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Digital euro pilot

Functional requirements



Disclaimer: This document is indicative and may be subject to modifications. The design, features, and scope of a digital euro may also differ if issued in the future.

1. Functional requirements overview

This document defines the functional and operational model of the different services in scope of the digital euro pilot. The functional and operational model is supported by detailed end-to-end (E2E) process flows which can be found in **Digital euro pilot – End-to-end process flows**. Summarised end-to-end process flows are included in this document. The process flows were designed on the basis of illustrative user journeys, available in **Digital euro pilot – User journeys & minimum UX requirements**.

1.1 Illustrative user journeys

User journeys illustrate how the various functions and features of the beta digital euro are utilised from an end user perspective and provide an overview of specific user-related processes.

FUR.01 The user journeys are illustrative of the intended outcomes and are not directly binding for pilot PSPs.

FUR.02 Pilot PSPs may offer additional features not included in the illustrative user journeys.

1.2 Identification of end users

1.2.1 Digital Euro Access Number (DEAN)

A DEAN is the unique account number assigned to an end user's beta digital euro account, enabling identification of both the end user and their account among others, and facilitating transactions with individual end users or business end users. During the pilot, the DEAN reflects the beta digital euro nature and not the digital euro as defined by the digital euro Regulation.

FUR.03 When onboarding a new end user, pilot PSPs shall provide them with a Digital Euro Access Number (DEAN) requested from the digital euro service platform (DESP).

FUR.04 A DEAN is requested by a pilot PSP from the DESP. The DESP generates the DEAN and then provides it to the requesting pilot PSP. The pilot PSP then assigns the DEAN to the end user who wishes to use pilot payment services.

FUR.05 The DEAN is independent of the requesting pilot PSP and does not rely on country identification.

FUR.06 DEAN is pilot PSP and country agnostic.

FUR.07 DEANs are composed of 18 alphanumeric characters and respect a specific structure:

1. The first two characters are the Latin alphabetic characters 'E' and 'U'.
2. The third and fourth characters are two check digits generated using the ISO/IEC 7064, MOD 97-10 algorithm.
3. The fifth to eighteenth characters are 14 digits known as the Basic European Account Number (BEAN).

1.2.2 Alias

The DEAN is the basic identifier for payment transactions in beta digital euro, yet it can be accompanied by alternative identification means – an alias. The alias could be used in the same way as the DEAN for identifying the individual end user in the payment process as long as the alias is registered.

FUR.08 The use of an alias by the end user is voluntary. If an end user chooses to use an alias, he/she will have to provide one to its pilot PSP.

FUR.09 Pilot PSPs shall support the alias registration.

FUR.10 Individual end users can use an alias, mapped to the corresponding DEAN, for identifying their account and using pilot payment services.

FUR.11 An alias shall only be a phone number that is owned by and/or attributed to the individual end user.

FUR.12 There is only a one-to-one relationship between the alias (phone number) and DEAN.

FUR.13 Pilot PSPs shall perform an alias verification when registering alias (e.g. sending a one-time password to the phone number provided by the individual end user and the individual end user needs to enter it in the app or the internet banking application). Should the alias already be registered with the pilot PSP for the respective end user is the verification not needed.

FUR.14 In case an individual end user's mobile number changes, then the individual end user should be able within the set of access management features offered by his/her pilot PSP to request the change of alias. His/her pilot PSP should then take the request further to the DESP component – following the alias verification as outlined above. It is also recommended that

pilot PSPs put in place a periodic reconfirmation requirement to ensure that their customers' alias is still up to date.

FUR.15 Business end users are not able to use an alias as an identification method.

1.3 Authentication of individual end users

1.3.1 Individual end users onboarded on the digital euro app

FUR.16 Once developed and made available by the Eurosystem, pilot PSPs shall implement and make available seamless authentication for m-commerce transactions. Seamless authentication relies on public key cryptography and the use of biometrics (or alternatively a PIN depending on end user's preferences) and aims at allowing consumers to stay in the merchant app environment to authenticate, consent and initiate a transaction without any visible redirection to another authentication app.

FUR.17 Pilot PSPs shall offer individual end users the possibility to enroll into the seamless authentication solution when the individual end user onboards on its mobile device. Redirection will be the default authentication in the digital euro app, while seamless authentication will be offered for selected use cases.

FUR.18 For e-commerce transactions, decoupled authentication using biometrics or a PIN via a notification in the individual end user's digital euro app is the authentication method.

1.3.2 Individual end users relying on pilot PSPs' digital instruments

FUR.19 Pilot PSPs are free to implement their preferred strong customer authentication method when individual end users rely on their digital instruments, including the support of EDIW (for online payment transactions only). The authentication method shall comply with all applicable regulatory frameworks and associated security requirements.

FUR.20 Pilot PSPs must abide by the minimum User Experience (UX) requirements as set in **Digital euro pilot – User journeys & minimum UX requirements**.

1.3.3 Authentication for offline payment transactions

FUR.21 Authentication for offline payment transactions (P2P) relies on the device's local authentication mechanisms for both the digital euro app and proprietary pilot PSP app. For offline operations that require internet connectivity, such as (de)funding or device

deactivation, the same authentication approach used for online payment transactions is applied (refer to **sections 1.3.4**).

