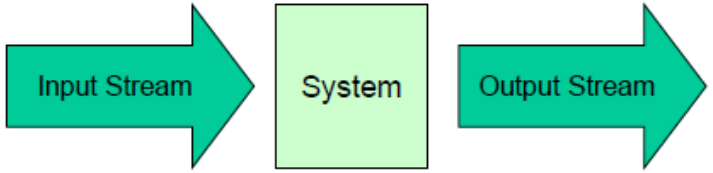
RECAP

24/25.02.2014

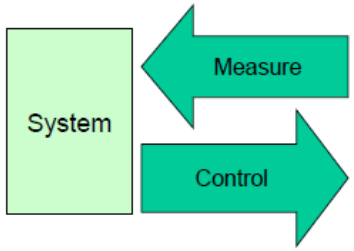
- Systems & Realtime
- Macros
- Includes

3 Embedded Systems

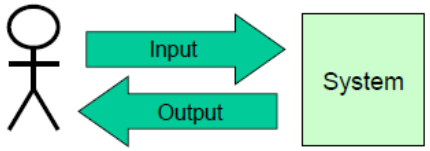
- Transforming System
  - Throughput [Bytes/s]
  - Data processing quality
  - system utilization



- Reactive System
  - ext. Events are driving system (closed loop control systems)
  - Guaranteed response time
  - Realtime



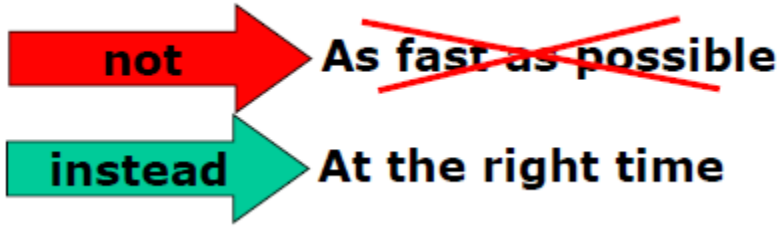
- Interactive System
  - short response time
  - High system utilization
  - HMI



Realtime

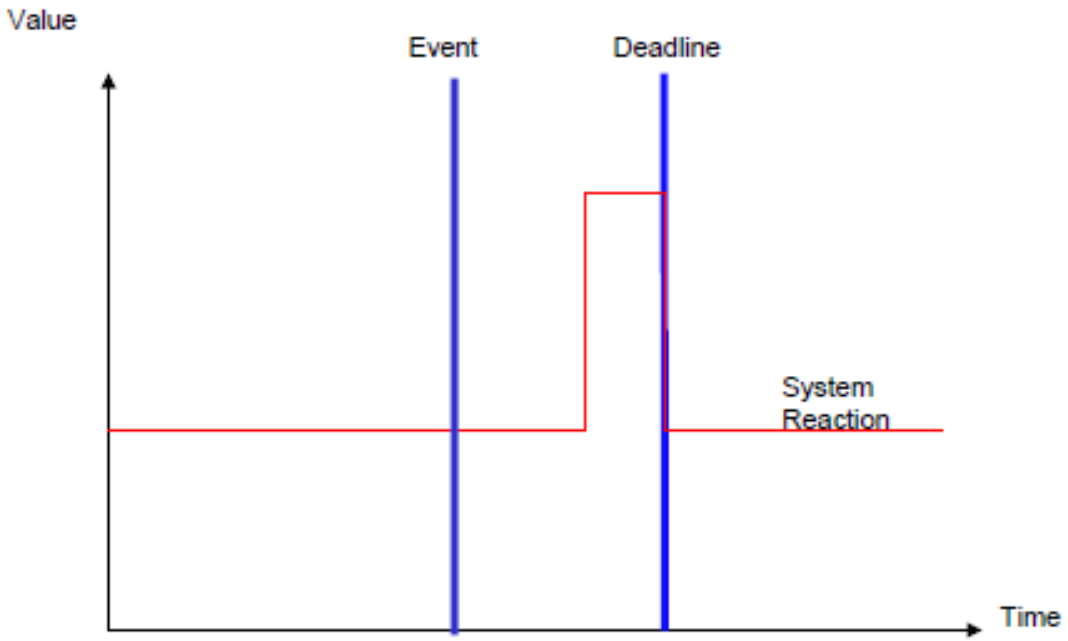
A computer is classified as Realtime if it can react on external events in the real world:

-With the correct result
-At the correct time
-Independent of current system load
-In a deterministic and foreseeable way



