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Developing a blockchain technology to enhance tracking and tracing of food items throughout the value chain to ensure food security in Africa

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FINAL REPORT ON CHALLENGE #7: Application of Blockchain Technology for Food Security in Africa

Jiří Kvapil

INTRODUCTION

African food supply chain is made of smallholder farmers who often do not get the due reward for their produce thereby leaving the farmers poorer.

For ages, the production and supply chains have been **heavily fragmented coupled with non-transparent, inefficient and non-communicating business networks** which have diminished farmer's productive capacity and wellbeing.

From a food supply and marketing side, selfish minded individuals have capitalized in this space by creating **processes and networks that are exploitative.**

Likewise, processes that deal with production and transactional data between actors and products are rarely integrated let alone shared. As such, the disconnection and **lack of transparency and accountability complicates fair pricing and quality of products.**

The goals of the challenge

1. Collation of information on African farmers' challenges on farm transactions and the use of technology.
2. **Development of blockchain technology software** that will be used for mapping and traceability of food packages which is very much needed in both production and supply chain.
3. Ensure that the blockchain technology is accessible, affordable and farmers friendly (easy to use).

IDENTIFIED AFRICAN FARM TRANSACTION CHALLENGES

Participants from Africa were asked to gather information from their country's local farmers on farm stakeholders challenges and challenges on the use of technology that will be addressed in the development of the blockchain technology software. Participants from **Nigeria, Cameroun, Zambia, Uganda and Kenya** submitted the challenges faced by their farmers:

The challenges were:

1. Illiteracy
2. **Cost of the technology**
3. **Poor extension services**
4. **Lack of transparency in the farm transactions**
5. **Too many middlemen**

Therefore, the group concentrated on the development and application of the blockchain technology in two areas

1. Technology which will serve to **store data and information that various actors and stakeholders generate throughout the entire value-added process**, from seed to sale, of producing an agricultural product.
2. **Food supply chain** where the common problems such as **food traceability, food safety and quality**, food trust and supply chain inefficiency, which add additional risks on the entire society, economy and the health of human is tackled.

Blockchain concept

- 1/ All transactions have their own hashes (i.e. unique IDs)
- 2/ History of transactions can not be changed
 - Checksumming of previous transaction hashes
 - Series of hashes create bigger and bigger blocks – checking of integrity of these blocks
- 3/ All transactions are traceable
 - Who? Whom? What? How much?

Blockchain technology requirements (for our challenge test case)

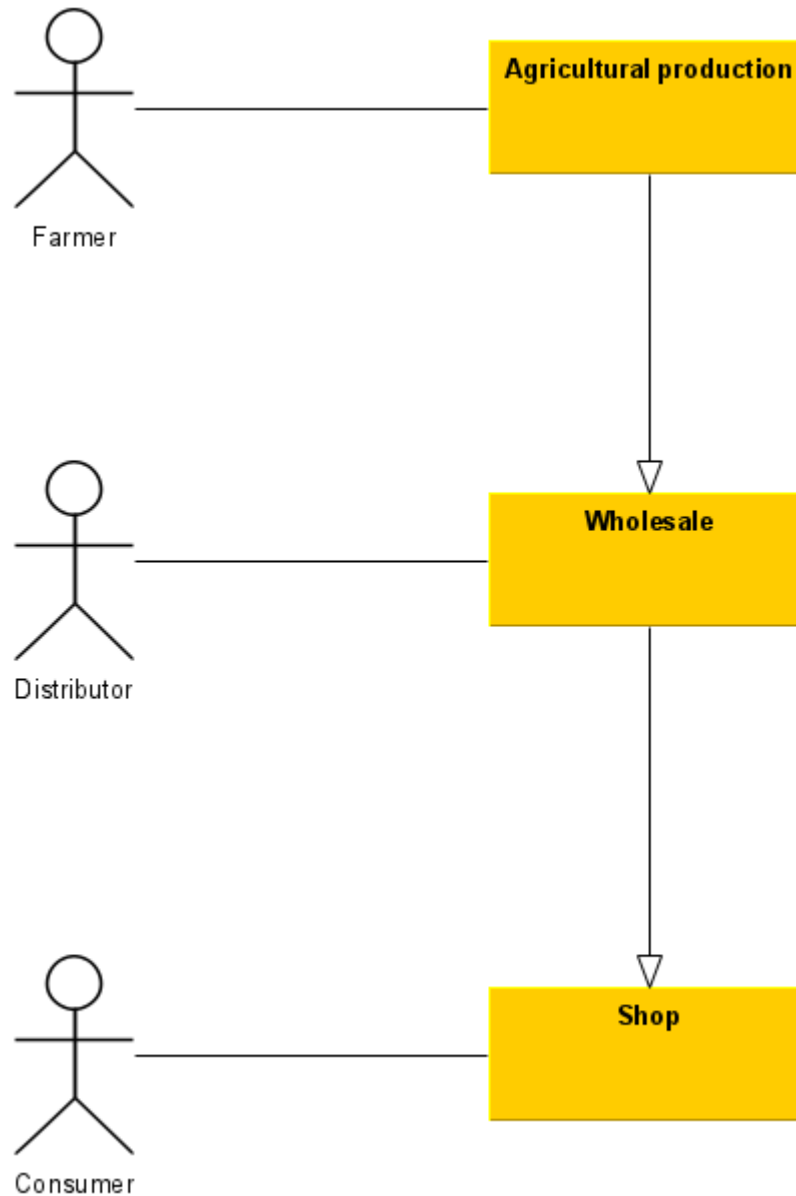
- 1/ Availability of web interface or at least a command line interface (CLI)
- 2/ Simple and without excessive functions
- 3/ Good documentation
- 4/ Friendly installation

