AVR272: USB CDC Demonstration UART to USB Bridge

Features

- **Supported by Windows® 2000 or later**
- **No driver installation**
- **Virtual COM Port Enumeration**
- **USB to RS232 Bridge with dynamic baudrate**
- **Bus powered**

1. Introduction

The RS232 interface has disappeared from the new generation of PCs replaced by the USB interface. To follow this change, applications based on UART interface have to migrate to USB. Migration to USB can mean heavy development both on the PC and on the device side. To avoid this development, Atmel offers you a solution based on the CDC class (Communication Device Class) with the following advantages:

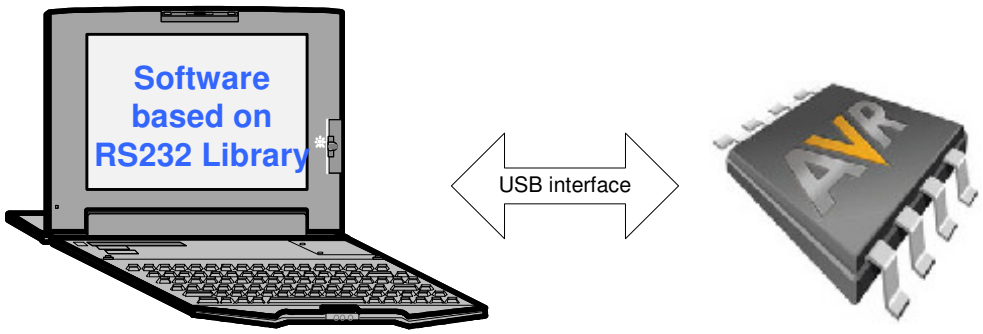
No need to change the PC application

Few modifications from the device side

The aim of this document is to describe how to start and implement a CDC (Virtual COM Port and UART to USB bridge) application using the STK525 starter kit and FLIP in-system programming software.

A familiarity with *USB Software Library for AT90USBxxx Microcontrollers* (Doc 7675, Included in the CD-ROM & Atmel website) and the CDC specification (http://www.usb.org) is assumed.

Figure 1-1. Virtual COM Port Application



8-bit AVR® Microcontrollers

Application Note

7619B–AVR–04/08

2. Hardware Requirements

The USB CDC application requires the following hardware:

1. AVR USB evaluation board (STK525, AT90USBKey, STK526...or your own board)
2. AVR USB microcontroller
3. USB cable (Standard A to Mini B)
4. RS232 crossed Cable (DB9 male to DB9 female)
5. PC running on Windows® (2000, XP) with USB 1.1 or 2.0 host

Note: An additional STK 52x and USB port are required if the PC has no RS232 interface.

3. In system programming and Device Firmware Upgrade

To program the device you can use the following methods:

- The JTAG interface using the JTAGICE MKII
- The SPI interface using the AVRISP MKII
- The USB interface thanks to the factory DFU bootloader and Flip software
- The parallel programming using the STK500 or the STK600

Please refer to the hardware user guide of the board you are using (if you are using Atmel starter kit) to see how to program the device using these different methods.

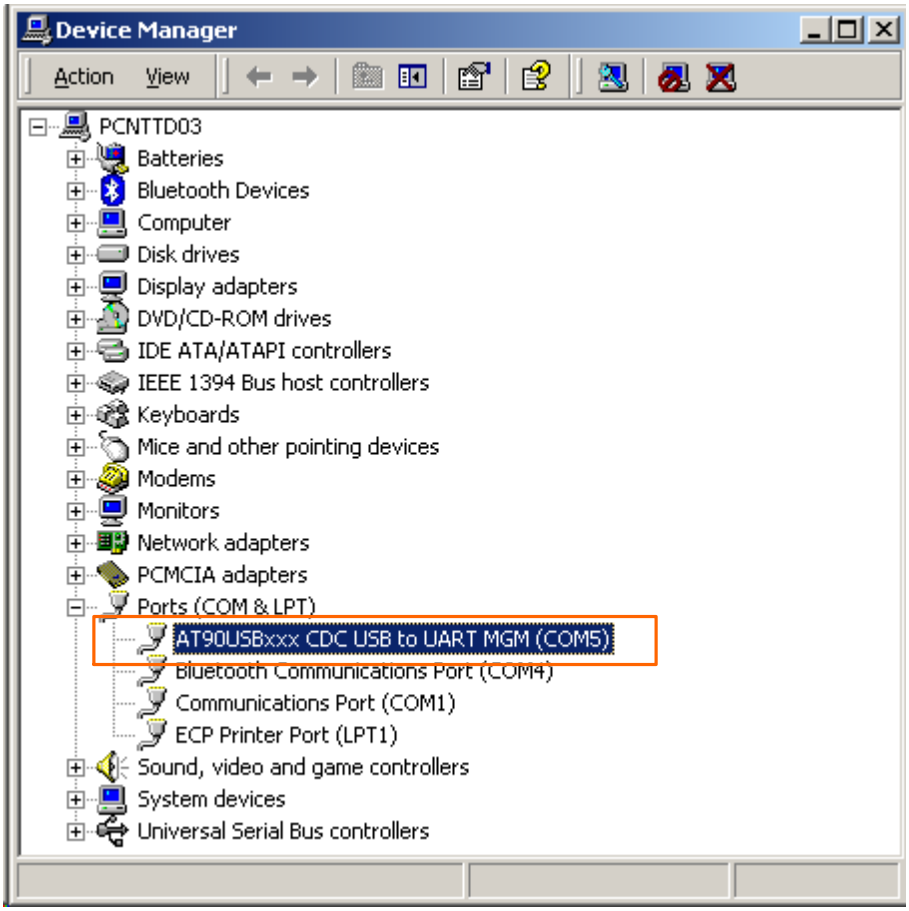
Please refer to Flip[(1)] help content to see how to install the USB driver and program the device through the USB interface.

Note: 1. Flip is a software provided by atmel to allow the user to program the AVR USB devices through the USB interface (No external hardware required) thanks to the factory DFU bootloader.

4. Quick Start

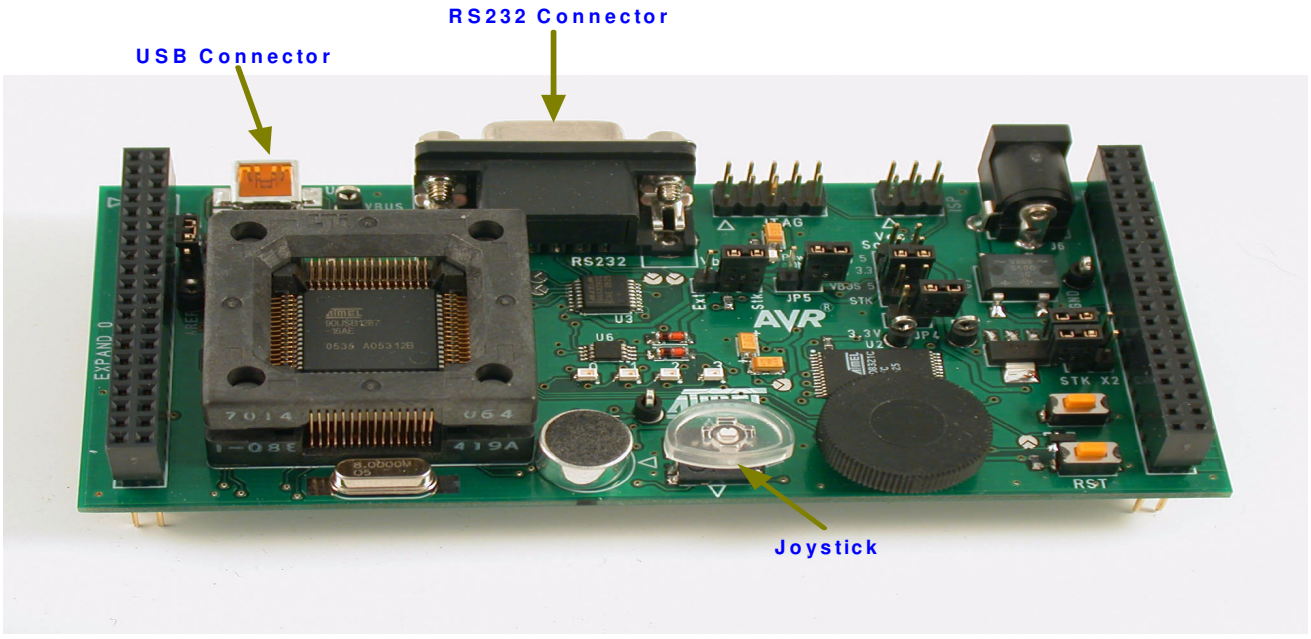
Once your device is programmed with *usb_cdc.a90* file, click on Start Application button on FLIP or push the reset button from the STK525 board to start the CDC demonstration. **A new device detection wizard will appear, point the wizard to the inf folder included in the CDC package**. Check that your device is enumerated as COM port (see Figure 4-1), then you can use the STK525 as a Virtual COM Port or USB to UART bridge.

