# What is Decentralized Identity?

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# Internet and Identity

The Internet was created without a way of positively identifying the people and organizations who use it.

*"On the Internet, nobody knows you're a dog."*

# TRUST

## The main reason we have identity systems is to establish trust.

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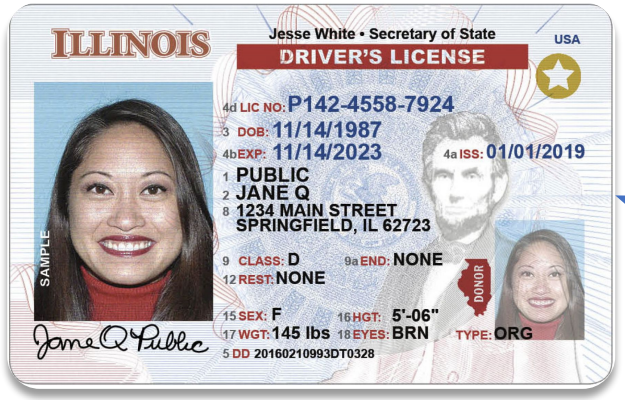
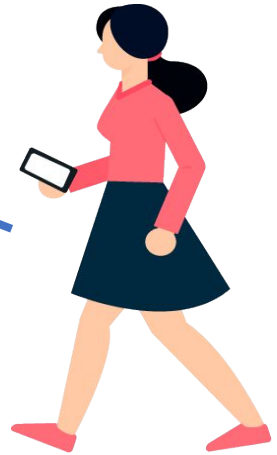
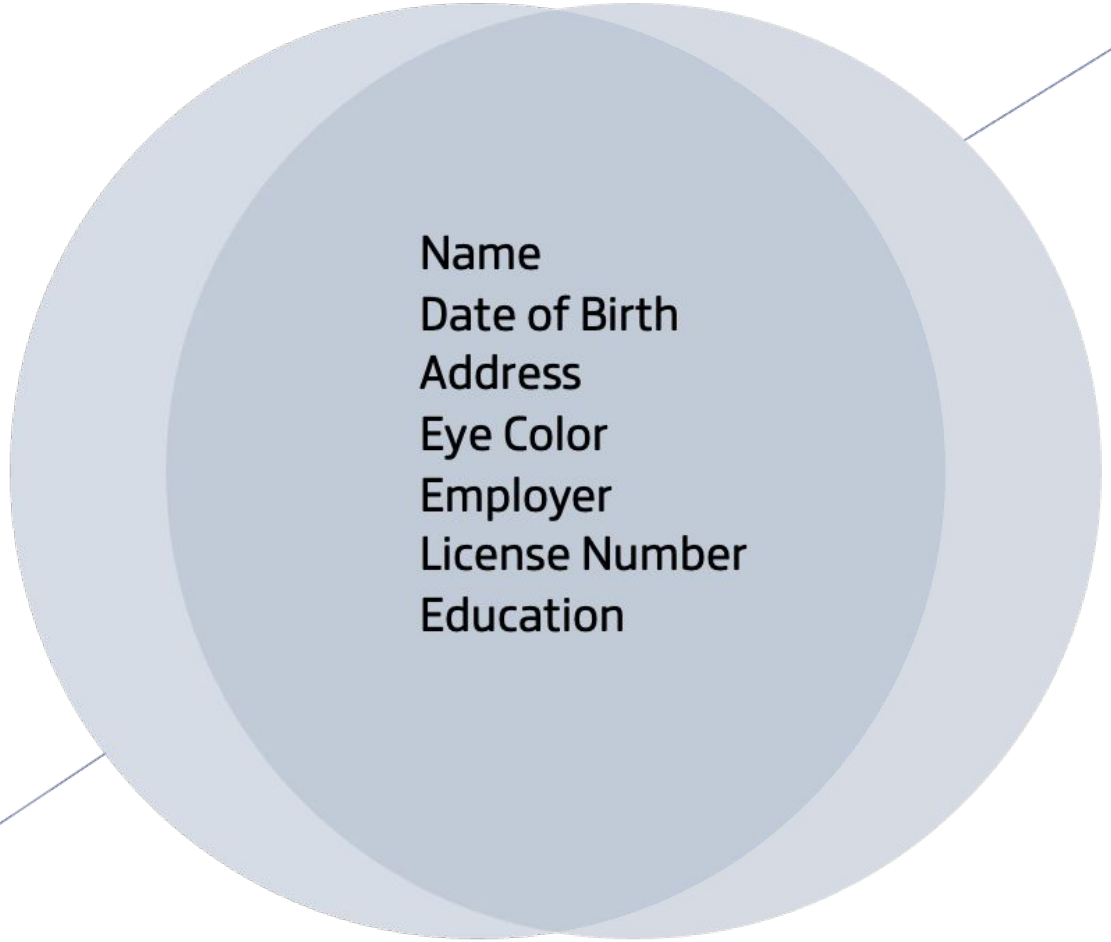
# What is identity?



# What is identity anyway?

*Who is this person?*




Verifiable Credential

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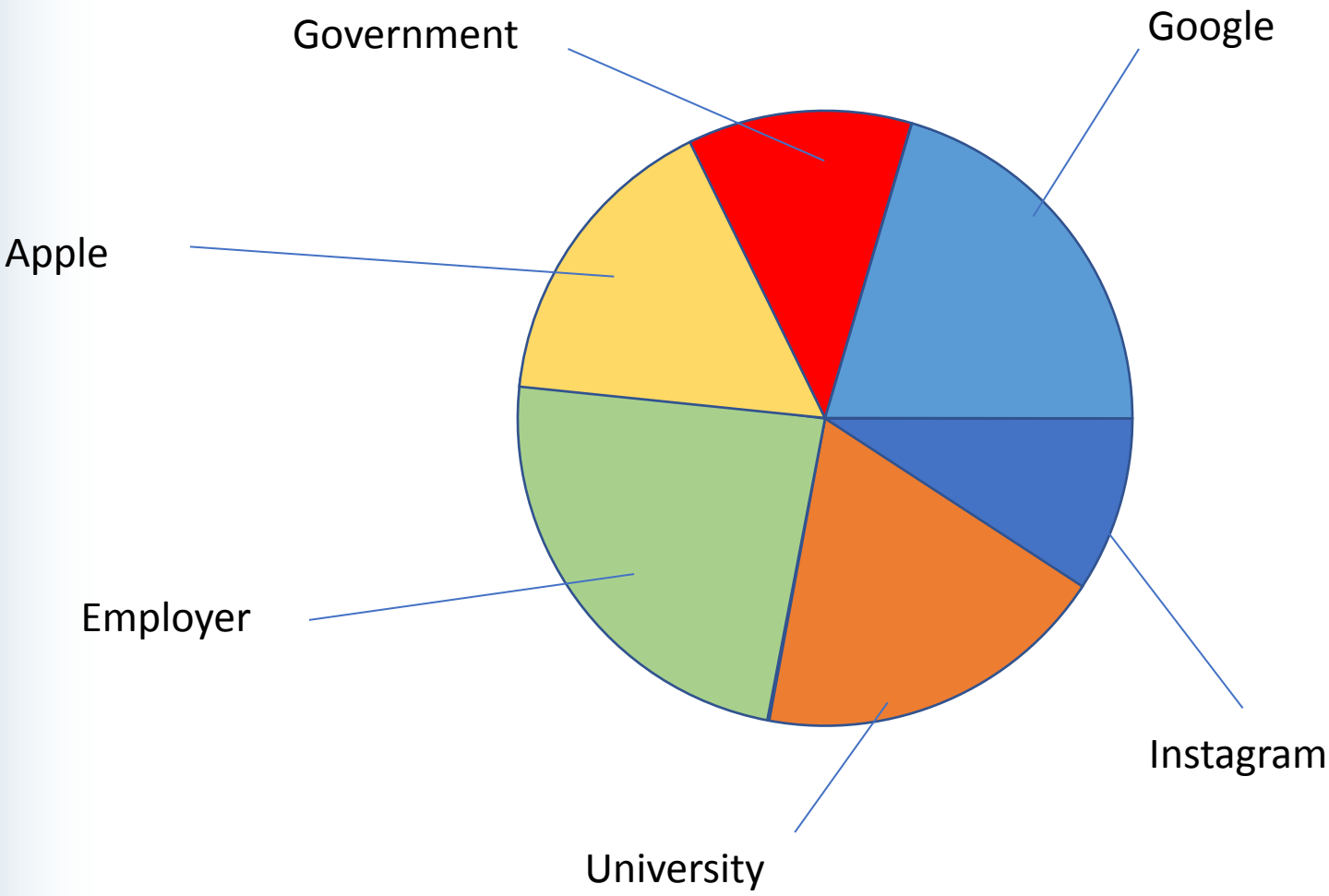
# What is “identity?”




Any given data point can be used to PROVE something about yourself, and therefore, *any data point* can become a constituent of your identity.

