Contiki-NG
Timers

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Contiki-NG Timers (1/2)

- **`timer`**: requires to manually check if timers have expired

- Generate events for protothreads
  - **`etimer`**: generates events when timers expire
  - **`stimer`**: like **`etimer`** for longer periods

Contiki-NG Timers (2/2)

- Execute callbacks
  - `ctimer`: schedule function executions in time
  - `rtimer`: preempts currently running functions with callback execution
    - As a result, provides predictable timer semantics

Example `ctimer`

- Useful to encode aynchronous execution flows

- Trigger asynchronous callbacks when expiring

- Data may be passed to the callback as a byte buffer

```
PROCESS_THREAD(hello_world_ctimer, ev, data)
{
  PROCESS_BEGIN();
  static struct ctimer print_ctimer;
  //…

  /* Schedule the ctimer. */
  ctimer_set(&print_ctimer, CLOCK_SECOND,
      ctimer_callback, "Hello world CT\n");

  //…
  PROCESS_END();
}
```

```
static void ctimer_callback(void *data){

  printf("%s", (char *)data);

  /* Reschedule the ctimer. */
  ctimer_set(&print_ctimer, CLOCK_SECOND,
      ctimer_callback, "Hello world CT\n");
}
```

Example `rtimer`

- Useful to achieve accurate timing
  - Use maximum clock resolution available from the hardware
  - Preempt any other running protothread
  - "Execute now" semantics!!

- The **`rtimer`** API uses callbacks like **`ctimer`**, but works with **absolute times!**

- A reference to the **`rtimer`** is also passed carrying metadata

```
PROCESS_THREAD(hello_world_ctimer, ev, data)
{
  PROCESS_BEGIN();

  rtimer_init();
  //…

  /* Schedule the rtimer: absolute time! */
  rtimer_set(&print_rtimer,RTIMER_NOW()+RTIMER_SECOND,
      0, rtimer_callback, "Hello world RT\n");

  // …
  PROCESS_END();
}
```
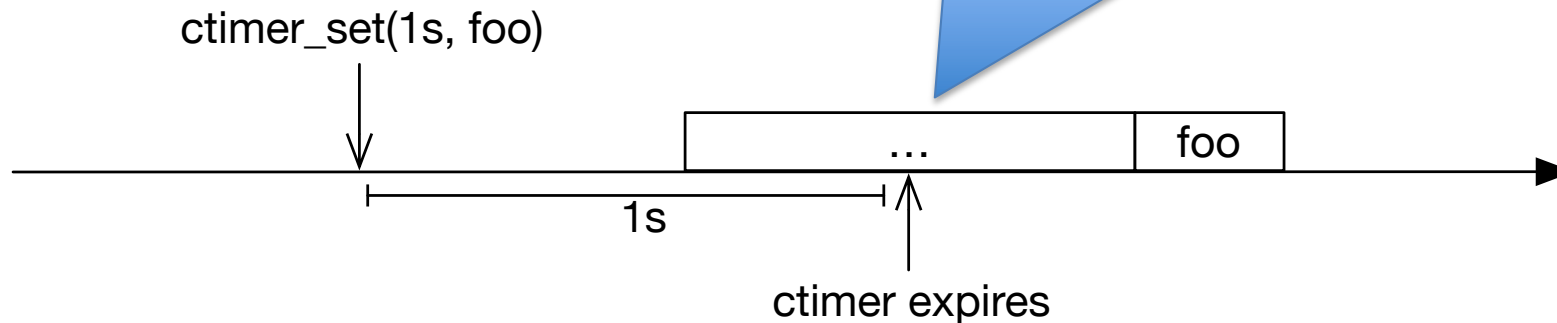
```
static void rtimer_callback(struct rtimer *t, void *data){

  printf("%s", (char *)data);

  /* Reschedule the rtimer. */
  rtimer_set(&print_rtimer,RTIMER_NOW()+RTIMER_SECOND,
      0, rtimer_callback, "Hello world RT\n");
}
```
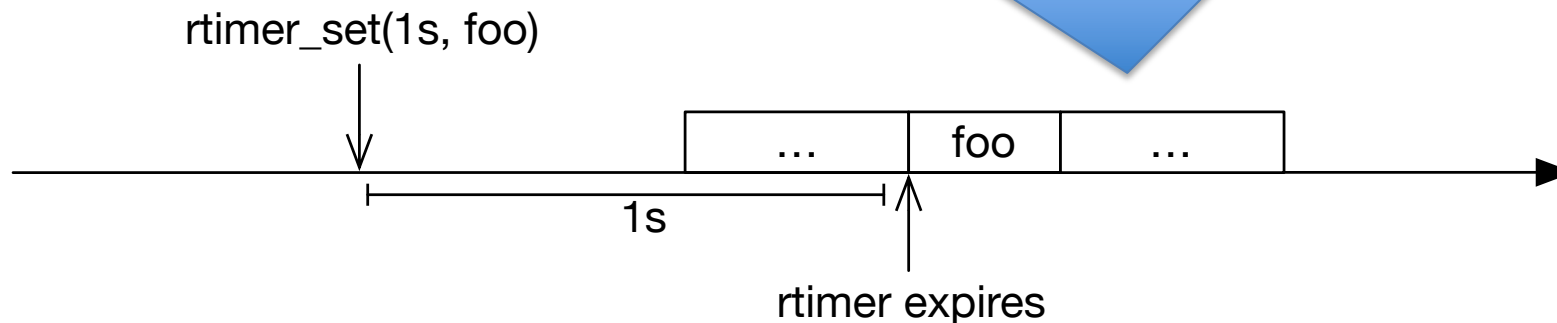
Comparison `ctimer` vs `rtimer`

Find code under **examples/timers**!