

PayCircle 1.0 Specification An Extract of the Payment Blueprints

AB-005-002



*Standards that get
m-commerce flowing*

Introduction

Document Structure

This document introduces a simple e-payment model first. This model has some limitations, but shows the most important business roles, functional entities and the relationships between them. In the first wave of deployments, this model is most likely to be the one to be implemented.

Building on the simple e-payments model, the document introduces different enhancements. The enhancements are hopefully orthogonal and thus can be combined. This approach allows isolating different issues for easier understanding.

Terms and Definitions

E-Payment

e-payment is the technology that allows to conduct payments via electronic communications and that does not involve any cash.

An **e-payment transaction** is an individual payment that is performed in an e-payment infrastructure.

Service

Within the scope of this document, the term *service* denotes a value delivered by a merchant to a customer and paid for by the customer by utilizing e-payment technology.

The term *service* serves as a generalization of concepts such as a Web application providing downloadable items or information, a vending machine selling soft drinks, a shop selling whatever items, or a mail order business mailing physical goods.

The merchant is used throughout this document for business entities that provide a service. This term is commonly used for somebody running a real world's shop. Within the scope of this document, we extend the term to all concepts covered by the term "service".

Business Layer

Functional Layer

Network Layer

Role

A role is an abstract concept in the business layer, defining a set of responsibilities in a payment process.

In a real deployment of an e-payment infrastructure, a particular business organization or an individual will assume each of the roles. Since a business organization will own and operate a certain administrative domain, the roles can be associated with the respective administrative domain.

Note that a business organization could assume multiple roles at a time. A very common example for this is a mobile network operator acting as both a payment service provider and a merchant. The mobile network operator would then assume the responsibilities defined for both roles. In this case, subscribers of the mobile network operator will act as customers.

Simple E-Payment Model

This simple e-payments model is the simplest possible one and the basis for the all other models.

Business Layer

Roles

The following roles are involved in a simple e-payment:

Customer: The customer is an actor who accesses a service that needs to be paid.

Typically, customers are individuals; very often they are mobile network subscribers. The customer could be a company, which is represented by its employees. Most likely, the customer is the one to pay for service access, however somebody else could pay the service fee partly or completely as well (sponsoring).

Merchant: The merchant is an actor who provides a service and requests a payment for service usage.

The term merchant is used more generally as in common language. Even if no physical merchandise is involved, such as for Web based weather forecasts, we call the provider a merchant.

Payment Service Provider (PSP): The payment service provider is an actor who enables merchants and customers to conduct payments with each other.

