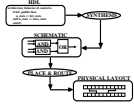


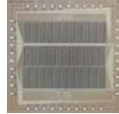
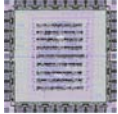
## THE IMPACT OF VLSI INTEGRATION



ECE JUNIOR SEMINAR  
7 November 2007



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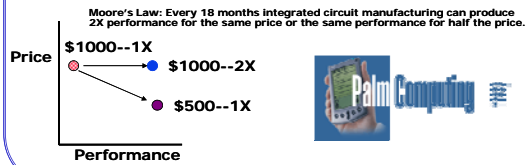
## OUTLINE OF THIS PRESENTATION

- Electronic Products are Pervasive and Always Improving
- Impact of VLSI Integration
- Applications may use Microprocessors and/or FPGAs/ASICs
- The Designer Productivity Crisis
- Design Involves Multiple Levels of Abstraction
- Using HDL and Synthesis
- For More Information

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## ELECTRONIC PRODUCTS ARE PERVASIVE AND ALWAYS IMPROVING



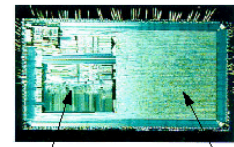
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## Design Example

Nokia 9000 wireless phone/PDA

Nokia 9000



Embedded  $\mu$ P Core      90K CBA gates

- ◆ Personal digital assistant (PDA) and GSM cellular phone
- ◆ Embedded block imported into a CBA foundation
- ◆ "Required 2 Mask Designers instead of 20"

CR: Design with Portable Blocks#10197  
© 1997 Synopsys, Inc.

SYNOPSYS

## TODAY'S AUTOMOBILE CONTAINS 50 MICROPROCESSORS

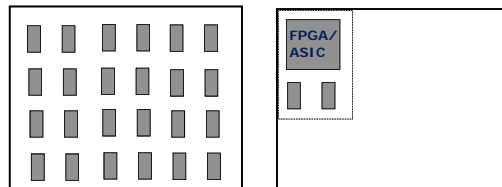


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## IMPACT OF VLSI INTEGRATION

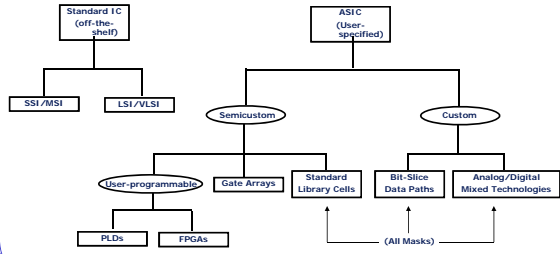
- In this application, the same functionality provided by a board with 24 packaged parts has been integrated into one new VLSI chip plus two other parts and placed on a new board.
- The new board uses only 1/5 the board space, costs only 1/2 as much and consumes only 1/4 the power.



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## APPLICATIONS MAY USE STANDARD ICs or FPGAs/ASICs

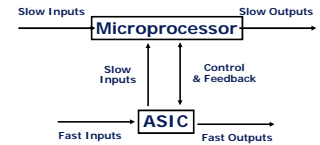


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## SYSTEM FUNCTIONS ARE OFTEN SHARED

- The most economical means of implementing logic functions is to use a microprocessor.
- When the microprocessor is too slow or too busy to handle some fast inputs and outputs, an ASIC can be used to implement "random" logic.



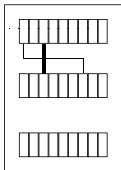
**ASIC = Application-Specific Integrated Circuit**

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## FIELD-PROGRAMMABLE GATE ARRAYS

### FPGAs



- Vendor prefabricates parts with rows of gates and programmable connections
- User specifies connections to implement logic functions
- Replaces 2,000 to 200,000 gates (or more)
- Electrically programmable (some are erasable) by the user one at a time within hours
- Production quantity < 200,000
- PC-based development system costs \$5-10K

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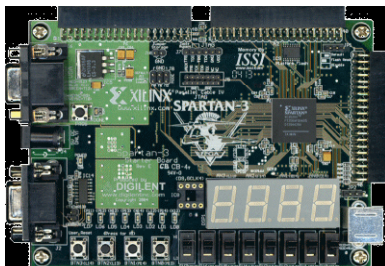
## FPGA HIGH VOLUME APPLICATIONS



