Embedded Systems

Ch 2A. Embedded Board with Linux

Byung Kook Kim
Dept of EECS
Korea Advanced Institute of Science and Technology

Overview

- 2.1 Embedded board – EZ-X5
- 2.2 EZ-X5 Booting with Windows
- 2.3 EZ-X5 Booting with Linux
- 2.4 ARM Linux Installation with Linux

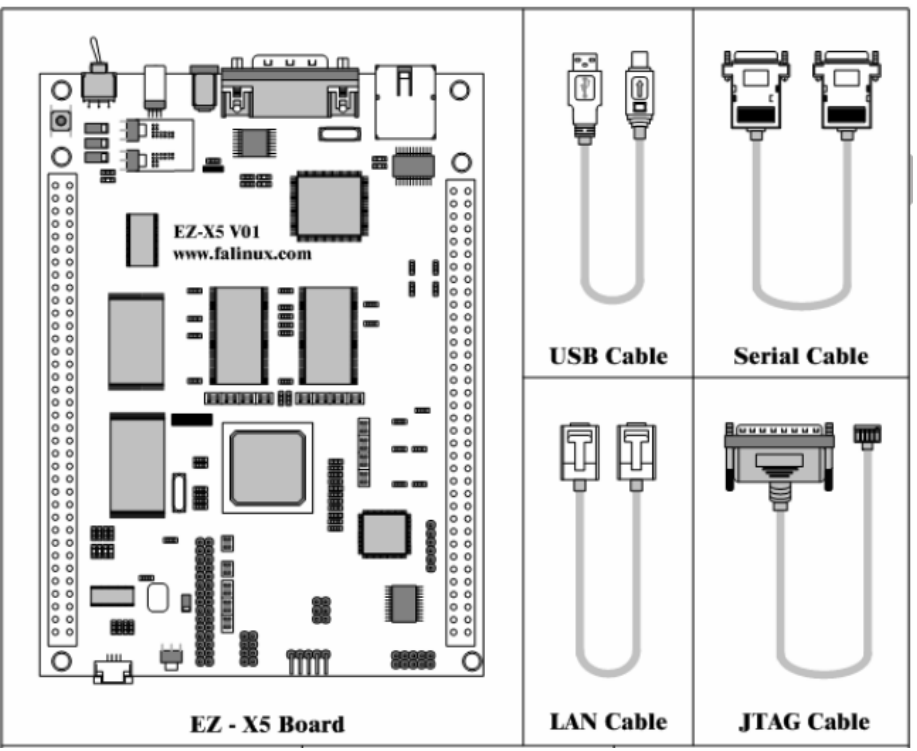
2.1 Embedded Board – EZ-X5

- EZ-X5 by falinux.com
  - Intel PXA255-400 을 탑재한 보드
  - 일반 사용자들도 쉽게 접할 수 있게 설계 개발된 제품
  - 3개의 시리얼포트
  - 이더넷 통신환경
  - 하드웨어 디버깅을 할 수 있는 JTAG 포트
  - 그래픽환경(GUI)을 위해 터치패드와 최대 1024x768 을 지원할 수 있는 LCD 인터페이스
  - 리눅스를 탑재
  - 좀더 많은 어플리케이션을 원활하게 이용하기 위해 64Mbyte의 램과 롬을 기본 탑재
  - 160핀의 보드커넥터는 PXA255에서 지원하는 대부분의 신호선을 연결
  - 개발관련 자료가 풍부

EZ-X5 (II)

- Specifications
  - PCB 100 mm x 140 mm
  - MCU 400MHz PXA255 ARM RISC Chip ARM10
  - RAM 64 Mbytes SDRAM **최대** 128 MBytes
  - ROM1 512Kbytes Boot Flash **최대** 8 MBytes
  - ROM2 64Mbyte NAND-Flash **최대** 256 MByte
  - Ethernet CS 8900 10-Mbps
  - Serial RS – 232C 3Port Full UART-1
  - USB USB Client
  - LCD 640x480 TTL-Port **최대** 1024x768
  - Touch 4**선식**
  - LED Debugging 4 Bits
  - JTAG ON – Board JTAG Convertor
  - Extension Connector 160-pins Board to board Connector

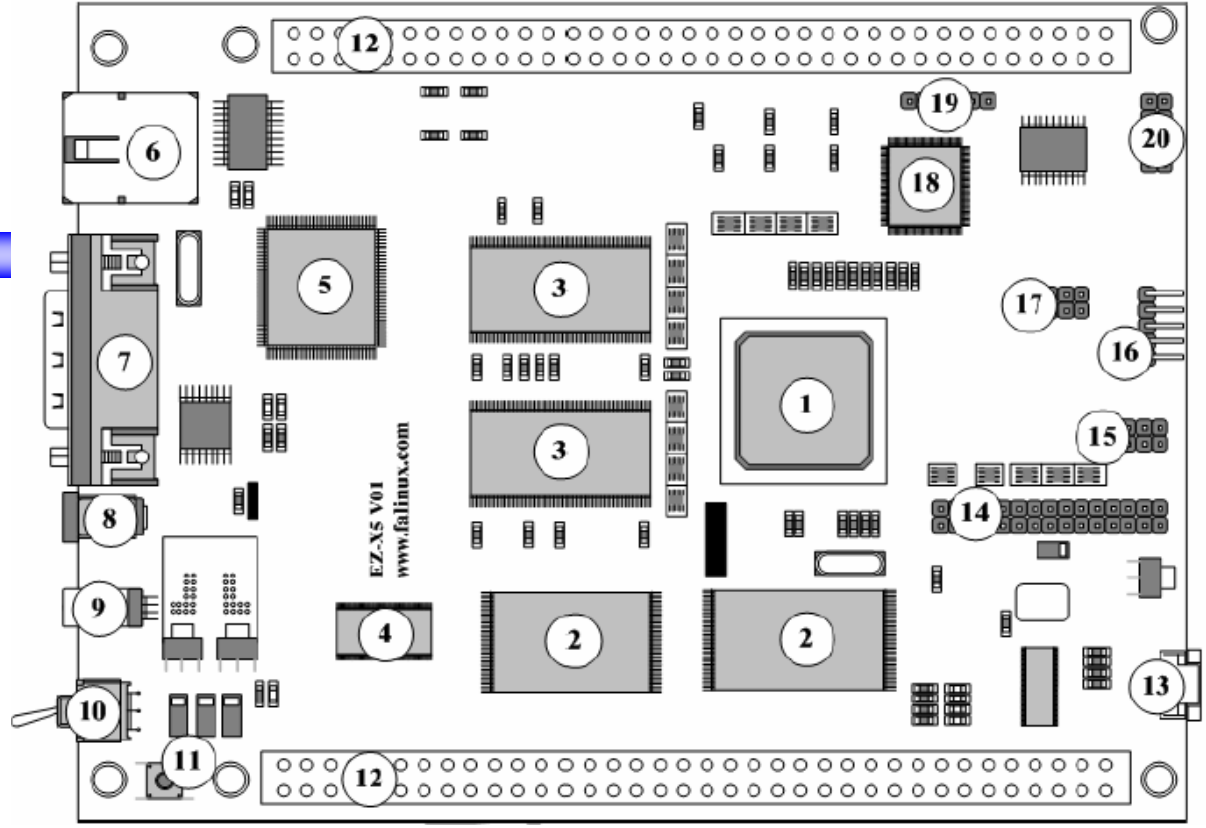
EZ-X5 (III)



