A Public Database for the Planet

Trent McConaghy
@trentmc0

BIGCHAINDB **IPDB**
INTERPLANETARY DATABASE

Motivation
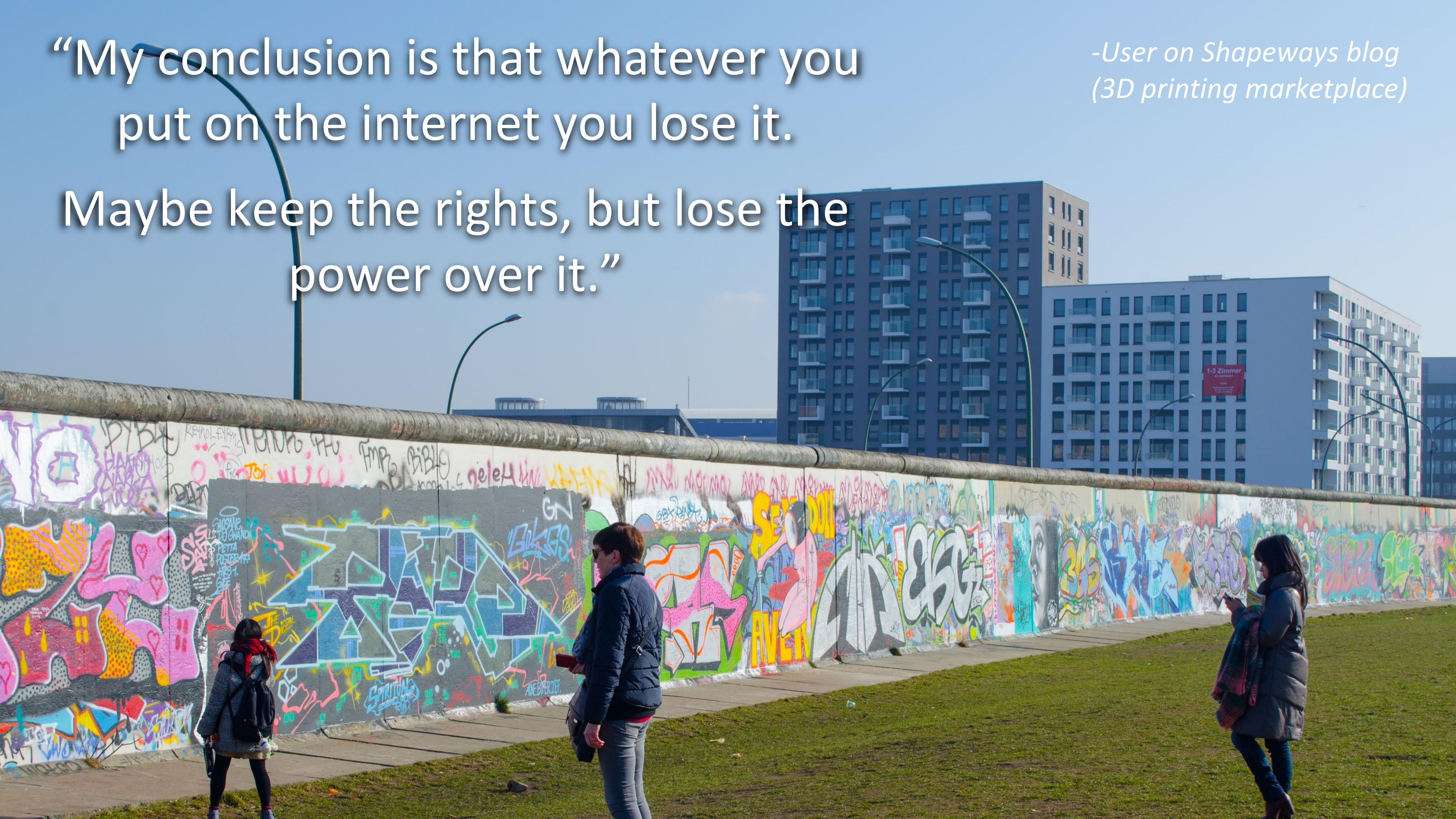
"My conclusion is that whatever you put on the internet you lose it.

Maybe keep the rights, but lose the power over it."

The Web isn't working for us anymore

Your data isn't really yours
Walled gardens – you can't share how you want
Data silos – You can't take it with you if you want to leave
Filter bubbles – Your data governs your feed, but you can't control it
Your medical records are scattered in random hospitals

Creative works are backwards
Others' stuff – hard to use legally, pay $
Your stuff – hard not to lose

And more
Billions go unbanked, can't take loans for education
We don't where our medicine or food comes from

Imagine a more equitable society, where...

