Authentic Data Collection in an Untrustworthy Computer Environment

Thomas J. Wilke <tjw@prz.tu-berlin.de>

12 June 2002

This talk is not about

- Cryptographic algorithm analysis
- Secure communication methods or protocols
- Public key infrastructures implementation or operation
- Smart card programming or management

The talk wants to

- motivate why a secure data collection is needed.
- give an idea about the problem of insecure data collection and solution available today addressing the problem.
- present a method how the data collection process can be protected in an trustworthy manner.
- show how this method can be implemented and applied in practice.
- give an outlook for future applications which will base on a secure data collection process.

Contents

- The process of digital signing
- The problem of authentic data collection
- Practical solution: Authentic Data collection Device
- Outlook and future work: E-contracting services
- References and contact

Digital Signing

Digital signing is one of the most demanding applications for trustworthy data collection since:

- it provides a technical base to make binding declarations associated with real monetary or legal values which have exclusive electronic representation.
- some governments have put handwritten signatures par digital signatures.
- it is one key component to establish an e-commerce and e-government completely processed on computer systems.

Digital Signing

Trustworthiness of digital signatures can only be guaranteed if the following conditions can be fulfilled:

- the secret key should only be accessible to the person it has been dedicated to since its represents its digital identity
- the public key distribution has to be trustworthy
- the cryptography used should be adequate to the common security standards
- the process of generating digital signatures has to be done in a trustworthy environment
- the signature verification has to take place in a trustworthy environment

The problem of authentic data collection

To ensure a trustworthy signing process on an insecure desktop computer system the following operation sequence will have to be protected:

- data collection from a trustable device and transfer to a temporary storage
- temporary storage of the collected data
- hash calculation
- public key encryption of the hash value

The problem of authentic data collection

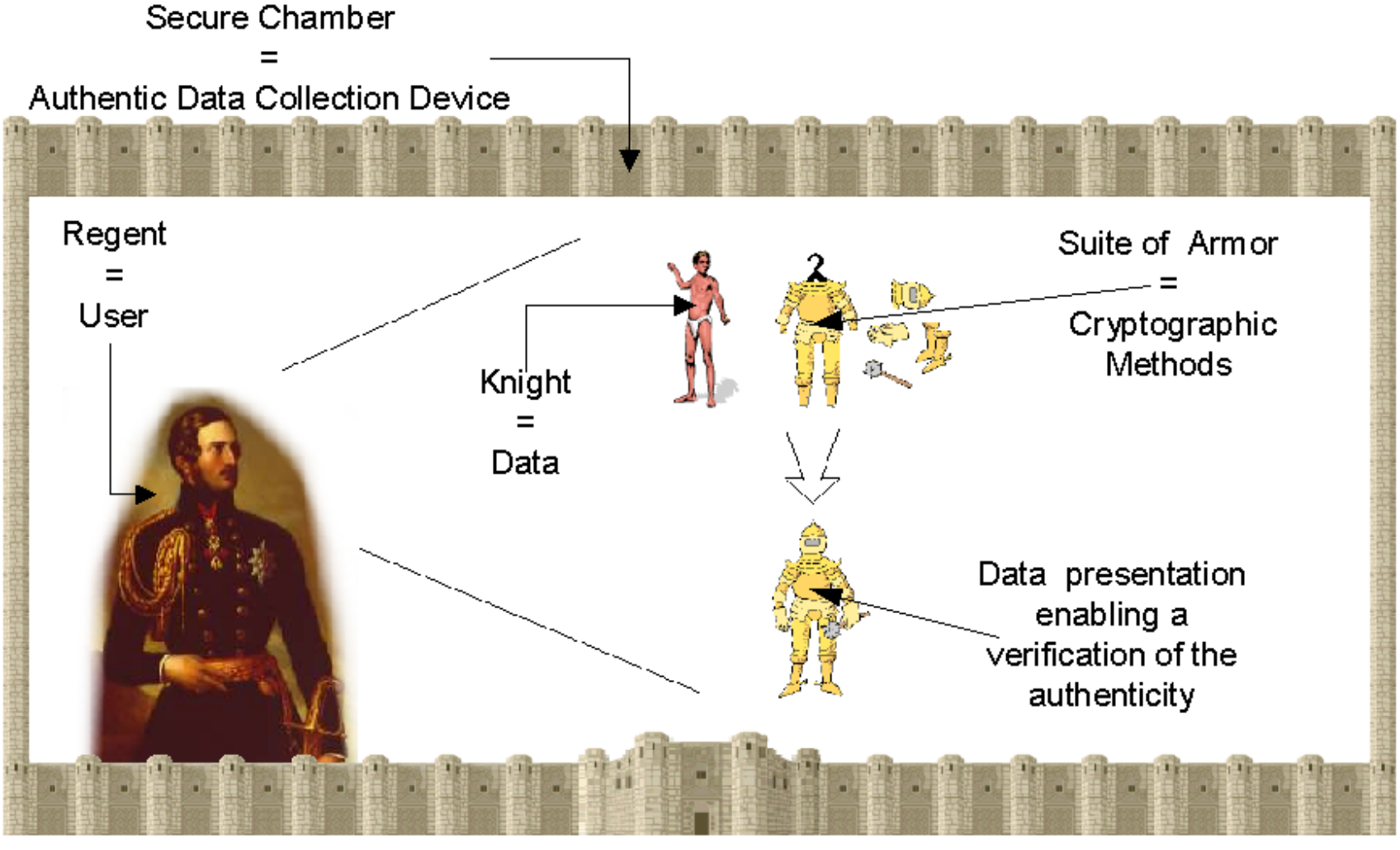
Digital signing is a special case of authentic data collection. A more general way to guarantee a trustable data collection is:

- get the data to be collected from a source
- check the correctness of the collected data
- transform the collected data into a representation that can be proved to be authentic

The whole operation sequence has to take place in a trustable environment (“Trusted Point”).

The problem of authentic data collection

Analogy to the method ensuring an authentic data collection process.



Authentic Data Collection Device

Common keyboard extended with the following additional units:

- Card reader
- Crypto unit
- Radio controlled clock and GPS receiver
- Video unit to fade in a data display over the regular video signal of the computer
- RS232 interface

Mobile Authentic Data Collection Device

Design issues of the Mobile Authentic Data Collection Device:

- same basic feature as the ADD
- high flexibility in interoperation with different kind of devices
- intuitive and easy to use Man Machine Interface
- providing a trustworthiness environment for different applications
- functional networked services (e-payment, contract supervision)
- approved and standardized hardware based to be used as mobile device
- memory card interface
- optionally: advanced person identification mechanism

Mobile Authentic Data Collection Device

Hardware base is a PDA driven by linux that

- can exchange data with external devices via a bluetooth-, infrared-, keyboard-, serial- and USB-interface.
- can interoperate with man via an LCD-display, microphone, speaker, writing with an stylus an the display or an external connected device (e.g. keyboard)

Mobile Authentic Data Collection Device

Hardware and functional extensions of the Linux PDA are:

- an integrated smart card reader
- integrated radio driven clock and GPS receiver
- optional integrated biometric sensors
- only data with a authentic provable data representation can leave the MADD via any device interface.
- executable code cannot be loaded on the PDA by a user
- verification mechanism to check whether authentic hard- and software function is given or not
- case is protected to detect any mechanical manipulations

Outlook and future work: E-contracting services

1. step: is done by establishing the usage of certificates, smart-cards and authentic data collection!
2. step: processes have to be defined which ensure that e-contracts can be handled like old fashioned ones in respect of law. Therefore secure processes are needed to archive the contracts to be applicable in a legal case.
3. step: these services have to be established to be available for everyone and for every kind of legal declarations.

Contact and References

Contact: tjw@prz.tu-berlin.de,
http://www.prz.tu-berlin.de/~tjw/

References:

- Thomas J. Wilke, *Verfahren und Vorrichtung zur Erfassung von Daten und deren Übermittlung in authentischer Form*, Offenlegungsschrift DE 197 03 970 A1, Jun. 1998, Deutsches Patentamt
- Thomas J. Wilke, *Konzeption zur authentischen vertraulichen Kommunikation über offene Rechnernetze*, TU-Karlsruhe, Sep. 1997
- Thomas J. Wilke, *Konzeption eines modularen und vernetzten Zugangskontrollsystem auf Basis der Produktfamilie SIPORT*, Diplomarbeit, TU-Karlsruhe, Jun. 1996