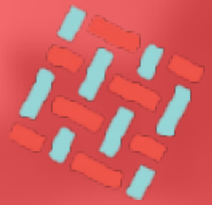
BLOCKCHAIN



HYPERLEDGER
FABRIC

HYPERLEDGER
EXPLORER

Welcome at Sfeir School
Hyperledger **FABRIC** Introduction


DÉBUTANT
CONFIRMÉ
EXPERT
School

Agenda

- Hyperledger
- Hyperledger projects
- Hyperledger Fabric
  - Concepts
  - How is working ?
  - TPs
  - Additional concepts
- Hyperledger Explorer
  - Concepts
  - TPs

Hyperledger

Linux Foundation

FRAMEWORKS

TOOLING

School

Hyperledger

Hyperledger Fabric

FABRIC

Founded in 2015

Private and Permissioned Blockchain implementation for **finance**, **banking**, **Internet of Things**, **supply chains**, **manufacturing** and **Technology** fields.

Smart contracts, assets …

Members of network enroll through a trusted **Membership Service Provider** (MSP)

Hyperledger Fabric

CONCEPTS

Shared Ledger : Two components « **World state** » and « **Transaction Logs** »

Smart Contract : is written in chaincode and invoked by peer.

Privacy

Consensus : mechanisms currently include SOLO and Kafka.

Hyperledger Fabric

CONCEPTS

IDENTITY

Digital identity (X.509 digital certificate)

→ Can be **verifiable** and must be **trusted**

Allows to attribute roles

Allows to determine exact permission over resources

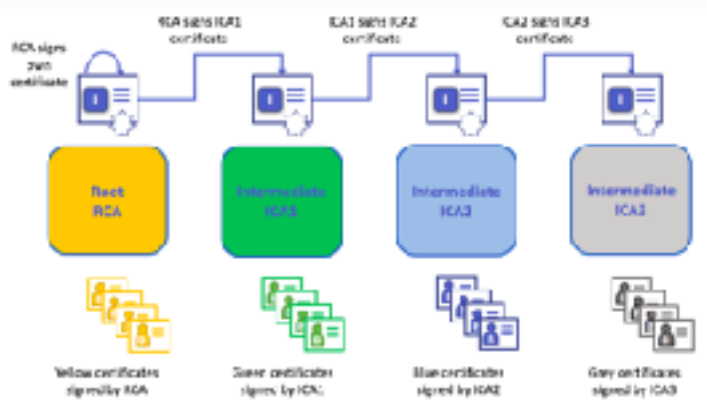
Hyperledger Fabric

CONCEPTS

IDENTITY

CA (certificate authorities)

Chain of trusts



Hyperledger Fabric

CONCEPTS

MEMBERSHIPS

Membership Service Provider (MSP)

