FEITIAN

iR301-U Smart Card Reader

Developer Guide

Revision History:

Date	Revision	Description
Jul. 2012	V1.0	Release of the first version
Mar. 2013	V1.1	Release of the second version
April. 2014	V1.2	Release of the third version
May, 2014	V1.3	Fixed describe error in FtDukptSetEncMod API
June 4, 2014	V1.4	Add background running support

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Contents

Chapter 1. Overview

This chapter describes how to develop iR301U reader applications, including the development interfaces supported by the product (iR301U) and how to develop applications based on these interfaces.

FEITIAN iR301-U is specially engineered to accommodate a range of smart card applications. Developers use it as a platform to generate and deploy related products and services. Moreover, FEITIAN iR301-U is a terminal unit which is seamlessly integrated to all major systems of operation. Additional features such as the built-in inclusive support for different smart card interfaces has facilitated the wide scale and cross industry adoption of iR301-U.

iR301-U suits customers where security concerns are the most salient and satisfies the demand for a flexible solution for ID authentication, e-commerce, e-payment, information security and access control.

iR301-U and the rest of FEITIAN's line of smart card readers offer each customer a complete solution for all manner of utilizations.

Chapter 2. New features

The new reader has been published, included key management and data space.

New features:

1. More security

    DUKPT (Derived Unique Key Per Transaction) is a key management scheme in which for every transaction, a unique key is used which is derived from a fixed key. Therefore, if a derived key is compromised, future and past transaction data are still protected since the next or prior keys cannot be determined easily. DUKPT is specified in ANSI X9.24 part 1.

    The security standard defines card data of chip card can't be in iOS. Card reader device must be encrypting all transfer information before sending to iOS.

2. Supported 256bytes data space for customer, customer can through API to write/read data from reader.

We through below picture to give customer a clear concept of DUKPT:

http://en.wikipedia.org/wiki/DUKPT

Chapter 3. Definitions

Error codes

The following is a list of commonly used errors. Since different cards produce different errors they must map over to these error messages.

SCARD_S_SUCCESS

SCARD_E_INVALID_VALUE

SCARD_E_INVALID_PARAMETER

SCARD_E_INVALID_HANDLE

SCARD_E_INSUFFICIENT_BUFFER

SCARD_E_NO_SMARTCARD

SCARD_E_READER_UNAVAILABLE

SCARD_E_UNSUPPORTED_FEATURE

SCARD_F_COMM_ERROR

SCARD_E_NOT_TRANSACTED

Chapter 4. API Reference

3.1 SCardEstablishContext

Synopsis:

#include <winscard.h>

LONG SCardEstablishContext(DWORD dwScope,

    /*@unused@*/ LPCVOID pvReserved1,

    /*@unused@*/ LPCVOID pvReserved2,

    LPSCARDCONTEXT phContext);

Parameters:

dwScope   IN   Scope of the establishment

pvReserved1   unused

pvReserved2   unused

phContext   OUT   Returned reference to this connection

Description:

This function creates a communication context to the PC/SC Resource Manager. This must be the first function called in a PC/SC application.

Value of dwScope Meaning

    SCARD_SCOPE_USER   Not used

    SCARD_SCOPE_TERMINAL   Not used

    SCARD_SCOPE_GLOBAL   Not used

    SCARD_SCOPE_SYSTEM   Services on the local machine

Example:

SCARDCONTEXT   hContext;

LONG   rv;

rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);

Returns:

SCARD_S_SUCCESS   Successful

SCARD_E_INVALID_VALUE   Invalid scope type passed

SCARD_E_INVALID_PARAMETER   Invalid parameter

3.2SCardListReaders

Synopsis:

#include <winscard.h>
LONG SCardListReaders(SCARDCONTEXT hContext,
  /*@null@*/ /*@out@*/ LPCSTR mszGroups,
  /*@null@*/ /*@out@*/ LPSTR mszReaders,
  /*@out@*/ LPDWORD pcchReaders);

Parameters:

hContext	IN	Connection context to the PC/SC Resource Manager
mszGroups	IN	List of groups to list readers (not used)
mszReaders	OUT	Multi-string with list of readers
pcchReaders	OUT	Size of multi-string buffer including NULL's

Description:

This function returns a list of currently available readers on the system. mszReaders is a pointer to a character string that is allocated by the application. If the application sends mszGroups and mszReaders as NULL then this function will return the size of the buffer needed to allocate in pcchReaders. The reader names is a multi-string and separated by a nul character ('\0') and ended by a double null character. "Reader A\0Reader B\0\0".

