Hands-On Session 2

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Goal of this session

- Adjust OpenACC directives in the example codes
- Get a first impression on speed and correctness of different approaches

Tasks (1/4)

Take the example program from the previous hands-on. Investigate the following effects on the `matmul_naive()` subroutine (if you haven't done so already):

1. What happens if `if(acc)` is removed from `!$acc parallel loop if(acc)`?
2. What happens if you replace the parallel statements with kernel statements? That is, `!$acc parallel loop if(acc)` and its end directive with `!$acc kernels if(acc)` and its end directive?
3. What happens if `!$acc parallel loop if(acc)` and its end directive is moved one level up, i.e around the the `do` loop with `it = 1, iter`?

Tasks (2/4)

4. What is the effect of specifically targeting loops with `gang` and `vector`? Can you observe a difference between using `!$acc parallel loop gang vector if(acc)` or using `!$acc parallel loop if(acc)` as before and decorating all inner loops with either `!$acc loop gang`, `!$acc loop vector`, or `!$acc loop seq`?
5. Can you apply `collapse` and still get the same result? What about performance?
6. Replace `!$acc parallel loop if(acc)` with `!$acc parallel loop async(1) if(acc)` and add `!$acc wait(1)` AFTER the end of the `1, niter` do-loop. What happens?

Tasks (3/4)

Take the program three_kernels.f90, which is not yet ported to GPUs.

7. Compile and run it on CPU to calculate a reference result. Also note the elapsed time.
8. Port the three kernels to GPU (one at a time) and check that the result stays the same.
9. Improve the performance with explicit data movement (outside the timed region)
10. Change the actual code (i.e. rewrite and fuse loops) to make the code even more preformant

Tasks (4/4)

Use the example files jacobi.f90 and laplace2d.f90.

11. Compile and run the example on CPU.
12. Port it to GPU (one kernel at a time) and check the result
13. Improve the performance of your ported code with explicit data movement (you can also try additional optimizations).