

DEPARTMENT OF INFORMATICS

TECHNISCHE UNIVERSITÄT MÜNCHEN

Bachelor's Thesis in Informatics

**Transferring Hardware-related Information  
in sys-sage Across Processes and HPC Nodes**

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**Übertragung von Hardware-Informationen  
in sys-sage Bibliothek Zwischen Prozessen  
und HPC Knoten**

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I confirm that this bachelor's thesis in informatics is my own work and I have documented all sources and material used.

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## Acknowledgments

# Abstract

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# 1 Introduction

## 1.1 Motivation

Due to the large number of cores used in high-performance computing (HPC), Non-Uniform Memory Access (NUMA) is often used in HPC clusters to achieve more efficient memory access. NUMA systems use a distributed memory hierarchy to allow cores faster access to local memory regions, whereas accessing non-local memory can cause severe performance decreases. [GM11]

Due to the high degree of parallelization in HPC systems, memory bandwidth and cache usage have tremendous impact on the overall performance. [Bro+10b] Thus, making full use of the hardware topology to schedule threads accordingly is crucial in HPC clusters. Threads working closely together will often benefit from sharing a cache to utilize local memory as much as possible, whereas independent, memory intensive jobs could be better scheduled onto separate processors so as not to limit their memory bandwidth and available cache storage. [Bro+10a]

Many tools, such as *Portable Hardware Locality (hwloc)* [Bro+] already exist to gather information about the hardware topology and make it available for these purposes. Hwloc is a software library that represents hardware resources such as cores or caches in a hierarchical tree structure to store easily accessible and versatile information about the hardware topology of HPC systems. [Bro+10a]

Hwloc collects the entire topology information at startup and makes the static information available to the application. [Bro+10a] While this approach offers better performance due to the low overhead at runtime, the topology tree can't be adapted to dynamically changing factors at runtime.

Sys-sage [Van] is a library that extends hwloc's functionality to include dynamically changing hardware information and allow representation of arbitrary custom data. Since sys-sage is fully compatible with hwloc, users can easily use hwloc to initialize their topology data and complement it with custom data as needed.

## 1.2 Related Work Or Objectives

## 2 Related Work

### 2.1 Section

Citation test [Lam94].



## List of Figures

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