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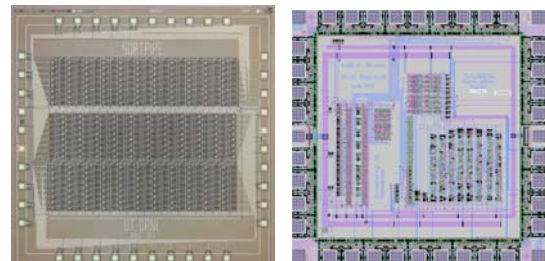
## ECE 491/551 PROJECTS INVOLVE RAPID PROTOTYPING USING FPGAs



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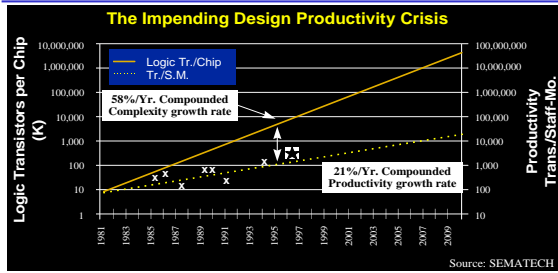
## GRADUATE COURSES INVOLVE CUSTOM DESIGN AT THE PHYSICAL LEVEL



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## DESIGN PRODUCTIVITY LAGS MANUFACTURING CAPABILITY

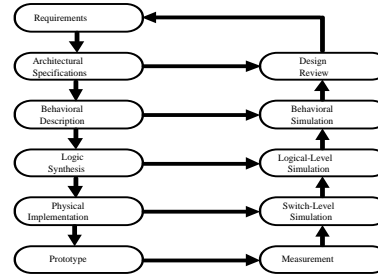


Maya Rubelz USAF Wright Labs maya.rubelz@sn.wpaafb.af.mil http://raasp.scra.org

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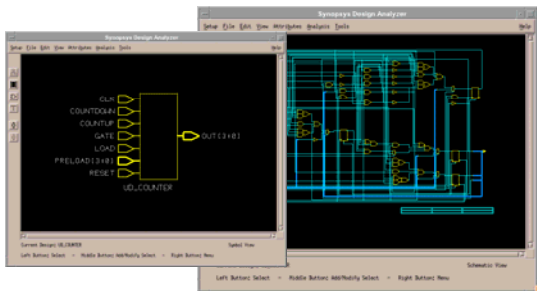
## MICROELECTRONIC SYSTEM DESIGN INVOLVES LEVELS OF ABSTRACTION AND ITERATION



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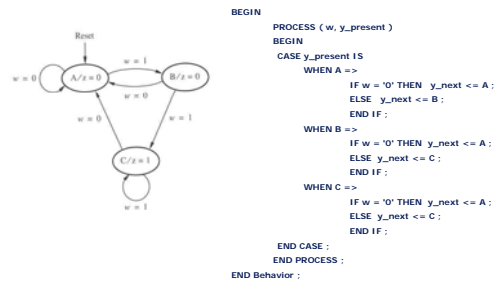
## A SCHEMATIC CAN SPECIFY STRUCTURE WITH COMPONENTS AND INTERCONNECTIONS



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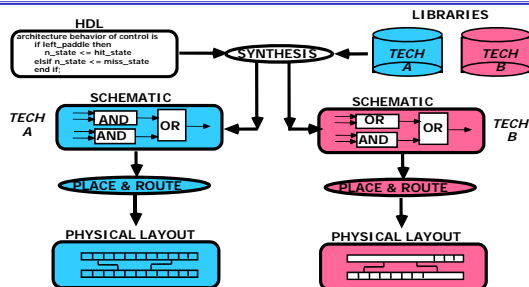
## A HARDWARE DESCRIPTION LANGUAGE IS BEST FOR STATE DIAGRAMS



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## HDL DESIGNS CAN BE TARGETED TO MULTIPLE LAYOUTS



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## FOR MORE INFORMATION

[http://visi1.utk.edu/ece/bouldin\\_courses/](http://visi1.utk.edu/ece/bouldin_courses/)

Juniors

ECE 551/ECE 491

ECE 552

ECE 651

ECE 652

<http://www.ece.utk.edu/undergrad/faq.html>

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