

## Lecture 6

# Application Domains II: M-Payment II



Mobile Business II (SS 2020)

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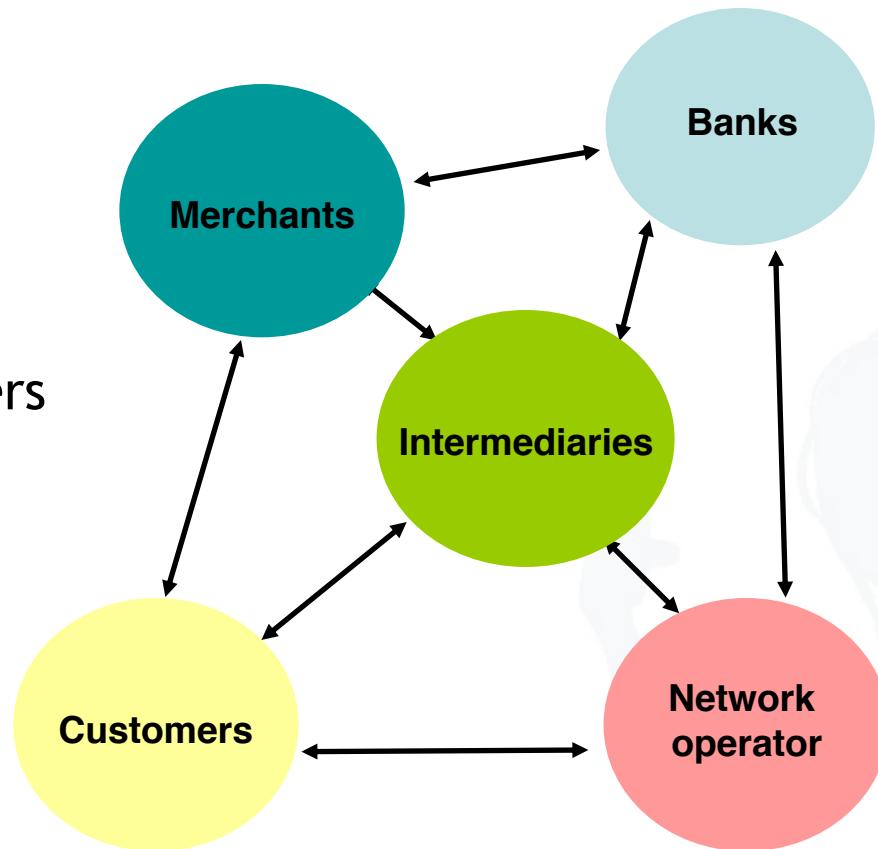
- Introduction
- M-Payment Parties
- Different Interests & Conflicts
- M-Payment Infrastructures
- Examples of M-Payment
- Conclusion

- The mobile payment space is becoming more and more competitive, with both established leaders and start-ups entering the market.
- All parties are staking their claim for market share and consumer acceptance.
- In addition to differences in the applied technologies (cf. Lecture 5), these solutions also differ in their business models, the involved parties, and their interests.

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Different parties with different interests:

- Customers
- Merchants
- Network operators
- Intermediary
- Financial Service Providers



It was often argued that mobile payment services provide several advantages to customers such as:

- Mobility properties enable the efficient utilisation of travel and waiting time.
- Increased comfort & user friendliness through the independence towards time and place (particular due to the fact that there are less and less branches).
- In conjunction with personalised offers, spontaneous, time-independent shopping & payment is enabled.
- Enhanced security with regard to payment transactions in the on- & offline-world.



*But:* Are these “advantages” obvious to customers?

*And:* How do these “advantages” relate to traditional means of payment?



- Intermediaries are processing payments between the different parties (e.g. between the bank of a merchant and the bank of a customer) and therefore charge transaction fees.
- Many of the intermediaries are owned by other M-Payment parties such as merchants, operators or banks:
  - Click and Buy (owned by Deutsche Telekom, closed in 2016)
  - Paypal (initially owned by eBay, since 2015 independent company)
  - Yapital (initially owned by Otto Group, since 2014 integrated into Verifone)
- Some intermediaries try to push their own hardware into the market (e.g. Apple Pay, Samsung Pay)
- Intermediaries can act with bank license (e.g. Paypal) and without bank license (e.g. Yapital).



- Credit card companies were the first movers using the NFC technology with contactless credit cards.
- Nowadays they are trying to virtualize their credit cards and position themselves into the different mobile wallets.



Visa  
payWave 

MasterCard  
paypass™

- Banks are currently not as present in the M-Payment market as online payment providers and operators, but they have the following assets:
  - Established large customer bases
  - Extensive experience in risk management, security, fraud mitigation, and payments processing
  - Possession of the only true gateway to the payments infrastructure (card issuing, automated clearing house, and wire)
  - Data from card and check usage that can be used to identify broad buying behaviors and individual customers who generate a large number of transactions
  - Relationships with merchants – both on the credit/cash management side and on the acquiring side

- Merchants are faced with a large amount of different M-Payment solutions.
- They need to install new hardware (e.g. NFC terminals), new software (e.g. QR Code Payment) and train their employees to adopt these new processes.
- Up to now it is not clear which technology will be adopted by the customer.
- Therefore, most merchants are holding back the introduction of new technologies.

- Network operators such as Telekom, Vodafone and Telefónica all developed their own wallet solution.
- Therefore they are cooperating with credit card companies and online payment providers for payment processing.

My Wallet  
(Deutsche Telekom)



Vodafone Wallet



O2 Wallet  
(Telefónica)





Any mobile payment scheme involving an **exclusive link to the operator would face serious challenges** in attracting merchants, since the absence of a national (or multinational) standard could lead to a situation where each operator is pursuing an own solution.

Most commonly, such alliances will be **between operators and the financial services industry.**

- **EMPS**, Finland (Nokia, Nordea, Visa International)
- **M-Pesa**, Kenia (Safaricom, Vodafone)
- **MobilMat**, Italy (Wind TLC, Banca Sella)
- **Mobipay**, Spain\_(Telefonica, Vodafone, Amena, BBVA, BSCH, Sermepa, Sistema 4B, Euro 6000) - till 2009
- **Moxmo**, Netherlands (since beginning of 2002), Germany (since end of 2003), both till 2004
- **mpass**, Germany (Vodafone, O<sub>2</sub>) [closed down 2016-10-01]
- **NFC Forum**, U.S. (NXP, Semiconductors, Sony, Nokia), Since 2004
- **Obopay**, U.S. and India (Nokia and other investors)
- **Omnipay**, Italy (Omnitel, Visa International, BankAmericard)
- **Orange Mobile Payment**, Denmark (Orange Denmark, PBS, Gemplus)
- **Paiement CB Sur Mobile**, France (Orange France, CB, SFR)
- **Paybox**, Europe (Deutsche Bank, Debitel – till 2002)
- **Simpay** (T-Mobile, Telefónica, Vodafone, Orange, O<sub>2</sub>, TIM, Debitel), till 2005

