

Recap RTOS – SW7

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Reasons for a RTOS

- Solving of synchronization problems
- OS makes applications scalable

Advantages / Disadvantages

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- Reliability
- Simplified programming of complex hardware
- hardware abstraction

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- needs resources
- Complexity for small programs

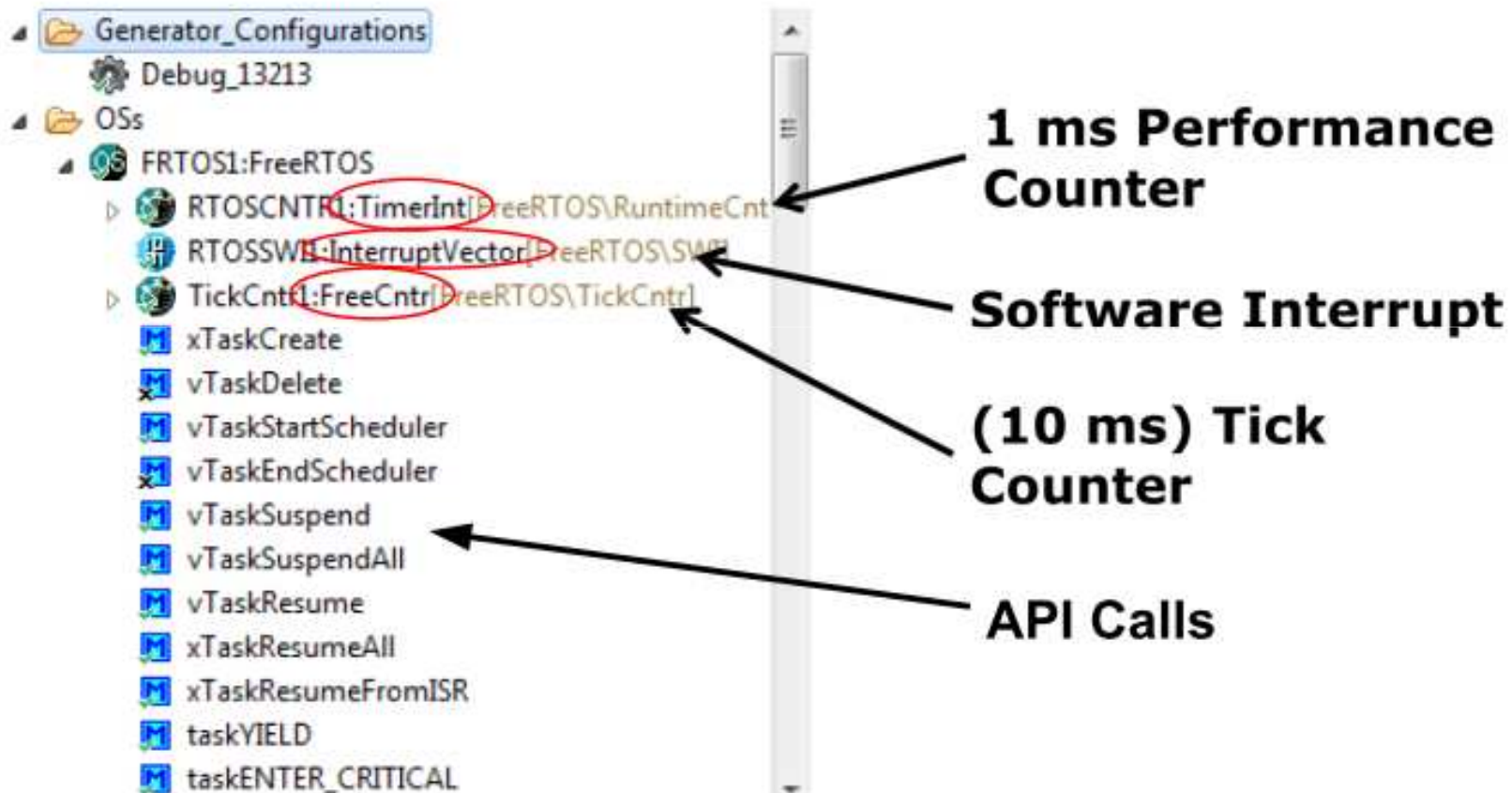
Free RTOS

- Simple, Portable, Royalty free, Concise
- Micro Real-time Kernel
- Choice of RTOS scheduling policy: Pre-emptive or Cooperative
- Messages Queue
- Semaphores (via macros)
- RTOS kernel uses multiple priority lists
- Ports are available for the most important microcontroller manufacturer