Identify Role of actor, set an access privileges

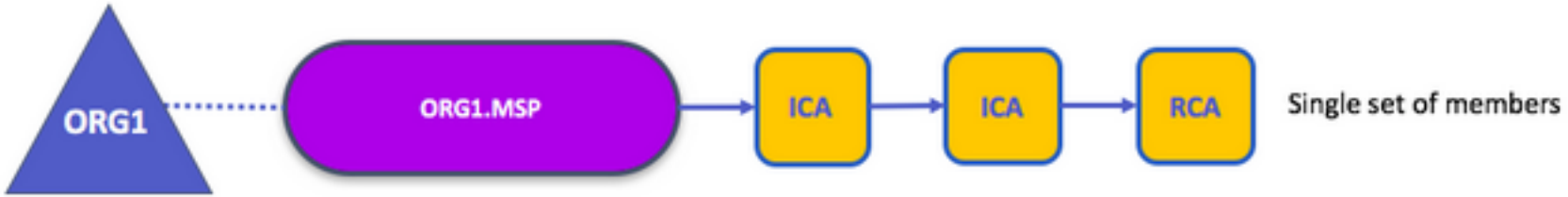
Define Organization

Mapping MSP with Organizations

Hyperledger Fabric

CONCEPTS

MEMBERSHIPS



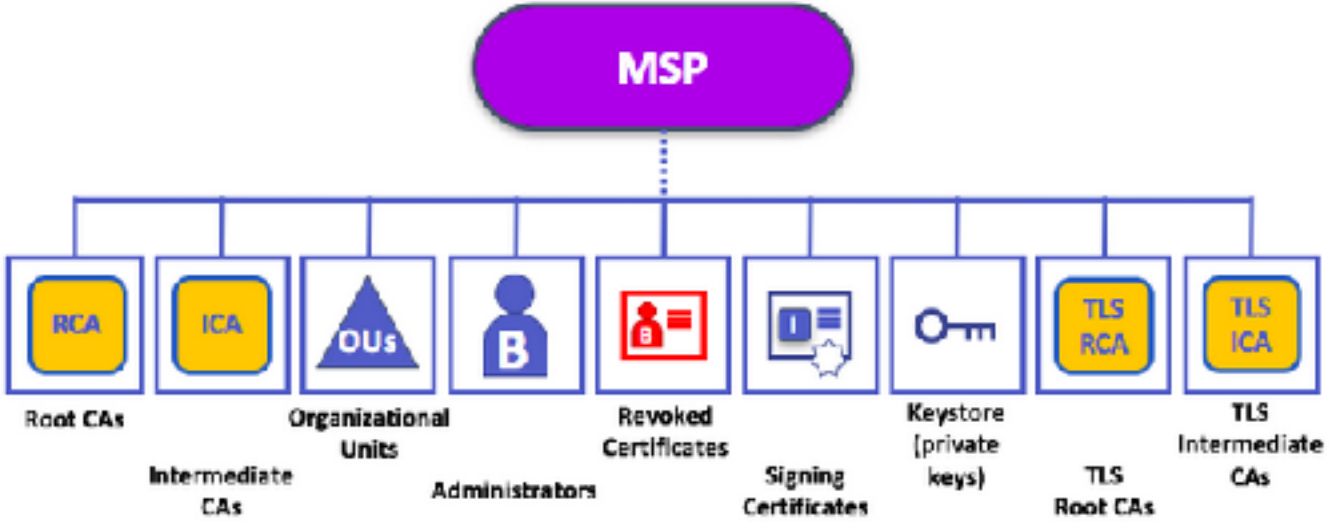
Different levels :

Network MSP
Channel MSP
Peer MSP
Orderer MSP

Hyperledger Fabric

CONCEPTS

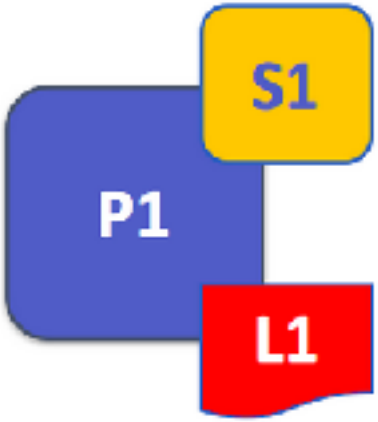
MSP Structure



Hyperledger Fabric

CONCEPTS

PEERS

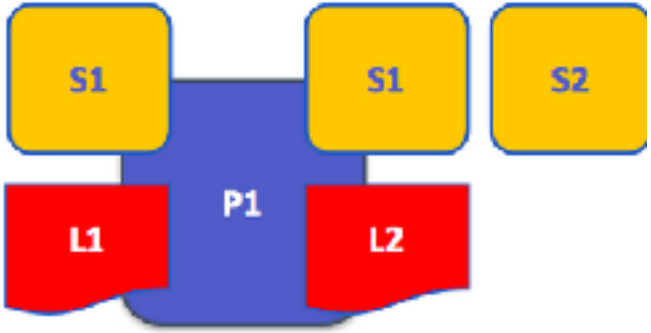


S	Smart contract (aka chaincode)
L	Ledger

Hyperledger Fabric

CONCEPTS

PEERS



Endorser peer
Anchor peer
Orderer peer

Hyperledger Fabric

CONCEPTS

ORDERER

Collect and **distribute proposed** ledger **updates** to **validate** and **include** on the ledger

Mediation role on the consensus workflow

Hyperledger Fabric

CONCEPTS

CHANNEL

Private communication between two or more specific network **members**

Allow to conduct **private** and **confidential** transaction

Each transaction is executed on channel

Each party must be **authenticated** and **authorized**

Hyperledger Fabric

CONCEPTS

CONSENSUS MECHANISM

Sending Tx proposals	Simulating Tx	Receive RW Set & Signature	Tx Endorsement	Send ordered Tx(s)	Validating ordered Tx(s)	Adding Block
APPLICATION	Endorsing Peers	APPLICATION	Orderer	Committing Peers	Committing Peers	Committing Peers

{RW Set}

Tx Endorsement

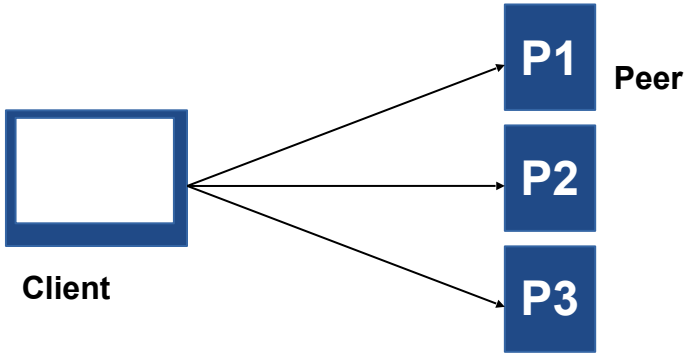
Submit for ordering

Hyperledger Fabric

CONSENSUS

1- initiating transaction

Client Application sent for each Peer a **Tx Proposal** (cryptographic user transaction proposal = request on channel)

