Exercise 2 : Solution

Paul Burton

April 2015

General Guidance

- **Break it into managable pieces to deal with**
  - **Already nicely broken down into neat subroutines!**
- **Look at the data structures**
  - **How are you going to split between processors?**

Parallel Initialisation

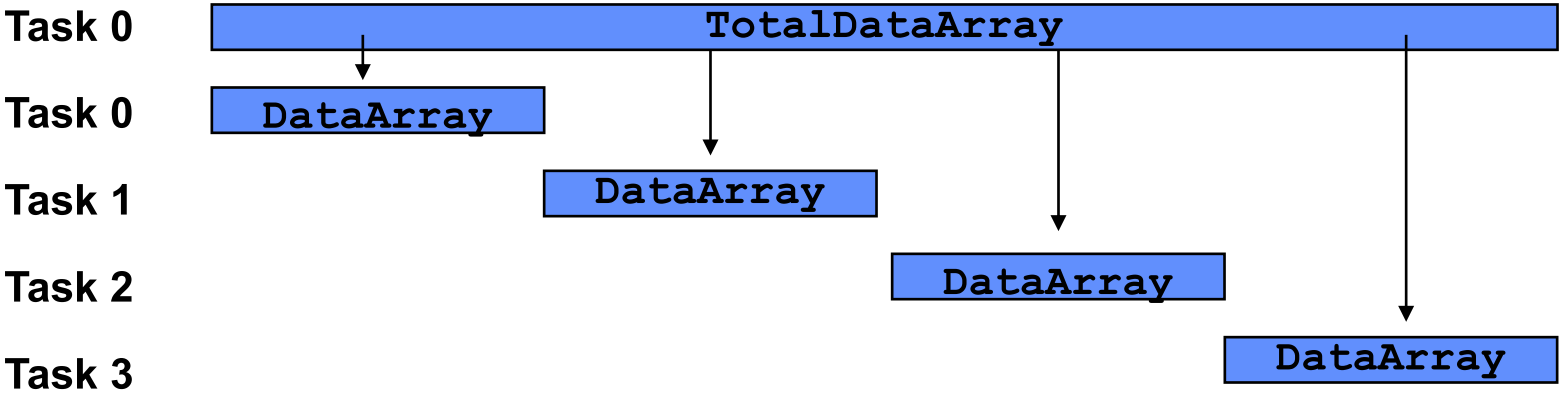
- **Need to find out from MPI:**
  - **How many processors? (`NTasks`)**
    - `CALL MPI_COMM_SIZE(MPI_COMM_WORLD,NTasks,ierror)`
  - **What is my ID/Rank? (`MyTask`)**
    - `CALL MPI_COMM_RANK(MPI_COMM_WORLD,MyTask,ierror)`
  - **Who are my neighbours?**
    - `MyNeighbourLeft=MyTask-1`
    - `MyNeighbourRight=MyTask+1`
  - **Don’t forget the wrap around, so it’s a bit different for `MyTask=0` and `MyTask=NTasks-1`**
  - **Calculate `NPointsPerTask`**

Call Model_Driver

- **No longer with `npoints` (Total number of points)**
  - **Use `NPointsPerTask` (from `Parallel_Info_Mod`)**

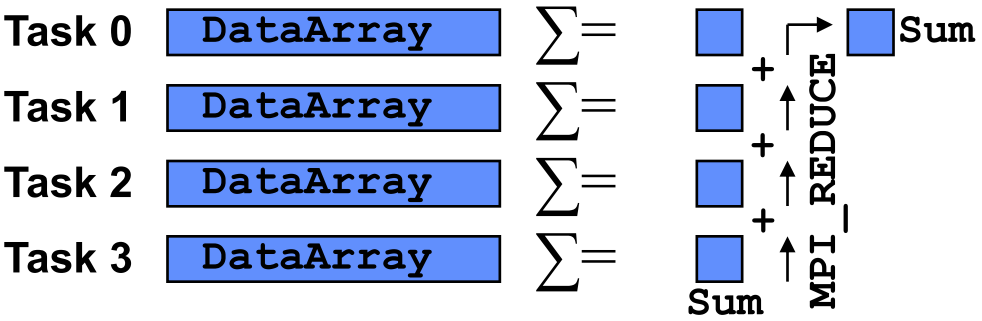
Read_Data

- Read all the data on Task 0
  - Need some logic to select the right task
  - We'll need a temporary array to hold the data on task 0
- Then scatter the data from Task 0 to all the tasks
  - Could use SEND/RECV
  - Easier to use `MPI_SCATTER`



