개발환경 구축:
Cross compiler, bootp, tftp, NFS 등

단국대학교

컴퓨터학과

2009

백승재

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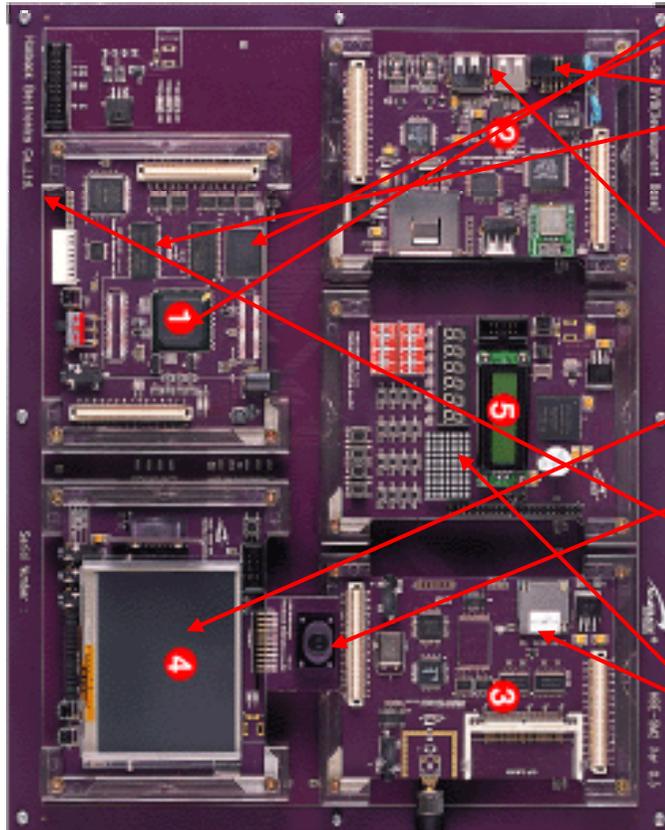
http://embedded.dankook.ac.kr/~ibanez1383

강의 목표

- Target board에 대한 기본적인 이해

- 개발 과정 이해 및 환경 구축

- 개발 사례 파악
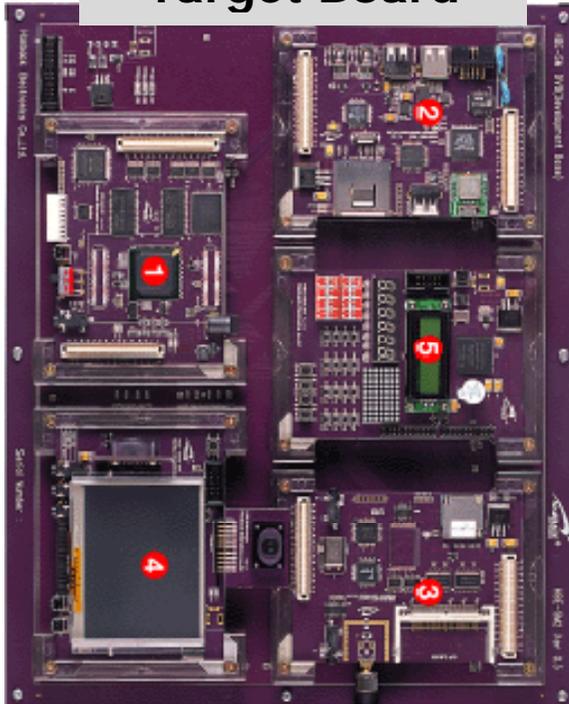
Target board

■ HBE-SM II-P320

Items	Hardware Specifications
CPU	Marvell PXA320B1C806 (806MHz)
Memory	NAND Flash Memory : Samsung K9F1G08U0B (128M x 8bit) Mobile-DDR RAM : 128MByte (512Mbit x 2ea)
FPGA	Altera Cyclone-2 (EP2C8F256C8ES) x 2ea
CPLD	Altera MAXII (EPM1270GF256C5) x 1ea
SRAM	Samsung K6R4016V1C (256Kx16 Bit) x 3ea
Ethernet	1 Port 10/100Base-T Ethernet
Audio	AC'97 Audio Codec (Built-in Touch Screen I /F) 1 Port Stereo Out (Stereo Jack), 1 Port Line IN (Stereo Jack), 1 Port MIC IN (Stereo Jack)
LCD	3.5" TFT LCD 1ea
Touch Screen	3.5 Touch Screen x 1ea
Camera	1.3M Pixel CMOS Camera x 2ea
USB	USB 1.1 Host : A type Connector x 1ea USB 1.1 Client : Mini type Connector x 1ea USB 2.0 Host : A type Connector x 1ea USB 2.0 OTG : Mini type Connector x 1ea
UART	RS232 Level : Stereo type Connector x 3ea 3.3V TTL Level : 2 Port for GPS & Bluetooth : 1 Port
I²C	1 Port
IrDA	1 Port (Compliant to IrDA 1.1)
Storage	1ea CF Connector 1ea SD / MMC Connector
Wireless LAN	1 Port Wireless LAN (IEEE802.11b/g)
I / O Application	Text LCD, 7-Segment, Dot Matrix (7 x 5 x 2ea), Key Pad (4 x 4), DIP Switch (8point x 2ea), LED (8ea), Buzzer, Tact Switch (4ea)
I / F Module	1ea Bluetooth Module (On-Board)

