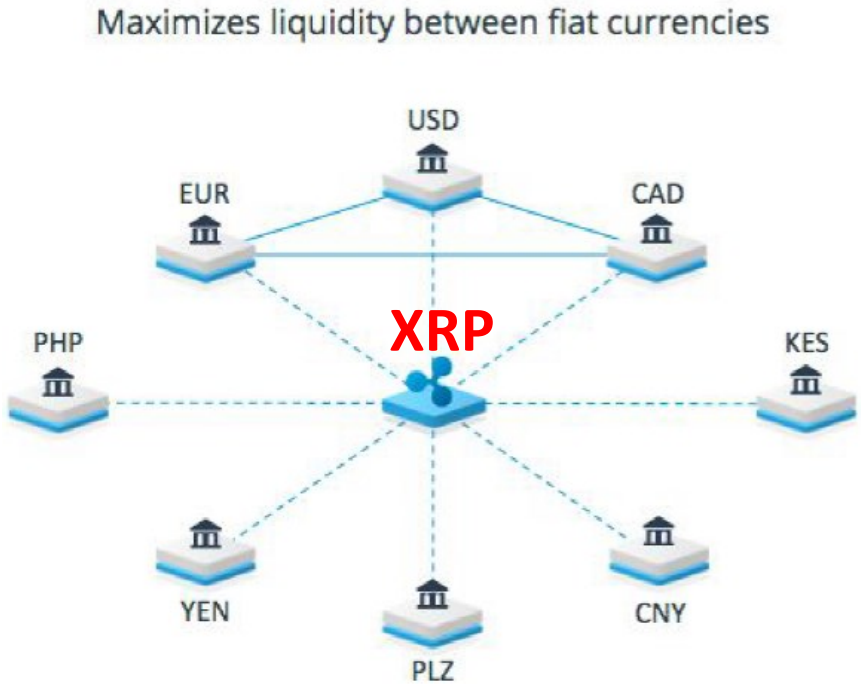
- **Few high-volume currency pairs** beyond USD, UKP, Euro, CAD
- **Need liquidity** to easily convert between the originating and destination currencies.
- Historically, financial institutions accessed liquidity through pre-funding accounts in destination country.
- **Opportunity costs** of scarce capital sitting idle in accounts, compliance & account maintenance
- Model is **not viable** for low-volume currency pairs.



Solution:

Use A 'Digital Asset' Instead

ripple **XRP**



SETTLEMENT

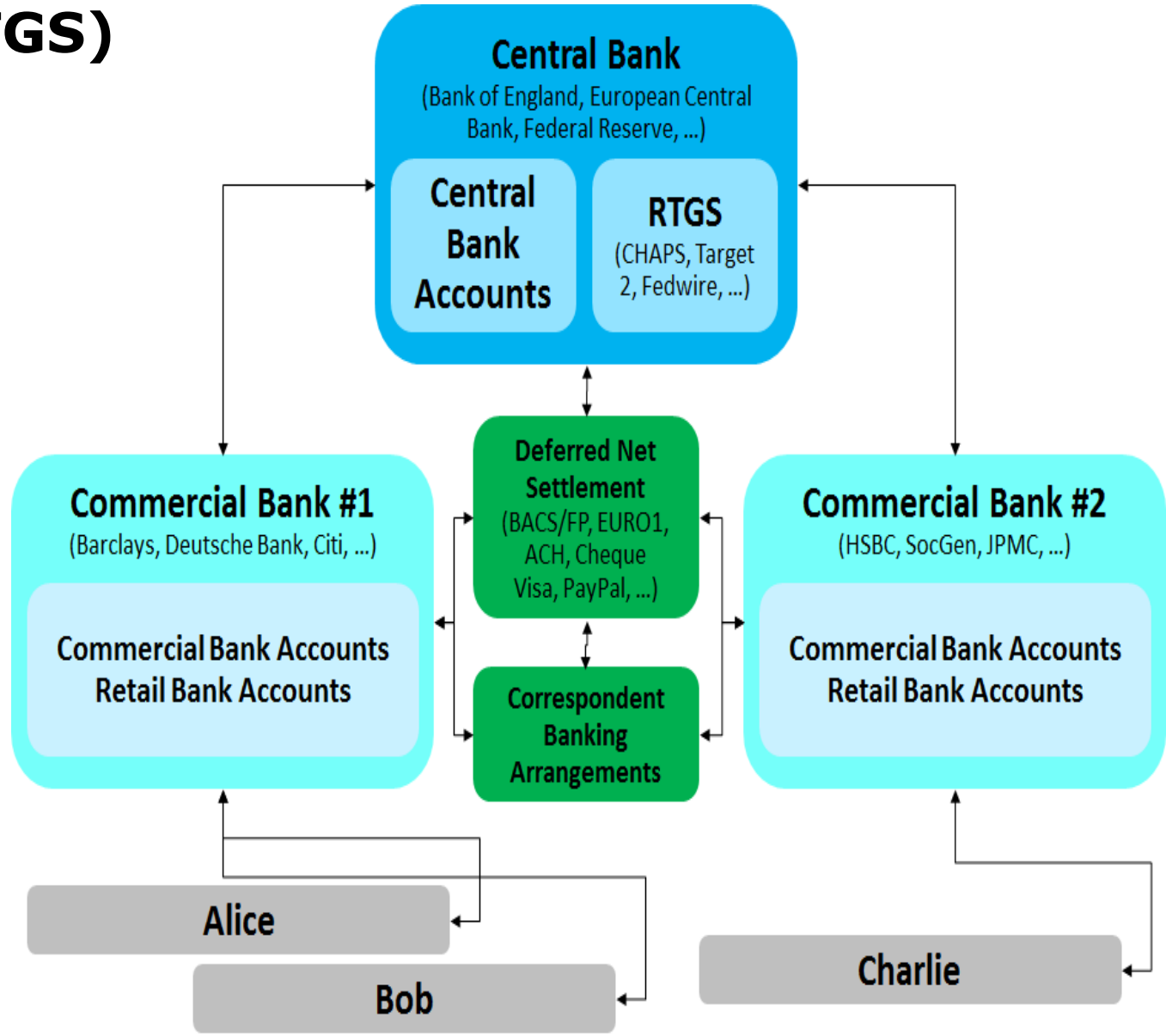
Real Time Gross Settlement (RTGS)

- Housed at Central Bank
- Where **banks pay one another**

- RTGS Requires:
  - Collateral (able to settle)
  - High availability
  - Settlement **finality** (non-reversal)

