

임베디드 시스템 C프로그래밍

강의 소개

현대자동차 입문교육
박대진 교수

임베디드 시스템 C프로그래밍

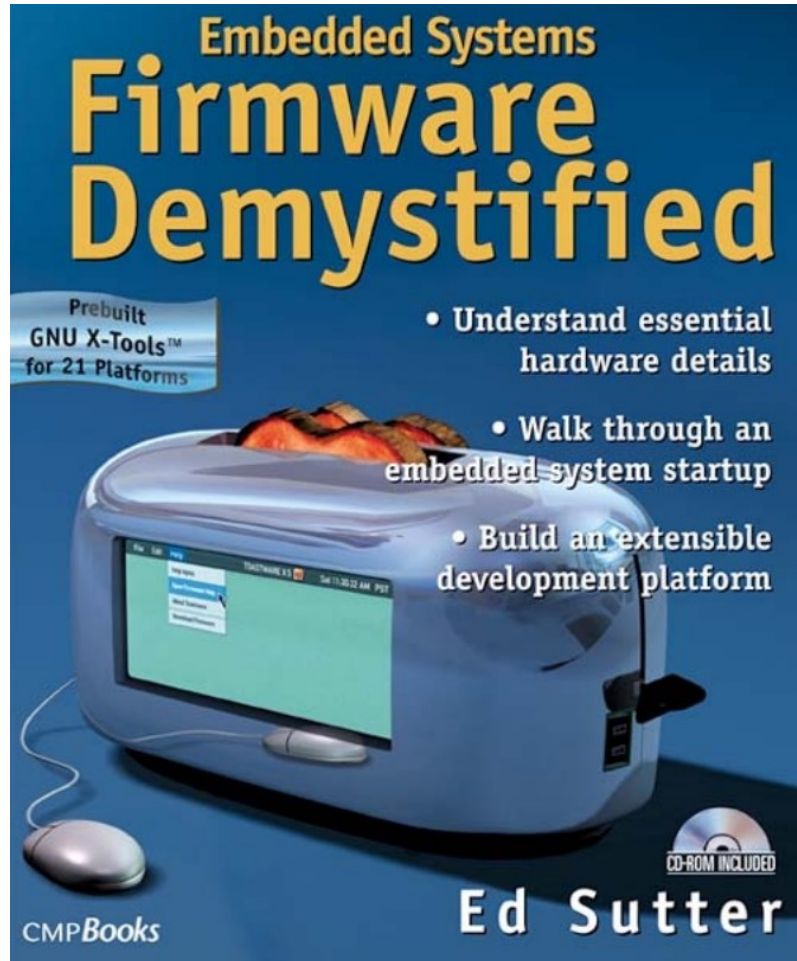
무엇을 배우는가 ? 그리고 배워야 하는 이유?

현대자동차 입문교육
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강의 Overview

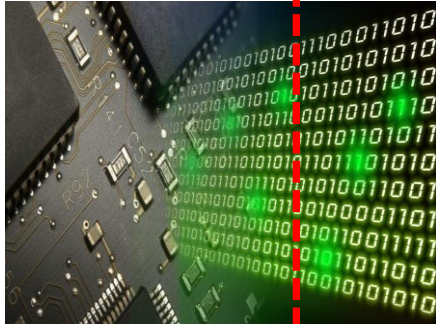
- 3개의 세션
 - Day 1 - Embedded Systems 및 System Programming
 - Day 2 - Embedded Systems Programming을 위한 C언어 실전
 - Day 3 - System Software를 타겟 프로세서에 Embedding

