HYPERLEDGER
BLOCKCHAIN TECHNOLOGIES FOR BUSINESS

Understanding Hyperledger Fabric

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Introducing Hyperledger

THE LINUX FOUNDATION PROJECTS

https://hyperledger.org/

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Hyperledger Momentum

3.5
Years since launch

126K+
Commits

9
Tools

6
Frameworks

3
1.0+ Production Releases

260+
Members
(50+ in AsiaPac)

11
Active Community
Working Groups &
Special Interest Groups

165+
Meetups
Worldwide
(66 countries)

56K+
Meetup
Participants

2,000+
Media Clips Per Month

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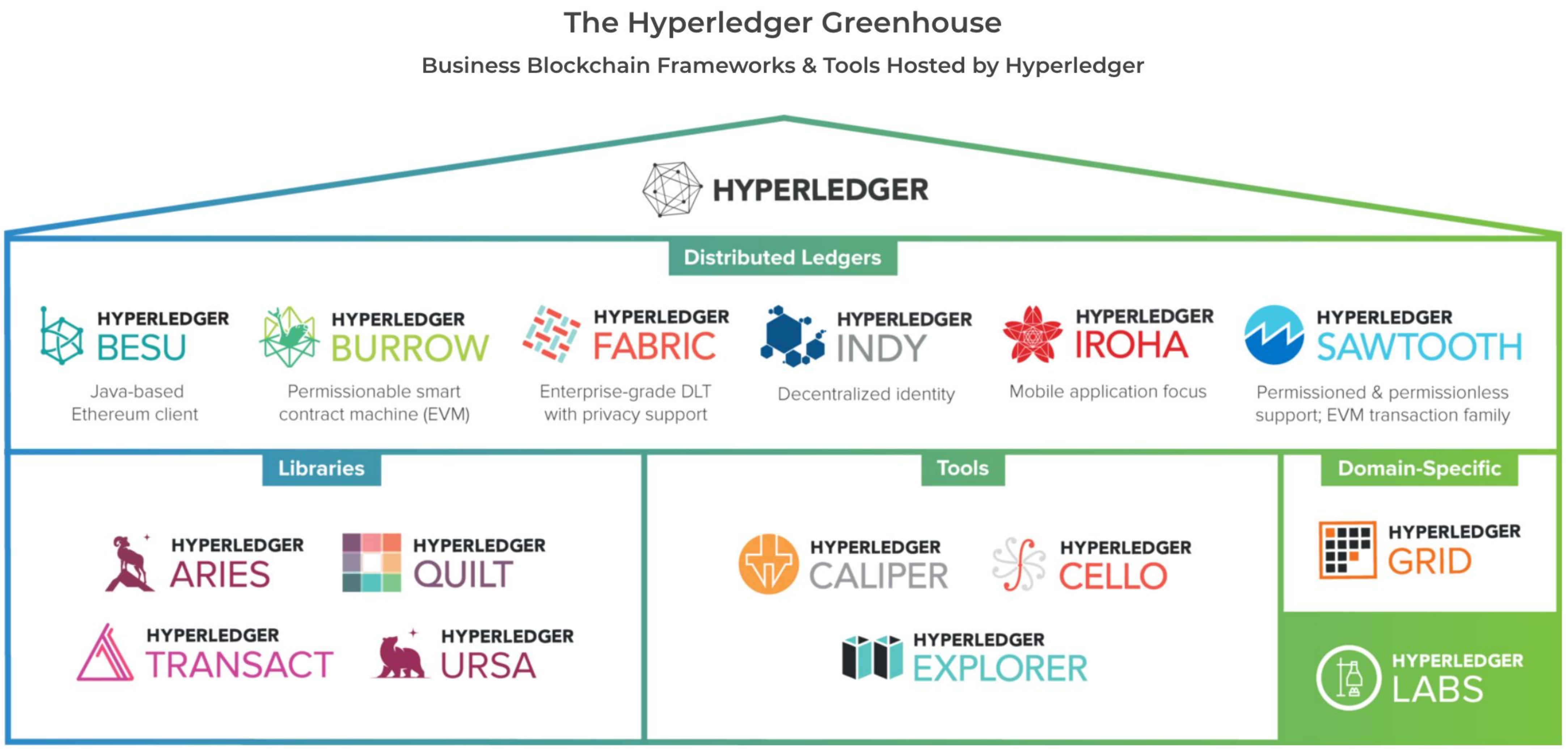
The Hyperledger Greenhouse



