GP webpay - Private Key Management and signing messages

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1.3	25.11.2019	GPE Application Development	New version of the GP webpay Kestore Manager Examples update

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1. Formula clause

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2. Introduction

This document describes principle of creating payments in the GP webpay payment gateway environment and authorization of subsequent operations with payments.

2.1 General GP webpay security principle

In order to secure itself, the GP webpay system uses the so-called PKI (Public Key Infrastructure) model. This model uses asymmetric cryptography, using two different keys.

1. Private key – this part is secret and is owned only by the authorized person (i.e. key owner)
2. Public key – the public part that can be distributed any channel (even the unsecured) – e-mail, public repository of keys …

A main characteristic of the private key is that no two keys in the world are identical – i.e. each and every key is original.

2.1.1 How to obtain the private key

- Public certification authority – a trusted commercial authority providing management of keys (i.e. issuance, revocation, renewal…). Its public key is located directly in web browsers, or in various run-times (run-time environment for other software – e.g. Java, .NET…). Keys issued by this authority are widely accepted as credible and are used for communication with banks and public institutions – e.g. Thawte (https://www.thawte.com/), První certifikační autorita a.s. (http://www.ica.cz/).
- Various general solutions – private keys are not generally accepted, nevertheless they are built on trust between a client and specific key provider – e.g. Komerční banka has its own certification authority and provides its clients with keys to enable their communication with internet banking.
- GP webpay enables its clients to obtain a private key via the web portal. This key can be used only in the GP webpay environment.

2.1.2 PKI functions

- access authentication (user's identity verification)
- messages integrity verification (message has not been altered in any way)
- undeniableness – using electronic signature
- privacy – messages encryption, symmetric and asymmetric encryption

GP webpay uses only two of the above mentioned functions – integrity verification and undeniableness.

2.2 Using PKI in GP webpay

2.2.1 Ways of use

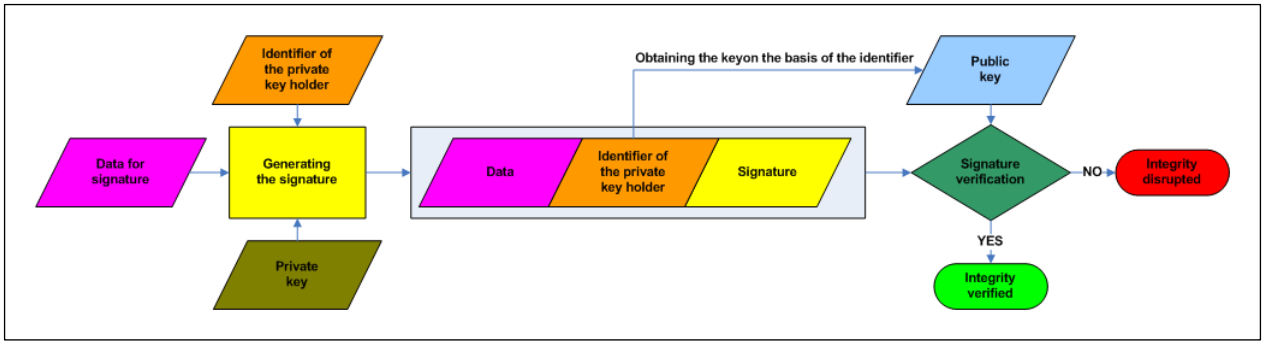
The private key is used for generating a signature of all the messages enabling manipulation with payments. A verified signature guarantees integrity of transmitted data and correct identity (undeniableness of identity) of a message sender – there is no possibility to create a signature using the public part of key.

Types of messages:

- Creating new payments by means of standard HTTP interface
- Payments management in the Portal – money capture/refund of a card holder
- Payments management by means of web-services – used at direct connection of the GP webpay system with merchant's payment system

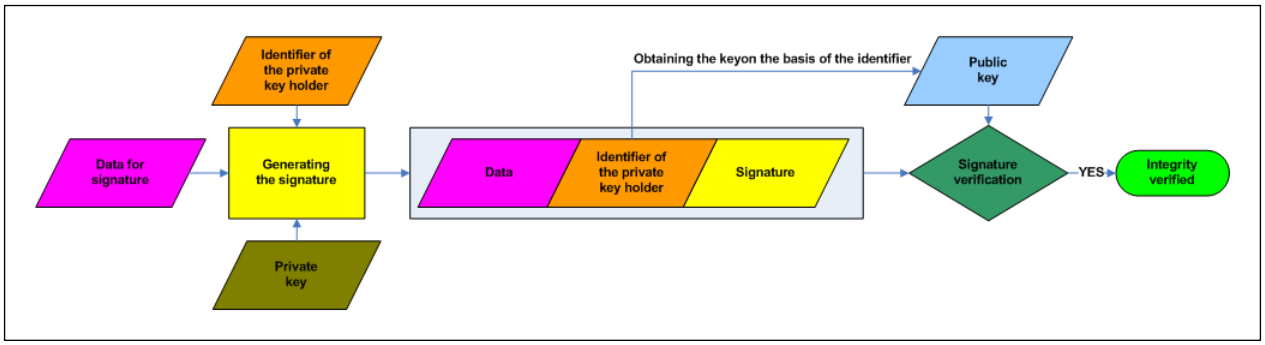
2.2.2 Message integrity verification

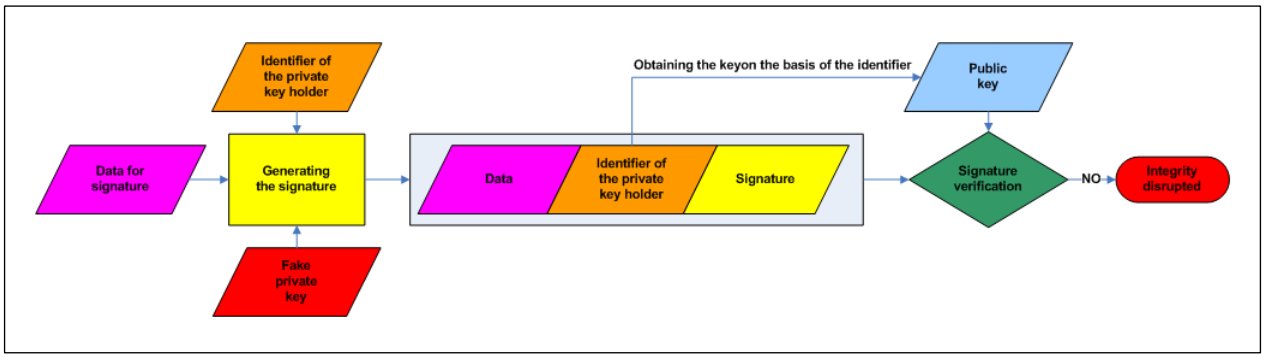
Every message modifying data (whether it is creating payments or operations with payments) contains not only data, but also a signature box. Signature is created on the side of the private key owner on the basis of input data and the private key with the use of a general algorithm for signature calculation. After the data are sent to the server, it carries out verification a similar way, but using relevant public key (public key is searched out on the basis of identifier of the message sender; the identifier is sent in a message). If the calculation differs, there must have occurred data disruption in the course of their transmission.



2.2.3 Message sender identity verification

A part of transmitted data is also an identifier of the message sender. On the basis of this identifier, the relevant public key is selected on the server side. If it was possible to verify the signature and provided that there are no two identical private keys, it can be stated that the data had really been sent by the private key holder.


Identifier of the private key holder
Data for signature
Generating the signature
Private key
Obtaining the keyon the basis of the identifier
Public key
Data
Identifier of the private key holder
Signature
Signature verification
YES
Integrity verified


Identifier of the private key holder
Data for signature
Generating the signature
Fake private key
Obtaining the keyon the basis of the identifier
Public key
Data
Identifier of the private key holder
Signature
Signature verification
NO
Integrity disrupted

3. Private key and its management

3.1 Private key in general

Private key is the basis of security of the GP webpay system. This key is solely owned by the key holder and it is necessary to observe maximally all the security requirements for confidentiality:

- Keep it in a secure place
- Always have it protected by password
- If the key is compromised, it is necessary to obtain a new key and to inform all the subjects using its public part for identity verification that the key has been compromised

Private key is stored in a data file. This file is called a repository, or keystore. Keystore can contain more private and public keys. To be able to differentiate among the keys in the keystore, there are names assigned to them – the so-called aliases. The keystore is protected by the central password and besides that, every private key is protected by its own password.

There are several formats of keystores. For our purposes, the following ones are sufficient (the below described conversion application supports precisely these formats):

JCEKS – keystore in the format supported by JAVA programming language

PFX – keystore in the format supported by Microsoft corporation (PKCS12)

PEM – keystore in the format supported by PHP programming language

The formats for distribution of the public key relate to these types as well:

PEM – keystore in the text format

DER – keystore in the binary format

3.2 How to obtain the private key

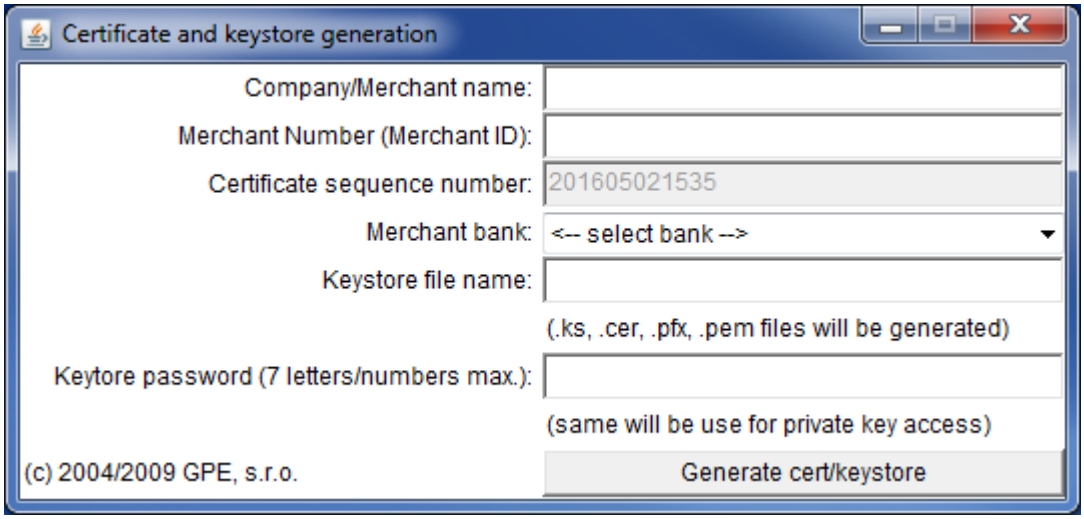
As mentioned above, private key can be obtained in a few different ways. For commercial purposes, or for communication with public administration, it is necessary to obtain a key from a trusted certification authority.

For the purposes of operating the GP webpay system, it is sufficient to obtain it by means available in the GP webpay.

If you have already bought any private key (there are several commercial certification authorities issuing/selling private keys), it can be used as well.

3.2.1 History

From the very beginning of functioning of the GP webpay, there has been a possibility to get the private key by means of individually delivered application “Key and certificate generation”. This application has been downloadable from the user environment GP webpay GUI and also as a part of distribution package of the documentation.



The following files are the result of generation:

`<name>.ks` – keystore file in the Java format – contains both the private and the public key

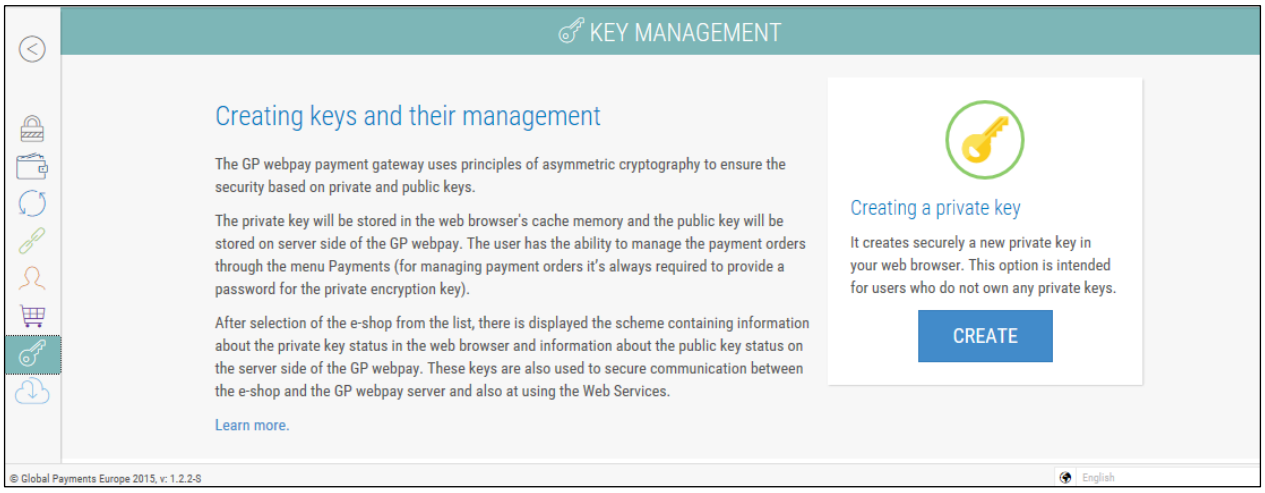
`<name>.pfx` – keystore file in the PKCS#12 format – contains both the private and the public key

`<name>.pem` – keystore file in the PEM format – contains both the private and the public key – e.g. for PHP apps

`<name>.cer` – file containing the public key

3.2.2 The present

The GP webpay Portal, the new graphic interface for management of orders, has incorporated management of both private and public keys of individual e-shops. Its part is also the possibility to generate the private key by means of the web browser.



The result of generation is the file "`gpwebpay-pvk.key`" in text format PEM.

This key can be inserted into the web browser (by import in the Portal).

At the same time it has to be preserved for future use – e.g. in another web browser.

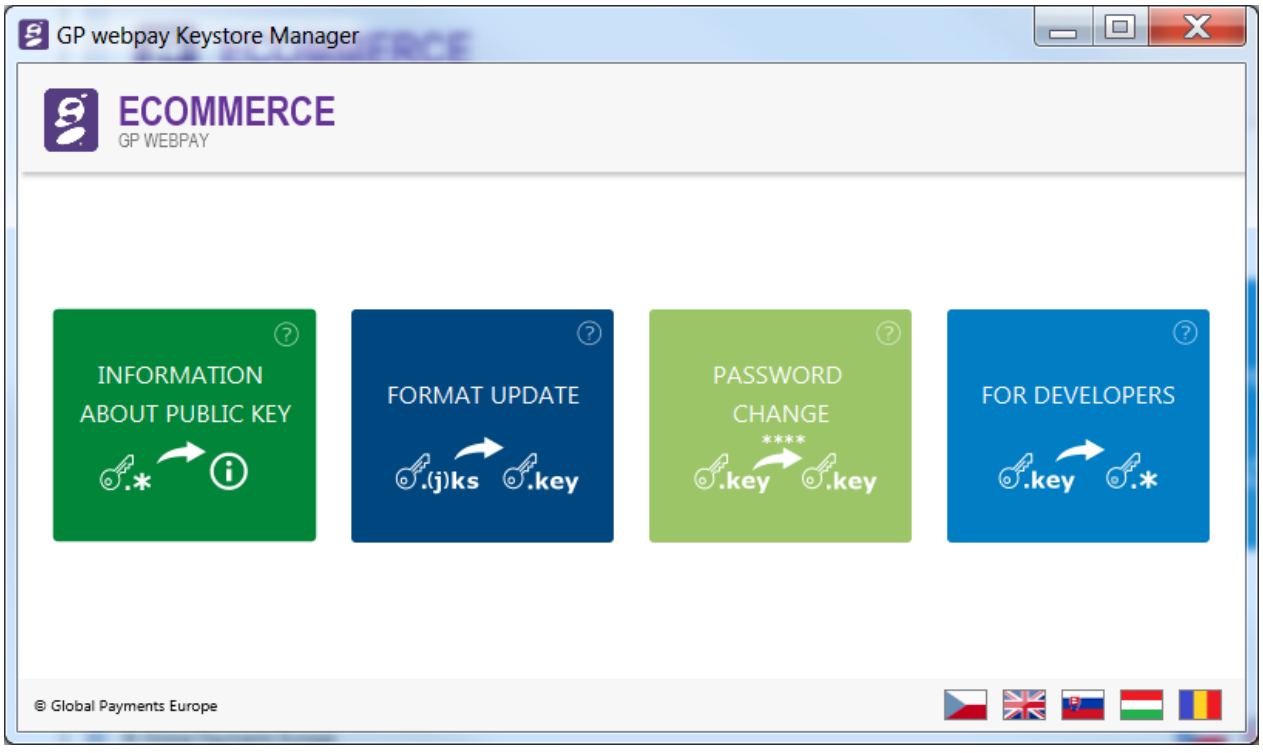
3.3 The private key management

To be able to operate with payments in the web application GP webpay Portal (hereinafter referred as the Portal), it is necessary to upload the private key to the web browser. This upload can be carried out after a successful login, directly in the environment of the Portal. The private key has to be stored in the text format PEM; this format is created also during key generation in the Portal (file "`gpwebpay-pvk.key`").

