



# QuickStart Guide

PKCS#11 (R2)  
Linux

## Imprint

|                  |                                                                    |
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# 1 Introduction

PKCS#11 is the standard used to define a programming interface for security tokens such as smart-cards or hardware security modules. From the PKCS#11 viewpoint, a security token is a device that stores objects and can perform cryptographic functions. These objects may be keys or certificates. In addition, the objects can each have different attributes which not only define how you handle them but may also limit the areas in which they can be used.

This quick start guide describes how to install, configure and use PKCS#11 (R2) with the SafeGuard CryptoServer.

## 2 PKCS#11

This chapter describes the installation, configuration and the usage of PKCS#11 and it is divided into three further sections. The first describes the installation of the necessary files followed by the adjustment of the configuration files and finally how to use PKCS#11 basically. By means of examples finally it is shown how PKCS#11 can be put into operation.

### 2.1 Setup

The PKCS#11 applications, libraries, and configuration data is manually copied from the product CD to your operating system installation. The installation paths are based on standard installation locations of Linux. Deviations from the suggested installation locations are possible and for appropriate information on other options it is referred to *CryptoServer PKCS#11 Interface* [1]. Follow these steps to copy necessary files to your operating system:

1. Copy the *libcs2\_pkcs11.so* library file to */usr/lib*.
2. Copy the *cs2\_pkcs11.ini* configuration file to */etc/utimaco*.
3. Copy *p11tool* to */usr/bin*.

You can find the previous mentioned files on the product CD in path *Software\Linux\[x86-32|x86-64]\Crypto\APIs\PKCS*. Choose the correct architecture for the libraries and *p11tool* application which fits best for your operating system, either *x86-32* or *x86-64*. If you are uncertain about the architecture of your operating system, the next Linux command might help to determine this information:

```
# uname -a
```

The result of this command will look similar to the next output. The output illustrates a *x86\_64* architecture.

```
Linux nexus 2.6.35-32-server #64-Ubuntu SMP Tue Jan 3 02:11:24 UTC
2012 x86_64 GNU/Linux
```

It is recommend to use the same paths mentioned before as they are used in all documents addressing PKCS#11 environments. Make sure that the *p11tool* application has the right file permission to be executed before proceeding with the adjustment of the configuration file.

```
# chmod u+x /usr/bin/p11tool
```

## 2.2 Configuration

The PKCS#11 library requires an environment variable `CS2_PKCS11_INI` which refers to a necessary configuration file *cs2\_pkcs11.ini*. There are two options available to setup an environment variable:

- Create a temporarily environment variable

```
# export CS2_PKCS11_INI=/etc/utimaco/cs2_pkcs11.ini
```

- Create a permanent environment variable

Add a variable to the end of a users profile *.bashrc* file. This will permanently add the environment variable to each new bash shell the user opens.

```
...
```

```
export CS2_PKCS11_INI=/etc/utimaco/cs2_pkcs11.ini
```

A simple *cs2\_pkcs11.ini* looks like shown in listing 1. Adjust the device specifier parameter `<device>` according to your SafeGuard CryptoServer device you are going to use. A typical SafeGuard CryptoServer device specifier is an ip address or Linux device (e.g. */dev/cs2*). For more information to a SafeGuard CryptoServer device specifier it is referred to *SafeGuard CryptoServer - Administration Guide for CSADM* [2].

Listing 1: *cs2\_pkcs11.ini*

```
[Global]
```

```
Timeout = 5000
```

```
Logging = 0
```

```
Logpath = /tmp
```

```
[CryptoServer]
```

```
Device      = <device>
```

```
Timeout     = 600000
```

```
AppTimeout  = 1800
```

```
SlotCount   = 5
```

To check whether your adjustments are correct and the configuration is valid, use the next *p11tool* command to check this:

```
# p11tool listslots
```

If the configuration file is valid, *p11tool* shows a listing of available PKCS#11 slots.

```
0: 00000000
```

```
1: 00000001
```

```
2: 00000002
```

```
3: 00000003
```

```
4: 00000004
```

Listing 2: ListSlots

Otherwise you will retrieve an error message. Double check in this case your configuration settings and execute the previous command again.

## 2.3 Basic Usage

This chapter shows some useful *p11tool* commands you typically use to initialize a PKCS#11 and retrieve some information about the PKCS#11 token, slot and objects.