Example:

SCARDCONTEXT hContext;
LPSTR   mszReaders;
DWORD   dwReaders;
LONG   rv;
rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);
rv = SCardListReaders(hContext, NULL, NULL, &dwReaders);
mszReaders = malloc(sizeof(char)*dwReaders);
rv = SCardListReaders(hContext, NULL, mszReaders, &dwReaders);

Returns:

SCARD_S_SUCCESS	Successful
SCARD_E_INVALID_HANDLE	Invalid Scope Handle
SCARD_E_INSUFFICIENT_BUFFER	Reader buffer not large enough
SCARD_E_INVALID_PARAMETER	Invalid parameter

3.3 SCardConnect

Synopsis:

#include <winscard.h>
LONG SCardConnect(SCARDCONTEXT hContext,
  LPCSTR szReader,
  DWORD dwShareMode,
  DWORD dwPreferredProtocols,
  LPSCARDHANDLE phCard,

LPDWORD pdwActiveProtocol);

Parameters:

hContext	IN	Connection context to the PC/SC Resource Manager
szReader	IN	Reader name to connect to
dwShareMode	IN	Mode of connection type: exclusive or shared
dwPreferredProtocols	IN	Desired protocol use
phCard	OUT	Handle to this connection
pdwActiveProtocol	OUT	Established protocol to this connection.

Description:

This function establishes a connection to the friendly name of the reader specified in szReader. The first connection will power up and perform a reset on the card. Value of dwShareMode Meaning

SCARD_SHARE_SHARED This application will allow others to share the reader

SCARD_SHARE_EXCLUSIVE This application will NOT allow others to share the reader

SCARD_SHARE_DIRECT Direct control of the reader, even without a card

SCARD_SHARE_DIRECT can be used before using SCardControl() to send control commands to the reader even if a card is not present in the reader.

Value of dwPreferredProtocols Meaning

SCARD_PROTOCOL_T0 Use the T=0 protocol

SCARD_PROTOCOL_T1 Use the T=1 protocol

SCARD_PROTOCOL_RAW Use with memory type cards

dwPreferredProtocols is a bit mask of acceptable protocols for the connection. You can use (SCARD_PROTOCOL_T0 | SCARD_PROTOCOL_T1) if you do not have a preferred protocol.

Example:

```
SCARDCONTEXT       hContext;
SCARDHANDLE      hCard;
DWORD             dwActiveProtocol;
LONG              rv;
rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);
rv = SCardConnect(hContext, "Reader X", SCARD_SHARE_SHARED,
SCARD_PROTOCOL_T0, &hCard, &dwActiveProtocol);
```

Returns:

SCARD_S_SUCCESS	Successful
SCARD_E_INVALID_HANDLE	Invalid hContext handle
SCARD_E_INVALID_PARAMETER	Invalid parameter
SCARD_E_NO_SMARTCARD	no smart card
SCARD_E_READER_UNAVAILABLE	Could not power up the reader or card
SCARD_E_UNSUPPORTED_FEATURE	Protocol not supported

3.4 SCardStatus

Synopsis:

#include <winscard.h>

LONG SCardStatus(SCARDHANDLE hCard,

  LPSTR mszReaderNames,

  LPDWORD pcchReaderLen,

  LPDWORD pdwState,

  LPDWORD pdwProtocol,

  LPBYTE pbAtr,

  LPDWORD pcbAtrLen);

Parameters:

hCard	IN	Connection made from SCardConnect
mszReaderNames	IN OUT	Friendly name of this reader
pcchReaderLen	IN OUT	Size of the szReaderName multistring
pdwState	OUT	Current state of this reader
pdwProtocol	OUT	Current protocol of this reader
pbAtr	OUT	Current ATR of a card in this reader
pcbAtrLen	OUT	Length of ATR

Description:

This function returns the current status of the reader connected to by hCard. It's friendly name will be stored in mszReaderNames. pcchReaderLen will be the size of the allocated buffer for mszReaderNames, while pcbAtrLen will be the size of the allocated buffer for pbAtr. If either of these is too small, the function will return with SCARD_E_INSUFFICIENT_BUFFER and the necessary size in pcchReaderLen and pcbAtrLen. The current state, and protocol will be stored in pdwState and pdwProtocol respectively. pdwState is a DWORD possibly OR'd with the following values:

Value of pdwState Meaning

SCARD_ABSENT	There is no card in the reader
SCARD_PRESENT	There is a card in the reader, but it has not been moved into position for use
SCARD_SWALLOWED	There is a card in the reader in position for use. The card is not powered
SCARD_POWERED	Power is being provided to the card, but the reader driver is unaware of the mode of the card
SCARD_NEGOTIABLE	The card has been reset and is awaiting PTS negotiation
SCARD_SPECIFIC	The card has been reset and specific communication protocols have been established

