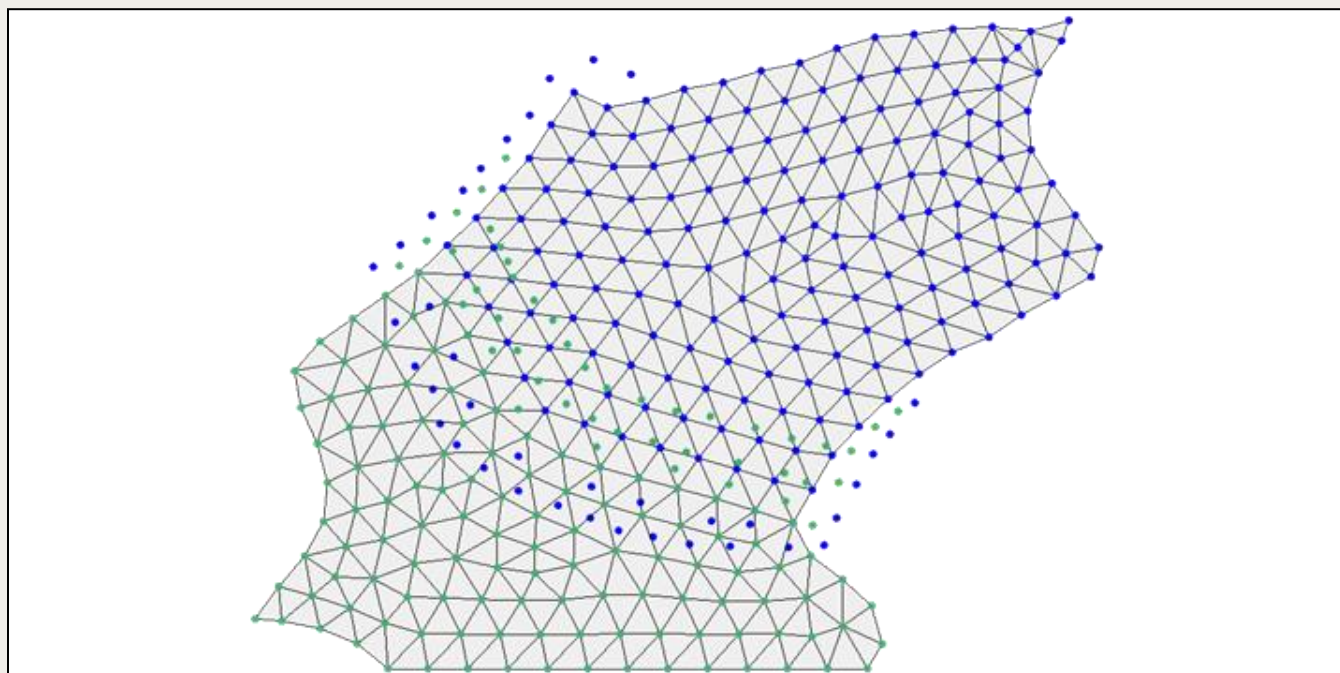*SMS 13.3 Tutorial*

Merging UGrids

Merging Unstructured Grids in SMS

Objectives

Learn multiple ways to merge UGrids.

Prerequisite Tutorials	Required Components	Time
• Overview	• SMS Core	• 10–15 minutes

1   Introduction

This tutorial demonstrates multiple ways to merge unstructured grids, or "UGrids." The examples use UGrids with disjointed cells, matching boundary cells, overlapping cells, and overlapping cells with free points.

2   Getting Started

To begin the tutorial, import the project files:

1. Press *Ctrl+N* to reset to the default settings.

2. Select *File |* **Open…** to bring up the *Open* dialog.

3. Select "Project Files (*.sms)" from the *Files of type* drop-down.

4. Browse to the *data files* folder for this tutorial and select "disjoint.sms".

5. Click **Open** to import the project into SMS.
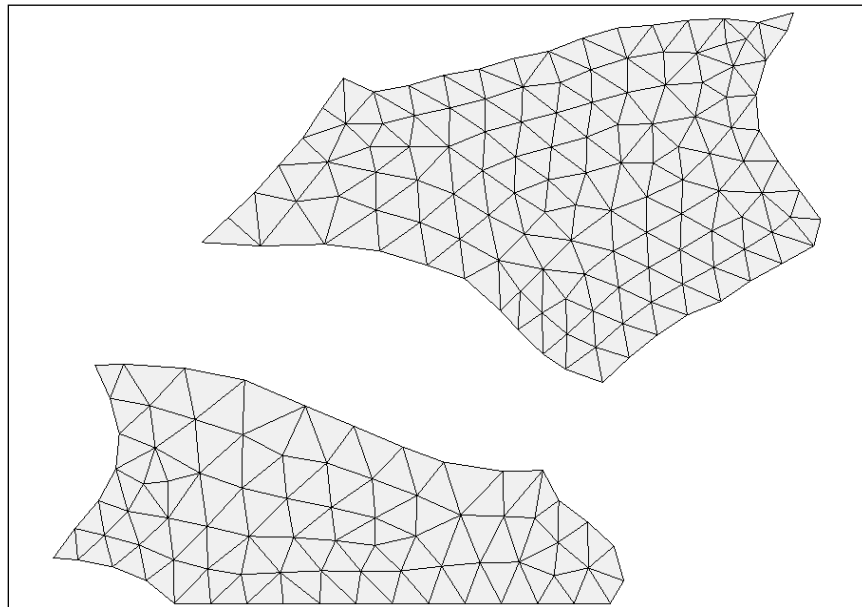
The project should appear similar to Figure 1.

Figure 1   Imported UGrids

3   Merging with Disjointed Cells

UGrids that have no overlapping or touching cells can be merged. As shown in Figure 1, the two UGrids do not overlap at all, nor are they directly adjacent to each other. To merge them, do the following:

1. Click the **Toolbox** 📦 macro to open the *Toolbox* dialog.

2. In the *Tools* tab, expand the "Unstructured Grids" folder and select the *Merge 2D UGrids* tool.

3. Click **Run Tool…** to open the *Merge 2D Grids* dialog.

4. For the *Primary grid*, select "disjoint_primary".

5. For the *Secondary grid*, select "disjoint_secondary".

Because, in this case, there are no overlapping cells or nodes, it doesn't particularly matter which grid is selected as primary. In this case, the primary grid will have no effect on the formation of the merged grid.

6. Leave the *Duplicate point tolerance* and *Buffer distance option* at the default values.

7. For the *Merged grid*, enter "disjoint merged".

8. Click **OK** to run the tool.

9. When the tool finishes, click **OK** to close the *Merge 2D Grids* dialog.

10. Click **Close** to exit the *Toolbox* dialog.

11. Turn off "◈ disjoint_primary" and "◈ disjoint_secondary" in the Project Explorer.

The new "◈ disjoint merged" mesh should show both grids (as shown in Figure 1). As with the two original UGrids, this one has disjointed sections.

4   Merging with Matching Boundary Cells

UGrids that have adjacent boundary cells can be merged. Begin by importing a new project:

1. Press *Ctrl+N* to reset to the default settings.

2. Select *File* | **Open…** to bring up the *Open* dialog.

3. Select "Project Files (*.sms)" from the *Files of type* drop-down.

4. Browse to the *data files* folder for this tutorial and select "matching_boundary.sms".

5. Click **Open** to import the project into SMS.

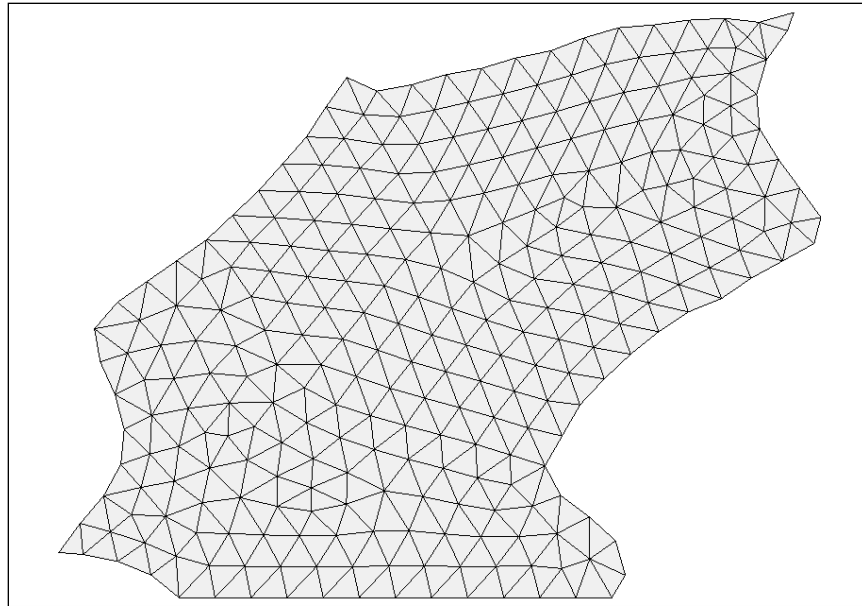The project should appear similar to Figure 2.