- Project Jasper
  - Bank of Canada

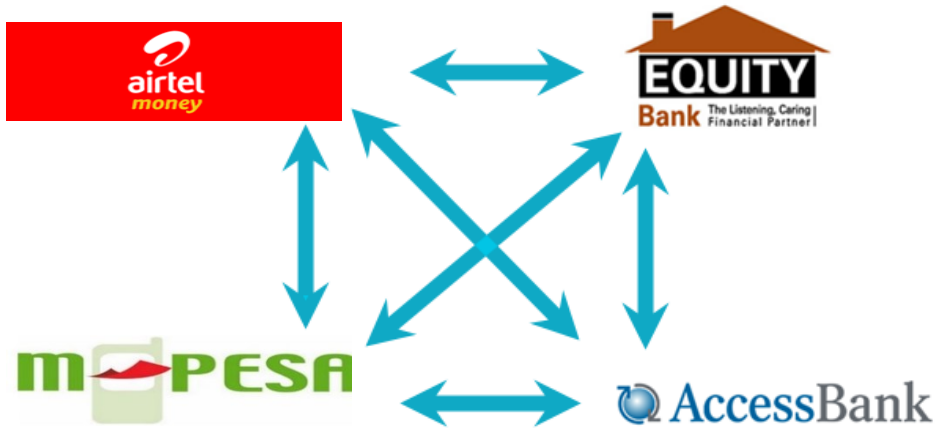
- Project Ubin
  - Monetary Authority of Singapore



Bank of Canada ‘Jasper’ DLT Trial for Interbank Settlement

Principle	LVTS	Phase 1 (Ethereum)	Phase 2 (Corda)
Credit & Liquidity risk	Satisfied	DDR backed 1:1 with cash collateral on LVTS	
Settlement **Finality**	Satisfied	**Probabilistic** finality	Satisfied (requires further investigation)
Operational Risk – resilience	Central system engineered for HA and DR. Minimal participant work.	Tolerant to partial failure – rely on network, not individual nodes. High redundancy.	**Requires engineering** for High Availability and Disaster Recovery at central node *and* participant’s nodes
Operational Risk – **scalability**	high throughput	Ethereum limited to about 12 tx/sec	No inherent limitation. Central functions can cause bottlenecks (e.g. notary)

‘Mobile Money’ Interoperability Settlement



‘Current’ Clearing & Settlement Style

- Risk
- Fees
- Etc.

Potential C&S Via Blockchain

- Real-time liquidity check
- Cheaper
- Faster

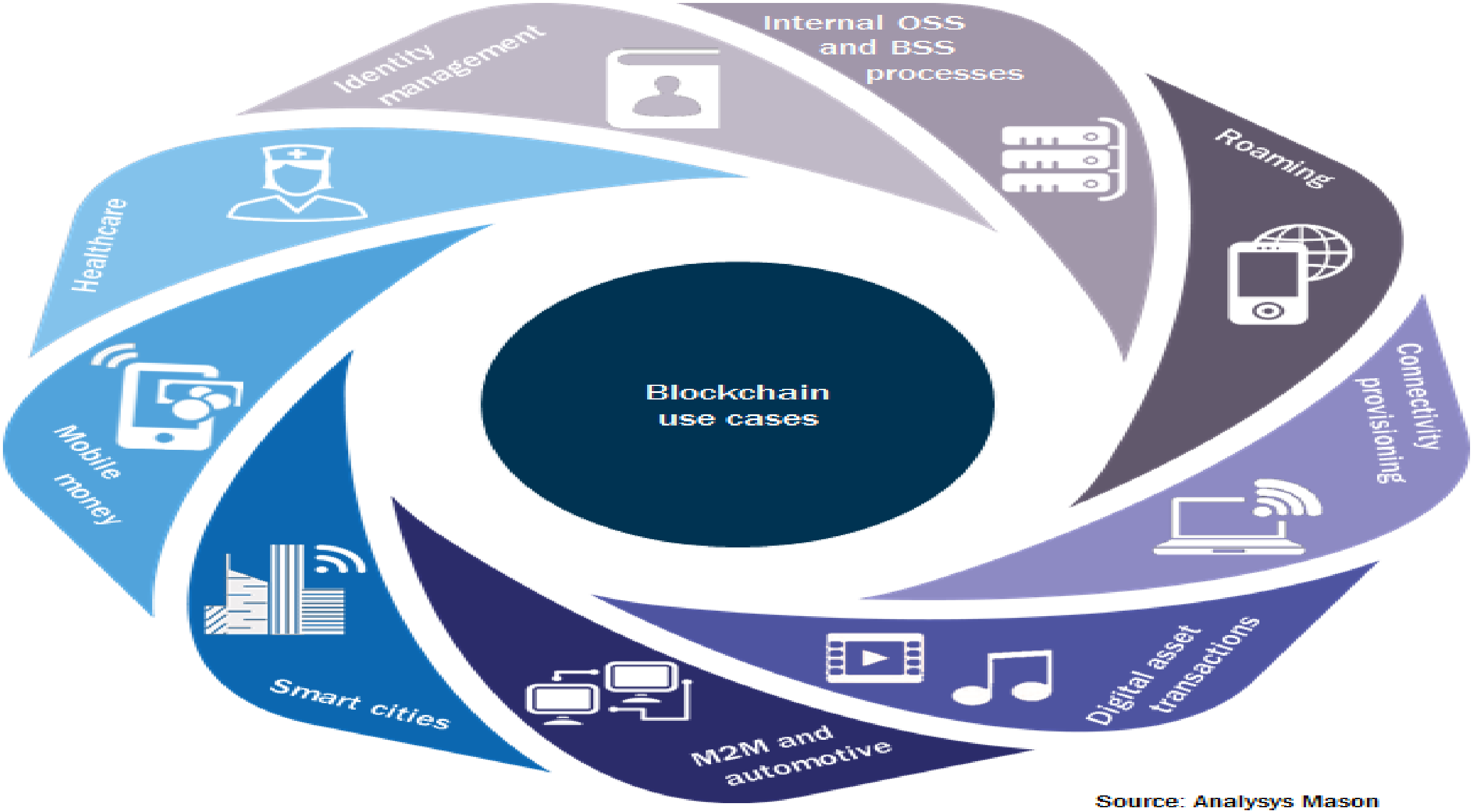
Digital Fiat Currencies/CBDC

- Issued by a central bank (fiat money)
  - **Plans:** Thailand (August 2018); India; Russia; UAE/Saudi; East Caribbean etc

- Features:
  - Infrastructure & a payment system and is part of the base money supply
  - Reduce single-point of failure in some parts of the payment system
  - Available to consumers (like cash)
  - Increase non-bank access to settlement services in central money
  - No need for conversion to e-money (costly) = **already** digital
  - **May** affect commercial bank viability in crises (Bank of England report)

- AML/KYC benefits: can 'track use'
  - Digital Dollar (Barbados)
  - Counters de-risking
  - Could act as a 'smart money': prevent usage (eg tax liability, underage)

TELECOMS-RELATED



Source: Analysys Mason

Drivers

- Increasing Support for OSS/BSS Processes
- Rising Security Concerns
- Need for efficiencies, streamline internal processes
- Movement from pure telco to technology enablers, solution providers
- IoT & Smart cities
- Lower ARPU
- Fraud Management
- Regulatory reporting
- 5G technology
- Fraud Management
- eKYC/AML

The DLT in telecom market size is expected to grow from $46.6 million in 2018 to $993.8 million by 2023, at a Compound Annual Growth Rate of 84.4%

Internal processes

- For Operations Support System/Business Support System (OSS and BSS) processes
- Billing, eSIM provisioning and number portability databases
- Use hybrid blockchains, which have both public and private (intra-firm) components.

