Biometric Transaction Authentication Protocol (BTAP)

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Sensitive Messages

Scenario: online banking / financial transactions

- Bilateral communication on a sensitive topic
- Risk to manipulate or replay messages

- The message: Order to transfer volume X from account Y to Z

Objective

Biometric Message Authentication

- Person authentication
  - Proof that a registered individual and only this subject hast initiated a transaction/order
- Data authentication
  - the registered individual has viewed and authorized the transaction data

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you may loose, forget or forward to someone else,
with biometrics this is more difficult.

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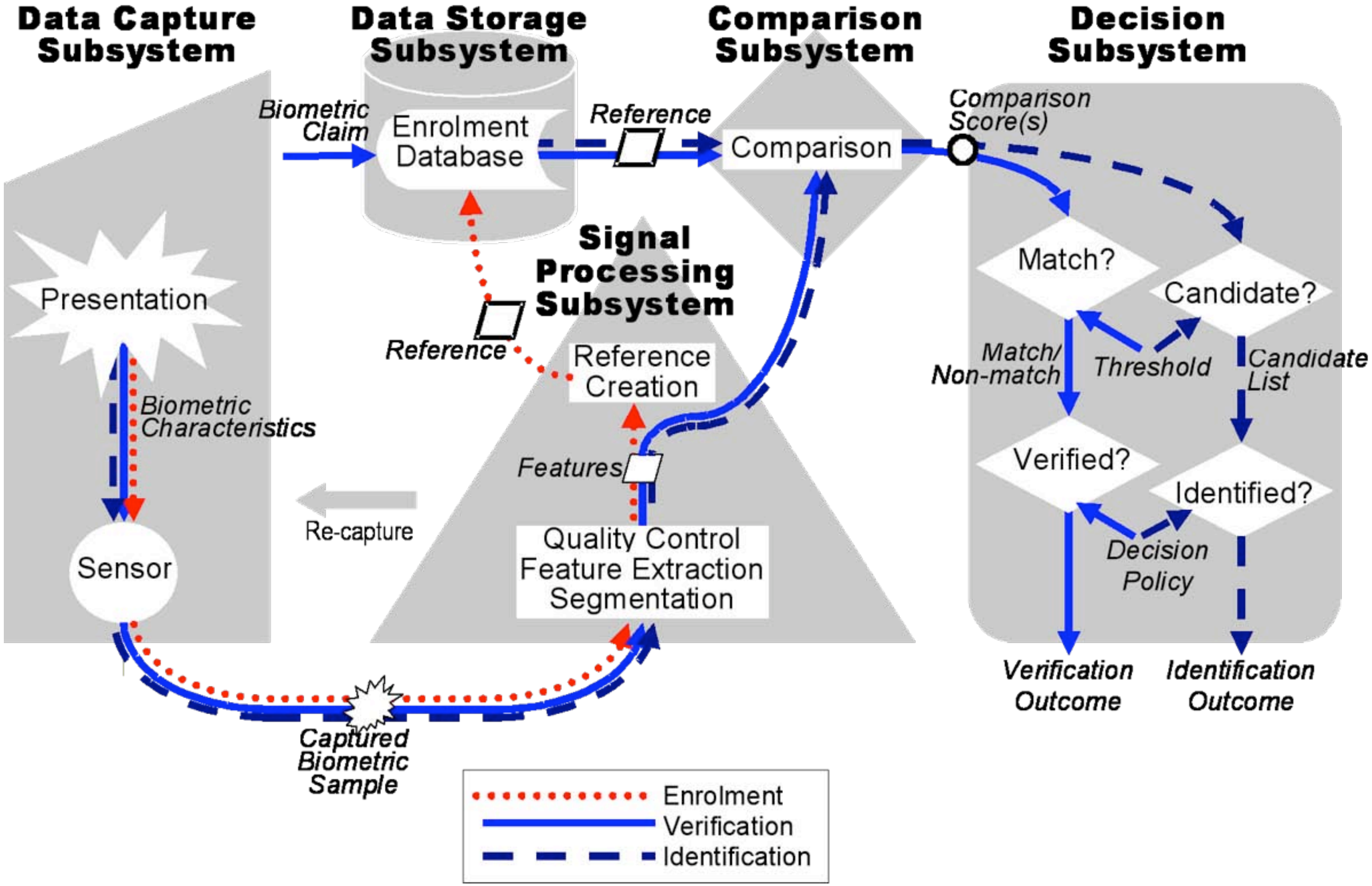
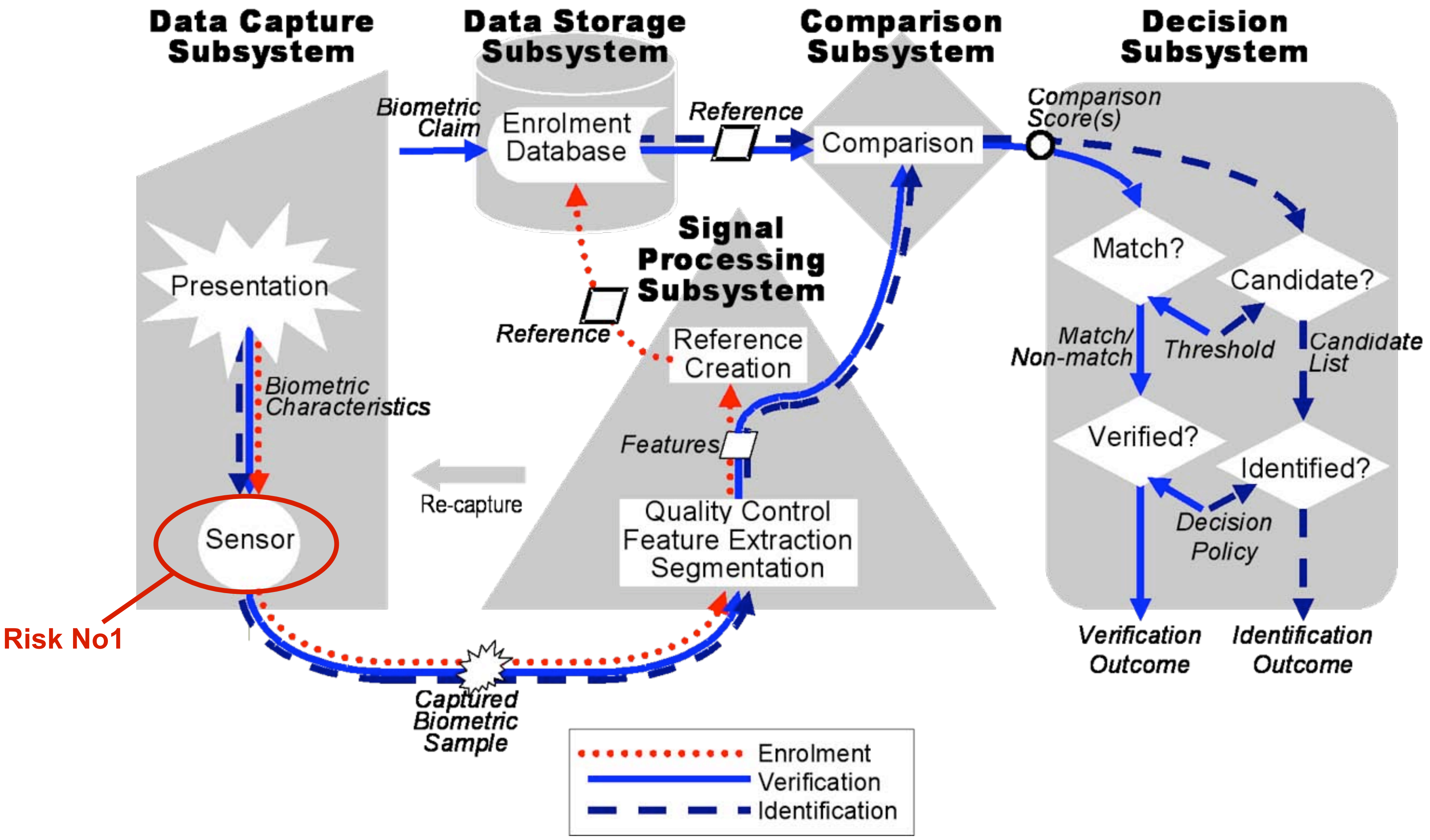
- security policy not violated by delegation
- non-repudiation of transactions
  „This transaction was initiated by *Igor Popov*, who was mis-using my card“

Risks in Biometric Systems



Source: ISO/IEC JTC1 SC37 SD11 Reference Architecture

Risks in Biometric Systems



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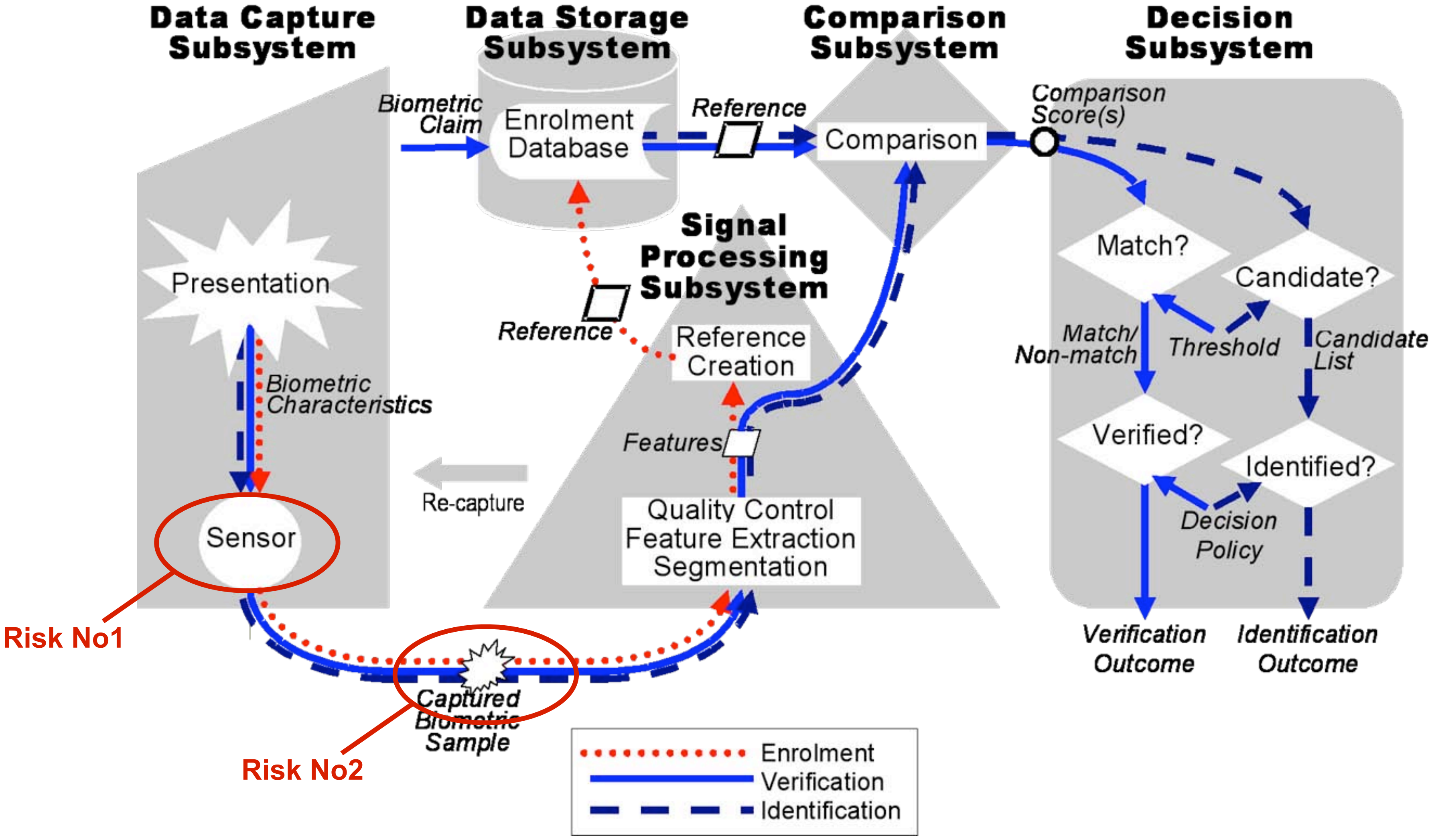

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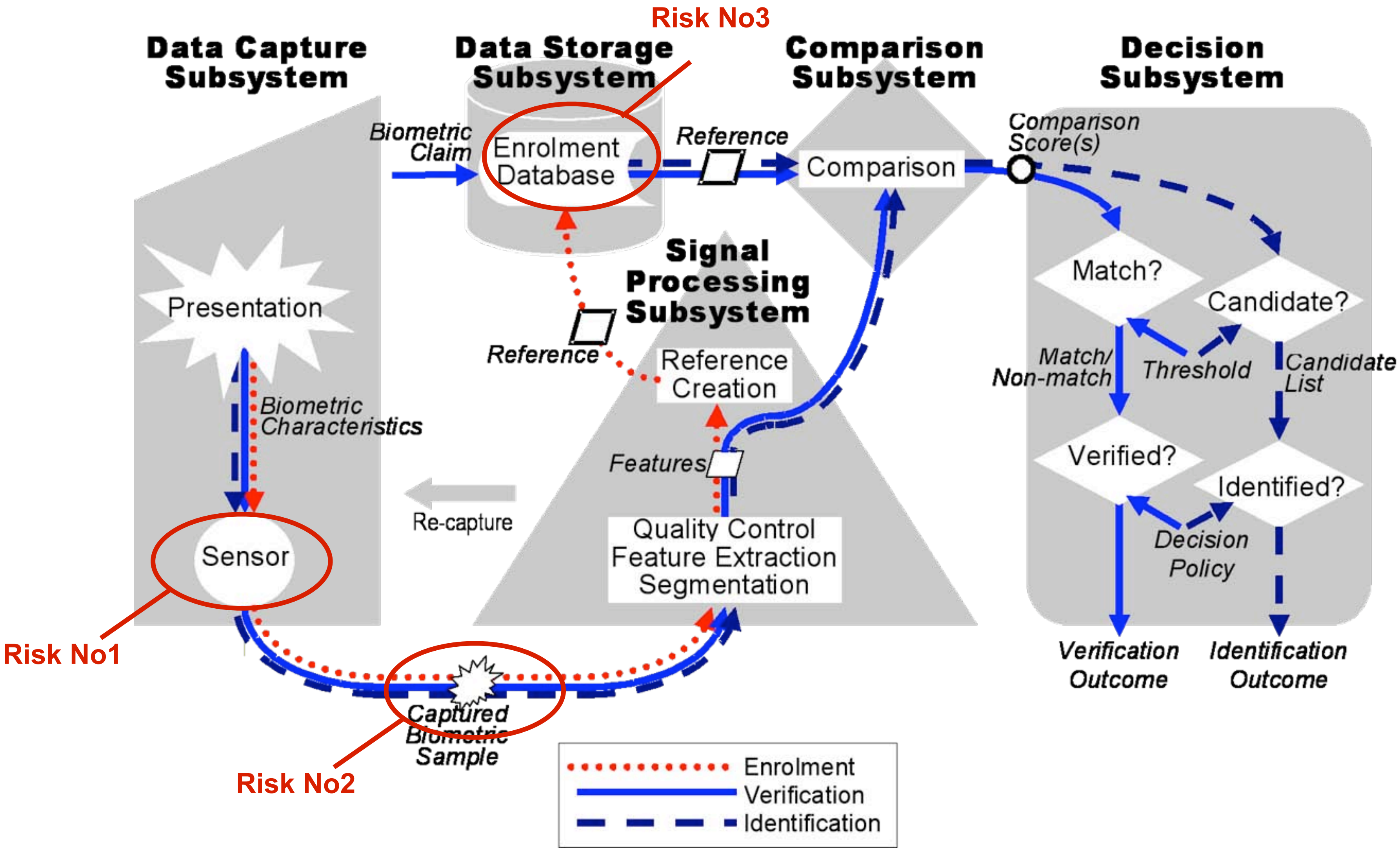

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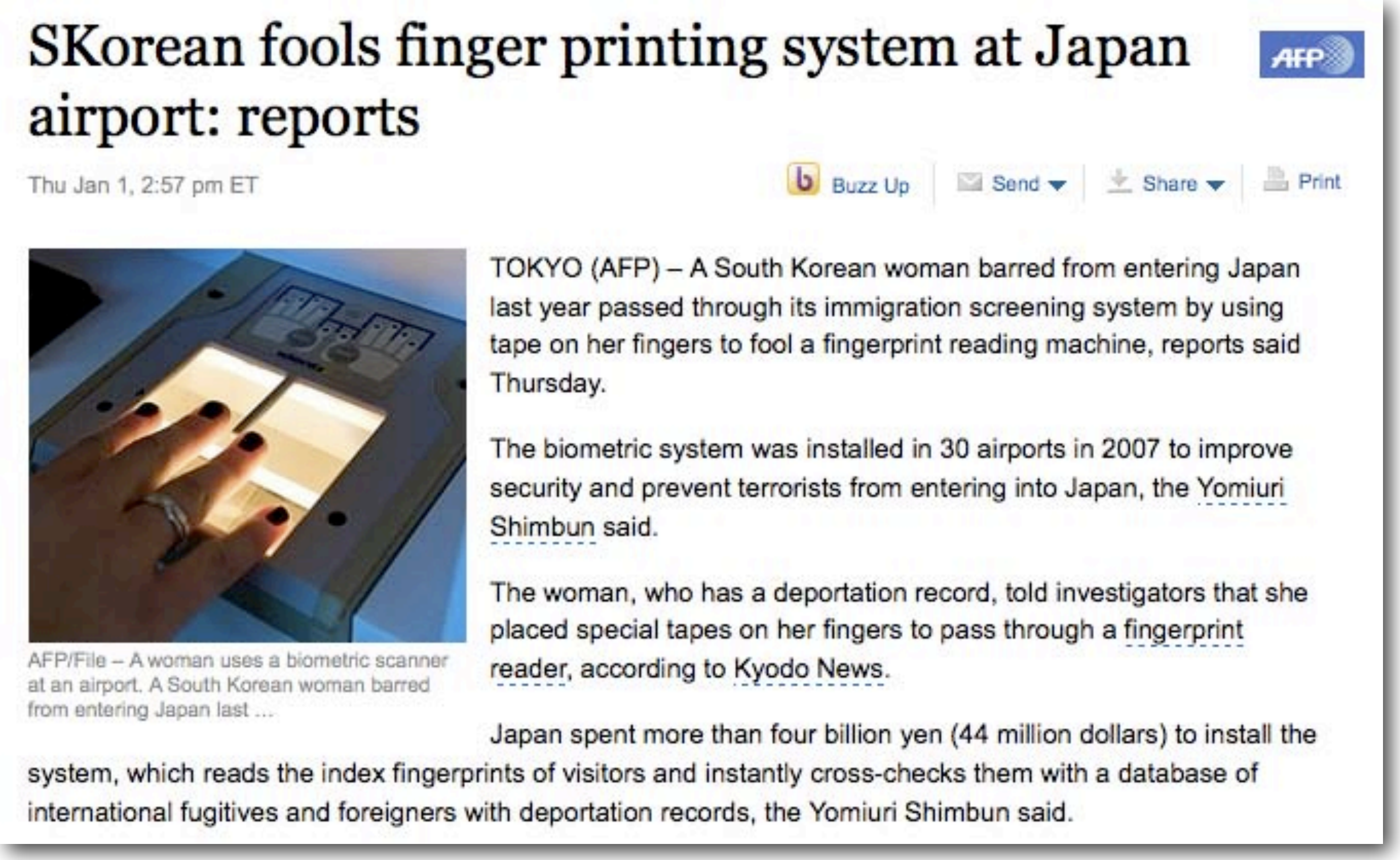
Attacks with Artefact Fingers

Gummi Fingers



SKorean fools finger printing system at Japan airport: reports

Thu Jan 1, 2:57 pm ET

AFP/File – A woman uses a biometric scanner at an airport. A South Korean woman barred from entering Japan last ...

TOKYO (AFP) – A South Korean woman barred from entering Japan last year passed through its immigration screening system by using tape on her fingers to fool a fingerprint reading machine, reports said Thursday.

The biometric system was installed in 30 airports in 2007 to improve security and prevent terrorists from entering into Japan, the Yomiuri Shimbun said.

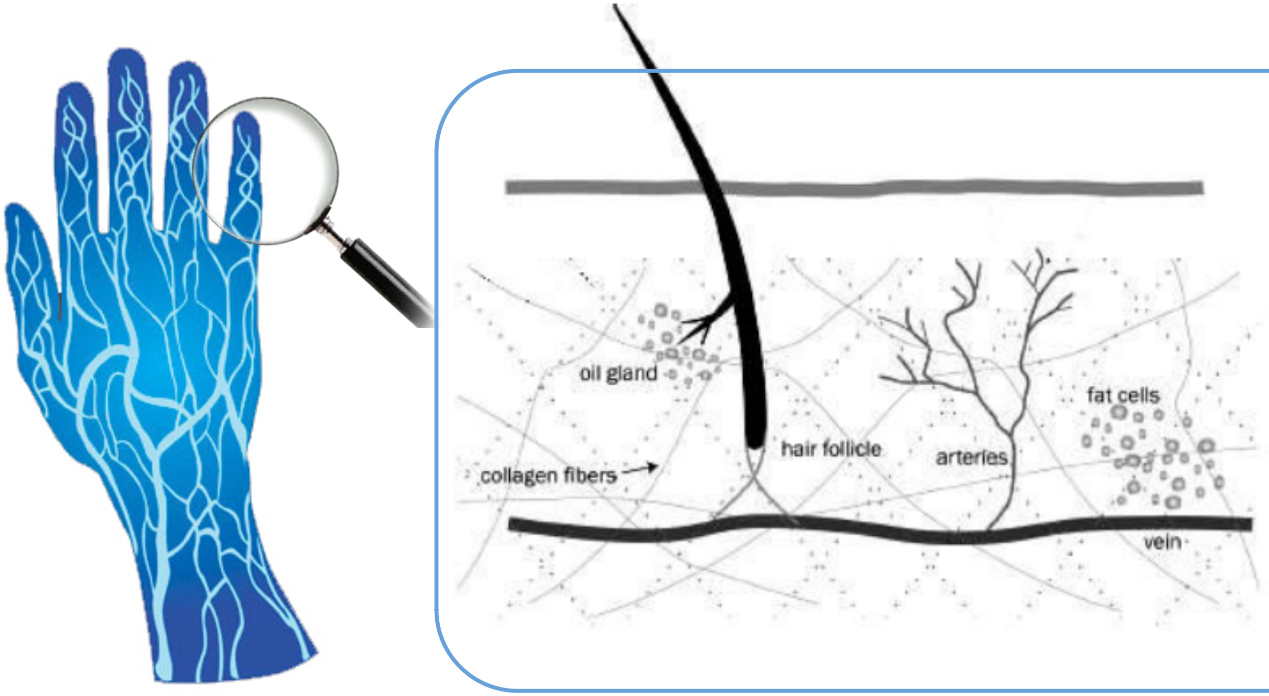
The woman, who has a deportation record, told investigators that she placed special tapes on her fingers to pass through a fingerprint reader, according to Kyodo News.

