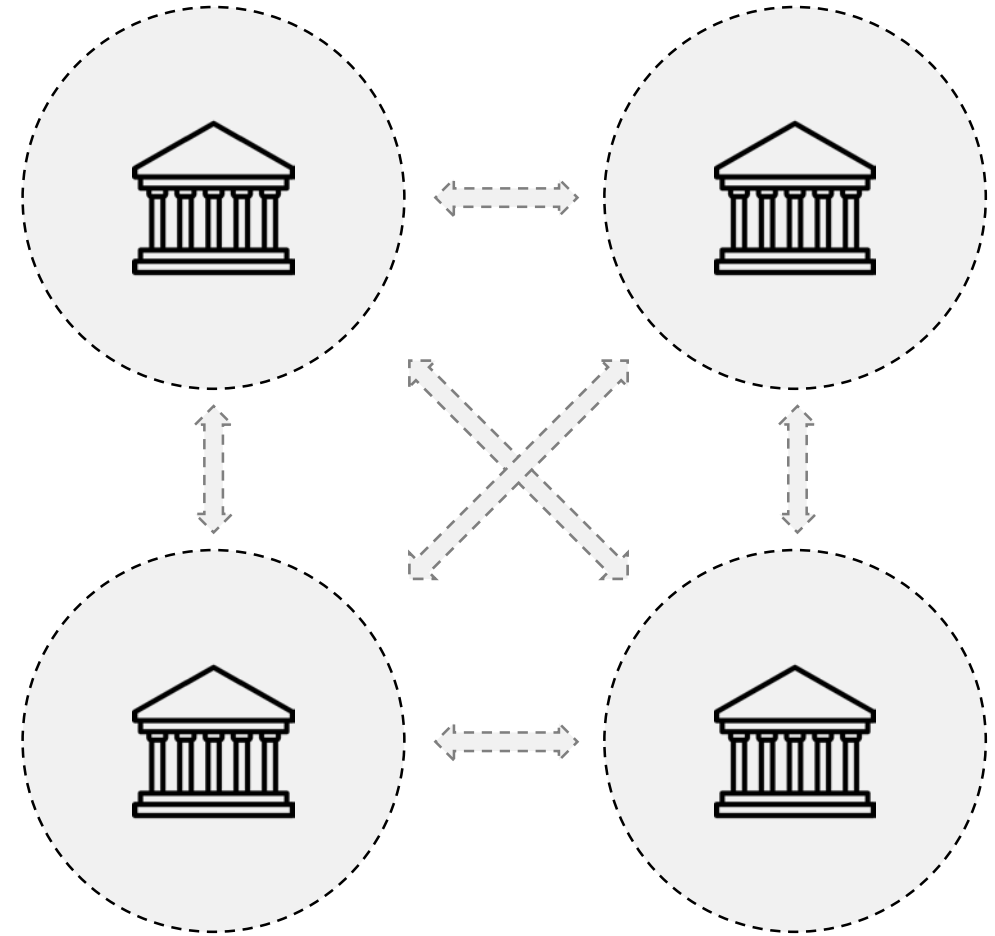
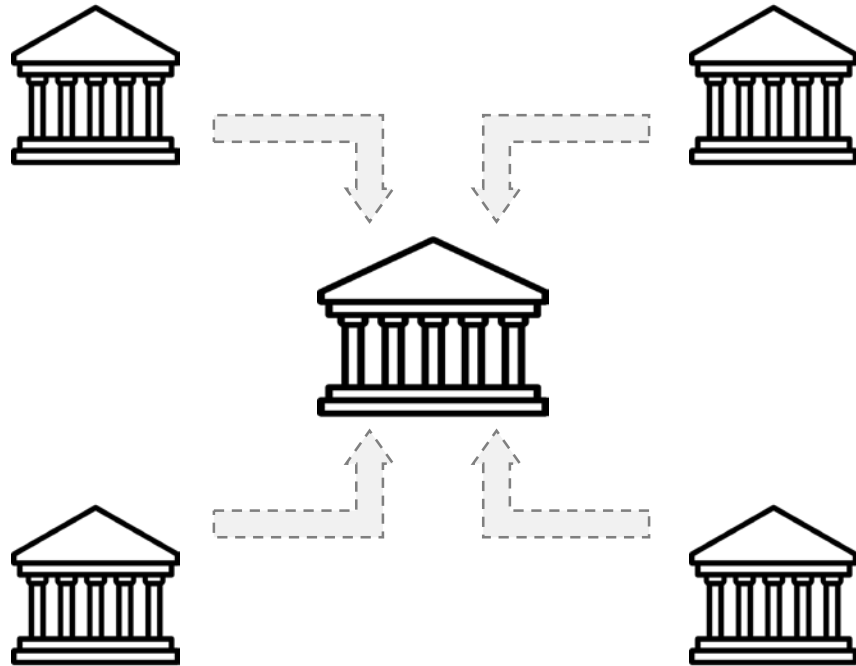