1.4 Pilot payment services - steps and requirements

This section provide a high-level description of the pilot payment services (for a detailed list, refer to **PSP Call for expression of interest – Annex 1 – Pilot Payment Services**).

- **Access management – registration and management of end users:** describes the processes for onboarding, offboarding, and lifecycle management for end users (see **section 1.3.2**).
- **Liquidity management – issuance and redemption of a beta digital euro:** describes manual funding/defunding of the end user’s DEAN from and to a commercial bank money account, to be available 24 hours a day during all calendar days of the year. It also describes the steps to enforce the end user’s holding limit (see **section 1.3.3.5**).
- **Transaction management – processing of payment transactions:** describes the services that enable end users to make payment transactions in beta digital euro (through a one-off service). It comprises activities including authentication, transaction initiation and payment confirmation/rejection (see **section 1.3.4**).

Access management	Liquidity management	Transaction management
Onboarding of end users	Funding	Person-to-Person payment
End user lifecycle management	Defunding	E-/m-commerce payment
Offboarding of end users	Reverse waterfall	Point-of-sale payment
	Waterfall	Refund
	Holding limit	

Figure 3-1 High-level overview of pilot payment services

1.4.1 Functional requirements specific naming conventions

This section describes the naming conventions used. The descriptions are based on the concepts of process and process-step:

- A **process** refers to an end-to-end completion of the major business functions/a major business function carried out by [one of] the different parties involved.
- A **process-step** is defined as the realisation of each step of one process executed by the parties involved in that step.

1.4.2 Access management

1.4.2.1 Onboarding of end users

FUR.22 Pilot PSPs are responsible for the onboarding of end users.

FUR.23 Pilot PSPs shall comply with the applicable business rules and end-to-end process flows for the onboarding of an end user as defined in this subsection.

Onboarding can take place online within a pilot PSP's proprietary app integrating the pilot payment services, or through the digital euro app offered by the Eurosystem.

Onboarding consists of activities that provide an end user access and ability to use the beta digital euro online and offline, including the allocation of DEAN(s) and the provisioning of payment instruments.

Individual end users may ask for a registration of an alias to receive online payments, in addition to being addressable via a DEAN.



Figure 3-2 High level flow for the onboarding of an end user

Description of steps:

1. The end user requests its pilot PSP to provide access to pilot payment services.
2. The pilot PSP onboards (only if unknown) and/or authenticates the end user according to its processes and applicable regulations.
3. The pilot PSP requests the DESP to generate a DEAN mapped to the pilot PSP.
4. The DESP generates a DEAN and maps it to the pilot PSP.
5. The DESP returns the generated DEAN and confirms to the pilot PSP the updated mapping.
6. The Pilot PSP receives and links the DEAN to the end user, activates the end user's payment instruments and sets up liquidity management and notification preferences (if requested by the end user).
7. The pilot PSP informs the end user about successful onboarding and shares the DEAN associated with the end user.



Business rules	
Individual end user business rules	
AM-011-001	An individual end user can have only one DEAN.
AM-011-002	An individual end user can have only one offline device.
AM-011-003	Upon receipt of an onboarding request from an individual end user, the pilot PSP shall check whether the individual end user already holds a DEAN.
AM-011-005	When opening a new DEAN upon the individual end user's onboarding request, the pilot PSP must request a DEAN and registration of the individual end user in the DESP, including the mapping to itself as the corresponding pilot PSP and including a potential alias.
End-to-end process flows	
AM-1.1	Onboarding of an individual end user (online and offline)
AM-1.2	Onboarding of a business end user (online)
AM-1.3	Digital euro app configuration and onboarding of an individual end user

1.4.2.2 Lifecycle management

FUR.24 Pilot PSPs are responsible for the lifecycle management of end users and for enabling an end user to interact with the beta digital euro environment.

FUR.25 Pilot PSPs shall comply with the business rules and end-to-end process flows for the lifecycle management of an end user as defined in this subsection.

The pilot payment services on individual end user lifecycle management includes the following features:

- manage DEAN(s) (including DEAN blocking and unblocking);
- view, register or edit profile settings such as alias(-es);
- enable/disable different types of notifications;
- checking beta digital euro balance and transaction history;
- block and unblock payment instruments.

Business rules - Managing DEAN(s)	
Individual end user business rules	
AM-021-001	The pilot PSP must give individual end users the possibility to block and unblock their DEAN. Individual end users can only unblock their DEAN if they have blocked it



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	themselves (i.e. if it was not blocked by the pilot PSP for e.g. compliance or fraud reasons).
Business rules - Viewing, registering or editing profile settings such as alias(-es)	
Individual end user business rules	
AM-021-002	The pilot PSP is only allowed to register aliases for individual end users to which it provides pilot payment services.
AM-021-003	The pilot PSP is only allowed to register aliases for individual end users.
AM-021-004	The pilot PSP must give individual end users the possibility to register, change or disable an alias. Individual end users can choose not to register an alias.
AM-021-005	Registration of an alias, changes to an alias registration and disablement of an alias are executed at the request of the individual end user.
AM-021-006	Only one alias can be registered per DEAN.
AM-021-007	The pilot PSP must verify that the alias provided is available to the individual end user.
AM-021-008	The pilot PSP must manage its individual end user's aliases by promptly updating, amending and deactivating them as soon as a change is required by the individual end user.
AM-021-009	The pilot PSP is responsible for the correctness of the association between the alias and the individual end user's DEAN and shall be liable for any damage caused by an incorrect association.
AM-021-010	The pilot PSP is not permitted to use the registered alias(es) received as part of a payment instruction/request for any other purpose than the initiation of a payment transactions.
Business rules - Enabling/disabling different types of notifications	
Individual end user business rules	
AM-021-011	The pilot PSP must allow individual end users to specify for which events they wish to receive at least the following notifications: <ul style="list-style-type: none">• a credit to their DEAN• a debit to their DEAN• execution of a waterfall transaction• execution of a reverse waterfall transaction
AM-021-012	The pilot PSP must allow individual end users to select the means of notification.
AM-021-013	The pilot PSP must allow individual end users to modify their notification settings at any point in time.
Business rules - Viewing and adding/removing linked commercial bank money account(s)	
General business rules	