Figure 4-1. CDC enumeration



The figure below shows the STK525 used by the demo (you may use another kit: AT90USBKey, STK526, depending on the AVR USB product you are working with):

Figure 4-2. STK525



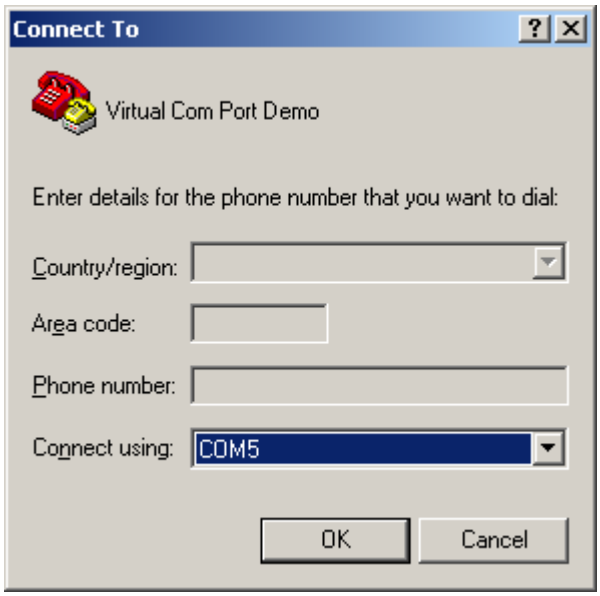
4.1 Virtual COM Port Demo

The purpose of the Virtual COM Port demonstration is to communicate with a RS232 PC application without any software modification.

Follow the instructions below to start the demo:

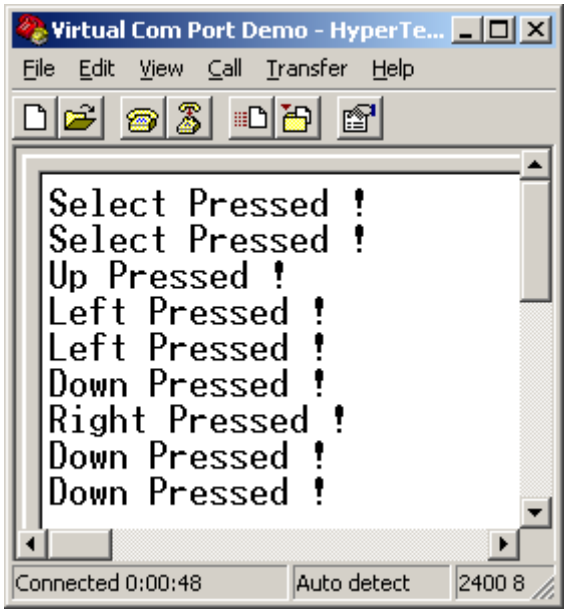
1. Lauch the HyperTerminal application and select the correct COM port as indicated in the device manager.

Figure 4-3. COM Port selection



2. Press the joystick and you will see the selection or the direction status written on the HyperTerminal window.

Figure 4-4. Virtual COM Port Demo



4.2 USB to UART Bridge

The aim of the USB to UART bridge is to transfer data in full duplex mode between UART and USB interface. This application can be used to connect any RS232 device to a PC which does not have an RS232 interface.