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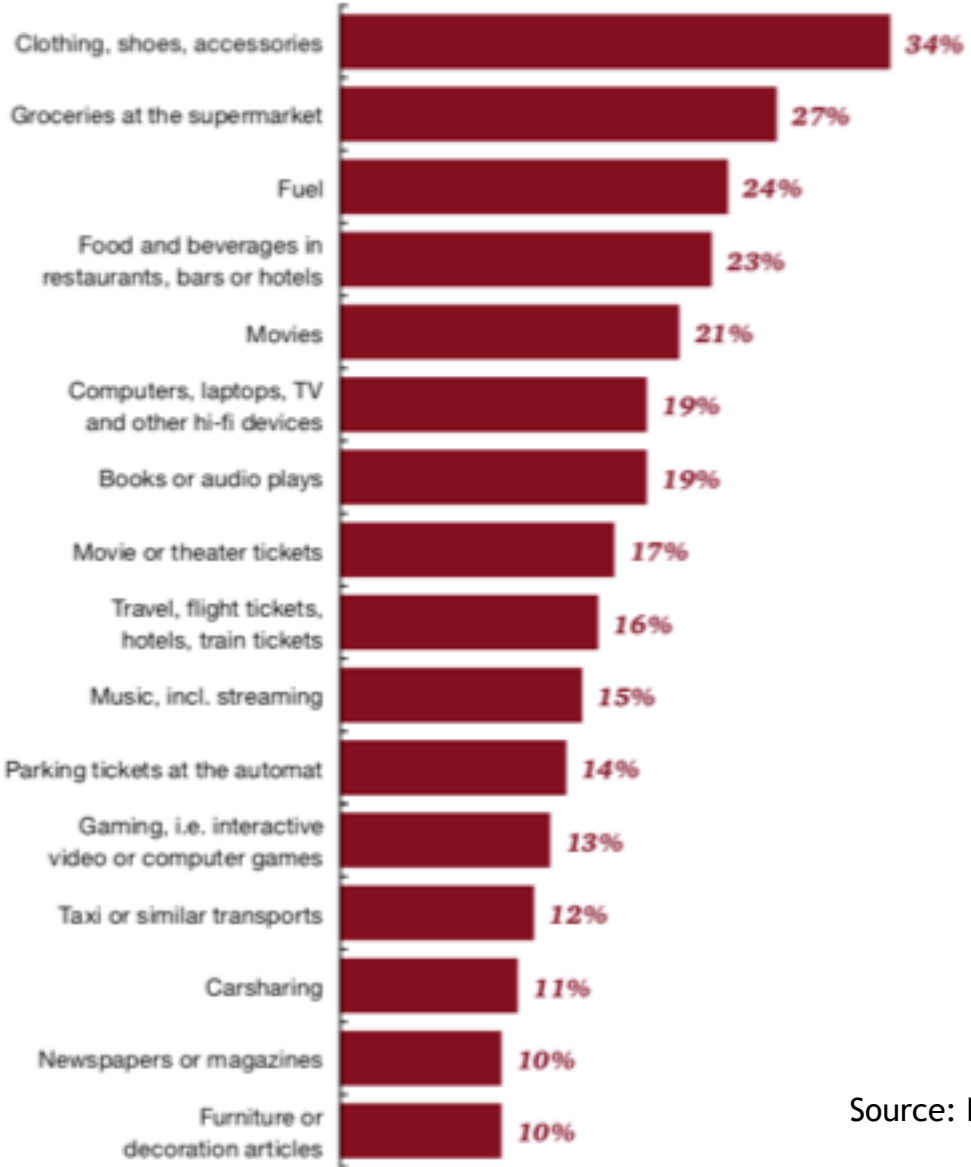
# Some Relevant Interests in the M-Payment-Area

- **Customers:**  
Only a small number of (trustworthy) parties should have access to personal financial data.
- **Merchants:**  
Accepted payments should be enforceable.
- **Network operators:**  
Offering of new (security-relevant) services (e.g. billing-services), increase customer loyalty and decrease churn rates
- **Banks: Controlling** the payment-process
- **Central Banks:**  
No direct C2C payments to avoid a shadow currency

# Different Drivers for M-Payment

	Banks/ card networks	Mobile operators	Online payment providers	Retailers
Cash replacement	✓		✓	✓
Speedier transactions				✓
Customer retention	✓	✓		✓
Promoting own payment service	✓	✓	✓	✓
Extending reach to physical world		✓	✓	
Reducing capex/opex	✓			✓
Seeking extra revenue stream(s)	✓	✓	✓	
P2P payments	✓	✓	✓	

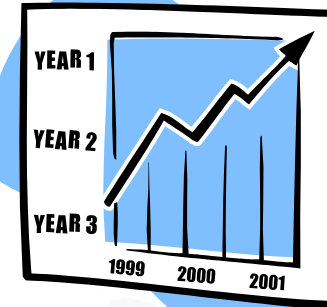
A survey among German customers highlighted some use cases for mobile payment solutions



# Different Interests & Conflicts

## The Customer's perspective

- Factors affecting the acceptance of mobile payment services:
  - Perceived usefulness
  - Perceived ease of use
  - Perceived credibility
  - Perceived self-efficacy
  - Perceived financial cost