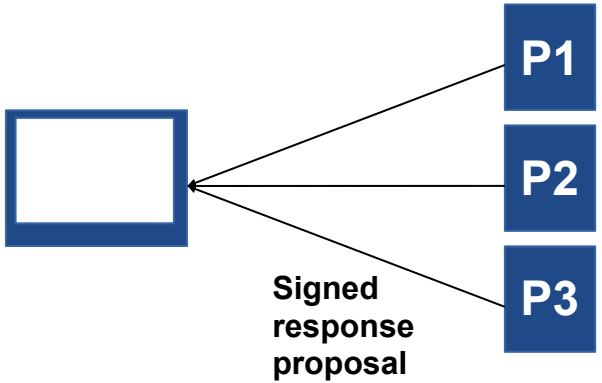


Hyperledger Fabric

CONSENSUS

2- simulating transaction

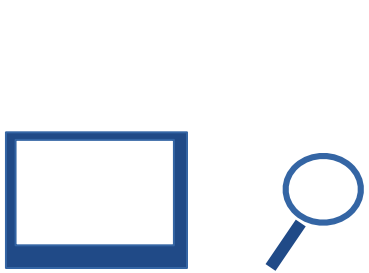
Each peer simulates the business transaction proposal but without committed data, and returns a response proposals



Hyperledger Fabric

CONSENSUS

3- Verifying proposal response (signature, membership ...)



