

# Generation and Transportation of Transaction Documents using Payment Infrastructure

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Abstract: Mobile payments are rapidly increasing during e-commerce transactions. Industry has well established procedures how to process the payments. However processes of management of transaction documents (e.g. warranty cards, insurance policies, etc.) are still undeveloped and raise issues of information system and document format fragmentation. This paper address transaction document management issue with introduction of improvements in payment procedures, such as transaction processing using multiple payment methods for single payment, point of interaction dividing into elements for further dividing of needs for associate parties, transaction messaging schemes, which can be used for transportation of transaction documents. Aim of this research is to propose improvements of payment processing process models by introducing generation and transportation of transaction documents using unified documents and concepts. Improved procedures are further planned to implement in micropayment company payment processing processes for approbation. The results show that distribution of transaction document into multiple types provides the ability to track generation steps of transaction documents and to correspond these steps with transaction processing results and messages, by therefore making these two non-connected before processes as whole new global service processing process. Proposed improvements of mobile payment infrastructure support creation and management of transaction documents using unified documents and concepts.

## 1 INTRODUCTION

Management of transaction documents is important and challenging process in e-commerce. Examples of transaction documents are bills, warranty cards, bank statements and insurance policies. Transaction documents have various lifecycles. Most of the documents are valid and used only during transaction or short while after transaction. However some transaction documents (e.g. warranty cards, medical receipts) have to be kept safely for multiple years and some may be submitted to other party, such as tax refund documents.

Typically transaction documents are generated during or after payment transaction. Recently mobile and NFC payments are used more frequently and in future application of such payments can rapidly increase (Oliveira et al., 2016). To execute mobile payments, external payment methods are integrated into mobile applications, usually raising issues of fragmentation of payment processors and entities

that perform generation and transportation of transaction documents.

Fragmentation of payment and transaction document managers further leads to multiple issues for users, such as various transportation methods, formats and platforms such as e-mails, information systems, SMS and others (Bojjagani and Sastry, 2015).

Integration of existing online payment methods (e.g. Paypal, Google Wallet, Stripe) into mobile payment systems partially allows solving fragmentation issues. However such integration is possible only in certain cases and raise the risks of data integrity and security (Preibusch et al., 2016).

In e-commerce industry transaction document generation and transportation is mostly detached from payment processing and includes only transaction documents containing transaction processing result data. For payment processing, typically concepts and models introduced by financial service companies VISA (IBM, 2011;

VISA, 2012) and MasterCard (Mastercard, 2016) is used.

Aim of this research is to propose improvements of payment processing process models by introducing generation and transportation of transaction documents using unified documents and concepts.

## 2 PROPOSED IMPROVEMENTS FOR TRANSACTION DOCUMENT MANAGEMENT

Standard banking procedures focus on transaction processing, whereas main problems of other payment infrastructures (e.g. micropayment, mobile payments) development lie in transaction document generation and transportation, including transaction initializing based on these transaction documents. Therefore it is necessary to identify systems as processing partners, which would be able to develop and maintain all functionality required to perform any type of transaction. Additionally it is necessary to precisely determine the ratio between generation and transportation of transaction documents and improvements for existing standard banking flows to implement such integrated processes (Fig. 1).

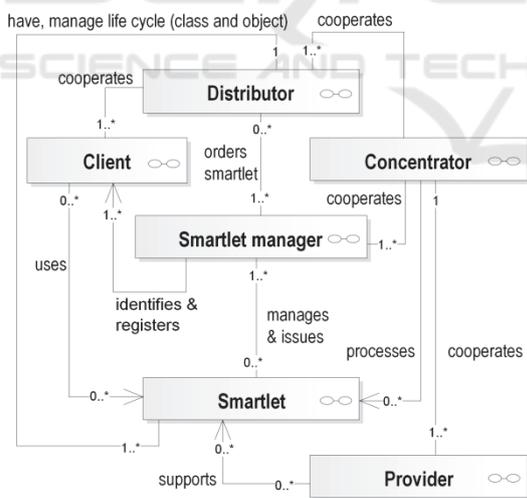


Figure 1: Proposed role distribution in mobile and smartcard payment infrastructure (Vitols et al., 2015).

