Data Structure in Parasolid

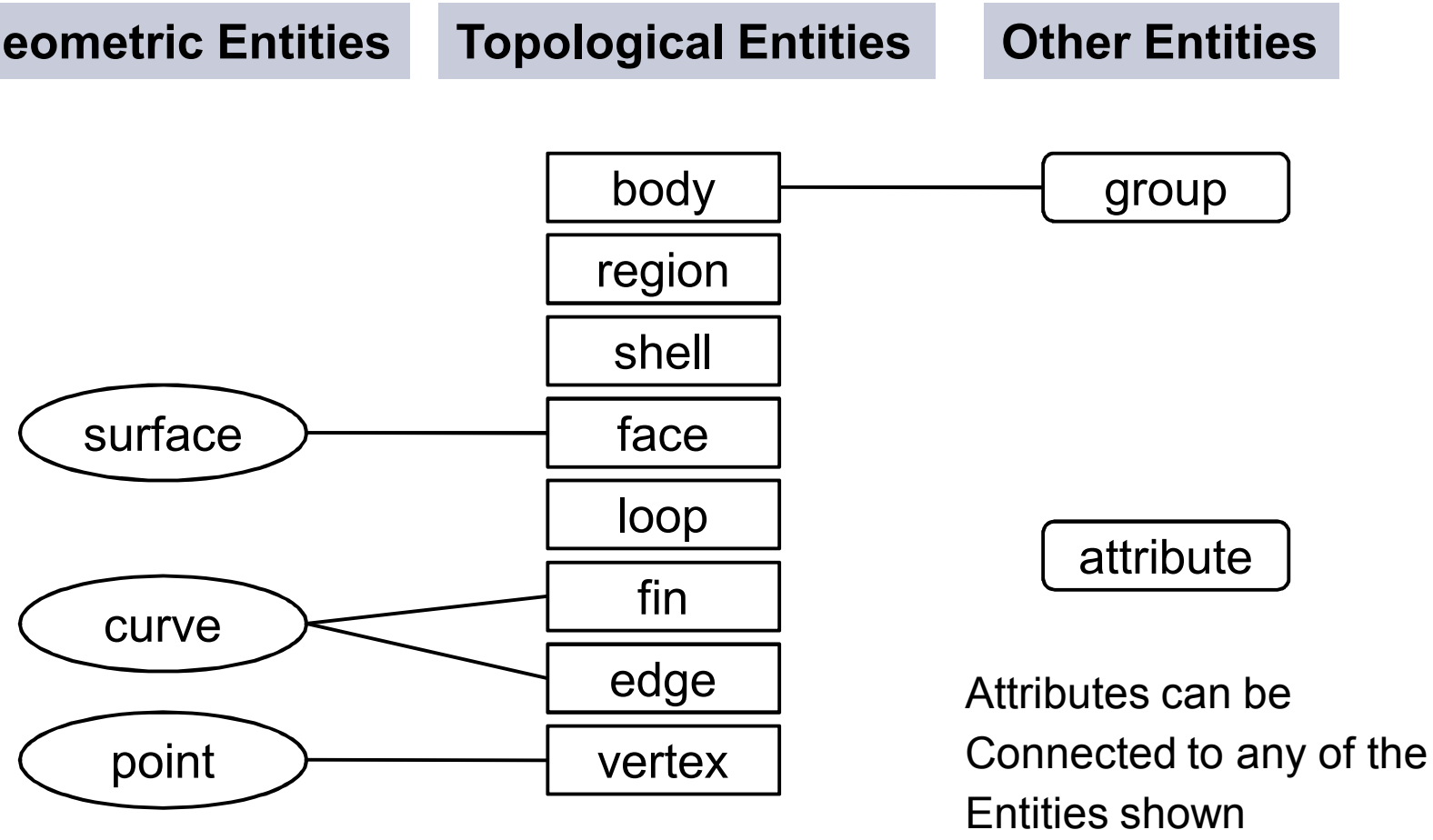
www.parasolid.com

Manifold model

- Geometric Modelers
  - PARASOLID， Unigraphics Solutions Inc: Unigraphics, IDEAS, SolidEdge, Solidworks
  - ACIS，Spatial Technology: AutoCAD，CADKEY，Mecha nical Desktop，Bravo
  - CAS.CADE，MDTV(Matra Datavision): Euclid-IS, QUAN TUM

