CRYPTOCURRENCY FOR THE GIFT ECONOMY

DOCUMENT COIN

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QCon London 2016

TAKEHOME LESSONS

- Blockchain without global consensus is interesting
- WebCrypto APIs will bring innovation to blockchain applications
- Application developers not cryptographers?!?
- IETF JOSE means standardized implementations

https://www.flickr.com/photos/ultimatekiwi/5154416336/

DOYLE OWL TRADING CARD

Number 4 of 7

The Owliphant says,
"I shall return."

This card is worth 1 time point.

Brought to you by Tom Petersen and Gloria, too!

BACKGROUND ASSUMPTIONS

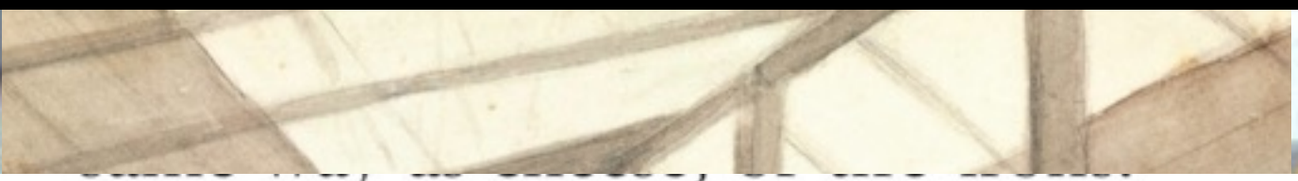
IDEOLOGY

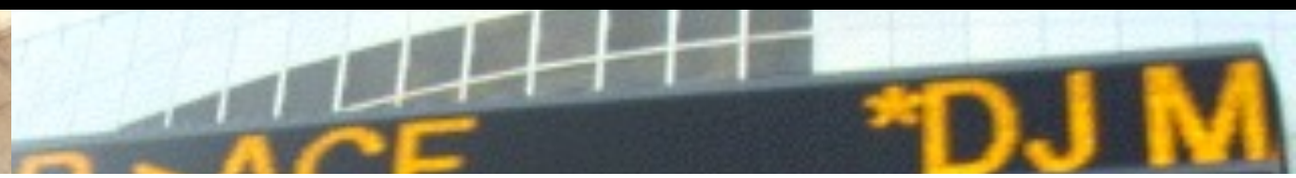
WHERE WOULD YOU RATHER LIVE?

LEGIBILITY

HOW WE KNOW SOMETHING IS IMPORTANT

VALUE

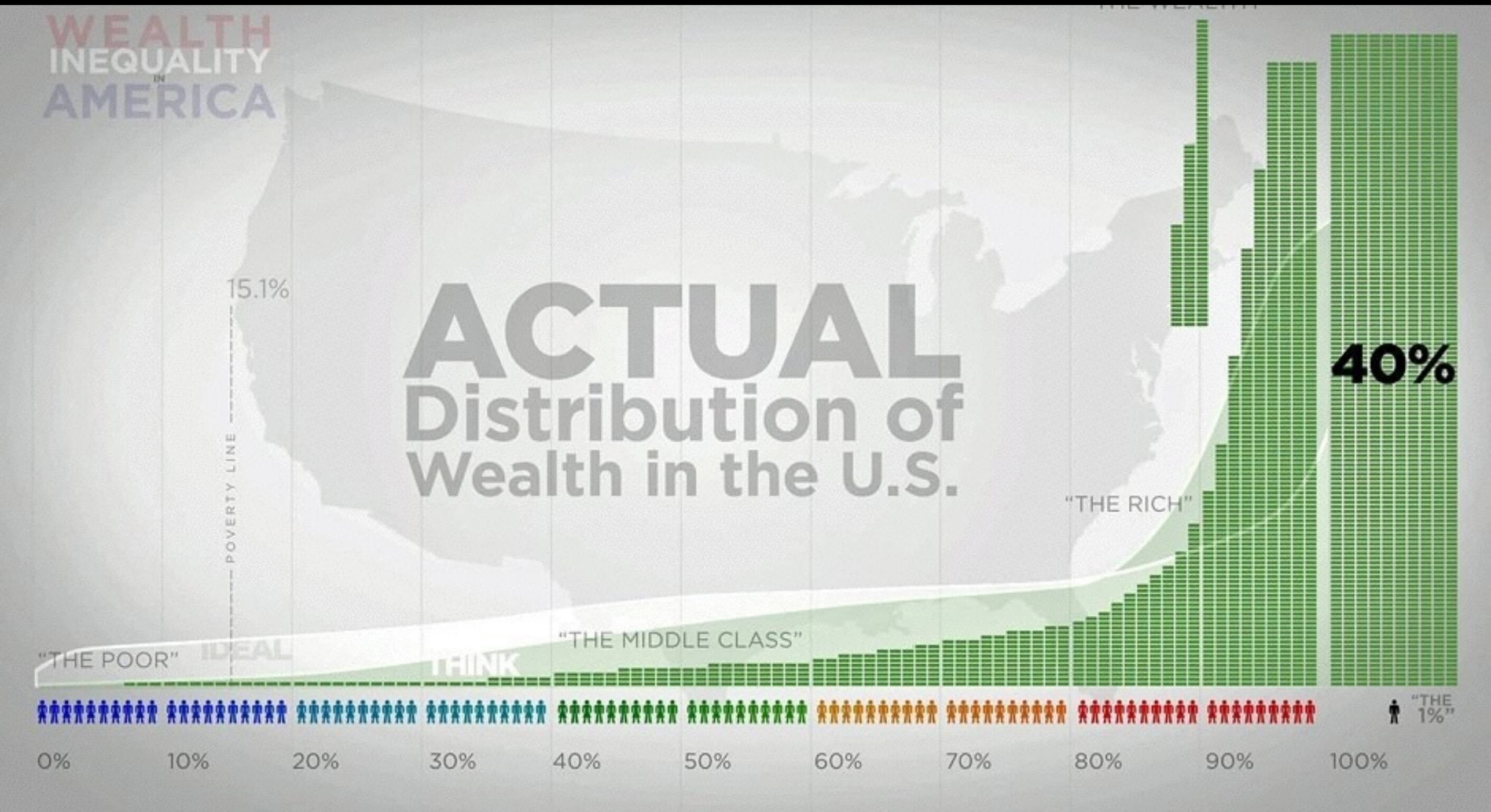




Gregory lays out a tidy set of oppositions. Gifts are transactions that are meant to create or effect "qualitative" relations between persons; they take place within a preexisting web of personal relations; therefore, even the objects involved have a tendency to take on the qualities of people. Commodity exchange, on the other hand, is meant to establish a "quantitative" equivalence of value between objects; it should ideally be done quite impersonally; therefore, there is a tendency to treat even the human beings involved like things. Giving someone a gift usually puts that person in your debt; hence, success in gift exchange becomes a matter of giving away as much wealth as possible, so as to gain a social advantage. In a commodity system, it's the things that are important; therefore, people try to accumulate as much wealth as they can.

