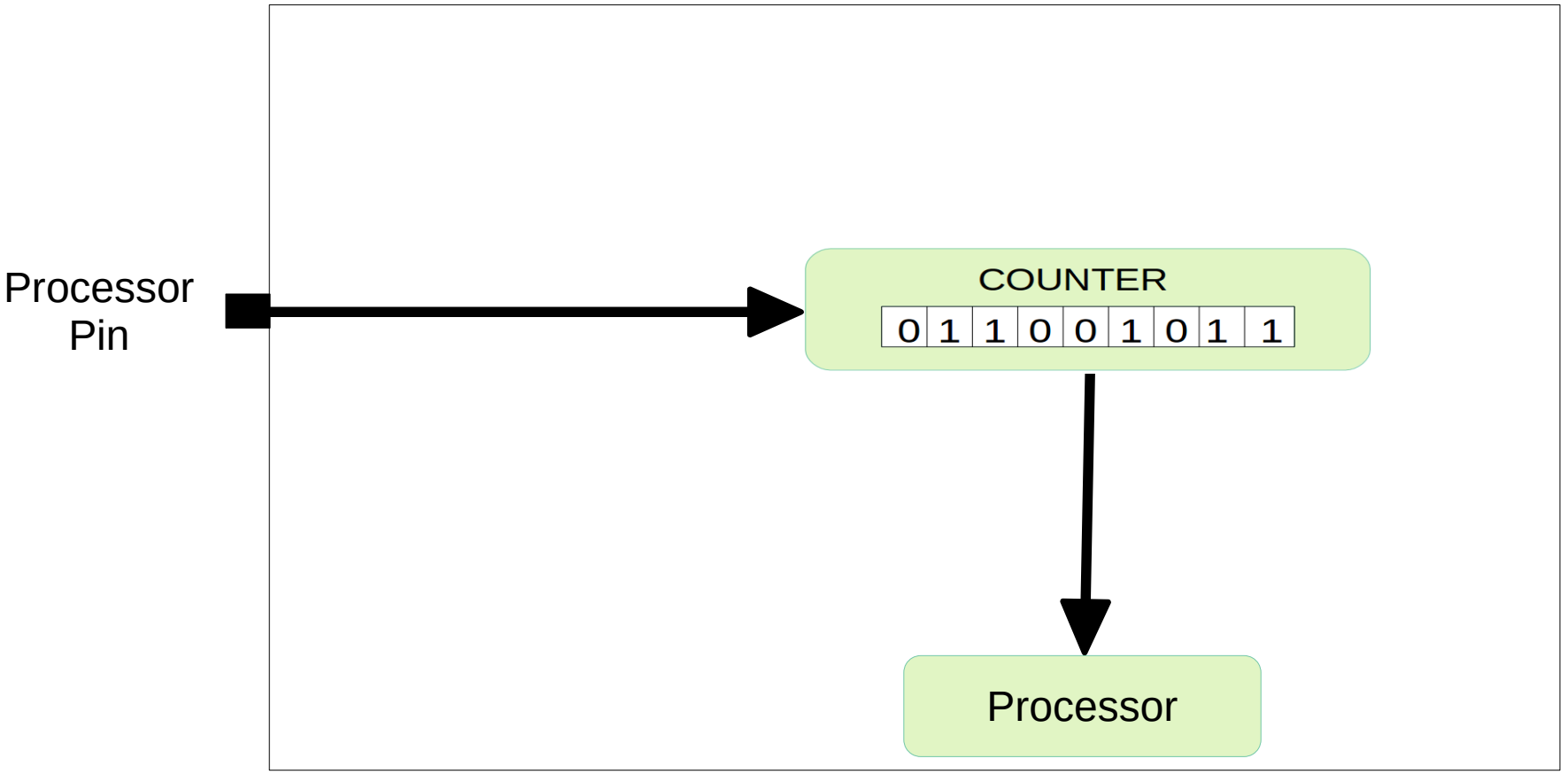
Timers and Counters

Ahmet Onat, 2022

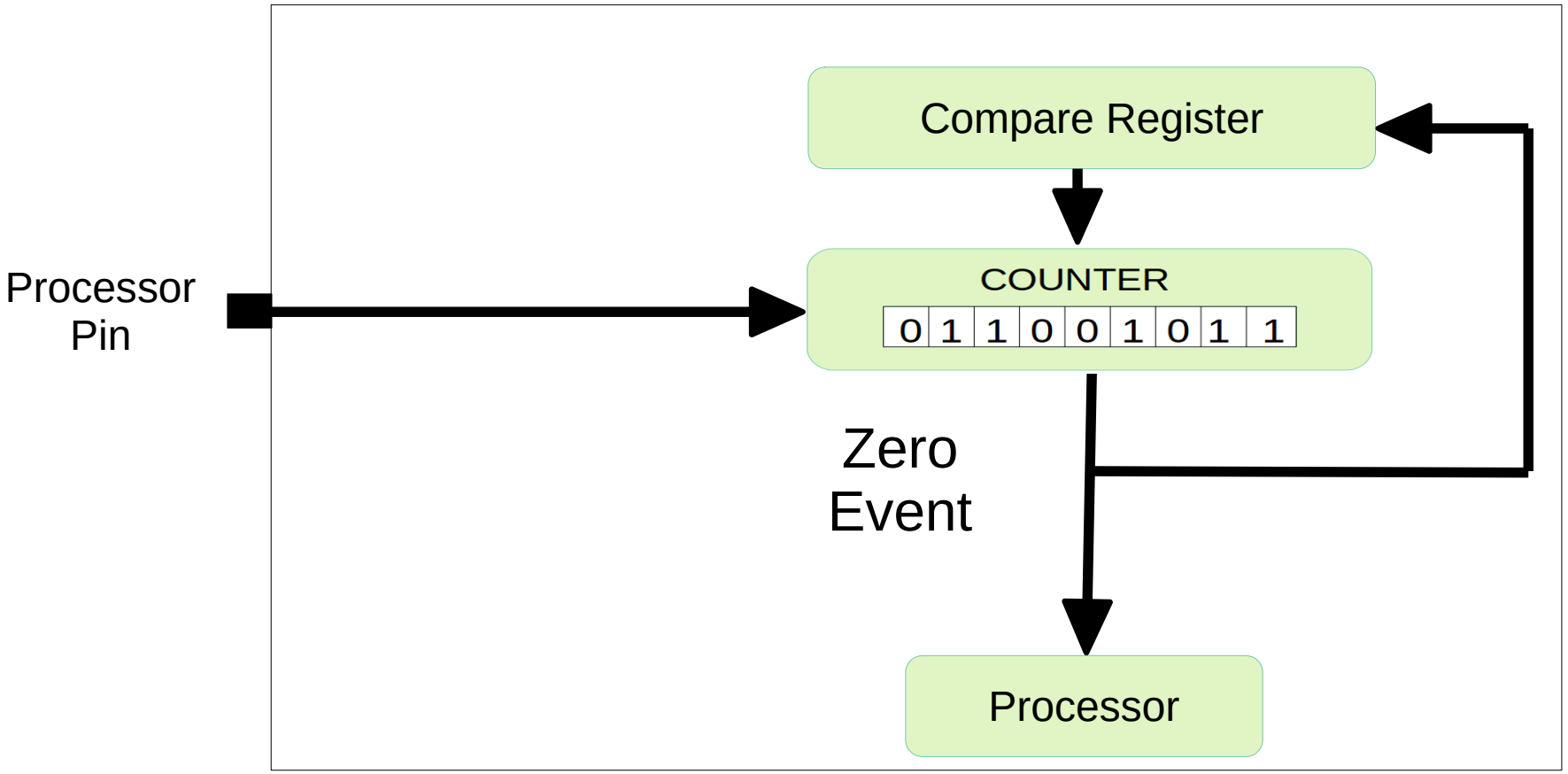
Structure of a counter

- A pulse on an external pin increments or decrements the counter.
- Counter is a physical logic circuit. It can count fast.