Entities in Parasolid

- Entities are grouped into three main types



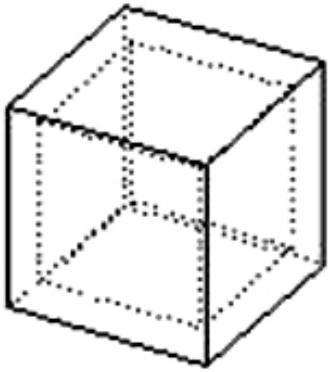
Entities in Parasolid – cont'

- Topological Entities
  - Comprise all the entities that constitute the structure or skeleton of a model

- Body
  - Acorn: An isolated vertex.
  - Wire: Connected edges. (manifold)
  - Sheet: Connected faces. (manifold)
  - Solid: A solid region.
  - General

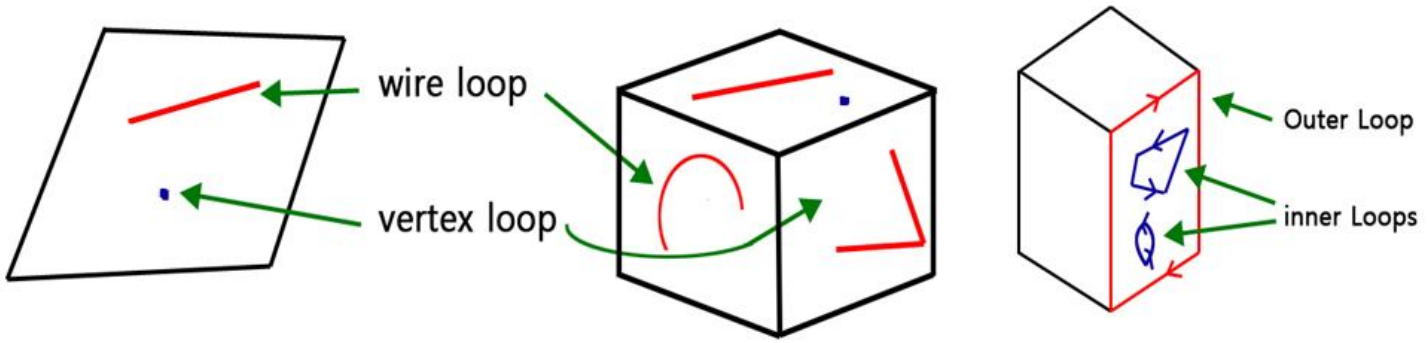
Entities in Parasolid – cont'

- Region
  - Subset of 3-d space
  - A body always has an infinite void region,
    all regions in a body comprises the whole of 3D space
- Shell
  - Can be regarded as a boundary of a region
- Face
  - A subset of a surface



Entities in Parasolid – cont'

- Loop
  - A connected component of a face boundary.
  - The direction of the loop is such that the face is locally on the left of the loop, when seen from above the face and looking in the direction of the loop



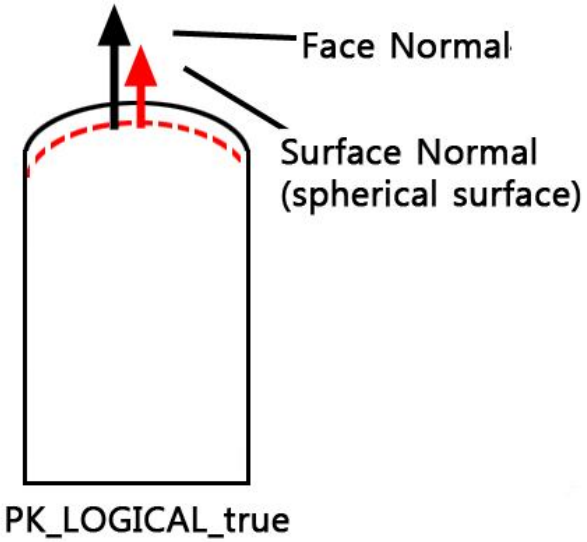
Entities in Parasolid – cont'