Everything is Powered by Software



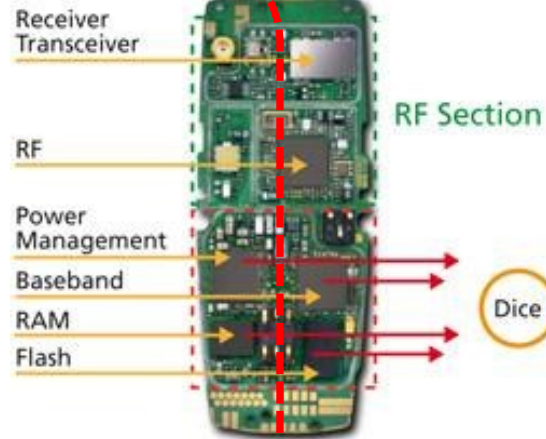
Things,
powered by
Software

EE/CS분야에서 시스템 프로그래밍의 영역



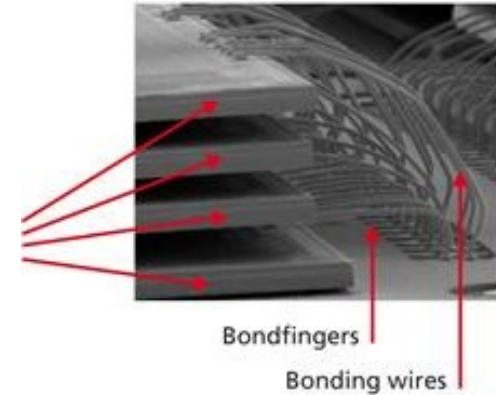
Connectivity & Intelligence

(Networks, Computer Archi., O/S, Embedded S/W, Platform)



Smart Systems

(VLSI, Control, Signal Processing, Robotics)

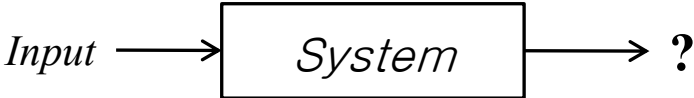
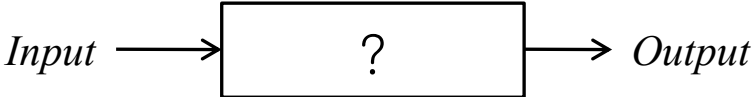
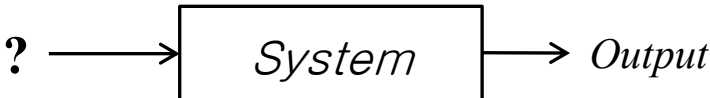


Emerging Device

(Semiconductor, Nano Technology, RF)

시스템 설계

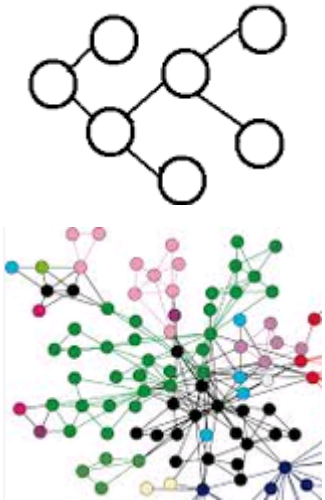
- Research objectives:
 - Given two out of {input, system, output} find the rest.

 <p><i>Input</i> → System → ?</p>	<p>Analysis — { Behavior Performance</p>
 <p><i>Input</i> → ? → <i>Output</i></p>	<p>Design : Iteration of Plan-Generation-Analysis</p>
 <p>? → System → <i>Output</i></p>	<p>Control (Management): Goal-oriented Optimization</p>

프로그래밍을 통한 시스템 설계

System-Software-on-Chip (MCU)

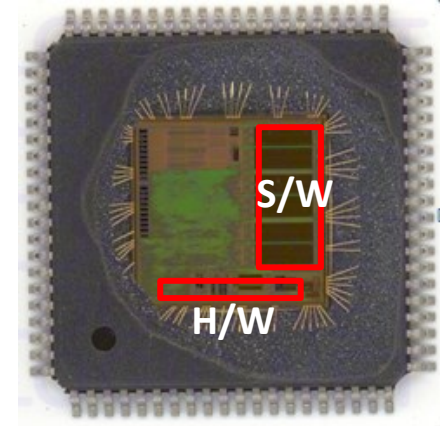
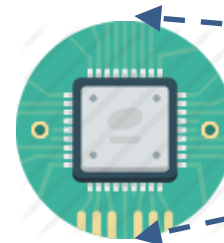
Designing Data
Structure