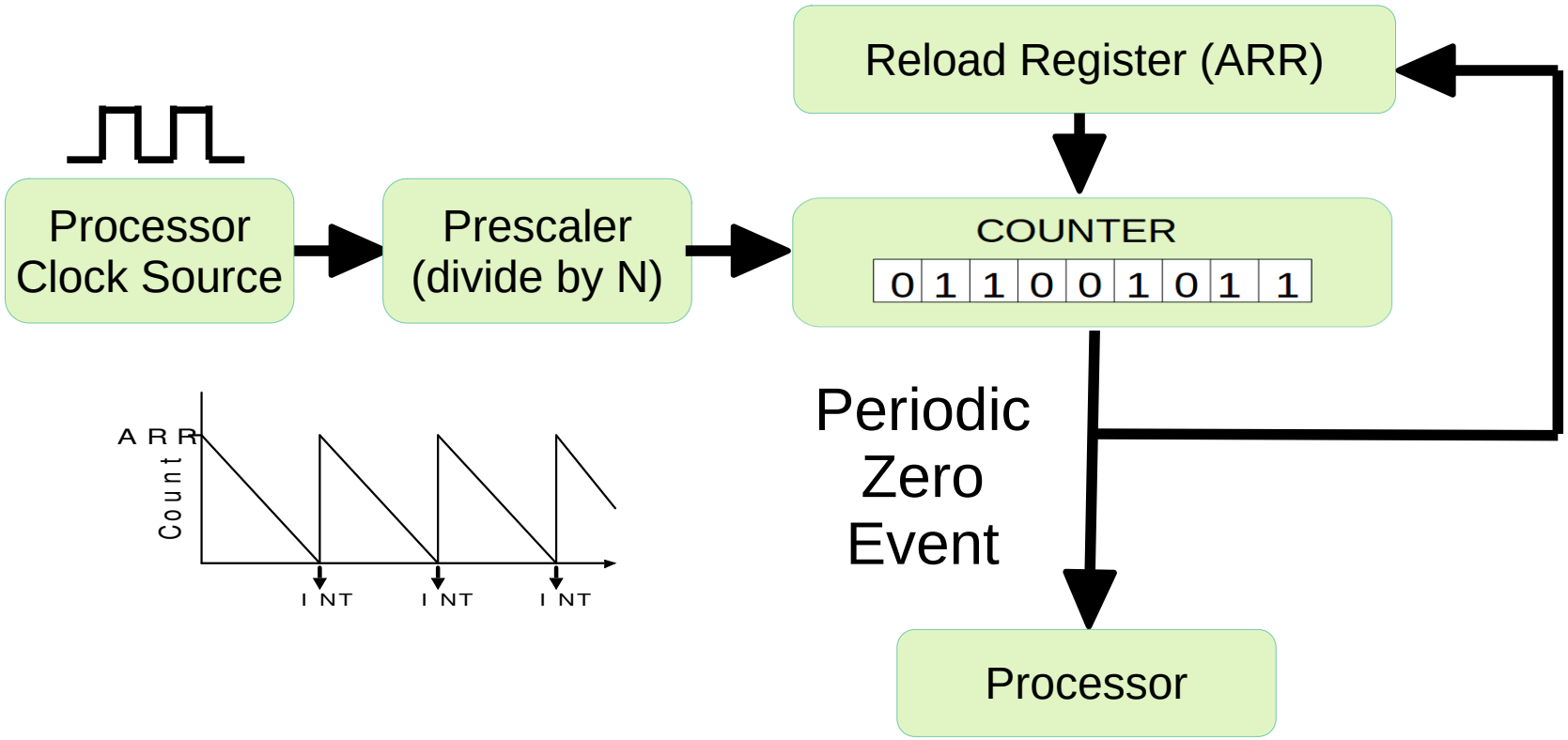
Structure of a counter

- If the counter value equals Compare Register:
  Its value is re-set to zero.
- It can count ARR pulses.



