

EDA:

Where Electronics Begins

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Electronic Design Automation

- ❑ Automatic generation of electronic designs, huh?
 - Electronic design is highly automated!
- ❑ EDA: entry point of electronic designs
 - Where electronics begins!
- ❑ Digital circuit designers are sketchers and programmers, sort of
 - EDA takes care of the rest, ideally speaking

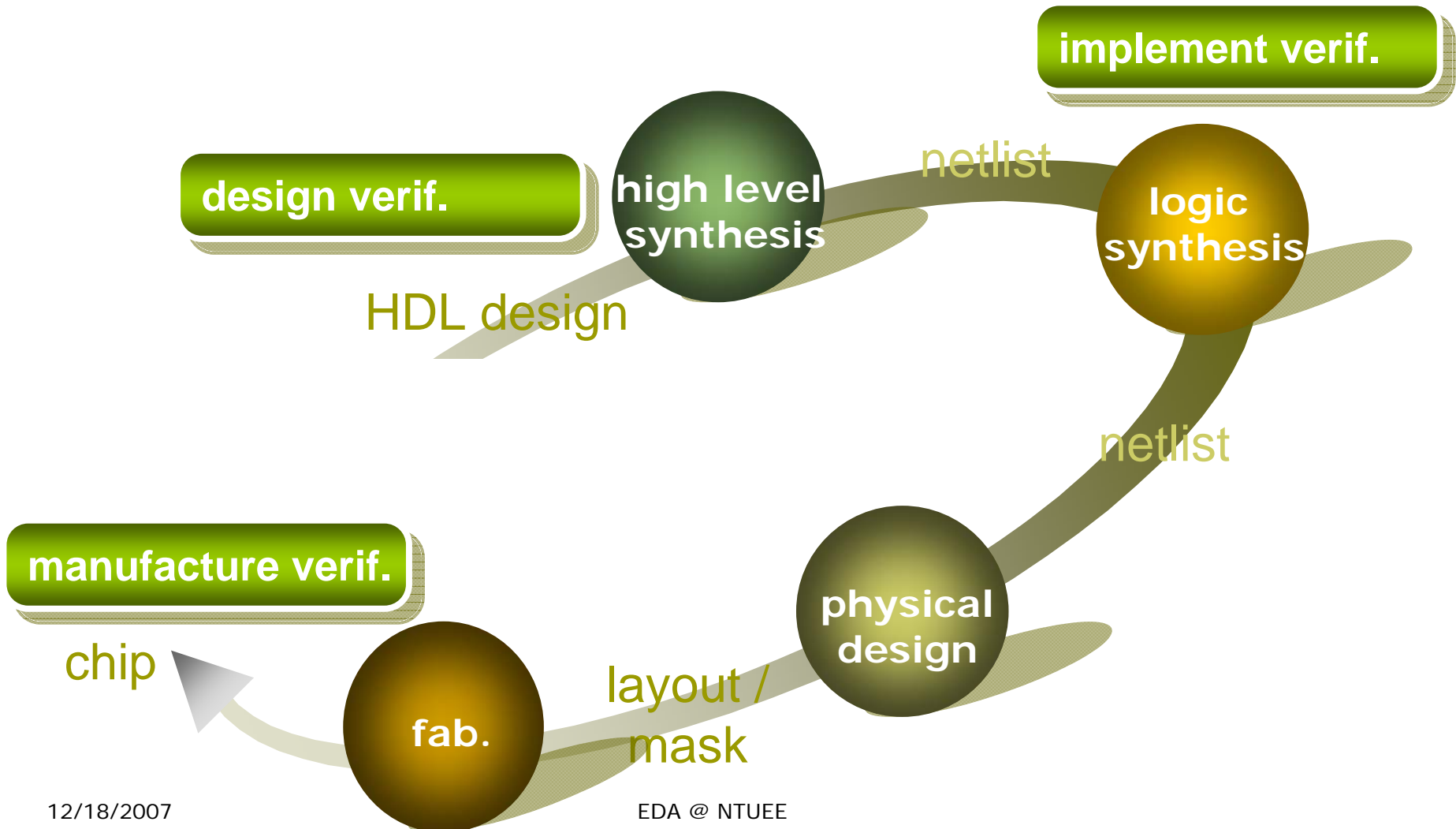
Hard & Soft of EDA

- EDA sits in-between electrical engineering and computer science
 - Deals with both hardware and software
 - Uses algorithmic approaches to automating hardware (and software) design

