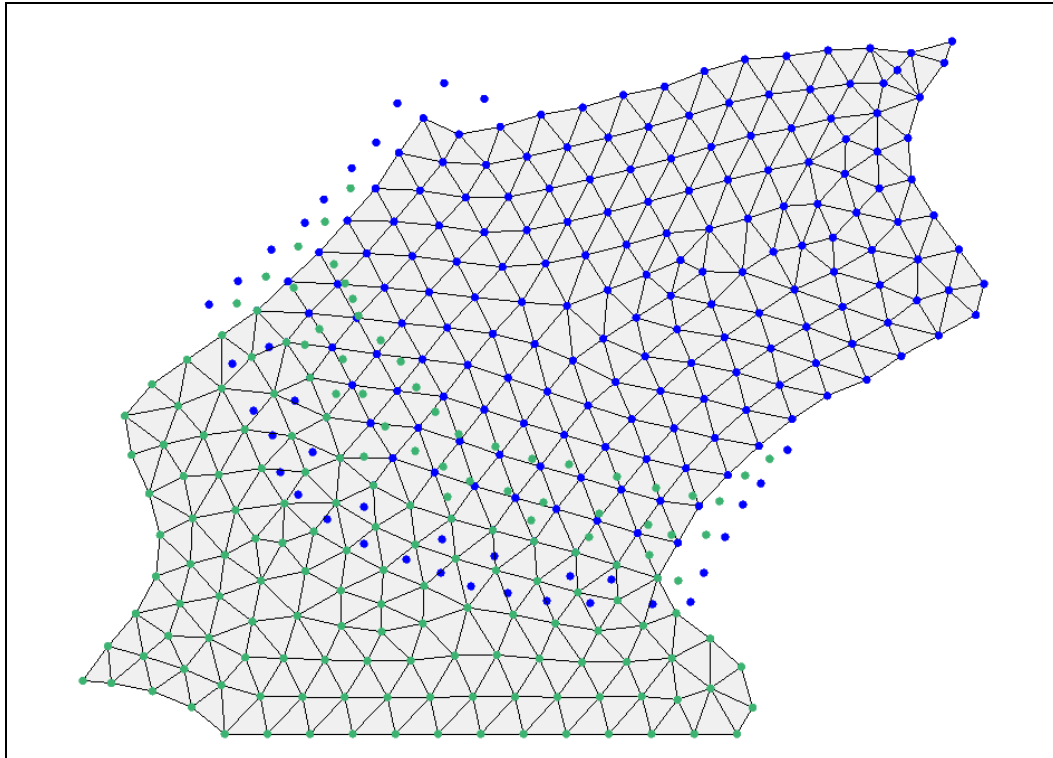*SMS 13.0 Tutorial*

Merging UGrids

Objectives

Learn multiple ways to merge UGrids.

Prerequisites

- Overview Tutorial

Requirements

- UGrid Module
- Map Module

Time

- 10–15 minutes

1   Introduction

This tutorial demonstrates multiple ways to merge unstructured grids, or "UGrids". The examples use UGrids with overlapping points, 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.   Launch SMS. If it is already launched, 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 "points.sms".

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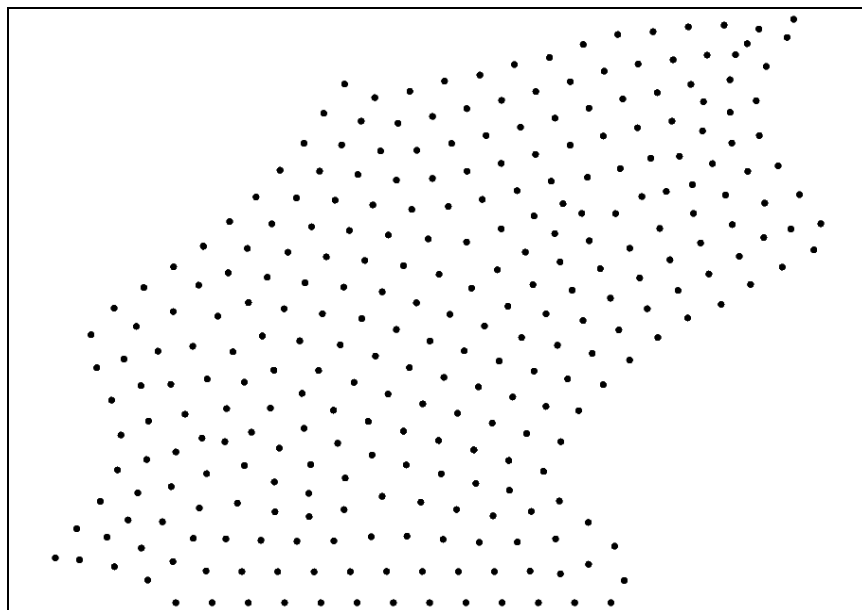
The project should appear similar to Figure 1.