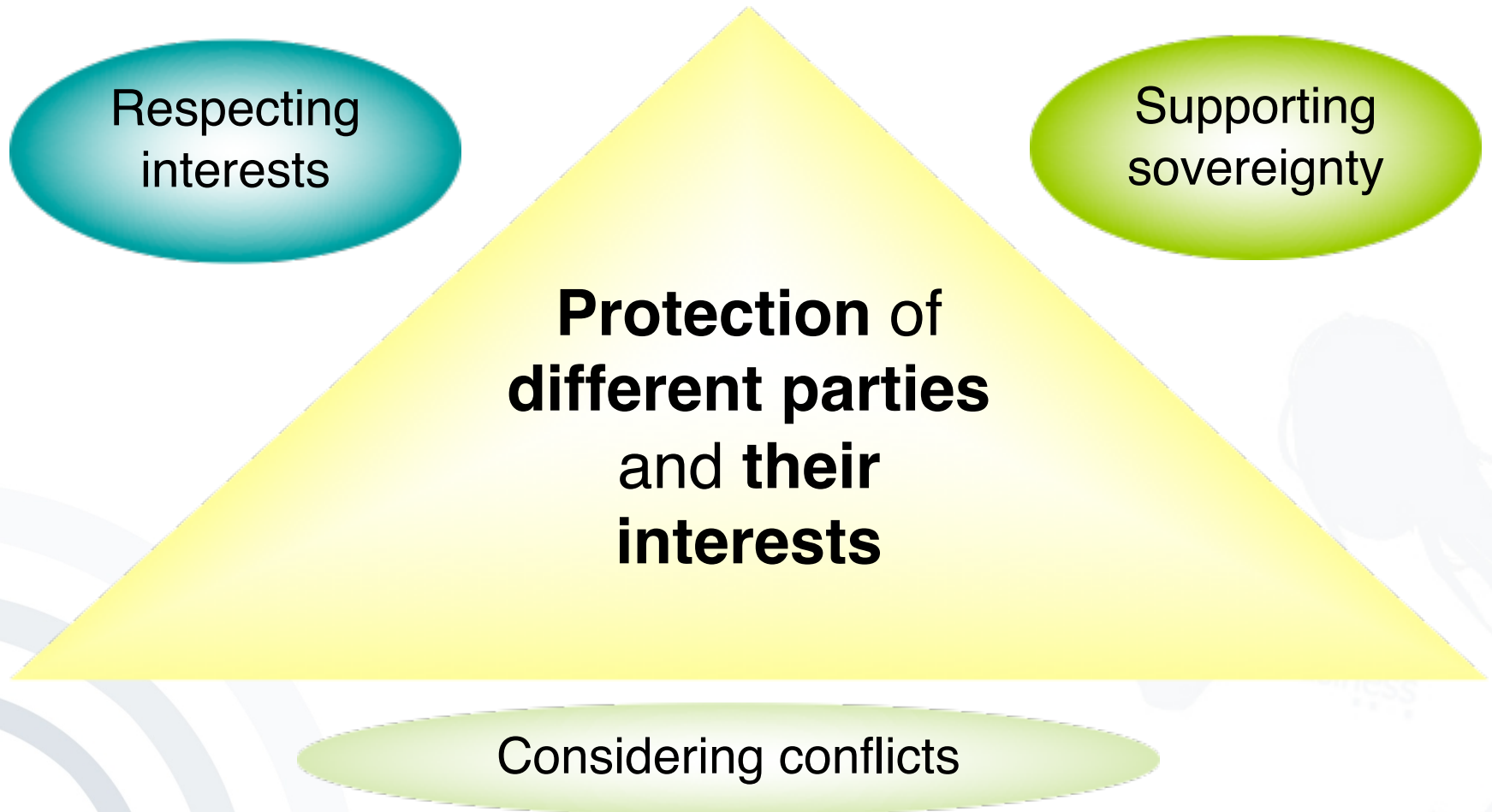


- Customers are not willing to pay more to use M-Payment.
- Merchants want to keep as much as possible of the money and are not willing to pay more than 2-3% transaction fee.
- Banks, credit card companies and intermediaries want to maximize their share.

# M-Payment Transaction Fees | 2

- By covering the whole value chain between merchant and consumer, mobile online payment solutions can claim a relatively big share of the transaction fee.

	Merchant	Merchant-acquiring bank	Payment network	Card-issuing bank
Cash	100%			
Credit/debit cards	CC: ~98% Offline DC: ~99% Online DC: >99%	0.4% (shared w/processors) 0.25% (shared w/processors) 0.16% (shared w/processors)	0.1% 0.1% 0.05%	1.5% (shared w/processors) 0.77% (shared w/processors) 0.25% (shared w/processors)
Checks	96%	US\$0.25 per transaction (verification) AND 2% + US\$0.15-0.25 per transaction (guarantee)		May collect banking fees from consumers
Online P2P payments	~97% ~98%	PayPal: 1.9% to 2.9% + US\$0.30 per transaction Google: 2% + US\$0.20 per transaction		
mPayments	~97%	<1%	0.1%	~2%



## Respecting interests

- Parties can define their own **interests**.
- Conflicts can be **detected** and **negotiated**.
- Negotiated **results** can be **enforced**.

## Supporting sovereignty

- Parties aren't forced to trust **other parties**.
- Parties only need a **minimum of trust** into the **technology** of others.

➔ Security of **different parties** and **their interests**



## Multilateral Security & M-Payment?

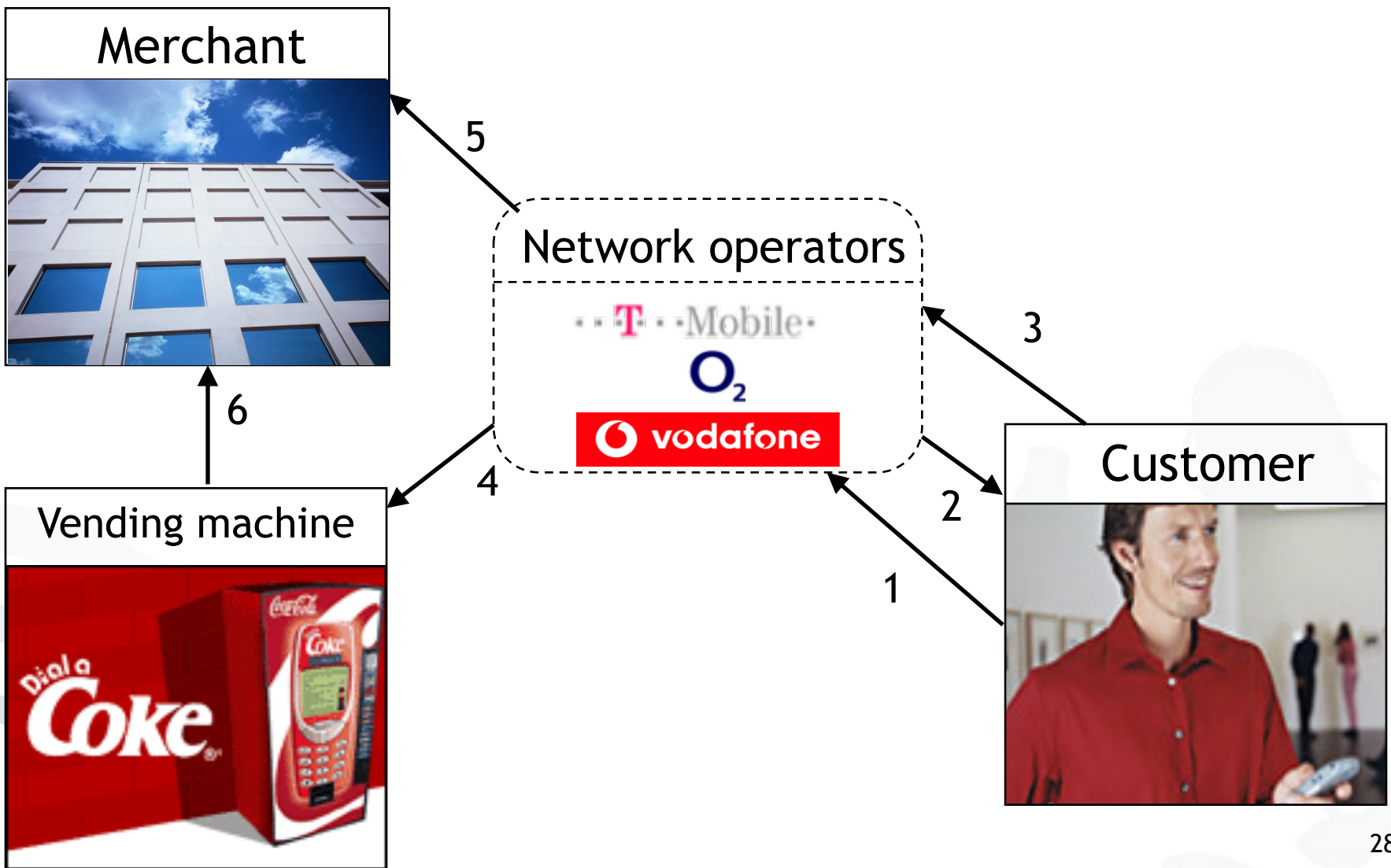
Trade-Off: On the one hand it should be **easy to use**, on the other hand it should be **secure**, for example:

- TAN input vs. TAN storage on the phone

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# M-Payment Infrastructures

Transactions processed by Network Operators



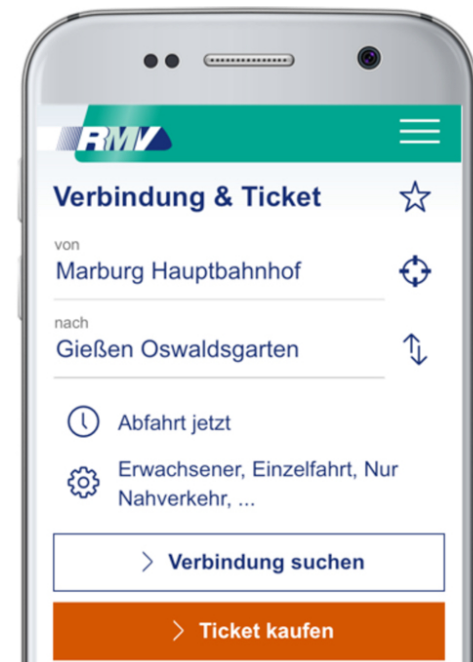
# M-Payment Infrastructures

## Transactions processed by Network Operators

1. Customer **requests a transaction** by calling a **product-specific number**, displayed on the vending machine.
2. Network-operator responds with transaction-details (product information, costs) and **asks for PIN**.
3. Customer **enters PIN** and **confirms transaction**.
4. Network-operator **verifies PIN**, checks details of the customer-account and **orders** the vending machine to **hand out** the product.
5. Network **operator informs** the **merchant** (in this case the owner of the vending machine) about the transaction.
6. Merchant receives **stock-level information** from the vending machine.