- Connections
  - USB cable
    - Power applied from PC to Ez Board
    - Ez Board is the USB client, PC is the USB host
  - Serial cable
    - RS-232C Serial connection to PC
    - Ez Board console
    - PC with hyperterm or minicom
  - LAN cable
    - Ethernet connection for networking
    - Network File System
  - JTAG cable
    - JTAG connection to the parallel port in PC
    - System test and debug
    - Flash program

EZ-X5 (IV)

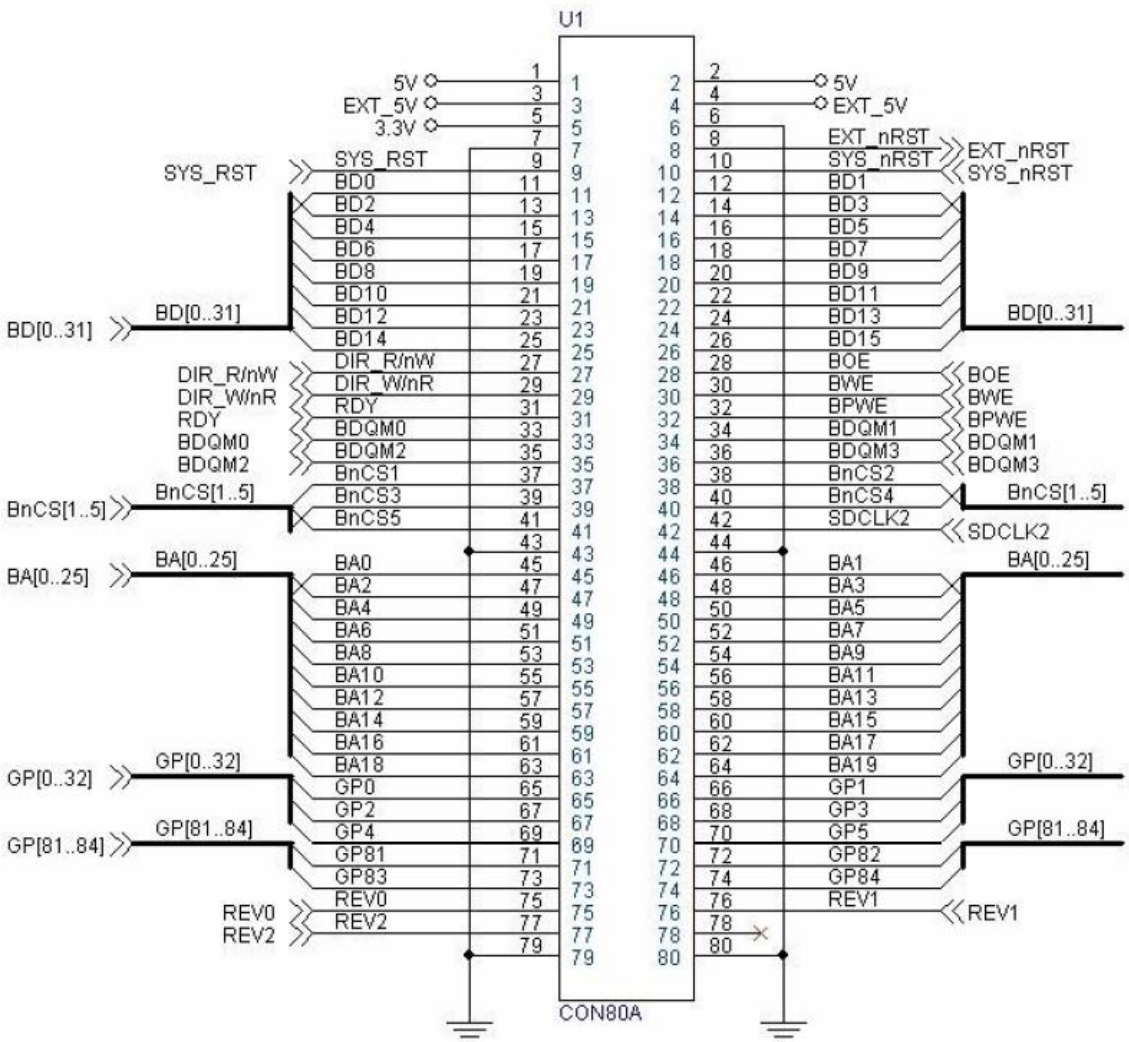
Major parts & connectors



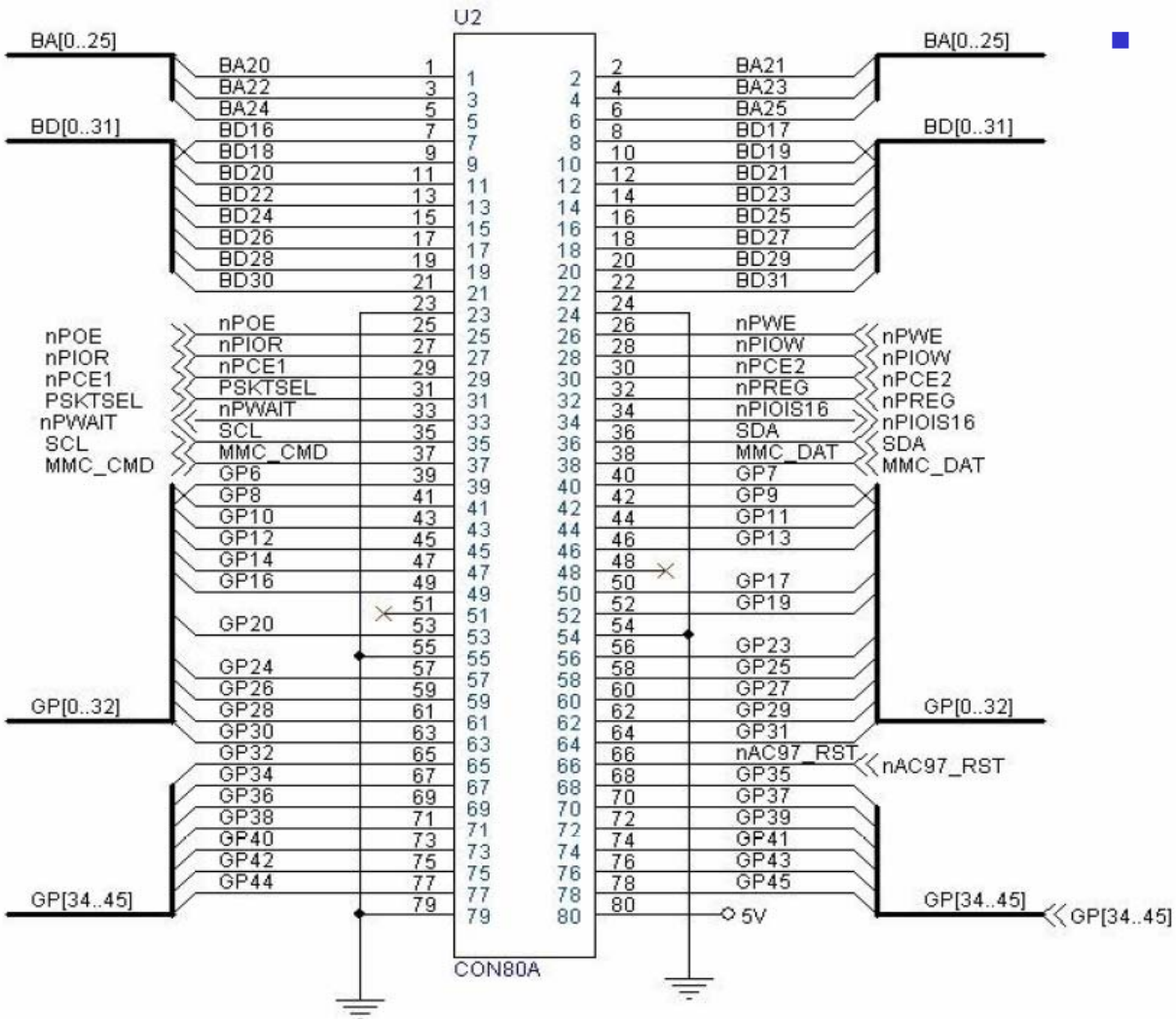
- 1. PXA255 ARM RISC chip 400MHz
- 2. 64Mbytes NAND Flash
- 3. 32MBytes SDRAM x2
- 4. 512KBytes Boot Flash
- 5. CS8900 Ethernet Chip
- 18. CPLD
- 6. RJ45 LAN connector
- 7. Serial connector
- 8. 5V adapter jack
- 9. USB client
- 10. Power switch
- 11. Reset switch
- 12. Extension connector x2
- 16. JTAG connector

EZ-X5 (V)

- Connector U1 pin descriptions (Switch side)
  - BD: Buffered Data
  - BA: Buffered Address
  - BnCS: Buffered Chip Select Not
  - GP: General Purpose Input Output
