Detailed Routing

Readings: Chapter 6

Determine exactly how each signal is routed through each region

Seeks to reduce routing area

Channel Routing vs. Switchbox Routing

Channel: terminals on at most two opposite sides (two+ sides unconstrained)
  Simpler routing problem, better results

Switchbox: terminals on three or more sides, or two adjacent sides
  Note: if “switchboxes” routed before channels, location on channel edges fixed. In general we route channels before switchboxes.
Channel Description

Describe channel as list of nets connected to terminals on top and bottom (0 = no terminal)

<table>
<thead>
<tr>
<th>Col #</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<td>1</td>
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</tbody>
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Terminology:
- Track
- Trunk
- Branch
- Dog-leg

Goal: Route in as few tracks as possible

Channel Constraints & Constraint Graphs

Two overlapping trunks cannot share a track

Horizontal Constraint Graph
The top pin in a column must be routed on a higher track than the bottom pin

Vertical Constraint Graph

HCG:

VCG:
Left Edge Algorithms

Assume: No doglegs allowed, ignore vertical constraints
sort trunks based on left end position
while nets left {
    place leftmost unrouted trunk into highest available track
    add additional unrouted trunks to this track, leftmost first
}

Left Edge with Vertical Constraints Algorithms

Assume: No doglegs allowed

Same as normal left edge, but only consider trunks without predecessors in VCG
Vertical Constraint Graph Cycles

Cycles can occur on VCG, meaning that no assignment of trunks will work. Must break trunk into pieces. “Doglegs” can also reduce track count.

Dog-leg Algorithm

Break all trunks at any branch point for that net. Run constrained left edge algorithm, allowing segments of a trunk to touch.

Non-dogleg VCG:

Dogleg VCG: