

Building models

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Lecture Overview

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1 Building models

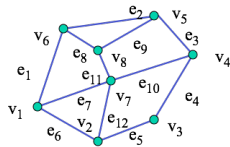
Mesh

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A mesh is a set of polygons that share vertices and edges which describe the shape of a geometric object. Meshes can be simple consisting only of a few primitives, or very complex. Consider the following mesh,



- ▶ there are 8 nodes and 12 edges
- ▶ 5 interior polygons
- ▶ 6 interior (shared) edges
- ▶ each vertex has a location $v_i = (x_i y_i z_i)$

Simple representation

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Define each polygon by the geometric locations of its vertices:

```
glm::vec3 v1 = glm::vec3(x1, y1, z1);
```

```
glm::vec3 v2 = glm::vec3(x2, y2, z2);
```

...

→ inefficient and unstructured

Inward and outward facing polygons

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The order v_1, v_2, v_7 and v_2, v_7, v_1 are equivalent in that the same polygon will be rendered by OpenGL but the order v_1, v_7, v_2 is different

The first two describe outwardly facing polygons

Use the right-hand rule = counter-clockwise encirclement of outward-pointing normal

OpenGL can treat inward and outward facing polygons differently

Geometry vs topology

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Geometry: locations of the vertices

Topology: organization of the vertices and edges

Example: a polygon is an ordered list of vertices with an edge connecting successive pairs of vertices and the last to the first

Topology holds even if geometry changes

Vertex lists

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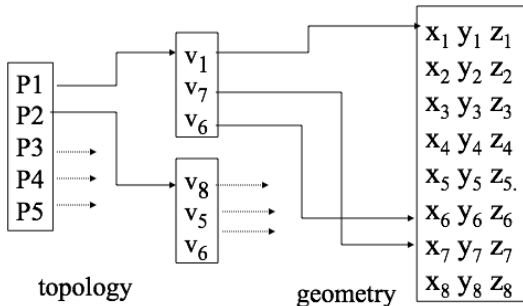
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Put the geometry in an array

Use pointers from the vertices into this array

Introduce a polygon list



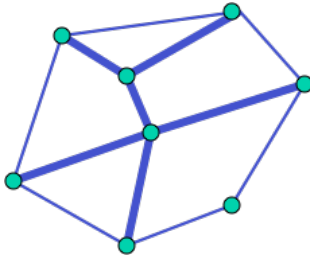
Shared edges

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Vertex lists will draw filled polygons correctly but if we draw the polygon by its edges, shared edges are drawn twice

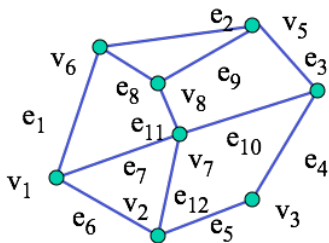
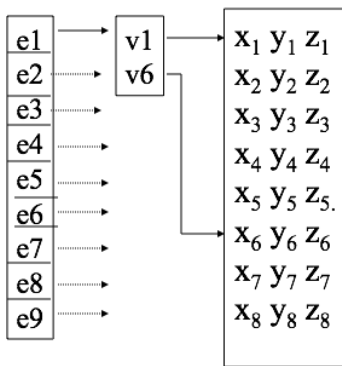


Edge lists

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Note polygons are
not represented

Vertex array objects (VAO)

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OpenGL provides a facility called vertex arrays that allows us to store array data in the implementation attributes e.g. position, color, texture coordinates, indices, normals

- ▶ VAO, VBO, EBO