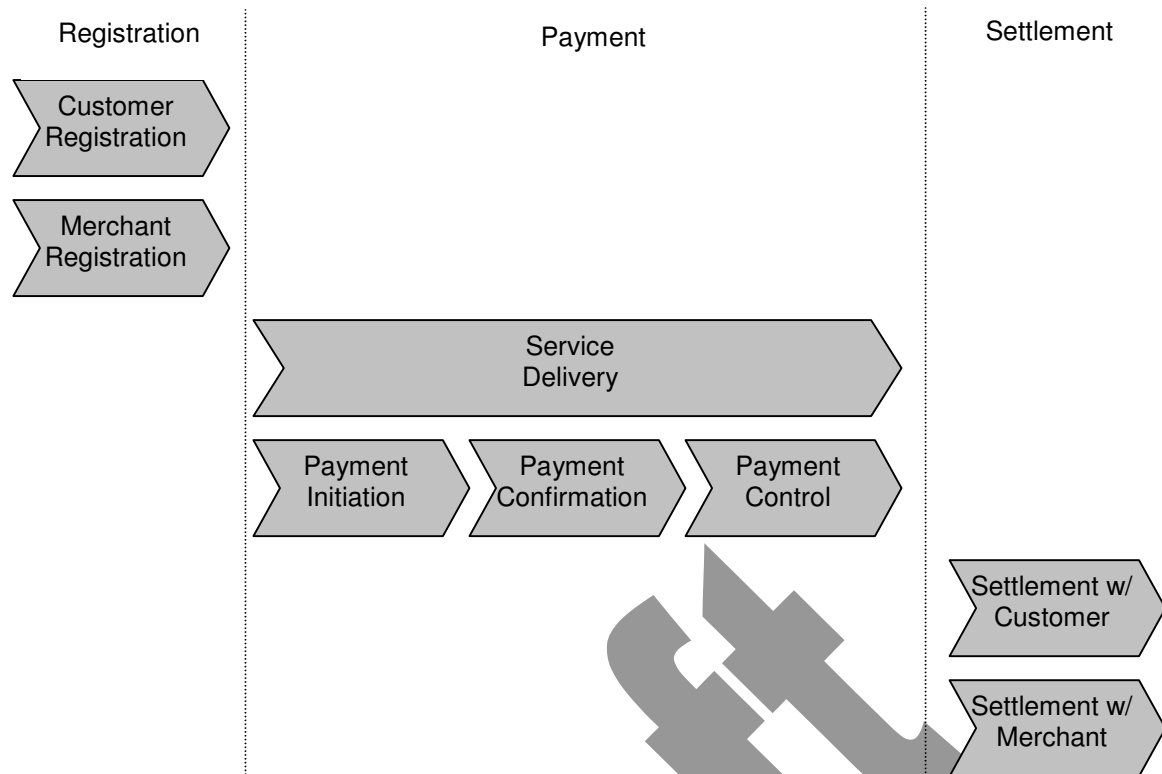
Typically, a utility provider (e.g. a mobile network operator) will take this role as an additional source of revenue. There could be a company as well that provides payment services to merchants and customers as their only business.

Financial Service Provider (FSP): The financial service provider is an actor who enables other parties to settle with each other.

In the scope of this document, it will be engaged by the PSP to settle with customers and merchants. Typically, a bank will take role of an FSP, but a credit card acquirer could serve as an FSP as well.

Payment Process

The payment process comprises a number of steps. Their chronological order is shown in the diagram below, a discussion of each step follows afterwards.



Customer and Merchant Registration: To participate in an e-payment, both the customer and the merchant need to register with the PSP for the respective roles.

The registration of customers may be done implicitly .e. g. as an option of a mobile network subscription, or explicitly, by signing an appropriate contract. The registration of merchants shall always be explicit.

Upon registration of a customer the PSP shall:

- Create an account for the customer,
- Assign one or multiple identification(s) to the customer. Typical identifications are: The customer's mobile phone number, or an identification specifically allocated by the PSP,
- Create a profile for the customer, which can be configured by the customer. The profile should specify the payment instrument the customer wants to use for settlement, the customer's preferences for payment confirmations, and other preferences by which the customer can control the payment process in an offline manner.

Upon registration of a merchant the PSP shall:

- Create an account for the merchant,
- Create authentication credentials for the merchant.

Service Delivery: Service delivery and payment processing happen concurrently, but there are synchronization points. There are the following options:

- The service is delivered completely first, then payment initiation, confirmation and further control happen.
- Payment initiation and confirmation happen first, then the service is delivered. After successful service delivery, merchant requests completion of the payment transaction through payment control.

- Payment initiation and confirmation happen first, then the service delivery starts. During service delivery, merchant requests stepwise progress of the payment transaction through payment control. After completion of the service delivery, the merchant requests completion of the payment transaction through payment control.

Payment Initiation: The merchant requests from the PSP to open a payment transaction between him and the customer.

The merchant shall indicate the paying customer and the expected amount of the payment.

Upon initiation of a payment, the PSP shall investigate if he can complete the payment by verifying:

- Can the initiator of the payment be identified and authenticated? Has the initiator of the payment been registered as a merchant?
- Has the specified customer been registered?
- Does the specified customer have sufficient credit?
- Does the customer accept the payment? This check is called payment confirmation and is discussed below.

If the PSP cannot ensure that the payment can be completed, the PSP shall reject the payment.

If the PSP can successfully verify that the payment can be completed, he will accept the payment. When accepting the payment, the PSP shall create a transaction context. Payment control, as described below, basically controls this transaction context.

