Date: 4/4/2019

To: James Ahrens

cc: David Pugmire, David Rogers, Hank Childs, Berk Geveci

From: Kenneth Moreland, WBS 2.3.4.13 / ECP/VTK-m

Milestone Deliverable – STDA05-18

Milestone Due Date: March 31, 2019

Milestone Completion Date: March 28, 2019

Description of Milestone:
The STDA05-18 P6 Activity has the following 4 tasks.

Ghost Cells: A common way to support continuity across multi-block data boundaries is the use of ghost cells. While full support for multi-block data will be provided by another layer in the software stack, the data model in VTK-m needs to provide a representation for ghost cells, and VTK-m algorithms and filters need to appropriately handle ghost cells.

Merge Points: For a variety of reasons it is possible for a mesh structure to contain points that are incident with each other, and it may be necessary to identify these incident points and merge them. In the most general case, coincident points must be identified by locating points with spatial coordinates. In many specialized situations, coincident points can be identified via hashed keys. Although less general, these approaches tend to be faster and more robust.

Connected Components: For a variety of reasons it is possible for a mesh structure to contain points that are incident with each other, and it may be necessary to identify these incident points and merge them. In the most general case, coincident points must be identified by locating points with spatial coordinates. In many specialized situations, coincident points can be identified via hashed keys. Although less general, these approaches tend to be faster and more robust.

Advect Time Varying: This includes the ability to advect many particles in 2D and 3D flows where the flow direction does change over time. Supporting multiple time steps usually requires streaming data over time from another source. Hence, this version of the algorithm might require integration into other parts of the software stack.

Completion Proof of the Milestone:
The predefined objective completion criteria of this P6 Activity for all the tasks were the following items:

- Implementation is merged to the master branch of the central VTK-m repository.
- Documentation is added to the VTK-m User's Guide working document.

The following table provides evidence for each implemented feature with links to the completed merge requests (evidence that the implementation is merged into the master branch) and a link to the excerpt from the VTK-m User's Guide documenting the feature.

Deliverable	Merge Requests	Documentation
Ghost Cells	• Ghost zone support for structured grids. (!1404) • Add support for rectilinear and unstructured grids. (!1453) • Filter for adding ghost zones. (!1540) • Add UInt8 as a default type. (!1565) • Rename ghost zone filters (!1601)	• https://jira.exascaleproject.org/secure/attachment/16104/Ghost%20Cell%20Classification%20Pages%20from%20VTKmUsersGuide.pdf • https://jira.exascaleproject.org/secure/attachment/16105/Ghost%20Cell%20Removal%20Pages%20from%20VTKmUsersGuide-2.pdf
Merge Points	• Add point merge capabilities to CleanGrid filter (!1558)	https://jira.exascaleproject.org/secure/attachment/15936/Point%20Merge%20Pages%20from%20VTKmUsersGuide.pdf
Connected Components	• Connected component (!1044) • Connected component (!1104) • Add ImageConnectivity worklet (!1154) • Connected component (!1581)	https://jira.exascaleproject.org/secure/attachment/16156/Pathlines%20Pages%20from%20VTKmUsersGuide.pdf
Advect Time Varying	• Temporal particleadvection filter (!1602)	https://jira.exascaleproject.org/secure/attachment/16173/Connected%20Components%20Pages%20from%20VTKmUsersGuide.pdf

Tasks to Complete the Milestone:
In the case for each of the tasks, implementation started in a private topic branch. That branch was later submitted as a merge request where the code was run through regression tests across multiple test platforms. The merge requests were also subjected to human reviewers for approval. After necessary modifications were made, the code was merged to VTK-m's master branch. Subsequently, documentation was written for the VTK-m User's Guide.

Person(s) Responsible for Completing the Milestone:
Kenneth Moreland, David Pugmire, David Rogers, Hank Childs

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