



# Embedded Operating Systems

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# An Real-Time OS: $\mu$ C/OS-II Quick Overview

# Introduction of $\mu$ C/OS-II (1 / 2)

- ▶ The name is from micro-controller operating system, version 2
- ▶  $\mu$ C/OS-II is certified in an avionics product by FAA in July 2000 and is also used in the Mars Curiosity Rover
- ▶ It is a very small real-time kernel
  - Memory footprint is about 20KB for a fully functional kernel
  - Source code is about 5,500 lines, mostly in ANSI C
  - It's source is open but not free for commercial usages
- ▶ Preemptible priority-driven real-time scheduling
  - 64 priority levels (max 64 tasks)
  - 8 reserved for  $\mu$ C/OS-II
  - Each task is an infinite loop

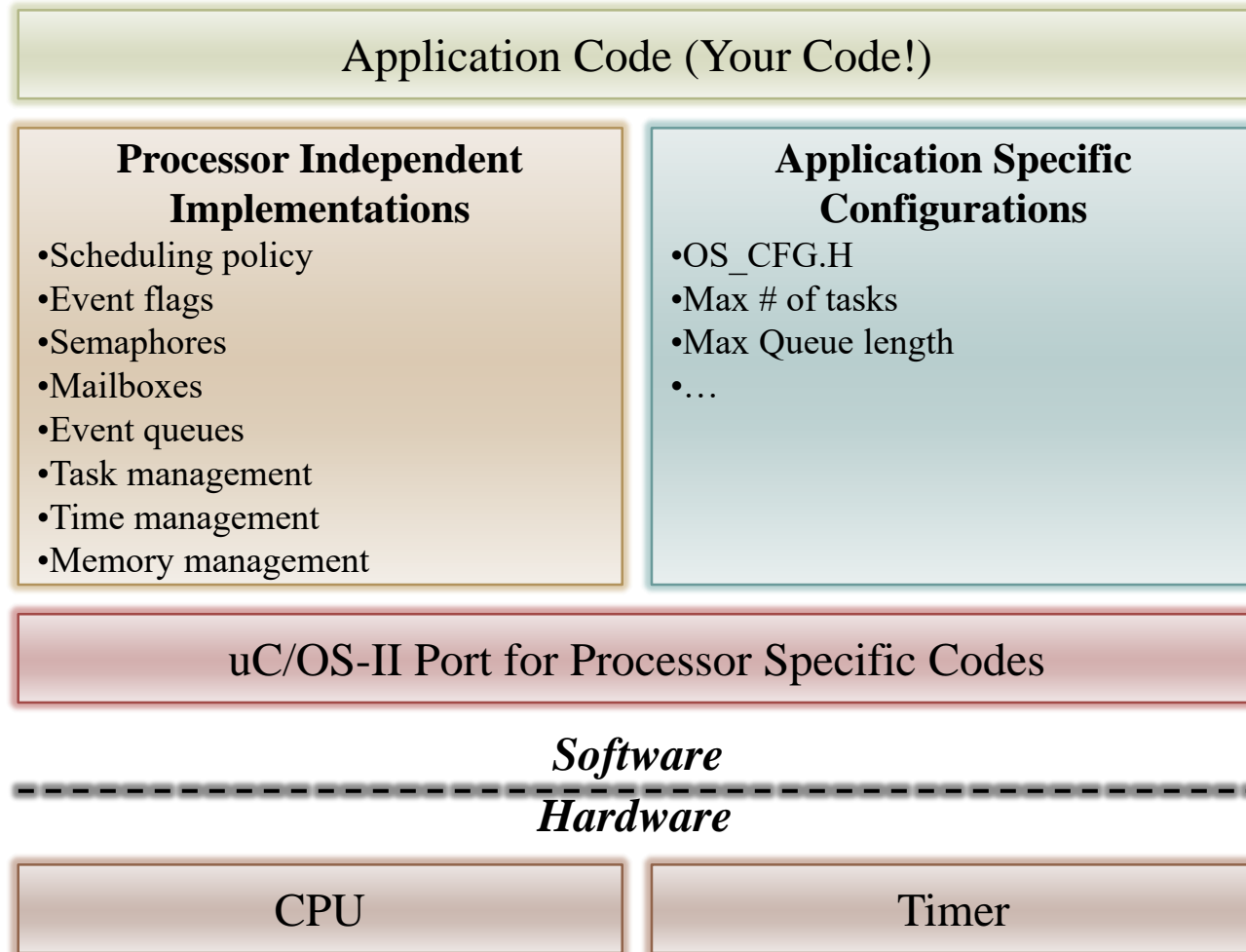


# Introduction of $\mu$ C/OS-II (2 / 2)

- ▶ Deterministic execution times for most  $\mu$ C/OS-II functions and services
- ▶ Nested interrupts could go up to 256 levels
- ▶ Supports of various 8-bit to 64-bit platforms: x86, ARM, MIPS, 8051, etc.
- ▶ Easy for development: Borland C++ compiler and DOS (optional)
- ▶ However,  $\mu$ C/OS-II still lacks of the following features:
  - Resource synchronization protocol
  - Soft-real-time support