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AM-020-001	The commercial bank money account to be linked to a DEAN can be any payment account held by the end user at the same pilot PSP which services that end user's DEAN.
Individual end user business rules	
AM-021-014	The pilot PSP must allow individual end users to link a commercial bank money account to their DEAN for funding and defunding purposes including waterfall and reverse waterfall (see section 1.3.3), either during onboarding or at any later point in time.
AM-021-015	The pilot PSP must allow individual end users to change or remove the link to a commercial bank money account at any point in time. If the individual end user chooses to remove the linked payment account, all liquidity management options, including waterfall and reverse waterfall, must be disabled as well.
Business end user business rules	
AM-022-004	The pilot PSP must ensure that a business end user links a commercial bank money account(s) to their beta digital euro account(s) and must allow to change the link to a payment account(s), while ensuring that a business end user's DEAN has a commercial bank money account linked to it at all times.
Business rules - Checking balance and transaction history	
General business rules	
AM-020-002	For online holdings, the pilot PSP must inform the end user about the current online balance and transaction history at the end user's request. For offline holdings, the pilot PSP must inform the end user of the current offline balance stored locally on the end user's offline device.
Business rules - Blocking and unblocking payment instruments	
Individual end user business rules	
AM-021-017	The pilot PSP must give individual end users the ability to block, unblock, add, or remove their payment instrument(s) (e.g., app, offline device).
AM-021-018	The pilot PSP must verify that the end user reporting a stolen or lost payment instrument is indeed the authorised individual end user of the payment instrument.
AM-021-019	The pilot PSP must ensure that a disabled payment instrument is not allowed to initiate or receive transactions, to fund or defund or to query transactions.
AM-021-020	The pilot PSP must change the status of the payment instrument from disabled to enabled when it is reported found or recovered by the authorised individual end user.
AM-021-021	When an offline device connects online, the pilot PSP must check whether the offline device has been reported lost or stolen and if so the status of the offline device shall be set as disabled.
Business end user business rules	

AM-022-005	The pilot PSP must give business end users the possibility to block, unblock, add or remove their acceptance solution(s) (e.g. SoftPOS terminal, payment gateway, offline device). Business end users can only unblock their acceptance solution(s) if blocked on their behalf (i.e. if not blocked by the pilot PSP for e.g. compliance or fraud reasons).
End-to-end process flows	
AM-4.1.1	Individual end user amendments (account linkage)
AM-4.1.2	Individual end user amendments (liquidity management settings)
AM-4.1.3	Individual end user amendments (online notification preferences)
AM-4.1.4	Individual end user amendments (offline notification preferences)
AM-4.1.5	Individual end user amendments (un-blocking payment instrument(s))
AM-4.1.6	Individual end user amendments (un-blocking DEAN)
AM-4.1.7	Individual end user amendments (de-activate form factors)
AM-4.1.8	Individual end user amendments (user data)
AM-4.1.9	Individual end user amendments (alias registration)

1.4.2.3 Offboarding of end users

FUR.26 Pilot PSPs are responsible for the offboarding of end users.

FUR.27 Pilot PSPs shall comply with the business rules and end-to-end process flows for the offboarding of an end user as defined in this subsection.

The offboarding is a procedure initiated to close the end users' DEAN. The pilot PSP shall be able to return the funds associated with a DEAN or an offline device to the offboarding end user (online and offline defunding) and disable access to payment instruments or acceptance solutions.



Figure 3-3 - High level flow for the offboarding of an end user

Description of steps:

1. The end user requests the pilot PSP to be offboarded from pilot payment services.
2. The pilot PSP authenticates the end user, locks the beta digital euro account and payment instrument(s).



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3. If the end user's DEAN has a positive balance (online and/or offline), the pilot PSP sends a defunding instruction to DESP to defund the beta digital euro holdings (for online the defunding is triggered by the pilot PSP, while for offline defunding is triggered by the end user).
4. The DESP validates and defunds the end user's DEAN.
5. The DESP confirms the defunding to the pilot PSP.
6. The pilot PSP credits the commercial bank money account.
7. The pilot PSP requests the DESP to close the end user's DEAN and deactivate end user registration.
8. The DESP deactivates the end user registration and closes the end user's DEAN.
9. The DESP confirms the deactivation of end user registration and closing of the end user's DEAN to the pilot PSP.
10. The pilot PSP disables pilot payment services and payment instrument(s) for the offboarded end user.
11. The pilot PSP informs the end user about successful offboarding.