Figure 2   Project with matching boundary cells

To see the boundary where the two UGrids meet, do the following:

6. Turn off "⬦ stitched_primary" in the Project Explorer.

7. Turn on "⬦ stitched_primary" and turn off "⬦ stitched_secondary," noting the set of adjacent boundary cells (Figure 3).
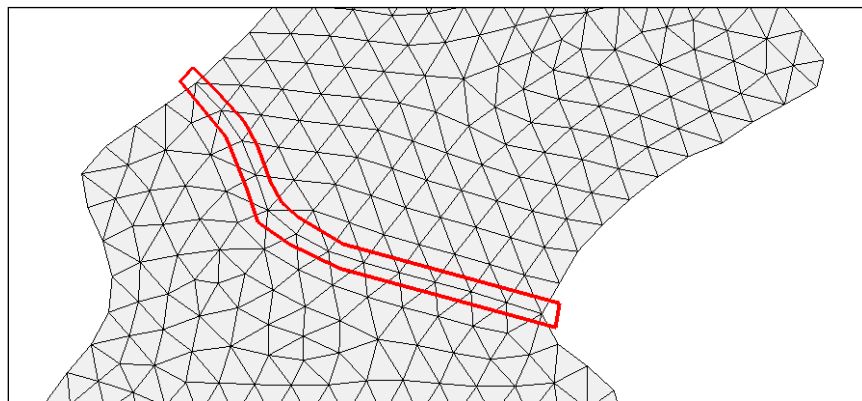

Figure 3   Boundary where cells are adjacent

Now merge the two UGrids:

8. Click the **Toolbox** 🧰 macro to open the *Toolbox* dialog.

9. In the *Tools* tab, expand the "📁 Unstructured Grids" folder and select the *Merge 2D UGrids* tool.

10. Click **Run Tool…** to open the *Merge 2D Grids* dialog.

11. For the *Primary grid*, select "stitched_primary".

12. For the *Secondary grid*, select "stitched_secondary".

For overlapping boundaries, the boundary points on the UGrid selected as the Primary UGrid are the boundary points that are preserved, along with all of their attributes.

Therefore, any attributes attached to the secondary UGrid boundary points will not be passed through to those points in the merged UGrid.

13. For the *Merged grid*, enter "stitched merged".

14. Click **OK** to run the tool.

15. When the tool finishes, click **OK** to close the *Merge 2D Grids* dialog.

16. Click **Close** to exit the *Toolbox* dialog.

17. Turn off both "⬙ stitched_primary" and "⬙ stitched_secondary" in the Project Explorer.

The merged UGrid will appear the same as in Figure 2.

5   Merging with Overlapping Cells

UGrids that have overlapping boundary cells can be merged. Begin by importing a new project:

1. Press *Ctrl+N* to reset to the default settings.

2. Select *File |* **Open…** to bring up the *Open* dialog.

3. Select "Project Files (*.sms)" from the *Files of type* drop-down.

4. Browse to the *data files* folder for this tutorial and select "overlap.sms".

5. Click **Open** to import the project into SMS.

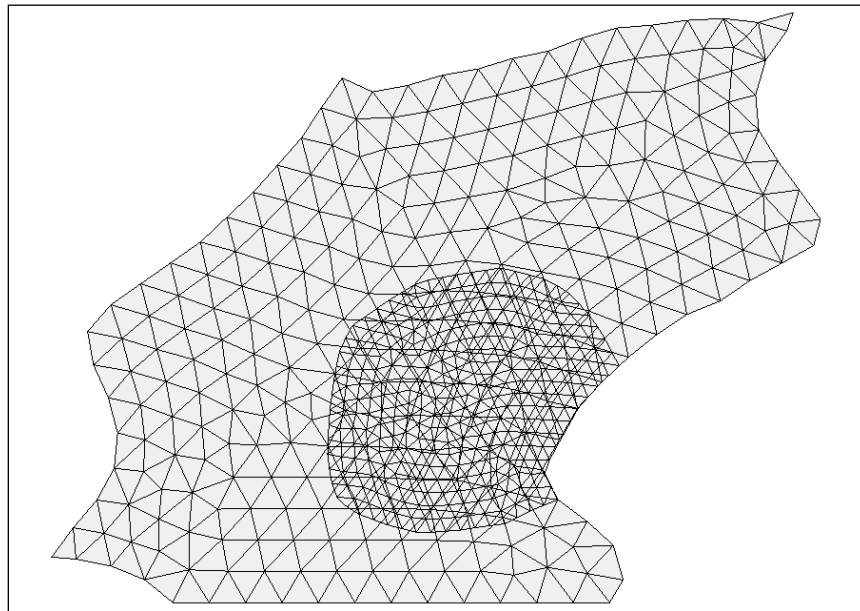The project should appear similar to Figure 4.

