VSB TECHNICAL UNIVERSITY OF OSTRAVA | IT4INNOVATIONS NATIONAL SUPERCOMPUTING CENTER

Services from the High Level Support Team

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IT4Innovations

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HLST — one team, many doors

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HLST

analyse · advise · optimise · port

One of the five groups of the Infrastructure Research Laboratory at IT4Innovations.

FOUR DOORS IN

IT4Innovations users

You run on IT4Innovations systems.

Write to support@it4i.cz.

EPICURE

Your project holds a EuroHPC allocation.

Level 2 and Level 3 support.

POP

Any parallel code, academia or SME, anywhere in the EU.

Free performance assessments and more.

Contract research

Industry and SMEs.

Paid engagements.



Whichever door you come through, the work behind it is the same. Only the funding route and the paperwork differ.

What users bring us

It stops scaling

Fine on a hundred cores; at a few hundred the extra nodes buy nothing.

It only lives on old hardware

Built once, on one machine, and never touched since — so it never sees a GPU.

The allocation burns too fast

The core-hours go, and the science per core-hour stays low.

“It is too slow”

…and nobody knows why. The most common one.



Your job is the science. Finding where the time goes in a parallel code is ours.

What we do

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Deployment

Codes built, configured and running well on the machine at hand: toolchains, dependencies, job setup, runtime environment.

Performance analysis

Profiling and tracing to find where time and resources actually go, at the scale you really run at.

Optimisation

Removing what the analysis exposes: load imbalance, communication, memory access patterns, I/O.

Porting

Moving codes to current CPU and GPU architectures without losing performance or maintainability.

+ Energy

MERIC, built at IT4Innovations, measures the energy of each code region and tunes the hardware while it runs.



COLLABORATIVE BY DESIGN

You keep your code. The understanding of it stays with your team: every engagement is meant to leave your group able to do more on its own.

How an engagement runs

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1 · Intake
Understand the code, the science goal, and what “too slow” means for you.

2 · Assessment
Measure at scale, build the efficiency picture, find the limiting factor.

3 · Report
A written analysis with concrete, prioritised actions.

4 · Implementation
Where agreed, we make the change and show the gain on real hardware.

5 · Follow-up
Re-measure, confirm the improvement, hand the knowledge back.

What we need from you
- the code, and a representative test case
- the target machine and the scale that matters
- what “fast enough” would look like

What you get back
- a written report with prioritised, concrete actions
- the measurement data behind every claim
- where agreed, an optimised version and the gain it delivers



