

# *Open Smart Card Infrastructure for Europe*

## V2



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# **eESC TB5 Mobile Payment Business Requirements**

**Version 2.0.1**

**Final Report**



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## **Executive Summary**

This report has two objectives: 1) to study business models and to reveal major players' roles and interests, and 2) to propose possible actions for leading and arranging the overall success of involved industries.

There might be many possible ways for modes of mobile payment to emerge. However, there is no standard. Instead, individual systems are launched independently. Mobile payment standards require at least two different industries' collaboration. These are financial institutions such as banks and credit card organizations, and mobile phone network operators. There are several groups trying to promote standardization activities from various segments of industries that are involved in mobile payment. Those are often technology based discussions and oriented to mobile phone manufacturers, or to banks, etc.

In this report, we have tried to focus on a business model of the main chain of the mobile payment (consumer – merchant – bank – mobile network operator) neglecting the sub-chains such as mobile phone manufacturers or digital contents industries. This is because we believe that only if there is sufficient benefit to the main chain players can a sound mobile payment system be maintained as an infrastructure in the upcoming mobile generation.

In order to share common understanding of the mobile payment business, we introduce several assumptions that directly link to the major players' business schemes. Sometimes those might be too simple to reflect any detail in the reality of the business. However, through such assumptions we can compare the revenue stream of major players and we will have a better basis on which to estimate or expect the real roles and interests of major players. Therefore, there appear in this report some business figures such as interchange rates and acquiring rates, but they do not represent any figures used in the currently available specific mobile payment systems. We have taken those figures as assumptions, which could be accepted in the range of the commercial norm.

In most mobile payment business schemes, there are typically two different models based on the underlying payment instruments. Electronic direct debit and credit card requires three layers

1. Demand – supply layer, where consumers and merchants interact,
2. Payment service layer, where mobile network operators play major roles, and
3. Financial service layer, where banks finalize the settlement and clearing.

Stored value and operator billing reduce the third layer, since the settlement and clearing can be done in the second layer. This fact makes it difficult for banks and mobile network operators to collaborate. Actually, when one tries to establish standards in this business, at least the user interface in the first layer, a mobile specific authentication method in between first and second layers, and mobile settlement and clearing in the second layer are the minimum requirements.

We have interviewed major mobile network providers and payment service providers that are active in mobile payment. We have asked not only their plans to support

different technologies for user interfaces and authentication method, but also what they think of the other major players' roles and interests. The answers show interesting features such as a need for payment guarantee.

By using simple business models, we have estimated the business volume for the major players. The result shows good business figures for mobile network operators for digital content bought and paid by mobile, and non-negligible figures for banks for the case when mobile payment penetrates to real POS and vending machines. The reduction of risk premium could be one of the main interests for merchants. A rough estimation of a possible collaboration between banks and mobile network operators has also been performed.

Based on the expected roles and interests of major players, we have considered possible ways to arrange individual activities into a unified direction.

## 1. Mobile Payment Business Schemes

Mobile payment business is one of the focal subjects of financial and telecommunication industries today. Along with the approach starting from independent projects such as Bank oriented (e.g., paybox), MNO (Mobile Network Operator) oriented (e.g., T-Mobile online) or Bank – MNO collaboration activities (e.g., Mobipay), there emerged a new approach, planned by several projects, to realize the interoperability of those independent projects. Those projects are trying to expand their applicable area. In this report, assuming simple relations and figures as little as possible, we first try to reveal the currently active business models and the “roles and interests” of major players in behind. The target of this report is 1) to study the business models of current mobile payment activities and 2) to propose possible actions for leading and arranging the overall success of the industries.

Our final goal is to achieve a successful mobile payment environment, namely

1. Mobile payment becomes a trusted and well-used channel.
2. All parts of the mobile payment chain (consumer – consumer side MNO/Bank – merchant – merchant side MNO/Bank) enjoy standardized systems to be developed,
3. The main chain enhances new business opportunities for the other branches of industries such as mobile phone set manufacturers, digital contents suppliers, etc.

The major players are banks and MNOs. They have the main customer basis for this business. Without banks – MNOs collaboration, the final goal cannot be achieved. In this sense, the success of mobile payment business is a new challenge for both industries, neither of which has ever made such a sensitive collaboration that finally requires them to share their customer basis information in some way. Their real roles and interests are not publicly accessible and hardly imaginable. On the other hand, consumers’ and merchants’ roles and interests are relatively clear. Nowadays, consumers do not want to spend money on new devices that are not useful. The same holds true for merchants, who know in detail how the card payment systems work. Once the merchant has made a contract with a bank, he/she is open to any other cards issued in the world. Therefore merchants naturally expect such a unified system to come.

In retail business, including mobile payment, all that is needed is volume. When the volume is big enough, the cost per transaction gets cheaper and more profitable. Any closed environment, such as one MNO’s specific solution, has a serious limitation on the volume. It is a very good exercise to imagine what would happen if we did not have any standard for bank card payments. Merchants would have to have a separate POS terminal for each card they accepted. If a merchant were to accept all cards, the number of terminals would probably be higher than the number of goods and sales in his shop! With a unified system, merchants only need to have one or at most a few POS terminals. This is exactly what is happening in the mobile payment area. Some of the major MNOs are discussing how to achieve interoperable platforms that benefit their customers strongly. However others go their own ways. This tendency brings a more chaotic situation and is bad for both consumers and

merchants. Some of the merchants will probably invest in a specific solution, which will not work out profitably. Thus the purposes of our report are

- 1) to take an overview of the situation,
- 2) to analyze roles and interests of major players by using simple models, and then
- 3) to try to propose a possible compromise for major players to come closer and realize a standard for an all win realization.

Chapter 1 covers purpose 1, and chapters 2 and 3 analyze the business model, roles and interests (purpose 2). Chapters 4 and 5 are the basic discussions for future possibilities of the standard (purpose 3).

### **1.1. Mobile Payment Application Areas**

There have been many discussions on the mobile payment scheme. However, it seems that current mobile payment schemes could be categorized into the following 3 domains, namely,

- Replace plastic cards with Mobile,
- Buy and Pay on Mobile, and
- Pay on Mobile.

The first scheme (hereafter we call it just “Replace”) is a kind of mobile extension of traditional real POS. Consumers pay using their mobile at a real shop or a vending machine, for instance. In some cases, a consumer does not have to use plastic cards (either credit cards or debit cards, etc.) in the traditional way, but uses a mobile phone with which he/she can insert (Dual-slot) or pre-configure (Dual-chip) his/her own card/chip. One of the biggest merits for consumers is that he/she does not have to show his/her card to the payment attendant at the POS. This is also an advantage for merchants. The shop owners or managers do not have to take care whether his/her employees are checking the signature or the card itself at the POS. The mobile operator might be able to authenticate the user and banks can authorize the transaction, both over the mobile phone network.

The second scheme (we call “Buy&Pay” in this paper for simplicity) is a straightforward extension of virtual POS (e-commerce) using mobile platforms. There are many mobile phone oriented information or other services which are already available on the net. One can select such a service and purchase whenever needed. Since the mobile phone specific information, such as MSISDN, could work an additional authentication method without forcing complexity onto consumers, it can enhance the payment security dramatically.