In case you have the private key from earlier, it is necessary to update the original format to the new one. The GP webpay Keystore Manager application can be used for this purpose. Application is available in the "Downloads" menu of the Portal and for its operation it requires to have the installed Java (downloadable from Oracle website http://www.java.com).

GP webpay Keystore Manager application has these functionalities:

- Public key information – the key "fingerprint" – it can be compared with the value in the GP webpay Portal
- Format update – format conversion of the initial file containing the private key
- Password change – changing the private key password in the new format
- For developers – automatic conversion of the private key in the new format into formats supported by various developer tools



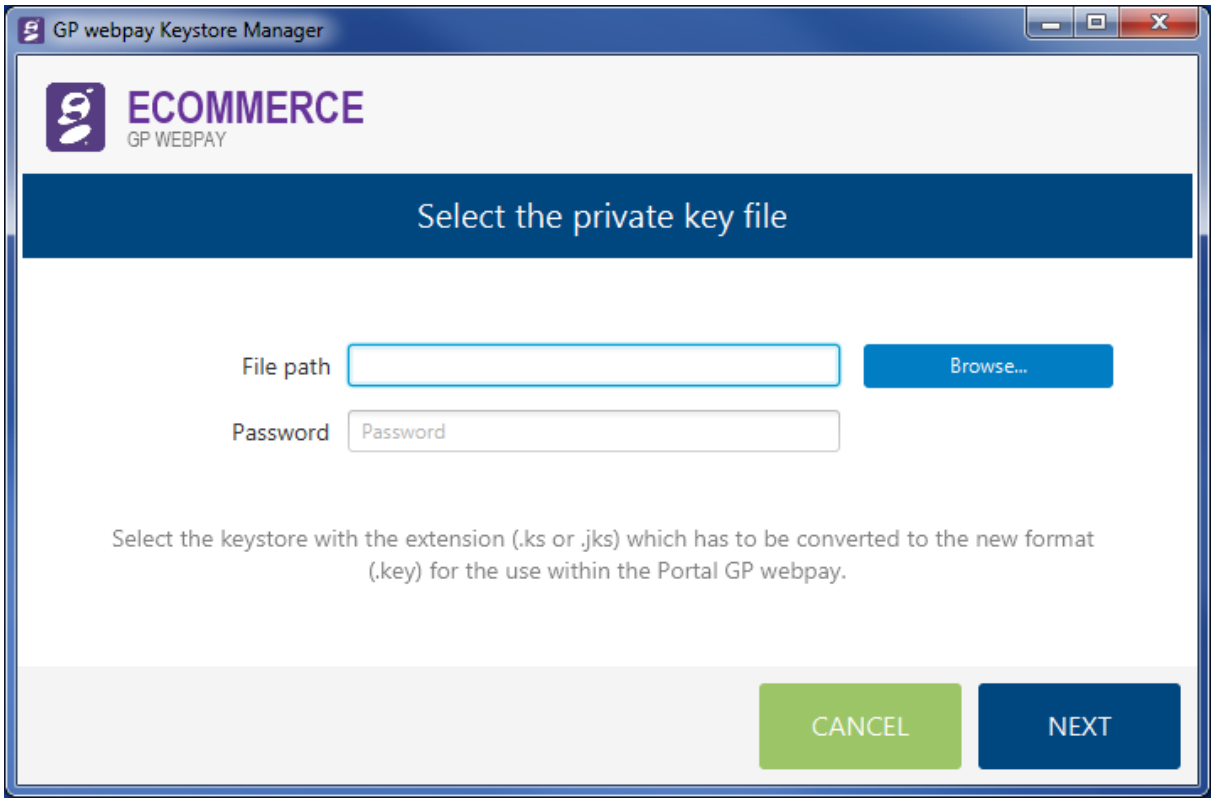
Hover your mouse over a "tile" to display a brief description of functionality:

The application supports a few language versions. To switch among them, use the flag icons in the bottom part of the screen.

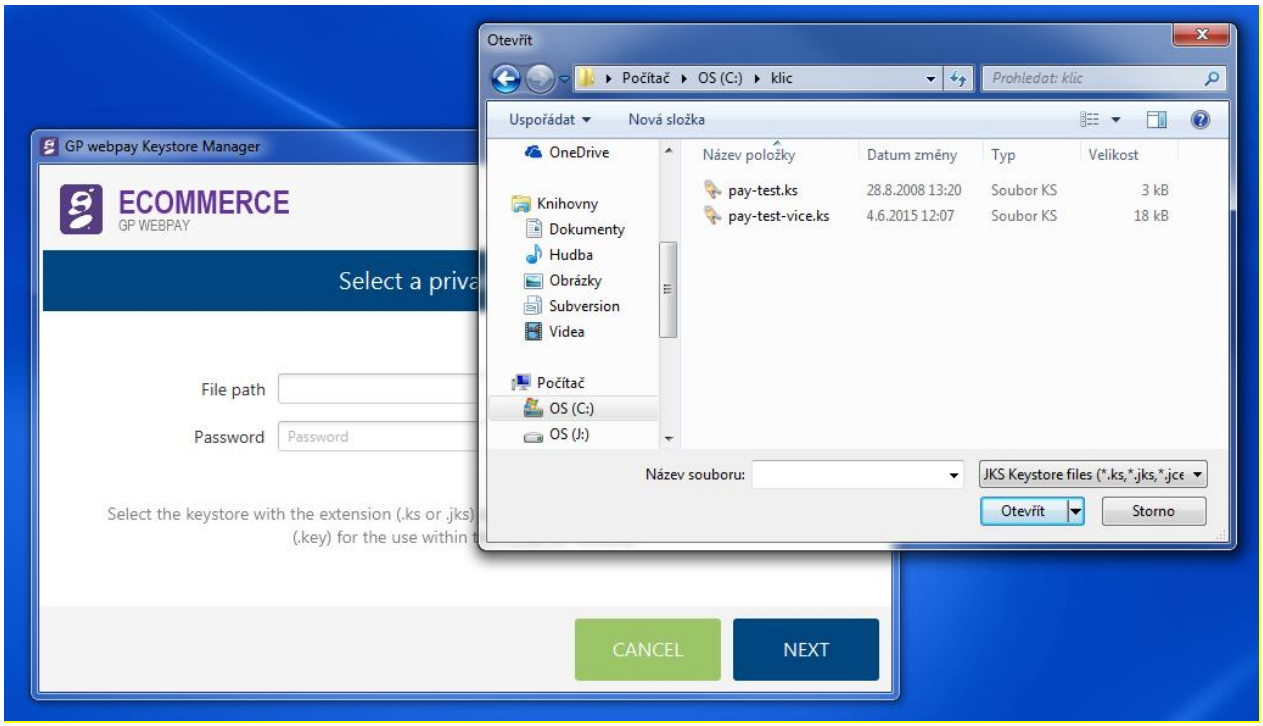
3.3.1 Public key information

“Tile” is designed to show the “fingerprint” of the public key. The “Fingerprint” can be compared with value in GP webpay Portal to be sure that the key in keystore is the same as the key stored GP webpay server.

By clicking the “INFORMATION ABOUT PUBLIC KEY” tile, there is displayed a window to select the file containing the private key:



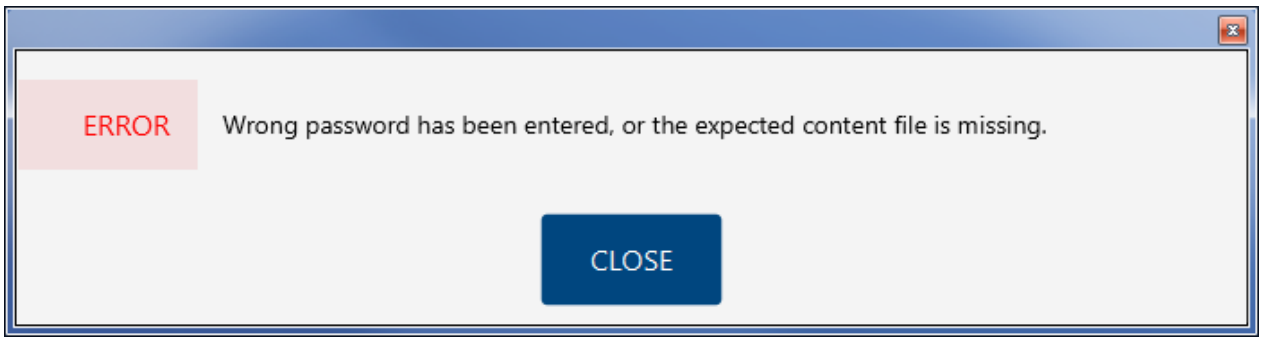
In the input box “File path”, it is necessary to find the file containing the original key by scrolling through the directory structure.



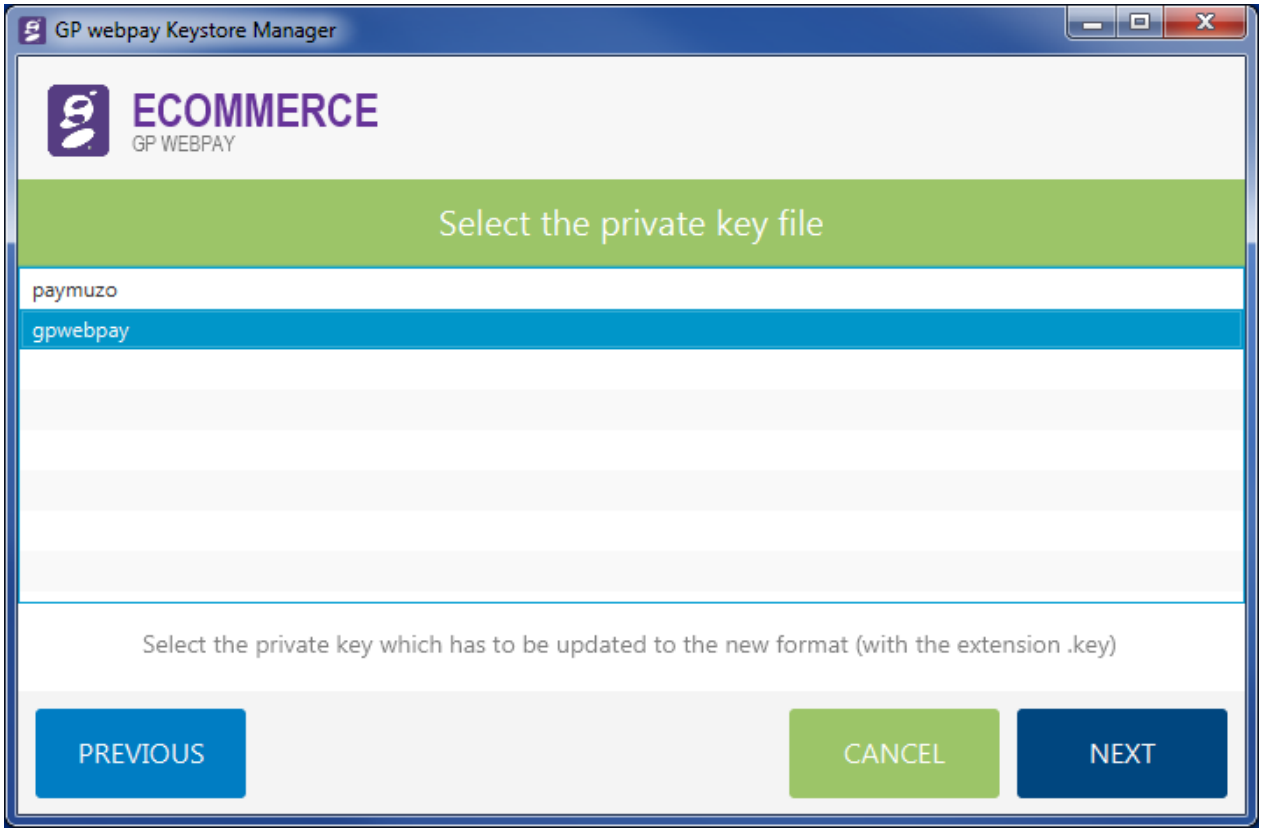
Confirm your selection of the private key file by clicking the “Open” button.

The selection window closes and the application waits for the password to the keystore and for pressing the “Next” button. There follows an attempt to retrieve the file content.

If the wrong password is entered, or if the file does not contain the private key, the following message is displayed:

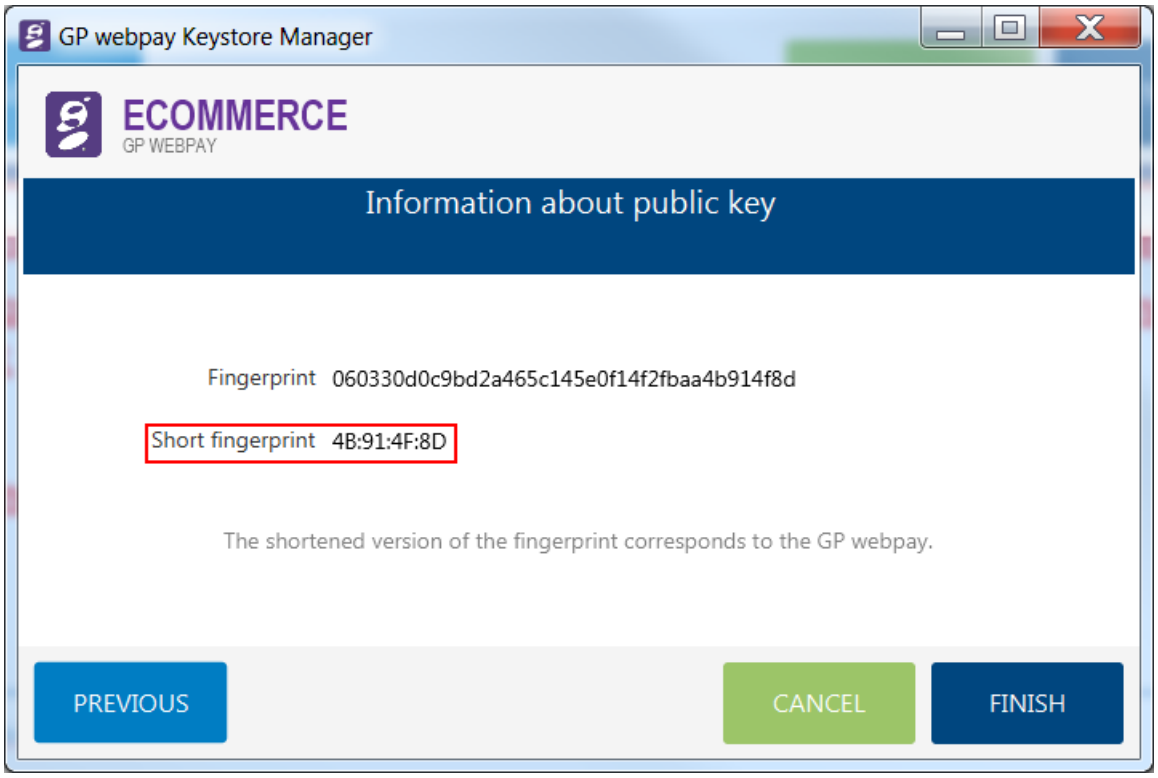


In case that the keystore file contains more private keys, the list of keys is displayed and it is necessary to select the right private key:

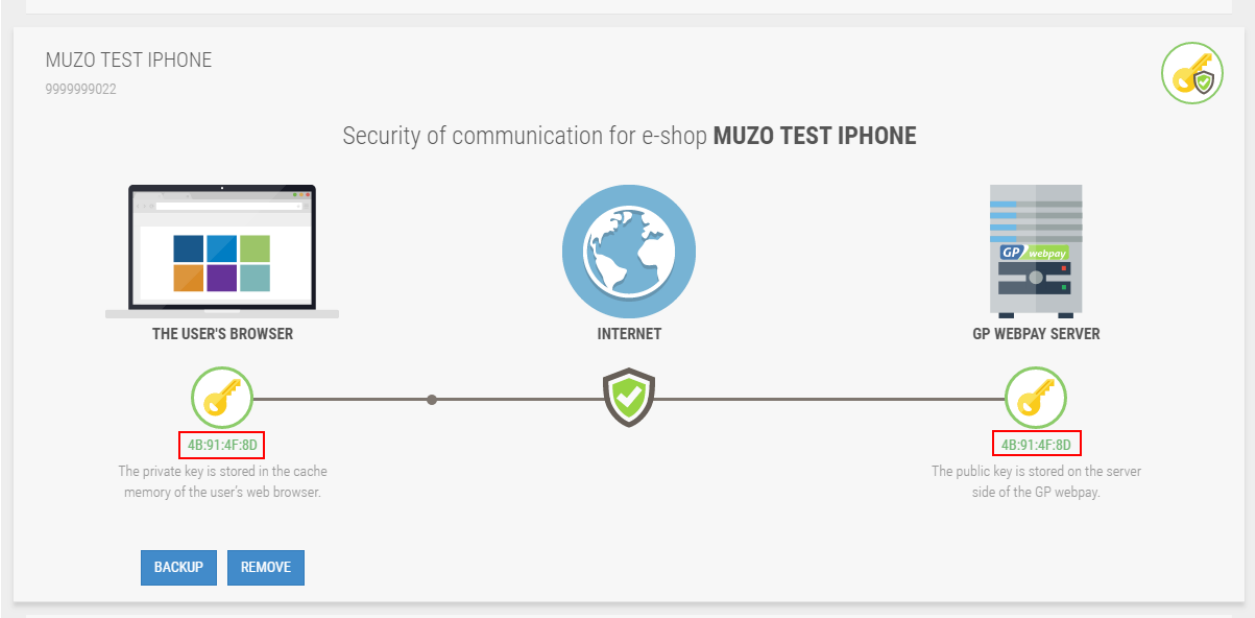


and continue by clicking the “Next” button“. If there is only one private key, this screen is skipped.