R1 Signed response proposal

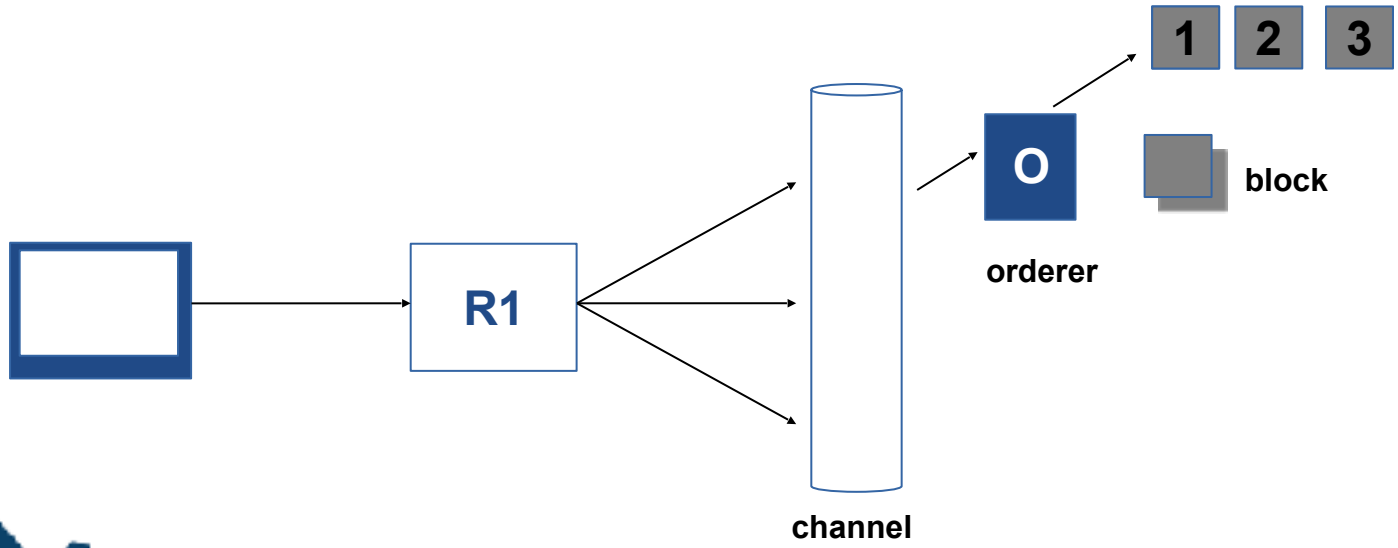
R2 Signed response proposal

R3 Signed response proposal

Hyperledger Fabric

CONSENSUS

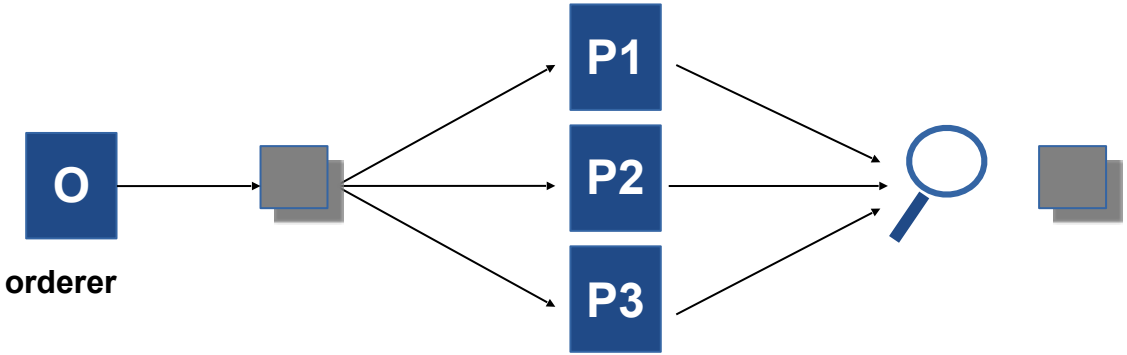
4- broadcasting transaction to the ordered