Japan spent more than four billion yen (44 million dollars) to install the system, which reads the index fingerprints of visitors and instantly cross-checks them with a database of international fugitives and foreigners with deportation records, the Yomiuri Shimbun said.

Yahoo News of January 1st, 2009

The Finger Characteristic

Skin cross-section:



epidermis
0,03 – 0,15 mm

dermis
0,6 - 3 mm

subcutaneous
layer
0,05 - 3 mm

Why Vein Recognition?

Expectations

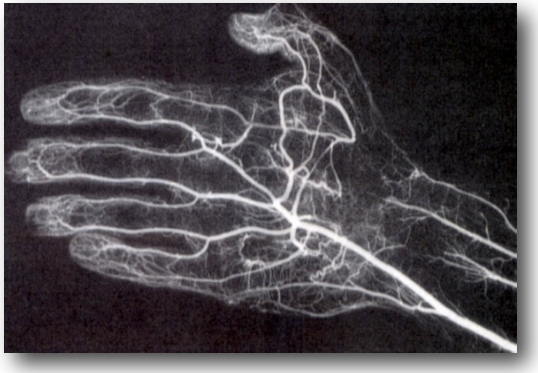
- Good biometric performance
  - very few False-Rejects and False-Accept cases.

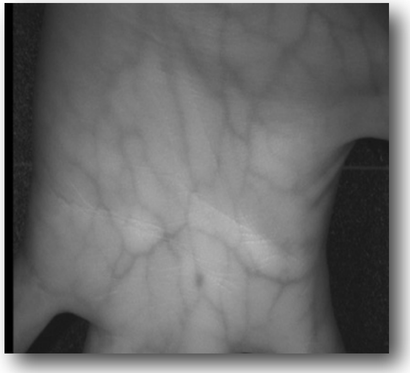
Vein recognition has reached product state

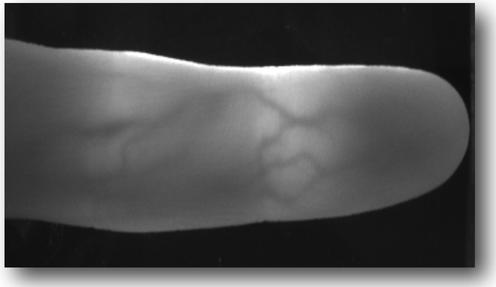
- Sony, Fujitsu, Hitachi, Techsphere, Morpho

Observed body parts

- Identifying the subcutaneous (beneath the skin) vein pattern







Fake Resistent Biometric Sensor

Capture devices for vein recognition

- Devices from Sony, Hitachi (finger) and Fujitsu, Techsphere (palm)
- Hybrid systems from Morpho (finger) and Fujitsu (hand)

Hitachi finger vein scanner

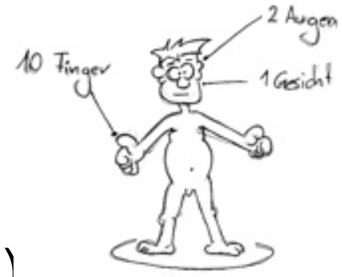
Sony finger vein scanner

Fujitsu palm vein scanner

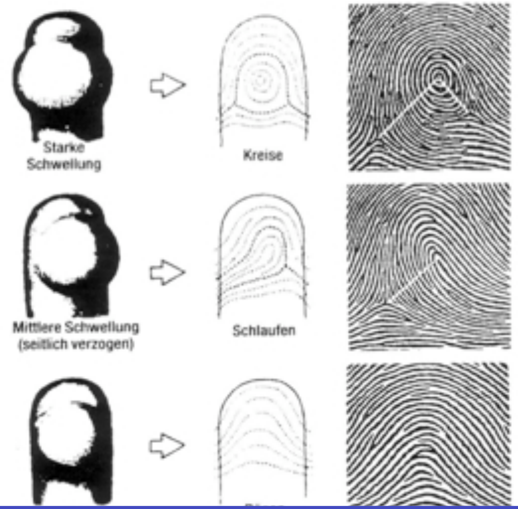
Risks for Biometric References

Possible attacks on reference data

- Cross-Comparison: Identical template can establish unwanted links for one individual between several databases
- Renewability: The biometric characteristic can not be revised
  - Only 10 finger, 2 eyes, 1 face, ...
  - Once compromised, compromised for ever
  - For PW-based system you would expect renewal frequently (e.g. every 3 month)



- Additional information
  - almost for each biometric characteristic



Is encryption of biometric references a sufficient level of protection?

Hash Functions

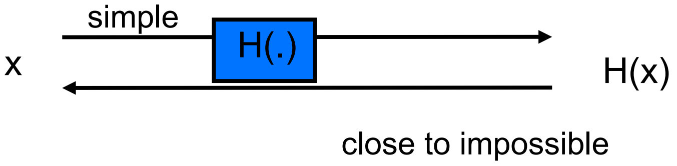
Hashing the reference?

- Approach analog to UNIX Password authentication
- Public assessable file: /etc/passwd

```
id:<login_name>:hash(password)
```

- Authentication:

```
hash(input) =?= hash(password)
```



Challenges

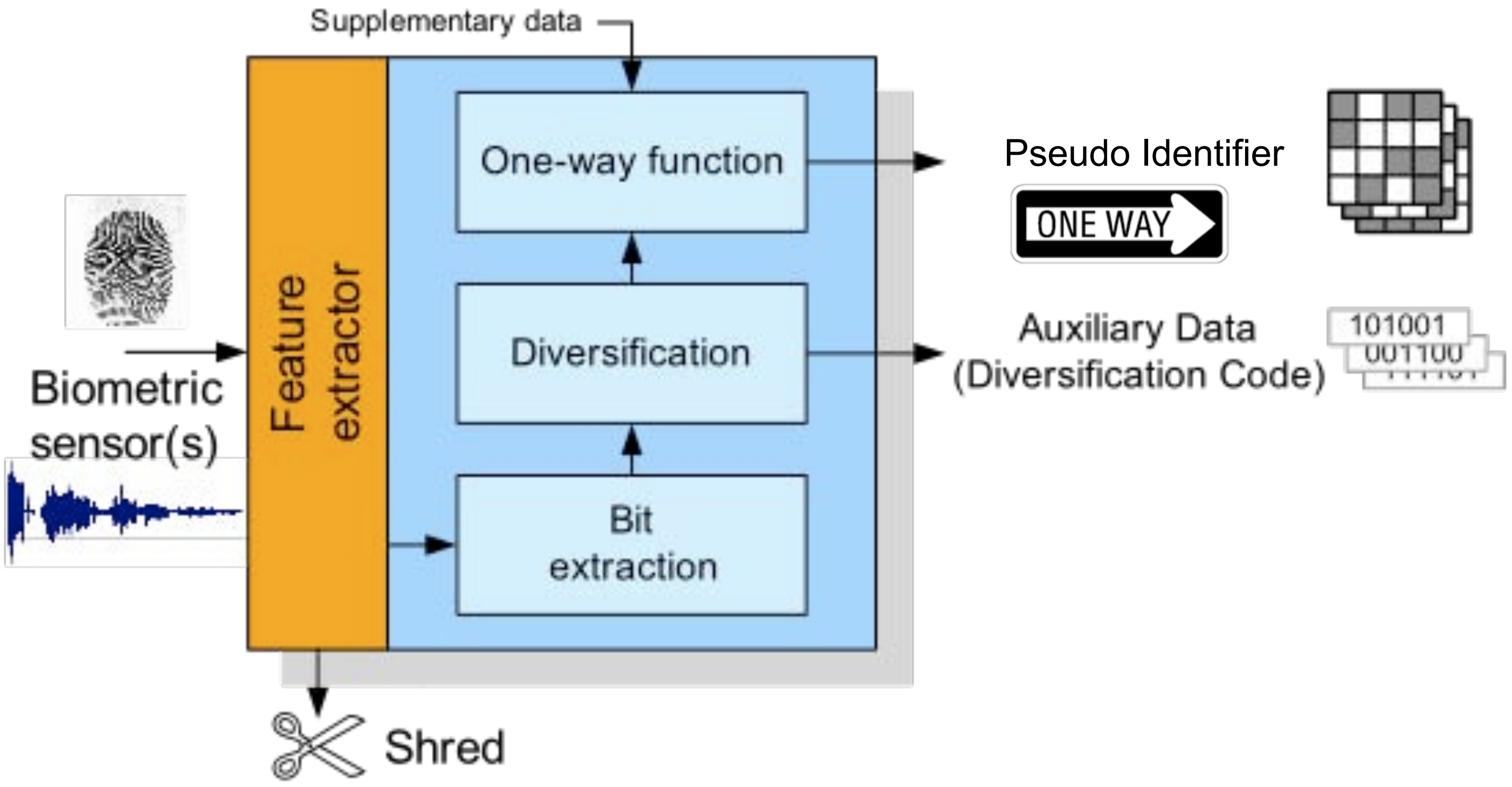
Difference between passwords and biometric samples

`h(01000101)` is not similar to `h(01010101)`

- Biometric measurements are influenced by noise
- Cryptographic one way functions are (by purpose) extremely sensitive to smallest changes in the input data

Classical crypto hashing does not solve the problem either

Template Protection Scheme in ISO 24745



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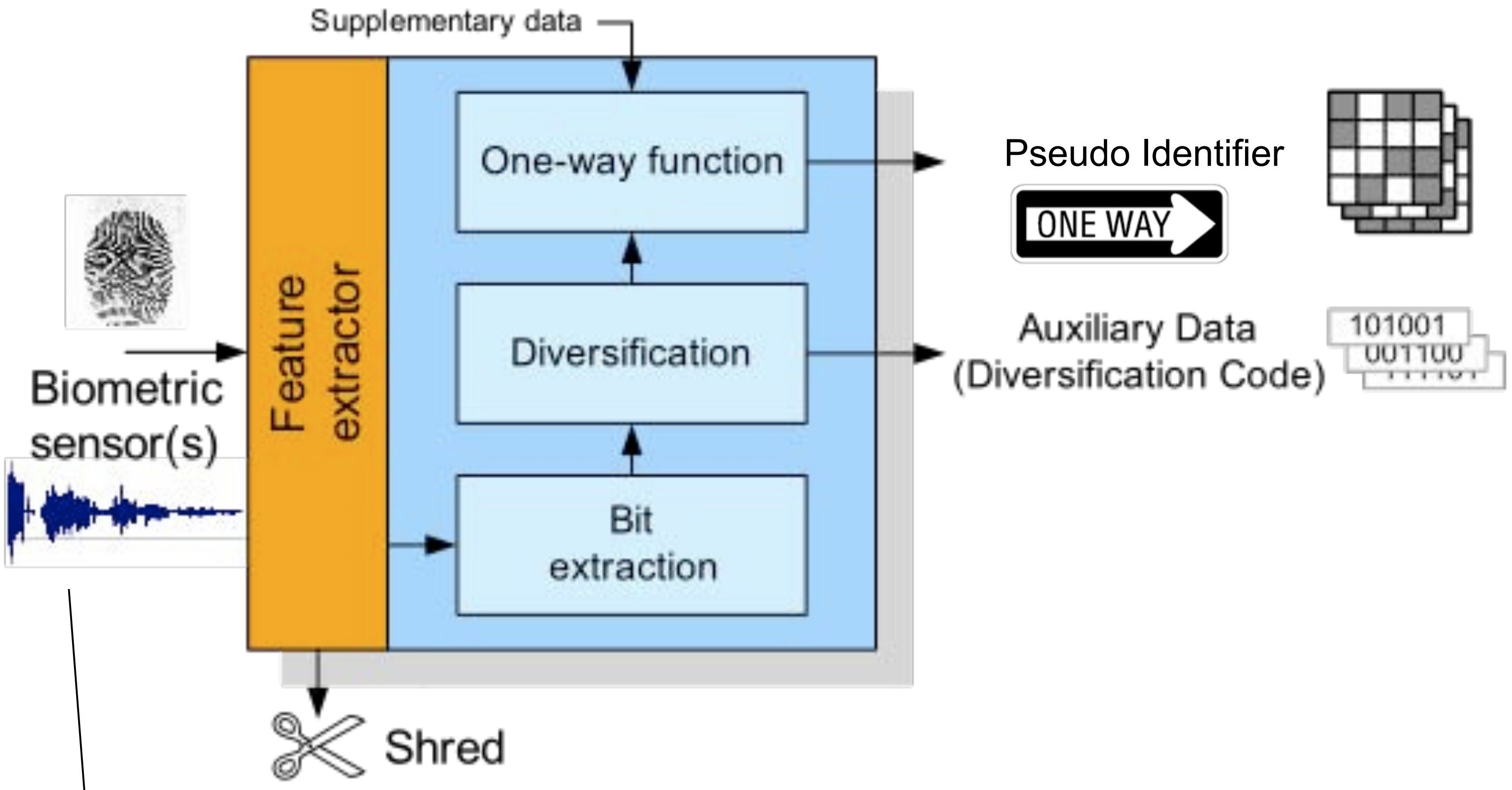
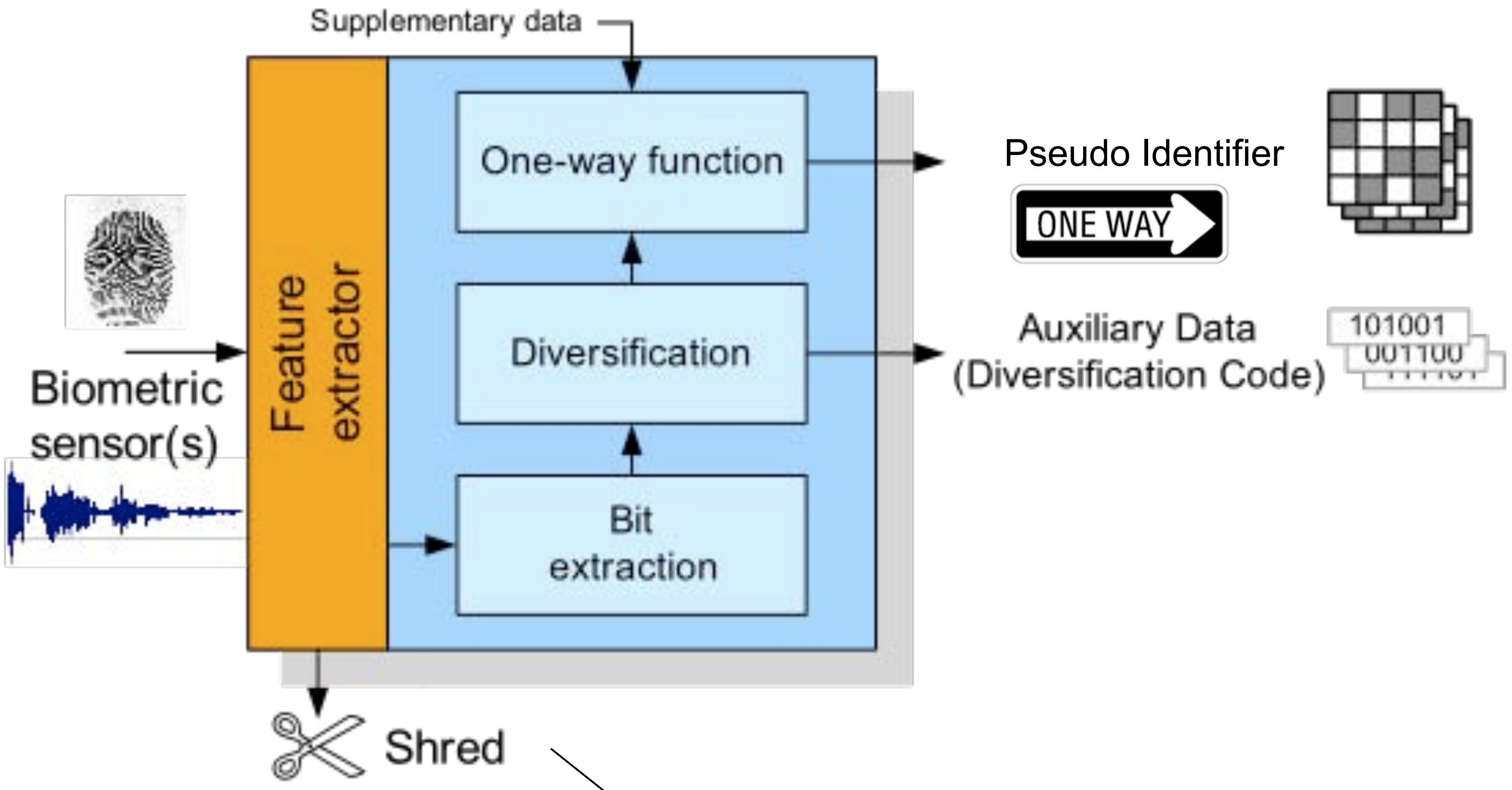


Support for all biometric modalities

Template Protection Scheme in ISO 24745



Create features and discard biometric sample

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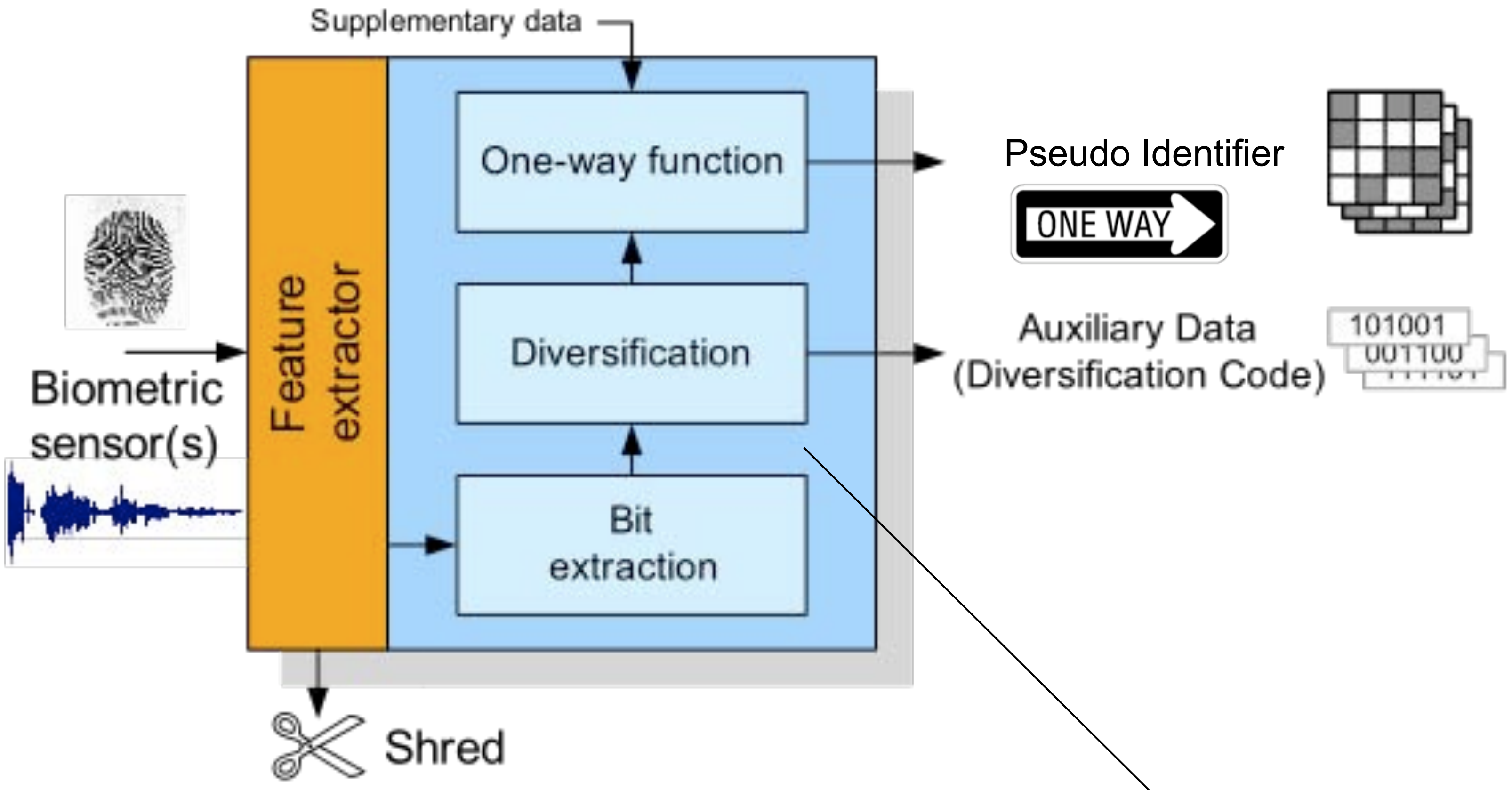
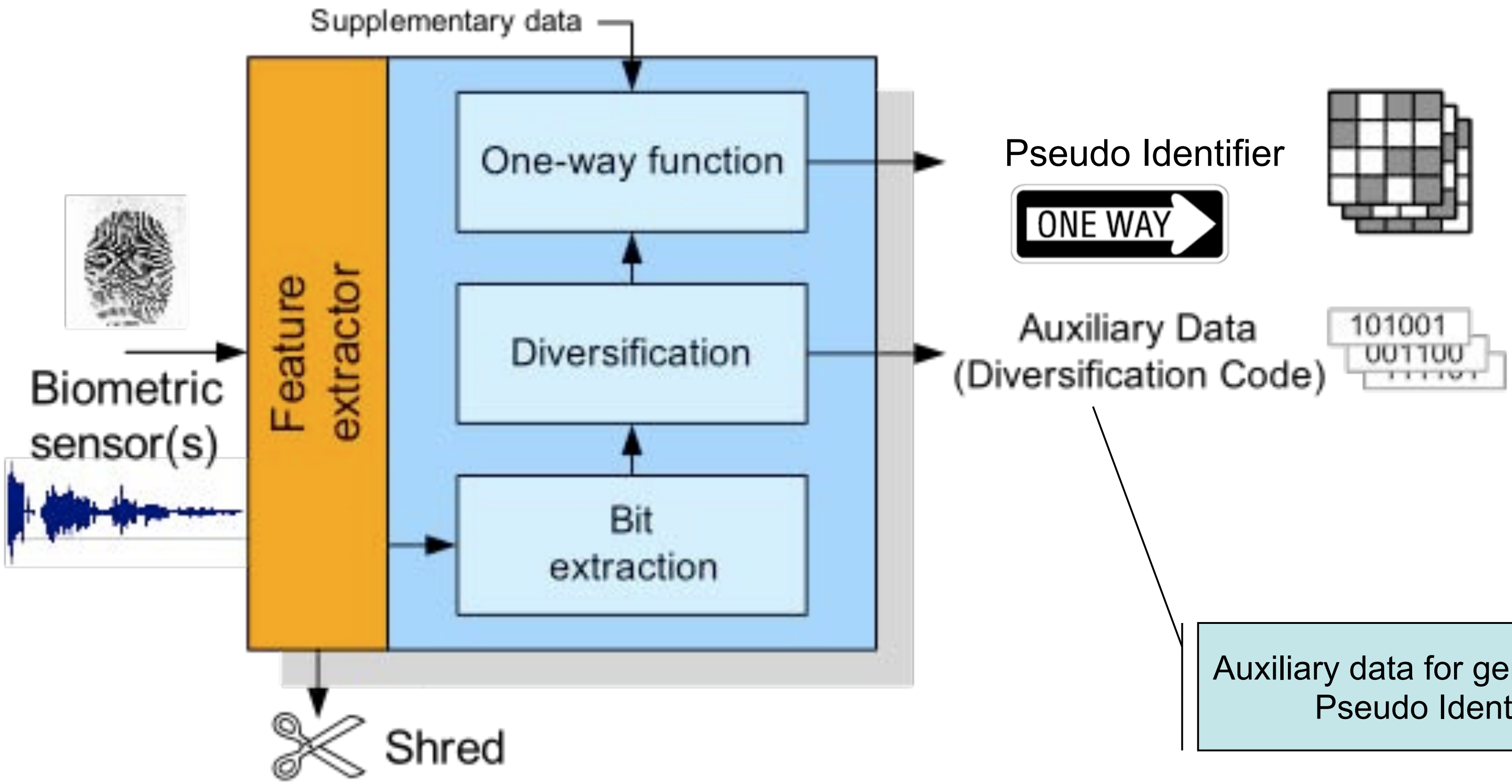