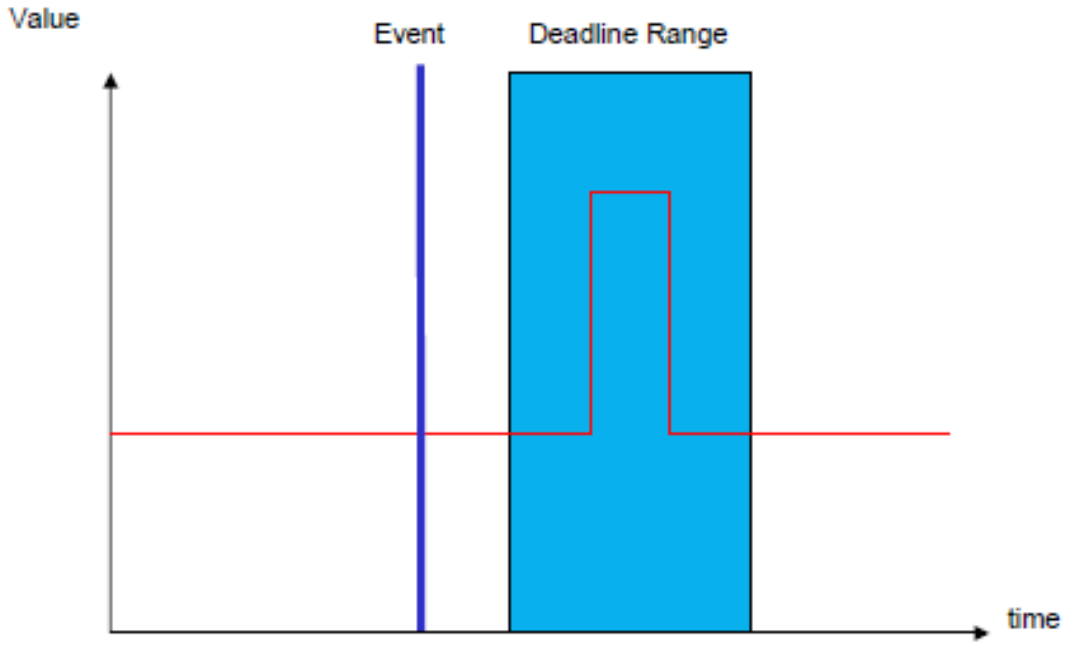
Hard Realtime (Airbag)

- Incorrect if correct result does not meet with the time conditions



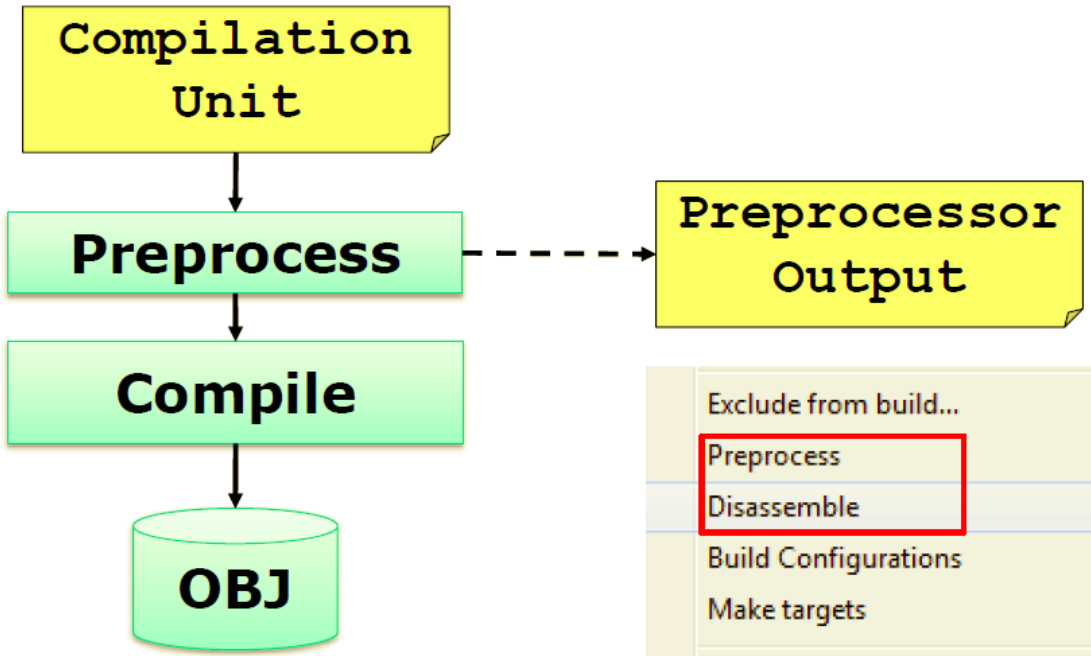
Soft Realtime (video encoder)