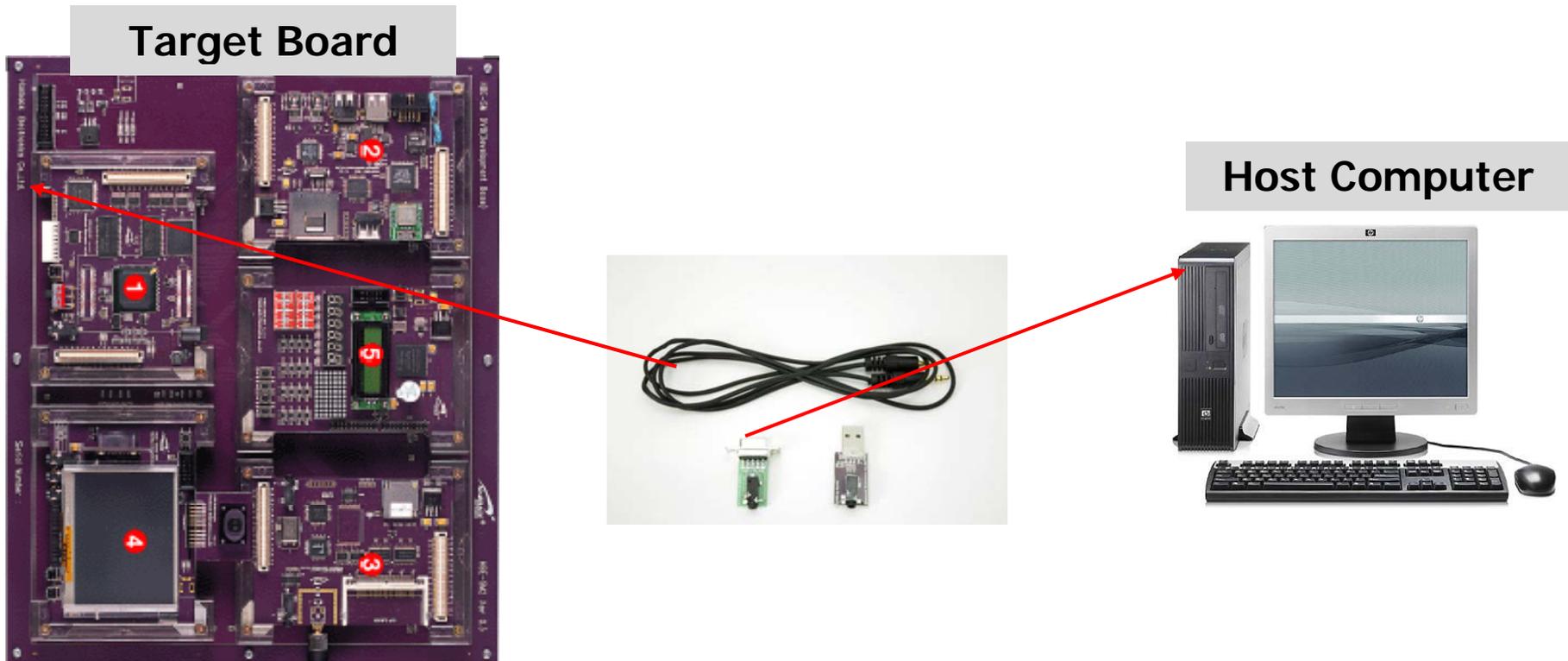# Step1: Serial port & minicom settup

Target Board

Host Computer

- Target board have no 'monitor'
- Serial port와 minicom 프로그램을 이용해 보드에 가상 적인 모니터를 만들어 주자

Step1: Serial port & minicom settup

Target Board

Host Computer

- Serial이나 USB 둘 중 하나만 사용하여 target board와 host computer를 연결

Step1: Serial port & minicom settup

- **minicom : 리눅스용 터미널 에뮬레이터**
  - ## 2. Minicom 환경 설정

Boudrate	115200bps
Date Size	8
Parity	None
Stop bits	1
H/W flow control	NO
S/W flow control	NO

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Step1: Serial port & minicom settup

- ## minicom : 리눅스용 터미널 에뮬레이터
  - ### 2. Minicom 환경 설정
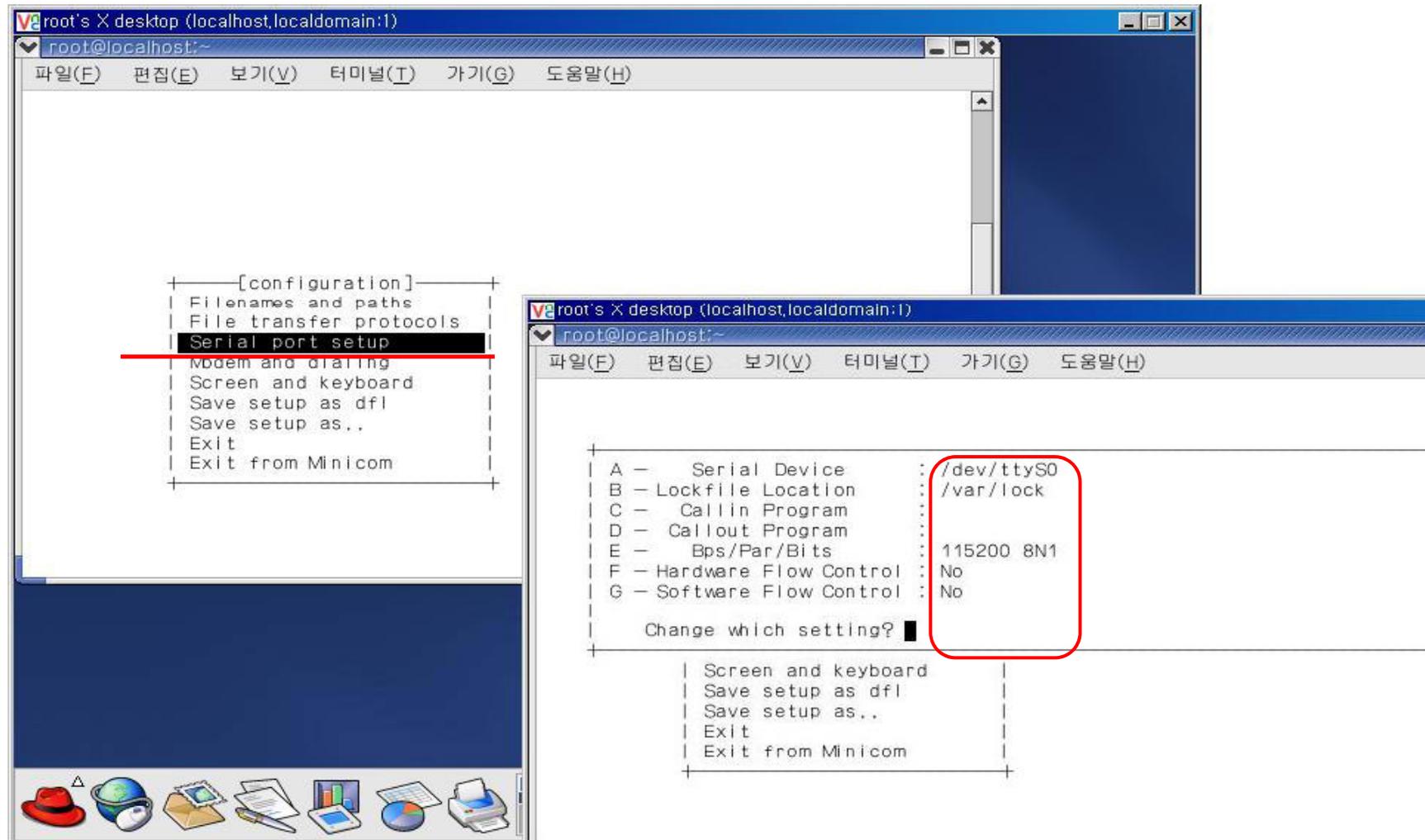
Step1: Serial port & minicom settup