After the correctness of the input file is verified, or key selection is confirmed, the “fingerprints” are displayed:



Displayed value should be the same as the value in GP webpay Portal:

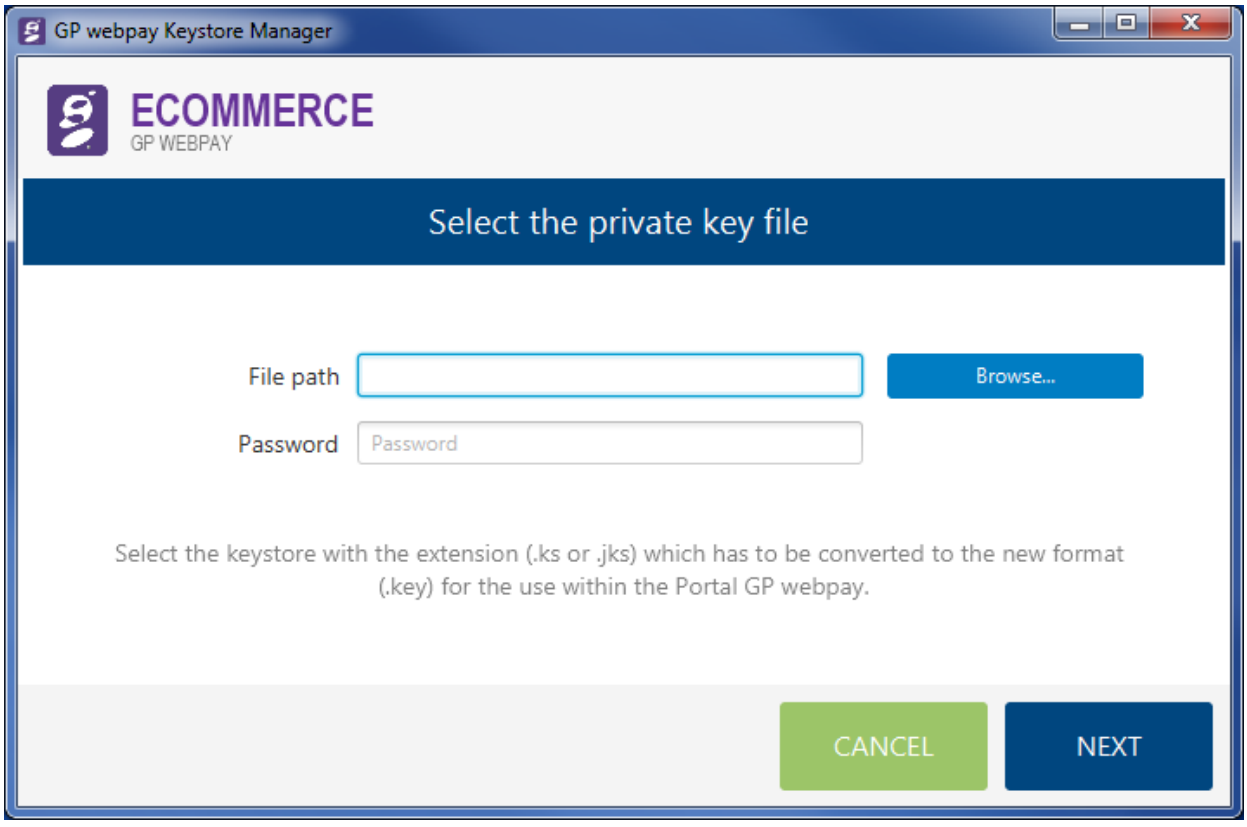


By pressing the “Finish” button, the application returns to the initial screen.

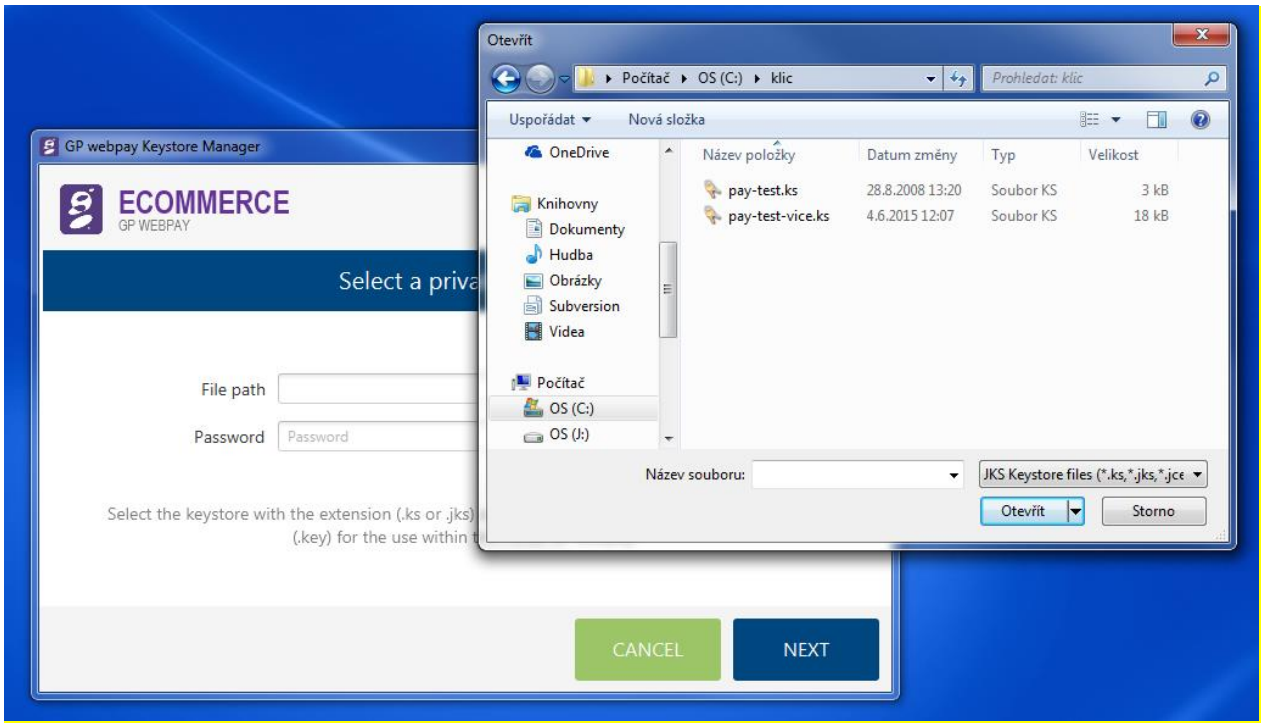
3.3.2 Format update

This “tile” serves for the format update of the initial private key, which was used in the old GUI for merchants. The original format is in the JAVA structure and has – in most cases – file name extension “.ks”, “.jks” or “.jceks”. The new format is in the PEM structure and the private key is stored in the file “gpwebpay-pvk.key”.

By clicking the “FORMAT UPDATE” tile, there is displayed a window to select the file containing the private key in the old format:



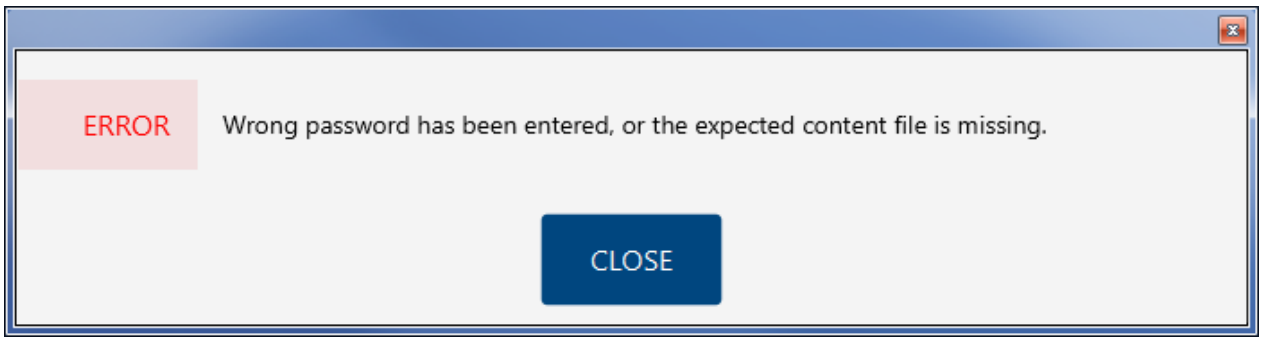
In the input box “File path”, it is necessary to find the file containing the original key by scrolling through the directory structure.



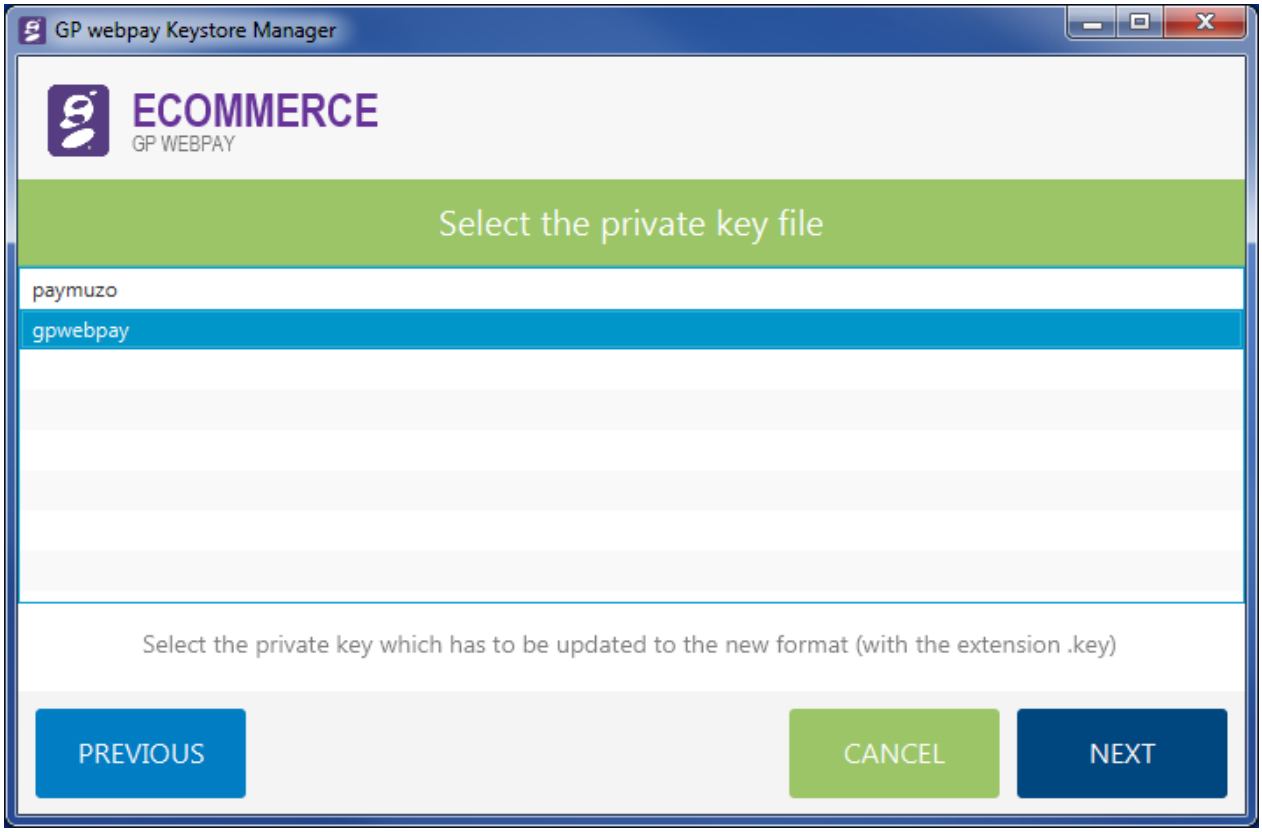
Confirm your selection of the private key file by clicking the “Open” button.

The selection window closes and the application waits for the password to the original keystore and for pressing the “Next” button. There follows an attempt to retrieve the file content.

If the wrong password is entered, or if the file does not contain the private key, the following message is displayed:



In case that the keystore file contains more private keys, the list of keys is displayed and it is necessary to select the right private key:

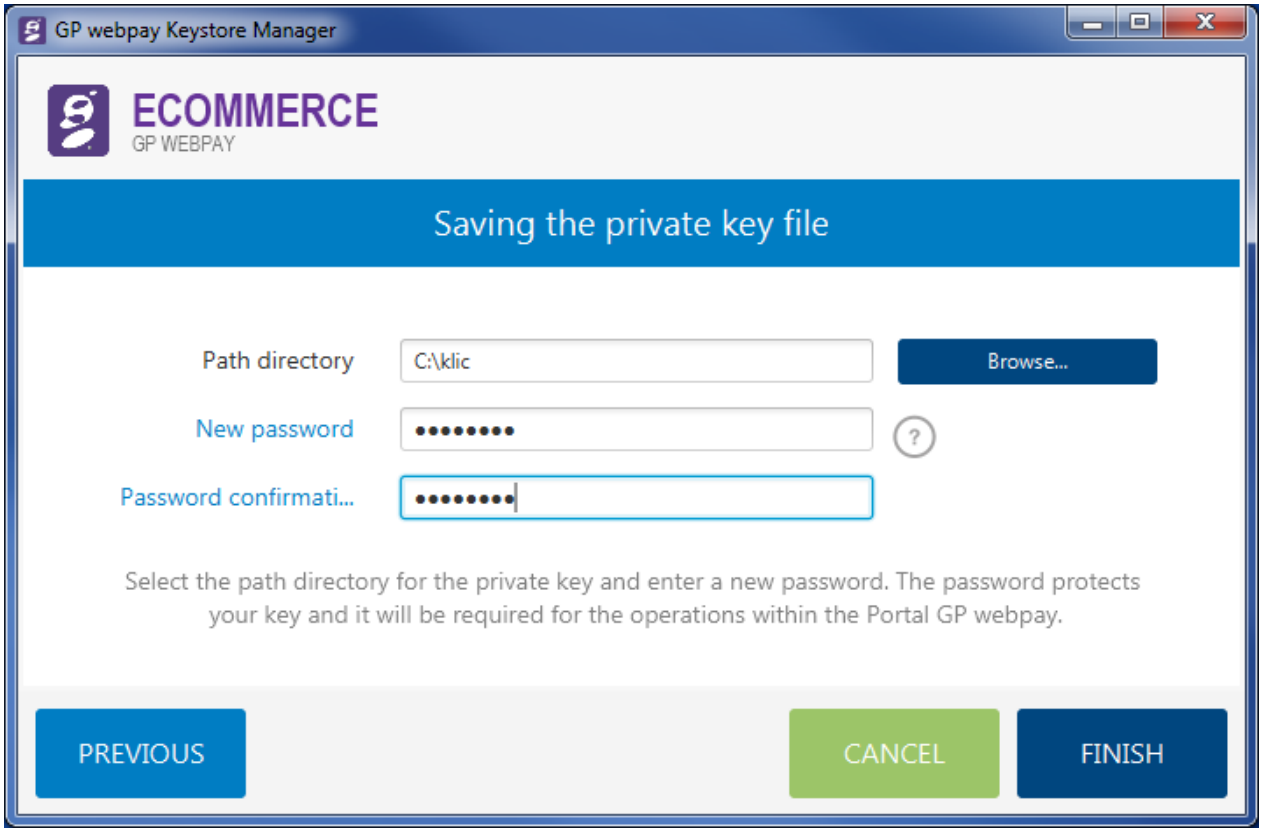


and continue by clicking the “Next” button“. If there is only one private key, this screen is skipped.

