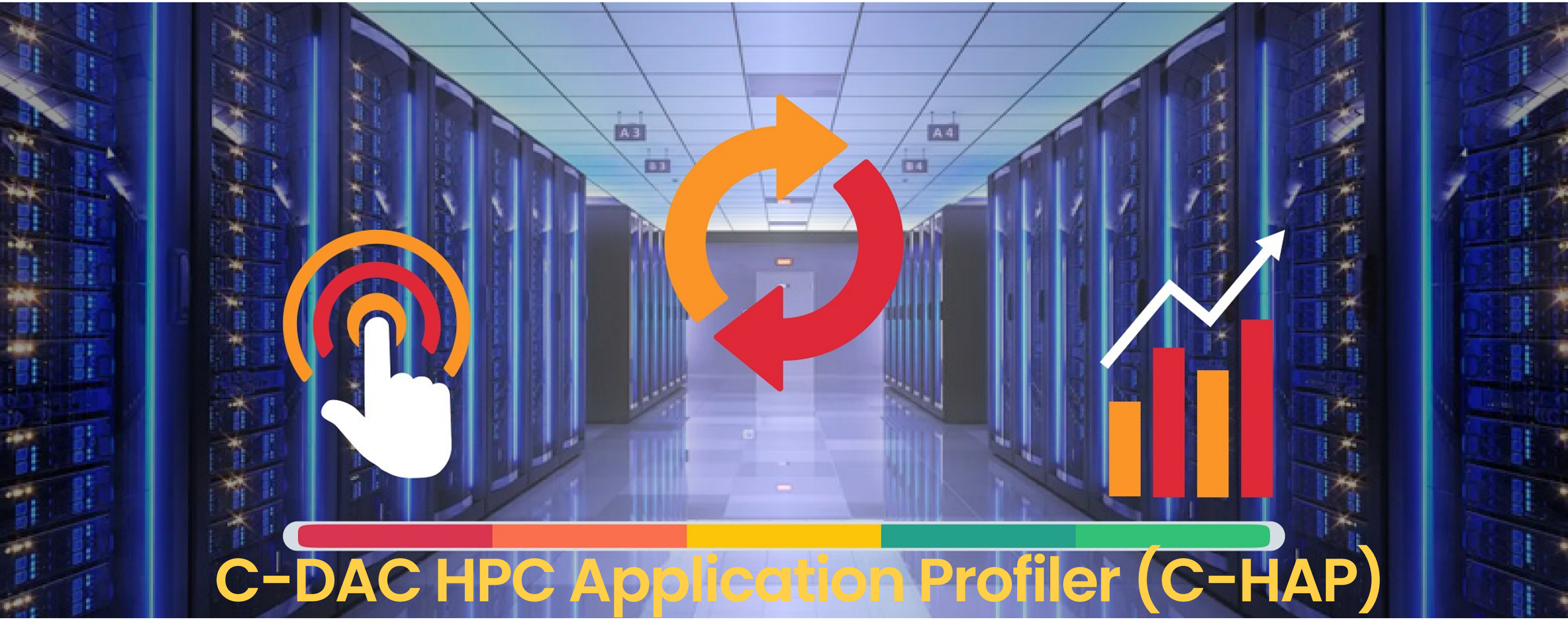


Shamjith K V
Scientist-F

Abhishek Patil
Project Associate

HPC Applications

HPC Applicaton

HPC Cluster

HPC Applications – Runtime Behaviour

HPC Applicaton

Memory

Resource Utilization

Computation

Libraries

Power

Communication

I/O

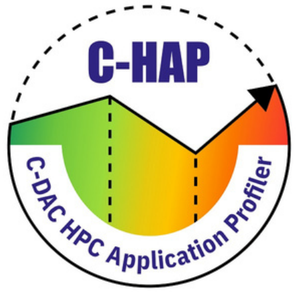
Runtime Behaviour

HPC Applicaton

HPC Application Profiling

HPC application profiling helps identify **performance bottlenecks**, **optimize code**, and **improve efficiency**. It provides insights into the application's **runtime behavior** and **resource utilization**, leading to better **scalability**, **faster execution**, and **reduced cost**.

CDAC HPC Application Profiler (C-HAP)



Key Features

Application Performance summary

Brings out the details of execution time , no. of processes, architecture, application characteristics

Guided profiling

From the performance summary, user can get to the specific sections of bottlenecks with respect each processes and threads

Hotspot identification

Sections of the code that consumes more time compared to other sections of code per each process

Potential Performance suggestions

Provides verbose suggestions for improving the hotspot sections, like vectorizing certain sections, Combining the arithmetic operations, Info on Slow Data structures.

Multi-dimension analysis

Analysing the application with respect to execution, memory usage, communication, I/O and Power

Minimal Overhead

The overhead added for carrying out profiling is very minimal.