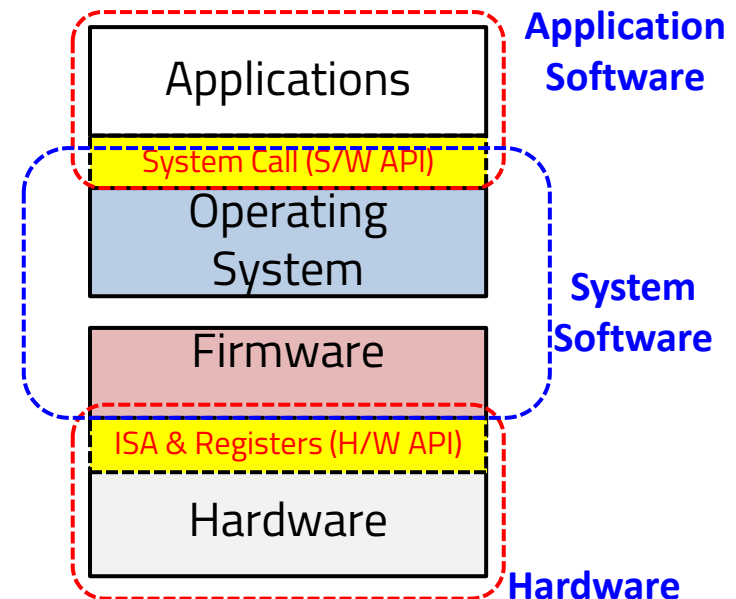
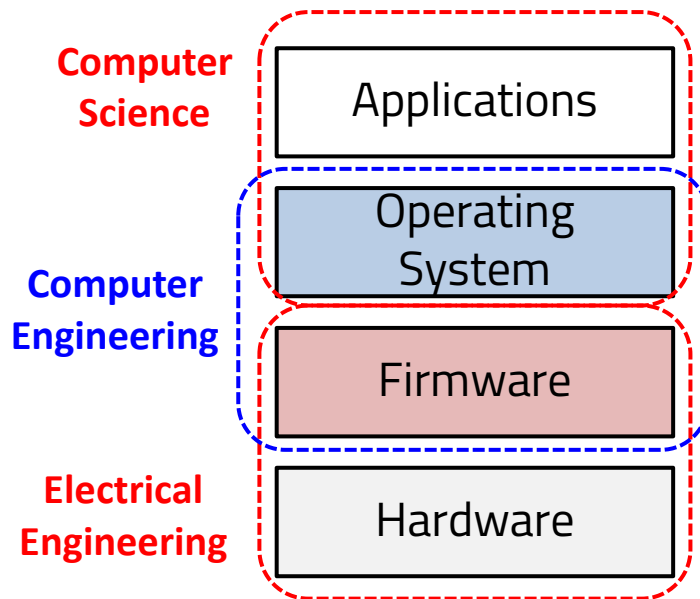
Programming
S/W