Tools and expertise

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Tracing and profiling

Extrae · Paraver · Dimemas

Score-P · Scalasca · Cube

Vampir

Node and GPU analysis

NVIDIA Nsight Systems

NVIDIA Nsight Compute

Intel VTune · Advisor

Linaro MAP

Built at IT4Innovations

MERIC — energy-efficient runtime

RADAR — measurement visualiser

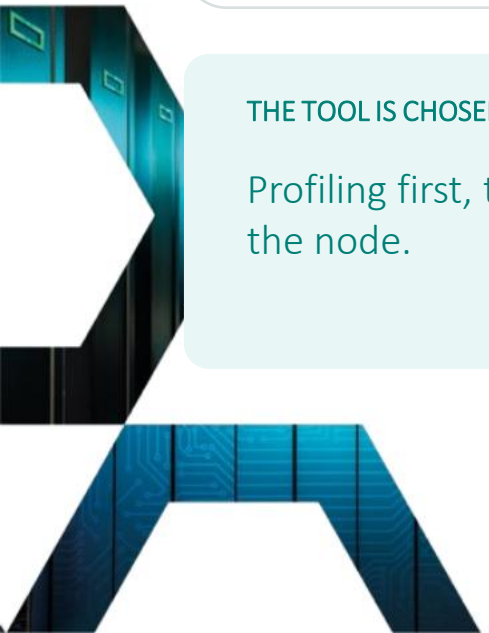
Models and platforms

MPI · OpenMP · MPI+X

CUDA · HIP · SYCL / oneAPI

Karolina · Barbora

LUMI and other EuroHPC systems



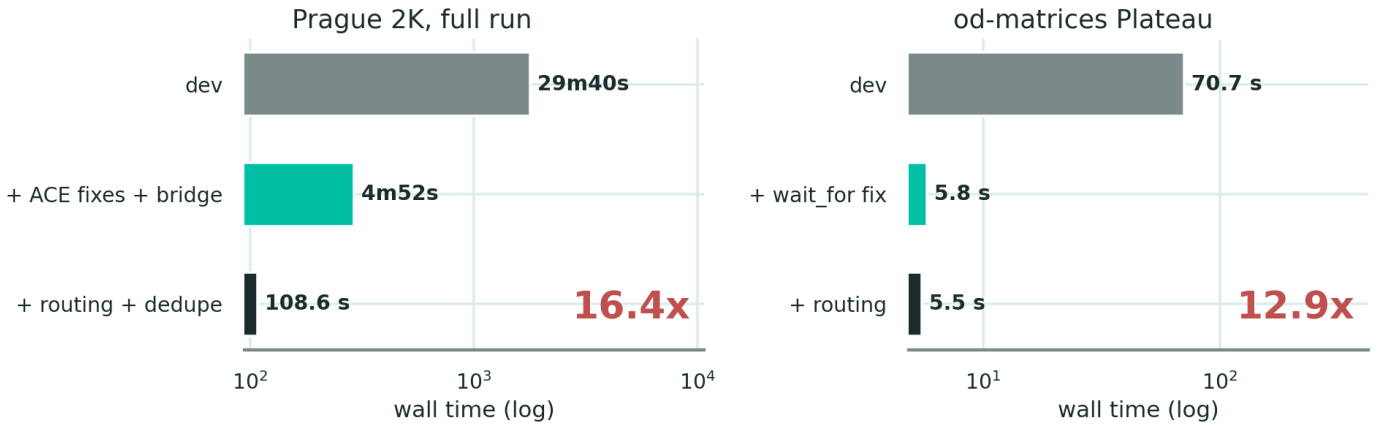
THE TOOL IS CHOSEN FOR THE QUESTION

Profiling first, to see the shape of the run. Tracing when the cause sits between processes. Hardware counters when it is inside the node.

Up close: a traffic simulator, 16× faster

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PRAGUE 2K, WALL TIME (LOG SCALE)



16.4×

Prague 2K: 29m40 → 1m48.6

+124%

vehicles finished, 50K in 5.5 h

bit-identical

output, after every change



HOW EVERY CHANGE WAS ACCEPTED

Baseline, same day and machine ➡ Profile with 5 tools, one view ➡ Change one thing ➡ **Output bit-identical, all tests pass** ➡ Measure the full run

A regression or an output mismatch sends the change back. EPICURE project, IT4Innovations lead, on Karolina and LUMI.

Up close: where the time was hiding

Waiting on the wrong condition

Every wait took its full 100 ms timeout.

70.7 → 5.8 s

Zero-copy Python–C++ bridge

One NumPy buffer, interpreter lock released.

17×

Routing hash map

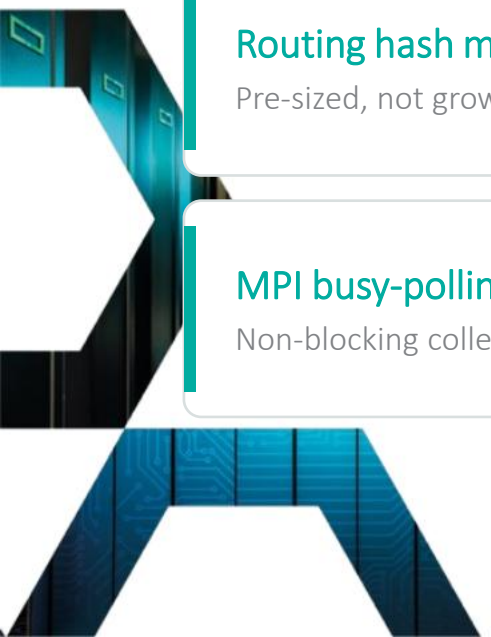
Pre-sized, not grown on every query.

–31% alone

MPI busy-polling

Non-blocking collectives with a backoff.

–84% in libmpi



Picked by the profile

Each target came from the measurement, not from intuition — and every fix kept the output bit-identical.

One honest lesson

A production branch merged cleanly and passed every test — and was 19% slower. Rolled back. The gate made that cheap to see. Fixed afterwards.

How to ask for HLST support

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YOU RUN ON IT4INNOVATIONS SYSTEMS

support@it4i.cz

Write that it is for the High Level Support Team.

