ARM926EJ-S™ Based

32-bit Microprocessor

NuDesign NK-980ETH2P
使用手冊

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1 概論

新唐的NuDesign NK-980ETH2P演示板是基於使用新唐NUC980DK61Y芯片，包括2套10/100 Mbps以太網端口和8套UART串口。NuDesign NK-980ETH2P演示板可用於遠程控制多個串行設備，用於工業自動化數據傳輸和遠端環境監測。

用戶可以按照本文件快速啟動NuDesign NK-980ETH2P演示板。

2 快速使用 NuDesign NK-980ETH2P

2.1 安裝 BSP

Linux BSP 包含了三個目錄。各目錄的內容列在下表:

目錄名稱	內容
BSP	一個包含了交叉編譯工具, 預編映像檔以及根文件系統的壓縮包。
Documents	BSP 相關文件。
Tools	Windows 上的NuWriter燒錄工具以及驅動程式. 以及 SD Writer。

Table 2-1 BSP 包內容

BSP 的源碼可以使用 repo 工具下載. 以下使使用 repo 下載的方式.
確認帳號主目錄下存在 bin/ 目錄, 且路徑有加入path 環境變數中.

```
$ mkdir ~/bin
$ export PATH=~/bin:$PATH
```

下載 repo 工具並設定可執行屬性.

```
$ curl https://storage.googleapis.com/git-repo-downloads/repo >
~/bin/repo
$ chmod a+x ~/bin/repo
```

產生一個空的工作目錄.

```
$ mkdir WORKING_DIR
$ cd WORKING_DIR
```

設定 git 使用的姓名及電子郵件地址.

```
$ git config --global user.name "Your Name"
$ git config --global user.email "you@example.com"
```

使用以下兩個命令其中之一下載 NUC980 BSP 的 manifest 檔案. 第一個是從 Github 下載, 第二個是從 Gitee 下載. 使用者依據所在的的連線速度擇一使用即可

```
$ repo init -u git://github.com/OpenNuvoton/manifest.git -b nuc980-
2019.09 -m github.xml
```

或

```
$ repo init -u https://gitee.com/OpenNuvoton/manifest.git -b nuc980-
2019.09 -m gitee.xml
```

接著用以下命令下載源碼.

```
$ repo sync
```

下載完源碼後, 請將 BSP 目錄中的壓縮包複製到 Linux 開發機器上，並使用以下的命令解壓縮：

```
$ tar zxvf nuc980bsp.tar.gz
```

在此目錄中有安裝腳本 install.sh，此腳本需要管理者權限才可以執行。可以選擇使用 “su” 命令切換到管理者來執行。

```
$ su
Password: (Enter password of root)
# ./install.sh
```

或是使用 sudo 來執行安裝腳本 (若是安裝的 Linux 沒有開放 root 權限，例如 Ubuntu，則可以使用本方式來安裝 BSP) 。

```
# sudo ./install.sh
```

以下為安裝過程的控制台輸出, 過程中輸入的目錄需要跟之前設定的 WORKING_DIR 相同.

```
Now installing arm_linux_4.8 tool chain to /usr/local/
Setting tool chain environment
Installing arm_linux_4.8 tool chain successfully
Install rootfs, applications, u-boot and Linux kernel
Please enter absolute path for installing(eg:/home/<user name>) :
BSP will be installed in /<path you input>/nuc980bsp
/home/someone
Extract rootfs and pre-build images
...
...
NUC980 BSP installion complete
```

2.2 編譯 U-Boot

用戶可以按照以下步驟編譯 NuDesign NK-980ETH2P 使用的 U-Boot。

進入U-Boot資料夾。

```
# cd u-boot-2016.11
```

配置NuDesign NK-980ETH2P演示板的 U-Boot 設定。

```
$ make nuc980_eth2uart_defconfig
```

編譯U-Boot。

```
$ make
......
  COPY    u-boot.bin
  SYM     u-boot.sym
./scripts/check-config.sh u-boot.cfg \
                ./scripts/config_whitelist.txt . 1>&2
```

2.3 編譯應用程式

用戶可以按照以下步驟編譯 NuDesign NK-980ETH2P application code。

進入 applications 資料夾。

```
# cd applications
```

輸入 “make eth2uart” 編譯 application code及將相關檔案複制到rootfs資料夾。

```
$ make eth2uart
```