Ambition of EDA

- EDA targets a solution for **all designs**
 - IC design targets a solution for **some specific design**
- EDA sees a global picture
 - Problem definition
 - Problem solving

EDA by Subjects



EDA in Industry

- EDA companies
 - Cadence, Synopsis, Mentor Graphics, Magma, Novas, SpringSoft, ...
- Design houses
 - Intel, IBM, MediaTek, ...
- FPGA companies
 - Xilinx, Altera, Actel, ...
- Foundries
 - TSMC, UMC
- Software companies
 - Software model checking (SLAM project at Microsoft)

EDA in Academia

- Worldwide

- Berkeley, MIT, Stanford, UIUC, UM, CMU, UCLA, UT Austin, USC, ...

- Domestic

- NTU, NTHU, NCTU, ...

EDA in NTU


- An independent research group since August 2004.
- Current status
 - 10+2 professors
 - About 70+ M.S. and ~30 Ph.D. students
 - Covers all areas of electronic design automation
- The strongest EDA program in Taiwan, though not the largest
- Strong ties with EDA & IC design/manufacturing industry
- High international visibility
- Still growing

EDA Related Courses




□ Undergrad courses

- Introduction to Electronic Design Automation
- Logic Design
- Algorithms
- Data structures




Faculty Members (1/4)

Name	Title	Research Areas
郭斯彥  Sy-Yen Kuo	Professor IEEE Fellow	<ul style="list-style-type: none">□ System-level verification□ Software reliability□ Dependable distributed systems□ Mobile computing and networks
陳少傑  Sao-Jie Chen	Professor	<ul style="list-style-type: none">□ Physical layout automation□ SOC HW/SW co-design□ RF/Digital IC design
張耀文  Yao-Wen Chang	Professor	<ul style="list-style-type: none">□ VLSI physical design□ Design for VLSI manufacturing□ Layout and packaging co-design




Faculty Members (2/4)

Name	Title	Research Areas
王 凡  Farn Wang	Professor	<ul style="list-style-type: none">▣ Verification Automation▣ Software Testing
陳 中 平  Chung-Ping Chen	Associate Professor	<ul style="list-style-type: none">▣ VLSI/CAD special in Timing, Power, Signal Integrity, DFY/DFM▣ Microprocessor Design▣ Lithography Simulation/Optimization
李 建 模  Chien-Mo Li	Associate Professor	<ul style="list-style-type: none">▣ Design of built-in self test (BIST)▣ Design for testability (DfT)▣ SOC testing and diagnosis▣ Fault diagnosis

Faculty Members (3/4)

Name	Title	Research Areas
黃俊郎  Jiun-Lang Huang	Assistant Professor	<ul style="list-style-type: none">□ Analog/mixed-signal testing & DfT□ System-on-chip testing
黃鐘揚  Chung-Yang Huang	Assistant Professor	<ul style="list-style-type: none">□ Design verification for SoCs□ Design for verifiability□ Constraint satisfaction problems
盧信嘉  Hsin-Chia Lu	Assistant Professor	<ul style="list-style-type: none">□ IC packaging characterization□ Low-temperature cofired ceramic design/synthesis□ RF IC design

Faculty Members (4/4)

Name	Title	Research Areas
江介宏  Jie-Hong R. Jiang	Assistant Professor	<ul style="list-style-type: none"> ▣ System analysis & verification ▣ Hardware synthesis & optimization ▣ Quantum computation
劉炯朗  C. L. Liu	Chair Professor 中研院院士 ACM/IEEE Fellow	<ul style="list-style-type: none"> ▣ VLSI design automation ▣ Algorithms ▣ Combinatorial optimization
李德財  D. T. Lee	Professor 中研院院士 ACM/IEEE Fellow	<ul style="list-style-type: none"> ▣ Algorithm design for VLSI/CAD Layouts ▣ Design for VLSI Manufacturing