### 2.3.1 Slot Initialization

Before including a PKCS#11 slot into your application you need to initialize it. The initialization makes the slot ready to be used as key container and PKCS#11 cryptography interface.

```
# p11tool slot=<slotno> Label=<label_name> InitToken=<so_pin>
```

```
# p11tool slot=<slotno> LoginSO=<so_pin> InitPin=<user_pin>
```

The parameter *Label* is optional but sometimes useful because your application may rely on this identifier to find the right slot. Pin's should have a minimum length of four and can be of alphanumeric. The next example illustrates the initialization of slot zero which is found in lots of typical applications integration.

```
# p11tool slot=0 Label=Utimaco InitToken=12345678
```

```
# p11tool slot=0 LoginSO=12345678 InitPin=87654321
```

## 2.3.2 List Slots

This example shows how to list the available PKCS#11 slots. It does not show which PKCS#11 slot has been already initialized.

```
# p11tool ListSlots
```

```
0: 00000000
1: 00000001
2: 00000002
3: 00000003
4: 00000004
```

Listing 3: ListSlots

## 2.3.3 Show Token Information

To retrieve some more information about the PKCS#11 token the *GetTokenInfo* command can be used for this.

```
# p11tool GetTokenInfo
```

```
TokenInfo:
  label      43727970 746f5365 72766572 20504b43 |CryptoServer PKC|
             53313120 546f6b65 6e202020 20202020 |S11 Token       |
  manufacturerID 5574696d 61636f20 53616665 77617265 |Utimaco Safeware|
             20414720 20202020 20202020 20202020 |AG              |
  model      43727970 746f5365 72766572 20202020 |CryptoServer    |
  serialNumber 53653130 30302020 43533431 31393237 |Se1000 CS411927|

flags              : 0x0000064d
```

```

random number generator : yes
write protected         : no
login required           : yes
user pin initialized     : yes
restore key not needed   : no
clock on token           : yes
protected auth. path     : no
dual crypto operations   : yes
token initialized        : yes

user pin count low       : no
user pin final try       : no
user pin locked          : no
user pin to be changed   : no

S0 pin count low         : no
S0 pin final try         : no
S0 pin locked            : no
S0 pin to be changed     : no

Max Session Count        : 256
Sessions Open             : 0
RW Sessions Count        : 0

```

Listing 4: `GetTokenInfo`

### 2.3.4 Show Slot Information

The command *GetSlotInfo* displays the information about a specific PKCS#11 slot. Sometimes this is useful to get the current label of the token.

```
# p11tool slot=<slotno> GetSlotInfo
```

The following example retrieves detailed slot information from the PKCS#11 slot zero.

```
# p11tool slot=0 GetSlotInfo
```

```

-----
SlotID: 0x00000000
slotDescription 43727970 746f5365 72766572 20446576 |CryptoServer Dev|
69636520 2731302e 31372e34 2e313130 |ice '10.17.4.110|
27202d20 536c6f74 204e6f3a 20302020 |' - Slot No: 0 |
20202020 20202020 20202020 20202020 |
manufacturerID 5574696d 61636f20 53616665 77617265 |Utimaco Safeware|
20414720 20202020 20202020 20202020 | AG
flags           : 0x00000005
present         : yes
removable       : no
hardware        : yes
hardwareVersion : 0.0
firmwareVersion : 1.1

```

Listing 5: `GetSlotInfo`

### 2.3.5 Help Information

For further usage and context help information the *help* command of the *p11tool* can be used.



```
# p11tool help
```

```
@(#) p11tool - CryptoServer PKCS11 Adapter Administration Tool Version 1.4.6
```

```
Valid commands are:
```

```
Parameter:
```

|          |          |      |           |
|----------|----------|------|-----------|
| Dev=     | Device=  | Lib= | Password= |
| Slot=    | Timeout= | Id=  | Label=    |
| Subject= |          |      |           |

```
Basic Commands:
```

|      |       |             |         |
|------|-------|-------------|---------|
| Help | Help= | PrintError= | Version |
|------|-------|-------------|---------|

```
PKCS#11 Commands:
```

|              |              |            |             |
|--------------|--------------|------------|-------------|
| GetTokenInfo | GetSlotInfo  | ListSlots  | InitToken=  |
| InitPin=     | Login=       | LoginSO=   | SetPin=     |
| ListObjects  | DeleteObject | ImportP12= | ImportCert= |
| ExportCert   | ExportCert=  | GenKey=    |             |

```
Backup / Restore Commands:
```

|              |              |             |              |
|--------------|--------------|-------------|--------------|
| AuthRSASign= | AuthSHA1Pwd= | BackupSlot= | RestoreSlot= |
| DeleteSlot   |              |             |              |

```
Configuration Commands:
```

|            |            |
|------------|------------|
| ConfigGet= | ConfigSet= |
|------------|------------|

```
Use p11tool help=<command> to get further help
```

Listing 6: Help

Specific information to a *p11tool* command can be retrieved using the help command like this:

```
# p11tool help=<p11tool command>
```

For example:

```
# p11tool help=GetSlotInfo
```

Get Slot Information

Syntax:

```
[Slot=<number>] GetSlotInfo
```

## 3 PKCS#11 R2

This chapter describes the installation, configuration and the usage of PKCS#11 R2 and it is divided into three further sections. The first describes the installation of the necessary files followed by the adjustment of the configuration files and finally howto use PKCS#11 R2 basically. By means of examples finally it is shown how PKCS#11 R2 can be put into operation.