2.4 編譯 Linux 內核

用戶可以按照以下步驟編譯 kernel image。

進入kernel資料夾。

```
# cd linux-4.4.y
```

設定NuDesign NK-980ETH2P演示板的內核配置。

```
# make nuc980_eth2uart_defconfig
```

編譯內核。

```
$ make uImage
......
    Kernel: arch/arm/boot/Image is ready
cp arch/arm/boot/Image   ../image/980image
  Kernel: arch/arm/boot/Image is ready
cp arch/arm/boot/Image   ../image/980image
  GZIP    arch/arm/boot/compressed/piggy.gzip
  AS      arch/arm/boot/compressed/piggy.gzip.o
  LD      arch/arm/boot/compressed/vmlinux
  OBJCOPY arch/arm/boot/zImage
  Kernel: arch/arm/boot/zImage is ready
  Kernel: arch/arm/boot/Image is ready
cp arch/arm/boot/Image   ../image/980image
  Kernel: arch/arm/boot/zImage is ready
  UIMAGE  arch/arm/boot/uImage
Image Name:   Linux-4.4.115
Created:      Tue Dec 25 16:15:24 2018
Image Type:   ARM Linux Kernel Image (uncompressed)
Data Size:    8039480 Bytes = 7851.05 kB = 7.67 MB
Load Address: 00008000
Entry Point:  00008000
  Image arch/arm/boot/uImage is ready
cp arch/arm/boot/uImage   ../image/980uimage
$ ls ../image/
980image 980uimage
```

