Blockchain Demystified: Ins, Outs and Tolling Applications

Presented By IBTTA YOUNG PROFESSIONALS

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Supported By IBTTA Blockchain Working Group

Mobility & Transportation in the AWS Cloud

Tracey Trexel, Tolling Leader

November 18, 2021

What the cloud brings to mobility and transportation

Migrate and free-up resources

Ensure security, compliance and resiliency

Adopt modern application development practices

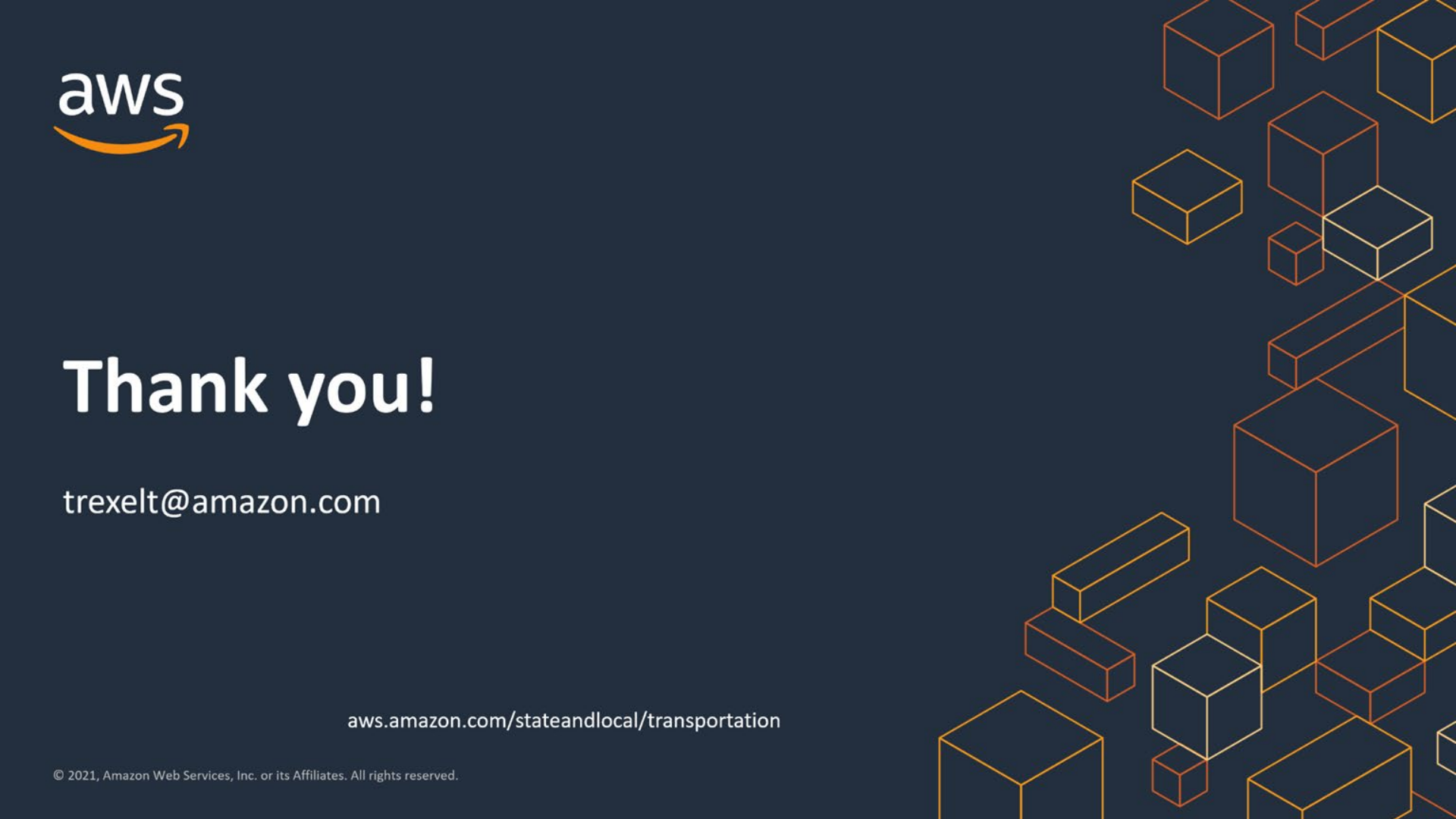
Gain faster, deeper insights with analytics

Organize for speed and agility

Bridge skills and experience gaps rapidly

aws

aws.amazon.com/stateandlocal/transportation



Thank you!