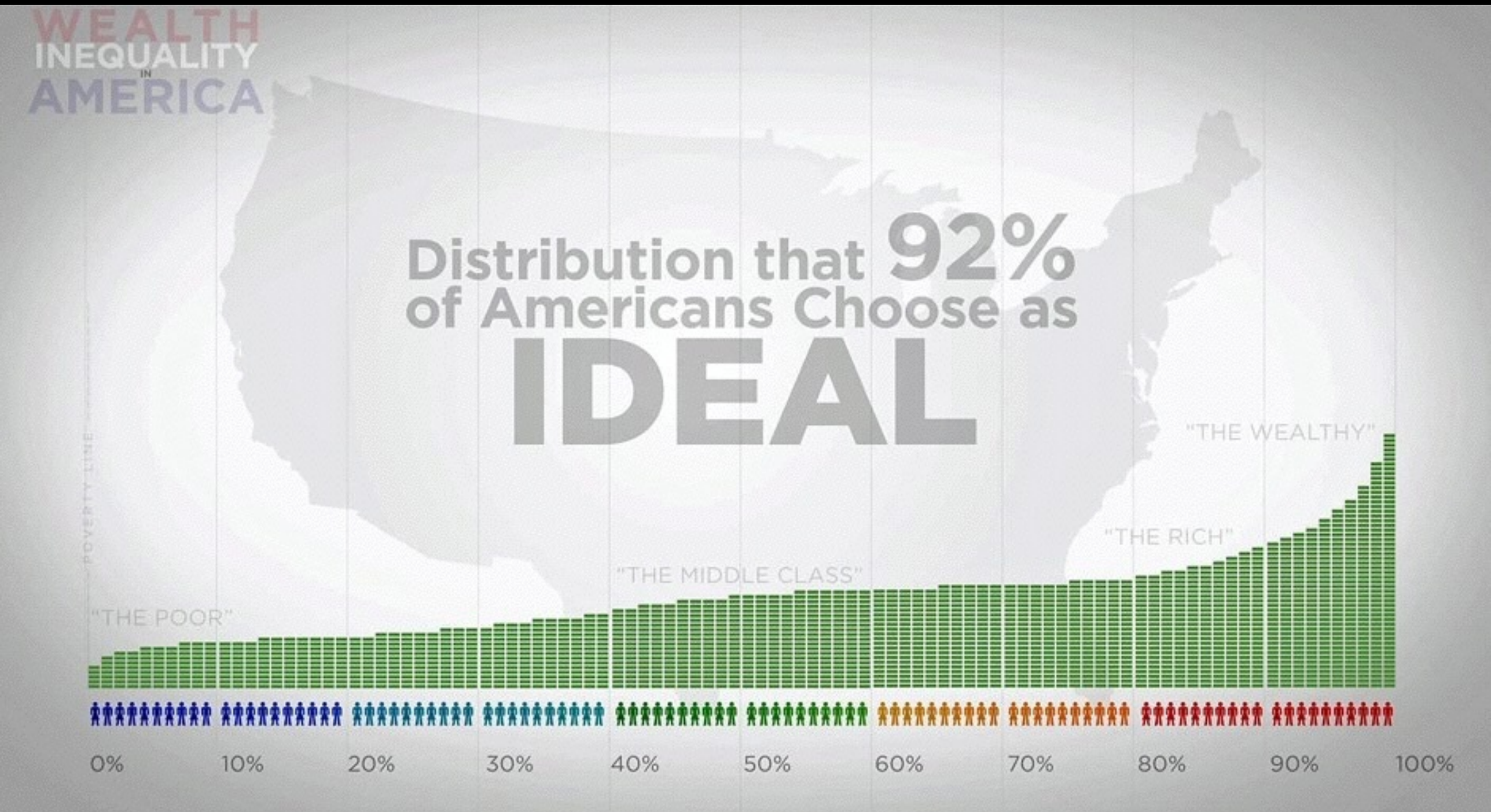
99% OF PEOPLE HAVE 60% OF THE WEALTH

INEQUALITY



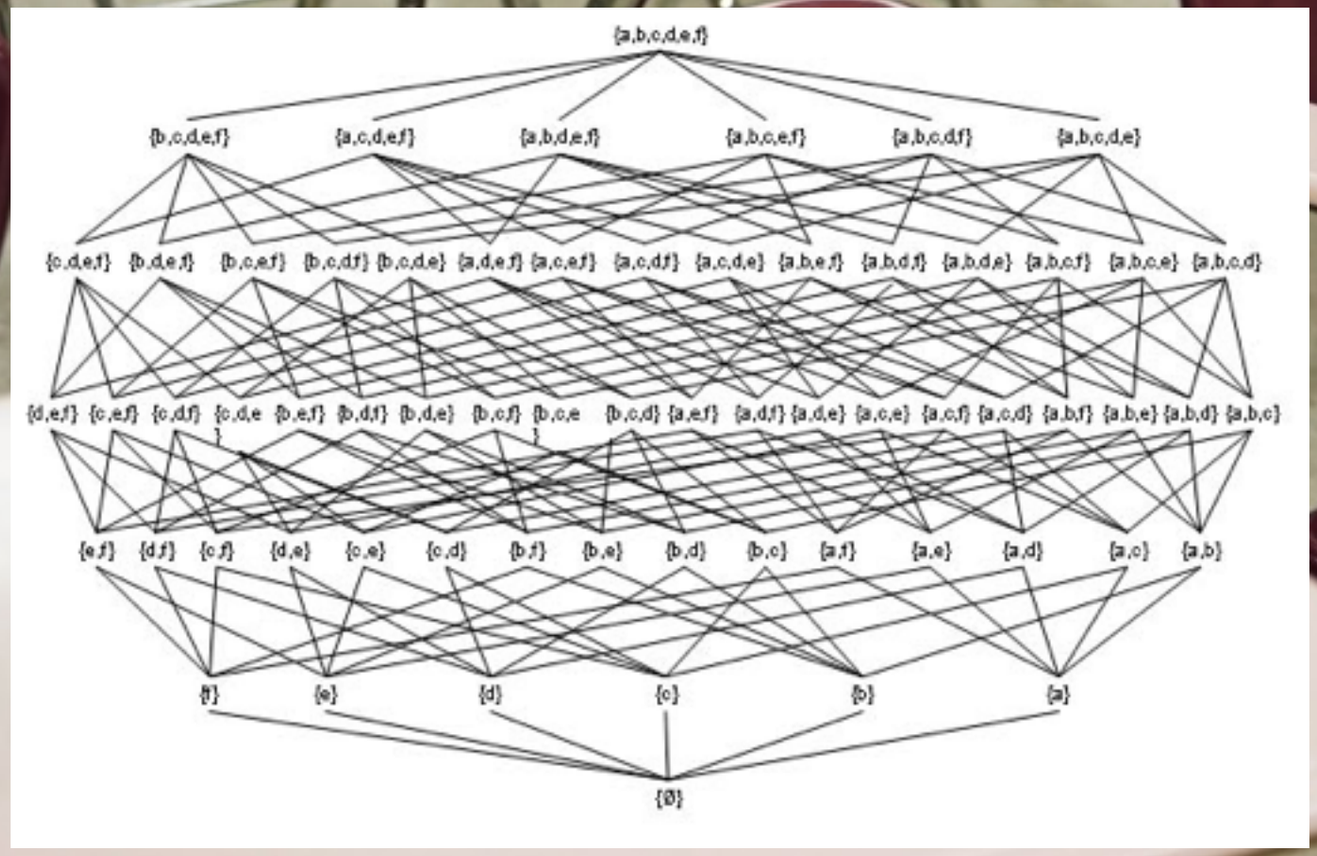
ADJUSTING THE CURVE

PROGRESSIVISM



DO WE NEED IT?

GLOBAL PARTIAL ORDERING



WE CAN LIVE WITHOUT NUMBERS

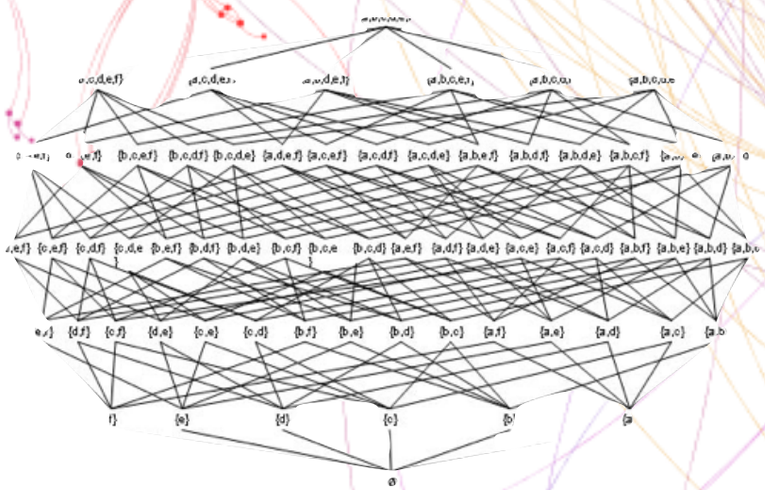
PIRAHÃ

CAN WE SCALE IT?