The Hyperledger Greenhouse

Business Blockchain Frameworks & Tools Hosted by Hyperledger

Hyperledger Fabric Project News

- Maintaining a quarterly release cadence
- Hyperledger Fabric v1.4.3 released August 2019
- Hyperledger Fabric v2.0.0-alpha released for early access testing
- v1.4.x is our first long term support release

New Features:

- v1.4.1 support for Raft consensus orderer
- v1.4.2 support for Kafka to Raft migration
- v1.4.3 patch release
- v2.0.0-alpha
    - new chaincode lifecycle support
    - Alpine based images
    - StateDB caching

Characteristics

Characteristics

- Permissioned
- Highly modular
- Smart contracts in general purpose languages
- Pluggable consensus
- Privacy
- No “mining” or native crypto-currency required for consensus
- ***Execute-order-validate vs order-execute***

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Permissioned vs Permissionless

- Permissionless
  - Anyone can participate
  - Everyone is anonymous
  - No trust, must treat all entities as adversarial
- Permissioned
  - Participation is selective
  - Identity is known and often vetted
  - Operate under a shared governance model
  - Certain degree of trust can be established

Highly modular platform

- Pluggable *ordering service* establishes consensus
- Pluggable *membership service provider*
- Optional *peer-to-peer gossip service*
- Ledger can be configured to support a variety of DBMSs
    - LevelDB, CouchDB, BerkleyDB*, SAP Hana*
- Pluggable endorsement and validation policy enforcement

Smart Contracts

Highly Modular and Configurable

- Written in traditional programming languages
  - Golang, Java, Javascript, …
  - Implement a language specific shim
- Do not need to be deterministic

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Order-execute

Highly Modular and Configurable

- Most existing smart-contract capable blockchain platforms follow an “***order-execute***” architecture in which the consensus protocol:
  - validates and orders transactions then propagates them to all peer nodes,
  - each peer then executes the transactions sequentially
- Contracts must be deterministic
- Sequential execution limits performance & scale