- ■ minicom : 리눅스용 터미널 에뮬레이터

3. 설정 저장 및 실행

```
+----------[configuration]----------+
| Filenames and paths               |
| File transfer protocols           |
| Serial port setup                 |
| Modem and dialing                 |
| Screen and keyboard               |
| Save setup as dfl                 |
| Save setup as..                   |
| Exit                              |
| Exit from Minicom                 |
+-----------------------------------+
```

```
+----------[configura|  Configuration saved  |
| Filenames and    |                          |
| File transfer    +--------------------------+
| Serial port setup               |
| Modem and dialing               |
| Screen and keyboard             |
| Save setup as dfl               |
| Save setup as..                 |
| Exit                            |
| Exit from Minicom               |
+---------------------------------+
```

```
+----------[configuration]----------+
| Filenames and paths               |
| File transfer protocols           |
| Serial port setup                 |
| Modem and dialing                 |
| Screen and keyboard               |
| Save setup as dfl                 |
| Save setup as..                   |
| Exit                              |
| Exit from Minicom                 |
+-----------------------------------+
```

```
+---------------------------+
|                           |
| Initializing Modem        |
|                           |
+---------------------------+
```

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Step2: Cross compiler

(native)
Compiler
.c → Intel Binary

User App.c

010101..

Host Computer

■ Native compiler
- ✓ generates code for its own execution environment

Step2: Cross compiler

(cross)

Compiler

.c → ARM Binary

Target Board

101010...

User App.c
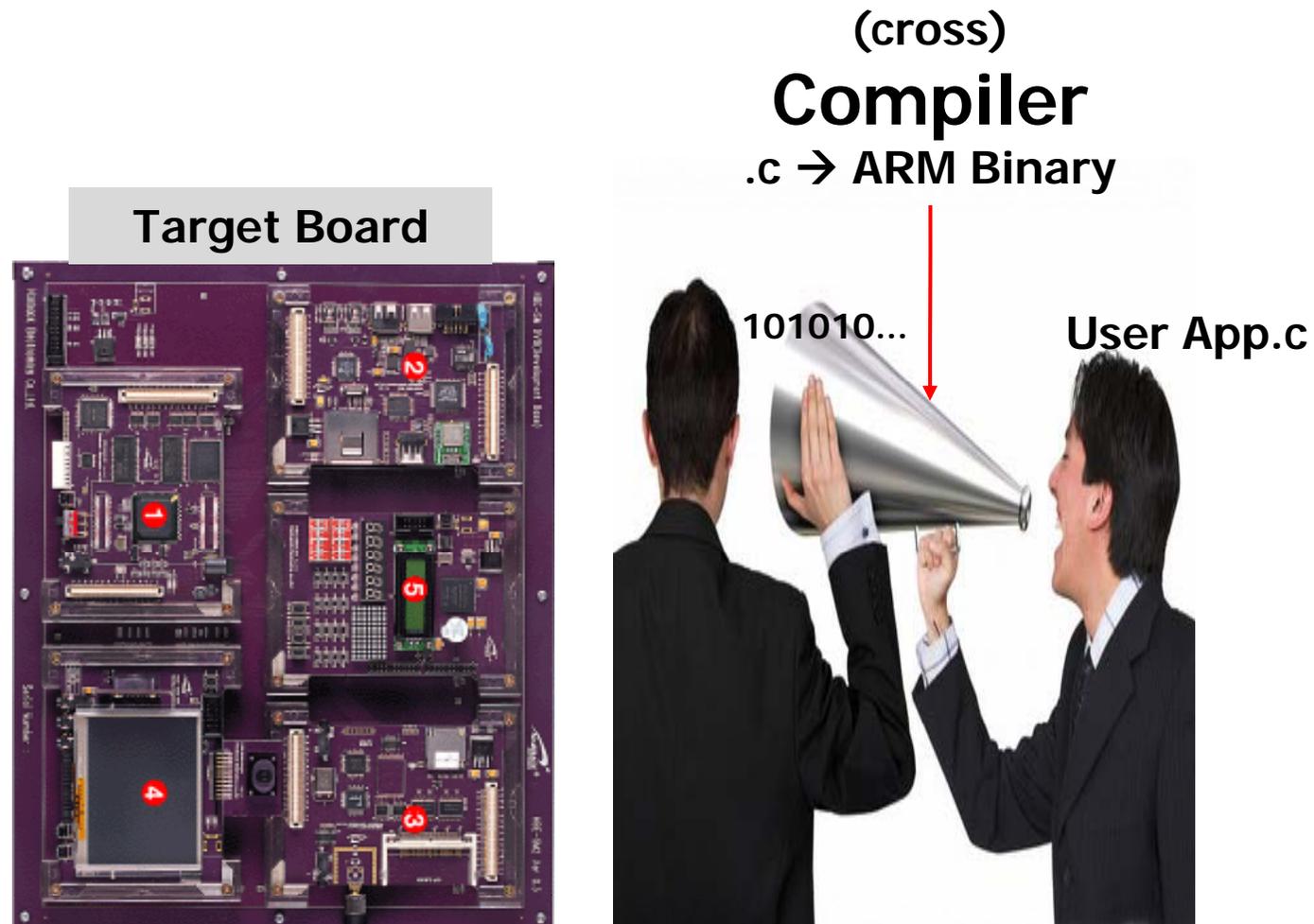
■ Cross compiler
  ✓ executes in one environment and generates code for another

Step2: Cross compiler

- **Cross compiler**
  - ✓ Modify the compiler, compile the compiler and use it
  - ✓ Download the compiler(already modified) for your architecture
    - ▪ tar.gz
    - ▪ rpm, …
- **HBE-SMII-P320 보드의 경우 CD에 cross compiler를 제공한다**
  - ✓ /usr/local 디렉토리에 압축해제 한 후
  - ✓ PATH 설정 하여 사용하면 된다

Step2: Cross compiler

Step2: Cross compiler

각 파일이 어느 아키텍쳐에서 실행가능한지 확인할 수 있다.

