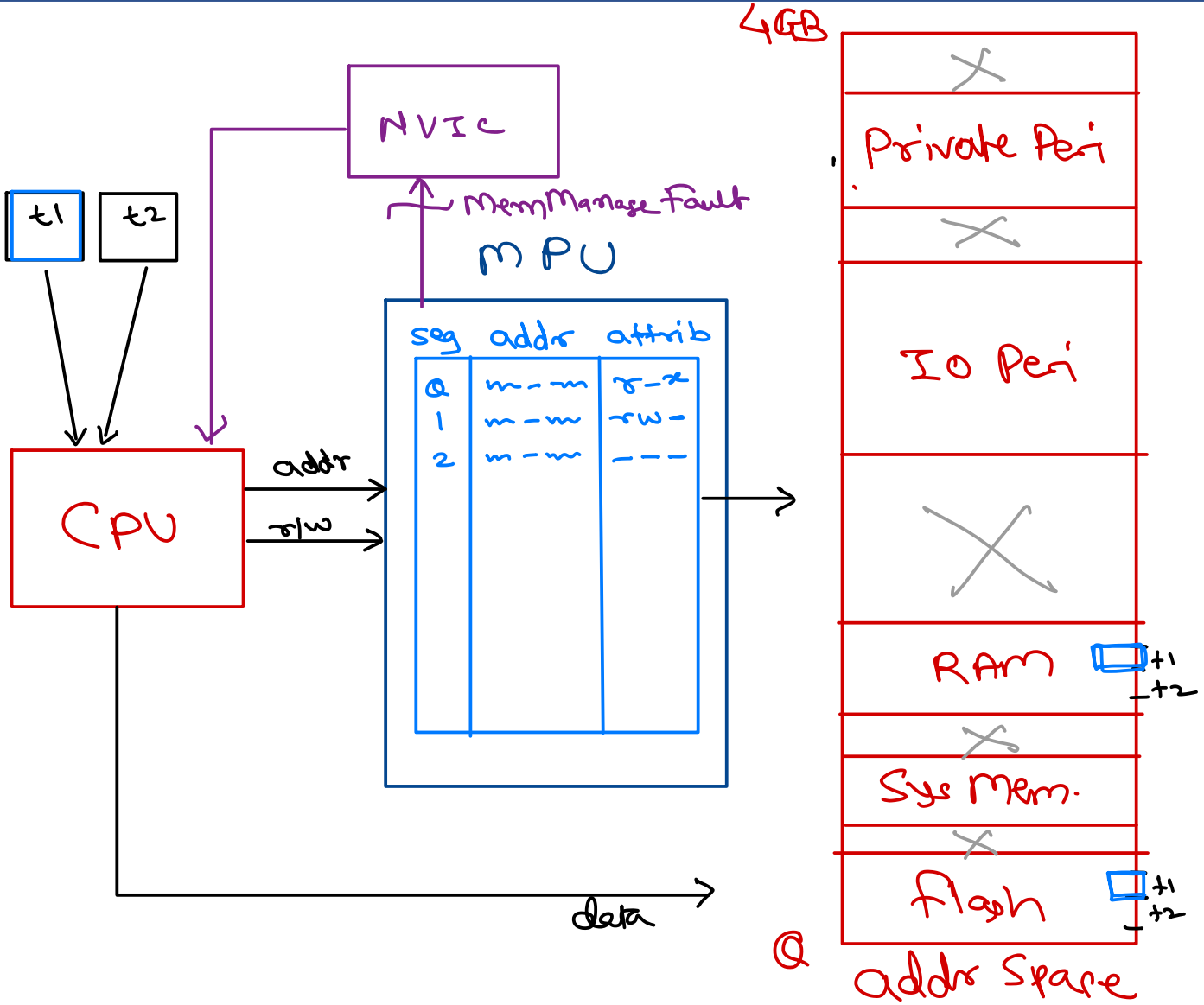
Advanced Micro-controllers - ARM

DESD @ Sunbeam Infotech

ARM CM3 Faults

- MemManage Fault
  - Faults due to MPU configuration (unprivileged code accessing privileged region, accessing location not defined in MPU, writing to read only region).
  - Executing code from xN (execute never) attribute.
  - Can be enabled by
    - SCB->SHCSR |= BV(MEMFAULT); //bit 16
- Bus Fault
  - Errors received from processor bus interface during memory access.
  - Like pre-fetch abort and data abort.
  - Also when device to access is not ready.
  - Can be enabled by
    - SCB->SHCSR |= BV(BUSFAULT); //bit 17
- Usage Fault
  - Accessing a feature that is not available in hw.