After the correctness of the input file is verified, or key selection is confirmed, you are prompted for selection of the destination directory to save the converted file and a request to enter a new password for the private key. The password has to be entered twice to avoid typing errors.

The password must be min. 8 characters and contain at least 3 types of the following requested types of characters:

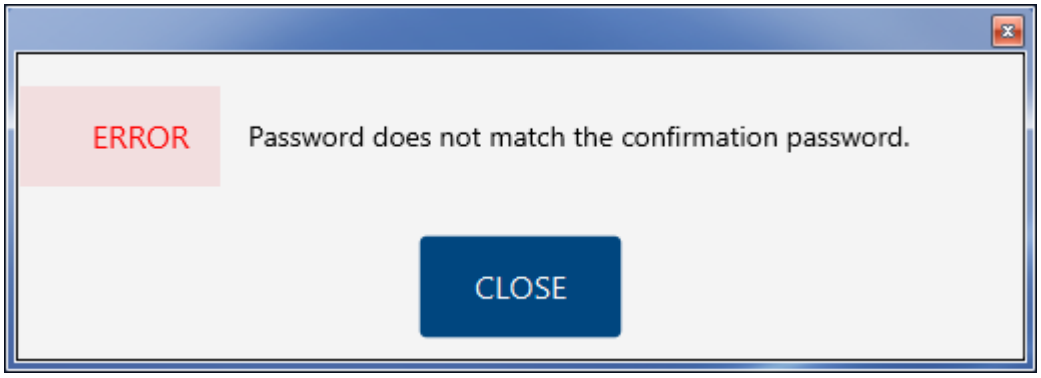
- upper case letter
- lower case letter
- figure
- special character



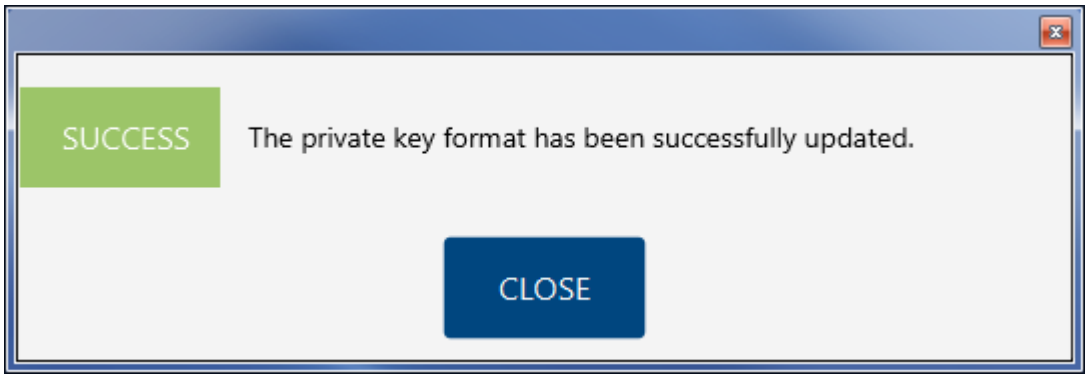
As all necessary information is entered, it is possible to finish the action by pressing the “Finish” button. It is also possible to return to the previous step by pressing the “Previous” button, or to jump back to the start screen by pressing the “Cancel” button.

If a non-existing directory is entered, the following message is displayed, when you try to continue:

In case of inequality of passwords, the following message is displayed:



If everything has been entered correctly, the key is converted and the following message is displayed:



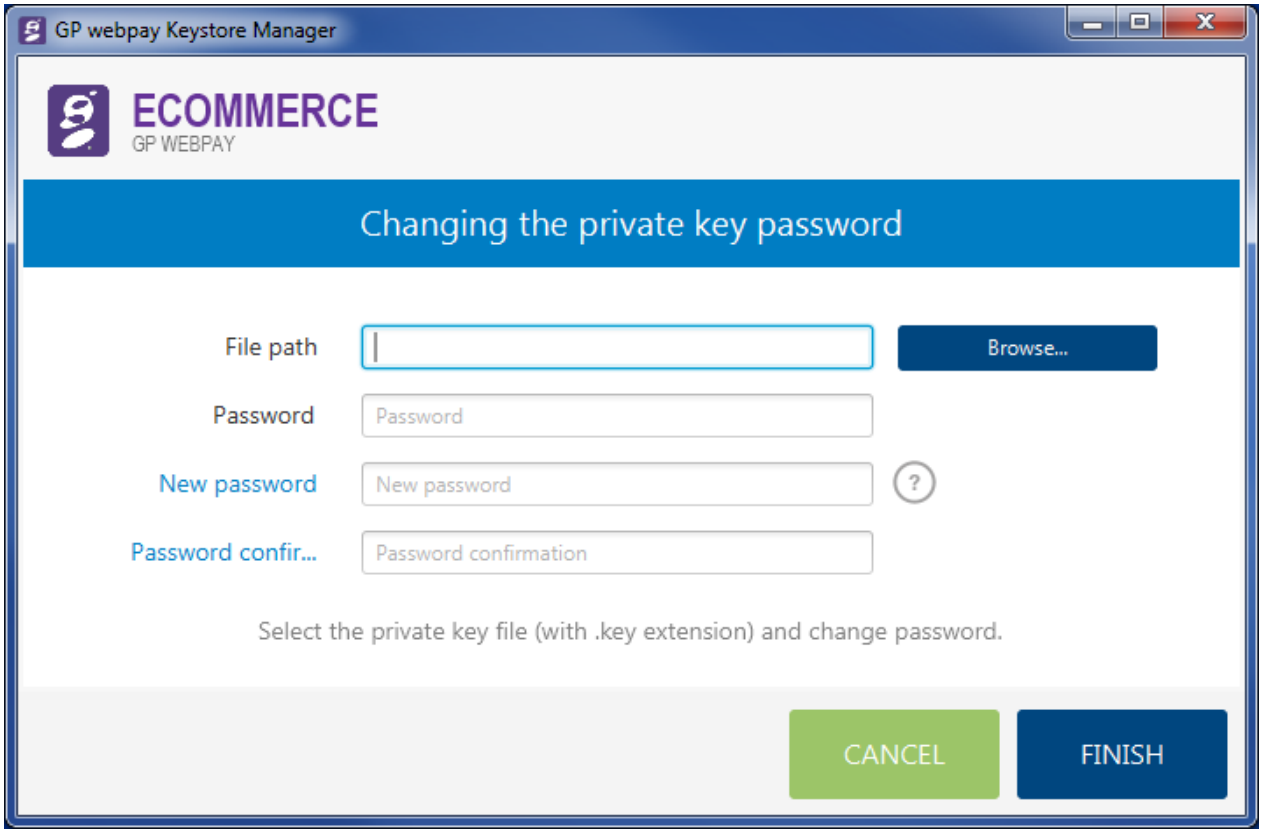
In the selected destination directory is created a file named “gpwebpay-pvk.key”. The file contains the private key in the text format PEM.

By pressing the “Close” button, the application returns to the initial screen.

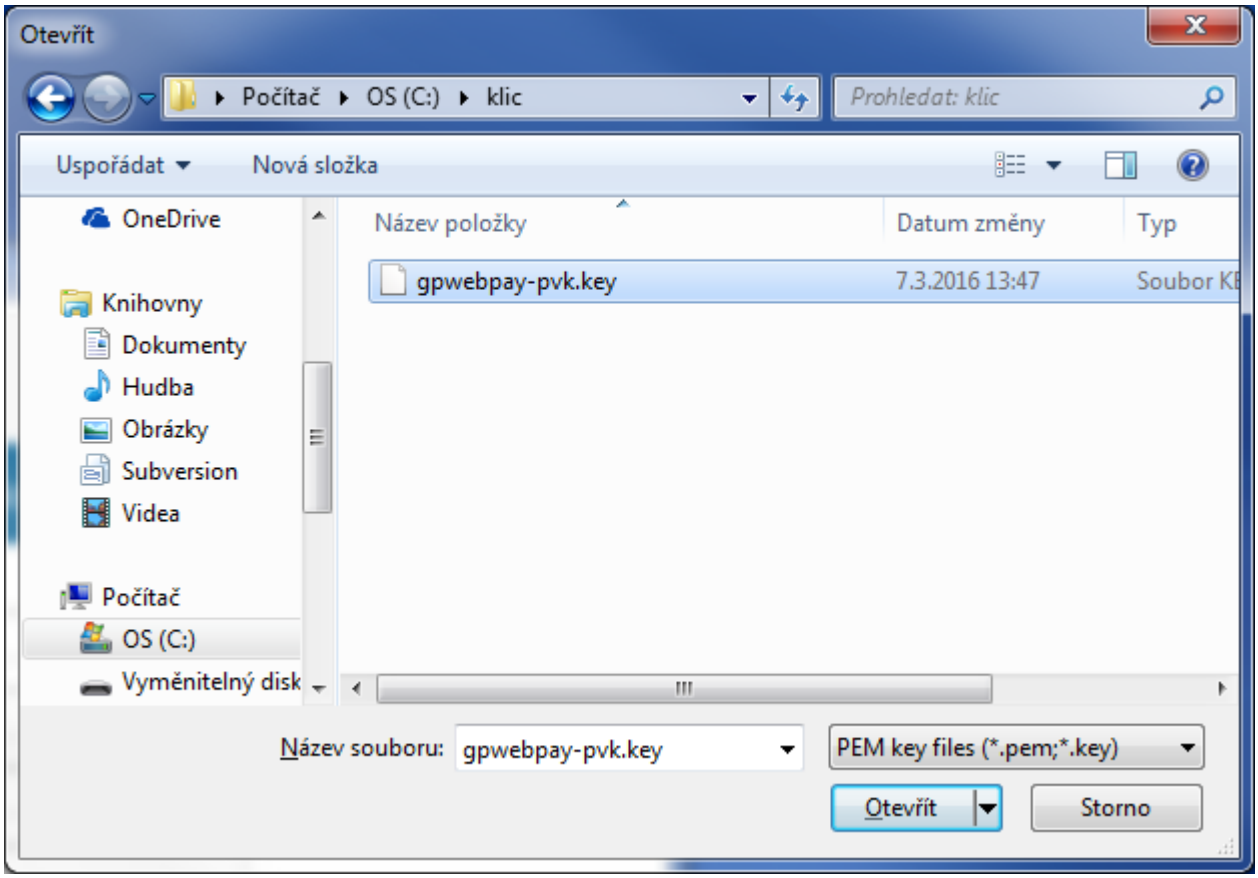
3.3.3 Password change

This option works with the new format of keystore and it is necessary to update the keystore file first – see the previous chapter – or to use the file in the new format obtained from the GP webpay Portal.

By pressing the “tile”, a new window is opened to enter the necessary data:



First, it is necessary to find the directory containing the private key file by means of the “Browse” button:

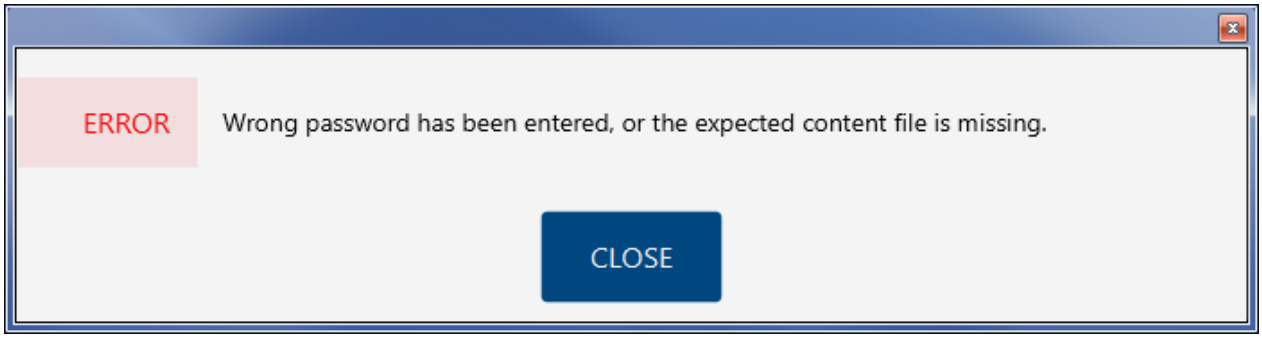


and to “Open” the relevant file. It is also necessary to enter the password to the original key and the new password as well (and of course to verify the new password by entering it twice).

The password must be min. 8 characters and contain at least 3 types of the following requested types of characters:

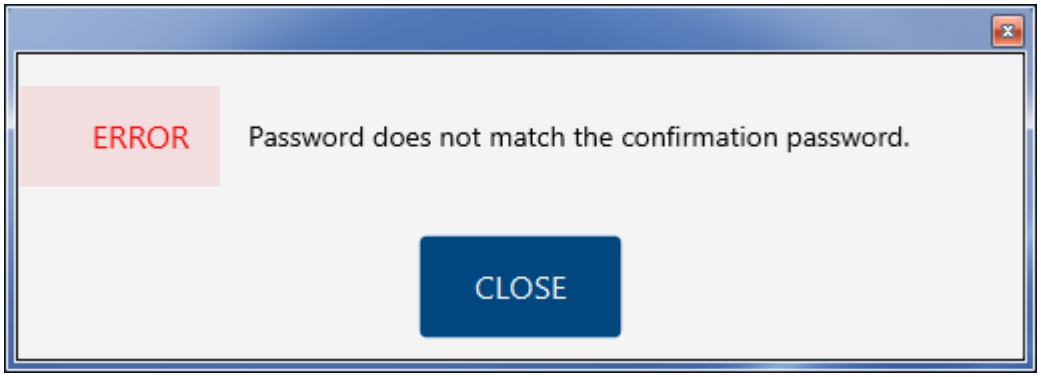
- upper case letter
- lower case letter
- figure
- special character

If the incorrect old password is entered or if the file format is incorrect, the following message is displayed:

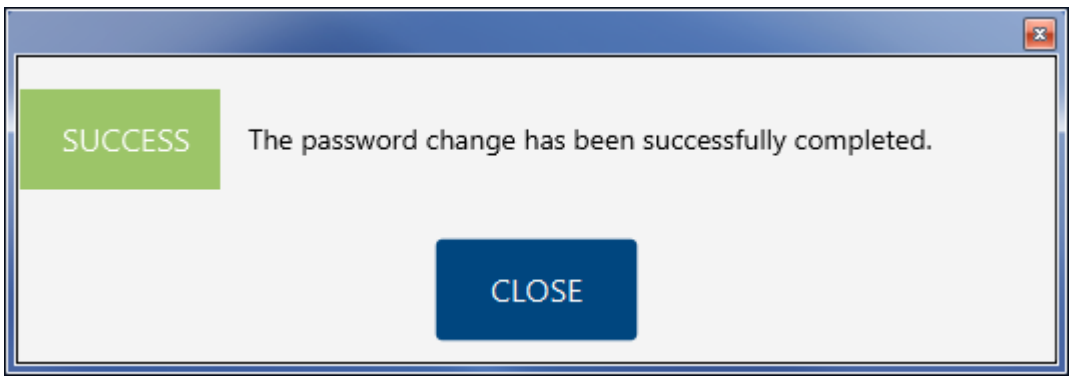


If the new password is not entered or it does not meet the necessary security requirements, the following message is displayed:

If the new password does not match the confirmation password, this situation is indicated by the following message:



If the values are entered correctly, there is displayed the following confirmation of a successful password change:



And there follows a return to the start screen.

3.3.4 For developers

The section "FOR DEVELOPERS" is primarily devoted for programmers implementing the payment gateway into a merchant's e-shop.

Selection starts the process of converting the keystore format to the next most common keystore formats and simultaneously saves the public part of the key into the generally used formats.