The last scheme (“Pay”) looks like the mobile version of EBPP (Electronic Bill Presentment) or mobile online banking.

In the last 10 years, people have been stimulated to an extreme belief in the potential of Internet commerce. It has been in a sense true only for some very famous Internet merchants. These famous Internet merchants have invested substantial sums to establish brand on the net as well as to achieve stable system operation. This shows

how difficult it is to establish “trust” on the net. One of the key factors of such trust is security. Consumers cannot trust merchants on the net, and merchants cannot trust consumers who buy on the net. This has been the case for most merchants. The only exceptions are the above-mentioned big Internet merchants. They have well-established brands that ease consumers’ trust feeling, and they operate highly sophisticated customer relation management systems that enable them to rate their customers for various purposes.

Now the mobile phone is getting involved in this exercise. Consumers can use their mobile (and pre-registered payment instruments) to choose contents and confirm their payment. Consumers do not have to enter their personal information, such as card numbers. By this scheme, consumers and merchants can trust the payment schemes that are represented by PSP (payment service operator) s, MNOs or Banks, who are expected to take and control the risks which have been the main reasons why e-commerce is struggling.

## 1.2. Mobile Payment Service Layers

Although many mobile business schemes are possible, mobile payment business schemes have certain limitation due to the number of payment instrument types that are available and generally accepted in real and virtual commerce, i.e.,

- Electronic direct debit (EDD),
- Credit card (CC),
- Stored-value (pre-paid account) and
- Operator bill (post-paid account).

When one looks for a possibility to find a unification or standardization of mobile payment business activities, it is very useful to introduce 3 different function layers:

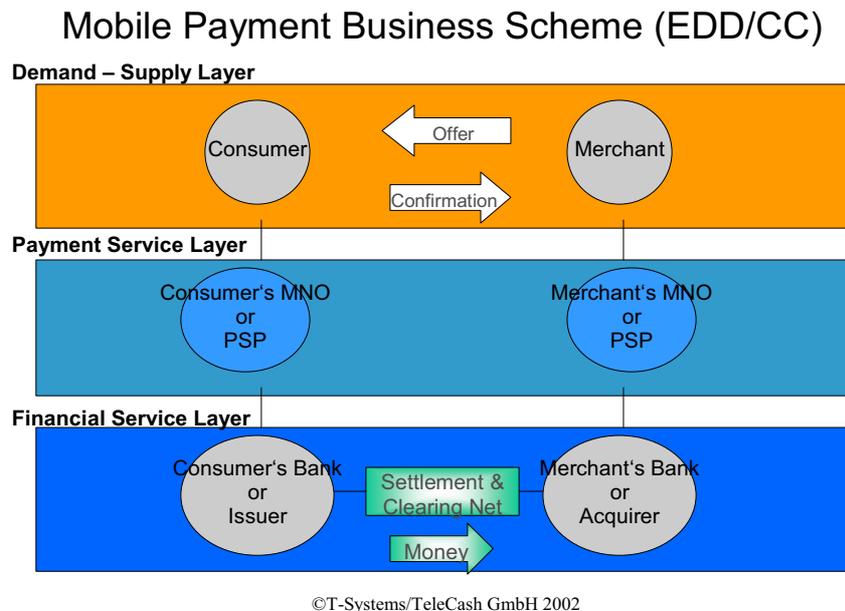
- Demand – Supply Layer,
- Payment Service Layer, and
- Financial Service Layer.

Interoperability within the financial service layer has been established for a long time, and the interfaces between the lower two layers are almost standardized already. Therefore what we need for the payment framework of mobile payment business standard is in fact to achieve the interface between the upper two layers, and between the layers. Deploying those layers, it becomes clearer that there are two distinct business schemes in the mobile payment (in fact this applies also to other payment systems, such as real and internet payment). Figure 1-1 shows payment schemes using EDD and CC.

Note that traditional real POS and Internet virtual POS payment also use a similar framework. For the traditional real POS, the payment service layer of the consumer side is nothing, and that of the merchant side is for instance a POS network operator. One of the reasons why the framework has been working well is its interoperability among different financial service providers. Historically, banks have developed both national and international settlement and clearing networks. Not only technical interfaces, but also business interfaces are well defined and established all over the

world. Therefore, merchants can make business contracts with their banks mostly independently from their customers' banks.

Even in the case of mobile payment business, if the payment instruments are chosen as conventional methods such as EDD or CC (either using server-wallets which require pre-registration by consumers, Slot or Dual-SIM) the framework remains essentially as it is.



*Figure 1-1: Mobile Payment Business Scheme (EDD/CC)*

Figure 1-2 depicts the cases of stored value and operator billing. In this business scheme, MNOs as payment service providers are going to play dominant roles in payment.

For both the stored value (pre-paid account) and the operator billing (post-paid account) payments, the money will be transferred from the consumer's account in the MNO to the merchant's account.

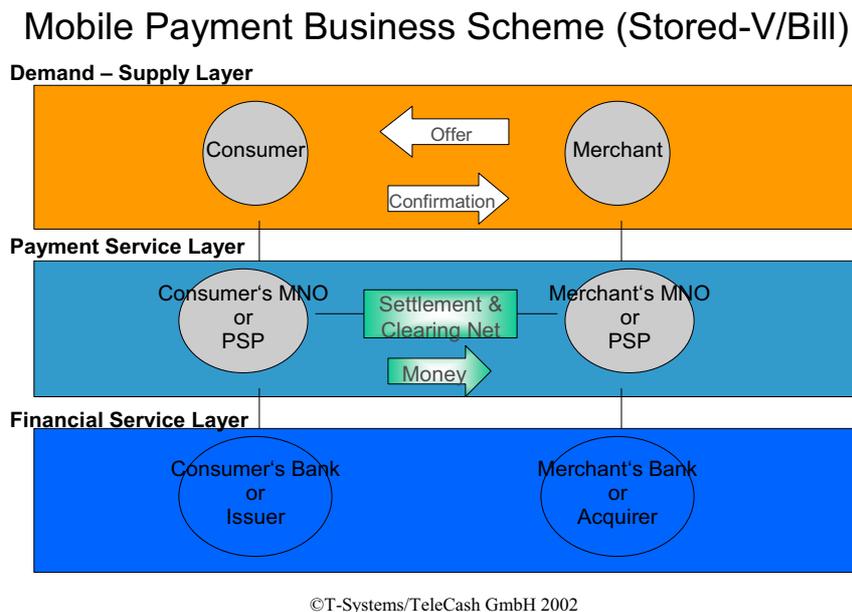


Figure 1-2: Mobile Payment Business Scheme (Stored-Value/Bill)

In the figure, we show the settlement and clearing network between MNOs. Generally speaking, it is critical to have a similar functionality that is targeted to inter-MNOs settlement and clearing by some organization because the MNOs of consumers and that of merchants generally differ from each other. If the banks' issuer – acquirer model has been a real key success factor for the credit card business, this consumer side MNO – merchant side MNO model seems reasonable. Mobile clearinghouses for roaming services perform a similar functionality. The technical requirement for the payment extension will be discussed in chapter 5 separately.