Generate multiple binary derivatives

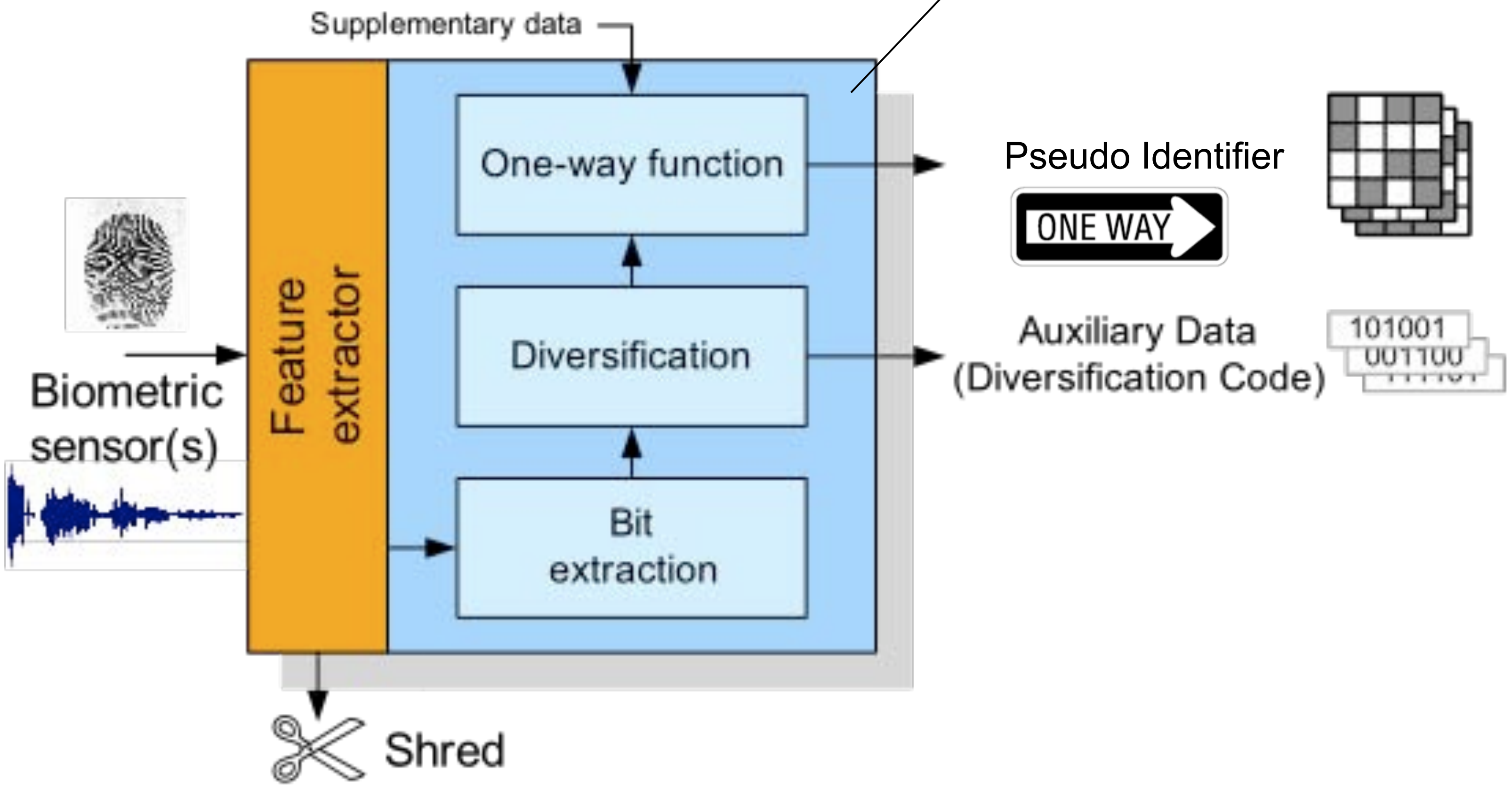
Template Protection Scheme in ISO 24745



Auxiliary data for generation of Pseudo Identifier

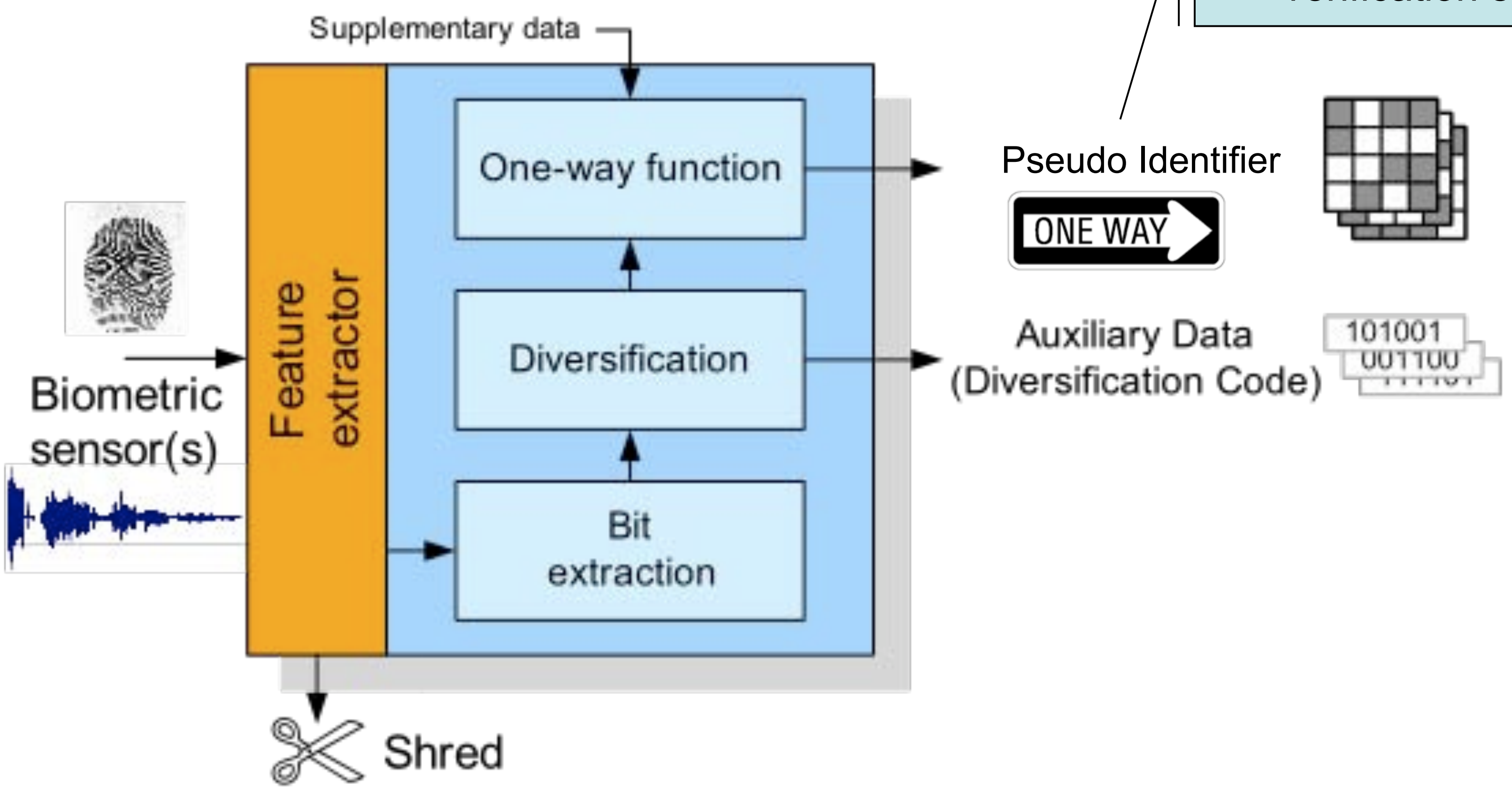
Template Protection Scheme in ISO 24745

Cryptographic one-way function with extra input



Template Protection Scheme in ISO 24745

Protected identifier verification string



Supplementary data

One-way function

Diversification

Bit extraction

Feature extractor

Biometric sensor(s)

Shred

Pseudo Identifier

ONE WAY

Auxiliary Data (Diversification Code)

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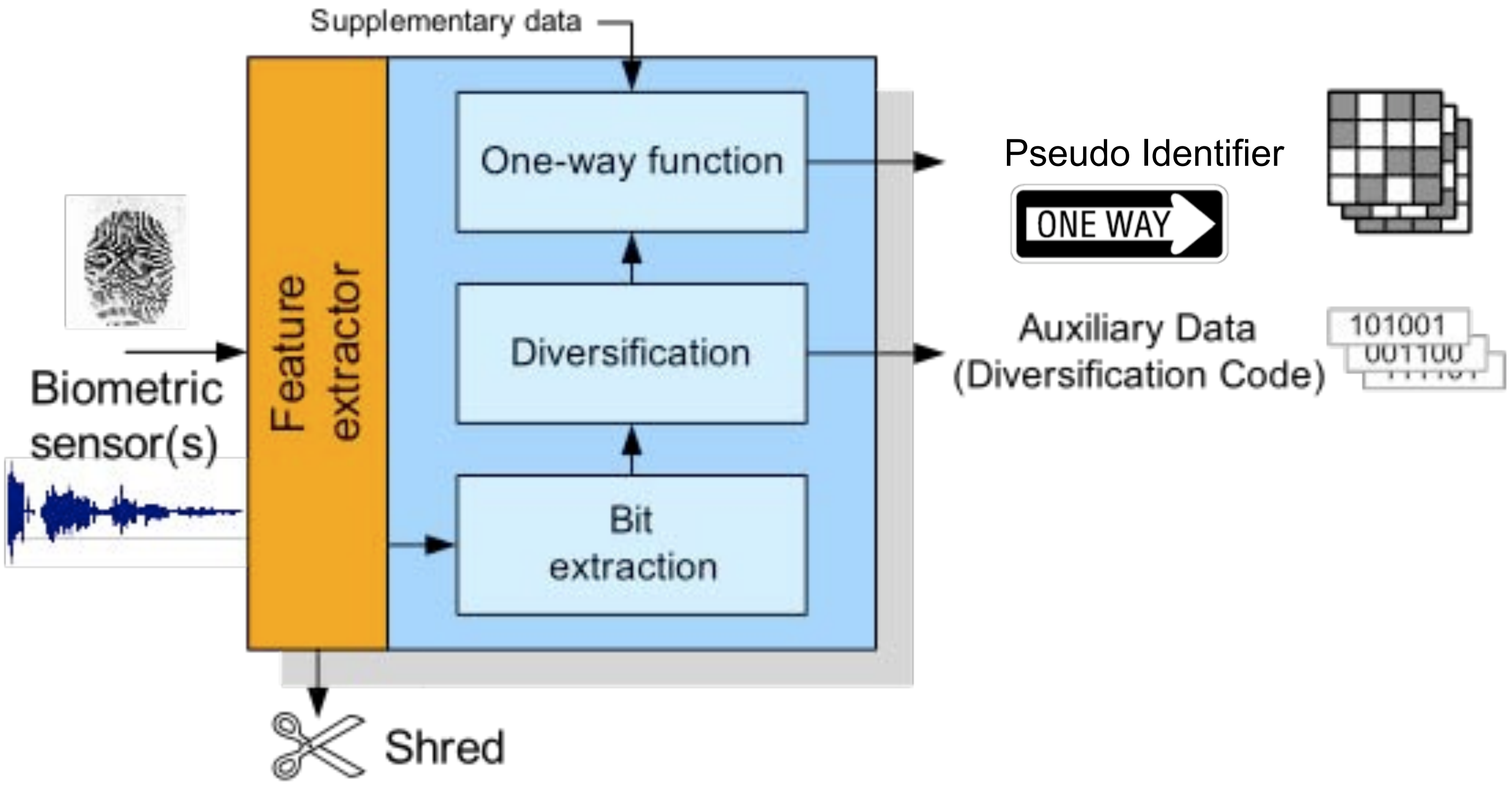

Biometric Transaction and Authentication Protocol (BTAP)

Financial Transactions

The relevant information in financial transactions:

- Which reciever account ?
  - Receiver-Account-Number (RAN)
- What is the volume of the transaction?
  - Ordered Amount (ORA)
- From which sender account is the volume withdrawn?
  - Sender-Account-Number (SAN)
- Which natural person has initiated and confirmed the transaction data?

Online-Banking-Scenario

Elements in the Online-Banking-Scenario:

Online
Banking
Server
(OBS)

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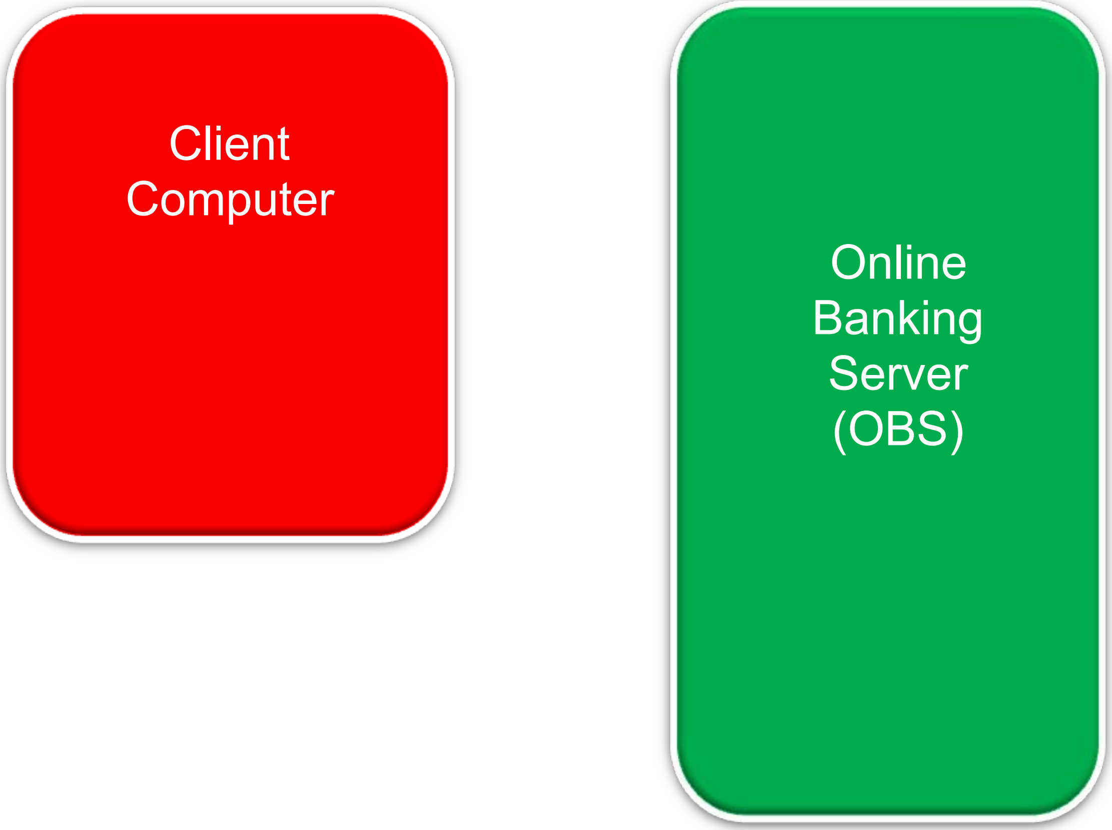

Client Computer

Online Banking Server (OBS)

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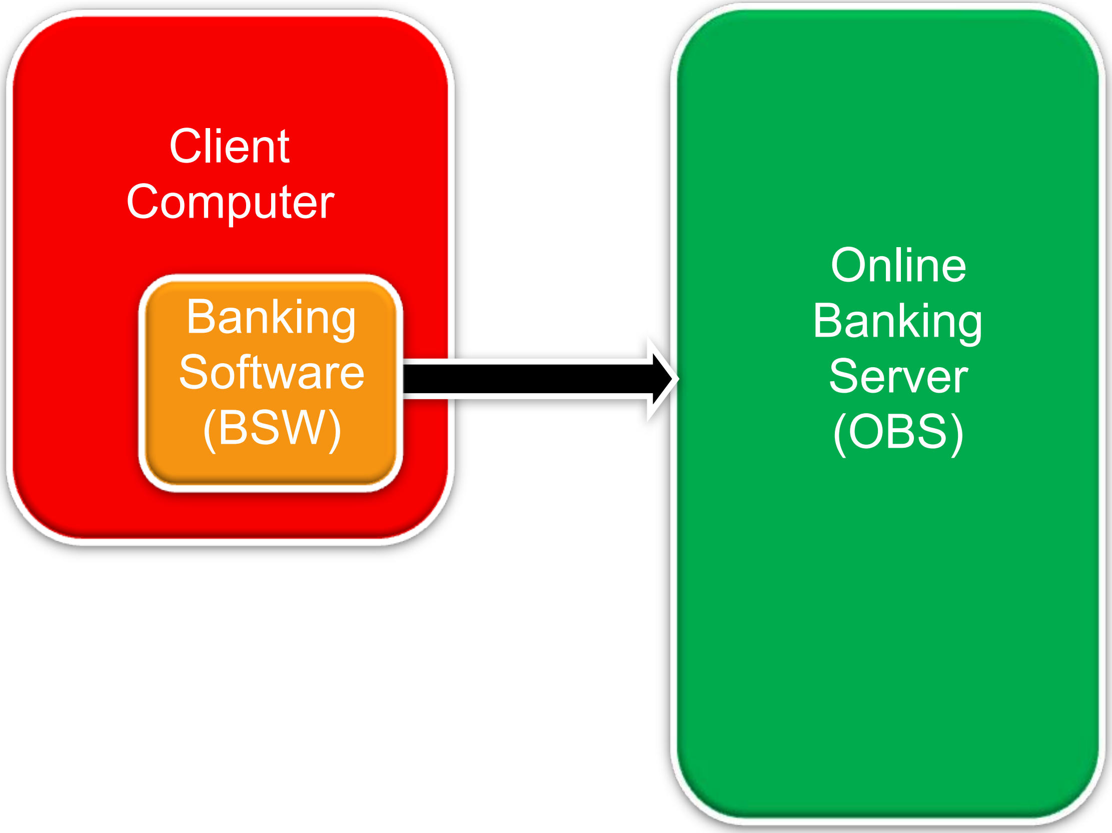

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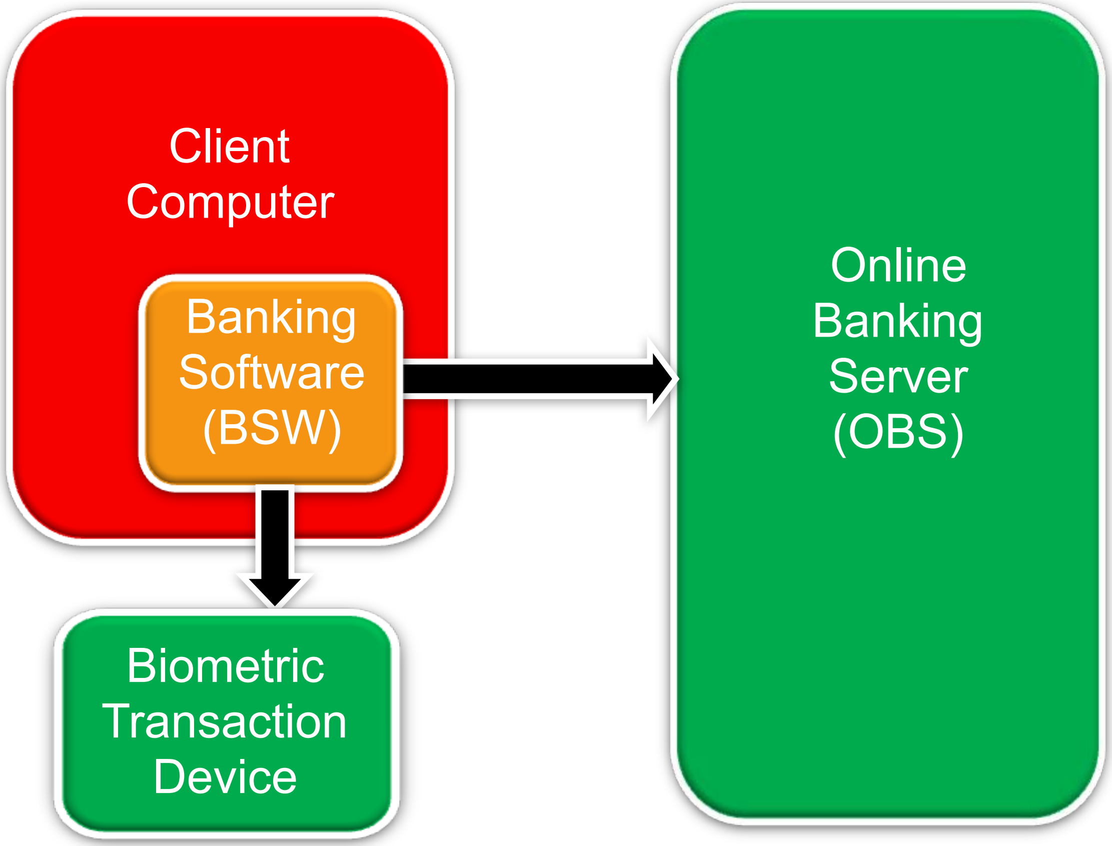