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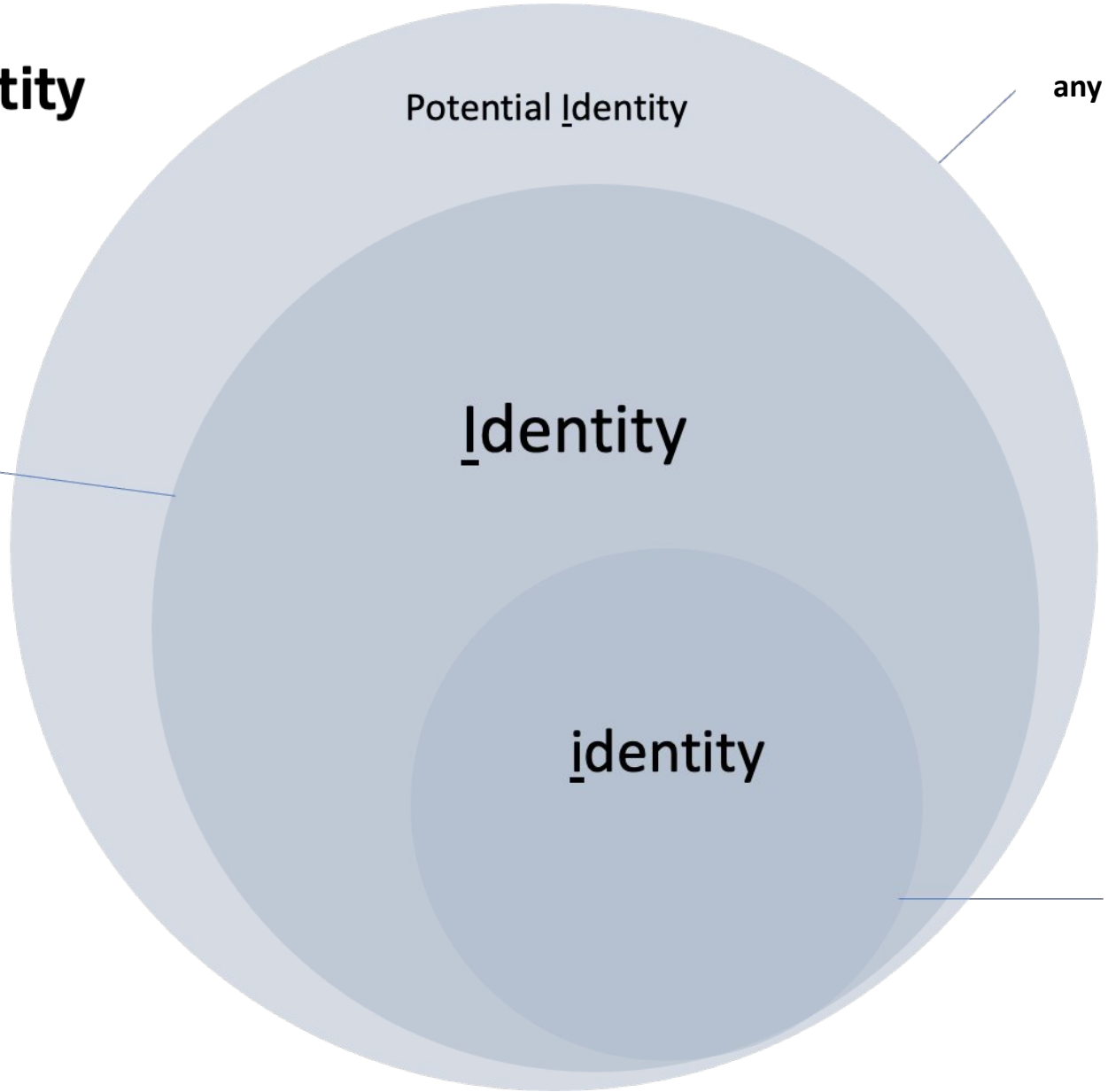
# The Everything Identity




**any** data point that may be valuable and can be shared with consent

**any conceivable data point**

**traditional** biographic and demographic data about a person

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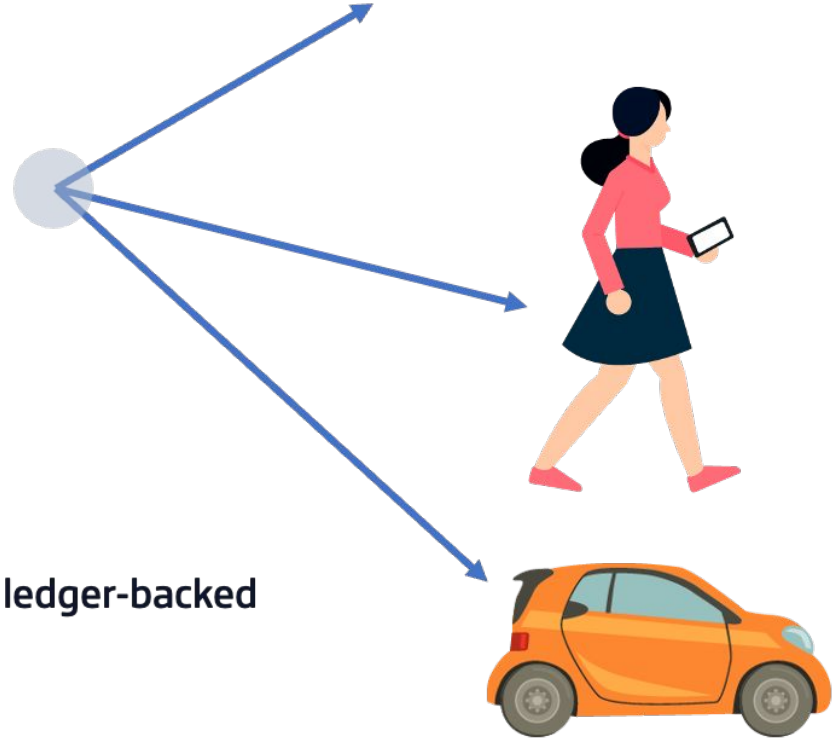
# Identity is Everything!

**(and anything you want it to be)**



## Any data point that refers to a particular data subject.

- Database stores
- Biometric data or authentication
- Regulatory attestation authority

## All can be used as a form of identity with a ledger-backed Verifiable credential

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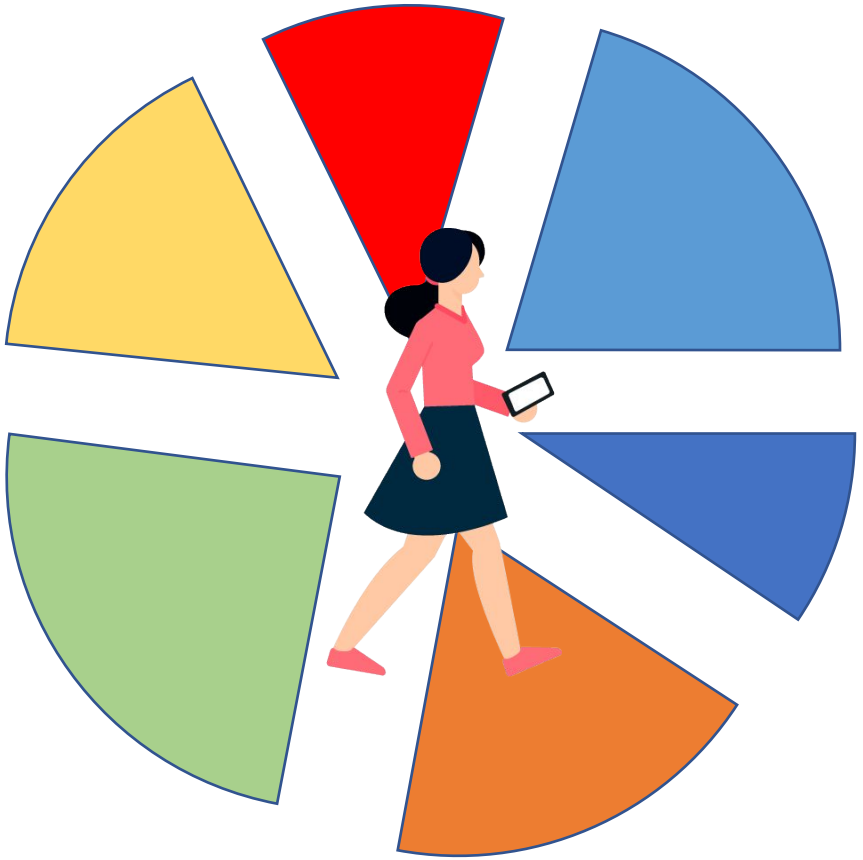
# Decentralization



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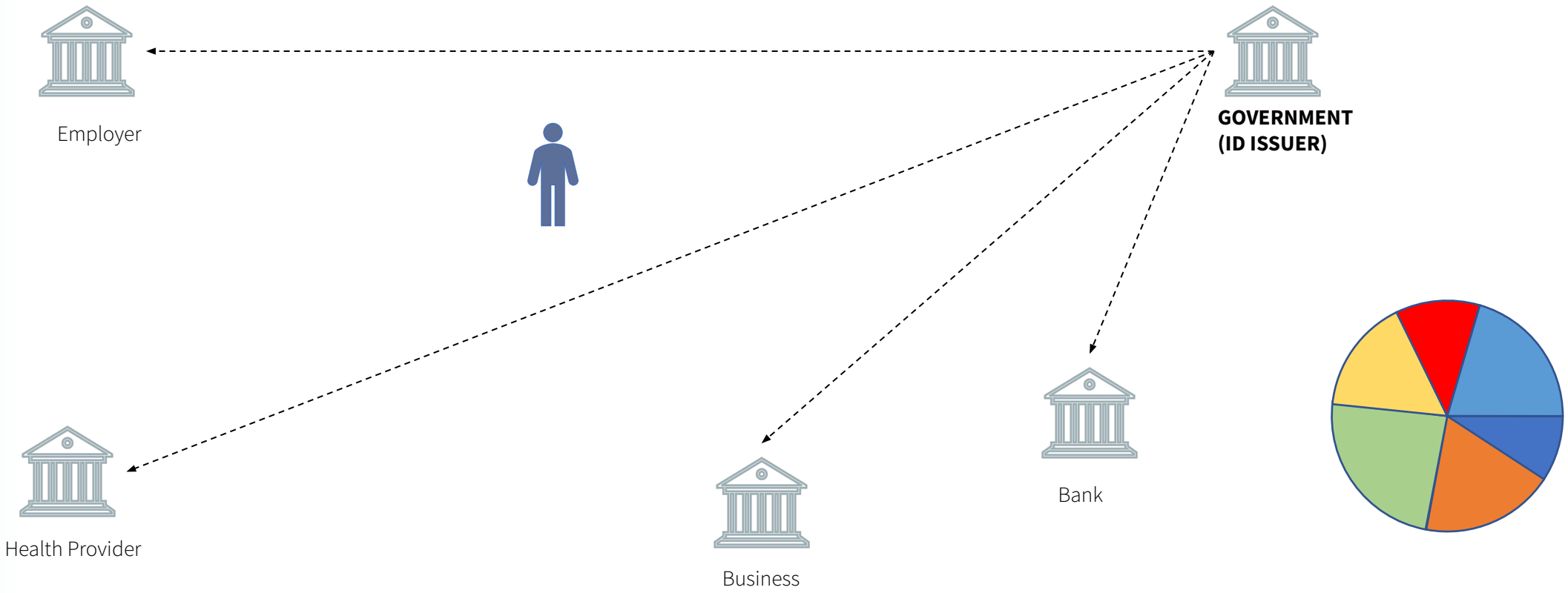
# The problem with centralization

When data is controlled, shared and handled primarily by third parties (not the data subject),

**consent, compliance, tracking and transparency are difficult to achieve**

To gain efficiency and trust, entities must integrate systems, which is difficult, costly, and compromises privacy

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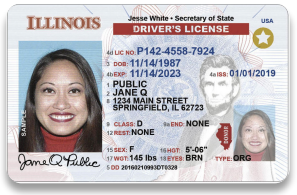
# A digital model of the analog world




