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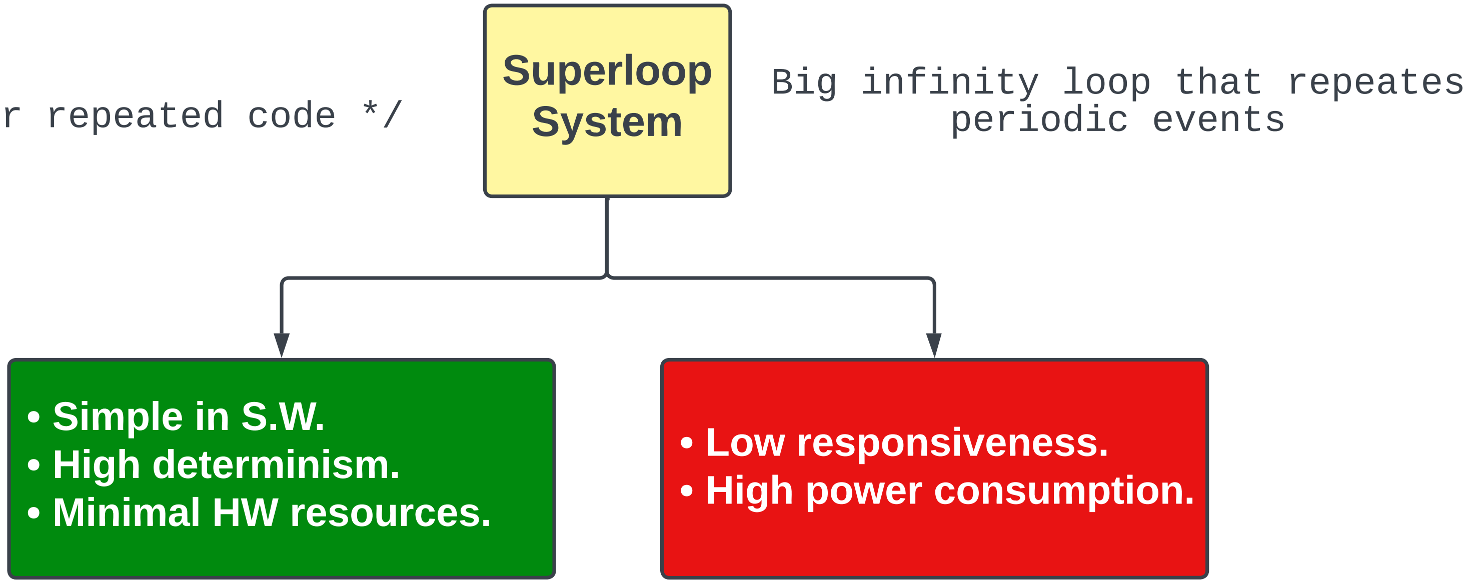
SYSTEM TYPES