### 1.3. Mobile Payment Standard

We have been discussing common features that we can find from various existing mobile payment business activities to find out possible scenarios for realizing a EU wide business standard on mobile payment. As we have seen above, the mobile payment business schemes themselves are not entirely new. All schemes are based on traditional well-established payment models. Therefore, it is natural to expect that the business models are not very different from the traditional credit/debit cards and operator billing models except for mobile specific features. Examples of the mobile specific features are

- Mobile user interface (e.g., Server-wallet, Dual-chip and Dual-slot)
- Mobile authentication (e.g., Voice, SMS, WAP, iMode and USSD channels)
- Strong concentration of the market place organized by MNOs and the settlement and clearing among MNOs

This means, in other words, that any mobile payment business standard has to have at least three common standard functionalities included in the **minimum technical requirements**:

- Mobile user interface standard
- Mobile authentication standard
- Mobile settlement and clearing standard

We will come back to this aspect in chapter 5.

For banks, stored-values and operator billing schemes drastically suppress the number of transactions which they could transact daily, since those pre-paid and post-paid account methods typically require settlement and clearing transaction only once or a few times per month. Most payment transactions are settled and cleared in MNOs' account internally. On the contrary, EDD and CC require a transaction at least once a day. Therefore for MNOs and banks, the acceptance of those payment instruments by their customers, which will be slowly converging by market principle, must be at the centre of their interest.

## **2. Roles and Interests of Major Players**

As we have discussed in chapter 1, the major players in this area are banks and MNOs. However, they cannot neglect the importance of the consumers and merchants. Even if they make a technically fantastic system, it will be worth nothing if they do not reach a critical mass of consumers and merchants. If one could find out the real interests of banks and MNOs, it might be possible to reach a compromise for both of them, which would enable mutual collaboration to bring the two industries into the same direction.

### **2.1. Major Players Roles**

Mobile payment business consists of various players, from consumers to suppliers (from mobile phones to services on the net), payment system operators and regulators. In this paper, we focus on the following three major players that are at the core or backbone of the payment service infrastructure and its life cycle.

- Merchants
- Mobile Network Operators
- Banks and Credit Card Organizations

The role of merchants is clearly to supply goods and services that are demanded by consumers who initiate the money flow in the mobile payment business schemes. Most merchants have been misled by lots of exaggerated forecasts and now are very wary of new technology oriented business schemes. They are carefully looking for the real market movements.

Mobile network operators are suppliers of major goods and services as well as payment information carriers and sometimes play a role as payment and settlement and clearing services. MNOs are generally looking for new sources of revenues in the payment business, and banks are also seeking new channels for their services. Furthermore, MNOs have to find out the most economic and dramatic ways to generate more traffic, since the new technologies create the potential to transfer more traffic and they have to cover the huge cost of the third generation mobile licences. The payment service might provide MNOs with both requirements at the same time.

Banks and credit card organizations are traditional and historically the most trusted parties who handle payment, settlement and clearing services. They have been investing huge amounts in the next generation chip card payment framework called EMV. For banks, it would be very beneficial if their EMV investments covered future business prospects, such as mobile payment, by using, for instance, Dual SIM technology.

### **2.2 Major Players Interests**

In this chapter, we cover the interests of some major players studied through interviews with them. We believe that it is worthwhile to overview some of their ideas (We only made interviews with MNOs or PSPs). The current status of those MNO/PSPs is summarized in Table 2-1, where already available and planned application areas, payment instruments, user interface, user authentication method, and interoperability are given.

Services	MNO/PSP 1	MNO/PSP 2	MNO/PSP 3	MNO/PSP 4
<b>Application areas</b>				
Buy & Pay at Real POS	Available	Planned	Planned	Planned
Buy & Pay at Virtual POS	Available	Planned	Available	Available
Pay for services purchased through different channels	Available	Planned		Available
Others	Available (Person2person, internet to bank, vending machines)			
<b>Payment instruments</b>				
Stored value	Planned	Planned	Available	Planned
Operator bill	Planned	Planned	Available	Planned
EDD	Available	Planned	Available	Available
CC	Available	Planned	Available	Available
<b>User interface</b>				
Server-wallet		Planned	Available	Available
Slot				
Dual-SIM				
Others	Nothing (Paper/Web based registration)			
<b>User authentication</b>				
Voice		Planned	Available	Available
SMS		Planned	Available	
WAP		Planned		Available
iMode	No information available			
USSD				
Others	Caller-ID			
<b>Interoperability</b>				
Interoperable with		Planned with MNO/PSP 4		Planned with MNO/PSP 2

Table 2-1: Currently available and planned services

One of the common features we have observed is that all of the MNO/PSPs are planning to, or already support all major payment instruments. It means that the mobile payment business is not a business of only banks or only MNOs. Both parties are actually needed. The other important fact is that all MNO/PSPs are trying to extend their application areas. The business itself is not yet well developed, thus players are still trying to find out the best opportunities. There is evidence of the "trial and error phase" of the industry. As to the user interface and authentication methods, all of the MNO/PSPs prefer to use currently existing systems such as server-wallets and not to require consumers to pay for new mobile phone sets. Interoperability is also planned by some of MNO/PSPs.

Table 2-2 shows personal opinions of professionals who are intensively involved in this business. Most of them think full support of payment instruments is very important. However, there are no common opinions on the authentication method and the user interface. Especially on the settlement and clearing, opinions vary across a broad range. Here are the notations: A: Very important, B: Important, C: Usual, D: Not necessary.

Opinions	Point range
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Payment instruments	
Full support of Stored-Value, Operator Bill, EDD and CC	A
Support of Stored Value	A – B
Support of Operator Bill	A – B
Support of EDD	A
Support of CC	A – C
Settlement and Clearing	
Between different MNOs	A – D
Between different FSPs	A – C
Necessity of centralized clearing houses for Operator Bill etc.	B – D
Mobile authentication method	
Full support of Voice, SMS, WAP, iMode, and USSD	C
Support of Voice	A
Support of SMS	B – C
Support of WAP	
Support of iMode	
Support of USSD	B – D
Mobile user interface	
Full support of Server-wallet, Slot, and Dual-SIM	D
Support of Server-wallet	A – D
Support of Slot	D
Support of Dual-SIM	D

*Table 2-2: Players' opinion to the technical requirements*

Table 2-3 shows the MNO/PSPs view on key success factors of Mobile payment business. For instance, MNO/PSPs consider that merchants are interested in the enhancement of core business (the opinion varies from A to C) etc. Payment guarantee is also regarded as an important topic.

Opinions	Point range
Merchant	
Enhancement of core business (e.g., real POS synergy)	A – C
New business development	A – C
Payment guarantee	A – C
Cost for integration/operation	A – B
Cost for PSP and FSP	A – B
MNO/PSP	
Enhancement of core business (e.g., real POS synergy)	A – B
New business development	A – B
Risk management	A – B
Cost for integration/operation	A – B
FSP	
Enhancement of core business (e.g., real POS synergy)	A
New business development	B
Risk management	A – B
Cost for integration/operation	A – C

*Table 2-3: Players' opinion on the players' major interests*

It seems that MNO/PSPs also regard the mobile payment business as their new business but not banks'. They expect FSP (Financial Service Provider such as Banks or Credit card organizations) s' main interest to be the enhancement of core business.