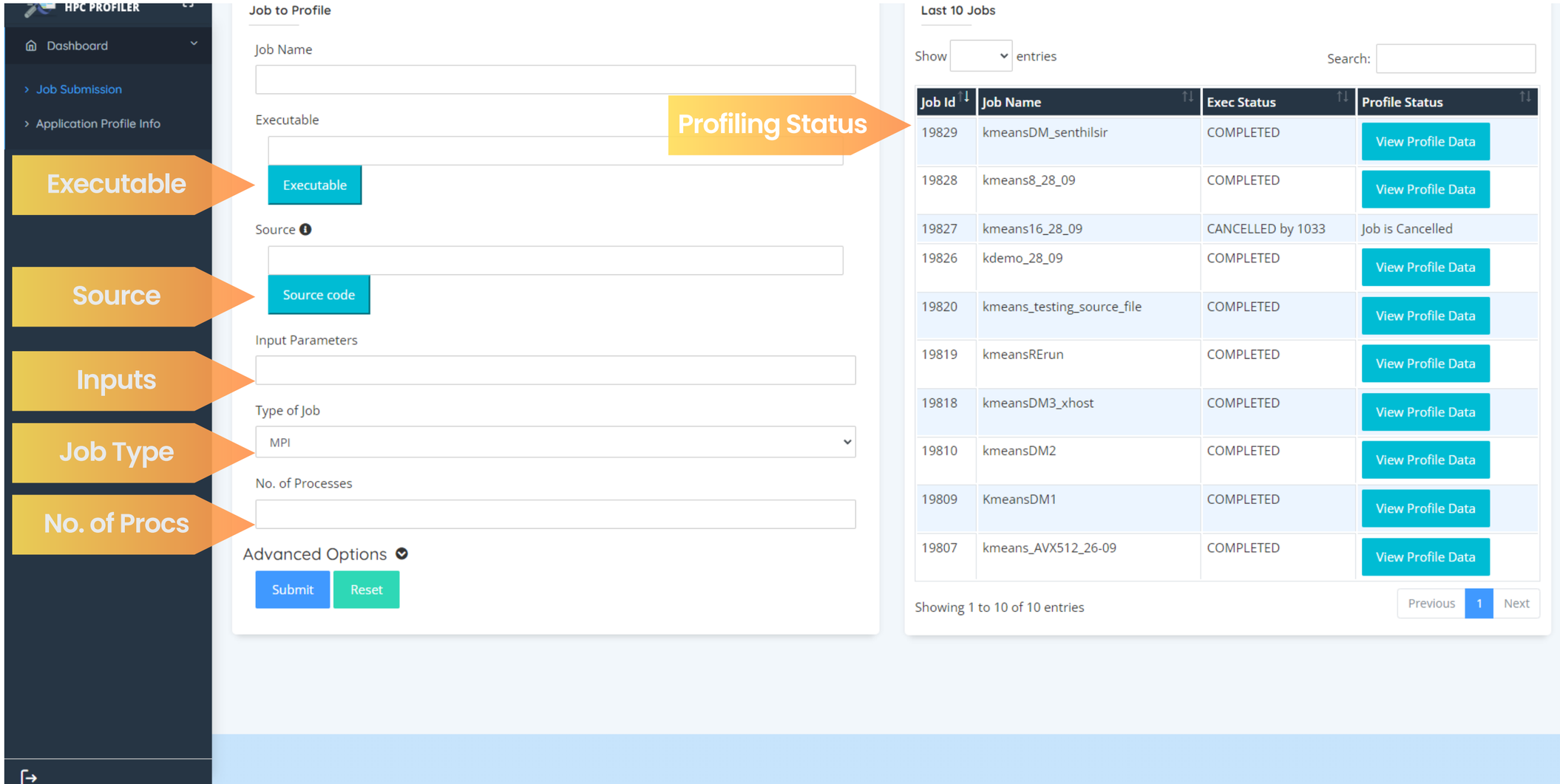
Integration with LRMs

The software is well integrated with SLURM resource manager so that it can seamlessly submit jobs on to the HPC cluster for performance analysis