2.5 燒錄 Linux Kernel 及 U-Boot 至 SPI Flash

本節介紹如何將U-Boot和內核燒錄至SPI Flash。

A. 安裝NuWriter驅動程序。(請參閱“NUC980 NuWriter User Manual”)

B. 將SW1(Power On Setting) 設置成從 USB 開機(參照 Table 2-2 和 Figure 2-1) 。將 USB0 連接到PC 並將 UARTconsole 連接到 PC。

SW1.2/SW1.1 Switch State	Function
ON/ON	Boot from USB
ON/OFF	Boot from SD/eMMC

OFF/OFF	Boot from SPI Flash

Table 2-3 Power On Setting

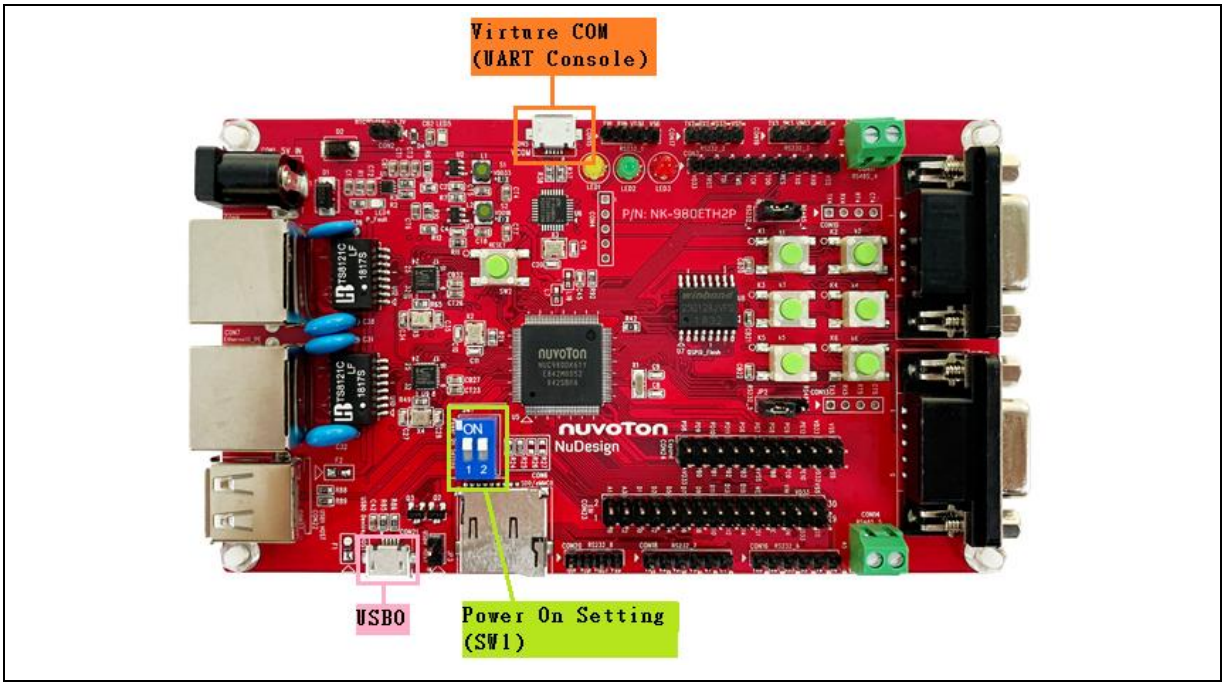

Figure 2-2 Burn Kernel to SPI Flash

C. 打開NuWriter，將Select target chip 設置成 “NUC980 series” 並將 Select DDR parameter 設置成 “NUC980DK61Y.ini” 。再按下 “Continue” 按鈕。

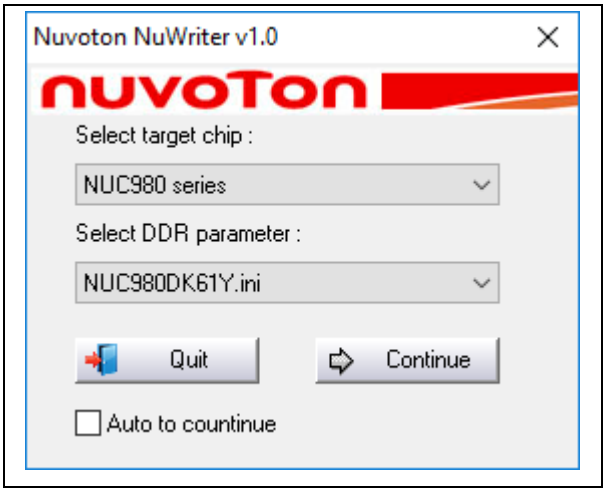

Figure 2-3 Nu-Writer 設置

D. 燒錄“uboot_v2016.11” 資料夾內的 u-boot.bin 步驟:

1. 依下圖,先將 Choose type 選成 “SPI” mode
2. 輸入參數
   - **Image Name** : u-boot.bin (參照2.2節)