Intro to RTOS
part 1

```
while(1)
{
  /* your repeated code */
}
```

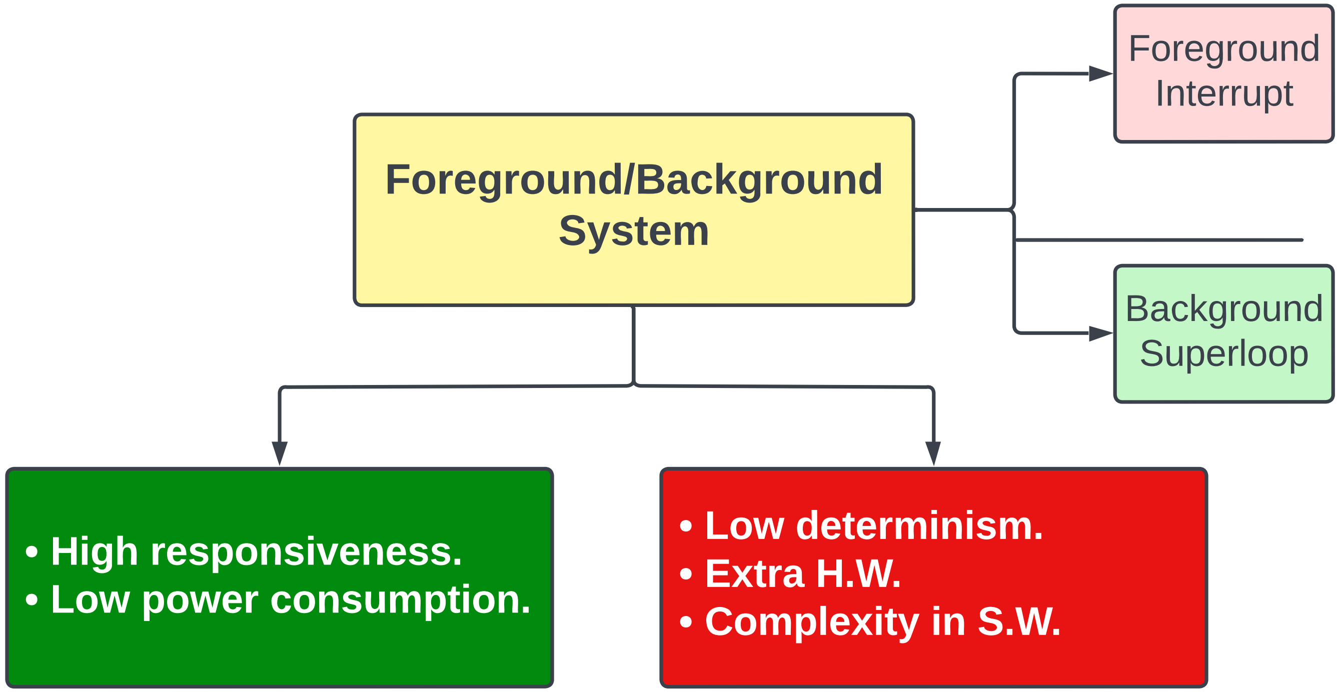


Superloop System

Big infinity loop that repeates periodic events

- Simple in S.W.
- High determinism.
- Minimal HW resources.

- Low responsiveness.
- High power consumption.



Foreground/Background System

Foreground Interrupt

Background Superloop

- High responsiveness.
- Low power consumption.

- Low determinism.
- Extra H.W.
- Complexity in S.W.

