Nomenclature

- Geometry consists of geometric entities
    - 3-D **volumes**, which are bounded by
    - 2-D **surfaces**, which are bounded by
    - 1-D **curves**, which are bounded by
    - 0-D **nodes**
    - Solid modeling engine tracks a topological relationship among these
    - There are also **groups** which are collections of 0 or more geometric entities
- Mesh consists of mesh entities
    - 2-D† **elements** (e.g. triangles), which are adjacent to
    - 1-D **edges**, which connect
    - 0-D **vertices**
    - There are also **EntitySets** which are collections of 0 or more mesh entities
    - EntitySets may have **Parent/Child** relationships with each other
    - All entities and EntitySets can be **Tagged** with arbitrary key=value data

†There are also 3-D elements (e.g. tetrahedra), but those are not relevant to our data model

DAGMC Data Model Fundamentals

- DAGMC “geometries” are actually mesh-based representations
- In a DAGMC representation, each geometric entity is represented by a MOAB **EntitySet**
    - Each of those **EntitySet**s is tagged with a Category **Tag** and/or Dimension **Tag** to indicate which kind of geometric entity it is
    - The following types of EntitySets contain the following things:
        - Node set (dim = 0) *contains* the MOAB Vertex (dim = 0) that is equivalent to that node
        - Curve set (dim = 1) *contains* all of the MOAB Edges (dim = 1) that are created by faceting the curve
        - Surface set (dim = 2) *contains* all of the MOAB Triangles (dim = 2) that are created by faceting the surfaces
        - Volume set (dim = 3) *contains* nothing!

DAGMC Data Model Fundamentals - Parent/Child

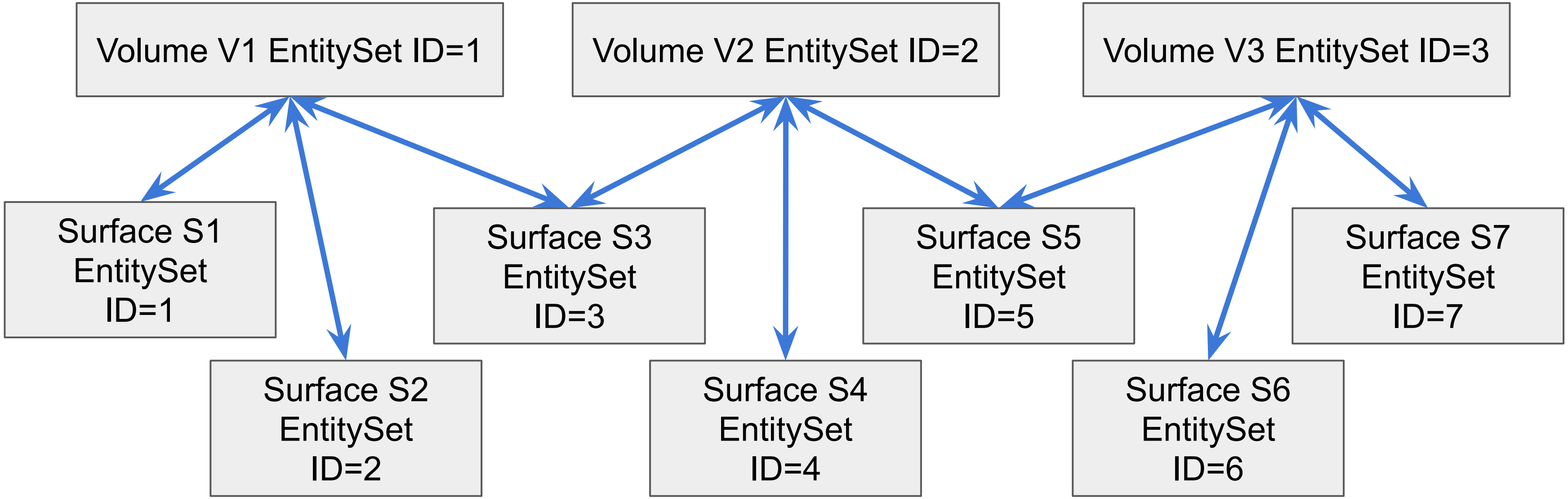
- Each kind of **EntitySet** has a parent/child relationship with the **EntitySet**s of neighboring dimension that bound it

Parent	**Children**
Volume Set	Surface Sets
Surface Set	Curve Sets
Curve Set	Node Sets

- Note the difference between a *containing* relationship and a **parent/child** relationship

Complex Example

(See next slide for discussion of tags)


