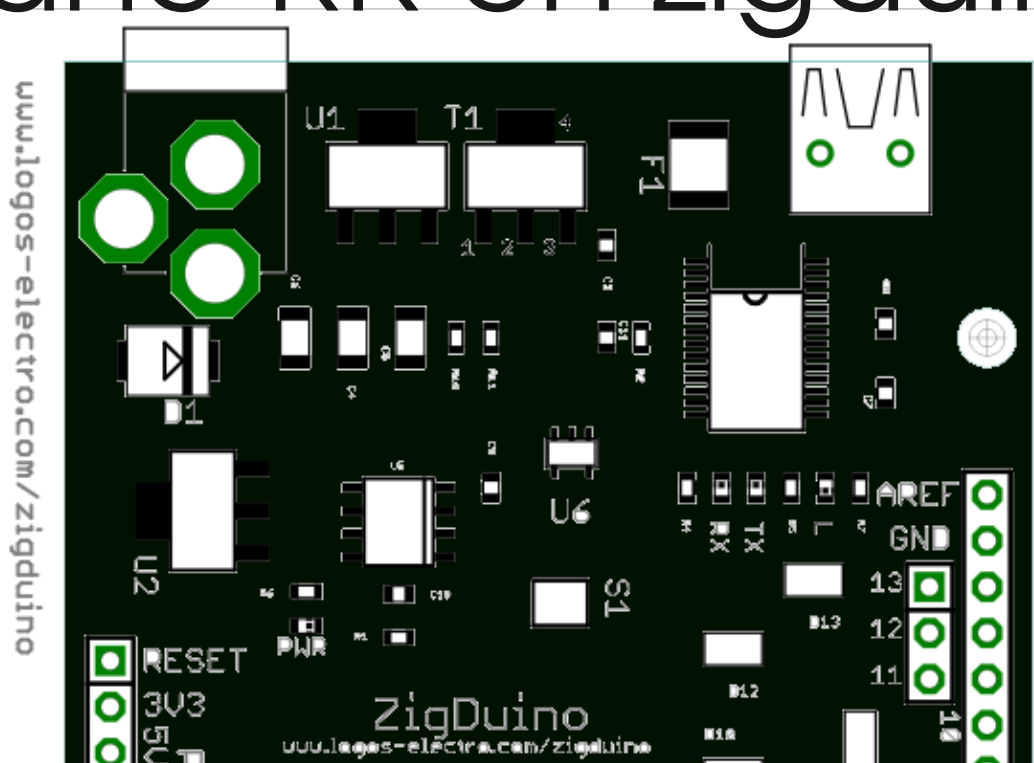




Nano-RK on zigduino



Today's outline

- Nano-RK
 - Nano-RK TASKs
 - Period time, Reserve time
 - Wait and Signal
 - Nano-RK bmac & basic_rf
 - Tips and Tricks

