Hyperledger Network Hands-on

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Event Organizers

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THINKING BREAKTHROUGHS

GOVERNMENT OF TELANGANA

What this session is and is not?

is

Foundation to Hyperledger Fabric

Helps get Hands on Blockchain

DIY: Do it yourself

is not

Foundation to Blockchain Concepts

Theoretical

Endorsement of Hyperledger Fabric

Agenda

- Setup Development Environment
- Network Setup
- Membership Service Provider
- Orderers and Peers and Client
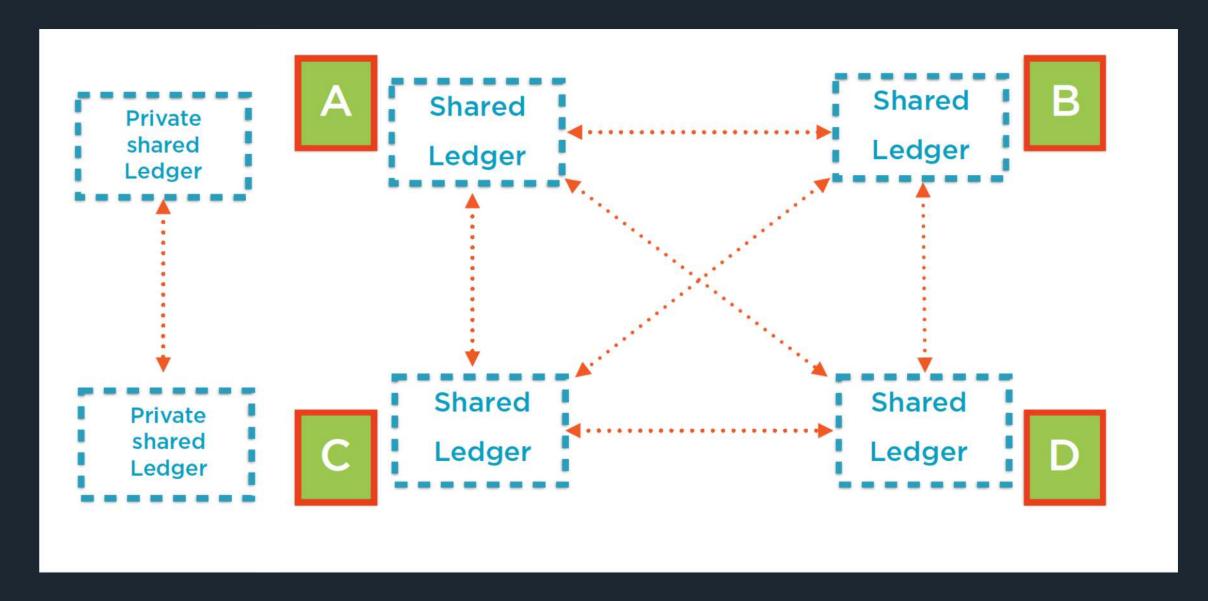- Channels |Chaincode | Database
- Transaction Flow

Hyperledger Umbrella   Frameworks & Tools

Hyperledger Fabric Network

Things to know..!

❖ <u>**Channel**</u>

A Hyperledger Fabric channel is a private "subnet" of communication between two or more specific network members, for the purpose of conducting private and confidential transactions.

❖ <u>**Certificate Authority (CA)**</u>

The Hyperledger Fabric CA is a Certificate Authority (CA) for Hyperledger Fabric. It provides features such as:

a. registration of identities, or connects to LDAP as the user registry

b. issuance of Enrollment Certificates (ECerts)

c. certificate renewal and revocation

Things to know..!

