What Every Driver Developer Should Know about RT : Question

HW06

1. Where does Julia Cartwright work?

   She is working at National Instruments.

2. What is PREEMT_RT?

   Realtime Preemption is a patch which tries to improve real time performance of the Linux kernel. Scheduling latency under Linux and its principal real-time variant, the PREEMPT RT patch, are typically measured using cyclictest, a tracing tool that treats the kernel as a black box and directly reports scheduling latency[2].

3. What is mixed criticality?

   A mixed criticality system is a system containing computer hardware and software that can execute several applications of different criticality, such as safety-critical and non-safety critical, or of different Safety Integrity Level[1]. For example Julia Cartwright talked about communication between different processes which have to different degrees of time sensitiveness.

4. How can drivers misbehave?

   Systems that run preempt are sharing the Kernel, Scheduler, device stack or subsystems. Therefore you don't get isolation of the different processes, why driver can misbehave and can not executed in time. For example the processes which are happing on the non real-time kernel influences the time critical processes.

5. What is Δ in Figure 1?

   Delta is the latency on a real-time guarantee. The time in which an external event, like an interrupt occurs to until a relevant real-time task executes.

6. What is Cyclictest[2]?

   Cyclictest is a process to measure the delta. For example take a time stamp and sleep for a fix duration (10ms) and then take a time stamp when the thread is waking up. If you take the differences between the two time stamps, the amount of time is the time the thread actually slept(11ms). You had a fixed duration and the difference between the duration and the amount of time it slept is the delta. $\Delta = 11ms - 10\ ms = 1ms$.

7. What is plotted in Figure 2?

   In figure two is the executions time of different processes plotted. Purpel, is the regular config preempt settings time in a mainline kernel. Green is the execution time from the preempt- rt patch on the same hardware.

8. What is dispatch latency? Scheduling latency?

   The Delta latency is the sum of the dispatch latency and the scheduling latency.

   Display latency is the time between the hardware and the actually firing process (like interrupts) for relevant threads.

   Scheduler latency is the time between a wakeup (like interrupt) signaling that an event has occurred and the kernel scheduler getting an opportunity to schedule the thread that is waiting for the wakeup to occur (the response).

9. What is mainline?

   Mainline is the normal execution environment for long running interrupts. That means interrupt handlers are executed in hard irq context, they are implicitly executed with interrupts disabled.

10. What is keeping the External event in Figure 3 from starting?

    The noncritical IRQ which got executed at first.

11. Why can the External event in Figure 4 start sooner?

    They force irq threads. Because of little code that is executed in heard interrupt context and waking up the necessary threads.

References

[1]Cerqueira, F., & Brandenburg, B. B. (2013). *A Comparison of Scheduling Latency in Linux, PREEMPT-RT, and LITMUS RT*. Abgerufen am 4. 10 2018 http://pubman.mpdl.mpg.de/pubman/item/escidoc:2173547/component/escidoc:2173546/ospert13.pdf

[2]Napier, K., Horst, O., & Prehofer, C. (2016). *Comparably Evaluating Communication Performance within Mixed-Criticality Systems*. opend 10.3 2018 https://hal.archives-ouvertes.fr/hal-01417283