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Step3: JTAG

Target Board
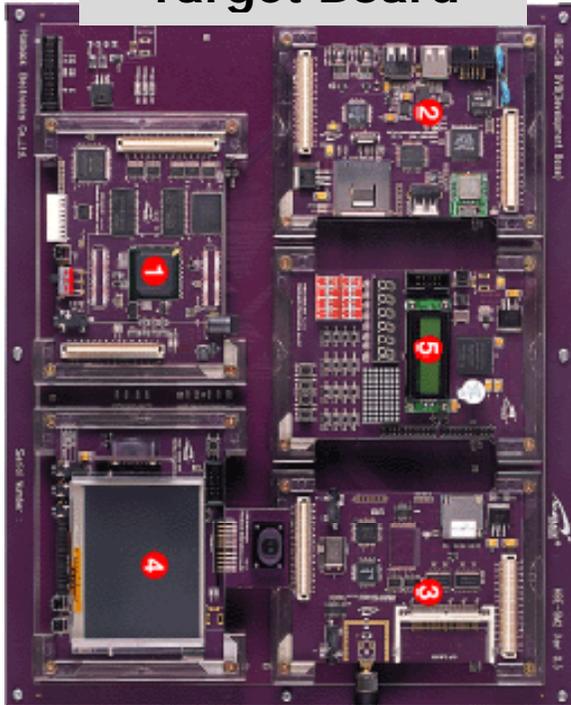
Host Computer

- PC of ARM cpu have the value 0x00000000 after power on
- Bootloader must be written in 0x00000000
- NOR flash memory located in 0x00000000

- How can you writing bootloader into NOR flash memory?

Step3: JTAG

Target Board

Bootloader(src)

Cross compiler

Bootloader(bin)

Host Computer

JTAG

Marvell(R) XDB Debugger - Startup

Project

New ... | Settings ... | Browse...

Start

Cancel

c:\program files\marvell\sdt2.1\xdb\configurations\ocd\pxa320.xsf

[Common Settings]
Interactive mode
Target: JTAG CPU
Working Directory: ~
Batch File: pxa320.xdb

[CPU - JTAG]
Target Connection: lpt1:1
Scan-chain: PXA3XX
Monitor at: 0xFFFFF000

About ...
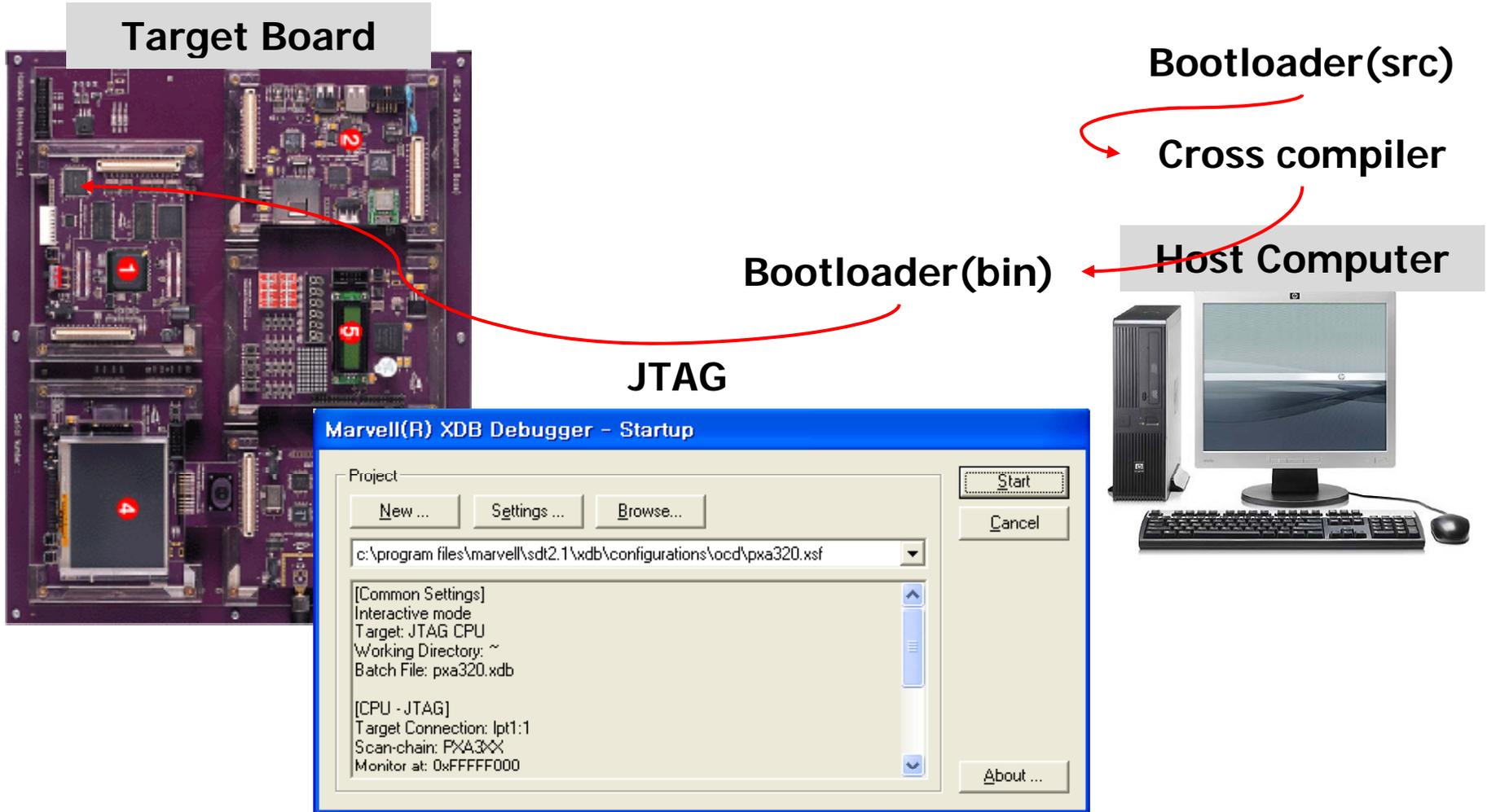
- In the Linux?
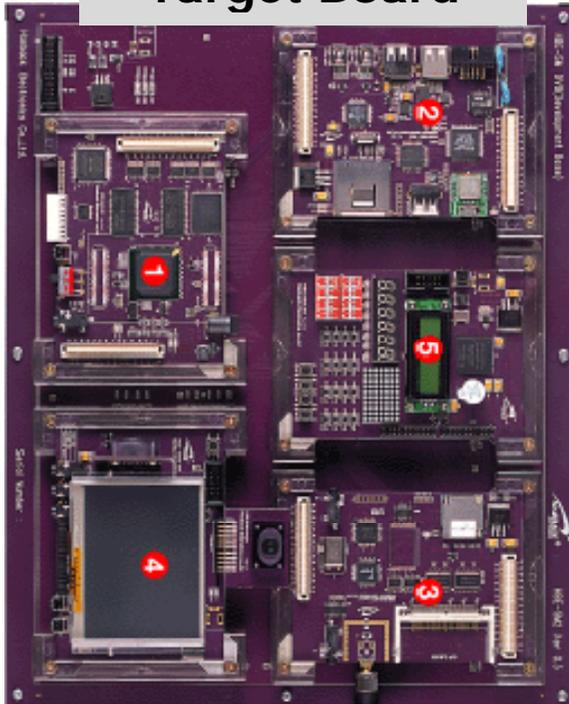
Step4: bootp