Government

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# Trust:
## Then and now

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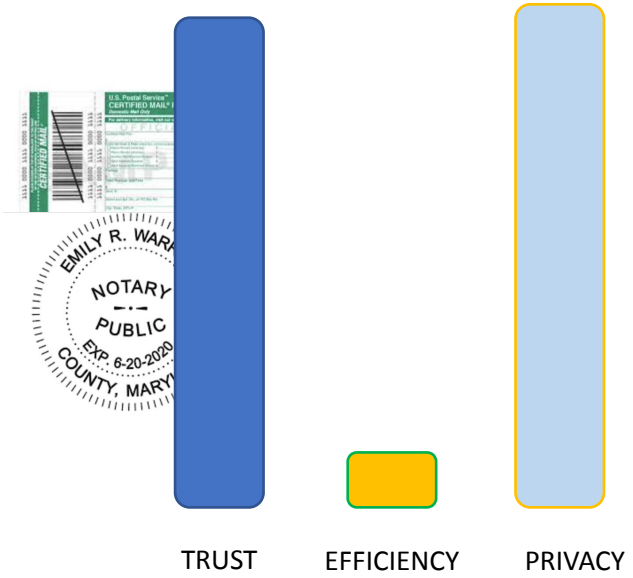
# The goal of decentralized identity

Analog functionality with digital efficiency

## Analog World

3200 BC ~ 1964



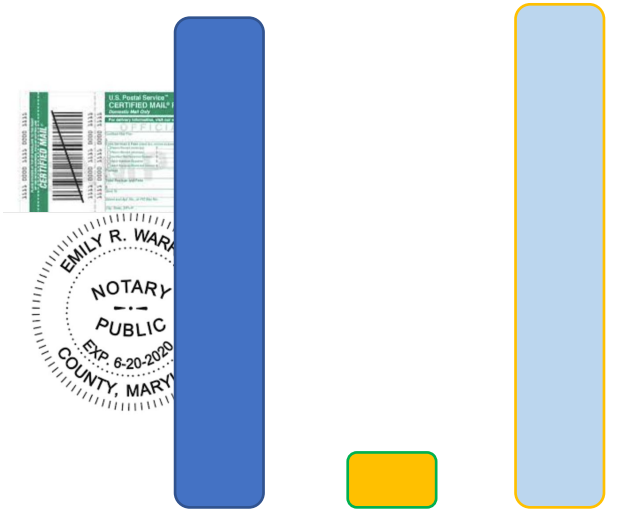

*Physical documents sent, shown, signed, notarized, sealed…*

# The goal of decentralized identity

Analog functionality with digital efficiency

## Analog World

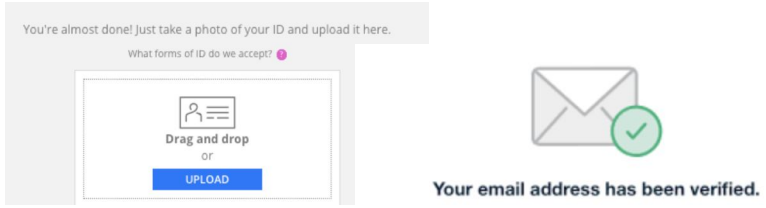
3200 BC ~ 1964

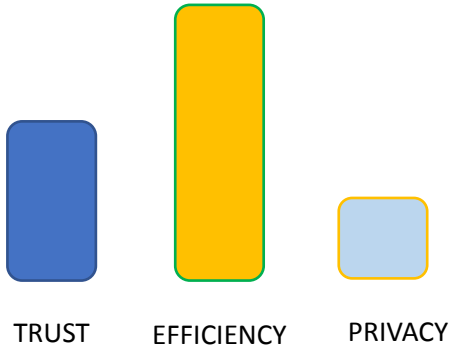



*Physical documents sent, shown, signed, notarized, sealed…*

## Hybrid World

~1964 - 2020



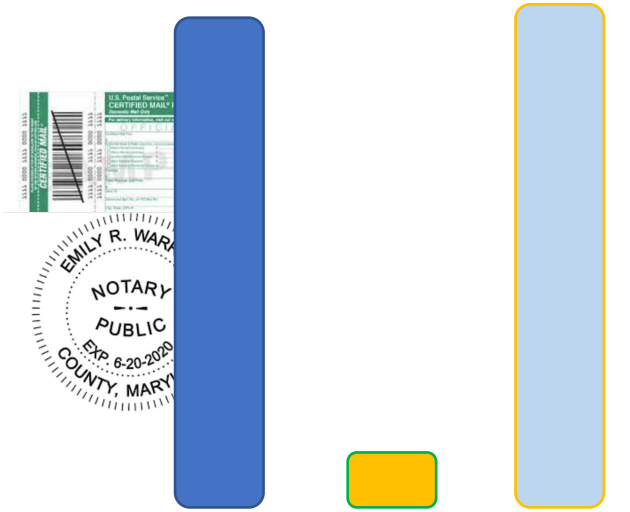

*Duplicate and/or digitized documents sent electronically*

# The goal of decentralized identity

Analog functionality with digital efficiency

## Analog World

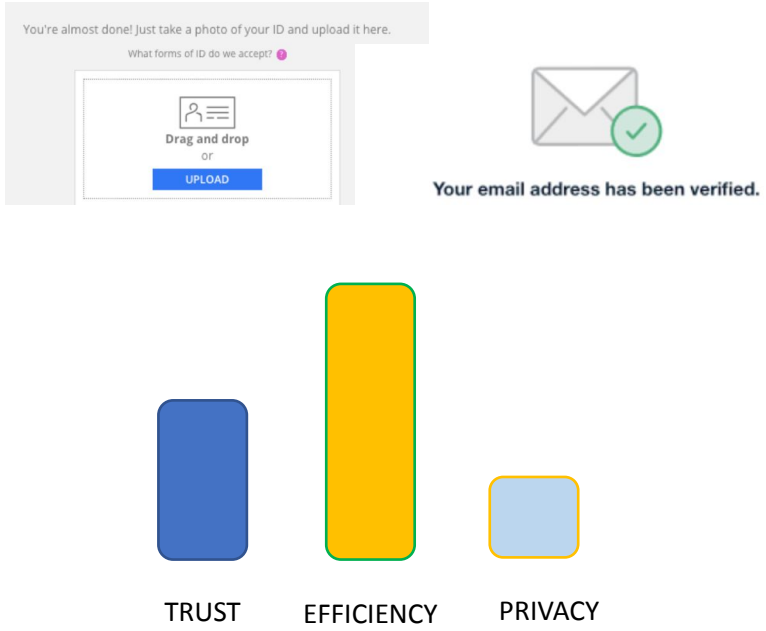
3200 BC ~ 1964




*Physical documents sent, shown, signed, notarized, sealed…*

## Hybrid World

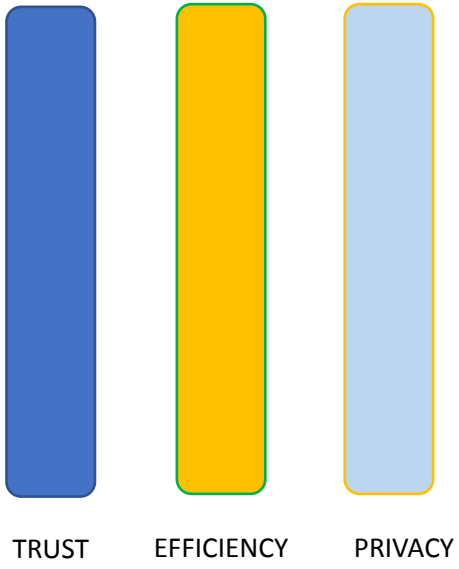
~1964 - 2020




*Duplicate and/or digitized documents sent electronically*

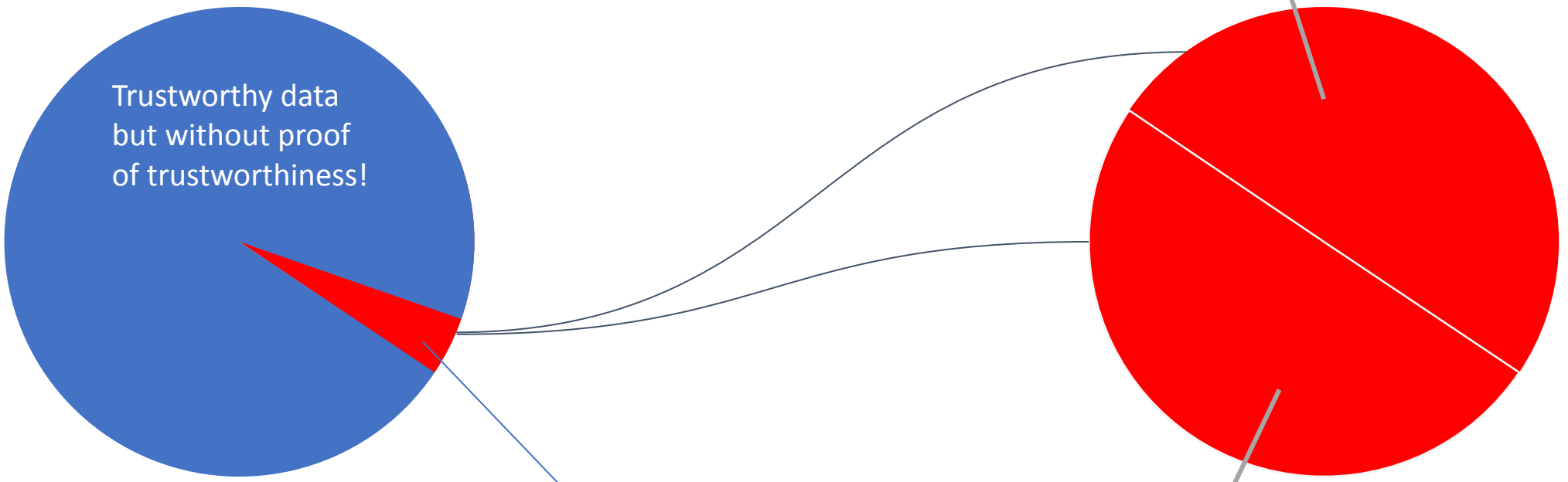
## Decentralized World

~2020 ---




*Verification of digital document authenticity and integrity is possible!*

# Trust in Data:
# Small percentage, big risk




**RISK COST**
from intake of untrustworthy data because you don't want to increase analysis costs

**ANALYSIS COST**
of work to prove trustworthy data is truly trustworthy and weed out untrustworthy data



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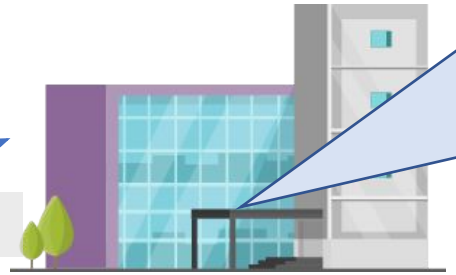
# Placing Trust in Representations and Attestations

## Carries Cost and Risk in a Hybrid World


SCAN

Email/Upload



How do I know it's real?
How do I know it hasn't been digitally altered?