All models that are currently available/active by MNO/PSPs in the market, need a bi-lateral agreement between MNO/PSPs and the merchant. This necessarily limits the number of merchants participating in the scheme. However, from a merchant point of view, and also from that of creating a merchant acceptance network, it is usual to expect that once a merchant has signed a contract with a bank (for a card payment), the merchant is already open to the cards of all other issuers in the world, without the need of any additional bi-lateral contracts. This is a common understanding of merchants and this has a huge impact on the speed at which a multi-operators' merchant acceptance network can be developed.

Obviously the opinions shown in Table 2-3 (cost part for merchant) indicate the direction which the industry had better follow. However there is not yet any common agreement about the cost for merchants directly related to the interoperability of different MNO/PSPs.

### 3. Mobile Payment Business Models

In this chapter, we first introduce a simple model of Money flow, and then try to estimate the basic architecture of the mobile payment business models.

There are dozens of forecasts that cover the e/m-commerce market size and trends. However, it is very rare that such research discloses the reasons or basis of the forecasts. We will use a very simple model so that the basic assumptions are clear enough to be easily changeable if needed by anybody.

#### 3.1. Money flow at a glance

The typical mobile payment money flow using EDD and CC is simply summarized in Figure 3-1. This is nothing but the traditional EDD/CC business model. There is additional money flow related only to mobile authentication (it is written as Service in the chart), consumer traffic and portal listing for merchants. Those are the main money sources.

Mobile Payment Business Money Flow (EDD/CC)

	Service	Acquiring fee	Interchange fee	EDD/CC	Misc.
Consumer	↑ Service				Traffic
Merchant		↑			Listing Service
Merchant's MNO/PSP		$X(1 - R_a - R_i)$		X	↓ S
Consumer's MNO/PSP					↓ Y
Merchant's Bank/Acquirer			↑ $X(1 - R_i)$		↓ Z
Consumer's Bank/Issuer					↓ S

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Figure 3-1: Mobile Payment Business Money Flow (EDD/CC)

Here we use the following notation in the chart. For simplicity we have assumed that all fees are per transaction based and dependent on the actual price of goods or services that are sold even though most EDD fees are fixed price based.

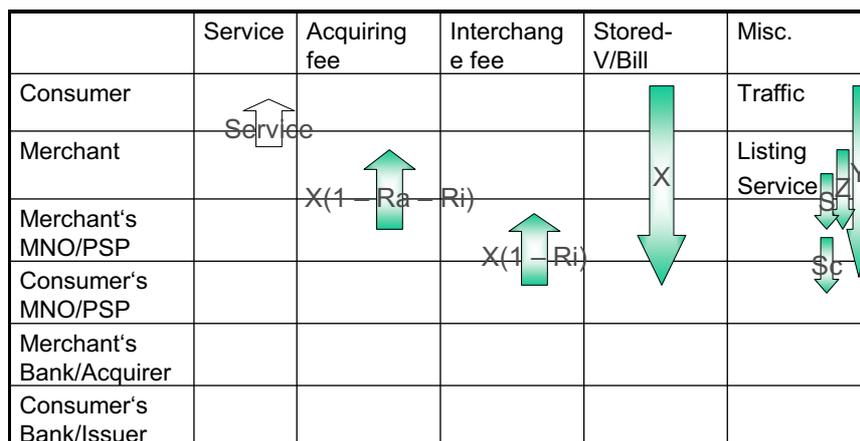
- X: Price of contents
- $R_i$ : Interchange rate
- $R_a$ : Acquiring rate
- Y: Consumer's traffic cost for purchase
- Z: Merchant's cost for portal listing
- S: Mobile authentication cost for merchants

Sc: Mobile authentication cost for merchant's MNO

The case of stored-value and operator billing, can be seen as shown in Figure 3-2. In this case the money flows only among consumers, merchants and MNOs. No financial institutions are directly involved. Of course to issue stored-value cards, or to perform monthly settlement of operator billing, bank functions are required in this scheme as well. However, those are not a main part of the mobile payment transaction life cycle. Note that stored-value is quite similar to (E)DD and the operator billing could be regarded as a MNO's credit card programme.

Based on these simple business models, we will estimate some rough business volume in this document. At the end of the next chapter, we will try to evaluate the cost of risk management and its impact on the prices (change on service fee rates).

Mobile Payment Business Money Flow (Stored-V/Bill)



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Figure 3-2: Mobile Payment Business Money Flow (Stored-V/Bill)

3.2. Order estimation of business volume

Let us summarize the players' revenue scheme based on the following basic assumptions and the above money flows. For simplicity we omit the enhanced traffic and the portal listing revenue. Our basic notations are summarized in Table 3-1:

Description	Notation	Unit
Average consumer spends	A	€ per month
Total number of subscribers	C	
Interchange rate	$R_i$	%
Acquiring rate	$R_a$	%

Service rate	S	%
Service commission	c	%

Table 3-1: Basic notation

Based on these notations, the major players revenues are given in simple formulae as shown in Table 3-2:

Description	EDD/CC model	Stored-V/Bill model	Unit
Total sales via mobile payment (Market size)	$V = A * C$	$V = A * C$	€ per month
Consumer side banks' total revenue	$R_{cb} = R_i * V$	$R_{cb} = 0$	€ per month
Merchant side banks' total revenue	$R_{mb} = R_a * V$	$R_{mb} = 0$	€ per month
Consumer side MNOs' total revenue	$R_{ct} = S * (1 - c) * V$	$R_{ct} = \{R_i + S * (1 - c)\} * V$	€ per month
Merchant side MNOs' total revenue	$R_{mt} = S * c * V$	$R_{mt} = \{R_a + S * c\} * V$	€ per month

Table 3-2: Major players revenue for models

As we have shown in the last chapter, most MNO/PSPs are preparing to support all payment instruments. Thus assuming the usage ratio of EDD/CC and Stored-value/Operator Bill as  $u : 1 - u$  (e.g.,  $u = 50\%$ ,  $1 - u = 50\%$ ), the revenue scheme will be given by

Description	Mixture model (in reality)	Unit
Total sales via mobile payment (Market size)	$V = A * C = V * (u + 1 - u)$	€ per month
Consumer side banks' total revenue	$R_{cb} = R_i * V * u$	€ per month
Merchant side banks' total revenue	$R_{mb} = R_a * V * u$	€ per month
Consumer side MNOs' total revenue	$R_{ct} = \{R_i * (1 - u) + S * (1 - c)\} * V$	€ per month
Merchant side MNOs' total revenue	$R_{mt} = \{R_a * (1 - u) + S * c\} * V$	€ per month
Merchants' total revenue	$R_m = \{1 - R_i - R_a - S\} * V$	€ per month

Table 3-3: Major players' revenue in mixture model

To obtain some realistic feeling, let's set the figures as shown in Table for reference.

Note that the assumption below is for digital goods or services in a few years. The potential market size of the real POS via mobile payment is much larger than the following (Many households spend several hundreds € per month. This means a market size at least ten times more.)

