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# Payment Procedures for Electronic Government Services

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**Abstract:** In this paper, we analyse payment procedures for their suitability for electronic government. We provide an overview of the payment procedures currently available on the market, compare the situation in electronic government with the situation in electronic commerce and analyze what we can transfer. Based on functional requirements we propose a scheme that allows public agencies to examine the appropriateness of any given payment procedure for electronic government.

**Keywords:** Electronic government, payment procedures

## 1. Introduction

In *electronic commerce (EC)*, market participants had to realize that the potential of business models only based on sponsoring or advertisement is limited. In order to generate direct revenues, adequate forms of payment are required. Thus, the integration of payment functionalities in EC applications is crucial.

Although the reason is different, we find the same problem regarding *electronic government (EG)*. Citizens and enterprises (further referred to as *users*) are increasingly able to use EG services on the Internet. However, whereas simple and free information services are already widespread, the introduction of services with costs is a major difficulty because their implementation in EG underlies a special set of requirements and restrictions. Nevertheless, solving the paying problem in EG could prove to be beneficial for EC, too, as such a solution could introduce a de-facto and legally secure payment standard for many applications.

We define EG according to von Lucke and Reiner mann (2002: 1) as the execution of business processes in connection with governance and administration (government) by information and communication technologies over electronic media.

EG services are not only beneficial to users but also to public agencies. Users receive faster and more convenient services with a smaller error rate and a larger transparency of the services from a more responsive and informed public agency (Trinkle, 2001: 7; Müller, 2004: 1). Public agencies themselves realize benefits in the form of improved efficiency, effectiveness, quality of services and proximity to users (Trinkle, 2001: 7; Holznagel, Krahn and Werthmann, 1999: 1478). These potentials are far from being utilized to their full extent if EG services lack electronic payment functionality. In connection with EG services with costs adequate payment procedures are most important in realizing the potential of EG (Watson and Mundy, 2001: 28) and provide an essential infrastructure precondition for EG services connected with fees, contributions, deliveries and taxes (Mehlich, 2002: 174).

As is shown later, for many EG services it is necessary to select a procedure meeting a special set of requirements and restrictions. The nearly unclear number of payment procedures currently available on the market and the dynamism of the payment system complicate the search and the selection of a suitable payment procedure. The selection is thus no trivial task and must take into account the circumstances of each individual EG service. For example, requirements to a payment procedure in connection with an EG service frequently used by a professional are of a quite a different nature as with an EG service rarely used by a citizen. For this reason, the weight of some requirements could differ from EG service to EG service.

The aim of this paper is to examine some of the relevant characteristics of payment procedures with a focus on the special set of requirements to payment procedures in order to be used for EG applications. Based on this, we provide a scheme that allows public agencies to specify the

requirements of their EG service to a payment procedure and to assess any given payment procedure for compliance.

We organize the paper as follows: In section 2, we provide a general overview of payment procedures currently available on the market. In section 3, we transfer experiences from commercial EC to EG and analyse the additional requirements from the viewpoint of a public agency and of an EG service. In section 4, we derive an according assessment scheme that allows public agencies to assess the suitability of any given payment procedure for any EG service. In section 5 we close with conclusion and outlook.

Please note that our discussion of a general payment method, such as credit card usage, electronic payment, or mobile payment, refers to the term *payment systems*. When we talk about concrete solutions such as Paypal, we use the term *payment procedures*.

## 2. Overview of electronic payment systems

One matter unites all online merchants: They want to get money for their goods and services. Since the beginning of the nineties, it is tried to solve the paying problem on the Internet with a multiplicity of innovative procedures, thus most of the new payment procedures build on established payment systems (Stroborn and Pousttchi, 2003: 354). In the following, we provide a brief overview of payment systems used in the Internet.