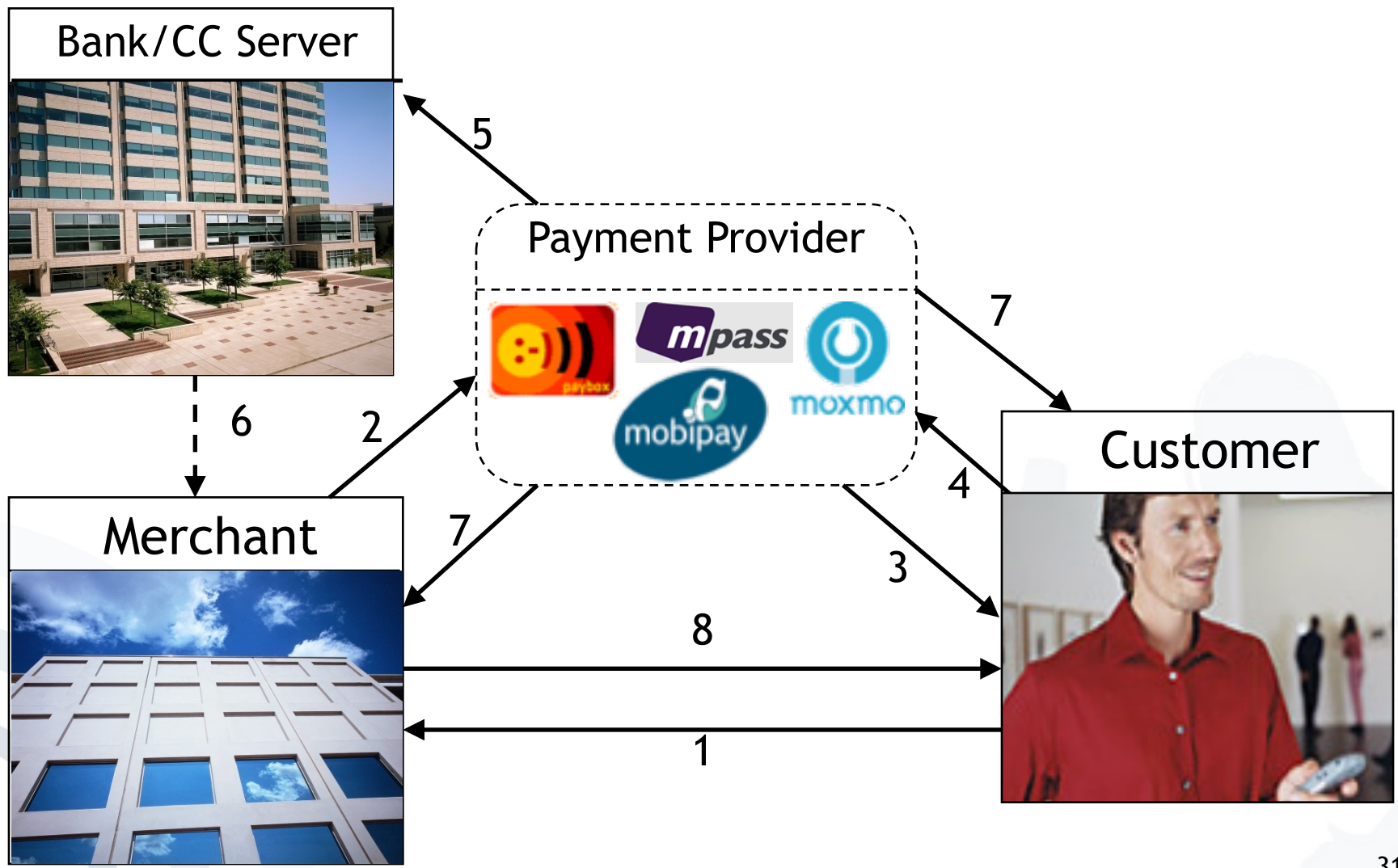
Current example: Rhein-Main-Verkehrsverbund

- Offers the possibility to pay with mobile phone bill via the RMV app
- Service fee 18%-25%
- Advantage: no user login needed