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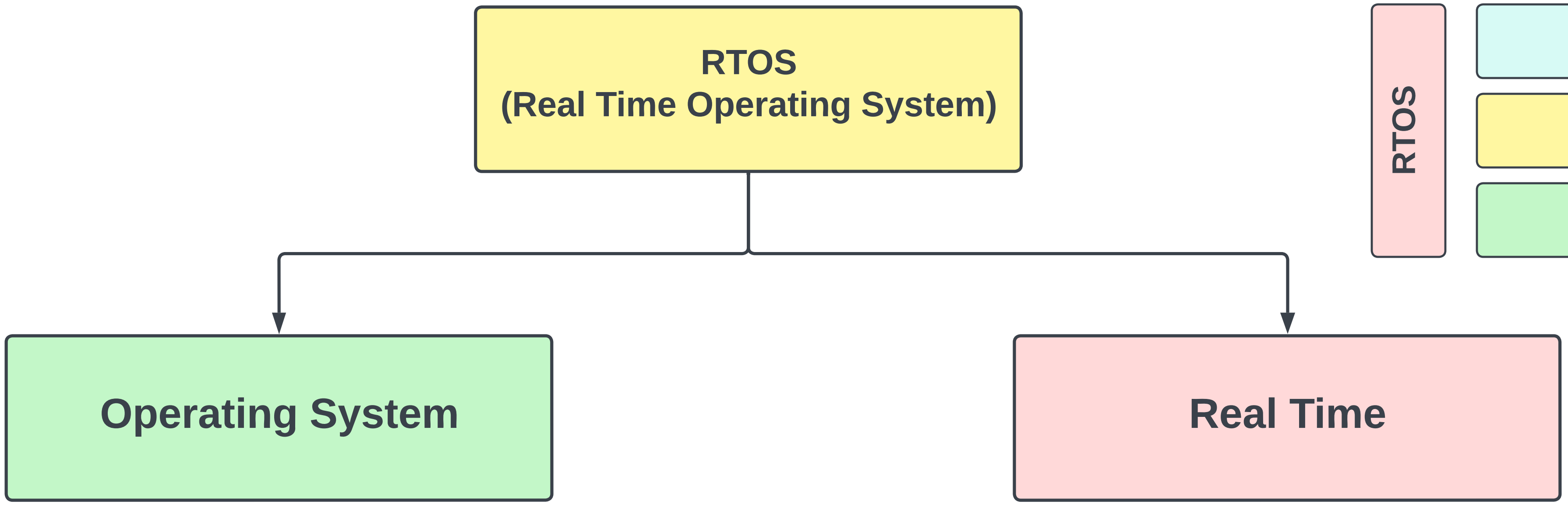
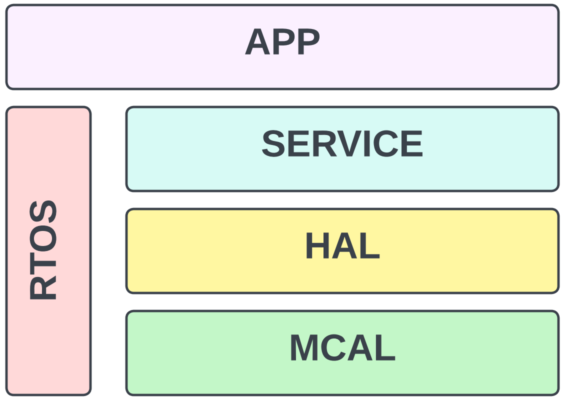


RTOS
(Real Time Operating System)

Operating System

Real Time

RTOS Arch



APP

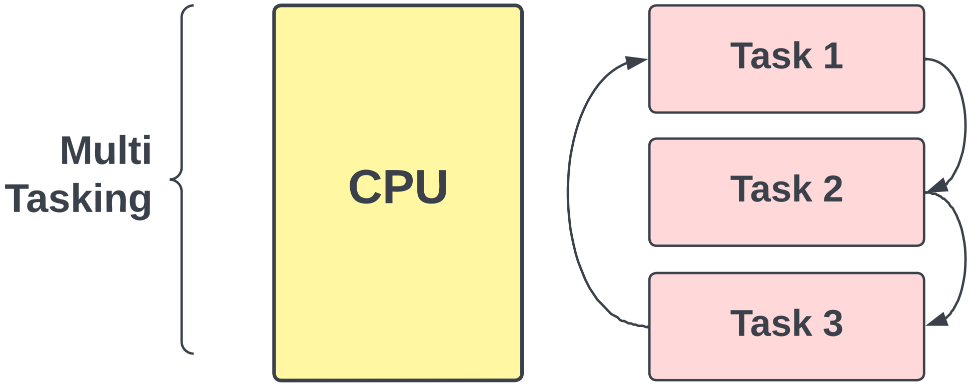
RTOS

SERVICE

HAL

MCAL

System that takes # of task and execute them every specific time called **periodicity**



Multi Tasking

CPU

Task 1

Task 2

Task 3

Correct function at Correct Time
(Time Boundary)

Real Time doesn't mean fast

Hard Realtime Systems	Soft Realtime Systems
related to human life	related to loss in money
- missle defence system - Airbag	- Video Games , etc.
Tolerance about 5%-10%	Tolerance > 10%