# Blockchain and Real Estate

Ludvig Öberg

# Two Ways to synchronize state/data



# Blockchain in a nutshell



A database that can be used by parties that don't fully trust each other.

A middleman is not needed:

- Lower costs
- Lower risks

Additional benefits:

- Resilience
- Auditability



# Opportunity



Leading enterprises are investing in blockchain technologies

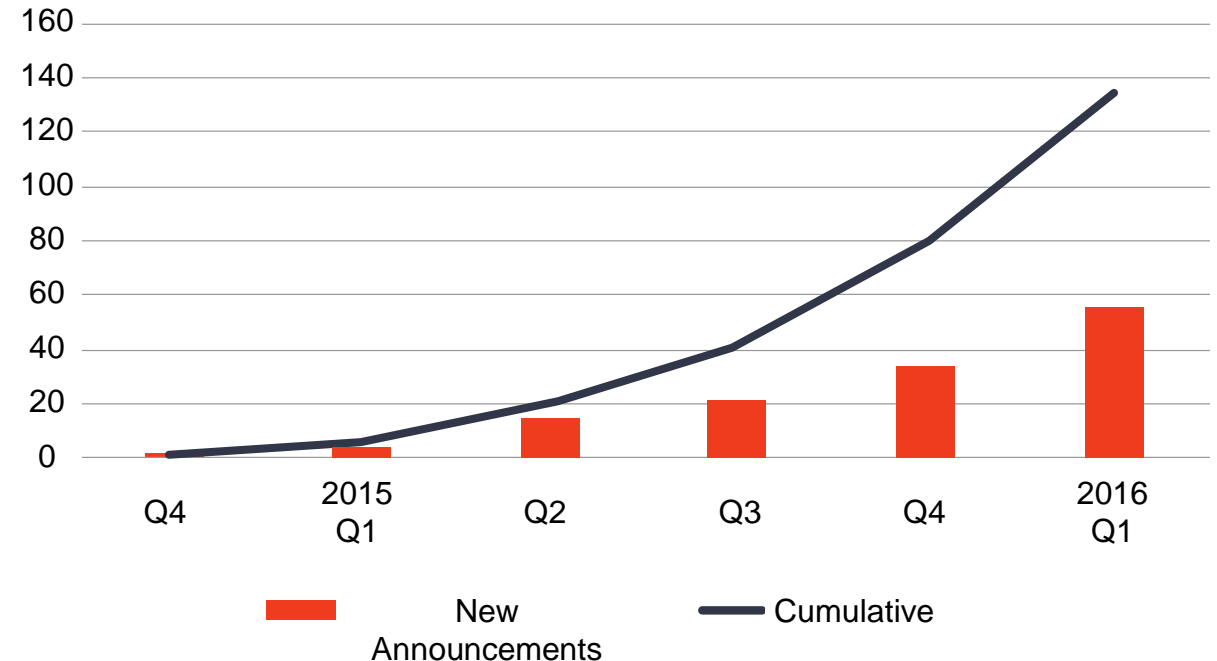
Banks have been leading the way



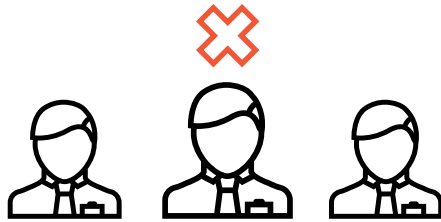
Other industries are now joining



Traditional Institutions Exploring Blockchain



# Impact of Blockchains



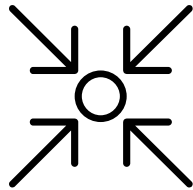
Middle men  
are removed



Increased competition  
due to open platforms



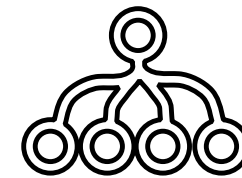