Description	Reference data (assumption)	Unit
Average consumer spends	$A = 10$	€ per month
Total number of subscribers	$C = 100$ Million	In EU wide
Market size	$V = A * C = 1000$ Million	€ per month

EDD/CC and Stored-V/Bill ratio	$u : 1 - u = 50 : 50$	%
Interchange rate	$R_i = 1$	%
Acquiring rate	$R_a = 1$	%
Service rate	$S = 1$	%
Service commission	$c = 50$ ( $S^*c = 0.5\%$ )	%

*Table 3-4: Assumed figures as a reference*

Note that the rates (interchange, acquiring and service) are set as 1% for simplicity. The figures may vary from case to case. Then the reference revenue of major players looks like

Description	Relation	Unit
Total sales via mobile payment (Market size)	$V = 1000$ Million	€ per month
Consumer side banks' total revenue	$R_{cb} = 5$ Million	€ per month
Merchant side banks' total revenue	$R_{mb} = 5$ Million	€ per month
Consumer side MNOs' total revenue	$R_{ct} = 5$ (interchange) + 5 (Service) Million	€ per month
Merchant side MNOs' total revenue	$R_{mt} = 5$ (acquiring) + 5 (Service) Million	€ per month

*Table 3-5: Major players' revenue as a reference*

MNOs have other sources of revenues such as enhanced traffic and portal listing. If the average sold price is about 1€ (e.g., vending machines, digital goods), the number of transaction per month is 1000 Millions. Even if the traffic for a payment transaction costs 0.05€ for each, the total traffic generates 50 Millions € per month for MNOs. If one compares those figures, one can easily imagine that the payment solution is a good tool for enhancing the core business for MNOs.

In order to check the feasibility of our assumptions and discussions, we can study the NTTDoCoMo's annual report as a real market reference. NTTDoCoMo's iMode shows a similar revenue case (\*estimated by the author based on their IR report published by NTTDoCoMo on their web site).

Year/Quarter	03/2001	06/2001	09/2001	12/2001
iMode Subscribers	21,695,000	24,989,000	27,769,000	30,182,000
iMode ARPU	2,110 Yen	2,300 Yen	2,180 Yen	2,130 Yen
iMode basic monthly fee	300 Yen	300 Yen	300 Yen	300 Yen
Net iMode ARPU	1,810 Yen	2,000 Yen	1,880 Yen	1,830 Yen
Net Monthly iMode revenue*	39 B Yen	50 B Yen	52 B Yen	55 B Yen
iMenu site access %	30 %	23 %	23 %	24 %

iMenu access monthly revenue*	12 B Yen	12 B Yen	12 B Yen	13 B Yen
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*Table 3-6 : iMode revenue as a reference (1€ is about 117 Yen: End of April/2002)*

*\* estimation by the author*

iMode ARPU is the average monthly revenue per unit. Subscribers pay for their iMode access to the iMode-site such as iMenu-site, usual web site and mail servers. Some of iMenu-site providers (information providers) will charge the service fee via NTTDoCoMo. Some information providers, such as online brokers, offer access without charging via NTTDoCoMo but by their own account. Therefore the row "iMenu access monthly revenue" is the maximum size of the iMode payment business market size. From this amount, we have to subtract the traffic revenue for NTTDoCoMo, and then the rest is the payment service revenue for NTTDoCoMo. iMode charges 0.3 Yen for one packet (=128Bytes). If we assume that the average digital contents size is about 1280Bytes, 3 Yen is the average traffic revenue for NTTDoCoMo. Let us assume that 100 Yen is the average contents (mostly melody, picture, games, etc.) price, and 3% for the payment service fee goes to the information providers. Then 6 Yen are for NTTDoCoMo every time that 100 Yen contents are sold over the iMode. Therefore in this assumption, the ratio of traffic revenue and the payment service revenue is 50:50. Let us further assume that 10% of iMenu sites are offering charged services. Then about 0.6 B Yen (about 5 M €) is the payment service revenue of NTTDoCoMo. This market size is generated by about 20 to 30 Million subscribers. In case of 100 Million subscribers, we can expect that the total payment service revenue could be in a range of 20 to 25 M € per month. This matches our basic assumption given in Table 3-5.

The important point is that NTTDoCoMo's data shows us that the mobile payment functionality of iMode generates the payment service revenue 0.6 B Yen as well as traffic revenue of the same amount. NTTDoCoMo's service is currently limited to digital contents, although several pilot cases are already active. Thus we cannot estimate the Virtual POS for real goods and real POS market volume with their figures.

Back to our original discussions, these figures in Table 3-5 do not look very attractive to banks. Only several millions of EUR for all players per month will never cover the whole cost which is needed to invest and to operate. But for the MNOs, as we have mentioned above, the other revenue sources, especially the traffic, can be a real driving force for the system development (one can easily expect good synergies between payment and traffic for MNOs).

Although our business models are too simple to represent detailed reality in the mobile payment business, the following rough estimation is derived as a reference:

For mainly digital contents (Buy&Pay, Pay), assuming 100 Million consumers spend 10€ per month in average, and 50% EDD/CC, 50% Stored-Value/Operator Billing, all banks' revenue is just 10 Million € per month and all MNOs' revenue is 20 Million € per month excluding other revenues such as traffic and portal listing incomes. For vending machines (Replace cash), assuming 100 Million consumers spend 100€ per month in average, and 75% EDD/CC, 25% Stored-Value/Operator Billing, all banks'

revenue is now 150 Million € per month and all MNOs' revenue is 150 Million € per month. The same stands for real POS (Replace plastic cards), assuming again 100 Million consumers spend 100€ per month in average (75% EDD/CC, 25% Stored-Value/Operator Billing, all banks' revenue is 150 Million € per month and all MNOs' revenue is 150 Million € per month.

#### 4. Mobile Payment Risk Premium

The uniqueness of mobile payment (in comparison with traditional card payment) is the following:

- 1) Mobile specific authentication (additional security and opportunity for consumer profiling)
- 2) Usage of device (one can have many plastic cards, but only one for mobile)
- 3) Special benefit for MNOs such as enhanced traffic and portal listing revenue

These features characterize the mobile payment in essence. Due to higher security (at least as expected), the service rates could be lower than typical e-commerce rates (for example, the credit card “card is not shown” rate for virtual POS is higher than real POS because of the risk). If MNOs and banks cooperate for the risk management, we believe that better service rates could be realized. Otherwise the conventional WAP or iMode web service will be used. There is no incentive for merchants to use new mobile payment systems. The usage of a mobile phone set generates more centralization of consumers’ purchase information than those of plastic cards. It means that better consumer profiling could be possible and it leads to better risk management by MNOs and banks.

In this chapter, we discuss a maximum benefit we could expect by mobile payment collaboration among MNOs and banks. Our target in this chapter is to understand how risk premium is set and to estimate the size of the premium that is usually embedded in the interchange rates and acquiring rates. Therefore, in an ideal situation where mobile authentication achieved the nearly perfect detection of fraud and even consumer default or delinquency, the total service fee rates that could be achieved would be those of a risk free world.

##### 4.1. Evaluation of Risks

We will consider how the risks will affect the service structure in the following chapter. First let us discuss the major risks separately to help our understanding.

