The Energy Web Foundation

Enabling and accelerating the transition to a democratized, decentralized, decarbonized, and digitized electricity grid

energy web
FOUNDATION

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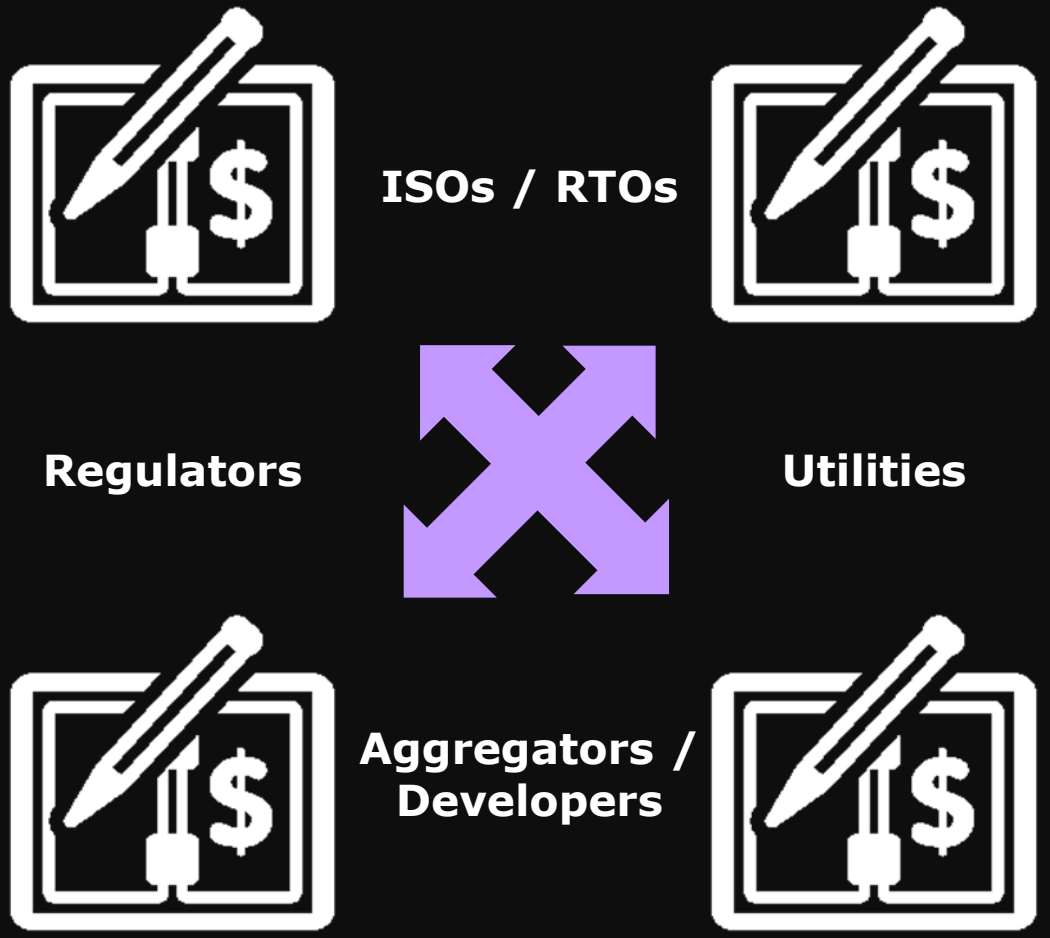
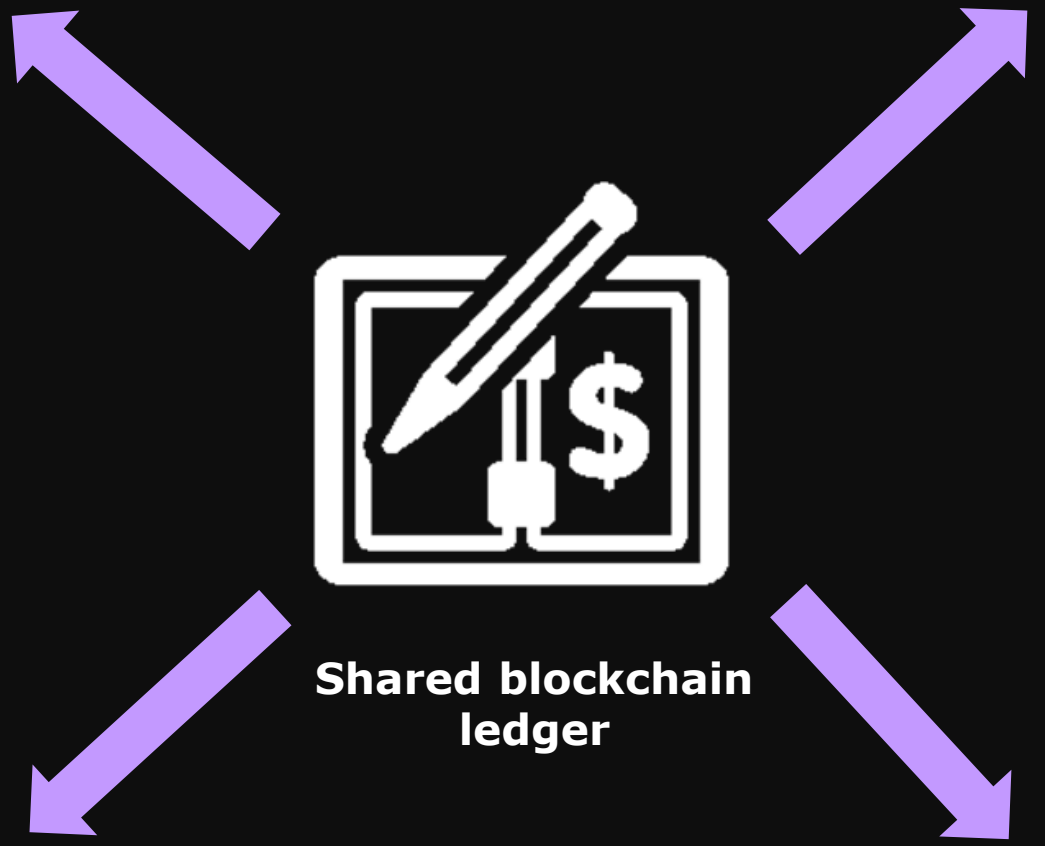
Once trust is built in, only one shared ledger is needed

Without blockchain (today)



With blockchain (tomorrow)



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The value should be shifting to the customer

And, generation should be shifting to renewables more quickly!