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Young Professionals Council (YPC)

- **Vision:** To drive the future of the International Bridge, Tunnel and Turnpike Association.
- **Mission:** To build a community that will enable young professionals and bridge the gap between generations of IBTTA innovators and integrators.
- **Steering Committee:** Helps drive direction
  - 3 Initiative Sub-Committees: Education, Networking, Community
  - 2 Administrative Sub-Committees: Finance, Communications
- **Join us!** https://ypcouncil.com/
- **Network** with us on Discord

Today's Logistics

- This meetup will last 60 minutes.
- You are currently muted, please remain on mute unless you are talking.
- **Two views** – **Upper right of your screen:** Gallery View & Speaker View.
  Speaker View is recommended during presentations.
- **View options –**top-middle of your screen. Choose "Side-by-side mode" and then move the vertical slider between the speaker and the presentation to the size of your liking.
- **Q&A:** Ask questions via chat for the moderator pick up. Be sure to ask **"panelists and attendees" in the chat box** so that all can benefit from your question.
- We are recording this meeting.

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Presentation Definitions

- **Block:** A uniquely identifiable container of information that is validated by each node, secured using cryptography, and then added to the end of the chain of the other blocks.
- **Blockchain:** Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network.
- **Consensus:** An opinion or position reached by a group as a whole. In blockchain context, this means to agree on a protocol that determines the “true” state of the ledger.
- **Cryptography:** Any of various mathematical techniques for encrypting and decrypting data to keep it private when transmitted or stored electronically. Blocks in a blockchain use hashes.
- **Digital Personal Identity (DID):** A unique digital ID for a person that can be used to confidently validate someone as who they claim. It would contain data such as Name, Birth Date, Social Security Number, Etc.
- **Digital Vehicle Identity (VID):** A unique digital ID for a vehicle that can be used to confidently validate a vehicle and its owner. It would be comprised of static data about the vehicle including the Owner’s DID, Vehicle Identification Number (VIN), the Year, Make, Model, Color, Etc.
- **Distributed Ledger Technology (DLT):** A database that is consensually shared and synchronized across multiple sites, institutions, or geographies, accessible by multiple people, systems, or agencies.
- **Hash**: The output of a hashing algorithm like MD5 (Message Digest 5) or SHA (Secure Hash Algorithm). These algorithms produce a unique, fixed-length string – the hash value – for any given piece of data.
- **Immutable:** Not subject or susceptible to change.
- **Interoperability:** The ability to exchange and use information, usually in a large heterogeneous network made up of several local area networks.
- **Node**: Any system or device connected to a computer network.
- **Road User Charging (RUC):** An alternative funding mechanism to the current fuel tax that will support road maintenance and construction.
- **Smart Contracts:** A self-executing contract with the terms of the agreement between buyer and seller being directly written into lines of code, usually in the form of “if/when...then…” statements.

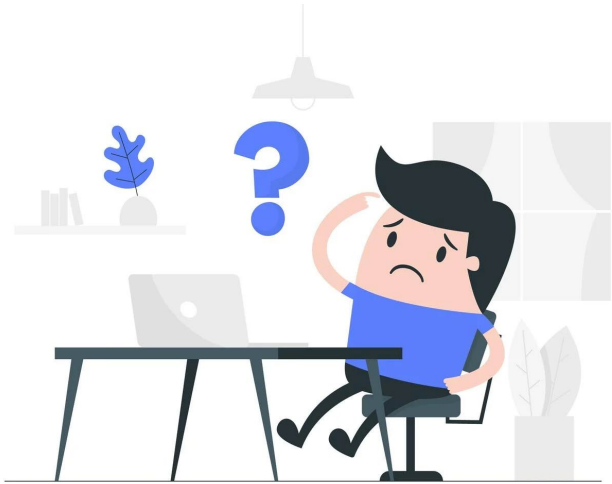
What is Blockchain?