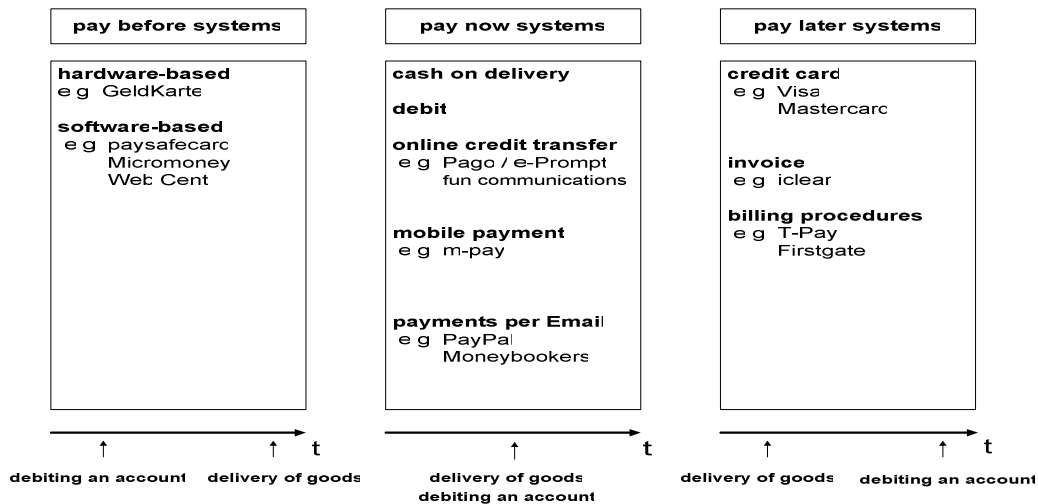
Because of the large number of payment procedures available, the question arises how these can be meaningfully categorised for the purposes of an overview. We distinguish between pay before systems, pay now systems and pay later systems depending on temporal proximity of delivery of goods and debiting an account (Stroborn and Pousttchi, 2003: 354-355).

The first category is *pay before systems* that can be either hardware-based or software-based. Either the user buys a smart card, where the money value is stored, and then pays off of this credit for goods or services desired, or he can upload a digital wallet with electronic coins on a prepaid basis. Subscription of special services can be another pay before systems in which one pays for something first and receives the service later at a specific point in time. All of these pay before systems usually allow anonymity on the payer's side and are already used for payments in electronic commerce. Its advantage is for the payee that he gets an immediate payment guarantee. We show the relevance of payment guarantee later.

Another category is *pay now systems*. These payments are triggered as soon as the user accepts the offer. An example is the direct debiting systems such as the "Maestro". Debit cards have in Europe and North America a high penetration rate among the population and are widely accepted within the stationary merchant scenario as well as in EC scenario. They are easy to use, and all that is needed for the user is a checking account at the bank issuing the card.

The third category is *pay later systems*. The user purchases a product or service and is charged for it later. Typical examples are so called "offline-systems" such as credit cards, billing procedures or invoices. These are typically used in traditional payment scenarios such as for stationary merchant scenario or for catalogue shopping. They are also widespread and generally accepted.

Based on these three categories Figure 1 (that is not exhaustive) shows the categorization with typical example. An explanation of the examples can be found in (Institut für Wirtschaftspolitik und Wirtschaftsforschung, 2004).



**Figure 1:** Categorisation of Internet payment systems (Stroborn and Pousttchi, 2003: 355)

As shown in section 1, two aspects complicate the search and the selection of a suitable payment procedure: The first aspect is the nearly unclear number of payment procedures currently available on the market that has grown enormously as the Internet has gained in importance for commercial transactions in recent years. It is estimated that more than 150 payment procedures used on the Internet exist. The second aspect is the dynamic of the payment procedures market, in which new payment procedures are permanently being offered while others disappear again after existing on the market for only a short time (Mürl, 2002: 130).

The choice is thus no trivial task for payees such as online merchants and public agencies. In case of public agencies, it also must take into account the circumstances of each individual EG service as shown later. In order to decide whether or not a payment procedure is suitable for a special EG service a closer examination is necessary.