  - Undefined instruction executed.
  - Accessing FPU when not available.
  - Accessing Co-processor (not available in CM3)
  - Switching to ARM state (i.e. T=0).
  - Invalid EXC_RETURN value.
  - Executing SVC when not permitted (in lower interrupt level).
  - Divide by zero or unaligned memory access (if configured).
  - Can be enabled by
    - SCB->SHCSR |= BV(~~MEM~~FAULT); //bit 18
- Hard Fault
  - When any fault occurs, but not enabled in code
  - Bus error while vector fetch.
  - BKPT when debug exception disabled.

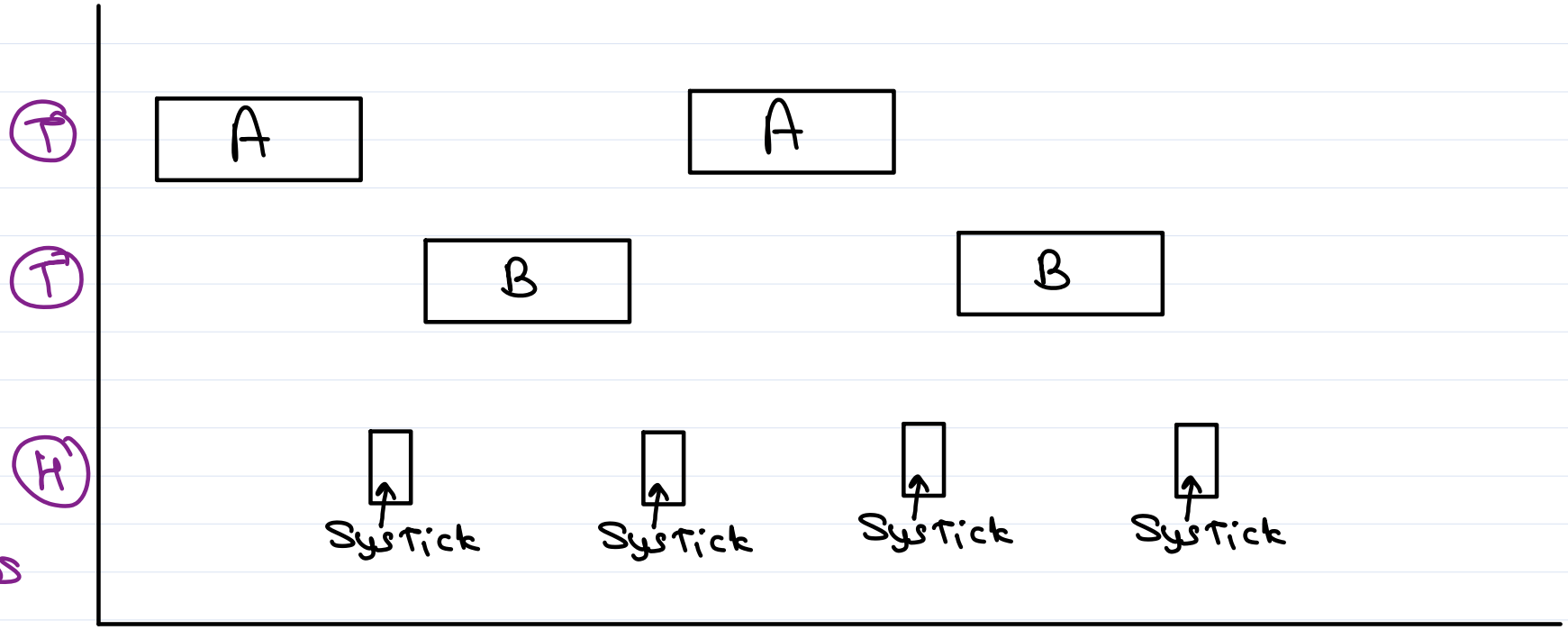
MPU


4GB
NVIC
MemManage Fault
MPU
t1
t2
seg addr attrib
0
1
2
CPU
addr
r/w
data
Private Peri
IO Peri
RAM
t1
t2
Sys Mem.
flash
t1
t2
0
addr Space