Execute-order-validate

Highly Modular and Configurable

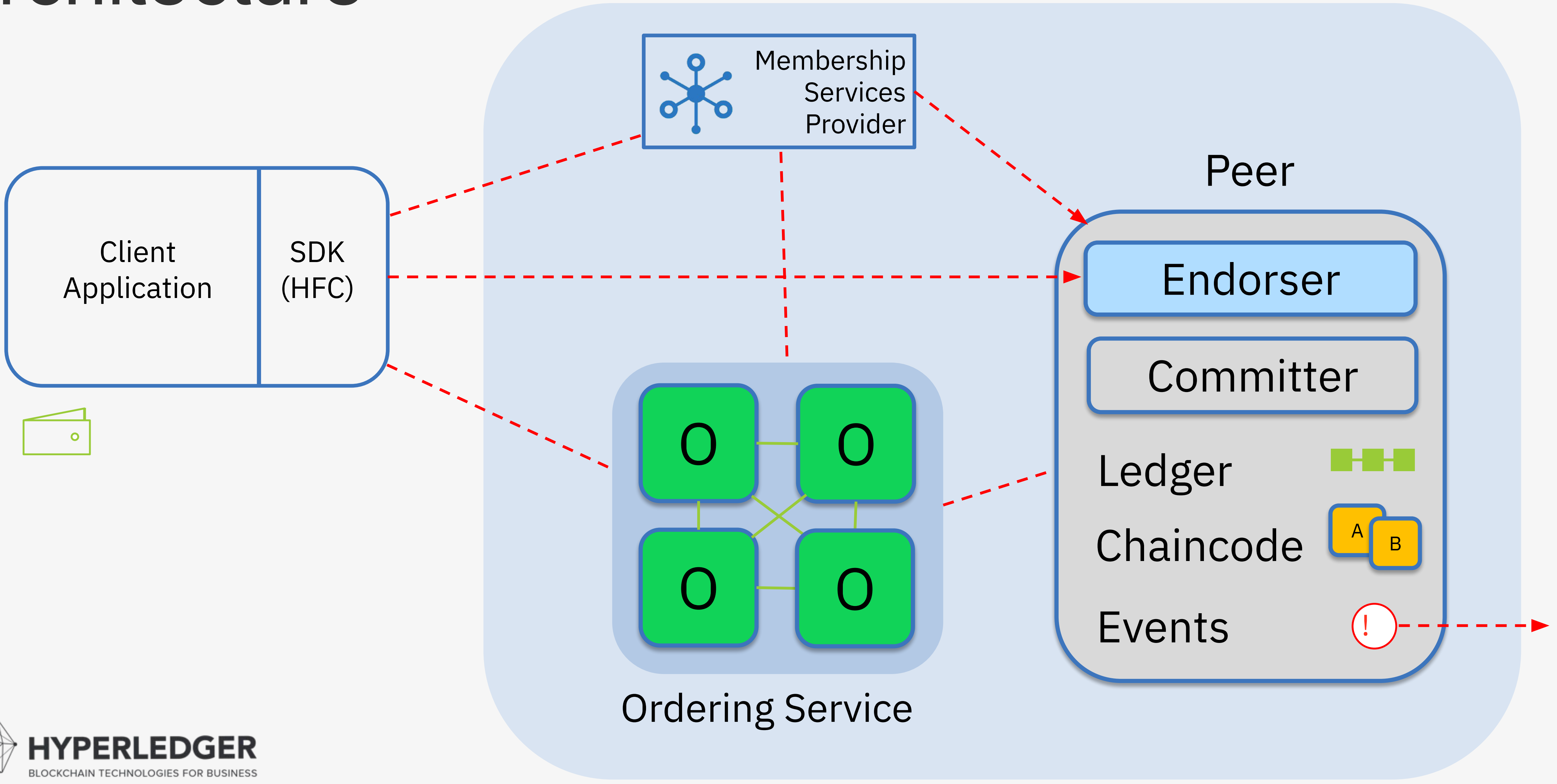
- Separates the transaction flow into three steps:
  - executing a transaction and checking its correctness, and endorsing it;
  - ordering transactions through a consensus protocol; and
  - transactions validated against an application-specific endorsement policy and committed to the ledger
- 1st step eliminates non-determinism
- Allows for parallel execution
- Allows for pluggable consensus