Customer Contracts

- **July 2018:** NTT unveils new contract agreements system based on DLT
  - Store contracts without allowing for documents to be tampered with

- New DLTs being developed that will offer ‘marketplace offerings’ for services
  - Customers can provide needs (eg price, data) and the DLT will broadcast needs to telcos
  - Telcos will make offer
  - Use smart contracts to finalize contracts, automate payments

Roaming

- Database for subscriber authentication during roaming
  - Faster identification of visiting subscribers
  - Prevention of fraudulent traffic and claims reduction

- Use hybrid blockchains with permissioned and public components
  - Facilitate the implementation of databases that usually require costly integrations and trusted access settings.

International Carrier Blockchain Initiatives

- Carrier Blockchain Study Group (CBSG) formed Sep 2017
- Group of ASEAN and South Asian global telecommunications carriers created global consortium to jointly explore how they can work together on building a next-generation cross-carrier blockchain platform and ecosystems
- Provide the telecom industry and public a secured global digital payment system, personal identification, clearing and settlement, IoT applications and other services through the DLT.
- **August 2018 Members:** Philippine Long Distance and Telephone Co. (PLDT); Axiata Group Berhad (Axiata), PT. Telekomunikasi Indonesia International (Telin) of Indonesia; Viettel Telecom Corporation (Viettel) of Vietnam; Zain Group (Zain) of Kuwait and Turkcell of Turkey.

Inter-carrier settlement of wholesale international services

- Elimination of clearing houses could lead to significant cost reduction.
- Colt, PCCW Global, BT, HGC Global Communications, Telefonica and Telstra.
  - Trial using DLT to automate the traditionally labour-intensive and costly inter-carrier settlement of wholesale international services
  - Developed using technology from Clear
  - Initial tests were for settlement of wholesale voice minutes using historical data.
  - **Now**: Using live data feeds into the blockchain system
    - Allows data traffic to be automatically verified and settled between carriers.
- **Korea Telecom** using DLT to automatically settle roaming charges in real-time.
  - Previously took a month
  - Uses smart contracts

Metro Ethernet Forum Bandwith PoC

- MEF Lifecycle Service Orchestration PoC Via DLT
  - CBCcom, PCCW Global, Sparkle and Tata Communications
- Bandwidth-on-Demand PoC will demonstrate the viability of a synchronized and decentralized global supply chain for inter-carrier bandwidth-on-demand services.
- Carriers can automatically discover, quote, deliver and settle multi-product, multi-party services, eliminating reliance on a centralized intermediating party.

Spam

- India's telecommunications regulator ordered operators to use blockchain to help curb spam calls
  - TRAI will record all the consents and approvals by customers related to accepting telemarketing calls and then create a massive database of this list.
  - List will be created of approval telemarketers, who are eligible to make such calls.
  - A user’s consent will have to be explicitly recorded on the blockchain to receive marketing calls. The users should also be able to revoke their consent anytime they want.
  - Since blockchain is a distributed ledger, being updated in real-time, no party can deny the records.

- Tech Mahindra & Microsoft to develop a DLT spam ecosystem
  - Will bring all relevant parties onto the same ecosystem, including all telecom operators, legal authorities, users, and even telemarketers

Internet of Things & Smart cities

Internet of Things (IoT)

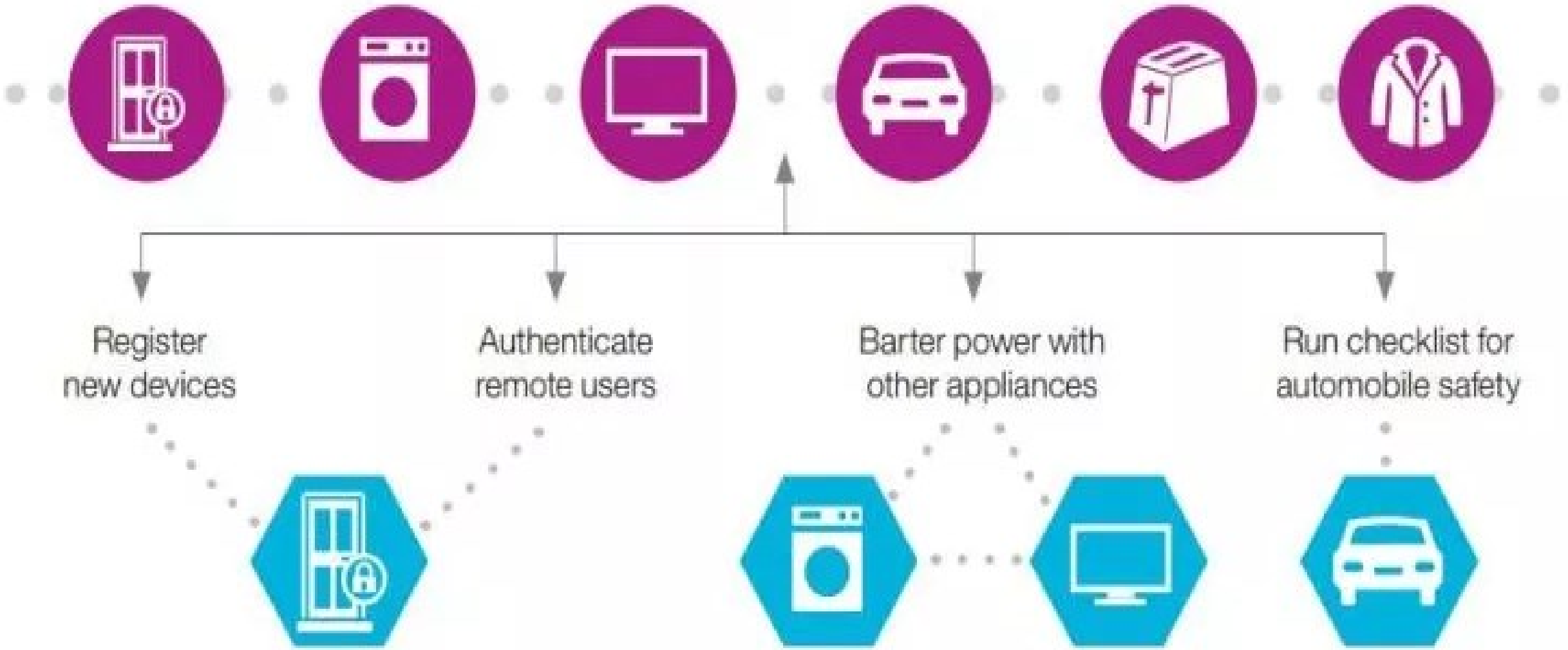
- **Then**:
  - M2M (connect devices)

- **Now**:
  - IoT harmonizes our interactions with devices
  - Everyday objects go online
  - Information sharing and interoperability
  - Ubiquitous connectivity and automation
  - Suited for 5G

Total number of connected IoT sensors and devices is expected to leap from 21 billion in 2018 to 50 billion by 2022 - Juniper Research.