Hyperledger Fabric

CONSENSUS

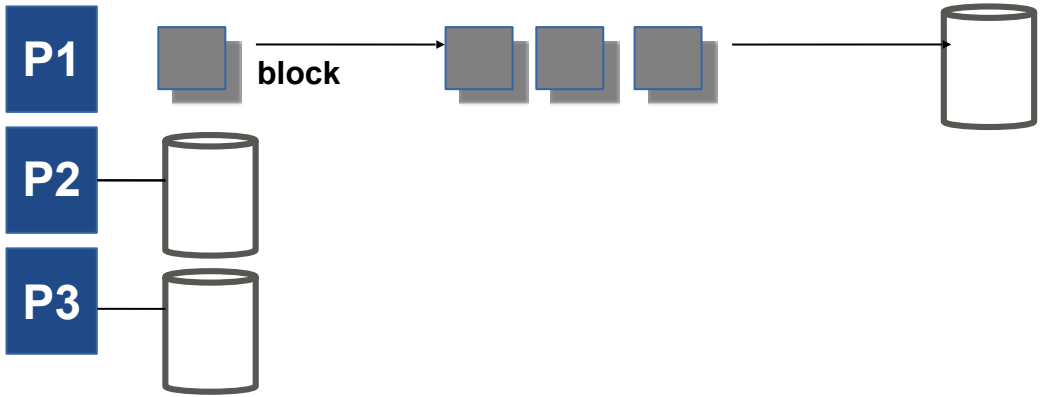
5- Delivering block to peers



Hyperledger Fabric

CONSENSUS

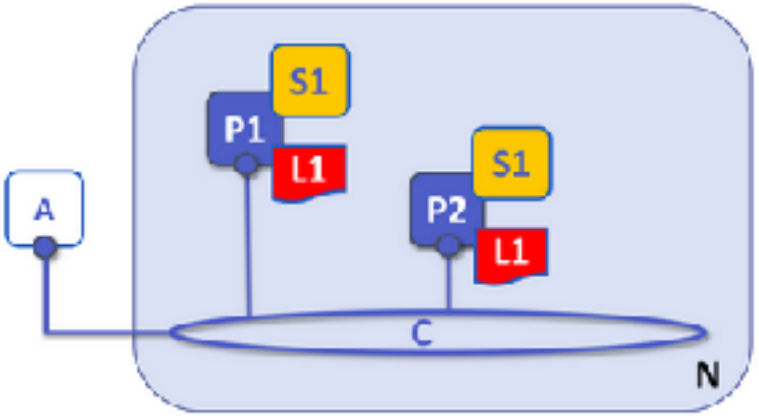
6- committing to the ledger



Hyperledger Fabric

CONCEPTS

EXAMPLE

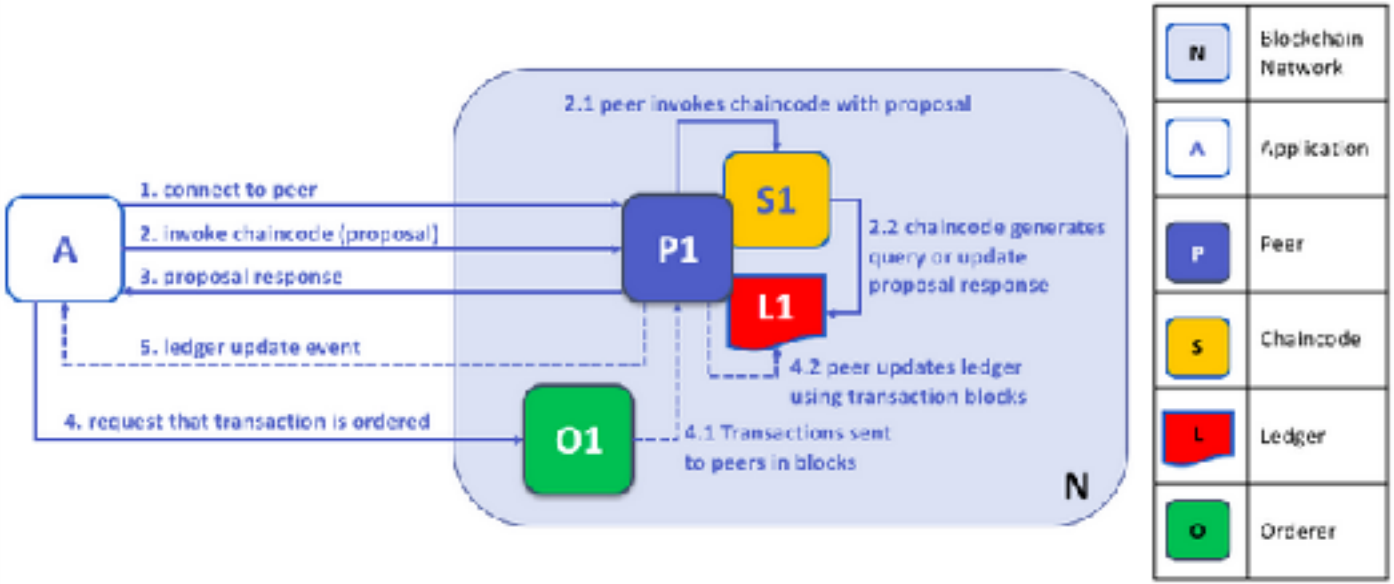


N	Blockchain Network	L	Ledger
C	Channel	A	Application
P	Peer	PA / C	Principal PA (e.g. A, P1) communicates via channel C.
S	Chaincode		

Hyperledger Fabric

CONCEPTS

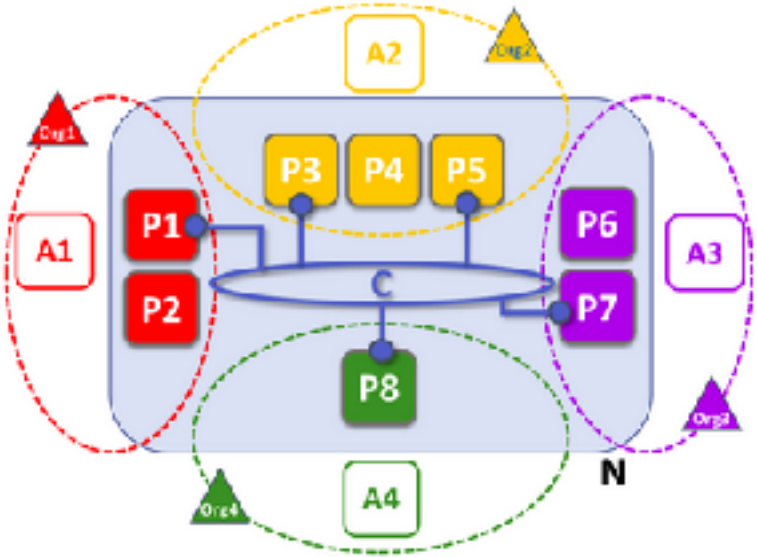
EXAMPLE
Client – Peer – Ledger – Chaincode - Orderer