Generation → **Transmission** → **Distribution** → **Ratepayer**

Where the value has been

Generation → **Transmission** → **Distribution** → **Customer**

Where the value will be

The system can not yet take advantage of DERs

New complexities due to emerging system architecture

Legacy system architecture

Utility

kWh $

Customer

Emerging system architecture

Wholesale

Thousands of participants

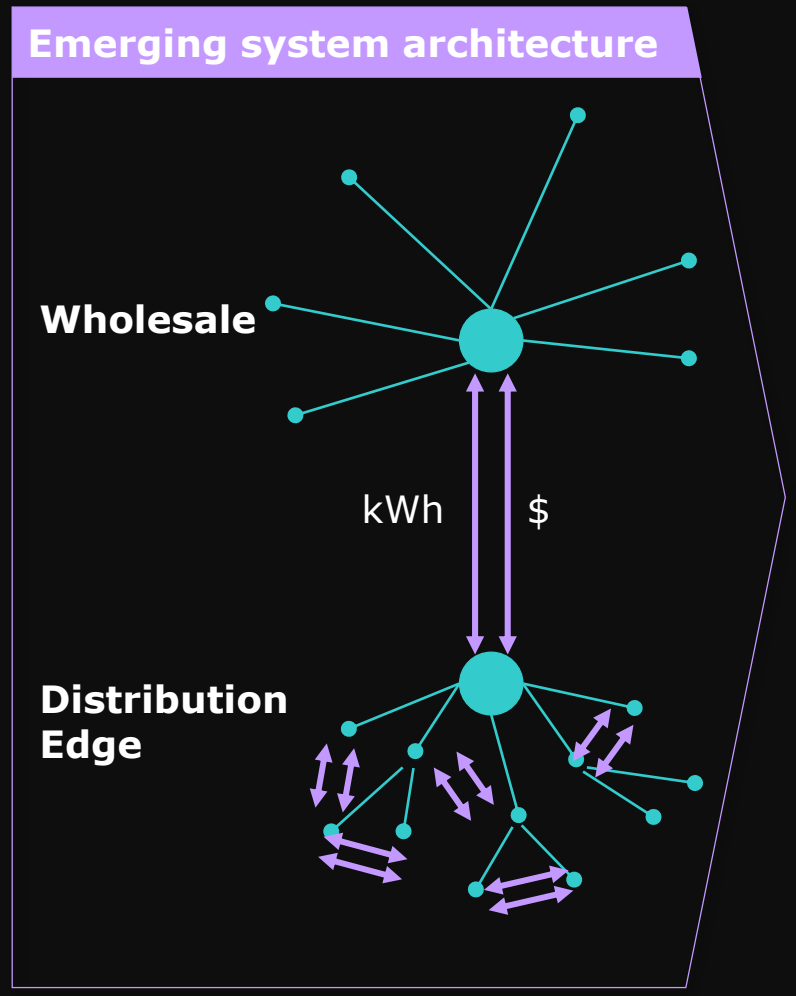
kWh $

Distribution Edge

Millions and potentially billions (IoT) of participants

A number of issues need to be addressed

Barriers to scaling the emerging system architecture

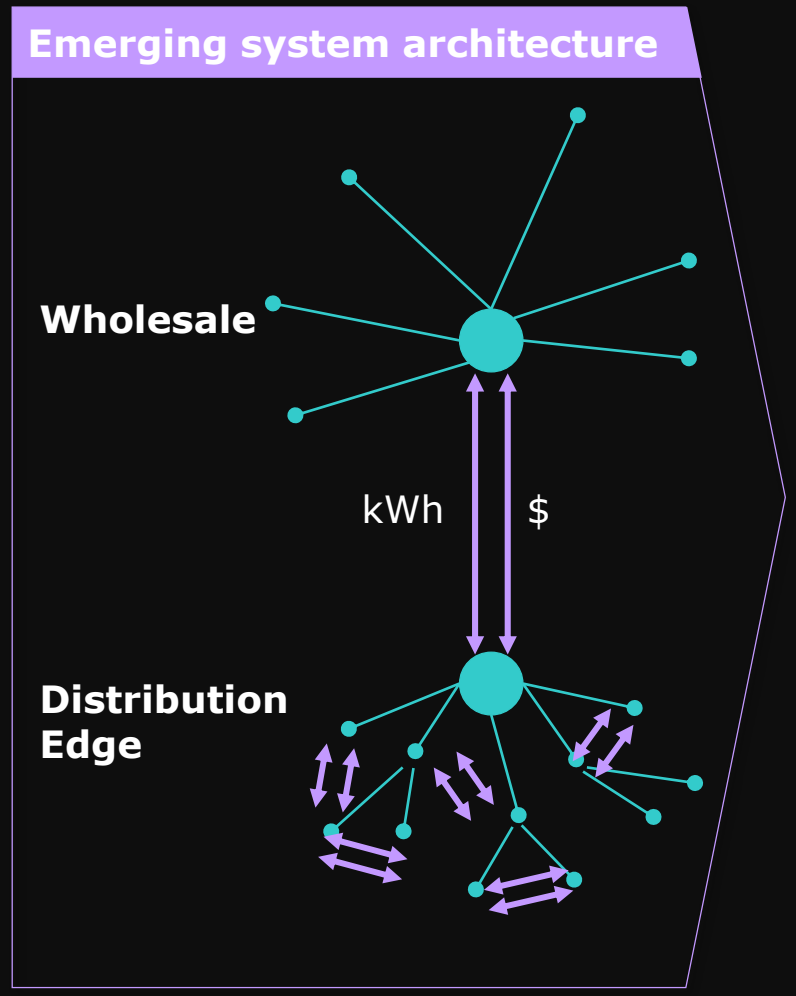


Issues to address

- Secure metering
- Data sharing
- Data privacy
- Smart contracts
- Contract privacy
- Transaction costs
- Transaction speed
- Cyber security
- Regulatory compliance