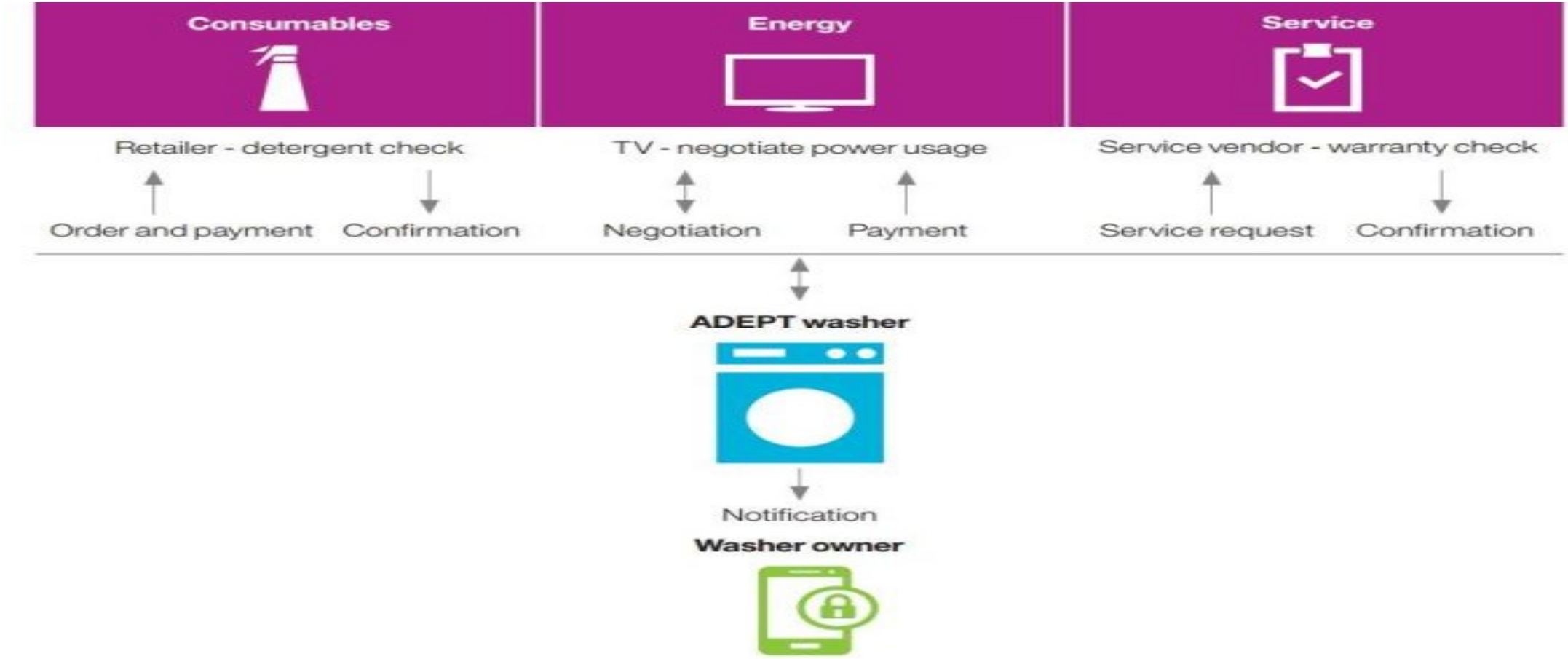
DLT Use in IoT

- **Smart contracts**
  - Devices would auto-execute smart contracts according to set parameters
  - Automate payments
- **Security**
  - Help make the security of web connected devices more scalable.
  - The verification and validation baked into blockchain could enable service providers to stop unauthorized devices from connecting to their network.
- **Big Data**
  - Allow predicative AI and ML algorithms to predict behaviours in ‘Smartcities’
- **Tracking**
  - IBM launched an IoT-to-blockchain service as an add-on to its existing IoT Connection Service. It enables IoT devices, such as RFID location chips, barcode scans or device-reported data, to be transmitted to a permissioned blockchain on IBM's cloud service.

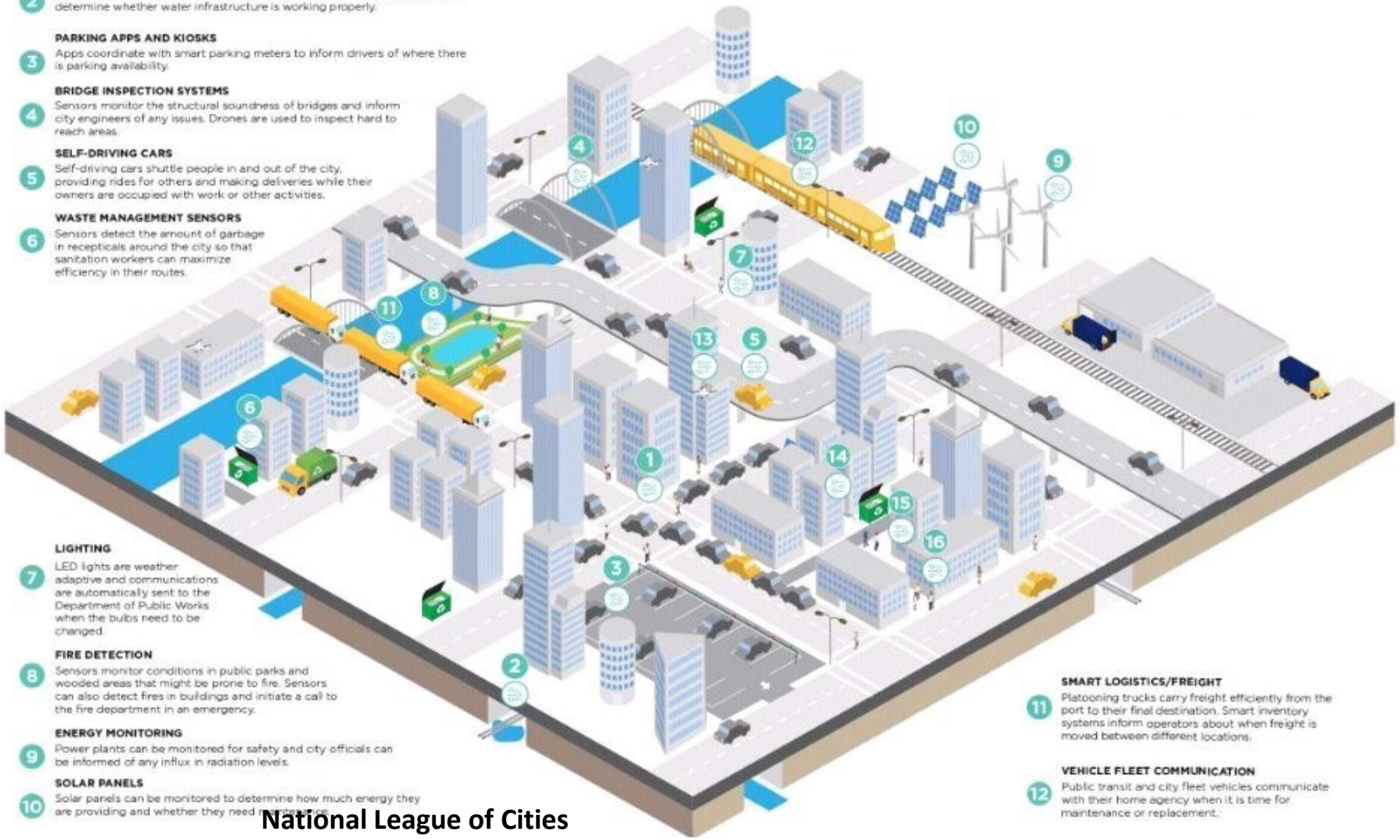

Register
new devices
Authenticate
remote users
Barter power with
other appliances
Run checklist for
automobile safety

ADEPT: Autonomous Decentralized Peer-to-Peer Telemetry

- IBM & Samsung's developing devices that comply with ADEPT standard



Smart Cities Connected via IoT & DLT



1 TRANSPORTATION CONGESTION SENSORS
Smart transportation systems use sensors to detect congestion and bottlenecks in traffic patterns. They also rely on cameras to enforce speed and traffic infractions. In doing so, these tools gather real time information that can be used by city DOTs to make mobility networks safer and more efficient.