## 3.1 Setup

The PKCS#11 R2 applications, libraries, and configuration data is manually copied from the product CD to your operating system installation. The installation paths are based on standard installation locations of Linux. Deviations from the suggested installation locations are possible and for appropriate information on other options it is referred to *SafeGuard CryptoServer - PKCS#11 (R2) Development Guide* [4]. Follow these steps to copy necessary files to your operating system:

1. Copy the *libcs\_pkcs11\_R2.so* library file to */usr/lib*.
2. Copy the *cs\_pkcs11\_R2.cfg* configuration file to */etc/utimaco*.
3. Copy *p11tool2* to */usr/bin*.

You can find the previous mentioned files on the product CD in path *Software\Linux\[x86-32|x86-64]\Crypto\APIs\PKCS*. Choose the correct architecture for the libraries and *p11tool2* application which fits best for your operating system, either *x86-32* or *x86-64*. If you are uncertain about the architecture of your operating system, the next Linux command might help to determine this information:

```
# uname -a
```

The result of this command will look similar to the next output. The output illustrates a *x86\_64* architecture.

```
Linux nexus 2.6.35-32-server #64-Ubuntu SMP Tue Jan 3 02:11:24 UTC
2012 x86_64 GNU/Linux
```

It is recommended to use the same paths mentioned before as they are used in all documents addressing PKCS#11 R2 environments. Make sure that the *p11tool2* application has the right file permission to be executed before proceeding with the adjustment of the configuration file.

```
# chmod u+x /usr/bin/p11tool2
```

## 3.2 Configuration

The PKCS#11 R2 library requires an environment variable *CS\_PKCS11\_R2\_CFG* which refers to a necessary configuration file *cs\_pkcs11\_R2.cfg*. There are two options available to setup an environment variable:

- Create a temporarily environment variable

```
# export CS_PKCS11_R2_CFG=/etc/utimaco/cs_pkcs11_R2.cfg
```

- Create a permanent environment variable

Add a variable to the end of a users profile *.bashrc* file. This will permanently add the environment variable to each new bash shell the user opens.

...

```
export CS_PKCS11_R2_CFG=/etc/utimaco/cs_pkcs11_R2.cfg
```

A simple *cs\_pkcs11\_R2.cfg* looks like shown in listing 7. Adjust the device specifier parameter *<device>* according to your SafeGuard CryptoServer device you are going to use. A typical SafeGuard CryptoServer device specifier is an ip address or Linux device (e.g. */dev/cs2*). For more information to a SafeGuard CryptoServer device specifier it is referred to *SafeGuard CryptoServer - Administration Guide for CSADM* [2].

Listing 7: *cs\_pkcs11\_R2.cfg*

```
[Global]
# Path to the logfile (name of logfile is attached by the API)
Logpath = /tmp

# Loglevel (0 = NONE; 1 = ERROR; 2 = WARNING; 3 = INFO; 4 = TRACE)
Logging = 0

# Maximum size of the logfile in bytes (file is rotated with an
# backupfile if full)
Logsize = 1000000

# Created/Generated keys are stored in an external or internal
# database
KeysExternal = false

# If true, every session establishes its own connection
SlotMultiSession = false

# Maximum number of slots that can be used
```

```
SlotCount = 5

# If true, leading zeroes of decryption operations will be keep
KeepLeadZeros = false

# Prevents expiring session after inactivity of 15 minutes
KeepAlive = false

# Timeout of the open connection command in ms
ConnectionTimeout = 5000

# Timeout of command execution in ms
CommandTimeout = 60000

[CryptoServer]
# Device specifier
Device = <device>
```

To check whether your adjustments are correct and the configuration is valid, use the next *p11tool2* command to check this:

```
# p11tool2 listslots
```

If the configuration file is valid, *p11tool* shows a listing of available PKCS#11 slots.

```
0: 00000000
1: 00000001
2: 00000002
3: 00000003
4: 00000004
```

Listing 8: ListSlots

Otherwise you will retrieve an error message. Double check in this case your configuration settings and execute the previous command again.