How do I know it's coming from the person they claim to be?

**No one has ever used a fake email, or had their email hacked, have they??**

**2FA with email is fine… really…**

# What is trust in data?

Trust in data comes from three parts:

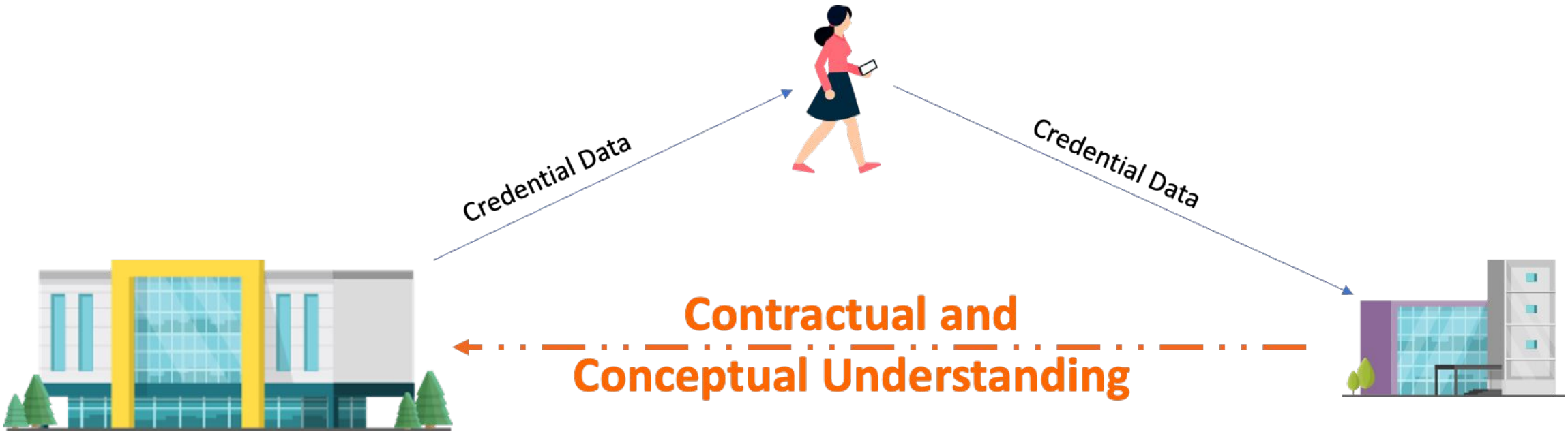
1. **Authenticity** Being able to identify the source of the data
   → *Does it come from the place it claims to be from?*
2. **Integrity** Being able to identify if the data is "real," or has arrived "as-issued"
   → *Has it been altered or tampered with?*

# What is trust in data?

Trust in data comes from three parts:

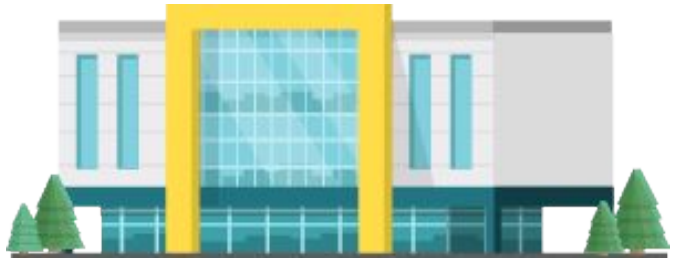
3 **Usefulness** Once provenance is assured, how well do I know the originator of the data?

→ *Do I trust their processes, regulatory environment and compliance practices?*



# Useless if untrustworthy?

**(it's actually more useful)**



Credential Issuer
(identity data source)

**INSTANT**
EFFICIENCY

**Trusted Source?**

**Untrusted Source?**

**INSTANT**
RISK
REDUCTION

Credential Verifier
(identity data receiver)



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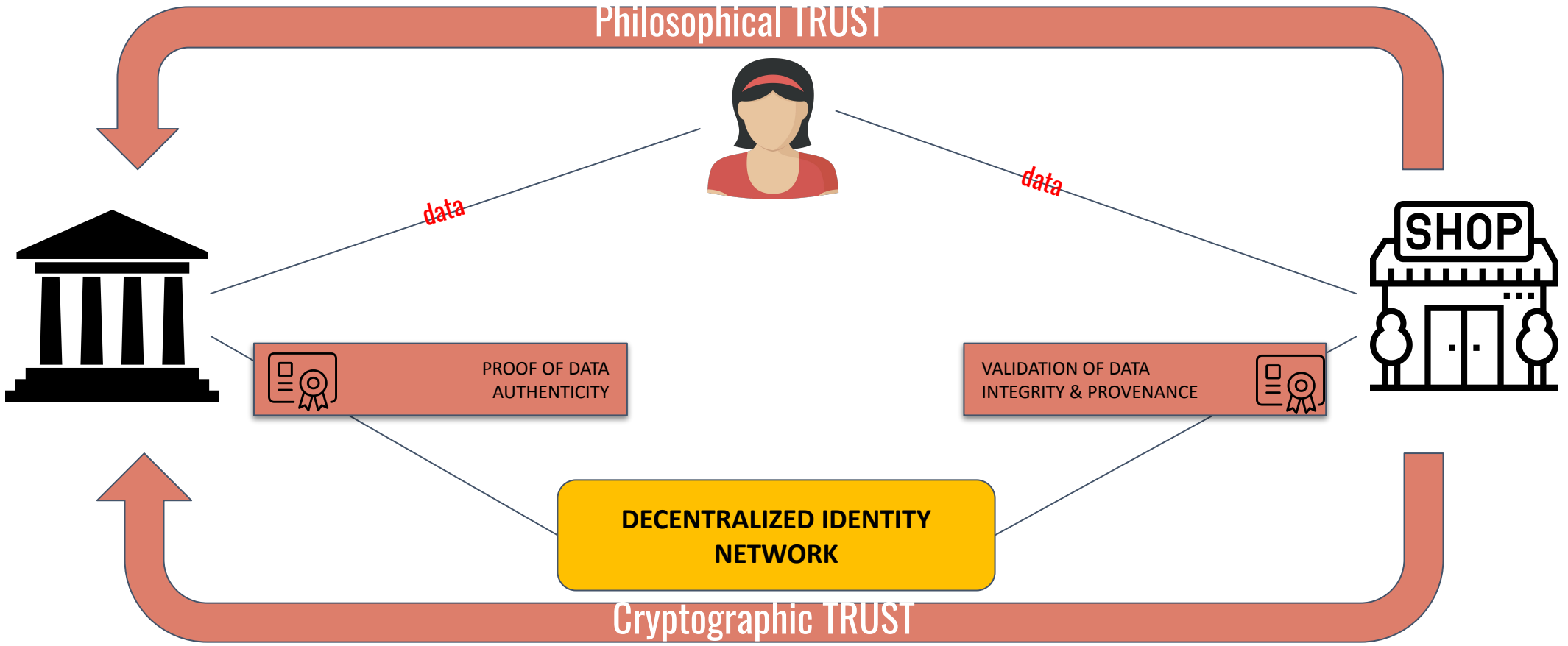
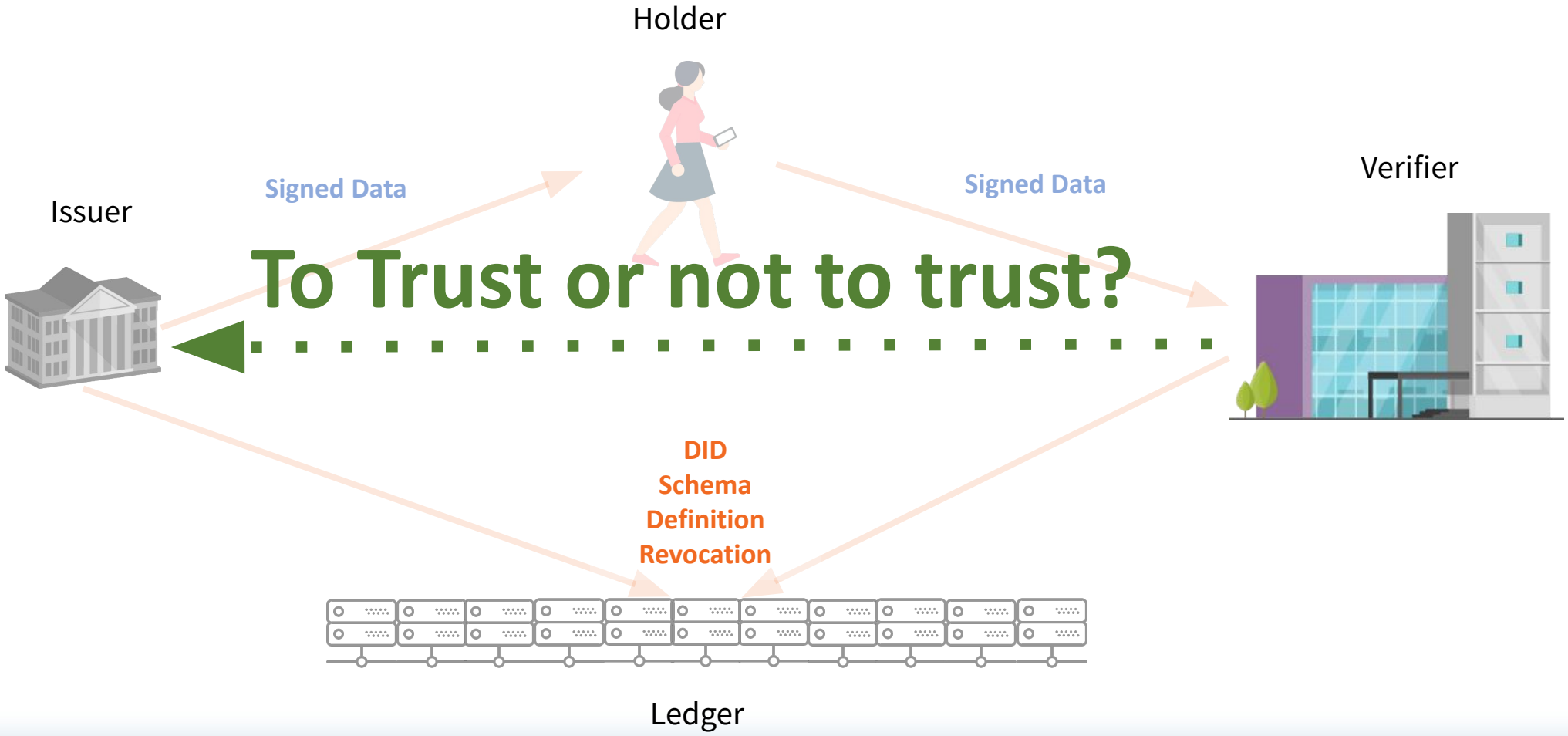
# The Trust Model