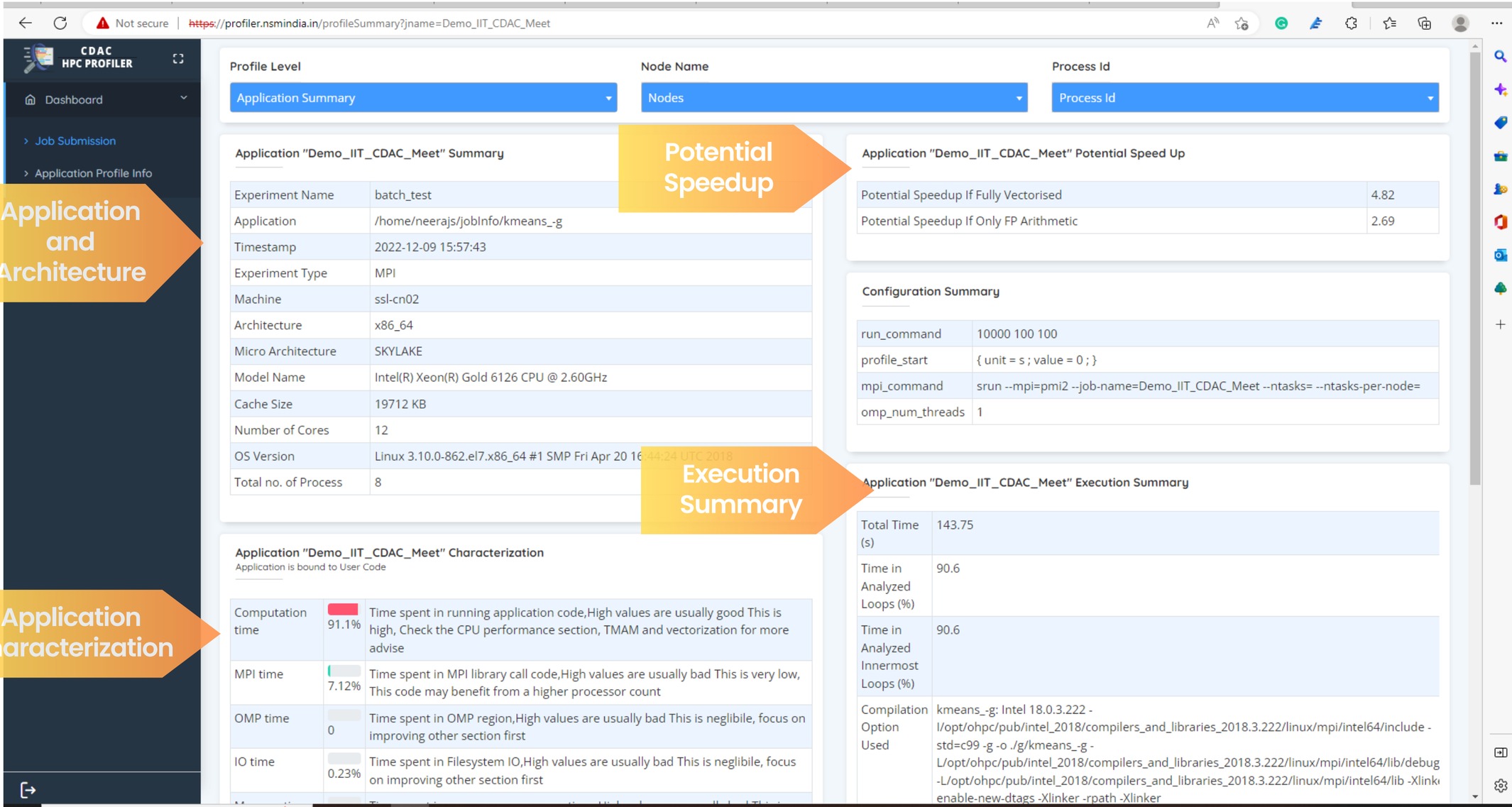
Web Interface

The profiling job submission, and analysis are provided through a web interface to avoid the trouble in using commandline interfaces