A number of issues need to be addressed

Barriers to scaling the emerging system architecture



Issues to address	Addressed by blockchain
• Secure metering	✓
• Data sharing	✓
• Data privacy	✓
• Smart contracts	✓
• Contract privacy	✓
• Transaction costs	✓
• Transaction speed	✓
• Cyber security	✓
• Regulatory compliance	✓


Today:
Networks run by a
trusted conductor

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EWF = developing *the* global, open source blockchain

EWF Team

Founders	Gridsingularity, Rocky Mountain Institute
Development Partners	parity, slock.it

EWF = developing *the* global, open source blockchain

Purpose built for the energy sector

EWF's Mission

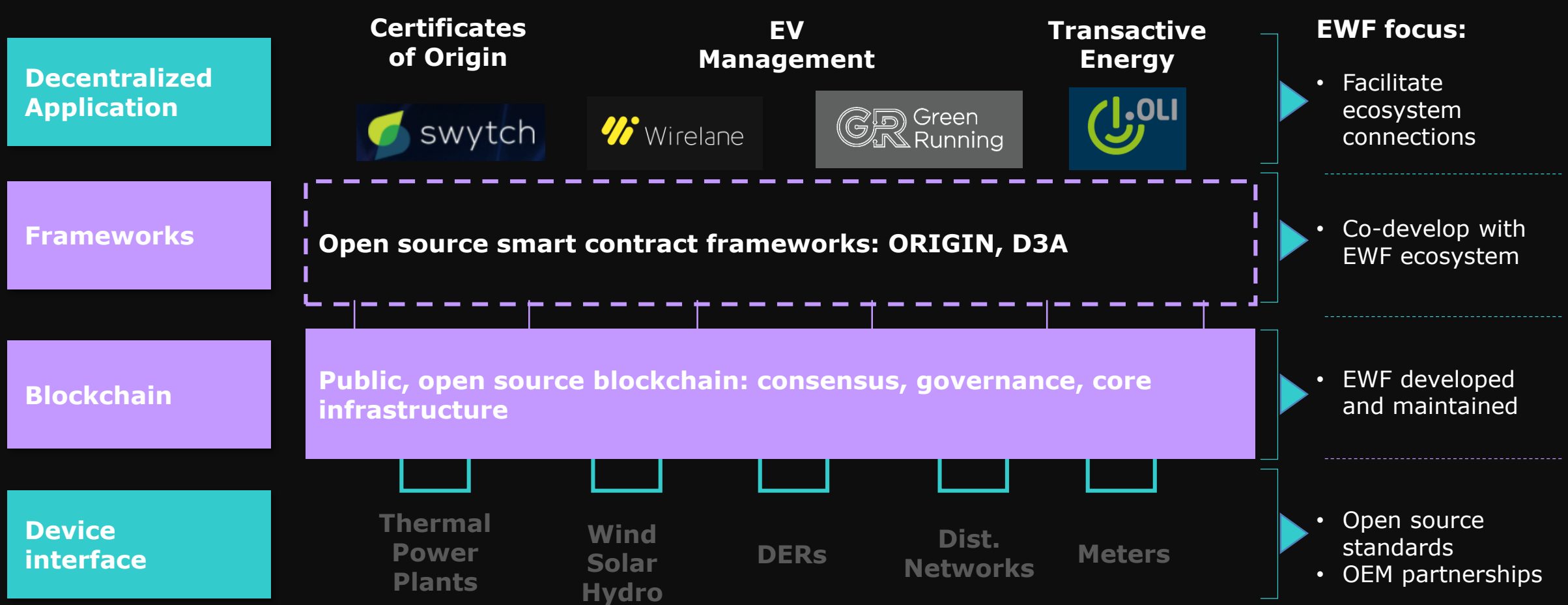
- We are a nonprofit foundation **unleashing blockchain's potential** to accelerate the transition to a decentralized, democratized, decarbonized, and resilient energy system

What we are doing

1. Building a **commercial-grade, open source blockchain-based infrastructure** that is purpose-built for the energy sector
2. Facilitating, educating, and incubating a **diverse ecosystem of market participants, innovators, and regulators** in support of the technology

Energy-specific building blocks of the EWF chain

EWF is primarily focused on the blockchain itself



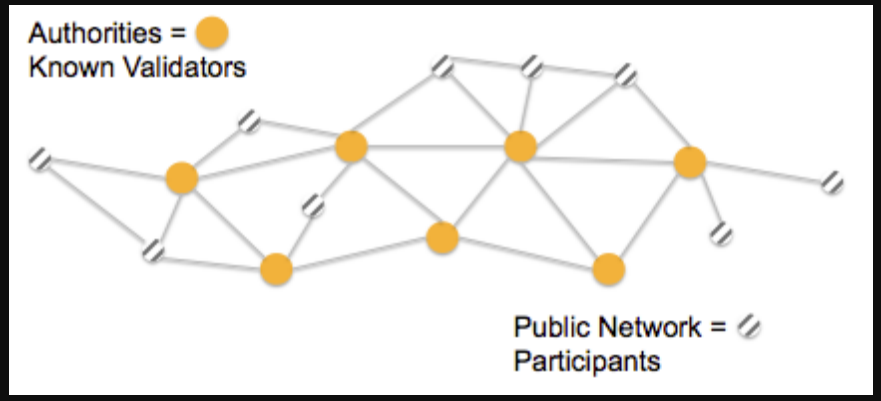
Energy-specific building blocks of the EWF chain