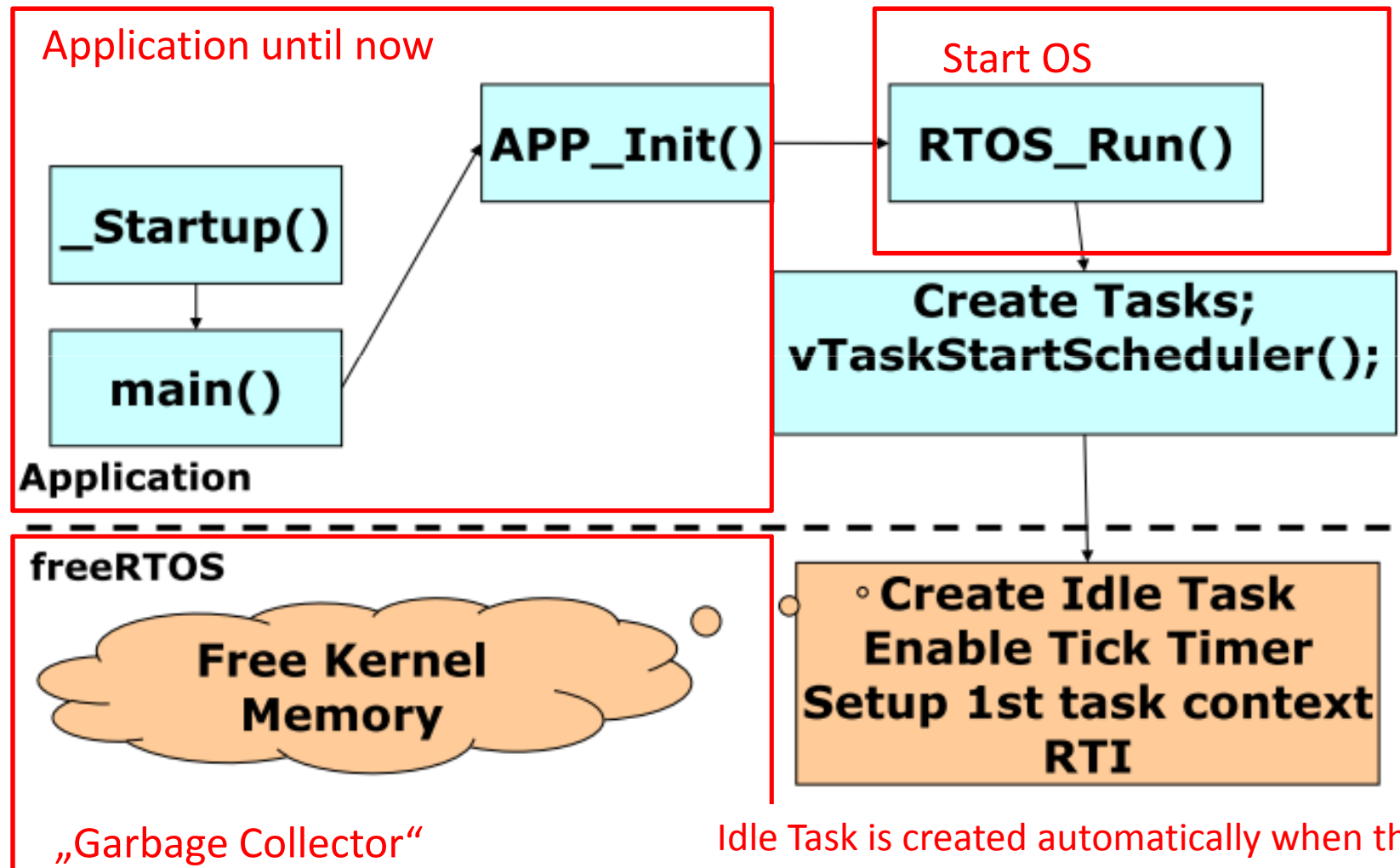
Pre-emptive vs. Cooperative

- **Pre-emptive:** Always runs the highest available task. Tasks of identical priority share CPU time
- **Cooperative:** Context switches only occur if a task blocks, or explicitly calls yield.