Nano-RK task



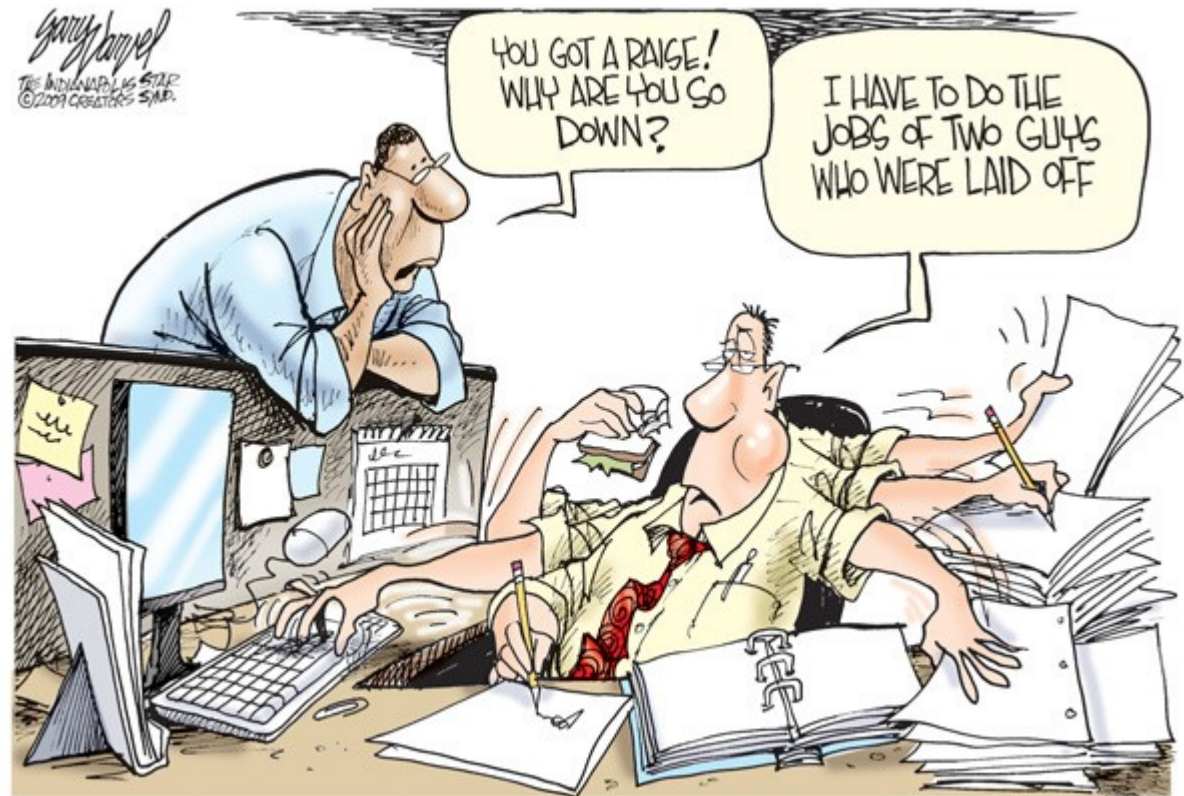
What is nano-RK?

- A Real-time Operating System for sensor nodes for use in wireless sensor networks
 - Priority-Based Preemptive Multitasking
 - Resource Reservations



