Towards RTOS support for mixed time-triggered and event-triggered task sets

How slot-shifting works?

Offline

Periodic tasks with simple and complex constraints

Offline schedule with simple constraints and information about unused resources

Sporadic tasks guaranteed for the worst-case arrival pattern on top of the offline schedule.

Online

At run-time, periodic tasks can run flexibly within their assigned intervals

Slot shifting

Keep track on sporadic arrivals to reduce the pessimism of the offline guarantee

Firm aperiodic tasks are guaranteed on top of offline schedule and sporadic tasks

Implementation

[Isovic and Fohler, RTSJ2009]
Extending a COTS RTOS

- **MicroC/OS-II is**
  - A commercial RTOS for embedded systems
  - Event-driven fixed-priority scheduling
  - Available at [http://micrium.com/](http://micrium.com/)

- **We extended MicroC/OS-II with**
  - Time-keeping for time-triggered tasks
  - EDF scheduler
  - WCET monitoring
Implementation complexity

- On the efficiency of monitoring the spare capacities:

  “executing an offline task in an other interval than the designated interval only swaps spare capacities.”

- Updating spare capacities may propagate through the entire hyper period…
Handling a-periodic requests

- **Trade-off:**
  
  estimated spare capacities vs.
  
  exact spare capacity.

- **Demand-bound test for sporadic tasks can be computationally expensive.**

- **Reserve execution time for the admission control itself.**