###### (A) Consumer default risk

Suppose that  $X_{CD}$  of customers default monthly (e.g., 0.1% of  $A = 100$  Million). For simplicity we consider that the number of new consumers who register monthly is the same as the number of consumers who default monthly, so the total number of the consumers never changes. The consumer side bank (for EDD/CC) or MNO (for Stored-value/Operator bill) face the loss of the money which amounts to  $V \cdot X_{CD}$  monthly. The expected loss caused by the consumer default ( $L_{CD}$ ) is expressed as  $L_{CD} = V \cdot X_{CD}$  per month. With the previous setting given by Table 3-5, this costs  $1000 \cdot X_{CD}$  Million € per month.

In 1996, U.S. consumer bankruptcy filings numbered 1,125,006 cases (Source: American Bankruptcy Institute, Washington, D.C., 1997). This shows about 0.1% of consumers could default every month. Therefore, if  $X_{CD} = 0.1\% = 0.001$  in EU, it costs 1 Million € per month.

## (B) Merchant bankruptcy risk

Suppose again that the number of merchants who default each month ( $X_{MB}$  of merchants) and the number of merchants who register newly each month are the same. The possible problem in this case is for the consumer who has paid for the goods, but cannot obtain the Chargeback even if he wanted to and sent the goods back to the merchant.

Let the Chargeback rate be  $C_{BR}$ , then the expected loss caused by the merchant bankruptcy ( $L_{MB}$ ) with the Chargeback is expressed as  $L_{MB} = C_{BR} * V * X_{MB}$  per month. The case of Table 3-5 leads to  $1000 * X_{MB} * C_{BR}$  Million €, and the same source shows that in 1996, U.S. business bankruptcy filings amounted to 53,549 cases. More than 0.1% of merchants could be defaulting every month.

It might be reasonable to assume  $X_{MB} = 1(\%)$ , since the electronic market or new economy has rather higher competition than the physical real market. It costs  $10 * C_{BR}$  Million €. If  $C_{BR} = 10(\%)$ , the cost becomes 1 Million € per month.

## (C) Delinquency interest

We suppose that  $X_{DI}$  of consumers delayed the payment monthly with a certain time distribution. For simplicity we consider that the mean is  $T$  (year) (for example, 90 days = 0.25 year). The consumer side issuer and MNO lose the money which amounts to  $V * X_{DI}$  monthly. But this amount will be paid later on.

If we consider the risk free interest rate  $r$  (continuous compound annual base) with which the bank or MNO can lend the money for a while until the money comes from the consumers, the net loss of the money for the delinquency interest could be written roughly as  $L_{DI} = V * X_{DI} * (\exp(r * T) - 1)$ .

In the same way using Table 3-4, this costs  $1000 * X_{DI} * (\exp(r/4) - 1)$  Million €. If  $r$  is about 0.1, and  $X_{DI} = 0.1$ , it costs 2.5 Million € for one month.

## 4.2. Risk premium

In the previous section, we discussed the financial impacts of the risks separately for each case. Using the same notation, we hereby estimate how the risks or the potential financial impacts are already embedded.

### (A) Consumer default risk

The expected loss by consumer default can be expressed as  $L_{CD} = V * X_{CD}$  per month. Remembering the fact that the consumer side issuer and MNO revenues are also written in the similar form as  $R_{cb} = R_i * V * u$  and  $R_{ct} = \{R_i * (1 - u) + S * (1 - c)\} * V$  per month, the interchange rate  $R_i$  which is the source of the consumer side bank's and MNO's revenue, must be premièred by  $X_{CD}$  to cover this risk, namely

$$R_i' = R_i + X_{CD}.$$

**(B) Merchant bankruptcy risk**

In the same way as (A), the acquiring fee  $R_a$  will be premièred by  $C_{BR} * X_{MB}$  as

$$R_a' = R_a + C_{BR} * X_{MB}.$$

**(C) Delinquency interest risk**

Finally, the premium for the delinquency interest risk, is derived using the expected loss by the delinquency interest  $L_{DI} = V * X_{DI} * (\exp(r * T) - 1)$  per month, thus

$$R_i' = R_i + X_{DI} * (\exp(r * T) - 1).$$

The premium setting of the interchange and acquiring fee is the most natural way to absorb the financial risks.

Note that it is important to consider damage caused by the Chargeback that does not generate any revenue to consumer and merchant side banks and MNOs though the operation is required even if the merchant does not go bankrupt. Therefore the Chargeback premium must be already applied to the service fee rates too, independent from the merchant bankruptcy risk. This means

$$R_a' = R_a * (1 + C_{BR}), \text{ and } R_i' = R_i * (1 + C_{BR}).$$

Therefore the relationship between assumed rates  $R$  and risk premièred rates  $R'$  is summarized as

Interchange rate:  $R_i' = R_i * (1 + C_{BR}) + X_{CD} + X_{DI} * \{\exp(r * T) - 1\}$

Acquiring rate:  $R_a' = R_a * (1 + C_{BR}) + X_{MB} * C_{BR}$

Service rate:  $S$  (for mobile authentication by MNO/PSPs)

The expected values for those figures are summarized in Table 3-4.

Note that we have set all figures as 0,1, 1 or 10 (%) just to differentiate the order of the amounts.

	Value	Unit
Acquiring fee rate $R_a$	1	% of sales amount
Interchange fee rate $R_i$	1	% of sales amount
Chargeback rate $C_{BR}$	10	% of sales amount
Consumer default rate $X_{CD}$	0.1	% per month
Merchant bankruptcy rate $X_{MB}$	1	% per month

Delinquency rate $X_{DI}$	10	% per month
Risk free interest rate $r$	10	% per year
Average delinquency period $T$	0.25	Year
Premiered Acquiring fee rate $R_a'$	1.20	% of sales amount
Premiered Interchange fee rate $R_i'$	1.45	% of sales amount

*Table 4-1: Payment service rate values with risk premium*

Now the questions are coming. Consumers or merchants can somehow accept the logic of the risk premium for Internet commerce, since it is widely known that the Internet is a very insecure environment. Mobile commerce, banks and MNO/PSPs have another source of authenticating consumers, namely mobile authentication. If we simply add the service fees in our example, merchants' cost is about 3.65% (= 1.20 + 1.45 + 1%). However it is natural to imagine that merchants expect better service rates as good as real POS ("card is shown"), such as about 3% (this usually varies country to country and by industry segments), since MNO/PSPs say better security is implemented in the system.

The risk premium parts can be compressed in principle by means of technologies such as customer profiling and suitable setting of credit limits. The realization of mobile payment standard should also lead to such a benefit for the merchants (and equivalently consumers) through mutual collaboration regarding different knowledge and know how on their customers by banks and MNOs.

## 5. Minimum Technology Requirements

As we have discussed in chapter 1, in order to create any kind of mobile payment standard, we need to achieve at least interoperability (or one choice) for the Mobile user Interface (Server-wallet, Slot and SIM), interoperability (or one choice) for the Mobile authentication (Voice, SMS, WAP, iMode and USSD) method, and a common standard for Risk management and regulation (e.g., for Mobile Clearing Houses). We will try to point out the most important points for future discussions.

### 5.1 Mobile user interface

There are currently several Mobile user interfaces for mobile payment.