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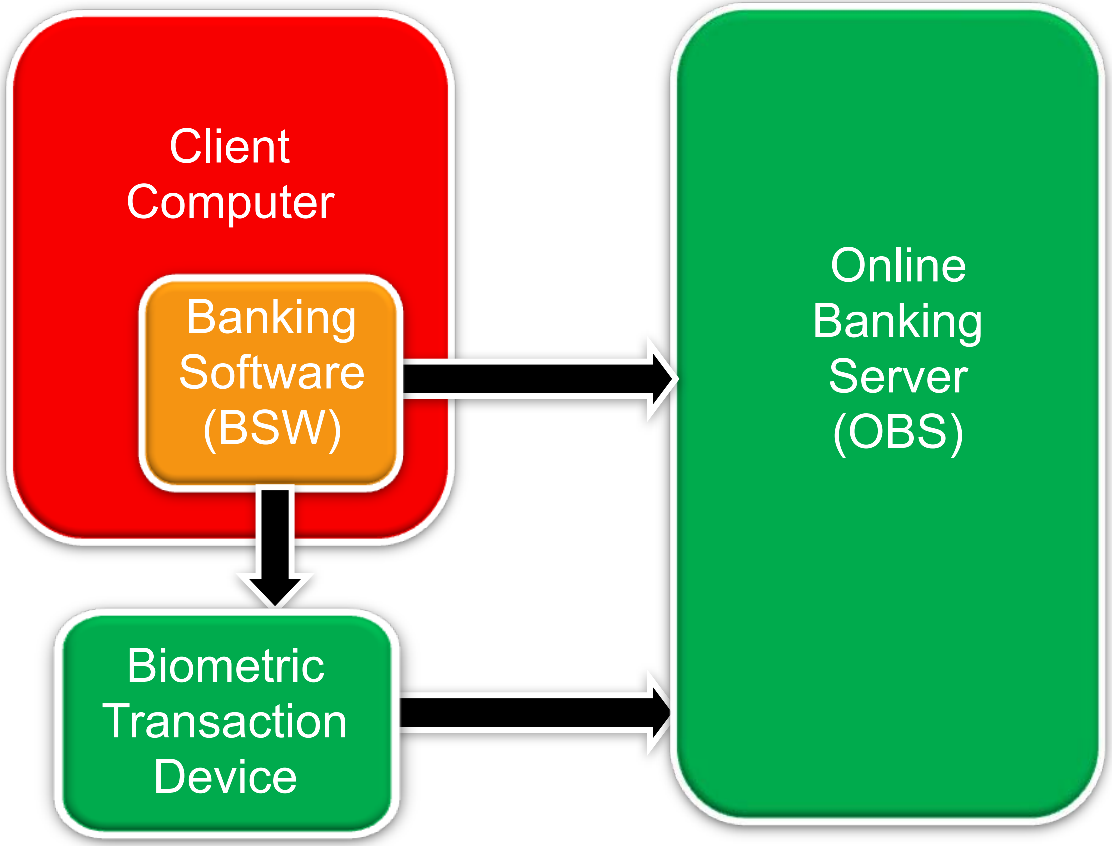
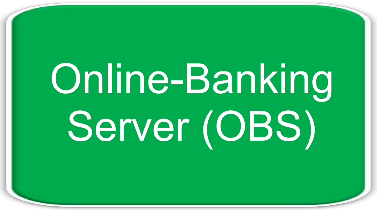


Assumptions

For the Online-Banking-Scenario exists:

1.) A secure Online-Banking-Server (OBS)



- Communication with the Online-Banking-Software (BSW)
- Can recognize a Biometric Transaction Device (BTD) as reliable communication partner
- Implements the transactions

Assumptions (II)

For the Online-Banking-Scenario exists:

2.) An insecure customer PC hosting a standard unprotected Online-Banking-Software (BSW)

- The customer PC is exposed to trojanian horses, root-kits etc.
- The BSW communicates with the Online-Banking-Server (OBS) and transfers orders
  - Transaction-Order-Record (TOR) includes:
    - Transaction-Identifier (TID), Sender-Account-Number (SAN) Receiver-Account-Number (RAN), Ordered Amount (ORA)
- Connected with the customer PC and the BSW is a trustworthy Biometric-Transaction-Device (BTD)

Assumptions (III)

For the Online-Banking-Scenario exists:

3.) A secure Biometric-Transaction-Device (BTD)

which is quasi a Biometric Secoder

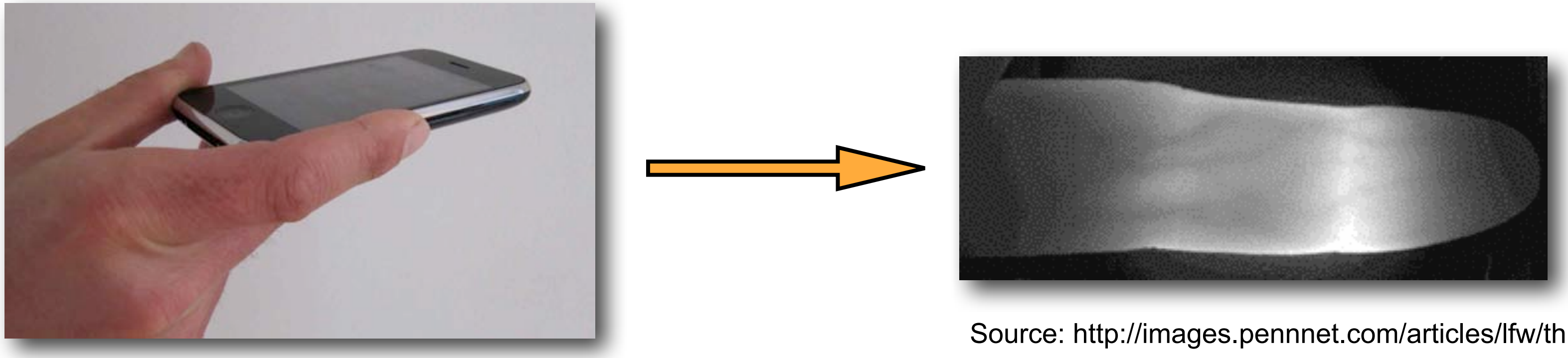
- Connected with the custormer PC
- Trustworthy hardware, which has been evaluated according to Common Criteria
- Can not be manipulated by malware
- BTD can capture a biometric characteristic
- Can recognize a Online-Banking-Server (OBS) as reliable communication partner and can establish a communication with the OBS

Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples of the customer are captured with BTD



Source: http://images.pennnet.com/articles/lfw/thm/th_121040.gif

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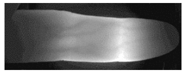
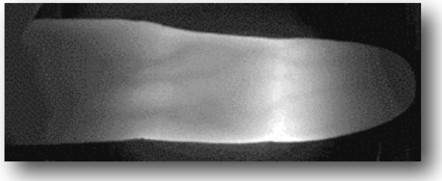
- Biometric samples  are captured with BTD
- Quantized binary vector generated from features



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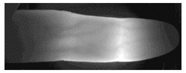
- Biometric samples  are captured with BTD
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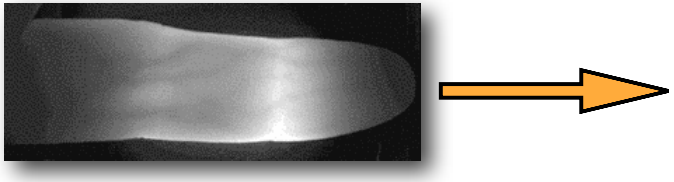

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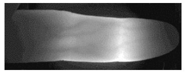
- Biometric samples  are captured with BTD
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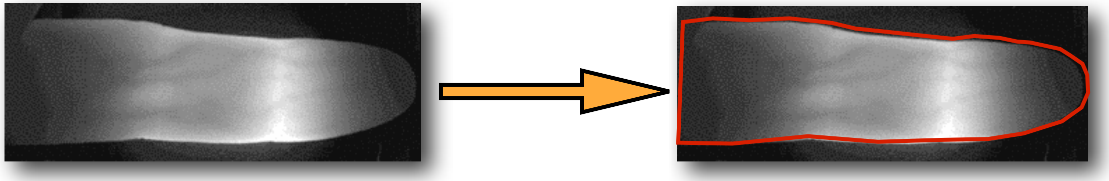

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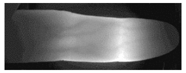
- Biometric samples  are captured with BTD
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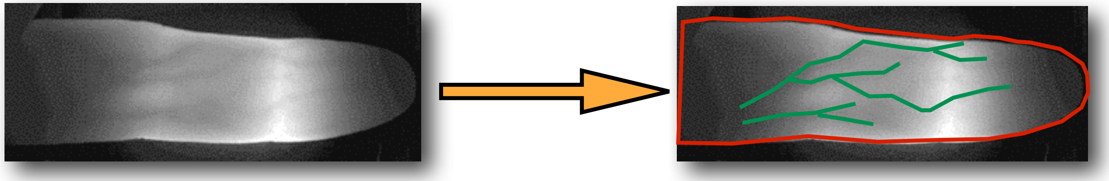

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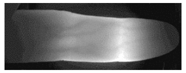
- Biometric samples  are captured with BTD
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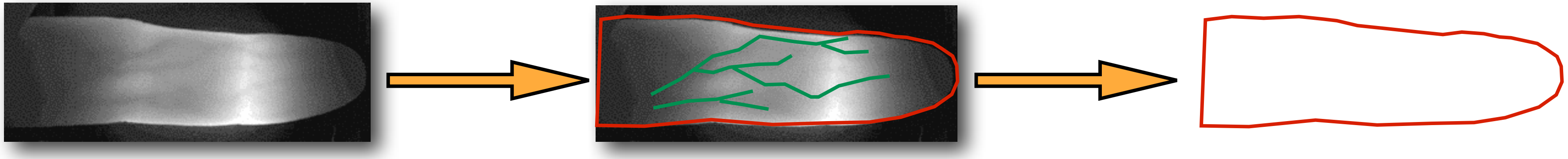

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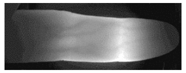
- Biometric samples  are captured with BTD
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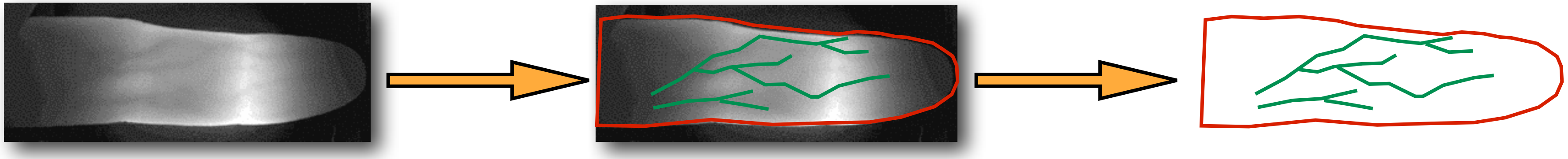

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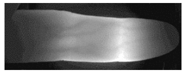
- Biometric samples  are captured with BTD
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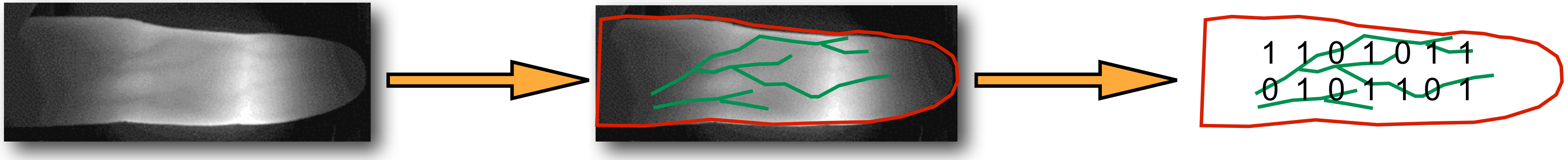

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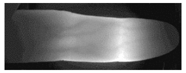
- Biometric samples  are captured with BTD
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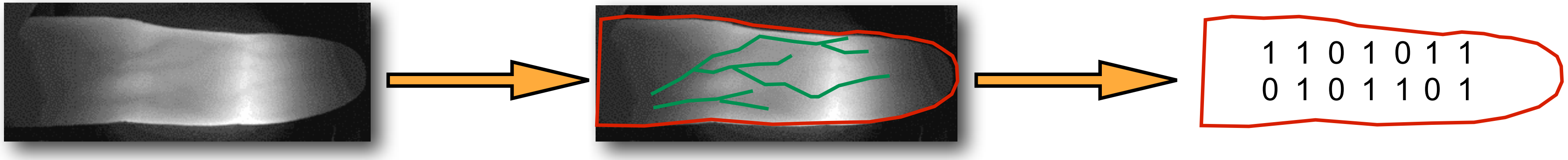

1 1 0 1 0 1 1
0 1 0 1 1 0 1

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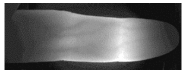
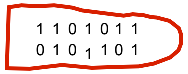
- Biometric samples  are captured with BTD
- Quantized binary vector  1 1 0 1 0 1 1 0 1 0 1 1 0 1 generated from features
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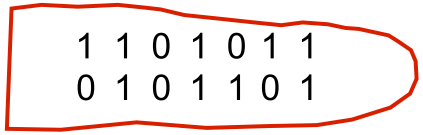

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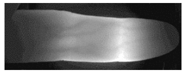
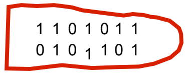
- Biometric samples  are captured with BTD
- Quantized binary vector  generated from features
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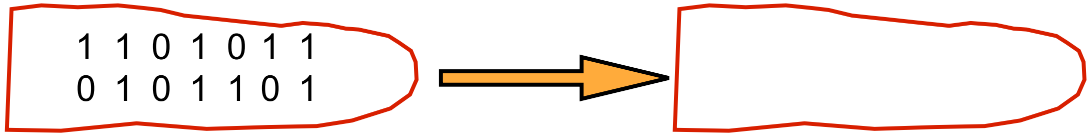

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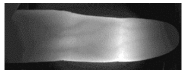
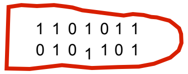
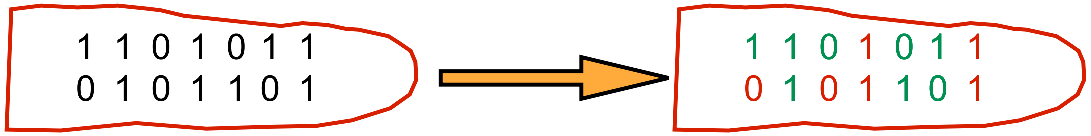
- Biometric samples  are captured with BTD
- Quantized binary vector  generated from features

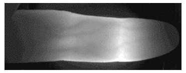
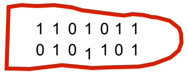
- Binary vector reduced down to reliable features (RBV) and relevant positions (AD1) are stored



Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples  are captured with BTD
- Quantized binary vector  generated from features
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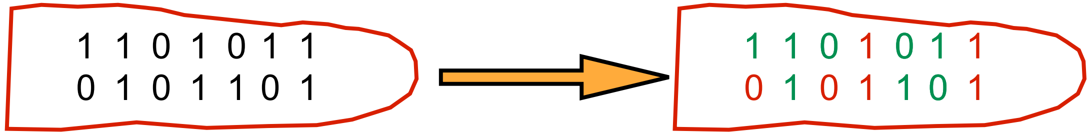

1 1 0 1 0 1 1
0 1 0 1 1 0 1

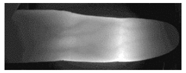
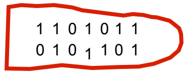
1 1 0 1 0 1 1
0 1 0 1 1 0 1

Recall Auxilliary Data (AD1): Bit-Indices = 0,1,2,4,5,8,11,12

Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples  are captured with BTD
- Quantized binary vector  generated from features
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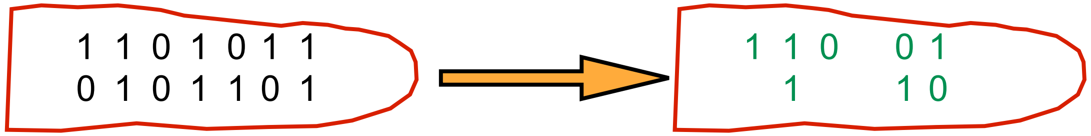


1 1 0 1 0 1 1
0 1 0 1 1 0 1

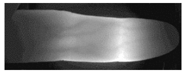
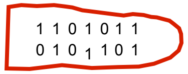
1 1 0 0 1
1 1 0

Recall Auxilliary Data (AD1): Bit-Indices = 0,1,2,4,5,8,11,12

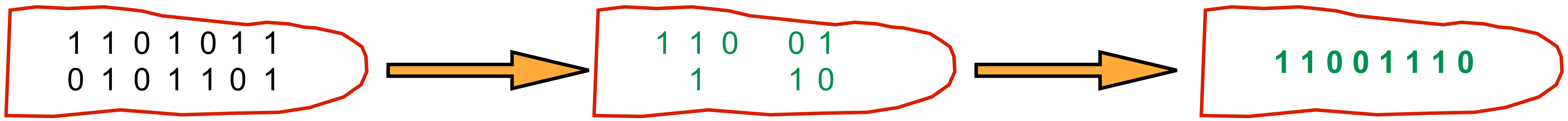
Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples  are captured with BTD
- Quantized binary vector  generated from features

- Binary vector reduced down to reliable features (*RBV*) and relevant positions (AD1) are stored



1 1 0 1 0 1 1
0 1 0 1 1 0 1

1 1 0 0 1
1 1 0

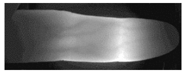
1 1 0 0 1 1 1 0

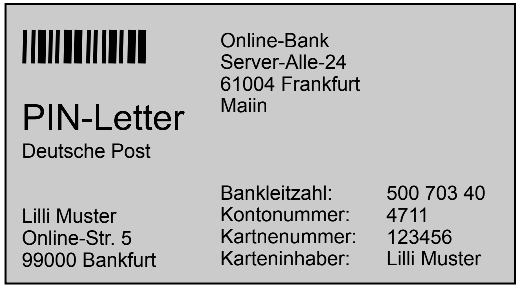
Recall Auxilliary Data (AD1): Bit-Indices = 0,1,2,4,5,8,11,12

Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometrische samples  are captured with BTD
- Quantized binary vector 1101011 0101101 generated from features
- Binary vector reduced down to reliable features (RBV) 11001110 and relevant positions (AD1) are stored { 0,1,2,4,5,8,11,12 }
- Customer receives analog letter with PIN and enter these once



Online-Bank
Server-Alle-24
61004 Frankfurt
Maiin

PIN-Letter
Deutsche Post

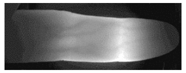
Lilli Muster
Online-Str. 5
99000 Bankfurt

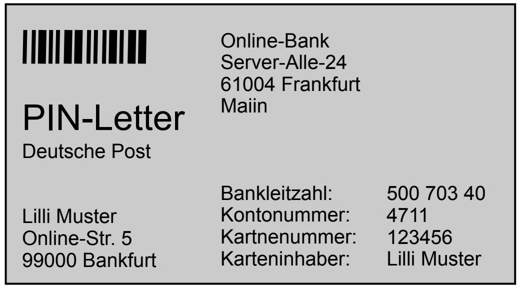
Bankleitzahl:	500 703 40
Kontonummer:	4711
Kartnenummer:	123456
Karteninhaber:	Lilli Muster

Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometrische samples  are captured with BTD
- Quantized binary vector 1 1 0 1 0 1 1 0 1 0 1 1 0 1 generated from features
- Binary vector reduced down to reliable features (*RBV*) 1 1 0 0 1 1 1 0 and relevant positions (AD1) are stored { 0,1,2,4,5,8,11,12 }
- Customer receives analog letter with PIN and enter these once



Online-Bank
Server-Alle-24
61004 Frankfurt
Maiin

PIN-Letter
Deutsche Post

Lilli Muster
Online-Str. 5
99000 Bankfurt

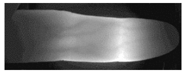
Bankleitzahl:	500 703 40
Kontonummer:	4711
Kartnenummer:	123456
Karteninhaber:	Lilli Muster

PIN = 4768 0569

Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometrische samples  are captured with BTD
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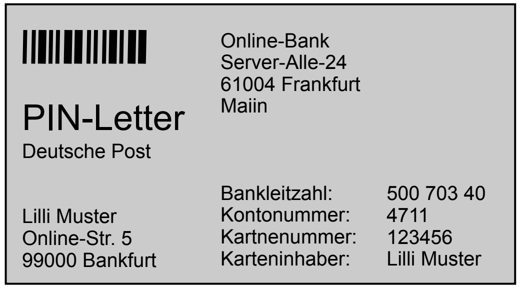


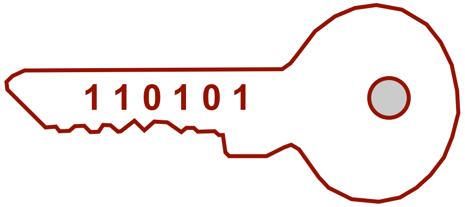
Online-Bank
Server-Alle-24
61004 Frankfurt
Maiin

PIN-Letter
Deutsche Post

Lilli Muster
Online-Str. 5
99000 Bankfurt

Bankleitzahl:	500 703 40
Kontonummer:	4711
Kartnenummer:	123456
Karteninhaber:	Lilli Muster

PIN = 4768 0569

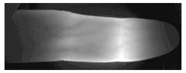
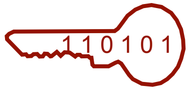


SBV = 110101

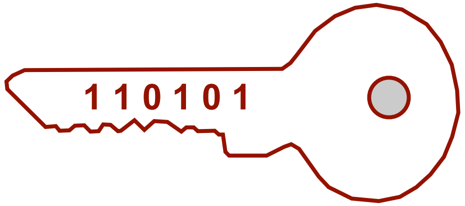
Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples  are captured with BTD
- Quantized binary vector 1 1 0 1 0 1 1 0 1 0 1 1 0 1 generated from features
- Binary vector reduced down to reliable features (*RBV*) 1 1 0 0 1 1 1 0 and relevant positions (AD1) are stored { 0,1,2,4,5,8,11,12 }
- Postal PIN letter provides unique key 

- Secret vector *CBV* is generated from key with error correcting codec

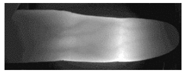


SBV = 110101

Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples  are captured with BTD
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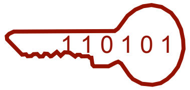
- Postal PIN letter provides unique key 

