SETTING THE STAGE

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AGENDA

- ✓ The Problem
- ✓ Solution Attempts
- ✓ Need For Decentralization
- ✓ Laying The Bricks

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SCENE 1 – THE CREDIT SALE

Through the month

Supplier maintains the records

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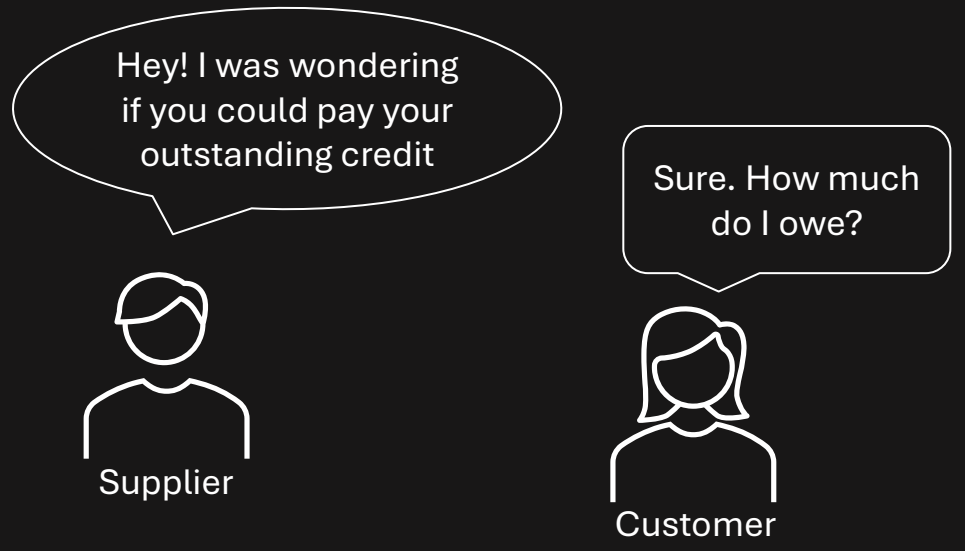
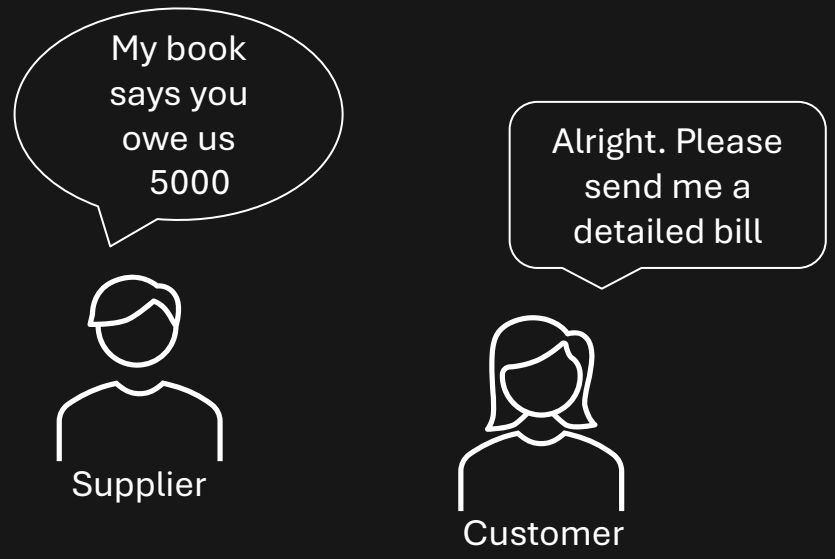
SCENE 1 – THE CREDIT SALE

Supplier maintains the records

31st of the month





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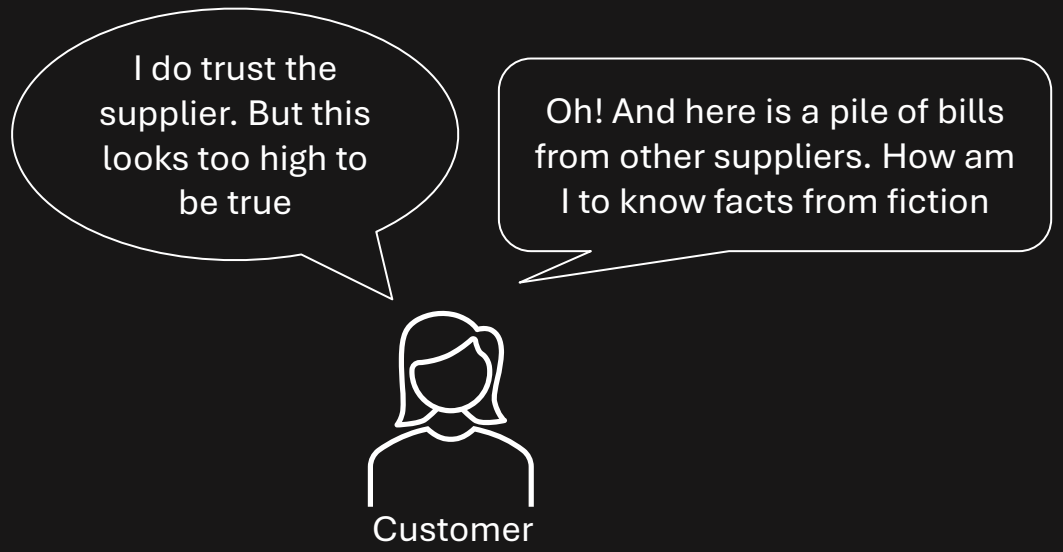
SCENE 1 – THE CREDIT SALE

Supplier maintains the records

On receipt of the bills



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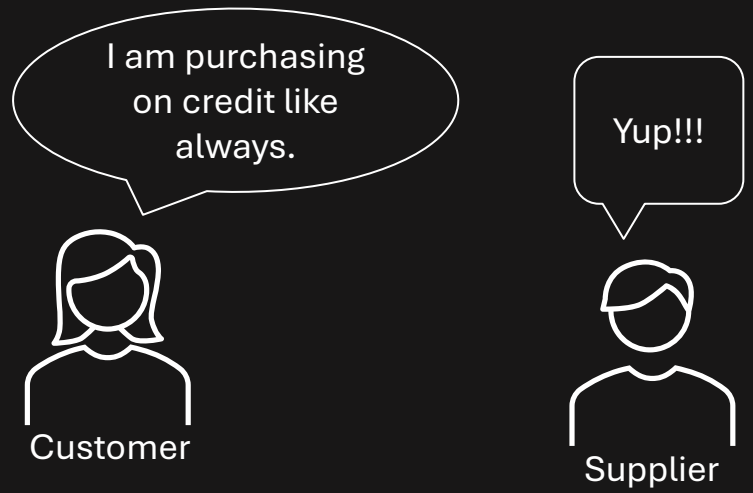
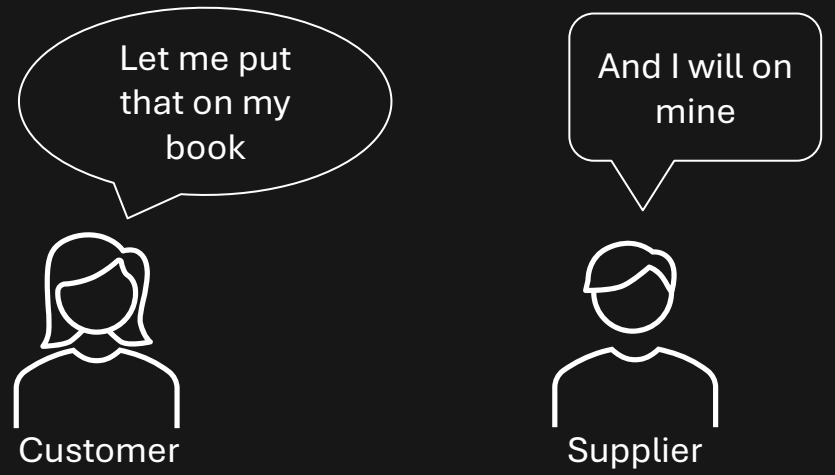
How do we solve this?