VLSI Design Flow & Related People

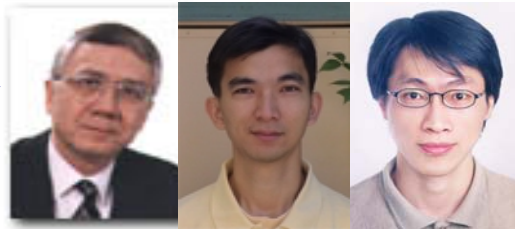
System-level
verification &
simulation



Hardware/software
co-design



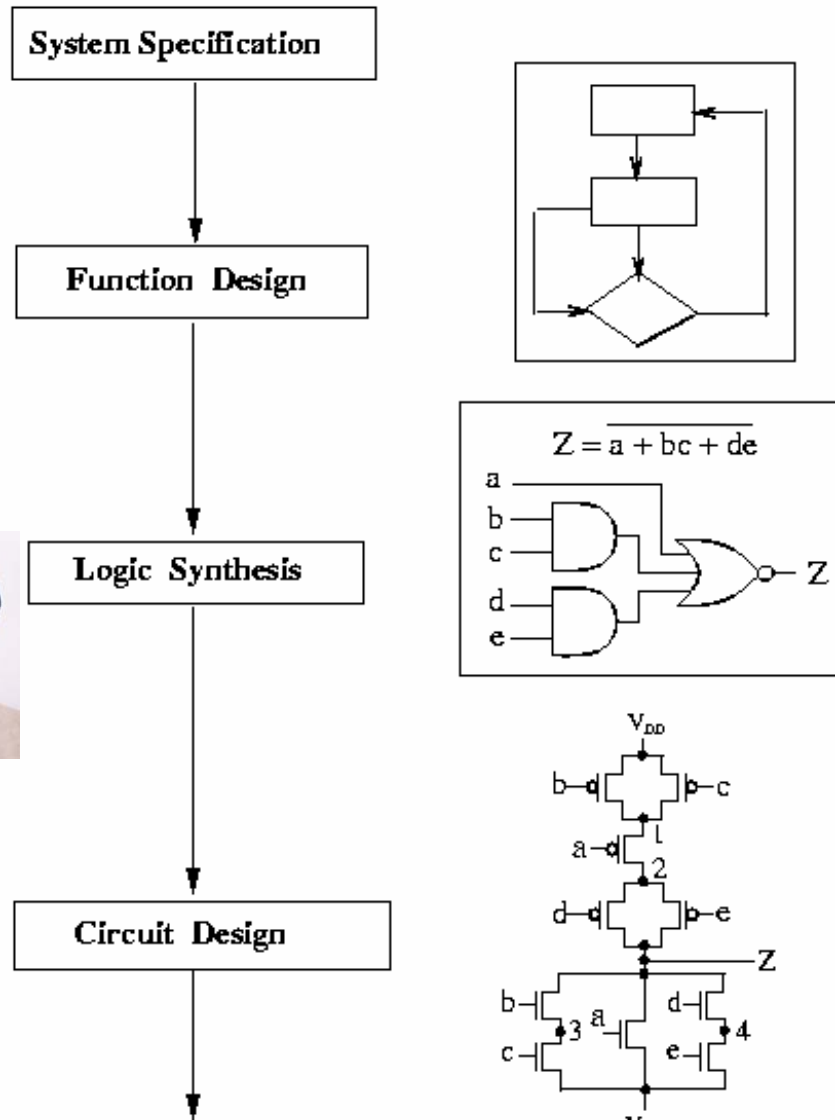
Formal
verification &
logic
synthesis



Circuit
simulation



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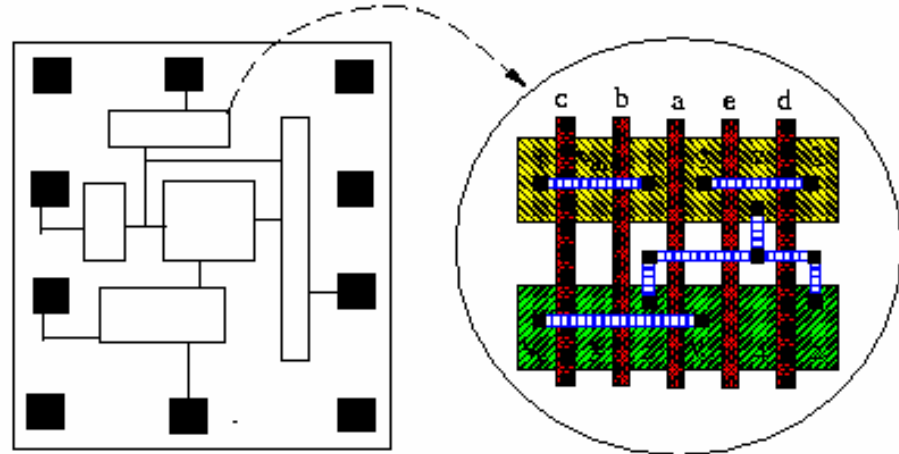