Volume V1 EntitySet ID=1
Volume V2 EntitySet ID=2
Volume V3 EntitySet ID=3
Surface S1 EntitySet ID=1
Surface S2 EntitySet ID=2
Surface S3 EntitySet ID=3
Surface S4 EntitySet ID=4
Surface S5 EntitySet ID=5
Surface S6 EntitySet ID=6
Surface S7 EntitySet ID=7

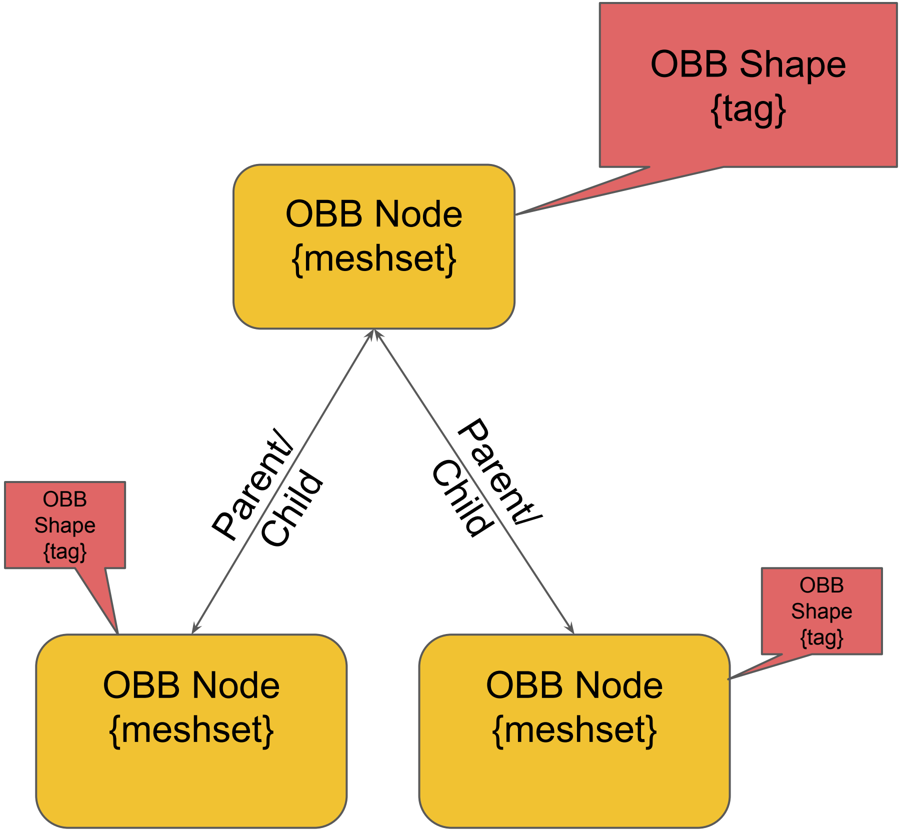
Complex Example Tags

EntitySet	Geom	Category	ID	Sense (Forward/Reverse)
V1	3	Volume	1	-
V2	3	Volume	2	-
V3	3	Volume	3	-
S1	2	Surface	1	(1/0)
S2	2	Surface	2	(1/0)
S3	2	Surface	3	(1/2)
S4	2	Surface	4	(0/2)
S5	2	Surface	5	(3/2)
S6	2	Surface	6	(3/0)
S7	2	Surface	7	(0/3)

Understanding Sense

- Sense is usually set with MOAB methods GeomTopoTool::set_sense()
- Each surface EntitySet is tagged with “handles” to up to 2 volume EntitySets
    - One is defined as being FORWARD (the first entry in the vector of length 2)
    - One is defined as being REVERSE (the second entry in the vector of length 2)
- All triangles in a surface set have a natural orientation of their normals, based on a canonical ordering of their vertex connectivity
- A surface has a FORWARD sense with respect to a volume if the natural orientation of the normals is outward from volume (and vice versa)
- If a surface has only one sense defined:
    - It forms part of the “implicit complement”
    - That sense may be FORWARD or REVERSE (consistent with above)
- Sense is defined between Curve & Surface EntitySets in an analogous manner

OBB’s and OBB Trees



OBB Node Meshsets contain

- Volume Root node:
  - Volume entitySet handle
- Surface Root node:
  - Surface entitySet handle
- Leaf node:
  - Triangles

Established in `OBBTreeTool->build_tree()` :

- parent/child relationships
- Triangles inserted into meshset

Established in `GeometryTopoTool->construct_obb_tree()` :

- Volume/Surface entitySet handle inserted into meshet