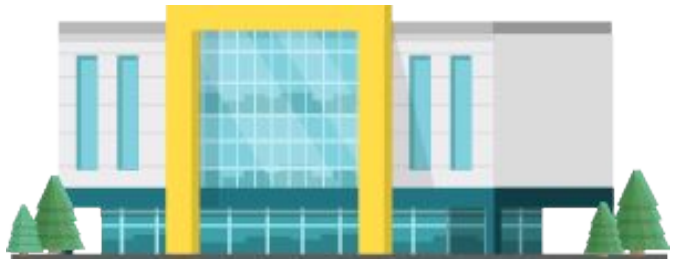


# That is the question:
# And the answer is up to each participant – autonomy and control

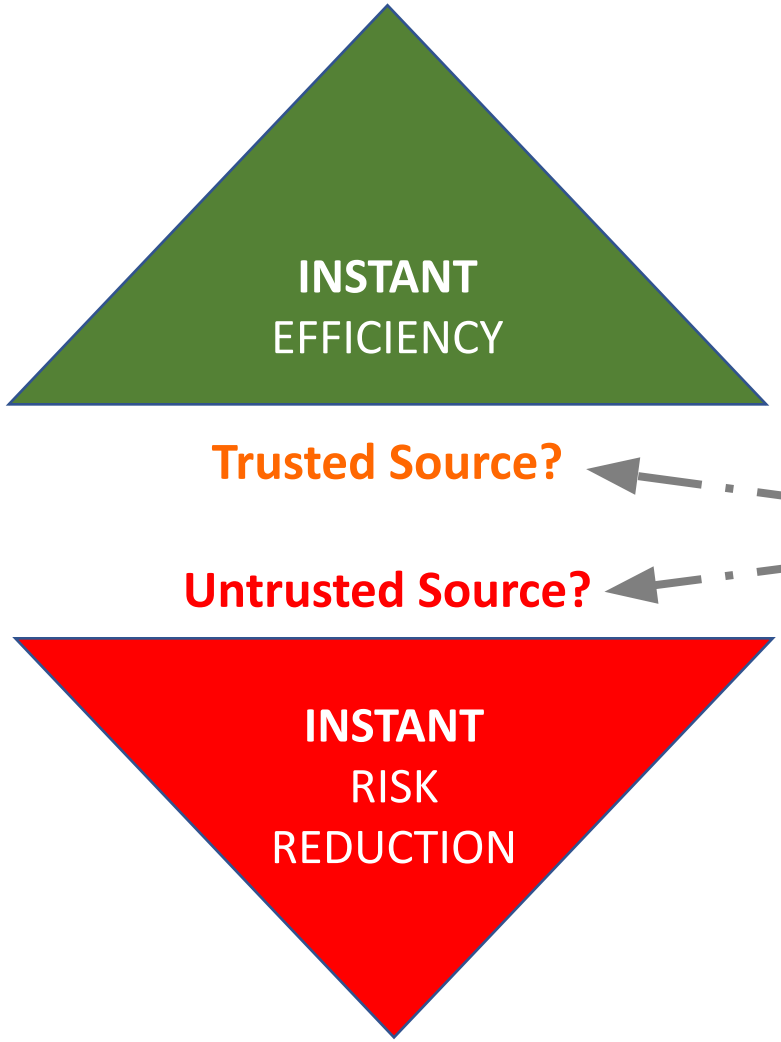


# Instantly Actionable Data

## Verified Data increases efficiency and reduces risk instantly



Credential Issuer
(identity data source)




Credential Verifier
(identity data receiver)



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# Efficiency and Trust without Integration or Centralization

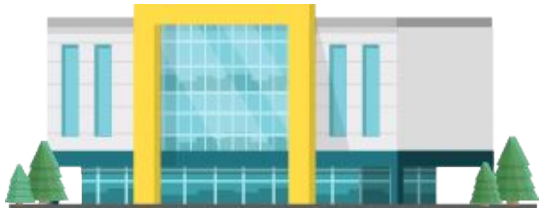
## Fostering commercial relationships via credential value

Verifiable DTC
Passport Biometric
Data

**Border Control Agency**

**Airline for efficient proof of identity for other services**

Bags, Alcohol purchase,
Unaccompanied Minor Transport



**Financial Services**

Trusted issuers have already done KYC/AML processes


**Hotel for efficient check-in**

Instant proof of identity and check-in

**Car Rental for instant pick-up**

Use to sign rental agreements, purchase ancillary services and efficiently move through a complicated workflow



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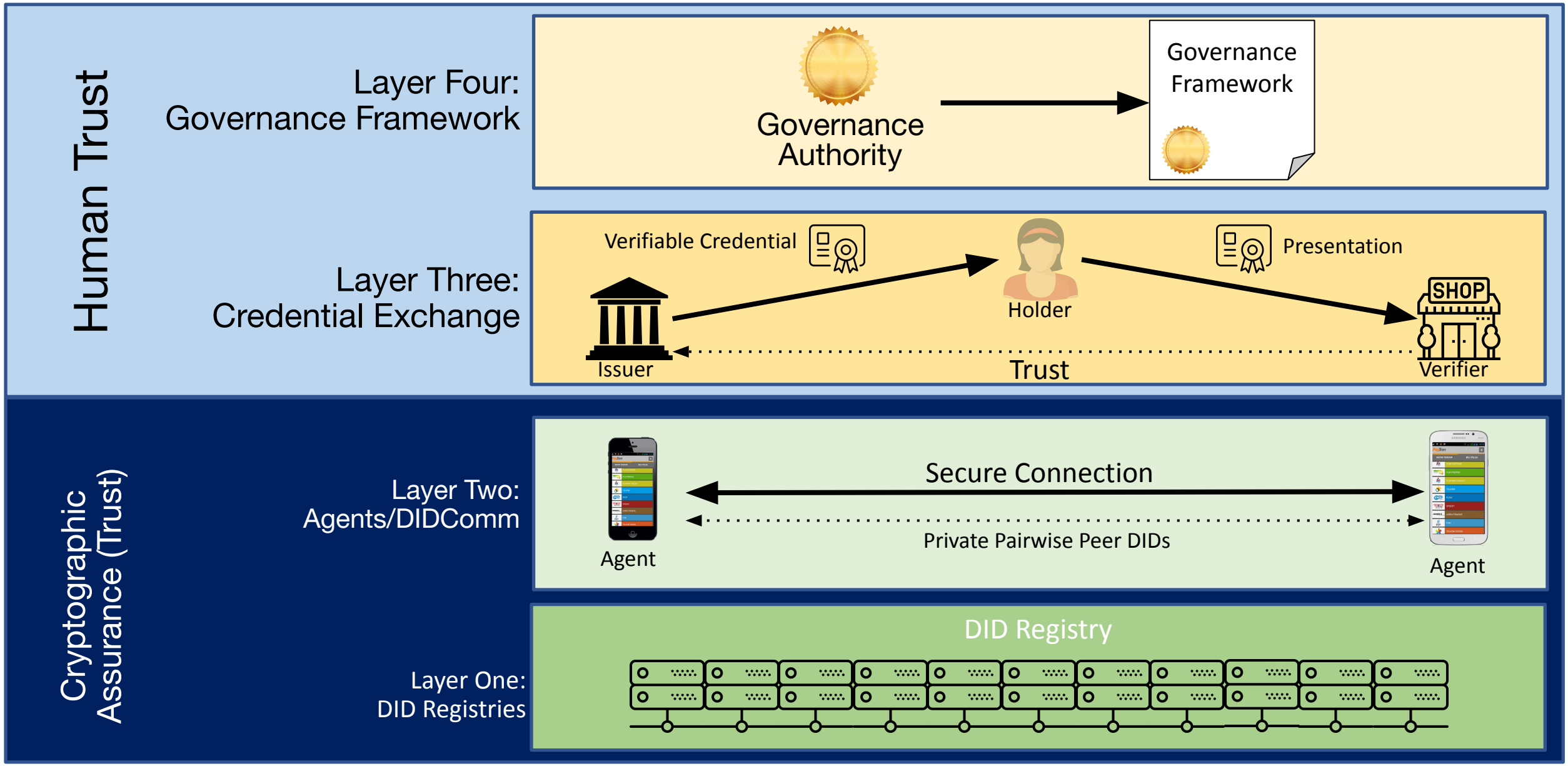
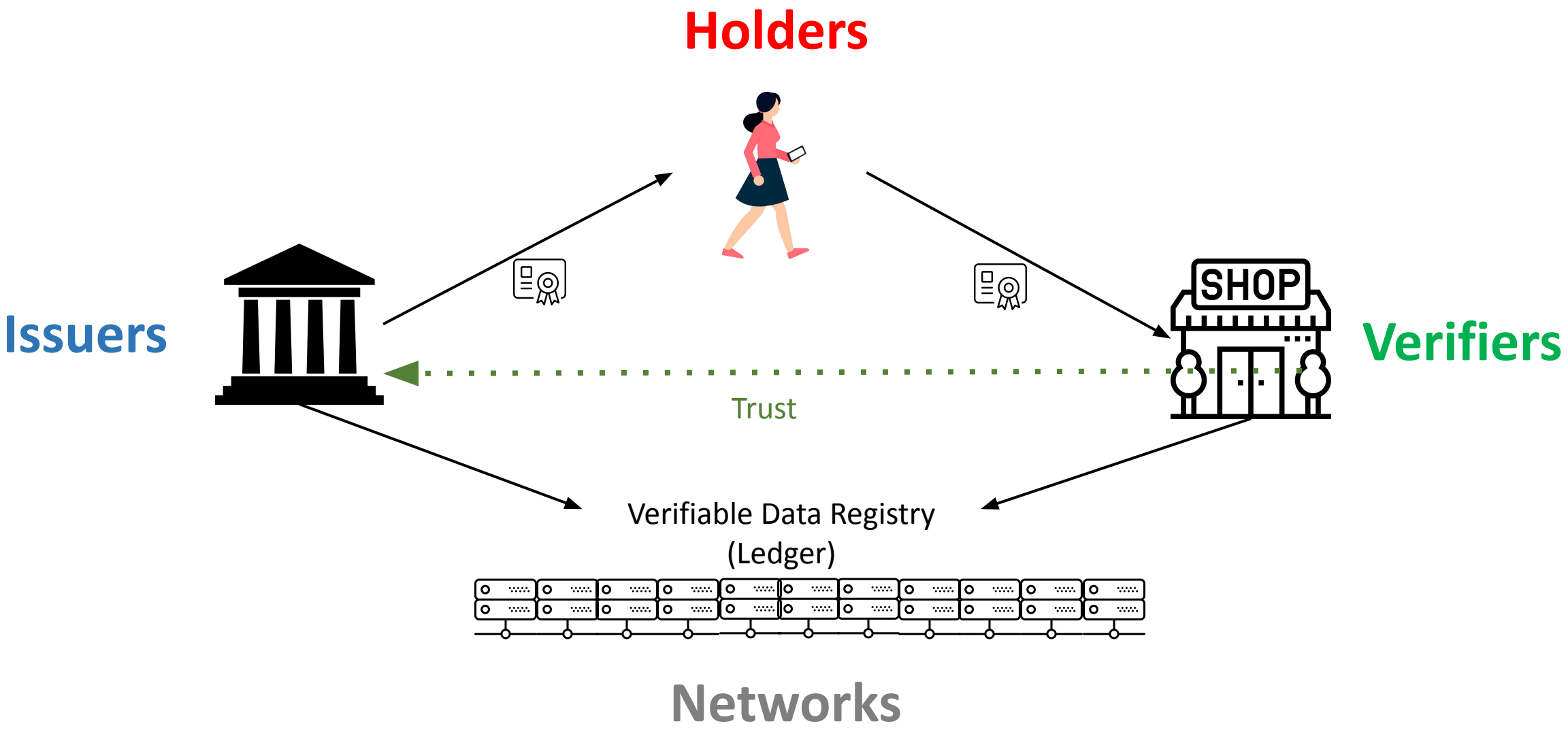
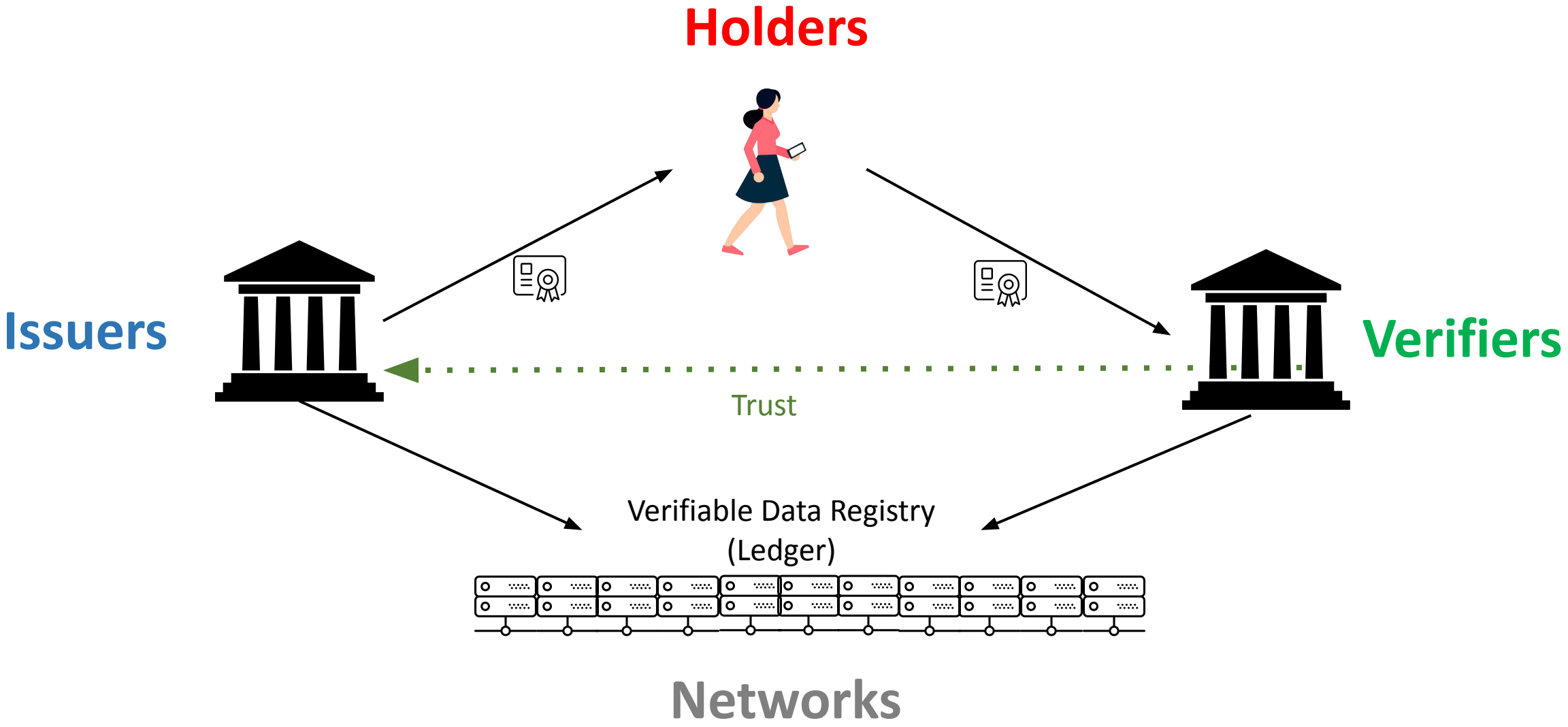