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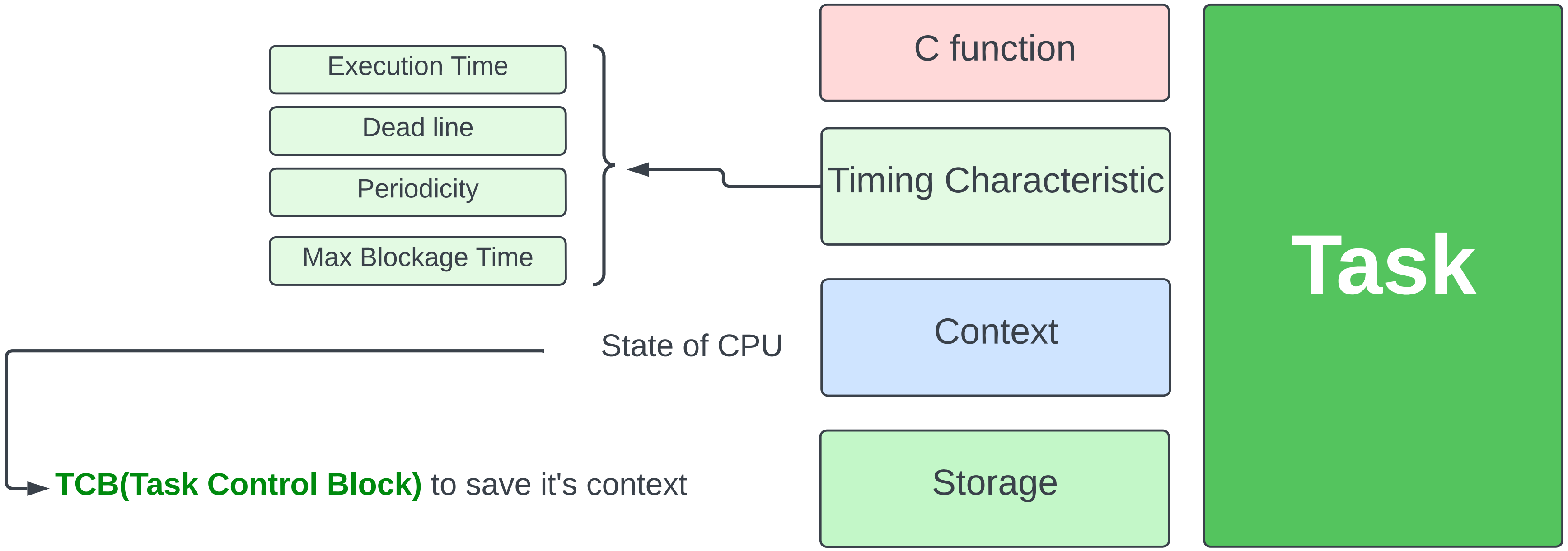
RTOS Composition