Four distinguishing features compared to other projects

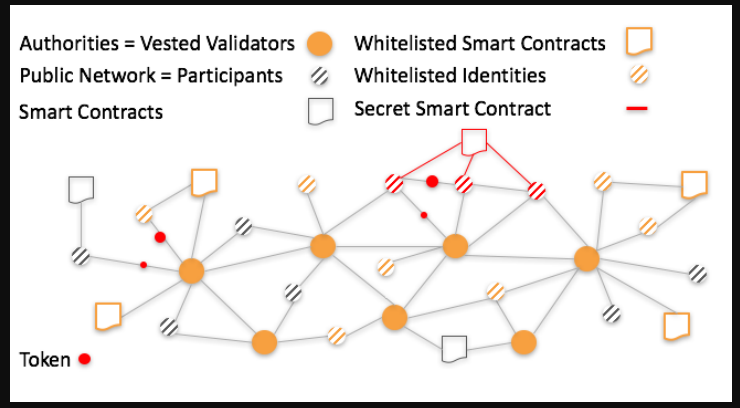
1: Program the chain in C++

2: Open source light client for IoT

3: Blockchain governance



4: Private transactions

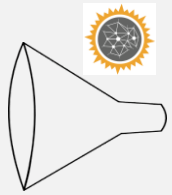


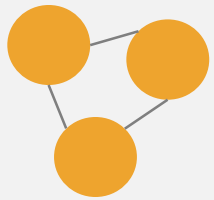
Energy-specific building blocks of the EWF chain

3: first-of-its-kind governance structure based on Proof-of-Authority consensus

Off-chain governance

- **EWF Foundation Council** sets initial authority certification requirements for consideration
- The greater **energy and blockchain ecosystem** generates ideas and protocol improvement proposals
- A "Protocol Implementation Team" recruited by EWF **facilitates the ecosystem, identifies / develops the most popular innovations, and submits to authorities** for consideration

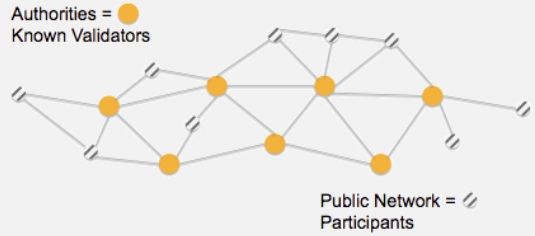




Ecosystem > Implementation Team > Authorities

On-chain governance

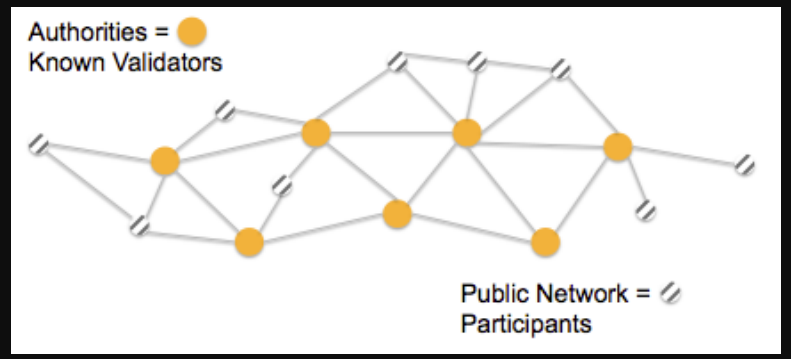
- **EWF blockchain is a public network** (any party / device can participate and submit transactions)
- Unlike other public networks, **anonymous validators (e.g., miners, stakers) do not maintain state** or run virtual machine
- Instead, **permissioned, publicly known and validated authorities** validate transactions, run virtual machine, and consider protocol upgrades

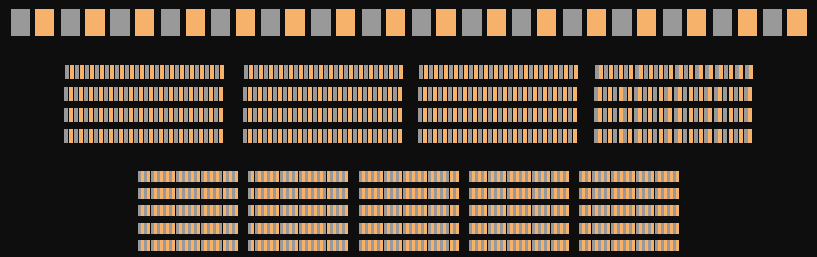


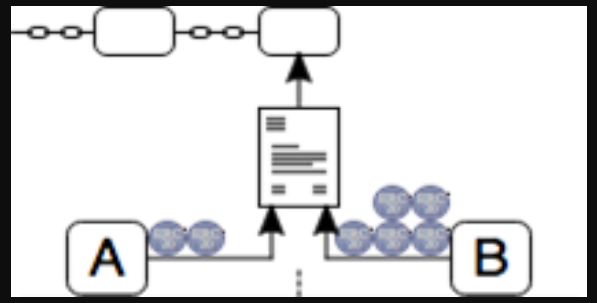
EWF is actively experimenting with variations of this structure on our test network in advance of genesis block

Network performance and “transactions per second”

Scaling strategies, putting throughput numbers into perspective







EWF PoA-based test network

Actually measured simple transactions:

750 transactions per second

Polkadot / Sharding

Example: 1 main chain, 16 federal states, 20 cities

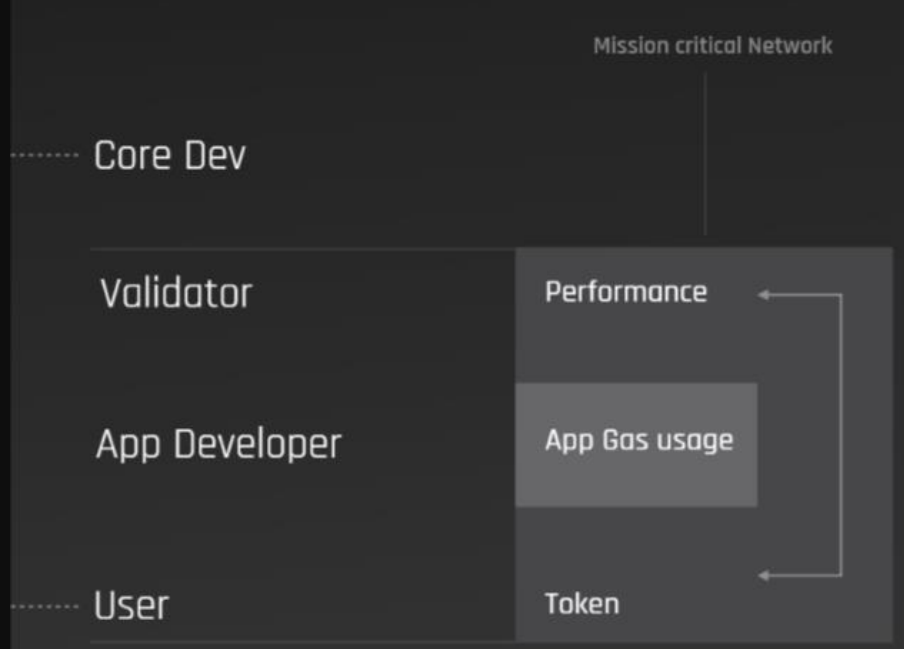
240,000 transactions per second

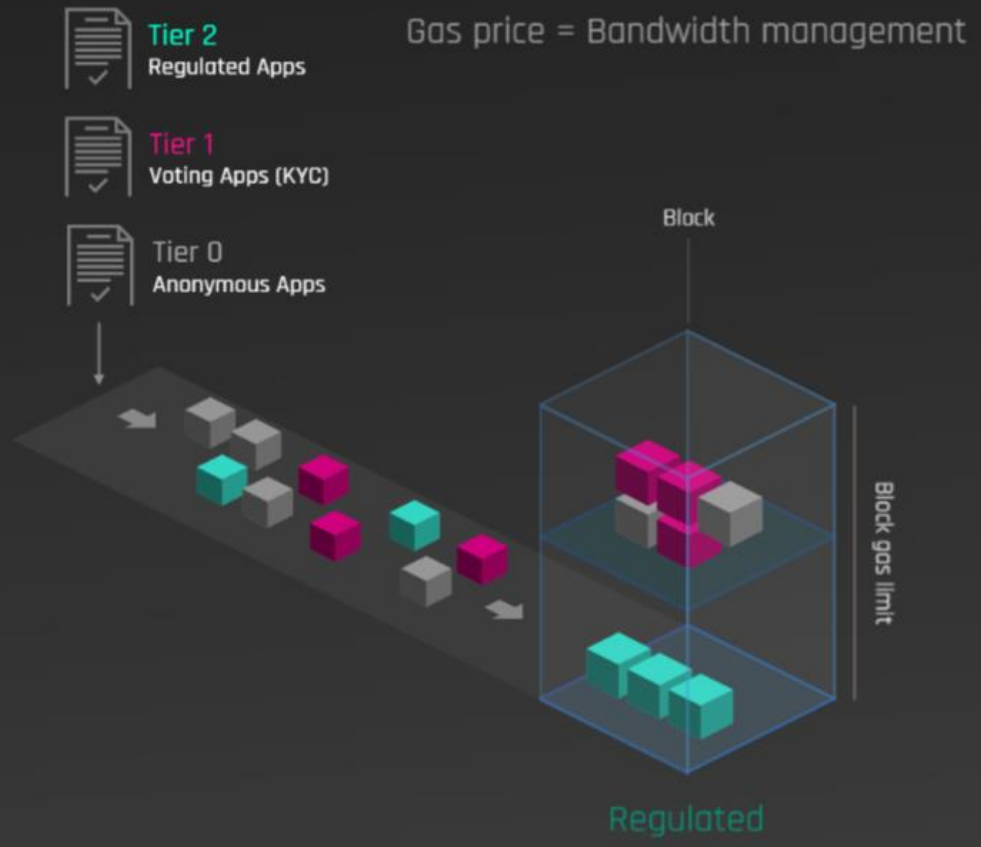
Payment channels

1 chain, 1 payment channel / household / day

64,800,000 transactions per second

Governance & Regulation





Ecosystem Development

EWF affiliate ecosystem as of April 20, 2018

EWF Affiliates

* Total number of EWF Affiliates = 51

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Why join EWF?

Benefits of joining

Benefit	Detail
LEARN how blockchains can be used in energy	• Research and analysis on blockchain use cases • Pilot EWF-developed decentralized apps and frameworks • EWF tech support • Workshops, hackathons, and educational bootcamps to forge connections across corporates and blockchain / energy innovators • Co-develop our tech and governance structure with us
Special LICENSE for commercial products	• EWF Affiliates receive a special license for the EWF Parity Client
TOKENS	• EW blockchain is public, and relies on tokens to secure network and manage transaction costs • Affiliates receive a voucher for pre-allocated tokens at a discounted rate