The simple version:

- A blockchain is a chain of blocks that contains information.
- It is a distributed ledger that can be accessed by anyone on the network.

A bit more complicated:

- A blockchain is a chronological list of recorded information that is grouped into manageable blocks which are then secured and linked together using cryptography.
- The linked group of blocks, the blockchain, is simultaneously distributed across all participants in the network to ensure security and redundancy.

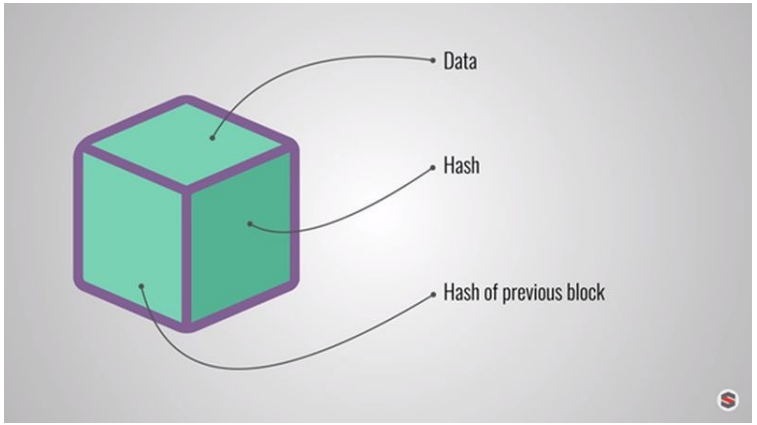


Details of a Block

Example Data
From: Kevin Ko
To: Yufan Luo
Amount: $10

OR

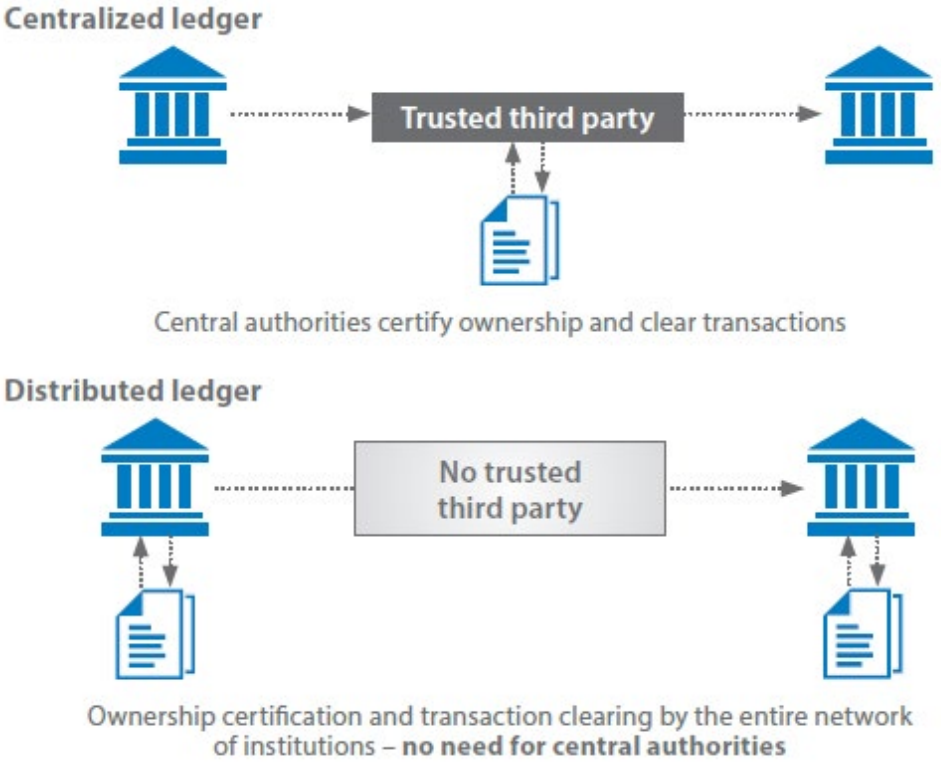
Agency: EZPass
Customer: Kevin Ko
Amount: $5