- **Image Type** : Loader
- **Image execute address** : 0xE00000

3. 按下 “Program” 鍵
4. 等待燒錄完成
5. 按下 “Verify” 鍵,檢查燒錄內容的正確性

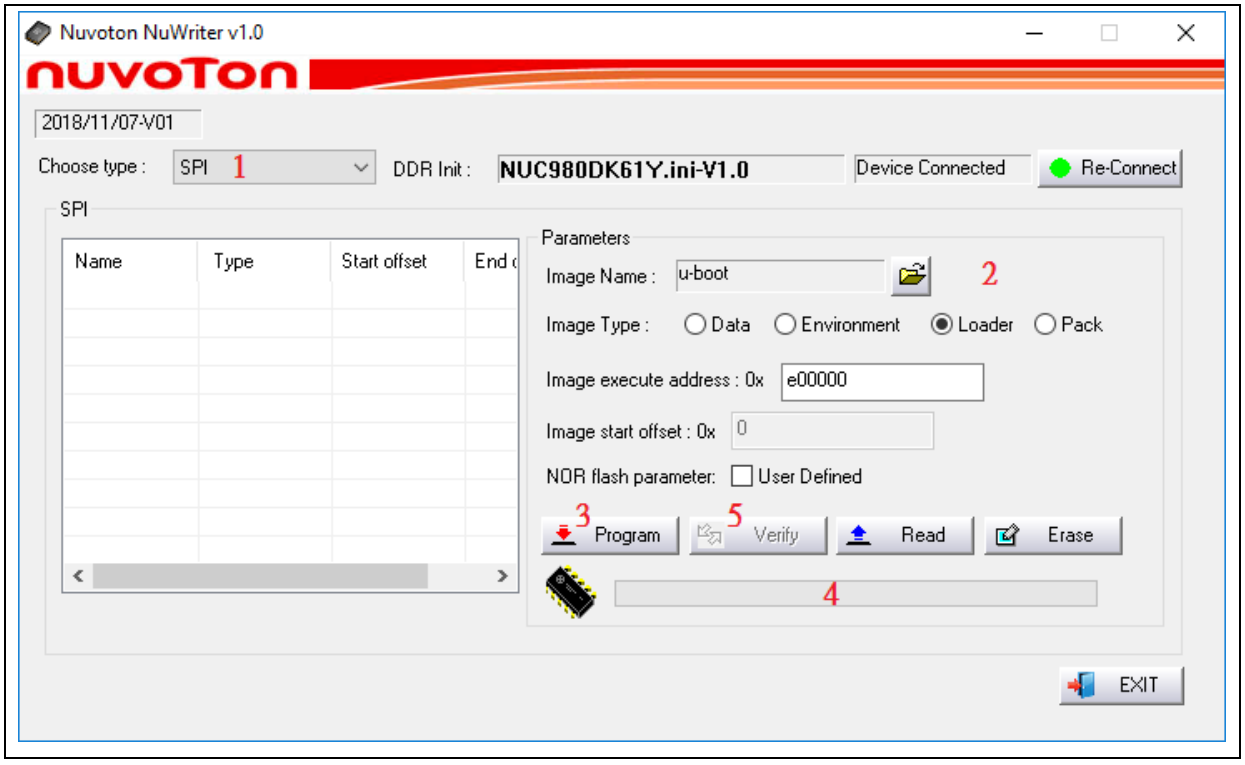

Figure 2-4 燒錄 u-boot

E. 燒錄 kernel image:

1. 依下圖,先將 Choose type 選成 “SPI” mode
2. 輸入參數
   - **Image Name** : 980uimage (參照2.4節)
   - **Image Type** : Data
   - **Image start offset** : 0x200000
3. 按下 “Program” 鍵
4. 等待燒錄完成
5. 按下 “Verify” 鍵,檢查燒錄內容的正確性