2 WATER AND WASTEWATER MONITORING
Monitoring devices can detect leaks as well as changes in water pressure to determine whether water infrastructure is working properly.

3 PARKING APPS AND KIOSKS
Apps coordinate with smart parking meters to inform drivers of where there is parking availability.

4 BRIDGE INSPECTION SYSTEMS
Sensors monitor the structural soundness of bridges and inform city engineers of any issues. Drones are used to inspect hard to reach areas.

5 SELF-DRIVING CARS
Self-driving cars shuttle people in and out of the city, providing rides for others and making deliveries while their owners are occupied with work or other activities.

6 WASTE MANAGEMENT SENSORS
Sensors detect the amount of garbage in recepticals around the city so that sanitation workers can maximize efficiency in their routes.

7 LIGHTING
LED lights are weather adaptive and communications are automatically sent to the Department of Public Works when the bulbs need to be changed.

8 FIRE DETECTION
Sensors monitor conditions in public parks and wooded areas that might be prone to fire. Sensors can also detect fires in buildings and initiate a call to the fire department in an emergency.

9 ENERGY MONITORING
Power plants can be monitored for safety and city officials can be informed of any influx in radiation levels.

10 SOLAR PANELS
Solar panels can be monitored to determine how much energy they are providing and whether they need maintenance.

11 SMART LOGISTICS/FREIGHT
Platooning trucks carry freight efficiently from the port to their final destination. Smart inventory systems inform operators about when freight is moved between different locations.

12 VEHICLE FLEET COMMUNICATION
Public transit and city fleet vehicles communicate with their home agency when it is time for maintenance or replacement.

13 DRONES
Drones can be used for law enforcement and firefighting, as rural ambulances, for infrastructure inspections, and for environmental monitoring. Commercial uses include precision farming, aerial photography, and in the near future, package delivery.

14 SURVEILLANCE CAMERAS
Cameras ensure security by monitoring activity in areas that are not frequented by public safety officers. Areas that are not open to public access can be monitored to keep unauthorized personnel out.

15 BODY CAMERAS
Public safety officers can wear body cameras that capture footage of interactions between themselves and city residents to ensure safety for both parties.

16 WEARABLE DECTECTION
Cities can build in smartphone and wearable detection sensors so that people can be an active part of the internet ecosystem, communicating with the city, and with each other.

17 BROADBAND INFRASTRUCTURE
A reliable internet ecosystem is the glue that holds the internet of things together.

National League of Cities

Smart Cities

- Kinsey Analysts predict 600 smart cities by 2020
  - By 2015 'almost 60%of the world's GDP will be produced in them.'
- Traffic, public services and document circulation are fully automated
  - 5G is optimized for IoT & Smart cities
- Integrates big data and the IoT to optimize the efficiency of urban processes and services and connect to residents
  - Public Wi-Fi authentication and payments could be made more cost-effective through autonomous blockchain-based transactions between devices and access points
  - Light sensors that save electricity and road surveillance costs.
  - Smart Bridges eg New York Tapenzee Bridge

ENERGY PROVISION

DLT in wholesale power transactions streamlines a complex process

Prosumers generate power beyond their needs and feed it into the grid through a blockchain-enabled meter

The flow of electricity is automatically encoded into the blockchain

Algorithms match buyers and sellers in real time based on preferences and encode smart contracts into the blockchain

Smart contracts execute when electricity is delivered, transferring payment in cryptocurrency from buyer to seller

Other nodes in the network verify the transactions

Source: Lux Research, Inc.

LOGISTICS

Logistics

- Maersk and IBM testing a DLT for more efficient tracking of goods in shipping
  - Also facilitating links to trade finance solutions and freight insurance.

- SAP partnered with IBM for IoT and blockchain automating a pharmaceutical supply chain for both tracking and reporting purposes.
  - Tracks and manages pharma supply chains using smart contract rules.
  - Eg temperature control

Company	Focus	What's the Problem?	What's the Solution?
Blockfreight	Complete Shipping Blockchain	Fragmented IT systems with limited interoperability	A complete blockchain for shipping, with built-in cryptocurrency token
Wave BL	Bill of Lading (BoL)	BoL serves as receipt, contract of carriage and tittle of goods. Must be negotiable (also anonymously). Currently mainly analogue	Blockchain application allowing for sharing of BoL data, and anonymous trading of BoL
Mærsk; IBM	Documentation Pipeline	Over 30 different documents are needed to process an export consignment across multiple supply chain steps.	Shared Blockchain based repository (i) making the needed documents only visible to the parties required to see them, and (ii) tracking and time stamping changes in the chain of custody of a shipment.
Port of Rotterdam; ABN AMRO; Royal Flora Holland; TU Delft; and more	Trade Finance	Cumbersome Letter of credit process involving banks in source and destination countries.	Self-executing smart contracts triggering payment on proof of delivery
SKUchain	Trade Finance	Cash flow issues related to the current trade finance process.	Smart contracts. So called BRACKETS, i.e. Blockchain based release of funds, that are conditionally key-signed, and triggered by signals

Precious Material Tracking

- **Trustchain:** New global jewelry consortium
  - Using DLT to create an indelible tracking system for the diamond and gold in six types of popular rings.
  - TrustChain process requires companies at every stage of the process, including miners and shippers, to create a shared record on a blockchain ledger.
  - Involves precious metal suppliers, refiners and manufacturers working using IBM blockchain tools to allow anyone in the supply chain—and eventually the customer—to verify the provenance of the rings.
  - No more certificates needed

- **Rare Carat Report** tool
  - Uses DLT & AI to let consumers intelligently evaluate diamonds for sale anywhere in the world, both online and offline.