Figure 1   Initial project

3   Merging with Overlapping Points

This project has two UGrids with a set of overlapping points. This can be shown by doing the following:

1. Turn off "⬨ points_primary" in the Project Explorer.

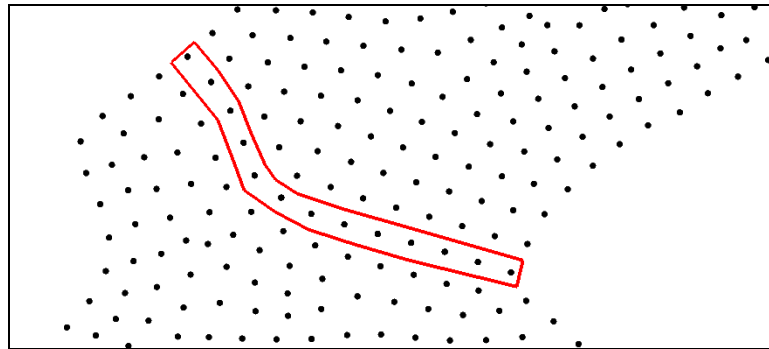2. Turn on "⬨ points_primary" and turn off "⬨ points_secondary", noting the set of overlapping points (Figure 2).

Figure 2   Overlapping points

To merge both sets of points into one, do the following:

3. Select "⬨ points_primary", then select "⬨ points_secondary" while holding down the *Ctrl* key.

4. Right-click on one of the selected UGrids and select **Merge UGrids** to bring up the *Merge UGrids* dialog.

5. Select "⬨ points_primary" from the *Primary UGrid* drop-down.

For overlapping points, the point on the UGrid selected as the Primary UGrid is the point that is preserved, along with all of its attributes. Therefore, any attributes attached to the secondary UGrid point will not be passed through to that point in the merged UGrid.

6. Click **OK** to close the *Merge UGrids* dialog

A new "⬨ points_primary merged" UGrid will appear in the Project Explorer. Note that only two UGrids at a time may be merged.

4   Merging with Disjointed Cells

UGrids that have no overlapping or touching 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 "disjoint.sms".

5. Click **Open** to import the project into SMS.
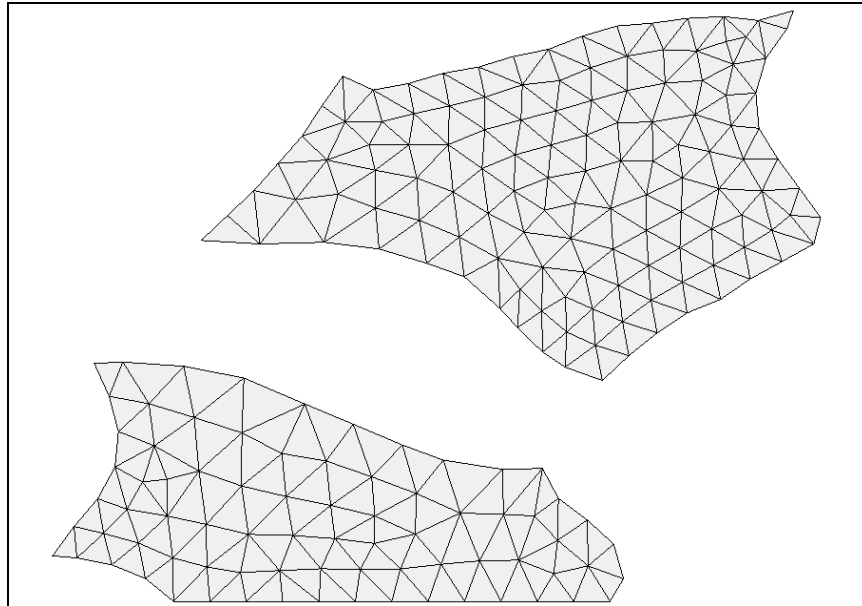
The project should appear similar to   Figure 3.