❖ Endorser Peer

Upon receiving the "transaction invocation request" from the Client application the Endorser peer
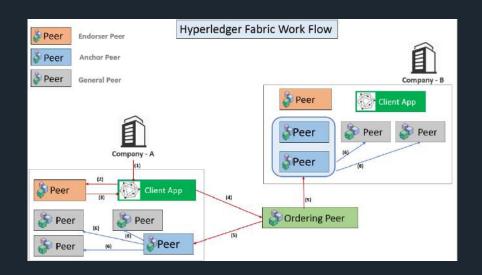- Validates the transaction.
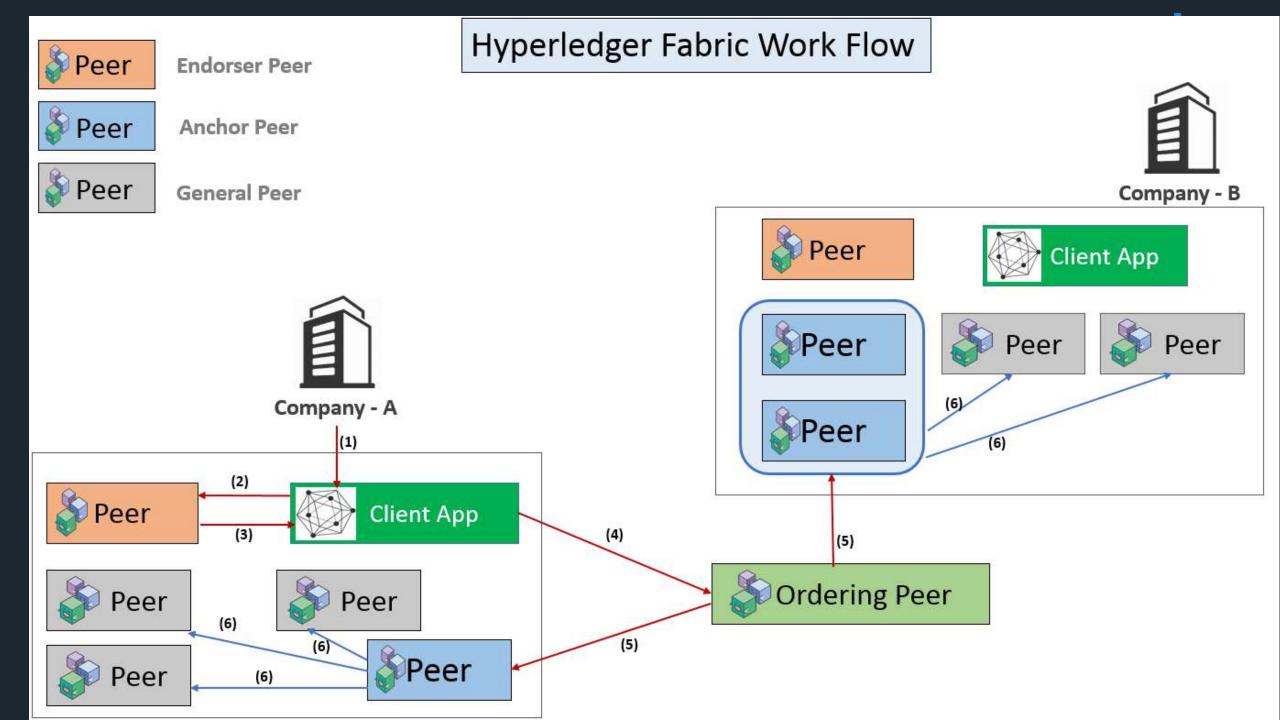- Executes the Chaincode(ie Smart Contract)

❖ Anchor Peer

Anchor peer or cluster of Anchor peers is configured at the time of Channel configuration. Anchor peer receives updates and broadcasts the updates to the other peers in the organization. Anchor peers are discoverable.

❖ Orderer Peer

Orderer peer is considered as the central communication channel for the Hyperledger Fabric network. Orderer peer/node is responsible for consistent Ledger state accross the network.