Creativity is encouraged

- Creators are fairly compensated
- The cultural commons is protected

Your identity is yours

- You own your personal data
- You manage your reputation
- Your choose what to share and what stays private

And more

- Equal opportunity for banking
- Know where your atoms come from

Could technology & governance, designed appropriately, help?

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What if we had
shared global compute infrastructure

- Decentralized: No single entity owns or controls

- Self-sustaining

- Planetary scale

- All the pieces: processing, file system, database

To develop shared global compute infrastructure,

we must first understand the *status quo* of infrastructure,

...and how to change it accordingly.

Status quo compute infrastructure
Modern apps use processing, file system, database

CONNECT NETWORKS e.g. TCP/IP	APPLICATION
	PLATFORM e.g. AWS, Azure
	PROCESSING e.g. EC2
	FILE SYSTEM e.g. S3, HDFS	DATABASE e.g. MySQL, MongoDB

Towards **decentralized** compute infrastructure

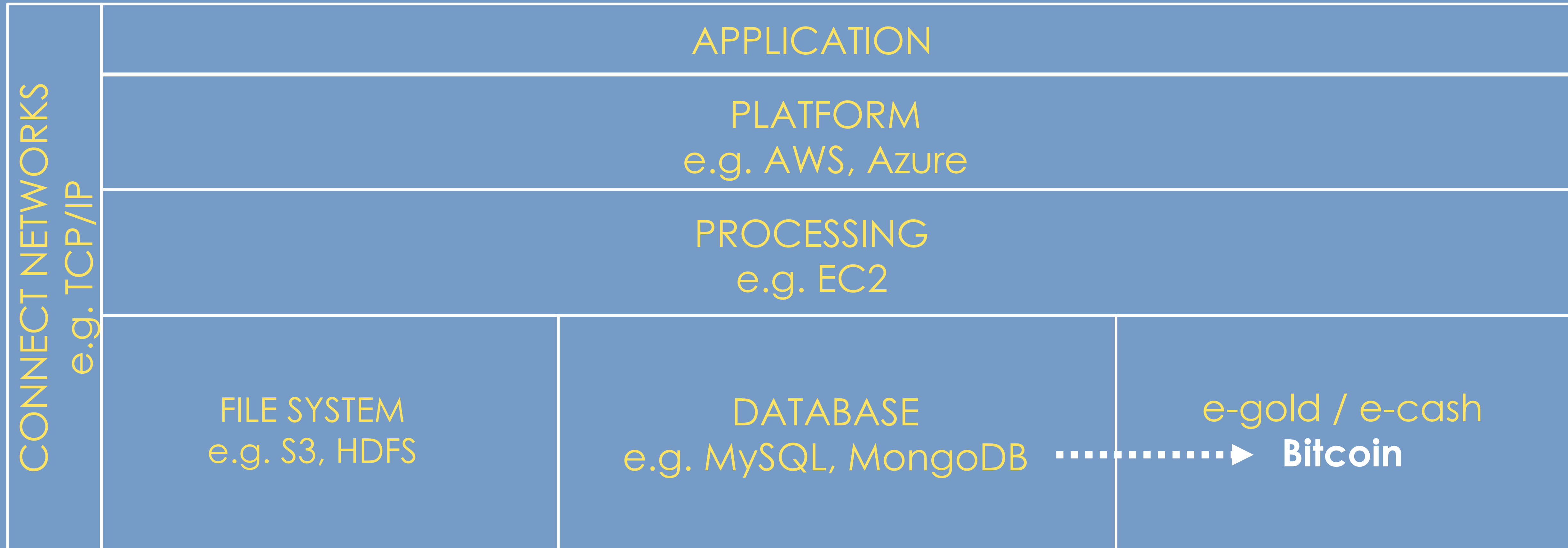| CONNECT NETWORKS e.g. TCP/IP | APPLICATION |
	PLATFORM e.g. AWS, Azure
	PROCESSING e.g. EC2
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Towards **decentralized** compute infrastructure

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	FILE SYSTEM e.g. S3, HDFS	DATABASE e.g. MySQL, MongoDB ┈┈┈┈▶	e-gold / e-cash **Bitcoin**