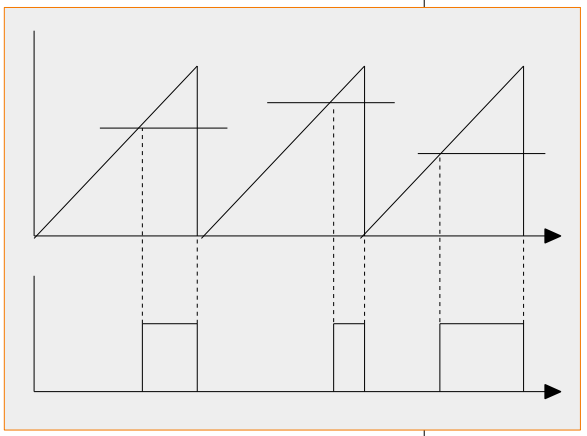
Structure of a timer

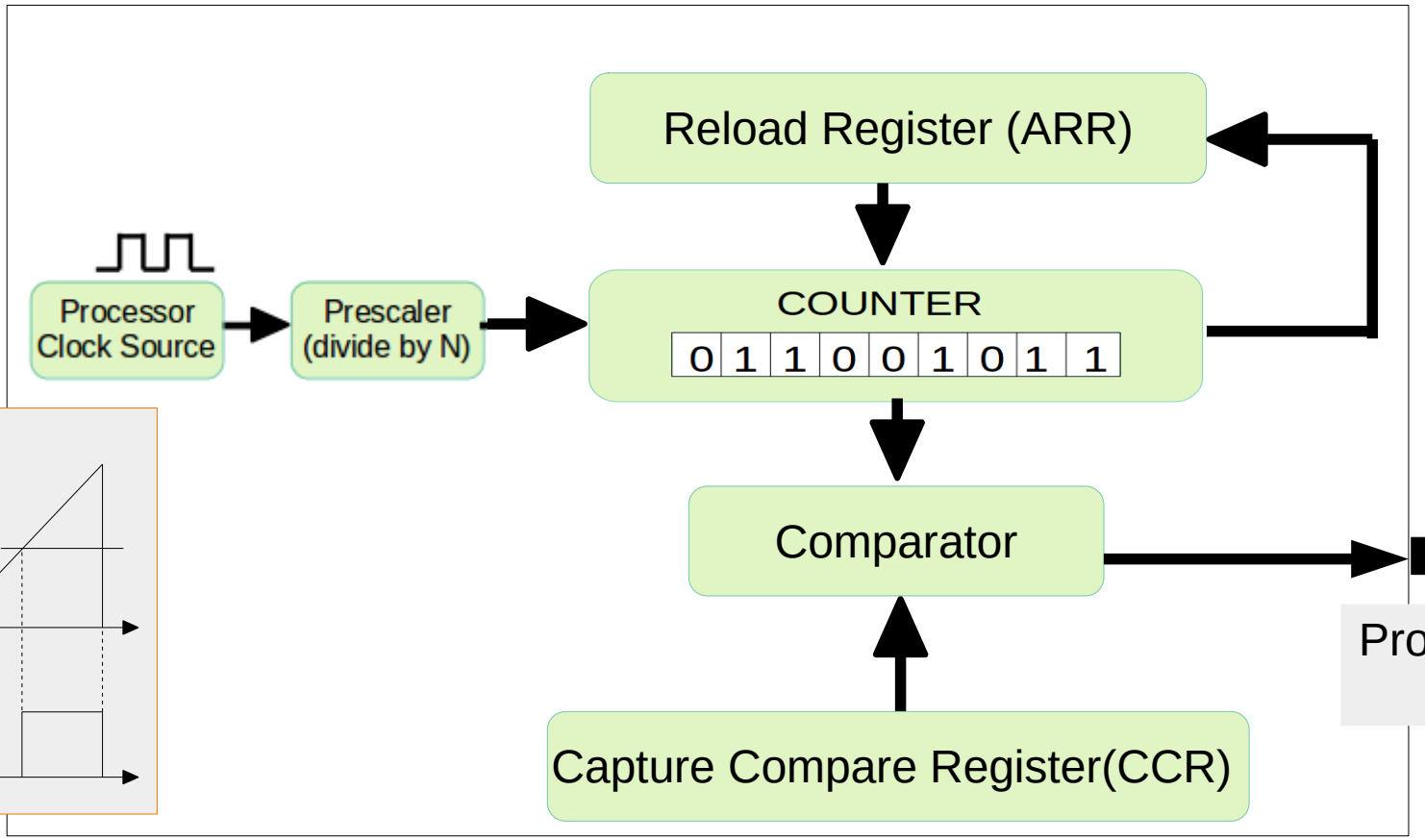
- Same structure.
- But pulses are now provided by the processor clock.
- It now functions as a timer.



