## DCEL (Doubly-Connected Edge List)

- Record for each face, edge and vertex:
  - Geometric information
  - Topological information
  - Attribute information
- aka Half-Edge Structure

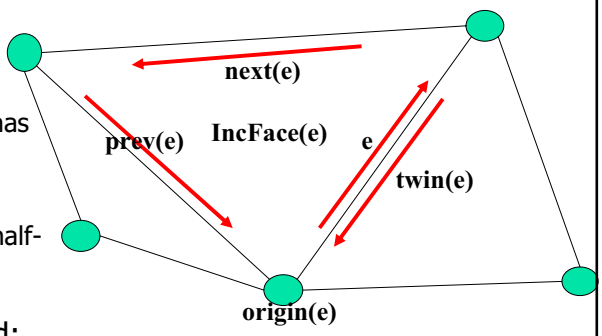


University of British Columbia

27

## DCEL (cont.)

- Vertex record:
  - Coordinates
  - Pointer to one half-edge that has v as its origin
- Face record:
  - Pointer to one half-edge on its boundary
- Half-edge record:
  - Pointer to its origin, origin(e)
  - Pointer to its twin half-edge, twin(e)
  - Pointer to the face it bounds, IncidentFace(e) (face lies to left of e when traversed from origin to destination)
  - Next and previous edge on boundary of IncidentFace(e)






University of British Columbia

28

Copyright 2002-2006 A. Sheffer & C. Gotsman

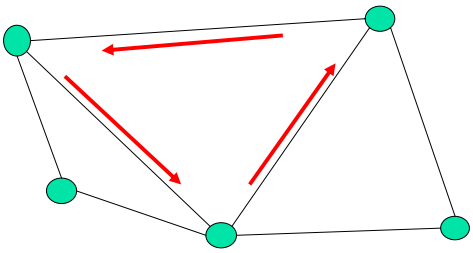
UBC/ Technion





## DCEL (cont.)

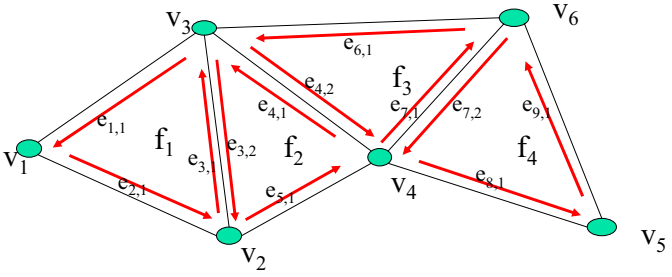
- Operations supported:
  - Walk around boundary of given face
  - Visit all edges incident to vertex v
- Queries:
  - Most queries are O(1)



University of British Columbia

29

## DCEL - example




| Vertex | coordinate | IncidentEdge |
|---|---|---|
| $v_1$ | $(x_1,y_1,z_1)$ | $e_{2,1}$ |
| $v_2$ | $(x_2,y_2,z_2)$ | $e_{5,1}$ |
| $v_3$ | $(x_3,y_3,z_3)$ | $e_{1,1}$ |
| $v_4$ | $(x_4,y_4,z_4)$ | $e_{7,1}$ |
| $v_5$ | $(x_5,y_5,z_5)$ | $e_{9,1}$ |
| $v_6$ | $(x_6,y_6,z_6)$ | $e_{7,2}$ |

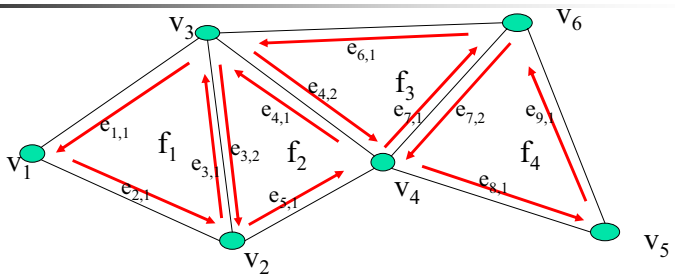
| face | edge |
|---|---|
| $f_1$ | $e_{1,1}$ |
| $f_2$ | $e_{5,1}$ |
| $f_3$ | $e_{4,2}$ |
| $f_4$ | $e_{8,1}$ |

University of British Columbia

30

Copyright 2002-2006 A. Sheffer & C. Gotsman
UBC/ Technion

## DCEL – example (cont.)




| Half-edge | origin | twin | IncidentFace | next | prev |
|---|---|---|---|---|---|
| $e_{3,1}$ | $v_2$ | $e_{3,2}$ | $f_1$ | $e_{1,1}$ | $e_{2,1}$ |
| $e_{3,2}$ | $v_3$ | $e_{3,1}$ | $f_2$ | $e_{5,1}$ | $e_{4,1}$ |
| $e_{4,1}$ | $v_4$ | $e_{4,2}$ | $f_2$ | $e_{3,2}$ | $e_{5,1}$ |
| $e_{4,2}$ | $v_3$ | $e_{4,1}$ | $f_3$ | $e_{7,1}$ | $e_{6,1}$ |



University of British Columbia



## DCEL – pros and cons

- Pros:
  - All queries in O(1) time
  - All operations are O(1) (usually)
- Cons:
  - Represents only manifold meshes



University of British Columbia



Copyright 2002-2006 A. Sheffer & C. Gotsman
UBC/ Technion