### 3. Requirements to a payment procedure for Electronic Government

#### 3.1 Public agency requirements

In this section, we derive the requirements to a payment procedure in EG. The transfer of experiences from EC should be connected with caution and with critical reflection (Bruecher and Gisler, 2002: 8). Taking account of that, we identify requirements of online merchants to payment procedures and examine, whether these apply also to public agencies. Subsequently, we regard requirements which result from special characteristics of the EG services.

Henkel (2002) investigates five requirements especially from the viewpoint of the online merchant: Payment guarantee, low costs, technical aspects, close customer relationship and high diffusion rate. Examining the relevance of these requirements Hinrichs, Stroborn and van Baal (2004) indicate in an empirical study that payment guarantee, high diffusion rate and low costs have an extremely great importance for online merchants. Behind these main criteria, aspects of the customer relationship and technical aspects follow with nevertheless high weights.

Providing a *payment guarantee* is also important for public agencies, because it is in their interests to receive the payment prior to delivery. In case of "moto"-transactions (mail order/ telephone order), e.g. credit card payments or direct debiting systems, no payment guarantee is given. If the customer denies making the payment and the online merchant may not be able to prove the fact even if the transaction was legitimate, this causes in addition to the sales shortfall a charge-back cost for the merchant. Further problems arise, if the account is insufficient covered and therefore the payment is refused. The consequence for the merchant is also an expensive charge back (Henkel, 2002: 8; Wichmann, 2002: 123-124).

As well as online merchants, public agencies prefer payment procedures with *low costs*, because they have substantial financial problems in recent years. In addition, public agencies are

constrained by the requirement to allocate resources and provide services that are in the best interest of the public (Jorgenson and Cable, 2002: 17).

Payments to the public agencies are closely connected with other internal processes, such as initiation of the creation or delivery of goods and services or posting of the payments. Therefore, the payment procedure must be *capable of being integrated into existing processes* within the agencies as simply and rapidly as possible (Himmelsbach et al 1996: 5). Furthermore, care should be taken that the *scalability* of the payment procedure is given as far as the prospect exists that the transaction volume increases strongly in the future. Scalability means the guarantee that a high number of users can make transactions at the same time (Stolpmann, 1997: 50).

Online merchants can develop a *close customer relationship* much better than in the stationary merchant scenario. Providing an exact customer profile by retaining of past transaction information permits a purposeful marketing (one-to-one marketing). Therefore, online merchants prefer non-anonymous payment procedures to collect much as possible data about their customer (Henkel, 2002: 9). In contrast, public agencies do not have any interest in user profiling. Moreover, the German Teleservices Data Protection Act and the German Interstate Treaty on Media Services contain the basic principle of data economy and data avoidance. From this principle there arises the requirement to a payment procedures that necessitates the collection of as little data as possible that is not essential to the use of the online transaction. Therefore, it should be possible to make use of the services and pay for them on an anonymous basis or under a pseudonym (Eifert, Püschel and Stapel-Schulz, 2003: 91). In this context, *anonymity* means anonymity in relation to the public agency, i.e. the public agency cannot determine who has made the payment based on the data transmitted by the payment procedure.

In connection with user data and public agencies, the *confidentiality* of data is very important. Confidentiality is the property ensuring that unauthorised persons cannot view transaction information (Merz, 2002: 155). For example, tax payments and associated personal data are subject not only to the Data Protection Act but also to taxpayer confidentiality as an official secret. Due to the sensitivity of the data, the disclosure of payment information is especially serious since, amongst other things, the information could be useful to a competitor. As a result, any payment procedures must satisfy special confidentiality requirements (Breitschaft et al, 2004: 29). Confidentiality can be realised in different ways, like SSL or SET, and should be very high, in order to avoid an attack of third party. The other security objectives authentication, integrity, authorization and non-repudiation according to Merz (2002) play also a role when evaluating payment procedures. However, we do not examine them in this paper, because from our view the crucial security objective is the confidentiality of the data.