VLSI Design Flow & Related People

Physical design



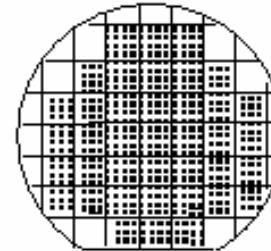
Physical Design



Testing



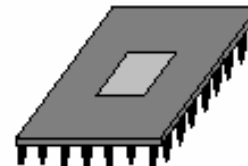
Fabrication



Packaging



Packaging



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Industrial & Governmental Sponsorship

- More than 15 industrial & governmental sponsors for students' fellowships, research projects, and donation.
- Average number of projects:
about 5 projects/person-year
- Average research grant:
about 160K USD/person-year



International Visibility

- Published the most top-rated ICCAD/DAC papers among all Taiwanese and Asian universities / institutes during the past 6 years

Year	Taiwan	NTU/EDA
2002 (DAC+ICCAD)	3	3
2003 (DAC+ICCAD)	6	3
2004 (DAC+ICCAD)	7	5
2005 (DAC+ICCAD)	14	10
2006 (DAC+ICCAD)	20	6
2007 (DAC+ICCAD)	12+15	5+9
Total	77	41

DAC

	2002 (147#)	2003 (152)	2004 (163)	2005 (154)	2006 (201)	2007 (153)
1 st	U.S.A (103)	U.S.A (116)	U.S.A (120)	U.S.A (114)	U.S.A (125)	U.S.A (98)
2 nd	Korea Germany (6)	Canada (7)	Korea (6)	Canada (10)	Taiwan (8)	Taiwan (12)
3 rd		Italy (5)	Germany (5)	Germany (5)	China (5)	Canada (8)
4 th	Belgium (5)	Korea Germany Israel India (3)	Japan Canada Italy (4)	Taiwan Korea France (4)	Korea Canada Germany Spain (4)	China (7)
5 th	Switzerland (4)					Germany (5)
6 th	Canada France (3)		Netherlands (4)			
7 th		Taiwan (3)	Japan (3)	Israel (3)		

* 2002, 2003: Taiwan (1)

of papers; Consider 1st authors only

+ NTU papers: 2002 (1), 2003 (1), 2004 (1), 2005 (2), 2006 (2), 2007 (5)

12/18/2007 Ranking: NTU #2 in the world

EDA @ NTUEE

ICCAD

	2002 (105#)	2003 (129)	2004 (127)	2005 (128)	2006 (128)
1 st	U.S.A (86)	U.S.A (97)	U.S.A (98)	U.S.A (110)	U.S.A (97)
2 nd	Canada (4)	Canada (7)	Canada (5)	Taiwan (3)	Taiwan (10)
3 rd	Japan (3) Korea (3) Belgium (3)	Germany (4)	Taiwan (3) Japan Switzerland	Korea	Canada (5)
4 th		Taiwan (3)		China (4)	
5 th		Japan Korea France Iran (2)	Korea Australia Sweden (2)	Japan Germany Sweden (2)	Japan Germany France Italy (3)
6 th	India (2)				

* 2002: Taiwan (1)