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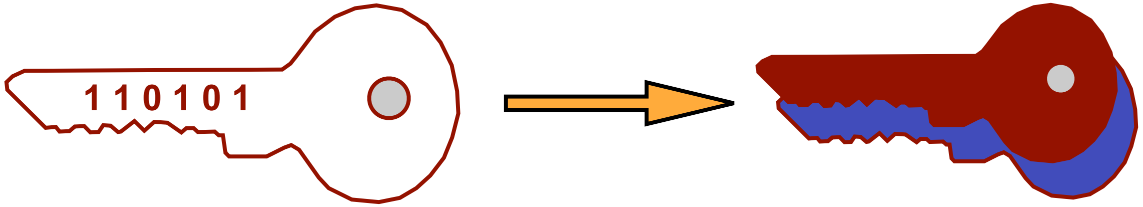


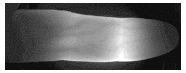
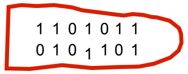
SBV = 110101

110101 + 10

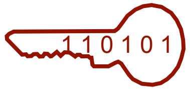
Transaction-Authentication-Protocol

BTAP - Enrolment

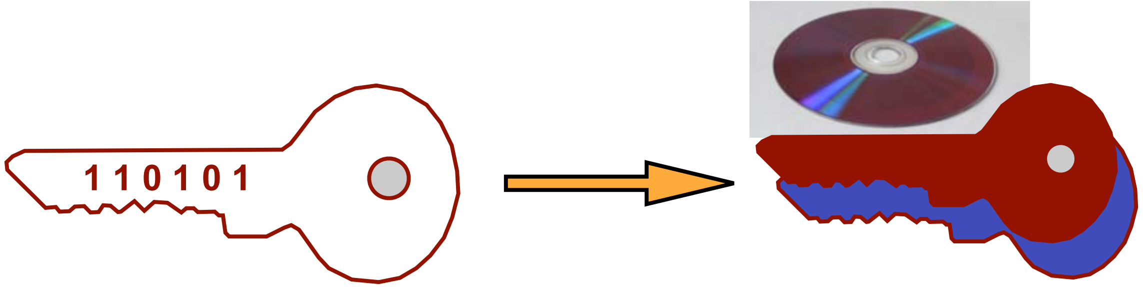
1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples  are captured with BTD
- Quantized binary vector 

 generated from features
- Binary vector reduced down to reliable features (RBV)

and relevant positions (AD1) are stored { 0,1,2,4,5,8,11,12 }
- Postal PIN letter provides unique key 

- Secret vector CBV is generated from key with error correcting codec



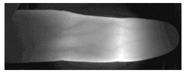
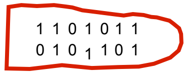
SBV = 110101

110101 + 10

Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples  are captured with BTD
- Quantized binary vector  generated from features

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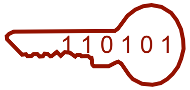
- Postal PIN letter provides unique key 

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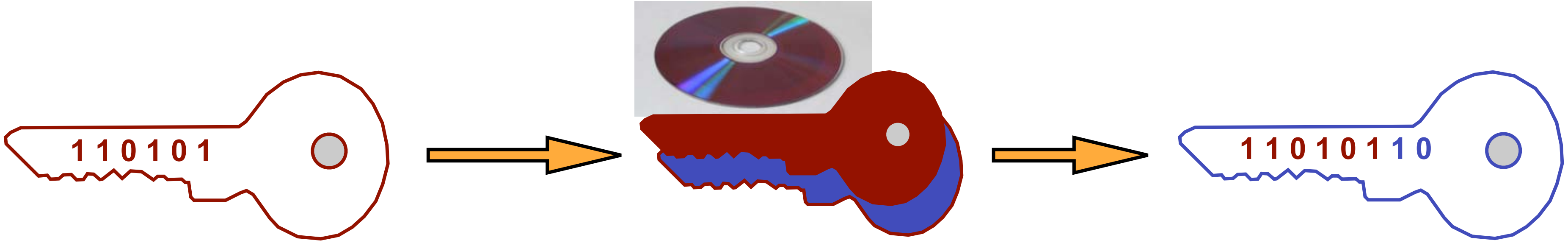


SBV = 110101

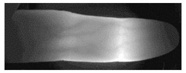
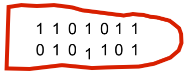
110101 + 10

CBV = 11010110

Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples  are captured with BTD
- Quantized binary vector  generated from features

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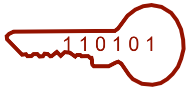
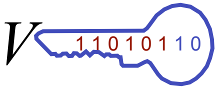
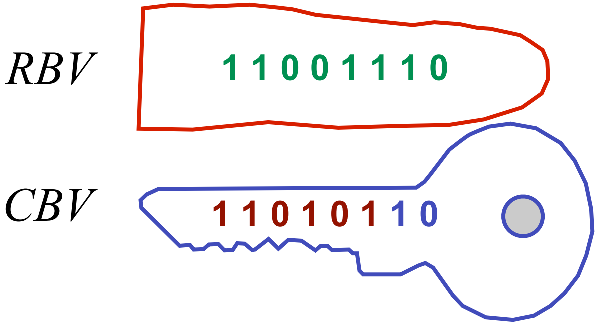
- Postal PIN letter provides unique key 

- Secret vectore CBV  is generated

- Reduced binary vector RBV will be combined with the secret vector CBV with a XOR operation



Transaction-Authentication-Protocol

BTAP - Enrolment

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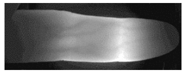
- Biometric samples  are captured with BTD
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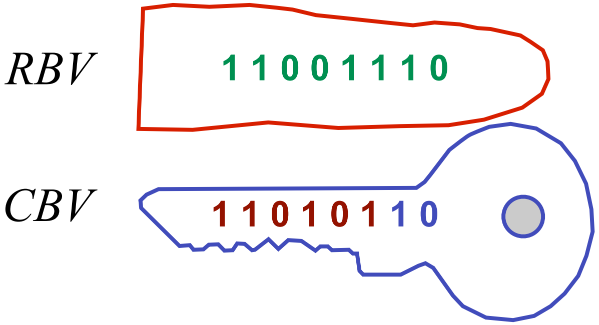
- Binary vector reduced down to reliable features (RBV) 1 1 0 0 1 1 1 0 and relevant positions (AD1) are stored { 0,1,2,4,5,8,11,12 }
- Postal PIN letter provides unique key 1 1 0 1 0 1
- Secret vectore CBV 1 1 0 1 0 1 1 0 is generated
- Reduced binary vector RBV will be combined with the secret vector CBV with a XOR operation

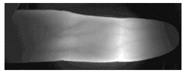
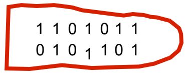


1 1 0 0 1 1 1 0

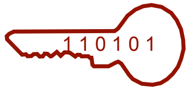
Transaction-Authentication-Protocol

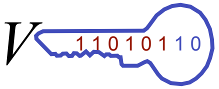
BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples  are captured with BTD
- Quantized binary vector 

generated from features
- Binary vector reduced down to reliable features (RBV)

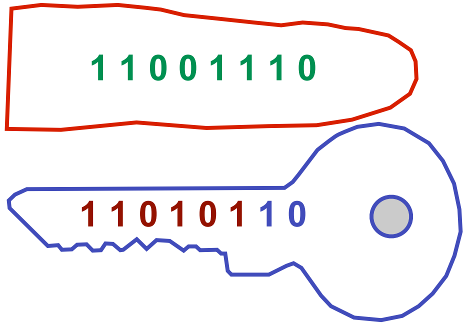
and relevant positions (AD1) are stored { 0,1,2,4,5,8,11,12 }
- Postal PIN letter provides unique key 

- Secret vectore CBV 

is generated
- Reduced binary vector RBV will be combined with the secret vector CBV with a XOR operation

RBV

CBV



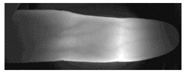
1 1 0 0 1 1 1 0

1 1 0 1 0 1 1 0

Transaction-Authentication-Protocol

BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

- Biometric samples  are captured with BTD
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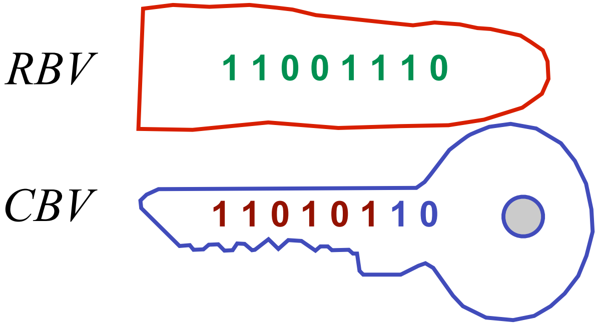
- Postal PIN letter provides unique key 1 1 0 1 0 1
- Secret vectore CBV 1 1 0 1 0 1 1 0 is generated
- Reduced binary vector RBV will be combined with the secret vector CBV with a XOR operation

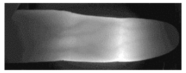
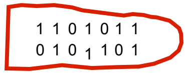


$$
\begin{array}{l}
1\ 1\ 0\ 0\ 1\ 1\ 1\ 0 \\
1\ 1\ 0\ 1\ 0\ 1\ 1\ 0 \quad \text{XOR} \\
\hline
\end{array}
$$

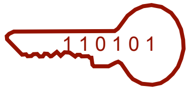
Transaction-Authentication-Protocol

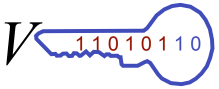
BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

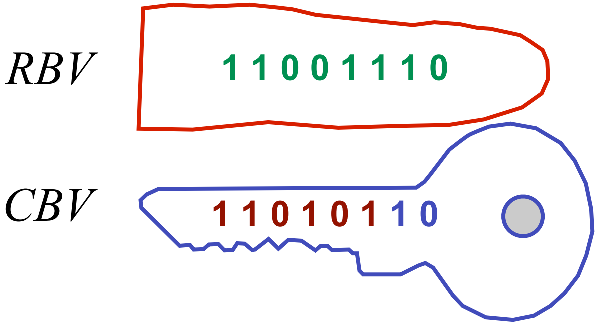
- Biometric samples  are captured with BTD
- Quantized binary vector  generated from features

- Binary vector reduced down to reliable features (RBV) and relevant positions (AD1) are stored { 0,1,2,4,5,8,11,12 }

- Postal PIN letter provides unique key 

- Secret vectore CBV  is generated

- Reduced binary vector RBV will be combined with the secret vector CBV with a XOR operation

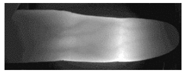
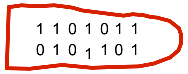


```
  1 1 0 0 1 1 1 0
  1 1 0 1 0 1 1 0   XOR
  ---------------
  0 0 0 1 1 0 0 0  = AD2
```

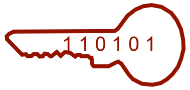
Transaction-Authentication-Protocol

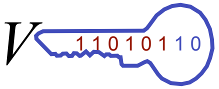
BTAP - Enrolment

1.) Enrolment with Biometric Transaction Device (BTD)

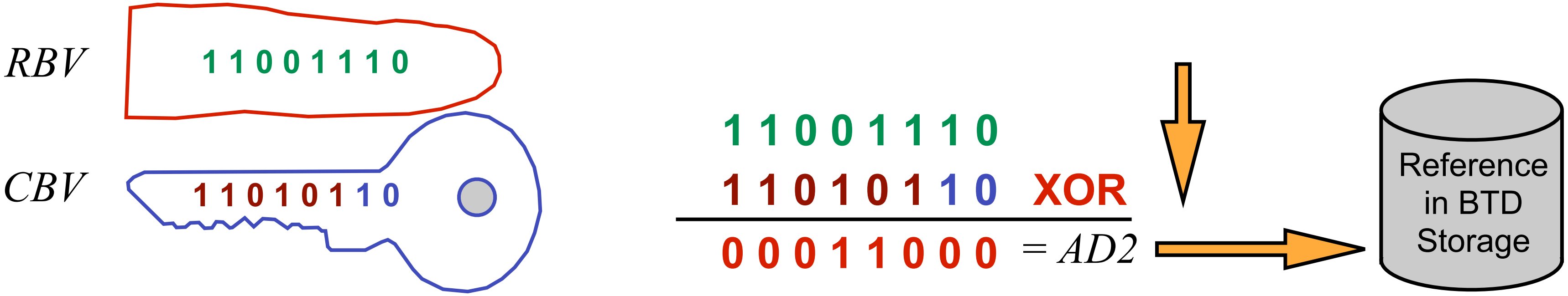
- Biometric samples  are captured with BTD
- Quantized binary vector  generated from features

- Binary vector reduced down to reliable features (*RBV*) and relevant positions (AD1) are stored { 0,1,2,4,5,8,11,12 }

- Postal PIN letter provides unique key 

- Secret vectore *CBV*  is generated

- Reduced binary vector *RBV* will be combined with the secret vector *CBV* with a XOR operation



```
  1 1 0 0 1 1 1 0
  1 1 0 1 0 1 1 0   XOR
  ---------------
  0 0 0 1 1 0 0 0   = AD2
```

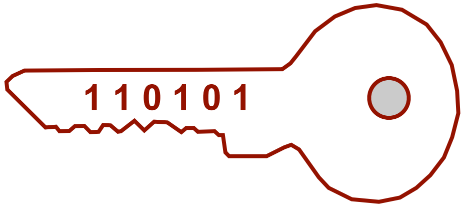
- Auxilliary data *AD1* and reference *AD2* stored in BTD

Transaction-Authentication-Protocol

BTAP - Enrolment

2.) Enrolment with Online-Banking-Server (OBS)

- Create a customer record with Account-Number (AN)
- Hash-value of secret key SBV
  is stored with the customer record in the OBS-database
  - Hash-value corresponds to Pseudonymous-Identifier according to ISO 24745



Transaction-Authentication-Protocol

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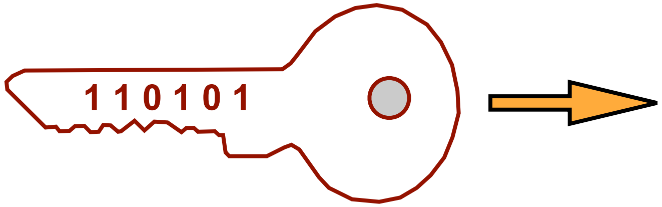

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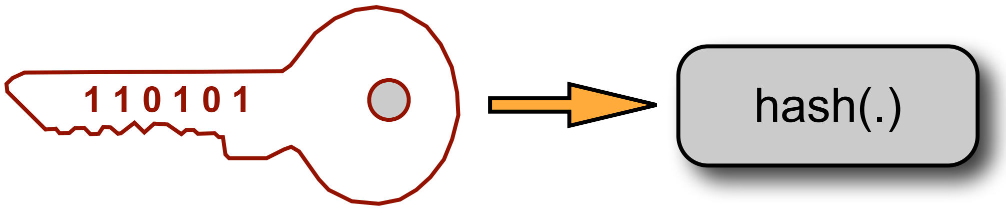

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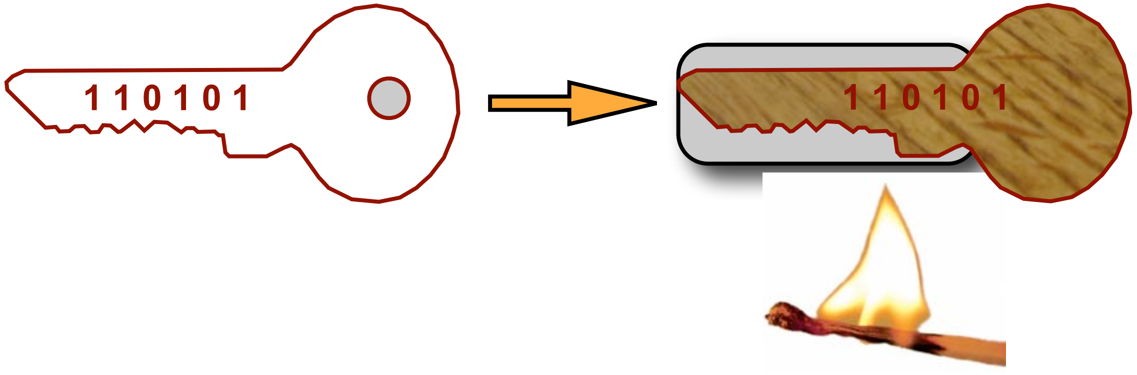

Transaction-Authentication-Protocol

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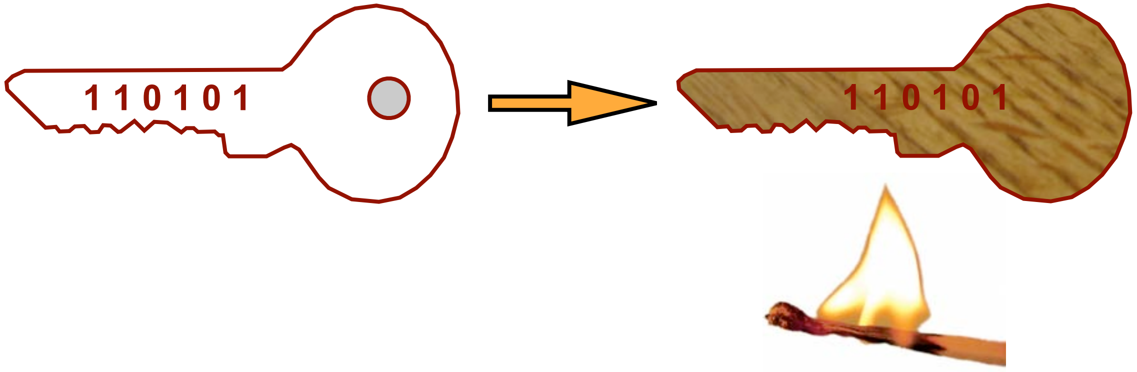

Transaction-Authentication-Protocol

BTAP - Enrolment

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Transaction-Authentication-Protocol

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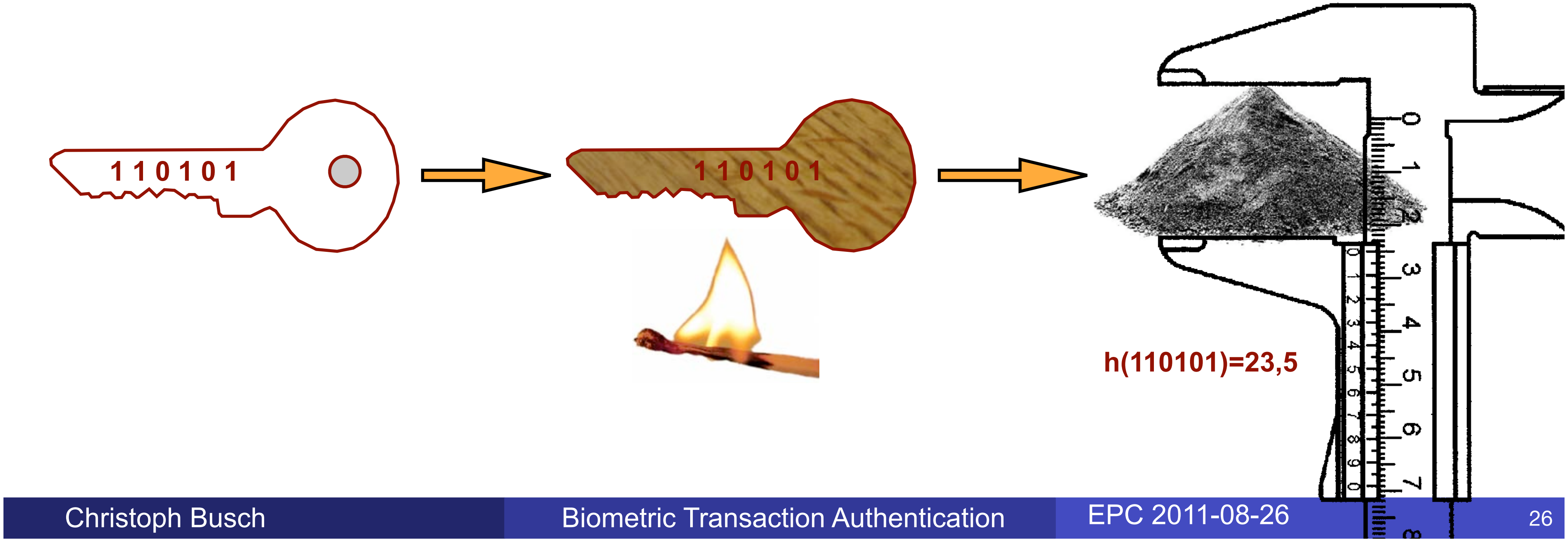


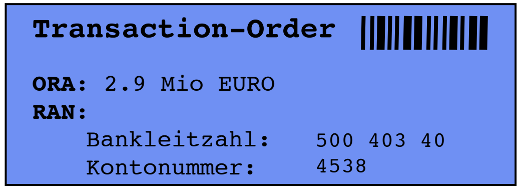
Biometric Transaction and Verification

Transaction-Verification

BTAP - Transaction

1.) Operations of the Online-Banking-Software (BSW)

- Customer generates by interacting with the BSW-Software a new Transaction-Order-Record (TOR)



Transaction-Order

ORA: 2.9 Mio EURO
RAN:
Bankleitzahl: 500 403 40
Kontonummer: 4538

  This TOR consist of:

  - Transaction-Identifier (TID), Sender-Account-Number (SAN) Receiver-Account-Number (RAN), Ordered Amount (ORA)

Transaction-Verification

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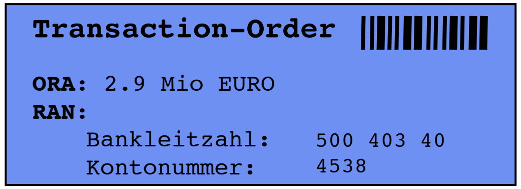


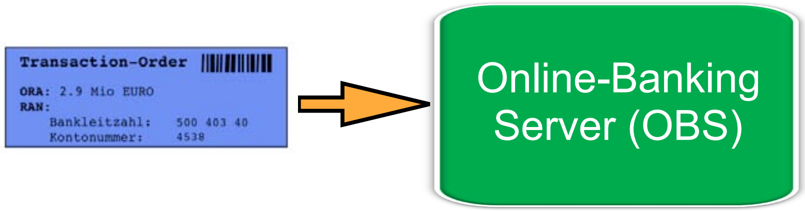
```
Transaction-Order

ORA: 2.9 Mio EURO
RAN:
    Bankleitzahl:     500 403 40
    Kontonummer:      4538
```

  This TOR consist of:

  - Transaction-Identifier (TID), Sender-Account-Number (SAN) Receiver-Account-Number (RAN), Ordered Amount (ORA)

- BSW transfers TOR to the Online-Banking-Server (OBS)