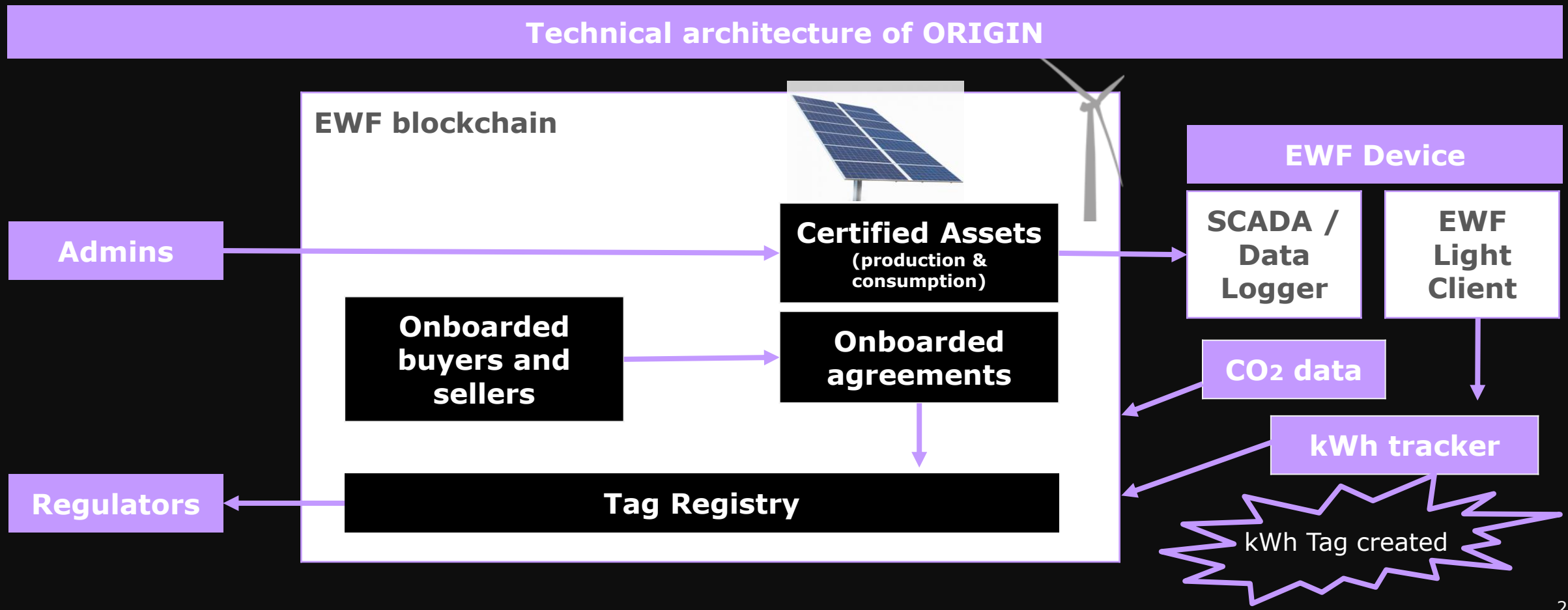
Learn how blockchains can be used in energy

Engage with application development in four primary ways

Convenings	Energy Web Connect	Technical support	dApp development
Workshops and gatherings focused on: 1. App identification 2. Technical trainings on specific topics 3. Co-development of app requirements 4. Hackathons	Build business relationships with ecosystem of reviewed / vetted startups in support of: 1. Collaboration opportunities 2. RFPs 3. Early stage investing	Affiliates access dedicated technical resources to: 1. Review application ideas 2. Answer technical questions	EWF is actively developing open source applications. Affiliates can launch demonstrations using framework apps in their own markets: • *Origin*: renewable energy certification • *D3A:* peer to peer / transactive energy

Energy Web Origin

Pilot EW Origin: an open source dApp for renewable certificates of origin



Learn how blockchains can be used in energy

Experiment with the D3A

D3A = Decentralized Autonomous Area Agent

- **A smart contract-based, recursive, peer to peer transactive energy framework**
- Responsible for managing a range of "areas": country, municipality, balancing authority, region, substation, feeder, house, device etc.
- April 2018: web-based simulation environment for grid operators globally to experiment with
- Long term goal: define a globally replicable blockchain-based transactive market framework

Lowest hierarchy area controller: Home #1

Upscaled hierarchies: (left) Street #1, (right) Region #1

Learn how blockchains can be used in energy

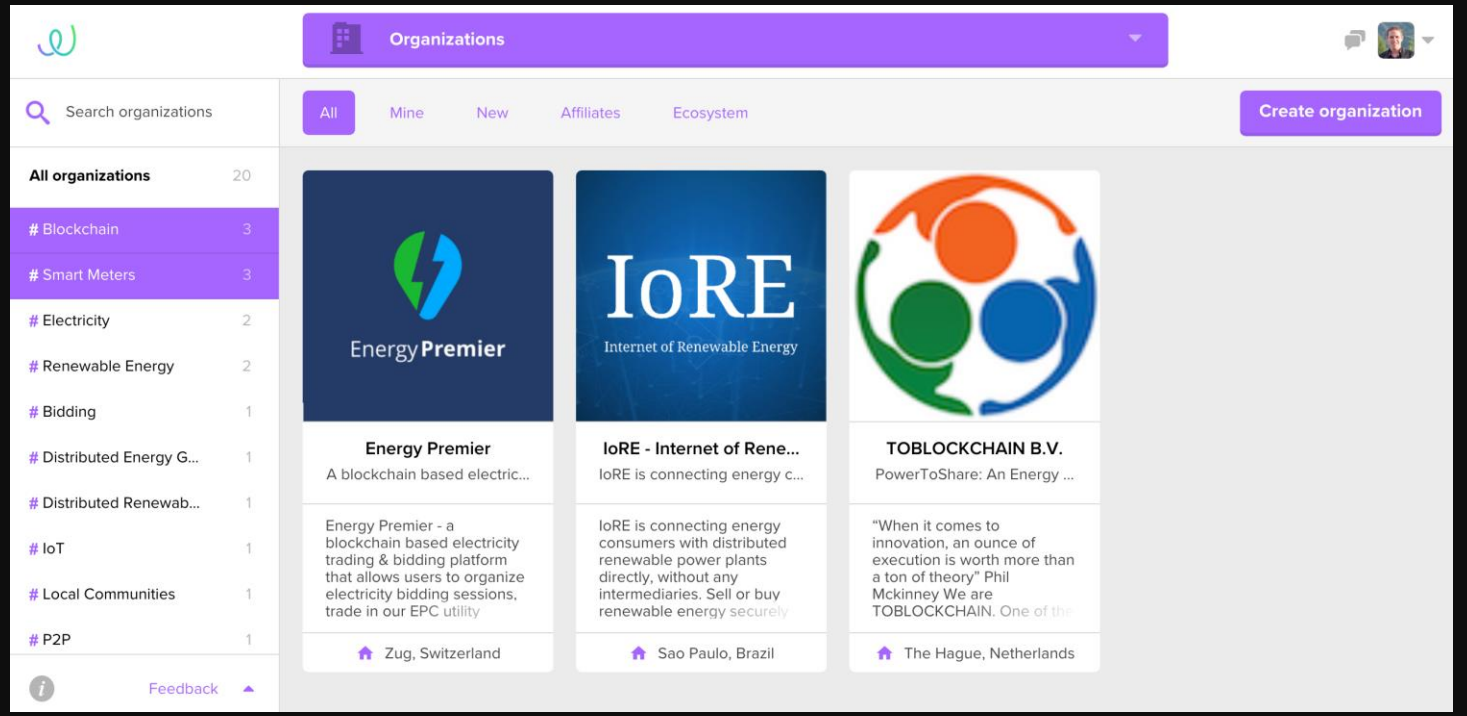
Use EW Connect—a platform for corporates, startups, and everything in between