Figure 3   Imported UGrids

As shown in   Figure 3, the two UGrids do not overlap at all, nor are they directly adjacent to each other. To merge them, do the following:

6.   Select "⬖ disjoint_primary", then select "⬖ disjoint_secondary" while holding down the *Ctrl* key.

7.   Right-click on one of the selected UGrids and select **Merge UGrids** to bring up the *Merge UGrids* dialog.

Because there are no overlapping cells or nodes, no Primary UGrid needs to be selected from the drop-down. By default, the top UGrid in the Project Explorer will be selected as the primary (in this case, "disjoint_primary"), but this selection has no effect on the formation of the merged UGrid in this example.

8.   Click **OK** to close the *Merge UGrids* dialog.

9.   Turn off "⬖ disjoint_primary" and "⬖ disjoint_secondary" in the Project Explorer.

The new "⬖ disjoint_primary merged" UGrid should show both grids (as shown in Figure 3). As with the two original UGrids, this one has disjointed sections.

5   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.

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

5. Click **Open** to import the project into SMS.
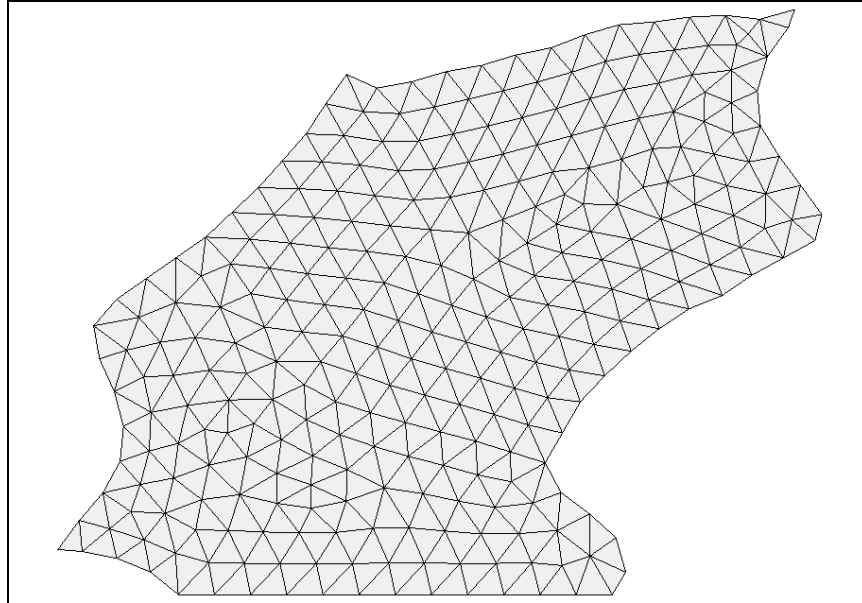
The project should appear similar to Figure 4.

Figure 4   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 5).
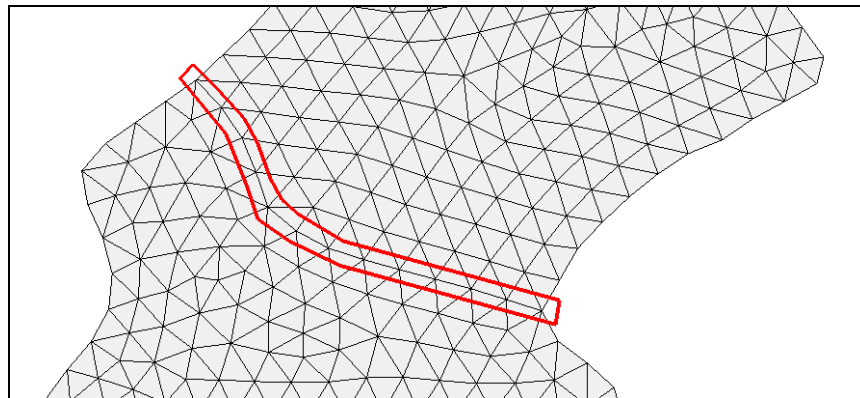

Figure 5   Boundary where cells are adjacent

Now merge the two UGrids:

8. Select "⬙ stitched_primary", then select "⬙ stitched_secondary" while holding down the *Ctrl* key.

9. Right-click on one of the selected UGrids and select **Merge UGrids** to bring up the *Merge UGrids* dialog.

10. Select "⬦ stitched_primary" from the *Primary UGrid* drop-down.

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 that points in the merged UGrid.