Transaction-Verification

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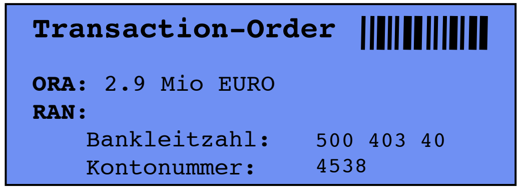

```
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ORA: 2.9 Mio EURO
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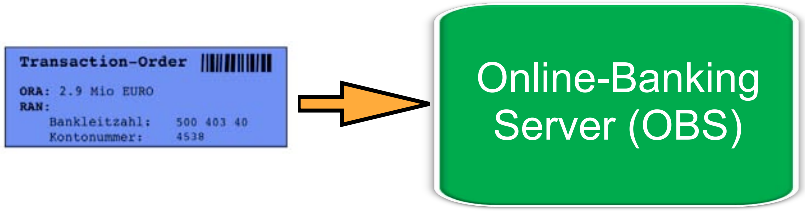
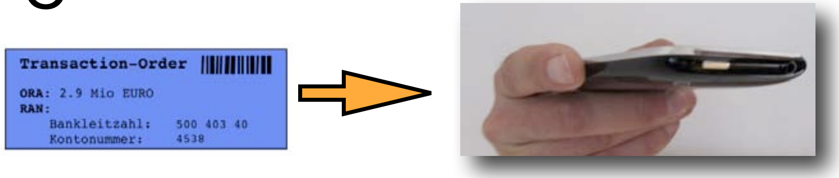


```
Transaction-Order

ORA: 2.9 Mio EURO
RAN:
     Bankleitzahl:     500 403 40
     Kontonummer:      4538
```

- BSW transfers TOR to the Biometric-Transaction-Device (BTD) that is connected to the customer PC