SCENE 2 – THE CREDIT SALE

Through the month





Supplier & Customer maintain their own records

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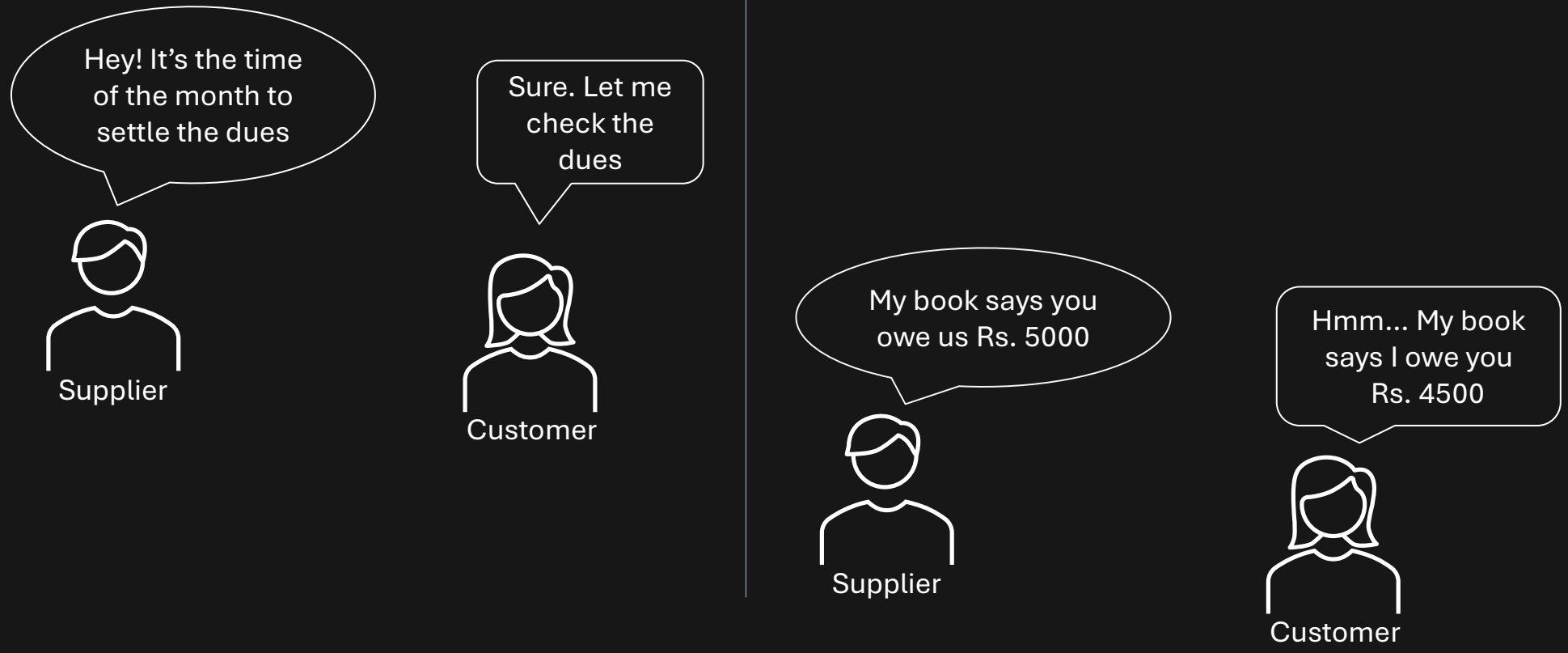
SCENE 2 – THE CREDIT SALE

Supplier & Customer maintain their own records

31st of the month



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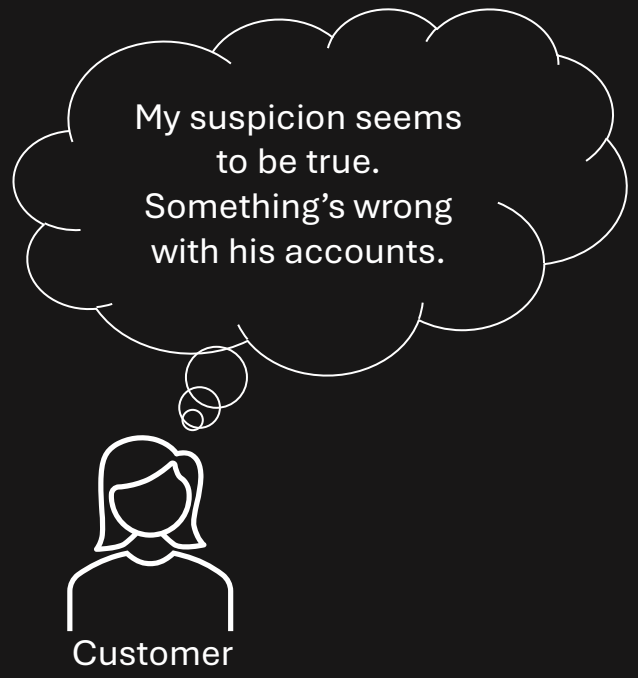
SCENE 2 – THE CREDIT SALE

Supplier & Customer maintain their own records

A few moments later



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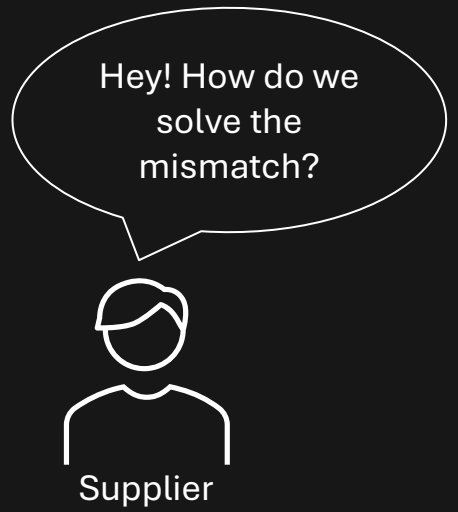
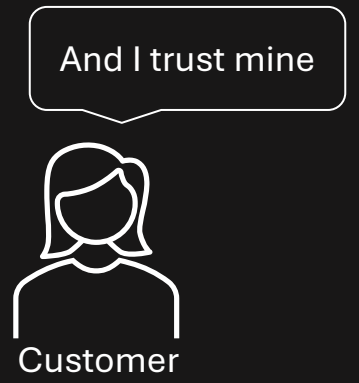
SCENE 2 – THE CREDIT SALE

Supplier & Customer maintain their own records



After a few days



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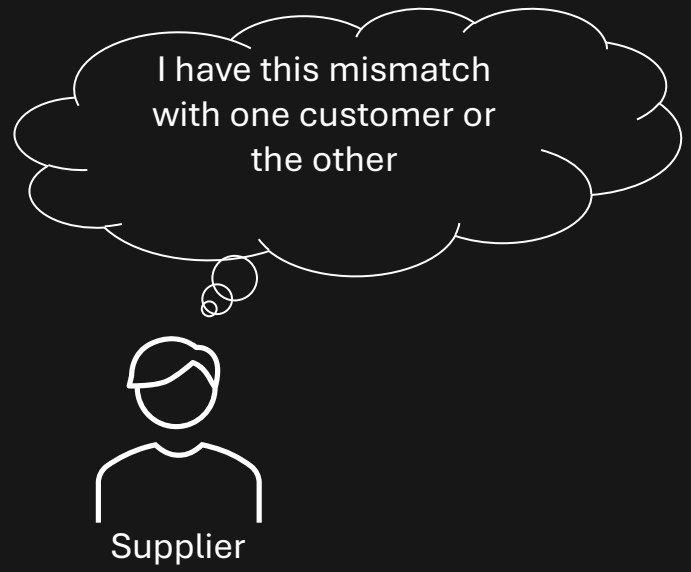
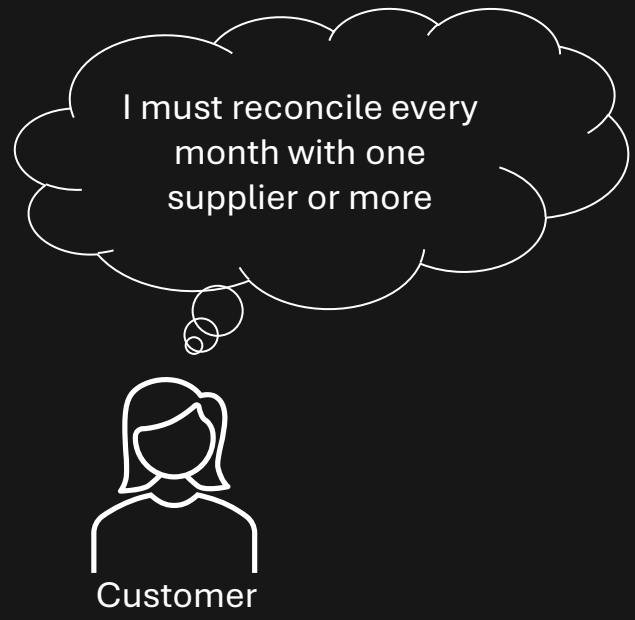
SCENE 2 – THE CREDIT SALE

Supplier & Customer maintain their own records

Every month





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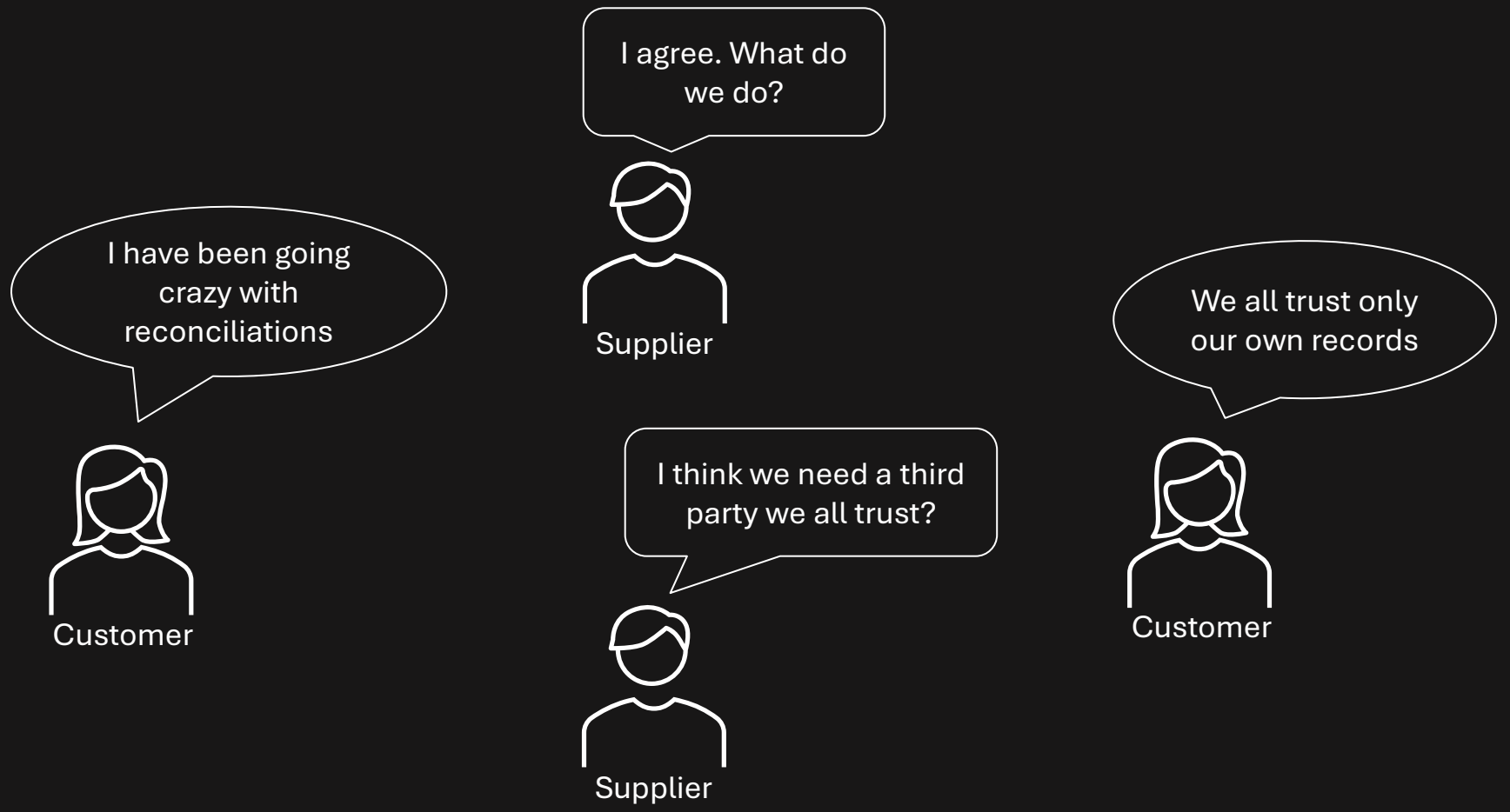
How do we fix this?