The mutual interaction between roles of mobile payment infrastructure was proposed in previous research (Vitols et al., 2015), where focus was put on execution of mobile payments using multi-application smartcards (Bumanis, Vitols, et al., 2014). Classic e-commerce payment processing

schemes includes such roles as client, merchant, issuer, acquirer and intermediate organization, which provides routing functions, for example, MasterCard. The following mobile payment infrastructure roles were introduced:

- concentrator, entity which performs intermediate organization's functionality, manages contractual and identification registers for associate parties, manages transaction document transportation mechanism and provides protocol for its usage;
- smartlet manager is responsible for smartlet creation, issuing and life cycle management, and point of interaction creation and management;
- distributor orders smartlet, stores and manages client database;
- client as smartlet user;
- smartlet, where smartlet is a device with payment initiation capabilities, for example, smartphone or smartcard;
- provider, including payment provider and service provider, where payment provider is responsible for acceptance and processing of transactions. Service provider is managing point of interaction and physical or virtual point of sales meant for purchases of this service provider's products.

During research following functions were proposed:

- payment acceptance;
- payment authorization and clearance;
- smartlet identification and authorization;
- client authorization;
- generation of transaction documents.

Specialized methods were identified for payment providers, assuming one payment provider may perform either one or both methods. Respectively those are payment method and processing method, where payment method is responsible for accepting and processing transactions, but processing method would be used in case if additional calculations are required, such as subsidy administration, or/and changes to client accounting system's data must be done (Bumanis, Zacepins, et al., 2014).

Main proposed improvements of this research are transaction processing using multiple payment methods for single payment, addition of functionality for point of interaction and transaction messaging schemes, which can be used for transportation of transaction documents.

Transaction documents are documents created in the process of realization of particular service, where documents are used for initiation of one or multiple transactions, as well as for transaction result verification (Bouazzouni et al., 2016).

Transaction documents for different services and products may require different unique data. In this case the format of transaction documents must comply with formatting requirements for ordering of particular service, for example, the ticket ordering requires trip time and station names, and whereas paying for parking spot require auto number and start time. It is inefficient to use unique formats of transaction documents for each individual service while implementing various services into one system. Therefore, it is necessary to develop subsystem, which would be able to transform ordering data of various services into unified transaction document format to manage these objects. For this point we propose the usage of your country specified requirements for electronic document formats. In Latvia, for reference, such requirements are described by law accepted by cabinet of ministry (Cabinet of Ministers and Republic of Latvia, 2014), stating the usage of XML definition format and XSD scheme for its validation.

Each service, offered by service providers, requires point of interaction for transaction initiation. Point of interaction can be accessed from client's device, such as smartphone's application or internet web store. Transaction initiation is performed by point of sale connection to this point of interaction, where point of sale corresponds to particular payment method. Whereas implementing multiple payment methods in the way of payment instruments into single point of interaction results in potentially longer usage time. Researchers identified (Kujala et al., 2017) that prolonged usage is based on client's positive expectations before service platforms usage and realization of those expectation during exploitation time. As improvement, point of interaction was divided into two forms - service ordering form and payment form, respectively named, sPOI and pPOI (Fig. 2).

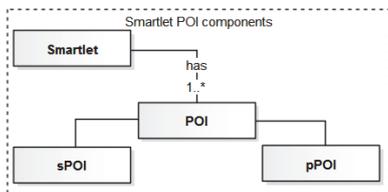


Figure 2: Smartlet POI components.

Firstly, functionality of sPOI includes inputting parameters for service ordering, performed by client, for example - providing auto number for parking spot ordering service realization. Secondly, pPOI provides access to service specified payment instruments, which together form a payment

combination. Technically, pPOI is interface to point of sales with particular payment methods. Model of transaction document mechanism is based around different objects, including price matrix, payment combination, payment instrument, user interface of payment combination authorization and payment instrument authorization (Fig. 3).