Value of pdwProtocol Meaning

SCARD_PROTOCOL_T0	Use the T=0 protocol
SCARD_PROTOCOL_T1	Use the T=1 protocol

Example:

SCARDCONTEXT hContext;

SCARDHANDLE hCard;

```
DWORD            dwActiveProtocol;
DWORD            dwState, dwProtocol, dwAtrLen, dwReaderLen;
BYTE             pbAtr[MAX_ATR_SIZE];
rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);
rv = SCardConnect(hContext, "Reader X", SCARD_SHARE_SHARED,
SCARD_PROTOCOL_T0, &hCard, &dwActiveProtocol);
dwAtrLen = sizeof(pbAtr);
rv=SCardStatus(hCard, NULL, &dwReaderLen, &dwState, &dwProtocol,pbAtr, &dwAtrLen);
```

Returns:

SCARD_S_SUCCESS	Successful
SCARD_E_INSUFFICIENT_BUFFER	Not enough allocated memory for mszReaderNames or for pbAtr

3.5 SCardGetAttrib

Synopsis:
```
#include <winscard.h>
LONG SCardGetAttrib(SCARDHANDLE hCard,
      DWORD dwAttrId,
      LPBYTE pbAttr,
      LPDWORD pcbAttrLen);
```

Parameters:

hCard	IN	Connection made from SCardConnect
dwAttrId	IN	Identifier for the attribute to get
pbAttr	OUT	Pointer to a buffer that receives the attribute
pcbAttrLen	IN/OUT	Length of the pbAttr buffer in bytes

Description:
This function get an attribute from the IFD Handler. The list of possible attributes is:
• SCARD_ATTR_ATR_STRING

Example:
```
LONG            rv;
SCARDCONTEXT    hContext;
SCARDHANDLE     hCard;
DWORD           dwActiveProtocol;
unsigned char   pbAtr[MAX_ATR_SIZE];
DWORD           dwAtrLen;
rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);
rv = SCardConnect(hContext, "Reader X", SCARD_SHARE_SHARED,
SCARD_PROTOCOL_RAW &hCard, &dwActiveProtocol);
rv = SCardGetAttrib(hCard, SCARD_ATTR_ATR_STRING, pbAtr, &dwAtrLen);
```

Returns:

SCARD_S_SUCCESS   Successful
SCARD_E_INVALID_HANDLE   Invalid hCard handle
SCARD_E_INVALID_PARAMETER   Invalid parameter
SCARD_E_INSUFFICIENT_BUFFER   receive buffer not large enough
SCARD_E_NOT_TRANSACTED   Data exchange not successful
SCARD_E_SHARING_VIOLATION   Someone else has exclusive rights
SCARD_E_READER_UNAVAILABLE   The reader has been removed

3.6 SCardTransmit

Synopsis:
#include <winscard.h>
LONG SCardTransmit(SCARDHANDLE hCard,
        const SCARD_IO_REQUEST *pioSendPci,
        LPCBYTE pbSendBuffer,
        DWORD cbSendLength,
        SCARD_IO_REQUEST *pioRecvPci,
        LPBYTE pbRecvBuffer,
        LPDWORD pcbRecvLength);

Parameters:

hCard   IN   Connection made from SCardConnect
pioSendPci   IN/OUT   Structure of protocol information
pbSendBuffer   IN   APDU to send to the card
cbSendLength   IN   Length of the APDU
pioRecvPci   IN/OUT   Structure of protocol information
pbRecvBuffer   OUT   Response from the card
pcbRecvLength   IN/OUT   Length of the response

Description:
This function sends an APDU to the smart card contained in the reader connected to by SCardConnect(). The card responds from the APDU and stores this response in pbRecvBuffer and it's length in SpcbRecvLength. SSendPci and SRecvPci are structures containing the following:
typedef struct {
        DWORD dwProtocol; /* SCARD_PROTOCOL_T0 or SCARD_PROTOCOL_T1 */
        DWORD cbPciLength; /* Length of this structure - not used */
} SCARD_IO_REQUEST;
Value of pioSendPci Meaning
SCARD_PCI_T0   Pre-defined T=0 PCI structure
SCARD_PCI_T1   Pre-defined T=1 PCI structure

Example:

LONG   rv;

SCARDCONTEXT   hContext;

SCARDHANDLE   hCard;

DWORD   dwActiveProtocol, dwSendLength, dwRecvLength;

SCARD_IO_REQUEST   pioRecvPci;

BYTE   pbRecvBuffer[10];