# M-Payment Infrastructures

Transactions processed by Payment Providers



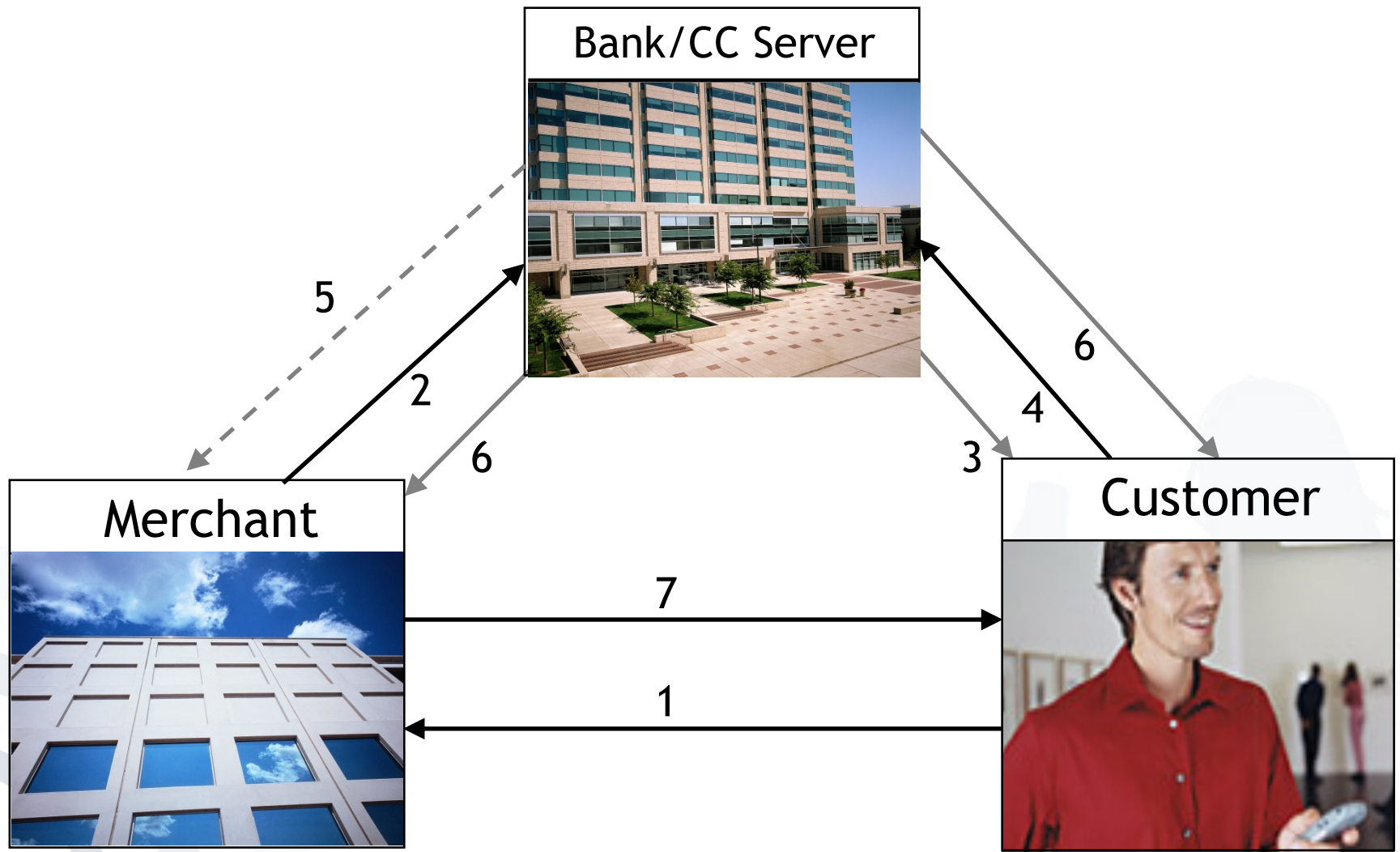
# M-Payment Infrastructures

## Transactions processed by Payment Providers

1. Customer requests a transaction on the merchant's website by entering an identification-code (for example his mobile phone number - MSISDN).
2. Merchant contacts the payment provider and passes details about the transaction (product information, price).
3. Payment provider contacts the customer and asks for PIN and confirmation.
4. Customer confirms the transaction and enters the PIN.
5. Payment provider verifies PIN and instructs the bank or credit institute to transfer the money to the merchant.
6. Bank or credit institute transfers the money to the merchant.
7. Payment provider sends transaction confirmation to customer and merchant.
8. Merchant executes transaction and sends a receipt to the customer.

# M-Payment Infrastructures

## Transactions processed by Banks-Server Wallet





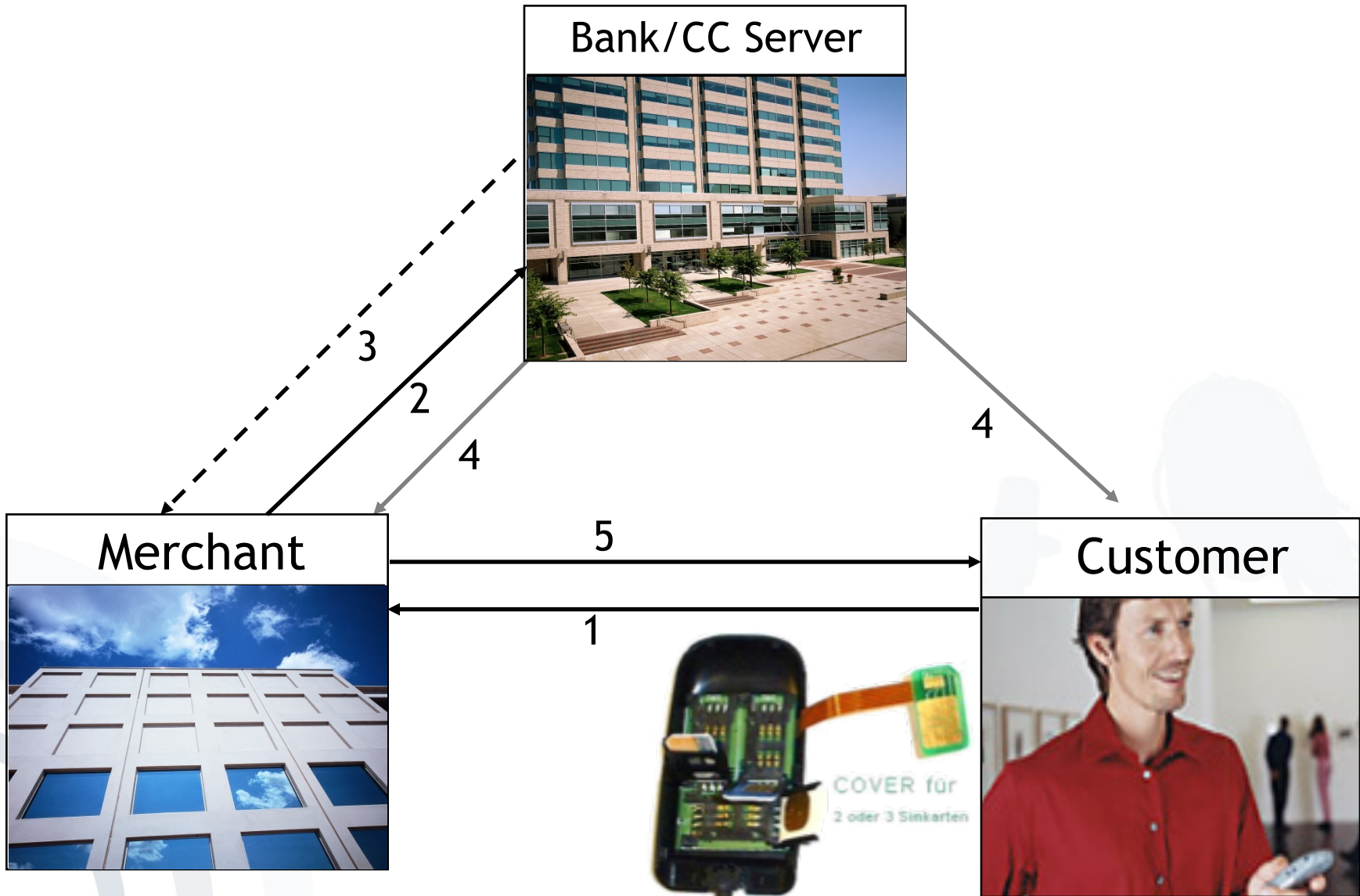
# M-Payment Infrastructures

## Transactions processed by Banks-Server Wallet

1. Customer asks for transaction on merchant's web page and selects whether he wants to pay with credit card or bank card.
2. Merchant sends order details to the bank or credit card server.
3. Bank or credit card server sends order details to the customer and asks for confirmation.
4. Customer enters PIN and confirms the transaction.
5. Bank or credit card server verifies PIN, checks details of the customer account and authorizes the transaction. Then the server transfers the money to the merchant deducting service charge.
6. Bank or credit card server informs merchant and customer that the transaction was authorized.
7. Merchant confirms transaction & customer receives an "m-bill".