Privacy & Confidentiality

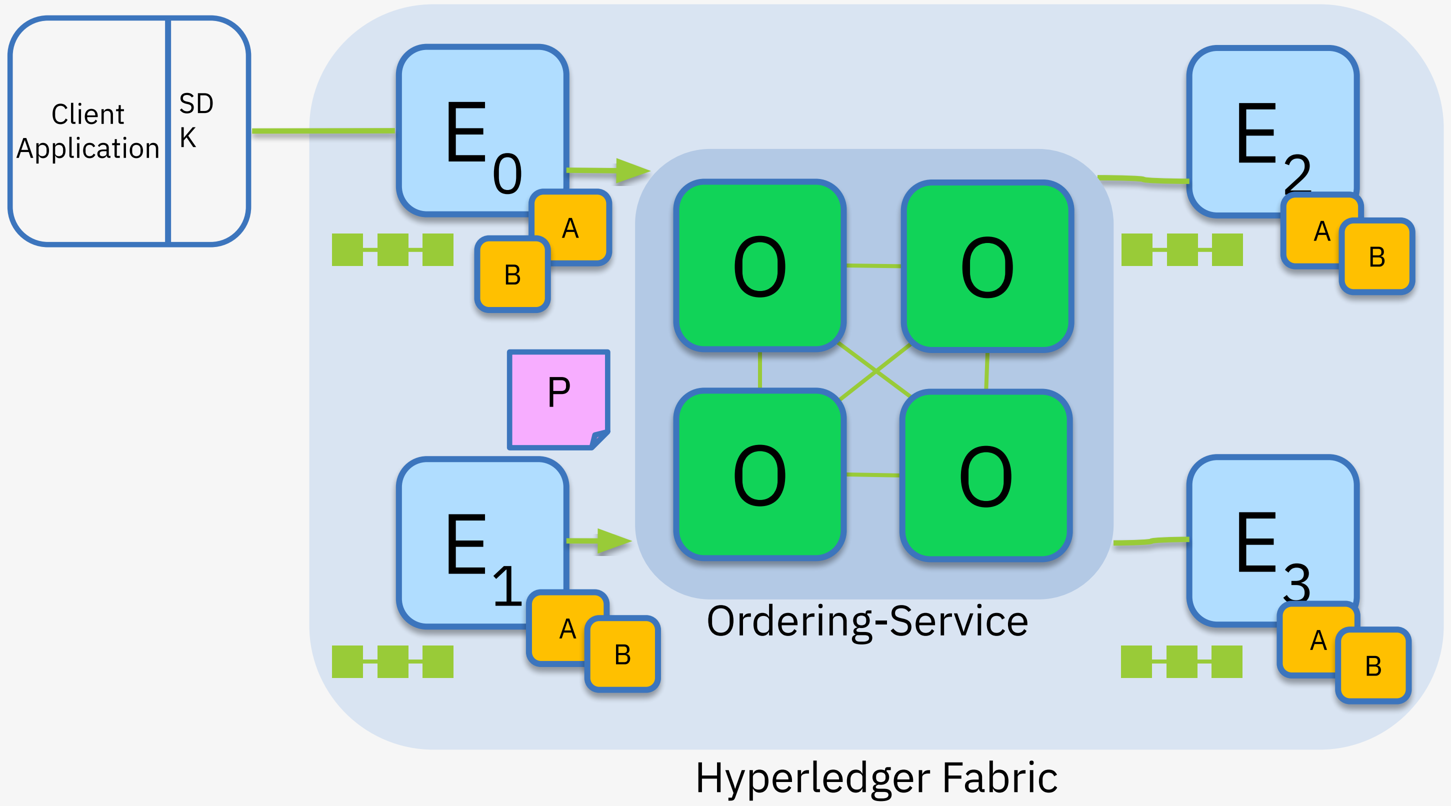
Highly Modular and Configurable

- Channel architecture
- Private data collections
- Zero knowledge proofs
  - Identity mixer
  - ZKAT - coming soon after token capabilities added

Architecture



Channels



- Similar to v0.6 PBFT model
- All peers connect to the same system channel (blue).
- All peers have the same chaincode and maintain the same ledger
- Endorsement by peers E_0, E_1, E_2 and E_3

Key:

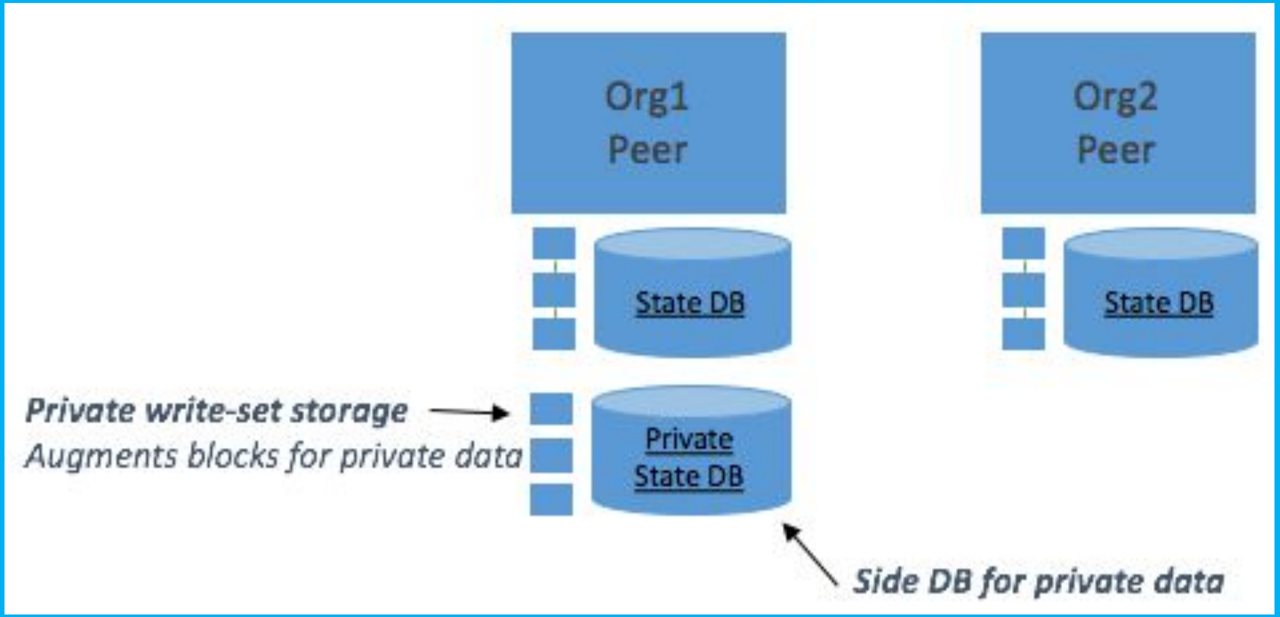
Endorser	🟦	🟩🟩🟩	Ledger
Committing Peer	⬜	⬜	Application
Ordering Node	🟩		
Smart Contract (Chaincode)	🟨	🟪	Endorsement Policy

Private Data Collections

Keep chaincode data confidential among a subset of channel members.