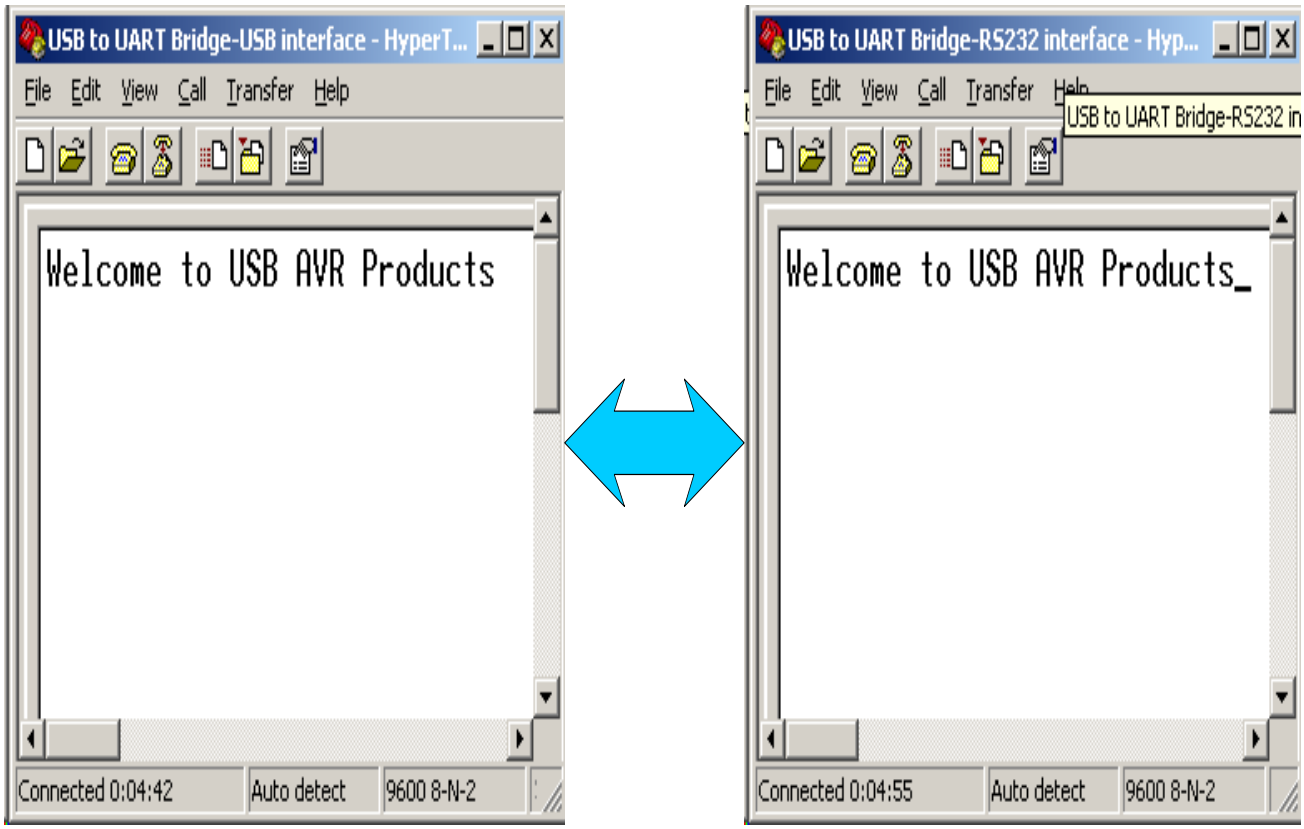
Follow the instructions hereunder to start the demo:

1. Connect the RS232 port of the STK 525 to The PC RS232 port.

Note: If the PC has no RS232 interface you can use another STK525: Connect the two boards with a RS232 crossed cable and connect each board to a USB port on the PC.

2. Lauch two HyperTerminal applications (one with the RS232 port and the second with the Virtual COM port) with the same configuration (Baudrate, Data bits, Parity, Stop bits, Flow control).
3. Write something in one HyperTerminal, it will be displayed in the other.

