COALA IP Protocol Specification

Agenda I

Introduction

- Goals

- Ideas

The LCC Framework

Technical details

- What is IPLD?

- What is Linked Data? + useful RDF schemata

- What is the Interledger Protocol?

Agenda II

The COALA IP Protocol

- Transformations from LCC RRM
- Evaluations and Challenges
- Roadmap

Introduction

Goals

A licensing framework for digital assets that:

- Is easily approachable by all participants (devs, rights holders, copyright societies, …)
- Is easily extensible and future-proof
- Guarantees immutability and tamper-resistance
- Is blockchain-agnostic
- Is free (free as in FoS/FOSS) for everyone to participate and use

Ideas

Let’s use:

- Linked Data, it’s easily extensible
- IPLD, it’s integrity is cryptographically verifiable
- ILP, it allows COALA IP to live on many ledgers
- The LCC framework, it’s concise and applicable

History

COALA - spinout from MIT & Harvard for blockchain workshops. Meet 3-4 times per year.

IP working group started in fall 2015. Meet at each COALA workshop. Communication in between.

Contributors from COALA, IPFS, Ujo / Consensys, Mycelia, ascribe / BigchainDB, more. Relations to mediachain, SoundCloud, Open Music Initiative, W3C, more.

The LCC Framework

The LCC Framework

Catalogue of documents (main ones used):

- LCC Entity Model (short: LCC EM)
- LCC Rights Reference Model (short: LCC RRM)
- LCC Ten Targets for a Rights Network
- LCC Principles of Identification

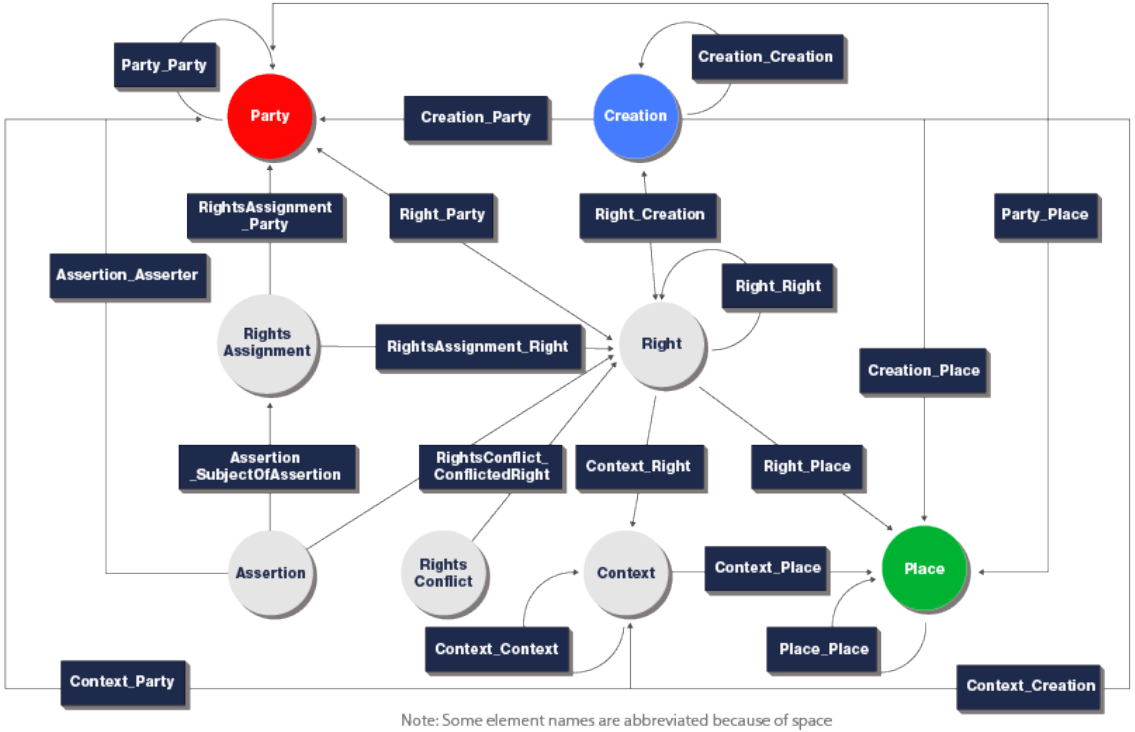
⇒ style of writing: “implementation-agnostic”

The LCC Rights Reference Model

Represent IP rights digitally

Data model on top of the LCC EM

⇒ 7 (main) entities



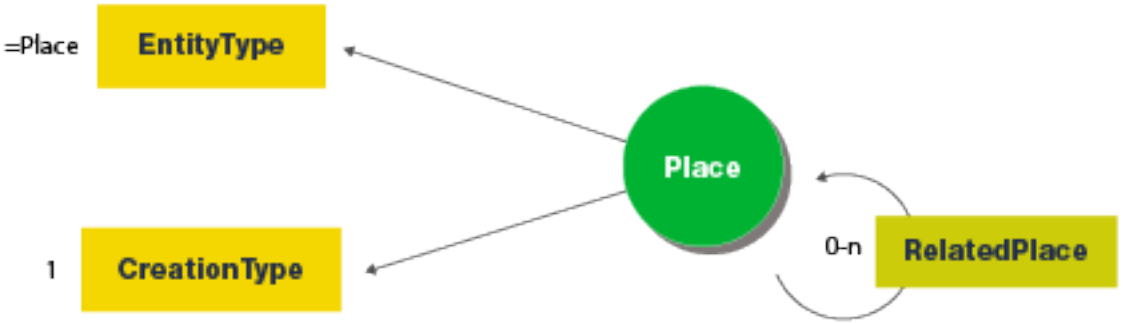
LCC RRM: Place

A localizable or virtual place

For example:

“New York City”; or

“https://newyork.city”



LCC RRM: Party

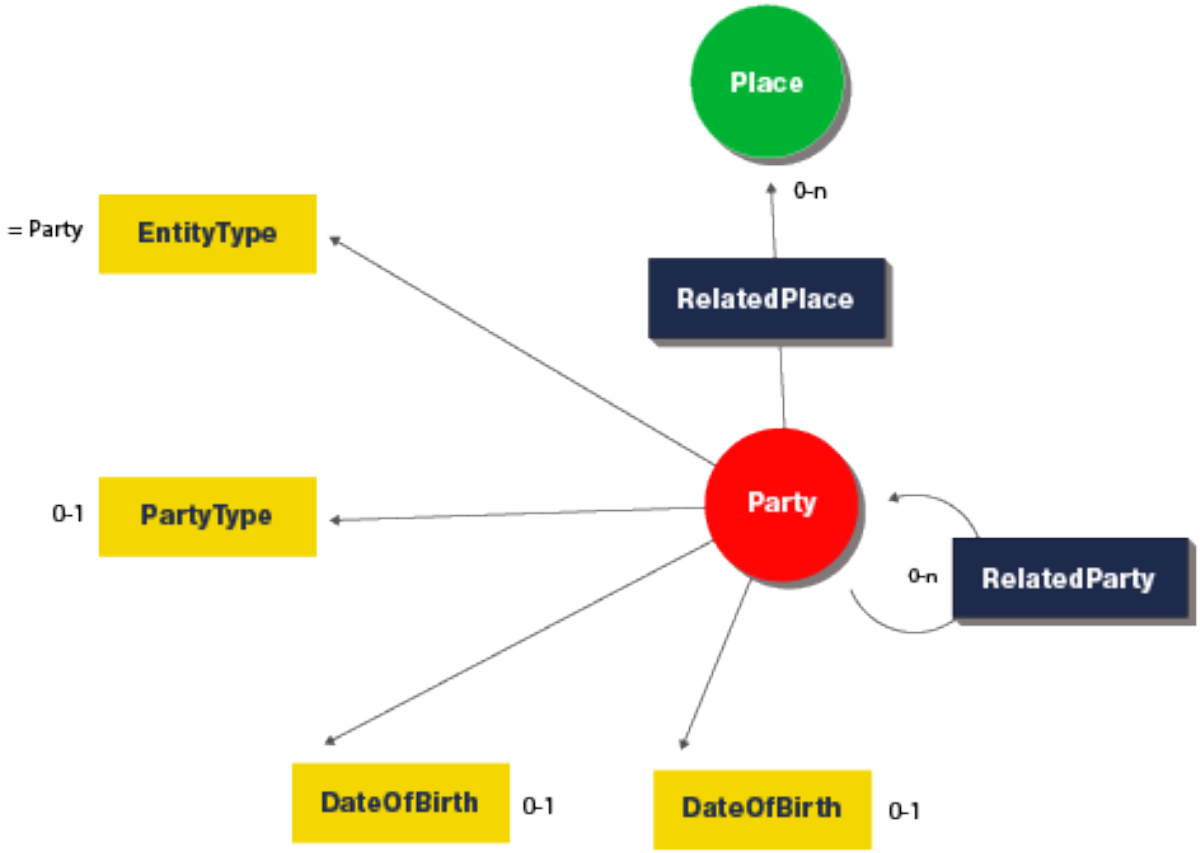
An individual or a group of individuals (organization)