Hyperledger Fabric

CONCEPTS

EXAMPLE
Organisations

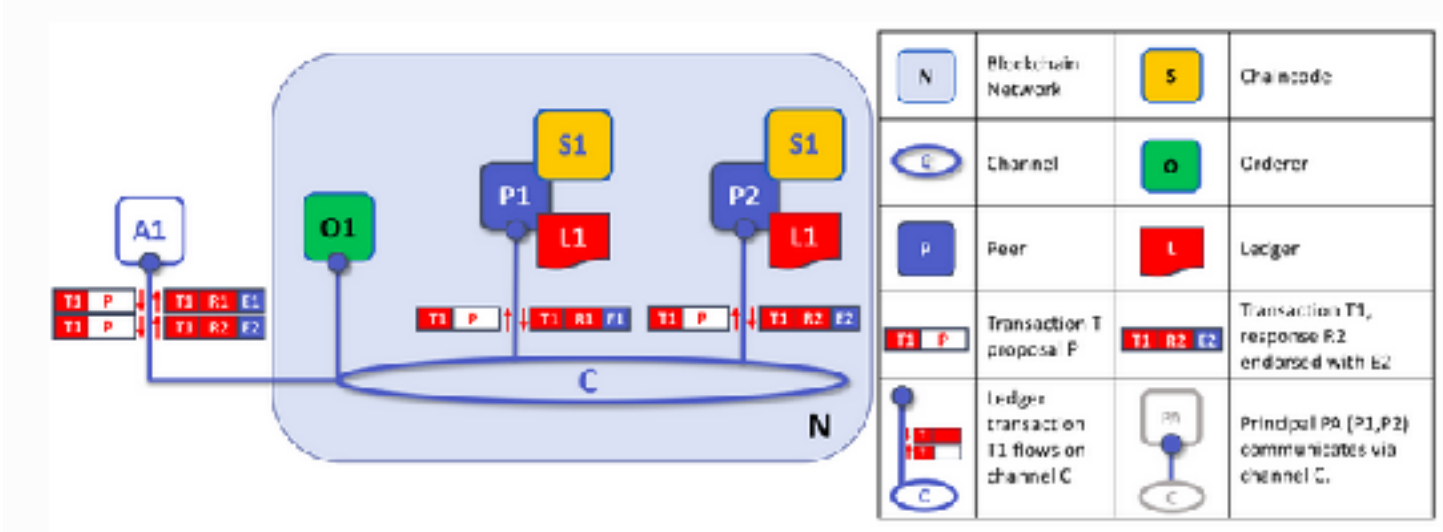


N	Blockchain Network	L	Ledger
C	Channel	A	Application
P	Peer	PA C	Principal PA (e.g. A1, P5) communicates via channel C.
		Org	Organization
A1 P1 P2			Organization R owns application A1 and peers P1, P2.

Hyperledger Fabric

CONCEPTS

CONSENSUS - Proposal



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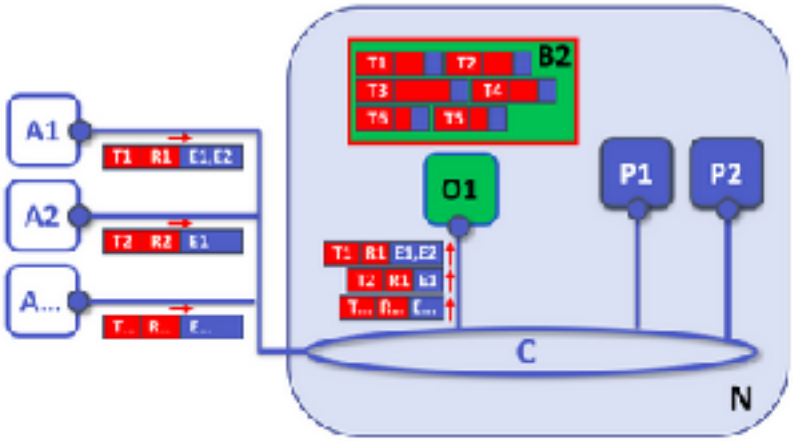
CONCEPTS

CONSENSUS - Packaging

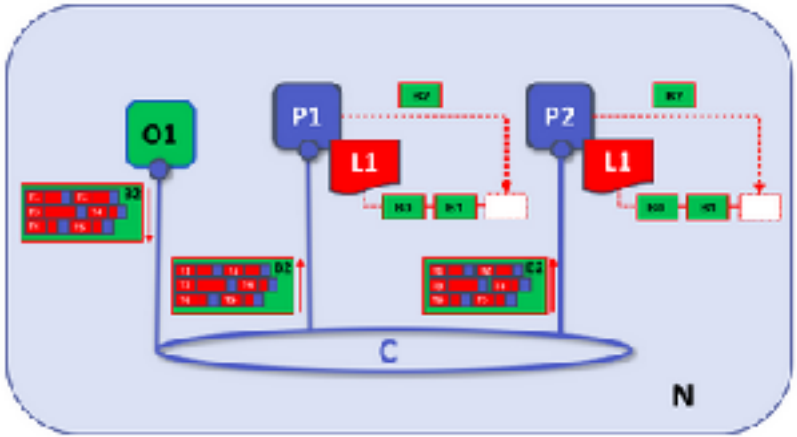


N	Blockchain Network	P	Peer
B1	Block B1	O	Orderer
T1 R2a E2	Transaction T1, response R2a endorsed with E2	C	Channel
T3 R1 T2 T6	Block B1 contains transactions T1, T2, T3...		
T3 T1 C	Ledger transaction T1 flows on channel C	PA C	Principal PA (P1,P2) communicates via channel C

Hyperledger Fabric

CONCEPTS

CONSENSUS - Validation



N	Blockchain Network	P	Peer
C	Channel	O	Orderer
L	Ledger	B	Block B
L1	Ledger L1 has blockchain with blocks B0, B1	B1	Block B1 contains transactions T1, T2, T3...
B1 C	Block B1 flows on channel C	P1 C	Principal PA (P1, P2) communicates via channel C.

Hyperledger Fabric

TPs

Hyperledger Fabric

ADDITONAL CONCEPT

PRIVATE DATA

Starting in v1.2

Private data **Collection**

Store on **private database** on Ledger (side database)

To keep data confidential among a set of organization in the channel definition.

