Advanced Programming for Scientific Computing (PACS) Hybrid Programming and Cluster Usage

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Hybrid Programming

Pro:

- It can be used to exploit the full potential of the hardware.
- It can reduce the communication overhead.

Cons:

- Not simple to program and develop an efficient solution.

Syntax Review

`MPI_Init_thread`: Initialize the MPI environment with a specified level of thread support.

```
int MPI_Init_thread( int *argc, char ***argv, int required, int *provided )
```

- `required` Level of desired thread support
- `provided` Level of provided thread support

Available keyword for `required`:

`MPI_THREAD_SINGLE`: Only one thread will execute MPI calls: **no hybridization**.

`MPI_THREAD_FUNNELED`: The main thread will execute MPI calls.

`MPI_THREAD_SERIALIZED`: Only one thread at a time will execute MPI calls.

`MPI_THREAD_MULTIPLE`: Multiple threads can execute MPI calls.

Exercise

Implement a matrix - vector multiplication application with both MPI and OpenMP.

- Matrix is stored in a vector.
- The matrix is defined locally with a random generator.

Cluster

Live session on the cluster.

Results