Multi-tasking

A) Task1: ADC task

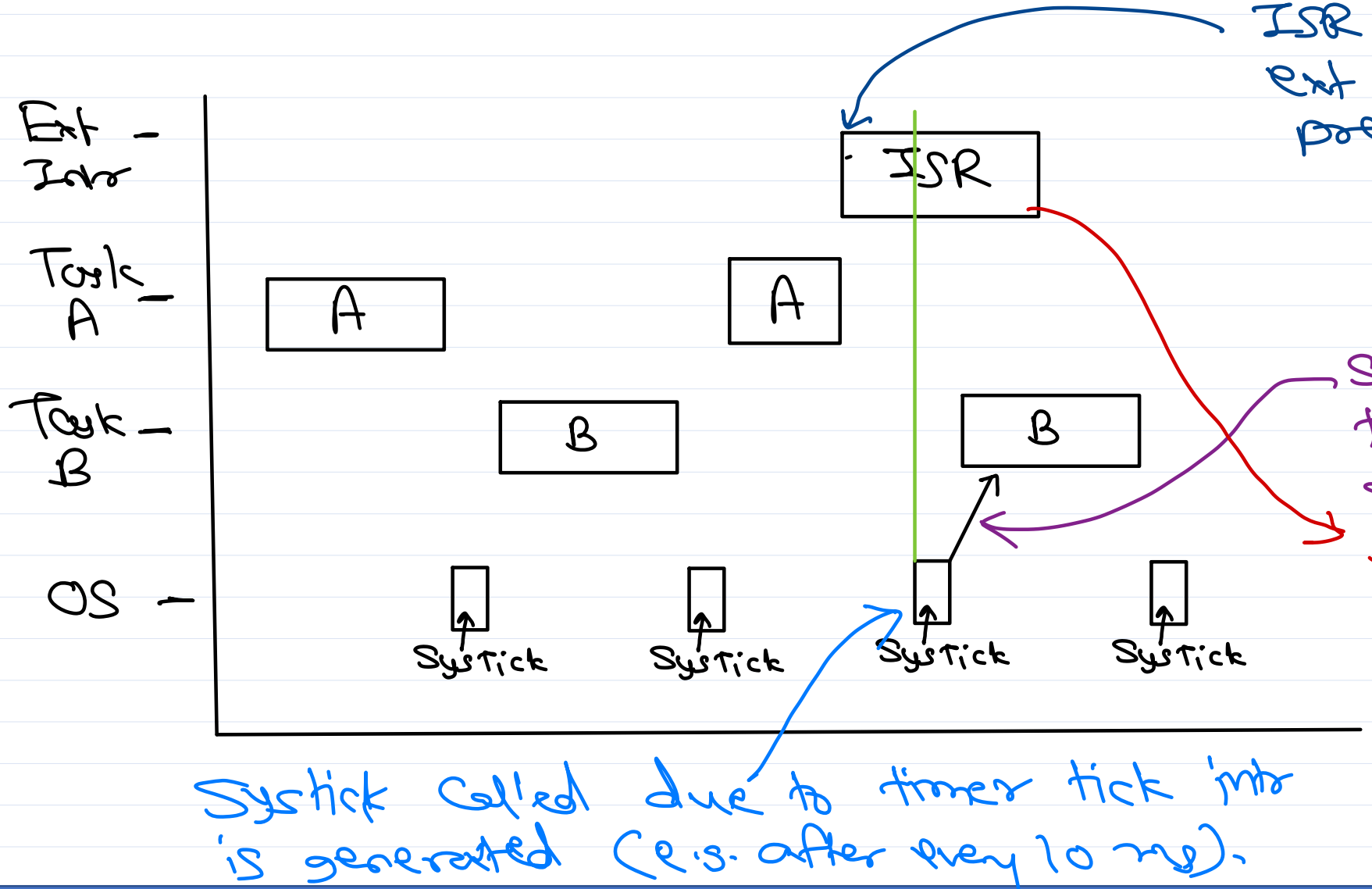
B) Task2: UART task



Cortex-M modes

1) Thread mode
   - ↳ User Appln/task/OS code running.