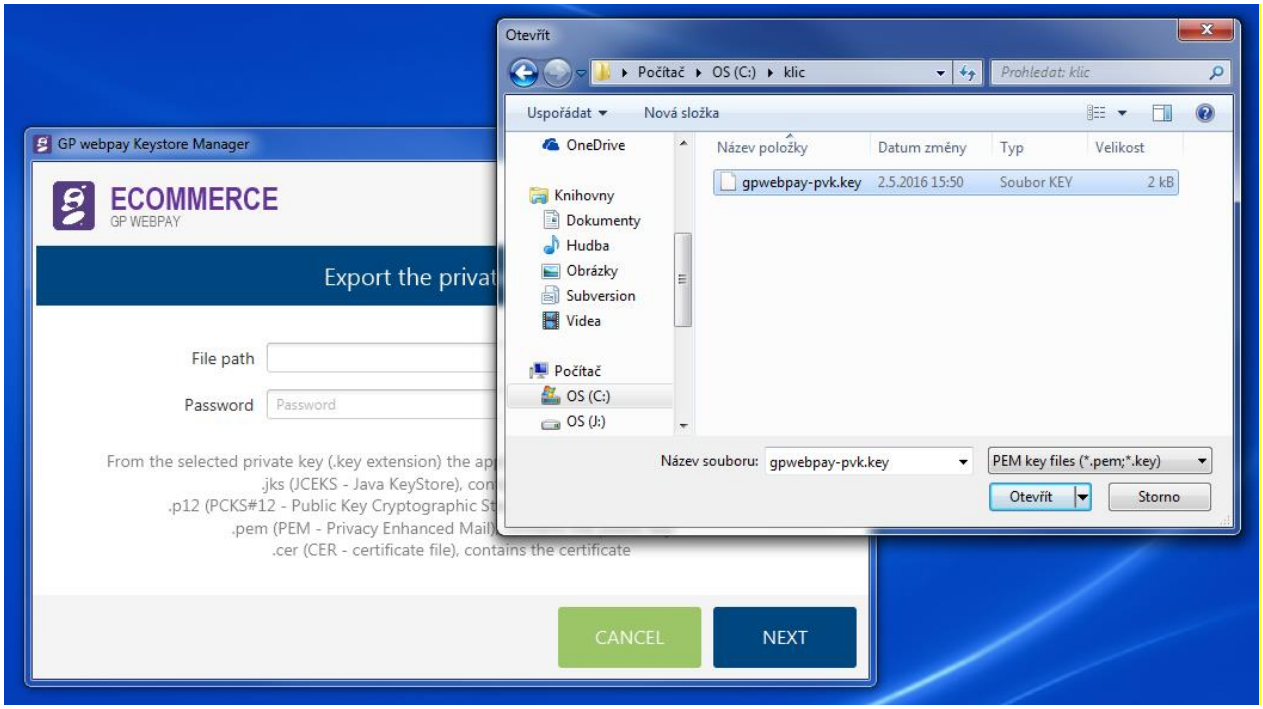
Input format of the keystore:

- text format PEM (PVK) – `gpwebpay-pvk.key`

Output formats of keystores and files:

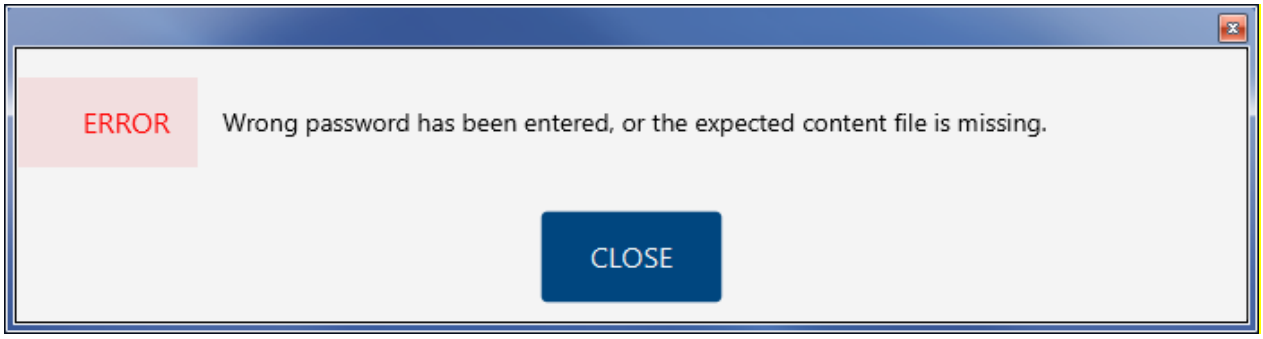
- keystore:
  - JAVA format JCEKS – `gpwebpay-pvk.jceks`
  - Microsoft PKCS12 – `gpwebpay-pvk.p12`
- public key file:
  - text format PEM – `gpwebpay-pub.pem`
  - binary format DER – `gpwebpay-pub.cer`

The first step of conversion is selection of the keystore file. Use the "Browse" button to select the keystore file:



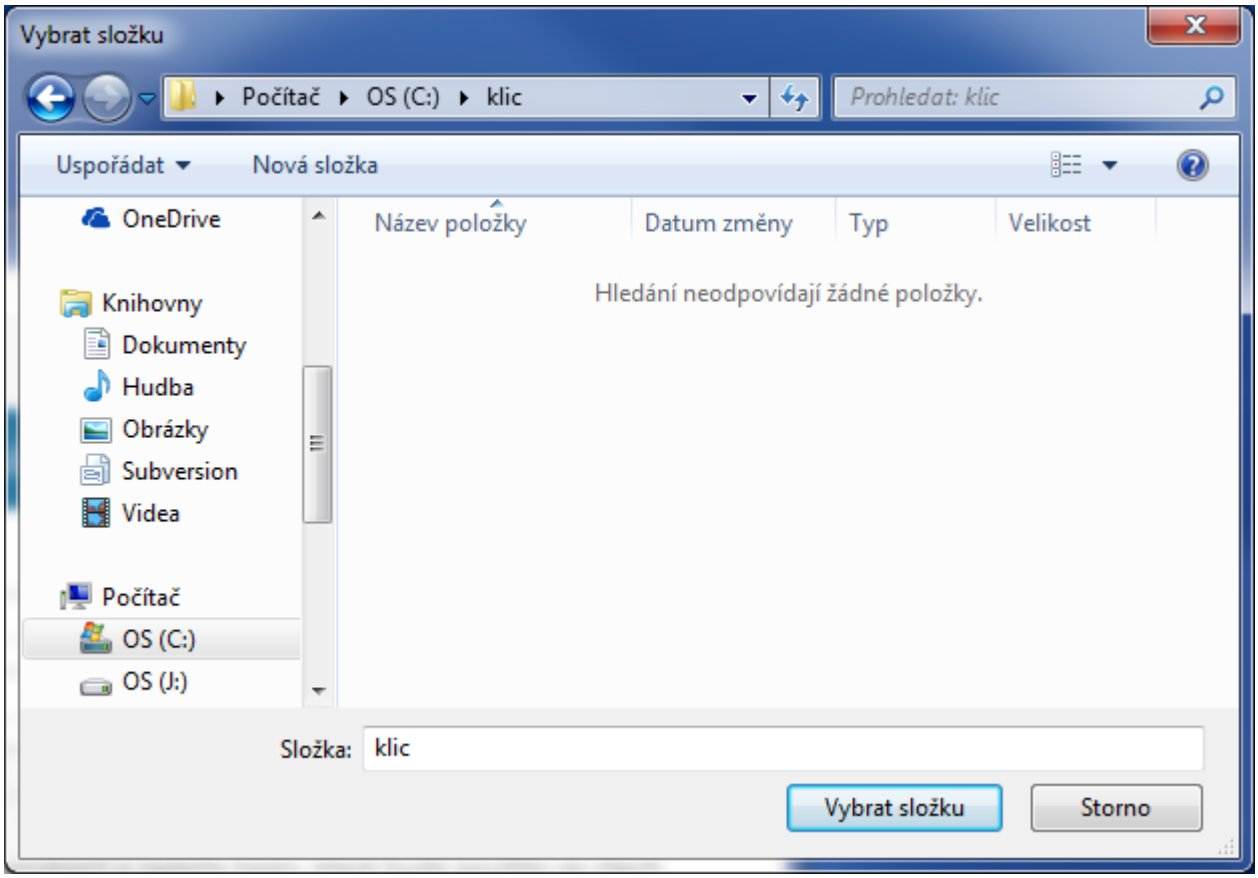
"Open" the file, enter password and press the "Next" button.

If the password or the inner keystore format is incorrect, the following message is displayed:



Otherwise, you are prompted for selection of output directory to save the new created files and to enter the new keystore password (the same password is used also to protect the private key in the keystore; the original password can be used as well).

The “Browse” button opens the window for selection of the output directory; after the necessary space in the file system is found, it is necessary to confirm the selection by the “Select folder” button:



then it is necessary to enter the password and confirm it.

The password must be min. 8 characters and contain at least 3 types of the following requested types of characters:

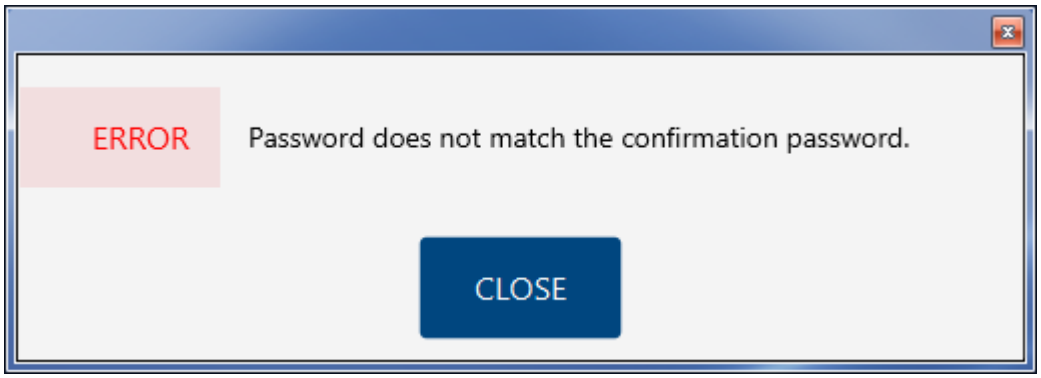
- upper case letter
- lower case letter
- figure

- special character

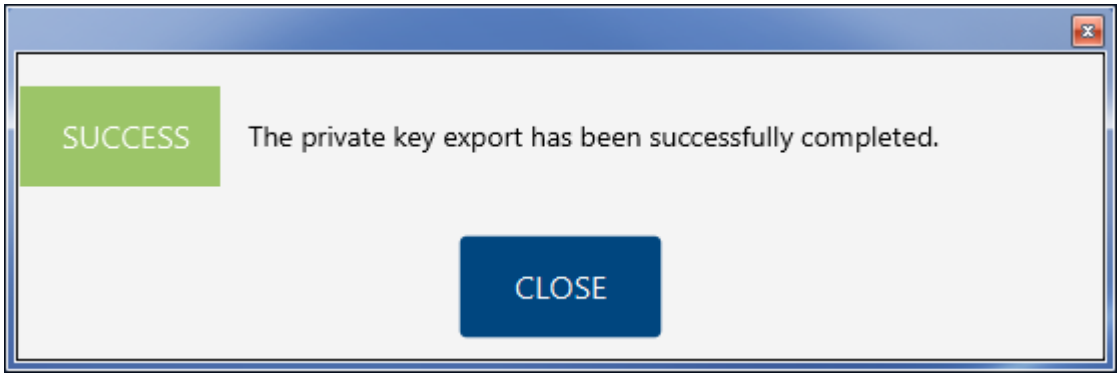
Then the “Finish” button is to be pressed.

If a new password is not entered, or if it does not meet the necessary security requirements, the following message is displayed:

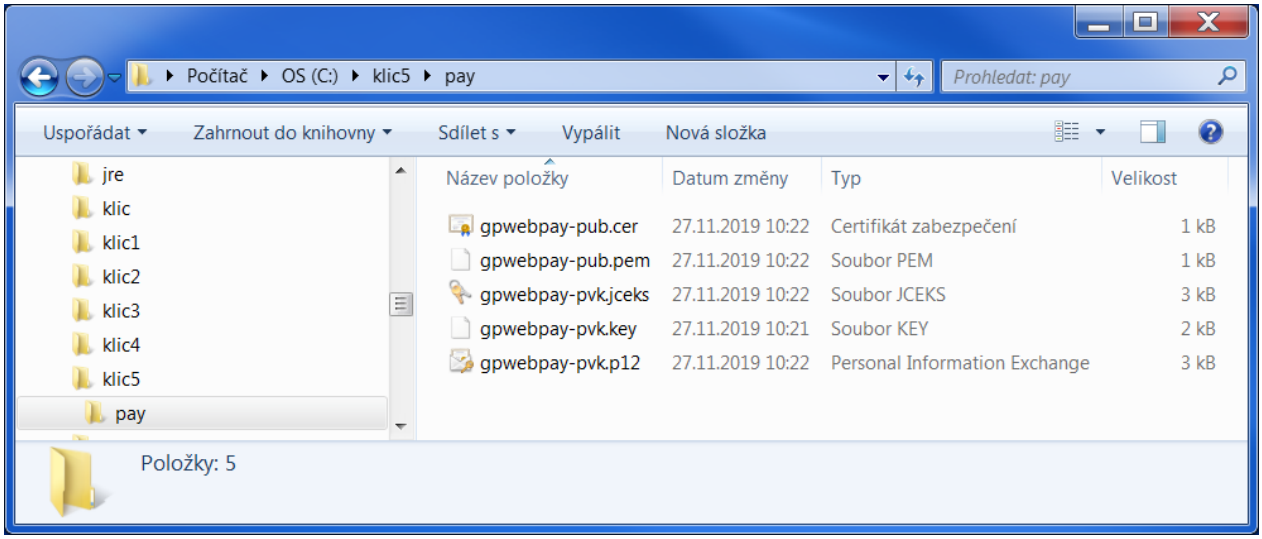
If the new password is not identical to the password confirmation, the situation is indicated by the following message:



If all the values are entered correctly, the successful export of the private key is confirmed by the following message:



This concludes the process of export of the private key, and in the selected output directory are created the following files:



- `gpwebpay-pvk.key` – private key generated by GP webpay Portal
- `gpwebpay-pvk.jceks` – private key in the keystore in JAVA language (JCEKS)

  – applicable for JSP/JAVA applications
- `gpwebpay-pvk.p12` – private key in the keystore in Microsoft structure (PKCS12 – P12)

  – applicable for .NET applications
- `gpwebpay-pub.pem` – text PEM (PVK) format of the public key

  – applicable for PHP applications for verification of the accuracy of the signature value created by the private key
- `gpwebpay-pub.cer` – binary DER format of the public key

  – applicable for .NET applications for verification of the accuracy of the signature value created by the private key

  – format for sending the public key to the GP webpay application support, if recording of the public key by means of the GP webpay Portal fails

After pressing the “Close” button the application returns to the start screen.

4. Signing messages

4.1 General technical basis

4.1.1 Signing a request

(The complete example is in chapter Digest examples)

GP webpay accepts only requests for which it can be proved that the originator of the request is an authorized subject (i.e. merchant) with whom GPE, s.r.o. has signed a contract for GP webpay services.

The DIGEST field is used to prove the origin of the request. Its contents are generated based on the following data:

- Data sent – this data is used to prove that the contents of the fields have not been changed on the way to the system.
- Private key – the private key is used to prove that the request comes from the merchant.

At the moment of beginning the integration, the merchant using the GP webpay Portal generates a private key, which he/she stores securely and provides it to the developer for integration. The merchant's public key is stored automatically on the GP webpay server and before the merchant,s request is accepted, it will be used for verifying, if the merchant has signed the request by his/her private key.

DIGEST parameter contained in transmitted requests contains electronic signature of all other fields of the request. The electronic signature guarantees integrity and undeniableness of the transmitted request.

Any request not containing the DIGEST field or with non-matching contents of the DIGEST field will be rejected with the following explanation:

- PRCODE=5 SRCODE=34 "Mandatory field missing, DIGEST" or
- PRCODE =31 "Invalid signature".

To generate and verify the electronic signature, a string composed as a concatenation of the text interpretation of the values of all fields contained in the request sent, except from the DIGEST field. When compiling the input message, the merchant has to use the same order of fields as that used in the definition of the request and intersperse individual fields by delimiter "|" (pipe, ASCII 124, hexa 7C). The delimiter must not be preceded or followed by whitespace. URLEncode parameters are used only for data transmission, original data have to be used to generate a signature.

Source for generating the DIGEST field in case of method CREATE_ORDER is the value created by concatenation of the fields in the order given here:

MERCHANTNUMBER + | + OPERATION + | + ORDERNUMBER + | + AMOUNT + | + CURRENCY + | + DEPOSITFLAG + | + MERORDERNUM + | + URL + | + DESCRIPTION + | + MD

If the request does not contain any of optional fields, this field is skipped. If the field is sent empty, it is necessary to include it in generating for the DIGEST field and in the string, there will be two separators next to each other – ||.

If the merchant sends only obligatory parameters, for generating the DIGEST field serves the value: MERCHANTNUMBER + | + OPERATION + | + ORDERNUMBER + | + AMOUNT + | + CURRENCY + | + DEPOSITFLAG + | + URL

4.1.2 Response verification

All the responses from the GP webpay system also contain the DIGEST field. Its contents are generated as follows:

- based on the data contained in the response;
- and, at the same time based on the GP webpay private key.

At the moment of beginning the integration, the merchant downloads the GP webpay public key from the GP webpay Portal. It is used by the merchant to verify the contents of the DIGEST field.

This way the merchant can easily verify that:

- the response really comes from the GP webpay;
- the response has not been changed on the way to the merchant.

Furthermore, the response contains also the DIGEST1 parameter, which further enhances the security of the response. The DIGEST1 parameter is generated as the DIGEST parameter, but parameter "MERCHANTNUMBER" is added to the parameters for validation of the DIGEST parameter. This parameter is not sent in the response and the merchant has to add it by himself/herself because he/she knows its value.