# The Verifiable Credential Trust Triangle

The participants:



# Roles are not mutually exclusive



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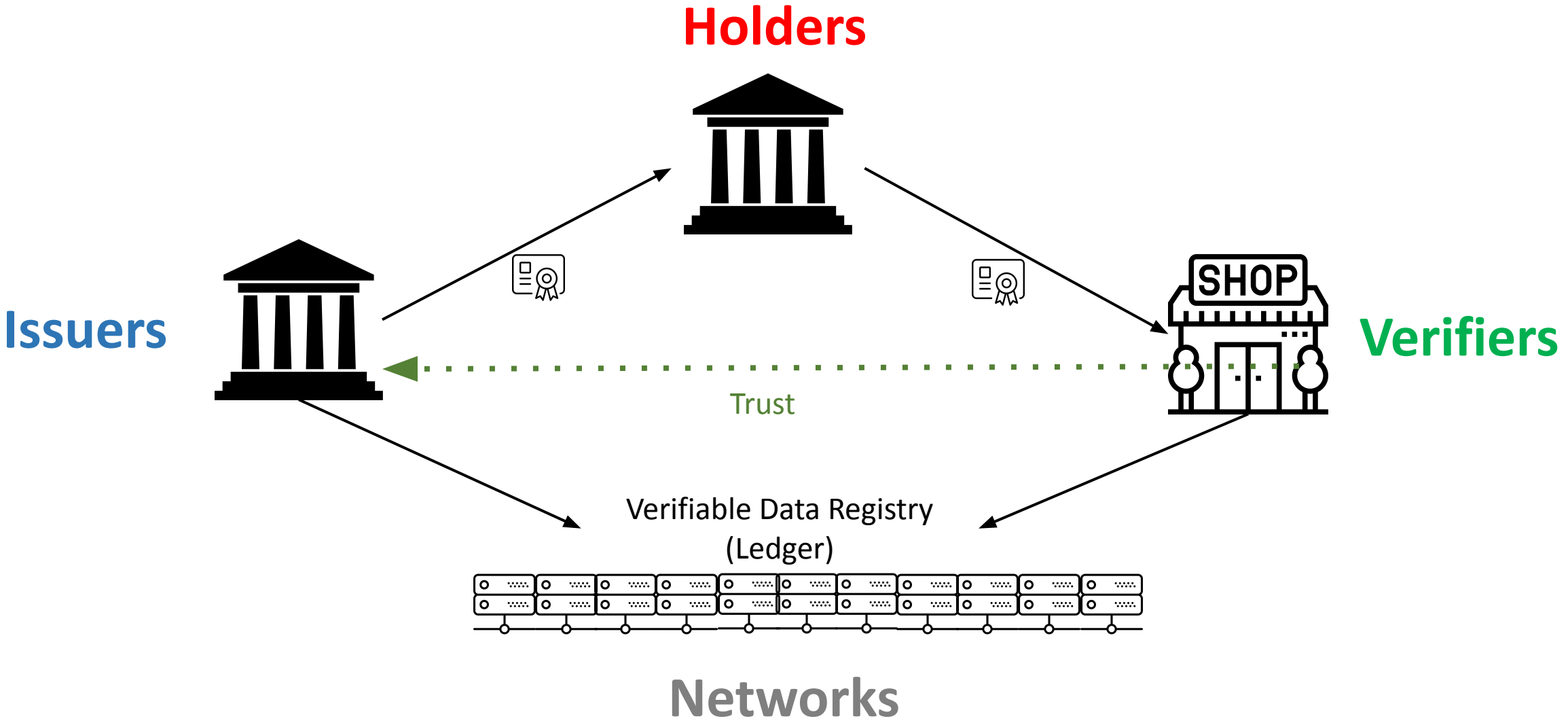
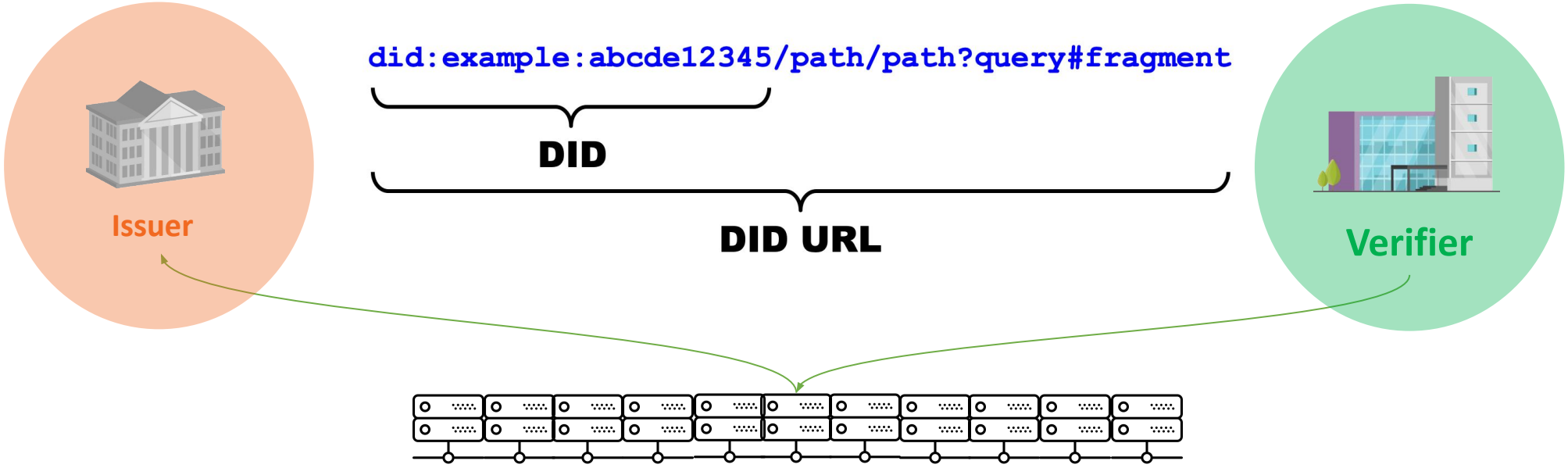