  - SYS_RST: System Reset
  - EXT_RST: External Reset
  - BOE: Buffered Output Enable
  - BWE: Buffered Write Enable
  - BPWE: Buffered PCMCIA Write Enable
  - BDQM: Buffered Data Query Mode



EZ-X5 (VI)



- Connector U2 pin descriptions (Ethernet side)
  - nPOE: PCMCIA Output Enable Not
  - nPWE: PCMCIA Write Enable Not
  - nPIOR: PCMCIA IO Read
  - nPIOW: PCMCIA IO Write
  - npCE: PCMCIA Chip Enable
  - PSKSEL: PCMCIA Socket Select
  - nPREG: PCMCIA Register
  - nPWAIT: PCMCIA Wait
  - nPIOIS16: PCMCIA IO Size 16
  - SCL: I2C Clock
  - SDA: I2C Data
  - MMC_CMD: MMC Command
  - MMC_DAT: MMC Data

2.1.2 Software in EZ-X5

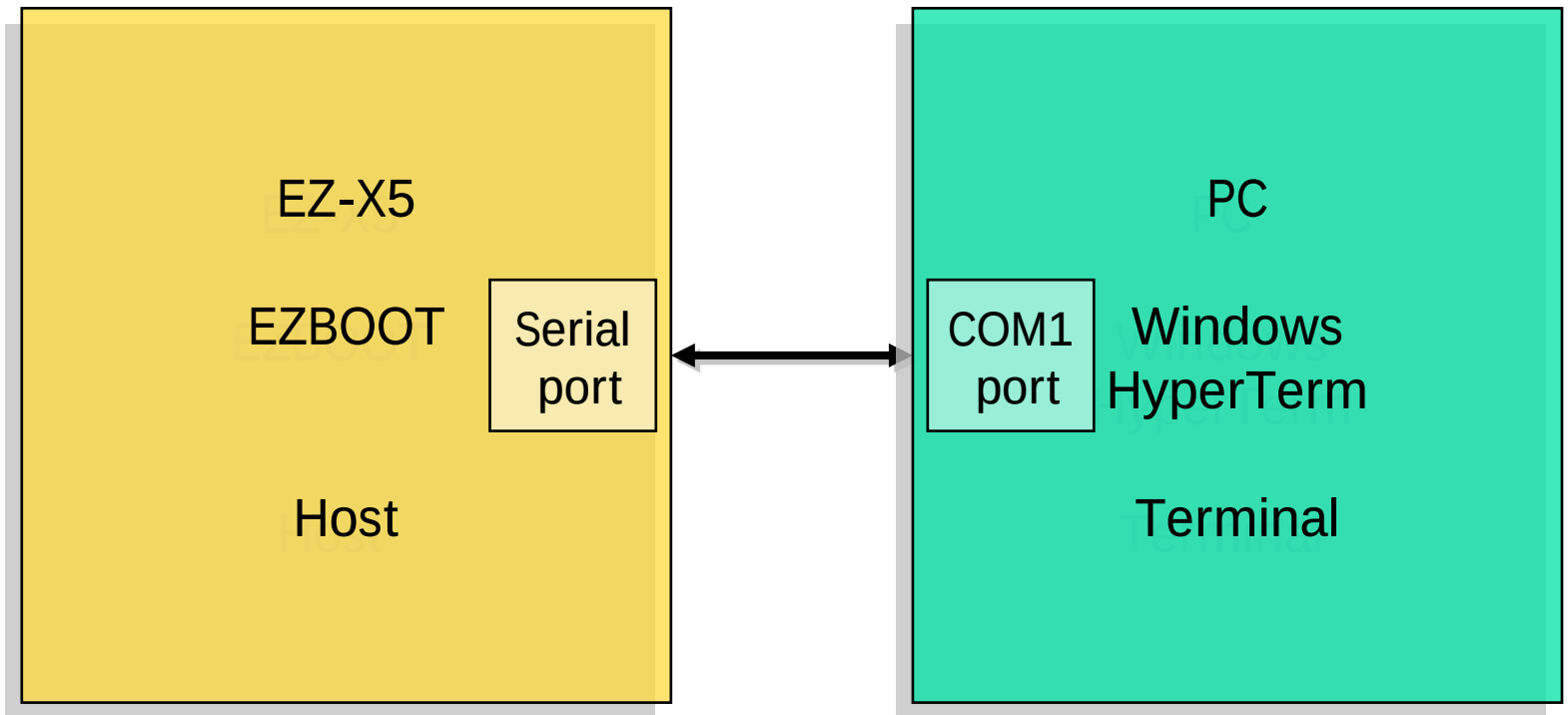
- Program storage
  - RAM – Loss of contents when power-off
  - Flash – No loss when power off. Preinstalled software can reside.
- Current software in Flash
  - Monitor program in Boot Flash
    - EZBOOT.X5 ver. 1.0
  - Linux Kernel and operating system in NAND Flash
    - zImage.x5: ARM Linux kernel
    - Ramdisk.x5.gz: Compressed Ramdisk image
- More info
  - *http://www.falinux.com*