Mechanism of Trust

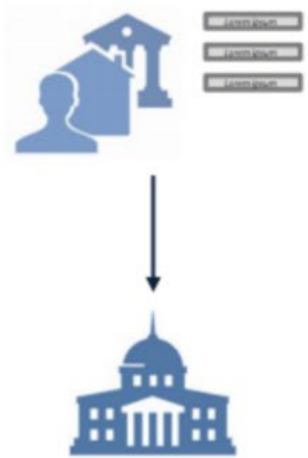
"Trust is is the fundamental currency of commerce."
Richie Etwaru - TEDxMorristown

Blockchain is the technology that will be used to eliminate the trust gap in business transactions.



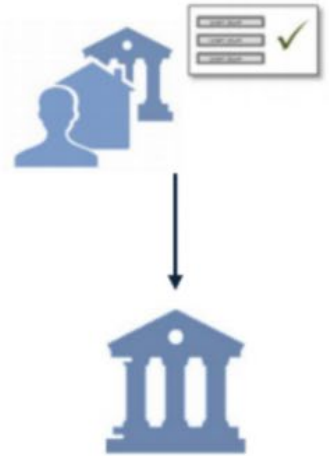
The Structure of Identity Systems

1. *The user presents a set of attributes to a third party*



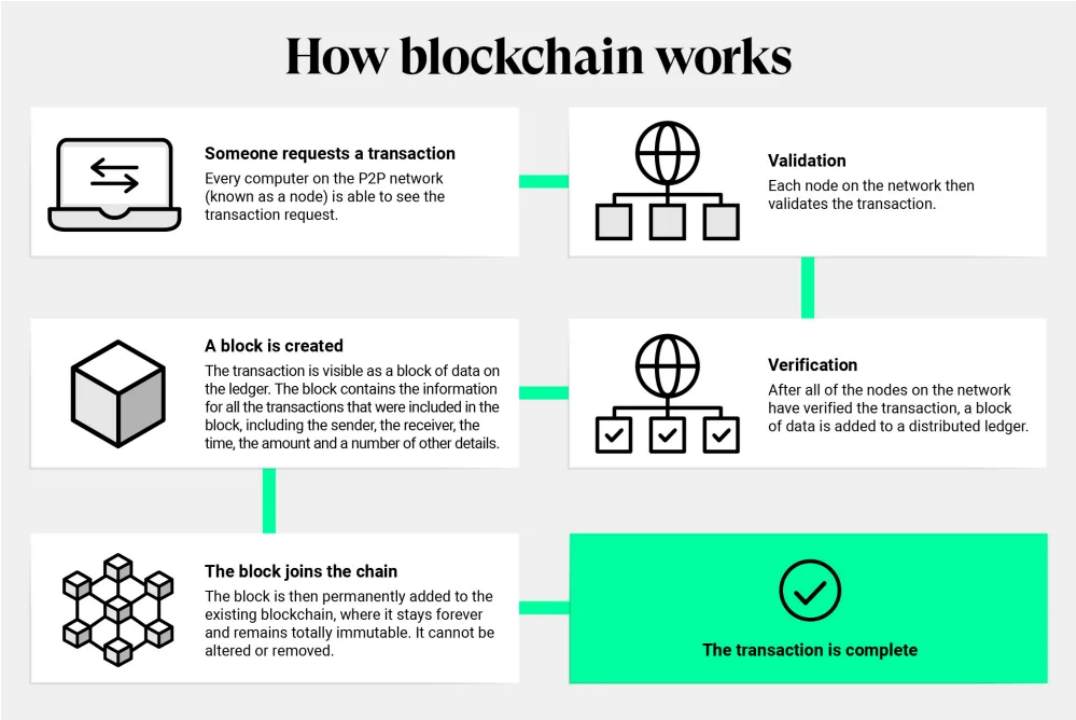
2. *The third party verifies the attributes and attaches its attestation to the attributes, becoming an identity provider for the user*

3. *The user then uses the credential from the identity provider in transactions with RPs*