## 3.3 Basic Usage

This chapter shows some useful *p11tool2* commands you typically use to initialize a PKCS#11 and retrieve some information about the PKCS#11 token, slot and objects.

### 3.3.1 Slot Initialization

Before including a PKCS#11 slot into your application you need to initialize it. The initialization makes the slot ready to be used as key container and PKCS#11 cryptography interface.

```
# p11tool2 slot=<slotno> \  
    Login=<administrative user>,<authentication token> \  
    Label=<label_name> InitToken=<so_pin>
```

```
# p11tool2 slot=<slotno> LoginSO=<so_pin> InitPin=<user_pin>
```

The parameter *Label* is optional but sometimes useful because your application may rely on this identifier to find the right slot. Pin's should have a minimum length of four and can be of alphanumeric. The parameter *Login* has changed in PKCS#11 R2. Formerly *Login* has been used as authentication parameter for the PKCS#11 user. In PKCS#11 R2 this parameter requires the name of a CryptoServer user with administrative privileges (e.g. default ADMIN user) and an authentication token. Further information to the new usage of parameter *Login* and *p11tool2*, it is referred to *SafeGuard CryptoServer - Manual for CryptoServer PKCS#11 Administration Tool Release 2* [3]. The next example illustrates the initialization of slot zero which is found in lots of typical applications integration.

```
# p11tool2 slot=0 \  
    Login=ADMIN,:cs2:cyb:USB0 \  
    Label=Utimaco InitToken=12345678  
  
# p11tool2 slot=0 LoginSO=12345678 InitPin=87654321
```

### 3.3.2 List Slots

This example shows how to list the available PKCS#11 slots. It does not show which PKCS#11 slot has been already initialized.

```
# p11tool2 ListSlots
```

```

0: 00000000
1: 00000001
2: 00000002
3: 00000003
4: 00000004

```

Listing 9: ListSlots

### 3.3.3 Show Token Information

To retrieve some more information about the PKCS#11 token the *GetTokenInfo* command can be used for this.

```
# p11tool2 GetTokenInfo
```

```
CK_TOKEN_INFO (slot ID: 0x00000000):
```

```

label          43727970 746f5365 72766572 20504b43 |CryptoServer PKC|
                53313120 546f6b65 6e202020 20202020 |S11 Token       |

manufacturerID 5574696d 61636f20 53616665 77617265 |Utimaco Safeware|
                20414720 20202020 20202020 20202020 | AG             |

model          43727970 746f5365 72766572 20202020 |CryptoServer    |

serialNumber    53653130 30302020 43533431 31393237 |Se1000 CS411927|

```

```
flags: 0x0000064d
```

```

CKF_RNG                : CK_TRUE
CKF_WRITE_PROTECTED    : CK_FALSE
CKF_LOGIN_REQUIRED     : CK_TRUE
CKF_USER_PIN_INITIALIZED : CK_TRUE
CKF_RESTORE_KEY_NOT_NEEDED : CK_FALSE
CKF_CLOCK_ON_TOKEN     : CK_TRUE
CKF_PROTECTED_AUTHENTICATION_PATH : CK_FALSE
CKF_DUAL_CRYPT_OPS     : CK_TRUE
CKF_TOKEN_INITIALIZED  : CK_TRUE
CKF_SECONDARY_AUTHENTICATION : CK_FALSE
CKF_USER_PIN_COUNT_LOW : CK_FALSE
CKF_USER_PIN_FINAL_TRY : CK_FALSE
CKF_USER_PIN_LOCKED   : CK_FALSE
CKF_USER_PIN_TO_BE_CHANGED : CK_FALSE
CKF_SO_PIN_COUNT_LOW  : CK_FALSE
CKF_SO_PIN_FINAL_TRY  : CK_FALSE
CKF_SO_PIN_LOCKED     : CK_FALSE
CKF_SO_PIN_TO_BE_CHANGED : CK_FALSE

```

```

ulMaxSessionCount : 256
ulSessionCount    : 0
ulMaxRwSessionCount : 256
ulRwSessionCount  : 0
ulMaxPinLen       : 255
ulMinPinLen       : 0
ulTotalPublicMemory : -1
ulFreePublicMemory : -1
ulTotalPrivateMemory : -1
ulFreePrivateMemory : -1

```

```

hardwareVersion      : 0.00
firmwareVersion      : 0.00

utcTime              32303132 30393231 31343038 34382e33 |20120921140848.3|