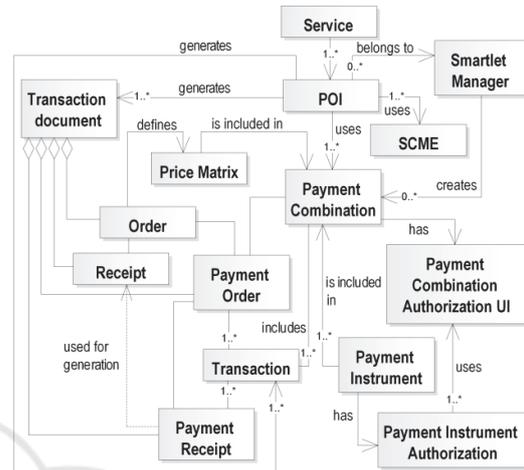


Figure 3: Model of transaction document mechanism.

Four transaction document types were defined for transaction document mechanism:

- Order - document, defining service ordering data and service provider's identification and authorization parameters in unified specified format;
- Payment Order - document, defining necessary data for initiation of one or multiple transactions, including payment amount;
- Payment Receipt - document, generated after transactions are performed and contains result of processing these transactions;
- Receipt - document, which includes all data regarding performed payment, including completed transactions.

## 2.1 Sequence for Generation Process

Generation of transaction documents is performed by service's POI components - sPOI and pPOI. Each service has own unique POI. When client inputs ordering parameters and presses "Order" button sPOI generates transaction document "Order", which is then along with price matrix is sent to pPOI for processing. In result, pPOI modifies the price matrix according to accessible payment instruments and generates the transaction document named "Payment Order", after which client must choose one or multiple offered payment instruments, basically, the

currency, for example, cash or bonus points, for order payment. By pressing button "Pay" client authorizes transaction initiation. Transactions are initiated for each payment method corresponding to selected payment instruments, by respective point of sale, either physical point of sale, virtual point of sale or EMV (Europay, MasterCard, and Visa) payment application. According to transaction processing results pPOI generates transaction document named "Payment Receipt". "Payment Receipt" is generated for both, successfully and unsuccessfully completed transactions, where in case of unsuccessfully processed transaction client may be prompted to choose different payment instruments and repeat the payment process. When payment is successfully completed, pPOI sends transaction document named "Payment Receipt" to sPOI, which in result generates transaction document named "Receipt" in unified format for storage in the client's profile and further usage by the client. Transaction document "Receipt" is saved based on sPOI settings defining necessity to save transaction documents in distributors system or on smartcards.

## 2.2 Transportation Flow

Generation and transportation of transaction documents are performed in close collaboration with transaction processing using payment provider system's mechanisms (Fig. 4). Implementation of transportation functionality as part of transaction processing requires some sort of message routing between partners. Existing payment processing organization's schemes includes subsystems providing transaction data routing between partners incorporated in transaction processing, as well as providing authorization functionality. MasterCard organization uses system called MasterCard Network (Mastercard, 2016), providing routing between issuer and acquirer, whereas Visa organization's system VisaNet (IBM, 2011; VISA, 2012) in addition to routing function is responsible for clearing and settlement. Based on how these organizations route transaction data between partners we concluded the necessity of hub type of system's component or subsystem. Therefore, such element was introduced named "TRX Router" (see Fig 4). "TRX Router" was implemented as payment provider's payment method system's component, which is responsible for routing transaction data and transactional message to processing method and authorization performing systems. Functionality of

this hub is based around messaging flow with both entry and exit nodes, identified as:

- processor gate for processing system and its hub "Processing Router";
- point of interaction (POI) gate for device, used for payment initiation;
- authorization gate for client and transaction authorization.

Connection between systems is implemented by using gates and corresponding interfaces. Processing method used when additional calculations, such as government subsidy calculations or automatic money account balance increment, are required, uses hub named "Processing Router", which is connected to partner systems using following entry and exit nodes:

- processor gate for external processing system;
- TRX gate for payment method and its hub "TRX Router";
- smartlet manager gate for smartlet manager's system;
- accounting gate for client's accounting system.

Implementation of transportation mechanism where multiple hubs of various partners are used requires usage of unified easy-to-identify format for both transaction messages and transportation of transaction documents. Proposed solution uses transaction messaging system as platform for transportation of transaction documents, and therefore message types must be identified.

