

Building parallel information from distributed meshes

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Abstract

This documents shows how to build parallel information from distributed submeshes.

Assign global IDs

Here we are given submeshes on each processor, `MESH_AssignGlobalID()` assigns each entity a unique global ID. For an entity shared by 2 or more processors, we assign its ownership to the processor with lowest rank. It uses partition boundary vertex coordinate values to detect ghost vertex.

Besides assigning global IDs, it also sets master partition id and ptype for all entities.

All to all communication

If the distributed submesh has no additional information, i.e. each submesh does not know its neighbors, `MESH_AssignGlobalIDs()` should be called. It has 4 subroutines, assign global ID for vertex, edge, face and region respectively. It uses `Allgather()` communication routine in MPI.

After this function, call `MESH_BuildConnection()` to build parallel information.

Point to point communication

If the parallel information is given, i.e. each submesh knows its neighbors, `MESH_AssignGlobalIDs_point()` should be called. It has 4 subroutines, assign global ID for vertex, edge, face and region respectively. It uses `Send()` communication routine in MPI.

Label PType

`MESH_LabelPType()` labels 1-ring boundary elements. It assigns all the elements with a `POVERLAP` or `PGHOST` vertex as `POVERLAP`, the corresponding ghost entities remain to be `PGHOST`, otherwise become `POVERLAP`.

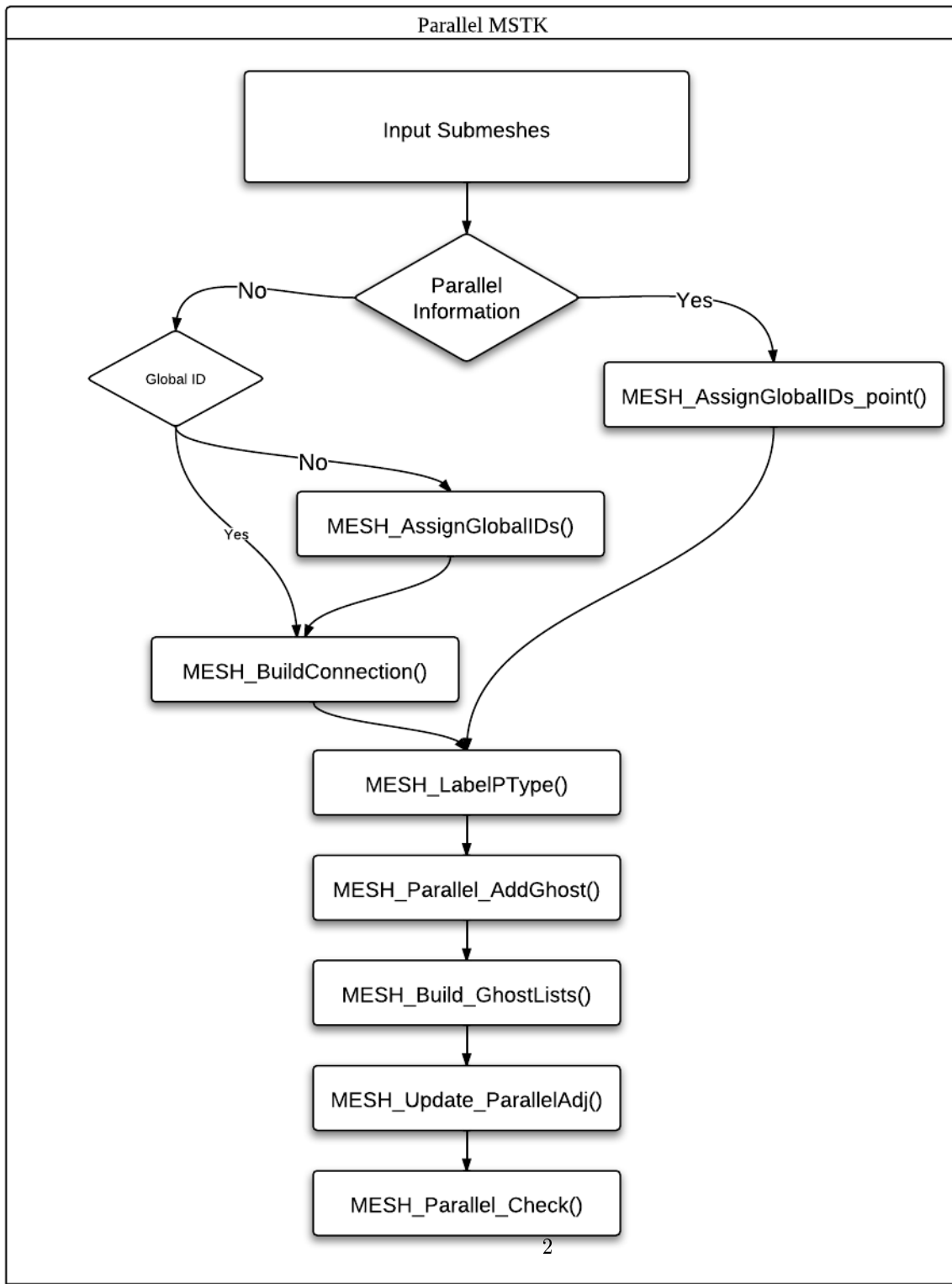


Figure 1: The overall flow chart

Parallel Add Ghost

MESH_Parallel_AddGhost() adds 1-ring ghost elements through inter processor point to point communications. First it builds a mesh of 1-ring overlap layer through MESH_BuildSubMesh() on each submesh then uses MESH_SendMesh() to send it to neighbor processors, MESH_RecvMesh() is used to receive layers from neighbor processors, add these layers onto each submesh through MESH_ConcatSubMesh()

Parallel Checking

MESH_Parallel_Check() checks if the parallel mesh is valid. First it checks if every ghost entity has a master partition number that is different from current partition, and if other PType entities has the same master partition number as this partition. Second, it sends ghost entities to their host processor and check if it exists and if the information matches.