2.2 EZ-X5 Booting with Windows

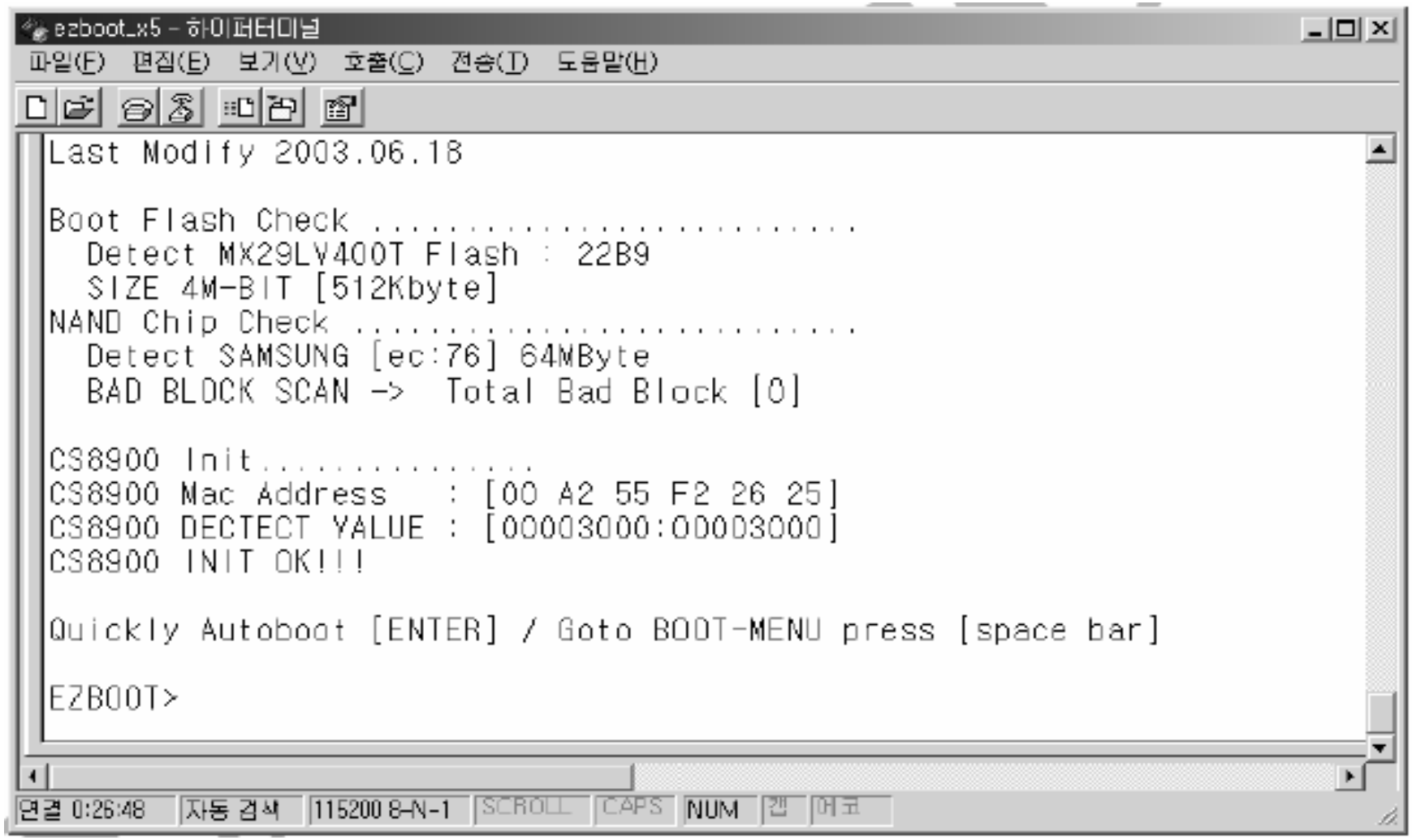
- EZ-X5
  - EZBOOT and Linux require a serial console
  - Assume: Kernel and Ramdisk are already installed.
- PC
  - Hyper Terminal
    - Text-based serial communication software
    - Using COM1 or COM2
    - Included in Windows OS
      - **시작 – 프로그램 – 보조프로그램 – 통신 – 하이퍼터미널**
  - **설정**
    - **새연결**
    - Select COM1 [or COM2] depending on EZ-X5 serial connection
    - Port **설정**
      - 115200 bps, 8 data, no parity, 1 stop, no flow control
    - Save session

EZ-X5 Booting with Windows (II)

