Aalto University
School of Science
Degree Programme in Computer Science and Engineering

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Energy Efficiency in High Throughput Computing

Tools, techniques and experiments

Master's Thesis
Espoo, 1 December, 2014

DRAFT! — October 16, 2014 — DRAFT!

Supervisors: Professor Jukka K. Nurminen
Advisor: Zhonghong Ou (Post-Doc.)

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ABSTRACT OF
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Thank you, and keep up the good work!

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Abbreviations and Acronyms

2k/4k/8k mode	COFDM operation modes
3GPP	3rd Generation Partnership Project
ESP	Encapsulating Security Payload; An IPsec security protocol
FLUTE	The File Delivery over Unidirectional Transport protocol
e.g.	for example (do not list here this kind of common acronymbs or abbreviations, but only those that are essential for understanding the content of your thesis.
note	Note also, that this list is not compulsory, and should be omitted if you have only few abbreviations

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2.3.1 Literature review

In [1] show how important energy efficiency is for developers in general

2.4 ARM architecture

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Tools and techniques for measuring energy efficiency of scientific software applications

Chapter 4

Experiments

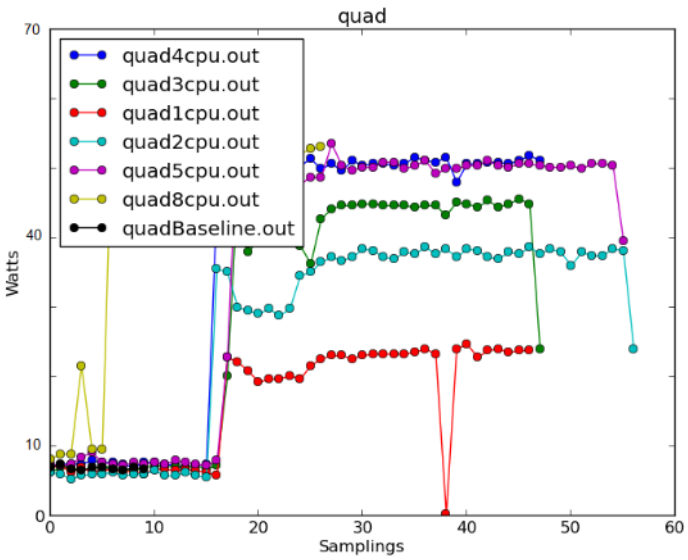


Figure 4.1: Full single threading CMS experiments on Intel Quad

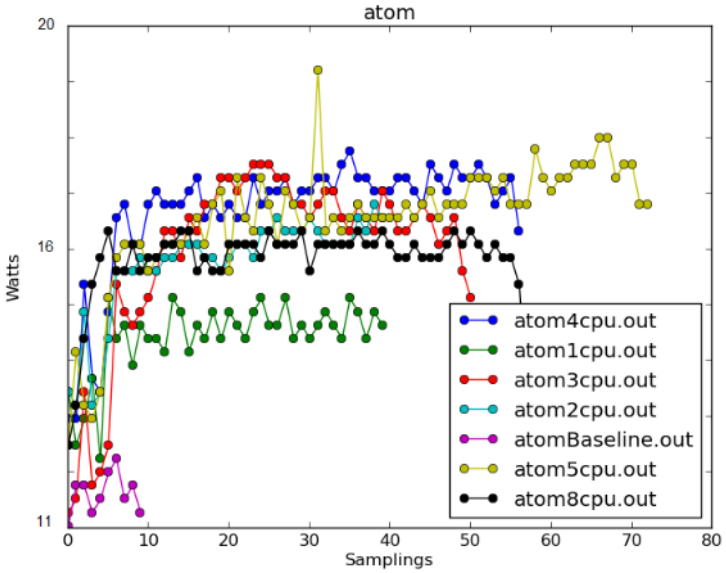


Figure 4.2: Full single threading CMS experiments on Intel Atom

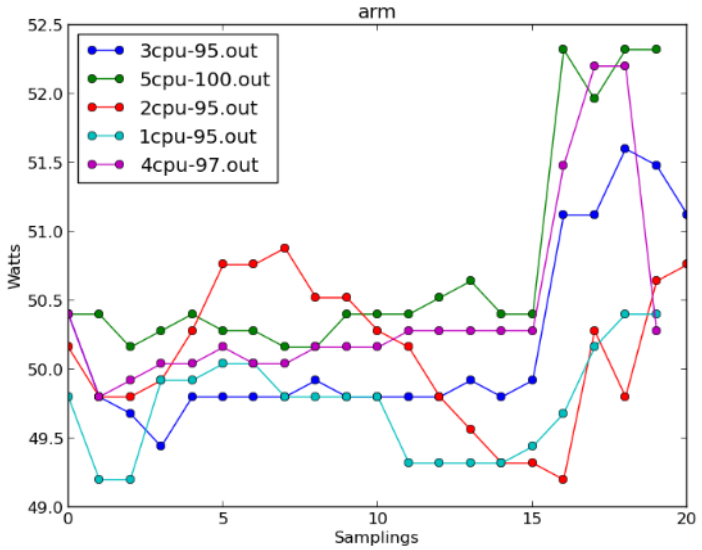


Figure 4.3: Full single threading CMS experiments on ARMv7 server

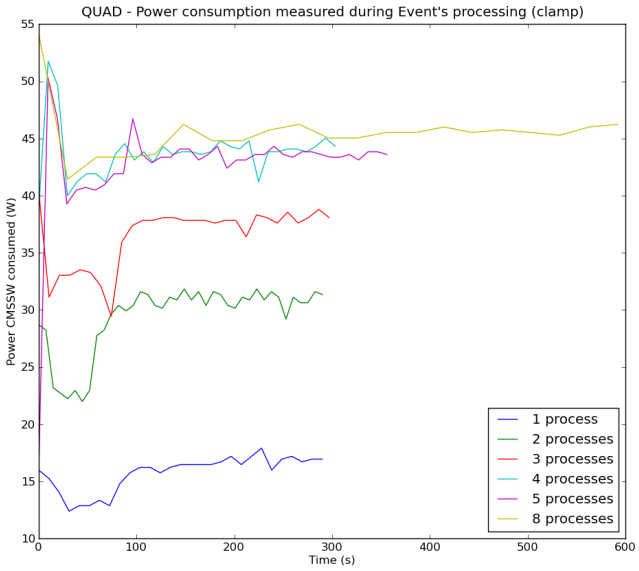


Figure 4.4: Full single threading CMS experiments on Intel Quad - event processing only

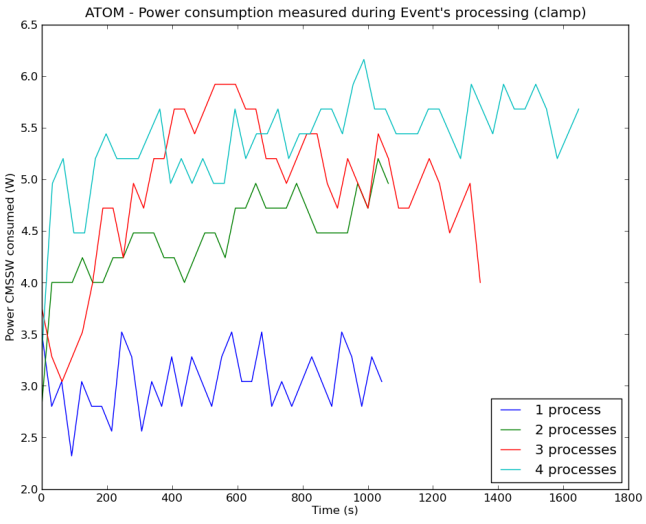


Figure 4.5: Full single threading CMS experiments on Intel Atom - event processing only