Priority-Based Preemptive Multitasking

- Priority
- Preemptive
- Multi-task



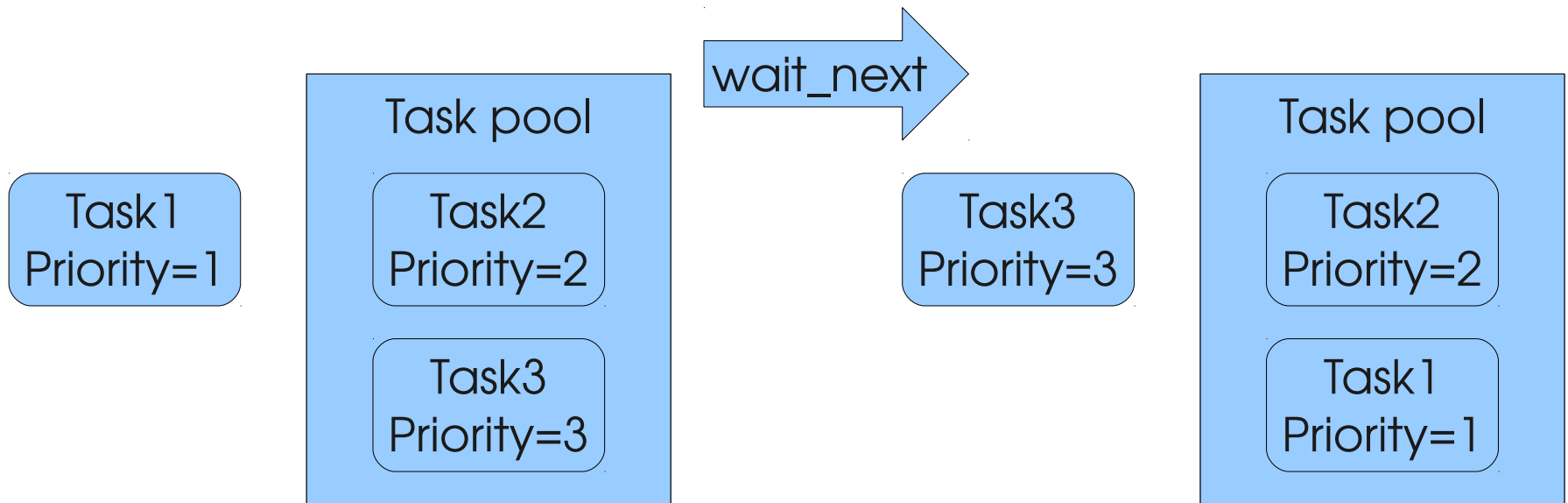
Creating a Nano-RK Task

```
NRK_STK TaskOne_Stack[NRK_APP_STACKSIZE];  
nrk_task_type TaskOne;  
void Task1(void);
```

```
...  
TaskOne.task = Task1;  
nrk_task_set_stk( &TaskOne, TaskOne_Stack, NRK_APP_STACKSIZE);  
TaskOne.prio = 2;  
TaskOne.FirstActivation = TRUE;  
TaskOne.Type = BASIC_TASK;  
TaskOne.SchType = PREEMPTIVE;  
TaskOne.period.secs = 0;  
TaskOne.period.nano_secs = 100*NANOS_PER_MS;  
TaskOne.cpu_reserve.secs = 0;  
TaskOne.cpu_reserve.nano_secs = 10*NANOS_PER_MS;  
TaskOne.offset.secs = 0;  
TaskOne.offset.nano_secs = 0;  
nrk_activate_task (&TaskOne);
```

Control the Nano-RK tasks

- Task Management
 - `nrk_wait_uuntil_next_period();`
 - Scheduling base on priority



