ICT-eMuCo

Embedded Multi-Core Processing for Mobile Communication Systems

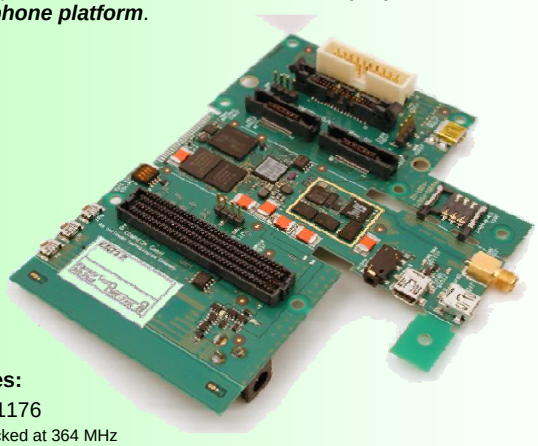
eMuCo software platform basis on one core competitive IFX platform

SEVENTH FRAMEWORK PROGRAMME

Infineon X-Gold 618

The ***X-Gold 618*** SoC from Infineon is a HSDPA capable cellular platform, which is employed in many high-end mobile phones. It therefore serves as a ***reference platform to evaluate the performance and limitations of the eMuCo software approach on a realistic, single core mobile phone platform***. The one core reference platform actually consist of a highly integrated SoC with seven cores but the ***computing system running all applications (modem and multimedia) in this demo uses only one ARM11.***

The comparison of the performance figures of the X-Gold and Realview MPCore platforms enables us to ***assess the properties of a multi-core mobile phone platform***.



Features:

- ARM1176
  - Clocked at 364 MHz
  - 32K L1 Data and Instruction Caches
- HSDPA/HSUPA capabilities of 7.2Mbps/2.9Mbps
- various HW accelerators for multimedia
- highly integrated design

Real-time Performance

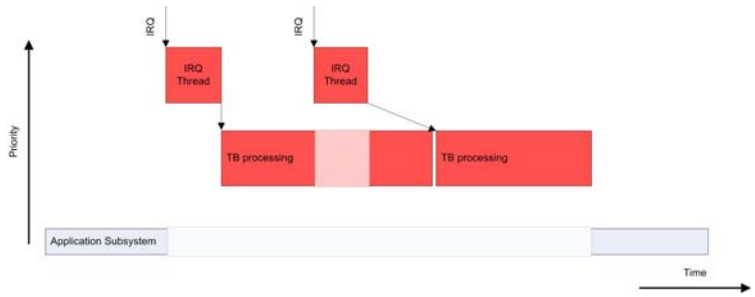
Methodology

To estimate the ***real-time performance*** of the ***eMuCo software platform*** we evaluate the response time of the L4 microkernel by comparing its ***system-call latency and preemption times*** with those of an industrial grade RTOS.

In order to verify the approach of ***combining modem subsystem (real time application) and application subsystem*** on a single processor, we measure the ***response time of the LTE protocol stack*** under different loads in the application subsystem.

Real-time Application

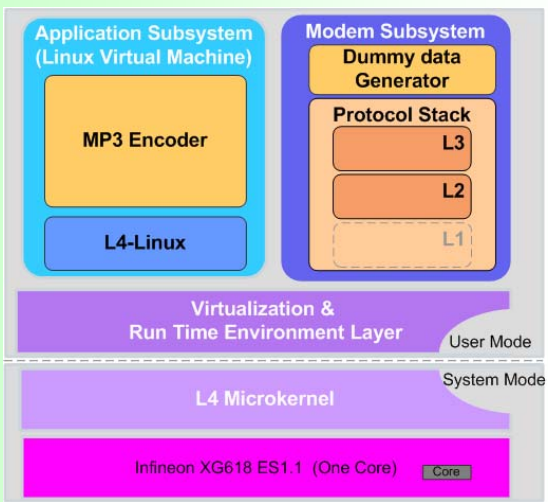
The processing of Transport Blocks is triggered by interrupts. The ***IRQ latency*** and ***the time to process a Transport Block*** are measured by hardware timers. The interrupt trigger can be configured for different loads, thereby causing preemption of the data processing threads, and scaling the data rate between 5MBit/s and 25MBit/s.



Depending on the data rate, the protocol stack consumes a maximum of approximately 25% of processing resources. The remaining resources can be used by the application subsystem, which causes cache contention and thereby affects the real-time application.

Demonstration Setup

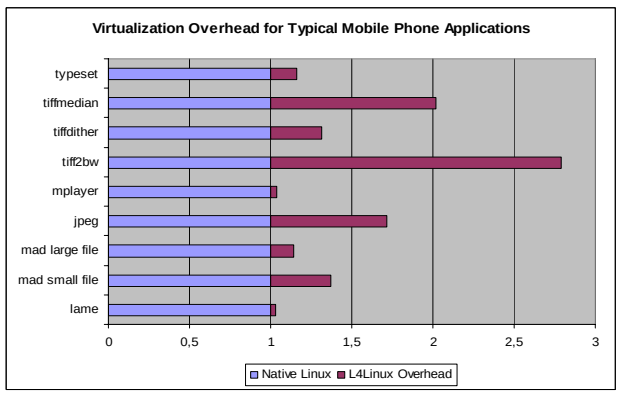
In this scenario we execute a ***real-time application at the modem subsystem*** and a ***typical mobile phone application at the application subsystem*** on the single-core processor of the X-Gold platform to estimate the impact on the subsystems performance.



We estimate the ***virtualization overhead*** for various L4Linux applications and the ***performance of a real-time application*** under different system loads. In this setup, ***a native L4 hand-coded program which performs the data plane LTE protocol stack downlink functionality serves as real-time application at the modem subsystem*** .

Virtualization Overhead

Several typical mobile applications are executed and benchmarked on both native ***Linux and L4Linux*** to estimate the virtualization overhead.



Absolute Execution Time (s)

	Lame	Mplayer	Typeset	Mad large	Mad small	Tiffdither	Tiffmedia	Jpeg	Tiff2bw
Native Linux	78,8	5,5	7,8	7,9	1,8	1,4	1,7	0,8	0,6
L4Linux	81,1	5,7	9,1	9,0	2,5	1,9	3,5	1,4	1,8

The virtualization overhead of L4Linux can be quite low (e.g. about 3% for the *"lame"* mp3 decoder), especially when the applications execution time is long. This indicates that the main overhead is caused during start-up and initialization of applications.

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