Reduced costs



More  
specialization



Global transparent  
network create trust



Flat Structures

# Land Registry

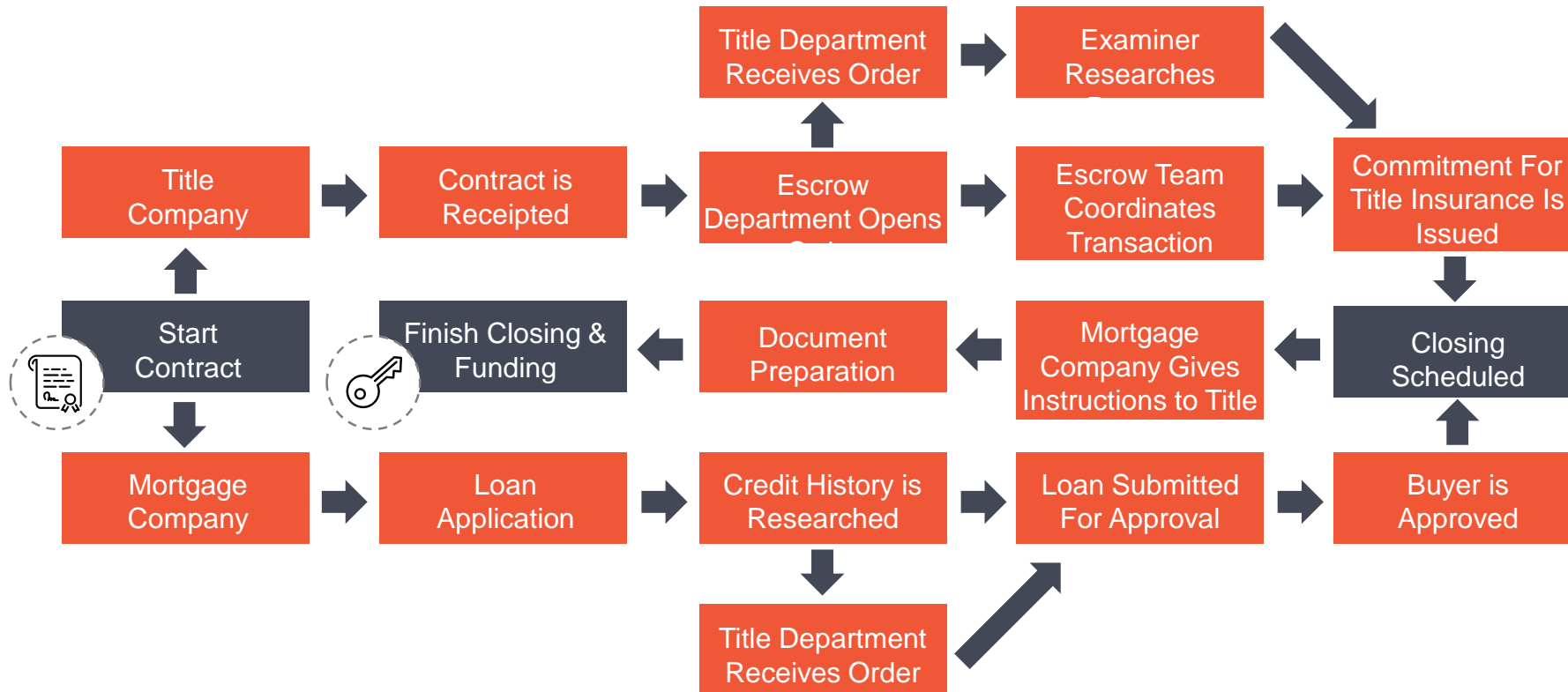


Real Estate

Create a digital process of a property transaction with an immutable history:

- Increase auditability/reduce fraud
- Fast transaction speed
- Less manual work
- Allows private information that can be retrospectively revealed/proven
- Prevent corruption

# The problem with real estate



“The reason that we are looking at this particular technology is that it’s very secure at the same time as it supports processes in several different ways and provides transparency. Being able to assign pending title deed is also something of value for all parties. Everyone will benefit from this.”