Hyperledger Fabric

ADDITONAL CONCEPT

ACL

```
Policies:
  MyPolicy:
    Type: Signature
    Rule: "Org1.Peer OR Org2.Peer"
```

Type :

Signature : AND | OR

ImplicitMeta : ALL | ANY | MAJORITY

+ Role : Admin, Member, Reader, Writer

Hyperledger Fabric

ADDITONAL CONCEPT

ACL

Define at **configtx.yaml**

Resources : system chaincode, user chaincode …

Identify : <component>/<resources> **ex : cscc/GetConfigBlock**

Hyperledger

Hyperledger Explorer

EXPLORER

INCUBATION

Hyperledger Explorer is a Nodejs based web app (Node/ ExpressJS | MySQL)

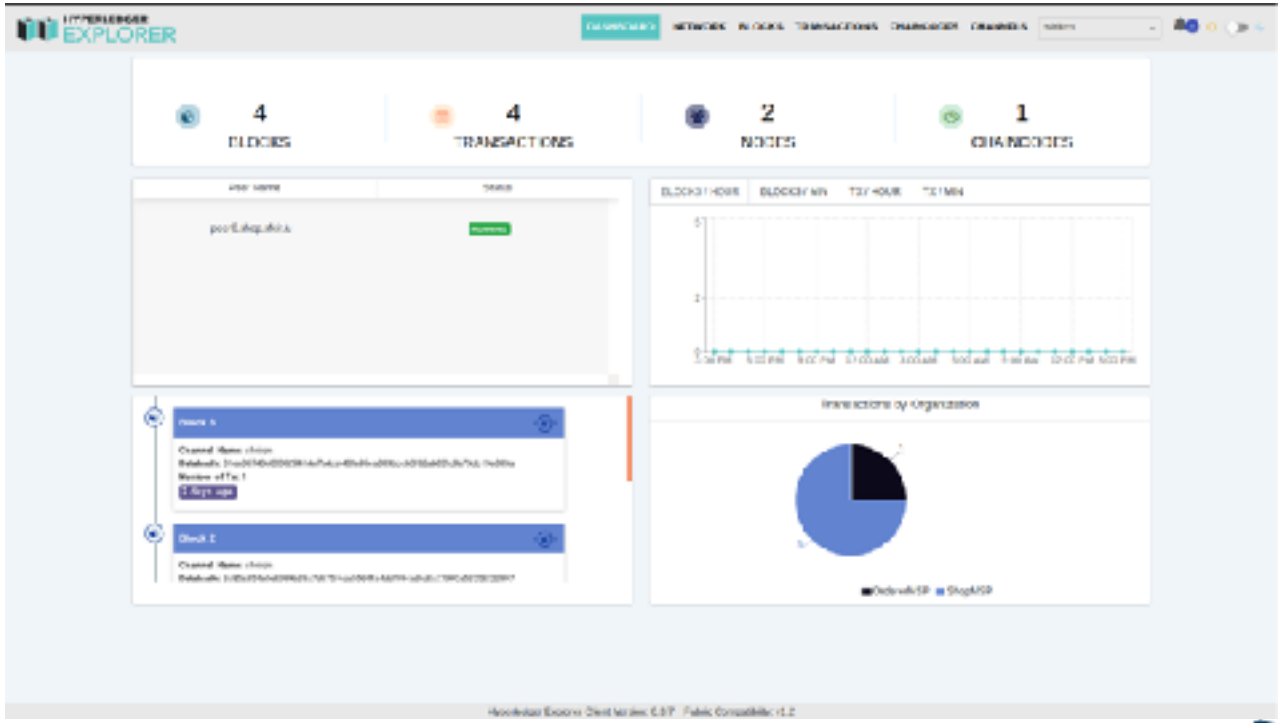
Provides details related Fabric blockchain network

Provide details related to a **channel** including **number of peers**, **blocks**, **transactions**, **chaincode**