SCENE 3 –SUPPLIER CUSTOMER CONF



Let's get an intermediary

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SCENE 3 –THE INTERMEDIARY

Let's meet our intermediary

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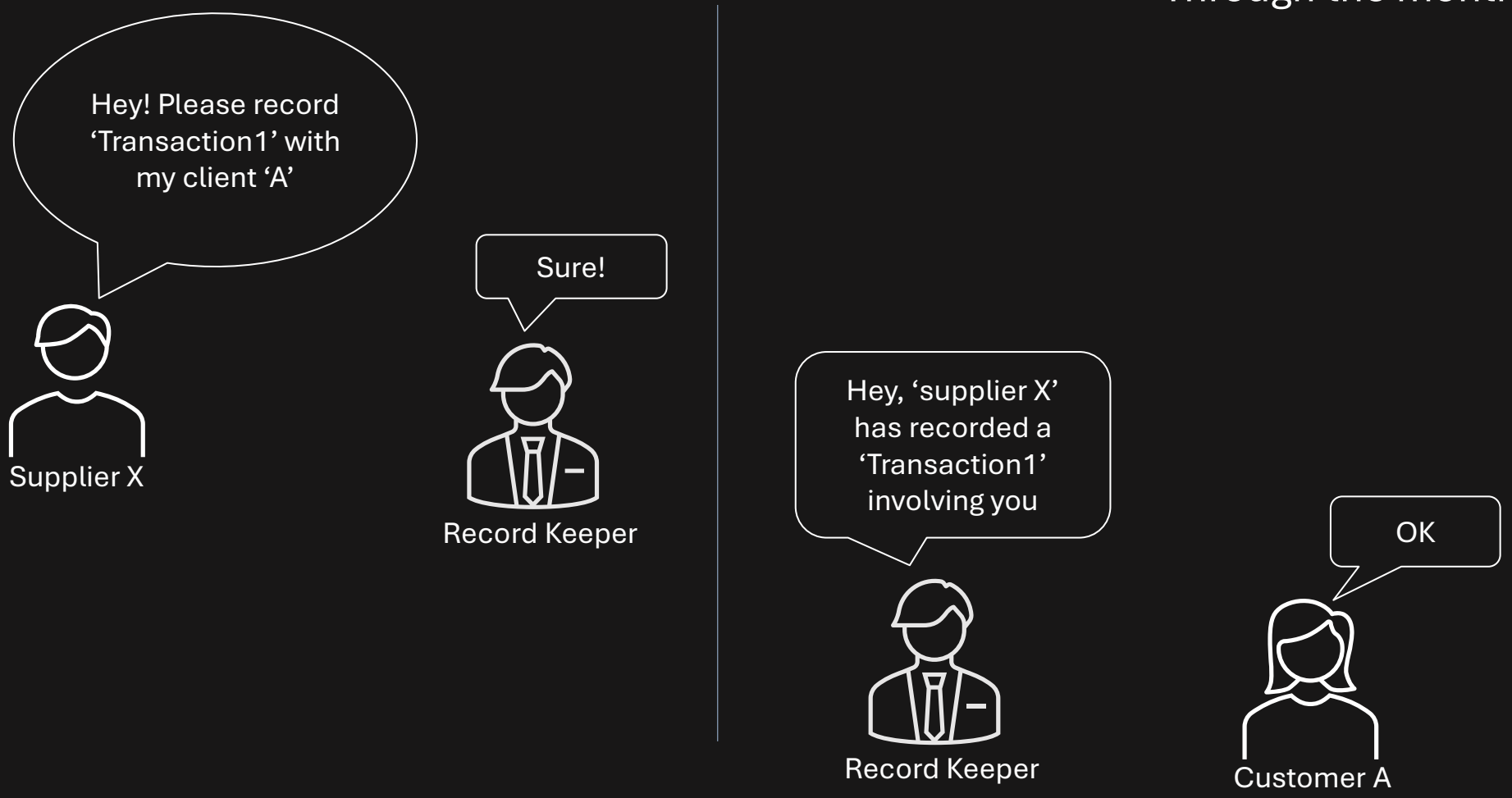
SCENE 3 – THE CREDIT SALE

Transacting with the help of intermediary

Through the month



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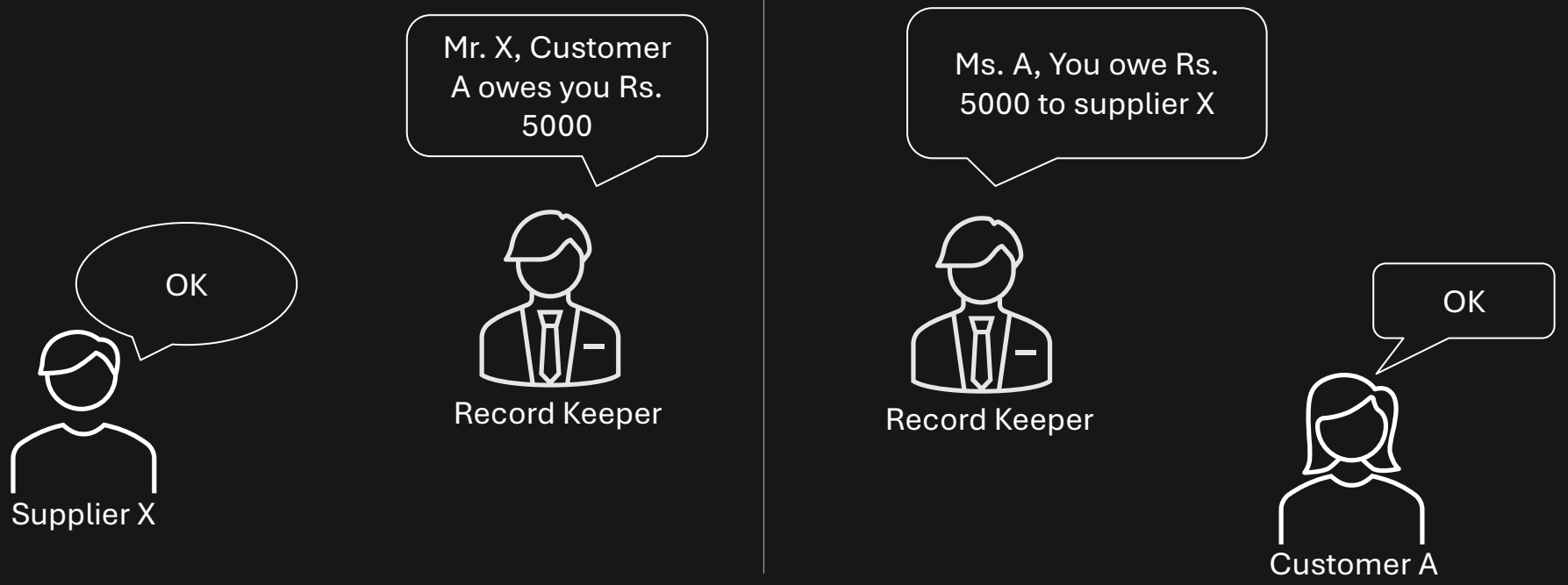
SCENE 3 – THE CREDIT SALE