Control the Nano-RK tasks

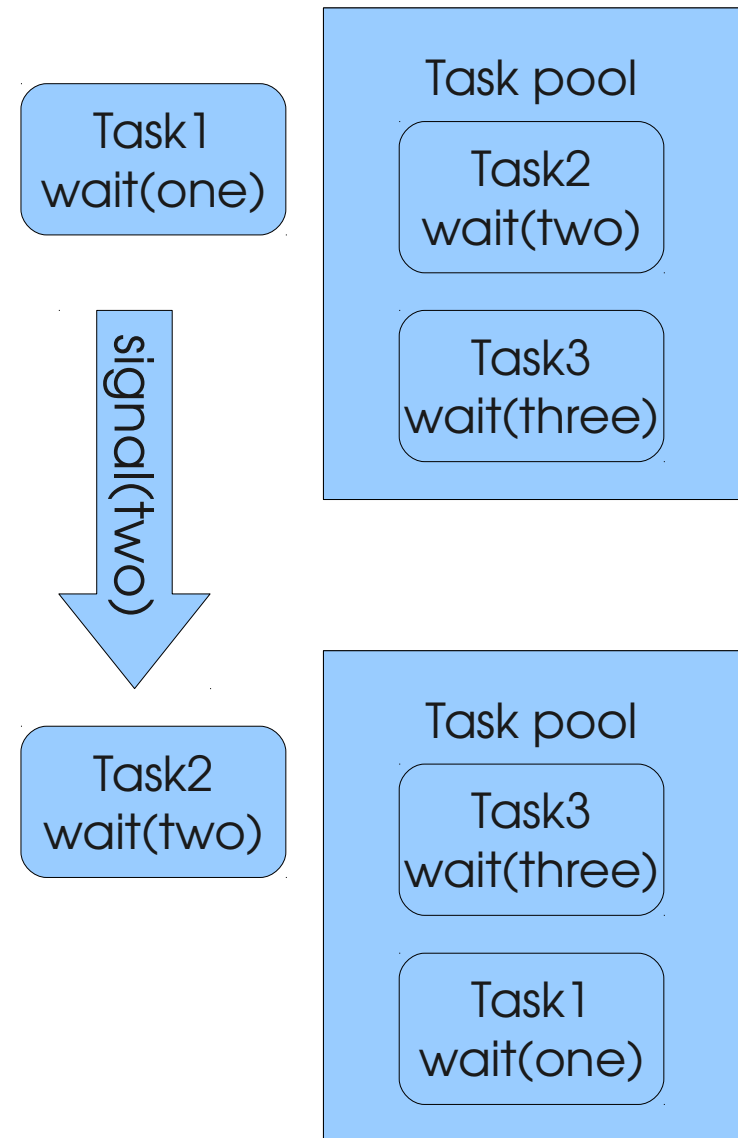
- Signals

- Create and signal

- `nrk_sig_t signal_one;`
- `signal_one=nrk_signal_create();`
- `nrk_event_signal(signal_one);`

- Wait a signal

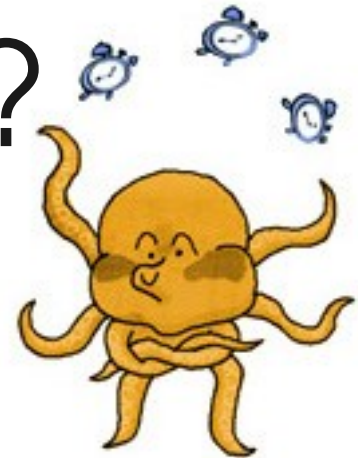
- `nrk_signal_register(signal_one);`
- `nrk_event_wait(SIG(signal_one));`



Cpu reserve time

- Resource Reservations
 - Task is forced to stop when overdraw its budget
 - Recharge budget next time running
 - Reserve time = 0 → disable reservations
- ERROR? Program halt?
 - *NRK ERROR(1): Task Reserve Violated
 - `//#define NRK_REPORT_ERRORS`
 - `//#define NRK_HALT_ON_ERROR`

Any questions about
Nano-RK task?



