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FROM ATOMS TO SYSTEMS

Parasitic Extraction

Integrated Full Chip and Cell Level RC Extraction
Combine Rule-Based and Field Solver Solutions

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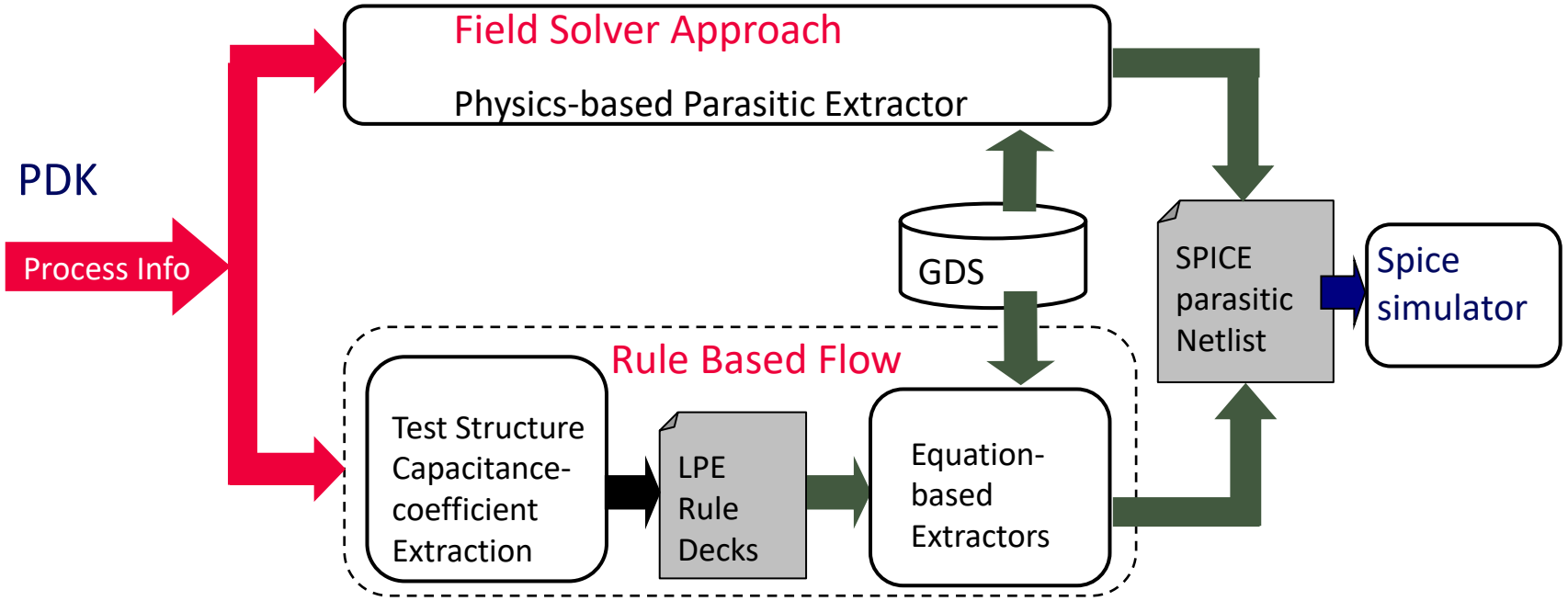
Introduction

- Many solution methodologies for RC extraction (RCX)
- No one methodology is suitable for all circuit blocks
- Choose solution methods for each cell or block
- Common integrated platform to localize user options
- Consider intended user skill set, CAD versus TCAD
- Consider size and topology versus simulation speed
- How much accuracy is really needed?
- Choices are technology dependent

Solution Methodologies

- Rule-based (fastest) or Field solver based (most accurate)