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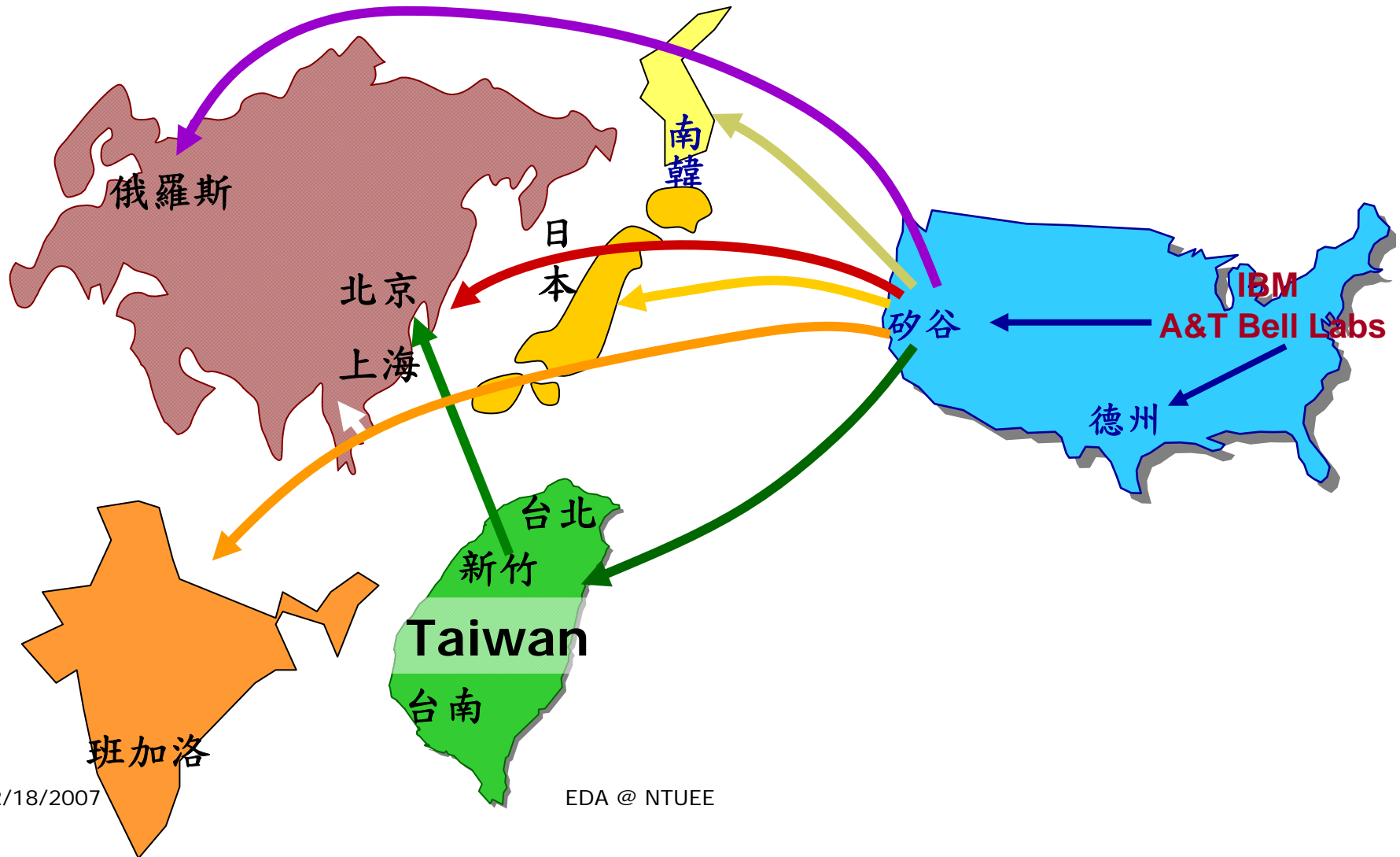
+ NTU papers: 2002 (1), 2003 (1), 2004 (1), 2005 (2), 2006 (6), 2007 (9)

+ 2007 Ranking: NTU (9), UCLA (7), U of Michigan (7); Industry: IBM (5)

International Visibility

- Received many Best Paper Awards/Nominations in top-rated conferences and journals
 - 2007 IEEE/ACM ICCAD best paper nominations
 - 2007 IEEE/ACM ICCAD CAD Contest: 1st, 2nd Place
 - 2007 ACM ISPD best paper nomination
 - 2006 IEEE/ACM ICCAD CAD Contest: 3rd Place
 - 2006 ACM ISPD International Placement Contest: 3rd Place
 - 2005 ACM/IEEE DAC best paper nomination
 - 2004 ACM/IEEE ASP-DAC best paper nomination
 - 2003 ACM ISPD best paper award
 - 2003 ACM Trans. DAES best paper nomination
 - 2002 IEEE/ACM ICCAD best paper nomination
 - 2001 IEEE ICCD best paper nomination
 - 2000 ACM/IEEE DAC best paper nomination
 - 1999 IEEE Trans. Computer-Aided Design best paper nomination
 - 1996 Int'l Symp. Software Reliability Engr. best paper award
 - 1995 IEEE ICCD best paper award
 - 1986 ACM/IEEE DAC best paper award