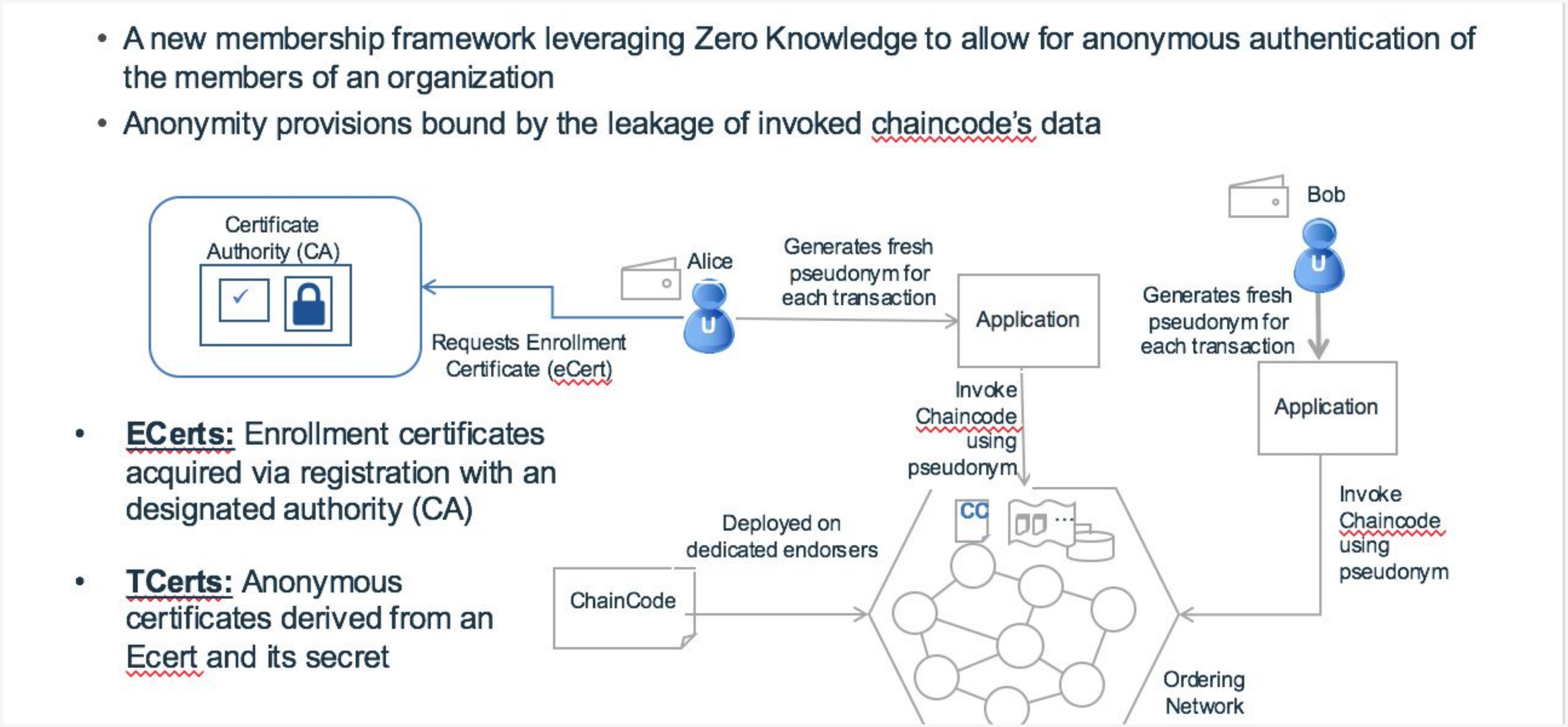
Store private data alongside the public ledger with hashes on the public ledger serving verifiable proof of the data.

- Private data grouped in ***collections*** *having* ***access policies***
- Private data of a collection stored solely to peers who satisfy the collection's access policy



For more details see charts at https://jira.hyperledger.org/browse/FAB-1151

Identity Mixer



- A new membership framework leveraging Zero Knowledge to allow for anonymous authentication of the members of an organization
- Anonymity provisions bound by the leakage of invoked chaincode's data

- **ECerts:** Enrollment certificates acquired via registration with an designated authority (CA)
- **TCerts:** Anonymous certificates derived from an Ecert and its secret

Certificate Authority (CA)
Requests Enrollment Certificate (eCert)
Alice
U
Generates fresh pseudonym for each transaction
Application
Invoke Chaincode using pseudonym
Bob
U
Generates fresh pseudonym for each transaction
Application
Invoke Chaincode using pseudonym
Deployed on dedicated endorsers
ChainCode
CC
Ordering Network