Processor Expert Component







System Startup



Idle Task is created automatically when the RTOS scheduler is started to ensure there is always at least one task that is able to run

FreeRTOS Events

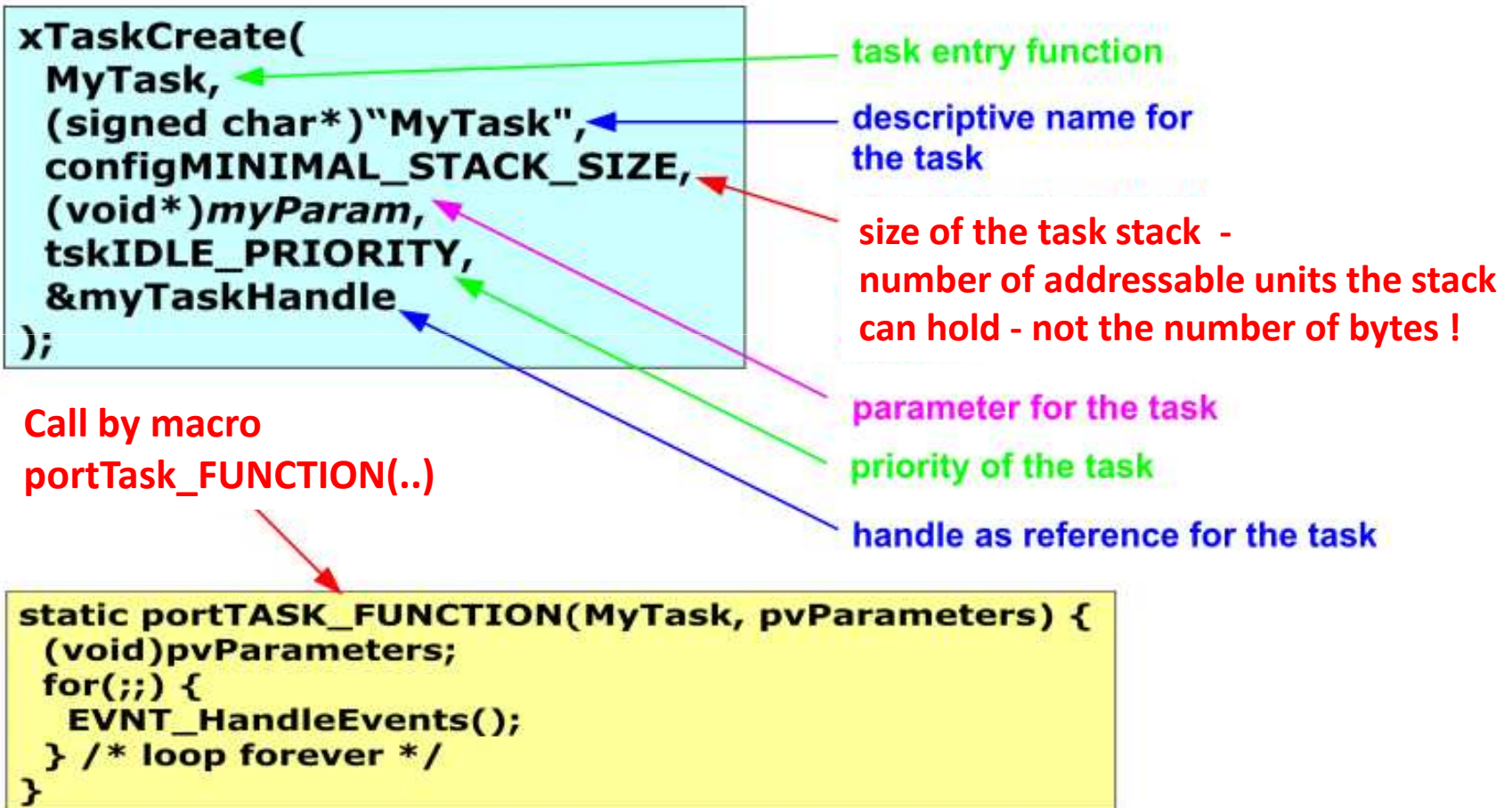
 FRTOS1_vApplicationStackOverflowHook
 FRTOS1_vApplicationTickHook
 FRTOS1_vApplicationIdleHook
 FRTOS1_vApplicationMallocFailedHook

- **Idle Hook** - will only get executed when there are no tasks of higher priority that are able to run ¹
- **Tick Hook** - optionally called by tick interrupt ¹
- **Malloc Failed** - problems caused by lack of heap memory ¹
- **Stack Overflow** - assists in the detection and correction of stack overflows ²

¹ (source: <http://www.freertos.org/a00016.html>)

² (source: <http://www.freertos.org/Stacks-and-stack-overflow-checking.html>)

Task creation



Task Delay

Delay a task for a given number of ticks:

- `vTaskDelay(500/portTICK_RATE_MS);`

Relative to the time at which vTaskDelay() is called.

- `vTaskDelayUntil(&xLastWakeTime,500/portTICK_RATE_MS);`

Specifies a relative time at which the task wishes to unblock