- Fin
  - Represents the oriented use of an edge by a loop
- Edge
  - An edge is a bounded piece of a single curve
  - A wireframe - no fins
  - A laminar - one fin
  - A manifold - two fins
  - A general edge - more than 2 fins
- Vertex
  - A vertex represents a point in space

Entities in Parasolid – cont'

- Loop, fin and edge directions
  - The direction of a face's loop determines the direction of the edges and fins of that face:
  - A loop represents one boundary of a face as a closed set of fins, therefore the direction of the fin is the same as that of the loop that contains the fin.
  - An edge, which (on a manifold solid) has a left and right fin, takes its direction from the left fin (which takes its direction from its loop)

Entities in Parasolid – cont'



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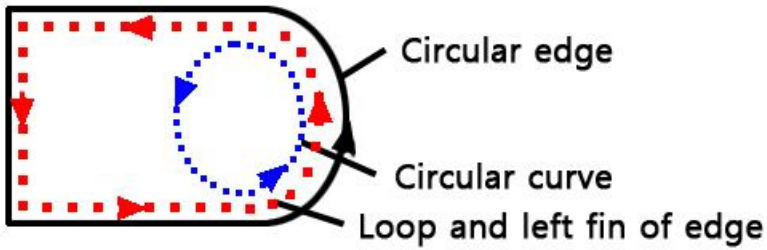

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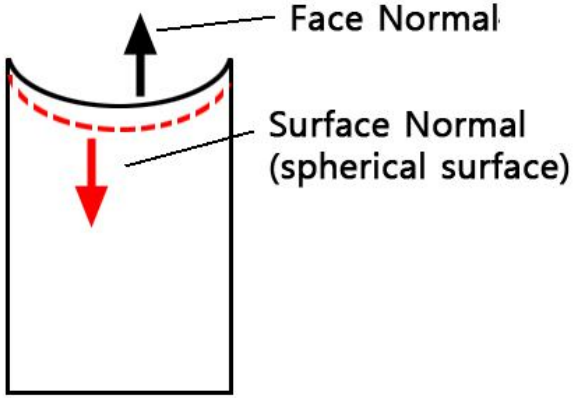

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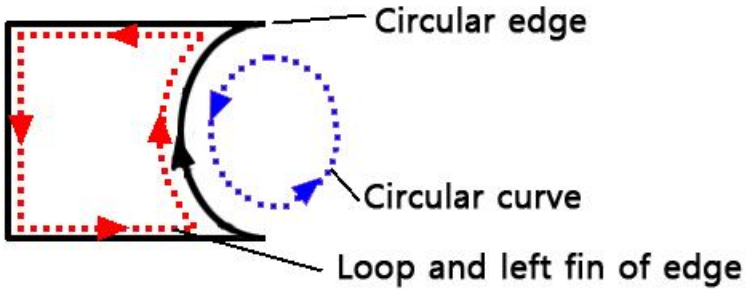

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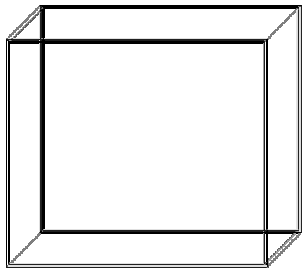
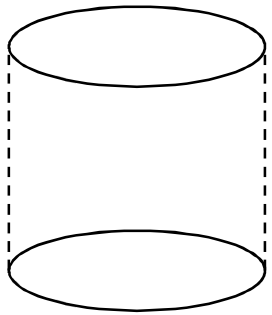
Entities in Parasolid – cont'



Block

Body	1
Region	2
Shell	2
Face	6
Loop	6
Fin	24
edge	12
vertex	8



Cylinder

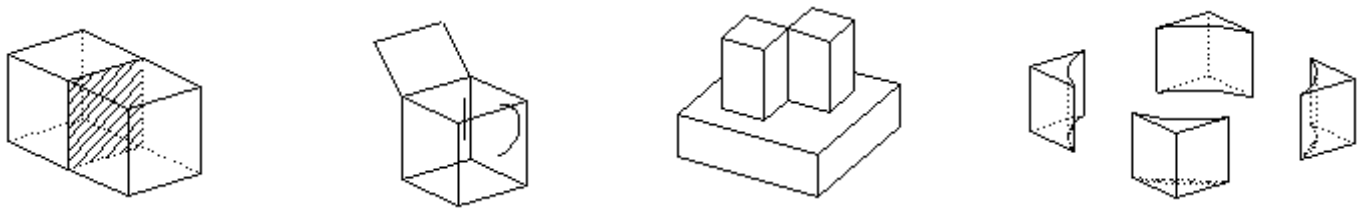
Body	1
Region	2
Shell	2
Face	3
Loop	4
Fin	4
edge	2