Transacting with the help of intermediary

31st of the month



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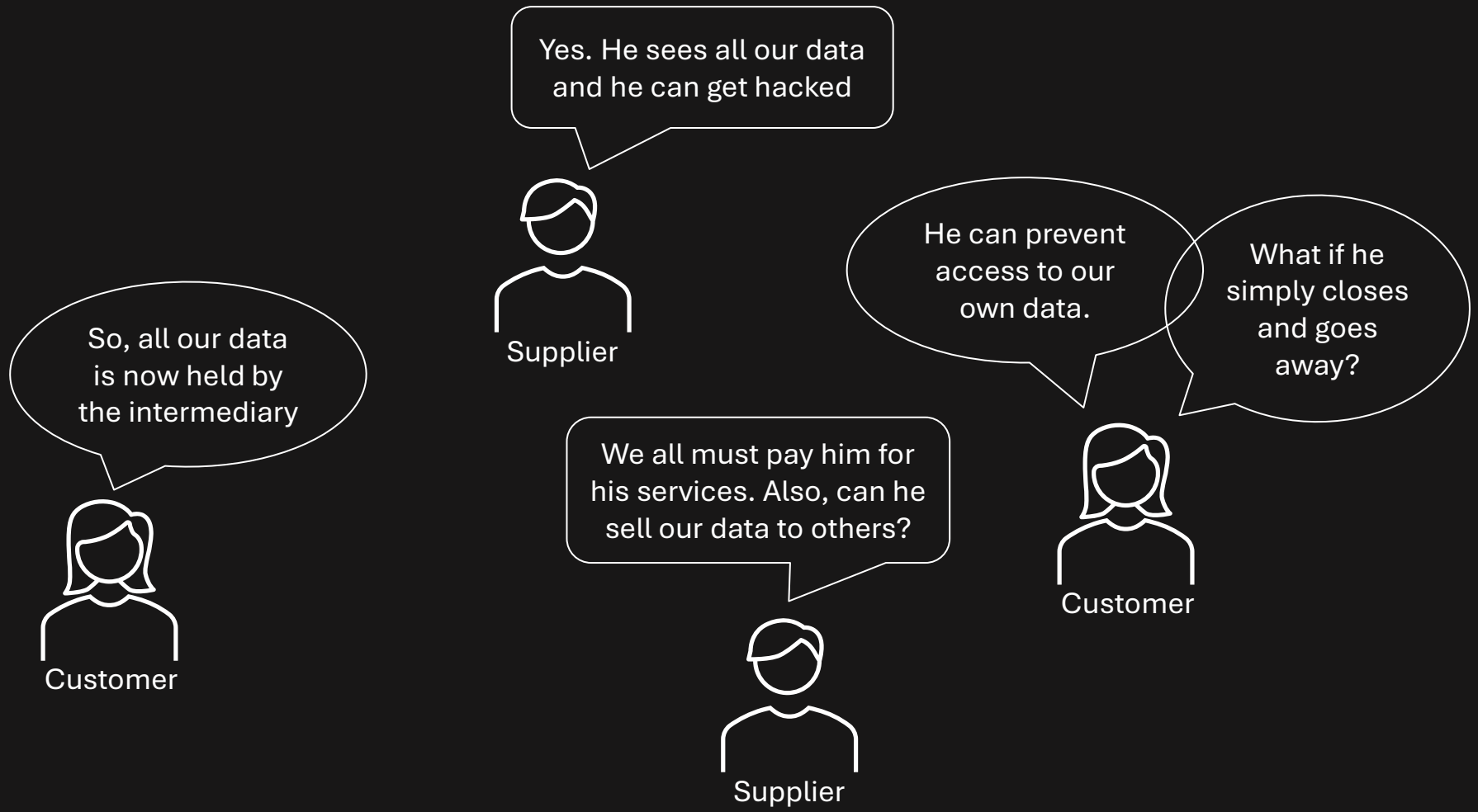
Can you name some intermediaries?

SCENE 4 – ANNUAL MEETING



We thought a 3rd party would help. But it has its own problems

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Can you identify problems with having an intermediary?

PROBLEMS

PRIVACY

The intermediary has complete view of the data, and further can even share it with a third party without our knowledge

CENSORSHIP

The intermediary can at any point restrict the clients from using the services or accessing their own data

SINGLE POINT OF FAILURE

Any issues in the intermediary's infrastructure renders the whole ecosystem nonfunctional

COSTS

In an asymmetrical relationship the intermediaries mostly have an undue advantage in dictating the fees

DATA SECURITY

The data collected acts as a honey pot and despite several measures, data breaches are a frequent occurrence

DATA TAMPERING RISK

With no second source of truth available for verification, there is no security against the intermediary unilaterally modifying the data

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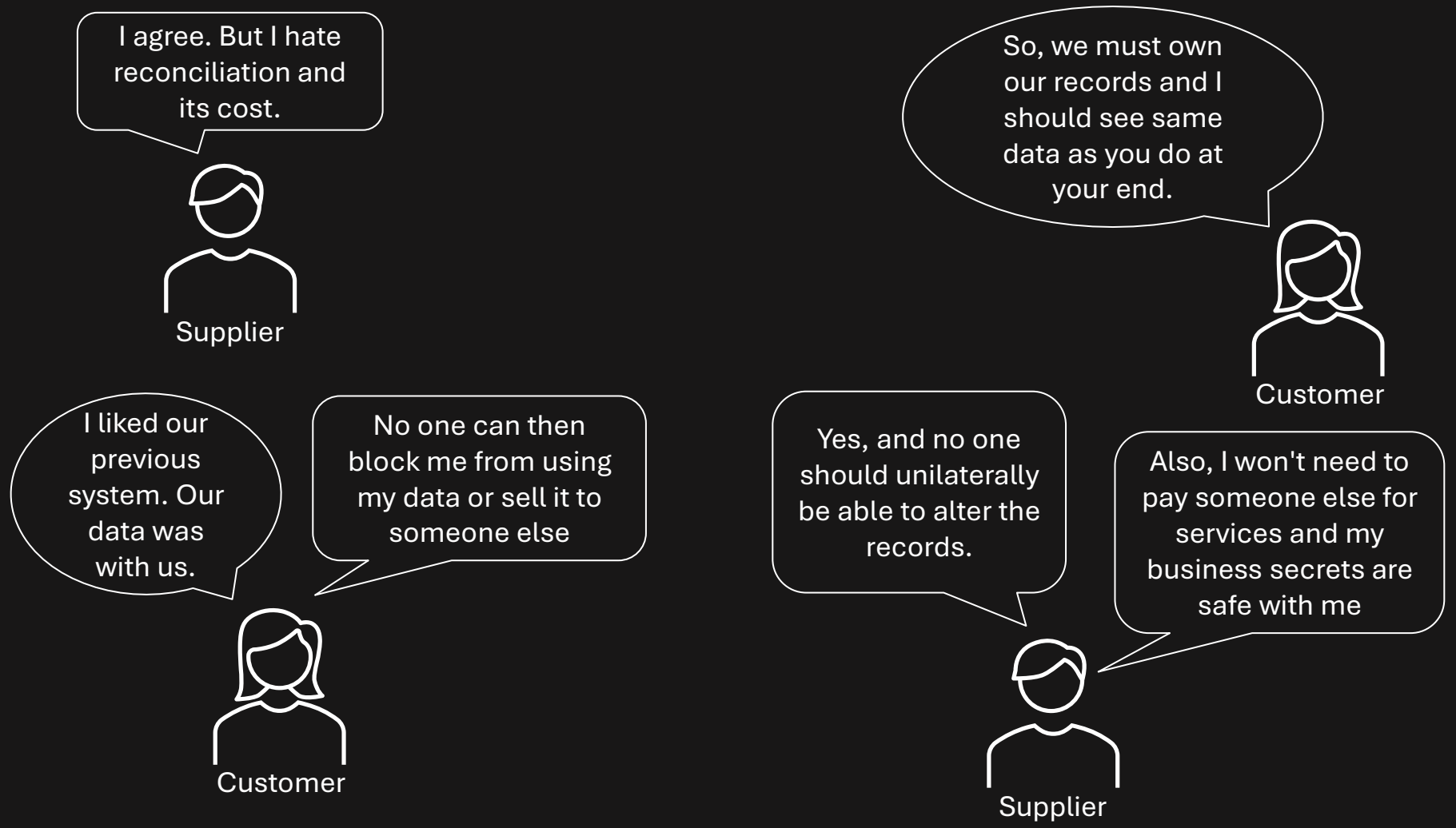
So, using an intermediary has its own problems.
What do we do now?

SCENE 4 – ANNUAL MEETING



We need our old system but a new approach

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Wait a min, intermediaries like banks, exchanges, e-commerce portals have existed for decades and centuries. That means they have served us well for a reason. No?

WHAT KEEPS INTERMEDIARIES IN CHECK?

1. REGULATIONS

For many industries, the government sets regulations and provides oversight to ensure smooth functioning. For e.g., Regulations such as Anti Money Laundering law and entities such as RBI and SEBI for finance domain

2. COMPETITION

Multiple service providers in same space are competing for clients. Any malpractice would drive clients to competitors hampering long term gains

However, these are reactive measures. Without a solution inherent to the design a reliable system is difficult to achieve

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Now that we mentioned banks let’s try to imagine what will it take to eliminate banks?

Let’s build one brick at a time

Its time we meet a team of engineers who are trying to solve the same problem.

MEETING WITH ENGINEERING TEAM

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WHAT IS MONEY?