```

Listing 10: GetTokenInfo

### 3.3.4 Show Slot Information

The command *GetSlotInfo* displays the information about a specific PKCS#11 slot. Sometimes this is useful to get the current label of the token.

```
# p11tool2 slot=<slotno> GetSlotInfo
```

The following example retrieves detailed slot information from the PKCS#11 slot zero.

```
# p11tool2 slot=0 GetSlotInfo
```

```
CK_SLOT_INFO (slot ID: 0x00000000):
```

```

slotDescription      43727970 746f5365 72766572 20446576 |CryptoServer Dev|
                     69636520 2731302e 31372e34 2e313130 |ice '10.17.4.110|
                     27202d20 534c4f54 5f303030 30202020 |' - SLOT_0000 |
                     20202020 20202020 20202020 20202020 |
                     |
manufacturerID       5574696d 61636f20 53616665 77617265 |Utimaco Safeware|
                     20414720 20202020 20202020 20202020 | AG |
                     |

flags: 0x00000005
  CKF_TOKEN_PRESENT   : CK_TRUE
  CKF_REMOVABLE_DEVICE : CK_FALSE
  CKF_HW_SLOT         : CK_TRUE

hardwareVersion       : 0.00
firmwareVersion       : 0.00

```

Listing 11: GetSlotInfo

### 3.3.5 Help Information

For further usage and context help information the *help* command of the *p11tool* can be used.

```
# p11tool2 help
```

```
@(#) p11tool2 - CryptoServer PKCS#11 Administration Tool Release 2 Version 2.0.1
```

```
Valid commands are:
```

```
Parameter:
```

```

Lib=                Slot=                Label=
Id=                 Subject=              KeyAttr=
PubKeyAttr=         PrvKeyAttr=           CertAttr=
Force=

```

```
Basic Commands:
```

```

Help[=]             PrintError=          Version

```

## PKCS#11 Commands:

|              |                  |               |
|--------------|------------------|---------------|
| ListSlots    | GetInfo          | GetSlotInfo   |
| GetTokenInfo | InitToken=       | LoginSO=      |
| LoginUser=   | Login=           | InitPIN=      |
| SetPIN=      | ListObjects      | DeleteObject  |
| ImportP12=   | ImportCert=      | ExportCert[=] |
| GenerateKey= | GenerateKeyPair= |               |

## Backup/Restore Commands:

|                |                      |                      |
|----------------|----------------------|----------------------|
| GetBackupInfo= | BackupInternalKeys=  | BackupExternalKeys=  |
| BackupConfig=  | RestoreInternalKeys= | RestoreExternalKeys= |
| RestoreConfig= | DeleteSO             |                      |

## Configuration Commands:

|                  |                 |                  |
|------------------|-----------------|------------------|
| ListConfig       | GetLocalConfig= | GetGlobalConfig= |
| SetGlobalConfig= | GetSlotConfig=  | SetSlotConfig=   |

Use `p11tool2 help=<command>` to get further help.

Listing 12: Help

Specific information to a *p11tool2* command can be retrieved using the help command like this:

```
# p11tool2 help=<p11tool2 command>
```

For example:

```
# p11tool2 help=GetSlotInfo
```

## SYNTAX

```
p11tool2 [Lib=<lib_path>] [Slot=<slot_id>] GetSlotInfo
```

## DESCRIPTION

Get information about a specific slot

## PARAMETER

```
lib_path
    path to the PKCS#11 shared library to be loaded
    default: the built-in CryptoServer PKCS#11 Library Release 2 will be
    used.

slot_id
    ID of the slot as number
    default: 0
```

## EXAMPLE

Get information about the slot with ID = 1

```
p11tool2 Slot=1 GetSlotInfo
```



## 4 Further Information

This document forms a part of the information and support which is provided by the Utimaco Safeware. Additional documentation can be found on the product CD in the documentation directory.

All SafeGuard CryptoServer product documentation is also available at the Utimaco Safeware website: <http://hsm.utimaco.com>

## References

- [1] UTIMACO SAFEWARE AG. *CryptoServer PKCS#11 Interface*, 2011. 2006-0003.
- [2] UTIMACO SAFEWARE AG. *SafeGuard CryptoServer - Administration Guide for CSADM*, 2011. 2009-0003.
- [3] UTIMACO SAFEWARE AG. *SafeGuard CryptoServer - Manual for CryptoServer PKCS#11 Administration Tool Release 2*, 2012. 2012-0004.
- [4] UTIMACO SAFEWARE AG. *SafeGuard CryptoServer - PKCS#11 (R2) Development Guide*, 2012. 2012-0007.





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