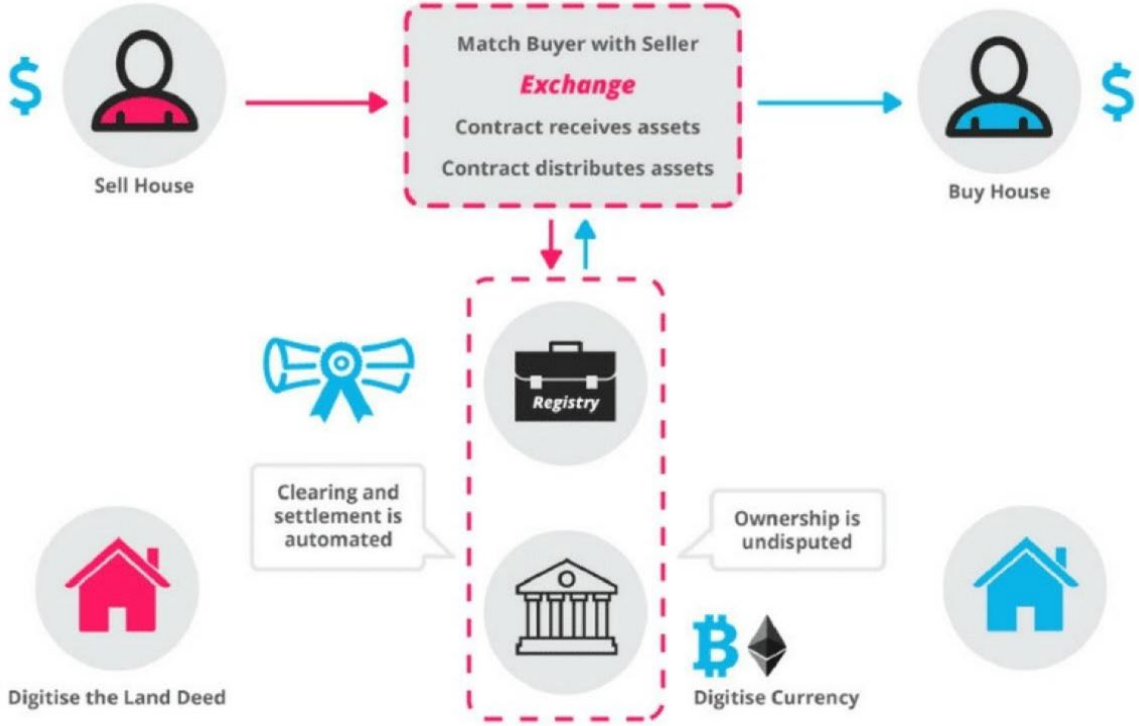


How Does It Work?

1. Someone requests a transaction
2. Each node validates the transaction
3. All nodes verify the transaction
4. A block is created
5. The block joins the chain



How Smart Contracts Work?



Weaknesses of Blockchain

- Smart contracts cannot pull data from off-chain resources
- Potential slight time difference in information
- Additional parties needed, which introduces points of failure

Distributed Ledgers in Tolling

Distributed ledgers provide three distributed sets of information that would be shared by the participants in the system:

- A shared, replicated, and transparent ledger for data;
- A secure, unified register of customers and agency assets;
- A method for any customer to transact directly with any agency.