- Connection



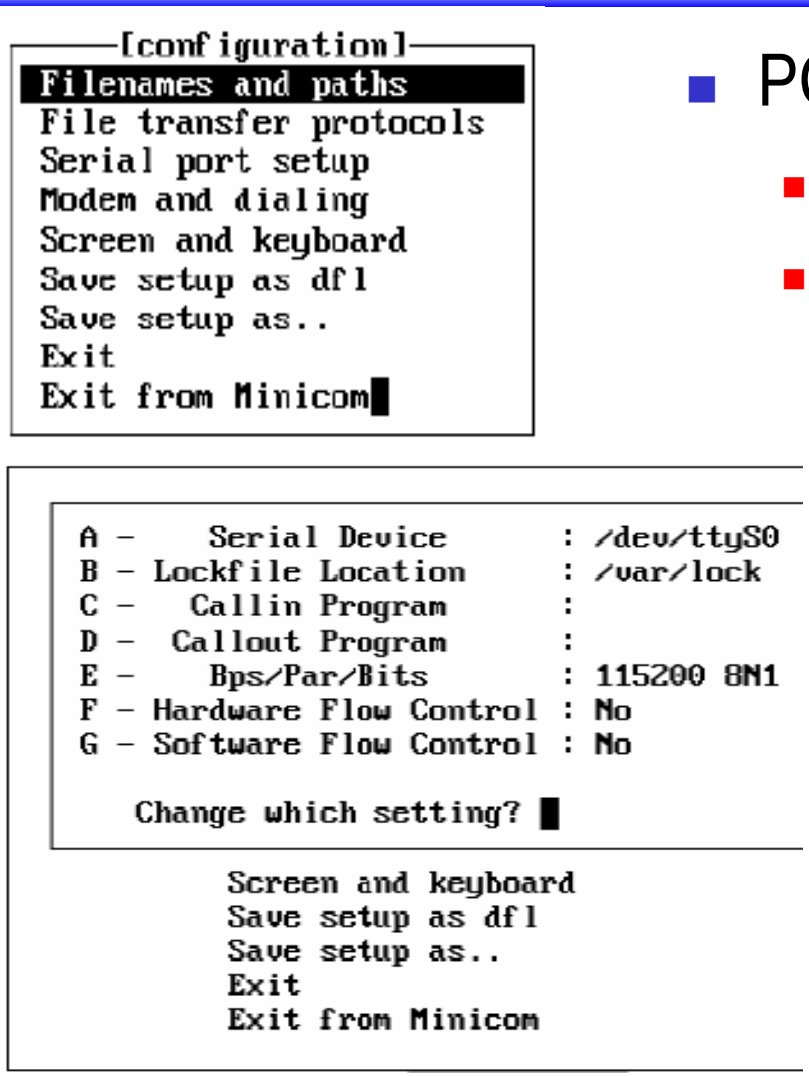
EZ-X5 Booting with Windows (III)



EZ-X5 Booting with Windows (IV)

- Test with EzBoot
  - Press space bar within 10 sec.
  - Prompt of “EZBOOT> “ appears
- Termination of Hyper Terminal
  - File – Exit or
  - Alt+F4
- *100 Reasons why the System is not Working*
  - .....
  - .....