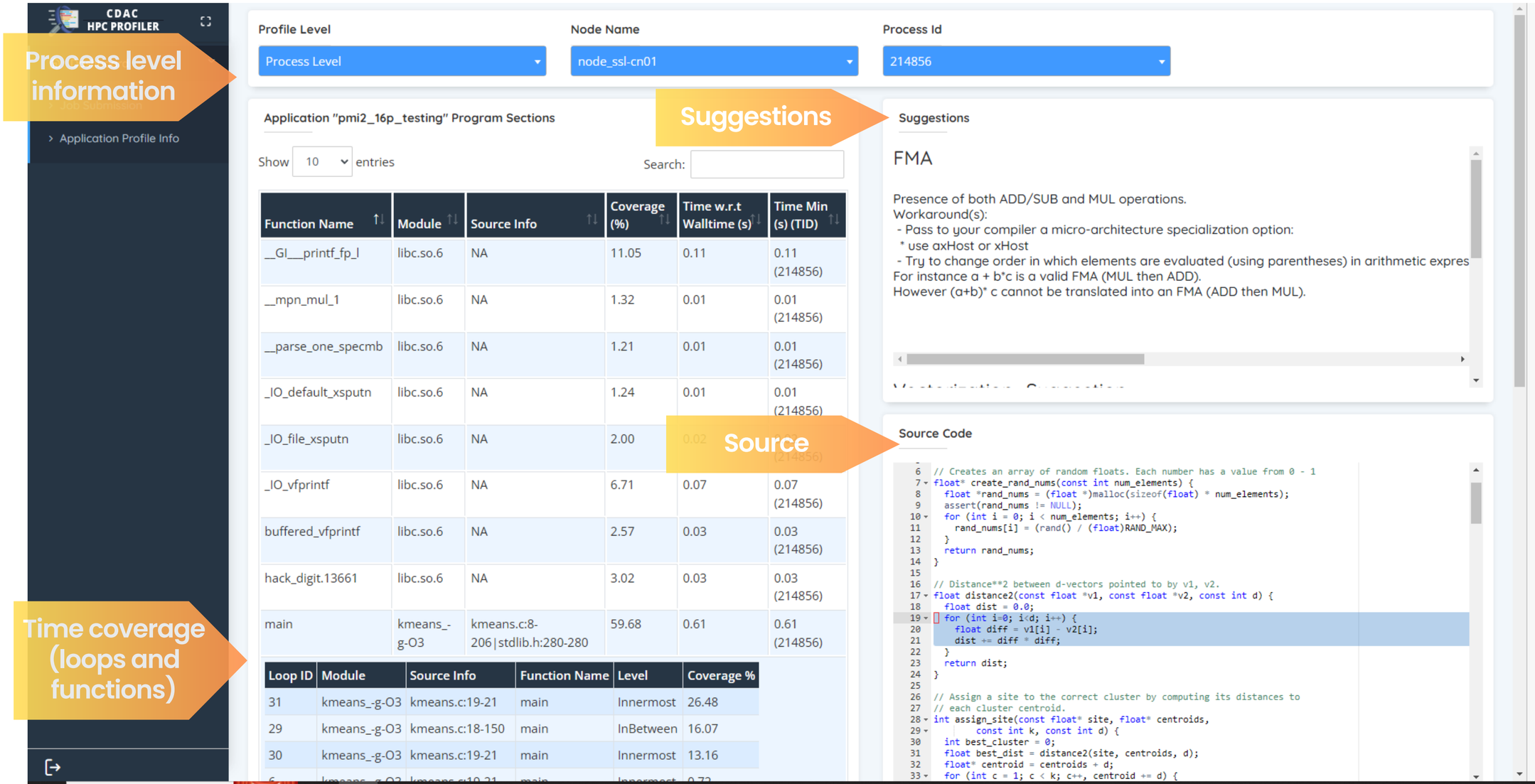
Job Submission for Profiling



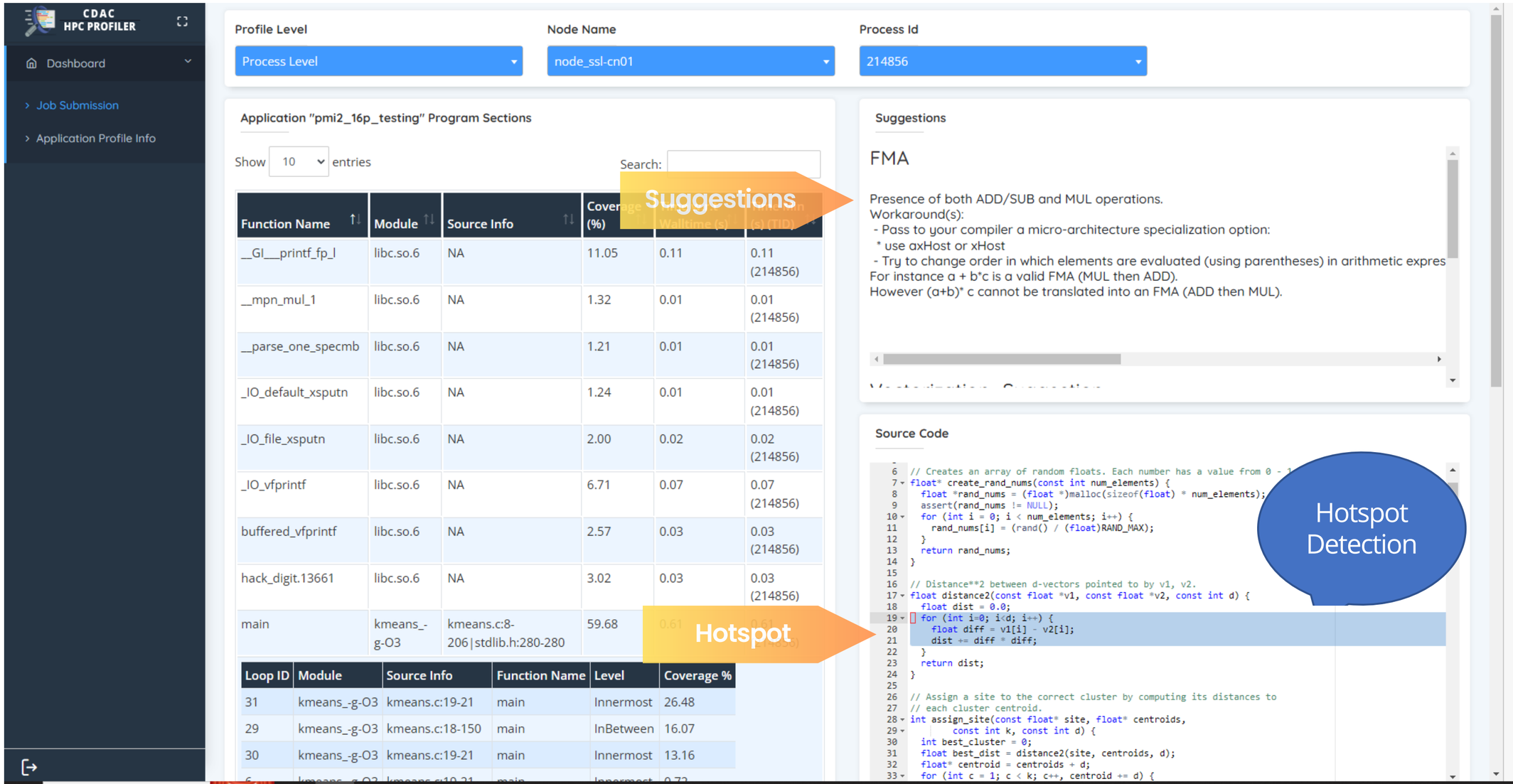
Application Summary



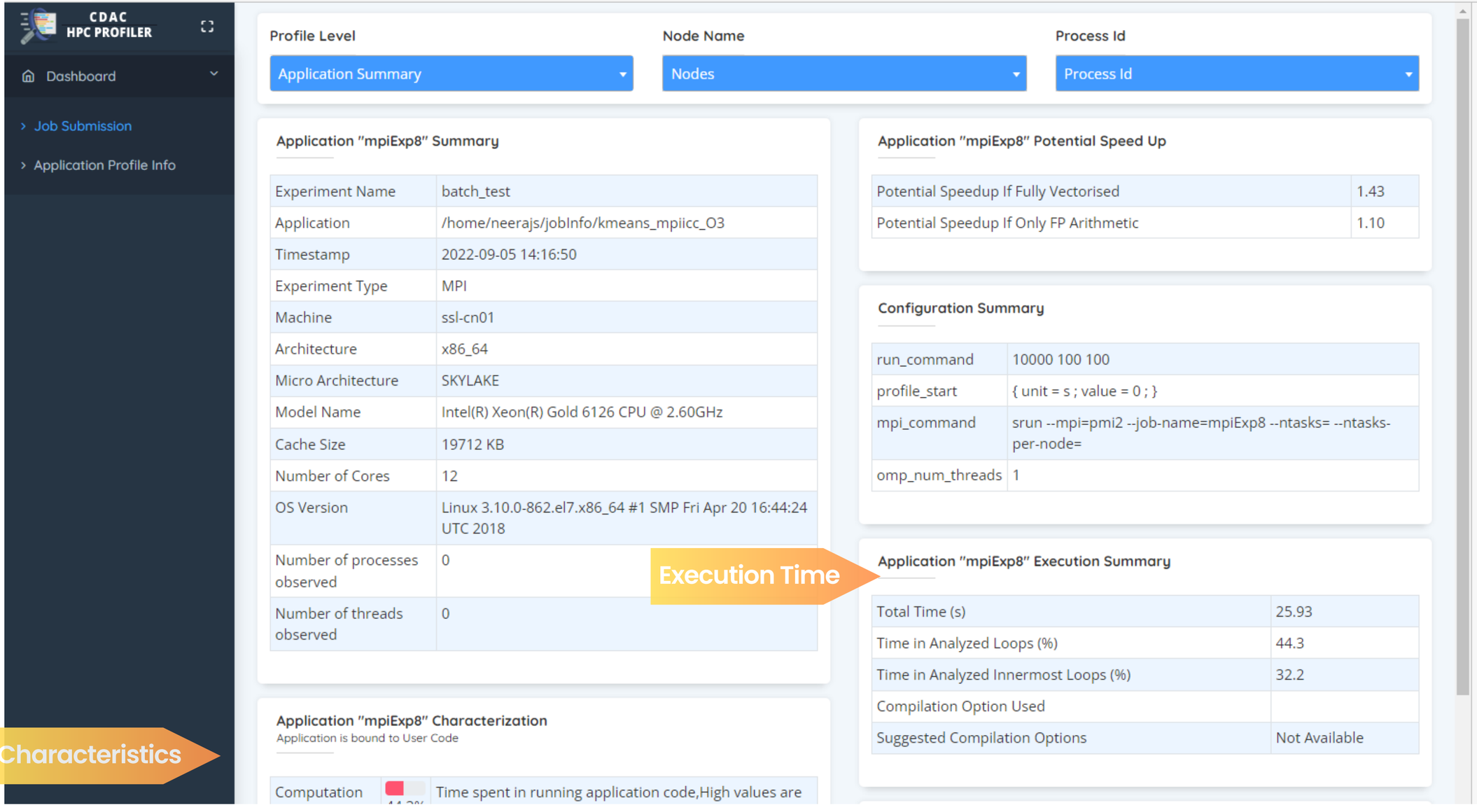
Process Level Profiling Information



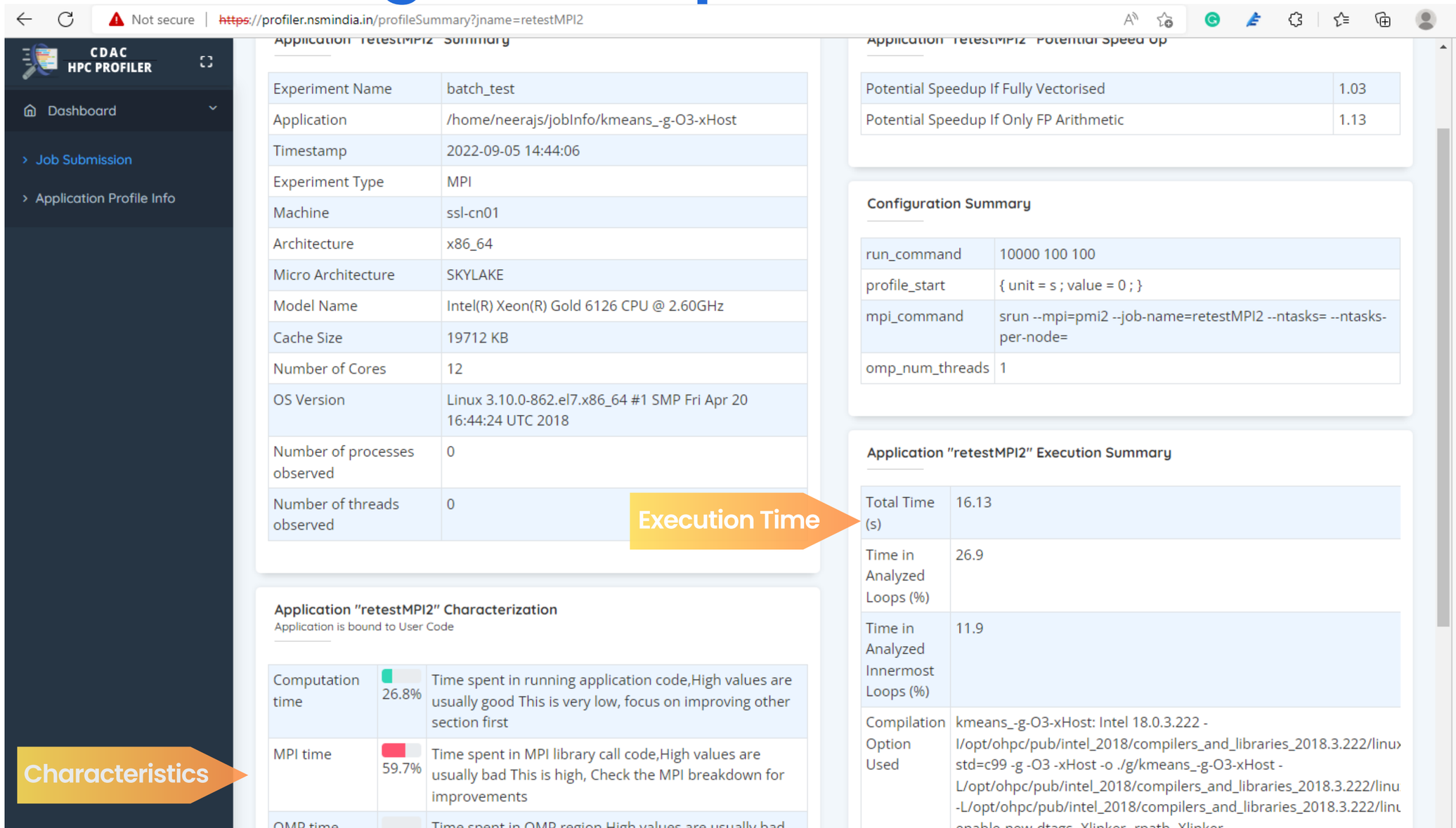
Hotspot Identification



Application Profiling – without optimization