Host Computer

- Bootloader will running on the target board
  - ✓ You can use peripherals

- Kernel image and rootfilesystem also should be written to Flash memory on the board

- Use faster interface than JTAG

Step4: bootp

Target Board
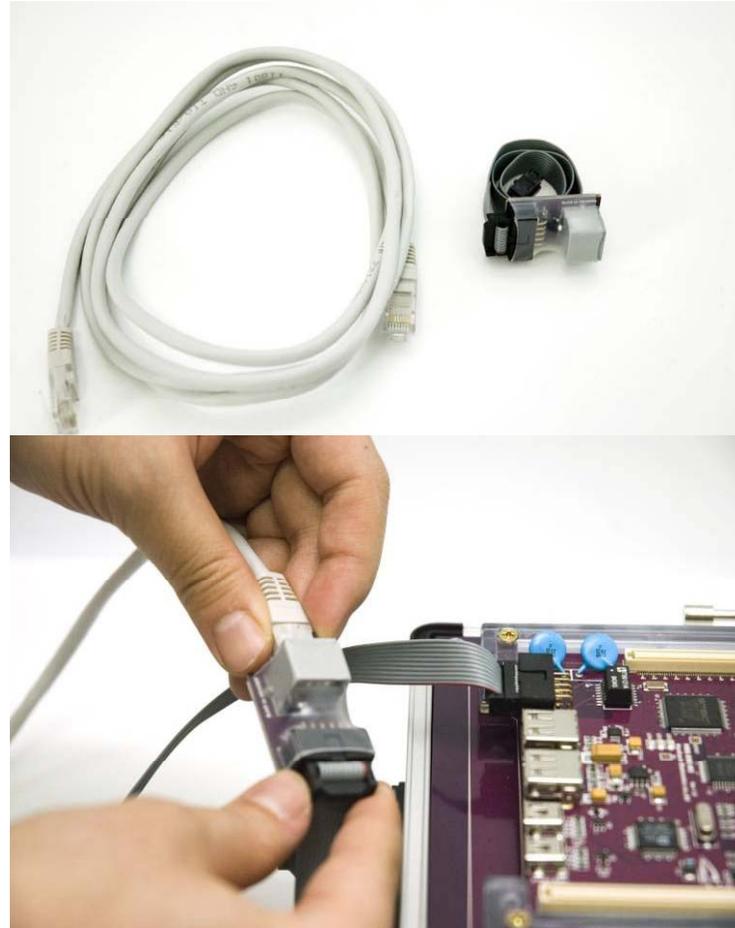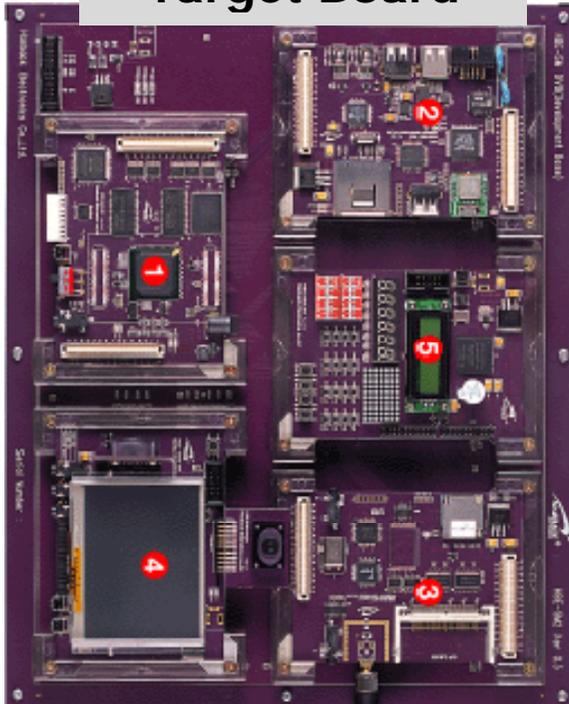
Host Computer