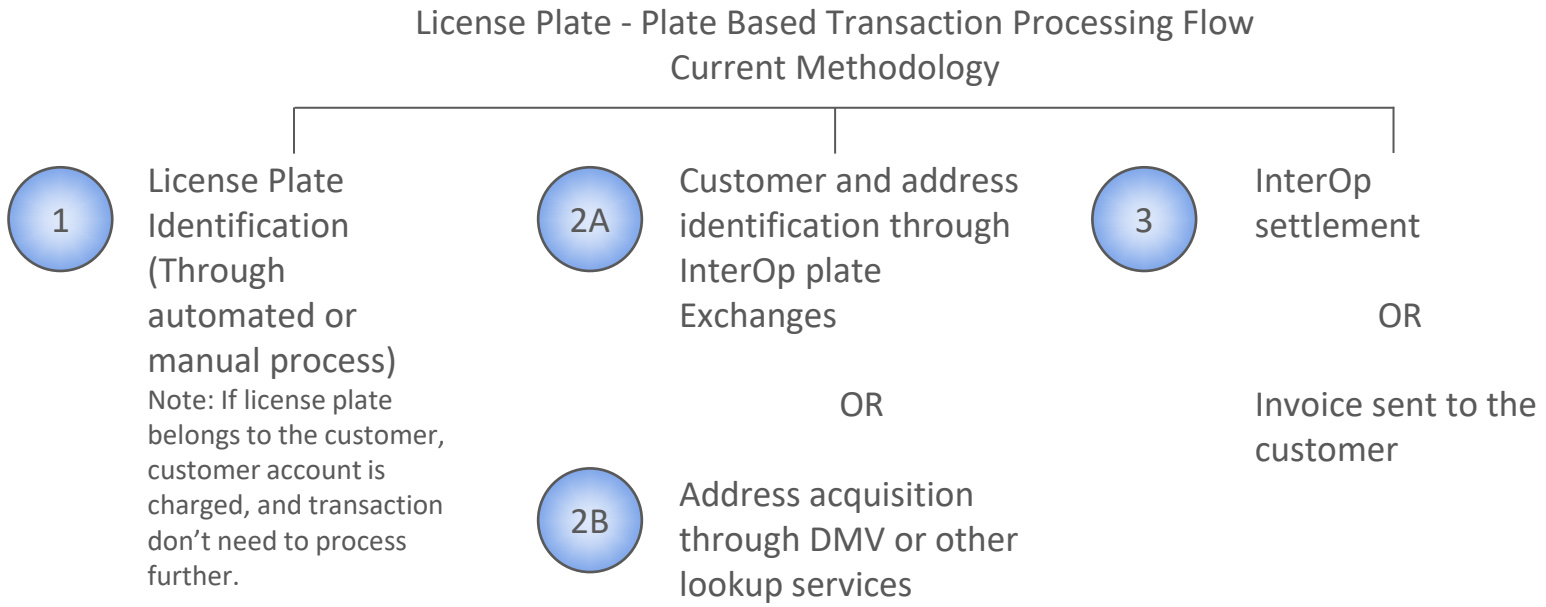
Distributed ledgers eliminate the need for tolling agencies to:

- Share transponder and license plate validation lists;
- Exchange and reconcile interoperable transactions and funds.

Blockchain Facilitates Digital Identities

- Their distributed architecture means they are **not controlled by a single central authority**, but require participant consensus. This feature may be appealing for verification of identity for individuals engaged in cross-border trade, seasonal migrants, or individuals displaced by conflict or humanitarian disasters.
- They provide **an immutable record of chronological transactions** providing users with a reliable and auditable record of interactions.
- They create **transparent records of transactions** that can be validated by any participant in the network. This transparency can empower users by ensuring they can access the ledger of transactions at any and all times.

How Distributed Ledgers Could Help Streamline Plate Based Transaction Processing



How Distributed Ledgers Could Help Streamline Plate Based Transaction Processing

License Plate - Plate Based Transaction Processing Flow
Future Methodology Using Blockchain

1

License Plate Identification
(through automated or manual process)
Note: If license plate belongs to the customer, customer account is charged, and transaction don't need to process further.

2A

Customer self reporting and identification through Distributed Ledger

2B

Settlement between the customer (Fleet) and Toll Agency.

Potential Benefits of using distributed ledger:

1. Fleet accounts can be added with ease, with all Tolling agencies have access to information
2. Reduces the need for DMV lookup (and cost), where plate owner is self-reported
3. Reduces the need for InterOp settlement and associated cost
4. Instant client to agency settlement, no need for invoicing

Improving Interoperability with Blockchain

- Interoperability has proven to be:
  - Feasible to achieve at a limited geographical or regional scale
  - Challenging, when considering broader (e.g. national) scale

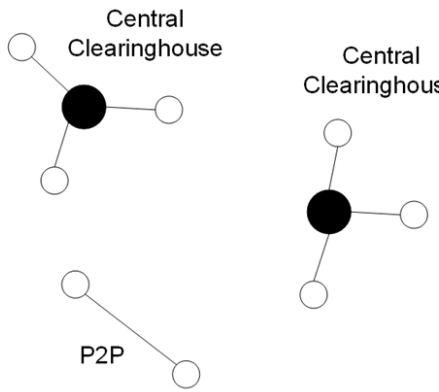
- Technical & business challenges:
  - A variety of business rules, technical protocols and interfaces
  - Duplication of information across systems
  - Slow information exchange
  - Lengthy settlement procedures
  - Limited resilience & scalability