Payment Confirmation: The customer confirms that he agrees to the payment.

The PSP should ensure that the customer is aware of the fact that he is about to pay for a service. There is an exception: The customer may authorize the PSP to accept payments without validating that the customer is aware of it, at least under certain circumstances. For example, the customer may authorize the PSP to accept payments issued by merchant X and not exceeding the amount Y per day, because the customer trusts merchant X and believes that this merchant will not initiate fraudulent payments.

Remark: A specific subject paper should investigate/categorize confirmation models in more detail. A reference to this document shall be added here.

Payment Control: The merchant controls a payment transaction that has been accepted upon the payment initiation process. Through payment control, the merchant may request

- To do a partial payment,
- To complete the payment transaction, or
- To cancel the payment transaction

To complete the payment, the PSP shall:

- Produce an accounts payable on the merchant's account
- Produce an accounts receivable on the customer's account.

The accounts receivable on the customer's account shall reflect the amount that has been requested by the merchant.

The accounts payable on the merchant's account may be smaller than the accounts receivable on the customer's account. The difference is considered as the PSP's earnings and shall be credited to an appropriate account.

Settlement with the customer: A financial transaction takes place between the PSP and the customer to reconcile the customer's debts. The FSP is engaged to actually perform the financial transaction.

The PSP may aggregate the accounts receivable on the customer's account during a billing period, and settle with the customer in a single financial transaction after the billing period is over, or the PSP may settle the accounts payable resulting from a single payment immediately. The PSP may decide for each payment to use either option.

At the end of the billing period, the PSP shall produce an invoice listing the aggregated payments.

Settlement with the merchant: A financial transaction takes place between the PSP and the merchant to reconcile the PSP's debts. The FSP is engaged to actually perform the financial transaction.

The PSP may aggregate the accounts payable on the merchant's account during a billing period, and settle with the merchant in a single financial transaction after the billing period is over, or the PSP may settle the accounts payable resulting from a single payment immediately. The PSP may decide for each payment to use either option.

At the end of the billing period, the shall PSP produce an invoice listing the aggregated payments.

The billing periods for customer and merchant shall be independent. The billing periods for multiple customers and multiple merchants are independent as well.

Relationships between the Business Roles

Customer and PSP: In the contract between the customer and the PSP, the parties shall agree on the following issues/responsibilities:

- The customer agrees that the PSP accepts payment request that specify the customer as the payer. They agree on a policy how the PSP can decide if a payment request is to be accepted or rejected. The policy could consider e.g. the amount to be paid, the general rating of the requesting merchant, or could require to initiate an interaction with the customer.
- The parties need to agree on a billing period.
- The parties agree if there will be a fee for using the payment service, and how much it will be.

Merchant and PSP: In the contract between the merchant and the PSP, the parties agree on the following issues/responsibilities:

- The PSP allows the merchant to request payments from customers that have subscribed to the PSP
- The PSP assumes responsibility to collect the requested amount from the respective customer through a clearing/settlement process.
- The parties agree on a billing period. During the billing period, the PSP stores payments from different customers but requested by the same merchant on an account that is associated with the merchant. At the end of the billing period, the PSP and the merchant settle with each other, which typically means that the PSP transfers to the merchant the major part of the payments collected on his behalf.
- The parties agree on a charging policy for the payment service. This could be a flat fee, or a percentage of each payment, or a mix of the two.
- The parties need to agree on who assumes a risk of fraud.

PSP and FSP: The PSP will have an agreement with am FSP (a bank or a credit card acquirer). This agreement will allow the PSP to

- Request payments from a customer, e.g. from his credit card, in order to settle the monthly bill with the customer or to recharge his prepaid account.
- Transfer payments towards a merchant at the end of a billing period.

Functional Plane

Functional Entities

Technically, there are the following functional entities:

User Agent: The user agent is an entity that interacts with a service or an application on behalf of the customer.

The user agent is typically built into a terminal device, such as a mobile phone, a PDA, a PC, or a vending machine. The customer controls the user agent through a man-machine interface, such as a graphical user interface.