2) Handler mode
   - ↳ Inside Handler/ISR code running



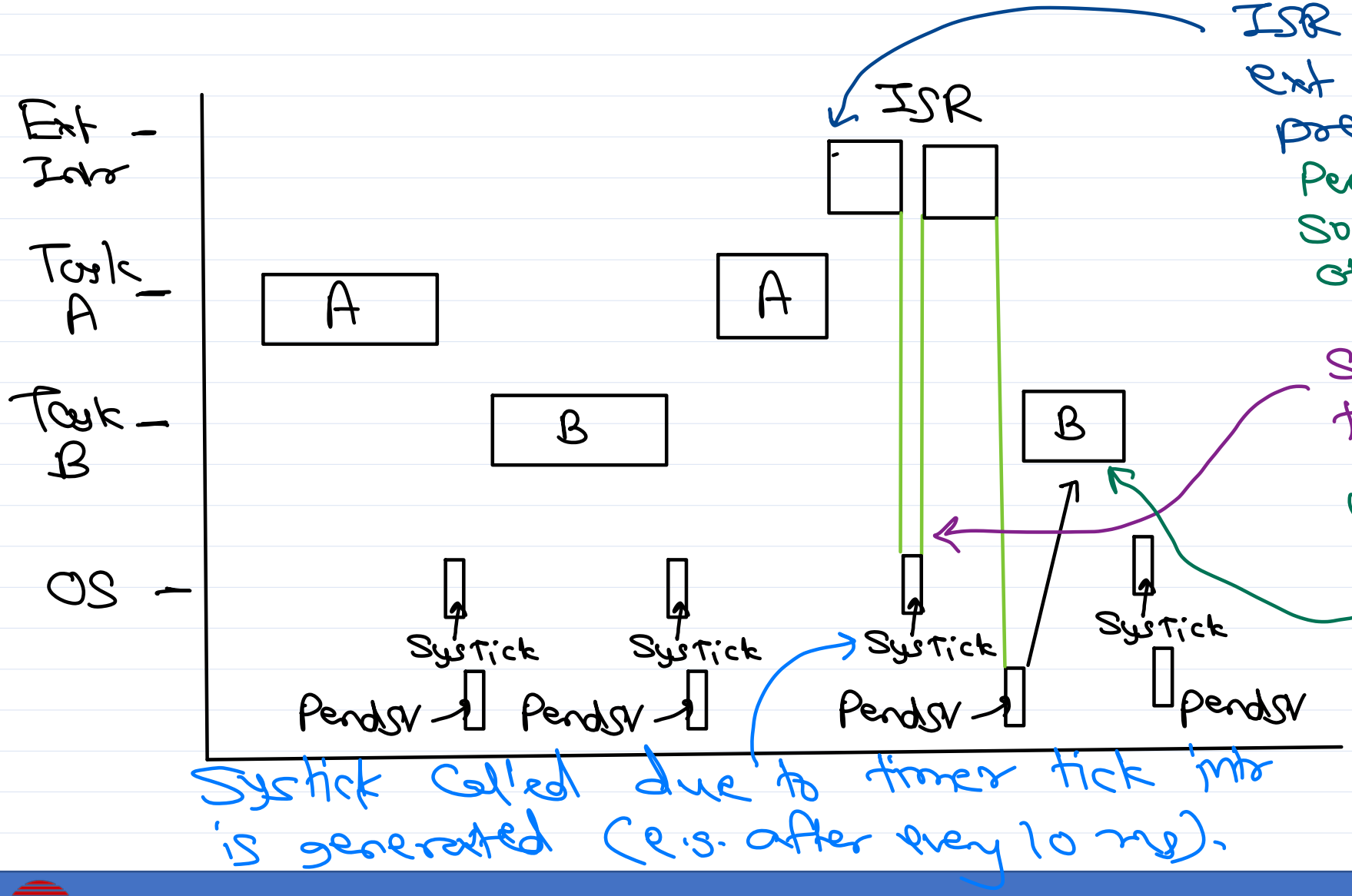
ISR called due to ext intr (e.g. switch pressed) :-

SysTick/OS will schedule task B. Then task B will start.

But ISR is still incomplete

Returning from Handler mode to Thread mode without completing ISR will cause Usage fault.

Systick called due to timer tick intr is generated (e.g. after every 10 ms).



ISR called due to ext intr (e.g. switch pressed):-
PendSV is lowest prio exception, So it will execute when no other ISR is pending.

SysTick/OS will schedule task B & trigger PendSV..

When PendSV runs, it will start executing the next task.

Systick called due to timer tick intr is generated (e.g. after every 10 ms).

Thank you!

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