Represents: right holders, licensors, users

For example:

“Andy Warhol”; or

“Warner Bros. Entertainment”



LCC RRM: Creation

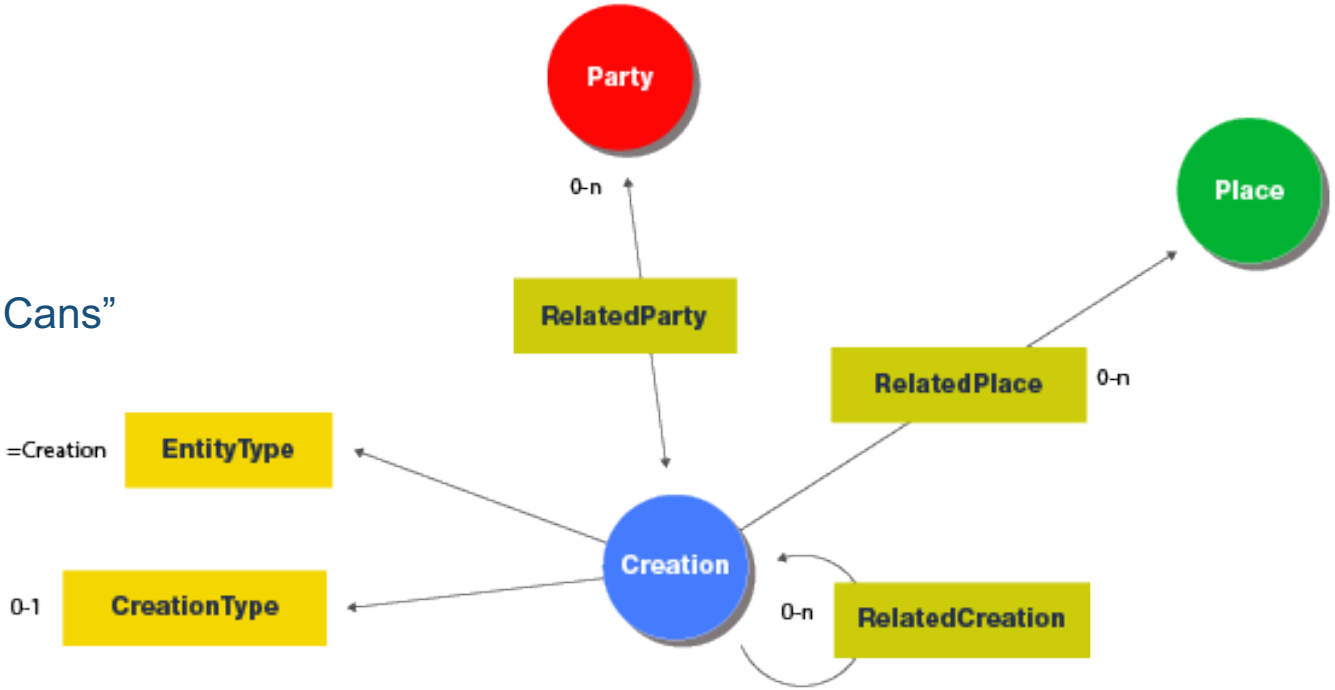
Smth (in)directly made by human beings

Separation:

Work and;
Manifestation

For example:

“32 Campbell’s Soup Cans”
(by Andy Warhol)

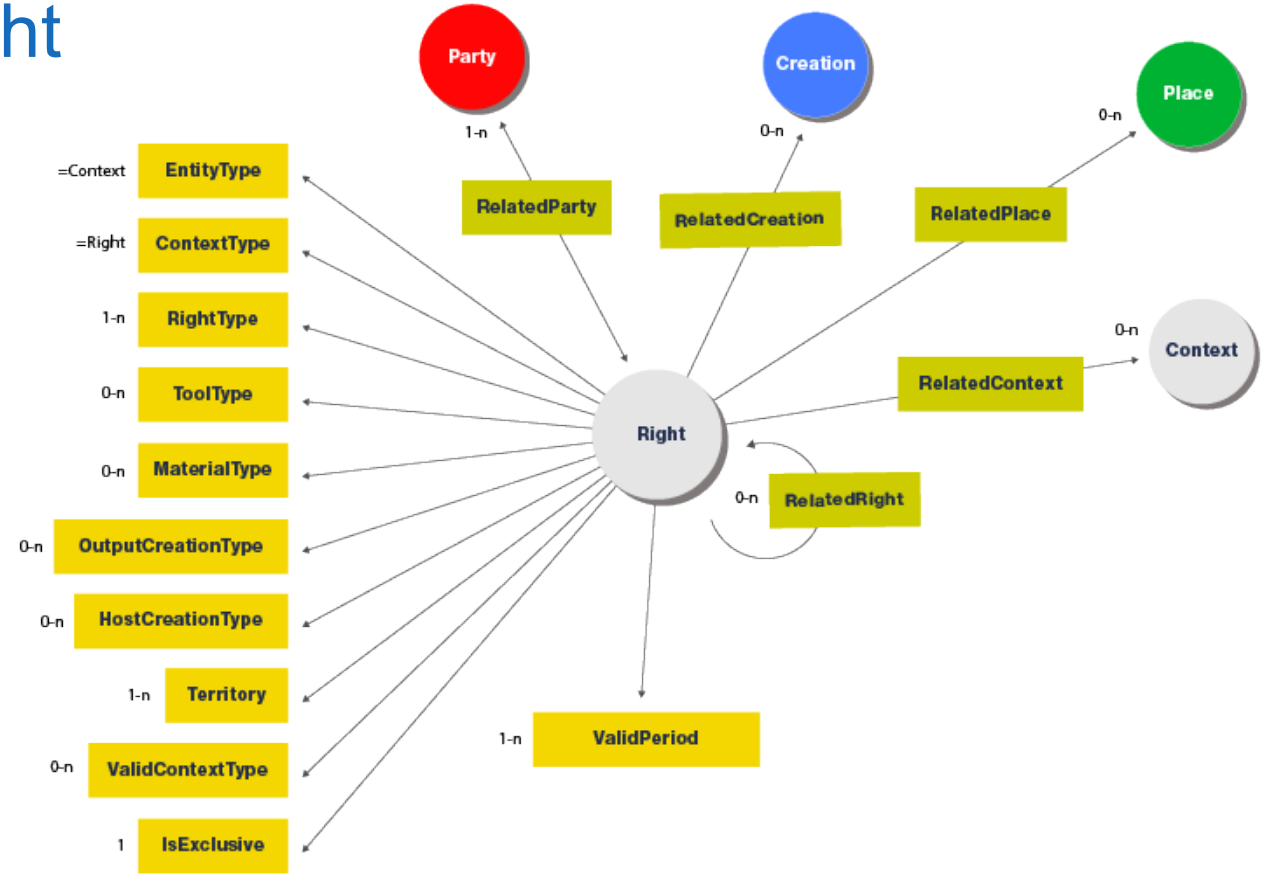


LCC RRM: Right

Set of permissions that entitle a Party to do something with a Creation

For example:

“Andy Warhol controls all Rights to 32 Campbell’s Soup Cans”