- 1) Server-wallet (with Single chip)
- 2) Dual chip
- 3) Dual slot

Server-wallet is also used for registration of consumers and self-care, where consumers can set their payment instruments. The advantage of this approach is that consumers do not have to purchase any other new mobile phone set. However in most cases consumers have to use a PC to get access to the wallet-server. The mobile phone set itself does not have to change from the conventional single SIM chip design.

The second candidate is the dual chip. A handset contains another SIM chip where a payment chip (such as an EMV compatible chip card) could be inserted. In this case the second chip card issuer can control the payment scheme, as with a plastic card business (credit card, debit card). However consumers have to spend money on the new handset before trying to start mobile payment. It means that the barrier to be penetrated is rather high at this stage.

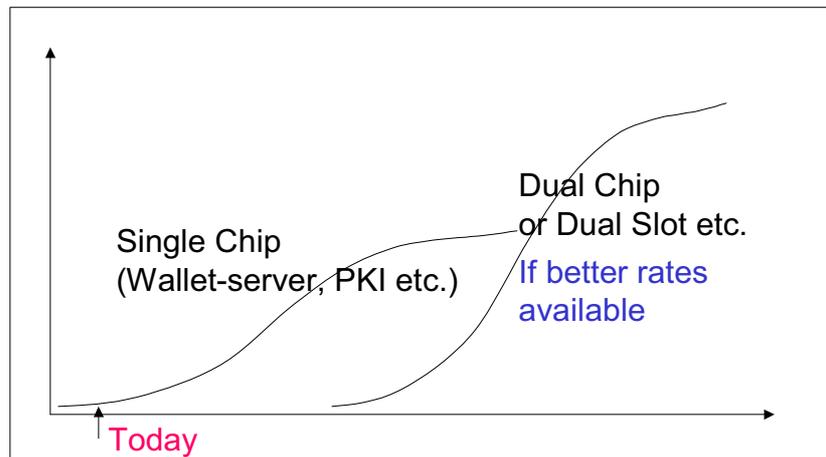
The dual slot is already available in some domestic market. Consumers have to get the new handset as well as the dual chip model. For the same reason, the driving force to involve mass market seems to be not strong enough.

Traditional payment industries such as banks and credit card organizations are investing huge amounts of money in the EMV direction. For banks and credit corps, it makes sense to collaborate with MNOs only if the EMV solutions will be available on the common platform. Otherwise, the server-wallet solution (nothing but a simple mobile extension of Internet payment) is the only way to go.

From these considerations, we believe that to realize a mobile payment standard some common milestone setting is the most appropriate. In the current situation, the server-wallet is the best way to the market. Consumers do not have to spend additional costs for the handset. And merchants and payment service providers/MNOs easily adopt the server-wallet. Banks have to do nothing special; there are more or less the same technical requirements for e-commerce except for mobile authentication handling. After the growth of the market and wide acceptance of mobile payment culture, the industry can gradually start to introduce dual chip or

dual slot solutions if needed by offering further better service rates. In conclusion, the following migration path is a possible way to go.

### Mobile Payment User Interface Migration



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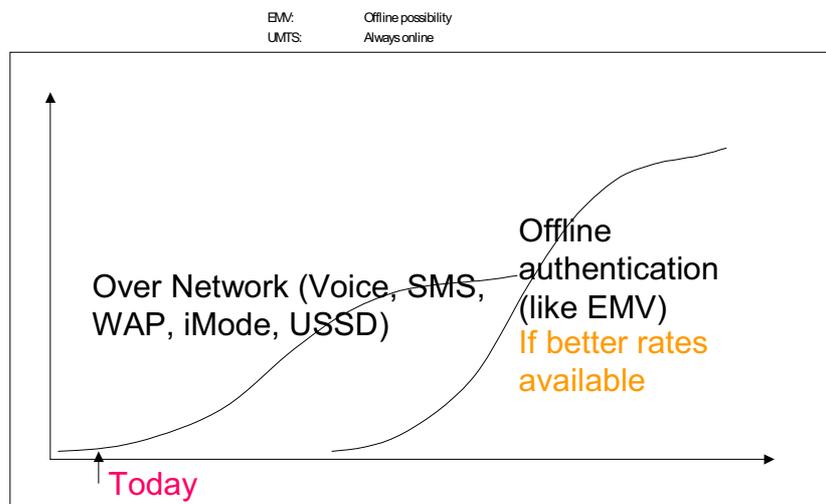
*Figure 5-1: From Single Chip to Dual Chip or Slot*

It is of real importance to provide a common standard/user interface for consumers to accept mobile payment in the same way as credit cards or debit cards. On the other hand it is essential for consumers that there exist enough merchants that support such an interface for accepting the payment. In this sense it is also critical to organize and recruit merchants in this direction, saying that once the interface has been incorporated, the platform is open to most mobile users (not only customers of a specific MNO). The standard in this layer (Demand – Supply layer) closely relates to Payment service layer since interoperability among the payment service layers enhances the good/wide acceptance of the Demand – Supply layer interface such as server-wallet. In other words, we cannot expect any successful user interface standard without backup from the payment service layer interoperability.

## 5.2 Mobile authentication method

The currently available mobile payment systems use MSISDN for user authentication. This is an additional security factor to non-mobile Internet payment. Because of this additional security, one can expect a better service rate (due to more effective fraud detection and consumer profiling with higher accuracy). There are several ways to check consumers. This data can be transmitted over voice, SMS, WAP, or USSD additional to PIN. Payment service providers/MNOs can verify the PIN together with the MSISDN. This functionality is also to be standardized to speed up market acceptance. In the payment service layer, the interoperability to exchange mobile authentication data (MSISDN and PIN verification data) is necessary to realize a real mass market.

## Mobile Payment Authentication



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*Figure 5-2: Mobile Authentication method*

Some operators are willing to introduce mobile PKI (Public Key Infrastructure) by asking consumers to download keys onto their handset. WIM (Wireless Identification Module) is another technology which can be inserted into the second chip slot. These new technologies enhance the security or accuracy of user authentication. What we definitively know is that consumers prefer to use simple, cost effective and widely accepted means.

Besides many technical possibilities for mobile authentication methods, one has to consider interoperability where the authentication happens. The usage of MSISDN generally requests the authentication in centralized systems. Integration for the interoperability is not so difficult in this case. MNOs' migration path of the data transport carriers such as GSM, GPRS and UMTS should not affect the method. However, if the authentication is performed in the handset, a strict standard such as EMV specifications is needed for sharing the authenticated trust.

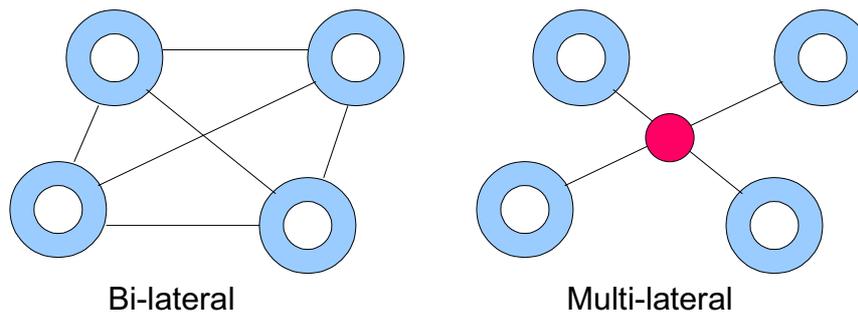
### 5.3 Mobile settlement and clearing

To the extent that mobile payment schemes use only EDD and CC as the payment instruments, interoperability among FSPs is guaranteed. The financial service layers are well established and the payment service layers have to accept the interface definition to use. In this sense, once mobile user interface and authentication method are standardized, the whole system with EDD and CC could be easily interoperable.

