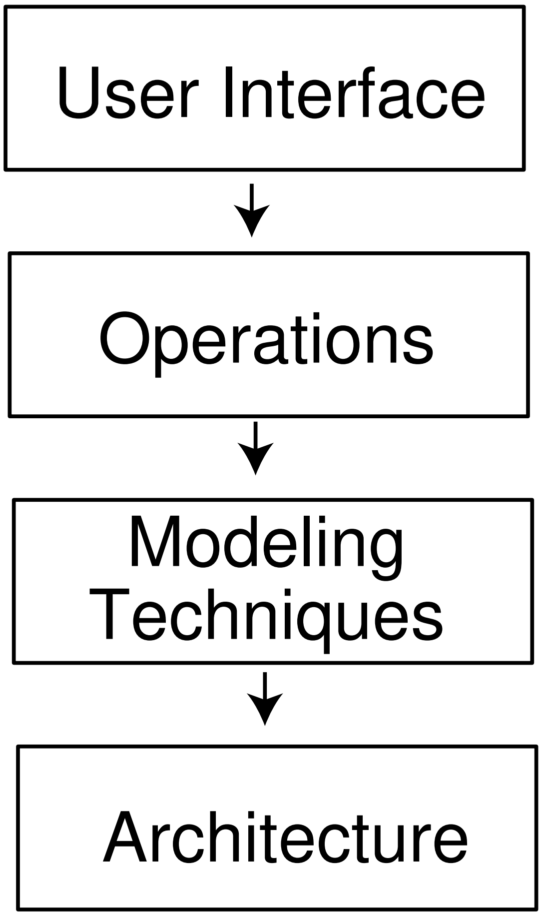
Conceptual Framework



Modeling Systems

- Operations with Models
- Conversion Between Models
- Modeling Systems
- Modeling Techniques

Operations with Models

- Topological Operations
  - Euler
- Combination Operations
  - Point Set
  - Blending
- Geometric Operations
  - Rigid Motions
  - Deformations

Euler Operators

- Formula

  $$V - E + F = 2$$

- Operations

Point Set Operations

- Regularized Union

$\cup^*$	*in*	*on*	*out*
in	in	in	in
on	in	?	on
out	in	on	out

- Regularized Intersection

$\cap^*$	*in*	*on*	*out*
in	in	on	out
on	on	?	out
out	out	out	out

Geometric Transformations

- Rigid Motions
- Deformations

Composite Objects

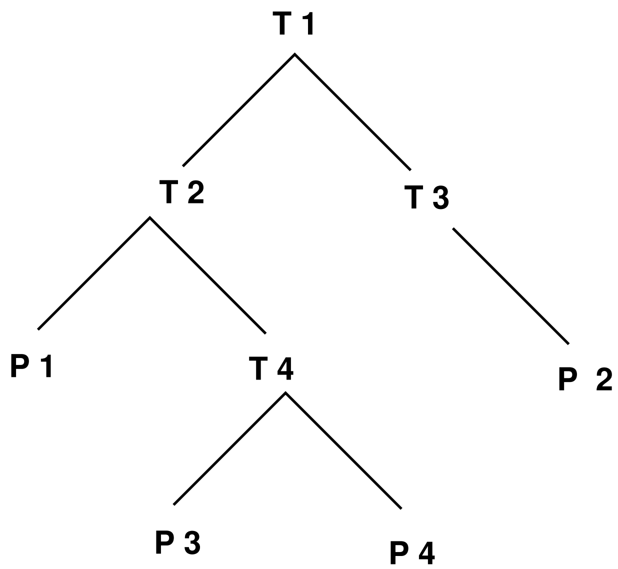
- Primitive Objects
- Transformations

Representation

- Hierarchies
- Instancing

Hierarchies

- Tree Structure



- Flat Structure

T 1 : P 1
T 2 : P 2
.
.
.
T n : P n

Implementation

- Tree Traversal
- CTM
- Stack
- Operations
  - Push
  - Pop
  - Multiply

Instancing

- Local Coordinate System
- Copying
- Linking

Transforming Models

- Parametric
- Implicit

Affine Invariance

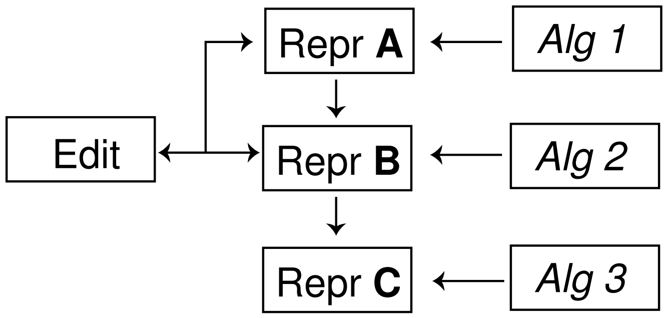
- Points
- Lines / Polygons
  - Endpoints
- Parametric Curves/Surfaces
  - Control Points
- Implicit (Algebraic)
  - Matrices
- Implicit (General)
  - Points

Conversion between Models

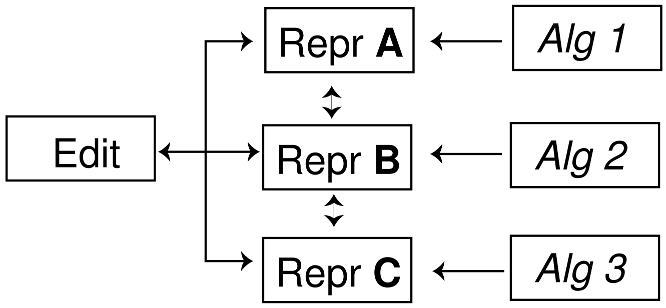
- Geometry Specification
  - Implicit $\rightarrow$ Parametric
  - Parametric $\rightarrow$ Implicit
- Representation
  - CSG $\rightarrow$ R-Rep
    (Boundary Evaluation)
  - B-Rep $\rightarrow$ CSG
    (Space Decomposition)

Systems Architecture

- Single Representation
- Multiple Representation
  - Hybrid



  - Dual



Modeling Techniques

- Free Form
- Building Blocks
- Transformation Groups
  - lofting
  - sweeping
- Sampling / Reconstruction