The user agent comprises the following sub-functions:

- The **service agent** is responsible to render the service on the terminal device.
- The **confirmation agent** is responsible to perform the payment confirmation.

Examples for a user agent are:

- Web browsers
- WAP browsers.

The service accessed by the user agent requests that the customer pays for service usage. Therefore, entities providing a service or applications are called request engines.

Request Engine: A request engine is an entity providing a customer (or, more precisely, a customer's user agent) with a service and requesting payment for service usage.

The service is provided on behalf of a merchant, who owns the request engine. The request engine may also meter the usage of the service (accounting), for instance the number of kilobytes transferred.

The request engine contains the following sub-functions:

- The **service engine** implements the service delivery.
- The **payment agent** is responsible for the payment initiation and control. The payment agent synchronizes with the service engine to ensure that the payment transaction proceeds in sync with the service delivery.

Examples for request engines are:

- A Web server may provide static content, such as HTML pages, WML decks, digital photos or MP3 audio files.
- An application may provide a customer with functionality, such as fetching traffic information or playing online chess against another customer.
- A vending machine may offer soft drinks.
- A shop may offer goods and allow e-payments.

Payment Engine: The payment engine is the entity that is responsible for processing a payment transaction initiated and controlled by a request engine.

The payment engine maintains the payment transactions initiated and controlled by a request engine's payment agent. The payment engine is owned and operated by a PSP.

The payment engine comprises the following sub-functions:

- The **transaction management engine** implements the lifecycle of payment transactions.
- The **account management engine** maintains accounts for customers, merchants and the PSP himself. The accounts payable and accounts receivable that result from a completed payment transaction are stored on these accounts.

- The **confirmation agent** is responsible for requesting payment confirmation from the confirmation engine.
- The **settlement agent** is responsible for initiating the settlement process with either the customer or the merchant through the settlement engine.

Confirmation Engine: The confirmation engine is an entity that decides on behalf of the customer if a payment request is to be accepted or rejected.

The confirmation engine implements the payment confirmation process as described in the business plane. The payment engine's confirmation agent initiates the confirmation process during payment initiation. According to the payment confirmation process, the confirmation engine may either confirm the payment transaction on behalf of the customer, or may initiate an interaction with the customer's user agent to obtain confirmation for the payment transaction.

The confirmation engine is owned and operated by the PSP.

Rating Engine: A rating engine is an entity that computes a price of a certain service.

A rating engine is always involved in an e-payment to determine the amount to be paid. The rating engine may be coupled either with the request engine, so that the payment initiation already lists specifies the price to be paid, or it may be coupled with the payment engine, so that the payment engine determines the price on its own by communicating with the rating engine. A rating engine coupled with the request engine is not in the scope of this specification.

If involved in an e-payment, the rating engine processes information such as

- type of service provided to the customer,
- metering information (volume, duration),
- configuration data provided by the merchant (tariff tables, etc.),
- context (time of day, location of the user, etc.)

Remark: Rating should eventually be included in the payment process as a process of its own. The rating process would probably be prior to the service delivery process. Payment initiation would not start before the rating has been completed.