The resulting string for validation of the DIGEST1 field looks like this:

<string for the field DIGEST> + | + MERCHANTNUMBER

4.1.3 Generating the electronic signature

Inputs:

- Data message (message)
- Private RSA key (with a K-length modulus)

Outputs:

- Electronic signature (BASE64 encoded), approximate length K*1.5

The electronic signature is generated as follows

a) the value of the function SHA-1 [3] is derived from the message

b) the hash is encoded into the input value for the RSA signature, using the EMSA-PKCS1-v1_5-ENCODE algorithm as described in paragraph 9.2.1 [1]. The encoding is made as follows:

   01 | FF* | 00 | 30 21 30 09 06 05 2B 0E 03 02 1A 05 00 04 14 | hash

   where FF characters are repeated as many times as necessary for the total length of the string to be one octet shorter than the key modulus. The character | is used for the strings concatenation.

c) the RSA signature is calculated using the output value from b), as described in 8.1.1 [1] RSASSA-PKCS1-V1_5-SIGN

d) The output from c) is encoded using BASE64

4.1.4 Verification of the electronic signature

Inputs:

- Data message
- Electronic signature (BASE64 encoded)
- Public RSA key

Outputs:

- Logical value - YES – the signature is valid
- Logical value - NO – the signature is invalid or its verification has not been possible.

The electronic signature is verified as described in 8.1.2 [1] in the following main steps:

a) depending on the settings for the merchant in the GPE system, the correct public key is selected and its integrity is verified;

b) the electronic signature is decoded using BASE64;

c) the output from b) is decrypted using the selected public key;

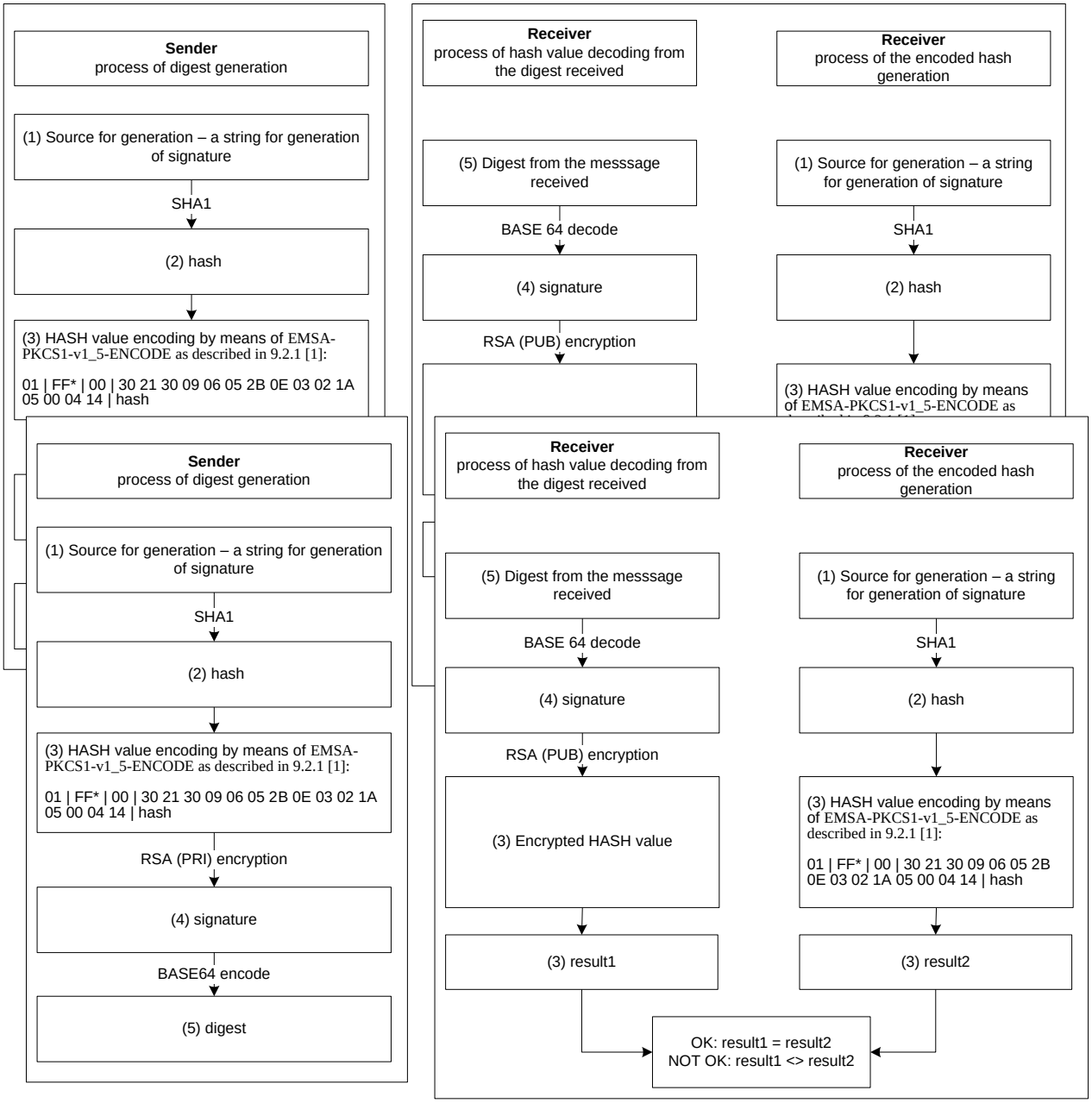
d) a miniature (hash) is generated based on the message and encoded as described in “Generating of the electronic signature”, paras a) and b);

e) the electronic signature decoded according to c) is compared with the result from d). If they are identical, the function returns a logical truth (the signature is valid).

Otherwise, the function returns a logical untruth (the signature is not valid).

The application used for verification of the electronic signature has to identify a signature as invalid also in the case, if verification of the signature has not been possible (for example, due to unavailability of the key).

4.1.5 Graphic representation of key generation and verification



4.1.6 Keys used

To generate the electronic signature (DIGEST), RSA keys (keyPair) are used with a modulus length of 2048 bits. During the communication between GP webpay and the merchant, the following key pairs are used:

GPE's KeyPair	GPE's private key (GPE_{PRI})	Used for the calculation of the electronic signature for messages sent by GPE.	
	GPE's public key (certificate) (GPE_{PUB})	Used by the merchant to verify the electronic signature in messages sent by GPE.	Delivered in the form of a X509 certificate

Merchant's KeyPair	Merchant's private key ($MERCH_{PRI}$)	Used for generating the electronic signature for messages sent by the merchant.	
	Merchant's public key (certificate) ($MERCH_{PUB}$)	Used by GPE to verify the electronic signature in messages sent by the merchant.	Delivered in the form of a X509 self-signed certificate

The application used to generate a self-signed certificate is delivered to the merchant when the merchant applies GPE, s.r.o. for signing a contract. Commercially issued keys can be used as well, but their validity is limited to 1 or 2 years (in comparison with the key generated by the application, there the key validity is longer).

4.1.7 Logging

The application used to verify the electronic signature must store in its audit logs all information about successful and non-successful verification of the electronic signature.

For the purpose of verification of the audit logs, all data required for the verification and re-verification of the electronic signature must be logged. This data includes mainly the electronic signature, the fields, which have been used for its generation, and the result of its verification. If any logs are missing or incomplete, the authenticity of such transactions cannot be confirmed.

4.1.8 References

For further information about the mechanism used to generate the DIGEST field, see the following documents:

[1] RFC 2437, PKCS #1: RSA Cryptography Specifications, October 1998;

[2] XML-Signature Syntax and Processing, W3C Recommendation 12 February 2002,

http://www.w3.org/TR/xmldsig-core/;

[3] RFC 3174 - US Secure Hash Algorithm 1 (SHA1), September 2001;

[4] RFC 2459 – Internet X.509 Public Key Infrastructure Certificate and CRL Profile,

January 1999

The following cryptographic libraries and components may be used to generate the electronic signature:

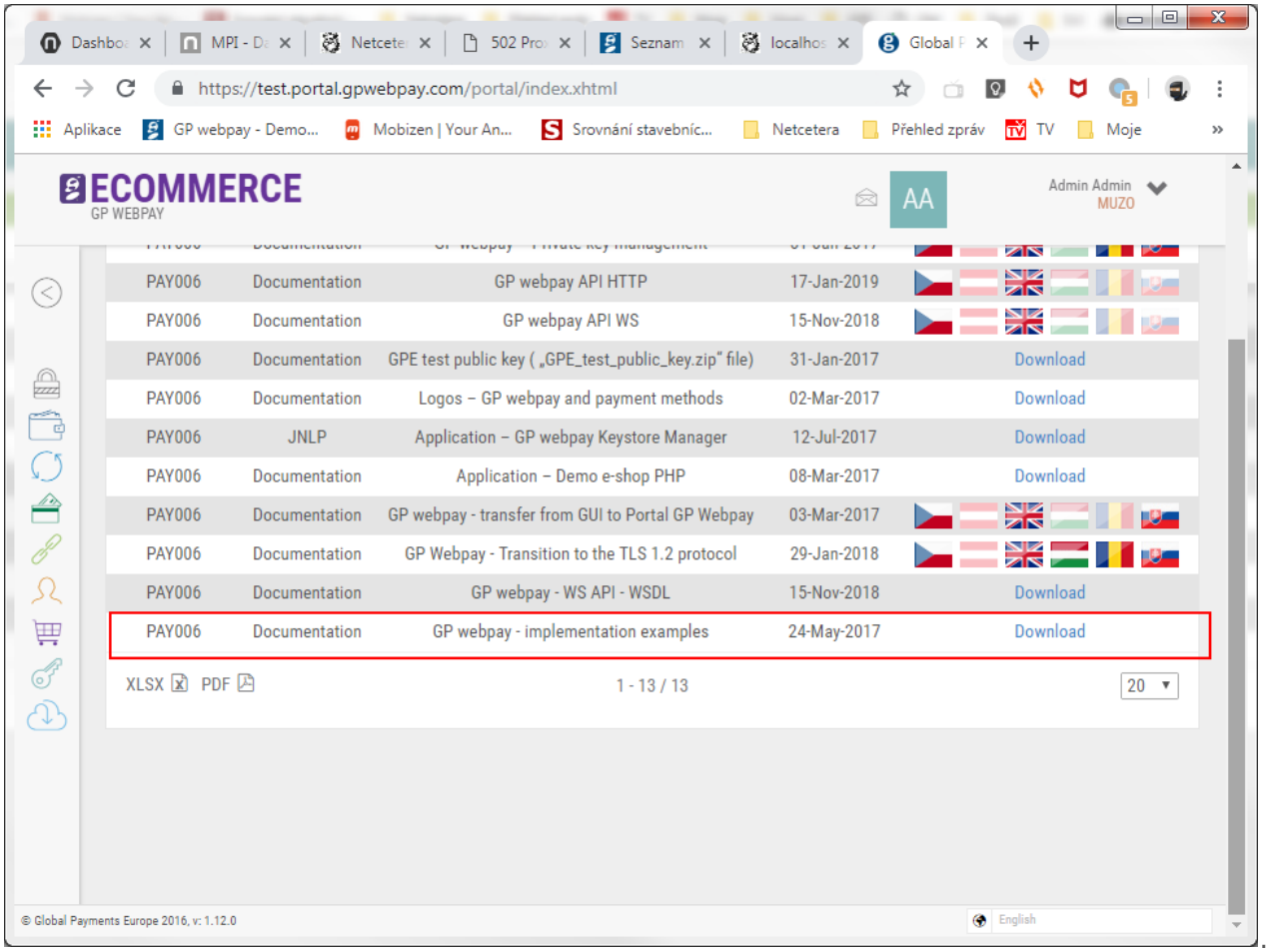
- JCE Cryptix: Alternative JCE provider offering an algorithm for the RSA/SHA1/PKCS#1 signature, **www.cryptix.org**
- Bouncy Castle: Alternative JCA provider offering libraries for the generation of certificates and work with the PKCS#12 certificate storage, www.bouncycastle.org.

Crypto++, a free C++ class library of cryptographic schemes supporting also the RSA/SHA1/PKCS#1 algorithm, www.cryptopp.com

4.2 Digest examples

4.2.1 Test key and application ZIP file

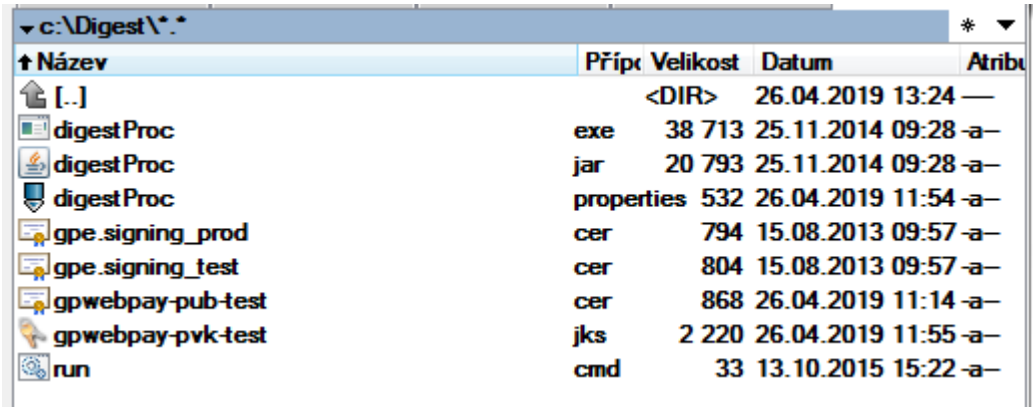
Due to security reasons, it is not possible to insert application into document and send it via e-mail. You have to download it from GP webpay Portal from “Download section”:



From downloaded zip file copy this files into directory unzipped from “digest_app.zip” file.

Directory in downloaded ZIP – “**overovani_podpisu-digest_verification**”, files “**run.cmd**”, “**digestProc.exe**”, “**digestProc.jar**”.

The final directory should be:



Files

`digestProc.exe` – the application executable in the MS Windows environment

`digestProc.jar` – Java archive of the application

`gpwebpay-pub-test.jks` – testing keystore

`gpwebpay-pub-test.cer` – testing public key (certificate)

`digestProc.properties` – configuration file

`gpe.signing_prod.cer` – GPE production environment public key

`gpe.signing_test.cer` – GPE testing environment public key

Configuration file

Content of the file	Meaning in English
`` ####### Privatni klic ####### #nazev keystore s privatnim klicem keyStoreFile = gpwebpay-pvk-test.jks #heslo ke keystore keyStorePwd = Abcd1234 #jmeno (alias) privatniho klice privateKeyAlias = alias #heslo k privatnimu klici privateKeyPwd = Abcd1234 ####### Privatni klic ####### ####### Verejny klic ####### #jmeno souboru s verejnym klicem - cizi verejny klic publicKeyFile = gpwebpay-pub-test.cer #publicKeyFile = gpe.signing_test.cer #publicKeyFile = gpe.signing_prod.cer ####### Verejny klic ####### ####### URLEncoding ####### #predepsane enkodovani vstupnich parametru encoding = UTF-8 #digest na vstupu je URLEncoded # input_urlencoded = true input_urlencoded = false #na vyslednem digestu udelat URLEncode # output_urlencoded = true output_urlencoded = false ####### URLEncoding ####### ```	``` ####### Private key ####### #name of the keystore containing the private key keyStoreFile = gpwebpay-pvk-test.jks #password to the keystore keyStorePwd = Abcd1234 #name (alias) of the private key privateKeyAlias = alias #password to the private key privateKeyPwd = Abcd1234 ####### Private key ####### ####### Public key ####### #name of the file containing the public key - somebody else's public key publicKeyFile = gpwebpay-pub-test.cer #publicKeyFile = gpe.signing_test.cer #publicKeyFile = gpe.signing_prod.cer ####### Public key ####### ####### URLEncoding ####### #required encoding of input parameters encoding = UTF-8 #input digest is URLEncoded # input_urlencoded = true input_urlencoded = false #to make URLEncode over the output digest # output_urlencoded = true output_urlencoded = false ####### URLEncoding ####### ```

Start-up

Java applications need for their run the so called Java Runtime. Java Runtime is a runtime environment and it is necessary to be installed additionally into the majority of operation systems. Java Runtime is freely downloadable from:

http://www.java.com

As concerns the offered versions, the Java SE JRE (Standard Edition, Java Runtime Environment) version is absolutely sufficient. The application is functional also with Java Runtime of other providers.

If you start up the application without parameters:

```
digestProc.exe

java -jar digestProc.jar
```

then help is displayed:

Help displayed:	Meaning in English
Digest Processing, (c) 08/2004 Dimitrij R. Holovka Pouziti: - vypocet podpisu: java -jar digestProc.jar -s <retezec pro vypocet> - overeni podpisu: java -jar digestProc.jar -v <retezec pro vypocet> <podpis> nebo - vypocet podpisu: digestProc.exe -s <retezec pro vypocet> - overeni podpisu: digestProc.exe -v <retezec pro vypocet> <podpis> Pokud <retezec pro vypocet> obsahuje mezery je nutne jej dat do uvozovek.	Digest Processing, (c) 08/2004 Dimitrij R. Holovka Usage: - generation of signature: java -jar digestProc.jar -s <string for generation> - verification of signature: java -jar digestProc.jar -v < string for generation> <digest> or - generation of signature: digestProc.exe -s <string for generation > - verification of signature: digestProc.exe -v <string for generation > <digest> If <string for generation> contains spaces, it is necessary to put it into quotation marks.