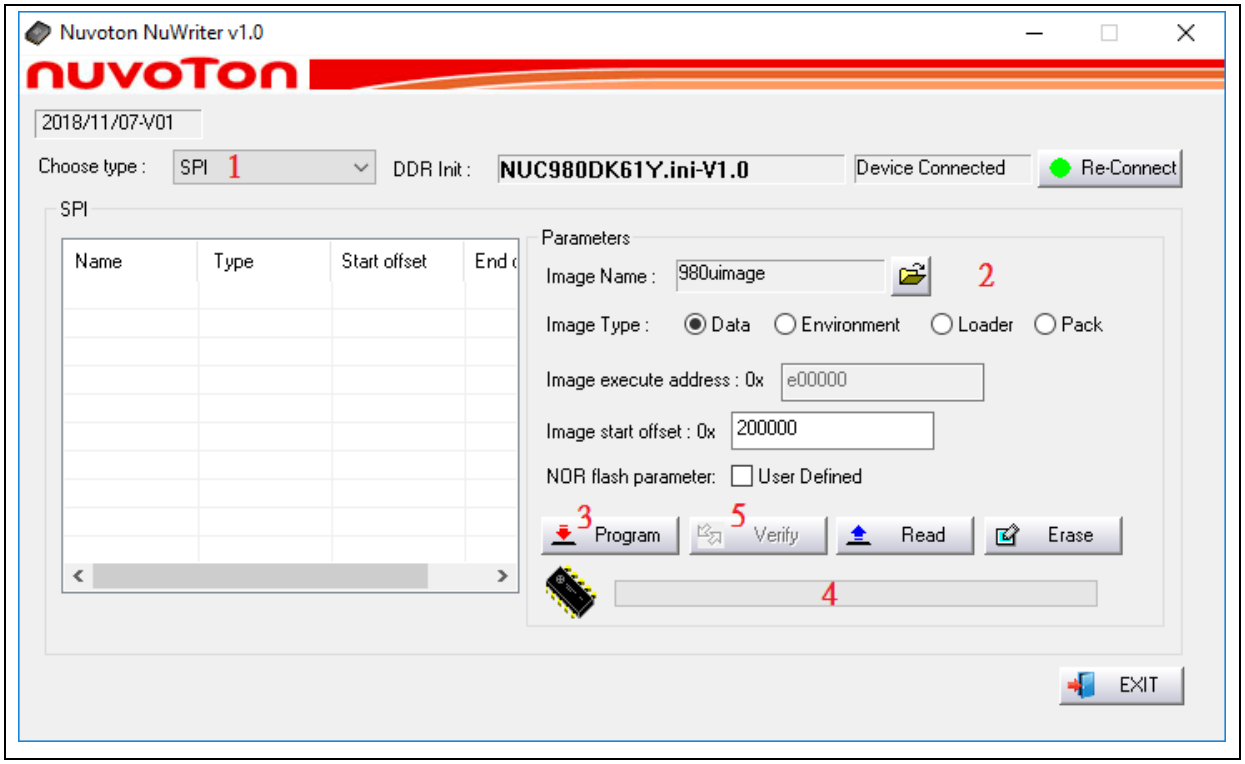

Figure 2-5 燒錄 Kernel image

2.6 完成 Linux 內核開機

本節說明如何從SPI flash啟動Linux內核。

A. 將SW1(Power On Setting) 設置成從QSPI 0 Flash開機(參照 Table 2-4 和 Figure 2-6) 。

B. 按下演示板上的Reset 鍵,從 UART console 打印訊息，可以發現系統進入了U-Boot. 用戶需要按照以下步驟由U-Boot 帶起內核。

- 輸入 “sf probe 0 18000000” 去設定 SPI 的速度 (可忽略)
- 輸入 “sf read 0x7FC0 0x200000 0x760000” 將kernel image從SPI Flash讀到DDR內
- 輸入 “bootm 0x7FC0” 啟動 Linux kernel image

```
U-Boot 2016.11-g9618a94-dirty (Dec 25 2018 - 08:46:04 +0800)

CPU: NUC980
Board: NUC980
DRAM:  64 MiB
NAND:  NAND Flash not found !
NUC980 NAND CONTROLLER IS NOT SUPPORT THE PAGE SIZE. (0, 0)
0 MiB
SF: Detected W25Q128BV with page size 256 Bytes, erase size 4 KiB,
total 16 MiB
*** Warning - bad CRC, using default environment


In:    serial
```

```
Out:   serial
Err:   serial
Net:   Net Initialization Skipped
No ethernet found.
=> sf probe 0 18000000
SF: Detected W25Q128BV with page size 256 Bytes, erase size 4 KiB,
total 16 MiB
=> sf read 0x7FC0 0x200000 0x760000
device 0 offset 0x200000, size 0x760000
SF: 7733248 bytes @ 0x200000 Read: OK
=> bootm 0x7FC0
## Booting kernel from Legacy Image at 00007fc0 ...
   Image Name:   Linux-4.4.115+
   Image Type:   ARM Linux Kernel Image (uncompressed)
   Data Size:    7573624 Bytes = 7.2 MiB
   Load Address: 00008000
   Entry Point:  00008000
   Verifying Checksum ... OK
   XIP Kernel Image ... OK

Starting kernel ...
```

C. 從打印訊息可以發現 Linux kernel 完成開機。

```
Freeing unused kernel memory: 5456K
[Mount JFFS2]: /dev/mtdblock0 --> /mnt/mtdblock0
nuc980-emac0 nuc980-emac0: eth0 is OPENED
nuc980-emac1 nuc980-emac1: eth1 is OPENED
random: arm-linux-light: uninitialized urandom read (8 bytes read, 7
bits of entropy available)



BusyBox v1.22.1 (2016-02-03 14:11:04 CST) built-in shell (ash)
Enter 'help' for a list of built-in commands.


~ #
```