Improving Interoperability with Blockchain

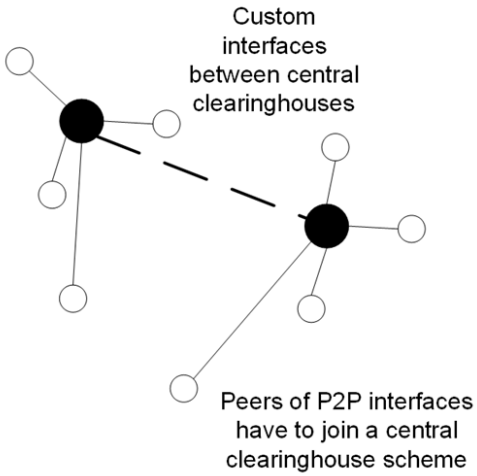
- Challenges resulting in increased costs to:
  - Implement and maintain interoperability
  - Add more peers to a scheme

- Limited interconnectivity with the rest of the mobility ecosystem

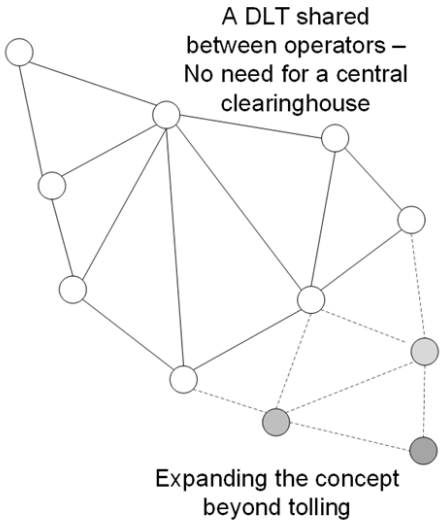
Improving Interoperability with Blockchain



Current Condition
Regional interoperability
"pockets"



Centralized architecture
interfaces between central
clearinghouses



Decentralized architecture
A DLT shared between peers

Simplifying Third-Party Access

- Distributed Ledgers can improve interoperability and simplify access:
  - Resilient and secure by design
  - No need for centralized organizations (with their own operational costs)
  - Standardized smart contracts allow for:
    - Lower operational costs
    - Frictionless addition of peers
    - Greater trust amongst agencies
  - Fast transaction settlement, in the case that digital coins are used

- A concept that can be more open to the broader mobility ecosystem

Blockchain and Road User Charging (RUC)

What is RUC?

Road User Charging (RUC) refers to a collection mechanism that uses total vehicle distance traveled in a given period to collect infrastructure funding taxes from users and is expected to be a replacement of the current fuel tax. Some form of a hybrid system may be implemented to ensure collection from out-of-state drivers.

Why is RUC important?

- Lack of Federal Increases
- Improved fuel-efficiency vehicles
- Hybrid and All Electric vehicles

A RUC system becomes an important option in terms of replacing the current funding streams.

OReGO

UDOT Keeping Utah Moving
ROAD USAGE CHARGE

Spend On Auto

CDOT CO

RUC west

THE EASTERN TRANSPORTATION COALITION
MBUF STUDY

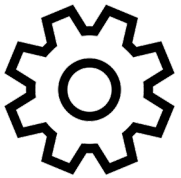
What Current RUC Programs Are Using...

Register For Service

- User Info (Name, Address, Contact Info, etc.)
- Payment Info (Credit Card, Payment Method, etc.)
- Vehicle(s) Info (VIN, Plate #, Make-Model, etc.)

Drive and Track Mileage-driven

- On Board Diagnostic II Device (OBD II) + Mobile network (LTE)
- Embedded telematics
- Annual Inspection Tracking
- Manual Tracking



Customer Account Management (CAM)

- Sends the State a report providing the miles driven.
- Sends the driver a mileage report and invoice.
- Maintains user privacy.