Hyperledger Explorer

EXPLORER

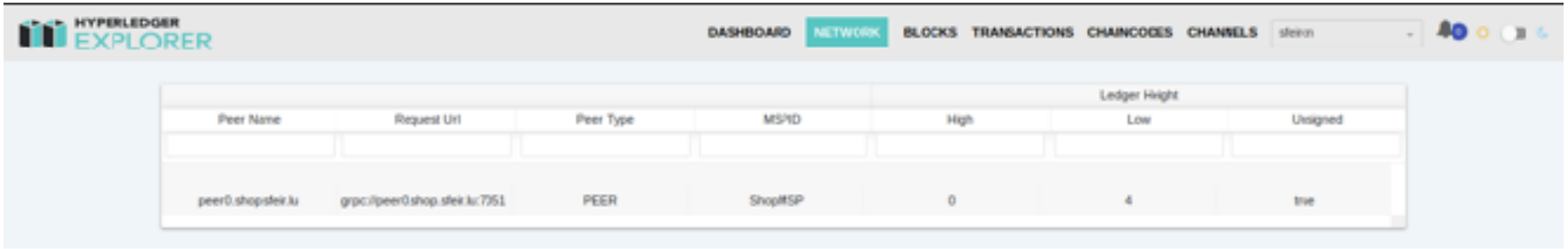
DASHBOARD



Hyperledger Explorer

EXPLORER

NETWORK LIST



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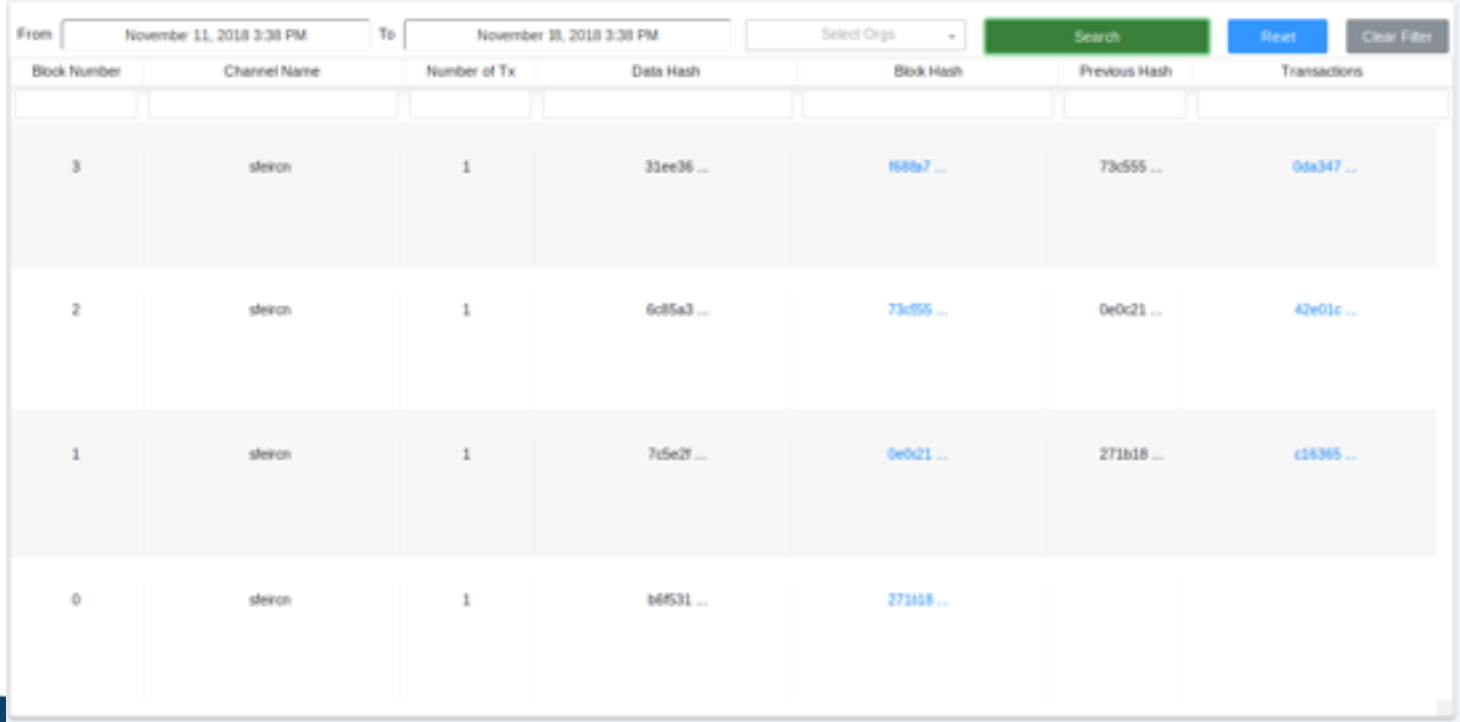
EXPLORER

BLOCK DETAILS



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EXPLORER

PEER LIST

ID	Channel Name	Blocks	Transactions	Timestamp
3	[illegible]	4	4	2018-11-16T17:45:04.000Z

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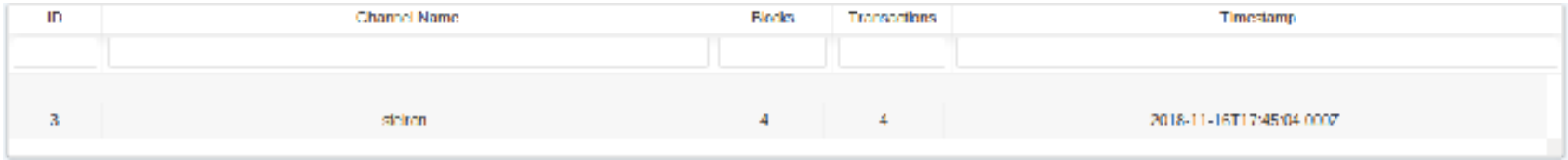
EXPLORER

CHAINCODE



ID	Channel Name	Blocks	Transactions	Timestamp
3	[illegible]	4	4	2018-11-16T17:45:04.000Z

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TPs

1 – Get source of project

2 – Configure network

3 – Start project and discover

Questions ?