Business rules	
General business rules	
AM-040-001	End users can request their pilot PSPs to be offboarded at any point in time. A pilot PSP can only reject such a request for any of the following reason: <ul style="list-style-type: none">• the end user's DEAN(s) is (are) blocked by the pilot PSP for e.g. compliance or fraud reasons.
Individual end user business rules	
AM-041-001	The pilot PSP accepting the offboarding of an individual end user must ensure that the end user can neither receive nor send any further payment transactions and that the individual end user's online and/or offline holdings are defunded and offline device deactivated prior to the completion of the offboarding.
Business end user business rules	
AM-042-001	The pilot PSP accepting the offboarding of a business end user must ensure that the business end user can neither receive nor send any further payment transactions and that the offline device(s) is (are) deactivated prior to the completion of the offboarding.
AM-042-002	The pilot PSP accepting the offboarding of a business end user must ensure that a DEAN for that business end user is maintained after closure for the purpose of processing refunds, until the formal conclusion of the pilot.
End-to-end process flows	

AM-3.1	Offboarding of an individual end user (online and offline)
AM-3.2	Offboarding of a business end user (online and offline)

1.4.3 Liquidity management

Pilot PSPs shall support liquidity management of end users within the holding limit (see [section 1.3.3.5](#)), supporting the full range of methods for end users to fund (see [section 1.3.3.1](#)) and defund (see [section 1.3.3.2](#)) their holdings.

To maximise payment convenience, an individual end user may choose to link an online DEAN to a commercial bank money account to pay with beta digital euro even though available beta digital euro holdings do not suffice (see [section 1.3.3.3](#)) or receive a payment transaction that would exceed the holding limit and defund the amount in excess (see [section 1.3.3.4](#)). In these cases, the individual end user has the option to set up reverse waterfall and waterfall functionalities, which requires linking an existing commercial bank money account with the online DEAN.

Neither a commercial bank money account nor a link between such an account and an online DEAN are prerequisites for individual end users to receive access to pilot payment services. A business end user shall always link the DEAN(s) to a commercial bank money account enabling (at least) the waterfall function necessary to enforce the business end user's holding limit.



Figure 3-4 High level flow for a manual (de)funding operation

Description of steps:

1. The end user initiates (de)funding of the DEAN.
2. The pilot PSP assures the end user is authenticated and that sufficient funds are available for (de)funding.
3. The pilot PSP sends the (de)funding instruction to the DESP.
4. The DESP validates and (de)funds the end user's DEAN.
5. The DESP confirms completion of the (de)funding operation to the pilot PSP.
6. The pilot PSP confirms the (de)funding of the DEAN to the end user.

1.4.3.1 Funding

FUR.28 Pilot PSPs shall support the full range of funding functionalities for end users to fund their holdings.

FUR.29 Pilot PSPs shall comply with the applicable business rules and end-to-end process flows for funding as defined in this subsection.

The funding functionalities allow end users to manually fund their holdings online and offline. Funding can only be done from a commercial bank money account held at the same pilot PSP that services the end user's DEAN. Manual funding from commercial bank money account shall be available 24 hours a day and on all calendar days of the year.

Offline funding

- Offline manual funding from a commercial bank money account;
- Offline manual funding from online holdings;

Manual funding from a commercial bank money account may be triggered by the end user from any payment account held by the end user at the same pilot PSP that services the end user's DEAN.

Business rules	
General business rules	
LM-020-001	The pilot PSP shall ensure that the manual funding functionalities from a commercial bank money account are available to end users on 24 hours a day and on all calendar days of the year. The commercial bank money account can be any payment account held by the end user at either the same pilot PSP which services the end user's DEAN or at another pilot PSP that is a pilot PSP.
Individual end user business rules	
LM-021-001	The pilot PSP must offer individual end users the possibility to fund its offline device from online holdings. This requires the pilot PSP to request defunding first (see section 1.3.3.2), followed by a funding request (see section 1.3.3.1).
LM-021-006	If the individual end user has linked a commercial bank money account to the DEAN, this linked payment account should be presented by the pilot PSP as the default source account for manual funding.
End-to-end flows	



Online end-to-end process flows	
LM-1.1	Online manual funding from commercial bank money account– same pilot PSP
Offline end-to-end process flows	
LM-1.8	Offline manual funding from commercial bank money account via app
LM-1.9	Offline manual funding from online holdings via app

1.3.3.2 Defunding

FUR.30 Pilot PSPs shall support manual defunding functionalities for end users to defund their beta digital euro holdings.

FUR.31 Pilot PSPs shall comply with the applicable business rules and end-to-end process flows for defunding as defined in this subsection.

Defunding functionalities allow end users to manually defund their holdings online and offline. Defunding can only be done to a commercial bank money account held at the same pilot PSP that services the end user's DEAN. Defunding functionalities to a commercial bank money account shall be available 24 hours a day and on all calendar days of the year.

Online defunding

- Online manual defunding to a commercial bank money account;

Offline defunding

- Offline manual defunding to a commercial bank money account;
- Offline manual defunding to online holdings;

Manual defunding to a commercial bank money account can be triggered by the end user from any payment account held by the end user at the same pilot PSP that services the end user's DEAN.