Figure 4-5. USB to UART Bridge



5. Application Overview

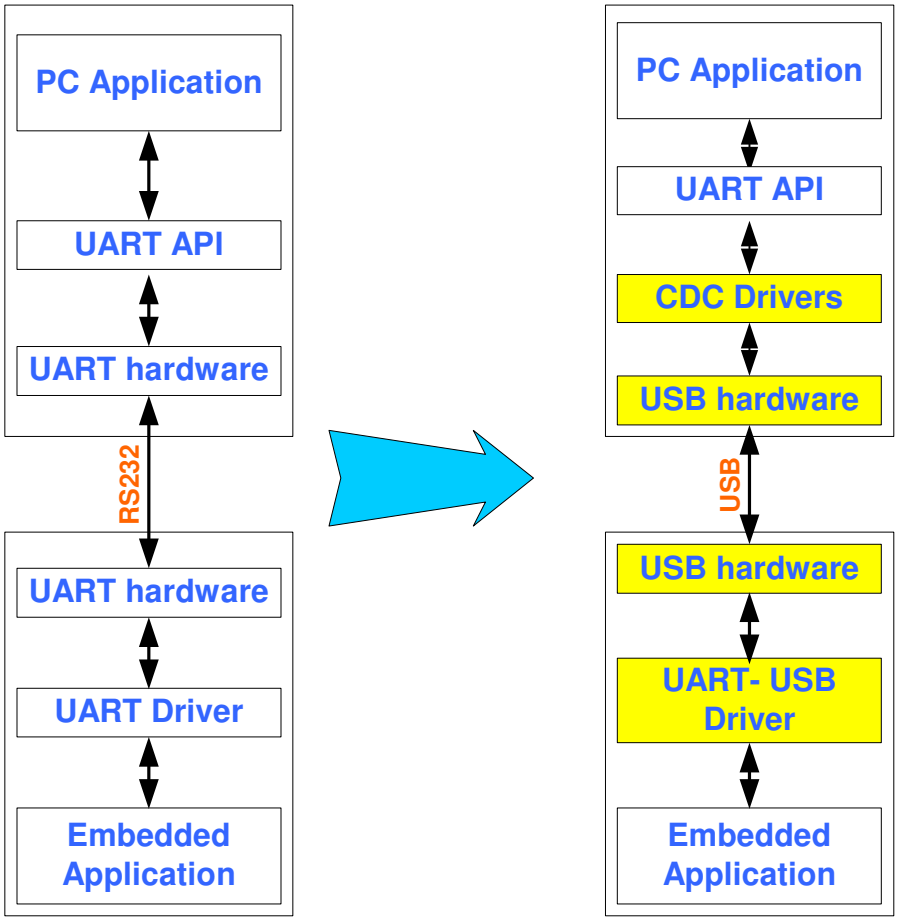
The CDC application allows the user to simulate an RS232 port using the USB hardware. The device appears as a COM port instead of USB device in the device manager. This allows the user to use his RS232 application without changing his PC application.

From the embedded side, the UART driver is replaced by the UART-USB Driver. The user has to use the UART-USB functions instead of the UART functions to communicate with the PC.

Once the device has enumerated, the application ensures a full duplex data transfer between the PC and the peripheral.

The figure below shows the structure:

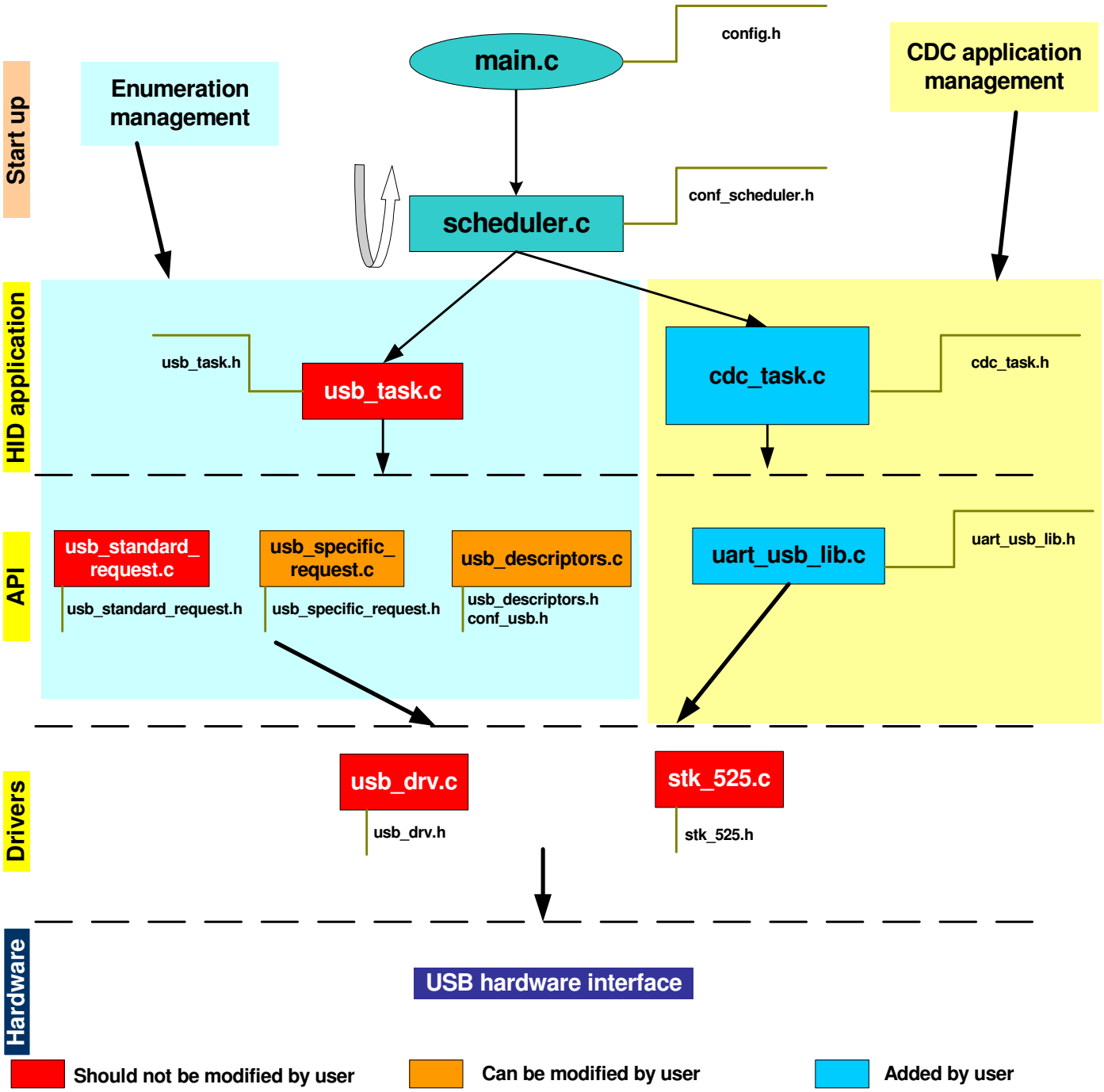
Figure 5-1. USB to UART migration



6. Firmware

As explained in the *USB Software Library for AT90USBxxx Microcontrollers*, all USB firmware packages are based on the same architecture (please refer to this document for more details).