ASSET REGISTERS

Public Asset Registries

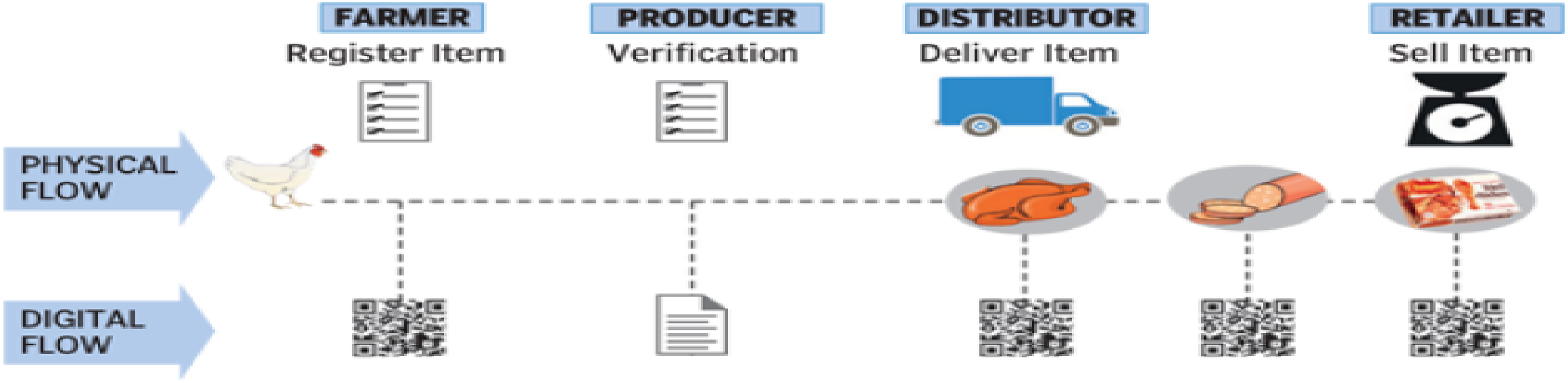
- **Problem:**
  - Many countries have inaccurate land/property registries
  - Often data is changed via government insiders
  - Leads to property theft, squatting, inability to get credit based on assets

- Republic of Georgia
  - Testing the use of DLT to provide more transparent access to reliable data on **land titles**
  - Could also apply to other types of asset registries.

- Ghana
  - Implementing **land registry** application in 28 communities
  - Enables tamper-resistant property ownerships.
  - Help to counter the perception that the country has corrupt practices

FOOD & AGRICULTURAL VALUE CHAIN

DLTs To Track Food Sources



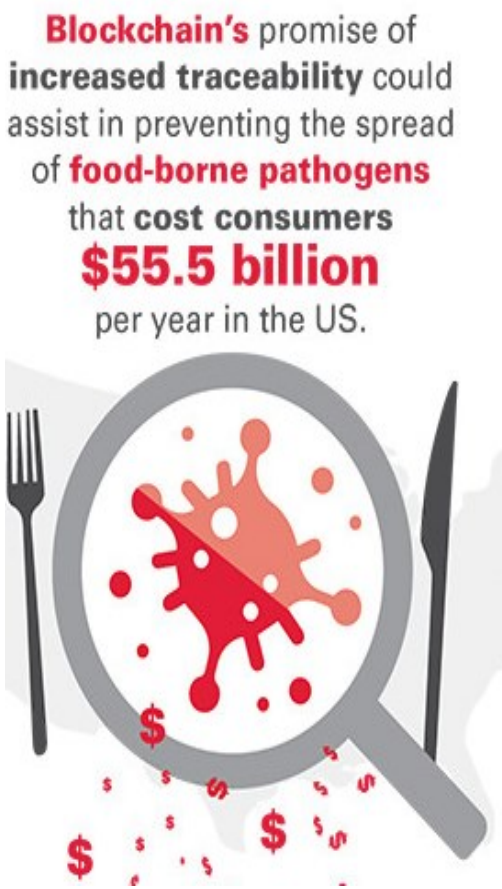
CONSUMER

Back-track item supply chain from internet

Q: "Is this organic, non-GMO?"

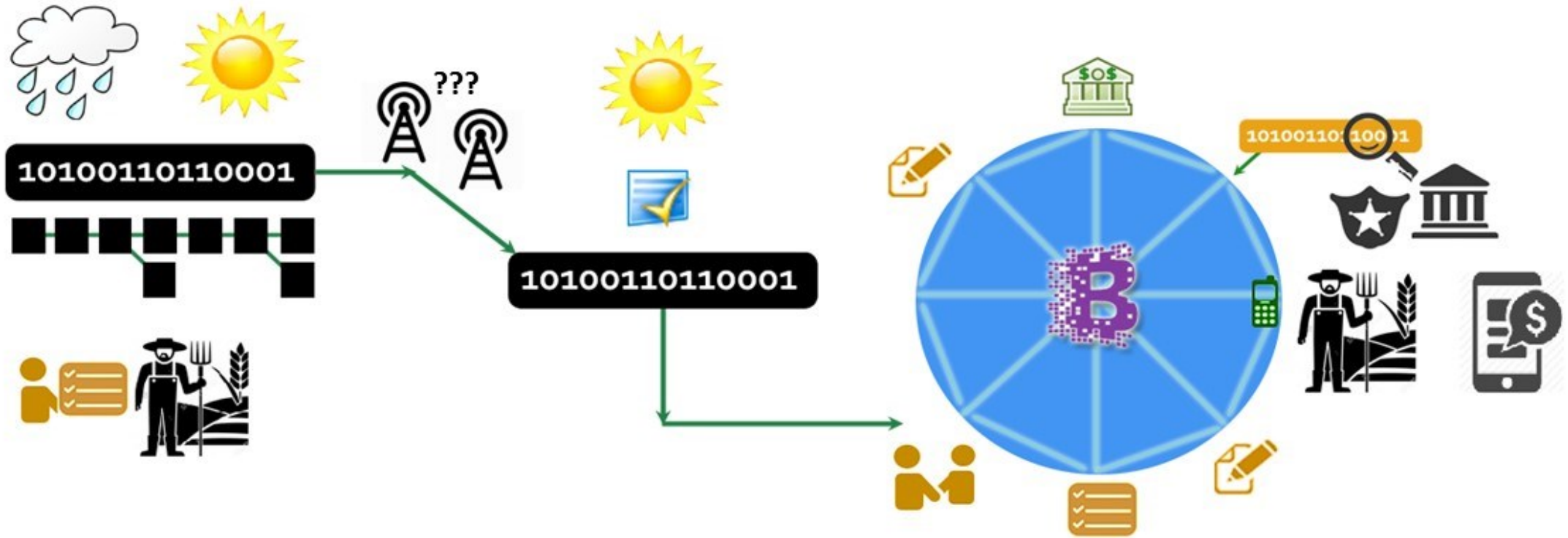
Food Source/Labelling

- Sourcing, tracing
  - Prevent fake food and diseases
- Provenance and Coop
  - Testing the use of DLT to trace the origin of tuna from dock to store.
- Walmart & IBM
  - Testing the use of DLT to trace the origin of food (like pork or greens) from source to store
  - Reduces the time needed to determine source of contamination.



Sources: Rockefeller Foundation, Ohio State University, Michigan State University, Gro Intelligence

Micro-insurance for small farmers



1

Smart Contract

'If drought, *then* pay farmer'

2

Drought!