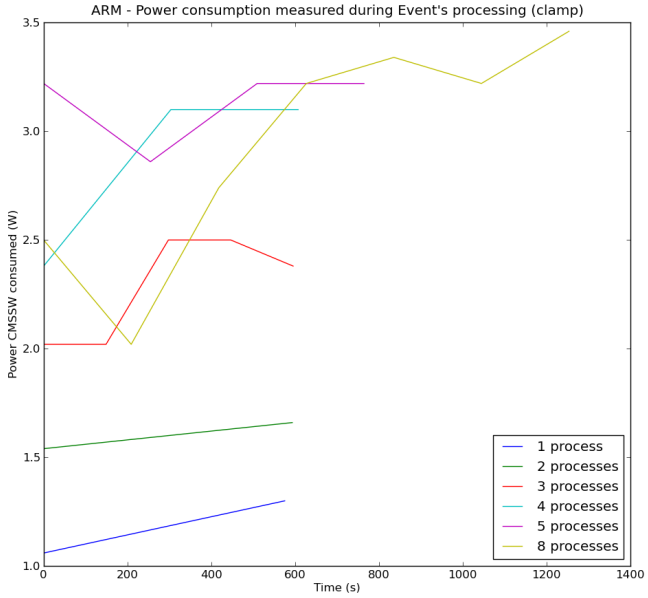
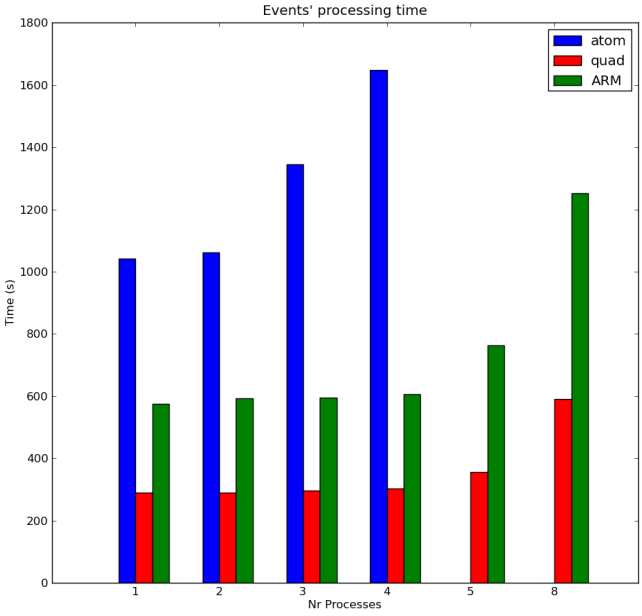


Figure 4.6: Full single threading CMS experiments on ARMv7 server - event processing only



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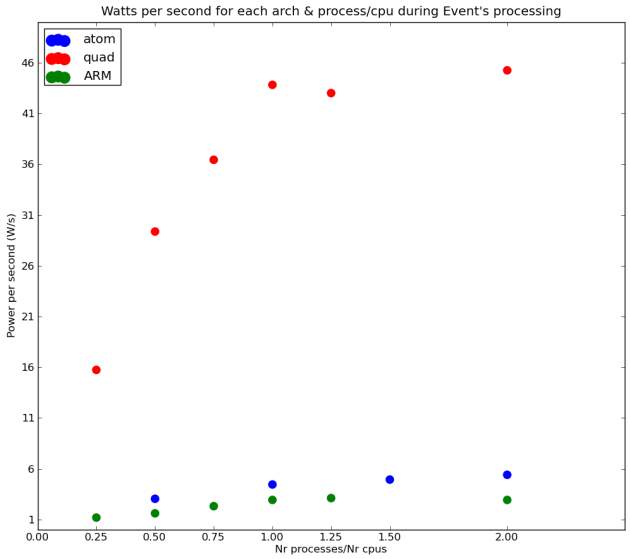

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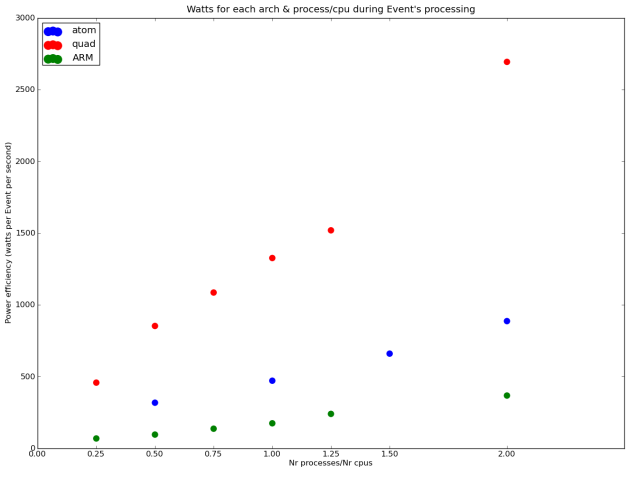