Finally, online merchants are reluctant to invest in the infrastructure of payment procedures that have a low *diffusion rate* and so far only a small number of customers use it (Henkel, 2002: 9). That applies particularly to public agencies too, because public agencies are responsible for providing access to information and services to the entire eligible population (Jorgensen and Cable: 2002, 17).

### **3.2 Requirements resulting from electronic government services**

Now we regard characteristics of EG services and derive requirements that need to be considered when selecting a payment procedure.

The invoice amounts (*payment levels*) that will normally be paid in connection with EG service will significantly influence the choice of a suitable payment procedure. The spectrum of possible payments ranges from a few euro, e.g. to get information from an archive, to several thousand euro, e.g. tax payments. Since there are no standardised definitions for payment levels, we differ two categories: Micropayments ( $\leq \text{€}10$ ) and macropayments ( $> \text{€}10$ ). Picopayments, which are defined as amounts of 10 cents or less, down to fractions of a cent, was a third category mentioned in previous research activities, e.g. Kieser (2001). As we hardly find EG services handling with this payment level we ignore the category in the following. While within the category of macropayments transaction costs can usually be neglected, they are critical when it comes to micropayments, since

they may be greater than the total revenue made with the service. A payment procedure may, therefore, be considered a reasonable means of payment, as long as the payment amount is larger than its total transaction costs (Kreyer et al: 2003, 14)

A study of the European commission reveals that enterprises demand cross national services (European Commission: 2002, 9). In the case of EG services used from abroad, care must be taken to ensure *internationality* of the chosen payment procedures, e.g. it is also available abroad. This is not the case with the direct debit, for example, as a direct debit from a foreign account is not possible. The requirement is especially important in cases users are not familiar with the basic conditions and administrative structures. However, it is not easy to determine how widely a given payment procedure is used abroad, as this could differ extremely from country to country (Breitschaft et al, 2004: 18).

#### 4. Characteristics of payment procedures for electronic government

Based on the results in section 3 we will now develop a scheme using the morphological method according to Zwicky (1966). This method allows us to fractionalize any given problem into its multidimensional characteristics and to identify the various instances of each characteristic. The characteristics and their instances can then – as is a key element within the morphological method – easily be summarized and visualized in a table, the so-called morphological box. When applying the morphological method to given payment procedures we are, through the combination of the characteristics and instances, able to select payment procedures for EG. Furthermore, we can identify missing elements and are able to propose improvements as well as new solutions. As mentioned in section 1, based on special characteristics of EG services the weight of some requirements could differ from EG service to EG service. Taking account of that, we use, if necessary, the instance weight of the characteristic. To facilitate quick understanding we write the aspects as well as the instances in italics.

First, we analyze whether payment procedures provide a *payment guarantee* for the public agency and whether a payment guarantee is important for the special EG service (Figure 2). For providing a payment guarantee, we assign three different instances: *Not fulfilled*, *to a limited degree fulfilled* and *fulfilled*. We assign not fulfilled, if the payment could not be met because the user disputes having initiated the payment. We assign to a limited degree fulfilled, if the payment could fail to be met by the user without good reason (e.g. due to lack of funds in the account). Finally, we assign fulfilled, if the payment procedure offers an immediate payment guarantee. The *weight of payment guarantee* depends on several factors. For example, there are cases in which “delivery” has already occurred before invoicing, e.g., in the case of a fine. In these cases, a payment guarantee is irrelevant, as it is unlikely that a user initiates payment and then cancels. If it is a question of digital goods or services, the question of the effect of the payment guarantee is especially crucial. Whereas several days’ delay before the payment reaches the sender is acceptable in the case of a consignment of physical products, customers for digital goods and services typically want to use them immediately. Therefore, the payment procedure must be capable of offering shortly a payment guarantee. Whether in providing the service the public agency exercises governmental powers or not, affects also the relevance of a payment guarantee. If charges in respect of services that involve the exercise of governmental powers are not paid, then the public agency concerned does not have to initiate debt recovery proceedings in order to obtain enforceable title, but can initiate enforcement directly. However, this does not apply when foreign users use the service (Breitschaft et al, 2004: 19-20).