- Money is a global database to track ‘I Owe You’
- The amount of money you have is a marker for how much the world owes you
- Currency is a form of money

COMMON FORMS OF CURRENCY

- Cash
- Records in banks ledger

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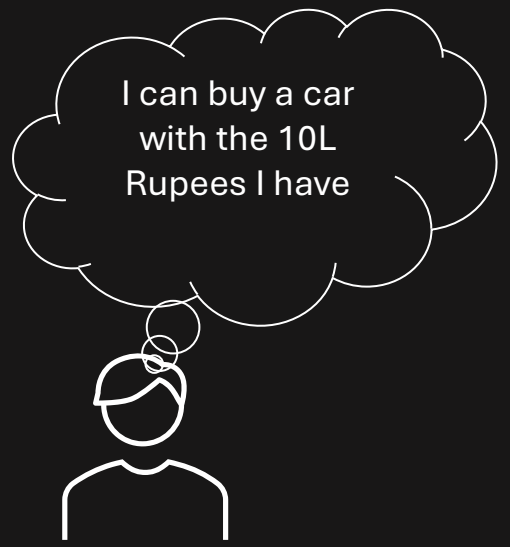
FUNCTIONS OF CURRENCY -1

Store of Value



After 3 years

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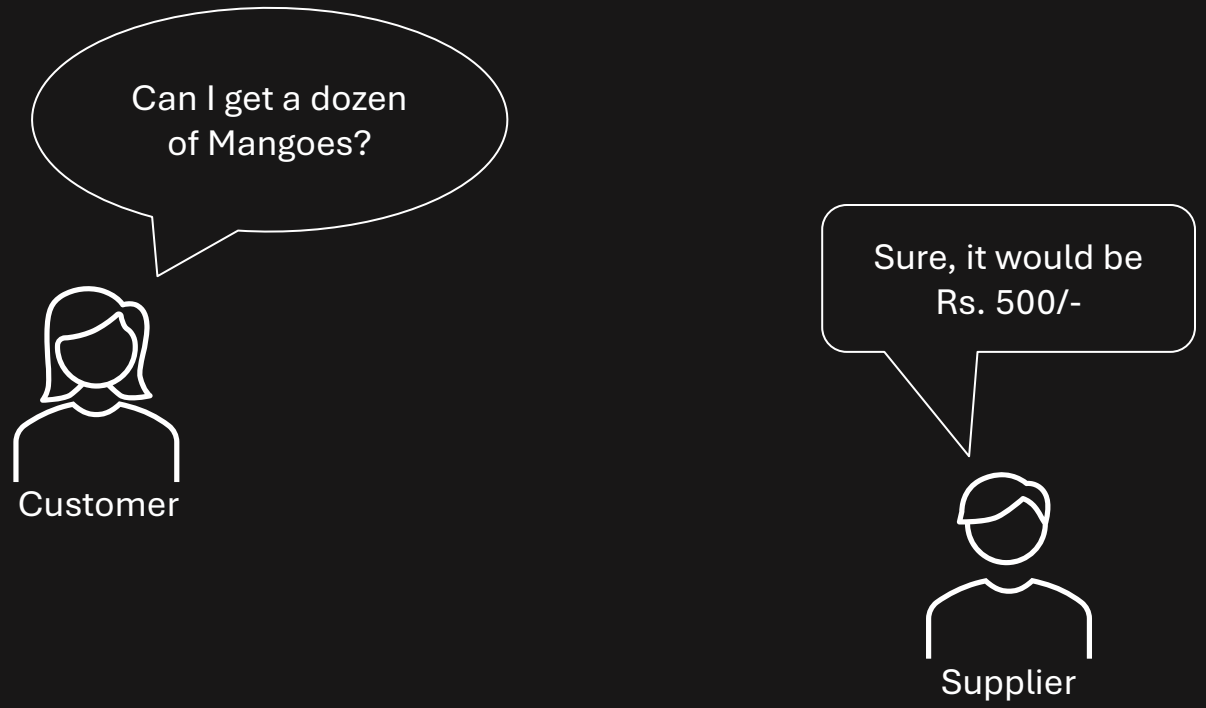
FUNCTIONS OF CURRENCY 2

Medium of Exchange



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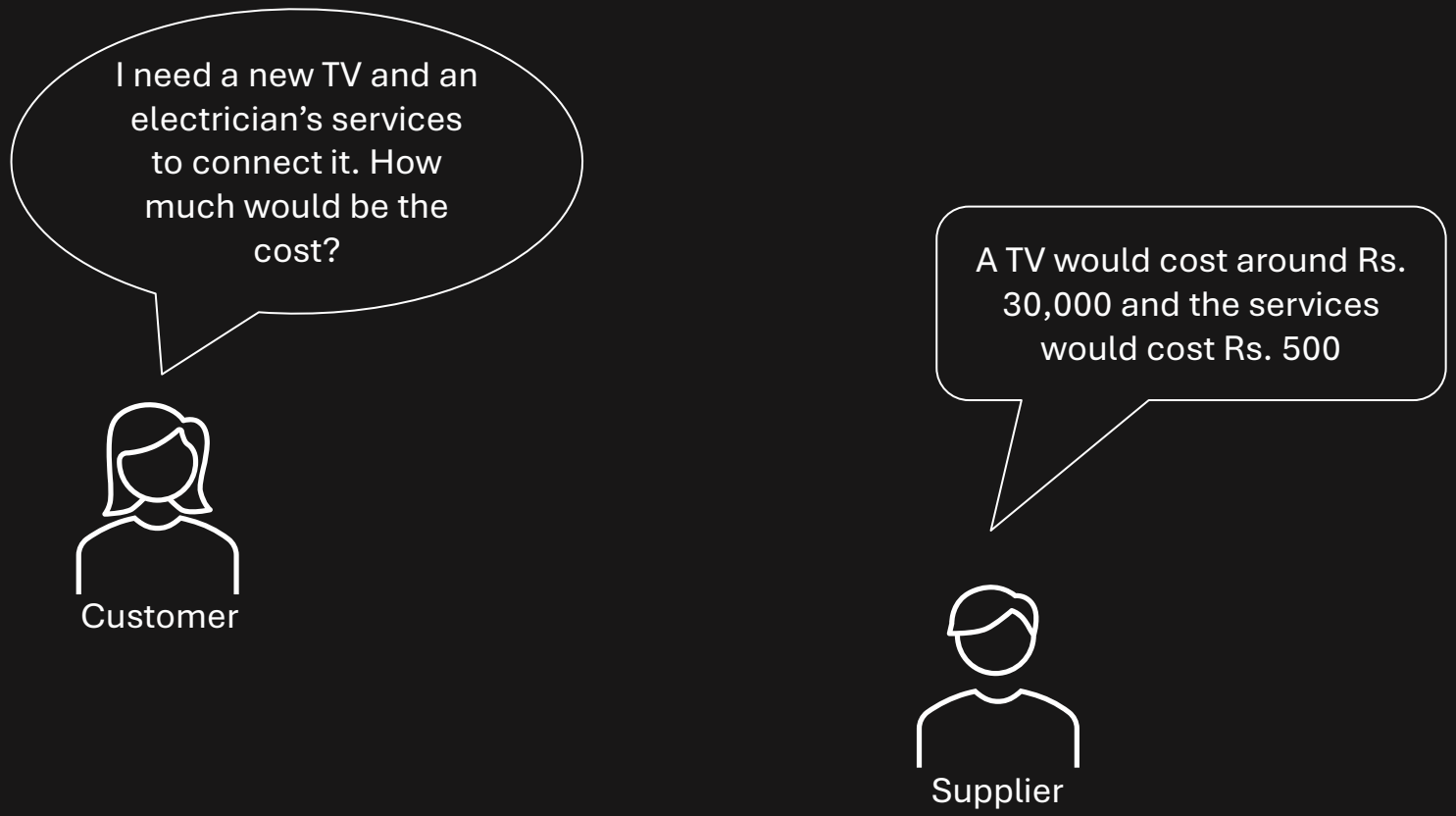
FUNCTIONS OF CURRENCY 3

Unit of Account



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MEETING WITH ENGINEERING TEAM

Can you explain a bit more on the forms of money?

Can you please elaborate?

Engineering Manager

Sure. The 1st form is a currency note printed by the central bank. This explicitly establishes the liability of central bank to give you value worth the note you possess

The 2nd form is a record of your balance in a bank's ledger. This is mostly a digital record in current times

Sure. Let's see an example of how these records are maintained

Domain expert

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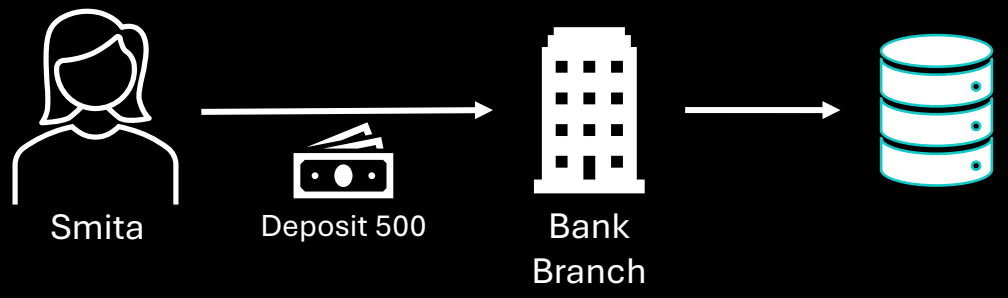
DIGITAL LEDGERS



Accounts

User	Balance
Anil	1000
Smita	1000

Balance sheet

Head	Amount
Assets	
Cash	2000
Liability	
SB Acc	2000

- Account balances are only numbers maintained in bank's databases
- The cash deposited is now an asset for the bank
- Oversight by regulators ensures parity between the accounts and balance sheets minimizing the possibility of malpractice
- But as said, this is a reactive approach. Any wrongdoing would be caught only at the time of audits