(Mats Snäll, Head of Development of Real Estate Registration, at the Swedish Land Registry)

# Swedish Real Estate Project



## PROJECT PARTICIPANTS

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Landshypotek Bank

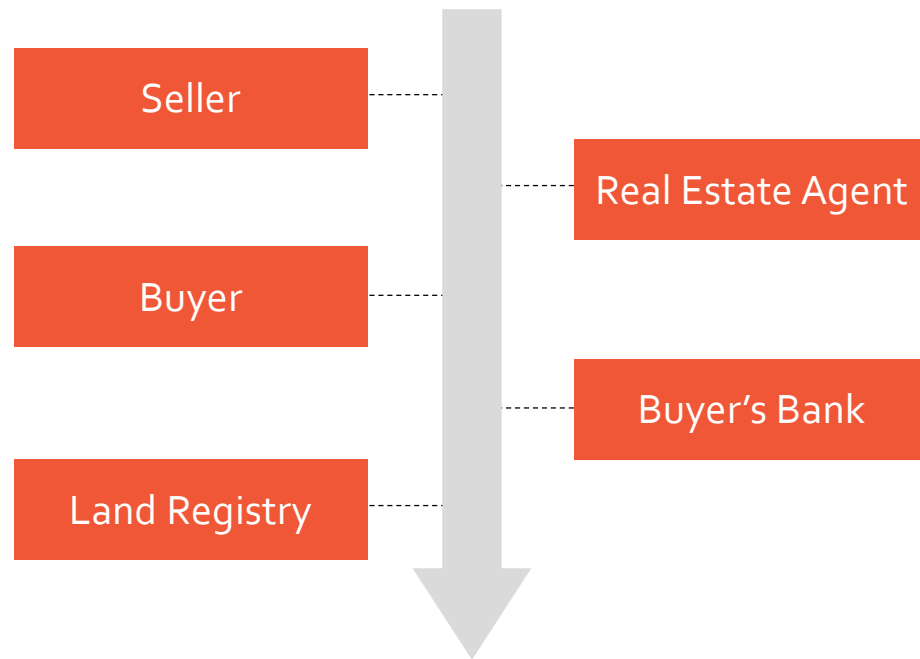
**SBAB!**



**KAIROS  
FUTURE**

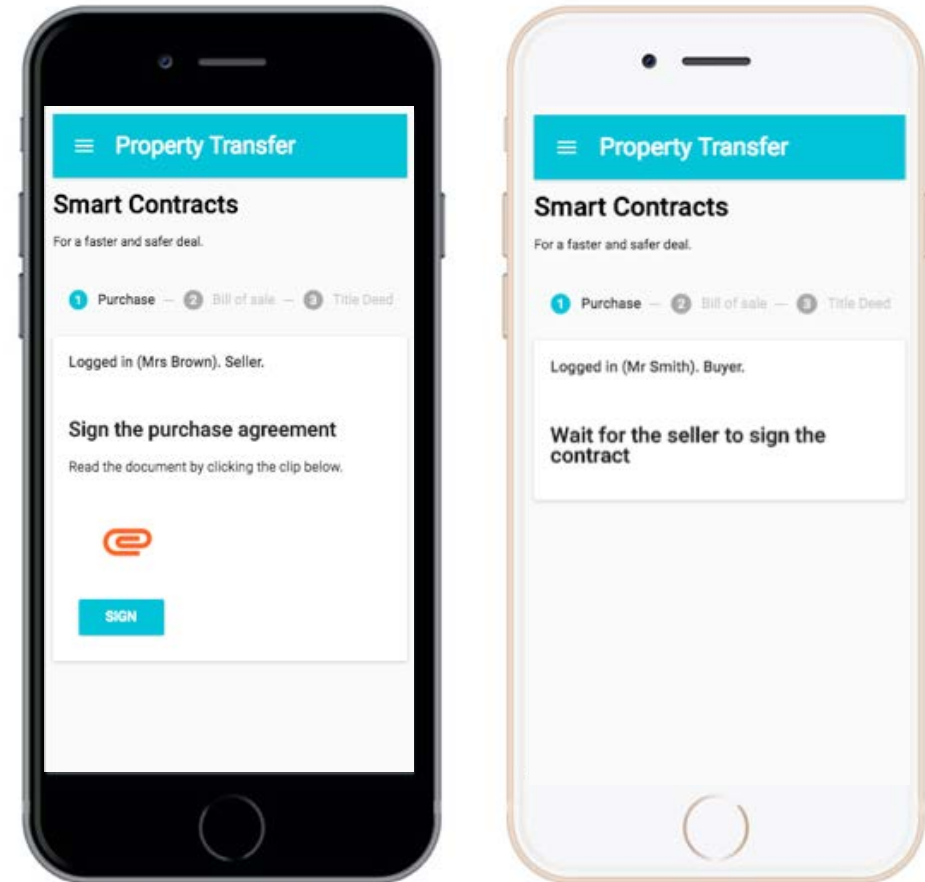


# Decentralized real estate (Lantmäteriet)



Time reduced from **months** to **hours**

Large **reduction of fraud**



# Demo



PropertyTransactionMain

Edit

Compile

Save

```
1 (defcontract property_transaction_main_contract ()
2   (fields
3     (buyer_0 :type pubkey :init nil)
4     (buyer_1 :type pubkey :init nil)
5     (seller_0 :type pubkey)
6     (seller_1 :type pubkey)
7     (real_estate_agent :type pubkey :init nil)
8     (sellers_bank :type pubkey :init nil)
9     (buyers_bank :type pubkey :init nil)
10    (land_registry :type pubkey :init nil)
11    (telia :type pubkey :init nil)
12
13    (property_ID :type string :init nil)
14    (price :type integer :init nil)
15    (access_date :type integer :init nil)
16    (access_place :type string :init nil)
17    (contract_date :type integer :init nil)
18    (deposit_amount :type integer :init nil)
19    (escrow_account :type string :init nil)
20    (seller_account :type string :init nil)
21    (buyer_ID :type integer :init nil) ; Field for Personal number used by telia, format: YYYYMMDDXXXX
22    (seller_ID :type integer :init nil) ; Field for Personal number used by telia, format: YYYYMMDDXXXX
23    (purchase_contract :type string :init nil)
24    (bill_of_sale :type string :init nil)
25    (hash_of_credit_document :type string :init nil)
26    (hash_of_mortgage_loan_document :type string :init nil)
27    (mortgage_deed_sub_contract_ID :type string :init nil)
28    (state :type string :init nil))
29   (actions
30
31     (initiate ((agent-pk pubkey))
32       "Invite Real Estate Agent"
33     (guard
34       (signatures seller_0)
35       (eq1 state nil))
36
37     (locally
38       (invite agent-pk))
39     (update real_estate_agent agent-pk
40       state :set_property_information))
41
42     (set-property-information
43       ((property-id string) (price-local integer) (contract-date integer) (deposit-amount integer) (escrow-account string) (sell
44       "Input price contract date deposit amount escrow account seller account"
```

## Result

Compile PropertyTransactionMainContract OK:

Parsing action INITIATE

Parsing action SET-PROPERTY-INFORMATION

Parsing action INVITE-PARTIES

Parsing action VERIFY-SELLER

Parsing action VERIFY-BUYER

Parsing action UPLOAD-PURCHASE-CONTRACT

Parsing action BUYER-SIGN-PURCHASE-CONTRACT

Parsing action SELLER-SIGN-PURCHASE-CONTRACT

Parsing action BUYERS-BANK-OFFERS-CREDIT-LOAN

Parsing action BUYER-ACCEPTS-CREDIT-LOAN

Parsing action BUYER-AUTHORIZES-DEPOSIT-PAYMENT

Parsing action BUYERS-BANK-CONFIRMS-PAYMENT

Parsing action REAL-ESTATE-AGENT-CONFIRMS-PAYMENT

Parsing action REAL-ESTATE-AGENT-CANCELS-CONTRACT

Parsing action LAND-REGISTRY-ISSUES-PRELIMINARY-TITLE-DEED

Parsing action REAL-ESTATE-AGENT-PAYOUT-DEPOSIT

Parsing action SELLER-CONFIRMS-RECEIVED-PAYMENT

Parsing action BUYERS-BANK-OFFERS-MORTGAGE-LOAN

Parsing action BUYER-SIGNS-MORTGAGE-LOAN-DOCUMENT

Parsing action REAL-ESTATE-AGENT-CONFIRMS-SETTLEMENT

Parsing action REAL-ESTATE-AGENT-CONFIRMS-ACCESS-DATE

Parsing action REAL-ESTATE-AGENT-CONFIRMS-FINAL-SETTLEMENT-UPLOAD-BILL-OF-SALE

Parsing action BUYER-SIGNS-BILL-OF-SALE

Parsing action SELLER-SIGNS-BILL-OF-SALE

Parsing action BUYER-AUTHORIZES-FULL-PAYMENT

Parsing action BUYERS-BANK-SENDS-FULL-PAYMENT

Parsing action SELLER-CONFIRMS-FULL-PAYMENT

Parsing action REAL-ESTATE-AGENT-CONFIRMS-KEYS-TRANSFER



Buyer

Seller\*

Real Estate Agent

Land Registry

Telia

Buyers Bank

Sellers Bank

Create new actor

Seller

Public key: 02daad408e054c05dacc2a53ed677bd9fa582e506a9b1bb92802d85fd3165b0d6c

Private key: sL3b3z3RHbM2YJkEMrPwJtBHVGMd5AYfS4g9xmeuByNByFf3eYEsW

New contract instance ▾

Load contract definition

Contracts

contract property\_transaction\_main\_contract\_0\*

property\_transaction\_main\_contract\_0

State

seller\_0:  
02daad408e054c05dacc2a53e  
d677bd9fa582e506a9b1bb928  
02d85fd3165b0d6c

seller\_1:

contractHash:  
4513747943418565635

buyer\_0:

buyer\_1:

Actions

(no action selected)

initiate

No action selected

Message chain

0

{ "payload": "{ \"prev\_msg\_hash\": \"9dbce1bb9dcc7a05460b7774582359aee9ff7760\", \"action\": \"4513747943418565635\", \"params\": { \"seller\_0\": \"02daad408e054c05dacc2a53ed677bd9fa582e506a9b1bb92802d85fd3165b0d6c\", \"seller\_1\": \"\", \"contractHash\": \"4513747943418565635\" } }", "signatures": [] }

# Demo



## Contracts

contract\_property\_transaction\_main\_contract\_0\*

### property\_transaction\_main\_contract\_0

#### State

seller\_0:  
**02daad408e054c05dacc2a53  
ed677bd9fa582e506a9b1bb9  
2802d85fd3165b0d6c**

seller\_1:

contractHash:  
**4513747943418565635**

buyer\_0:

buyer\_1:

real\_estate\_agent:  
**0209d45d4e0fec3dd2a7a762c  
5204a5c3ca6fefb3cd09be5ba  
6ac589ad247cd0ca**

sellers\_bank:

buyers\_bank:

land\_registry:

telia:

property\_id:  
**12923921838**

price:  
**10000000**

access\_date:

#### Actions

(no action selected)  
inviteParties

#### Action parameters:

buyer0Pk:

Set buyer0Pk

buyer1Pk:

Set buyer1Pk

buyersBankPk:

Set buyersBankPk

sellersBankPk:

Set sellersBankPk

landRegistryPk:

Set landRegistryPk

teliaPk:

Set teliaPk

inviteParties

#### Message chain

0

```
{ "payload": "{ \"prev_msg_hash\": \"9dbce1bb9dcc7a05460b7774582359aee9ff7760\", \"action\": \"4513747943418565635\", \"params\": { \"seller_0\": \"02daad408e054c05dacc2a53ed677bd9fa582e506a9b1bb92802d85fd3165b0d6c\", \"seller_1\": \"\", \"contractHash\": \"4513747943418565635\" } }\", \"signatures\": [] }
```