Hyperledger Fabric Work Flow

Peer — Endorser Peer

Peer — Anchor Peer

Peer — General Peer

Company - B

Peer

Client App

Peer

Peer

Peer

(6)

(6)

Company - A

(1)

(2)

Client App

Peer

(3)

(4)

(5)

Ordering Peer

(5)

Peer

Peer

Peer

(6)

(6)

Peer

(6)

Peer

Hyperledger Transaction Flow

Execute

- Chaincode for smart contracts using GO,Node, Java etc
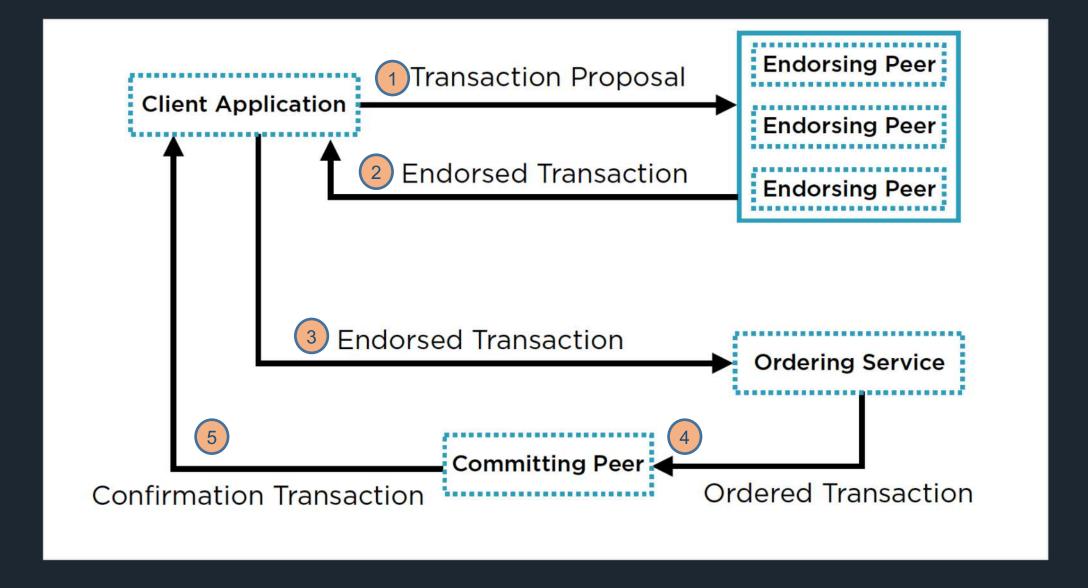
Order

- Add to ledger if enough peers endorse transaction
- Only endorsed transactions need to be ordered

