Transversal activities on addressing future evolution of software infrastructure

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Background and motivation

• Non-traditional hardware platforms may offer great computing power at relatively low energy usage.

• Other consortia and institutes have made significant efforts to take advantage of that:
  • MeteoSwiss rewrote the COSMO dynamical core in CUDA
  • UKMO investigating Domain-Specific Language tools to offer flexibility wrt dynamics
  • ECMWF investigating several paths in their Scalability Programme

• ACCORD is a bit lagging behind ...
Background and motivation

• In a community as diverse as ours, we can't expect everyone to master every possible emerging technology.

• At the same time, we don't know how technologies will evolve ...

• So **flexibility** of the code is crucial ...

• ... all the more for a model used operationally in 26 countries!
Background and motivation

Regarding urgency:

- LUMI HPC being installed in Finland, delivering 550 Pflop/s, but largely powered by (AMD) GPU's.
- ECMWF aims to have IFS ready for heterogeneous architectures by the next HPC procurement (2024).
Separation of concerns

- We should aim for a "separation of concerns", i.e. make scientific developments independent of the low-level hardware-specific implementation.

- Several approaches can be considered to achieve this:
  - Libraries such as *Atlas*, abstracting the memory layout of the data. Several LAM features have been implemented (grids, biperiodic meshes, geographic projections) and tested on toy applications, but the integration with the NWP code will require more work.
  - *Domain-Specific Language* toolchains translating high-level computational patterns in optimized low-level code.
  - Source-code translator tools such as CLAW, adding accelerator-ready parallelized horizontal loops to 1D column code (Single Column Abstraction).
SPTR Work Package: first steps

- The first stage will consist in investigating the different possibilities, and making a decision
- This will also depend on the work being done at ECMWF
- ... but keep in mind our specific situation:
  - 26 operational settings
  - Different partners with different needs
  - 3 CSC's
Thank you!