D. 關於詳細的Linux kernel 編譯和設定，用戶可以參閱 “NUC980 Linux BSP User Manual” 。

2.7 硬體設置

A. 將SW1(Power On Setting) 設置成從QSPI 0 Flash開機(參照 Table 2-5 和 Figure 2-7) 。

B. 連接 UART console port。

C. 連接 Ethernet0 到 PC 並且連接 UART1~8 到其他的 UART 設備 (如:PC COM port) 。

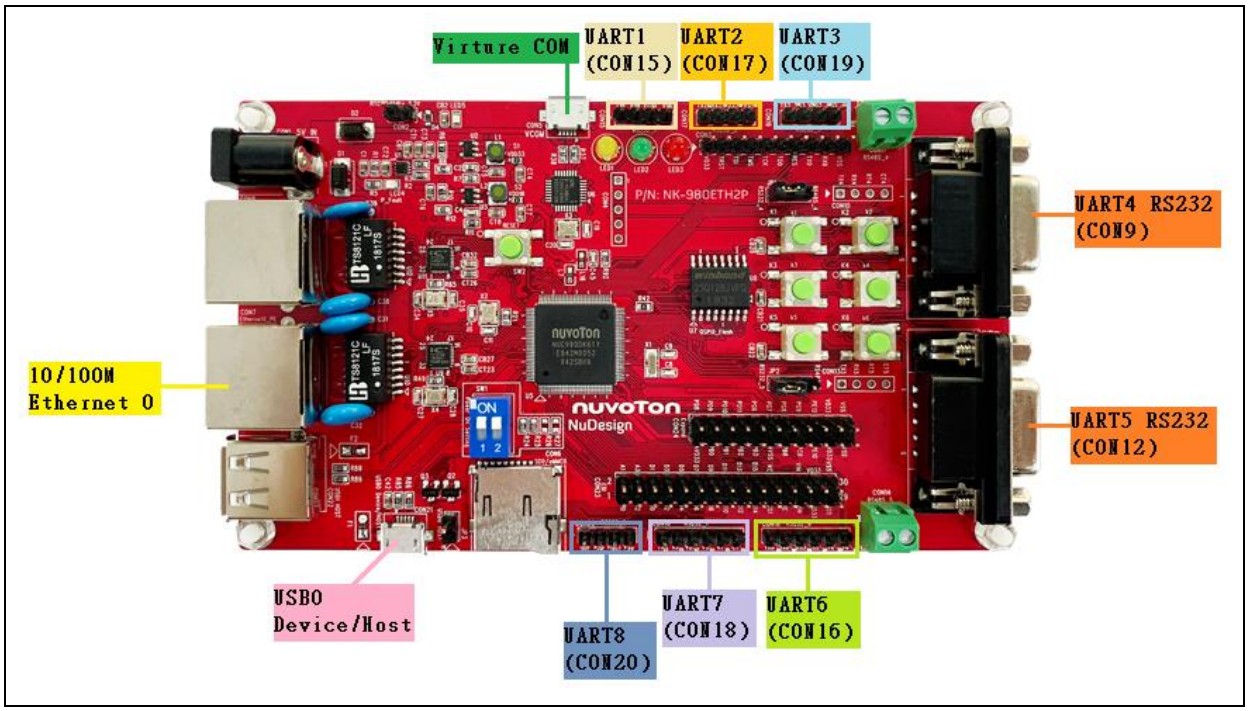

Figure 2-8 NuDesign NK-980ETH2P Board 設置

2.8 執行範例程式

首先，確保UART console連接到PC並使用終端工具(如Putty或Teraterm) ，將serial COM port打開。 Serial COM port設置為115200波特率，8 位數據長度和無奇偶校驗。