Structure of a timer

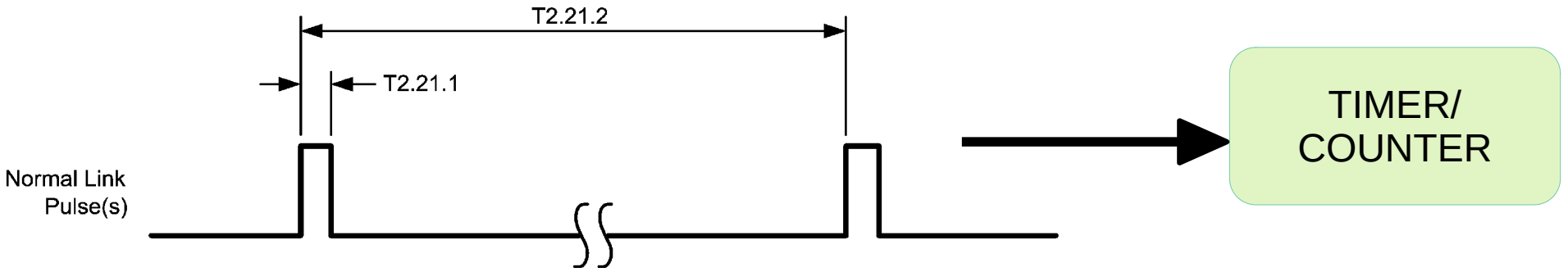
- **Mode**: PWM generator
  - Value of reload register determies PWM frequency
  - Value of compare register determines duty cycle



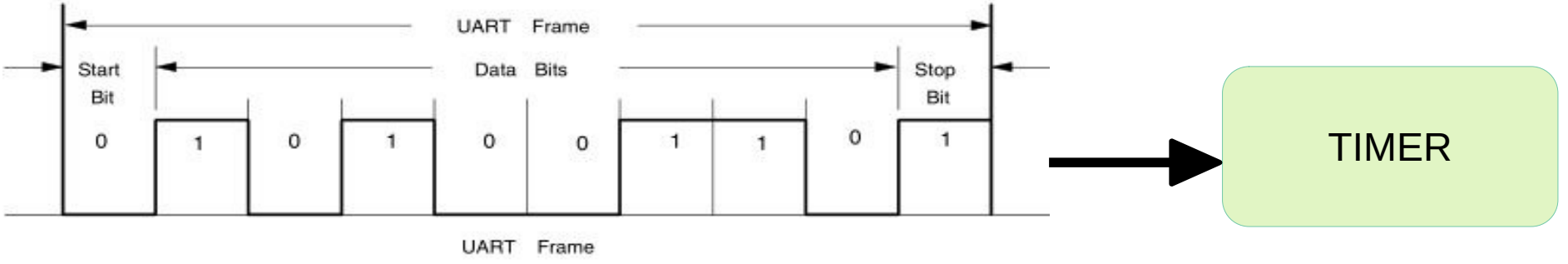


Where timer-counters are used

- Timers are used to:
  - Time external events



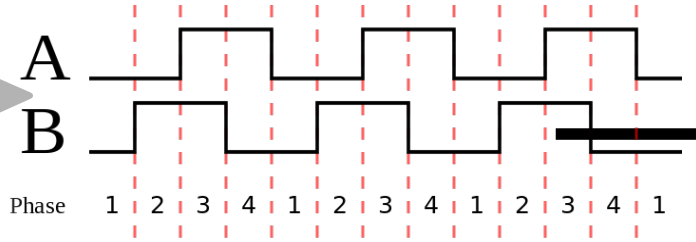
  - Time '0' and '1' for incoming data stream (Ethernet, CAN...)