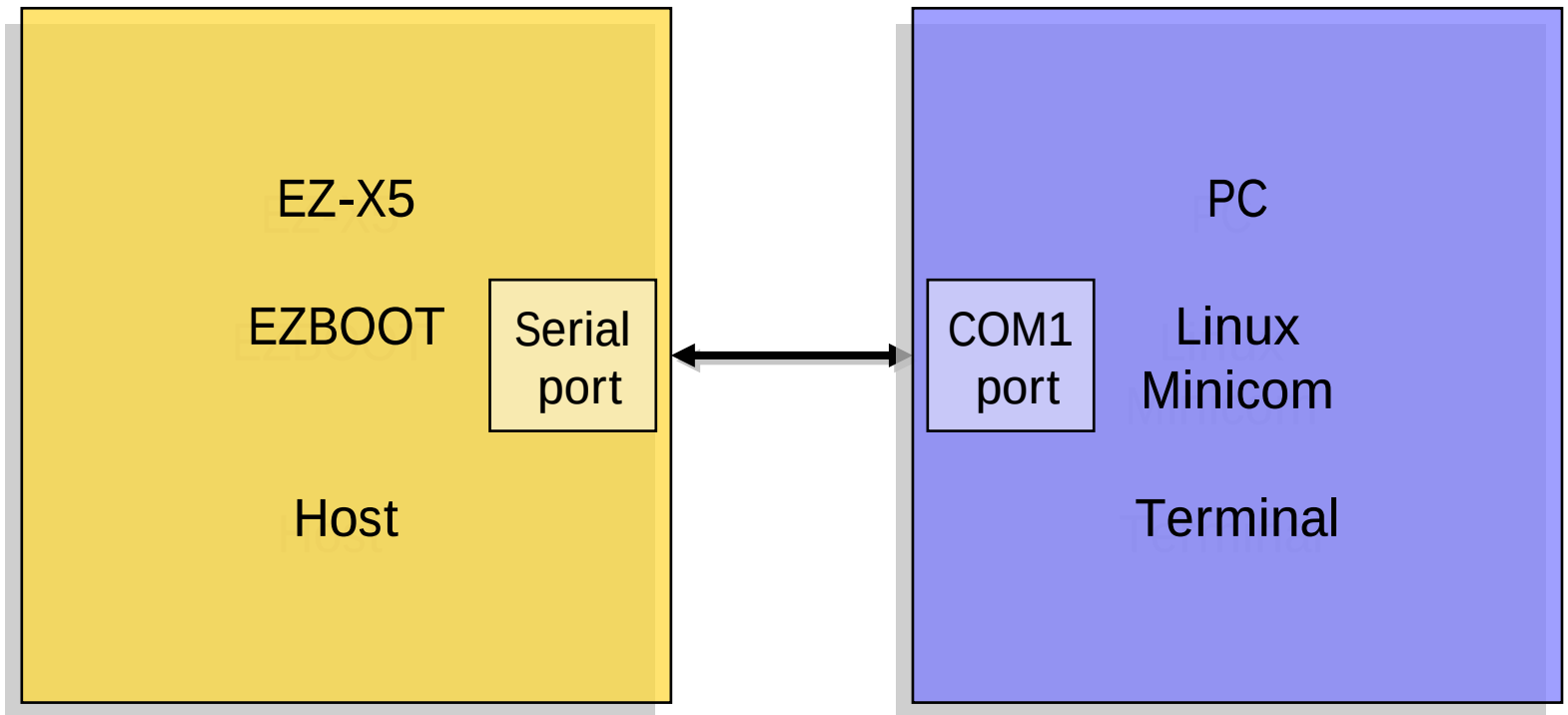
2.3 EZ-X5 Booting with Linux



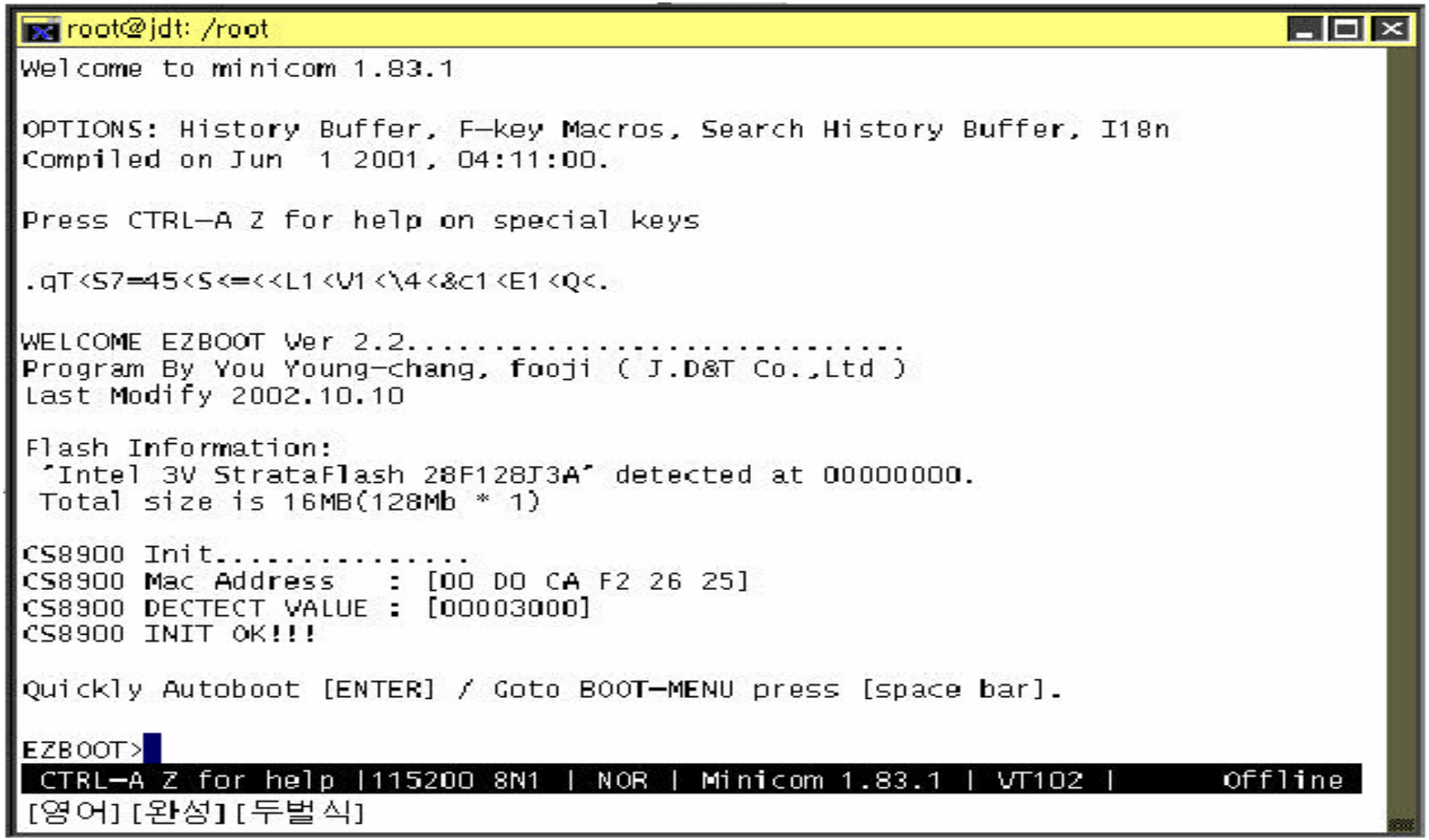
- PC using Linux
  - [Re]Boot PC to run Linux!
  - Minicom
    - Linux terminal emulator
    - Setting
      - Acquire root privilege: #su
      - #minicom –s
      - Serial port setup
        - Serial device: /dev/ttyS0
        - Bps/par/bits: 115200 8N1
        - Hardware flow control: No
        - Software flow control: No
      - Save setup as dfl
      - Exit

EZ-X5 Booting with Linux (II)

- Connection



EZ-X5 Booting with Linux (III)



EZ-X5 Booting with Linux (IV)

- Help on EzBoot
  - Type ‘help’ or ‘?’
  - EZBOOT> help
- Termination of minicom
  - Ctrl+a, q
  - Pop-up window: Leave without reset? Yes <Enter>
- Help on minicom
  - Ctrl+a, z