Towards **decentralized** compute infrastructure

CONNECT NETWORKS e.g. TCP/IP, **Interledger**	APPLICATION		
	PLATFORM e.g. AWS, Azure, **Eris/Monax**, **BlockApps**		
	PROCESSING e.g. EC2, **Ethereum**, **Hyperledger**, **Tendermint**, **Lisk**		
	FILE SYSTEM e.g. S3, HDFS, **IPFS**	DATABASE e.g. MySQL, MongoDB	e-gold / e-cash **Bitcoin**, **zcash**

Towards **decentralized** compute infrastructure

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Towards **decentralized** compute infrastructure

CONNECT NETWORKS e.g.TCP/IP, Interledger	APPLICATION		
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	FILE SYSTEM e.g. S3, HDFS, **IPFS**	DATABASE e.g. MySQL, MongoDB **BigchainDB + IPDB**	e-gold / e-cash **Bitcoin, zcash**

Elements of a planetary-scale database

1. Blockchain Database SW: combines best of traditional DBs & blockchains.

BIGCHAINDB

2. Network running the software, with thoughtful **governance**

iPDB
INTERPLANETARY DATABASE

Elements of a planetary-scale database

1. Blockchain Database SW: combines best of traditional DBs & blockchains.

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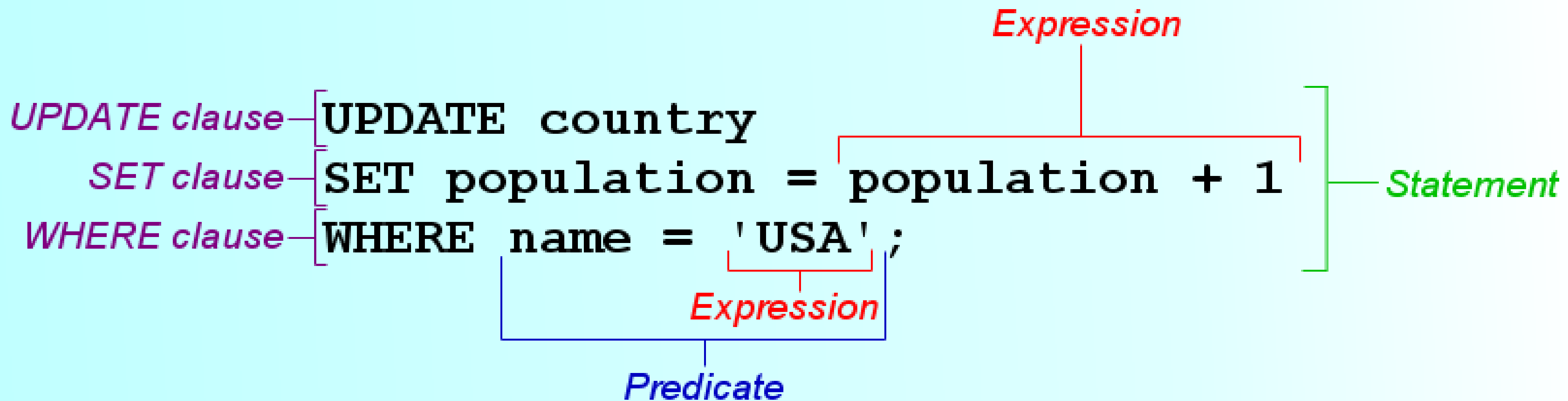## 2. Network running the software, with thoughtful governance

iPDB
INTERPLANETARY DATABASE

What's the difference between a database and a csv file?
Querying. From M's of records, find the relevant ones.

1 Line of standard code, optimized

Vs

50-500 lines of slow custom code, unoptimized

The first "Blue Ocean" DBs: Relational DBs
Benefits: powerful structured querying
Winner: Oracle, 80s and 90s

The next "Blue Ocean" DB:
Website-ready DBs
New benefits: lightweight for startups
Winner: MySQL, early 2000s