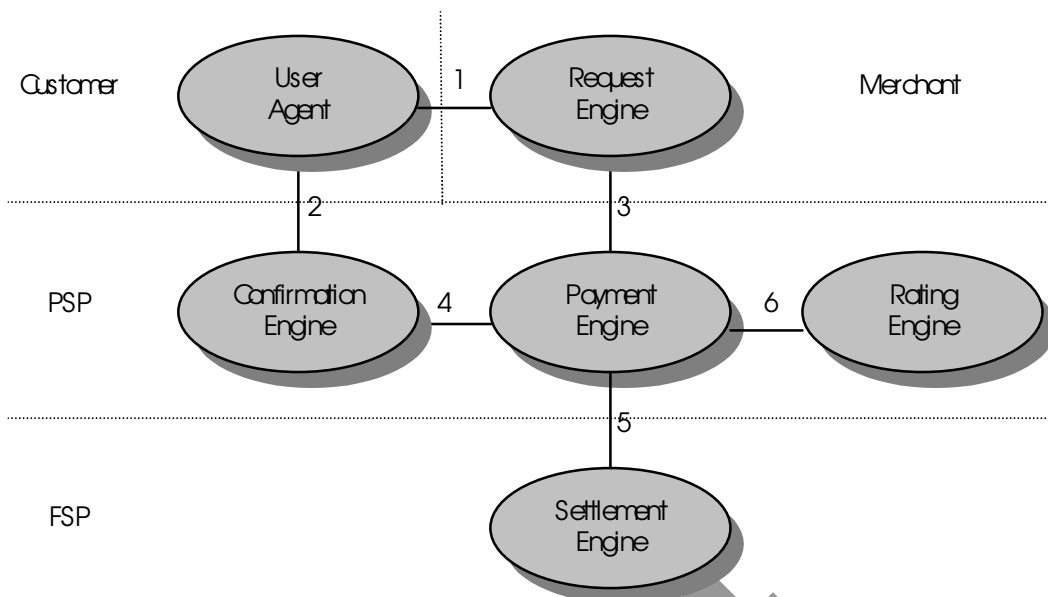
Settlement Engine: The settlement engine is an entity that enables the payment engine to initiate settlement of the PSP with both customers and merchants.

At the end of a billing period, the payment service provider needs to settle with its customers and merchants. The payment service provider will utilize a bank for the settlement. The settlement engine is a physical server provided by a bank where the payment service provider's payment engine can connect to in order to settle with customers and merchants.

The settlement engine is typically owned by a bank and considered an existing service. Therefore, the internal structure of the settlement engine is not investigated any further in this specification.

Abstract Model

The abstract model below shows the interactions between the functional entities and the administrative domain they belong to. Note that there is an administrative domain for each business role.



Interfaces

Service Delivery (1): Via this interface, the customer accesses the service provided by the merchant. The realisation of this interface depends on the particular service. In case of digital goods or online services, it will be a computer protocol, such as HTTP or a proprietary, service specific protocol. In a vending machine or physical POS scenario, no formal protocol is used, but there's an interaction between the customer and the vending machine's front panel or the shop assistant.

User Dialogue (2): The confirmation engine may use this interface to request an explicit confirmation for a payment from the customer. It depends on the concrete deployment if this interface is needed, but in general it is desirable to have it. The communication protocol used here depends on the terminal equipment the customer currently uses (namely on the confirmation agent sub-function of the user agent), as well as on the implementation of the confirmation engine.

Payment (3): The request engine uses this interface to initiate and control payment transactions. The payment engine sends indications about success or failure of payments via this interface.

Authorization (4): Via this interface, the payment engine asks the authorisation engine to confirm ("authorize") a payment that has been requested by a merchant. The authorization engine performs a number of checks, which may include a user interaction and then sends a positive or negative response to the payment engine. The communication at this interface shall not depend on the concrete realisation of the interfaces (1) or (2), nor on the implementation of the request engine.

Clearing/Recharging (5): The payment engine uses this interface to initiate the settlement processes. Depending on the concrete setup, the payment engine may request money from a subscriber's bank account to pay the last month's bill, or to recharge a prepaid account. It may be used to query payments the operator has received on his bank accounts, so that the telephony account of the respective subscriber can be recharged. Or, the Payment Engine may ask the bank to transfer the earnings of a certain merchant to that merchant's bank account.

Rating (6): The request engine sends charge events to the rating engine. The rating engine computes a price out of them. The rating engine may take into account the tariff model chosen by the merchant, some parameters describing the delivered service (number of kilobytes transferred, category of the content delivered, etc.), the time of the day, day of week, and so on.

Role Assignments

In the simple e-payments model, the functional entities described above belong to the following business roles:

Functional Entity	Role/Administrative Domain
User agent	customer
Request engine	merchant
Payment engine	PSP
Confirmation engine	
Rating engine	
Settlement engine	FSP

Draft