AN2271
APPLICATION NOTE

Ekey-Udisk solution

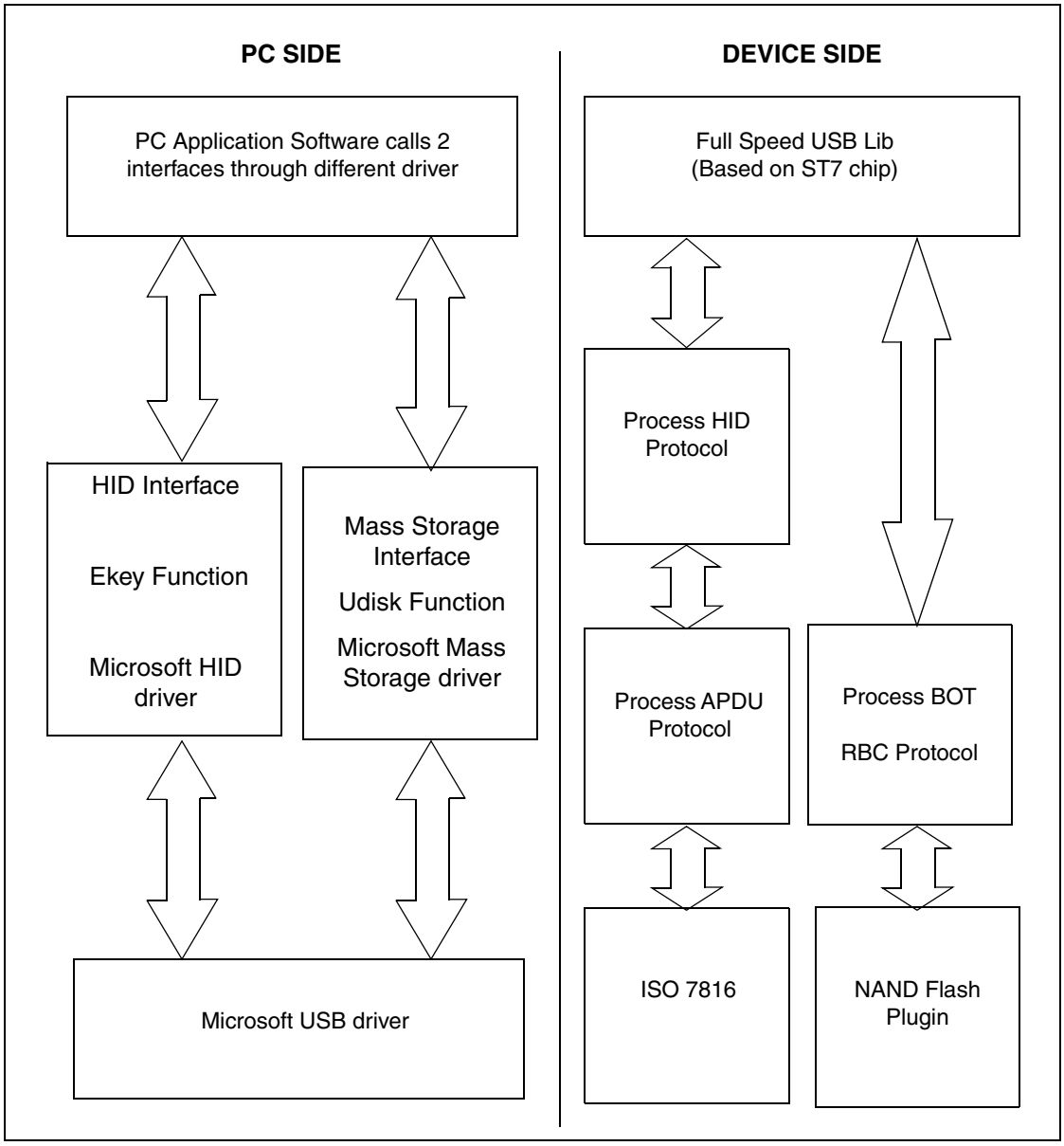
Introduction

This document describes a firmware implementation for an Ekey-Udisk device based on ST72651.

