Virtualisation for Embedded Real-Time Systems

–Abstract–

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Virtualisation technology has recently received an increased interest, both from academia as well as practitioners, mainly due to the new applicability of this approach to non-mainframe computers. The main protagonists in this area have been Xen [1] and VMware [2]. Both enable multiple operating systems to coexist securely within a single machine and both are widely used in the area of server consolidation as well as on desktop machines. Embedded systems, however, have so far hardly been regarded as a possible target for virtualisation, although applying the technology here would also stand to reason: Embedded applications have grown to become complex pieces of code and they often suffer from their underlying operating systems not being up to the resulting challenges. Virtualisation would allow these complexity problems to be tackled with a ”divide and conquer” approach. Today’s embedded systems in many cases have the necessary resources to support virtualisation, nevertheless, applying the technology here presents some new problems that are not present in the field of server consolidation. Most notably, there frequently exist programs that must fulfil hard timing requirements. The spatial and temporal *separation* between virtual machines as it is provided by the current approaches does not suffice: spatial and temporal *determinism* are also required.

In this contribution, we concentrate on the problem of achieving temporal determinism with virtual machines because this aspect is not sufficiently addressed by the current virtualisation techniques. We will give an estimation of the impact that virtualisation has on real-time programs and we will introduce some possible approaches to reduce this impact.

References

[1] Paul Barham, Boris Dragovic, Keir Fraser, Steven H, Tim Harris, Alex Ho, Rolf Neugebauer, Ian Pratt, and Andrew Warfield. Xen and the Art of Virtualization, 2003.

[2] VMware. VMware ESX Server Online Documentation, 2005.