BYTE   pbSendBuffer[] = { 0xC0, 0xA4, 0x00, 0x00, 0x02, 0x3F, 0x00 };

rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);

rv = SCardConnect(hContext, "Reader X", SCARD_SHARE_SHARED,

      SCARD_PROTOCOL_T0, &hCard, &dwActiveProtocol);

dwSendLength = sizeof(pbSendBuffer);

dwRecvLength = sizeof(pbRecvBuffer);

rv = SCardTransmit(hCard, SCARD_PCI_T0, pbSendBuffer, dwSendLength,

&pioRecvPci, pbRecvBuffer, &dwRecvLength);

Returns:

SCARD_S_SUCCESS	Successful
SCARD_E_INVALID_HANDLE	Invalid hCard handle
SCARD_E_INSUFFICIENT_BUFFER	receive buffer not large enough
SCARD_E_NOT_TRANSACTED	Data exchange not successful
SCARD_E_INVALID_PARAMETER	invalid parameter
SCARD_E_INVALID_VALUE	Invalid Protocol, reader name, etc

3.7 SCardGetStatusChange

Synopsis:

#include <winscard.h>

LONG SCardGetStatusChange(SCARDCONTEXT hContext,

      DWORD dwTimeout,

      LPSCARD_READERSTATE rgReaderStates,

      DWORD cReaders);

Parameters:

hContext	IN	Connection context to the PC/SC Resource Manager
dwTimeout	IN	Maximum waiting time (in miliseconds) for status change, zero (or INFINITE) for infinite
rgReaderStates	IN/OUT	Structures of readers with current states
cReaders	IN	Number of structures

Description:

This function blocks execution until the current availability of the cards in a specific set of readers changes.

The caller supplies a list of readers to be monitored through an $\mathrm{SCARD\_READERSTATE}$ array and the maximum amount of time, in seconds, that it is willing to wait for an action to occur on one of the listed readers. The function returns when there is a change in availability, having filled in the *dwEventState* members of the **SCARD_READERSTATE** structures appropriately.

Example:
```
SCARDCONTEXT          hContext;
SCARD_READERSTATE_A      rgReaderStates[1];
LONG      rv;
rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);
rgReaderStates[0].szReader = "Reader X";
rgReaderStates[0].dwCurrentState = SCARD_STATE_UNAWARE;
rv = SCardGetStatusChange(hContext, INFINITE, rgReaderStates, 1);
printf("reader state: 0x%04X\n", rgReaderStates[0].dwEventState);
```

Returns:

SCARD_S_SUCCESS	Successful
SCARD_E_READER_UNAVAILABLE	The reader is unavailable

3.8 SCardDisconnect

Synopsis:
```
#include <winscard.h>
LONG SCardDisconnect(SCARDHANDLE hCard,
     DWORD dwDisposition);
```

Parameters:

hCard	IN	Connection made from SCardConnect
dwDisposition	IN	Reader function to execute

Description:

This function terminates a connection to the connection made through SCardConnect.

dwDisposition can have the following values:

Value of dwDisposition Meaning

SCARD_LEAVE_CARD	Do nothing
SCARD_RESET_CARD	Reset the card (warm reset)
SCARD_UNPOWER_CARD	Unpower the card (cold reset)
SCARD_EJECT_CARD	Eject the card

Example:
```
SCARDCONTEXT hContext;
```

SCARDHANDLE hCard;

DWORD dwActiveProtocol;

LONG rv;

rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);

rv = SCardConnect(hContext, "Reader X", SCARD_SHARE_SHARED,

SCARD_PROTOCOL_T0, &hCard, &dwActiveProtocol);

rv = SCardDisconnect(hCard, SCARD_UNPOWER_CARD);

Returns:

SCARD_S_SUCCESS   Successful

SCARD_E_INVALID_HANDLE   Invalid hCard handle

SCARD_E_INVALID_VALUE   Invalid dwDisposition

3.9 SCardReleaseContext

Synopsis:

#include <winscard.h>

LONG SCardReleaseContext(SCARDCONTEXT hContext);

Parameters:

hContext   IN   Connection context to be closed

Description:

This function destroys a communication context to the PC/SC Resource Manager. This must be the last function called in a PC/SC application.

Example:

SCARDCONTEXT   hContext;

LONG   rv;

rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);

rv = SCardReleaseContext(hContext);

Returns:

SCARD_S_SUCCESS   Successful

SCARD_E_INVALID_HANDLE   Invalid hContext handle

4.0 FtGetSerialNum(private interface)

Synopsis:

#include <winscard.h>

LONG FtGetSerialNum(unsigned int reader_index,

```
        unsigned int    length,
        char * buffer);
```

Parameters:

reader_index	IN	reader index
length	IN	length of buffer(>=8)
buffer	OUT	Serial number

Description:

This function userd to get serial number of reader.