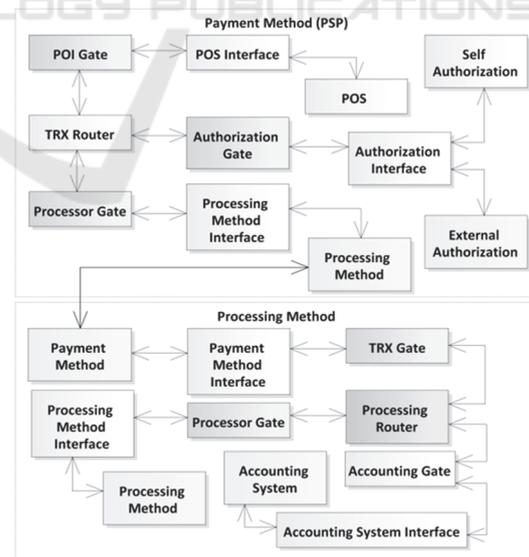


Figure 4: Proposed transportation flow between payment method and processing method.

Payment and processing method specialized messages were named as "TRX Message". Two

types of messages were defined: Request, which is used for request message and Response, used for answer message. Response always uses Request as reference message, so hubs can easily identify message sources. We propose following message actions:

- Authorize - request type message for authorization;
- Capture - request type message to execute transaction capture;
- Cancel - request type message to cancel transaction processing;
- Accepted - response type message, indicating successful authorization of transaction in particular system or subsystem;
- Approved - response type message, indicating approval of transaction execution;
- Canceled - response type message, indicating cancelation of transaction due to particular technical reasons, including timeout;
- Denied - response type message, indicating declining of transaction due to particular reasons.

### 3 DISCUSSION

Proposed payment infrastructure allows implementing transportation of transaction documents along with transaction messages; however for functionally comprehensive transaction document management separate system must be developed. This system would work in collaboration with transaction messaging system and in the same time would be responsible for generation and transportation of transaction documents which are not necessary related to transaction processing partners, for example, distributor. Separate system will allow realization of transportation for informal messages as well, for example, reports.

Usually by integrating multiple e-commerce systems difficulties with transaction document formats (Mitasiunas and Bykovskij, 2015) may occur; however, electronic document format (Wawrzyniak and El Fray, 2016) will be available to each system in unified structure, containing five components - abstract, XML data, JavaScript methods, CSS/HTML5 and mandates. Our proposed document structure provides both data and functionality, therefore we believe it will suit e-commerce needs.

As additional improvements message format is proposed, which is built around two parts - header and body, providing possibility to transport and process messages by every system with inclusion of

unique data required by each different service. In this case document body part is responsible for handling service specified data, in other words body is transaction object, whereas document header contains necessary information for message routing. Verification and validation of these messages is done during implementation phase using XML and XML scheme 1.1, whereas authorization is realized by encapsulating XML formatted message into eDoc container. Using both eDoc and XML provides secure transportation of transaction documents.

These improvements allows interoperating of different transaction documents for various services, provides ease of transportation using one messaging system, which transfers both formal and informal messages. This allows usage of unified format for transaction documents to store and later manage them by different parties and systems.

### 4 CONCLUSIONS

Distribution of transaction document types provides the ability to track generation steps of transaction documents and correspond these steps with transaction processing results and messages, by therefore making these two non-connected before processes as whole new global service processing process.

Standard banking procedures typically does not provide processes for transportation of transaction document and focus mainly of payment processing.

Existing payment processing workflows and payment infrastructure allows usage of entities such as banks to provide secure client authorization in case client uses bank account.

Proposed transportation mechanism describes mostly transaction messages used during transaction processing, however it potentially can be used for transportation of transaction documents between transaction processing partners. During the research it was concluded, that transportation of transaction documents requires delivering message to additional parties, therefore separate system must be developed, which could use unified formats for both transaction documents and transportation messages.

Proposed improvements of mobile payment infrastructure support creation and management of transaction documents using unified documents and concepts.

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