Mask Data Preparation (MDP)

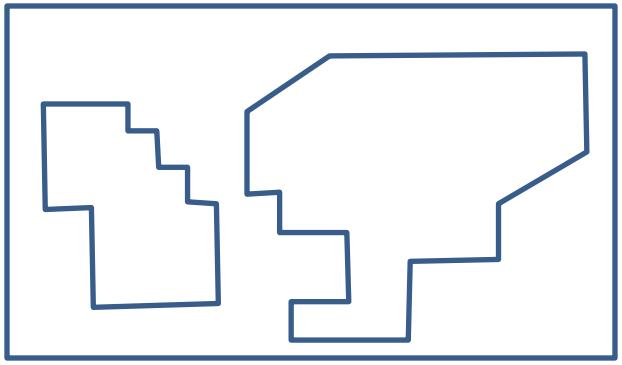
Roadmap

- Layout data and Mask data
- Quality of mask data
- MDP flow
- Fracturing
  - Grid division
  - Merger
- Sources

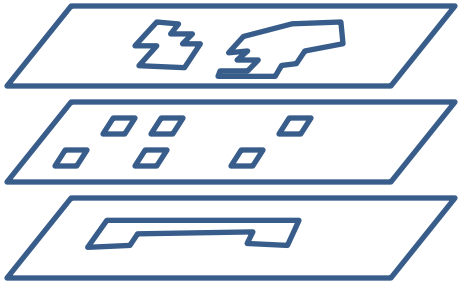
Layout data and Mask data

- Layout data: Representation of an IC in terms of geometrical shapes spread across one or more layers. Stored in file formats like GDSII, Oasis, Mebes etc.
- Mask data: Layout data fractured into rectangles/trapezoids, required to synthesize photomasks (stencil). Contains only rectangles and/or trapezoids. Stored in file formats like Jeol, VSB12.

Layout data

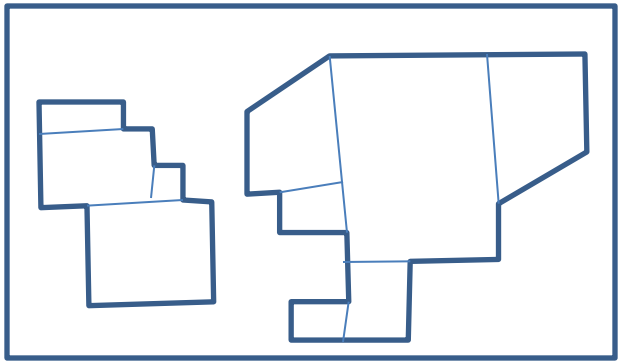


Single layer (layer 1) top-view



Multi-layer cross-sectional view

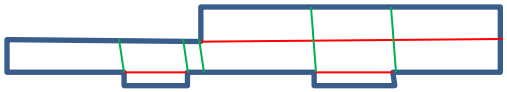
Mask data

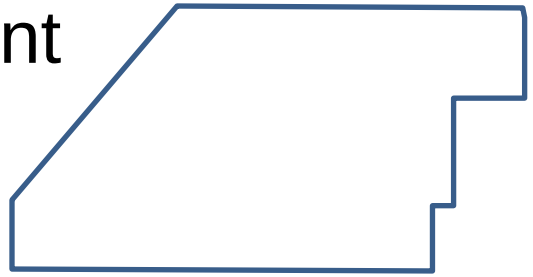


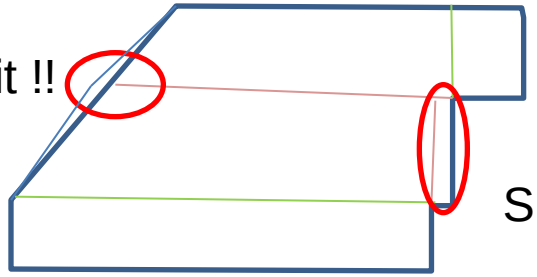
Fractured layer 1

Quality of mask data

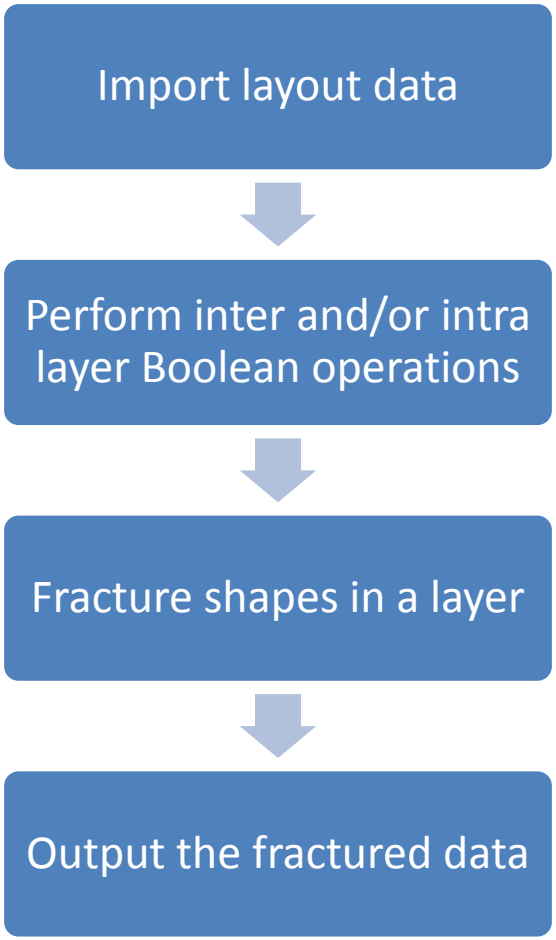
- Factors determining mask quality
  - Sliver Count
  - All Angle Split
  - Critical Dimension (CD) Split
  - Figure Perimeter & Shot Perimeter
  - Figure Count & Shot Count





