Towards Sustainable Software Infrastructures for Data-Intensive Systems
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Introduction

Modern Software Systems
Complex components
Heterogeneous Infrastructure
Energy efficiency
Security
QoS
Privacy

Figure 1: Modern software systems constraints

Context and challenges

Focus on data workflows architecture:
• Consume data produced by a multitude of devices
• Hosted in a cloud environments (shared resources)
• Requires the execution of secured tasks (e.g., anonymization of attributes)

Figure 2: Example of Data-intensive infrastructure

Our research consists in providing solutions to:
• Account the power consumption beyond the scale of nodes
• Maximize the availability of the hosting infrastructure
• Minimize the energy footprint of secured or non-secured tasks

Research agenda

Main objectives of this PhD thesis:
• Exploring the trade-off between security and energy efficiency
• Optimization of the resource usage of data-intensive software infrastructures

Important steps
• Providing accurate and fine-grained power estimations
• Evaluating the energy impact of secure isolation mechanisms
• Optimization of the resources usage (including power consumption)

Preliminary results

SmartWatts, a software defined power meter based on PowerAPI to monitor the CPU and RAM power consumption of application containers in a datacenters.

Current approaches problems:
• Use an external power meter as reference for global power consumption
• Requires off-line generation of power models on a reference machine
• No fine-granularity DRAM power estimations

Our approach:
• Provides on-line per-container power estimations for CPU and DRAM
• Generation at run-time of the power model using active-learning methods
• Hardware Performance Counters (HPC) as resource activity baseline
• Intel Running Average Power Limit (RAPL) as power usage reference

Figure 3: SmartWatts per-container CPU power usage estimations

Future work
• Provides power estimations for ARM CPUs
• Monitoring of Intel Software Guard Extensions (SGX) secure enclaves

Related Work