Validate

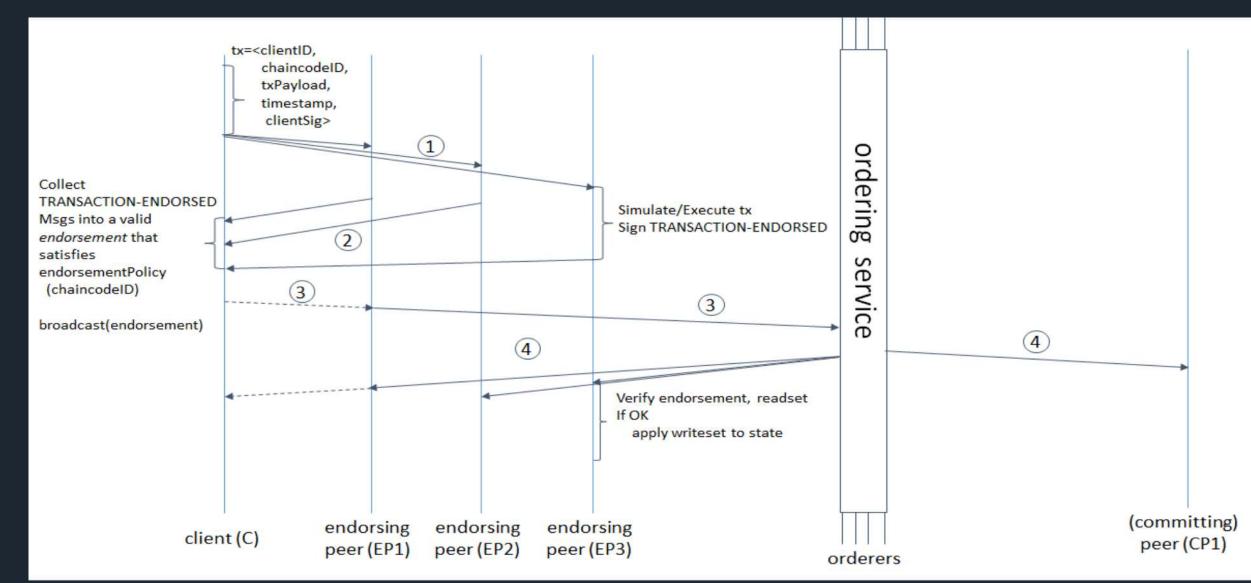- Each peer validates transaction

Hyperledger Transaction Flow

Hyperledger Transaction Flow

Transaction Flow

Transaction has multiple stages

- Proposal – Read / Write

- Endorsement response

- Block Creation

- Validation

- Committing

- Double spend Problem and Solution

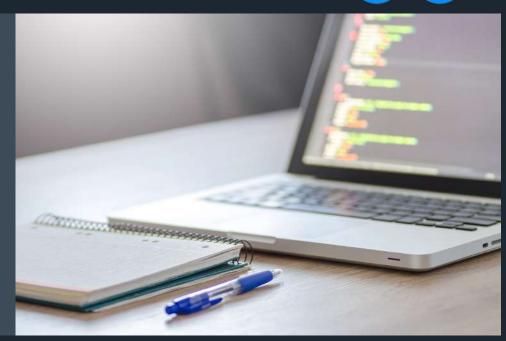# Recommended Blockchain Foundation for Workshop

Please go thorough below Blockchain resources & fulfil the following pre-requisites to make best use of the sessions (below are clickable links):

- Why   : BlockChain Business Overview

- What   : BlockChain Technology Foundation

✋ Hands-on Hyperledger Fabric, pre-requisites

- Please do this If interested in following the hands-on sessions
- What & How   : Install Hyperledger Fabric 1.4, Docker, Node.js etc as per the Resources on (next page)

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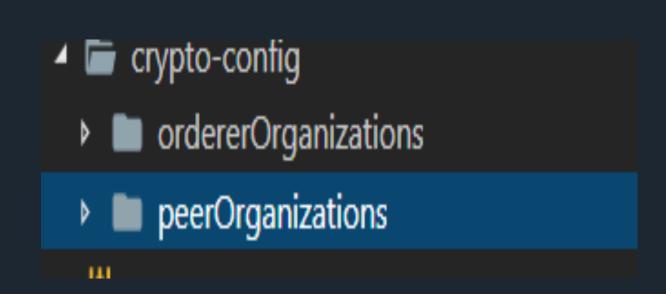
Resources to get started with Hyperledger Fabric

S.No	Category	Resource
1	Course	Linux Foundation course on Hyperledger
2	Install / Setup	Install Pre Requisites Install Fabric and Samples Getting Started Node.js 8.9x - https://nodejs.org/dist/latest-v8.x/
3	Additional tools	Install Postman from the link & Install ExpressJS from the link
4	Additional References	Start your own Hyperledger blockchain the Easy Way! Fundamentals of Hyperledger Architecture Learn Docker in 12 min
5	Uninstall Hyperledger	To remove all npm packages for Hyperledger npm uninstall -g composer-cli npm uninstall -g composer-rest-server npm uninstall -g generator-hyperledger-composer npm uninstall -g yo npm uninstall -g composer-playground To remove all docker containers and images: docker kill $(docker ps -q) docker rm $(docker ps -aq) docker rmi $(docker images -q) Remove composer cards folder rm -rf ~/.composer To remove the scripts and tools to create Fabric: rm -rf ~/.fabric-tools To remove docker-compose: sudo rm /usr/local/bin/docker-compose To remove docker: sudo apt-get remove docker-ce To check if any Docker images or processes are already there is there , docker ps -a docker images -a

Mebership Service Provider

Generate or provide Crypto material for identity

- Who needs Identity
  - Orderer
  - Peers
  - Users
  - Organization Admins
  - SDK Clients
- Fabric-CA