Business rules	
General business rules	
LM-040-001	The pilot PSP must ensure that manual defunding functionalities to a commercial bank money account are available to end users 24 hours a day and on all calendar days of the year. The commercial bank money account must be held by the end user at the same pilot PSP which services the end user's DEAN.



LM-040-003	The pilot PSP must credit the end user's commercial bank money account immediately after receiving the confirmation from DESP that the defunding instruction has been settled.
Individual end user business rules	
LM-041-001	The pilot PSP must offer individual end users the possibility to defund its offline device to online holdings. This requires the pilot PSP to request defunding first (see section 1.3.3.2), followed by a funding request (see section 1.3.3.1).
LM-041-002	The pilot PSP must support manual defunding functionalities for individual end users. Defunding must be initiated by the end user and processed manually, allowing the end user to transfer holdings to a commercial bank money account held at the same pilot PSP.
LM-041-004	If the individual end user initiates manual defunding and the defunding amount is not available on the DEAN, the defunding process must be aborted, and the pilot PSP must inform the individual end user.
LM-041-005	If the individual end user initiates manual defunding after processing an incoming transaction to their DEAN, the pilot PSP shall ensure the defunding process is completed manually, subject to the available balance on the DEAN.
End-to-end process flows	
Online end-to-end process flows	
LM-2.1	Online manual defunding to commercial bank money account same pilot PSP
Offline end-to-end process flows	
LM-2.10	Offline manual defunding to commercial bank money account via app
LM-2.11	Offline manual defunding to online holdings via app

1.3.3.3 Reverse waterfall

The reverse waterfall functionality allows an individual end user to automatically transfer money from the linked commercial bank money account, if holdings are not sufficient to complete a payment transaction. The activation of the reverse waterfall is mandatory for business end users to enforce business end user's online holding limit while ensuring an adequate user experience when paying a business end user in beta digital euro (see **section 1.3.3.5**).

The reverse waterfall is solely available for online payment transactions.

In case the individual end user does not have sufficient holdings, the reverse waterfall (if activated by the individual end user) will be triggered to cover for the insufficient holdings to perform the outgoing payment transactions. The check whether reverse waterfall is required is integrated into the pre-settlement validation of an online payment transactions (so called 'balance pre-check', executed by the



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payer's pilot PSP). Likewise, the settlement of reverse waterfall is fully integrated into the settlement of an online payment transactions.

If the reverse waterfall is not activated, or if it fails due to, e.g., insufficient funds on the linked commercial bank money account (within the financial agreement specified between the individual end user and the pilot PSP providing the commercial bank money account), both the payment transaction and the reverse waterfall will be rejected.

Further details on the management of beta digital euro transactions can be found under **section 1.3.4**.

Business rules	
General business rules	
LM-030-001	The pilot PSP must ensure that the reverse waterfall functionality is available to end users on 24 hours a day and on all calendar days of the year.
LM-030-002	If reverse waterfall is required, the pilot PSP must instruct the funding of the transaction amount deducted from the end user's balance.
LM-030-003	If a transaction including reverse waterfall fails, the pilot PSP must immediately reverse the debit made on the end user's commercial bank money account
Individual end user business rules	
LM-031-001	The pilot PSP must allow individual end users to activate or deactivate the reverse waterfall option.
LM-031-002	The pilot PSP must allow individual end users to specify that the reverse waterfall can only be applied if the linked commercial bank money account holds sufficient balance, within the financial agreement specified between the individual end user and the pilot PSP providing the commercial bank money account.
Business end user business rules	
LM-032-001	The pilot PSP must ensure that a business end user has activated the reverse waterfall option at all times.
End-to-end process flows	
The reverse waterfall is directly integrated into the following end-to-end process flows that are part of the beta digital euro pre-transaction processing	
sTM-31	Balance pre-check payer sub-flow.

1.3.3.4 Waterfall

FUR.32 An individual end user may allow automatic transfers of money to the linked commercial bank money account via a waterfall functionality if the online holding limit is reached.



FUR.33 Pilot PSPs shall comply with the applicable business rules and end-to-end process flows for the waterfall functionality as defined in this subsection.

The waterfall functionality allows an individual end user to automatically transfer money to the linked commercial bank money account, if the online holding limit is reached. The activation of the waterfall is mandatory for business end users to enforce business end users online holding limit when accepting payment transactions.

The waterfall functionality is solely available for online payment transactions.

In case an incoming payment transaction would exceed the end user's holding limit, the waterfall (if activated by the end user) will be triggered for the excess amount above the holding limit (current balance plus transaction amount minus holding limit). The check whether waterfall is required is integrated into the pre-settlement validation of an online payment transactions (so called 'balance pre-check' executed by payee's pilot PSP). Likewise, the settlement of waterfall is integrated into the settlement of an online payment transactions.

If the waterfall is not activated, or if it fails, with an incoming payment transaction exceeding the holding limit, both the payment transactions and the waterfall will not be processed.

Further details on the management of payment transactions can be found under **section 1.3.4**.

