

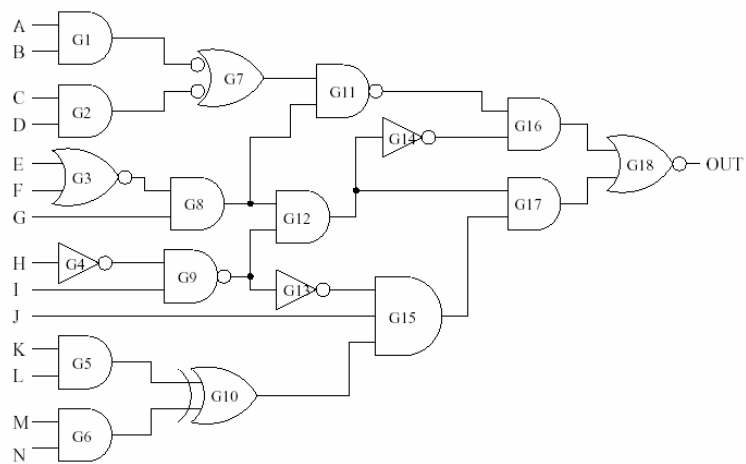
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## Midterm Review

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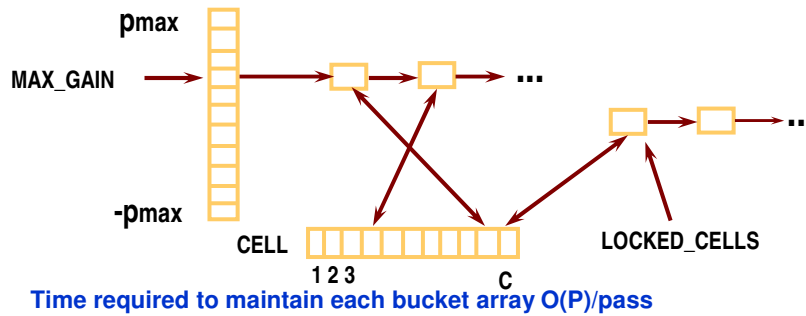
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### Problem 1: Timing



## Problem 2: Two-Way Partitioning: Fiduccia & Mattheyses)

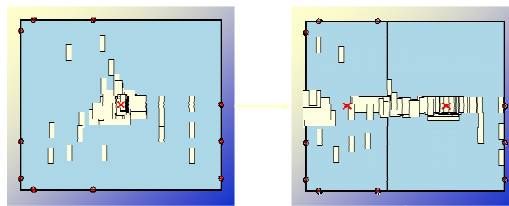
If  $p(i)$  = no. of pins on cell  $i$ :  $-p(i) < g_i < p(i)$   
 Bin-sort cells on  $g_i$



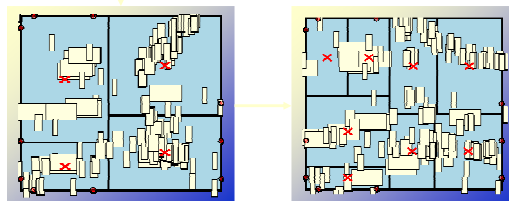
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## Problem 3: Placement

Initial Placement

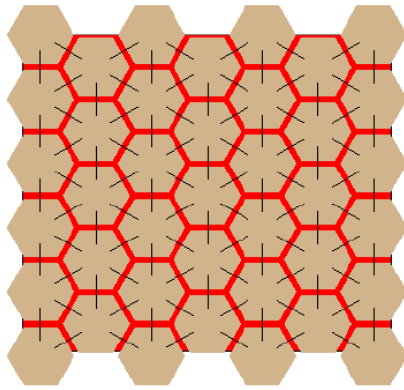


Partition and Replace



A. Kahng

## Problem 4: Non-Manhattan Routing



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## Problem 5: Layer Assignment

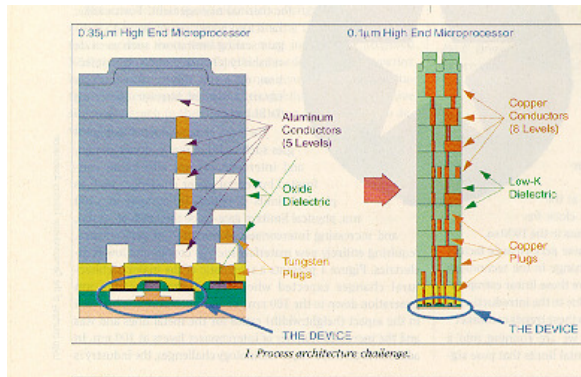


Photo courtesy:  
Jan M. Rabaey  
Anantha Chandrakasan  
Borivoje Nikolic

Given:

- Cell placement
- 100K nets
- 8 layers
- Assign each net to a (primary) layer

Intel 65nm

- M1 105nm,
- M2 105;
- M3 110;
- M4 140;
- M5 165;
- M6 240;
- M7, 360;
- M8 540)

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## ***Routing Objectives***

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### **Minimize path delay**

- **Timing driven → maintain timing constraints**
- **Minimize wire length**
- **Balance congestion**

### **Minimize noise**

- **Noise driven → minimize cross-coupled capacitance**

### **Minimize clock skew**

- **Balance clock trees**
- **Keep buses together**

## ***Problem 5a: When to do layer assignment?***

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**Advantages/disadvantages for global routing**

**Advantages/disadvantages for detail routing**

### ***Problem 5b: Linear time algorithm?***

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- Identify routing resources to be used
- [Identify layers (and tracks) to be used]
- Assign particular nets to these resources
- Also used in floorplanning and placement
  
- Within global routing
  - Advantages/disadvantages to doing layer assignment before routing region assignment
  - Advantages/disadvantages to doing layer assignment after routing region assignment

### ***Linear time algorithm***

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Before routing region assignment?

- Simply take Euclidean distance of each net
- Bin nets according to distance – longer nets higher layers
- Improvement?
- Use Rectilinear Steiner Trees

After routing region assignment?

- Simply take length of RST of each net
- Bin nets according to distance – longer nets higher layers