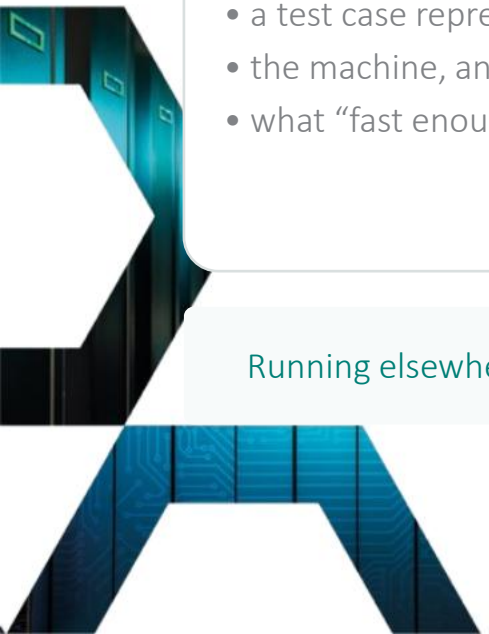
Czech, Slovak or English.

What helps us start

- the code
- a test case representative of your real runs
- the machine, and the scale that matters to you
- what “fast enough” would look like

No diagnosis needed

“It is slow and I don't know why” is a perfectly good first ticket.



Running elsewhere in Europe? Two more doors: EPICURE and POP.

EPICURE

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2024–2028
four-year EuroHPC application support project

16 centres
every EuroHPC system covered

Free
for academia, industry and SMEs

40 projects
with IT4Innovations, on 8 EuroHPC systems

Level 2 — targeted help

- a well-defined problem
- a porting question
- a scaling bottleneck or a performance regression

Level 3 — long-term collaboration

- an expert team embedded in your project
- working alongside your own developers
- for up to eighteen months



ALLOCATION FIRST, THEN THE REQUEST

pm.epicure-hpc.eu/support/request/

How to get the allocation: the previous session, “Accessing EuroHPC Systems”.

POP3 → POP4

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A EuroHPC Centre of Excellence

IT4Innovations is one of 8 partners; HLST delivers POP services from Ostrava.

Free of charge

Academic and industrial users across the EU, SMEs included. Any domain, any parallel code.

POP3 Jan 2024 → Dec 2026
POP4 Jan 2027 → Dec 2029

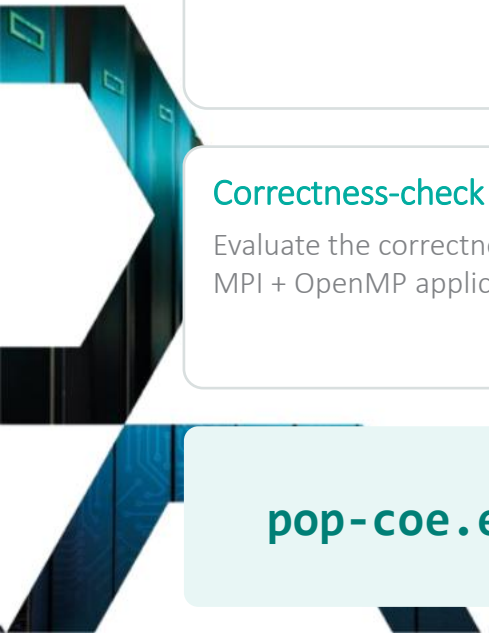
POP3 runs until the end of this year, POP4 follows

Performance assessment

Measure the code at scale, quantify the inefficiency with the POP metrics, name the limiting factor.

Proof of concept

Explore the potential benefit of proposed optimisations by applying them to selected regions of the applications.



Correctness-check

Evaluate the correctness of hybrid MPI + OpenMP applications.

Energy-efficiency study

Investigate potential improvements of energy consumption or efficiency.

Advisory study

Ongoing consultancy for customers that choose to implement proposed optimisations on their own.

Compiler Analysis

Detailed comparative analysis of several compiler options and compilers.

pop-coe.eu

A short request form. POP assigns the partner with the right technical and domain fit.

One code is enough to start

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Send us one code this month.

1 · Pick one code
and one test case like your real runs

→

2 · Email support@it4i.cz
say it is for HLST

→

3 · Intake with HLST
we measure, you decide

IT4Innovations users

support@it4i.cz

Scan: opens the email, subject filled in.

EuroHPC allocation

pm.epicure-hpc.eu/support/request/

EPICURE request form. Level 2 or Level 3.

Anywhere in the EU

pop-coe.eu

POP3 runs until 31 Dec 2026. POP4 follows.



Talk to us at the coffee break, right after this session. All three routes are free.