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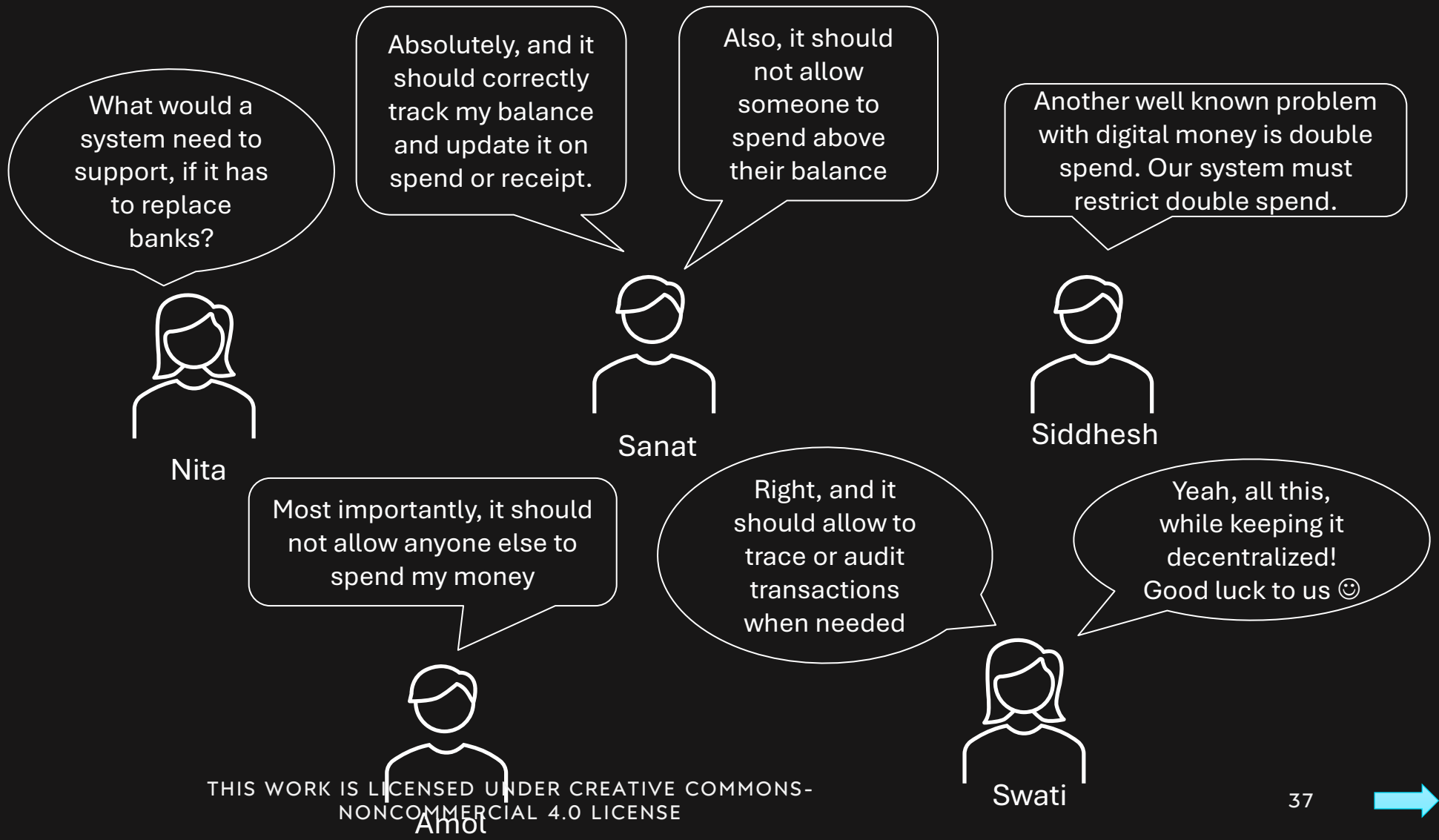
Back to replacing the banks...

SOFTWARE ENGINEERS MEETING



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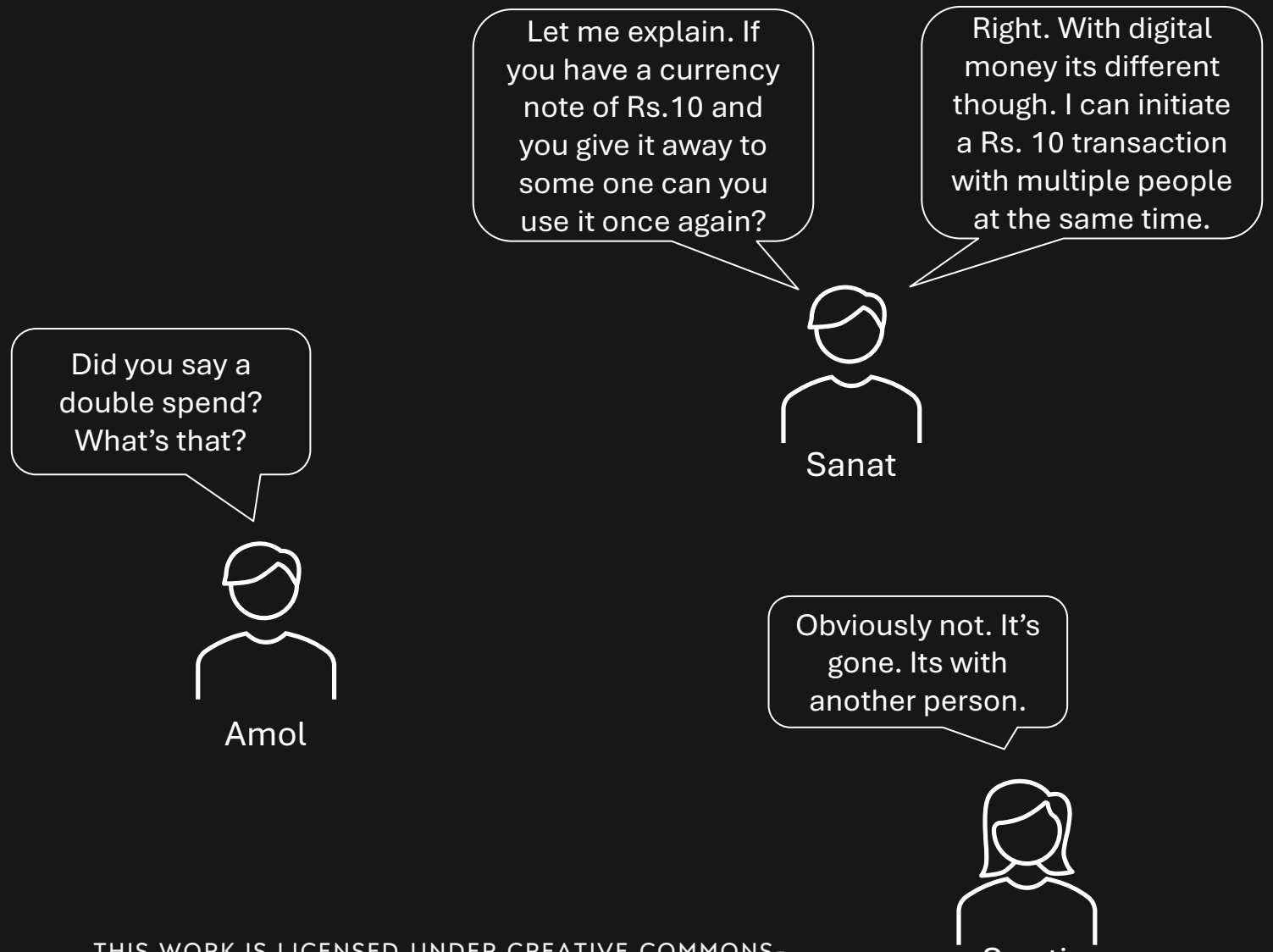
SOFTWARE ENGINEERS MEETING



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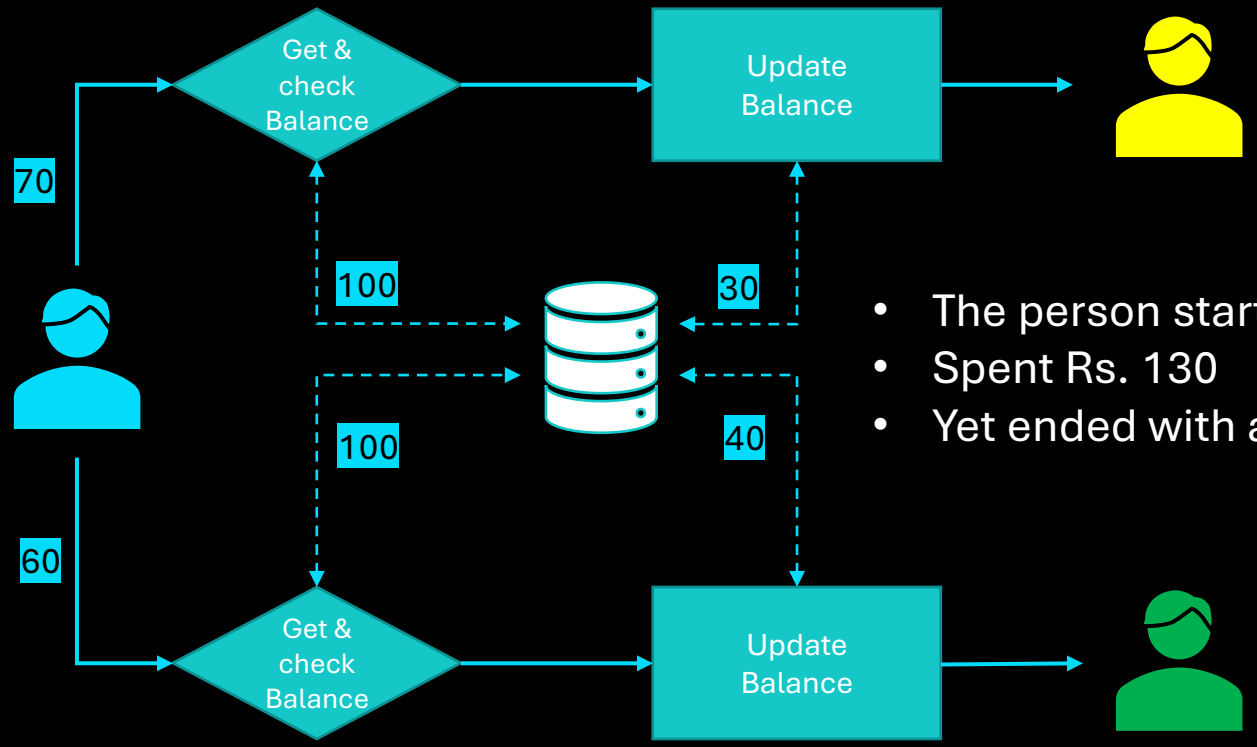
DOUBLE SPEND – DEEPER DIVE