1

```
{ "payload": "{ \"prev_msg_hash\": \"6a4a8f4a7e22e9061c7377c2f8c37dfe3ce5330923b268f8ef03852d35e34677\", \"action\": \"initiate\", \"params\": { \"agentPk\": \"0209d45d4e0fec3dd2a7a762c5204a5c3ca6fefb3cd09be5ba6ac589ad247cd0ca\" } }\", \"signatures\": [ { \"pub\": \"02daad408e054c05dacc2a53ed677bd9fa582e506a9b1bb92802d85fd3165b0d6c\", \"sig\": \"3045022100a16344730c68a22a756cb69f2d1c32f1560dd674a1d00d496d3de90076a3250b02206475d69d92db5f61e661eb0cfd2723f982cb7fef911cf0d800180ac458a28621\" } ] }
```

2

```
{ "payload": "{ \"prev_msg_hash\": \"220ebb734f2261f6ac80883d2ff445ef166e976cc71da b52ad0e13cc541585f0\", \"action\": \"setPropertyInformation\", \"params\": { \"propertyId\": \"12923921838\", \"priceLocal\": \"10000000\", \"contractDate\": \"20170316\", \"depositAmount\": \"5000000\", \"escrowAccount\": \"4003-1929290\", \"sellerAccount\": \"3200-3993932\" } }\", \"signatures\": [ { \"pub\": \"0209d45d4e0fec3dd2a7a762c5204a5c3ca6fefb3cd09be5ba6ac589ad247cd0ca\", \"sig\": \"3046022100960a46cd235fcdcbf610be9b72b00364e31f69d311e1a1a6c4ce09b4321effcd02210091e8c42c843ccaea14a742b766cc763ae08d5416ba1136958ae4e8b6dd8a8753\" } ] }
```

## Postchain Block & Transactions Visualizer

### Block 251 [+]

- 1256\301\216\315\301\305X(1\225\331\222|-1316\354\252x\304\325+/\303\227\352\271\$•I353{"payload": {"prev\_msg\_hash": "edd2d2836897de2baeee46a467f45f0183ea3ce3a1257621182883e3938dd616", "action": "realEstateAgentConfirmsKeysTransferred", "params": {}}, "signatures": [{"pub": "02a7826b4b2d9705a2e77e869622c81124ad7f29872e297ff4829ae50aac49bb95", "sig": "3044022063c6c09fecdd49e618ee2f4ec9cb2dd18deca1dd84b5cd7a8fb39d8e491f2df3f02200deefcd6c1ec08d7301ad7ddff6c81a6fa424c57de7626c66d131bc897af43"}]}

### Block 250 [+]

- 1256\301\216\315\301\305X(1\225\331\222|-1316\354\252x\304\325+/\303\227\352\271\$•I353{"payload": {"prev\_msg\_hash": "395cc818a5ea9af198b8fe46a746b3531170a4f658101ef9241038587828175e", "action": "sellerConfirmsFullPayment", "params": {}}, "signatures": [{"pub": "036f115d4aeb096c92fb7142755f4ead62ef9c753acdfe690431757bda54c716cf", "sig": "3046022100ed8ac5796536e50d43340006d62e8dc6a3913facb1b974f4a773939a22201f23022100a1e4ab99305870112126027cac98cd4c5ff1834c387fc31cb0006adfb754515b"}]}

### Block 249 [+]

- 1256\301\216\315\301\305X(1\225\331\222|-1316\354\252x\304\325+/\303\227\352\271\$•I353{"payload": {"prev\_msg\_hash": "fd961d0e69e91713e7eca607dede1ec83b48b62021a9426f0703e35b2d7a6114", "action": "buyersBankSendsFullPayment", "params": {}}, "signatures": [{"pub": "024f390effe2633d737d005bd97ab242b356fea987c59bd65a75acedc653c030fc", "sig": "30450220048648fb26d9719af2247209f966a44a6a19eb7d92b423f5e9c4ca3f6d63c55022100b303598c00543c3e8153350e6d7d2157cb77fecdd969094063c5032866db3bda1"}]}

### Block 248 [+]

# Questions



Ludvig Öberg



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