Triggers SC terms

3

Payout To Farmer

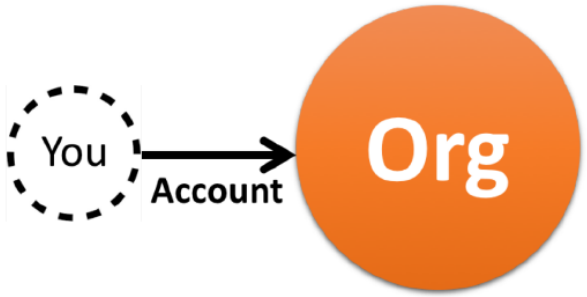
$ Notification to farmer phone

Credit mobile/bank account

IDENTITY-RELATED

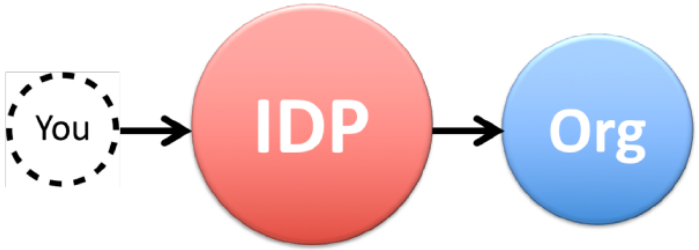
Three Models of ID Provision

Siloed (Centralized) Identity



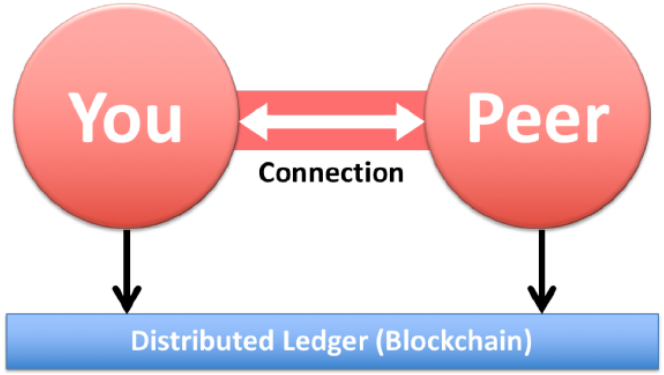
Government/Business

IDP (Federated) Identity



Facebook, LinkedIn Credentials

Self-Sovereign Identity (SSI)



Identification ‘Process’

- **My Claim**: I’m Leon Perlman
- **My Proof:** ‘Here’s Photocopy of my passport bio page’
- **My Attestation:** ‘My passport issued by the government authority’

ID Problems

- **'Proofs'**
  - Usually **unstructured data**, taking the form of images and photocopies. This means that someone in the bank has to manually read and scan the documents to extract the relevant data to type into a system for storage and processing.
  - When the **data changes** in real life (such as a change of address, or a change in a company's ownership structure), the customer obliged to tell the various financial service providers they have relationships with.
  - Some forms of proof (eg photocopies of original documents) can be **easily faked**, meaning extra steps to prove authenticity need to be taken, such as having photocopies notarised, leading to extra friction and expense.
- This results in expensive, time-consuming and troublesome processes that annoy everyone.

From Bitsonblocks

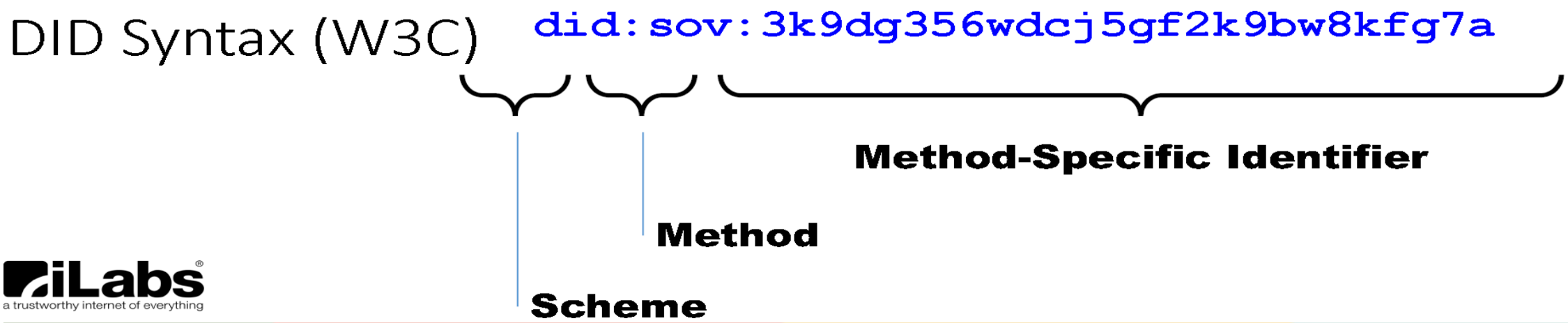
Identity

- A number of startups attempting to facilitate greater user control over the sharing and use of identity-related information, such as by banks or companies for know-your-customer (KYC) purposes.
  - Some focused on so-called "**self sovereign**" ID systems
  - Others using DLT-based applications to link together disparate ID information spread across multiple institutions.
  - **Examples**:
    - identity.com (uses zeroknowledge concepts)
    - Abt Associates assisted the Central Bank of Papua New Guinea to pilot a solar-powered device for issuing IDs to people in remote communities that linked to a DLT-based system.

Not all stakeholders convinced that DLT-based ID systems are yet suitable for personal data beyond niche circumstances.

Self Sovereign ID

- Lifetime portable identity for any person, organization, or thing that does not depend on any centralized authority and can never be taken away!
- The SSID is **Attested** (that its you) by an authority



PUBLIC KEY MODEL (Simplified)