The next "Blue Ocean" DB: Distributed / NoSQL DBs
New benefits: "Big data" scale, flexible schemas
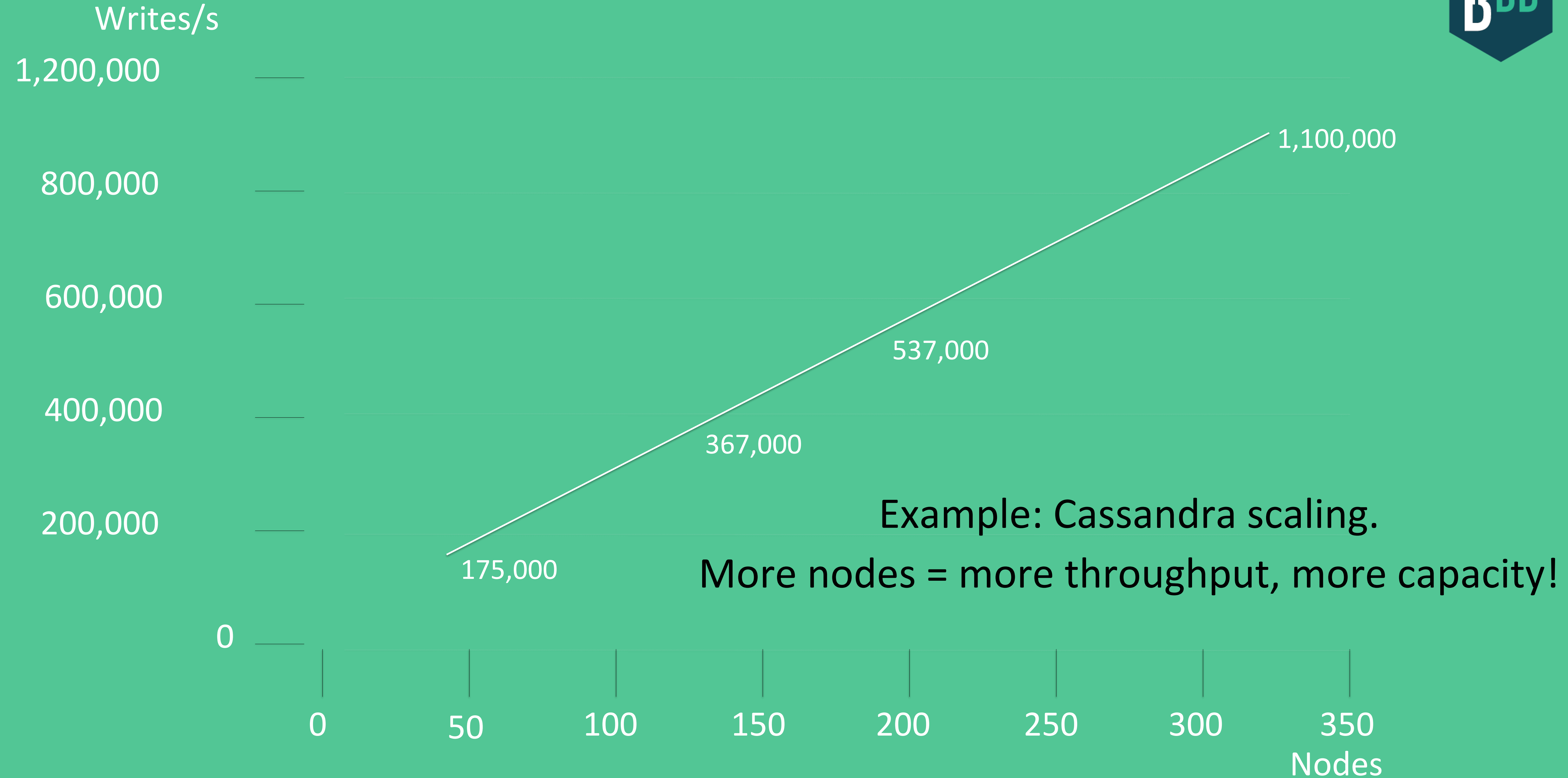Winner: MongoDB, late 2000s-now

How do "big data" databases scale?
Answer: Distribute storage across many machines, i.e. sharding

A "consensus" algorithm keeps distributed nodes in sync.

How *well* do "big data" distributed DBs scale?

Writes/s

1,200,000

800,000

600,000

400,000

200,000

0

1,100,000

537,000

367,000

175,000

Example: Cassandra scaling.

More nodes = more throughput, more capacity!