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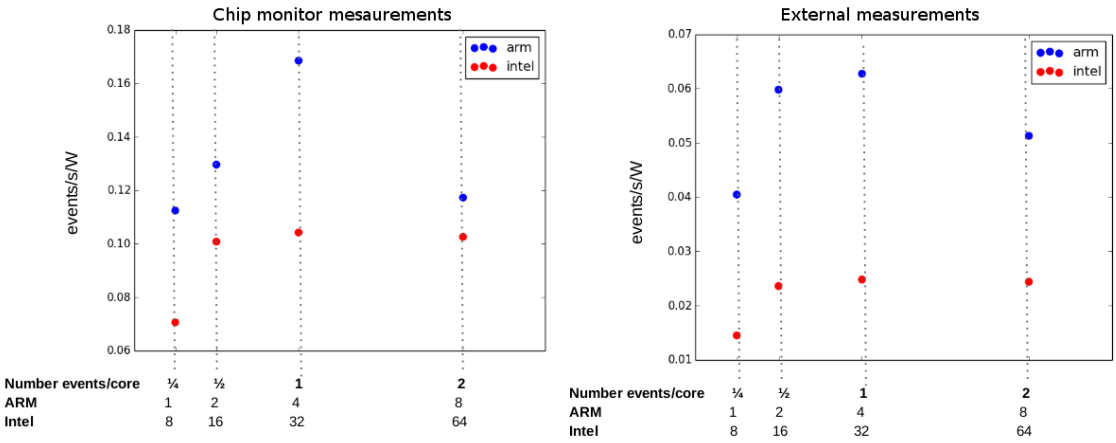