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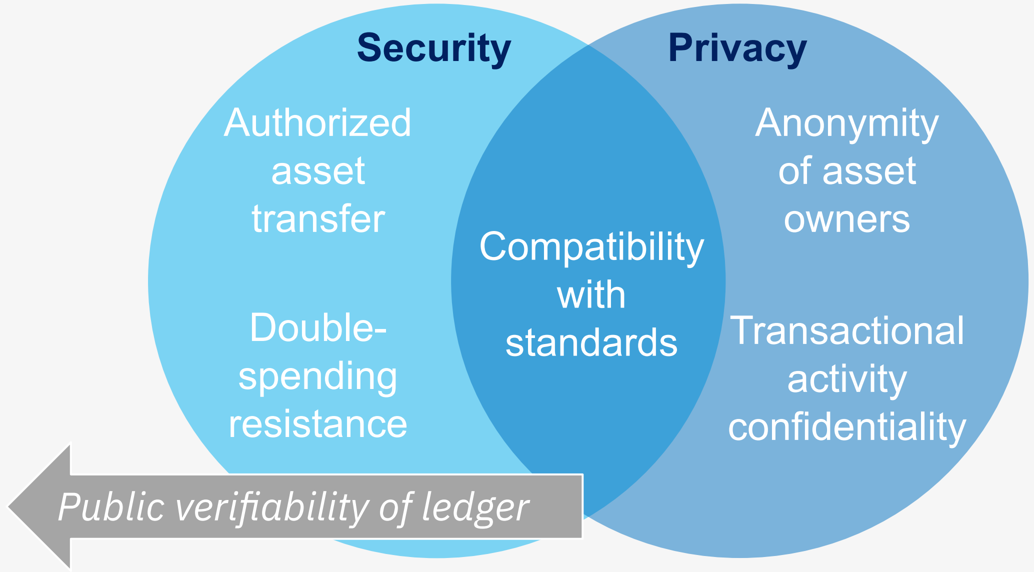
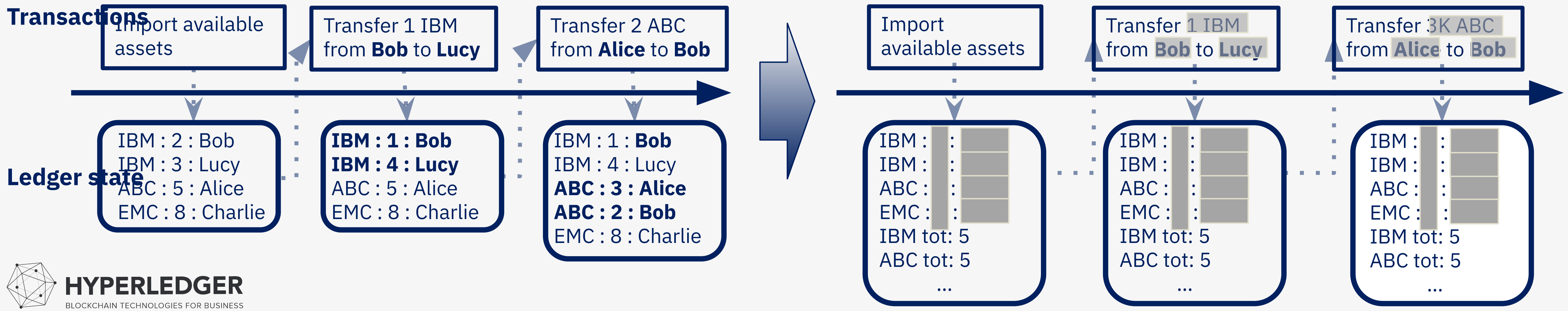
Privacy Preserving Asset Mgt

Relevant in multiple use-cases
- Financial asset transfer
- Securities trading
- Virtual payments