- Degradation, if correct result does not meet the time conditions



Macros

- Preprocessor instructions which replaced before the compile
- Support the reusability
- Platform.h or cofig.h



Macros

- Textual replacement

```
#define BLUE   0
#define RED    1
#define YELLOW 2
```

```
int ChangeColor(int color) {
  if (color == BLUE) {
    return RED;
  }
}
```

```
int ChangeColor (int color) {
  if (color == 0) {
    return 1;
  }
}
```

Macros

- For configuration optional if-request

```
/* led.h */
#include "platform.h"

#if PL_LED_USE_MACROS
  #define LED_On(leds)       (setReg8Bits(LED_REG_DATA, leds))
#else /* use function call */
  void LED_On(LED_Set Leds);
#endif
```

Includes

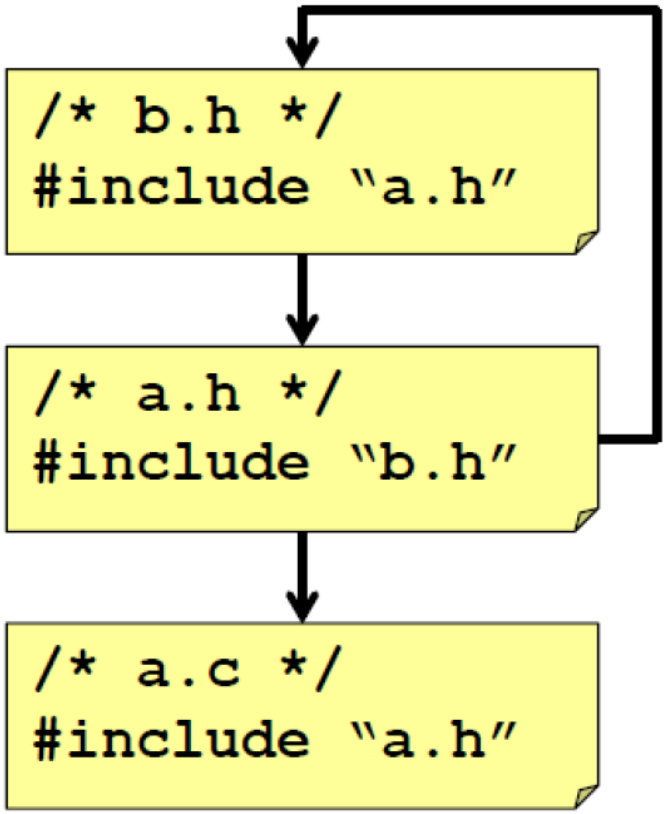
- 2 files:
  - *.c: implementation, definition
  - *.h: Interface/Header File: external Declaration

- Local variables in *.c-File
- Global varibles in *.h-File

- <……> libraries
- ‘’……’’ h files

Includes

- Problem: Recursive includes



- Corrective:
  - Preprocessor-Definition: __<FileName>_H_

```
/* platform.h */
#ifndef __PLATFORM_H_
#define __PLATFORM_H_
  #define LED PORTA
#endif /* __PLATFORM_H_ */
```

Questions

- Name each one example for a transfoming system, reactive system and interactive system?

  TS: Video encoder, RS: PID Controller, IS: ticket selling machine

Questions

- Why schould placed everytime brackets on preprocessor commands with calculations?

  Example:

  #define CALC1 (2+5)

  #define CALC2 (5*3)

  In some situations it get calculated wrong.

  Int example = 10*CALC1;

  Without brackets: (10*2)+5

Questions

- Advantages and disadvantages of Macros

- Advantages:
  - Faster code
  - Smalle
- Disadvantages:
  - Interface
  - Encapsulation
  - Debugging

Questions

- How looks the definition of the led.h-Files to avoid recursive inclusion

```
#ifndef__LED_H_
#define__LED_H_
//expresions of the led.h file
#endif
```

Questions

- How and where get global variables defined?

- In the *.h file with the extension «extern»: extern intLED_global; Chose a good name with prefix because the Name is visible in the whole project.

Questions

- Is it possible to include a picture or other files than *.h-Files and libraries?

- Yes, to include a bmp: #include’’bmp.txt’’