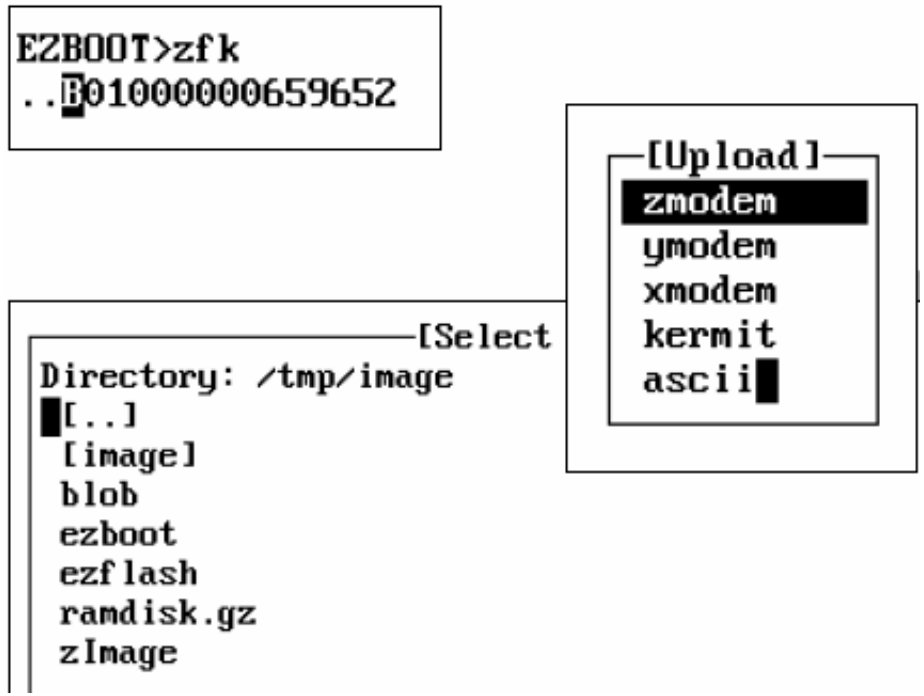
2.4 ARM Linux Installation with Linux

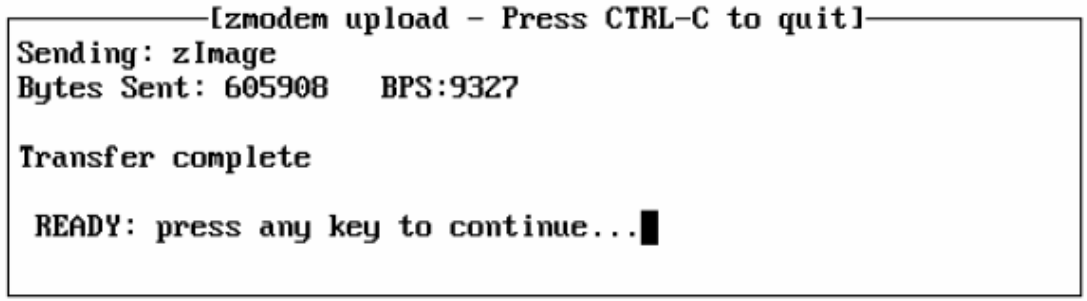
- Purpose
  - Install the Linux software in the Flash of EZ-X5, which is composed of zImage and ramdisk.gz using Linux PC

- **1. 프로그램 복사**
  - Mount the CDROM in then PC with Linux
    - # mount /dev/cdrom /mnt/cdrom
    - Mount: block device /dev/cdrom is write-protected, mounting read-only
    - #
  - Copy all the files in /sw/image
    - # cd mnt/cdrom/sw
    - # ls –la
    - # cp –a image /tmp/image
  - Check if zImage.x5 and ramdisk.x5.gz exist in /tmp/image

ARM Linux Installation with Linux (II)

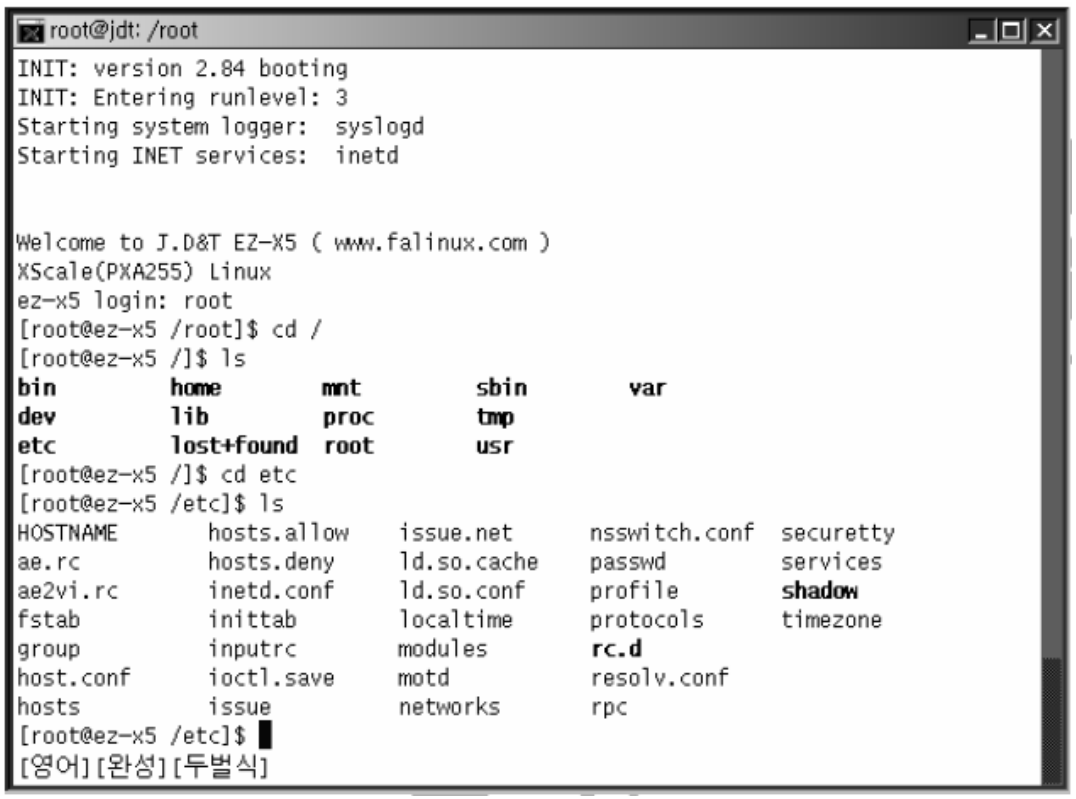
- 2. Loading zImage/ramdisk into EZ-X5
  - Start the minicom in PC Linux
  - Type 'zfk'/'zfr' command
    - Z: Serial z-modem protocol
    - F: Flash
    - K: Kernel image
    - R: Ramdisk image
  - Press <Ctrl+a>, s
    ; Send
    - Select Upload – zmodem
    - Select file: zImage
  - Writing: |========
    - Press any key to continue