Task

C function

Timing Characteristic

Context

Storage

Execution Time

Dead line

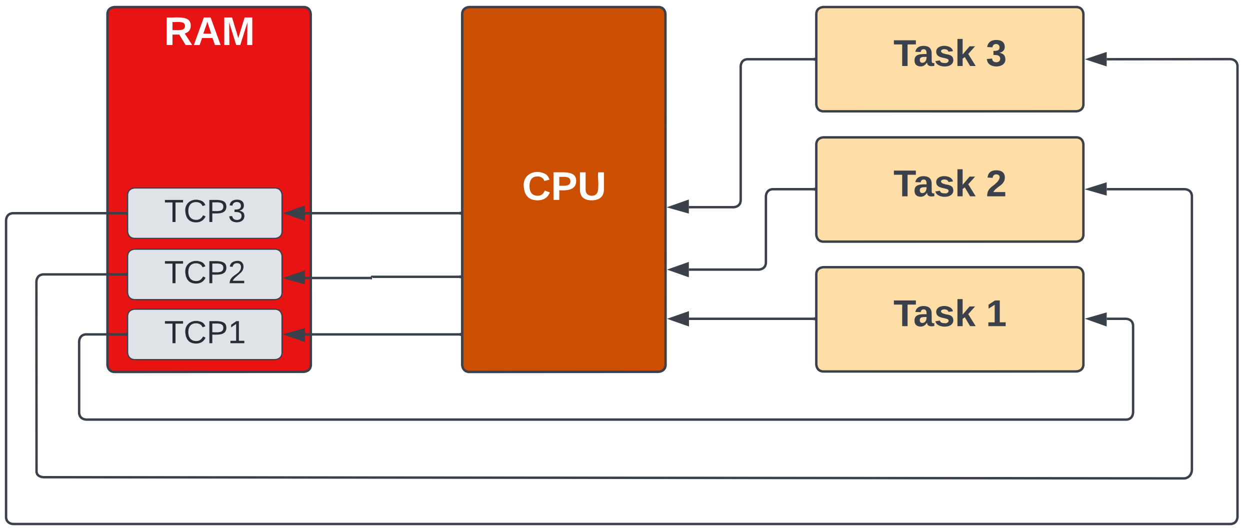
Periodicity

Max Blockage Time

State of CPU

TCB(Task Control Block) to save it's context

- job that has to be done independently of the other tasks of the system.
- it thinks it has the CPU all to itself



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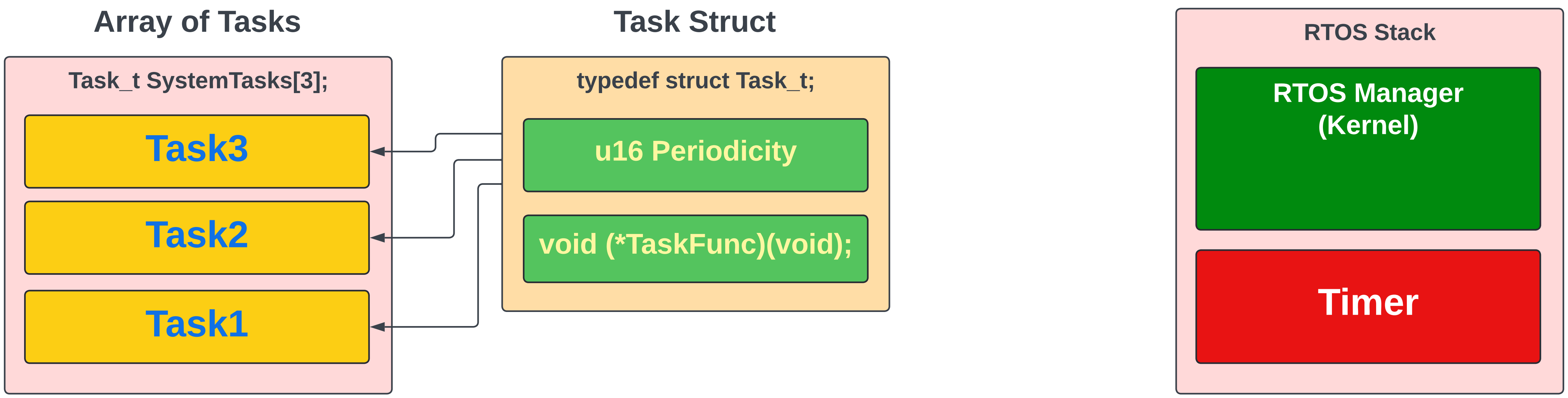
RTOS Implementation



Array of Tasks

Task_t SystemTasks[3];

Task Struct

typedef struct Task_t;

RTOS Stack

How Schedular works?

Configure Timer to genrate interrupt every 0.5 ms

Task 1	0.5 ms	evey tick
Task 2	1 ms	every 2 ticks
Task 3	1.5 ms	every 3 ticks
Task 4	3 ms	every 6 ticks
Task 5	4 ms	every 8 ticks

schedular

```
ISR(TIMER_vect)
{
  Counter++;
  if(Counter % periodicity of task i == 0)
  {
    InvokeTaskFunc();
  }
}
```