- ■ (Cross)Ethernet cable 연결

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Step4: bootp

Target Board

Bootp client

Bootp server

Host Computer

eth
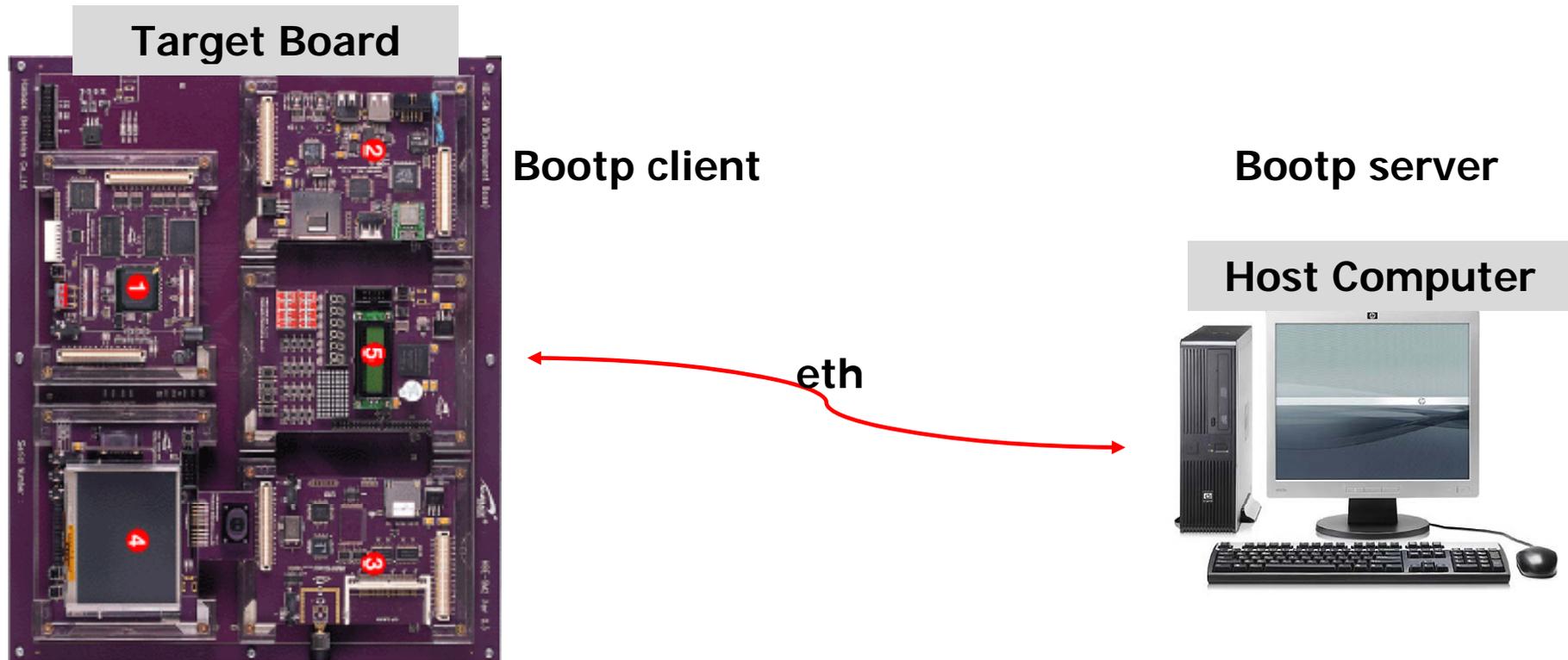
- IP address required(for target board)
- You can get IP address automatically using DHCP if there is DHCP server

- Bootp (your host computer shoud be bootp server)

Step4: bootp


```
root's X desktop (localhost.localdomain:1)
root@localhost:/etc
파일(F)   편집(E)   보기(V)   터미널(T)   가기(G)   도움말(H)
[root@localhost tftpboot]# cd /etc
[root@localhost etc]# ls -al | grep bootptab
-rw-r--r--   1 root       root          133  9월  10 22:02 bootptab
[root@localhost etc]# vi bootptab █
```

```
root's X desktop (localhost.localdomain:1)
root@localhost:/etc
파일(F)   편집(E)   보기(V)   터미널(T)   가기(G)   도움말(H)
.default:\
          :hd=/tftpboot:bf=null:\
          :sm=255.255.255.192
amiboard:\
          ht=1:\
          ha=0x122221122221:\
          tc=.default:\
          ip=192.168.184.138:
~
~
~
~
~
~
~
~
~
~
~
~
~
~
"bootptab" 8L, 133C
```

```
[root@localhost etc]#
[root@localhost etc]# cd /etc/xinetd.d
[root@localhost xinetd.d]#
[root@localhost xinetd.d]#
[root@localhost xinetd.d]# pwd
/etc/xinetd.d
[root@localhost xinetd.d]# ls -al | grep bootp
-rw-r--r--   1 root       root          171  9월   7 12:23 bootp
[root@localhost xinetd.d]#
[root@localhost xinetd.d]# vi bootp█
```

```
root's X desktop (localhost.localdomain:1)
root@localhost:/etc/xinetd.d
파일(F)   편집(E)   보기(V)   터미널(T)   가기(G)
service bootps
{
          disable        = no
          flags          = REUSE NAMEINARGS
          socket_type    = dgram
          protocol       = udp
          wait           = yes
          user           = root
          server         = /usr/sbin/bootpd
          server_args    = -s
]
```

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Step4: tftp

Host Computer

eth

- What program do you use when you download some files from server?

- You can download file from FTP server using FTP client program

- TFTP(your host computer should be tftp server)