Network Data

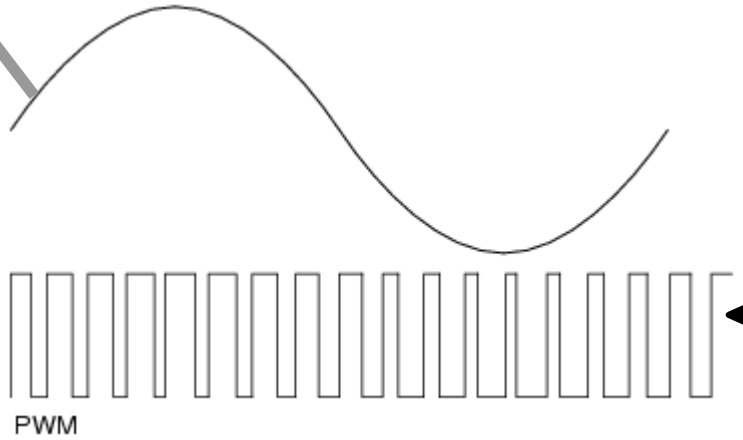
Where timer-counters are used

- Timers are used to:
  - Count events (position encoder etc.)



COUNTER

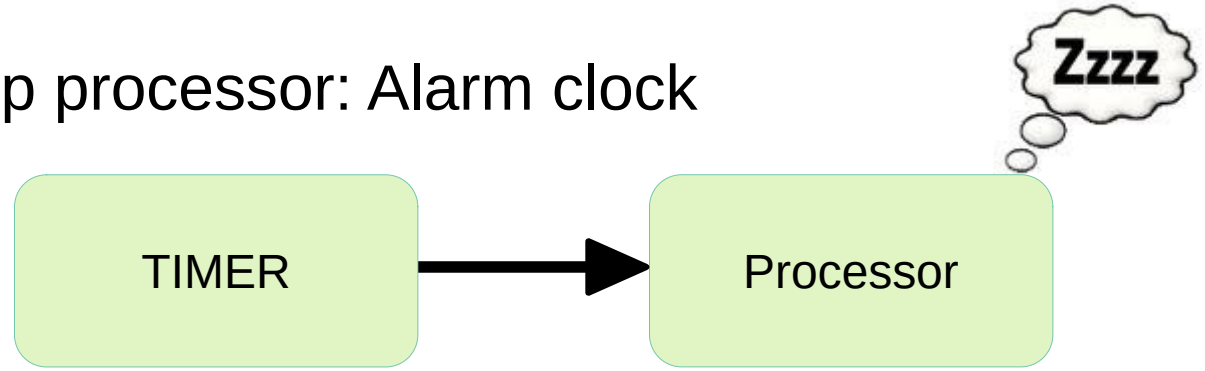
  - PWM generation (motor control etc.)



