18-322 Layouts: The Good, the Bad, and the Ugly

A Motivational Talk
Good layouts

• Compact
  – Less capacitance
  – Less bigness

• Uniform
  – Cell Height
  – Plan to abut cells to neighboring cells

• Structured
  – Layers can have “functions”
  – Layers can have “directions”
Bad Layouts

• Layers not used for their intended purposes
  – Poly and active should be kept fairly short
Bad Layouts

• Layers not used for their intended purposes
  – Poly and active should be kept fairly short
  – Use interconnect layers systematically
    • Lower layers for lower levels
      – Gates: M1, M2
      – Inter-gate Interconnect: M3, M4…
    • Assign a direction to each layer
      – For example: M3 is North-South, M4 is East-West, etc.
      – No more problematic crossovers
Ugly Layouts

• The “Mishmash Effect”
  – Keep sight of your goal & think objectively about your layout
  – Don’t stick to rules that don’t make sense
Ugly Layouts

• The “Mishmash Effect”
  – Keep sight of your goal & think objectively about your layout
  – Don’t stick to rules that don’t make sense

• Unplanned / Poorly Planned Layouts
  – A good layout will not look like your schematic!
    (unless your schematic looks like a good layout)
How NOT to start:

Hmmm...
Time to start my 322 layouts!

Ok, I’m a smart guy…
I’m going to try to do all the cells using only Poly and M1*

* This is pretty aggressive
How NOT to start:

…and I’m going to make all my gates have the same height!

Man, I’m glad I thought this through. I’m saving myself loads of work!
How NOT to start:

Now… I’ll start with my minimum-size inverter layout.

Ha ha! That’ll be easy!
Why is that guy in trouble?

Think about it:

• If you limit your number of layers, you will need room to “go around” things
How to Start Off Smart™

• Start with a larger, more complex gate

• Think about transistor sizing
  – What are the max & min loads driven by a gate?
  – Do you need more than one version of some gates?

• Think about driving large loads
  – Do you want a high-drive gate?
  – Or, do you want to use a buffer?
The key point:

We all know that doing layout can be a time-consuming chore…

…but it’s not half as bad as re-doing layout.
The key point:

Try to recognize choices that will be difficult to change later:

- Cell heights
- Power & Ground routing
- Clock & Reset distribution
- Wiring tracks
- Floorplan wisely

} Have a plan!
One last “motivational” thought

Your layouts are due in

TWO WEEKS