Step4: tftp

전체 구성도

Target Board

Cross compiler

Host Computer

JTAG

Bootp client
tftp client

eth

Bootp server
tftp server

UART

Minicom
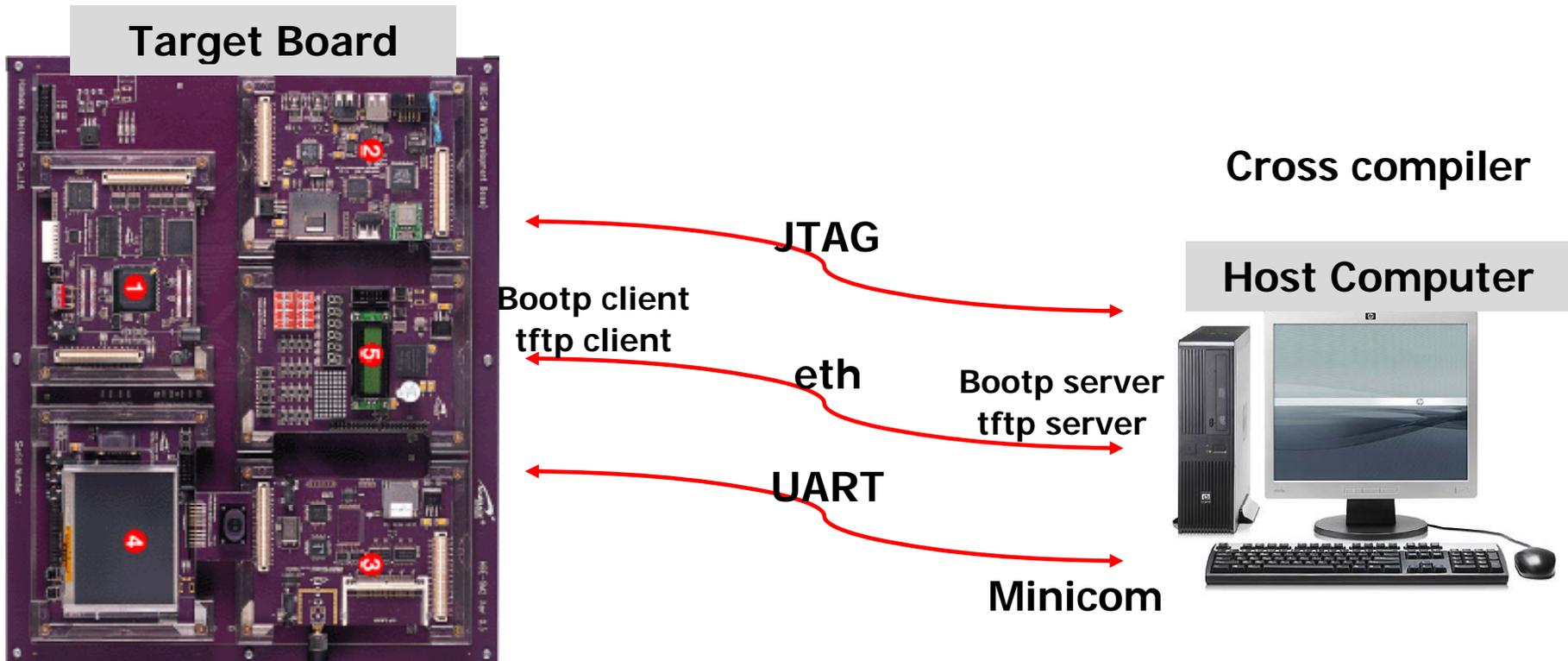
Linux booting 확인

Step5: NFS

Target Board

Cross compiler

Host Computer

JTAG

Bootp client
tftp client
NFS client

eth

Bootp server
tftp server
NFS server

UART

Minicom
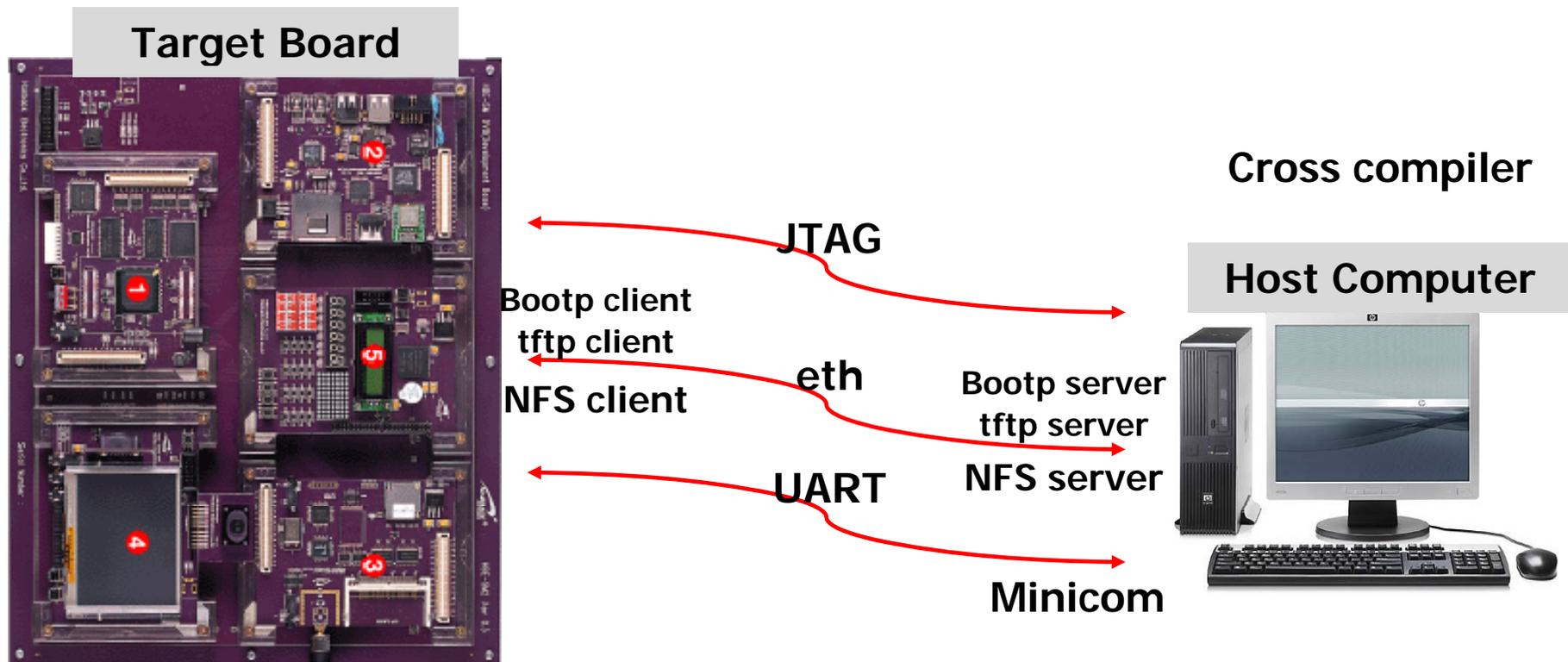
- Target board에서 Linux booting후
  ✓ Device driver 및 application 개발

- 매번 tftp로 download?

Step5: NFS

클라이언트로 부터의
마운트 요청시 서비스
할 디렉토리 생성

접근 권한 문제 등으로 인해
마운트가 실패하는 것을
방지하기 위한 설정

Step5: NFS

- ## NFS환경 파일 수정
  - ✓ /etc/exports 의 내용을 읽어 어떤 호스트에게 마운트를 허가하고, 어떤 제한을 둬야 하는지 판단

root's X desktop (localhost,localdomain:1)
root@localhost:/
파일(F)   편집(E)   보기(V)   터미널(T)   가기(G)   도움말(H)

```
/nfs      localhost(rw,insecure)
/nfs      192.168.184.0/24(rw,insecure)
```