Energy Web Connect facilitates connects the global EWF ecosystem by

Facilitating connections between and amongst corporate Affiliates (e.g., utilities) and ecosystem Affiliates (e.g., blockchain & energy startups)

Giving corporate Affiliates **a platform to issue RFPs for development support** to developers and startups

Creating a way for **venture-minded EWF Affiliates to review startups** for potential investment



Learn how blockchains can be used in energy

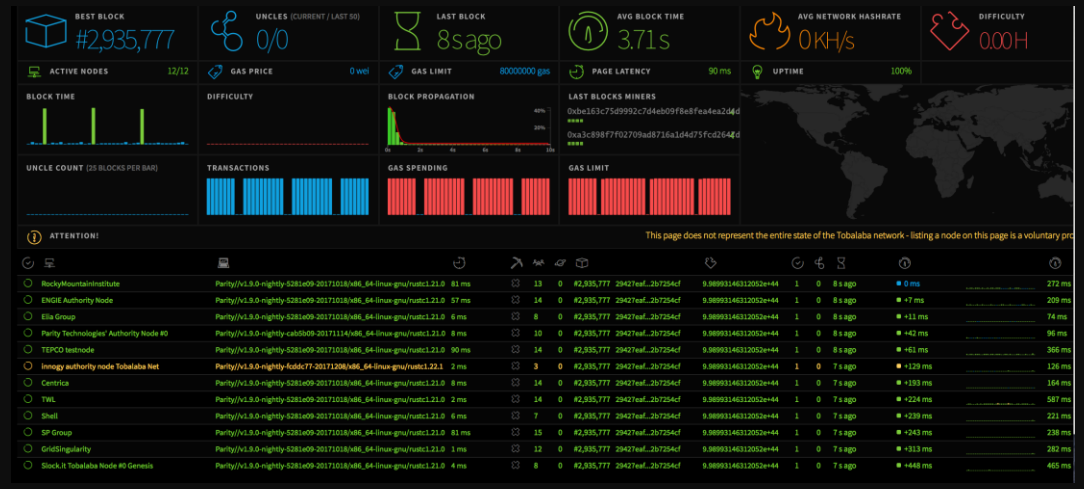
Build the blockchain with us

Affiliates become authorities on test network and provide feedback on tech development

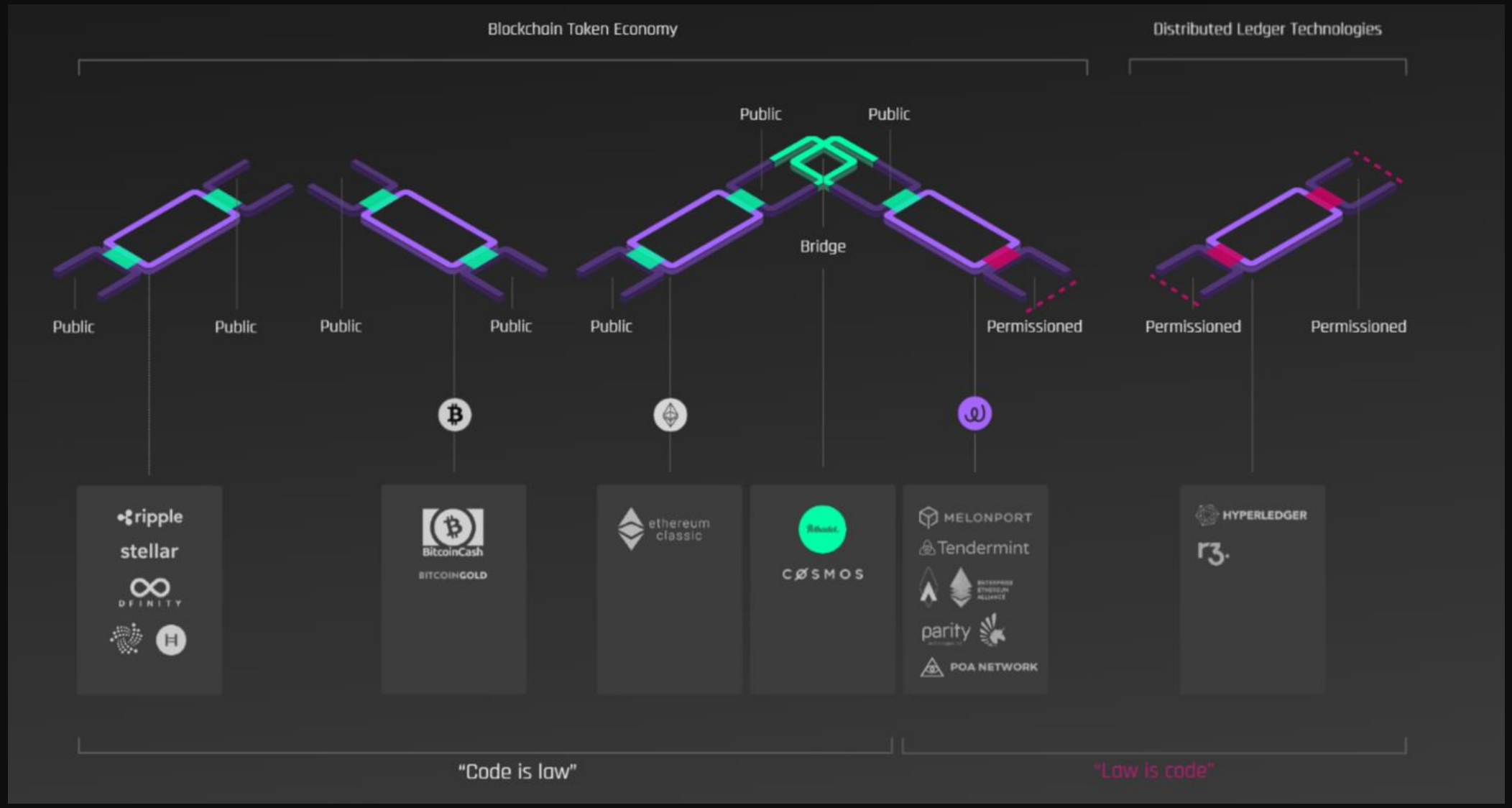
- EWF chain = proof-of-authority consensus mechanism
- Interoperable with other public & private chains
- Purpose built for energy sector