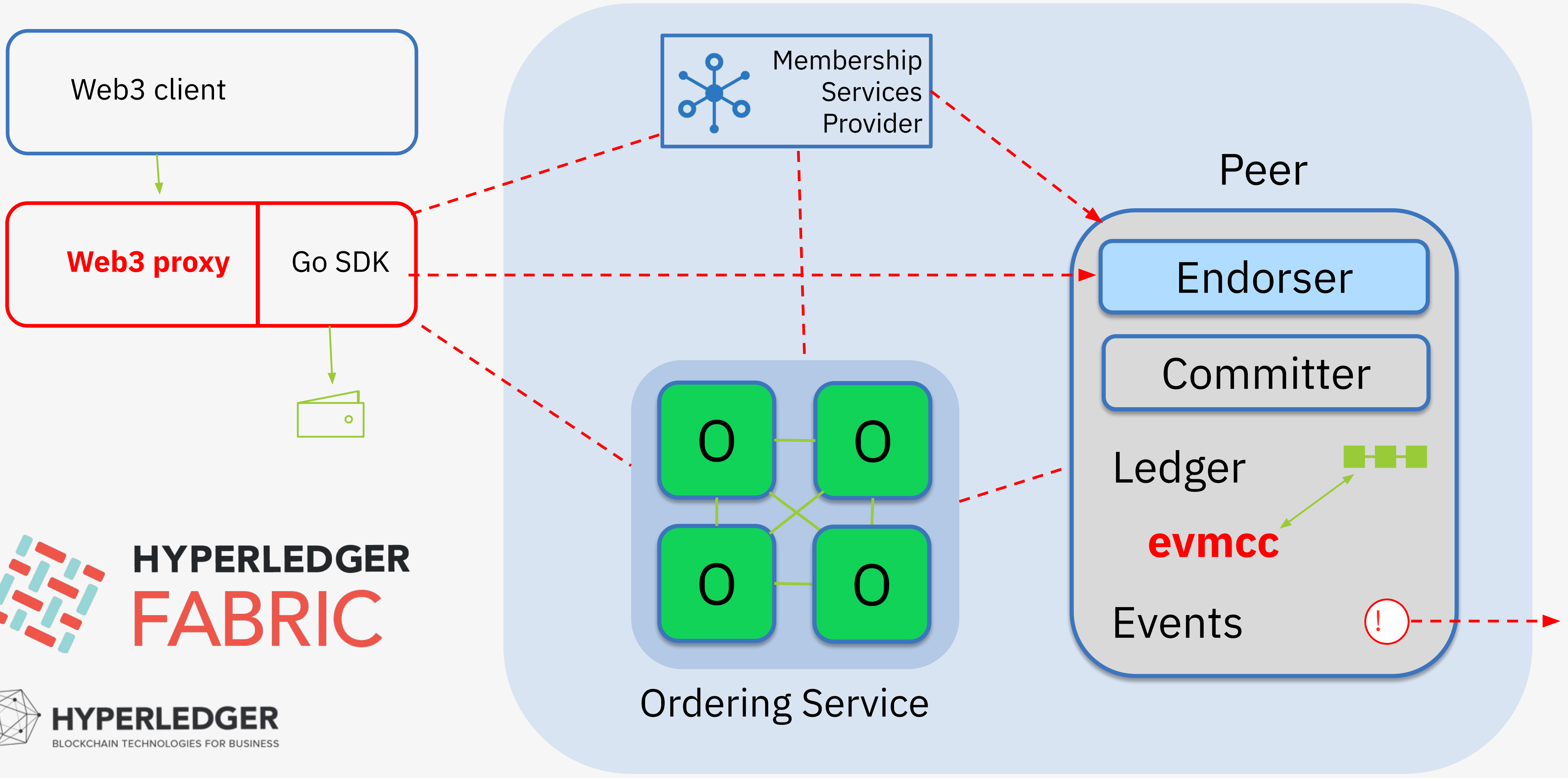
Value: Extend automation, trusted record keeping without the need for trusted mediators


Security
Privacy
Authorized asset transfer
Double-spending resistance
Compatibility with standards
Anonymity of asset owners
Transactional activity confidentiality
Public verifiability of ledger

Shareholder example:



Hyperledger Burrow EVM Integration



HYPERLEDGER FABRIC

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Paving the way for a more powerful Fabric

Concepts we are working to pull into Fabric on an experimental basis

- Pushing transaction functions down into Fabric to provide a “proper” smart contract authoring experience
- Improving the usability of client SDKs
- Modelling of data stored on the ledger and in the world state
- Generation of domain specific RESTful APIs
- Generation of domain and programming language specific SDKs (JavaScript, Java, Go, etc.)
- Skeleton smart contract generation

v2.0 Roadmap (proposed)

Enable further **operational** and **token capabilities**

- RAFT Consensus
- Chaincode Lifecycle
- Local Collections
- Programming model additions
- Sample improvements (advanced commercial paper)
- Alpine images

https://jira.hyperledger.org/secure/Dashboard.jspa?selectPageId=10104

Get Started!

https://wiki.hyperledger.org/projects/fabric

Contribute – become one of the nearly 300 developers working on this critical technology

Consume – leverage the most mature of the emerging enterprise blockchain platforms

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Thank you!

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@cbf on rocketchat