Recording obligations in multi-phase transactions

This paper considers how a Mojaloop switch should record obligations in cases where a transaction consists of more than one transfers. Examples of multi-phase transactions are payments which involve currency conversion.

# Assumptions

This analysis makes the following assumptions:

1. Each phase of the transfer other than the transfer itself will have a *dependent* entry associated with the transfer execution request.
2. The content of a *dependent* entry will be as follows:
	1. The identifier of the credit party associated with the reservation – for instance, the FXP in a currency conversion reservation.
	2. The condition which identifies the reservation.
	3. The fulfilment which guarantees the reservation.
3. Conditions will be unique in the list of dependencies.

# Use cases

We consider the following use cases:

## Currency conversion initiated by the debtor party

In this use case, the debtor party negotiates currency conversion with an FXP. The currency conversion is executed and funds are reserved before the transfer itself is executed, and the transfer is denominated in the target currency.

## Currency conversion initiated by the creditor party

In this use case, the creditor party negotiates currency conversion with an FXP. The currency conversion is executed and funds are reserved after funds are reserved for the transfer itself, and the transfer is denominated in the source currency.

## Currency conversion initiated by both parties

In this use case, currency conversion passes through a reference currency. Both the creditor and the debtor parties perform a currency conversion: the debtor party converts from the source currency to the reference currency before the transfer itself is executed, and the creditor party converts from the reference currency to the target currency before the transfer is confirmed. The transfer is denominated in the reference currency.

# Reservations

Reservations are made at the point where the execution of a currency conversion or a transfer is requested by the debtor party. The funds of a reservation must be reserved in a currency in which the debtor party holds an account (otherwise the liquidity check could not be made); but in the process of currency conversion it will sometimes be the case that the debtor participant will not hold an account in the currency in which the reservation should be made.

For instance, if currency conversion is initiated by the debtor party, the transfer itself will be denominated in the target currency of the transfer, in which it is likely that the debtor party does not hold an account. Conversely, if currency conversion is initiated by the creditor party, then the currency conversion request will be denominated in the source currency of the transfer, in which it is likely that the creditor party does not have an account.

In order to preserve correctness in liquidity cover and the ability to assign transfer amounts to the correct accounts, it will be necessary for the switch to assign reservations to the correct accounts based on the characteristics of the transfer. The following algorithm should allow reservations reliably to be made against the correct accounts.

1. If the debtor party holds an account in the currency of the payment execution request, then perform the liquidity check and make the reservation against that account.
2. If the debtor party does not hold an account in the currency of the payment execution request, then:
	1. If this is a request to execute currency conversion, then perform the liquidity check and make the reservation against the account of the creditor party to the currency conversion request, in the target currency of the currency conversion request.
	2. If this is a request to execute a transfer, then:
		1. If there are no dependent transfers associated with the transfer request, then this is an error.
		2. Otherwise, perform the liquidity check and make the reservation against the account of the participant named in the first dependent transfer.

This process will result in the following reservations for the different use cases. Reservations are assessed at the point when the transfer is completed and the obligations are to be recorded. Each reservation is identified by a condition.

1. Debtor party initiated
	1. A reservation against the debtor party’s account in the source currency of the transfer, per rule 1 above.
		1. The condition is the condition for the currency conversion.
		2. The participant identified in the dependency is the FXP.
	2. A reservation against the FXP’s account in the target currency of the transfer, per rule 2.b.ii above.
		1. The condition is the condition for the transfer.
		2. There is no dependency.
2. Creditor party initiated.
	1. A reservation against the debtor party’s account in the source currency of the transfer, per rule 1 above.
		1. The condition is the condition for the transfer.
		2. There is no dependency.
	2. A reservation against the creditor party’s account in the source currency of the transfer, per rule 2.a above.
		1. The condition is the condition for the currency conversion.
		2. The participant identified in the dependency is the FXP.
3. Reference currency conversion
	1. A reservation against the debtor party’s account in the source currency of the transfer, per rule 1 above.
		1. The condition is the condition for the first currency conversion.
		2. The participant identified in the dependency is the first FXP.
	2. A reservation against the first FXP’s account in the reference currency of the transfer, per rule 2.b.ii above.
		1. The condition is the condition for the transfer.
		2. There is no dependency.
	3. A reservation against the second FXP’s account in the target currency of the transfer, per rule 2.a above.
		1. The condition is the condition for the second currency conversion.
		2. The participant identified in the dependency is the second FXP.

# Desired outcomes

For each use case, the expected outcomes in terms of recorded obligations are as follows:

1. Debtor party initiated
	1. An obligation between the debtor party and the FXP in the source currency of the transfer The reservation for this has been correctly assigned to the debtor party per 1)a) above.
	2. An obligation between the FXP and the creditor party in the target currency of the transfer. The reservation for this has been correctly assigned to the FXP per 1)b) above.
2. Creditor party initiated.
	1. An obligation between the debtor party and the FXP in the source currency of the transfer. The reservation for this has been correctly assigned to the debtor party per 2)a) above.
	2. An obligation between the FXP and the creditor party in the target currency of the transfer. The reservation for this has been correctly assigned to the FXP per 2)b) above.
3. Reference currency conversion
	1. An obligation between the debtor party and the first FXP in the source currency of the transfer. The reservation for this has been correctly assigned to the debtor party per 3)a) above.
	2. An obligation between the first FXP and the second FXP in the reference currency of the transfer. The reservation for this has been correctly assigned to the first FXP per 3)b) above.
	3. An obligation between the second FXP and the creditor party in the target currency of the transfer. The reservation for this has been correctly assigned to the second FXP per 3)c) above.

# Obligations

The following rules will allow the obligations reliably to be derived from the reservations and the dependents:

* If there are no dependencies, then create an obligation between the account where the reservation was created and the analogous account (same currency, same ledger account type) for the participant identified in the transfer.
* Otherwise, traverse the list of dependencies in order.
	+ If the reservation referred to by the dependency’s condition is against the debtor party for the transfer, then it represents a currency conversion initiated by the debtor participant: create an obligation between the account where the reservation was created and the analogous account (same currency, same ledger account type) for the participant identified in the dependency list. The amount and currency of the obligation are the same as the reservation.
	+ If the reservation referred to by the dependency’s condition is against an FXP, then it represents a currency conversion initiated by the creditor participant: create an obligation between the account where the reservation was created and the analogous account (same currency, same ledger account type) for the credit party for the transfer. The amount and currency of the obligation are the same as the reservation.
* When all dependencies have been traversed, create an obligation based on the reservation for the transfer itself. In all cases, the amount and currency of the obligation are as given in the reservation.
	+ If the reservation for the transfer is in the same currency as the payee receive amount of the transfer, then currency conversion is between the source and target currencies and has been initiated by the debtor participant: create an obligation between the FXP named in the associated dependency and the creditor party.
	+ If the reservation for the transfer is in the same currency as the amount of the transfer, then currency conversion is between the source and target currencies and has been initiated by the creditor participant: create an obligation between the debtor party and the FXP named in the associated dependency.
	+ Otherwise, currency conversion goes via a reference currency: create an obligation between the first participant identified in the dependency list and the second participant identified in the dependency list.