Affiliates also help the EWF team set the standard for blockchain governance in energy

- Known, trusted authority nodes act as validators
- Semi-centralized decision-making enables quicker updates and better alignment
- Governance experiments ongoing



EWF PoA Blockchain Netstats page


Blockchain Token Economy
Distributed Ledger Technologies
Public
Public
Public
Public
Public
Public
Public
Bridge
Permissioned
Permissioned
Permissioned
ripple
stellar
DFINITY
BitcoinCash
BITCOINGOLD
ethereum classic
COSMOS
MELONPORT
Tendermint
parity
POA NETWORK
HYPERLEDGER
r3.
"Code is law"
"Law is code"

Build open source and proprietary dApps

EWF grants an exclusive license to Affiliate organizations

Past	Future
Parity client only offered in GPLv3	Special license applicable for commercial products **Exclusive to EWF Affiliates** who build applications that run on the chain

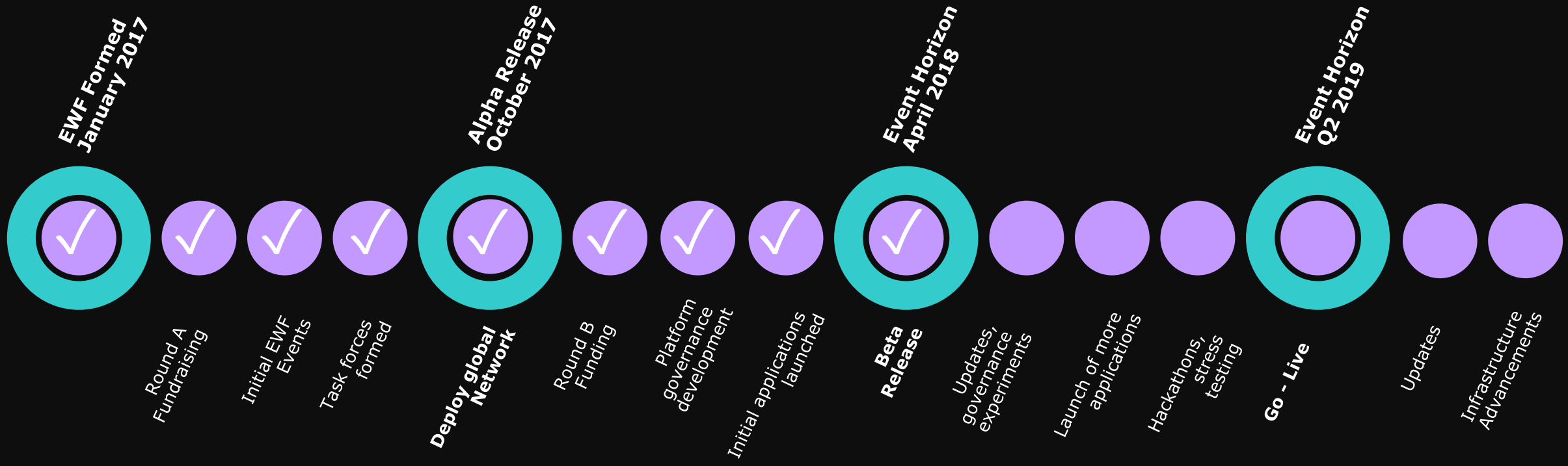
Secure and stable network

Tokens are crucial to operation of the EWF platform and perform two main functions	
Function	**Description**
Maintain Network Security	• EWF blockchain considers transactions submitted by any party (as with other public blockchains e.g., ethereum) • Exposes network to certain attack vectors (e.g., DDOS) • Tokens used to secure network
Manage Transaction Costs	• EWF platform uses proof of authority consensus mechanism • Authorities incur costs to process transactions / validate blocks • Tokens used to pay transaction costs

For additional reading, we recommend reviewing Ethereum's Ether-Gas function: https://ethereum.gitbooks.io/frontier-guide/content/costs.html

Key achievements and milestones

We have maintained a strong focus on timely delivery



EWF Established and Affiliates Engaged	Test Network and Initial Applications Launched	Test Phase and Further Market Engagement and Development

Thanks!

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