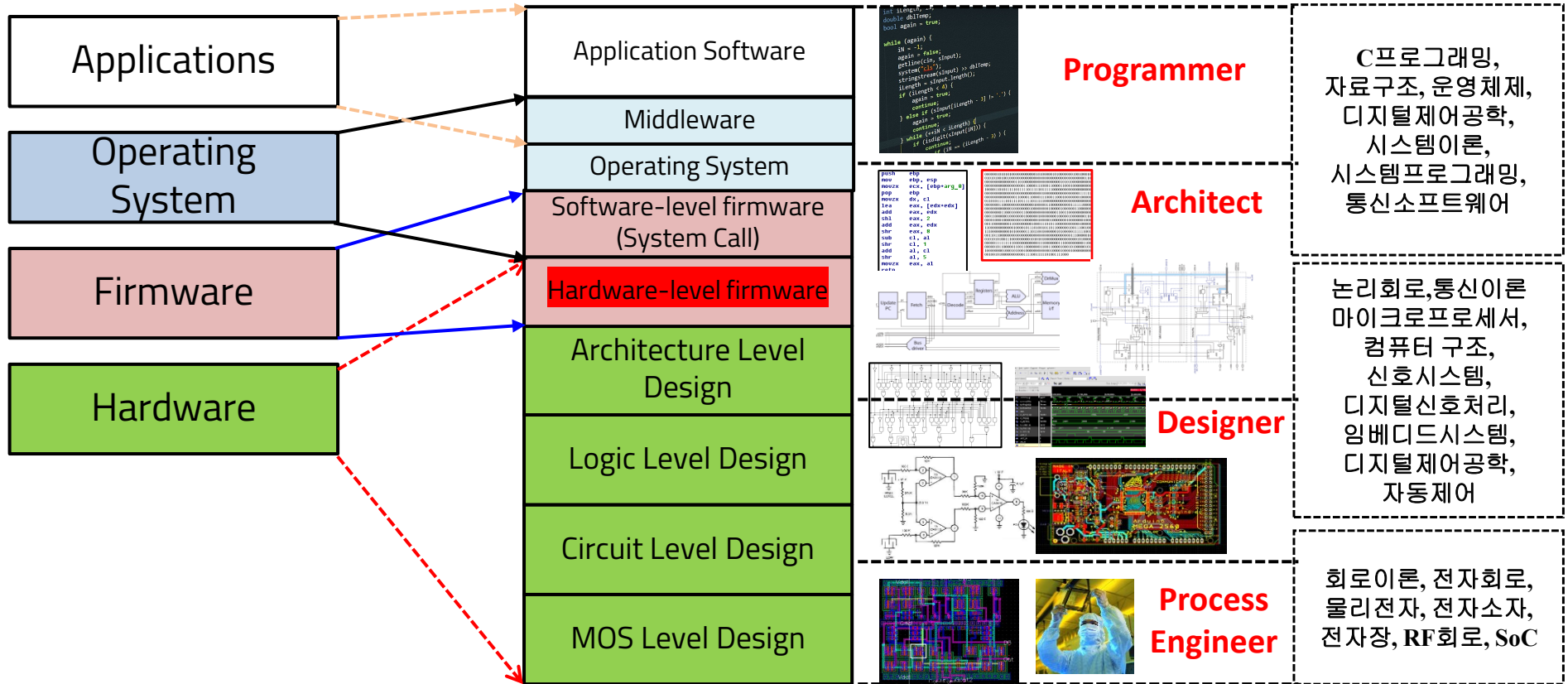
Programming
H/W



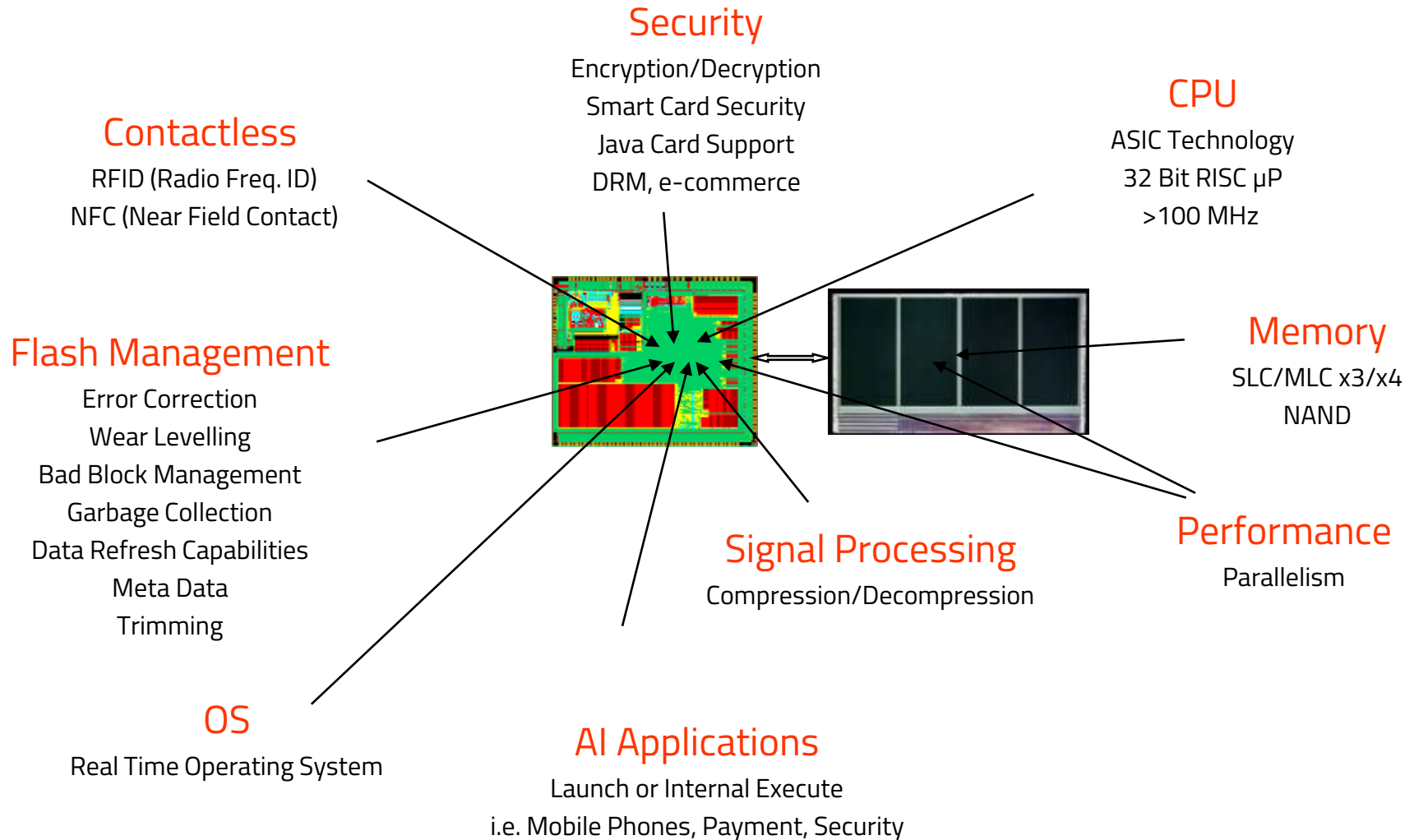
시스템 소프트웨어는 어디에 위치하나?



배워야할 많은 것들의 너무 많다~



하드웨어-소프트웨어 통합된 임베디드 시스템



Debugging

Compilation

C language

Assembling

Assembly code (Machine code)

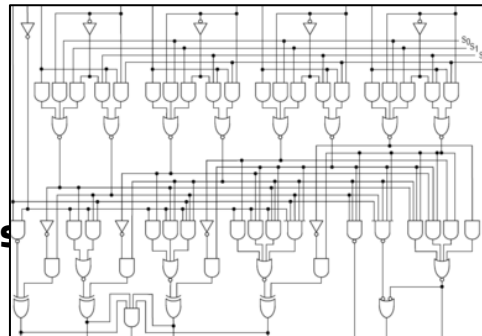
Binary code (App)



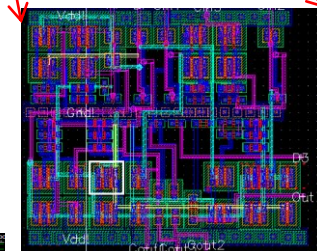
S/W

H/W

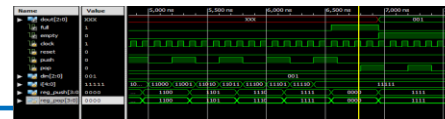
Synthesis



Place & Route (Layout)



Simulation



임베디드 시스템 프로그래밍 → 0/1을 온칩에 임베딩

- Software is deeply injected into the hardware silicon
 - Your dirty software code ... is directly translated into the machine code.
 - So that performance degradation starts from inefficiency of my code.

