Description of the ASCII DAT file format.

1 Introduction

This file format describes triangular multiresolution meshes. Each such mesh consists of some number of top level triangles which form a base mesh. The base mesh has arbitrary connectivity and can represent arbitrary topology. Each triangle of the base mesh is subdivided to form finer resolution mesh. Topologically, subdivision is done by inserting midpoints (”odd” vertices) on the edges and quadrisecting the triangle (see Figure 1).

Each vertex in the mesh may have many different values, depending on the multiresolution level. The depth of the vertex is the number of levels where the vertex exists. For instance, a top vertex exists at all (maximal depth + 1) levels, and a finest level vertex exist only at the finest level. Only one geometric position per vertex is listed in the file. The DAT format doesn't make any assumptions on these geometric values. They can represent limit positions on subdivision surface, finest control points, wavelet coefficients, etc. For example, wavelet transform tools assumes that the vertex data are finest control points for input meshes but write resulting wavelet coefficients in the same DAT format.

The DAT format allows adaptive subdivision when triangles in some areas are subdivided finer then in the others. Adaptive subdivision has depth restriction, that is a ring of triangles which share any given vertex must have the difference in the finest depth at most 1.

The details of the representation depends on the following naming convention.

2 Naming convention

The vertices of any triangle have names **V1**, **V2**, **V3**. These names correspond to the order of the vertices in the file. For example, if some triangle was defined with indices 11 15 25 then V1 is the vertex 11, V2 is the vertex 15, and V3 is 25. Edges have names **E1**, **E2**, **E3**. Edge **E1** corresponds to **V1** (it has endpoints **V2** and **V3**) and so on.

There is no naming consistency between top level triangles in the base domain. Each top triangle has its own naming of the vertices which is defined by the order the vertices are listed in the file (see Figure 1 right). (For the right orientation, this ordering must be counterclockwise.) It means that the same vertex can have different names in different top triangles.

The naming convention for finer levels of multiresolution is defined recursevly. The children of a quadrisected triangle are assigned the names **T0**, **T1**, **T2**, **T3**. **T0** is the center child, **T1** is the child which share the vertex **V1** with its parent and so on. The vertices inserted during subdivision are named after the corresponding edges (vertex on the edge **E1** has a name **V1**). The naming convention is consistent inside any top level triangle: Any vertex have the same name at any level of the hierarchy. This property IS ASSUMED in this file format, that is for all children of any top triangle this hierarchical naming MUST coincide with the order vertices are listed. It means that any vertex must be always listed with the same name. For example, if vertex with the index 11 was the first vertex for some triangle, then for all children of this triangle the vertex with the index 11 MUST be listed first. Also, vertex naming must be consistent for any two triangles which share vertex. If these two triangles are children of different top triangles then the naming must agree with the renaming defined by the top triangles.

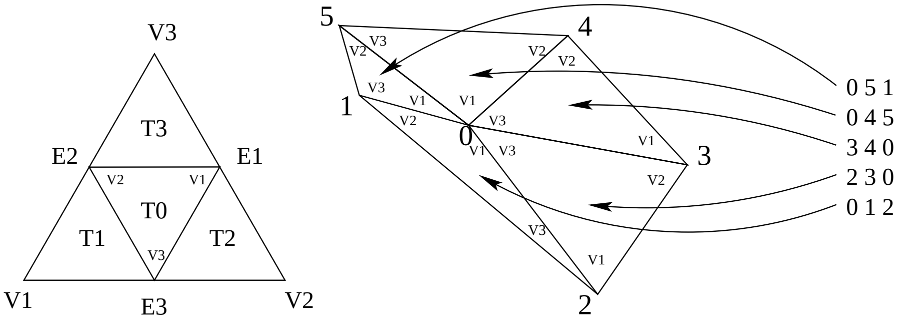

Figure 1: *On the left: parent-children naming convention. On the right: vertex naming in the base domain.*

3 File format

Multires data file	*;signature*
depth <int>	*;maximal depth of the mesh*
Vertices	*;vertex section*
<int> <float X> <float Y> <float Z>	*;vertex depth and XYZ coordinates*
.	
.	
.	
Triangles	*;connectivity section*
name: <0, 1, 2, or 3> <0 or 1 - root>	<int V1> <int V2> <int V3>
.	
.	
.	
end	*;end of the file*

name: <0, 1, 2, or 3> <0 or 1 -root> <int V1> <int V2> <int V3>
The first number is the name of the triangle in its parent (0 for root triangles), the second number is 1 for root triangles (with no parent) and 0 otherwise. the last three numbers are indices of V1, V2, and V3 vertices. The children of any triangle MUST be listed right after the description of the triangle (depth first).

The order of the children must always be **T0**, **T1**, **T2**, **T3**. Note, that between any two such children some grandchildren (children of the first children) are listed, if any.

4 Example

For this example we consider one root triangle, subdivided once, and then its T1 child is also subdivided. Note that the mesh is not uniform.

```
Multires data file
depth 2
Vertices
3 0 0 0
3 1 0 0
3 0 1 0
2 0.5 0.5 0
2 0 0.5 0
2 0.5 0 0
1 0.25 0.25 0
1 0.25 0 0
1 0 0.25 0
Triangles
name: 0 1 0 1 2 ; the root
name: 0 0 3 4 5 ; T0 child, depth 1
name: 1 0 0 4 5 ; T1 child, depth 1
name: 0 0 6 7 8 ; T0 child of previous triangle, depth 2
name: 1 0 0 7 8 ; T1 depth 2
name: 2 0 6 4 8
name: 3 0 6 7 5 ; the last child, depth 2, going up
name: 2 0 3 1 5 ; T2 at depth 1
name: 3 0 3 4 2 ; T3 at depth 1
end
```

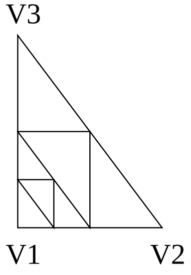

Figure 2: *The adaptively subdiveded mesh, represented by this example*