```
Transaction-Order

ORA: 2.9 Mio EURO
RAN:
     Bankleitzahl:     500 403 40
     Kontonummer:      4538
```

Transaction-Verification

BTAP - Transaction

2.) Operations of the Biometric-Transaction-Device (BTD)

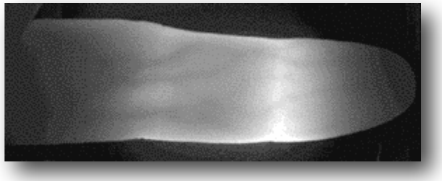
- The relevant Information of the Transaction-Order-Record (TOR) is visualized in the display of the BTD:
  - Receiver-Account-Number (RAN), Ordered Amount (ORA)
- For approval of the intended transaction the customer
  - places his finger on the biometric sensor
  - and thus the BTD generates a probe sample

Transaction-Verification

BTAP - Transaction

2.) Operations of the Biometric-Transaction-Device (BTD)

- The relevant Information of the Transaction-Order-Record (TOR) is visualized in the display of the BTD:
  - Receiver-Account-Number (RAN), Ordered Amount (ORA)
- Approval of the intended transaction by probe sample
- Auxilliary Data $AD1_{\{0,1,2,4,5,8,11,12\}}$ is extracted from BTD-storage
- A binarized fresh feature vector XBV is generated from probe XRV and the Auxilliary Data $AD1$



Transaction-Verification

BTAP - Transaction

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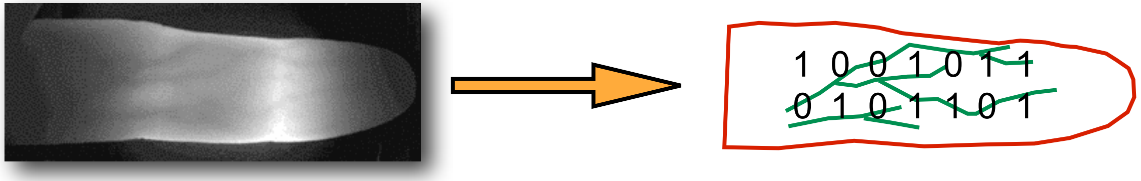

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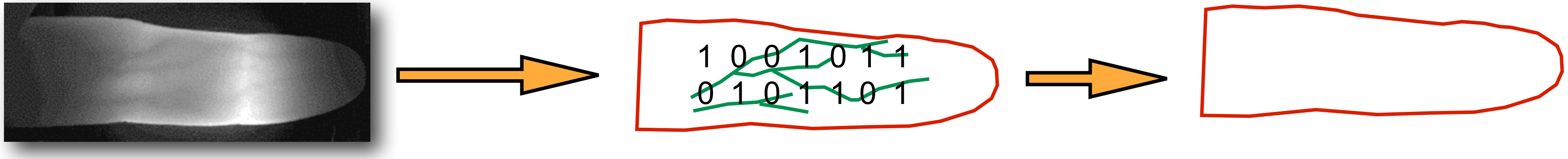

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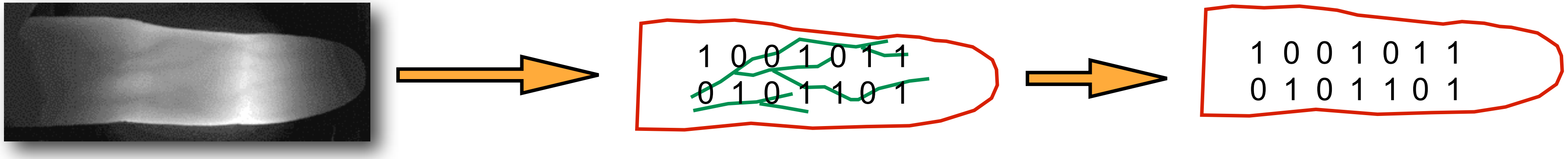

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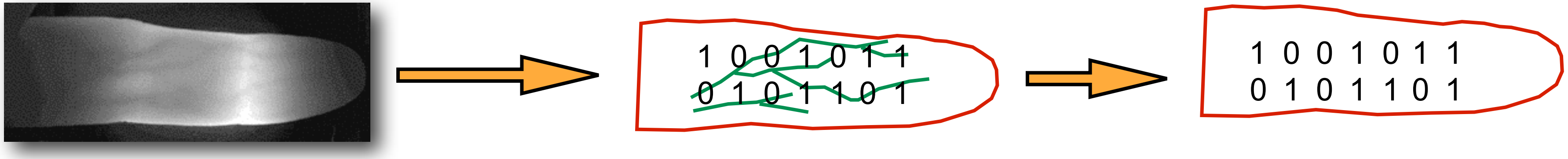

Auxilliary Data ($AD1$): Bit-Indices = 0,1,2,4,5,8,11,12

Transaction-Verification

BTAP - Transaction

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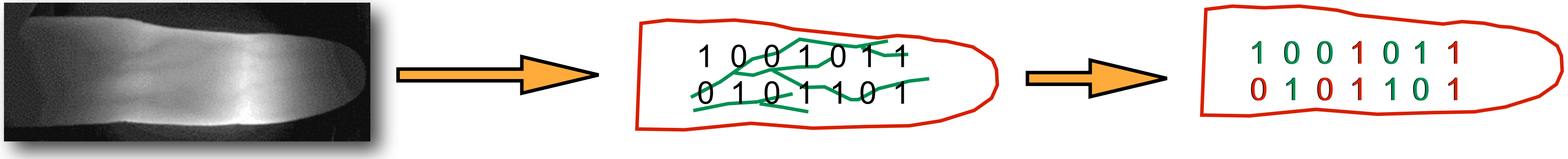

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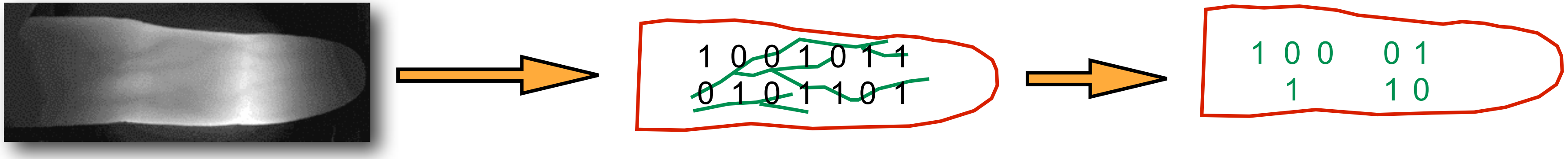

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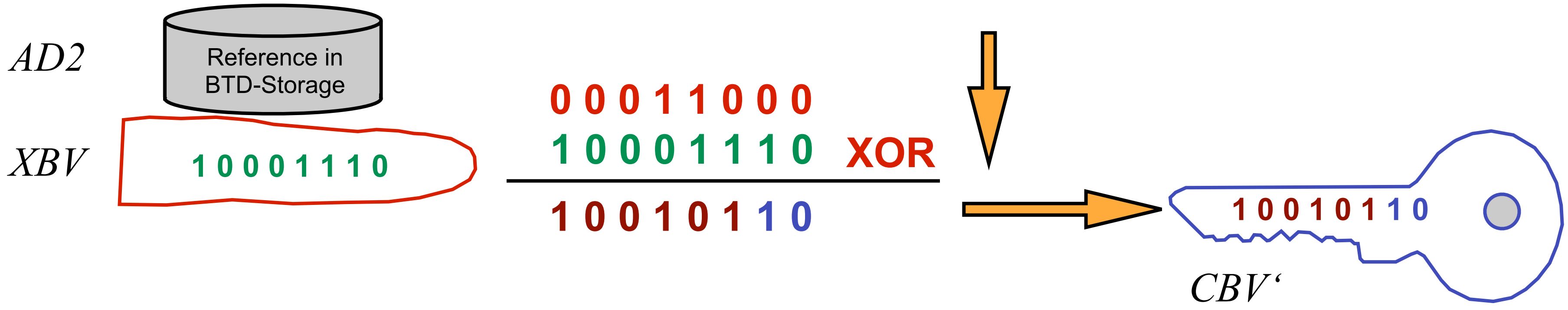
- Auxilliary Data $AD1_{\{0,1,2,4,5,8,11,12\}}$ is extracted from BTD-storage
- A binarized feature vector XBV 1 0 0 0 1 1 1 0 is reconstructed
- A secret vector CBV' is reconstructed with XOR operation from the Auxilliary Data $AD2$ Reference that was stored in the BTD and from the binarized feature vector XBV 1 0 0 0 1 1 1 0



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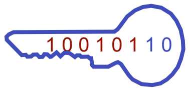
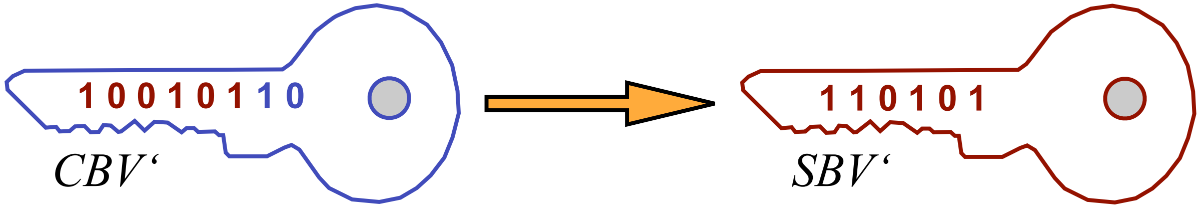
- A secret vector CBV'  is reconstructed
- The secret key SBV' is freshly computed from CBV'

$SBV' = dec\,(CBV')$



Transaction-Verification

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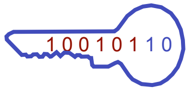
- A secret vector CBV' 

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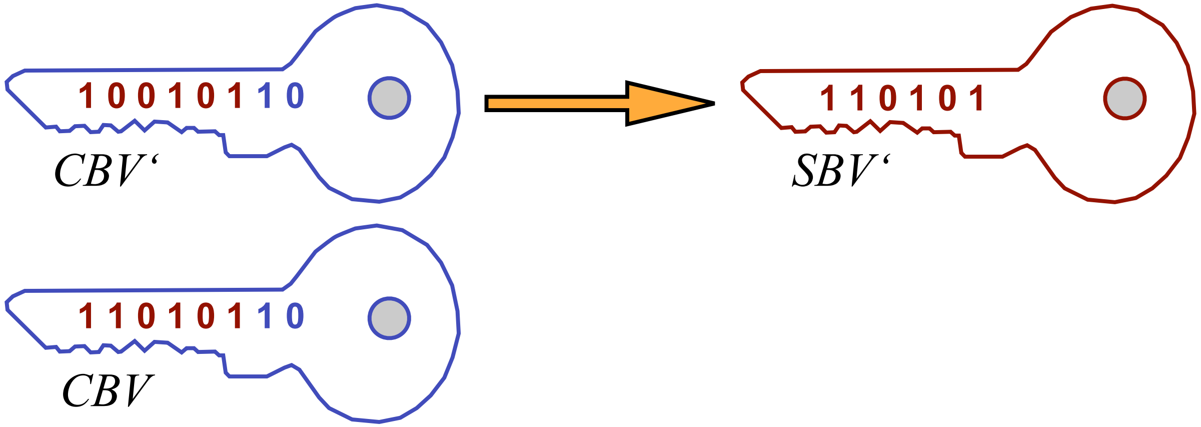

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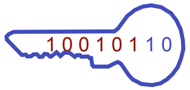
- A secret vector CBV' 

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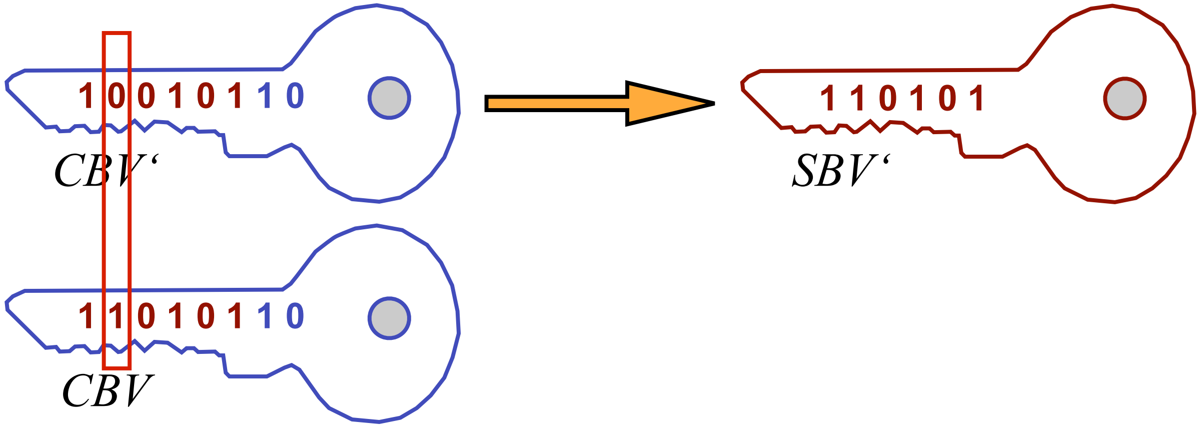

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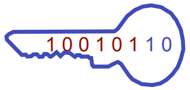
- A secret vector CBV'  is reconstructed
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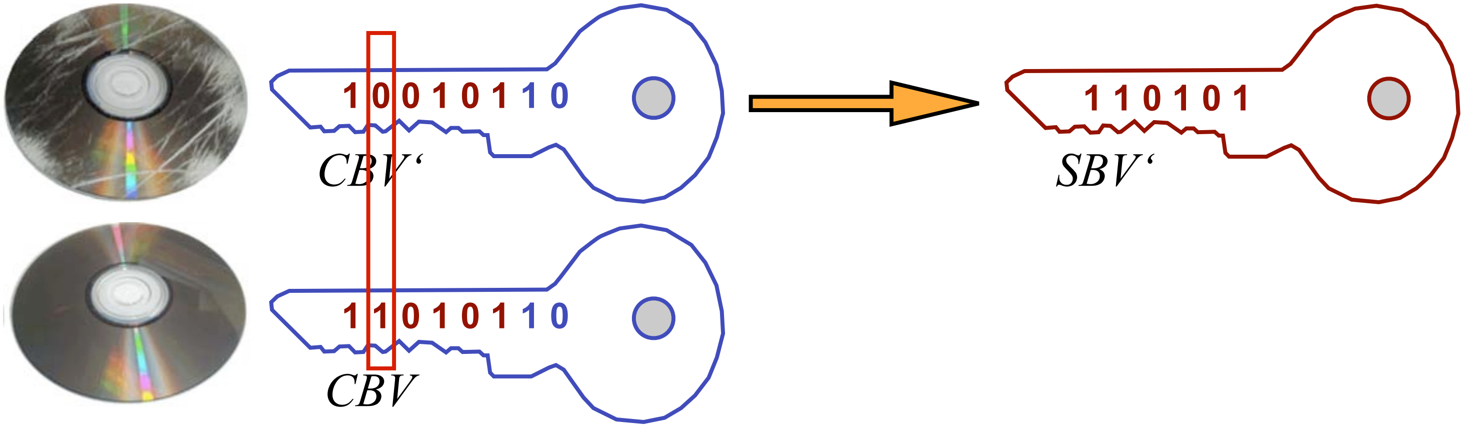
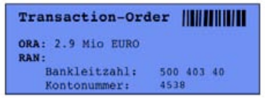


Transaction-Verification

BTAP - Transaction

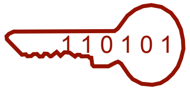
2.b) Mirror-Operations of the BTD

- A Transaction-Order-Seal (TOS‘) is computed
  - of the Transaction-Order-Record *TOR*
  - and the reconstructed secret key *SBV‘*
    TOS‘ = MAC (h(TOR), PI‘)
    PI‘ = h(SBV‘)



Transaction-Order

ORA: 2.9 Mio EURO
RAN:
Bankleitzahl: 500 403 40
Kontonummer: 4538



Transaction-Verification

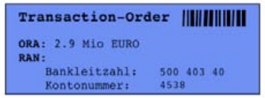
BTAP - Transaction

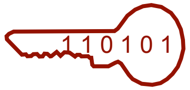
2.b) Mirror-Operations of the BTD