用戶還需要確保PC的Ethernet port連接到演示板的Ethernet0(或Ethernet1) port。 PC 的Internet設置可參考下圖。

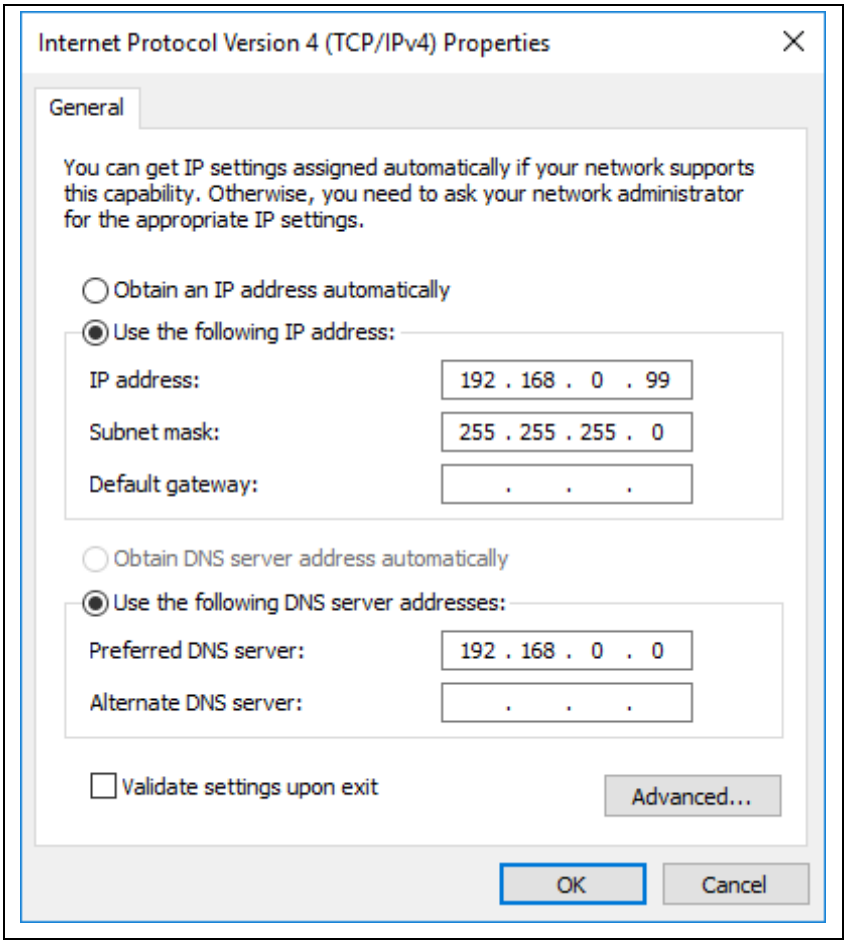

Figure 2-9 Internet Setting

打開電源及按下演示板上的 Reset 鍵重新開機(參照2.6節內的開機程序) 。

```
Freeing unused kernel memory: 5456K
[Mount JFFS2]: /dev/mtdblock0 --> /mnt/mtdblock0
nuc980-emac0 nuc980-emac0: eth0 is OPENED
nuc980-emac1 nuc980-emac1: eth1 is OPENED
random: arm-linux-light: uninitialized urandom read (8 bytes read, 7
bits of entropy available)



BusyBox v1.22.1 (2016-02-03 14:11:04 CST) built-in shell (ash)
Enter 'help' for a list of built-in commands.


~ #
```

用戶使用終端工具打開serial COM port (從UART1 到 UART8) 。

再使用終端工具打開TCP / IP連接。Ethernet 0 IP 位址是 192.168.0.100，Port number 從 50001

到 50008。Ethernet 1 IP 位址是 192.168.10.100，Port number 從 50001 到 50008。Port number 50001 ~ 50008 的傳送和接收分別對應到 UART1 ~ 8。

以下為 Ethernet 傳送 Data 到 UART 範例。在連接到port number 50001的TCP/IP的終端工具連接視窗中輸入“123” 。同時在UART1 serial COM port的視窗中會印出“123”訊號。

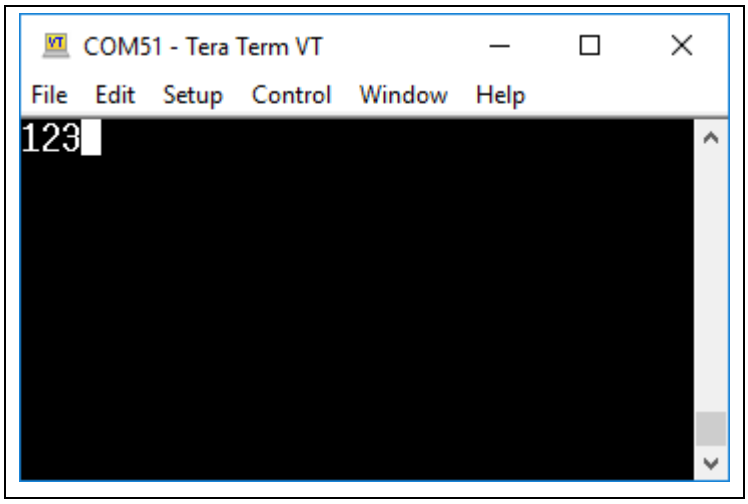

Figure 2-10 Serial COM Port

以下為UART 傳送 Data to Ethernet 範例。從UART1 serial COM port的終端工具連接視窗中輸入“123” 。同時在port number 50001的TCP/IP連接視窗中會印出“123” 。

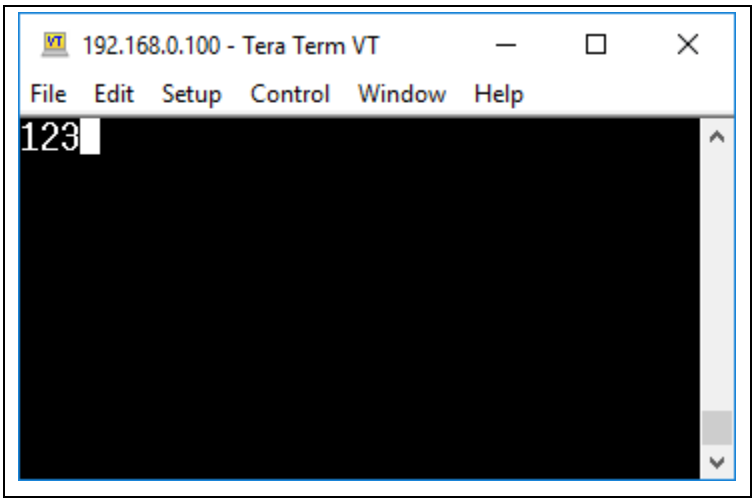

Figure 2-11 TCP/IP 連接視窗

用戶可用下列方法透過瀏覽器改變UART的設定:

1. 使用瀏覽器連接到網址http://192.168.0.100(Ethernet 0)或 http://192.168.10.100 (Ethernet 1)
2. 設置UART setting: 包含 UART port，baud-rate，data length，parity, stop bit，flow control，始能RS485。
3. 設置完成後,按下”Submit”鍵。

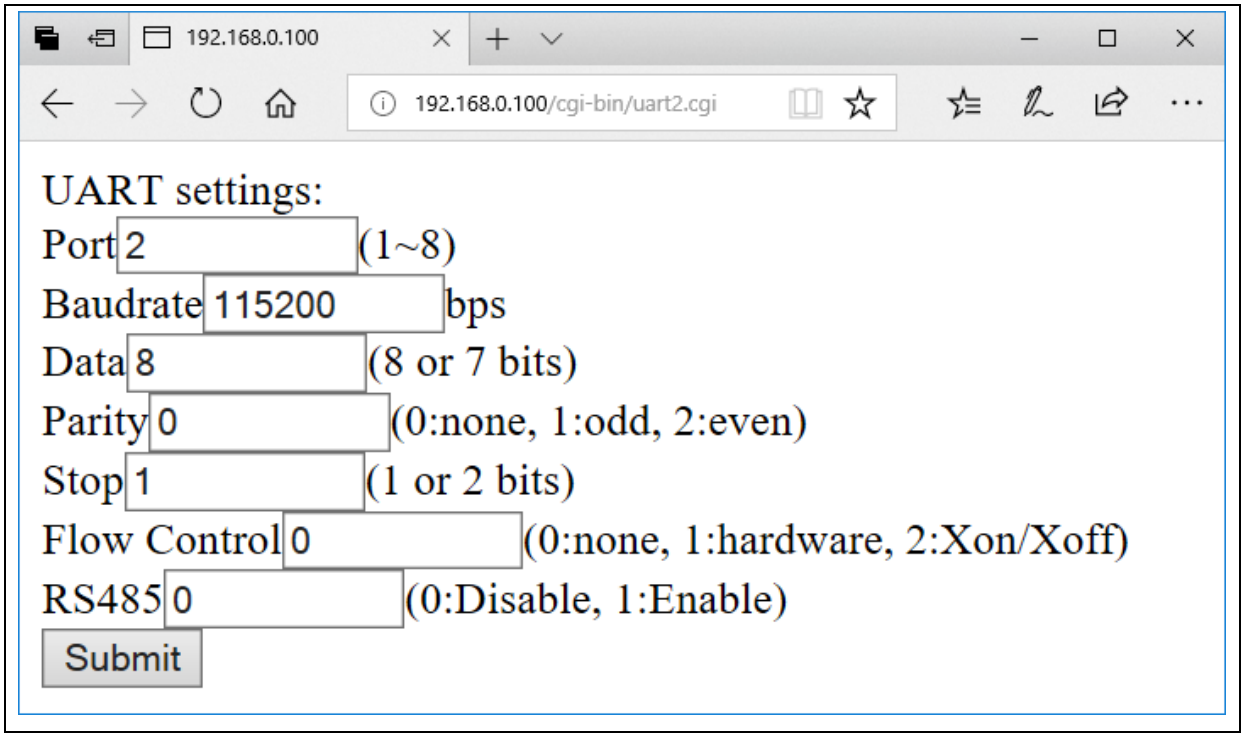

Figure 2-12 UART 設定網頁

3 結論

Nuvoton的NuDesign NK-980ETH2P演示代碼可以立即將UART接收的數據傳輸到以太網，也可以將以太網接收的數據傳輸到UART。

用戶可以基於該範例代碼開發應用程序，尤其是在工業自動化的數據傳輸將有很大的幫助。

4 版本歷史

版本號	日期	說明
1.00	Dec. 25, 2018	Initial release
1.01	Mar. 21, 2019	更新 manifest 檔案下載分支
1.02	Apr. 22, 2019	编缉性修改

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