11. Click **OK** to close the *Merge UGrids* dialog.

12. Turn off both "⬦ stitched_primary" and "⬦ stitched_secondary" in the Project Explorer.

The merged UGrid will appear the same as in Figure 4.

6   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.

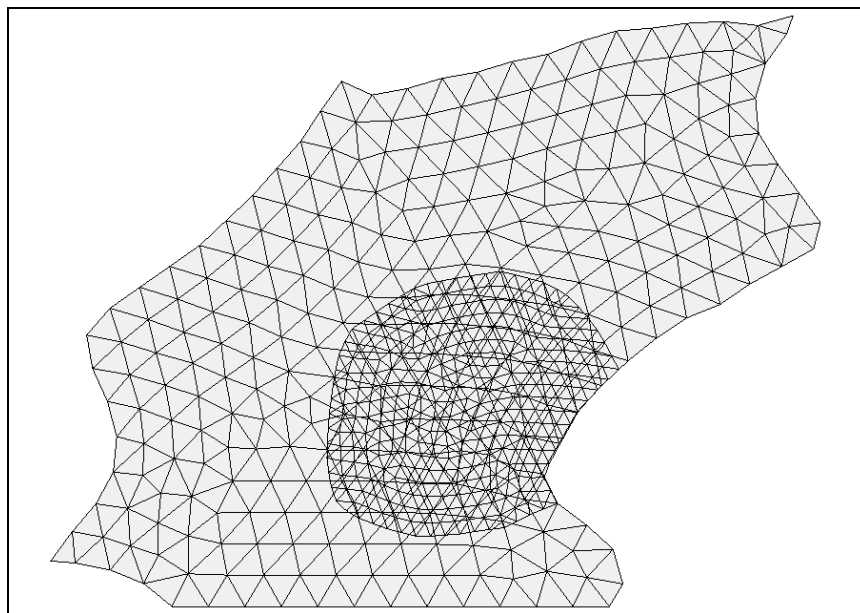The project should appear similar to Figure 6.

Figure 6   UGrids with overlapping cells

To merge the two UGrids, do the following:

6. Select "⬦ overlap_primary", then select "⬦ overlap_secondary" while holding down the *Ctrl* key.

7. Right-click on one of the selected UGrids and select **Merge UGrids** to bring up the *Merge UGrids* dialog.

8. Select "⬦ overlap_primary" from the *Primary UGrid* drop-down.

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.

9. Click **OK** to close the *Merge UGrids* dialog.

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

The merged UGrid should appear similar to Figure 7. Depending on the needs of the simulation being run, some cleanup of the merged UGrid may be required.
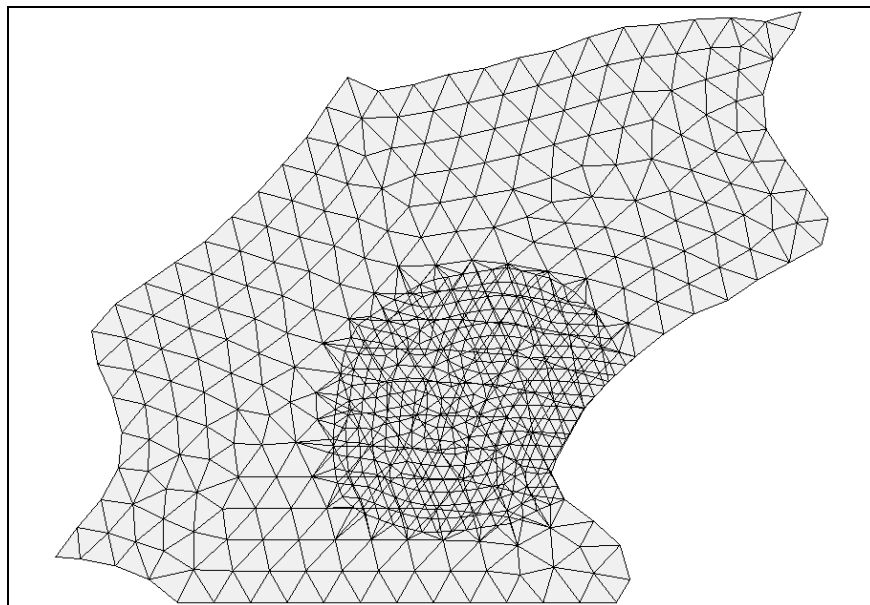

Figure 7   The overlapping cells after merging

7   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 "overlap.sms".