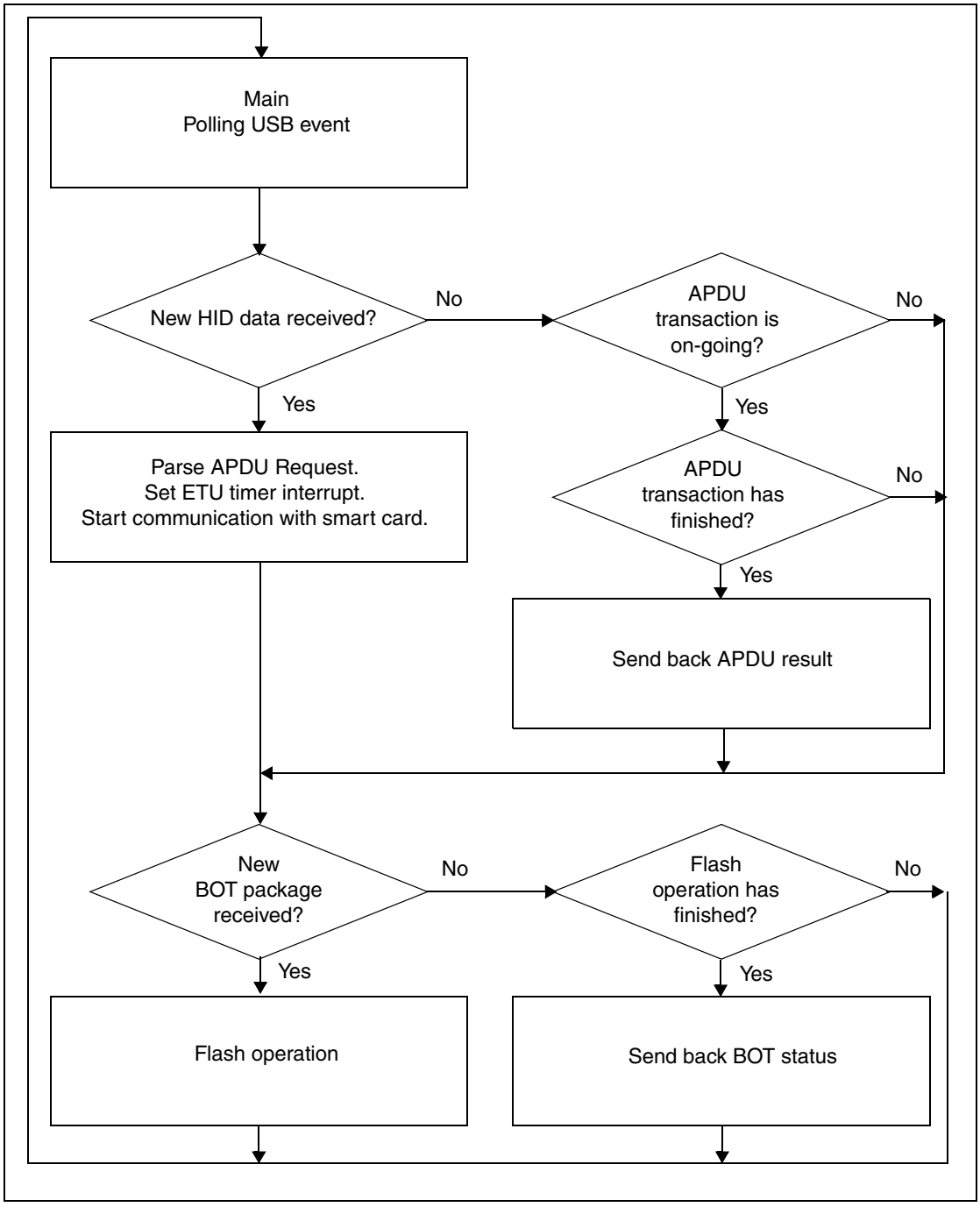
The software is divided into 3 parts:

- **USB management**: the main USB operations are managed by a USB library with USB hardware, which is not the focus in this documentation. For further information on this subject, please refer to the ST7 USB software library documentation.
- **NAND Flash interface**: this part software is migrated from PFD solution. How to implement it is not mentioned in this documentation.
- **Smart Card interface**: this interface is implemented by timer and accords ISO7816-1, 2, 3.