# M-Payment Infrastructures

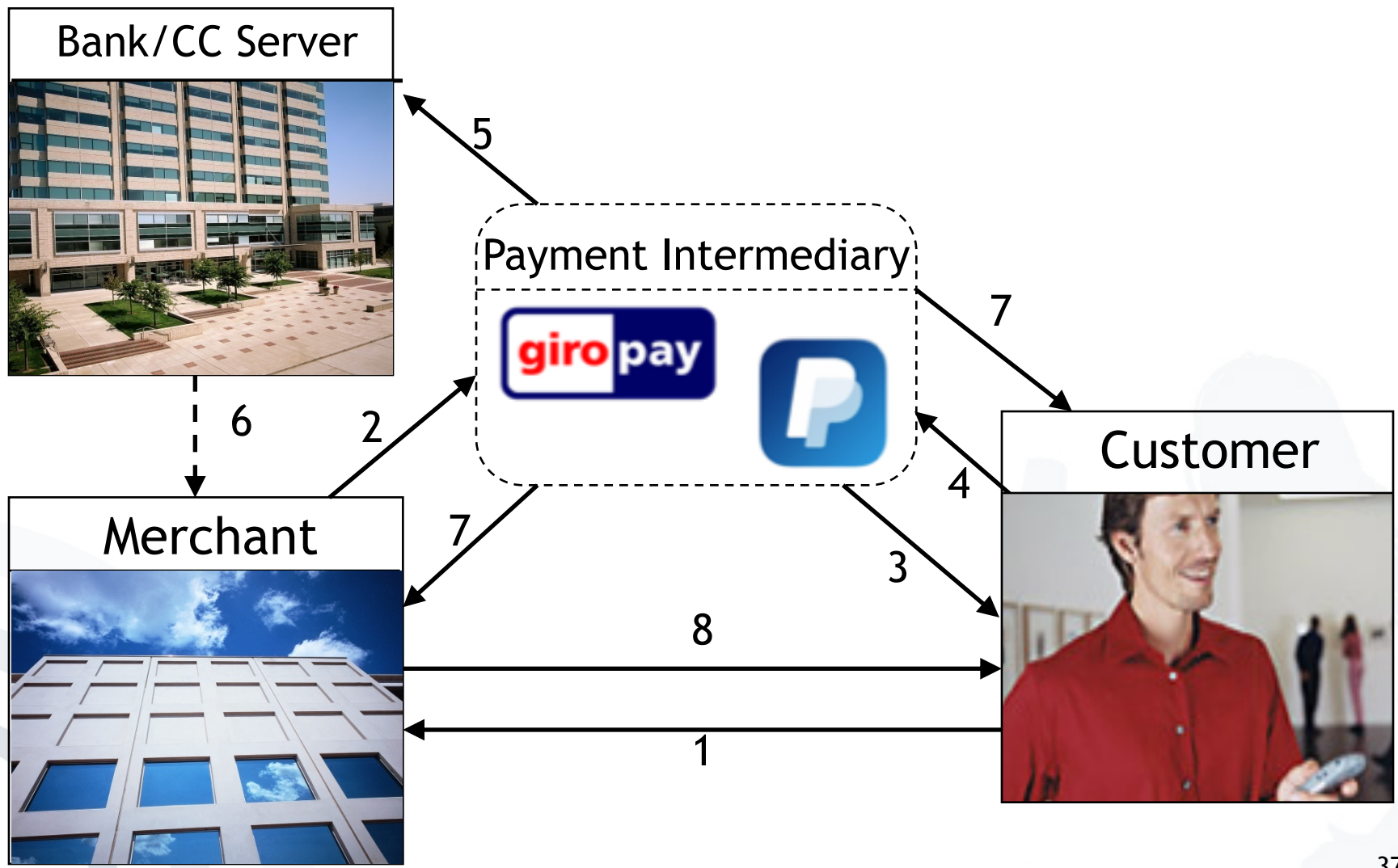
Transactions processed by Banks-Handset Wallet



1. Customer asks for transaction on merchant's WWW/WAP page, selects whether he wants to pay with credit card or bank card and enters his PIN. Then information on purchase order, transaction information and details of the account and delivery address is transferred.
2. Merchant sends details on the order to the bank or credit card server.
3. Bank or credit card server verifies the PIN, checks details of the customer account and authorizes the transaction. Then the server transfers the money to the merchant.
4. Bank or credit card server informs the merchant and the customer that the transaction was authorized and completed on the side of the bank.
5. Merchant executes transaction and transfers the "m-bill".

# M-Payment Infrastructures

Transactions processed over Intermediaries



# M-Payment Infrastructures

## Transactions processed over Intermediaries

1. Customer buys something on the merchant's website and chooses one of the payment intermediaries as a payment method.
2. Merchant contacts the payment intermediaries and passes details about the transaction (product information, price).
3. Payment provider requests credentials of the customer's online banking account. (PayPal: customer can choose between different bank accounts and also credit cards)
4. Customer enters the online banking credentials as well as a one-time TAN for this transaction (comparable to a regular online banking transaction).
5. Payment intermediaries verifies credentials and instructs the bank or credit institute to transfer the money to the merchant.
6. Bank or credit institute transfers the money to the merchant.
7. Payment intermediaries sends transaction confirmation to customer and merchant.
8. Merchant executes transaction and sends a receipt to the customer.

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## Example of a Proprietary Payment Provider: PayPal Mobile | 1

- Text message-based mobile payment system introduced by PayPal (former eBay company) in April 2006.
- Users need a regular PayPal account to use this service. Furthermore, to activate the mobile component, one has to sign up separately for the mobile payment service.
- The service is integrated into the eBay auction and clearance system.
- PayPal surpassed the 130 million account mark in 2006 (use of existing customer base important due to network effects).



**Example:** Sending money by text:

1. In the first step, a text message is sent to PayPal, containing the recipients phone number and the amount to be paid.
2. In the second step, the payment system calls the user, and the PIN is entered to authorise the transaction.
3. In the third step, PayPal notifies the recipient of the payment and tells him/her how to claim it.



Text to 729725  
(PAYPAL)



Confirm with PIN



Recipient notified



- PayPal App is available for iOS and Android devices.
- Requirement for payment: a PayPal account
- How to make payment:
  1. Log into your PayPal Account on the app.
  2. Enter the mobile phone number or the email of the recipient of the payment.
  3. Enter the amount of the payment.
  4. The recipient has to confirm the receipt, or reject it (in the latter case, the payment is cancelled).
- Payment can be made in 25 currencies worldwide.
- A fee of 1.9% + 0.35 euros/transaction is charged only at the time of sale (to the merchant).

- Origin in Spain
- Participants: Amena, Telefónica Moviles, Vodafone, and about 80% of Spanish banks
- Development
  - 00-02: Project announced
  - 01-03: Mobipay founded
  - 02-09: Pilot trial in Madrid
  - 03-06: 54.000 merchants incl. > 10.000 taxis
  - 06-05: 6.500 merchants including 2.500 taxis
- Investment (total): 42 Mln. €
- Closed in 2009