5. Click **Open** to import the project into SMS.
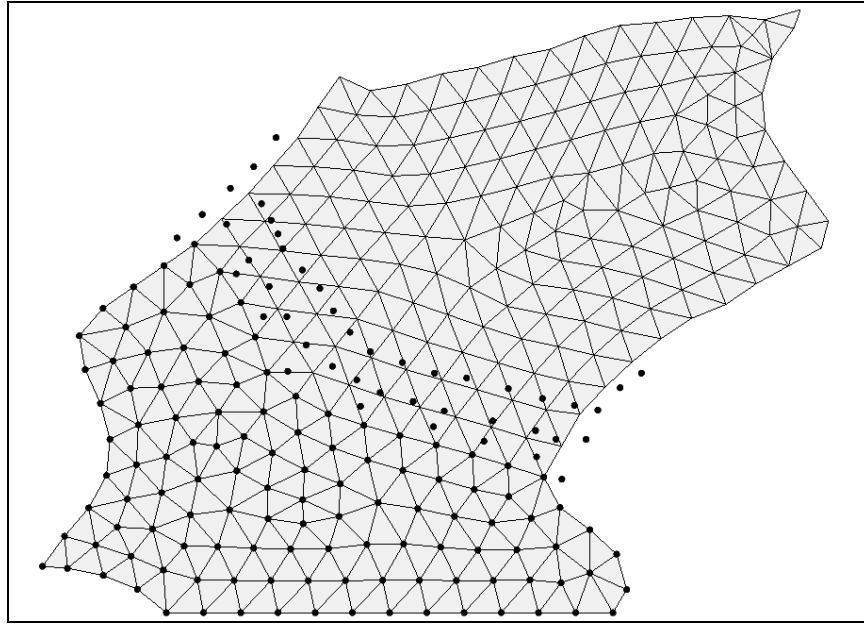
The project should appear similar to Figure 8.

Figure 8   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 off "⬧ both_primary" and turn on "⬧ both_secondary".

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

8. Turn on "⬧ both_primary".

9. Select "⬧ both_primary", then select "⬧ both_secondary" while holding down the *Ctrl* key.

10. Right-click on one of the selected UGrids and select **Merge UGrids** to bring up the *Merge UGrids* dialog.

11. Select "⬧ both_primary" from the *Primary UGrid* drop-down.

12. Click **OK** to close the *Merge UGrids* dialog.

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

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

15. On the *UGrid* tab, turn on *Nodes* and click **OK** to close the *Display Options* dialog.

16. Turn off "⬧ both_primary" in the Project Explorer.

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

17. 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 9 shows the "◇ both_primary merged" UGrid.
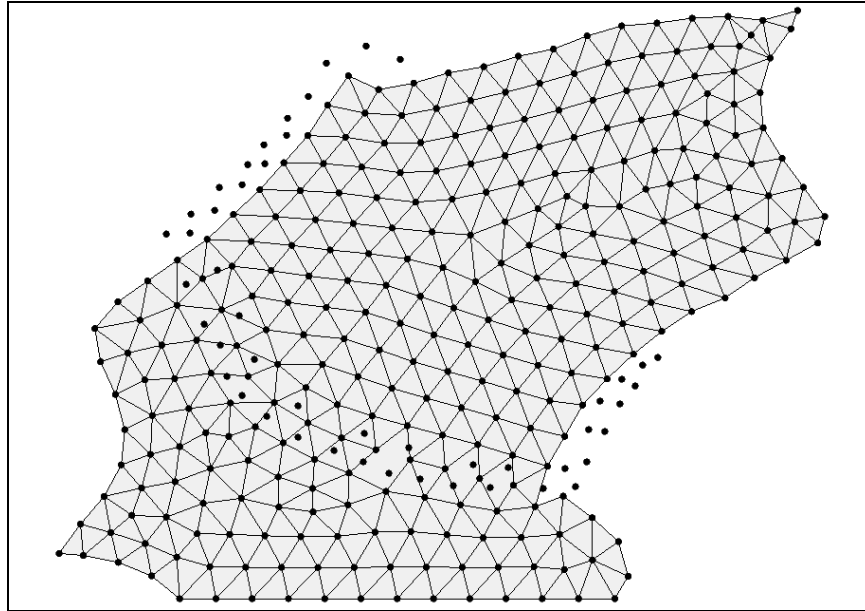

Figure 9   Merged UGrid

8   Conclusion

This concludes the "Merging UGrids" tutorial. Feel free to continue experimenting with the SMS interface, or exit the program.