bitsonblocks.net

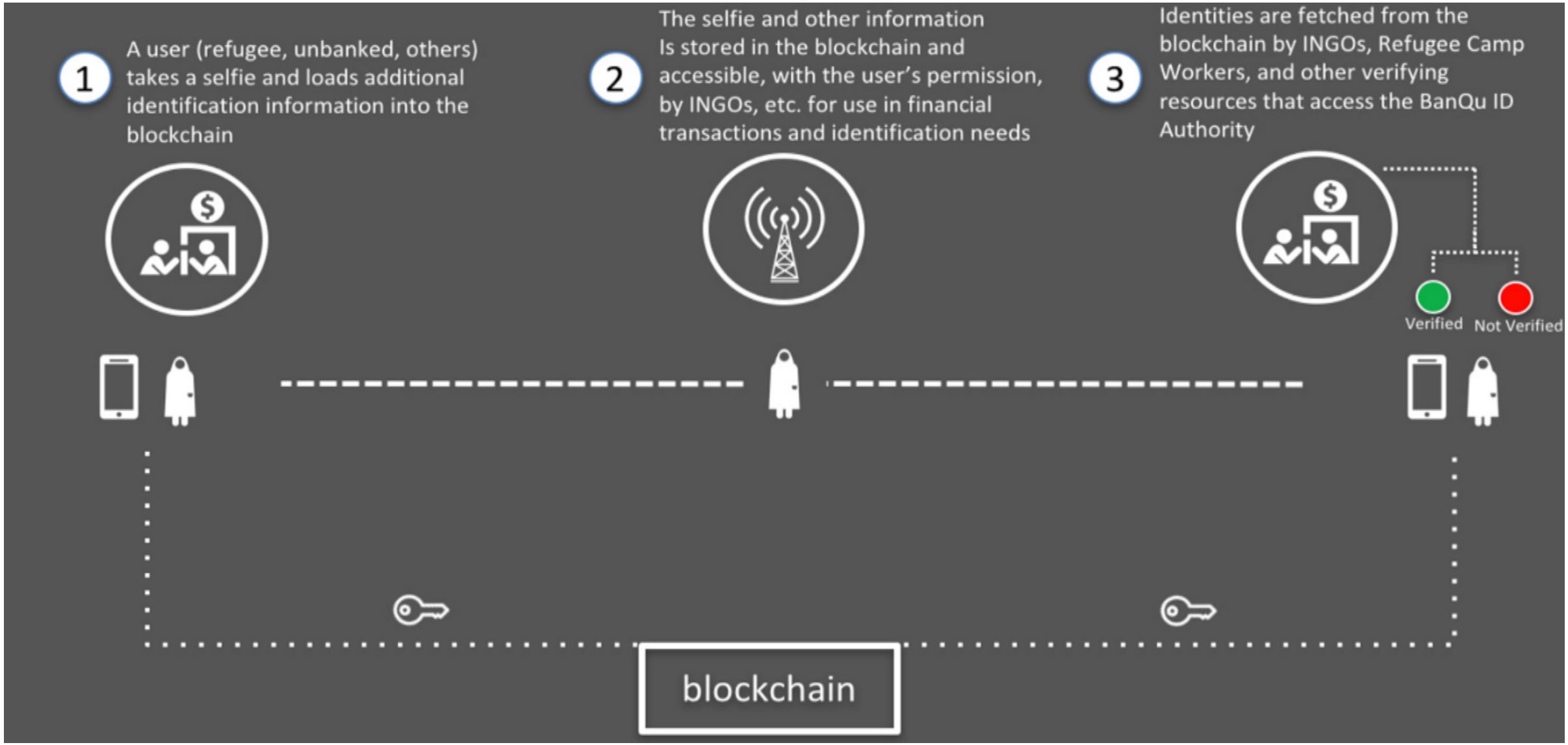
1. Create a keypair

Generate random numbers
Do some maths
Create keypair
→ Created:
<public>**7MFSz...tEwET**</public>
<private>**1pFodc...kno8SEf**</private>

2. Get attestations

3. Send attested information to requesters

Public Keys	Nicknames
a16Ei0m...TVJS6Z	Amy
3dHEf...iZ0PPe	Beth
7MFSz...tEwET	Claire


1
A user (refugee, unbanked, others) takes a selfie and loads additional identification information into the blockchain
2
The selfie and other information Is stored in the blockchain and accessible, with the user's permission, by INGOs, etc. for use in financial transactions and identification needs
3
Identities are fetched from the blockchain by INGOs, Refugee Camp Workers, and other verifying resources that access the BanQu ID Authority
Verified
Not Verified
blockchain

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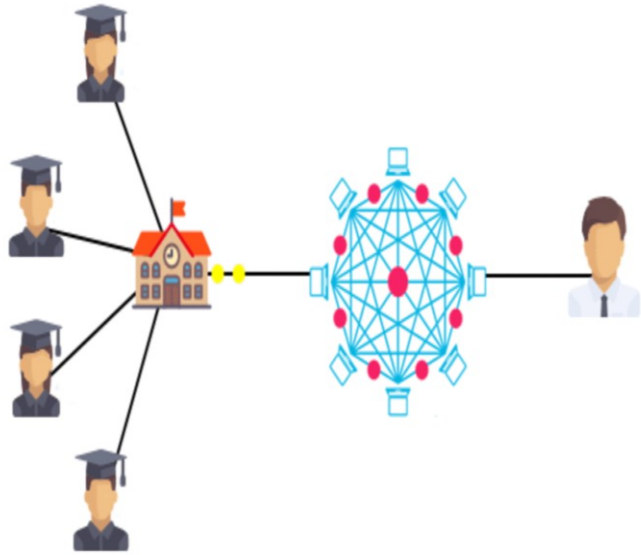
Citizenry

- **Estonia**
  - Launched 2012, following massive 2007 data breach
  - DLTs used in national health, judicial, legislative, security and commercial systems.
  - Mass adoption
  - Citizens can control their personal data
    - Control, view and, if necessary, challenge illegal access to their information
    - Can **check** medical specialists or civil servants who's accessed their medical card, insurance or driver's license.
    - Any official who accesses personal data without permission can be prosecuted.

HR & EDUCATION

Certificate Authentication

- Massive global problem of fake certificates; and from degree mills
- Also costly and slow to get transcripts of genuine degree
- New methodologies to ‘hash’ issued certificate on a blockchain that anyone can verify:
  - MIT developed open source system to hash certificates
  - Creating Digital version has its own digital identification like a QR code that a degree holder can share with anyone who wants to verify the degree
  - Once the degree is pushed on blockchain, the university will share with the student the unique identification that he or she can share with anyone who is interested to verify the degree



HEALTH-RELATED

Health Records

- **Estonia:**
  - Guardtime deploys a blockchain system to secure over 1 million patient records within Estonia's eHealth programme.
  - Access to and updates of patient records across multiple institutions and systems.
- **USA:**
  - AMCHART is a patient driven EHR on a hybrid public/private blockchain with AI for analytics

How to leverage **Blockchain Technology** across Pharma Value Chain?

Blockchain Technology can be used across pharmaceutical value chain to address many challenges.

CHALLENGES	SOLUTION
Drug Discovery • Potential breach of research Lab data and drug formula • To verify user identity to access confidential data	• Storage in distributed database • Authentication and Verification
Drug Development • Clinical trial results manipulation • Paper submissions of NDA in certain countries	• **Smart Contracts;** Data Storage and Transfer
Drug Manufacturing • Tampering of chemical formulas and improper mix of ingredients • Tracking the origins of potential compounds	• Serialisation + Blockchain
SCM and Distribution • To effectively track and trace drugs through complex drug supply chain • Third-party required to verify the fulfillment of contract terms	• Serialization + Blockchain • Blockchain enabled Supply Chain Management
Sales and Marketing • Receipt of payments for drugs sold as per contracts terms • Customer RFPs management	• Smart Contracts

Source: Beroe Analysis

Pfizer testing use of DLT to trace medicine from lab to the patient, prevent counterfeits.

INTELLECTUAL PROPERTY RIGHTS

Entertainment publishers and distributors in music, gaming, television or cinema connect to the blockchain platform

Business terms and conditions are agreed upon by the group

Terms and conditions are coded, reviewed and approved by the group

Consumers buy content online or from retail stores and generate millions of transactions daily

Royalty transactions are recorded on blockchain as per the terms and conditions

	Debit	Credit
Distributor	5.00	5.00
Publisher	15.00	15.00
Developer	3.00	3.00

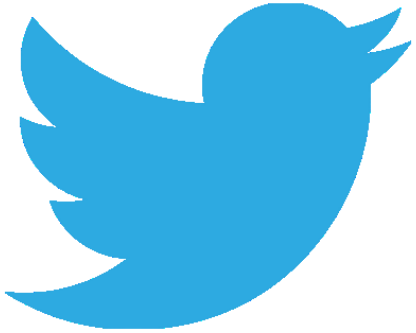
Distributors and publishers get instant access to applicable information and review data

Distributors and publishers review information, have better visibility to financial positions, and in the future, may more quickly make royalty payments to downstream participants like entertainers, graphic designers, game developers.

EY

Microsoft

Thank you!



@leonperlman