GIFT ECONOMY

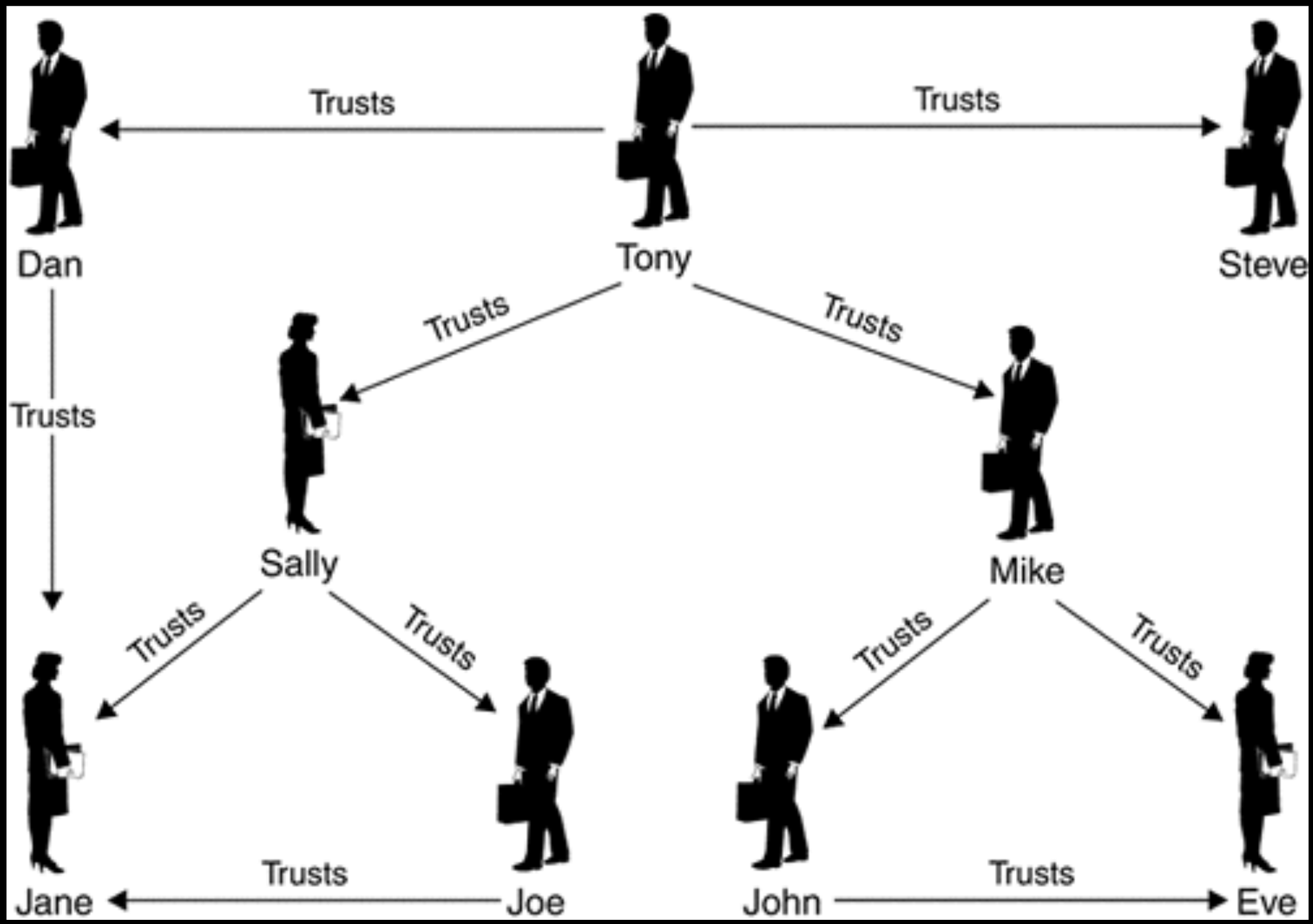
EVERYONE SEES A DIFFERENT PARTIAL ORDERING

SUBJECTIVE VALUE



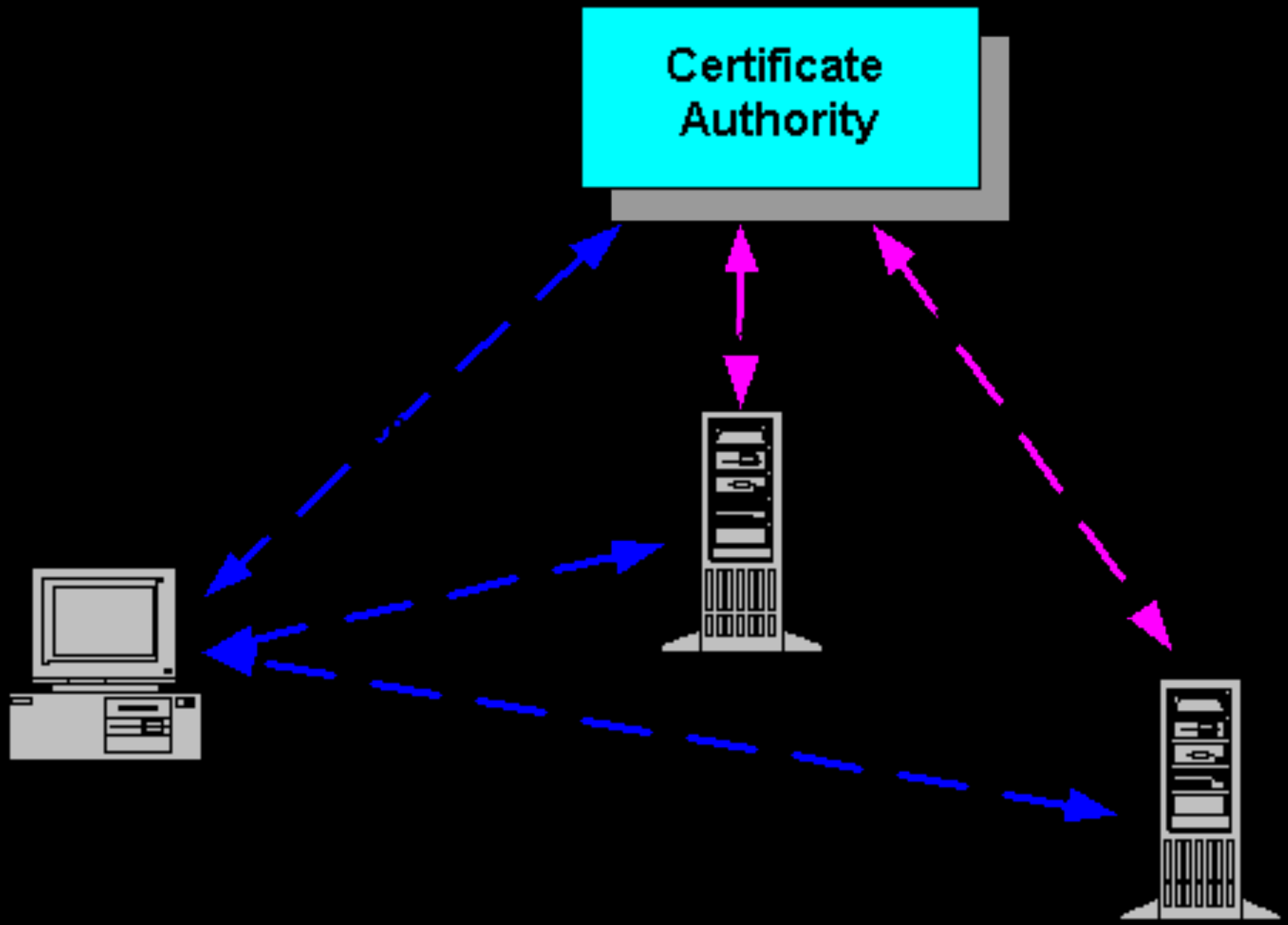
PRIOR ART

WEB OF TRUST



WHO WATCHES THE WATCHERS?