Digital Identities and Blockchain Make RUC Better

Digital ID

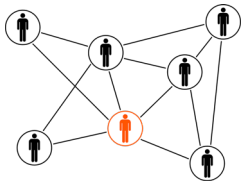
Ensure privacy, security, and accuracy

Vehicle ID

Ensure privacy, security, and accuracy

Smart Contracts

Enable faster reconciliation and increase operational efficiency



Distributed Ledgers

Enables immutability, security and trust.

A robust, decentralized RUC system that can support secure, private, efficient and accurate transaction management processing that everyone can trust.

Blockchain and Road User Charging (RUC)

Blockchain as the Foundation of RUC provides many operational advantages compared to a technically traditional RUC deployment.

- **Agency Perspective**
  - Enhances operational efficiency
  - Provides high Level data accuracy
  - Enables low cost of administrative burden
  - Builds trust between agencies for future data sharing objectives
- **Drivers' Perspective**
  - Ensures privacy, security and accuracy of user data, which builds confidence and helps ensure user acceptance and compliance
  - Provides an easy to use system requiring little user input, similar to current fuel tax.
  - Lower costs for drivers because of operational efficiencies on agency side

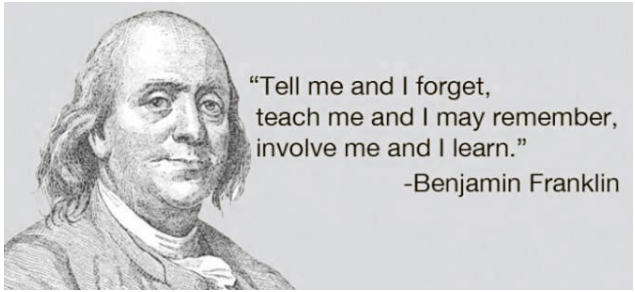
Blockchain is the Future

- Blockchain is ingenious in its methodology to build and maintain trust in a technical world where trust is a commodity that is challenging to cultivate and maintain.
- If there is no trust, there is no business.
- From our earlier examples: How do you trust that your product will ship once you have provided payment? How do you know that your payment will be sent once you ship the product? Currently third-party mediators, like a bank or PayPal, serve as the trust mechanism and cover your losses should the other party default, but at a cost to you.
- We firmly believe that with all the tools provided in the technology, blockchain deserves to be at the foundation of tomorrow’s transportation and tolling industries.

Future of the IBTTA Blockchain Working Group

- Future of the Working Group
  - Continue to educate ourselves about the pros and cons and variations of blockchain to be better suited to evaluate and work to creatively solve industry problems.
  - Resume the development of the Working Group lab environment with a functional demo of tolling interoperability using blockchain.
  - Work to develop additional functional demos using blockchain and provide the industry with viable solutions to widespread technical challenges.
  - Grow industry-wide relationships that promote knowledge sharing and the brainstorming of solutions to complex technical problems.
  - Enhance the development of educational content to support the industry and its growing appetite for more detailed information related to blockchain.
- Questions?

Resources For Continued Learning



IBTTA Young Professional Council

- Join the YPC! https://ypcouncil.com/

Blockchain

- IBM - What is Blockchain Technology? https://www.ibm.com/topics/what-is-blockchain
- Blockchain Working Demo https://andersbrownworth.com/blockchain/distributed
- Blockchain Working Demo Video - 1 Blockchain 101 - A Visual Demo - Part 1 (YouTube)
- Blockchain Working Demo Video - 2 Blockchain 101 - A Visual Demo - Part 2 (YouTube)

Road Usage Charging

- OreGo RUC Program https://www.oregon.gov/ODOT/Programs/Pages/OReGO.aspx
- Utah RUC Program https://rucutah.utah.gov/
- California RUC Pilot Program https://spendonauto.com/california-road-charge-pilot/
- Road Usage Charge (RUC) | IBTTA https://www.ibtta.org/road-usage-charge-ruc

Upcoming Events

Global Outlook: Forecasting Toll Revenues in a Time of Uncertainty

Tuesday, November 30, 2021 – 11:00am to 12:30pm ET

Presented by the IBTTA International Committee

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