Example:

```
SCARDCONTEXT       hContext;
SCARDHANDLE        hCard;
DWORD              dwActiveProtocol;
LONG               rv;
Char               buffer[20] = {0};
rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);
rv = SCardConnect(hContext, "Reader X", SCARD_SHARE_SHARED,
SCARD_PROTOCOL_T0, &hCard, &dwActiveProtocol);
rv = FtGetSerialNum(0, sizeof(buffer), buffer);
```

Returns:

SCARD_S_SUCCESS	Successful
SCARD_F_COMM_ERROR	Get serial Num failed
SCARD_E_INVALID_PARAMETER	Invalid parameter

4.1 FtWriteFlash   (private interface)

Synopsis:

```
#include <winscard.h>
LONG FtWriteFlash(unsigned int reader_index,
     unsigned char bOffset,
     unsigned char blength,
     unsigned char buffer[]);
```

Parameters:

reader_index	IN	reader index
bOffset	IN	Offset of flash to write
blength	IN	The length of data
buffer	IN	The data for write

Description:

This function userd to write data to flash.

Example:
SCARDCONTEXT   hContext;
SCARDHANDLE   hCard;
DWORD   dwActiveProtocol;
LONG   rv;
unsigned char buffer[255] ={0};
rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);
rv = SCardConnect(hContext, "Reader X", SCARD_SHARE_SHARED,SCARD_PROTOCOL_T0, &hCard,
&dwActiveProtocol);
for (int i=0; i< 255; i++) {
      buffer[i]= i;
}
rv = FtWriteFlash(0, 0,255, buffer);

Returns:
SCARD_S_SUCCESS   Successful
SCARD_F_COMM_ERROR   write data   failed
SCARD_E_INVALID_PARAMETER   Invalid parameter

4.2 FtReadFlash(private interface)

Synopsis:
#include <winscard.h>
LONG FtReadFlash(unsigned int reader_index,
      unsigned char bOffset,
      unsigned char blength,
      unsigned char buffer[]);

Parameters:
reader_index   IN   reader index
bOffset   IN   Offset of flash to write
blength   IN   The length of read data
buffer   OUT   The read data

Description:
This function used to read data from flash.

Example:
SCARDCONTEXT   hContext;
SCARDHANDLE   hCard;
DWORD   dwActiveProtocol;

```
LONG               rv;
unsigned char buffer[255] ={0};
rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);
rv = SCardConnect(hContext, "Reader X", SCARD_SHARE_SHARED, SCARD_PROTOCOL_T0, &hCard,
&dwActiveProtocol);
rv = FtReadFlash (0, 0,255, buffer);
```

Returns:

SCARD_S_SUCCESS   Successful
SCARD_F_COMM_ERROR   write data failed
SCARD_E_INVALID_PARAMETER   Invalid parameter

4.3 FtSetTimeout (private interface)

Synopsis:

```
#include <winscard.h>
LONG FtSetTimeout (SCARDCONTEXT hContext,
      DWORD dwTimeout)
```

Parameters:

SCARDCONTEXT   IN   Connection context to the PC/SC Resource Manager
DWORD   IN   dwTimeou   New transmission timeout value of between 301 and card (millisecond)
t (the unit value is "s")

Description:

This function use to set timeout, the default time out is 6 s.
When you using this function, the   dwTimeout value must be higher than 1s.
The function New transmission timeout value of between 301 and card.

Example:

```
SCARDCONTEXT       hContext;
DWORD             dwTimeout;
LONG               rv;
unsigned char buffer[255] ={0};
rv = SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL, &hContext);
rv = SCardConnect(hContext, "Reader X", SCARD_SHARE_SHARED, SCARD_PROTOCOL_T0, &hCard,
&dwActiveProtocol);
rv = FtSetTimeout (hContext, 6);
```

Returns:

SCARD_S_SUCCESS   Successful
SCARD_F_COMM_ERROR   write data failed
SCARD_E_INVALID_PARAMETER   Invalid parameter

4.4 FtDukptInit (private interface)

Synopsis:
#include <winscard.h>
LONG FtDukptInit(SCARDHANDLE hCard,
                    unsigned char *encBuf,
                    unsigned int nLen);

Parameters:
hCard   IN   Connection made from SCardConnect(Ignore this parameter and just set to zero in iOS system)
encBuf   IN   Ciphertext use TDES_ECB_PKCS7/AES_ECB_PKCS7 (See "Key C"), the data is
IPEK+KSN+0XFFFF+CRC
nLen   IN   encBuf length(40(TDES_ECB_PKCS7 ciphertext length) 48(AES_ECB_PKCS7 ciphertext length))

