Experimental PREEMPT_RT Linux Usage in Railway Interlocking System

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Station Scheme
Interlocking System

- Obtains trains positions
- Controls switches
- Controls signals
- Generates control command to trains
- Performs service tasks
Processes Synchronization

Sync driver

Sync events

Process 1

Process 2

Process 3
Main Cycle Of Sync Driver

```c
static int main_cycle(void* data)
{
    s32 dev;

    DECLARE_WAITQUEUE(wait, current);
    add_wait_queue(&myevent_waitqueue, &wait);

    while( !kthread_should_stop() ) {
        set_current_state(TASK_INTERRUPTIBLE);
        schedule();

        // ...
        // Unblock chardevs read()
        for ( dev = 0; dev < MAX_CHARDEVS; dev++ ) {
            usleep_range(timeout_us_sync_read[dev],
                         timeout_us_sync_read[dev] + TIMEOUT_US_LIMIT);

            device_descriptor[dev]->data_to_userspace_available = 1;
            wake_up_interruptible(&device_descriptor[dev]->inq);
        }
    }
    // ...
    return 0;
}
```
Underlying System

• Requirements
  – Precision of unblocking moments
  – Kernelspace and userspace threads priorities
  – Deterministic execution time for processes under given priorities

• Existing Problems
  – Network packets processing determinism
  – Safe timing isolation of applications in mixed criticality systems