However, as we have discussed in previous chapters, stored-value and operator billing are quite attractive payment instruments for MNOs. As most MNO/PSPs consider that full support of all payment instruments is very important, we must consider how it is possible to achieve the inter MNOs settlement and clearing.

In this case, the settlement and clearing happen within the payment service layer mostly without help from the financial service layer. Therefore a standard is needed for the settlement and clearing as well as mobile authentication standard in this layer.

## Mobile Payment Interoperability



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*Figure 5-3: Bi-lateral or Multi-lateral*

Figure 5-1 shows possible architectures for interoperability. It is often naively believed, that interoperability among different MNO/PSPs creates larger market size in the demand – supply layer, since more consumers and more merchants have a chance to meet in a global market. Bi-lateral architecture could be used for bigger MNO/PSPs. They can simply make a bi-lateral agreement for mobile payment similar to the current roaming services. For smaller MNO/PSPs, it is ideal to use centralized systems such as mobile clearinghouses for international roaming service, since the number of contracts is related to costs and efforts.

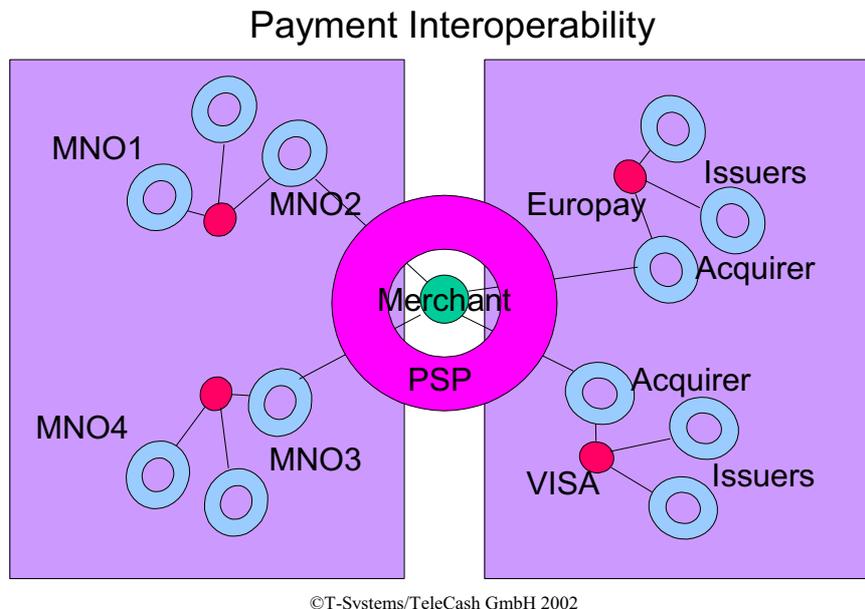
From a merchant point of view again, the existence of such bi-lateral agreements or multi-lateral agreements in MNO/PSPs strongly encourages participation in the market and sound market competition. This has a huge impact on the speed at which a multi-operator merchant acceptance network can be developed as we have mentioned before.

As we know banks, especially internationally active banks, are regulated by authorities to prevent systemic financial risk. The above situation also leads to a potential systemic risk, since any MNO/PSPs carry a credit risk. The settlement and clearing are best performed as nearly as possible in real time and on a gross basis. Note that stored-value is no longer a risk free payment method in this case.

As we have seen in the last chapter, there will always be risk for with those who play a major role in payment systems. Monitoring consumers and merchants is mandatory for MNO/PSPs. When interoperability opens other MNO's territory, the MNO/PSP has

to monitor the counter parties (e.g., other MNOs and banks) as well. This is essential for any organization that participates in payment services.

If Mobile clearinghouses offer such a platform for mobile payment interoperability, their functionalities must be upgraded to real time (at least daily) gross settlement.



*Figure 5-4: Payment Interoperability*

For MNO/PSPs, some security technologies such as asset backed securities are also important to hedge consumer risks (default, delinquency, etc.) as well as for managing consumers by credit rating and profiling.

Based on the customer data of a MNO, for instance, a top customer analysis is performed by use of telecommunication service specifications: Usage distribution in time, number of calls, average length of calls, type of contract, etc. Since consumer side MNOs also know each consumer's account status, the following information is available as well:

- Status and history of cash-flow at the account
- Duration of the account
- Delay in paying in the past
- Purpose of usage (premium call, international call, etc.)
- Employment status (length of service, job title, company's status)
- Personal status (single, married, divorced, widowed, sex)
- Residential status (how long, owned, rented)
- Age
- Nationality

Some of these features can be calculated easily or obtained directly, and the others can be estimated indirectly. For example, income-range could be estimated from the job title, age, residence and company's status.

This is regarded as a job historically done by banks. Therefore banks are regulated more strictly than any other industries, not only for their credit risks but also for the treatment of personal data. If MNO/PSPs start similar functionalities as banks (which they must do so when involved in payment), there follows a simple question: how one can guarantee a fair competition between two industries regulated differently?.

## 6. Conclusions

Introducing simple business models, we have discussed possible roles and interests of major players (merchants, banks and mobile network operators). From merchants' point of view, the collaborative work by banks and mobile network operators is one of the biggest interests, since "consumer trust", "payment guarantee", and the lowering of service fees are only feasible by such collaboration.

Mobile network operators are rushing to the market based on existing technologies. They know that it is very important to show their presence and take a share before the market saturates. Digital contents business is the key for them. It might stop or at least delay decreasing ARPU that is their management requirement.

The digital contents market for mobile payment seems not big enough for banks at this moment. Nobody knows what will happen in future. However what we can at least say is that there is a possibility for mobile payment to penetrate into the real POS market, and the impact is not then negligible at all.

New committed technology might influence the payment industry structure drastically. Since the current major activities of mobile payment are driven with existing and available technologies such as single chip with server-wallet, WAP, etc., the likelihood of standardization could be for the next generation, where the fusion of EMV and UMTS technologies has to be the key success factor.

Placing milestones for the future while accepting the current situation is the only way to unify mobile payment activities for all major players (consumer – merchant – bank – mobile network operator) in the main chain.

## Acknowledgement

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## **Appendix-A List of Abbreviations**

ARPU	Average Revenue Per Unit
CC	Credit Card
EBPP	Electronic Bill Presentment and Payment
EDD	Electronic Direct Debit
EMV	Europay Mastercard VISA chip card specification
FSP	Financial Service Provider
GSM	Global System for Mobile communications
GPRS	General Packet Radio Services
MNO	Mobile Network Operator
PKI	Public Key Infrastructure
POS	Point Of Sale
PSP	Payment Service Provider
SMS	Short Message Service
UMTS	Universal Mobile Telecommunication System
USSD	Unstructured Supplementary Service Data
WAP	Wireless Application Protocol
WIM	Wireless Identification Module