Figure 6-1. USB CDC Firmware Architecture

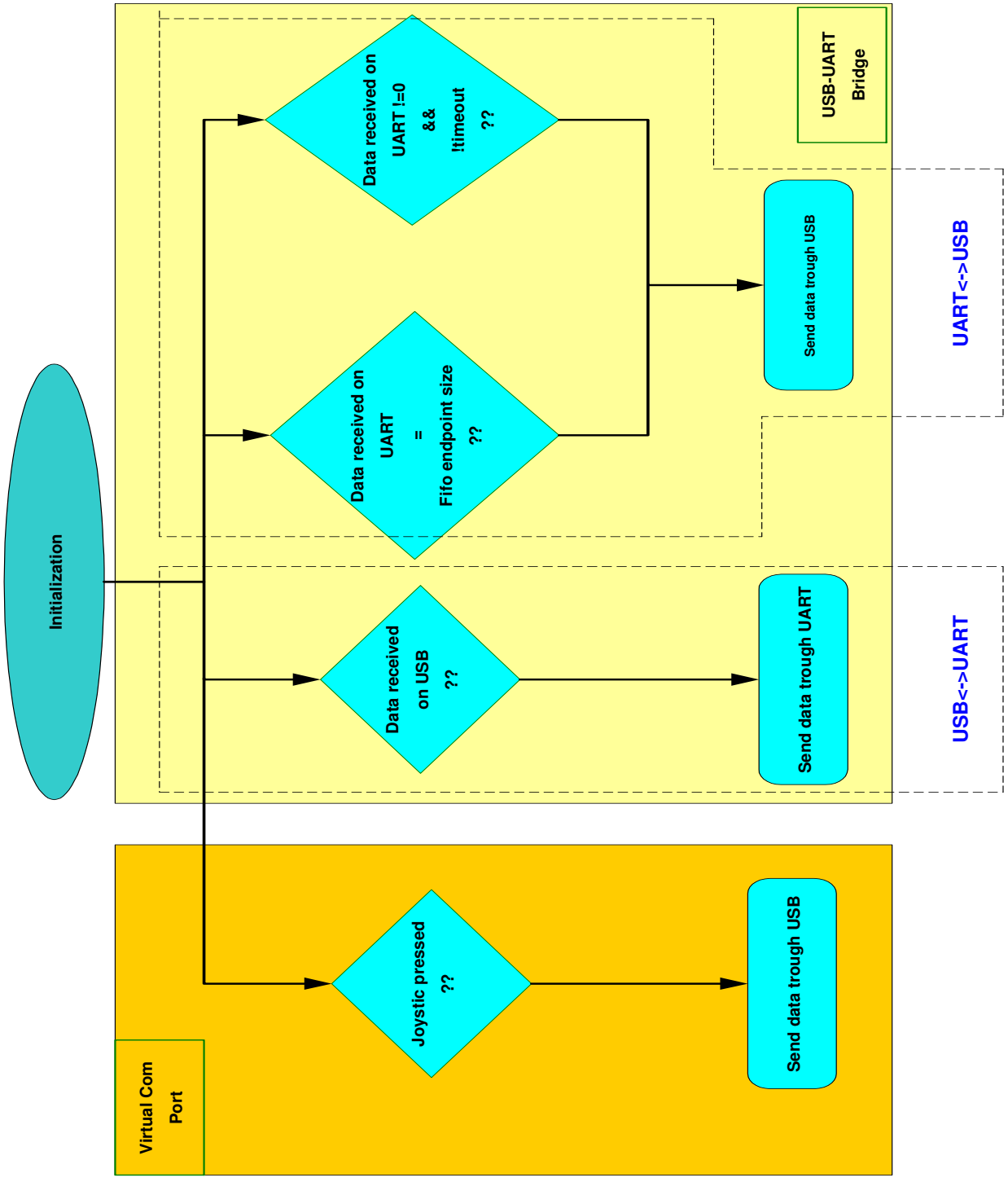


This section is dedicated to the CDC module only. The customization of the files described here-after allow the user to build his own CDC Application.

6.1 cdc_task.c

This file contains the functions to initialize the hardware which will be used by the application, collect data and transfer it.

Figure 6-2. CDC Application



6.1.1 cdc_task_init

This function performs the initialization of the CDC parameters and hardware resources (joystick...).

6.1.2 cdc_task

This function manages the data transfer for the two demonstrations (Virtual COM Port and UART to USB Bridge).

6.2 uart_usb_lib

6.2.1 uart_usb_test_hit

This function checks if at least one character has been received on the USB.

6.2.2 uart_usb_getchar

This function returns the byte received in the OUT endpoint FIFO.

6.2.3 uart_usb_putchar

This function writes the byte put in parameter into the USB IN endpoint FIFO. It also replaces the putchar function of the UART library. For example the printf will be based on uart_usb_putchar fuction instead of putchar.

6.2.4 uart_usb_tx_ready

This function checks if a byte can be written in the IN endpoint FIFO.

6.2.5 uart_usb_flush

This function sends data stored in the IN endpoint.

6.3 stk_525.c.

This file contains all the routines to manage the STK 525 board resources (joystick, potentiometer, temperature sensor, LEDs...).

7. PC Software

The CDC application uses the native Windows drivers. It requires only an INF file located in the inf folder from the CDC package.

8. Limitations

This application does not work with Windows 98 and ME (no native driver of CDC device).

This application can work with Linux OS, but support depends on configuration.

9. Related Documentation

- AVR USB Datasheet
- USB Software Library for AT90USBxxx Microcontrollers
- USB CDC class specification

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