Manifold & General

- Body types in Parasolid
  - Manifold bodies :

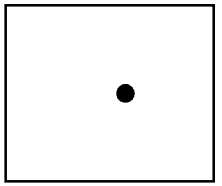
    default type, Acorn body, wire body, sheet body, solid body

  - General bodies
    - Cellular bodies: general body partitioned by an internal face
    - General body of mixed dimensions
    - Non-manifold body: the edge between two bosses is non-manifold
    - General body consisting of four disconnected pieces

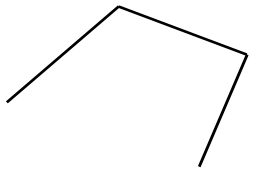


Manifold Bodies

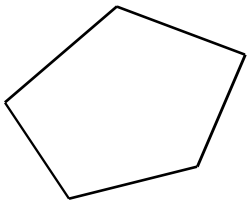
- Acorn body
  - Contains only one type of geometry - points
  - Minimum body: a single void region, a single shell



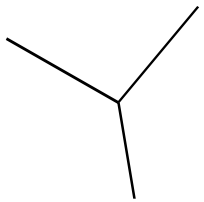
- Wire body
  - A set of connected edges
  - Consist of a single void region
  - Every vertex is used by exactly one or two edges



open wire body



closed wire body

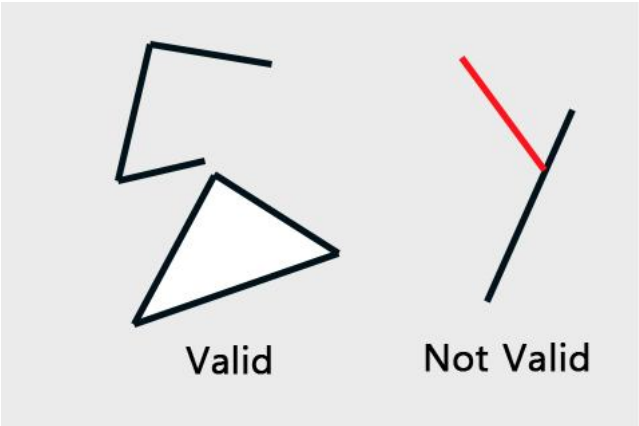


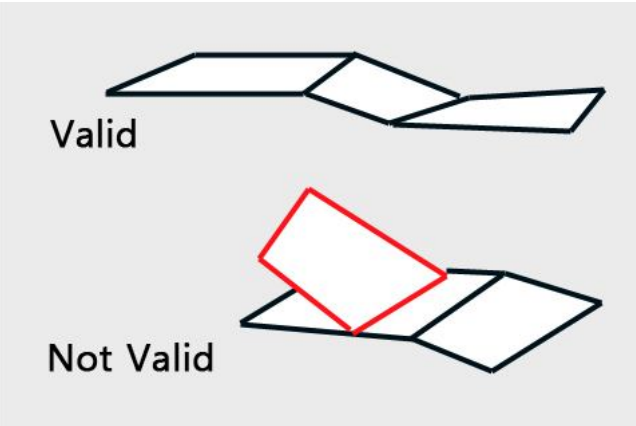
Not permitted
as a minifold wire body!!

Manifold Bodies – cont'

- Sheet body
  - A set of connected faces
  - Open (a sheet of paper)
  - Closed (bounds a volume, a hollow sphere for example)

- Example) an edge has only one or two fins





Manifold Bodies – cont'

- Solid body
  - Contains no acorn vertex or wireframe edge
  - Has exactly 1 infinite void region
  - Has at least 1 face
  - Each edge has exactly 2 fins
  - Every vertex must either belong to a single isolated loop, or one or more edges