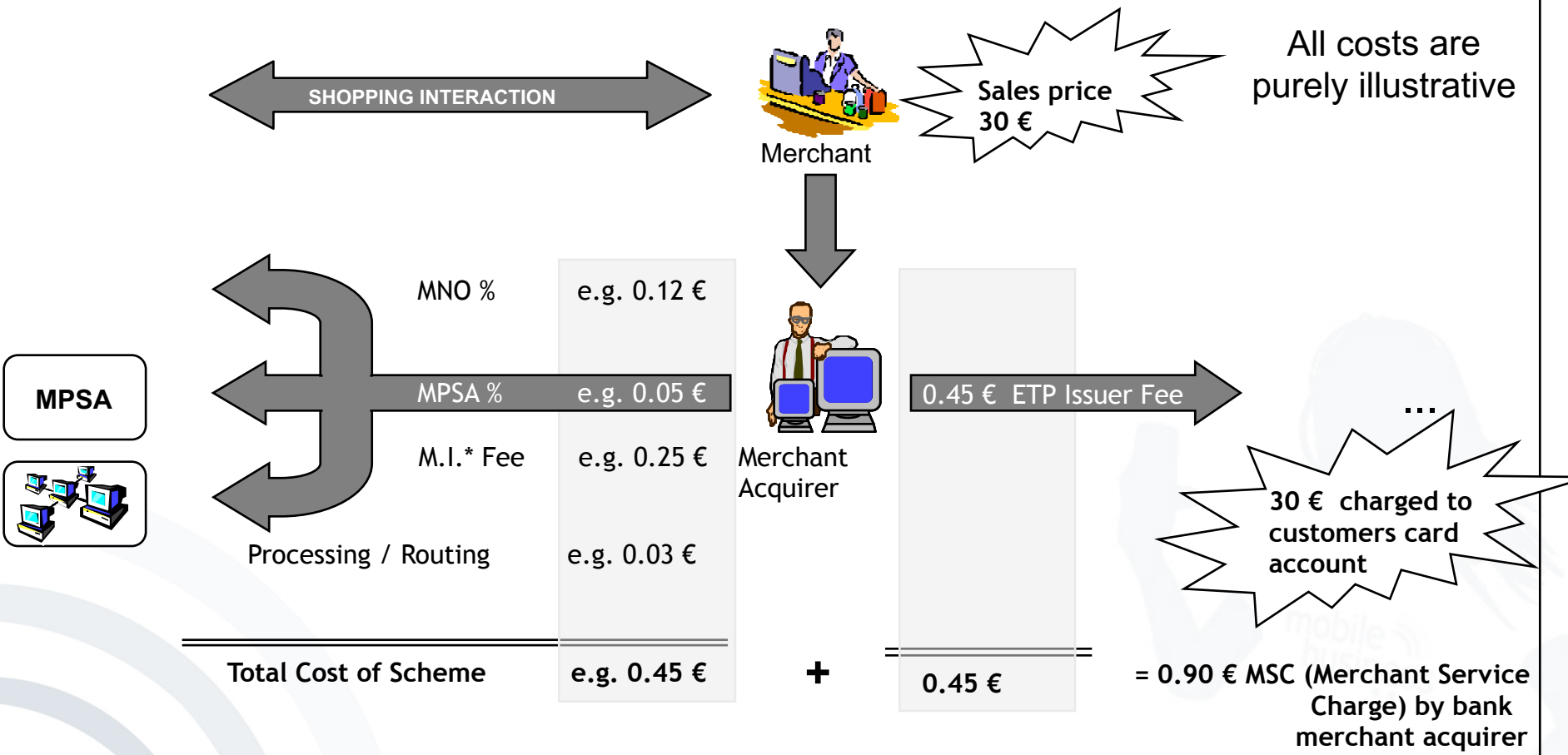
- Nonprofit company founded by Orange, Telefónica, T-Mobile, and Vodafone
- An open m-payment standard, represented by one single brand with following advantages
  - Customers can do big or small purchases on a mobile infrastructure
  - Easy and secure mobile standard to use existing credit/debit cards
- Therefore, a unified brand strategy and platform with open interfaces was implemented.

Founders

Members



Simpay's business model



MNO: Mobile Network Operator

M.I.\* Fee: Mobile Internet Fee

MPSA: Mobile Payment Solution Alliance

ETP: Enabled Third Party Payments

- Debit payment system initiated by Vodafone and Telefonica O2, later also Telekom (but not limited to customers of these providers)
- SMS-based (initially)
  1. User visits online shop.
  2. User enters mobile phone number and mpass PIN.
  3. User receives SMS.
  4. User confirms by replying to that SMS.
- Security
  1. mpass PIN and TAN required for online purchase
  2. Through ownership of mobile phone - external NFC Chip for on-store payments



- Connection to “bank account” with WireCard bank
  - Registration of customer information is required.
  - Every transaction needs to be authorized by WireCard bank.
- Online payment using the computer or the mpass mobile app
  - PIN and TAN required (PIN for payments over 25 EUR)
  - TAN sent to mobile phone
  - In-store payment possible (Tap & pay):
    - Examples in Germany: Vapiano (Frankfurt), McDonalds (Frankfurt)
    - Payment through the external NFC sticker (chip)
- C2C money transfers (in real-time)
- Payment modes:
  - Prepaid cash: money preloaded on the mpass account
  - Direct debit: transfers from the customer’s own (registered) bank account
- Closed down 2016-10-01

- Concept for Obopay occurred during a stay in the Democratic Republic of Congo in 2002
  - Interesting phenomenon: People carry mobile phones even if they don't carry a wallet
  - Combining the prevalence of mobile phones and the lack of much-needed financial services would be a great opportunity
- Operating in the U.S., India, Kenya, Senegal
- Nokia invested \$70 million into the start-up (March 2009)



- What can you do with Obopay?
  - Send, spend and receive money from mobile phone to mobile phone (P2P)
  - Obopay uses a prepaid model
  - 25 cent per transaction (sender pays)
  - No fees for receiving money
- Preconditions:
  - Obopay account
  - Existing bank account (needed for registration)
  - Any kind of mobile phone
- Transaction process is similar to PayPal mobile
  - But no additional authorization call, just the PIN
  - Money is sent directly to recipients' mobile
- Obopay system is called “social money”.





# Example of NFC Wallet Payment

## Apple Pay - Storage of Card Details

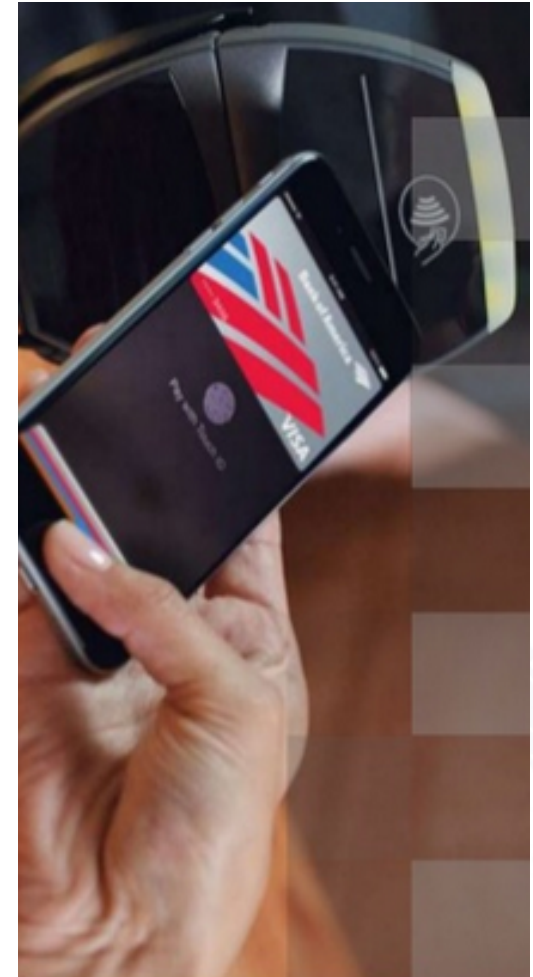
- Card details are stored on the handset
  - In a dedicated memory (Secure Element)
  - Available since iPhone 6
  - Older devices can use Apple Pay together with Apple Watch (Secure Element is on the watch).
  - Secured by Touch ID thumbprint
  - A new card can be added by taking a picture of it.