rw : r(읽기), w(쓰기)허용
Insecure : 암호 인증 하지 않음

NFS로 공유할 디렉토리

192.168.184대역은
모두 허용

2,34-37   모두

Step5: NFS

편집한 내용을 반영하기 위해서 **nfs** 데몬을 다시시작한다.
#/etc/rc.d/init.d/nfs restart

데몬이 잘 작동 되는지 확인

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Step5: NFS

■ Board에서 nfs서버 접속

Target Board에서 Host에 NFS로
접속 하기 위하여 target의 IP를 설정.
Host NIC의 IP에 맞게 적절히
설정해줘야 함

nfs에 연결될
마운트 디렉토리

Step5: NFS

Host에서 만든 파일이 **target board**에서도 보이는 것을 확인 할 수 있다

Step5: NFS

반대로, **unmount** 한 후에는 **host**의 파일을 볼수 없게 된다

Term project 사례

- PMP, MP3, Mintpad

Target Board
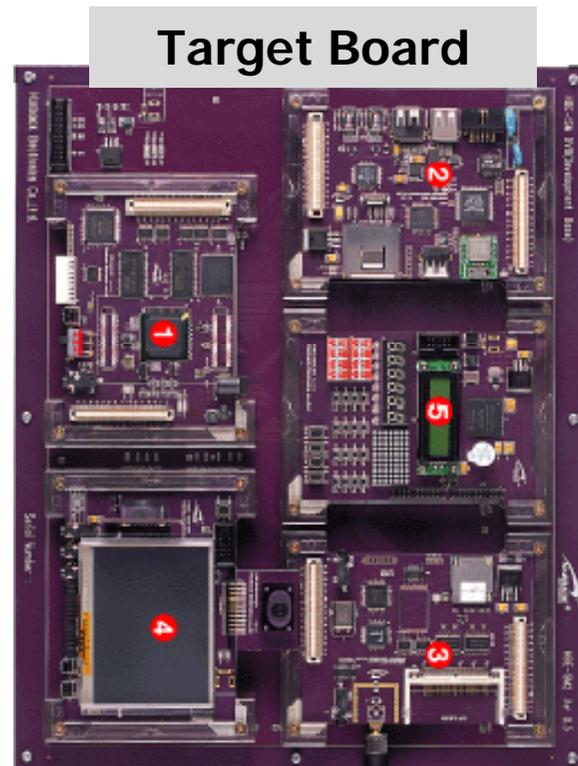
Term project 사례

- **BoA나 GoAhed Webserver와 CGI 연동**
  - ✓ 핸드폰으로 가전제품 제어...

Target Board
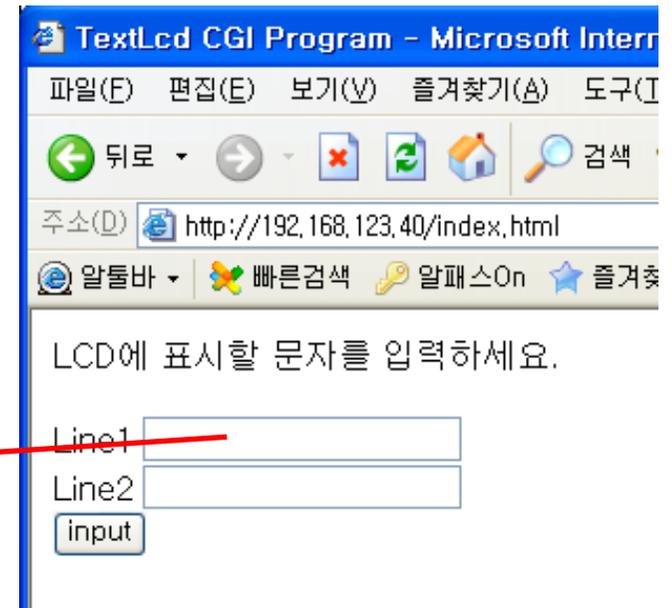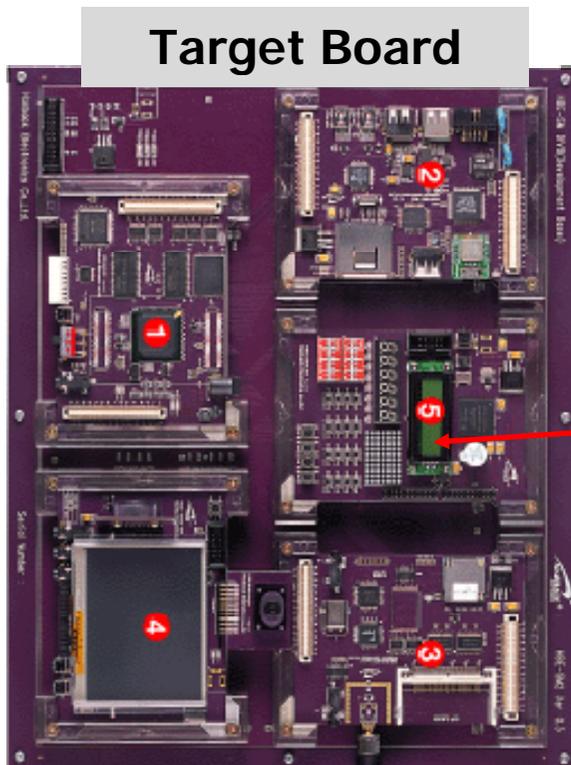
Term project 사례

- ## Qt 관련 응용
  - ✓ 게임 및 기타 app

Target Board
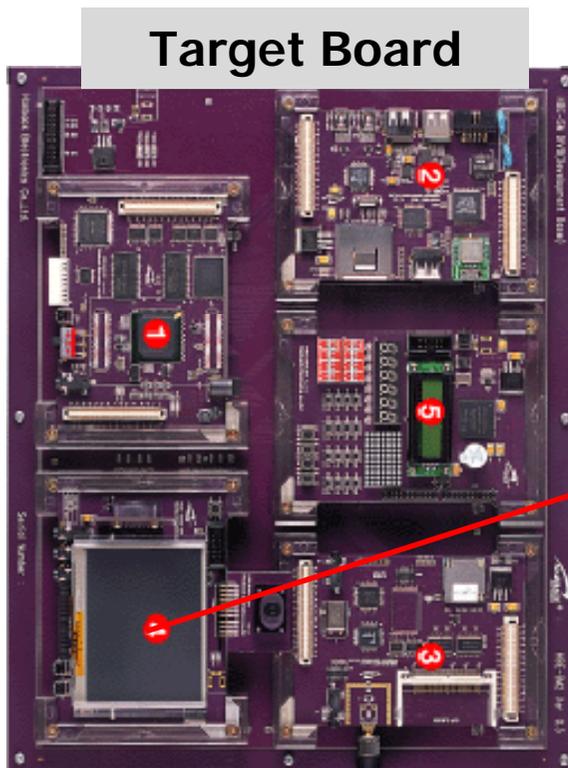
Term project 사례

- 생체인식(음성, 안면, ...), 필기체인식, ...
- 신체일부 트래킹(안구, 손, ...)
- 감시장치(움직임, 충격 감지 및 영상 저장)
- 그 외에 Sensor, LBS, RFID, Bluetooth, HCI, Wearable 등의 키워드

- TTS, STT
- 네비게이션, 길안내 프로그램
- 글자 인식, 공공장소 표지판 인식...
  ➔ 맹인 안내 도구

- *흥미로운* 주제 아무것이나 좋습니다
- 기술적 난이도를 무시할 순 없지만 그보다는
- *새롭고 신선한 아이디어*의 제안 및 *실제 구현*이 중요합니다