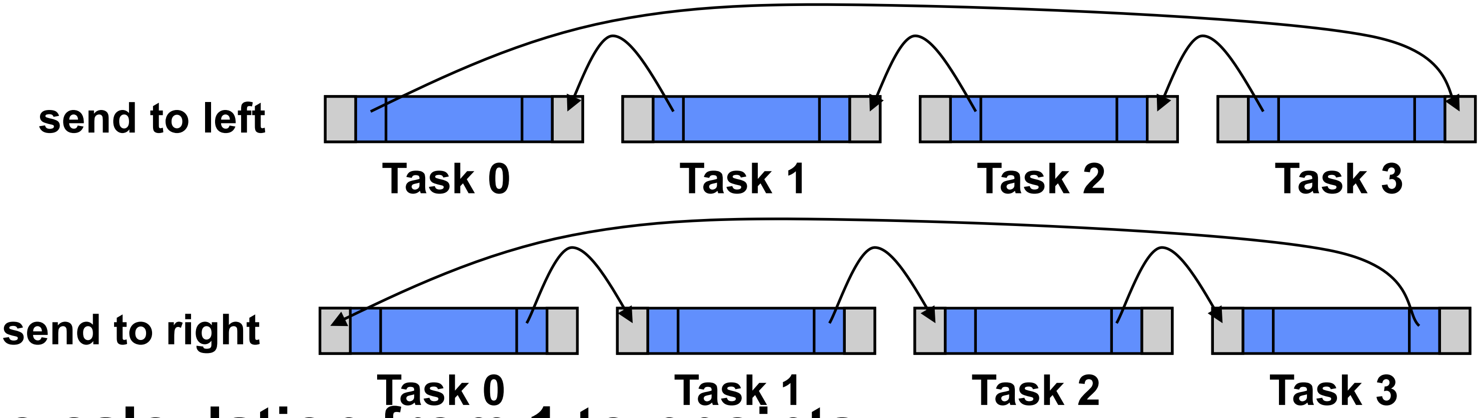
Sum_Data

- First calculate local sum
- Then add together all the local sums
  - Put the result on task 0
  - Could have all tasks sending local sum to task 0
    - Task 0 would then add these up
  - Better solution is to use `MPI_REDUCE`
    - Which does it all for you (efficiently hopefully!)



Finite_Difference

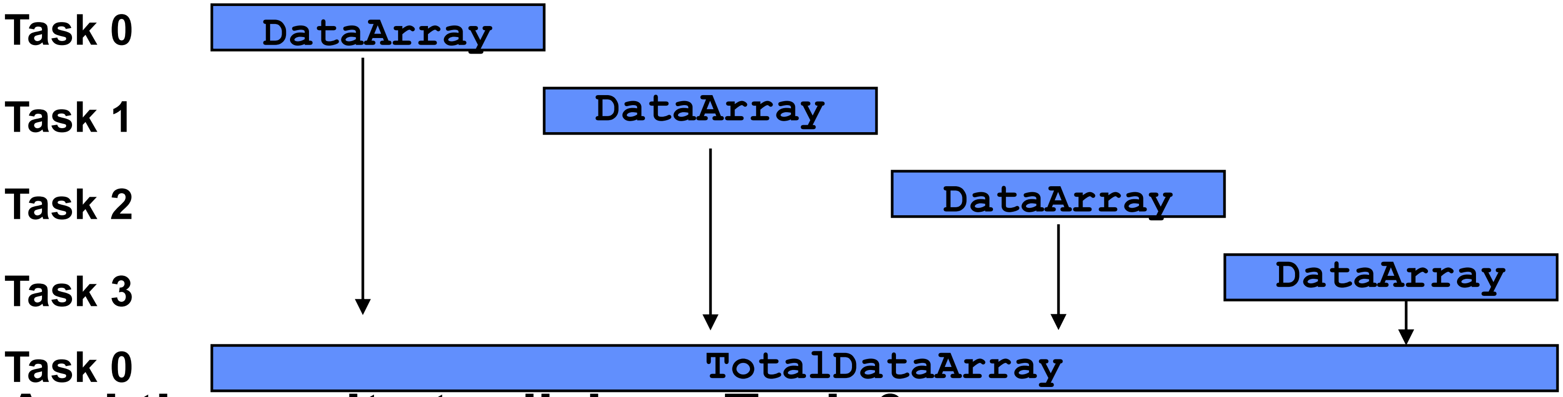
- **Copy `DataArray` to `OldData`**
  - **But overdimension `OldData(0:npoints+1)`**
  - **We'll use the extra points at start and end as copies of points from the neighbouring tasks**
- **Communication**
  - **Could use SEND / RECV – but need to avoid blocking**
  - **Easier to use SENDRECV**



- **Do calculation from 1 to npoints**

Write_Data

- **Reverse of Read_Data**
- **Collect all the data onto Task 0**
  - **We'll need a temporary array to hold the data on task 0**
- **Gather the data from the tasks to Task 0**
  - **Could use SEND/RECV**
  - `Easier to use` **MPI_Gather**



Task 0 `DataArray`

Task 1 `DataArray`

Task 2 `DataArray`

Task 3 `DataArray`

Task 0 `TotalDataArray`

- **And then write to disk on Task 0**