Description:
Init iR301 new ipek and ksn for dukpt.
The IPEK is based on computer between KSN (Key Serial Number) and BDK(Base Derivation Key). More
information, please follow below documents.
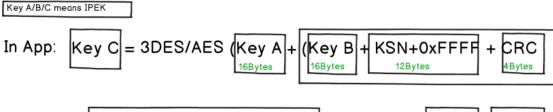Section DUKPT http://download.ftsafe.com/files/reader/ANSIX9.24PART1-2004.pdf
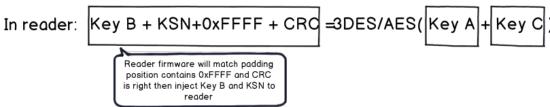
Here is a solution of init DUKPT:

1. the reader will set default key once out of factory, the default key is 16bytes filled by 0xFF.
2. You can through inject key tool use below solution to update key.

Key A means default key(16bytes filled by 0xFF) once out of factory.
Key B means your key.

In application, use key A as master key through 3DES arithmetic to encryption and get Key C.

Key A/B/C means IPEK

In App: Key C = 3DES/AES (Key A + (Key B + KSN+0xFFFF + CRC
                          16Bytes   16Bytes   12Bytes   4Bytes

In reader: Key B + KSN+0xFFFF + CRC =3DES/AES(Key A + Key C)

Reader firmware will match padding
position contains 0xFFFF and CRC
is right then inject Key B and KSN to
reader

Example:
Please refer in FtDukptGetKSN example

4.5 FtDukptSetEncMod (private interface)

Synopsis:

#include <winscard.h>
LONG FtDukptSetEncMod(SCARDHANDLE hCard,unsigned int bEncrypt,unsigned int bEncFunc,

unsigned int bEncType)

Parameters:

hCard   [IN] Connection made from SCardConnect(Ignore this parameter and just set to zero in iOS system)

bEncrypt   [IN] 0: Non- encrypted communication   1: Encrypted communication

bEncFunc   [IN] 0:using 3DES to encryption 1:using AES to encryption

bEncType   [IN] 0:Two ways to encryption(send and return data) 1: one-way encryption(only return data
encrypted

Description:

To set DUKPT's encryption mode

Ntice:Only can set this mode when power off from card.,

Example:

Please refer in FtDukptGetKSN example

4.6 FtDukptGetKSN(private interface)

#include <winscard.h>

LONG FtDukptGetKSN(SCARDHANDLE hCard, unsigned int * pnlength,unsigned char *buffer)

Parameters:

hCard   [IN] Connection made from SCardConnect(Ignore this parameter and just set to zero in iOS system)

pnlength   [IN/OUT] KSN's length

buffer   [IN/OUT] KSN

Description:

To get reader's KSN ,

Example:

```
    void derive_IPEK(BYTE *bdk, BYTE *ksn, BYTE *ipek);

    void derive_PEK(BYTE *ipek, BYTE *ksn, BYTE *pek);

    int  TDES_ECB_PKCS7(unsigned char *inBuf, unsigned int inLen, unsigned char *outBuf,
unsigned  int *outLen, unsigned char *key,unsigned  int keyLen, int mode);

    int  AES_ECB_PKCS7(unsigned char *inBuf, unsigned int inLen, unsigned char *outBuf,
unsigned  int *outLen, unsigned char *key,unsigned  int keyLen, int mode);


    #define MODE_ENCRYPT            1

    #define MODE_DECRYPT            0


    static unsigned int crc_table[256];


    static void init_crc_table(void);

    static unsigned int crc32(unsigned int crc, unsigned char * buffer, unsigned int size);


    /*init crc table*/

    static void init_crc_table(void)

    {

        unsigned int c;

        unsigned int i, j;

        for (i = 0; i < 256; i++) {

            c = (unsigned int)i;

            for (j = 0; j < 8; j++) {

                if (c & 1)

                    c = 0xedb88320L ^ (c >> 1);

                else

                    c = c >> 1;

            }
```

```
        crc_table[i] = c;

    }

}

/*Calculate crc*/

static unsigned int crc32(unsigned int crc,unsigned char *buffer, unsigned int size)

{

    unsigned int i;

    for (i = 0; i < size; i++) {

        crc = crc_table[(crc ^ buffer[i]) & 0xff] ^ (crc >> 8);

    }

    return crc ;

}

static void i2dw(int value, unsigned char buffer[])

{

    buffer[0] = value & 0xFF;

    buffer[1] = (value >> 8) & 0xFF;

    buffer[2] = (value >> 16) & 0xFF;

    buffer[3] = (value >> 24) & 0xFF;

} /* i2dw */


unsigned char BDKBuffer[64]="\x01\x23\x45\x67\x89\xAB\xCD\xEF

\xFE\xDC\xBA\x98\x76\x54\x32\x10";

unsigned char KSNBuffer[64]="\xff\xff\x98\x76\x54\x32\x10\xe0\x00\x00";

unsigned int KSNLength=0;

unsigned char IPEK[16]={0};

unsigned char PEK[16]={0};

unsigned                                                              char
OLDIPEK[16]="\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff\xff

\xff\xff";

unsigned char encBuffer[64]={0};
```

```
unsigned char unencBuffer[64]={0};

unsigned int encLength=0;

unsigned char SendBuffer[5]="\x00\x84\x00\x00\x08";

unsigned int SendLength = sizeof(SendBuffer);

unsigned char ReBuffer[512]={0};

unsigned int ReLength = sizeof(ReBuffer);

unsigned int CRC=0xffffffff;

LONG ReturnValue=0;


BOOL encType=FALSE;

BOOL encFunc=TRUE;

BOOL encCrypt=TRUE;


if(16!=strlen(BDKBuffer)){

    printf("BDK data's format is error.\n");

}

if(10!=strlen(KSNBuffer)){

    printf("KSN data's format is error.\n");

}

derive_IPEK(BDKBuffer, KSNBuffer, IPEK);

KSNBuffer[7]= KSNBuffer[7]&0xE0;

KSNBuffer[8]=0x00;

KSNBuffer[9]=0x00;

memcpy(unencBuffer,IPEK,16);

memcpy(unencBuffer+16,KSNBuffer,10);

unencBuffer[26]=0xFF;

unencBuffer[27]=0xFF;


init_crc_table();
```

```
CRC=crc32(CRC, unencBuffer,28);

i2dw(CRC, unencBuffer+28);


//Thde default encryption mode is 3DES

TDES_ECB_PKCS7(unencBuffer,32, encBuffer, &encLength, OLDIPEK,16, MODE_ENCRYPT);

ReturnValue=FtDukptInit(0, encBuffer, encLength);

if(ReturnValue!=0){

    printf("FtDukptInit error %08x\n", ReturnValue);

}

ReturnValue =FtDukptSetEncMode(0, encrypt, encFunc, encType);

if(ReturnValue!=0){

    printf("FtDukptSetEncMode error %08x\n", ReturnValue);

}

if(encrypt&& encType==FALSE){

    memset(KSNBuffer,0,sizeof(KSNBuffer));

memset(IPEK,0,sizeof(IPEK));

    ReturnValue =FtDukptGetSN(0,&KSNLength,KSNBuffer)

    if(ReturnValue!=0){

        printf("FtDukptGetSN error %08x\n", ReturnValue);

}

    derive_IPEK(BDKBuffer,KSNBuffer,IPEK);

derive_PEK(IPEK, KSNBuffer,PEK);

if(encFunc){

        AES_ECB_PKCS7(SendBuffer,5, ReBuffer, &ReLength, PEK,16, MODE_ENCRYPT);

}else{

        TDES_ECB_PKCS7(SendBuffer,5, ReBuffer,& ReLength,PEK,16, MODE_ENCRYPT);

}

Memcpy(SendBuffer, ReBuffer, ReLength);

    }
```

```
    SCARD_IO_REQUEST pioSendPci

    ReturnValue=SCardTransmit(gCardHandle,&pioSendPci,SendBuffer,ReLength,NULL,ReBuf
fer,

    &ReLength);

    if(ReturnValue != SCARD_S_SUCCESS){

        printf("SCardTransmit error %08x\n", ReturnValue);

    }else{

        if(encrypt && ReLength >10){

            memset(IPEK,0,sizeof(IPEK));

            memset(PEK,0,sizeof(PEK));

            memset(KSNBuffer,0,sizeof(KSNBuffer));

            memcpy(KSNBuffer,ReBuffer+ReLength-10,10);

            derive_IPEK(BDKBuffer,KSNBuffer,IPEK);

    derive_PEK(IPEK, KSNBuffer,PEK);

    if(encFunc){

        AES_ECB_PKCS7(ReBuffer,    ReLength,    SendBuffer,    &ReLength,    PEK,16,
MODE_DECRYPT);

    }else{

        TDES_ECB_PKCS7(ReBuffer,    ReLength,    SendBuffer,&    ReLength,PEK,16,
MODE_DECRYPT);

    }

        }

    memcpy(ReBuffer, SendBuffer, ReLength);

    }
```