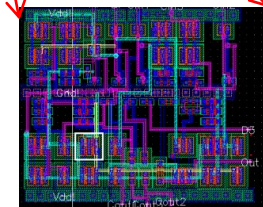
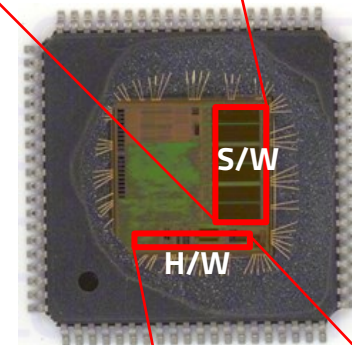
Compilation/Assembling/Linking/Downloaded

```
int main() {
    int s, y;
    s = 1;
    y = s + 2;
    return y;
}
```

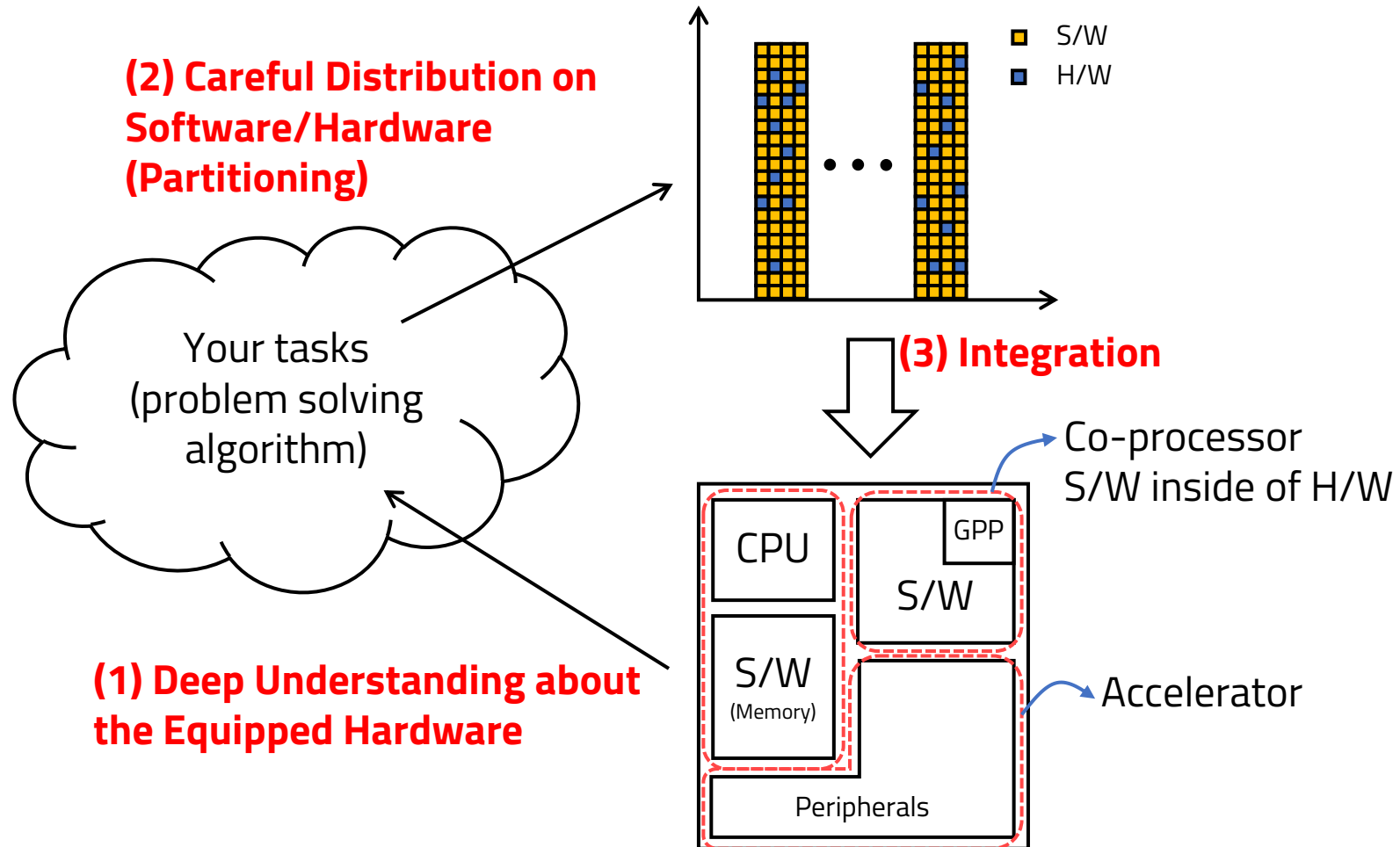
```

004013e0 <main>:
int main() {
    4013e0: 55                push    %ebp
    4013e1: 89 e5            mov     %esp,%ebp
    4013e3: 83 e4 f0        and     $0xfffffffff0,%esp
    4013e6: 83 ec 10        sub     $0x10,%esp
    4013e9: e8 a2 04 00 00  call   401890 <main>
        int s, y;
        s = 1;
    4013ee: c7 44 24 0c 01 00 00 movl    $0x1,0xc(%esp)
    4013f5: 00
        y = s + 2;
    4013f6: 8b 44 24 0c      mov     0xc(%esp),%eax
    4013fa: 83 c0 02        add     $0x2,%eax
    4013fd: 89 44 24 08      mov     %eax,0x8(%esp)
        return y;
    401401: 8b 44 24 08      mov     0x8(%esp),%eax
}