Examples:

Generation of signature:

Start-up: `digestProc.exe -s "hello world"`

Result:

Result displayed:	Meaning in English
Digest Processing, (c) 08/2004 Dimitrij R. Holovka ---- Nacitani parametru --- OK Soubor keyStore: test.ks Heslo keyStore: changeit Alias privatniho klice: paymuzo Heslo privatniho klice: changeit Privatni klic: OK Verejny klic: OK Soubor publicKeyStore: test.cer Verejny klic: OK URLEncoded podpis na vstupu: false Provadet URLEncode na vystupu: false Kodova stranka: WINDOWS-1250 ---------- Vytvoreni podpisu pomoci privatniho klice: Delka podpisu: 344 Soubor s podpisem: digestProc.sign Podpis:	Digest Processing, (c) 08/2004 Dimitrij R. Holovka ---- Reading of parameters --- OK File keyStore: test.ks KeyStore password: changeit Alias of the private key: paymuzo Private key password: changeit Private key: OK Public key: OK File publicKeyStore: test.cer Public key: OK Input URLEncoded signature: false To make URLEncode on the output: false Code page: WINDOWS-1250 ---------- Generation of signature using the private key: Length of signature: 344 File with signature: digestProc.sign Signature:

Signature:

```
et2dmSt7+9y43r6pCjAAiLKzDws9VgAm/Qh1ZZxyy1QWS43WLHlywUHBS2f68hXPARAMPOaCpLiswz8iS3pameakq
wTdlmeff6hOAR2s1/ACToo/dICYZoCkXdXg8dKzHqcWVnqeiGBY+NmewyH2/KHg/IzxxqF6AeLbTJsH5drPlUBVsT
bRprUfNAzoCizLRLM3fLXvy8bvDte35cq7Syly6snFjo3crUBwEzXLLrjU/XEYPvzL/XwNo3IZ7PhGspdx8gSWYj7
7t2zasLh/AxpkI8qYqwQlEYzmBHKB3NFetjJoR9jDCvFFtxMvI4bHYHKnjJ1mPyBPxJp00sxp/w==
```

The application generates – by means of the **private key** “gpwebpay” stored in keystore “test.ks” - signature of the string “hello world“. The signature is displayed on the screen and at the same time is saved in the “digestProc.sign” file.

Verification of the signature:

Start-up:

```
digestProc.exe -v "hello world"
"et2dmSt7+9y43r6pCjAAiLKzDws9VgAm/Qh1ZZxyy1QWS43WLHlywUHBS2f68hXPARAMPOaC
pLiswz8iS3pameakqwTdlmeff6hOAR2s1/ACToo/dICYZoCkXdXg8dKzHqcWVnqeiGBY+Nmew
yH2/KHg/IzxxqF6AeLbTJsH5drPlUBVsTbRprUfNAzoCizLRLM3fLXvy8bvDte35cq7Syly6s
nFjo3crUBwEzXLLrjU/XEYPvzL/XwNo3IZ7PhGspdx8gSWYj77t2zasLh/AxpkI8qYqwQlEYz
mBHKB3NFetjJoR9jDCvFFtxMvI4bHYHKnjJ1mPyBPxJp00sxp/w=="
```

Result:

Result displayed:	Meaning in English
Digest Processing, (c) 08/2004 Dimitrij R. Holovka ---- Nacitani parametru --- OK Soubor keyStore: test.ks Heslo keyStore: changeit Alias privatniho klice: paymuzo Heslo privatniho klice: changeit Privatni klic: OK Verejny klic: OK Soubor publicKeyStore: test.cer Verejny klic: OK URLEncoded podpis na vstupu: false Provadet URLEncode na vystupu: false Kodova stranka: WINDOWS-1250 ---------- Overeni podpisu pomoci verejneho klice: Vysledek overeni: true	Digest Processing, (c) 08/2004 Dimitrij R. Holovka ---- Reading of parameters --- OK KeyStore file: test.ks KeyStore password: changeit Alias of the private key: paymuzo Private key password: changeit Private key: OK Public key: OK File publicKeyStore: test.cer Public key: OK Input URLEncoded signature: false To make URLEncode on the output: false Code page: WINDOWS-1250 ---------- Verification of signature using the public key: Result of verification: true

The application verifies the string signature “hello world” by means of the public key (certificate) stored in the “test.cer” file. The result of verification is displayed on the last line – „`Vysledek overeni: true`“ (i.e. „`Verification Result: true`“).

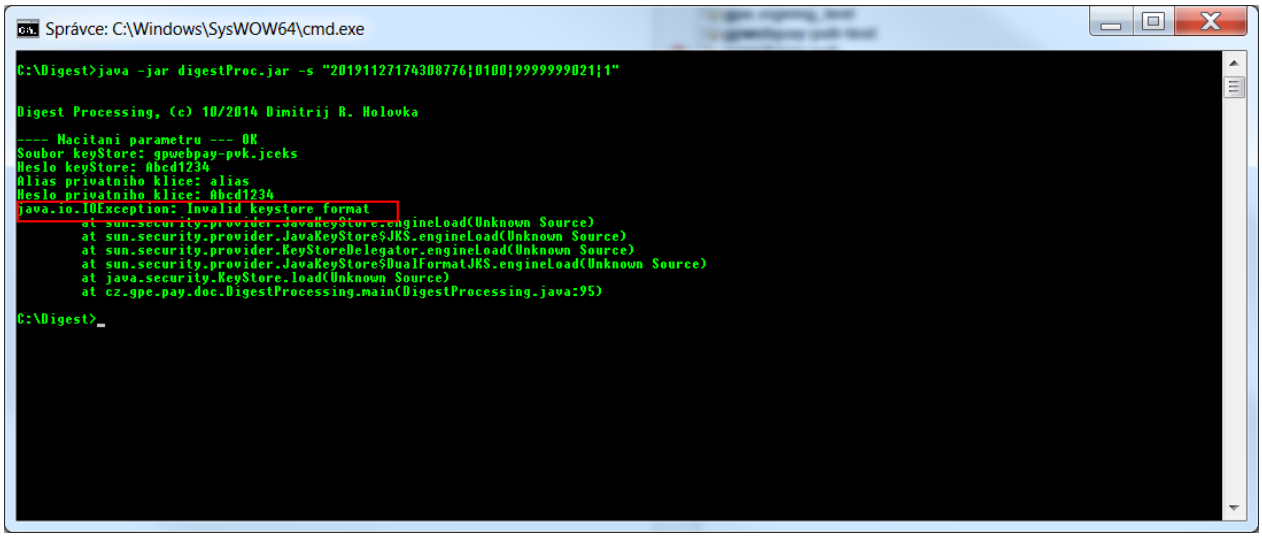
To verify the response of the GP webpay systems it is necessary to change the parameter „`publicKeyFile`“ in the configuration file as follows:

- Testing environment: `gpe.signing_test.cer`
- Production environment: `gpe.signing_prod.cer`

4.2.2 Digest example

! This is only example, it doesn't work in real testing environment (it uses the test key without corresponding public part on GP webpay server) !

If an "Invalid keystore format" error occurs when trying to sign/verify a string, the different type of keystore (JCEKS, P12…) than the supported "JKS" is used:



You need to convert the used private keystore to the correct format using one of the key-handling programs – e.g. KeyStore Explorer, OpenSSL…

4.2.2.1 HTTP

4.2.2.1.1 Request

HTTP request
https://test.3dsecure.gpwebpay.com/pgw/order.do?MERCHANTNUMBER=9999999021&OPERATION=CREATE_ORDER&ORDERNUMBER=157487125803&AMOUNT=100&CURRENCY=203&DEPOSITFLAG=1&MERORDERNUM=155912254545&URL=https%3A%2F%2Flocalhost%3A443%2Fdemoshop%2Fpayment%2Fpayment.php&userparam2=59452C6A0381B48B3B164A80E202983F542759CC17AF36DE37B4CDB4B9908EB7&email=dholovka%40gpe.cz&DIGEST=BZlXwJJGku1m2uhyHU%2ByIyhzRv%2BVKfNdI%2F1Y5pSG61FfJb88JzYlLs7CGfhY6%2Bonle3q0sDH6V%2FM9EF4uIWMcSJxBpqzPmh7U6ud7nYa3UINr7ljSU3WC8FQd8qIc%2FLWeVFgh%2BPgxq0cdI47vvFZXuoBtzFpZQZWI0AOOQxhKAzZ4UrRafdNGYKtYI1BwZD4u5Aq3wSrOOBRBu%2BFompn%2BIWAN8xpAySA2A9VvBEHGvD1tFLSMIVlCCOMfqq0EEQj0TceXrWoQ8Y02gQoolRcCDb1geOsshELdaseuKUtcFnsZE49%2B700G1lxYz9%2F4RNMOTa%2FPpwTVBc00qlqlgfjWQ%3D%3D

Data for digest:

9999999021|CREATE_ORDER|157487125803|100|203|1|155912254545|https://localhost:443/demoshop/payment/payment.php|59452C6A0381B48B3B164A80E202983F542759CC17AF36DE37B4CDB4B9908EB7|dholovka@gpe.cz

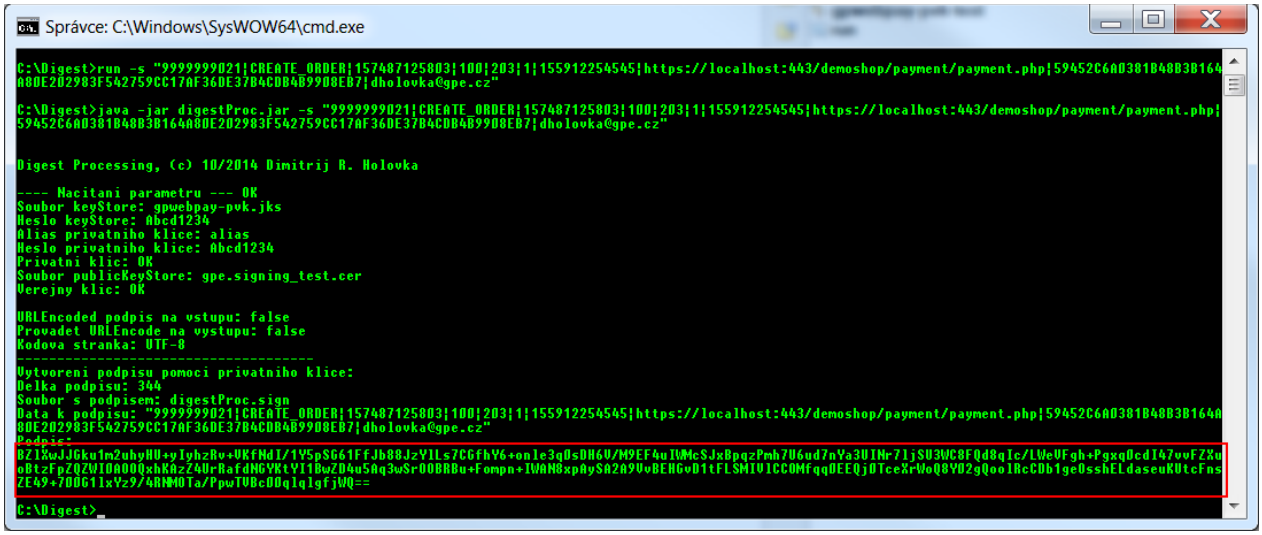
Digest:

BZlXwJJGku1m2uhyHU+yIyhzRv+VKfNdI/1Y5pSG61FfJb88JzYlLs7CGfhY6+onle3q0sDH6V/M9EF4uIWMcSJxBpqzPmh7U6ud7nYa3UINr7ljSU3WC8FQd8qIc/LWeVFgh+Pgxq0cdI47vvFZXuoBtzFpZQZWI0AOOQxhKAzZ4UrRafdNGYKtYI1BwZD4u5Aq3wSrOOBRBu+Fompn+IWAN8xpAySA2A9VvBEHGvD1tFLSMIVlCCOMfqq0EEQj0TceXrWoQ8Y02gQoolRcCDb1geOsshELdaseuKUtcFnsZE49+700G1lxYz9/4RNMOTa/PpwTVBc00qlqlgfjWQ==

Command to start the application:

```
java -jar digestProc.jar -s
"9999999021|CREATE_ORDER|157487125803|100|203|1|155912254545|https
://localhost:443/demoshop/payment/payment.php|59452C6A0381B48B3B16
4A80E202983F542759CC17AF36DE37B4CDB4B9908EB7|dholovka@gpe.cz"
```

The result is displayed on the screen and saved in the file “digestProc.sign”:



4.2.2.1.2 Response

HTTP response
https://localhost:443/demoshop/payment/payment.php?OPERATION=CREATE_ORDER&ORDERNUMBER=157487125803&MERORDERNUM=155912254545&PRCODE=0&SRCODE=0&RESULTTEXT=OK&DETAILS=59452c6a0381b48b3b164a80e202983f8e9c5459c948e292465bc638b8be647d&USERPARAM1=2F89879EAF57B52B37E23DFD1D2B1BA6567A13BC2547F16DBB54EF5BE3A743A7&TOKEN=AA74E7D735D3201A926971BE5A92C8CE14D2E685DC399E4A3E2BE12C64605EC7&EXPIRY=2012&ACCODE=69Z4IV&ACSRES=A&PANPATTERN=405607******0016&DAYTOCAPTURE=04122019&ACRC=00&RRN=000001267633&DIGEST=o9uwRov2%2BWkF5QcZ5EhL0Ka7d8cObEW2n59j62WFDWcAL5HUD2g5%2F9lwfo3ZD2EKvaNtXmn9QYLXK4mwlgRWpdjCtuYgJxmHBa%2BsE%2FfUSRVBV3y2Qt47eLZNH8UGtSXlHy3IzGt%2FCX4UYeOwoZ%2BI4keiQr1F%2FRC7w6AOQCLM5rSEtNhM487eM8A5kI2E%2BpuzQeVtSr9X3nCa3N531N1Fm9p96bQKejpI7nX9%2FJJk8pk6n0MXBGzYbxX%2B0YNt2sUlCfFJrCg44LWQsBZYl1vLlxHdZHfKK6F6LBwMTAb0qD5zE1fQUdzLYPWFalb4tTtHC6srwv3p1e5A0Z3efWzPOA%3D%3D&DIGEST1=hudnVKmuIHpBG4U4BXsNGTdxoiOq9860K%2Fntgher8gwHab2TOavI5DCNs2hURSAC9nX4nDJa30g2E7FVigWI%2BYf45kHgQ2MQEASGQgllTDqyHRoYFZwqM69hXHoUgd3RXEZDmYnLm6VvJ4PvVKqCa8FBC2JUyo9saKN2rXVjv2yox265u724r7JoIlGg5ka%2F5Schu7bxRuG%2BdID4YNePR4gz9C6K9V8b2bWQ%2FifYOEHGtySMfZ7BrPIDXRNRJM5YrnGUlLghsYfpJwI%2Bp4d5kpUSHkiwQ5yNXhLPI8xER%2BCO%2Bmve9xV6n%2FvphiQo8T1RBcp2bAK4IOAr5%2FT7%2BTBVtQ%3D%3D

Data for verification:

```
CREATE_ORDER|157487125803|155912254545|0|0|OK|59452c6a0381b48b3b16
4a80e202983f8e9c5459c948e292465bc638b8be647d|2F89879EAF57B52B37E23
DFD1D2B1BA6567A13BC2547F16DBB54EF5BE3A743A7|AA74E7D735D3201A926971
BE5A92C8CE14D2E685DC399E4A3E2BE12C64605EC7|2012|A|69Z4IV|405607***
***0016|04122019|00|000001267633|9999999021
```

Digest (DIGEST1 – URLDecoded):