Figure 4.10: Multithreaded ParFullCMS comparison Intel Xeon vs ODROID ARMv7

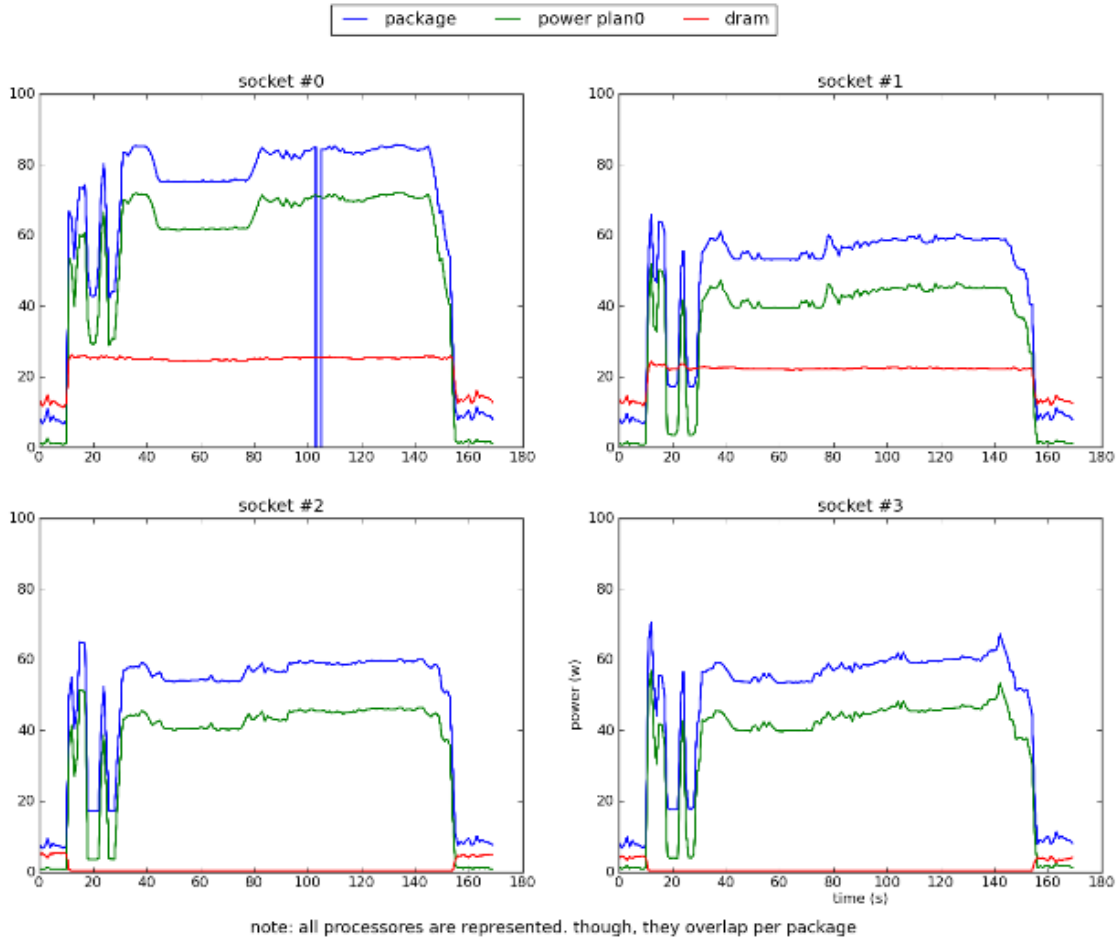


Figure 4.11: RAPL measurements of NUMA nodes - 16 processes with no explicit binding