0   50   100   150   200   250   300   350

Nodes

The next blue ocean DB: *blockchain* database
New benefits: decentralized, immutable, native assets
Who: BigchainDB

How to build a scalable blockchain database (BigchainDB)

1. Start with an enterprise-grade distributed DB, e.g. MongoDB
2. Engineer in blockchain characteristics

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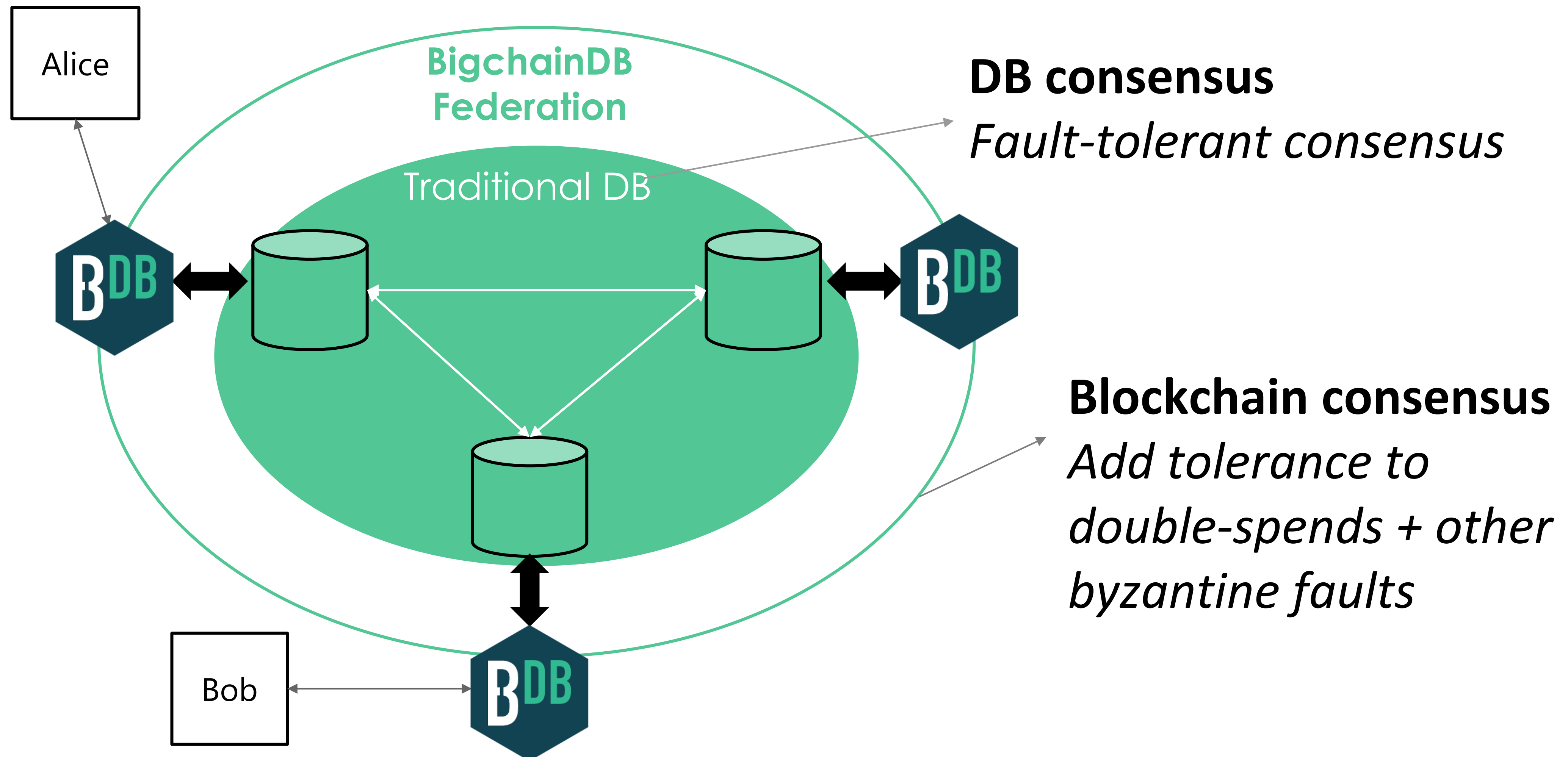|	
Decentralized / Shared Control	• Each DB node is a federation node
Immutable / Audit Trails	• Hash Previous Blocks • Append-only
Native assets	• "Own" = have private key • Asset lives on the database