Application Profiling – with optimization

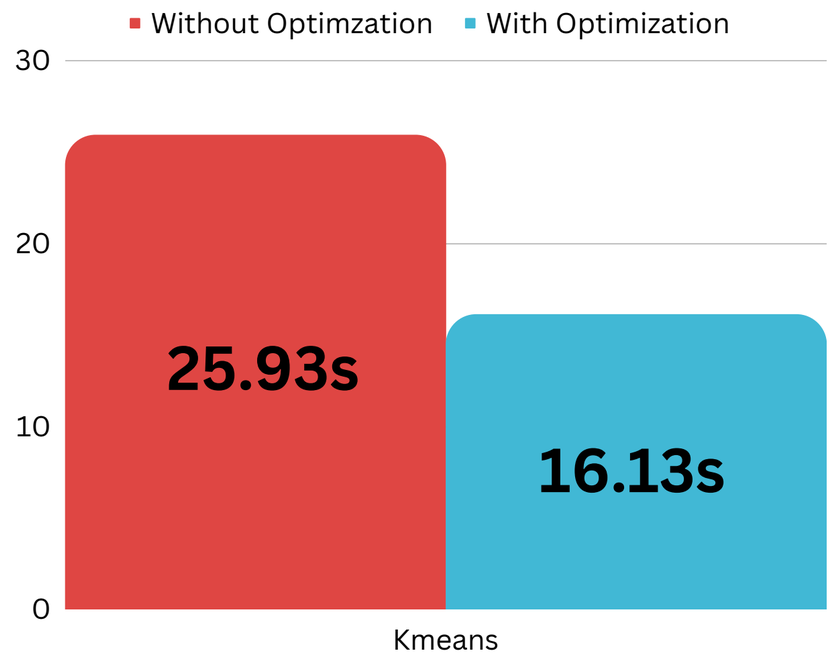


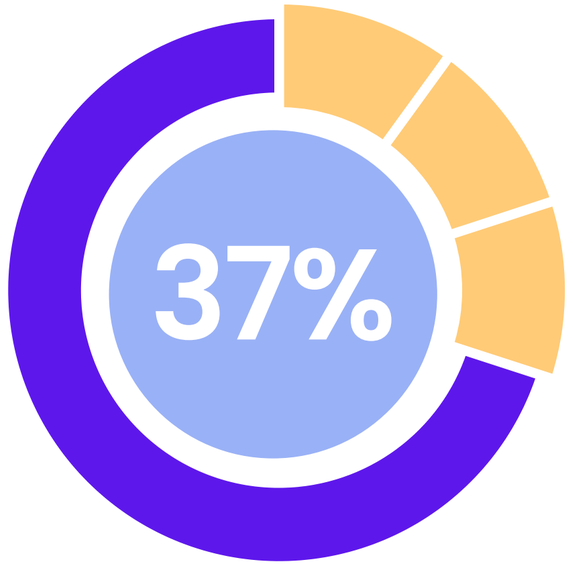
Applications

KMeans

Without optimizations

Total Time (s)	25.93
Time in Analyzed Loops (%)	44.3
Time in Analyzed Innermost Loops (%)	32.2
Compilation Option Used	
Suggested Compilation Options	Not Available





With optimizations