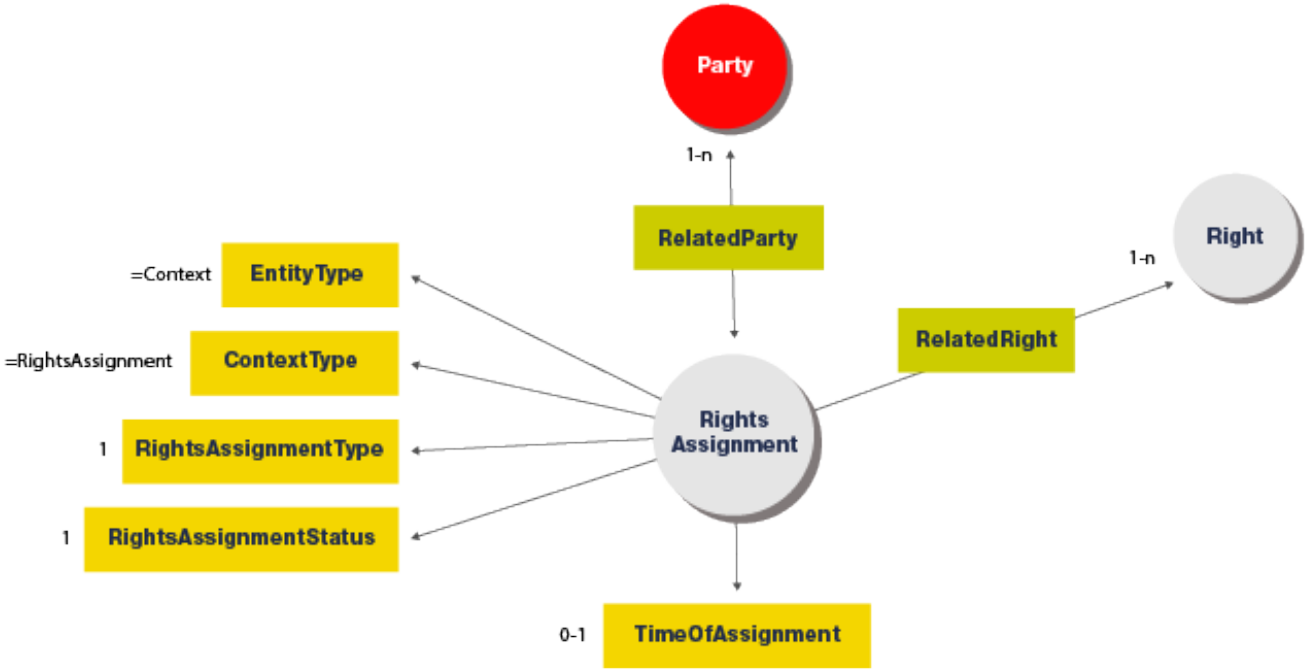


LCC RRM: RightsAssignment

Every possible way to “transfer” a Right from Party to Party

For example:

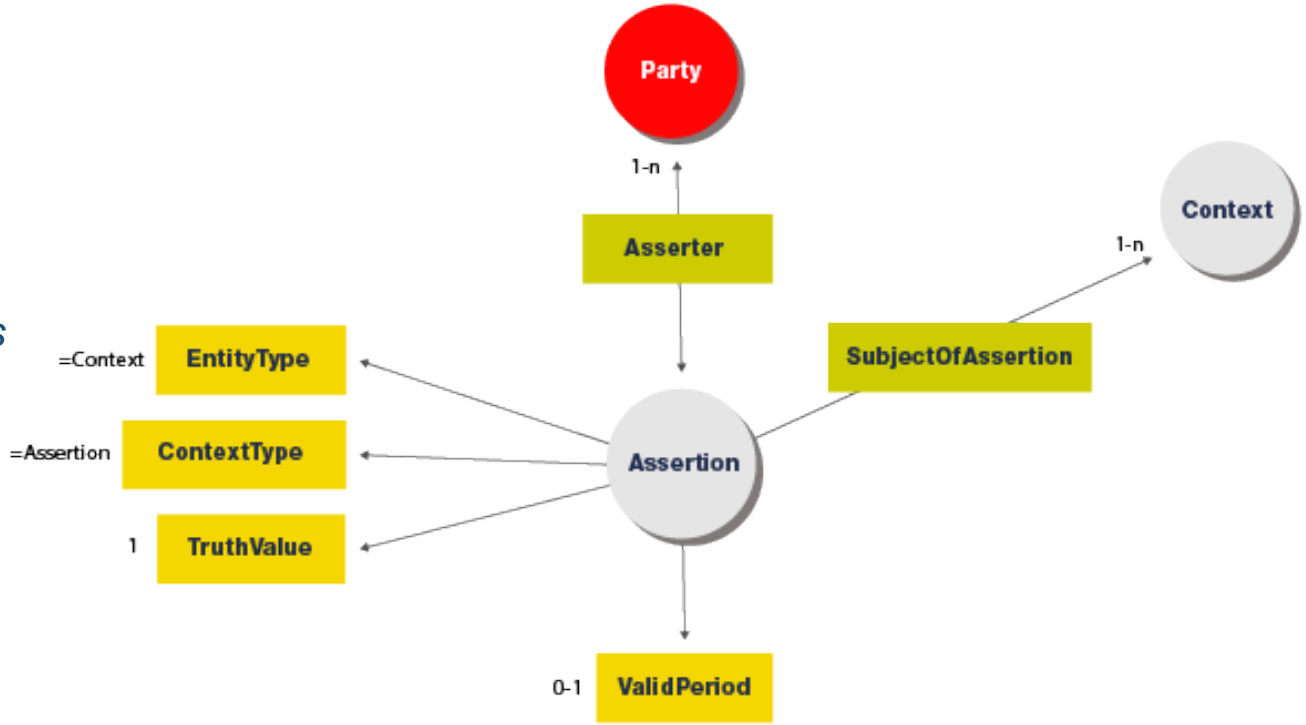
“I, Andy Warhol declare that ‘32 Campbell’s Soup Cans’ shall be published under CC free use license”



LCC RRM: Assertion

A claim made about the substance of a Right

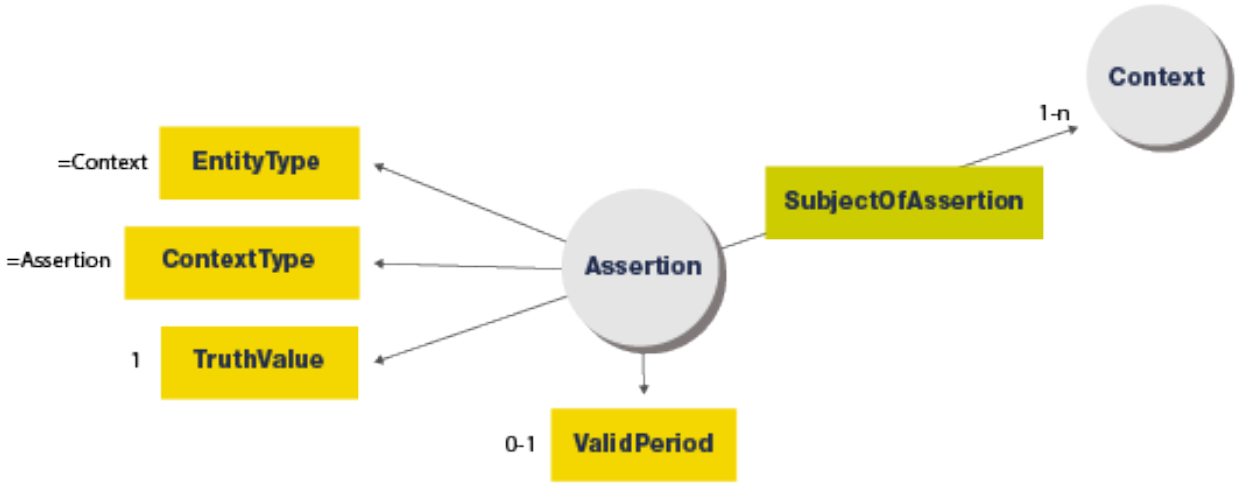
For example:
“I, the MoMa, New York, claim that Andy Warhol is the righteous creator of ‘32 Campbell’s Soup Cans’”



LCC RRM: RightsConflict

A statement of disagreement over a Right

For example:
*"I, Tim, declare that Andy Warhol is **NOT** the righteous creator of '32 Campbell's Soup Cans'"*



Technical Details

Main technical components

IPLD: Merkle-linking of JSON objects

JSON-LD: URI-linking of JSON objects

Interledger Protocol: Linking of ordered transactions on blockchains

Some canonical identity protocol for the web (specifics: unclear as of now - “Reboot the Web of Trust”?)

What is IPLD?

What is IPLD?

Merkle-linking JSON objects

Cryptographic integrity-checking of data

Merkle-paths JSON objects

Content-addressable data/storage

IPLD: Merkle-Linking example II

```
In [5]: creation = {

    "name":"32 Campbell's Soup Cans",

    "dateCreated": "01-01-1962",

    "exampleOfWork": "https://en.wikipedia.org/wiki/.../media/File:Campbells_Soup_Cans_MOMA.jpg",

    "author": { "/": "QmRinxtytQFizqBbcRfJ3i1ts617W8AA8xt53DsPGTfisC" } # see resulting hash prev slide

}

In [6]: serialized_creation = ipld.multihash(ipld.marshal(creation))

Out[6]: 'QmfMLNLyJZgvSPkNMvsJspRby2oqP6hWZ8Nd2PvKLhudmK'
```

Merkle-paths example

Resolve path to specific set of information

```
In [7]: ipld.resolve('/ipfs/QmfMLNLyJZgvSPkNMvsJspRby2oqP6hWZ8Nd2PvKLhudmK/author')

Out[7]:

{“givenNamen”: “Andy”,

 “familyName”: “Warhol”,

 “birthDate”: “1928-08-06”}
```

Why IPLD?