- The person started with Rs. 100
- Spent Rs. 130
- Yet ended with a balance of Rs. 40

- Transactions cannot execute in parallel
- Transaction order is critical

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THE NEW SYSTEM REQUIREMENTS

I MUST OWN MY DATA

- Spending rights are only with the owner
- Censorship resistant
- Highly available

ALWAYS IN SYNC TRANSACTION RECORDS

- Any transaction updates the system state across all participants
- This state is used as base for all future transactions

IMMUTABLE RECORDS

- A transaction once done cannot be modified or reversed by anyone

AUDITABILITY

- A trail of transactions is available for audit and scrutiny when needed

COST EFFECTIVE

- Cost of a transaction should be competitive as compared to the current centralized payment systems

DOUBLE SPEND RESISTANT

- Should not allow double spend of the currency

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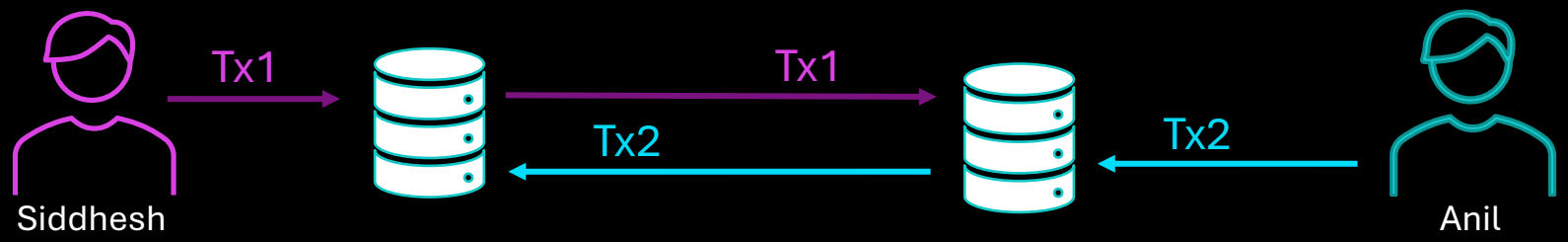
BRICK 1 – OWN & IN-SYNC DATABASES



Tx	From	To	Amount
1	Siddhesh	Anil	5000
2	Anil	Siddhesh	3500

User	Balance
Anil	1500
Siddhesh	6500

Tx	From	To	Amount
1	Siddhesh	Anil	5000
2	Anil	Siddhesh	3500

User	Balance
Anil	1500
Siddhesh	6500

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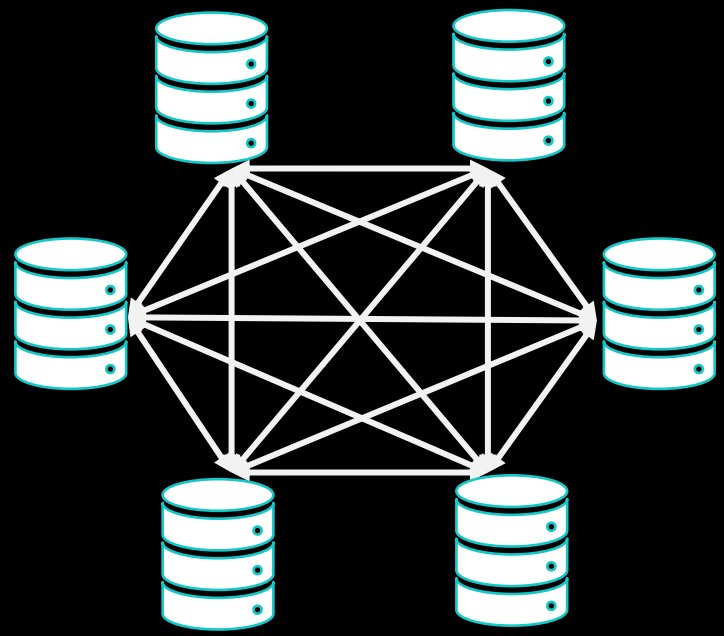
That looks like a distributed database to me. What's the difference?

BRICK 2 – P2P COMMUNICATION



User	Balance
Anil	1500
Siddhesh	6500

User	Balance
Anil	1500
Siddhesh	6500

User	Balance
Anil	1500
Siddhesh	6500

User	Balance
Anil	1500
Siddhesh	6500

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Can this be a simple database replication?

BRICK 3 – EVALUATE, THEN ACCEPT

- Is the sender authenticated?
- Does the sender have enough balance?
- Has the sender sent the amount multiple times?
- Is the receiver eligible to receive the money?

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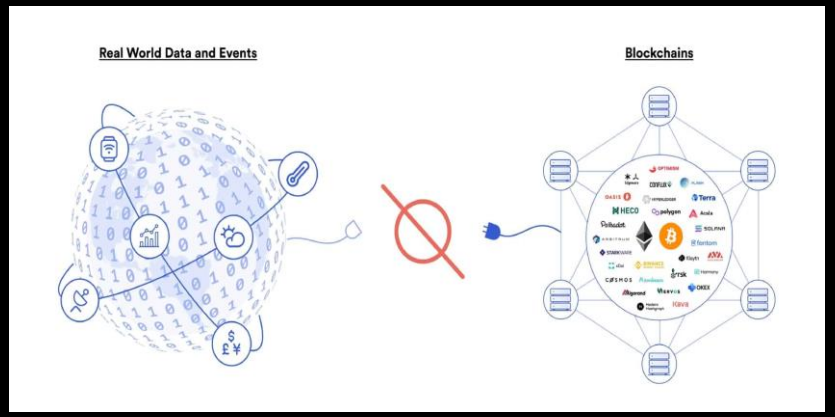
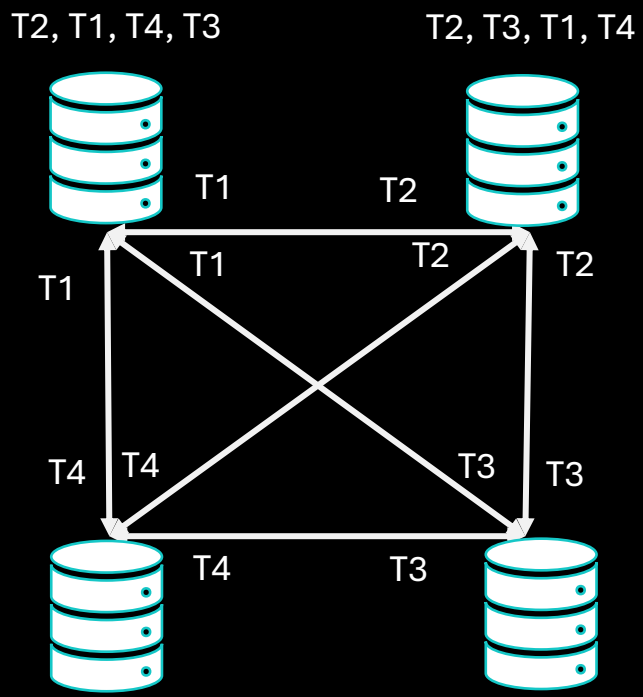
How do we guarantee that all evaluations lead to same conclusion?

BRICK 4 – DETERMINISM





The term Determinism in Computer Science refers to a system where the future state of the system is entirely determined by the prior state and the current operation.
Determinism means that we reach the same state as everybody else if we enact the same operational steps in the same order. This property makes a blockchain what it is.

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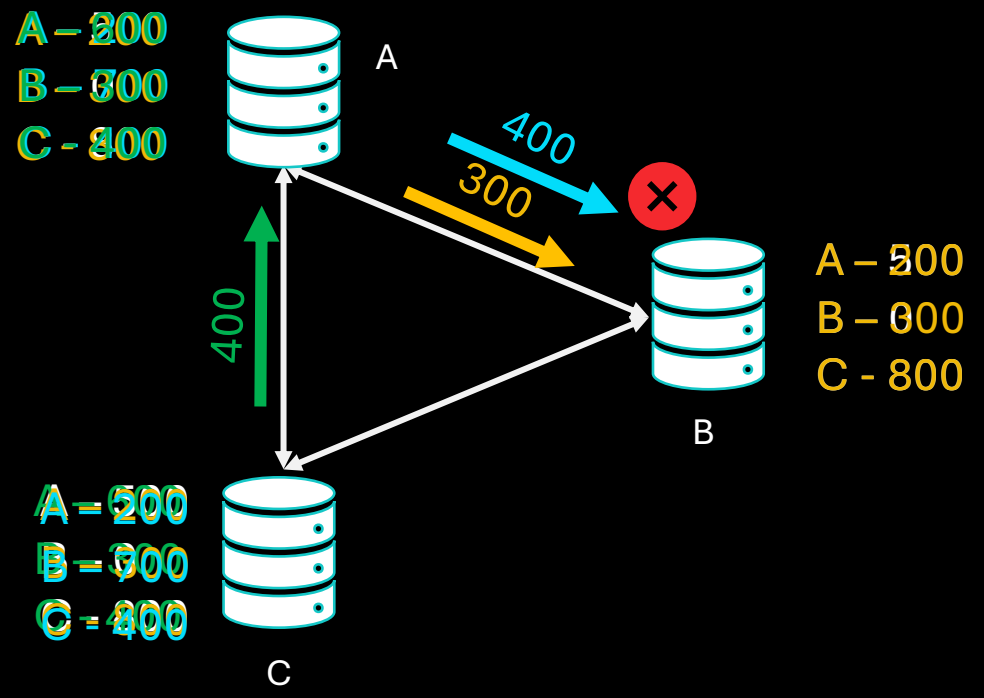
I don’t understand this problem of order of transactions. Why not process transactions as they come in?