Figure 4   UGrids with overlapping cells

To merge the two UGrids, do the following:

6. Click the **Toolbox** 🧰 macro to open the *Toolbox* dialog.

7. In the *Tools* tab, expand the "📁 Unstructured Grids" folder and select the *Merge 2D UGrids* tool.

8. Click **Run Tool…** to open the *Merge 2D Grids* dialog.

9. For the *Primary grid*, select "overlap_primary".

10. For the *Secondary grid*, select "overlap_secondary".

As with previous merges, the overlapping and matching points and cells on the primary UGrid are preserved, while those on the secondary UGrid are not. In addition, gaps between the primary and secondary are connected.

11. For the *Merged grid*, enter "overlap merged".

12. Click **OK** to run the tool.

13. When the tool finishes, click **OK** to close the *Merge 2D Grids* dialog.

14. Click **Close** to exit the *Toolbox* dialog.

15. Turn off both "⬦ overlap_primary" and "⬦ overlap_secondary" in the Project Explorer.

The merged UGrid should appear similar to Figure 5. Depending on the needs of the simulation being run, some cleanup of the merged UGrid may be required.
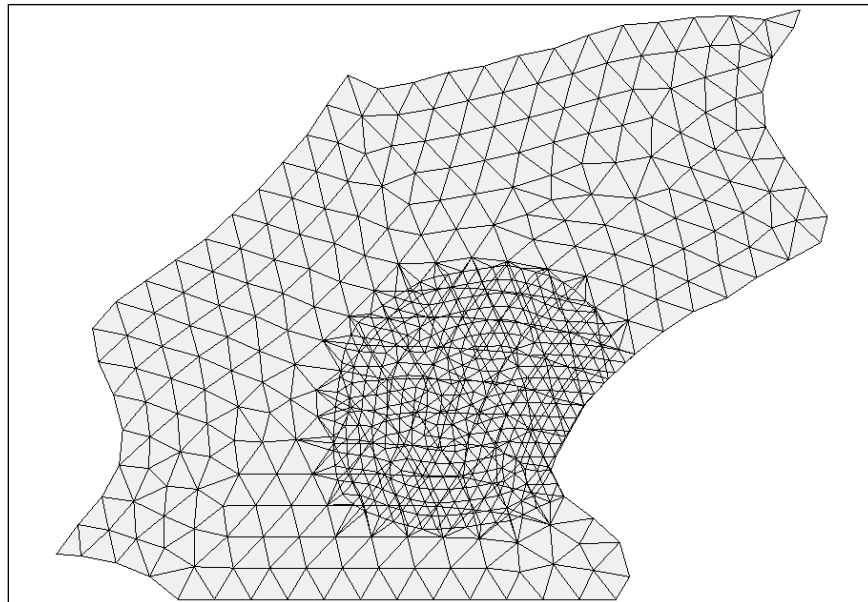

Figure 5   The overlapping cells after merging

6   Merging with Free Points

UGrids that have free points (nodes not directly on the grid) have slightly different rules when they are merged. Begin by importing a new project:

1. Press *Ctrl+N* to reset to the default settings.

2. Select *File |* **Open…** to bring up the *Open* dialog.

3. Select "Project Files (*.sms)" from the *Files of type* drop-down.

4. Browse to the *data files* folder for this tutorial and select "cells_and_free.sms".

5. Click **Open** to import the project into SMS.

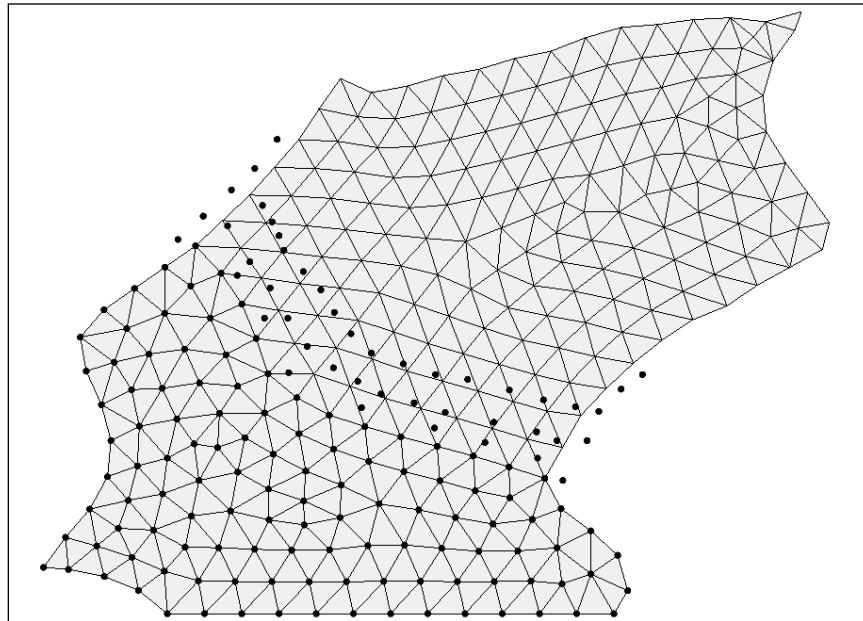The project should appear similar to Figure 6.