Total Time (s)	16.13
Time in Analyzed Loops (%)	26.9
Time in Analyzed Innermost Loops (%)	11.9
Compilation Option Used	kmeans_-g-O3-xHost: Intel 18.0.3.222 -I/opt/ohpc/pub/intel_2018/compilers_and_libraries_2018.3.222/linux std=c99 -g -O3 -xHost -o ./g/kmeans_-g-O3-xHost -L/opt/ohpc/pub/intel_2018/compilers_and_libraries_2018.3.222/linu -L/opt/ohpc/pub/intel_2018/compilers_and_libraries_2018.3.222/linu enable-new-dtags -Xlinker -rpath -Xlinker /opt/ohpc/pub/intel_2018/compilers_and_libraries_2018.3.222/linux -Xlinker -rpath -Xlinker

Matrix Multiplication

Without optimizations

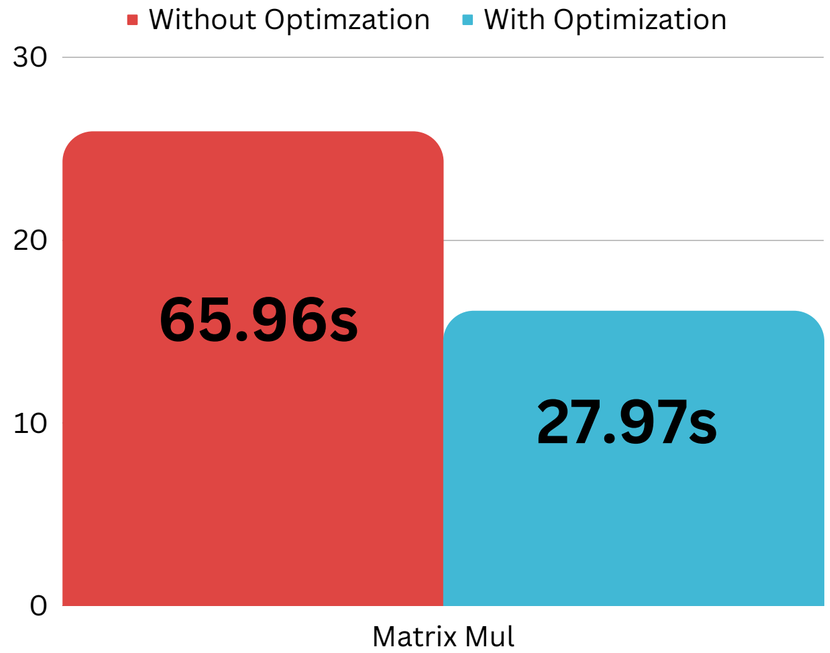
Application "mm_mpi_interchnage_1" Execution Summary