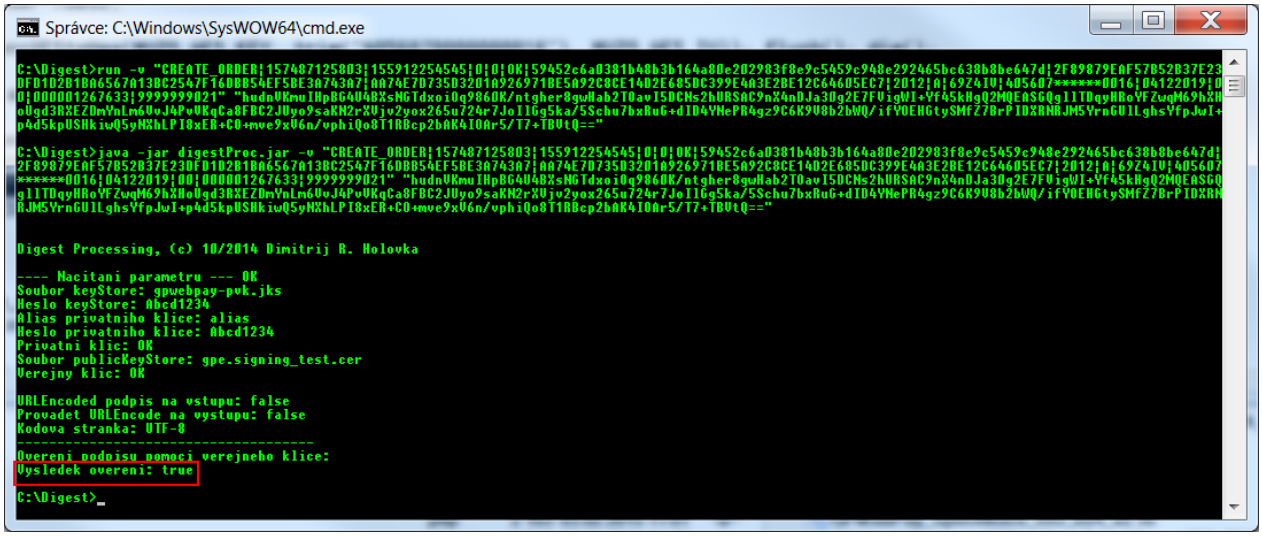
```
hudnVKmuIHpBG4U4BXsNGTdxoiOq9860K/ntgher8gwHab2TOavI5DCNs2hURSAC9n
X4nDJa30g2E7FVigWI+Yf45kHgQ2MQEASGQgllTDqyHRoYFZwqM69hXHoUgd3RXEZD
mYnLm6VvJ4PvVKqCa8FBC2JUyo9saKN2rXVjv2yox265u724r7JoIlGg5ka/5Schu7
```

**bxRuG+dID4YNePR4gz9C6K9V8b2bWQ/ifYOEHGtySMfZ7BrPIDXRNRJM5YrnGUlLgh
sYfpJwI+p4d5kpUSHkiwQ5yNXhLPI8xER+CO+mve9xV6n/vphiQo8T1RBcp2bAK4IO
Ar5/T7+TBVtQ==**

Command to start the application:

```
java -jar digestProc.jar -v
"CREATE_ORDER|157487125803|155912254545|0|0|OK|59452c6a0381b48b3b1
64a80e202983f8e9c5459c948e292465bc638b8be647d|2F89879EAF57B52B37E2
3DFD1D2B1BA6567A13BC2547F16DBB54EF5BE3A743A7|AA74E7D735D3201A92697
1BE5A92C8CE14D2E685DC399E4A3E2BE12C64605EC7|2012|A|69Z4IV|405607**
****0016|04122019|00|000001267633|9999999021"
"hudnVKmuIHpBG4U4BXsNGTdxoiOq9860K/ntgher8gwHab2TOavI5DCNs2hURSAC9
nX4nDJa30g2E7FVigWI+Yf45kHgQ2MQEASGQgllTDqyHRoYFZwqM69hXHoUgd3RXEZ
DmYnLm6VvJ4PvVKqCa8FBC2JUyo9saKN2rXVjv2yox265u724r7JoIlGg5ka/5Schu
7bxRuG+dID4YNePR4gz9C6K9V8b2bWQ/ifYOEHGtySMfZ7BrPIDXRNRJM5YrnGUlLg
hsYfpJwI+p4d5kpUSHkiwQ5yNXhLPI8xER+CO+mve9xV6n/vphiQo8T1RBcp2bAK4I
OAr5/T7+TBVtQ=="
```

The result is displayed on the screen:



4.2.2.2 WS

4.2.2.2.1 Request

WS request

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
xmlns:v1="http://gpe.cz/pay/pay-ws/proc/v1" xmlns:type="http://gpe.cz/pay/pay-ws/proc/v1/type">
   <soapenv:Header/>
   <soapenv:Body>
      <v1:getPaymentStatus>
         <v1:paymentStatusRequest>
            <type:messageId>20191127174308776</type:messageId>
            <type:provider>0100</type:provider>
            <type:merchantNumber>9999999021</type:merchantNumber>
            <type:paymentNumber>1</type:paymentNumber>
            <type:signature>
lTFcQSdDX9BMwup7B3YgC9SWKUROQYbuIe4TZmtGIFEP4kAMsLkkHMmFCJjJcDtaU3x5NVTVSJTSel2J1Q8DIemhf/2eWWmDgPps
Dj/E/bg2mZQINr0R8c2OAMnXyffEX1ky3s1siAcu2aBDIYgpB9wi9fVvhmpIkLQY2QzDCrZtPMzsvLZ54v4uOScgXgTLwXxSeS04
xDZQlA8Ng6ojX/d+lIvdPEk4qD9RjDKfuMvRj1WO4i+cQPY9u9QN3aJtmda2VO3JicoMbVhUETlHdjHD/xAcARS6St8/xIfuzg25
SpoOrQnjCwB/dNNPRsx5F+NUrZvDY8uPxqjCGuwayA==</type:signature>
         </v1:paymentStatusRequest>
      </v1:getPaymentStatus>
   </soapenv:Body>
</soapenv:Envelope>
```

Data for digest: **20191127174308776|0100|9999999021|1**

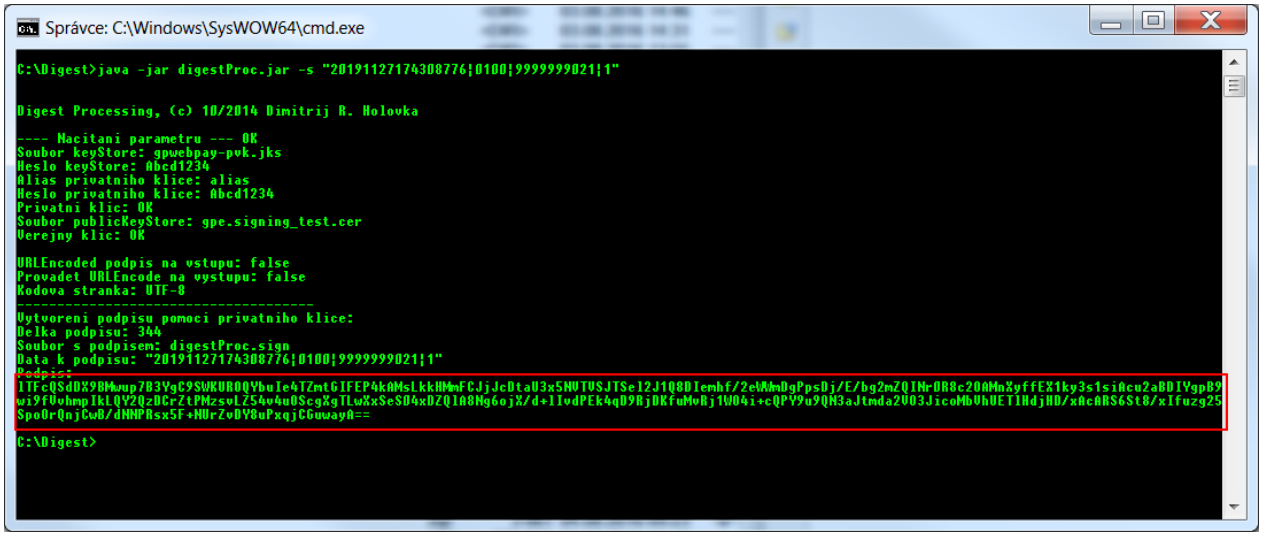
Digest:

lTFcQSdDX9BMwup7B3YgC9SWKUROQYbuIe4TZmtGIFEP4kAMsLkkHMmFCJjJcDtaU3x5NVTVSJTSel2J1Q8DIemhf/2eWWmDgPpsDj/E/bg2mZQINr0R8c2OAMnXyffEX1ky3s1siAcu2aBDIYgpB9wi9fVvhmpIkLQY2QzDCrZtPMzsvLZ54v4uOScgXgTLwXxSeS04xDZQlA8Ng6ojX/d+lIvdPEk4qD9RjDKfuMvRj1WO4i+cQPY9u9QN3aJtmda2VO3JicoMbVhUETlHdjHD/xAcARS6St8/xIfuzg25SpoOrQnjCwB/dNNPRsx5F+NUrZvDY8uPxqjCGuwayA==

Command to start the application:

java -jar digestProc.jar -s "20191127174308776|0100|9999999021|1"

The result is displayed on the screen and saved in the file “digestProc.sign”:



4.2.2.2.2 Response

WS response

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/">
   <soapenv:Body>
      <ns4:getPaymentStatusResponse xmlns:ns4="http://gpe.cz/pay/pay-ws/proc/v1"
xmlns="http://gpe.cz/gpwebpay/additionalInfo/response"
xmlns:ns5="http://gpe.cz/gpwebpay/additionalInfo/response/v1" xmlns:ns2="http://gpe.cz/pay/pay-
ws/core/type" xmlns:ns3="http://gpe.cz/pay/pay-ws/proc/v1/type">
         <ns4:paymentStatusResponse>
            <ns3:messageId>20191127174308776</ns3:messageId>
            <ns3:state>1</ns3:state>
            <ns3:status>UNPAID</ns3:status>
            <ns3:subStatus>INITIATED</ns3:subStatus>

<ns3:signature>M49XARQA7zu9xPHzaTgVUbFjpgXSC7OOH+BiN46mVldTrfqJYoSoQ9yAmcVrwF9Czv82ubHpY5+Q14MeQLMc0
iK7vohROjZscHHnMDUrpqj3l5WAaU/LEN/c0SR6dJDqHlbD1wvW557dTrTh3yjZWHT/bAqCqNU5S9rGVGNjB4kPcnxEPUsrApBuM
Gb+/Nugyf9VMUTdWeEbfuvgYfa//7fRUwABa5bhryiJW+1dvslR9MFaMYgqfhLeGDr+q8SaRIfE4qd/4XGKKF8Aa1xlhWldPVCKV
4pfag0/RcimaQ7IBb2IYV2rdtYyKhRwPj0WSU4OnkDzkU6MnauD3iRySA==</ns3:signature>
         </ns4:paymentStatusResponse>
      </ns4:getPaymentStatusResponse>
   </soapenv:Body>
</soapenv:Envelope>
```

Data for digest: **20191127174308776|1|UNPAID|INITIATED**

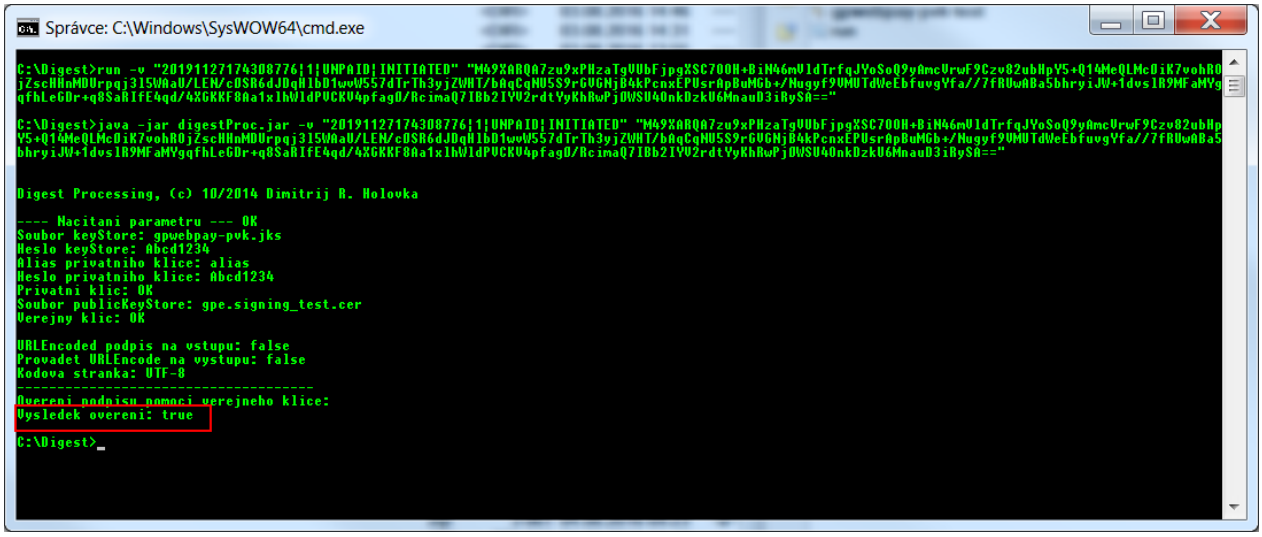
Digest:

M49XARQA7zu9xPHzaTgVUbFjpgXSC7OOH+BiN46mVldTrfqJYoSoQ9yAmcVrwF9Czv82ubHpY5+Q14MeQLMc0iK7vohROjZscHHnMDUrpqj3l5WAaU/LEN/c0SR6dJDqHlbD1wvW557dTrTh3yjZWHT/bAqCqNU5S9rGVGNjB4kPcnxEPUsrApBuMGb+/Nugyf9VMUTdWeEbfuvgYfa//7fRUwABa5bhryiJW+1dvslR9MFaMYgqfhLeGDr+q8SaRIfE4qd/4XGKKF8Aa1xlhWldPVCKV4pfag0/RcimaQ7IBb2IYV2rdtYyKhRwPj0WSU4OnkDzkU6MnauD3iRySA==

Command to start the application:

java -jar digestProc.jar -v "20191127174308776|1|UNPAID|INITIATED" "M49XARQA7zu9xPHzaTgVUbFjpgXSC7OOH+BiN46mVldTrfqJYoSoQ9yAmcVrwF9Czv82ubHpY5+Q14MeQLMc0iK7vohROjZscHHnMDUrpqj3l5WAaU/LEN/c0SR6dJDqHlbD1wvW557dTrTh3yjZWHT/bAqCqNU5S9rGVGNjB4kPcnxEPUsrApBuMGb+/Nugyf9VMUTdWeEbfuvgYfa//7fRUwABa5bhryiJW+1dvslR9MFaMYgqfhLeGDr+q8SaRIfE4qd/4XGKKF8Aa1xlhWldPVCKV4pfag0/RcimaQ7IBb2IYV2rdtYyKhRwPj0WSU4OnkDzkU6MnauD3iRySA=="

The result is displayed on the screen:


Správce: C:\Windows\SysWOW64\cmd.exe
C:\Digest>run -v "201911271743087761¦1¦UNPAID¦INITIATED" "M49XARQA7zu9xPNzaTgVUbFjpgXSC7OOH+BiN46mVldTrfqJYoSoQ9yAmcVrwF9Czv82ubHpY5+Q14MeQLMcOiK7vohROjZscHHnMDUrpqj3l5WAaU/LEN/cOSR6dJDqN1bD1wvV557dTrTh3yjZWHT/bAqCqMU5S9rGVGMjB4kPcnxEPUsrApBuMGb+/Nugyf9VMUTdVeEbfuvgVfa//7fRUwABa5bhryiJV+1dvs1R9MFaMYgqfhLeGDr+q8SaRIfE4qd/4XGKKF8Aa1x1hWldPUCKV4pfagO/RcimaQ7IBb2IYV2rdtYyKhRwPjOWSU4OnkDzkU6MnauD3iRySA=="
C:\Digest>java -jar digestProc.jar -v "201911271743087761¦1¦UNPAID¦INITIATED" "M49XARQA7zu9xPNzaTgVUbFjpgXSC7OOH+BiN46mVldTrfqJYoSoQ9yAmcVrwF9Czv82ubHpY5+Q14MeQLMcOiK7vohROjZscHHnMDUrpqj3l5WAaU/LEN/cOSR6dJDqN1bD1wvV557dTrTh3yjZWHT/bAqCqMU5S9rGVGMjB4kPcnxEPUsrApBuMGb+/Nugyf9VMUTdVeEbfuvgVfa//7fRUwABa5bhryiJV+1dvs1R9MFaMYgqfhLeGDr+q8SaRIfE4qd/4XGKKF8Aa1x1hWldPUCKV4pfagO/RcimaQ7IBb2IYV2rdtYyKhRwPjOWSU4OnkDzkU6MnauD3iRySA=="
Digest Processing, (c) 10/2014 Dimitrij R. Holovka
---- Nacitani parametru --- OK
Soubor keyStore: gpwebpay-pvk.jks
Heslo keyStore: Abcd1234
Alias privatniho klice: alias
Heslo privatniho klice: Abcd1234
Privatni klic: OK
Soubor publicKeyStore: gpe.signing_test.cer
Verejny klic: OK
URLEncoded podpis na vstupu: false
Provadet URLEncode na vystupu: false
Kodova stranka: UTF-8
Overeni podpisu pomoci verejneho klice:
Vysledek overeni: true
C:\Digest>