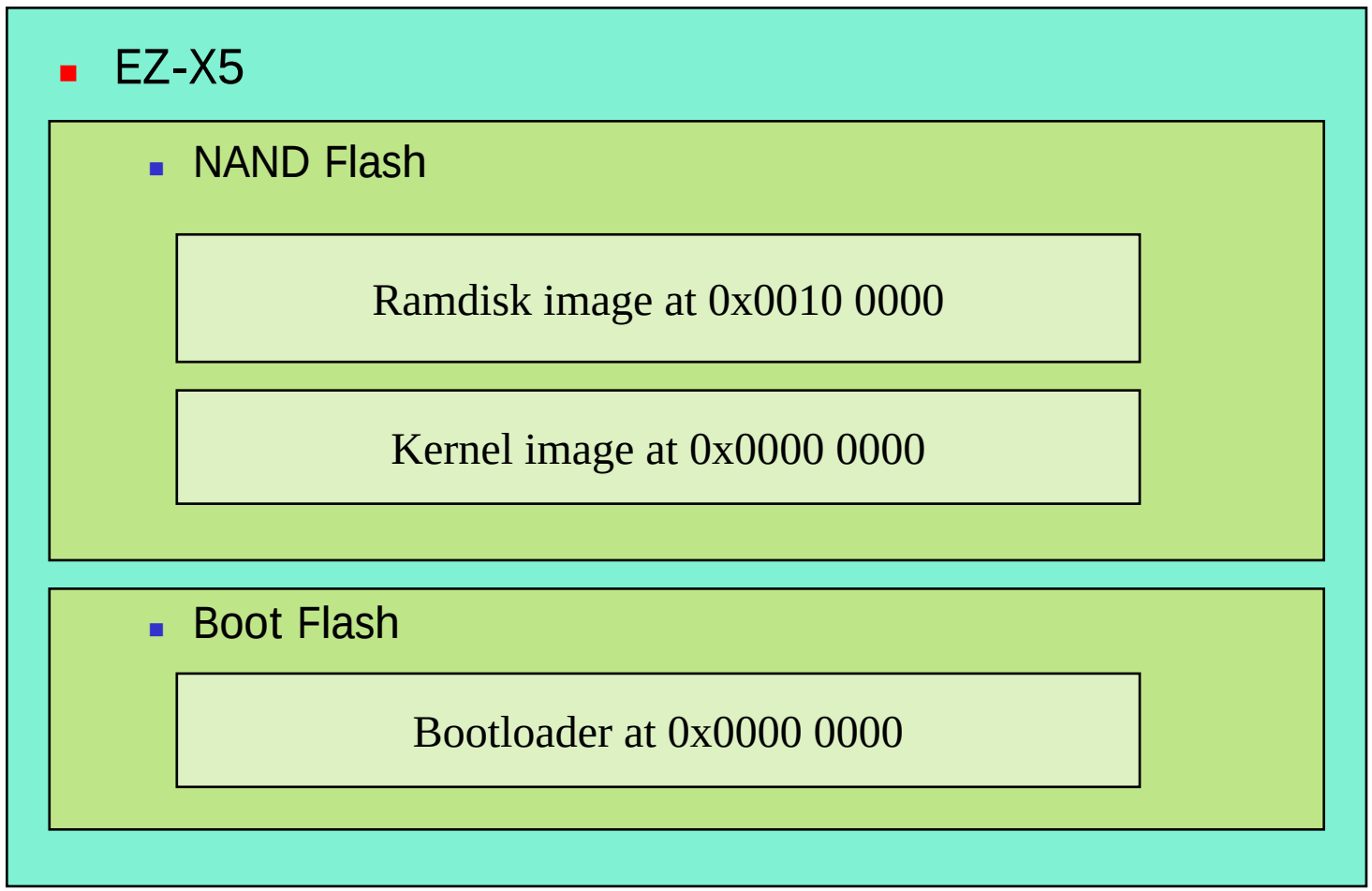
ARM Linux Installation with Linux (III)

- 3. Running ARM Linux
  - Three ways to start
    - Power ON
    - Press Reset switch
    - Key in “rst” in EZBOOT
  - Login
    - EZ-X5 Login: root
    - Password: [Enter]
      ; Just press enter key



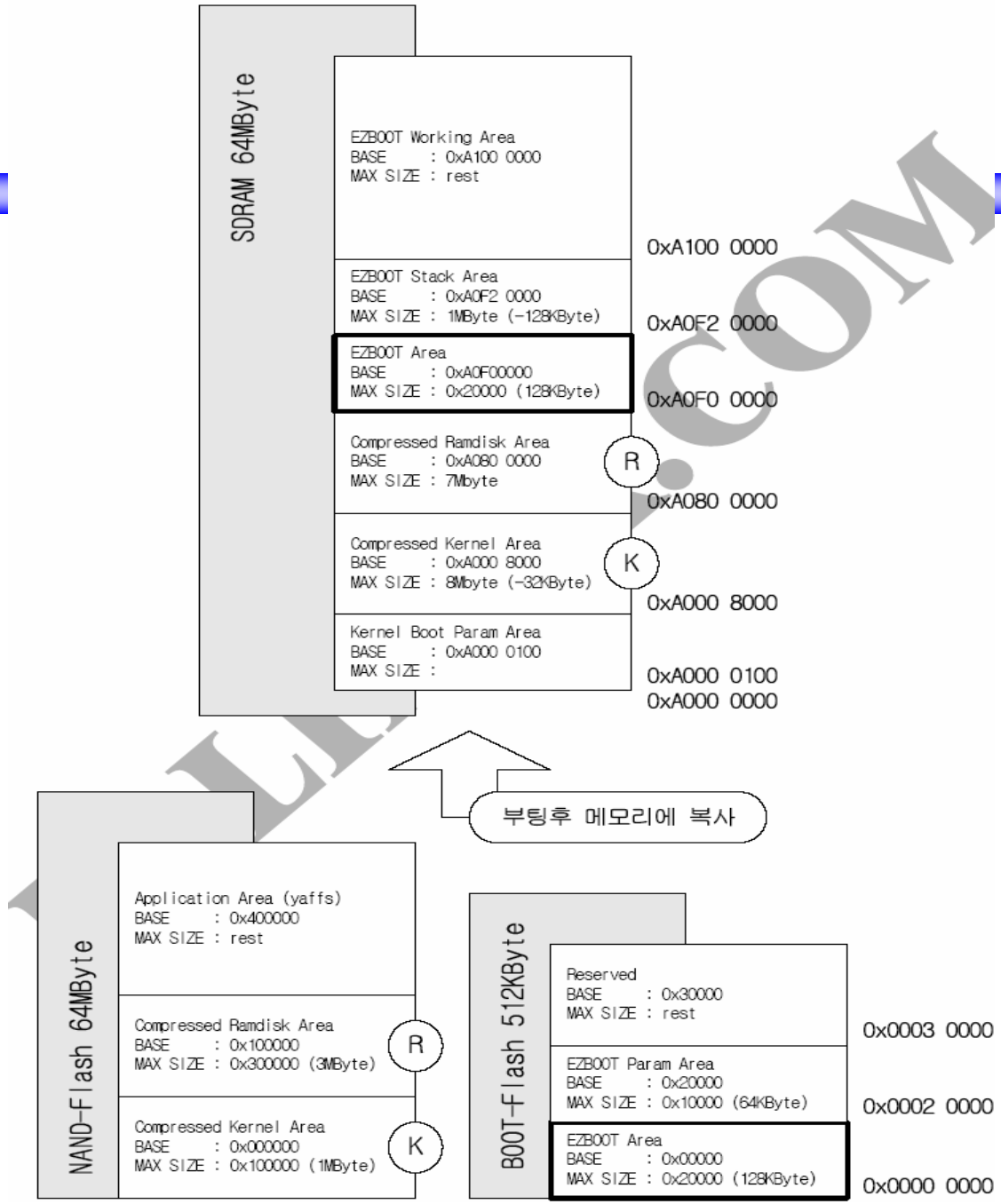
ARM Linux Installation with Linux (IV)

- What you've done:



ARM Linux Installation with Linux (V)

- Memory map



Reference

- EZ-X5 User's Manual, Ch. 1-4, http://www.falinux.com