Benefits:

Crypto-integrity checking

Content-addressing

Inter-ledger resolvability

Canonicalized ID

Immutability

Future-proof (multihash)

Caveats:

Non-standard protocols (multi-x)

Breakage with established protocols (e.g. URI)

Non-compatible with LD ontology

What is Linked Data?

Resource Description Framework (short: RDF)

A way to express assertions in a schematic way


```
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
         xmlns:xhtml="http://www.w3.org/1999/xhtml/vocab#">

  <rdf:Description rdf:about="http://lessig.org/blog">
      <xhtml:license resource="http://creativecommons.org/licenses/by/3.0/" />
  </rdf:Description>

</rdf:RDF>
```

What is JSON-LD?

Data structure serialize RDF in JSON

```
{
  "@type": "http://schema.org/Person",
  "@id": "http://example.com/data/AndyWarhol",
  "givenName": "Andy",
  "familyName": "Warhol",
}

http://example.com/data/AndyWarhol
  http://www.w3.org/1999/02/22-rdf-syntax-ns#type
    http://schema.org/Person .
```

Why JSON-LD?

Benefits:

Approachable (compared to XML/RDF)

Extensible

Well-shaped data

Maybe: Cross-usage from *Semantic Web*

Caveats:

Assumption: Data is mutable

Incompabilities with IPLD

Useful RDF Schemata

Useful RDF schemata I

LCC RRM Party:

schema.org/Person

schema.org/Organization

LCC RRM Creation:

schema.org/CreativeWork

And its subtypes: Book, Movie, MusicComposition

Useful RDF schemata II

LCC RRM Place:

schema.org/Place

LCC RRM Assertion:

schema.org/AssessAction

Additionally: Web of Trust Ontology

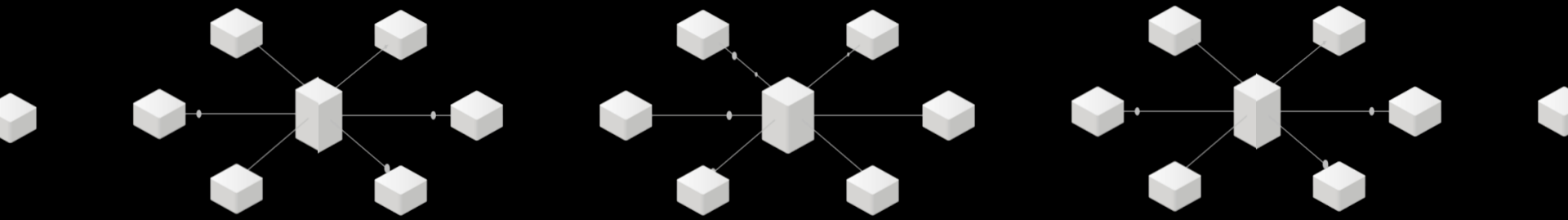
What is the Interledger Protocol?