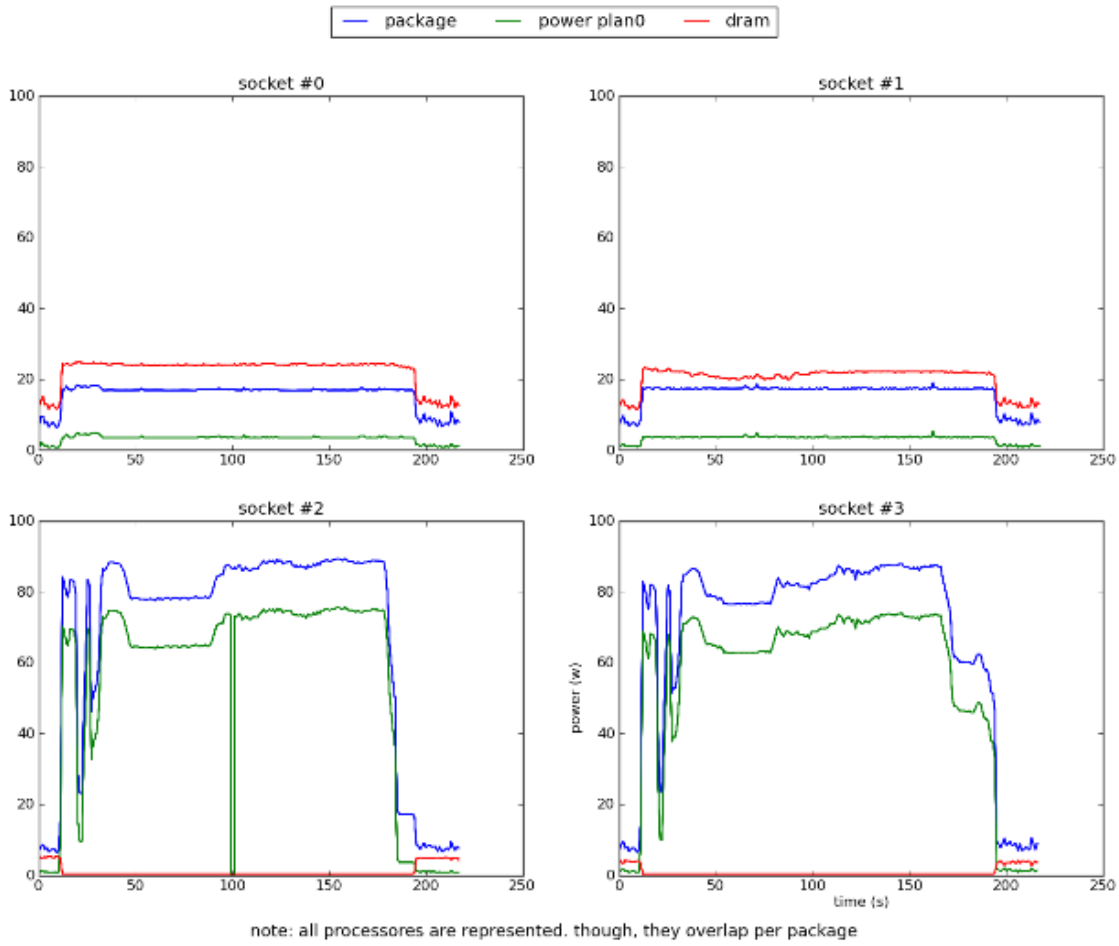
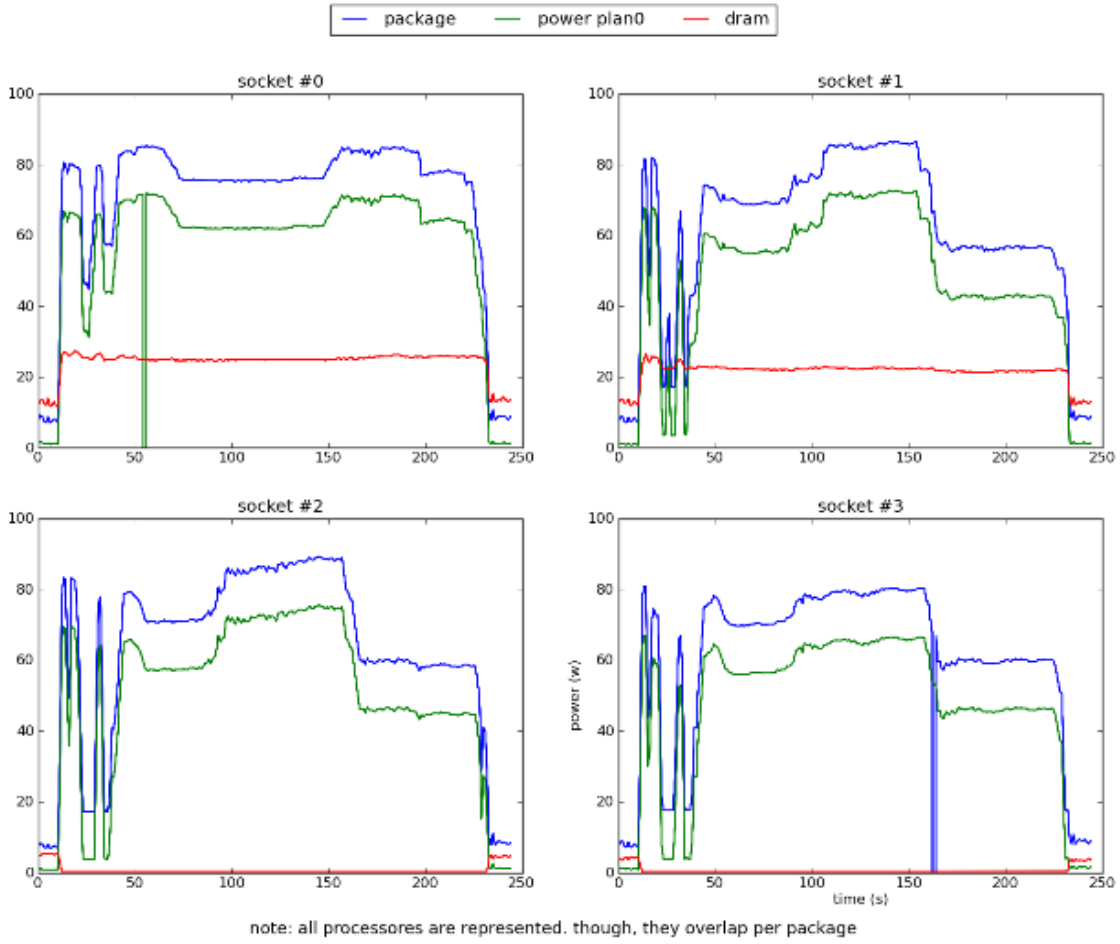