Channel – Chaincode - Database

Channel if for isolating the Data, Policies, and chaincode

- Common Channel

- Channel for Similar interest

- Private Data Collection

- Use Configtxgen to for generating Channel config and genesis block

- Database
    - Ledger
    - State

Nodes

Multiple nodes interact with network

- Orders
- Peers
    - Endorsing Peers
    - Committing Peers / Anchor Peers
- SDK Client
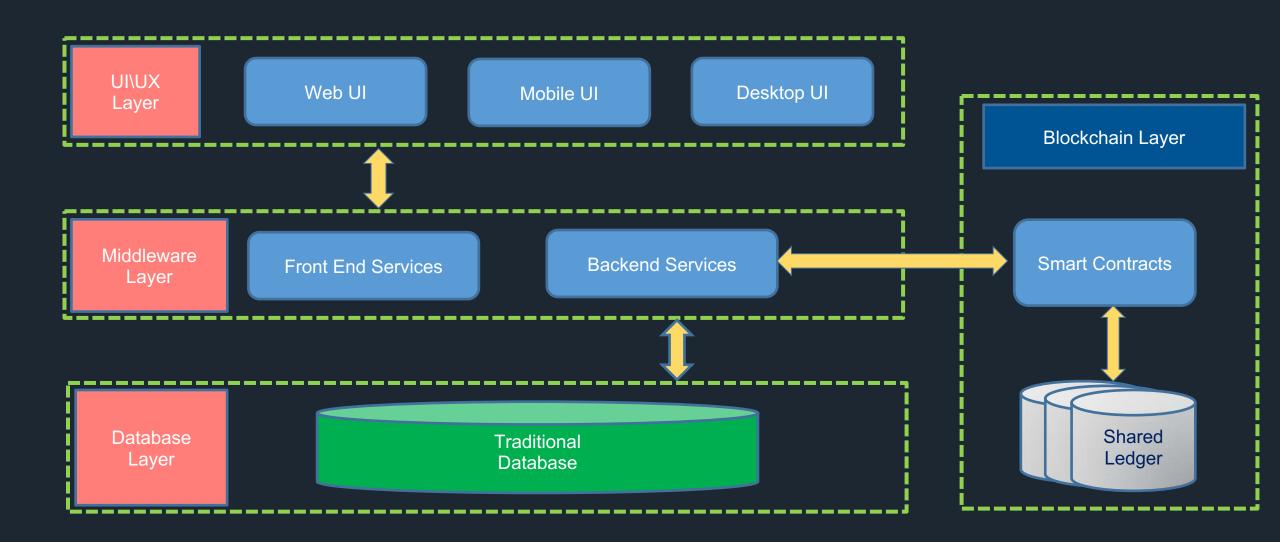
Application Development

Fabric based Application development

- Planning

- SDK (NodeJS, JAVA)

    - Fabric-Client

    - Fabric-CA-Server

    - Fabric-CA-Client

- Event Hubs

- REST Service

- User interface

Sample Blockchain Architecture

UI\UX Layer

Web UI

Mobile UI

Desktop UI

Blockchain Layer

Middleware Layer

Front End Services

Backend Services

Smart Contracts

Database Layer

Traditional Database

Shared Ledger

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SIMPLIFYING BUSINESS

HYPERLEDGER
BLOCKCHAIN TECHNOLOGIES FOR BUSINESS
HYDERABAD

Endorsers Execute Proposals

E_0, E_1 & E_2 will each execute the *proposed* transaction. None of these executions will update the ledger

Each execution will capture the set of **R**ead and **W**ritten data, called **RW sets**, which will now flow in the fabric.

Key:

Endorser		Ledger	
Committer		Application	
Orderier			
Smart Contract (Chain code)		Endorsement Policy	

Application submits responses for ordering

Application submits responses as a **transaction** to be ordered.

Ordering happens across the fabric in parallel with transactions submitted by other applications

Orderer delivers to all committing peers

Ordering service collects transactions into blocks for distribution to committing peers. Peers can deliver to other peers using gossip (not shown)

Different ordering algorithms available:
- SOLO (single node, development)
- Kafka (blocks map to topics)
- SBFT (tolerates faulty peers, future)

Key:

Endorser		Ledger
Committer		Application
Orderier		
Smart Contract (Chain code)		Endorsement Policy

Committing peers notify applications

Applications can register to be notified when transactions succeed or fail, and when blocks are added to the ledger

Applications will be notified by each peer to which they are connected