Abstract:

Locks are widely used as a synchronization method to guarantee the mutual exclusion for accesses to shared resources in multi-core embedded systems. They have been studied for years to improve performance, fairness, predictability etc. and a variety of lock implementations optimized for different scenarios have been proposed. In practice, applying an appropriate lock type to a specific scenario is usually based on the developer's hypothesis, which could mismatch the actual situation. A wrong lock type applied may result in lower performance and unfairness. Thus, a lock profiling tool is needed to increase the system transparency and guarantee the proper lock usage. In this paper, an operating-system-independent lock profiling approach is proposed as there are many different operating systems in the embedded field. This approach detects lock acquisition andlock releasing using hardware tracing based on hardware-level spinlock characteristics instead of specific libraries or APIs. The spinlocks are identified automatically; lock profiling statistics can be measured and performance-harmful lock behaviors are detected. With this information, the lock usage can
be improved by the software developer. A prototype as a Java tool was implemented to conduct hardware tracing and analyze locks inside applications running on the Infineon AURIX microcontrollers.

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