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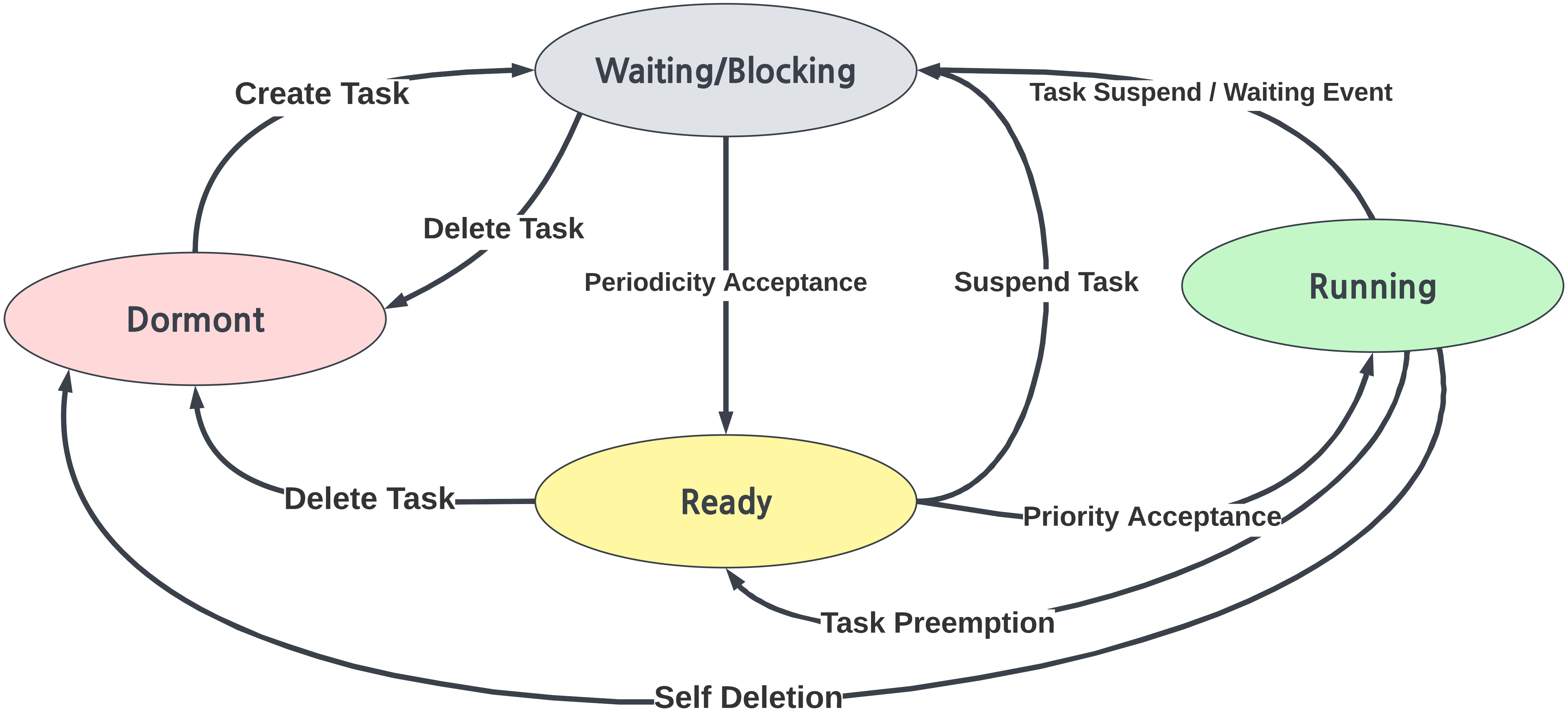
TASK STATES



