

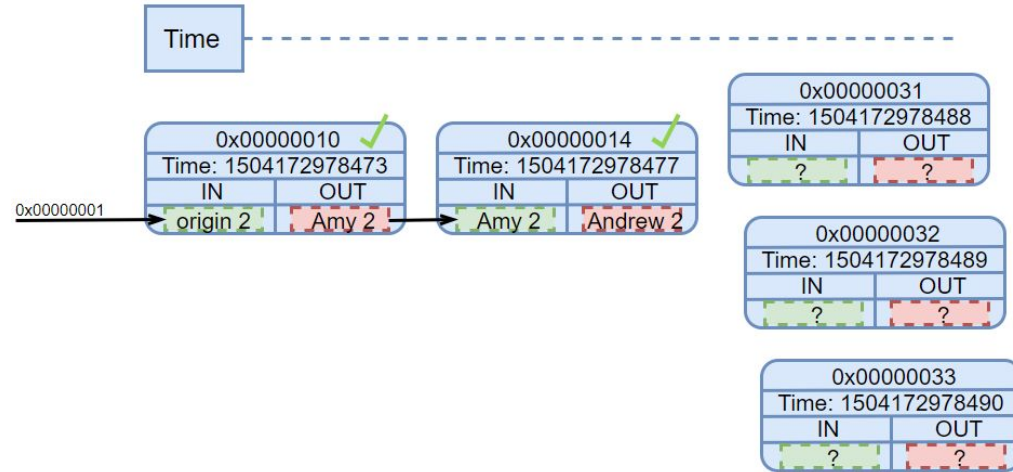
## Level 4 - Transactions Continued

### Definitions

- Funds are passed on through transaction linking
- Transaction requests need to be fulfilled

### Task

- Filter invalid transactions
- Report valid transactions
- Filter invalid transactions requests
- Report valid performed transactions requests



# Transactions and Requests

## Transactions (like level 3)

- Can have multiple input and output elements
- Sum of input amounts must match sum of output amounts
- Input-elements must be output-elements of previous transactions
  - Except initial funding that comes from **origin**
  - Any other funding must have been the output of a valid previous transaction, that is **mentioned** in the input file
- Input-elements need to be **spent completely** / One transaction output-element can only be used once for inputs
- Any amount has to be an integer number **greater zero**
- Transactions are executed in order of submission time
- You can assume that the submission time is unique amongst transactions

## Transaction Requests

- Transaction requests are executed in order of submission time
- The **oldest available** fundings (previous output-elements) have to be used as input-elements
  - Collect them by age until the desired amount is met
- The **change** needs to be redirected to the owner (see example)

# Data format

## Input (same as Level 3)

<NumberOfTransactions> the number of transactions in the banking system

NumberOfTransactions lines: <TransactionID> <NumberOfInputs> NumberOfInputs \* InputElement <NumberOfOutputs>

NumberOfOutputs \* OutputElement <TransactionSubmitTime>

InputElement: <InputTransactionID> <InputTransactionOwner> <InputTransactionAmount>

OutputElement: <OutputTransactionOwner> <OutputTransactionAmount>

## Additional Input

<NumberOfTransactionRequests> the number of transaction requests

NumberOfTransactionRequests lines: <TransactionID> <FromOwner> <ToOwner> <Amount> <TransactionSubmitTime>

# Data format

## Output (same as Level 3)

`<NumberOfTransactions>` the number of transactions in the banking system

NumberOfTransactions lines: `<TransactionID>` `<NumberOfInputs>` NumberOfInputs \* InputElement `<NumberOfOutputs>`

NumberOfOutputs \* OutputElement `<TransactionSubmitTime>`

InputElement: `<InputTransactionID>` `<InputTransactionOwner>` `<InputTransactionAmount>`

OutputElement: `<OutputTransactionOwner>` `<OutputTransactionAmount>`

## Example

### Input

```
2
0x00000010 1 0x00000001 origin 2 1 Amy 2 1504172978473
0x00000014 1 0x00000010 Amy 2 1 Andrew 2 1504172978477
3
0x00000031 Andrew Amy 1 1504172978488
0x00000032 Andrew Amy 1 1504172978489
0x00000033 Andrew Amy 3 1504172978490
```

### Output

```
4
0x00000010 1 0x00000001 origin 2 1 Amy 2 1504172978473
0x00000014 1 0x00000010 Amy 2 1 Andrew 2 1504172978477
0x00000031 1 0x00000014 Andrew 2 2 Amy 1 Andrew 1 1504172978488
0x00000032 1 0x00000031 Andrew 1 1 Amy 1 1504172978489
```