BigchainDB Architecture:
Two-Layer consensus

BigchainDB Federation

Traditional DB

Alice

Bob

DB consensus
Fault-tolerant consensus

Blockchain consensus
Add tolerance to double-spends + other byzantine faults

Database part : data
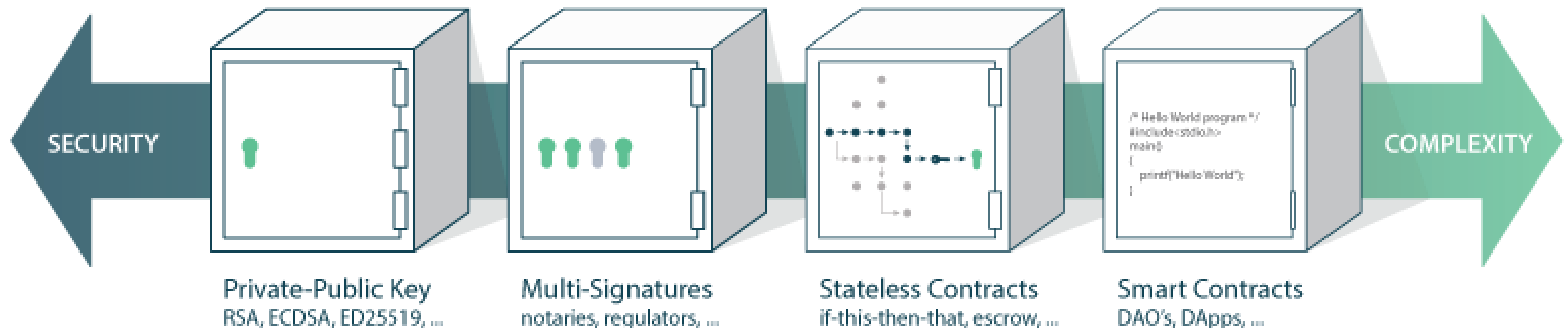
Via ReQL (JSON meets SQL). "Look, act, feel like a database"

+ Blockchain part : assets, transaction-style

Via Interledger Protocol (Crypto-conditions)

SECURITY   COMPLEXITY

Private-Public Key
RSA, ECDSA, ED25519, ...

Multi-Signatures
notaries, regulators, ...

Stateless Contracts
if-this-then-that, escrow, ...

Smart Contracts
DAO's, DApps, ...

BigchainDB: best of traditional DBs & blockchains = a blockchain database

	Traditional blockchains	Traditional Databases	BigchainDB
Immutability	✓		✓
Decentralized Control	✓		✓
Native Assets	✓		✓
Scalable		✓	✓
Queryability		✓	✓
Operationalized		✓	✓

Elements of a planetary-scale database

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SW: combines best of traditional DBs & blockchains.

BIGCHAIN DB

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iPDB
INTERPLANETARY DATABASE