- Simple
- Rapid deployment (Docker image)
- Command line interface (CLI)
- Updated documentation (sort of...)

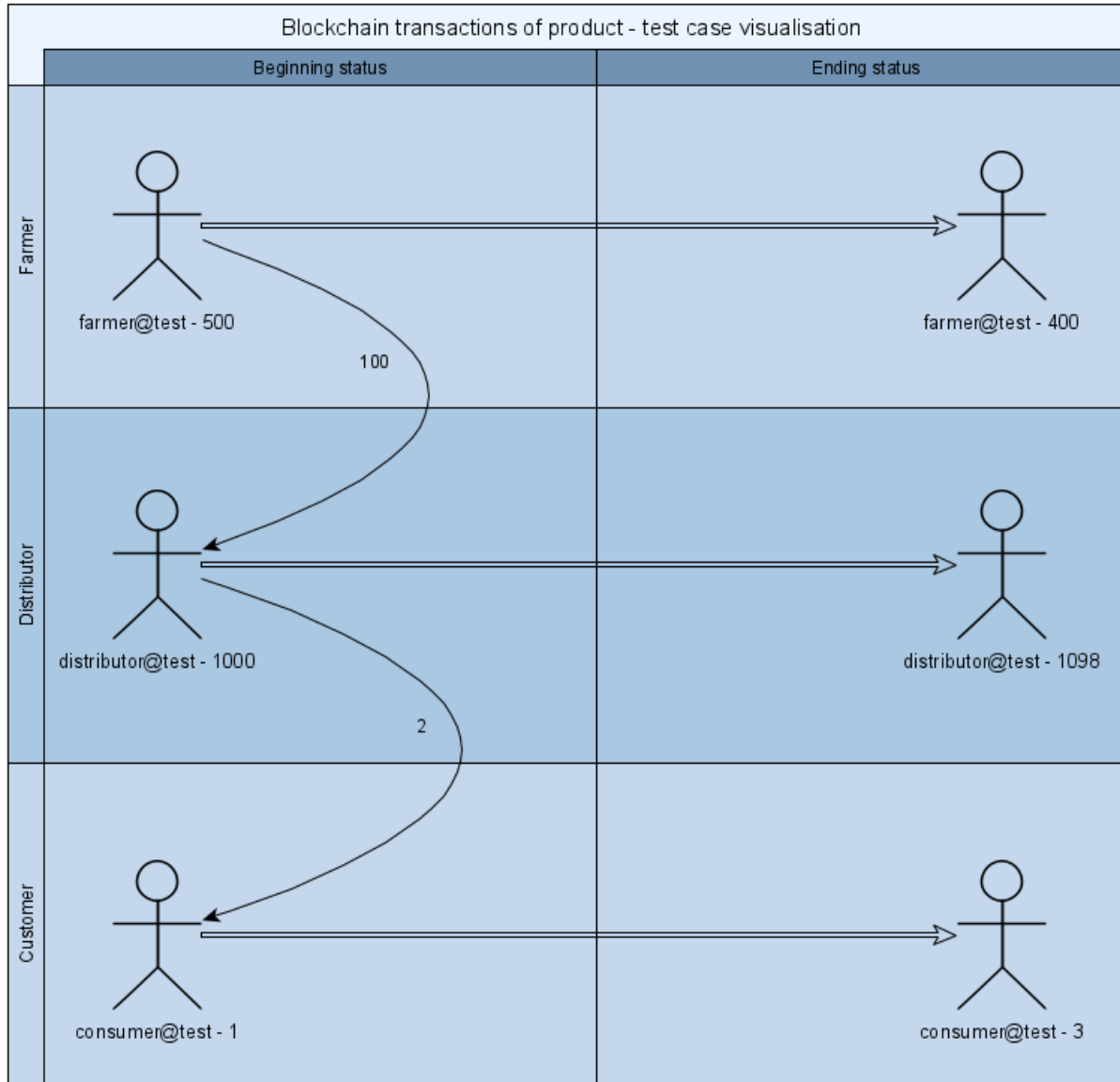


```
root@f1bb98d91b09:/opt/iroha_data# iroha-cli -peer_ip localhost -account_name
admin@test
Welcome to Iroha-Cli.
Choose what to do:
1. New transaction (tx)
2. New query (qry)
3. New transaction status request (st)
> :
```