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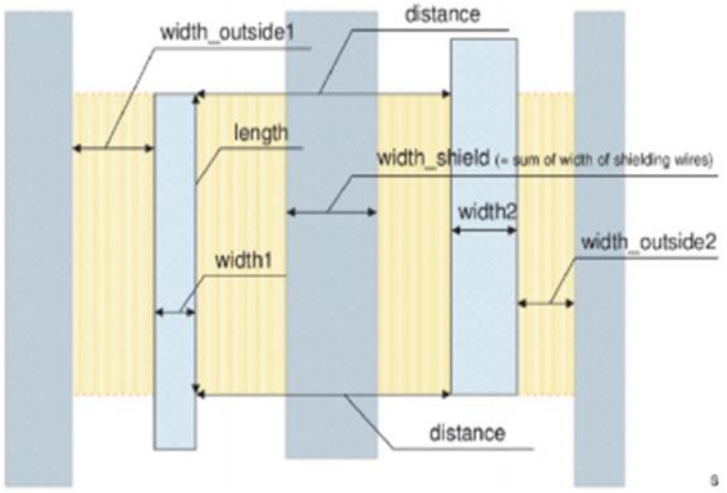
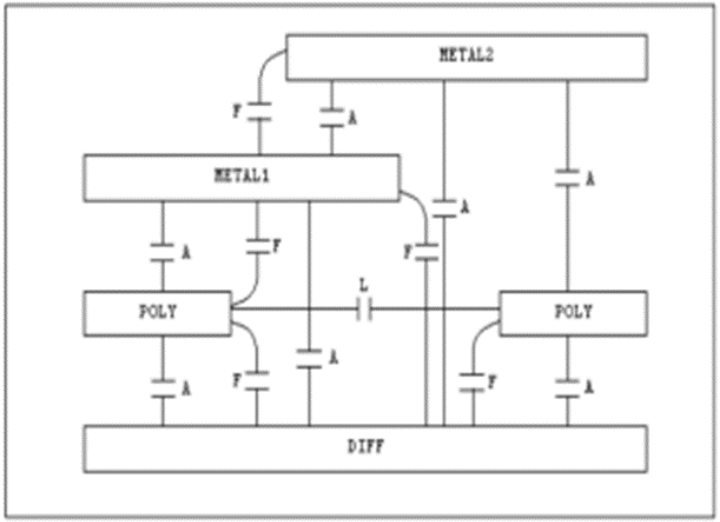
Rule-Based Extraction

- Capacitance – extract geometry from layout polygons
- Resistance – count conductor length in “squares”
- Coefficient database converts polygons into C & R values





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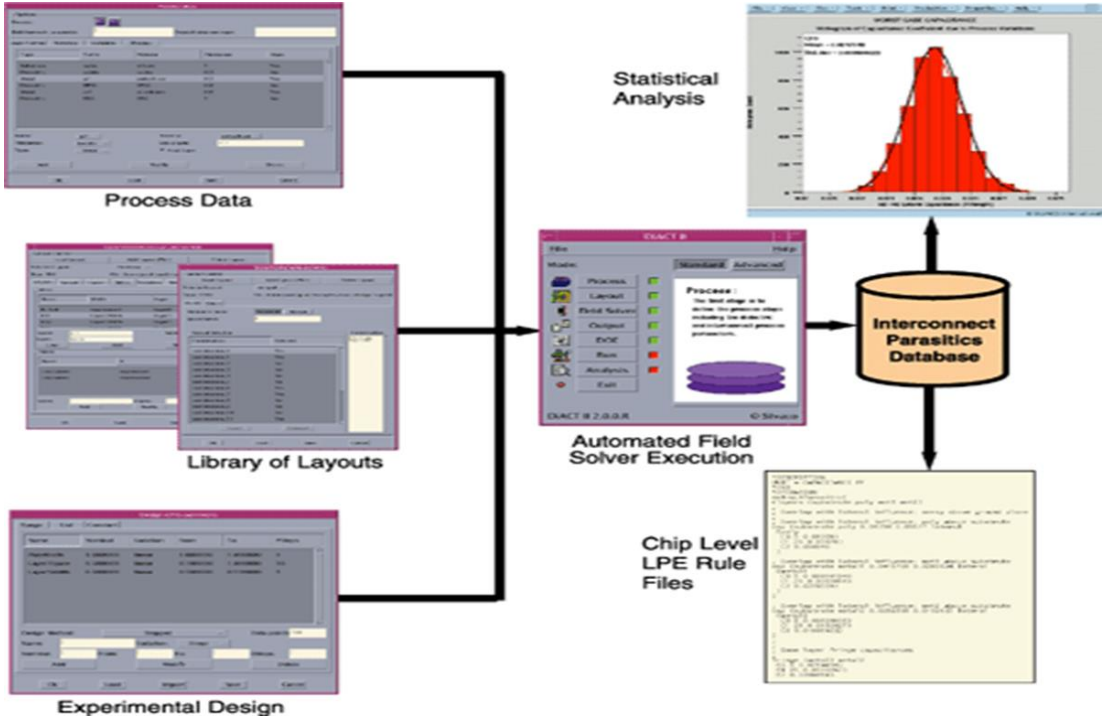
Generating the Parasitic Database



- Generating the large capacitance coefficient database for rule-based extraction requires a field solver
- One time per technology