Figure 4.12: RAPL measurements of NUMA nodes - 16 processes. Explicit binding on node #2 and node #3 binding



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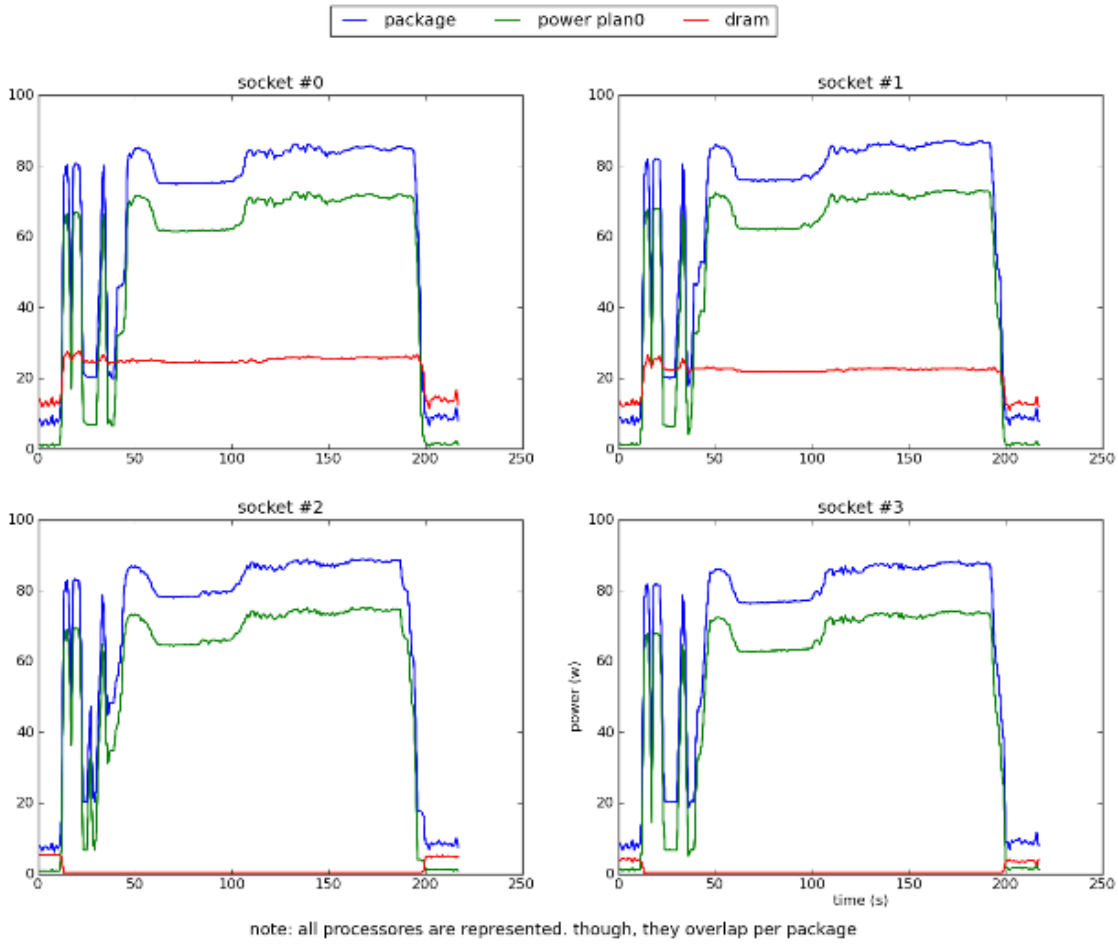

Figure 4.14: RAPL measurements of NUMA nodes - 32 processes. Processes distributed evenly explicitly - 8 processes per node.

Chapter 5

Analysis

Chapter 6

Conclusions

Bibliography

[1] Pinto, G., Castor, F., and Liu, Y. D. Mining questions about software energy consumption. In *Proceedings of the 11th Working Conference on Mining Software Repositories* (New York, NY, USA, 2014), MSR 2014, ACM, pp. 22–31.

Appendix A

First appendix

This is the first appendix. You could put some test images or verbose data in an appendix, if there is too much data to fit in the actual text nicely.