CERTIFICATE AUTHORITY



KEY SIGNING PARTY

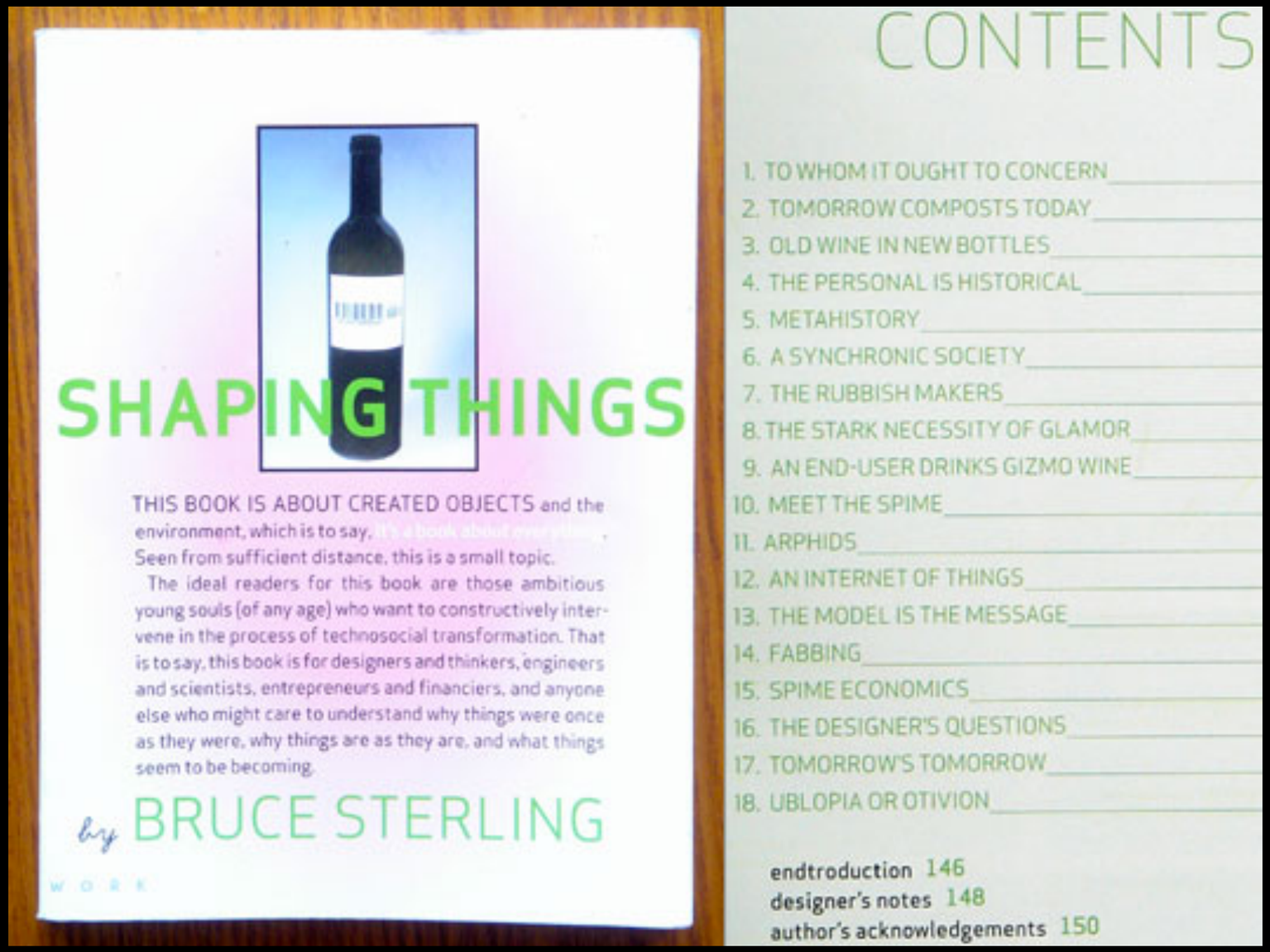
NOW WE HAVE **N** PROBLEMS

OBJECT BLOCKCHAIN

- Blockchain allows us to create digital objects
- Heirlooms
- Gamify the web of trust

FROM CLASSES TO INSTANCES

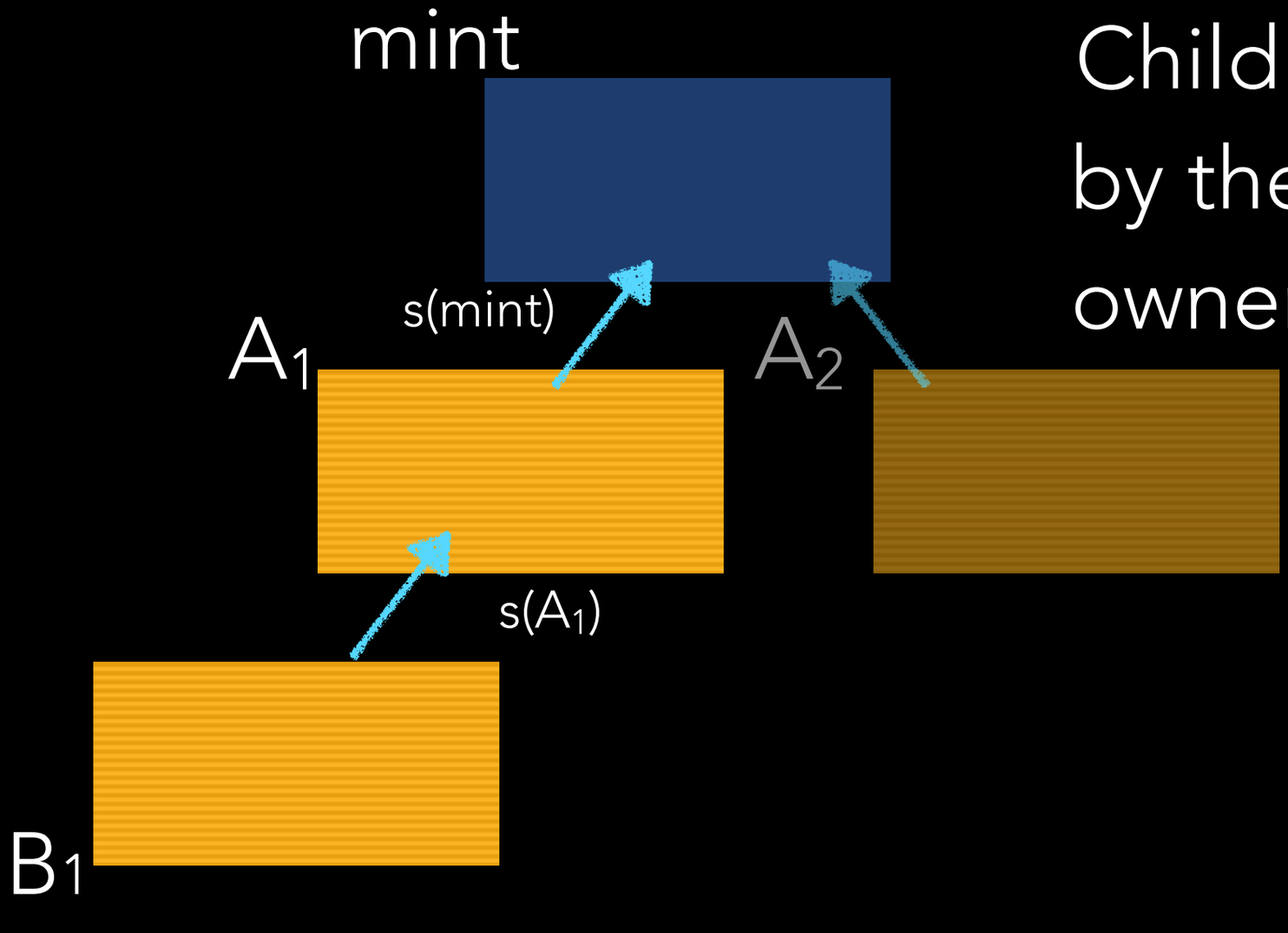
INTERNET THINGS



GIVE TREE

- Per document blockchain
- Don’t wait for global consensus
- Data provenance structures allows the tracking of how ownership of a piece of data got to you
- TODO: Encrypt the content of the coins.

GIVE TREE



Child nodes are signed by the keys encoded as owner of parent blocks.