# Decentralized Identifiers (DIDs)

## Secrets management

- A Decentralized Identifier (DID) is a URL that returns a DID Document
- A DID subject is an entity (person, organization, or thing)




Resolution of a DID to a DID Document provides means to:

- Authenticate keys
- Send messages to the Subject



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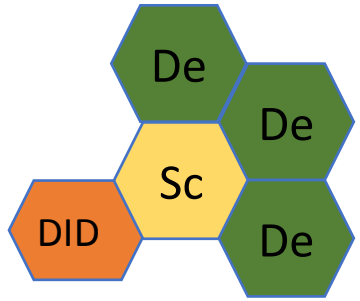
# DID-Schema-Definition

## Relationships

Definitions provide a means of managing relationships between verifiers, holders and issuers, where the issuer *defines* the attributes available to a particular set of verifiers




*Driver License 1.0*
Last Name
First Name
Date of Birth
Eye Color
License Number
Issue Date
Expiration Date

De

*Driver License 1.0*
Last Name
First Name
Date of Birth
~~Eye Color~~
~~License Number~~
~~Issue Date~~
Expiration Date

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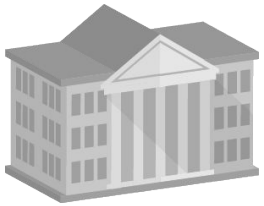

Gov


Sc

*Driver License 1.0*
Last Name
First Name
Date of Birth
Eye Color
License Number
Issue Date
Expiration Date

De

*Driver License 1.0*
Last Name
First Name
Date of Birth
~~Eye Color~~
License Number
Issue Date
Expiration Date

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# Hyperledger Indy Network



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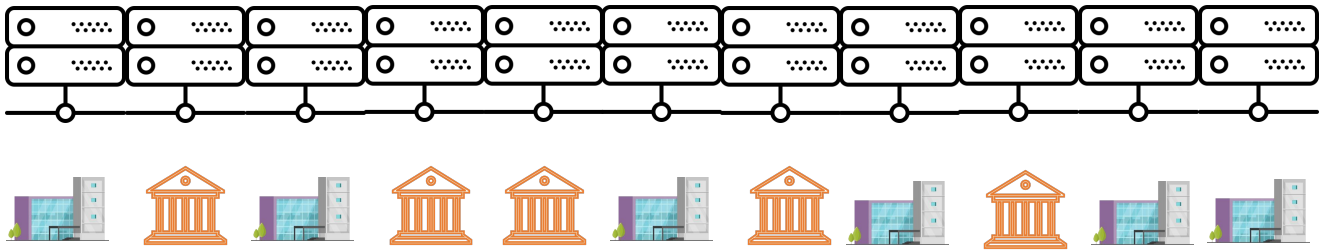
# Hyperledger Indy Network

**Nodes**

support and create a network





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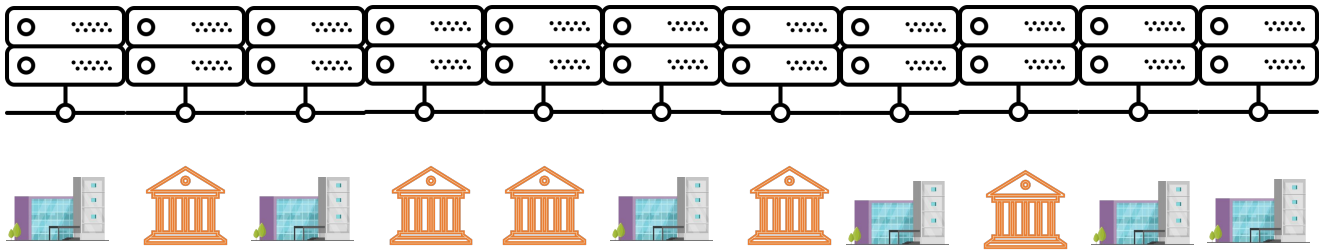
# Hyperledger Indy Network

Enterprise Agent

Edge Agents

**“Agents”**

Are simply **software programs** that act on behalf of a participant to perform a function of interacting with the network and ledger





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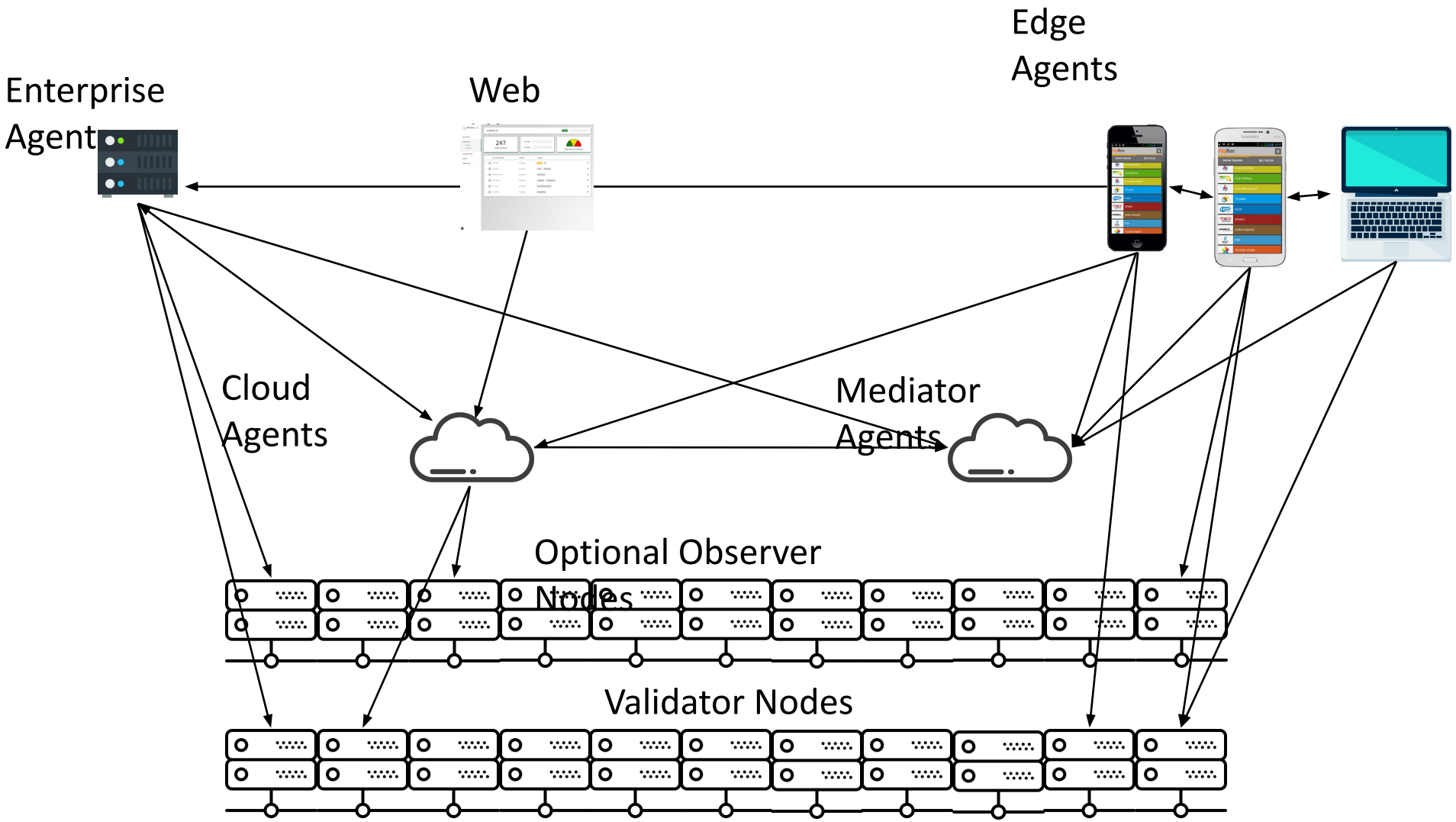
# Hyperledger Indy Network

How is it organized?



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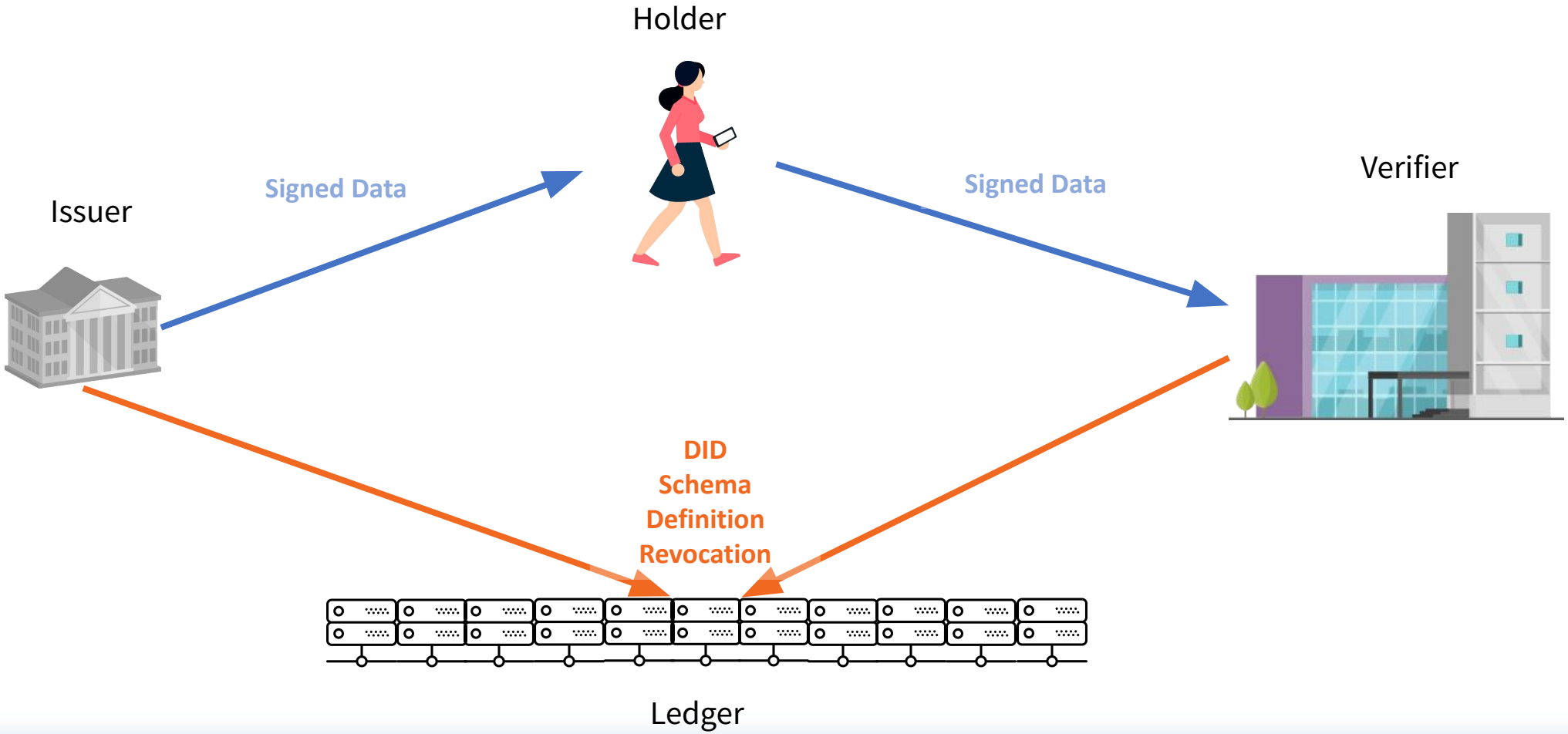
# PII (and all Credential Data) stays with data's owner or authorized controller

