



Bachelor thesis No. 1066

## Developing an Intelligent Metrics and Analysis Framework for High-Performance Computing Workflows



### Methods

Data Analysis  
Software Engineering  
Performance Monitoring  
Cross-Language Integration

### Topics

High-Performance Computing  
System Metrics  
Workflow Optimization  
Performance Analysis

### Background

High-performance computing environments require sophisticated tools for job submission, monitoring, and analysis. While basic wrapper interfaces provide convenience, they often lack intelligent features for metrics collection, analysis, and optimization. Modern software systems benefit from structured logging, comprehensive metrics collection, and intelligent analysis capabilities to improve user productivity and system performance. Cross-language integration between Python and Julia offers unique opportunities and challenges for building efficient analysis frameworks.

### Problem Description

This thesis focuses on extending an existing HPC wrapper system with intelligent metrics collection and analysis capabilities. The project consists of the following steps:

- Analyze the existing Python wrapper and HPC infrastructure
- Design and implement an extensible logging and metrics framework
- Develop efficient cross-language integration between Python and Julia components
- Create intelligent analysis tools for performance monitoring and optimization
- Implement automated reporting and visualization capabilities
- Research and evaluate optimal metrics collection strategies

### Acquired Knowledge and Skills

Through this thesis, you will gain expertise in designing large-scale monitoring systems, cross-language integration patterns, and performance analysis. You will work with modern logging frameworks, time-series databases, and develop skills in building maintainable scientific software.

### Requirements

Strong Programming Skills  
Experience with Software Design

### Desirable knowledge

Experience with Logging Frameworks  
Database Knowledge  
Basic Statistical Analysis Skills

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