VALIDATE THE GIVE TREE

- Verify the root content hash and mint signature match the unique coin id.
- For each child in the tree, verify that the signature is correct and comes from the public key listed in the parent block.
- Application level policy can flag branches of the tree that exceed a **give limit**. Physical objects are simulated with a give limit of one.

GIVE TREE

mint

Maude

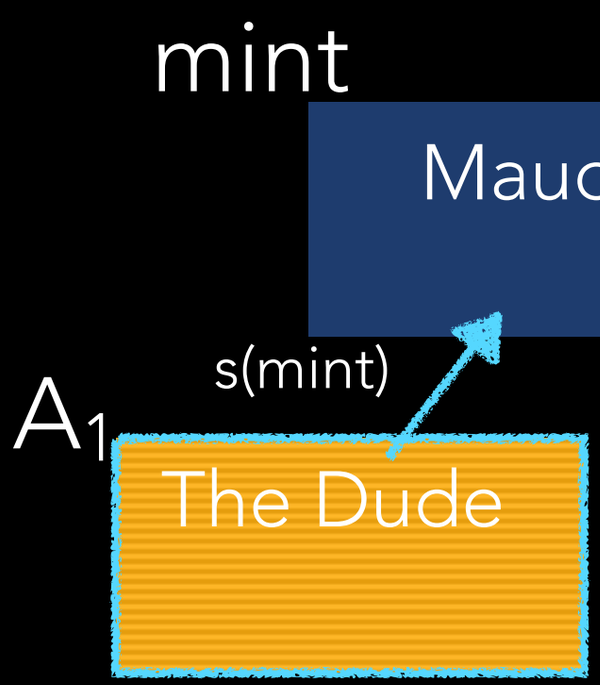
mint

to (Maude keys)

on (content hash)

signed (Maude)

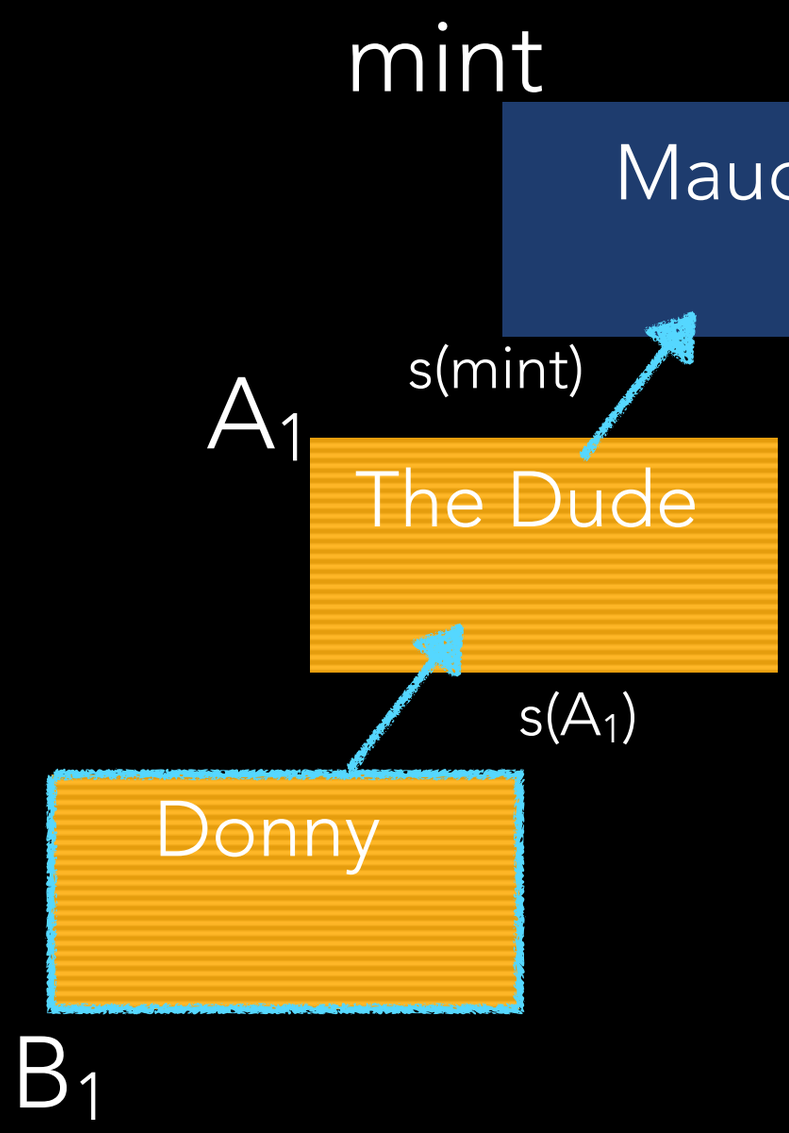
GIVE TREE



A_1

to (The Dude)
on (parent hash)
signed (Maude)

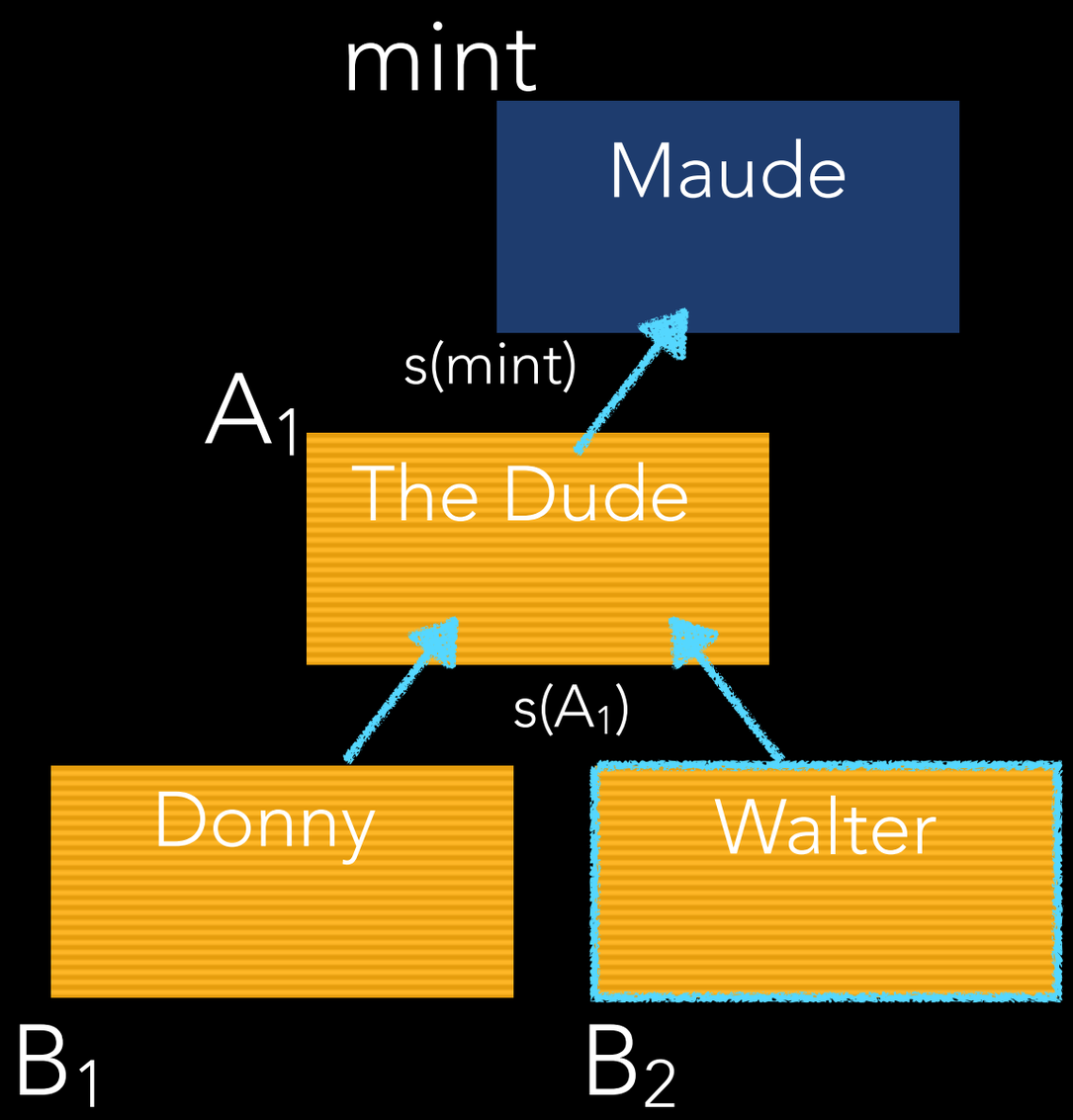
GIVE TREE



B_1

to (Donny keys)
on (parent hash)
signed (The Dude)