Interledger

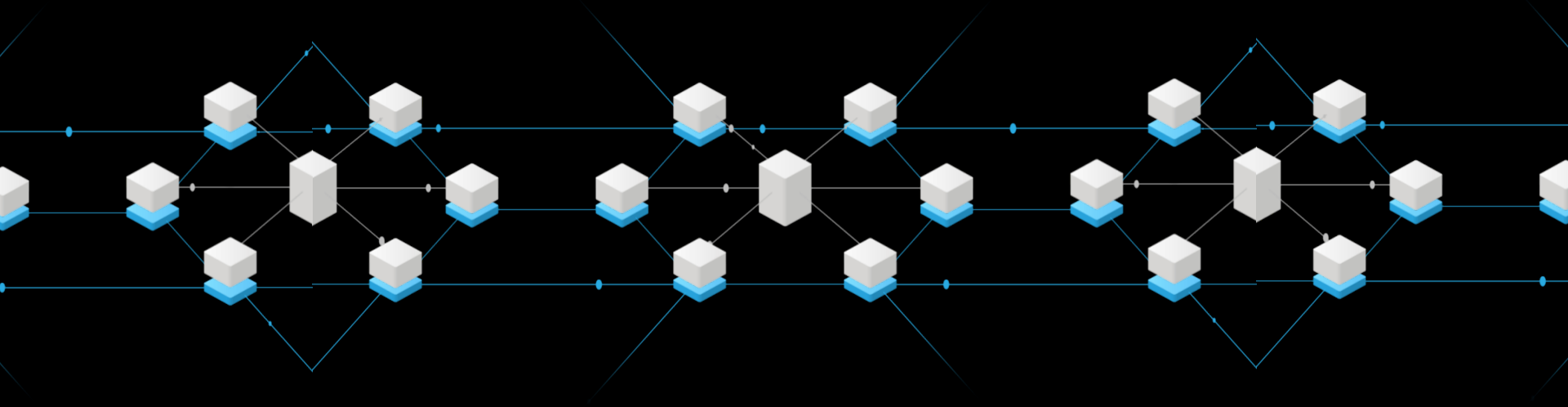
The protocol for connecting blockchains

The World Will **Never Agree** On a Single Ledger

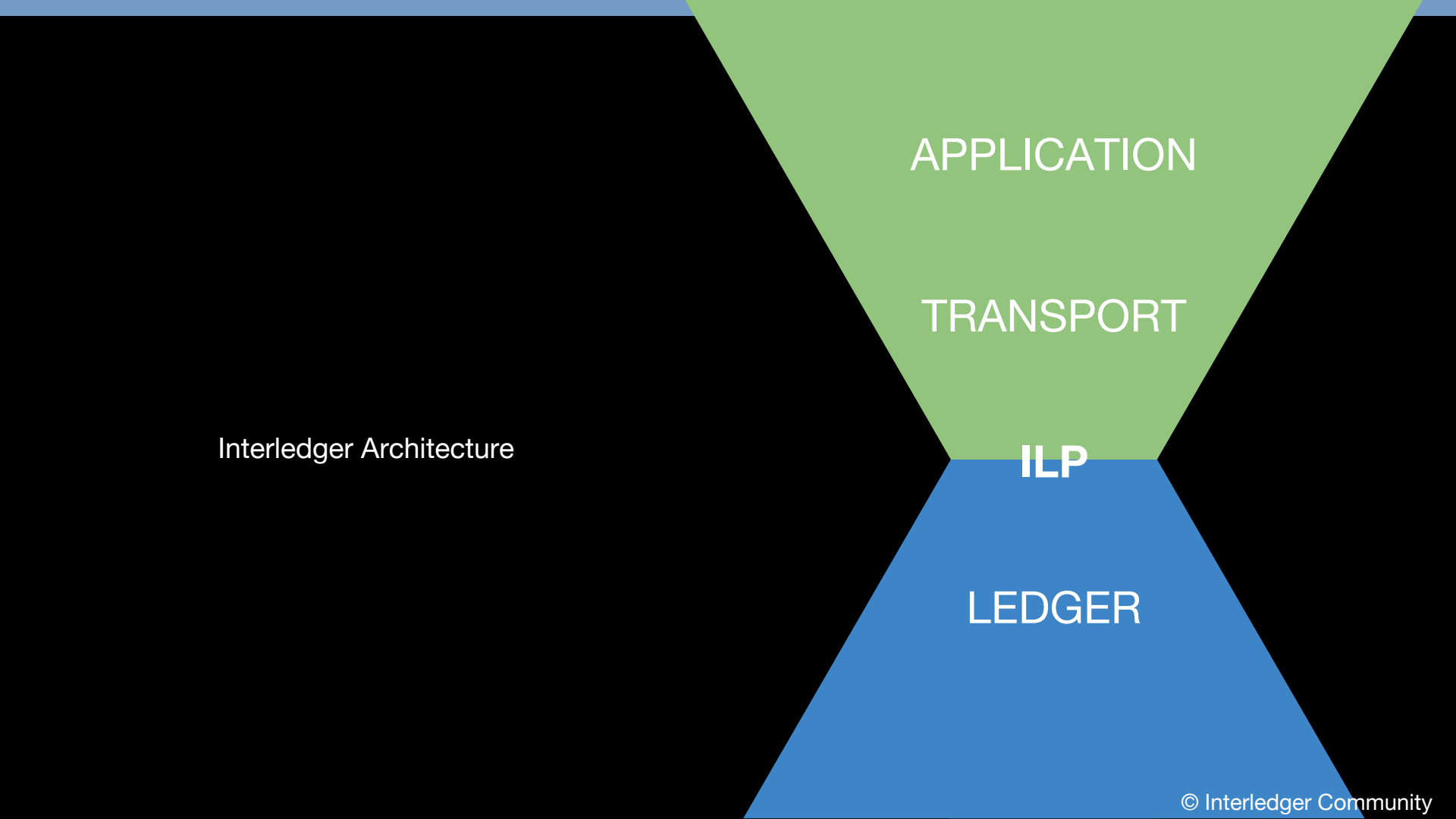
Learning From History



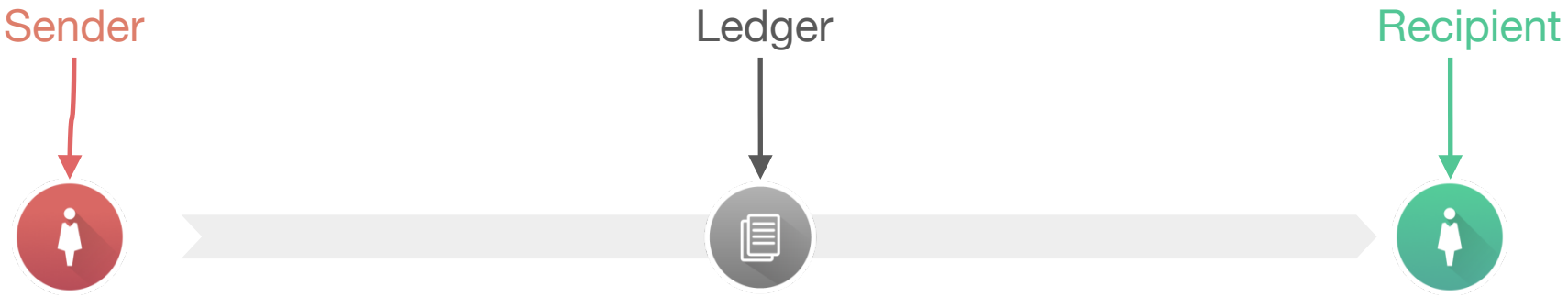
*Inter*net: Network of Networks



Interledger Architecture

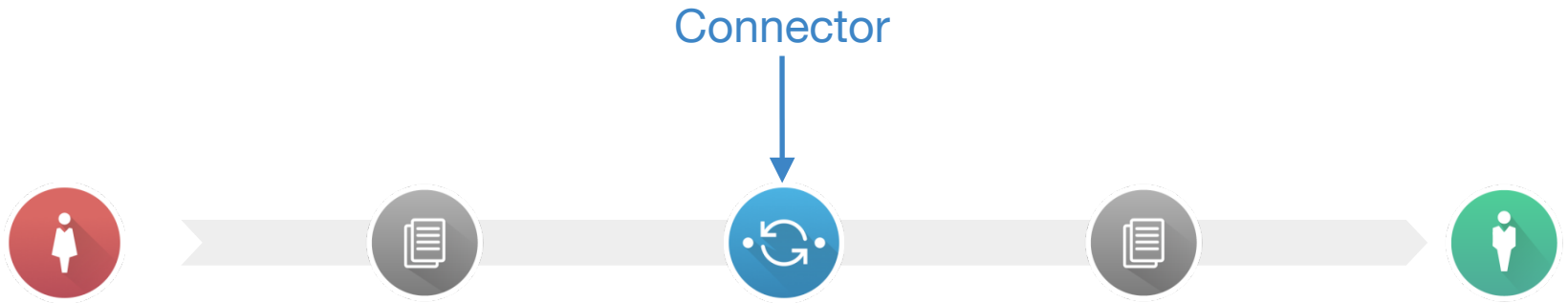


Ledgers track accounts and balances

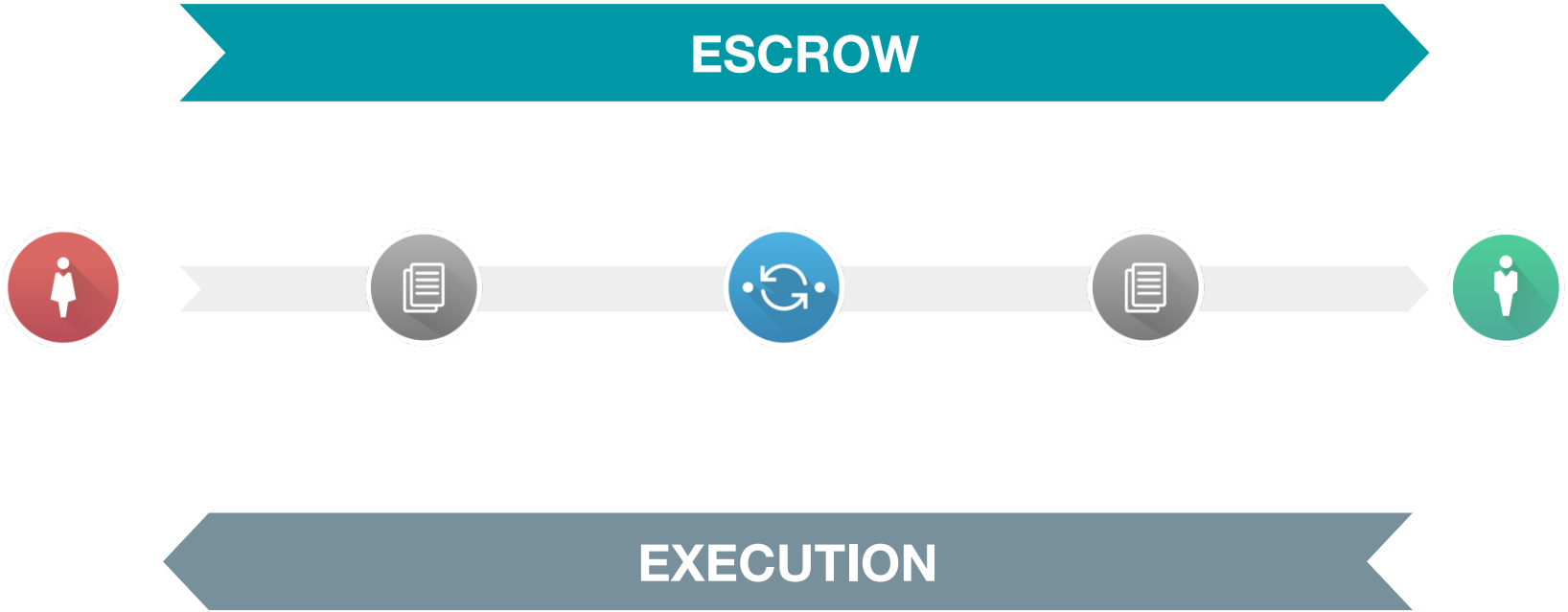


But not everyone is on the same ledger

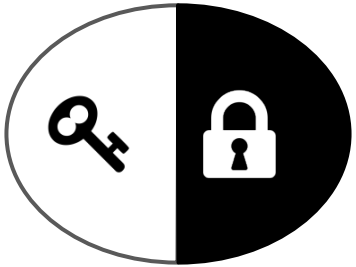
Connectors relay assets

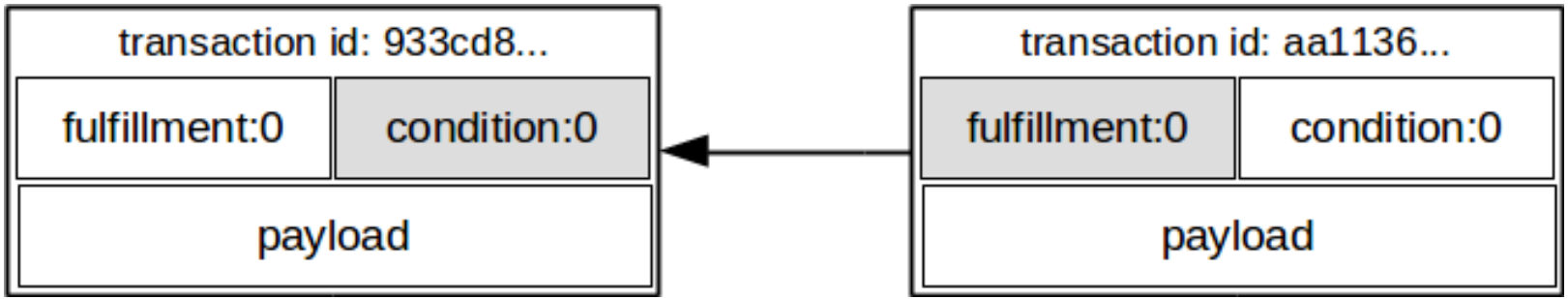


Transfers are escrowed L2R, executed R2L

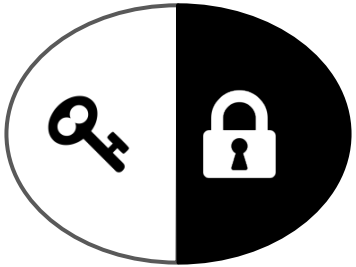


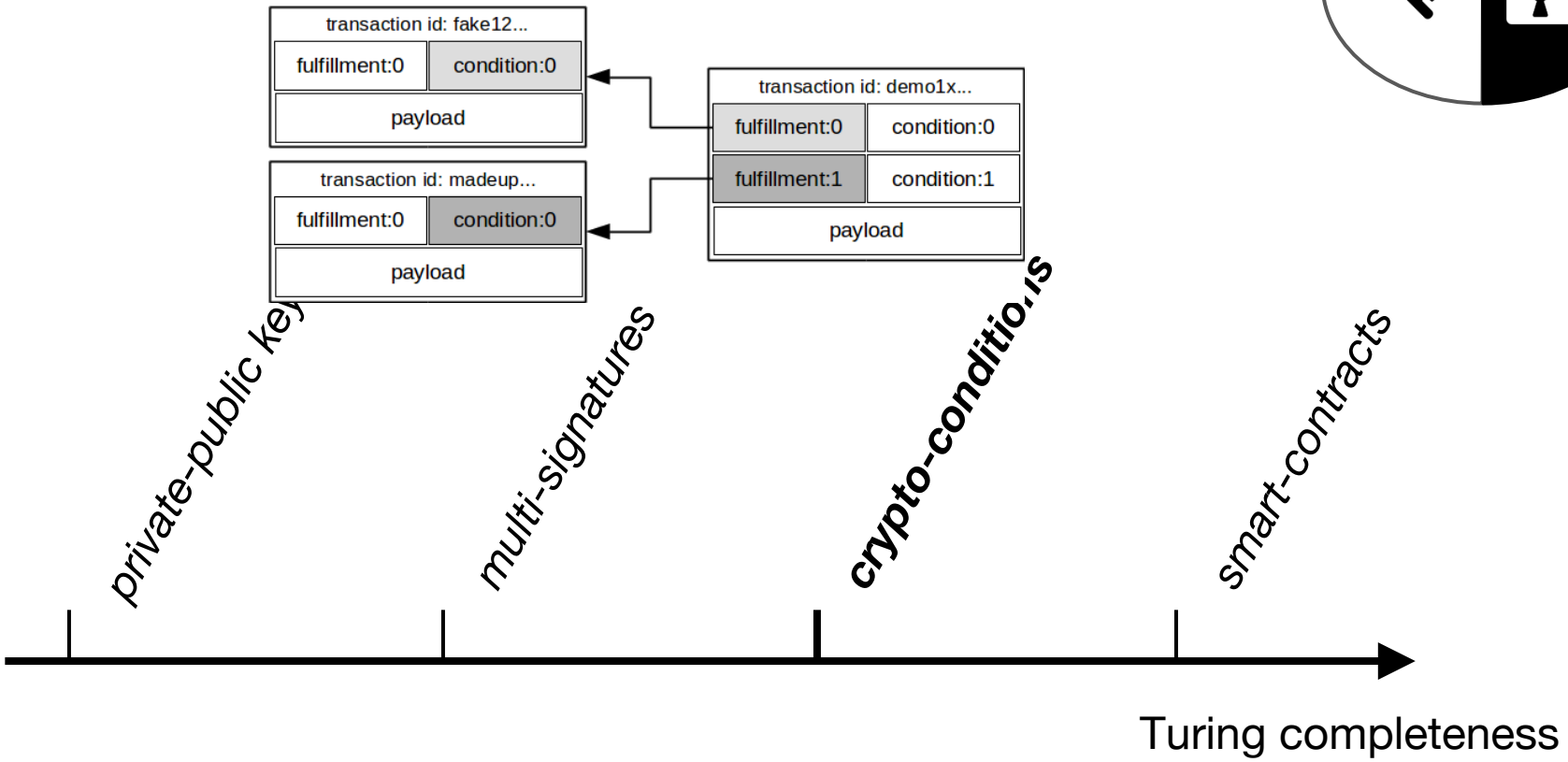
Assets with crypto-conditions



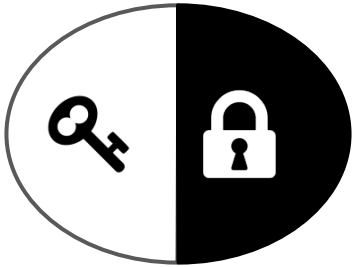


Assets with crypto-conditions



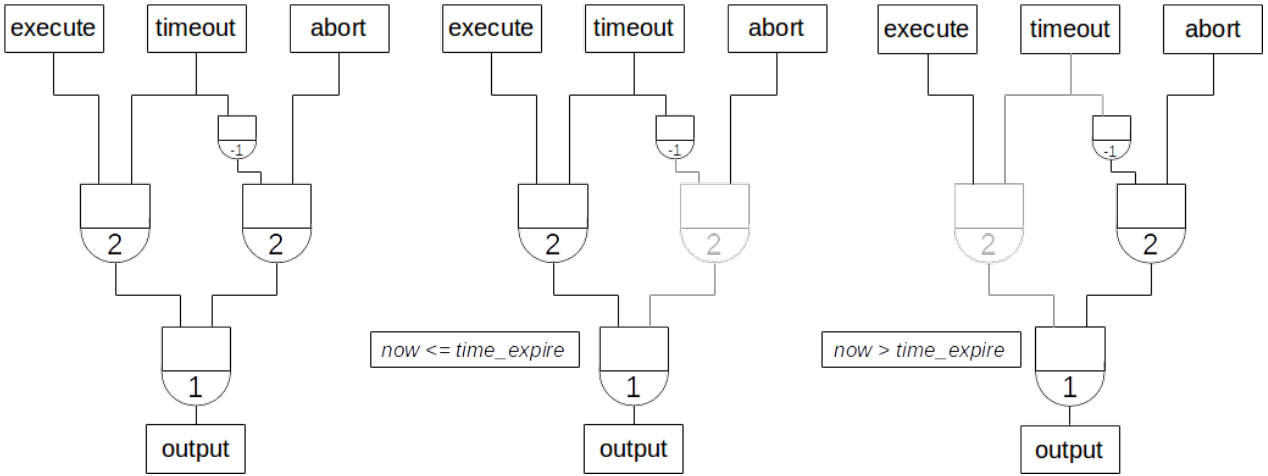


Assets with crypto-conditions



Boolean logic with signatures

Designed by the *Interledger* community



COALA IP Protocol

What is the COALA IP Protocol?

A community-driven minimum-viable set of data for Intellectual Property licensing (RDF schema definitions)

A free and open messaging protocol for license-transactions (Interledger & IPLD)

COALA IP: Place

```
{
    "@type": { "/": "<hash pointing to RDF-Schema of Place>" },
    "geo": {
        "@type": { "/": "<hash pointing to RDF-Schema of GeoCoordinates>" },
        "latitude": "40.75",
        "longitude": "73.98"
    },
    "name": "Empire State Building"
}
```

COALA IP: Party (only Individual)

```
{

    "@type": { "/": "<hash pointing to RDF-Schema of Individual>" },

    "givenName”: “Andy”,