4.7 FtDidEnterBackground(private interface)

Void FtDidEnterBackground(unsigned int bDidEnter)

Description:

Enter application to background, won't close session

Parameter:

bDidEnter   [IN] True (when you set to 1, it will support background running)

4.8 ReaderInterfaceDelegate(private interface)

4.8.1 readerInterfaceDidChange(private interface)

-(void)readerInterfaceDidChange:(BOOL)attached

Description:

To monitor the reader status's delegation

Parameter:

attached   [OUT] TRUE means the reader has inserted，FALSE means the reader has plug-out

Example: Please refer in isCardAttached

4.8.1 cardInterfaceDidDetach(private interface)

-(void)cardInterfaceDidDetach:(BOOL)attached

Describe:

The delegation is to monitor the card status

Parameter:

Attached   [OUT] Ture means the card has inserted, false means the card has removed out

Example:

Please refer in isCardAttached

4.9 @interface ReaderInterface(private interface)

4.9.1 setDelegate(private interface)

-(void)   setDelegate:(id<ReaderInterfaceDelegate>)delegate;

Description:

Set delegate:

Example:

Please refer in isCardAttached

4.9.2 isReaderAttached(private interface)

-(BOOL)   isReaderAttached

Descryption：

To get reader status (absent or attach)

Return:

The ture means the reader has inserted, false means reader plug out

Example: Please refer in isCardAttached

4.9.3 isCardAttached(private interface)

-(BOOL)   isCardAttached

Descryption:

To check the card slot status

Return:

The ture means the card inserted, the false means the card plug out

Example

```
@interface mainViewController:UIViewController<ReaderInterfaceDelegate>

{

    ReaderInterface *reader;

}
@end


@implementation mainViewController

- (id)initWithNibName:(NSString *)nibNameOrNil bundle:(NSBundle *)nibBundleOrNil

{

    self = [super initWithNibName:nibNameOrNil bundle:nibBundleOrNil];

    if (self) {

        // Custom initialization
```

```
    }

    return self;

}


- (void)viewDidLoad

{

    /*

     *To check the card status ReaderInterfaceDelegate

     */

SCARDCONTEXT cardContext;

    reader =[[ReaderInterface alloc] init];

[reader setDelegate:self];

SCardEstablishContext(SCARD_SCOPE_SYSTEM, NULL, NULL,

                            &cardContext);

[self test];

    [super viewDidLoad];

    // Do any additional setup after loading the view from its nib.

}


-(void)test

{

    BOOL ReaderStatus;

    BOOL   CardStatus;

    ReaderStatus = isReaderAttached;

if (ReaderStatus) {

        NSLog(@"\nreader is attached>>>");

    }else{

        NSLog(@"\nreader is disattached>>>");

    }
```

```
        CardStatus = isCardAttached;

    if (CardStatus) {

            NSLog(@"\ncard is attached>>>");

        }else{

            NSLog(@"\ncard is disattached>>>");

        }

    }


    - (void)didReceiveMemoryWarning

    {

        [super didReceiveMemoryWarning];

        // Dispose of any resources that can be recreated.

    }


    #pragma ReaderInterfaceDelegate

    -(void)readerInterfaceDidChange:(BOOL)attached

    {

        if (attached) {

            NSLog(@"\nreader is attached>>>");

        }else{

            NSLog(@"\nreader is disattached>>>");

        }

    }
    -(void)cardInterfaceDidDetach:(BOOL)attached

    {

        if (attached) {

            NSLog(@"\ncard is attached>>>");

        }else{

            NSLog(@"\ncard is disattached>>>");
```

```
        }
    }
```

5.0 Support background mode

If you application support background mode, please do below operation:

1. Add background support string in your Info.plist

```
<key>UIBackgroundModes</key>
    <array>
        <string>App communicates with an accessory</string>
    </array>
```

2. When you enter to background, please do release context.

```
extern  SCARDCONTEXT gContxtHandle;
    //If your application support background running, please do release context when enter
to background
    FtDidEnterBackground(1);
    SCardReleaseContext(gContxtHandle);

        }
```

3. Also when enter to foreground, please do create context also.

```
- (void)applicationDidBecomeActive:(UIApplication *)application {
    /*
     Restart any tasks that were paused (or not yet started) while the application was
inactive. If the application was previously in the background, optionally refresh the
user interface.
    */
    //When back to foreground, do create context
     SCardEstablishContext(SCARD_SCOPE_SYSTEM,NULL,NULL,&gContxtHandle);

}
```

5.1 Support bR301 also

If you application also want to support iR301 and bR301, please do below small change on your project.