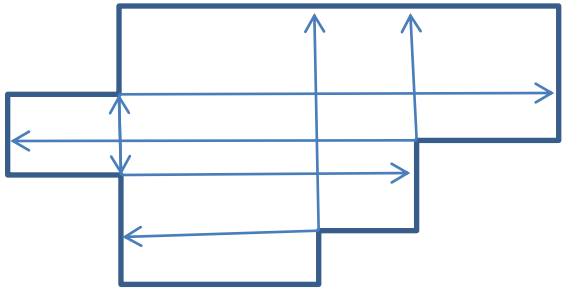


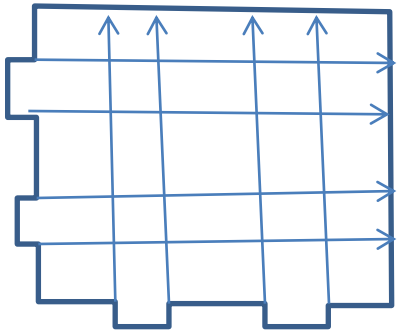
MDP Flow


Import layout data
Perform inter and/or intra layer Boolean operations
Fracture shapes in a layer
Output the fractured data

Fracturing

- Ray Based Fracturer
  - Rays are shot from convex vertices and costs are assigned to every ray segment.
  - Selects the ray segments with least cost.





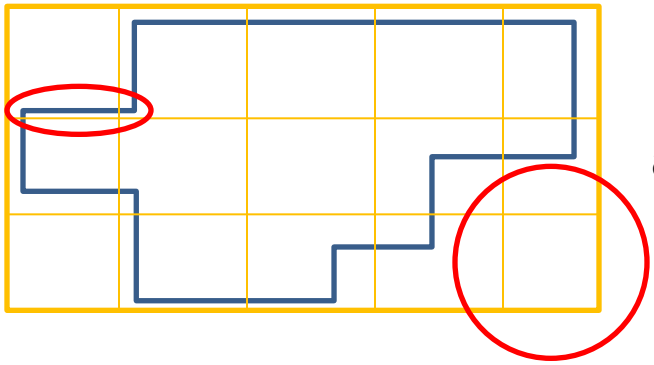
  - Memory consumed in storing ray segments is $O(n^2)$, where ‘n’ is the number of vertices. Therefore, input shape can not be too large.

Fracturing

- Pre processing the fracturing data
  - Method 1: Grid division
  - Method 2: Merger

- Grid division

Issue 1: Sliver generation

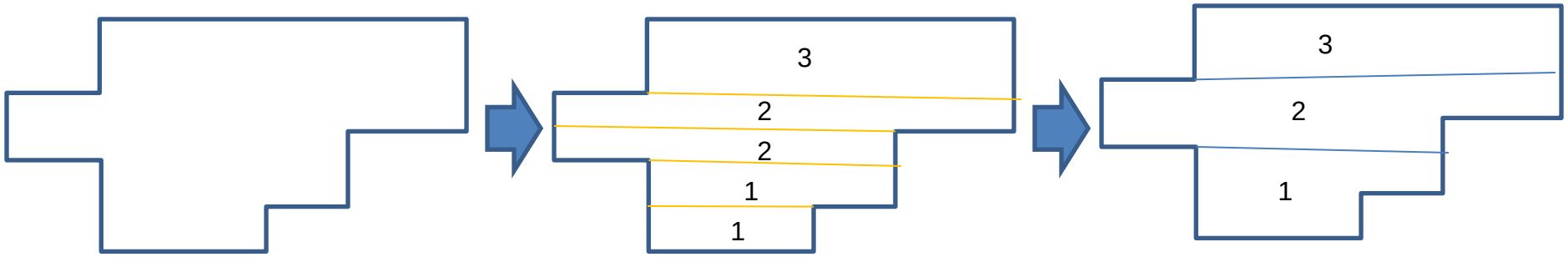


Issue 2: Empty regions
are unnecessarily processed

Issue 3: Uneven distribution of vertices

Fracturing

- Merger
  - Shape aware partitioning
  - Trapezoidalize the input shape
  - Cluster the ‘essential’ trapezoids



Original Shape Trapezoidalized Shape Clusters

Fracturing

- Advantages of Clustering
  - Lesser slivers
  - Faster
- Disadvantages of Clustering
  - ‘Not so good looking’ mask output, usually dominated by long clusters.
  - Increase in figure perimeter
  - Increase in figure count

Sources

- http://en.wikipedia.org/wiki/IC_layout