Privacy-by-design and compliance protections

**The ledger is a means of verifying the authenticity/source and integrity of data!**



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# Code architecture

Enterprise, Mobile Apps

Hyperledger Indy Plugins

Aries Agent

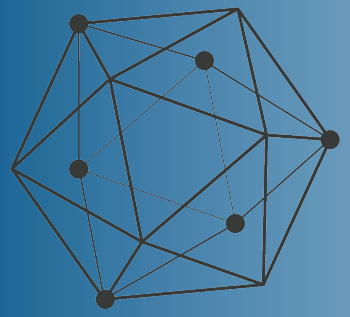
Hyperledger Indy Node (Identity Transactions)

Aries SDK

Hyperledger Indy Plenum (Consensus)

Indy Resolver

Hyperledger Ursa (Cryptography Library)



# Notes on components
## roles and conventions

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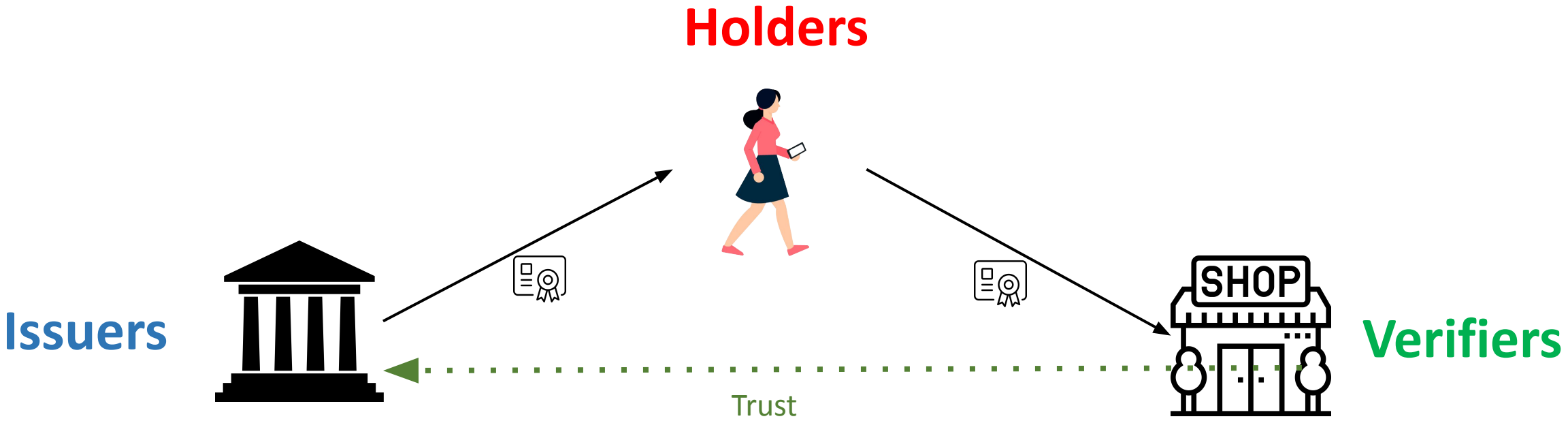
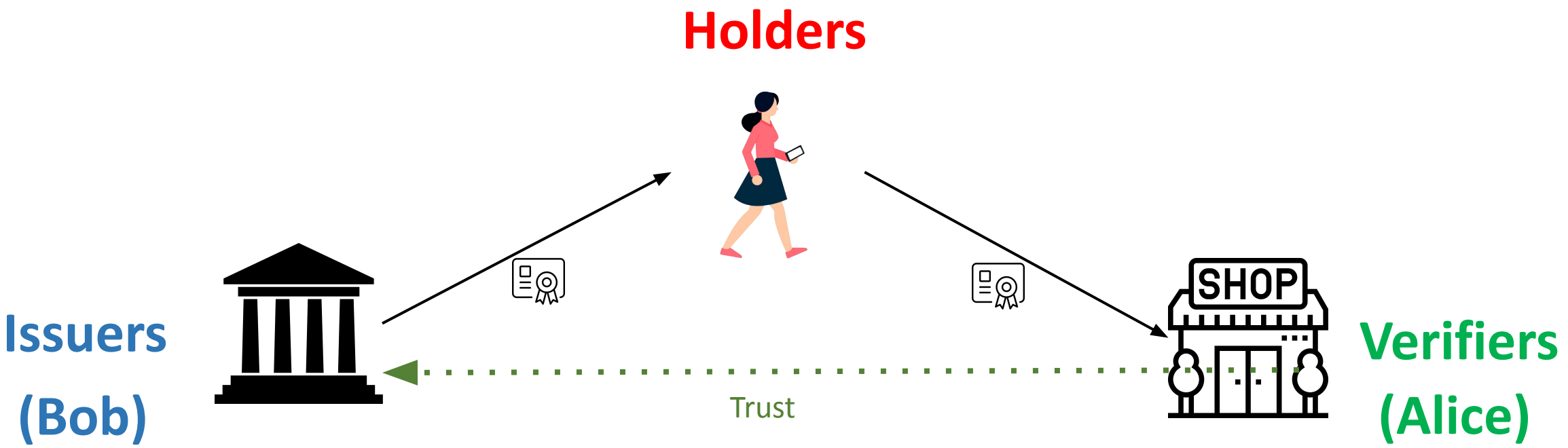
# Roles and Convention

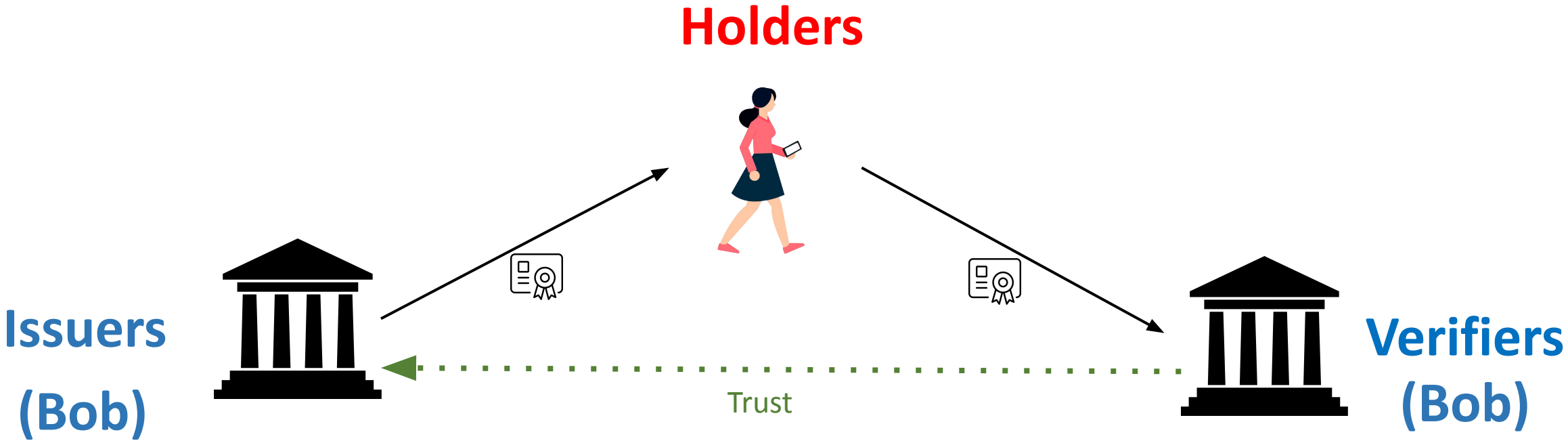


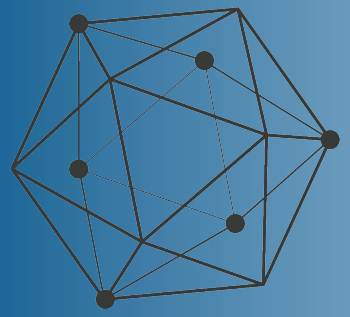
# Stories of Bob and Alice



# Roles may overlap

## Particularly those of ***Issuer*** and ***Verifier***





# Value

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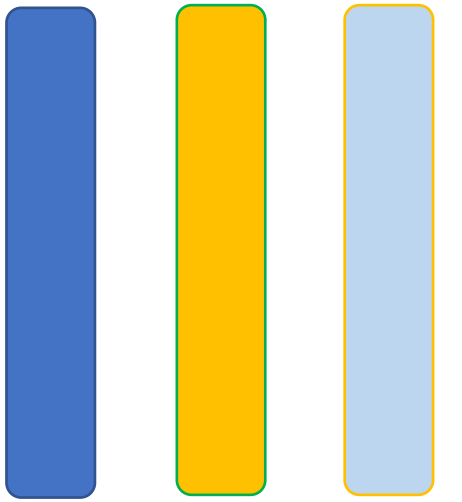
**Decentralized World**

~2020 ---




*Verification of digital document authenticity and integrity is possible!*

# Privacy

## Protecting individual data through **Privacy by Design**

- Use of Decentralized Identifiers (DIDs)
- Peer DIDs are pairwise unique
- No PII on the ledger!
- Zero-knowledge methods
- Verifiers don’t contact issuers
- Compliance

# Next:
# Technical Overview of Decentralized Identity

Tuesday 27 February 2023 12:00 EST

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