payment guarantee	provision of a payment guarantee			payment guarantee relevant
	not fulfilled	to a limited degree fulfilled	fulfilled	

**Figure 2:** Characteristic payment guarantee

Other security aspects regarding payment procedures are *anonymity* and closely connected *confidentiality* (Figure 3). In a first step, we examine the confidentiality of personal data and the danger of unauthorised access to transaction information. This unauthorized access can have different occurrences such as read along, read along and data to be circulated or read along and data modification. We assign for the evaluation of confidentiality the instances *low*, *middle* and *high* for personal data can be read along and modified, personal data can be read along, but not

modified and no personal data are exchanged meaning anonymity. In a second step, we investigate the *weight of anonymity*. With regard to the EG service, there is no need for an anonymous payment procedure if the name of the user is required in order to request the service, e.g. if an ordered product is to be delivered by post or in the case of application procedures (Breitschaft et al, 2004: 36).

anonymity and confidentiality	confidentiality			anonymity relevant
	low	middle	high	

**Figure 3:** Characteristic anonymity and confidentiality

To analyse the *costs* of payment procedures we distinguish between *variable costs* and *fixed costs* (Figure 4). Variable costs either can refer to the number of transactions or to the value of the amounts paid. For example, a GeldKarte transaction attracts a charge of 0.3% of the sale, subject to a minimum of €0.01. In the case of credit card payments, a fixed charge is normally payable for every authorisation query, in addition to an amount-dependent discount. To compare variable costs of different payment procedures we orientate to credit card payments, where merchants have to pay 3-5 per cent of their sales. We define variable costs as *middle* if they are comparable with the costs of a credit card payment. Variable costs, which lie below the credit card usage we denote *low* and above the credit card use we denote *high*. If the public agency does not have to pay variable costs but fixed costs, we assign *none*. Fixed costs consist of one-off initial costs plus recurring costs relating to the operation of the payment procedure. Factors that need to be considered include e.g. licence costs, charges from payment service provider, cost of hardware and software, cost of any certificates, installation costs, integration costs, communication costs and operating costs.

costs	variable costs				fixed costs
	none	low	middle	high	

**Figure 4:** Characteristic costs

Under *requirements arising from the process flow* (Figure 5), we regard requirements that arise from adaption of the specific EG process with the payment flow of the payment procedure. What is above all fundamental here is the question of exactly when the payment happens in the process and how long it takes to complete the payment process? For this purpose, a payment process is completed when the public agency acquires a payment guarantee. The requirements regarding the process flow may lead to the debarment of payment procedure where, although the payment procedure does offer a payment guarantee, payment under this procedure is initiated only late in the process (e.g. in the case of cash-on-delivery). The requirements regarding the process flow are also not fulfilled if processing of the payment is subject to an excessive interruption (e.g. in the case of a credit transfer it could take two to three working days). Moreover, with some e-government processes, it is also necessary to transfer a cash reference number upon payment, but this is not possible with all the payment procedures (Breitschaft et al, 2004: 44-45).

requirements arising from the process flow	not fulfilled	fulfilled
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**Figure 5:** Characteristic requirements arising from the process flow

As mentioned in section 3.1 care should be taken that the *scalability* (Figure 6) of the payment procedure is given as far as the prospect exists that the transaction volume increases strongly in the future. If an increasing number of payments affects (do not affect) the functionality scalability is *fulfilled* (*is not fulfilled*).

scalability	not fulfilled	fulfilled
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**Figure 6:** Characteristic scalability