# The $\mu$ C/OS-II File Structure



# Requirements of $\mu$ C/OS-II Emulator

## ► Operating System

- Windows XP 32bits
- Use virtual machine to install the OS
- Install “Guest Additions” for Virtualbox

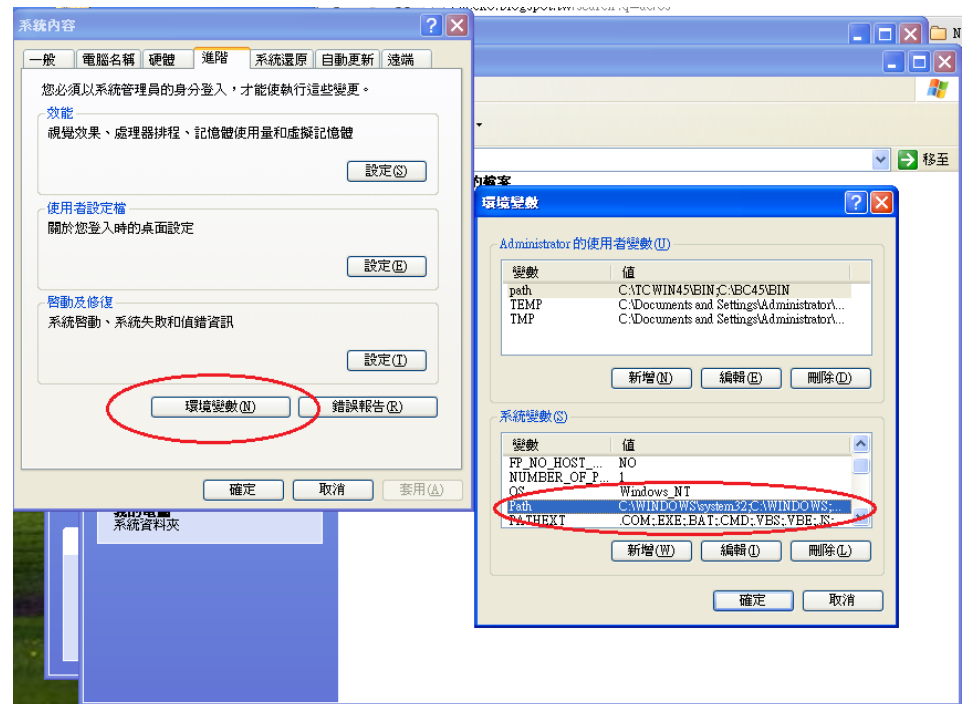
## ► Tools

- Borland C++ compiler (V4.5)
  - BC45 is the compiler
- Turbo Assembler
  - The assembler is in tasm
- The source code and the emulation environment of  $\mu$ C/OS-II
  - SOFTWARE is the package



# Borland C++ Compiler

- ▶ Download Borland C++ and install it on your windows XP environment
  - Double click the “INSTALL.EXE”
- ▶ Add “;C:\BC45\BIN” to your system Path





# Turbo Assembler

- ▶ Download Turbo assembler and unzip the file
- ▶ Copy “\tasm\BIN\TASM.EXE” to your “C:\BC45\BIN”
  - Include the missing assembler which is going to be used during we compile the source code of  $\mu$ C/OS-II





# Compile $\mu$ C/OS-II Example Code

- ▶ Download the source code and emulator  $\mu$ C/OS-II
  - It is recommended to put the source code package “SOFTWARE” directly in C:\
- ▶ Test the first example
  - Execute C:\SOFTWARE\uCOS-II\EX1\_x86L\BC45\TEST\TEST.EXE
  - Press ECS to leave
- ▶ Rename or remove the executable file
  - Rename TEST.EXE
- ▶ Compile the  $\mu$ C/OS-II and the source code of the first example
  - Run C:\SOFTWARE\uCOS-II\EX1\_x86L\BC45\TEST\MAKETEST.BAT
  - A new “TEST.EXE” will be created if we compile it successfully

# Common Mistakes

- ▶ Did you directly put the package “SOFTWARE” in C:\ ?
- ▶ Have you copied the correct file “TASM.EXE” to your “C:\BC45\BIN” directory?
- ▶ Did you set the Path correctly?
  - See the picture in Page 7
  - There is no space



# Homework

- ▶ Source code reading:
  - Examples 1-4 and semaphore management
- ▶ Study report: 2 pages
- ▶ Deadline: 20:00 on 2024/01/05
- ▶ The grading baseline: 85



# Report Format

- ▶ Each student should write a report
- ▶ Only two A4 pages
- ▶ Use 12 pt font
- ▶ File name: **EOS-Homework-StudentID**
- ▶ File type: PDF
- ▶ Send it to my email: [chewei@mail.cgu.edu.tw](mailto:chewei@mail.cgu.edu.tw)
- ▶ Email title: **EOS Homework-StudentID**