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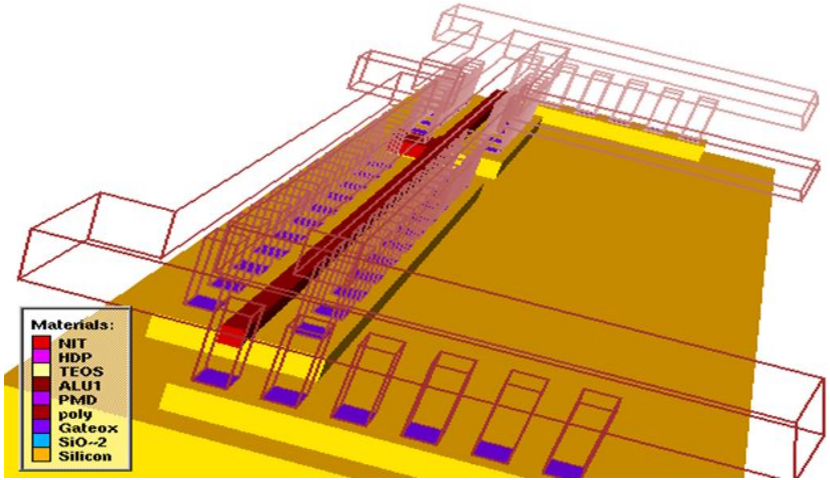
Field Solver Methods

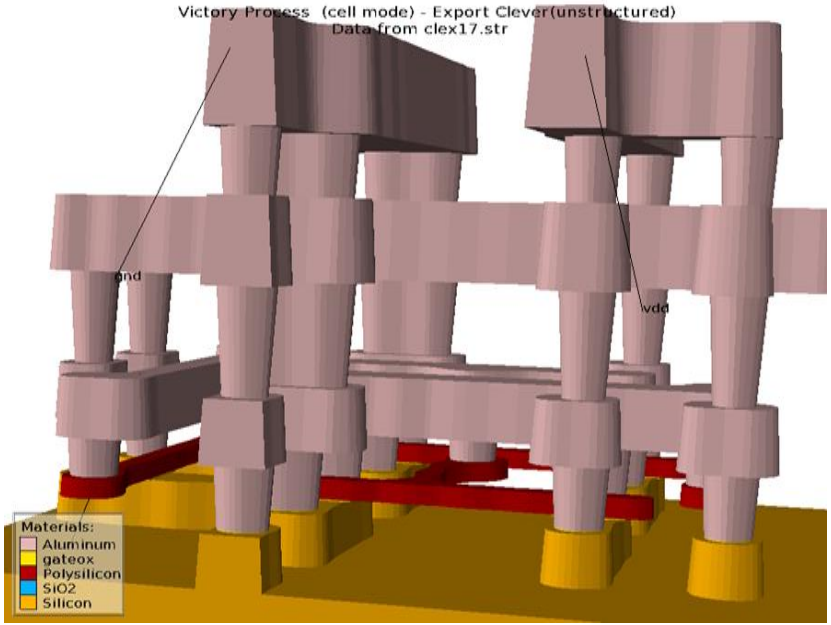
- Field Solver's have several methods to apply the physics to the physical representation of the structure
- Field solvers extract both capacitance and resistance
- Finite Difference and Finite Element Methods are:
  - - Optimal for complex and curved 3D shapes
- Boundary Element and Random Walk Methods are:
  - - Optimal for squared off simple "Manhattan" shapes
- Simulation speed versus shape complexity trade-off
- Silvaco tools uses field solvers from both categories

Boundary Element or Finite Element ?

- For uniform layer thickness and Manhattan shapes
  - Boundary Element Method



- For complex 3D shapes
  - Finite Element Method



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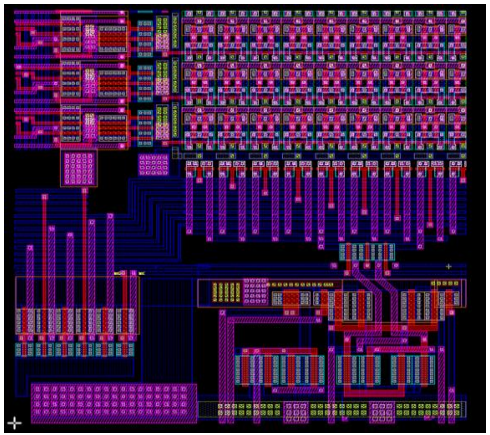
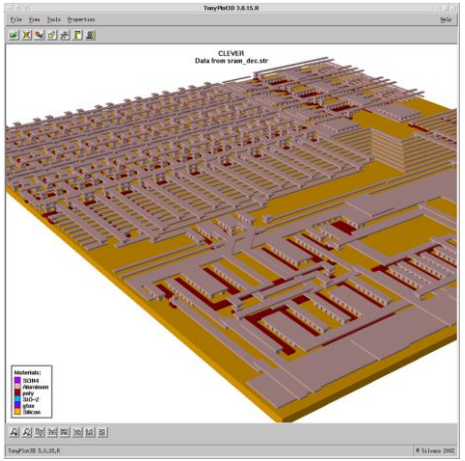
Summary

- Rule-based extraction used for most of the full chip
- Field solver extraction used with complex R & C layout
  - Highest accuracy is required for critical cells
- Mix and match techniques within one design



Typical maximum cell size for using field solve techniques.



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