1 System Structure



2 System Diagram



3 USB Interface

This solution uses a USB Composite Device to combine the Ekey and Udisk functions into one USB device.

The Ekey function uses an HID protocol, and the Udisk function uses a Mass Storage protocol. Both of these two functions use a Microsoft driver, so when an Ekey-Udisk device plugs in, Windows2000/XP recognizes one USB composite device comprised of one HID device and one Mass Storage device. No extra driver is needed.

The USB interface for Udisk is traditional.

The USB interface for Ekey is shown below, and the PC Application Software can use this data structure to communicate with Ekey through the HID driver.

Report ID (1 Byte)	Message Length (1 Byte)	Data (1-128 Bytes)

Enumerating a USB composite device with HID and a Mass Storage device is listed in the file `descript.c`

According to the HID protocol, PC communication is configured in USER_USB_Setup() in `User_lib.c`

Note: According to the limitation of the HID driver, in order to save time to send data to the device, PC Application Software should select the correct Report ID based on the Message Length. 9 report types are provided for use with supporting lengths from 0x0f to 0x8f. If necessary, additional descriptors can be created by modifying these to provide other report types.

Table 1. Report ID based on message length

ID	Length	Data Length
1	0x01~0x0f	Data(0x01~0x0f bytes)
2	0x01~0x1f	Data(0x01~0x1f bytes)
3	0x01~0x2f	Data(0x01~0x2f bytes)
4	0x01~0x3f	Data(0x01~0x3f bytes)
5	0x01~0x4f	Data(0x01~0x4f bytes)
6	0x01~0x5f	Data(0x01~0x5f bytes)
7	0x01~0x6f	Data(0x01~0x6f bytes)
8	0x01~0x7f	Data(0x01~0x7f bytes)
9	0x01~0x8f	Data(0x01~0x8f bytes)

4 NAND Flash Interface

This part firmware is migrated from the ST PFD solution, and for related applications, please refer to the PFD application note.

This NAND Flash Interface provides two partitions where one is the Public Partition and the other is the password-protected Security Partition.

Two types of NAND Flash (512B/page & 2kB/page) are supported. Other Flash formats can be supported by modifying software.

5 Smart Card Interface

This interface provides the user with a set of functions for using the Timer and I/O to communicate with the smart card. It is composed of 3 files:

- `HID_usb.c`
- `UARTT0.c`
- `Int_7265.c`

The `HID_usb.c` file provides the protocol conversion from the HID protocol to the ISO7816 APDU protocol for the main loop program.

The `UARTT0.c` file implements the ISO7816 T0 protocol to communicate with the smart card.

- CardPowerOn() function is called by `HID_usb.c` to provide a voltage to smart card
- CardSend() function is called by `HID_usb.c` to start a UART communication
- T0SendData() function is called by timer interrupt to send one bit at a set time
- T0ReceiveData() function is called by timer interrupt to receive one bit at a set time

The `Int_7265.c` file provides one timer interrupt management and one external interrupt management to implement the ISO7816 T0 protocol.

- INT_TIM() function is coded to call T0SendData() function or T0ReceiveData() function to receive or send one bit when a specific time is reached.
- INT_EI2() function is coded to start the timer when a UART start bit is detected.

The MCO pin of ST72651 is used to provide a clock signal to the smart card. The output of the MCO pin is 6MHz. In this solution, it should reduce to 3MHz to use as smart card clock, if the user wants another clock frequency, an external crystal could provide different clock.

The UsbVddf pin of ST72651 is used to provide Voltage to the smart card. The voltage output by this pin is 3.3V, so this interface is 3.3V. If you want another voltage interface, you should modify the I/O pins.

In this solution, the baud rate of the ISO7816 interface uses a default value of 8.064kbps. If you require another baud rate, the timer value should be modified.

6 Revision history

Table 2. Document revision history

Date	Revision	Changes
02-Dec-2005	0.1	Initial release
05-Dec-2005	1.0	System flowcharts modified *Table 1 on page 4* added