iPDB

INTERPLANETARY DATABASE

- For everyone, everywhere

- Free until heavy usage, then pay web service style

- Initial tech is BigchainDB

- Member caretakers will operate validating nodes

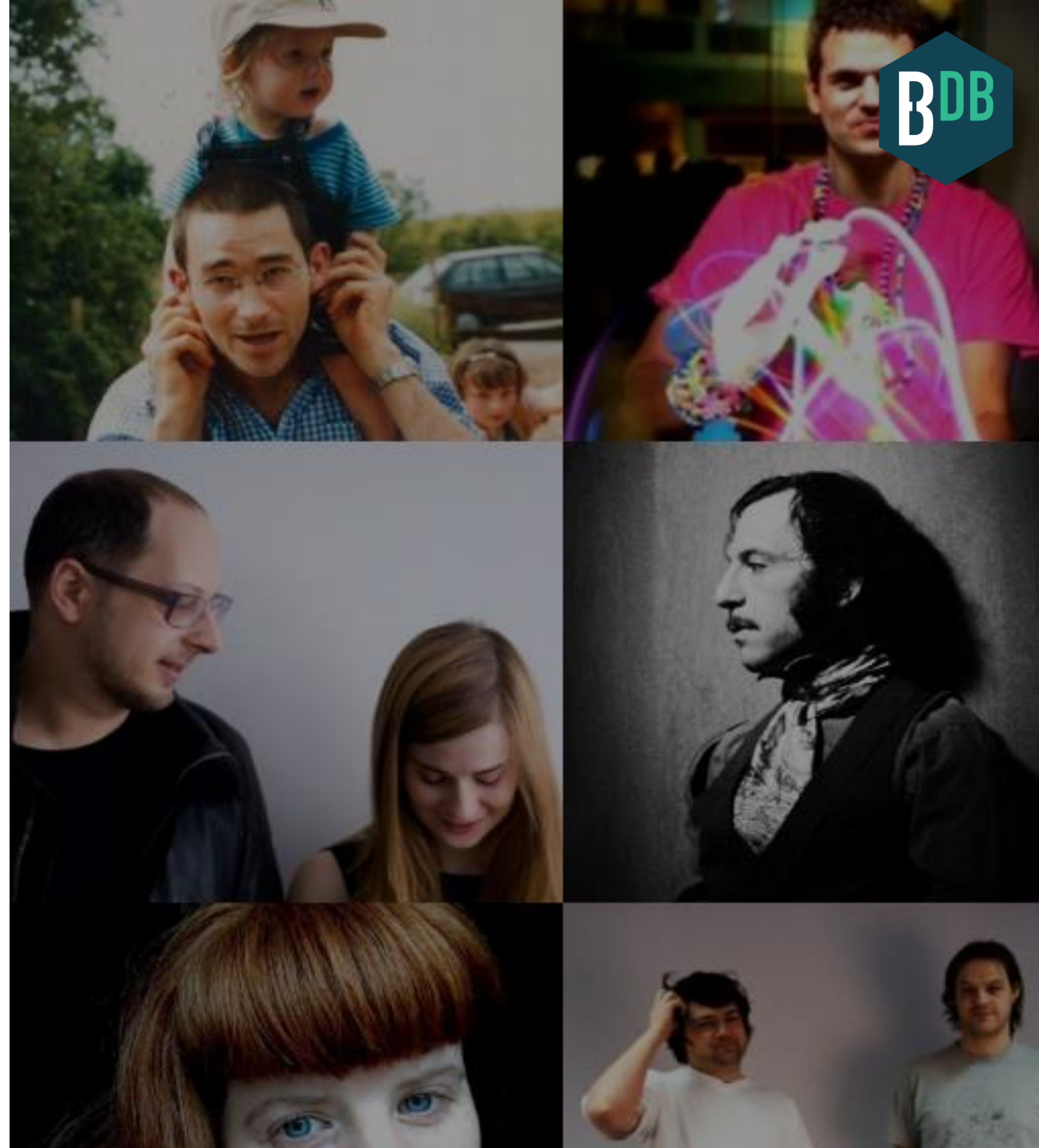- Governance - <next talk, by Greg!>

Use Cases

res( )nate

Vertical:

IP – Music rights

Value proposition:

A streaming service owned by all

ascribe

Vertical:

IP – Digital art

Value proposition:

Enables creators of digital art to get compensated, via claiming attribution & licensing

Certificate Of Authenticity

As of 30 November 2015, 17:36:00 GMT, Masha McConaghy is the owner.
To verify current owner, please visit http://ascri.be/1luAOpo

Currency

Date: 2014
Edition: 3 of 100
Created by: Dan Perjovschi
Owner: Masha McConaghy

ARTWORK DETAILS

Artwork ID: 17uZBwSbLGfXy3vRRMWzF5PMjFVNc1tkQ2
File: currency-2014.jpg (499 KB)

PROVENANCE/OWNERSHIP HISTORY

Apr. 30, 2015, 12:36:19 - Registered by mail@cointemporary.com
May. 01, 2015, 09:46:08 - Transferred to admin
May. 08, 2015, 13:04:59 - Transferred to trent
Nov. 27, 2015, 19:35:14 - Transferred to Masha McConaghy

CRYPTOGRAPHIC STAMP

Use the summary and signature below to authenticate this certificate:
http://ascri.be/1Srz45Q

Summary: Dan Perjovschi*Currency*3/100*2014*2015Apr30-12:36:19

Signature: 438B24CE06182FA3AA82BC285F867D03FB73F3BCC0F73FDBA6
EC2BFF7088E011E60355B7DC75D5745A9D5CA2A8115512FF835
C4ABEF6869BF6A991668A820F3FB03A48C6A9E05834716F6500
68E8E07E5266620BA815948DC265605D23FAF016CB46ACD4BC
BE75F08D0DEBD7AF55E4CB085B9A0A14583F135DBB399121B24
ED1L