In exceptional circumstances an additional waterfall may be necessary after settlement confirmation to handle the following scenario (so-called post-settlement holding limit check):

- Incoming payment transactions 1 is received. The check is performed to verify if it would result in a breach of the holding limit. This is not the case. Waterfall is not triggered.
- Incoming payment transactions 2 is received while transaction 1 has not yet been settled. The check is performed to verify if it would result in a breach of the holding limit. This is not the case at this point in time. However, after settlement of incoming transaction 1, transaction 2 would breach the holding limit. Waterfall is not triggered by the standard validation. To ensure the holding limit, the additional waterfall step is performed after settlement. Further details can be found in the relevant end-to-end process flows – **Digital euro pilot – End-to-end process flows**.

Business rules	
General business rules	
LM-050-001	The pilot PSP must ensure that the waterfall functionality is available to end users on 24 hours a day and on all calendar days of the year.



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LM-050-002	If waterfall is required, the pilot PSP must instruct the defunding of the excess amount above the holding limit (current balance plus payment transactions amount minus holding limit).
LM-050-003	The pilot PSP must credit the end user's commercial bank money account immediately after receiving the confirmation from DESP that the waterfall instruction has been settled.
Individual end user business rules	
LM-051-001	The pilot PSP must allow individual end users to activate or deactivate the waterfall option.
Business end user business rules	
LM-052-001	The pilot PSP must ensure that a business end user has the waterfall activated at all times.
End-to-end process flows	
The waterfall is integrated into the (post-) transaction processing and is represented by the following end-to-end process flows:	
sTM-33	Balance pre-check payee sub-flow
sTM-32	Post-settlement holding limit check (waterfall) sub-flow

1.3.3.5 Holding limit

FUR.34 Pilot PSPs shall comply with the business rules applicable to enforcing end users' holding limits as defined in this subsection.

Business rules	
General business rules	
LM-010-001	The pilot PSP is responsible for enforcing the end user's online holding limit.
Individual end user business rules	
LM-011-001	At no point in time shall the total sum of beta digital euro held by an individual end user exceed the individual end user's holding limit.
LM-011-002	An online DEAN owned by an individual end user has a holding limit assigned to it. This holding limit can never be exceeded.
LM-011-003	An offline device owned by an individual end user has a holding limit assigned to it. This holding limit can never be exceeded.
Business end user business rules	
LM-012-001	An online DEAN owned by a business end user has a holding limit of zero. Any online beta digital euro received by a business end user shall be defunded combined with the beta digital euro transaction via the waterfall functionality (see section 1.3.3.4).



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LM-012-002	An offline device owned by a business end user has a holding limit assigned to it. Offline holdings received by a business end user shall be defunded as soon as technically possible, down to the defined threshold. The business end user's offline device shall initiate a defunding operation towards the linked commercial bank money account as soon as a network connection is available (see section 1.3.3.2).
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1.3.4 Transaction management

FUR.35 Pilot PSPs shall be responsible for the transaction management outlining the ways of end user's paying and receiving payments at any time (24 hours a day and on all calendar days of the year) and everywhere.

FUR.36 Pilot PSPs shall comply with the business rules applicable to the general management and processing of payment transactions as defined in this subsection.

Pilot PSPs are responsible for the transaction management outlining the ways of end users paying and receiving payments at any time (24 hours a day and on all calendar days of the year) and everywhere. This involves providing a variety of payment instruments and acceptance solutions, such as payment apps for individual end users, and physical or virtual points of interaction for business end users, like SoftPOS or e/m-commerce systems. These instruments and solutions are supported by different communication technologies (e.g. NFC, and possibly an alias). The beta digital euro can be used in various payment transactions:

- (online and offline) P2P payment transactions (see **section 1.3.4.1**),
- (online) e-commerce and m-commerce payment transactions (see **section 1.3.4.2**), and
- (online) SoftPOS payment transactions (see **section 1.3.4.3**).

Offline payment transactions occur directly between payer and payee devices, enforcing any relevant rules locally on the device. Since pilot PSPs are not involved in these transactions, details about offline transactions will not be further covered in this section, except for references to the offline end-to-end process flows.

Online payment transactions processing depends on the payment instruments and acceptance solutions used and can fall into two categories with regard to the required interactions between the involved parties (payer, payee, payer's pilot PSP, payee's pilot PSP and DESP). The payment process begins when the first request, containing payment information (and settlement details, if initiated by the payer's pilot PSP), reaches the DESP:

- If the initial request with payment information is sent by the payee's pilot PSP, it is considered a payee-initiated payment.
- If the initial request comes from the payer's pilot PSP, it is a payer-initiated payment and also includes settlement details.

A high level flow of a payer-initiated online payment transactions using the example of a simplified P2P payment is shown in **Figure 3-5**.