    “familyName”: “Warhol”,

    “birthDate”: “1928-08-06”,

    “deathDate”: “1987-02-22”

    // and any other arbitrary meta data

    // TDB: Let’s use an established identity protocol here

}
```

COALA IP: Creation

```
{

    "@type": { "/": "<hash pointing to RDF-Schema of Creation>" },

    "name”: “Lord of the Rings”,

    “author”: { "/": "<hash pointing to the Author>" }

}
```

COALA IP: Creation (a *digital* Manifestation)

```
{   "@type": { "/": "<hash pointing to RDF-Schema of Manifestation>" },
    "name": "The Fellowship of the Ring",
    "creation": { "/": "<hash pointing to the Creation>" },
    "digital_work": { "/": "<hash pointing to a file on e.g. IPFS>" },
    "fingerprints": [
        "Qmbs2DxMBraF3U8F7vLAarGmZaSFry3vVY5zytuN3BxwaY",
        "<multihash/multifingerprint value>"
    ],
    "locationCreated": "<URI pointing to a Place object>"
}
```

COALA IP: Creation (a *physical* Manifestation)

```
{    "@type": { "/": "<hash pointing to RDF-Schema of Manifestation>" },

     "name": "The Fellowship of the Ring",

     "creation": { "/": "<hash pointing to the Creation>" },

     "datePublished": "29-07-1954",

     "locationCreated": "<URI pointing to a Place object>"

}
```

COALA IP: Right

```
{    "@type": { "/": "<hash pointing to RDF-Schema of Right>" },

     “usages”: “all|copy|play|stream|...”,

     “territory”: { “/”: “<hash pointing to a Place>” },

     “context”: “inflight|inpublic|commercialuse…”,

     “exclusive”: true|false,

      ...

     "manifestation": { "/": "<hash pointing to the Manifestation>" },

     "license": { "/": "<hash pointing to the License>" }

}
```