Blockchain Test case - schema



Blockchain Test case - transactions



Blockchain Test case – Balance query



Choose what to do:

1. New transaction (tx)
2. New query (qry)
3. New transaction status request (st)

> : 2

Choose query:

1. Get all permissions related to role (get_role_perm)
2. Get Transactions by transactions' hashes (get_tx)
3. Get information about asset (get_ast_info)
4. Get Account's Transactions (get_acc_tx)
5. Get Account's Asset Transactions (get_acc_ast_tx)
6. Get all current roles in the system (get_roles)
7. Get Account's Signatories (get_acc_sign)
8. Get Account's Assets (get_acc_ast)
9. Get Account Information (get_acc)
0. Back (b)

> : 8

Requested account Id: farmer@test

Requested asset Id: product#test

Query is formed. Choose what to do:

1. Send to Iroha peer (send)
2. Save as json file (save)
0. Back (b)

> : 1

Peer address (localhost):

Peer port (50051):

[2020-11-11 13:00:10.269995769][I][CLI/ResponseHandler/Query]: [Account Assets]

[2020-11-11 13:00:10.270056938][I][CLI/ResponseHandler/Query]: -Account Id:- farmer@test

[2020-11-11 13:00:10.270063895][I][CLI/ResponseHandler/Query]: -Asset Id- product#test

[2020-11-11 13:00:10.270068090][I][CLI/ResponseHandler/Query]: -Balance- 500

Blockchain Test case – Transaction



Choose what to do:

1. New transaction (tx)
2. New query (qry)
3. New transaction status request (st)

> : **1**

Forming a new transactions, choose command to add:

1. Set account key/value detail (set_acc_kv)
2. Detach role from account (detach)
3. Add new role to account (apnd_role)
4. Transfer Assets (tran_ast)
5. Subtract Assets Quantity (sub_ast_qty)
6. Set Account Quorum (set_qrm)
7. Remove Signatory (rem_sign)
8. Create new role (crt_role)
0. Back (b)

> : **4**

SrcAccount Id (admin@test): **farmer@test**

DestAccount Id (distributor@test): **distributor@test**

Asset Id (product#test): **product#test**

Amount to transfer, e.g 123.456 (1000): **100**

.....

.....

[2020-11-11 13:42:33.143481529][I][CLI/ResponseHandler/Transaction]: Transaction successfully sent

Congratulation, your transaction was accepted for processing.

Its hash is

17127cc9b1abcc039e536bb3c16b2e472cb1917c8e2dfaa86f6614abf486f53a

Blockchain Test case – Transaction result query



Choose what to do:

1. New transaction (tx)
2. New query (qry)
3. New transaction status request (st)

> : 3

Choose action:

1. Get status of transaction (get_tx_info)
0. Back (b)

> : 1

Requested tx hash: 17127cc9b1abcc039e536bb3c16b2e472cb1917c8e2dfaa86f6614abf486f53a

Tx hash is saved. Choose what to do:

1. Send to Iroha peer (send)
2. Save as json file (save)
0. Back (b)

> : 1

Peer address (localhost):

Peer port (50051):

Transaction was successfully committed.

Blockchain Test case – Transaction log query



Choose what to do:

1. New transaction (tx)
2. New query (qry)
3. New transaction status request (st)

> : 2

Choose query:

1. Get all permissions related to role (get_role_perm)
2. Get Transactions by transactions' hashes (get_tx)
3. Get information about asset (get_ast_info)
4. Get Account's Transactions (get_acc_tx)
5. Get Account's Asset Transactions (get_acc_ast_tx)
6. Get all current roles in the system (get_roles)
7. Get Account's Signatories (get_acc_sign)
8. Get Account's Assets (get_acc_ast)
9. Get Account Information (get_acc)
0. Back (b)

> : 2

Requested tx hashes: 17127cc9b1abcc039e536bb3c16b2e472cb1917c8e2dfaa86f6614abf486f53a

...

...

...

[2020-11-11 20:27:13.505861045][I][CLI/ResponseHandler/Query]: [Transaction]

[2020-11-11 20:27:13.505920927][I][CLI/ResponseHandler/Query]: -Hash-

17127cc9b1abcc039e536bb3c16b2e472cb1917c8e2dfaa86f6614abf486f53a

[2020-11-11 20:27:13.505928685][I][CLI/ResponseHandler/Query]: -Creator Id- farmer@test

[2020-11-11 20:27:13.505934057][I][CLI/ResponseHandler/Query]: -Created Time- 1605124546726

[2020-11-11 20:27:13.505938786][I][CLI/ResponseHandler/Query]: -Commands- 1

[2020-11-11 20:27:13.505966139][I][CLI/ResponseHandler/Query]: TransferAsset:

[src_account_id=farmer@test, dest_account_id=distributor@test, asset_id=product#test, description=, amount=Amount: [value=100,],]

Conclusions

- Blockchain solution has proven as usable and suitable
- Backend of the blockchain powered ledger is ready
- Web interface and/or mobile application frontend needs to be developed for any further development of the technology and involvement of real end users
- Huge potential for future projects



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Thank you for your attention!