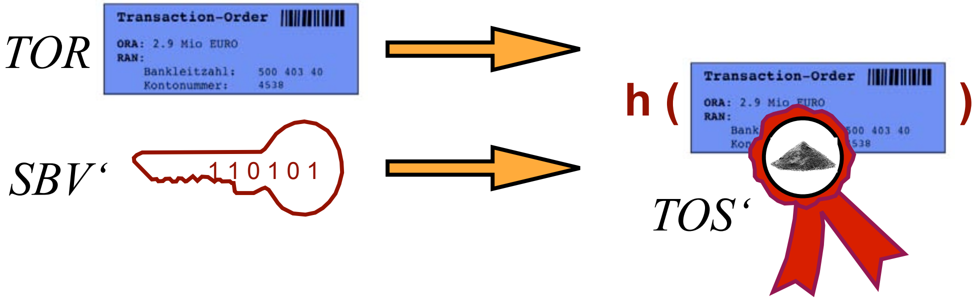
- A Transaction-Order-Seal (TOS‘) is computed
  - of the Transaction-Order-Record *TOR*
  - and the reconstructed secret key *SBV‘*

    $TOS' = MAC\,(h(TOR),\, PI')$

    $PI' = h(SBV')$







Transaction-Verification

BTAP - Transaction

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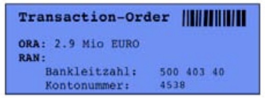
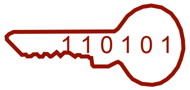
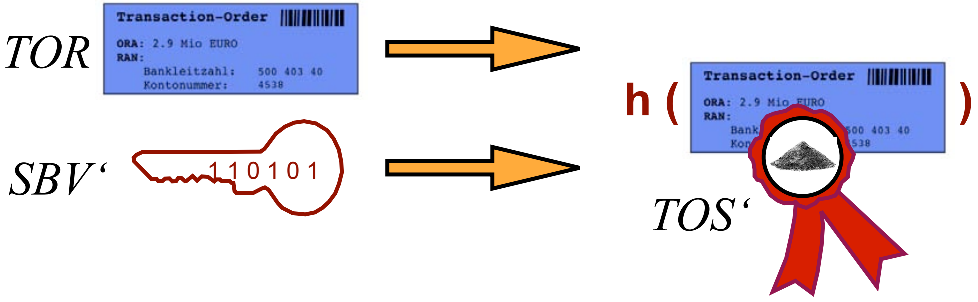


  - and the reconstructed secret key *SBV‘*



    TOS‘ = MAC (h(TOR), PI‘)
    PI‘ = h(SBV‘)



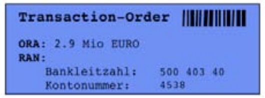
  - Implementation option with HMAC:
    TOS‘ = h(PI‘ XOR OPAD, h(PI’ XOR IPAD, TOR))

Transaction-Verification

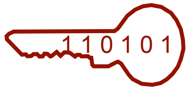
BTAP - Transaction

2.b) Mirror-Operations of the BTD

- A Transaction-Order-Seal (TOS‘) is computed
  - of the Transaction-Order-Record *TOR*

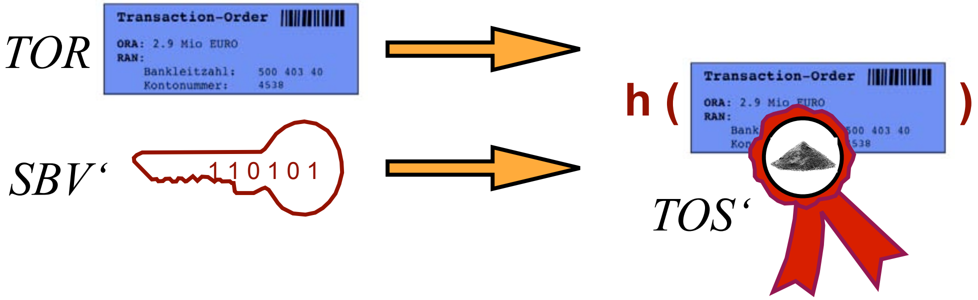


  - and the reconstructed secret key *SBV‘*



$TOS' = MAC(h(TOR), PI')$

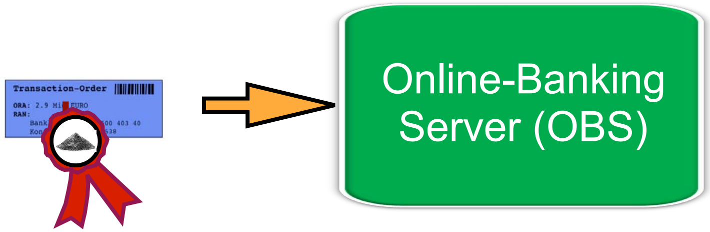
$PI' = h(SBV')$



  - Implementation option with HMAC:

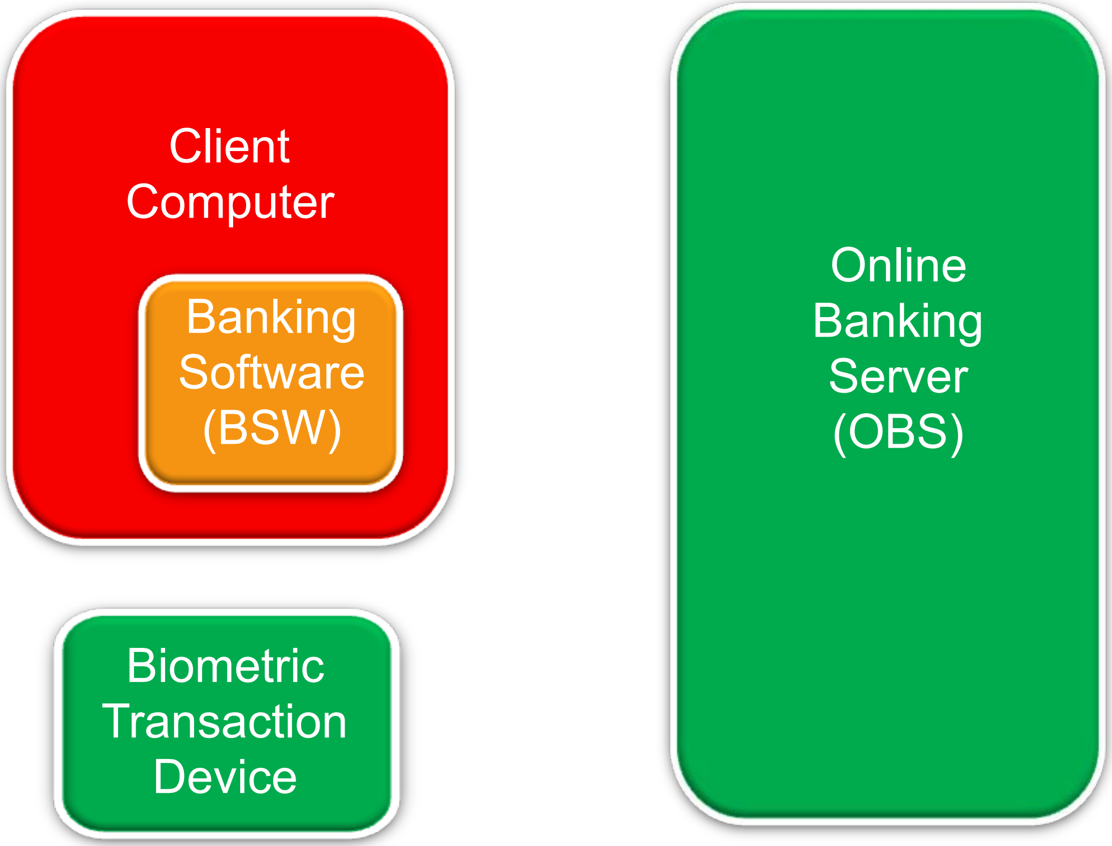
$TOS' = h(PI' \; XOR \; OPAD, h(PI' \; XOR \; IPAD, TOR))$

- The seal (TOS‘) is transfered to the Online-Banking-Server



Online-Banking-Scenario

Elements in the Online-Banking-Scenario:



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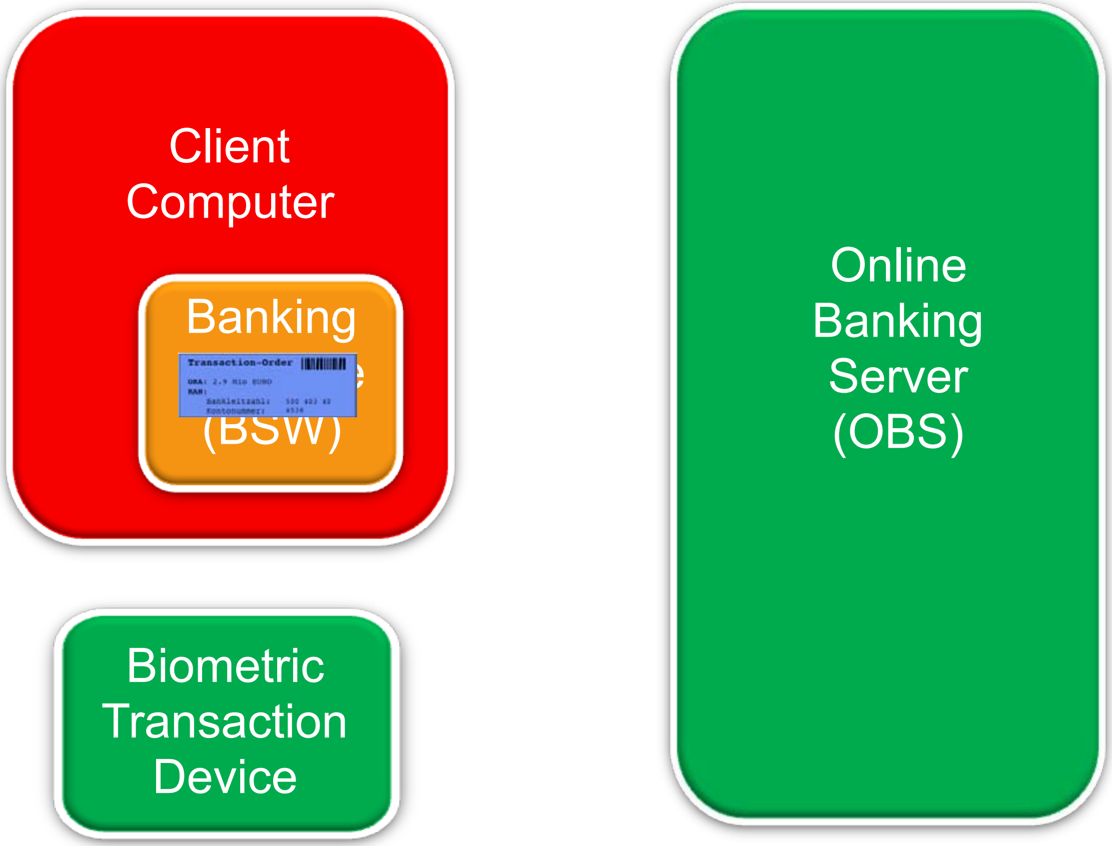

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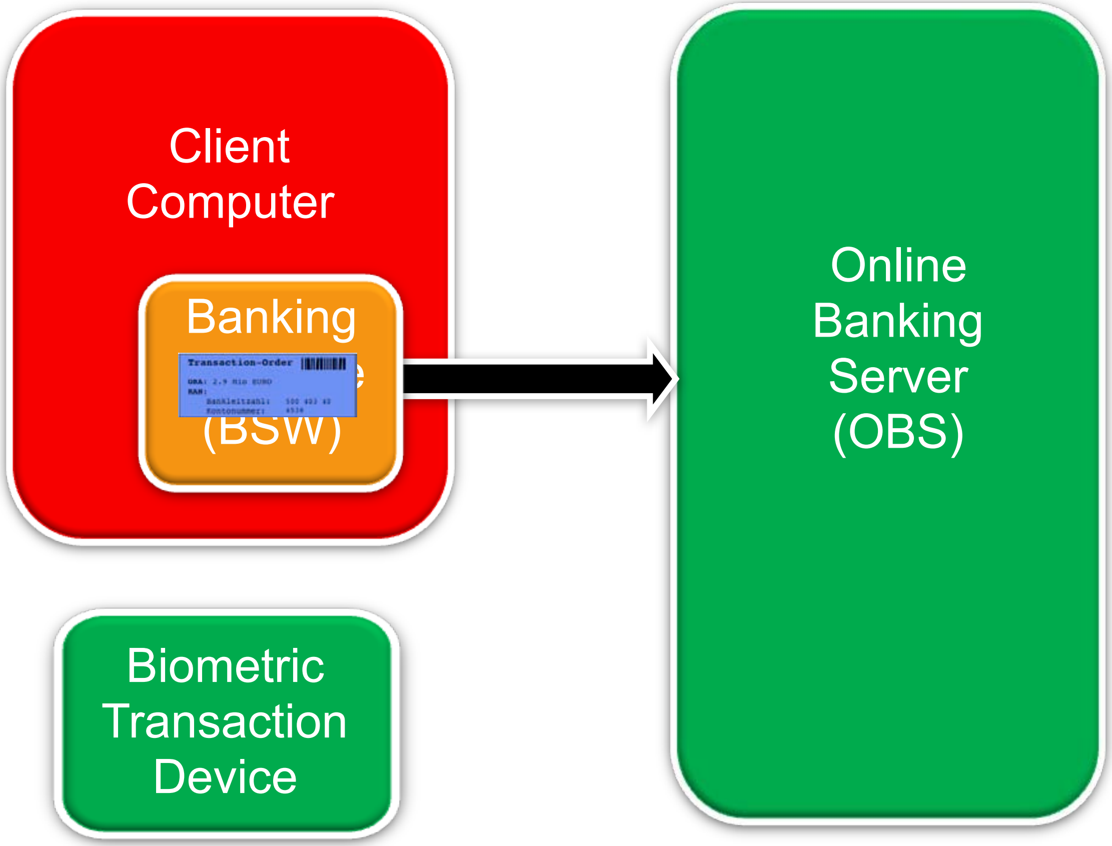

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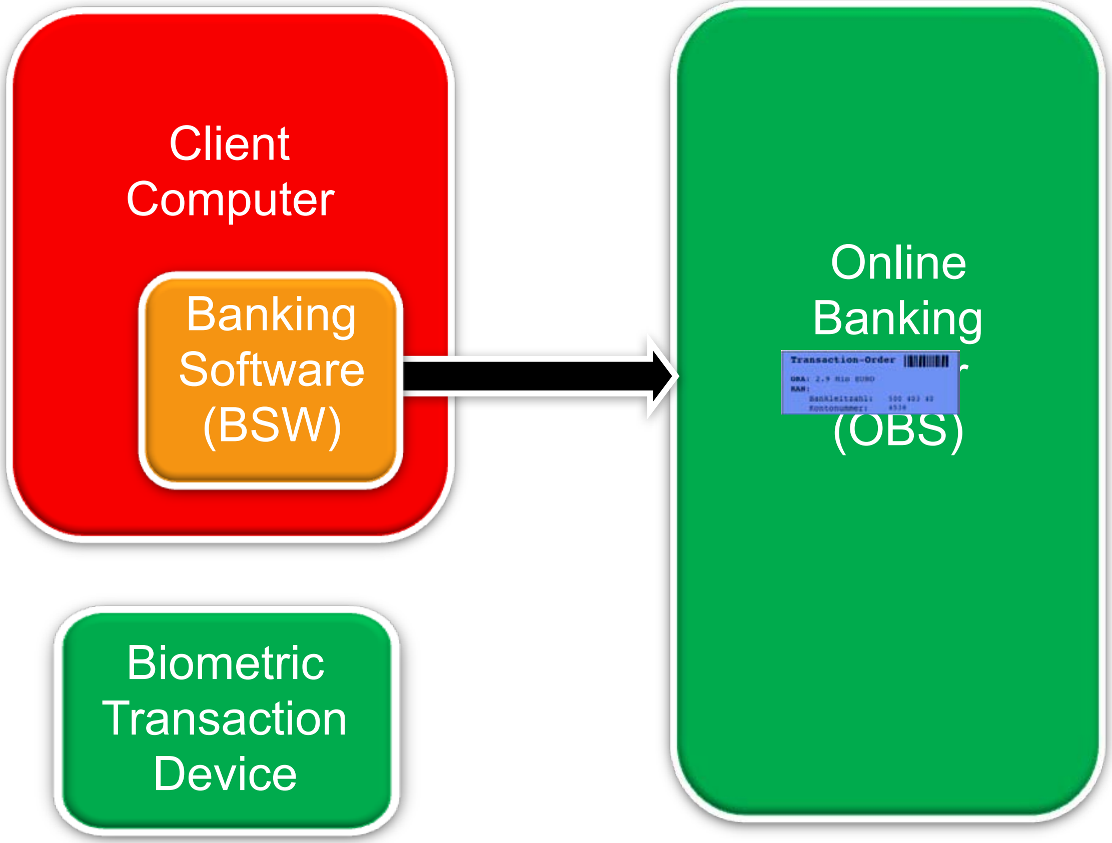

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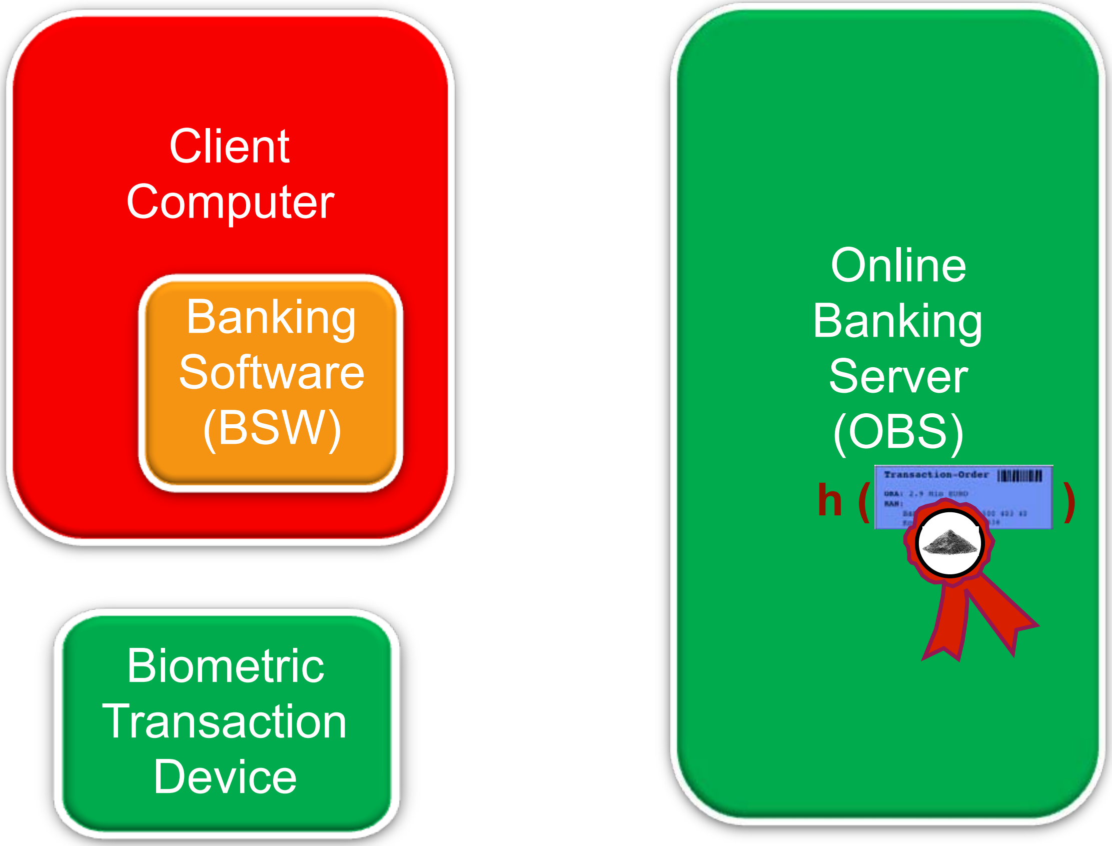

Client Computer

Banking Software (BSW)

Biometric Transaction Device

Online Banking Server (OBS)

Online-Banking-Scenario

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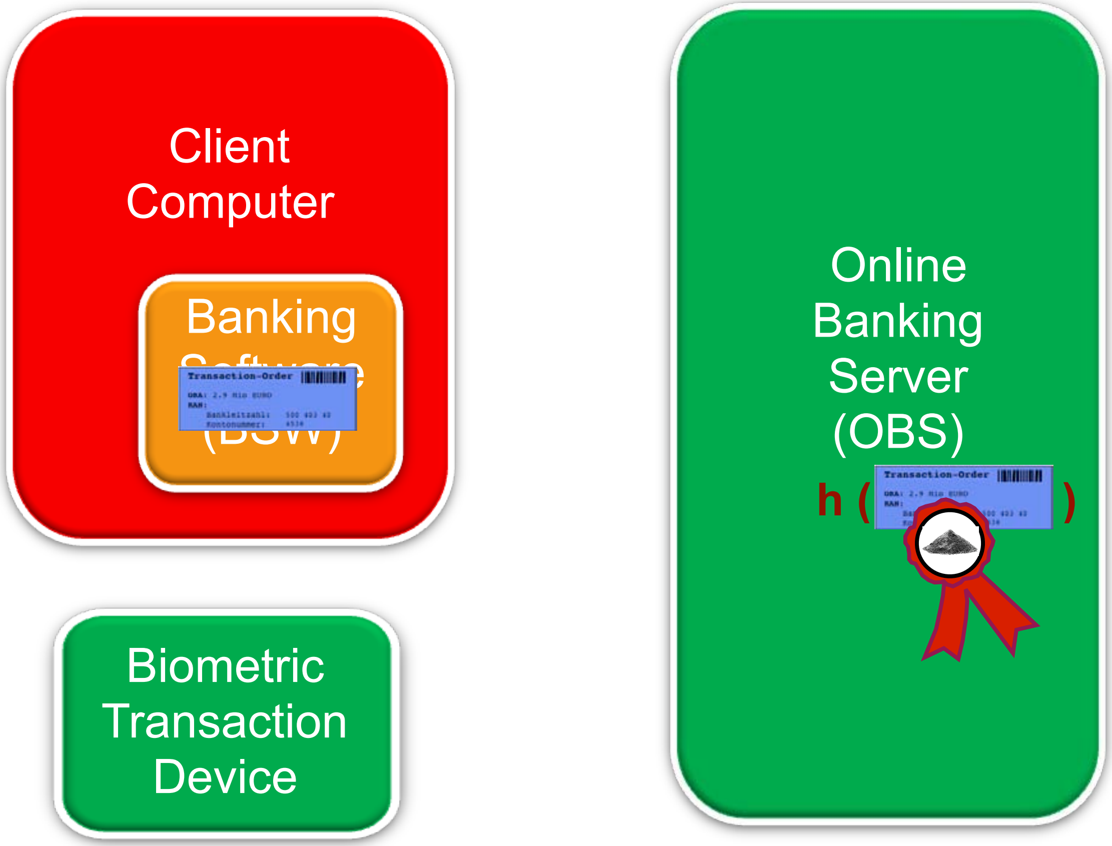

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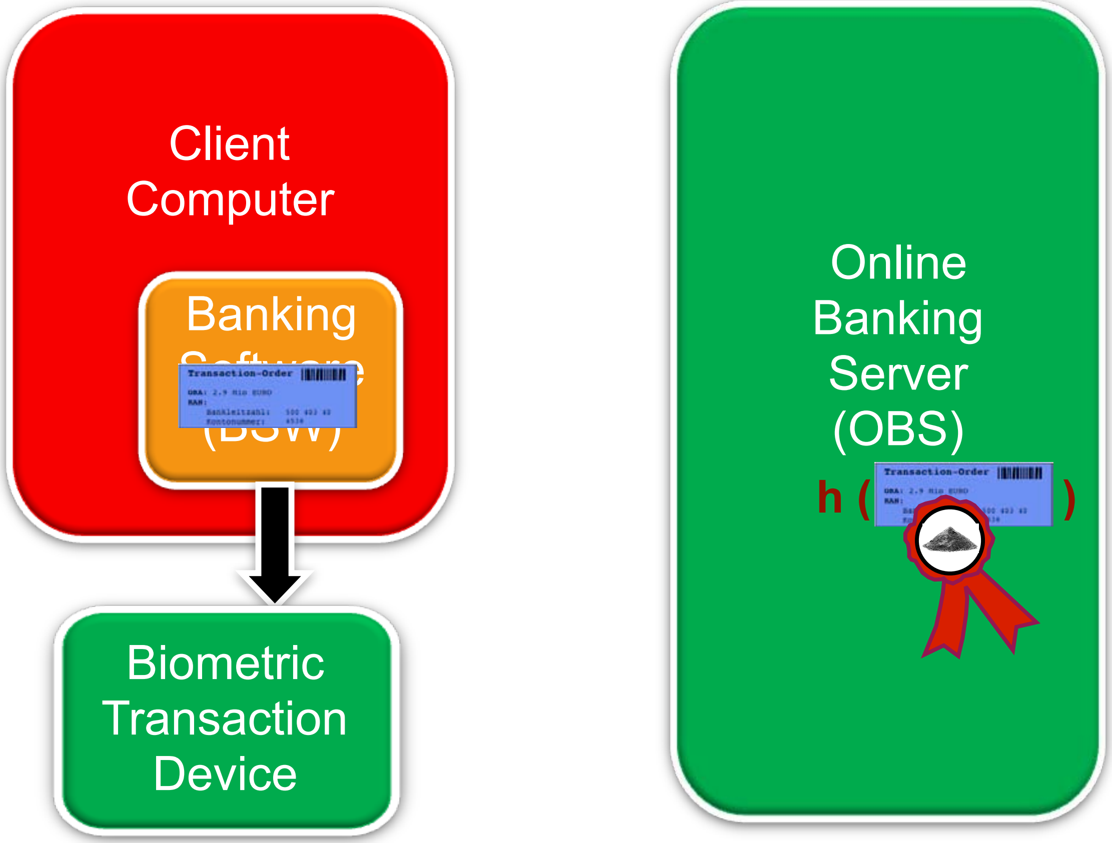

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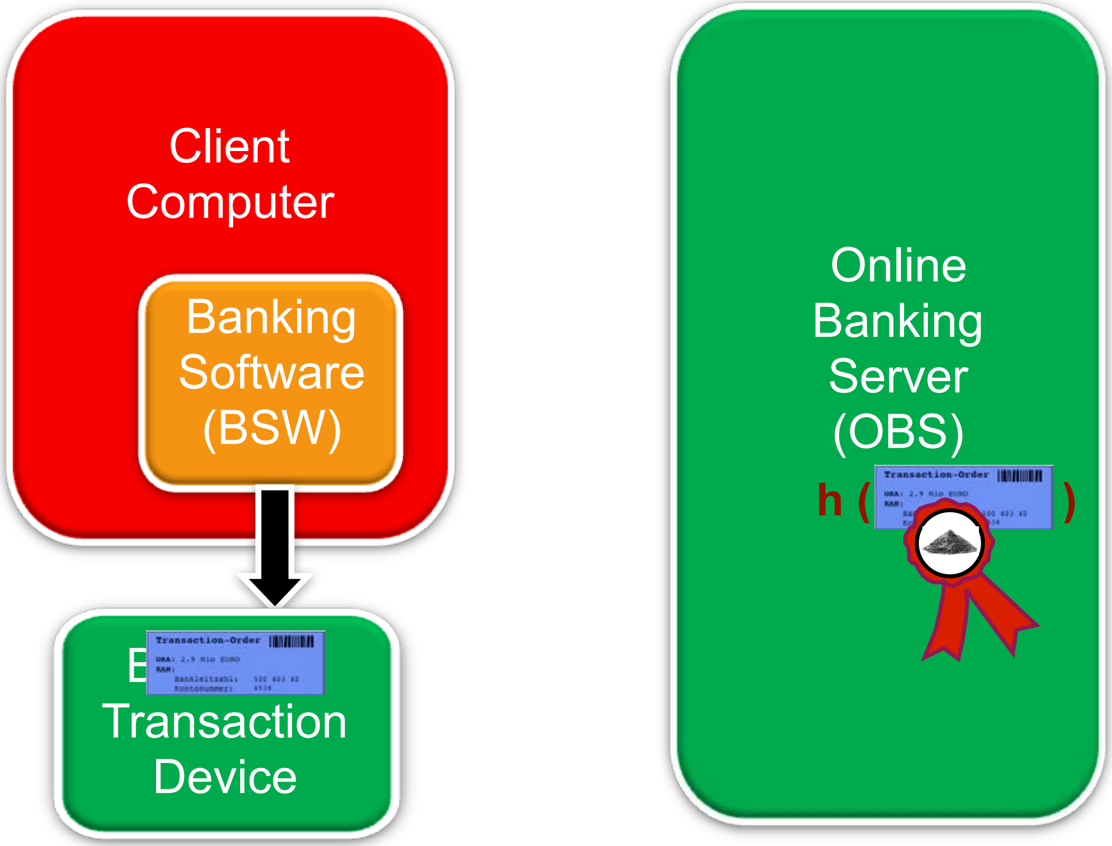

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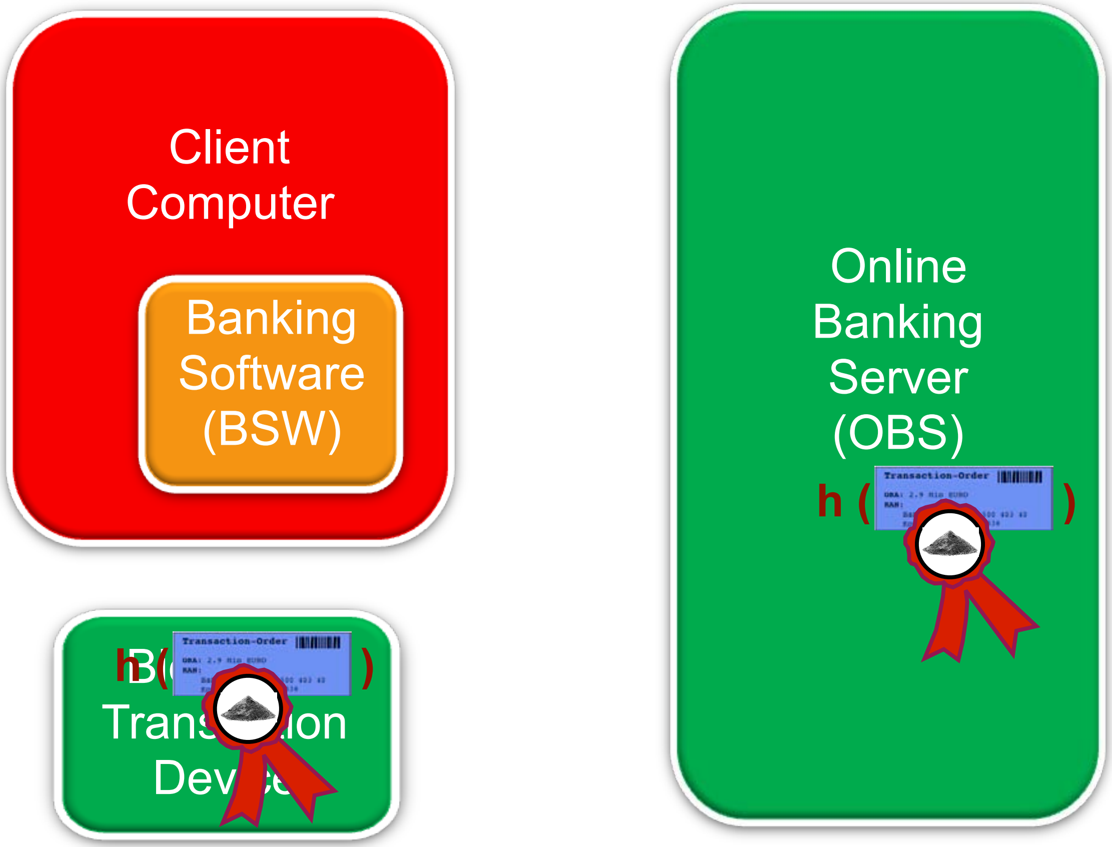
Elements in the Online-Banking-Scenario:



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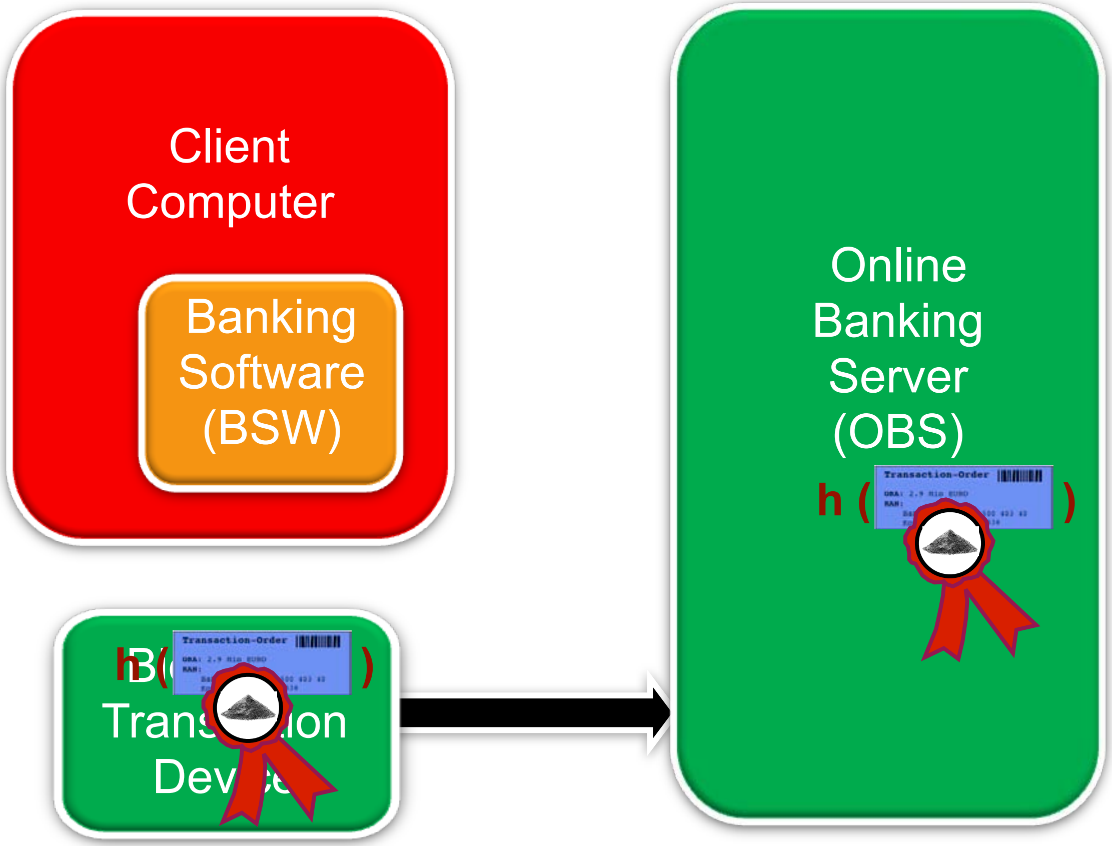

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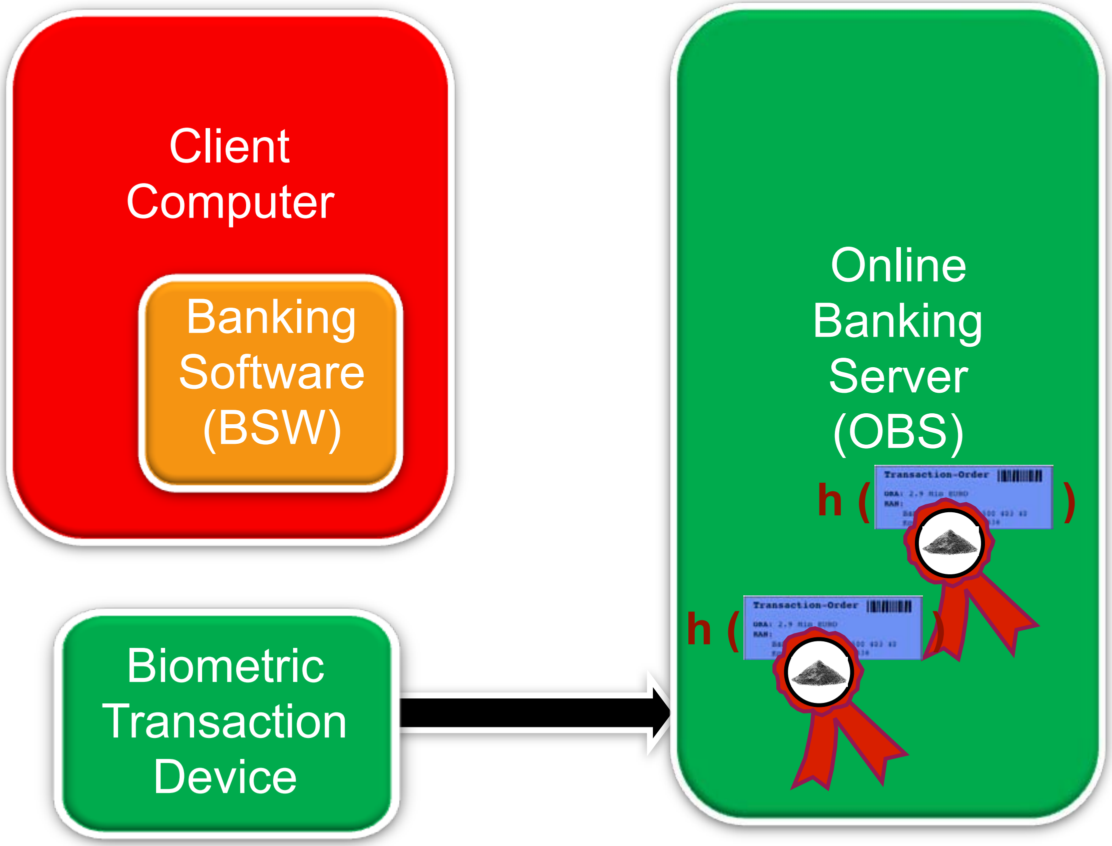

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Online-Banking-Scenario

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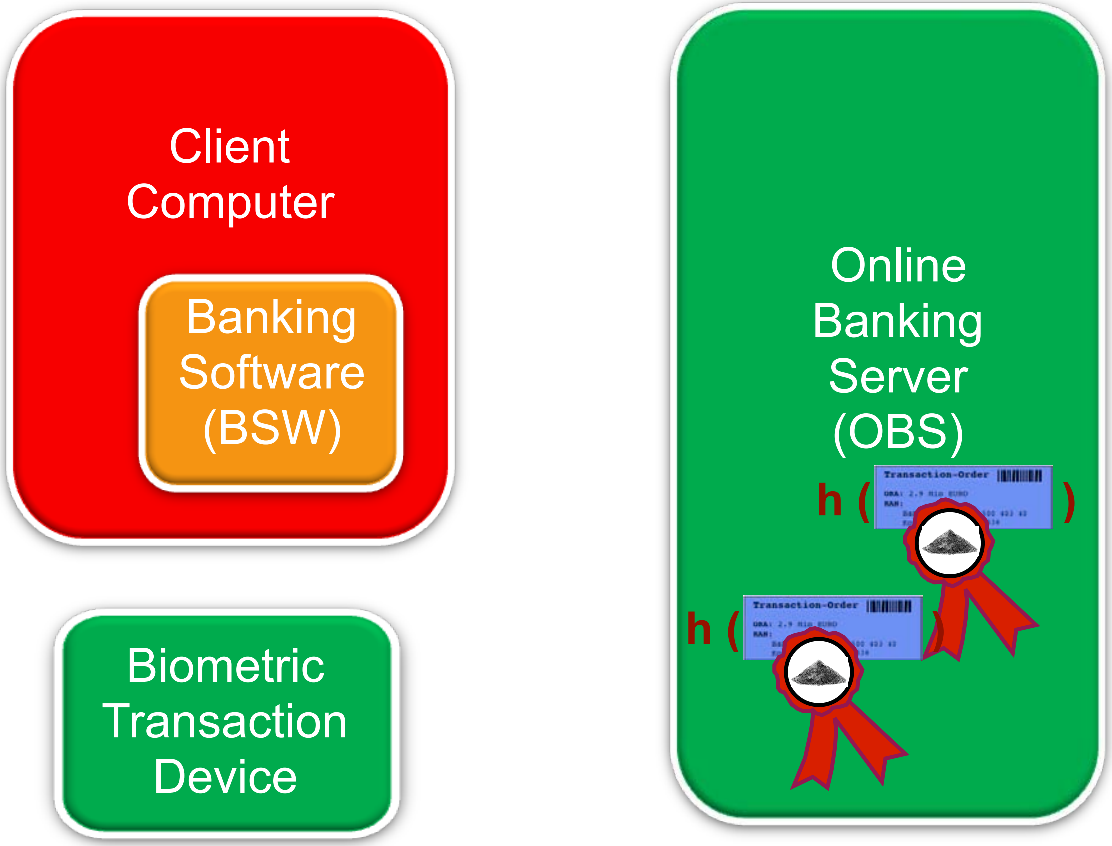
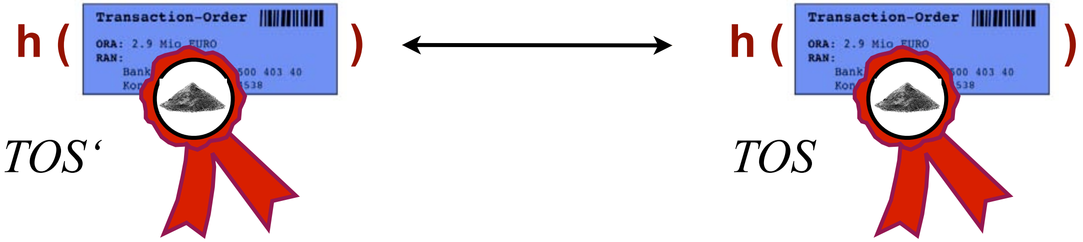


Transaction-Verification

BTAP - Transaction

3.) Operations of the Online-Banking-Server (OBS)

- Compares his own reconstruction of TOS with the delivered TOS ‘ from the BTD‘:
  TOS == TOS‘

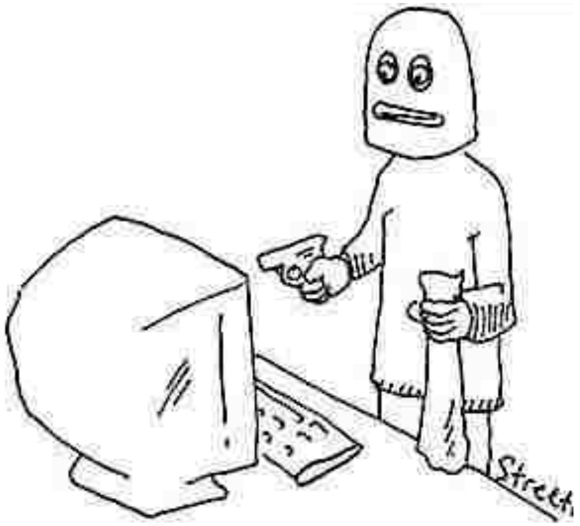


- The transaction is person- and data-authentic, if TOS and TOS‘ are identical.

Summary

The proposed data privacy friendly Biometric-Transaction-Authentication-Protocol provides

- a data-authentication and at the same time a person-authentication.
  - Thus a strong link between the customer and the relevant information is established
  - The bank can verify that a (authorized) natural person (individual) i approved the transaction.



Online banking

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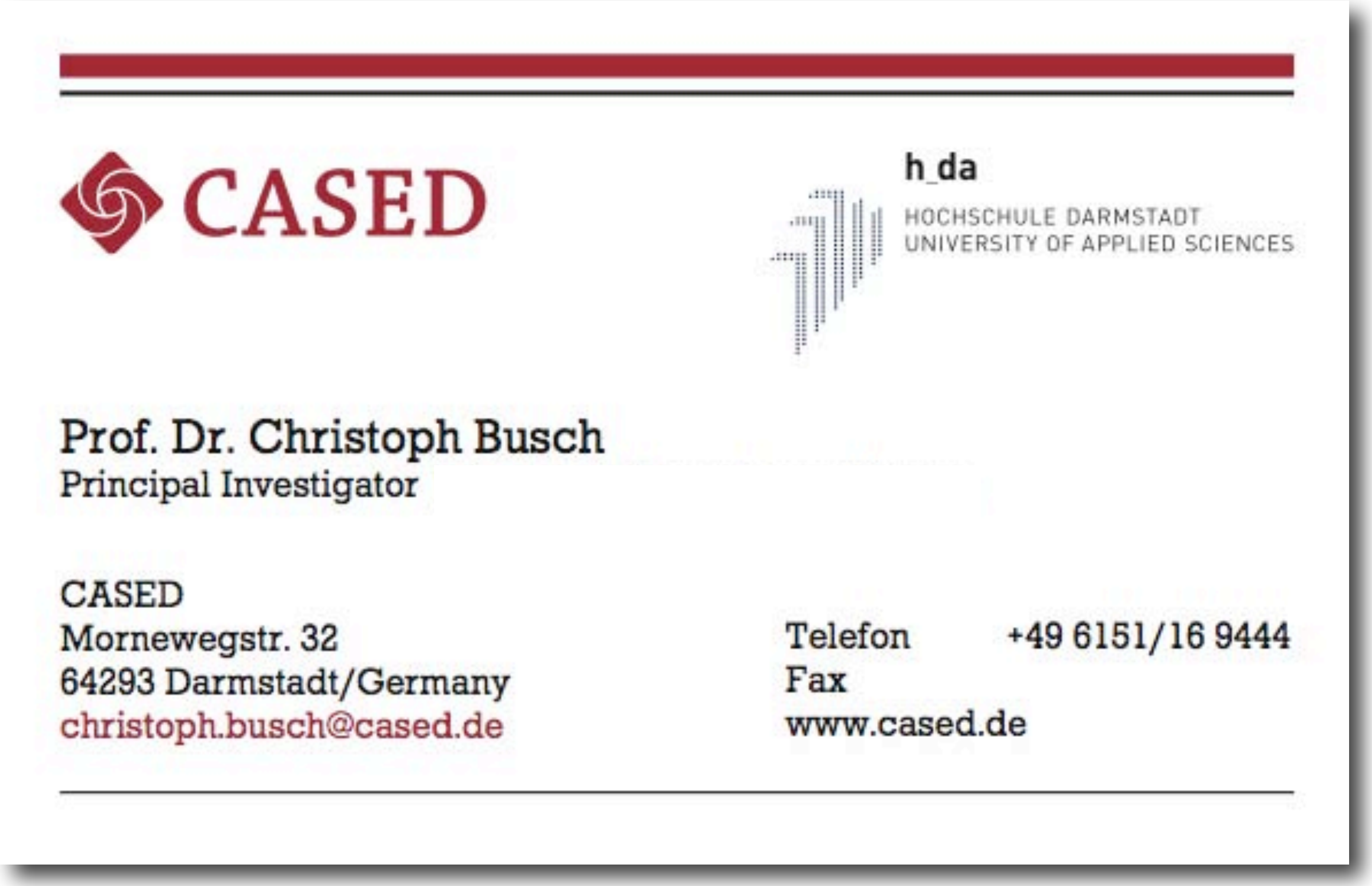
... but one should always have
an additional arrow in the quiver

Contact



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UNIVERSITY OF APPLIED SCIENCES

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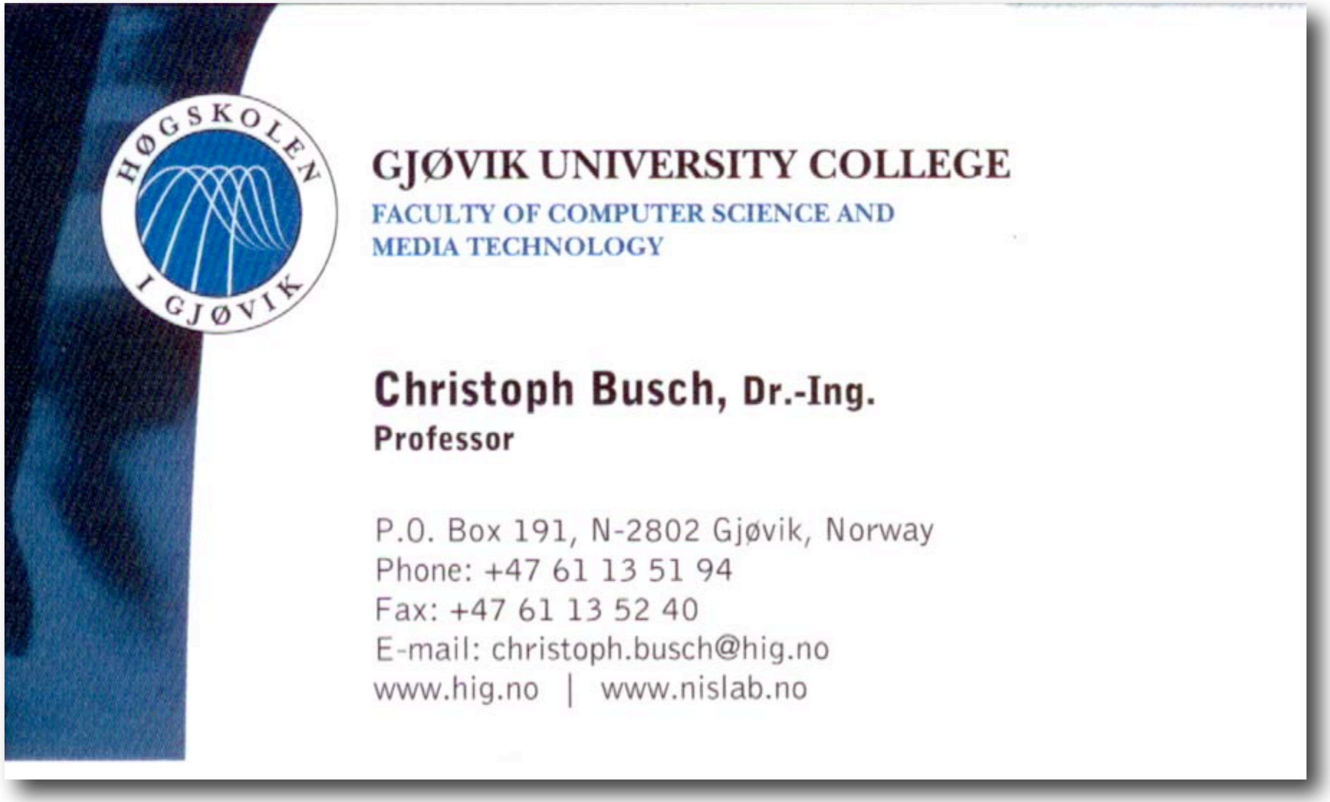
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