COALA IP: RightsAssignment

A special case: RightsAssignments must be stored in an ordered fashion

Store on an Interledger Protocol compliant ledger

- Provenance of assets (chain of events)
- True ownership of assets (priv and pub key)
- Enhanced transfers (escrowed, multi-sig)

⇒ e.g. BigchainDB (implements IPLD and ILP)

Intermezzo:
RightsAssignment on BigchainDB

BigchainDB: RightsAssignment example I

Add Right to payload of transaction to create it

```
# Create a Right and write it to BigchainDB

In [1]: tx_create = b.create_transaction(<node_pub>, <creator_pub>, None, 'CREATE',
payload=<Minimum viable data set of a Right>)

In [2]: tx_create_signed = b.write_transaction(b.sign_transaction(tx_create,
<creator_priv>))
```

BigchainDB: RightsAssignment example II

```
In [5]: tx_create_signed

Out[5]: {"id":"aa11365317cb89bfdae2375bae76d6b8232008f8672507080e3766ca06976dcd",

         "transaction": {

             "conditions": [...],

             "data": <Right>,

             "fulfillments": [...],

             "operation": "CREATE",

             "timestamp": "1460981671.262047"

    }

}
```

BigchainDB: RightsAssignment example III

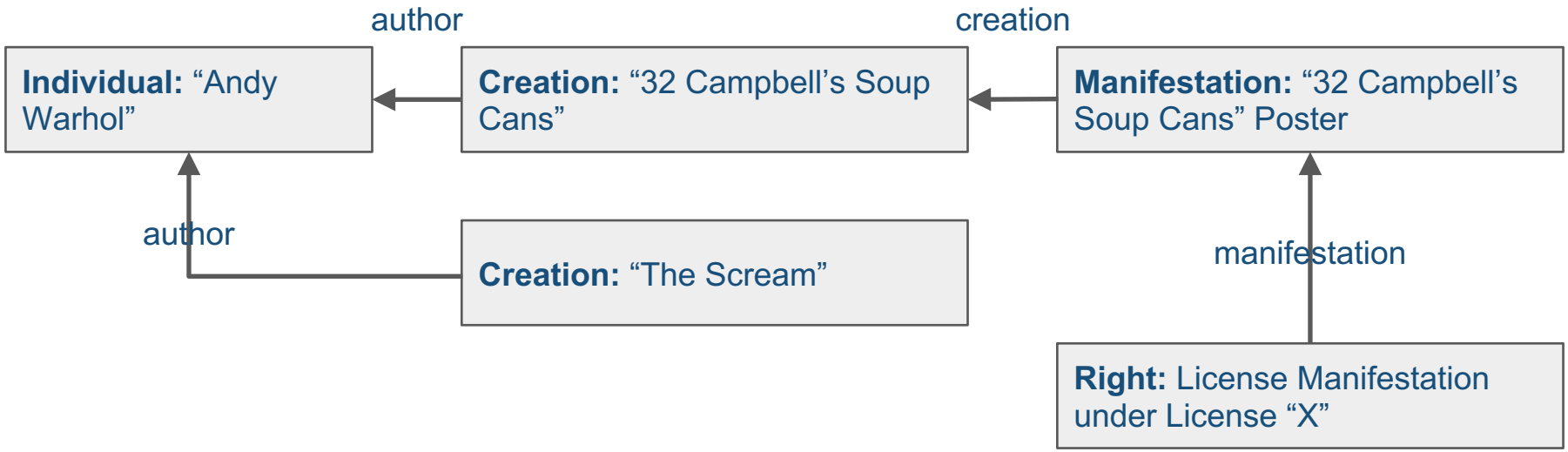
Transfer the asset representing the Right

```
# Transfer a Right with BigchainDB

In [3]: tx_transfer = b.create_transaction(<creator_pub, <transferee_pub>,
tx_signed['id'], 'TRANSFER')

In [4]: tx_transfer_signed = b.write_transaction(b.sign_transaction(tx_transfer,
<creator_pub>))
```

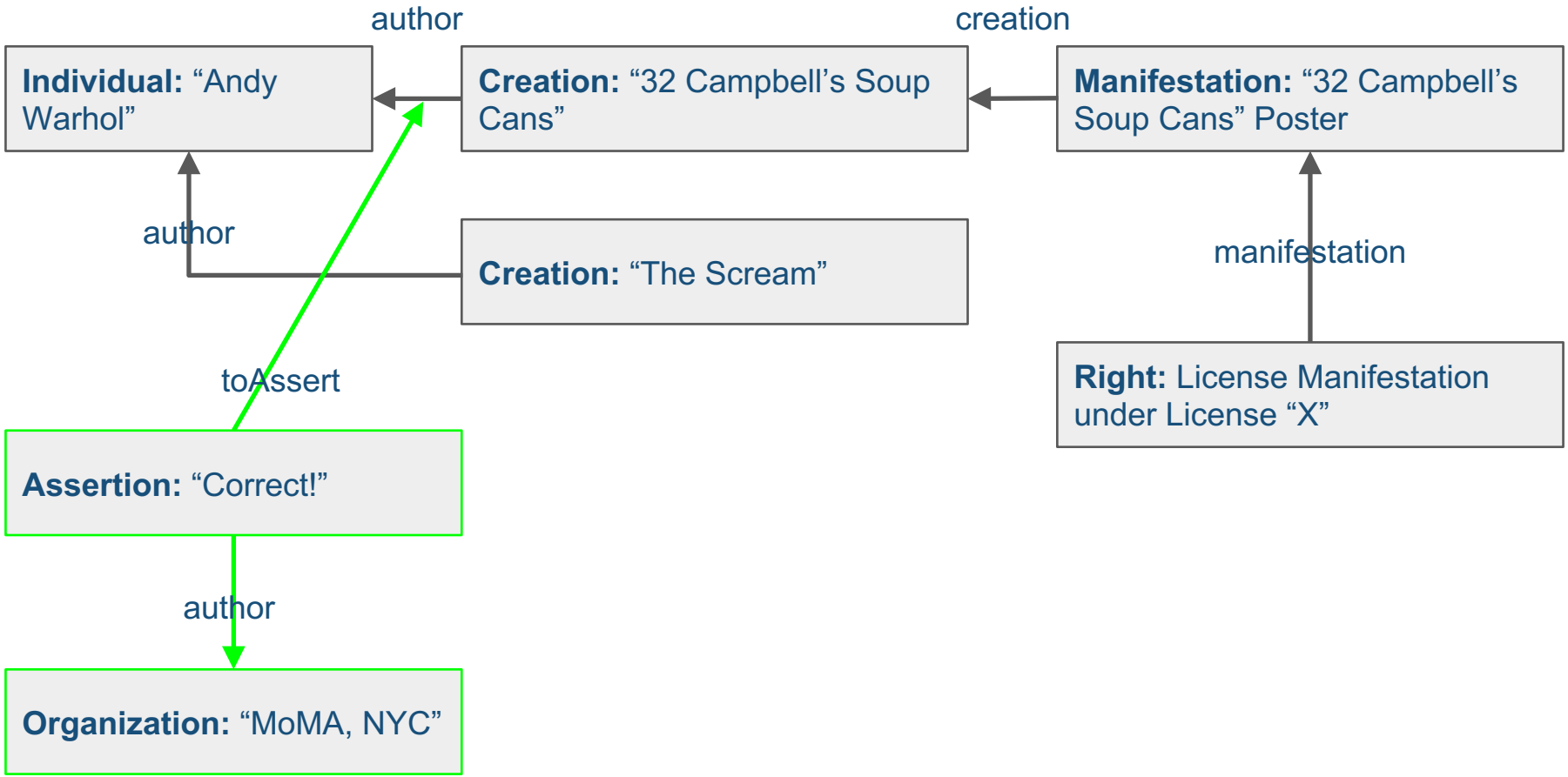
BigchainDB: RightsAssignment example IV

```
In [5]: tx_transfer_signed

Out[5]: {"id":"aa11365317cb89bfdae2375bae76d6b8232008f8672507080e3766ca06976dcd",

         "transaction": {

             "conditions": [...],

             "fulfillments": [...],

             "operation": "TRANSFER",

             "timestamp": "1460981677.472037"

    }

}
```