GIVE TREE

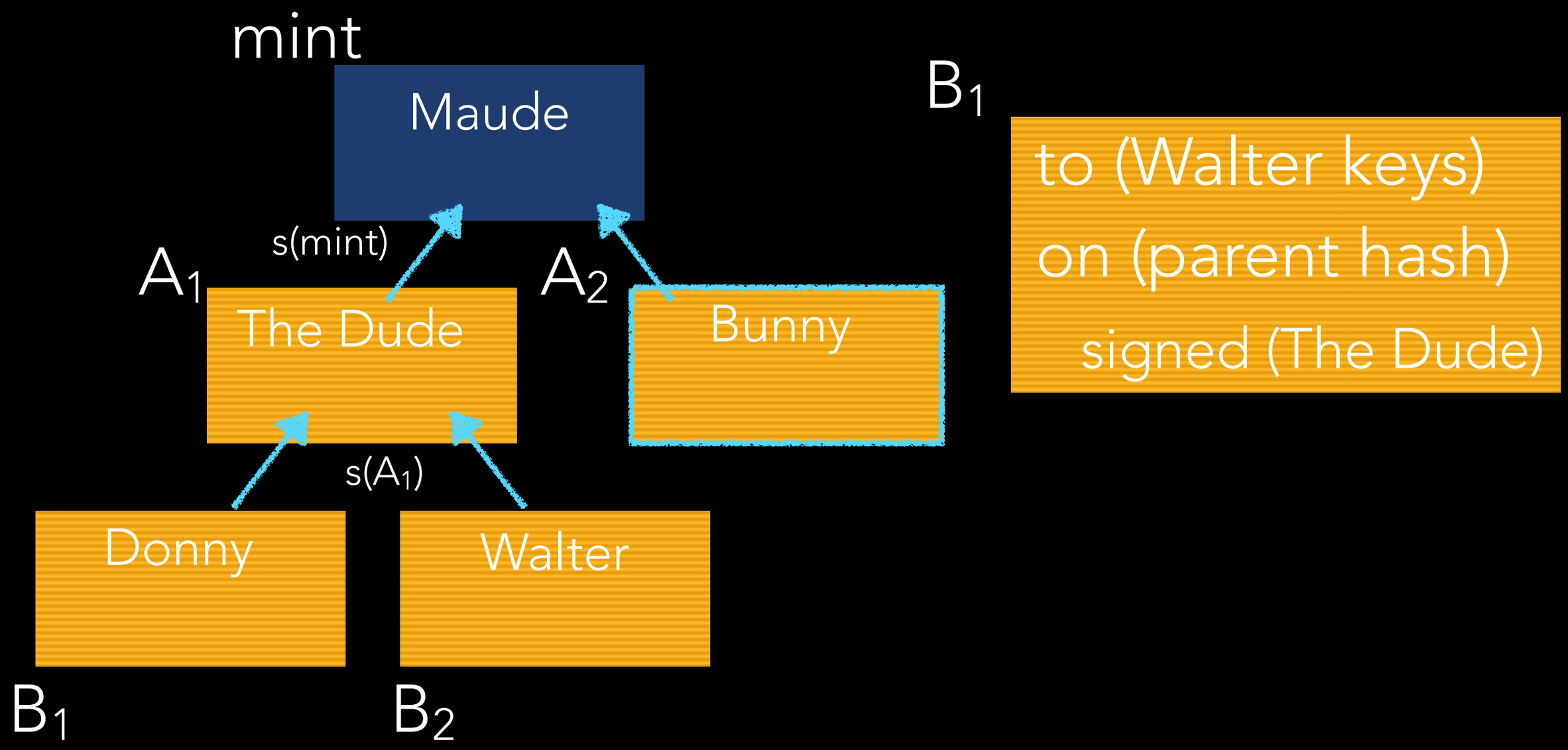


B_2

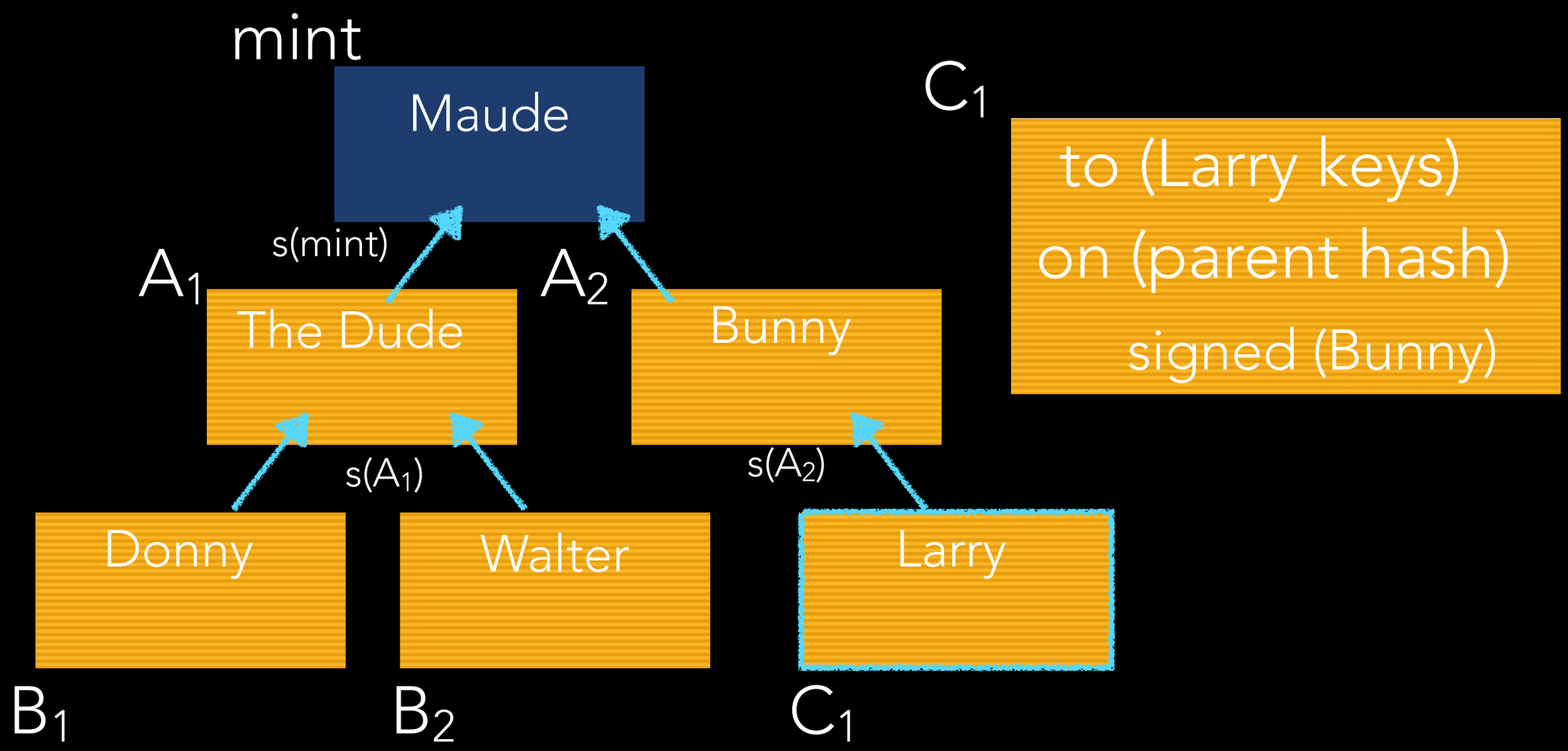
to (Walter keys)
on (parent hash)
signed (The Dude)

"It went OK, the old man told me to take any rug in the house."