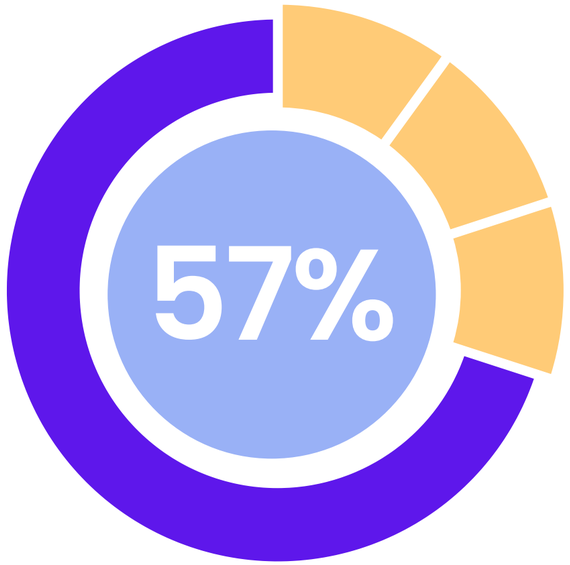
Total Time (s)	65.96
Time in Analyzed Loops (%)	29.3
Time in Analyzed Innermost Loops (%)	29.3
Compilation Option Used	mm_mpi_16384_interchnage: GNU 9.2.0 -mtune=generic -march=x86-64 -g
Suggested Compilation Options	mm_mpi_16384_interchnage: -O2

With optimizations

Application "mpi_16384_21_06" Execution Summary

Total Time (s)	27.97
Time in Analyzed Loops (%)	42.7
Time in Analyzed Innermost Loops (%)	42.7
Compilation Option Used	mm_mpi_16384: GNU 9.2.0 -mtune=generic -march=x86-64 -g -std=c99
Suggested Compilation Options	mm_mpi_16384: -O2





Search App

Without optimizations

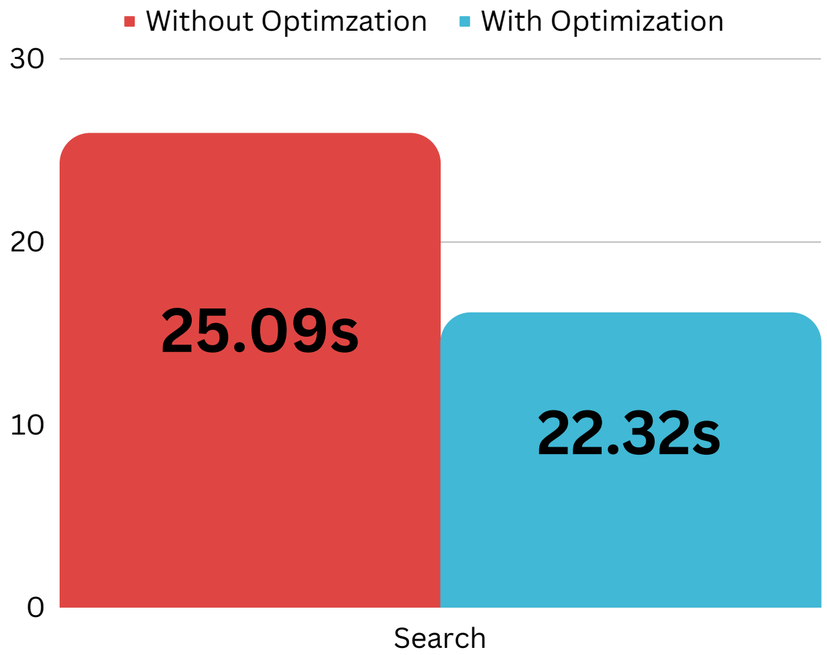
Application "job_search_mpi_21_06" Execution Summary

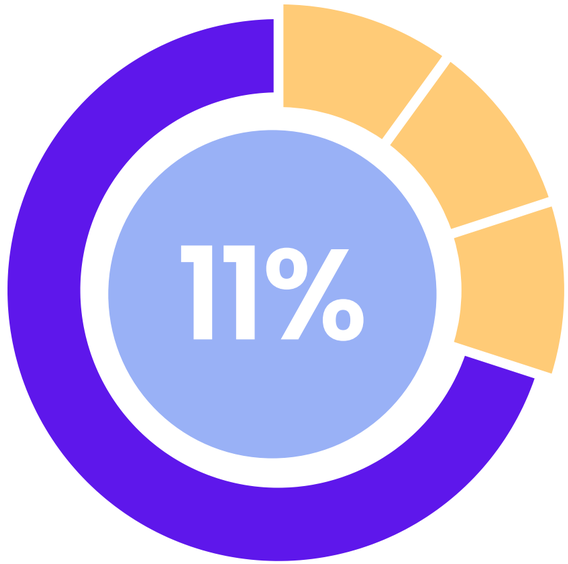
Total Time (s)	25.09
Time in Analyzed Loops (%)	95.3
Time in Analyzed Innermost Loops (%)	95.3
Compilation Option Used	search_mpi_-g: GNU 9.2.0 -mtune=generic -march=x86-64 -g -std=c99
Suggested Compilation Options	search_mpi_-g: -O2

With optimizations

Application "job_search_21_06" Execution Summary

Total Time (s)	22.32
Time in Analyzed Loops (%)	99.8
Time in Analyzed Innermost Loops (%)	99.8
Compilation	search_mpi_optimized: Intel 18.0.3.222 -





Demonstration

Thank you

Contact Us

nsmss@cdac.in

Feedback

bit.ly/hpcprof

Our Team

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