BRICK 5 – ORDERING



Who is right and who is wrong?

… and this is just a trailer of how bad things can get

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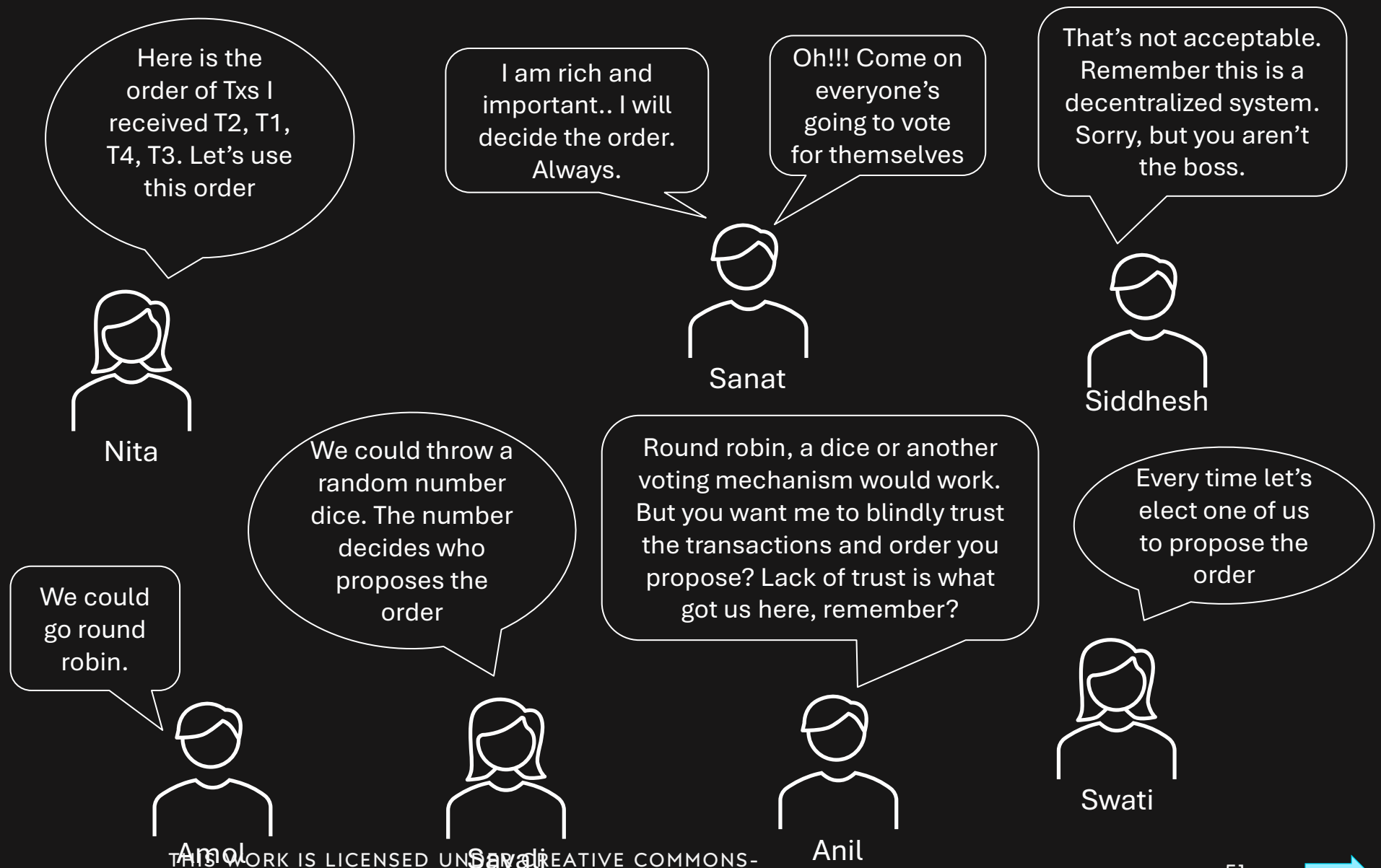
Interesting. If the system is decentralized, who decides the order?

AN ORDERING CONUNDRUM



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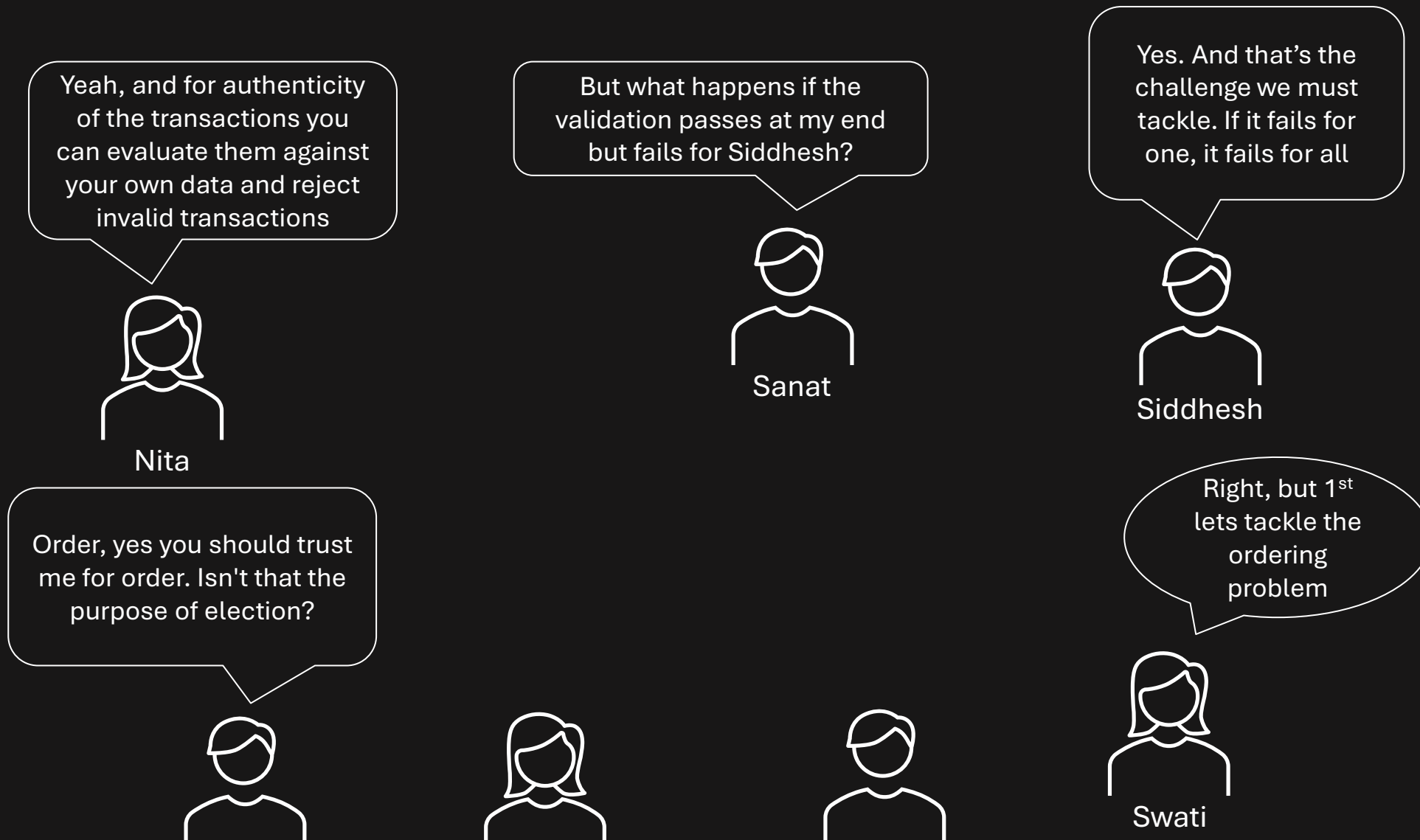
AN ORDERING CONUNDRUM



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THE CONSENSUS

POW

Proof of work (PoW) is a form of cryptographic proof in which one party (the prover) proves to others (the verifiers) that a certain amount of a specific computational effort has been expended. Verifiers can subsequently confirm this expenditure with minimal effort on their part. The concept was invented by Moni Naor and Cynthia Dwork in 1993 as a way to deter denial-of-service attacks and other service abuses such as spam on a network by requiring some work from a service requester, usually meaning processing time by a computer.

POS

Proof-of-stake (PoS) protocols are a class of consensus mechanisms for blockchains that work by selecting validators in proportion to their quantity of holdings in the associated cryptocurrency. This is done to avoid the computational cost of proof-of-work (POW) schemes.

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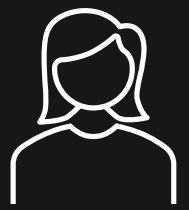
MANY MORE CONCERNS STILL

So, we all agree we need an algorithm/mechanism to decide who proposes order



Nita

But will these algorithms propose one transaction to commit at a time? That will be lot of computation and Tx backlog. The system will be extremely slow.

Sanat

How do I even trust that the transactions are coming from one of you? You can very well deny sending the transaction later

Sayali

... yeah, we could change the order too.

Anil

We are still using databases though. What stops any of us from changing data in there?

Swati

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- Also does every payer and payee need to deploy a node now? That’s just unthinkable.
- Then which node does a user connect to?
- If a user can connect to any node, it means my money, my balance is available on all nodes. Where is the much needed privacy?

THANK YOU

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