Authenticated by ascribe®

Authenteq

Vertical:
Identity

Value proposition:
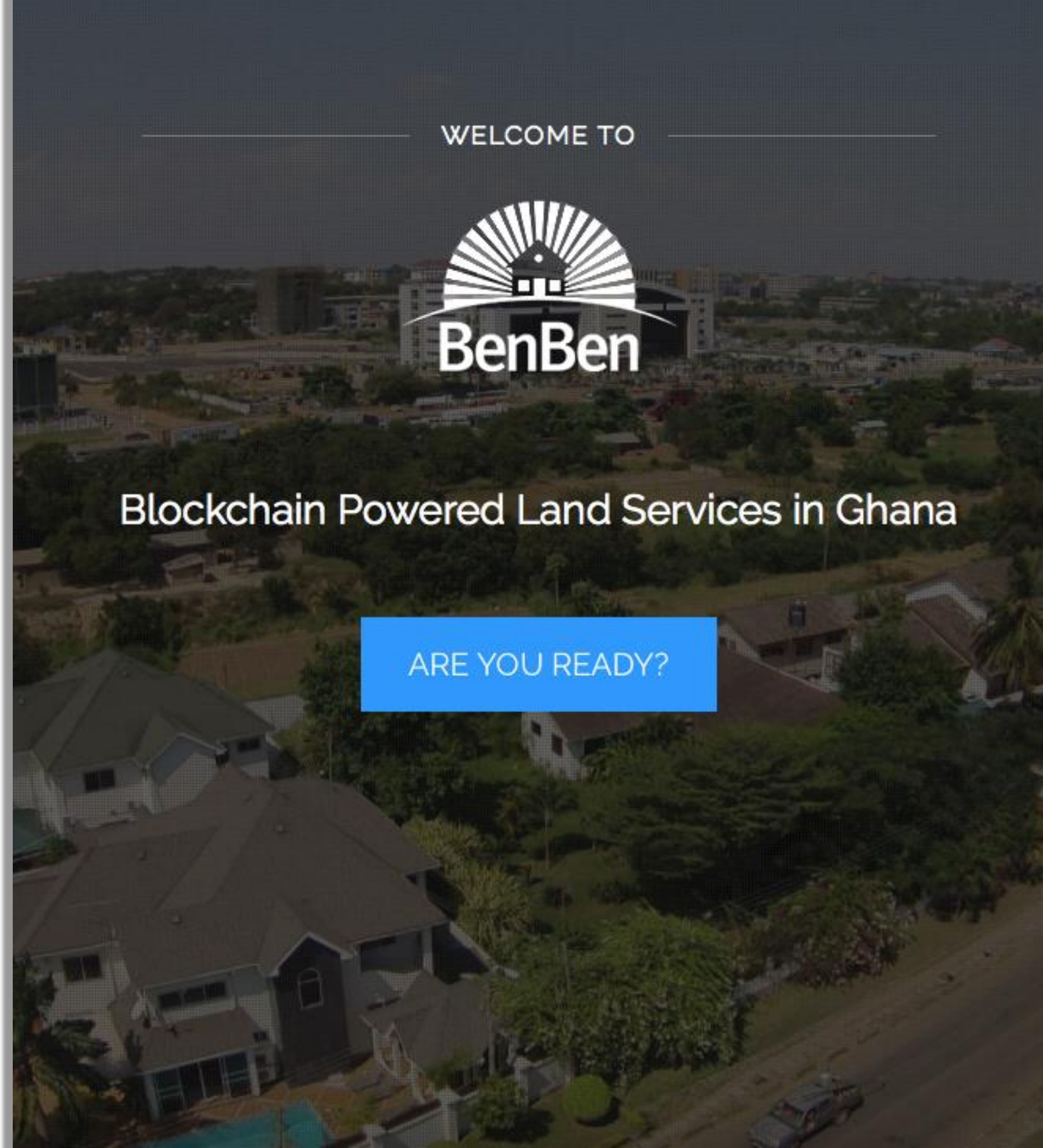Low-friction assurance, sovereign personal data

BenBen

Vertical:

Government – Land Registry

Value proposition:

Low-cost registry, less risk of corruption

Recruit

Vertical:

ID - Education Credentials

Value proposition:

reduce fraudulent degrees, lower HR friction

RWE

Vertical:
Energy

Value proposition:
manage $ flow in energy deregulation

Tangent⁹⁰

Vertical:
Supply Chain / Health

Value proposition:
government-mandated
transparent $ flow

Together, we're building **decentralized** compute infrastructure + applications

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	PROCESSING e.g. EC2, **Ethereum, Hyperledger, Tendermint, Lisk**
	FILE SYSTEM / DATABASE / e-gold

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BigchainDB + IPDB

e-gold / e-cash
Bitcoin, zcash

CONNECT NETWORKS
e.g.TCP/IP, Interledger

Planetary scale trust for human scale development.
For personal data, compensating creators, and more.

Start now with github.com/bigchaindb

BIGCHAIN DB

iPDB
INTERPLANETARY DATABASE

bigchaindb.com
ipdb.foundation

@trentmc0