GIVE TREE


mint
Maude
s(mint)
A_1
The Dude
A_2
Bunny
B_1
to (Walter keys)
on (parent hash)
signed (The Dude)
$s(A_1)$
Donny
Walter
B_1
B_2

GIVE TREE


mint
Maude
s(mint)
A_1
The Dude
A_2
Bunny
C_1
to (Larry keys)
on (parent hash)
signed (Bunny)
$s(A_1)$
$s(A_2)$
Donny
Walter
Larry
B_1
B_2
C_1

LIMITATIONS

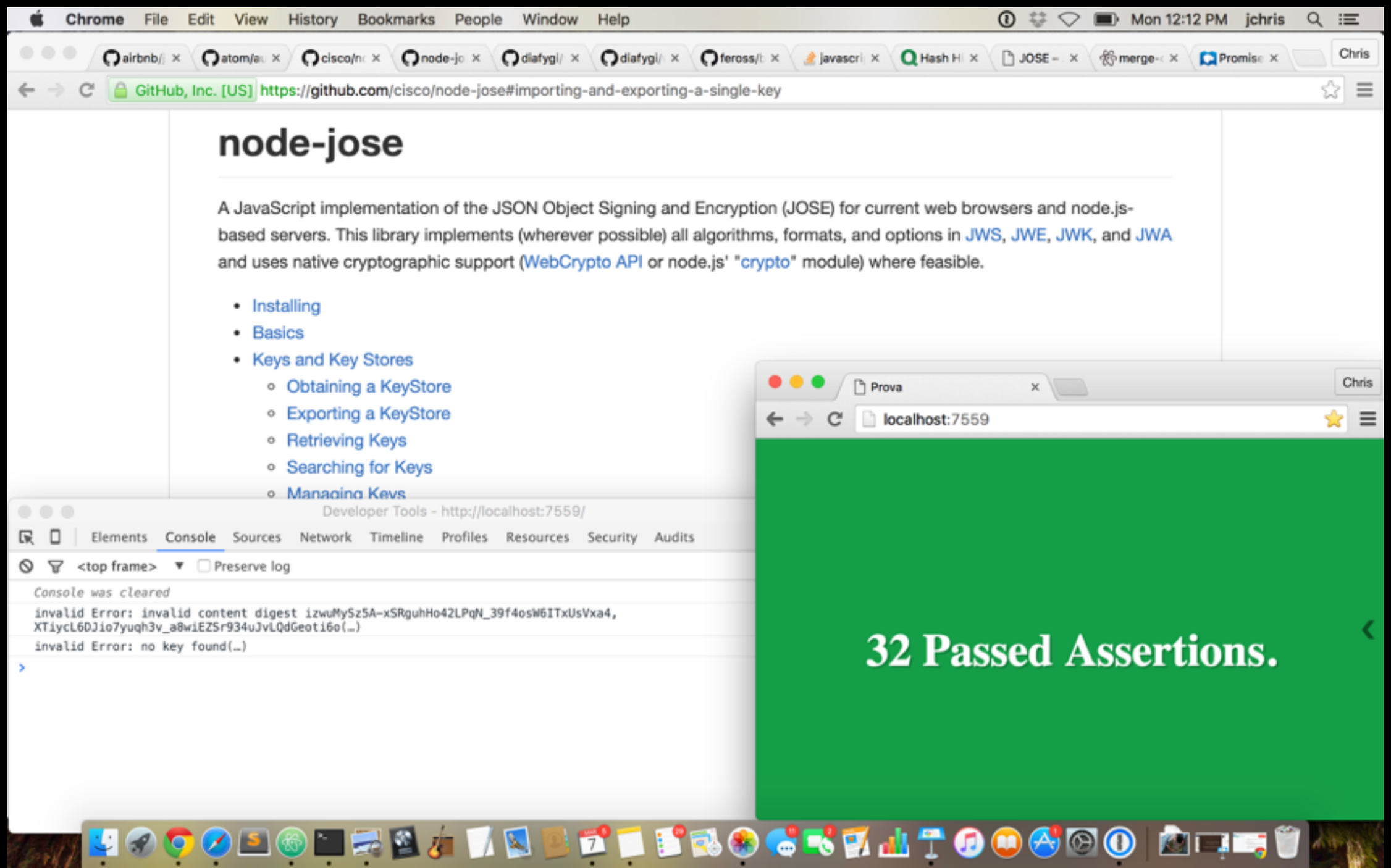
- The model, even if perfectly implemented, isn’t designed to prevent double spending, just to detect it.
- Research project, currently only dealing with public content and signatures.
- Haven’t implemented the Bill Murray rule yet.
- Want multi-sig mint blocks

IMPLEMENTATION

- Cisco's JOSE https://github.com/cisco/node-jose
- Prova test runner http://github.com/azer/prova
- Recursion!

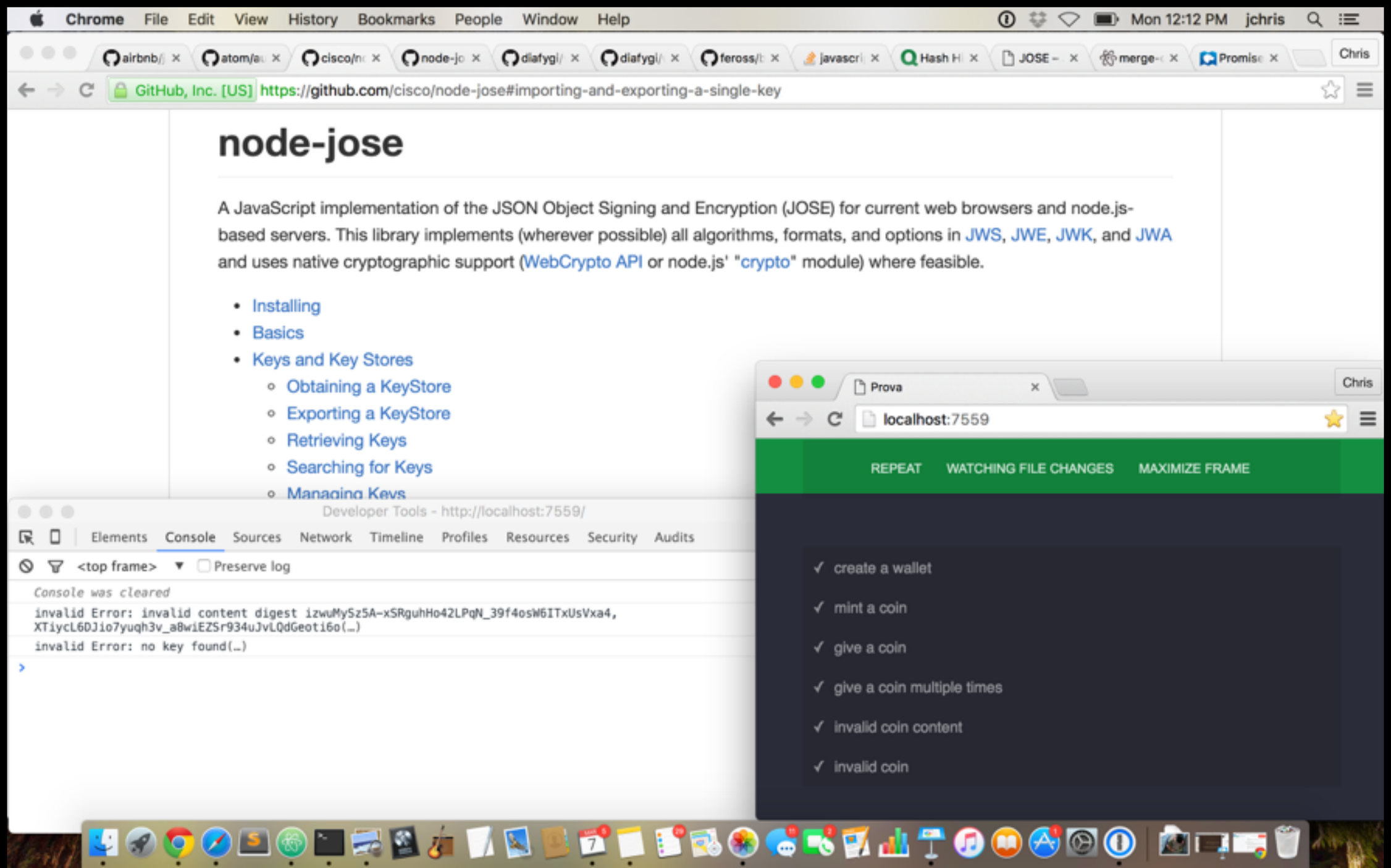
TEST IN THE BROWSER WITHOUT ANY BUILD SCRIPTS