Semiconductor Industry Going West



EDA Booming in Taiwan



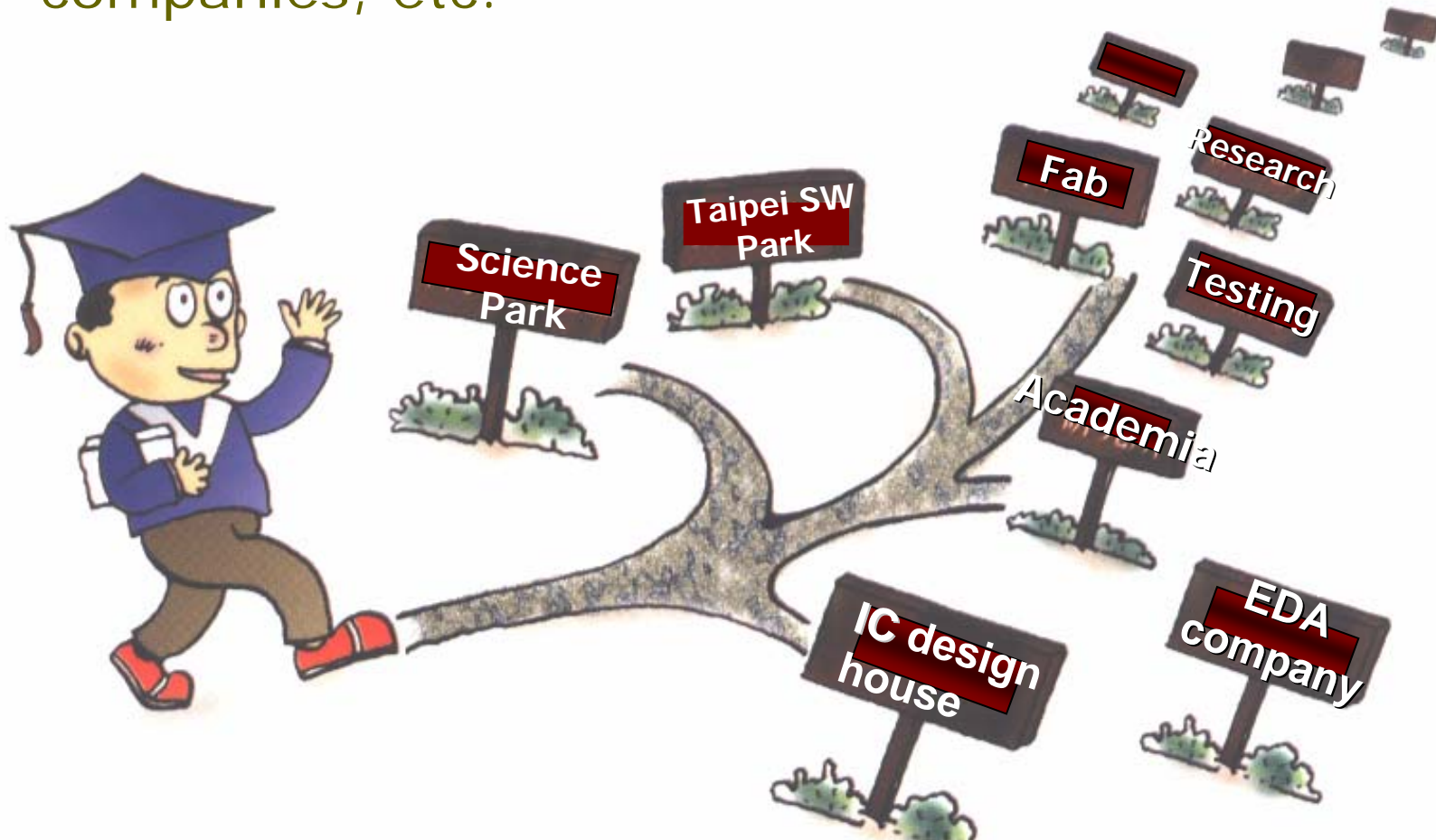
Synopsys Taiwan R&D Center

More new RD centers

- Apache: Hsinchu
- Cadence: Hsinchu & Taipei
- ClearShape: Hsinchu
- Incentia: Hsinchu
- Mentor Graphics: Taipei & Hsinchu
- SpringSoft (Novas): Taipei branch
- Synopsys: Taipei

EDA Jobs in Taiwan

- Academia, EDA companies, IC design houses, IC design service companies, Foundries, Packaging companies, etc.





Thank You!

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