# Example of NFC Wallet Payment

## Apple Pay - How it works

- How it works:
  - Place thumb on Home button (for Touch ID)
  - Tap on contactless ePOS unit
  - Payment is performed
- None of this requires a network signal or cellular data connection.



# Example of NFC Wallet Payment

## Apple Pay - DAN vs. PAN

- Instead of saving and transmitting the Primary Account Number (PAN) which identifies a credit/debit card, Apple Pay uses a new identifier: Digital Account Number (DAN).
- DAN is assigned by the Payment Network (e.g. Visa Tokenization Service/Mastercard MDES) and is not Apple specific.
- Advantages:
  - DAN and PAN can be cancelled independently if phone or credit card gets lost.
  - DAN on its own is useless (only valid with single-use EMV format cryptogram.)

# Example of NFC Wallet Payment

## Apple Pay - What's in it for Apple?

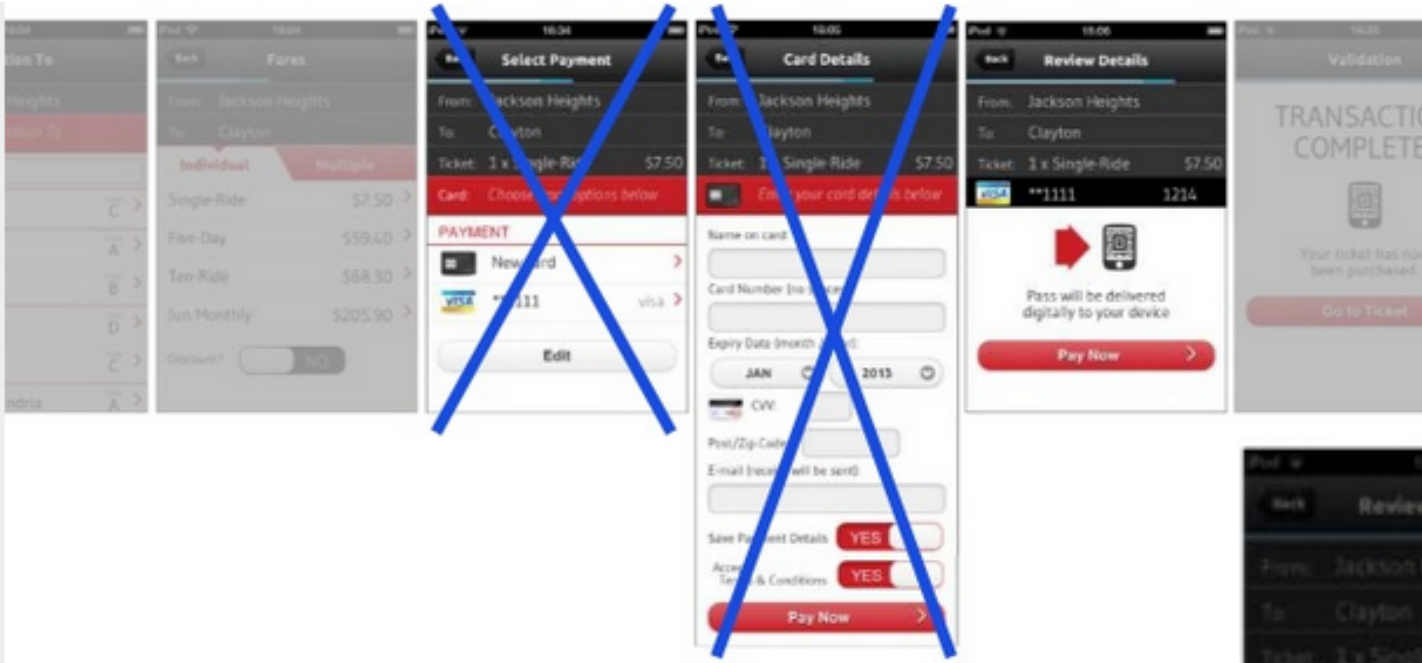
- Apple does not
  - clear the payment
  - get conventional interchange fees
- But banks/networks give Apple a cut of interchange fees made via Apple Pay
  - 0,15% of any transaction
- Apple left the card companies at the centre of payments, but reduced risk due to Touch ID & Secure Element.  
  
→ Distribution of the market might be questioned in the near future: Apple announced distributing an own credit card together with Goldman Sachs in March 2019  
(<https://www.apple.com/apple-card/>)

# Example of NFC Wallet Payment

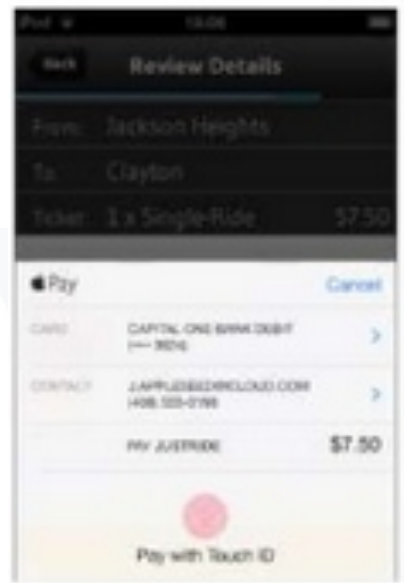
## Apple Pay - Where is it available?

- Since 2014 in US
  - Started with 220k contactless ePOS systems and increased to more than 80m in 2017 [BizReport2017]
- Global rollout is carried out country by country
  - Up to now, it is available in 59 countries  
→ in general, contactless payment is possible worldwide [WIKI2019]
  - In Europe 1.5m contactless ePOS systems are available. But DAN detokenization infrastructure is still rolling out and is only operated by the major payment networks (e.g. Visa or MasterCard) [NFCTimes2016]

# Example of NFC Wallet Payment Apple Pay vs. Credit Card



- Apple Pay replaces 2 app screens with 1 Apple Pay screen and gets rid of all data entry.



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- M-Payment is ONE important factor for the success of mobile commerce.
- The successful use of M-Payment solutions requires explicit respect of customers' interests.
- Will Apple Pay and Google Pay dominate the M-Payment market?
- Identification is not necessary for mobile payment.





- [BizReport2017] BizReport. *Apple Pay contactless user numbers to double in 2017*. Available at <http://www.bizreport.com/2017/04/apple-pay-contactless-user-numbers-to-double-in-2017.html> (Last accessed 12 April 2017)
- [FrostSullivan2002] Frost & Sullivan. *Mobile Commerce Payment*. 13 May 2002.
- [LuarnLin2004] Luarn, P. and Lin, H.-H. *Toward an understanding of the behavioral intention to use mobile banking*. *Computers in human behavior*, 21(6), pp. 873-891, 2005.
- [Masabi2014] Masabi. *Apple Pay in transit. A webinar exploring the potential*. Available at <https://de.slideshare.net/masabi/201410-apple-pay-webinar-2>
- [NFCTrends2016] NFC Times. *Networks continue to dominate tokenization as vendors wait for token service provider specs*. March 2016. Available at <http://www.nfctimes.com/news/networks-continue-dominate-tokenization-vendors-wait-token-service-provider-specs>
- [Pfahler2012] Sebastian Pfahler. *Goodbye Wallets - Wie Smartphones unsere Geldbörsen werden*. AV Akademikerverlag, 2012.
- [WIKI2019] Wikipedia. *Apple Pay*. Available at [https://en.wikipedia.org/wiki/Apple\\_Pay#Supported\\_countries](https://en.wikipedia.org/wiki/Apple_Pay#Supported_countries) (Last accessed 09 May 2019)