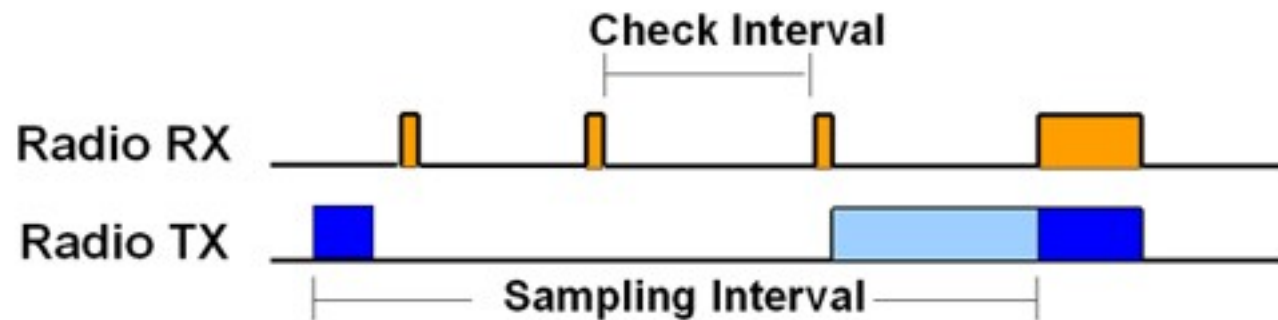


Nano-RK radio

- B-MAC
- Basic RF

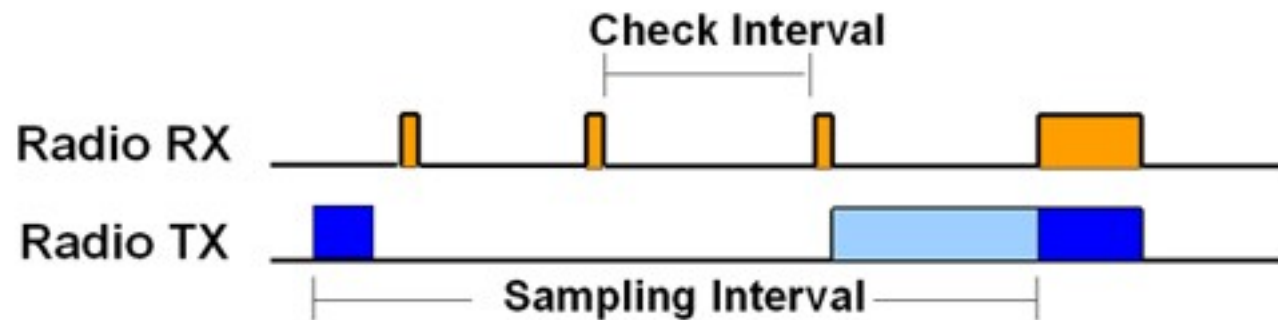
B-MAC

- CSMA base
- Low-power listen
- Preamble needed for TX
- Trade-off between check rate and preamble



B-MAC on nano-RK

- The preamble is replaced with repeating packets on the nano-RK w/ zigduino
- Receiver go sleep after getting a packet
- Implement by a bmac task
 - The api sets the config of this task.



Basic RF

- Aloha protocol (No mac protocol)
 - Which means you have to listen all the time
- Do nothing for collision avoidance
- Hardware ack is available
 - While the bmac ack is not working for now

Basic RF on nano-RK

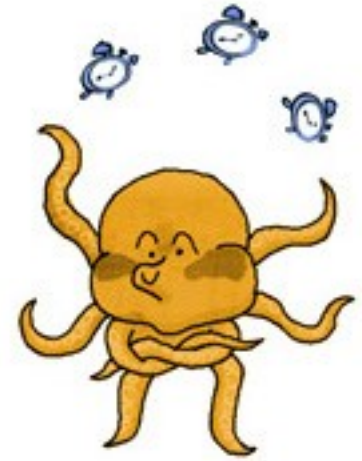
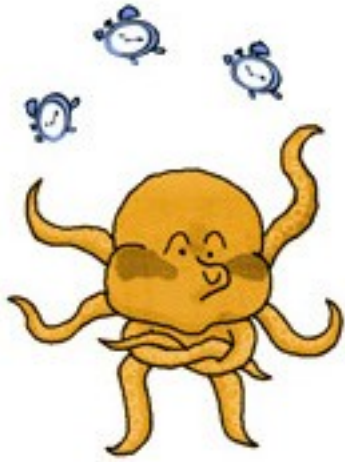
- Directly using the hardware radio
 - The chip atmega128rfa1
- For TX, hardware ack is available
 - While the bmac ack is not working for now
- For RX, support hardware CRC check
 - CRC fail => packet error

Basic RF V.S B-MAC

	BMAC	Basic RF
Hardware ACK	Not work	Work
Date rate	Lower	Higher
Collision avoidance	YES	NO
Task base	YES	NO

Any questions about
Nano-RK radio?





Tips & Tricks



It's all about stacks

- Don't Allocate Large Data Structures Inside Functions
- Use `nrk_kprintf()` Whenever Possible
- Be Very Careful With Dynamic Memory
 - Array will always be a good choice.
- Avoid floating point (NO FPU)

Do it by yourself?

- <http://www.nano-rk.org/wiki/Documentation>
- <http://140.112.91.208/nano-RK/HTML/>
- Take a look of the examples in nano-RK