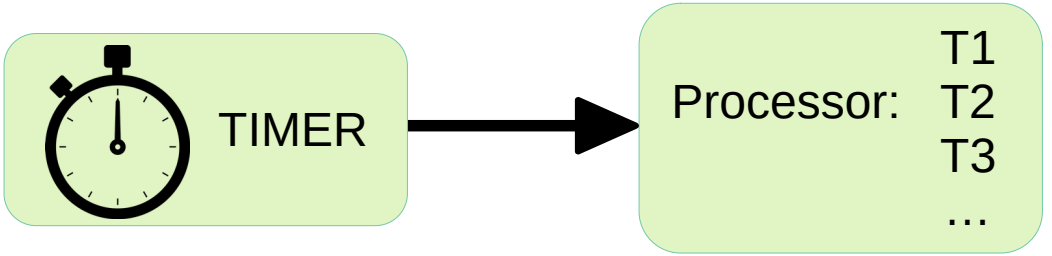
TIMER

Where timer-counters are used

- Timers are used to:
  - Wake up processor: Alarm clock

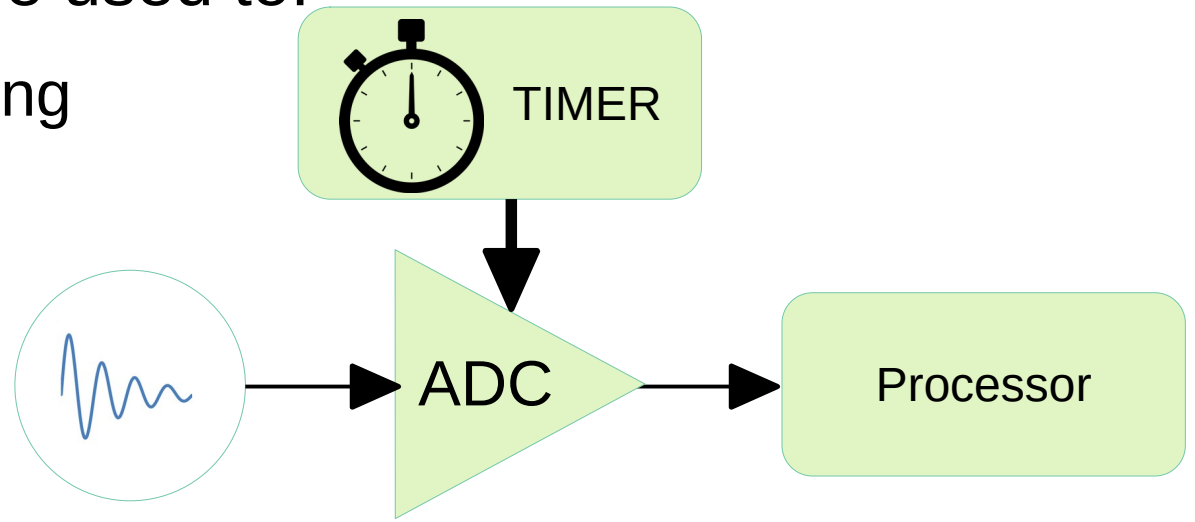


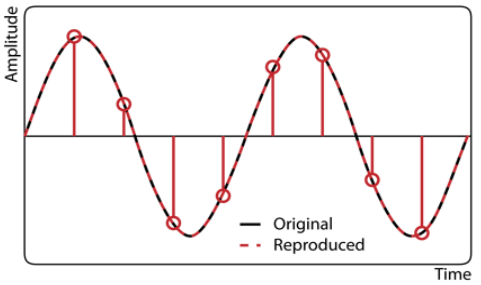
  - OS: Generate periodic events to run periodic tasks.



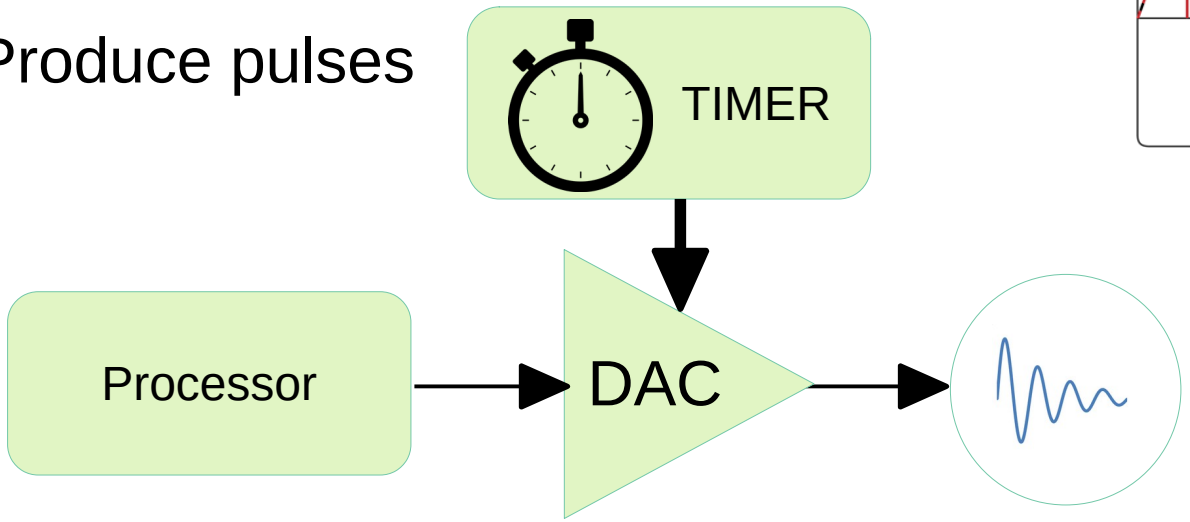
Where timer-counters are used

- Timers are used to:
  - Sampling





  - Produce pulses



Where timer-counters are used

- **Mode**: Count external events