```

[illegible]

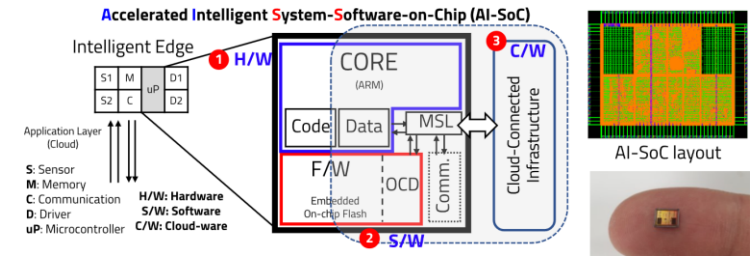
임베디드 S/W가 칩 내부의 H/W를 구동함



System On Chip (Latest Processor Architecture)

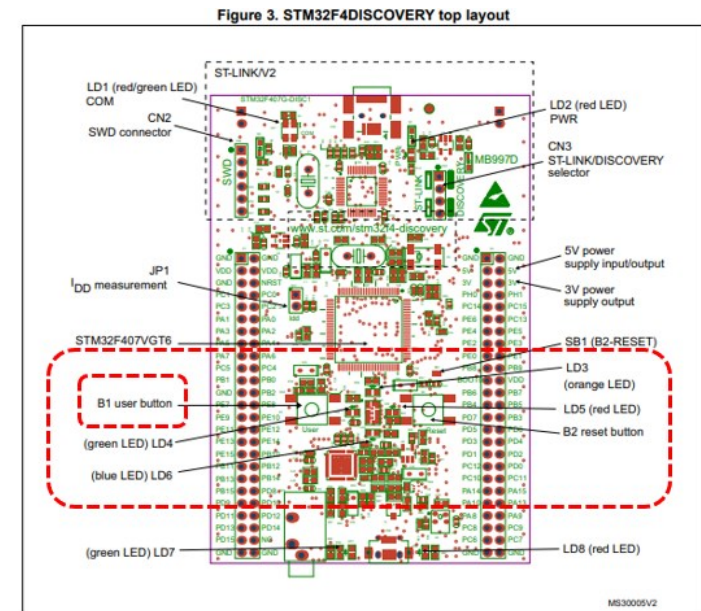
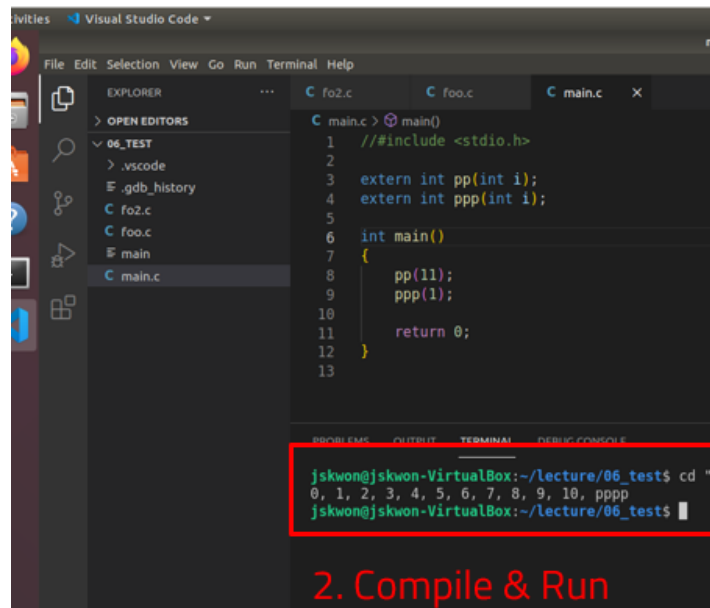
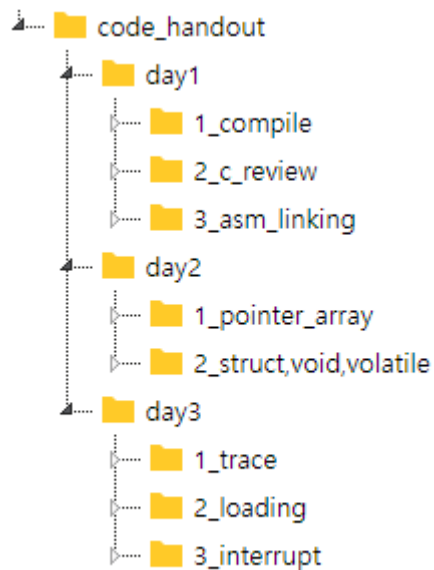
교수 소개 (박대진)

- 경북대학교 IT대학 전자공학부 부교수 (현)
- 2022년 과학기술진흥유공 국무총리표창 수상 (국가과학기술 유공자 선정)
- LG전자 역량평가 출제위원 (현)
- 경북대학교 융합소프트웨어학과 학과장 (현)
- 인공지능 임베디드 시스템온칩(SoC) 분야 다수의 국책연구과제 연구책임자
- 삼성전자/SK하이닉스 선임/수석연구원
- 국가기술고시(5급 사무관) 시험문제(자동제어) 출제위원
- 대통령 Postdoctoral Research Fellow 21인에 선정
- 한국과학기술원 (KAIST) 박사 Excellent Research Award 수상



강의 방식

- 메인교재 + 상세보충자료 + 실습 혼합
- 이론이 실제로 코드에서 어떻게 적용되는지 확인
- 직접 짜보는 Lab을 통해 학습하는 방식



잊지 말자!

- 온칩에는 결국 1과 0만 존재 (디지털)
- 0과 1은 디지털 CMOS회로의 노드에서 관찰되는 전압 VDD GND임
- 0과 1은 C코드로부터 컴파일된 결과
- 컴파일된 코드는 온칩 코드 메모리에 적재됨
- 적재된 코드를 CPU가 실행하며 결과가 데이터 메모리 (RAM)에 읽고 쓰게 됨
- 결국은 온칩 하드웨어는 코드를 실행하는 껍데기
- 핵심은 온칩 소프트웨어에 있으며, 영혼과도 같다