TASK STATE MACHINE

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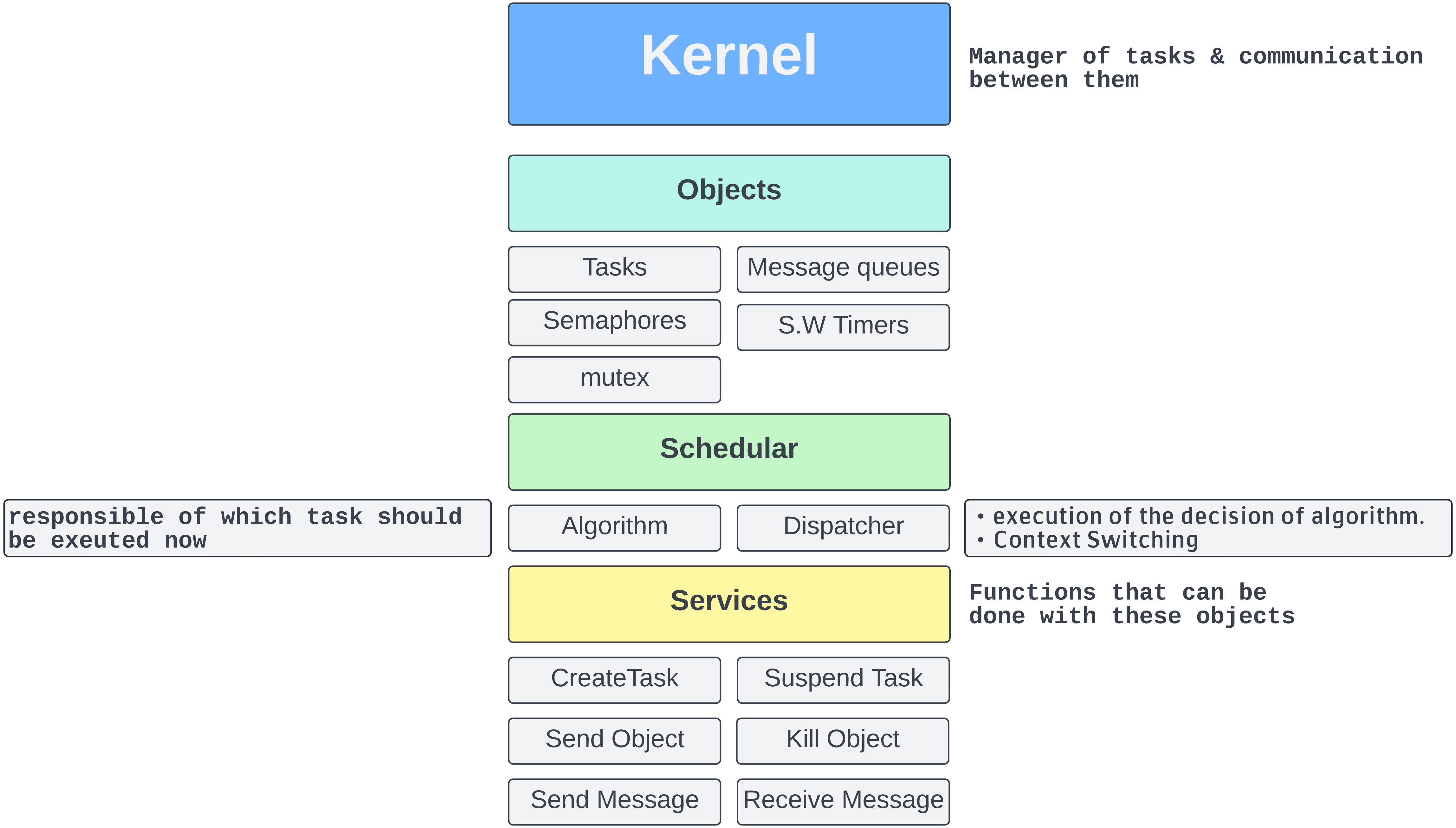

Kernel

Manager of tasks & communication between them

Objects

- Tasks
- Message queues
- Semaphores
- S.W Timers
- mutex

Schedular

- Algorithm
- Dispatcher

responsible of which task should be exeuted now

- execution of the decision of algorithm.
- Context Switching

Services

Functions that can be done with these objects

- CreateTask
- Suspend Task
- Send Object
- Kill Object
- Send Message
- Receive Message

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SCHEDULING ALGORITHMS

Priority Based

First Come First Serve

Shortest Job First

Shortest Remaining Time First

Roung Robin Scheduling

Earliest Deadline First

Rate Monotonic Scheduling