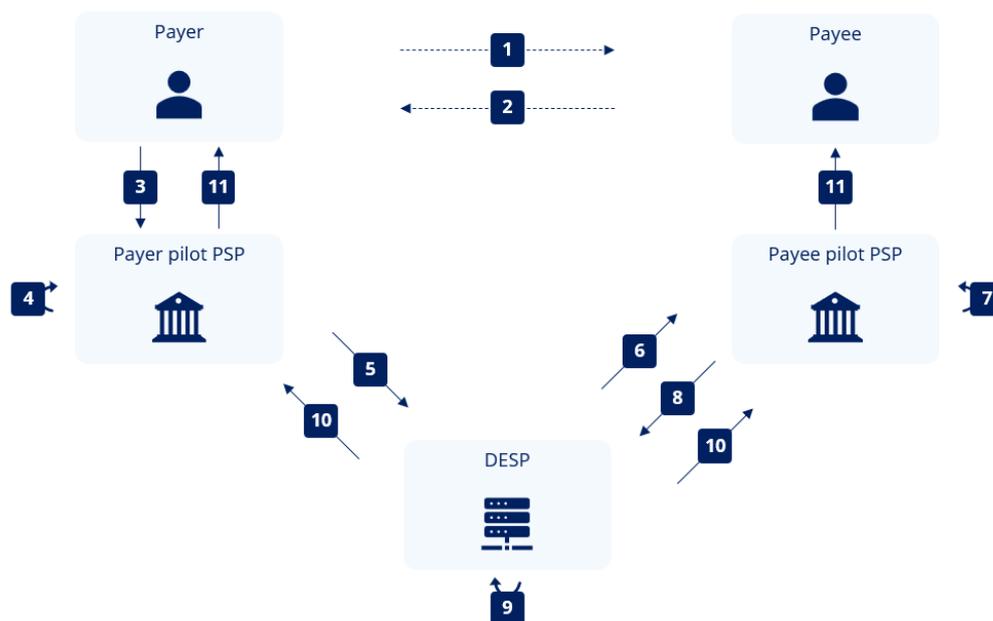


Figure 3-5 High level flow of a payer-initiated online transaction - P2P payment

Description of steps:

1. and 2. The payer and payee agree on the payment details and amount (*optional depending on the payment method used*).
3. The payer initiates the payment transactions with its pilot PSP.
4. The payer's pilot PSP validates the payment transactions.
5. The payer's pilot PSP submits the payment transactions to the DESP.
6. The DESP forwards the payment transactions to the payee's pilot PSP for validation.
7. The payee's pilot PSP validates the payment transactions.
8. The payee's pilot PSP sends the validation response to the DESP.
9. The DESP initiates the settlement instruction, after the involved pilot PSPs have confirmed and provided the settlement information, and settles the transaction.

10. The DESP confirms the settlement to the involved pilot PSPs.

11. The involved pilot PSPs confirm the settlement to the payer and the payee respectively.

A high level flow of a payee-initiated online payment transactions using the example of a simplified SoftPOS payment is shown in **Figure 3-6**.

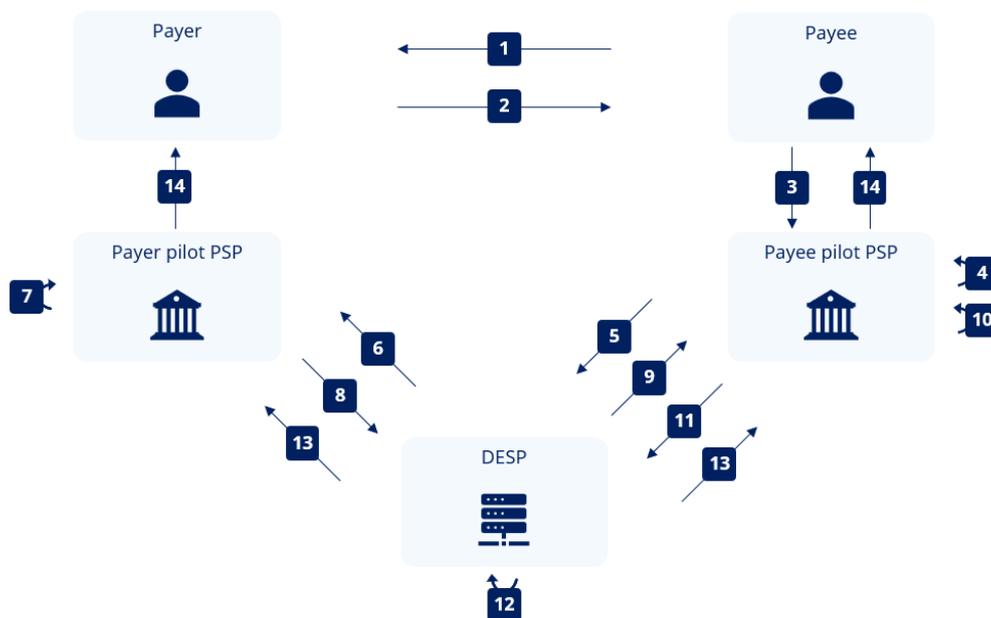


Figure 3-6 High level flow of a payee-initiated online transaction – SoftPOS payment

Description of steps:

1. The payee presents the amount payable to the payer at the SoftPOS.
2. The payer verifies the payment by authenticating and presenting the payment instrument.
3. The payee initiates the payment authorisation request, including consent details with its pilot PSP.
4. The payee’s pilot PSP validates the payment authorisation request.
5. The payee’s pilot PSP submits the payment authorisation validation request to the DESP.
6. The DESP forwards the payment authorisation validation request to the payer’s pilot PSP for validation.
7. The payer’s pilot PSP validates payment authorisation validation request.
8. The payer’s pilot PSP submits the payment transaction to the DESP.
9. The DESP forwards the payment transaction to the payee’s pilot PSP for validation.



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10. The payee's pilot PSP validates the payment transaction.
11. The payee's pilot PSP sends the validation response to the DESP.
12. The DESP initiates the settlement instruction, after the involved pilot PSPs have confirmed and provided the settlement information, and settles the transaction.
13. The DESP confirms the settlement to the involved pilot PSPs.
14. The involved pilot PSPs confirm the settlement to the payer and the payee respectively.