PROVA



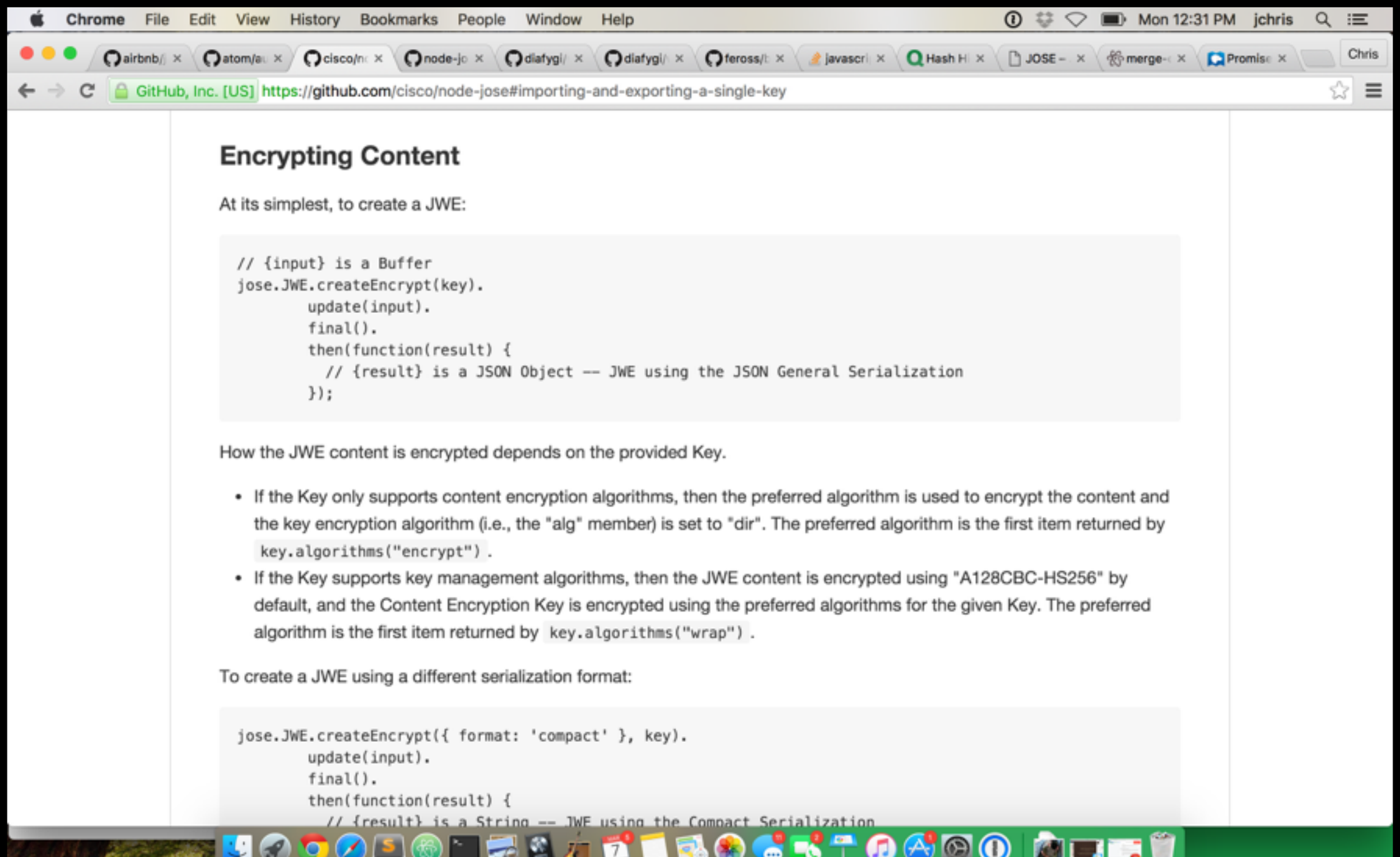
AUTOMAGICAL RELOAD AND RUN

PROVA



EASY AND CONSISTENT WRAPPER AROUND WEB CRYPTO

CISCO NODE-JOSE



VALIDATE A COIN

- Validate the root of the Give Tree
  - Coin ID is correct
  - Content signature matches
- Recursively validate all child nodes
  - Give limit policy violations are business errors, not validation errors

VALIDATE THE ROOT

```
validateRoot() {
  return this.rootDigest().then((signatureDigest) => {
    const basedDigest = URLSafeBase64.encode(signatureDigest);
    if (this.coinID !== basedDigest) {
      throw new Error("invalid coinID " + this.coinID + ", " + basedDigest)
    }
    // validate contentDigest
    return jose.JWA.digest("SHA-256", this.content).then((contentDigest)=>{
      const basedContentDigest = URLSafeBase64.encode(contentDigest);
      return this.decodeRootNode().then((results) => {
        if (results.rootPayload[0] != basedContentDigest) {
          throw new Error("invalid content digest " +
            results.rootPayload[0] + ", " + basedContentDigest)
        }
      })
    })
  })
}
```

```
rootDigest() {
  const rootBlock = this.givetree[0];
  const blockBuffer = new Buffer(rootBlock, "utf8");
  return jose.JWA.digest("SHA-256", blockBuffer)
}
```

VALIDATE THE ROOT

```
rootDigest() {
  const rootBlock = this.givetree[0];
  const blockBuffer = new Buffer(rootBlock, "utf8");
  return jose.JWA.digest("SHA-256", blockBuffer)
}
```

```
decodeRootNode() {
  var holderKey = this.mintKey;
  var node = this.givetree;
  var block = node[0];
  var children = node[1];
  return this.decodeBlock(block, holderKey).then((decoded) => {
    var rootPayload = JSON.parse(decoded.payload.toString())
    return {rootPayload:rootPayload, block:block, children:children};
  })
}
```

VALIDATE CHILDREN

```
validate() {
  return this.validateRoot().then(()=>{
    return this.foldBlockNodes((decodedBlock, rawBlock, children) => {
    })
  }).then(()=>{
    return true;
  }).catch((e)=>{
    console.log("invalid", e);
    return false;
  })
}
```

Empty Callback!

VALIDATE CHILDREN

```
foldBlockNode(callback, parentPayload, rawParentBlock, children) {
  callback(parentPayload, rawParentBlock, children)
  // for each child, decode the child and call foldBlockNode on it
  if (children.length > 0) {
    return jose.JWK.asKey(parentPayload[1]).then((holderKey) => {
      var decoders = children.map((childNode)=>{
        const rawChildBlock = childNode[0];
        const childChildren = childNode[1];
        return this.decodeBlock(rawChildBlock, holderKey).then((decoded) => {
          var childPayload = JSON.parse(decoded.payload.toString())
          return this.foldBlockNode(callback, childPayload, rawChildBlock, childChildren)
        })
      })
      return Promise.all(decoders);
    });
  } else {
    return true;
  }
}
```

Recursion!

NEXT STEPS

- Encrypted content
- PouchDB storage & sync
- Photo sharing application
- Public key graph browser

… PROFIT

- Distributed PKI
- Illustrate to users the value of partial disclosure
- Ecosystem interop
- Native HTML5 blockchain
- Platform for p2p social apps

CONCLUSION

- We are the world computer, build expressive software
- Blockchain assumptions can be inverted
- There is more room for innovation than we think

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