The characteristic *diffusion rate* refers to the number of users who will be in a position to use the payment procedure at present or in the near future without this involving great effort or expense on their part. A number of factors will influence the future diffusion rate of payment procedures, e.g. the cost of installation and registration, the costs incurred by the user, the number of acceptance points and security of the payment procedure and other aspects. In a first step, we estimate the *degree of the diffusion rate*, taking into account all the factors that have been mentioned. We

assign for the evaluation of the degree of diffusion rate three instances: *Low*, *middle* and *high*. We assign low, if the number of users is less than the number of credit card users, middle, if the number is comparable with the number of credit card users, and high, if it lies above. In a second step, we investigate the weight of diffusion rate. With regard to the EG service, in some cases there is no need for a widespread payment procedure, e.g. the EG services only used by a limited user group (e.g. architects) if that group made regular use of it. On the other hand, a widespread payment procedure is required, if the EG service only very seldom involves a broad user group, and each individual user made only occasional use of it.

diffusion rate	degree of diffusion rate			diffusion rate relevant
	low	middle	high	

**Figure 7:** Characteristic diffusion rate

Now we regard to characteristics of payment procedures that derive from special characteristics of the EG service. A crucial question is, whether the selected payment model is suitable for payment levels (Figure 8). As shown in section 3.2, we differentiate between micropayments and macropayments.

payment levels	micropayments ( $\leq \text{€}10$ )	macropayments ( $> \text{€}10$ )
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**Figure 8:** Characteristic payment level

The assessment of the characteristic *internationality* takes into account whether it is necessary to possess an account in Germany to use the procedure, as is the case with the direct debit. This would mean that the user would have to travel to Germany from abroad and to personally open an account in order to use the payment procedure. In this case, the characteristic of internationality is *not fulfilled*. The characteristic is *fulfilled*, if the user could register for a payment procedure using a variety of communication media, such as telephone, fax or internet, or if the payment procedure was also widely used abroad.

internationality	not fulfilled	fulfilled
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**Figure 9:** Characteristic internationality

Based on the discussion in the sections above, the main characteristics of payment procedures for EG services and their instances can be summarized in **Figure 10**.

characteristics	instances			
payment guarantee	providing a payment guarantee			payment guarantee relevant
	not fulfilled	to a limited degree fulfilled	fulfilled	
anonymity and confidentiality	confidentiality			anonymity relevant
	low	middle	high	
costs	variable costs			fixed costs
	none	low	middle	
requirements arising from the process flow	not fulfilled		fulfilled	
scalability	not fulfilled		fulfilled	
diffusion rate	degree of diffusion rate			diffusion rate relevant
	low	middle	high	
payment levels	micropayments ( $\leq \text{€}10$ )		macropayments ( $> \text{€}10$ )	
internationality	not fulfilled		fulfilled	

**Figure 10:** Compliance-testing scheme for payment procedure within EG applications

The expression “relevant” is adapted to a use of the scheme for specification of requirements and should read “given” if the scheme is used for assessment of payment procedures.

## 5. Conclusion

The outcome of this paper is an analysis of some of the relevant characteristics of payment procedures for EG services resulting in a scheme that allows to specify the relevant requirements



of an EG service to a payment procedure in a structured way as well as the assessment of any given payment procedure for compliance. A further application could be for mobile payment service providers in order to develop procedures according to the requirements of public agencies for their respective EG applications.

In the analysis of payment procedures for other purposes we were able to prove that different procedures as well as different requirements show clusters in the respective schemes which allow to derive standard types. For the EG domain this is subject to further research and could possibly allow for the construction of a payment system which aggregates different payment procedures in order to provide a unique solution for EG payments above the procedure level.

A more industry-driven approach would be the use of existing commercial e-payment platforms that already aggregate different payment procedures (Mehlich 2002: S.174). Up to now these are not only proprietary but also by no means suited to a lot of the EG requirements.

A solution in the above-mentioned direction could also open up the way to provider-comprehensive payment systems suited to EG requirements and thus contribute to standardization even in payments for EC outside of EG.

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