Figure 6   UGrids with free points

Notice the free points scattered throughout both UGrids. To show which free points belong to which UGrid, do the following:

6. Turn off "⬙ both_primary" in the Project Explorer.

7. Turn on "⬙ both_primary" and turn off "⬙ both_secondary".

Notice there is some overlap, with free points from each UGrid within the cells of the other UGrid.

8. Turn on "⬙ both_ secondary".

9. Click the **Toolbox** 🧰 macro to open the *Toolbox* dialog.

10. In the *Tools* tab, expand the "Unstructured Grids" folder and select the *Merge 2D UGrids* tool.

11. Click **Run Tool…** to open the *Merge 2D Grids* dialog.

12. For the *Primary grid*, select "both_primary".

13. For the *Secondary grid*, select "both_secondary".

14. For the *Merged grid*, enter "both merged".

15. Click **OK** to run the tool.

16. When the tool finishes, click **OK** to close the *Merge 2D Grids* dialog.

17. Click **Close** to exit the *Toolbox* dialog.

18. Click **Display Options** 🖥 to bring up the *Display Options* dialog.

19. Select "UGrid" from the list on the left.

20. Turn on *Points* and click **OK** to close the *Display Options* dialog.

21. Turn off "⬙ both_primary" in the Project Explorer.

Notice that there is no visible change in which free points are visible.

22. Turn off "both_secondary" in the Project Explorer.

Notice that many free points and some cells were removed when the UGrids were merged. The overlapping and matching points and cells on the primary UGrid are preserved, while those on the secondary UGrid are not. Any free points from the primary UGrid are preserved, while those from the secondary UGrid are not. Any secondary cells covered by primary points are also not preserved. Figure 7 shows the " 🔷 both merged" mesh.
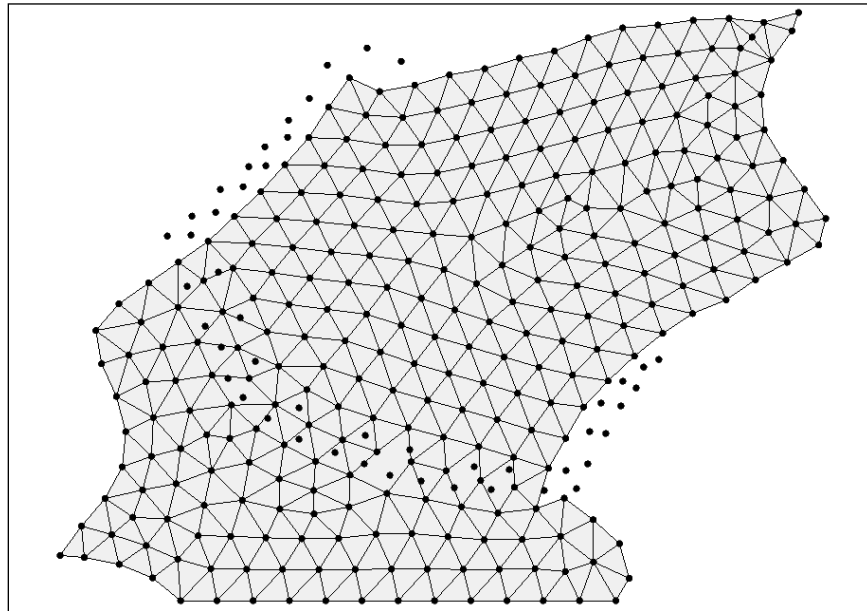

Figure 7   Merged UGrid

7   Conclusion

This concludes the "Merging UGrids" tutorial. This tutorial demonstrated merging Ugrids that are disjointed, have matching boundary cells, have over lapping cells, and have a mixture of both cells and free points. Feel free to continue experimenting with the SMS interface, or exit the program.