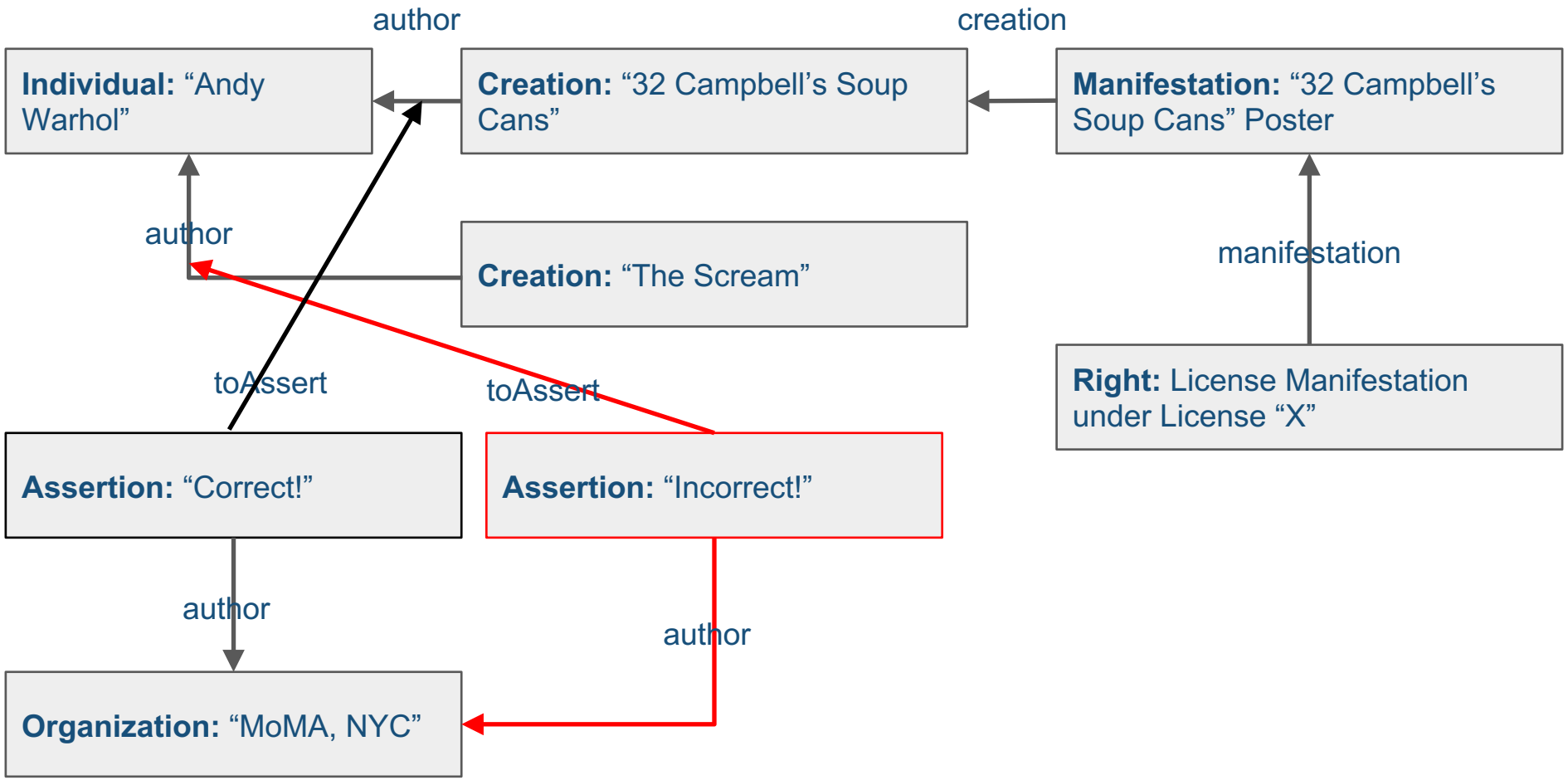
COALA IP: Assertion I



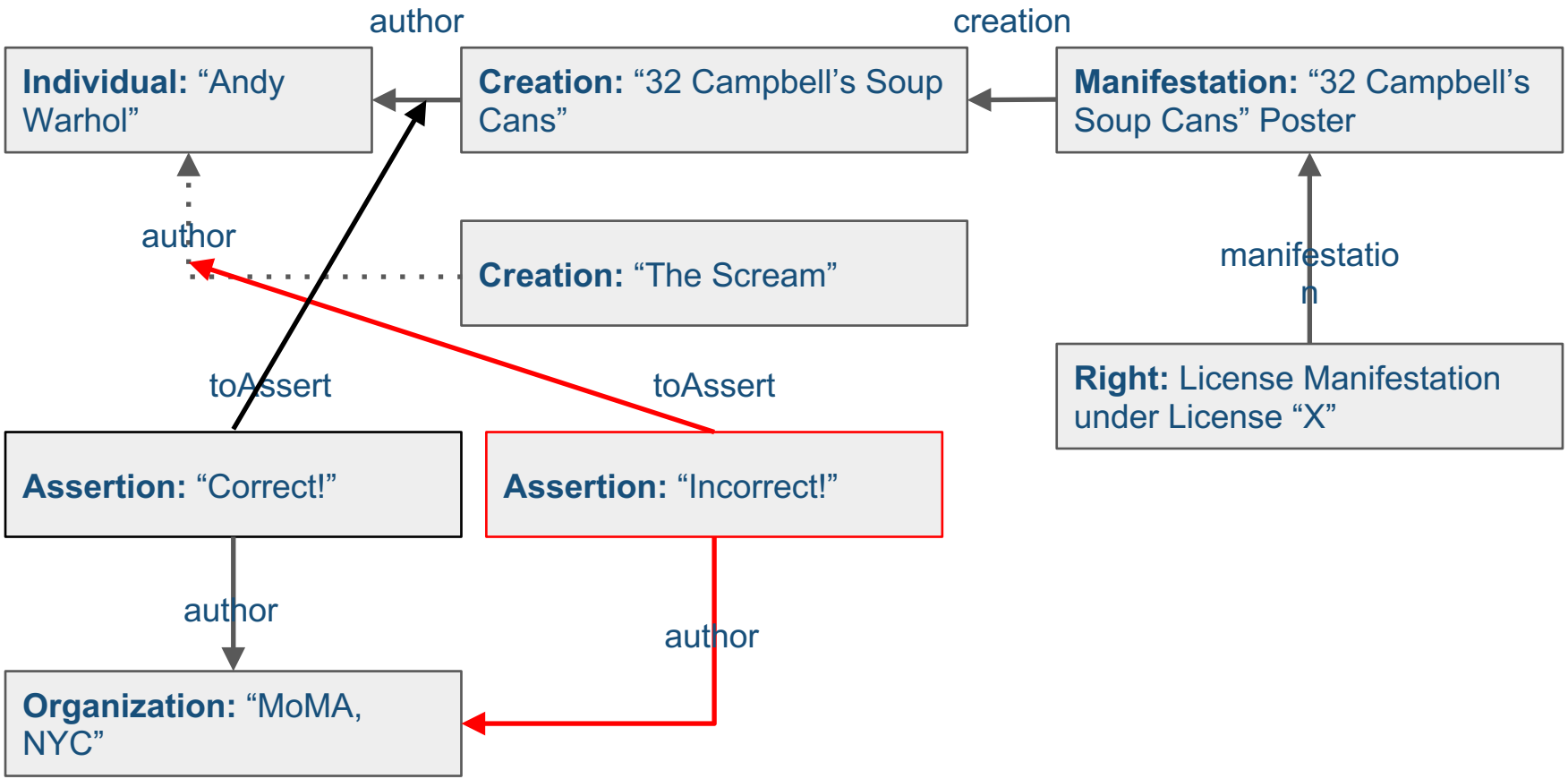
COALA IP: Assertion II



COALA IP: Assertion III



COALA IP: Assertion III



Evaluation

Challenges

Immutable ledgers and data structure: Backlinks only

Directed Graph: Unreachable nodes?

How can ILP and IPLD’s efforts be combined further?

The missing link: How does **identity** fit in?

Interoperability

With data *stores* through IPLD, compatibility with:

IPFS

Mediachain

...

With ledgers through IPLD & ILP compatibility with:

BigchainDB

Ripple

Bitcoin? Ethereum?

Extensibility

With RDF-based data structure:

Community-curatable *minimum viable data*

With Interledger Protocol:

Exciting escrow opportunities (Money ←escrow → digital license)

Other achievements

Both human and machine readable (compare to ascribe’s SPOOL protocol)

Hyperlinked media: Exciting times for crawlers

Fairly compliant with parts of the LCC framework

Roadmap & Organization

Roadmap

* - July ‘16: Finish COALA IP spec.

July ‘16 - Sept. ‘16: COALA IP reference implementation

After Sept. ‘16:

Use COALA IP reference impl. in prod. systems

Take COALA IP specs to IETF/W3C/???

Organization

Soon, there will be:

A spec hosted publicly on Github

A Github organization

A mailing list

⇒ Interested? Feedback? Ideas?: Please talk to us!

Thanks for listening!
Questions?