The business rules applicable to the general management and processing of payment transactions are included in the box below.

Business rules	
General business rules	
TM-000-001	The pilot PSP shall ensure that paying and receiving payments in beta digital euro is possible for end users on 24 hours a day and on all calendar days of the year.
TM-000-002	The pilot PSP shall perform validations of payment transactions (including funding/defunding).
TM-000-003	If the pilot PSP rejects a payment transactions from its end user or receives a rejection notification from DESP, the pilot PSP shall ensure that reason for the reject is communicated in a clear and easy to understand manner to the end user.
TM-000-004	Upon receipt of the settlement confirmation from the DESP, the pilot PSP immediately updates the end user's balance and notifies the end user in accordance with the end user's notification preferences (see section 1.4.4.2).
TM-000-005	The payer pilot PSP must verify that the payer either <ul style="list-style-type: none">• holds sufficient beta digital euro to complete the payment transactions, or• has a linked commercial bank money account which holds sufficient balance to compensate for the insufficient holdings, within the financial agreement specified between the end user and the pilot PSP providing the commercial bank money account, and has activated the reverse waterfall option (see section 1.3.3.3).
TM-000-006	The pilot PSP submitting a payment transactions to the DESP must ensure that at least one party that is to be debited (payer) or credited (payee) in the transaction is an individual end user.
TM-000-007	The payer's pilot PSP must accept all payment transactions received from either DESP or the payer that for processing, unless the identified payer account is closed, invalid or being monitored for suspected fraudulent or other illegal activity.



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TM-000-008	The payee's pilot PSP must accept all payment transactions received from either DESP or the payee for processing, unless the identified payee account is closed, invalid or being monitored for suspected fraudulent or other illegal activity.
TM-000-009	The pilot PSP must make the status/result of a payment transactions known to its end user immediately.
TM-000-010	Payment transactions cannot be cancelled once sent to the DESP.
Individual end user business rules	
TM-001-001	<p>If the payee is an individual end user, the payee's pilot PSP must verify that the payment transactions either;</p> <ul style="list-style-type: none"> • would not result in the payee's beta digital euro balance exceedance of the holding limit, or • would result in the triggering of the waterfall mechanism, if activated (see section 1.3.3.4).
TM-001-002	If the payee is an individual end user and the payee does not have a linked commercial bank money account with an activated waterfall option, the payee's pilot PSP must reject any further incoming payment transactions while an incoming transaction is still being processed.
Business end user business rules	
TM-002-001	If the payee is a business end user, the payee's pilot PSP must trigger the waterfall mechanism upon receipt of each incoming payment transactions (see section 1.3.3.4).

1.3.4.1 Person-to-Person payment

FUR.37 Individual end users may use the beta digital euro for initiating one-off P2P payment transactions.

FUR.38 Pilot PSPs shall comply with the end-to-end process flows for P2P payment transactions as stated in this subsection.

End-to-end process flows	
Online end-to-end process flows (payer-initiated)	
TM-3.5	P2P payment with alias (payer-initiated)
TM-3.10	P2P Account-to-account payment with DEAN (payer-initiated) – same PSP
Offline end-to-end process flows	



TM-3.4	Offline contactless P2P payment – mobile device to mobile device
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1.3.4.2 E-commerce or m-commerce payment

FUR.39 Individual end users and business end users may use the beta digital euro for initiating one-off e-commerce and m-commerce payment transactions.

FUR.40 Pilot PSPs shall comply with the end-to-end process flows for e-commerce/m-commerce payment transactions as stated in this subsection.

End-to-end process flows	
Online end-to-end process flows (payer-initiated)	
TM-2.4	M-Commerce payment (in-app)
Online end-to-end flows (payee-initiated)	
TM-2.2	E-commerce payment with alias or DEAN

1.3.4.3 Point-of-sale payment

FUR.41 Individual end users and business end users may use the beta digital euro for initiating one-off SoftPOS payment transactions.

FUR.42 Pilot PSPs shall comply with the end-to-end process flows for SoftPOS payment transactions as stated in this subsection.

End-to-end process flows	
Online end-to-end process flows (payee-initiated)	
TM-1.6	Online contactless SoftPOS payment with mobile device

1.3.4.4 Refund

FUR.43 Business end users may use the beta digital euro for initiating refunds.

FUR.44 Pilot PSPs shall comply with the business rules and end-to-end process flows for a refund as stated in this subsection.

Business end users may use the beta digital euro for initiating refunds. Refunds might be initiated online via the e-commerce website or the m-commerce app.



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Business rules	
General business rules	
TM-060-001	The payee's pilot PSP is not allowed to request decoding of the payer's details received as part of a refund.
Individual end user business rules	
TM-061-001	When the payer's pilot PSP receives a refund, it must verify that the refund either <ul style="list-style-type: none">• would not result in the individual end user's balance exceedance of the holding limit, or• would result in the triggering of the waterfall mechanism (see section 1.3.3.4).
Business end user business rules	
TM-062-001	When initiating a refund, the payee's pilot PSP must ensure that the refund relates to an original payment transaction that has already been settled.
End-to-end process flows	
Online end-to-end process flows (payee-initiated)	
TM-7.2	Refund (e-commerce)